



X150 - XK

VIN B00379 to VIN B32752

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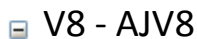
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1. GENERAL INFORMATION

100 : Service information

100-00 : General information

Description and operation

Application and Use of Specifications

Torque Specifications

Torque specifications are shown in the torque specifications chart located at the front of the relevant section

General Service Information

Repairs and Replacements

When service parts are required, it is essential that only genuine Jaguar/Daimler replacements are used.

Attention is drawn to the following points concerning repairs and the installation of replacement parts and accessories:

- Safety features embodied in the vehicle may be impaired if other than genuine parts are installed. In certain territories, legislation prohibits the installation of parts which are not produced to the vehicle manufacturer's specification.
- Torque wrench setting figures given in this manual must be strictly adhered to. Locking devices, where specified, must be installed. If the efficiency of a locking device is impaired during removal it must be renewed.
- Owners purchasing accessories while travelling abroad should make sure that the accessory and its installed location on the vehicle conform to mandatory requirements existing in their country of origin.
- The vehicle warranty may be invalidated by the installation of other than genuine Jaguar/Daimler parts. All Jaguar/Daimler replacements have the full backing of the factory warranty.
- Jaguar/Daimler dealers are obliged to supply only genuine service parts.

Vehicle Specifications

Purchasers are advised that the specification details set out in this manual apply to a range of vehicles and not to any specific one. For the specification of a particular vehicle, purchasers should consult their dealer.

The Manufacturer reserves the right to vary the specifications, with or without notice, and at such times and in such manner as the Manufacturer thinks fit. Major as well as minor changes may be involved, in accordance with the Manufacturer's policy of continuous improvement.

Whilst every effort is made to make sure the accuracy of the particulars contained in this manual, neither the Manufacturer nor the Dealer, by whom the manual is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

Service Repair Operation Numbering

A master index of numbered operations has been compiled for universal application to all vehicles manufactured by Jaguar Cars Ltd.

Each operation is allocated a number from the master index and cross-refers with an identical number in the Repair Operation Times schedule. The number consists of six digits arranged in three pairs.

Each maintenance procedure in this manual is described in the sequence necessary to complete the operation in the minimum time, as specified in the Repair Operation Times schedule.

References to Bank-1 and Bank-2

References to Bank-1 and Bank-2 are made with regard to the engine. When viewed from the flywheel the right-hand bank will be Bank-1 and the left-hand bank will be Bank-2.

Special Tools

Any special tools and equipment required to perform a maintenance procedure, are shown at the beginning of each procedure. When possible, illustrations are given to assist in identifying the tool needed.

Disconnecting/Connecting the Battery

Always stop the engine before disconnecting the battery negative lead and make sure the battery positive lead is isolated i.e. wrapped in a suitable cloth.



WARNING: Radio code saving devices must not be used when conducting work on Air Bag or Fuel systems. It must be noted that, when using these devices, the vehicle electrical system is still live albeit with a reduced current flow.

NOTE:

Before disconnecting the battery make sure that the radio receiver/cassette player/mini disc player and compact disc player keycodes are known and, that no data is required from the Engine Control Module (ECM) as battery disconnection will erase any fault codes and idle/drive values held in the Keep Alive Memory (KAM).

Always disconnect the battery before commencing repair operations which require:

- The vehicle to be jacked up
- Work on the engine
- Work underneath the vehicle
- Arc welding

Alternatively a Radio Code Saver may be used, when not working on the Air Bag or Fuel systems. With the battery disconnected, a Radio Code Saver will allow sufficient current to pass to maintain the radio receiver/cassette player/mini disc player and compact disc player memory, operate the clock and supply the door operated interior lights while isolating the battery in the event of a short circuit.

Reconnecting the Battery



WARNING: If the battery has been on bench charge the cells may be giving off explosive hydrogen gas. Avoid creating sparks, and if in doubt cover the vent plugs or covers with a damp cloth.

Always make sure that all electrical systems are switched OFF before reconnecting the battery to avoid causing sparks or damage to sensitive electrical equipment.

Always reconnect the battery positive lead first and the negative last, ensuring that there is a good electrical contact and the battery terminals are secure.

Restart the clock (where installed) and set it to the correct time.

Enter the radio receiver/cassette player/mini disc player and compact disc player keycodes and preset frequencies, if known.

Following reconnection of the battery, the engine should be allowed to idle until it has reached normal operating temperature as the stored idle and drive values contained within the ECM have been lost. Allow the vehicle to idle for a further three minutes. Drive the vehicle at constant speeds of approximately 48 km/h (30 mph), 64 km/h (40 mph), 80 km/h (50 mph), 96 km/h (60 mph) and 112 km/h (70 mph) for three minutes each. This will allow the ECM to relearn idle and drive values, and may cause driveability concerns if the procedure is not carried out.

Connecting a Slave Battery Using Jump Leads



WARNING: If the slave battery has recently been charged and is gassing, cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should arcing occur when connecting the jump leads.



CAUTION: A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all circuits are switched off. This can cause arcing when the jump leads are connected.



CAUTION: Whilst it is not recommended that the vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. In such an instance the discharged battery must be recharged immediately after jump starting to avoid permanent damage.

- Always make sure that the jump leads are adequate for the task. Heavy duty cables must be used.
- Always make sure that the slave battery is of the same voltage as the vehicle battery. The batteries must be connected in parallel.
- Always make sure that switchable electric circuits are switched off before connecting jump leads. This reduces the risk of sparks occurring when the final connection is made.



WARNING: Make sure that the ends of the jump leads do not touch each other or ground against the vehicle body at any time while the leads are attached to the battery. A fully charged battery, if shorted through jump leads, can discharge at a rate well above 1000 amps causing violent arcing and very rapid heating of the jump leads and terminals, and can even cause the battery to explode.

Always connect the jump leads in the following sequence.

- Slave battery positive first then vehicle battery positive.
- Slave battery negative next and then vehicle ground at least, 300 mm (12 in) from the battery terminal e.g. engine lifting bracket.

Always reduce the engine speed to idle before disconnecting the jump leads.

Before removing the jump leads, switch on the heater blower (high) or the heated rear screen, to reduce the voltage peak when the leads are removed.

Always disconnect the jump leads in the reverse order to the connecting sequence and take great care not to short the ends of the leads.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of 8 hours continuous driving with no additional loads placed on the battery.

Component Cleaning

To prevent ingress of dirt, accumulations of loose dirt and greasy deposits should be removed before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before inspection prior to reassembly.

Cleaning Methods:

- Dry Cleaning
- Removal of loose dirt with soft or wire brushes
- Scraping dirt off with a piece of metal or wood
- Wiping off with a rag



CAUTION: Compressed air is sometimes wet so use with caution, especially on hydraulic systems.

- Blowing dirt off with compressed air (Eye protection should be worn when using this method)
- Removal of dry dust using vacuum equipment. This method should always be used to remove friction lining material dust (asbestos particles)
- Steam Cleaning

Calibration of Essential Measuring Equipment



WARNING: Failure to comply may result in personal injury or damage to components.

It is of fundamental importance that certain essential equipment e.g. torque wrenches, multimeters,

exhaust gas analysers, rolling roads etc., are regularly calibrated in accordance with the manufacturers instructions.

Use of Control Modules

Control modules may only be used on the vehicle to which they were originally installed. Do not attempt to use or test a control module on any other vehicle.

Functional Test

On completion of a maintenance procedure, a thorough test should be carried out, to ensure the relevant vehicle systems are working correctly.

Preparation

Before disassembly, clean the surrounding area as thoroughly as possible. When components have been removed, blank off any exposed openings using grease-proof paper and masking tape. Immediately seal fuel, oil and hydraulic lines when separated, using plastic caps or plugs, to prevent loss of fluid and the entry of dirt. Close the open ends of oil ways, exposed by component removal, with tapered hardwood plugs or readily visible plastic plugs. Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts. Before dismantling a component, clean it thoroughly with a recommended cleaning agent; check that the agent will not damage any of the materials within the component. Clean the bench and obtain marking materials, labels, containers and locking wire before dismantling a component.

Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when parts of the brake, fuel or hydraulic systems are being worked on. A particle of dirt or a fragment of cloth could cause a dangerous malfunction if trapped in these systems. Clean all tapped holes, crevices, oil ways and fluid passages with compressed air.



WARNING: Do not permit compressed air to enter an open wound. Always use eye protection when using compressed air.

Make sure that any O-rings used for sealing are correctly reinstalled or renewed if disturbed. Mark mating parts to make sure that they are replaced as dismantled. Whenever possible use marking materials which avoid the possibilities of causing distortion or the initiation of cracks, which could occur if a center punch or scriber were used. Wire together mating parts where necessary to prevent accidental interchange (e.g roller bearing components). Tie labels on to all parts to be renewed and to parts requiring further inspection before being passed for reassembly. Place labelled parts and

other parts for rebuild in separate containers. Do not discard a part which is due for renewal until it has been compared with the new part, to make sure that the correct part has been obtained.

Inspection

Before inspecting a component for wear or performing a dimensional check, make sure that it is absolutely clean; a slight smear of grease can conceal an incipient failure. When a component is to be checked dimensionally against figures quoted for it, use the correct equipment (surface plates, micrometers, dial gauges etc.) in serviceable condition. The use of makeshift equipment can be dangerous. Reject a component if its dimensions are outside the limits quoted, or if damage is apparent. A component may be reinstalled if its critical dimension is exactly to the limit size and it is otherwise satisfactory. Use Plastigauge 12 Type PG-1 for checking bearing surface clearance, e.g. big end bearing shell to crank journal. Instructions for the use of Plastigauge and a scale giving bearing clearances in steps of 0,0025 mm (0.0001 in) are supplied with the package.

On-Board Diagnostics (OBD)

This vehicle uses programmed electronic control systems to provide engine management and emission regulation, automatic transmission operation and anti-lock braking control. These control systems are integral with the On-Board Diagnostics (OBD) facility that is used in conjunction with either the Jaguar approved diagnostic system or the more restricted scan tools.

The OBD information in this manual provides diagnostic and rectification procedures for emission related electrical and mechanical systems. The information is intended to facilitate fault diagnosis and the subsequent rectification of the vehicle without recourse to the Jaguar approved diagnostic system.

The diagnosis and testing sections within the manual cover:

- System principles of operation with links to the relevant Description and Operation sections
- Self tests (where appropriate)
- Inspection and Verification - manual checks, symptom and Diagnostic Trouble Code (DTC) driven diagnostic charts with actions required to rectify concerns
- Component tests (where appropriate)

Circuit Diagrams

To understand the relationship between the vehicle electrical system and the system circuit diagrams, Refer to the Electrical Guide.

In the interest of clarity, single lines may represent multiple wires. Refer to the color code (1st alpha) followed by the wire reference (numeric/alpha/numeric) to trace origin and destination.

e.g. BW 647B002. BW (black with white trace) 647 (wire reference) B002 (stage from origin).

Glossary of Terms

This glossary of terms is intended to cover mainly emissions-related (to SAE J 1930) terminology, and other abbreviations that may be used in this manual.

The required term may be looked-up in the left-hand column, and subsequent columns give the standard acronym, unit or abbreviation, and definition.

Term(s)	Acronym/Unit/Abbreviation	Definition
Air Conditioning	A/C	
Accelerator Pedal Position	APP	Is a multitrack sensor which inputs the drivers demand into the engine control module (ECM)
After Bottom Dead Center	ABDC	Event occurring after bottom dead center
After Top Dead Center	ATDC	Event occurring after top dead center
Anti-lock Brake System	ABS	System which prevents wheel lock-up under braking by sensing lack of rotation of a wheel(s) and diverting fluid pressure away

		from it (them)
Alternating Current	ac	
Amplitude Modulation	AM	
Automatic Temperature Control	ATC	
Automatic Transmission Fluid	ATF	
Ampere	A	SI unit of current
Ampere hour	Ah	
Barometric Pressure	BARO	Pressure of surrounding air at any given temperature and altitude
Battery positive voltage	B+	The positive voltage from a battery or any circuit connected directly to it
Before Bottom Dead Center	BBDC	Event occurring before bottom dead center
Before Top Dead Center	BTDC	Event occurring before top dead center

Bottom Dead Center	BDC	Lowest point of piston travel in a reciprocating engine
Battery Junction Box	BJB	
Brake Pedal Position	BPP	
Brake Horsepower	BHP	Effective horsepower developed by an engine or motor, as measured by a brake applied to its output shaft
British Standard	BS	Standard specification issued by the British Standards Institution
Brake Traction Control System	BTCS	
Bus	Topology of a communication network	
Coast Clutch Solenoid	CCS	
Camshaft Position	CMP	Indicates camshaft

		position
Carbon dioxide	CO ²	Colorless gas with a density of approximately 1.5 times that of air
Carbon monoxide	CO	Poisonous gas produced as the result of incomplete combustion
Chlorofluorocarbon	CFC	
Catalytic converter		In-line exhaust system device used to reduce the level of engine exhaust emissions
Celsius	C	SI term for the Centigrade scale, with freezing point at zero and boiling point at 100 degrees
Compact Disc	CD	
Cylinder Head Temperature Sensor	CHT Sensor	A sensor for measuring the

		temperature of the cylinder head
Central Junction Box	CJB	
Crankshaft Position	CKP	Indicates crankshaft position
Clutch Pedal Position	CPP	Indicates clutch pedal position
Controller Area Network	CAN	A communication system which allows control modules to be linked together
Constant Velocity	CV	
Cubic centimeter	cm ³	
Central Security Module	CSM	Electronic module to support security system functionality
Data Link Connector	DLC	Connector providing access and/or control of the vehicle information, operating

		conditions, and diagnostic information
Driver Door Module	DDM	Electronic module to support driver door functionality
Driver Seat Module	DSM	Electronic module to support driver seat functionality
Daytime Running Lamps	DRL	
Deutsche Institut fur Normung	DIN	German standards regulation body
Diagnostic Trouble Code	DTC	An alpha/numeric identifier for a fault condition identified by the On-Board Diagnostic (OBD) system
Direct current	dc	Current which flows in one direction only, though it may

		have appreciable pulsations in its magnitude
Domestic Data Bus	D2B	
Digital Versatile Disc	DVD	
Electronic Automatic Temperature Control	EATC	
Exhaust Gas Recirculation	EGR	
Exhaust Gas Recirculation Temperature Sensor	EGRT	Sensing EGR function based on temperature change
Electronic Brake Force Distribution	EBD	
Engine Control Module	ECM	Electronic module to support engine functionality
Electronic Crash Sensor	ECS	Sensor to measure severity of impact
Engine Coolant Temperature	ECT	
Engine Oil Pressure	EOP	

European On-Board Diagnostic	EOBD	
Electronic Pressure Control	EPC	
Electrically Erasable Programmable Read-Only Memory	EEPROM	
Erasable Programmable Read-Only Memory	EPROM	
Evaporative Emission	EVAP	System designed to prevent fuel vapor from escaping into the atmosphere. Typically includes a charcoal filled canister to absorb fuel vapor
Flash Electrically Erasable Programmable Read-Only Memory	FEEPROM	
Front Electronic Module	FEM	

Flash Erasable Programmable Read-Only Memory	FEPROM	
Frequency Modulation	FM	
Fuel Pump Driver Module	FPDM	
Fuel Rail Pressure	FRP	
Generic Electronic Module	GEM	
Ground	GND	Electrical conductor used as a common return for an electrical circuit or circuits, and with a relative zero potential
Global Positioning System	GPS	
Global System for Mobile Communication	GSM	
Gross Vehicle Weight	GVW	
Heated Oxygen Sensor	HO2S	Electrically heated oxygen sensor which induces fuelling

		corrections
Hydrofluorocarbon	HFC	
High tension	HT	
Hydrocarbon	HC	
Idle Air Control	IAC	Stepper motor driven device which varies the volume of air by-passing the throttle to maintain the programmed idle speed
Intake Air Temperature	IAT	Temperature of intake air
Inertia Fuel Shut-off	IFS	An inertia system that shuts off the fuel supply when activated by pre-determined force limits brought about by (e.g.) collision
Input Shaft Speed	ISS	Indicates input shaft speed

Key On, Engine Off	KOEO	
Key On, Engine Running	KOER	
Kilogram (mass)	kg	
Kilogram (force)	kgf	
Kilogram force per square centimeter	kgf/cm ²	
Kilometer	km	
Kilometer per hour	km/h	
Kilopascal	kPa	
Kilovolt	kV	
Knock Sensor	KS	Sensor which detects the onset of detonation, and signals the ECM to retard the ignition
Liquid Crystal Display	LCD	Optical digital display system, to which applied voltage varies the way the crystals reflect light, thereby modifying the

		display
Lighting Control Module	LCM	
Light Emitting Diode	LED	
Low Tension	LT	Primary circuit of the ignition system, linking the battery to the primary winding in the ignition coil
Left-Hand	LH	
Left-Hand Drive	LHD	
Mass Air Flow	MAF	System which provides information on the mass flow rate of the intake air to the engine
Manifold Absolute Pressure	MAP	Absolute pressure of the intake manifold air
Manifold Absolute Pressure and Temperature	MAPT	

Malfunction Indicator Lamp	MIL	A required on-board indicator to alert the driver of an emission related malfunction
Meter (measurement)	m	
Metric (screw thread, e.g. M8)	M	
Farad	F	Unit of electrical capacitance
Millimeter	mm	
Millimeter of mercury	mmHg	
Millisecond	ms	
Model year	MY	
Newton	N	SI unit of force. 1 N = 0.2248 pounds force
Newton Meter	Nm	SI unit of torque. Must not be confused with nm (nanometer)
Negative Temperature	NTC	

Coefficient		
Naturally aspirated	N/A	Fuelling system using intake air at atmospheric pressure; not supercharged or turbocharged
Noise, Vibration and Harshness	NVH	
North American Specification	NAS	Vehicles for sale in the USA and Canadian markets
On-Board Diagnostic	OBD	A system that monitors some or all computer input and output control signals. Signal(s) outside the pre-determined limits imply a fault in the system or a related system
Oxides of Nitrogen	Nox	
Oxygen Sensor	O2S	A sensor which detects oxygen

		content in the exhaust gases
On-board Refuelling Vapour Recovery	ORVR	
Output State Control	OSC	
Output Shaft Speed	OSS	
Passenger Air Bag Deactivation	PAD	
Pulsed Secondary Air Injection	PAIR	
Passive Anti-Theft System	PATS	
Positive Crankcase Ventilation	PCV	
Parameter Identification	PID	An index number referring to a parameter within a module without knowledge of its storage location
Park/Neutral Position	PNP	
Pulse Width Modulation	PWM	

<p>Programmable Electronic Control Units System</p>	<p>PECUS</p>	<p>Process whereby a common ECM is programmed on the production line to suit the market requirements of a particular vehicle</p>
<p>Programmable Read-only Memory</p>	<p>PROM</p>	<p>ROM with some provision for setting the stored data after manufacture</p>
<p>Portable Support Electronics</p>	<p>PSE</p>	
<p>Power Steering Pressure</p>	<p>PSP</p>	
<p>Polytetrafluoroethylene</p>	<p>PTFE</p>	
<p>Random Access Memory</p>	<p>RAM</p>	<p>Fast access memory store which is accessible for entry or extraction of data</p>

Read Only Memory	ROM	Fast access memory in which data is fixed and may not be changed
Restraints Control Module	RCM	Electronic module to support functionality of the Supplemental Restraints System
Radio Data System	RDS	
Rear Electronic Module	REM	
Remote Keyless Entry	RKE	
Right-hand	RH	
Right-hand drive	RHD	
Research Octane Number	RON	
Rear Seat Module	RSM	Electronic module to support functionality of rear seats
Supercharger	SC	An intake system which

		<p>utilizes a supercharger (mechanically driven device that pressurizes intake air, thereby increasing density of charge air and the consequent power output from a given displacement)</p>
Serial Communications Link	SCL	
Standard Corporate Protocol	SCP	<p>A high-speed, serial communication system linking all body system control modules. Control messages and data are passed between modules at up to 786 messages per second</p>

Supplemental Restraints System	SRS	
Shift Solenoid	SS	Controls shifting in an automatic transmission
Seat Control Module	SCM	Module controlling the seat motor systems (not electric raise/lower-only seats)
Secondary Air Injection	AIR	System used for a period of time each time the engine is started, unless certain temperature criteria are met. Pumps air directly into the exhaust system which generates extra heat and reduces the time taken for the catalytic converters to reach operating

		temperature
Service Repair Operation (number)	SRO	Number generated by Jaguar Methods & Techniques system which relates to the time allowed to complete a repair operation. Further information on the system can be found in the separate Jaguar Publications (for each model range) entitled 'Repair Operation Times'
Society of Automotive Engineers	SAE	
Timing/Coast Clutch Solenoid	T/CCS	
Torque Converter Clutch	TCC	

Transmission Control Indicator Lamp	TCIL	
Throttle Position	TP	
Top Dead Center	TDC	
Transmission Control Module	TCM	Controls the shifting pattern of the (automatic) transmission
Transmission Control Switch	TCS	Modifies the operation of electronically controlled transmissions
Transmission Fluid Temperature	TFT	Indicates temperature of transmission fluid
Transmission Range	TR	The range in which the transmission is operating
Turbine Shaft Speed	TSS	Indicates rotational speed of transmission output shaft or turbine shaft

Variable Assist Power Steering	VAPS	
Variable Camshaft Timing	VCT	A system by which the relationship of the crankshaft and camshaft may be altered during engine running
Vehicle Identification Number	VIN	Number assigned to the vehicle by the manufacturer, primarily for licensing and identification purposes
Vehicle Speed Sensor	VSS	Sensor which provides vehicle speed information
Worldwide Diagnostic System	WDS	Jaguar approved diagnostic system
Wide Open Throttle	WOT	Full throttle position

How To Use This Manual

Copyright Statement

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Workshop Manual Organization

This manual covers descriptive, diagnostic (including OBD), and repair aspects to service the vehicle effectively.

The manual is arranged in sections, each section dealing with a specific part of a vehicle system. For example, Section 412-03 [Air Conditioning] covers air conditioning, which is part of the climate control system.

The first digit of the section number indicates the group (in the above example this being Electrical). There are five groups:

- General Information.
- Chassis.
- Powertrain.
- Electrical.
- Body and Paint.

The second and third digits of the section number indicate the vehicle system (12 in the above example being Climate Control).

The last two digits of the section number indicate the part of the system covered by the section (03 in the example denotes Air Conditioning).

Important Safety Instructions

Safety Notice

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the safety of the person doing the work. This manual provides general directions for accomplishing service and repair work with tested effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the person doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in the manual must first establish that neither personal safety or vehicle integrity is compromised from choices of methods, tools or parts.

Road/Roller Testing

Road or roller testing may be carried out for various reasons and a procedure detailing pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test is given in this section.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system/s being checked can be extracted.

Pre - Test Checks



WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test checks, and functional tests of those systems/circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or roller test.

- Engine oil level
- Engine coolant level
- Tires, for correct pressure, compatible types and tread patterns, and wear within limits
- There is sufficient fuel in the tank to complete the test
- All around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test

Starting the Engine



CAUTION: On initial drive away from cold and within the first 1.5 km (1 mile), do not depress accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition switched off, check:

- The parking brake is applied
- The transmission selector lever is in Park
- All instrument gauges (except fuel gauge) read zero

With the ignition switched on, check:

- Ignition controlled warning lamps come on

- Engine coolant temperature gauge registers a reading compatible with the engine coolant temperature
- Fuel gauge registers a reading appropriate to the fuel level in the tank
- The operation of the parking brake and brake fluid level warning lamps

On Road or Roller Test Check:



CAUTION: If road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

- Initial gear engagement is smooth
- Parking brake control operates smoothly and the parking brake releases quickly and completely
- Transmission takes up the drive smoothly, without judder
- The engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation not stiff or heavy, and engine speed returns to idle correctly
- There is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions
- Steering operation, including power steering, is smooth, accurate, not excessively heavy or with excessive free play or vibration. Does not pull to one side and self centres smoothly after cornering
- Speedometer, oil pressure warning lamp, coolant temperature gauge and tachometer register the correct readings or operate correctly
- Switches and controls operate smoothly and positively, warning lamps operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position
- Heating and ventilation systems work correctly and effectively
- Brake operation and efficiency

Brake Testing



WARNING: When brake testing, avoid breathing the smoke or fumes from hot brakes, this may contain asbestos dust which is hazardous to health, see Health and Safety Precautions.

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.



CAUTION: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A disc which feels hot, or appreciably hotter than the others, indicates that the brake is binding.

After completion of the test, check for:

- Oil, coolant, hydraulic, air and fuel leaks
- Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission, axle etc., which might indicate over tightness or lack of lubrication

Solvents, Sealants and Adhesives



WARNING: Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.



CAUTION: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

The Solvents, Sealers and Adhesives subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken.

Adhesives and Sealers

Highly flammable, flammable, combustible – observe No Smoking policy.

Generally should be stored in No Smoking' areas. Cleanliness and tidiness in use should be observed e.g. disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

Solvent - based Adhesives/Sealers - See Solvents

Follow manufacturer's instructions.

Water - based Adhesives/Sealers

Those based on polymer emulsions and rubber latexes may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut - out and adequate extraction.

Resin - based Adhesives/Sealers e.g. Epoxide and Formaldehyde Resin - based

Mixing should be carried out in well ventilated areas, as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

Anaerobic, Cyanoacrylate (Super - glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and/or respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturer's instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and seek immediate medical attention. Do not attempt to pull tissue apart. Use in well ventilated areas as vapors can cause irritation to the nose and eyes.

For two - pack systems see Resin - based and Isocyanate Adhesives/Sealers.

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin - based Adhesives

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapor concentrations may result in adverse health effects.

Prolonged contact with the skin may lead to skin irritation and, in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapors and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

Standard Workshop Practices

Protecting the Vehicle

Always install covers to protect the fenders before commencing work in the engine compartment. Always install the interior protection kit, wear clean overalls and wash hands or wear gloves before working inside the vehicle. Avoid spilling hydraulic fluid, antifreeze or battery acid on the paintwork. In the event of spillage, wash off with water immediately. Use polythene sheets in the luggage compartment to protect carpets. Always use the recommended service tool, or a satisfactory equivalent, where specified. Protect temporarily exposed screw threads by replacing nuts or installing caps.

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

- The parking brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards
- If the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust fumes is installed
- There is adequate room to jack up the vehicle and remove the wheels, if necessary
- Fender covers are always installed if any work is to be carried out in the engine compartment
- The battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is jacked up



CAUTION: When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

- If using welding equipment on the vehicle, ensure a suitable fire extinguisher is readily available.

100-01 : Identification codes

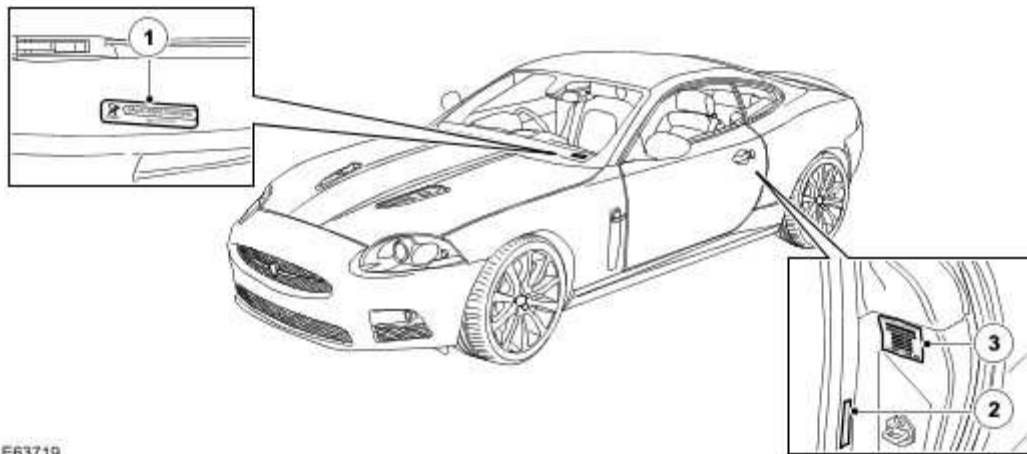
Description and operation

Identification Codes - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Vehicle Identification Number (VIN)

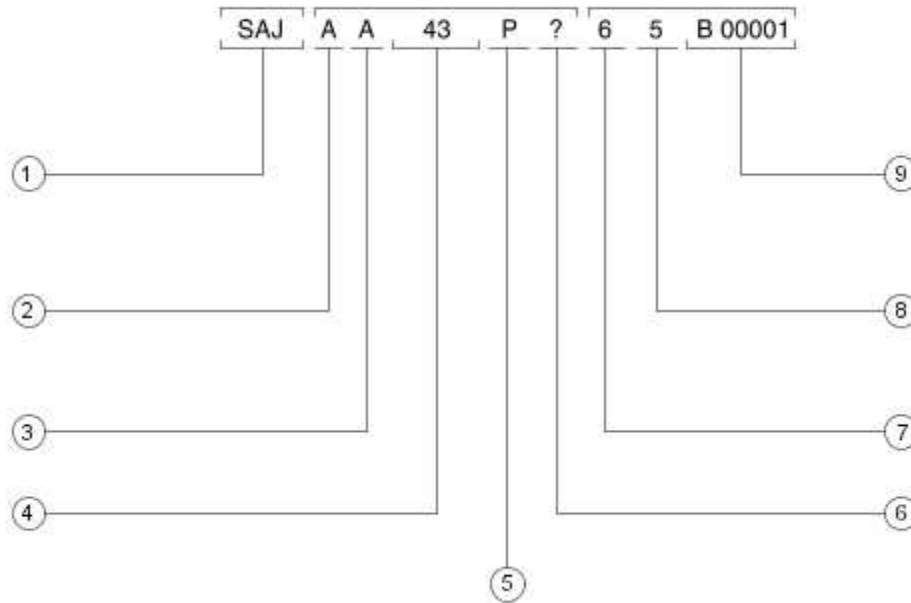
The official VIN for title and registration purposes is stamped on a metal plate and fastened to the instrument panel. It is positioned close on the left-hand side of the vehicle and is visible from the outside.

The vehicle identification number is also located on the vehicle certification label.



Item	Description
1	VIN plate
2	Bar code label (America)
3	Vehicle certification label (Europe/rest of world shown)

Vehicle Identification Number (Typical)



E63720

Item 1 - World Manufacturer Identifier

Codes	Manufacturer	Make	Type
SAJ	Jaguar Cars Limited, England	Jaguar	Passenger Car

Item 2 - Market, Air Bag Specification

VIN code	Description
A	Rest of the world with four air bags
D	USA with four air bags
F	Canada with four air bags
K	Japan with four air bags
P	Mexico with four air bags

Item 3 - Transmission, Steering Code

VIN Code	Description
A	Automatic LHS
C	Automatic RHS

Item 4 - Body Code

VIN Code	Description
43	X150 2 door Coupe
44	X150 2 door Convertible

Item 5 - Engine Emission System

VIN Code	Description
B	4.2L Naturally aspirated ULEV II
F	4.2L Naturally aspirated Stage 2
K	4.2L Naturally aspirated Stage 3
P	4.2L Naturally aspirated stage 4
U	4.2L Naturally aspirated Stage 2 (91 RON)
X	4.2L Naturally aspirated Stage 2 (E22 RON)

Item 6 - Check Digit

VIN Code	Description
0 - 9 or X	Calculated in accordance with American standard CFR part 565

Item 7 - Model Year

VIN Code	Description
6	2006 model year
7	2007 model year
8	2008 model year

Item 8 - Assembly Plant and Model Line

VIN Code	Description
5	Castle Bromwich 4.2L

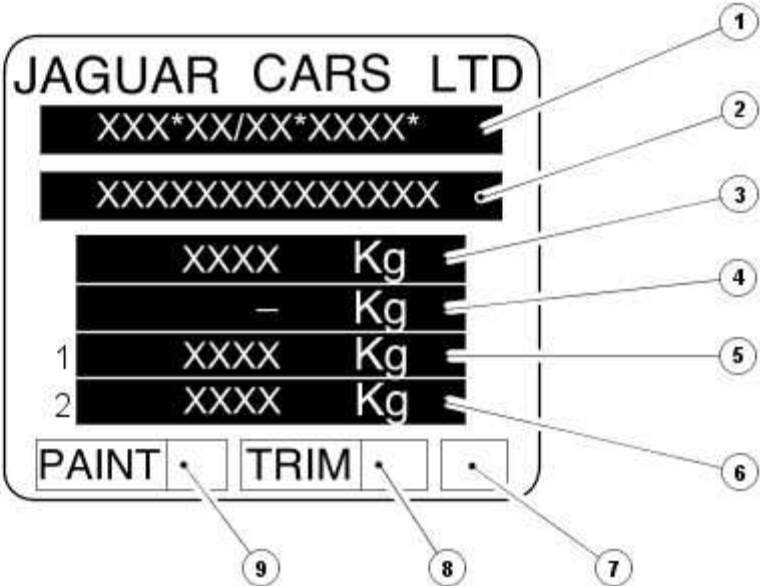
Item 9 - Production Sequence Number

Sequence Number
B00001 - B99999

Vehicle Certification Label

The vehicle certification label also contains the 17 character vehicle identification number.

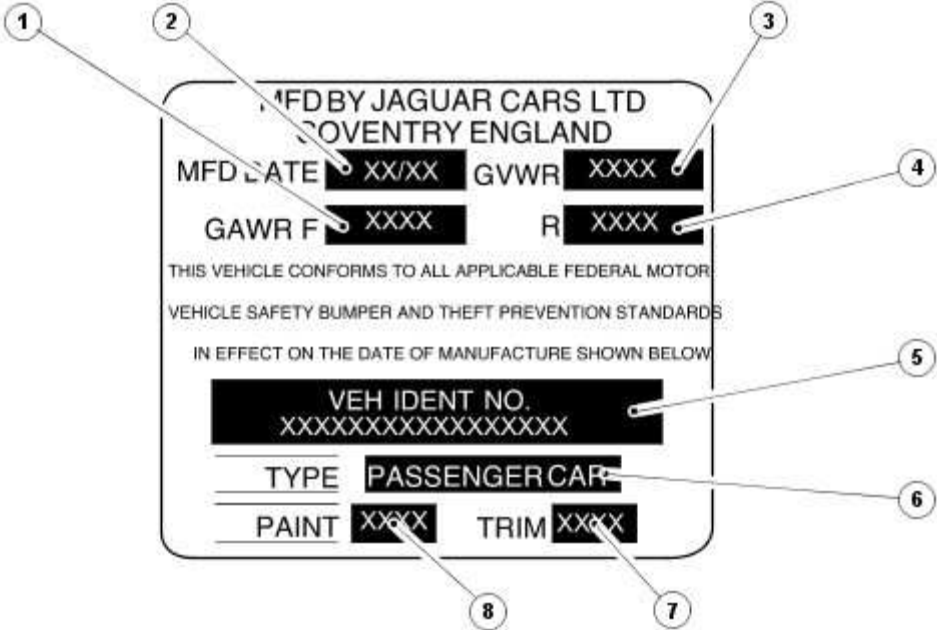
Vehicle Certification Label (Europe and Rest of the world)



E36533

Item	Description
1	Whole Vehicle Type Approval (WVTA) number printed here when applicable
2	Vehicle identification number
3	Gross vehicle weight
4	Gross train weight
5	Maximum permitted front axle loading
6	Maximum permitted rear axle loading
7	Date of manufacture
8	Interior trim code
9	Paint code

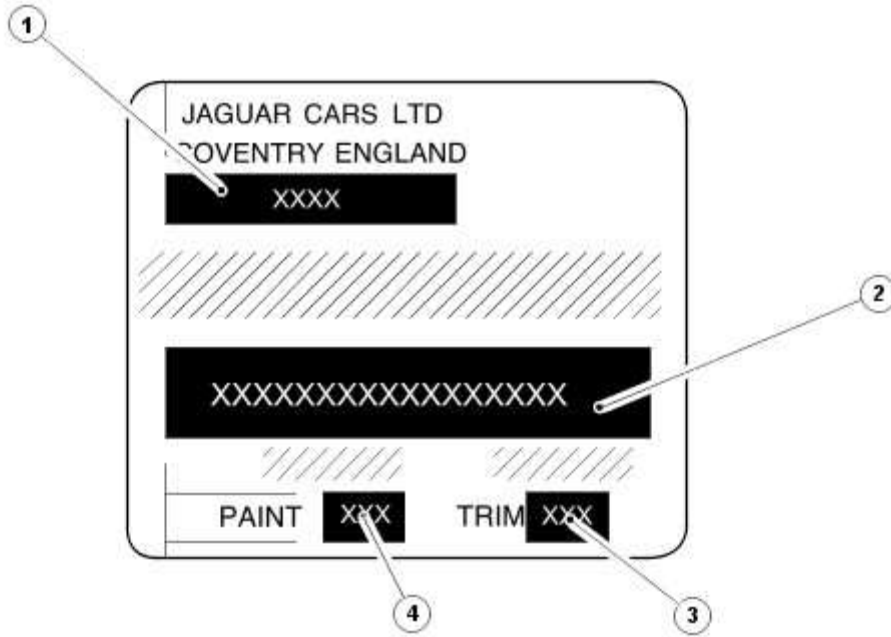
Vehicle Certification Label (North America)



E36534

Item	Description
1	Maximum permitted front axle loading
2	Date of manufacture
3	Maximum permitted rear axle loading
4	Gross vehicle weight
5	Vehicle identification number
6	Type
7	Interior trim code
8	Paint code

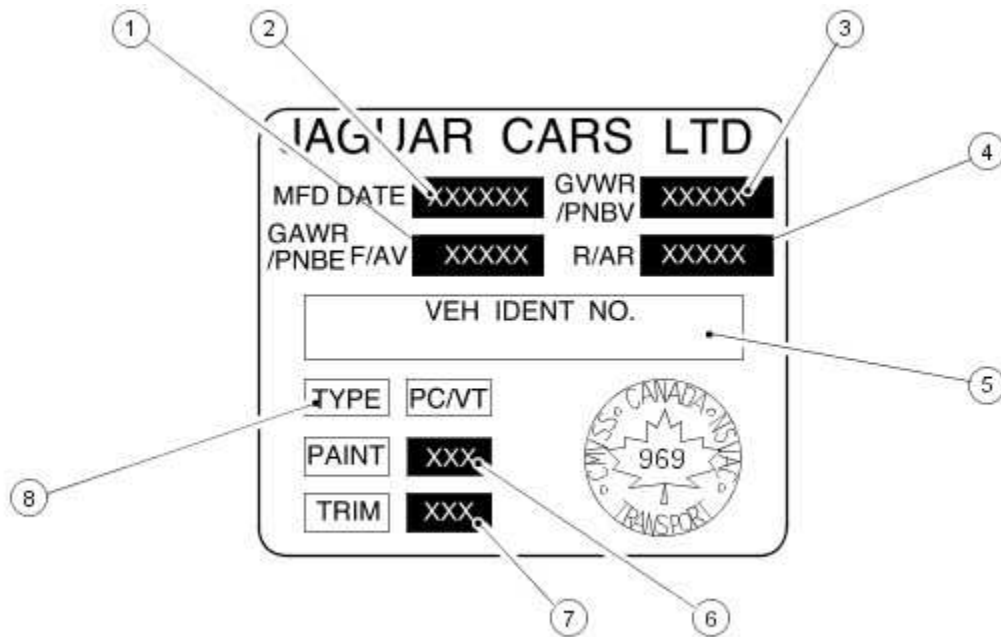
Vehicle Certification Label (Saudi Arabia and Gulf States)



E36535

Item	Description
1	Date of manufacture
2	Vehicle identification number
3	Interior trim code
4	Paint code

Vehicle Certification Label (Canada)



E36536

Item	Description
1	Maximum permitted front axle loading
2	Date of manufacture
3	Maximum permitted rear axle loading
4	Gross vehicle weight
5	Vehicle identification number
6	Paint code
7	Interior trim code
8	Type

Automatic Transmission Number

The serial number of the transmission unit is etched into the transmission casing.

Engine Number

The engine serial number is stamped on an engine web on the left-hand side of the cylinder block behind the engine mounting.

100-02 : Jacking and Lifting

Description and operation

Jacking

Safety Precautions




WARNING: The jack provided with the vehicle is intended to be used in an emergency for changing a deflated tire. To avoid damage to the vehicle, never use the jack to raise the vehicle for any other purpose. Refer to the Driver Handbook when using the jack supplied with the vehicle. Failure to follow these instructions may result in personal injury.


The following safety precautions must be observed when raising the vehicle to carry out service operations:


- Never rely on a jack alone to support a vehicle. Always use suitable vehicle stands to provide rigid support.
- When working beneath a vehicle, whenever possible use a vehicle hoist instead of a jack and vehicle stands.
- Make sure that the vehicle is standing on firm, level ground before using a jack.
- Do not rely on the parking brake alone; chock the wheels and put the automatic transmission into Park if possible.
- Check that any lifting equipment used has adequate capacity for the load being lifted and is in correct working order.

Lifting


Lifting Points—Two-Post Lift


 **CAUTION:** Do not allow the hoist adapters to contact the steering linkage, suspension arms, stabilizer bar, rear subframe stabilizer brackets or to compress the lower suspension arm stabilizer bar insulator. Damage to the suspension, exhaust and steering linkage components may occur if care is not exercised when positioning the hoist adapters of two-post lift prior to lifting the vehicle.

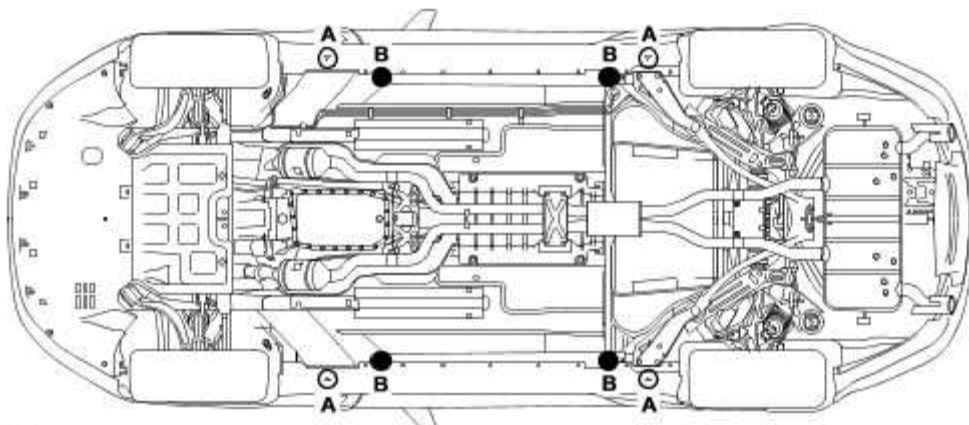
 **CAUTION:** Never use the rear axle as a lift point. Damage to the rear axle seals and bushes may occur.

 **CAUTION:** When using a two-post lift, a cushioned pad must be utilized to avoid body damage.

Lifting Points—Floor Jack and Axle Stands

 **CAUTION:** When using a floor jack, a cushioned pad must be utilized to avoid body damage.

 **CAUTION:** When using axle stands, a cushioned pad must be utilized to avoid damage to the body.



E64162

Item	Description
A	Jacking point
B	Axle stand positioning point

Vehicle Recovery

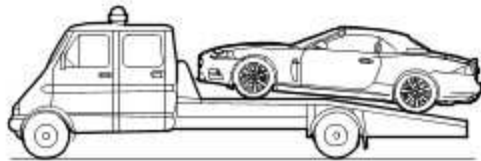
NOTE:

Prior to vehicle recovery, make sure the vehicle keys are available and the security system is disarmed.

Vehicle recovery methods are:

- By transporter or trailer
- Emergency towing

Transporter or Trailer Recovery



E64163

When the vehicle is being recovered by transporter or trailer:

- The parking brake must be applied and the wheels chocked
- The gear selector lever must be in Neutral. Do not select Park on automatic transmission vehicles, as the park lock mechanism may be damaged by the forward and backward rocking motion of the vehicle
- The vehicle must be securely tied down to the transporter or trailer

Emergency Towing



WARNING: If the engine is not running, the steering will become heavy and the force necessary to effectively apply the brakes will be greatly increased.



CAUTION: A vehicle with a defective transmission must be recovered by transporter or trailer.

When the vehicle is being towed on its own wheels:

- Local regulations for the towing of vehicles must be adhered to. In some countries the registration number of the towing vehicle and an 'On Tow' sign or warning triangle must be displayed at the rear of the towed vehicle
- The gear selector lever must be in Neutral
- The ignition switch must be in position II to release the steering lock and to allow for the operation of the direction indicators, horn and stop lamps
- A distance of 0,8 km (0.5 mile) must not be exceeded
- A speed of 48 km/h (30 mph) must not be exceeded
- The tow rope must be attached to the front towing

100-04 : Noise, Vibrations and Harshness

Description and operation

Noise, Vibration and Harshness (NVH)

Noise, vibration and harshness (NVH) is becoming more important as vehicles become more sophisticated and passenger comfort levels increase. This section is designed to aid in the diagnosis, testing and repair of NVH concerns.

- Noise is defined as sounds not associated with the operation of passenger compartment equipment that interface with customer satisfaction.
- Vibration is defined as impulses felt by the customer that are not caused by road surface changes.
- Harshness is a ride quality issue where the customer feels that the vehicle response to the road surface is sharply transmitted to the customer.

Diagnostic Theory

Diagnosis is more than just following a series of interrelated steps in order to find the solution to the specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also it is knowing how the system should work and whether it is working correctly.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition is usually found the first time through the system.

Know the System

- Know how the parts go together.
- Know how the system operates as well as its limits and what happens when the system goes wrong.
- Sometimes this means checking the system against one that is known to be working correctly.

Know the History of the System

A clue in any one of these areas may save time:

- How old or new is the system?
- What kind of treatment has it had?
- Has it been repaired in the past in such a manner that might relate to the present condition?
- What is the repair history?

Know the History of the Condition

- Did it start suddenly or appear gradually?
- Was it related to some other occurrence such as a collision or previous part renewal?
- Know how the condition made itself known; it may be an important clue to the cause.

Know the Probability of Certain Conditions Developing

- Look for the simple rather than the complex.
- For example: Electrical conditions usually occur at connections rather than components. An engine no-start is more likely to be caused by a loose wire or small adjustment rather than a sheared-off camshaft.
 - Electrical conditions usually occur at connections rather than components.
 - An engine no-start is more likely to be caused by a loose wire or small adjustment rather than a sheared-off camshaft.
- Know the difference between impossible and improbable. Certain failures in a system can be improbable but still happen.
- New parts are just that, new. It does not mean they are always good functioning parts.

Do Not Cure the Symptom and Leave the Cause

Lowering the pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original condition.

Be Positive the Cause is Found

- Double check the findings.
- What caused a worn component?
- A loose transmission or engine mount could indicate that other mounts are also loose.

Diagnostic Charts

Charts are a simple way of expressing the relationship between basic logic and a physical system of components. They help discover the cause of a condition in the least time. Diagnostic charts combine many areas of diagnosis into one visual display:

- probability of certain things occurring in a system
- speed of checking certain components or functions before others
- simplicity of carrying out certain tests before others
- elimination of checking huge portions of a system by carrying out simple tests
- certainty of narrowing down the search to a small portion before carrying out in-depth testing

The fastest way to find a condition is to work with the tools that are available. This means working with proven diagnostic charts and the correct special equipment for the system.

Noise, Vibration and Harshness (NVH)

Principle of Operation

For a detailed description of Noise, Vibration and Harshness issues, refer to the Description and Operation section of the workshop manual.

Noise, Vibration and Harshness (NVH)

Inspection and Verification

- 1 . Verify the customer's concerns by operating the vehicle to duplicate the condition.
- 2 . Visually inspect the vehicle to determine any obvious cause(s) of the concern(s).
- 3 . If the inspection reveals obvious causes that can be readily identified, repair as necessary.
- 4 . If the concern(s) remains after the inspection, determine the symptom(s) and refer to the Symptom Chart.

How To Use This Diagnostic Procedure Section

- Noise, vibration and harshness (NVH) concerns have become more important as vehicles have become more sensitive to these vibrations. This section is designed as an aid to identifying these situations
- The section provides diagnostic procedures based on symptoms. If the condition occurs at high speed, for instance, the most likely place to start is under High Speed Shake
- The road test procedure will tell how to sort the conditions into categories and how to tell a vibration from a shake
- A series of Road Test Quick Checks is provided to make sure that a cause is either pinpointed or eliminated
- Name the condition, proceed to the appropriate section and locate the correct diagnosis. When the condition is identified, the job is partly done
- Follow the diagnostic procedure as outlined
- Quick Checks are described within the step, while more involved tests and adjustments are outlined in General Procedures
- Always follow each step exactly and make notes to recall important findings later

Customer Interview

The road test and customer interview (if available) provide information that will help identify the concerns and will provide direction to the correct starting point for diagnosis.

Identify the Condition

NVH problems usually occur in a number of areas:

- tires
- engine accessories
- suspension
- driveline
- air leakage (wind noise)
- squeaks and rattles
- heating ventilation and air conditioning (HVAC)
- electrical (e.g. motor noise)
- transmission
- engine

It is important, therefore, that an NVH concern be isolated into its specific area(s) as soon as possible. The easiest and quickest way to do this is to carry out the Road Test as outlined.

Noise Diagnostic Procedure

Non-Axle Noise

The five most important sources of non-axle noise are exhaust, tires, roof racks, trim and mouldings, and transmission.

Therefore, make sure that none of the following conditions are the cause of the noise before proceeding with a driveline tear down and diagnosis.

- Under certain conditions, the pitch of the exhaust may sound very much like gear noise. At other times, it can be mistaken for a wheel bearing rumble
- Tires, especially snow tires, can have a high pitched tread whine or roar, similar to gear noise. Radial tires, to some degree, have this characteristic. Also, any non-standard tire with an unusual tread construction may emit a roar or whine type noise
- Trim and mouldings can also cause whistling or a whining noise
- Clunk may be a metallic noise heard when the automatic transmission is engaged in reverse or drive, or it may occur when the throttle is applied or released. It is caused by backlash somewhere in the driveline
- Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a damaged wheel bearing

Noise Conditions

- Gear noise is typically a howling or whining due to gear damage or incorrect bearing preload. It can occur at various speeds and driving conditions, or it can be continuous
- Chuckle is a particular rattling noise that sounds like a stick against the spokes of a spinning bicycle wheel. It occurs while decelerating from approximately 64 km/h (40 miles/h) and can usually be heard all the way to a stop. The frequency varies with vehicle speed

- Knock is very similar to chuckle, though it may be louder and occurs on acceleration or deceleration. The tear down will disclose what has to be corrected

Check and rule out tires, exhaust and trim items before disassembling the transmission to diagnose and correct gear noise.

The noises described under Road Test usually have specific causes that can be diagnosed by observation as the unit is disassembled. The initial clues are the type of noise heard on the road test and the driving conditions.

Vibration Conditions

NOTE:

New Constant Velocity (CV) joints should not be installed unless disassembly and inspection revealed unusual wear.

Clicking, popping or grinding noises may be caused by the following:

- Cut or damaged CV joint boots resulting in inadequate or contaminated lubricant in the outboard or inboard CV joint bearing housings
- Loose CV joint boot clamps
- Another component contacting the rear drive half shaft
- Worn, damaged or incorrectly installed wheel bearing, suspension or brake component

Vibration at highway speeds may be caused by the following:

- Out-of-balance front or rear wheels
- Out-of-round tires
- Driveline imbalance
- Driveline run-out (alignment)

NOTE:

Rear drive half shafts are not balanced and are not likely to contribute to rotational vibration disturbance.

Shudder or vibration during acceleration (including from rest) may be caused by the following:

- Driveline alignment
- Excessively worn or damaged outboard or inboard CV joint bearing housing
- Excessively high CV joint operating angles caused by incorrect ride height. Check ride height, verify correct spring rate and check items under Inoperative Conditions
- Excessively worn driveshaft components

Leakage Conditions

- 1 . Inspect the CV joint boots for evidence of cracks, tears or splits.
- 2 . Inspect the underbody for any indication of grease splatter in the vicinity of the rear drive half shaft, outboard and inboard CV joint boot locations, which is an indication of CV joint boot or CV joint boot clamp damage.
- 3 . Inspect the inboard CV joint bearing housing seal for leakage.

Inoperative Conditions

If a CV joint or rear drive half shaft pull-out occurs, check the following:

- suspension components for correct location, damage or wear
- bushings for wear
- subframe for damage
- bent or worn components Stabilizer bar link Left-hand rear suspension lower arm and bushing Right-hand rear suspension lower arm and bushing Rear wheel hub and rear drive half shaft

Road Test

A gear-driven unit will produce a certain amount of noise. Some noise is acceptable and may be audible at certain speeds or under various driving conditions as on a newly paved blacktop road. The slight noise is in no way detrimental and must be considered normal.

The road test and customer interview (if available) provide information needed to identify the condition and give direction to the correct starting point for diagnosis.

- 1 . Make notes throughout the diagnosis routine. Make sure to write down even the smallest piece of information, because it may turn out to be the most important.
- 2 . Do not touch anything until a road test and a thorough visual inspection of the vehicle have been carried out. Leave the tire pressures and vehicle load just where they were when the condition was first observed. Adjusting tire pressures, vehicle load or making other adjustments may reduce the conditions intensity to a point where it cannot be identified clearly. It may also inject something new into the system, preventing correct diagnosis.
- 3 . Make a visual inspection as part of the preliminary diagnosis routine, writing down anything that does not look right. Note tire pressures, but do not adjust them yet. Note leaking fluids, loose nuts and bolts, or bright spots where components may be rubbing against each other. Check the luggage compartment for unusual loads.
- 4 . Road test the vehicle and define the condition by reproducing it several times during the road

test.

5 . Carry out the Road Test Quick Checks as soon as the condition is reproduced. This will identify the correct diagnostic procedure. Carry out the Road Test Quick Checks more than once to verify they are providing a valid result. Remember, the Road Test Quick Checks may not tell where the concern is, but they will tell where it is not.

Road Test Quick Checks

1 . 24-80 km/h (15-50 miles/h): With light acceleration, a moaning noise is heard and possibly a vibration is felt in the front floor pan. It is usually worse at a particular engine speed and at a particular throttle setting during acceleration at that speed. It may also produce a moaning sound, depending on what component is causing it. Refer to Tip-In Moan in the Symptom Chart.

2 . Acceleration/deceleration: With slow acceleration and deceleration, a shake is sometimes noticed in the steering wheel/column, seats, front floor pan, front door trim panel or front end sheet metal. It is a low frequency vibration (around 9-15 cycles per second). It may or may not be increased by applying brakes lightly. Refer to Idle Boom/Shake/Vibration in the Symptom Chart.

3 . High speed: A vibration is felt in the front floor pan or seats with no visible shake, but with an accompanying sound or rumble, buzz, hum, drone or booming noise. Coast with the clutch pedal depressed or shift control selector lever in neutral and engine idling. If vibration is still evident, it may be related to wheels, tires, front brake discs, wheel hubs or front wheel bearings. Refer to High Speed Shake in the Symptom Chart.

4 . Engine rpm sensitive: A vibration is felt whenever the engine reaches a particular rpm. It will disappear in neutral coasts. The vibration can be duplicated by operating the engine at the problem rpm while the vehicle is stationary. It can be caused by any component, from the accessory drive belt to the torque converter which turns at engine speed when the vehicle is stopped. Refer to High Speed Shake in the Symptom Chart.

5 . Noise/vibration while turning: Clicking, popping, or grinding noises may be due to a worn, damaged, or incorrectly installed front wheel bearing, rear drive half shaft or CV joint.

6 . Noise/vibration that is road speed relative: This noise/vibration can be diagnosed independent of engine speed or gear selected (engine speed varies but torque and road speed remain constant). The cause may be a rear drive axle/differential whine.

Road Conditions

An experienced technician will always establish a route that will be used for all NVH diagnosis road tests. The road selected should be reasonably smooth, level and free of undulations (unless a particular condition needs to be identified). A smooth asphalt road that allows driving over a range of speeds is best. Gravel or bumpy roads are unsuitable because of the additional road noise produced. Once the route is established and consistently used, the road noise variable is eliminated from the

test results.

NOTE:

Some concerns may be apparent only on smooth asphalt roads.

If a customer complains of a noise or vibration on a particular road and only on a particular road, the source of the concern may be the road surface. If possible, try to test the vehicle on the same type of road.

Vehicle Preparation

Carry out a thorough visual inspection of the vehicle before carrying out the road test. Note anything which is unusual. Do not repair or adjust any condition until the road test is carried out, unless the vehicle is inoperative or the condition could pose a hazard to the technician.

After verifying the condition has been corrected, make sure all components removed have been installed.

Lift Test

After a road test, it is sometimes useful to do a similar test on a lift.

When carrying out the high-speed shake diagnosis or engine accessory vibration diagnosis on a lift, observe the following precautions:



WARNING: If only one drive wheel is allowed to rotate, speed must be limited to 55 km/h (35 miles/h) indicated on the speedometer since actual wheel speed will be twice that indicated on the speedometer. Speed exceeding 55 km/h (35 miles/h) or allowing the drive wheel to hang unsupported could result in tire disintegration, differential failure, constant velocity joint and drive half shaft failure, which could cause serious personal injury and extensive vehicle damage. Failure to follow these instructions may result in personal injury.



CAUTION: The suspension should not be allowed to hang free. When the CV joint is run at a very high angle, extra

vibration as well as damage to the seals and joints can occur.

The rear suspension lower arm should be supported as far outboard as possible. To bring the vehicle to its correct ride height, the full weight of the vehicle should be supported in the rear by floor jacks.

Jacking

Lifting

1 . Raise and support the vehicle.

Jacking

Lifting

2 . Explore the speed range of interest using the Road Test Quick Checks as previously described.

3 . Carry out a coast down in neutral. If the vehicle is free of vibration when operating at a steady indicated speed and behaves very differently in drive and coast, a transmission concern is likely.

Note, however, that a test on the lift may produce different vibrations and noises than a road test because of the effect of the lift. It is not unusual to find vibrations on the lift that were not found in the road test. If the condition found on the road can be duplicated on the lift, carrying out experiments on the lift may save a great deal of time.

Exhaust Neutralization Procedure

1 . Raise vehicle on lift and slacken all exhaust fixings.

2 . With all fixings loose, neutralize the exhaust system.

3 . Tighten all fixings to correct torque, starting at the rear-most point working towards the front of the vehicle.

Symptom Chart

High-speed shake

Possible Source(s):

- Wheel end vibration
- Engine/transmission
- Driveline

Action(s) to take:

- GO to Pinpoint Test G543314p1.

Tip-in moan

Possible Source(s):

- Air cleaner
- Power steering
- Powertrain
- Engine mounts
- Exhaust system

Action(s) to take:

- GO to Pinpoint Test G543314p2.

Idle boom/shake/vibration, or shudder

Possible Source(s):

- Cable(s)/hoses(s)
- Intake air distribution and filtering system
- Engine mounts
- Exhaust system
- Belt/pulleys

Action(s) to take:

- GO to Pinpoint Test G543314p3.

Wheel end vibration analysis

Possible Source(s):

- Suspension/rear drive halfshaft and CV joints
- Tires/wheels
- Wheel bearings
- CV joint boots

Action(s) to take:

- GO to Pinpoint Test G543314p4.

Non-axle noise

Possible Source(s):

- Trim/mouldings
- A/C system
- Accessories

Action(s) to take:

- GO to Pinpoint Test G543314p5.

Pinpoint Tests

NOTE:

These Pinpoint Tests are designed to take the technician through a step-by-step diagnosis procedure to determine the cause of a condition. It may not always be necessary to follow the chart to its conclusion. Carry out only the Pinpoint Test steps necessary to correct the condition. Then check operation of the system to

make sure the condition is corrected.

After verifying that the condition has been corrected, make sure all components removed have been installed.

PINPOINT TEST G543314p1 : HIGH-SPEED SHAKE

G543314t1 : NEUTRAL COAST

1. Carry out the neutral coast test.

- **Does the vibration disappear during the neutral coast test?**

-> **Yes**

CHECK and INSTALL new engine/transmission mounts as necessary. REPEAT Road Test as outlined.

-> **No**

GO to Pinpoint Test G543314t9.

PINPOINT TEST G543314p2 : TIP-IN MOAN

G543314t2 : CHECK THE AIR CLEANER

1. Check the air cleaner.

Check the air cleaner, inlet tube, outlet tube, resonators and all other components associated with the air induction system for correct installation and tightness of all connections.

- **Are the components OK?**

-> **Yes**

GO to Pinpoint Test G543314t3.

-> **No**

CORRECT the condition. REPEAT the Road Test as outlined.

G543314t3 : CHECK THE EXHAUST SYSTEM

1. Carry out the exhaust system neutralizing procedure in this section.

- **Is the exhaust system OK?**

-> **Yes**

GO to Pinpoint Test G543314t4.

-> **No**

REPAIR as necessary. RESTORE vehicle. REPEAT the Road Test as outlined.

G543314t4 : CHECK THE POWER STEERING

1. Remove the auxiliary drive belt and test for tip-in moan.

- **Is the tip-in moan OK?**

-> **Yes**

REPAIR the power steering as necessary. For additional information, refer to Power Steering

-> **No**

CHECK and INSTALL new engine/transmission mounts as necessary. REPEAT Road Test as outlined.

PINPOINT TEST G543314p3 : IDLE BOOM/SHAKE/VIBRATION/SHUDDER

G543314t5 : CHECK CABLE/HOSES

1. Check the engine compartment for any component that may be grounding between the engine and body or chassis. Example: air conditioning (A/C) hoses.

- **Are the components OK?**

-> **Yes**

GO to Pinpoint Test G543314t16.

-> **No**

CORRECT the condition. REPEAT the Road Test as outlined.

G543314t16 : CHECK INTAKE AIR DISTRIBUTION AND FILTERING SYSTEM

1. Check the intake air distribution and filtering system for loose/damaged components (primarily upstream of the Mass Air Flow (MAF) sensor).

- **Are the components OK?**

-> **Yes**

GO to Pinpoint Test G543314t6.

-> **No**

CORRECT the condition. REPEAT the road test as outlined.

G543314t6 : CHECK THE STEERING WHEEL DAMPER

1. Remove the driver air bag module and visually inspect the steering wheel damper for correct installation or any touch condition.

- **Is the damper OK?**

-> **Yes**

GO to Pinpoint Test G543314t7.

-> **No**

CORRECT the condition. REPEAT the Road Test as outlined.

G543314t7 : CHECK THE COOLING RADIATOR

1. Check the engine cooling radiator mountings and bushings for security and condition. Check the radiator installation for any component that may have a touch condition.

- **Are the installation and bushings OK?**

-> **Yes**

GO to Pinpoint Test G543314t8.

-> **No**

CORRECT the condition. REPEAT the Road Test as outlined.

G543314t8 : CHECK THE EXHAUST SYSTEM

1. Carry out the exhaust system neutralizing procedure in this section.

- **Is the exhaust system OK?**

-> **Yes**

CHECK and INSTALL new engine/transmission mounts as necessary. REPEAT Road Test as outlined.

-> **No**

REPAIR as necessary. REPEAT Road Test.

PINPOINT TEST G543314p4 : WHEEL END VIBRATION ANALYSIS

G543314t9 : INSPECT THE TIRES

1. Inspect the tires.

Raise and support the vehicle.

Lifting

Inspect the tires for:

Correct tire pressures

Correct tire size

Tire/wheel compatibility

Wear or damage

Tire beads correctly seated

- **Are the tires OK?**

-> **Yes**

GO to Pinpoint Test G543314t10.

-> **No**

REPAIR as necessary. REPEAT the Road Test as outlined.

G543314t10 : INSPECT WHEEL BEARINGS

1. Inspect the wheel bearings.

- **Are the wheel bearings OK?**

-> **Yes**

GO to Pinpoint Test G543314t11.

-> **No**

REPAIR as necessary. REPEAT the Road Test as outlined.

G543314t11 : INSPECT THE CONSTANT VELOCITY (CV) JOINT BOOTS

1. Inspect the CV joint boots.

Inspect for evidence of cracks, tears, splits or splattered grease

- **Are the CV joint boots OK?**

-> **Yes**

GO to Pinpoint Test G543314t12.

-> **No**

REPAIR as necessary. REPEAT the Road Test as outlined.

G543314t12 : INSPECT WHEEL AND TIRE RUNOUT

1. Inspect the wheel and tire runout.

- **Is the wheel and tire runout OK?**

-> **Yes**

Balance the wheels and tires. Refer to the wheel balance equipment manufacturers instructions.

-> **No**

REPAIR as necessary.

REPEAT the Road Test as outlined.

PINPOINT TEST G543314p5 : NON-AXLE NOISE

G543314t13 : INSPECT VEHICLE TRIM

1. Check the grille and trim mouldings to see if they are the source of the noise.

- **Are the vehicle trim components causing the noise?**

-> **Yes**

INSTALL new trim or REPAIR as necessary.

-> **No**

GO to Pinpoint Test G543314t14.

G543314t14 : CHECK THE A/C SYSTEM FOR NOISE

1. Check the A/C system components for noise by turning the A/C system on and off.

- **Is the A/C system causing the noise?**

-> **Yes**

Diagnose the A/C system.

Climate Control System

-> **No**

GO to Pinpoint Test G543314t15.

G543314t15 : CHECK NON-FACTORY ACCESSORIES

1. Inspect any accessories for being the source of the noise. Example: grounding body-to-frame, antennas, visors, bug deflectors and fog lights.

- **Are the accessories the cause of the noise?**

-> **Yes**

ADJUST, REPAIR or INSTALL new accessories or fasteners as required.

-> **No**

Verify the customer concern

2. CHASSIS

204 : Suspension

204-00 : Suspension system – General information

Specifications

Specifications

Wheel Alignment Specification - Front

All Right-Hand Drive and Japan without dynamics pack				
Item		LH	RH	Split LH-RH
Castor	Decimal degrees	$7.05^{\circ} \pm 0.75^{\circ}$	$6.51^{\circ} \pm 0.75^{\circ}$	$0.55^{\circ} \pm 0.75^{\circ}$
	Degrees/minutes	$7^{\circ} 3' \pm 45'$	$6^{\circ} 31' \pm 45'$	$0^{\circ} 33' \pm 45'$
Camber	Decimal degrees	$-0.7^{\circ} \pm 0.75^{\circ}$	$-0.3^{\circ} \pm 0.75^{\circ}$	$-0.4^{\circ} \pm 0.75^{\circ}$
	Degrees/minutes	$-0^{\circ} 42' \pm 45'$	$-0^{\circ} 18' \pm 45'$	$-0^{\circ} 24' \pm 45'$
Total toe	Decimal degrees	$0.17^{\circ} \pm 0.20^{\circ}$		
	Degrees/minutes	$0^{\circ} 10' \pm 12'$		

All Right-Hand Drive and Japan with dynamics pack				
Item		LH	RH	Split LH-RH
Castor	Decimal degrees	$7.28^{\circ} \pm 0.75^{\circ}$	$6.74^{\circ} \pm 0.75^{\circ}$	$0.55^{\circ} \pm 0.75^{\circ}$
	Degrees/minutes	$7^{\circ} 17' \pm 45'$	$6^{\circ} 44' \pm 45'$	$0^{\circ} 33' \pm 45'$
Camber	Decimal degrees	$-1.0^{\circ} \pm 0.75^{\circ}$	$-0.6^{\circ} \pm 0.75^{\circ}$	$-0.4^{\circ} \pm 0.75^{\circ}$
	Degrees/minutes	$-0^{\circ} 60' \pm 45'$	$-0^{\circ} 36' \pm 45'$	$-0^{\circ} 24' \pm 45'$
Total toe	Decimal degrees	$0.14^{\circ} \pm 0.20^{\circ}$		
	Degrees/minutes	$0^{\circ} 8' \pm 12'$		

USA, Canada, Mexico and Dominican Republic without dynamics pack				
Item		LH	RH	Split LH-RH

Castor	Decimal degrees	$6.78^\circ \pm 0.75^\circ$	$6.78^\circ \pm 0.75^\circ$	$0^\circ \pm 0.75^\circ$
	Degrees/minutes	$6^\circ 47' \pm 45'$	$6^\circ 47' \pm 45'$	$0^\circ 0' \pm 45'$
Camber	Decimal degrees	$-0.25^\circ \pm 0.75^\circ$	$-0.75^\circ \pm 0.75^\circ$	$0.5^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 15' \pm 45'$	$-0^\circ 45' \pm 45'$	$0^\circ 30' \pm 45'$
Total toe	Decimal degrees	$0.17^\circ \pm 0.20^\circ$		
	Degrees/minutes	$0^\circ 10' \pm 12'$		

USA, Canada, Mexico and Dominican Republic with dynamics pack

Item		LH	RH	Split LH-RH
Castor	Decimal degrees	$7.01^\circ \pm 0.75^\circ$	$7.01^\circ \pm 0.75^\circ$	$0^\circ \pm 0.75^\circ$
	Degrees/minutes	$7^\circ 1' \pm 45'$	$7^\circ 1' \pm 45'$	$0^\circ 0' \pm 45'$
Camber	Decimal degrees	$-0.55^\circ \pm 0.75^\circ$	$-1.05^\circ \pm 0.75^\circ$	$0.5^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 33' \pm 45'$	$-0^\circ 63' \pm 45'$	$0^\circ 30' \pm 45'$
Total toe	Decimal degrees	$0.14^\circ \pm 0.20^\circ$		
	Degrees/minutes	$0^\circ 8' \pm 12'$		

Rest of the World without dynamics pack

Item		LH	RH	Split LH-RH
Castor	Decimal degrees	$6.78^\circ \pm 0.75^\circ$	$6.78^\circ \pm 0.75^\circ$	$0^\circ \pm 0.75^\circ$
	Degrees/minutes	$6^\circ 47' \pm 45'$	$6^\circ 47' \pm 45'$	$0^\circ 0' \pm 45'$
Camber	Decimal degrees	$-0.4^\circ \pm 0.75^\circ$	$-0.6^\circ \pm 0.75^\circ$	$0.2^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 24' \pm 45'$	$-0^\circ 36' \pm 45'$	$0^\circ 12' \pm 45'$
Total toe	Decimal degrees	$0.17^\circ \pm 0.20^\circ$		
	Degrees/minutes	$0^\circ 10' \pm 12'$		

Rest of the World with dynamics pack

Item		LH	RH	Split LH-RH
Castor	Decimal degrees	$7.01^\circ \pm 0.75^\circ$	$7.01^\circ \pm 0.75^\circ$	$0^\circ \pm 0.75^\circ$
	Degrees/minutes	$7^\circ 1' \pm 45'$	$7^\circ 1' \pm 45'$	$0^\circ 0' \pm 45'$
Camber	Decimal degrees	$-0.7^\circ \pm 0.75^\circ$	$-0.9^\circ \pm 0.75^\circ$	$0.2^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 42' \pm 45'$	$-0^\circ 54' \pm 45'$	$0^\circ 12' \pm 45'$
Total toe	Decimal degrees	$0.14^\circ \pm 0.20^\circ$		
	Degrees/minutes	$0^\circ 8' \pm 12'$		

Wheel Alignment Specification - Rear

Naturally Aspirated (NA)			
Item		LH	RH
Camber	Decimal degrees	$-0.53^\circ \pm 0.75^\circ$	$-0.53^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 32' \pm 45'$	$-0^\circ 32' \pm 45'$
Toe	Decimal degrees	$0.125^\circ \pm 0.14^\circ$	$0.125^\circ \pm 0.14^\circ$
	Degrees/minutes	$0^\circ 7.5' \pm 8'$	$0^\circ 7.5' \pm 8'$
Total toe	Decimal degrees	$0.25^\circ \pm 0.20^\circ$	
	Degrees/minutes	$0^\circ 15' \pm 12'$	
Rear thrust angle	Decimal degrees	$0^\circ \pm 0.14^\circ$	
	Degrees/minutes	$0^\circ 0' \pm 8'$	

Supercharged (SC) without dynamics pack			
Item		LH	RH
Camber	Decimal degrees	$-0.63^\circ \pm 0.75^\circ$	$-0.63^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 38' \pm 45'$	$-0^\circ 38' \pm 45'$
Toe	Decimal degrees	$0.125^\circ \pm 0.14^\circ$	$0.125^\circ \pm 0.14^\circ$
	Degrees/minutes	$0^\circ 7.5' \pm 8'$	$0^\circ 7.5' \pm 8'$
Total toe	Decimal degrees	$0.25^\circ \pm 0.20^\circ$	
	Degrees/minutes	$0^\circ 15' \pm 12'$	
Rear thrust angle	Decimal degrees	$0^\circ \pm 0.14^\circ$	
	Degrees/minutes	$0^\circ 0' \pm 8'$	

Supercharged (SC) with dynamics pack			
Item		LH	RH
Camber	Decimal degrees	$-0.99^\circ \pm 0.75^\circ$	$-0.99^\circ \pm 0.75^\circ$
	Degrees/minutes	$-0^\circ 59' \pm 45'$	$-0^\circ 59' \pm 45'$
Toe	Decimal degrees	$0.125^\circ \pm 0.14^\circ$	$0.125^\circ \pm 0.14^\circ$
	Degrees/minutes	$0^\circ 7.5' \pm 8'$	$0^\circ 7.5' \pm 8'$
Total toe	Decimal degrees	$0.25^\circ \pm 0.20^\circ$	
	Degrees/minutes	$0^\circ 15' \pm 12'$	
Rear thrust angle	Decimal degrees	$0^\circ \pm 0.14^\circ$	
	Degrees/minutes	$0^\circ 0' \pm 8'$	

Vehicle ride height

	Front	Rear
--	--------------	-------------

Naturally aspirated (NA)	396 mm ± 15 mm	396 mm ± 15 mm
Supercharged (SC) without dynamics pack	394 mm ± 15 mm	393 mm ± 15 mm
Supercharged (SC) with dynamics pack	384 mm ± 15 mm	379 mm ± 15 mm

- All the above figures are measured at "kerb" height -all fluids at full and a full fuel tank.
- Tires must be inflated to normal pressure
- Rear thrust angle = (LH toe - RH toe) ÷ 2
- Ride height is measured from the centre of the wheel to the apex of the wheel arch, through the wheel centre line.

Front Toe Adjustment (57.65.01)



CAUTION: Make sure the vehicle is on a flat level surface.



CAUTION: Make sure the tire pressures are within specification.



CAUTION: Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



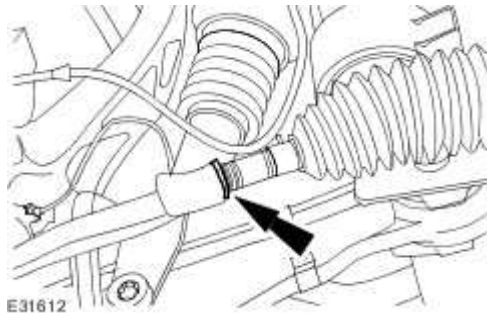
CAUTION: Make sure the steering is in the straight ahead position.

1. For wheel alignment information, refer to the suspension specification section.
2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
 - Adjust or repair any worn, damaged or incorrectly adjusted components.
3. Check and adjust tire pressures.

4. Position the vehicle on a calibrated, level, vehicle lift.
5. Release the vehicle parking brake.
6. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.
7. **NOTE:**

LH illustration shown, RH is similar.

To adjust, loosen the tie rod end lock nuts.



8.

 **CAUTION: Do not allow the gaiter to twist.**

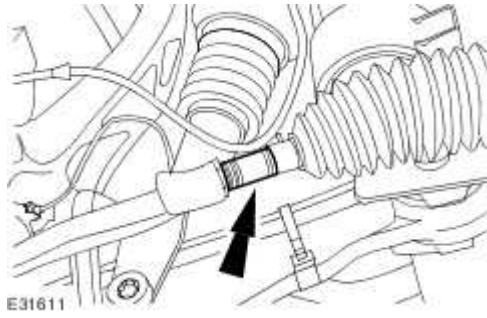
NOTE:

Both tie rods must be rotated by an equal amount.

NOTE:

LH illustration shown, RH is similar.

Adjust the front toe.



9. Tighten the tie rod end lock nuts to 55 Nm (40 lb.ft).

10. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.

Rear Toe Adjustment (57.65.08)



CAUTION: Make sure the vehicle is on a flat level surface.



CAUTION: Make sure the tire pressures are within specification.



CAUTION: Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



CAUTION: Make sure the steering is in the straight ahead position.

1. For wheel alignment information, refer to the suspension specification section.
2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
 - Adjust or repair any worn, damaged or incorrectly adjusted components.
3. Check and adjust tire pressures.
4. Position the vehicle on a calibrated, level, vehicle lift.

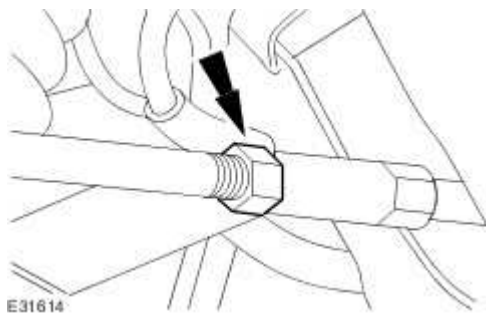
5. Release the vehicle parking brake.

6. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.

7. **NOTE:**

LH illustration shown, RH is similar.

To adjust, loosen the toe link locknuts.



8.

⚠ CAUTION: Do not allow the gaiter to twist.

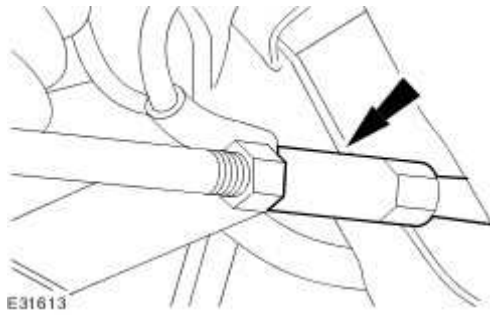
NOTE:

Both tie rods must be rotated by an equal amount.

NOTE:

LH illustration shown, RH is similar.

Adjust the rear toe.



9. Tighten the toe link locknuts to 55 Nm (40 lb.ft).

10. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.

Four-Wheel Alignment



CAUTION: Make sure the vehicle is on a flat level surface.



CAUTION: Make sure the tire pressures are within specification.



CAUTION: Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



CAUTION: Make sure the steering is in the straight ahead position.

1. For wheel alignment information, refer to the suspension specification section.
2. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
 - Adjust or repair any worn, damaged or incorrectly adjusted components.
3. Check and adjust tire pressures.
4. Position the vehicle on a calibrated, level, vehicle lift.

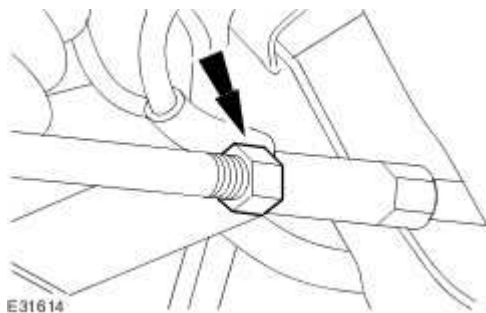
5. Release the vehicle parking brake.

6. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.

7. **NOTE:**

LH illustration shown, RH is similar.

To adjust, loosen the toe link locknuts.



8.

 **CAUTION: Do not allow the gaiter to twist.**

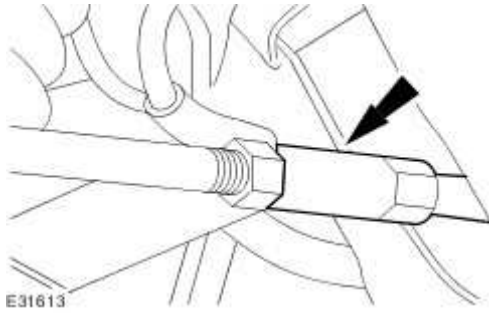
NOTE:

Both tie rods must be rotated by an equal amount.

NOTE:

LH illustration shown, RH is similar.

Adjust the rear toe.

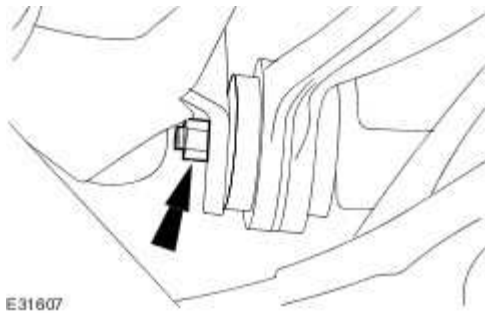


9. Tighten the toe link locknuts to 55 Nm (40 lb.ft).

10. **NOTE:**

LH illustration shown, RH is similar.

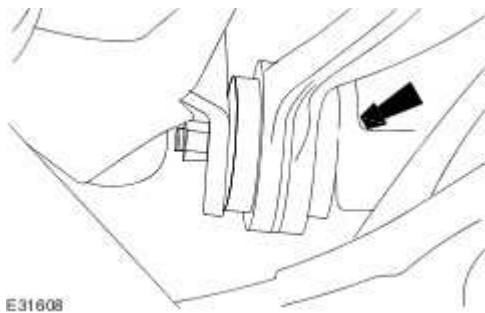
To adjust the caster, loosen the front lower arm lock nuts.



11. **NOTE:**

LH illustration shown, RH is similar.

Rotate the caster adjustment cam bolt.



12.

⚠ CAUTION: Make sure the caster adjustment bolt does not rotate while the lock nut is being tightened.

Tighten the caster adjustment cam bolt nut.

- Tighten the nut and bolt to 175 Nm (129 lb.ft).

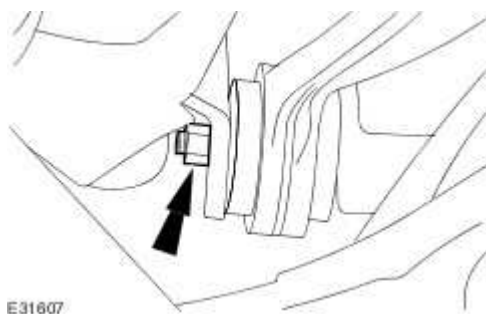
13.

⚠ CAUTION: Adjustments made to the camber setting will affect the front toe setting. Therefore , the camber and toe may need to be adjusted at the same time.

NOTE:

LH illustration shown, RH is similar.

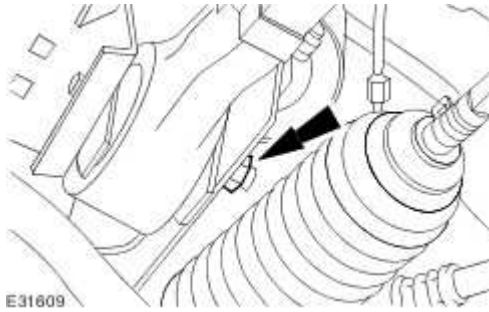
To adjust the camber, loosen the rear lower arm lock nuts.



14. NOTE:

LH illustration shown, RH is similar.

Rotate the camber adjustment cam bolt.



15.

! **CAUTION:** Make sure the camber adjustment bolt does not rotate while the lock nut is being tightened.

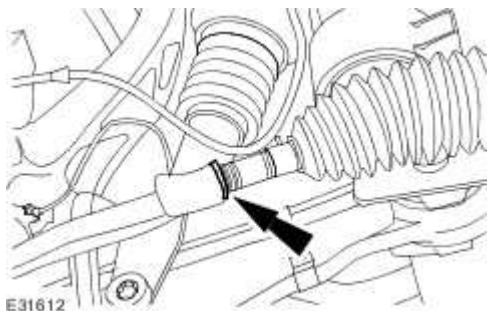
Tighten the camber adjustment cam bolt nut.

- Tighten the nut and bolt to 175 Nm (129 lb.ft).

16. **NOTE:**

LH illustration shown, RH is similar.

To adjust, loosen the tie rod end lock nuts.



17.

! **CAUTION:** Do not allow the gaiter to twist.

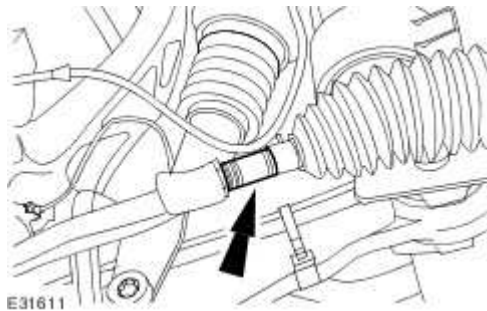
NOTE:

Both tie rods must be rotated by an equal amount.

NOTE:

LH illustration shown, RH is similar.

Adjust the front toe.



18. Tighten the tie rod end lock nuts to 55 Nm (40 lb.ft).

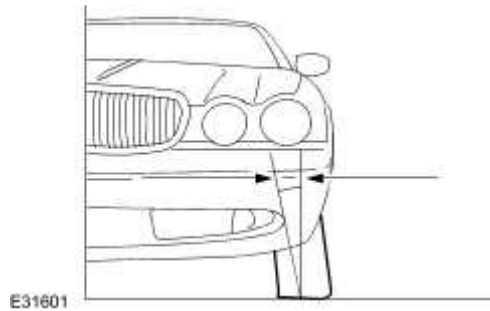
19. Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment.

Wheel Alignment Angles

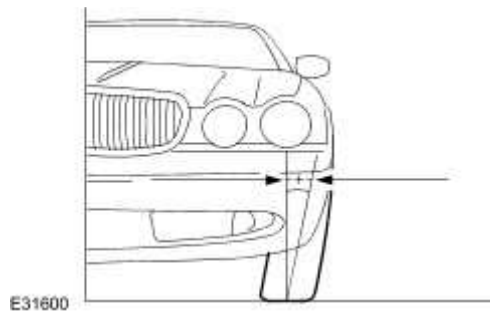
Camber, caster and toe are adjustable on the front suspension system. Only the toe is adjustable on the rear suspension system. Camber and caster are adjusted by means of eccentric cams on the lower arm mounting bolts. The front toe is adjusted by use of the front tie-rod. The rear toe is adjusted by the use of toe link assemblies connecting the knuckles to the rear sub-frame.

Camber

Negative Camber

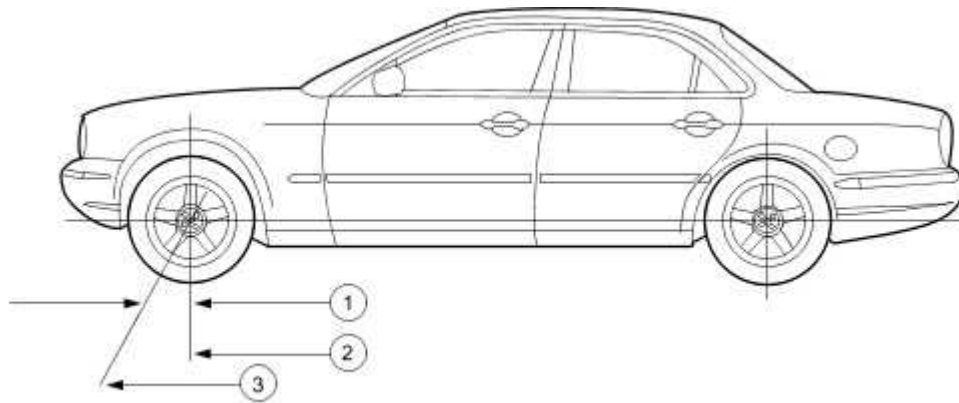


Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

Caster



E31602

Item	Description
1	Positive caster
2	True vertical
3	Steering axis

Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

Toe

Positive Toe (Toe-In)



E31603

Negative Toe (Toe-Out)



The vehicle toe setting:

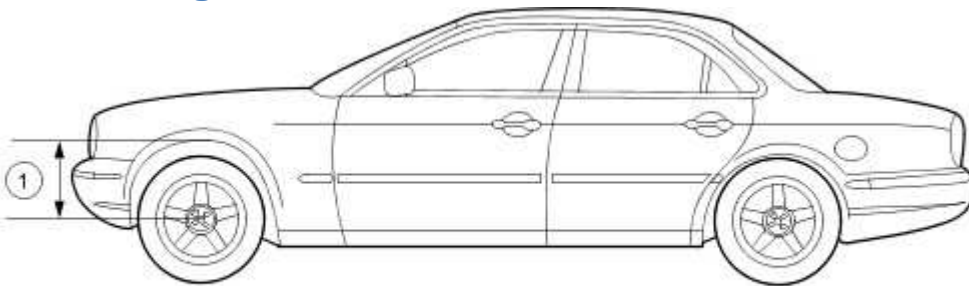
- affects tire wear and directional stability.

Ride Height

NOTE:

All ride height measurements are carried out with vehicle empty and 9 liters of fuel in the tank (showroom condition). The vehicle must be driven above 40 km/h (25 miles/hour) for a minimum of five minutes to make sure that the reservoir is full.

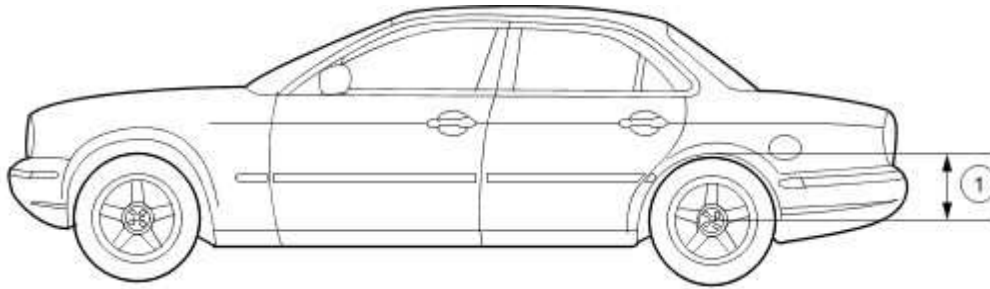
Front Ride Height Measurement



E31605

Item	Description
1	Ride height

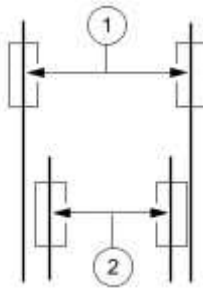
Rear Ride Height Measurement



E31606

Item	Description
1	Ride height

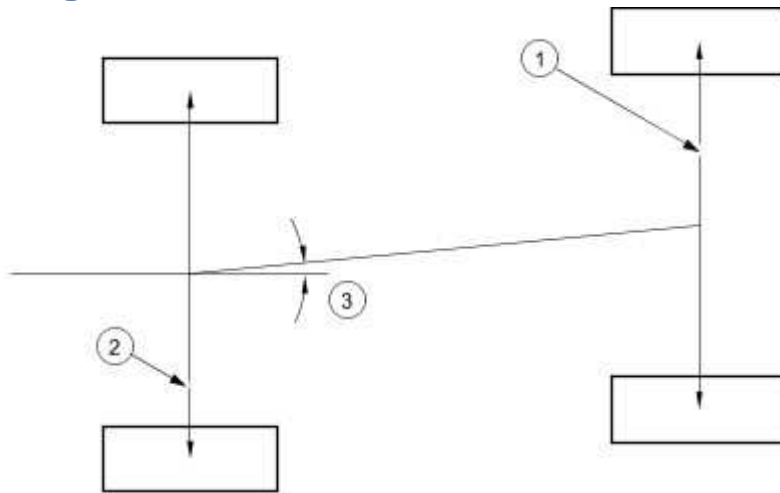
Wheel Track



A0001102

Item	Description
1	Front track
2	Rear track

Crabbing



E31475

Item	Description
1	Front track
2	Rear track
3	Crabbing angle

Crabbing is the condition in which the independent rear suspension (IRS) system is not square to the chassis. Heavily crowned roads can give the illusion of crabbing.

Wander

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

Shimmy

Shimmy, as observed by the driver, is rotational oscillations of the steering wheel which may come and go over time, generally resulting from wheel and tire imbalances.

Shimmy can be experienced at any speed but generally between 80 to 145 km/h (50 to 90 miles/hour) and is most often experienced on smooth roads at steady speeds.

Nibble

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces or brake disc irregularity and observed by the driver as small rotational oscillations of the steering wheel.

Poor Returnability of the Steering

Poor returnability of the steering is used to describe the poor return of the steering wheel to center after a turn or the steering correction is completed.

Drift/Pull

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (i.e., wind, road crown).

Vague On-Center Feel

Vague on-center feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center".

- In the diagnosis of a roadability problem, it is important to understand the difference between wander and vague on-center feel.

Suspension System

Principle of Operation

For a detailed description of the suspension system, refer to the relevant Description and Operation section of the workshop manual.

Wheel Alignment Angles

Inspection and Verification

1 . Verify the customer's concern by carrying out a road test on a smooth road. If any vibrations are apparent, refer to

Noise, Vibration and Harshness (NVH)

2 . Visually inspect for obvious signs of damage and system integrity.

Visual Inspection Chart

Mechanical
<ul style="list-style-type: none">• Damaged tires• Wheel bearing(s)• Loose or damaged front or rear suspension components• Loose, damaged or missing suspension fastener(s)• Incorrect spring usage• Damaged or sagging spring(s)• Damaged or leaking shock absorber(s)• Damaged or leaking strut(s)• Worn or damaged suspension bushing(s)• Loose, worn or damaged steering system components• Damaged axle components

1 . If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the next step.

2 . If the fault is not visually evident, verify the symptom and refer to the following Symptom Chart.

Symptom Chart

Crabbing

Possible Source(s):

- Incorrect rear thrust angle.

Action(s) to take:

- CHECK the rear toe adjustment.
Specifications
Rear Toe Adjustment (57.65.08)

Possible Source(s):

- Front or rear suspension components.

Action(s) to take:

- INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary.
Front Suspension
Rear Suspension

Possible Source(s):

- Drive axle damaged.

Action(s) to take:

- INSTALL a new rear drive axle/differential.
Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug (51.25.13)

Drift/Pull

Possible Source(s):

- Unequal tire pressure.

Action(s) to take:

- CHECK and ADJUST the tire pressures. INSPECT the tire for excessive wear.
Specifications

Possible Source(s):

- Incorrect wheel alignment.

Action(s) to take:

- CHECK and ADJUST the wheel alignment. Specifications

Possible Source(s):

- Tires.

Action(s) to take:

- CHECK and ADJUST the tire pressures. INSPECT the tire for excessive wear. Specifications

Possible Source(s):

- Unevenly loaded or overloaded vehicle.

Action(s) to take:

- NOTIFY the customer of incorrect vehicle loading.

Possible Source(s):

- Damaged steering components.

Action(s) to take:

- CHECK the steering system.
Steering System

Possible Source(s):

- Brake drag.

Action(s) to take:

- CHECK the brakes.
Brake System

Front Bottoming or Riding Low

Possible Source(s):

- Coil springs.

Action(s) to take:

- CHECK the ride height. INSTALL new springs as necessary.

Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(60.30.04)

Incorrect Tire Wear

Possible Source(s):

- Incorrect tire pressure (rapid center rib or inner and outer edge wear).

Action(s) to take:

- CHECK and ADJUST the tire pressure. INSPECT the tire for excessive wear.
Specifications

Possible Source(s):

- Excessive front or rear toe (rapid inner or outer edge wear).

Action(s) to take:

- CHECK and ADJUST the wheel alignment.
Front Toe Adjustment (57.65.01)

Possible Source(s):

- Excessive negative or positive camber (rapid inner or outer edge wear).

Action(s) to take:

- CHECK and ADJUST the wheel alignment.
Four-Wheel Alignment

Possible Source(s):

- Tires out of balance (tires cupped or dished).

Action(s) to take:

- BALANCE the tires.

Rough ride

Possible Source(s):

- Spring(s)

Action(s) to take:

- Check and install new spring(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Shimmy or Wheel Tramp

Possible Source(s):

- Loose wheel nut(s).

Action(s) to take:

- CHECK and TIGHTEN the wheel nuts to specification.
Specifications

Possible Source(s):

- Loose front suspension fasteners.

Action(s) to take:

- CHECK and TIGHTEN the suspension fasteners to specification.
Specifications

Possible Source(s):

- Front wheel bearing(s).

Action(s) to take:

- CHECK the wheel bearings.
Front Wheel Bearing and Wheel Hub (60.25.03)

Possible Source(s):

- Worn or damaged suspension component bushing.

Action(s) to take:

- CHECK and INSTALL new components as necessary.
Rear Lower Arm Bushing (60.35.56)
Shock Absorber Bushing (60.30.16)
Stabilizer Bar Link Bushing (60.10.03)

Possible Source(s):

- Wheel/tires.

Action(s) to take:

- CHECK the wheels/tires. BALANCE or INSTALL new wheel/tires as necessary.
Wheel and Tire (74.20.05)

Possible Source(s):

- Loose, worn or damaged ball joint(s).

Action(s) to take:

- CHECK the Ball Joint(s).
Front Suspension

Possible Source(s):

- Loose, worn or damaged steering components.

Action(s) to take:

- CHECK and INSTALL new components as necessary.

Possible Source(s):

- Front wheel alignment.

Action(s) to take:

- CHECK and ADJUST the wheel alignment.
Front Toe Adjustment (57.65.01)

Possible Source(s):

- Shock absorber(s).

Action(s) to take:

- CHECK and INSTALL new shock absorber(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Possible Source(s):

- Spring(s).

Action(s) to take:

- CHECK and INSTALL new springs as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Poor self center action of the steering

Possible Source(s):

- Ball joints.

Action(s) to take:

- CHECK the Ball Joints.
Suspension System

Possible Source(s):

- Steering components.

Action(s) to take:

- CHECK and INSTALL new components as necessary.

Steering wheel off-center

Possible Source(s):

- Unequal front or rear toe settings.

Action(s) to take:

- CHECK and ADJUST the wheel alignment.
Front Toe Adjustment (57.65.01)
Rear Toe Adjustment (57.65.08)

Possible Source(s):

- Steering components.

Action(s) to take:

- CHECK and INSTALL new components as necessary.

Sway or roll

Possible Source(s):

- Overloaded, unevenly or incorrectly loaded vehicle.

Action(s) to take:

- NOTIFY the customer of incorrect vehicle loading.

Possible Source(s):

- Loose wheel nut(s).

Action(s) to take:

- CHECK and TIGHTEN the wheel nut(s) to specification.
Specifications

Possible Source(s):

- Coil spring(s).

Action(s) to take:

- CHECK and INSTALL new coil springs as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(60.30.04)

Possible Source(s):

- Loose front stabilizer bar or rear stabilizer bar.

Action(s) to take:

- CHECK and TIGHTEN the stabilizer bar to specification.
Specifications
Specifications

Possible Source(s):

- Worn lower suspension arm stabilizer bar insulators.

Action(s) to take:

- INSTALL new lower suspension arm stabilizer bar as necessary.
Front Stabilizer Bar Link - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(60.10.02)

Rear Stabilizer Bar Link (64.35.24)

Possible Source(s):

- Shock absorber(s).

Action(s) to take:

- CHECK and INSTALL new shock absorber(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Vehicle Leans to One Side

Possible Source(s):

- Unevenly loaded or overloaded vehicle.

Action(s) to take:

- NOTIFY the customer of incorrect vehicle loading.

Possible Source(s):

- Front or rear suspension components.

Action(s) to take:

- INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary.

Possible Source(s):

- Shock absorber(s).

Action(s) to take:

- CHECK and INSTALL new shock absorber(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Possible Source(s):

- Coil spring(s).

Action(s) to take:

- CHECK and INSTALL new spring(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Possible Source(s):

- Incorrect ride height. Lateral tilt out of specification.

Action(s) to take:

- CHECK the ride height. INSTALL new spring(s) as necessary.
Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Vibration/Noise

Possible Source(s):

- Tires/wheels.
- Wheel bearings.
- Wheel hubs.
- Brake components.
- Suspension components.
- Steering components.

Action(s) to take:

- CHECK and INSTALL new components as necessary.
Noise, Vibration and Harshness (NVH)

Wander

Possible Source(s):

- Unevenly loaded or overloaded vehicle.

Action(s) to take:

- NOTIFY the customer of incorrect vehicle loading.

Possible Source(s):

- Ball joint(s).

Action(s) to take:

- CHECK the Ball Joint(s).
Suspension System

Possible Source(s):

- Front wheel bearing(s).

Action(s) to take:

- CHECK the wheel bearings.

Possible Source(s):

- Loose, worn or damaged suspension components.

Action(s) to take:

- CHECK and INSTALL new suspension components as necessary.

Possible Source(s):

- Loose suspension fasteners.

Action(s) to take:

- CHECK and TIGHTEN the suspension fasteners to specification.
Specifications
Specifications

Possible Source(s):

- Steering components.

Action(s) to take:

- CHECK and INSTALL new steering components.

Possible Source(s):

- Wheel alignment (excessive total front toe-out).

Action(s) to take:

- CHECK and ADJUST the wheel alignment.
Specifications
Front Toe Adjustment (57.65.01)

Component Tests

Ball Joint Inspection

NOTE:

The front suspension is shown in the following procedures. The inspection of the rear suspension upper ball joint is similar.

1 . Raise and support the vehicle.

Lifting

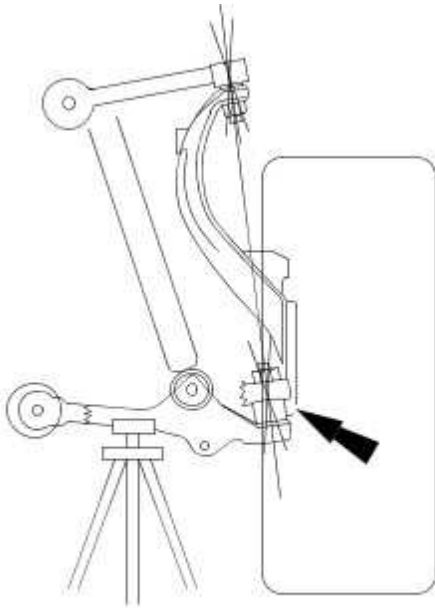
2 . Prior to carrying out any inspection of the ball joints, inspect the front wheel bearings.

3 .



CAUTION: The safety stand beneath the suspension lower arm must only support the weight of the suspension and not the full weight of the vehicle. Failure to follow this instruction may result in damage to the components.

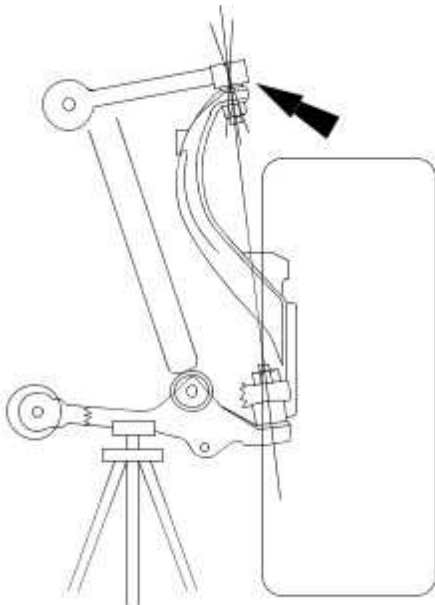
Position a safety stand beneath the front suspension lower arm or rear suspension lower arm to be tested.



VUJ0005101

4 . While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the front suspension lower arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new wheel knuckle as necessary.

Wheel Knuckle (60.25.23)



VUJ0005100

5 . While an assistant pulls and pushes the top and bottom of the tire, observe the relative movement between the ball joint and the

front suspension upper arm or rear suspension upper arm. Any movement at or exceeding the specification indicates a worn or damaged ball joint. Install a new upper arm as necessary.

**Upper Arm LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(60.35.41)**

**Upper Arm RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(60.35.42)**

Upper Arm (64.25.31)

6 . Remove the safety stand.

7 . Lower the vehicle.

204-01 : Front suspension

Specifications

Specifications

Torque Specifications



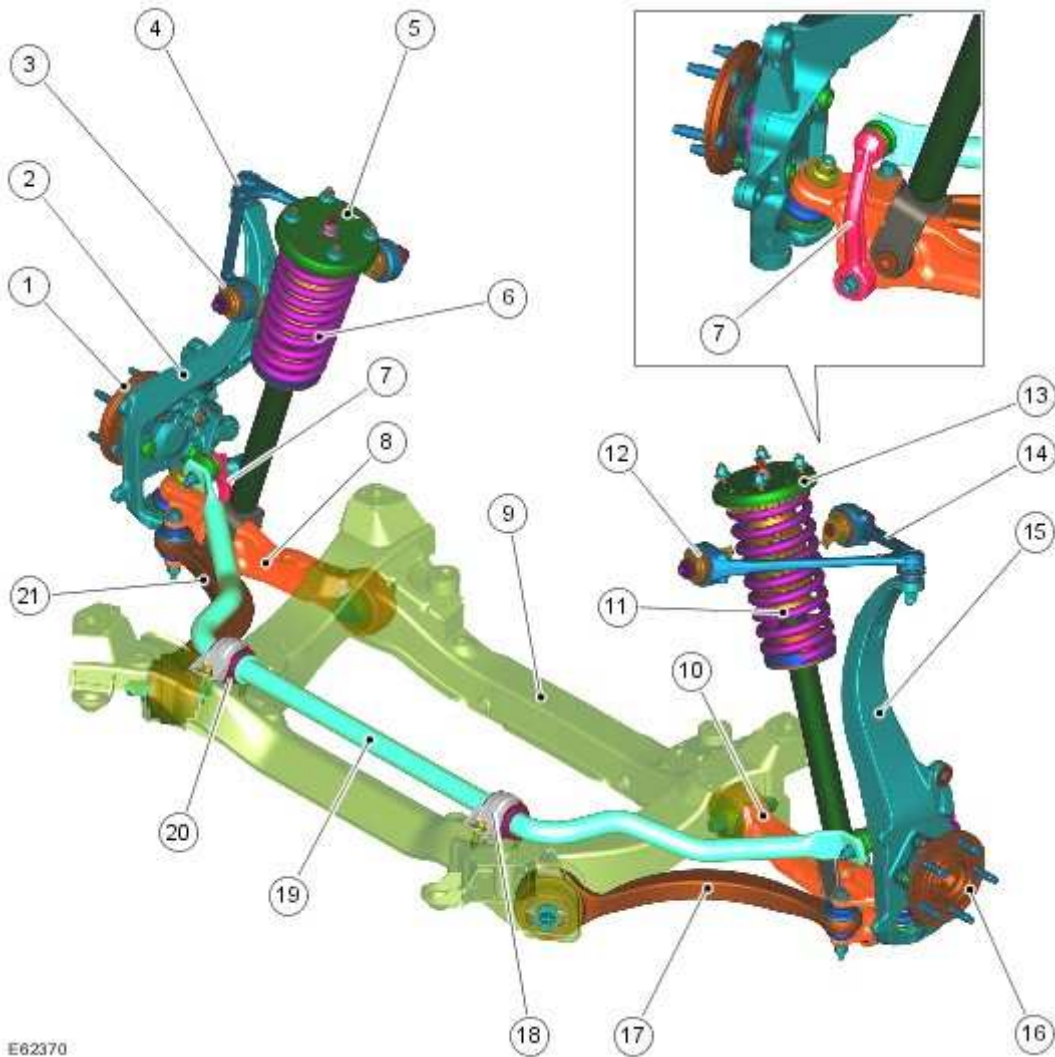
CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

Description	Nm	lb-ft
Front lower arm to rear lower arm - nut *:		
Stage 1	60	44
Stage 2	135 degrees in clockwise direction	135 degrees - clockwise direction
Front lower arm to subframe - nut *	175	129
Rear lower arm to subframe - nut *	175	129
Rear lower arm to wheel knuckle ball joint - nut *	92	68
Shock absorber to spring - nut:		
Active shock absorber	50	37
Passive shock absorber	27	20
Shock absorber and spring assembly to lower arm - bolt	175	129
Shock absorber and spring assembly to top mount - nuts	27	20
Stabilizer bar clamp to subframe - bolt	55	40
Stabilizer bar link to lower arm - nut *	70	52
Stabilizer bar link to stabilizer bar - nut *	43	32
Upper arm ball-joint - nut *	90	66
Upper arm to subframe brackets - nut *	60	44
Wheel bearing and hub assembly to wheel knuckle - bolts *	90	66

* New nut/bolt must be installed.

Front Suspension

COMPONENT LOCATION



E62370

Item	Part Number	Description
1		Right Hand (RH) wheel hub and bearing assembly
2		RH wheel knuckle
3		Upper control arm bush (2 off)
4		RH upper control arm

5		RH top mount plate
6		RH damper and spring assembly
7		Stabilizer link
8		RH lower lateral control arm
9		Front subframe
10		Left Hand (LH) lower lateral control arm
11		LH damper and spring assembly
12		Upper control arm bush (2 off)
13		LH top mount plate
14		LH upper control arm
15		LH wheel knuckle
16		LH wheel hub and bearing assembly
17		LH lower control arm
18		Mounting bracket (2 off)
19		Stabilizer bar
20		Stabilizer bar bush (2 off)
21		RH lower control arm

INTRODUCTION

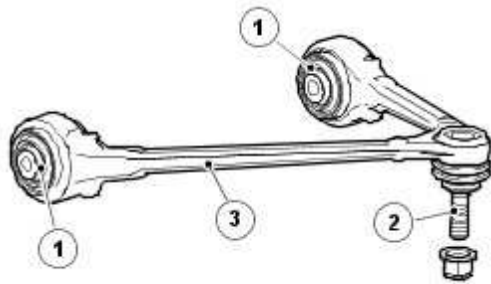
The front suspension is a fully independent design. The front suspension components are attached to the front subframe and the vehicle body. The subframe is attached to the vehicle body with four long bolts which pass through bushes located in the subframe.

The front suspension on each side comprises:

- Upper control arm
- Lower lateral control arm
- Lower control arm
- Wheel knuckle and hub assembly

- Stabilizer bar
- Spring and damper module.

UPPER CONTROL ARM



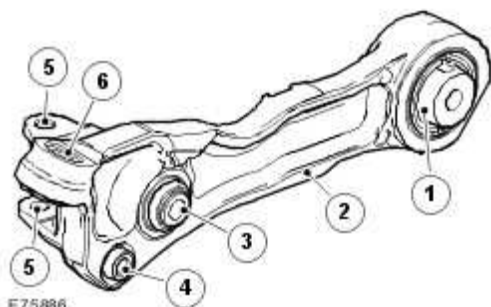
E75885

Item	Part Number	Description
1		Bush (2 off)
2		Ball joint and locknut
3		Upper control arm

The forged aluminum upper control arm is a wishbone design with three mounting points. The two inner mounting points are fitted with bushes. The outer mounting is fitted with a ball joint which locates in a hole in the wheel knuckle and is secured with a locknut.

The inclination of the upper control arm axis provides an anti-dive and anti-squat action during vehicle braking and acceleration and also improves castor trail which in turn improves steering 'feel'.

LOWER LATERAL CONTROL ARM



E75886

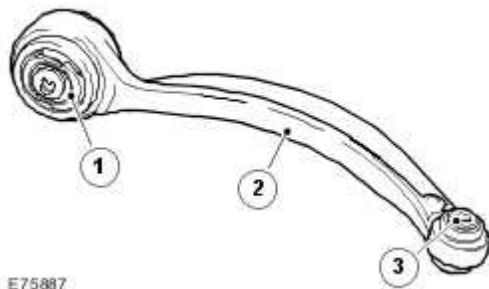
Item	Part Number	Description
1		Bush - subframe attachment
2		Lower lateral control arm

3		Damper module attachment
4		Insert - stabilizer link attachment
5		Lower control arm attachment
6		Wheel knuckle attachment

The forged aluminum lower lateral control arm is fitted with a bush in its inner end which locates between brackets on the subframe. The arm is secured with an eccentric bolt, an eccentric washer and a locknut which allow for the adjustment of the suspension camber geometry.

The outer end of the control arm has a tapered hole which locates on a ball joint fitted to the wheel knuckle. Two cast brackets on the forward face of the control arm allow for the attachment of the lower control arm. A threaded insert is fitted behind the two cast brackets and provides for the attachment of the stabilizer link with a bolt. A bush is fitted to a cross-holes in the control arm which provides the locations for the forked attachment of the damper module.

LOWER CONTROL ARM



Item	Part Number	Description
1		Hydrabush
2		Lower control arm
3		Spherical bearing

The cast lower control arm is fitted with a hydrabush in its inner end which locates between brackets on the subframe. The arm is secured with an eccentric bolt, an eccentric washer and a locknut which allow for adjustment of the castor and camber geometry.

The outer end of the control arm is fitted with a spherical bearing and locates between the cast brackets on the lower lateral control arm. The lower lateral control arm and lower control arm together form a wishbone design.

WHEEL KNUCKLE



Item	Part Number	Description
1		Upper control arm attachment
2		Ball joint locknut
3		
4		Bolt - Hub attachment (2 off)
5		Torx bolt - Hub attachment (2 off)
6		Steering tie rod ball joint attachment
7		Disc shield attachment
8		Ball joint - lower lateral arm attachment
9		Wheel hub and bearing assembly
10		Wheel knuckle

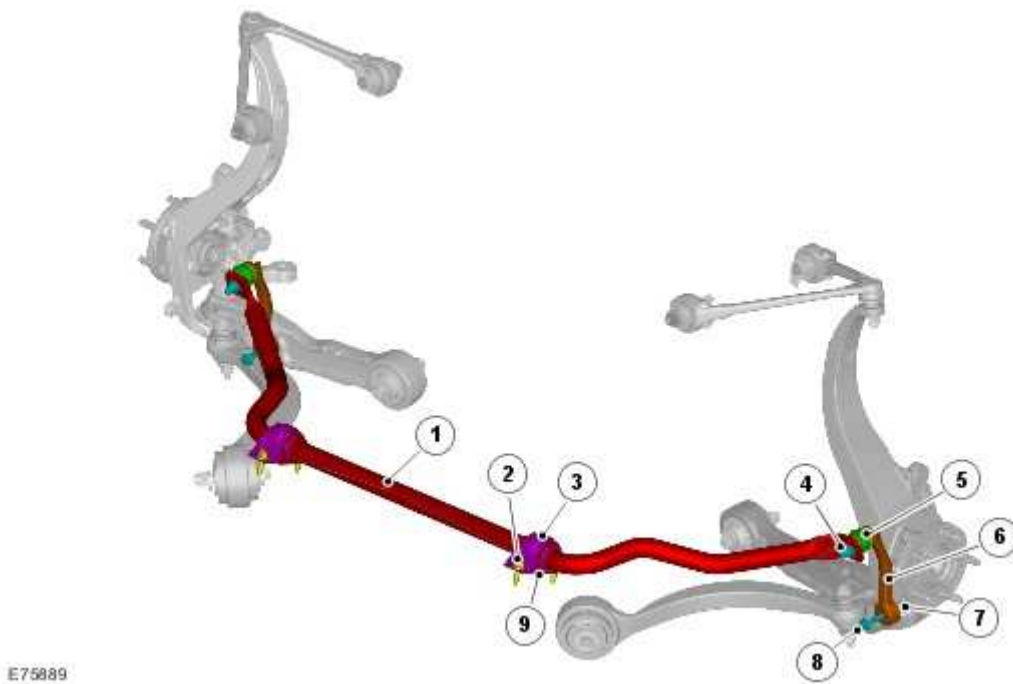
The cast aluminum wheel knuckle is a swan neck design which provides the attachment for the upper control arm and lower lateral control arm. The lower lateral control arm locates on a non serviceable ball joint integral with the wheel knuckle. The lower boss on the knuckle provides for the attachment

of the steering gear tie-rod ball joint.

The wheel knuckle also provides the mounting locations for the wheel hub and bearing assembly, the wheel speed sensor and also the brake caliper and disc shield. which is retained with 3 rivets.

The wheel hub assembly includes the wheel bearing and ABS sensor pulse ring. The hub assembly is a non-serviceable component and requires replacement as a complete assembly. The wheel hub is secured to the knuckle with 2 bolts and 2 Torx bolts.

STABILIZER BAR



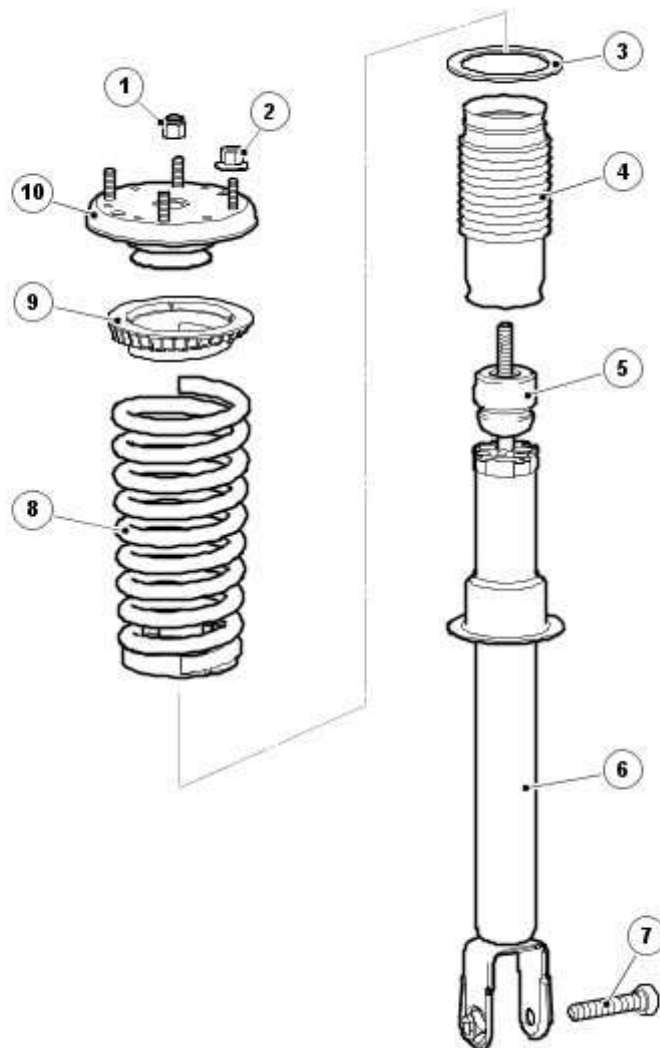
Item	Part Number	Description
1		Stabilizer bar
2		Bolt (4 off)
3		Bracket (2 off)
4		Locknut (2 off)
5		Ball joint (2 off)
6		Stabilizer link (2 off)
7		Locknut (2 off)

8		Bolt (2 off)
9		Bush (2 off)

The stabilizer bar is attached to the front of the subframe with bushes and mounting brackets. The pressed steel brackets locate over the bushes and are attached to the cross member with bolts screwed into threaded locations in the subframe. The stabilizer bar has crimped, 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The stabilizer bar is manufactured from 32 mm diameter, manganese steel bar. Each end of the stabilizer bar curves rearwards to attach to a ball joint on a stabilizer link. Each stabilizer link is secured to a bush in the lower lateral arm with a bolt and locknut. The links allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

SPRING AND DAMPER MODULE



Item	Part Number	Description
1		Damper self locking nut
2		Top mount self locking nut (4 off)
3		Spring packer
4		Gaitor
5		Spring aid
6		Damper
7		Bolt
8		Spring
9		Upper spring seat
10		Top mount

The spring and damper assemblies are located between the lower lateral arm and the front suspension housing in the inner wing. Two coil spring damper variants are available; a conventional oil damped strut and a Computer Active Technology Suspension (CATS) adaptive damper. For additional information, refer to Vehicle Dynamic Suspension (204-05)

Different combinations of springs and dampers are available depending on the vehicle model. The damper and spring assemblies are similar in their construction with the CATS adaptive damper having a solenoid operated valve installed in the damper body.

The dampers are a monotube design with a spring seat welded onto the damper tube. The lower end of the damper has a forked mounting with a cross hole and captive nut. The fork locates over

the lower lateral control arm and is secured with a bolt.

The damper functions by restricting the flow of hydraulic fluid through internal galleries in the damper piston, providing damping of undulations in the road surface. The CATS damper has a solenoid operated valve which further restricts the flow of hydraulic fluid, providing a stiffer damping characteristic for the damper and improving vehicle handling. The solenoid is computer controlled and can switch between soft and hard damping settings depending on driving style and vehicle speed. For additional information, refer to Vehicle Dynamic Suspension (204-05)

The damper piston is connected to a damper rod which is sealed at its exit point from the damper body. The threaded outer end of the damper rod locates through a hole in the top mount. A self locking nut secures the top mount to the damper rod. The damper rod on CATS dampers have an electrical connector on the outer end of the damper rod.

The damper rod is fitted with a spring aid which prevents the top mount making contact with the top of the damper body during full suspension compression and also assists with the suspension tune.

The spring rate of the coil springs can differ between models and are color coded for identification. The coil spring locates on a spring packer and a lower spring seat which is integral with the damper body. The spring locates in an upper spring seat which is located on the underside of the top mount.

The top mount has four studs which locate through mating holes in the vehicle inner wing and are secured with self locking nuts.

Front Suspension

For additional information, refer to [<<204-00>>](#)


Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)

Special Service Tools



Suspension spring compressor
204-476-01

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

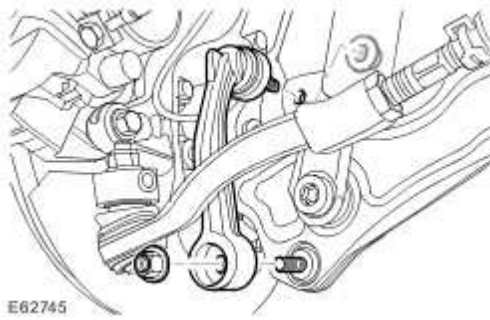
- 2 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . **NOTE:**

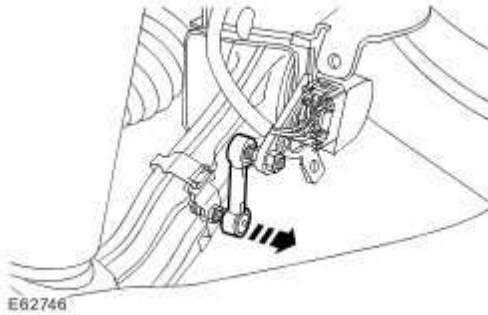
Use an additional wrench to prevent the ball joint rotating.

Disconnect the LH stabilizer bar link.

-  Remove and discard the 2 nuts.




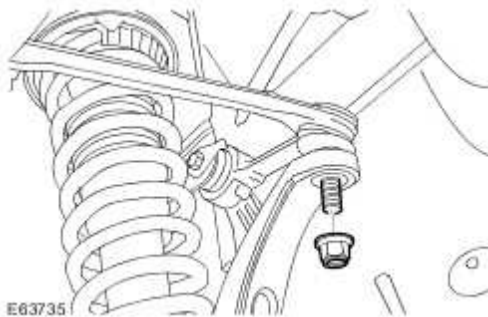
4 . Disconnect the height sensor link.



5  **CAUTION:** Use an Allen key to prevent the ball joint rotating whilst removing the nut.

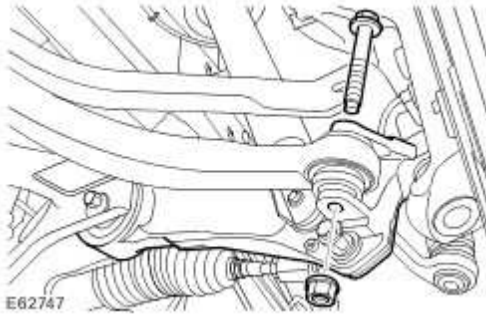
Release the upper suspension arm ball joint.

 Remove and discard the nut.



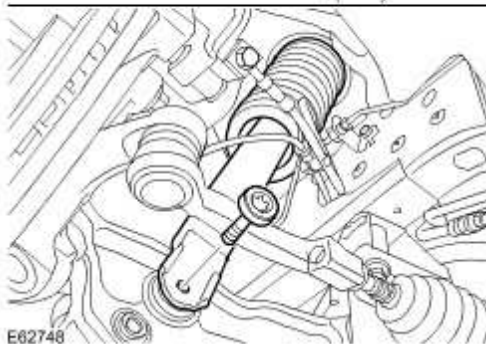
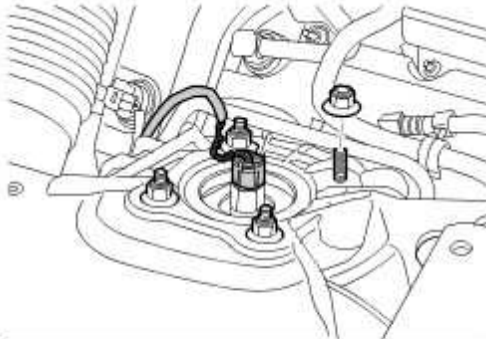
6 . Release the LH lower suspension arm.

- ▶ Remove the bolt and discard the nut.



7 . Remove the shock absorber and spring assembly.

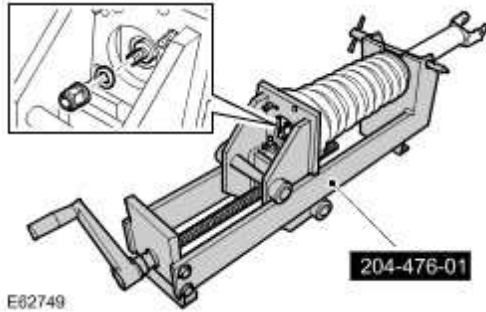
- ▶ Active shock absorber: Disconnect the electrical connector.
- ▶ Remove the Torx bolt.
- ▶ Remove the 4 nuts.



8 . Using the special tool, compress the suspension spring to remove the shock absorber.

▶ Compress the spring.

▶ Remove the nut.

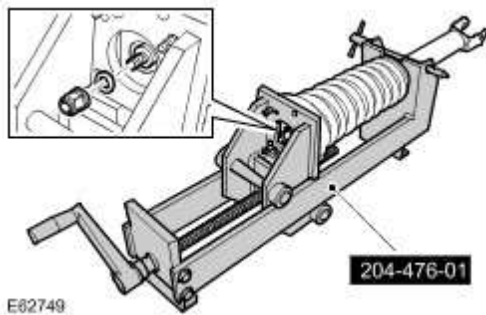


Installation

1 . Using the special tool, compress the spring to install the shock absorber.

▶ Passive shock absorber: Tighten the nut to 27 Nm (20 lb.ft).

▶ Active shock absorber: Tighten the nut to 50Nm (37 lb.ft).



2 . Install the shock absorber and spring assembly.

▶ Tighten the nuts to 27 Nm (20 lb.ft).

▶ Tighten the Torx bolt to 175 Nm (129 lb.ft).

▶ Active shock absorber: Connect the electrical connector.

3 . Install the lower suspension arm.

▶ Install the bolt and tighten the new nut to 60 Nm (44 lb.ft) + 135 degrees.

4



· **CAUTION: Use an Allen key to prevent the ball joint rotating whilst installing the nut.**

Connect the upper suspension arm ball joint.

▶ Tighten the nut to 90 Nm (66 lb.ft).

5 . Connect the height sensor link.

6 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the stabilizer bar link.

▶ Tighten the nuts to 43 Nm (30 lb.ft).

7 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Front Lower Arm (60.35.53)

Removal



CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

1



- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 . Remove the LH front wheel and tire.

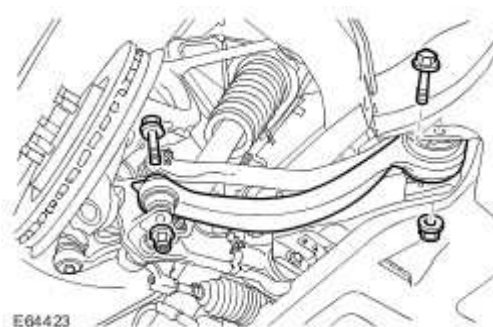
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . **NOTE:**

Note the fitted position.

Release the forward lower control arm.

- ▶ Remove the 2 bolts and discard the nuts.



Installation

1 . Install the forward lower control arm.

▶ Install the bolt and tighten the new nut to 60 Nm (44 lb.ft) + 135 degrees.

▶ Tighten the 14mm bolt to 175 Nm (129 lb.ft).

2 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

3 Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment, and adjust if required.

Rear Lower Arm (60.35.54)

Removal



CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the LH front wheel and tire.

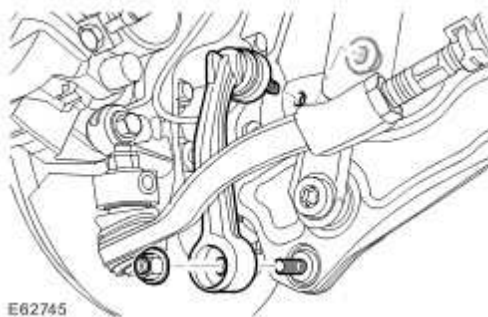
For additional information, refer to Wheel and Tire (74.20.05)

3 . **NOTE:**

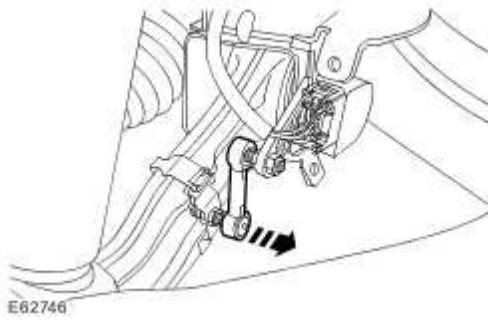
Use an additional wrench to prevent the ball joint rotating.

Disconnect the LH stabilizer bar link.

▶ Remove and discard the 2 nuts.

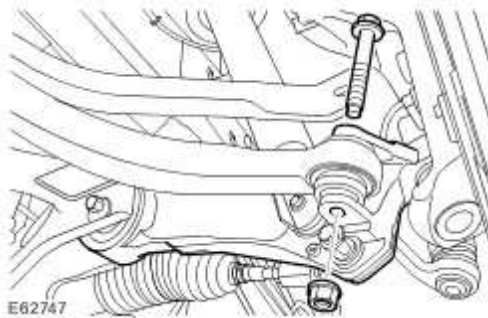


4 . Disconnect the height sensor link.



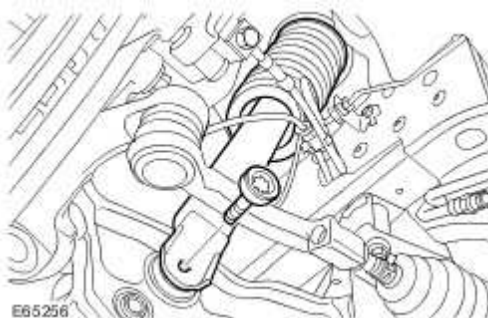
5 . Release the forward lower control arm.

▶ Remove the bolt and discard the nut.



6 . Release the shock absorber from the lower arm.

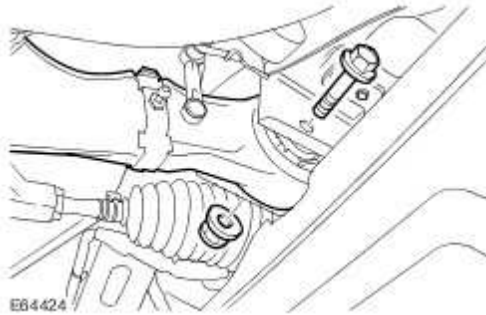
▶ Remove the Torx bolt.



7 . **NOTE:**

Note the fitted position.

Remove the lower arm nut and bolt; discard the nut.



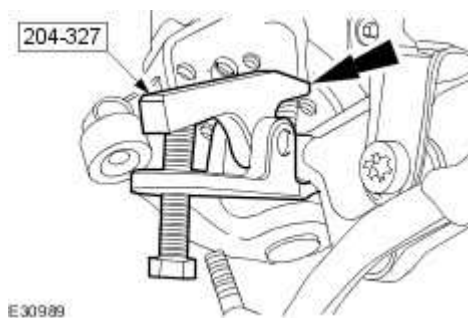
8



CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Remove the LH lower arm.

- ▶ Remove and discard the nut.
- ▶ Using the special tool, release the ball joint from the lower suspension arm.




Installation


1 . **NOTE:**

Align to the position noted on removal.

Install the lower suspension arm.

 Tighten the nut and bolt to 175 Nm.


2 . Install the forward lower control arm.


 Install the bolt and tighten the new nut to 60 Nm + 135 degrees.

3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Install the lower arm ball joint


 Clean the component mating faces.

 Tighten the nut to 92 Nm.

4 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the stabilizer bar link.

 Tighten the nuts to 43 Nm.

5 . Connect the height sensor link.

6 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

7 Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment,
. and adjust if required.

Rear Lower Arm Bushing (60.35.56)

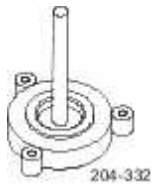
Special Service Tools



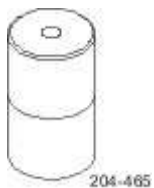
Rear lower arm bushing remover and installer
204-464



Rear lower arm bushing remover
204-333



Rear lower arm bushing installer
204-332




Rear lower arm bushing installer
204-465



Rear lower arm bushing installer
204-334

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

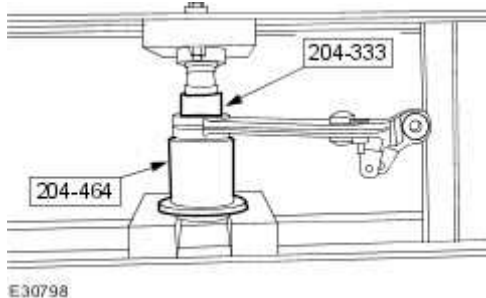
Raise and support the vehicle.

- 2 . Remove the LH lower arm.
For additional information, refer to Rear Lower Arm (60.35.54)

- 3 . **NOTE:**

Note the fitted position.

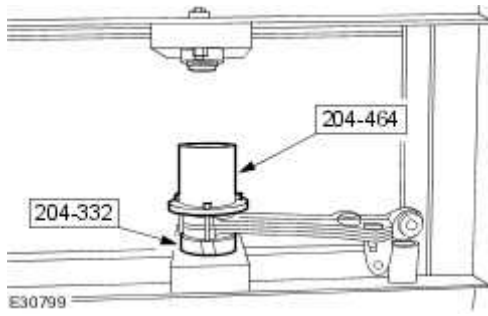
Using the special tools, remove and discard the lower arm rear bushings.



Installation

- 1 . Install the special tools to the rear lower arm.

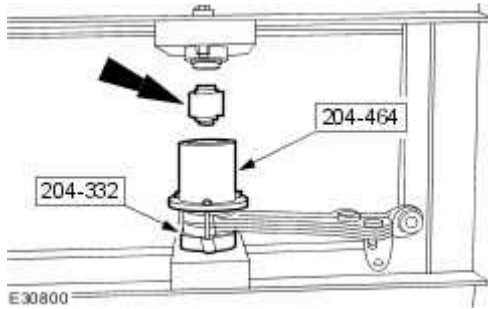
 Tighten the bolts.



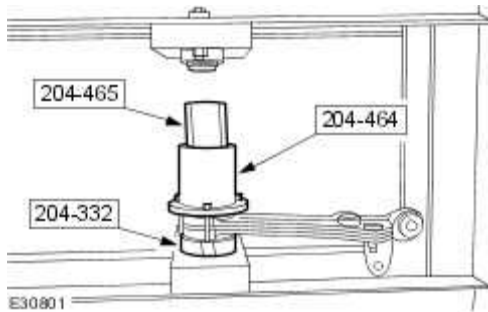
2 . NOTE:

Align to the position noted on removal.

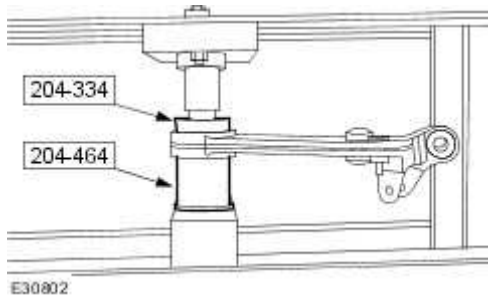
Position the bushing in the special tool.



3 . Using the special tools, partially install the lower arm bushing.



4 . Change the special tools, then complete installation of the bushing.



5 . Install the lower suspension arm.

For additional information, refer to Rear Lower Arm (60.35.54)

Shock Absorber Bushing (60.30.16)

Special Service Tools



Replacer support-bush
204-337



Replacer-bush
204-338



Remover-bush
204-336



Remover support-bush
204-335

Removal

1



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

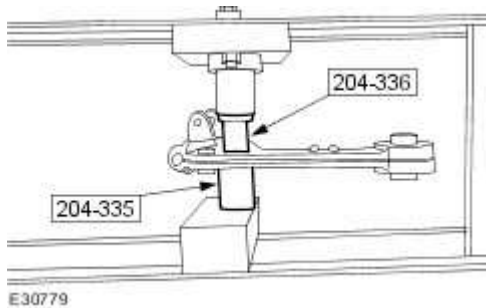
Raise and support the vehicle.

- 2 . Remove the front lower suspension arm.
For additional information, refer to Rear Lower Arm (60.35.54)

3 . **NOTE:**

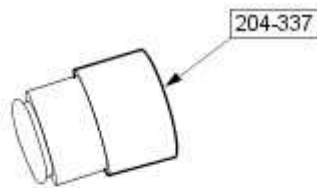
Take note of the fitted position of the bush.

Using the special tools, remove the shock absorber bushing.



Installation

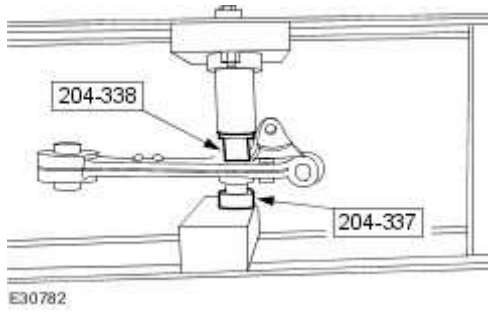
- 1 . Install the bushing into the special tool.



2 . **NOTE:**

Align to the position noted on removal.

Using the special tools, install the shock absorber bushing.



3 . Install the lower suspension arm.

For additional information, refer to Rear Lower Arm (60.35.54)

Front Stabilizer Bar - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.10.01)

Special Service Tools



303-021

Engine support bracket
303-021



303-749

Engine lifting brackets
303-749



HTJ12002

Power train assembly jack
HTJ1200-2




502-010

E65082

Subframe alignment bolts
502-010


Removal

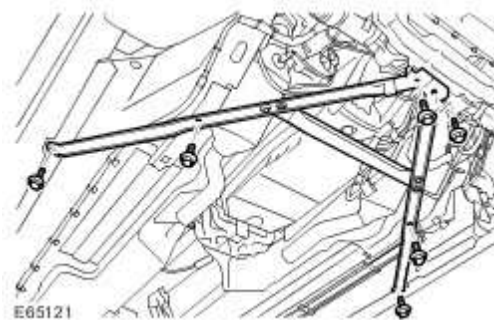
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the radiator air deflector.
For additional information, refer to Radiator Splash Shield (76.22.90)
- 4 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)
- 5 . Remove the lower suspension arms.
For additional information, refer to Rear Lower Arm (60.35.54)
- 6 . Remove the throttle body.
For additional information, refer to Throttle Body (19.70.04)
- 7 . With assistance, remove the A-frame.

 Remove the 6 bolts.



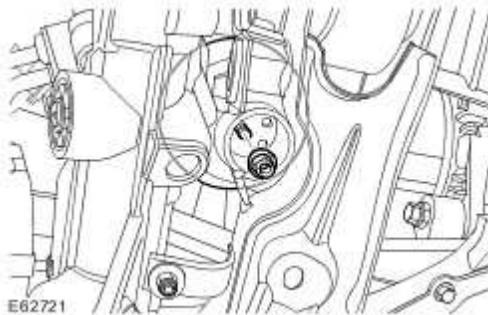
8 . NOTE:

RH illustration shown, LH is similar

Release the engine mounts.

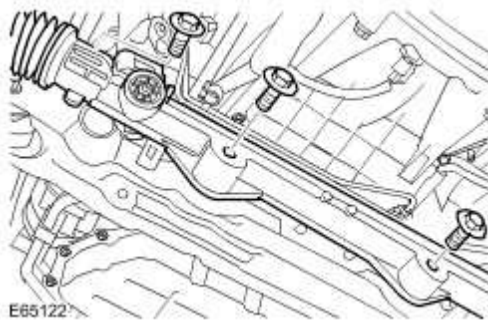
▶ Remove and discard the 2 nuts.

▶ Raise the engine.




9 . Support and release the power steering rack.

▶ Remove the 3 bolts.

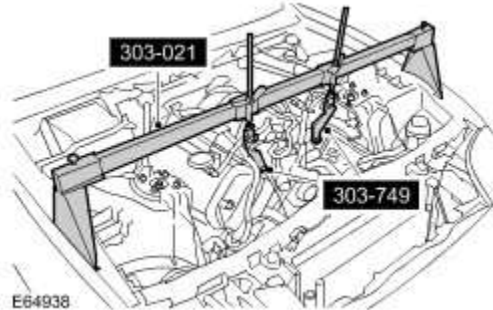


10 . Secure the radiator assembly.

▶ Secure with cable ties.

- 11 .  **CAUTION: Protect the paintwork during this operation.**

Using the special tools, support the engine.



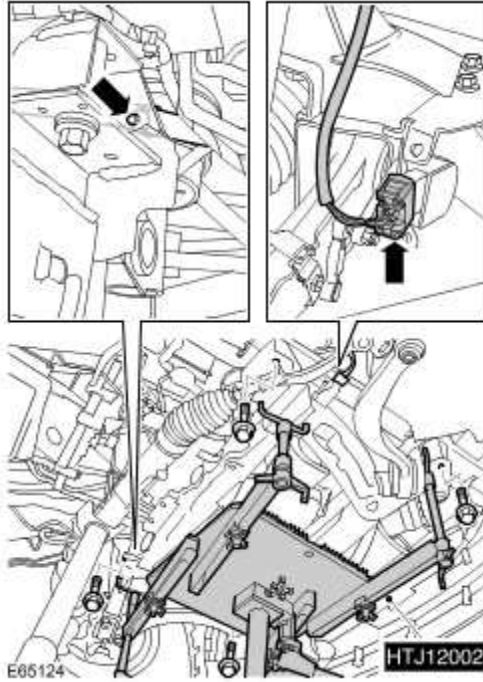
- 12 . Using the special tool, support the subframe.

- 13 . **NOTE:**

Note the fitted position.

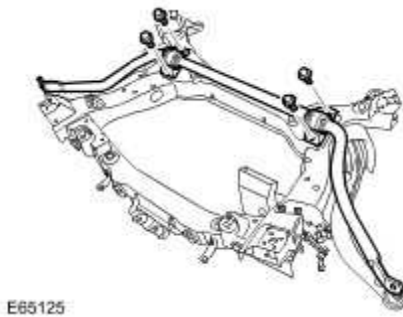
With assistance, remove the front subframe assembly.

- ▶ Remove the 4 bolts.
- ▶ Release the PAS pipe to subframe clip.
- ▶ Disconnect the electrical connector.



14 . Remove the stabilizer bar.

- ▶ Remove the 4 bolts.
- ▶ Remove the stabilizer bar bushing.



Installation

1 . Install the stabilizer bar.

- ▶ Install the stabilizer bar bushings.

- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

2



CAUTION: To align the sub-frame, install the special bolts in place of the front fixings. Tighten the rear fixings to set the position, remove the special bolts.

With assistance, install the front subframe.

- ▶ Position the radiator mountings.
- ▶ Using the special the special tools, align the subframe.
- ▶ Connect and secure the electrical connector.

3 . Tighten the subframe bolts.

- ▶ Tighten the front bolts (M15) to 80 Nm plus 360deg.
- ▶ Tighten the rear bolts (M12) to 80 Nm plus 270deg.

4 . With assistance, install the A-frame.

- ▶ Tighten the bolts to 55 Nm (40 lb.ft).

5 . Lower the engine onto its mounts.

- ▶ Tighten the new nuts to 63 Nm (46 lb.ft).
- ▶ Remove the special tools.

6 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

7 . Install the radiator deflector.

For additional information, refer to Radiator Splash Shield (76.22.90)

8 . Remove and discard the 2 cable ties.

9 . Install the lower suspension arms.

For additional information, refer to Rear Lower Arm (60.35.54)

10 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)


11 . Connect the battery ground cable and install the cover.

For additional information, refer to

12 Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment,
. and adjust if required.

Front Stabilizer Bar Link - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.10.02)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

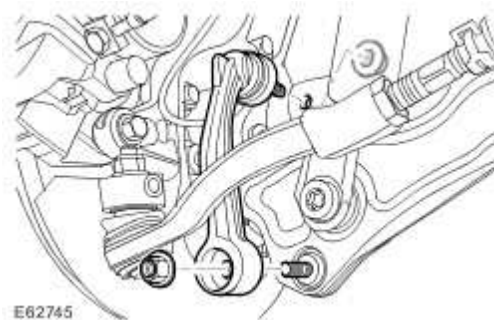
- 2 . Remove the front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Remove the LH stabilizer bar link.

-  Remove and discard the 2 nuts.




Installation

- 1 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Install the stabilizer bar link.

 Tighten the nuts to 48 Nm (35 lb.ft).

2 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Stabilizer Bar Link Bushing (60.10.03)

Special Service Tools



Bush installer
204-340



Bush remove
204-342



Support
204-341



Support
204-339

Removal

1



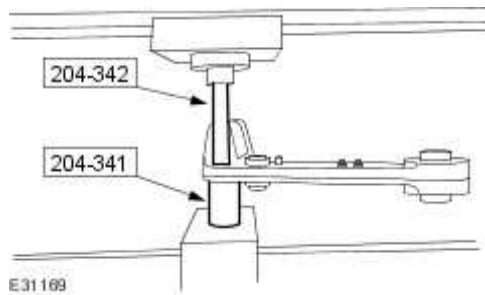
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the LH lower arm.

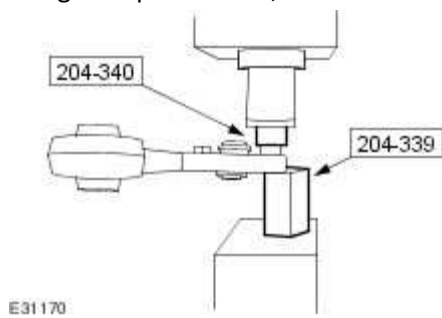
For additional information, refer to Rear Lower Arm (60.35.54)

3 . Using the special tools, remove and discard the stabilizer bar link bushing.



Installation

1 . Using the special tools, install the stabilizer bar link bushing.




2 . Install the lower suspension arm.

For additional information, refer to Rear Lower Arm (60.35.54)

Upper Arm LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.35.41)

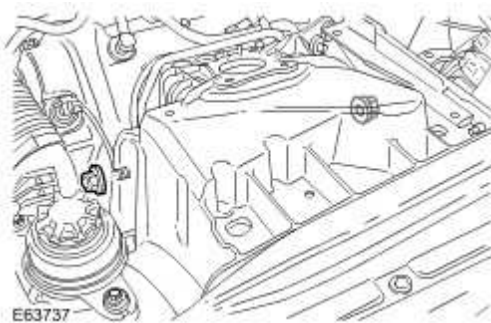
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Remove the shock absorber and spring assembly.
 - For additional information, refer to Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
- 3 . Remove the engine control module (ECM).
 - For additional information, refer to Engine Control Module (ECM) (18.30.01)
- 4 . Remove the LH upper suspension arm.

- ▶ Remove and discard the 2 nuts.



Installation

- 1  **CAUTION: The final tightening of the upper arm must be carried out with the**

vehicle on it's wheels.

Install the upper arm.

 Install the bolts and new nuts.

2 Install the shock absorber and spring assembly.

- . For additional information, refer to Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)

3



- . **CAUTION: The final tightening of the upper arm must be carried out with the vehicle on it's wheels.**


Tighten the upper suspension arm nuts to 60 Nm (44 lb.ft).

4 . Install the ECM.

For additional information, refer to Engine Control Module (ECM) (18.30.01)

Upper Arm RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.35.42)

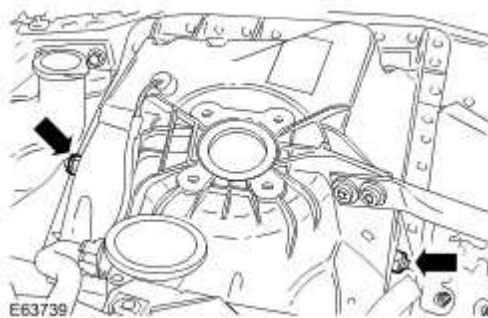
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Remove the shock absorber and spring assembly.
 - For additional information, refer to Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)
- 3 . Remove the coolant expansion tank.
 - For additional information, refer to Coolant Expansion Tank (26.15.01)
- 4 . Remove the LH upper suspension arm.

- ▶ Remove and discard the 2 nuts.



Installation

- 1  **CAUTION: The final tightening of the upper arm must be carried out with the**

vehicle on it's wheels.

Install the upper arm.

 Install the bolts and new nuts.

2 . Install the shock absorber and spring assembly.

. For additional information, refer to Front Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.30.04)


3 . Tighten the upper suspension arm nuts to 60 Nm (44 lb.ft).

4 . Install the coolant expansion tank.

For additional information, refer to Coolant Expansion Tank (26.15.01)

Front Wheel Bearing and Wheel Hub (60.25.03)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

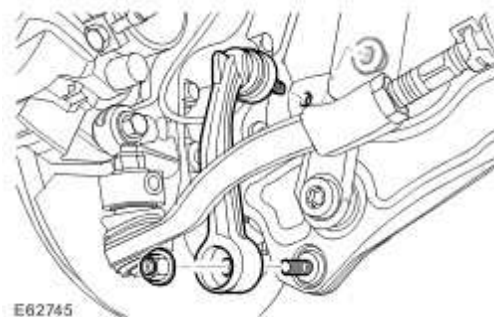
- 2 Remove the front brake disc.
 - For additional information, refer to Brake Disc - Vehicles With: Standard Brakes (70.10.10)
 - For additional information, refer to Brake Disc - Vehicles With: High Performance Brakes (70.10.10)
 - For additional information, refer to
 - For additional information, refer to

3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Remove the LH stabilizer bar link.

- ▶ Remove and discard the 2 nuts.



- 4 . Remove the wheel speed sensor.

▶ Release the clip.

▶ Tie aside.

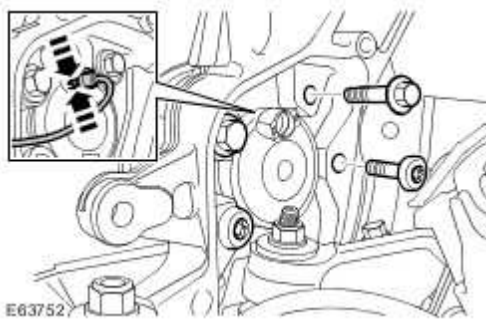
5 . NOTE:

Note the fitted position.

LH front: Carefully remove the hub assembly.

▶ Remove and discard the 2 Torx bolts.

▶ Remove and discard the 2 bolts.



Installation

1 . NOTE:

Align to the position noted on removal.

NOTE:


Make sure all component mating faces are clean.

LH front: Carefully install the hub assembly.

▶ Clean the component mating faces.

▶ Tighten the bolts to 90 Nm (66 lb.ft).


2 . Install the wheel speed sensor.

 Secure the clip.

3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Install the stabilizer bar link.

 Tighten the nuts to 48 Nm (35 lb.ft).

4 Install the front brake disc.

. For additional information, refer to Brake Disc - Vehicles With: Standard Brakes (70.10.10)

For additional information, refer to Brake Disc - Vehicles With: High Performance Brakes (70.10.10)

For additional information, refer to


For additional information, refer to

Wheel Knuckle (60.25.23)

Special Service Tools


Ball joint splitter
204-327

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 2 . Remove the hub assembly.
For additional information, refer to Front Wheel Bearing and Wheel Hub (60.25.03)
- 3 . Remove the brake disc shield.

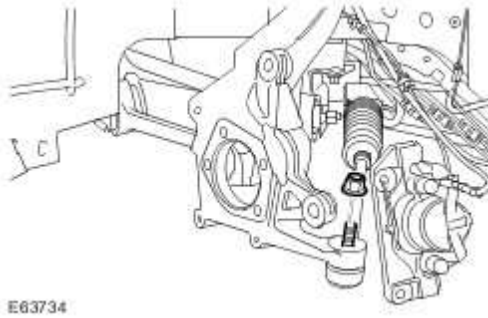
 Remove the 3 rivets.

- 4 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Disconnect the steering gear tie rod end ball joint.

 Remove and discard the tie rod end retaining nut.

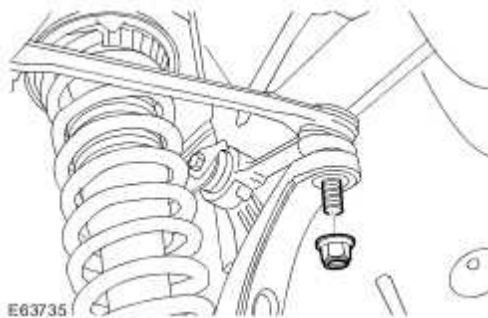


5 . NOTE:

Use an additional wrench to prevent the ball joint rotating.

Disconnect the upper arm from the wheel knuckle.

▶ Remove and discard the nut.



6



CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

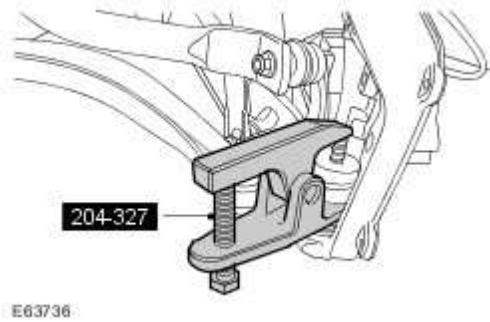
NOTE:

Use an additional wrench to prevent the ball joint rotating.

Remove the wheel knuckle.

▶ Remove and discard the nut.

- ▶ Using the special tool, release the ball joint from the lower suspension arm.



Installation

1 . NOTE:

Use an additional wrench to prevent the ball joint rotating.

Install the wheel knuckle.

- ▶ Clean the component mating faces.
- ▶ Tighten the nut to 92 Nm.

2 . Install the brake disc shield.

- ▶ Install the rivets.
- ▶ Repeat the above procedure for the other side.

3 . NOTE:

Use an additional wrench to prevent the ball joint rotating.


Connect the upper arm and wheel knuckle.

- ▶ Tighten the nut to 90 Nm.

4 . NOTE:

Use an additional wrench to prevent the component from rotating.

Connect the tie-rod end ball joint.

 Tighten the nut to 55 Nm.

5 . Install the hub assembly.

For additional information, refer to Front Wheel Bearing and Wheel Hub (60.25.03)

204-02 : Rear suspension

Specifications

Specifications

Torque Specifications



CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

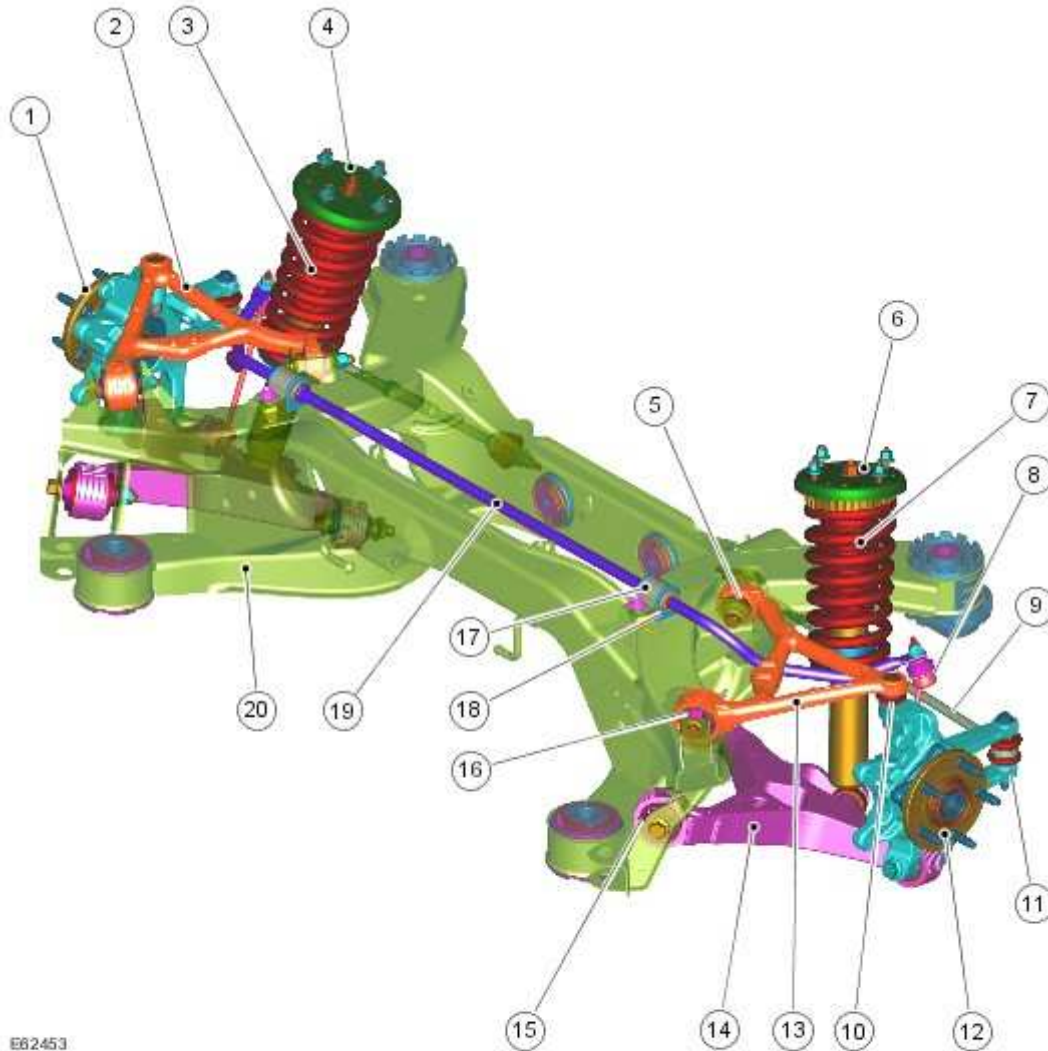
Description	Nm	lb-ft
Halfshaft/hub - nut *	300	221
Lower arm to subframe - nut *	164	121
Lower arm to wheel knuckle - nut *	150	110
Shock absorber to spring - nut:		
Active shock absorber	50	37
Passive shock absorber	27	20
Shock absorber and spring assembly to top mount - nuts	27	20
Shock absorber and spring assembly to lower arm - bolt	133	98
Stabilizer bar clamp to subframe - nut *	55	40
Stabilizer bar link to lower arm - nut *	48	35
Stabilizer bar link to stabilizer bar - nut *	48	35
Toe link to subframe - ball joint nut *	90	66
Toe link to wheel knuckle - nut *	55	40
Upper arm to subframe - nut *	97	71
Upper arm to wheel knuckle - ball-joint nut *	90	66
Wheel bearing to wheel knuckle - bolts	70	52

* New nut/bolt must be installed.

Description and operation

Rear Suspension

COMPONENT LOCATION



E662453

Item	Part Number	Description
1		Right Hand (RH) wheel hub and bearing assembly
2		RH upper control arm
3		RH spring and damper assembly

4		RH top plate
5		Bush - upper control arm
6		Left Hand (LH) top plate
7		LH spring and damper assembly
8		Stabilizer link
9		Toe-link (2 off)
10		Ball joint
11		LH wheel knuckle
12		LH wheel hub and bearing assembly
13		LH upper control arm
14		LH lower control arm
15		Bush - lower control arm
16		Bush - upper control arm
17		Mounting bracket (2 off)
18		Bush (2 off)
19		Stabilizer bar
20		Rear crossbeam

INTRODUCTION

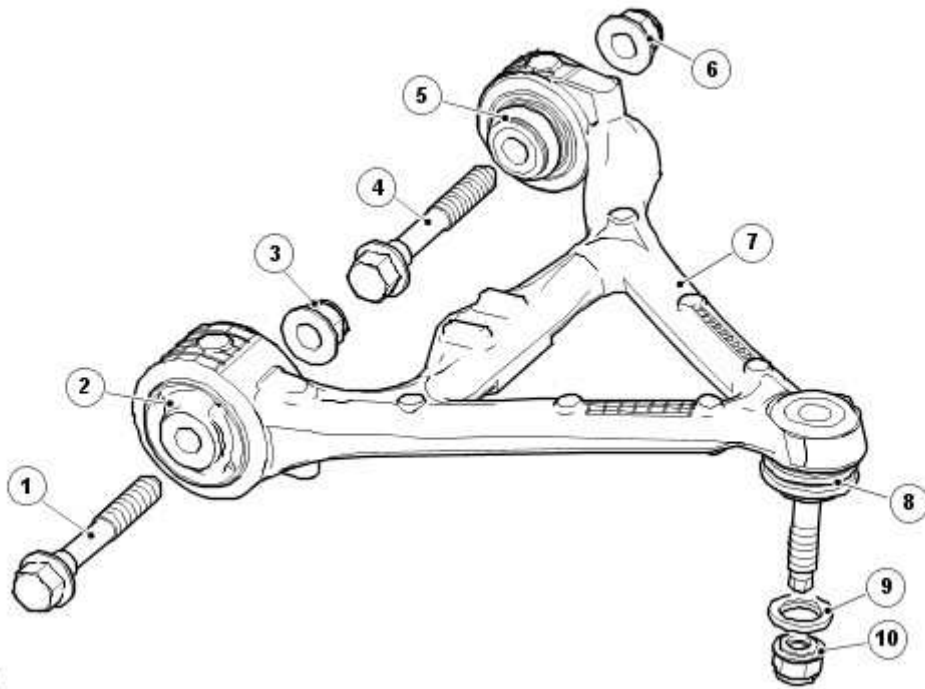
The rear suspension is a double wishbone design which is attached to a rear crossbeam. The crossbeam is attached to the vehicle body with 4 long bolts which pass through bushes located in the crossbeam.

The rear suspension on each side comprises:

- Upper control arm
- Lower control arm
- Toe-link
- Wheel knuckle and hub assembly

- Stabilizer bar
- Spring and damper module.

UPPER CONTROL ARM

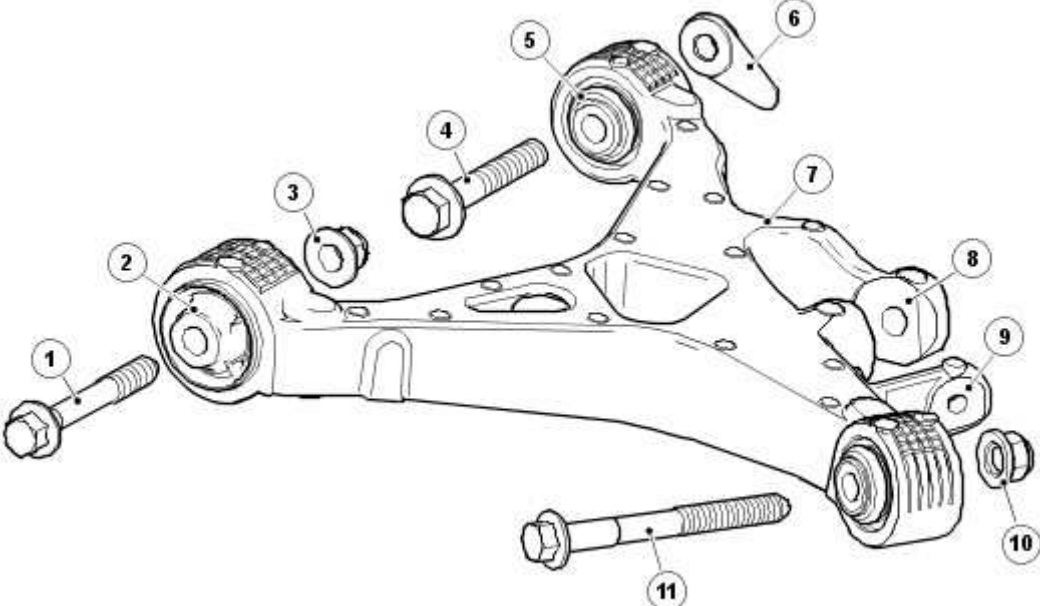


Item	Part Number	Description
1		Bolt
2		Bush
3		Locknut
4		Bolt
5		Bush
6		Locknut
7		Upper control arm
8		Ball joint
9		Washer
10		Locknut

The cast aluminum upper control arm is a wishbone design with 3 mounting points. Two bushed

mountings locate in brackets on the crossbeam. The outer end has a ball joint which mates with the wheel knuckle.

LOWER CONTROL ARM



E76075

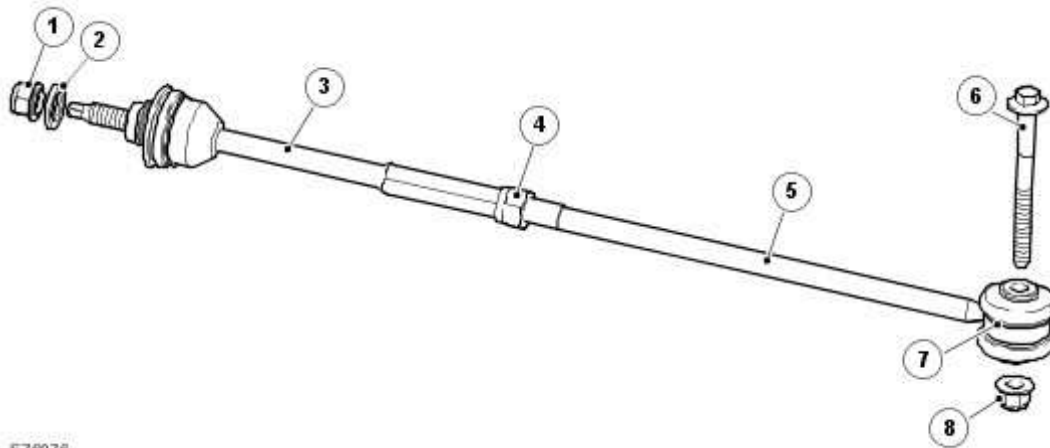
Item	Part Number	Description
1		Bolt
2		Bush
3		Locknut
4		Bolt
5		Bush
6		Caged nut
7		Lower control arm
8		Rear damper attachment
9		Stabilizer link attachment
10		Locknut

11		Bolt
----	--	------

The cast aluminum lower control arm is a wishbone design with 3 bushed mounting points. Two bushes locate between brackets on the crossbeam and the outer bush locates in the wheel knuckle.

The rear of the control arm has mounting points for the damper and the stabilizer link.

TOE-LINK



E76076

Item	Part Number	Description
1		Locknut
2		Washer
3		Inner rod and ball joint
4		Locknut
5		Outer rod
6		Bolt
7		Outer ball joint
8		Locknut

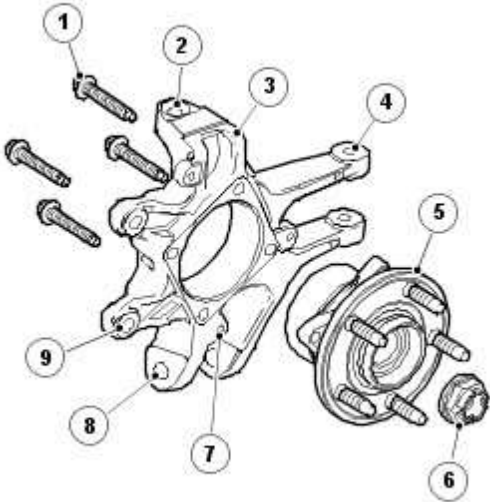
The toe-link is located between the wheel knuckle and brackets on the rear crossbeam.

The toe-link comprises an inner rod with integral ball joint. The inner ball joint has a threaded spigot which locates in a bracket on the crossbeam and is secured with a washer and locknut. The rod has an internal thread which accepts the outer rod.

The outer rod has a ball joint at its outer end which is located between 2 brackets on the wheel knuckle, and is secured with a bolt and locknut.

The length of the toe-link can be adjusted by rotating the inner and outer rods. This allows for adjustment of the toe angle for the rear wheel. Once set the inner and outer rods can be locked in position by tightening a locknut against the inner rod.

WHEEL KNUCKLE



E76077

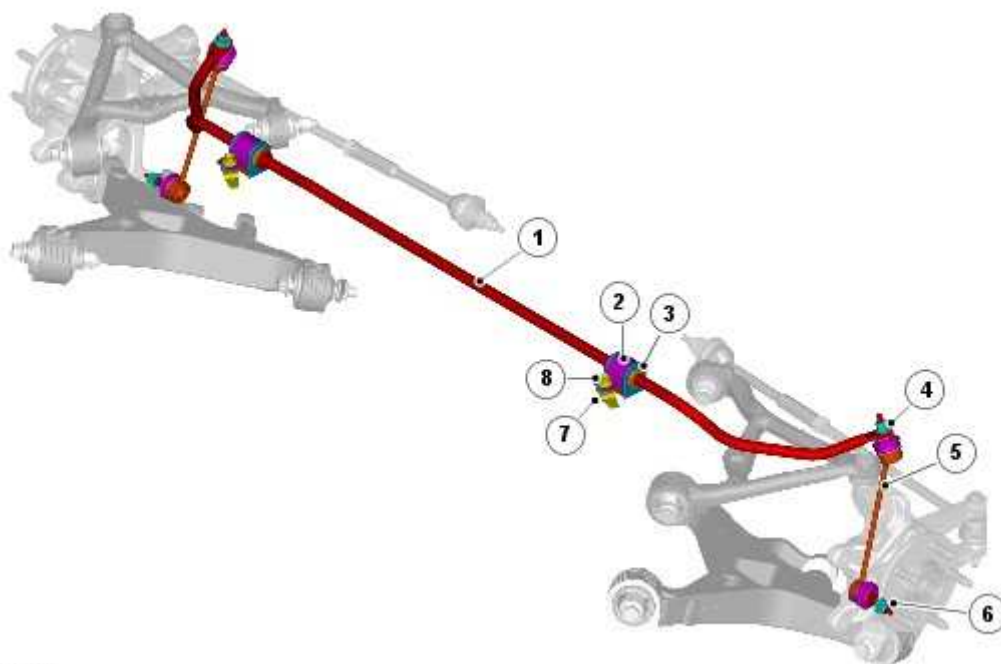
Item	Part Number	Description
1		Hub attachment bolt (4 off)
2		Upper control arm attachment
3		Wheel knuckle
4		Toe-link attachment
5		Wheel hub and bearing assembly
6		Half shaft nut
7		Brake dust shield attachment
8		Lower control arm attachment

9		Brake caliper attachment
---	--	--------------------------

The wheel knuckle is an aluminum casting which provides for the attachment of the upper and lower control arms and the toe-link. The wheel knuckle also provides the mounting locations for the wheel hub and bearing assembly, the wheel speed sensor and the brake caliper and brake dust shield which is secured with 3 rivets.

The wheel hub assembly includes the wheel bearing. The hub assembly is a non-serviceable component and requires replacement as a complete assembly. The wheel hub is secured to the knuckle with 4 bolts.

STABILIZER BAR



E76078

Item	Part Number	Description
1		Stabilizer bar
2		Bracket (2 off)
3		Bush (2 off)
4		Locknut (2 off)
5		Stabilizer link (2 off)
6		Locknut (2 off)

7		Caged nut (2 off)
8		Bolt (2 off)

The stabilizer bar is attached to the top of the crossbeam with 2 bushes and mounting brackets. The brackets are secured to the crossbeam with bolts and caged nuts. The stabilizer bar has crimped, 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The stabilizer bar is manufactured from manganese steel bar and is available in 2 diameters, dependant on the vehicle model. Each type of stabilizer bar has a different torsional rate and is also color coded for identification.

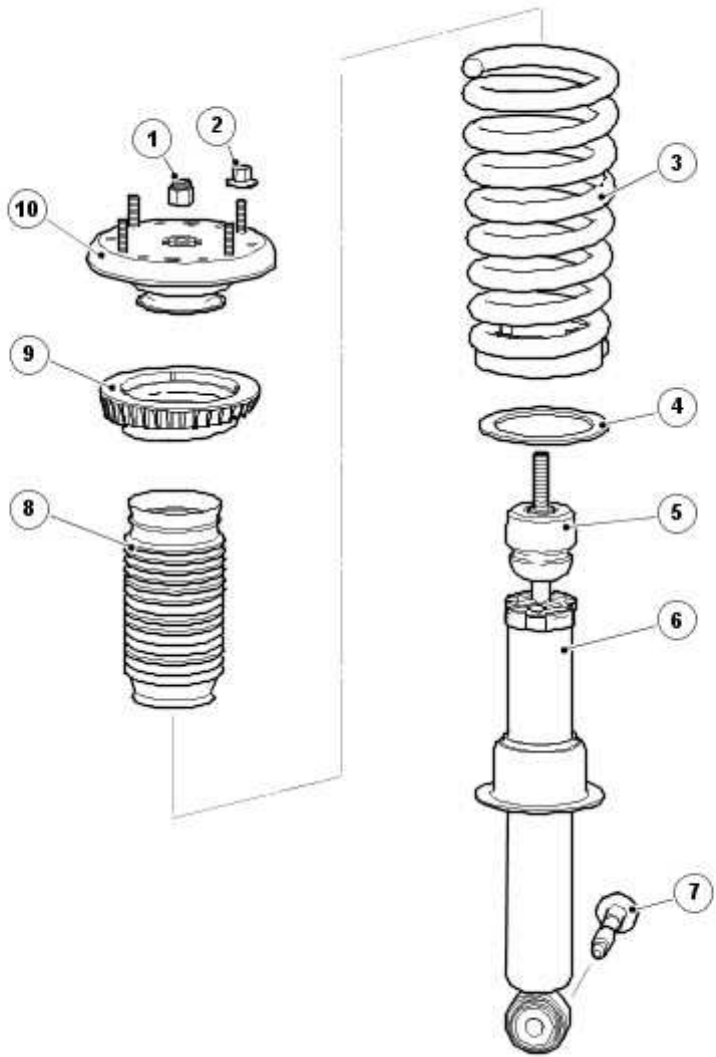
Stabilizer Bar Diameters

Engine Type	Model	Diameter mm (in)
4.2L naturally aspirated	Coupe	17 mm (0.669 in)
4.2L naturally aspirated	Convertible	16 mm (0.629 in)
4.2L supercharged	All models	17 mm (0.669 in)

Each end of the stabilizer bar curves rearward to attach to a ball joint on each stabilizer link. Each link is attached via a second ball joint to a cast bracket on the lower control arm which is secured with a locknut. The links allow the stabilizer bar to move with the wheel travel providing maximum effectiveness.

The stabilizer bar is attached to the forward face of the chassis front subframe. The stabilizer bar is attached to the subframe with 2 rubber bushes. Pressed steel brackets locate over the bushes and are attached to the cross member with bolts screwed into threaded locations in the subframe.

SPRING AND DAMPER MODULE



E76079

Item	Part Number	Description
1		Damper rod self locking nut
2		Top mount self locking nut
3		Spring
4		Spring packer
5		Spring aid
6		Damper
7		Bolt

8		Gaitor
9		Upper spring seat
10		Top mount

The spring and damper modules are attached to cast brackets on the lower control arms and to the rear floor side member assemblies via the 4 studs in the top plate. Similar to the front suspension, two variants are available; passive and active. The active spring and damper assemblies employ the CATS active suspension system.

Different combinations of springs and dampers are available depending on the vehicle model. The damper and spring assemblies are similar in their construction with the CATS adaptive damper having a solenoid operated valve installed in the damper body.

The dampers are a monotube design with a spring seat welded onto the damper tube. The lower end of the damper has a bushed mounting which locates in the lower control arm and is secured with a bolt.

The damper functions by restricting the flow of hydraulic fluid through internal galleries in the damper piston, providing damping of undulations in the road surface. The CATS damper has a solenoid operated valve which further restricts the flow of hydraulic fluid, providing a stiffer damping characteristic for the damper and improving vehicle handling. The solenoid is computer controlled and can switch between soft and hard damping settings depending on driving style and vehicle speed. For additional information, refer to Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension)

The damper piston is connected to a damper rod which is sealed at its exit point from the damper body. The threaded outer end of the damper rod locates through a hole in the top mount. A self locking nut secures the top mount to the damper rod. The damper rod on CATS dampers have an electrical connector on the outer end of the damper rod.

The damper rod is fitted with a spring aid which prevents the top mount making contact with the top of the damper body during full suspension compression and also assists with the suspension tune.

The spring rate of the coil springs can differ between models and are color coded for identification. The coil spring locates on a spring packer and a lower spring seat which is integral with the damper body. The spring locates in an upper spring seat which is located on the underside of the top mount.

The top mount has 4 studs which locate through mating holes in the vehicle rear floor side member and are secured with self locking nuts.

Rear Suspension

For additional information, refer to <<204-00>>.

Lower Arm - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.35.43)

Removal



CAUTION: Nuts and bolts must be tightened with the weight of the vehicle on the suspension.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

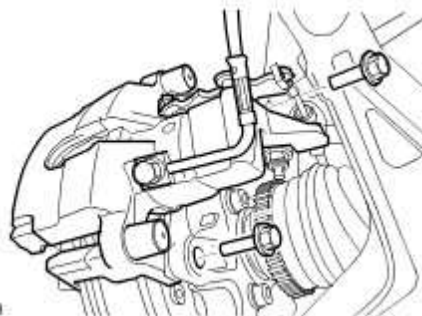
2 . Remove the LH rear wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

3 . Release the brake caliper.

▶ Remove and discard the 2 bolts.

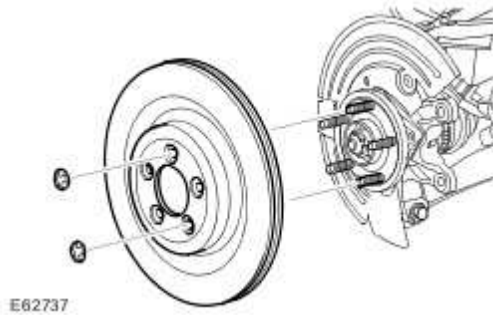
▶ Tie the brake caliper aside.



E64610

4 . Remove the rear brake disc.

▶ Remove the 2 clips.

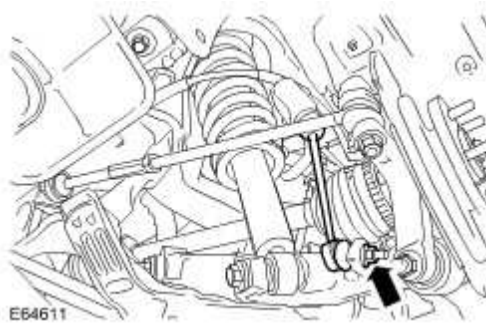


5 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

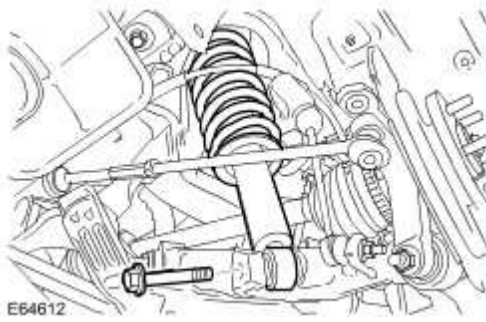
Disconnect the stabilizer bar link.

▶ Remove and discard the nut.



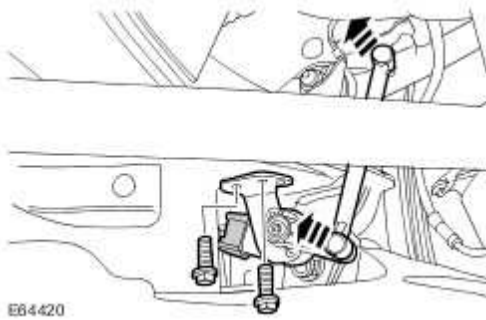
6 . Release the rear shock absorber from the lower suspension arm.

▶ Remove the bolt.



7 . Remove the suspension height sensor.

- ▶ Release the height sensor link.
- ▶ Release and disconnect the electrical connector.
- ▶ Remove the 2 bolts.



8 . Release the lower suspension arm from the hub assembly.

- ▶ Remove the bolt and discard the nut.
- ▶ Position a transmission jack to support the hub assembly.

9 . Remove the lower arm.

- ▶ Remove the 2 bolts and discard the nuts.



Installation

1 . Install the rear suspension arm.

▶ Tighten the nuts and bolts to 97 Nm (72 lb.ft).

2 . Attach the hub assembly to the lower arm.

▶ Tighten the nut and bolt to 150 Nm (110 lb.ft).

3 . Install the shock absorber.

▶ Tighten the bolt to 133 Nm (98 lb.ft).

4 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the stabilizer bar link.

▶ Tighten the nuts to 48 Nm (35 lb.ft).

5 . Install the height sensor.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

▶ Secure the height sensor link.

▶ Connect and secure the electrical connector.

6 . Install the brake disc.

▶ Secure the clips.

7 . Install the brake caliper.

▶ Tighten the bolts to 103 Nm (76 lb.ft).

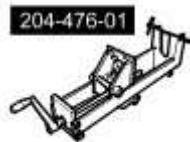
8 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

9 . Carry out the final suspension tightening with the vehicle on its wheels.

Rear Shock Absorber - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.30.02)

Special Service Tools



E64117

Suspension spring compressor

204-476-01

Removal

- 1 . Remove the LH loadspace trim panel.
For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)
For additional information, refer to Loadspace Trim Panel - Convertible (76.13.73.60)

2



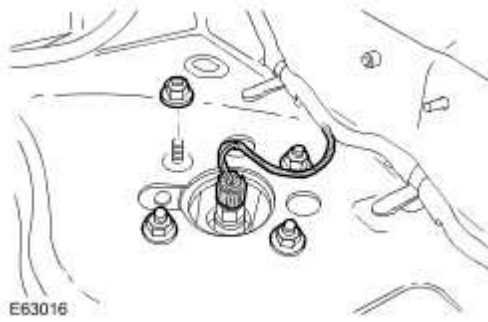
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 4 . Release the shock absorber and spring assembly.

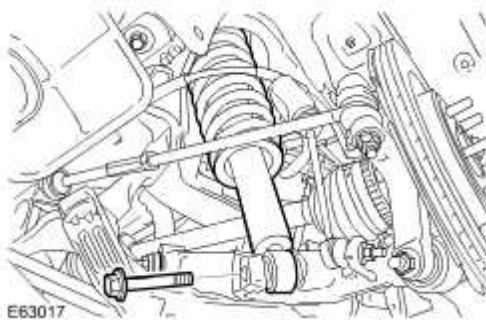
▶ Active shock absorber: Disconnect the electrical connector.

▶ Remove the 4 nuts.



5 . Remove the shock absorber and spring assembly.

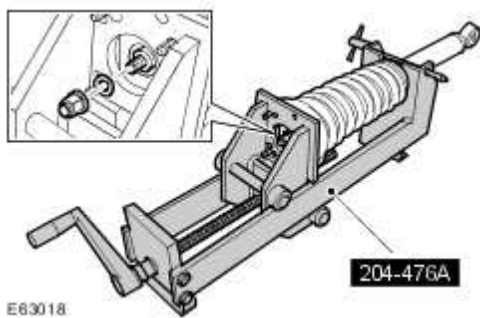
▶ Remove the bolt.



6 . Using the special tool, compress the suspension spring to remove the shock absorber.

▶ Compress the spring.

▶ Remove the nut.

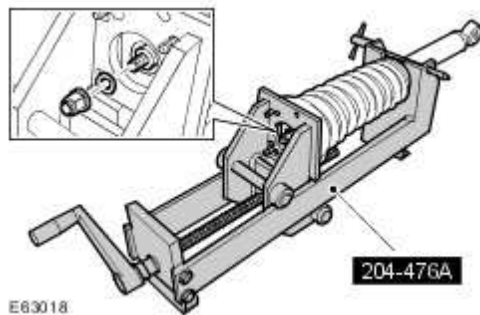


Installation

1 . Using the special tool, compress the spring to install the shock absorber.

▶ Passive shock absorber: Tighten the nut to 27 Nm (20 lb.ft).

▶ Active shock absorber: Tighten the nut to 50 Nm (37 lb.ft).



2 . Install the shock absorber and spring assembly.

▶ Tighten the nuts to 27 Nm (20 lb.ft).

▶ Tighten the bolt to 133 Nm (98 lb.ft).

▶ Active shock absorber: Connect the electrical connector.

3 . Install the LH rear wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

4 . Install the loadspace trim panel.


For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)

For additional information, refer to Loadspace Trim Panel - Convertible (76.13.73.60)

5 Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

Rear Stabilizer Bar (64.35.08)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

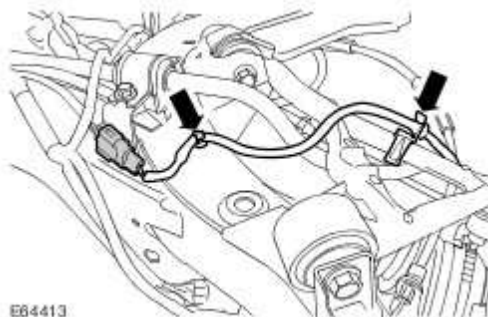
- 2 . Remove the rear sub-frame assembly.
For additional information, refer to Rear Subframe (64.25.01)

- 3 . **NOTE:**

LH illustration shown, RH is similar.

Disconnect the LH rear ABS sensor.

- ▶ Disconnect the electrical connector.
- ▶ Release the 2 clips.
- ▶ Carefully tie the harness aside.
- ▶ Repeat the above procedure for the other side.

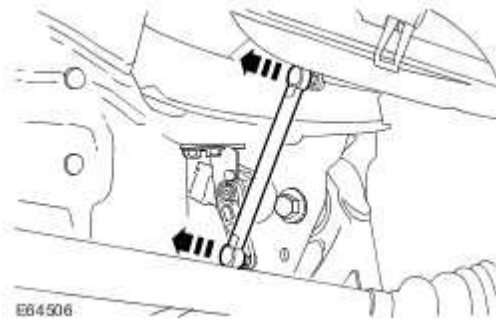


- 4 . Disconnect the electronic parking brake actuator electrical connector.

- ▶ Release the electrical connector.



- 5 . Remove the headlamp levelling sensor link.



- 6 . **NOTE:**

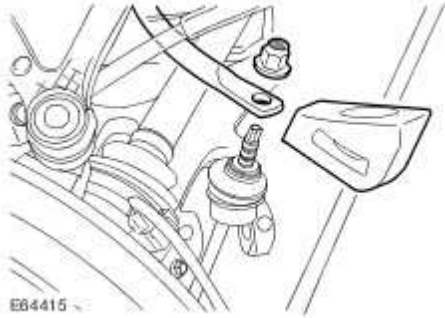
Use an additional wrench to prevent the component from rotating.

NOTE:

LH illustration shown, RH is similar.

Release both stabilizer bar links.

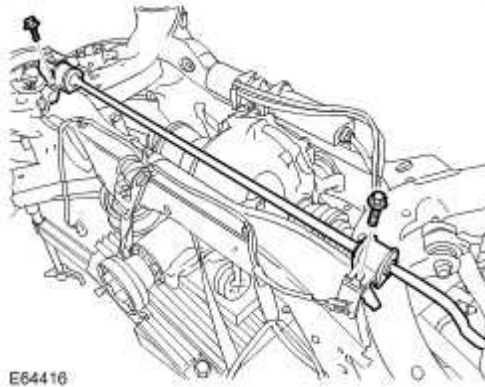
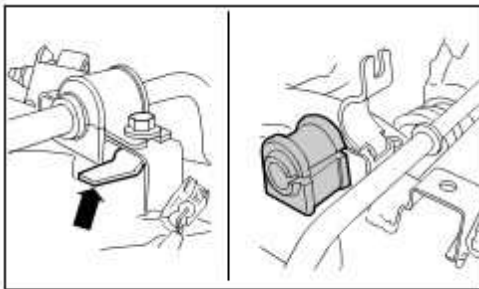
- ▶ Remove the bump stops.
- ▶ Remove and discard the 2 nuts.



7 . Remove the stabilizer bar bushings.

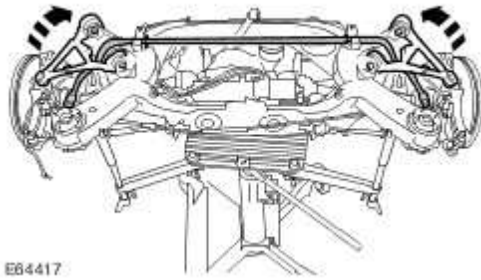
▶ Remove the 2 bolts and discard the cage nuts.

▶ Release the bushings.



8 . With assistance, remove the rear stabilizer bar.

▶ Raise the suspension arms, to release the bar.



Installation

1 . With assistance, install the rear stabilizer bar.

2 . Install the stabilizer bar bushings.

▶ Tighten the bolts and new nuts to 55 Nm (40 lb.ft).

3 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the stabilizer bar links.

▶ Install the bump stops.

▶ Tighten the nuts to 48 Nm (35 lb.ft).

4 . Connect the electronic parking brake actuator electrical connector.

▶ Secure the electrical connector

5 . Install the height sensor link.

6 . Connect the LH rear ABS sensor.


- ▶ Connect the electrical connector.
- ▶ Carefully secure the clips.
- ▶ Repeat the above procedure for the other side.

7 . Install the rear sub-frame.

For additional information, refer to Rear Subframe (64.25.01)

Rear Stabilizer Bar Link (64.35.24)

Removal

- 1 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

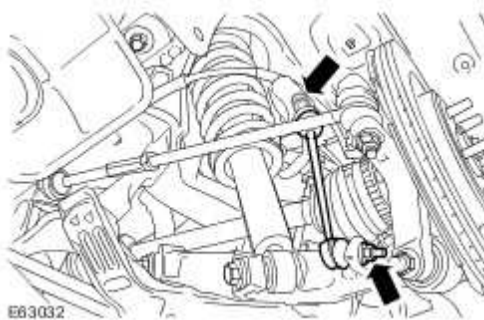
- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Remove the LH stabilizer bar link.

-  Remove and discard the 2 nuts.




Installation

- 1 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Install the stabilizer bar link.

 Tighten the nuts to 48 Nm (35 lb.ft).

2 . Install the wheel and tire.

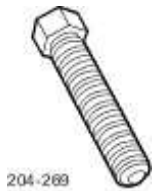
For additional information, refer to Wheel and Tire (74.20.05)

Rear Wheel Bearing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.15.14)

Special Service Tools



Hub puller
205-491




Flange remover forcing screw
204-269



Adaptor nuts
205-491-01

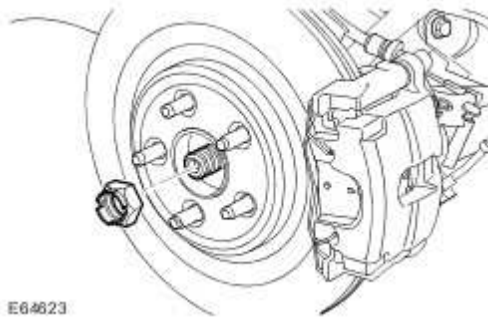
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

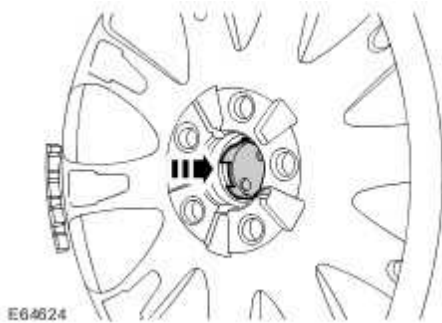
Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

3 . With assistance, remove the halfshaft retaining nut, and retain it for the install procedure.



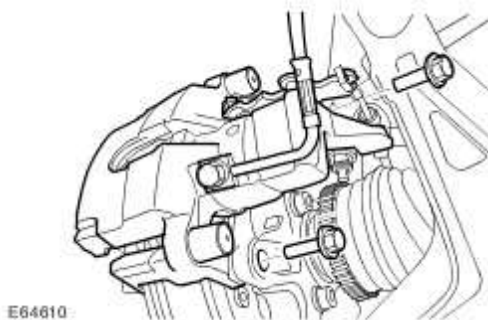
4 . Remove the wheel trim.



5 . Release the brake caliper.

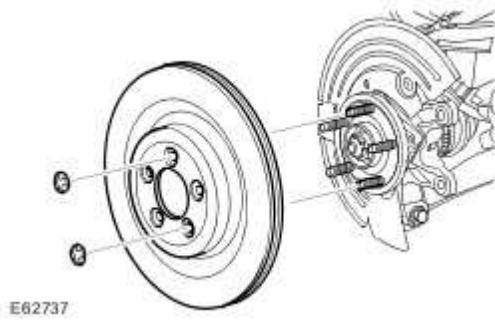
▶ Remove and discard the 2 bolts.

▶ Tie the brake caliper aside.



6 . Remove the rear brake disc.

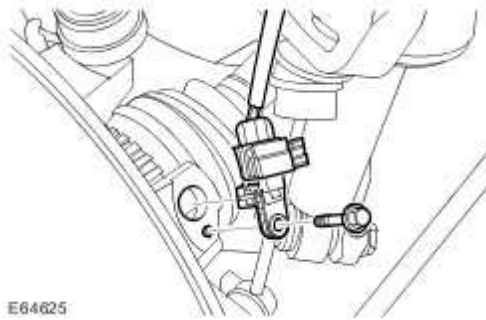
▶ Remove the 2 clips.



7 . Remove the wheel speed sensor.

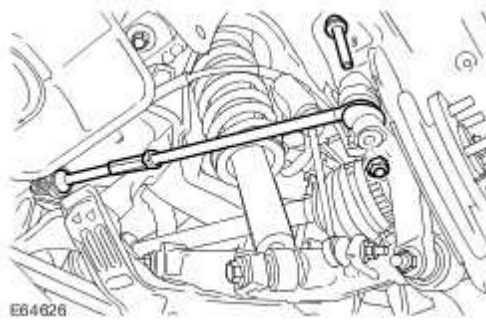
▶ Remove the bolt.

▶ Tie aside.



8 . Disconnect the toe link.

▶ Remove the bolt and discard the nut.

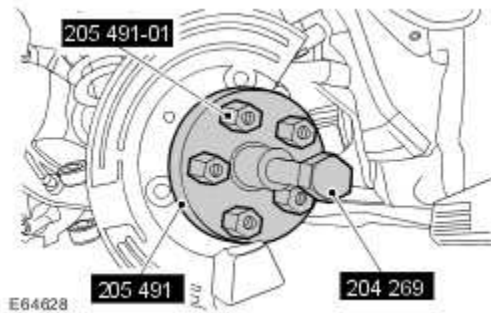


9 . Release the lower arm.

▶ Remove the bolt and discard the nut.



10 . Using the special tools, release the halfshaft from the drive flange.

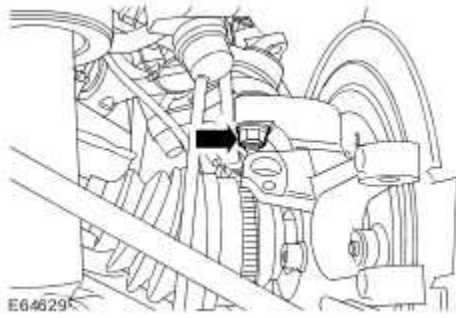


11 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

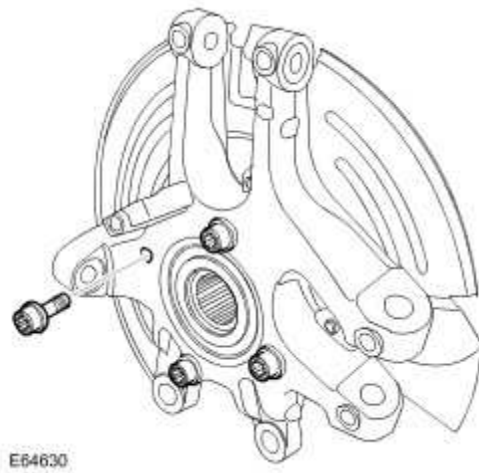
Remove the wheel knuckle.

▶ Release the upper suspension arm ball joint.



12 . Remove the wheel bearing assembly.

▶ Remove the 4 Allen bolts.



Installation

1 . Install the wheel bearing.

▶ Tighten the bolts to 70 Nm (52 lb.ft).

2 . Install the knuckle assembly.


▶ Tighten the nut to 90 Nm (66 lb.ft).

3 . **NOTE:**

Do not fully tighten the locking nut at this stage.


Install the halfshaft.

▶ Tighten the old nut.

- 4 .  **CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.**

Install the lower arm nut and bolt.

▶ Tighten the nut and bolt to 150 Nm (110 lb.ft).

- 5 .  **CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.**

Connect the toe link.

▶ Tighten the nut and bolt to 55 Nm (40 lb.ft).

- 6 . Install the wheel speed sensor.

▶ Install the bolt and tighten to 10 Nm (7 lb.ft).

- 7 . Install the brake disc.

▶ Secure the clips.


- 8 . Install the brake caliper.

▶ Tighten the bolts to 103 Nm (76 lb.ft).

9 . Install the wheel and tire assembly.

For additional information, refer to Wheel and Tire (74.20.05)


10 . Remove the old halfshaft nut and install the new one, tighten to 300 Nm (222 lb.ft)

 Install the wheel trim.

11 . Install the wheel trim.

Tie Bar

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

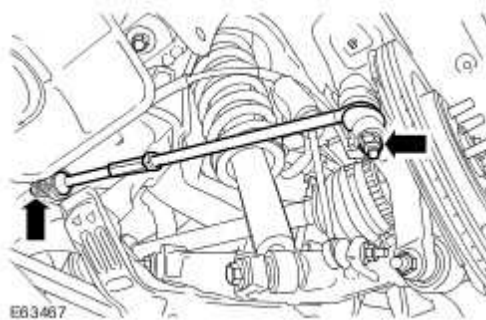
- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Remove the tie rod.

-  Remove and discard the 2 tie-rod end retaining nuts.



Installation

- 1 . **NOTE:**

Use an additional wrench to prevent the ball joint rotating.

Install the tie rod.

▶ Tighten the new inner nut to 90 Nm (59 lb.ft).

▶ Tighten the new outer nut to 55 Nm (41 lb.ft).

2 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

3 Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.


Upper Arm (64.25.31)

Special Service Tools




Brake pedal hold down tool JDS 9013

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3  **CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.**

NOTE:

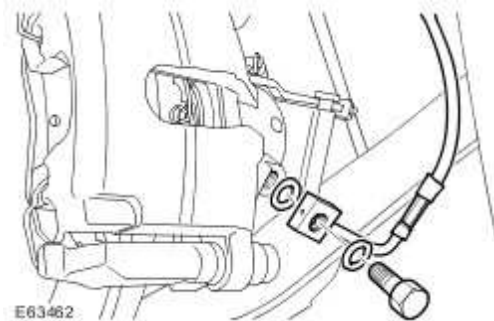
Some fluid spillage is inevitable during this operation.

NOTE:

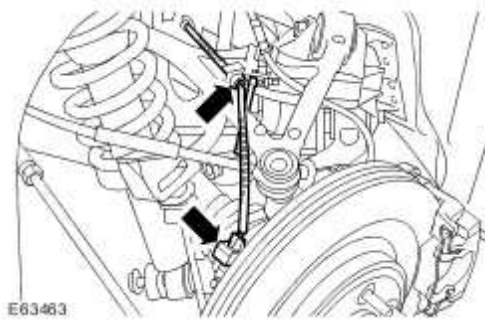
Note the fitted position.

Disconnect the brake hose from the brake caliper.

- ▶ Using the special tool, press and hold the brake pedal.
- ▶ Remove and discard the two sealing washers.

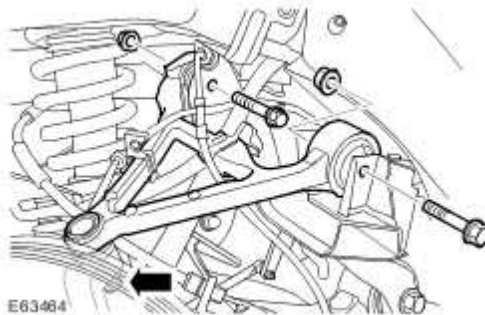


4 . Release the rear wheel speed sensor lead.




5 . Remove the LH upper arm.

- ▶ LH rear: Remove the upper arm 2 nuts and bolts.
- ▶ Remove and discard the nut.



Installation

- 1 .  **CAUTION: The final tightening of the upper arm must be carried out with the vehicle on it's wheels.**

Install the upper arm.

- ▶ Tighten the nuts and bolts to 97 Nm (72 lb.ft).
- ▶ Tighten the nut to 90 Nm (66 lb.ft).

2 . NOTE:

Align to the position noted on removal.

Connect the brake hose to the brake caliper.

- ▶ Install 2 new sealing washers.
- ▶ Tighten the union to 35 Nm (26 lb.ft).

3 . Install the rear wheel speed sensor lead.

4 . Install the wheel and tire.


For additional information, refer to Wheel and Tire (74.20.05)

5 . Bleed the brake system.

For additional information, refer to Brake System Bleeding (70.25.03)

Wheel Knuckle - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.15.22)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Remove the wheel knuckle.
 - For additional information, refer to Rear Wheel Bearing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.15.14)
- 3 . Remove the brake disc shield.

- ▶ Remove the 3 rivets.



Installation

- 1 . Install the brake disc shield.
 - ▶ Install the rivets.
 - ▶ Repeat the above procedure for the other side.

2 Install the wheel knuckle.

- . For additional information, refer to Rear Wheel Bearing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.15.14)

204-04 : Wheels and Tires

Specifications

Specifications

Wheel and Tire Specification

NOTE:

Spare wheel assembly not fitted with runflat tires.

NOTE:

As tire fitment can vary in individual markets, consult the vehicle handbook or tire label for further information.

Wheel Size	Tire Type	Tire Size
8.5" x 18"	Continental Sport Contact 2	245/45R 18 96Y
9.5"v x 18"	Continental Sport Contact 2	275/40R 18 99Y
8.5" x 19"	Dunlop Sport 01	245/40R 19 94Y
8.5" x 19" (runflat)	Dunlop Sport 01 DSST	245/40R 19 94Y
9.5" x 19"	Dunlop Sport 01	275/35R 19 96Y
9.5" x 19" (runflat)	Dunlop Sport 01 DSST	275/35R 19 96Y
8.5" x 20"	Dunlop Sport Maxx Directional	255/35R 20 97Y
9.5" x 20"	Dunlop Sport Maxx Directional	285/30R 20 99Y
4" x 18"	Pirelli (spare)	T135/80R 18 104M

Tire Pressures

Description	Tire Pressure		
	Front	Rear	Space Saver Spare
All Derivatives	2.1 bar (30 lb/in ²)	2.3 bar (33 lb/in ²)	4.2 bar (60 lb/in ²)

Torque Specifications

Description	Nm	lb-ft
Wheel nuts	125	92
Tire low pressure sensor	6.5	5

Wheels and Tires

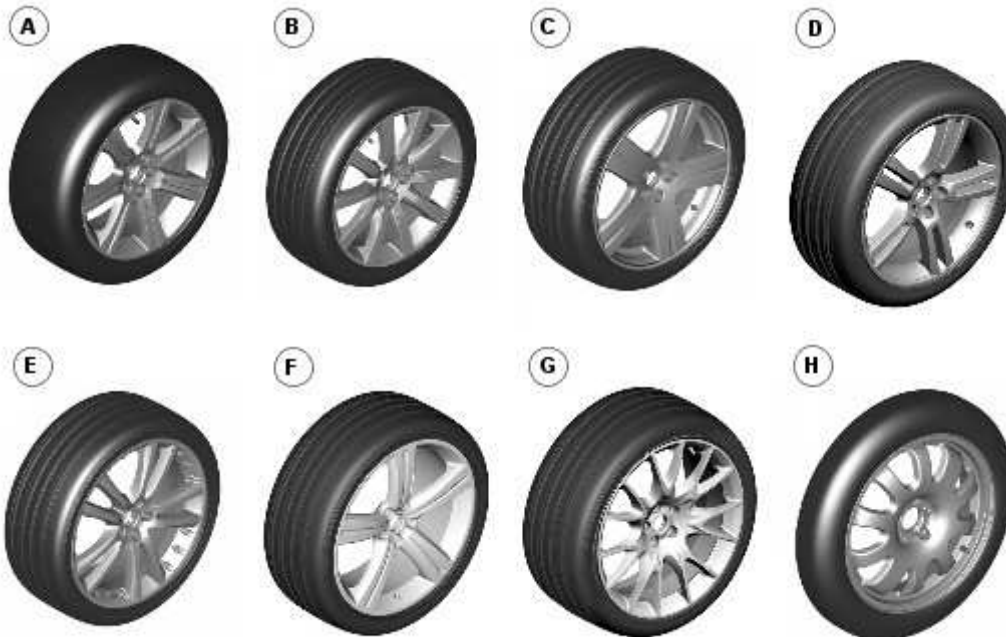
INTRODUCTION

A number of alloy wheels are available ranging from 18 in. to 20 in. diameter. The rim widths are 8.5 or 9.0 in. for front wheels and 9.5 or 10.5 in. for rear wheels. An alloy space saver wheel is a standard fitment, except for vehicles fitted with run-flat tires.

A Tire Pressure Monitoring System (TPMS) is also available as a standard or optional fitment dependant on market. The TPMS is a driver warning system if a tire pressure is outside predetermined thresholds.

A 'run-flat' tire option is available with the 19 in. wheel option. Vehicles fitted with these tires have the TPMS fitted as standard and are not supplied with a spare wheel, vehicle jack or wheel brace.

WHEELS



E 101651

Item	Part Number	Description
A		Venus (8.5J X 18 Front/9.5J X 18 Rear)
B		Carelia (8.5J X 19 Front/9.5J X 19 Rear)
C		Sabre - Run-flat tires (8.5J X 19 Front/9.5J X 19 Rear)

D		Jupiter (8.5J X 19 Front/9.5J X 19 Rear)
E		Senta (8.5J X 20 Front/9.5J X 20 Rear)
F		Cremona (8.5J X 20 Front/9.5J X 20 Rear)
G		Vortex (9.0J X 20 Front/10.5J X 20 Rear)
H		Space saver wheel (4J X 18)

TIRES

Tires are available in a number of sizes and tread patterns dependent on vehicle specification. Tire sizes are as follows:

- T135/80R18 (space saver wheel)
- 245/45ZR18 Front / 275/40ZR18 Rear
- 245/40ZR19 Front / 275/35ZR19 Rear
- 255/35ZR20 Front / 285/30ZR20 Rear
- 255/35ZR20 Front / 295/30ZR20 Rear.

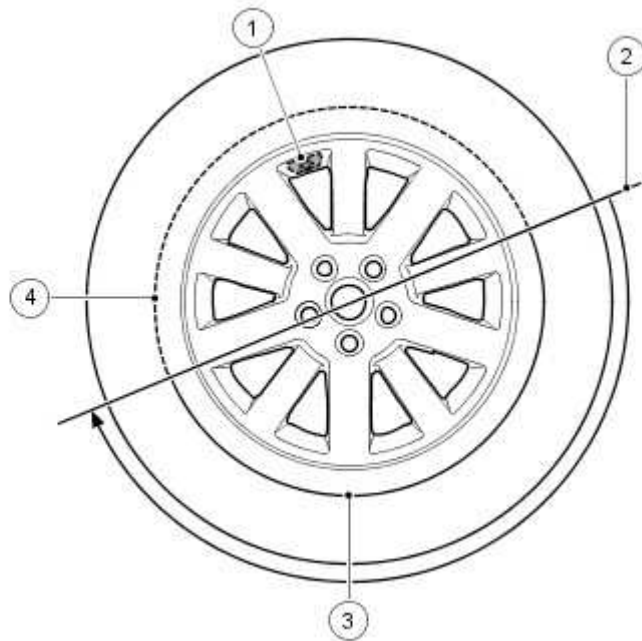


WARNING: Tires should be inflated to the recommended pressures (shown on a label on the 'B' pillar) only when the tires are cold (ambient temperature). If the tires have been subjected to use or exposed to direct sunlight, move the vehicle into a shaded position and allow the tires to cool before checking/adjusting the pressures.

Tire Changing

On vehicles fitted the TPMS, care must be taken when removing and refitting tires to ensure that the tire pressure sensor is not damaged.

Vehicles fitted with TPMS can be visually identified by an external metal locknut and valve of the tire pressure sensor on the road wheels. Vehicles without TPMS will have rubber tire valve.



E45549

Item	Part Number	Description
1		Tire valve and pressure sensor
2		Tire fitting/removal tool initial start position
3		High tire and bead tension area
4		Low tire and bead tension area

When removing the tire, the bead breaker must not be used within 90 degrees of the tire valve in each direction on each side of the tire.

When using the tire removal machine, the fitting arm start position must be positioned as shown in the tire changing illustration for each side of the tire. The wheel can then be rotated through 180 degrees in a counter-clockwise direction. This will relieve tension from the tire bead allowing the remaining 180 degrees of the tire to be manually pulled from the rim.

When refitting the tire, position the fitting arm as shown. Rotate the tire and take care that the bead on the low tension side of the tire does not damage the sensor.

Run-Flat Tires

Run-flat tires can be handled, fitted and removed using the same principles as used for normal low profile and high-performance tires, with two exceptions:

- They are always fitted with tire pressure sensors
- They have thicker bead cores and more rigid sidewalls which require special care when being mounted on the rims.

It is recommended that the tire fitting machine is fitted with plastic rollers for the upper and lower bead. This will ensure that the bead is removed gently, protecting the rims and the tire pressure sensors.

Adequate amounts of special fitting lubricant must be used to ensure that the sidewalls move with the minimum exertion and locate on the rim flange correctly.

Run-flat tires can be identified by the marking 'RSC' on the tire sidewall.

NOTE:

Vehicles fitted with run-flat tires are not supplied with a spare wheel, vehicle jack or wheel brace.

TREAD Act - NAS Only

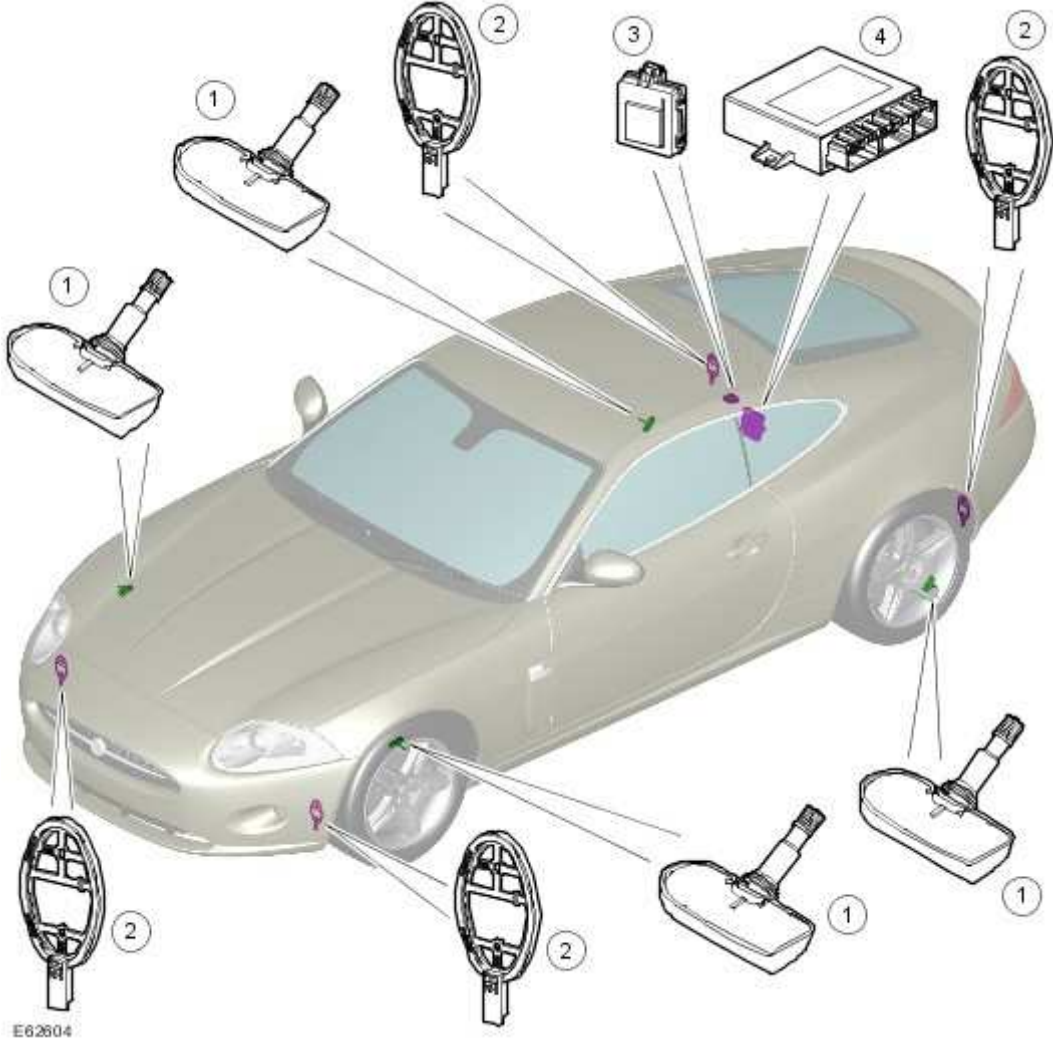
Vehicles supplied to the North American markets must comply with the legislation of the Transport Recall Enhancement, Accountability and Documentation (TREAD) act. Part of the requirement of the TREAD act is for the vehicle to display a label which defines the recommended tire inflation pressure, load limits and maximum load of passengers and luggage weight the vehicle can safely carry. This label will be specific to each individual vehicle and will be installed on the production line. The label is positioned on the driver's side 'B' pillar on NAS vehicles and the inside rear face of the LH door on Canadian specification vehicles.

This label must not be removed from the vehicle. The label information will only define the specification of the vehicle as it came off the production line. It will not include dealer or owner fitted accessory wheels and tires of differing size from the original fitment.

If the label is damaged or removed for body repair, it must be replaced with a new label specific to that vehicle. A new label is requested from Jaguar parts and will be printed specifically for the supplied VIN of the vehicle.

TIRE PRESSURE MONITORING SYSTEM (TPMS)

COMPONENT LOCATION



E62804

Item	Part Number	Description
1		Tire pressure sensor (4 off)
2		Initiator (4 off)
3		Tire Pressure Monitoring System (TPMS) receiver
4		TPMS module

OVERVIEW

The TPMS is a driver assistance system which assists the driver to maintain the tire pressures at the optimum level. The TPMS is a standard fitment on North American Specification (NAS) vehicles and an optional fitment in other markets. The TPMS system has the following benefits:

- Improve fuel consumption
- Maintain ride and handling characteristics
- Reduce the risk of rapid tire deflation - which may be caused by under inflated tires
- Comply with legislation requirements in relevant markets.



CAUTION: The TPMS is not intended as a replacement for regular tire pressure and tire condition checks and should be considered as additional to good tire maintenance practices.

The TPMS measures the pressure in each of the tires on the vehicle (the space saver spare wheel is not monitored) and issues warnings to the driver if any of the pressures deviate from defined tolerances.

NOTE:

During a 'blow-out' a very rapid reduction in pressure is experienced. The system is not intended to warn the driver of a 'blow-out', since it is not possible to give the driver sufficient warning that such an event is occurring, due to its short duration. The design of the TPMS is to assist the driver in keeping the tires at the correct pressure, which will assist to reduce the likelihood of a tire 'blow-out' occurring.

The controlling software for the TPMS is located within a TPMS module. The software detects the following:

- the tire pressure is below the recommended low pressure value - under inflated tire
- the position of the tire on the vehicle.

The system comprises a TPMS module, a Radio Frequency (RF) receiver, 4 initiators and 4 tire pressure sensors (the space saver spare wheel is not fitted with a sensor).

The TPMS module is located behind the Left Hand (LH) rear passenger seat, behind the Auxiliary Junction Box (AJB) and the TPMS RF receiver is located on the AJB mounting bracket. The front initiators are positioned at the front of the wheel arches, behind the fender splash shields. The rear initiators are positioned at the rear of the rear wheel arches, behind the fender splash shields.

The 4 initiators are hard wired to the TPMS module. The initiators transmit 125 KHz Low Frequency (LF) signals to the tire pressure sensors which respond by modifying the mode status within the RF transmission. The 315 or 433 MHz RF signals are detected by the RF receiver which is connected directly to the TPMS module. The received RF signals from the tire pressure sensors are passed to the TPMS module and contain identification, pressure, temperature and acceleration information for

each wheel and tire.

The TPMS module communicates with the instrument cluster via the medium speed CAN bus to provide the driver with appropriate warnings. The TPMS module also indicates status or failure of the TPMS or components.

Tire Location and Identification

The TPMS can identify the position of the wheels on the vehicle and assign a received tire pressure sensor identification to a specific position on the vehicle, for example FL (front left), FR (front right), RL (rear left) and RR (rear right). This feature is required because of the different pressure targets and threshold between the front and rear tires.

The wheel location is performed automatically by the TPMS module using an 'auto-location' function. This function is fully automatic and requires no input from the driver. The TPMS module automatically re-learns the position of the wheels on the vehicle if the tire pressure sensors are replaced or the wheel positions on the vehicle are changed.

The TPMS software can automatically detect, under all operating conditions, the following:

- one or more new tire pressure sensors have been fitted
- one or more tire pressure sensors have stopped transmitting
- TPMS module can reject identifications from tire pressure sensors which do not belong to the vehicle
- two 'running' wheels on the vehicle have changed positions.

If a new tire pressure sensor is fitted on any 'running' wheel, the module can learn the new sensor identification automatically when the vehicle is driven for more than 15 minutes at a speed of more than 20 km/h (12.5 mph).

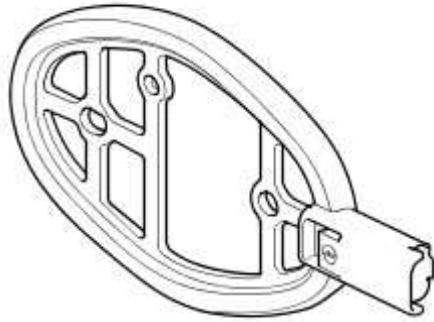
The tire learn and location process is ready to commence when the vehicle has been stationary or travelling at less than 12 mph (20 km/h) for 15 minutes. This is known as 'parking mode'. The learn/locate process requires the vehicle to be driven at speeds of more than 12 mph (20 km/h) for 15 minutes. If the vehicle speed reduces to below 12 mph (20 km/h), the learn process timer is suspended until the vehicle speed increases to more than 12 mph (20 km/h), after which time the timer is resumed. If the vehicle speed remains below 12 mph (20 km/h) for more than 15 minutes, the timer is set to zero and process starts again.

If the tire pressure sensors fitted to the running wheels vehicle are changed, the module can learn the new sensor identifications automatically. The learn function requires no manual intervention by the driver.

Spare Tire Identification

Tire pressure sensors are not fitted to the space saver spare wheel and therefore the spare wheel is not monitored.

Initiators



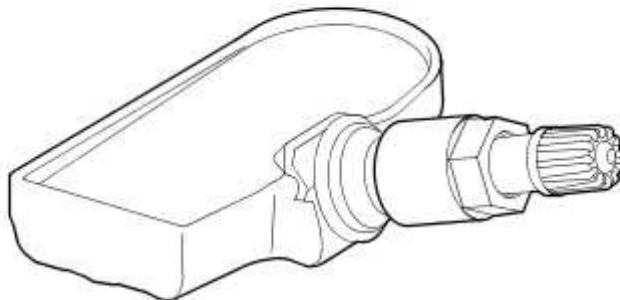
E45552

Four initiators are fitted to the vehicle. The front initiators are located near the front of the front wheel arches, behind the fender splash shields. The rear initiators are located at the rear of the rear wheel arches, behind the fender splash shields. Each initiator has a connector which connects to the vehicle body harness.

The initiator is a passive, LF transmitter. The initiators transmit their signals which are received by the tire pressure sensors, prompting them to modify their mode status.

The TPMS module energises each initiator in turn using LF drivers. The corresponding tire pressure sensor detects the LF signal and responds by modifying the mode status within the RF transmission.

Tire Pressure Sensor



E45553

The TPMS uses active tire pressure sensors which are located on each wheel, inside the tire cavity. The sensor incorporates the tire valve and is secured in the wheel by a nut on the outside of the wheel. The sensor contains a Printed Circuit Board (PCB) which houses a Positive Temperature Coefficient (PTC) sensor, a Piezo pressure sensor, a radio receiver and transmitter and a lithium battery.

The tire pressure sensors use the PTC sensor and the Piezo sensor to periodically measure the

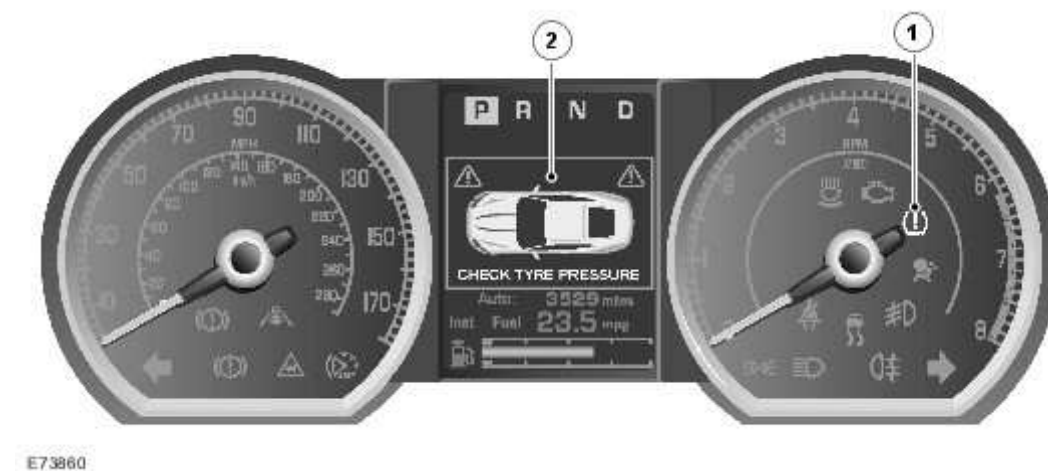
pressure and temperature of the air inside the tire. The data is transmitted by RF data signals at either 315 MHz or 433 MHz dependant on market requirements.

The RF transmission from the sensor contains a unique identification code in its transmission data. This allows the TPMS to identify the wheel on the vehicle. If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is driven at speed of more than 20 km/h (12.5 mph) for 15 minutes.

The tire pressure sensor can also detect when the wheel is rotating. In order to preserve battery power, the sensor uses different transmission rates when the wheel is stationary or moving.

The care points detailed in 'Tire Changing' earlier in this section must be followed to avoid damage to the sensor. If a new sensor is fitted, a new nut, seal and washer must also be fitted and the sensor nut tightened to the correct torque as given in the Service Repair Manual.

Instrument Cluster Indications



Item	Part Number	Description
1		Low tire pressure warning indicator
2		Message centre

The warning indications to the driver are common on all vehicles fitted with TPMS. The driver is alerted to system warnings by a low tire pressure warning indicator in the instrument cluster and an applicable text message in the message centre.

The TPMS module passes system status information to the instrument cluster on the medium speed CAN bus. The instrument cluster then converts this data into illumination of the warning indicator and display of an appropriate message.

When the ignition is switched on, the warning indicator is illuminated for 3 seconds for a bulb check.

NOTE:

If the vehicle is not fitted with the TPMS, the warning indicator will not illuminate.

The instrument cluster checks, within the 3 second bulb check period, for a CAN bus message from the TPMS. During this time the TPMS performs internal tests and CAN bus initialisation. The warning indicator will be extinguished if the TPMS module does not issue a fault message or tire pressure warning message.

If a TPMS fault warning message is detected by the instrument cluster at ignition on, the warning indicator will illuminate on vehicles up to 2007.25MY and will flash on vehicles from 2007.25MY for 72 seconds after the 3 second bulb check period and then remain permanently illuminated.

If a tire pressure warning message is detected by the instrument cluster at ignition on, the warning indicator will extinguish briefly after the 3 second bulb check period, before re-illuminating to indicate a tire pressure warning.

The following table shows the warning indicator functionality for given events:

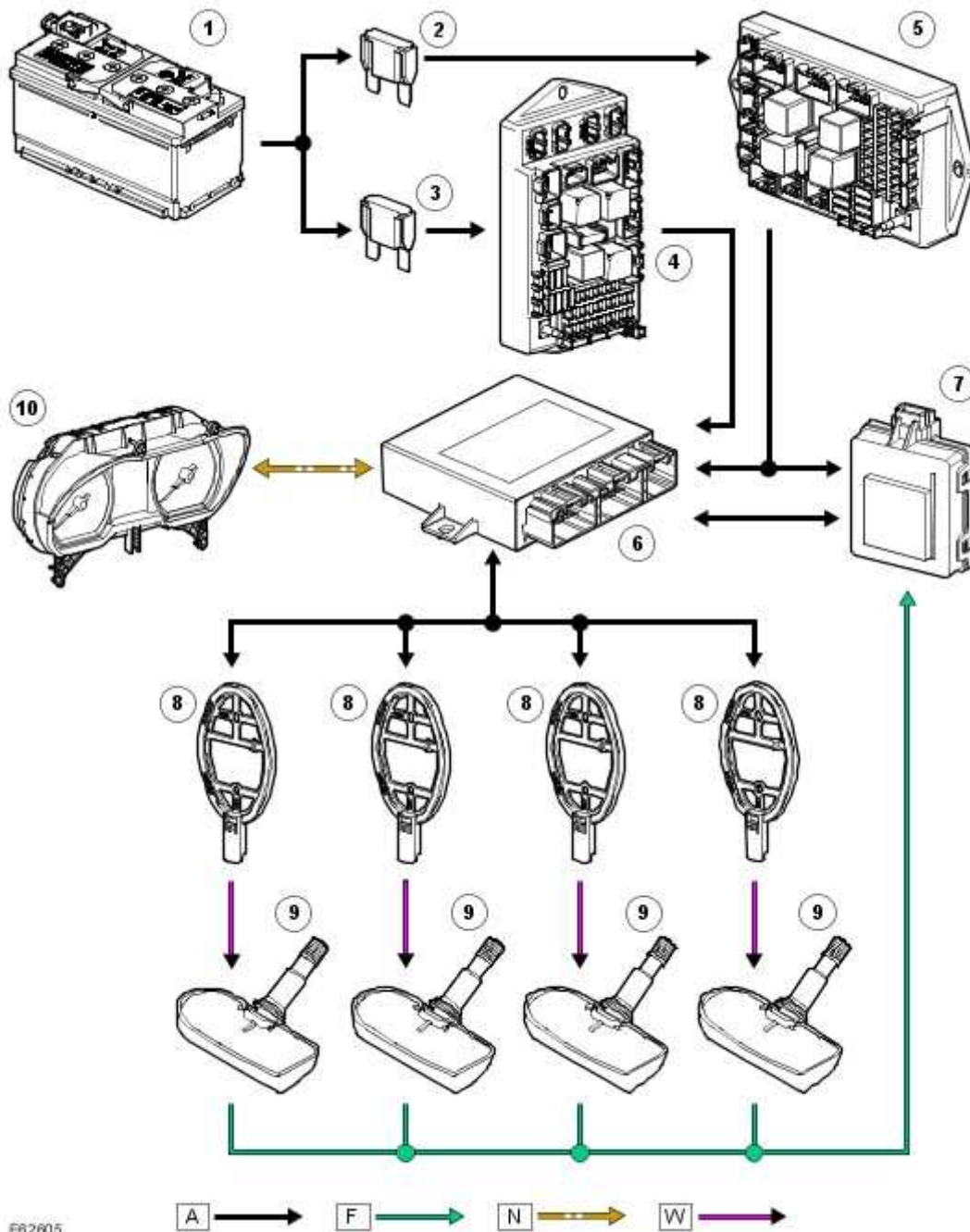
Event	Instrument Cluster Indications
Low pressure warning limit reached in one wheel	Warning indicator illuminated. 'CHECK TYRE PRESSURE' message displayed and applicable tire highlighted on display.
Low pressure warning limit reached in one or more wheels in low speed mode (only if programmed or learning)	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES' message displayed.
TPMS fault	On vehicles up to 2007.25MY - Warning indicator permanently illuminated. On vehicles from 2007.25MY - Warning indicator flashes for 72 seconds and is then permanently illuminated. 'TYRE PRESSURE SYSTEM FAULT' message displayed.
No transmission from a specific tire pressure sensor or Specific tyre pressure sensor fault	Warning indicator illuminated. 'TYRE NOT MONITORED' message displayed and Amber LED flashes for 72 seconds. Amber LED illuminated at next and subsequent ignition on cycle.
No transmission from more than one tyre pressure sensor or More than one tyre pressure sensor fault	Warning indicator illuminated. 'TYRE PRESSURE SYSTEM FAULT' message displayed and Amber LED flashes for 72 seconds. Amber LED illuminated at next and subsequent ignition on cycle.
CAN signals missing	On vehicles up to 2007.25MY - Warning indicator permanently illuminated. On vehicles from 2007.25MY - Warning indicator

flashes for 72 seconds and is then permanently illuminated.
'TYRE PRESSURE SYSTEM FAULT' message displayed.

CONTROL DIAGRAM

NOTE:

A = Hardwired; F = RF Transmission; N = Medium speed CAN bus; W = LF Transmission



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Central Junction Box (CJB)
5		Auxiliary junction box
6		TPMS module
7		TPMS receiver
8		Initiators
9		Tire pressure sensors
10		Instrument cluster

PRINCIPLES OF OPERATION

Each time the vehicle is driven the TPMS module activates each initiator in turn to transmit a LF 125 KHz signal to each tire pressure sensor. The LF signal is received by the tire pressure sensor which responds by transmitting a 315 or 433 MHz (depending on market) signal which is received by the RF receiver. The signal contains coded data which corresponds to sensor identification, air pressure, air temperature and acceleration data and is passed to the TPMS module.

When the vehicle has been parked for more than 15 minutes and then driven at a speed of more than 12.5 mph (20 km/h), the initiators fire in turn for 6 seconds on all 433 MHz vehicles or for 18 seconds on 315 MHz vehicles in the following order:

- Front left
- 6 second pause (for the TPMS module to detect a response from the tire pressure sensor)
- Front right
- 6 second pause
- Rear right
- 6 second pause
- Rear left
- 6 second pause.

Each tire pressure sensor responds in turn which allows the TPMS module to establish the sensor positions at the start of the drive cycle. This process is repeated up to three times but less if the sensor positions are already known. The process is known as 'Auto Location' and takes 2 to 4 minutes

to complete.

During this period the tire pressure sensors transmit at regular intervals, once every 5 seconds (once every 15 seconds on 315 MHz vehicles). For the remainder of the drive cycle the tire pressure sensors transmit once every 60 seconds or more often if a change of tire pressure is sensed until the vehicle stops and the TPMS returns to the parking mode.

Once the wheel positions have been established, the initiators stop transmitting the LF signal and do not transmit again until the vehicle has been parked for more than 15 minutes.

The warning appears in the instrument cluster message centre when the inflation pressure has fallen to 25% of the nominal pressure. The displayed message will also include the position(s) of the affected wheel(s) displayed on a vehicle graphic.

The TPMS enters 'Parking Mode' after the vehicle speed has been less than 20 km/h (12.5 mph) for 15 minutes. In parking mode the tire pressure sensors transmit a coded RF signal once every 13 hours. If the tire pressure decreases by more than 0.06 bar (1 lbf/in²), the sensor will transmit more often if pressure in the tire is being lost.


Wheels and Tires - VIN Range: B10572- >B32752

Principle of Operation


For a detailed description of the wheels and tires, refer to the relevant Description and Operation section in the workshop manual.

Wheels and Tires

Inspection and Verification

 **CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.**

1 . Verify the customer complaint. As much information as possible should be gathered from the driver to assist in diagnosing the cause(s). Confirm which of the following two warning types (A or B) exist for the Tire Pressure Monitoring System when the ignition status is switched from 'OFF' to 'ON'

(A) Check Tire Pressure Warnings. A low tire pressure warning will **continuously** illuminate the low tire pressure warning lamp. This warning may be accompanied by a text message such as CHECK  TIRE PRESSURE (refer to owner literature). The manufacturer approved diagnostic system does NOT need to be used. Diagnostic Trouble Codes (DTCs) are not generated with this type of warning. To extinguish this warning it is essential that, with the

ignition 'ON', all vehicle tires (including the spare) are to be set to the correct pressure as stated in the vehicle handbook or as indicated on the placard label in the passenger/driver door aperture. **It is not necessary to drive the vehicle to clear 'check tire pressure' warnings - just changing the tire pressure causes the tire low pressure sensor to transmit new data.**

NOTE:

The tire pressures should be set by:

- Using a calibrated tire pressure gauge
- With 'cold' tires (vehicle parked in the ambient temperature for at least one hour, not in a garage with an artificial ambient temperature)

NOTE:

If the tire pressure warning does not clear within two minutes, it is likely that the gauge is not correctly calibrated or the tires are 'warm'. Carry out the following steps until the warning has cleared:

- Increase the tire pressures by 3psi
- Wait a further two minutes
- When the tires are at ambient temperature and a **calibrated** gauge is available, reset the tire pressures to the correct pressure.

NOTE:

Tire pressure adjustments are part of routine owner maintenance. Tire pressure adjustments that are required due to a lack of owner maintenance are not to be claimed under vehicle warranty.

(B) System Fault Warnings. When a system fault is detected, the low tire pressure warning lamp will flash for approximately 75 seconds prior to being continuously illuminated. Visually inspect for obvious signs of damage and system integrity. Check for the presence of tire low pressure sensors on all four wheels (note: a tire low pressure sensor has a metal valve stem rather than a rubber one).

2 . Check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

NOTE:

If the tester fails to communicate with the Tire Pressure Monitoring System module, the following actions are recommended:

- Remove the Tire Pressure Monitoring System power supply fuse, inspect and re-install (if intact). Test to see if communications have been re-established.
- Remove the Tire Pressure Monitoring System ignition fuse (if applicable), inspect and re-install (if intact). Test to see if communications have

been re-established.

- With ignition status set to 'ON', refer to the electrical circuit diagrams and check Tire Pressure Monitoring System module for power, ignition and ground supplies .
- Carry out CAN network integrity test using the manufacturer approved diagnostic system.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. If this is the case, match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the

manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C1A5 6-31	Left Front Tire Pressure Sensor and Transmitter Assembly-no signal	<ul style="list-style-type: none">• Missing, incompatible or defective tire low pressure sensor or	GO to Pinpoint Test G561999p6.

		radio frequency receiver	
C1A5 6-68	Left Front Tire Pressure Sensor and Transmitter Assembly-event information	<ul style="list-style-type: none"> Information only - vehicle exposed to extreme temperature environment and/or tire low pressure sensor low battery voltage event 	No action required.
C1A5 6-91	Left Front Tire Pressure Sensor and Transmitter Assembly-parametric	<ul style="list-style-type: none"> Tire low pressure sensor has reported out of range information for pressure, temperature or acceleration 	Replace defective tire low pressure sensor. Refer to the relevant section of the workshop manual.
C1A5 6-93	Left Front Tire Pressure	<ul style="list-style-type: none"> No tire low pressure 	GO to Pinpoint Test

	Sensor and Transmitter Assembly-no operation	sensor can be localized at this position due to an initiator or tire low pressure sensor malfunction	G561999p7.
C1A5 7-11	Left Front Initiator-circuit short to ground	<ul style="list-style-type: none"> Left front initiator circuit is short to ground 	GO to Pinpoint Test G561999p2. Refer to Pinpoint test B1
C1A5 7-12	Left Front Initiator-circuit short to battery	<ul style="list-style-type: none"> Left front initiator circuit is short to power 	GO to Pinpoint Test G561999p2. Go to Pinpoint test B2
C1A5 7-13	Left Front Initiator-circuit open	<ul style="list-style-type: none"> Left front initiator circuit open 	GO to Pinpoint Test G561999p2. Go to Pinpoint test B9
C1A5 8-31	Right Front Tire Pressure	<ul style="list-style-type: none"> Missing, incompatible or 	GO to Pinpoint Test

	Sensor and Transmitter Assembly-no signal	defective tire low pressure sensor or radio frequency receiver	G561999p6.
C1A5 8-68	Right Front Tire Pressure Sensor and Transmitter Assembly-event information	<ul style="list-style-type: none"> Information only - vehicle exposed to extreme temperature environment and/or tire low pressure sensor low battery voltage event 	No action required.
C1A5 8-91	Right Front Tire Pressure Sensor and Transmitter Assembly-parametric	<ul style="list-style-type: none"> Tire low pressure sensor has reported out of range information for pressure, temperature or 	Replace defective tire low pressure sensor. refer to the relevant section of the workshop manual.

		acceleration	
C1A5 8-93	Right Front Tire Pressure Sensor and Transmitter Assembly-no operation	<ul style="list-style-type: none"> No tire low pressure sensor can be localized at this position due to an initiator or tire low pressure sensor malfunction 	GO to Pinpoint Test G561999p7.
C1A5 9-11	Right Front Initiator-circuit short to ground	<ul style="list-style-type: none"> Right front initiator circuit is short to ground 	GO to Pinpoint Test G561999p3. Go to Pinpoint test C1
C1A5 9-12	Right Front Initiator-circuit short to battery	<ul style="list-style-type: none"> Right front initiator circuit is short to power 	GO to Pinpoint Test G561999p3. Go to Pinpoint test C2
C1A5 9-13	Right Front Initiator-circuit open	<ul style="list-style-type: none"> Right front initiator circuit open 	GO to Pinpoint Test G561999p3. Go to Pinpoint

			test C9
C1A6 0-31	Left Rear Tire Pressure Sensor and Transmitter Assembly-no signal	<ul style="list-style-type: none"> Missing, incompatible or defective tire low pressure sensor or radio frequency receiver 	GO to Pinpoint Test G561999p6.
C1A6 0-68	Left Rear Tire Pressure Sensor and Transmitter Assembly-event information	<ul style="list-style-type: none"> Information only - vehicle exposed to extreme temperature environment and/or tire low pressure sensor low battery voltage event 	No action required.
C1A6 0-91	Left Rear Tire Pressure Sensor and Transmitter Assembly-	<ul style="list-style-type: none"> Tire low pressure sensor has reported out of range 	Replace defective tire low pressure sensor, refer to the relevant

	parametric	information for pressure, temperature or acceleration	section of the workshop manual.
C1A6 0-93	Left Rear Tire Pressure Sensor and Transmitter Assembly-no operation	<ul style="list-style-type: none"> No tire low pressure sensor can be localized at this position due to an initiator or tire low pressure sensor malfunction 	GO to Pinpoint Test G561999p7.
C1A6 1-11	Left Rear Initiator-circuit short to ground	<ul style="list-style-type: none"> Left rear initiator circuit short to ground 	GO to Pinpoint Test G561999p4. Go to Pinpoint test D1
C1A6 1-12	Left Rear Initiator-circuit short to battery	<ul style="list-style-type: none"> Left rear initiator circuit short to power 	GO to Pinpoint Test G561999p4. Go to Pinpoint test D2

C1A6 1-13	Left Rear Initiator-circuit open	<ul style="list-style-type: none"> Left rear initiator circuit open 	GO to Pinpoint Test G561999p4. Go to Pinpoint test D9
C1A6 2-31	Right Rear Tire Pressure Sensor and Transmitter Assembly-no signal	<ul style="list-style-type: none"> Missing, incompatible or defective tire low pressure sensor or radio frequency receiver 	GO to Pinpoint Test G561999p6.
C1A6 2-68	Right Rear Tire Pressure Sensor and Transmitter Assembly-event information	<ul style="list-style-type: none"> Information only - vehicle exposed to extreme temperature environment and/or tire low pressure sensor low battery voltage event 	No action required.
C1A6	Right Rear	<ul style="list-style-type: none"> Tire low 	Replace

2-91	Tire Pressure Sensor and Transmitter Assembly-parametric	pressure sensor has reported out of range information for pressure, temperature or acceleration	defective tire low pressure sensor, refer to the relevant section of the workshop manual.
C1A6 2-93	Right Rear Tire Pressure Sensor and Transmitter Assembly-no operation	<ul style="list-style-type: none"> No tire low pressure sensor can be localized at this position due to an initiator or tire low pressure sensor malfunction 	GO to Pinpoint Test G561999p7.
C1A6 3-11	Right Rear Initiator-circuit short to ground	<ul style="list-style-type: none"> Right rear initiator circuit short to ground 	GO to Pinpoint Test G561999p5. Go to Pinpoint test E1
C1A6 3-12	Right Rear Initiator-circuit	<ul style="list-style-type: none"> Right rear initiator circuit short 	GO to Pinpoint Test

	short to battery	to power	G561999p5. Go to Pinpoint test E2
C1A6 3-13	Right Rear Initiator-circuit open	<ul style="list-style-type: none"> Right rear initiator circuit open 	GO to Pinpoint Test G561999p5. Go to Pinpoint test E9
C1A6 4-68	Spare Wheel Tire Pressure Sensor and Transmitter Assembly-event information	<ul style="list-style-type: none"> Information only - vehicle exposed to extreme temperature environment and/or tire low pressure sensor low battery voltage event 	No action required.
C1A6 4-91	Spare Wheel Tire Pressure Sensor and Transmitter Assembly-parametric	<ul style="list-style-type: none"> Tire low pressure sensor has reported out of range information for pressure, 	Replace defective tire low pressure sensor, refer to the relevant section of the

		temperature or acceleration	workshop manual.
C1A6 4-93	Spare Wheel Tire Pressure Sensor and Transmitter Assembly-no operation	<ul style="list-style-type: none"> • Missing, incompatible or defective tire low pressure sensor or radio frequency receiver 	GO to Pinpoint Test G561999p8.
C1D1 9-11	External Receiver Data Line-circuit short to ground	<ul style="list-style-type: none"> • Tire pressure monitoring system radio frequency receiver or data line circuit is short to ground 	GO to Pinpoint Test G561999p1.
C1D1 9-12	External Receiver Data Line-circuit short to battery	<ul style="list-style-type: none"> • Tire pressure monitoring system radio frequency 	GO to Pinpoint Test G561999p9.

		receiver or data line circuit is short to power	
C1D1 9-87	External Receiver Data Line-missing message	<ul style="list-style-type: none"> • Radio Frequency reception blocked • Tire pressure monitoring system radio frequency receiver faulty • Tire pressure monitoring system radio frequency receiver or data line circuits open circuit • Missing, incompatible or defective tire low 	GO to Pinpoint Test G561999p10.

		pressure sensors	
U0010-88	Medium Speed CAN Communication Bus-bus off	<ul style="list-style-type: none"> • CAN bus fault 	Carry out CAN network integrity tests. Refer to the electrical wiring diagrams and check CAN network for short, open circuit.
U0140-00	Lost communication with body control module-no sub type information	<ul style="list-style-type: none"> • CAN bus fault • Central Junction Box fault 	Refer to the electrical wiring diagrams and check Central Junction Box power and ground supplies for short, open circuit. Carry out CAN network integrity tests.
U0142-00	Lost Communication With Body Control Module "B" -	<ul style="list-style-type: none"> • CAN bus fault • Auxiliary Junction Box fault 	Refer to the electrical wiring diagrams and check Auxiliary Junction Box

	no sub type information		power and ground supplies for short, open circuit. Carry out CAN network integrity tests.
U0155-00	Lost Communications With Instrument Panel Cluster (IPC) Control Module-no sub type information	<ul style="list-style-type: none"> • CAN bus fault • Instrument cluster fault 	Refer to the electrical wiring diagrams and check instrument cluster power and ground supplies for short, open circuit. Carry out CAN network integrity tests.
U0164-00	Lost Communication With HVAC Control Module-no sub type information	<ul style="list-style-type: none"> • CAN bus fault • Climate control module fault 	Refer to the electrical wiring diagrams and check climate control module power and ground supplies for short, open circuit. Carry out

			CAN network integrity tests.
U0300-00	Internal Control Module Software Incompatibility -no sub type information	<ul style="list-style-type: none"> Incompatible tire pressure monitoring system module for vehicle CAN network 	Check correct tire pressure monitoring system module is installed to vehicle specification, otherwise suspect the Auxiliary Junction Box.
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module-no subtype information	<ul style="list-style-type: none"> Invalid data received from the Anti-Lock Braking System Control Module CAN bus fault Anti-Lock Braking System fault 	Check Anti-Lock Braking System control module and Instrument Cluster for related DTCs and refer to the relevant DTC Index. Carry out CAN network integrity tests.
U0424-00	Invalid Data Received	<ul style="list-style-type: none"> HVAC control 	Check climate control module

	From HVAC Control Module-no sub type information	module fault	for related DTCs and refer to relevant DTC Index.
U1A1 4-49	CAN Initialisation Failure-internal electronic failure	<ul style="list-style-type: none"> Tire pressure monitoring system module fault 	Install a new tire pressure monitoring module. Refer to the new module/component installation note at the top of the DTC Index.
U3000 -55	Control Module-not configured	<ul style="list-style-type: none"> Tire pressure monitoring system configuration data is invalid 	Check and amend the car configuration file.
U3000 -87	Control Module-missing message	<ul style="list-style-type: none"> Tire pressure monitoring system configuration data not 	Check the Auxiliary Junction Box for related DTCs and refer to the relevant DTC

		received	Index. Carry out CAN network integrity test.
U3002-81	Vehicle Identification Number - invalid serial data received	<ul style="list-style-type: none"> • Tire pressure monitoring system module and vehicle VIN mis-match 	<p>NOTE:</p> <p>This DTC indicates that the tire pressure monitoring system module is not the original part installed to the vehicle at the factory/dealer and could have been substituted. Refer to the note above the DTC index about replacing components which may remain under</p>

			<p>manufacturer warranty.</p> <p>Re-install the original or a new tire pressure monitoring system control module.</p>
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Component Tests

Wheels and Tires

For wheel and tire specification information (pressures, torques, etc).
Specifications

When replacing wheels or tires, local legislation regarding health and safety must be complied with.

If the vehicle has a Tire Pressure Monitoring System installed, only Jaguar approved wheels and tires should be used. If the wheel and tire size is changed (for example from R18 to R20) the Tire Pressure Monitoring System module should be updated with the correct pressure information appropriate to the new wheel and tire set. Update the Tire Pressure Monitoring System module using the Jaguar approved diagnostic system.

As a general guideline, only replace tires in pairs or as a set, and only with tires of equivalent size and specification.

Confirm the symptoms of the customer complaint.

As much information as possible should be gathered from the driver to assist in diagnosing the cause(s).

1 . Before a road test, carry out a basic inspection to make sure the vehicle is safe and legal to drive.

Basic inspection

- Correct tire inflation.
Specifications

- Legal tire tread depth
- Cuts/Bulges in tire sidewall(s)
- Tire ply separation
- Embedded objects
- Wheel rim damage
- Correct tire installation (specification, direction of rotation, etc)
- Any obvious distortion of the tire (flat/high spots)
- Worn/Damaged steering or suspension components

Road test

If the results of the basic inspection are acceptable, carry out a road test to confirm the symptoms.

To reproduce the symptoms, test the vehicle on similar roads to those on which the fault occurs and at similar speeds (provided it is legal to do so).

If the vibration or noise can be reproduced, note the speed at which it occurs and see if it is possible to drive through the symptom, meaning, is it possible to alter the fault by driving faster or slower than the speed at which it occurs?

If it **is** possible, it is likely that the fault is caused by an imbalance in the wheel or tire.

If the vibration or noise gets worse as the vehicle speed increases, it is likely that the fault is caused by distortion in the wheel or tire, or worn or damaged components.

Distortion checks

Check for distortion by raising the vehicle so that the wheels are free and placing an axle stand or similar fixed object next to each wheel in turn.

If the stand is placed at the tread of the tire, the tire can be checked for ovality by turning the wheel by hand and checking for high or low spots where the gap between the tread and the stand increases or reduces.

If the stand is placed next to the wheel rim or tire sidewall, the wheel and tire can be checked for run-out in a similar way.

Pinpoint Tests

PINPOINT TEST G561999p1 : C1D1911 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO GROUND

G561999t1 : C1D1911 Verify External Receiver Data Line Circuit Short To Ground

1. Ignition off. 2. Disconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Measure the resistance between

CA131, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 5 Ohms?

-> **Yes**

GO to A2. GO to Pinpoint Test G561999t2.

-> **No**

GO to A3. GO to Pinpoint Test G561999t3.

G561999t2 : C1D1911 Check The External Receiver Data Line Circuit For Short Circuit To Ground

1. Disconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109. 2. Measure the resistance between

CA131, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 5 Ohms?

-> **Yes**

REPAIR the short circuit in wiring harness.

-> **No**

GO to A4. GO to Pinpoint Test G561999t4.

G561999t3 : C1D1911 Check The Tire Pressure Monitoring System External Receiver For Short Circuit To Ground

1. Reconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 2. Using manufacturer approved diagnostic system run On Demand Self Test **(0x0202)**.

- **Is the DTC C1D1911 set?**

-> **Yes**

Replace Tire Pressure Monitoring Receiver.

-> **No**

Investigate possible cause of intermittent failure.

G561999t4 : C1D1911 Check The Tire Pressure Monitoring System Control Module For Short Circuit To Ground

1. Reconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109. 2. Reconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Using manufacturer approved diagnostic system run On Demand Self Test **(0x0202)**.

- **Is the DTC C1D1911 set?**

-> **Yes**

Replace Tire Pressure Monitoring System Control Module.

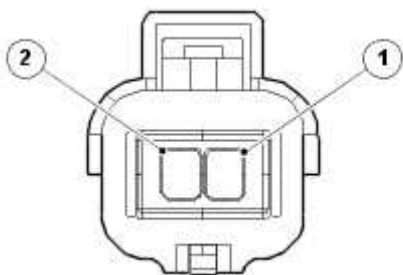
-> **No**

Investigate possible cause of intermittent failure.

PINPOINT TEST G561999p2 : LEFT FRONT LOW FREQUENCY INITIATOR CIRCUIT

G561999t5 : Check the initiator circuit for short circuit to ground

1. Ignition off. 2. Disconnect the left hand front low-frequency initiator electrical connector, FB013. 3.



E63857

4. Measure the resistance between:

FB013, harness side	Battery
Pin 2	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t9.

-> **No**

GO to Pinpoint Test G561999t6.

G561999t6 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

FB013, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t10.

-> **No**

GO to Pinpoint Test G561999t7.

G561999t7 : Check the initiator circuit for short circuit to ground

1. Measure the resistance between:

FB013, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t11.

-> **No**

GO to Pinpoint Test G561999t8.

G561999t8 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

FB013, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

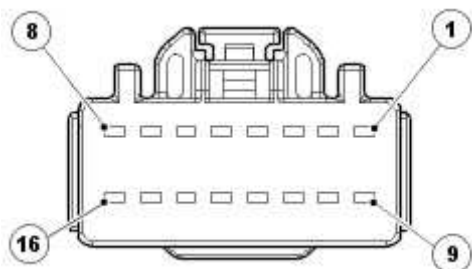
GO to Pinpoint Test G561999t12.

-> **No**

GO to Pinpoint Test G561999t13.

G561999t9 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E63855

3. Measure the resistance between:

FB013, harness side	Battery
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Pin 2	Negative terminal
-------	-------------------

- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

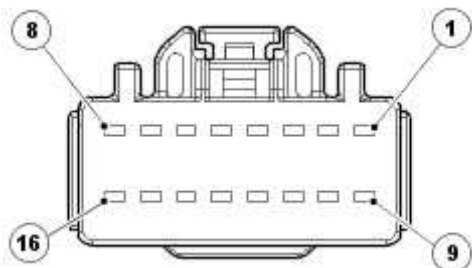
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t10 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



3. Measure the resistance between:

FB013, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

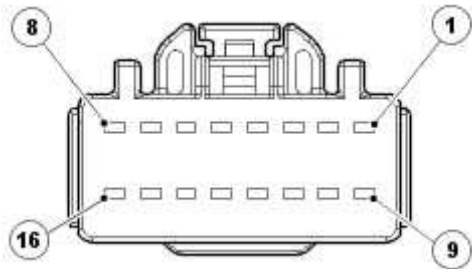
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t11 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E83655

3. Measure the resistance between:

FB013, harness side	Battery
Pin 1	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

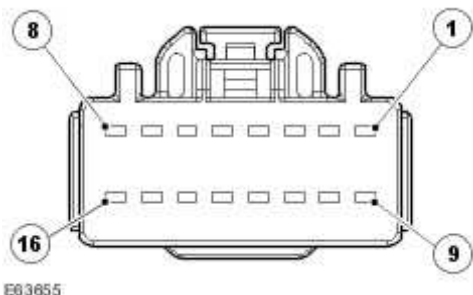
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t12 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



3. Measure the resistance between:

FB013, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

INSTALL a new Tire Pressure Monitoring System module.
 Tire Pressure Monitoring System (TPMS) Module - Convertible
 Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t13 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	FB013, harness side
Pin 14	Pin 2

- Is the resistance greater than 5 ohms?

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connectors, FB001 and FL070.

For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

GO to Pinpoint Test G561999t14.

G561999t14 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	FB013, harness side
Pin 13	Pin 1

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connectors, FB001 and FLO70. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

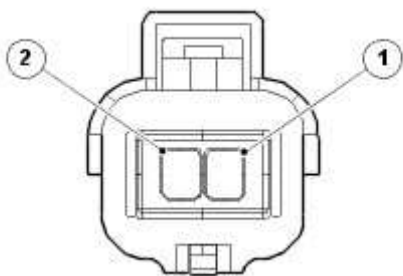
-> **No**

INSTALL a new left hand front low-frequency initiator.
Tire Pressure Monitoring System (TPMS) Front Antenna

PINPOINT TEST G561999p3 : RIGHT FRONT LOW FREQUENCY INITIATOR CIRCUIT

G561999t15 : Check the initiator circuit for short circuit to ground

1. Ignition off. 2. Disconnect the right hand front low-frequency initiator electrical connector, FB012. 3.



E63857

Measure the resistance between:

FB012, harness side	Battery
Pin 2	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t19.

-> **No**

GO to Pinpoint Test G561999t16.

G561999t16 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

FB012, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t20.

-> **No**

GO to Pinpoint Test G561999t17.

G561999t17 : Check the initiator circuit for short circuit to ground

1. Measure the resistance between:

FB012, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t21.

-> **No**

GO to Pinpoint Test G561999t18.

G561999t18 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

FB012, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

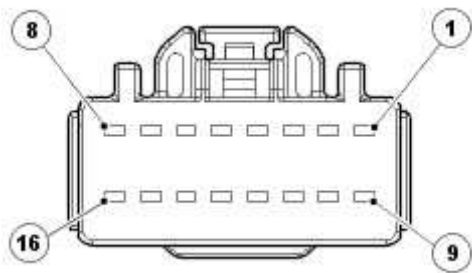
GO to Pinpoint Test G561999t22.

-> **No**

GO to Pinpoint Test G561999t23.

G561999t19 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E63855

Measure the resistance between:

FB012, harness side	Battery
----------------------------	----------------

Pin 2	Negative terminal
-------	-------------------

- Is the resistance less than 10,000 ohms?

-> Yes

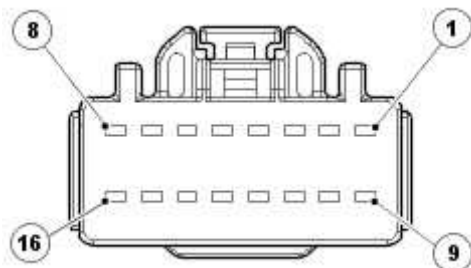
REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

INSTALL a new Tire Pressure Monitoring System module.
 Tire Pressure Monitoring System (TPMS) Module - Convertible
 Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t20 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E03655

Measure the resistance between:

FB012, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

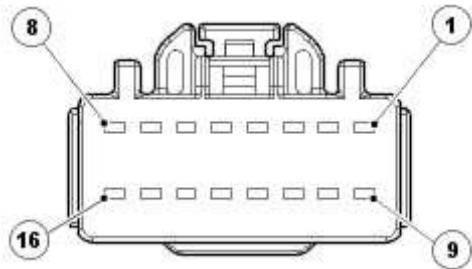
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t21 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, FB072. 2.



E83655

Measure the resistance between:

FB012, harness side	Battery
Pin 1	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

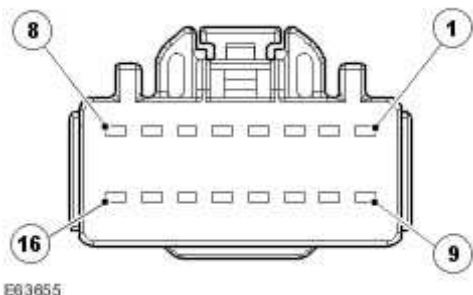
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t22 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



Measure the resistance between:

FB012, harness side	Battery
Pin 1	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connectors, FB001 and FL070. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

INSTALL a new Tire Pressure Monitoring System module.
 Tire Pressure Monitoring System (TPMS) Module - Convertible
 Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t23 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	FB012, harness side
Pin 16	Pin 2

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connectors, FB001 and FL070.

For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

GO to Pinpoint Test G561999t24.

G561999t24 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	FB012, harness side
Pin 15	Pin 1

- Is the resistance greater than 5 ohms?

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connectors, FB001 and FLO70. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

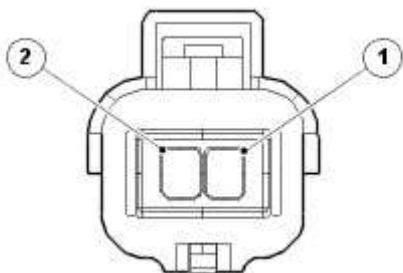
-> **No**

INSTALL a new right hand front low-frequency initiator.
Tire Pressure Monitoring System (TPMS) Front Antenna

PINPOINT TEST G561999p4 : LEFT REAR LOW FREQUENCY INITIATOR CIRCUIT

G561999t25 : Check the initiator circuit for short circuit to ground

1. Ignition off. 2. Disconnect the left hand rear low-frequency initiator electrical connector, RB010. 3.



E83857

Measure the resistance between:

RB010, harness side	Battery
Pin 2	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t29.

-> **No**

GO to Pinpoint Test G561999t26.

G561999t26 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

RB010, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t30.

-> **No**

GO to Pinpoint Test G561999t27.

G561999t27 : Check the initiator circuit for short circuit to ground

1. Measure the resistance between:

RB010, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t31.

-> **No**

GO to Pinpoint Test G561999t28.

G561999t28 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

RB010, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

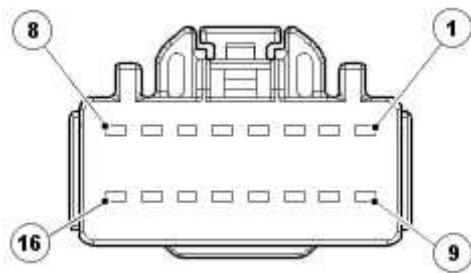
GO to Pinpoint Test G561999t32.

-> **No**

GO to Pinpoint Test G561999t33.

G561999t29 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



Measure the resistance between:

RB010, harness side	Battery
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Pin 2	Negative terminal
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- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

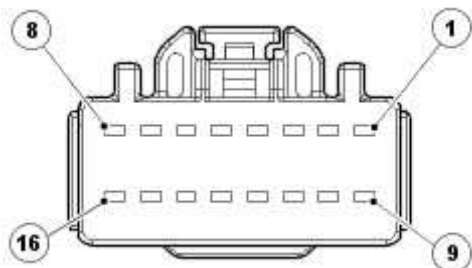
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t30 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E03655

Measure the resistance between:

RB010, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

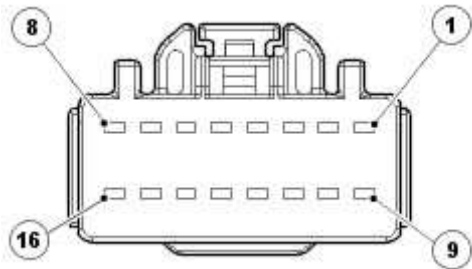
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t31 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



83655

Measure the resistance between:

RB010, harness side	Battery
Pin 1	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

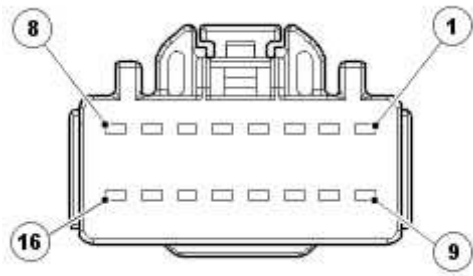
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t32 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E83855

Measure the resistance between:

RB010, harness side	Battery
Pin 1	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t33 : Check the initiator return circuit for high resistance

1. Measure the resistance between:

CA072, harness side	RB010, harness side
Pin 6	Pin 2

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connector, RB001. For additional

information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

GO to Pinpoint Test G561999t35.

G561999t34 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	RB010, harness side
Pin 5	Pin 1

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

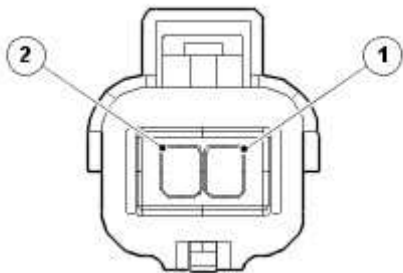
-> **No**

INSTALL a new rear left hand low-frequency initiator.
Tire Pressure Monitoring System (TPMS) Rear Antenna

PINPOINT TEST G561999p5 : RIGHT REAR LOW FREQUENCY INITIATOR CIRCUIT

G561999t35 : Check the initiator circuit for short circuit to ground

1. Ignition off. 2. Disconnect the right hand rear low-frequency initiator electrical connector, RB009.
3.



E63857

Measure the resistance between:

RB009, harness side	Battery
Pin 2	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t39.

-> **No**

GO to Pinpoint Test G561999t36.

G561999t36 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

RB009, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t40.

-> **No**

GO to Pinpoint Test G561999t37.

G561999t37 : Check the initiator circuit for short circuit to ground

1. Measure the resistance between:

RB009, harness side	Battery
Pin 1	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

GO to Pinpoint Test G561999t41.

-> **No**

GO to Pinpoint Test G561999t38.

G561999t38 : Check the initiator circuit for short circuit to power

1. Measure the resistance between:

RB009, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

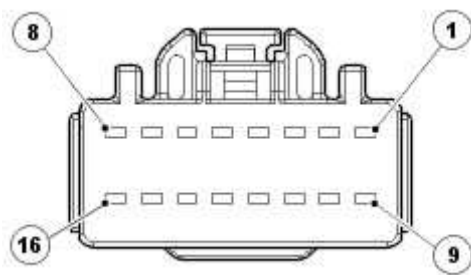
GO to Pinpoint Test G561999t42.

-> **No**

GO to Pinpoint Test G561999t43.

G561999t39 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E63855

Measure the resistance between:

RB009, harness side	Battery
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Pin 2	Negative terminal
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- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

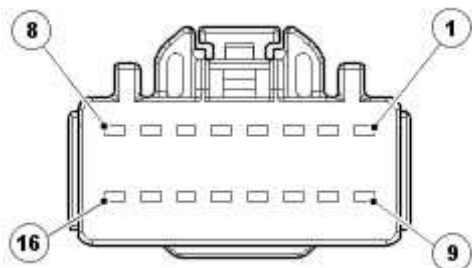
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t40 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E03655

Measure the resistance between:

RB009, harness side	Battery
Pin 2	Positive terminal

- Is the resistance less than 10,000 ohms?

-> Yes

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> No

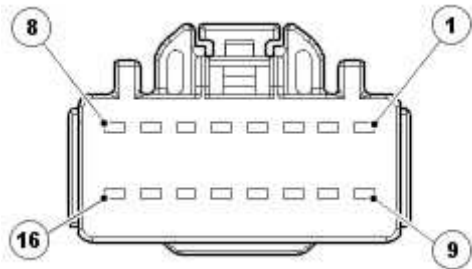
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t41 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E83655

Measure the resistance between:

RB009, harness side	Battery
Pin 1	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

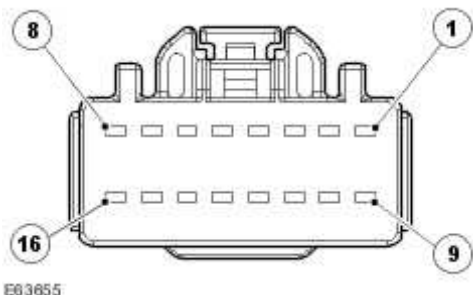
INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t42 : Check whether the short circuit is in the harness or the module

1. Disconnect the Tire Pressure Monitoring System module connector, CA072. 2.



E83855

Measure the resistance between:

RB009, harness side	Battery
Pin 1	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

INSTALL a new Tire Pressure Monitoring System module.

Tire Pressure Monitoring System (TPMS) Module - Convertible

Tire Pressure Monitoring System (TPMS) Module - 2-Door

G561999t43 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	RB009, harness side
Pin 8	Pin 2

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connector, RB001. For additional

information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

GO to Pinpoint Test G561999t44.

G561999t44 : Check the initiator circuit for high resistance

1. Measure the resistance between:

CA072, harness side	RB009, harness side
Pin 7	Pin 1

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. This circuit contains intermediate connector, RB001. For additional information, refer to the wiring diagram. Clear the DTC and run an On Demand Self Test (ODST) using the manufacturer approved diagnostic system to confirm rectification.

-> **No**

INSTALL a new rear right hand low-frequency initiator.

Tire Pressure Monitoring System (TPMS) Rear Antenna

PINPOINT TEST G561999p6 : MISSING, INCOMPATIBLE OR DEFECTIVE RUNNING TIRE LOW PRESSURE SENSOR OR RECEIVER

G561999t45 : Check for correct wheel and tire assembly and tire low pressure sensor

1. Establish that a full size running wheel and tire assembly has a tire low pressure sensor installed. As a visual confirmation, a tire low pressure sensor has a metal valve stem rather than a rubber one and cannot be installed to a mini/space saver spare wheel.

- **Is a full size wheel and tire assembly with tire low pressure sensor installed?**

-> **Yes**

GO to Pinpoint Test G561999t46.

-> **No**

Install the correct wheel and tire assembly or tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application.

G561999t46 : Check for additional DTCs

1. Remove the Tire Pressure Monitoring System power supply fuse and re-install it. Clear DTCs and leave the vehicle stationary for 15 minutes, then drive it at a speed greater than 15.5 mph (25 kph) continuously for at least 10 minutes. Note: If the vehicle speed drops below this value, the drive time to complete the test will need to be increased. The use of the manufacturer approved diagnostic system, and the datalogger signal 'Tire pressure monitor system status – learn mode status' will verify the completion of the test when the value returns to 'Inactive'. 2. Check for additional DTCs C1A5631, C1A5831, C1A6031, C1A6231, with identical time stamps.

- **Have all four DTCs logged with identical time stamps in the tire pressure monitoring system module?**

-> **Yes**

Replace the tire pressure monitoring system radio frequency receiver.
Tire Pressure Monitoring System (TPMS) Receiver

-> **No**

GO to Pinpoint Test G561999t47.

G561999t47 : Verify the position of the defective tire low pressure sensor

1. Check tire pressure monitoring system DTCs.

- **Are any C1AXX31 DTCs logged?**

-> **Yes**

Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position identified by the logged DTC.

Tire Low Pressure Sensor

-> **No**

No further action is required. Note: The use of the manufacturer approved diagnostic system, and the datalogger signal 'Tire pressure monitor system status – learn completed successfully' will verify the successful completion of the test.

PINPOINT TEST G561999p7 : LOCALIZATION FAILURE

G561999t48 : Check for additional DTCs

1. Check for additional DTCs: C1A5711, C1A5712, C1A5713. C1A5911, C1A5912, C1A5913, C1A6111, C1A6112, C1A6113, C1A6311, C1A6312, C1A6313.

- **Are any of the DTCs listed above also logged?**

-> **Yes**

Refer to the DTC Index and remedial actions.

-> **No**

GO to Pinpoint Test G561999t49.

G561999t49 : Check for additional DTCs

1. Check for additional DTCs: C1A5631, C1A5831, C1A6031 or C1A6231

- **Is a C1A5631, C1A5831, C1A6031 or C1A6231 DTC also logged?**

-> **Yes**

Refer to the DTC Index and remedial actions.

-> **No**

GO to Pinpoint Test G561999t50.

G561999t50 : Check Initiator installation

1. Check for correct installation of Initiator.

Tire Pressure Monitoring System (TPMS) Front Antenna

Tire Pressure Monitoring System (TPMS) Rear Antenna

- **Is the Initiator correctly installed?**

-> **Yes**

GO to Pinpoint Test G561999t51.

-> **No**

Rectify as required.

Tire Pressure Monitoring System (TPMS) Front Antenna

Tire Pressure Monitoring System (TPMS) Rear Antenna

G561999t51 : Check for short circuit in Initiator harness

1. Locate and remove module blue connector L. 2. Measure the resistance across the relevant initiator circuits within the blue connector.

- **Is the resistance less than 1 Ohm?**

-> **Yes**

A value of less than 1 Ohm indicates a short circuit, rectify the short circuit as required.

-> **No**

Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position identified by the logged DTC.

Tire Low Pressure Sensor

PINPOINT TEST G561999p8 : SPARE TIRE LOW PRESSURE SENSOR NO OPERATION

G561999t52 : Establish the type of spare wheel and tire assembly installed

1. Establish the type of spare wheel and tire assembly Installed.

- **Is the spare wheel a mini/space saver type?**

-> **Yes**

Tire low pressure sensors are not installed to mini/space-saver spare wheels. Tire low pressure sensors are installed to full size spare wheels only. The DTC is to be ignored and no repair action is required.

-> **No**

GO to Pinpoint Test G561999t53.

G561999t53 : Establish that the spare wheel has a tire low pressure sensor installed

1. Establish that the spare wheel has a tire low pressure sensor installed, considering the following additional information:

a) As a visual confirmation, the tire low pressure sensor has a metal valve stem rather than a rubber one.

- **Is a tire low pressure sensor installed?**

-> **Yes**

GO to Pinpoint Test G561999t54.

-> **No**

A new spare tire low pressure sensor should be installed. Note: Refer to the note above the DTC index about replacing components which may remain under manufacturer warranty. Refer to the relevant section of the workshop manual.

G561999t54 : Confirm operation of the spare wheel pressure sensor

1. Deflate the spare tire, in close proximity to the vehicle, until it is completely deflated. 2. Complete an ignition cycle to ignition on and verify that the instrument cluster reports a spare tire pressure warning for approximately 20 seconds. 3. Re-inflate the spare tire, in close proximity to the vehicle, to the recommended spare tire pressure. 4. Complete an ignition cycle to ignition on and verify that the instrument cluster no longer reports a spare tire pressure warning.

- **Does the instrument cluster continue to report a spare tire pressure warning?**

-> **Yes**

GO to Pinpoint Test G561999t55.

-> **No**

No repair action is required. It is possible that the customer may have placed items in the vehicle's luggage compartment that prevented correct RF reception.

G561999t55 : Verify that the spare Tire Low Pressure Sensor ID has been correctly programmed to the module

1. Remove tire low pressure sensor. Record the 8 character hexadecimal ID written on the casing. 2. Use the approved diagnostic system to read the spare tire sensor ID from the module. Refer to the relevant procedure in the workshop manual. 3. Compare the IDs from steps 1 & 2.

- **Do the IDs match?**

-> **Yes**

Replace the spare tire low pressure sensor. Refer to the relevant installation section in the workshop manual.

The identification for the sensor must be programmed into the tire pressure monitoring system module using the manufacturer approved diagnostic system. The identification code is provided on a label with the complete assembly and is also printed on the casing of each sensor.

-> **No**

Program the spare tire sensor ID, recorded in step 1, to the module using the approved diagnostic system. The identification code is provided on a label with the complete assembly and is also printed on the casing of each sensor.

Repeat test to ensure correct operation. GO to Pinpoint Test G561999t54.

PINPOINT TEST G561999p9 : C1D1912 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO POWER

G561999t56 : C1D1912 Verify External Receiver Data Line Circuit Short To Power

1. Ignition off. 2. Disconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Measure the resistance between

CA131, harness side	Battery
Pin 1	Positive terminal

- Is the resistance less than 5 Ohms?

-> **Yes**

GO to Pinpoint Test G561999t57.

-> **No**

GO to Pinpoint Test G561999t58.

G561999t57 : C1D1912 Check The External Receiver Data Line Circuit For Short Circuit To Power

1. Disconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109. 2. Measure the resistance between

CA131, harness side	Battery
Pin 1	Positive terminal

- **Is the resistance less than 5 Ohms?**

-> **Yes**

REPAIR the short circuit in wiring harness.

-> **No**

GO to Pinpoint Test G561999t59.

G561999t58 : C1D1912 Check The Tire Pressure Monitoring System External Receiver For Short Circuit To Power

1. Reconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 2. Using manufacturer approved diagnostic system run On Demand Self Test **(0x0202)**.

- **Is the DTC C1D1912 set?**

-> **Yes**

Replace Tire Pressure Monitoring Receiver.

-> **No**

Investigate possible cause of intermittent failure.

G561999t59 : C1D1912 Check The Tire Pressure Monitoring System Control Module For Short Circuit To Power

1. Reconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109. 2. Reconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Using manufacturer approved diagnostic system run On Demand Self Test **(0x0202)**.

- **Is the DTC C1D1912 set?**

-> **Yes**

Replace Tire Pressure Monitoring System Control Module.

-> **No**

Investigate possible cause of intermittent failure.

PINPOINT TEST G561999p10 : C1D1987 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE MISSING MESSAGE

G561999t60 : C1D1987 Verify External Receiver Data Line Missing Message

1. Using manufacturer approved diagnostic system run On Demand Self Test (0x0202).

- **Is the DTC C1D1987 set?**

-> **Yes**

GO to Pinpoint Test G561999t61.

-> **No**

GO to Pinpoint Test G561999t64.

G561999t61 : C1D1987 Check External Receiver Data Line Circuit

1. Ignition off. 2. Disconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Disconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109 4. Measure the resistance between

CA131, harness side	CA109, harness side
Pin 1	Pin4

- **Is the resistance less than 5 ohms?**

-> **Yes**

GO to Pinpoint Test G561999t62.

-> **No**

REPAIR the high resistance/open circuit in wiring harness.

G561999t62 : C1D1987 Check External Receiver

1. Reconnect the Tire Pressure Monitoring System Control Module electrical connector, CA109 2. Reconnect the Tire Pressure Monitoring System Receiver electrical connector, CA131. 3. Using manufacturer approved diagnostic system run On Demand Self Test (**0x0202**).

- **Is the DTC C1D1987 set?**

-> **Yes**

Replace Tire Pressure Monitoring Receiver. GO to Pinpoint Test G561999t63.

-> **No**

Investigate possible cause of intermittent failure.

G561999t63 : C1D1987 Check Tire Pressure Monitoring System Control Module

1. Using manufacturer approved diagnostic system run On Demand Self Test (**0x0202**).

- **Is the DTC C1D1987 set?**

-> **Yes**

Replace Tire Pressure Monitoring System Control Module.

-> **No**

Test is complete. No further action is required.

G561999t64 : C1D1987 Check Wheels Have Tire Sensors Installed

1. **NOTE:**

As a visual check, a tire low pressure sensor has a metal valve stem rather than a rubber one and cannot be installed to a mini/space saver spare wheel.

Check that all full size running wheel and tire assemblies have tire low pressure sensors installed.

- **Is a full size wheel and tire assembly with tire low pressure sensor installed to all running wheel positions?**

-> **Yes**

GO to Pinpoint Test G561999t65.

-> **No**

If agreed with the customer install correct tire low pressure sensors in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, as required. Note: Confirm why the vehicle has non-TPMS wheel & tire assemblies fitted before installing tire low pressure sensors, which are not to be claimed under vehicle warranty.

G561999t65 : C1D1987 Check Tire Sensor Compatibility To Tire Pressure Monitoring System Receiver

1. Remove tire low pressure sensor from 1 wheel. 2. Verify the tire low pressure sensor part number from the information on the casing.

- **Is the tire low pressure sensor the correct part for the vehicle?**

-> **Yes**

Replace Tire Pressure Monitoring Receiver. Carry out the following to verify repair.

Remove the Tire Pressure Monitoring System power supply fuse and re-install it. Clear DTCs and leave the vehicle stationary for 15 minutes, then drive it at a speed greater than 15.5 mph (25 kph) continuously for at least 10 minutes.

Note: If the vehicle speed drops below this value, the drive time to complete the test will need to be increased. The use of the manufacturer approved diagnostic system, and the datalogger signal 'Tire pressure monitor system status – learn mode status' will verify the completion of the test when the value returns to 'Inactive'.

-> **No**

Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position(s) identified. Note: Confirm why the vehicle has incorrect TPMS wheel & tire assemblies fitted before installing tire low pressure sensors, which are not to be claimed under vehicle warranty.

Wheels and Tires - VIN Range: B00379- >B10571

Principle of Operation

For a detailed description of the wheels and tires, refer to the relevant Description and Operation section in the workshop manual.

Wheels and Tires

Inspection and Verification

1 . Verify the customer complaint.

NOTE:

Record any messages displayed by the system.

2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Tire pressures• Tire/Wheel damage. Refer to component tests in this section• Tire low pressure sensor installation/damage• Front antenna installation/damage• Rear antenna installation/damage	<ul style="list-style-type: none">• Fuses• Front antenna installation/damage• Rear antenna installation/damage• Tire Pressure Monitoring System (TPMS) module• Connectors/harnesses

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident use the Jaguar approved diagnostic system or a scan tool to retrieve the Diagnostic Trouble Codes (DTCs) before proceeding to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. If this is the case, match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C1A5616	Left hand front tire low pressure sensor	<ul style="list-style-type: none"> Low battery detected 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A5631	Left hand front tire low pressure sensor	<ul style="list-style-type: none"> No signal detected 	<ul style="list-style-type: none"> Check for stored DTC C1A5616 and follow the actions indicated. If this DTC is not stored replace the tire low pressure sensor. Tire Low Pressure

			Sensor
C1A5691	Left hand front tire low pressure sensor	<ul style="list-style-type: none"> Data out of range 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A5693	Left hand front tire low pressure sensor	<ul style="list-style-type: none"> No sensor can be found at this location 	<ul style="list-style-type: none"> Check for stored DTCs C1A5711, C1A5712, C1A5713 or C1A5631 and follow the actions indicated.
C1A5711	Left hand front antenna	<ul style="list-style-type: none"> Left hand front antenna circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A5712	Left hand front antenna	<ul style="list-style-type: none"> Left hand front antenna circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A5713	Left hand front antenna	<ul style="list-style-type: none"> Left hand front antenna circuit - high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A5816	Right hand front tire low pressure sensor	<ul style="list-style-type: none"> Low battery detected 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A5831	Right hand front tire low pressure sensor	<ul style="list-style-type: none"> No signal detected 	<ul style="list-style-type: none"> Check for stored DTC C1A5816 and follow the actions indicated. If this DTC is not stored replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A5891	Right hand front tire low pressure	<ul style="list-style-type: none"> Data out of range 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure

	sensor		Sensor
C1A5893	Right hand front tire low pressure sensor	<ul style="list-style-type: none"> No sensor can be found at this location 	<ul style="list-style-type: none"> Check for stored DTCs C1A5911, C1A5912, C1A5913 or C1A5831 and follow the actions indicated.
C1A5911	Right hand front antenna	<ul style="list-style-type: none"> Right hand front antenna circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A5912	Right hand front antenna	<ul style="list-style-type: none"> Right hand front antenna circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A5913	Right hand front antenna	<ul style="list-style-type: none"> Right hand front antenna circuit - high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6016	Left hand rear tire low pressure sensor	<ul style="list-style-type: none"> Low battery detected 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6031	Left hand rear tire low pressure sensor	<ul style="list-style-type: none"> No signal detected 	<ul style="list-style-type: none"> Check for stored DTC C1A6016 and follow the actions indicated. If this DTC is not stored replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6091	Left hand rear tire low pressure sensor	<ul style="list-style-type: none"> Data out of range 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6093	Left hand rear tire low pressure	<ul style="list-style-type: none"> No sensor can be found at this location 	<ul style="list-style-type: none"> Check for stored DTCs C1A6111, C1A6112, C1A6113 or C1A6031

	sensor		and follow the actions indicated.
C1A6111	Left hand rear antenna	<ul style="list-style-type: none"> Left hand rear antenna circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6112	Left hand rear antenna	<ul style="list-style-type: none"> Left hand rear antenna circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6113	Left hand rear antenna	<ul style="list-style-type: none"> Left hand rear antenna circuit - high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6216	Right hand rear tire low pressure sensor	<ul style="list-style-type: none"> Low battery detected 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6231	Right hand rear tire low pressure sensor	<ul style="list-style-type: none"> No signal detected 	<ul style="list-style-type: none"> Check for stored DTC C1A6216 and follow the actions indicated. If this DTC is not stored replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6291	Right hand rear tire low pressure sensor	<ul style="list-style-type: none"> Data out of range 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6293	Right hand rear tire low pressure sensor	<ul style="list-style-type: none"> No sensor can be found at this location 	<ul style="list-style-type: none"> Check for stored DTCs C1A6311, C1A6312, C1A6313 or C1A6231 and follow the actions indicated.
C1A6311	Right hand rear	<ul style="list-style-type: none"> Right hand rear antenna 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this

	antenna	circuit - short to ground	DTC using the manufacturer approved diagnostic system
C1A6312	Right hand rear antenna	<ul style="list-style-type: none"> Right hand rear antenna circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6313	Right hand rear antenna	<ul style="list-style-type: none"> Right hand rear antenna circuit - high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A6416	Spare tire low pressure sensor	<ul style="list-style-type: none"> Low battery detected 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6491	Spare tire low pressure sensor	<ul style="list-style-type: none"> Data out of range 	<ul style="list-style-type: none"> Replace the tire low pressure sensor. Tire Low Pressure Sensor
C1A6493	Spare tire low pressure sensor	<ul style="list-style-type: none"> No sensor can be found at this location 	<ul style="list-style-type: none"> If the vehicle has a temporary spare wheel and tire installed take no action. Check for stored DTC C1A6416 and follow the actions indicated. If this DTC is not stored replace the tire low pressure sensor. Tire Low Pressure Sensor
C1D1800	Location failure	<ul style="list-style-type: none"> The control module cannot locate the sensor 	<ul style="list-style-type: none"> Check for DTCs indicating a component fault
C1D1911	External receiver data line short to ground	<ul style="list-style-type: none"> External receiver data line circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

C1D1912	External receiver data line short to power	<ul style="list-style-type: none"> External receiver data line circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D1987	External receiver message missing	<ul style="list-style-type: none"> External receiver data line circuit - high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U001088	Medium speed CAN	<ul style="list-style-type: none"> Bus OFF 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communications with instrument cluster	<ul style="list-style-type: none"> Lost communications with instrument cluster 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> Lost communication with CJB 	<ul style="list-style-type: none"> For Network tests. Communications Network
U014200	Lost communication with RJB	<ul style="list-style-type: none"> Lost communication with RJB 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U016400	Lost communication with climate control module	<ul style="list-style-type: none"> Lost communication with climate control module 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	<ul style="list-style-type: none"> Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the TPMS module, refer to the new module

			installation note at the top of the DTC Index
U041600	Invalid data received from ABS control module	<ul style="list-style-type: none"> Vehicle speed signal fault 	<ul style="list-style-type: none"> Check ABS module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U042400	Invalid data received from climate control module	<ul style="list-style-type: none"> Invalid data received from climate control module 	<ul style="list-style-type: none"> Check climate control module for DTCs and refer to DTC Index. Climate Control System
U1A1449	CAN error	<ul style="list-style-type: none"> Internal electronic failure 	<ul style="list-style-type: none"> Install a new TPMS module, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	<ul style="list-style-type: none"> Re-configure the RJB using the manufacturer approved diagnostic system. Check TPMS module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	<ul style="list-style-type: none"> Install original module, check for DTCs and refer to relevant DTC Index

Component Tests

Wheels and Tires

For wheel and tire specification information (pressures, torques, etc).
Specifications

When replacing wheels or tires, local legislation regarding health and safety must be complied with.

If the vehicle has TPMS installed, only Jaguar approved wheels and tires should be used. If the wheel

and tire size is changed (for example from R18 to R20) the TPMS module should be updated with the correct pressure information appropriate to the new wheel and tire set. Update the TPMS module using the Jaguar approved diagnostic system.

As a general guideline, only replace tires in pairs or as a set, and only with tires of equivalent size and specification.

Confirm the symptoms of the customer complaint.

As much information as possible should be gathered from the driver to assist in diagnosing the cause(s).

1 . Before a road test, carry out a basic inspection to make sure the vehicle is safe and legal to drive.

Basic inspection

- Correct tire inflation.
Specifications
- Legal tire tread depth
- Cuts/Bulges in tire sidewall(s)
- Tire ply separation
- Embedded objects
- Wheel rim damage
- Correct tire installation (specification, direction of rotation, etc)
- Any obvious distortion of the tire (flat/high spots)
- Worn/Damaged steering or suspension components.
Front Suspension
Rear Suspension

Road test

If the results of the basic inspection are acceptable, carry out a road test to confirm the symptoms.

To reproduce the symptoms, test the vehicle on similar roads to those on which the fault occurs and at similar speeds (provided it is legal to do so).

If the vibration or noise can be reproduced, note the speed at which it occurs and see if it is possible to drive through the symptom, meaning, is it possible to alter the fault by driving faster or slower than the speed at which it occurs?

If it is possible, it is likely that the fault is caused by an imbalance in the wheel or tire.

If the vibration or noise gets worse as the vehicle speed increases, it is likely that the fault is caused by distortion in the wheel or tire, or worn or damaged components.

Distortion checks

Check for distortion by raising the vehicle so that the wheels are free and placing an axle stand or similar fixed object next to each wheel in turn.

If the stand is placed at the tread of the tire, the tire can be checked for ovality by turning the wheel by hand and checking for high or low spots where the gap between the tread and the stand increases or reduces.

If the stand is placed next to the wheel rim or tire sidewall, the wheel and tire can be checked for run-out in a similar way.

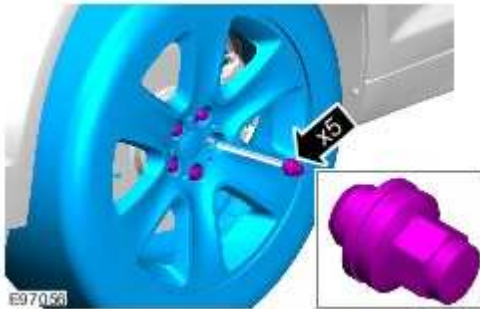
Wheel and Tire (74.20.05)

Removal


1.  **WARNING: Make sure to support the vehicle with axle stands.**

Raise and support the vehicle.

- 2 . TORQUE: 125 Nm



Installation

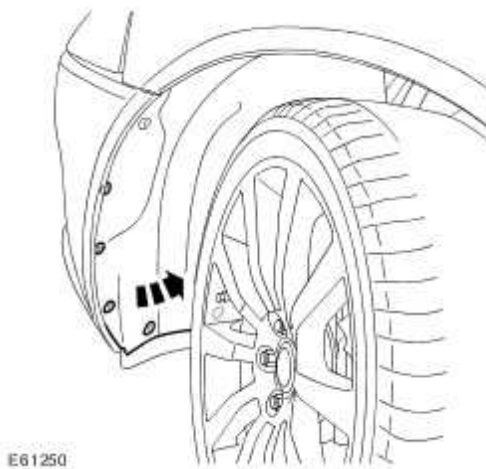
- 1  **CAUTION: Apply a small amount of grease to the bore and spigot areas of the wheel before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.**

To install, reverse the removal procedure.

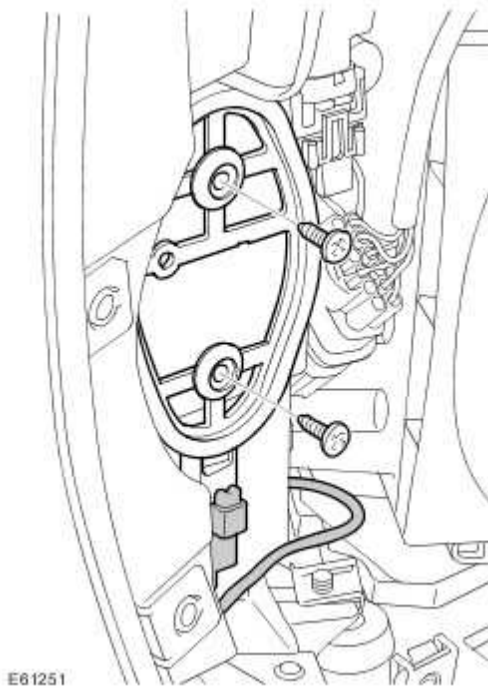
Tire Pressure Monitoring System (TPMS) Front Antenna

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to
- 2 . Turn the steering on to full lock for access.
- 3 . Release the front of the fender splash shield.
 - ▶ Remove the 5 Torx bolts.
 - ▶ Tie the splash shield aside.



- 4 . Remove the tire pressure antenna.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 2 clips.



Installation

1 . Install the tire pressure antenna.

- ▶ Install the clips.
- ▶ Connect the electrical connector.

2 . Install the fender splash shield.


- ▶ Tighten the Torx bolts.

3 . Connect the battery ground cable.
For additional information, refer to

Tire Pressure Monitoring System (TPMS) Rear Antenna

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

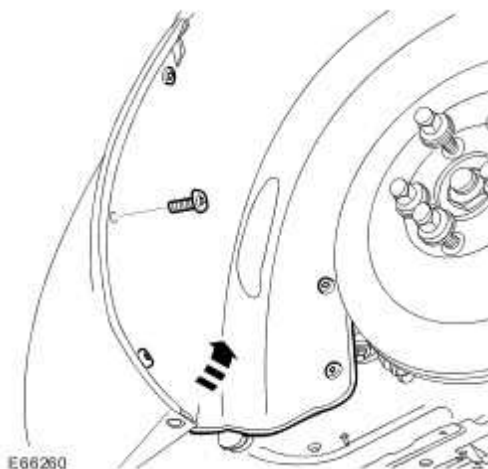
Raise and support the vehicle.

- 3 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 4 . Release the rear lower edge of the rear fender splash shield.

▶ Remove the 5 Torx bolts.

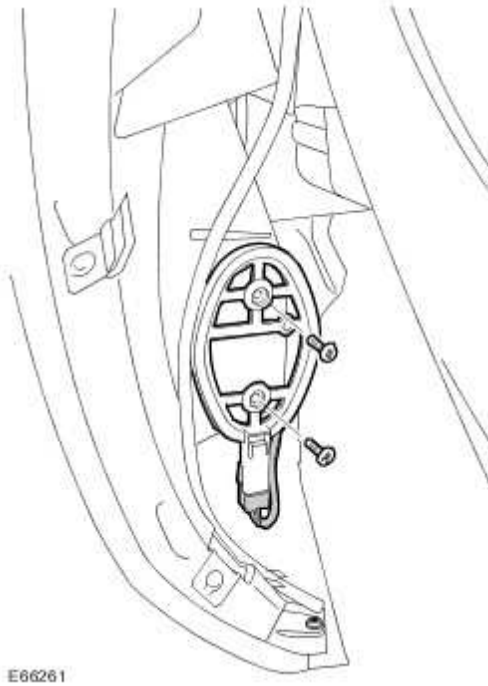
▶ Tie the splash shield aside.



5 . Remove the tire pressure antenna.

▶ Disconnect the electrical connector.

▶ Remove the 2 clips.



Installation

1 . Install the tire pressure antenna.

▶ Install the clips.

▶ Connect the electrical connector.

2 . Install the fender splash shield.

▶ Tighten the Torx bolts.

3 . Install the wheel and tire assembly.

For additional information, refer to Wheel and Tire (74.20.05)

- 4 . Connect the battery ground cable.
For additional information, refer to

Tire Pressure Monitoring System (TPMS) Module - Convertible

Removal

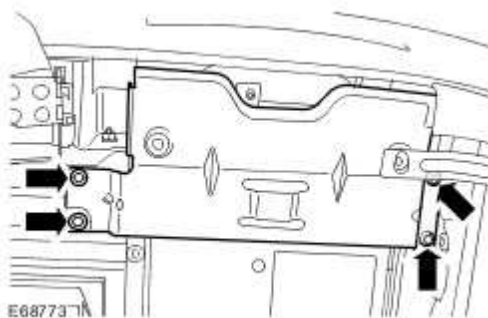
1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

2 . Make the SRS system safe.

3 . Remove the LH roll over protection unit.

4 . Remove the rear seat RH backrest retaining bracket.

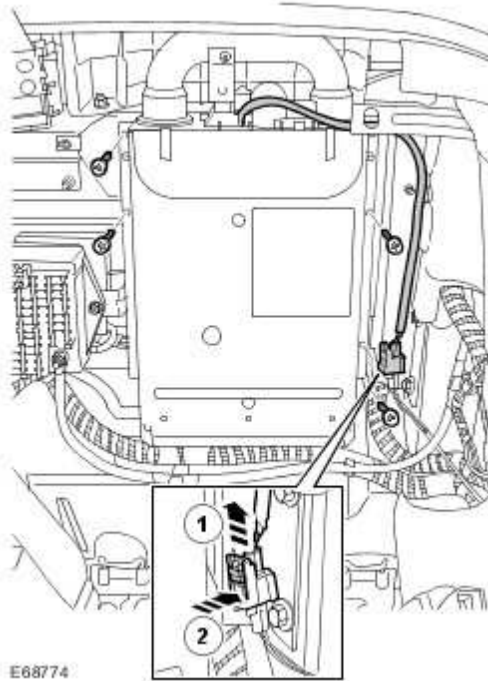
▶ Remove the 2 nuts and 2 bolts.



5 . Remove the RH roll over protection unit.

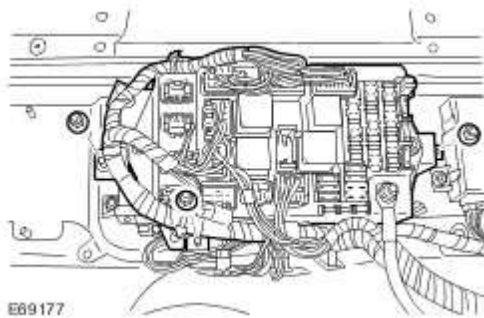
▶ Disconnect the electrical connector.

▶ Remove the 4 Torx bolts.



6 . Release the auxiliary junction box mounting bracket.

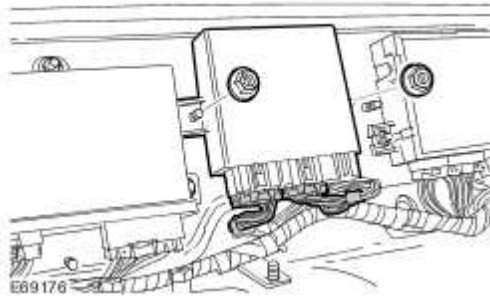
▶ Remove the 3 nuts.



7 . Remove the tire pressure monitoring module.

▶ Remove the 2 nuts.

▶ Disconnect the 2 electrical connectors.



Installation

- 1 . Install the tire pressure monitoring module.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connectors.

- 2 . Secure the auxiliary junction box mounting bracket.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).

- 3 . Install the rear seat RH backrest retaining bracket.
 - ▶ Tighten the nuts and bolts to 10 Nm (7 lb.ft).

- 4 . Install the RH roll over protection unit.
 - ▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - ▶ Connect the electrical connector.

- 5 . Install the LH roll over protection unit.

- 6 . Connect the battery ground cable and install the cover.

For additional information, refer to

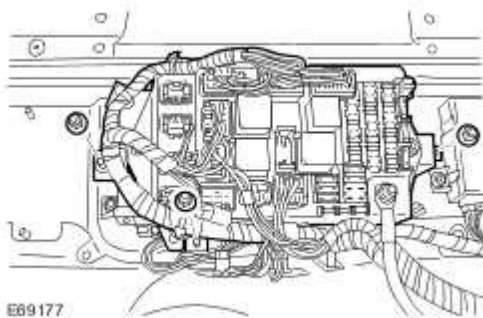
7 . Using WDS, configure a new module.

Tire Pressure Monitoring System (TPMS) Module - 2-Door

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the rear seat backrest.
For additional information, refer to Rear Seat Backrest (76.70.38)
- 3 . Release the auxiliary junction box mounting bracket.

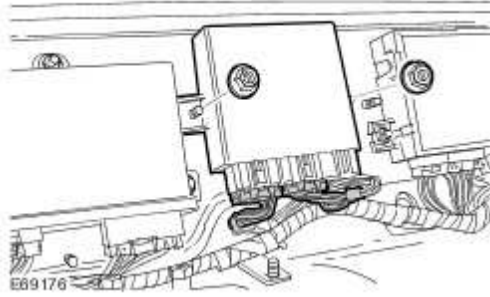
▶ Remove the 3 nuts.



- 4 . Remove the tire pressure monitoring module.

▶ Remove the 2 nuts.

▶ Disconnect the 2 electrical connectors.



Installation

- 1 . Install the tire pressure monitoring module.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connectors.

- 2 . Secure the auxiliary junction box mounting bracket.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).

- 3 . Install the rear seat backrest.

For additional information, refer to Rear Seat Backrest (76.70.38)

- 4 . Connect the battery ground cable and install the cover.

For additional information, refer to

- 5 . Using WDS, configure a new module.

Tire Low Pressure Sensor

Removal

NOTE:

It is strongly recommended that the valve seal and steel washer is replaced each time a tire is changed to avoid a seal failure. The seal and washer must be replaced if the sensor is removed. Removal of the sensor retaining nut must be regarded as sensor removal. The valve cap must always be in place except when inflating, releasing pressure or checking pressure.

1



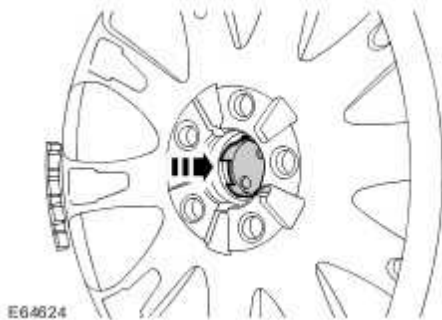
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

3 . Remove the wheel trim.




4



CAUTION: To avoid damage to the tire low pressure sensor, release the tire bead from the rim, 180 degrees from the valve.

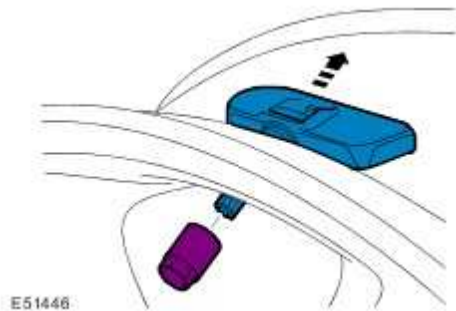
Remove the tire from the wheel.

- 5
-  **CAUTION: Do not push on the valve.**

 **CAUTION: If the tire low pressure sensor is to be re-installed, a new washer, seal and nut must be installed.**

Remove the tire low pressure sensor.

- ▶ Remove the nut.
- ▶ Release and withdraw the sensor along the valve axis.



- 6 If necessary, install a new seal and washer.

- ▶ Remove and discard the seal and washer.
- ▶ Install a new washer and seal, making sure the valve remains pressed fully onto its seat.



Installation

1



- **CAUTION: Do not use compressed air to clean the sensor. Do not clean the sensor with solvents or cleaning agents of any type, use a clean dry cloth.**

Clean the component mating faces.

2



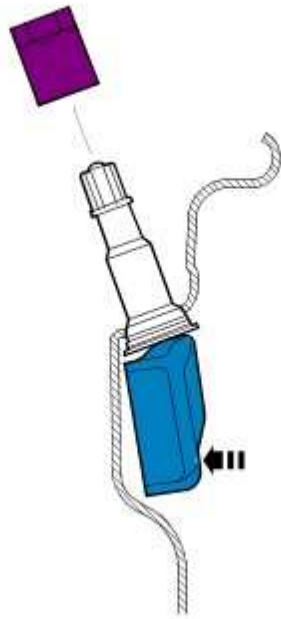
- **CAUTION: Do not apply any lubricant to the new valve.**

NOTE:

If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt in the first 15 minutes of the vehicle is being driven. If a new sensor is fitted to the spare wheel the identification for that sensor must be programmed into the Tire Pressure Monitoring System (TPMS) module using WDS. The identification code is provided on a label with the complete assembly and is also printed on the sensor assembly.

Install the tire low pressure sensor.

- ▶ Install and hand tighten the nut whilst keeping the sensor in place.
- ▶ Tighten the nut to 6.5 Nm (4.8 lb.ft).



E51449

3 . Install the tire and balance the wheel.

4 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

5 . Install the wheel trim.

Tire Pressure Monitoring System (TPMS) Receiver

Removal

- 1 . Remove the floor console.
For additional information, refer to Floor Console (76.25.01)
- 2 . Remove the tire pressure monitoring receiver.
 - ▶ Disconnect the electrical connector.
 - ▶ Release from the mounting pad.



Installation

- 1 . Install the tire pressure monitoring receiver.
 - ▶ Connect the electrical connector.
 - ▶ Secure to the mounting pad.
- 2 . Install the floor console.
For additional information, refer to Floor Console (76.25.01)

204-05 : Vehicle dynamic suspension

Specifications

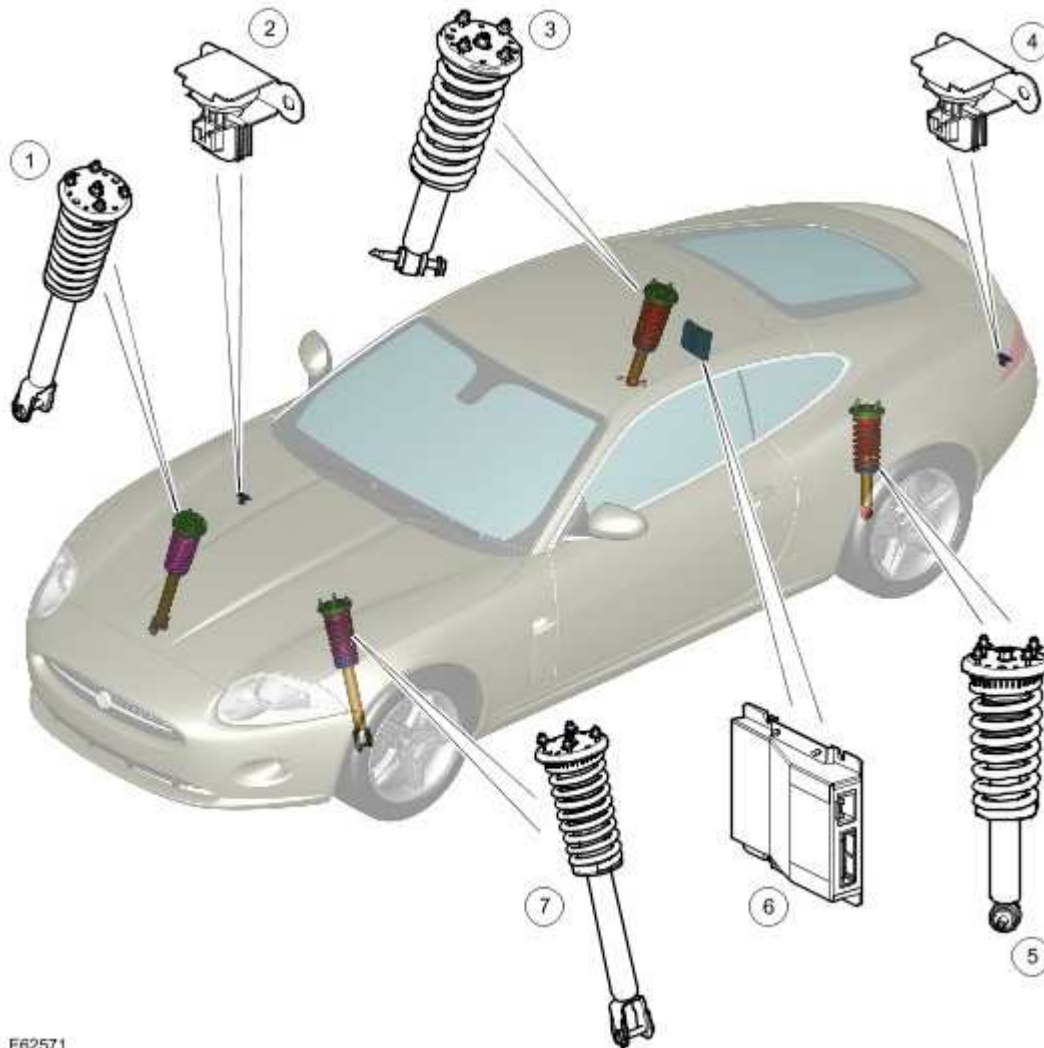
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Accelerometer - bolt	8	6	71
Adaptive damping control module - nut	4	3	35
Front shock absorber.	-	-	-
Rear shock absorber.	-	-	-

Vehicle Dynamic Suspension

COMPONENT LOCATION



E62571

Item	Part Number	Description
1		Right Hand (RH) front spring and damper assembly
2		Front vertical acceleration sensor
3		RH rear spring and damper assembly
4		Rear vertical acceleration sensor

5		Left Hand (LH) rear spring and damper assembly
6		Adaptive Damping Control Module (ADCM)
7		LH front spring and damper assembly

INTRODUCTION

An adaptive damping system, known as Computer Active Technology Suspension (CATS) is available on certain models. The CATS system is an electronically controlled suspension system which constantly adjusts the damping characteristics of the suspension dampers in reaction to the current driving conditions.

The system is controlled by an Adaptive Damping Control Module (ADCM) which is located behind the backrest of the RH rear passenger seat. The ADCM receives signals from two dedicated vertical acceleration sensors in addition to inputs from other electronic system components to determine vehicle body motion and driver inputs. These signals are used by the ADCM to control the damping characteristics of each damper from soft to firm to give the optimum vehicle ride.

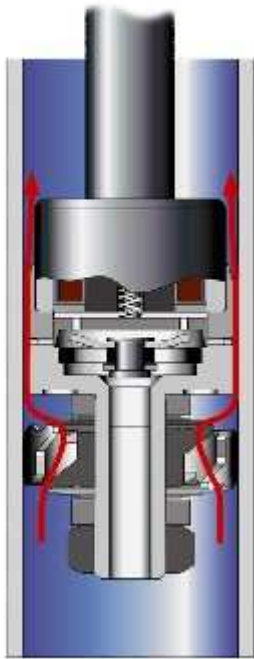
DAMPERS

The CATS dampers are monotube, nitrogen gas and oil filled units, manufactured by Bilstein. The dampers have a two-stage adjustment which allows the damping force to be electrically adjusted when the vehicle is being driven. The two stage dampers provide the optimum compromise between performance handling and ride comfort.

The CATS dampers can be easily identified by an electrical connector on the end of the piston rod, in the center of the top mount.

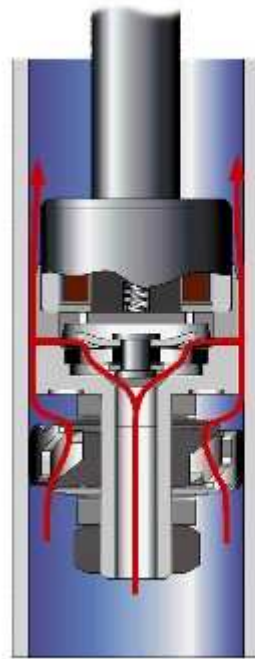
The two-stage adjustment is achieved by a solenoid controlled valve. When the solenoid valve is deenergized, the damper is on its firm setting and oil flow is restricted to flowing at a controlled rate through orifices in the damper piston. The restricted oil flow stiffens the damper action improving the handling when braking, accelerating and cornering.

A



E72756

B



Item	Part Number	Description
A		Firm setting
B		Soft setting

The solenoid is connected to a by-pass valve which allows additional oil flow through the damper. When the solenoid is energized, the valve is lifted from its seat, allowing oil to flow through a hollow piston rod in the center of the damper piston and out through additional orifices. The increased oil flow softens the damper action providing a more comfortable ride quality.

The solenoid is operated by a 400 Hz Pulse Width Modulation (PWM) signal from the ADCM. When energized, the ADCM applies a 1.3 Ampere (A) push current for 75 milliseconds to move the valve and then applies a 0.5 A hold current to operate the damper in the 'soft' setting. For additional information, refer to Vehicle Dynamic Suspension (204-05)

ACCELERATION SENSORS

Two acceleration sensors are used in the CATS system. The front sensor is located in the rear of the RH front wheel arch, behind the washer reservoir. The rear sensor is mounted in the luggage compartment, in the rear LH corner adjacent to the rear lamp assembly.

The sensors measure acceleration in the vertical plane and output a corresponding analogue signal to the ADCM.

Each sensor is connected to the ADCM via three wires which supply ground, 5 V supply and signal return. The sensor terminals are gold plated due to the low signal currents.

The acceleration sensors are of the capacitive type. The sensing element comprises two parallel plate capacitors. The capacitors alter the peak voltage which is generated by an internal oscillator when the sensor is subjected to acceleration. Detection circuits within the sensor measure the peak voltage and pass an analogue output signal to the ADCM. The sensors output a signal voltage of approximately $1 \text{ V/g} \pm 0.05 \text{ V/g}$. For additional information, refer to Vehicle Dynamic Suspension (204-05)

CATS SYSTEM FAULT MESSAGE

The ADCM has a CAN connection to the instrument cluster. If a fault is detected by the ADCM, a message is sent to the instrument cluster and a message 'CATS SYSTEM FAULT' is displayed.

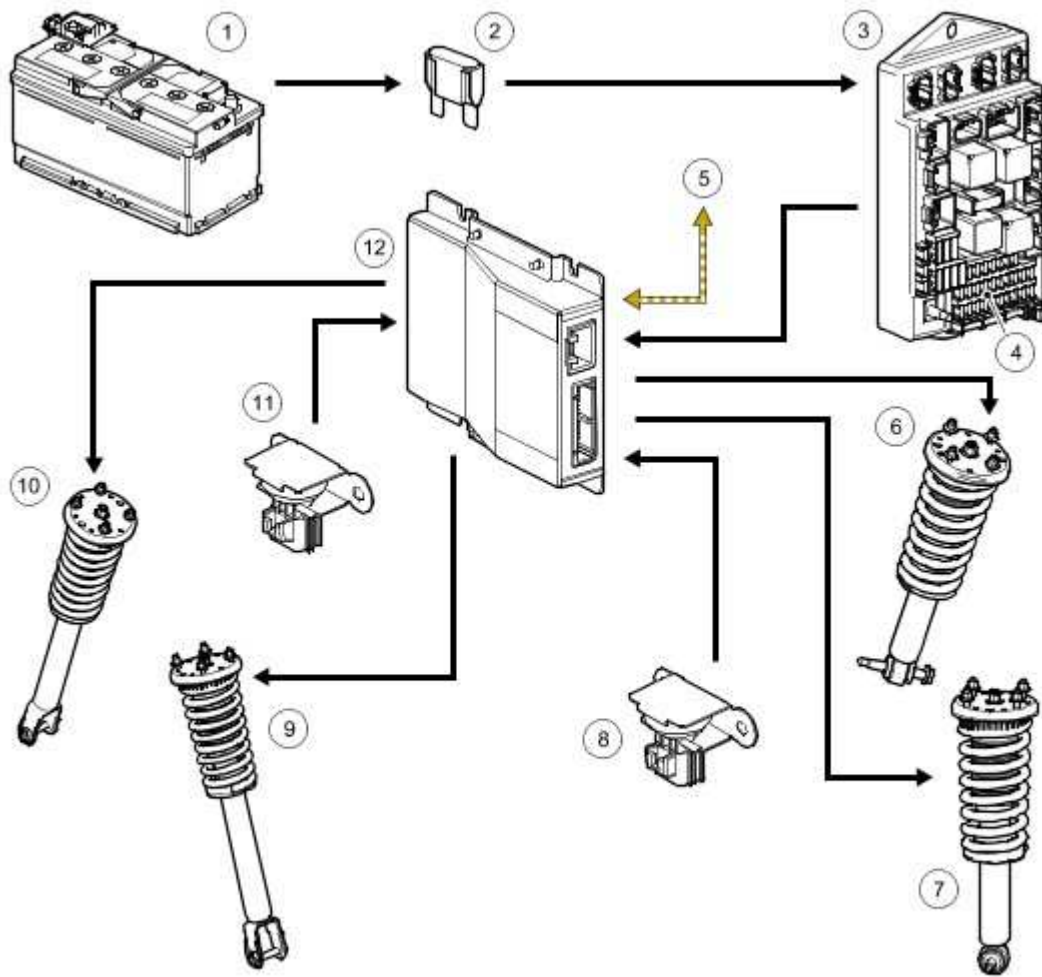
When this message is displayed a fault has been detected and an appropriate Diagnostic Trouble Code (DTC) will be logged in the ADCM. The faults can be interrogated using the Integrated Diagnostic System (IDS).

When a fault is detected, the ADCM stops outputs to the active dampers and the dampers operate continually on their default 'hard' setting until the fault is corrected.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus



E62572

Item	Part Number	Description
1		Battery
2		Megafuse (175 A)
3		Central Junction Box (CJB)
4		Fuse 14 (15 A) - ACM power supply
5		High Speed CAN connection to other vehicle systems
6		RH rear active damper
7		LH rear active damper

8		Rear vertical acceleration sensor
9		LH front active damper
10		RH front active damper
11		Front vertical acceleration sensor
12		ADCM

PRINCIPLES OF OPERATION

The ADCM uses a combination of information from other system modules and data from the acceleration sensors to measure the vehicle motion and driver inputs. Using this information, the ADCM applies algorithms to control the dampers for the current driving conditions.

The ADCM receives signals on the high speed Controller Area Network (CAN) bus from the following system components:

- Vehicle speed - Anti-lock Brake system (ABS) module
- Brake switch status - Engine Control Module (ECM)
- Brake pressure - ABS module
- Gear position - Transmission Control Module (TCM)
- Lateral acceleration - ABS module
- Throttle pedal position - ECM
- Power mode - CJB via instrument cluster gateway
- Steering wheel angle - Steering angle sensor via ABS module
- Steering wheel speed - Steering angle sensor via ABS module
- Engine speed - ECM
- Engine running status - ECM
- Car Configuration File (CCF) Data - Auxiliary junction box via instrument cluster gateway
- Master configuration identification - Auxiliary junction box via instrument cluster gateway
- Vehicle information parameters - Auxiliary junction box via instrument cluster gateway.

The ADCM also outputs information for use by other systems as follows:

- CATS Fault - instrument cluster
- Front left damper status - ECM
- Front right damper status - ECM
- Rear left damper status - ECM
- Rear right damper status - ECM.

The ADCM monitors the input signals and operates the damper solenoids. The input signals are compared against algorithms with the ADCM and preset speed thresholds.

The vehicle speed signal is the main input for the ADCM. The ADCM contains upper and lower speed thresholds at which the dampers are set to the firm setting. The gear position signal is also used to

determine longitudinal detection and, along with the speed signal, is compared against algorithms to select the appropriate damper setting.

The firm setting has a higher priority than the soft setting. This is because the firm setting provides better vehicle control in any driving condition. The dampers are set to firm when driving at high speed or if a system fault is detected.

When the vehicle is stationary with the engine running, the dampers are set to the soft setting.

The ADCM receives its power supply via a relay in the CJB. The relay remains energised for a period of time after the ignition is off. This allows the ADCM to record and store any fault codes relating to CATS system faults.

Vehicle Dynamic Suspension

Principle of Operation

For a detailed description of the adaptive damping system operation, refer to the relevant Description and Operation section of the workshop manual.

Vehicle Dynamic Suspension

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">• Coil spring(s)• Shock absorber(s)• Accelerometer(s) installation	<ul style="list-style-type: none">• Fuse(s)• Wiring harness/electrical connectors• Accelerometer(s)• Adaptive damping module

- 1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 2 . If the failure is not visually evident, check the system for any logged Diagnostic Trouble Codes (DTCs) and refer to the DTC index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five-digit codes. Match the five-digits from the scan tool to the first five-digits of the seven-digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are logged and, after carrying out the pinpoint tests, a fault is not identified, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
C110A12	Front vertical acceleration sensor	<ul style="list-style-type: none"> • Front vertical acceleration sensor circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front vertical acceleration sensor circuit for short to power
C110A14	Front vertical acceleration sensor	<ul style="list-style-type: none"> • Front vertical acceleration sensor circuit - short to ground, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check front vertical acceleration

			sensor circuit for short to ground, open circuit
C110A29	Front vertical acceleration sensor	<ul style="list-style-type: none"> Signal not changing or out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C110B12	Rear vertical acceleration sensor	<ul style="list-style-type: none"> Rear vertical acceleration sensor circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rear vertical acceleration sensor circuit for short to power
C110B14	Rear vertical acceleration sensor	<ul style="list-style-type: none"> Rear vertical acceleration sensor circuit - short to ground, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check rear vertical acceleration sensor circuit for short to ground, open circuit
C110B29	Rear vertical acceleration sensor	<ul style="list-style-type: none"> Signal not changing or out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C110C12	Left front damper solenoid	<ul style="list-style-type: none"> Left front damper solenoid circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to power
C110C14	Left front damper solenoid	<ul style="list-style-type: none"> Left front damper solenoid circuit - short to ground, open circuit Left front damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to ground, open

			circuit. Check and install a new damper as required
C110C1D	Left front damper solenoid	<ul style="list-style-type: none"> • Left front damper solenoid circuit - short to ground/power, open circuit • Left front damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left front damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
C110D12	Right front damper solenoid	<ul style="list-style-type: none"> • Right front damper solenoid circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to power
C110D14	Right front damper solenoid	<ul style="list-style-type: none"> • Right front damper solenoid circuit - short to ground, open circuit • Right front damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
C110D1D	Right front damper solenoid	<ul style="list-style-type: none"> • Right front damper solenoid circuit - short to ground/power, open circuit • Right front damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right front damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
C110E12	Left rear damper	<ul style="list-style-type: none"> • Left rear damper solenoid 	Carry out any pinpoint tests associated with this DTC using

	solenoid	circuit - short to power	the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to power
C110E14	Left rear damper solenoid	<ul style="list-style-type: none"> • Left rear damper solenoid circuit - short to ground, open circuit • Left rear damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required
C110E1D	Left rear damper solenoid	<ul style="list-style-type: none"> • Left rear damper solenoid circuit - short to ground/power, open circuit • Left rear damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check left rear damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
C110F12	Right rear damper solenoid	<ul style="list-style-type: none"> • Right rear damper solenoid circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to power
C110F14	Right rear damper solenoid	<ul style="list-style-type: none"> • Right rear damper solenoid circuit - short to ground, open circuit • Right rear damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to ground, open circuit. Check and install a new damper as required

C110F1D	Right rear damper solenoid	<ul style="list-style-type: none"> • Right rear damper solenoid circuit -short to ground/power, open circuit • Right rear damper failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check right rear damper solenoid circuit for short to ground, power, open circuit. Check and install a new damper as required
C1A391C	Sensor supply voltage	<ul style="list-style-type: none"> • Circuit voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U000188	High speed CAN communication bus	<ul style="list-style-type: none"> • Vehicle CAN Bus off condition 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U010087	Lost communications with ECM	<ul style="list-style-type: none"> • Missing message from ECM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ECM power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U010187	Lost communication with TCM	<ul style="list-style-type: none"> • Missing message from TCM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check TCM power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved

			diagnostic system
U012187	Lost communication with anti-lock control - stability assist module	<ul style="list-style-type: none"> • Anti-lock control - stability assist system failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check ABS module power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U042286	Lost communication with CJB	<ul style="list-style-type: none"> • Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check CJB power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U015587	Lost communication with instrument cluster	<ul style="list-style-type: none"> • Missing message from Instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check instrument cluster power and ground supplies for short, open circuit. Carry out the CAN network integrity tests using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> • CAN master configuration ID incorrect 	Re-configure the RJB using the manufacturer approved diagnostic system, clear DTCs and re-test. If DTC still logged suspect Adaptive damping module, refer to new module installation note at top of DTC

			Index
U040186	Invalid data received from ECM/PCM	<ul style="list-style-type: none"> Signal invalid 	Check for engine management DTCs. Electronic Engine Controls
U040286	Invalid data received from TCM	<ul style="list-style-type: none"> Signal invalid 	Check for transmission DTCs. Diagnostic Strategy
U041586	Invalid data received from ABS control module	<ul style="list-style-type: none"> Signal invalid 	Check for ABS DTCs.
U042386	Invalid data received from Instrument Cluster	<ul style="list-style-type: none"> Signal invalid 	Check for instrument cluster DTCs. Instrument Cluster
U1A1400	CAN initialisation failure	<ul style="list-style-type: none"> CAN network harness short, disconnected 	Check CAN network. Communications Network
U300001	Control module	<ul style="list-style-type: none"> General electrical failure 	Check integrity of electrical connectors and pins to module. Check damper negative circuits for short to ground. Install a new adaptive damping module. Adaptive Damping Module - Convertible (86.56.35) Adaptive Damping Module - 2-Door (86.56.35)
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Suspect adaptive damping module, refer to new module installation note at top of DTC Index
U300055	Control module	<ul style="list-style-type: none"> Not configured 	Configure adaptive damping module using manufacturer approved diagnostic system
U300281	Vehicle identification number	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module installed from donor vehicle 	Install original module, check for adaptive damping related DTCs and refer to DTC Index
U30031C	Battery voltage	<ul style="list-style-type: none"> Circuit voltage out of range 	Carry out any pinpoint tests

			associated with this DTC using the manufacturer approved diagnostic system
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Adaptive Damping Module - Convertible (86.56.35)

Removal



WARNING: To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



WARNING: Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



WARNING: To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



WARNING: To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



WARNING: To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



WARNING: Never probe the electrical connectors of air bag modules or any other

supplemental restraint system component. Failure to follow this instruction may result in personal injury.



WARNING: Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

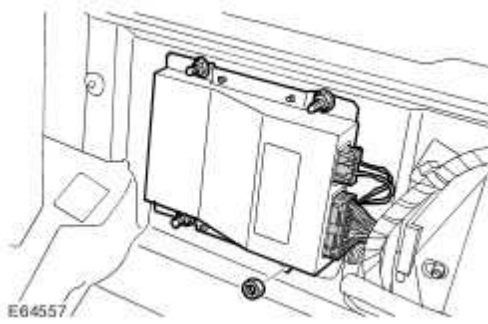
2



WARNING: Make sure that sufficient time has elapsed after disconnecting the battery ground cable(s), before commencing work on the supplemental restraint system (SRS). Failure to follow these instructions may result in personal injury.

Make the air bag supplemental restraint system (SRS) safe.

- 3 . Remove the RH roll over protection unit.
For additional information, refer to Rollover Protection Unit
- 4 . Remove the active damping module.
 - ▶ Remove the 4 nuts.
 - ▶ Disconnect the 2 electrical connectors.



Installation

1 . Install the active damping module.

▶ Tighten the nuts to 10 Nm.

▶ Connect the electrical connectors.

2 . Install the RH roll over protection unit.

For additional information, refer to Rollover Protection Unit

3 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Adaptive Damping Module - 2-Door (86.56.35)

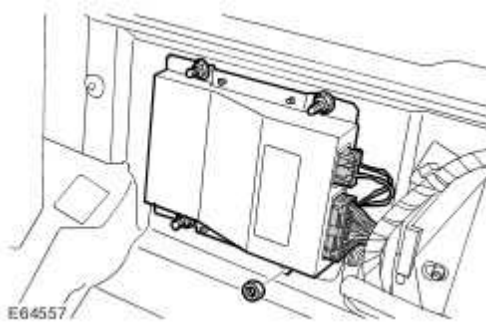
Removal

- 1 . Remove the rear seat backrest.
For additional information, refer to Rear Seat Backrest (76.70.38)

- 2 . Remove the active damping module.

▶ Remove the 4 nuts.

▶ Disconnect the 2 electrical connectors.



Installation

- 1 . Install the active damping module.

▶ Tighten the nuts to 10 Nm (7 lb.ft).


▶ Connect the electrical connectors.

- 2 . Install the rear seat backrest.

For additional information, refer to Rear Seat Backrest (76.70.38)


Front Suspension Vertical Accelerometer

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

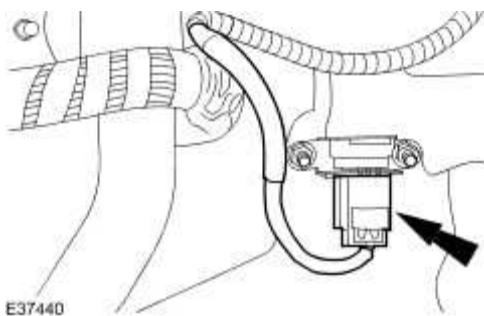
Raise and support the vehicle.

- 2 . Remove the windshield washer reservoir.
For additional information, refer to Windshield Washer Reservoir (84.10.01)

- 3  **CAUTION: Make sure the accelerometer is not dropped as damage will be caused to the internal components.**


Remove the accelerometer.

- ▶ Remove the 2 nuts.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the accelerometer.
 - ▶ Tighten the nuts to 8 Nm (6 lb.ft).

 Connect the electrical connector.

2 . Install the windshield washer reservoir.

For additional information, refer to Windshield Washer Reservoir (84.10.01)

Rear Suspension Vertical Accelerometer

Removal

- 1 . Remove the LH loadspace trim panel.

For additional information, refer to Loadspace Trim Panel - Convertible (76.13.73.60)

For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)

2

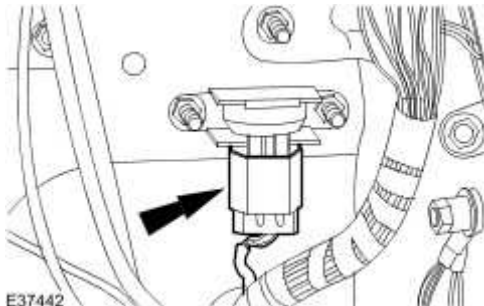


CAUTION: Make sure the accelerometer is not dropped as damage will be caused to the internal components.

Remove the accelerometer.

▶ Remove the 2 nuts.

▶ Disconnect the electrical connector.



Installation

- 1 . Install the accelerometer.

▶ Tighten the nuts to 8 Nm (6 lb.ft).

▶ Connect the electrical connector.

- 2 . Install the LH loadspace trim panel.

For additional information, refer to Loadspace Trim Panel - Convertible (76.13.73.60)

For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)

205 : Driveline

205-00 : Driveline system – General information

Diagnosis and testing

Driveline System

Principle of Operation

For a detailed description of driveline operation, refer to the relevant Description and Operation section in the workshop manual.

Driveshaft

Rear Drive Axle and Differential - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Rear Drive Halfshafts

Inspection and Verification



CAUTION: Only serviceable items can be renewed or adjusted. Failure to follow this instruction may result in the warranty of the component being rejected.

Certain driveline trouble symptoms are also common to the engine, transmission, wheel bearings, tires, and other parts of the vehicle. For this reason, make sure that the cause of the trouble is in the driveline before adjusting, repairing, or installing any new components. For additional information, Noise, Vibration and Harshness (NVH)

- 1 . Verify the customer concern by carrying out a road test of the vehicle.
- 2 . Visually inspect for obvious signs of mechanical damage and system integrity.
- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

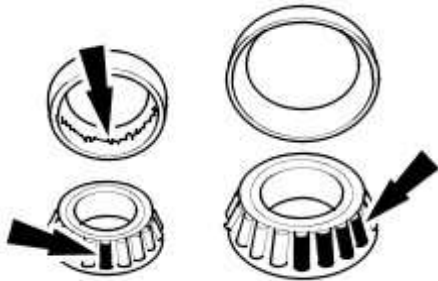
Identify the Condition

Gear Howl and Whine

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload.

Bearing Whine

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which is speed dependent.



ELE0012864

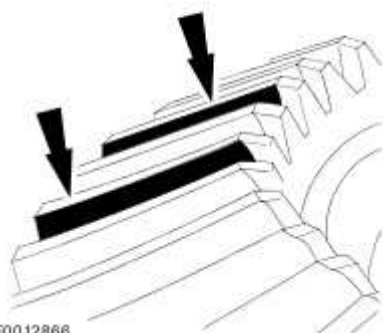
As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is only one pinion bearing that is worn/damaged, the noise may vary in different driving phases.

A wheel bearing noise can be mistaken for a pinion bearing noise.

Chuckle

Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore.

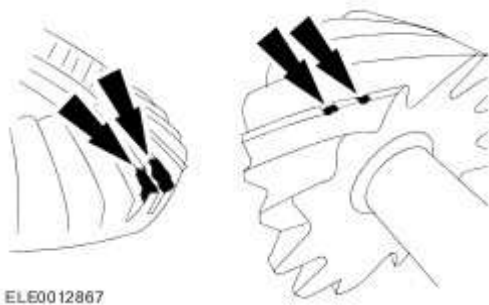
Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise.



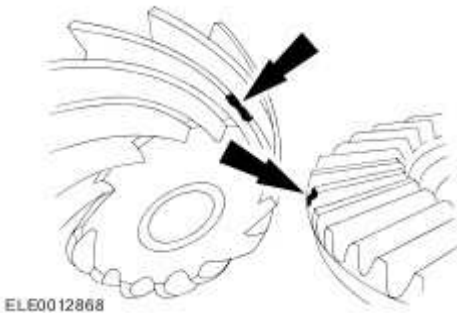
ELE0012866

Knock

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset.



A gear tooth damaged on the drive side is a common cause of the knock.



Clunk

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also occur when the throttle is applied or released. Clunk is caused by transmission calibration, backlash in the driveline or loose suspension components and is felt or heard in the vicinity of the rear drive axle.

Bearing Rumble

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third of the driveshaft speed. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all four driving modes.

Symptom Chart

Noise is at constant tone over a narrow vehicle speed range. Usually heard on light drive and coast conditions.

Possible Source(s):

- Rear drive axle.

Action(s) to take:

- For additional information, GO to Pinpoint Test G544822p1.

Noise is the same on drive or coast

Possible Source(s):

- Road.

Action(s) to take:

- Normal conditions.

Possible Source(s):

- Worn or damaged driveshaft joint.

Action(s) to take:

- INSTALL new components as necessary.

Possible Source(s):

- Driveshaft center bearing.

Action(s) to take:

- INSTALL new components as necessary.

Possible Source(s):

- Wheel bearing.

Action(s) to take:

- CHECK and INSTALL a new wheel bearing as necessary.
Rear Wheel Bearing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8
(64.15.14)

Noise is produced with the vehicle standing and driving

Possible Source(s):

- Engine.

Action(s) to take:

- For additional information,
Engine

Possible Source(s):

- Transmission.

Action(s) to take:

- For additional information,
Diagnostic Strategy

Loud clunk in the driveline when shifting from reverse to forward

Possible Source(s):

- Transmission calibration.

Action(s) to take:

- Using the Jaguar approved diagnostic system, re-configure the Transmission Control Module (TCM) with the latest available calibration.

Possible Source(s):

- Transmission Mount.

Action(s) to take:

- INSPECT and INSTALL new transmission mounts as necessary.

Possible Source(s):

- Transmission.

Action(s) to take:

- For additional information,
Diagnostic Strategy

Possible Source(s):

- Suspension components.

Action(s) to take:

- INSPECT and INSTALL new suspension components as necessary.

Possible Source(s):

- Backlash in the driveline.

Action(s) to take:

- INSPECT and INSTALL new driveline components as necessary.

Possible Source(s):

- Engine idle speed set too high.

Action(s) to take:

- Check and adjust the idle speed as necessary.

Possible Source(s):

- Engine mount.

Action(s) to take:

- INSPECT and INSTALL new engine mounts as necessary.

Clicking, popping, or grinding noises

Possible Source(s):

- Inadequate or contaminated lubrication in the rear drive halfshaft constant velocity (CV) joint.

Action(s) to take:

- INSPECT, CLEAN and LUBRICATE with new grease as necessary.

Possible Source(s):

- Another component contacting the rear drive halfshaft.

Action(s) to take:

- INSPECT and REPAIR as necessary.

Possible Source(s):

- Wheel bearings, brakes or suspension components.

Action(s) to take:

- INSPECT and INSTALL new components as necessary.

Vibration at highway speeds

Possible Source(s):

- Out-of-balance wheel(s) or tire(s).

Action(s) to take:

- BALANCE and INSTALL new wheel(s) and tire(s) as necessary.
Wheel and Tire (74.20.05)

Possible Source(s):

- Driveline out of balance/misalignment.

Action(s) to take:

- For additional information, refer to the Jaguar approved diagnostic system.

Possible Source(s):

- Driveshaft center bearing touching body mounting point.

Action(s) to take:

- Check for correct spacer washer thickness. INSPECT and INSTALL new washers as necessary.

Shudder, Vibration During Acceleration

Possible Source(s):

- Powertrain/driveline misalignment.

Action(s) to take:

- CHECK for misalignment. INSTALL new components as necessary. For driveshaft

alignment, GO to Pinpoint Test G544822p1.

Possible Source(s):

- High constant velocity (CV) joint operating angles caused by incorrect ride height.

Action(s) to take:

- CHECK the ride height and VERIFY the correct spring rate. INSTALL new components as necessary.

Lubricant Leak

Possible Source(s):

- Rear drive axle breather.

Action(s) to take:

- Check oil level and correct as necessary.

Possible Source(s):

- Damaged seal.

Action(s) to take:

- INSTALL new components as necessary.

Possible Source(s):

- Rear drive axle filler plug.

Action(s) to take:

- INSTALL new components as necessary.

Possible Source(s):

- Rear drive axle rear cover joint.

Action(s) to take:

- INSTALL new components as necessary.

Pinpoint Tests

PINPOINT TEST G544822p2 : EXCESSIVE DRIVELINE NOISE

G544822t1 : CHECK NOISE FROM VEHICLE ON ROAD TEST

1. Road test vehicle to determine load and speed conditions when noise occurs. 2. Assess the noise with different gears selected.

- Does the noise occur in different gears at the same vehicle speed?

-> Yes

INSTALL a new rear drive axle/differential assembly.

Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug (51.25.13) RE-TEST the system for normal operation.

-> No

Engine

Diagnostic Strategy

PINPOINT TEST G544822p1 : DRIVESHAFT ALIGNMENT

G544822t2 : CHECK DRIVESHAFT COMPOUND ANGLE

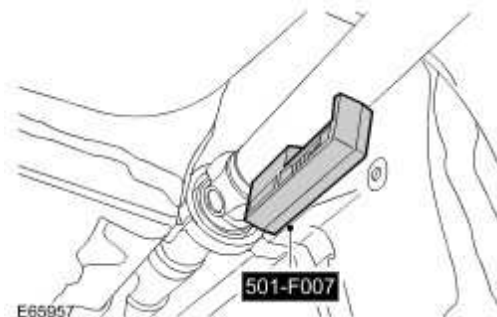
1. Remove exhaust system and center heat shield.

Exhaust System 2.



E65956

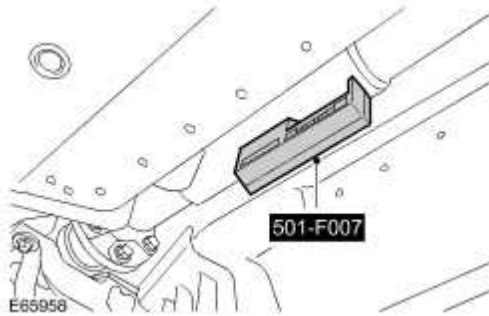
Place inclinometer (special tool number 501-F007) on flat surface and calibrate. 3.



E65957

Using the inclinometer check the angle of the driveshaft rearwards of the center bearing and note

the reading (reading one) 4.



Check the angle of the driveshaft forward of the center bearing and note the reading (reading two). Subtract reading two from reading one to obtain the compound angle of the driveshaft. The correct specification for the driveshaft compound angle is $1.1^\circ \pm 0.3^\circ$

- **Is driveshaft compound angle correct?**

-> **Yes**

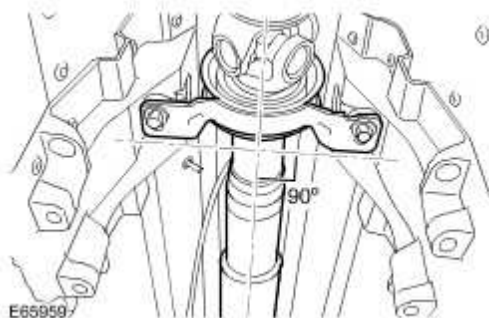
GO to Pinpoint Test G544822t3.

-> **No**

Adjust driveshaft center bearing height by adding or removing shims (refer to parts catalogue for selection of shims available) and re-check compound angle. GO to Pinpoint Test G544822t3.

G544822t3 : CHECK CENTER BEARING ALIGNMENT

1.



Check the center bearing is aligned at 90° to front section of driveshaft.

- **Is the center bearing aligned correctly?**

-> **Yes**

Driveshaft alignment is correct. Install center heat shield and exhaust system.
Exhaust System

-> **No**

Undo but do not remove center bearing bolts, align center bearing to front section of driveshaft, tighten bolts to correct torque.

Specifications Install center heat shield and exhaust system.
Exhaust System

205-01 : Driveshaft

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Center bearing - bolt*	40	29	-
Driveshaft balance - nut*	12	9	-
Driveshaft flange to differential flange - nut/bolt*	88	65	-
Driveshaft flange to transmission flange - nut/bolt*	108	80	-

* New nut/bolt must be installed.

Driveshaft Runout and Balancing

1. For additional information, refer to the Jaguar Approved Diagnostic System.

Driveshaft

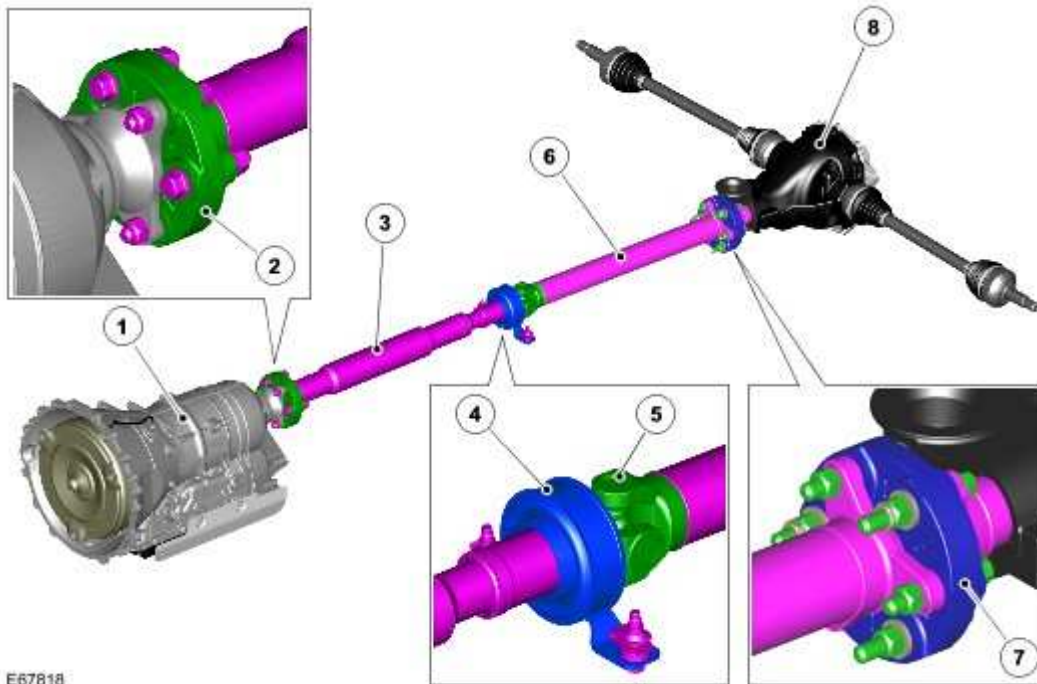
COMPONENT LOCATION



E63162

Item	Part Number	Description
1		Driveshaft

INTRODUCTION



E67818

Item	Part Number	Description
1		Transmission
2		Transmission flexible joint
3		Collapsible front driveshaft tube
4		Center bearing
5		Universal joint
6		Rear driveshaft tube
7		Rear drive axle flexible joint
8		Rear drive axle/differential

The driveshaft consists of the following components:

- A two-piece welded steel tube with a splined center slip joint
- One universal joint
- A center bearing
- Two flexible joints.

The two-piece driveshaft is manufactured from lightweight steel and is used to transmit drive from the engine, via the transmission, to the differential. The driveshaft aligns with the centerline of the vehicle's body and is supported by a center bearing.

The driveshaft's front tube is of a swaged construction, designed to collapse in a controlled manner in the event of the vehicle being involved in a front-end collision. Low friction splines at the center of the driveshaft provide the driveshaft's plunge capability.

A flexible coupling is used to connect the driveshaft assembly to the transmission and the differential, allowing for angular movement of the drive shafts due to acceleration and braking. The centre universal joint is lubricated during manufacture and sealed for life. This joint is positioned to a specified angle using shims between the center bearing and the body.

Driveshaft

For additional information, refer to [205-00](#).


Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

Removal

NOTE:

Select NEUTRAL before disconnecting the battery, to allow the driveshaft to be turned.


- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

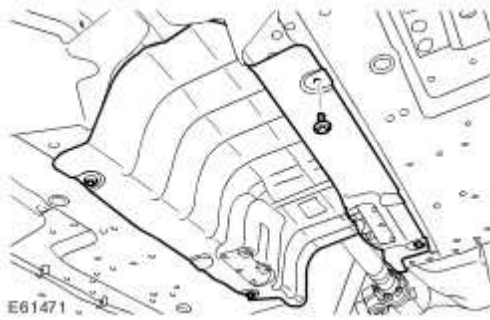
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.


- 3 . Remove the exhaust system.
For additional information, refer to Exhaust System

- 4 . Remove the center heat shield.


 Remove the 4 bolts.

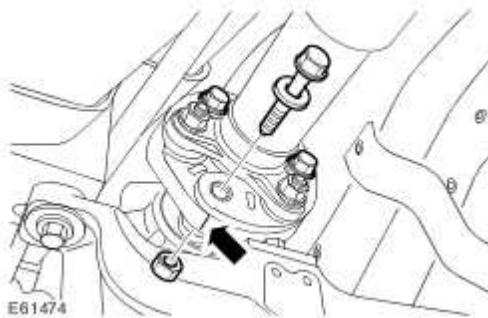



- 5  **CAUTION:** Mark the position of the driveshaft flange in relation to the drive pinion flange.

 **CAUTION:** Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

Release the driveshaft from the transmission drive flange.

-  Remove the 3 nuts and bolts.



- 6  **CAUTION:** Mark the position of the driveshaft flange in relation to the drive pinion flange.

 **CAUTION:** To avoid damage to the joint or gaiter, do not allow the driveshaft to

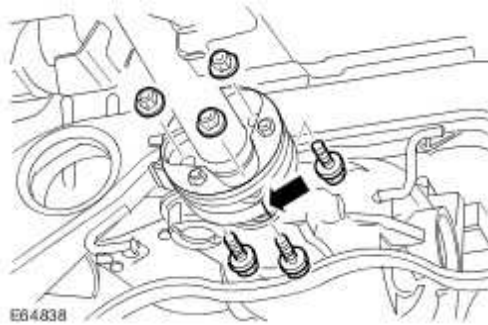
hang.



CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

Release the driveshaft from the rear axle drive flange.

- ▶ Remove the 3 nuts and bolts.



7 . NOTE:

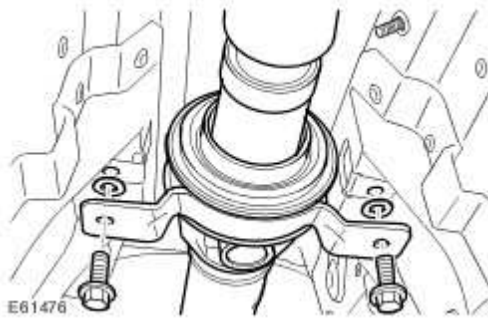
Spacers are fitted between the centre bearing and the body.

NOTE:

Note the fitted position.

With assistance, remove the driveshaft.

- ▶ Remove the 2 driveshaft center bearing mount bolts.
- ▶ Collect the spacers.



Installation

1 . NOTE:

Replace the spacers to the fitted position.

With assistance, install the driveshaft and secure the center bearing.

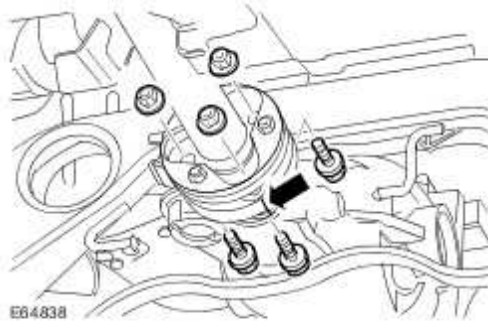
- ▶ Install the spacers.
- ▶ Align the center bearing mount.
- ▶ Install the bolts, but do not tighten fully at this stage.

2 . NOTE:

Align to the position noted on removal.

Attach the driveshaft to the rear axle drive flange.

- ▶ Tighten the nuts and bolts to 88 Nm (65 lb.ft).

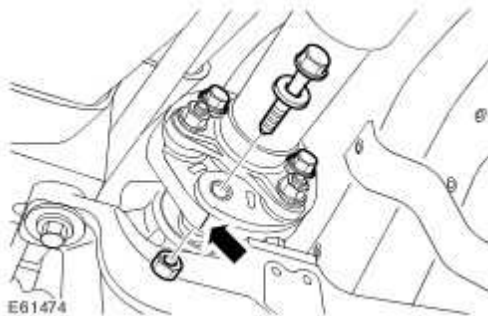


3 . **NOTE:**

Align to the position noted on removal.

Attach the driveshaft to the transmission flange.

▶ Tighten the nuts and bolts to 110 Nm (81 lb.ft).




4



CAUTION: Make sure the center bearing mount is not under tension and central within the slots.

Carefully tighten the centre bearing bolts to 40 Nm (30 lb.ft) keeping the bearing in a central position.

5 . Install the center heat shield.

 Install the bolts and tighten to 10 Nm (7 lb.ft).

6 . Install the exhaust system.

For additional information, refer to Exhaust System

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

205-02 : Rear drive axle / Differential

Specifications

Specifications

General Specifications

Item	Specification
Differential Ratio	3.31 : 1

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Differential fluid type	M2C 192A Synthetic

Capacities

	Liters
Differential fluid capacity	1.25 liters

Torque Specifications

Item	Nm	lb-ft	lb-in
Differential flange to driveshaft flange - nuts/bolts*	88	65	-
Differential flange to pinion shaft - nut*	A	-	-
Differential front mounting - bolt*	90	66	-
Differential rear mounting - bolt*	163	120	-

NOTE:

A = refer to the procedure for correct torque sequence.

* New nut/bolt must be installed.

Rear Drive Axle and Differential - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

COMPONENT LOCATION



E64049

Item	Part Number	Description
1		Differential

INTRODUCTION

The differential is supported at three mounting points, one at the front of the unit, and two at the rear, through rubber bushes to the vehicle's rear subframe. This mounting arrangement plus the subframe to vehicle-body mounting arrangement provides the rear driveline with double isolation from the vehicle's body.

The unit is constructed of a lightweight cast-iron main casing and an aluminum rear cover. The rear cover incorporates fins to aid cooling.

The pinion shaft aligns with the centerline of the vehicle's body and is supported by two taper-roller bearings. The hypoid-gear set is also supported by taper roller bearings.

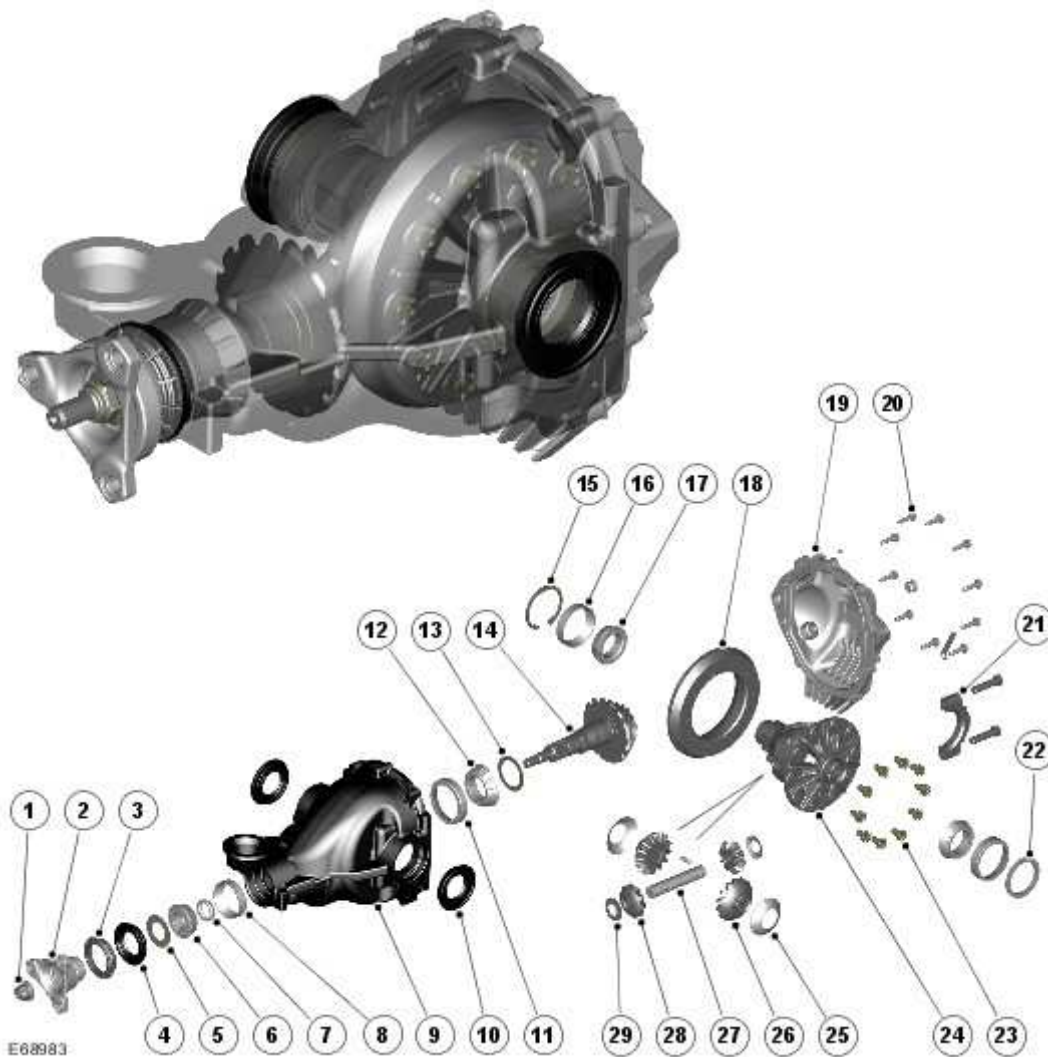
The unit has a final drive ratio of 3.31:1 and the lubricant is fill for life.



CAUTION: Running-in For Final Drive Unit During the first 1500 km (940 miles) and if at any time a new final drive unit is fitted:

- avoid full throttle applications
- do not exceed 190 km/h (120 mph)
- do not participate in motor racing events, test track days, sports driving schools or similar
- avoid towing during running-in period.

OPERATION



Item	Part Number	Description
------	-------------	-------------

1		Pinion nut
2		Pinion flange
3		Dust shield
4		Pinion oil seal
5		Pinion shaft oil slinger
6		Pinion bearing
7		Collapsible spacer
8		Pinion bearing cup
9		Differential housing
10		LH Output shaft oil seal
11		Differential pinion bearing cup
12		Pinion bearing
13		Drive pinion bearing adjustment shim
14		Pinion
15		Circlip
16		Differential bearing cup
17		Differential pilot bearing
18		Ring gear
19		Differential rear cover
20		Rear cover bolt (10 off)
21		Differential bearing cap
22		Differential bearing adjustment shim
23		Ring gear bolt (10 off)

24		Differential
25		Dished plate
26		Sunwheel
27		Shaft
28		Planet gear
29		Thrust washer

The rear axle drive pinion receives power from the engine through the transmission and driveshaft. The drive pinion gear rotates the differential drive gear, which is bolted to the differential housing outer flange. Inside the differential housing, two differential pinion gears are mounted on a differential shaft, which is pinned to the differential housing. These differential pinion gears are engaged with the differential side gears to which the halfshafts are splined. As the differential gear turns, it rotates the halfshafts and rear wheels.

When it is necessary for one wheel and halfshaft to rotate faster than the other, the faster turning differential side gear causes the differential pinion gears to roll on the slower turning differential side gear. This allows differential action between the two halfshafts.

Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug (51.25.13)


Special Service Tools



Power train assembly jack HTJ
1200-2

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove both the rear halfshafts.
For additional information, refer to Rear Halfshaft (47.10.13)
- 4 . Remove the exhaust system.
For additional information, refer to Exhaust System

5



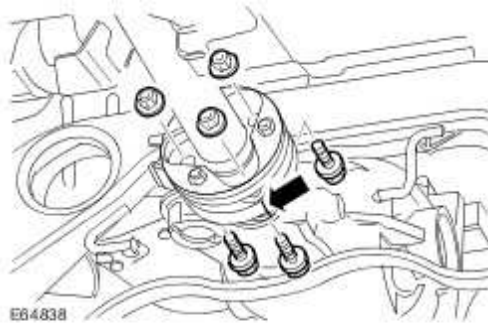
CAUTION: Mark the position of the driveshaft flange in relation to the drive pinion flange.



CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the driveshaft.

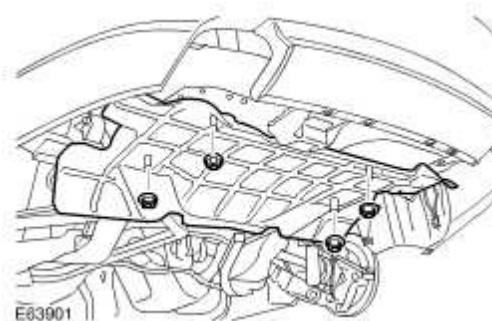
Release the driveshaft from the rear axle drive flange.

▶ Remove the 3 nuts and bolts.



6 . Remove the exhaust rear heat shield .

▶ Remove the 4 nuts.

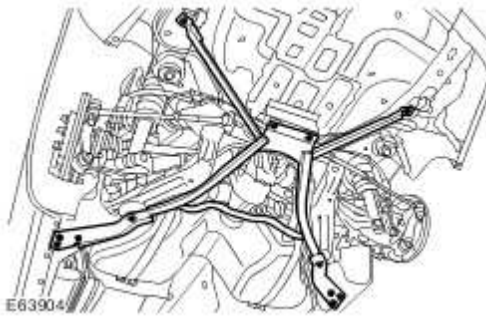


7 . With assistance: Remove the body K-frame.

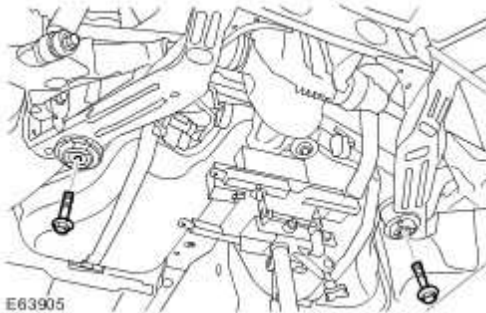
▶ Using a jack, support the differential.

▶ Remove the 8 bolts.

▶ Remove the 4 Torx bolts.



8 . Install the 2 sub-frame mounting bolts and remove the support jack.

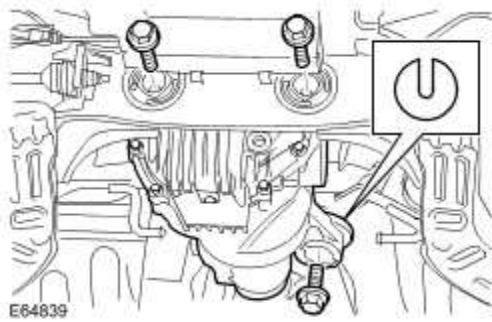


9 . Using a transmission jack, support the differential.

10 .  **CAUTION: Note the fitted position of the special washers.**

Remove the rear differential.

▶ Remove the 3 bolts.



Installation

1 . NOTE:

Align to the position noted on removal.

Install the rear differential.


- ▶ Tighten the 14mm bolts to 163Nm (120 lb.ft).
- ▶ Tighten the 12mm bolt to 90Nm (66 lb.ft).

2 . With assistance, install the K-frame.

- ▶ Remove the 2 bolts.
- ▶ Tighten the M10 bolts to 40 Nm (30 lb.ft).
- ▶ Tighten the M12 bolts to 133 Nm (98 lb.ft).
- ▶ Tighten the sub frame bolts to 60 Nm (44 lb.ft), then a further 240 degrees.

3 . Remove the transmission jack.


4 . Install the heat shield.

 Tighten the nuts to 10 Nm (7 lb.ft).

5 . NOTE:

Align to the position noted on removal.

Install the driveshaft.

 Tighten the nuts and bolts to 88Nm (65 lb.ft).


6 . Install the exhaust system.

For additional information, refer to Exhaust System

7 . Install both the halfshafts.

For additional information, refer to Rear Halfshaft (47.10.13)

8 . Check and top-up the differential case.

 Tighten the filler plug to 34 Nm (25 lb.ft).

9 . Connect the battery ground cable and install the cover.

For additional information, refer to

Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles With: Differential Drain Plug (51.25.13)

No Data Available

Axle Housing Bushing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (64.25.30)

Special Service Tools



204-275

Forcing screw
204-275



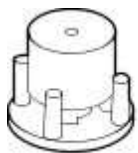
204-274

Forcing screw nut
204-274



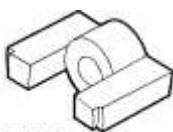
JAG-061

Bearing kit JAG-061



205-534

Receiving cup and mount plate
205-534



205-533

Remover front mount bush
205-533




Installer front mount bush
204-245



Installer front mount bush
204-243

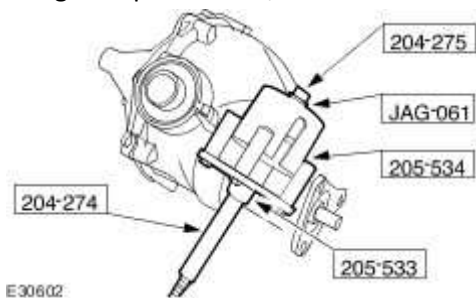
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

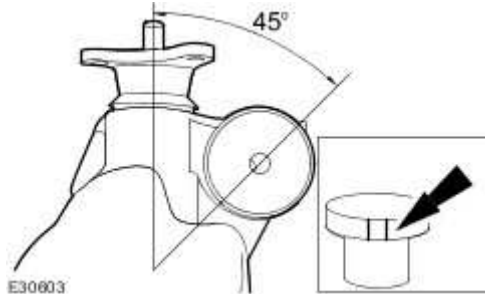
- 2 Remove the rear differential.
 - For additional information, refer to Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug (51.25.13)

- 3 . Using the special tools, remove the differential bushing.

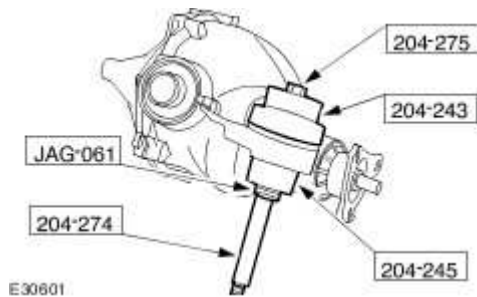


Installation

- 1 The raised mouldings on the bushing, should be set at 45 degrees to the center line of the pinion shaft.



- 2 Using the special tools, install the bushing.



- 3 Install the rear differential.
 - For additional information, refer to Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug (51.25.13)

Drive Pinion Seal - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (51.20.01)

Special Service Tools

205-053



E54574

Flange holding tool

205-053



204-264

Pinion seal installer

204-264



204-265

Flange remover/replacer

204265



204-266

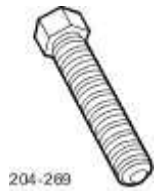
Flange remover/replacer boss

204-266




204-267

Flange remover/replacer shaft centre
204-267




Flange remover/replacer forcing screw
204-269


Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

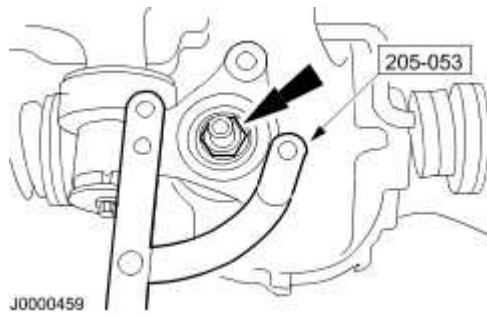
- 2 Remove the driveshaft.
 - For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

- 3  **CAUTION: The following step must be carried out to make sure the correct drive pinion flange retaining nut torque is achieved.**

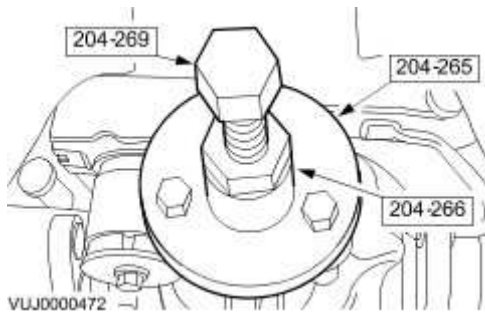
 **CAUTION: Only use a paint mark to match mark the drive pinion flange, loosen the nut 180 degrees then tighten back to mark and note the torque value.**

Remove the drive pinion flange retaining nut.

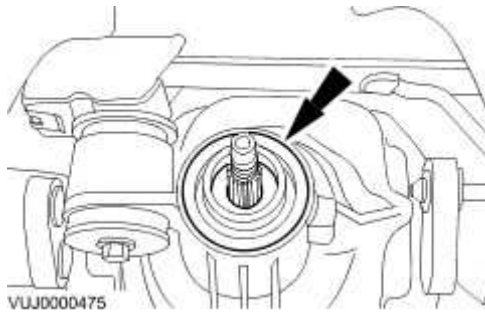
- ▶ Mark the drive pinion flange to nut relationship.
- ▶ Loosen the nut 180 degrees, then tighten back to the mark and note the torque value.



4 . Using the special tool, remove the drive pinion flange.

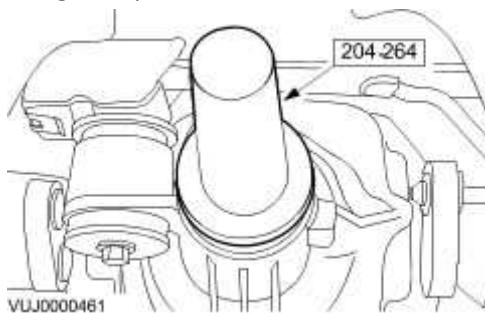


5 . Carefully remove and discard the oil seal.

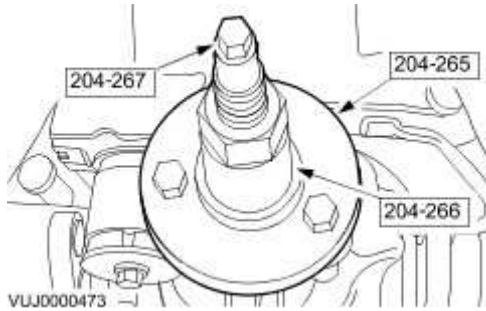


Installation

1 . Using the special tool, install a new oil seal.



2 . Using the special tools, install the drive flange.



3

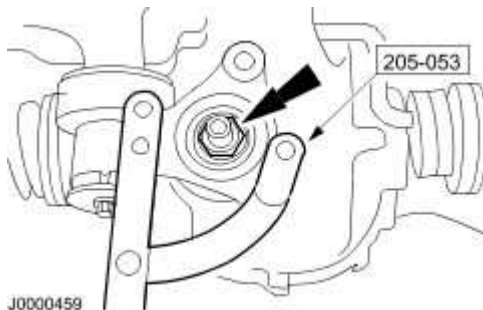


CAUTION: Tighten the drive pinion flange nut to the force noted on removal.




CAUTION: Tighten the drive pinion flange nut to a further 10%.

Install the drive pinion flange retaining nut, and tighten to the torque noted on removal, then a further 10%.



4 . Check and top-up the differential case.

 Tighten the filler plug to 34 Nm (25 lb.ft).

5 Install the driveshaft.

· For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

205-05 : Rear drive halfshafts

Specifications

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Constant velocity (CV) grease	Optimal LN 584 LO
Driveshaft locking compound	Loctite WSK-M2G349-A4

Capacities

	Liters
Grease for inner CV joint/boot	140g
Grease for outer CV joint/boot	120g

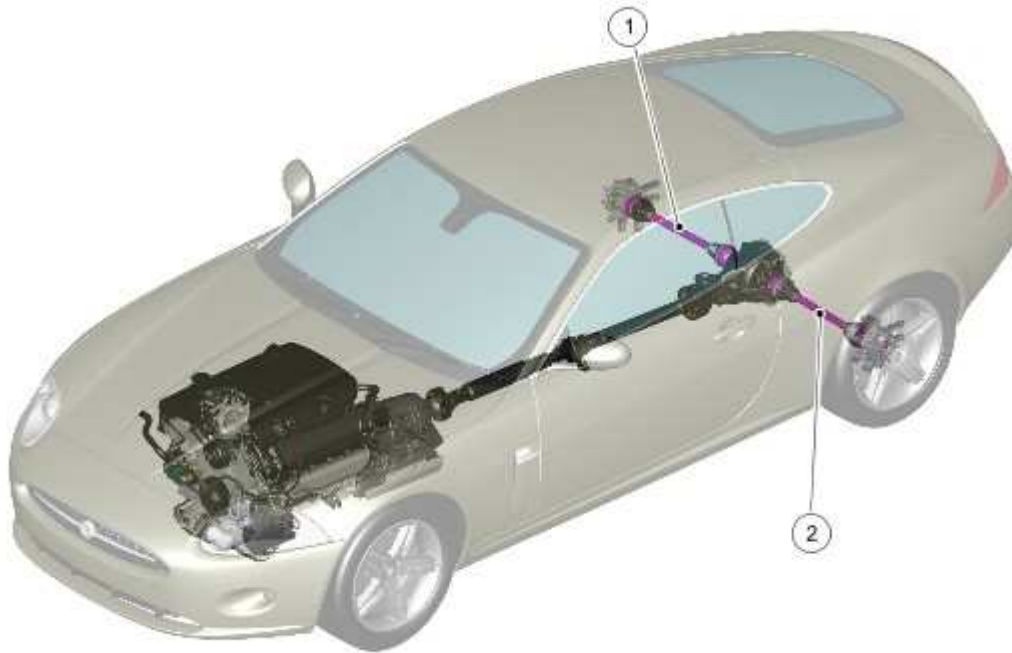
Torque Specifications

Item	Nm	lb-ft	lb-in
Halfshaft/hub - nut *	300	222	-

* New nut/bolt must be installed.

Rear Drive Halfshafts

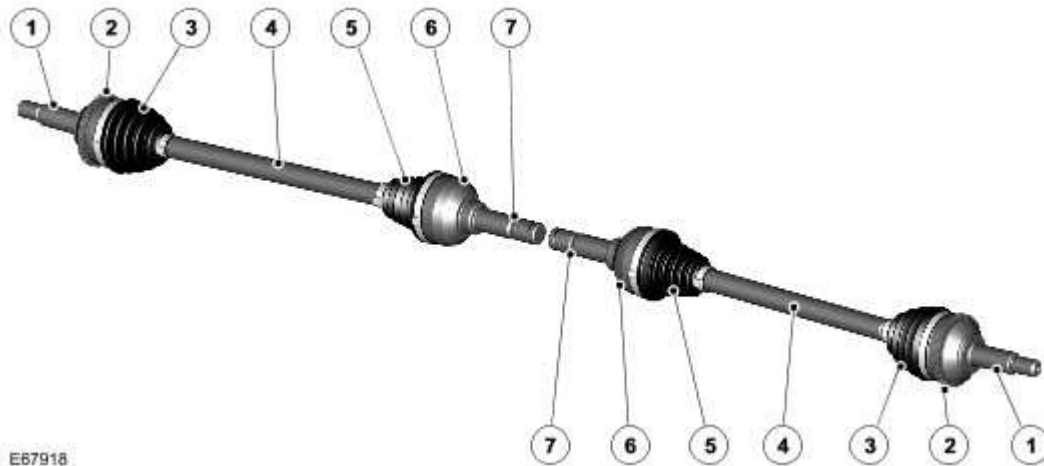
COMPONENT LOCATION



E63163

Item	Part Number	Description
1		RH rear drive halfshaft
2		LH rear drive halfshaft

INTRODUCTION



E67918

Item	Part Number	Description
1		Outer Constant Velocity (CV) joint
2		Anti-lock Braking System (ABS) ring
3		Outer CV joint gaiter
4		Rear drive halfshaft
5		Inner CV joint gaiter
6		Inner CV joint
7		Spring clip

The rear drive halfshafts are of unequal length and both inner and outer joints are of the CV type, with plunging inboard and fixed outboard capability allowing for suspension movement.

The outer CV joints are fitted with an ABS ring, which is continuously monitored by the wheel speed sensor.

The inner and outer CV joints are linked by a solid bar halfshaft with a spline interference-fit into the wheel hub. The inner CV joint is of a spline slide-fit arrangement and is retained in the rear drive axle with the aid of a spring clip.

Rear Drive Halfshafts

For additional information, refer to [<<205-00>>](#).

Rear Halfshaft (47.10.13)

Special Service Tools



205-461

Halfshaft seal protector

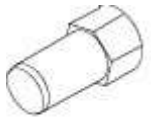
205-461



205-491

Hub puller

205-491



205-491-01

Adapter nuts

205-491-01



204-269


Flange remover forcing screw


204-269




Halfshaft oil seal installer
205-532

Removal

 **CAUTION:** Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

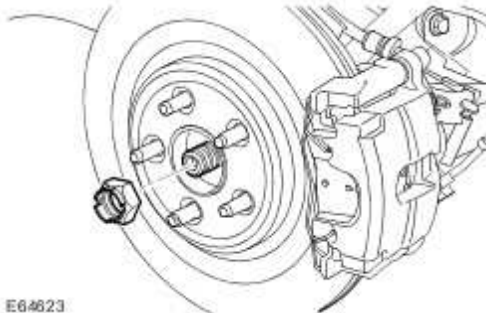
 **CAUTION:** Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

- 1  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

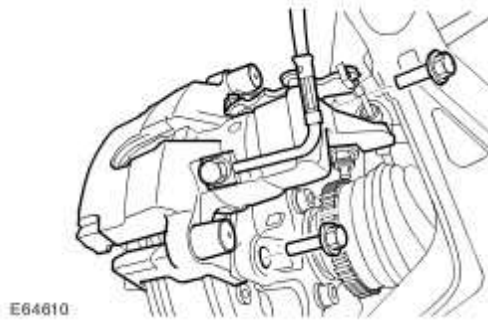
- 3 . With assistance, remove the halfshaft retaining nut, and retain it for the install procedure.



4 . Release the brake caliper.

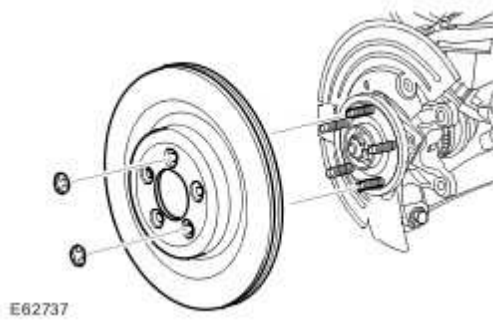
▶ Remove and discard the 2 bolts.

▶ Tie the brake caliper aside.

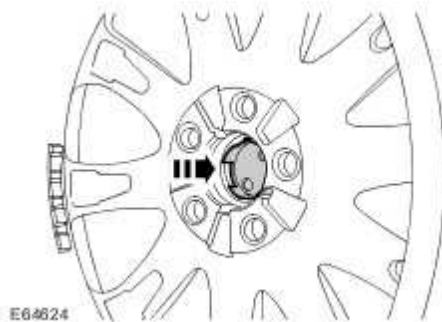


5 . Remove the rear brake disc.

▶ Remove the 2 clips.



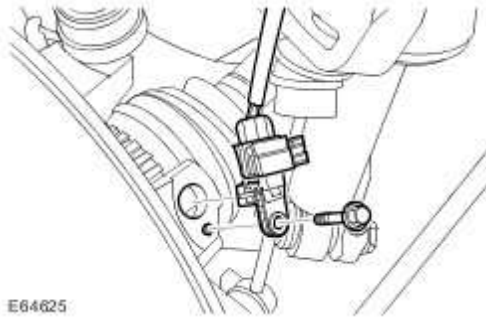
6 . Remove the wheel trim.



7 . Remove the wheel speed sensor.

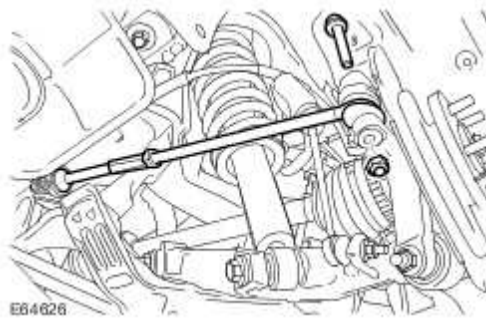
▶ Remove the bolt.

▶ Tie aside.



8 . Disconnect the toe link.

▶ Remove the bolt and discard the nut.

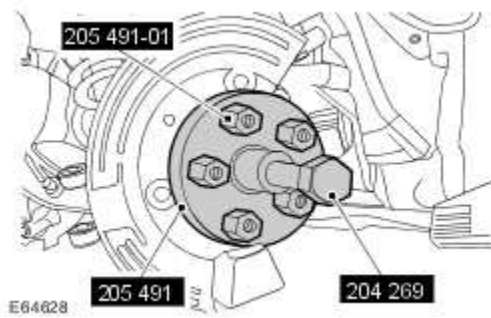


9 . Release the lower arm.

▶ Remove the bolt and discard the nut.



10 . Using the special tools, release the halfshaft from the drive flange.

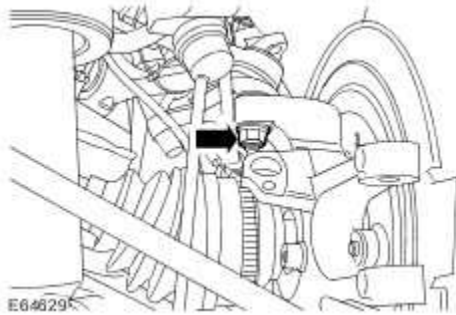


11 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

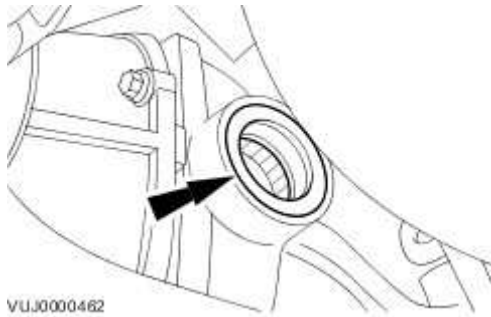
Remove the wheel knuckle.

- ▶ Release the upper suspension arm ball joint.
- ▶ Remove and discard the nut.

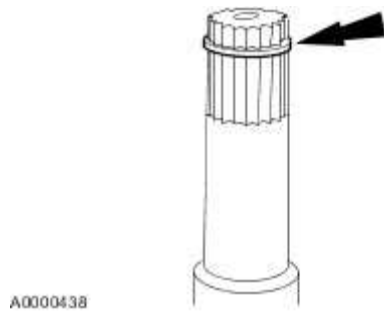


12 . Release the halfshaft from the differential.

13 . Remove and discard the halfshaft oil seal.



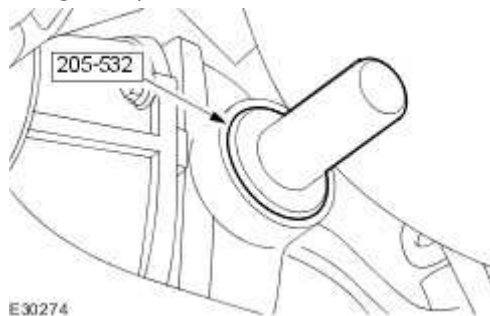
14 . Remove and discard the circlip.




Installation

1 . Clean the components mating faces.

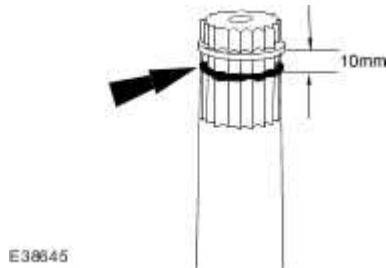
2 . Using the special tool, install a new halfshaft oil seal.




3 . Install a new circlip.

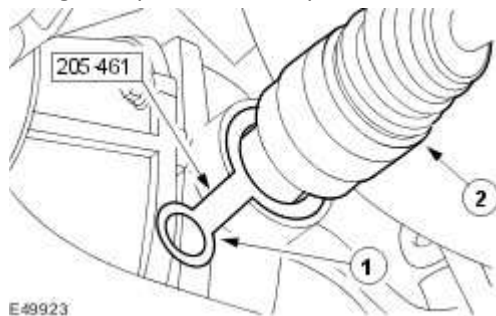
- 4  **CAUTION:** Use Loctite WSK-M2G349-A4 or equivalent, meeting the Jaguar specification.

Apply a 3 mm (0.125) diameter bead of sealant to the halfshaft splines.



- 5  **CAUTION:** Application of the sealant to assembly must take no longer than 5 minutes.

Using the special tool, to protect the seal install the halfshaft.



6 . Remove the special tool.

7 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the knuckle assembly.

▶ Tighten the nut to 90 Nm (66 lb.ft).

8 . **NOTE:**

Do not fully tighten the locking nut at this stage.

Install the halfshaft.

▶ Lightly tighten the old nut.

9



· **CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.**

Install the lower arm nut and bolt.

▶ Tighten the nut and bolt to 150 Nm (110 lb.ft).

10



· **CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.**

Connect the toe link.

▶ Tighten the nut and bolt to 55 Nm (40 lb.ft).


11 . Install the wheel speed sensor.

▶ Install the bolt and tighten to 10 Nm (7 lb.ft).


12 . Install the brake disc.

▶ Secure the clips.

13 . Install the brake caliper.

 Tighten the bolts to 103 Nm (76 lb.ft).


14 . Remove the old halfshaft nut and install the new one, tighten to 300 Nm (222 lb.ft)

 Install the wheel trim.

15 . Install the wheel trim.

16 .  **CAUTION: Only use lubricants meeting the Jaguar specification.**

Check and top-up the differential case.

 Tighten the filler plug to 34 Nm (25 lb.ft).

Inner Constant Velocity (CV) Joint Boot (47.10.33)

Removal



CAUTION: The inboard joint has angularly adjusted roller (AAR) joints. AAR joints have no internal retaining mechanism and can separate.

1



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

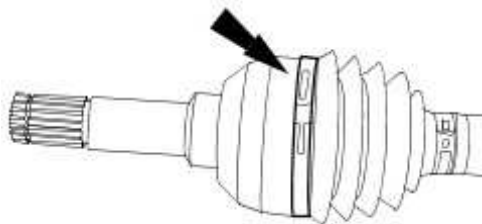
- 2 . Remove the halfshaft.

For additional information, refer to Rear Halfshaft (47.10.13)

- 3 . **NOTE:**

Position and secure component in a bench vice fitted with soft jaws.

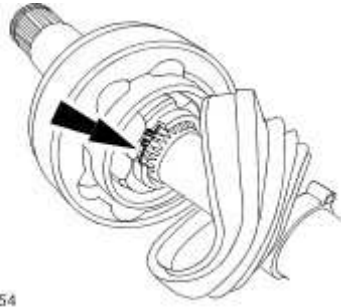
Remove and discard the CV joint boot outer retaining clamp.



VUJ0005653

- 4 . Remove the outer CV joint.

▶ Carefully release the clip.



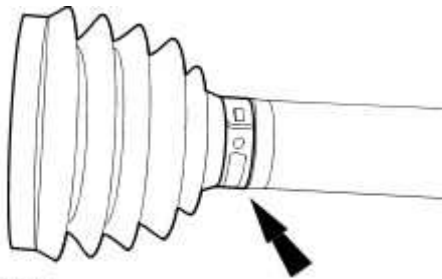
VUJ0005654

5 . NOTE:

Note the fitted position.

Remove the outer CV joint boot.

▶ Remove and discard the CV joint boot inner retaining clamp.



VUJ0005651

Installation

1 . Clean and inspect the components for deterioration.

2 . NOTE:

Align to the position noted on removal.

Install the CV joint boot.

▶ Secure the clip.

3 . **NOTE:**

Check that the circlip is fully engaged.

Install the outer CV joint.

4 .



CAUTION: Only use lubricants meeting the Jaguar specification.


Pack the CV joint with the grease supplied.

5



CAUTION: Ensure enough air is present in the CV boot before the retaining clip is secured.

Install the CV joint boot to the CV joint.

 Secure the clip.

6 . Install the halfshaft.

For additional information, refer to Rear Halfshaft (47.10.13)

Outer Constant Velocity (CV) Joint Boot (47.10.32)

Removal



CAUTION: The inboard joint has angularly adjusted roller (AAR) joints. AAR joints have no internal retaining mechanism and can separate.

1



- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

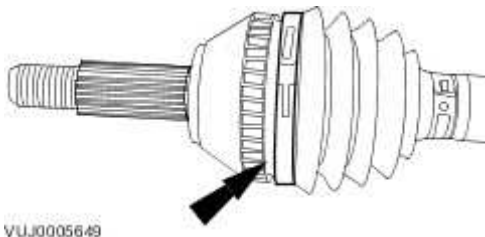
2 . Remove the halfshaft.

For additional information, refer to Rear Halfshaft (47.10.13)

3 . **NOTE:**

Position and secure component in a bench vice fitted with soft jaws.

Remove and discard the CV joint boot outer retaining clamp.



4

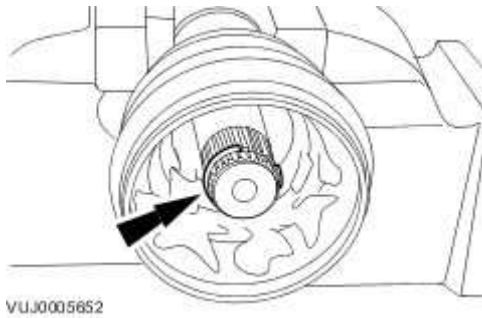


- CAUTION:** Use a soft face hammer or soft drift to release the C V joint from the retaining circlip.

Remove the outer CV joint.



5 . Remove and discard the circlip.

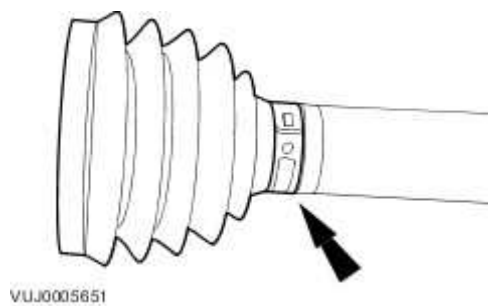


6 . **NOTE:**

Note the fitted position.

Remove the outer CV joint boot.

▶ Remove and discard the CV joint boot inner retaining clamp.




Installation

1 . Clean and inspect the components for deterioration.

2 . **NOTE:**

Align to the position noted on removal.

Install the CV joint boot.

 Secure the clip.

3 . Install the circlip.


4 . **NOTE:**

Check that the circlip is fully engaged.


Install the outer CV joint.

5 .  **CAUTION: Only use lubricants meeting the Jaguar specification.**

Pack the CV joint with the grease supplied.

6 .  **CAUTION: Ensure enough air is present in the CV boot before the retaining clip is secured.**

Install the CV joint boot to the CV joint.

 Secure the clip.

7 . Install the halfshaft.

For additional information, refer to Rear Halfshaft (47.10.13)

206 : Brake system

206-00 : Brake system – General information

Specifications

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Brake fluid	Shell ESL (Dot 4)

Brake Disc Runout Check

Check

1. Remove the wheel and tire.

[Wheel and Tire \(74.20.05\)](#)

2. Install all wheel nuts and tighten equally to 20 Nm (15 lb.ft).

- Make sure that the brake disc is fully seated against the hub face.

3. Install a dial test indicator gauge and holding fixture to a suitable mounting point.

4. **NOTE:**

If the runout is outside specification, check the hub face runout.

Using the dial test indicator, measure the inner and outer faces of the brake disc.

[Specifications](#)

[Specifications](#)

1. Position the gauge so that it contacts the disc 10 mm (0.4 in) from the outer edge.
2. Slowly rotate the hub/disc assembly. Note the reading.

5. If a front hub runout check is required, remove the front brake disc.

[Brake Disc - Vehicles With: Standard Brakes \(70.10.10\)](#)

6. If a rear hub runout check is required, remove the rear brake disc.

[Brake Disc \(70.10.11\)](#)

7. **NOTE:**

The hub surface should be free from dirt and corrosion. Do not use abrasive cloths to clean hub faces.

Using the dial test indicator, measure the hub face runout.

1. Position the gauge so that it contacts the mounting tube between the stud and the chamfer.
2. Slowly rotate the hub and note the runout. For additional information, refer to the specification chart.

- If the front hub runout exceeds the specifications, install a new hub, brake disc and recheck. If the rear hub runout exceeds the specifications, install a new hub, brake disc and recheck.

[Front Wheel Bearing and Wheel Hub \(60.25.03\)](#)

[Rear Wheel Bearing - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 \(64.15.14\)](#)

8. If the front hub face is within specification, install a new brake disc. If the rear hub face is within specification, install a new disc.

[Brake Disc - Vehicles With: Standard Brakes \(70.10.10\)](#)

[Brake Disc \(70.10.11\)](#)

9. Install the wheel and tire.

[Wheel and Tire \(74.20.05\)](#)

Brake System Bleeding (70.25.03)



CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

NOTE:

1.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.

3. Remove the brake master cylinder cover.

- Remove the 4 clips.



4.



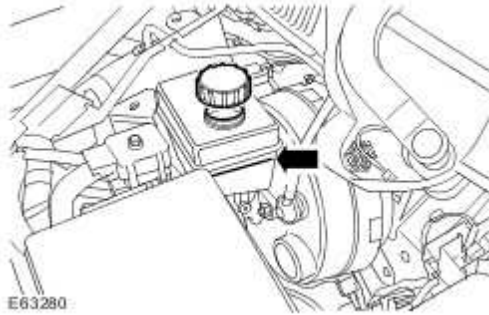
WARNING: Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.



CAUTION: Brake fluid will damage paint finished surfaces. If spilled,

immediately remove the fluid and clean the area with water.

Remove the brake fluid reservoir cap.

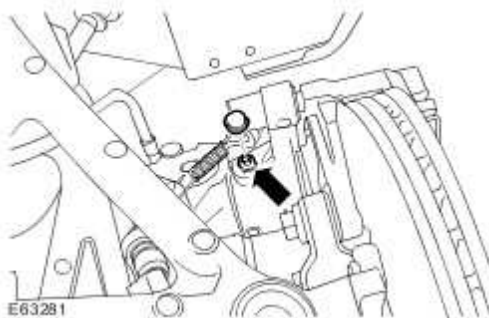


5. Fill the brake fluid reservoir to the MAX mark.

6. Install the bleed tube to the right hand rear brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar, containing a small quantity of approved brake fluid.

- Remove the bleed screw covers.

7. Loosen the bleed screw by one-half to three-quarters of a turn.



8.

 **CAUTION: The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.**

NOTE:

If the bleed tube used, does not have a one way valve the bleed screw will need to be closed before the brake pedal is returned to the rest position. Then opened again and the procedure repeated for each pedal application.

With assistance, depress the brake pedal steadily through its full stroke and allow it to return to the rest position. Repeat the procedure until brake fluid, clean and air-free flows into the bleed jar.

9.



CAUTION: Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw.

- Vehicles with standard brakes: Tighten the front caliper bleed screw to 8 Nm (6 lb.ft).
- Vehicles with high performance brakes: Tighten the front caliper bleed screw to 15 Nm (11 lb.ft).
- Tighten the rear bleed screw to 15 Nm (11 lb.ft).

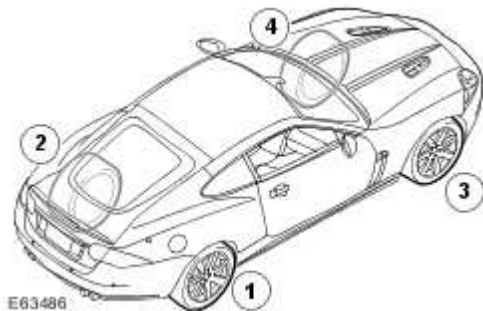
10. Fill the brake fluid reservoir to the MAX mark.

11.



WARNING: Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.



12. Fill the brake fluid reservoir to the MAX mark.

13. Apply the brakes and check for leaks.

14. Install the brake fluid reservoir cap.

15. Install the brake master cylinder cover.

- Carefully secure the clips.

Brake System

Principle of Operation

For a detailed description of the brake system, refer to the relevant Description and Operation section in the workshop manual.

Front Disc Brake

Rear Disc Brake

Parking Brake

Hydraulic Brake Actuation

Brake Booster

Anti-Lock Control - Stability Assist - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Inspection and Verification

NOTE:

Prior to carrying out any diagnosis, make sure that the brake system warning indicator is functional.

Visually examine the front and rear wheel and tire assemblies for damage such as uneven wear patterns, tread worn out or sidewall damage. Verify the tires are the same size, type and, where possible, same manufacturer. Replace the damaged wheel or excessively worn tire.

Wheel and Tire (74.20.05)

Wheels and tires must be cleared of any foreign matter and tire pressures adjusted to the correct specification.

If the tires exhibit uneven wear or feathering, the cause must be corrected. Check the steering and suspension components for damage or wear and, if necessary, check and adjust front wheel alignment.

Specifications

Front Toe Adjustment (57.65.01)

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none"> • Brake master cylinder • Brake caliper piston(s) • Brake discs • Wheel bearings • Brake pads • Power brake booster 	<ul style="list-style-type: none"> • Parking brake actuator • Parking brake module • Parking brake switch • Damaged or corroded wiring harness • Brake master cylinder fluid level switch

- | | |
|--|--|
| <ul style="list-style-type: none">• Brake pedal linkage• Brake booster vacuum hose• Tires• Debris | |
|--|--|

Road Test

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while others will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, pulsation) occurs only with the parking brake, the concern is in the rear brake system.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

Symptom Chart

Brakes noisy

Possible Source(s):

- Brake pads.
- Brake discs.

Action(s) to take:

- GO to Pinpoint Test A.

Vibration when brakes are applied

Possible Source(s):

- Wheels require balancing.
- Wheel hub nuts.
- Brake caliper mounting bolts.
- Brake pads.
- Foreign material/scratches/corrosion on brake disc contact surfaces.
- Excessive brake disc thickness variation.
- Excessive brake disc runout.
- Wheel bearing wear or failure.
- Suspension bushing wear or failure.
- Steering bushing wear or failure.

Action(s) to take:

- Go to Pinpoint Test B.

The brakes pull or drift

Possible Source(s):

- Tire pressures/wear.
- Brake calipers.
- Brake pads.
- Brake discs.
- Wheel alignment adjustment.
- Wheel bearing.
- Suspension bushings and ball joints.

Action(s) to take:

- GO to Pinpoint Test C.

The pedal feels spongy

Possible Source(s):

- Air in brake system.
- Leak in hydraulic system.
- Brake booster/master cylinder.
- Brake pads.

Action(s) to take:

- GO to Pinpoint Test D.

The pedal goes down fast

Possible Source(s):

- Air in brake system.
- Leak in hydraulic system.
- Brake booster/master cylinder.
- Brake pads.

Action(s) to take:

- GO to Pinpoint Test E.

The pedal goes down slowly

Possible Source(s):

- Air in brake system.
- Brake booster/master cylinder.

Action(s) to take:

- Go to Pinpoint Test F.

Excessive brake pedal effort

Possible Source(s):

- Brake pads.
- Brake booster.

Action(s) to take:

- GO to Pinpoint Test G.

Brake lockup during light brake pedal force

Possible Source(s):

- Brake pads.
- Brake calipers.

Action(s) to take:

- GO to Pinpoint Test H.

Brakes drag

Possible Source(s):

- Parking brake control applied/malfunction.

- Seized parking brake cables.
- Seized caliper slide pins.
- Seized brake caliper.
- Brake booster.
- Pedal gear.

Action(s) to take:

- GO to Pinpoint Test I.

Excessive/Erratic brake pedal travel

Possible Source(s):

- Hydraulic system.
- Brake pads.
- Brake discs.
- Hub and bearing assembly.

Action(s) to take:

- GO to Pinpoint Test J.

The red brake warning indicator is always on

Possible Source(s):

- Fluid level.

Action(s) to take:

- FILL the system to specification. CHECK for leaks.

Possible Source(s):

- Brake fluid level sensor.

Action(s) to take:

- INSTALL a new brake master cylinder fluid reservoir.
Brake Fluid Reservoir (70.30.16)

Possible Source(s):

- Parking brake control.

Action(s) to take:

- For additional information,
Parking Brake

Possible Source(s):

- Electrical circuit.

Action(s) to take:

- For additional information,
Parking Brake

Slow or incomplete brake pedal return

Possible Source(s):

- Brake pedal binding.
- Brake booster/master cylinder.

Action(s) to take:

- GO to Pinpoint Test K.

Pinpoint Tests

PINPOINT TEST G545069p1 : BRAKES NOISY

G545069t1 : INSPECT BRAKE PADS

1. Inspect the condition of the front and rear brake pads. Check for damage to any anti-squeal shims.

- **Are the brake pads OK?**

-> **Yes**

GO to Pinpoint Test G545069t2.

-> **No**

CLEAN the front brake pads or INSTALL new front brake pads if necessary.

Brake Pads - Vehicles With: Standard Brakes (70.40.02) CLEAN the rear brake pads or INSTALL new rear brake pads if necessary.

Brake Pads (70.40.03) Test vehicle for presence of brake squeal.

G545069t2 : INSPECT BRAKE DISCS

1. Inspect the brake discs for excessive corrosion, wear or disc thickness variation.

- **Does excessive corrosion, wear or disc thickness variation exist?**

-> **Yes**

INSTALL new front brake discs and brake pads.

Brake Disc - Vehicles With: Standard Brakes (70.10.10)

Brake Pads - Vehicles With: Standard Brakes (70.40.02) . INSTALL new rear brake discs and brake pads.

Brake Disc (70.10.11)

Brake Pads (70.40.03) TEST the system for normal operation.

-> **No**

Vehicle is OK.

PINPOINT TEST G545069p2 : VIBRATION WHEN BRAKES ARE APPLIED

G545069t3 : ROAD TEST VEHICLE

1. Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes.

- **Is the vibration present?**

-> **Yes**

TEST for noise vibration and harshness.

Noise, Vibration and Harshness (NVH) REPEAT road test if necessary.

-> **No**

GO to Pinpoint Test G545069t4.

G545069t4 : CHECK FOR BRAKE VIBRATION

1. Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.

- **Is a vibration present?**

-> **Yes**

CHECK the brake caliper mounting bolts and wheel hub nuts and TIGHTEN as necessary. CHECK the balance of all road wheels and tyres and REPAIR as necessary. CHECK the brake discs for excessive wear, runout, thickness variation or cracks. INSTALL new brake discs and brake pads as necessary. GO to Pinpoint Test G545069t5.

-> **No**

Vehicle is OK.

G545069t5 : IS VIBRATION STILL PRESENT UNDER BRAKE APPLICATION?

1. Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.

- **Is a vibration present?**

-> **Yes**

CHECK for wear or failure of steering gear bushings. CHECK for wear or failure of steering gear ball joints. CHECK for wear or failure of front wheel bearings, suspension bushings and ball joints. CHECK for wear or failure of rear wheel bearings, suspension bushings and ball joints. REFER to relevant section in workshop manual and INSTALL new parts as necessary.

-> **No**

Vehicle is OK.

PINPOINT TEST G545069p3 : THE BRAKES PULL OR DRIFT

G545069t6 : ROAD TEST VEHICLE

1. Road test the vehicle and apply the brake pedal.

- **Does the vehicle pull or drift?**

-> **Yes**

GO to Pinpoint Test G545069t7.

-> **No**

Vehicle is OK.

G545069t7 : INSPECT TIRE CONDITION/PRESSURE

1. Check for excessive tire wear or incorrect pressures.

- **Are the tires at the correct pressure and in good condition?**

-> **Yes**

GO to Pinpoint Test G545069t8.

-> **No**

ADJUST the tire pressures or INSTALL new tires if excessively worn. TEST the system for normal operation.

G545069t8 : CHECK CALIPERS

1. Check the disc brake caliper pistons and pins for binding, leaking or sticking.

- **Do the disc brake caliper pistons and pins bind, leak or stick?**

-> **Yes**

RECTIFY sticking pins and INSTALL new brake calipers as necessary.

Brake Caliper - Vehicles With: Standard Brakes (70.55.02)

Brake Caliper (70.55.03) TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G545069t9.

G545069t9 : INSPECT BRAKE DISCS

1. Check the brake discs for excessive damage, thickness variation or runout.

Brake Disc Runout Check

- **Does excessive damage or runout exist?**

-> **Yes**

INSTALL new brake discs and brake pads as necessary. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G545069t10.

G545069t10 : INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY

1. Check the front hub and wheel bearing assembly.

- **Are the wheel bearings OK?**

-> **Yes**

GO to Pinpoint Test G545069t11.

-> **No**

INSTALL new wheel bearings.

Front Wheel Bearing and Wheel Hub (60.25.03) TEST the system for normal operation.

G545069t11 : CHECK SUSPENSION BUSHINGS AND BALL JOINTS.

1. Check all suspension bushings and ball joints.

- **Are the suspension bushings and ball joints OK?**

-> **Yes**

GO to Pinpoint Test G545069t12.

-> **No**

INSTALL new front suspension bushings and ball joints as necessary. INSTALL new rear suspension bushings and ball joints as necessary. REFER to the relevant section in the workshop manual.

G545069t12 : CHECK VEHICLE ALIGNMENT

1. Check the vehicle alignment.

Front Subframe (76.10.05)

- **Is the alignment within specification?**

-> **Yes**

Vehicle is OK.

-> **No**

Adjust the alignment as necessary.

Front Subframe (76.10.05)

PINPOINT TEST G545069p4 : THE PEDAL FEELS SPONGY

G545069t13 : CHECK FOR SPONGY PEDAL (ENGINE OFF)

1. Check for a firm brake pedal.

- **Is the brake pedal effort and brake pedal travel normal?**

-> **Yes**

Vehicle is OK.

-> **No**

GO to Pinpoint Test G545069t14.

G545069t14 : CHECK BRAKE PEDAL RESERVE (ENGINE OFF)

1. Pump the brake pedal 10 times and hold on the final application.

- **Does the brake pedal feel firm on final application?**

-> **Yes**

GO to Pinpoint Test G545069t15.

-> **No**

BLEED the brake system.

Brake System Bleeding (70.25.03)

G545069t15 : CHECK BRAKE PEDAL RESERVE (ENGINE ON)

1. Engine is idle. 2. Apply the brake pedal lightly three or four times. 3. Wait 15 seconds for the vacuum to recover. 4. Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs. 5. Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min. 6. Release the accelerator pedal.

- **Does the brake pedal move downward as the engine speed returns to idle?**

-> **Yes**

GO to Pinpoint Test G545069t16.

-> **No**

CHECK the vacuum to brake booster.

G545069t16 : CHECK BRAKE FLUID LEVEL

1. Check the brake master cylinder reservoir fluid level.

- **Is the fluid level OK?**

-> **Yes**

BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation.

-> **No**

CHECK for leaking brake system and RECTIFY as necessary. ADD fluid and BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation. REPEAT road test if necessary.

PINPOINT TEST G545069p5 : THE PEDAL GOES DOWN FAST

G545069t17 : ROAD TEST VEHICLE

1. Road test the vehicle and apply the brake pedal.

- **Is the brake pedal effort and brake pedal travel normal?**

-> **Yes**

Vehicle is OK.

-> **No**

GO to Pinpoint Test G545069t19.

G545069t19 : CHECK BRAKE PEDAL TRAVEL-PRESSURIZE SYSTEM

1. Pump the brake pedal rapidly (five times).

- **Does the brake pedal travel build up and then hold?**

-> **Yes**

BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G545069t20.

G545069t20 : CHECK FOR BRAKE SYSTEM LEAKS

1. Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.

- **Are leaks found?**

-> **Yes**

REPAIR as necessary, ADD fluid and BLEED brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation.

-> **No**

System is OK.

PINPOINT TEST G545069p6 : THE PEDAL GOES DOWN SLOWLY

G545069t21 : ROAD TEST VEHICLE - CHECK BRAKE PEDAL OPERATION

1. Check if the condition occurs during actual stopping application by applying the brake pedal while the vehicle is moving.

- **Does the condition occur when the vehicle is moving?**

-> **Yes**

GO to Pinpoint Test G545069t22.

-> **No**

GO to Pinpoint Test G545069t23.

G545069t22 : CHECK FOR BRAKE SYSTEM LEAKS

1. Check for external brake system leaks. For additional information, refer to brake master cylinder component test in this section.

- **Are there any external brake system leaks?**

-> **Yes**

REPAIR as necessary. ADD fluid and BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G545069t23.

G545069t23 : CARRY OUT A BRAKE MASTER CYLINDER BYPASS TEST

1. Test for brake master cylinder bypass condition. Refer to Brake master cylinder component test in this section.

- **Are any concerns found?**

-> **Yes**

INSTALL a new brake master cylinder, ADD fluid and BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation.

-> **No**

System is OK.

PINPOINT TEST G545069p7 : EXCESSIVE BRAKE PEDAL EFFORT

G545069t24 : CHECK BRAKE PADS

1. Check the brake pads for wear, contamination, correct installation, damage and type.

- **Are any concerns found?**

-> **Yes**

INSTALL the front brake pads correctly or INSTALL new front brake pads if necessary.

Brake Pads - Vehicles With: Standard Brakes (70.40.02) INSTALL the rear brake pads correctly or INSTALL new rear brake pads if necessary.

Brake Pads (70.40.03) TEST the system for normal operation. REPEAT road test.

-> **No**

GO to Pinpoint Test G545069t25.

G545069t25 : CHECK VACUUM

1. Disconnect the vacuum hose from the brake booster. 2. Connect a vacuum/pressure tester to the vacuum hose. 3. Run the engine at normal operating temperature. 4. Record the vacuum reading.

- **Is the reading 40.5 kPa (12 in-Hg) or greater?**

-> **Yes**

GO to Pinpoint Test G545069t26.

-> **No**

LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.

G545069t26 : INSPECT SYSTEM

1. Switch the engine off. 2. Reconnect the vacuum hose. 3. Inspect the brake booster, rubber grommet, and all vacuum plumbing for cracks, holes, damaged connections, or missing clamps. 4. Pump the brake pedal several times to exhaust the vacuum. Push down on the brake pedal and hold.

- **Does the brake pedal move down when the engine is started?**

-> **Yes**

Vacuum system is OK.

-> **No**

GO to Pinpoint Test G545069t27.

G545069t27 : CHECK POWER BRAKE BOOSTER VALVE

1. Check the brake booster valve. For additional information, refer to Brake Booster component test in this section.

- **Is the power brake booster valve OK?**

-> **Yes**

CHECK the brake booster. For additional information, refer to Brake Booster component test in this section. INSTALL a new brake booster if necessary.

Brake Booster - RHD RWD (70.50.17)

Brake Booster - LHD RWD (70.50.17) TEST the system for normal operation.

-> **No**

INSTALL a new brake booster valve. TEST the system for normal operation.

PINPOINT TEST G545069p8 : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

G545069t28 : TEST BRAKE LOCKUP

1. Road test the vehicle and apply the brake pedal lightly.

- **Do the brakes lockup?**

-> **Yes**

GO to Pinpoint Test G545069t29.

-> **No**

Vehicle is OK.

G545069t29 : INSPECT BRAKE PADS

1. Inspect brake pads for contamination, correct installation, damage and type.

- **Are any concerns found?**

-> **Yes**

INSTALL the front brake pads correctly or INSTALL new front brake pads if necessary.

Brake Pads - Vehicles With: Standard Brakes (70.40.02) INSTALL the rear brake pads correctly or INSTALL new rear brake pads if necessary.

Brake Pads (70.40.03) TEST the system for correct operation.

-> **No**

GO to Pinpoint Test G545069t30.

G545069t30 : INSPECT BRAKE CALIPERS

1. Inspect brake calipers for binding, leaking or sticking.

- **Are any concerns found?**

-> **Yes**

INSTALL the brake calipers correctly or INSTALL new brake calipers as necessary.

Brake Caliper - Vehicles With: Standard Brakes (70.55.02)

Brake Caliper (70.55.03) TEST the system for normal operation.

-> **No**

Vehicle is OK.

PINPOINT TEST G545069p9 : BRAKES DRAG

G545069t31 : ROAD TEST VEHICLE

1. Road test the vehicle and apply the brakes.

- **Are the brakes functioning correctly?**

-> **Yes**

Vehicle is OK.

-> **No**

GO to Pinpoint Test G545069t32.

G545069t32 : CHECK BRAKE CALIPERS

1. Check the front caliper pistons and pins for binding, leaking or sticking.

Brake Caliper - Vehicles With: Standard Brakes (70.55.02) Check the rear caliper pistons and pins for binding, leaking or sticking.

Brake Caliper (70.55.03)

- **Do the disc brake caliper pistons and pins bind, leak or stick?**

-> **Yes**

INSPECT the brake calipers and parking brake cables. INSTALL new components as necessary. Test the system for normal operation. Road test vehicle if necessary.

-> **No**

GO to Pinpoint Test G545069t33.

G545069t33 : CHECK BRAKE BOOSTER

1. Check the brake booster connecting rod alignment and travel.

- **Is the connecting rod OK?**

-> **Yes**

Vehicle is OK.

-> **No**

INSTALL a new brake booster.

Brake Booster - RHD RWD (70.50.17)

Brake Booster - LHD RWD (70.50.17) TEST the system for normal operation.

PINPOINT TEST G545069p10 : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL

G545069t34 : TEST ON ROUGH ROAD

1. Road test the vehicle on rough road conditions. 2. Apply the brakes slowly.

- **Is the brake pedal effort and brake pedal travel normal?**

-> **Yes**

Vehicle is OK.

-> **No**

GO to Pinpoint Test G545069t35.

G545069t35 : CHECK BRAKE FLUID LEVEL

1. Check the brake master cylinder reservoir fluid level.

- **Is the fluid level OK?**

-> **Yes**

GO to Pinpoint Test G545069t36.

-> **No**

CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake master cylinder component test in this section. ADD brake fluid and BLEED the brake system.

Brake System Bleeding (70.25.03) TEST the system for normal operation. REPEAT road test if necessary.

G545069t36 : CHECK BRAKE PEDAL RESERVE

1. Run engine at idle speed. 2. Apply the brake pedal lightly three or four times. 3. Wait 15 seconds for the vacuum to replenish. 4. Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs. 5. Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min. 6. Release the accelerator pedal.

- **Does the brake pedal move downward as the engine speed returns to idle?**

-> **Yes**

GO to Pinpoint Test G545069t37.

-> **No**

CHECK the vacuum to the brake booster.

G545069t37 : CHECK THE FRONT WHEEL BEARING ASSEMBLY

1. Check the front wheel bearing assembly.

- **Are the front wheel bearings loose?**

-> **Yes**

INSTALL a new front wheel bearing if damaged.

Front Wheel Bearing and Wheel Hub (60.25.03) TEST the system for normal operation.

-> **No**

CHECK the front brake discs for thickness variances.

PINPOINT TEST G545069p11 : SLOW OR INCOMPLETE BRAKE PEDAL RETURN

G545069t38 : CHECK FOR BRAKE PEDAL RETURN

1. Run the engine at idle while making several brake applications. 2. Pull the brake pedal rearward with approximately 44.5 N (10lb) force. 3. Release the brake pedal and measure the distance to the toe board. 4. Make a hard brake application. 5. Release the brake pedal and measure the brake pedal to toe board distance. The brake pedal should return to its original position.

- **Does the brake pedal return to its original position?**

-> **Yes**

Vehicle is OK.

-> **No**

GO to Pinpoint Test G545069t39.

G545069t39 : CHECK FOR BRAKE PEDAL BINDING

1. Disconnect the brake booster from the brake pedal. Check the brake pedal to ensure free operation.

- **Is the brake pedal operating freely?**

-> **Yes**

INSTALL a new brake booster.

Brake Booster - RHD RWD (70.50.17)

Brake Booster - LHD RWD (70.50.17) TEST the system for normal operation.

-> **No**

REPAIR or INSTALL new brake pedal. TEST the system for normal operation.

Component Tests

Brake Booster

1 . Check all hoses and connections. All unused vacuum connectors should be capped. Hoses and their connections should be correctly secured and in good condition with no holes and no collapsed areas. Inspect the valve on the brake booster for damage.

2 . Check the hydraulic brake system for leaks or low fluid.

3 . With the automatic transmission in PARK, stop the engine and apply the parking brake. Pump the brake pedal several times to exhaust all vacuum in the system. With the engine switched off and all vacuum in the system exhausted, apply the brake pedal and hold it down. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the vacuum booster system is not functioning.

4 . Remove the vacuum hose from the brake booster. Manifold vacuum should be available at the brake booster end of the hose with the engine at idle speed and the automatic transmission in PARK. Make sure that all unused vacuum outlets are correctly capped, hose connectors are correctly secured and vacuum hoses are in good condition. When it is established that manifold vacuum is available to the brake booster, connect the vacuum hose to the brake booster and repeat Step 3. If no downward movement of the brake pedal is felt, install a new brake booster.

5 . Operate the engine for a minimum of 10 seconds at a fast idle. Stop the engine and allow the vehicle to stand for 10 minutes. Then, apply the brake pedal with approximately 89 N (20lb) of force. The pedal feel (brake application) should be the same as that noted with the engine running. If the brake pedal feels hard (no power assist), install a new valve and then repeat the test. If the brake pedal still feels hard, install a new brake booster. If the brake pedal movement feels spongy, bleed

the brake system.

Brake System Bleeding (70.25.03)

Brake Master Cylinder

Usually, the first and strongest indicator of anything wrong in the brake system is a feeling through the brake pedal. In diagnosing the condition of the brake master cylinder, check pedal feel as evidence of a brake concern. Check for brake warning lamp illumination and the brake fluid level in the brake master cylinder reservoir.

Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of repair.

- Modern brake systems are designed to produce a pedal effort that is not as hard as in the past. Complaints of light pedal efforts should be compared to the pedal efforts of another vehicle of the same model and year.
- The fluid level will fall with brake pad wear.

Abnormal Conditions

Changes in the brake pedal feel or brake pedal travel are indicators that something could be wrong in the brake system. The diagnostic procedure and techniques use brake pedal feel, warning indicator illumination and low brake fluid level as indicators to diagnosing brake system concerns. The following conditions are considered abnormal and indicate that the brake master cylinder is in need of repair:

NOTE:

Prior to carrying out any diagnosis, make sure the brake system warning indicator is functional.

- Brake pedal goes down fast. This could be caused by an external or internal leak.
- Brake pedal goes down slowly. This could be caused by an internal or external leak.
- Brake pedal is low or feels spongy. This condition may be caused by no fluid in the brake master cylinder, reservoir cap vent holes clogged or air in the hydraulic system.
- Brake pedal effort is excessive. This may be caused by a bind or obstruction in the pedal/linkage, a faulty non-return valve, booster or insufficient booster vacuum.
- Rear brakes lock up during light pedal force. This may be caused by damaged brake pads, a partially applied parking brake, a damaged ABS sensor or bearing failure.
- Brake pedal effort erratic. This condition could be caused by the brake booster or incorrectly installed brake pads.
- Brake warning indicator is on. This may be caused by low fluid level or float assembly damaged.

Non Pressure Leaks

Any reduced fluid volume in the brake master cylinder reservoir may be caused by two types of non pressure external leaks.

Type 1: An external leak may occur at the brake master cylinder reservoir cap because of incorrect positioning of the gasket and cap. Reposition cap and gasket.

Type 2: An external leak may occur at the brake master cylinder reservoir mounting seals. Repair such a leak by installing new seals and make sure that the brake master cylinder reservoir retaining bolt is correctly installed.

206-03 : Front disc brake

Specifications

Specifications

Brake Disc

Item	Specification
Disc type	Ventilated
Disc diameter	326 mm (12.83 in)
Disc diameter (Supercharged models)	355 mm (13.98 in)
Disc diameter (vehicles fitted with Alcon braking system)	400 mm (15.75 in)
Disc thickness (new)	30 mm (1.18 in)
Disc thickness (Supercharged models new)	32 (1.26 in)
Disc thickness (vehicles fitted with Alcon braking system new)	36 mm (1.42 in)
Minimum disc thickness (service limit)	28 mm (1.10 in)
Minimum disc thickness (Supercharged models service limit)	30mm (1.18 in)
Minimum disc thickness (vehicles fitted with Alcon braking system service limit)	34 mm (1.34 in)
Disc thickness variation (new)	0.008 mm (0.0003 in)
Maximum disc run-out - installed	0.09 mm (0.0035 in)
Maximum hub face run-out - installed	0.0135 mm (0.00053 in)

Caliper and pads

Item	Specification
Caliper	Floating cast iron caliper with 60 mm single piston
Caliper (Supercharged models)	Floating cast iron/aluminium composite caliper with 60mm single piston
Caliper (vehicles fitted with Alcon braking system)	Opposed aluminium caliper with 6 pistons. Piston diameters 38.1 mm, 34.9 mm and 30.2 mm
Minimum pad thickness (service limit)	2 mm (0.078 in)
Minimum pad thickness (vehicles fitted with Alcon braking system service limit including	8.5 mm (0.335 in)

brake pad back plate)	
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Torque Specifications

Item	Nm	lb-ft
Brake caliper anchor plate - bolts*	115	85
Brake caliper - guide pins	28	21
Brake caliper - guide pins (Supercharged models)	58	43
Brake hose to caliper - union	35	26
Brake hose to caliper - union (Supercharged models)	38	28

* New nuts/bolts must be installed **Torque Specifications - vehicles fitted with Alcon braking system**

NOTE:

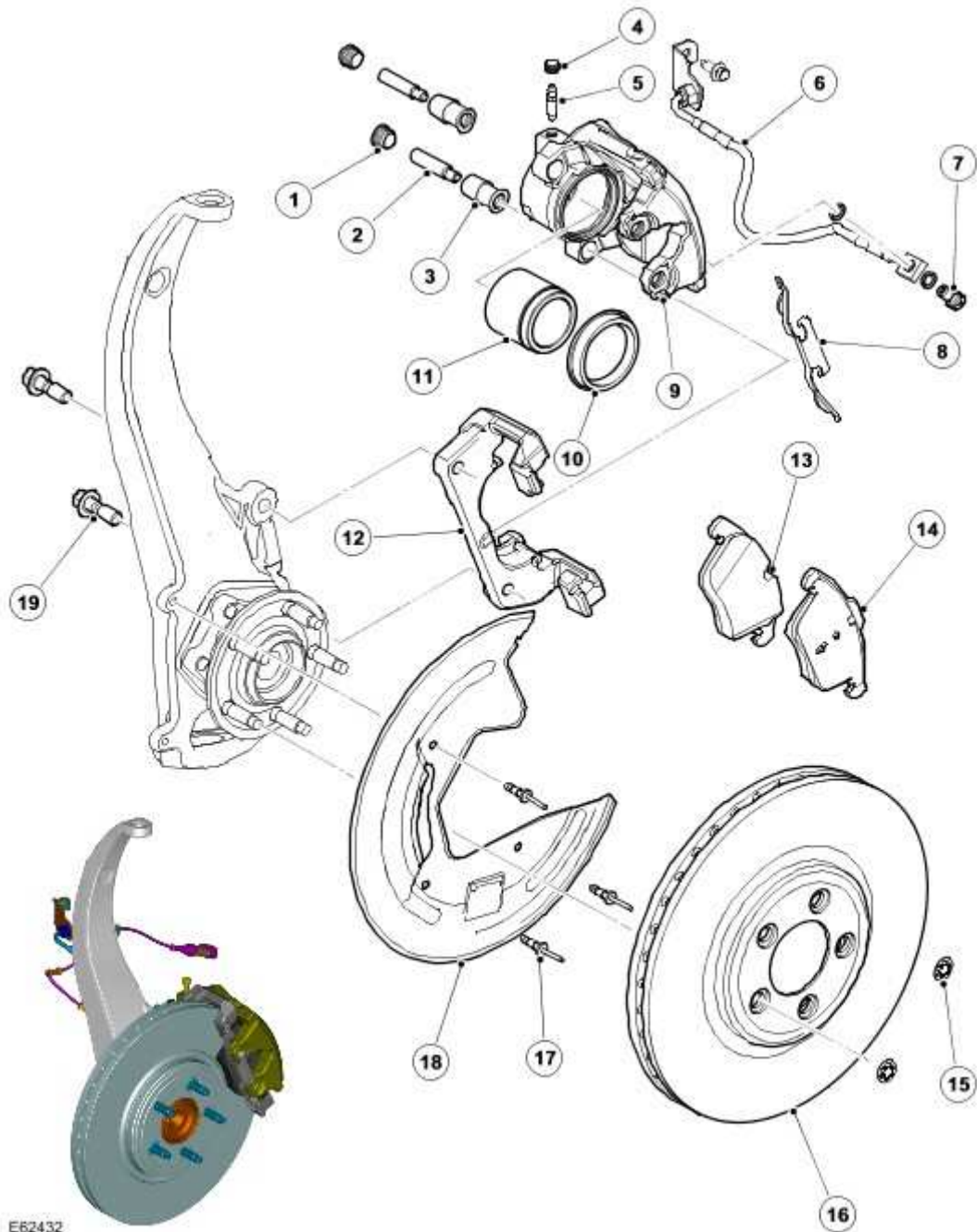
Alcon brake system can be identified by the existence of half-moon shaped marking in the friction surface of the brake disc.

Item	Nm	lb-ft
Brake caliper anchor plate to wheel knuckle - bolts*	108	80
Brake caliper to caliper anchor plate - bolts	115	85

* New nuts/bolts must be installed

Front Disc Brake

STANDARD BRAKES - COMPONENT LOCATION



E62432

Item	Part Number	Description
1		Guide pin dust cover (2 off)

2		Guide pin (2 off)
3		Guide pin bush (2 off)
4		Bleed screw dust cap
5		Bleed screw
6		Brake hose
7		Bolt - brake hose to caliper
8		Anti-rattle spring
9		Brake caliper housing
10		Piston dust cover
11		Piston
12		Caliper carrier
13		Inboard brake pad
14		Outboard brake pad
15		Retaining washers (2 off)
16		Brake disc
17		Rivets (3 off)
18		Brake dust shield
19		Caliper carrier bolts (2 off)

INTRODUCTION

The front standard type braking system used on the naturally aspirated vehicles features 326 x 20 mm (12.83 x 0.79 in) diameter ventilated brake discs and cast iron, single piston, sliding calipers.

The caliper is mounted within a fixed carrier that is secured to the front wheel knuckle with 2 bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against the brake disc. The caliper reacts and slides along 2 guide pins to bring the outer pad into contact with the brake disc.

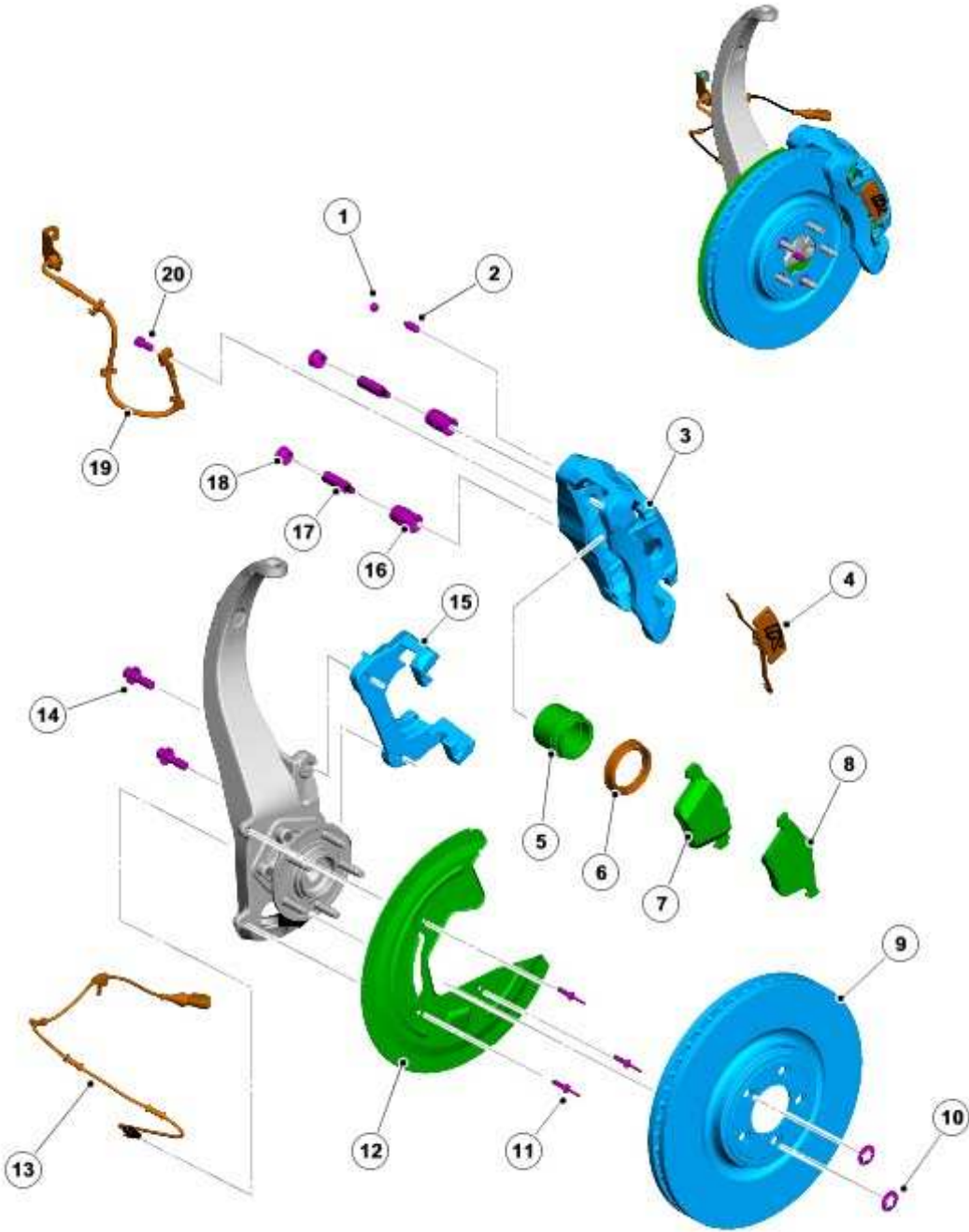
Each inboard brake pad is installed with a pressed steel anti-rattle spring.

NOTE:

There is no wear indicator installed to the front brake pads.

The brake disc is manufactured from cast iron and is of the vented type. The disc is retained on the wheel hub by 2 retaining washers and the wheel nuts.

PERFORMANCE BRAKES - COMPONENT LOCATION



E83350

Item	Part Number	Description
1		Bleed screw dust cap
2		Bleed screw
3		Brake caliper housing

4		Anti-rattle spring (with 'R' type badge)
5		Piston
6		Piston dust cover
7		Inboard brake pad
8		Outboard brake pad
9		Brake disc
10		Retaining washers (2 off)
11		Rivets (3 off)
12		Brake dust shield
13		Anti-lock Brake System (ABS) sensor cable
14		Caliper carrier bolts (2 off)
15		Caliper carrier
16		Guide pin bush (2 off)
17		Guide pin (2 off)
18		Guide pin dust cover (2 off)
19		Brake hose
20		Bolt - brake hose to caliper

INTRODUCTION

The front performance type braking system used on the supercharged vehicle features 355 x 32 mm (13.98 x 1.26 in) diameter ventilated brake discs, and composite aluminum and cast iron, single piston, sliding calipers.

In addition, the brake calipers on the supercharged vehicle are painted and a logo badge is formed on the anti-rattle spring.

The caliper is mounted within a fixed carrier that is secured to the front wheel knuckle with 2 bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against

the brake disc. The caliper reacts and slides along 2 guide pins to bring the outer pad into contact with the brake disc.

Each inboard brake pad is installed with a pressed steel anti-rattle spring.

NOTE:

There is no wear indicator installed to the front brake pads.

The brake disc is manufactured from cast iron and is of the vented type. The disc is retained on the wheel hub by 2 retaining washers and the wheel nuts.

Front Disc Brake

For additional information, refer to [206-00](#).

Brake Caliper - Vehicles With: Standard Brakes (70.55.02)

Special Service Tools



Brake pedal hold down tool JDS 9013

Removal



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

1



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 . Remove the LH front wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

3



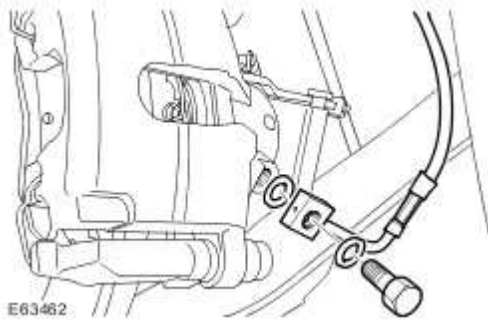
- **CAUTION:** Always plug any open connections to prevent contamination.

NOTE:

To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm (1.6 in) below the rest position.

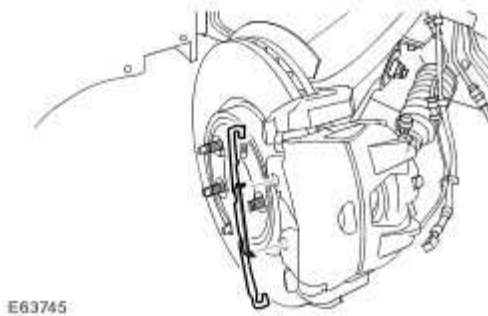
Disconnect the brake hose from the brake caliper.

- ▶ Using the special tool, press and hold the brake pedal.
- ▶ Remove and discard the two sealing washers.



4 . Remove the LH anti-rattle spring.

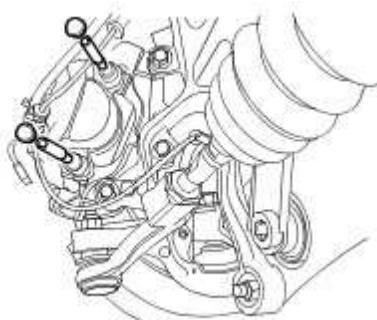
- ▶ Release the 2 clips.



5 . Remove the LH brake caliper.

- ▶ Remove the 2 access plugs.
- ▶ Release the 2 brake caliper guide pins.

E63746



6 . Release the inboard brake pad from the caliper.

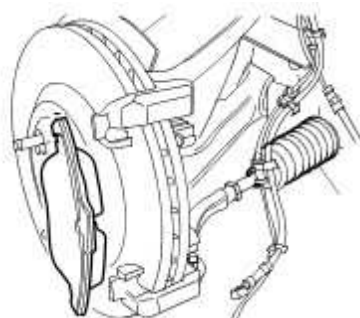
▶ Release the clip.

E63747



7 . Remove the outboard brake pad.

E63748

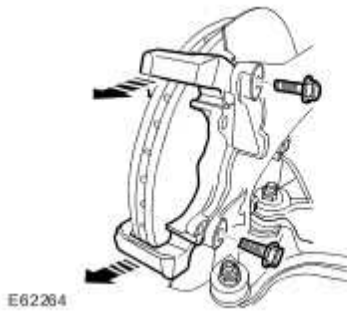


8 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the brake caliper anchor plate.

- ▶ Remove and discard the 2 bolts.



Installation

- 1 . Install the brake caliper anchor plate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 115 Nm (85 lb.ft).

- 2 . Install the LH brake pads.

- ▶ Secure the inboard brake pad in the clip.
- ▶ Position the outboard brake pad.

- 3 . Install the LH brake caliper.

- ▶ Tighten the guide pins to 28 Nm (21 lb.ft).
- ▶ Install the access plugs.

- 4 . Install the LH anti-rattle spring.

- ▶ Carefully secure the clips.

5 . Connect the brake hose to the brake caliper.

▶ Install new sealing washers.

▶ Tighten the union to 35 Nm (26 lb.ft).

6 . Install the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

7 . Bleed the brake system.

Brake Disc - Vehicles With: Standard Brakes (70.10.10)

Removal



CAUTION: Brake discs must be renewed in pairs.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

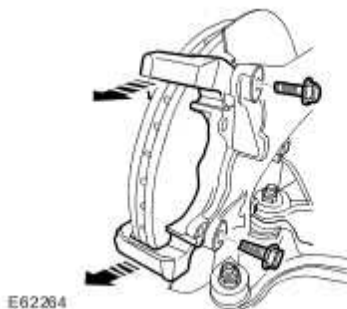
Raise and support the vehicle.

2 . Remove the front brake pads.

For additional information, refer to Brake Pads - Vehicles With: Standard Brakes (70.40.02)

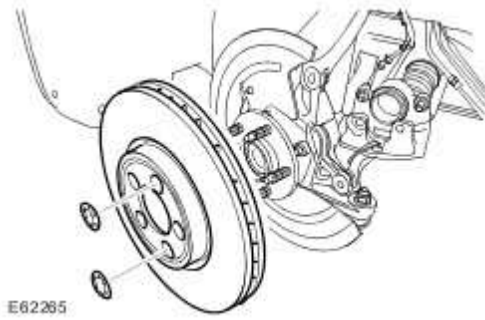
3 . Remove the brake caliper anchor plate.

▶ Remove and discard the 2 bolts.




4 . Remove the brake disc.

▶ Remove the 2 clips.



Installation

- 1  **WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.**

Install the brake disc.

- ▶ Clean the component mating faces.
- ▶ Secure the clips.

- 2 . Install the brake caliper anchor plate.


- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 115 Nm (85 lb.ft).

- 3 . Install the brake pads.

For additional information, refer to Brake Pads - Vehicles With: Standard Brakes (70.40.02)

Brake Disc - Vehicles With: High Performance Brakes (70.10.10)

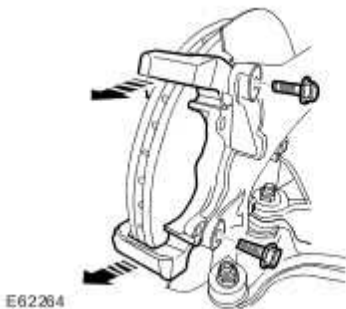
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Remove the front brake pads.
 - For additional information, refer to Brake Pads - Vehicles With: High Performance Brakes (70.40.02)
- 3 . Remove the brake caliper anchor plate.

▶ Remove and discard the 2 bolts.



- 4 . Remove the brake disc.

▶ Remove the 2 clips.



Installation

1



- **WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.**

Install the brake disc.

- ▶ Clean the component mating faces.
- ▶ Secure the clips.

2 . Install the brake caliper anchor plate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 115 Nm (85 lb.ft).

3 Install the brake pads.

- For additional information, refer to Brake Pads - Vehicles With: High Performance Brakes (70.40.02)

Brake Pads - Vehicles With: Standard Brakes (70.40.02)

Removal



WARNING: Brake pads must be renewed in axle sets only. Failure to follow this instruction may result in braking efficiency being impaired.



WARNING: Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

1



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

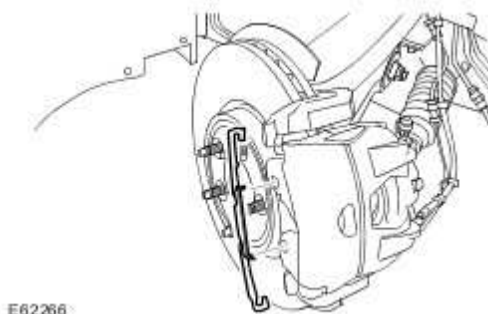
Raise and support the vehicle.


- 2 . Remove the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

- 3 . Remove the LH anti-rattle spring.

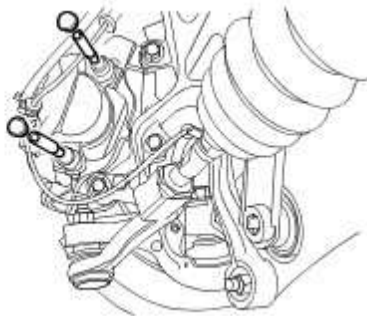
▶ Release the 2 clips.



- 4 .  **CAUTION: Do not allow the brake caliper to hang on the brake hose.**

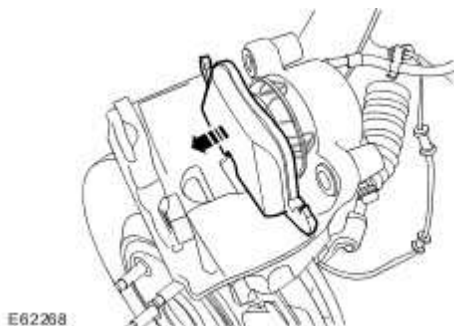
Remove the LH brake caliper.

- ▶ Remove the 2 access plugs.
- ▶ Remove the 2 caliper guide pins.
- ▶ Tie the brake caliper aside.



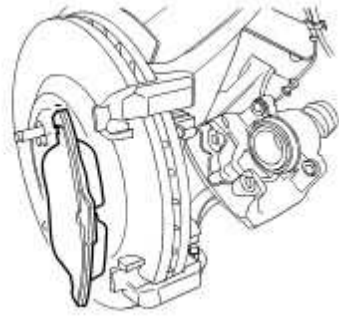
- 5 . Release the inboard brake pad from the caliper.

- ▶ Release the clip.




- 6 . Remove the outboard brake pad.

E62289





7 . Repeat the above procedure for the RH caliper.

Installation

- 1  **WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.**

Clean the caliper housings and anchor plates, using brake cleaning fluid.

- 2  **CAUTION: As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.**

 **CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.**

Press the LH pistons into the caliper housing.

3 . Install the LH brake pads.

▶ Secure the inboard brake pad in the clip.

▶ Position the outboard brake pad.

4 . Install the LH brake caliper.

▶ Tighten the guide pins to 28 Nm (21 lb.ft).

▶ Install the access plugs.

5 . Install the LH anti-rattle spring.

▶ Carefully secure the clips.

6 . Repeat the above procedure for the RH caliper.

7 . Install the front wheels and tires.

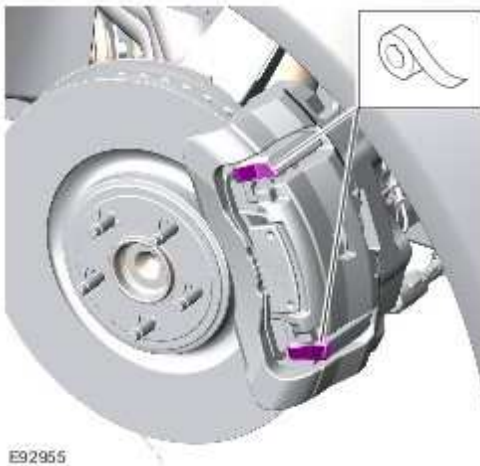
For additional information, refer to Wheel and Tire (74.20.05)


Brake Pads - Vehicles With: High Performance Brakes (70.40.02)

Removal

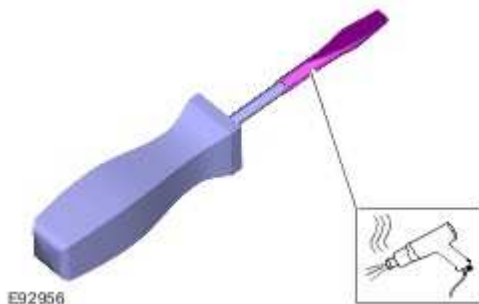
- 1 . Raise and support the vehicle.
- 2 . Remove the front road wheels and tires.
For additional information, refer to Wheel and Tire (74.20.05)


- 3 . Apply protective tape to the caliper.



- 4 .  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

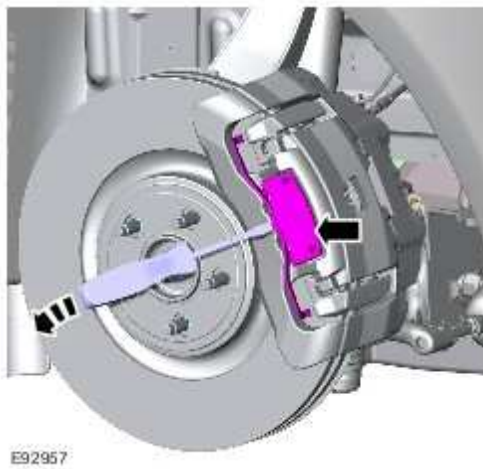
Apply heatshrink or protective tape to the end of the screw-driver.




- 5  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

Remove the anti-rattle spring.

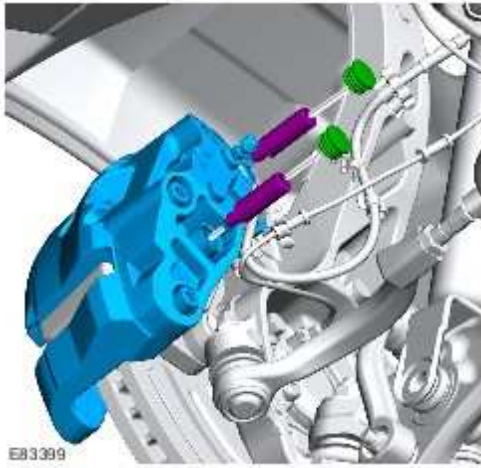
- ▶ Lever the anti-rattle spring in the center of the spring until either side is released.



6.  **CAUTION: Do not allow the brake caliper to hang on the brake hose.**

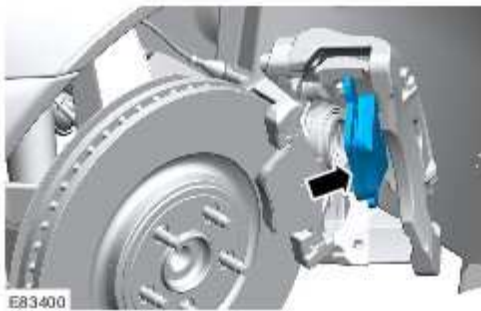
Remove the brake caliper.

- ▶ Remove the 2 access plugs.
- ▶ Remove the 2 caliper guide pins.
- ▶ Tie the brake caliper aside.

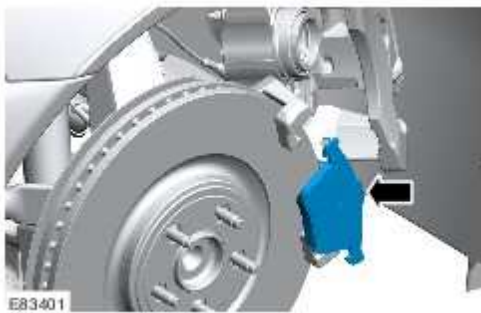


7 . Release the inboard brake pad from the caliper.


▶ Release the clip.




8 . Remove the outboard brake pad.




Installation

- 1  **WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.**

Clean the brake caliper housings and anchor plates, using brake cleaning fluid.

- 2  **CAUTION: As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.**

 **CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.**

Press the piston into the caliper housing.

- 3 . Install the brake pads.

- ▶ Secure the inboard brake pad in the clip.
- ▶ Position the outboard brake pad.

- 4 . Install the brake caliper.

- ▶ Tighten the guide pins to 58 Nm (43 lb.ft).
- ▶ Install the access plugs.

- 5 Install the anti-rattle spring.

- ▶ Secure the bottom arm of the anti-rattle spring under the bottom anchor bracket of the caliper.

- ▶ Compress the upper spring arm into the correct position, under the upper anchor bracket, whilst retaining the logo plate.
- ▶ Using the screw-driver, tap the central locating tag into the locked position.

6 . Repeat the above procedure on the opposite side.

7 . Install both wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

206-04 : Rear disc brake

Specifications

Specifications

Brake Disc

Item	Specification
Disc type	Ventilated
Disc diameter	326 mm (12.8 in)
Disc diameter (vehicles fitted with Alcon braking system)	350 mm (13.78 in)
Disc thickness (new)	20 mm (0.78 in)
Disc thickness (vehicles fitted with Alcon braking system new)	28 mm (1.10 in)
Minimum disc thickness (service limit)	18 mm (0.70 in)
Minimum disc thickness (vehicles fitted with Alcon braking system service limit)	26 mm (1.02 in)
Disc thickness variation (new)	0.008 mm (0.0003 in)
Maximum disc run-out - installed	0.075 mm (0.0029 in)
Maximum hub face run-out - installed	0.0135 mm (0.00053 in)

Caliper and pads

Item	Specification
Caliper	Floating aluminium caliper with 45 mm single piston and integral park brake mechanism
Caliper (vehicles fitted with Alcon braking system)	Opposed aluminium caliper with four 31.8 mm diameter pistons.
Minimum pad thickness (service limit)	2 mm (0.078 in)
Minimum pad thickness (vehicles fitted with Alcon braking system service limit including brake pad back plate)	7.5 mm (0.30 in)

Torque Specifications

Item	Nm	lb-ft
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Brake caliper anchor plate - bolts*	103	76
Brake caliper - guide pins	28	21
Brake hose to caliper - union	35	26

* New nuts/bolts must be installed **Torque Specifications - vehicles fitted with Alcon braking system**

NOTE:

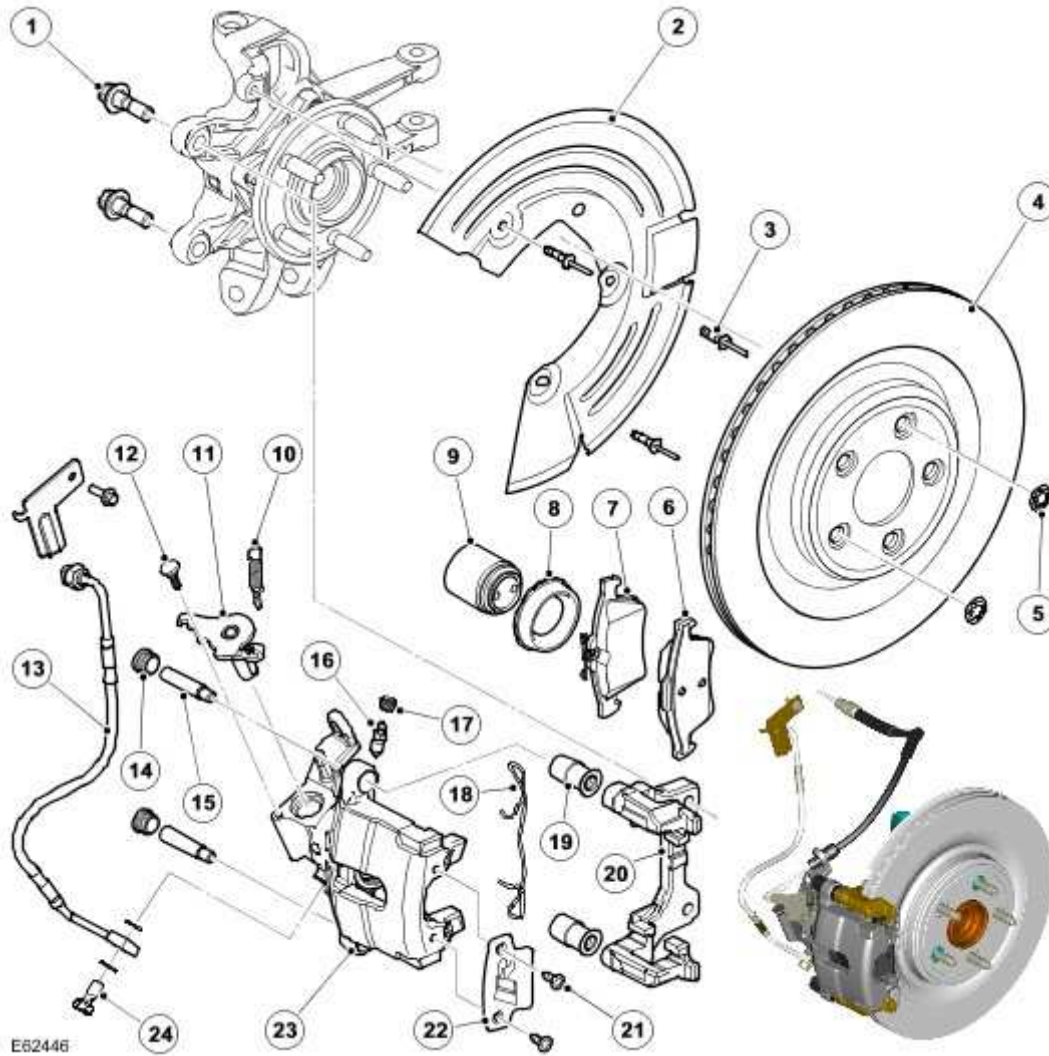
Alcon brake system can be identified by the existence of half-moon shaped marking in the friction surface of the brake disc.

Item	Nm	lb-ft
Hydraulic brake caliper anchor plate to wheel knuckle - bolts*	108	80
Hydraulic brake caliper to caliper anchor plate - bolts	115	85
Parking brake caliper to caliper anchor plate - bolts	63	46
Parking brake caliper anchor plate to rear wheel knuckle - front bolt	70	52
Parking brake caliper anchor plate to rear wheel knuckle - rear bolt	63	46

* New nuts/bolts must be installed

Rear Disc Brake

COMPONENT LOCATION



Item	Part Number	Description
1		Caliper carrier bolts (2 off)
2		Brake dust shield
3		Rivets (3 off)
4		Brake disc

5		Retaining washers (2 off)
6		Outboard brake pad
7		Inboard brake pad
8		Piston dust cover
9		Piston
10		Parking brake return spring
11		Parking brake lever
12		Parking brake lever stop
13		Brake hose
14		Guide pin dust cover (2 off)
15		Guide pins (2 off)
16		Bleed screw
17		Bleed screw dust cap
18		Anti-rattle spring
19		Guide pin bush (2 off)
20		Caliper carrier
21		Screw (2 off) - (supercharged model)
22		'R' type logo badge (supercharged model)
23		Brake caliper housing
24		Bolt - brake hose to caliper

INTRODUCTION

The rear braking system on both the naturally aspirated and supercharged vehicles features 326 x 20 mm (12.83 x 0.79 in) diameter ventilated brake discs with aluminum, single acting piston, sliding calipers.

The brake calipers on the supercharged vehicle are painted and also include a logo badge. The logo badge must be removed in order to renew the brake pads.

The caliper is mounted within a fixed carrier that is secured to the rear wheel knuckle with 2 bolts. When hydraulic pressure is supplied to the caliper, the piston extends to force the inner pad against the brake disc. The caliper reacts and slides along 2 guide pins to bring the outer pad into contact with the brake disc.

Each inboard brake pad is installed with a wire type anti-rattle spring.

NOTE:

There is no wear indicator installed to the rear brake pads.

The brake disc is manufactured from cast iron and is of the vented type. The disc is retained on the wheel hub by 2 retaining washers and the wheel nuts.

Also incorporated into each rear brake caliper carrier is the parking brake mechanism. For additional information, refer to Parking Brake (206-05 Parking Brake and Actuation)

Repairs



CAUTION: Do not use the 'Emergency Release' tool to allow work to be carried out on the rear brakes. Work can only be carried out on the rear brakes after the 'parking brake unjam' routine is run.

Before carrying out any work on the rear brakes, the Jaguar approved diagnostic system must be connected and the 'parking brake unjam' routine run.

When all work is carried out on the rear brakes, the parking brake system will require resetting. For additional information, refer to Parking Brake (206-05 Parking Brake and Actuation)

Rear Disc Brake

For additional information, refer to [206-00](#).

Brake Caliper (70.55.03)


Special Service Tools



Brake pedal hold down tool
JDS9013

Removal

All vehicles

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 3 . Release the parking brake cable tension.
For additional information, refer to Parking Brake Cable Tension Release

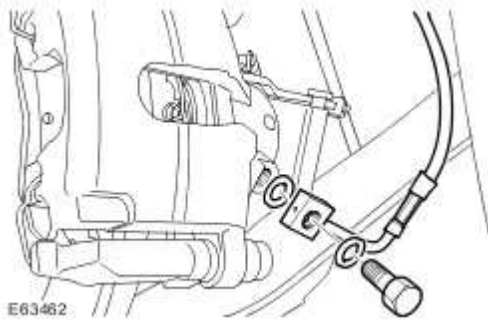
- 4  **CAUTION: Always plug any open connections to prevent contamination.**

NOTE:

To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm (1.6 in) below the rest position.

Disconnect the brake hose from the brake caliper.

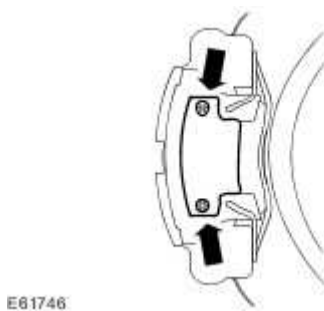
- ▶ Using the special tool, press and hold the brake pedal.
- ▶ Remove and discard the 2 sealing washers.



Vehicles with high performance brakes

5 . Remove the logo badge.

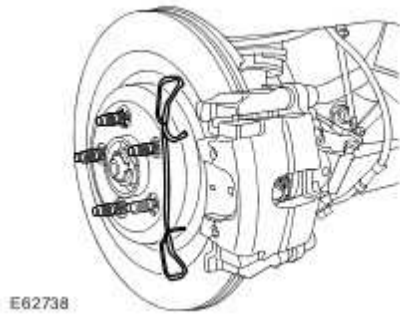
- ▶ Remove the 2 screws.



All vehicles

6 . Remove the LH anti-rattle spring.

▶ Release the 2 clips.



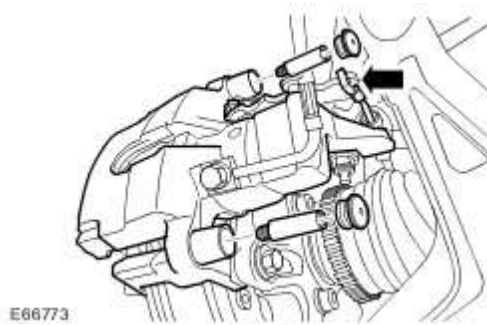
7 . Disconnect and release the parking brake cable from the caliper.

▶ Release the clip.

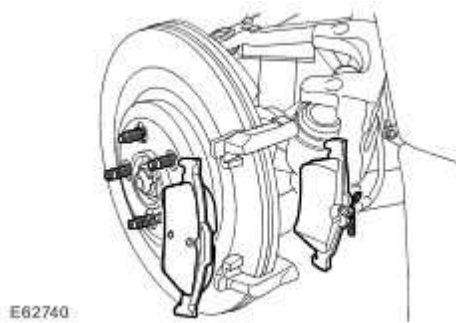
8 . Remove the LH brake caliper.

▶ Remove the 2 access plugs.

▶ Release the 2 brake caliper guide pins.



9 . Remove the brake pads.



10 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the brake caliper anchor plate.

- ▶ Remove and discard the 2 bolts.



Installation


All vehicles


1 . Install the brake caliper anchor plate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 103 Nm (76 lb.ft).


2 . Install the LH brake pads.

3 . Install the LH brake caliper.

 Tighten the guide pins to 28 Nm (21 lb.ft).

 Install the access plugs.

4 . Install the LH anti-rattle spring.

 Carefully secure the clips.


Vehicles with high performance brakes


5 . Install the logo badge.

 Tighten the screws to 5 Nm (3 lb.ft).


All vehicles

6 . Connect the brake hose to the brake caliper.

 Install new sealing washers.

 Tighten the union to 35 Nm (26 lb.ft).

7 . Connect the parking brake cable.

 Carefully secure the clips.

8 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

9 . Bleed the brake system.

For additional information, refer to Brake System Bleeding (70.25.03)

Brake Disc (70.10.11)

Removal



WARNING: Brake pads must be renewed in axle sets only. Failure to follow this instruction may result in braking efficiency being impaired.

1



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 . Remove the rear brake pads.

For additional information, refer to Brake Pads (70.40.03)

- 3 . Tie the brake caliper aside.

- 4 . Remove the brake caliper anchor plate.

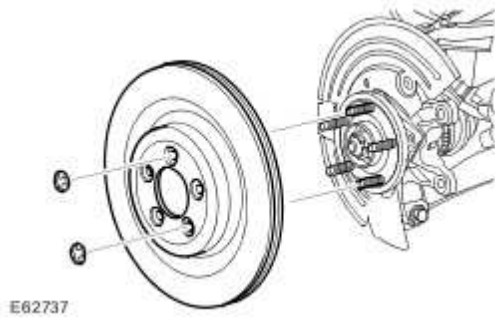
▶ Remove and discard the 2 bolts.




E62736

- 5 . Remove the brake disc.

- ▶ Remove the 2 clips.



Installation

- 1  **WARNING: Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.**

Install the brake disc.

- ▶ Clean the component mating faces.
- ▶ Secure the clips.

- 2 . Install the brake caliper anchor plate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 103 Nm (76 lb.ft).

- 3 . Install the brake pads.

For additional information, refer to Brake Pads (70.40.03)

206-05 : Parking brake and Actuation

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Parking brake actuator - bolts	20	15	-
Parking brake module - nuts	4	3	35
Parking brake switch- bolts	6	4	53

Parking Brake Cable Tension Release

Special Service Tools



Electric parking brake release tool 206-082. Only to be used for EMERGENCY brake release



Electric parking brake release tool link lead 206-082-01. Only to be used for EMERGENCY brake release



WARNING: Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.



CAUTION: Ensure the vehicle transmission is in park position before the cable tension is released.



CAUTION: The warranty of the electric parking brake release tool will be invalidated if the casing has been removed.

NOTE:

The tools shown must only be used in the event of an emergency.

1.



WARNING: Always use Jaguar approved diagnostic equipment to release the cable tension, when carrying out repair operations on the electric park brake which require cable tension release.

Connect the Jaguar approved diagnostic equipment to release the electric parking brake cable tension.

- Follow the on-screen instructions.

2.



WARNING: The procedure below should only be used in emergency situations, to release the electric park brake. All calibration of the parking brake system will be lost, and the parking brake will need to be re-calibrated to function correctly.

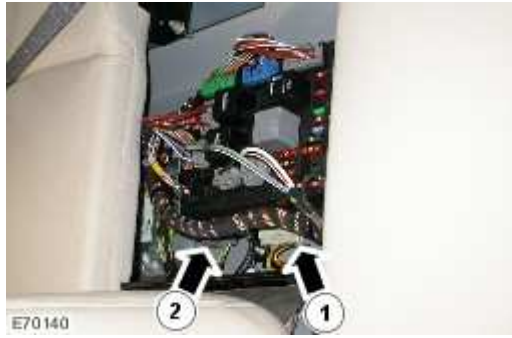
Release the auxiliary junction box access cover.

- Release from the clip.

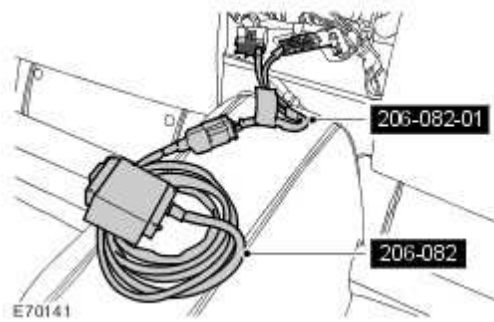


3. Disconnect the parking brake module.

- Disconnect the 2 electrical connectors in the sequence illustrated.

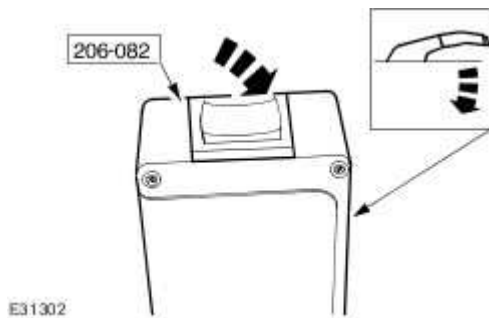


4. Connect the special tool.



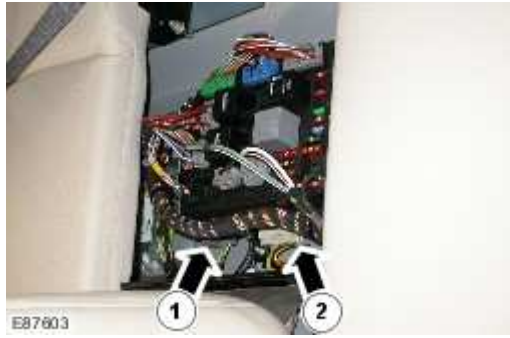
5. Release the parking brake cable tension.

- An audible 'click', signals complete parking brake cable tension release.



6. Remove the special tool.

- Reverse the removal sequence, connect and secure the electrical connectors.



7. Secure the auxiliary junction box access cover.

- Align the pegs and secure the clip.

8.



WARNING: Calibrate the electric park brake using Jaguar approved diagnostic equipment. If Jaguar approved diagnostic equipment is not available disconnect the battery for approximately 30 seconds , the vehicle will then prompt the driver to carry out the calibration procedure as per the vehicle hand book on re-connection.

Re-calibrate the electric park brake.

Parking Brake

Principle of Operation

For a detailed description of the Parking Brake operation, refer to the relevant Description and Operation section of the workshop manual.

Parking Brake

Parking Brake Calibration

The parking brake system must be calibrated whenever the battery has been disconnected or has been in a state of discharge, or repairs have been carried out to the rear service or parking brake system.

NOTE:

If new rear brake pads have been installed, pressure must be applied to the brake pedal a minimum of five times prior to calibration of the parking brake system.

To calibrate the parking brake system:

- 1 . Place gear selector lever in 'P' Park position.
- 2 . Release parking brake cable tension to service position.
Parking Brake Cable Tension Release
- 3 . Set the ignition status to 'ON'.
- 4 . Apply and hold the footbrake then pull up the parking brake switch.
- 5 . To release the parking brake, apply and hold the footbrake then release and press down the parking brake switch.

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Parking brake cable• Parking brake actuator• Brake caliper	<ul style="list-style-type: none">• Fuse(s)• Wiring harness/electrical connectors• Check for bent/corroded pins

- | | |
|--|---|
| <ul style="list-style-type: none">• Brake pads• Stabilizer bar drop link caps | <ul style="list-style-type: none">• Parking brake switch• Parking brake module |
|--|---|

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident check the system for any logged Diagnostic Trouble Codes (DTCs) and proceed to the DTC Index , alternatively, verify the customer concern and refer to the Symptom Chart.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B131700	Parking Brake Module voltage high	<ul style="list-style-type: none"> Battery voltage is high (above 18 volts) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B131800	Parking Brake module voltage low	<ul style="list-style-type: none"> Battery voltage is low (below 8 volts) (not logged on battery disconnect) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B134200	Parking Brake module is defective	<ul style="list-style-type: none"> Internal module fault 	Install new Parking Brake module, refer to the new module installation note at the top of the DTC Index
C109400	Primary parking brake apply switch circuit failure	<ul style="list-style-type: none"> Connector fault - bent, loose or corroded pin(s) Harness fault - high resistance, open circuit Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C140800	Primary parking brake release switch circuit voltage out of range	<ul style="list-style-type: none"> Connector fault - bent, loose or corroded pin(s) Harness fault - low resistance to ground Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C140900	Primary parking brake apply switch circuit voltage out of range	<ul style="list-style-type: none"> Connector fault - bent, loose or corroded pin(s) Harness fault - low resistance to ground Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

C176900	Primary parking brake apply switch circuit short to ground	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to ground • Switch fault 	Refer to the electrical circuit diagrams and test primary parking brake apply switch circuit for short to ground
C178200	Primary parking brake release switch circuit failure	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - high resistance, open circuit • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C178300	Primary parking brake release switch circuit short to ground	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to ground • Switch fault 	Refer to the electrical circuit diagrams and test primary parking brake release switch circuit for short to ground
C178400	Parking brake motor output circuit short to ground	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to ground • Actuator fault 	Refer to the electrical circuit diagrams and test parking brake motor output circuit for short to ground
C178500	Parking brake motor output circuit open circuit	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - open circuit • Actuator fault 	Refer to the electrical circuit diagrams and test parking brake motor output circuit for high resistance
C178600	Parking brake motor output circuit short to power	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to power • Actuator fault 	Refer to electrical circuit diagrams and test parking brake motor output circuit for short to power
C179900	Hall effect circuit failure	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Hall effect sensor power circuit fault • Hall effect sensor ground circuit fault • Hall effect sensor signal circuit fault • Mechanical fault with sensor/actuator 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C180100	Motor engage current reached	<ul style="list-style-type: none"> • Service brake not correctly adjusted following lining 	Refer to parking brake calibration procedure. Check

	before full apply travel distance	<ul style="list-style-type: none"> replacement • Parking brake not calibrated after lining replacement • Cables fouled, trapped or damaged • Cables incorrectly routed or fixed • Caliper malfunction • Actuator malfunction 	for mechanical failure of parking brake system
C180200	Motor engage current not reached or travelled too far upon apply	<ul style="list-style-type: none"> • Service brake not correctly adjusted following lining replacement • Parking brake not calibrated after lining replacement • Cables broken • Cables incorrectly routed or fixed • Caliper malfunction • Actuator malfunction 	Refer to parking brake calibration procedure. Check for mechanical failure of parking brake system
C180300	Motor disengage full travel distance not reached upon release	<ul style="list-style-type: none"> • Intermittent motor and circuit - open circuit • Actuator malfunction (excessive noise may be heard during release) 	Check for additional motor circuit DTCs and refer to DTC Index. Check for mechanical failure of parking brake system
C198900	Parking brake apply and release switches are active at the same time	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - apply and release circuits - short to each other • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0062	Apply switch active then release switch active	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0064	Erroneous apply switch active	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - primary or secondary apply circuit • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0066	Parking brake apply/release switch signal has too many	<ul style="list-style-type: none"> • High amount of apply/release applications in short space of time (switch 	Cycle ignition to re-enable switch functionality

	transitions/events	locked out due to abuse)	
C1D0711	Secondary parking brake apply switch circuit short to ground	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to ground • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0715	Secondary parking brake apply switch circuit failure	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - high resistance, open circuit • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D071C	Secondary parking brake apply switch circuit voltage out of range	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - low resistance to ground • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0811	Secondary parking brake release switch circuit short to ground	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - short to ground • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D0815	Secondary parking brake release switch circuit failure	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - high resistance, open circuit • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D081C	Secondary parking brake release switch circuit voltage out of range	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - low resistance to ground • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D1000	Field effect transistor circuit over current/over temperature	<ul style="list-style-type: none"> • Internal module fault 	Install a new parking brake module, refer to the new module installation note at the top of the DTC Index
C1D1162	Release switch active then apply switch active	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

C1D1164	Erroneous release switch active	<ul style="list-style-type: none"> • Connector fault - bent, loose or corroded pin(s) • Harness fault - primary or secondary apply circuit • Switch fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D1564	Brake switch status	<ul style="list-style-type: none"> • ECM off Bus (ECM off Bus DTC may also be logged) • Harness fault - brake switch circuit open circuit to parking brake module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D1614	High power battery feed circuit failure	<ul style="list-style-type: none"> • Fuse • Harness fault - high resistance, open circuit • Connector fault - bent, loose or corroded pin(s) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1D2092	Vehicle deceleration, performance or incorrect operation	Implausible vehicle speed message sent from ABS	Cycle the ignition. Check ABS for DTCs and refer to DTC Index
U000187	High speed CAN communication bus	All CAN messages are detected missing at Ignition ON	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U000188	High speed CAN communication Bus - bus off	<ul style="list-style-type: none"> • CAN Bus circuit fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost communication with ECM	<ul style="list-style-type: none"> • ECM off Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010100	Lost communication with the TCM	<ul style="list-style-type: none"> • TCM off Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010400	Lost communication with speed control front distance range	<ul style="list-style-type: none"> • Speed control module off Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer

	sensor		approved diagnostic system
U012100	Lost communication with anti-lock brake system	<ul style="list-style-type: none"> • ABS module off Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> • Instrument cluster off Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> • Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the Parking Brake module, refer to the new module installation note at the top of the DTC Index
U040100	Invalid data received from ECM	<ul style="list-style-type: none"> • Invalid message from the ECM 	No fault with parking brake system if this DTC is logged. Check ECM for DTCs and refer to the DTC Index. Electronic Engine Controls
U040200	Invalid data received from TCM	<ul style="list-style-type: none"> • Invalid message from the TCM 	No fault with parking brake system if this DTC is logged. Check TCM for DTCs and refer to the DTC Index. Diagnostic Strategy
U041500	Invalid data received from anti-lock control - stability assist module	<ul style="list-style-type: none"> • Invalid message from the anti-lock brake system 	No fault with parking brake system if this DTC is logged. Check anti-lock control - stability assist module for DTCs and refer to the DTC Index.
U042200	Invalid data received from Central Junction	<ul style="list-style-type: none"> • Invalid message from the CJB 	No fault with parking brake system if this DTC is logged. Check CJB for DTCs and refer

	Box (CJB)		to the DTC Index. Communications Network
U042300	Invalid data received from instrument cluster	<ul style="list-style-type: none"> Invalid message from the instrument cluster 	No fault with parking brake system if this DTC is logged. Check the instrument cluster for DTCs and refer to DTC Index. Instrument Cluster
U043364	Invalid data received from speed control front distance range sensor	<ul style="list-style-type: none"> Incorrect apply request from the speed control when the conditions were not correct 	No fault with parking brake system if this DTC is logged. Check the speed control module for DTCs and refer to DTC Index. Speed Control
U200168	Reduced system function	<ul style="list-style-type: none"> Invalid or missing message from ABS with ignition OFF and vehicle speed > 3Kph 	No fault with parking brake system if this DTC is logged. Check the anti-lock control - stability assist module for DTCs and refer to the DTC Index.
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component VIN mismatch between RJB and parking brake module, module installed from donor vehicle 	Install original module, check for parking brake related DTCs and refer to DTC Index. If DTC remains suspect parking brake module, refer to new module installation note at top of DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between parking brake module and RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Symptom Chart

Symptom	Possible Cause	Action
The parking brake will not engage or release	<ul style="list-style-type: none"> Cables fouled, trapped or damaged 	<ul style="list-style-type: none"> Check the rear and primary cables for

<p>(with no parking brake warning message)</p>	<ul style="list-style-type: none"> • Cables incorrectly routed or installed • Rear lining wear • Service brake incorrectly adjusted following lining change • Caliper malfunction 	<p>correct installation and damage.</p> <p>Parking Brake Switch - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.35.46)</p> <p>Parking Brake Cable LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</p> <p>Parking Brake Cable RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</p> <ul style="list-style-type: none"> • Inspect the rear brake linings for wear • Re-calibrate the parking brake, refer to the calibration procedure • Check the rear service brake for correct installation and operation
<p>The parking brake will not engage or release (with parking brake warning message)</p>	<ul style="list-style-type: none"> • Cables fouled, trapped or damaged • Cables incorrectly routed or installed • Rear lining wear • Actuator malfunction • Caliper malfunction 	<ul style="list-style-type: none"> • Check the rear and primary cables for correct installation and damage. <p>Parking Brake Release Actuator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.35.45)</p> <p>Parking Brake Switch - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.35.46)</p> <p>Parking Brake Cable LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</p> <p>Parking Brake Cable RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8</p> <ul style="list-style-type: none"> • Inspect the rear brake linings for wear • Re-calibrate the parking brake, refer to the calibration procedure • Check the rear service brake for correct installation and operation
<p>No communication with the parking brake</p>	<ul style="list-style-type: none"> • Fuse • Module off Bus 	<ul style="list-style-type: none"> • Check fuses • Ensure battery is fully

module	<ul style="list-style-type: none"> • CAN network error • Parking brake module fault 	<p>charged and in serviceable condition. Check battery voltage at parking brake module</p> <ul style="list-style-type: none"> • Check CAN network using manufacturer approved diagnostic system
'Parkbrake Fault' displayed on message center with associated warning lamps	<ul style="list-style-type: none"> • Parking brake system fault 	<ul style="list-style-type: none"> • Check the parking brake module for DTCs and refer to DTC Index
Brakes drag	<ul style="list-style-type: none"> • Parking brake not re-calibrated after battery has been disconnected or has been in a state of discharge, or repairs have been carried out to the rear service or parking brake system • Service brake system fault 	<ul style="list-style-type: none"> • Re-calibrate parking brake, refer to the calibration procedure • Check the service brake for correct operation

Parking Brake Cable LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal



WARNING: Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

1



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

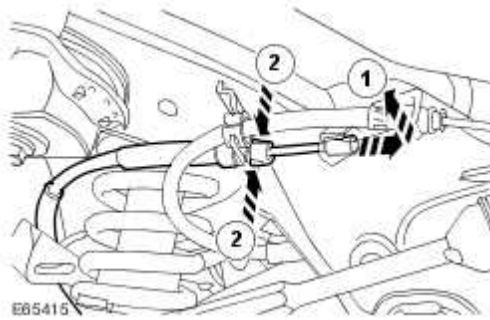
- 3 . Release the parking brake cable tension.

For additional information, refer to Parking Brake Cable Tension Release

- 4 . Disconnect the LH parking brake cable.



Release the clip.

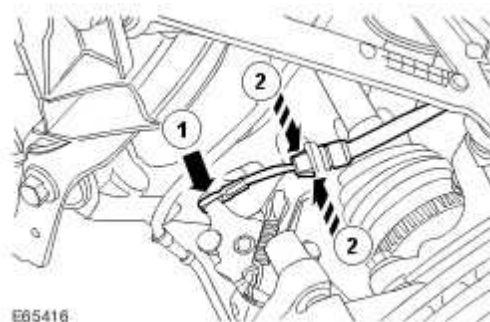


5 . NOTE:

Note the fitted position.

Disconnect and release the parking brake cable from the caliper.

- ▶ Release the 2 clips.
- ▶ Remove the LH parking brake cable.



Installation


1 . NOTE:

Align to the position noted on removal.

Install the parking brake cable.

- ▶ Carefully secure the clips.

2 . Connect the parking brake cable.

 Carefully secure the clips.

3 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Parking Brake Cable RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Removal



WARNING: Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the RH rear wheel and tire.

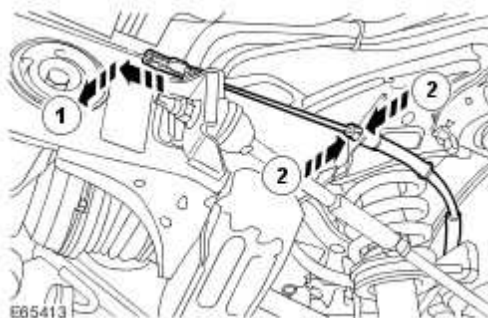
For additional information, refer to Wheel and Tire (74.20.05)

3 . Release the parking brake cable tension.

For additional information, refer to Parking Brake Cable Tension Release

4 . Disconnect the RH parking brake cable.

▶ Release the 2 clips.

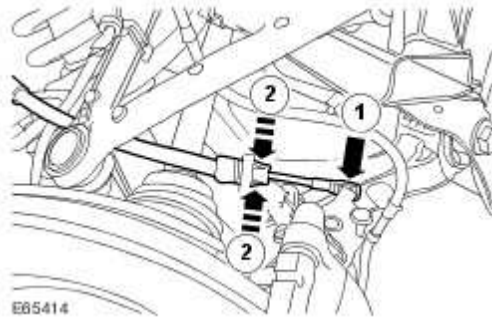


5 . NOTE:

Note the fitted position.

Disconnect and release the parking brake cable from the caliper.

- ▶ Release the 2 clips.
- ▶ Remove the LH parking brake cable.



Installation

1 . NOTE:

Align to the position noted on removal.

Install the parking brake cable.

- ▶ Carefully secure the clips.

2 . Connect the parking brake cable.

- ▶ Carefully secure the clips.

3 . Install the wheel and tire.

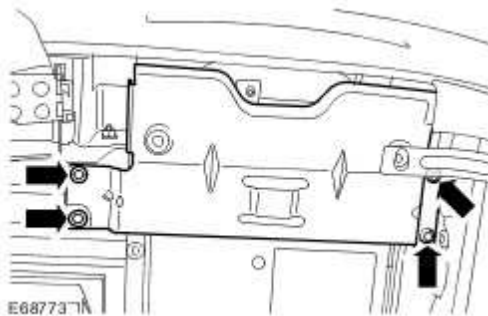
For additional information, refer to Wheel and Tire (74.20.05)

Parking Brake Module - Convertible (70.35.47)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the LH roll over protection unit.
For additional information, refer to Rollover Protection Unit
- 4 . Remove the rear seat RH backrest retaining bracket.

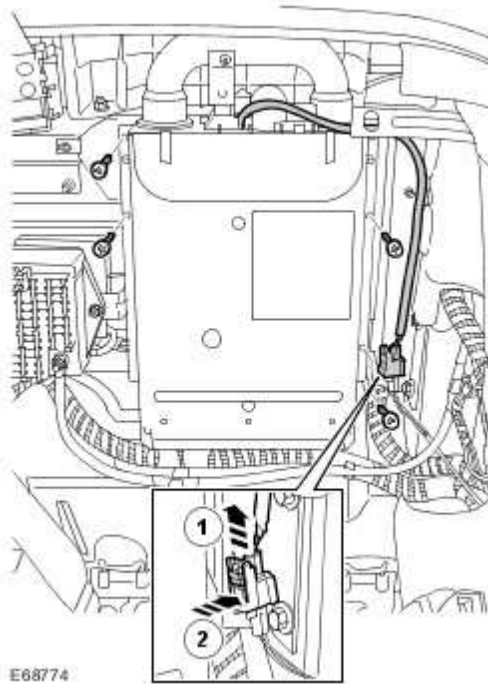
▶ Remove the 2 nuts and 2 bolts.



- 5 . Remove the RH roll over protection unit.

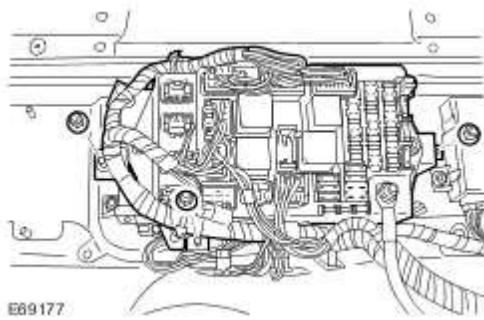
▶ Disconnect the electrical connector.

▶ Remove the 4 Torx bolts.



6 . Release the auxiliary junction box mounting bracket.

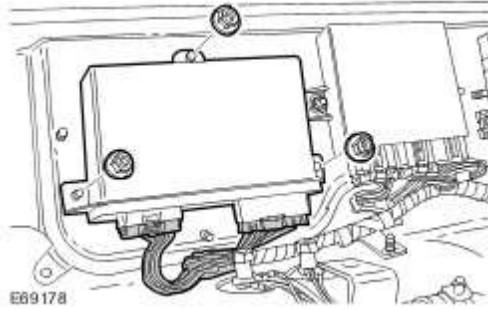
▶ Remove the 3 nuts.



7 . Remove the parking brake module.

▶ Remove the 3 nuts.

▶ Disconnect the 2 electrical connectors.



Installation

1 . Install the parking brake module.

- ▶ Tighten the nuts to 4 Nm (3 lb.ft).
- ▶ Connect the electrical connectors.

2 . Secure the auxiliary junction box mounting bracket.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

3 . Install the rear seat RH backrest retaining bracket.

- ▶ Tighten the nuts and bolts to 10 Nm (7 lb.ft).

4 . Install the RH roll over protection unit.

- ▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).
- ▶ Connect the electrical connector.

5 . Install the LH roll over protection unit.

For additional information, refer to Rollover Protection Unit

6 . Connect the battery ground cable and install the cover.
For additional information, refer to

7 . Connect WDS to the vehicle and configure a new module.

Parking Brake Module - 2-Door (70.35.47)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.

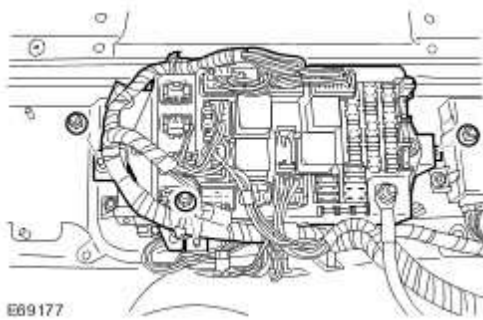
For additional information, refer to

- 2 . Remove the rear seat backrest.

For additional information, refer to Rear Seat Backrest (76.70.38)

- 3 . Release the auxiliary junction box mounting bracket.

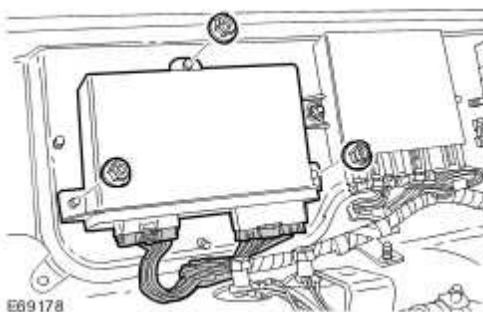
▶ Remove the 3 nuts.



- 4 . Remove the parking brake module.

▶ Remove the 3 nuts.

▶ Disconnect the 2 electrical connectors.



Installation

1 . Install the parking brake module.

▶ Tighten the nuts to 4 Nm (3 lb.ft).

▶ Connect the electrical connectors.

2 . Secure the auxiliary junction box mounting bracket.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

3 . Install the rear seat backrest.

For additional information, refer to Rear Seat Backrest (76.70.38)

4 . Connect the battery ground cable and install the cover.

For additional information, refer to

Parking Brake Release Actuator - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.35.45)

Removal



WARNING: Failure to release the tension and calibrate the electric parking brake during rear parking brake related service procedures, could cause the parking brake to function incorrectly or become inoperative.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the exhaust system.

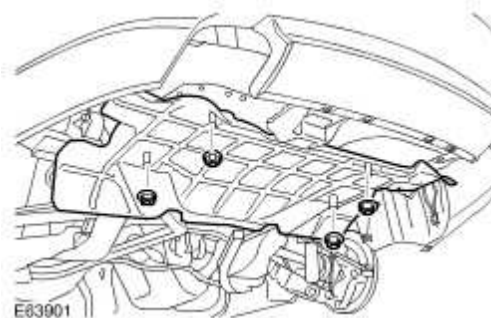
For additional information, refer to Exhaust System

3 . Release the parking brake cable tension.

For additional information, refer to Parking Brake Cable Tension Release

4 . Remove the exhaust rear heat shield .

▶ Remove the 4 nuts.

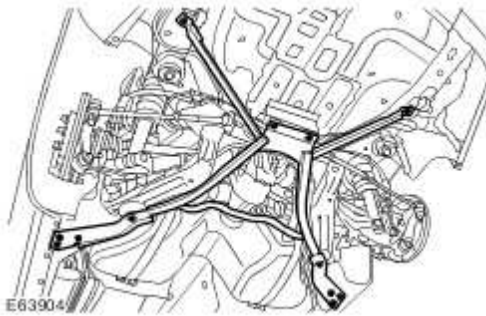


5 . With assistance: Remove the body K-frame.

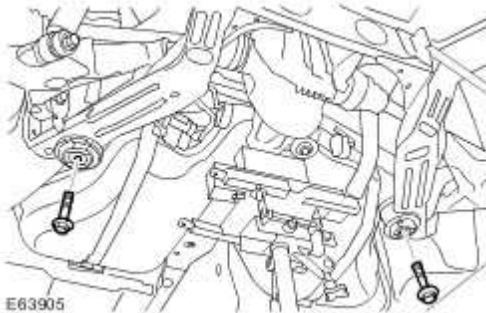
▶ Using a jack, support the differential.

▶ Remove the 8 bolts.

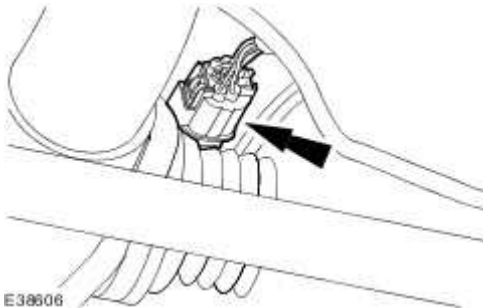
▶ Remove the 4 Torx bolts.



6 . Install the 2 subframe mounting bolts and remove the jack.



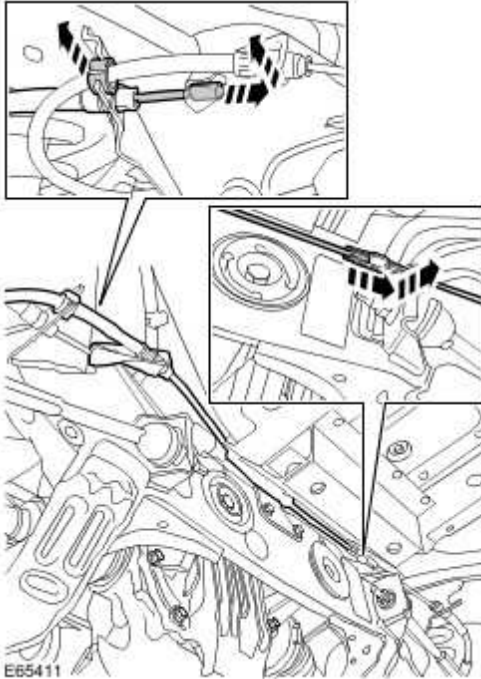
7 . Disconnect the electrical connector.



8 . Release the LH and RH cables.

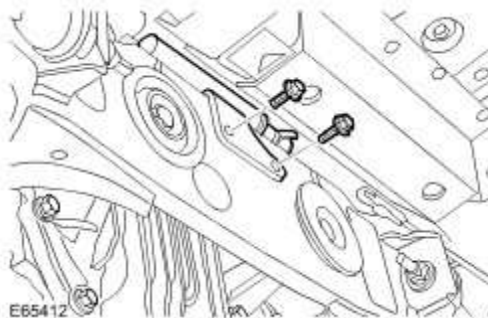
▶ Release the clip.

9 . Release the cable securing clip.



10 . Release the parking brake actuator.

▶ Remove the 2 bolts.

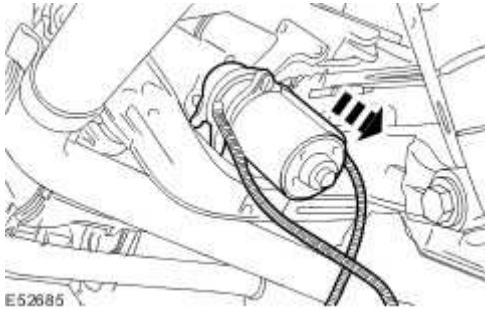


11 . **NOTE:**

Note the fitted position.

Remove the parking brake actuator and cable assembly.

▶ Remove the 2 bolts.



Installation

1 . NOTE:

Align to the position noted on removal.

Install the parking brake actuator and cable assembly.

▶ Tighten the bolts to 20 Nm (15 lb.ft).

2 . Connect the parking brake cable.

▶ Secure the clips.

3 . Connect and secure the electrical connector.

4 . Using a transmission jack, support the differential.

▶ Remove the 2 bolts.

5 . With assistance, install the K-frame.

- ▶ Tighten the M10 bolts to 40 Nm (30 lb.ft).
- ▶ Tighten the M12 bolts to 133 Nm (98 lb.ft).
- ▶ Tighten the sub frame bolts to 60 Nm (44 lb.ft), then a further 240 degrees.

6 . Remove the transmission jack.

7 . Install the heat shield.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

8 . Install the exhaust system.

For additional information, refer to Exhaust System

9 . Calibrate the parking brake actuator.

For additional information, refer to Parking Brake Cable Tension Release

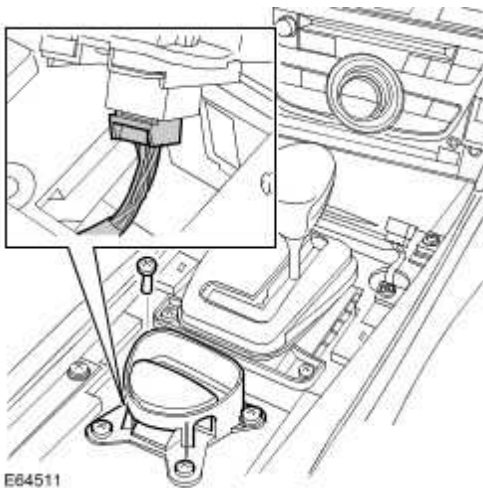
Parking Brake Switch - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.35.46)

Removal

- 1 . Remove the floor console veneer trim panel.
For additional information, refer to Floor Console Finish Panel (76.47.26)

- 2 . Remove the parking brake switch.

- ▶ Remove the 4 Torx bolts.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the parking brake switch.

- ▶ Connect the electrical connector.
- ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).

- 2 . Install the floor console veneer trim panel.
For additional information, refer to Floor Console Finish Panel (76.47.26)

206-06 : Hydraulic brake actuation

Specifications

Specifications

General

Item	Specification
Brake master cylinder diameter	26.9 mm

Lubricants, Fluids, Sealers and Adhesives

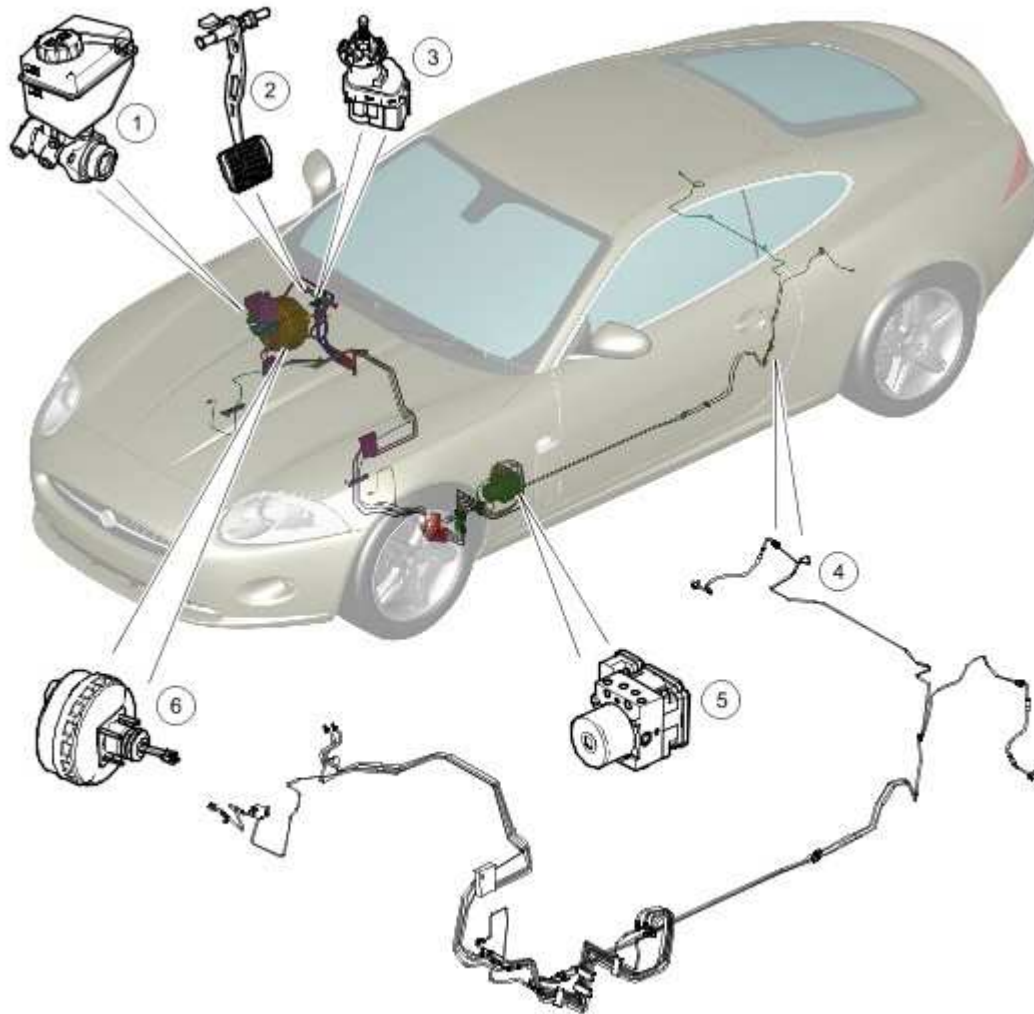
	Specifications
Brake fluid	Shell ESL (Dot 4)

Torque Specifications

Item	Nm	lb-ft	lb-in
Bleed nipple - front brake caliper	8	6	70
Bleed nipple - front brake caliper (Supercharged models)	14	10	-
Bleed nipple - rear brake caliper	14	10	-
Brake master cylinder to brake booster - nuts	25	18	-
Brake tube to components - union nut	17	13	-
Master cylinder reservoir to master cylinder	6	4	53
Master cylinder reservoir to master cylinder (Supercharged models)	4	3	35
Pedal bracket	25	18	-

Hydraulic Brake Actuation

COMPONENT LOCATION



E64682

Item	Part Number	Description
1		Brake master cylinder and fluid reservoir
2		Brake pedal
3		Stoplamp switch
4		Brake pipes

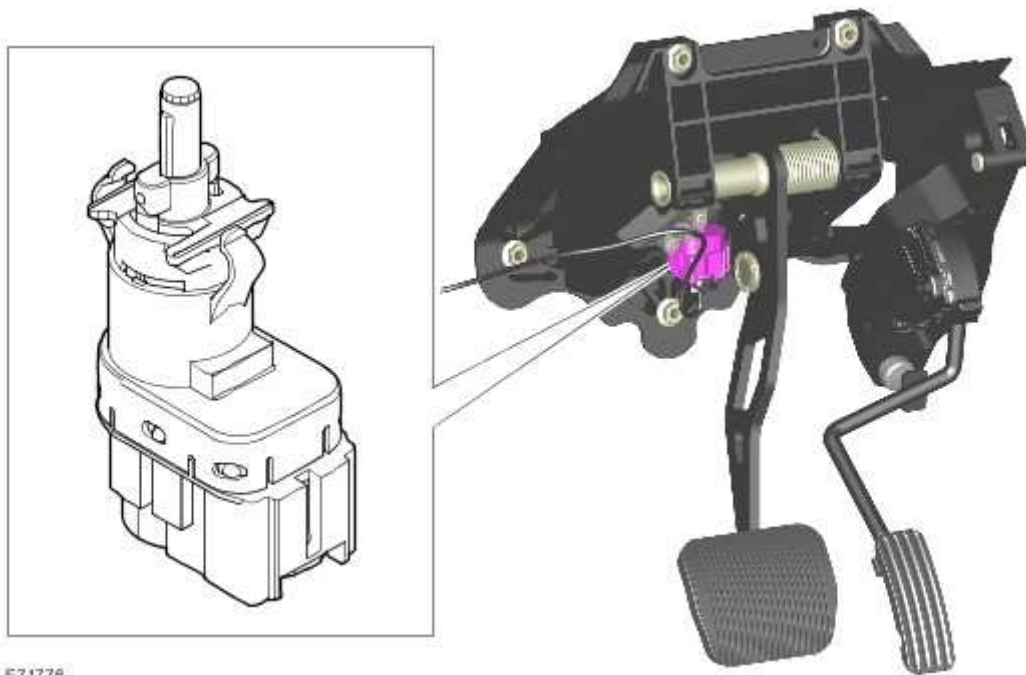
5		Anti-lock Brake System (ABS) module
6		Brake booster

INTRODUCTION

The hydraulic brake system is a diagonally split dual line system, and consists of the brake pedal, brake master cylinder and hydraulic pipes and hoses. The system also features a non-active brake booster. For additional information, refer to Brake Booster (206-07 Power Brake Actuation)

Brake pipes distribute pressure from the master cylinder to the 4 corners of the vehicle via the ABS module. Braided steel hoses are used to connect the brake pipes to the front and rear calipers.

BRAKE PEDAL



E71776

The brake pedal is mounted in a bracket attached to the rear side of the engine bulkhead. The bracket also contains the accelerator pedal. A clevis pin connects the brake pedal to the push rod of the brake booster.

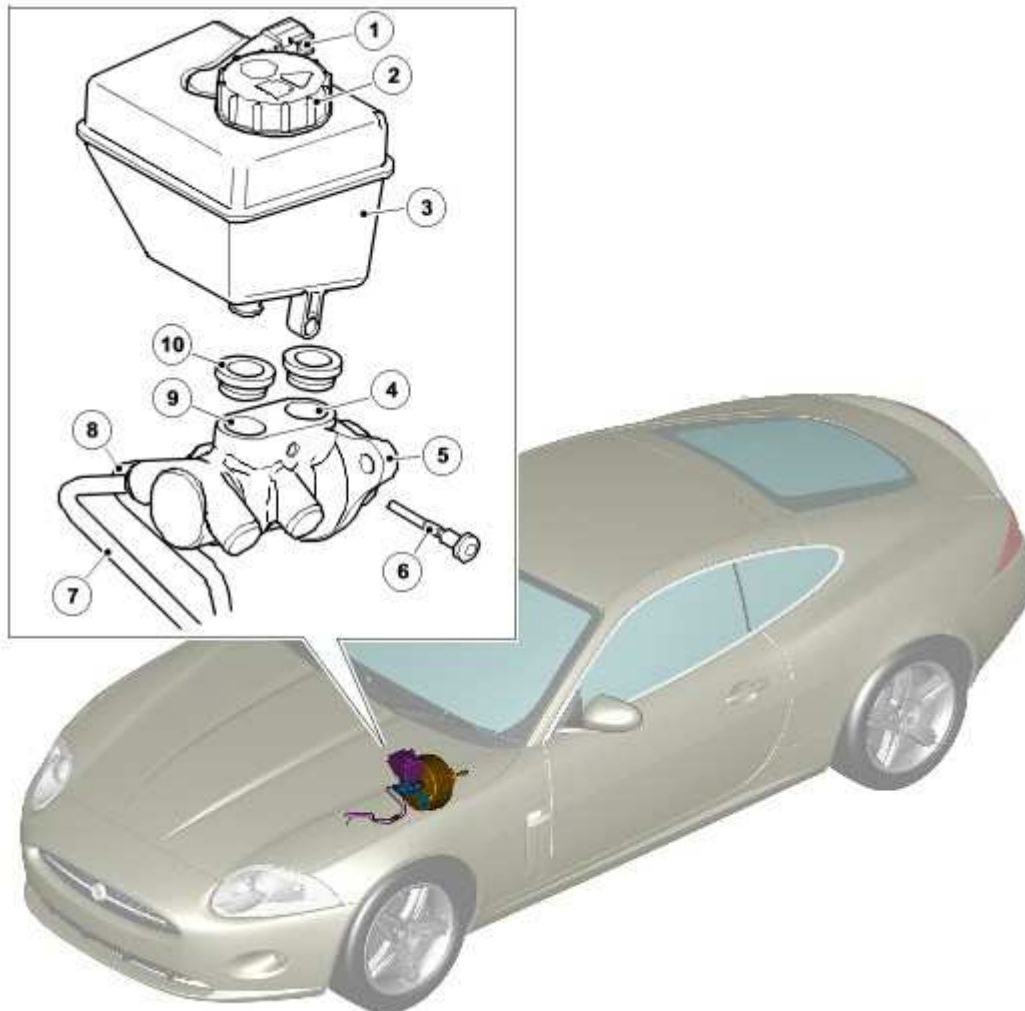
The stoplamp switch is mounted in the brake pedal bracket and is operated by the brake pedal. The stoplamp switch is also used by the speed control system and the ABS. For additional information, refer to Speed Control (310-03 Speed Control)

For additional information, refer to Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist)

BRAKE MASTER CYLINDER AND FLUID RESERVOIR

NOTE:

Left-Hand Drive (LHD) shown, Right-Hand Drive (RHD) similar



E73934

Item	Part Number	Description
1		Brake fluid level switch electrical connector
2		Brake fluid reservoir cap
3		Brake fluid reservoir
4		Primary circuit inlet port
5		Brake master cylinder

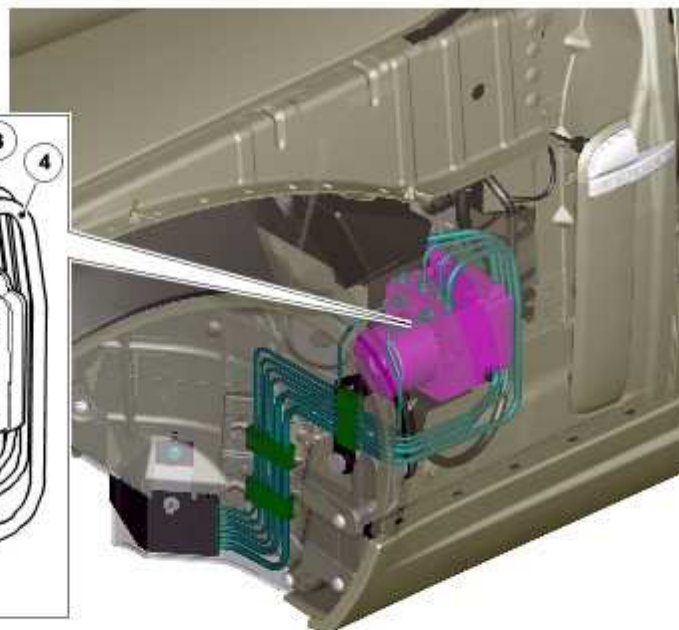
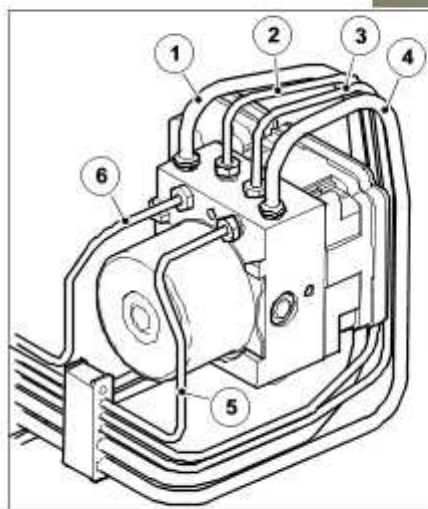
6		Torx bolt
7		Secondary circuit outlet port
8		Primary circuit outlet port
9		Secondary circuit inlet port
10		Reservoir to master cylinder seal (2 off)

The brake master cylinder is attached to the front of the brake booster, on the drivers side of the engine compartment. The brake master cylinder consists of a cylinder housing containing 2 pistons in tandem. The rear piston produces pressure for the primary braking circuit and the front piston produces pressure for the secondary circuit. A reservoir is mounted on top of the master cylinder to provide a supply of brake fluid for the primary and secondary circuits. The reservoir also provides a location for the brake fluid level switch.

BRAKE FLUID LEVEL SWITCH

The brake fluid level switch is located in the fluid reservoir and is hardwired to the ABS module. When the level of fluid in the reservoir reaches a predetermined low level, the switch contacts close and provide a signal feed back to the ABS module. The ABS module then broadcasts a message on the high speed Controller Area Network (CAN) bus to the instrument cluster. On receipt of the message, the brake fluid red warning indicator will illuminate and 'BRAKE FLUID LOW' will be displayed in the message center.

ANTI-LOCK BRAKING SYSTEM MODULE



Item	Part Number	Description
1		Secondary circuit inlet port
2		Left Hand (LH) front brake
3		Right Hand (RH) front brake
4		Primary circuit inlet port
5		LH rear brake
6		RH rear brake

The ABS module is located in the LH front wheel arch and incorporates the Hydraulic Control Unit (HCU). The HCU is a 4 channel unit that modulates the supply of hydraulic pressure to the brakes under control of the ABS module.

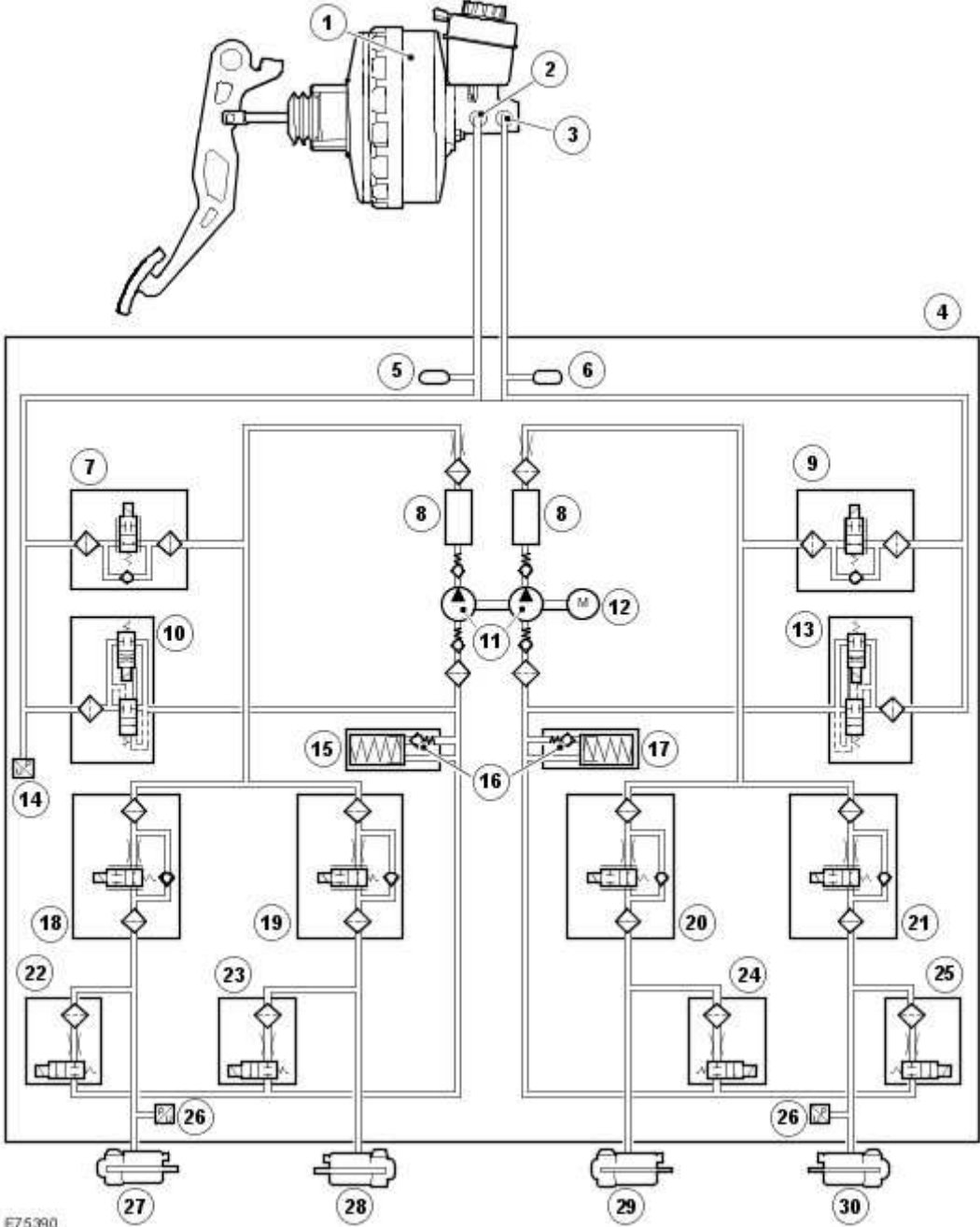
The primary and secondary outlets of the master cylinder are connected to the primary and secondary circuits within the HCU. The primary circuit in the HCU has separate outlet ports to the RH front and LH rear brakes. The secondary circuit in the HCU has separate outlet ports to the LH front and RH rear brakes.



CAUTION: The ABS module and the Hydraulic Control Unit (HCU) are a single unit and must not be separated.

CONTROL DIAGRAM

Hydraulic Control Unit



E75390

Item	Part Number	Description
1		Brake booster
2		Primary circuit
3		Secondary circuit

4		HCU
5		Pulsation damper
6		Pulsation damper
7		Separation valve
8		Damping chambers
9		Separation valve
10		Shuttle valve
11		Hydraulic pumps
12		Motor
13		Shuttle valve
14		Pressure sensor - all vehicles
15		Low pressure accumulator
16		Check valve
17		Low pressure accumulator
18		Inlet valve
19		Inlet valve
20		Inlet valve
21		Inlet valve
22		Outlet valve
23		Outlet valve
24		Outlet valve
25		Outlet valve
26		Pressure sensors - vehicles fitted with adaptive speed control only

27		Right front brake
28		Left rear brake
29		Right rear brake
30		Left front brake

PRINCIPLES OF OPERATION

When the brake pedal is pressed, the front push rod in the brake booster pushes the master cylinder primary piston along the bore of the housing. This produces pressure in the primary pressure chamber which, in conjunction with the primary spring, overcomes the secondary spring and simultaneously moves the secondary piston along the bore. The initial movement of the pistons away from the piston stops closes the primary and secondary center valves in the master cylinder. Further movement of the pistons then pressurises the fluid in the primary and secondary chambers and thus the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the pistons and can flow unrestricted through the inlet ports between the chambers and the reservoir.

Pressurised fluid enters the HCU, which is mounted on the front of the ABS module. The HCU modulates the supply of pressurised fluid to the brakes under control of the ABS module. For additional information, refer to Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist)

Hydraulic Brake Actuation

For additional information, refer to [206-00](#).

Brake Master Cylinder - LHD RWD (70.30.08)

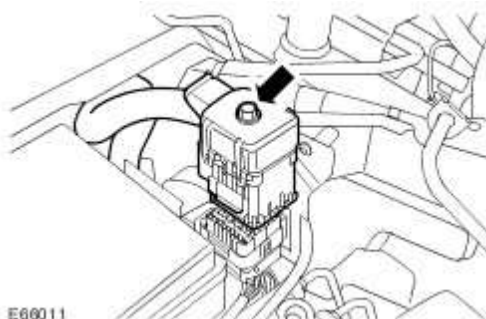
Removal



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

- 1 . Remove the brake fluid reservoir.
For additional information, refer to Brake Fluid Reservoir (70.30.16)
- 2 . Release and disconnect the electrical connector.

▶ Fully loosen the bolt.



3 . **NOTE:**

Some fluid spillage is inevitable during this operation.

Disconnect the brake master cylinder lines.

4

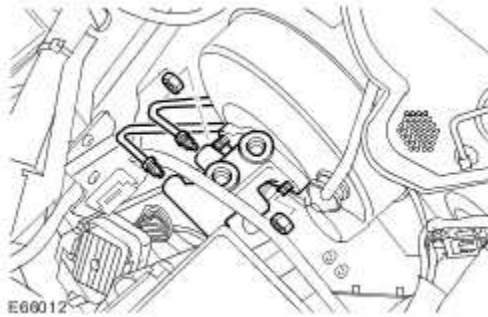


CAUTION: Before disconnecting or removing the components, ensure the area

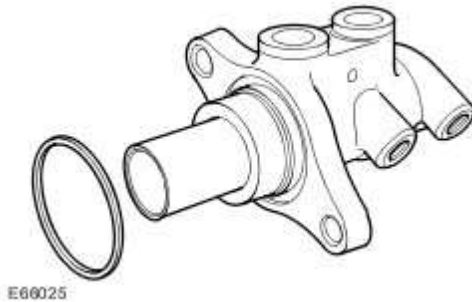
around the joint faces and connections are clean. Plug open connections to prevent contamination.

Remove the brake master cylinder.

▶ Remove the 2 nuts.



5 . Remove and discard the O-ring seal.




Installation

1 . Install a new O-ring seal.


2 . Install the brake master cylinder.

▶ Tighten the nuts to 25 Nm (18 lb.ft).

3 . Connect the brake master cylinder lines.

 Tighten the brake line unions to 17 Nm (13 lb.ft).

4 . Connect and secure the electrical connector.

 Tighten the bolt.

5 . Install the brake fluid reservoir.

For additional information, refer to Brake Fluid Reservoir (70.30.16)

Brake Master Cylinder - RHD RWD (70.30.08)

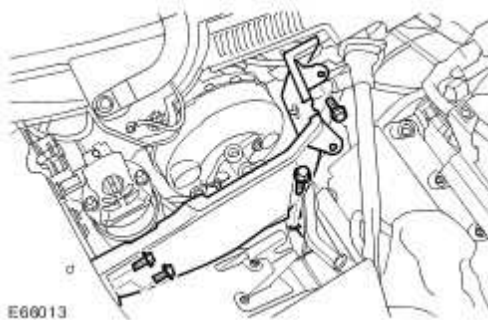
Removal



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

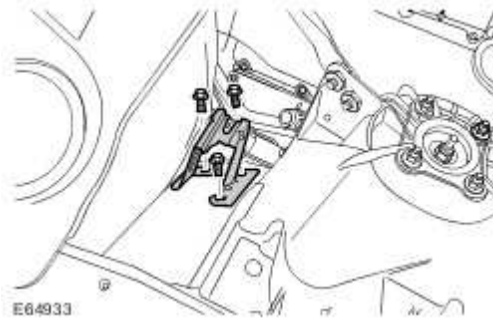
- 1 . Remove the coolant expansion tank.
For additional information, refer to Coolant Expansion Tank (26.15.01)
- 2 . Remove the brake fluid reservoir.
For additional information, refer to Brake Fluid Reservoir (70.30.16)
- 3 . Release the plenum box sidewall.

▶ Remove the 4 bolts.



- 4 . Remove the coolant expansion tank mounting bracket.

▶ Remove the 3 nuts.



5 . **NOTE:**

Some fluid spillage is inevitable during this operation.

Disconnect the brake master cylinder lines.

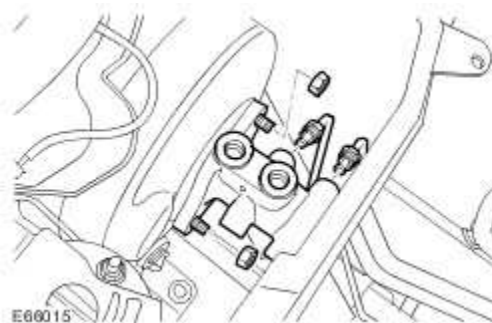
6



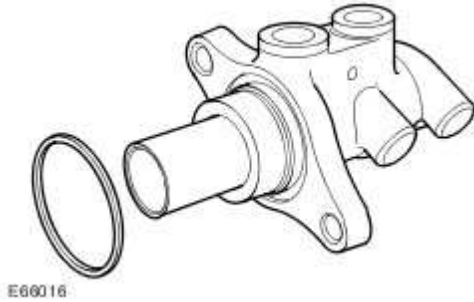
CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Remove the brake master cylinder.

▶ Remove the 2 nuts.



7 . Remove and discard the O-ring seal.



Installation

- 1 . Install a new O-ring seal.
- 2 . Install the brake master cylinder.
 - ▶ Tighten the nuts to 25 Nm (18 lb.ft).
- 3 . Connect the brake master cylinder lines.
 - ▶ Tighten the brake line unions to 17 Nm (13 lb.ft).
- 4 . Install the plenum chamber panel.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- 5 . Install the coolant expansion tank mounting bracket.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
- 6 . Remove the brake fluid reservoir.
For additional information, refer to Brake Fluid Reservoir (70.30.16)
- 7 . Install the coolant expansion tank.

For additional information, refer to Coolant Expansion Tank (26.15.01)

Brake Fluid Reservoir (70.30.16)

Removal



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

1 . NOTE:

LH illustration shown, RH is similar.

Remove the air intake cover.

▶ Remove the 4 clips.



2 . Siphon the fluid from the brake master cylinder.

▶ Position an absorbent cloth to collect fluid spillage.

3 . Disconnect the low brake fluid warning indicator switch electrical connector.

4 .



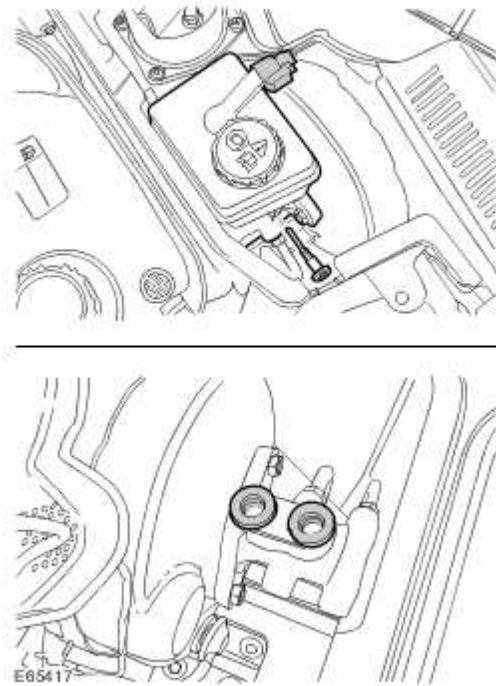
CAUTION: Always plug any open connections to prevent contamination.

NOTE:

Some fluid spillage is inevitable during this operation.

Remove the brake fluid reservoir.

- ▶ Remove the Torx bolt.
- ▶ Remove and discard 2 brake fluid reservoir seals.




Installation

- 1 . Clean the components.
- 2 . Install the brake fluid reservoir.
 - ▶ Install new brake fluid reservoir seals.
 - ▶ Tighten the Torx bolt to 6 Nm (4 lb.ft).
- 3 . Connect the low brake fluid warning indicator switch electrical connector.

4 . Bleed the brake system.

For additional information, refer to Brake System Bleeding (70.25.03)

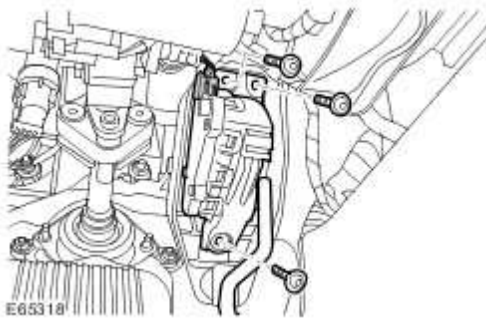
5 . Install the air intake cover.

 Carefully secure the clips.

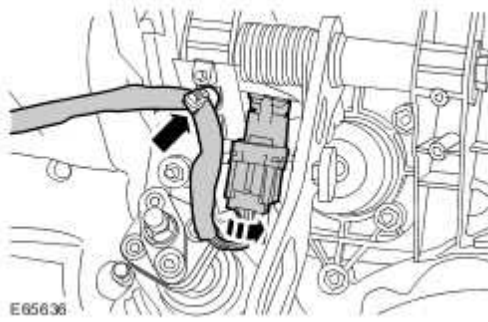
Brake Pedal and Bracket (70.35.03)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)
- 3 . Remove the windshield wiper arms.
For additional information, refer to Wiper Pivot Arm (84.15.03)
- 4 . Remove the throttle pedal assembly.
 - ▶ Remove the 3 Torx screws.
 - ▶ Disconnect the electrical connector.



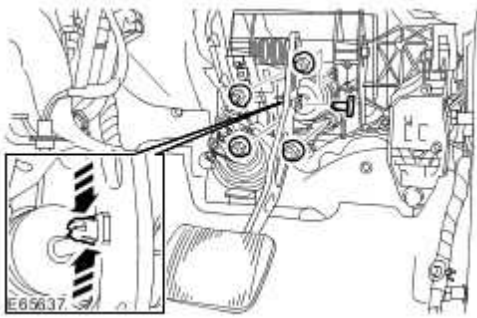
- 5 . Release the brake switch.
 - ▶ Rotate clockwise approximately 30 degrees.



6 . Release the brake booster.

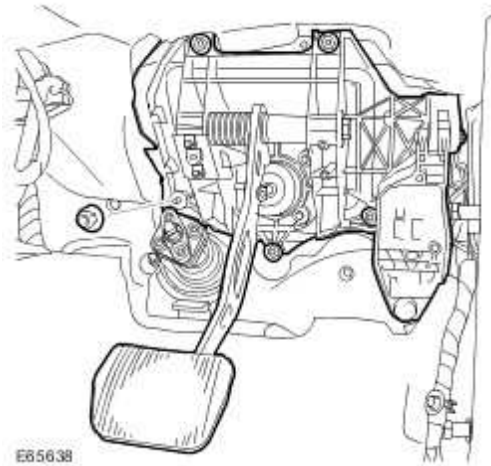
▶ Remove the brake pedal clevis pin.

▶ Remove the 4 nuts.



7 . Remove the nuts from the brake pedal bracket.

▶ Remove the 5 nuts.



8 . NOTE:

Working from the engine bay.

Remove the air intake cover.

▶ Remove the 4 clips.



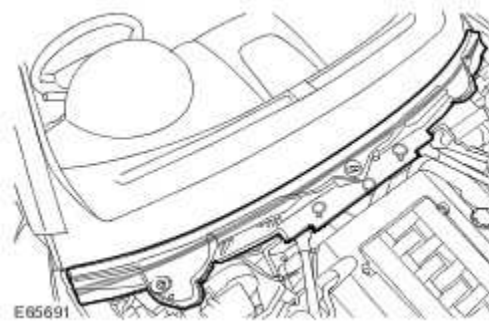
9 . Remove the brake master cylinder cover.

▶ Remove the 3 clips.



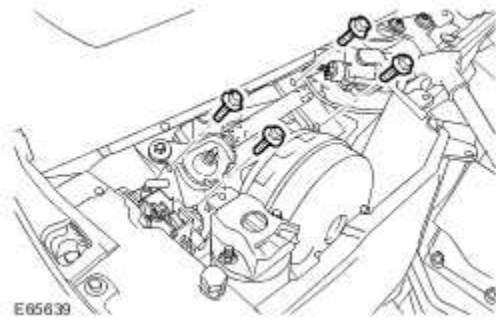
10 . Remove the plenum chamber panel.

- ▶ Release the retaining clip.
- ▶ Release the 3 clips.
- ▶ Disconnect the washer jet hose.



11 . Remove the brake pedal bracket.

- ▶ Remove sealant for access to the bulkhead screw heads.
- ▶ Remove the 4 screws.
- ▶ Release the electrical harness clip.



Installation

- 1 . Install the brake pedal bracket.
 - ▶ Align to the studs and lightly tighten the nuts.
 - ▶ Install and tighten the bulkhead screws.
 - ▶ Apply sealant to the bulkhead screw heads.
 - ▶ Secure the electrical harness with the clip.

- 2 . Tighten the brake pedal bracket nuts to 25 Nm (18 lb.ft).

- 3 . Install the plenum chamber panel.
 - ▶ Connect the washer jet hose.
 - ▶ Carefully secure the clips.

- 4 . Install the brake master cylinder cover.
 - ▶ Carefully secure the clips.

- 5 . Install the air intake cover.
 - ▶ Carefully secure the clips.

6 . Secure the brake booster.

▶ Tighten the nuts to 25 Nm (18 lb.ft).

▶ Install the brake pedal clevis pin.

7 . Install the brake switch.

8 . Install the throttle pedal assembly.

▶ Connect the electrical connector.

▶ Install the Torx screws.

9 . Install the windshield wiper arms.

For additional information, refer to Wiper Pivot Arm (84.15.03)

10 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

11 . Connect the battery ground cable and install the cover.

For additional information, refer to

206-07 : Power brake actuation

Specifications

Specifications

General

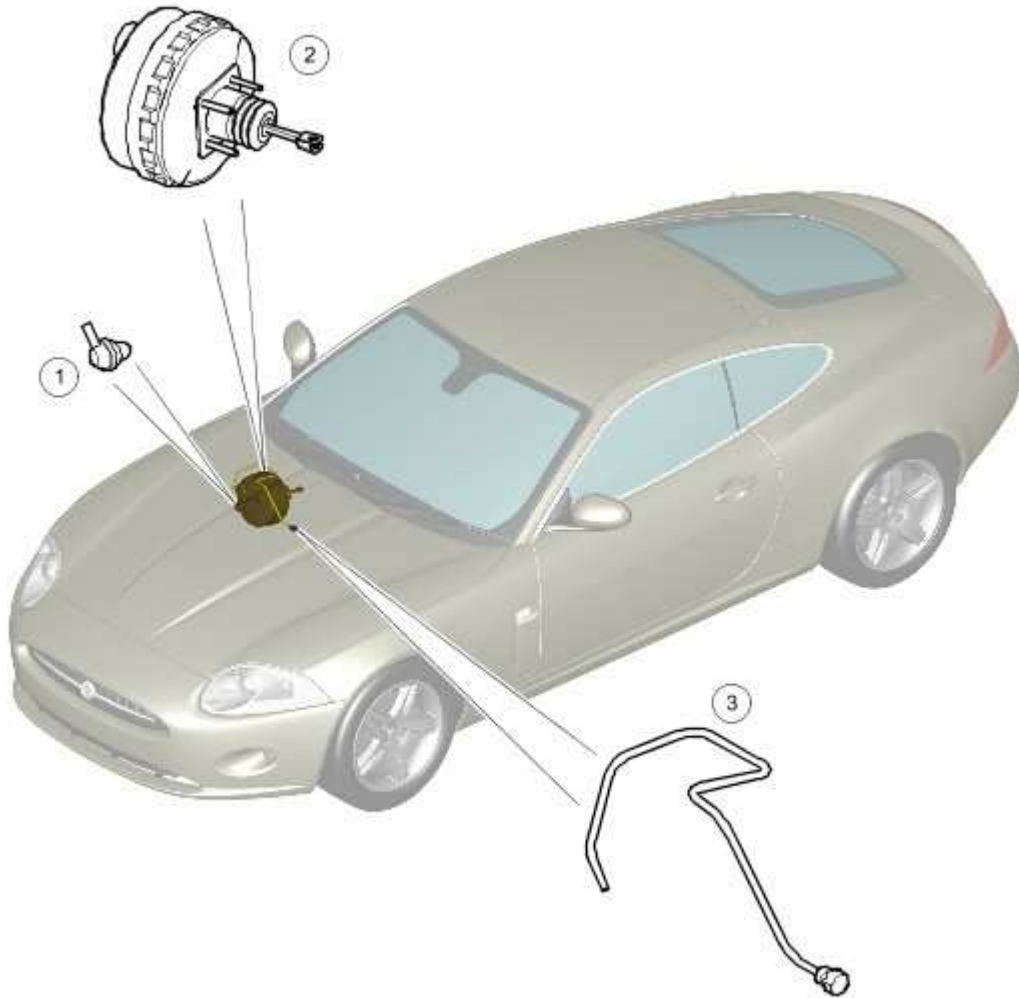
Item	Specification
Brake booster - boost ratio	5.8:1
Brake booster - boost ratio (Supercharged models)	6.2:1

Torque Specifications

Item	Nm	lb-ft	lb-in
Brake booster to bulk head/pedal bracket - nuts	25	18	-

Brake Booster

COMPONENT LOCATION



E64818

Item	Part Number	Description
1		Check valve
2		Brake booster
3		Vacuum pipe

INTRODUCTION

Power assistance for the braking system is provided by a vacuum operated non-active brake booster. The unit gives a boost ratio of 6.2:1 and is secured to the drivers side of the engine compartment bulkhead by 4 studs/nuts.

The input push rod within the brake booster is connected to the brake pedal. The output rod locates in the primary piston of the brake master cylinder. For additional information, refer to Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation)

VACUUM PIPE

A 2 piece plastic vacuum pipe connects the brake booster to the inlet manifold to provide the necessary vacuum inside the booster. The connection into the brake booster also contains a check valve to maintain the vacuum and prevent fuel vapour from entering the brake booster.

Power Brake System

For additional information, refer to <<206-00>>.

Brake Booster - LHD RWD (70.50.17)

Removal

- 1 . Remove the brake master cylinder.

For additional information, refer to Brake Master Cylinder - LHD RWD (70.30.08)

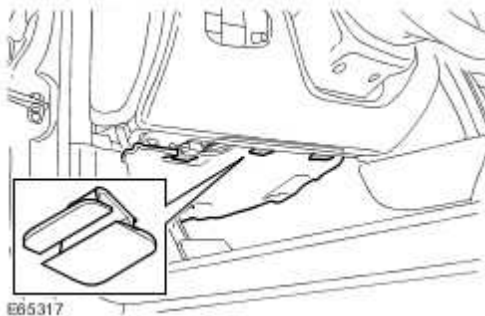
2



CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

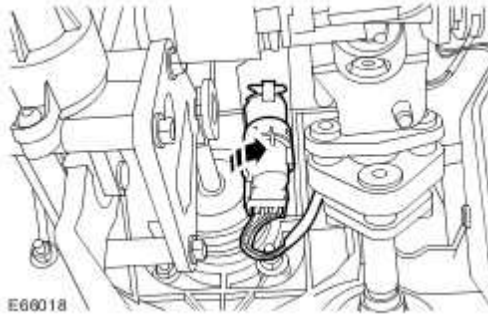
Remove the driver's side footwell trim panel.

▶ Carefully release the 3 clips.

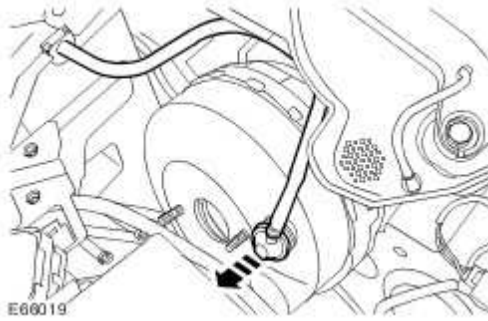


- 3 . Release the brake switch.

▶ Rotate clockwise approximately 30 degrees.



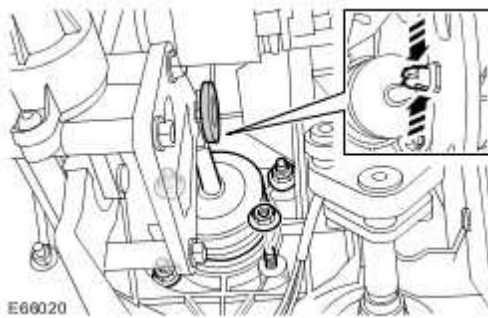
4 . Release the vacuum pipe.



5 . Remove the brake booster.

▶ Remove the brake pedal clevis pin.

▶ Remove the 4 nuts.




6 . Remove and discard the gasket.

Installation

1 . Install new gaskets.

2 . Install the brake booster.


 Tighten the nuts to 25 Nm (18 lb.ft).

 Install the brake pedal clevis pin.

3 . Connect the vacuum hose.

4 . Install the brake switch.

5 . Install the driver's side footwell trim panel.

 Carefully align and secure the clips.

6 . Install the brake master cylinder.

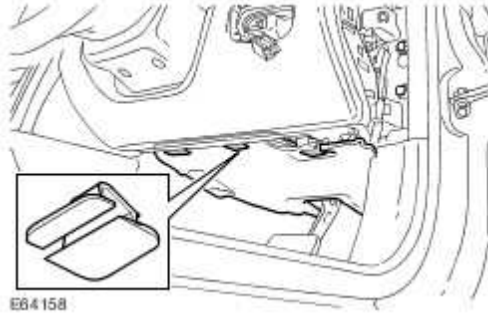
For additional information, refer to Brake Master Cylinder - LHD RWD (70.30.08)

Brake Booster - RHD RWD (70.50.17)

Removal

- 1 . Remove the brake master cylinder.

For additional information, refer to Brake Master Cylinder - RHD RWD (70.30.08)



- 2  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

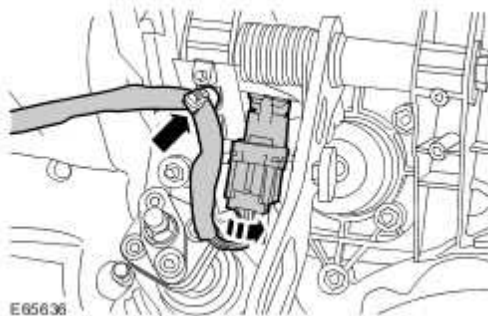
Remove the driver's side footwell trim panel.

- ▶ Carefully release the 3 clips.

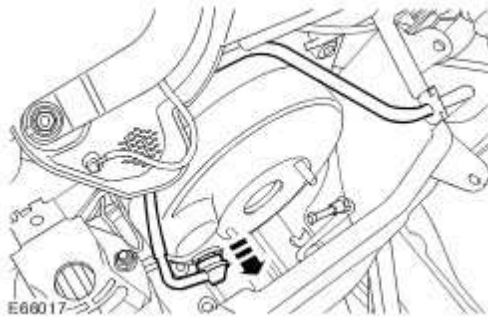
- 3 . Release the brake switch.

- ▶ Rotate clockwise approximately 30 degrees.

- ▶ Carefully release the clip.



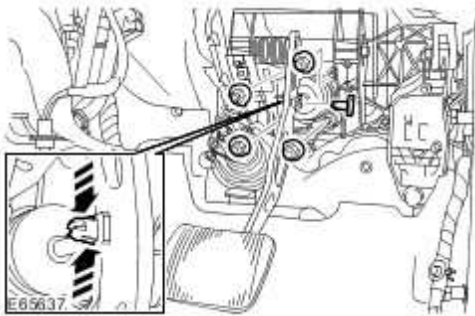
4 . Release the vacuum pipe.



5 . Remove the brake booster.

▶ Remove the brake pedal clevis pin.

▶ Remove the 4 nuts.



6 . Remove and discard the gasket.

Installation

1 . Install new gaskets.

2 . Install the brake booster.


▶ Tighten the nuts to 25 Nm (18 lb.ft).

▶ Install the brake pedal clevis pin.

3 . Connect the vacuum hose.

4 . Install the brake switch.

5 . Install the driver's side footwell trim panel.

 Carefully align and secure the clips.

6 . Install the brake master cylinder.

For additional information, refer to Brake Master Cylinder - RHD RWD (70.30.08)

206-09 : Anti-lock control – stability assist

Specifications

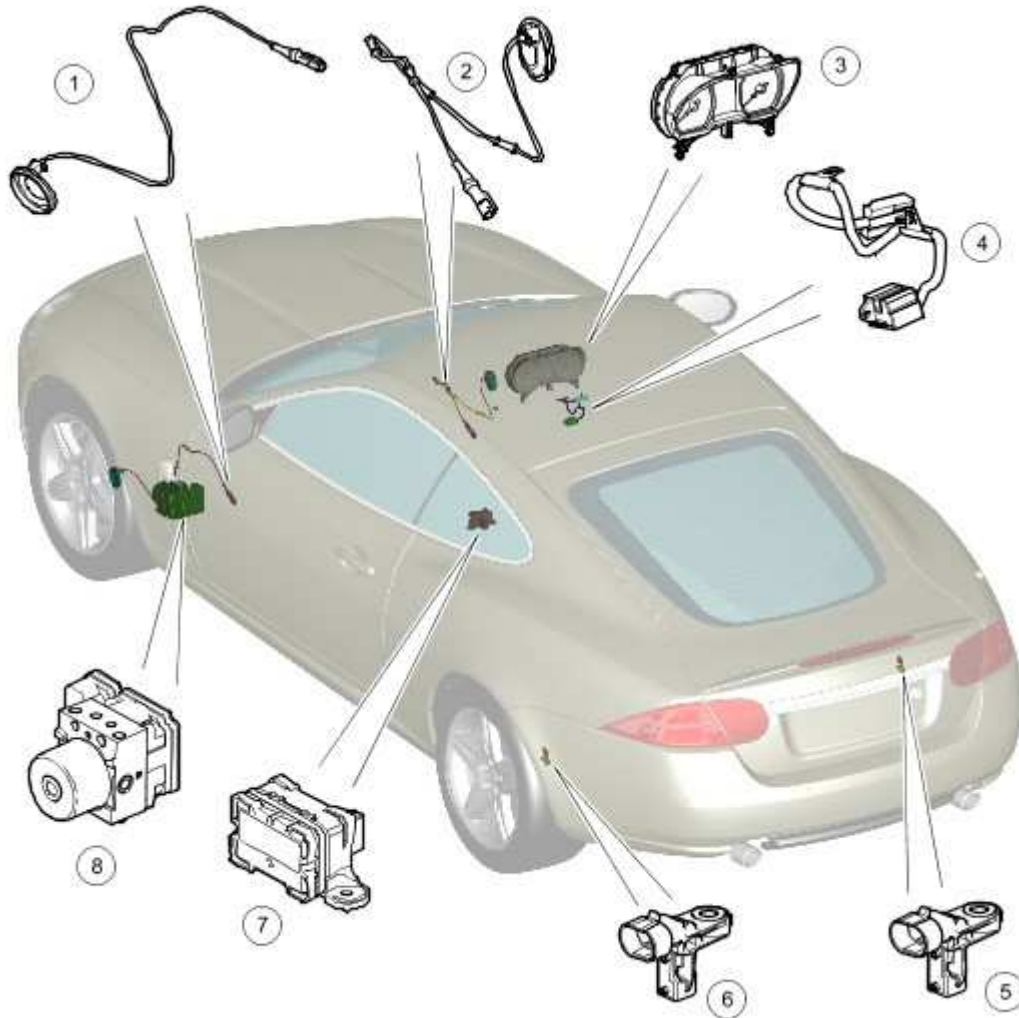
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Brake tubes to hydraulic control unit - union nut	17	13	-
Hydraulic control unit bracket to vehicle - bolt	9	7	79
Hydraulic control unit to bracket - bolt	9	7	79
Rear wheel speed sensor - bolt	9	7	79
Steering angle sensor - screw	4	3	35
Yaw rate sensor and accelerometer - nut	9	7	-

Anti-Lock Control - Stability Assist - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

COMPONENT LOCATION



E64749

Item	Part Number	Description
1		Left Hand (LH) front wheel speed sensor
2		Right Hand (RH) front wheel speed sensor
3		Instrument cluster

4		Steering angle sensor
5		RH rear wheel speed sensor
6		LH rear wheel speed sensor
7		Yaw rate and lateral acceleration sensor
8		Anti-Lock Brake System (ABS) module

INTRODUCTION

The Dynamic Stability Control system utilizes information on wheel speed, steering angle and vehicle body attitude to enhance the stability of the vehicle. This is achieved by controlling engine torque and application of the brakes at individual wheels. Dynamic Stability Control incorporates the following systems:

- ABS
- Traction Control
- Panic Brake Assist
- Active Yaw Control
- Braking in Curve Stability

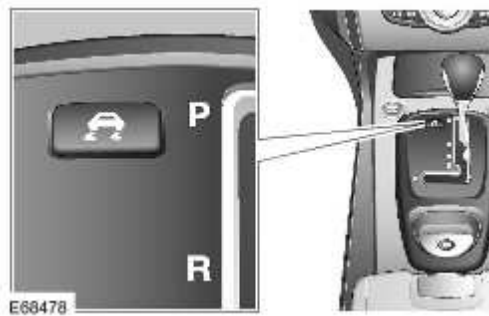
The Dynamic Stability Control system software also controls the braking functions of the Adaptive Speed Control system. For additional information, refer to Speed Control (310-03 Speed Control)

The Dynamic Stability Control software is contained within the ABS module and can apply or release braking force to each individual wheel, and increase or reduce engine torque to correct oversteer, understeer, wheel spin and wheel lock.



WARNING: Although the vehicle is fitted with Dynamic Stability Control, it remains the drivers responsibility to drive safely according to the prevailing conditions.

DYNAMIC STABILITY CONTROL SWITCH



The non-latching dynamic stability control switch is mounted in the floor console adjacent the L gate and forms part of the gear selector module assembly.

Dynamic Stability Control becomes active whenever the engine is running. A momentary press of the switch allows the driver to toggle between the standard Dynamic Stability Control settings and the optimized 'Trac DSC' settings. For more information on 'Trac DSC' refer to 'Principles of Operation'.

On early (06.5 model year) naturally aspirated vehicles, Dynamic Stability Control can be switched off by pressing and holding the switch for more than 3 seconds. On later (07.25 model year) naturally aspirated and supercharged vehicles the switch needs to be pressed and held for more than 10 seconds to switch Dynamic Stability Control off.

In each case the message 'DSC OFF' will be displayed in the instrument cluster message center to confirm Dynamic Stability Control has been switched off. The amber Dynamic Stability Control warning indicator in the instrument cluster will remain illuminated however. The system can be switched back on again by simply pressing and releasing the switch. The message 'DSC ON' will then appear in the instrument cluster message center to confirm the system is on.

NOTE:

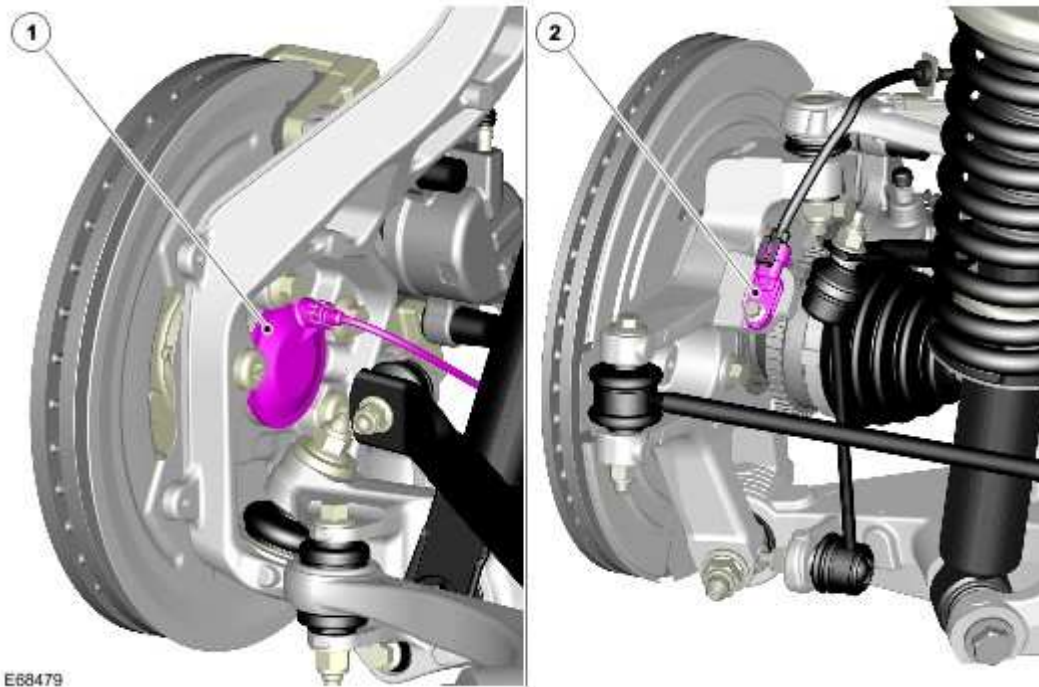
Switch requests may be delayed if the switch is pressed while a Dynamic Stability Control operation is taking place. The switch request will be displayed in the instrument cluster but the ABS module will not initiate any stability changes until it is safe to do so.

If a fault is detected with the Dynamic Stability Control switch, the ABS module defaults to the 'DSC ON' setting and any switch requests are ignored.



WARNING: It is recommended that when using snow chains, Trac DSC is switched on.

WHEEL SPEED SENSORS



Item	Part Number	Description
1		Front wheel speed sensor
2		Rear wheel speed sensor

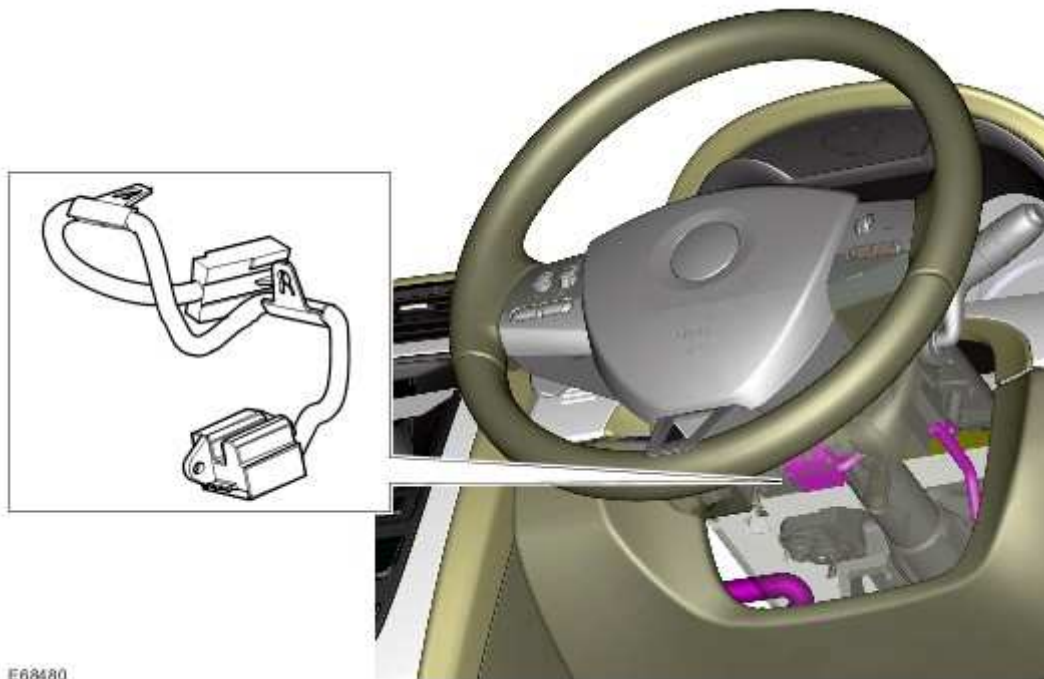
An active wheel speed sensor is installed in each wheel hub to provide the ABS module with a rotational speed signal from each road wheel. The head of each wheel speed sensor is positioned close to a 46 tooth sensor ring. The rear sensor rings are located on the outer diameter of the halfshaft constant velocity joints. The front sensor rings are located within the wheel hub and bearing assemblies. A fly lead connects each sensor to the vehicle wiring.

The wheel speed sensors each have a signal and a return connection with the ABS module. When the ignition is ON the ABS module supplies a signal feed to the wheel speed sensors and monitors the return signals. Any rotation of the road wheels induces current fluctuations in the return signals, which are converted into individual wheel speeds and overall vehicle speed by the ABS module.

The ABS module broadcasts the individual wheel speeds and the vehicle speed on the high speed Controller Area Network (CAN) bus for use by other systems.

If a wheel speed sensor fault is detected by the ABS module, 'ABS FAULT' will be displayed in the instrument cluster message center and an amber warning indicator lamp will illuminate. For additional information, refer to Information and Message Center (413-08 Information and Message Center)

STEERING ANGLE SENSOR



E68480

The steering angle sensor measures the steering wheel angle and the rate of change of the steering wheel angle. These measurements are received by the ABS module and broadcast on the high speed CAN bus for use by other systems.

The steering angle sensor is mounted on the steering column upper shroud mounting bracket, immediately behind the multifunction switches, and is secured by 2 screws. A fly lead connects the sensor to the passenger compartment wiring harness via a 4 pin multiplug.

The sensor is housed in a 'U' shaped plastic casing and contains 2 offset Light Emitting Diode's (LED's) facing 2 detectors.

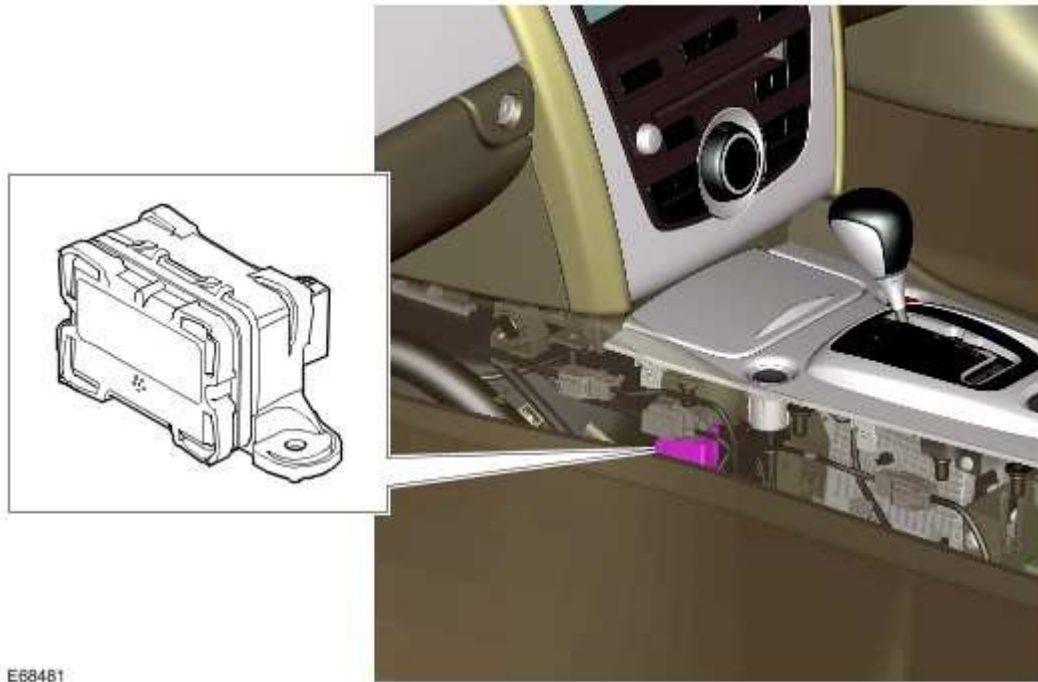
An encoder ring is mounted on the inner steering column shaft and intersects the LED's and detectors. The encoder ring contains 60 slots which break and restore the light beams between the LED's and the detectors as the steering wheel is rotated. The ABS module is able to determine the direction of rotation of the steering wheel by monitoring when the light beams change state. The LED's and detectors are mounted in such a way that only one beam will change state, either to broken or restored, at any one time.

The center (straight ahead) position of the steering wheel has to be learned by the ABS module every time the ignition is switched ON. The steering angle sensor is unable to determine the center position so inputs from the yaw rate and lateral acceleration sensor and wheel speed signals are also used by the ABS module to help it perform this process. If extreme weather conditions are present, for example ice causing extreme wheel spin or understeer/oversteer, the ABS module may not be able to determine the center position of the steering wheel. In this situation 'DSC NOT AVAILABLE' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate. For additional information, refer to Information and Message Center (413-08 Information and

Message Center)

'DSC NOT AVAILABLE' will also be displayed if the ABS module detects a steering angle sensor fault. The amber warning indicator will also illuminate until the fault is rectified.

YAW RATE AND LATERAL ACCELERATION SENSOR



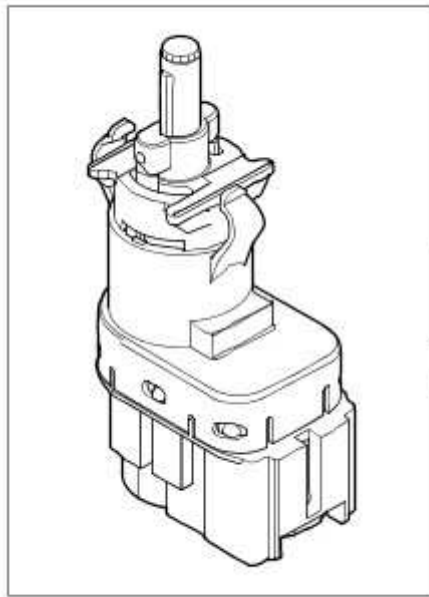
E68481

The yaw rate and lateral acceleration sensor is mounted on the transmission tunnel, forward of the gear selector module. The sensor is secured by 2 screws and connects to the vehicle wiring via a 4 pin multiplug.

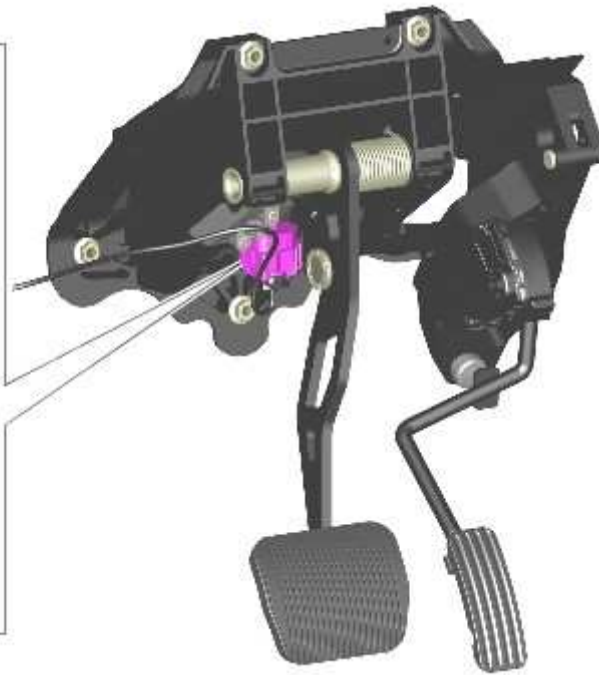
When the ignition is ON, the sensor receives a power feed from the ABS module. The ABS module also provides a ground path for the sensor. The sensor measures the yaw rate and lateral acceleration of the vehicle, providing values to the ABS module via a dedicated, private high speed CAN bus connection. The ABS module broadcasts these values on the high speed CAN bus for use by other systems.

If a sensor fault is detected by the ABS module, 'DSC NOT AVAILABLE' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate. For additional information, refer to Information and Message Center (413-08 Information and Message Center)

STOPLAMP SWITCH



E71776



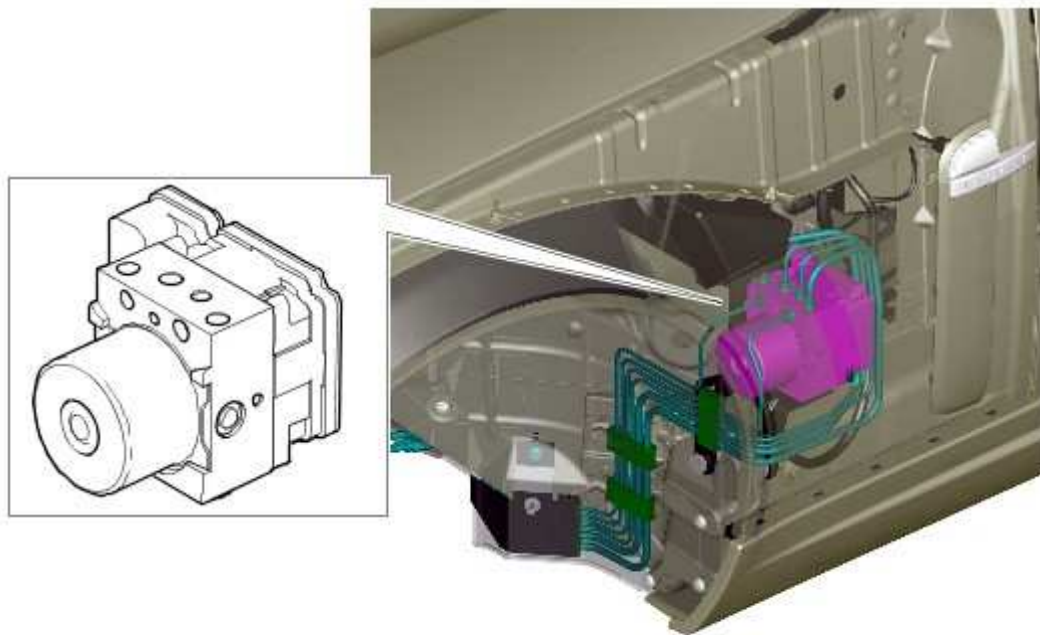
The stoplamp switch is mounted on the brake pedal bracket and is connected to the vehicle harness via a 4 pin multiplug.

When the brake pedal is pressed, the switch contacts close. This allows a hard wired signal feed to be sent to the Engine Control Module (ECM). A stoplamp switch status message is then sent from the ECM to the ABS module on the high speed CAN bus. The ABS module is then able to control braking force accordingly in conjunction with the Hydraulic Control Unit (HCU).

NOTE:

The stoplamp switch also forms part of the speed control system. For additional information, refer to Speed Control (310-03 Speed Control)

ABS MODULE



E68482

The ABS module is secured to a mounting bracket located in the LH front wheel arch. The module is mounted on the rear face of the Hydraulic Control Unit (HCU), which it uses to control all braking and stability functions by modulating hydraulic pressure to the individual wheel brakes.

Two different ABS modules are available; one for vehicles with standard Speed Control, one for vehicles fitted with Adaptive Speed Control. Both incorporate analogue valves which offer refined pressure control and reduced noise levels over previously used systems.

If an ABS modulator fault is detected, 'ABS FAULT' will be displayed in the instrument cluster message center and the amber warning indicator will illuminate. For additional information, refer to Information and Message Center (413-08 Information and Message Center)



CAUTION: The ABS module and the Hydraulic Control Unit (HCU) are a single unit and must not be separated.

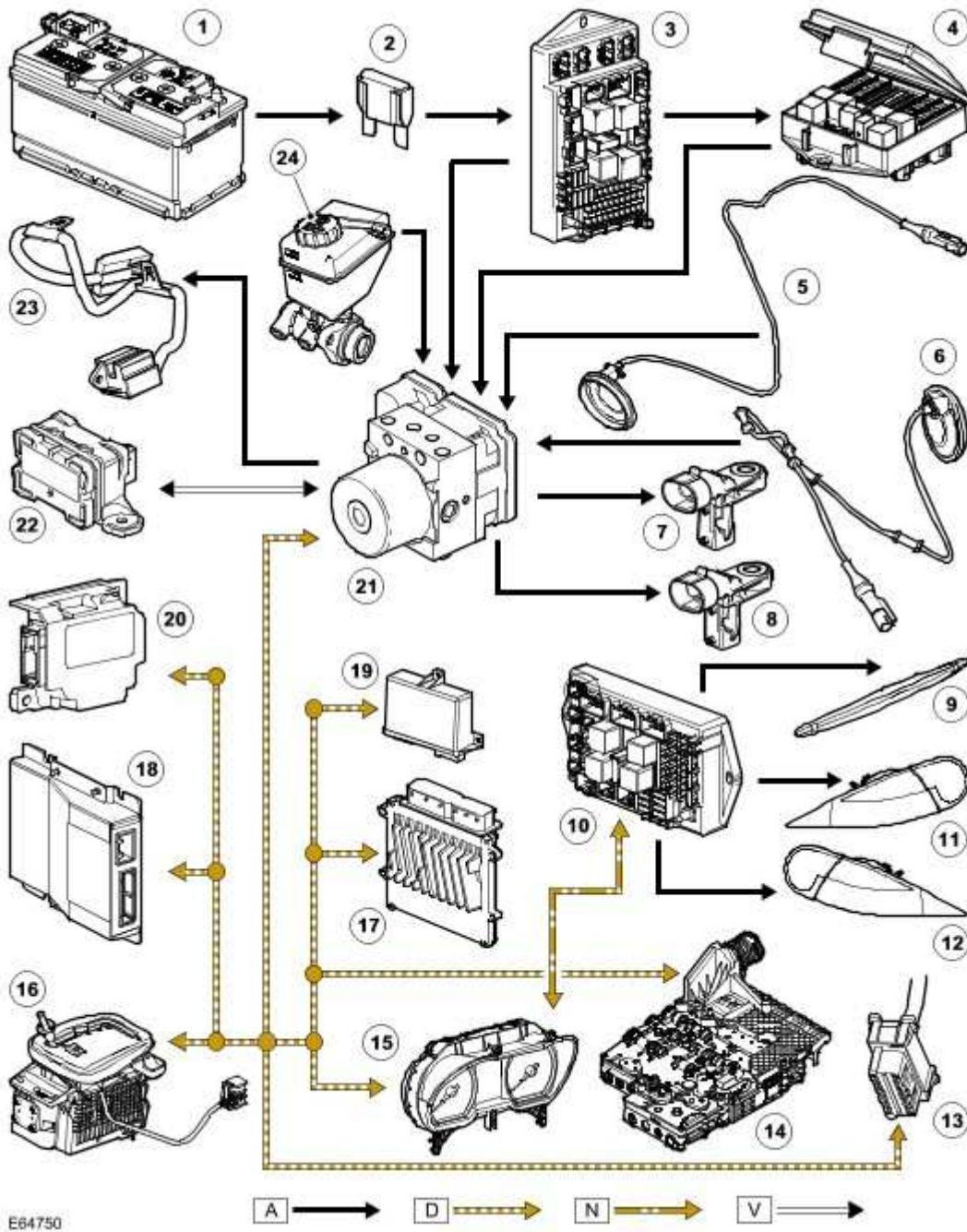
HYDRAULIC CONTROL UNIT (HCU)

The HCU is a 4 channel unit, secured to a mounting bracket located in the LH front wheel arch. The HCU modulates the supply of hydraulic pressure to the brakes under the control of the ABS module. For additional information, refer to Hydraulic Brake Actuation (206-06 Hydraulic Brake Actuation)

CONTROL DIAGRAM

NOTE:

A = Hardwired; D = High Speed CAN bus; N = Medium Speed CAN bus; V = Private CAN bus



Item	Part Number	Description
1		Battery
2		Megafuse (175A)

3		CJB
4		Power distribution box
5		RH front wheel speed sensor
6		LH front wheel speed sensor
7		RH rear wheel speed sensor
8		LH rear wheel speed sensor
9		High mounted stop lamp
10		Auxiliary junction box
11		LH stop lamp
12		RH stop lamp
13		Diagnostic socket
14		Transmission Control Module (TCM)
15		Instrument cluster
16		Gear selector module
17		ECM
18		Adaptive Damping Control Module (ADCM)
19		Park brake control module
20		Adaptive speed control module
21		ABS module
22		Yaw rate and lateral acceleration sensor
23		Steering angle sensor
24		Brake fluid level switch

PRINCIPLES OF OPERATION

Trac DSC

'Trac DSC' optimizes the Dynamic Stability Control settings to maximize traction in difficult conditions such as deep snow, gravel, sand or when snow chains are fitted. This makes greater traction possible, without losing the benefits of Dynamic Stability Control, however the stability of the vehicle may be less than normal.



WARNING: 'Trac DSC' must only be used when necessary for the prevailing conditions. The vehicle should then only be driven appropriately for those conditions. When conditions improve sufficiently, full stability of the vehicle must be regained by switching 'Trac DSC' off and returning the vehicle to the Dynamic Stability Control mode.

Pressing and releasing the Dynamic Stability Control switch will switch the vehicle between normal Dynamic Stability Control settings and 'Trac DSC' settings. To confirm which setting has been selected, either 'DSC ON' or 'Trac DSC' will be temporarily displayed in the instrument cluster message center.

When 'Trac DSC' is selected, the amber Dynamic Stability Control warning indicator located in the instrument cluster will illuminate. The warning indicator will remain illuminated until 'Trac DSC' becomes active. At this point the warning indicator will flash.

NOTE:

If speed control is engaged it will automatically disengage if Dynamic Stability Control or 'Trac DSC' becomes active. For additional information, refer to Speed Control (310-03 Speed Control)

ABS

ABS controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. This prevents the wheels from locking, which helps to retain effective steering control of the vehicle in a braking situation.

Traction Control

Traction control attempts to optimize forward traction by reducing engine torque or braking a spinning wheel until it regains grip.

Traction control is activated if an individual wheel speed is above that of the vehicle reference speed and the brake pedal is not pressed. The spinning wheel is braked, allowing the excess torque to be transmitted to the non-spinning wheel through the driveline. If necessary, the ABS module also sends a high speed CAN bus message to the Engine Control Module (ECM) to request a reduction in engine torque.

Panic Brake Assist

Panic Brake Assist (PBA) helps the driver bring the vehicle to a halt in an emergency braking situation by automatically maximizing the braking effort. There are 2 situations when the ABS module will invoke PBA:

- When the brake pedal is pressed very suddenly
- When the brake pedal is pressed hard enough to bring the front brakes into ABS operation.

When the brake pedal is pressed very suddenly, the ABS module increases hydraulic pressure to all of the brakes until they reach the threshold for ABS operation, thus applying the maximum braking effort for the available traction. The ABS module monitors for the sudden application of the brakes using inputs from the stoplamp switch and from a pressure sensor within the HCU. With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the ABS module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into ABS operation, the ABS module increases the hydraulic pressure to the rear brakes up to the ABS threshold.

PBA operation continues until the driver releases the brake pedal enough for the hydraulic pressure in the HCU to drop below a threshold value stored in the ABS module.

Active Yaw Control

Active Yaw Control monitors the vehicle for oversteer or understeer by comparing signals from the yaw rate and lateral acceleration sensor with signals from the steering angle sensor. If the ABS module determines the vehicle is not responding correctly to steering inputs from the driver it will control the HCU to;

- apply brake pressure to the inner wheels to correct understeer
- apply brake pressure to the outer wheels to correct oversteer.

Braking in Curve Stability

Braking in Curve Stability influences the brake pressures below the Dynamic Stability Control and ABS thresholds to counteract the yawing movement produced when braking in a corner. Braking in Curve Stability produces a correction torque by limiting the brake pressure on one side of the vehicle.

System Malfunction

If an error is detected in the Dynamic Stability Control system, a message will be displayed in the instrument cluster message center and the amber warning indicator will illuminate. In this condition the vehicle is still safe to drive but the system may not react under slide or wheel spin conditions. For additional information, refer to Anti-Lock Control - Stability Assist (206-09 Anti-Lock Control - Stability Assist)

Anti-Lock Control - Stability Assist

No Data Available

Anti-Lock Brake System (ABS) Module (70.60.02)

Removal

NOTE:

The ABS Module is part of the hydraulic control unit (HCU) and cannot be serviced separately.

- 1 . Remove the HCU.

For additional information, refer to Hydraulic Control Unit (HCU) (70.60.18)


Installation

- 1 . Install the HCU.

For additional information, refer to Hydraulic Control Unit (HCU) (70.60.18)

Front Wheel Speed Sensor - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.60.03)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

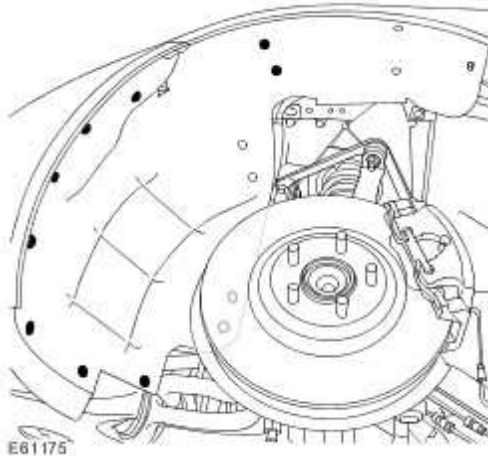
Raise and support the vehicle.

- 2 . Remove the LH front wheel.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . Release the front of the fender splash shield.

▶ Remove the 11 Torx bolts.

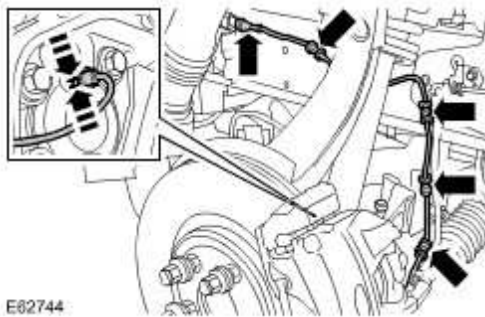
▶ Tie the splash shield aside.



- 4 . Remove the wheel speed sensor.

▶ Remove the retaining clip.

- ▶ Carefully release the 4 clips.
- ▶ Disconnect the electrical connector.



Installation

1 . Install the wheel speed sensor.

- ▶ Install the retaining clip.
- ▶ Carefully secure the clips.
- ▶ Connect and secure the electrical connector.

2 . Install the fender splash shield.

- ▶ Tighten the Torx bolts.

3 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Hydraulic Control Unit (HCU) (70.60.18)

Special Service Tools



Brake pedal hold down tool

JDS9013

Removal



CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to

3 . Remove the front LH fender splash shield.

For additional information, refer to Fender Splash Shield (76.10.90)

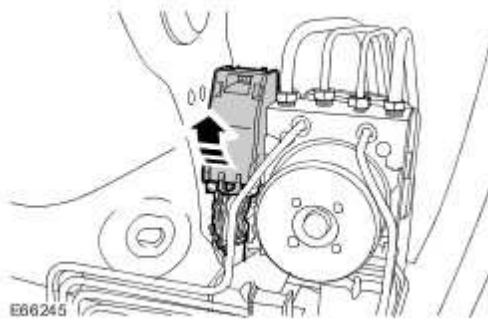
4 **NOTE:**


To prevent the loss of brake fluid, using the special tool apply the brake pedal and set to 40mm (1.6 in) below the rest position.

Using the special tool, press and hold the brake pedal.

5 . Disconnect the hydraulic control unit (HCU) electrical connector.

▶ Carefully release the clip.

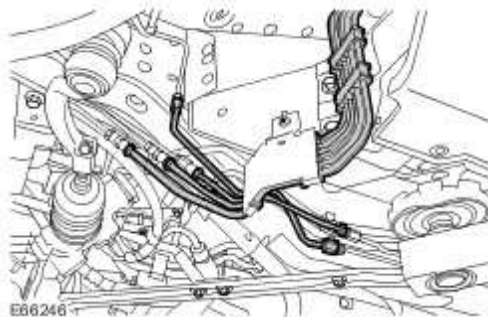


6 .  **CAUTION: Always plug any open connections to prevent contamination.**

NOTE:

Some fluid spillage is inevitable during this operation.

Disconnect the 6 brake pipe unions.

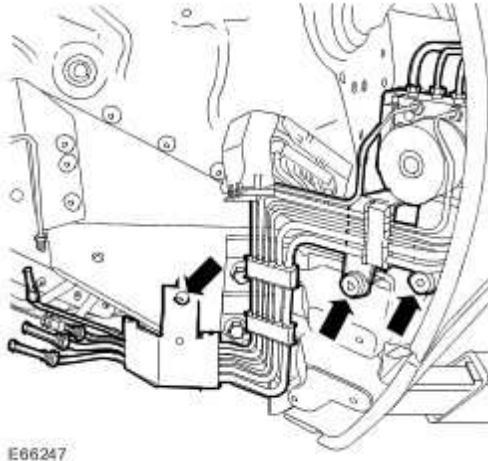


7 . **NOTE:**

Note the fitted position of the locating pegs.

Remove the HCU and pipe assembly.

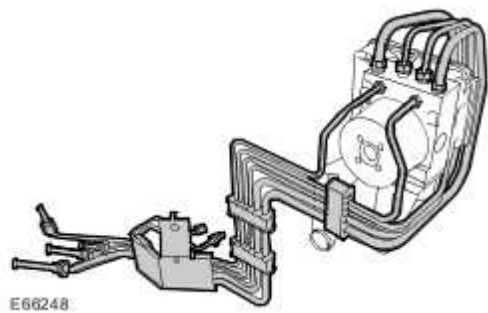
▶ Remove the 3 Torx bolts.



8.  **CAUTION: Always plug any open connections to prevent contamination.**

Remove the HCU.

▶ Disconnect the 6 brake pipe unions.

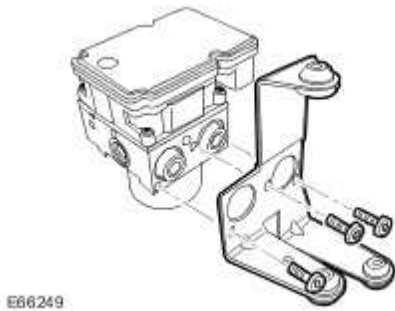


- 9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the HCU bracket.

- ▶ Remove the 3 Torx bolts.



Installation

- 1 . Install the HCU bracket.

- ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).

- 2 . Connect the brake pipe unions.

- ▶ Tighten the brake line unions to 17 Nm (13 lb.ft).

- 3 . **NOTE:**

When installing the HCU , make sure the locating peg fits securely into the grommet.

Install the HCU and pipe assembly.

- ▶ Position the locating peg.
- ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
- ▶ Tighten the brake line unions to 17 Nm (13 lb.ft).

- 4 . Connect and secure the electrical connector.

5 . Remove the special tool.

6 . Bleed the brake system.

For additional information, refer to Brake System Bleeding (70.25.03)

7 . Install the fender splash shield.

For additional information, refer to Fender Splash Shield (76.10.90)


8 . Connect the battery ground cable and install the cover.

For additional information, refer to

9 . Using WDS, configure a new HCU.

Rear Wheel Speed Sensor - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (70.60.04)

Removal

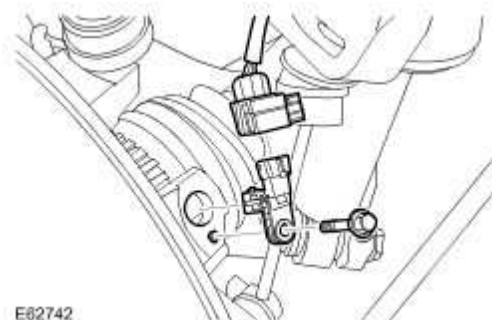
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)


- 3 . Remove the wheel speed sensor.

- ▶ Remove the bolt.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the wheel speed sensor.
 - ▶ Clean the component mating faces.
 - ▶ Connect and secure the electrical connector.

 Install the bolt and tighten to 10 Nm (7 lb.ft).

2 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Yaw Rate Sensor and Accelerometer (86.56.64)

Removal

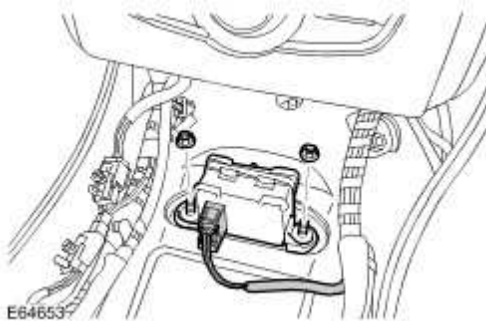
- 1 . Remove the floor console.

For additional information, refer to Floor Console (76.25.01)

- 2 . Remove the accelerometer.

▶ Remove the 2 nuts.

▶ Disconnect the electrical connector.



Installation

- 1 . Install the accelerometer.

▶ Tighten the nuts to 9 Nm (7 lb.ft).

▶ Connect the electrical connector.

- 2 . Install the floor console.

For additional information, refer to Floor Console (76.25.01)

211-00 : Steering system – General information

Specifications

Specifications

Specifications

Power Steering System Bleeding (57.15.02)

1. Clean power steering fluid reservoir around the filler cap and fluid indicator.
 - Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.

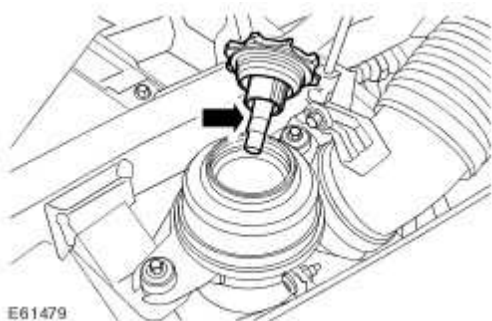
2.



CAUTION: Fluid must always be present in the reservoir during bleeding.

Remove the filler cap and fill to the MAX level mark.

- Install the reservoir filler cap.



3. Start the engine and allow to run for 10 seconds, stop the engine.
 - Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.

4.



CAUTION: Do not hold steering on full lock for longer than 10 seconds.

Start the engine and turn steering fully lock to lock, stop the engine.

- Check and top-up power steering fluid level.

5. Start and run the engine for 2 minutes, turn the steering fully lock to lock.

- Check and top-up power steering fluid level.

Power Steering System Flushing (57.15.08)

NOTE:

If heavy steering or contamination within the power steering system is found, it is necessary to carry out the system flush procedure as detailed below. If any components have been replaced in the power steering system the procedure below must be carried out in full.

NOTE:

Some variation in the illustrations may occur, but the essential information is always correct.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable syringe, remove the power steering fluid from the power steering fluid reservoir.
- 3.



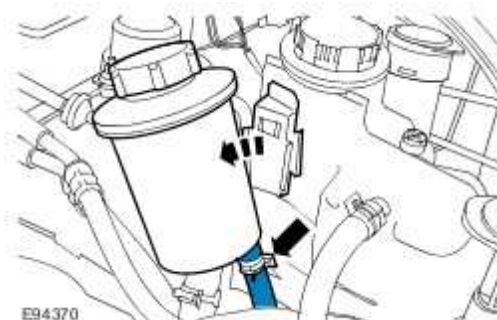
CAUTION: Be prepared to collect escaping fluids.

NOTE:

Note the orientation of the clip.

Detach the power steering fluid reservoir.

- Detach but do not remove the power steering fluid reservoir.
- Release the power steering fluid return hose from the power steering fluid reservoir.
- If a quick release coupling is fitted to the power steering return hose, release the power steering fluid return hose from the coupling by removing the clip.



- 4.



CAUTION: Be prepared to collect escaping fluids.

NOTE:

Make sure that all openings are sealed. Use new blanking caps.

Using a suitable blanking cap, cap the power steering reservoir return pipe.



5.

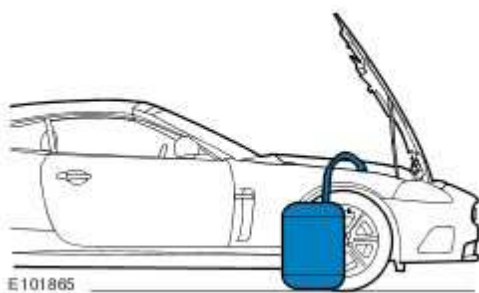


CAUTION: Be prepared to collect escaping fluids.

NOTE:

Make sure the extended pipe is not kinked or twisted and is correctly secured with hose clips.

Attach a suitable pipe to the power steering return hose to allow the fluid to drain.



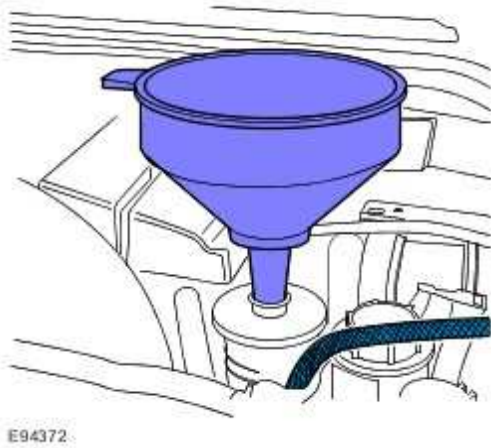
6. **NOTE:**

The suitable funnel should have the a capacity of 4 litres and O-ring seal

NOTE:

The suitable funnel must be tightly sealed to the power steering fluid reservoir to avoid fluid leakage.

Install a suitable funnel onto the power steering fluid reservoir.



7.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle with the wheels just clear of the ground.

8.



CAUTION: Steps 8 and 9 must be carried out within 2 - 3 seconds of each other. Failure to follow this instruction may result in damage to the power steering system.



CAUTION: Be prepared to collect escaping fluids.

Using the suitable funnel, top up the power steering system with the specified fluid. Make sure the fluid level is maintained at two thirds full in the funnel.

9.



CAUTION: Be prepared to collect escaping fluids.



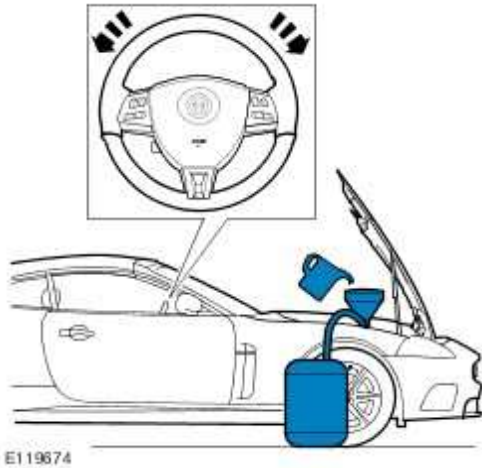
CAUTION: Do not allow the power steering fluid level in the power steering fluid reservoir to fall below the minimum power steering fluid level. Failure to follow this instruction may result in damage to the power steering system.



CAUTION: Make sure the engine is switched off as soon as the full 4 litres of power steering fluid has entered the power steering fluid reservoir.

Flush the power steering system.

- Start the engine
- With assistance turn the steering slowly lock to lock 3 times at approximately 1 revolution every 5 seconds.
- Continue to flush the power steering system until 4 litres of power steering fluid has been added to the power steering reservoir. This should take approximately 30 seconds.



10.



CAUTION: Be prepared to collect escaping fluids.

Remove the suitable funnel.

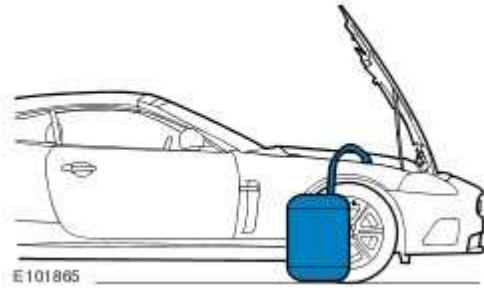


11.



CAUTION: Be prepared to collect escaping fluids.

Remove the suitable pipe to the power steering return hose.



12.



CAUTION: Be prepared to collect escaping fluids.

NOTE:

Note the orientation of the clip.

If a quick release coupling is fitted to the power steering return hose, connect the power steering fluid return hose to the coupling by installing the clip.

13. Install a new power steering fluid reservoir.

Steering System

Principle of Operation

For a detailed description of the steering system operation, refer to the relevant Description and Operation section of the workshop manual.

Power Steering

Steering Column

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Tire condition/pressure • Fluid level • Leaks • Security, condition and correct installation of suspension components • Security, condition and correct installation of steering system components 	<ul style="list-style-type: none"> • Fuses • Harnesses for damage/corrosion • Electrical connector(s) • Damaged/corroded pins



CAUTION: If a steering gear assembly is returned under warranty with leaking output shaft seals, but there is also damage to the steering gear boot/boots the steering gear warranty will be invalid. This is due to the steering gear output shaft seals being damaged due to foreign materials entering the steering gear boot and damaging the steering gear output shaft seals thereafter.

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

- 4 . If the concern is not visually evident, verify the symptom and refer to the symptom chart.

Symptom Charts



WARNING: It is not possible to CHECK the torque of a patchlock bolt, if the torque is suspected to be low, the bolt must be REMOVED/DISCARDED and a new bolt MUST be INSTALLED

and torqued to the correct value.

Fluid Leakage


NOTE:


Confirm the position of the fluid leak. CLEAN the area of the leak, inspect the area and confirm the exact position. Ensure the fluid is not from another system on the vehicle.

Symptom	Possible Causes	Action
<ul style="list-style-type: none"> Power steering fluid leakage 	<ul style="list-style-type: none"> Overfilled system 	<ul style="list-style-type: none"> CORRECT the fluid level as necessary
	<ul style="list-style-type: none"> Steering gear 	<ul style="list-style-type: none"> Install new steering gear. Steering Gear (57.10.01)
	<ul style="list-style-type: none"> Damaged fluid cap/reservoir 	<ul style="list-style-type: none"> INSTALL a new fluid cap/reservoir. Power Steering Fluid Reservoir - 4.2L NA V8 - AJV8 (57.15.08)
	<ul style="list-style-type: none"> Loose or damaged hoses and fittings O-ring or Dowty seals 	<ul style="list-style-type: none"> TIGHTEN the hose connection or latch plate fixing to the recommended torque. Specifications INSTALL new components as necessary INSTALL new O-ring or Dowty seals as necessary
	<ul style="list-style-type: none"> Fluid cooler 	<ul style="list-style-type: none"> INSTALL new fluid cooler. Power Steering Fluid Cooler - 4.2L NA V8 - AJV8 (57.15.11)
	<ul style="list-style-type: none"> Power steering pump 	<ul style="list-style-type: none"> INSTALL a new power steering pump. Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)


Functional

Symptom	Possible Causes	Action
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<ul style="list-style-type: none"> Steering wheel misalignment 	<ul style="list-style-type: none"> Steering not correctly centred 	<ul style="list-style-type: none"> CHECK the steering alignment. Specifications
<ul style="list-style-type: none"> Excessive free play at steering wheel (refer to the Steering Linkage Inspection and Backlash (Free play) Check in this section) 	<ul style="list-style-type: none"> Steering wheel loose 	<ul style="list-style-type: none"> CHECK and TIGHTEN the steering wheel retaining bolt as necessary. Steering Wheel (57.60.01)
	<ul style="list-style-type: none"> Excess play in the steering linkage 	<ul style="list-style-type: none"> INSTALL new components as necessary
	<ul style="list-style-type: none"> Steering gear not correctly adjusted (causing excessive backlash) 	<p> CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty</p> <ul style="list-style-type: none"> INSTALL a new steering gear as necessary. Steering Gear (57.10.01)
	<ul style="list-style-type: none"> Lower steering column universal joint pinch bolts loose 	<ul style="list-style-type: none"> CHECK and TIGHTEN the lower steering column pinch bolts as necessary. Specifications
	<ul style="list-style-type: none"> Excessive wear in steering column universal joints 	<ul style="list-style-type: none"> INSTALL a new steering column or steering column lower shaft as necessary. Steering Column (57.40.01) Steering Column Lower Shaft (57.40.05)
	<ul style="list-style-type: none"> Steering gear mounting bolts loose or damaged 	<ul style="list-style-type: none"> CHECK/TIGHTEN and INSTALL new steering gear mounting bolts as necessary.

		Specifications
	<ul style="list-style-type: none"> Wear in steering gear tie-rod end ball joints 	<ul style="list-style-type: none"> INSTALL new tie-rod ends as necessary. Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)
	<p>NOTE:</p> <p>Inner ball joint wear is rare. The steering gear installed to all Jaguar vehicles has a spring loaded pinion to ensure the correct level of engagement between the rack and pinion. This play is optimized with the steering gear in the central position and should not be confused with inner ball joint wear. Check for vertical motion in the inner ball joint with the steering gear in the central position.</p> <ul style="list-style-type: none"> Wear in steering gear inner ball joints 	<ul style="list-style-type: none"> INSTALL new steering gear as necessary. Steering Gear (57.10.01)
	<ul style="list-style-type: none"> Wear in suspension ball joints/bushings 	<ul style="list-style-type: none"> INSTALL new components as necessary
<ul style="list-style-type: none"> Veer under braking 	<ul style="list-style-type: none"> Steering gear not correctly adjusted 	 <p>CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty</p> <ul style="list-style-type: none"> INSTALL a new steering gear as necessary.

		Steering Gear (57.10.01)
	<ul style="list-style-type: none"> Contamination of brake pads and discs 	<ul style="list-style-type: none"> RECTIFY the source of the contamination and INSTALL new brake pads and discs as necessary. Brake Disc - Vehicles With: Standard Brakes (70.10.10) Brake Disc - Vehicles With: High Performance Brakes (70.10.10) Brake Pads - Vehicles With: Standard Brakes (70.40.02) Brake Pads - Vehicles With: High Performance Brakes (70.40.02)
	<ul style="list-style-type: none"> Seized front brake caliper slide pins or piston Damaged brake discs 	<ul style="list-style-type: none"> RECTIFY sticking slide pins and INSTALL new calipers as necessary. Brake Caliper - Vehicles With: Standard Brakes (70.55.02) Brake Caliper - Vehicles With: High Performance Brakes (70.55.02) INSTALL new brake discs as necessary. Brake Disc - Vehicles With: Standard Brakes (70.10.10) Brake Disc - Vehicles With: High Performance Brakes (70.10.10)
<ul style="list-style-type: none"> Vehicle pulls to one side when driving on a level surface 	<ul style="list-style-type: none"> Uneven tire wear Incorrect tire pressure 	<ul style="list-style-type: none"> For further information on diagnosis of uneven tire wear. Suspension System ADJUST tire pressures. Specifications

	<ul style="list-style-type: none"> • Incorrect geometry adjustment 	<p>NOTE:</p> <p>Dealerships must keep a copy of the BEFORE and AFTER geometry figures with job card for future reference</p> <ul style="list-style-type: none"> • ADJUST as necessary. Specifications
	<ul style="list-style-type: none"> • Vehicle is unevenly loaded or overloaded 	<ul style="list-style-type: none"> • Notify the customer of incorrect vehicle loading
	<ul style="list-style-type: none"> • Steering gear is not correctly adjusted 	<p> CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty</p> <ul style="list-style-type: none"> • INSTALL a new steering gear as necessary. Steering Gear (57.10.01)
	<ul style="list-style-type: none"> • Loose, damaged or worn front suspension components 	<ul style="list-style-type: none"> • TIGHTEN and INSTALL new front suspension components as necessary. Specifications
	<ul style="list-style-type: none"> • Loose, damaged or worn rear suspension components 	<ul style="list-style-type: none"> • TIGHTEN and INSTALL new rear suspension components as necessary. Specifications
	<ul style="list-style-type: none"> • Incorrect brake operation 	<ul style="list-style-type: none"> • For further information on diagnosis of the brake system.

		Brake System
	<ul style="list-style-type: none"> Incorrect underbody alignment 	<ul style="list-style-type: none"> SET underbody alignment referring to the Removal and Installation procedures for instruction. Front Subframe (76.10.05) Rear Subframe (64.25.01)
<ul style="list-style-type: none"> Vehicle wanders from side to side when driven straight ahead and the steering wheel is held in a firm position 	<ul style="list-style-type: none"> Incorrect tire pressure or tire size 	<ul style="list-style-type: none"> CHECK and ADJUST the tire pressure. Specifications INSTALL a new tire as necessary. Wheel and Tire (74.20.05)
	<ul style="list-style-type: none"> Vehicle is unevenly or excessively loaded 	<ul style="list-style-type: none"> Notify the customer of incorrect vehicle loading
	<ul style="list-style-type: none"> Incorrect toe adjustment 	<ul style="list-style-type: none"> ADJUST as necessary. Specifications Front Toe Adjustment (57.65.01)
	<ul style="list-style-type: none"> Loose or worn steering gear tie-rod end(s) 	<ul style="list-style-type: none"> TIGHTEN and INSTALL a new tie-rod end as necessary. Specifications Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)
	<ul style="list-style-type: none"> Loose or worn suspension ball joint(s) 	<ul style="list-style-type: none"> TIGHTEN and INSTALL a new suspension ball joint assembly as necessary. Specifications Wheel Knuckle (60.25.23)
	<ul style="list-style-type: none"> Steering column universal joint pinch bolt loose 	<ul style="list-style-type: none"> TIGHTEN the steering column universal joint pinch bolt to the correct torque.

		Specifications
	<ul style="list-style-type: none"> Loose or worn rear suspension components 	<ul style="list-style-type: none"> TIGHTEN and INSTALL new rear suspension components as necessary. Specifications
<ul style="list-style-type: none"> Poor self center action of the steering 	<ul style="list-style-type: none"> Incorrect tire pressure, size or type 	<ul style="list-style-type: none"> CHECK/ADJUST the tire pressure and INSTALL correct tire as necessary. Specifications Wheel and Tire (74.20.05)
	<ul style="list-style-type: none"> Incorrect geometry adjustment 	<p>NOTE:</p> <p>Dealerships must keep a copy of the BEFORE and AFTER geometry figures with job card for future reference</p> <ul style="list-style-type: none"> ADJUST as necessary. Specifications
	<ul style="list-style-type: none"> Steering column/steering column lower shaft interference 	<ul style="list-style-type: none"> CHECK the steering column and steering column lower shaft are free from interference from the engine harness, sound proofing and floor covering
	<ul style="list-style-type: none"> Steering column shroud fouling on the steering wheel 	<ul style="list-style-type: none"> Correctly INSTALL/ALIGN as necessary
	<ul style="list-style-type: none"> Steering column universal joints binding or stiff 	<ul style="list-style-type: none"> INSTALL a new upper or lower steering column as necessary. Steering Column (57.40.01) Steering Column Lower

		Shaft (57.40.05)
	<ul style="list-style-type: none"> Steering column lower shaft floor seal incorrectly installed, binding or damaged 	<ul style="list-style-type: none"> Correctly INSTALL and INSTALL new lower shaft as necessary. Steering Column Lower Shaft (57.40.05)
	<ul style="list-style-type: none"> Binding or damaged steering gear tie-rod(s) 	<ul style="list-style-type: none"> INSTALL a new tie-rod end as necessary. Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)
	<ul style="list-style-type: none"> Loose, damaged or worn front suspension components 	<ul style="list-style-type: none"> TIGHTEN and INSTALL new front suspension components as necessary. Specifications
<ul style="list-style-type: none"> Excessive steering efforts required during low speed/rapid manoeuvring and/or during parking manoeuvres 	<ul style="list-style-type: none"> Low power steering fluid 	<ul style="list-style-type: none"> CHECK and RECTIFY any fluid leakage. Steering System Fill to correct level
	<ul style="list-style-type: none"> Damaged Front End Accessory Drive (FEAD) belt tensioner 	<ul style="list-style-type: none"> INSTALL a new FEAD belt tensioner. Accessory Drive Belt Tensioner - 4.2L NA V8 - AJV8 (12.10.41)
	<ul style="list-style-type: none"> Power steering hose or fluid cooler restriction 	<ul style="list-style-type: none"> CHECK hoses and cooler for restriction/damage and INSTALL new components as necessary. Power Steering Fluid Cooler - 4.2L NA V8 - AJV8 (57.15.11)
	<ul style="list-style-type: none"> Fluid aeration 	<ul style="list-style-type: none"> BLEED the system. Power Steering System Bleeding (57.15.02)
	<ul style="list-style-type: none"> Steering transducer not closed - no feed voltage or 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering

	cable fault	transducer circuit
	<p>NOTE:</p> <p>REFER to the power steering pressure check in this section.</p> <ul style="list-style-type: none"> Power steering fluid delivery pressure or flow too low Internal steering gear leakage 	<ul style="list-style-type: none"> INSTALL a new power steering pump or steering gear as necessary. Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14) Steering Gear (57.10.01)
<ul style="list-style-type: none"> Steering operation is very heavy when VEHICLE IS IN MOTION AT LOW SPEED, but when stationary manoeuvring is NORMAL 	<ul style="list-style-type: none"> Steering transducer open early 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering transducer circuit
	<ul style="list-style-type: none"> Speedometer signal error 	<ul style="list-style-type: none"> Check for vehicle speed related DTCs and refer to the relevant DTC Index
<ul style="list-style-type: none"> Steering operation is very light when VEHICLE IN MOTION AT HIGHER SPEED, but when stationary manoeuvring is NORMAL 	<ul style="list-style-type: none"> Steering transducer not open, (no power steering fluid flow) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering transducer circuit
	<ul style="list-style-type: none"> Speedometer signal error 	<ul style="list-style-type: none"> Check for vehicle speed related DTCs and refer to the relevant DTC Index
	<ul style="list-style-type: none"> Power steering fluid low pressure pipe/hose restricted flow 	<ul style="list-style-type: none"> CHECK for kinking or blockage of pipe/hose Ensure CORRECT INSTALLATION and INSTALL a new power steering fluid low pressure pipe/hose as necessary
	<ul style="list-style-type: none"> Fluid reservoir filter blocked 	<ul style="list-style-type: none"> INSTALL a new reservoir, refill with fluid and bleed the system.

		Power Steering Fluid Reservoir - 4.2L NA V8 - AJV8 (57.15.08) Power Steering System Bleeding (57.15.02)
<ul style="list-style-type: none"> Steering operation is heavy in one direction 	<ul style="list-style-type: none"> Lower steering column interference 	<ul style="list-style-type: none"> CHECK the steering column is free from interference from the engine harness, sound proofing or the floor covering
	<ul style="list-style-type: none"> Incorrect steering geometry 	<p>NOTE:</p> <p>Dealerships must keep a copy of the BEFORE and AFTER geometry figures with job card for future reference.</p> <ul style="list-style-type: none"> CHECK the front wheel alignment. Specifications
	<ul style="list-style-type: none"> Faulty rotary valve/seal 	<p>NOTE:</p> <p>Refer to the power steering pressure check in this section</p> <ul style="list-style-type: none"> If the power steering system pressure is low but the power steering pump maximum output pressure is correct INSTALL a new steering gear. Steering Gear (57.10.01)
	<ul style="list-style-type: none"> Tire fouling on the wheel arch liner or suspension 	<ul style="list-style-type: none"> CHECK for correct installation or damage to wheel arch liner and

	<p>components</p>	<p>suspension components. Correctly INSTALL and INSTALL new components as necessary</p> <ul style="list-style-type: none"> CHECK tire for correct size, type and pressure
	<ul style="list-style-type: none"> Damaged steering gear cylinder feed pipe 	<ul style="list-style-type: none"> INSTALL new components as necessary
<ul style="list-style-type: none"> Steering operation is heavy in both directions 	<ul style="list-style-type: none"> Low power steering fluid 	<ul style="list-style-type: none"> CHECK and RECTIFY any fluid leaks. Refer to the fluid leakage symptom charts in this section Fill power steering system to correct level
	<ul style="list-style-type: none"> Faulty rotary valve/seal 	<p>NOTE:</p> <p>Refer to the power steering pressure check in this section</p> <ul style="list-style-type: none"> If the power steering system pressure is low but the power steering pump maximum output pressure is correct, INSTALL a new steering gear. Steering Gear (57.10.01)
	<p>NOTE:</p> <p>Refer to the power steering pressure check in this section</p> <ul style="list-style-type: none"> Power steering fluid delivery pressure or flow too low Internal steering gear 	<ul style="list-style-type: none"> INSTALL a new power steering pump or steering gear as necessary. Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14) Steering Gear (57.10.01)

	leakage	
	<ul style="list-style-type: none"> Fluid loss at the power steering pump shaft seal 	<ul style="list-style-type: none"> INSTALL a new power steering pump as necessary. Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)
	<ul style="list-style-type: none"> Steering column universal joints binding or stiff 	<ul style="list-style-type: none"> INSTALL a new upper or lower steering column as necessary. Steering Column (57.40.01) Steering Column Lower Shaft (57.40.05)
	<ul style="list-style-type: none"> Seized front ball joints 	<ul style="list-style-type: none"> INSTALL new components as necessary. Wheel Knuckle (60.25.23) Upper Arm LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.35.41) Upper Arm RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (60.35.42)
	<ul style="list-style-type: none"> Seized or worn steering gear 	<ul style="list-style-type: none"> INSTALL new steering gear as necessary. Steering Gear (57.10.01)
<ul style="list-style-type: none"> Steering operation varies from heavy to light when driving at constant speed 	<ul style="list-style-type: none"> Lower steering column interference 	<ul style="list-style-type: none"> CHECK the steering column is free from interference from the engine harness, sound proofing and floor covering
	<ul style="list-style-type: none"> Incorrect speedometer signal 	<ul style="list-style-type: none"> Check for vehicle speed related DTCs and refer to the relevant DTC Index
	<ul style="list-style-type: none"> Steering transducer circuit fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering

		transducer circuit
	<ul style="list-style-type: none"> Steering column universal joint binding or stiff 	<ul style="list-style-type: none"> INSTALL a new upper or lower steering column as necessary. Steering Column (57.40.01) Steering Column Lower Shaft (57.40.05)
<ul style="list-style-type: none"> Uncharacteristic effort/speed relationship 	<ul style="list-style-type: none"> Steering transducer circuit fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering transducer circuit
<ul style="list-style-type: none"> Excessive kick-back through steering wheel 	<ul style="list-style-type: none"> Incorrect tire pressure, size or type 	<ul style="list-style-type: none"> CHECK/ADJUST the tire pressure and INSTALL correct tire as necessary. Specifications Wheel and Tire (74.20.05)
	<p>NOTE:</p> <p>Inner ball joint wear is rare. The steering gear installed to all Jaguar vehicles have a spring loaded pinion to ensure the correct level of engagement between the rack and pinion. This play is optimized with the steering gear in the central position and should not be confused with inner ball joint wear. Check for vertical motion in the inner ball joint with the steering gear in the central position.</p> <ul style="list-style-type: none"> Badly worn steering gear/linkage 	<ul style="list-style-type: none"> INSTALL new steering gear and tie-rod ends as necessary. Steering Gear (57.10.01) Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)
	<ul style="list-style-type: none"> Loose or worn front 	<ul style="list-style-type: none"> TIGHTEN and INSTALL

	suspension components/bushings	new front suspension components as necessary. Specifications
<ul style="list-style-type: none"> • Column will not adjust • Column will not move to memory position 	<ul style="list-style-type: none"> • Electrical/electronic failure 	<ul style="list-style-type: none"> • CHECK column adjust switch datalogger signal using the manufacturer approved diagnostic system • CHECK fuses/relays • Check instrument cluster for column movement/memory related DTCs and refer to DTC Index. Instrument Cluster If DTCs B1C3314, B1C3514 are stored, and the column inches when the switch is activated and there is no memory recall function, there will be an existing fault with the circuit, if the column function is OK the fault is intermittent If DTCs B1C3277, B1C3477 are stored, these should be ignored in this case • CHECK condition of wiring and connectors • CHECK column calibration. The BAR code information is located in the right hand luggage compartment floor area below the carpet • CHECK seat control memory module
	<ul style="list-style-type: none"> • Motor locked/jammed 	<ul style="list-style-type: none"> • CHECK to see if mechanism has reached hard end stops • Free mechanism • Replace motor with

		appropriate service kit
<ul style="list-style-type: none"> • Column easy entry/exit does not function 	<ul style="list-style-type: none"> • Electrical/electronic failure 	<ul style="list-style-type: none"> • Turn column adjust switch to AUTO position, check that 'Column Adjust AUTO' text is displayed in the instrument cluster message center • CHECK column adjust switch datalogger signal using the manufacturer approved diagnostic system • CHECK fuses/relays • Check instrument cluster for column movement/memory related DTCs and refer to DTC Index. Instrument Cluster If DTCs B1C3314, B1C3514 are stored, and the column inches when the switch is activated and there is no memory recall function, there will be an existing fault with the circuit, if the column function is OK the fault is intermittent If DTCs B1C3277, B1C3477 are stored, these should be ignored in this case • CHECK condition of wiring and connectors • CHECK column calibration. The BAR code information is located in the right hand luggage compartment floor area below the carpet • CHECK seat control memory module for DTCs and refer to DTC Index

<ul style="list-style-type: none"> When driver memory recall requested from driver switch pack - Column and exterior mirrors DO NOT move to memory position - Driver seat DOES move to memory position 	<ul style="list-style-type: none"> Driver seat has passenger seat module installed 	<ul style="list-style-type: none"> Install the correct module to the driver seat
<ul style="list-style-type: none"> When passenger memory recall requested from passenger switch pack - Column, exterior mirrors and passenger seat ALL move to memory position 	<ul style="list-style-type: none"> Passenger seat has driver seat module installed 	<ul style="list-style-type: none"> Install the correct module to the passenger seat
<ul style="list-style-type: none"> Electromechanical Steering column lock will not operate 	<ul style="list-style-type: none"> Internal lock failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test steering column lock circuit Install a new steering column lock as necessary

Noise


Symptom	Possible Causes	Action
<ul style="list-style-type: none"> Continuous noise 	<ul style="list-style-type: none"> Low power steering fluid level 	<ul style="list-style-type: none"> CHECK for leaks and RECTIFY as necessary. For further information refer to the symptom charts for leakage in this section. FILL power steering fluid reservoir to correct level
	<p>NOTE:</p> <p>Look for small air bubbles visible in the fluid, air may also get trapped in the hydraulic system</p>	<ul style="list-style-type: none"> BLEED the power steering system. Power Steering System Bleeding (57.15.02)

	<ul style="list-style-type: none"> Air in hydraulic system 	
	<ul style="list-style-type: none"> Power steering pipe/hose in contact with the vehicle body 	<ul style="list-style-type: none"> CHECK and REPOSITION, or INSTALL new IF damaged/deformed, power steering pipe/hose
	<ul style="list-style-type: none"> Power steering pipe/hose restricted or twisted 	<ul style="list-style-type: none"> CHECK and CLEAR restriction to pipe/hose REPOSITION power steering pipe/hose. INSTALL new pipe/hose IF permanently damaged/deformed
	<ul style="list-style-type: none"> Power steering pump mounting bolts loose 	<ul style="list-style-type: none"> TIGHTEN the power steering pump mounting bolts to the correct torque. Specifications
<ul style="list-style-type: none"> Noise gets worse when system is loaded 	<p>NOTE:</p> <p>Refer to the power steering pressure check in this section</p> <ul style="list-style-type: none"> Low power steering fluid level Aerated fluid Low power steering pump pressure 	<ul style="list-style-type: none"> CHECK and FILL power steering fluid reservoir to correct level Bleed the power steering system. Power Steering System Bleeding (57.15.02) CHECK power steering pump pressure. If the pump pressure is low, INSTALL a new power steering pump. Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)
<ul style="list-style-type: none"> Front End Accessory Drive (FEAD) belt squeal 	<ul style="list-style-type: none"> FEAD belt incorrectly tensioned or glazed 	<ul style="list-style-type: none"> CHECK FEAD belt tension CHECK FEAD belt condition and INSTALL a new belt as necessary. Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)
<ul style="list-style-type: none"> Chirp noise from the steering pump when a load is applied 	<ul style="list-style-type: none"> Loose or worn FEAD belt 	<ul style="list-style-type: none"> CHECK FEAD belt tension CHECK FEAD belt condition and INSTALL a new belt as necessary. Accessory Drive Belt - 4.2L NA

		V8 - AJV8 (12.10.40)
<ul style="list-style-type: none"> Scrape/grind noise from behind steering wheel while steering 	<ul style="list-style-type: none"> Steering column shroud foul condition or clockspring 	<ul style="list-style-type: none"> Correctly INSTALL the steering column shroud to eliminate the foul condition INSTALL a new clockspring as necessary. Clockspring
	<ul style="list-style-type: none"> Foreign objects 	<ul style="list-style-type: none"> REMOVE foreign objects from between steering column shroud and steering wheel/steering column rotating components
<ul style="list-style-type: none"> Click 	<ul style="list-style-type: none"> Clockspring or steering column multifunction switch LH 	<ul style="list-style-type: none"> Correctly INSTALL and INSTALL new components as necessary. Clockspring Steering Column Multifunction Switch LH (86.65.78)
	<ul style="list-style-type: none"> Loose universal joint pinch bolt 	<ul style="list-style-type: none"> INSTALL a new universal joint pinch bolt and TIGHTEN to correct specification. Specifications
<ul style="list-style-type: none"> Squeak 	<ul style="list-style-type: none"> Steering column shroud joints 	<ul style="list-style-type: none"> APPLY Krytox spray to steering column shroud joints
	<ul style="list-style-type: none"> Clockspring 	<ul style="list-style-type: none"> INSTALL new clockspring as necessary. Clockspring
<ul style="list-style-type: none"> Knock 	<ul style="list-style-type: none"> Loose fixings (universal joint pinch bolt and steering column fixings) 	<ul style="list-style-type: none"> TIGHTEN fixings to correct specification. Specifications
<ul style="list-style-type: none"> Rattle 	<ul style="list-style-type: none"> Foreign objects 	<ul style="list-style-type: none"> REMOVE foreign objects from between steering column shroud and steering wheel/steering column rotating components
	<ul style="list-style-type: none"> Loose fixings 	<ul style="list-style-type: none"> TIGHTEN steering column fixings to correct specification. Specifications

<ul style="list-style-type: none"> Noise while adjusting column 	<ul style="list-style-type: none"> Electric motor/solenoid 	<p>NOTE:</p> <p>Before carrying out repairs/replacement, assess column adjustment noise levels against other vehicles of the same model</p> <ul style="list-style-type: none"> Install new components as necessary
	<ul style="list-style-type: none"> Motor spindle/lead screw 	<ul style="list-style-type: none"> Lubricate lead screw

Vibration

Symptom	Possible Causes	Action
<ul style="list-style-type: none"> Wheel Fight (Kick Back) - condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces 	<ul style="list-style-type: none"> Loose or worn steering components/bushings 	<p> CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.</p> <ul style="list-style-type: none"> TIGHTEN and INSTALL new steering components/bushings as necessary
	<ul style="list-style-type: none"> Loose or worn suspension components/bushings 	<ul style="list-style-type: none"> TIGHTEN and INSTALL new suspension components/bushings as necessary
<ul style="list-style-type: none"> Nibble (Shimmy) - condition where oscillation of the steering wheel occurs (not vertical which is Shake). This is driven 	<ul style="list-style-type: none"> Road wheel and tire condition 	<ul style="list-style-type: none"> CHECK for wheel and tire damage. INSTALL new components as necessary. Wheel and Tire (74.20.05) CHECK for tire uniformity. INSTALL new tire(s) as

by road wheel imbalance		necessary
	<ul style="list-style-type: none"> Road wheel imbalance 	<ul style="list-style-type: none"> CHECK and ADJUST road wheel balance as necessary
<ul style="list-style-type: none"> Shake - condition where vertical vibration of the steering wheel/column occurs (not oscillation which is Nibble) 	<p>NOTE:</p> <p>Vibration smooths out after several miles of driving</p> <ul style="list-style-type: none"> Road wheel imbalance due to tire flat-spotting 	<ul style="list-style-type: none"> ENSURE tires installed are to Jaguar specification. INSTALL new tires as necessary CHECK and ADJUST tire pressures to correct specification

Component Tests

Steering Linkage Inspection and Backlash (Free play) Check



CAUTION: Steering gear boots must be handled carefully to avoid damage. Use new clamps when installing steering gear boots.

Inspect the boots for cuts, deterioration, twisting or distortion. Check the steering gear boots to make sure they are tight. Install new boots or clamps as necessary.

NOTE:

The following steps must be carried out with assistance.

- 1 . With the wheels in the straight ahead position, gently turn the steering wheel to the left and the right to check for free play.
- 2 . Free play should be between 0 and 6 mm (0 and 0.24 in) at the steering wheel rim. If the free play exceeds this limit, either the ball joints are worn, the lower steering column joints are worn or the backlash of the steering gear is excessive.



CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.

3 . The backlash of the steering gear cannot be adjusted, install a new steering gear if excessive backlash is diagnosed.

4 . Grasp the steering wheel firmly and move it up and down and to the left and right without turning the wheel to check for column bearing wear, steering wheel or steering column.

Power Steering Fluid Condition Check

1 . Run the engine for 2 minutes.

2 . Check the power steering fluid system level.

3 . Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black.

4 . Using a suitable clean syringe extract a suitable amount of fluid from the reservoir.

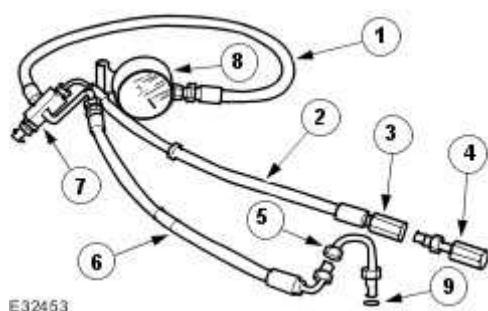
5 . Allow the fluid to drip onto a facial tissue and examine the stain.

6 . If evidence of solid material is found, the power steering fluid system should be drained for further inspection.

7 . If fluid contamination or steering component failure is confirmed by the sediment in the power steering fluid system, REFER to Steering Fault Diagnosis by Symptom Charts in this section.

Power Steering Pressure Test

Test Equipment



Item	Part Number	Description
1	211-011	Pressure Gauge Hose
2	211-011-08	Pump Return Hose
3	211-011-07	Pump Return Hose Connector

4	211-011-03/2	Test Equipment to High Pressure Hose Adaptor
5	211-011-03/1	Pump High Pressure Outlet to Hose Adaptor
6	211-011-02	Pump Adaptor to Control Valve Hose
7	211-011-01	Control Valve
8	211-011	Pressure Gauge
9	-	'O' Ring Seal

The measurement of the maximum system pressure, (which is governed by the pressure relief valve) is achieved by inserting the Service Tool (pressure gauge and adaptors) into the fluid circuit of the power steering system. Run the engine at idle speed, turn the steering from lock to lock and read the maximum pressure recorded on the gauge.

Installing Test Equipment

To install the pressure test equipment:

- Place a suitable drain tray below the power steering pump.
- Install a hose clamp on the reservoir to pump hose prior to disconnecting any hoses, to avoid unnecessary loss of fluid.
- Disconnect the hose from the power steering pump high pressure outlet.
- Install the pump outlet to hose adaptor (5). Do not omit the 'O' ring seal (9).
- Connect the power steering pump adaptor to control valve hose (6) of the test equipment.
- Install the adaptor (4) in the high pressure hose previously removed from the power steering pump outlet.
- Connect the connector (3) of the test equipment hose (2) to the adaptor (4).
- Remove the hose clamp from the reservoir hose.
- Start the engine to check the system pressure.

With the control valve (7) OPEN and the engine idling, the following system pressures may be checked:

- During turning when static (dry parking pressure).
- When the steering is held on full lock (maximum system pressure or pressure relief).
- With the steering at rest (idle pressure or back pressure).



CAUTION: To avoid excessive heating of the power steering pump when CHECKING the pressure, do not close the valve for more than 5 seconds maximum.



CAUTION: When CHECKING the pump pressure DO NOT drive the vehicle with the test

equipment installed.

With the control valve (7) CLOSED the power steering pump maximum output pressure can be checked.

Removing Test Equipment

To remove the test equipment:

- Install a hose clamp on the reservoir to power steering pump hose.
- Removing the test equipment is a reversal of the installation instructions.
- Install a new 'O' ring seal (9) to the power steering pump high pressure outlet to hose connection.
- Install the original hose to the power steering pump.
- Remove the clamp from the reservoir to the power steering pump hose.
- Top-up the reservoir fluid.
- Bleed the power steering system.
Power Steering System Bleeding (57.15.02)

Description of Terms

General Steering System Noises

Boom

Rhythmic sound like a drum roll or distant thunder. May cause pressure on the ear drum.

Buzz

Low-pitched sound, like a bee. Usually associated with vibrations.

Chatter

Rapidly repeating metallic sound.

Chuckle

Rapid noise that sounds like a stick against the spokes of a spinning bicycle wheel.

Chirp

High pitched rapidly repeating sound, like chirping birds.

Click

Light sound, like a ball point pen being clicked.

Click/Thump

Heavy metal-to-metal sound, like a hammer striking steel.

Grind

Abrasive sound, like a grinding wheel or sandpaper rubbing against wood.

Groan/Moan

Continuous, low-pitched humming sound.

Groan/Howl

Low, guttural sound, like an angry dog.

Hiss

Continuous sound like air escaping from a tire valve.

Hum

Continuous sound of varying frequencies, like a wire humming in the wind.

Knock

Heavy, loud repeating sound like a knock on a door.

Ping

Similar to knock, except at higher frequency.

Rattle

A sound suggesting looseness, such as marbles rolling around in a can.

Roar

Deep, long, prolonged sound like an animal, or winds and ocean waves.

Rumble

Low, heavy continuous sound like that made by wagons or thunder.

Scrape

Grating noise like one hard plastic part rubbing against another.

Squeak

High-pitched sound like rubbing a clean window.

Squeal

Continuous, high-pitched sound like running finger nails across a chalkboard.

Tap

Light, hammering sound like tapping pencil on edge of table. May be rhythmic or intermittent.

Whirr/Whine

High-pitched buzzing sound, like an electric motor or drill.

Whistle

Sharp, shrill sound, like wind passing a small opening.

Specific Steering System Noise Types

Belt Squeal

Belt squeal is a high frequency air-borne noise generated by slippage of the ribbed Vee belt on the power steering pump pulley. Squeal increases with system loading and at full lock.

Clonk

Clonk is a structure-borne noise heard as a loose-sounding rattle or vibration coming from the steering column. Clonk can be identified by driving and turning over cobblestones, rough roads, or high frequency bumps such as 25-50 mm tall tar strips. Clonk requires a tie-rod load impact.

Column Knock

Column knock is a loose-sounding rattle or vibration generated by the steering column shaft contacting other portions of the column assembly. The noise is both audible and tactile. Column knock is generated by driving over cobblestones or rough pavement. It is not necessary to turn the steering wheel to create this noise.

Column Rattle

Column rattle is a metallic sounding noise created when applying a highly impulsive force to the steering wheel. Column rattle is often used to combine the more general group of column noises including clonk and column knock. Column rattle noises can be caused by clonk, knock, loose column components, bonus parts etc. A series of parked, straight-line driving, and cornering tests should be carried out to isolate the source/sources.

Grinding/Scrape

Grinding is a low frequency noise in the column when the steering wheel is turned. It is generally caused by interference between moving components such as the steering wheel to steering column shroud.

Grunt (Squawk/Whoop)

Grunt is a 'honking' sound elicited when coming off one of the steering stops. Grunt is generally excited during parking manoeuvres with a low to medium speed steering input.

Hiss (Swish)

Hiss or Valve Hiss is a high-frequency sound coming from the steering gear when the system is loaded. It is a rushing or 'swish' noise that doesn't change frequency with RPM. Hiss is the general noise generated by the flow of hydraulic fluid through restrictions in the steering system. Restrictions include the rotary steering valve, power steering tubes, connectors, tuning orifices, etc. Hiss can be air-borne and structure-borne, but the structure-borne path through the steering intermediate shaft is usually dominant.

Moan (Groan)

Moan is the general structure-borne noise of the steering system. Moan is primarily transmitted to the driver via the body structure through the pump mount, engine mounts, power steering lines and power steering brackets. On some vehicles, moan is a loud humming noise, often present when the

wheel is turned and the system is loaded. It may change frequency with engine RPM and if the system is loaded or unloaded.

Steering Gear Knock (Steering Gear Slap)



CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will invalidate the steering gear warranty.

Steering gear knock is a rattle sound and steering wheel vibration caused by separation of the steering gear and pinion while driving over bumps. It is a structure-borne noise transmitted through the intermediate shaft and column. Steering gear knock can also be heard as a 'thump' or impact noise that occurs with the vehicle stationary when the steering wheel is released from a loaded position and allowed to return to rest. Noise occurs with the engine on or off.

Rattles

Rattles are noises caused by knocking or hitting of components in the steering system. Steering rattles can occur in the engine compartment, the suspension, or the passenger compartment. Rattles can be caused by loose components, movable and flexible components, and improper clearances.

Squeaks/Scrapes

Squeaks/Scrapes are noises due to friction or component rubbing anywhere in the steering system. Squeaks/Scrapes have appeared in steering linkages and joints, in column components and in column and steering wheel trim.

Weep

Weep is an air-borne noise, occasionally generated when turning the steering across lock at a constant rate. When present on a vehicle the noise, once initiated can often be maintained across a large proportion of the available steering movement.

Whistle

Whistle is similar to hiss but is louder and of a higher frequency. It is also more of a pure tone noise than hiss. Whistle is air-borne and is generated by a high flow rate of hydraulic fluid through a small restriction.

Zip

Zip noise is the air-borne noise generated by power steering pump cavitation when power steering fluid does not flow freely through the suction hose from the reservoir to the pump. Zip primarily occurs during cold weather at start-up.

Steering System Vibrations and Harshness

Buzz

Buzz is a tactile rotary vibration felt in the steering wheel when steering inputs are slow. Buzz can also be called a grinding feel and it is closely related to grunt and is caused by high system gain with

low damping. Buzz is generally excited during parking manoeuvres with low to medium speed steering input.

Buzz (Electrical)

A different steering buzz can be caused by pulse width modulated (PWM) electric actuators used in variable assist steering systems. This buzz is felt by turning the ignition key to run without starting the engine and holding onto the steering wheel. In extreme cases, the buzz can be felt with the engine running also.

Column/Steering Wheel Shake

Column shake is a low frequency vertical vibration excited by primary engine vibrations.

Nibble (Shimmy)

Steering nibble is a rotary oscillation or vibration of the steering wheel, which can be excited at a specific vehicle speed. Nibble is driven by wheel and tire imbalance exciting a suspension recession mode, which then translates into steering gear travel and finally steering wheel nibble.

Shudder (Judder)

Shudder is a low frequency oscillation of the entire steering system (tire, wheels, steering gear and linkage, etc.) when the vehicle is steered during static-park or at low speeds. Shudder is very dependent on road surface.

Torque/Velocity Variation (Phasing/Effort Cycling)

Steering wheel torque variation occurring twice in one revolution is normally as a result of problems with the lower steering column (intermediate shaft), but foul conditions generally result in either constant stiffness or single point stiffness. Depending upon the orientation of the joints, the steering can feel asymmetric (torque falling off in one direction and rising in the other) or else it can simply have pronounced peaks and troughs as the steering moves from lock to lock.

Wheel Fight (Kick Back)

Wheel fight is excess feedback of sudden road forces through the steering system and back to the driver. It is evaluated at all vehicle speeds over cobblestones, rough roads, and potholes. The tires, wheels, and suspension generate forces into the steering systems. Steering friction, hydraulic damping, hydraulic compliance, mechanical compliance, steering ratio, and assist gain all affect how much is transmitted to the driver.

211-02 : Power steering

Specifications

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Power steering fluid	Mobil ATF (meeting Dexron 3 specification)

Capacities

	Liters
Power steering fluid	1

Torque Specifications

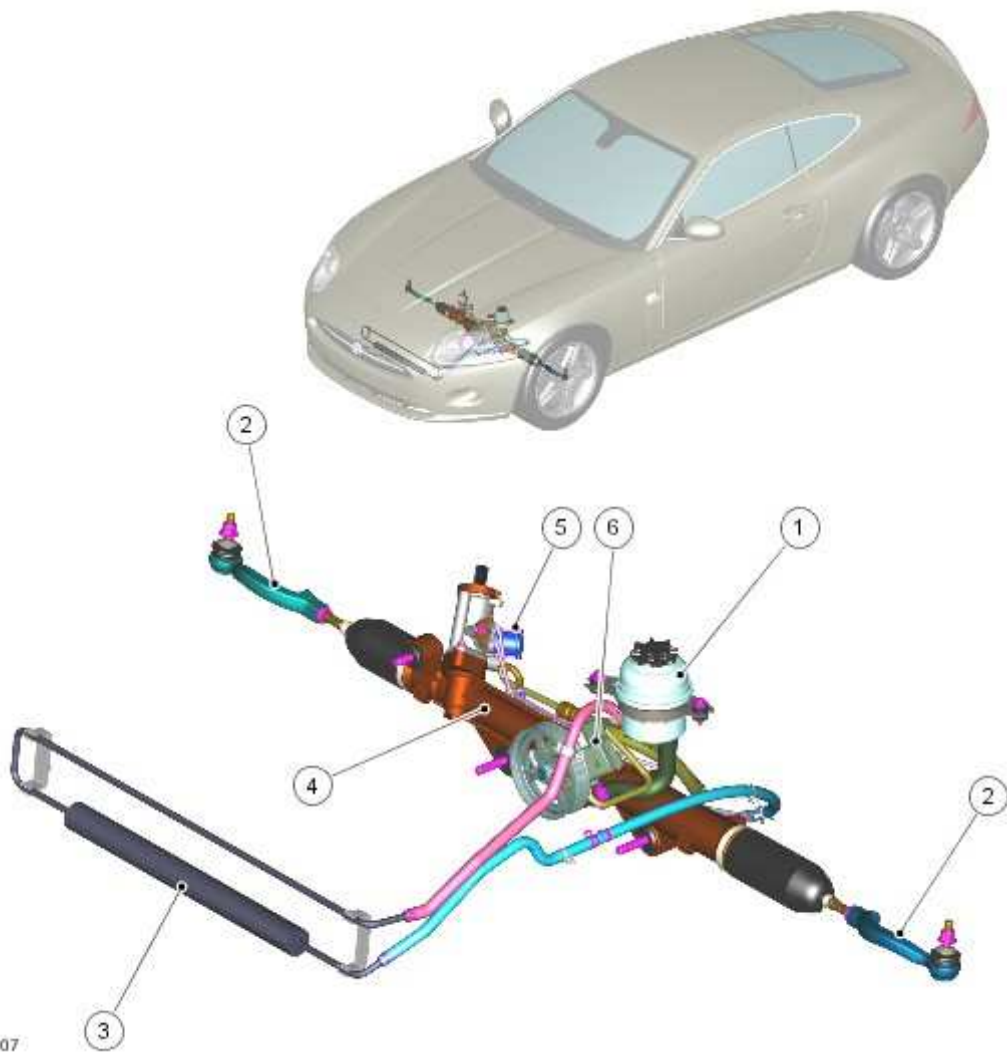
Item	Nm	lb-ft	lb-in
Power steering pump to bracket - bolt	25	18	-
Power steering pump bracket to engine - bolt	25	18	-
Steering gear to vehicle - bolt	100	74	-

Power Steering

COMPONENT LOCATION

NOTE:

Naturally aspirated shown, Supercharged similar



E62707

Item	Part Number	Description
1		Power steering fluid reservoir
2		Tie-rod

3		Power steering fluid cooler and hoses
4		Steering gear
5		Servotronic valve
6		Power steering pump

INTRODUCTION

The steering system comprises a ZF manufactured rack and pinion Servotronic 2 steering gear, a power steering pump, a fluid reservoir, a fluid cooler and fluid hoses. The steering gear is an end take-off rack and pinion power assisted unit with the addition of road speed proportional ZF Servotronic 2 assistance.

The steering rack is connected to the front wheel knuckles by adjustable tie-rods. The tie-rods allow for adjustment to centralize the steering wheel and also adjust the toe setting of the front wheel geometry.

The steering gear has a variable ratio rack. This provides conventional response when the steering is in the centre, straight ahead position, but provides more direct and faster steering as the turning angle increases. The variable ratio provides precise and rapid steering response at high speeds and provides optimized steering of the vehicle when manoeuvring into parking spaces, turning in tight areas and when cornering in extreme conditions.

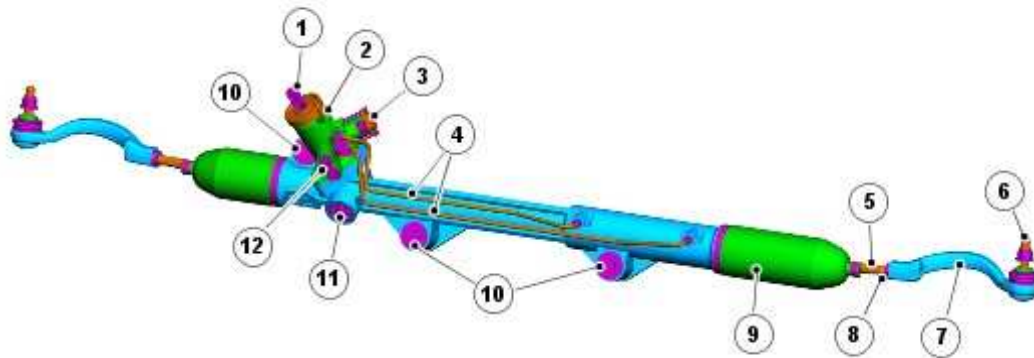
Fluid is supplied to the steering gear by a fixed displacement vane pump, belt driven from the crankshaft pulley. The pump is mounted on the LH (left-hand) side of the engine, above the A/C (air conditioning) compressor.

A fluid reservoir is positioned at the front LH (left-hand) side of the engine compartment, forward of the front suspension housing. A fluid cooler is located in front of the engine cooling radiator. On Supercharged models, a different design of fluid cooler to that fitted to naturally aspirated models is mounted in a higher position in front of the radiator.

Servotronic 2 adds electronic control and speed sensitive steering to the steering gear. The Servotronic 2 feature provides easy and comfortable steering operation when parking, improved 'road feel' at increased road speeds and adds an integrated, positive centre feel feature which optimises steering wheel torque during high speed driving.

The Servotronic 2 system is controlled by software which is incorporated into the instrument cluster. The software responds to road speed signals and controls the power assistance via a transducer valve located on the steering gear valve housing.

STEERING GEAR



E83973

Item	Part Number	Description
1		Input shaft
2		Valve unit
3		Servotronic valve
4		Pressure/Return pipes
5		Tie-rod
6		Locknut
7		Tie-rod end
8		Locknut
9		Steering gear boots
10		Mounting bolts and washers
11		Pinion housing
12		Pressure/Return connection from/to pump

The steering gear is located at the rear of the engine and attached to the front sub-frame. The gear is secured to the sub-frame with three bolts and washers which screw into threaded tubes which are integral with the sub-frame.

The steering gear comprises an aluminum, cast, valve housing which contains the hydraulic valve unit

and Servotronic valve. The mechanical steering rack and the hydraulic actuator are located in a steel cylinder which is attached to the cast valve housing.

The steering gear uses a rack with an integrated piston which is guided on plain bearings within the cylinder and the valve housing. The pinion, which is attached to the valve unit, runs in bearings and meshes with the rack teeth. The rack is pressed against the pinion by a spring loaded yoke which ensures that the teeth mesh with the minimum of play. The pinion is connected to the valve unit via a torsion bar. The rotary motion of the steering wheel is converted into linear movement of the rack by the rack and pinion mechanism and is initiated by the valve unit. This movement is transferred into movement of the road wheels by adjustable tie-rods.

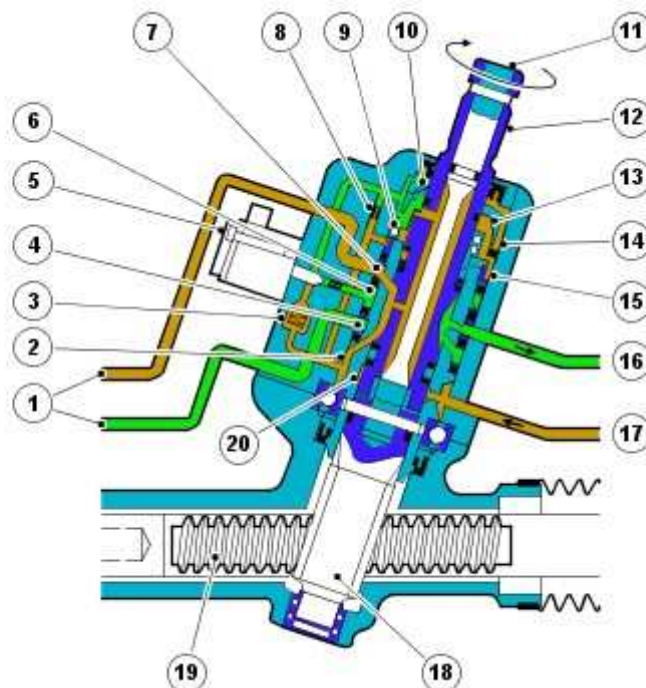
The teeth angles at the centre of the rack vary from those at the end sections. It is this variation in teeth angles which provides the variable ratio.

The piston of the hydraulic actuator is located on the rack bar. Each side of the piston is connected to fluid pressure or fluid return via external metal pipes which are connected to the valve unit.

Each end of the rack bar has a threaded hole which provides for the fitment of the tie-rod. The external ends of the gear are sealed with boots which prevent the ingress of dirt and moisture. The tie-rod has a long threaded area which allows for the fitment of the tie-rod end. The thread allows for the adjustment of the steering toe. When the correct toe setting is achieved, a locknut is tightened against the tie-rod end preventing inadvertent movement.

The gear has a central hole machined along most of its length. The hole allows the air in the boots to be balanced when the steering is turned. The boots are serviceable items and are retained on the gear housing and the tie-rod with clips.

Valve Unit



Item	Part Number	Description
1		Pressure/return to/from steering gear
2		Return fluid chamber
3		Cut-off valve
4		Radial groove
5		Servotronic transducer valve
6		Fluid feed radial groove
7		Radial groove
8		Orifice
9		Balls
10		Compression spring
11		Torsion bar
12		Valve rotor
13		Reaction piston
14		Reaction chamber
15		Centering piece
16		Pressure supply from pump
17		Return to reservoir
18		Pinion
19		Steering gear rack bar
20		Valve sleeve

The valve unit is an integral part of the steering gear. The principle function of the valve unit is to provide power assistance (i.e. when parking) to optimize the effort required to turn the steering wheel.

The pinion housing of the valve is an integral part of the main steering gear casting. The pinion housing has four machined ports which provide connections for pressure feed from the power steering pump, return fluid to the reservoir and pressure feeds to each side of the cylinder piston.

The valve unit comprises an outer sleeve, an input shaft, a torsion bar and a pinion shaft. The valve unit is co-axial with the pinion shaft which is connected to the steering column via the input shaft. The valve unit components are located in the steering gear pinion housing which is sealed with a cap.

The outer sleeve is located in the main bore of the pinion housing. Three annular grooves are machined on its outer diameter. PTFE rings are located between the grooves and seal against the bore of the pinion housing. Holes are drilled radially in each annular groove through the wall of the sleeve. The bore of the outer sleeve is machined to accept the input shaft. Six equally spaced slots are machined in the bore of the sleeve. The ends of the slots are closed and do not continue to the end of the outer sleeve. The radial holes in the outer sleeve are drilled into each slot.

The input shaft has two machined flats at its outer end which allow for the attachment of the steering column intermediate shaft yoke. The flats ensure that the intermediate shaft is fitted in the correct position. The inner end of the input shaft forms a dog-tooth which mates with a slot in the pinion shaft. The fit of the dog-tooth in the slot allows a small amount of relative rotation between the input shaft and the pinion shaft before the dog-tooth contacts the wall of the slot. This ensures that, if the power assistance fails, the steering can be operated manually without over stressing the torsion bar. The central portion of the input shaft has equally spaced longitudinal slots machined in its circumference. The slots are arranged alternately around the input shaft.

The torsion bar is fitted inside the input shaft and is an interference fit in the pinion shaft. The torsion bar is connected to the input shaft by a drive pin. The torsion bar is machined to a smaller diameter in its central section. The smaller diameter allows the torsion bar to twist in response to torque applied from the steering wheel in relation to the grip of the tyres on the road surface.

The pinion shaft has machined teeth on its central diameter which mate with teeth on the steering gear rack. A slot, machined in the upper end of the pinion shaft mates with the dog-tooth on the input shaft. The pinion shaft locates in the pinion housing and rotates on ball and roller bearings.

Servotronic Valve

The Servotronic transducer valve is located in a port in the side of the steering gear valve housing. The valve is sealed in the housing with an O-ring seal and is secured with two long screws into threaded holes in the housing. The Servotronic valve is a transducer controlled valve which responds to control signals supplied from Servotronic software in the instrument cluster.

The Servotronic valve determines the hydraulic reaction at the steering gear rotary valve and controls the input torque required to turn the steering wheel. The Servotronic system allows the steering to be turned with the optimum effort when the vehicle is stationary or manoeuvred at slow speed. The hydraulic reaction changes proportional to the vehicle speed, with the required steering effort increasing as the vehicle moves faster. At high speeds, the Servotronic system provides the

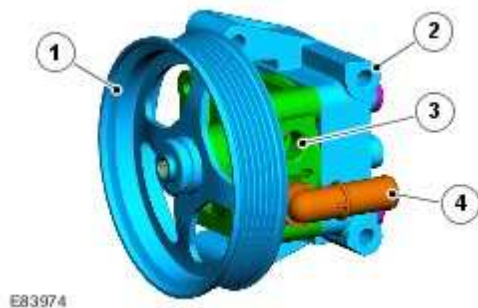
driver with a good feedback through the steering providing precise steering and improved stability.

The instrument cluster receives road speed signals from the ABS module and calculates the correct controlling signal for the Servotronic valve. The Servotronic software within the instrument cluster has a diagnostic capability which allows a Jaguar approved diagnostic system to check the tune of the steering and retrieve fault codes relating to the Servotronic valve. Two fault codes are stored relating to the valve for positive connection short to ground or battery and negative connection short to ground or battery.

The Servotronic software within the instrument cluster also contains a number of steering maps which are selected via the car configuration file depending on the vehicle model and tire fitment.

If a failure of the Servotronic valve or software occurs, the system will suspend Servotronic assistance and only a default level of assistance will be available. Fault codes relating to the fault are stored in the instrument cluster. No warning lamps are illuminated and the driver may be aware of the steering being 'heavier' than usual.

POWER STEERING PUMP



Item	Part Number	Description
1		Pulley
2		Pump body
3		High pressure outlet port (to steering gear)
4		Low pressure suction port (from reservoir)

The power steering pumps used on naturally aspirated and supercharged engine variants are basically the same pump with different flow control valve mechanisms. The pump is a positive displacement, vane type pump which supplies a constant fluid flow to the steering gear valve unit. The pump is driven by a Poly Vee belt from the crankshaft pulley. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

The pump has an internal pressure relief valve and a flow control valve. The pressure relief valve

limits the maximum pressure supplied to the steering gear to 110 bar (1595 lbf in²) ± 4 bar (58 lbf in²). The flow control valve limits the maximum flow to 7.5 l/min (1.64 gal/min) ± 0.75 l/min (0.16 gal/min) regardless of engine speed. The pump has a displacement of 10.5 cm³/rev (0.64 in³/rev).

A shaft runs longitudinally through the pump. One end of the shaft is fitted with a pressed-on drive pulley, the opposite end of the shaft is closed by a cover. The shaft runs in bearings located in the body and oil seals at each end of the shaft prevent leakage of hydraulic fluid. The pump contains ten vanes which rotate within a cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes.

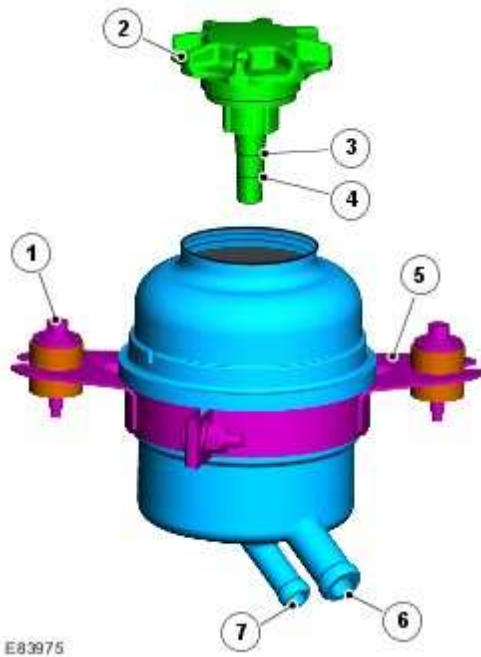
As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurises the hydraulic fluid trapped between them.

Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurised fluid passes from the pump outlet port into the pressure hose to the steering gear.

The pressurised fluid is subject to control by the flow control and pressure relief valve. The flow control valve maintains a constant flow of fluid supplied to the steering gear irrespective of engine speed variations. The pressure relief valve limits the maximum pressure on the output side of the pump. A metering orifice is included in the discharge port of the pump. If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the centre of the flow control valve is lifted from its seat and allows pressurised fluid to recirculate within the pump.

The pressure relief valve will operate if the discharge from the pump is restricted, i.e.; steering held on full lock. If the output from the pump is blocked, all output is recirculated through the pump. In this condition, as no fresh fluid is drawn into the pump from the reservoir, the fluid temperature inside the pump will increase rapidly. Consequentially, periods of operation of the steering gear on full lock should be kept to a minimum to prevent overheating of the pump and the fluid within it.

RESERVOIR



Item	Part Number	Description
1		Mounting bolt (2 off)
2		Cap
3		Maximum oil level
4		Minimum oil level
5		Bracket
6		Feed to pump
7		Return from cooler

The reservoir is located in the engine compartment, forward of the Left Hand (LH) suspension turret. A bracket attached to the reservoir is bolted via 2 rubber mounts, to 2 brackets on the front body crossmember.

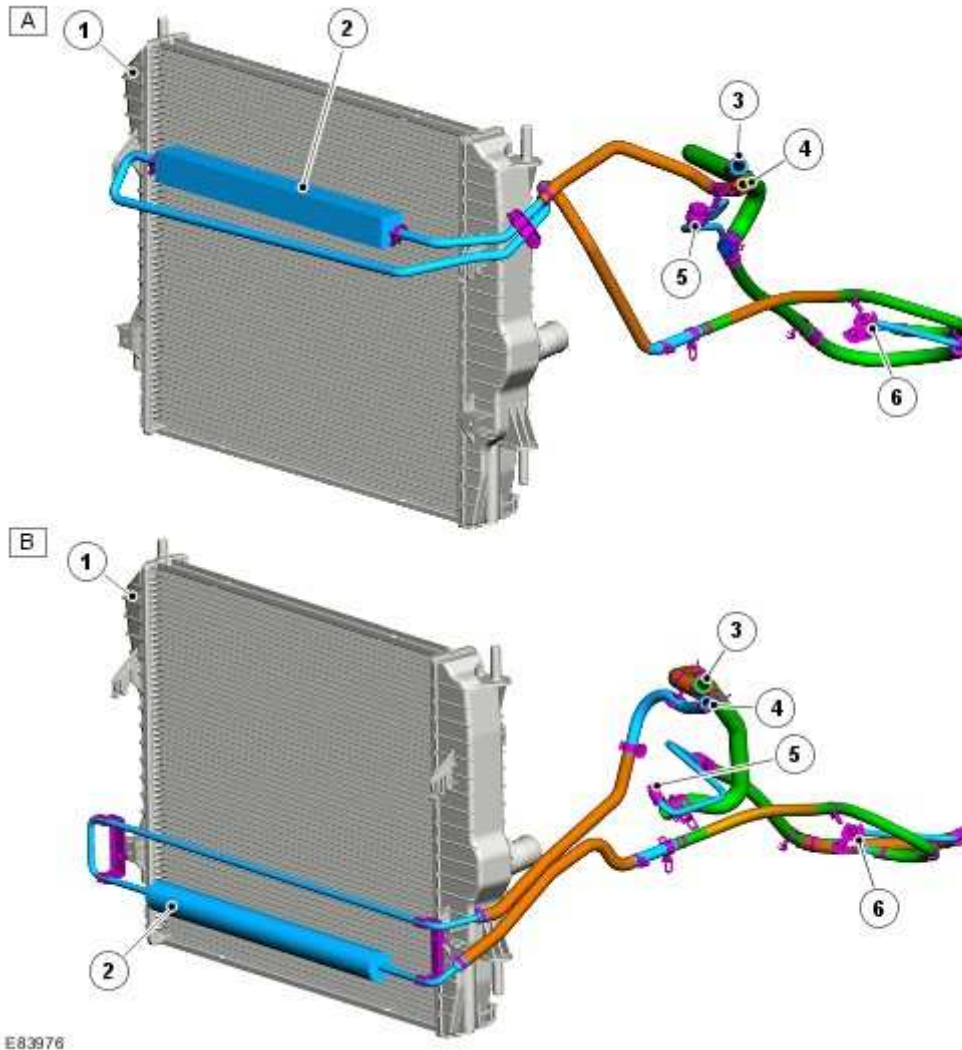
The reservoir is a plastic moulding with an integral 100 micron, non-serviceable filter. Two moulded ports at the base of the reservoir provide for attachment of the fluid supply hose to the power steering pump and fluid return hose from the fluid cooler.

The reservoir is fitted with a removable cap which is screwed into the reservoir body. The cap has a

dip stick with different diameters which denote the minimum and maximum fluid levels.

The reservoir has a fluid capacity to the maximum level of 400 cc (0.85 US pints).

HOSES AND FLUID COOLER



E83976

Item	Part Number	Description
A		Supercharged
B		Naturally aspirated
1		Engine cooling radiator
2		Power steering fluid cooler
3		Reservoir suction pipe

4		Reservoir return pipe
5		Power steering pump pressure pipe
6		Steering gear pressure/return pipes

The supercharged and naturally aspirated vehicles differ in the location of the fluid cooler and consequently the routing of the hoses. The remaining components of the power steering system are similar in both variants.

Hoses

A mixture of metal pipes and rubber hoses are used in the power steering on both models. The high pressure pipe from the pump and the return pipe to the cooler from the steering gear are attached to one mounting plate. The pipe connections are sealed with O ring seals and the plate is secured with a bolt screwed into the steering gear.

On both naturally aspirated models and supercharged models, the pump high pressure pipe is attached to the pump with a threaded, flared, pipe fitting which is sealed with an O ring seal.

Fluid Cooler

The fluid cooler is located in the return circuit from the steering gear to the reservoir. The cooler is an aluminum fin and tube design. Cool air entering the front of the vehicle passes over the cooler and flows through the fins. The fins act as heat exchangers, conducting heat from the fluid as it passes through the tube.

On naturally aspirated models the cooler is located near the bottom of the engine cooling radiator. On supercharged models, the cooler is located higher up, near the top of the radiator, to allow for the fitment of the charge air cooler required on the supercharged model.

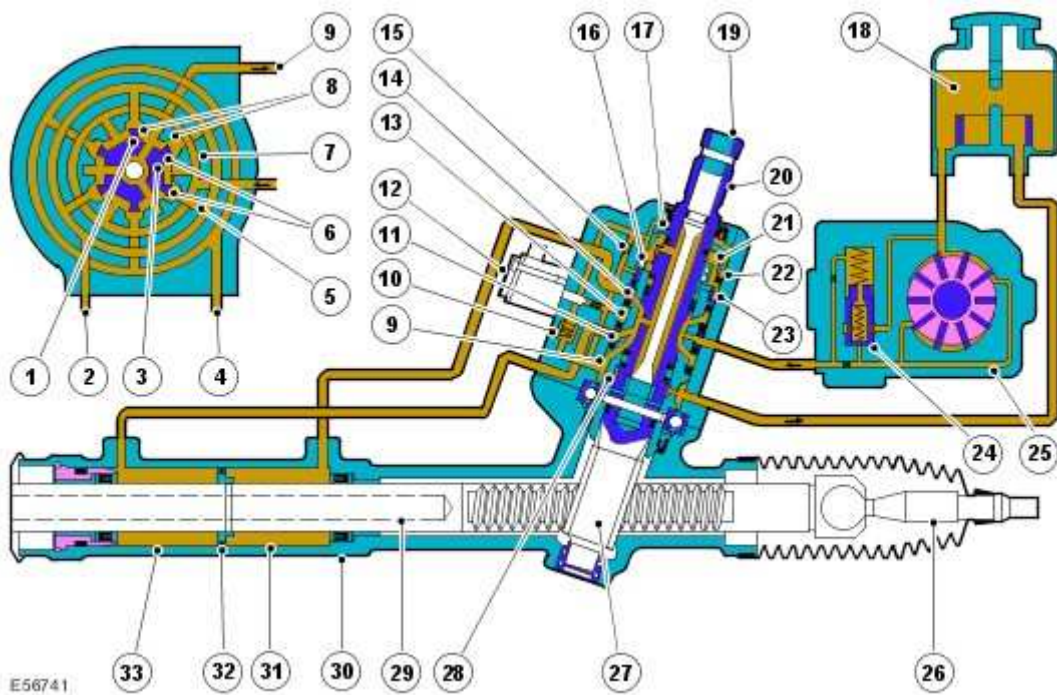
PRINCIPLES OF OPERATION

The following hydraulic circuits show power steering operation and fluid flow for the steering in a straight ahead, neutral position and when turning right. The circuit diagram for turning left is similar to that shown for turning right.

Power Steering in Neutral Position

NOTE:

Circuit shows steering rotary valve in neutral position with the vehicle not moving.



Item	Part Number	Description
1		Return fluid control groove
2		Radial groove
3		Feed fluid control groove
4		Radial groove
5		Axial groove
6		Feed fluid control edge
7		Feed fluid radial groove
8		Return fluid control edge
9		Return fluid chamber
10		Cut-off valve
11		Radial groove
12		Servotronic transducer valve

13		Feed fluid radial groove
14		Radial groove
15		Orifice
16		Balls
17		Compression spring
18		Torsion bar
19		Power steering fluid reservoir
20		Valve rotor
21		Reaction piston
22		Reaction chamber
23		Centering piece
24		Pressure relief/flow limiting valve
25		Power steering pump
26		Inner tie-rod
27		Pinion
28		Valve sleeve
29		Steering gear rack
30		Steering gear housing
31		Power assist cylinder - right
32		Piston
33		Power assist cylinder - left

When the engine is started, the power steering pump draws fluid from the reservoir down the low pressure suction line. The fluid passes through the pump and is delivered at pressure, via a hose, to the steering rack valve unit.

The pressurised fluid flows through a connecting bore in the valve and, via the feed fluid radial groove and the transverse bores in the valve sleeve, passes to the feed fluid control groove of the valve rotor.

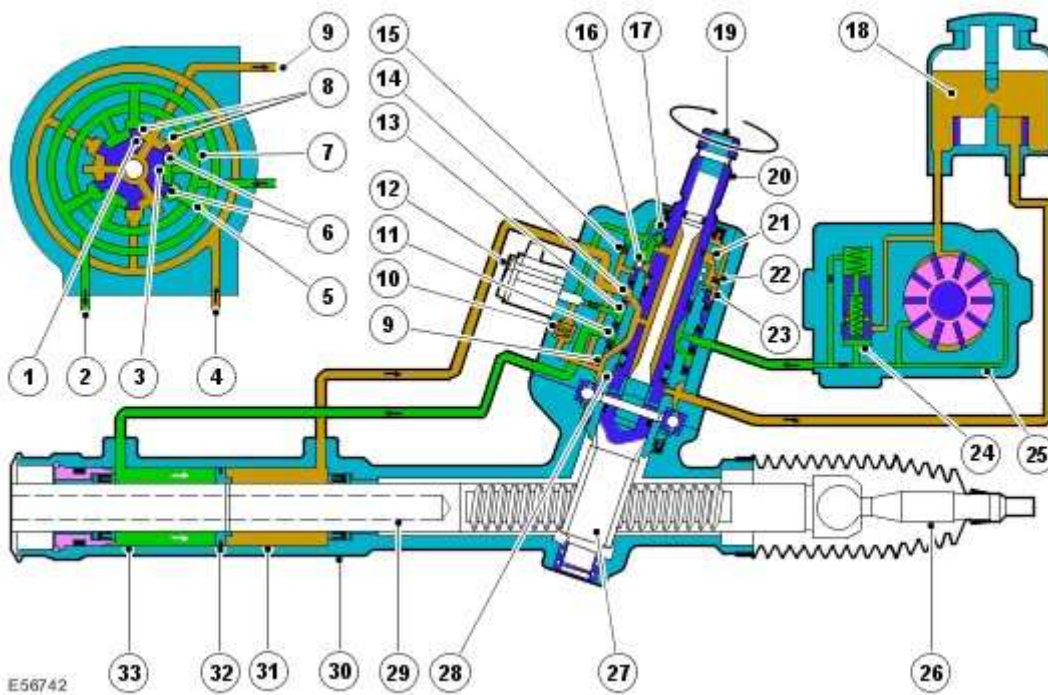
In the neutral (straight ahead) position, the fluid passes over the open feed fluid control edges to all valve sleeve axial grooves. The fluid then passes through return fluid control edges and the return fluid grooves of the valve rotor, back to the reservoir passes via the fluid cooler.

Simultaneously, the radial grooves of the valve and their associated pipes provide a connection the left and right power assist cylinders.

Power Steering in Right Turn Position

NOTE:

Circuit shows steering rotary valve in right turn position, at high vehicle speed and with rapid steering corrections. The Servotronic transducer valve is fully open and the maximum hydraulic reaction is limited by the cut-off valve.



Item	Part Number	Description
1		Return fluid control groove
2		Radial groove

3		Feed fluid control groove
4		Radial groove
5		Axial groove
6		Feed fluid control edge
7		Feed fluid radial groove
8		Return fluid control edge
9		Return fluid chamber
10		Cut-off valve
11		Radial groove
12		Servotronic transducer valve
13		Feed fluid radial groove
14		Radial groove
15		Orifice
16		Balls
17		Compression spring
18		Power steering fluid reservoir
19		Torsion bar
20		Valve rotor
21		Reaction piston
22		Reaction chamber
23		Centering piece
24		Pressure relief/flow limiting valve
25		Power steering pump

26		Inner track rod
27		Pinion
28		Valve sleeve
29		Steering gear
30		Steering gear housing
31		Power assist cylinder - right
32		Piston
33		Power assist cylinder - left

When the steering wheel is turned to the right, the steering rack and piston moves to the left in the piston bore. The valve rotor is rotated to the right (clockwise) and pressurised fluid is directed over the further opened feed fluid control edges and to the associated axial grooves, the radial groove and via an external pipe to the left power assist cylinder chamber. The pressure applied to the piston from the left power assist cylinder chamber provides the hydraulic assistance.

An adaptable pressure build-up is achieved by the partially or fully closed feed fluid control edges restricting or preventing a connection between the fluid pressure inlet and the other axial grooves connected to the radial groove.

Simultaneously, the fluid pressure outlet to the pressurised axial grooves are restricted or partially restricted by the closing return fluid control edges. The fluid displaced by the piston from the right power assist cylinder chamber, flows through an external pipe to the radial grooves. From there the fluid passes to the associated axial grooves and on to the return fluid control grooves, via the further opened return fluid control edges.

The return flow of fluid to the reservoir passes via interconnecting bores which lead to the return fluid chamber. When the steering wheel is turned to the left the operating sequence is as above but the pressure is applied to the opposite side of the piston.

Servotronic Operation

The Servotronic software contains a number of steering maps which are selected via the car configuration file depending on the vehicle mode and tire fitment.

If a failure of the Servotronic valve or software occurs, the system will suspend Servotronic assistance and only normal power steering wheel be available. Fault codes relating to the fault are stored, but no warning lamps are illuminated and the driver may be aware of the steering being 'heavier' than usual.

When the vehicle is manoeuvred into and out of a parking space (or other similar manoeuvre), the Servotronic software uses road speed data from the ABS module to determine the vehicle speed, which in this case will be slow or stationary. The Servotronic software analyses the signals and outputs an appropriate control current to the Servotronic transducer valve. The Servotronic valve closes and prevents fluid flowing from the feed fluid radial groove to the reaction chamber. An orifice also ensures that there is return pressure in the reaction chamber. This condition eliminates any 'reaction' ensuring that the steering is very light to operate, reducing the effort required to turn the steering wheel. .

As the vehicle is driven and the road speed increases, the Servotronic software analyses the road speed signals from the ABS module and reduces the amount of control current supplied to the Servotronic valve which increases the reaction pressure. This modifies the input torque applied through the steering wheel and provides the driver with an improved 'road feel' allowing precise steering and directional stability.

Power Steering

For additional information, refer to [211-00](#).

Power Steering Fluid Cooler - 4.2L NA V8 - AJV8 (57.15.11)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . Remove the front bumper cover.
For additional information, refer to Front Bumper Cover (76.22.78)

4 . NOTE:

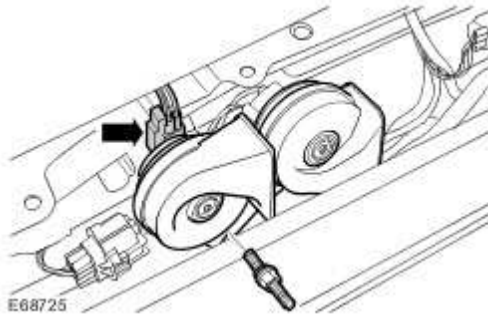
Note the fitted position.

Remove the horn assembly.

▶ Disconnect the electrical connector.

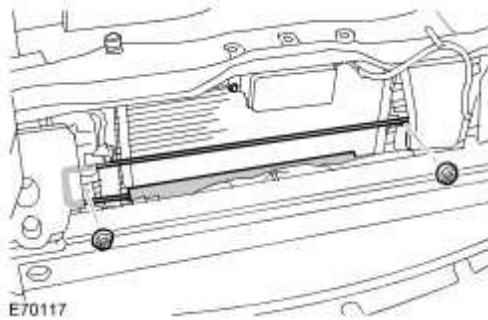
▶ Release the wiring harness clip.


▶ Remove the stud.



5 . Release the power steering fluid cooler.

▶ Remove the 2 nuts.

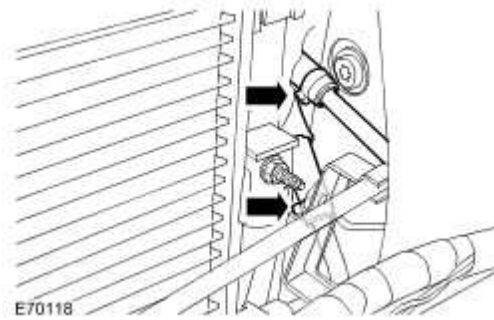


6  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.**

Remove the power steering fluid cooler.

▶ Remove and discard the hose clips.

▶ Position a container to collect the fluid spillage.



Installation

1 . Install the power steering fluid cooler.

- ▶ Clean the components.
- ▶ Connect the hoses and secure with the clips.
- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

2 . Install the horn assembly.

- ▶ Tighten the stud to 25 Nm (18 lb.ft).
- ▶ Attach the wiring harness.
- ▶ Connect the electrical connector.

3 . Install the front bumper cover.

For additional information, refer to Front Bumper Cover (76.22.78)

4 . Connect the battery ground cable and install the cover.

For additional information, refer to

5 . Refill and bleed the power steering.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Power Steering Fluid Cooler - 4.2L SC V8 - AJV8 (57.15.11)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to Specifications

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


- 3 . Remove the intake air resonator.

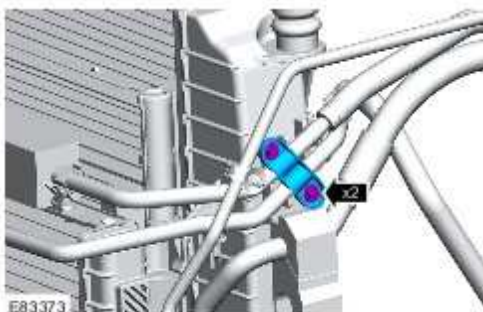
For additional information, refer to Intake Air Resonator

- 4 . Remove the front bumper cover.

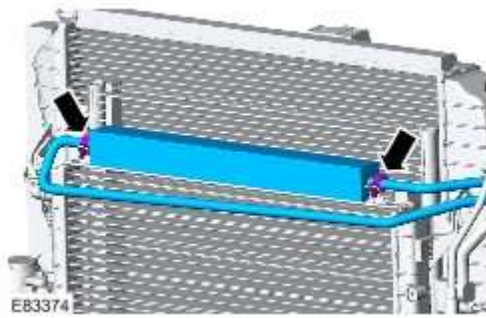
For additional information, refer to Front Bumper Cover (76.22.78)

- 5 . Release the power steering fluid cooler.

 Remove the 2 bolts.



6 . Release the 2 power steering fluid cooler clips.



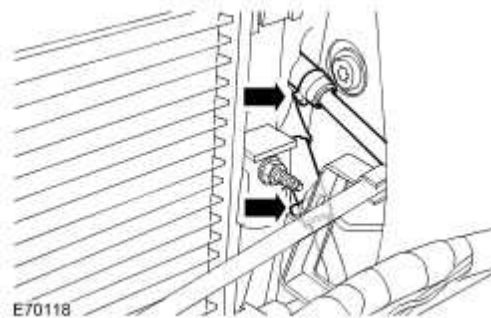
7



CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

Remove the power steering fluid cooler.


- ▶ Remove and discard the hose clips.
- ▶ Position a container to collect the fluid spillage.



Installation

1 . Install the power steering fluid cooler.

- ▶ Clean the components.
- ▶ Connect the hoses and secure with the clips.
- ▶ Tighten the bolts to 7 Nm (5 lb.ft).

 Secure with the clips.

2 . Install the front bumper cover.

For additional information, refer to Front Bumper Cover (76.22.78)

3 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

4 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

5 . Refill and bleed the power steering.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Power Steering Fluid Reservoir - 4.2L NA V8 - AJV8 (57.15.08)

Removal



CAUTION: If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

2 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)

3 . Remove the air intake duct.

▶ Remove the bolt.


▶ Release the 2 clips.



4 . Release the power steering fluid reservoir.

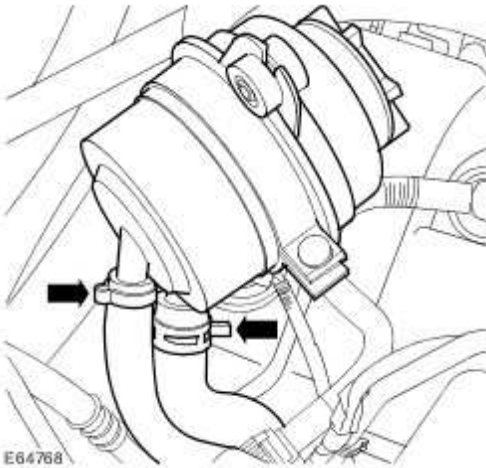
▶ Remove the 2 bolts.



- 5 .  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

Release the 2 power steering fluid reservoir lines.

- ▶ Position a container to collect the fluid.
- ▶ Release the feed line clip.
- ▶ Remove and discard the return line clip.



- 6 . Remove the power steering fluid reservoir.

Installation

1 . Attach the power steering fluid reservoir lines.

▶ Clean the components.

▶ Secure with the clips.

2 . Secure the power steering fluid reservoir.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

3 . Install the air intake duct.

▶ Tighten the clips.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

4 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to

6 . Check and top-up power steering fluid level.

For additional information, refer to Power Steering System Bleeding (57.15.02)

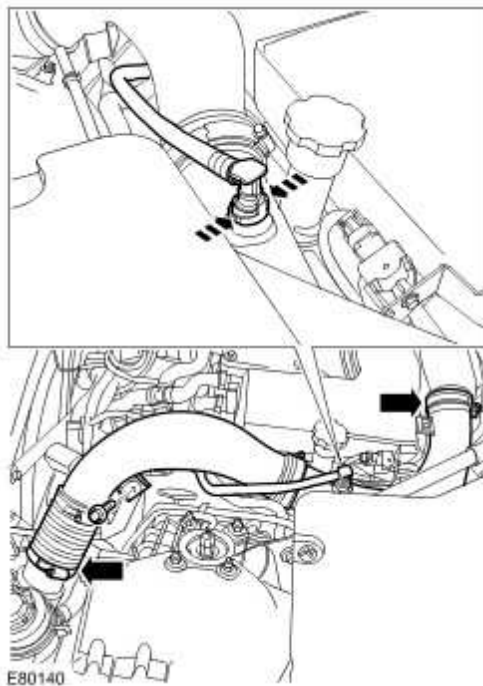
Power Steering Fluid Reservoir - 4.2L SC V8 - AJV8 (57.15.08)

Removal



CAUTION: If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.


- 1 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)
- 2 . Remove the LH intake air resonator.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the engine breather line.



3 . Release the power steering fluid reservoir.

▶ Remove the 2 bolts.



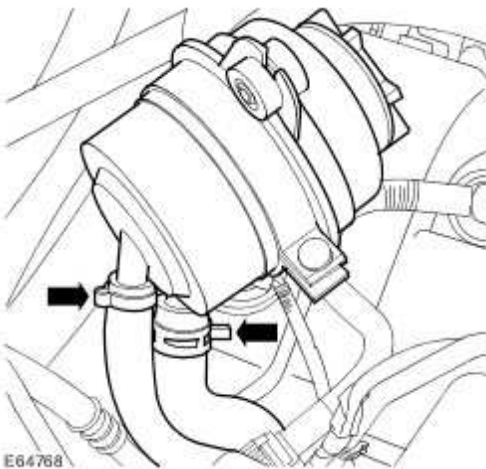
4 .  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.**

Release the 2 power steering fluid reservoir lines.

▶ Position a container to collect the fluid.

▶ Release the feed line clip.

▶ Remove and discard the return line clip.



5 . Remove the power steering fluid reservoir.

Installation

1 . Attach the power steering fluid reservoir lines.

▶ Clean the components.

▶ Secure with the clips.

2 . Secure the power steering fluid reservoir.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

3 . Install the intake air resonator.

▶ Tighten the clips.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

▶ Connect the engine breather line.

4 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)


5 . Check and top-up power steering fluid level.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)


Removal

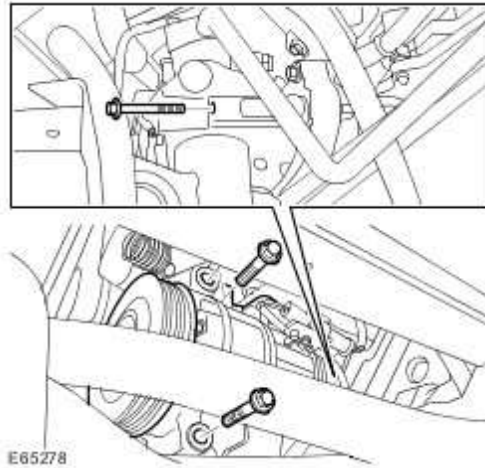
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 4 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)
- 5 . Release the air conditioning compressor.


 Remove the 3 bolts.




- 6 .  **WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.**

 **CAUTION: Always plug any open connections to prevent contamination.**

Disconnect the low pressure line from the power steering pump.


 Release the clip.

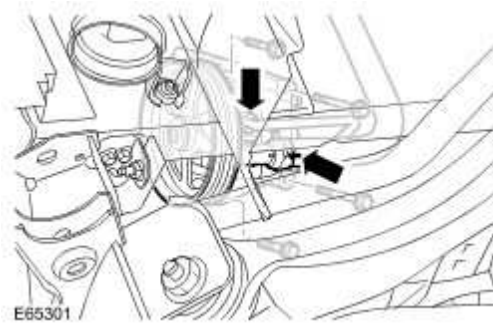
- 7 .  **CAUTION: Always plug any open connections to prevent contamination.**

Disconnect the high pressure line from the power steering pump.

 Remove and discard the O-ring seal.

- 8 . Remove the power steering pump.

 Remove the 4 bolts.



Installation

1 . Install the power steering pump.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

2 . Connect the high pressure line.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the union to 25 Nm (18 lb.ft).

3 . Connect the low pressure line.

- ▶ Clean the component mating faces.
- ▶ Secure with the clip.

4 . Secure the A/C compressor.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

5 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)

6 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

7 . Connect the battery ground cable and install the cover.

For additional information, refer to


8 . Check and top-up power steering fluid level.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Power Steering Pump - 4.2L SC V8 - AJV8 (57.20.14)


Removal

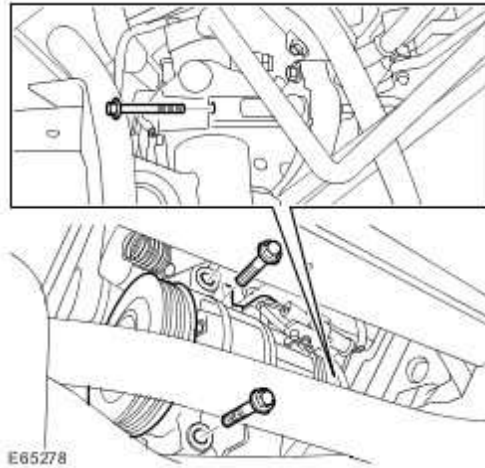
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 4 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)
- 5 . Release the air conditioning compressor.


 Remove the 3 bolts.




- 6 .  **WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.**

 **CAUTION: Always plug any open connections to prevent contamination.**

Disconnect the low pressure line from the power steering pump.


-  Release the clip.

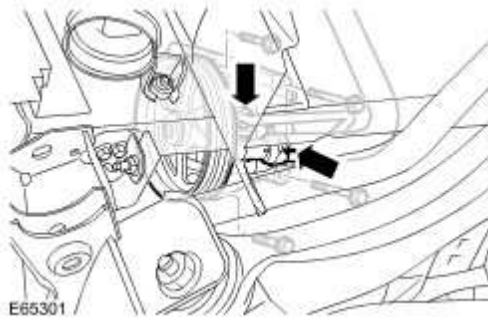
- 7 .  **CAUTION: Always plug any open connections to prevent contamination.**

Disconnect the high pressure line from the power steering pump.

-  Remove and discard the O-ring seal.

- 8 . Remove the power steering pump.

-  Remove the 4 bolts.



Installation

1 . Install the power steering pump.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

2 . Connect the high pressure line.

▶ Clean the component mating faces.

▶ Install a new O-ring seal.

▶ Tighten the union to 25 Nm (18 lb.ft).

3 . Connect the low pressure line.

▶ Clean the component mating faces.

▶ Secure with the clip.

4 . Secure the A/C compressor.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

5 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)

6 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

8 . Check and top-up power steering fluid level.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Steering Gear (57.10.01)

Removal



CAUTION: Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



CAUTION: Do not turn the steering wheel with the lower steering column disconnected as damage to the clock spring and steering wheel switches may occur.

NOTE:


Make sure the steering is in the straight ahead position.

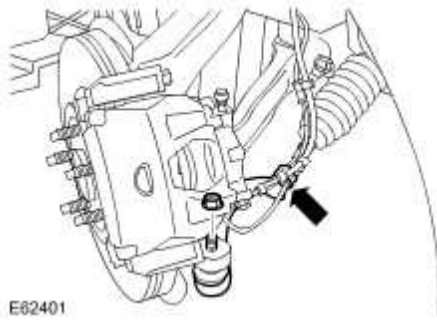
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 . Raise and support the vehicle.

- 3 . Remove the front wheels and tires.
For additional information, refer to Wheel and Tire (74.20.05)

- 4 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

- 5 . Release both tie-rod end ball joints.
 Remove and discard the 2 nuts.




6 . Disconnect the power steering control valve actuator electrical connector.



7 .  **CAUTION: Air tools MUST NOT be used on steering column bolts.**

Disconnect the lower steering column from the steering gear.

 Remove and discard the bolt.



8 . Release the power steering line support bracket.

9



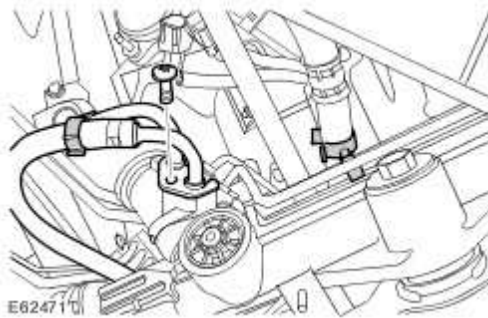
CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

NOTE:

Some fluid spillage is inevitable during this operation.

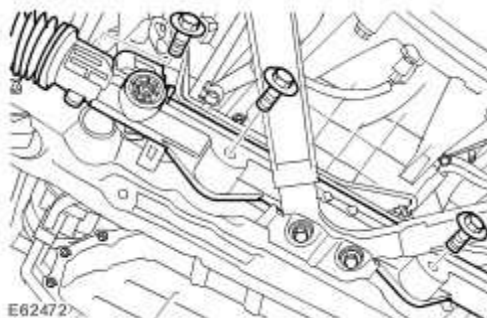
Disconnect the power steering feed and return fluid lines from the steering gear.

- ▶ Remove the bolt.
- ▶ Position a container to collect spillage.
- ▶ Remove and discard both O-ring seals.



10 . Remove the steering gear.

- ▶ Remove the 3 bolts.



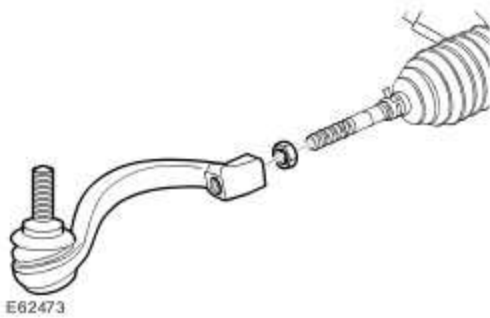
- 11 .  **CAUTION: Do not allow the gaiter to twist.**

NOTE:

Do not disassemble further if the component is removed for access only.

Remove both tie rod ends.

- ▶ Loosen the tie-rod end ball joint retaining nut.
- ▶ Repeat the above procedure for the other side.




Installation

- 1 . Install both tie rod ends.
 - ▶ Tighten the tie rod end lock nut to 55 Nm (40 lb.ft).
- 2 . Install the steering gear.
 - ▶ Tighten the bolts to 100 Nm (74 lb.ft).
- 3 . Connect the power steering feed and return fluid lines.
 - ▶ Install the new O-ring seals.
 - ▶ Tighten the bolt to 15Nm (11 lb.ft).

4 . Connect the power steering control valve actuator electrical connector.

5 . Secure the power steering line support mount.

6 . Connect the steering column lower shaft.

 Tighten the bolt to 35 Nm (26 lb.ft).

7 . Connect the tie-rod end ball joints.

8 . Install the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

9 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

10 . Connect the battery ground cable and install the cover.

For additional information, refer to

11 . Fill and bleed the power steering system.

For additional information, refer to Power Steering System Bleeding (57.15.02)

12 Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

Steering Gear Bushing (57.10.30)

Special Service Tools



204-275

Bushing remover and installer bolt
204-275



204-274

Bushing remover and installer nut
204-274



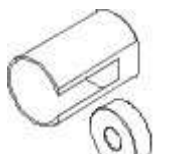
JAG-061

Bearing kit
JAG-061



204-273


Steering gear lower bushing remover and installer
204-273



211-271


Steering gear upper bushing remover and installer
211-271

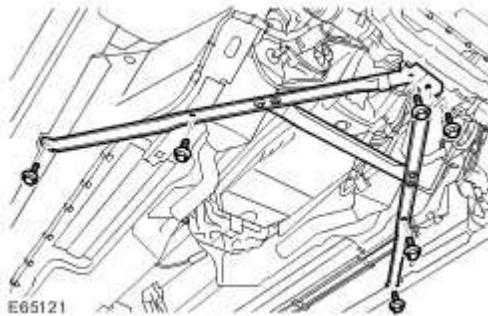
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)
- 3 . With assistance, remove the A-frame.

 Remove the 6 bolts.




- 4 . Disconnect the power steering control valve actuator electrical connector.
- 5 . Release the power steering line support bracket.




6.  **CAUTION: Air tools MUST NOT be used on steering column bolts.**

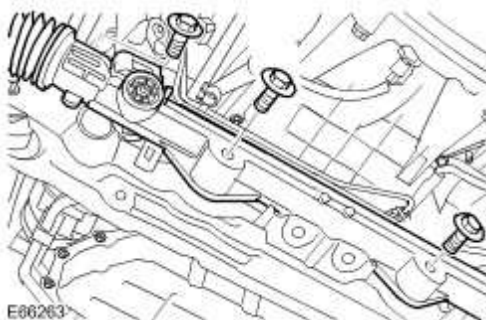
Disconnect the lower steering column from the steering gear.

-  Remove and discard the bolt.

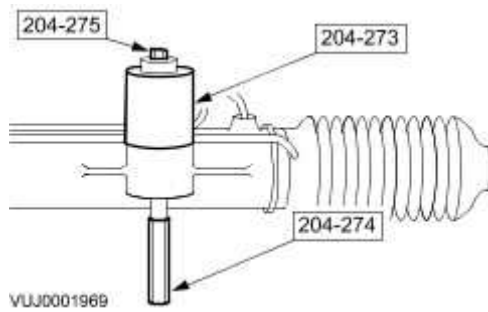


7. Release the steering gear.

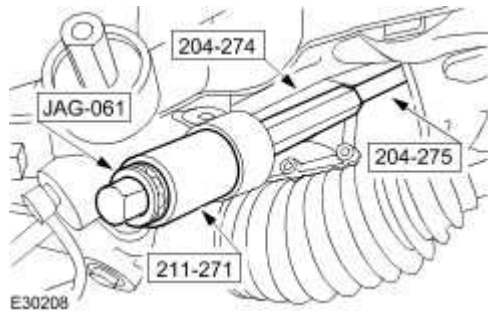
-  Remove the 3 bolts.



- Using the special tools, remove the steering gear lower bushing.

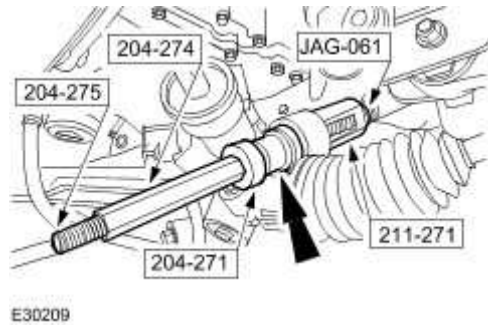


- Using the special tools, remove the steering gear upper bushing.

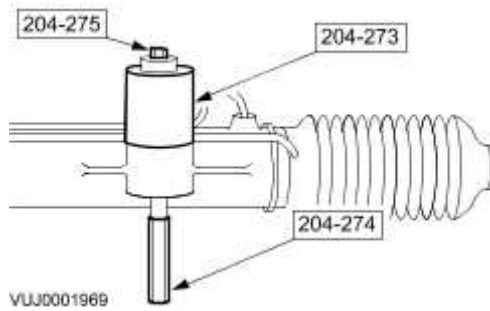


Installation

- Using the special tools, install the steering gear upper bushing.



- Using the special tools, install the steering gear lower bushing.



3 . Install the steering gear.

▶ Tighten the bolts to 100 Nm (74 lb.ft).

4 . Connect the power steering control valve actuator electrical connector.

5 . Secure the power steering line support bracket.

6 . Connect the steering column lower shaft.

▶ Tighten the bolt to 35 Nm (26 lb.ft).

7 . With assistance, install the A-frame.

▶ Tighten the bolts to 55 Nm (40 lb.ft).

8 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

Steering Angle Sensor

Removal

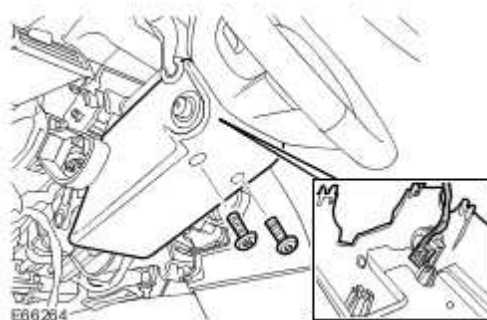
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Make the SRS system safe.
For additional information, refer to Standard Workshop Practices

- 3 . Remove the steering wheel.
For additional information, refer to Steering Wheel (57.60.01)

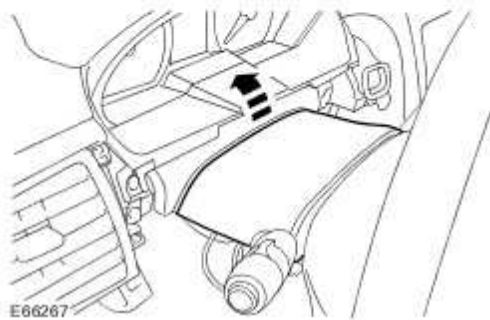
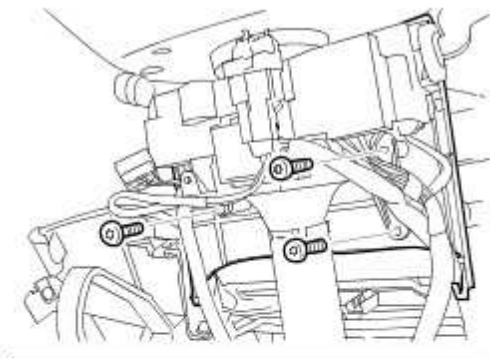
- 4 . Remove the instrument panel, lower trim panel.
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

- 5 Remove the steering column lower cowl.
 - ▶ Remove the 2 screws.
 - ▶ If installed, disconnect the steering column and foot pedal control switch electrical connector.



- 6 . Remove the steering column upper cowl.

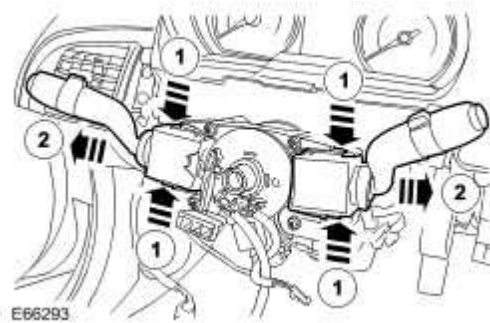
- ▶ Remove the 3 screws.



7 . Release the multifunction switch.

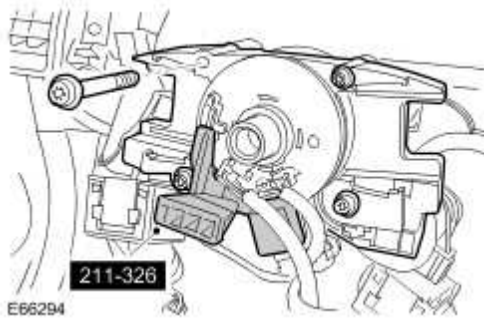
▶ Depress the 2 clips.

▶ Repeat the above procedure on the opposite hand.



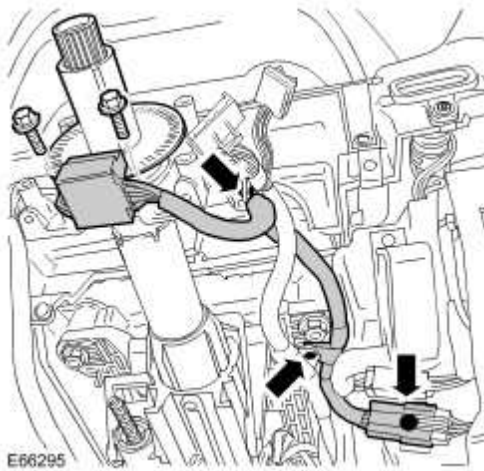
8 . Release the clockspring.

▶ Remove the 4 Torx bolts.



9 . Remove the steering angle sensor.

- ▶ Disconnect the electrical connector.
- ▶ Release the 3 wiring harness clips.
- ▶ Separate the harness.
- ▶ Remove the 2 bolts.
- ▶ Remove the reluctor ring.



Installation

1 . Install the steering angle sensor.

- ▶ Install the reluctor ring.

- ▶ Tighten the bolts to 3 Nm (2.2 lb.ft).

- ▶ Connect the electrical connector.

- ▶ Secure the clips.

2 . Install the clockspring.

- ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

3 . Install the steering column upper cowl.

- ▶ Install the screws.

4 Install the steering column lower cowl.

- ▶ If installed, connect the steering column and foot pedal switch electrical connector.

- ▶ Secure in the clips.

- ▶ Install the screws.

5 . Install the instrument panel, lower trim panel.

For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

6 . Install the steering wheel.

For additional information, refer to Steering Wheel (57.60.01)

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

211-03 : Steering linkage

Specifications

Specifications

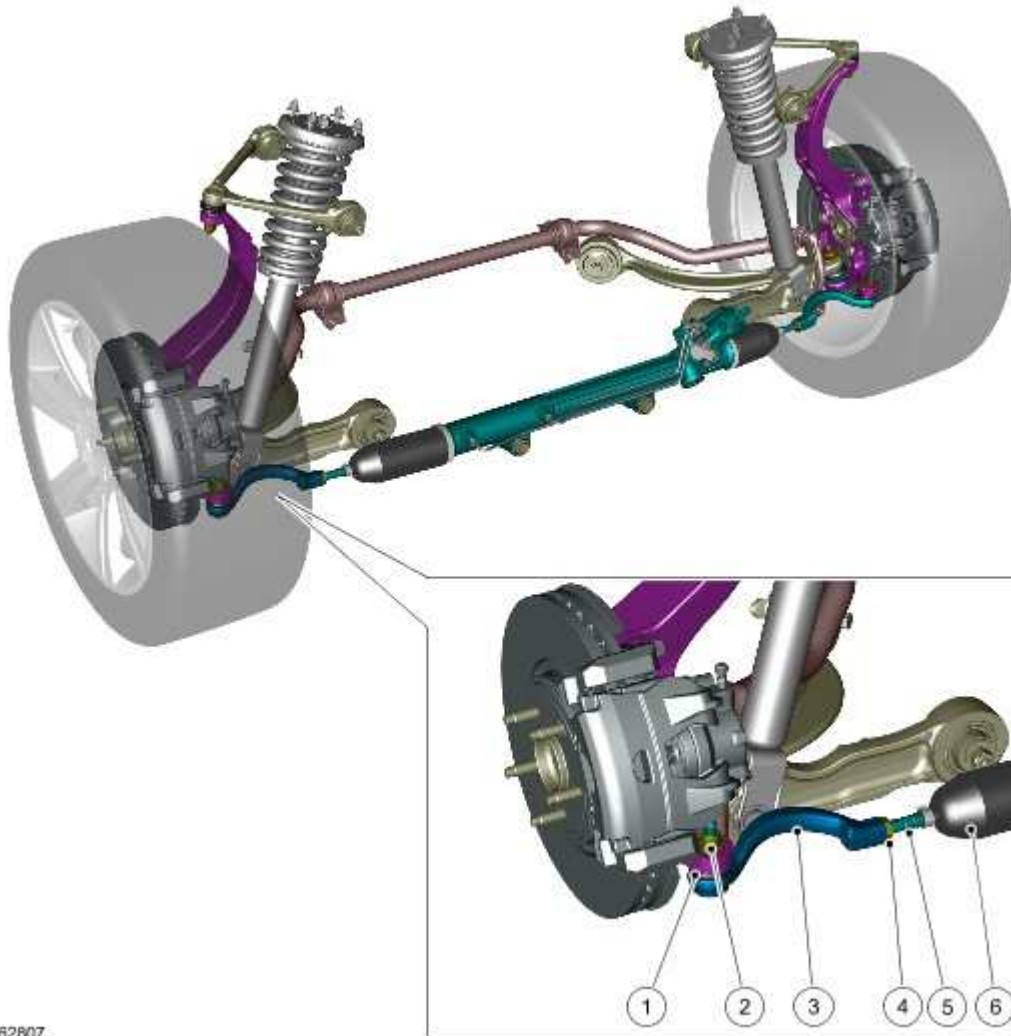
Torque Specifications

Item	Nm	lb-ft	lb-in
Tie rod end ball-joint to wheel knuckle - nut*	75	55	-
Tie rod end - locking nut*	55	40	-

* New nuts/bolts must be installed.

Steering Linkage

COMPONENT LOCATION



Item	Part Number	Description
1		Taper ball joint
2		Locknut
3		Tie rod arm - outer
4		Locknut

5		Tie rod arm - inner
6		Gaitor

INTRODUCTION

The steering linkage comprises the tie rod which provides the connection between the steering gear and the front wheel knuckle. Each end of the steering gear has a threaded hole which provides for the fitment of the tie rods. The external ends of the tie rods are sealed with gaitors to prevent the ingress of dirt and moisture into the steering gear.

Each tie rod comprises two parts; an inner and outer tie rod. The inner and outer tie rods are screwed into each other and locked with a locknut to prevent inadvertent movement. The threads on the tie rods allow the position of the outer tie rod to be adjusted in order to set the correct toe angle for each front wheel.


The outer tie rod incorporates a non-serviceable tapered ball joint which locates in a tapered hole in the front wheel knuckle and is secured with a self-locking nut. The ball joint has an internal hexagonal drive which enables the joint to be held stationary when the self-locking nut is tightened.

Steering Linkage

For additional information, refer to [211-00](#)

Steering Gear Boot (57.10.29)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Remove the tie-rod end.
 - For additional information, refer to Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)
 - For additional information, refer to

3 . **NOTE:**


Note the fitted position.

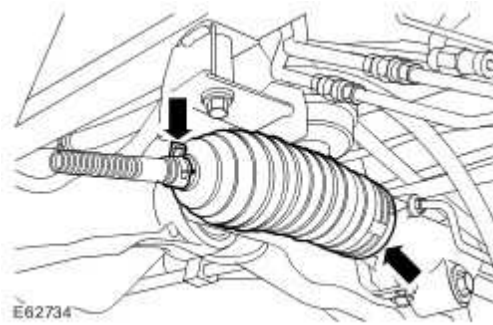
Remove the locknut.

4 . **NOTE:**

Clean the components general area prior to dismantling.

Remove the steering gear boot.

 Release the 2 clips.



Installation

1 . Install the steering gear boot.

- ▶ Clean the component mating faces.
- ▶ Carefully secure the clips.

2 . **NOTE:**

Align to the position noted on removal.

Install the locknut.

3 Install the tie-rod end.

- . For additional information, refer to Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)


For additional information, refer to

4 Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

For additional information, refer to Front Toe Adjustment (57.65.01)

Tie Rod End - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (57.55.02)


Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

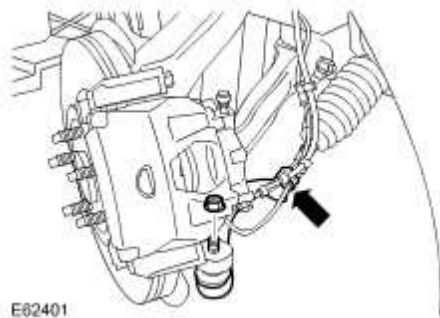
Raise and support the vehicle.

- 2 . Remove the front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

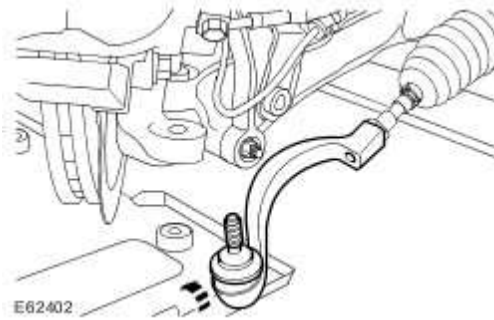
- 3 . Loosen the tie-rod end lock nut.

- 4  **CAUTION: To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.**

Remove and discard the tie rod end retaining nut.



- 5 . Remove the tie-rod end, note the number of turns for installation.



Installation

1 . Install the tie rod end, note the number of turns until adjacent to the locknut.

2



CAUTION: To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.

Connect the tie-rod end ball joint.

- ▶ Clean the component mating faces.
- ▶ Install a new nut and tighten to 75 Nm (55 lb.ft).

3 . Tighten the tie-rod locking nut.

- ▶ Clean the component mating faces.
- ▶ Tighten the nut to 55 Nm (40 lb.ft).

4 . Install the front wheel.

For additional information, refer to Wheel and Tire (74.20.05)

5 Using only four-wheel alignment equipment approved by Jaguar, check and adjust the wheel alignment.

211-04 : Steering column

Specifications

Specifications

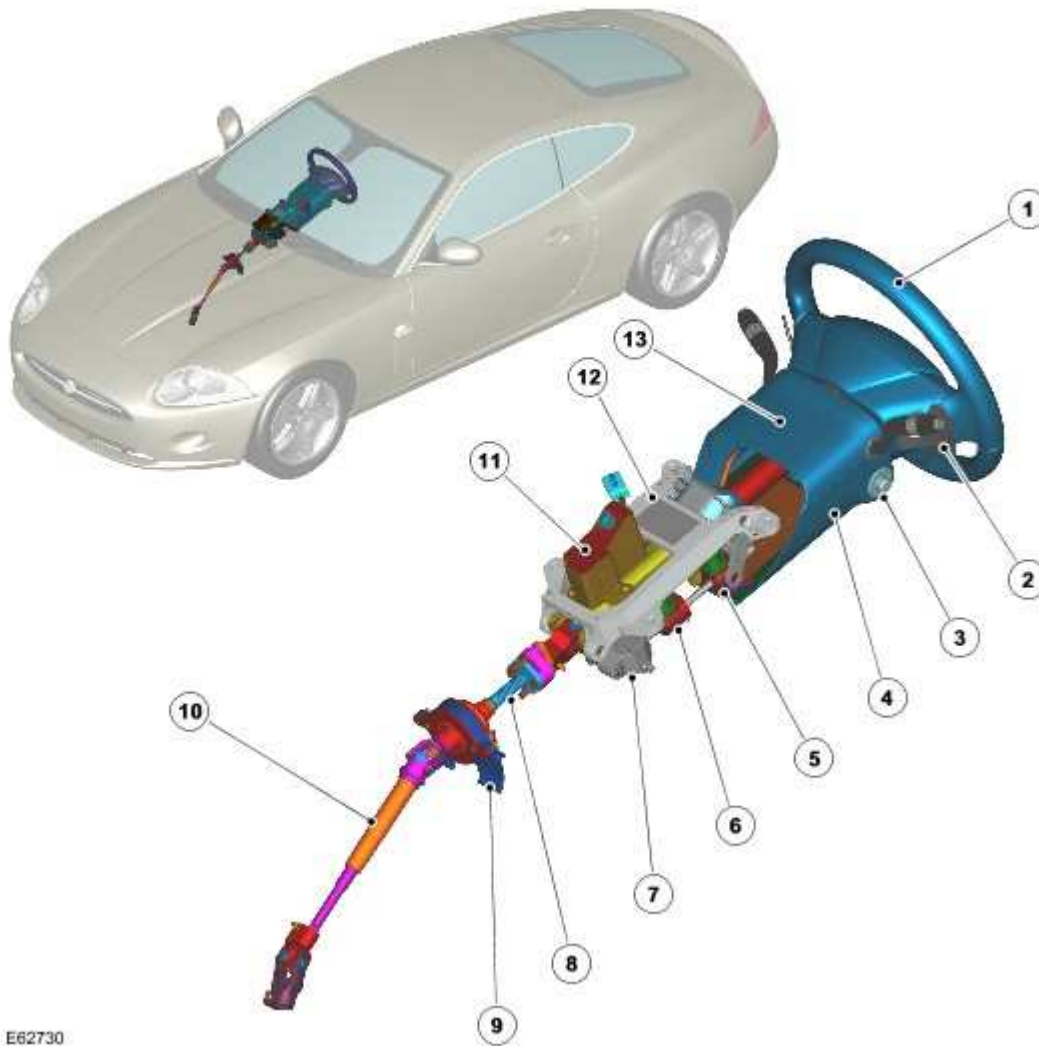
Torque Specifications

Item	Nm	lb-ft	lb-in
Clock spring to steering column - bolt	7	5	62
Lower steering column, bearing-carrier to body - bolt	9	7	80
Lower steering column, bearing to bearing carrier - bolt	9	7	80
Lower steering column to steering gear - universal-joint pinch bolt*	30	22	-
Steering column to vehicle body - nuts	24	18	-
Steering column to lower steering column - universal-joint pinch bolt*	30	22	-
Steering wheel to steering column - bolt	62	46	-

* New nuts/bolts must be installed.

Steering Column

COMPONENT LOCATION



E62730

Item	Part Number	Description
1		Steering wheel
2		Gear change paddle switch (if fitted)
3		Column adjust switch
4		Lower shroud

5		Rake adjustment housing
6		Reach adjustment housing
7		Column adjustment motor
8		Lower column - upper collapse shaft
9		Bulkhead bearing assembly
10		Lower column - lower collapse shaft
11		Electric steering column lock mechanism
12		Column mounting plate
13		Upper shroud

INTRODUCTION

The steering column comprises the upper column assembly, the lower column assembly and the steering wheel. The three components are positively connected together to pass driver rotary input from the steering wheel to a linear output of the steering gear.

The upper column assembly contains electrical adjustment for steering wheel reach and rake and also provides the location for the ignition switch, the electric steering column lock mechanism and the steering angle sensor.

The steering column is attached to the in-vehicle crossbeam. Crash load absorption is provided by a 'peeling tube' mechanism.

Column adjustment is provided by a single motor for both reach and rake adjustment. Operation of the column adjustment is controlled by a four way joystick type switch located in the column lower shroud. Column adjustment is an integral part of the driver position memory system and also incorporates an entry/exit mode to allow the driver additional room to enter and exit the vehicle.

An electric steering column lock mechanism is positioned on the column assembly. The lock is controlled by the CJB (central junction box) and is an integral function of the passive start system.

Two plastic shrouds are fitted to the upper column assembly. The lower shroud is fitted with an energy absorbing foam pad to minimize leg injury in the event of an accident.

The lower column assembly comprises two splined shafts connected by a universal joint in the center. The splines of the upper shaft locate in a flexible coupling which in turn is located in the yoke on the lower shaft of the upper column assembly. The splines allow the shaft to collapse in the event

of an accident. The flexible coupling controls axial and torsional movements and also assists with noise and vibration damping.

A bulkhead mounted bearing is located on the upper shaft and supports the lower column as it passes from the passenger compartment to the engine compartment.

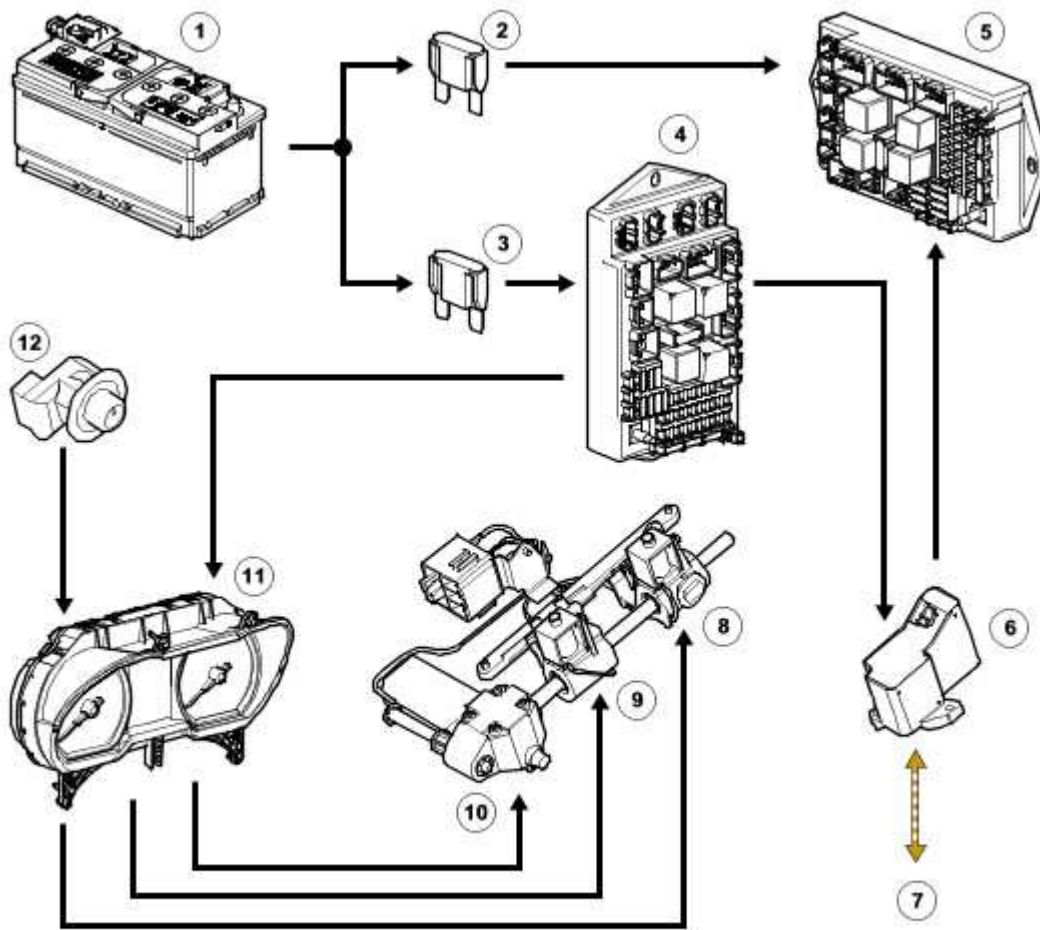
The splines on the lower shaft locate in a universal joint which in turn is connected to the steering gear input shaft. The lower column assembly incorporates a crash collapse mechanism in the form of a 'tube-in-tube' design.

The steering wheel locates on a splined shaft in the upper column assembly and is secured with a bolt. The steering wheel houses the driver's airbag and switches for the audio system, gear change (if fitted) and speed control. A clockspring is used to connect to the vehicle harness.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus



E62733



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Central Junction Box (CJB)
5		Auxiliary fusebox
6		Electric steering column lock mechanism
7		High Speed CAN connection to other vehicle systems

8		Rake adjustment solenoid and potentiometer
9		Reach adjustment solenoid and potentiometer
10		Steering column adjustment motor
11		Instrument cluster
12		Steering column adjustment switch

Steering Column

For additional information, refer to [<<211-00>>](#).

Steering Column (57.40.01)

Special Service Tools



E43628

Clockspring locking tool

211-326




E65858

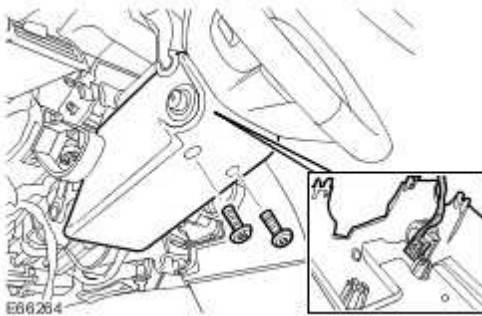
Driver air bag module remover

501-106

Removal

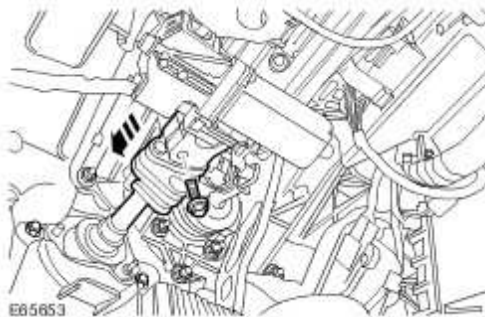
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Make the SRS system safe.
- 3 . Remove the instrument panel lower trim panel.
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)
- 4 Remove the steering column lower cowl.
.
 Remove the 2 screws.

- ▶ If installed, disconnect the steering column and foot pedal control switch electrical connector.



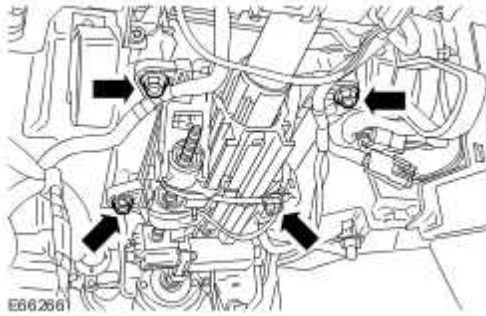
- 5
- ▶ **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Check the road wheels are in the straight ahead position, then remove the steering column universal joint upper clamp bolt.



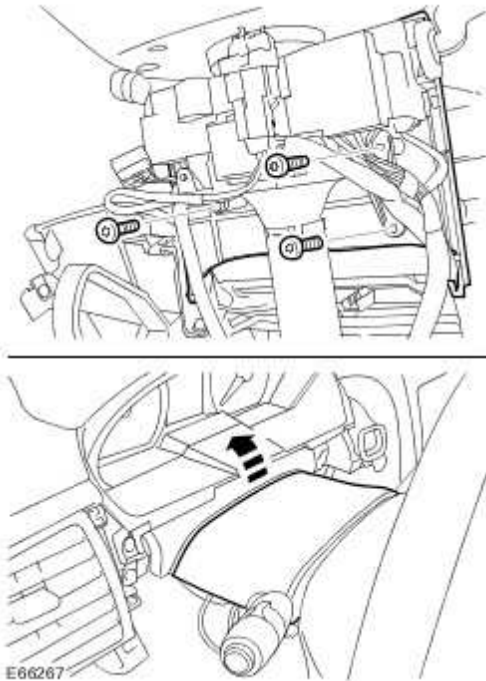
- 6 . Release the steering column.

- ▶ Loosen but do not remove the 4 nuts.



7 . Remove the steering column upper cowl.

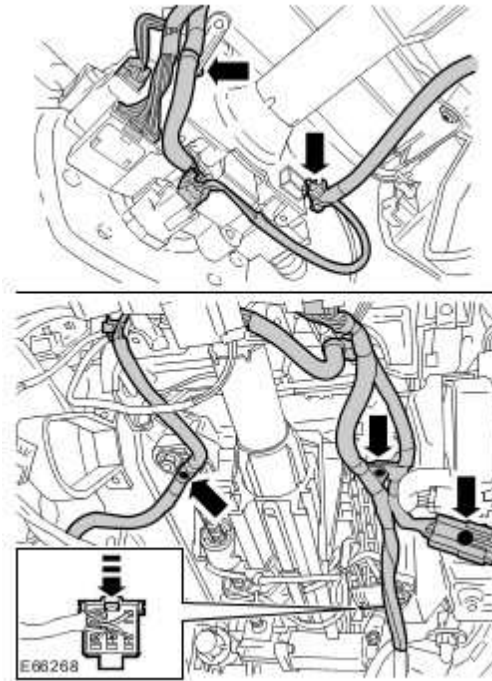
▶ Remove the 3 screws.



8 . Disconnect the upper steering column wiring harness connections.

▶ Disconnect the 6 electrical connectors.

▶ Release the 3 wiring harness clips.

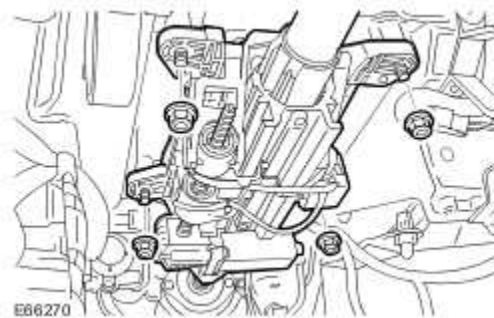


9 . Disconnect the steering angle sensor electrical connector.

▶ Release the 3 clips.

10 . Remove the steering column.

▶ Remove the 4 nuts.

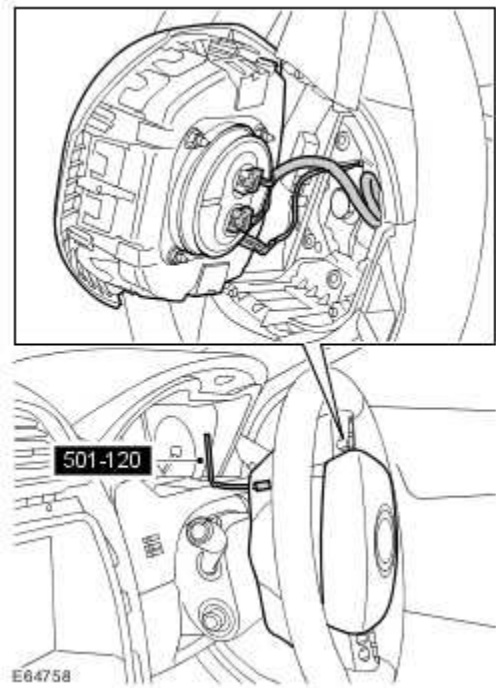


11 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Using the special tool, remove the driver air bag module.

- ▶ Rotate the steering wheel for access to slots.
- ▶ Carefully release the 2 clips.
- ▶ Disconnect the 3 electrical connectors.



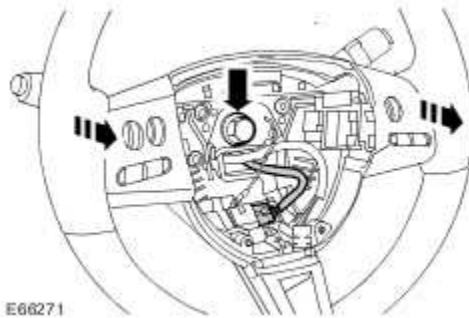
12 . NOTE:


Note the fitted position.

Remove the steering wheel.

- ▶ Disconnect the electrical connector.
- ▶ Loosen, but do not fully remove the bolt.
- ▶ Release the steering wheel from the spline.
- ▶ Remove the bolt.

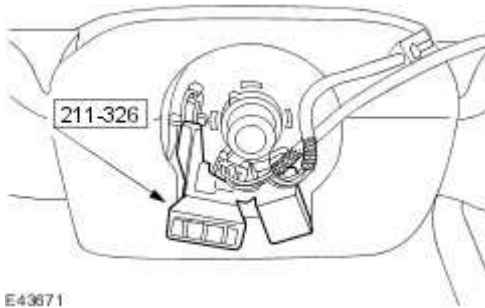
▶ Release the electrical harness.



- 13 .  **CAUTION: Failing to install the clockspring special tool, may result in damage to vehicle.**

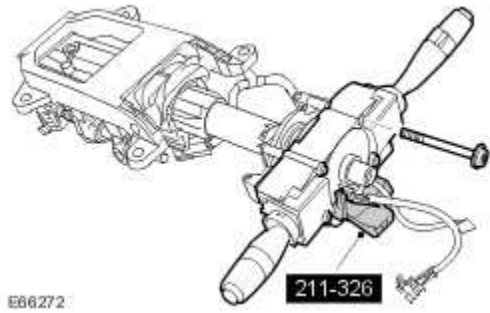
 **CAUTION: Do not dismantle the clockspring, it has no serviceable parts and must be replaced as a complete assembly.**

Install the special tool to the clockspring.



- 14 . Remove the clockspring.

▶ Remove the 4 Torx bolts.

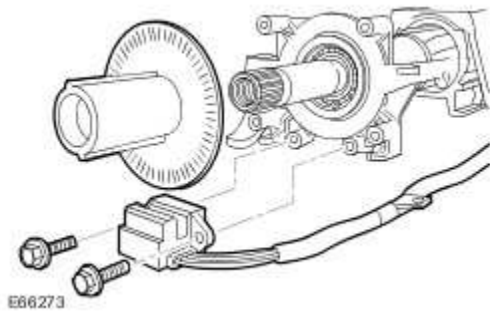


15 . NOTE:

Note the fitted position.

Remove the steering angle sensor.

- ▶ Remove the 2 bolts.
- ▶ Remove the reluctor ring.



Installation

1 . Install the steering angle sensor.

- ▶ Install the reluctor ring.
- ▶ Install the bolts and tighten to 3 Nm (2.2 lb.ft).

2 . Install the clockspring.

▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).

3 . Remove the special tool.

4 . **NOTE:**

Note the fitted position.

Install the steering wheel.

▶ Check the clockspring is aligned.

▶ Position the electrical harness.

▶ Tighten the bolt to 40 Nm (30 lb.ft).

▶ Connect the electrical connector.

5 . Install the driver air bag module.

▶ Connect the electrical connectors.

▶ Carefully align and secure the clips.

6 . Install the steering column.

▶ Install the 4 nuts, do not tighten at this time.

7 . Connect the steering angle sensor electrical connector.

▶ Secure the 3 clips.

8 . Connect the steering harness electrical connectors

▶ Secure the 3 clips.

9 . Install the steering column upper cowl.

▶ Install the screws.

10 . Secure the steering column.

▶ Tighten the nuts to 30 Nm (22 lb.ft).

11 . Connect the steering column lower shaft to the steering column.

▶ Align the shafts.

▶ Tighten the nuts to 30 Nm (22 lb.ft).

12 Install the steering column lower cowl.

▶ If installed, connect the steering column and foot pedal switch electrical connector.

▶ Secure in the clips.

▶ Install the screws.

13 . Install the instrument panel lower trim panel.

For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

14 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

15



WARNING: Do not work on or under a vehicle supported only by a jack. Always

support the vehicle on safety stands.

Raise and support the vehicle.

16 . Loosen the upper bolt from the steering column lower universal joint.

▶ Allow the steering column lower universal joint to settle.


▶ Tighten the bolt to 30 Nm (22 lb.ft).

17 . Connect WDS and configure the steering angle sensor.

Steering Column Lower Shaft (57.40.05)


Removal

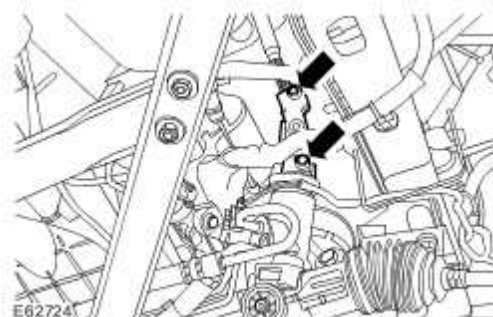
1 . Turn the steering wheel to the straight ahead position.

2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

3 . Remove the steering column lower universal joint assembly for access.

 Remove and discard the 2 bolts.



4 . Remove the instrument panel lower trim panel.

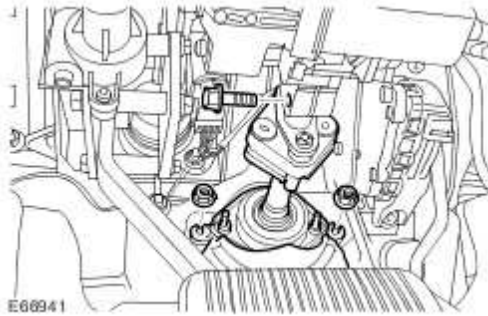
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

5 . Disconnect the steering column lower shaft from the steering column.

 Remove the bolt.

6 . Remove the steering column lower shaft.

- ▶ Remove the 2 nuts.
- ▶ Release the bearing carrier.
- ▶ Discard the gasket.

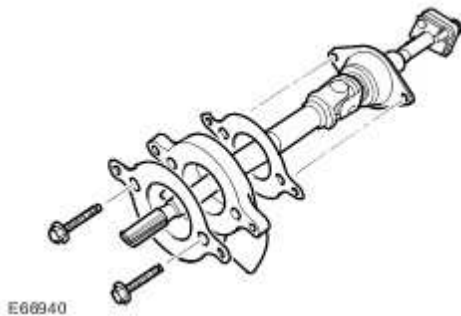


7 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the bearing carrier.

- ▶ Remove the 2 bolts.



Installation

1 . Install the bearing carrier.

- ▶ Install a new gasket.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

2 . Install the steering column lower shaft.

▶ Install a new gasket.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

3 . Connect the steering column lower shaft to the steering column.

▶ Align the shafts.

▶ Tighten the nuts to 30 Nm (22 lb.ft).

4 . Raise the vehicle.

5 . Install the steering column lower universal joint assembly.

▶ Align the shafts.

▶ Tighten the new bolts to 30 Nm (22 lb.ft).

6 . Install the instrument panel lower trim panel.

For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

Steering Wheel (57.60.01)

Special Service Tools



E43628

Clockspring locking tool
211-326

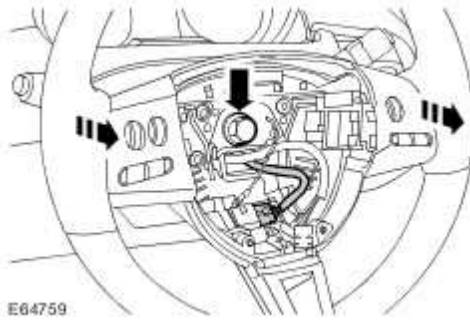
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Make the SRS system safe.
- 3 . Remove the driver air bag module.
For additional information, refer to Driver Air Bag Module (76.73.39)
- 4 . **NOTE:**

Note the fitted position.

Remove the steering wheel.

- ▶ Disconnect the electrical connector.
- ▶ Loosen, but do not fully remove the bolt.
- ▶ Release the steering wheel from the spline.
- ▶ Remove the bolt.
- ▶ Release the electrical harness.

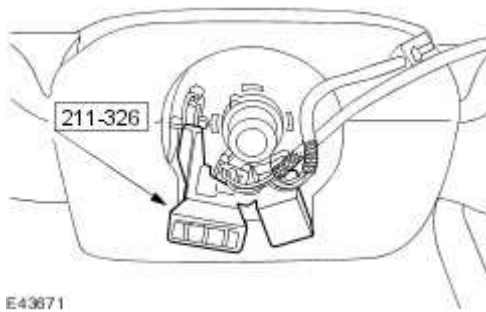


- 5 .  **CAUTION:** Failing to install the clockspring special tool, may result in damage to vehicle.

 **CAUTION:** Do not dismantle the clockspring, it has no serviceable parts and must be replaced as a complete assembly.

 **CAUTION:** Do not allow the clockspring to unwind.

Install the special tool to the clockspring.

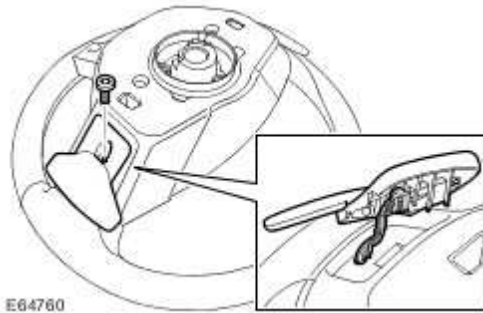


- 6 . **NOTE:**

Do not disassemble further if the component is removed for access only.

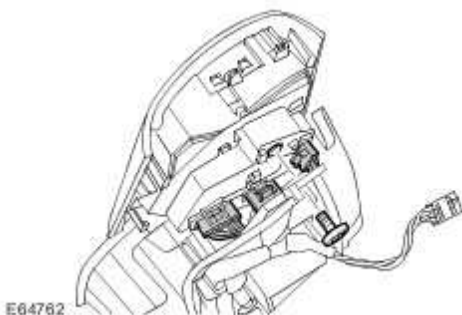
Remove the upshift and downshift paddle switches.

- ▶ Remove the Torx bolt.
- ▶ Release the assembly.
- ▶ Disconnect the electrical connector.
- ▶ Repeat the procedure and remove the opposite hand.



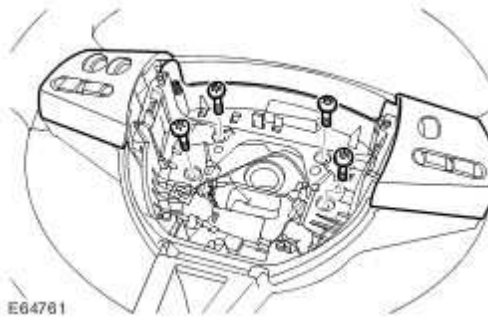
7 . Remove the steering wheel switch assembly.

- ▶ Remove the Torx bolt.
- ▶ Disconnect the electrical connectors.
- ▶ Repeat the procedure and remove the opposite hand.



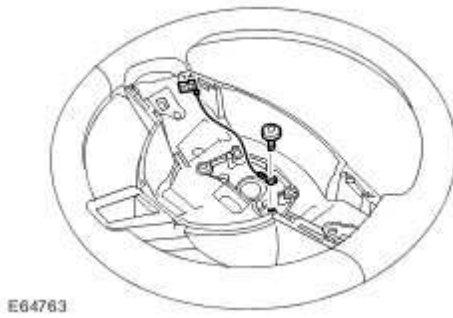
8 . Remove the air bag housing.

- ▶ Remove the 4 Torx bolts.
- ▶ Release the electrical harness.



9 . Remove the air bag ground cable.

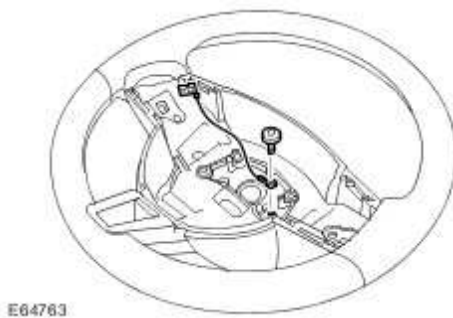
▶ Remove the Torx screw.



Installation

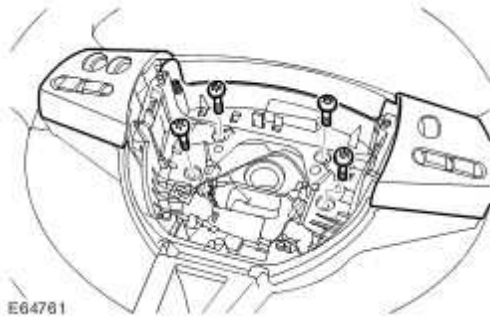
1 . Install the air bag ground cable.

▶ Install the Torx screw.



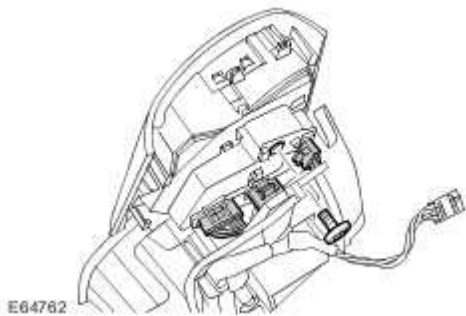
2 . Install the air bag housing.

- ▶ Secure the electrical harness.
- ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).



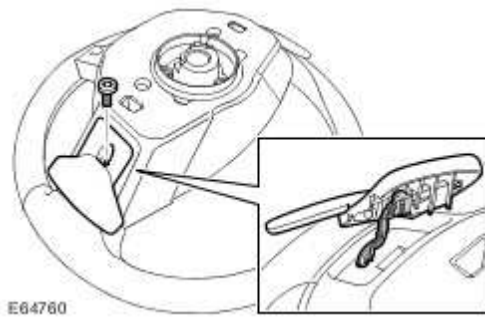
3 . Install the steering wheel switch assembly.

- ▶ Connect and secure the electrical connectors.
- ▶ Tighten the Torx bolt to 3 Nm (2 lb.ft).
- ▶ Repeat the above procedure on the opposite hand.



4 . Install the upshift and downshift paddle switches.

- ▶ Connect and secure the electrical connector.
- ▶ Tighten to 3 Nm.
- ▶ Repeat the above procedure on the opposite hand.



- 5
- ⚠ **CAUTION:** Make sure that the arrow on the cassette is centered and pointing vertically prior to the steering wheel installation. On removal of the special tool keep the clockspring cables taught to prevent the cassette moving from the set position. Do not allow the clockspring to unwind. Failure to follow this instruction may result in damage to the component.

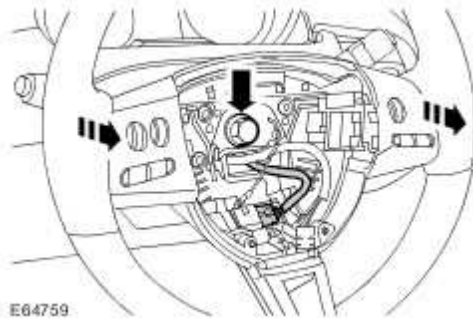
Remove the special tool.



- 6
- ⚠ **CAUTION:** Check the alignment arrow is still in the vertical position with the wheels straight ahead to make sure that the directional indicator cancellation is central.

Install the steering wheel.

- Position the electrical harness.
- Tighten the bolt to 40 Nm (30 lb.ft).
- Connect the electrical connector.



7 . Install the driver air bag module.

For additional information, refer to Driver Air Bag Module (76.73.39)

8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Clockspring

Special Service Tools



E43628

Clockspring locking tool
211-326

Removal



WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module.



WARNING: Carry a live air bag module with the air bag and trim cover pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.



WARNING: Do not set a live air bag module down with the trim cover face down. Failure to follow this instruction may result in personal injury.



WARNING: After deployment, the air bag surface can contain deposits of sodium hydroxide, a product of the gas generant combustion that is irritating to the skin. Wash your hands with soap and water afterwards. Failure to follow this instruction may result in personal injury.



WARNING: Never probe the connectors on the air bag module. Doing so may result in air bag deployment, which may result in personal injury. Failure to follow this instruction may result in personal injury.



WARNING: Air bag modules with discolored or damaged trim covers must be replaced, not repainted.



WARNING: Vehicle sensor orientation is critical for correct system operation. If a vehicle equipped with an air bag supplemental restraint system (SRS) is involved in a collision, inspect the sensor mounting bracket and wiring pigtail for deformation. If damaged, replace the sensor whether or not the air bag is deployed.



WARNING: To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplemental restraint system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait one minute. Failure to follow this instruction may result in personal injury.



CAUTION: Make sure the wheels are in the straight-ahead position. Failure to follow this instruction may result in damage to the component.

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to

- 2 . Make the SRS system safe.

For additional information, refer to

- 3 .

For additional information, refer to Driver Air Bag Module (76.73.39)

- 4



CAUTION: Make sure that special tool 211-326 is installed to the clockspring.



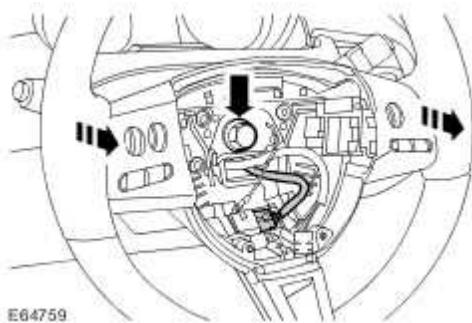
CAUTION: Make sure that the road wheels are in the straight ahead position, failure to follow this instruction may result in damage to the vehicle.

NOTE:

Note the fitted position.

Remove the steering wheel.

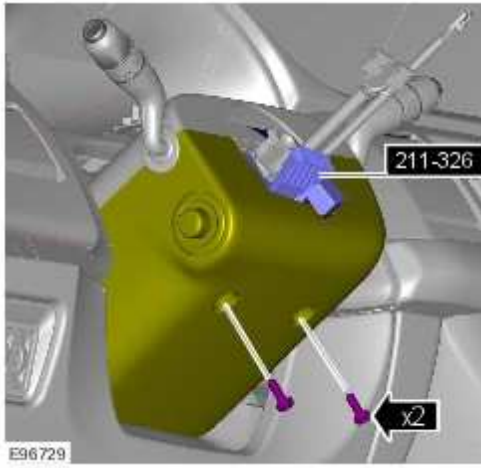
- ▶ Disconnect the electrical connector.
- ▶ Loosen, but do not fully remove the bolt.
- ▶ Release the steering wheel from the spline.
- ▶ Remove the bolt.
- ▶ Release the electrical harness.



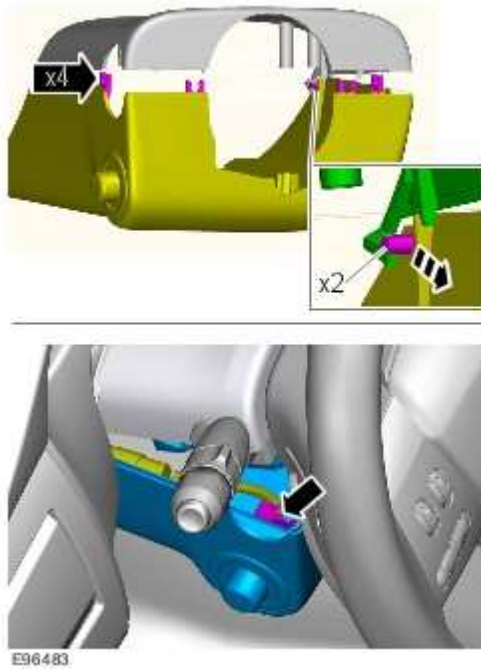
5



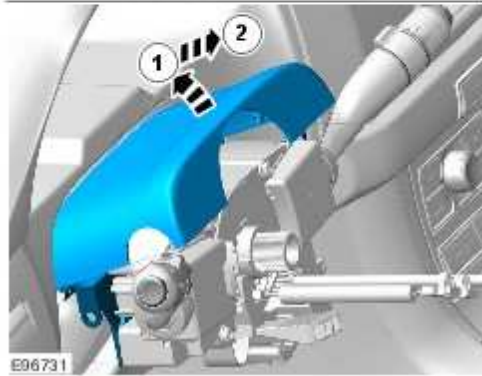
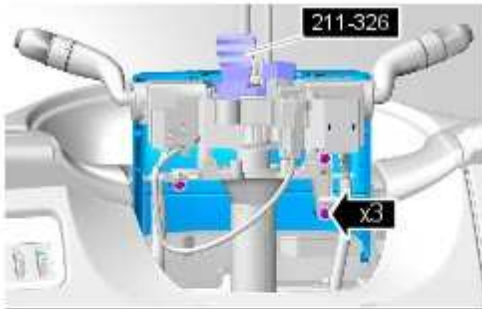
CAUTION: Failing to install the special tool to the clockspring may result in damage to the vehicle.




6.

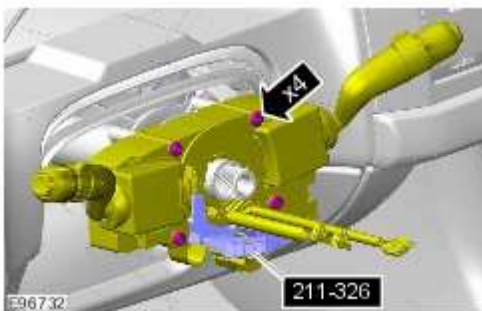



7.

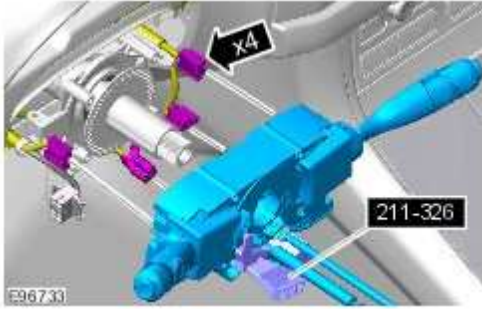


- 8  **CAUTION:** Failing to install the special tool to the clockspring may result in damage to the vehicle.

TORQUE: 6 Nm

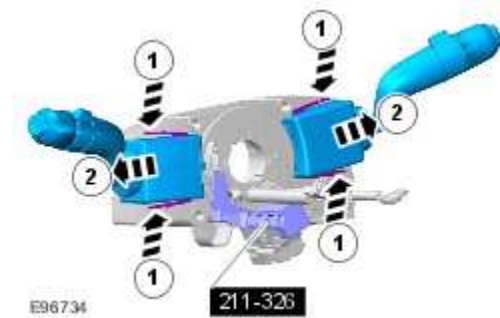


- 9  **CAUTION:** Make sure no damage is occurred to the electrical connectors. Failure to follow this instruction may result in damage to the vehicle.

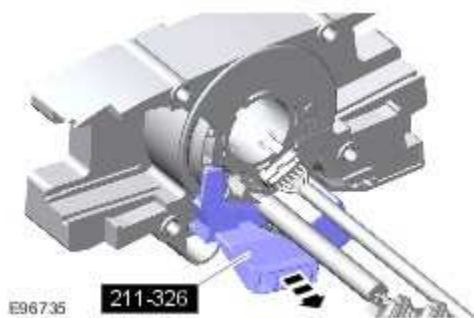


10 . NOTE:

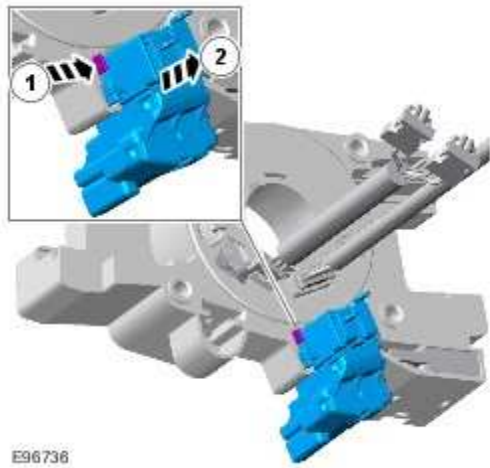
Do not disassemble further if the component is removed for access only.



11 . Remove the special tool.



12 .



Installation

1 . To install, reverse the removal procedure.

2



CAUTION: Make sure that special tool 211-326 is installed to the clockspring.



CAUTION: Make sure that the arrow on the cassette is centered and pointing vertically prior to the steering wheel installation. On removal of the special tool, keep the clockspring cables taught to prevent the cassette moving from the set position. Failure to follow this instruction may result in damage to the component.

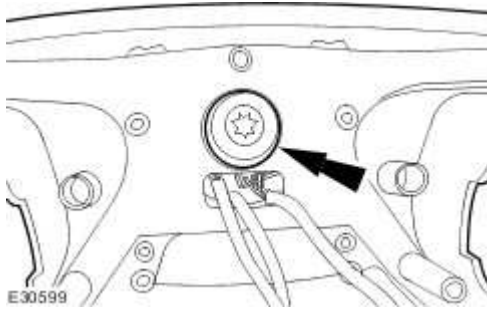
NOTE:

Make sure that the road wheels are in the straight ahead position, failure to follow this instruction may result in damage to the vehicle.

Install the steering wheel.



3 . Tighten to 65 Nm.



4 . Connect the battery ground cable and install the cover.
For additional information, refer to

211-05 : Steering column switch

Specifications

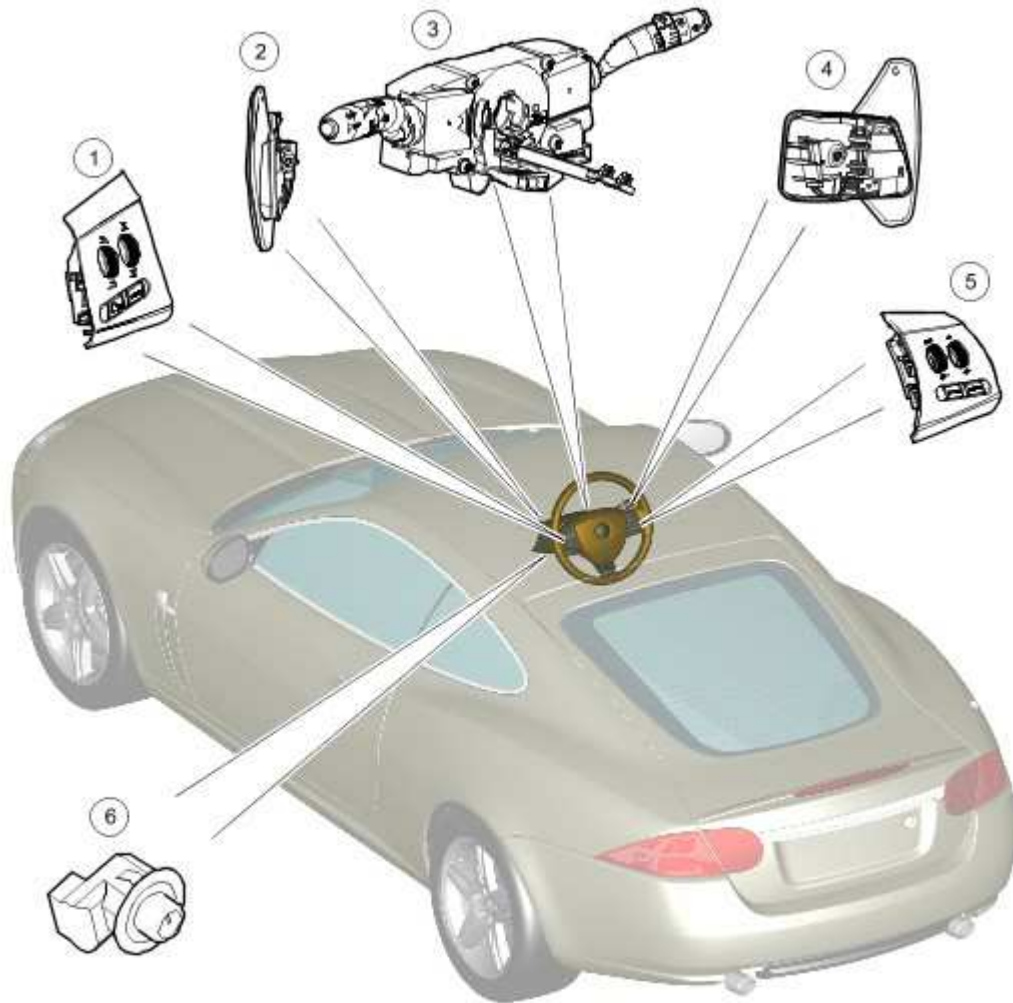
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Gearshift paddle switch	2.5	-	22
Speed and audio control switch	3.5	-	31
Steering column lock actuator	9	7	80

Steering Column Switches

COMPONENT LOCATION



E63020

Item	Part Number	Description
1		Audio and telephone switches
2		Left Hand (LH) (-) gear change paddle switch
3		Steering column multifunction switches and clockspring

4		Right Hand (RH) (+) gear change paddle switch
5		Speed control switches (Adaptive Speed Control switch pack shown, non adaptive speed control switch pack has a single thumbwheel)
6		Steering column adjustment switch

INTRODUCTION

The steering column switches comprise the following:

- Steering column multifunction switch
- Steering column adjustment switch
- Steering wheel mounted audio, telephone and speed control switches
- Heated steering wheel contact module.

The steering column multifunction switch is situated on the steering column and consists of the wiper switch and the direction indicator/lighting, trip computer switch.

The RH multifunction switch controls the following windshield wiper functions:

- Flick wipe
- Intermittent wipe
- Slow speed wipe
- High speed wipe
- Wash/Wipe
- Headlamp powerwash
- Rain sensing / variable wipe selection.

For additional information, refer to Wipers and Washers (501-16)

The LH multifunction switch controls the following lighting functions:

- Turn signal indicators
- Side lamps
- Headlamps
- Auto lamps
- High/low beam
- Headlamp flash
- Headlamp timer
- Trip computer.

For additional information, refer to Exterior Lighting (417-01)

For additional information, refer to Information and Message Center (413-08)

The steering column adjustment switch is located in the steering column lower shroud on the LH side. The switch is a four position 'joystick' which controls reach and rake adjustment.

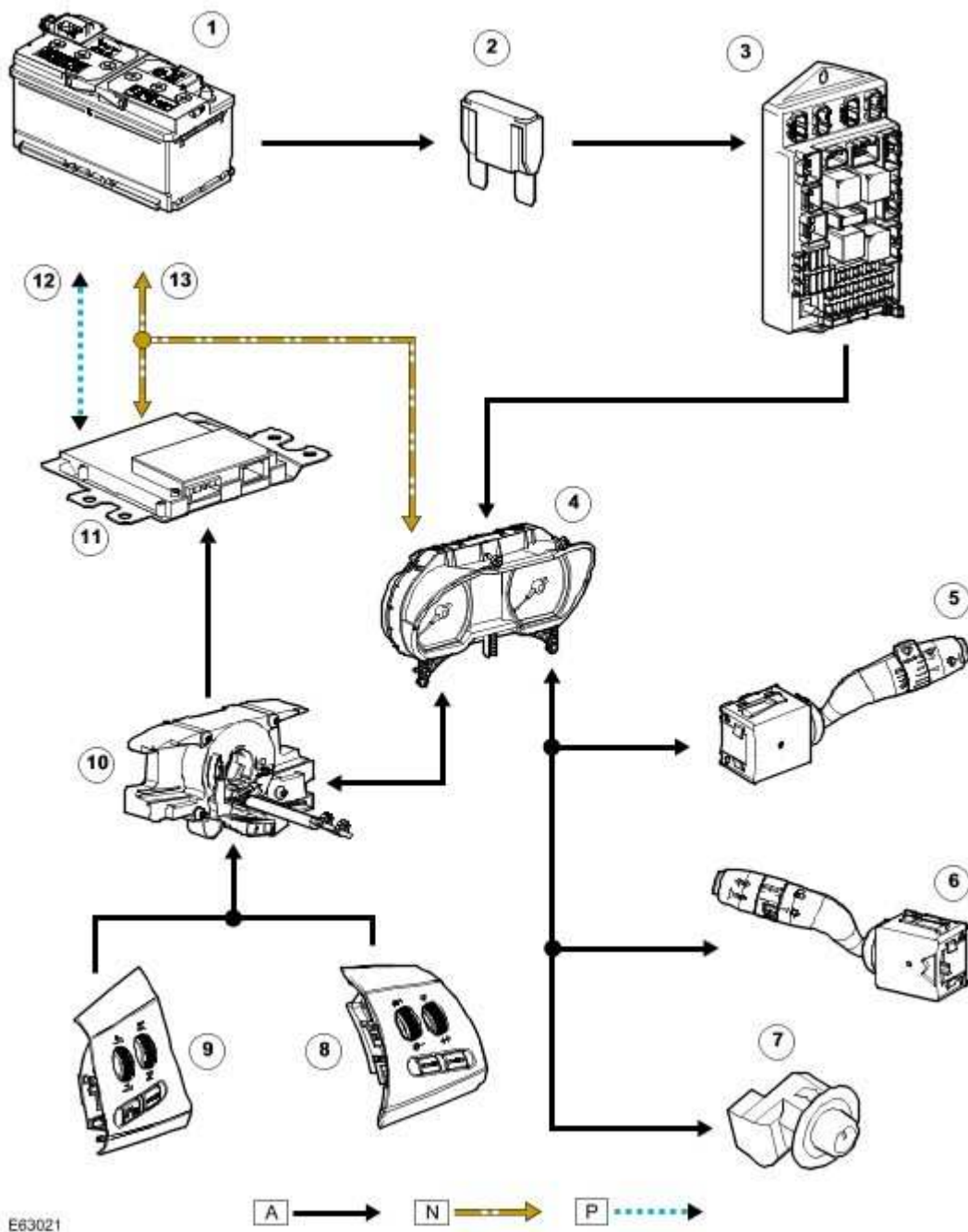
The trip button allows the driver to cycle through an option menu and also reset trip cycle mileage calculations. The trip computer information is displayed in the instrument cluster message center.

Steering wheel mounted switches on the LH side of the driver's airbag control the audio and telephone functions. Switches on the RH side of the driver's airbag control the speed control functions.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **N** = Medium speed CAN Bus; **P** = Fiber Optic MOST



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Central Junction Box (CJB)

4		Instrument cluster
5		Steering column RH multifunction switch
6		Steering column LH multifunction switch
7		Steering column adjustment switch
8		Speed control switches (Adaptive Speed Control switch pack shown, non adaptive speed control switch pack has a single thumbwheel)
9		Audio/telephone switches
10		Clockspring
11		Information and entertainment module
12		MOST connection to other vehicle systems
13		Medium speed CAN bus to other vehicle systems

Steering Column Switches

Principle of Operation

For a detailed description of the steering column switches, refer to the relevant Description and Operation section in the workshop manual.

Steering Column Switches

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Switches • Steering column lock 	<ul style="list-style-type: none"> • Fuse(s) • Electrical connector(s) • Wiring Harness

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for DTCs and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the

fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100D51	Column lock authorisation	<ul style="list-style-type: none"> Not programmed 	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> CAN fault Steering column lock fault Instrument cluster fault Incorrect module installed (Steering column lock/Instrument cluster) Target ID synchronisation error following re-programming Noise/EMC related error 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock	<ul style="list-style-type: none"> CAN fault Steering column lock fault 	Check CAN network to steering

	authorisation - signal plausibility failure	<ul style="list-style-type: none"> Instrument cluster fault 	column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> CAN fault Steering column lock fault Instrument cluster fault Low voltage at steering column lock < 8V 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster
U000188	High speed CAN communication bus	<ul style="list-style-type: none"> Vehicle CAN bus off condition 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the steering column lock, refer to the new module installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new steering column lock, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check steering column lock for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index

Steering Column Lock Actuator (57.40.41)

Special Service Tools



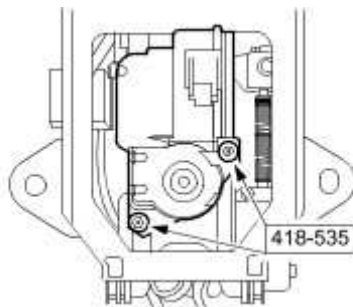
418-535

5 point security torx bit
418-535

Removal

- 1 . Remove the steering column. <<211-04>>
- 2 Remove the steering column lock actuator.

▶ Using the special tool, remove the steering column lock actuator retaining bolts.

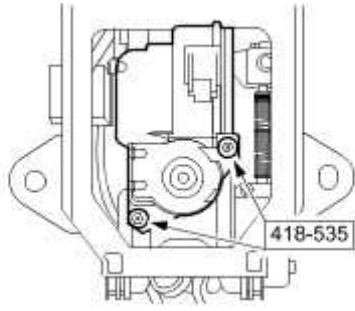


E30342

Installation

- 1 . To install, reverse the removal procedure.

▶ Tighten to 9 Nm.



E30342

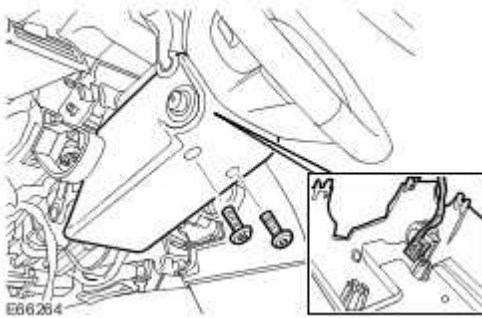
Steering Column Multifunction Switch LH (86.65.78)

Removal

1 Remove the steering column lower cowl.

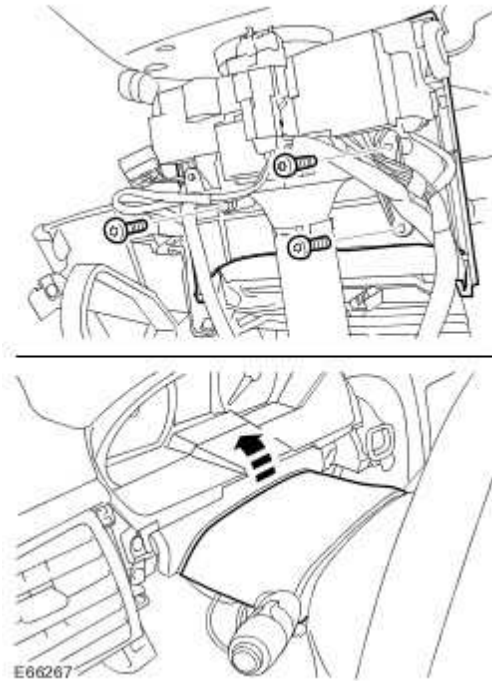
▶ Remove the 2 screws.

▶ If installed, disconnect the steering column and foot pedal control switch electrical connector.



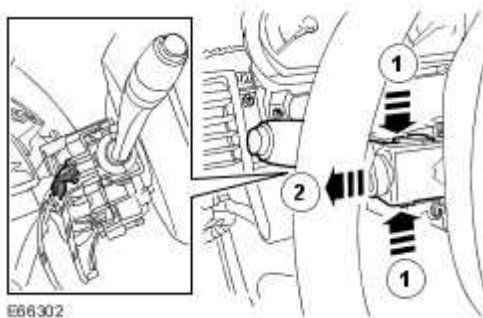
2 . Remove the steering column upper cowl.

▶ Remove the 3 screws.



3 . Remove the steering column multifunction switch.

- ▶ Depress the 2 clips.
- ▶ Disconnect the electrical connector.



Installation

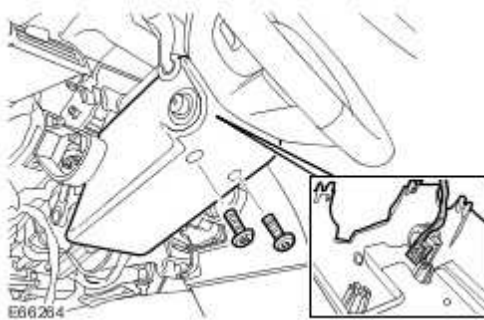
- 1 .  **CAUTION: Make sure the electrical harness is not trapped during the installation.**

To install, reverse the removal procedure.

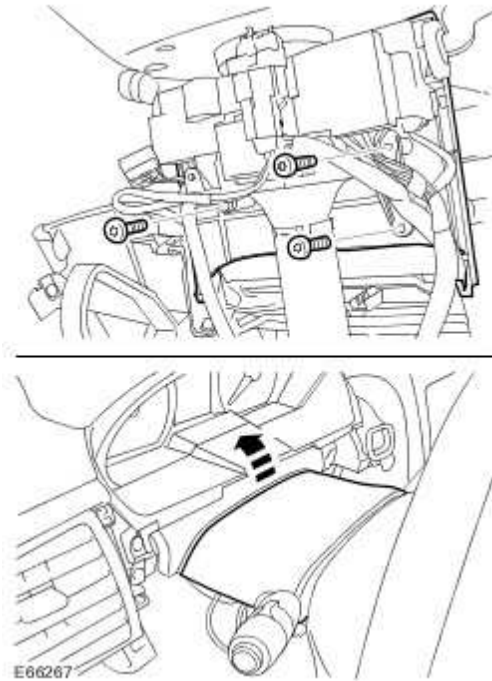
Steering Column Multifunction Switch RH (86.65.41)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Make the SRS system safe.
For additional information, refer to General Service Information
- 3 . Remove the instrument panel, lower trim panel.
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)
- 4 . Remove the steering column lower cowl.
 - ▶ Remove the 2 screws.
 - ▶ If installed, disconnect the steering column and foot pedal control switch electrical connector.



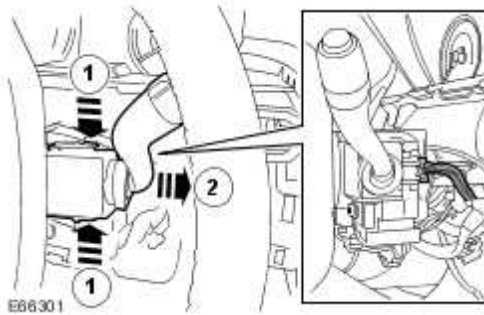
- 5 . Remove the steering column upper cowl.
 - ▶ Remove the 3 screws.



6 . Remove the steering column multifunction switch.

▶ Disconnect the electrical connector.

▶ Depress the 2 clips.



Installation

1 . Install the multifunction switch.

▶ Align the lugs and secure the clips.

▶ Connect the electrical connector.

2 . Install the steering column upper cowl.

▶ Install the screws.

3 Install the steering column lower cowl.

▶ If installed, connect the steering column and foot pedal switch electrical connector.

▶ Secure in the clips.

▶ Install the screws.

4 . Install the instrument panel, lower trim panel.

For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

3. POWERTRAIN

303 : Engine

303-00 : Engine System - General

Specifications

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Brake fluid	Shell ESL (Dot 4)

Bearing Inspection

1. Inspect bearings for the following defects.
 1. Cratering - fatigue failure
 2. Spot polishing - incorrect seating.
 3. Imbedded dirt engine oil.
 4. Scratching - dirty engine oil.
 5. Base exposed - poor lubrication.
 6. Both edges worn - journal damaged.
 7. One edge worn - journal tapered or bearing not seated.

Camshaft Bearing Journal Clearance

1. NOTE:

Make sure that the following stages are followed exactly. The tappets or followers must be removed to carry out this measurement.

NOTE:

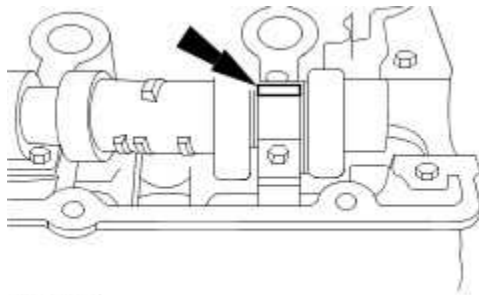
Make sure that the camshaft is to specification.

NOTE:

The bearing caps and journals should be free from engine oil and dirt.

Position a length of plastigage on the bearing cap.

- Insert the camshaft, without lubrication, into the cylinder head.
- Position a plastigage strip, which should be equal to the width of the bearing cap, on the bearing journal.



2. Install the camshaft bearing caps.

- Follow the relevant tightening sequence.

3. NOTE:

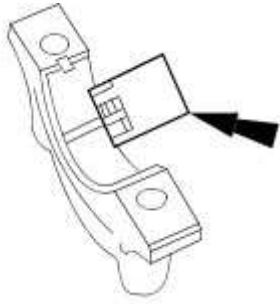
Do not strike the bearing caps.

Remove the camshaft bearing caps.

- Follow the relevant loosening sequence.

4. Using the special tool, read off the measurement.

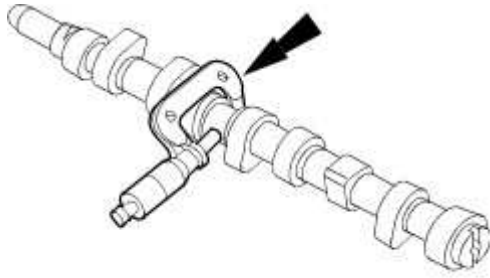
- Compare the width of plastigage with the plastigage scale.
- The value that is read off is the bearing clearance.
- If the values are not to specification install a new camshaft.



VUJ0001697

Camshaft Bearing Journal Diameter

1. Determine the diameter of the camshaft journals.
 - Using a micrometer measure the diameter at 90 degrees intervals to determine if the journals are out-of-round.
 - Measure at two different points on the journal to determine if there is any tapering.
 - If the measurements are out of the specified range, install a new camshaft.



VUJ0001895

Camshaft End Play

1. NOTE:

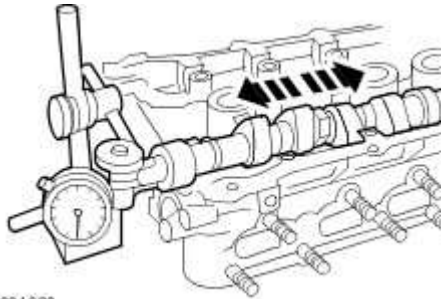
Make sure that the camshaft is to specification.

Using the special tool, measure the end play.

- Slide the camshaft in both directions. Read and note the maximum and minimum values on the dial indicator gauge.

End play = maximum value minus minimum value.

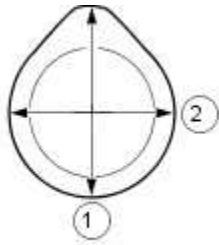
- If the measurement is out of specification, install new components.



VUJ0001698

Camshaft Lobe Lift

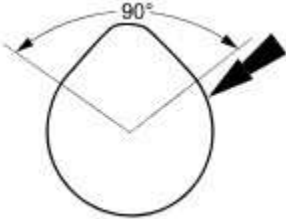
1. Measure the diameter (1) and diameter (2) with a vernier caliper. The difference in measurements is the lobe lift.



VUJ0001699

Camshaft Surface Inspection

1. Inspect camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.



VUJ0001700

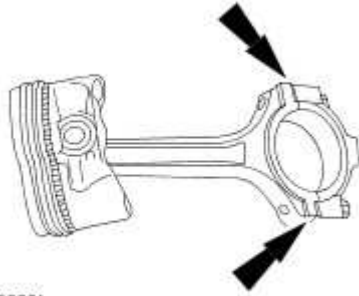
Connecting Rod Cleaning

1.



CAUTION: Do not use a caustic cleaning solution or damage to connecting rods may occur.

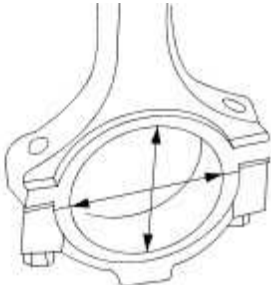
Mark and separate the parts and clean with solvent. Clean the oil passages.



VUJ0002224

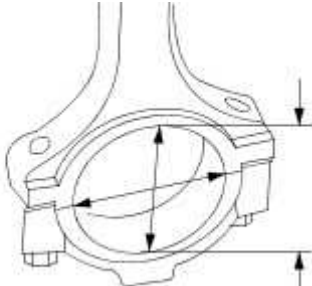
Connecting Rod Large End Bore

1. Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.



VUJ0002223

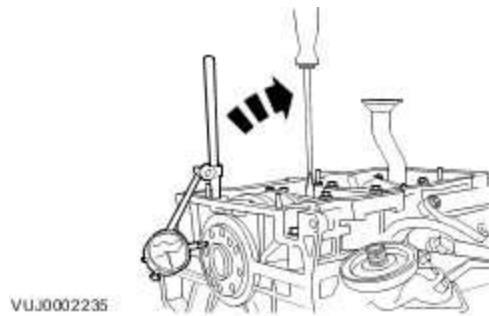
2. Measure the bearing bore diameter in two directions. Verify the bearing bore is within specification.



VUJ0002222

Crankshaft End Play

1. Using the Dial Indicator Gauge with Brackets, measure the end play.
 - Measure the end play by lifting the crankshaft using a lever.
 - If the value is out of the specification, install new thrust half rings to take up the end float and repeat the measurement.



VUJ002235

Crankshaft Main Bearing Journal Clearance



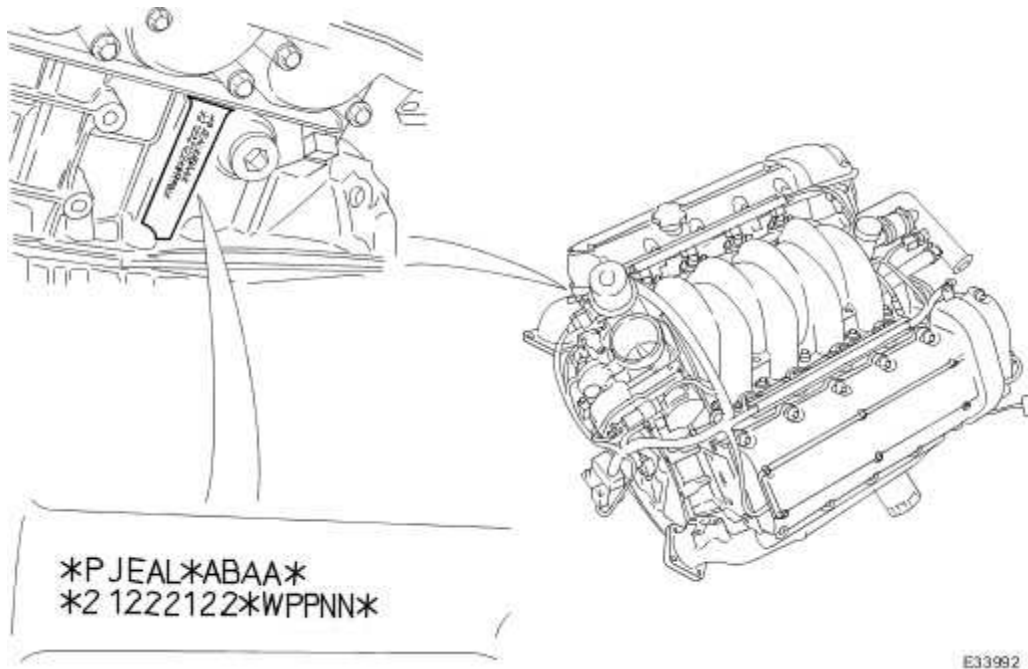
CAUTION: THESE PROCEDURES SHOULD NOT BE CARRIED OUT DURING THE MANUFACTURERS WARRANTY PERIOD.

1. NOTE:

Example - *PJEAL* - Crankshaft Main Journal Diameter.

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crank journal at the front of the engine is grade P, and at the rear is grade L.

- The selection of main bearing shells is described in the following chart.



2. NOTE:

Example - *ABAA* - Crankshaft (Big End Bearing) Crankpin Diameter

NOTE:

For vehicles built up to 2002 MY.

NOTE:

If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this

example engine, the crankpin at the front of the engine is grade A and at the rear is also grade A.

- Grade A = 56,000 to 55,994 mm (Bearing Shell Color Code - Blue).
- Grade B = 55,994 to 55,988 mm (Bearing Shell Color Code - Green).
- Grade C = 55,988 to 55,982 mm (Bearing Shell Color Code - Yellow).

3. **NOTE:**

Example - *ABAA* - Crankshaft (Big End Bearing) Crankpin Diameter

NOTE:

For vehicles built from 2002 MY.

NOTE:

If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crankpin at the front of the engine is grade A and at the rear is also grade A.

- Grade A = 53,000 to 52,994 mm (Bearing Shell Color Code - Blue).
- Grade B = 52,994 to 52,988 mm (Bearing Shell Color Code - Green).
- Grade C = 52,988 to 52,982 mm (Bearing Shell Color Code - Yellow).

4. **NOTE:**

Example - *21222122* - Cylinder Bore and Piston

The cylinder bore grades read from LEFT to RIGHT as follows:

- Bank 2 - Cylinder 1, Bank 2 - Cylinder 2, Bank 2 - Cylinder 3, Bank 2 - Cylinder 4, Bank 1 - Cylinder 4,
- Bank 1 - Cylinder 3, Bank 1 - Cylinder 2, Bank 1 - Cylinder 1.
- (Note, in earlier publications Bank 1 was described as A-Bank and Bank 2 as B-Bank)
- Grade 1 Bore = 85,990 to 86,000 mm.
- Grade 2 Bore = 86,000 to 86,010 mm.
- Grade 3 Bore = 86,010 to 86,020 mm.

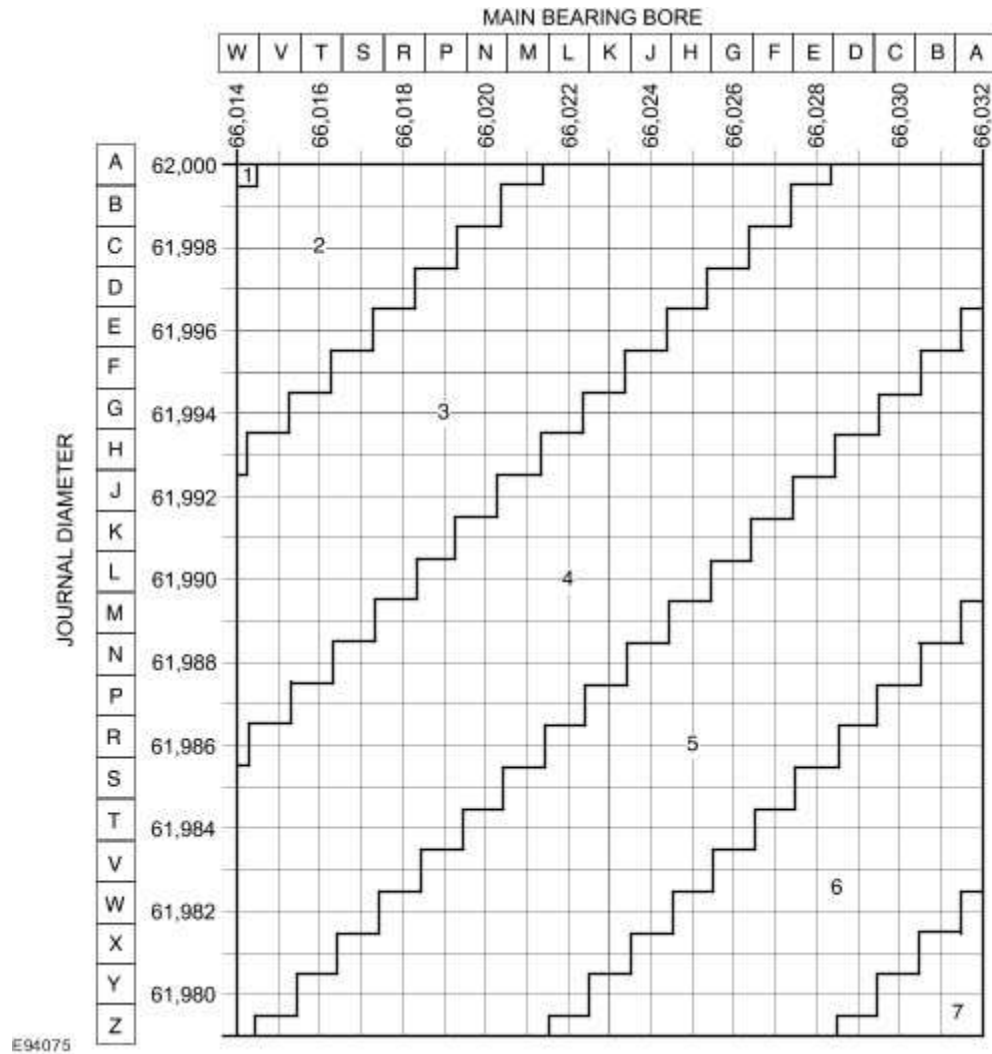
5. **NOTE:**

Example - *WPPNN* - Crankshaft Main Bearing Bore in Cylinder Block

Read the grade letters from LEFT to RIGHT = FRONT to REAR of engine eg. for this example engine, the crank journal bore at the front of the engine is grade W, and at the rear is grade N.

- The selection of main bearing shells is described in the following JOURNAL DIAMETER AND MAIN BEARING BORE CHART.

6. JOURNAL DIAMETER AND MAIN BEARING BORE CHART



7. NOTE:

THIS PROCEDURE SHOULD ONLY BE CARRIED OUT WHEN REPLACING MAIN BEARING SHELLS.

NOTE:

Refer to the JOURNAL DIAMETER AND MAIN BEARING BORE CHART in step 6 for tolerance and bearing information.

The number in each diagonal band represents a PAIR of color coded main bearing shells which must be used with a specific journal, depending on the combination of journal diameter and crankshaft bore diameter. The color codes for each band are as follows:

1. Blue / Green and Blue / Green
- Blue / Green and Blue

- Blue and Blue
- Blue and Green
- Green and Green
- Green and Yellow
- Yellow and Yellow
- Consider crankshaft journal 5 (from the example grade markings on the cylinder block) - the cylinder block bore is Grade N and the crankshaft journal diameter is Grade L. From the chart, it will be seen that the point of intersection is in Band 4 which equates to one Blue shell and one Green shell.
- When the appropriate pair of color codes have been selected for a journal, either color may be installed to the cylinder block or to the bedplate, but, the shell which is to be installed to the cylinder block must have an oil groove and the shell which is to be installed to the bedplate must be plain.

8. NOTE:

THIS PROCEDURE SHOULD ONLY BE CARRIED OUT WHEN A REPLACEMENT CRANKSHAFT OR CYLINDER BLOCK HAS BEEN FITTED.

NOTE:

Refer to the JOURNAL DIAMETER AND MAIN BEARING BORE CHART in step 6 for tolerance and bearing information.

The thickness grade of all main bearing shells are to be selected to give a total running clearance of not less than 0.022 mm or greater than 0.040 mm.

- Each bearing bore in the block/bedplate assembly should be measured at two mutually perpendicular diameters 45° to the vertical in the middle of the bearing.
- The minimum diameter of the two is to be used.
- Each crankshaft main bearing journal should be measured dynamically at a point in line with the middle of each bearing.
- When the appropriate pair of color codes have been selected for a journal, either color may be installed to the cylinder block or to the bedplate, but, the shell which is to be installed to the cylinder block must have an oil groove and the shell which is to be installed to the bedplate must be plain.

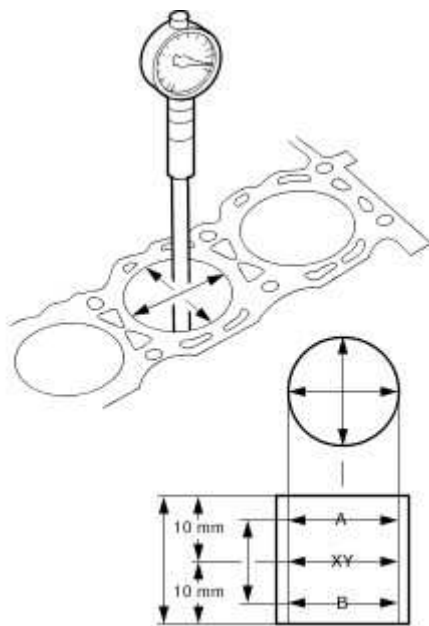
Cylinder Bore Out-of-Round

1. NOTE:

The main bearing caps or lower crankcase must be in place and tightened to the specified torque; however, the bearing shells should not be installed.

Measure the cylinder bore with an internal micrometer.

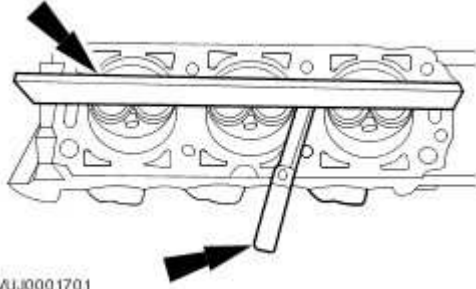
- Carry out the measurements in different directions and at different heights to determine if there is any out-of-roundness or tapering.
- If the measurement is out of the specified range, hone out the cylinder block or install a new block.



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Cylinder Head Distortion

1. Measure the cylinder block/cylinder head distortion.
 - Using the special tool, measure the mating face distortion.
 - If the value is not to specification rework the mating face.



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Exhaust Manifold Cleaning and Inspection

1. Inspect the cylinder head joining flanges of the exhaust manifold for evidence of exhaust gas leaks.
2. Inspect the exhaust manifold for cracks, damaged gasket surfaces, or other damage that would make it unfit for further use.

Piston Inspection

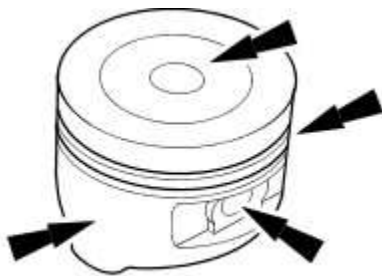
1.



CAUTION: Do not use any aggressive cleaning fluid or a wire brush to clean the piston.

Carry out a visual inspection.

- Clean the piston skirt, pin bush, ring grooves and crown and check for wear or cracks.
- If there are signs of wear on the piston skirt, check whether the connecting rod is twisted or bent.



VUJ0002233

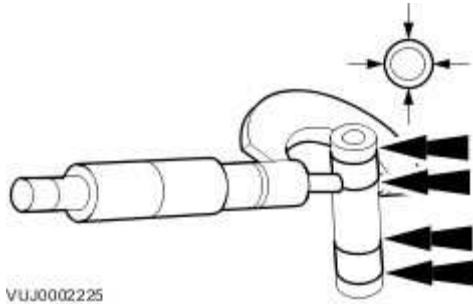
Piston Pin Diameter

1. NOTE:

The piston and piston pin are a matched pair. Do not mix up the components.

Measure the piston pin diameter.

- Measure the diameter in two directions.
- If the values are not to specification, install a new piston and a new piston pin.



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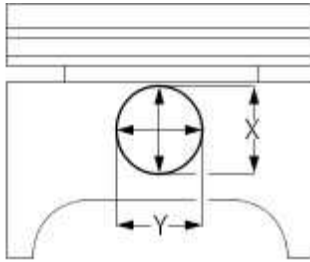
Piston Pin to Bore Diameter

1. NOTE:

The piston and piston pin form a matched pair. Do not mix up the components.

Measure the diameter of the piston pin bore.

- Measure the diameter in two directions.
- If the values are not to specification, install both a new piston and a new piston pin.



VUJ0002232

Piston Ring End Gap

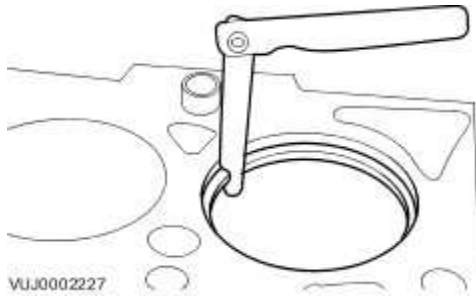
1.



CAUTION: Do not mix up the piston rings. Install the piston rings in the same position and location.

Using the Feeler Gauge, measure the piston ring gap.

- The values given in the specification refer to a gauge ring used during production.

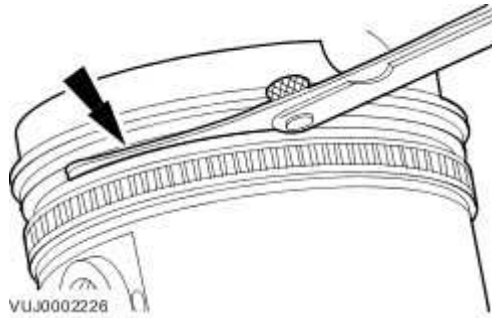


Piston Ring-to-Groove Clearance

1. NOTE:

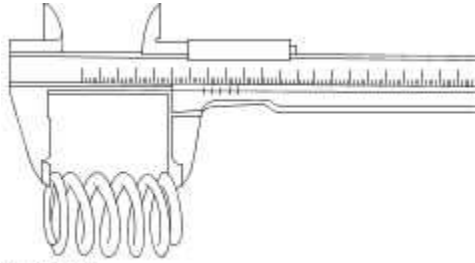
The piston ring must protrude from the piston groove. To determine the piston ring clearance, insert the Feeler Gauge right to the back of the groove, behind the wear ridge.

Using the Feeler Gauge, measure the piston ring clearance.



Valve Spring Free Length

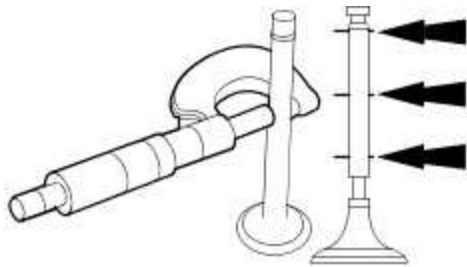
1. Using a vernier gauge, measure the free length of each valve spring. Verify the length is within specification.



VUJ0002221

Valve Stem Diameter

1. Using a micrometer measure the diameter of the valve stems.
 - If the measurements are not to specification, install a new valve.



VUJ0002220

Diagnosis and testing

Engine

Inspection and Verification

- 1 . Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Coolant leaks• Oil leaks• Leaks in the fuel system• Visibly damaged or worn parts• Loose or missing fixings	<ul style="list-style-type: none">• Fuses• Loose or corroded electrical connectors• Harnesses• Sensors

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

NOTE:

If an engine is suspect, when the vehicle remains under the Manufacturers warranty refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new engine.

NOTE:

Due to the possibility of loose carbon, that has become trapped between the valve face and seat, effecting the pressure readings, when carrying out a compression test and some cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

Symptom	Action
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All engine related issues	<ul style="list-style-type: none"> • Check ECM for Diagnostic Trouble Codes (DTCs) and refer to DTC Index. Electronic Engine Controls
Difficult to start hot and cold	<ul style="list-style-type: none"> • Carry out general engine checks: Compression test. Refer to component tests in this section. Valve clearances. Valve Clearance Check (12.29.47) Spark plug condition and color
Poor idle	<ul style="list-style-type: none"> • Ensure the air intake system is free from leaks • Carry out general engine checks: Compression test. Refer to component tests in this section. Valve clearances. Valve Clearance Check (12.29.47) Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank Positive readings of between 10-20%: check for air leaks in air intake system Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure Readings above 20%: check for DTCs and refer to DTC Index. Electronic Engine Controls • Carry out a vacuum gauge check. Refer to component tests in this section.
Insufficient power/Insufficient compression	<ul style="list-style-type: none"> • Ensure the air intake system is free from leaks • Carry out general engine checks: Compression test. Refer to component tests in this section. Valve clearances. Valve Clearance Check (12.29.47) Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank Positive readings of between 10-20%: check for air leaks in air intake system Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure Readings above 20%: check for DTCs and refer to DTC Index. Electronic Engine Controls • Carry out a vacuum gauge check. Refer to component tests in this section.
Oil consumption	<ul style="list-style-type: none"> • Carry out oil leak check followed by an oil consumption test. Refer to the component tests in this section • If oil consumption is excessive: • Check the integrity of the engine breather system • Carry out general engine checks: Compression test. Refer to component tests in this section. Valve clearances. Valve Clearance Check (12.29.47) Spark plug condition and color
Noise	<ul style="list-style-type: none"> • Refer to the Special Service Messages on the Electronic Product Quality Report (EPQR) system for sound files. If the symptom does NOT compare to any of the sound files, contact Dealer Technical

Component Tests

Engine Oil Leaks

NOTE:

Before installing new gaskets or oil seals, make sure that the fault is clearly established.

If the oil leak cannot be identified clearly by a visual inspection, carry out an Ultraviolet test:

Fluorescent Oil Additive Method

- 1 . Clean the engine with a suitable cleaning fluid (brake cleaner).
- 2 . Drain the engine oil and refill with recommended oil, premixed with Diesel Engine Oil Dye or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must first be added to the crankcase.
- 3 . Run engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using a 12 Volt Master UV Diagnostic Inspection Kit or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
- 4 . As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs. If the flywheel bolts leak oil, look for sealer on the threads.
- 5 . Repair all leaks as necessary.

Compression Test

General Remarks

NOTE:

Removing fuses and disconnecting electrical components may cause the Engine Control Module (ECM) to log Diagnostic Trouble Codes (DTCs). After the measurements have been carried out, DTCs should be cleared from memory by connecting to the Manufacturer Approved Diagnostic System.

NOTE:

Only check the compression pressure with the valves set to the prescribed clearance (if this can

be adjusted).

The compression pressure should be checked with the engine at operating temperature.

Check the Compression Pressure



WARNING: Move gear selector lever to 'P' position. Failure to follow this instruction may result in personal injury.

- 1 . Remove the fuel pump relay.
- 2 . Start the engine - the engine will start, run for a few seconds then stall.
- 3 . Remove the spark plugs.
- 4 . Install the compression tester.
- 5 . Install an auxiliary starter switch in the starting circuit. With the ignition switch OFF, using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
- 6 . Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
- 7 . Install the removed components in reverse order, observing the specified tightening torques.
- 8 . Clear all DTCs from the ECM.

Interpretation of the Results

NOTE:

Due to the possibility of loose carbon that has become trapped between the valve face and seat effecting the pressure readings, when carrying out a compression test and cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75% of the highest reading.

If the cylinder pressures are found to be low, carry out a leakdown test to determine the location of the fault (if any leakback can be heard through the engine breather system suspect the piston rings, if any leakback can be heard through the inlet system suspect the inlet valve or seat, if any leakback

can be heard through the exhaust manifold suspect the exhaust valve or seat. If the measurements for two cylinders next to each other are both too low then it is very likely that the cylinder head gasket between them is burnt through. This can also be recognized by traces of engine oil in the coolant and/or coolant in the engine oil).

Oil Consumption Test

The amount of oil an engine uses will vary with the way the vehicle is driven in addition to normal engine-to-engine variation. This is especially true during the first 16,100 km (10,000 miles) when a new engine is being broken in or until certain internal components become conditioned. Vehicles used in heavy-duty operation may use more oil. The following are examples of heavy-duty operation:

- Trailer towing applications
- Severe loading applications
- Sustained high speed operation

Engines need oil to lubricate the following internal components:

- Cylinder block cylinder walls
- Pistons and piston rings
- Intake and exhaust valve stems
- Intake and exhaust valve guides
- All internal engine components

When the pistons move downward, a thin film of oil is left on the cylinder walls. As the vehicle is operated, some oil is also drawn into the combustion chambers past the intake and exhaust valve stem seals and burned.

The following are examples of conditions that can affect oil consumption rates:

- Engine size
- Operator driving habits
- Ambient temperatures
- Quality and viscosity of oil
- Engine is being run in an overfilled condition (check the oil level at least five minutes after a hot shutdown with the vehicle parked on a level surface. The oil level should not be above the top of the cross-hatched area and the letter "F" in FULL).

Operation under varying conditions can frequently be misleading. A vehicle that has been run for several thousand miles on short trips or in below-freezing ambient temperatures may have consumed a "normal" amount of oil. However, when checking the engine oil level, it may measure up to the full mark on the oil level indicator due to dilution (condensation and fuel) in the engine crankcase. The vehicle then might be driven at high speeds on the highway where the condensation and fuel boil off. The next time the engine oil is checked it may appear that a liter of oil was used in about 160 km (100 miles). Oil consumption rate is about one liter per 2,400 km (1,500 miles).

Make sure the selected engine oil meets Jaguar specification and the recommended API performance

category "SG" and SAE viscosity grade as shown in the vehicle Owner's Guide. It is also important that the engine oil is changed at the intervals specified for the typical operating conditions.

The following diagnostic procedure is used to determine the source of excessive oil consumption.

NOTE:

Oil use is normally greater during the first 16,100 km (10,000 miles) of service. As mileage increases, oil use decreases. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

- 1 . Define excessive consumption, such as the number of miles driven per liter of oil used. Also determine customers driving habits, such as sustained high speed operation, towing, extended idle and other considerations.
- 2 . Verify that the engine has no external oil leaks as described under Engine Oil Leaks in this section.
- 3 . Carry out an oil consumption test:
 - ▶ Run the engine to normal operating temperature. Switch engine OFF and allow oil to drain back for at least five minutes .
 - ▶ With vehicle parked on level surface, check the engine oil level.
 - ▶ If required, add engine oil to set level exactly to the FULL mark.
 - ▶ Record the vehicle mileage.
 - ▶ Instruct the customer to return for a level check after driving the vehicle as usual for 1,610 km (1000 miles).

▶ Check the oil level under the same conditions and at the same location as the initial check.

NOTE:

If the oil consumption rate is unacceptable go to Step 4.

4 . Check the Positive Crankcase Ventilation (PCV) system. Make sure the system is not plugged.

5 . Check for plugged oil drain-back holes in the cylinder head and cylinder block.

6 . If the condition still exists after carrying out the above tests go to step 9.

7 . Carry out a cylinder compression test. Refer to the Compression Test procedure in this section. This can help determine the source of oil consumption such as valves, piston rings or other areas.

8 . Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.

9 . Worn or damaged internal engine components can cause excessive oil consumption. Small deposits of oil on the tips of the spark plugs can be a clue to internal oil consumption.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect a vacuum gauge or equivalent to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8 m (1,000 feet) of elevation above sea level.

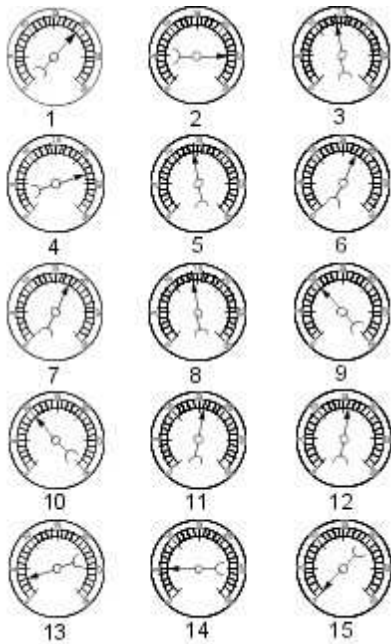
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust damper until needle moves easily without excessive flutter.

Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



VUJ0001694

1 . NORMAL READING: Needle between 51-74 kPa (15-22 in-Hg) and holding steady.

2 . NORMAL READING DURING RAPID ACCELERATION: When the engine is rapidly accelerated, the needle will drop to a low (not to zero) reading. When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.

3 . NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.

4 . WORN RINGS OR DILUTED OIL: When the engine is accelerated, the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).

5 . STICKING VALVES: When the needle remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.

6 . BURNED OR BENT VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or damaged valves. Insufficient hydraulic valve tappet or hydraulic lash adjuster clearance will also cause this reaction.

7 . POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating correctly.

8 . WORN VALVE GUIDES: When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.

9 . WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine RPM is increased, weak valve springs are indicated. The reading at idle could be relatively steady.

10 . LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.

11 . IGNITION TIMING RETARDED: Retarded ignition timing will produce a steady but somewhat low reading.

12 . INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.

13 . INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.

14 . BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head to cylinder block surface.

15 . RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine RPM is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory such as the power brake booster, the unit will not function correctly. Always repair vacuum leaks.

303-01A : Engine – 4.2L SC V8 – AJV8

Specifications

Specifications

Engine Data

Engine Description	Engine Capacity	Maximum Engine Torque (EEC)	Maximum Engine Power (EEC)	Maximum Engine Torque (SAE)	Maximum Engine Power (SAE)	Compression Ratio	Bore	Stroke
<ul style="list-style-type: none"> • 90° 'Vee' • 8 Cylinder • 32 Valves 	4196 cm ³	560 Nm/413 lb/ft at 4000 RPM	410 BHP/306 kW at 6250 RPM	560 Nm/413 lb/ft at 4000 RPM	420 BHP/313 kW at 6250 RPM	9.1:1 ± 0.5:1	86.0 mm	90.3 mm

Engine Firing Order

Firing Order

1 : 2 : 7 : 3 : 4 : 5 : 6 : 8

Engine Valve Clearance (cold)

Intake Valve	Exhaust Valve
0.18 - 0.22 mm	0.23 - 0.27 mm

Spark Plugs

Specification	Spark Plug Gap
AJ8 4575	0.9 - 1.0 mm

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Core plug and stub pipe retainer	WSK-M2G349-A4
Engine oil, SAE 5W-30	WSS-M2C-913B
Sealant	WSE-M4G323-A4

Capacities

Description	Liters
Engine oil, initial fill	8.5
Engine oil, service fill with oil filter change	7.0

Cylinder head and Valvetrain

Item	Specification
Cylinder head maximum permitted warp (mm)	0.125
Valve guide inner diameter (mm)	5.00 - 5.02
Intake valve effective length (mm)	88.87 - 89.17
Exhaust valve effective length (mm)	88.40 - 88.70
Valve stem to guide clearance intake decimetrical (mm)	0.022 - 0.057
Valve stem to guide clearance exhaust decimetrical (mm)	0.030 - 0.065
Valve head diameter intake (mm)	34.8 - 35.0
Valve head diameter exhaust (mm)	30.8 - 31.0
Intake valve face angle (degrees)	45° 15' 30" ± 7° 30'
Exhaust valve face angle (degrees)	45° - 44° 45'
Valve stem diameter intake (mm)	4.963 - 4.978
Valve stem diameter exhaust (mm)	4.955 - 4.970
Valve spring free length (mm)	43.5 MAX
Valve spring installed height (mm)	33.20
Camshaft lobe lift intake (mm)	8.50
Camshaft lobe lift exhaust (mm)	8.50
Camshaft journal to cylinder head bearing surface clearance diametrical (mm)	<ul style="list-style-type: none"> • Front bearing 0.045 - 0.085 • Other bearings 0.055 - 0.075
Camshaft journal diameter standard runout limit (mm)	<ul style="list-style-type: none"> • Center bearing to outer bearings 0.07 • Other bearings to outer

	bearings 0.05
Camshaft journal diameter standard out of round (mm)	0.005

Torque Specifications

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	40	30	-
Air conditioning compressor retaining bolts	25	18	-
Air conditioning compressor mounting bracket bolt	25	18	-
Camshaft bearing caps retaining bolts	10	7	88
Camshaft exhaust sprocket	A	-	-
Camshaft position sensor bolt	7	5	62
Connecting rod to bearing cap bolts	A	-	-
Coolant drain in engine block - plug M10 x 16	25	18	-
Coolant pump bolt	8 + 90°	6 + 90°	71 + 90°
Crankshaft damper pulley - bolt	320	236	-
Cylinder head - bolt	A	-	-
Engine cover (top)	4	3	35
Engine cover (top) mounting bracket - nut	6	4	53
Engine front cover retaining bolts	12	19	-
Engine mounting to engine mounting bracket - nut	48	35	-
Engine mounting to subframe - nut	63	46	-
Engine mounting bracket to engine - bolt	40	30	-
Engine wiring harness bracket - nut/bolt	10	7	88
Exhaust manifold - bolt	A	-	-
Exhaust manifold heat shield - bolt	3	2	27
Flexplate - bolt	A	-	-
Generator upper retaining bolts	2	15	-
Ignition coil retaining bolts	5	4	44
Intake manifold assembly retaining bolts	21	15	-
Intercoolers	12	9	-
Intercooler duct clamp plates	21	15	-
Knock sensor retaining nuts	20	14	-
Lifting eye (front) - bolt	30	22	-
Lifting eye (rear) - bolt	40	30	-
MAP sensor	6	4	53

Oil filter	17	13	-
Oil filter housing to engine - bolt	21	15	-
Oil level indicator tube - nut	6	4	53
Oil pan to oil pan body - bolt	A	-	-
Oil pan body to engine	A	-	-
Oil pan drain plug	25	18	-
Oil pump pick-up pipe to oil pan body - bolt	12	9	-
Oil pump to engine block - bolt	12	9	-
Oil pump to pick-up pipe - bolt	12	9	-
Piston cooling jet - bolt	9	7	80
Plug - M30 x 12 to engine block	50	37	-
Plug (flanged) - M30 - 1.5 x 20 to engine block	50	37	-
Power steering pump retaining bolts	25	18	-
Power steering pump bracket to engine - bolt	28	18	-
Primary timing chain tensioner - bolt	12	9	-
Primary timing chain tensioner, guide blade - bolt	12	9	-
Radio frequency interference suppressor to engine cover bracket - bolt	10	7	88
Secondary timing chain tensioner - bolt	12	9	-
Spark plugs	27	20	-
Starter motor retaining bolts	43	32	-
Supercharger	21	15	-
Supercharger outlet duct - bolt	10	7	88
Supercharger outlet duct - screw	21	15	-
Timing belt cover - bolt	A	-	-
Valve cover - bolt	A	-	-
Variable camshaft timing, oil control solenoid housing - bolt	22	16	-
Variable camshaft timing, oil control solenoid housing - nut	11	8	-
Variable camshaft timing sprocket - center bolt	A	-	-

A = refer to procedure for correct torque sequence

Valve Clearance Adjustment (12.29.48)

Special Service Tools



E65896

Tappet hold-down tool
303-540



E65897

Tappet hold-down tool adaptor
303-540/02



DWST074

Fan nozzle - air gun
303-590



CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.

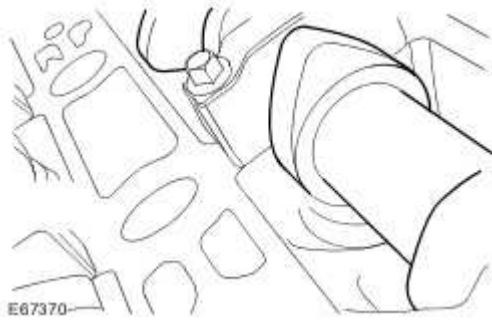


CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Remove the cover and disconnect the battery ground cable.
Specifications

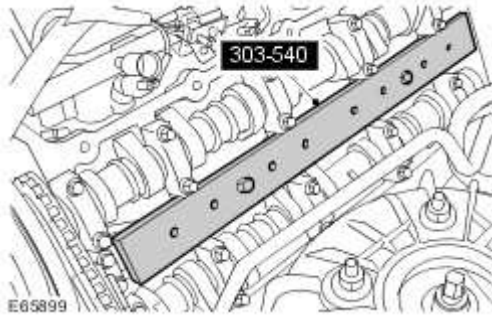
2. Check the valve clearances.
Valve Clearance Check (12.29.47)

3. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.



4. Install the special tool 303-540, to the cylinder head.

- Tighten the 2 bolts to 10 Nm (7 lb.ft).



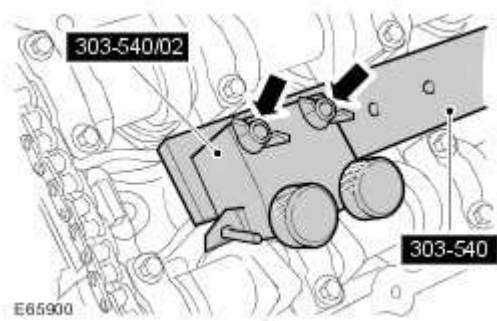
5.



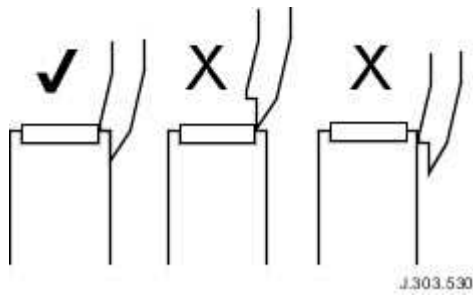
CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

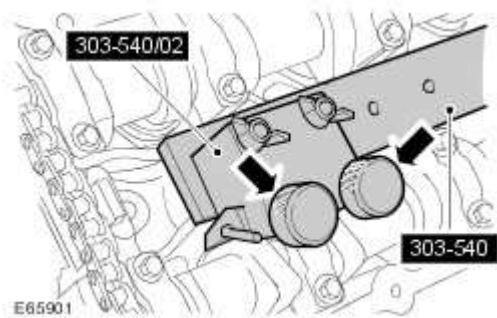
- Secure with the 2 wing nuts.



6. Position the special tool to the tappet as shown.



7. Using the special tool, compress the valve spring.



8.



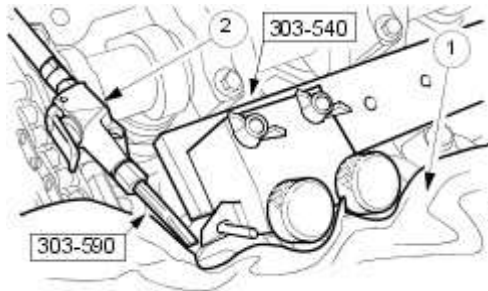
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



9.



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

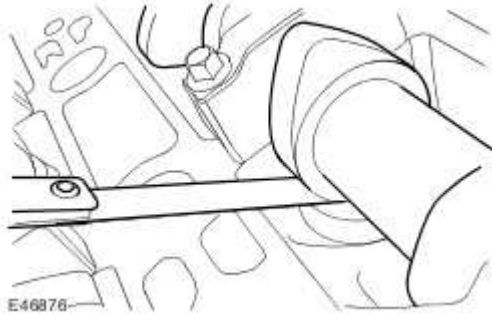


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

10. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



11. Repeat the above procedure for the remaining valves.

Valve Clearance Check (12.29.47)



CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Remove the cover and disconnect the battery ground cable.

[Specifications](#)

2. Remove the LH valve cover.

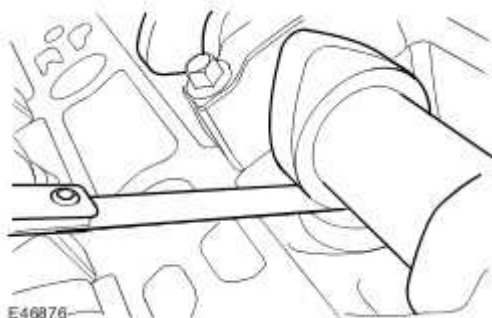
[Valve Cover LH \(12.29.43\)](#)

3. Remove the RH valve cover.

[Valve Cover RH \(12.29.44\)](#)

4. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

5. Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



6. Repeat the above procedure for the remaining 31 shims.

7. Adjust the clearance as necessary.

8. For cylinder head data, refer to specifications.

[Specifications](#)

9. Install the RH valve cover.

[Valve Cover RH \(12.29.44\)](#)

10. Install the LH valve cover.

[Valve Cover LH \(12.29.43\)](#)

11. Connect the battery ground cable and install the cover.

[Specifications](#)

Engine Oil Draining and Filling

Special Service Tools



Wrench, Oil filter
303-752



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.



CAUTION: Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

NOTE:

Clean the components general area prior to dismantling.

1. Remove the cover and disconnect the battery ground cable.

Specifications

2.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the engine undershield.

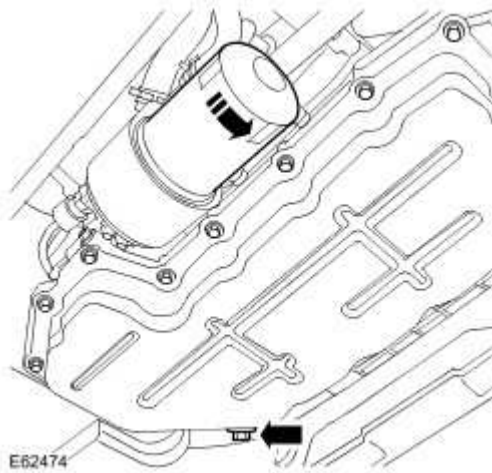
Air Deflector (76.11.41)

4. Remove the oil pan drain plug.

- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.

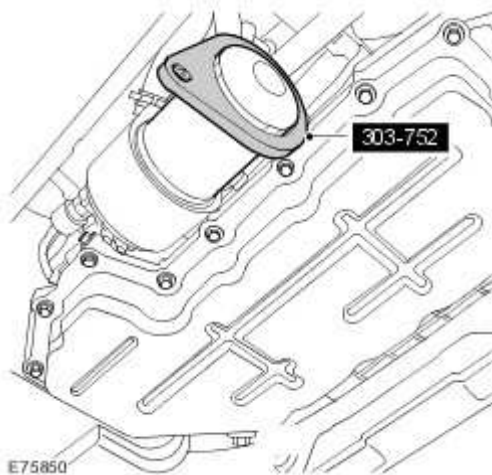
5. Remove the oil filter.

- Position a container to collect the fluid.
- Discard the oil filter.



6. Using the special tool, install the oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm (13 lb.ft).



7. Tighten the drain plug to 25 Nm (18 lb.ft).

- Install a new seal.

8. Fill the engine with oil.

9. Connect the battery ground cable and install the cover.

Specifications

10. Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.
- Check for leaks.

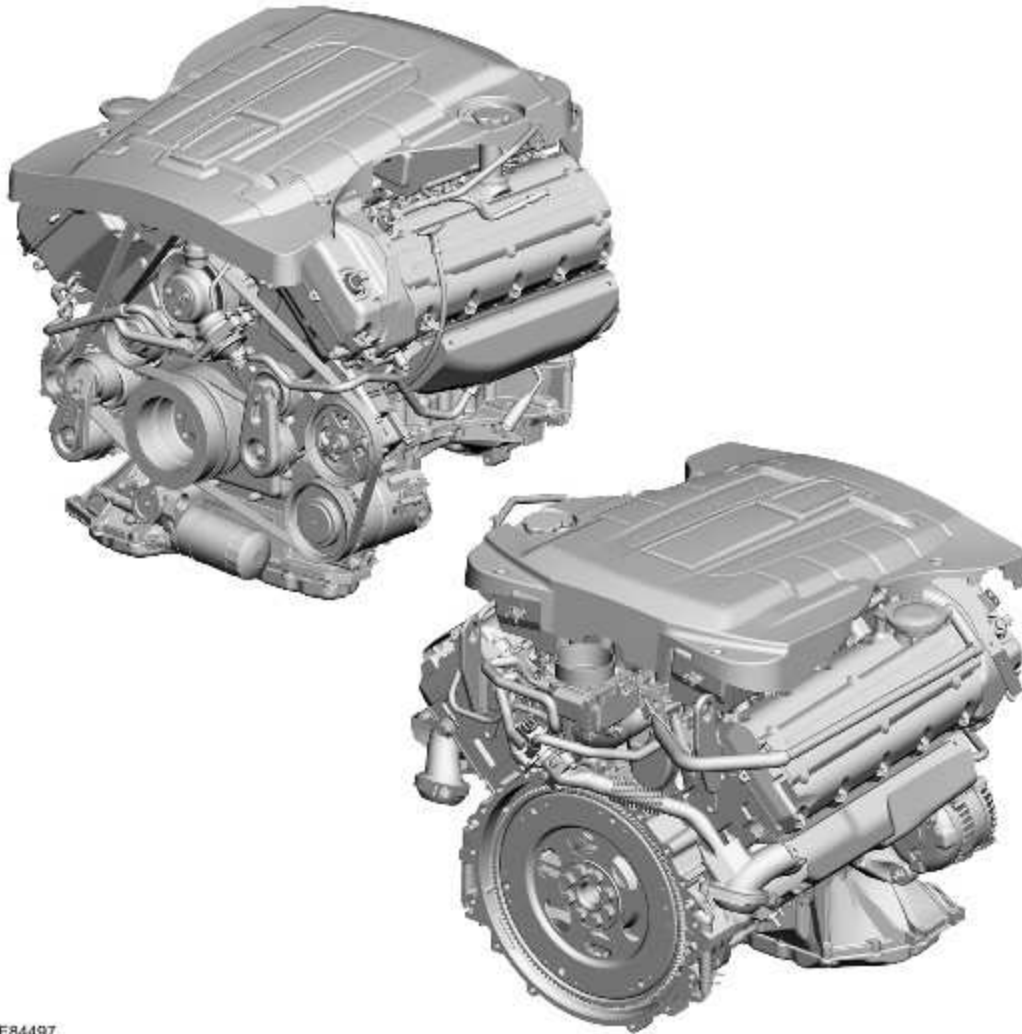
11. Install the engine undershield.

Air Deflector (76.11.41)

12. Check and top-up the engine oil.

Engine

EXTERNAL VIEW



E84497

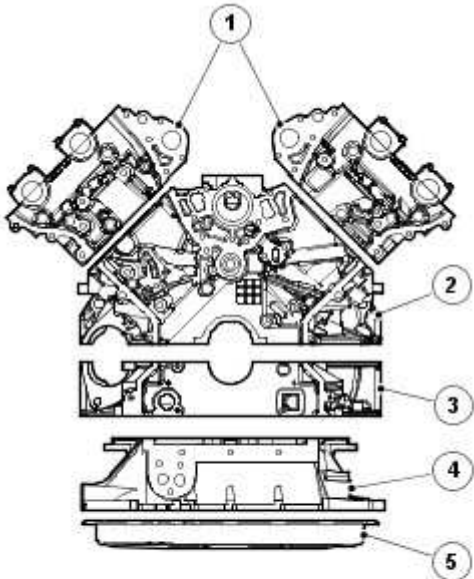
OVERVIEW

The V8 supercharged petrol engine is a 4.2 liter, 8-cylinder, 90 degrees 'Enclosed' V unit, with 4 valves per cylinder, operated by 2 overhead camshafts per cylinder head. The engine emissions comply with ECD4 (European Commission Directive) legislative requirements and employs catalytic converters, electronic engine management control and positive crankcase ventilation to limit the emission of pollutants. The cooling system is a low volume, high velocity system. The Engine Control Module (ECM) controls the fuel injection system, the ignition system and the electric throttle.

The cylinder block is of aluminum alloy construction with cast iron liners. A cast aluminum bedplate is bolted to the bottom of the block to improve lower structure rigidity. The cylinder heads are cast aluminum with thermo-plastic camshaft covers. The single-piece oil sump is also cast aluminum. The

fabricated stainless steel twin skin exhaust manifolds are unique for each cylinder bank. A moulded plastic acoustic cover is fitted over the upper engine to reduce engine-generated noise.

Engine Structure



E7 1998

Item	Part Number	Description
1		Cylinder heads
2		Cylinder block
3		Bedplate
4		Structural sump
5		Sump pan

TECHNICAL FEATURES

The technical features include:

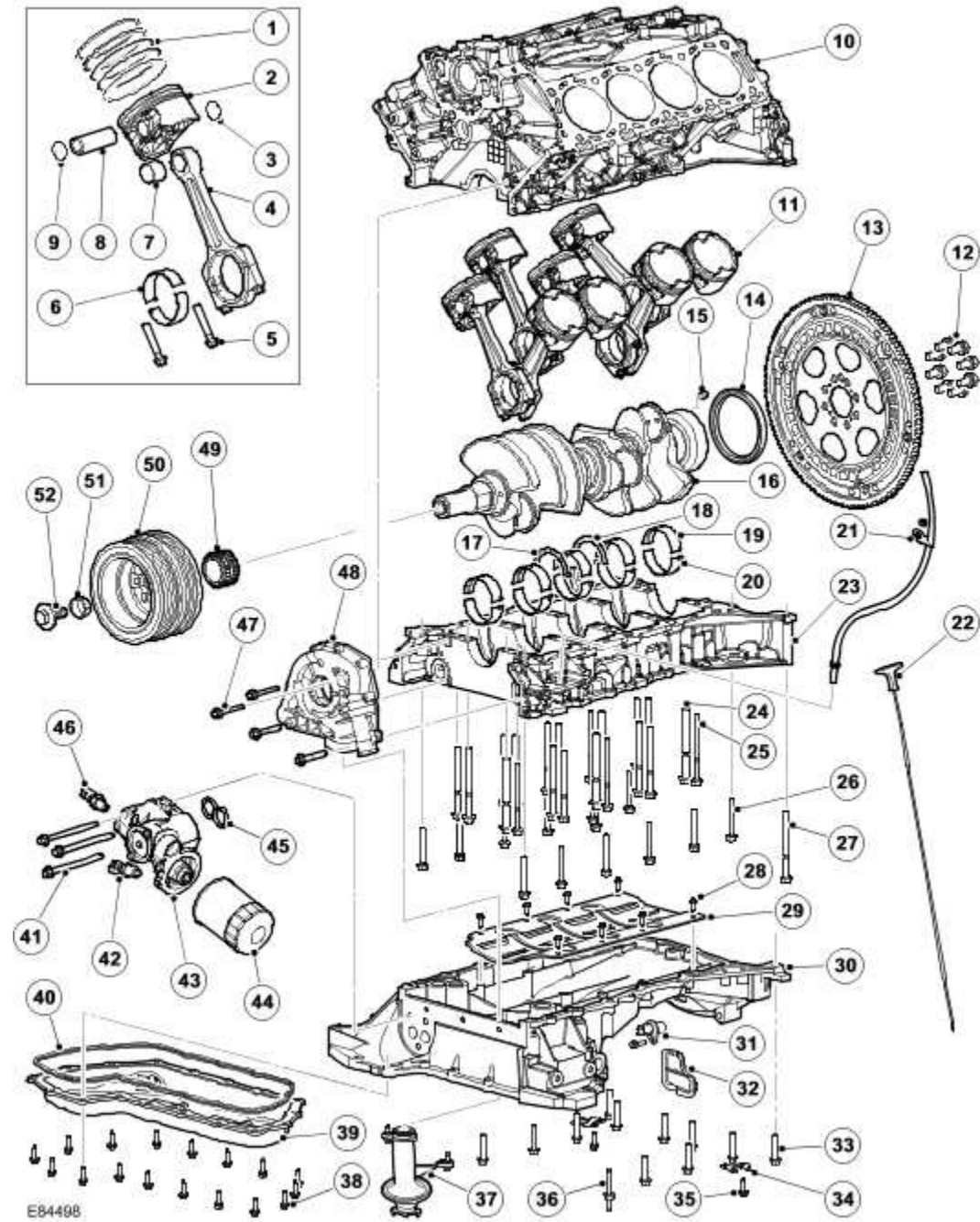
- An 8-cylinder 90-degree 'Enclosed V' configuration liquid cooled aluminum cylinder block with cast iron liners
- Pistons are of open-ended skirt design, with 2 compression rings and a 3-piece oil control ring
- Two aluminum cylinder heads, each incorporating 2 camshafts manufactured in chilled cast iron
- Four valves per cylinder

- Graded valve lifters (shimless)
- Belt driven supercharger
- Top fed, 12-hole fuel injectors
- Engine front cover manufactured from aluminum, accommodating the crankshaft front oil seal
- Primary and secondary chain drive for the camshafts
- An aluminum bedplate
- A cast iron crankshaft
- Fracture-split connecting rods in sintered-forged steel
- A twin multi-V belt, driving the front-end accessories
- Fabricated stainless steel twin skin exhaust manifolds
- An advanced engine management system incorporating electronic throttle control
- Meets with the fault handling requirements, as detailed in the European On-Board Diagnostic (EOBD) III, US Federal OBD and California OBDII legislation.

ENGINE DATA

DESCRIPTION	TYPE
Configuration	90 degree V8
Maximum power	283 kW at 5750 rpm
Maximum torque	550 Nm at 3500 rpm
Displacement	4196 liters
Stroke/bore	90.3/86 mm
Compression ratio	9.1 : 1
Firing order	1 5 4 2 6 3 7 8
Oil volume	7 liters (wet)

CYLINDER BLOCK COMPONENTS



Item	Part Number	Description
1		Piston rings
2		Piston
3		Circlip
4		Connecting rod

5		Bolts
6		Connecting rod bearing shells
7		Bearing
8		Piston pin
9		Circlip
10		Cylinder block
11		Piston assemblies
12		Bolts (8 off)
13		Flywheel
14		Seal
15		Dowel
16		Crankshaft
17		Thrust washer
18		Thrust washer
19		Bearing shells - upper
20		Bearing shells - lower
21		Oil level gage tube
22		Oil level gage
23		Bedplate
24		Bolts (10 off)
25		Bolts (10 off)
26		Bolts (12 off)
27		Bolt

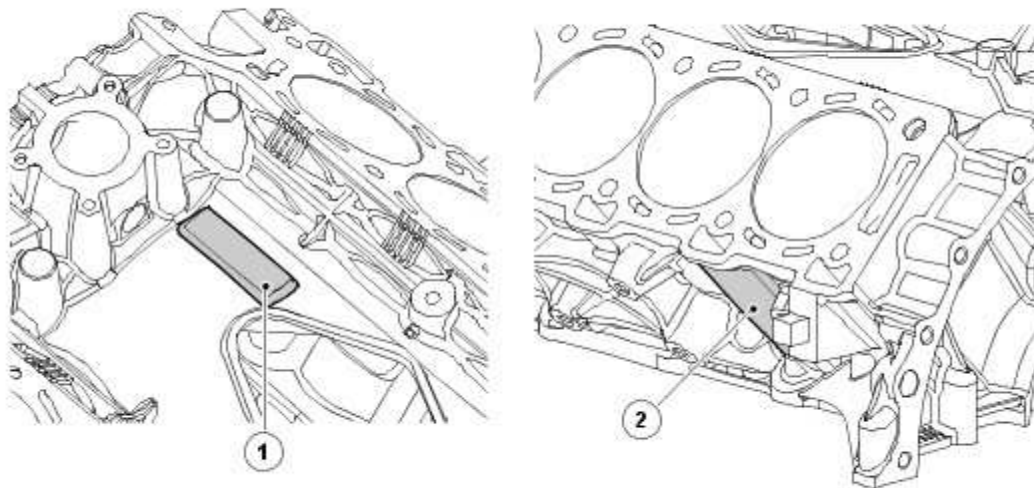
28		Bolts (8 off)
29		Windage tray
30		Sump
31		Crankshaft Position (CKP) sensor
32		Flange
33		Bolts (11 off)
34		Clip
35		Bolts (2 off)
36		Stud
37		Oil pick-up pipe
38		Bolts (17 off)
39		Sump pan
40		Gasket
41		Bolts (3 off)
42		Engine oil temperature sensor
43		Oil filter head assembly
44		Oil filter
45		Seal
46		Oil pressure switch
47		Bolts (4 off)
48		Oil pump
49		Crankshaft sprocket
50		Crankshaft pulley

51		Taper collet
52		Crankshaft bolt

Cylinder Block

The cylinder block is an 'Enclosed V' design, which provides an inherently rigid structure with good vibration levels. A low volume coolant jacket improves warm-up times and piston noise levels; the longitudinal flow design of the jacket, with a single cylinder head coolant transfer port in each bank, improves rigidity and head gasket sealing. The right hand cylinder bank is designated as 'A' bank, and the left hand as 'B' bank. The cylinder bores are numbered from 1 to 4, for bank 'A' and 5 to 8 for bank 'B', starting from the front of the engine (for more information refer to the Vehicle Specification Book (VSB)).

Engine Data Locations



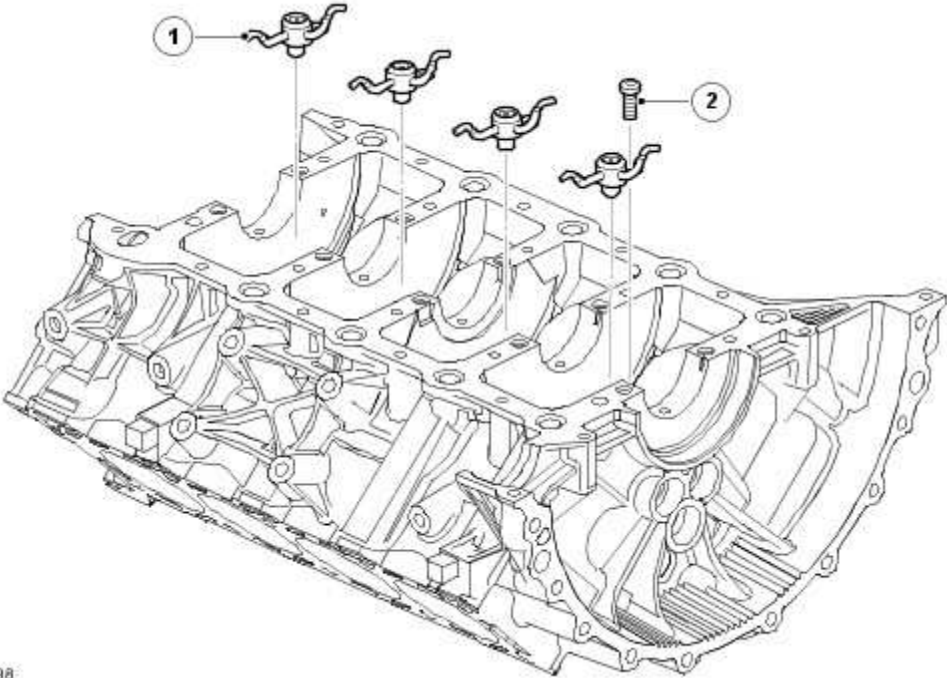
E43426

Item	Part Number	Description
1		Engine part number
2		Engine data (main bearing diameters, cylinder bore diameters, etc), emissions code and engine number

Engine data is marked at 3 locations, 2 on the cylinder block (shown) and 1 on the engine front cover, which consists of a label displaying the engine number. Component diameters are represented by

alphabetical and numerical codes; keys to the codes are in the Service Repair Procedures (SRP) section of this manual.

Piston Cooling Jets



E56198

Item	Part Number	Description
1		Piston cooling jet (4 off)
2		Bolt (4 off)

Jets located in the cylinder block provide piston and piston pin lubrication and cooling. These jets spray oil on the underside of the piston.

Lubrication oil is distributed through the cylinder block, via the main oil gallery and channels bored in the block, to all critical moving parts. These channels divert oil to the main and big-end bearings via holes machined into the crankshaft.

Connecting Rods and Pistons

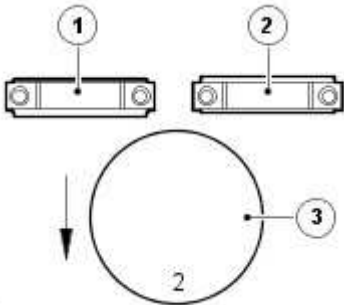


E43427

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is marked on adjoining sides of the joint to identify matching connecting rods and bearing caps. The connecting rod bearings are aluminum/tin split plain bearings.

The pistons are of the open-ended skirt design with a dished crown. They are also manufactured from a higher strength aluminum alloy and incorporate a thicker top land to resist the increased thermal and mechanical loads produced by supercharging. Three piston rings, 2 compression and 1 solid oil control ring, are installed on each piston. Each piston is installed on a piston pin located in an bronze bushing in the connecting rod.

Connecting Rod and Piston Installation



E43428

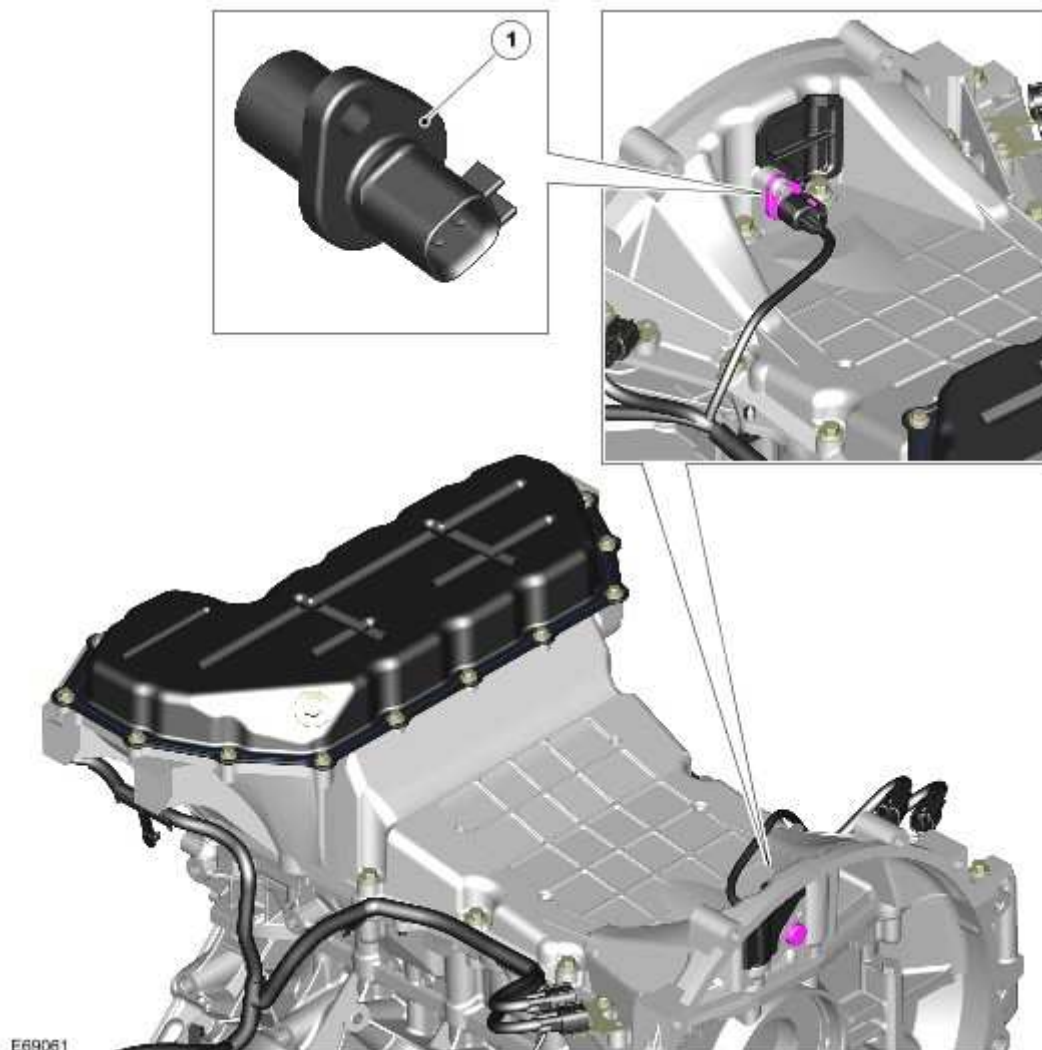
Item	Part Number	Description

1		Bank A (RHS)
2		Bank B (LHS)
3		Piston

The piston grade number is stamped on the crown of the piston and must coincide with that for each cylinder bore. The piston must be assembled in the correct orientation for the designated cylinder bore:

- Bank 'A' - piston grade number and the thick flange of the connecting rod must face the front of the engine
- Bank 'B' - piston grade number and the thin flange of the connecting rod must face the front of the engine

Crankshaft Position Sensor



Item	Part Number	Description

1		Crankshaft position sensor (CKP)
---	--	----------------------------------

The CKP sensor is installed at the rear of the sump. It is a variable reluctance sensor that provides an input of engine crankshaft speed and position. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

Knock Sensors

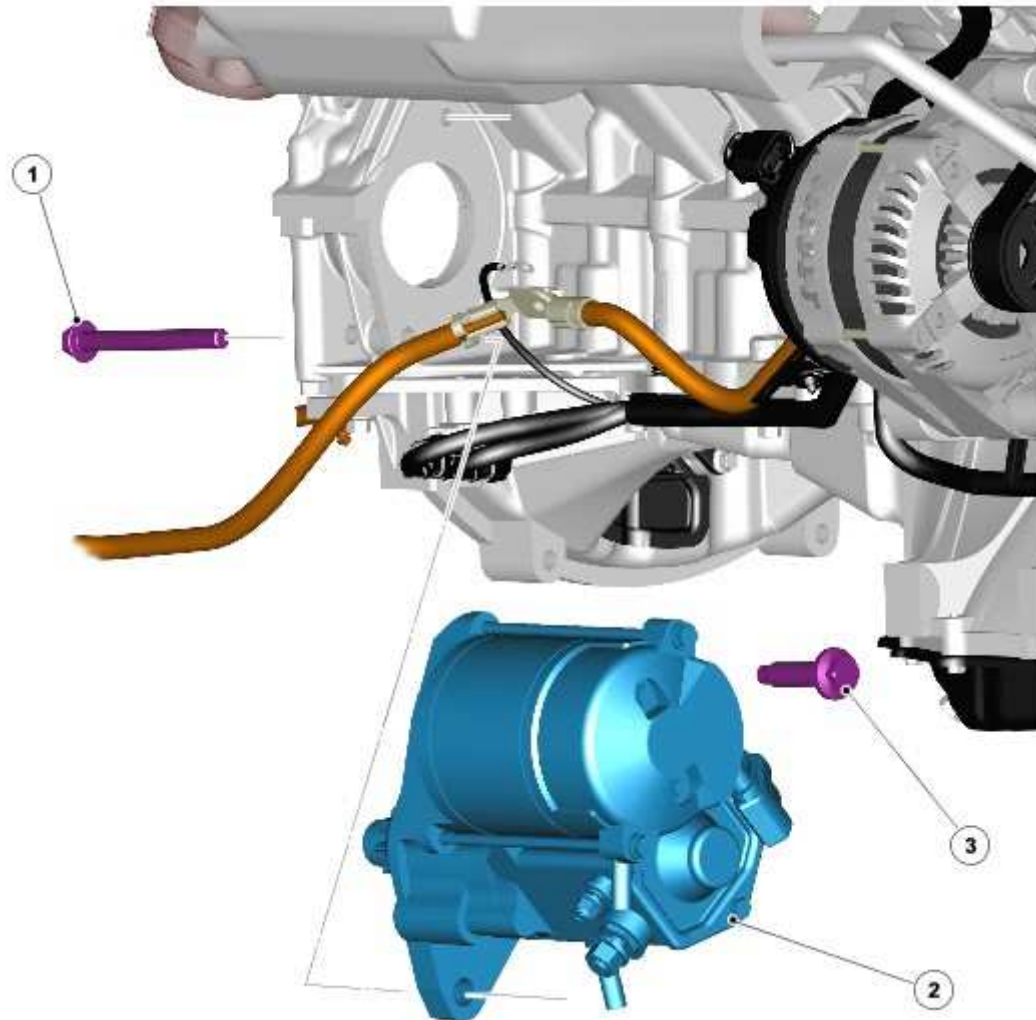


Item	Part Number	Description
1		Knock sensor
2		Bolt

The knock sensors are installed in the cylinder block on the inboard side of each cylinder bank. They are piezo-electric sensors that provide inputs to detect and locate detonation during combustion. For

additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

Starter

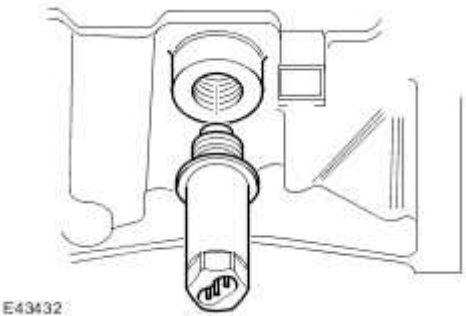


E69062

Item	Part Number	Description
1		Bolt
2		Starter motor
3		Bolt

The engine starter motor is installed at the rear right side of the engine, at the cylinder block to bedplate split line. For additional information, refer to Starting System (303-06 Starting System)

Coolant Drain Plug/Heater

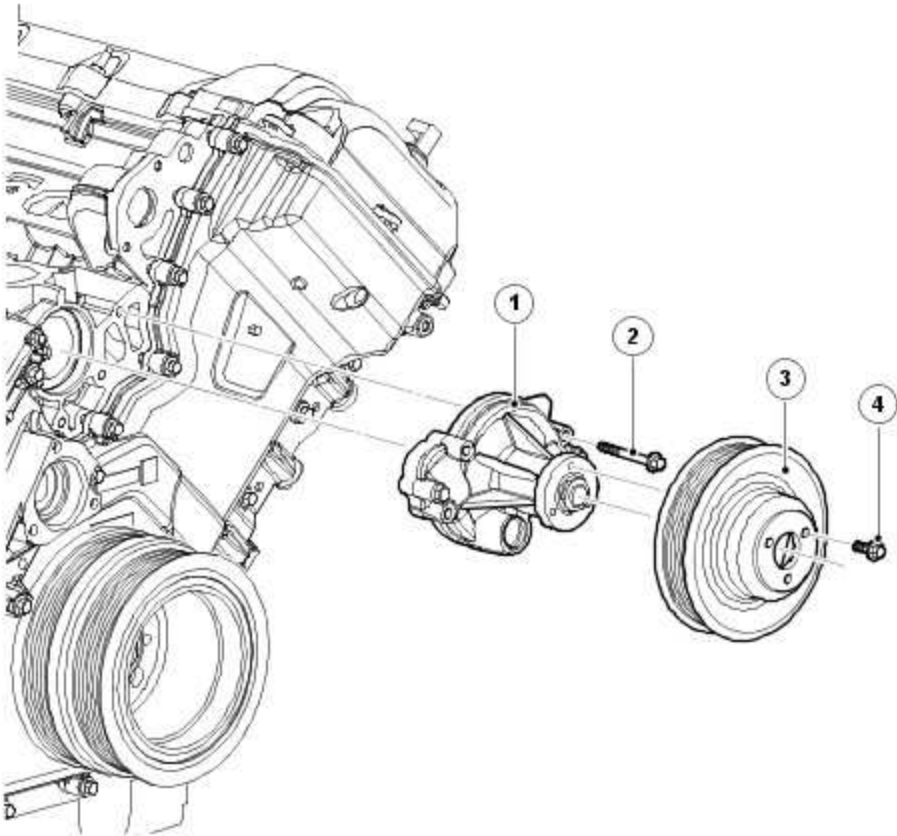


E43432

A coolant drain plug is installed on the rear left side of the cylinder block. On vehicles with the cold climate package, the cylinder block heater replaces the drain plug.

On vehicles destined for Canada, the coolant heater is installed during engine manufacture, but for Scandinavian vehicles the heater is supplied in kit form to be installed at the dealership.

Coolant Pump

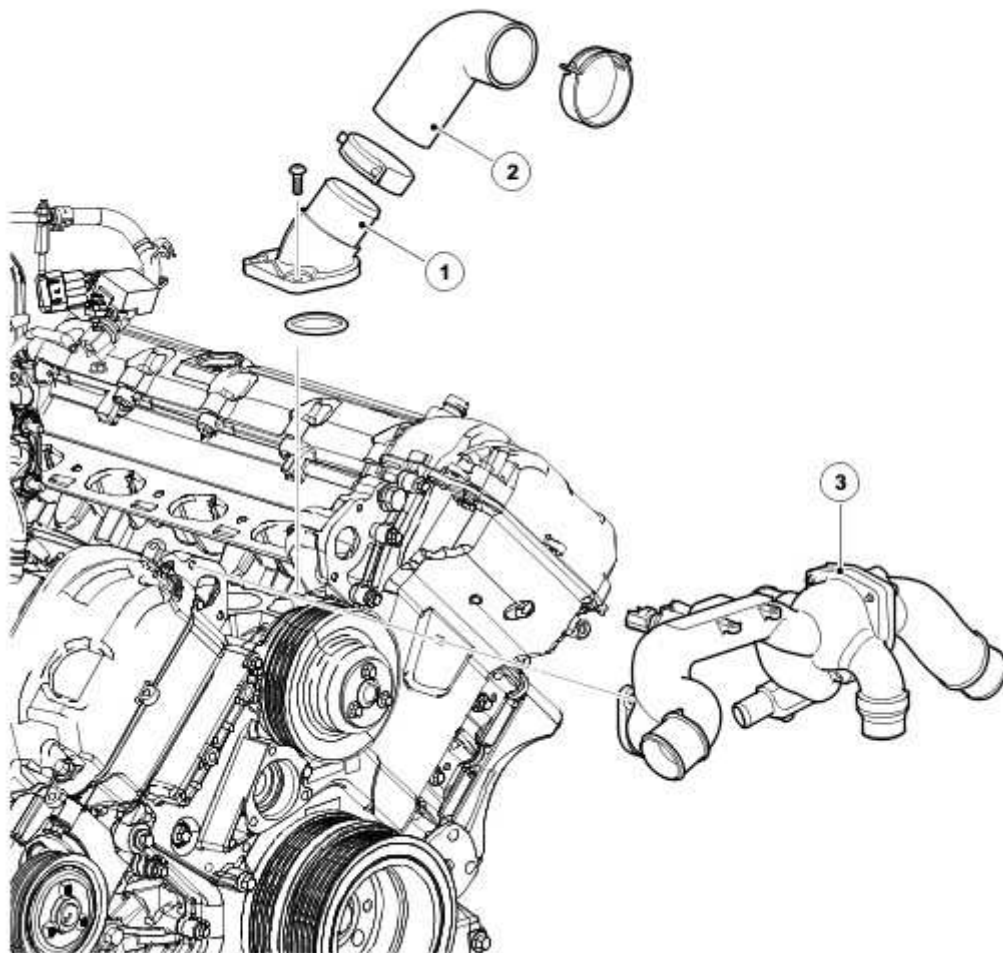


E43433

Item	Part Number	Description
1		Coolant pump
2		Bolt
3		Pulley
4		Bolt

The coolant pump is installed between the 2 cylinder banks, on the front face of the cylinder block.

Coolant Inlet and Outlet Assembly



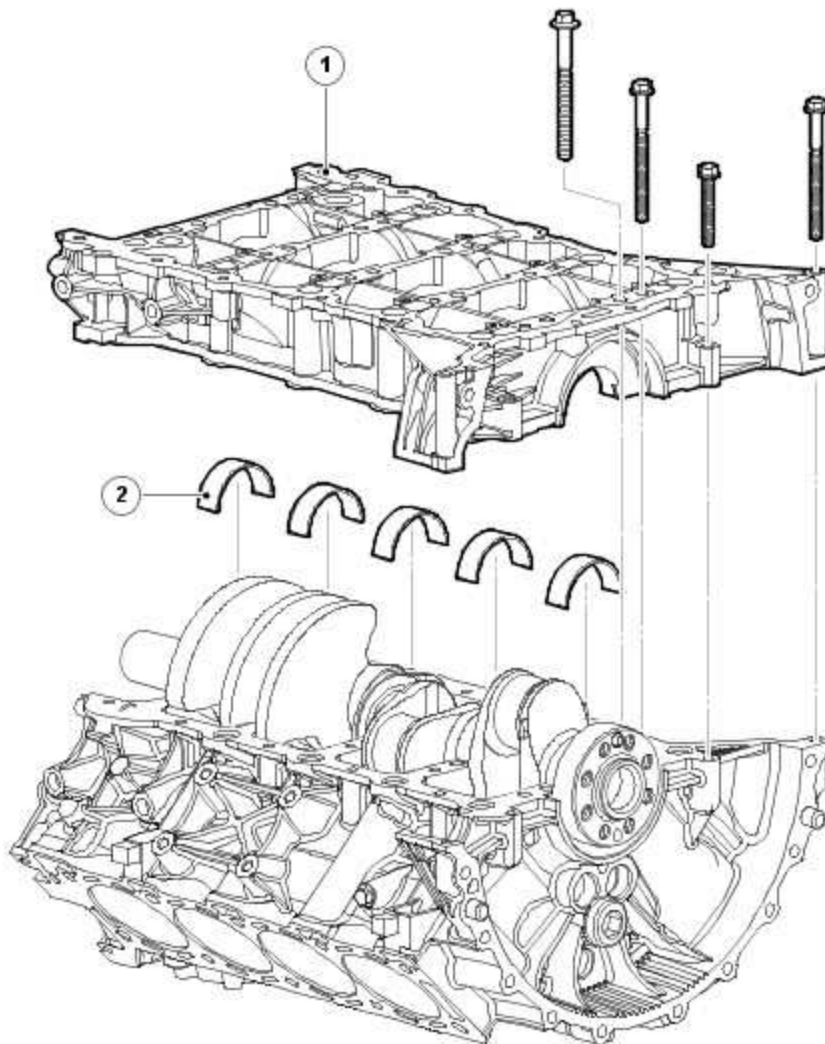
E56199

Item	Part Number	Description
1		Coolant outlet elbow

2		Coolant hose
3		Thermostat housing

To accommodate the installation of the supercharger, the thermostat housing and coolant outlet duct are combined into an aluminum alloy coolant outlet assembly, which is installed between the 2 cylinder banks, immediately above the coolant pump. A hose connects the coolant outlet assembly to a coolant inlet housing attached to the coolant pump intake on the cylinder block. The thermostat controls the flow of coolant through the radiator.

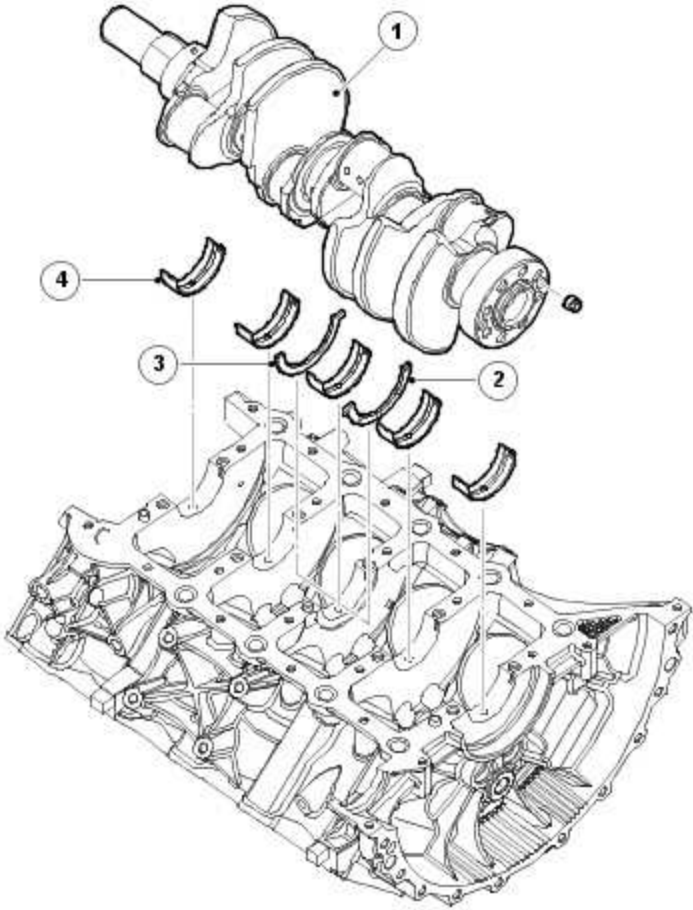
CRANKSHAFT AND SUMP COMPONENTS



E43435

Item	Part Number	Description
1		Bedplate
2		Main bearings - lower

Crankshaft and Main Bearings



E43436

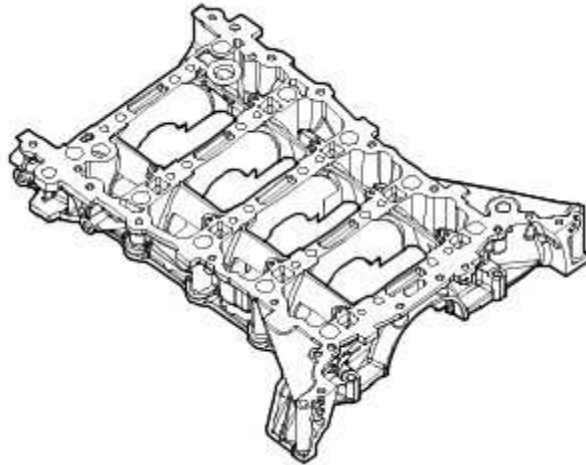
Item	Part Number	Description
1		Crankshaft
2		Thrust washer
3		Thrust washer
4		Main bearings - upper

Six counter-balance weights ensure low vibration levels from the 4 throw, 5 bearing crankshaft. Manufactured in cast iron, the crankshaft also has undercut and rolled fillets for improved strength.

The crankshaft rear oil seal is a press fit in the bedplate to cylinder block interface.

The main bearings are aluminum/tin split plain bearings. An oil groove in the upper half of each bearing transfers the oil into the crankshaft for lubrication of the connecting rod bearings. An aluminum/tin thrust washer is installed each side of the top half of the centre main bearing.

Bedplate



E43437

The bedplate is a structural casting bolted to the bottom of the cylinder block to retain the crankshaft. The use of a bedplate further improves rigidity. Iron inserts, cast into the main bearing supports of the bedplate, minimise main bearing clearance changes due to heat expansion.

Two hollow dowels align the bedplate with the cylinder block.

Beads of sealant seal the joint between the bedplate and the cylinder block.

Sump

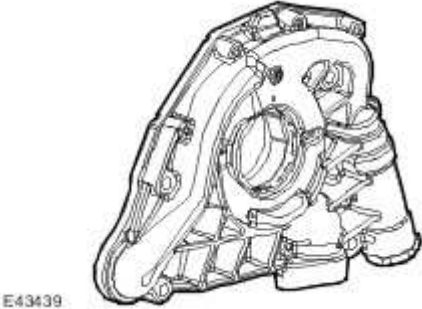


E69060

The aluminum alloy structural sump is bolted to the bedplate. A windage tray attached to the underside of the bedplate isolates the oil pan from the disturbed air produced by the rotation of the crankshaft, to prevent oil aeration and improve oil drainage. A rubber plug at the rear of the structural sump seals the port that provides access to the torque converter securing bolts. The engine oil drain plug is located in the pressed steel oil pan, which attaches to the underside of the aluminum alloy structural sump.

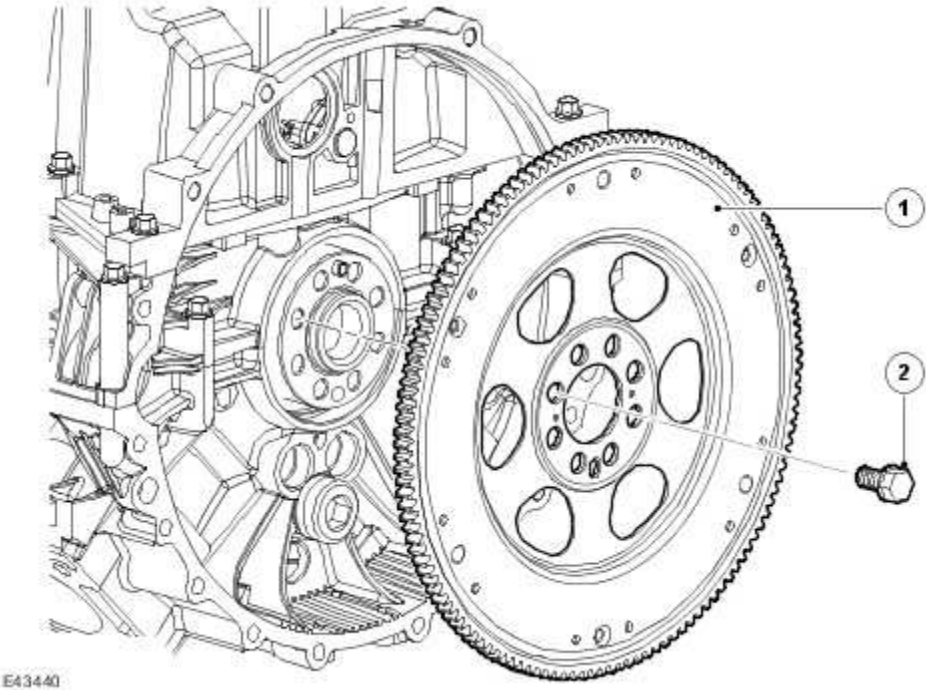
A bead of sealant seals the joint between the structural sump and the bedplate.

Oil Pump



The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate (See lubrication section for more information).

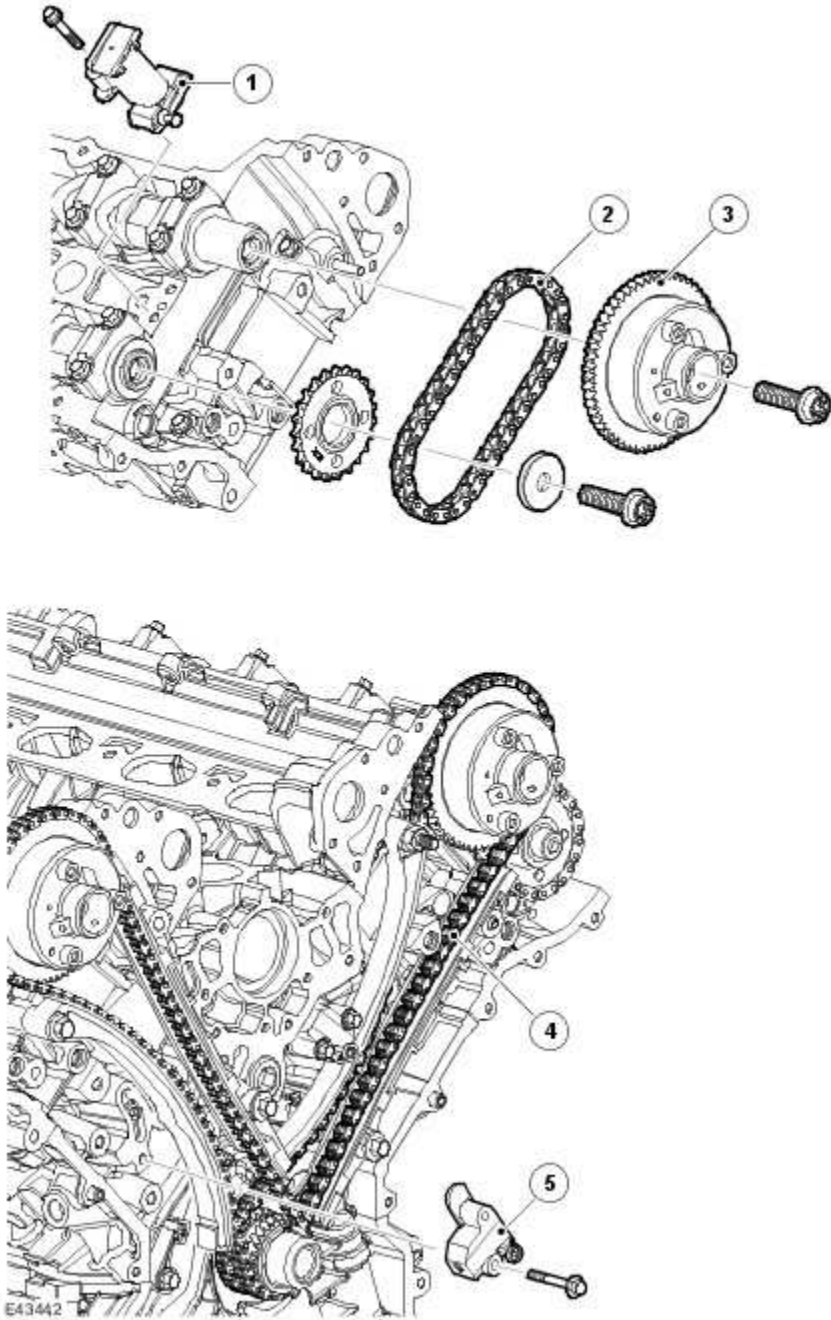
Starter Drive Plate



Item	Part Number	Description
1		Starter drive plate
2		Bolt

The starter drive plate is attached to the rear of the crankshaft. A timing disc, for the CKP sensor, is spot welded to the front face of the drive plate.

CAMSHAFT TIMING COMPONENTS



Item	Part Number	Description
1		Secondary chain tensioner
2		Secondary chain
3		Variable valve timing unit
4		Primary chain

5		Primary chain tensioner
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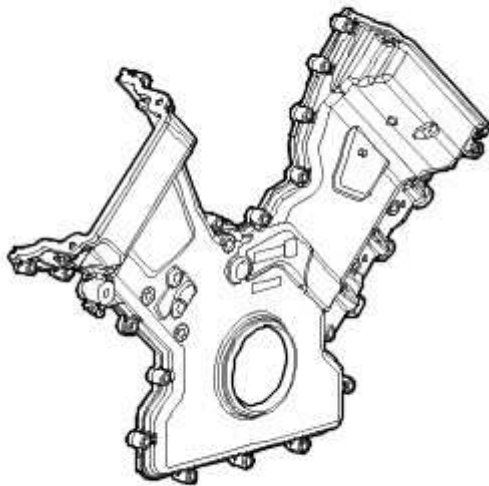
Timing Gear

Multiple link primary and single row secondary chains drive the camshafts of each cylinder bank. The primary chains transmit the drive from 2 sprockets on the crankshaft to variable valve timing units on the intake camshafts. The secondary chains transmit the drive from the variable valve-timing units to sprockets on the exhaust camshafts.

A key locates the 2 drive sprockets on the crankshaft. The crankshaft's torsional vibration damper retains the sprockets in position. The variable valve timing units and the exhaust camshaft sprockets are non-interference, non-keyed fits on their respective camshafts; the drive being transmitted by the face to face friction load produced by the valve timing unit/sprocket securing bolt.

Each chain has a hydraulic tensioner operated by engine oil. The primary chains are lubricated via oil squirt tubes located at the front of the engine block near the crankshaft drive sprockets. A jet of oil from the end of each secondary chain tensioner lubricates the secondary chains. The primary chain tensioners act on pivoting flexible tensioner blades. The secondary chain tensioners act directly on the chains. Guide rails are installed on the drive side of the primary chains.

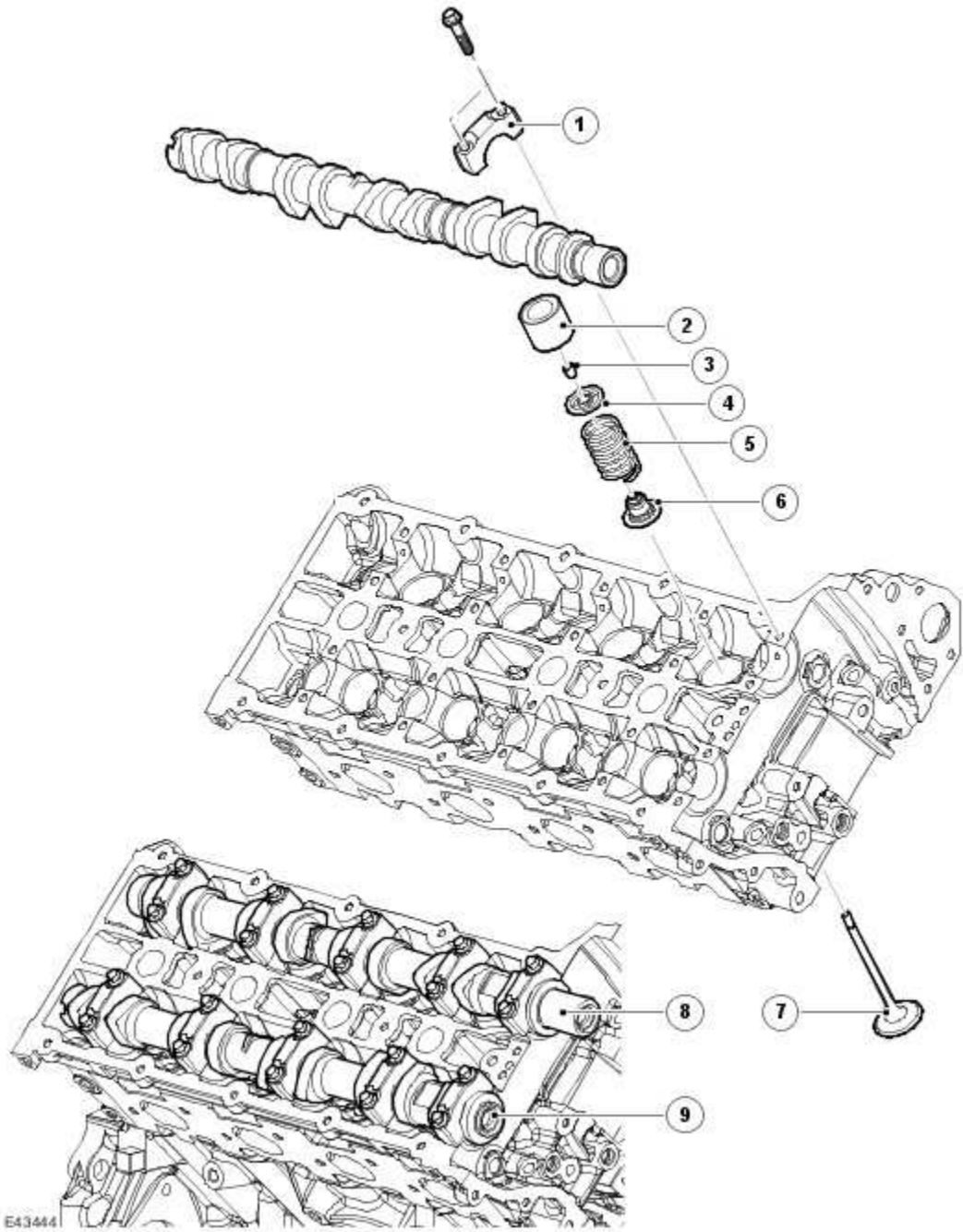
Timing Cover



E43443

The aluminum alloy timing cover accommodates the crankshaft front oil seal (a PTFE lip seal). Silicon rubber in-groove gaskets seal the joint between the timing cover and the front face of the engine.

CYLINDER HEAD COMPONENTS



Item	Part Number	Description
1		Camshaft bearing cap
2		Tappet (shimless)
3		Collet
4		Valve spring cap

5		Valve spring
6		Valve stem oil seal
7		Valve
8		Inlet camshaft
9		Exhaust camshaft

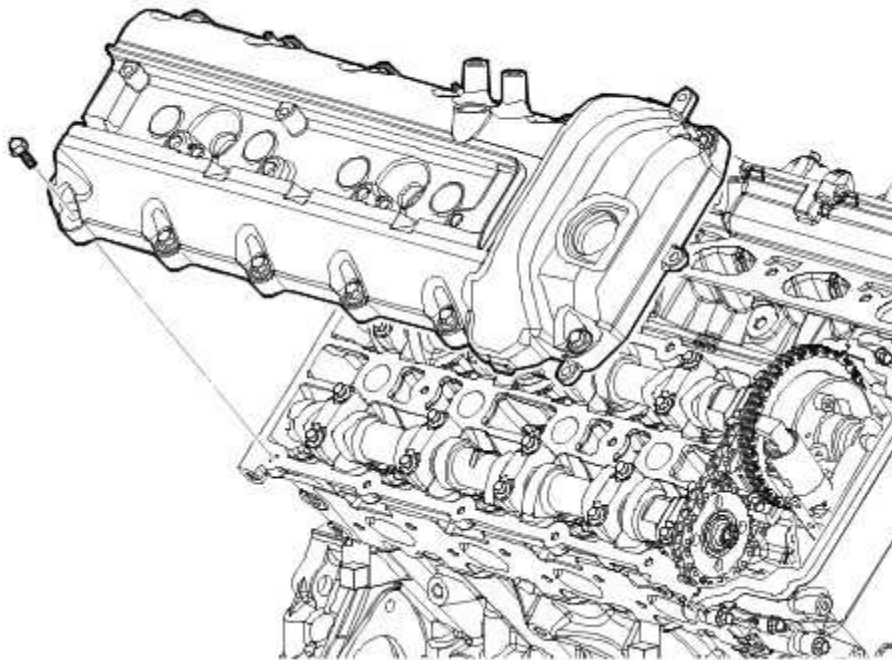
Cylinder Heads

The cylinder heads are unique to each cylinder bank. Deep-seated bolts, to reduce distortion, secure the cylinder heads to the cylinder block. Two hollow dowels align each cylinder head with the cylinder block.

The 14 mm (0.55 in) spark plugs, 1 per cylinder, locate in recesses down the centre line of each cylinder head.

The engine-lifting eyes are bolted to the cylinder heads, 2 on the rear (1 per head) and 1 at the front.

Camshaft Covers



E43445

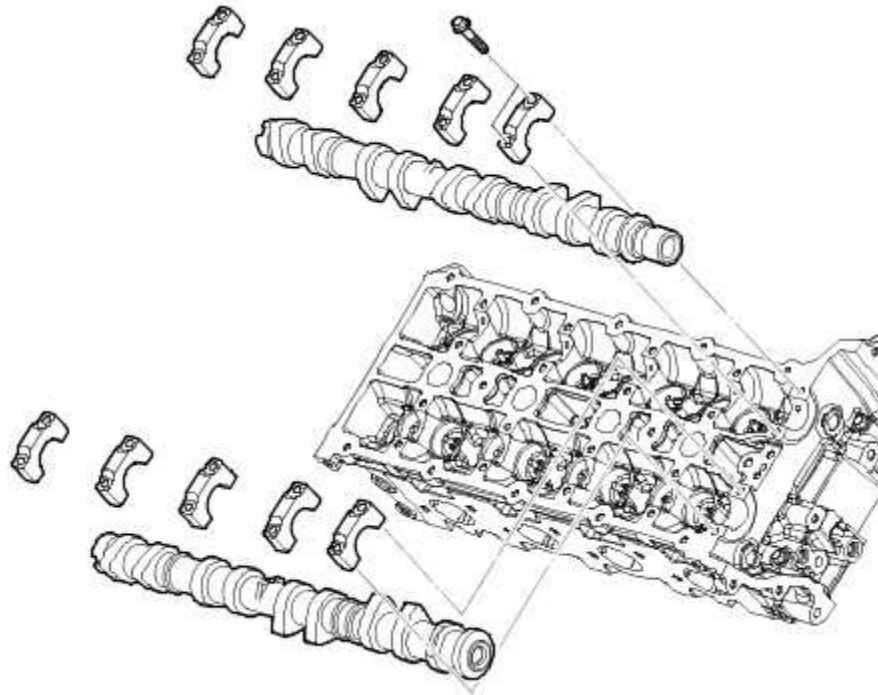
The camshaft covers are manufactured from thermo-plastic. The A bank camshaft cover incorporates an outlet for the part load engine breather and the Pressure Control Valve (PCV). The B bank camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. Identical oil separators are incorporated below the breather outlet in each cover.

Silicon rubber in-groove gaskets seal the joints between the camshaft covers and the cylinder heads. Together with spacers and seals on the camshaft cover fasteners, they also isolate the covers from direct contact with the cylinder heads, to reduce noise.

Cylinder Head Gasket

The multi-layered steel cylinder head gasket has cylinder specific water flow cross-sections for uniform coolant flow.

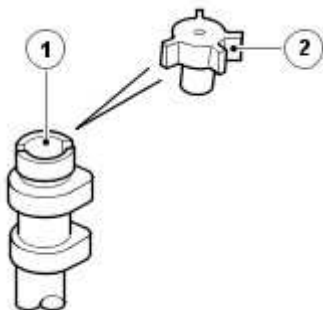
Camshafts



E43446

The camshafts are manufactured in chilled cast iron. Five aluminum alloy caps retain each camshaft. Location numbers, 0 to 4 for the intake camshaft and 5 to 9 for the exhaust camshaft, are marked on the outer faces of the caps.

Sensor Ring



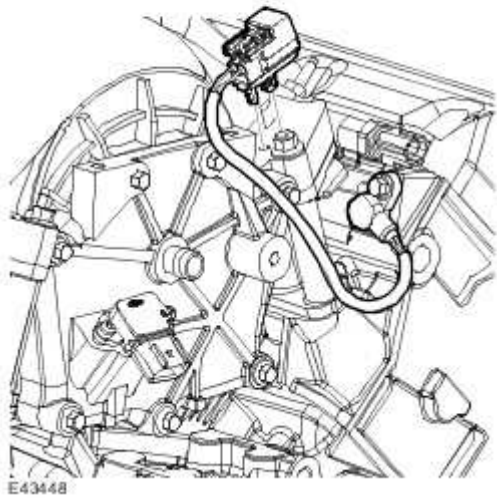
E43447

Item	Part Number	Description

1		Inlet camshaft
2		Sensor ring

Timing rings for each camshaft position sensor are located at the rear of both intake camshafts. A flat, machined near the front of each camshaft, enables the camshafts to be locked during the valve timing procedure.

Camshaft Position Sensor



The camshaft position sensors are installed in each cylinder head at the rear of the intake camshaft. It is a variable reluctance sensor that provides an input to the ECM regarding the position of the camshaft. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

Inlet and Exhaust Valves

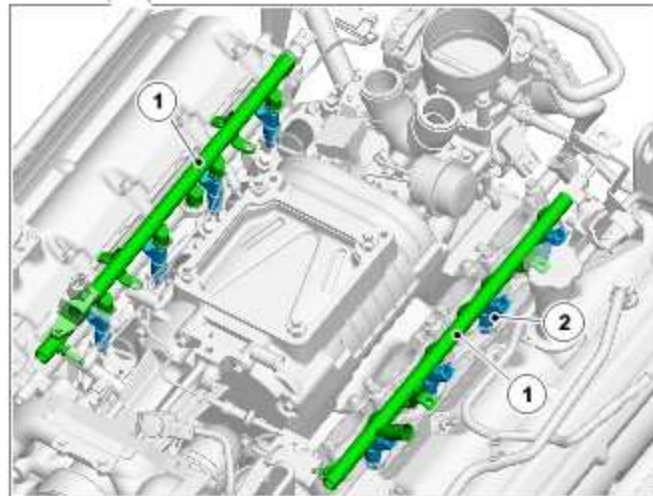
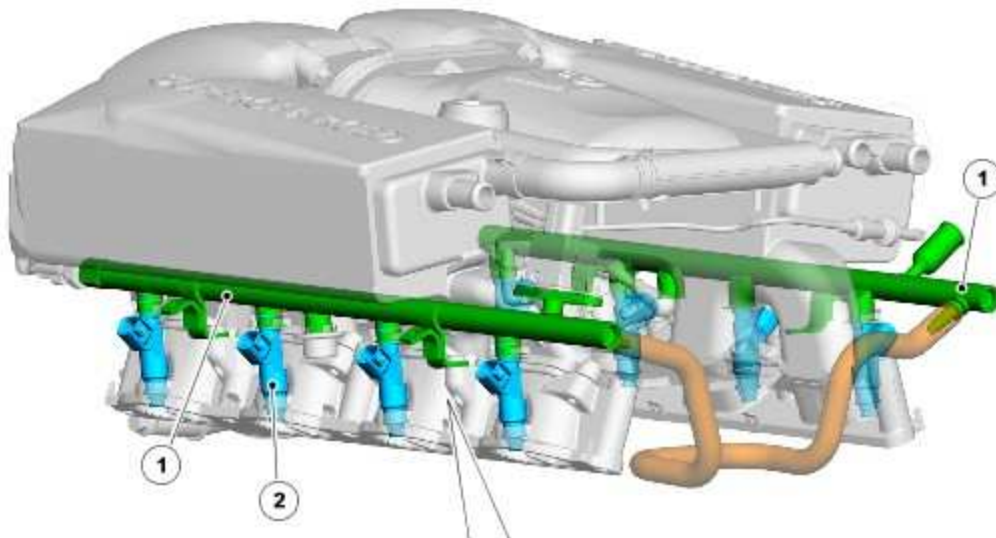
Each cylinder head incorporates dual overhead camshafts operating 4 valves per cylinder via solid shimless valve lifters.

The lightweight valve gear provides good fuel economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.



CAUTION: Due to slight variations in length, the valves are not interchangeable between marques (Land Rover, Jaguar and Aston Martin).

Fuel Injectors



E84500

Item	Part Number	Description
1		RH fuel rail (2 off, 1 per bank)
2		Injector (8 off, 4 per bank)

Eight, top fed, 12-hole, fuel injectors are installed in the fuel rails and are held in position by spring clips. Two O-rings are installed between the injector mounts of the fuel rails and the related recesses in the intercooler adapters. The injectors are electromagnetic solenoid valves controlled by the ECM.

The fuel jets from the injectors are directed onto the back of the intake valves. For additional information, refer to [Electronic Engine Controls \(303-14 Electronic Engine Controls - Vehicles Without: Supercharger\)](#)

Fuel Rails

The fuel rails are installed on the intercooler adapters. A fuel crossover pipe connects the fuel rails together at the front of the engine.

VARIABLE VALVE TIMING (VVT)

The continuously VVT unit turns the intake camshaft in relation to the primary chain to advance and retard the timing.

The system improves low and high-speed engine performance, engine idle quality and exhaust emission.

The VVT system changes the phasing of the intake valves, relative to the fixed timing of the exhaust valves, to alter:

- the mass of air flow into the engine's cylinders,
- and the engine's torque response and emissions

The VVT unit uses a vane device to control the camshaft angle (refer to VVT operation). The system operates over a range of 48 degrees and is advanced or retarded to the optimum angle within this range.

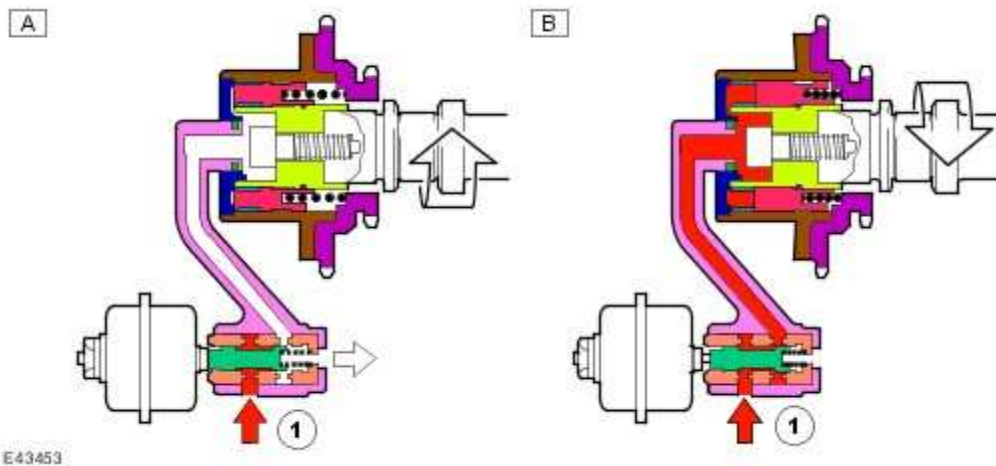
The ECM controls the VVT, using engine speed and load, and engine oil temperature signals to calculate the appropriate camshaft position. For additional information, refer to [Electronic Engine Controls \(303-14 Electronic Engine Controls - Vehicles Without: Supercharger\)](#)

The continuous VVT system provides the following advantages:

- Reduces engine emissions and fuel consumption by further optimising the camshaft timing, this improves the engine's internal exhaust gas re-circulation (EGR) effect over a wider operating range
- Improves full-load torque characteristics as the camshaft timing is optimised at all engine speeds for superior volumetric efficiency
- Improves fuel economy by optimising torque over the engine's speed range

This system also has the added benefits of operating at a lower oil-pressure and faster response time when compared to a non-VVT system.

Variable Valve Timing (VVT) Operation



Item	Part Number	Description
A		Retarded
B		Advanced
1		Engine oil pressure

The VVT unit is a hydraulic actuator mounted on the end of the intake camshaft, which advances or retards the intake camshaft timing and thereby alters the camshaft to crankshaft phasing. The oil control solenoid, controlled by the ECM, routes oil pressure to either the advance or retard chambers located either side of the 3 vanes interspersed within the machined housing of the unit.

The VVT unit is driven by the primary chain and rotates relative to the exhaust camshaft sprocket. When the ECM requests the camshaft timing to advance, the oil control solenoid is energized moving the shuttle valve to the relevant position to allow engine oil pressure, via a filter, into the VVT unit's advance chambers. When the camshaft timing is requested to retard, the shuttle valve moves position to allow oil pressure to exit the advance chambers, while simultaneously routing the oil pressure into the retard chambers.

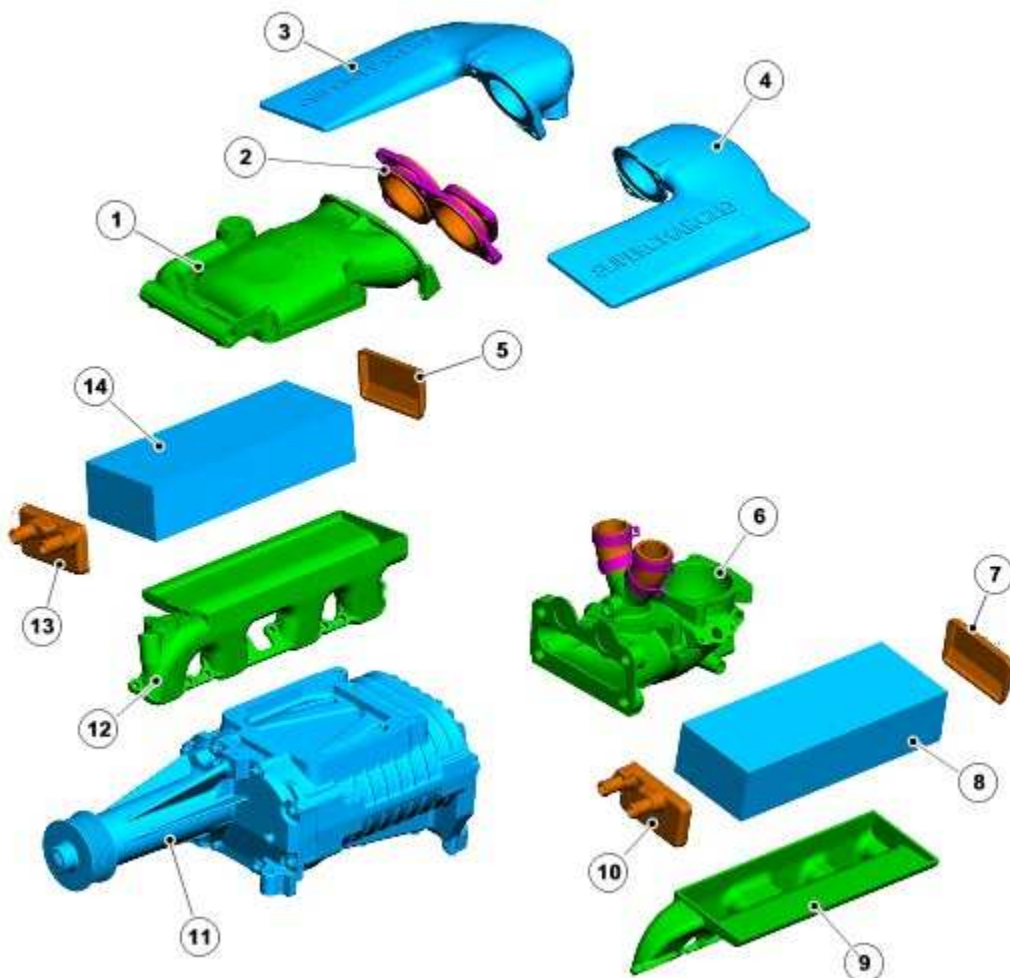
When directed by the ECM, the VVT unit will be set to the optimum position between full advance and retard for a particular engine speed and load. This is achieved when the ECM sends the energising signal to the oil control solenoid until the target position is met. At this point, the energising signal is reduced to hold the solenoid position, and as a result the position of the shuttle valve. This function is under closed-loop control, where the ECM will assess any decrease in shuttle-valve oil-pressure, via signals from the camshaft position sensor. The ECM will increase the energising signal, when required, to maintain the shuttle-valve hold position.

Engine oil properties and temperature can affect the ability of the VVT mechanism to follow demand changes to the cam phase angle. At very low oil-temperatures, movement of the VVT mechanism is

sluggish due to increased viscosity, and at high oil-temperatures the reduced viscosity may impair operation if the oil pressure is too low. To maintain satisfactory VVT performance, an increased capacity oil pump is installed, plus an engine oil temperature sensor to enable monitoring by the ECM. The VVT system is normally under closed-loop control except in extreme temperature conditions, such as cold starts below 0°C. At extremely high oil temperatures, the ECM may limit the amount of VVT advance to prevent the engine from stalling when returning to idle speed.

The VVT does not operate when engine oil-pressure is below 1 bar (14.5 psi), as there is insufficient pressure to control the phasing. This usually occurs when the engine is shutting-down and the VVT has returned to the retarded position. The stopper pin locks the camshaft to the VVT unit to ensure camshaft stability during the next engine start-up.

SUPERCHARGER



E84501

Item	Part Number	Description
1		Supercharger outlet assembly

2		Supercharger outlet duct clamp
3		RH intercooler air inlet duct
4		LH intercooler air inlet duct
5		RH Intercooler coolant return connection
6		Throttle body and by-pass valve adapter assembly
7		LH Intercooler coolant return connection
8		LH intercooler
9		LH intercooler adapter
10		LH Intercooler coolant inlet and outlet connection
11		Supercharger assembly
12		RH intercooler adapter
13		RH Intercooler coolant inlet and outlet connection
14		RH intercooler

The supercharger is a compressor used to pump air into the cylinders. This increases the concentration of oxygen and fuel in the charge to create a more powerful combustion inside the cylinder. This increases cylinder pressure upon ignition and creates more power.

As the supercharger compresses the air its temperature increases. This raise in air temperature reduces the potential for power gains. By installing intercoolers the air is cooled to overcome this.

The supercharger is an Eaton M112 unit attached to the 3 mounting bosses between the 'V' of the cylinder block. Positive alignment with the drive belt is provided by a dowled mounting bracket. An 8-ribbed belt drives the supercharger, via the crankshaft, at 2.1 engine speed. The maximum pressure increase is approximately 0.8 bar.

On the 4.2L V8 supercharged engine the intake manifold is replaced by:

- A supercharger
- Two intercoolers
- Outlet assembly
- A bypass valve
- A bypass valve actuator

- Two intercooler adapters

The supercharger has a sealed-for-life internal lubrication system.

Intercooler

Each of the 2 intercoolers is a fin and tube air-to-liquid heat exchanger. Two rubber ducts, secured by clamp plates, provide the interfaces between the outlet duct and the intercoolers. After passing through the heat exchanger core, the air flows into individual outlets to the cylinders. At the rear of the B bank intercooler there is a mounting boss for an air intake temperature sensor.

Outlet Assembly

The outlet assembly directs air from the supercharger into the 2 intercoolers. A filler point for the intercooler coolant system is integrated into the front and right side of the outlet duct. A vacuum take-off for the fuel pressure regulator/cruise control system is located on the right side of the outlet assembly. Isolating bolts, to reduce noise, secure the outlet assembly to the supercharger and a rubber gasket seals the supercharger to the outlet assembly throttle body and by-pass valve adapter.

Bypass Valve

The bypass valve attaches to an opening in the induction elbow and controls a bypass flow from the intercoolers back to the inlet side of the supercharger. At closed or partially open throttle settings (i.e. idle and most cruise conditions), the bypass valve is fully open to provide maximum bypass and optimum fuel economy. As the throttle opens, the bypass valve progressively closes to reduce the bypass flow and increase the pressure of air supplied to the engine for optimum power output.

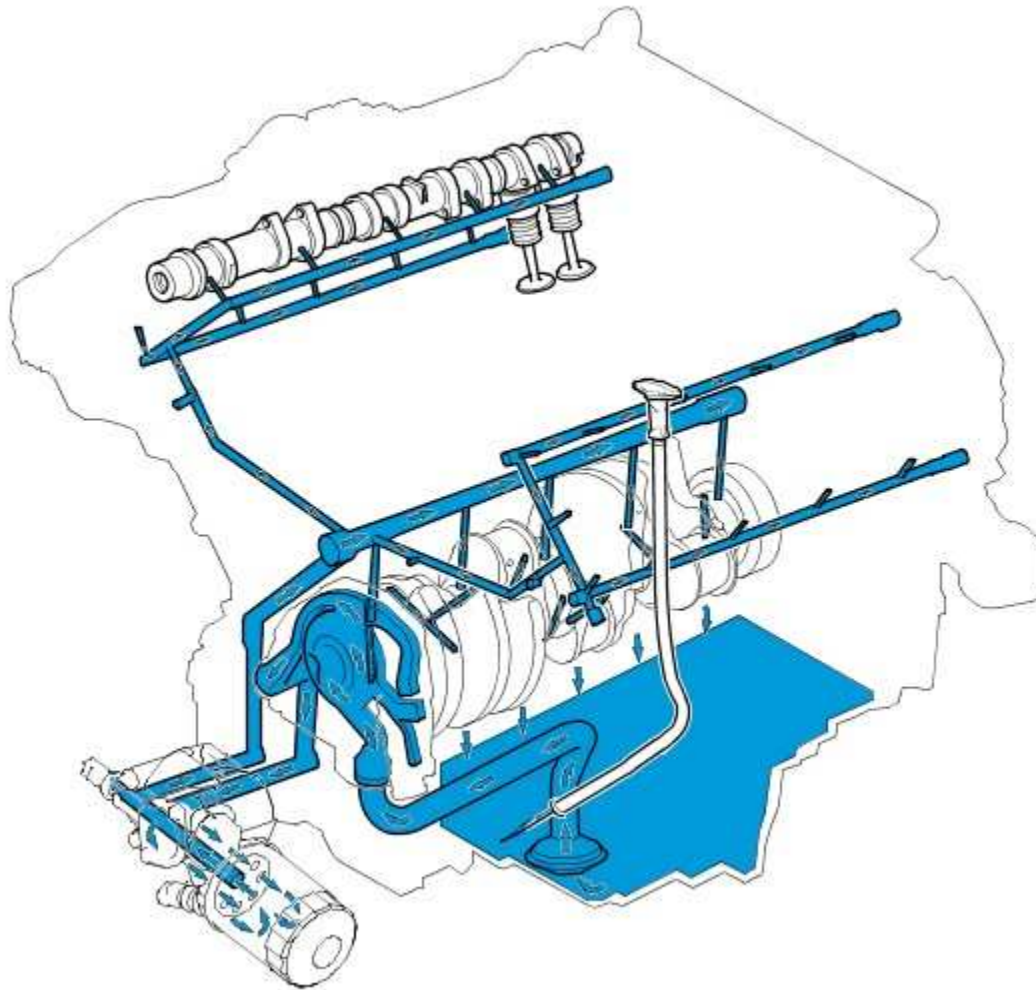
Bypass Valve Actuator

The bypass valve actuator is a diaphragm-operated actuator attached to the valve spindle of the bypass valve. A vacuum pipe connects the actuator to the induction elbow.

Intercooler Adapter

The intercooler adapters provide an interface between the intercoolers and the cylinder heads, and also locate the fuel rails and injectors. One-piece gaskets seal the joints between the intercoolers and the intercooler adapters, and between the intercooler adapters and the cylinder heads.

LUBRICATION SYSTEM



E84502

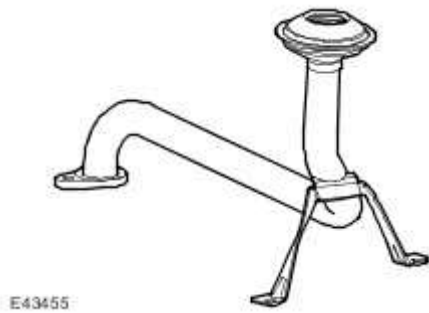
Oil is drawn from the reservoir in the oil pan and pressurised by the oil pump. The output from the oil pump is then filtered, cooled and distributed through internal oil passages.

All moving parts are lubricated by pressure or splash oil. Pressurised oil is also provided for the timing gear chain tensioners and the piston cooling jets.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

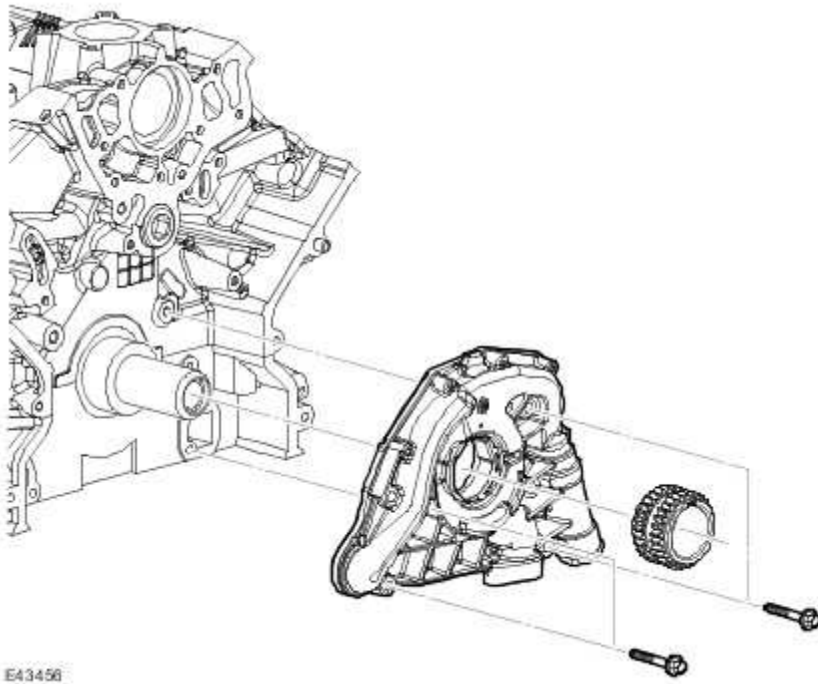
System replenishment is through the oil filler cap on the 'B' bank camshaft cover.

Oil Pick-up



The fabricated steel oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.

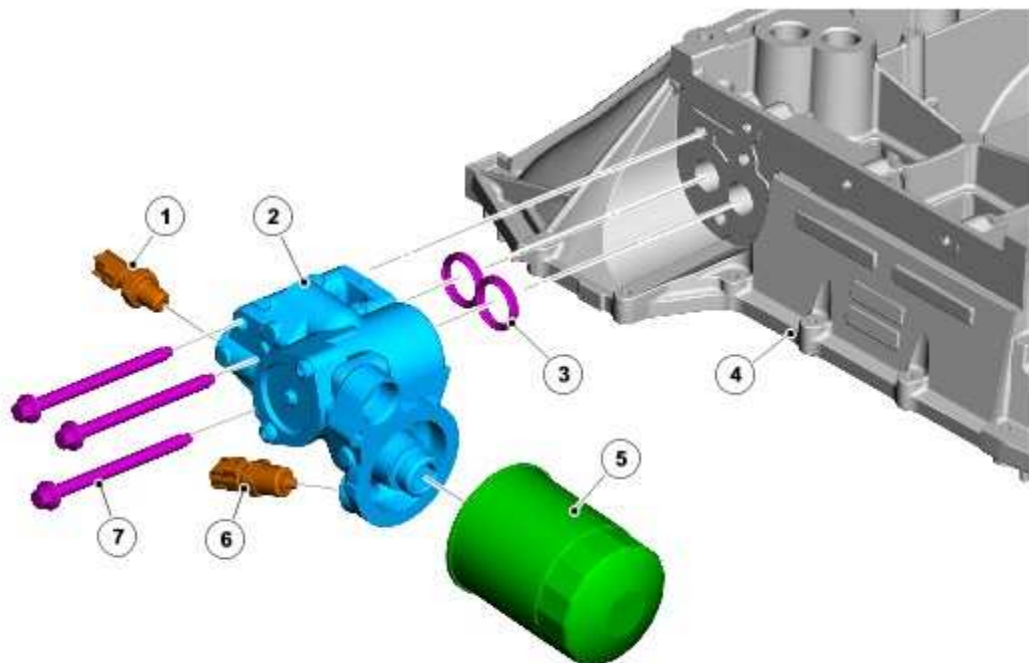
Oil Pump



The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 psi).

Oil Filter Assembly



E84503

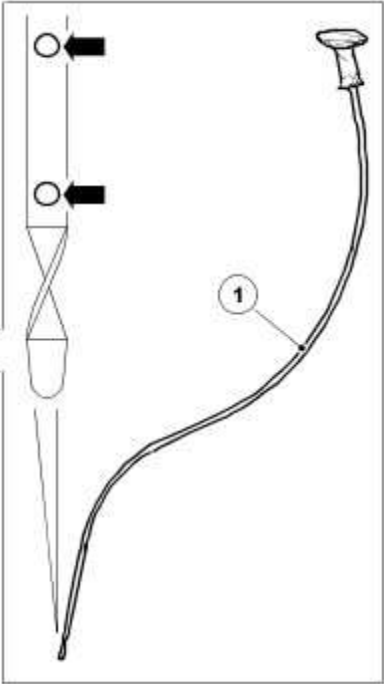
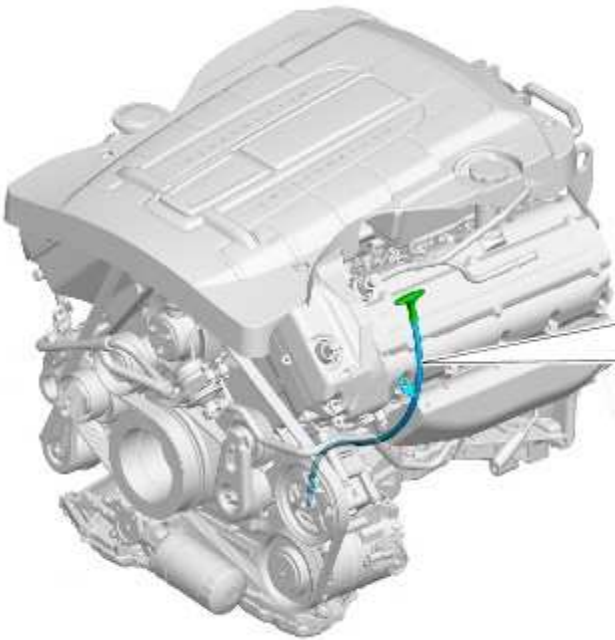
Item	Part Number	Description
1		Oil pressure switch
2		Oil filter head assembly
3		Seal
4		Sump
5		Oil filter
6		Oil temperature sensor
7		Bolt (3 off)

The oil filter is a replaceable cartridge installed on an adapter. An internal bypass facility permits full flow bypass if the filter is blocked.

The oil pressure switch connects a ground input to the instrument cluster when oil pressure is present. The switch operates at a pressure of 0.15 to 0.41 bar (2.2 to 5.9 psi).

Oil temperature is monitored through a Negative Temperature Coefficient (NTC) sensor. The sensor is mounted near to the oil pressure sensor at the front of the engine and locates into the oil filter head assembly.

Oil Level Gage

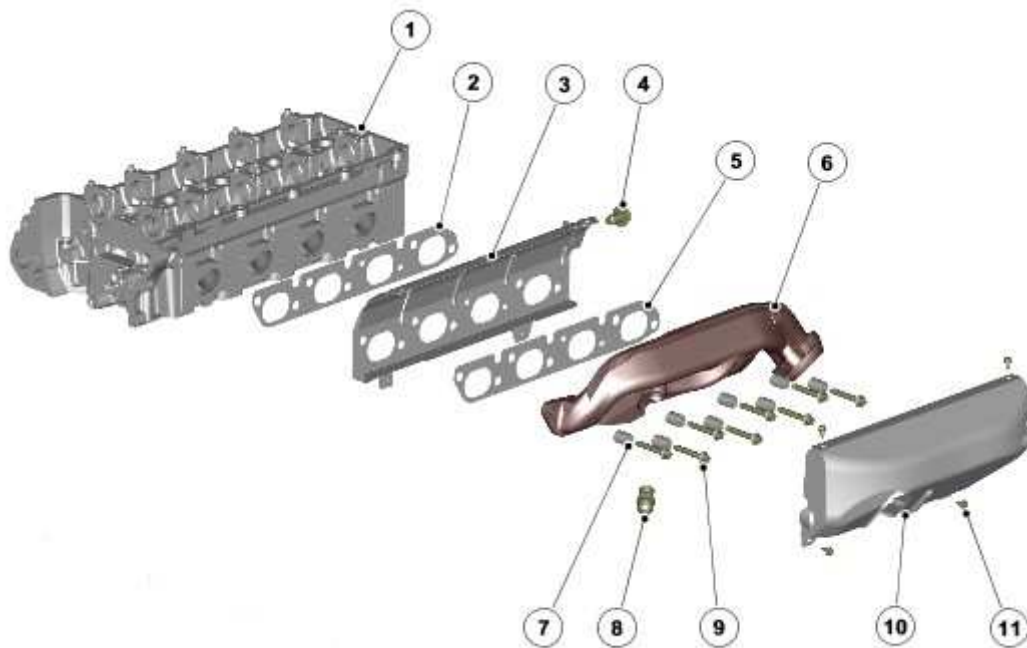


E84504

Item	Part Number	Description
1		Oil level gage

The oil level gage locates along the left side of the oil pan, supported in a tube installed in the sump. Two holes in the end of the gage indicate the minimum and maximum oil levels. There is a difference of approximately 1.5 liters (1.58 US quart) between the 2 levels.

EXHAUST MANIFOLD



E72001

Item	Part Number	Description
1		Cylinder head
2		Gasket
3		Heat shield
4		Bolt
5		Gasket
6		LH exhaust manifold
7		Spacer (8 off)
8		Connector for Secondary Air Injection (SAI)
9		Bolt (8 off)
10		Heat shield
11		Bolt (4 off)

The fabricated stainless steel twin skin exhaust manifolds are unique for each cylinder bank.

Each exhaust manifold assembly includes 2 metal gaskets, located either side of the inner heat shield, 2 heat shields and a connection for the Secondary Air Injection (SAI) system. For additional information, refer to Engine Emission Control (303-08 Engine Emission Control - Vehicles Without Supercharger)

Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads.

Engine

No Data Available

Removal and installation

Crankshaft Main Bearing Carrier

No Data Available

Removal

Engine (12.41.01)

Special Service Tools



303-536

Engine lifting brackets

303-536



303-749

Engine lifting brackets

303-749



E85340

Engine lifting bracket

303-1297



E45289

Fuel spring lock decoupling tool

310-D005

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2 . Evacuate the A/C system.

- . For additional information, refer to Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

3 . Remove the hood.

For additional information, refer to Hood (76.16.01)

4 . Remove the cowl vent screen.

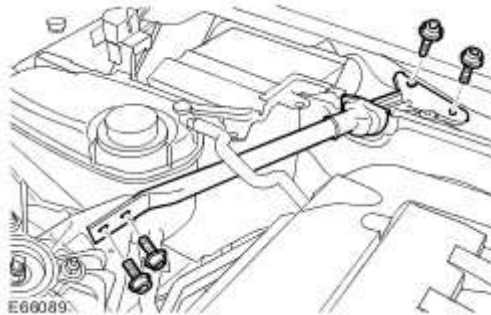
For additional information, refer to Cowl Vent Screen (76.10.01)

5 . Remove the engine compartment braces.

▶ Release the grommet.

▶ Remove the 4 Torx bolts.

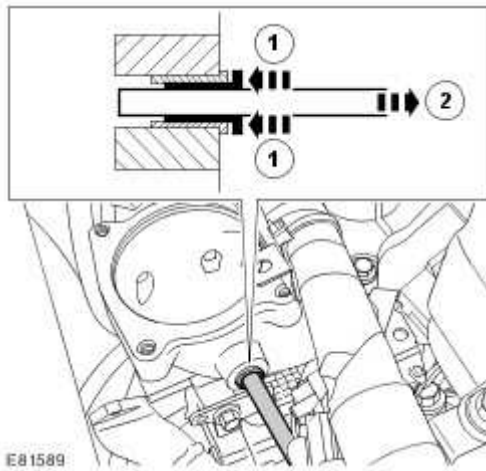
▶ Repeat the above procedure for the other side.



6 . Remove the intake air resonator.

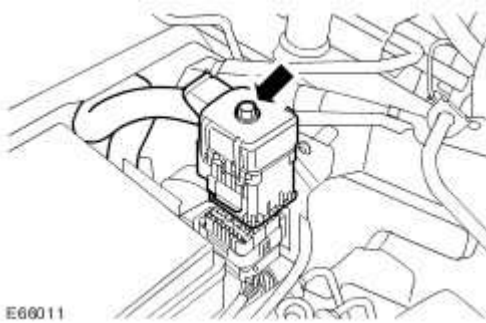
For additional information, refer to Intake Air Resonator

7 . Disconnect the brake booster vacuum hose quick release connector.



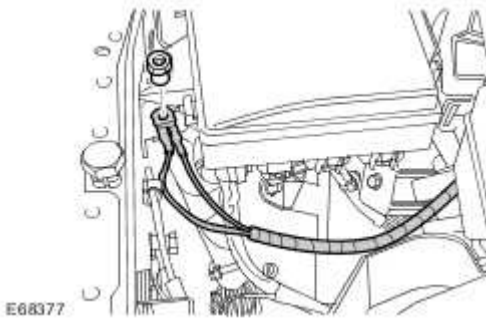
8 . Release and disconnect the engine wiring harness electrical connector.

▶ Fully loosen the bolt.



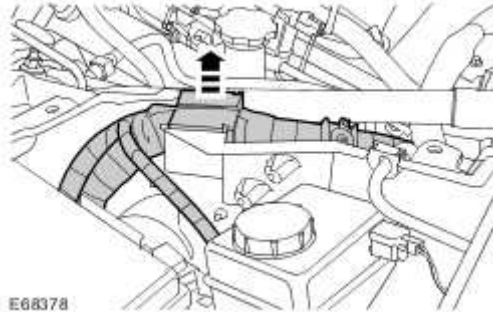
9 . Release the ground cable from the power distribution box bracket.

▶ Remove the nut.

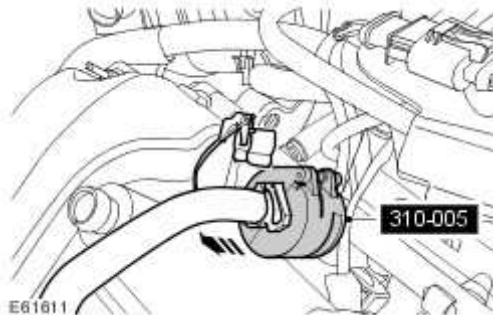


10 . Release the engine wiring harness from the engine compartment side wall.

▶ Release the grommet.



11 . Disconnect the fuel line.

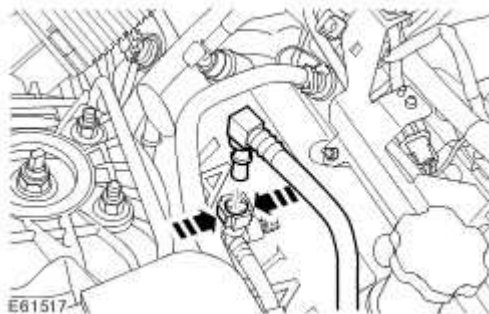


12



CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Release the clip and disconnect the purge inlet line.



13



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

14 . Remove the air deflector.

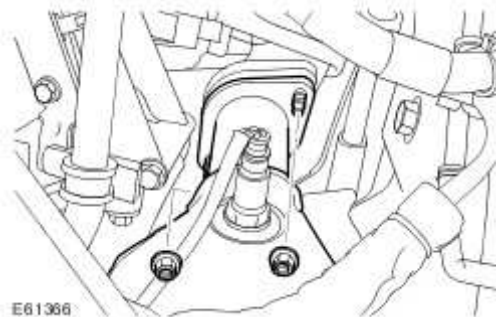
For additional information, refer to Air Deflector (76.11.41)

15 Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

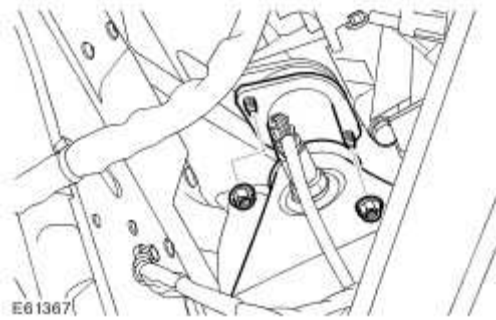
16 . Disconnect the LH catalytic converter from the exhaust manifold.

▶ Remove and discard the 2 nuts.



17 . Disconnect the RH catalytic converter from the exhaust manifold.

▶ Remove and discard the 2 nuts.



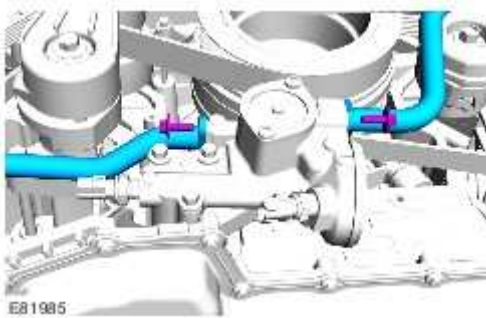
18



CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the 2 engine oil cooler lines.

- ▶ Remove the 2 bolts.
- ▶ Remove and discard the 2 O-ring seals.
- ▶ Position hoses in front of the anti roll bar.



19 .



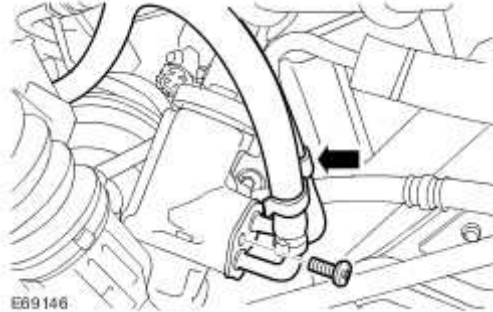
CAUTION: Always plug any open connections to prevent contamination.

Disconnect the high pressure line from the power steering gear.

- ▶ Remove and discard the Torx bolt.

▶ Remove and discard the O-ring seal.

▶ Release from the clip.



20

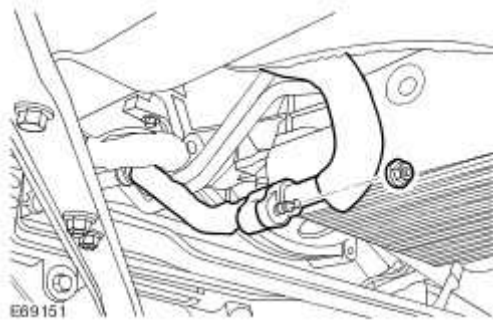


CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the A/C high-pressure line from the intermediate joint.

▶ Remove the nut.

▶ Discard the O-ring seal.

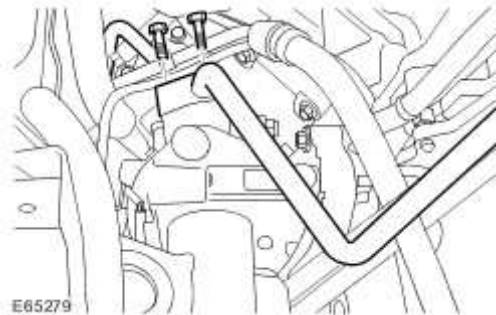



21 . Disconnect the refrigerant lines from the A/C compressor.

▶ Remove the 2 bolts.

▶ Remove and discard the 2 O-ring seals.

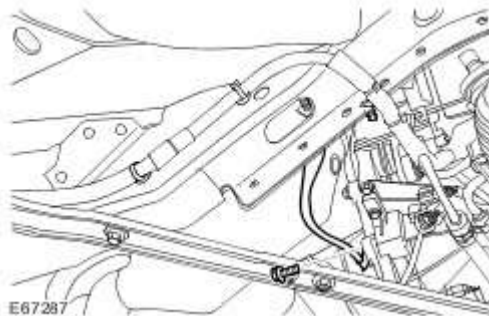
- ▶ Remove the lower A/C pipe.
- ▶ Disconnect and tie aside the upper A/C pipe.



- 22
- ▶  **CAUTION: The transmission ground cable must be replaced if disconnected from the vehicle body.**

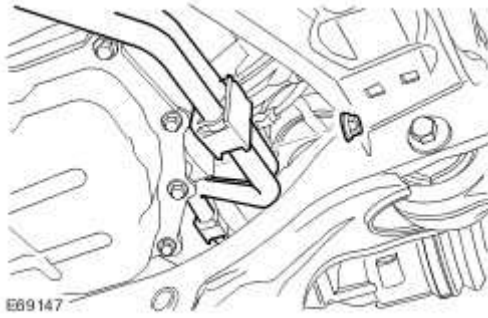
Disconnect the transmission ground cable.

- ▶ Remove the bolt.



- 23 . Release the transmission fluid lines from the engine.

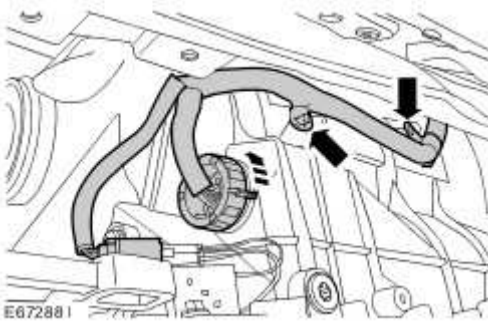
- ▶ Remove the nut.
- ▶ Release the clip.



24 . Release the wiring harness from the RH side of the transmission.

▶ Disconnect the 2 electrical connectors.

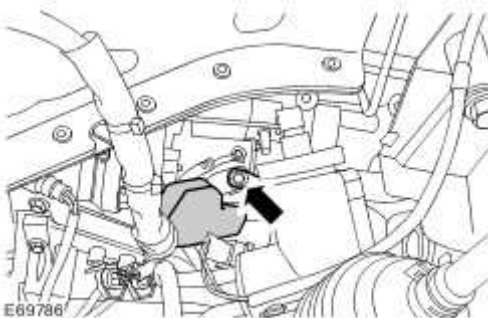
▶ Carefully release the 2 clips.



25 . Disconnect the battery positive and generator cables.

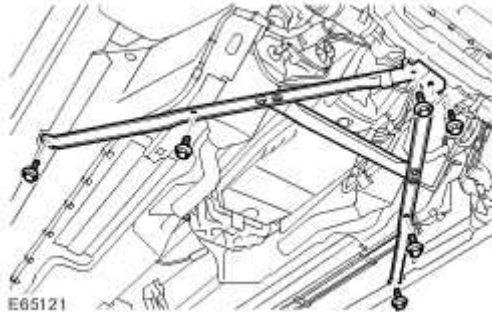
▶ Release the cover.

▶ Remove the nut.



26 . With assistance, remove the A-frame.

▶ Remove the 6 bolts.

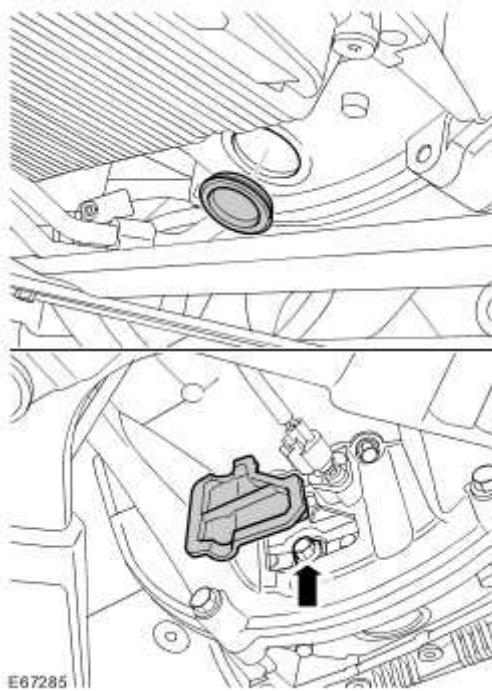


27 . Release the flexplate.

▶ Remove the access plugs.

▶ Rotate the crankshaft to access the retaining bolts.

▶ Remove and discard the 3 bolts.

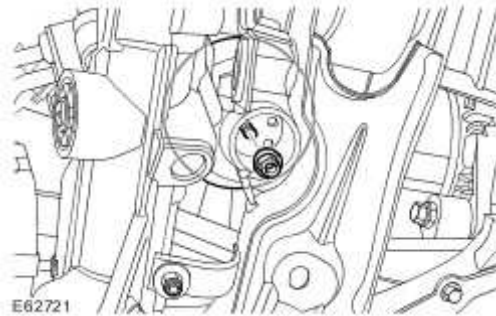


28 . **NOTE:**

RH illustration shown, LH is similar.

Release the engine mounts.

- ▶ Remove and discard the 2 nuts.



29 . Lower the vehicle.

30



CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTE:

Some variation in the illustrations may occur, but the essential information is always correct.

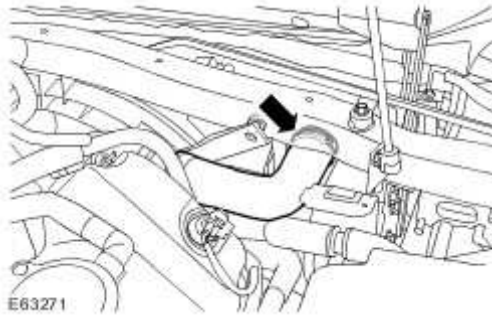
Disconnect the charge air cooler coolant hoses.

- ▶ Position an absorbent cloth to collect fluid spillage.
- ▶ Release the 2 clips.
- ▶ Tie aside.
- ▶ Repeat the above procedure on the opposite side.



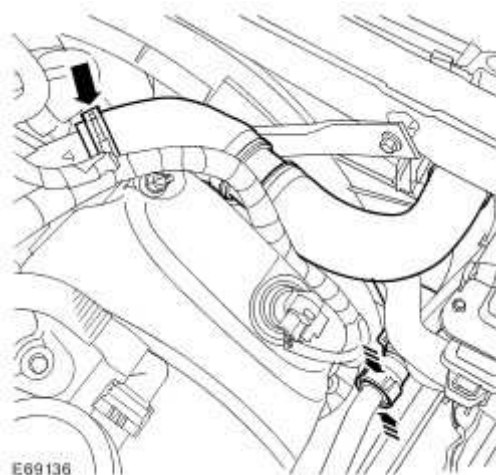
31 . Disconnect the radiator upper hose.

- ▶ Release the hose clip.



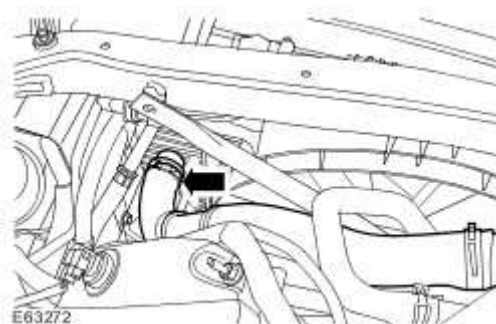
32 . Remove the radiator top hose.

- ▶ Release the clips.
- ▶ Disconnect the quick release connector.
- ▶ Tie the hose assembly aside for access.



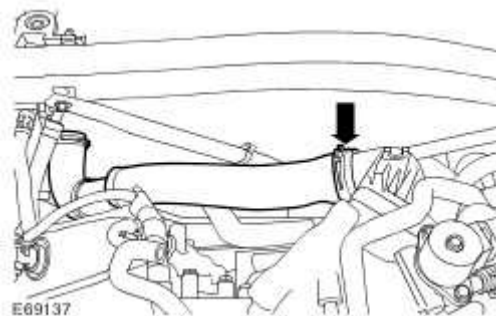
33 . Disconnect the radiator lower hose.

▶ Release the hose clip.



34 . Remove the radiator lower hose.

▶ Release the clip.

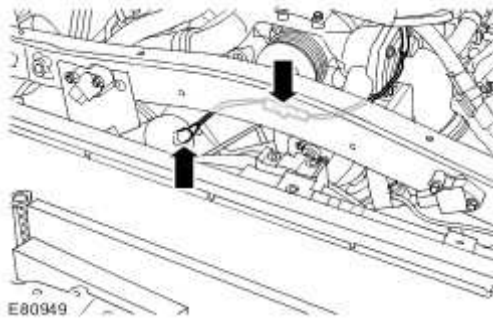


35 . Disconnect the secondary air injection (AIR) control valve supply hose.



36 . Disconnect the secondary air injection (AIR) reservoir vacuum line.

▶ Release the clip.



37 . Release the power steering fluid reservoir.

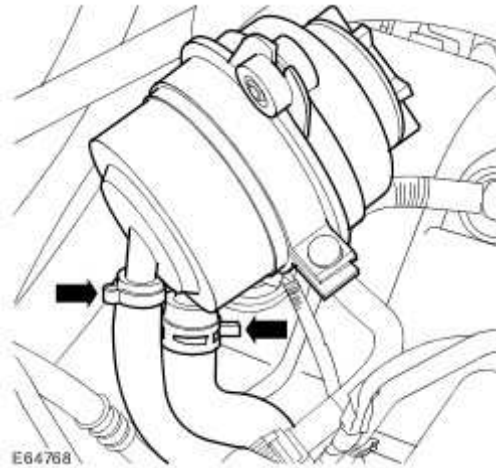
▶ Remove the 2 bolts.




38 . Disconnect the power steering supply hose.

▶ Position a container to collect the fluid spillage.

▶ Release the hose clip.

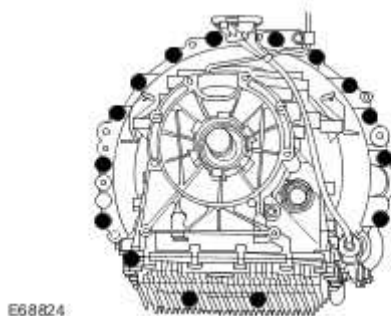


- 39 .  **CAUTION: Make sure the torque converter remains connected to the transmission.**

Release the transmission from the engine.

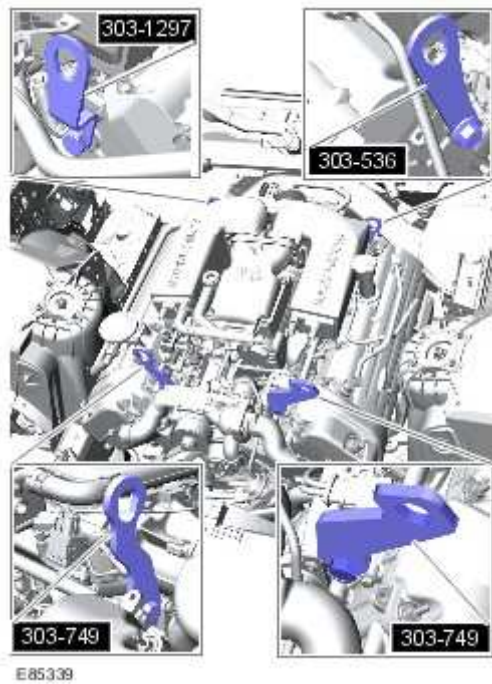
▶ Remove the 15 bolts.

▶ Support the transmission.



- 40 . Install the special tools to the engine.

▶ Support the engine.

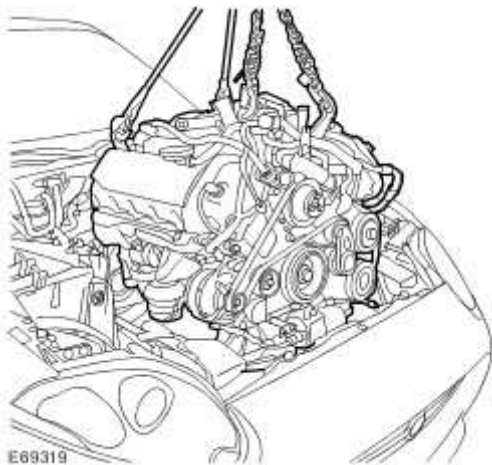


41



CAUTION: Protect the suspension turrets to prevent damage upon engine removal.

With assistance, carefully remove the engine.



42 . Install the torque converter retainer.

Engine (12.41.01)

Special Service Tools



303-536

Engine lifting brackets

303-536



303-749

Engine lifting brackets

303-749



E85340

Engine lifting bracket

303-1297



E45289

Fuel spring lock decoupling tool

310-D005

Installation

1 . Remove the torque converter retainer.

2 .  **CAUTION: Apply grease of the correct specification to the torque converter spigot.**

With assistance, carefully install the engine.

➤ Clean the component mating faces.


➤ Tighten the bolts to 45 Nm (33 lb.ft).

3 . Carefully lower the engine onto the engine mounts.

➤ Clean the components.

➤ Tighten the new nuts to 63 Nm (46 lb.ft).

4 . Remove the special tools.

5 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

6 . Attach the flexplate to the torque converter.

➤ Rotate the crankshaft to access the retaining bolts.

➤ Tighten the bolts to 45 Nm (33 lb.ft).

➤ Install the access plugs.

7 . With assistance, install the A-frame.

▶ Tighten the bolts to 55 Nm (40 lb.ft).

8 . Connect the battery positive and generator cables.

▶ Tighten the nut to 10 Nm (7 lb.ft).

▶ Secure the cover.

9 . Attach the wiring harness.

▶ Connect the electrical connectors.

▶ Secure the clips.

10 . Attach the transmission fluid lines to the engine.

▶ Secure with the clip.

▶ Tighten the nut to 6 Nm (4 lb.ft).

11 . Connect the transmission ground cable.

▶ Tighten the bolt to 45 Nm (33 lb.ft).

12 .



CAUTION: Lubricate the new seals with clean refrigerant oil.

Connect the A/C high-pressure line intermediate joint.

▶ Clean the component mating faces.

▶ Install the new O-ring seals.

▶ Tighten the nut to 10 Nm (7 lb.ft).

13 . Attach the power steering gear high-pressure line.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx bolt to 25 Nm (18 lb.ft).
- ▶ Secure in the clip.

14 . Connect the low pressure line to the power steering pump.

- ▶ Secure with the clip.

15 . Connect the engine oil cooler lines.

- ▶ Clean the component mating faces.
- ▶ Install new O-ring seals.
- ▶ Tighten the bolts to 7 Nm (5 lb.ft).

16 . Secure the LH catalytic converter to the exhaust manifold.

- ▶ Tighten the nuts to 40 Nm (29.5 lb.ft).

17 . Secure the RH catalytic converter to the exhaust manifold.

- ▶ Tighten the nuts to 40 Nm (29.5 lb.ft).

18 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

19 . Secure the power steering fluid reservoir.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

20 . Connect the AIR reservoir vacuum line.

21 . Install the radiator bottom hose.

▶ Install the hoses and secure with the clips.

▶ Connect the hoses and secure with the clips.

22 . Install the radiator top hose.

▶ Connect the quick release connector.

▶ Connect the hoses and secure with the clips.

23 . Attach the engine wiring harness to the engine compartment side wall.

▶ Position and secure the grommet.

24 . Attach the ground cable to the power distribution box bracket.

▶ Tighten the nuts to 25 Nm (18 lb.ft).

25 . Connect the engine wiring harness electrical connector and secure with the captive bolt.

26 . Connect the fuel line.

For additional information, refer to Spring Lock Couplings

27 . Connect the brake booster vacuum hose quick release connector.

28 . Install the engine compartment braces.

▶ Tighten the 4 Torx bolts to 25 Nm (18 lb.ft).

▶ Install the grommet.

▶ Repeat the above procedure for the other side.

29 . Install the cowl vent screen.

For additional information, refer to Cowl Vent Screen (76.10.01)

30 . Install the hood.

For additional information, refer to Hood (76.16.01)

31 . Recharge the A/C system.

32 . Connect the battery ground cable and install the cover.

33 . Refill and bleed the power steering.

For additional information, refer to Power Steering System Bleeding (57.15.02)

Camshafts LH (12.13.19)

Special Service Tools



Camshaft setting/locking tool
303-530



Timing Setting tool
303-645



Timing chain tensioning tool
303-532



Tappet hold-down tool
303-540




Tappet hold-down tool adaptor
303-540/02



Fan nozzle - air gun
303-590

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the timing drive components.
For additional information, refer to Timing Drive Components (12.65.13)

- 4 . Remove the special tool from the LH cylinder head.

- 5  **CAUTION: Evenly and progressively, release the camshaft bearing caps.**

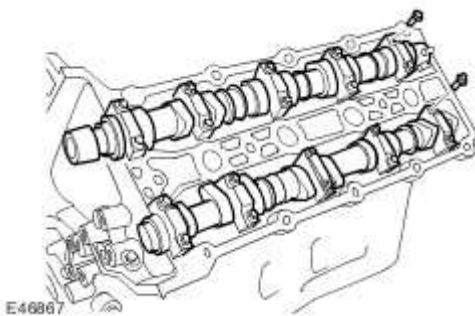
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- ▶ Remove the 20 bolts.

6 . Remove the camshafts.



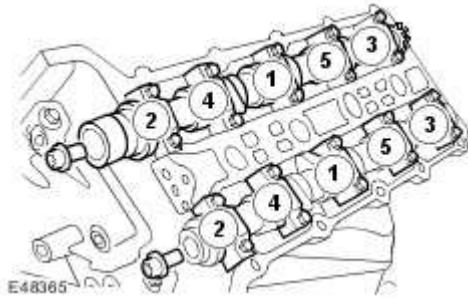
Installation

1 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Replace the valve shims, with the smallest shim available.
- ▶ Lubricate the journals and camshaft lobes.

2 Install the camshaft bearing caps.

- ▶ Clean the component mating faces.
- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).

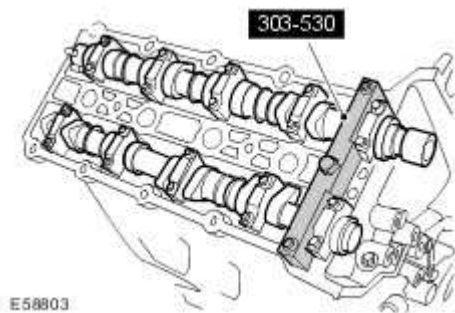


3 . NOTE:

RH illustration shown, LH is similar

Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



4 . NOTE:

Do not install the LH valve cover until valve clearance adjustment has been completed.


Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

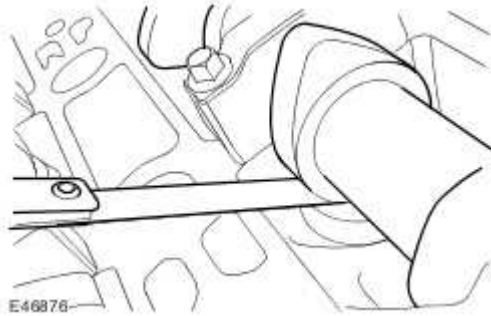
5 . For cylinder head data, refer to specifications.

For additional information, refer to Specifications

6 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

- 7
-  **CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.**

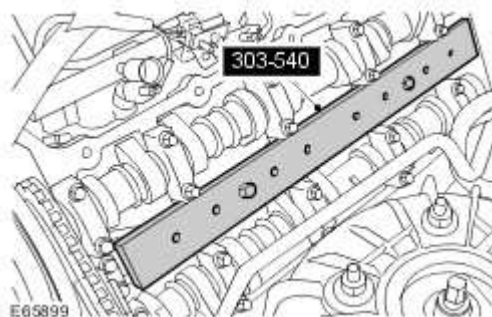
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



8 . Repeat the above procedure for the remaining 15 shims.

9 . Install the special tool 303-540, to the cylinder head.

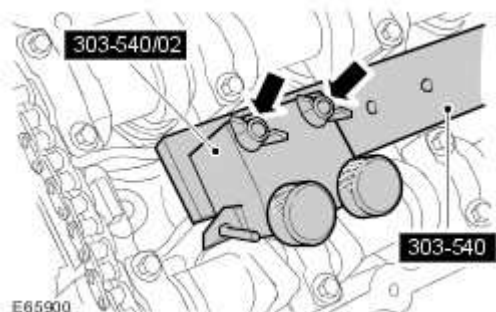
- ▶ Tighten the 2 bolts to 10 Nm (7 lb.ft).



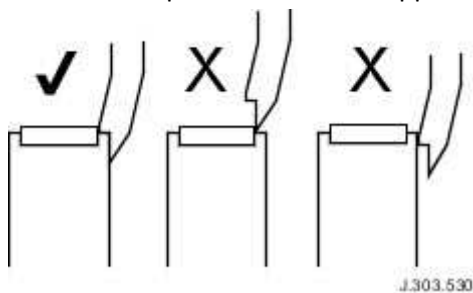
- 10
-  **CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.**

Attach the special tool 303-540/02 to 303-540.

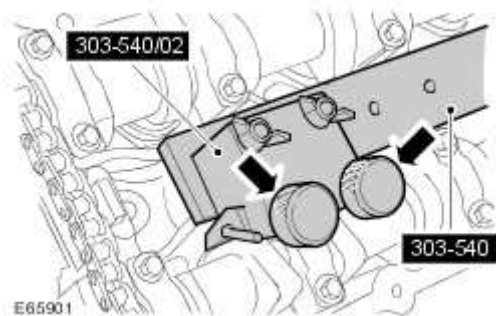
▶ Secure with the 2 wing nuts.



11 . Position the special tool to the tappet as shown.



12 . Using the special tool, compress the valve spring.



13



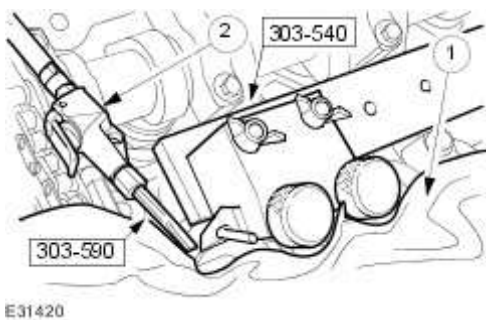
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



14



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

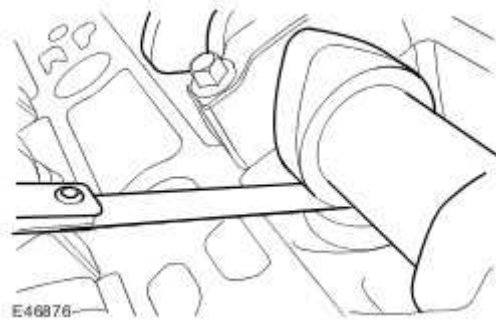


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

15 Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



16 . Repeat the above procedure for the remaining valves.

17 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Camshafts RH (12.13.18)

Special Service Tools



Camshaft setting/locking tool
303-530



Timing Setting tool
303-645



Timing chain tensioning tool
303-532



Tappet hold-down tool
303-540




Tappet hold-down tool adaptor
303-540/02



Fan nozzle - air gun
303-590

Removal


- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine front cover.
For additional information, refer to Engine Front Cover (12.65.01)

- 4 . Remove the crankshaft position (CKP) sensor.
For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

- 5  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

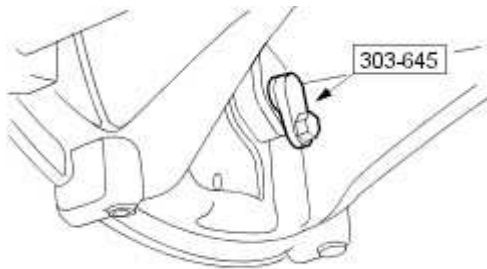


CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

▶ Install the special tool.

▶ Install the screw.

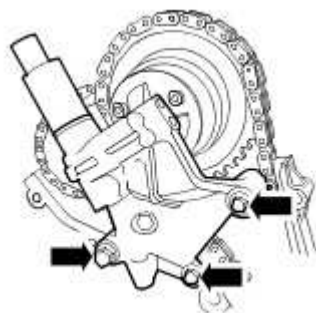


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6 . Remove the RH variable camshaft timing (VCT) control solenoid housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seals.

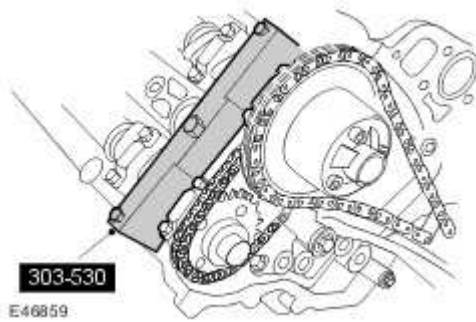


E46858

7 Install the special tool to the RH cylinder head.

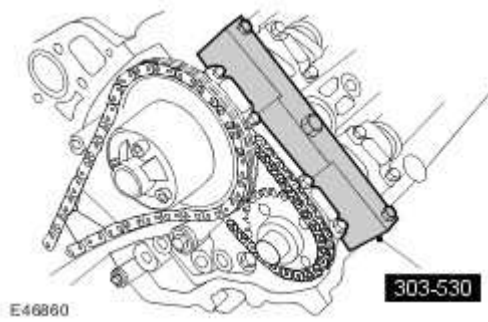
▶ Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.

▶ Install the 3 bolts.



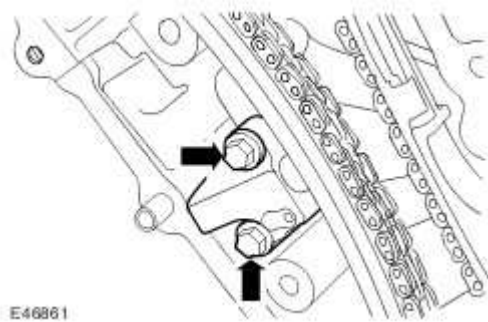
8 . Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



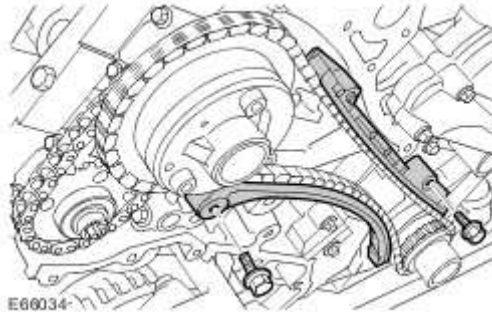
9 . Remove the RH primary timing chain tensioner.

▶ Remove the 2 bolts.

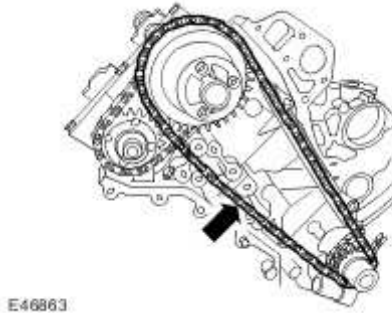


10 . Remove the RH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.

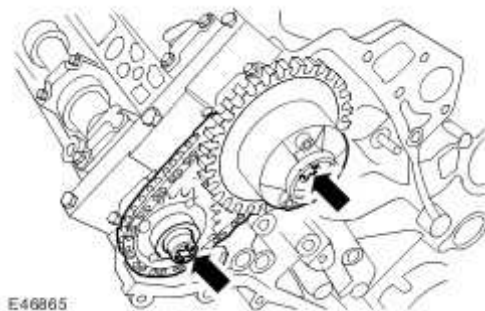


11 . Remove the RH primary timing chain.



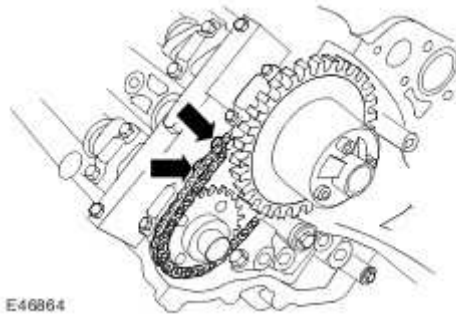
12 . Release the RH camshaft sprocket assembly.

▶ Remove and discard the 2 Torx bolts.



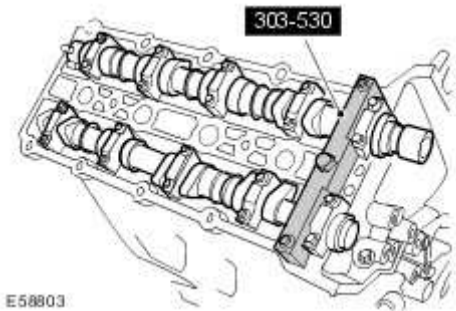
13 . Remove the RH secondary timing chain, tensioner and sprocket assembly.

▶ Remove the 2 retaining bolts.



14 . Remove the special tool from the RH cylinder head.

▶ Remove the 3 bolts.



15



CAUTION: Evenly and progressively, release the camshaft bearing caps.

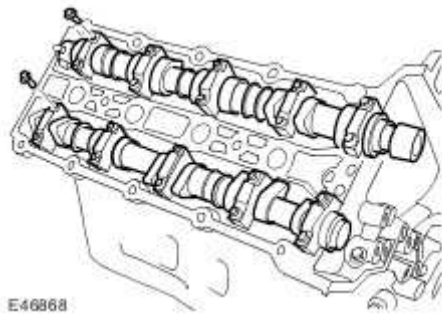
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

▶ Remove the 20 bolts.

16 . Remove the camshafts.



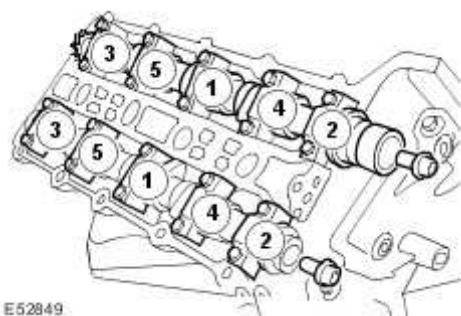
Installation

1 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Replace the valve shims, with the smallest shim available.
- ▶ Lubricate the journals and camshaft lobes.

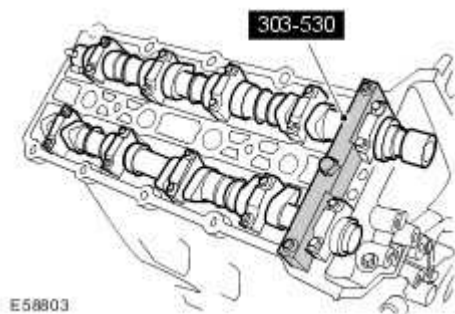
2 Install the camshaft bearing caps.


- ▶ Clean the component mating faces.
- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm.




3 . Install the special tool to the RH cylinder head.

▶ Install the 3 bolts.



4  **CAUTION: Make sure that new bolts are installed.**

 **CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.**

NOTE:

LH illustration shown, RH is similar.

Install the RH secondary timing chain, tensioner and sprocket assembly.

▶ Clean the components.

▶ Install the Torx bolts, but do not tighten fully at this stage.



5 . Install the RH secondary timing chain tensioner retaining bolts.

- ▶ Tighten the bolts to 12 Nm.

6 Install the RH primary timing chain.

- ▶ Clean the components.
- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

7 . Install the RH primary timing chain tensioner guides.

- ▶ Tighten the bolts to 12 Nm.

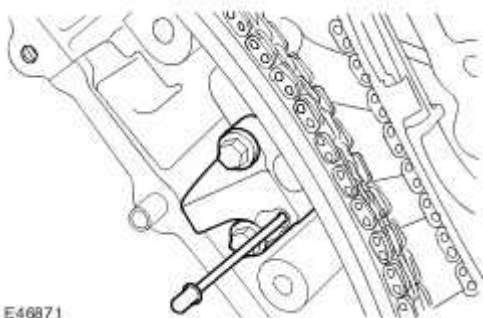
8



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- ▶ Clean the components.
- ▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.
- ▶ Tighten the bolts to 12 Nm.
- ▶ Remove the retaining rod.



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9



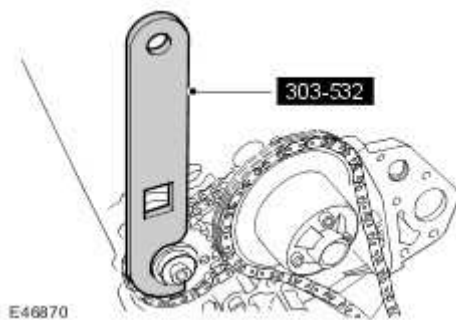
CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

Install the special tool to the RH exhaust camshaft sprocket.

- ▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- ▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.




10 . Install the RH VCT control solenoid housing.

- ▶ Clean the components.
- ▶ Install the new O-ring seals.
- ▶ Tighten the new bolts to 22 Nm.

11 . Remove the special tool from the RH cylinder head.

12 . Remove the special tool from the LH cylinder head.

13 . Remove the crankshaft locking tool.

 Remove the screw.

14 . Install the CKP sensor.

For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

15 . For cylinder head data, refer to specifications.

For additional information, refer to Specifications

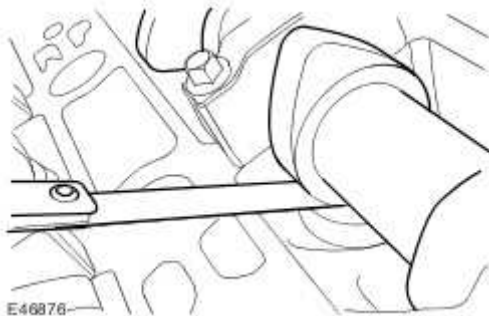
16 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

17



CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

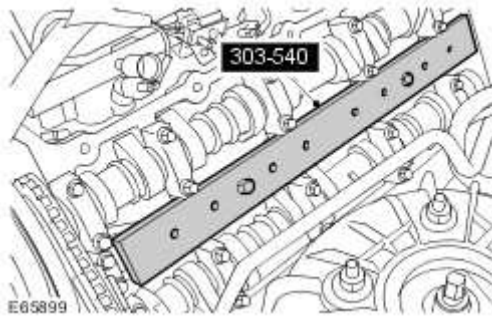
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



18 . Repeat the above procedure for the remaining 15 shims.

19 . Install the special tool 303-540, to the cylinder head.

▶ Tighten the 2 bolts to 10 Nm.



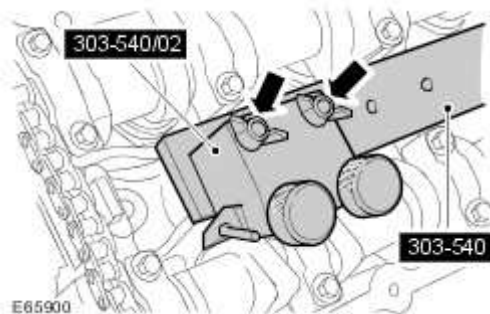
20



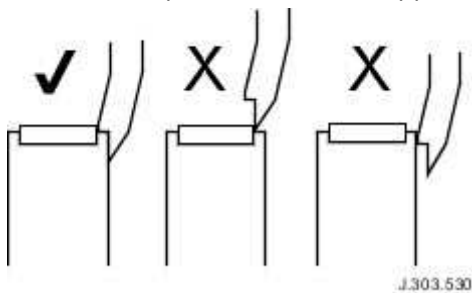
CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

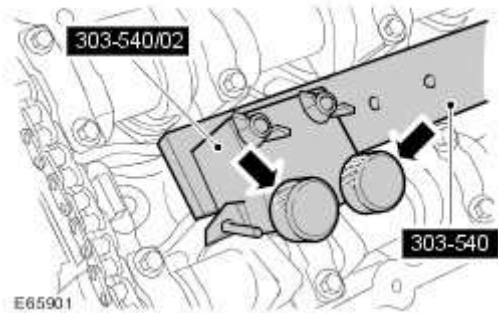
▶ Secure with the 2 wing nuts.



21 . Position the special tool to the tappet as shown.



22 . Using the special tool, compress the valve spring.



23



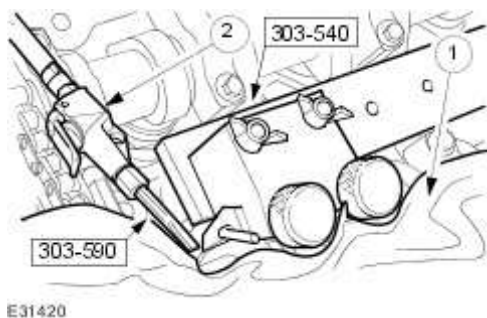
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



24



CAUTION: Shims must be fitted with the size markings facing the tappet, not the

camshaft.

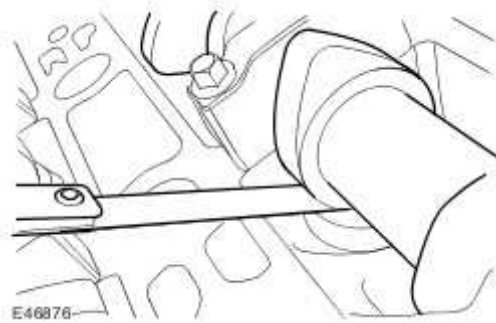


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

- 25 . Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



- 26 . Repeat the above procedure for the remaining valves.

- 27 . Install the engine front cover.

For additional information, refer to Engine Front Cover (12.65.01)

- 28 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Crankshaft Front Seal (12.21.14)

Removal

- 1 . Remove the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)

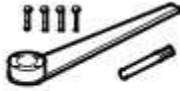
Installation

- 1 . Install the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)

Crankshaft Pulley (12.21.09)

Special Service Tools



303-191

Crankshaft pulley locking tool

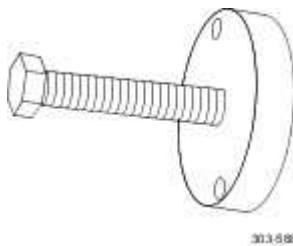
303-191



303-191-02

Crankshaft pulley locking tool adapter

303-191/02



303-588

Crankshaft pulley/damper remover

303-588



303-751

Seal extractor

303-751




303-750

Seal installer

303-750

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

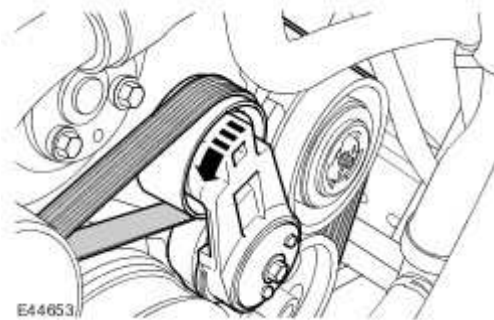
Raise and support the vehicle.


- 3 Remove the cooling fan motor and shroud.
For additional information, refer to Cooling Fan Motor and Shroud - Vehicles With:
Supercharger (26.25.25)

- 4 . Remove the oil filter housing.
For additional information, refer to Oil Filter Housing

- 5 Release the accessory drive belt.

-  Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



- 6  **CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.**

NOTE:

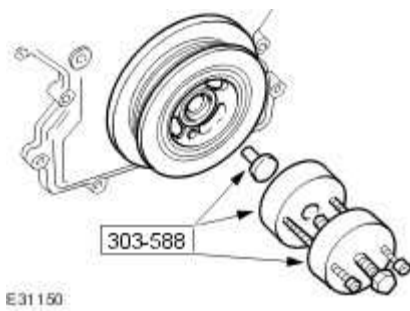
The crankshaft pulley retaining bolt will be very tight.

Using the special tool, retain the crankshaft front pulley.

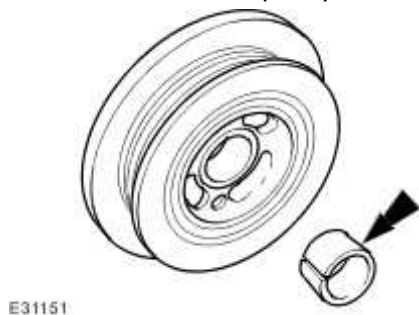
- ▶ Remove and discard the crankshaft pulley retaining bolt.
- ▶ Remove the special tools.

7 . Using the special tools, remove the crankshaft pulley.

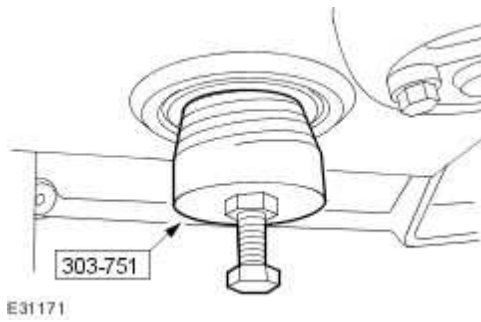
- ▶ Collect the locking ring.
- ▶ Remove the special tools.



8 . Check the crankshaft pulley and locking ring for damage.




9 . Using the special tool, remove the crankshaft front seal.



Installation

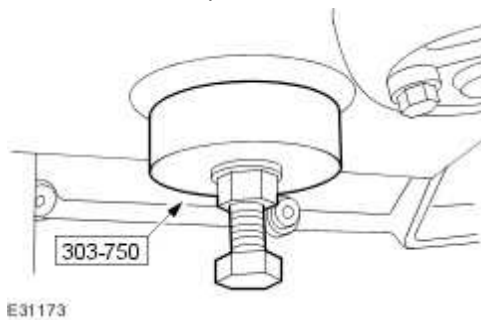
1.  **CAUTION: Make sure the crankshaft seal mating faces are clean and dry.**

-  **CAUTION: Do not remove the seal protector at this stage.**

Using the special tool, install the crankshaft front seal.


- ▶ Clean the component mating faces.

- 2 . Remove the seal protector.




- 3 . Install the crankshaft pulley.

- ▶ Lubricate the seal with clean engine oil.
- ▶ Install the locking ring.

- 4 .  **CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.**

Install, but do not tighten, the new crankshaft pulley bolt.

- 5 .  **CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.**

Using the special tools, retain the crankshaft pulley.

- ▶ Tighten the crankshaft pulley bolt to 380 Nm (280 lb.ft).
- ▶ Remove the special tools.

- 6 . Attach the accessory drive belt.

- 7 . Install the oil filter housing.
For additional information, refer to Oil Filter Housing

- 8 Install the cooling fan motor and shroud.
. For additional information, refer to Cooling Fan Motor and Shroud - Vehicles With:
Supercharger (26.25.25)

- 9 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Crankshaft Rear Seal (12.21.20)

Special Service Tools



Crankshaft rear oil seal remover/installer
303-538

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . Remove the torque converter flexplate.
For additional information, refer to Flexplate (12.53.13)

- 4 . Install the special tools.

▶ Install the 2 bolts.

▶ Tighten the 2 nuts to retain the special tool.

E46613



5 . Using the special tool, pierce the seal to create holes for the 6 self-tapping screws.

E46614




6 . Using the special tools, remove and discard the crankshaft rear oil seal.

- ▶ Install the 6 self-tapping screws.
- ▶ Adjust the 2 nuts.
- ▶ Tighten the center bolt.

E46615




Installation

1.  **CAUTION: Do not lubricate the components.**

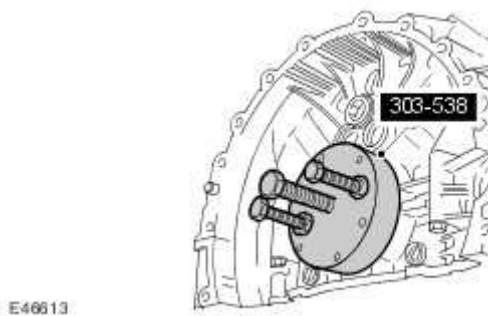
Partially install the crankshaft rear oil seal.

- ▶ Make sure the components are clean and dry.
- ▶ Carefully remove the transit sleeve, leaving the seal on the crankshaft.

- 2  **CAUTION: Make sure the seal is installed parallel**

Using the special tool, install the crankshaft rear oil seal.

- ▶ Tighten the special tool nuts evenly and progressively to fully install the seal.




- 3 . Install the torque converter flexplate.
For additional information, refer to Flexplate (12.53.13)
- 4 . Check and top-up the engine oil.
- 5 . Connect the battery ground cable.
For additional information, refer to Specifications

Cylinder Head LH (12.29.02)


Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications



- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

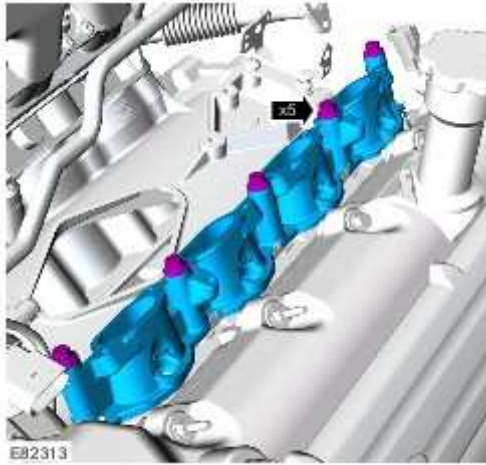
Raise and support the vehicle.

- 3 . Remove the fuel injection supply manifold.
For additional information, refer to Fuel Injection Supply Manifold (19.60.13)

- 4  **CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Remove the LH charge air cooler adaptor assembly.

-  Remove the 5 bolts.
-  Discard the gasket.



5 . Remove the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

6 . Remove the special tool from the LH cylinder head.

7




· **CAUTION: Evenly and progressively, release the camshaft bearing caps.**

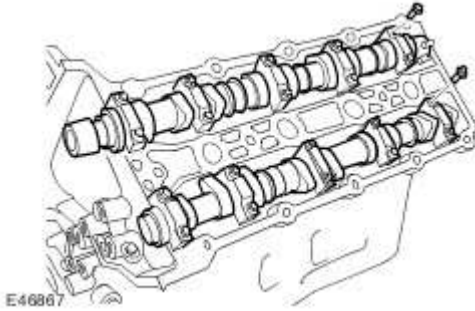
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

 Remove the 20 bolts.

8 . Remove the camshafts.



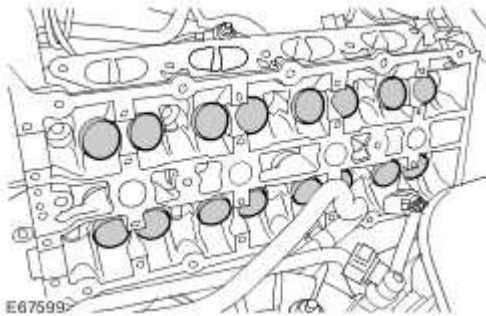
9 . NOTE:

Note the fitted position.

NOTE:

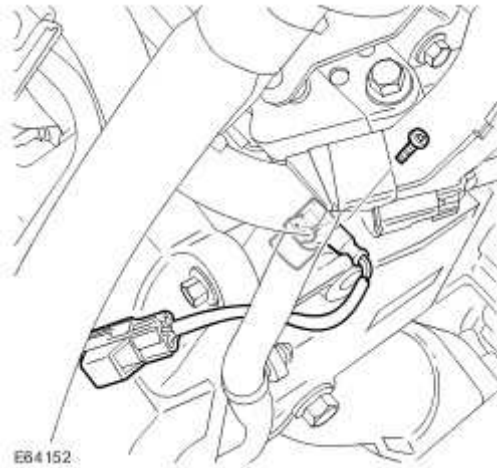
Make sure the shim remains with the tappet.

Remove the 16 tappets.



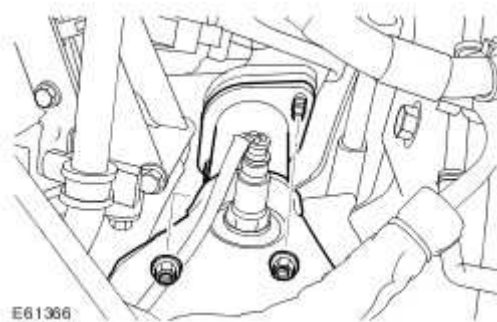
10 . Remove the CMP sensor.


- ▶ Remove the Torx bolt.
- ▶ Remove and discard the O-ring seal.




11 . Release the LH catalytic converter.

▶ Remove and discard the 2 nuts.



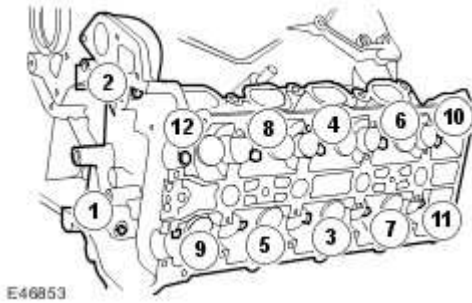
12  **CAUTION:** The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.

 **CAUTION:** Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

NOTE:

Remove the bolts in the indicated sequence.

Remove the 12 cylinder head bolts.



13

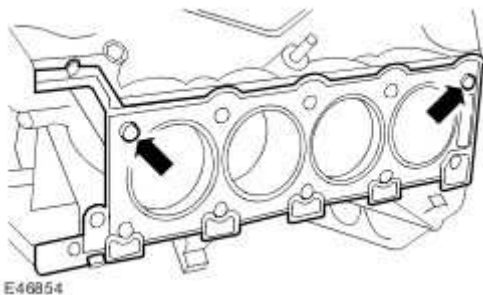


CAUTION: The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.

With assistance remove the cylinder head.

14 . Remove and discard the cylinder head gasket.

- ▶ Clean the cylinder head locating dowels.
- ▶ Clean and inspect the cylinder head and cylinder block.

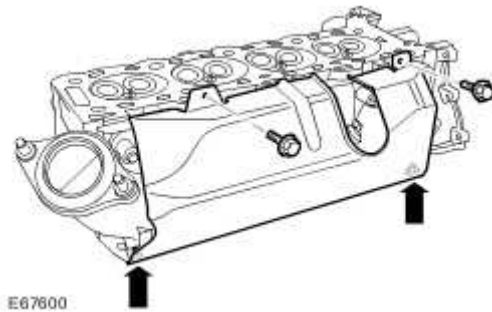


15 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the LH heat shield.

▶ Remove the 4 screws.



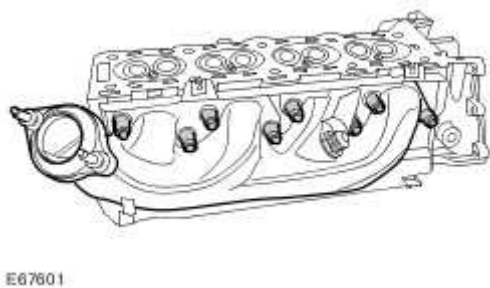
16 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the exhaust manifold.

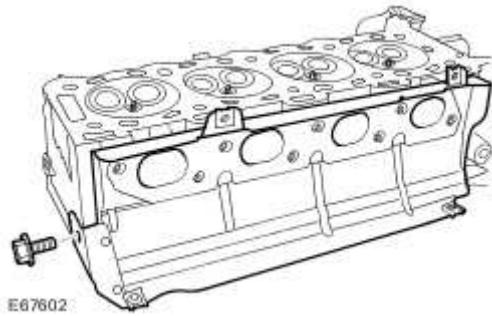
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



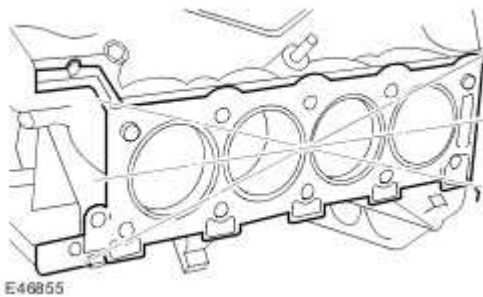
17 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



Installation

- 1 . Clean the component mating faces.
- 2 . Check cylinder head face for distortion, across the center and from corner to corner.



- 3 . For cylinder head face distortion data, refer to specifications.
For additional information, refer to Specifications

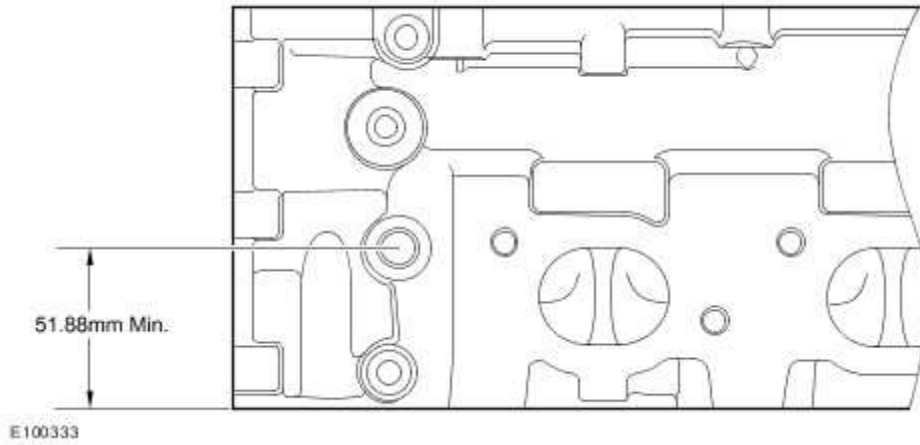
4 NOTE:

For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

Measure the cylinder head material.

- ▶ Check measurement from the centre of the exhaust dowel to the cylinder head face as shown.

- ▶ If the measurement is less than 51.88 mm the cylinder head requires replacement.

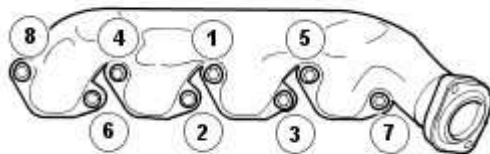


5 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).

6 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



E65731

7 . Install the heat shield.

▶ Tighten the screws.

8 .



CAUTION: The head gasket must be installed over the cylinder block dowels.

Install a new cylinder head gasket.

9 . With assistance install the cylinder head.

10 . **NOTE:**

Tighten the bolts 1 to 10 in the sequence shown.

Install the cylinder head bolts.

▶ Lubricate the new cylinder head bolt threads with clean engine oil.

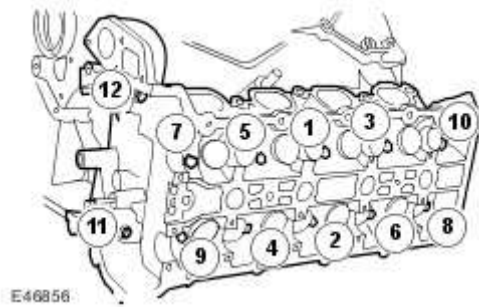
▶ Tighten the bolts 1 to 10 to 20 Nm (15 lb.ft).

▶ Tighten the bolts 1 to 10 to 35 Nm (26 lb.ft).

▶ Tighten the bolts 1 to 10, a further 90 degrees.

▶ Tighten the bolts 1 to 10, a further 90 degrees.

▶ Tighten the M8 bolts 11 and 12, to 25 Nm (18 lb.ft).



11 . Attach the catalytic coverter.

- ▶ Tighten the nuts to 40Nm (30 lb.ft).

12 . Install the CMP sensor.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).

13 . Install the tappets.

- ▶ Clean the components.
- ▶ Lubricate the components with clean engine oil.

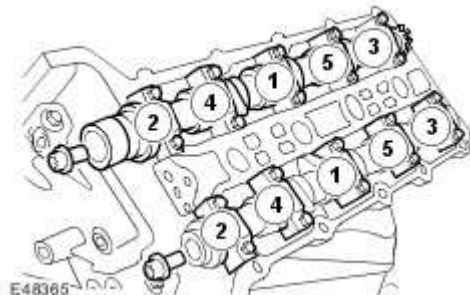
14 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Lubricate the journals and camshaft lobes with clean engine oil.

15 Install the camshaft bearing caps.

- ▶ Clean the component mating faces.

- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).

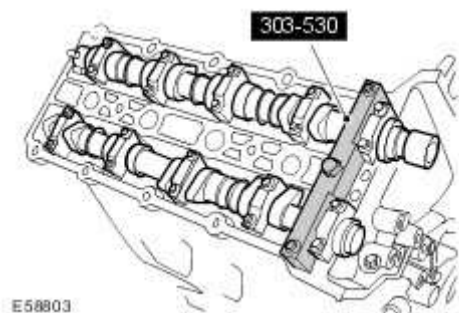


16 . **NOTE:**

RH illustration shown, LH is similar.

Install the special tool to the LH cylinder head.

- ▶ Install the 3 bolts.



17 . **NOTE:**

Do not install the LH valve cover until valve clearance adjustment has been completed.

Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

18 . Install the charge air cooler adaptor assembly.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

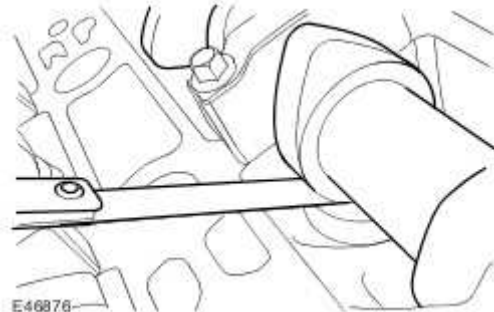
19 . Install the fuel injection supply manifold.

For additional information, refer to Fuel Injection Supply Manifold (19.60.13)

20 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

21  **CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.**

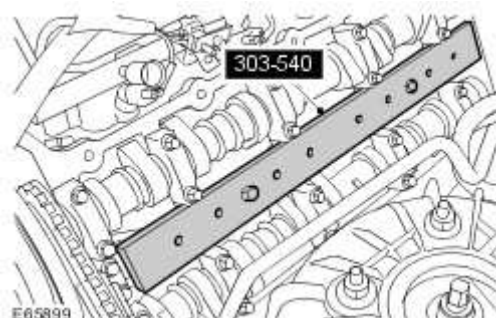
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



22 . Repeat the above procedure for the remaining 15 shims.


23 . Install the special tool 303-540, to the cylinder head.

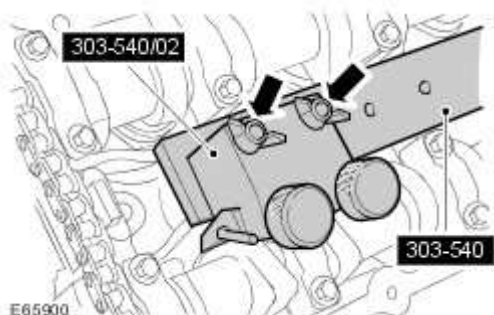
- ▶ Tighten the 2 bolts to 10 Nm (7 lb.ft).



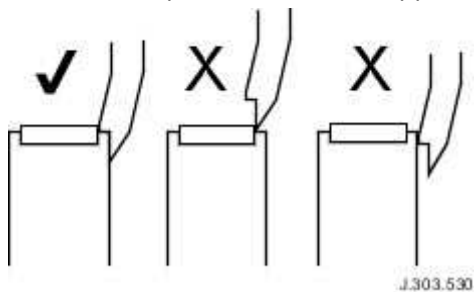
- 24 .  **CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.**

Attach the special tool 303-540/02 to 303-540.

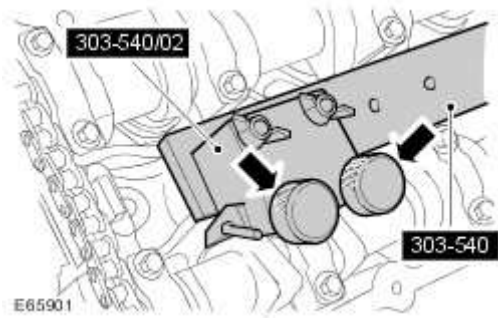
 Secure with the 2 wing nuts.



- 25 . Position the special tool to the tappet as shown.



- 26 . Using the special tool, compress the valve spring.



27



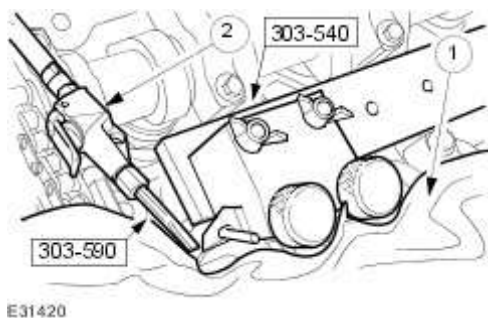
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



28



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

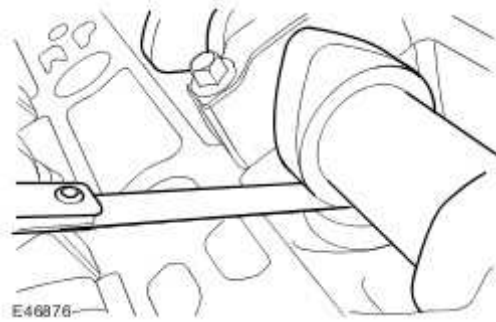


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

- 29 . Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



- 30 . Repeat the above procedure for the remaining valves.

- 31 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Engine Front Cover (12.65.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Recover the A/C refrigerant.

3



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 4 . Remove the hood.

For additional information, refer to Hood (76.16.01)

- 5 Vehicles with secondary air injection: Remove the air control valve to exhaust manifold tube.

- For additional information, refer to Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

- 6 . Remove the coolant manifold.

For additional information, refer to Coolant Manifold - Vehicles With: Supercharger

- 7 . Remove the LH valve cover.

For additional information, refer to Valve Cover LH (12.29.43)

- 8 . Remove the RH valve cover.

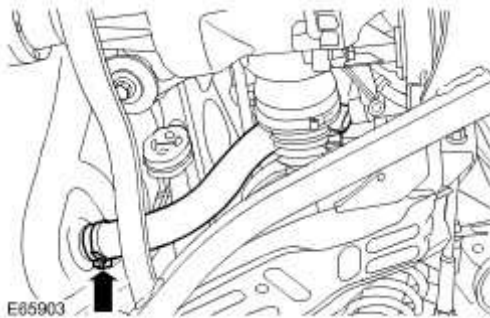
For additional information, refer to Valve Cover RH (12.29.44)

9 . Remove the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)

10 . Remove the radiator bottom hose.

▶ Release the clip.



11 . Remove the power steering pump.

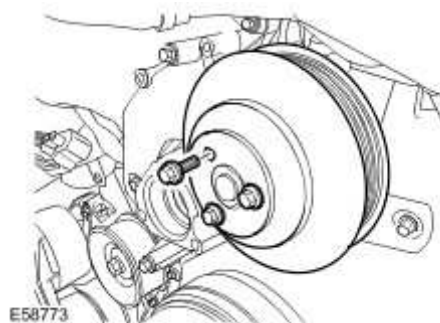
For additional information, refer to Power Steering Pump - 4.2L SC V8 - AJV8 (57.20.14)

12 . **NOTE:**

Restrain the pulley to aid the removal of the bolts.

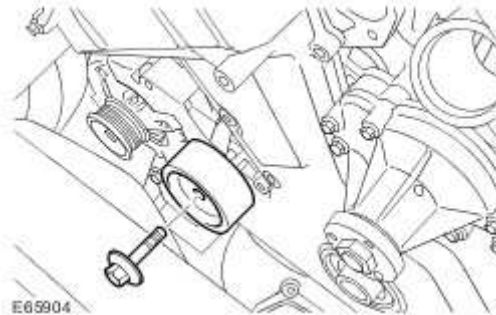
Remove the coolant pump pulley.

▶ Remove the 3 bolts.



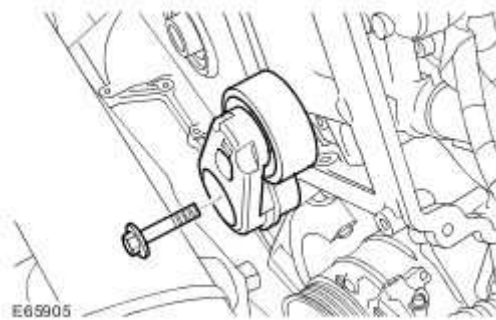
13 . Remove the accessory drive belt idler pulley.

▶ Remove the bolt.



14 . Remove the accessory drive belt tensioner.

▶ Remove the bolt.



15

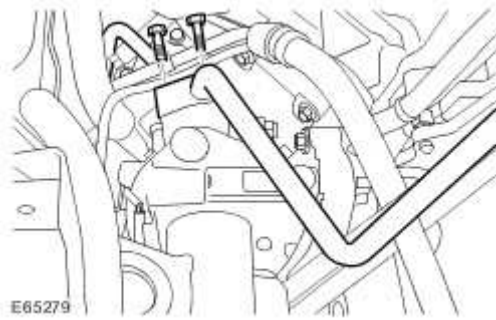


CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

▶ Remove the 2 bolts.

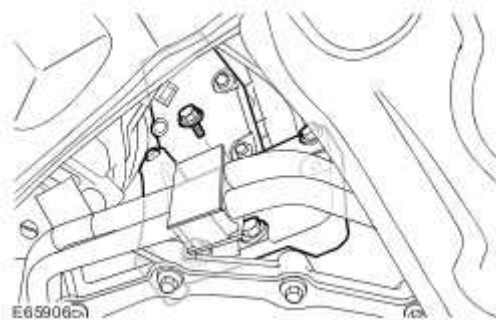
▶ Remove and discard the 2 O-ring seals.



16 . Position the A/C compressor aside to access the A/C compressor mounting bracket.

17 . Remove the A/C compressor mounting bracket.

▶ Remove the 4 bolts.



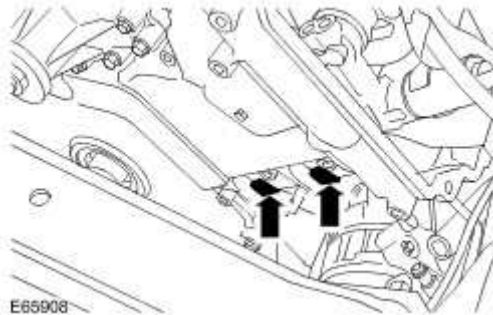
18 . Remove the power steering pump mounting bracket.

▶ Remove the 4 bolts.



19 . LH side: Release the wiring harness.

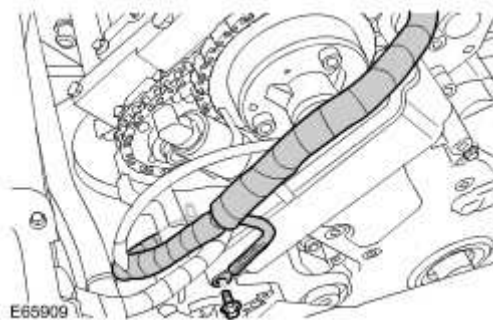
▶ Release the 2 clips.



20 . RH side: Release the wiring harness.

▶ Remove the bolt.

▶ Release the clip.

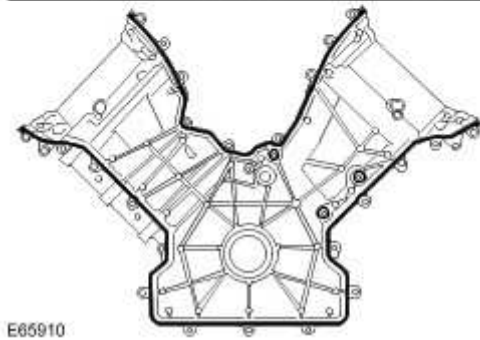
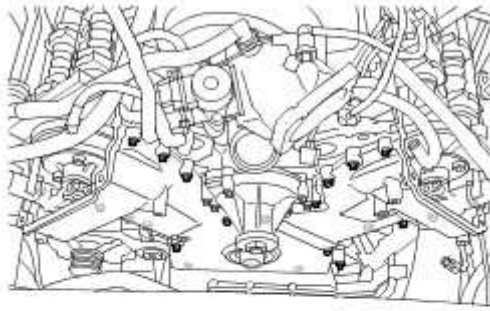


21 . Remove the engine front cover.

▶ Remove the 24 bolts.

▶ Remove and discard the 2 gaskets.

▶ Remove and discard the 3 O-ring seals.

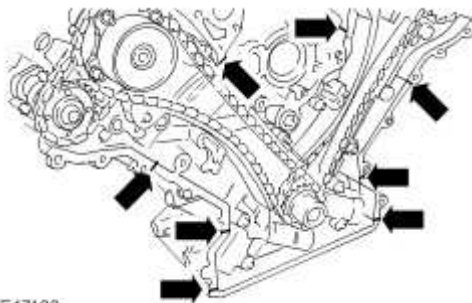


E65910

Installation

1 Install the engine front cover.

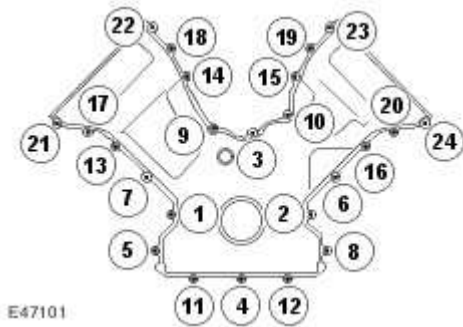
- ▶ Clean the component mating faces.
- ▶ Install the gaskets.
- ▶ Install the O-ring seals.
- ▶ Apply a bead of sealant 3 mm diameter, by 12 mm long, to the 8 places indicated.



E47100

2 Install the engine front cover bolts.

- ▶ Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



3 . RH side: Attach the wiring harness.

- ▶ Secure the clip.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

4 . LH side: Attach the wiring harness.

- ▶ Secure the clips.

5 . Install the power steering pump mounting bracket.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

6 . Install the A/C compressor mounting bracket.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

7 .  **CAUTION: Lubricate the new seals with clean refrigerant oil.**

Connect the refrigerant lines.

- ▶ Clean the component mating faces.
- ▶ Install the new O-ring seals.
- ▶ Tighten the bolts to 9 Nm (7 lb.ft).

8 . Install the accessory drive belt tensioner.

- ▶ Tighten the bolt to 45 Nm (33 lb.ft).

9 . Install the accessory drive belt idler pulley.

- ▶ Tighten the bolt to 45 Nm (33 lb.ft).

10 . Install the coolant pump pulley.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

11 . Install the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L SC V8 - AJV8 (57.20.14)

12 . Install the radiator bottom hose.

- ▶ Secure the clip.

13 . Install the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)

14 . Install the RH valve cover.

For additional information, refer to Valve Cover RH (12.29.44)

- 15 . Install the LH valve cover.
For additional information, refer to Valve Cover LH (12.29.43)

- 16 . Install the coolant manifold.
For additional information, refer to Coolant Manifold - Vehicles With: Supercharger

- 17 Vehicles with secondary air injection: Install the air control valve to exhaust manifold tube.
. For additional information, refer to Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

- 18 . Install the hood.
For additional information, refer to Hood (76.16.01)

- 19 . Recharge the A/C system.

- 20 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Engine Mount LH (12.45.01)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 4 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

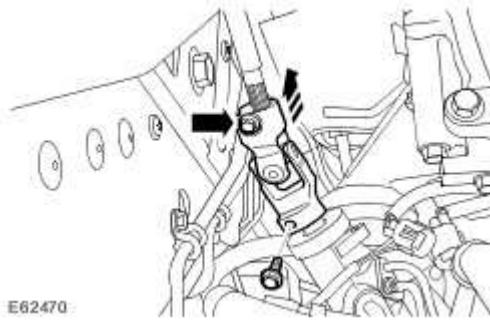
Left-hand drive vehicles

- 5 . **NOTE:**

Note the fitted position.

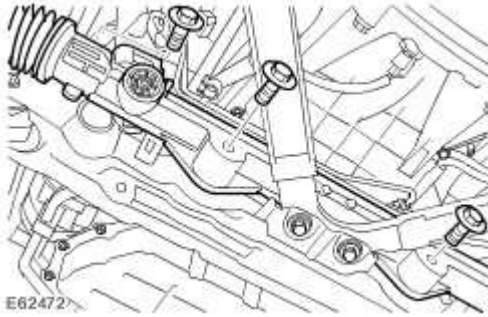
Remove the steering gear flexible coupling.

- ▶ Remove and discard the 2 bolts.



6 . Release the steering gear.

▶ Remove the 3 bolts.

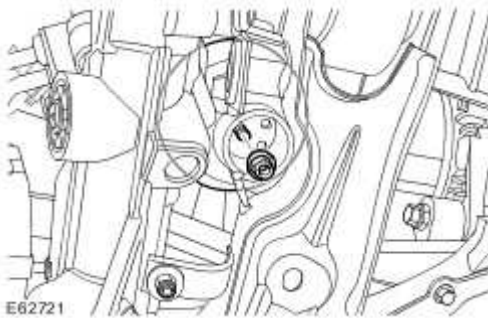


All vehicles

7 . Release the engine mount.

▶ Support the engine.

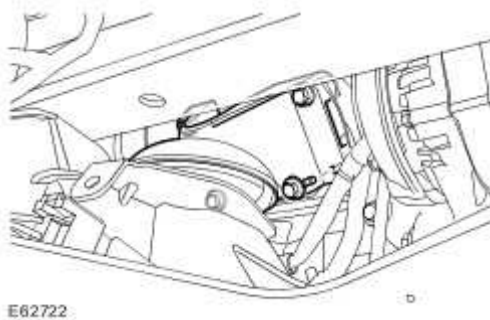
▶ Remove and discard the nut.



8 . Remove the engine mount and bracket.

▶ Raise the engine.

▶ Remove the 4 bolts.



9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the engine mount.

▶ Remove and discard the nut.



Installation

All vehicles

1 . Install the engine mount.

▶ Tighten the new nut to 55 Nm (41 lb.ft).

2 . Install the engine mount and bracket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- ▶ Lower the engine.
- ▶ Tighten the new nut to 63 Nm (46 lb.ft).

Left-hand drive vehicles

3 . Secure the steering gear.

- ▶ Tighten the bolts to 100 Nm (74 lb.ft).

4 . Install the steering gear flexible coupling.

- ▶ Tighten the new bolts to 35 Nm (26lb.ft).

All vehicles

5 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

6 . Install the front wheel.

For additional information, refer to Wheel and Tire (74.20.05)

7 . Connect the battery ground cable and install the cover.


For additional information, refer to Specifications

Engine Mount RH (12.45.03)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

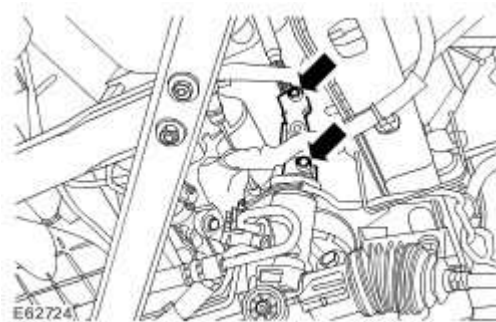
Right-hand drive vehicles

- 4 . **NOTE:**

Note the fitted position.

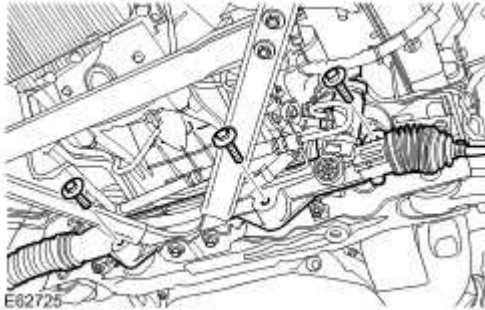
Remove the steering gear flexible coupling.

-  Remove and discard the 2 bolts.



5 . Release the steering gear.

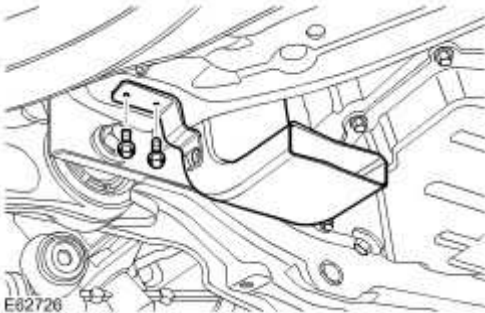
▶ Remove the 3 bolts.



All vehicles

6 . Remove the generator cooling duct.

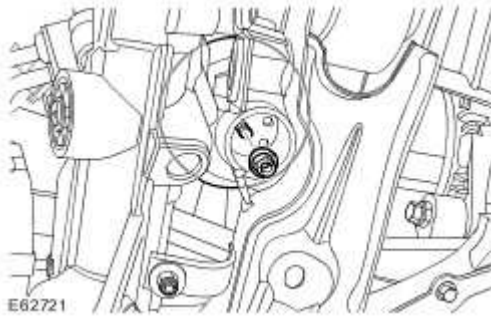
▶ Remove the 2 screws.



7 . Release the engine mount.

▶ Support the engine.

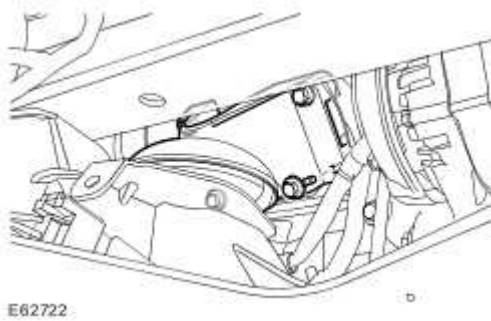
▶ Remove and discard the nut.



8 . Remove the engine mount and bracket.

▶ Raise the engine.

▶ Remove the 4 bolts.



9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the engine mount.

▶ Remove and discard the nut.



Installation

All vehicles

1 . Install the engine mount.

- ▶ Tighten the new nut to 55 Nm (41 lb.ft).

2 . Install the engine mount and bracket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- ▶ Lower the engine.
- ▶ Tighten the new nut to 63 Nm (46 lb.ft).

3 . Install the generator cooling duct.


- ▶ Tighten the screws.

Right-hand drive vehicles

4 . Secure the steering gear.

- ▶ Tighten the bolts to 100 Nm (74 lb.ft).

5 . Install the steering gear flexible coupling.

 Tighten the new bolts to 35 Nm (26lb.ft).

All vehicles

6 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold LH - Vehicles With: Secondary Air Injection (AIR) (30.15.55)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications


2



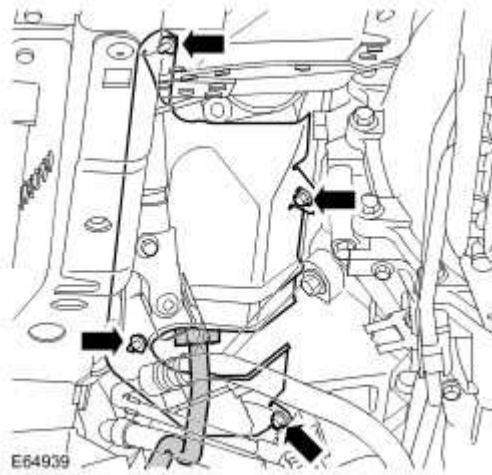
- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the oil level indicator and tube.
For additional information, refer to Oil Level Indicator and Tube
- 4 . Remove the exhaust system.
For additional information, refer to Exhaust System
- 5 . Remove the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)
- 6 . Release the LH exhaust manifold heat shield.

 Remove the 4 screws.

- 7 . Release the AIR tube from the LH exhaust manifold.

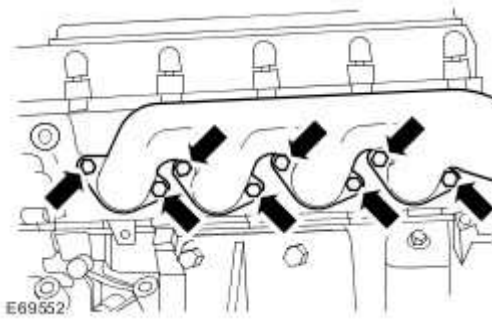


8 . Remove the LH exhaust manifold heat shield.

9 . Remove the exhaust manifold.

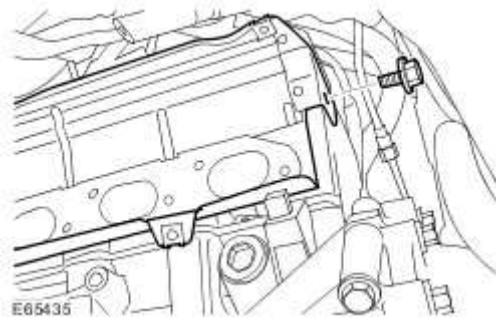
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



10 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



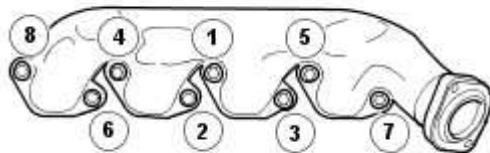
Installation

1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).


2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).




3 . Install the exhaust manifold heat shield.

4 . Attach the air tube.

 Tighten the union to 35 Nm (26 lb.ft).

5 . Secure the exhaust manifold heat shield.

 Tighten the screws.

6 . Install the LH engine mount.

For additional information, refer to Engine Mount LH (12.45.01)

7 . Install the exhaust system.

For additional information, refer to Exhaust System

8 . Install the oil level indicator and tube.

For additional information, refer to Oil Level Indicator and Tube


9 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold RH - Vehicles Without: Secondary Air Injection (AIR) (30.15.56)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

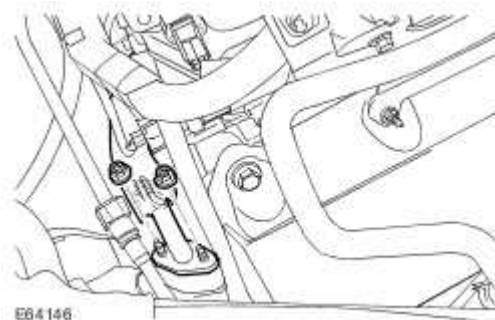
Raise and support the vehicle.

- 3 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

- 4 . Release the EGR valve to exhaust manifold pipe.

▶ Remove the 2 nuts.

▶ Remove and discard the gasket.



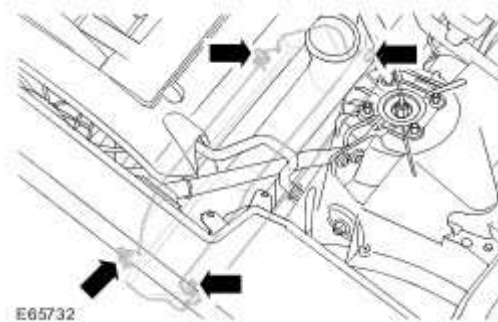
- 5 . Remove the exhaust system.
For additional information, refer to Exhaust System

6 . Remove the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Remove the RH heat shield.

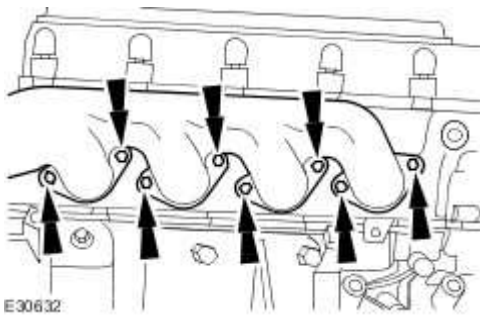
▶ Remove the 4 screws.



8 . Remove the exhaust manifold.

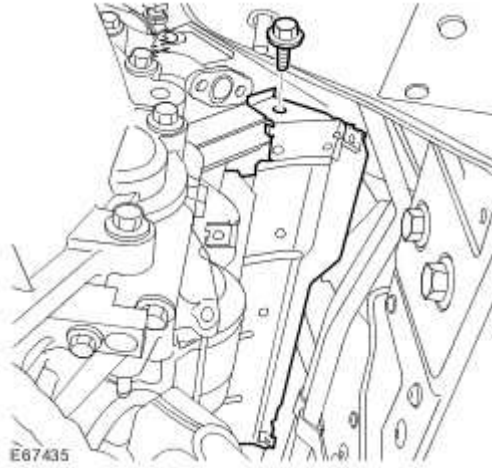
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



9 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



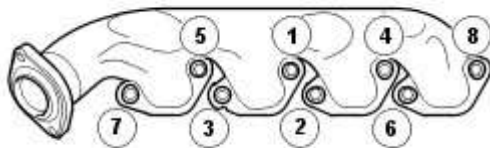
Installation

1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).


2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



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3 . Install the heat shield.

 Tighten the screws.

4 . Install the RH engine mount.


For additional information, refer to Engine Mount RH (12.45.03)


5 . Install the exhaust system.

For additional information, refer to Exhaust System

6 . Attach the EGR valve to exhaust manifold pipe.

 Clean the component mating faces.

 Install a new gasket.

 Tighten the nuts to 25 Nm (18 lb.ft).

7 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator


8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold RH - Vehicles With: Secondary Air Injection (AIR) (30.15.56)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

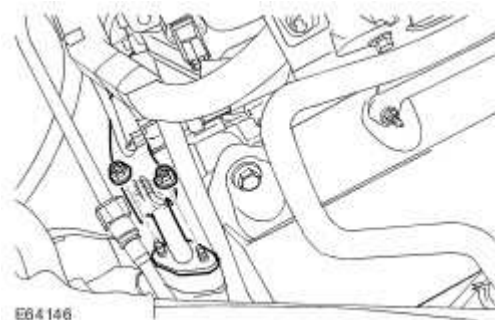
Raise and support the vehicle.

- 3 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

- 4 . Release the EGR valve to exhaust manifold pipe.

▶ Remove the 2 nuts.

▶ Remove and discard the gasket.



- 5 . Remove the exhaust system.
For additional information, refer to Exhaust System

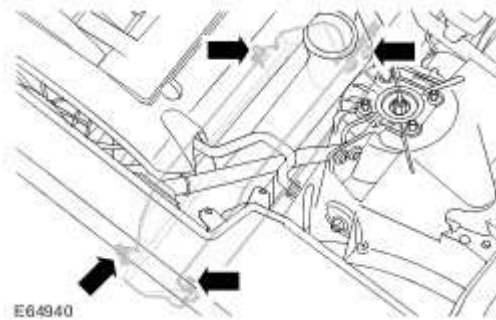
6 . Remove the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Release the RH exhaust manifold heat shield.

▶ Remove the 4 screws.

8 . Release the AIR tube from the RH exhaust manifold.

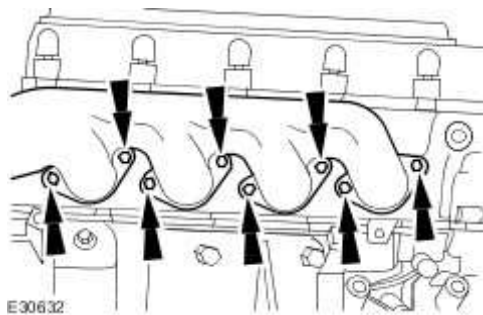


9 . Remove the RH exhaust manifold heat shield.

10 . Remove the exhaust manifold.

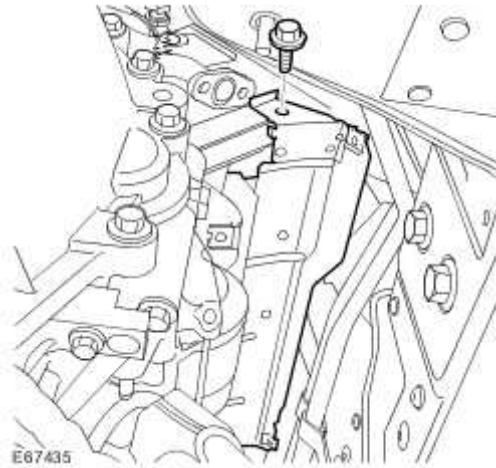
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



11 . Remove and discard the exhaust manifold gasket.

- ▶ Remove the bolt.



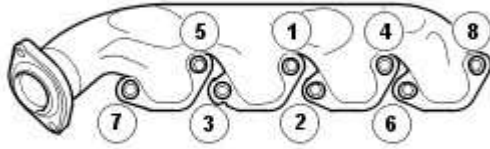
Installation

- 1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).

- 2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



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3 . Install the exhaust manifold heat shield.

4 . Attach the air tube.

▶ Tighten the union to 35 Nm (26 lb.ft).

5 . Secure the exhaust manifold heat shield.

▶ Tighten the screws.

6 . Install the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Install the exhaust system.

For additional information, refer to Exhaust System

8 . Attach the EGR valve to exhaust manifold pipe.

▶ Clean the component mating faces.

▶ Install a new gasket.

▶ Tighten the nuts to 25 Nm (18 lb.ft).

9 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator


10 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Flexplate (12.53.13)


Removal

1 . Remove the cover and disconnect the battery ground cable.

2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


3 . Remove the transmission.
For additional information, refer to Transmission (44.20.01)

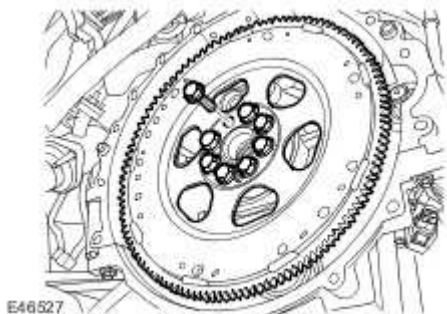
4  **CAUTION: The bolts can only be used 3 times, mark the bolts with a center punch. If 2 punch marks are visible, discard the bolts.**

NOTE:

Prevent the flexplate from rotating.

Remove the torque converter flexplate.

 Remove the 8 bolts.



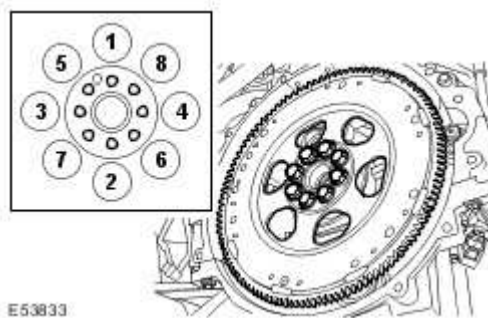
Installation

1 . NOTE:

Prevent the flexplate from rotating.

Install the torque converter flexplate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts evenly in 2 stages to the sequence shown.
- ▶ Tighten the bolts to 15 Nm (11 lb ft).
- ▶ Tighten the bolts to 110 Nm (81 lb.ft).




2 . Install the transmission.

For additional information, refer to Transmission (44.20.01)

3 . Connect the battery ground cable and install the cover.

Oil Pan (12.60.44)

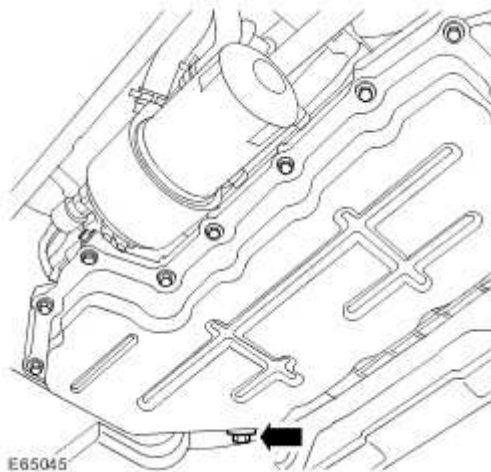
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

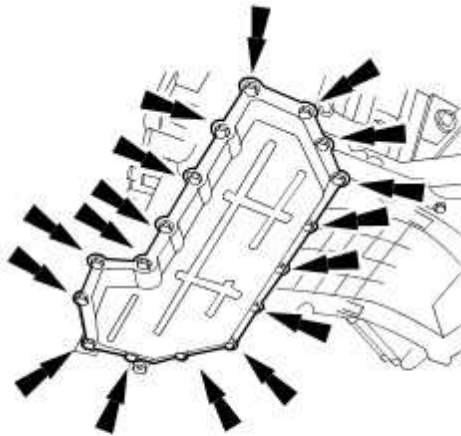
- 2 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)
- 3 . Remove the oil pan drain plug.

- ▶ Position a container to collect the fluid.
- ▶ Discard the oil pan drain plug seal.



- 4 . Remove the oil pan.
 - ▶ Position a container to collect the oil spillage.
 - ▶ Remove the 17 bolts.

- ▶ Remove and discard the gasket.



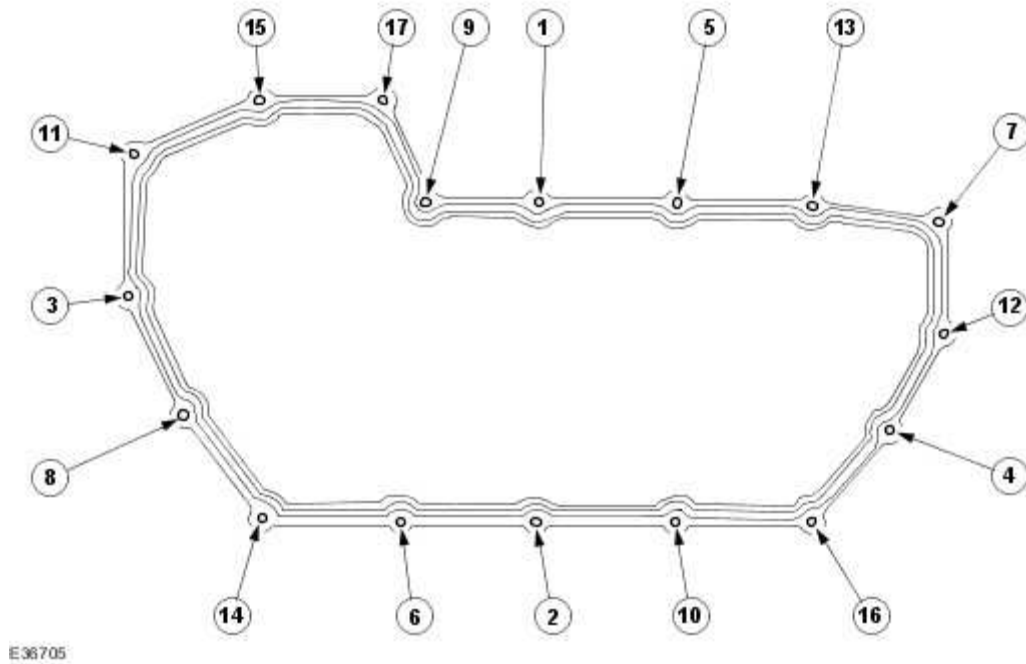
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Installation

- 1 . Install the oil pan.

- ▶ Clean the components.
- ▶ Install the new gasket.
- ▶ Install the bolts, but do not tighten fully at this stage.

- 2 . Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



3 . Tighten the drain plug to 25 Nm (18 lb.ft).

▶ Install a new seal.

4 . Install the engine undershield.


For additional information, refer to Air Deflector (76.11.41)

5 . Fill the engine with the recommended oil to the correct level.

Oil Pump (12.60.26)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the timing drive components.
For additional information, refer to Timing Drive Components (12.65.13)

- 4 . Remove the oil pan.
For additional information, refer to Oil Pan (12.60.44)

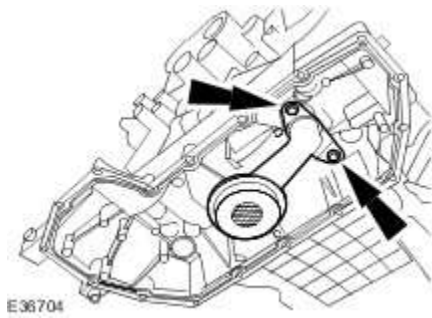
- 5 . **NOTE:**

The bolts will remain captive.

Remove the oil strainer pick-up assembly.

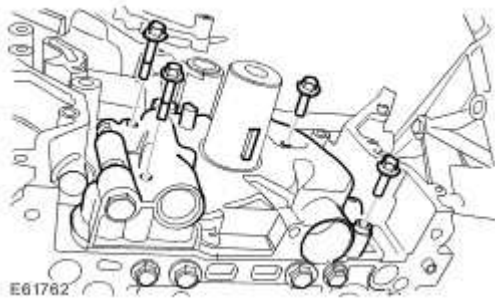
 Remove the 2 bolts.

 Remove and discard the O-ring seal.



6 . Remove the oil pump assembly.

- ▶ Remove the 4 bolts.
- ▶ Remove and discard the O-ring seal.



Installation

1 . Install the oil pump assembly.

- ▶ Clean the components mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

2 . Install the oil strainer pick-up assembly.

- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

3 . Install the oil pan.

For additional information, refer to Oil Pan (12.60.44)

4 . Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Timing Drive Components (12.65.13)

Special Service Tools



Camshaft setting/locking tool

303-530



Timing Setting tool

303-645



Timing chain tensioning tool


303-532

Removal

NOTE:

This procedure covers the removal and installation of the following components: timing chains, chain guides, tensioners and sprockets.


- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the engine front cover.
For additional information, refer to Engine Front Cover (12.65.01)


- 4 . Remove the crankshaft position (CKP) sensor.
For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

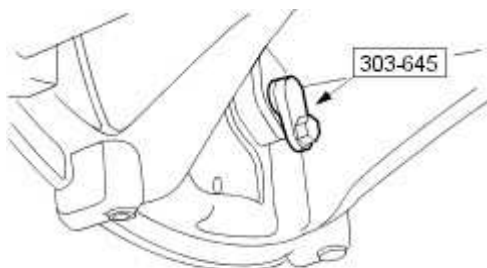
- 5 .  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

 **CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.**

Lock the crankshaft.

 Install the special tool.

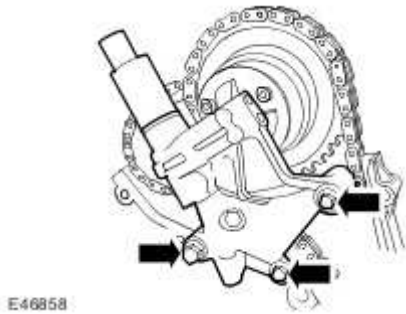
 Install the screw.



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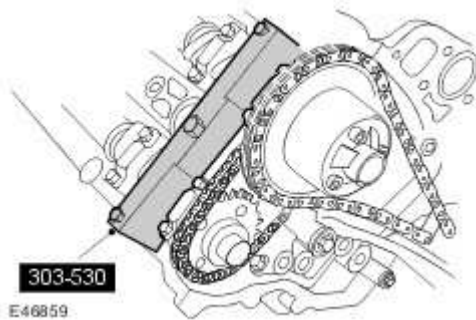
6 . Remove the RH variable camshaft timing (VCT) control solenoid housing.

- ▶ Remove the 3 bolts.
- ▶ Remove and discard the O-ring seals.



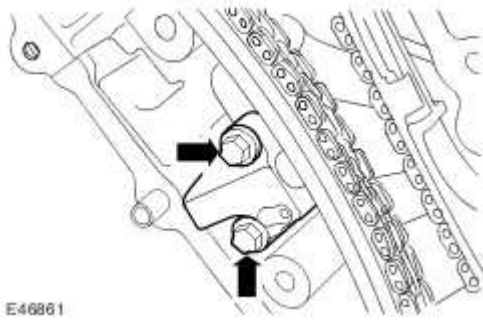
7 Install the special tool to the RH cylinder head.

- ▶ Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
- ▶ Install the 3 bolts.



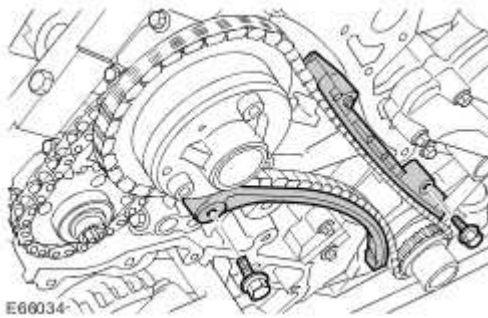
8 . Remove the RH primary timing chain tensioner.

- ▶ Remove the 2 bolts.

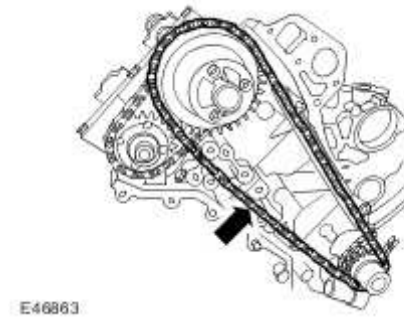


9 . Remove the RH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



10 . Remove the RH primary timing chain.

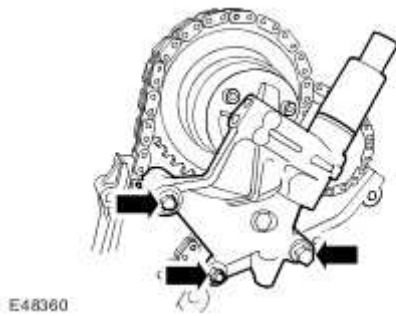


11 . Remove the LH variable camshaft timing (VCT) control solenoid housing.

▶ Remove the 2 bolts.

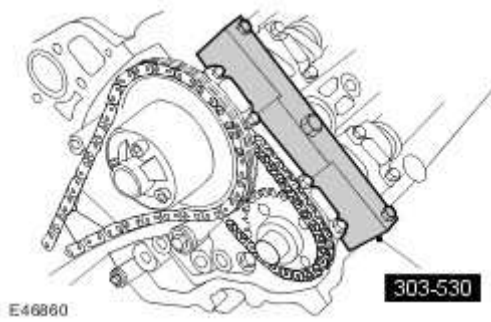
▶ Remove the nut.

▶ Remove and discard the O-ring seals.



12 . Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



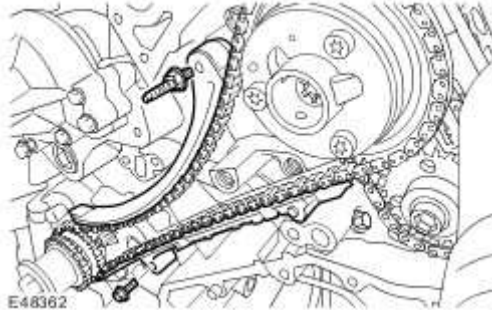
13 . Remove the LH primary timing chain tensioner.

▶ Remove the 2 bolts.

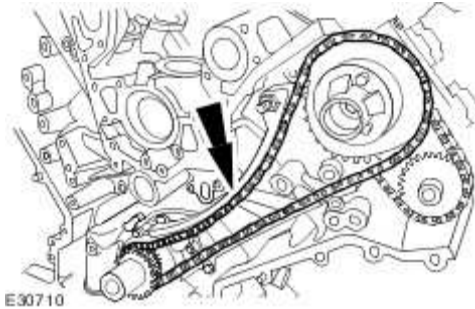


14 . Remove the LH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



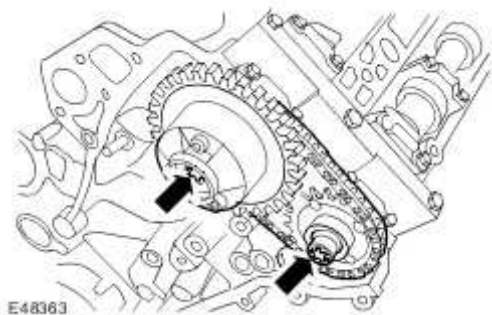
15 . Remove the LH primary timing chain.



16 .  **CAUTION: Discard the bolts.**

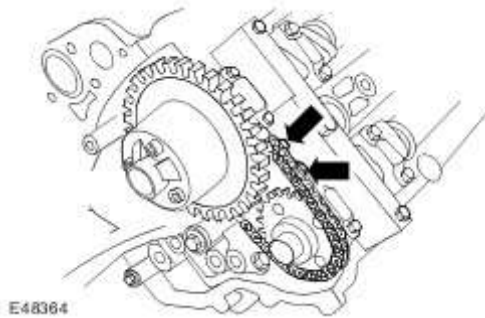
Release the LH camshaft sprocket assembly.

▶ Remove the 2 Torx bolts.



17 . Remove the LH secondary timing chain, tensioner and sprocket assembly.

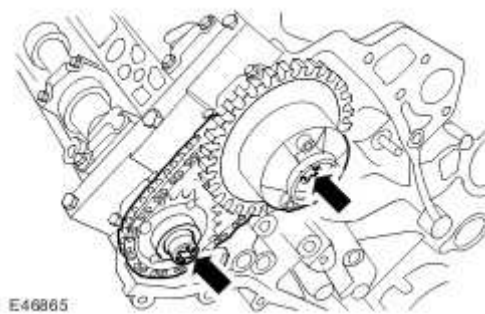
▶ Remove the 2 bolts.



18 .  **CAUTION: Discard the bolts.**

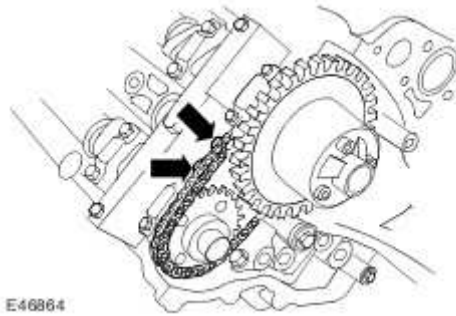
Release the RH camshaft sprocket assembly.

▶ Remove the 2 Torx bolts.



19 . Remove the RH secondary timing chain, tensioner and sprocket assembly.

▶ Remove the 2 retaining bolts.

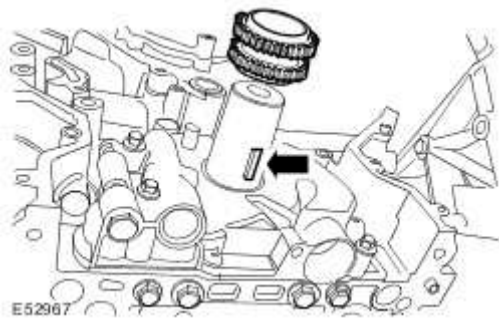


20 . NOTE:

Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

▶ Remove the crankshaft sprocket key.



Installation

1 . Install the crankshaft sprocket.

- ▶ Clean the components.
- ▶ Install the crankshaft sprocket key.

2



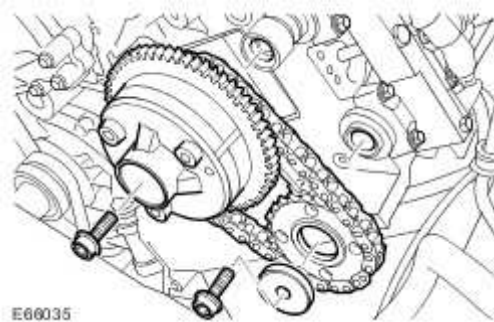
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

NOTE:

LH illustration shown, RH is similar.

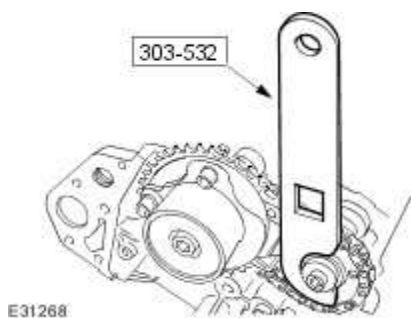
Install the LH secondary timing chain, tensioner and sprocket assembly.

- ▶ Clean the components.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.



3 Install the special tool to the exhaust camshaft sprocket.

- ▶ Reposition the camshaft sprockets for the most advantageous position for use of the special tool.



4 . Install the LH secondary timing chain tensioner retaining bolts.

- ▶ Tighten the bolts to 12 Nm.

5 Install the LH primary timing chain.

- ▶ Clean the components.
- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

6 . Install the LH primary timing chain tensioner guides.

- ▶ Clean the components.
- ▶ Tighten the bolts to 12 Nm.

7



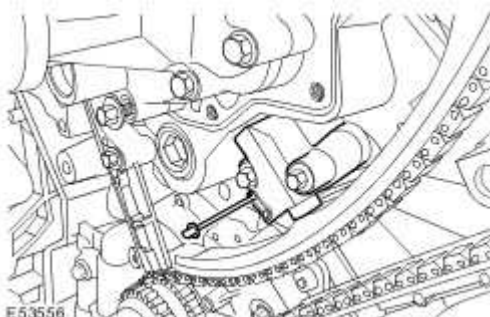
CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

NOTE:

LH illustration shown, RH is similar.

Install the LH primary timing chain tensioner.

- ▶ Clean the components.
- ▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.
- ▶ Tighten the bolts to 12 Nm.
- ▶ Remove the retaining rod.



8



CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



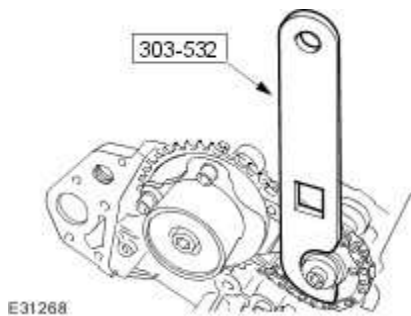
CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.



CAUTION: Make sure that new bolts are installed.

Install the special tool to the LH exhaust camshaft sprocket.

- ▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- ▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.



9 . Install the LH VCT control solenoid housing.

- ▶ Clean the components.
- ▶ Install the new O-ring seals.
- ▶ Tighten the new bolts to 22 Nm.
- ▶ Tighten the nut to 10 Nm.

10



CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the RH secondary timing chain, tensioner and sprocket assembly.

- ▶ Clean the components.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.

11 . Install the RH secondary timing chain tensioner retaining bolts.

- ▶ Tighten the bolts to 12 Nm.

12 Install the RH primary timing chain.

- ▶ Clean the components.
- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

13 . Install the RH primary timing chain tensioner guides.

- ▶ Tighten the bolts to 12 Nm.

14



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- ▶ Clean the components.
- ▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.

▶ Tighten the bolts to 12 Nm.

▶ Remove the retaining rod.

15



CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

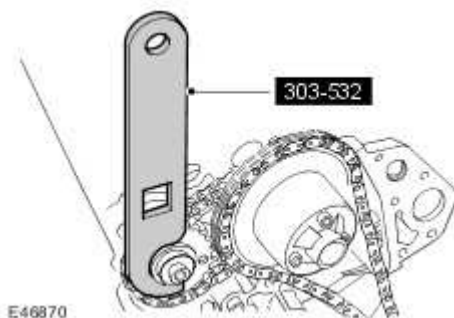


CAUTION: Make sure that new bolts are installed.

Install the special tool to the RH exhaust camshaft sprocket.

▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.

▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.




16 . Install the RH VCT control solenoid housing.

▶ Clean the components.


▶ Install the new O-ring seals.

 Tighten the new bolts to 22 Nm.

17 . Remove the special tool from the RH cylinder head.

 Remove the 3 bolts.


18 . Remove the special tool from the LH cylinder head.

 Remove the 3 bolts.

19 . Install the engine front cover.

For additional information, refer to Engine Front Cover (12.65.01)

20 . Remove the crankshaft locking tool.

 Remove the screw.

21 . Install the CKP sensor.

For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

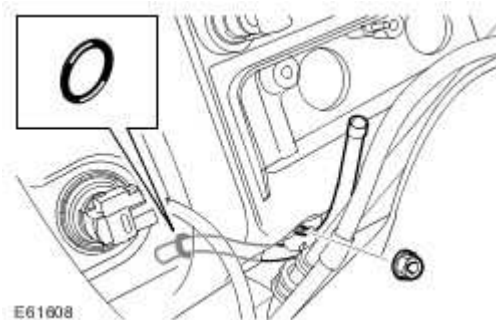
22 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

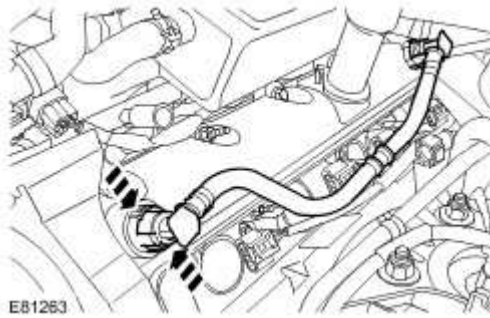
Valve Cover LH (12.29.43)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 Remove the purge valve.
For additional information, refer to Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8 (17.15.30)
- 3 . Remove the ignition coil-on-plug.
For additional information, refer to Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 (18.20.40)
- 4 . Remove the remaining ignition coil-on-plugs.
- 5 . Remove the oil level indicator and tube.
 - ▶ Remove the nut.
 - ▶ Remove and discard the O-ring seal.



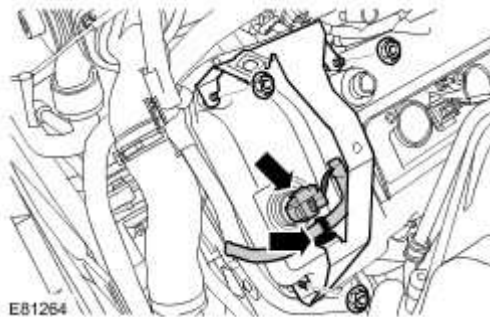
- 6 . Remove the engine breather line.



7 . Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.

8 . Remove the engine cover bracket.

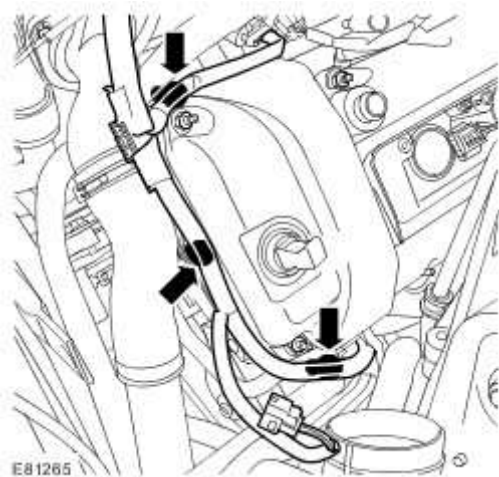
- ▶ Remove the 3 nuts.
- ▶ Release the wiring harness.



9 . Disconnect fuel line from the fuel rail.
For additional information, refer to Spring Lock Couplings

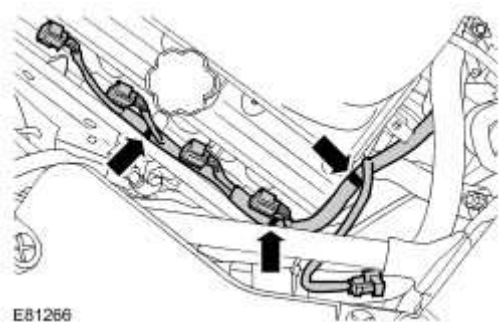
10 . Release the engine wiring harness.

- ▶ Release the 3 clips.



11 . Release the coil-on-plug wiring harness.

▶ Release the 3 clips.

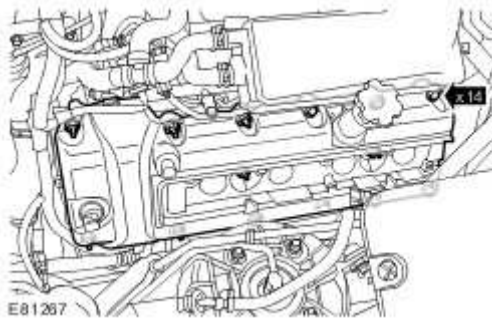


12 . **NOTE:**

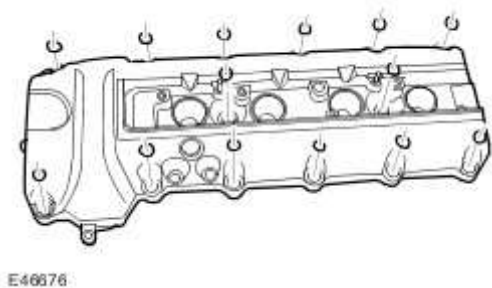
Note the fitted position of the retaining bolts prior to removal.

Remove the valve cover.

▶ Remove the 14 valve cover retaining bolts.



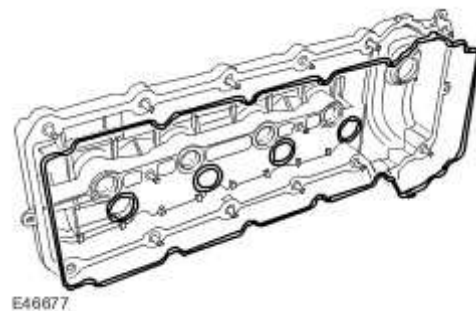
13 . Remove and discard the valve cover retaining bolt O-ring seals.



14 . Remove and discard the valve cover gasket.

▶ Carefully remove the sealant.

15 . Remove and discard the valve cover plug aperture seals.



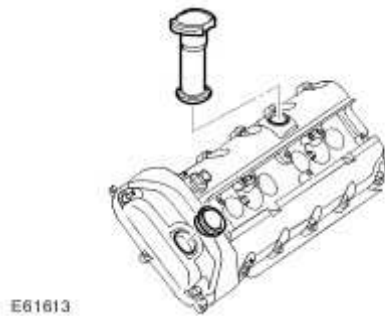
16 . Remove and discard the VCToil control solenoid seal.

17 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the oil filler pipe.

▶ Remove and discard the O-ring seal.



Installation

1 . Install the oil filler pipe.

▶ Install a new O-ring seal.

2 . Install the new VCT oil control solenoid seal.

3 . Install the new valve cover plug aperture seals.

4 . Install a new valve cover gasket.

▶ Clean the components.

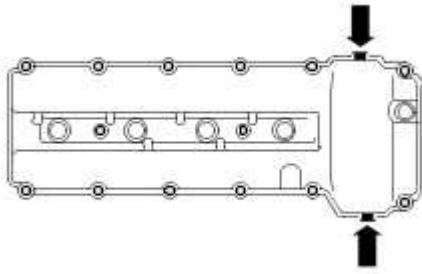
5 NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after

applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the valve cover.

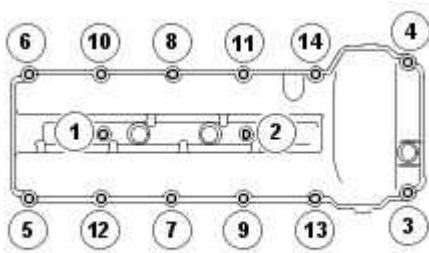
- ▶ Clean the component mating faces.



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6 . Install valve cover retaining bolts to their position previously noted.

- ▶ Install new valve cover bolt O-ring seals.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).
- ▶ Complete the tightening sequence as illustrated.



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7 . Attach the coil-on-plug wiring harness.

- ▶ Secure with the clips.

8 . Attach the engine wiring harness.

▶ Secure with the clips.

9 . Install the engine cover bracket.

▶ Tighten the nuts to 6 Nm (4 lb.ft).

▶ Attach the wiring harness.

10 . Connect the VCT oil control solenoid electrical connector.

11 . Install the engine breather line.

12 . Install the oil level indicator and tube.

▶ Install a new O-ring seal.

▶ Tighten the nut to 6 Nm (4 lb.ft).

13 . Connect the fuel line.

For additional information, refer to Spring Lock Couplings

14 . Install the ignition coil-on-plug.

For additional information, refer to Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 (18.20.40)

15 . Install the remaining ignition coil-on-plugs.

16 Install the purge valve.

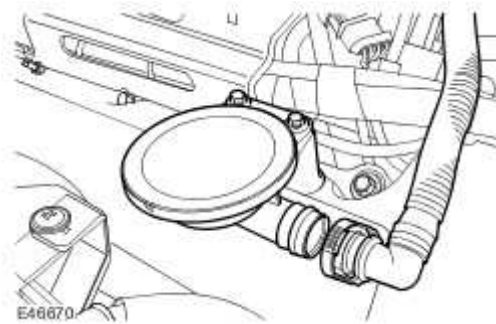
. For additional information, refer to Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8 (17.15.30)

- 17 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

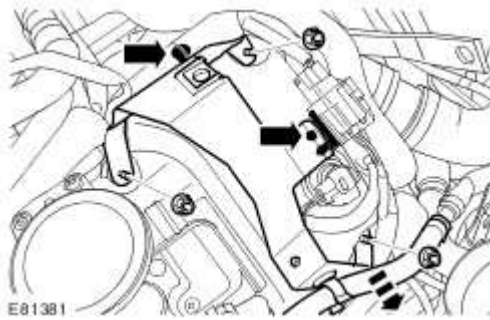
Valve Cover RH (12.29.44)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the ignition coil-on-plug.
For additional information, refer to Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 (18.20.40)
- 3 . Remove the remaining ignition coil-on-plugs.
- 4 . Disconnect the positive crankcase ventilation (PCV) line.

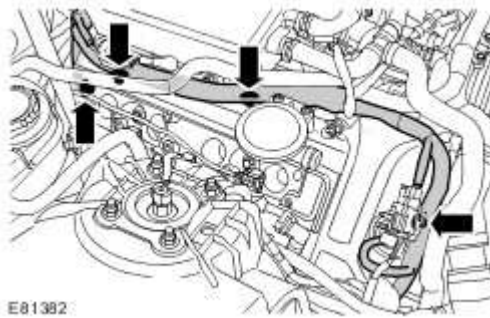


- 5 . Remove the engine cover bracket.
 - ▶ Remove the 3 nuts.
 - ▶ Release the 2 wiring harness clips.
 - ▶ Release the hose.



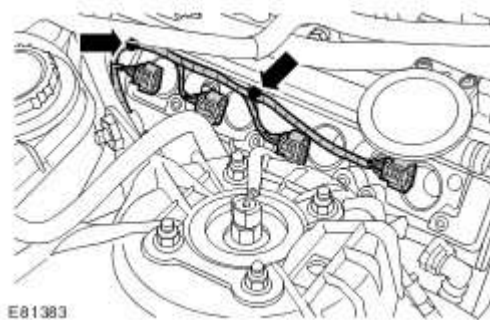
6 . Release the engine wiring harness.

▶ Release the 4 clips.

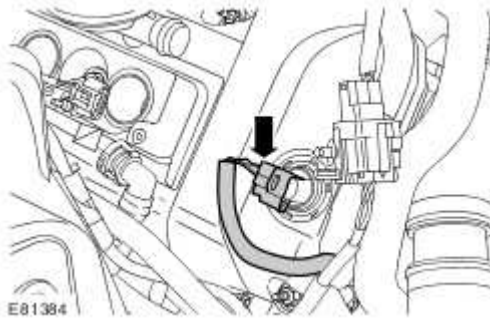


7 . Release the coil-on-plug wiring harness.

▶ Release the 2 clips.



8 . Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.

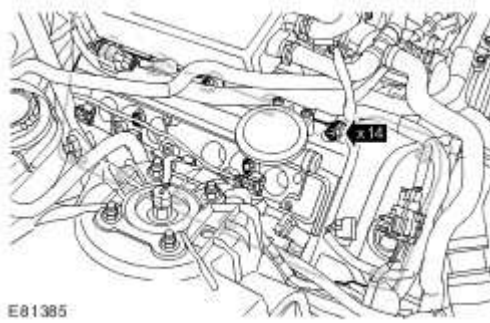


9 . NOTE:

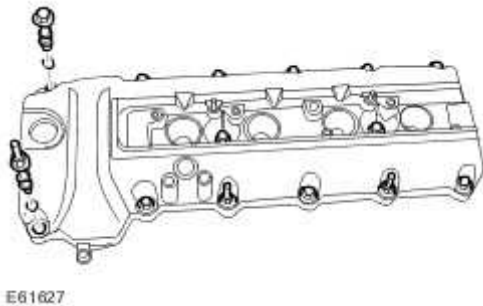
Note the fitted position of the retaining bolts prior to removal.

Remove the valve cover.

▶ Remove the 14 valve cover retaining bolts.



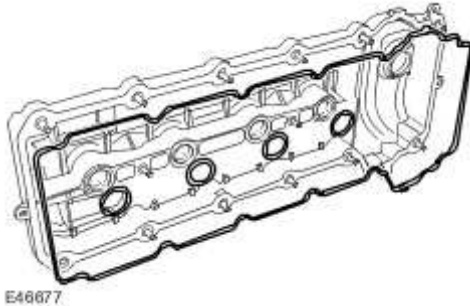
10 . Remove and discard the valve cover retaining bolt O-ring seals.



11 . Remove and discard the valve cover gasket.

▶ Carefully remove the sealant.

12 . Remove and discard the valve cover plug aperture seals.



13 . Remove and discard the VCToil control solenoid seal.

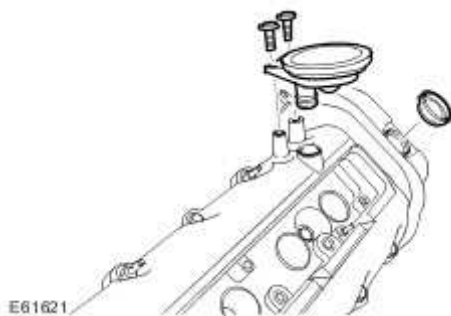
14 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the PCV valve.

▶ Remove the 2 Torx screws.

▶ Remove and discard the O-ring seal.



Installation

1 . Install the PCV valve.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx screws.

2 . Install the new VCT oil control solenoid seal.

3 . Install new valve cover plug aperture gaskets.

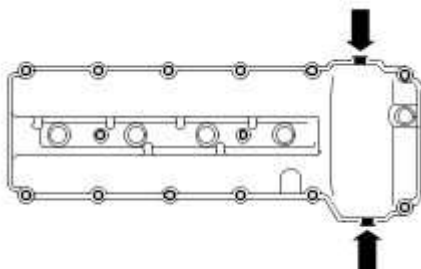
4 . Install a new valve cover gasket.

5 NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the valve cover.

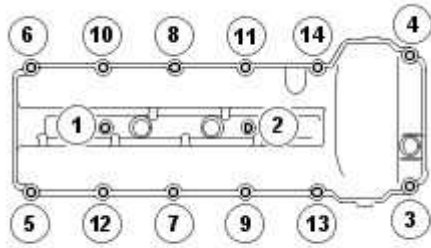
- ▶ Clean the component mating faces.



E49922

6 . Install valve cover retaining bolts to their position previously noted.

- ▶ Install new valve cover bolt O-ring seals.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).
- ▶ Complete the tightening sequence as illustrated.



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7 . Connect the VCT oil control solenoid electrical connector.

8 . Attach the coil-on-plug wiring harness.

- ▶ Secure with the clips.

9 . Attach the engine wiring harness.

- ▶ Secure with the clips.

10 . Install the engine cover bracket.

- ▶ Tighten the nuts to 6 Nm (4 lb.ft).
- ▶ Secure the wiring harness.
- ▶ Secure the hose.

11 . Connect the PCV line.

12 . Install the ignition coil-on-plug.

For additional information, refer to Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 (18.20.40)

13 . Install the remaining ignition coil-on-plugs.

14 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Oil Filter Housing


Special Service Tools



Wrench, Oil filter
303-752

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)

- 4 . Disconnect the engine oil temperature sensor electrical connector.



- 5 . Disconnect the engine oil pressure (EOP) sensor electrical connector.



6 . NOTE:

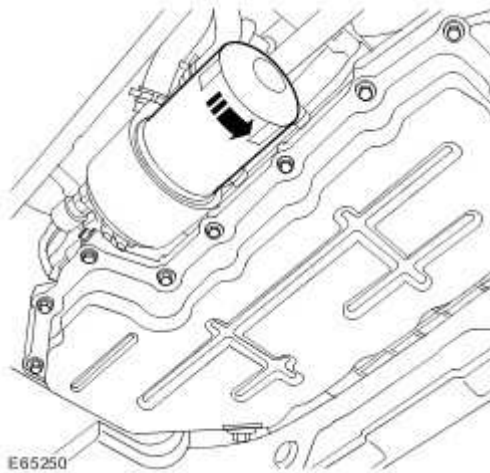
Some oil spillage is inevitable during this operation.

NOTE:

Clean the components general area prior to dismantling.

Remove the oil filter.

▶ Position a container to collect the fluid.



7

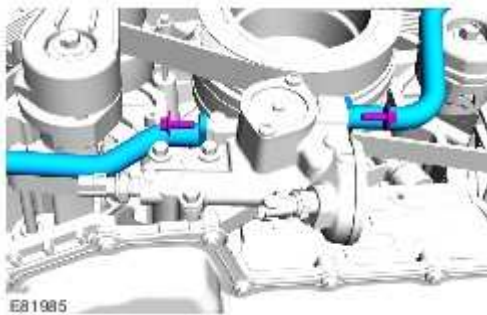


CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the 2 engine oil cooler lines.

▶ Remove the 2 bolts.

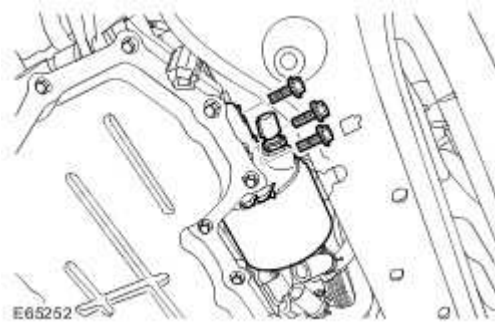
▶ Remove and discard the 2 O-ring seals.



8 . Remove the oil filter housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seal.

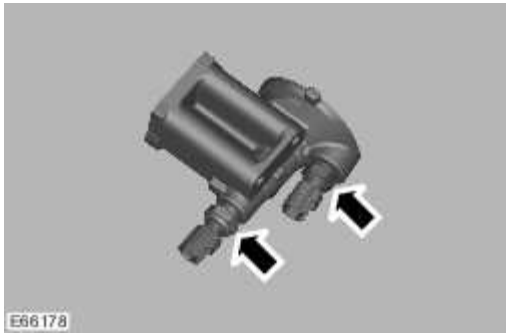


9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the engine oil temperature sensor.

10 . Remove the EOP sensor.



Installation

1 . Install the EOP sensor.

- ▶ Clean the components.
- ▶ Apply sealant of the correct specification to the sensor thread.
- ▶ Tighten the sensor to 15 Nm (11 lb.ft).

2 . Install the engine oil temperature sensor.

- ▶ Clean the components.
- ▶ Apply sealant of the correct specification to the sensor thread.
- ▶ Tighten the sensor to 15 Nm (11 lb.ft).

3 . Install the oil filter housing.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 20 Nm (15 lb.ft).

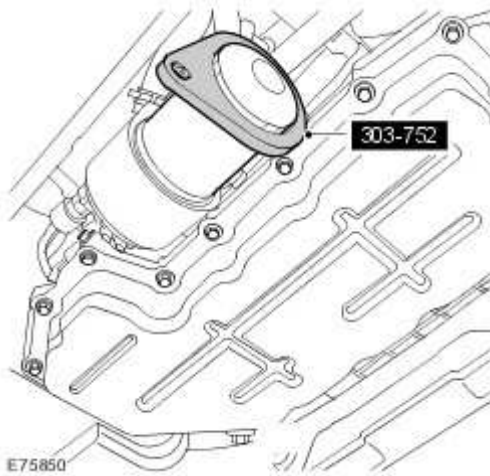
4 . Connect the engine oil cooler lines.

- ▶ Clean the component mating faces.

- ▶ Install new O-ring seals.
- ▶ Tighten the bolts to 7 Nm (5 lb.ft).

5 Using the special tool, install the oil filter.

- ▶ Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm (13 lb.ft).



6 . Connect the EOP sensor electrical connector.

7 . Connect the engine oil temperature sensor electrical connector.

8 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

9 . Connect the battery ground cable and install the cover.

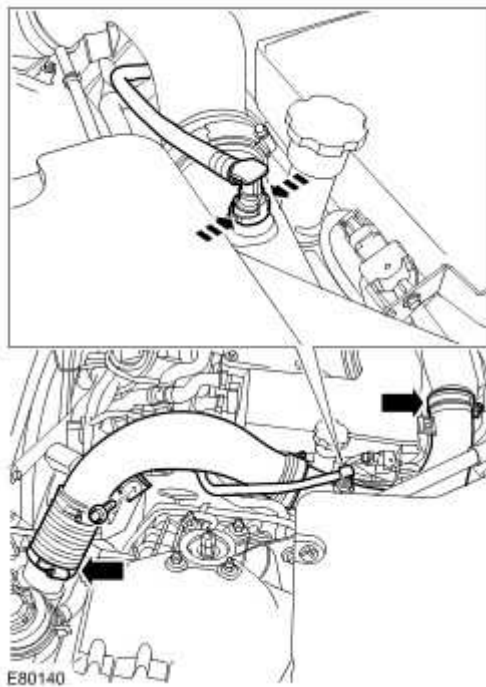
For additional information, refer to Specifications

10 . Check and top-up the engine oil.

Oil Level Indicator and Tube

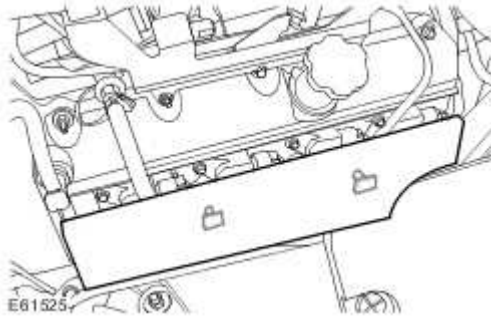
Removal


- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)
- 3 . Remove the LH intake air resonator.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the engine breather line.



- 4 . Remove the LH ignition coil-on-plug cover.

- ▶ Release the 2 clips.



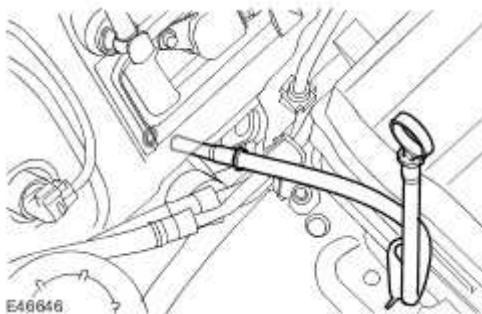
- 5  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 6 . Turn the steering on to full lock for access.

- 7 . Remove the oil level indicator and tube.

- ▶ Remove the nut.
- ▶ Discard the O-ring seal.



Installation

- 1 . With assistance, install the oil level indicator and tube.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Lubricate the O-ring seal with clean engine oil.
- ▶ Tighten the nut to 6 Nm (4 lb.ft).

2 . Install the LH ignition coil-on-plug cover.

3 . Install the intake air resonator.

- ▶ Secure with the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- ▶ Connect the engine breather line.


4 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

5 . Connect the battery ground cable and install the cover.

Oil Cooler (12.60.68)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

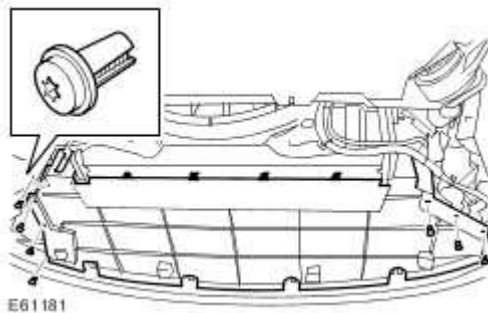
Raise and support the vehicle.

- 2 . Remove the radiator splash shield.
For additional information, refer to Radiator Splash Shield (76.22.90)

- 3 . Remove the front bumper air ducting.

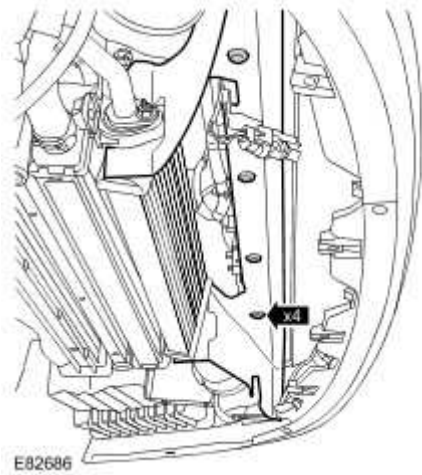
▶ Remove the 7 clips.

▶ Release the 4 clips.



- 4 . Remove the air deflector.

▶ Remove the 4 retainers.



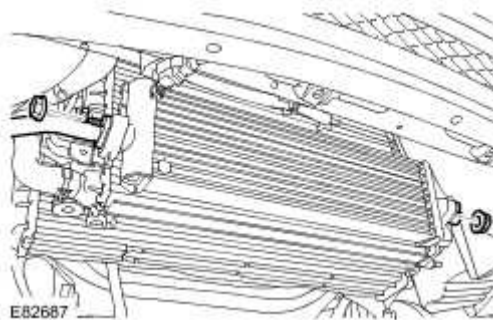
5



CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the 2 oil cooler lines.

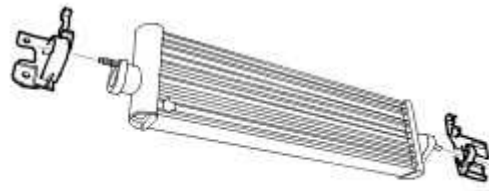
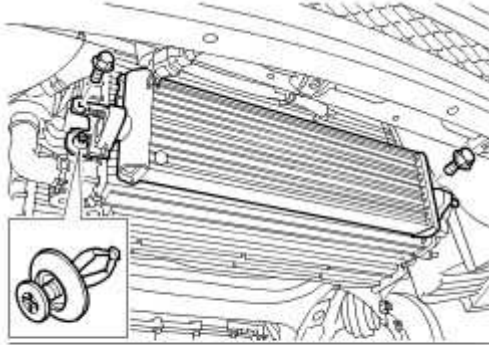
- ▶ Position a container to collect the engine oil.
- ▶ Remove the 2 nuts.
- ▶ Remove and discard the 2 O-ring seals.



6 . Remove the oil cooler.

- ▶ Remove the 2 bolts.

- ▶ Remove the retainer.
- ▶ Remove the 2 support brackets.



E82688

Installation


1 . Install the oil cooler.

- ▶ Install the support brackets.
- ▶ Tighten the bolts to 5 Nm (4 lb.ft).
- ▶ Install the retainer.


2 . Connect the oil cooler lines.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten the nuts to 7 Nm (5 lb.ft).

3 . Install the air deflector.

 Install the retainers.

4 . Install the front bumper air ducting.

 Secure with the clips.


5 . Install the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

6 . Check and top-up the engine oil.


Twin Oil Coolers

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the radiator splash shield.
For additional information, refer to

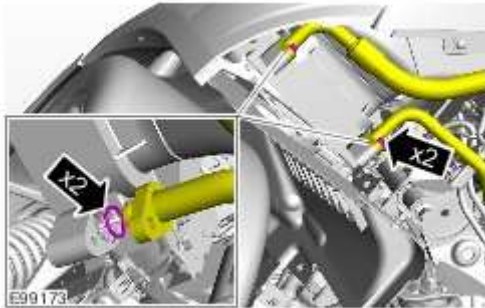
- 3  **CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.**

NOTE:

Right-hand shown, left-hand similar.

Disconnect the 2 oil cooler lines.

- ▶ Position a container to collect the engine oil.
- ▶ Remove the 2 nuts.
- ▶ Remove and discard the 2 O-ring seals.
- ▶ Remove the 2 brackets.

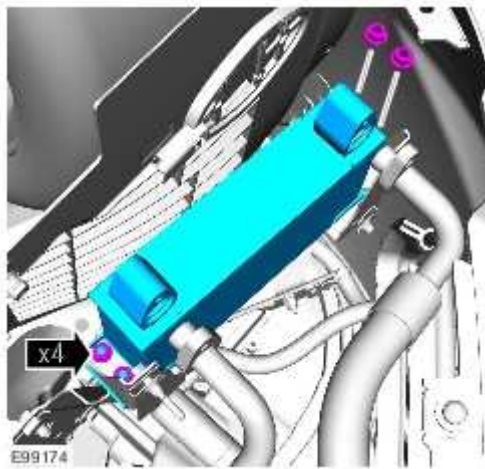


4 . NOTE:

Right-hand shown, left-hand similar.

Remove the oil cooler.

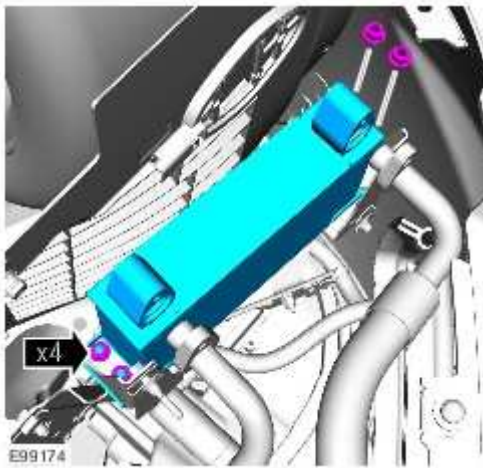
- ▶ Remove the 4 securing nuts.



Installation

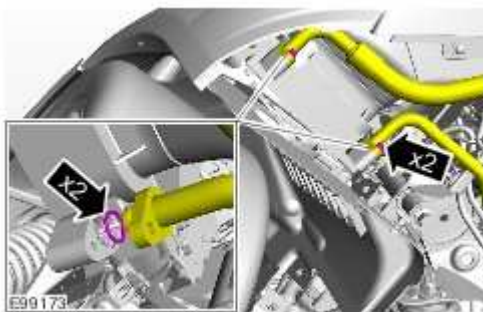
1 . Install the oil cooler.

- ▶ Install the support brackets.
- ▶ Install the retainer.
- ▶ Tighten to 5 Nm.



2 . Connect the oil cooler lines.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten to 7 Nm.



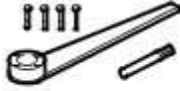
3 . Install the radiator splash shield.
For additional information, refer to

4 . Check and top-up the engine oil.

Disassembly

Engine

Special Service Tools



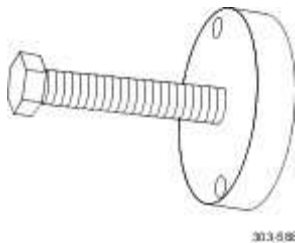
303-191

Crankshaft locking, main tool
303-191



303-191-02

Adapter
303-191-02

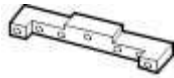


Crankshaft pulley/damper remover
303-588



303-645

Crankshaft setting, main tool
303-645



303-530

Camshaft setting

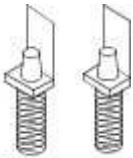
303-530



303D055

Crankshaft damper holding tool

303-D055



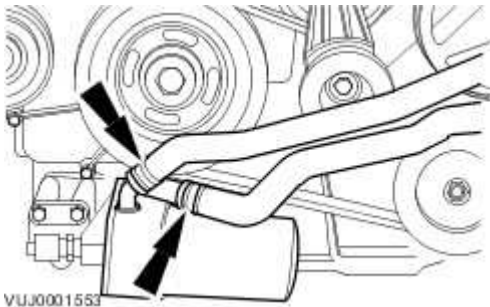
303535

Cylinder Bore Protectors

303-535

Disassembly

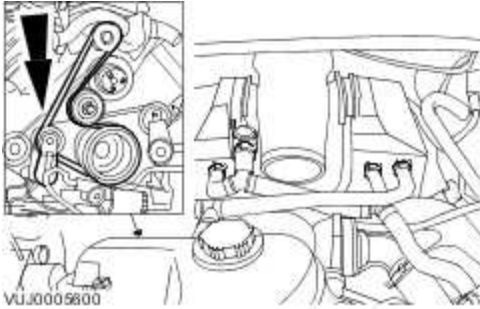
- 1 . Disconnect the oil cooler hoses.



VUJ0001553

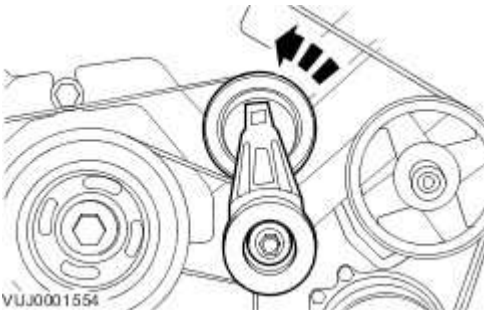
2 . Detach the supercharger belt.

- Use a 1/2 inch square drive bar to rotate the supercharger belt tensioner.
- Detach the supercharger belt.



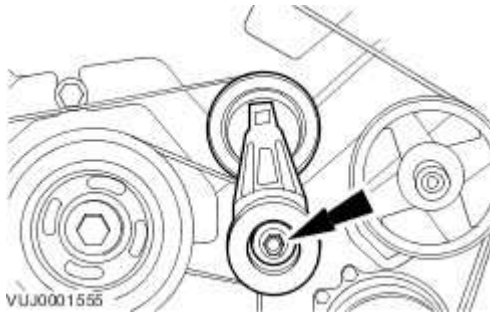
3 . Release the accessory drive belt tension.

- Use a 3/8 inch square drive bar to rotate the drive belt tensioner.
- Detach the accessory drive belt.

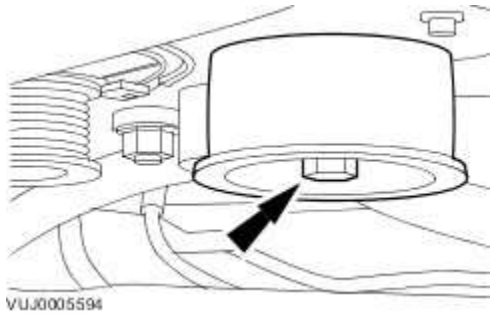


4 . Remove the accessory drive belt tensioner.

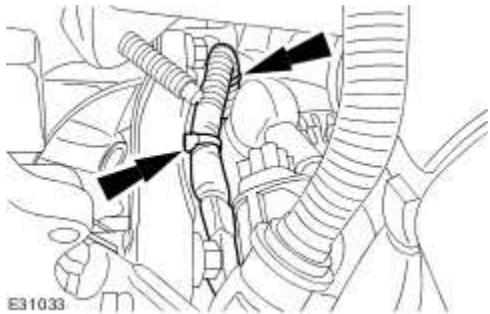
- Remove the accessory drive belt.



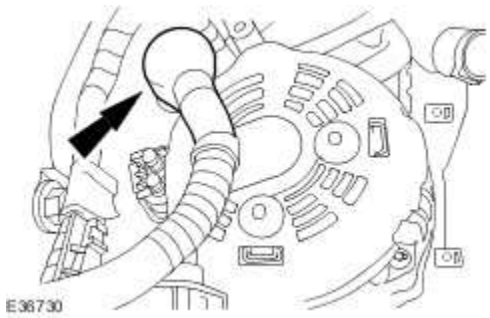
5 . Remove the accessory drive belt idler pulley.



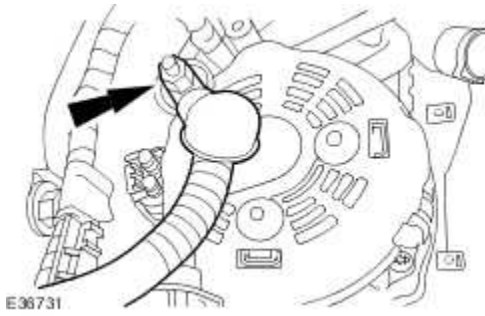
6 . Detach the wiring harness.



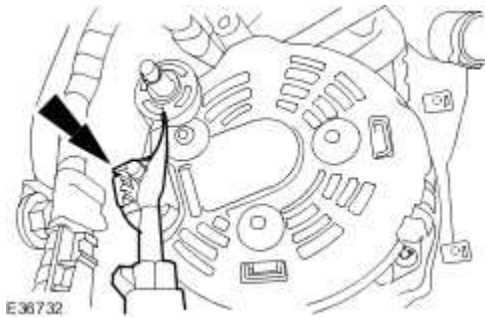
7 . Detach the generator battery positive cable protective cover.



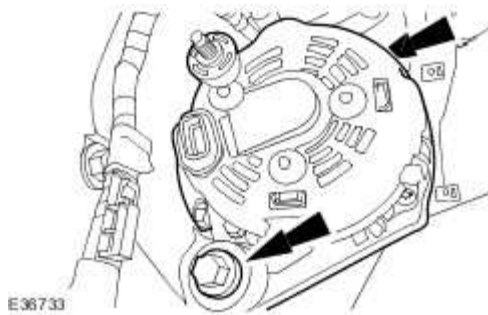
8 . Disconnect the generator battery positive cable.



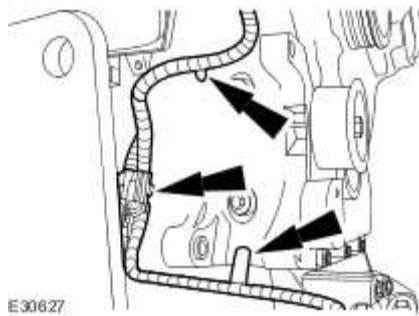
9 . Disconnect the generator electrical connector.



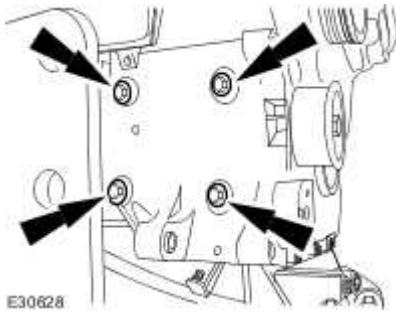
10 . Remove the generator.



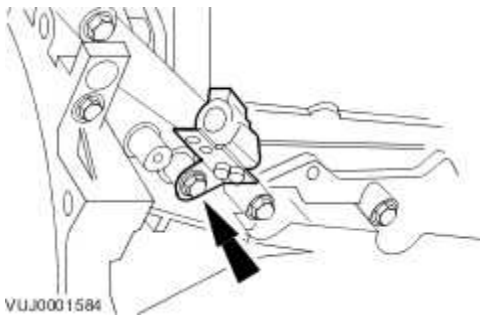
11 . Detach the engine wiring harness.



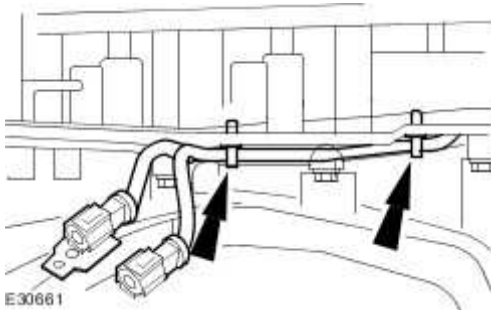
12 . Remove the generator mounting bracket.



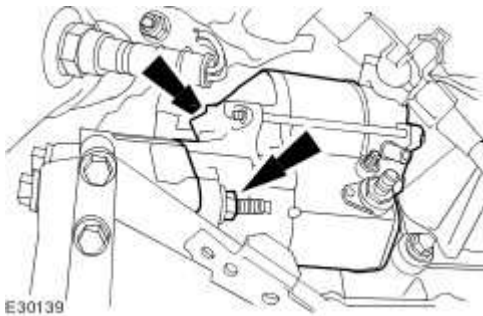
13 . Detach the right-hand oxygen sensor retaining bracket.



14 . Detach the engine wiring harness.



15 . Remove the starter motor.

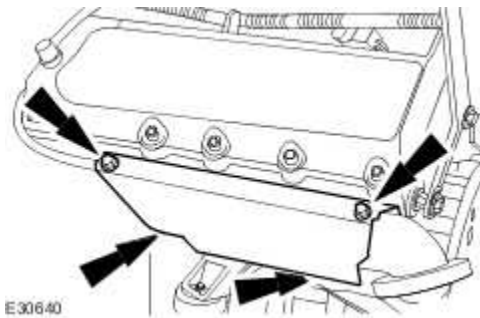


16 . Remove the oil level indicator and tube.

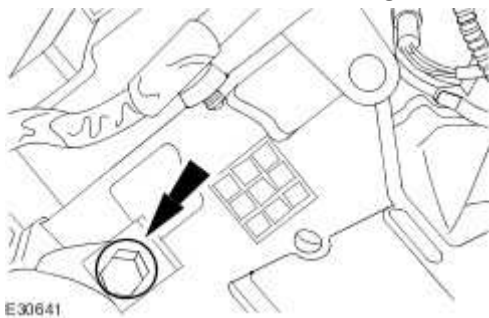
- Remove and discard the O-ring seal.



17 . Remove the heat shield.

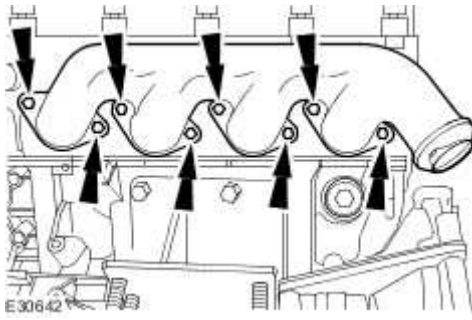


18 . Remove the heat shield retaining bolt.

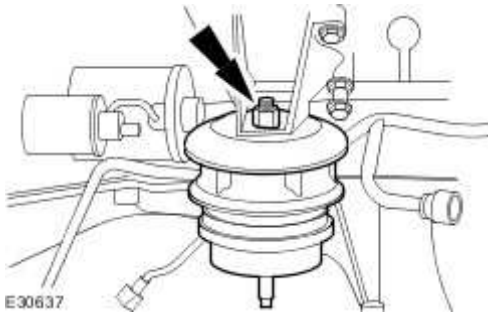


19 . Remove the left-hand exhaust manifold.

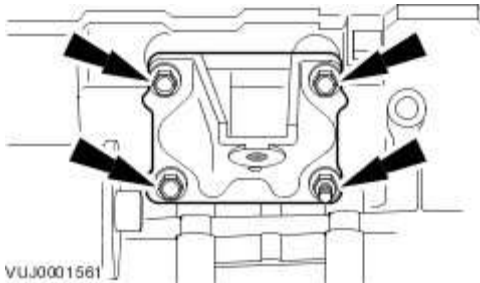
- Remove and discard the gasket.



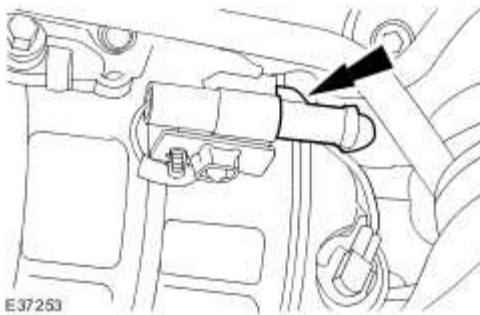
20 . Remove the left-hand engine mount.



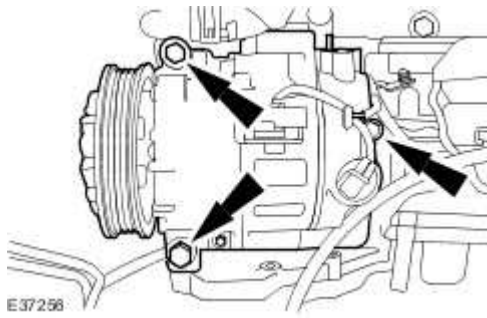
21 . Remove the left-hand engine mounting bracket.



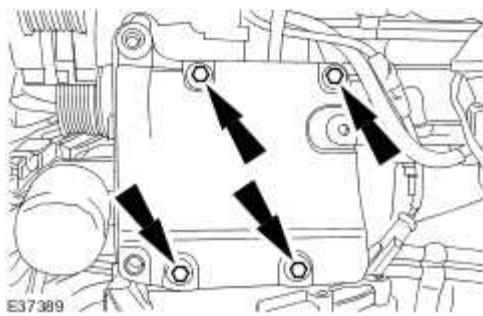
22 . Disconnect the A/C compressor electrical connector.



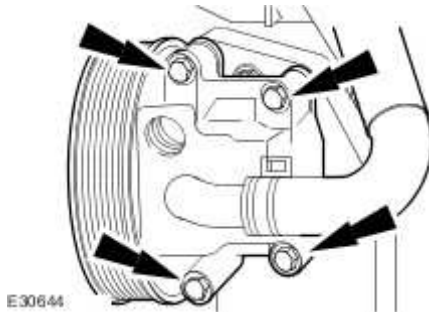
23 . Remove the A/C compressor.



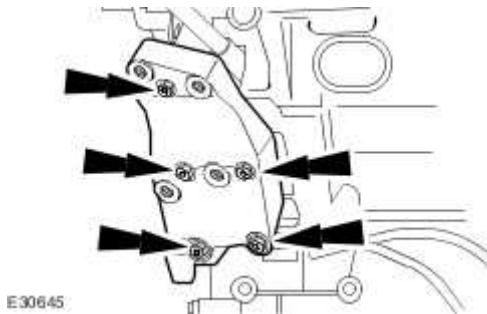
24 . Remove the air conditioning compressor mounting bracket.



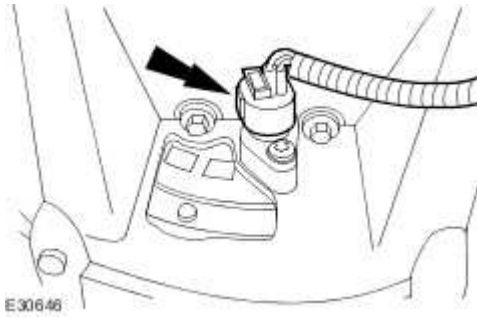
25 . Remove the power steering pump.



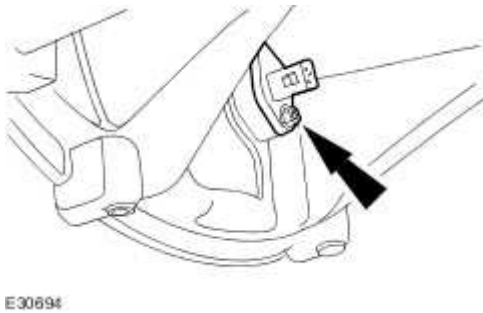
26 . Remove the power steering pump mounting bracket.



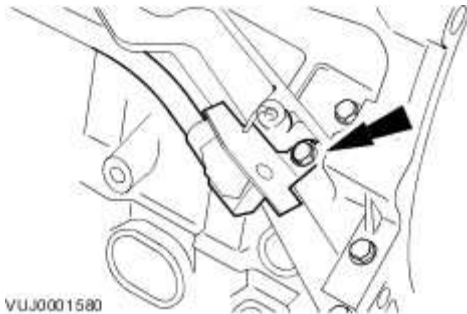
27 . Disconnect the crankshaft position sensor electrical connector.



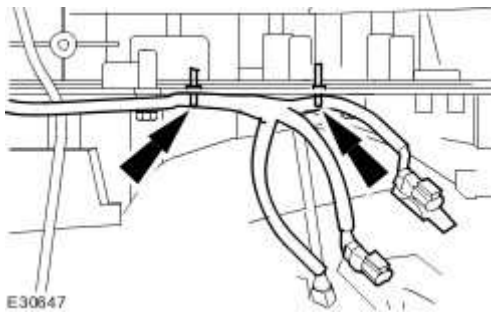
28 . Remove the crankshaft position sensor.



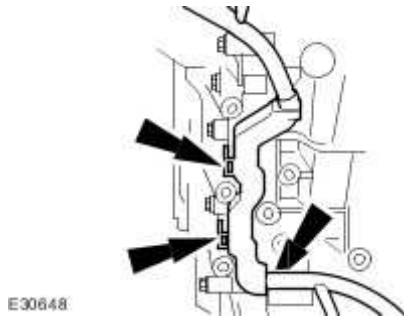
29 . Detach the engine wiring harness.



30 . Detach the engine wiring harness.

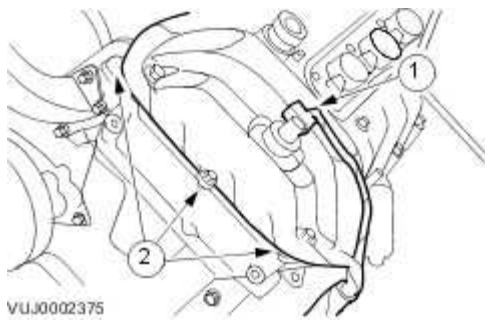


31 . Detach the engine wiring harness.

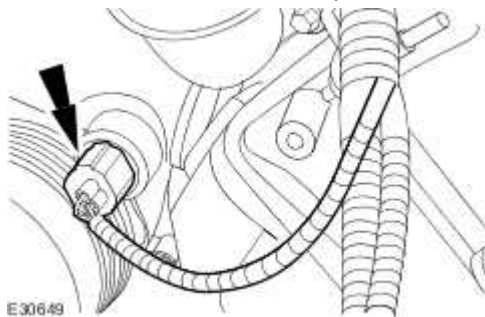


32 . Detach the engine wiring harness.

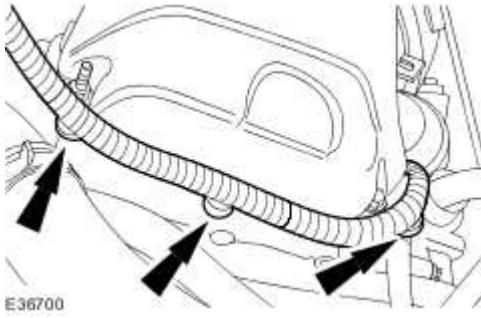
1. Disconnect the variable valve timing (VVT) solenoid electrical connector.
2. Detach the engine wiring harness.



33 . Disconnect the coolant temperature sensor electrical connector.

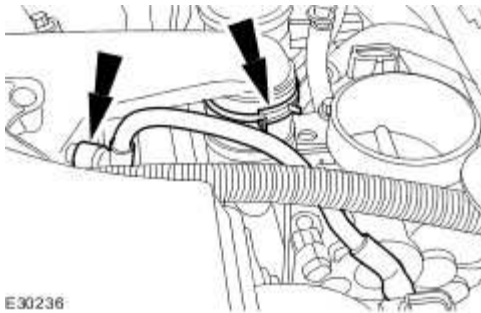


34 . Detach the engine wiring harness.



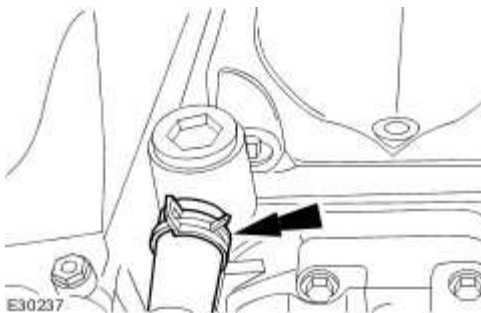
35 . Detach the hoses.

- Reposition the hose retaining clip.



36 . Detach the supercharger outlet pipe coolant hose.

- Cap the coolant ports.

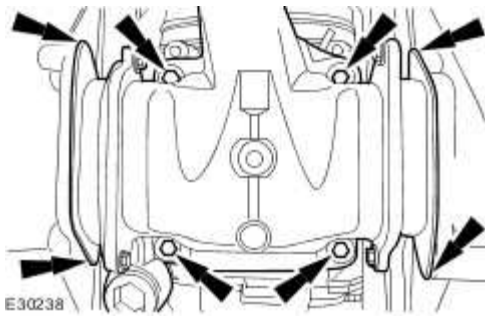


37 .



CAUTION: Make sure no foreign matter enters the supercharger.

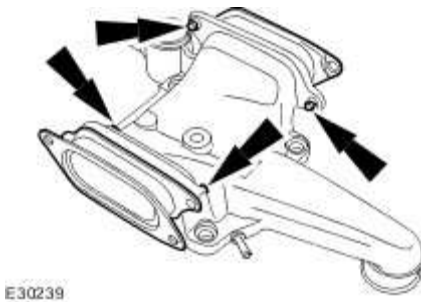
Remove the supercharger outlet pipe



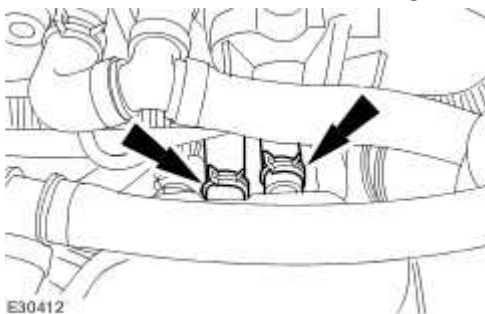
38 . Remove and discard the supercharger outlet pipe gasket.

39 . Remove and discard the supercharger outlet pipe retaining bolt seals.

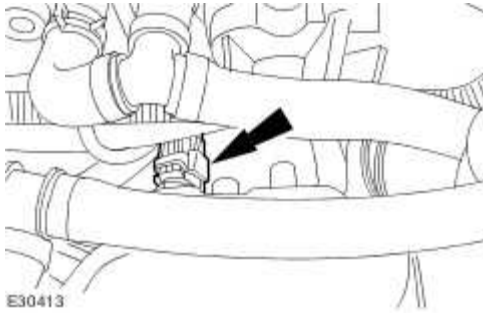
40 . Remove and discard the supercharger outlet pipe to charge air coolers ducts.



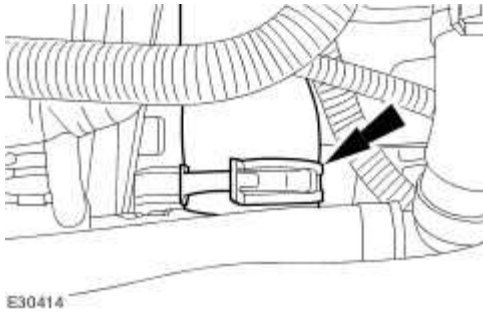
41 . Disconnect the thermostat housing hoses



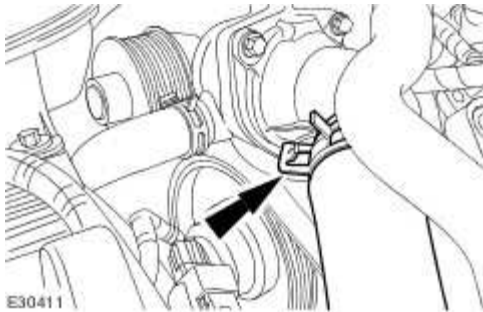
42 . Disconnect the coolant temperature sensor electrical connector.



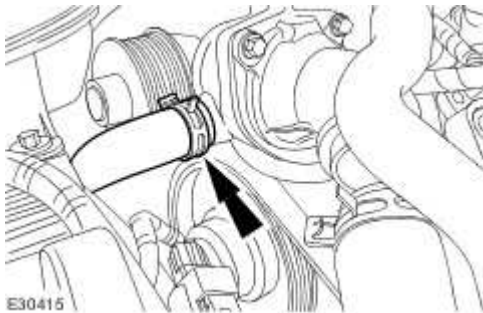
43 . Reposition the thermostat housing hose retaining clip.



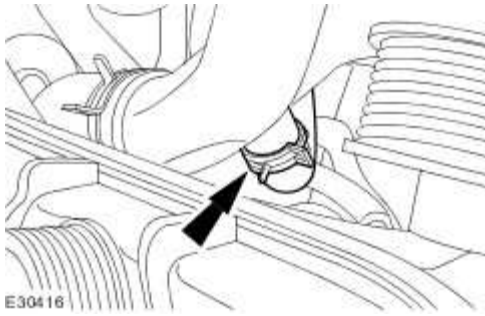
44 . Disconnect the hose.



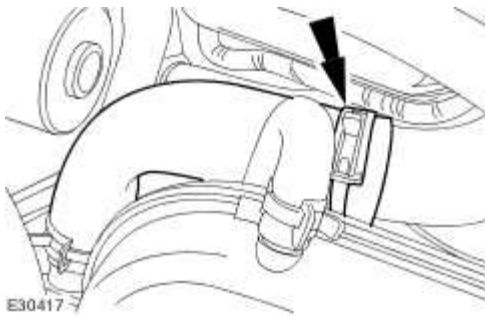
45 . Disconnect the hose.



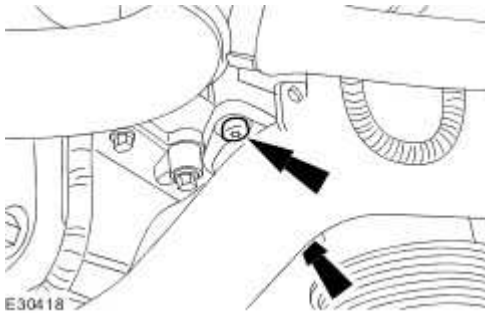
46 . Disconnect the hose.



47 . Disconnect the hose.

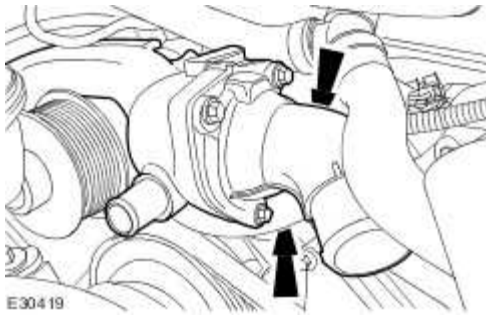


48 . Remove the thermostat housing retaining bolts.

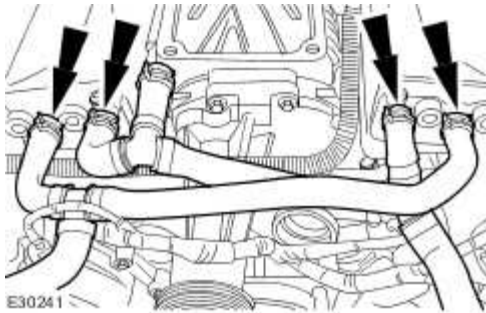


49 . Remove the thermostat housing.

- Remove and discard the thermostat housing O-ring seals.



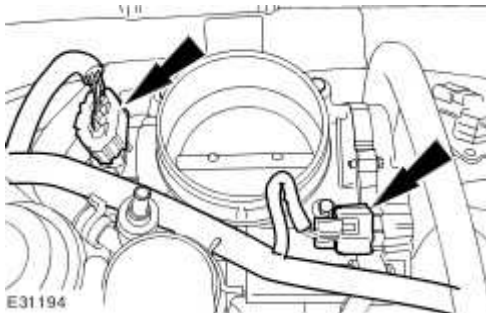
50 . Disconnect the charge air cooler coolant pipes.



51 . Disconnect the intake air temperature (IAT) sensor electrical connector.



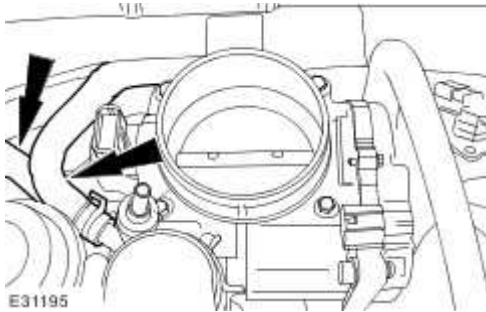
52 . Disconnect the electrical connectors.



53 . **NOTE:**

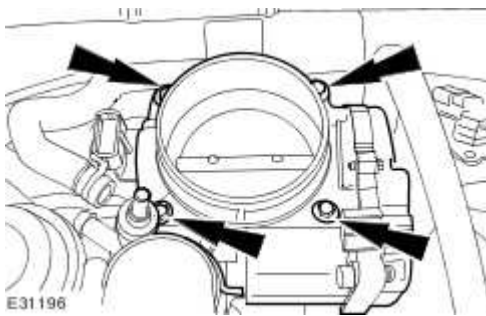
Cap the exposed ports.

Detach the coolant hose from the throttle body.

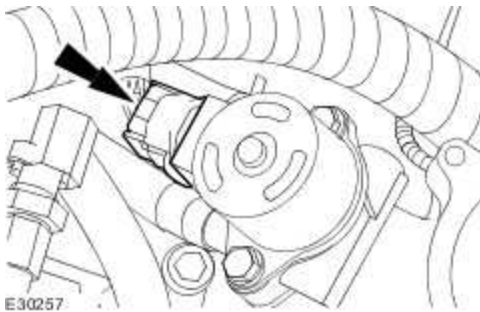


54 . Remove the throttle body.

- Remove and discard the gasket.



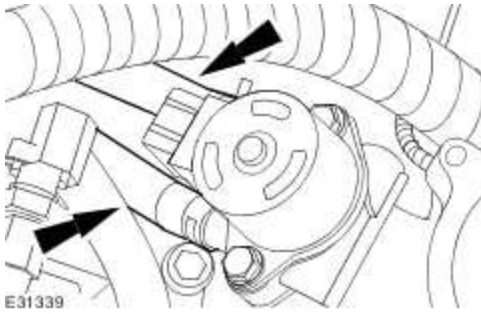
55 . Disconnect the exhaust gas recirculation (EGR) valve electrical connector.



56 . **NOTE:**

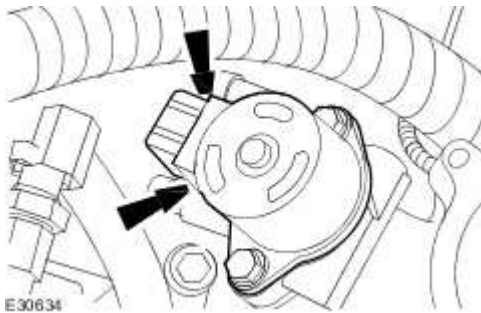
Cap the exposed ports.

Disconnect the coolant hoses.

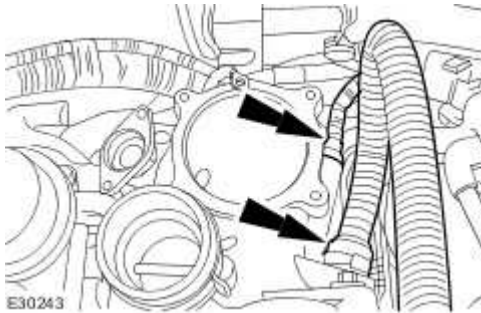


57 . Remove the EGR valve and the exhaust manifold to EGR valve tube.

- Remove the retaining bolts.
- Remove and discard the exhaust manifold to EGR valve tube gasket.
- Remove and discard the EGR valve to air intake elbow gasket.



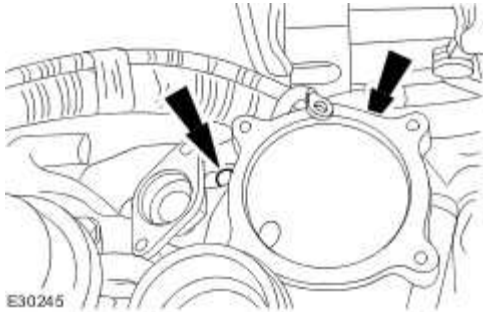
58 . Disconnect the air intake elbow pipes.



59 . **NOTE:**

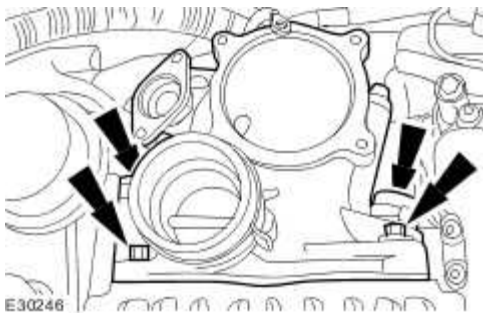
Make sure correct location of the ground strap is noted.

Remove the air intake elbow retaining bracket lower retaining bolts.



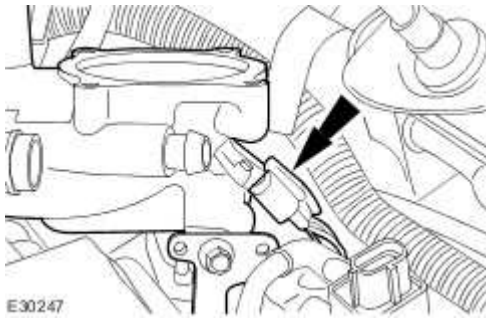
60 . Detach the air intake elbow.

- Remove and discard the gasket.
- Remove and discard the retaining bolt seals.



61 . Remove the air intake elbow.

- Disconnect the manifold absolute pressure (MAP) sensor.



62 . Remove the supercharger.



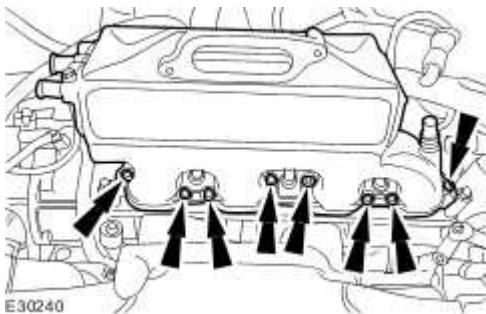
63 .  **CAUTION:** Make sure no foreign matter enters the cylinder head ports.

NOTE:

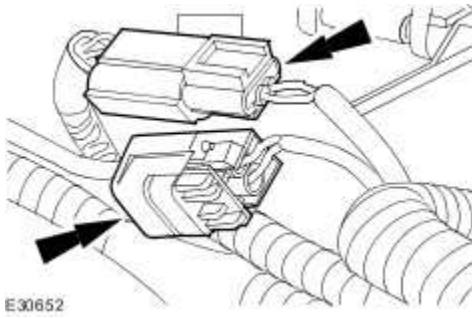
Right-hand shown, left-hand similar.

Remove the charge air coolers.

- Remove and discard the charge air cooler gasket.



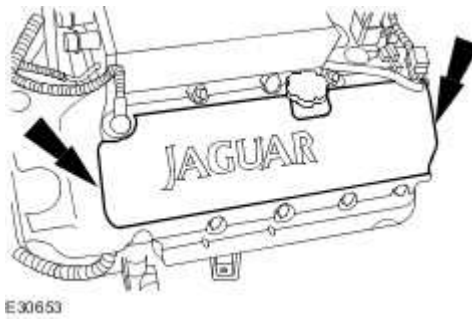
64 . Disconnect the knock sensor electrical connectors.



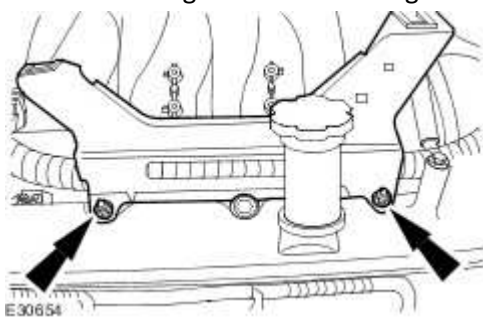
65 . **NOTE:**

Left-hand shown, right-hand similar.

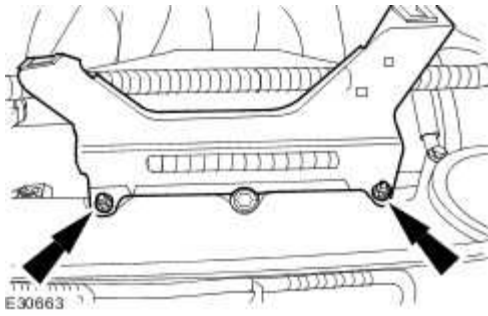
Remove the ignition coil cover.



66 . Remove the engine cover retaining bracket.



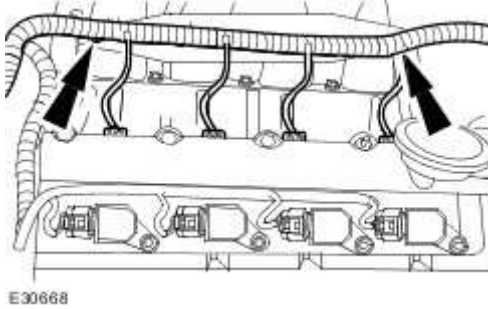
67 . Remove the engine cover retaining bracket.



68 . **NOTE:**

Right-hand shown, left-hand similar.

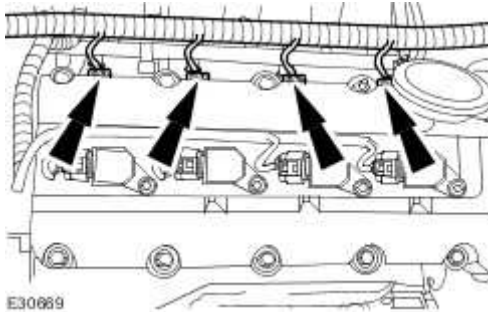
Detach the engine wiring harness.



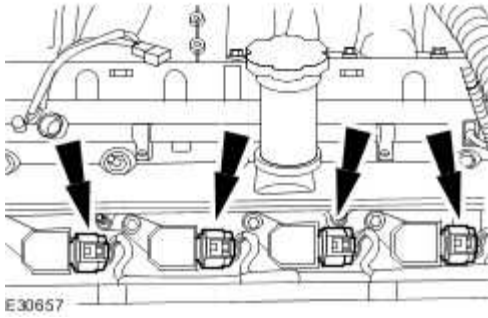
69 . **NOTE:**

Right-hand shown, left-hand similar.

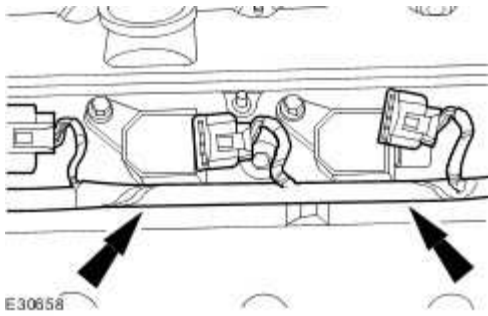
Disconnect the fuel injector electrical connectors.



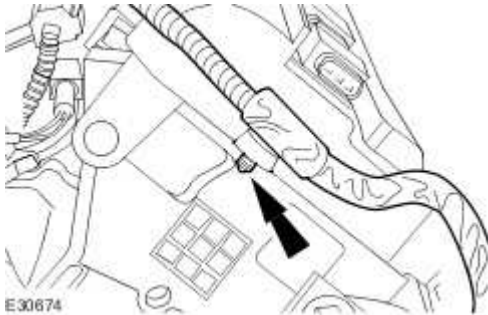
70 . Disconnect the ignition on-plug coil electrical connectors.



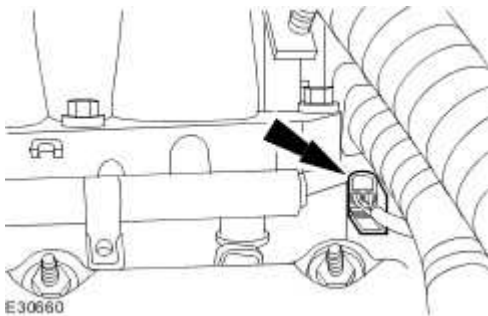
71 . Detach the engine wiring harness.



72 . Detach the engine wiring harness.



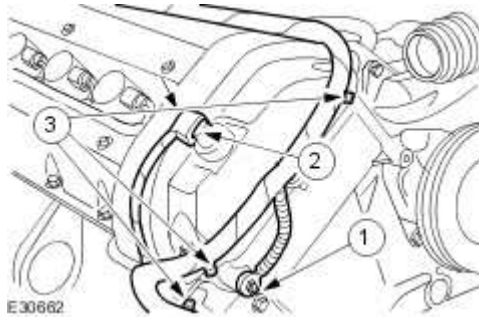
73 . Disconnect the camshaft position sensor electrical connector.



74 . Detach the engine wiring harness.

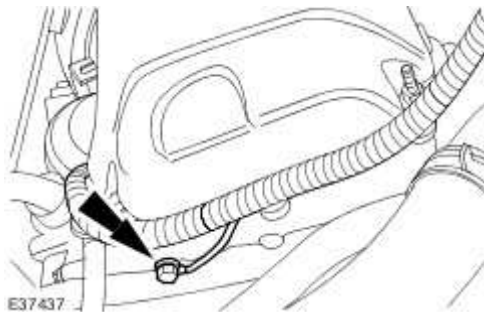
- Detach the ground cable.
- Disconnect the variable valve timing (VVT) solenoid electrical connector.

3. Detach the engine wiring harness.

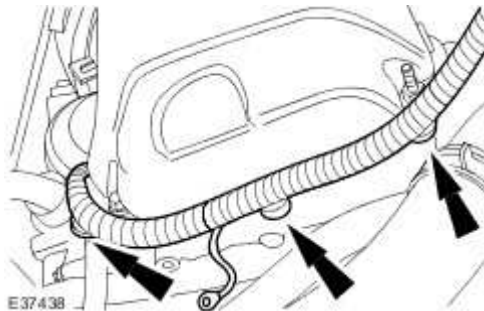


75 . Detach the engine wiring harness.

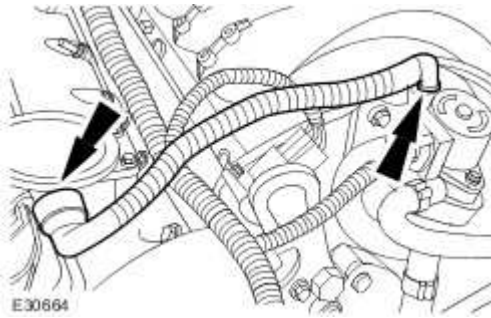
- Remove the retaining bolt.



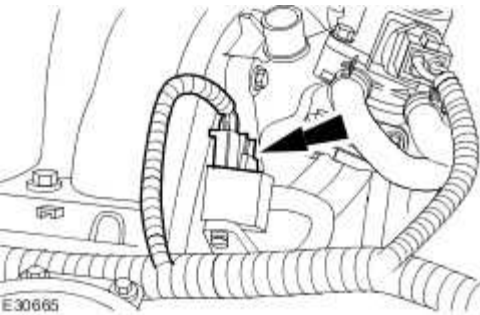
76 . Detach the engine wiring harness.



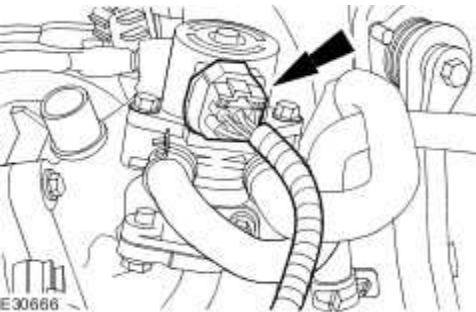
77 . Disconnect the positive crankcase ventilation pipe.



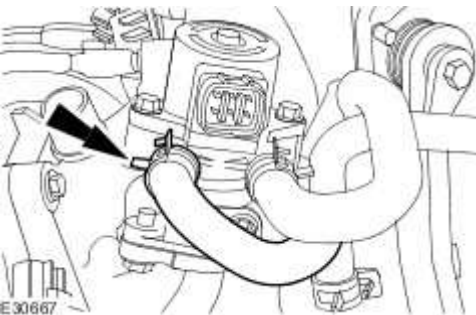
78 . Disconnect the fuel pressure regulator electrical connector.



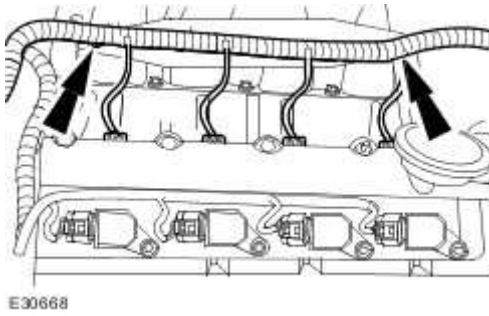
79 . Disconnect the exhaust gas recirculation valve electrical connector.



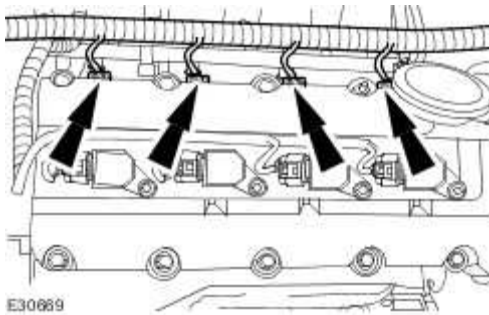
80 . Disconnect the exhaust gas recirculation valve coolant hose.



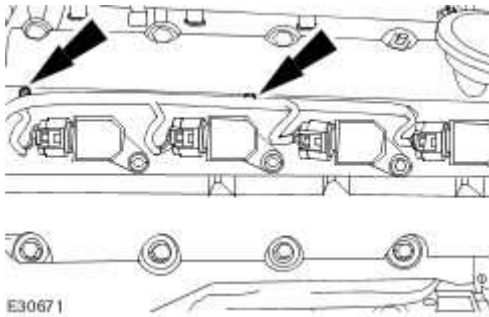
81 . Detach the engine wiring harness.



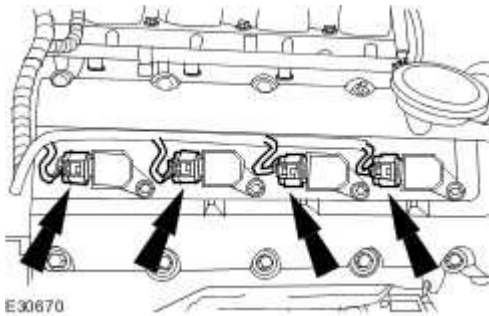
82 . Disconnect the fuel injector electrical connectors.



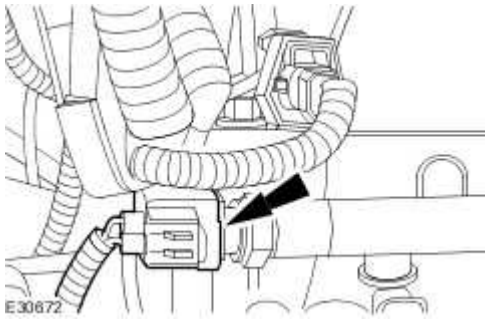
83 . Detach the engine wiring harness.



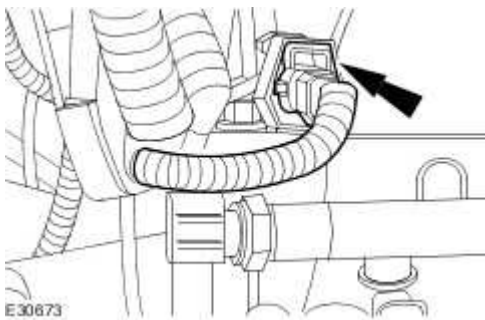
84 . Disconnect the ignition on-plug coil electrical connectors.



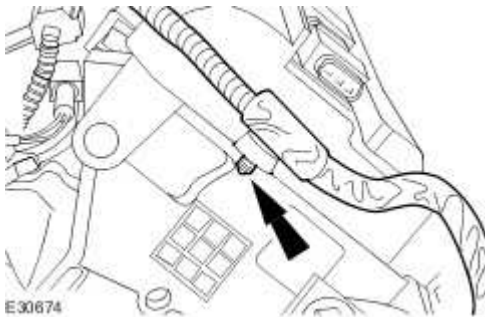
85 . Disconnect the fuel temperature sensor electrical connector.



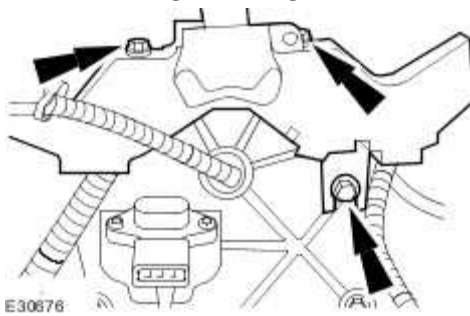
86 . Disconnect the camshaft position sensor electrical connector.



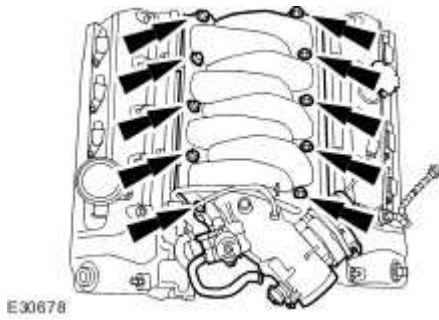
87 . Detach the engine wiring harness



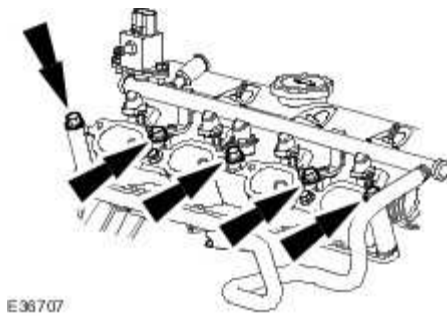
88 . Detach the engine wiring harness.



89 . Remove the intake manifold.



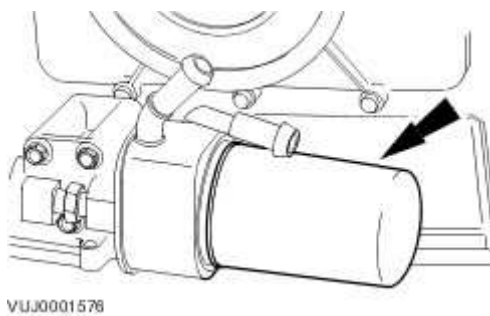
90 . Remove the lower intake manifold.



91 . **NOTE:**

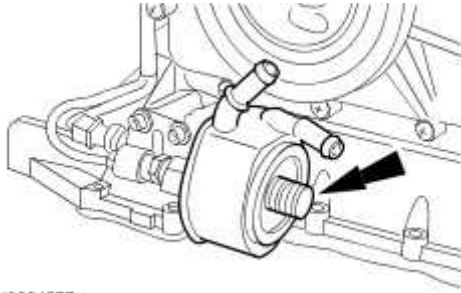
Place a suitable container underneath the filter to prevent oil spillage.

Remove the oil filter element.



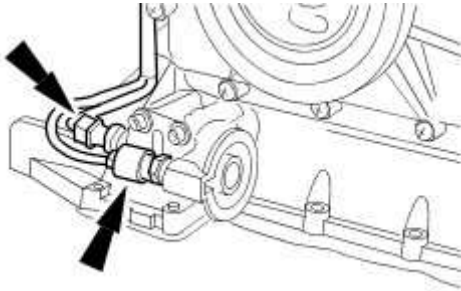
92 . Remove the oil cooler.

- Remove and discard the O-ring seal.



VUJ0001577

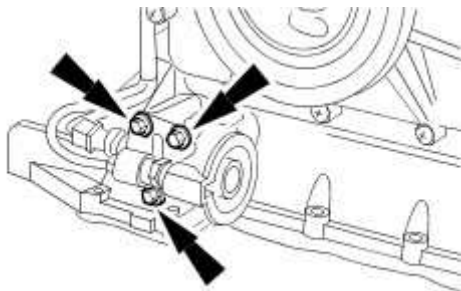
93 . Disconnect the oil pressure switch and oil temperature sensor electrical connectors.



VUJ0001578

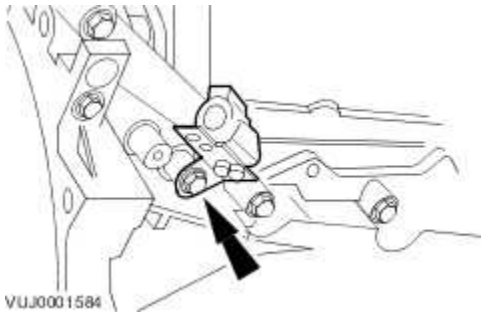
94 . Remove the oil filter housing.

- Remove and discard the O-ring seal.

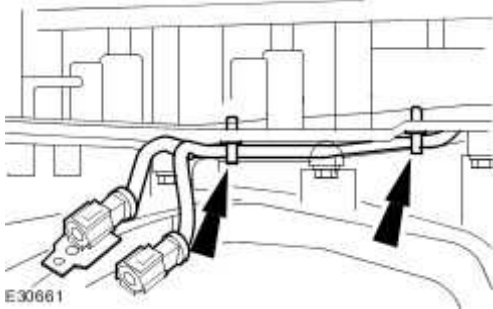


VUJ0001579

95 . Detach the right-hand oxygen sensor.

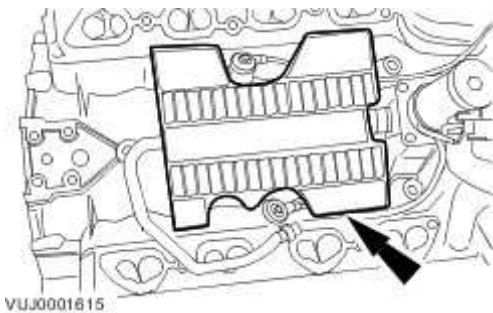


96 . Detach the engine wiring harness retaining clips.



97 . Remove the engine wiring harness

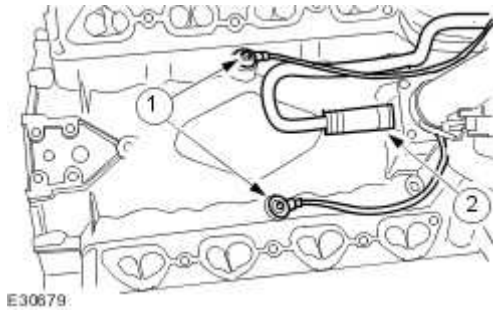
98 . Remove the noise and vibration insulating pad.



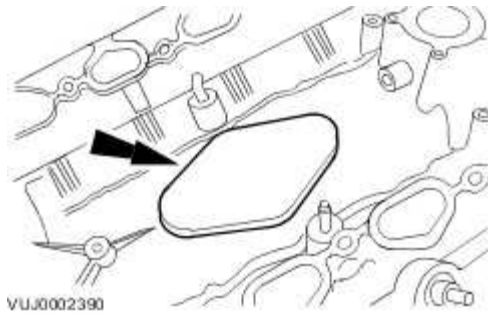
99 . Remove the intake manifold heater coolant hose.

4. Remove the knock sensors.

5. Remove the intake manifold heater coolant hose.

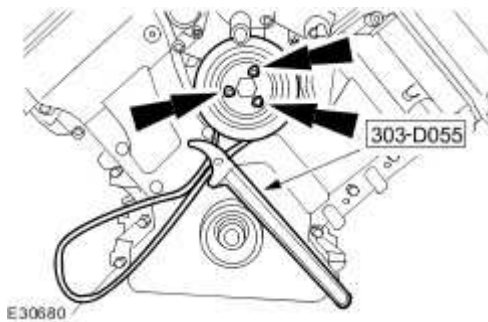


100 . Remove the engine block insulation grommet.



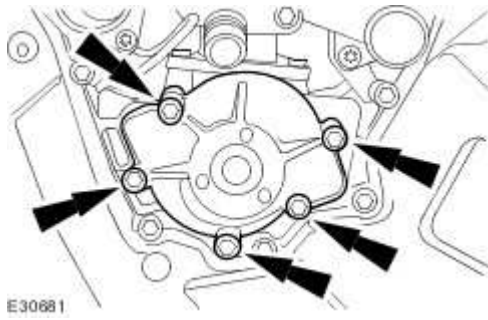
101 . Remove the water pump pulley.

- Using the special tool, retain the water pump pulley.



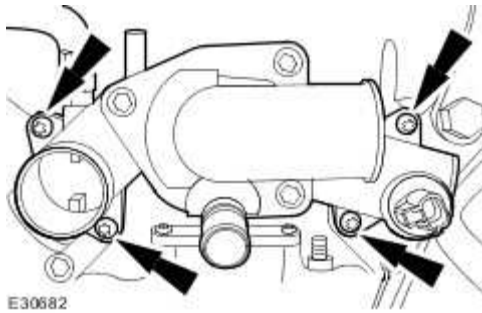
102 . Remove the water pump.

- Remove and discard the gasket.
- Remove and discard the O-ring seal.



103 . Remove the thermostat housing.

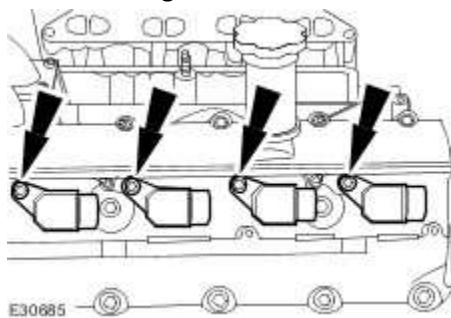
- Remove and discard the O-ring seals.



104 . **NOTE:**

Left-hand shown, right-hand similar

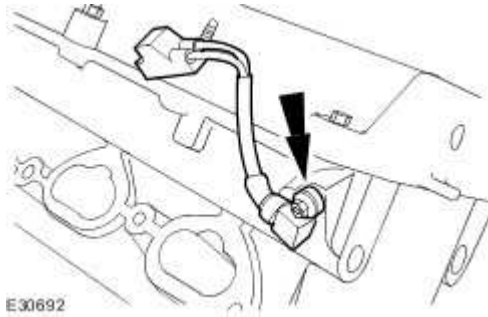
Remove the ignition coils.



105 . Remove the spark plugs.

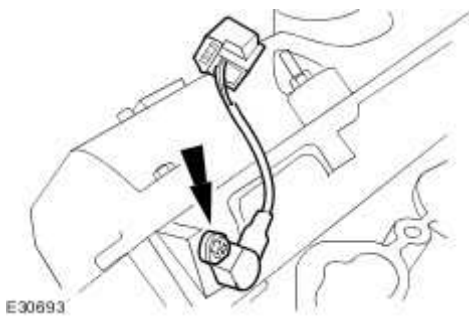
106 . Remove the right-hand camshaft position (CMP) sensor.

- Remove and discard the O-ring seal.



107 . Remove the left-hand camshaft position (CMP) sensor.

- Remove and discard the O-ring seal.



108



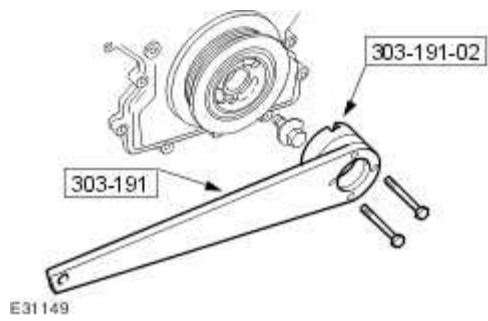
CAUTION: Under no circumstances should the crankshaft setting peg 303-645 be used in the following operations to lock the crankshaft.

NOTE:

The crankshaft retaining bolt will be very tight.

Using special tools, retain the crankshaft pulley.

- Remove and discard the crankshaft pulley bolt.



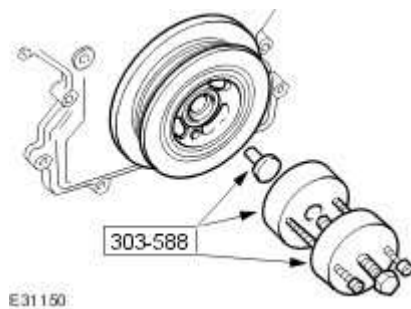
109 . Remove the special tools.

110 . **NOTE:**

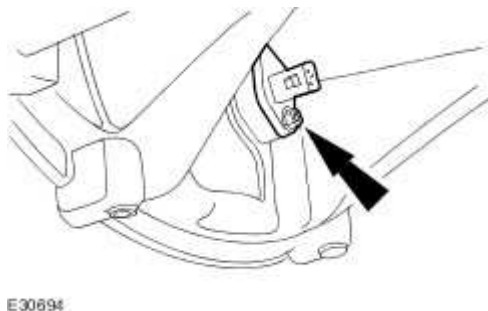
The crankshaft pulley will be very tight.

Using special tools, remove the crankshaft pulley.

- Collect the locking ring.
- Remove and discard the O-ring seal.



111 . Remove the crankshaft position (CKP) sensor.



112



CAUTION: Make sure the spark plugs are removed to enable the engine to rotate freely.

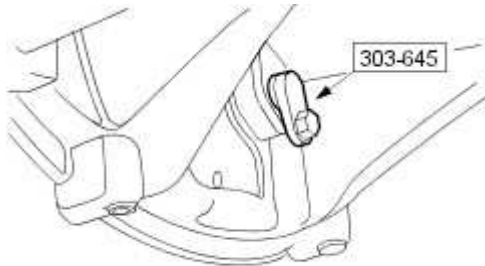


CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.



CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) No. 1 cylinder.

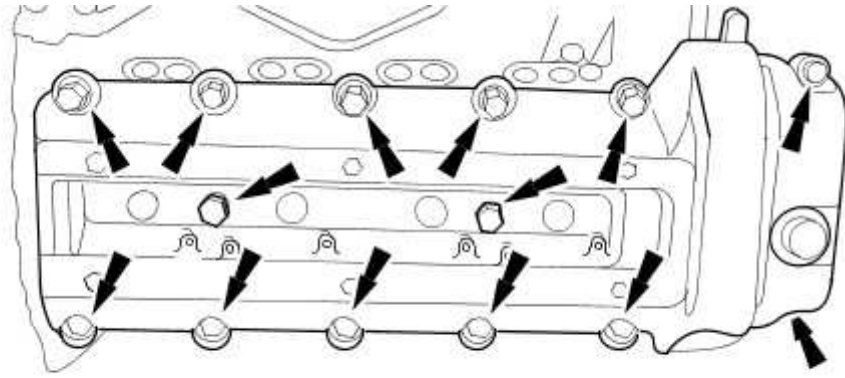
Install the special tool 303-645.



VUJ0002400

113 . Remove the right-hand valve cover.

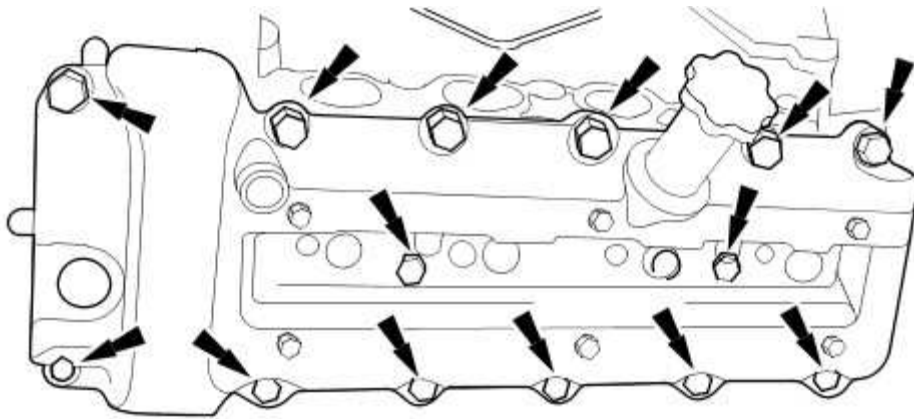
- Discard the valve cover gaskets.



E30698

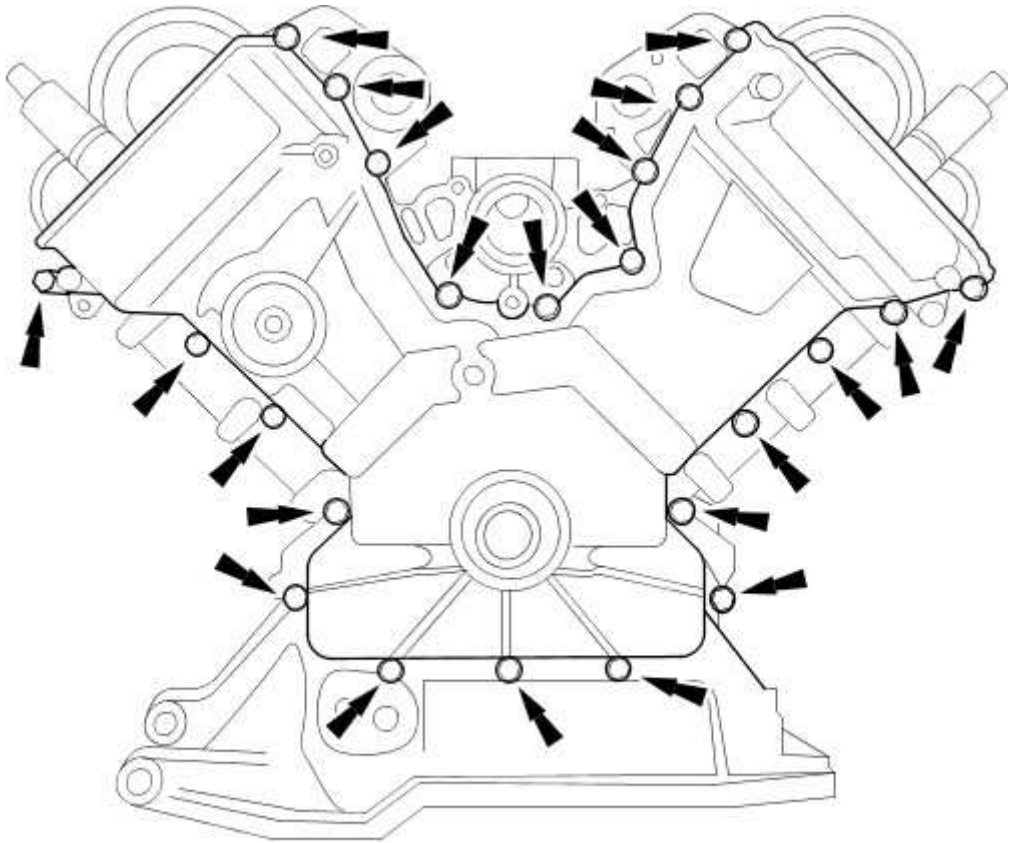
114 . Remove the left-hand valve cover.

- Discard the valve cover gaskets.



E30697

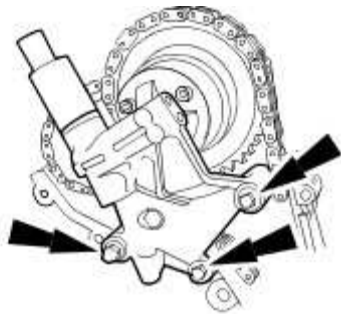
115 . Remove the engine front cover.



VUJ0002398

116 . Remove the right-hand variable camshaft timing oil control unit housing.

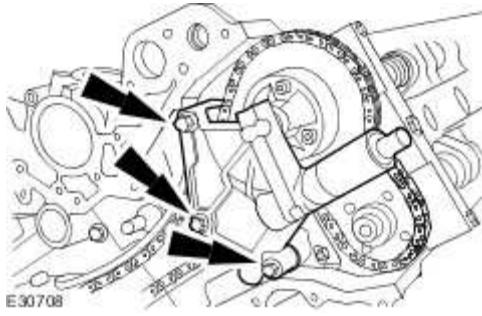
- Remove and discard the O-ring seals.



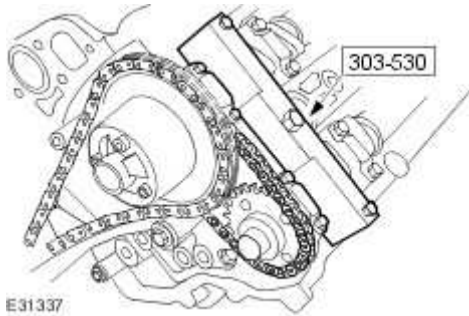
E30699

117 . Remove the left-hand variable camshaft timing oil control unit housing.

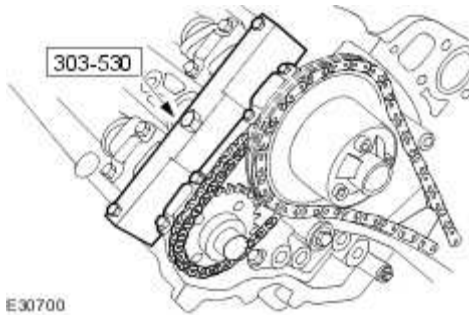
- Remove and discard the O-ring seals.



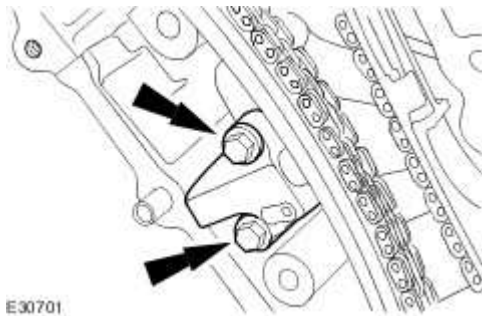
118 . Install the special tool to the left-hand cylinder head.



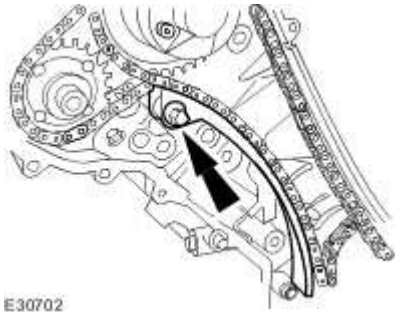
119 . Install the special tool to the right-hand cylinder head.



120 . Remove the primary timing chain tensioner assembly.

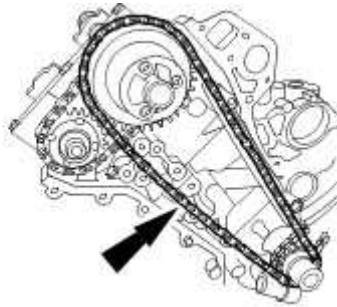


121 . Remove the primary timing chain tensioner guide.



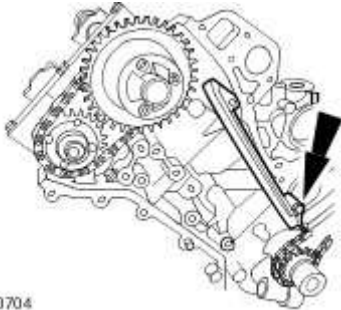
E30702

122 . Remove the primary timing chain.



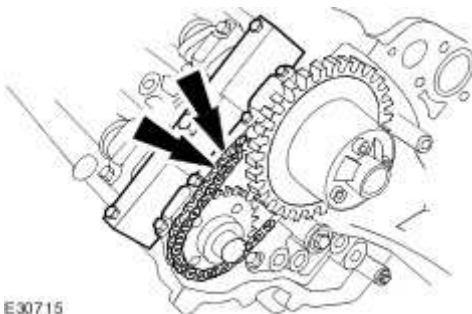
E30703

123 . Remove the primary timing chain guide.



E30704

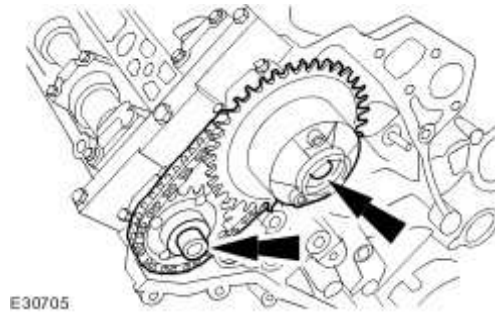
124 . Remove the secondary timing chain tensioner retaining bolts.



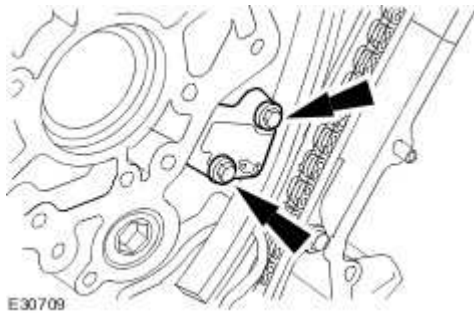
E30715

125 Remove the camshaft sprockets.

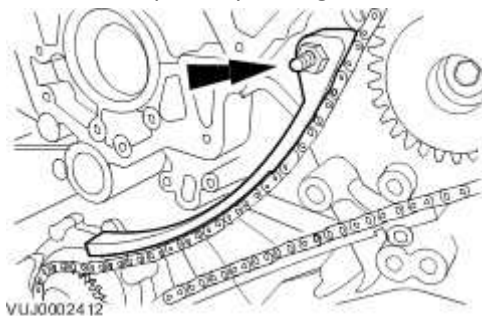
- Remove the secondary timing chain tensioner and secondary timing chain from the camshaft sprockets.



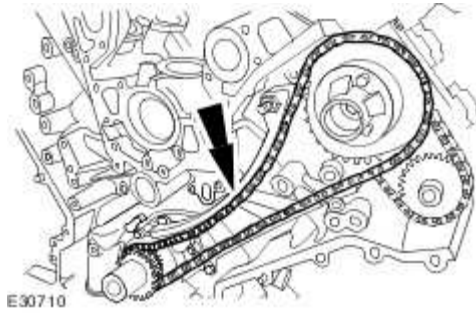
126 . Remove the primary timing chain tensioner assembly.



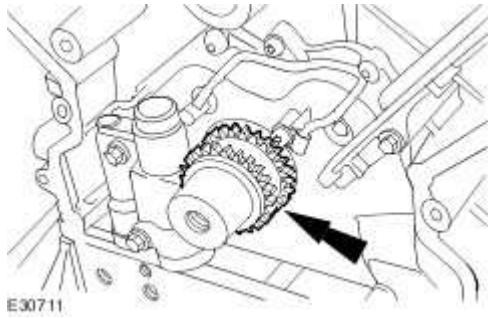
127 . Remove the primary timing chain tensioner guide.



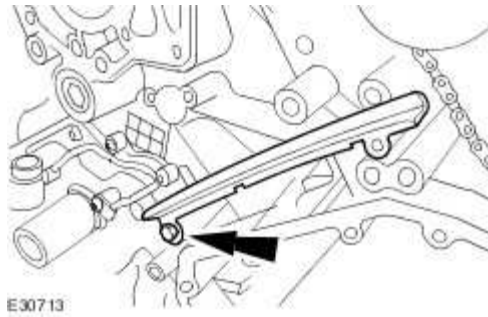
128 . Remove the primary timing chain.



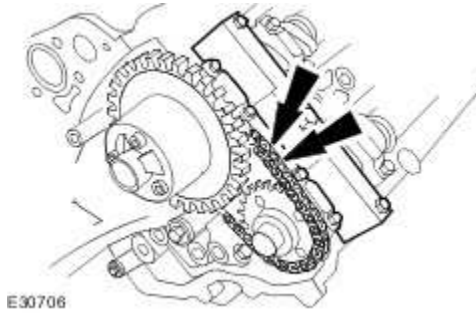
129 . Remove the crankshaft sprocket.



130 . Remove the primary timing chain tensioner guide.

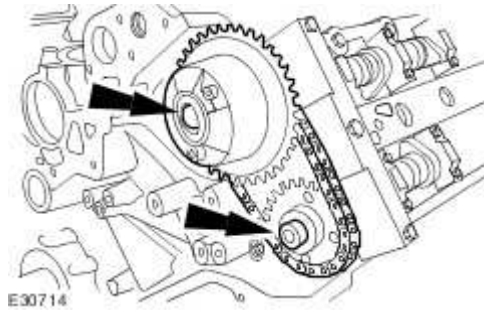


131 . Remove the secondary timing chain tensioner retaining bolts.

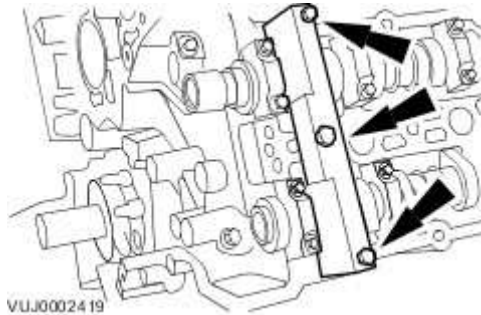


132 Remove the camshaft sprockets.

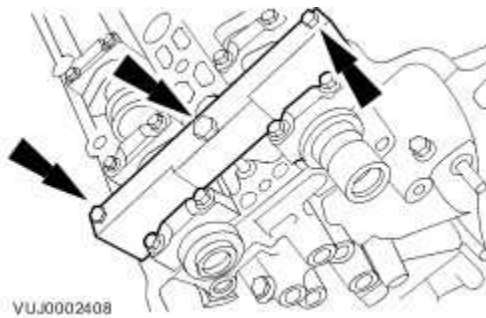
- Remove the secondary timing chain tensioner and secondary timing chain from the camshaft sprockets.



133 . Remove the camshaft setting tool.



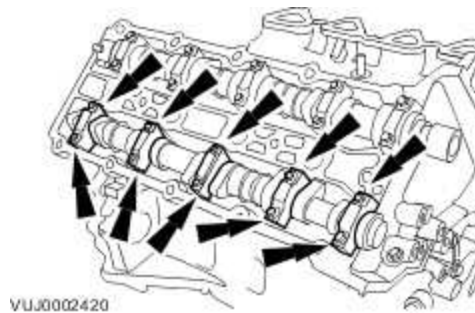
134 . Remove the camshaft setting tool.



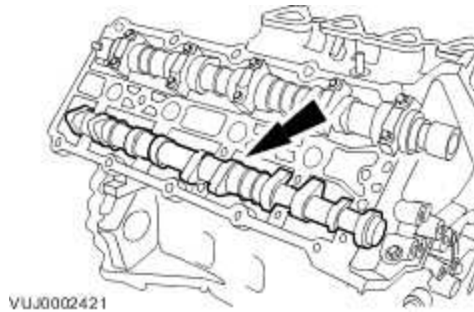
135 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is

marked with its position (a number) and orientation (an arrow).

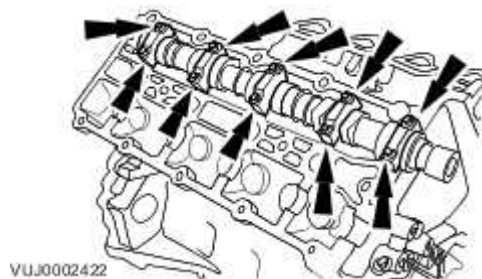


136 . Remove the right-hand exhaust camshaft.

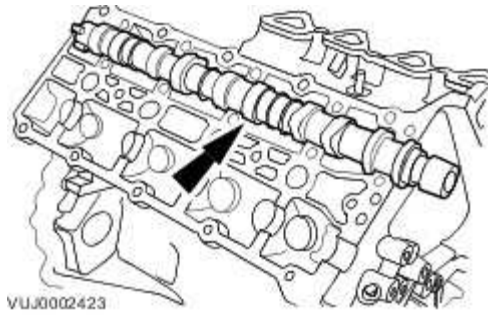


137 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is marked with its position (a number) and orientation (an arrow).

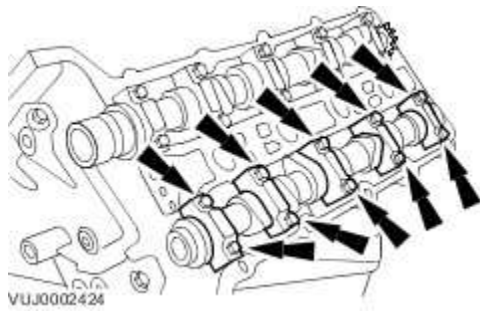


138 . Remove the right-hand intake camshaft.

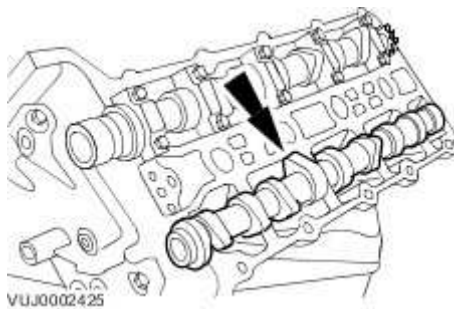


139 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is marked with its position (a number) and orientation (an arrow).



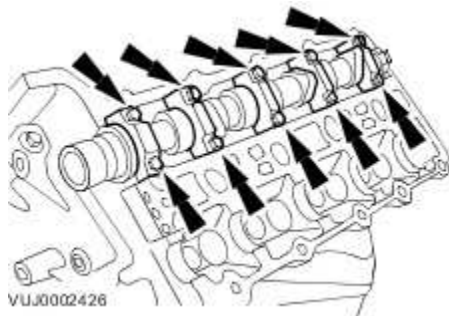
140 . Remove the left-hand exhaust camshaft.



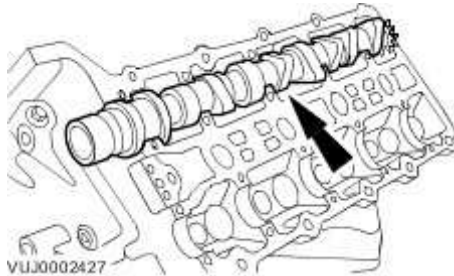
141 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is

marked with its position (a number) and orientation (an arrow).



142 . Remove the left-hand inlet camshaft.



143



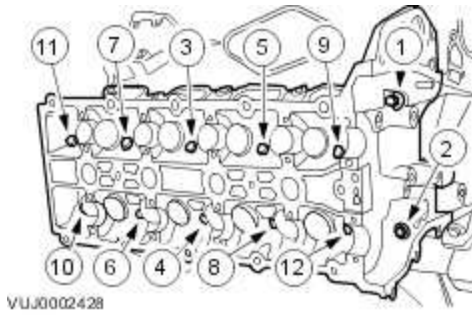
CAUTION: The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.



CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

Remove the right-hand cylinder head.

- Remove the bolts in the indicated sequence.
- Remove and discard the gasket.



144



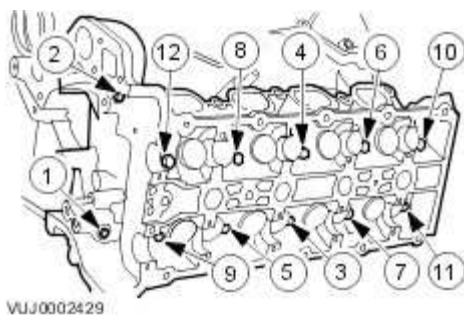
CAUTION: The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.



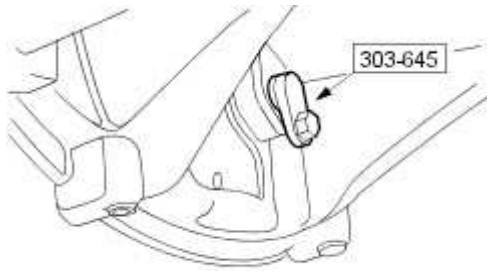
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

Remove the left-hand cylinder head.

- Remove the bolts in the indicated sequence.
- Remove and discard the gasket.



145 . Remove the crankshaft setting peg 303-645 from the crankshaft position sensor location.

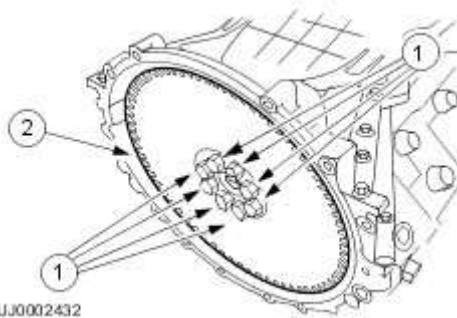


VUJ0002400

146 . Remove the flexplate.

6. Remove the flexplate retaining bolts.

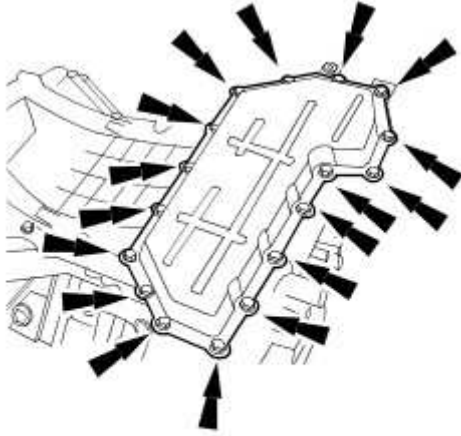
7. Remove the flexplate.



VUJ0002432

147 . Remove the lower oil pan.

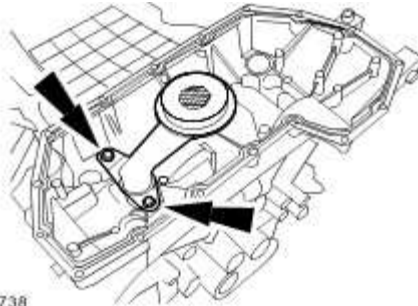
- Remove and discard the gasket.



VUJ0002433

148 . Remove the oil strainer.

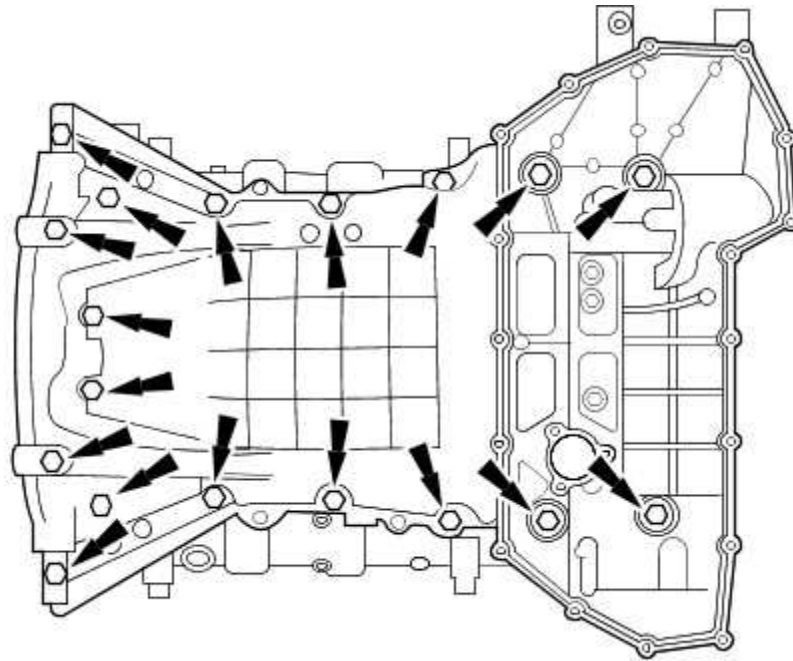
- Remove and discard the O-ring seal.



E30738

149 . Remove the upper oil pan.

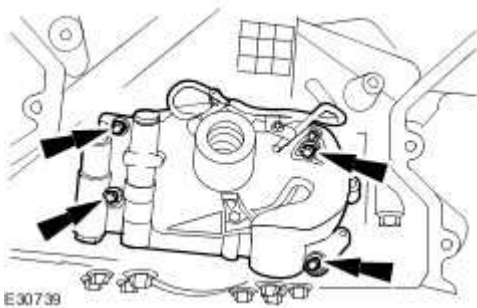
- Remove and discard the gasket.



VUJ0002435

150 . Remove the oil pump.

- Remove and discard the gasket.



E30739

151 Inspect the tops of the cylinder bores. As necessary remove ridge and carbon build up from each cylinder.

152 . Remove the piston cooling jets.

153



CAUTION: Pistons, connecting rods and connecting rod bearings should be

numbered to make sure they are reassembled in the same position.

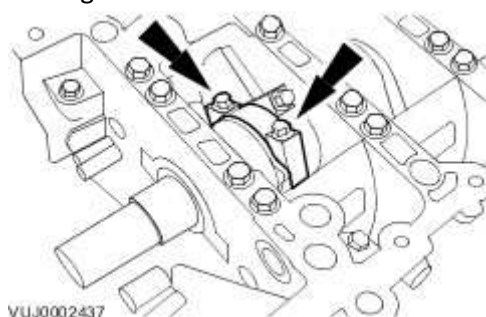
NOTE:

Mark the position of the connecting rod caps to the connecting rods to make sure of correct installation.

NOTE:

Discard the connecting rod bolts after removal.

Remove the connecting rod bolts, the connecting rod caps and the lower connecting rod bearings.

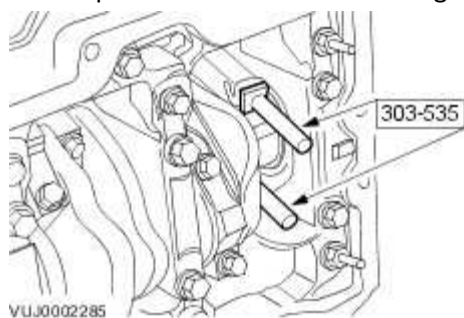


154



CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.



155



CAUTION: Care should be taken not to damage the connecting rod and cap joint

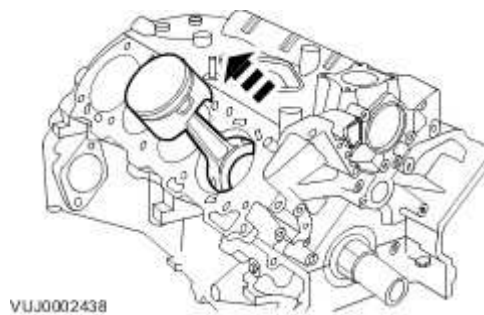
face surfaces or possible engine damage may occur. Avoid contaminating the fractured joint surfaces with dirt or grease.

NOTE:

Attach the connecting rods and caps after removal to avoid mismatch.

Remove the pistons.

- Rotate the crankshaft to locate pistons at the bottom of travel.
- Push the piston, connecting rod and upper bearing through the top of the cylinder.



156 . **NOTE:**

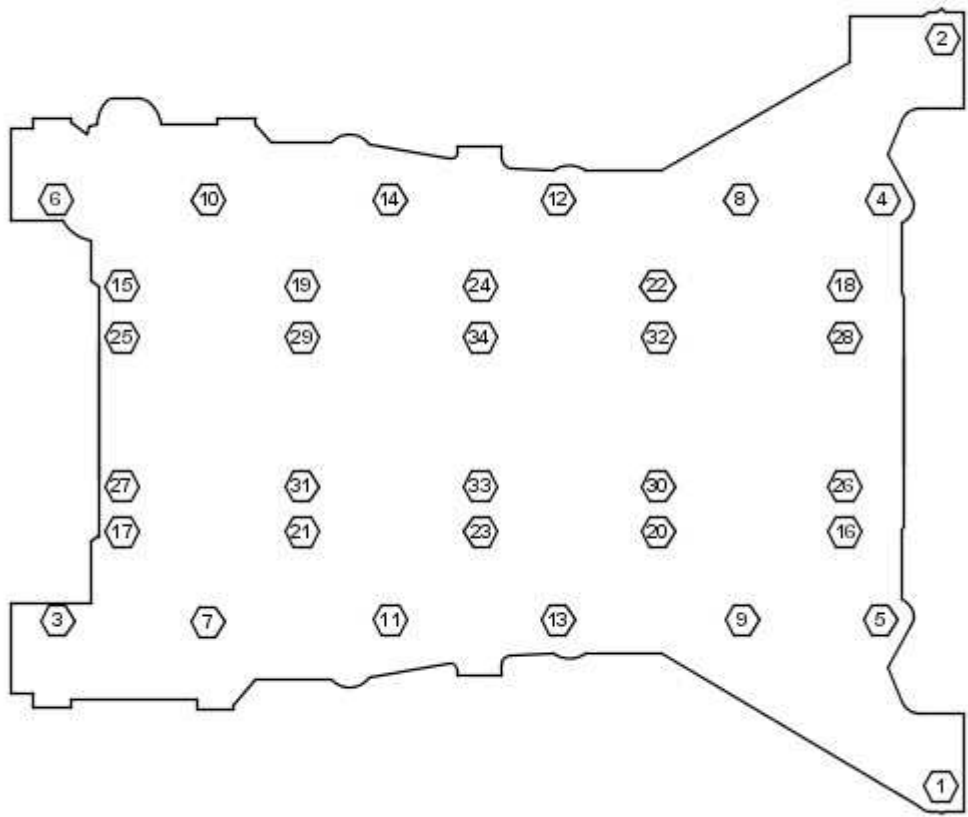
Remove the lower cylinder block bolts in the indicated sequence.

NOTE:

Mark the position of the upper and lower crankshaft main bearings for reassembly.

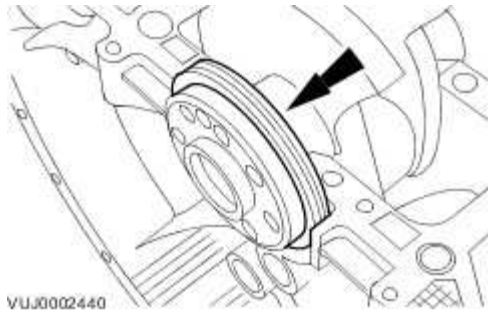
Remove the lower cylinder block.

- Remove the lower cylinder block retaining bolts in the indicated sequence.



VUJ0002439

157 . Discard the crankshaft rear main oil seal.



VUJ0002440

158

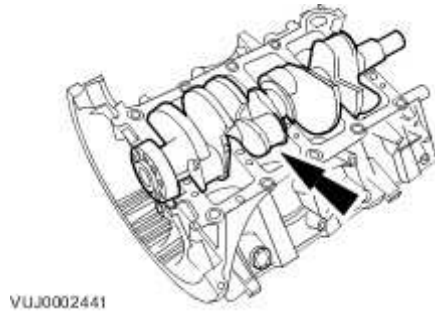


CAUTION: Avoid damage to any crankshaft bearing surfaces.

NOTE:

Never remove any pipe, plugs or dowels unless they are to be newly installed or the cylinder block is to be washed.

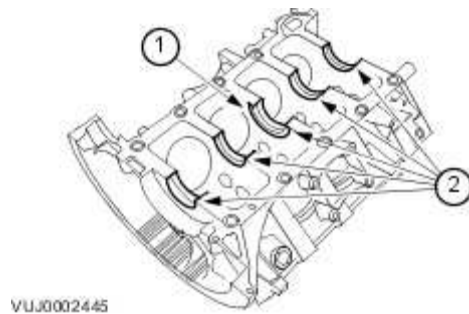
Remove the crankshaft.



159 . Remove the upper crankshaft main bearings.

8. Remove the upper crankshaft thrust washers.

9. Remove the upper crankshaft main bearings.



160 Clean the cylinder block with a soap and water solution. Dry the cylinder block completely with compressed air.

Cylinder Head (12.29.22)


Special Service Tools




303252

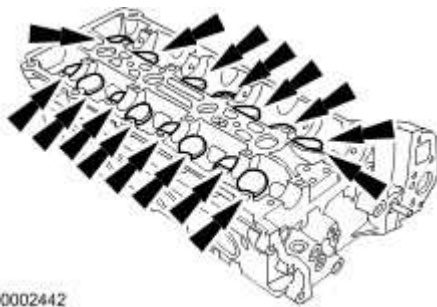
Valve Spring Compressor
303-252

Disassembly

- 1  **CAUTION:** Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

 **CAUTION:** If the cylinder head valve components are to be reused, mark the position of the valve components to make sure they are reassembled in the same position.

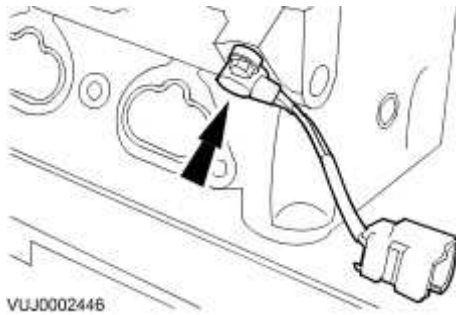
Remove the bucket tappet and shim assemblies.



VUJ0002442

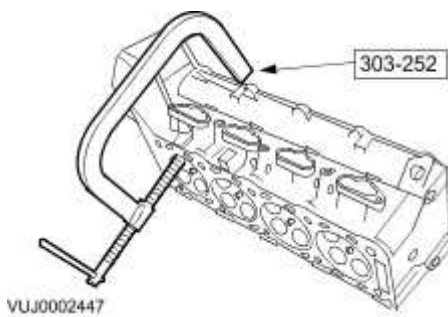
2 . Remove the camshaft position (CMP) sensor.

- Remove and discard the 'O' ring seal.



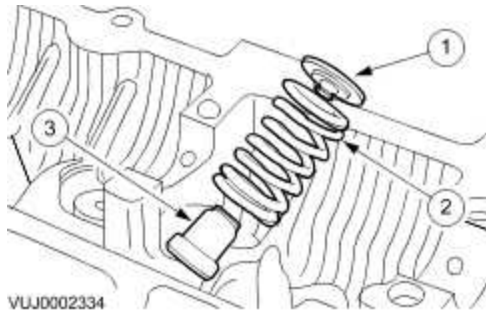
3 . Using the special tool, compress the valve springs.

- Remove the valve collets.



4 . Remove the valve spring retainers and valve springs.

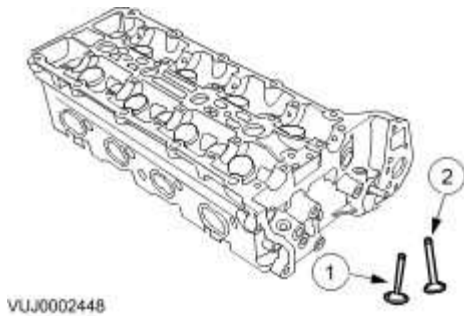
1. Remove the valve spring retainers.
2. Remove the valve springs.
3. Remove the valve stem oil seals.



5 . Remove the valves from the cylinder head.

4. Remove the intake valves.

5. Remove the exhaust valves.



6 Inspect the cylinder heads and related components. For additional information, refer to . <<303-00>>

7 . Remove the pipe plugs and alignment dowels as necessary to clean the cylinder heads.

Assembly

1



· **WARNING:** Eye protection is required during use of compressed air. Failure to follow

these instructions may result in personal injury.



CAUTION: The cylinder head surface finish is measured in microns. For correct head gasket sealing, avoid any contact of finish with metallic objects.

Clean gasket material, dirt and foreign material from cylinder heads. Wash with a suitable soap and water solution and dry the cylinder head completely using compressed air if pipe plugs have been removed.

2 . Install the pipe plugs and alignment dowels to cylinder heads.

- Apply pipe sealant to plugs prior to installation.

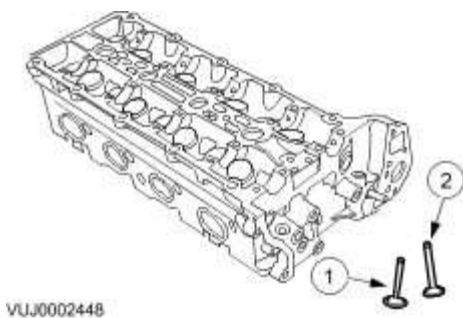
3 . **NOTE:**

Lubricate the valve stems before assembly.

Install the valves into the cylinder heads.

6. Install the intake valves.

7. Install the exhaust valves.

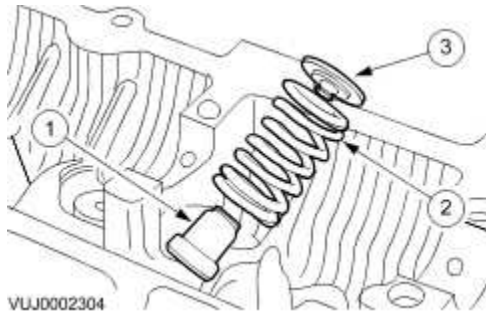


4 . Install the valve spring retainers and valve springs.

8. Install the valve stem oil seals.

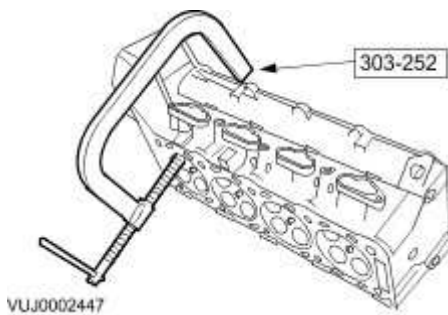
9. Install the valve springs.

10. Install the valve spring retainers.



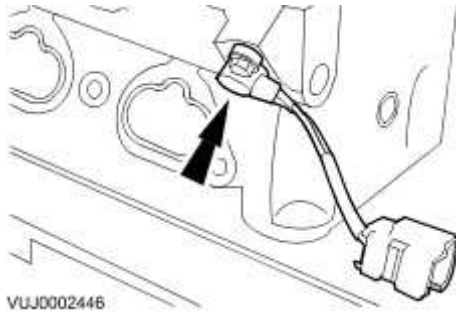
5 . Using the special tool, compress the valve springs.


- Install the valve collets.



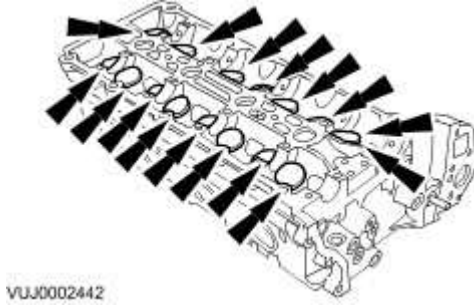
6 . Install the camshaft position (CMP) sensor.

- Install a new 'O' ring seal.
- Tighten to 7 Nm.



- 7
-  **CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.**

Install the bucket tappet and shim assemblies.



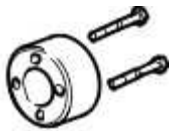
Engine

Special Service Tools



303-191

Crankshaft locking, main tool
303-191



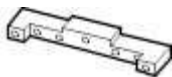
303-191-02

Adapter
303-191-02



303-645

Crankshaft setting, main tool
303-645



303-530

Camshaft setting
303-530



303-532

Timing chain tensioning tool
303-532



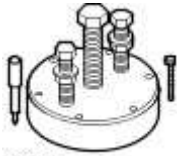
303535

Cylinder Bore Protectors
303-535



303372

Piston Ring Compressor
303-372



303-538

Crankshaft rear oil seal remover/replacer
303-538



303-750

Crankshaft front seal installer
303-538



303D055

Crankshaft damper holding tool
303-D055

Assembly

1



• **CAUTION: Use only a plastic scraper when removing old gasket material.**

Clean all the mating faces and reusable parts thoroughly and check for damage.

- If gasket material remains on the cylinder head after cleaning, use a plastic tipped scraper to remove remaining material.

2 . **NOTE:**

Never remove pipe plugs or alignment dowels unless they are to be serviced.

Reseal oil passage blanking plugs, as necessary.

3 . **NOTE:**

The main bearings are precision selective fit.

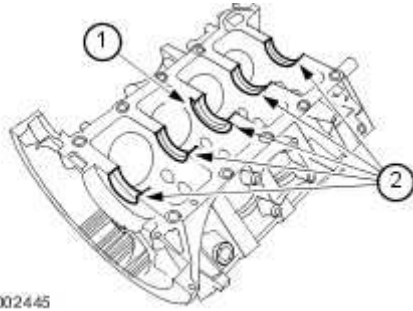
NOTE:

Lubricate the upper crankshaft main bearings and thrust washers.

Install the upper crankshaft main bearings.

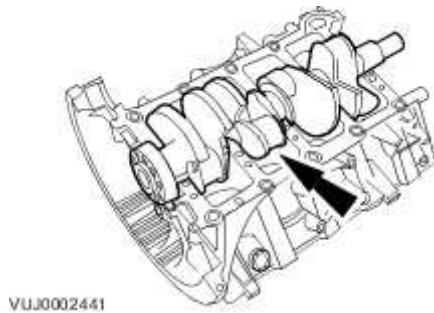
For additional information, refer to Camshaft Bearing Journal Clearance

1. Install the upper crankshaft thrust washers.
2. Install the upper crankshaft main bearings.



4.  **CAUTION: Avoid damage to any crankshaft bearing surfaces.**

Install the crankshaft.



5 **NOTE:**

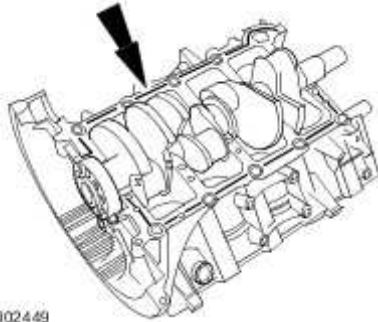
The main bearings are precision selective fit.

NOTE:

Install lower cylinder block and tighten bolts to specification within twenty minutes of applying sealer.

Apply a bead of sealant to the cylinder block housing.

- Use WSS-M4G320-A3-RTV sealant.



6



CAUTION: Make sure all dowels are fully seated into lower cylinder block prior to tightening the bolts.



CAUTION: Do not lubricate the lower cylinder block bolts.



CAUTION: Do not rotate crankshaft until all bolts are tightened to specification.



CAUTION: Bolts must be tightened within twenty minutes of applying sealer.

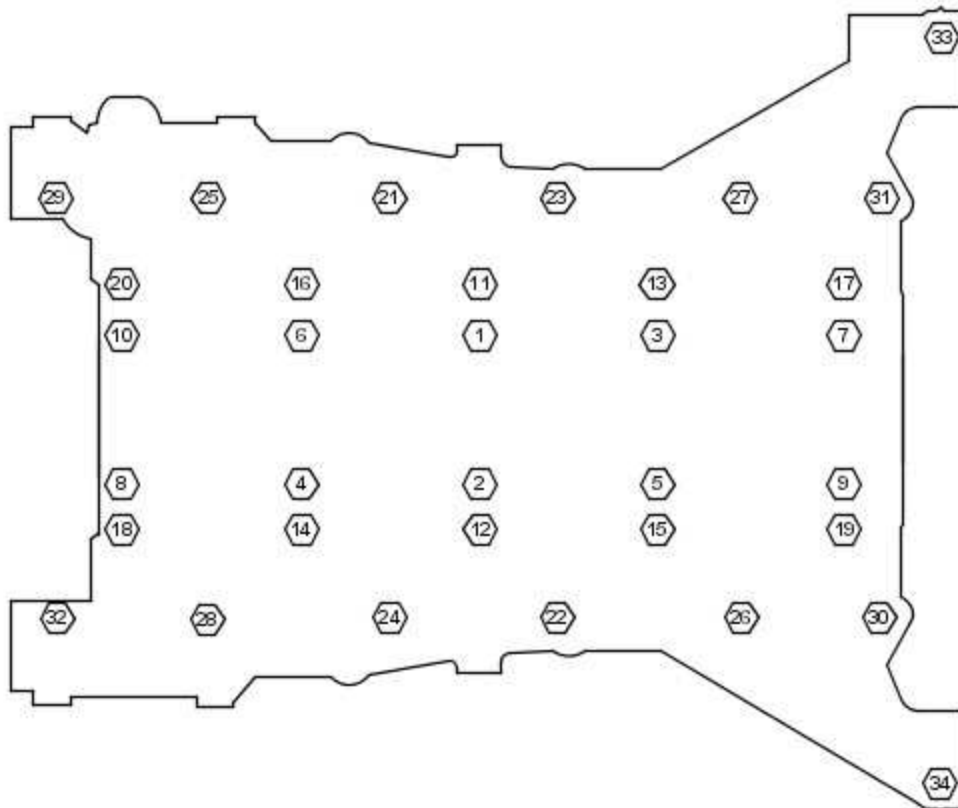


CAUTION: Tighten the bolts in the sequence shown.

Install the lower cylinder block to the upper cylinder block.

3. Tighten bolts 21 to 32 to 15 Nm
4. Tighten bolts 33 to 34 to 15 Nm
5. Tighten bolts 1 to 10 to 25 Nm


6. Tighten bolts 11 to 20 to 15 Nm
7. Tighten bolts 1 to 10 to 35 Nm +135°
8. Tighten bolts 11 to 20 to 20 Nm +150°
9. Tighten bolts 21 to 32 to 20 Nm +90°
10. Tighten bolts 33 to 34 to 20 Nm +150°



VUJ0002450

- 7 . Rotate the crankshaft to check correct operation.
- 8 . Remove excess sealant which may squeeze out at the front cover sealing surfaces.

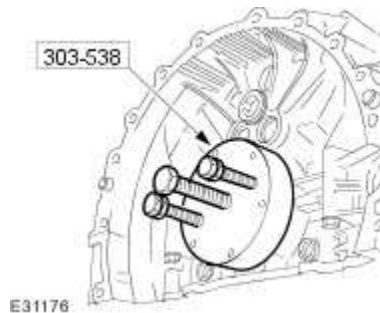
9.  **CAUTION: Do not use any lubricant on the seal, the transit sleeve or the crankshaft.**

-  **CAUTION: Make sure all components are clean and dry.**

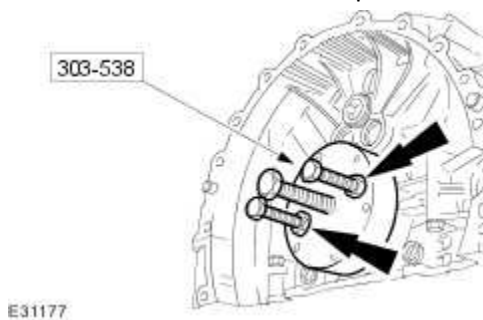
Make sure the transit sleeve is correctly in place and install the new seal over the crankshaft.

10. Carefully remove the transit sleeve, leaving the seal in place.

11. Install the special tool to the crankshaft.

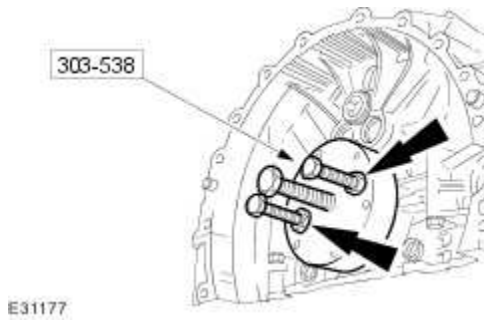


12. Reposition the nuts to hold the special tool against the crankshaft rear seal. Check that the crankshaft rear seal and the special tool are parallel to the rear of the engine.



13.  **CAUTION: Alternate nut tightening to correctly seat the crankshaft rear seal.**

Using the special tool, install the crankshaft rear seal.



14 . Remove the special tool from the crankshaft.

- Check that the seal is located correctly.

15



CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.

- Position the crankshaft journal at the bottom of the stroke.

16



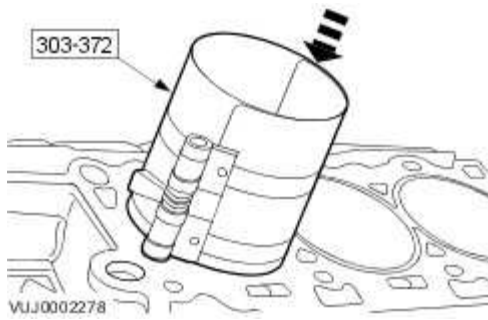
CAUTION: Make sure the piston rings are positioned at different positions opposite the thrust side of the piston before installation.



CAUTION: Install pistons with arrow to front of engine.

Using the special tool compress the rings and install the piston and connecting rod.

- Lubricate all piston components.



17



CAUTION: When assembling the connecting rods and connecting rod caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.



CAUTION: Connecting rod bolts are torqued to yield and must be replaced.



CAUTION: Bolts must be tightened equally.

NOTE:

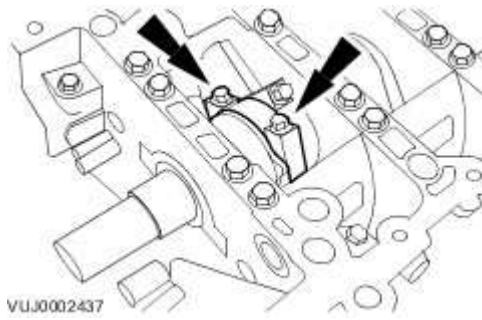
Remove the special tools from the connecting rods.

Position the connecting rod cap on the appropriate connecting rod.

11. Tighten to 10 Nm

12. Tighten to 30 Nm

13. Tighten to 90°



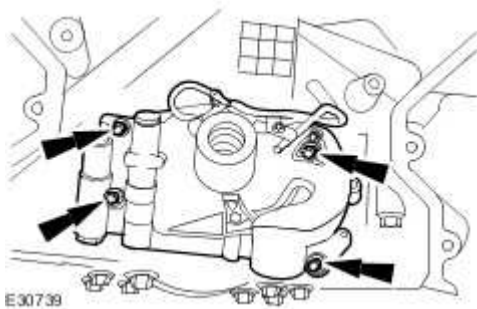
18 . Rotate the crankshaft to check correct operation.

19 . Install the piston cooling jets.

- Tighten to 9 Nm

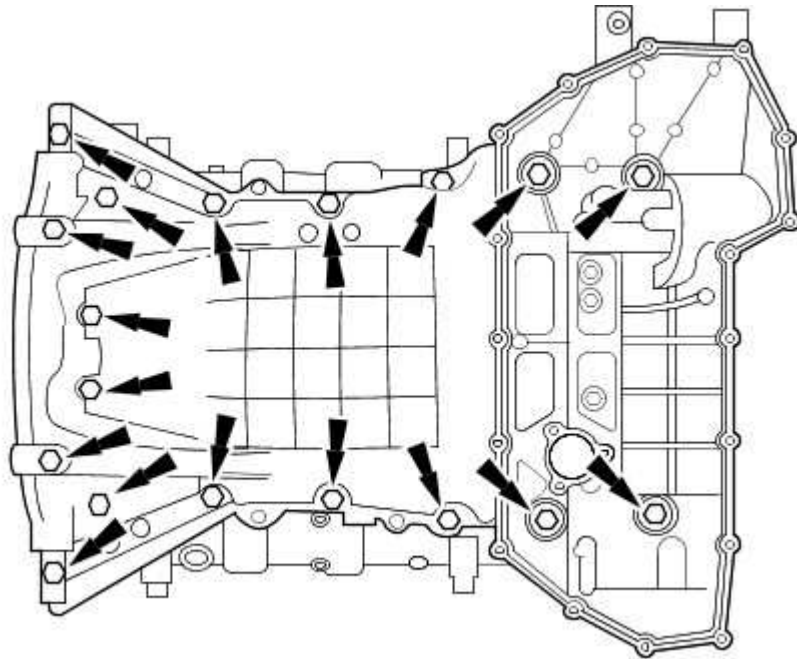
20 . Install the oil pump.

- Install a new gasket.
- Tighten to 12 Nm.



21 . Install the upper oil pan.

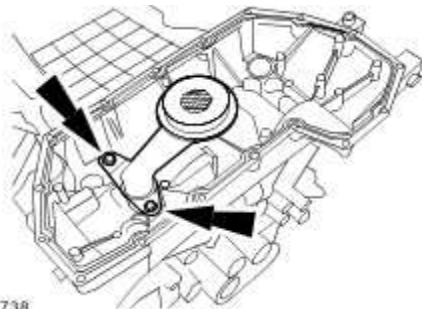
- Install a new gasket.
- Tighten to 21 Nm.



VUJ0002435

22 . Install the oil strainer.

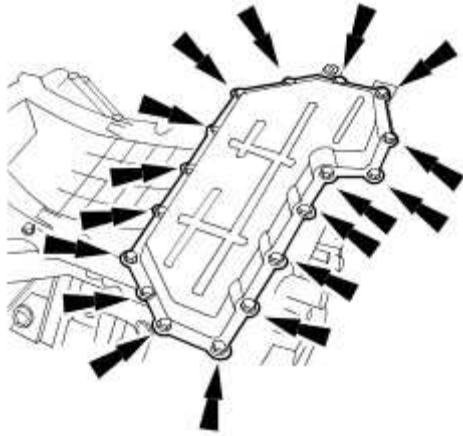
- Install a new O-ring seal.
- Tighten to 12 Nm.



E30738

23 . Install the oil pan.

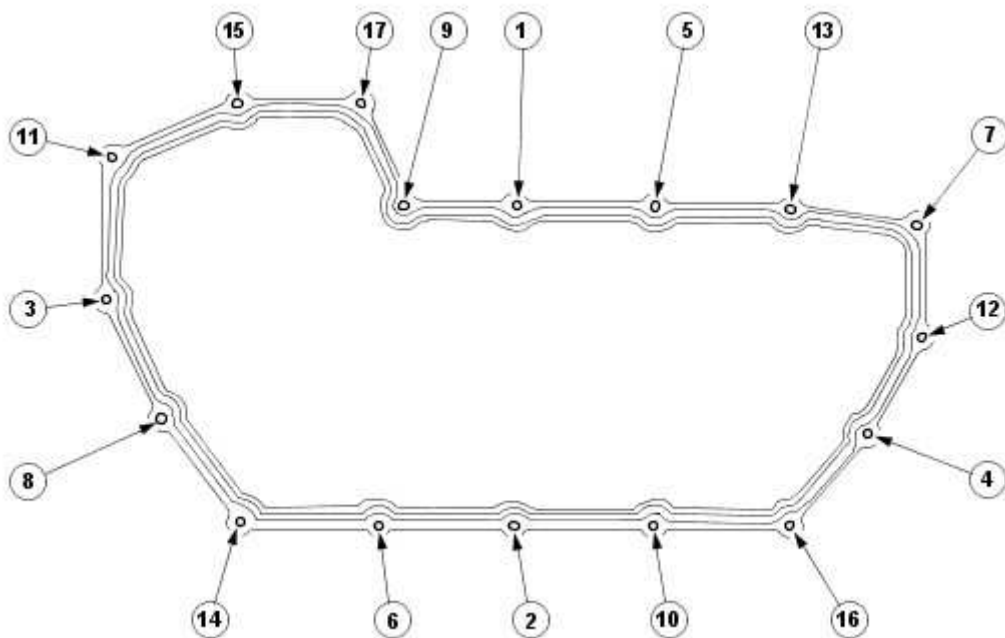
- Install a new gasket.
- Install, but do not fully tighten the retaining bolts.



VUJ0002433

24 Tighten to 12 Nm.

- Tighten in the sequence shown.
- A new oil pan is supplied with the drain plug installed. Check that the drain plug is tightened to 25 Nm.



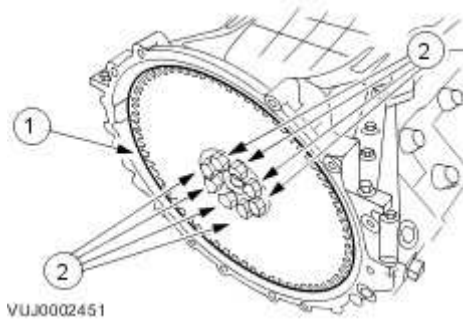
E36705

25 . Install the flexplate.

14. Install the flexplate.

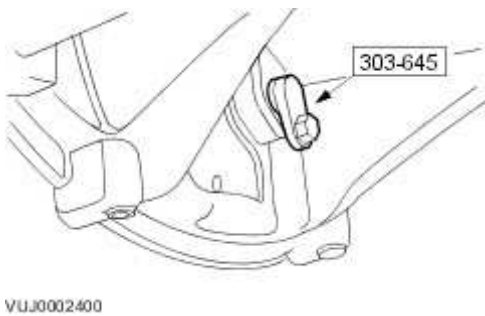
15. Install the flexplate retaining bolts.

- Tighten to 15 Nm.
- Tighten to 110 Nm.



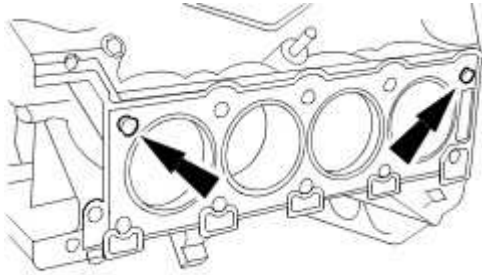
26 . Reposition the crankshaft.

- Install the crankshaft setting peg 303-645 to the crankshaft position sensor location.



27 . Install a new left-hand cylinder head gasket.

- Make sure the cylinder head dowels are correctly located.



E31267

28



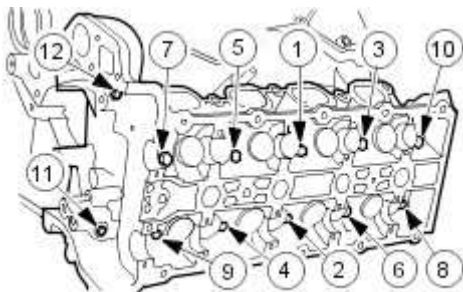
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be installed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.



CAUTION: Tighten the bolts 1 to 10 in the sequence shown.

Install the left-hand cylinder head.

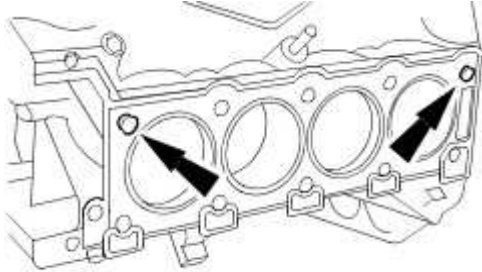
16. Tighten bolts 1 to 10 to 20 Nm.
17. Tighten bolts 1 to 10 to 35 Nm.
18. Tighten bolts 1 to 10 to 90°.
19. Tighten bolts 1 to 10 to 90°.
20. Tighten bolts 11 to 12 to 25 Nm.



VJJ0002452

29 . Install a new right-hand cylinder head gasket.

- Make sure the cylinder head dowels are correctly located.



E31267

30



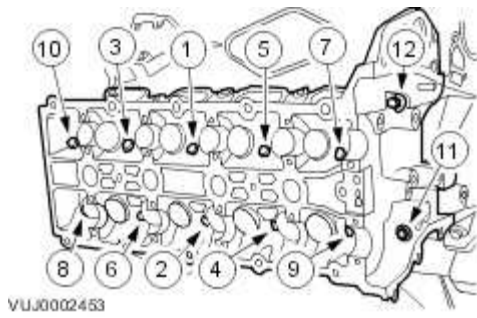
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be installed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.



CAUTION: Tighten the bolts 1 to 10 in the sequence shown.

Install the right-hand cylinder head.

21. Tighten bolts 1 to 10 to 20 Nm.
22. Tighten bolts 1 to 10 to 35 Nm.
23. Tighten bolts 1 to 10 to 90°.
24. Tighten bolts 1 to 10 to 90°.
25. Tighten bolts 11 to 12 to 25 Nm.

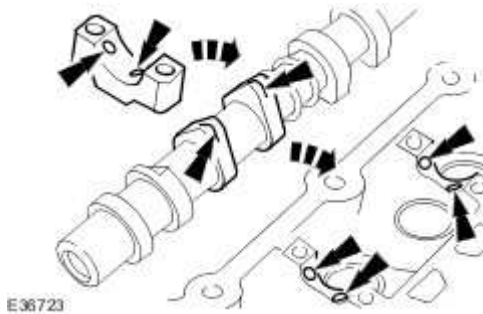


31 . NOTE:

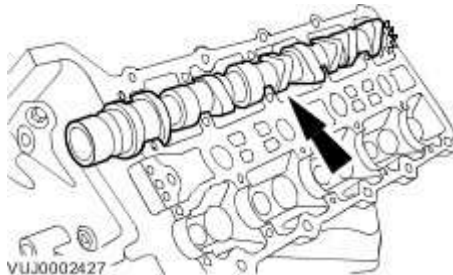
Make sure all components are clean.

Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.



32 . Install the left-hand inlet camshaft.



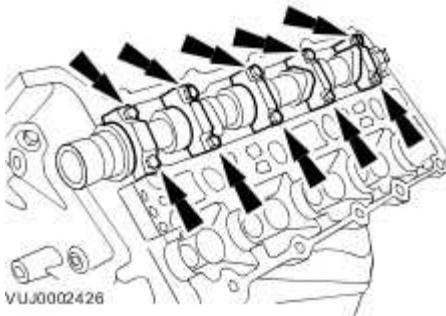
33 .



CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

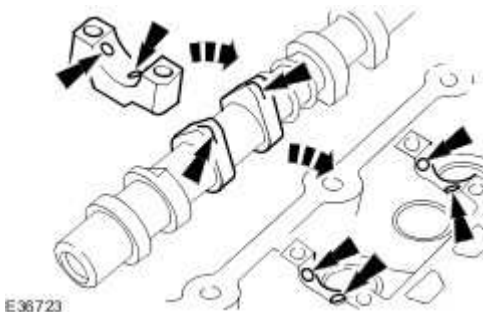


34 . **NOTE:**

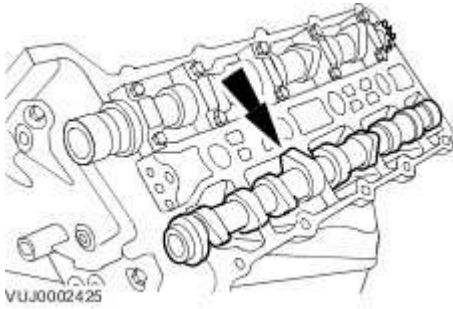
Make sure all components are clean.


Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes **ONLY**, not on the base circle area.



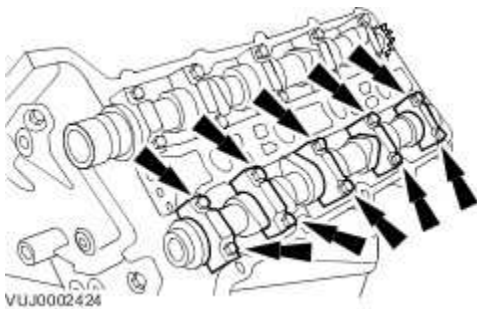
35 . Install the left-hand exhaust camshaft.



- 36 .  **CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.**

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

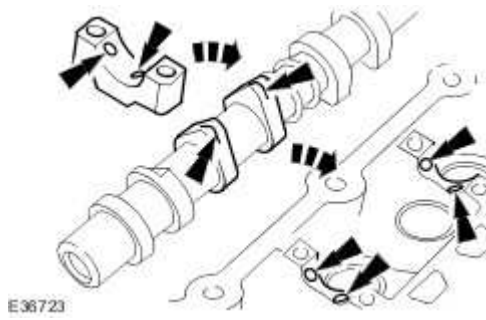


- 37 . **NOTE:**

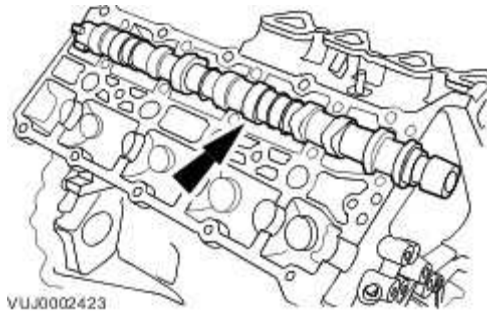
Make sure all components are clean.


Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes **ONLY**, not on the base circle area.



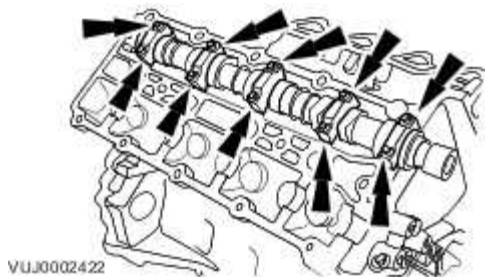
38 . Install the right-hand inlet camshaft.



39 .  **CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.**

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

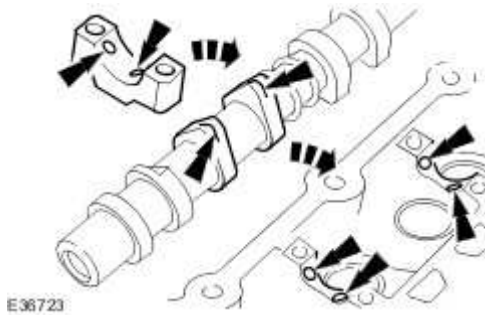


40 . **NOTE:**

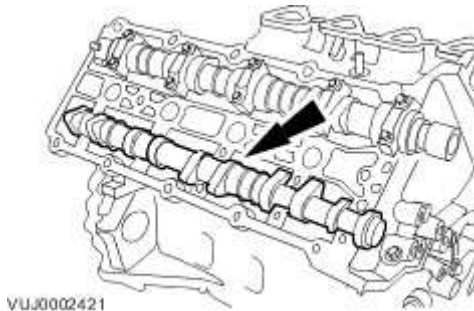
Make sure all components are clean.

Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.



41 . Install the right-hand exhaust camshaft.



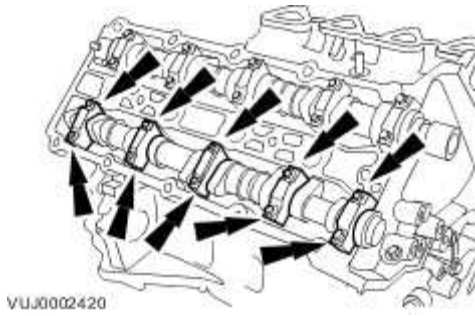
42 .



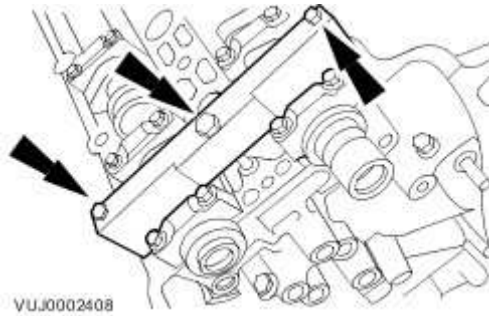
CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.

Install the camshaft bearing cap bolts evenly.

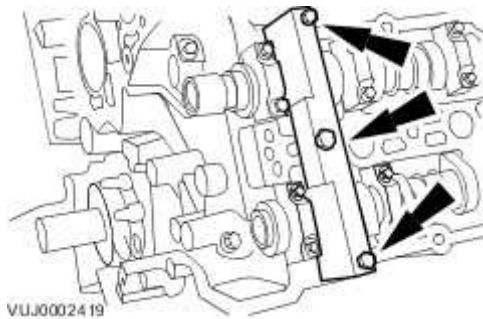
- Tighten to 10 Nm.



43 . Install the camshaft setting tool.



44 . Install the camshaft setting tool.



45



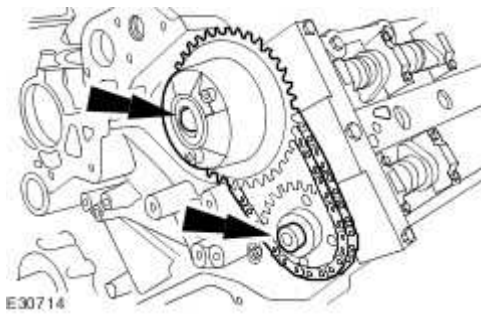
CAUTION: Do not tighten the camshaft sprocket retaining bolts.



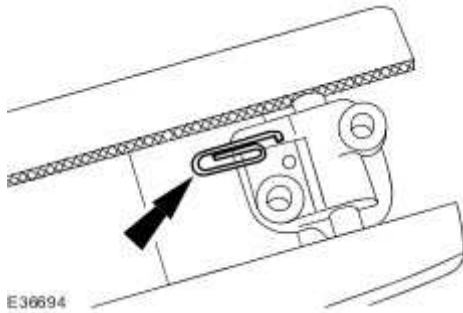
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the camshaft sprockets.

- Install the secondary timing chain tensioner and secondary timing chain to the camshaft sprockets.



- 46 . Using a suitable tool, retain the left-hand timing chain tensioner piston.

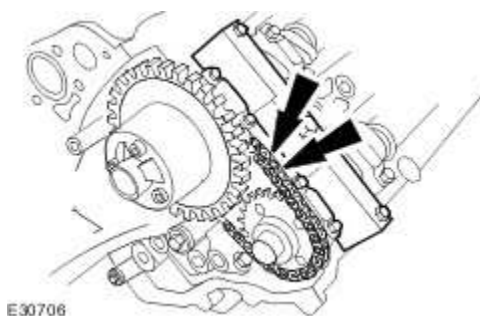


- 47 . Release the tension in the left-hand timing chain tensioner.

- Remove the retaining tool.

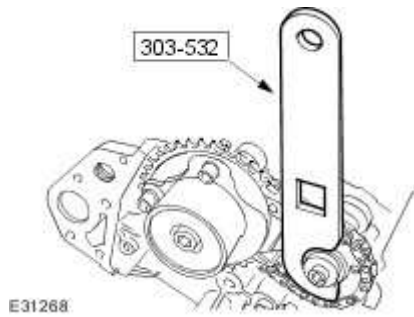
- 48 . Install the secondary timing chain tensioner.

- Tighten to 12 Nm.



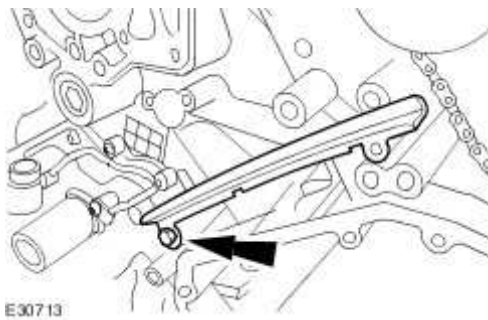
49 . Install the timing chain tensioning tool 303-532 to the exhaust camshaft sprocket.

- Reposition the camshaft sprockets for the most advantageous position for use of the tool.

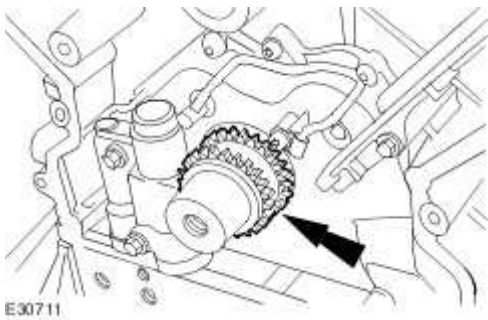


50 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.



51 . Install the crankshaft sprocket.



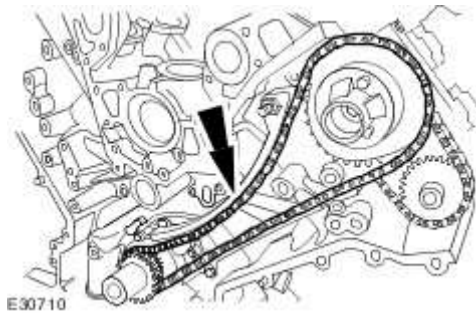
52



CAUTION: Make sure the timing chain slack is on the tensioned side of the timing chain.

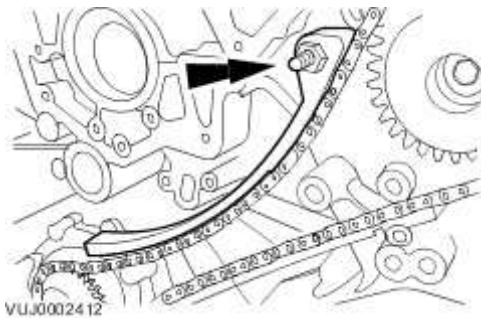
Install the primary timing chain.

- Install the primary chain over the crankshaft sprocket and the intake sprocket.



53 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.

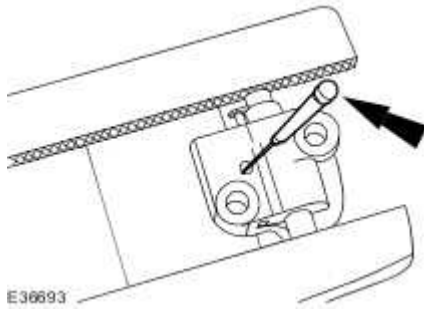


54



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Using a suitable tool, hold the left-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.



55 NOTE:

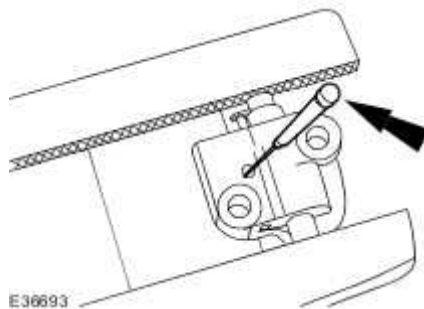
The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the left-hand timing chain tensioner.

56 NOTE:

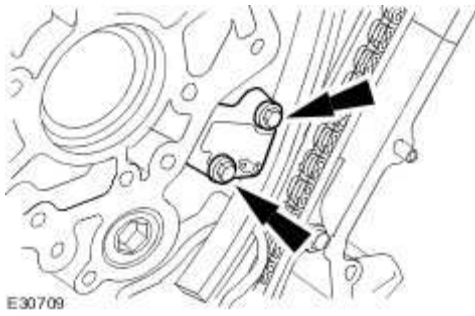
The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the left-hand timing chain tensioner piston.



57 . Install the primary timing chain tensioner assembly.

- Tighten to 12 Nm.



58 . Release the tension in the left-hand timing chain tensioner.

- Remove the retaining tool.

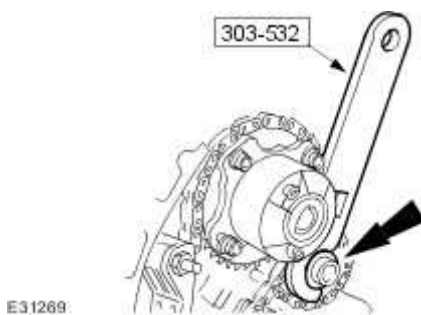
59



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.

- Tighten to 20 Nm + 90 deg.



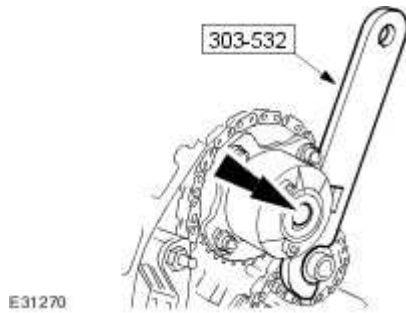
60



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction.

- Tighten to 20 Nm + 90 deg.



61



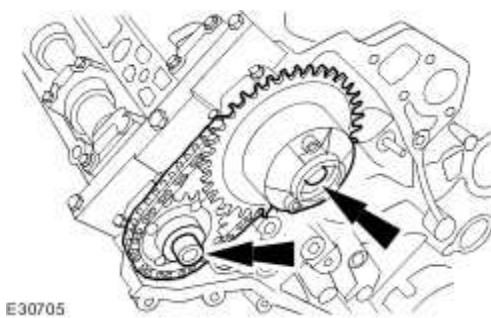
CAUTION: Do not tighten the camshaft sprocket retaining bolts.



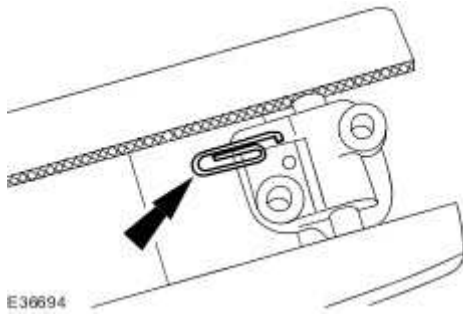
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the camshaft sprockets.

- Install the secondary timing chain tensioner and secondary timing chain to the camshaft sprockets.

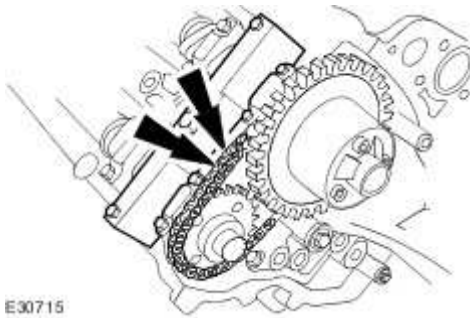


62 . Using a suitable tool, retain the right-hand timing chain tensioner piston.



63 . Install the secondary timing chain tensioner retaining bolts.

- Tighten to 12 Nm.

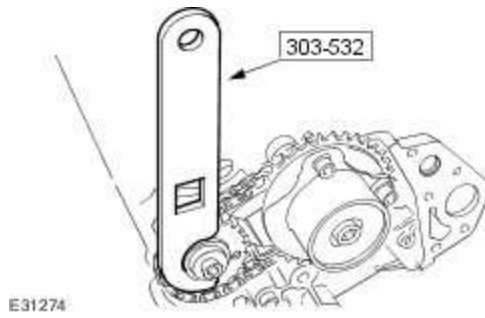


64 . Release the tension in the right-hand timing chain tensioner.

- Remove the retaining tool.

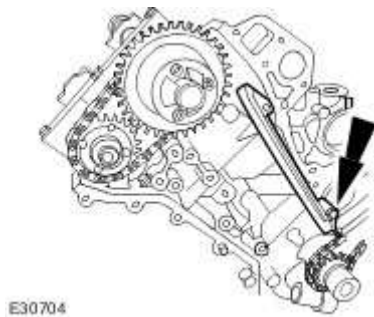
65 Install the timing chain tensioning tool 303-532 to the exhaust camshaft sprocket.

- Reposition the camshaft sprockets for the most advantageous position for use of the tool.



66 . Install the primary timing chain guide.

- Tighten to 12 Nm.



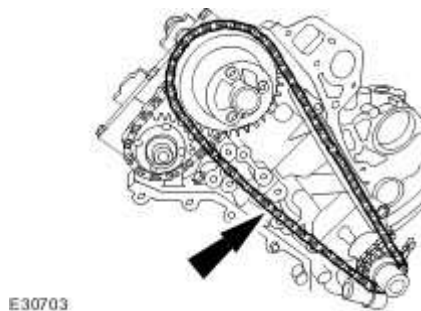
67



CAUTION: Make sure the timing chain slack is on the tensioned side of the timing chain.

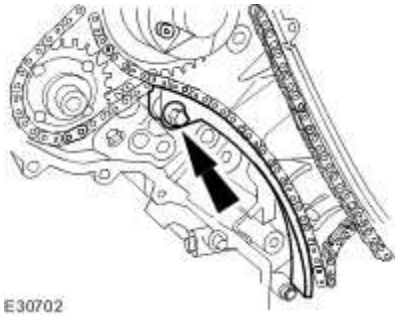
Install the primary timing chain.

- Install the primary chain over the crankshaft sprocket and the intake sprocket.



68 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.

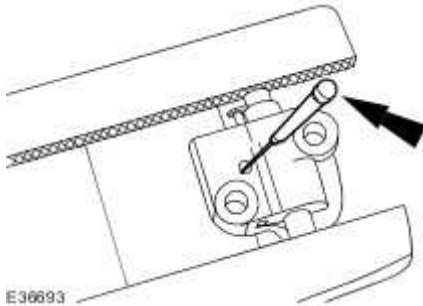


69



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Using a suitable tool, hold the right-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.



70 **NOTE:**

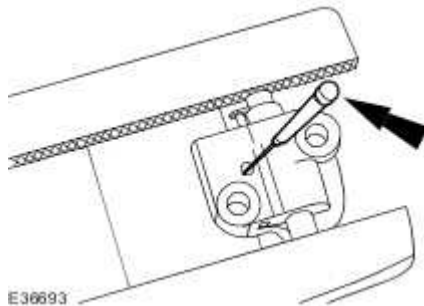
The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the right-hand timing chain tensioner.

71 **NOTE:**

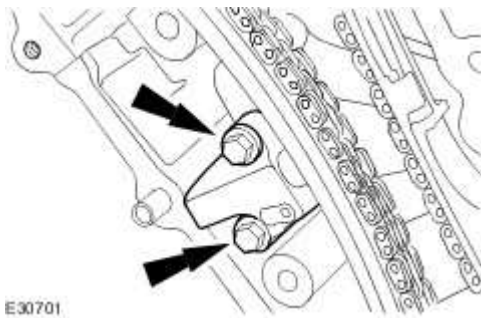
The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the right-hand timing chain tensioner piston.



72 . Install the primary timing chain tensioner assembly.

- Tighten to 12 Nm.



73 . Release the tension in the right-hand timing chain tensioner.

- Remove the retaining tool.

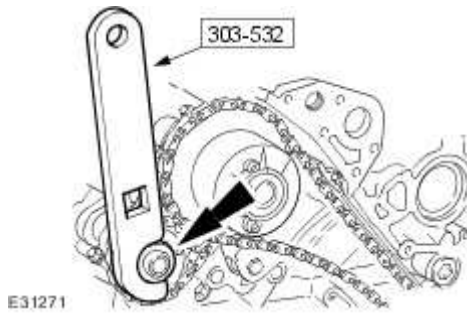
74



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.

- Tighten to 20 Nm + 90 deg.



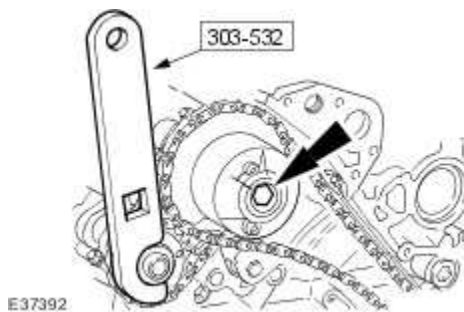
75



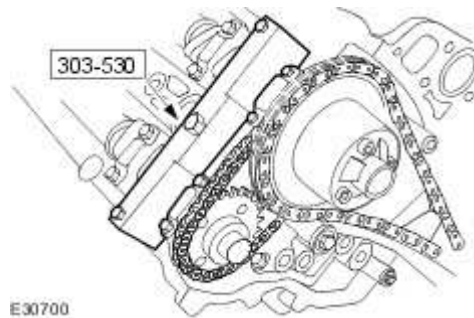
CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction.

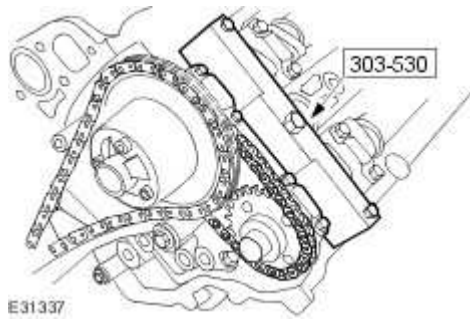
- Tighten to 20 Nm + 90 deg.



76 . Remove the special tool from the right-hand cylinder head.

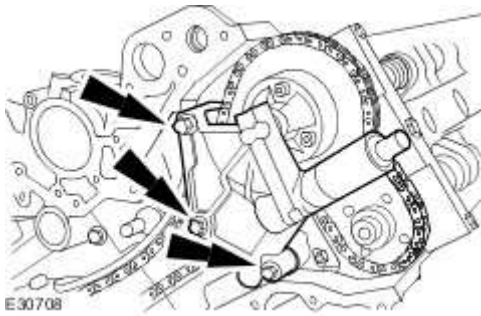


77 . Remove the special tool from the left-hand cylinder head.



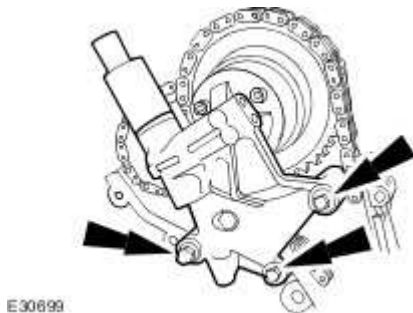
78 . Install the left-hand variable camshaft timing oil control unit housing.

- Install new O-ring seals.
- Tighten to 22 Nm.

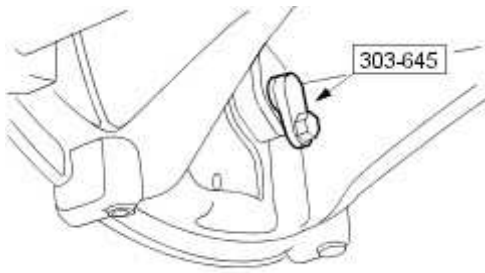


79 . Install the right-hand variable camshaft timing oil control unit housing.

- Install new O-ring seals.
- Tighten to 22 Nm.



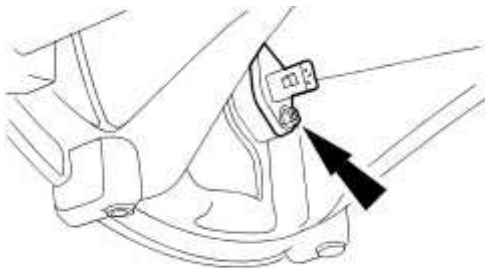
80 . Remove the special tool.



VUJ0002400

81 . Install the crankshaft position sensor.

- Tighten to 10 Nm.

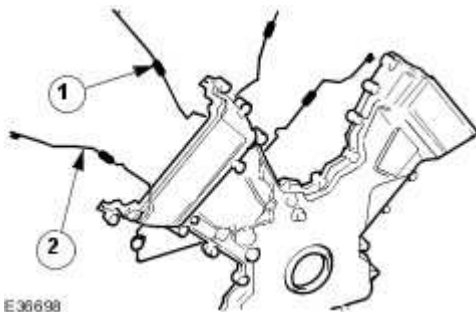


E30694

82 . Install new seals to the timing cover.

26. Install the new seal to the inner groove on the face of the timing cover.

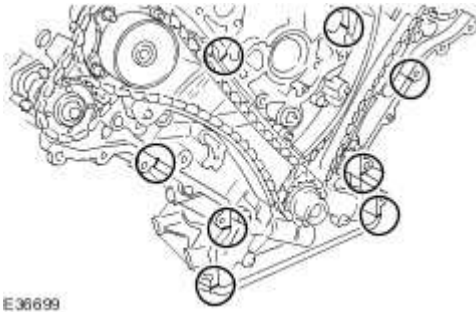
27. Install the new seal to the outer groove on the face of the timing cover.



E36698

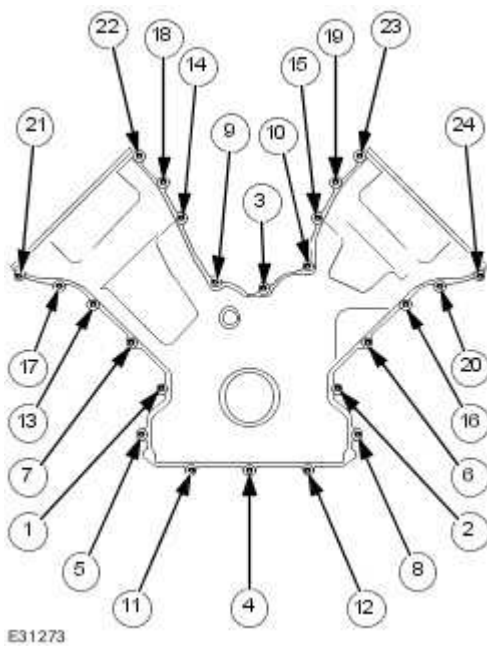
83 Apply sealant to the eight joints on the engine face.

- Sealant beads to be 3mm diameter and 12mm long. Cut the nozzle of the sealant tube to produce a 3 mm bead. (Install and tighten the securing bolts within twenty minutes of sealant application).



84 . Install the timing cover.

- Tighten in the sequence shown.
- Tighten to 13 Nm.



85 .

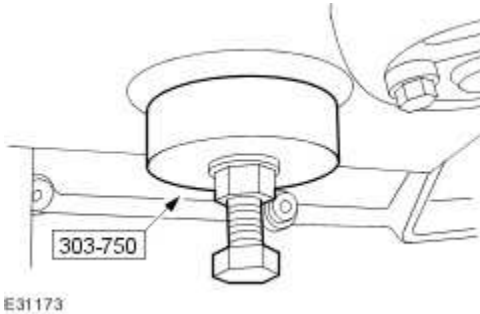


CAUTION: Make sure the crankshaft front seal mating faces are clean and dry.

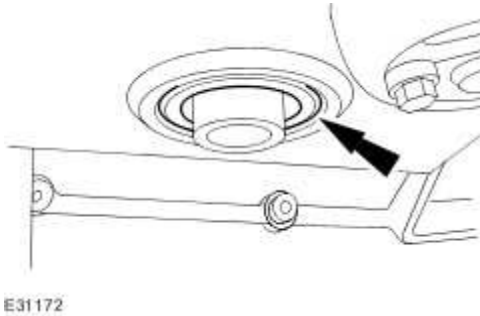


CAUTION: Do not remove the crankshaft front seal protector.

Using the special tool, install a new crankshaft front seal.



86 . Remove the crankshaft seal protector.



87 . Install a new O-ring seal to the crankshaft pulley.

- Lubricate the new O-ring.

88



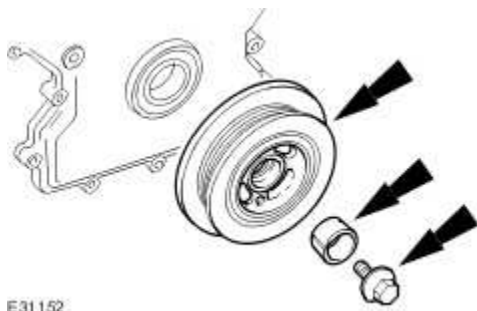
CAUTION: The screw thread in the crankshaft must be cleaned out before a new crankshaft pulley bolt is installed.



CAUTION: A new crankshaft pulley bolt must be used.

Install, but do not tighten, a new crankshaft pulley retaining bolt.

- Install the crankshaft pulley and locking ring to the crankshaft.



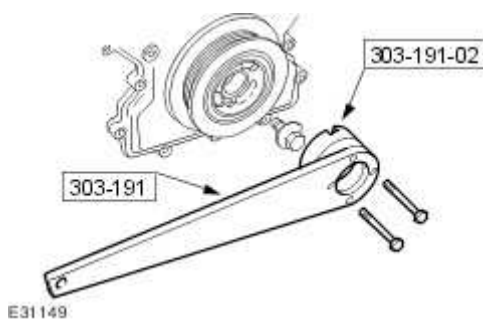
89



CAUTION: Under no circumstances should the crankshaft setting peg 303-645 be used in the following operations to lock the crankshaft.

Using special tools, retain the crankshaft pulley.

- Tighten the crankshaft pulley retaining bolt to 375 Nm.



90 . Remove the special tools.

91 . Carry out a valve clearance check.

For additional information, refer to Valve Clearance Check (12.29.47)

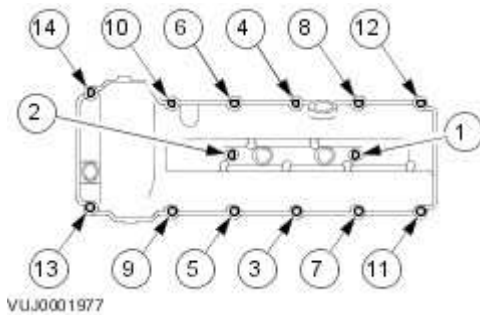
92 **NOTE:**

Apply an 8mm diameter bead of silicone gasket sealant on the two places where the

cylinder head and front cover join.

Install the left-hand valve cover.

- Install new valve cover gaskets.
- Tighten in the sequence shown.
- Tighten to 10 Nm.

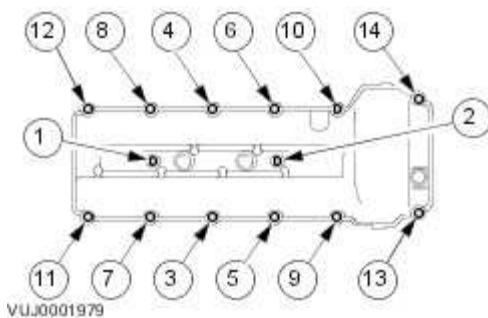


93 **NOTE:**

Apply an 8mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front cover join.

Install the right-hand valve cover.

- Install new valve cover gaskets.
- Tighten in the sequence shown.
- Tighten to 10 Nm.

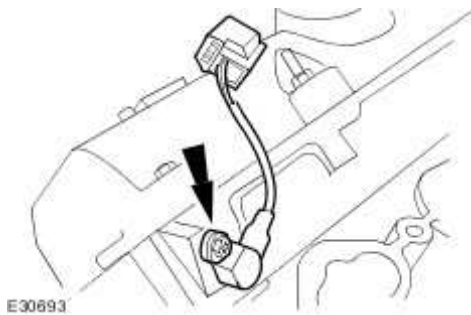


94 . Install the spark plugs.

- Tighten to 27 Nm.

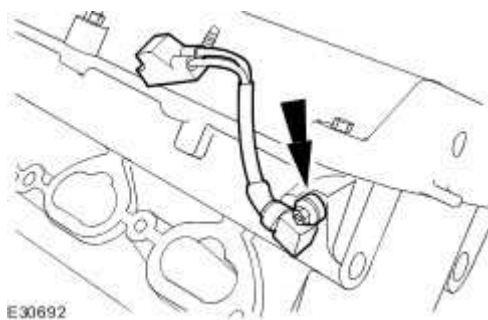
95 . Install the left-hand camshaft position (CMP) sensor.

- Install a new O-ring seal.
- Tighten to 7 Nm.



96 . Install the right-hand camshaft position (CMP) sensor.

- Install a new O-ring seal.
- Tighten to 7 Nm.

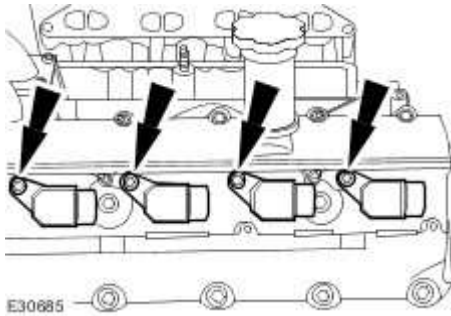


97 . **NOTE:**

Left-hand shown, right-hand similar

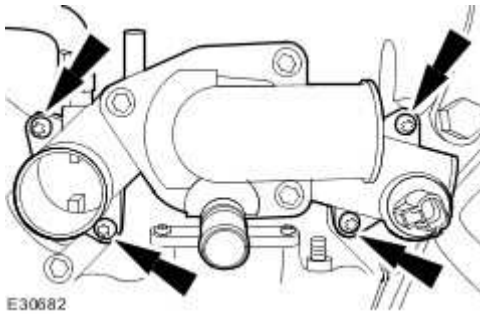
Install the ignition coils.

- Tighten to 5 Nm.



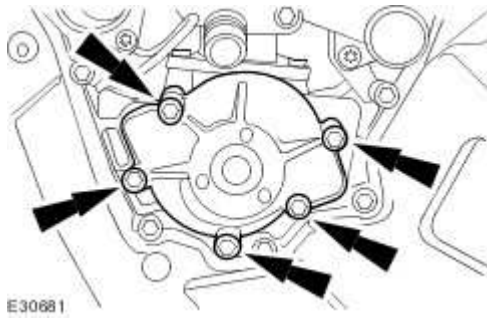
98 . Install the thermostat housing.

- Install new O-ring seals.
- Tighten to 10 Nm.



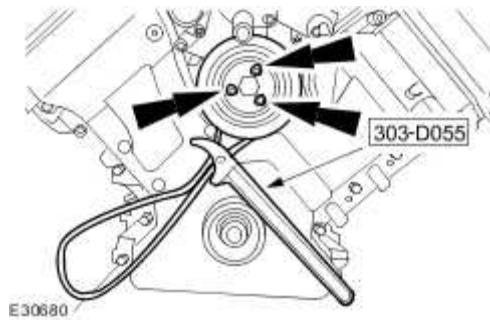
99 . Install the water pump.

- Install new O-ring seals and gaskets.
- Tighten to 12 Nm.

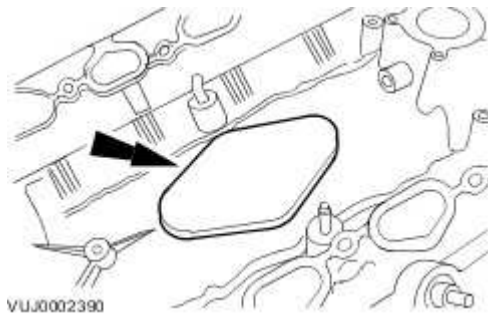


100 . Install the water pump pulley.

- Using special tool, retain the water pump pulley.
- Tighten to 10 Nm + 45°.



101 . Install the engine block insulation grommet.

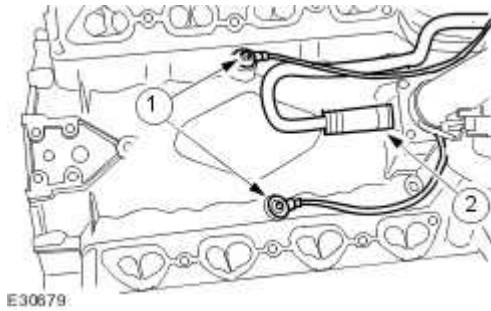


102 . Install the intake manifold heater coolant hose.

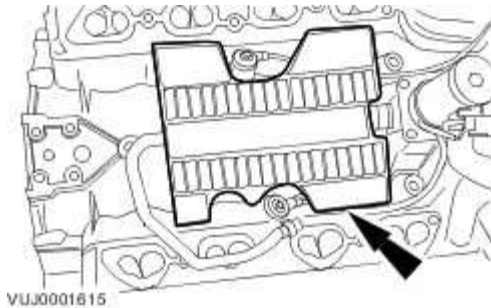
28. Install the knock sensors.

- Tighten to 20 Nm.

29. Install the intake manifold heater coolant hose.

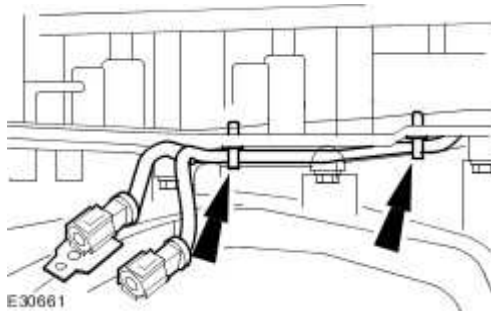


103 . Install the noise and vibration insulating pad.



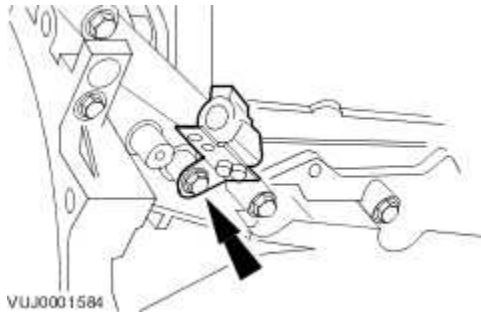
104 . Install the engine wiring harness.

105 . Attach the engine wiring harness retaining clips.



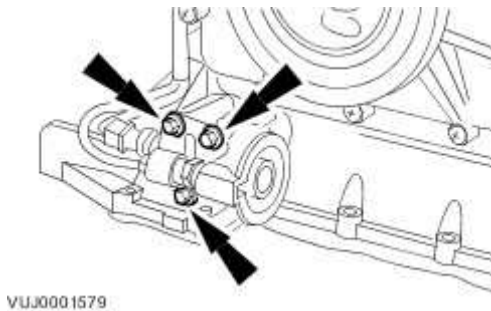
106 . Attach the right-hand oxygen sensor.

- Tighten to 10 Nm.

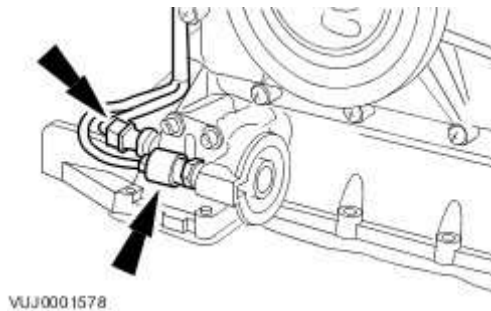


107 . Install the oil filter housing.

- Install a new O-ring seal.
- Tighten to 21 Nm.

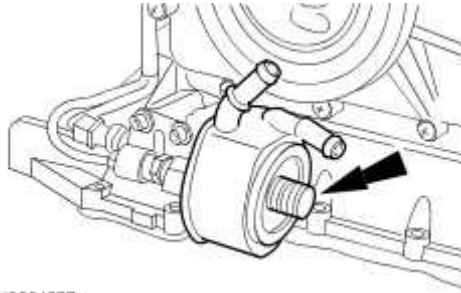


108 . Connect the oil pressure switch and oil temperature sensor electrical connectors.



109 . Install the oil cooler.

- Install a new O-ring seal.
- Tighten to 55 Nm.



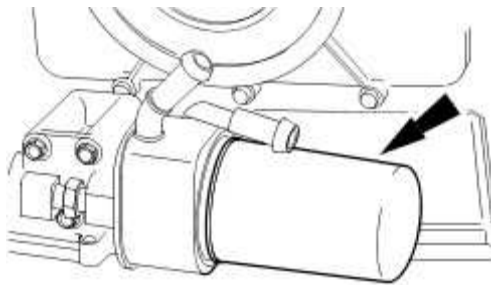
VUJ0001577

110 . NOTE:

Apply a suitable amount of clean engine oil to lubricate the oil filter O-ring seal.

Install a new oil filter.

- Tighten to 18 Nm.

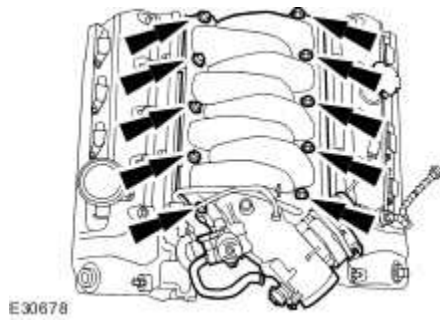


VUJ0001578

111 .

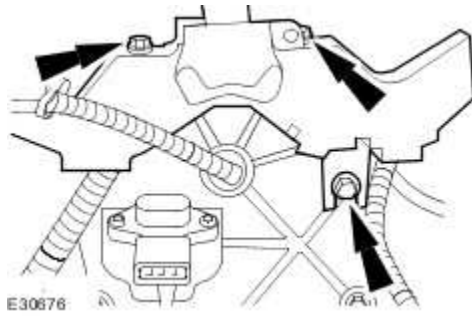
112 . Install the intake manifold.

- Tighten to 22 Nm.



113 . Attach the engine wiring harness.

- Tighten to 10 Nm.

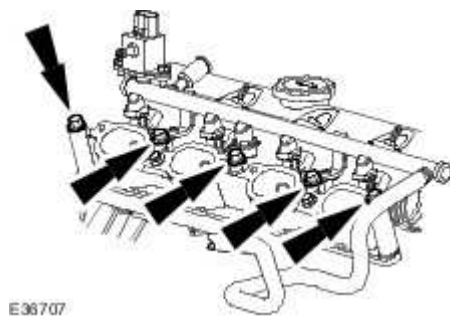


114 . **NOTE:**

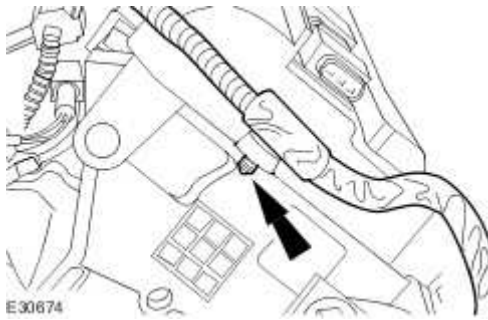
Left-hand shown, right-hand similar.

Install the lower intake manifold.

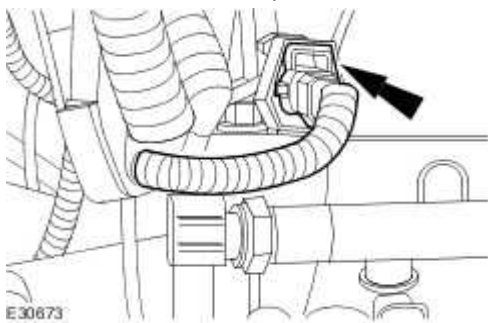
- Tighten to 22 Nm.



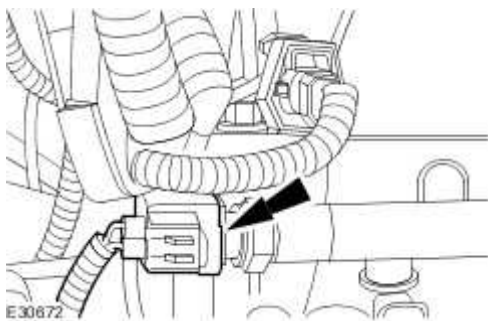
115 . Attach the engine wiring harness.



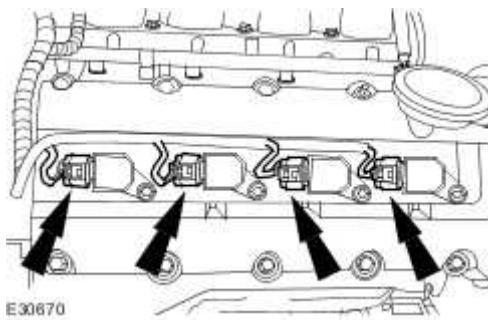
116 . Connect the camshaft position sensor electrical connector.



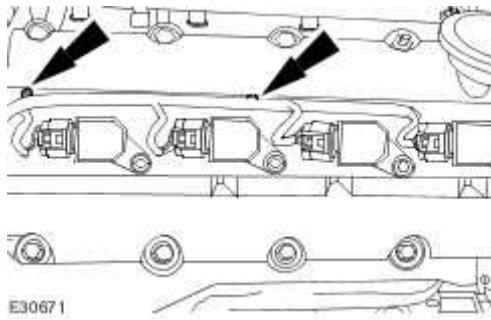
117 . Connect the fuel temperature sensor electrical connector.



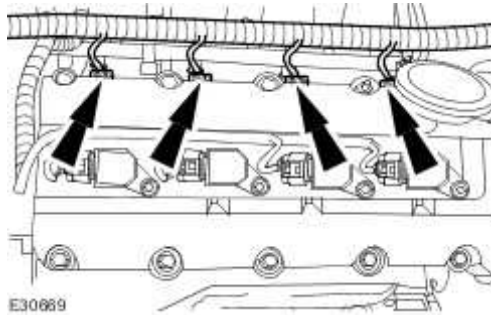
118 . Connect the ignition on-plug coil electrical connectors.



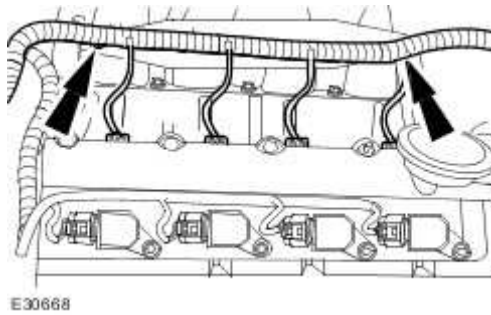
119 . Attach the engine wiring harness.



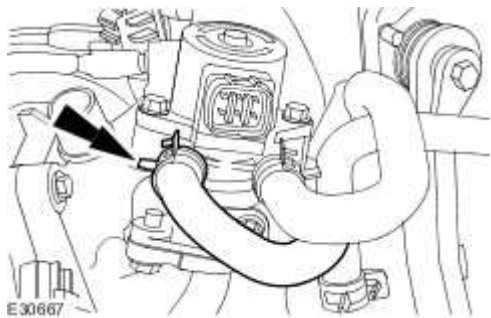
120 . Connect the fuel injector electrical connectors.



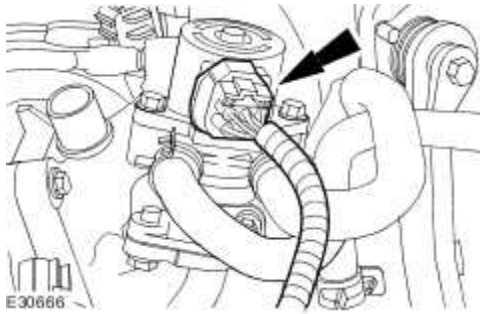
121 . Attach the engine wiring harness.



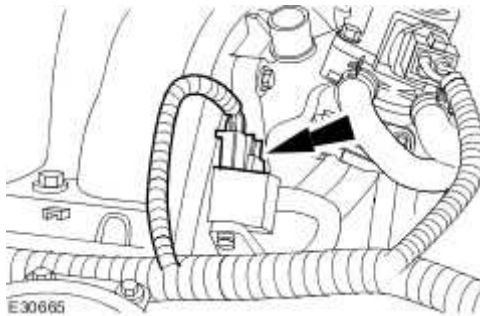
122 . Connect the exhaust gas recirculation valve coolant hose.



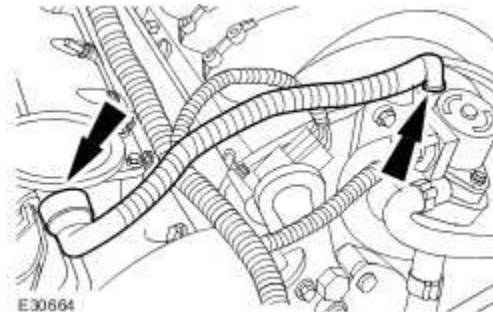
123 . Connect the exhaust gas recirculation valve electrical connector.



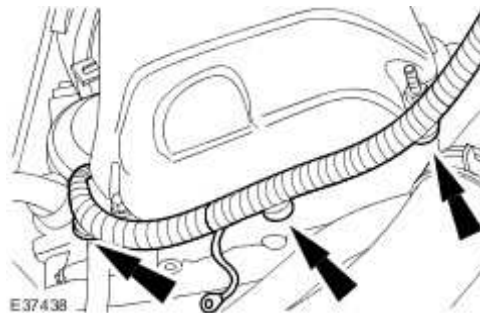
124 . Connect the fuel pressure regulator electrical connector.



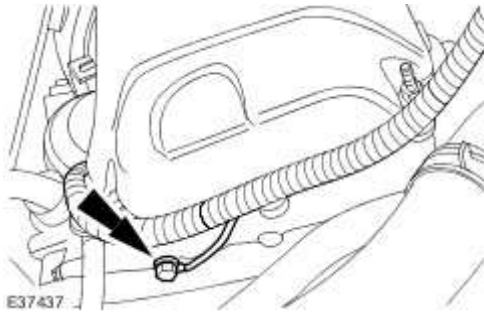
125 . Connect the positive crankcase ventilation pipe.



126 . Attach the engine wiring harness.



127 . Attach the engine wiring harness.

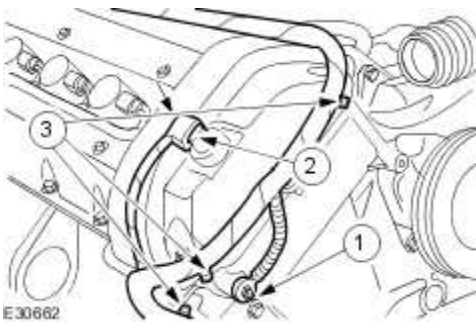


128 . Attach the engine harness.

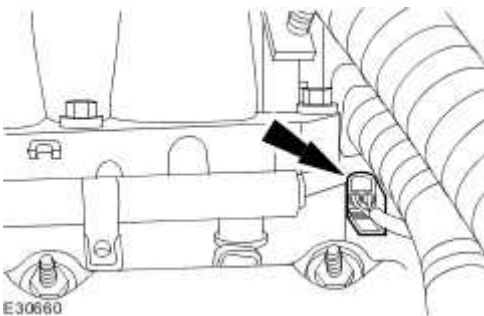
30. Connect the earth wire.

31. Connect the variable valve timing (VVT) solenoid electrical connector.

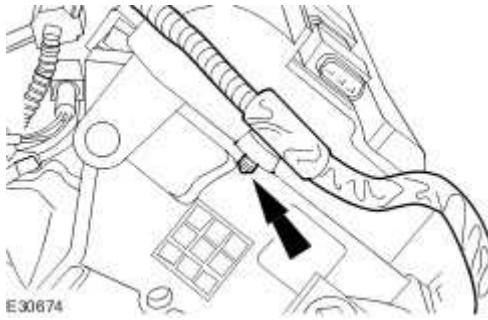
- Attach the engine harness.



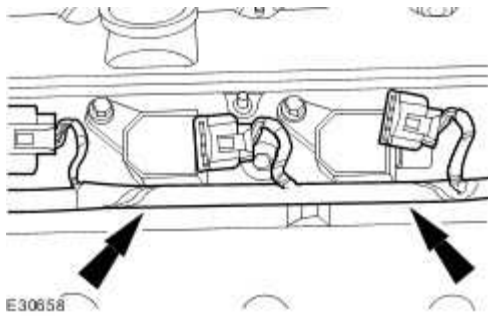
129 . Connect the camshaft position sensor electrical connector.



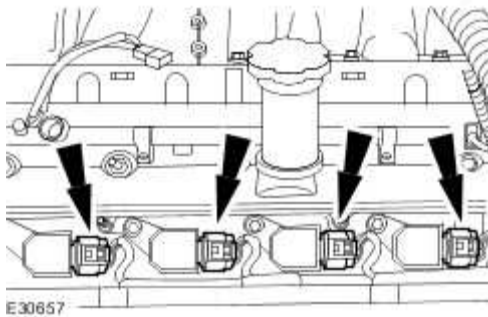
130 . Attach the engine wiring harness.



131 . Attach the engine wiring harness.



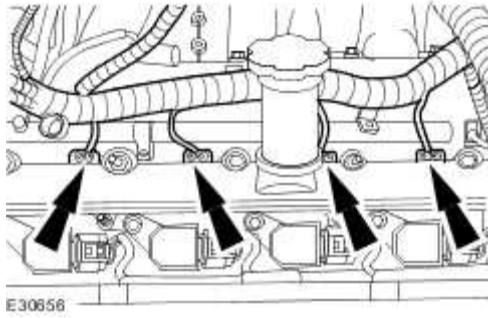
132 . Connect the ignition on-plug coil electrical connectors.



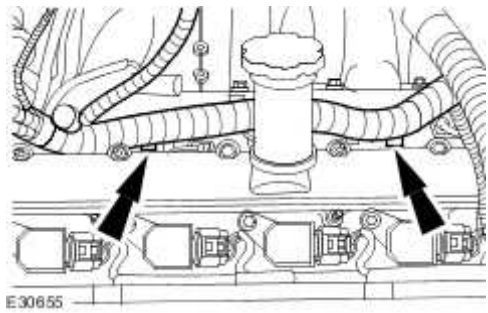
133 . **NOTE:**

Left-hand shown, right hand similar.

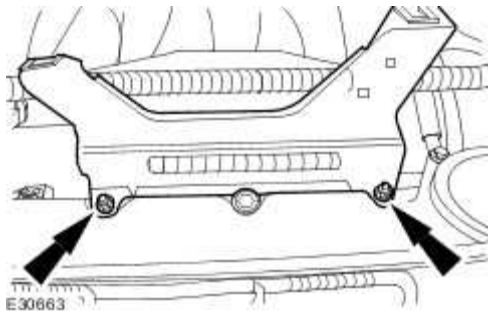
Connect the fuel injector electrical connectors.



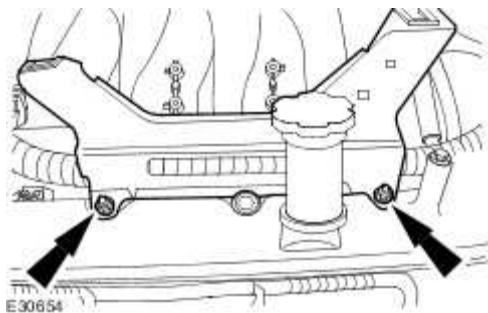
134 . Attach the engine wiring harness.



135 . Install the engine cover retaining bracket.



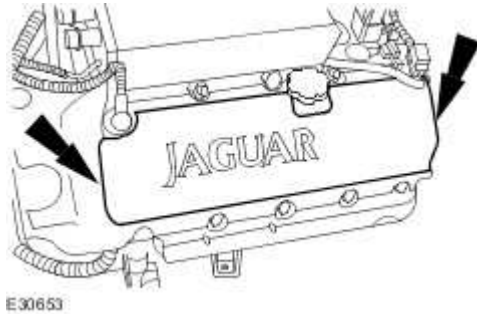
136 . Install the engine cover retaining bracket.



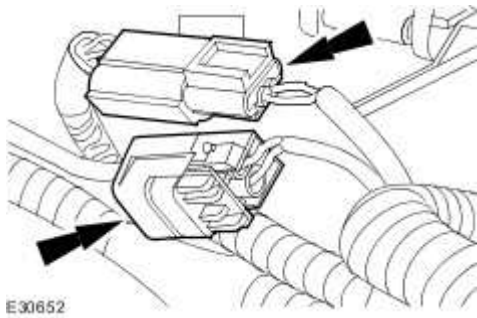
137 . **NOTE:**

Left-hand shown, right-hand similar.

Install the ignition coil cover.



138 . Connect the knock sensor electrical connectors.

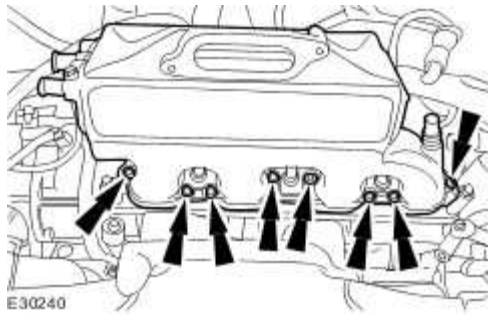


139 . **NOTE:**

Right-hand shown, left-hand similar.

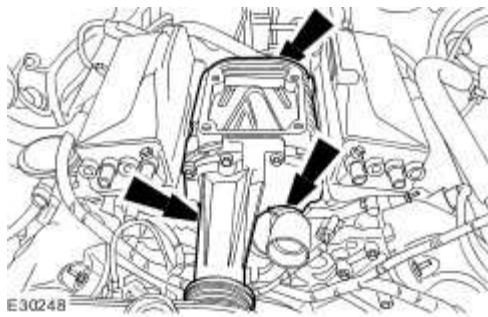
Install the charge air coolers.

- Install a new charge air cooler gasket.
- Tighten to 13 Nm.

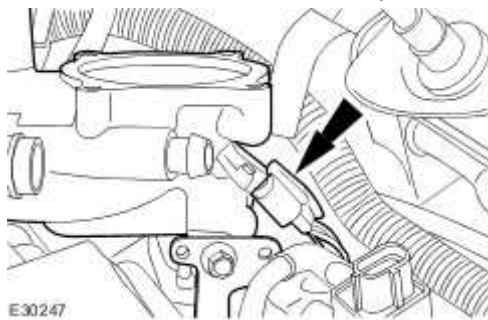


140 . Install the supercharger.

- Tighten to 24 Nm.

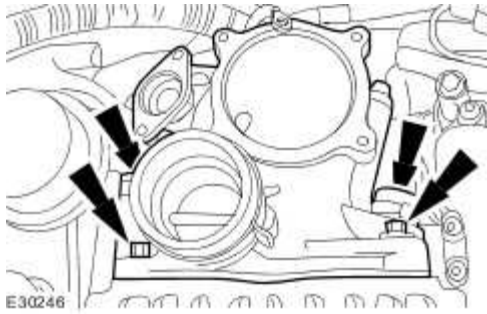


141 . Connect the manifold absolute pressure (MAP) sensor.



142 . Install the air intake elbow.

- Install a new gasket.
- Install new retaining bolt seals.
- Tighten to 24 Nm.

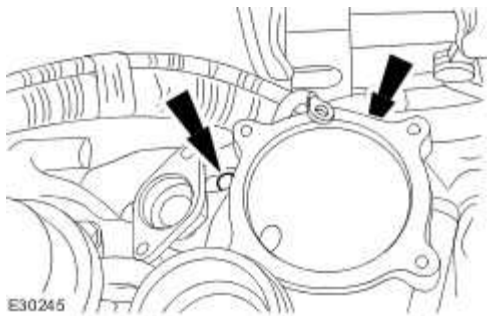


143 . **NOTE:**

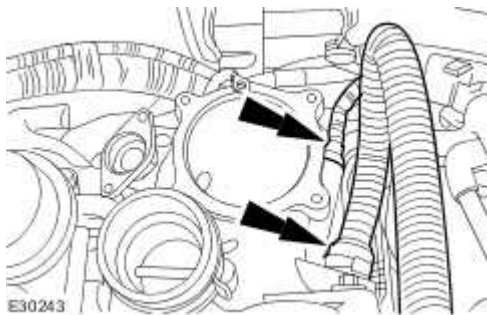
Make sure ground strap is correctly installed to the location noted.

Install the air intake elbow retaining bracket lower retaining bolts.

- Tighten to 20 Nm.



144 . Connect the air intake elbow pipes.



145

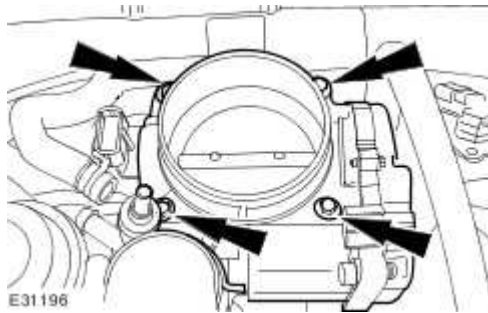


CAUTION: Do not attempt to clean the throttle body. The bore and the throttle

plate has a special coating applied during manufacture which should not be removed.

Install the throttle body.

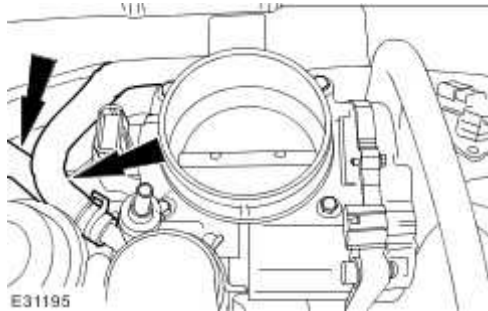
- Install a new throttle body gasket.
- Tighten to 10 Nm.



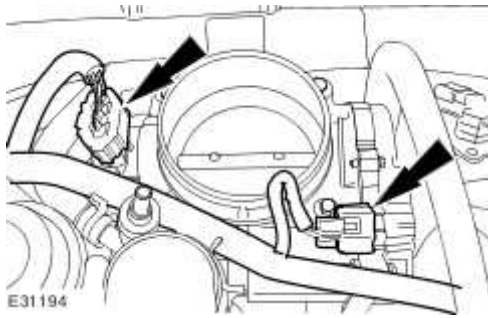
146 . **NOTE:**

Un-cap the coolant hose.

Attach the coolant hose to the throttle body.

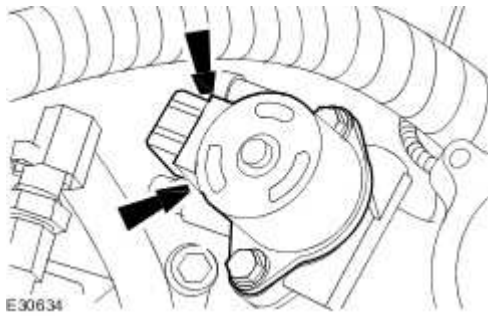


147 . Connect the electrical connectors.

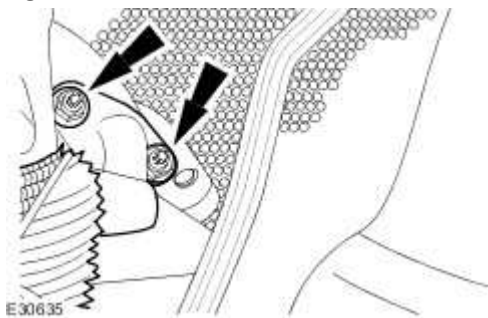


148 . Install the EGR valve and the exhaust manifold to EGR valve tube.

- Install a new exhaust manifold to EGR valve tube gasket.
- Install a new EGR valve to air intake elbow gasket.
- Tighten to 10 Nm.



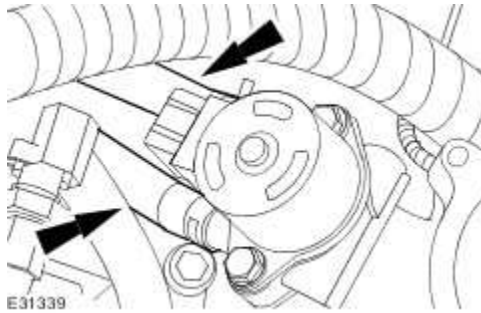
149 . Tighten to 21 Nm.



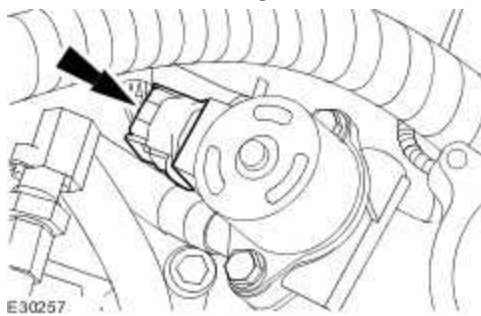
150 . **NOTE:**

Un-cap the exposed ports.

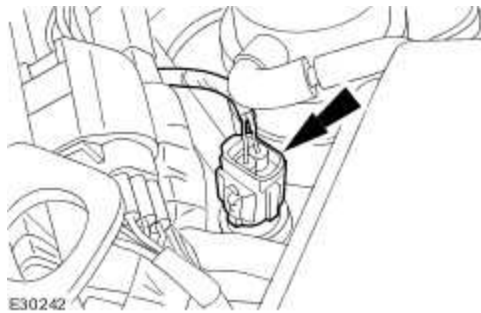
Connect the coolant hoses.



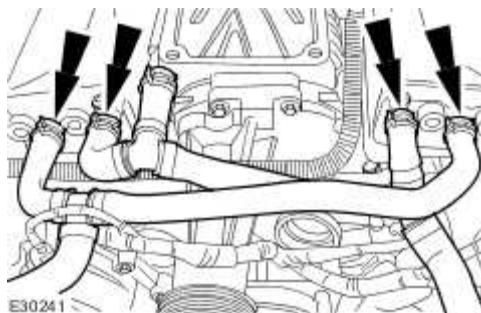
151 . Connect the exhaust gas recirculation (EGR) valve electrical connector.



152 . Connect the IAT sensor electrical connector.



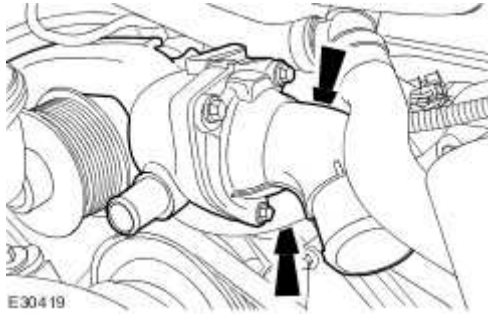
153 . Connect the charge air cooler coolant pipes.



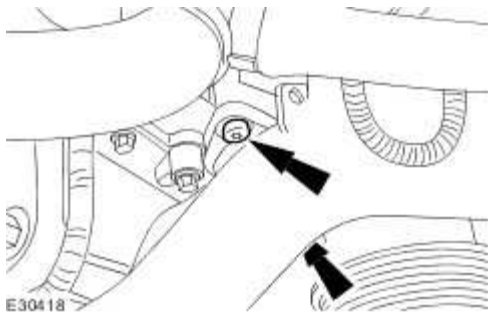
154 . Install new O-ring seals to the thermostat housing.

155 . Install thermostat housing.

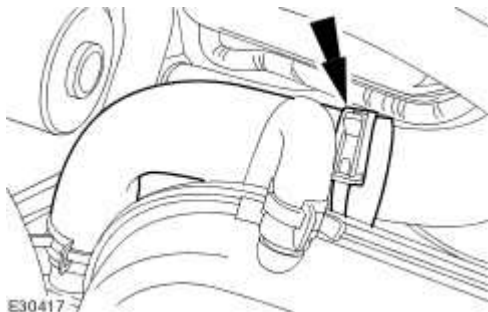
156 . Tighten to 10 Nm.



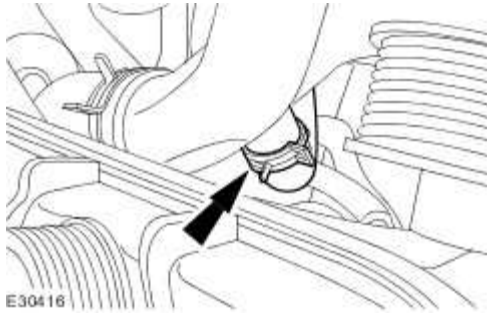
157 . Tighten to 10 Nm.



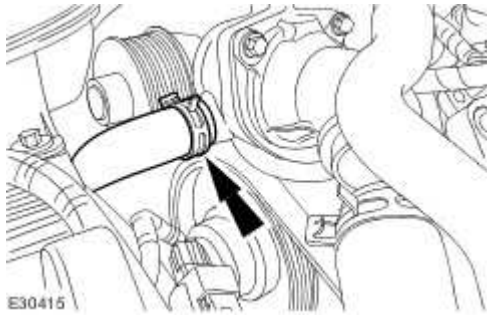
158 . Connect the hose.



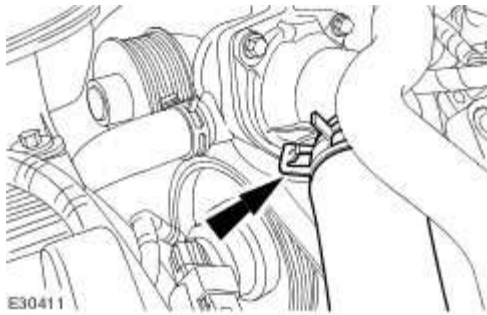
159 . Connect the hose.



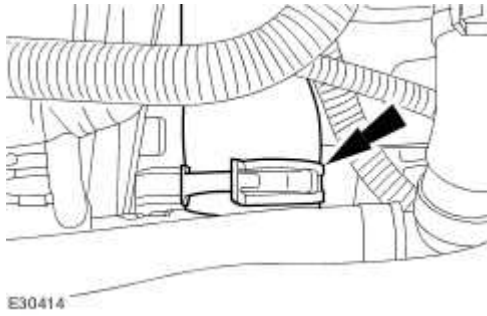
160 . Connect the hose.



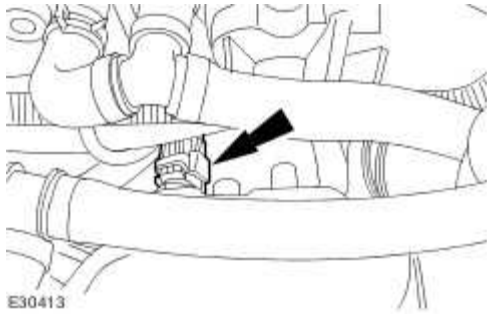
161 . Connect the hose.



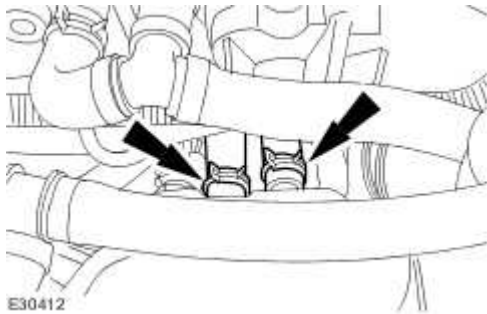
162 . Reposition the thermostat housing hose retaining clip.



163 . Connect the coolant temperature sensor electrical connector.

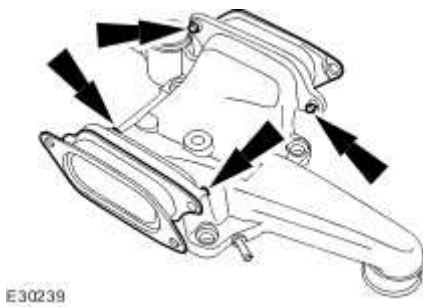


164 . Connect the thermostat housing hoses



165 . Install new supercharger outlet pipe to charge air coolers ducts.

- Tighten to 8 Nm.



166 . Install a new supercharger outlet pipe gasket.

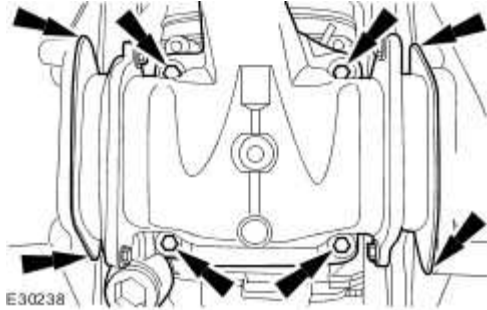
167 . Install new seals to the supercharger outlet pipe retaining bolts

168 .



CAUTION: Make sure no foreign matter enters the supercharger.

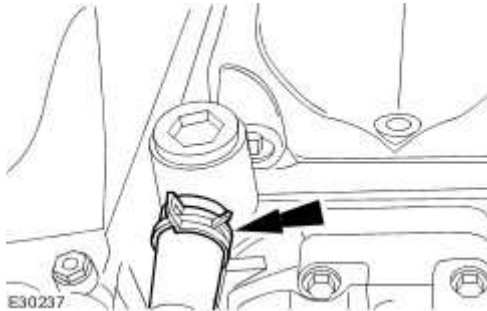
Install the supercharger outlet pipe



169 . **NOTE:**

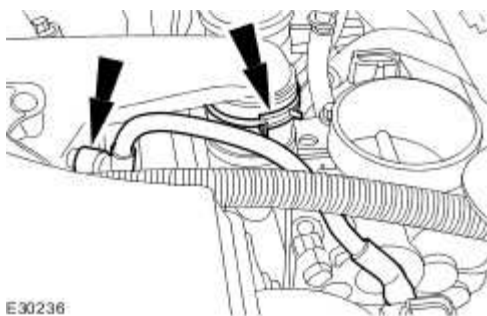
Un-cap the coolant ports.

Attach the supercharger outlet pipe coolant hose.

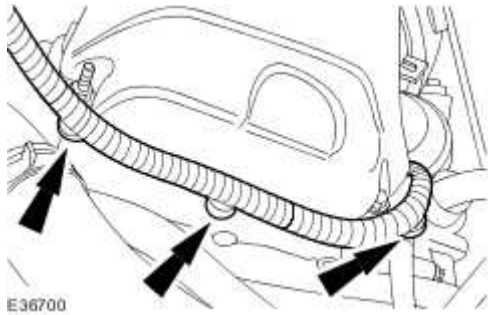


170 . Attach the hoses.

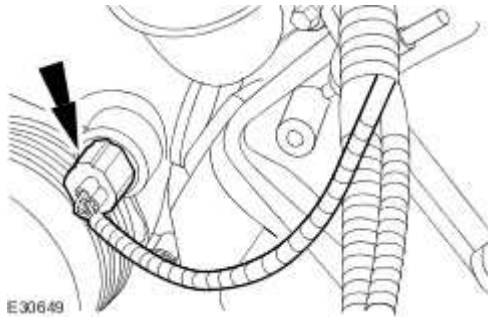
- Reposition the hose retaining clip.



171 . Attach the engine wiring harness.



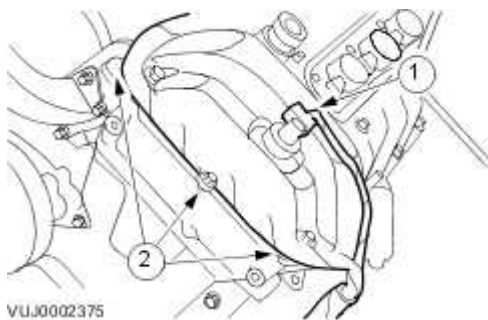
172 . Connect the coolant temperature sensor electrical connector.



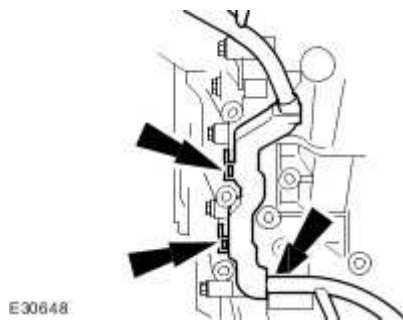
173 . Attach the engine wiring harness.

32. Connect the variable valve timing (VVT) solenoid electrical connector.

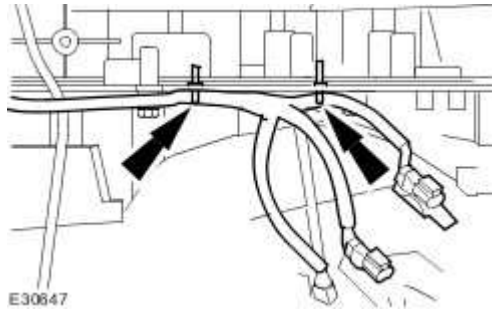
33. Attach the engine wiring harness.



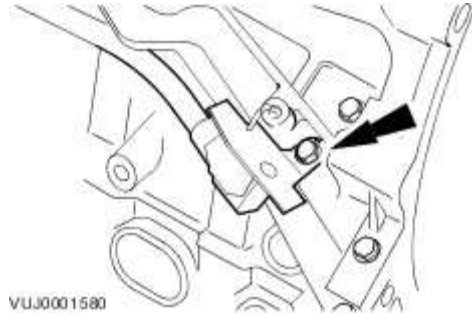
174 . Attach the engine wiring harness.



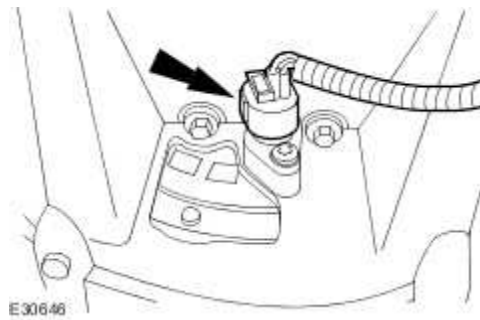
175 . Attach the engine wiring harness.



176 . Attach the engine wiring harness.

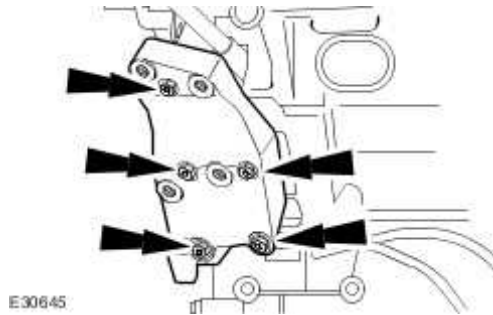


177 . Connect the crankshaft position sensor electrical connector.



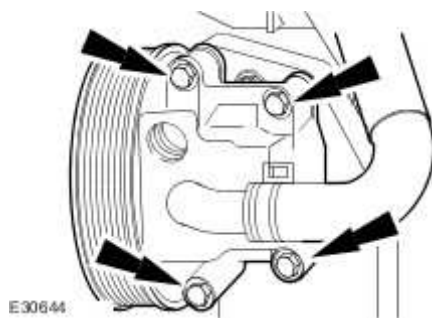
178 . Install the power steering pump mounting bracket.

- Tighten to 25 Nm.



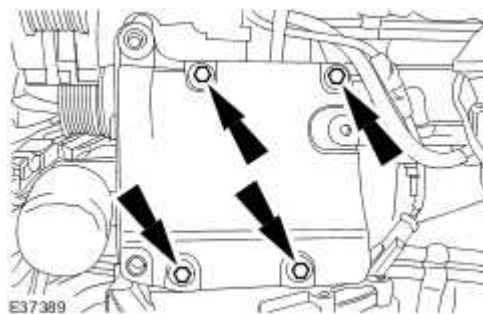
179 . Install the power steering pump.

- Tighten to 25 Nm.



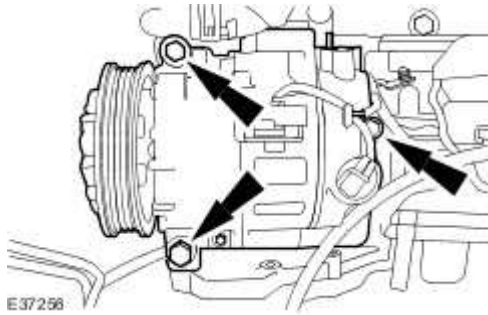
180 . Install the air conditioning compressor mounting bracket.

- Tighten to 25 Nm.

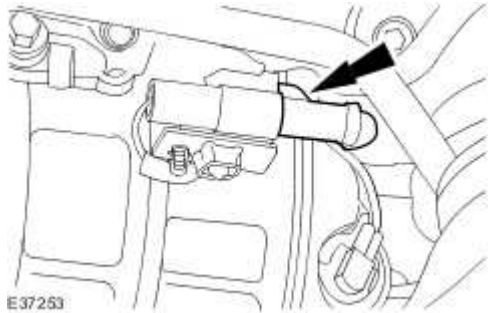


181 . Install the A/C compressor.

- Tighten to 25 Nm.

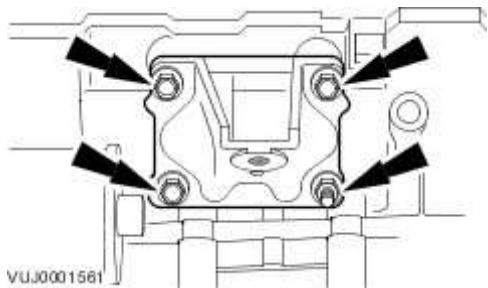


182 . Connect the air conditioning compressor electrical connector.



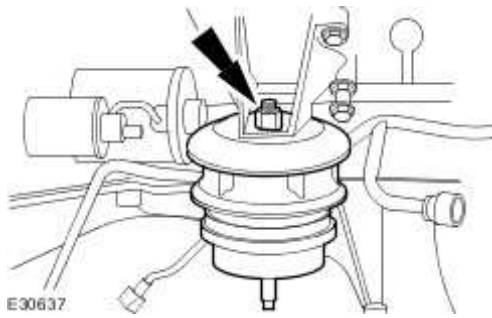
183 . Install the left-hand engine mounting bracket.

- Tighten to 25 Nm.



184 . Install the left-hand engine mount.

- Tighten to 43 Nm.



185



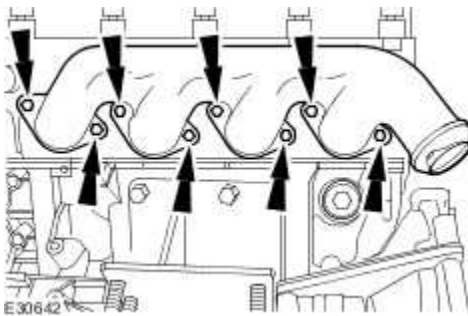
CAUTION: Make sure the exhaust manifold and gasket are correctly aligned to the cylinder head.



CAUTION: Make sure the exhaust manifold torque is checked after initial tighten.

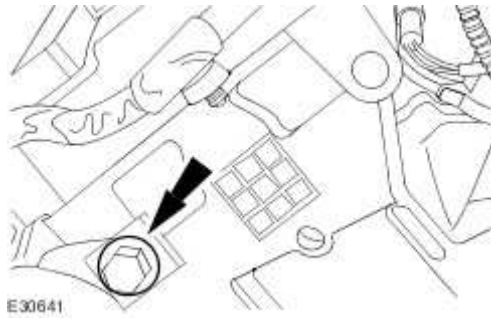
Install the left-hand exhaust manifold.

- Install a new gasket.
- Tighten to 20 Nm.



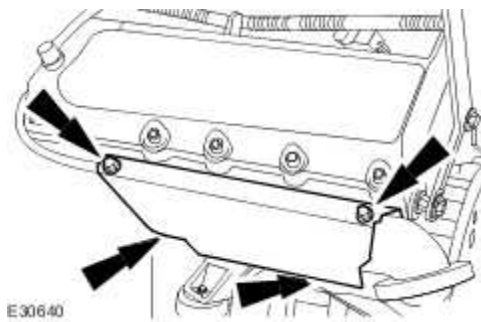
186 . Install the heat shield retaining bolt.

- Tighten to 50 Nm.



187 . Install the heat shield.

- Tighten to 3 Nm.



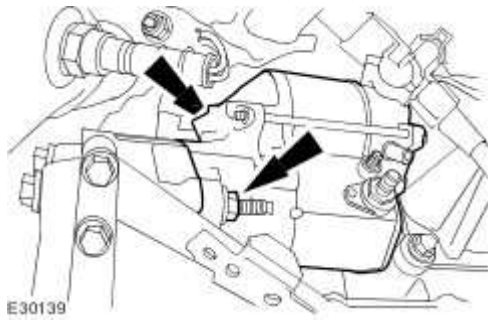
188 . Install the oil level indicator and tube.

- Install a new O-ring seal.
- Tighten to 6 Nm.

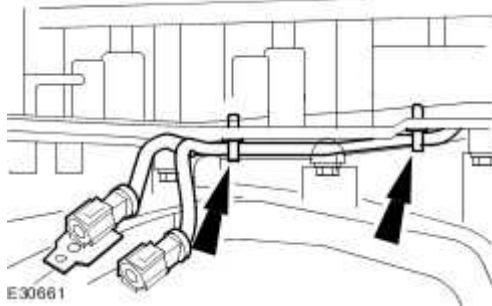


189 . Install the starter motor.

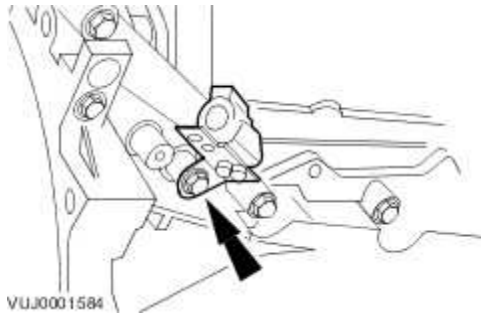
- Tighten to 45 Nm.



190 . Attach the engine wiring harness.

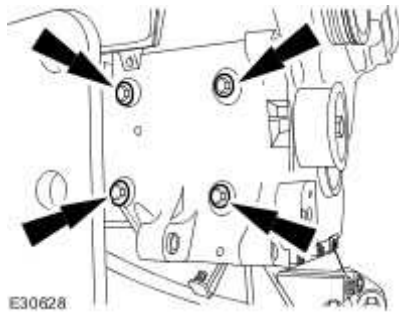


191 . Attach the right hand oxygen sensor retaining bracket.

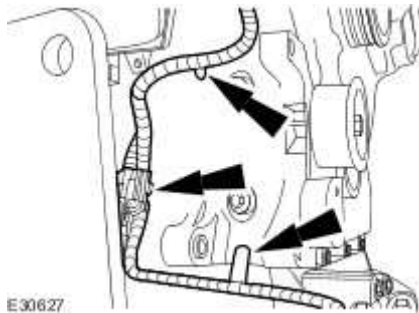


192 . Install the generator mounting bracket.

- Tighten to 45 Nm.

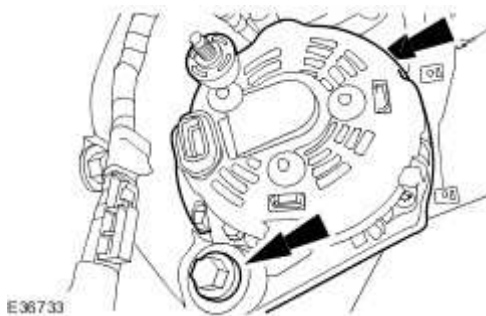


193 . Attach the engine wiring harness.

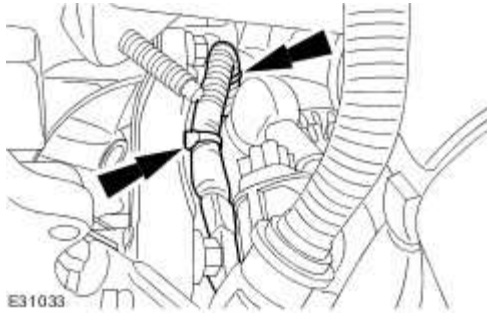


194 . Install the generator.

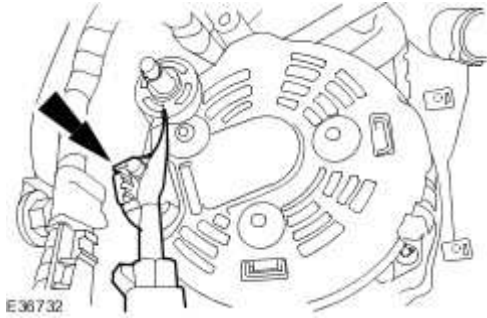
- Tighten the generator upper retaining bolt to 21 Nm.
- Tighten the generator lower retaining bolt to 40 Nm.



195 . Attach the wiring harness.

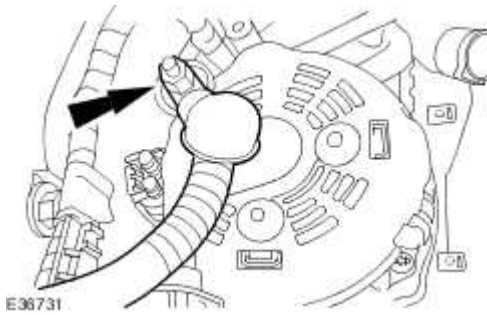


196 . Connect the generator electrical connector.

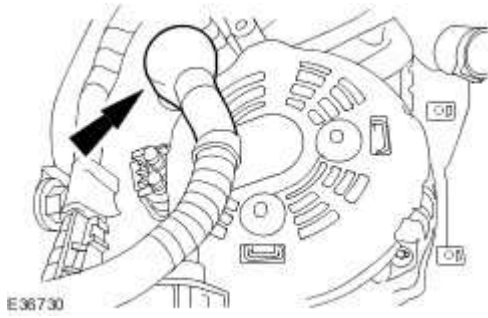


197 . Attach the generator battery positive cable.

- Tighten to 12 Nm

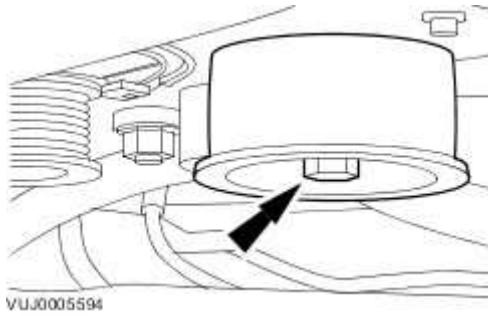


198 . Attach the generator battery positive cable protective cover.



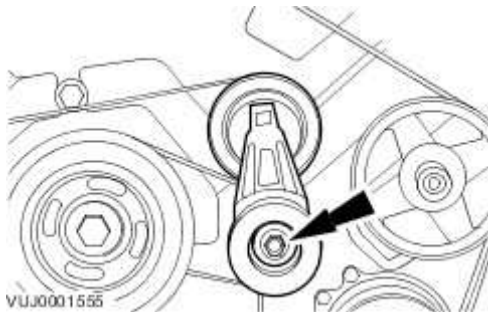
199 . Install the accessory drive belt idler pulley.

- Tighten to 25 Nm.



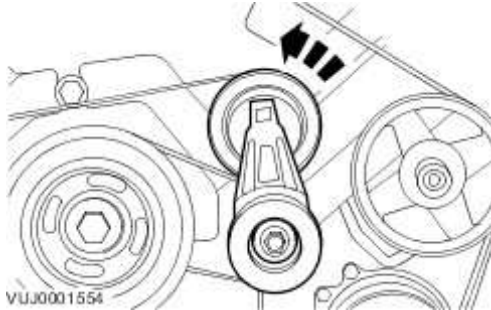
200 . Install the accessory drive belt tensioner.

- Install the accessory drive belt.
- Tighten to 45 Nm.



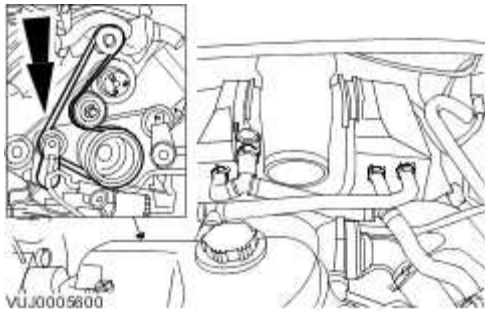
201 . Attach the accessory drive belt.

- Use a 3/8 inch square drive bar to rotate the drive belt tensioner.
- Attach the accessory drive belt.

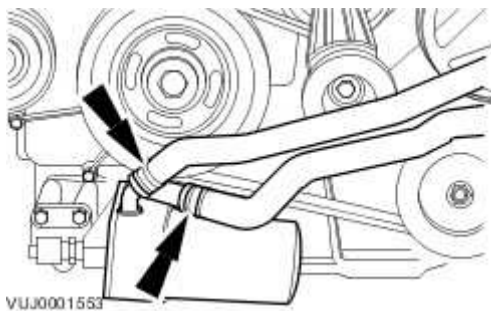


202 . Install the supercharger belt.

- Use a 1/2 inch square drive bar to rotate the supercharger belt tensioner.



203 . Connect the oil cooler hoses.



303-01B : Engine – 4.2L NA V8 – AJV8

Specifications

Specifications

Engine Data

Engine Description	Engine Capacity	Maximum Engine Torque (DIN)	Maximum Engine Power (DIN)	Maximum Engine Torque (EC and SAE)	Maximum Engine Torque (EC and SAE)	Compression Ratio	Bore	Stroke
<ul style="list-style-type: none">90° 'Vee'8 Cylinder32 Valves	4196 cm ³	420 Nm at 4100 RPM	300 BHP / 224 kW / 304 PS at 6000 RPM	410.8 Nm at 4100 RPM	293.5 BHP / 218.9 kW / 298 PS at 6000 RPM	11.0:1 ± 0.5:1	86.0 mm	90.3 mm

Engine Firing Order

Firing Order

1 : 2 : 7 : 3 : 4 : 5 : 6 : 8

Engine Valve Clearance (cold)

Intake Valve	Exhaust Valve
0.18 - 0.22 mm	0.23 - 0.27 mm

Spark Plugs

Specification	Spark Plug Gap
AJ8 4575	0.9 - 1.0 mm

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Core plug and stub pipe retainer	WSK-M2G349-A4
Engine oil, SAE 5W-30	WSS-M2C-913B
Sealant	WSE-M4G323-A4

Capacities

Description	Liters
Engine oil, initial fill	7.8
Engine oil, service fill with oil filter change	7.0

Cylinder head and Valvetrain

Item	Specification
Cylinder head maximum permitted warp (mm)	0.125
Valve guide inner diameter (mm)	5.00 - 5.02
Intake valve effective length (mm)	88.87 - 89.17
Exhaust valve effective length (mm)	88.40 - 88.70
Valve stem to guide clearance intake decimetrical (mm)	0.022 - 0.057
Valve stem to guide clearance exhaust decimetrical (mm)	0.030 - 0.065
Valve head diameter intake (mm)	34.8 - 35.0
Valve head diameter exhaust (mm)	30.8 - 31.0
Intake valve face angle (degrees)	45° 15' 30" ± 7° 30'
Exhaust valve face angle (degrees)	45° - 44° 45'
Valve stem diameter intake (mm)	4.963 - 4.978
Valve stem diameter exhaust (mm)	4.955 - 4.970
Valve spring free length (mm)	43.5 MAX
Valve spring installed height (mm)	33.20
Camshaft lobe lift intake (mm)	8.50
Camshaft lobe lift exhaust (mm)	8.50
Camshaft journal to cylinder head bearing surface clearance diametrical (mm)	* Front bearing 0.045 - 0.085 * Other bearings 0.055 - 0.075
Camshaft journal diameter standard runout	* Center bearing to outer bearings 0.07 * Other

limit (mm)	bearings to outer bearings 0.05
Camshaft journal diameter standard out of round (mm)	0.005

Torque Specifications

Description	Nm	lb-ft	lb-in
Camshaft bearing caps - bolt	10	7	88
Camshaft exhaust sprocket	A	-	-
Connecting rod to bearing cap - bolt	A	-	-
Coolant drain in engine block - plug M10 x 16	25	18	-
Crankshaft damper pulley - bolt	320	236	-
Cylinder head - bolt	A	-	-
Engine cover (top)	4	3	35
Engine cover (top) mounting bracket - nut	6	4	53
Engine mounting to engine mounting bracket - nut	48	35	-
Engine mounting to subframe - nut	63	46	-
Engine mounting bracket to engine - bolt	40	30	-
Engine wiring harness bracket - nut/bolt	10	7	88
Exhaust manifold - bolt	A	-	-
Exhaust manifold heat shield - bolt	3	2	27
Flexplate - bolt	A	-	-
Intake manifold - bolt	21	19	-
Lifting eye (front) - bolt	30	22	-
Lifting eye (rear) - bolt	40	30	-
Oil cooler to oil filter housing	58	43	-
Oil filter	17	12	-
Oil filter housing to engine - bolt	21	15	-
Oil level indicator tube - nut	6	4	53
Oil pan to oil pan body - bolt	A	-	-
Oil pan body to engine	A	-	-
Oil pan drain plug	23	17	-
Oil pump pick-up pipe to oil pan body - bolt	12	9	-
Oil pump to engine block - bolt	12	9	-
Oil pump to pick-up pipe - bolt	12	9	-
Piston cooling jet - bolt	9	7	80
Plug - M30 x 12 to engine block	50	37	-
Plug (flanged) - M30 - 1.5 x 20 to engine block	50	37	-

Primary timing chain tensioner - bolt	11	8	-
Primary timing chain tensioner, guide blade - bolt	11	8	-
Radio frequency interference suppressor to engine cover bracket - bolt	10	7	88
Secondary timing chain tensioner - bolt	11	8	-
Timing belt cover - bolt	A	-	-
Valve cover - bolt	A	-	-
Variable camshaft timing, oil control solenoid housing - bolt	21	15	-
Variable camshaft timing, oil control solenoid housing - nut	11	8	-
Variable camshaft timing sprocket - center bolt	A	-	-
A = refer to procedure for correct torque sequence			

Valve Clearance Adjustment (12.29.48)

Special Service Tools



E65896

Tappet hold-down tool
303-540



E65897

Tappet hold-down tool adaptor
303-540/02



DWST074

Fan nozzle - air gun
303-590



CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



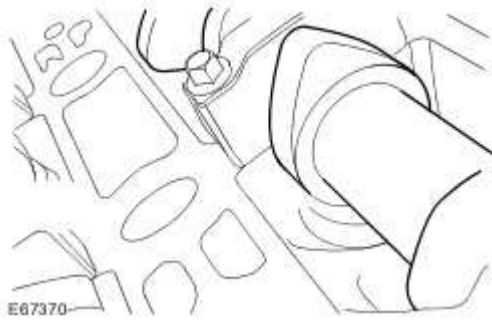
CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Remove the cover and disconnect the battery ground cable.

2. Check the valve clearances.

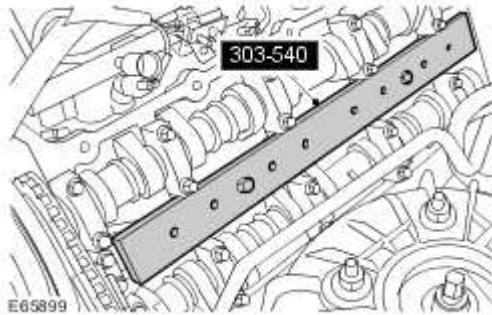
Valve Clearance Check (12.29.47)

3. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.



4. Install the special tool 303-540, to the cylinder head.

- Tighten the 2 bolts to 10 Nm (7 lb.ft).



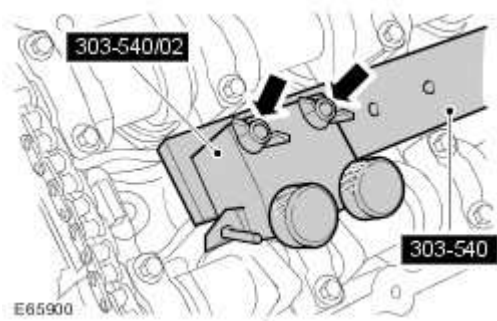
5.



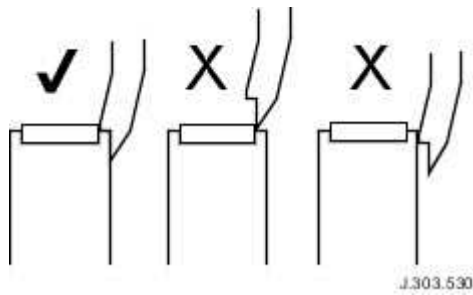
CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

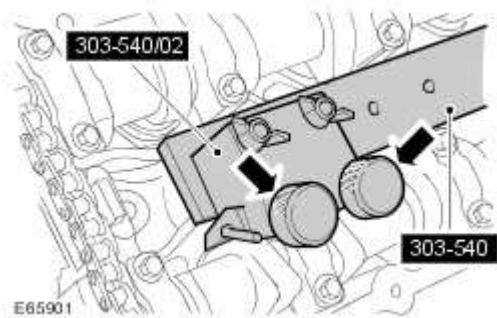
- Secure with the 2 wing nuts.



6. Position the special tool to the tappet as shown.



7. Using the special tool, compress the valve spring.



8.



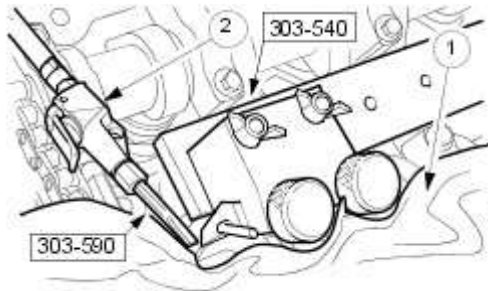
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



E31420

9.



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

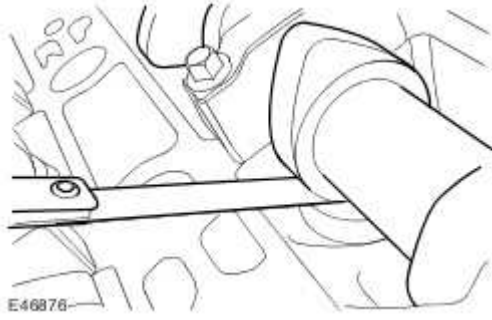


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- Clean the components.
- Lubricate the shim with clean engine oil.
- Release and remove the special tools as required.

10. Using the feeler gauge set, measure the clearance between the camshaft and the valve tappet.



11. Repeat the above procedure for the remaining valves.

Valve Clearance Check (12.29.47)

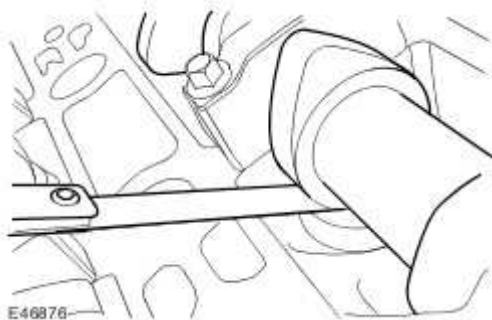


CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.



CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

1. Remove the cover and disconnect the battery ground cable.
2. Remove the LH valve cover.
[Valve Cover LH \(12.29.43\)](#)
3. Remove the RH valve cover.
[Valve Cover RH \(12.29.44\)](#)
4. Rotate the engine clockwise to position the camshaft lobe away from the valve tappet
5. Using the feeler gauge set, measure the clearance between the camshaft and the valve tappet.



6. Repeat the above procedure for the remaining 31 tappets.
7. Adjust the clearance as necessary.

8. For cylinder head data, refer to specifications.

9. Install the RH valve cover.

[Valve Cover RH \(12.29.44\)](#)

10. Install the LH valve cover.

[Valve Cover LH \(12.29.43\)](#)

11. Connect the battery ground cable and install the cover.

Engine Oil Draining and Filling

Special Service Tools



Wrench, Oil filter
303-752



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.



CAUTION: Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

NOTE:

Clean the components general area prior to dismantling.

1. Remove the cover and disconnect the battery ground cable.

Specifications

2.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the engine undershield.

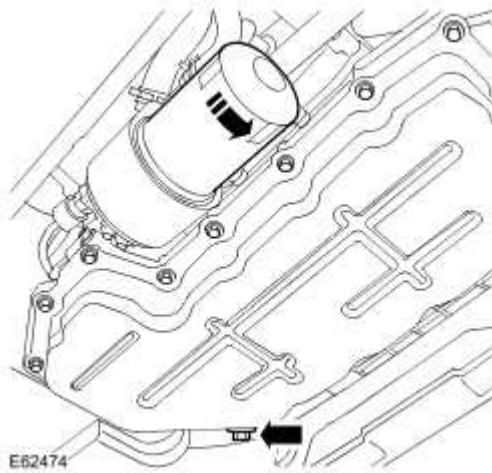
Air Deflector (76.11.41)

4. Remove the oil pan drain plug.

- Position a container to collect the fluid.
- Discard the oil pan drain plug seal.

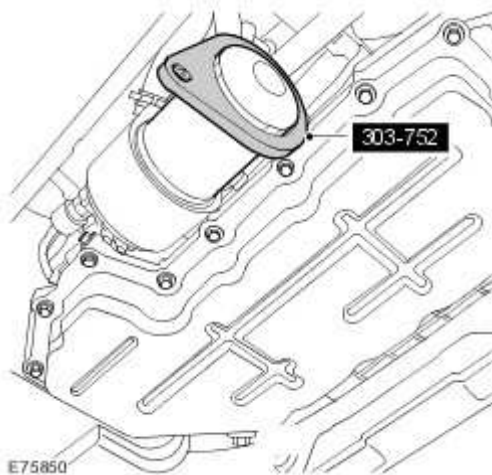
5. Remove the oil filter.

- Position a container to collect the fluid.
- Discard the oil filter.



6. Using the special tool, install the oil filter.

- Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm (13 lb.ft).



7. Tighten the drain plug to 25 Nm (18 lb.ft).

- Install a new seal.

8. Fill the engine with oil.

9. Connect the battery ground cable and install the cover.

Specifications

10. Start engine and run at idle speed until the oil pressure warning light extinguishes.

- Stop the engine.
- Check for leaks.

11. Install the engine undershield.

Air Deflector (76.11.41)

12. Check and top-up the engine oil.

Engine

EXTERNAL VIEW



E63164

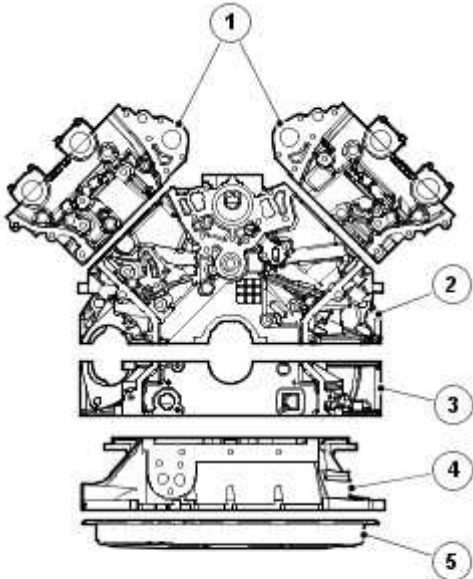
INTRODUCTION

The V8 petrol engine is a 4.2 liter, 8 cylinder, 90 degrees 'V' unit, with 4 valves per cylinder, operated by 2 overhead camshafts per cylinder head. The engine emissions comply with ECD4 (European Commission Directive) and US Federal Tier2 Bin 5 legislative requirements and employs catalytic

converters, electronic engine management control and positive crankcase ventilation to limit the emission of pollutants. The cooling system is a low volume, high velocity system. The Engine Control Module (ECM) controls the fuel injection system, the ignition system and the electric throttle.

The cylinder block is of aluminium alloy construction with cast iron liners. A cast aluminium bedplate is bolted to the bottom of the block to improve lower structure rigidity. The cylinder heads are cast aluminium with thermo-plastic camshaft covers. A pressed steel sump pan is bolted to the cast aluminium structural sump. The fabricated stainless steel twin skin exhaust manifolds are unique for each cylinder bank. A moulded plastic acoustic cover is fitted over the upper engine to reduce engine-generated noise.

Engine Structure



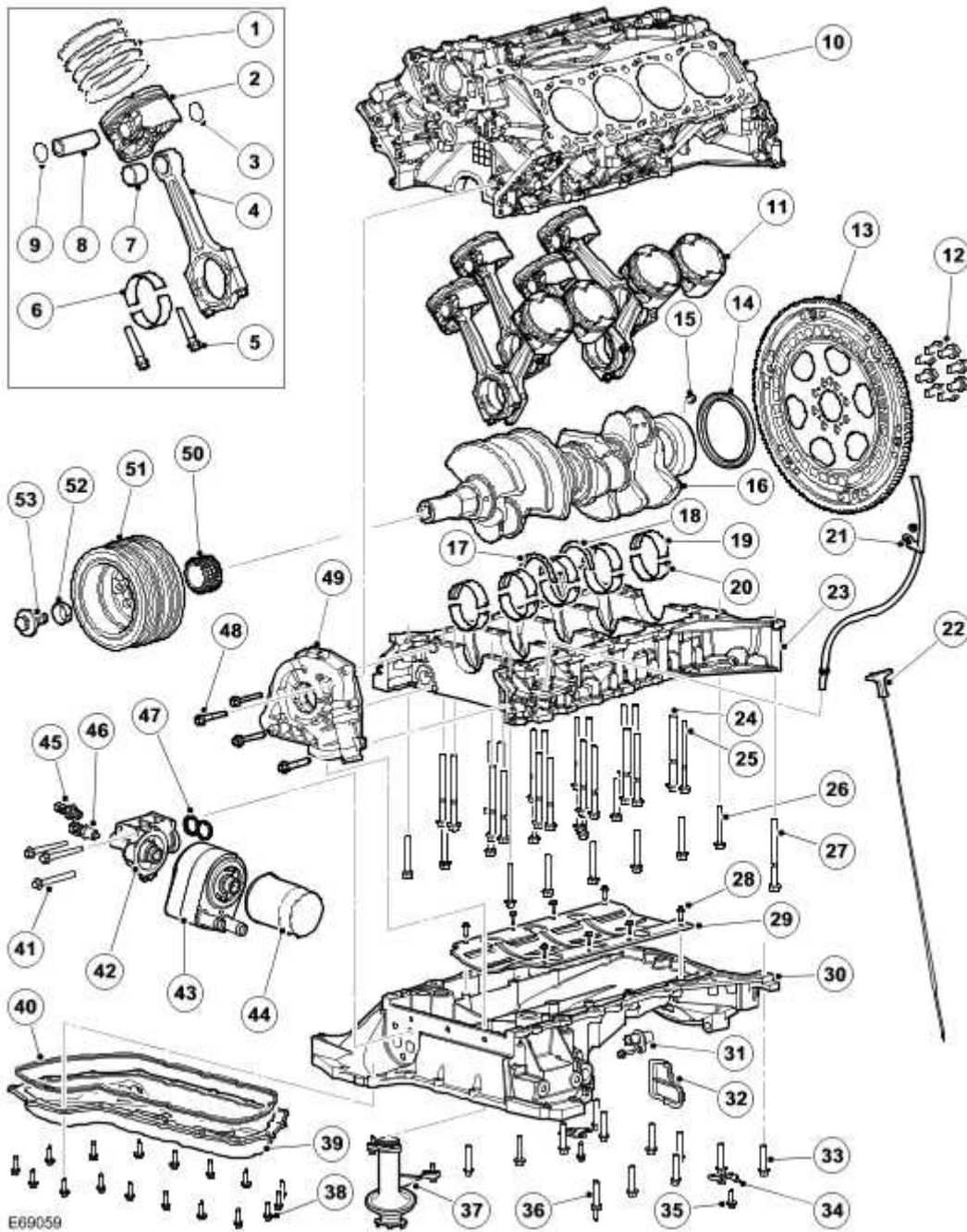
E71998

Item	Part Number	Description
1		Cylinder head (2 off)
2		Cylinder block
3		Bedplate
4		Structural sump
5		Sump pan

Technical Features

- An 8-cylinder 90-degree 'V' configuration liquid cooled aluminium cylinder block with cast iron liners
- Pistons are of open-ended skirt design, with two compression rings and a three-piece oil control ring
- Two aluminium cylinder heads, each incorporating two camshafts manufactured in chilled cast iron
- Four valves per cylinder
- Graded valve lifters (shimless)
- Top fed, 8-hole fuel injectors
- Engine front cover manufactured from aluminium, accommodating the crankshaft front oil seal
- Primary and secondary chain drive for the camshafts
- An aluminium bedplate
- A cast iron crankshaft
- Fracture-split connecting rods in sintered-forged steel
- A twin multi-vee belt, driving the front-end accessories
- Fabricated stainless steel twin skin exhaust manifolds
- An advanced engine management system incorporating electronic throttle control
- Meets with the fault handling requirements, as detailed in the European On-Board Diagnostic (EOBD) III, US Federal OBD and California OBDII legislation.

CYLINDER BLOCK COMPONENTS



Item	Part Number	Description
1		Piston rings
2		Piston
3		Circlip
4		Connecting rod

5		Bolts (16 off)
6		Connecting rod bearing shells
7		Bearing
8		Gudgeon pin
9		Circlip
10		Cylinder block
11		Pistons
12		Bolts (8 off)
13		Flywheel
14		Seal
15		Dowel
16		Crankshaft
17		Thrust washer
18		Thrust washer
19		Bearing shells - upper
20		Bearing shells - lower
21		Oil level gage tube
22		Oil level gage
23		Bedplate
24		Bolts (10 off)
25		Bolts (10 off)
26		Bolts (12 off)
27		Bolt

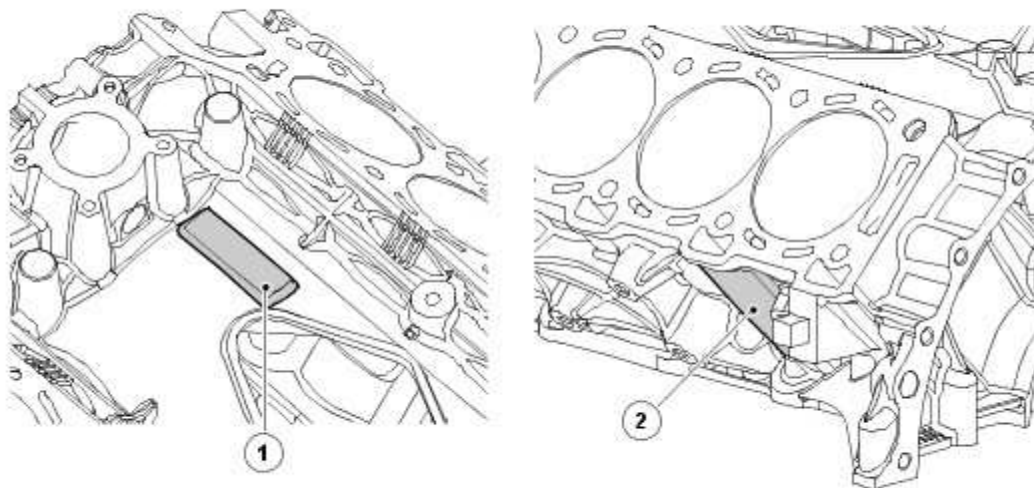
28		Bolts (8 off)
29		Windage tray
30		Sump
31		Crankshaft Position (CKP) sensor
32		Flange
33		Bolts (11 off)
34		Clip
35		Bolts (2 off)
36		Stud
37		Oil pick-up pipe
38		Bolts (17 off)
39		Sump pan
40		Gasket
41		Bolts (3 off)
42		Oil filter head assembly
43		Engine oil cooler
44		Oil filter
45		Oil pressure switch
46		Engine coolant temperature sensor
47		Seal
48		Bolts (4 off)
49		Oil pump
50		Crankshaft sprocket

51		Crankshaft pulley
52		Taper collet
53		Crankshaft bolt

Cylinder Block

The cylinder block is an 'Enclosed V' design, which provides an inherently rigid structure with good vibration levels. A low volume coolant jacket improves warm-up times and piston noise levels; the longitudinal flow design of the jacket, with a single cylinder head coolant transfer port in each bank, improves rigidity and head gasket sealing. The right hand cylinder bank is designated as 'A' bank, and the left hand as 'B' bank. The cylinder bores are numbered from 1 to 4, for bank 'A' and 5 to 8 for bank 'B', starting from the front of the engine.

Engine Data Locations



E43426

Item	Part Number	Description
1		Engine part number
2		Engine data (main bearing diameters, cylinder bore diameters, etc), emissions code and engine number

Engine data is marked at 3 locations, 2 on the cylinder block (shown) and 1 on the engine front cover,

which consists a label displaying the engine number. Component diameters are represented by alpha and numeric codes; keys to the codes are in the Service Repair Procedures (SRP) sections of this manual.

Connecting Rods and Pistons

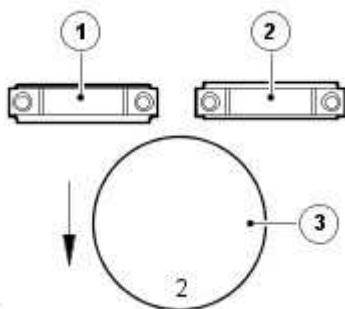


E43427

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is marked on adjoining sides of the joint to identify matching connecting rods and bearing caps. The connecting rod bearings are aluminium/tin split plain bearings.

The pistons are of the open-ended skirt design with a dished crown. Three piston rings, two compression and one three-piece oil control ring, are installed on each piston. Each piston is installed on a gudgeon pin located in a bronze bushing in the connecting rod.

Connecting Rod and Piston Installation



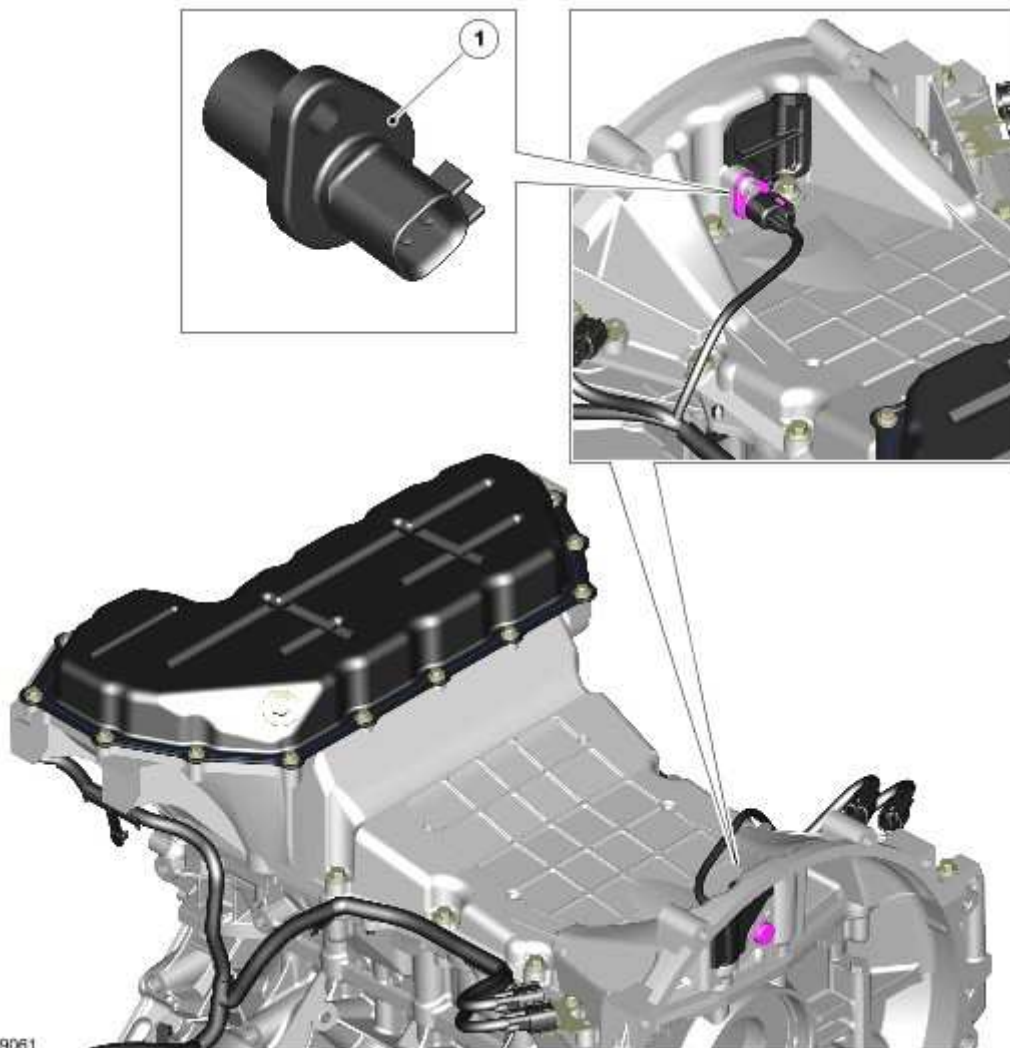
E43428

Item	Part Number	Description
1		Bank A (RHS)
2		Bank B (LHS)
3		Piston

The piston grade number is stamped on the crown of the piston and must coincide with that for each cylinder bore. The piston must be assembled in the correct orientation for the designated cylinder bore:

- Bank 'A' - piston grade number and the thick flange of the connecting rod must face the front of the engine
- Bank 'B' - piston grade number and the thin flange of the connecting rod must face the front of the engine

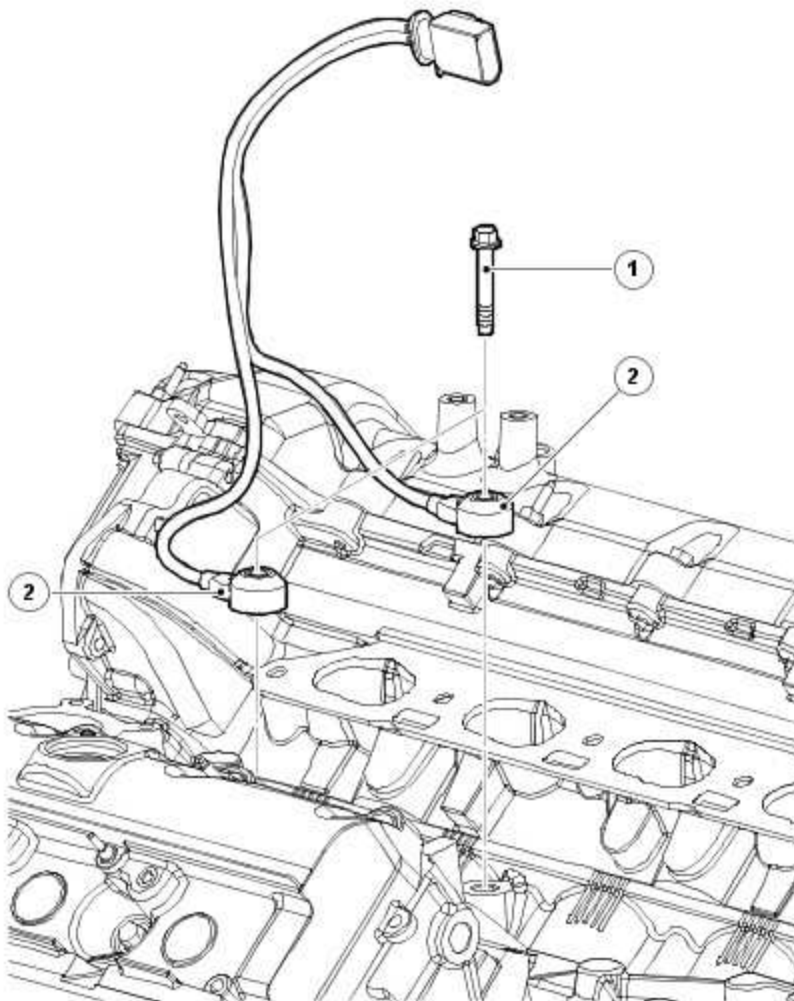
Crankshaft Position Sensor



Item	Part Number	Description
1		Crankshaft Position (CKP) sensor

The CKP sensor is installed at the rear of the sump. It is a variable reluctance sensor that provides an input of engine crankshaft speed and position. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

Knock Sensors

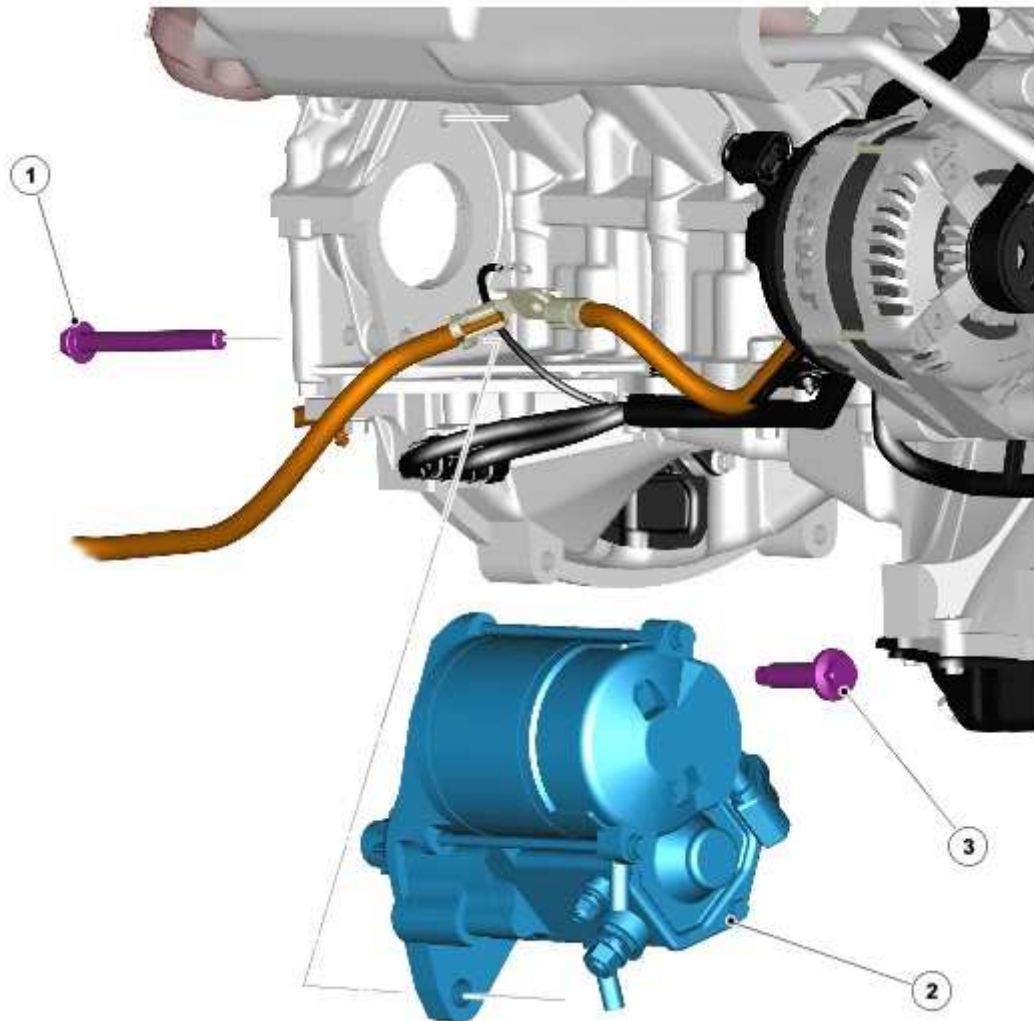


E43430

Item	Part Number	Description
1		Bolts (2 off)
2		Knock sensor

The knock sensors are installed in the cylinder block on the inboard side of each cylinder bank. They are piezo-electric sensors that provide inputs to detect and locate detonation during combustion. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

Starter Motor



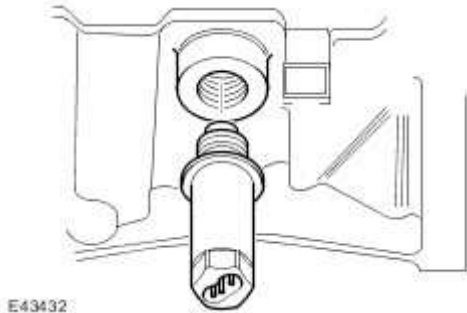
E69D62

Item	Part Number	Description
1		Bolt
2		Starter motor
3		Bolt

The engine starter motor is installed at the rear right side of the engine, at the cylinder block to

bedplate split line. For additional information, For additional information, refer to Starting System (303-06 Starting System)

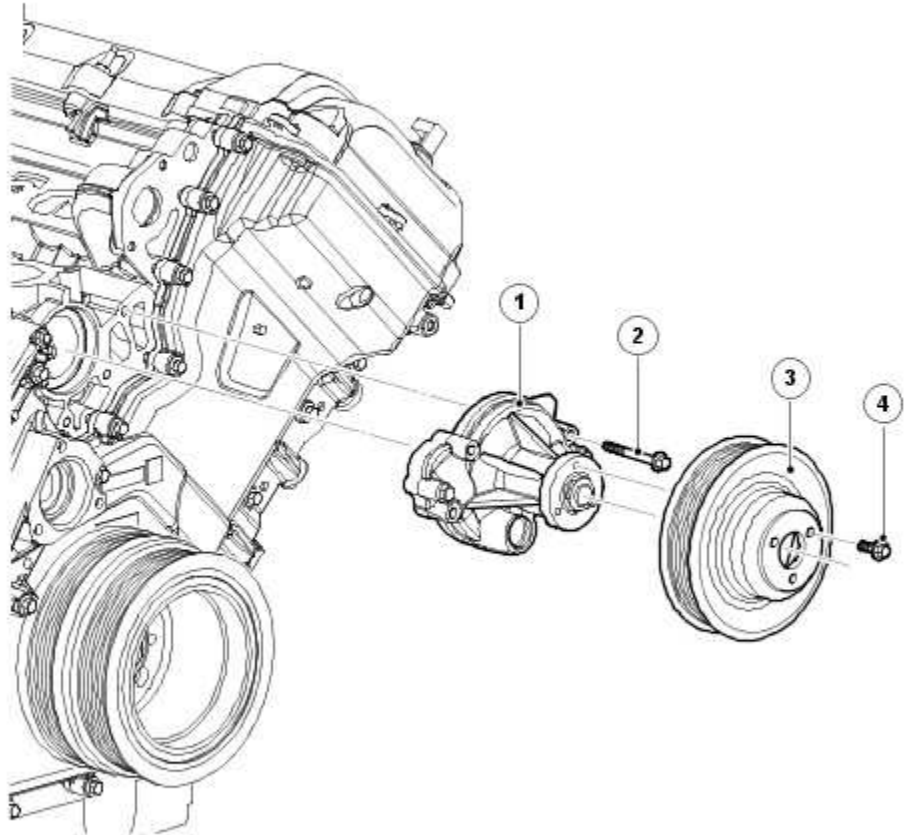
Coolant Drain Plug/Block Heater



A coolant drain plug is installed on the rear left side of the cylinder block. On vehicles with the cold climate package, the cylinder block heater replaces the drain plug.

On vehicles destined for Canada, the coolant heater is installed during engine manufacture. For Scandinavian vehicles the heater is supplied in kit form to be installed at the dealership.

Coolant Pump

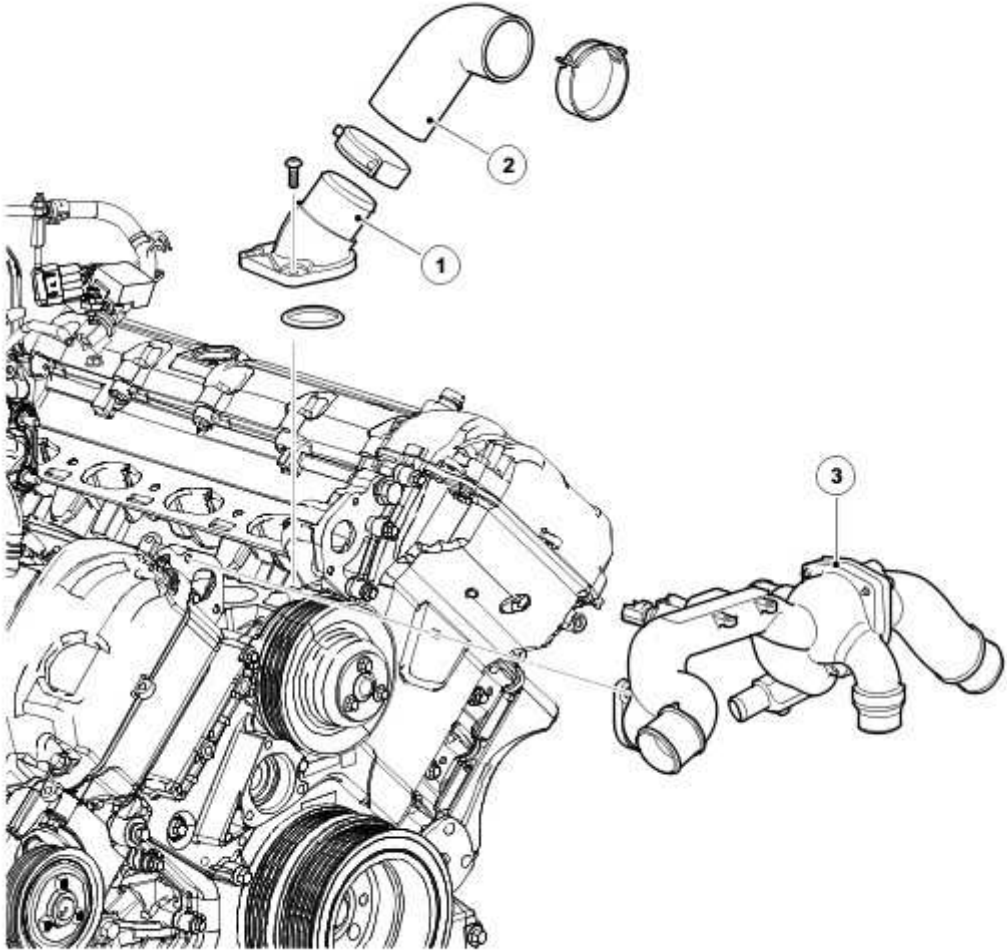


E43433

Item	Part Number	Description
1		Coolant pump
2		Bolts (4 off)
3		Pulley
4		Bolts (3 off)

The coolant pump is installed between the 2 cylinder banks, on the front face of the cylinder block.

Coolant Inlet and Outlet Assembly

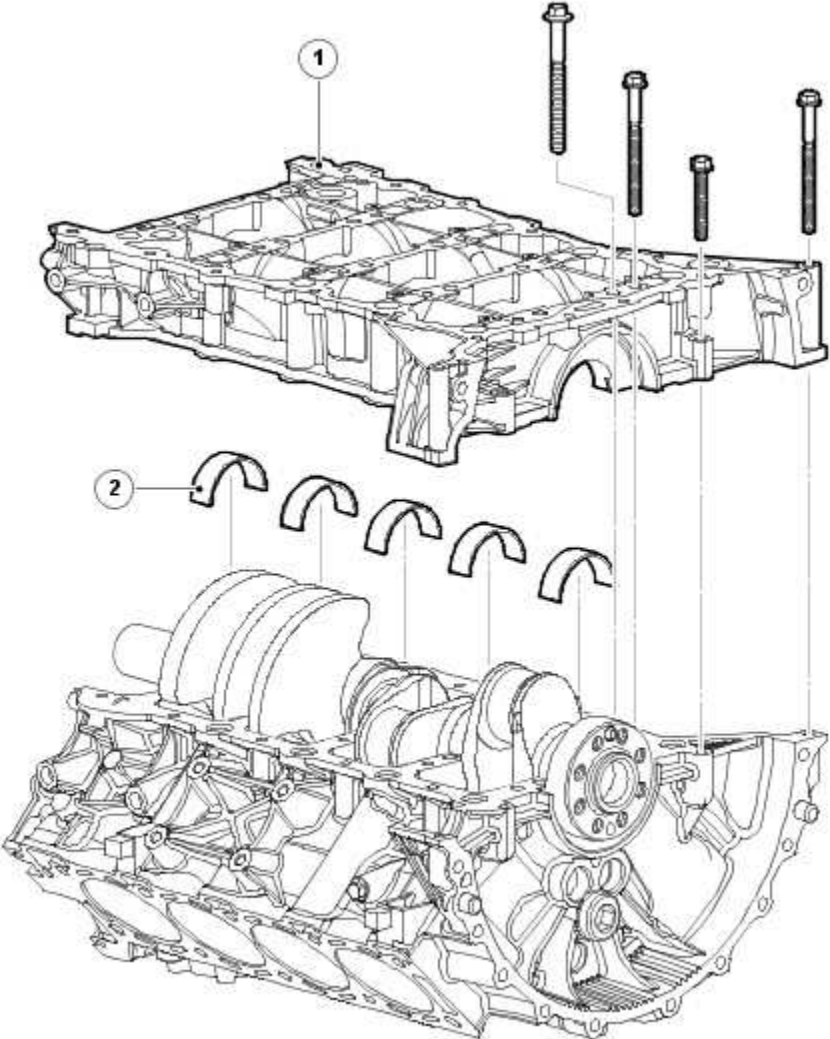


E56199

Item	Part Number	Description
1		Coolant outlet elbow
2		Coolant hose
3		Thermostat housing

The thermostat housing and coolant outlet duct are combined into an aluminium alloy coolant outlet assembly, which is installed between the 2 cylinder banks, immediately above the coolant pump. A hose connects the coolant outlet assembly to a coolant inlet housing attached to the coolant pump intake on the cylinder block. The thermostat controls the flow of coolant through the radiator.

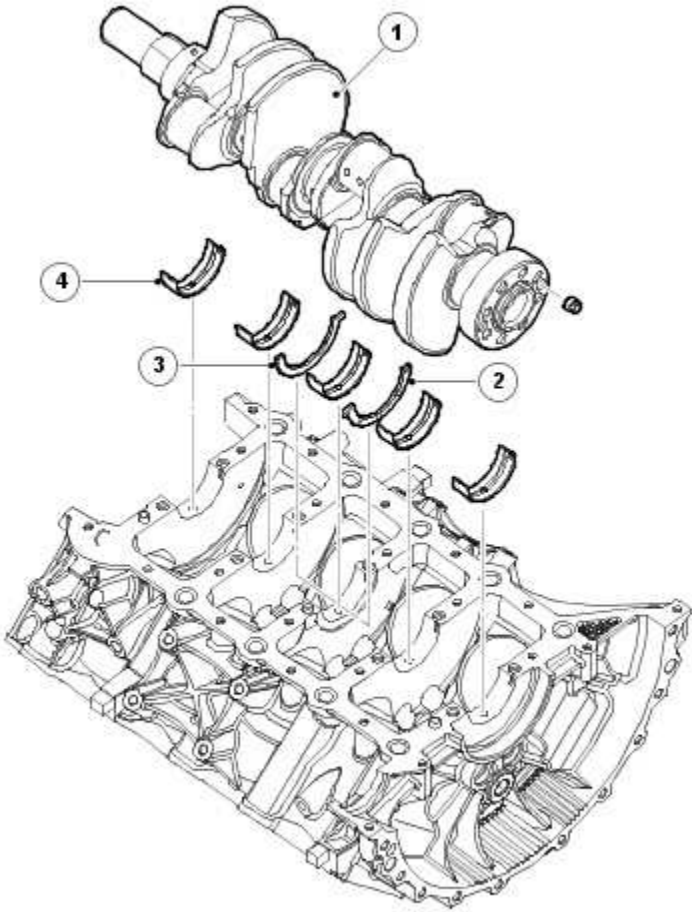
CRANKSHAFT AND SUMP COMPONENTS



E43435

Item	Part Number	Description
1		Bedplate
2		Main bearings - lower (5 off)

Crankshaft and Main Bearings



E43436

Item	Part Number	Description
1		Crankshaft
2		Thrust washer
3		Thrust washer
4		Main bearings - upper (5 off)

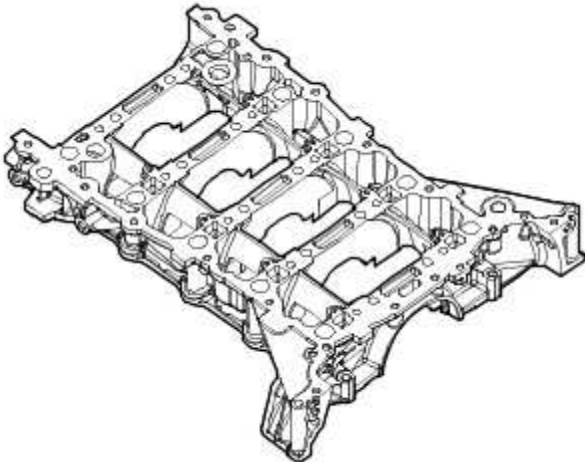
Six counter-balance weights ensure good vibration levels from the 4 throw, 5 bearing crankshaft. Manufactured in cast iron, the crankshaft also has undercut and rolled fillets for improved strength.

The crankshaft rear oil seal is a press fit in the bedplate to cylinder block interface.

The main bearings are aluminium/tin split plain bearings. An oil groove in the upper half of each

bearing transfers the oil into the crankshaft for lubrication of the connecting rod bearings. An aluminium/tin thrust washer is installed each side of the top half of the centre main bearing.

Bedplate



E43437

The bedplate is a structural casting bolted to the bottom of the cylinder block to retain the crankshaft. The use of a bedplate further improves rigidity. Iron inserts, cast into the main bearing supports of the bedplate, minimise main bearing clearance changes due to heat expansion.

Two hollow dowels align the bedplate with the cylinder block.

Beads of sealant seal the joint between the bedplate and the cylinder block.

Sump



E69060

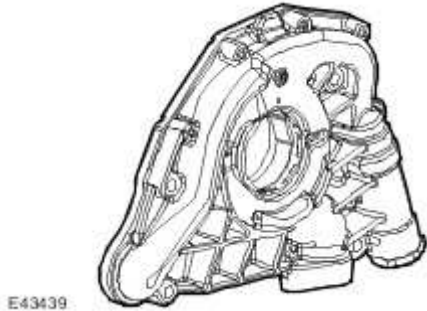
Item	Part Number	Description
1		Pressed steel oil pan
2		Aluminium alloy structural sump

The aluminium alloy structural sump is bolted to the bedplate. A windage tray attached to the underside of the bedplate isolates the oil pan from the disturbed air produced by the rotation of the crankshaft, to prevent oil aeration and improve oil drainage. A rubber plug at the rear of the

structural sump seals the port that provides access to the torque converter securing bolts. The engine oil drain plug is located in the pressed steel oil pan, which attaches to the underside of the aluminium alloy structural sump.

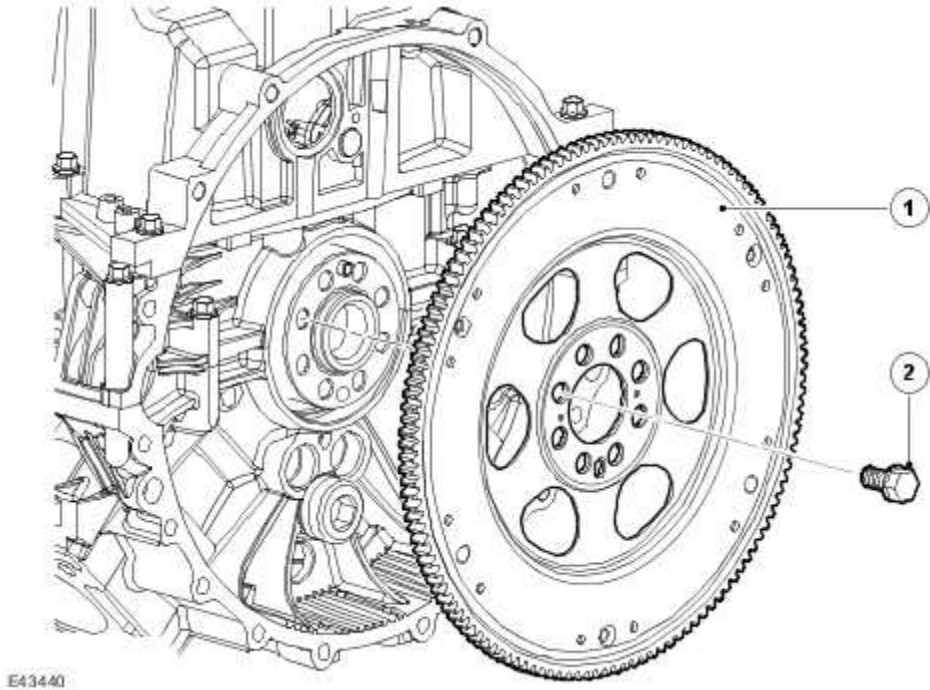
A bead of sealant seals the joint between the structural sump and the bedplate.

Oil Pump



The oil pump is installed on the crankshaft at the front of the engine. The pump outlet port aligns with oil passages in the bedplate (See lubrication section for more information).

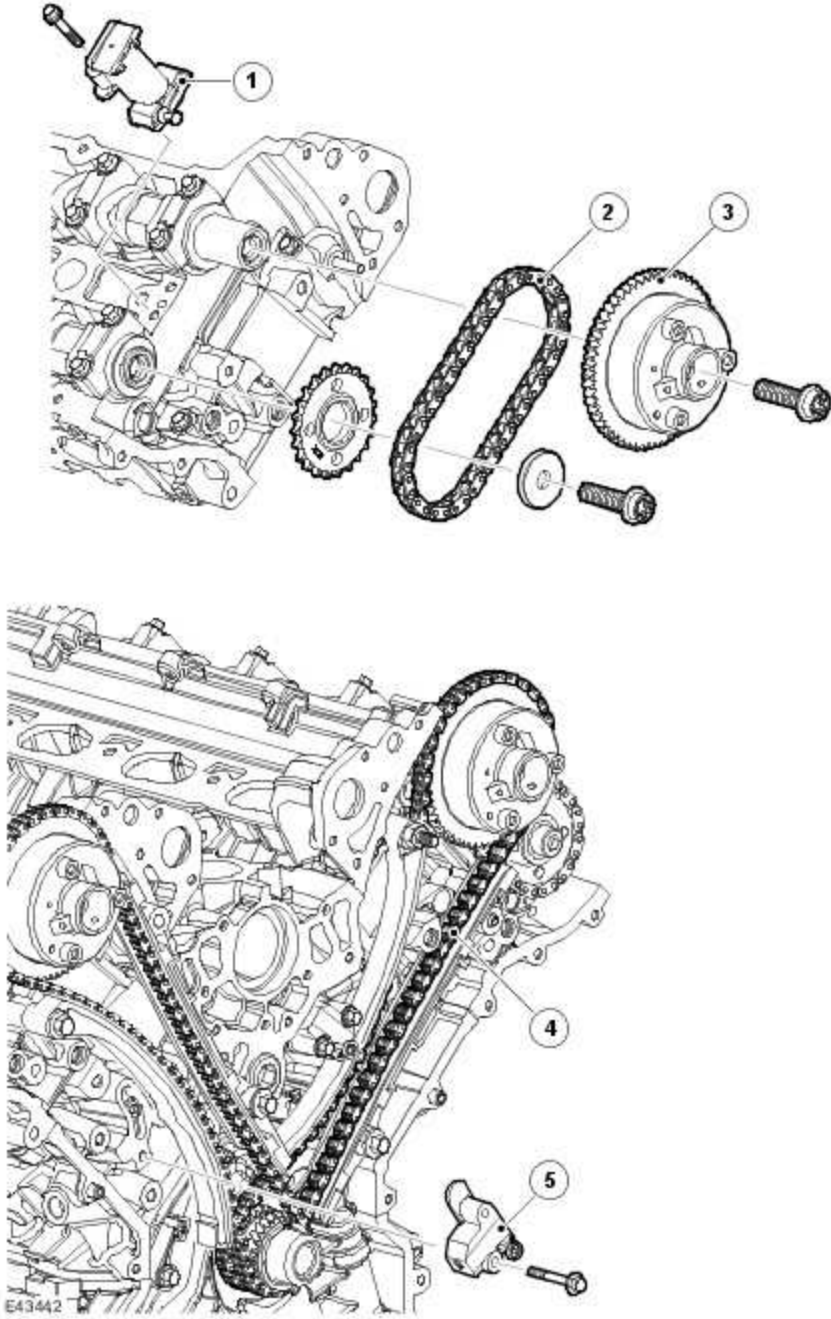
Starter Drive Plate



Item	Part Number	Description
1		Starter drive plate
2		Bolts (8 off)

The starter drive plate is attached to the rear of the crankshaft. A timing disc, for the CKP sensor, is spot welded to the front face of the drive plate.

CAMSHAFT TIMING COMPONENTS



Item	Part Number	Description
1		Secondary chain tensioner
2		Secondary chain

3		Variable valve timing unit
4		Primary chain
5		Primary chain tensioner

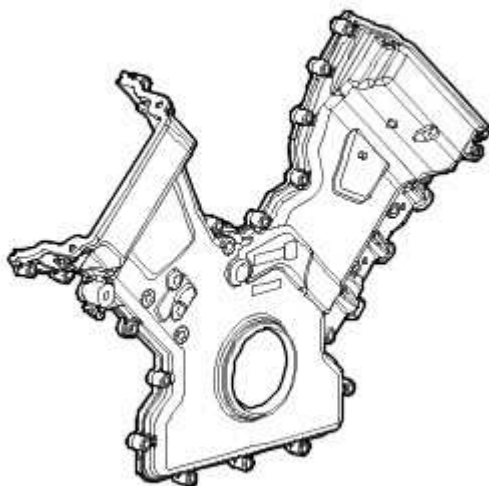
Timing Gear

Multiple link primary and single row secondary chains drive the camshafts of each cylinder bank. The primary chains transmit the drive from 2 sprockets on the crankshaft to variable valve timing units on the intake camshafts. The secondary chains transmit the drive from the variable valve-timing units to sprockets on the exhaust camshafts.

A key locates the 2 drive sprockets on the crankshaft. The crankshaft's torsional vibration damper retains the sprockets in position. The variable valve timing units and the exhaust camshaft sprockets are non-interference, non-keyed fits on their respective camshafts; the drive being transmitted by the face to face friction load produced by the valve timing unit/sprocket securing bolt.

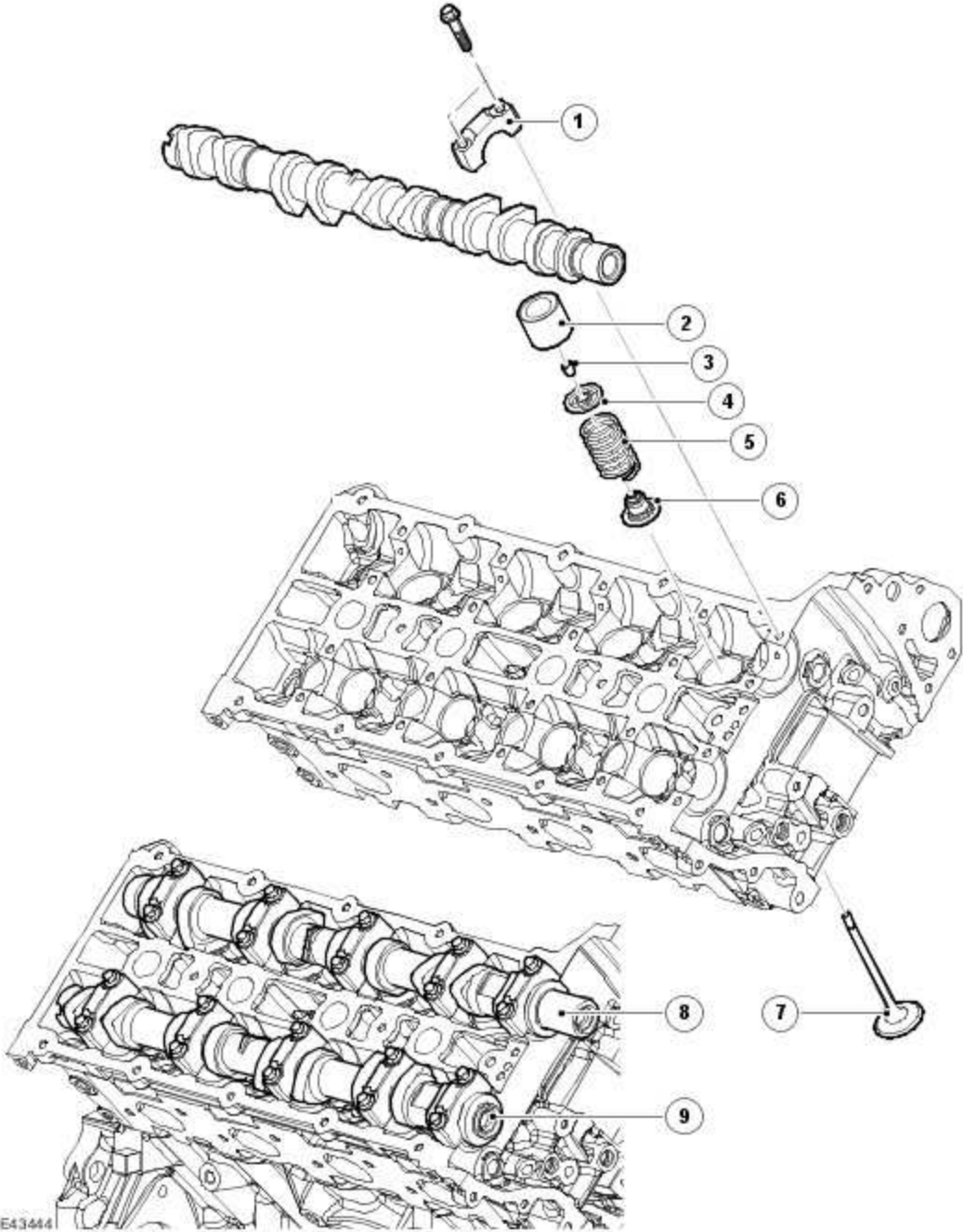
Each chain has a hydraulic tensioner operated by engine oil. The primary chains are lubricated via oil squirt tubes located at the front of the engine block near the crankshaft drive sprockets. A jet of oil from the end of each secondary chain tensioner lubricates the secondary chains. The primary chain tensioners act on pivoting flexible tensioner blades. The secondary chain tensioners act directly on the chains. Guide rails are installed on the drive side of the primary chains.

Timing Cover



The aluminium alloy timing cover accommodates the crankshaft front oil seal (a PTFE lip seal). Silicon rubber in-groove gaskets seal the joint between the timing cover and the front face of the engine.

CYLINDER HEAD COMPONENTS



Item	Part Number	Description
1		Camshaft bearing cap
2		Tappet (shimless)

3		Collet
4		Valve spring cap
5		Valve spring
6		Valve stem oil seal
7		Valve
8		Inlet camshaft
9		Exhaust camshaft

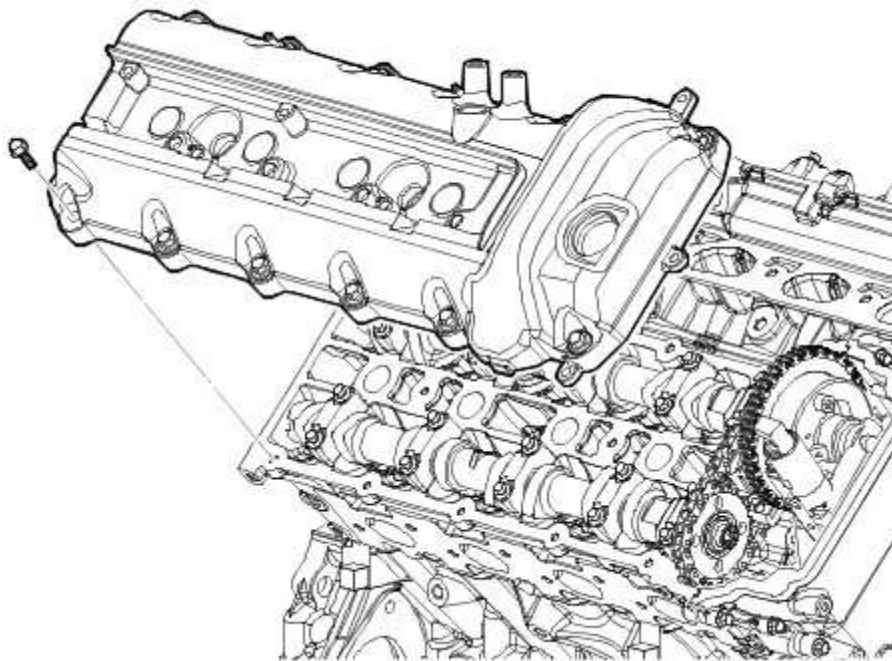
Cylinder Heads

The cylinder heads are unique to each cylinder bank. Deep-seated bolts, to reduce distortion, secure the cylinder heads to the cylinder block. Two hollow dowels align each cylinder head with the cylinder block.

The 14 mm (0.55 in) spark plugs, one per cylinder, locate in recesses down the centre line of each cylinder head.

The engine-lifting eyes are bolted to the cylinder heads, 2 on the rear (1 per head) and 1 at the front.

Camshaft Covers



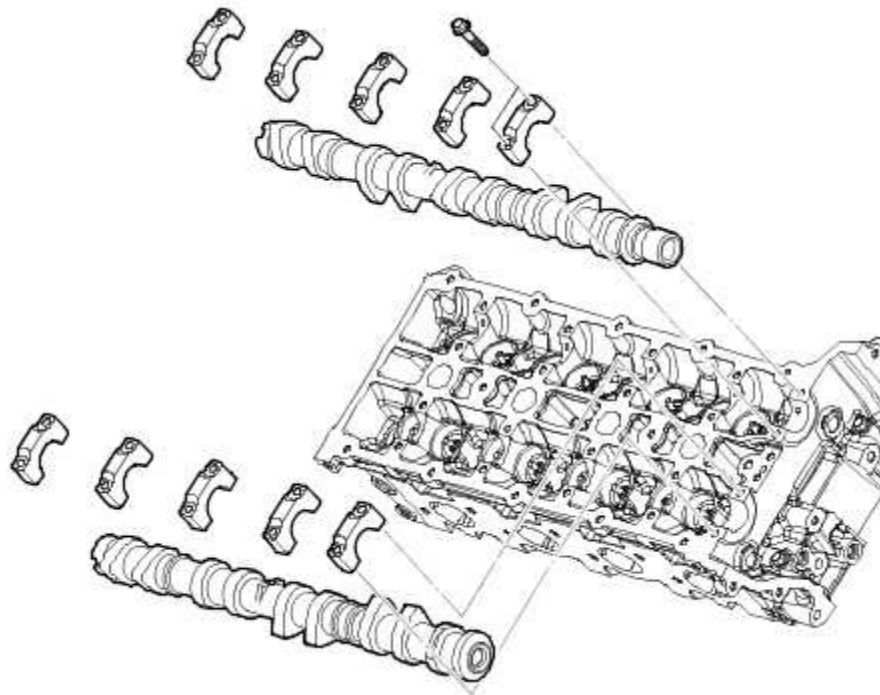
The camshaft covers are manufactured from thermo-plastic. The A bank camshaft cover incorporates an outlet for the part load engine breather and the Pressure Control Valve (PCV). The B bank camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. Identical oil separators are incorporated below the breather outlet in each cover. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

Silicon rubber in-groove gaskets seal the joints between the camshaft covers and the cylinder heads. Together with spacers and seals on the camshaft cover fasteners, they also isolate the covers from direct contact with the cylinder heads, to reduce noise.

Cylinder Head Gasket

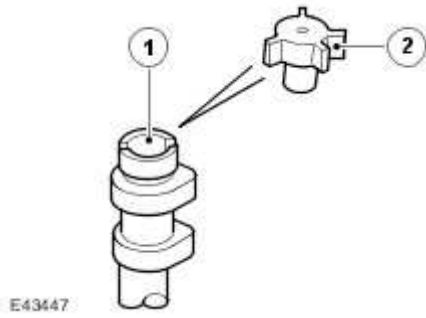
The multi-layered steel cylinder head gasket has cylinder specific water flow cross-sections for uniform coolant flow.

Camshafts



The camshafts are manufactured in chilled cast iron. Five aluminium alloy caps retain each camshaft. Location numbers, 0 to 4 for the intake camshaft and 5 to 9 for the exhaust camshaft, are marked on the outer faces of the caps.

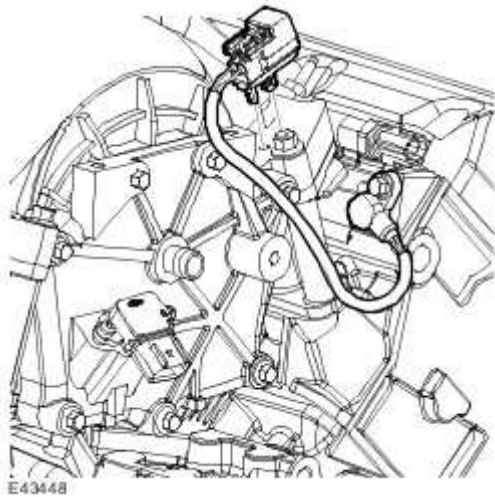
Sensor Ring



Item	Part Number	Description
1		Inlet camshaft
2		Sensor ring

Timing rings for each camshaft position sensor are located at the rear of both intake camshafts. A flat, machined near the front of each camshaft, enables the camshafts to be locked during the valve timing procedure.

Camshaft Position Sensor



The camshaft position sensors are installed in each cylinder head at the rear of the intake camshaft. It is a variable reluctance sensor that provides an input to the ECM regarding the position of the camshaft. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

Inlet and Exhaust Valves

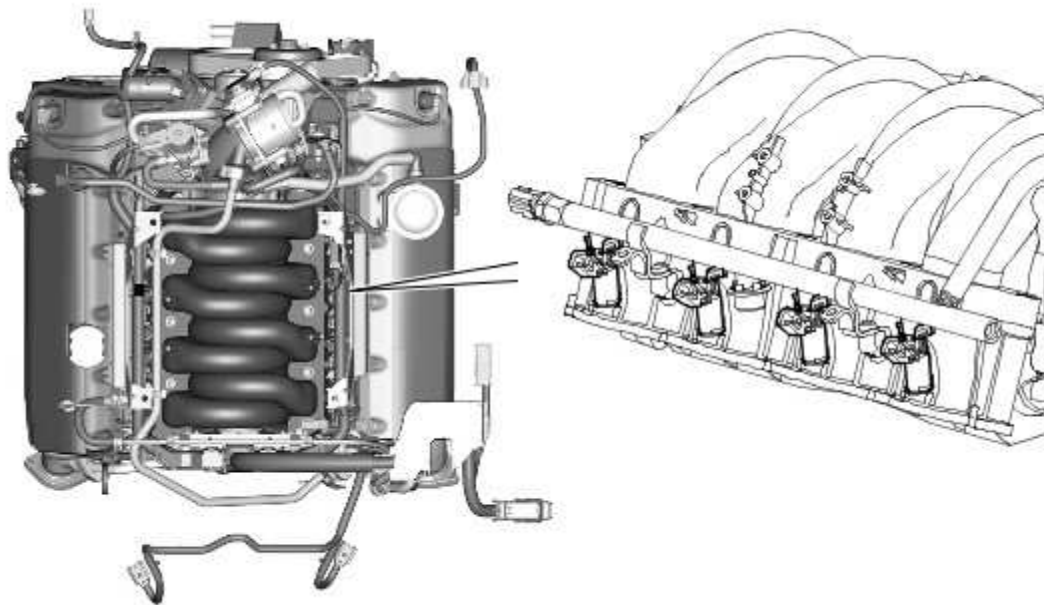
Each cylinder head incorporates dual overhead camshafts operating 4 valves per cylinder via solid shimless valve lifters.

The lightweight valve gear provides good fuel economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.



CAUTION: Due to slight variations in length, the valves are not interchangeable between marques (Land Rover, Jaguar and Aston Martin).

Fuel Injectors



E43449

Eight, top fed, twelve-hole, fuel injectors are installed in the fuel rails. The injectors are electromagnetic solenoid valves controlled by the ECM. Two O-rings seal each injector to manifold interface. The fuel jets from the injectors are directed onto the back of the intake valves. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

VARIABLE VALVE TIMING (VVT)

The continuously VVT unit turns the intake camshaft in relation to the primary chain to advance and retard the timing.

The system improves low and high-speed engine performance, engine idle quality and exhaust emission.

The VVT system changes the phasing of the intake valves, relative to the fixed timing of the exhaust valves, to alter:

- the mass of air flow into the engine's cylinders,
- and the engine's torque response and emissions.

The VVT unit uses a vane device to control the camshaft angle (refer to VVT operation). The system operates over a range of 48 degrees and is advanced or retarded to the optimum angle within this range.

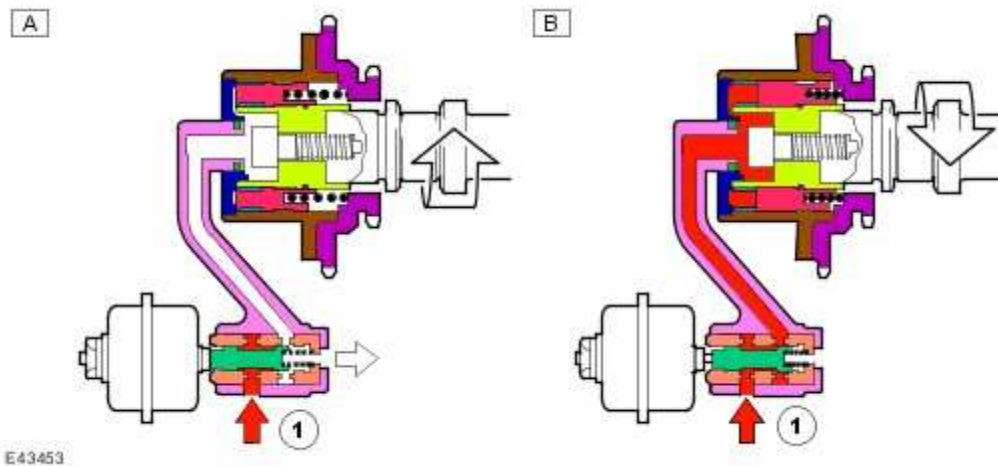
The ECM controls the VVT, using engine speed and load, and engine oil temperature signals to calculate the appropriate camshaft position. For additional information, For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

The continuous VVT system provides the following advantages:

- Reduces engine emissions and fuel consumption by further optimising the camshaft timing, this improves the engine's internal exhaust gas re-circulation (EGR) effect over a wider operating range
- Improves full-load torque characteristics as the camshaft timing is optimised at all engine speeds for superior volumetric efficiency
- Improves fuel economy by optimising torque over the engine's speed range.

This system also has the added benefits of operating at a lower oil-pressure and faster response time when compared to a non-VVT system.

PRINCIPLES OF OPERATION - VARIABLE VALVE TIMING



E43453

Item	Part Number	Description
A		Retarded
B		Advanced
1		Engine oil pressure

The VVT unit is a hydraulic actuator mounted on the end of the intake camshaft, which advances or retards the intake camshaft timing and thereby alters the camshaft to crankshaft phasing. The oil control solenoid, controlled by the ECM, routes oil pressure to either the advance or retard chambers located either side of the three vanes interspersed within the machined housing of the unit.

The VVT unit is driven by the primary chain and rotates relative to the exhaust camshaft sprocket. When the ECM requests the camshaft timing to advance, the oil control solenoid is energized moving the shuttle valve to the relevant position to allow engine oil pressure, via a filter, into the VVT unit's advance chambers. When the camshaft timing is requested to retard, the shuttle valve moves position to allow oil pressure to exit the advance chambers, while simultaneously routing the oil pressure into the retard chambers.

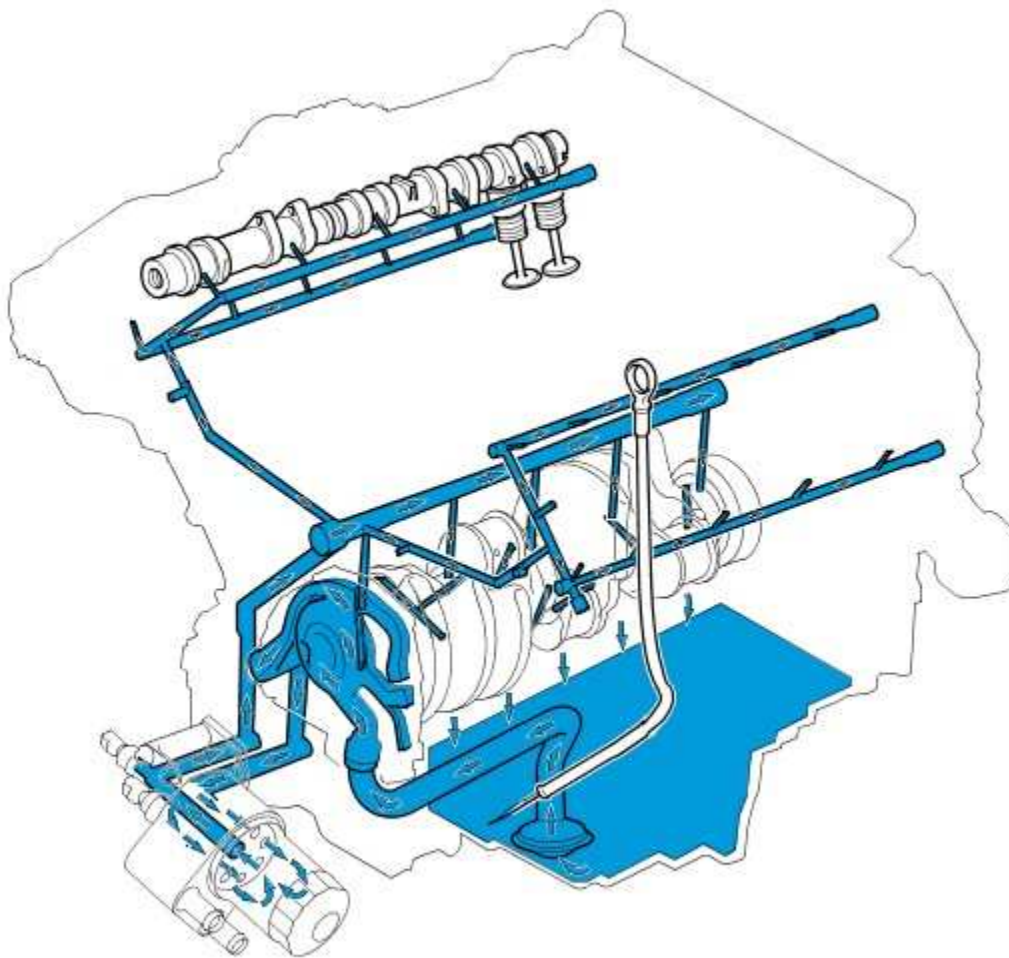
When directed by the ECM, the VVT unit will be set to the optimum position between full advance and retard for a particular engine speed and load. This is achieved when the ECM sends the energising signal to the oil control solenoid until the target position is met. At this point, the energising signal is reduced to hold the solenoid position, and as a result the position of the shuttle valve. This function is under closed-loop control, where the ECM will assess any decrease in shuttle-valve oil-pressure, via signals from the camshaft position sensor. The ECM will increase the energising signal, when required, to maintain the shuttle-valve hold position.

Engine oil properties and temperature can affect the ability of the VVT mechanism to follow demand changes to the cam phase angle. At very low oil-temperatures, movement of the VVT mechanism is

sluggish due to increased viscosity, and at high oil-temperatures the reduced viscosity may impair operation if the oil pressure is too low. To maintain satisfactory VVT performance, an increased capacity oil pump is installed, plus an engine oil temperature sensor to enable monitoring by the ECM. The VVT system is normally under closed-loop control except in extreme temperature conditions, such as cold starts below 0°C. At extremely high oil-temperatures, the ECM may limit the amount of VVT advance to prevent the engine from stalling when returning to idle speed.

The VVT does not operate when engine oil-pressure is below 1.25 bar (18 psi), as there is insufficient pressure to release the VVT unit's internal stopper pin. This usually occurs when the engine is shutting-down and the VVT has returned to the retarded position. The stopper pin locks the camshaft to the VVT unit to ensure camshaft stability during the next engine start-up.

LUBRICATION SYSTEM



E43454

Oil is drawn from the reservoir in the oil pan and pressurised by the oil pump. The output from the oil pump is then filtered, cooled and distributed through internal oil passages.

All moving parts are lubricated by pressure or splash oil. Pressurised oil is also provided for operation of the variable valve timing units and the timing gear chain tensioners.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

System replenishment is through the oil filler cap on the LH camshaft cover.

With the exception of the pump, all oil system components are installed on the structural sump.

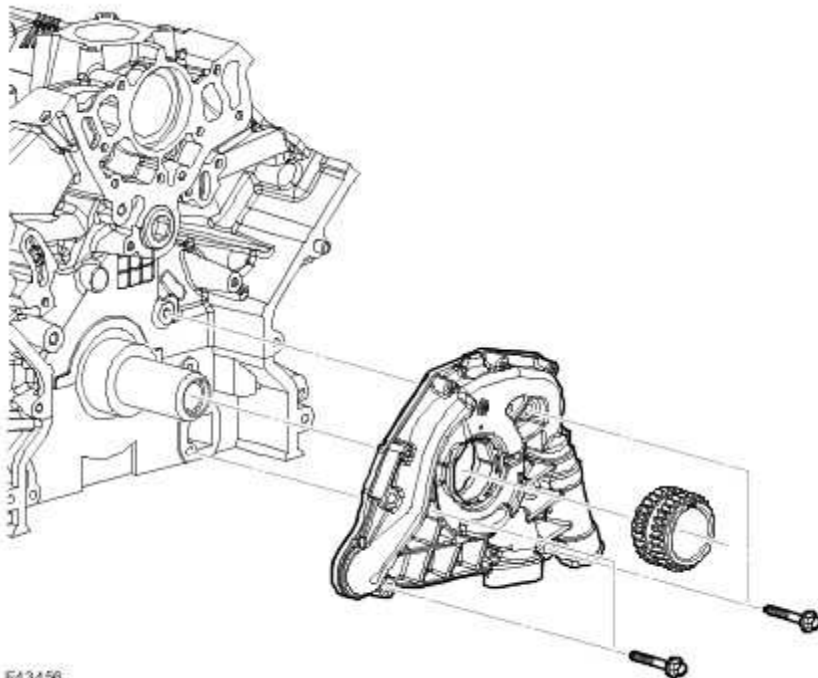
Oil Pick-up



E72000

The fabricated steel oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.

Oil Pump

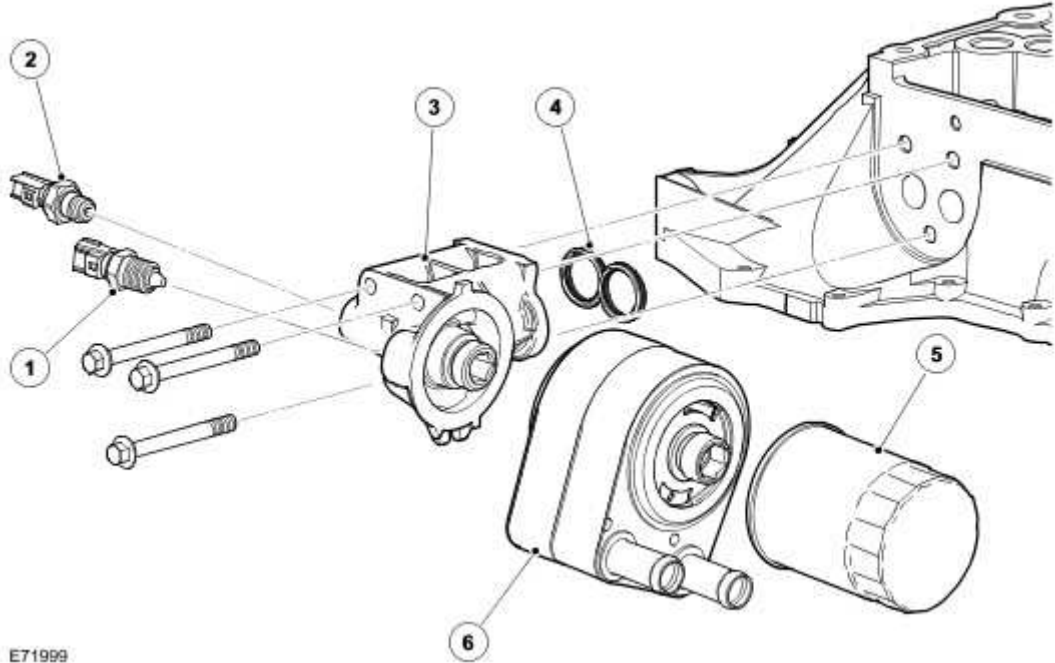


E43456

The oil pump is installed on the crankshaft at the front of the engine. The pump inlet and outlet ports align with oil passages in the bedplate.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 psi).

Oil Filter Housing Assembly



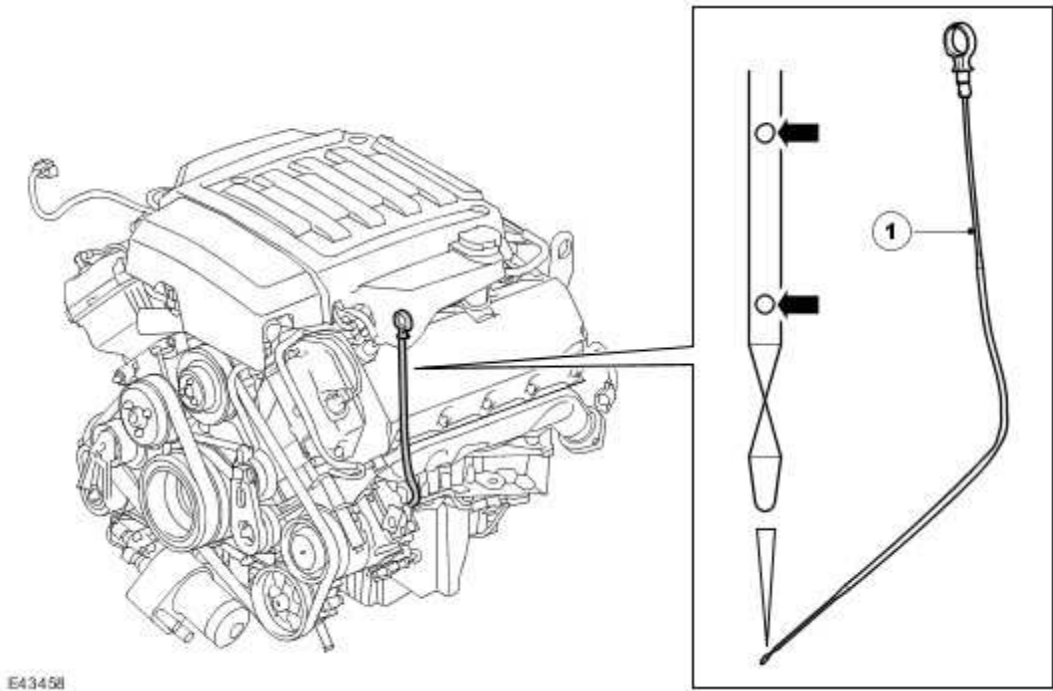
E71999

Item	Part Number	Description
1		Engine coolant temperature sensor
2		Oil pressure switch
3		Adapter
4		Seal
5		Filter
6		Engine oil cooler

The oil filter is a replaceable cartridge installed on an adapter via the oil cooler. An internal bypass facility permits full flow bypass if the filter is blocked.

The oil pressure switch connects a ground input to the instrument cluster when oil pressure is present. The switch operates at a pressure of 0.14 to 0.3 bar (2.0 to 4.5 psi).

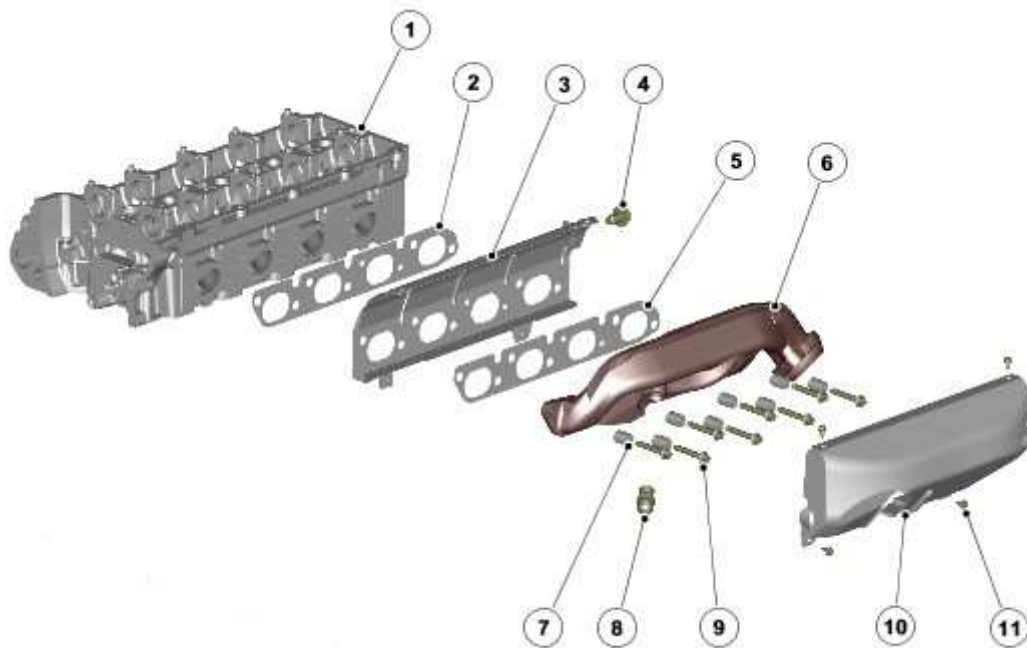
Oil Level Gauge



Item	Part Number	Description
1		Oil level gage

The oil level gage locates along the left side of the oil pan, supported in a tube installed in the sump. Two holes in the end of the gauge indicate the minimum and maximum oil levels. There is a difference of approximately 1.0 litres between the 2 levels.

EXHAUST MANIFOLD



E72001

Item	Part Number	Description
1		Cylinder head
2		Gasket
3		Heat shield
4		Bolt
5		Gasket
6		LH exhaust manifold
7		Spacer (8 off)
8		Connector for Secondary Air Injection (SAI)
9		Bolt (8 off)
10		Heat shield
11		Bolt (4 off)

The fabricated stainless steel twin skin exhaust manifolds are unique for each cylinder bank.

Each exhaust manifold assembly includes 2 metal gaskets, located either side of the inner heat shield, 2 heat shields and a connection for the Secondary Air Injection (SAI) system. For additional information, refer to Engine Emission Control (303-08 Engine Emission Control)

Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads.

Engine

For additional information, refer to <<303-00>>

Crankshaft Main Bearing Carrier

Special Service Tools



Bolts and spacers
303-191-04



Holding Tool Crankshaft Pulley
303-893(LRT-12-080)



Remover, crankshaft seal
303-D121



Timing Setting tool
303-645



Camshaft setting/locking tool
303-530



Crankshaft rear oil seal remover/installer
303-538



Seal installer
303-750




Seal extractor
303-751



Crankshaft pulley locking tool adapter
303-191/02

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the engine.
For additional information, refer to Engine (12.41.01)

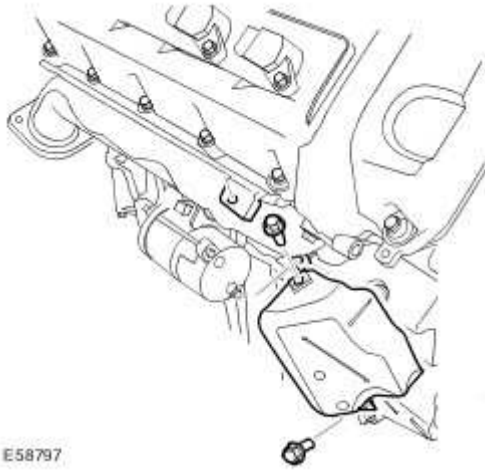
- 4 . Mount the engine to an engine stand.

- 5 . Disconnect the 2 oil cooler hoses.



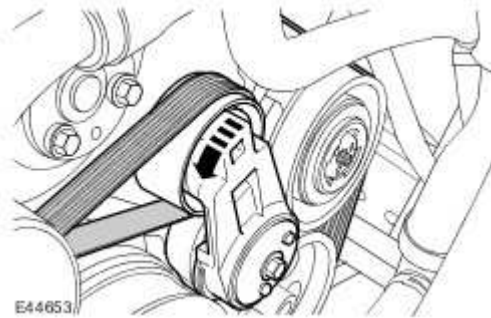
- 6 . Remove the exhaust manifold heat shield.

 Remove the 2 bolts.



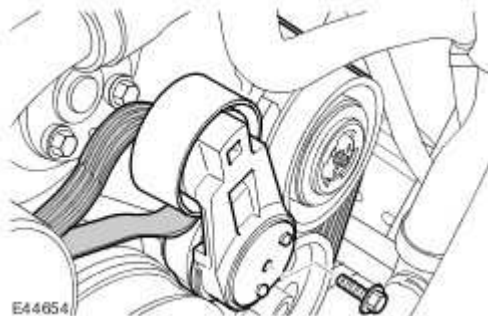
7 Release the accessory drive belt.

- ▶ Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



8 . Remove the accessory drive belt tensioner.

- ▶ Remove the bolt.



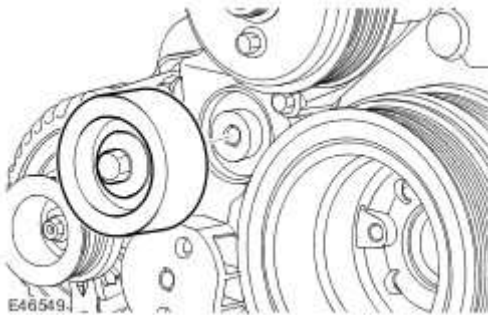
9 . NOTE:

Note the fitted position of the accessory drive belt.

Remove the accessory drive belt.

10 . Remove the accessory drive belt idler pulley.

▶ Remove the bolt.

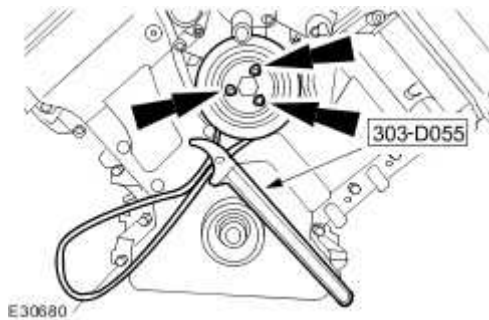


11 . NOTE:

Restrain the pulley to aid the removal of the bolts.

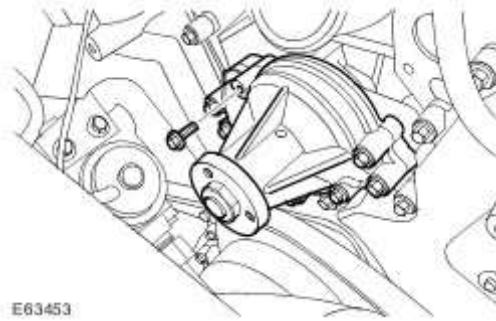
Using the special tool, remove the coolant pump pulley.

▶ Remove and discard the 3 bolts.



12 . Remove the coolant pump.

- ▶ Remove the 5 bolts.
- ▶ Remove and discard the gasket.

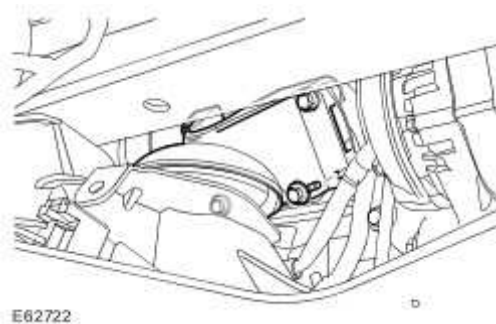


13 . **NOTE:**

Right-hand shown, left-hand similar.

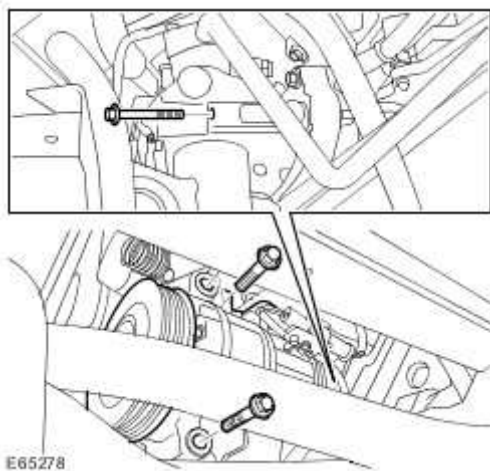
Remove both the engine mounts and brackets.

- ▶ Remove the 4 bolts.
- ▶ Repeat the above procedure for the other side.



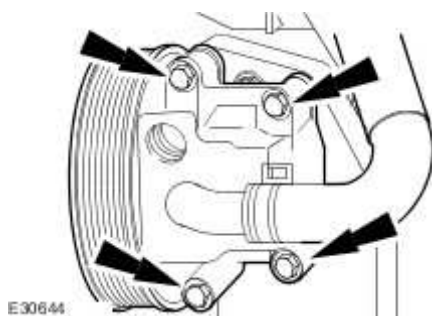
14 . Remove the air conditioning (A/C) compressor.

- ▶ Remove the 3 bolts.
- ▶ Disconnect the electrical connector.



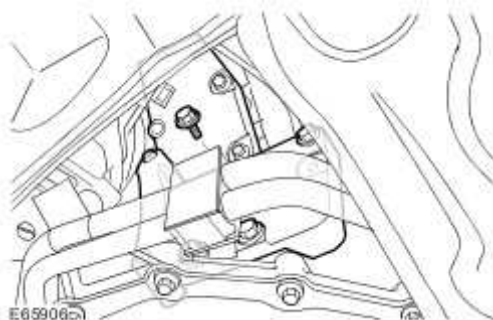
15 . Remove the power steering pump.

▶ Remove the 4 bolts.



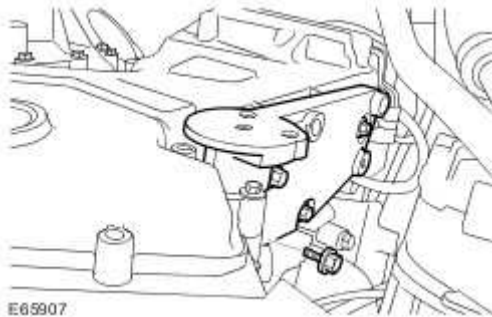
16 . Remove the A/C compressor mounting bracket.

▶ Remove the 4 bolts.



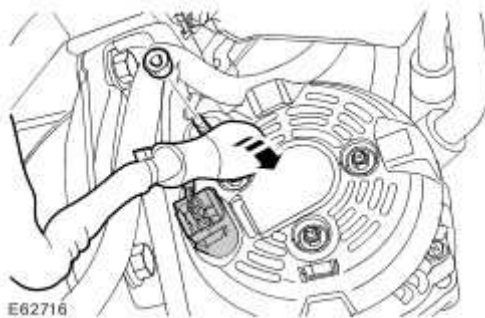
17 . Remove the power steering pump mounting bracket.

- ▶ Remove the 4 bolts.



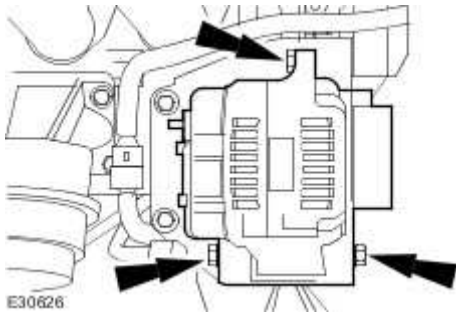
18 . Disconnect the battery positive cable and the generator electrical connector.

- ▶ Release the cover.
- ▶ Remove the nut.
- ▶ Disconnect the electrical connector.



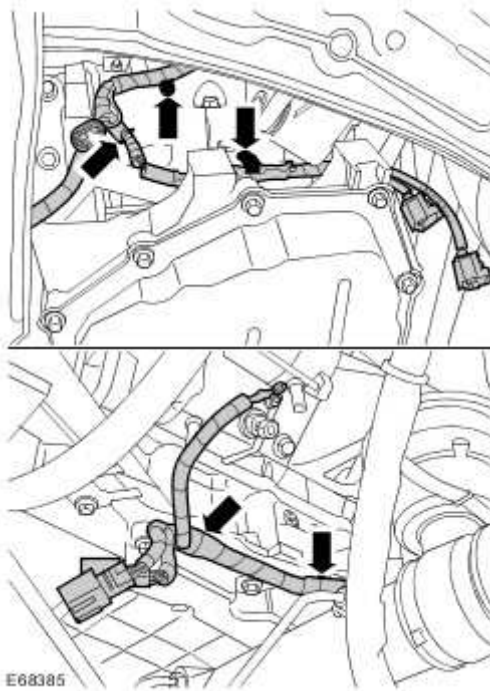
19 . Remove the generator.

- ▶ Remove the nut.
- ▶ Remove the nut and bolt.



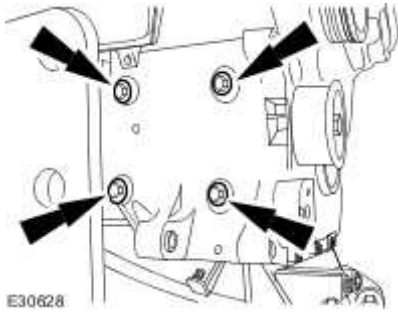
20 . RH side: Release the engine wiring harness.

▶ Release the 5 clips.



21 . Remove the generator mounting bracket.

▶ Remove the 4 bolts.



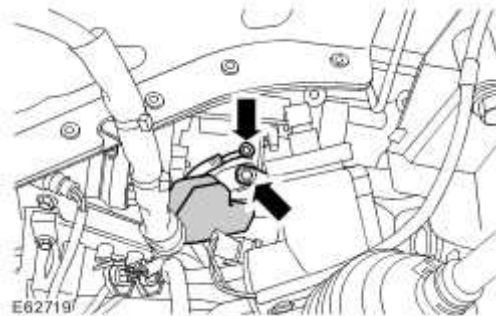
22 . Disconnect the battery positive cable.

▶ Release the cover.

▶ Remove the nut.

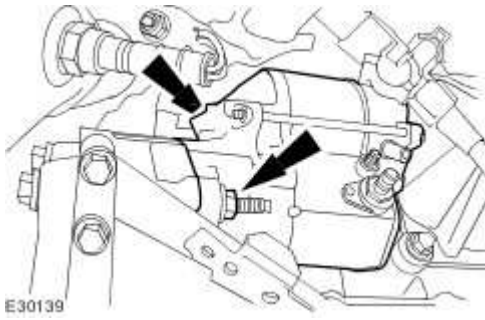
23 . Disconnect the starter motor solenoid electrical connector.

▶ Remove and discard the nut.



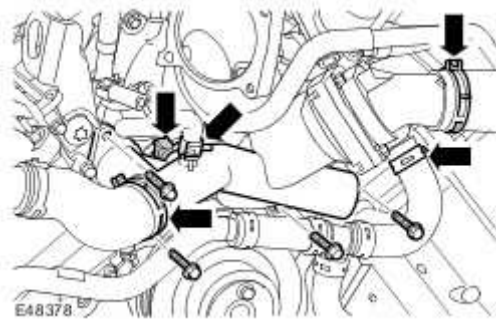
24 . Remove the starter motor.

▶ Remove the 2 bolts.



25 Remove the coolant manifold.

- ▶ Release the clips and disconnect the 4 coolant hoses.
- ▶ Remove the 4 bolts.
- ▶ Disconnect the engine coolant temperature (ECT) sensor electrical connector.



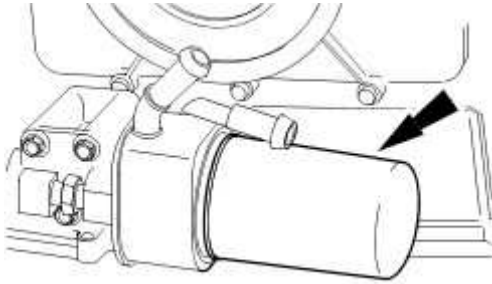
26 . **NOTE:**

Some oil spillage is inevitable during this operation.

NOTE:

Clean the components general area prior to dismantling.

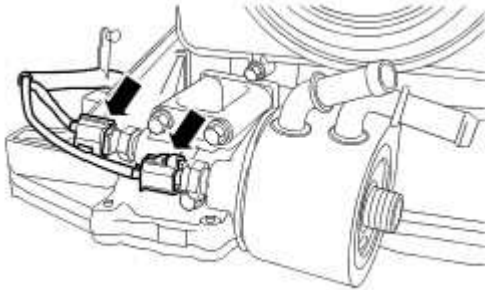
Remove the oil filter.



VUJ0001576

27 . Disconnect the engine oil pressure (EOP) sensor electrical connector.

28 . Disconnect the engine oil temperature sensor electrical connector.

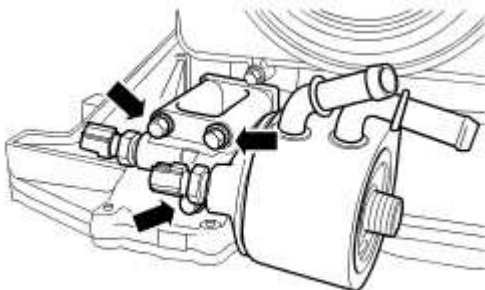


E82652

29 . Remove the oil filter housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seal.

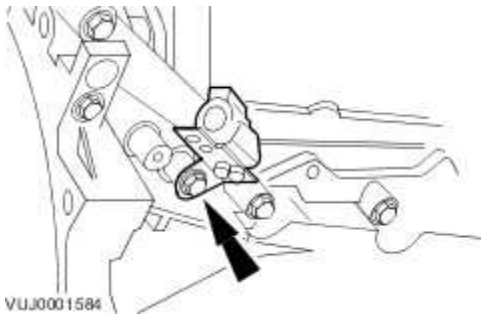


E82653

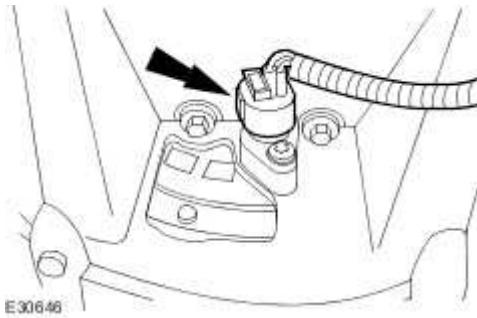
30 . **NOTE:**

Right-hand shown, left-hand similar.

Release the 2 heated oxygen sensor (HO2S) harness brackets.



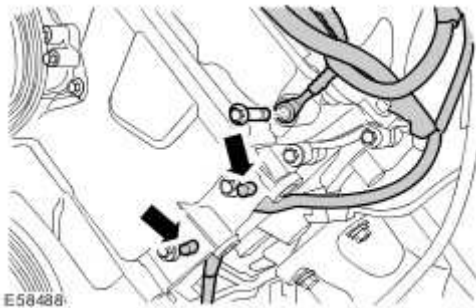
31 . Disconnect the crankshaft position (CKP) sensor electrical connector.



32 . Release the engine wiring harness.

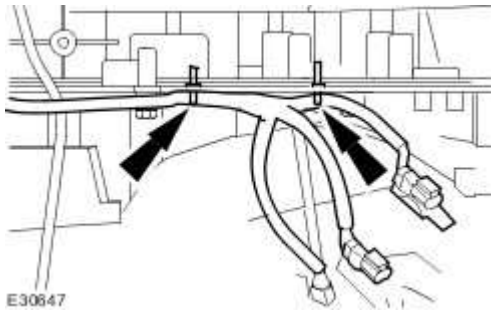
▶ Release the 2 clips.

▶ Remove the bolt.



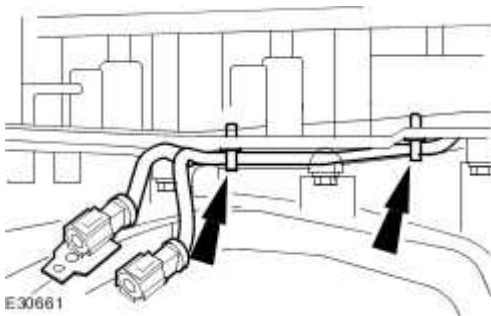
33 . Release the wiring harness from the LH side of the engine.

▶ Release the clips.



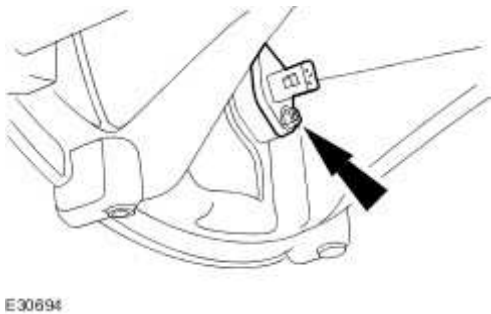
34 . Release the wiring harness from the RH side of the engine.

▶ Release the clips.



35 . Remove the CKP sensor.

▶ Remove the bolt.

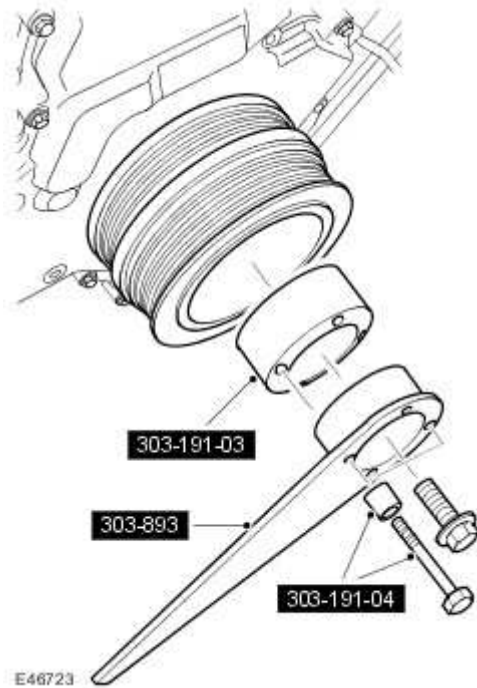


36



CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, retain the crankshaft pulley.



37 . **NOTE:**

The crankshaft pulley retaining bolt will be very tight.

Using the special tools, remove the crankshaft pulley bolt.

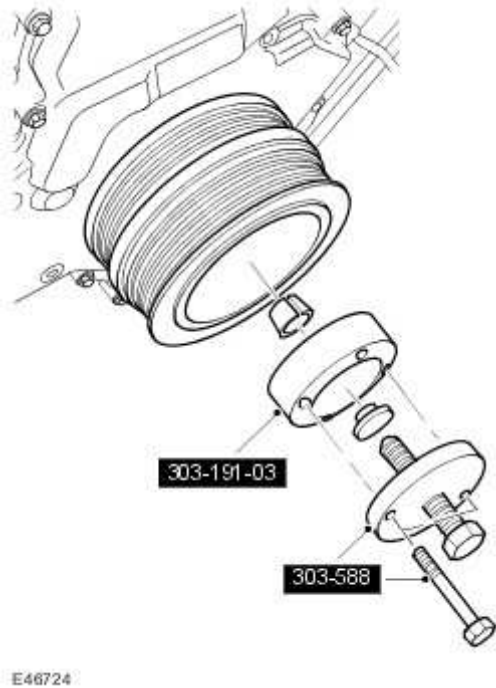
- ▶ Discard the bolt.
- ▶ Remove the special tools.

38 . **NOTE:**

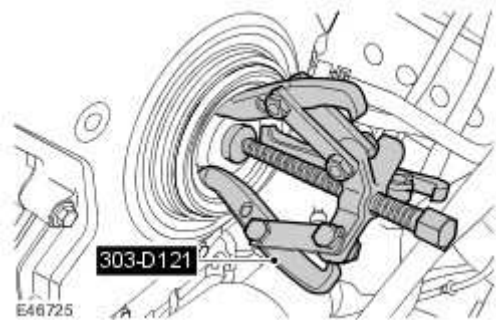
The crankshaft pulley will be very tight.

Using the special tools, remove the crankshaft pulley.

- ▶ Collect the locking ring.
- ▶ Remove the special tools.



39 . Using the special tool, remove and discard the crankshaft front seal.

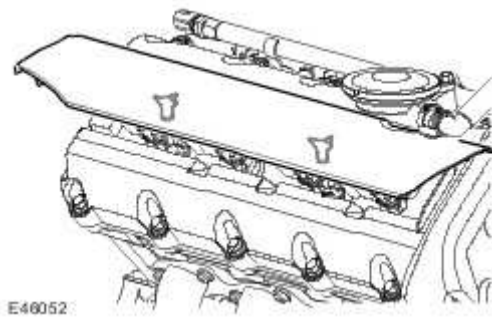


40 . **NOTE:**

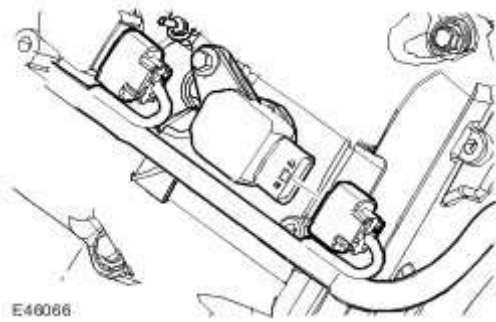
Right-hand shown, left-hand similar.

Remove both the ignition coil-on-plug covers.

- ▶ Release from the 2 clips.

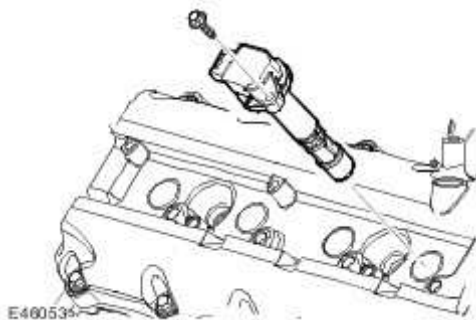


41 . Disconnect the RH ignition coil-on-plug electrical connector.



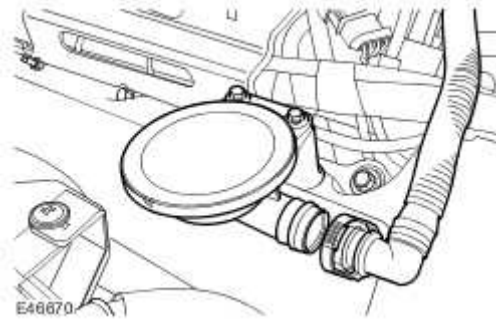
42 . Remove the RH ignition coil-on-plug.

- ▶ Remove the bolt.
- ▶ Remove and discard the seal.



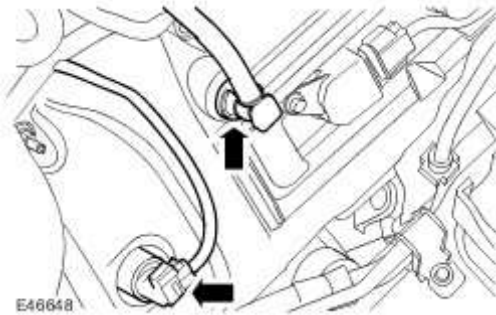
43 . Remove the remaining RH ignition coil-on-plugs.

44 . Disconnect the positive crankcase ventilation (PCV) line.

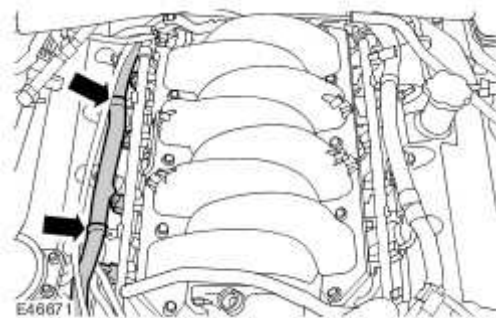


45 . Disconnect the LH variable camshaft timing (VCT) oil solenoid electrical connector.

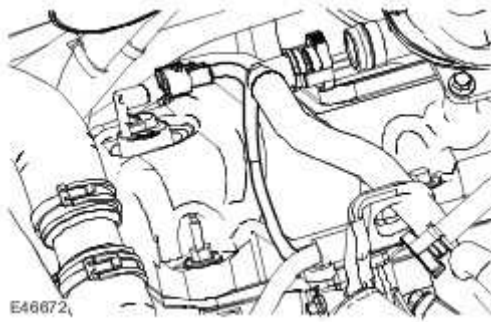
46 . Disconnect the valve cover breather hose.



47 . Release the engine wiring harness from the retaining bracket.



48 . Disconnect the RH variable camshaft timing (VCT) oil solenoid electrical connector.

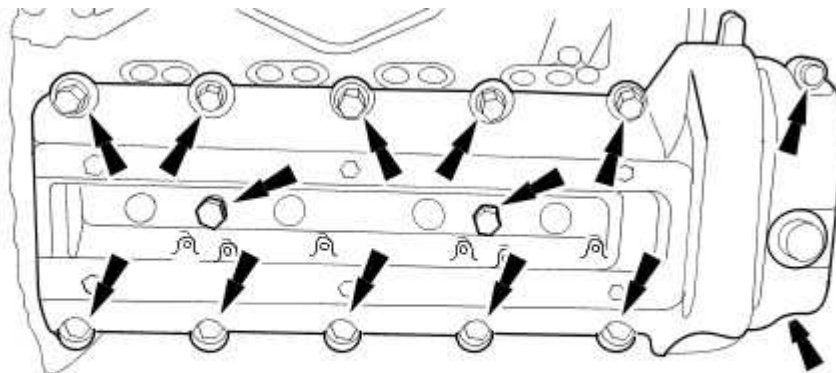


49 . NOTE:

Note the fitted position of the retaining bolts prior to removal.

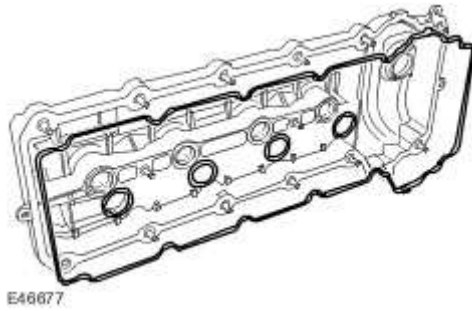
Remove the RH valve cover.

- ▶ Remove the 14 valve cover retaining bolts.
- ▶ Remove the engine cover bracket.

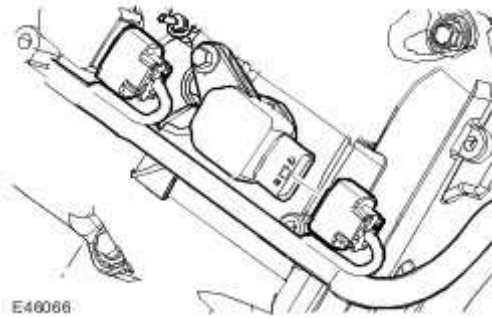


50 . Remove and discard the RH valve cover gaskets.

- ▶ Remove and discard the seals.

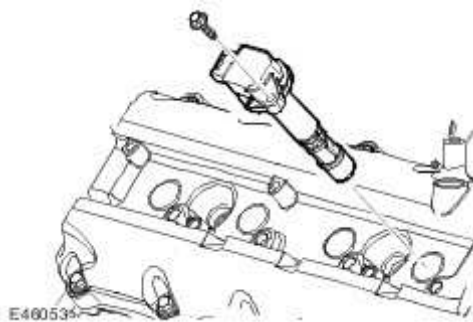


51 . Disconnect the LH ignition coil-on-plug electrical connector.



52 . Remove the LH ignition coil-on-plug.

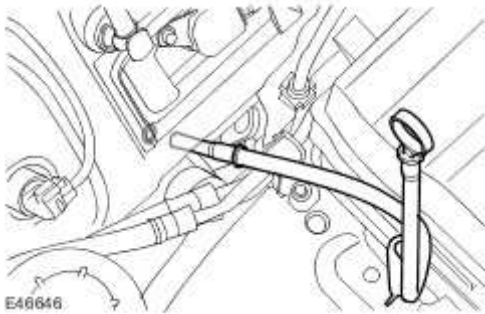
- ▶ Remove the bolt.
- ▶ Remove and discard the seal.



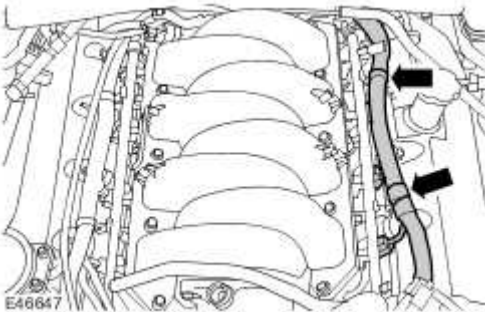
53 . Remove the remaining LH ignition coil-on-plugs.

54 . Remove the oil level indicator and tube.

- ▶ Remove the oil level indicator.
- ▶ Remove the nut.
- ▶ Remove the tube.
- ▶ Remove and discard the O-ring seal.



55 . Release the engine wiring harness from the retaining bracket.

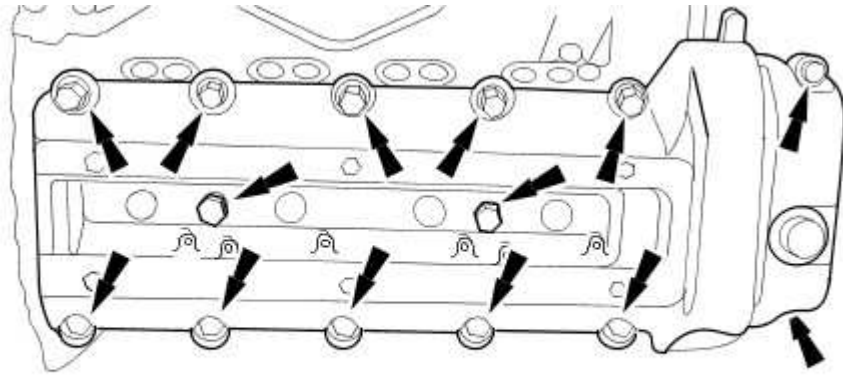


56 . **NOTE:**

Note the fitted position of the retaining bolts prior to removal.

Remove the LH valve cover.

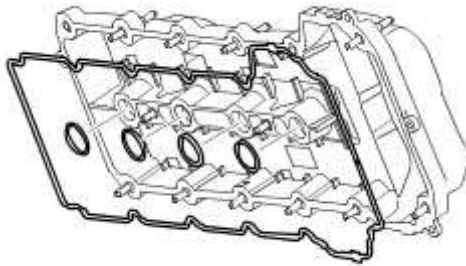
- ▶ Remove the 14 valve cover retaining bolts.



E30698

57 . Remove and discard the LH valve cover gaskets.

▶ Remove and discard the seals.



E46652

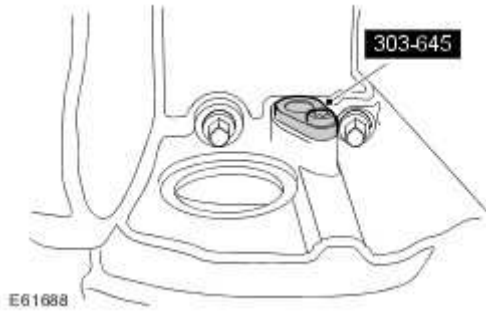
58 . **NOTE:**

Install the special tool to the crankshaft sensor aperture.

Lock the crankshaft.

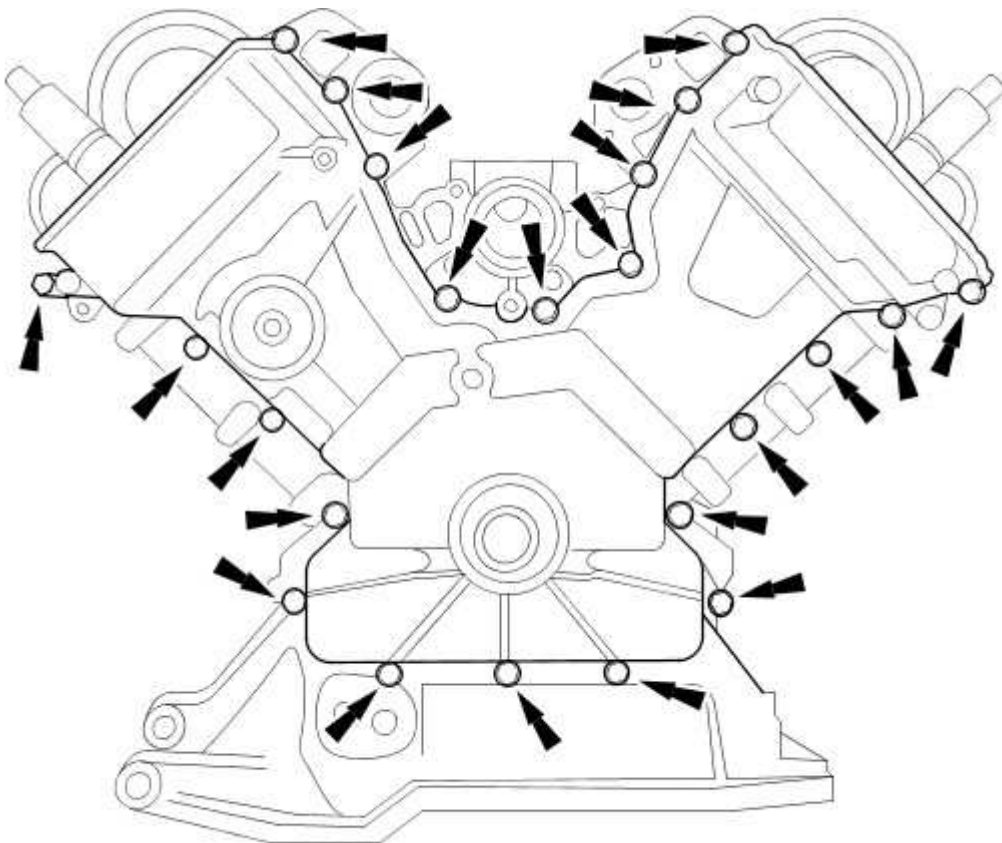
▶ Install the special tool.

▶ Install the bolt.



59 . Remove the engine front cover.

- ▶ Remove the 24 bolts.
- ▶ Remove and discard the gasket.
- ▶ Remove and discard the 3 O-ring seals.

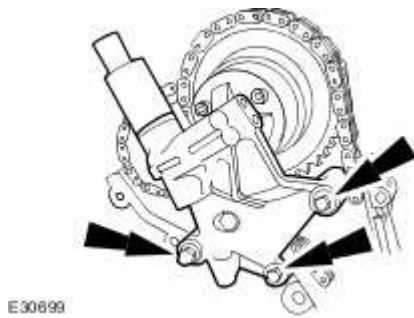


VUJ0002398

60 . Remove the RH VCT housing.

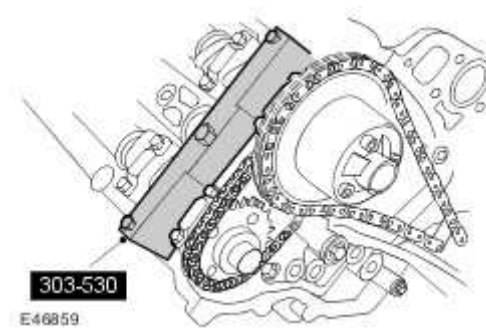
▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seals.



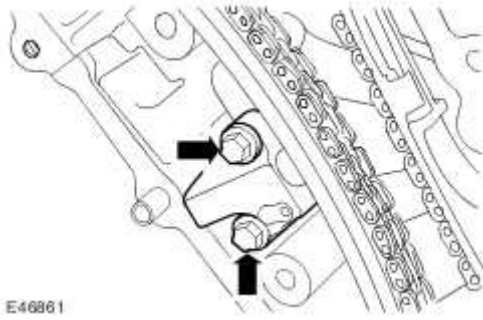
61 . Install the special tool to the RH cylinder head.

▶ Install the 3 bolts.



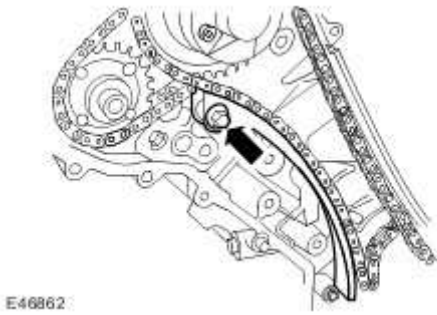
62 . Remove the RH primary timing chain tensioner assembly.

▶ Remove the 2 bolts.

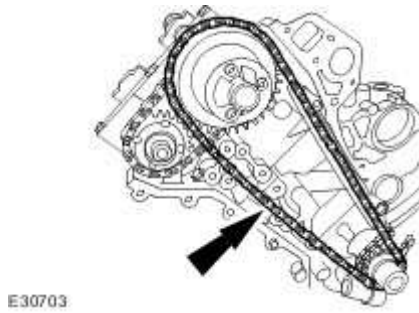


63 . Remove the RH primary timing chain tensioner guide.

▶ Remove the bolt.



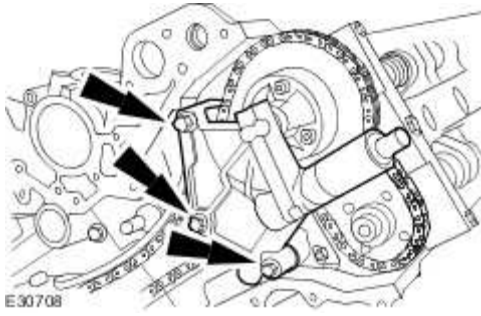
64 . Remove the RH primary timing chain.



65 . Remove the LH VCT housing.

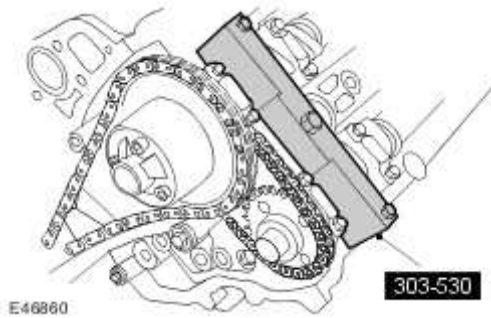
▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seals.



66 . Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



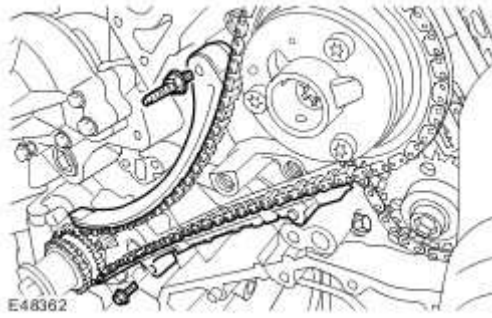
67 . Remove the LH primary timing chain tensioner.

▶ Remove the 2 bolts.

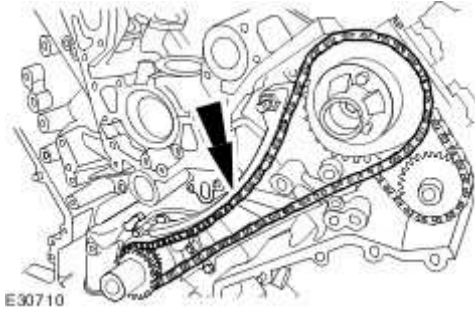


68 . Remove the LH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



69 . Remove the LH primary timing chain.

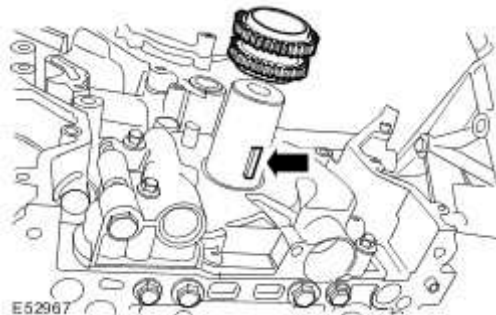


70 . **NOTE:**

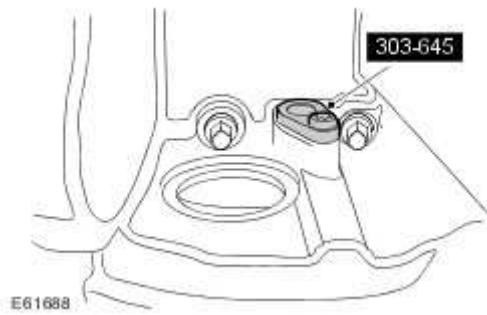
Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

▶ Remove the crankshaft sprocket key.



71 . Remove the special tool.



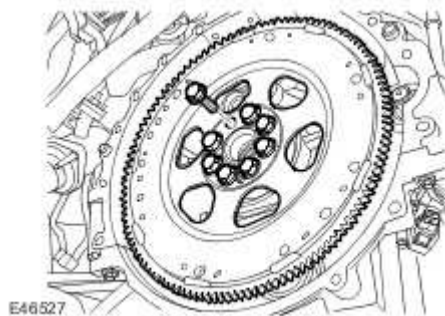
72



CAUTION: The bolts can only be used 3 times, mark the bolts with a center punch. If 2 punch marks are visible, discard the bolts.

Remove the torque converter flexplate.

▶ Remove the 8 bolts.



73 .

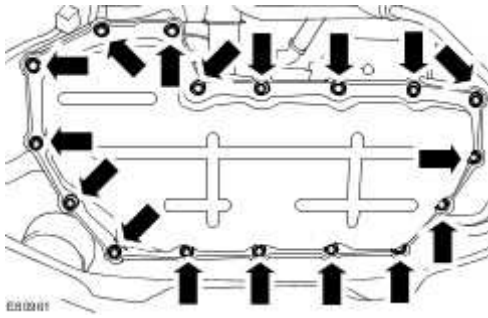


CAUTION: Note the position of the bolts, prior to removal.

Remove the oil pan.

▶ Remove the 17 bolts.

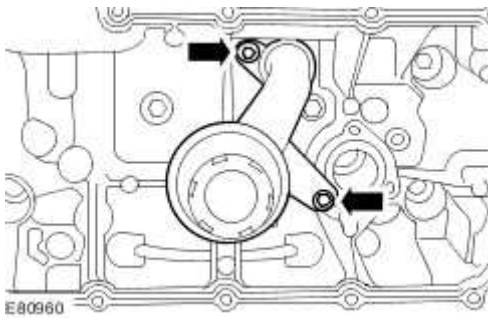
▶ Remove and discard the gasket.



74 . Remove the oil strainer pick-up assembly.

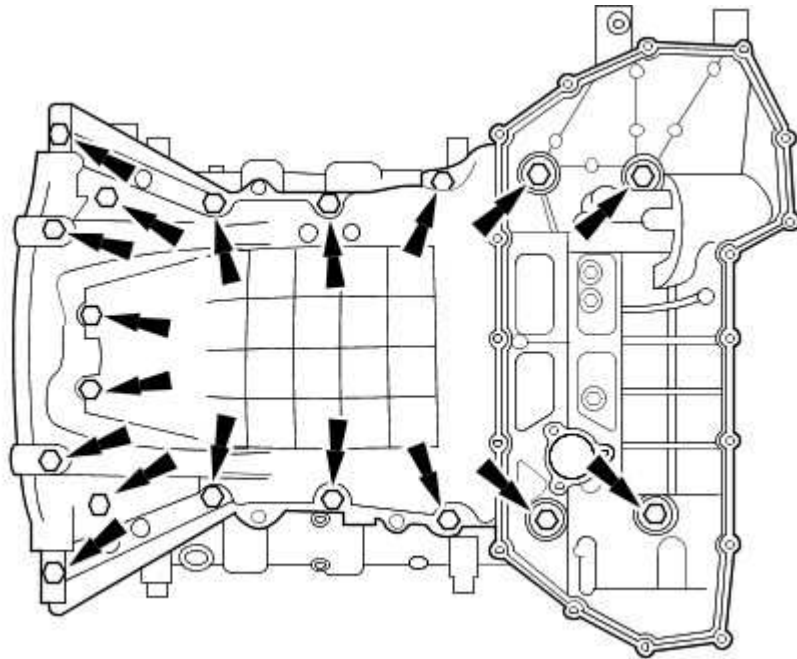
▶ Remove the 2 bolts.

▶ Remove and discard the O-ring seal.



75 . Remove the oil pan extension.

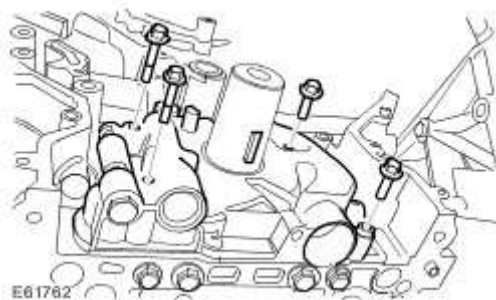
▶ Remove the 18 bolts.



VUJ0002435

76 . Remove the oil pump assembly.

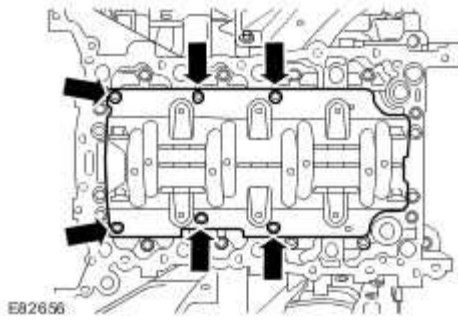
- ▶ Remove the 4 bolts.
- ▶ Remove and discard the gasket.
- ▶ Clean the component mating faces.



E61762

77 . Remove the baffle plate.

- ▶ Remove the 6 bolts.



78



WARNING: To make sure damage does not occur to the crankshaft and piston components, the engine must be inverted on the engine stand. Failure to follow this instruction may result in damage to the engine.

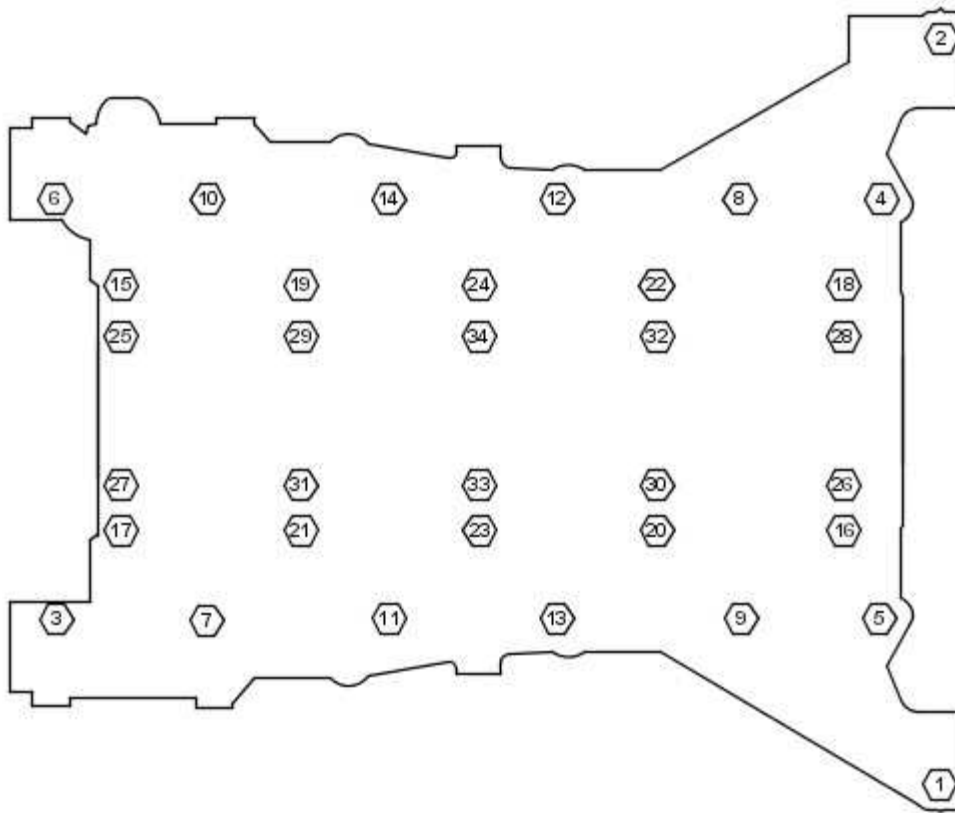
NOTE:

If the crankshaft main bearing carrier retaining bolts have been marked with a center punch dot, they must be discarded and new bolts installed.

Remove the crankshaft main bearing carrier.

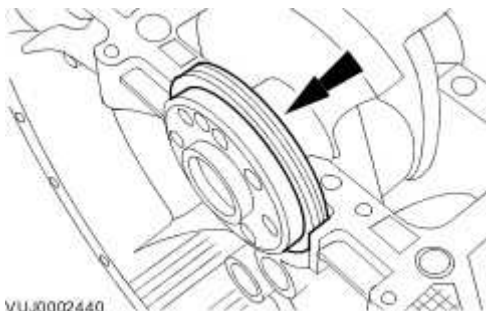


Remove the crankshaft main bearing carrier retaining bolts in the indicated sequence.



VUJ0002439

79 . Discard the crankshaft rear main oil seal.



VUJ0002440

Installation

1



· **CAUTION:** Use only a plastic scraper when removing the sealing material.




CAUTION: If any new bolts are to be installed to retain the crankshaft main bearing carrier, pre-stress the retaining bolts by installing the crankshaft main bearing carrier without any sealant and tightening the new retaining bolts to the specified torque. Remove the crankshaft main bearing carrier once the bolts have been pre-stressed. Failure to follow this instruction may result in damage to the vehicle.

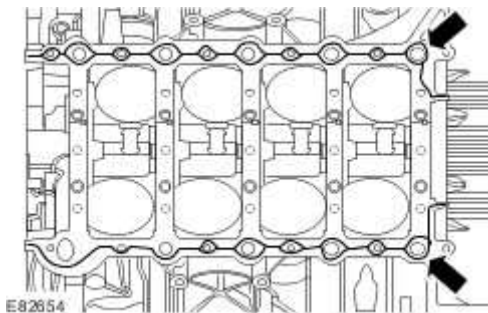
Clean all the mating faces and reusable parts thoroughly and check for damage.

2 NOTE:

Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 2 mm (0.08in) bead of sealant to the cylinder block in the area shown.


 Use WSS-M4G323-A4-RTV sealant.

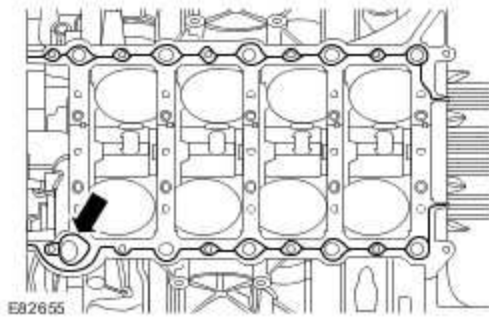


3 NOTE:

Install the crankshaft main bearing carrier and tighten bolts to specification within twenty minutes of applying the sealant.

Apply a 1 mm (0.039in) bead of sealant to the cylinder block in the area shown.

 Use WSS-M4G323-A4-RTV sealant.



- 4 .  **CAUTION:** Make sure all dowels are fully seated into the crankshaft main bearing carrier prior to tightening the bolts.

NOTE:

Do not lubricate the crankshaft main bearing carrier retaining bolts.

NOTE:

Do not rotate the crankshaft until all the retaining bolts are tightened to specification.

NOTE:

The retaining bolts must be tightened within twenty minutes of applying the sealant.

NOTE:

Tighten the retaining bolts in the sequence shown.

Install the crankshaft main bearing carrier to the cylinder block.

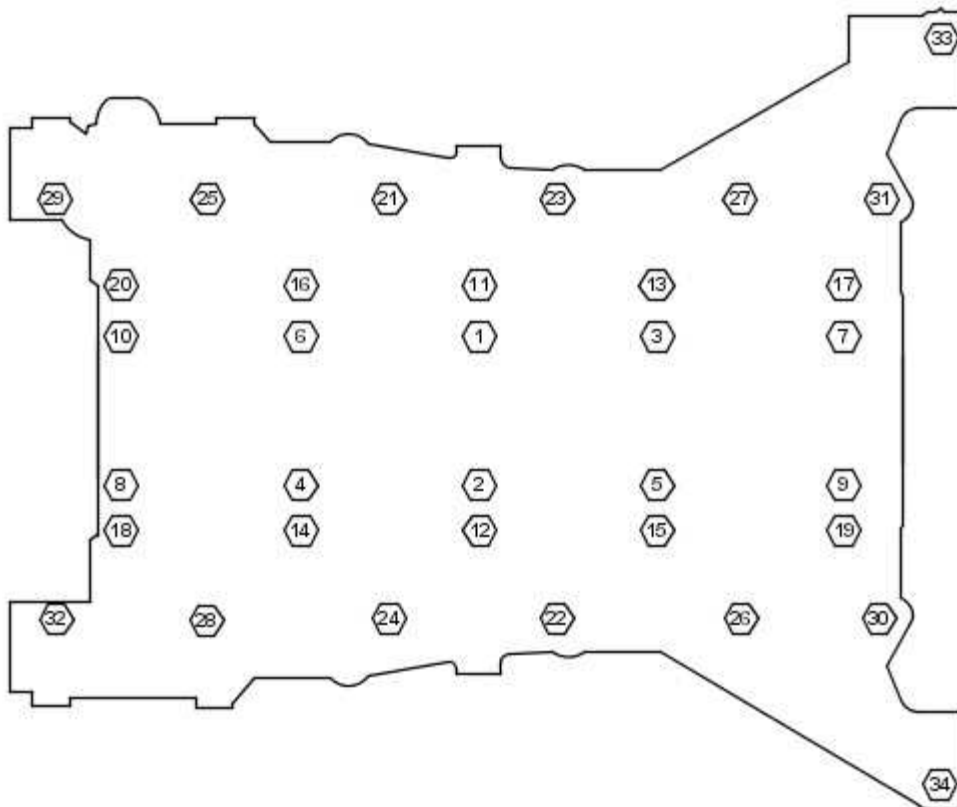
1) Stage 1: Bolts 21 to 32, tighten to 15 Nm (11 lb.ft).

2) Stage 2: Bolts 33 to 34, tighten to 15 Nm (11 lb.ft).

3) Stage 3: Bolts 1 to 10, tighten to 25 Nm (18 lb.ft).

4) Stage 4: Bolts 11 to 20, tighten to 15 Nm (11 lb.ft).

- 5) Stage 5: Bolts 1 to 10, tighten to 35 Nm (26 lb.ft), then a further 135 degrees.
- 6) Stage 6: Bolts 11 to 20, tighten to 20 Nm (15 lb.ft), then a further 150 degrees.
- 7) Stage 7: Bolts 21 to 32, tighten to 20 Nm (15 lb.ft), then a further 90 degrees.
- 8) Stage 8: Bolts 33 to 34, tighten to 20 Nm (15 lb.ft), then a further 150 degrees.
- 9) Stage 9: Center punch each of the bolt heads to indicate it has been reused.



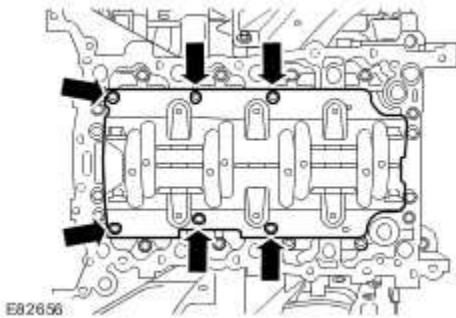
VUJ0002450

5 . Rotate the crankshaft to check correct operation.

6 . Remove excess sealant which may squeeze out at the front cover sealing surfaces.

7 . Install the baffle plate.

▶ Tighten the 6 bolts to 6 Nm (4 lb.ft).



8 NOTE:

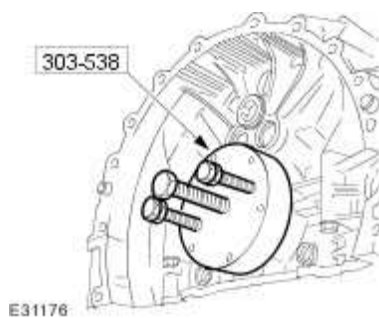
Carefully remove the transit sleeve, leaving the seal in place.


NOTE:

Make sure that the transit sleeve is correctly positioned and install the new seal over the crankshaft. Do not use any lubricant on the seal, the transit sleeve or the crankshaft.

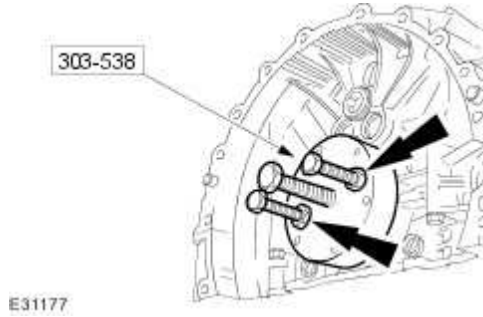
Using the special tool, position the crankshaft rear oil seal.


▶ Install the special tool to the crankshaft.



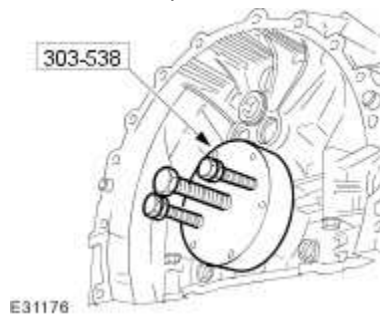
9.  **CAUTION: Alternate the nut tightening to correctly seat the crankshaft rear oil seal.**

Using the special tool, install the rear crankshaft oil seal.




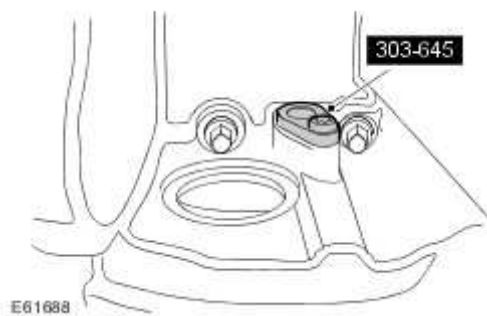
10.  **CAUTION: Make sure that the crankshaft rear oil seal is correctly located.**

Remove the special tool.



11. Install the special tool.

 Install the bolt.



12 . NOTE:

Install a new gasket.

Install the oil pump assembly.

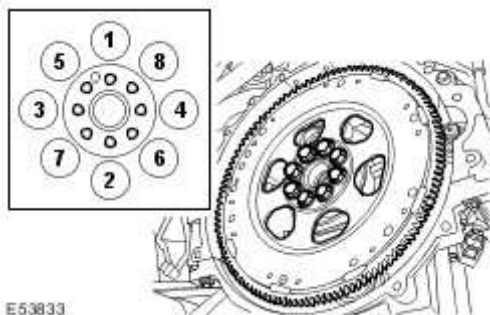
- ▶ Clean the component mating faces.
- ▶ Install the gasket.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

13 . NOTE:

Prevent the flexplate from rotating.

Install the torque converter flexplate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts evenly in 2 stages to the sequence shown.
- ▶ Tighten the bolts to 15 Nm (11 lb ft).
- ▶ Tighten the bolts to 110 Nm (81 lb.ft).



14 . NOTE:

Install a new O-ring seal.

Install the oil strainer pick-up assembly.

- ▶ Install the O-ring seal.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

15 . Install the crankshaft sprocket.

- ▶ Clean the component mating faces.
- ▶ Install the crankshaft sprocket key.

16 Install the LH primary timing chain.

- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

17 . Install the LH primary timing chain tensioner guides.

- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

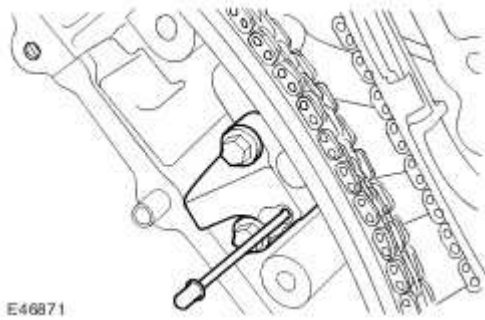
18



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the LH primary timing chain tensioner.

- ▶ Using a 3 mm (0.118 in) diameter rod, retain the chain tensioner piston.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).
- ▶ Remove the retaining rod.



- 19 .  **CAUTION: Make sure that new bolts are installed.**

NOTE:

Install new O-ring seals.

Install the LH VCT control solenoid housing.


- ▶ Install the O-ring seals.
- ▶ Tighten the bolts to 22 Nm (16 lb.ft).
- ▶ Tighten the nut to 10 Nm (7 lb.ft).

- 20 Install the RH primary timing chain.

- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

- 21 . Install the RH primary timing chain tensioner guide.

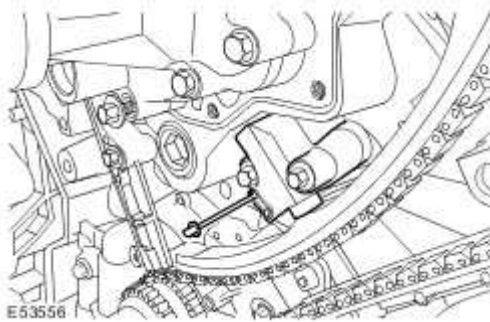
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

- 22  **CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the**

ratchet stem will result.

Install the RH primary timing chain tensioner.

- ▶ Using a 3 mm (0.118 in) diameter rod, retain the chain tensioner piston.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).
- ▶ Remove the retaining rod.



23 . NOTE:

Install new O-ring seals.

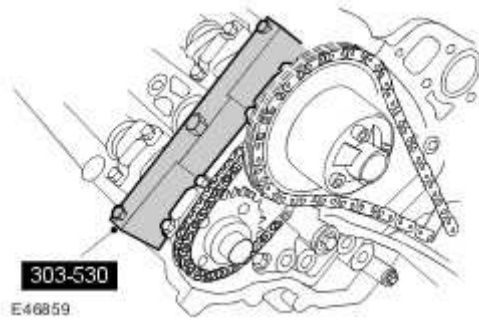
NOTE:

Make sure that new bolts are installed.

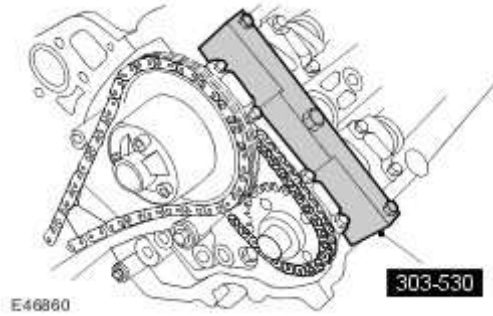
Install the RH VCT control solenoid housing.

- ▶ Install the O-ring seals.
- ▶ Tighten the bolts to 22 Nm (16 lb.ft).
- ▶ Tighten the nut to 10 Nm (7 lb.ft).

24 . Remove the special tool from the RH cylinder head.

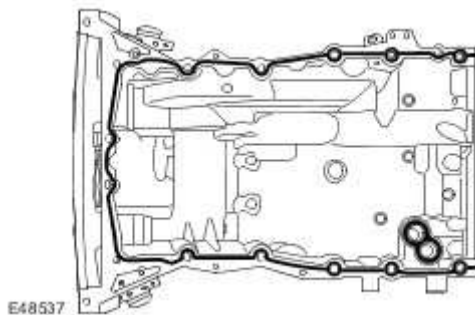


25 . Remove the special tool from the LH cylinder head.

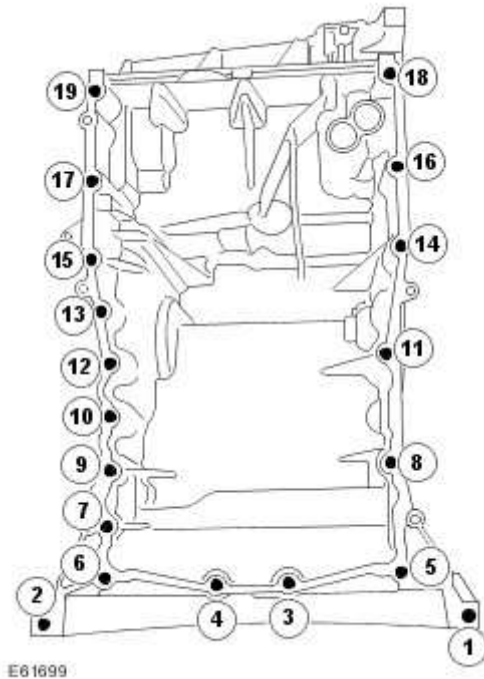


26 . Install the oil pan extension.

- ▶ Clean the component mating faces.
- ▶ Apply a 3 mm (0.118 in) diameter bead of sealant, to the area indicated.
- ▶ Install the bolts, but do not tighten fully at this stage.

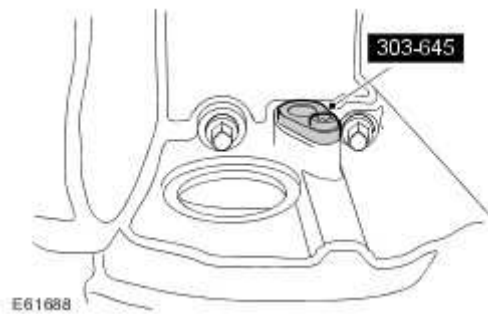


27 . Tighten the oil pan bolts in the sequence shown to 20 Nm (15 lb.ft).



28 . Remove the special tool.

▶ Remove the bolt.



29 . Install the CKP sensor.

▶ Tighten the bolt to 8 Nm (6 lb.ft)

30 . Attach the wiring harness to the LH side of the engine

▶ Secure the clips.

31 . Attach the wiring harness to the RH side of the engine.

▶ Secure the clips.

32 . Install the power steering pump mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

33 **NOTE:**

Install a new gasket.

NOTE:

Install a new O-ring seal.

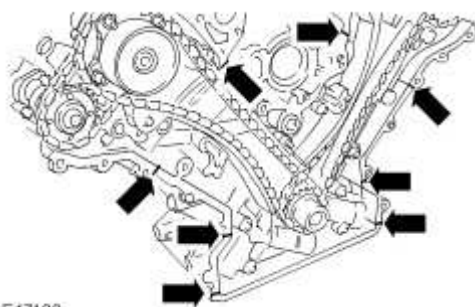
Install the engine front cover.

▶ Clean the component mating faces.

▶ Apply a 3 mm (0.118 in) diameter bead of sealant 12mm (0.47 in) long, to the 8 places indicated.

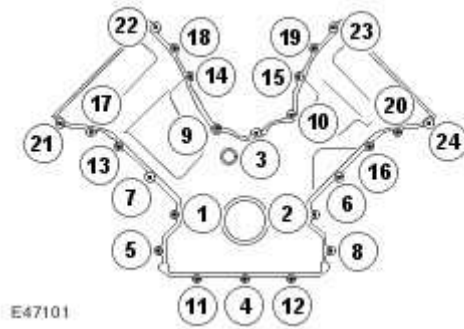
▶ Install the gasket.

▶ Install the O-ring seal.



E47100

34 . Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



35 . Attach the engine wiring harness.

- ▶ Secure the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

36 . **NOTE:**

Install new seals.

Install the LH valve cover plug aperture seals.

37 **NOTE:**

Install a new gasket.

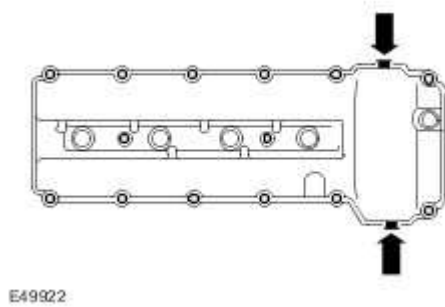
NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the LH valve cover.

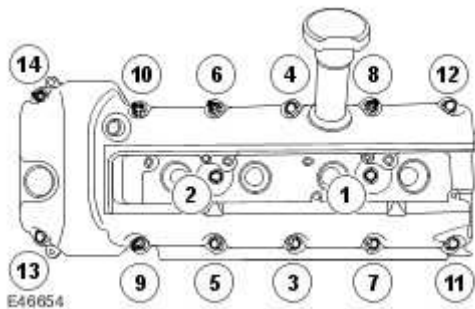
- ▶ Clean the component mating faces.

- ▶ Install the valve cover gasket.



- 38 . Install the LH valve cover bolts.

- ▶ Install the LH valve cover bolts to the positions previously noted.
- ▶ Tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



- 39 . Connect the LH VCT oil solenoid electrical connector.

- 40 . Attach the engine wiring harness to the retaining bracket.

- 41 . **NOTE:**

Install a new O-ring seal.

With assistance, install the oil level indicator and tube.

- ▶ Clean the component mating faces.
- ▶ Install the O-ring seal.
- ▶ Lubricate the O-ring seal with clean engine oil.
- ▶ Tighten the nut to 6 Nm (4 lb.ft).

42 . **NOTE:**

Install new O-ring seals.

Install the 4 LH ignition coil-on-plugs.

- ▶ Install the O-ring seals.
- ▶ Install the 4 ignition coil-on-plugs.
- ▶ Tighten the bolts to 6 Nm (4 lb.ft).

43 . Connect the 4 electrical connectors.

44 . Install the LH ignition coil-on-plug cover.

45 . **NOTE:**

Install new seals.

Install new RH valve cover plug aperture seals.

46 **NOTE:**

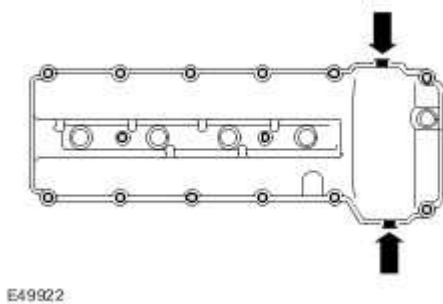
Install a new gasket.

NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3 mm (0.118 in) diameter 12 mm (0.47 in) long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

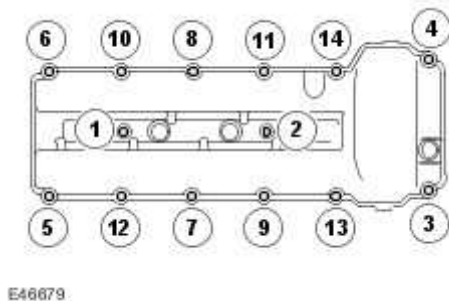
Install the RH valve cover.

- ▶ Clean the component mating faces.
- ▶ Install the gasket.



47 . Install the RH valve cover bolts.

- ▶ Install the RH valve cover bolts to the positions previously noted.
- ▶ Tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



48 . **NOTE:**

Install new O-ring seals.

Install the 4 RH ignition coil-on-plugs.

- ▶ Install the O-ring seals.
- ▶ Install the 4 ignition coil-on-plugs.
- ▶ Tighten the bolts to 6 Nm (4 lb.ft).

49 . Connect the 4 electrical connectors.

50 . Connect the RH VCT oil solenoid electrical connector.

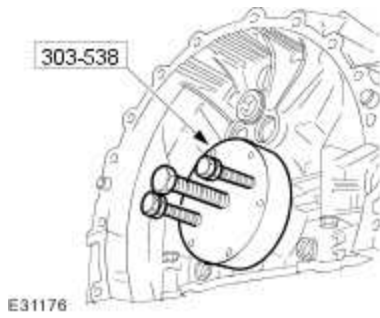
51 . Attach the engine wiring harness to the retaining bracket.

52 . Connect the PCV line to the RH valve cover.

53 . Clean the crankshaft pulley mating faces.

54 . Using the special tool, install the crankshaft front seal.


- ▶ Lubricate the seal with clean engine oil.
- ▶ Use the discarded crankshaft bolt with the special tool.
- ▶ Remove the special tools.




55 . Install the crankshaft pulley.

- ▶ Lubricate the seal with clean engine oil.

56 . Install the crankshaft pulley locking ring.

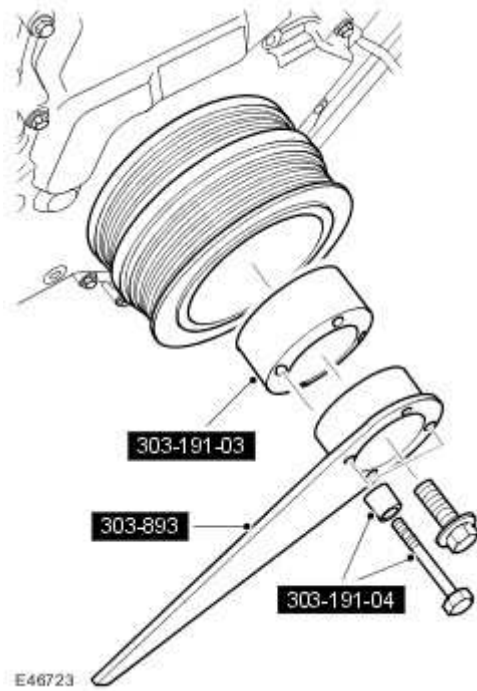
- 57
- ▶  **CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.**

Install, but do not tighten, the new crankshaft pulley bolt.

- 58
- ▶  **CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.**

Using the special tools, tighten the crankshaft pulley bolt.

- ▶ Tighten the crankshaft pulley bolt to 380 Nm (280 lb.ft).
- ▶ Remove the special tools.



59 . NOTE:

Install a new O-ring seal.

Install the oil filter housing.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 20 Nm (15 lb.ft).

60 NOTE:

Install a new engine oil filter.

Install the engine oil filter.

- ▶ Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm (13 lb.ft).

61 . Connect the EOP sensor electrical connector.

62 . Connect the engine oil temperature sensor electrical connector.

63 . Install the starter motor.

- ▶ Clean the component mating faces.

- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

64 . **NOTE:**

Install new O-ring seals.

Install the coolant manifold.

- ▶ Clean the components.

- ▶ Install the O-ring seals.

- ▶ Connect the 4 coolant hoses and install the clips.

- ▶ Attach the wiring harness bracket.

- ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).

65 . Connect the starter motor solenoid electrical connector.

- ▶ Tighten the new nut to 7 Nm (5 lb.ft).

66 . Connect the battery positive cable to the starter motor.

- ▶ Tighten the nut to 10 Nm (7 lb.ft).

- ▶ Secure the cover.

67 . Install the generator mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

68 . RH side: Attach the wiring harness.

▶ Secure the clips.

69 . Install the generator.

▶ Tighten the nut to 25 Nm (18 lb.ft).

▶ Tighten the nut and bolt to 40 Nm (30 lb.ft).

70 . Connect the battery positive cable and generator electrical connector.

▶ Tighten the nut to 12 Nm (9 lb.ft).

▶ Secure the cover.

71 . Install the exhaust manifold heat shield.

▶ Tighten the 2 bolts.

72 . Install the power steering pump mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

73 . Install the A/C compressor mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

74 . Install the power steering pump.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

75 . Install the A/C compressor.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

▶ Connect the electrical connector.

76 . Install both engine mounts and brackets.

▶ Clean the component mating faces.

▶ Tighten the bolts to 45 Nm (33 lb.ft).

▶ Repeat the above procedure for the other side.

77 . **NOTE:**

Install a new gasket.

Install the coolant pump.

▶ Clean the component mating faces.

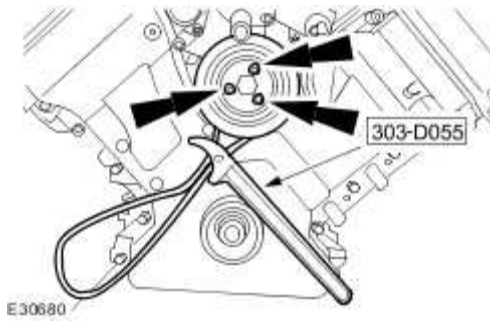
▶ Tighten the 5 bolts to 10 Nm (7 lb.ft).

78 . **NOTE:**

Make sure that new bolts are installed.

Using the special tool, install the coolant pump pulley.

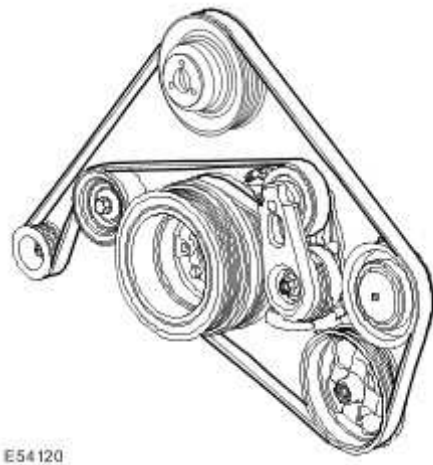
▶ Tighten the bolts to 25 Nm (18 lb.ft).



79 . Install the accessory drive belt idler pulley.

- ▶ Tighten the bolt to 25 Nm (18 lb.ft).

80 . Install the accessory drive belt.



81 . Install the accessory drive belt tensioner.

- ▶ Clean and inspect the drive pulleys for damage.
- ▶ Tighten the tensioner bolt to 40 Nm (30 lb.ft).

82 . Connect the oil cooler hoses.

83 . Remove the engine from the engine stand.

84 . Install the engine.

For additional information, refer to Engine (12.41.01)

85 . Connect the battery ground cable.

For additional information, refer to Specifications

Removal

Engine (12.41.01)

Special Service Tools



303-536

Engine lifting brackets

303-536




303-749

Engine lifting brackets

303-749

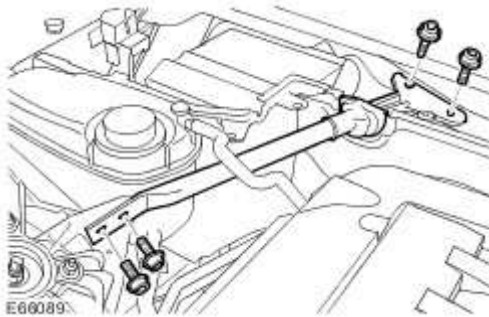
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Evacuate the A/C system.
- 3 . Remove the hood.
For additional information, refer to Hood (76.16.01)
- 4 . Remove the cowl vent screen.
For additional information, refer to Cowl Vent Screen (76.10.01)
- 5 . Remove the engine compartment braces.

 Release the grommet.

▶ Remove the 4 Torx bolts.

▶ Repeat the above procedure for the other side.



6 . Remove the throttle body.

For additional information, refer to Throttle Body (19.70.04)

7 . Using the special tool, disconnect the fuel line.

For additional information, refer to Spring Lock Couplings

8

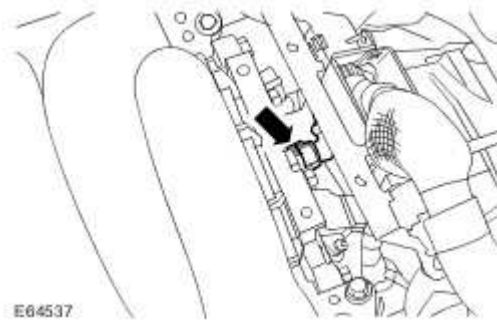


CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Release the clip and disconnect the purge inlet line.

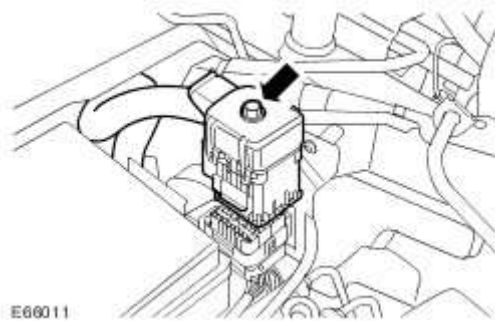


9 . Disconnect the brake booster vacuum hose from the intake manifold.



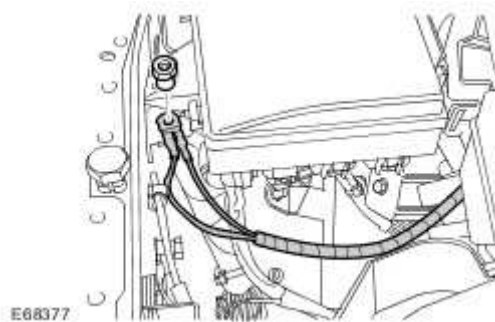
10 . Release and disconnect the engine wiring harness electrical connector.

▶ Fully loosen the bolt.



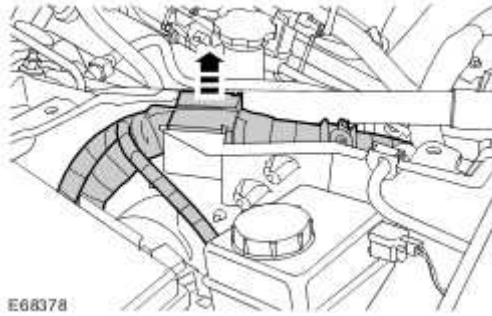
11 . Release the ground cable from the power distribution box bracket.

▶ Remove the nut.



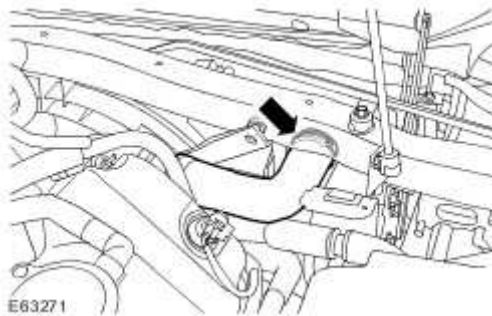
12 . Release the engine wiring harness from the engine compartment side wall.

▶ Release the grommet.



13 . Disconnect the radiator upper hose.

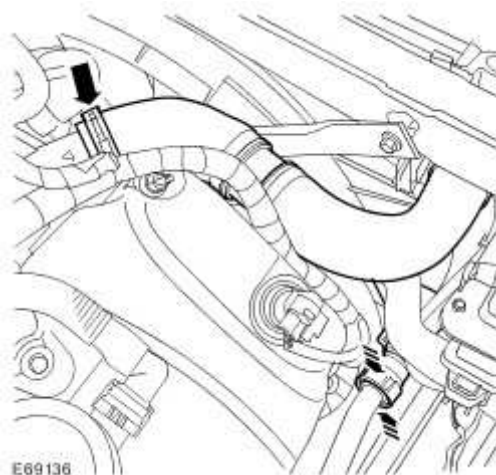
▶ Release the hose clip.



14 . Remove the radiator top hose.

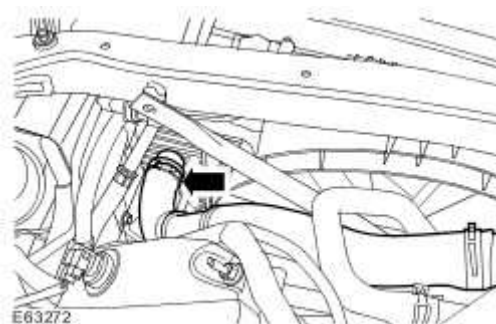
▶ Release the clip.

▶ Disconnect the quick release connector.



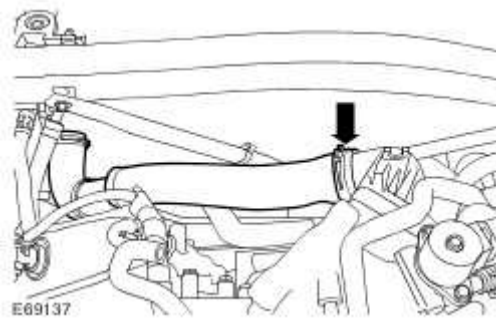
15 . Disconnect the radiator lower hose.

▶ Release the hose clip.



16 . Remove the radiator bottom hose.

▶ Release the clip.



17 . Release the power steering fluid reservoir.

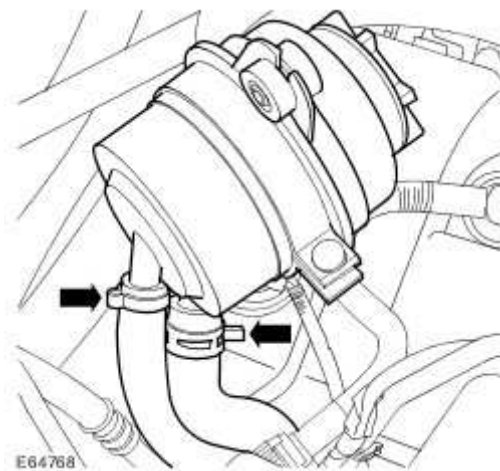
▶ Remove the 2 bolts.



18 . Disconnect the power steering supply hose.

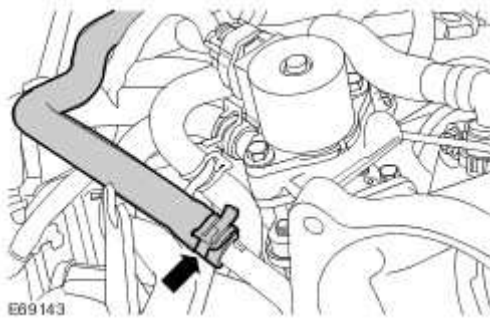
▶ Position a container to collect the fluid spillage.


▶ Release the hose clip.



19 . Disconnect the coolant expansion tank to thermostat housing coolant hose.

▶ Release the clip.




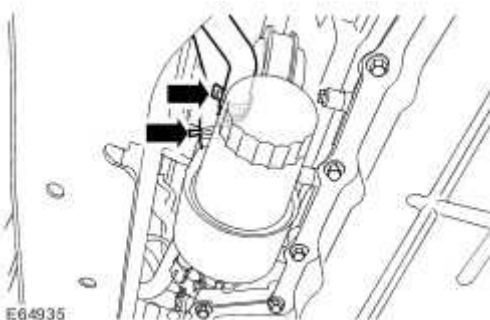
- 20 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 21 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

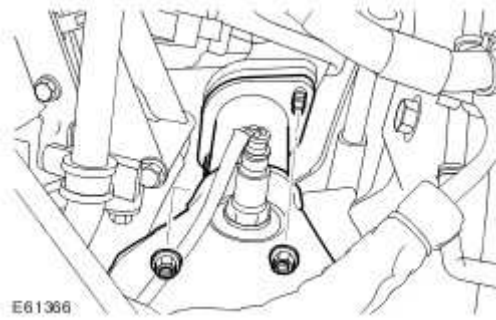
- 22 . Disconnect the coolant hoses from the engine oil cooler.

 Release the 2 clips.



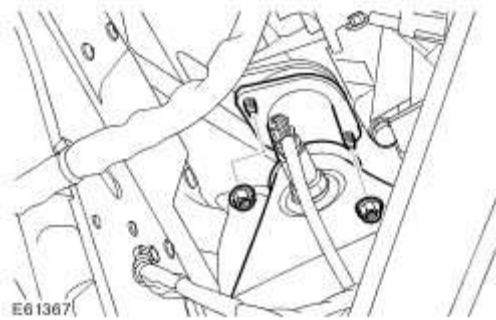
- 23 . Disconnect the LH catalytic converter from the exhaust manifold.

 Remove and discard the 2 nuts.



24 . Disconnect the RH catalytic converter from the exhaust manifold.

▶ Remove and discard the 2 nuts.



25



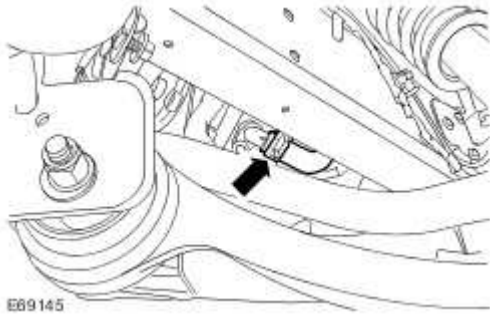
WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.




CAUTION: Always plug any open connections to prevent contamination.

Disconnect the low pressure line from the power steering pump.

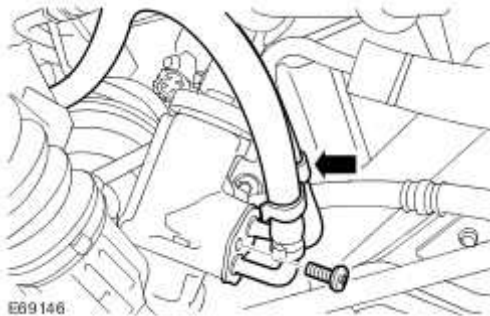
▶ Release the clip.



- 26 .  **CAUTION: Always plug any open connections to prevent contamination.**

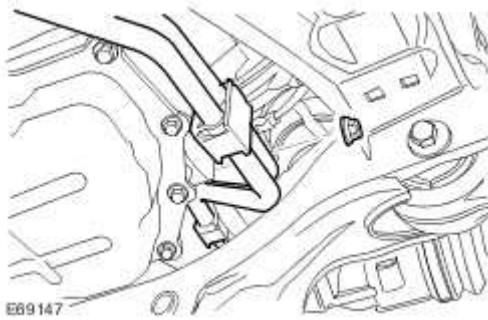
Disconnect the high pressure line from the power steering gear.

- ▶ Remove and discard the Torx bolt.
- ▶ Remove and discard the O-ring seal.
- ▶ Release from the clip.



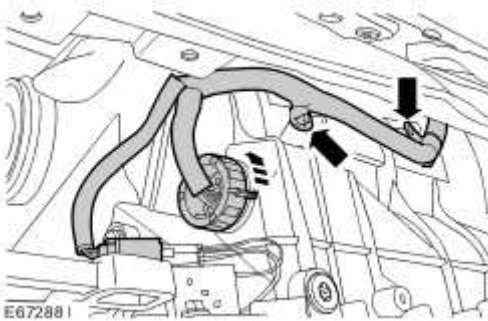
- 27 . Release the transmission fluid lines from the engine.

- ▶ Remove the nut.
- ▶ Release the clip.



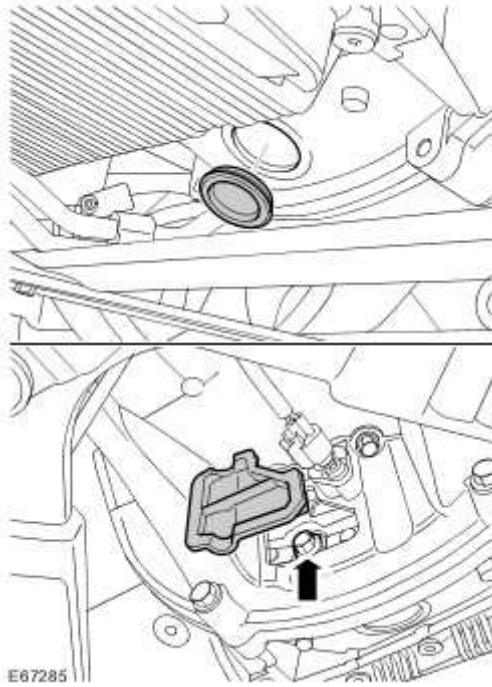
28 . Release the wiring harness from the RH side of the transmission.

- ▶ Disconnect the 2 electrical connectors.
- ▶ Carefully release the 2 clips.



29 . Release the flexplate.

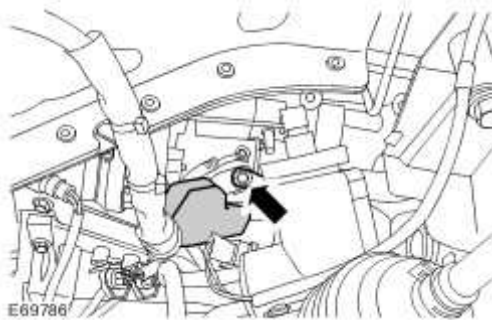
- ▶ Remove the access plugs.
- ▶ Rotate the crankshaft to access the retaining bolts.
- ▶ Remove and discard the 3 bolts.



30 . Disconnect the battery positive and generator cables.

▶ Release the cover.

▶ Remove the nut.



31

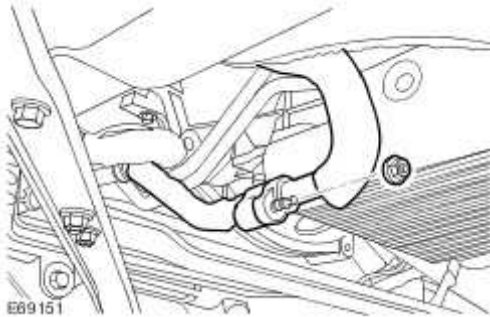


CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the A/C high-pressure line from the intermediate joint.

▶ Remove the nut.

▶ Discard the O-ring seal.

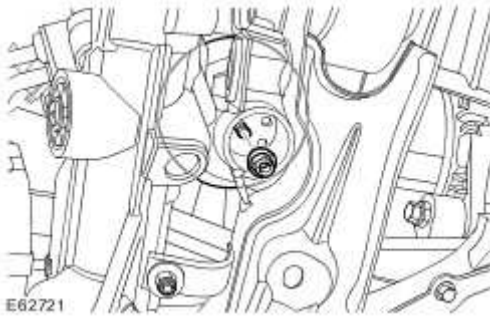


32 . **NOTE:**

RH illustration shown, LH is similar

Release the engine mounts.

▶ Remove and discard the 2 nuts.



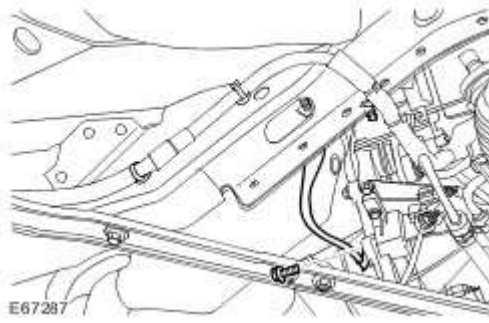
33



CAUTION: The transmission ground cable must be replaced if disconnected from the vehicle body.

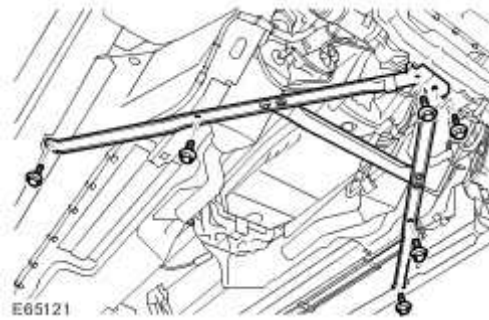
Disconnect the transmission ground cable.

▶ Remove the bolt.



34 . With assistance, remove the A-frame.

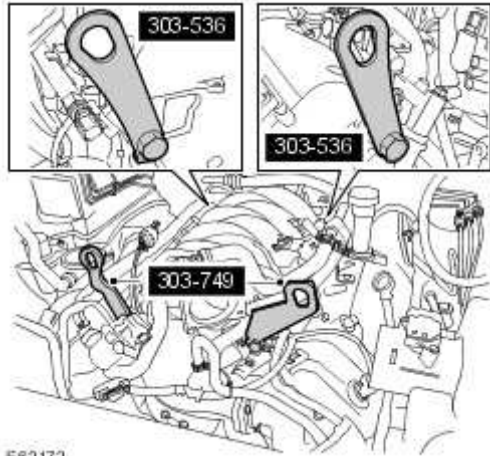
▶ Remove the 6 bolts.




35 . Lower the vehicle.

36 . Install the special tools to the engine.



▶ Support the engine.

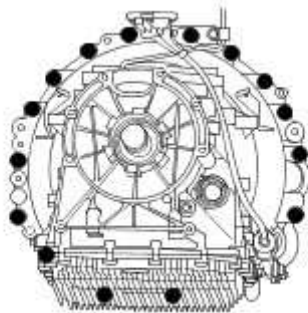


E62172

37.  **CAUTION: Make sure the torque converter remains connected to the transmission.**

Release the transmission from the engine.

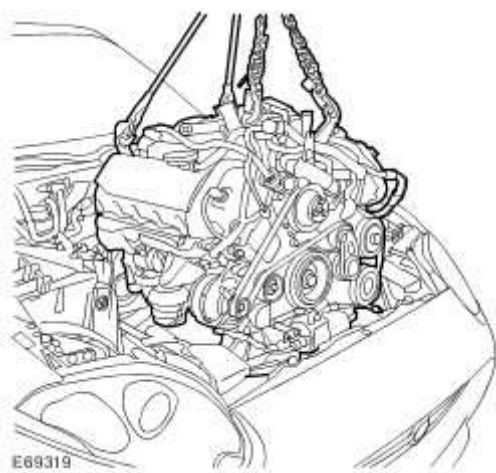
-  Remove the 15 bolts.
-  Support the transmission.



E68824

- 38  **CAUTION: Protect the suspension turrets to prevent damage upon engine removal.**

With assistance, carefully remove the engine.



39 . Install the torque converter retainer.

Engine (12.41.01)

Installation

1 . Remove the torque converter retainer.

2 .  **CAUTION: Apply grease of the correct specification to the torque converter spigot.**

With assistance, carefully install the engine.

▶ Clean the component mating faces.


▶ Tighten the bolts to 45 Nm (33 lb.ft).

3 . Carefully lower the engine onto the engine mounts.

▶ Clean the components.

▶ Tighten the new nuts to 63 Nm (46 lb.ft).

4 . Remove the special tools.

5 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

6 . Attach the flexplate to the torque converter.

- ▶ Rotate the crankshaft to access the retaining bolts.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- ▶ Install the access plugs.

7 . With assistance, install the A-frame.

- ▶ Tighten the bolts to 55 Nm (40 lb.ft).

8 . Connect the battery positive and generator cables.

- ▶ Tighten the nut to 10 Nm (7 lb.ft).
- ▶ Secure the cover.

9 . Attach the wiring harness.

- ▶ Connect the electrical connectors.
- ▶ Secure the clips.

10 . Attach the transmission fluid lines to the engine.

- ▶ Secure with the clip.
- ▶ Tighten the nut to 6 Nm (4 lb.ft).

11 . Connect the transmission ground cable.

- ▶ Tighten the bolt to 45 Nm (33 lb.ft).

12 .



CAUTION: Lubricate the new seals with clean refrigerant oil.

Connect the A/C high-pressure line intermediate joint.

- ▶ Clean the component mating faces.
- ▶ Install the new O-ring seals.
- ▶ Tighten the nut to 10 Nm (7 lb.ft).

13 . Attach the power steering gear high-pressure line.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx bolt to 25 Nm (18 lb.ft).
- ▶ Secure in the clip.

14 . Connect the low pressure line to the power steering pump.

- ▶ Secure with the clip.

15 . Lower the vehicle.


16 . Connect the coolant expansion tank to thermostat housing coolant hose.

- ▶ Secure with the clip.


17 . Secure the power steering fluid reservoir.


- ▶ Tighten the bolts to 6 Nm (4 lb.ft).

18 . Connect the engine oil cooler, coolant hoses.

 Secure with the clips.


19 . Install the radiator bottom hose.

 Install the hoses and secure with the clips.

 Connect the hoses and secure with the clips.

20 . Install the radiator top hose.


 Connect the quick release connector.

 Connect the hoses and secure with the clips.

21 . Attach the engine wiring harness to the engine compartment side wall.

 Position and secure the grommet.

22 . Attach the ground cable to the power distribution box bracket.

 Tighten the nuts to 25 Nm (18 lb.ft).

23 . Connect the engine wiring harness electrical connector and secure with the captive bolt.

24 . Connect the brake booster vacuum hose to the intake manifold.

25 . Connect the purge inlet line.

26 . Connect the fuel line.

For additional information, refer to Spring Lock Couplings

27 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)

28 . Install the engine compartment braces.

▶ Tighten the 4 Torx bolts to 25 Nm (18 lb.ft).

▶ Install the grommet.

▶ Repeat the above procedure for the other side.

29 . Install the cowl vent screen.

For additional information, refer to Cowl Vent Screen (76.10.01)

30 . Install the hood.

For additional information, refer to Hood (76.16.01)

31 . Recharge the A/C system.

32 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

33 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

34 . Refill and bleed the power steering.

For additional information, refer to Power Steering System Bleeding (57.15.02)

In vehicle repair

Special Service Tools



Camshaft setting/locking tool
303-530



Crankshaft locking tool
303-645



Timing chain tensioning tool
303-532



Tappet hold-down tool
303-540




Tappet hold-down tool adaptor
303-540/02



Fan nozzle - air gun
303-590

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the timing drive components.
For additional information, refer to Timing Drive Components (12.65.13)

- 4 . Remove the special tool from the LH cylinder head.

- 5  **CAUTION: Evenly and progressively, release the camshaft bearing caps.**

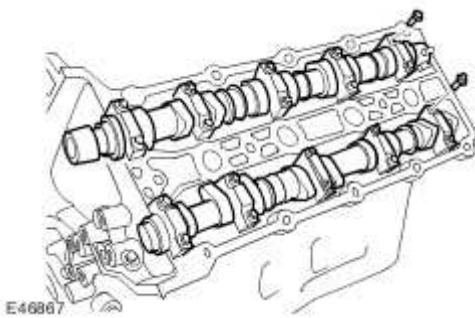
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- ▶ Remove the 20 bolts.

6 . Remove the camshafts.



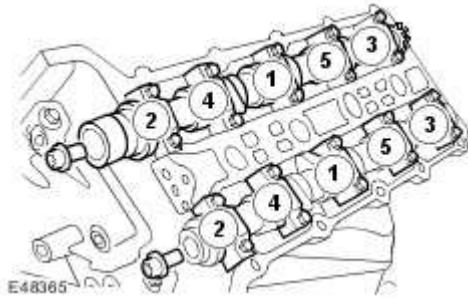
Installation

1 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Replace the valve shims, with the smallest shim available.
- ▶ Lubricate the journals and camshaft lobes.

2 Install the camshaft bearing caps.

- ▶ Clean the component mating faces.
- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).

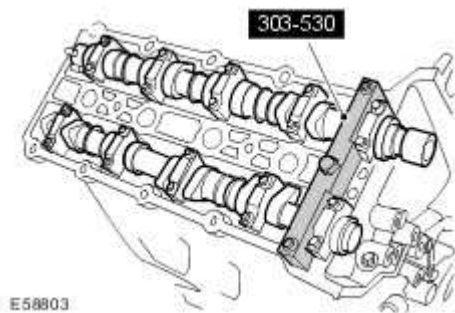


3 . NOTE:

RH illustration shown, LH is similar

Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



4 . NOTE:

Do not install the LH valve cover until valve clearance adjustment has been completed.


Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

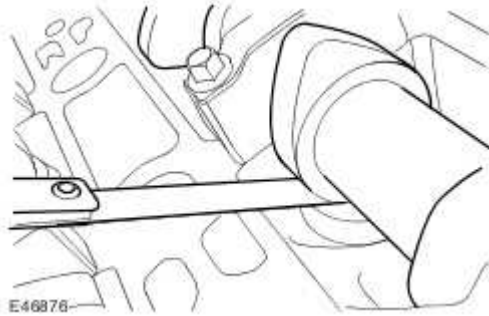
5 . For cylinder head data, refer to specifications.

For additional information, refer to Specifications

6 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

- 7
-  **CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.**

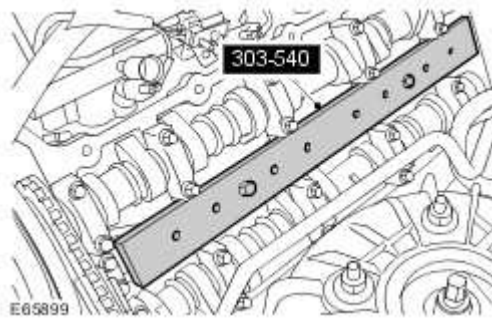
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



8 . Repeat the above procedure for the remaining 15 shims.

9 . Install the special tool 303-540, to the cylinder head.

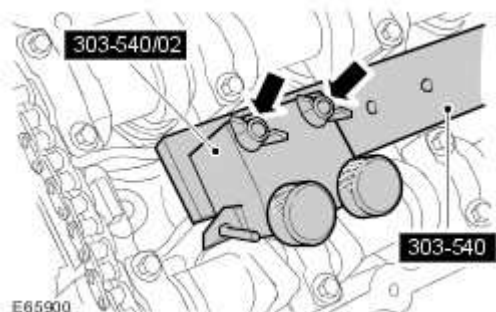
- ▶ Tighten the 2 bolts to 10 Nm (7 lb.ft).



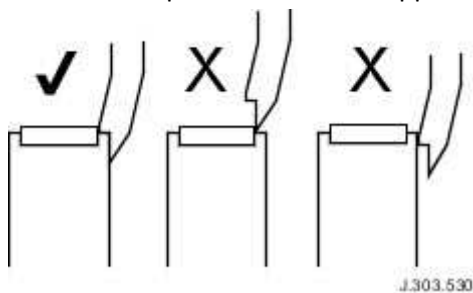
- 10
-  **CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.**

Attach the special tool 303-540/02 to 303-540.

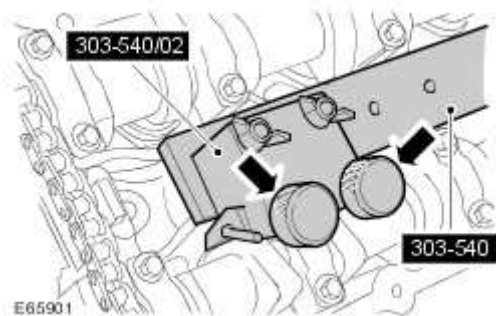
▶ Secure with the 2 wing nuts.




11 . Position the special tool to the tappet as shown.



12 . Using the special tool, compress the valve spring.



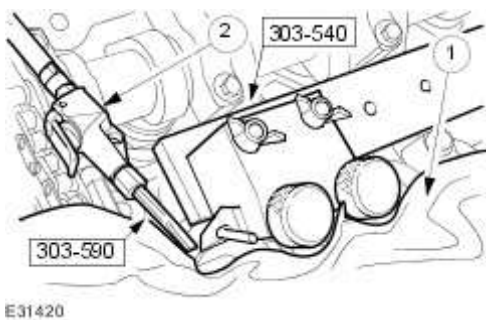
13  **CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.**

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



14



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

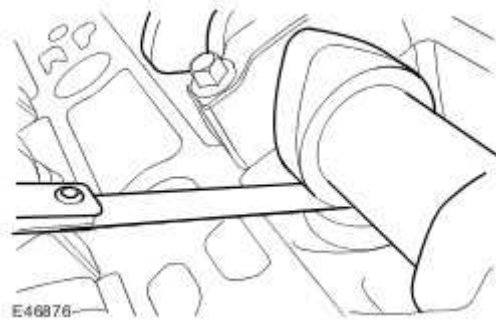


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

15 Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



16 . Repeat the above procedure for the remaining valves.

17 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Camshafts RH (12.13.18)

Special Service Tools



Camshaft setting/locking tool

303-530



Timing Setting tool

303-645



Timing chain tensioning tool

303-532

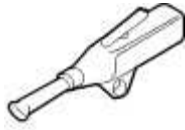


Tappet hold-down tool

303-540



Tappet hold-down tool adaptor
303-540/02




DWST074

Fan nozzle - air gun
303-590


Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine front cover.
For additional information, refer to Engine Front Cover (12.65.01)
- 4 . Remove the crankshaft position (CKP) sensor.
For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

- 5  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

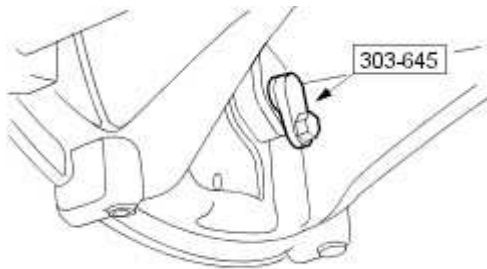


CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.

Lock the crankshaft.

▶ Install the special tool.

▶ Install the screw.

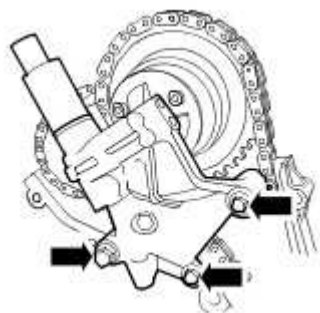


VUJ0002400

6 . Remove the RH variable camshaft timing (VCT) control solenoid housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seals.

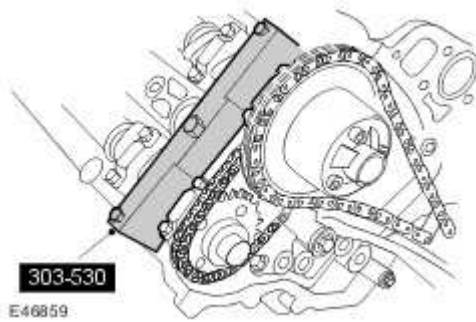


E46858

7 Install the special tool to the RH cylinder head.

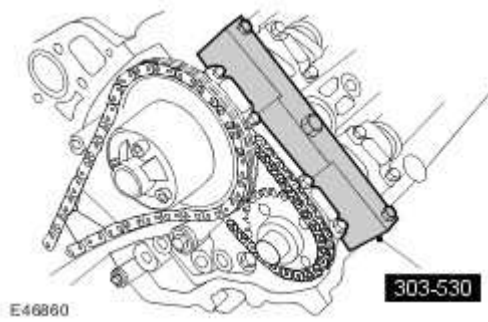
▶ Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.

▶ Install the 3 bolts.



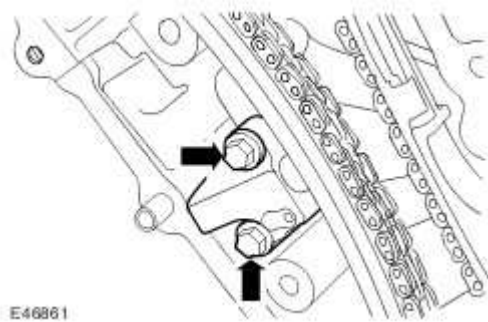
8 . Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



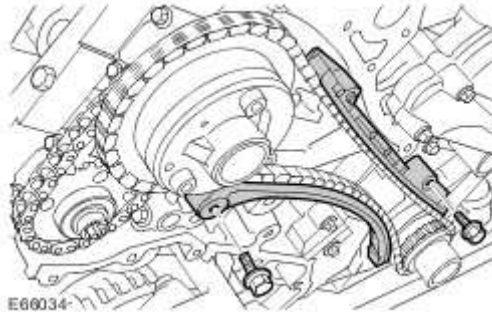
9 . Remove the RH primary timing chain tensioner.

▶ Remove the 2 bolts.

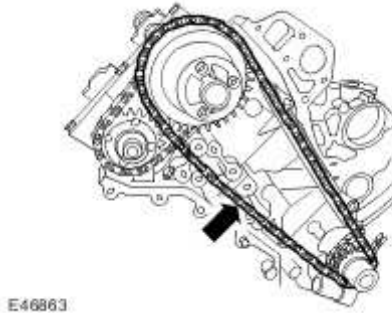


10 . Remove the RH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



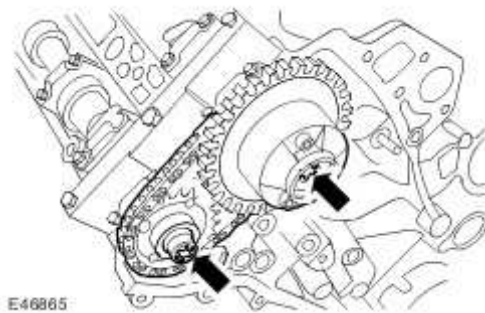
11 . Remove the RH primary timing chain.



12 .  **CAUTION: Discard the bolts.**

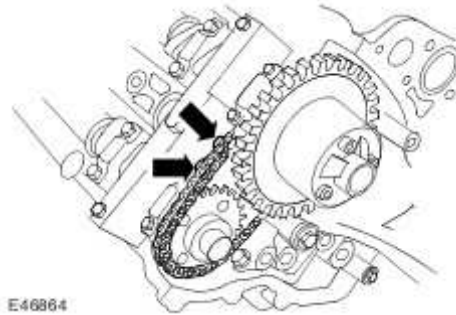
Release the RH camshaft sprocket assembly.

▶ Remove the 2 Torx bolts.



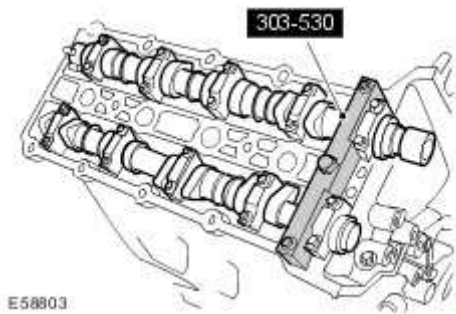
13 . Remove the RH secondary timing chain, tensioner and sprocket assembly.

▶ Remove the 2 retaining bolts.



14 . Remove the special tool from the RH cylinder head.

▶ Remove the 3 bolts.



15



CAUTION: Evenly and progressively, release the camshaft bearing caps.

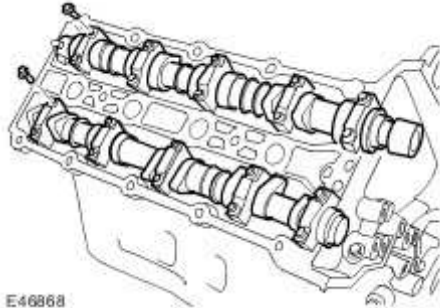
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

- ▶ Remove the 20 bolts.

16 . Remove the camshafts.



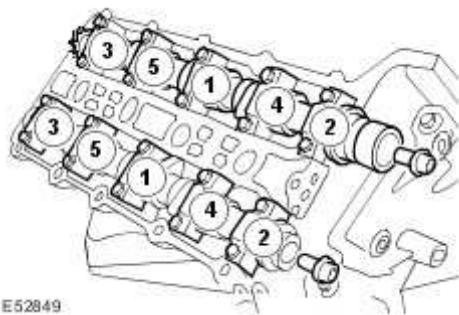
Installation

1 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Replace the valve shims, with the smallest shim available.
- ▶ Lubricate the journals and camshaft lobes.

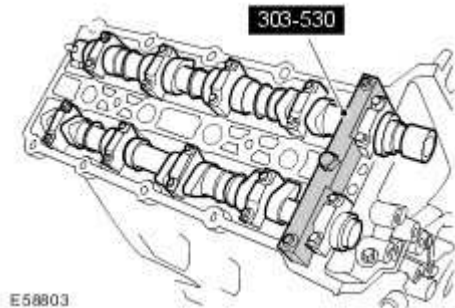
2 Install the camshaft bearing caps.

- ▶ Clean the component mating faces.
- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm.



3 . Install the special tool to the RH cylinder head.

▶ Install the 3 bolts.



4



CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

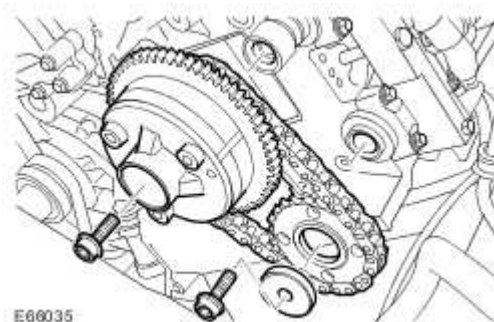
NOTE:

LH illustration shown, RH is similar.

Install the RH secondary timing chain, tensioner and sprocket assembly.

▶ Clean the components.

▶ Install the Torx bolts, but do not tighten fully at this stage.



5 . Install the RH secondary timing chain tensioner retaining bolts.

▶ Tighten the bolts to 12 Nm.

6 Install the RH primary timing chain.

▶ Clean the components.

▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

7 . Install the RH primary timing chain tensioner guides.

▶ Tighten the bolts to 12 Nm.

8



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

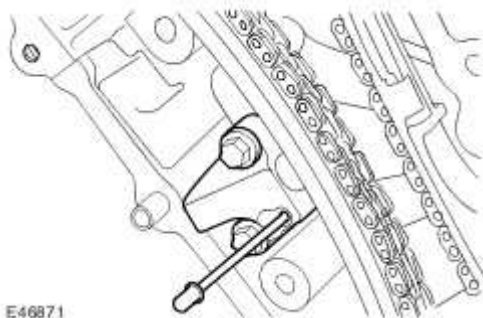
Install the RH primary timing chain tensioner.

▶ Clean the components.

▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.

▶ Tighten the bolts to 12 Nm.

▶ Remove the retaining rod.



9



CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



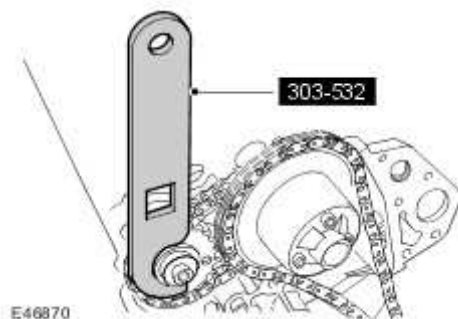
CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.



CAUTION: Make sure that new bolts are installed.

Install the special tool to the RH exhaust camshaft sprocket.

- ▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- ▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.




10 . Install the RH VCT control solenoid housing.

- ▶ Clean the components.
- ▶ Install the new O-ring seals.
- ▶ Tighten the new bolts to 22 Nm.

11 . Remove the special tool from the RH cylinder head.

12 . Remove the special tool from the LH cylinder head.

13 . Remove the crankshaft locking tool.

 Remove the screw.


14 . Install the CKP sensor.

For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

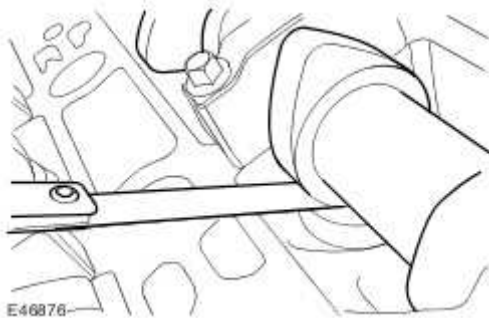
15 . For cylinder head data, refer to specifications.

For additional information, refer to Specifications

16 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

17  **CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.**

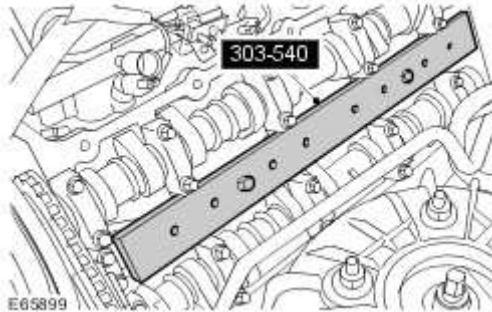
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



18 . Repeat the above procedure for the remaining 15 shims.

19 . Install the special tool 303-540, to the cylinder head.

▶ Tighten the 2 bolts to 10 Nm.



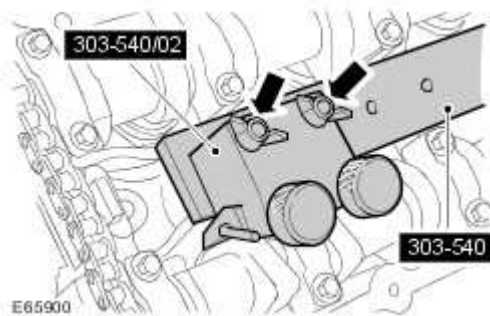
20



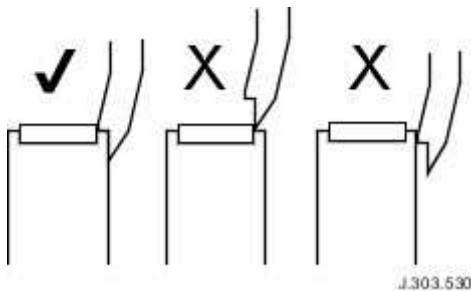
CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

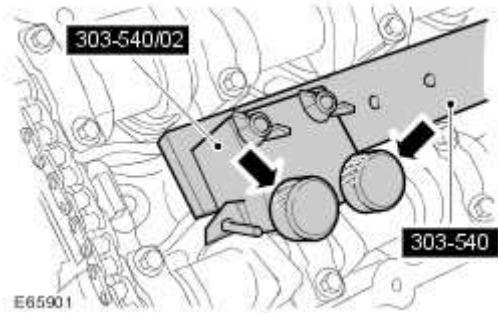
▶ Secure with the 2 wing nuts.



21 . Position the special tool to the tappet as shown.



22 . Using the special tool, compress the valve spring.



23



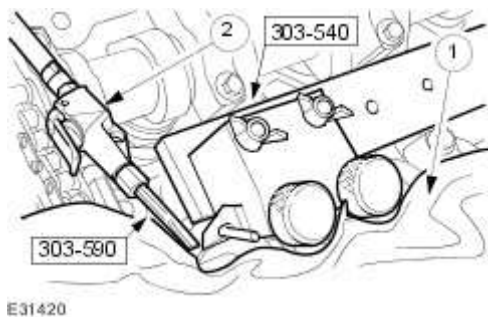
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



24



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

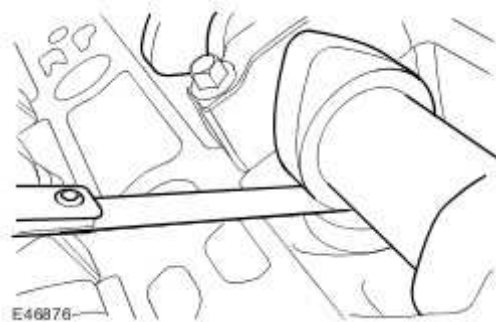


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

25 Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



26 . Repeat the above procedure for the remaining valves.

27 . Install the engine front cover.

For additional information, refer to Engine Front Cover (12.65.01)

28 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Crankshaft Front Seal (12.21.14)

Removal

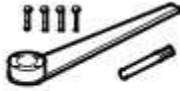
- 1 . Remove the crankshaft pulley.
For additional information, refer to Crankshaft Pulley (12.21.09)

Installation

- 1 . Install the crankshaft pulley.
For additional information, refer to Crankshaft Pulley (12.21.09)

Crankshaft Pulley (12.21.09)

Special Service Tools



303-191

Crankshaft pulley locking tool

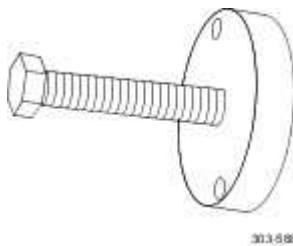
303-191



303-191-02

Crankshaft pulley locking tool adapter

303-191/02



303-588

Crankshaft pulley/damper remover

303-588



303-751

Seal extractor

303-751




303-750

Seal installer

303-750

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

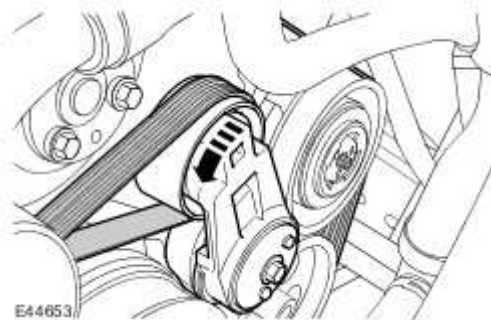
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

- 3 . Remove the oil filter housing.
For additional information, refer to Oil Filter Housing

- 4 Release the accessory drive belt.

- ▶ Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



- 5  **CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.**

NOTE:

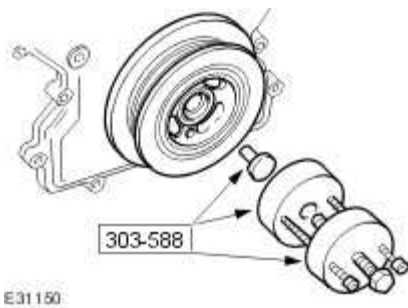
The crankshaft pulley retaining bolt will be very tight.

Using the special tool, retain the crankshaft front pulley.

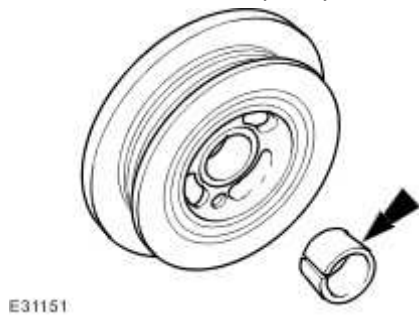
- ▶ Remove and discard the crankshaft pulley retaining bolt.
- ▶ Remove the special tools.

6 . Using the special tools, remove the crankshaft pulley.

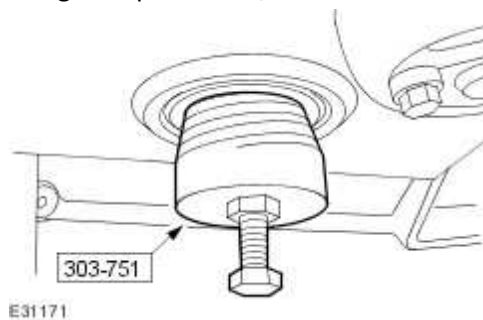
- ▶ Collect the locking ring.
- ▶ Remove the special tools.



7 . Check the crankshaft pulley and locking ring for damage.




8 . Using the special tool, remove the crankshaft front seal.



Installation

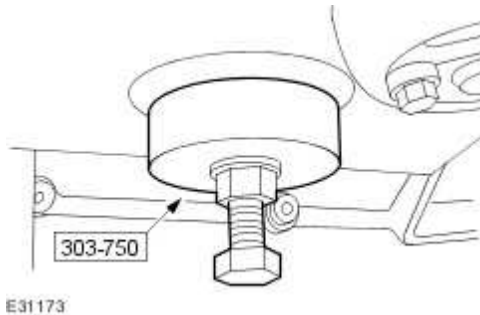
1.  **CAUTION: Make sure the crankshaft seal mating faces are clean and dry.**

-  **CAUTION: Do not remove the seal protector at this stage.**

Using the special tool, install the crankshaft front seal.

- ▶ Clean the component mating faces.


2. Remove the seal protector.



3. Install the crankshaft pulley.

- ▶ Lubricate the seal with clean engine oil.

- ▶ Install the locking ring.

- 4  **CAUTION: The screw thread in the crankshaft pulley must be cleaned out before installing a new crankshaft pulley bolt.**

Install, but do not tighten, the new crankshaft pulley bolt.

5



CAUTION: Under no circumstances should the crankshaft setting peg, 303-645, be used in the following operations, to restrain the crankshaft.

Using the special tools, retain the crankshaft pulley.

▶ Tighten the crankshaft pulley bolt to 380 Nm (280 lb.ft).

▶ Remove the special tools.

6 . Attach the accessory drive belt.

7 . Install the oil filter housing.

For additional information, refer to Oil Filter Housing

8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Crankshaft Rear Seal (12.21.20)

Special Service Tools



Crankshaft rear oil seal remover/installer
303-538

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . Remove the torque converter flexplate.
For additional information, refer to Flexplate (12.53.13)
- 4 . Install the special tools.
 - ▶ Install the 2 bolts.
 - ▶ Tighten the 2 nuts to retain the special tool.

E46613



5 . Using the special tool, pierce the seal to create holes for the 6 self-tapping screws.

E46614




6 . Using the special tools, remove and discard the crankshaft rear oil seal.

- ▶ Install the 6 self-tapping screws.
- ▶ Adjust the 2 nuts.
- ▶ Tighten the center bolt.

E46615




Installation

1.  **CAUTION: Do not lubricate the components.**

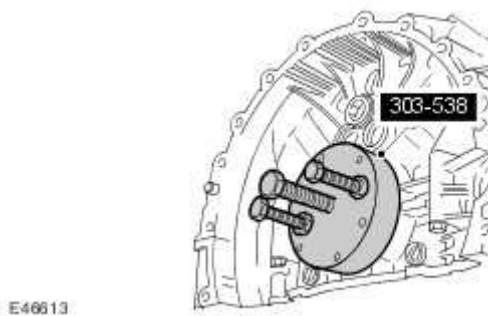
Partially install the crankshaft rear oil seal.

- ▶ Make sure the components are clean and dry.
- ▶ Carefully remove the transit sleeve, leaving the seal on the crankshaft.

- 2  **CAUTION: Make sure the seal is installed parallel**

Using the special tool, install the crankshaft rear oil seal.

- ▶ Tighten the special tool nuts evenly and progressively to fully install the seal.




- 3 . Install the torque converter flexplate.
For additional information, refer to Flexplate (12.53.13)
- 4 . Check and top-up the engine oil.
- 5 . Connect the battery ground cable.
For additional information, refer to Specifications

Cylinder Head LH (12.29.02)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the intake manifold.
For additional information, refer to Intake Manifold (30.15.01)

- 4 . Remove the timing drive components.
For additional information, refer to Timing Drive Components (12.65.13)


- 5 . Remove the special tool from the LH cylinder head.

- 6  **CAUTION: Evenly and progressively, release the camshaft bearing caps.**

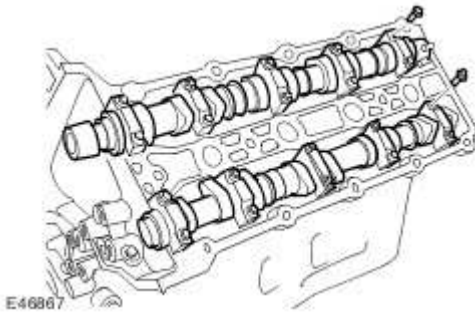
NOTE:

Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Remove the camshaft bearing caps.

-  Remove the 20 bolts.

7 . Remove the camshafts.



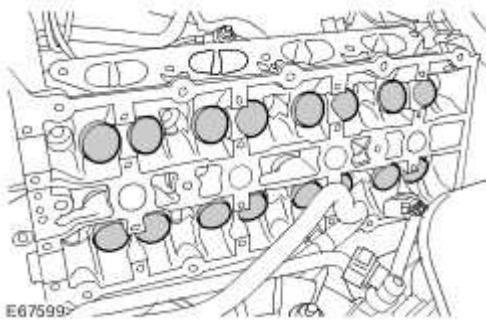
8 . **NOTE:**

Note the fitted position.

NOTE:

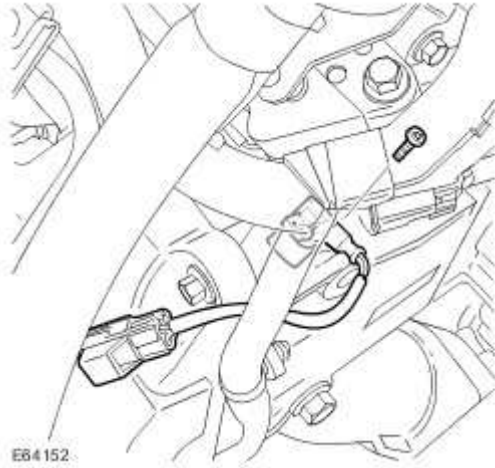
Make sure the shim remains with the tappet.

Remove the 16 tappets.



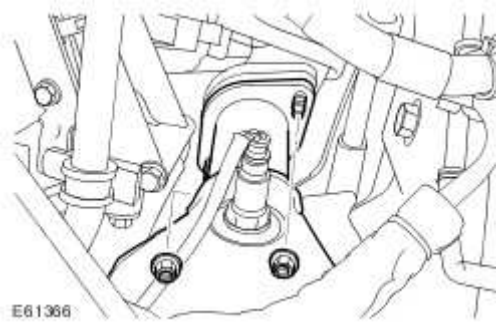
9 . Remove the CMP sensor.

- ▶ Remove the Torx bolt.
- ▶ Remove and discard the O-ring seal.



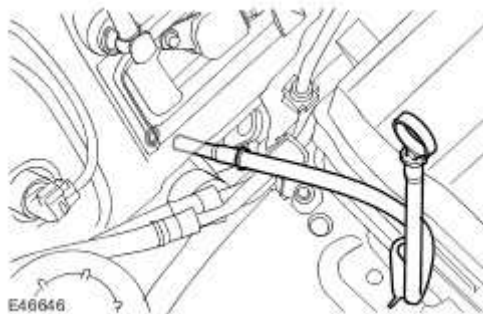
10 . Release the LH catalytic converter.

▶ Remove and discard the 2 nuts.



11 . Remove the oil level indicator and tube.

▶ Discard the O-ring seal.



12



CAUTION: The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.

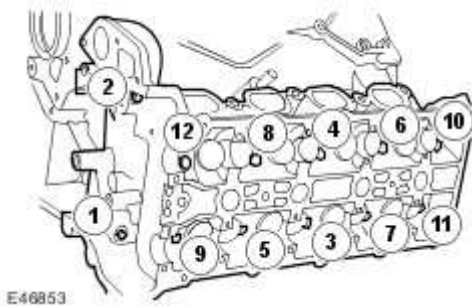


CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

NOTE:

Remove the bolts in the indicated sequence.

Remove the 12 cylinder head bolts.



13



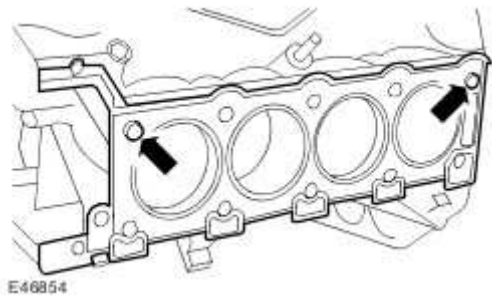
CAUTION: The cylinder head must not be placed mating face down. Failure to follow this instruction may result in damage to the vehicle.

With assistance remove the cylinder head.

14 . Remove and discard the cylinder head gasket.

▶ Clean the cylinder head locating dowels.

▶ Clean and inspect the cylinder head and cylinder block.

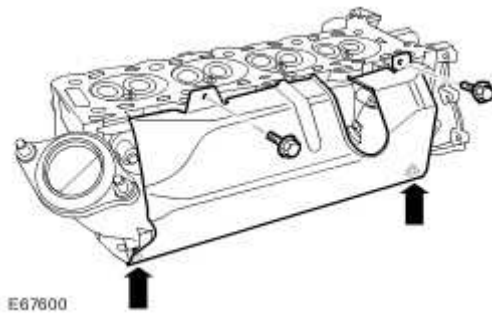


15 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the LH heat shield.

▶ Remove the 4 screws.



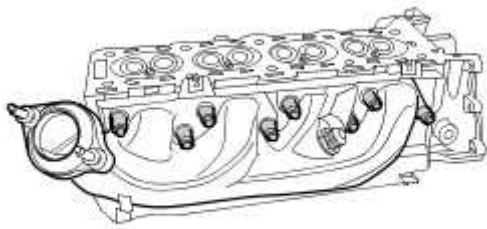
16 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the exhaust manifold.

▶ Remove and discard the 8 bolts.

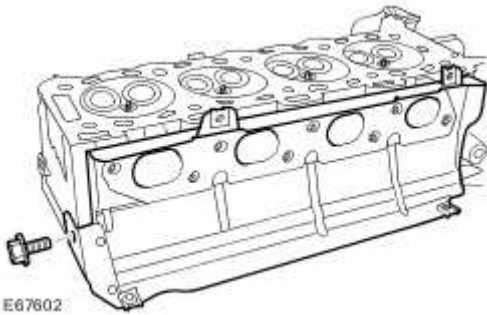
▶ Remove the 8 spacers.



E67601

17 . Remove and discard the exhaust manifold gasket.

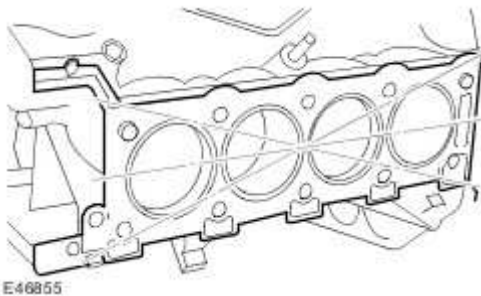
▶ Remove the bolt.



E67602

Installation

- 1 . Clean the component mating faces.
- 2 . Check cylinder head face for distortion, across the center and from corner to corner.



E46855

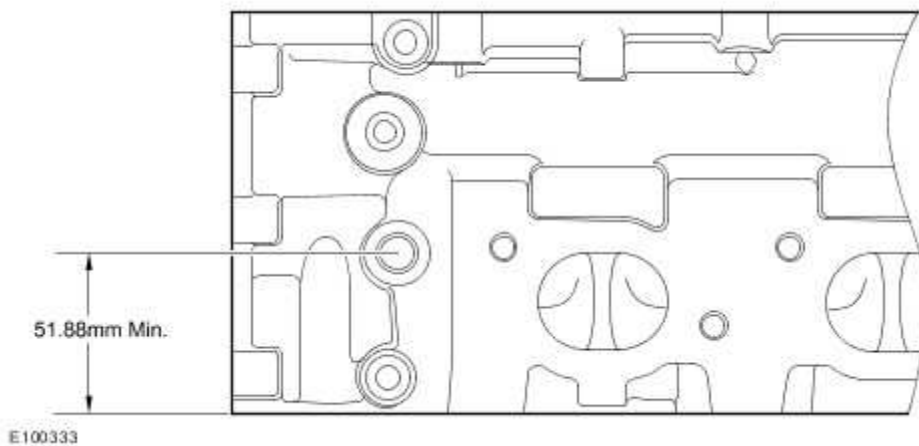
- 3 . For cylinder head face distortion data, refer to specifications.
For additional information, refer to Specifications

4 **NOTE:**

For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

Measure the cylinder head material.

- ▶ Check measurement from the centre of the exhaust dowel to the cylinder head face as shown.
- ▶ If the measurement is less than 51.88 mm the cylinder head requires replacement.



- 5 . Install the exhaust manifold gasket.

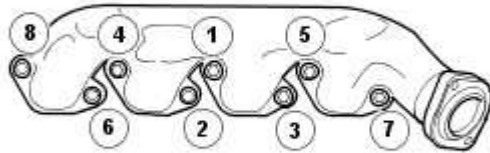
- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).

- 6 Install the exhaust manifold.

- ▶ Clean the component mating faces.

▶ Install the spacers.

▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



E65731

7 . Install the heat shield.

▶ Tighten the screws.

8 .



CAUTION: The head gasket must be installed over the cylinder block dowels.

Install a new cylinder head gasket.

9 . With assistance install the cylinder head.

10 . **NOTE:**

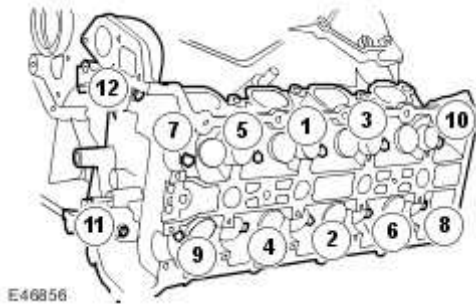
Tighten the bolts 1 to 10 in the sequence shown.

Install the cylinder head bolts.

▶ Lubricate the new cylinder head bolt threads with clean engine oil.

▶ Tighten the bolts 1 to 10 to 20 Nm (15 lb.ft).

- ▶ Tighten the bolts 1 to 10 to 35 Nm (26 lb.ft).
- ▶ Tighten the bolts 1 to 10, a further 90 degrees.
- ▶ Tighten the bolts 1 to 10, a further 90 degrees.
- ▶ Tighten the M8 bolts 11 and 12, to 25 Nm (18 lb.ft).



11 . Install the oil level indicator and tube.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Lubricate the O-ring seal with clean engine oil.

12 . Attach the catalytic coverter.

- ▶ Tighten the nuts to 40Nm (30 lb.ft).

13 . Install the CMP sensor.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).

14 . Install the tappets.

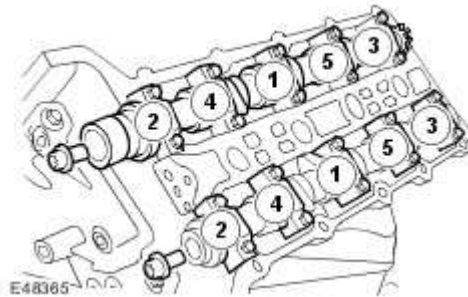
- ▶ Clean the components.
- ▶ Lubricate the components with clean engine oil.

15 . Install the camshafts.

- ▶ Clean the component mating faces.
- ▶ Lubricate the journals and camshaft lobes with clean engine oil.

16 Install the camshaft bearing caps.

- ▶ Clean the component mating faces.
- ▶ Evenly and progressively tighten the bolts in the sequence shown to 10 Nm (7 lb.ft).

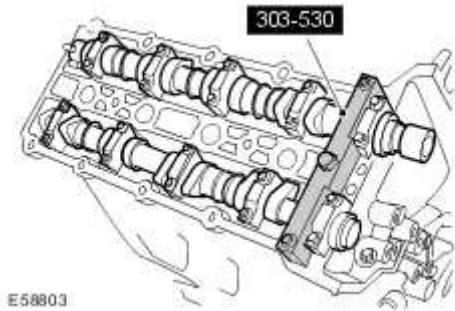


17 . **NOTE:**

RH illustration shown, LH is similar.

Install the special tool to the LH cylinder head.

- ▶ Install the 3 bolts.



18 . **NOTE:**

Do not install the LH valve cover until valve clearance adjustment has been completed.

Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

19 . Install the intake manifold.

For additional information, refer to Intake Manifold (30.15.01)

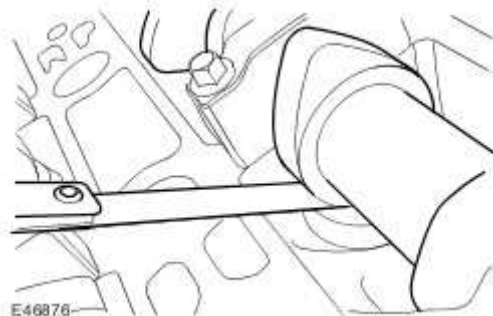
20 . Rotate the engine clockwise to position the camshaft lobe away from the valve tappet.

21



CAUTION: Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.

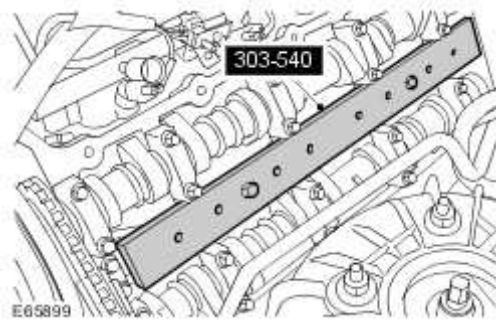
Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



22 . Repeat the above procedure for the remaining 15 shims.

23 . Install the special tool 303-540, to the cylinder head.

▶ Tighten the 2 bolts to 10 Nm (7 lb.ft).



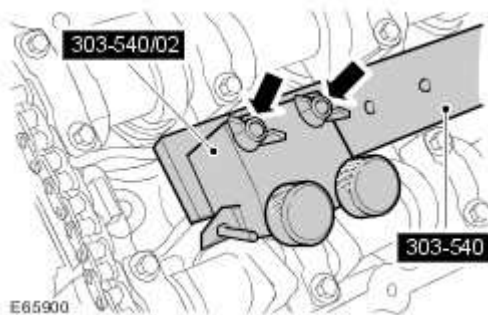
24



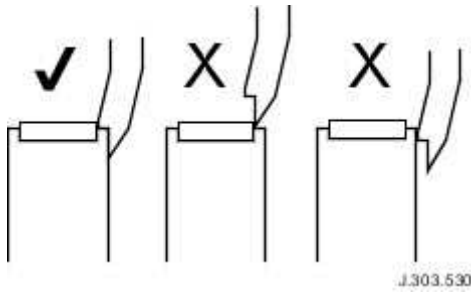
CAUTION: Do not rotate the crankshaft while the special tool 303-540/02 is attached to 303-540.

Attach the special tool 303-540/02 to 303-540.

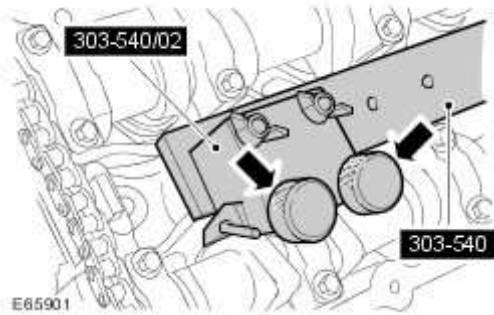
▶ Secure with the 2 wing nuts.



25 . Position the special tool to the tappet as shown.



26 . Using the special tool, compress the valve spring.



27



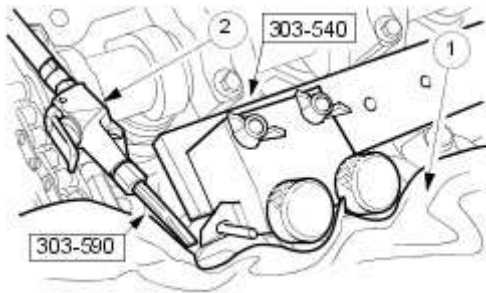
CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.

NOTE:

Use the following formula to calculate the required shim thickness. Original shim thickness + measured shim clearance - desired clearance = required shim thickness.

Remove, clean and measure the shim.

- ▶ Surround the immediate working area with a cloth, to retain any loose shims displaced by the compressed air.
- ▶ Use the special tool 303-590, aimed at the edge of the shim, to lift it from the tappet. Note the position of each one.



E31420

28



CAUTION: Shims must be fitted with the size markings facing the tappet, not the camshaft.

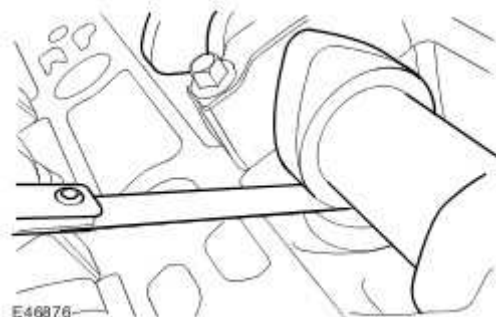


CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.

Install the new shim.

- ▶ Clean the components.
- ▶ Lubricate the shim with clean engine oil.
- ▶ Release and remove the special tools as required.

29 Using the feeler gauge set, measure the clearance between the camshaft and the valve shim.



30 . Repeat the above procedure for the remaining valves.

- 31 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Engine Front Cover (12.65.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Recover the A/C refrigerant.

3



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 4 . Remove the hood.

For additional information, refer to Hood (76.16.01)


- 5 Vehicles with secondary air injection: Remove the air control valve to exhaust manifold tube.


- For additional information, refer to Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

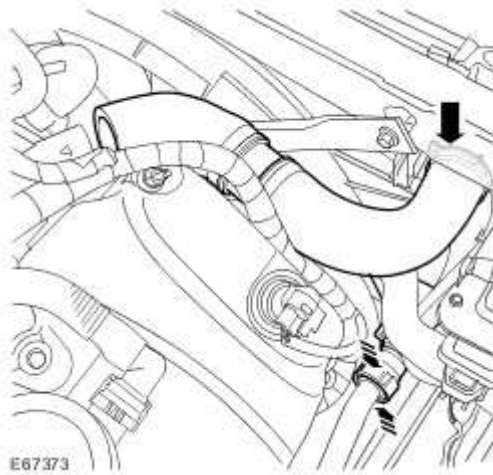
- 6 . Remove the thermostat housing.

For additional information, refer to Thermostat Housing - Vehicles Without: Supercharger

- 7 . Remove the radiator top hose.

 Release the clip.

 Disconnect the quick release connector.



8 . Remove the LH valve cover.

For additional information, refer to Valve Cover LH (12.29.43)

9 . Remove the RH valve cover.

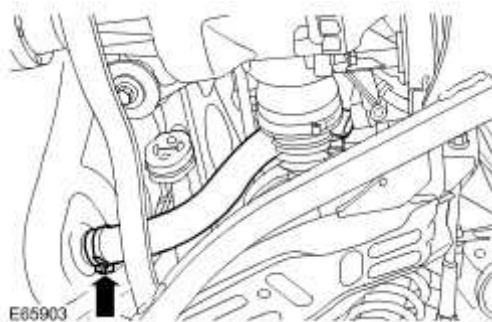
For additional information, refer to Valve Cover RH (12.29.44)

10 . Remove the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)

11 . Remove the radiator bottom hose.

▶ Release the clip.



12 . Remove the power steering pump.

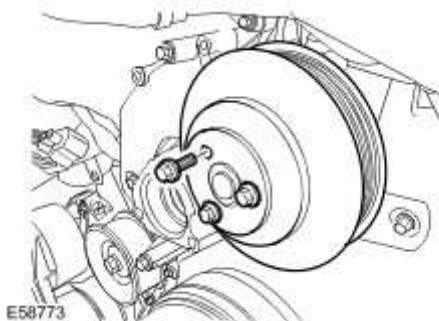
For additional information, refer to Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)

13 . **NOTE:**

Restrain the pulley to aid the removal of the bolts.

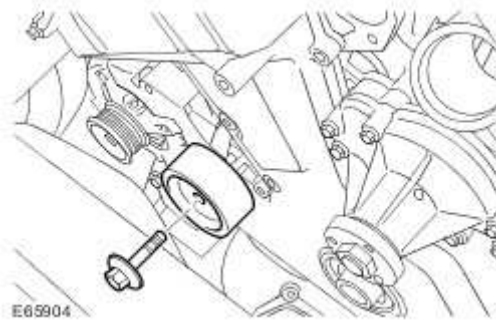
Remove the coolant pump pulley.

▶ Remove the 3 bolts.



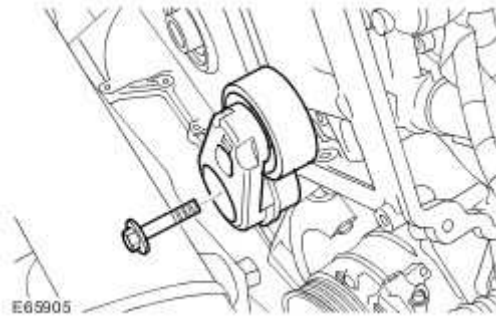
14 . Remove the accessory drive belt idler pulley.


▶ Remove the bolt.



15 . Remove the accessory drive belt tensioner.

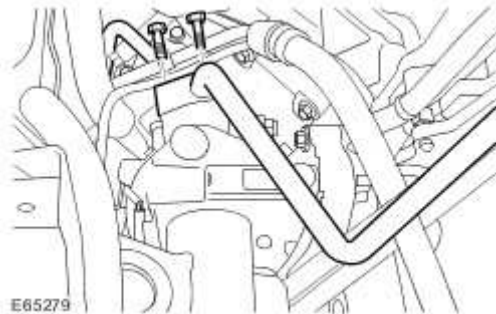
▶ Remove the bolt.



- 16  **CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.**

Disconnect the refrigerant lines from the A/C compressor.

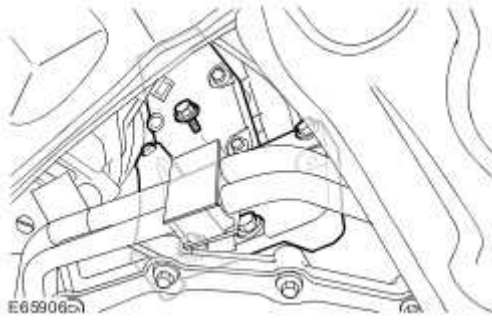
- ▶ Remove the 2 bolts.
- ▶ Remove and discard the 2 O-ring seals.



17 . Position the A/C compressor aside to access the A/C compressor mounting bracket.

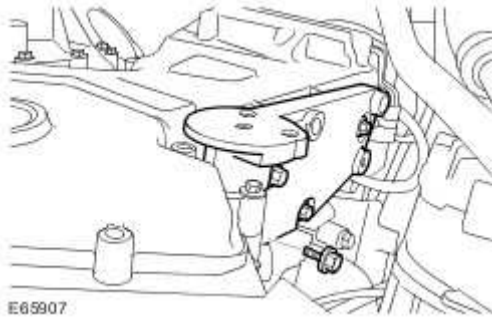
18 . Remove the A/C compressor mounting bracket.

- ▶ Remove the 4 bolts.



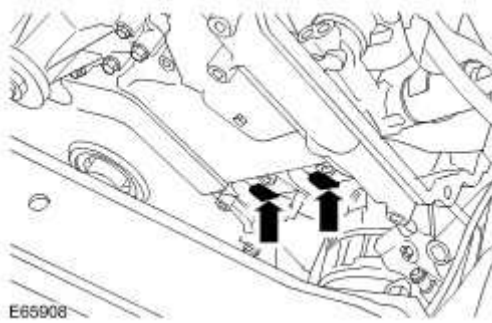
19 . Remove the power steering pump mounting bracket.

▶ Remove the 4 bolts.



20 . LH side: Release the wiring harness.

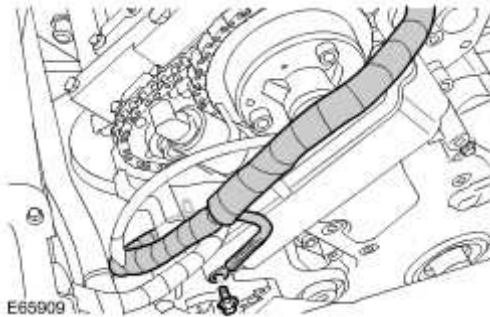
▶ Release the 2 clips.



21 . RH side: Release the wiring harness.

▶ Remove the bolt.

▶ Release the clip.

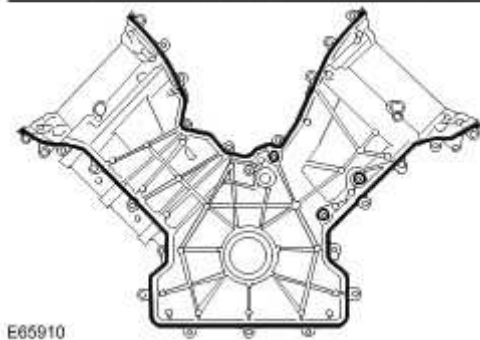
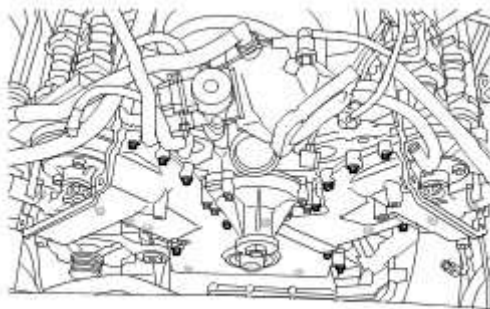


22 . Remove the engine front cover.

▶ Remove the 24 bolts.

▶ Remove and discard the 2 gaskets.

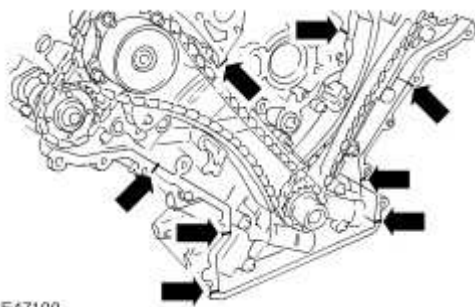
▶ Remove and discard the 3 O-ring seals.



Installation

1 Install the engine front cover.

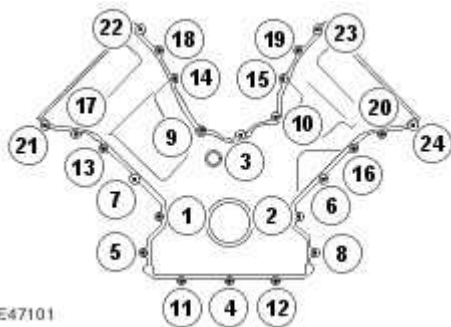
- ▶ Clean the component mating faces.
- ▶ Install the gaskets.
- ▶ Install the O-ring seals.
- ▶ Apply a bead of sealant 3 mm diameter, by 12 mm long, to the 8 places indicated.



E47100

2 Install the engine front cover bolts.

- ▶ Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



E47101

3 . RH side: Attach the wiring harness.

- ▶ Secure the clip.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

4 . LH side: Attach the wiring harness.

▶ Secure the clips.

5 . Install the power steering pump mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

6 . Install the A/C compressor mounting bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

7 .



CAUTION: Lubricate the new seals with clean refrigerant oil.

Connect the refrigerant lines.

▶ Clean the component mating faces.

▶ Install the new O-ring seals.

▶ Tighten the bolts to 9 Nm (7 lb.ft).


8 . Install the accessory drive belt tensioner.

▶ Tighten the bolt to 45 Nm (33 lb.ft).

9 . Install the accessory drive belt idler pulley.

▶ Tighten the bolt to 45 Nm (33 lb.ft).


10 . Install the coolant pump pulley.

 Tighten the bolts to 10 Nm (7 lb.ft).

11 . Install the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)

12 . Install the radiator bottom hose.

 Secure the clip.

13 . Install the crankshaft pulley.

For additional information, refer to Crankshaft Pulley (12.21.09)


14 . Install the RH valve cover.

For additional information, refer to Valve Cover RH (12.29.44)

15 . Install the LH valve cover.

For additional information, refer to Valve Cover LH (12.29.43)

16 . Install the radiator top hose.

 Secure the clip.

 Connect the quick release connector.

17 . Install the thermostat housing.

For additional information, refer to Thermostat Housing - Vehicles Without: Supercharger

18 Vehicles with secondary air injection: Install the air control valve to exhaust manifold tube.

. For additional information, refer to Secondary Air Injection (AIR) Control Valve to Exhaust

Manifold Tube

19 . Install the hood.

For additional information, refer to Hood (76.16.01)

20 . Recharge the A/C system.

21 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Engine Mount LH (12.45.01)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)
- 4 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

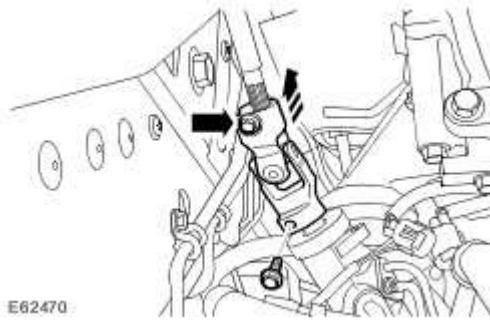
Left-hand drive vehicles

- 5 . **NOTE:**

Note the fitted position.

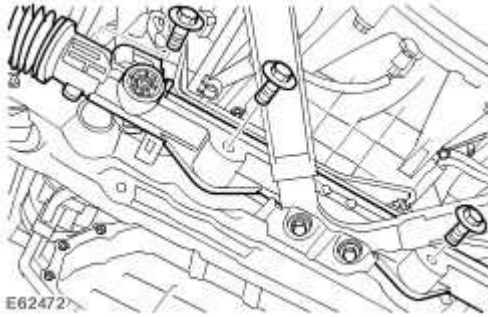
Remove the steering gear flexible coupling.

- ▶ Remove and discard the 2 bolts.



6 . Release the steering gear.

▶ Remove the 3 bolts.

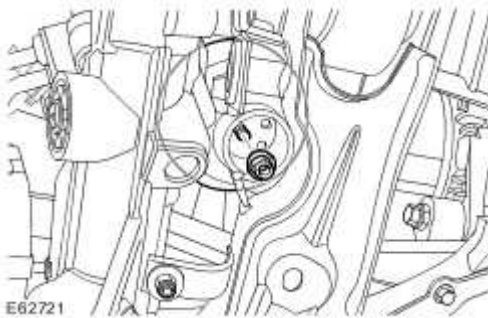


All vehicles

7 . Release the engine mount.

▶ Support the engine.

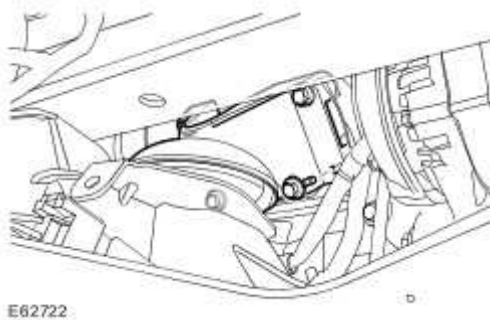
▶ Remove and discard the nut.



8 . Remove the engine mount and bracket.

▶ Raise the engine.

▶ Remove the 4 bolts.



9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the engine mount.

▶ Remove and discard the nut.



Installation

All vehicles

1 . Install the engine mount.

▶ Tighten the new nut to 55 Nm (41 lb.ft).

2 . Install the engine mount and bracket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- ▶ Lower the engine.
- ▶ Tighten the new nut to 63 Nm (46 lb.ft).

Left-hand drive vehicles

3 . Secure the steering gear.

- ▶ Tighten the bolts to 100 Nm (74 lb.ft).

4 . Install the steering gear flexible coupling.

- ▶ Tighten the new bolts to 35 Nm (26lb.ft).

All vehicles

5 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)

6 . Install the front wheel.

For additional information, refer to Wheel and Tire (74.20.05)

7 . Connect the battery ground cable and install the cover.


For additional information, refer to Specifications

Engine Mount RH (12.45.03)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the air deflector.
For additional information, refer to Air Deflector (76.11.41)

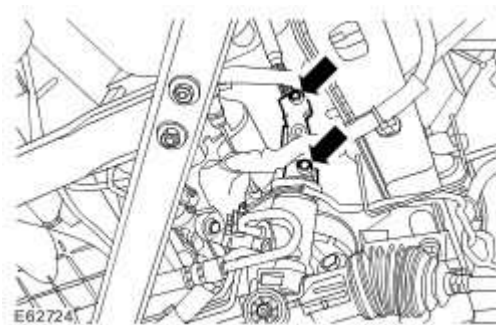
Right-hand drive vehicles

- 4 . **NOTE:**

Note the fitted position.

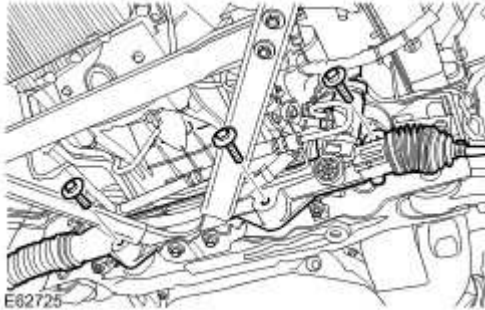
Remove the steering gear flexible coupling.

-  Remove and discard the 2 bolts.



5 . Release the steering gear.

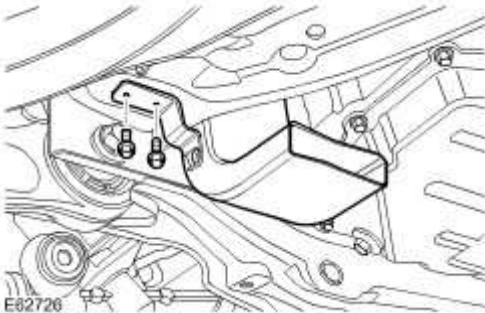
▶ Remove the 3 bolts.



All vehicles

6 . Remove the generator cooling duct.

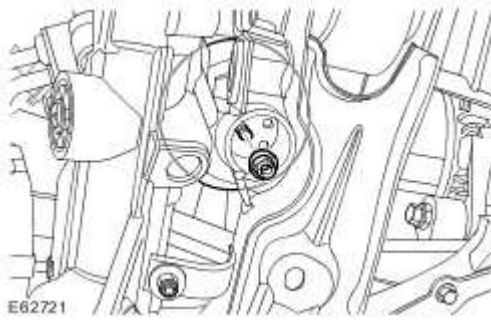
▶ Remove the 2 screws.



7 . Release the engine mount.

▶ Support the engine.

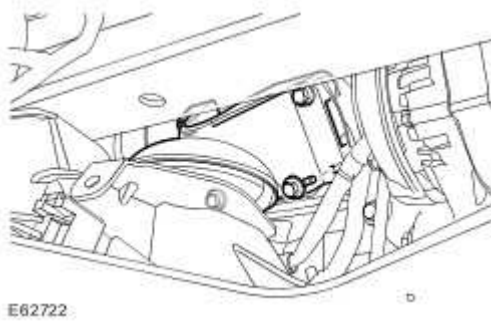
▶ Remove and discard the nut.



8 . Remove the engine mount and bracket.

▶ Raise the engine.

▶ Remove the 4 bolts.



9 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the engine mount.

▶ Remove and discard the nut.



Installation

All vehicles

1 . Install the engine mount.

- ▶ Tighten the new nut to 55 Nm (41 lb.ft).

2 . Install the engine mount and bracket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- ▶ Lower the engine.
- ▶ Tighten the new nut to 63 Nm (46 lb.ft).

3 . Install the generator cooling duct.


- ▶ Tighten the screws.

Right-hand drive vehicles

4 . Secure the steering gear.

- ▶ Tighten the bolts to 100 Nm (74 lb.ft).

5 . Install the steering gear flexible coupling.

 Tighten the new bolts to 35 Nm (26lb.ft).

All vehicles

6 . Install the air deflector.

For additional information, refer to Air Deflector (76.11.41)


7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold LH - Vehicles Without: Secondary Air Injection (AIR) (30.15.55)


Removal

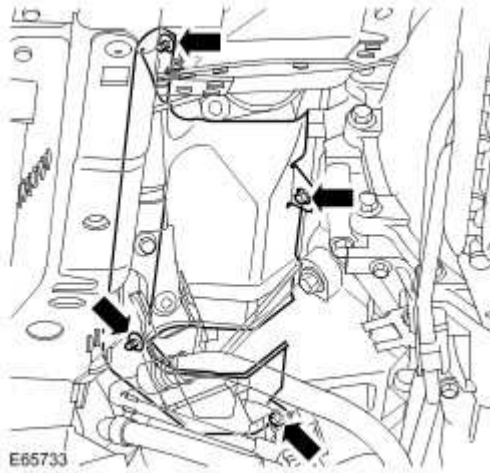
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the oil level indicator and tube.
For additional information, refer to Oil Level Indicator and Tube
- 4 . Remove the exhaust system.
For additional information, refer to Exhaust System
- 5 . Remove the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)
- 6 . Remove the LH heat shield.

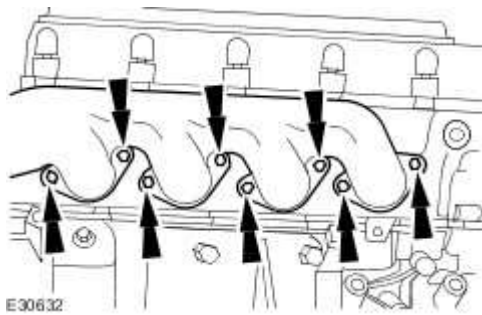
 Remove the 4 screws.



7 . Remove the exhaust manifold.

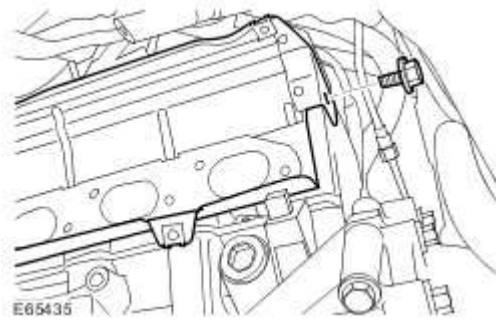
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



8 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



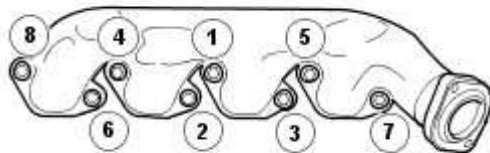
Installation

1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).

2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



3 . Install the heat shield.

- ▶ Tighten the screws.

- 4 . Install the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)

- 5 . Install the exhaust system.
For additional information, refer to Exhaust System

- 6 . Install the oil level indicator and tube.
For additional information, refer to Oil Level Indicator and Tube

- 7 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Exhaust Manifold LH - Vehicles With: Secondary Air Injection (AIR) (30.15.55)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

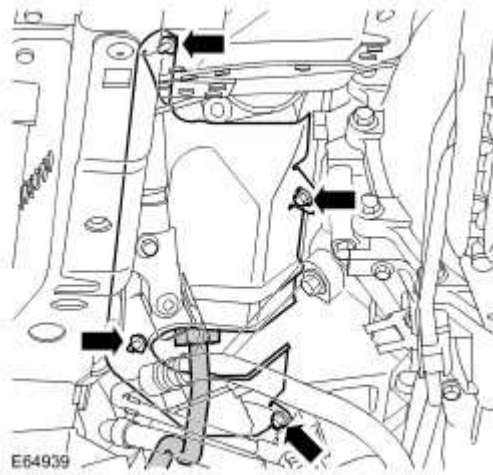
Raise and support the vehicle.

- 3 . Remove the oil level indicator and tube.
For additional information, refer to Oil Level Indicator and Tube
- 4 . Remove the exhaust system.
For additional information, refer to Exhaust System
- 5 . Remove the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)
- 6 . Release the LH exhaust manifold heat shield.



Remove the 4 screws.

- 7 . Release the AIR tube from the LH exhaust manifold.

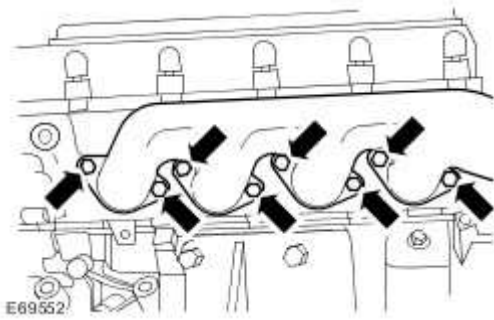


8 . Remove the LH exhaust manifold heat shield.

9 . Remove the exhaust manifold.

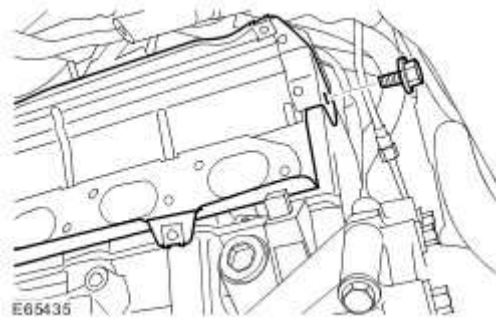
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



10 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



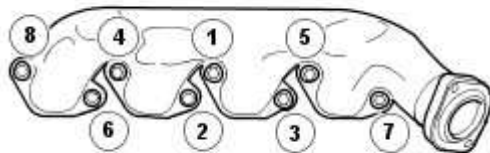
Installation

1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).


2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).




3 . Install the exhaust manifold heat shield.

4 . Attach the air tube.

 Tighten the union to 35 Nm (26 lb.ft).

5 . Secure the exhaust manifold heat shield.

 Tighten the screws.

6 . Install the LH engine mount.

For additional information, refer to Engine Mount LH (12.45.01)

7 . Install the exhaust system.

For additional information, refer to Exhaust System

8 . Install the oil level indicator and tube.

For additional information, refer to Oil Level Indicator and Tube


9 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold RH - Vehicles Without: Secondary Air Injection (AIR) (30.15.56)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

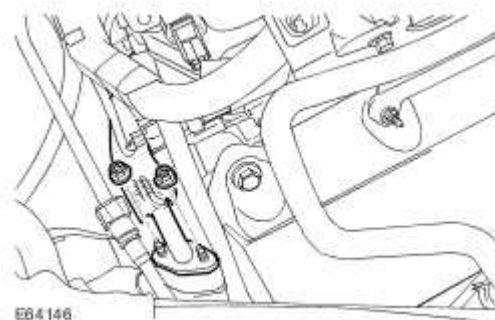
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)

- 4 . Release the EGR valve to exhaust manifold pipe.

- ▶ Remove the 2 nuts.
- ▶ Remove and discard the gasket.



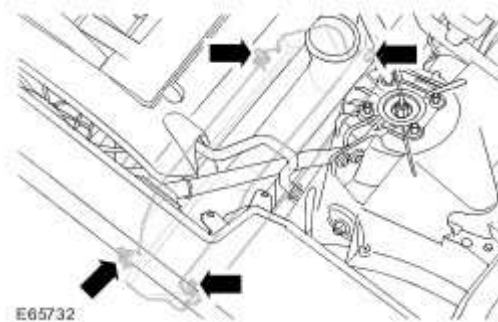
- 5 . Remove the exhaust system.
For additional information, refer to Exhaust System

6 . Remove the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Remove the RH heat shield.

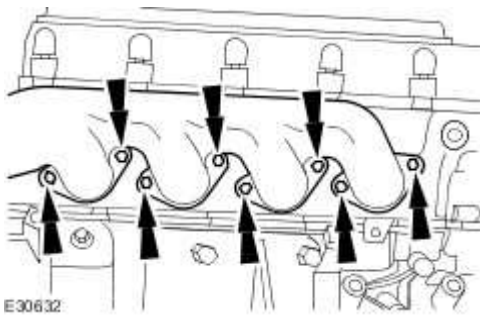
▶ Remove the 4 screws.



8 . Remove the exhaust manifold.

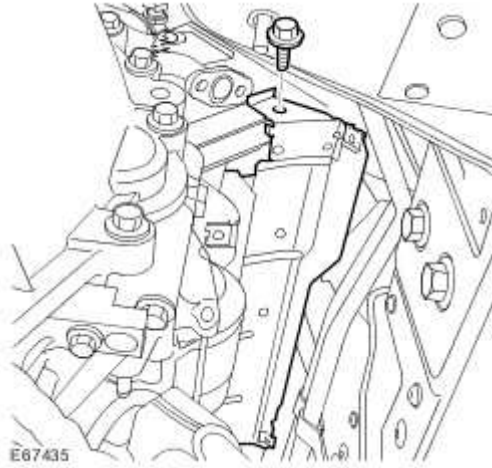
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



9 . Remove and discard the exhaust manifold gasket.

▶ Remove the bolt.



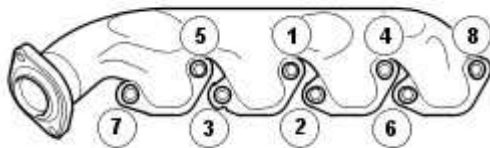
Installation

1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).


2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown, to 24 Nm (18 lb.ft).



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3 . Install the heat shield.

 Tighten the screws.

4 . Install the RH engine mount.


For additional information, refer to Engine Mount RH (12.45.03)


5 . Install the exhaust system.

For additional information, refer to Exhaust System

6 . Attach the EGR valve to exhaust manifold pipe.

 Clean the component mating faces.

 Install a new gasket.

 Tighten the nuts to 25 Nm (18 lb.ft).

7 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)


8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Exhaust Manifold RH - Vehicles With: Secondary Air Injection (AIR) (30.15.56)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

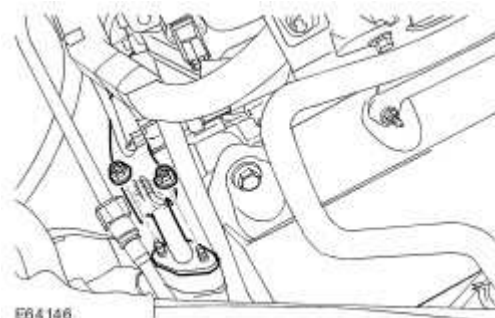
Raise and support the vehicle.

- 3 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)

- 4 . Release the EGR valve to exhaust manifold pipe.

▶ Remove the 2 nuts.

▶ Remove and discard the gasket.



- 5 . Remove the exhaust system.
For additional information, refer to Exhaust System

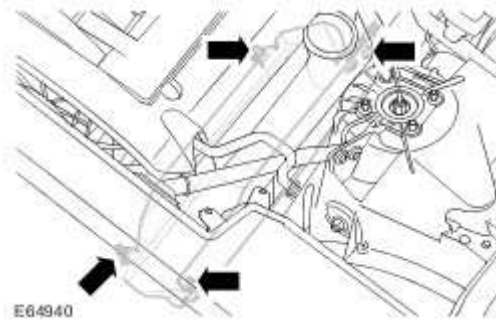
6 . Remove the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Release the RH exhaust manifold heat shield.

▶ Remove the 4 screws.

8 . Release the AIR tube from the RH exhaust manifold.

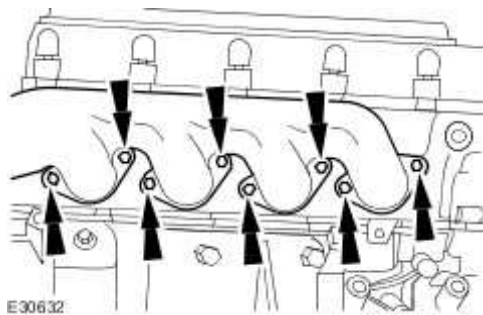


9 . Remove the RH exhaust manifold heat shield.

10 . Remove the exhaust manifold.

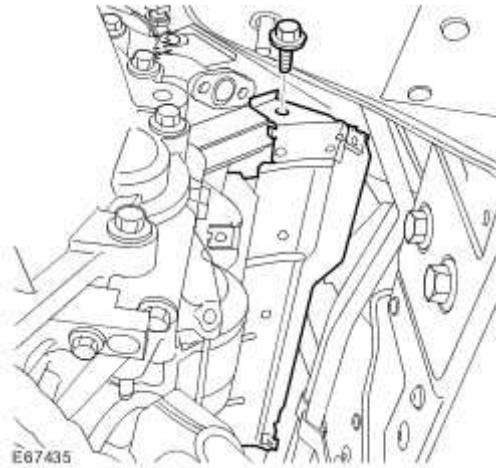
▶ Remove and discard the 8 bolts.

▶ Remove the 8 spacers.



11 . Remove and discard the exhaust manifold gasket.

- ▶ Remove the bolt.



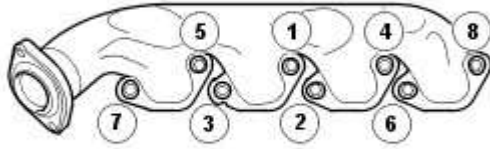
Installation

- 1 . Install the exhaust manifold gasket.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolt to 50 Nm (37 lb.ft).

- 2 Install the exhaust manifold.

- ▶ Clean the component mating faces.
- ▶ Install the spacers.
- ▶ Evenly and progressively, tighten the new bolts in the sequence shown to 24 Nm (18 lb.ft).



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3 . Install the exhaust manifold heat shield.

4 . Attach the air tube.

▶ Tighten the union to 35 Nm (26 lb.ft).

5 . Secure the exhaust manifold heat shield.

▶ Tighten the screws.

6 . Install the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Install the exhaust system.

For additional information, refer to Exhaust System

8 . Attach the EGR valve to exhaust manifold pipe.

▶ Clean the component mating faces.

▶ Install a new gasket.

▶ Tighten the nuts to 25 Nm (18 lb.ft).

9 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

10 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Flexplate (12.53.13)

Removal

1 . Remove the cover and disconnect the battery ground cable.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the transmission.

For additional information, refer to Transmission (44.20.01)

4




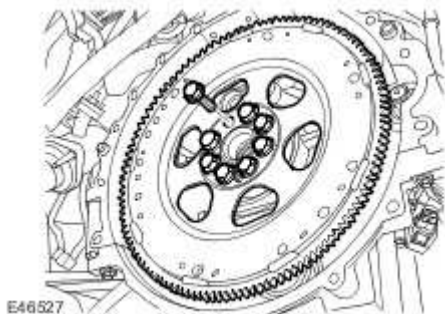
CAUTION: The bolts can only be used 3 times, mark the bolts with a center punch. If 2 punch marks are visible, discard the bolts.

NOTE:

Prevent the flexplate from rotating.

Remove the torque converter flexplate.

 Remove the 8 bolts.



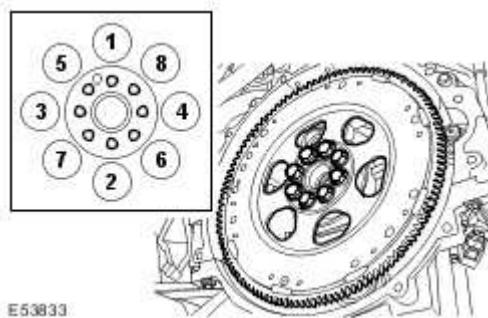
Installation

1 . NOTE:

Prevent the flexplate from rotating.

Install the torque converter flexplate.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts evenly in 2 stages to the sequence shown.
- ▶ Tighten the bolts to 15 Nm (11 lb ft).
- ▶ Tighten the bolts to 110 Nm (81 lb.ft).



2 . Install the transmission.

For additional information, refer to Transmission (44.20.01)

3 . Connect the battery ground cable and install the cover.

Intake Manifold (30.15.01)

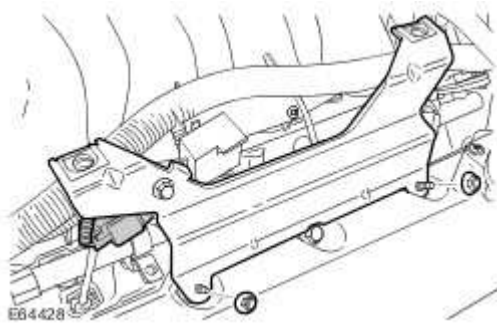
Removal

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2 . Remove the throttle body.
For additional information, refer to Throttle Body (19.70.04)

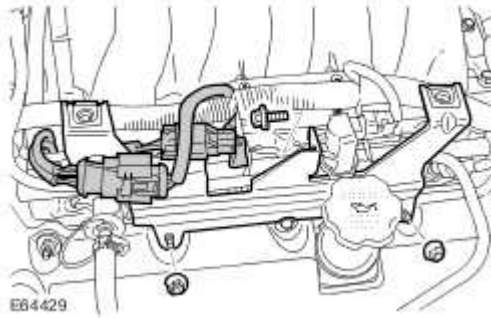
3 . Remove the RH engine cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Disconnect the electrical connector.



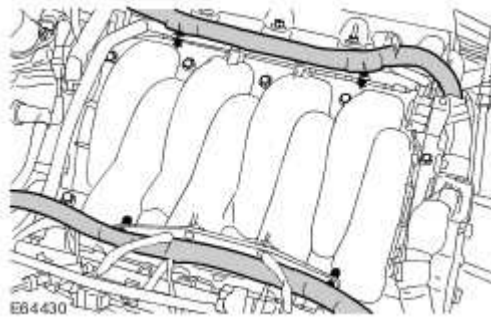
4 . Remove the LH engine cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Release the 2 electrical connectors.
- ▶ Remove the purge valve bolt.



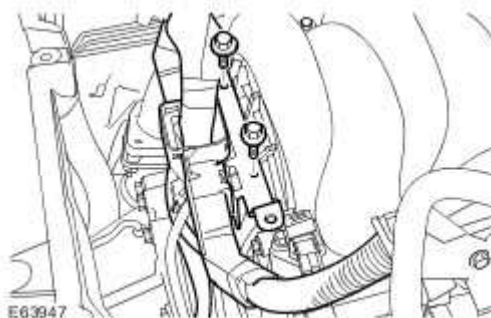
5 . Release the engine wiring harness from the intake manifold.

▶ Release the 4 clips.

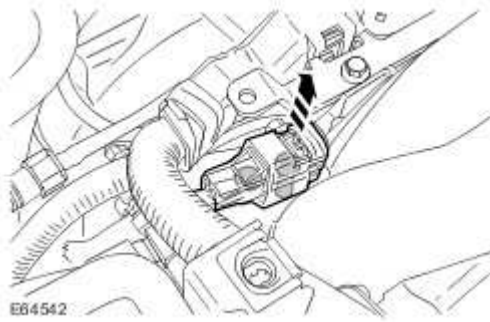


6 . Release the wiring harness from the rear of the engine.

▶ Remove the 2 bolts.

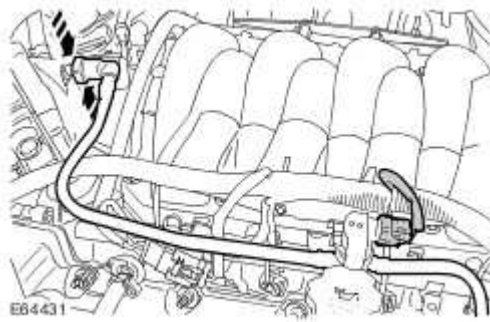


7 . Release the RH camshaft position (CMP) sensor electrical connector.



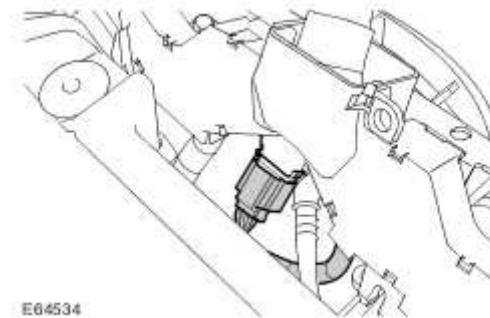
8 . Release the purge valve.

- ▶ Disconnect the quick release connector.
- ▶ Disconnect the electrical connector.



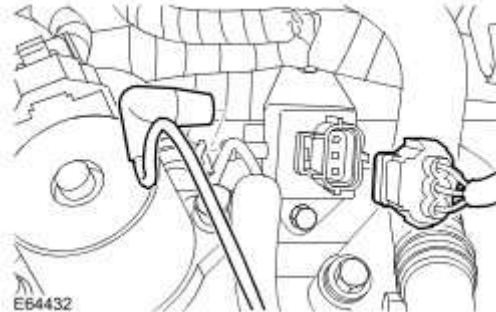
9 . Using the special tool, disconnect the fuel line.
For additional information, refer to Spring Lock Couplings

10 . Disconnect the MAP sensor electrical connector.



11 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.

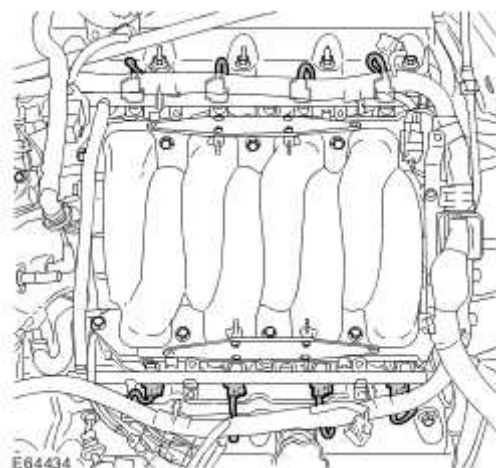
12 . Disconnect the FRP sensor vacuum line.



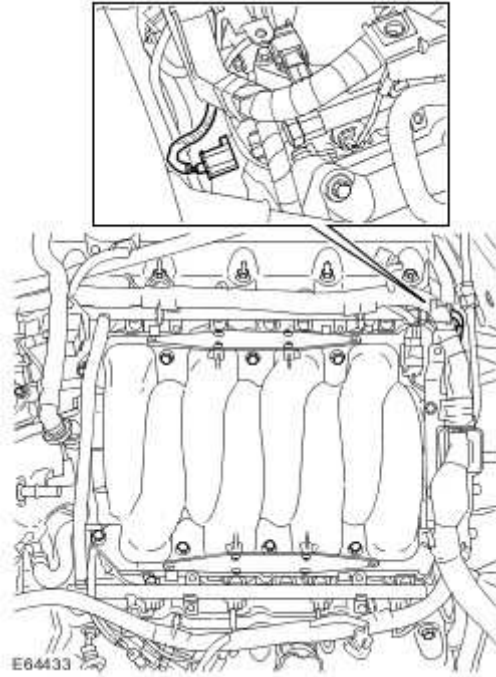
13 . Disconnect the knock sensors (KS) electrical connector.



14 . Disconnect the 8 fuel injector electrical connectors.

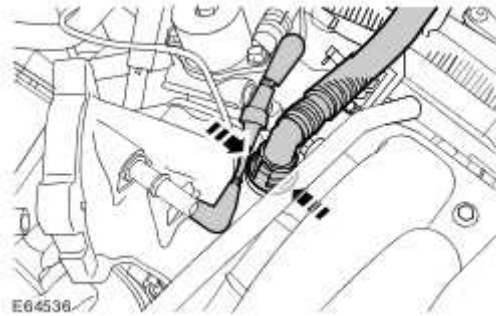


15 . Disconnect the fuel temperature sensor electrical connector.

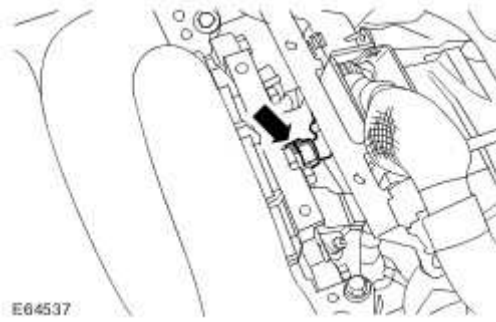


16 . Disconnect the throttle body elbow vacuum line.

17 . Disconnect the positive crankcase ventilation (PCV) line from the throttle body elbow.

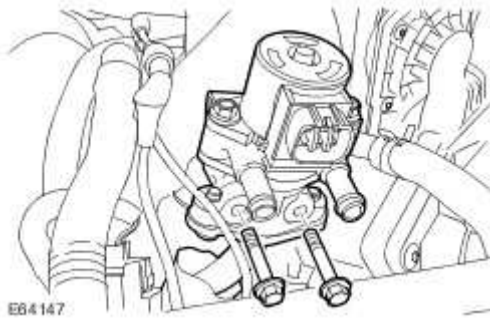


18 . Disconnect the brake booster vacuum hose from the intake manifold.



19 . Release the exhaust gas recirculation (EGR) valve.

- ▶ Remove the 2 bolts.
- ▶ Remove and discard the gasket.



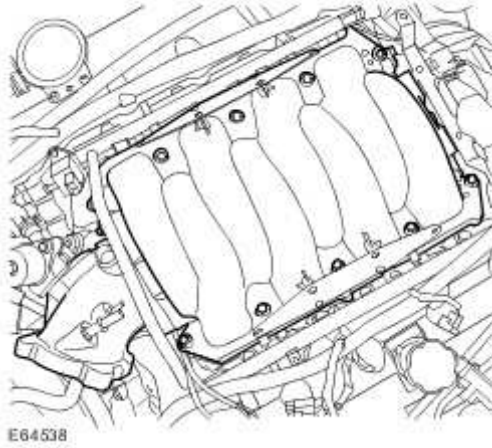
20 .



CAUTION: Always plug any open connections to prevent contamination.

Remove the intake manifold.

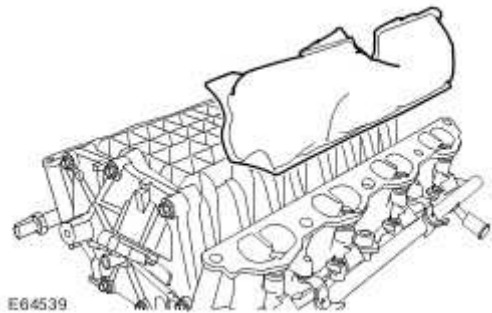
- ▶ Remove and discard the 2 gaskets.
- ▶ Remove the 10 bolts.



21 . **NOTE:**

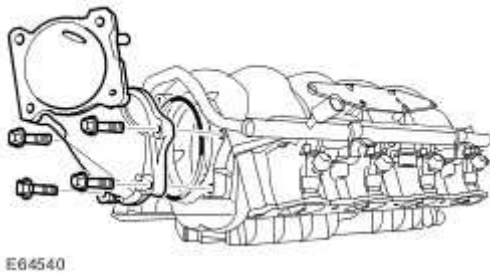
Do not disassemble further if the component is removed for access only.

Remove the foam pad.



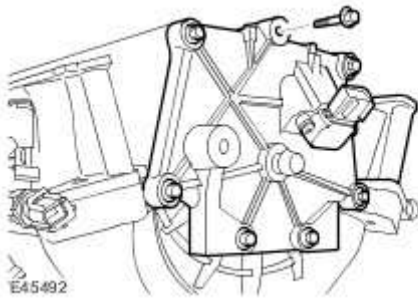
22 . Remove the throttle body elbow.

- ▶ Remove the 4 bolts.
- ▶ Remove and discard the O-ring seal.



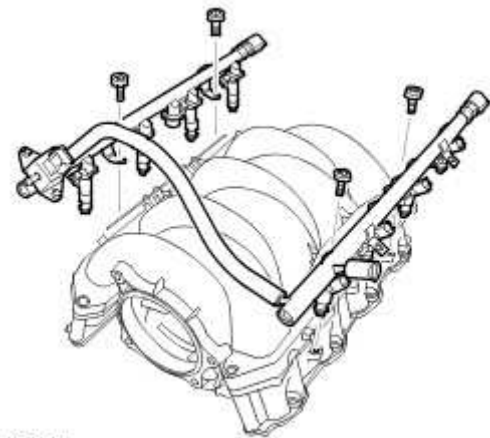
23 . Remove the intake manifold MAP sensor housing.

- ▶ Remove the 7 bolts.
- ▶ Remove and discard the O-ring seal.



24 . Remove the fuel injection supply manifold.

- ▶ Remove the 4 Torx bolts.
- ▶ Remove and discard the 8 O-ring seals.



25 . Remove the 2 intake manifold housings.

- ▶ Remove the 10 Torx screws.
- ▶ Remove and discard the 8 O-ring seals.



Installation

1 . Install the intake manifold housings.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten the Torx screws to 4 Nm (3 lb.ft).

2 . Install the fuel injection supply manifold.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).

3 . Install the intake manifold MAP sensor housing.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

4 . Install the throttle body elbow.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

5 . Install the foam pad.

6 . Install the intake manifold.

- ▶ Clean the components.
- ▶ Install new gaskets.
- ▶ Evenly and progressively tighten the bolts to 20 Nm (15 lb.ft).

7 . Attach the EGR valve.

- ▶ Clean the components.

▶ Install a new gasket.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

8 . Connect the brake booster vacuum hose.

9 . Connect the PCV line.

10 . Connect the throttle body elbow vacuum line.

11 . Connect the FRP sensor vacuum line.

12 . Connect the fuel temperature sensor electrical connector.

13 . Connect the fuel injector electrical connectors.

14 . Connect the KS electrical connector.

15 . Connect the FRP sensor electrical connector.

16 . Connect the MAP sensor electrical connector.

17 . Connect the fuel line.

For additional information, refer to Spring Lock Couplings

18 . Attach the purge valve.

▶ Connect the electrical connector.

▶ Connect the quick release connector.

19 . Attach the CMP sensor electrical connector.

20 . Attach the wiring harness.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

21 . Install the LH engine cover bracket.

▶ Attach the purge valve, align the peg and tighten the bolt to 6 Nm (4 lb.ft).

▶ Secure the electrical connectors.

▶ Tighten the nuts to 6 Nm (4 lb.ft).

22 . Install the RH engine cover bracket.

▶ Connect the electrical connector.

▶ Tighten the nuts to 6 Nm (4 lb.ft).

23 . Install the throttle body.


For additional information, refer to Throttle Body (19.70.04)

24 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Oil Pan (12.60.44)

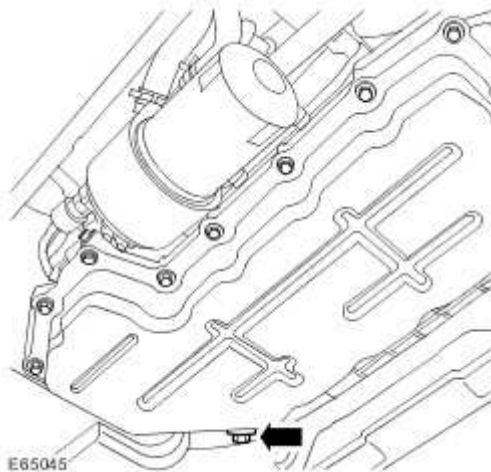
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

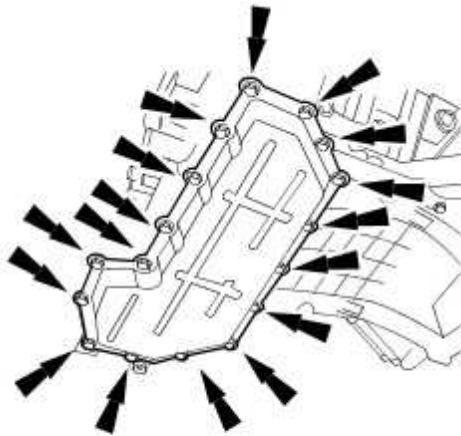
- 2 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)
- 3 . Remove the oil pan drain plug.

- ▶ Position a container to collect the fluid.
- ▶ Discard the oil pan drain plug seal.



- 4 . Remove the oil pan.
 - ▶ Position a container to collect the oil spillage.
 - ▶ Remove the 17 bolts.

- ▶ Remove and discard the gasket.



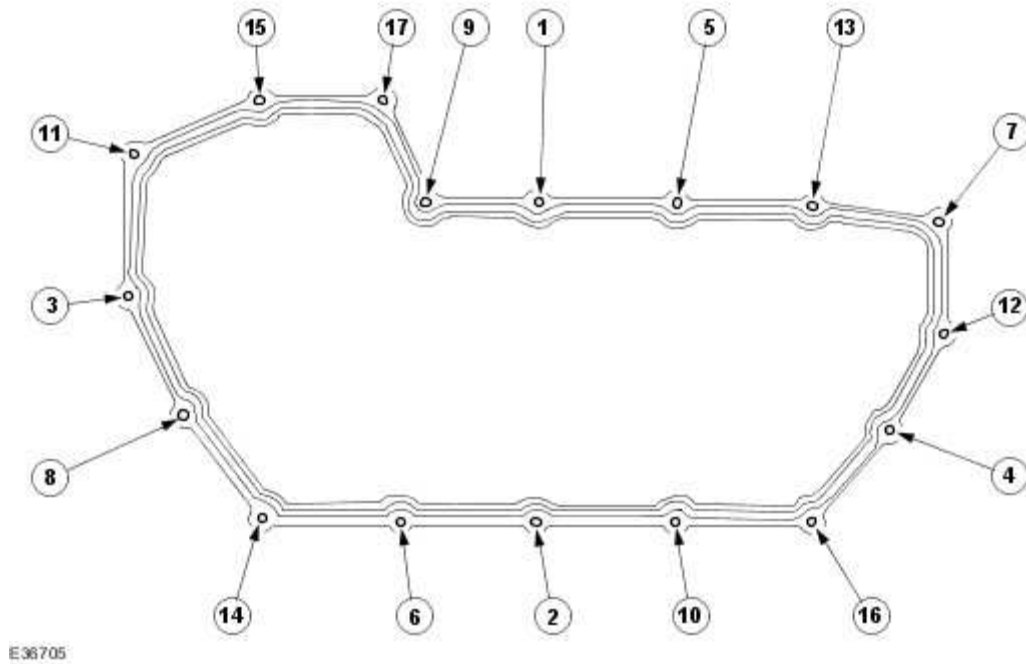
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Installation

- 1 . Install the oil pan.

- ▶ Clean the components.
- ▶ Install the new gasket.
- ▶ Install the bolts, but do not tighten fully at this stage.

- 2 . Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



3 . Tighten the drain plug to 25 Nm (18 lb.ft).

▶ Install a new seal.

4 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

5 . Fill the engine with the recommended oil to the correct level.

Oil Pump (12.60.26)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the timing drive components.
For additional information, refer to Timing Drive Components (12.65.13)

- 4 . Remove the oil pan.
For additional information, refer to Oil Pan (12.60.44)

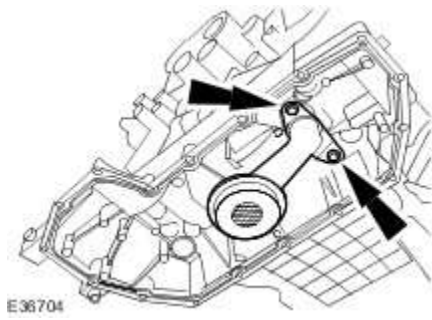
5 . **NOTE:**

The bolts will remain captive.

Remove the oil strainer pick-up assembly.

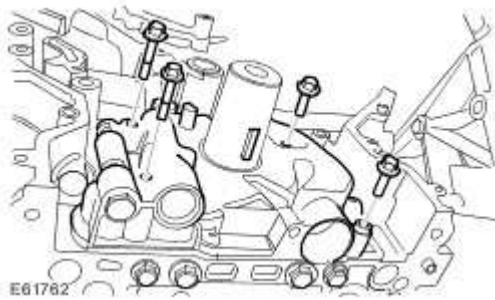
➤ Remove the 2 bolts.

➤ Remove and discard the O-ring seal.



6 . Remove the oil pump assembly.

- ▶ Remove the 4 bolts.
- ▶ Remove and discard the O-ring seal.



Installation

1 . Install the oil pump assembly.

- ▶ Clean the components mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

2 . Install the oil strainer pick-up assembly.

- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).

3 . Install the oil pan.

For additional information, refer to Oil Pan (12.60.44)

4 . Install the timing drive components.

For additional information, refer to Timing Drive Components (12.65.13)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Timing Drive Components (12.65.13)

Special Service Tools



Camshaft setting/locking tool

303-530



Timing Setting tool

303-645



Timing chain tensioning tool


303-532

Removal

NOTE:

This procedure covers the removal and installation of the following components: timing chains, chain guides, tensioners and sprockets.


- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2
-  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the engine front cover.
For additional information, refer to Engine Front Cover (12.65.01)


- 4 . Remove the crankshaft position (CKP) sensor.
For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

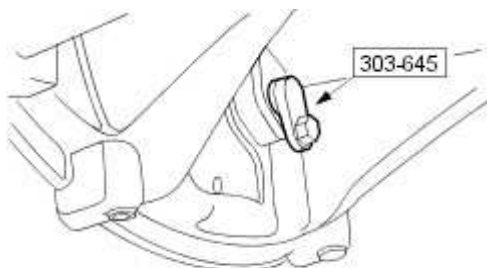
- 5
-  **CAUTION: Rotating the crankshaft in a counterclockwise direction may cause engine damage. Crankshaft journals are directionally machined. Rotating the crankshaft counterclockwise can raise burrs on bearing surfaces, reducing engine life.**

 **CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) number 1 cylinder.**

Lock the crankshaft.

 Install the special tool.

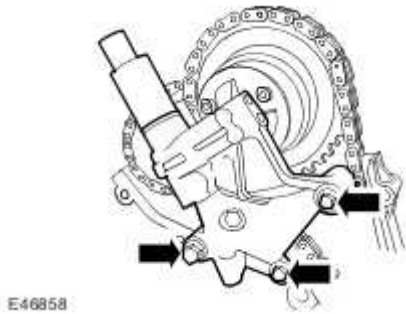
 Install the screw.



VUJ0002400

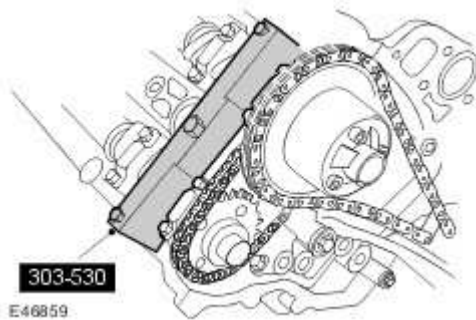
6 . Remove the RH variable camshaft timing (VCT) control solenoid housing.

- ▶ Remove the 3 bolts.
- ▶ Remove and discard the O-ring seals.



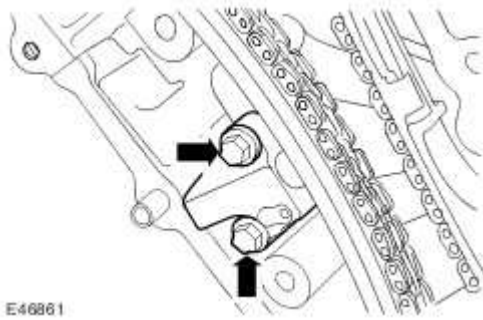
7 Install the special tool to the RH cylinder head.

- ▶ Rotate the crankshaft until the flats on the camshafts are parallel with the cylinder head joint faces.
- ▶ Install the 3 bolts.



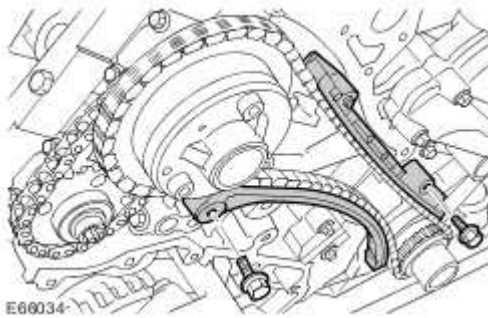
8 . Remove the RH primary timing chain tensioner.

- ▶ Remove the 2 bolts.

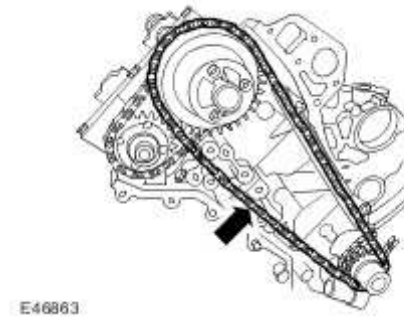


9 . Remove the RH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



10 . Remove the RH primary timing chain.

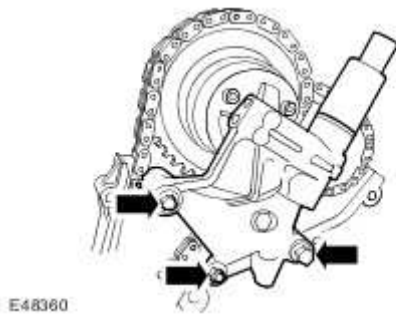


11 . Remove the LH variable camshaft timing (VCT) control solenoid housing.

▶ Remove the 2 bolts.

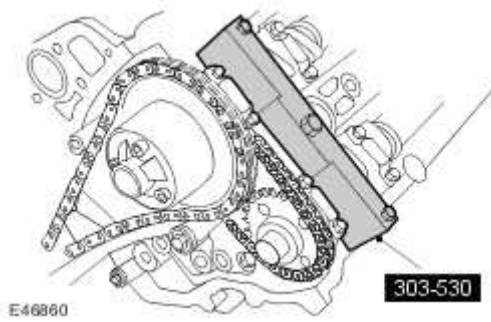
▶ Remove the nut.

▶ Remove and discard the O-ring seals.



12 . Install the special tool to the LH cylinder head.

▶ Install the 3 bolts.



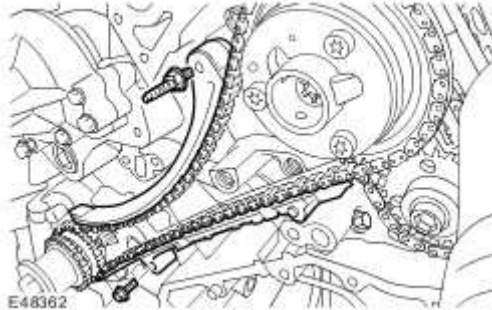
13 . Remove the LH primary timing chain tensioner.

▶ Remove the 2 bolts.

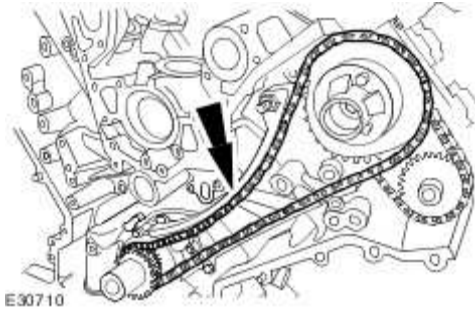


14 . Remove the LH upper and lower primary timing chain tensioner guides.

▶ Remove the 2 bolts.



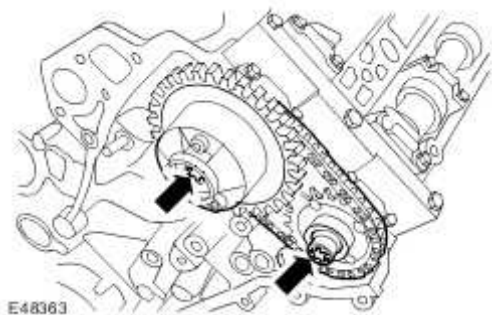
15 . Remove the LH primary timing chain.



16 .  **CAUTION: Discard the bolts.**

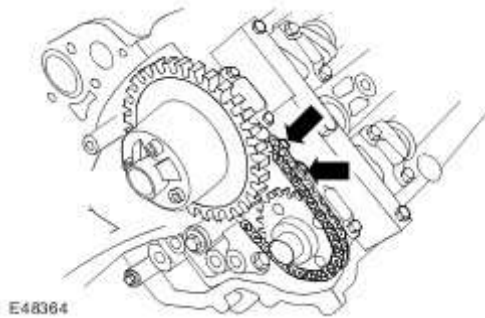
Release the LH camshaft sprocket assembly.

▶ Remove the 2 Torx bolts.



17 . Remove the LH secondary timing chain, tensioner and sprocket assembly.

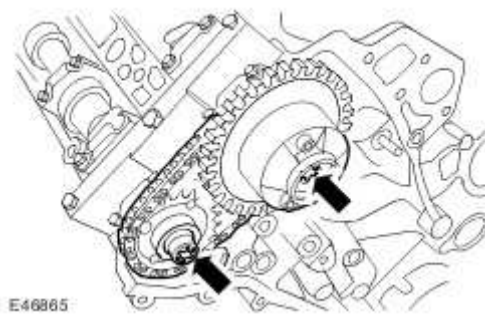
▶ Remove the 2 bolts.



18 .  **CAUTION: Discard the bolts.**

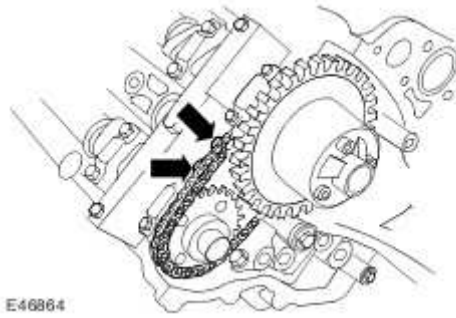
Release the RH camshaft sprocket assembly.

▶ Remove the 2 Torx bolts.



19 . Remove the RH secondary timing chain, tensioner and sprocket assembly.

▶ Remove the 2 retaining bolts.

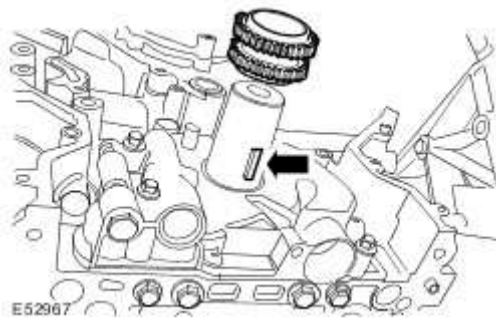


20 . NOTE:

Note the orientation of the crankshaft sprocket.

Remove the crankshaft sprocket.

▶ Remove the crankshaft sprocket key.



Installation

1 . Install the crankshaft sprocket.

- ▶ Clean the components.
- ▶ Install the crankshaft sprocket key.

2



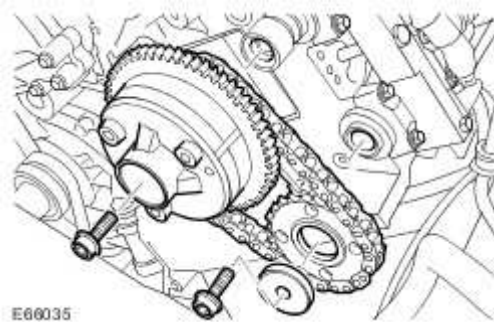
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

NOTE:

LH illustration shown, RH is similar.

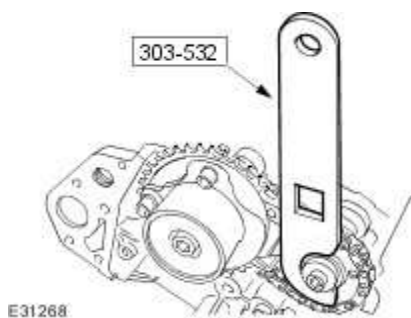
Install the LH secondary timing chain, tensioner and sprocket assembly.

- ▶ Clean the components.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.



3 Install the special tool to the exhaust camshaft sprocket.

- ▶ Reposition the camshaft sprockets for the most advantageous position for use of the special tool.



4 . Install the LH secondary timing chain tensioner retaining bolts.

- ▶ Tighten the bolts to 12 Nm.

5 Install the LH primary timing chain.

- ▶ Clean the components.
- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

6 . Install the LH primary timing chain tensioner guides.

- ▶ Clean the components.
- ▶ Tighten the bolts to 12 Nm.

7



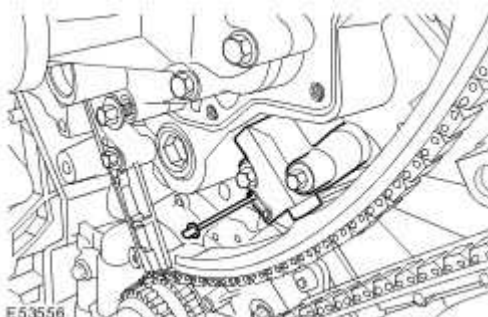
CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

NOTE:

LH illustration shown, RH is similar.

Install the LH primary timing chain tensioner.

- ▶ Clean the components.
- ▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.
- ▶ Tighten the bolts to 12 Nm.
- ▶ Remove the retaining rod.



8



CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



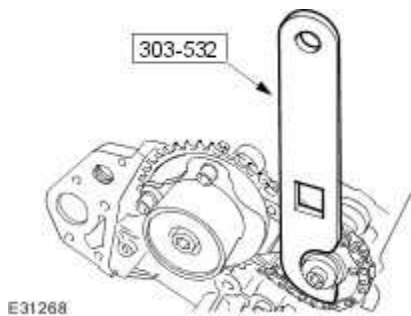
CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.



CAUTION: Make sure that new bolts are installed.

Install the special tool to the LH exhaust camshaft sprocket.

- ▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.
- ▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.



9 . Install the LH VCT control solenoid housing.

- ▶ Clean the components.
- ▶ Install the new O-ring seals.
- ▶ Tighten the new bolts to 22 Nm.
- ▶ Tighten the nut to 10 Nm.

10



CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the RH secondary timing chain, tensioner and sprocket assembly.

- ▶ Clean the components.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.

11 . Install the RH secondary timing chain tensioner retaining bolts.

- ▶ Tighten the bolts to 12 Nm.

12 Install the RH primary timing chain.

- ▶ Clean the components.
- ▶ Make sure the timing chain slack is on the tensioner side of the timing chain.

13 . Install the RH primary timing chain tensioner guides.

- ▶ Tighten the bolts to 12 Nm.

14



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Install the RH primary timing chain tensioner.

- ▶ Clean the components.
- ▶ Using 3 mm diameter metal rod, retain the chain tensioner piston.

▶ Tighten the bolts to 12 Nm.

▶ Remove the retaining rod.

15



CAUTION: Using the special tool, apply force to the tool in a counter-clockwise direction, to tension the primary timing chain on its drive side.



CAUTION: The intake camshaft sprocket retaining bolt **MUST** be tightened before the exhaust camshaft sprocket retaining bolt. Engine damage will occur if this procedure is not followed.

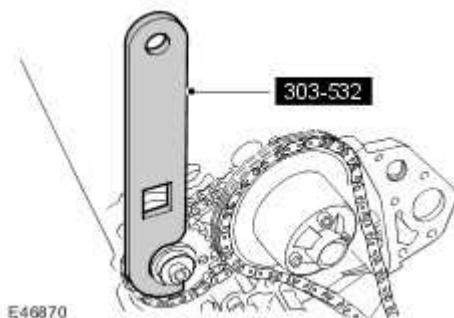


CAUTION: Make sure that new bolts are installed.

Install the special tool to the RH exhaust camshaft sprocket.

▶ Tighten the intake camshaft sprocket retaining bolt to 20 Nm + 90 deg.

▶ Tighten the exhaust camshaft sprocket retaining bolt to 20 Nm + 90 deg.




16 . Install the RH VCT control solenoid housing.

▶ Clean the components.


▶ Install the new O-ring seals.

 Tighten the new bolts to 22 Nm.

17 . Remove the special tool from the RH cylinder head.

 Remove the 3 bolts.


18 . Remove the special tool from the LH cylinder head.

 Remove the 3 bolts.

19 . Install the engine front cover.

For additional information, refer to Engine Front Cover (12.65.01)

20 . Remove the crankshaft locking tool.

 Remove the screw.

21 . Install the CKP sensor.

For additional information, refer to Crankshaft Position (CKP) Sensor (18.30.12)

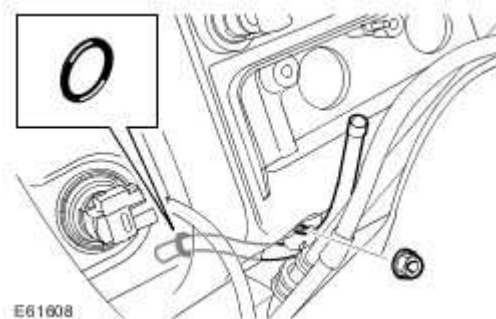
22 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

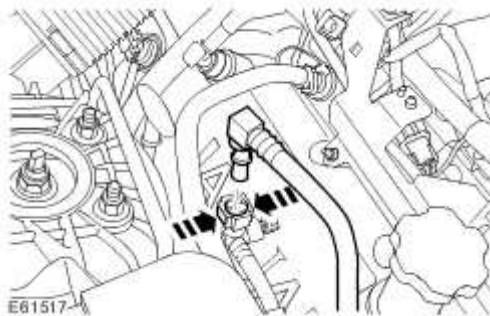
Valve Cover LH (12.29.43)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the ignition coil-on-plug.
For additional information, refer to Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 (18.20.40)
- 3 . Remove the remaining ignition coil-on-plugs.
- 4 . Remove the oil level indicator and tube.
 - ▶ Remove the nut.
 - ▶ Remove and discard the O-ring seal.



- 5 . Release the clip and disconnect the purge inlet line.

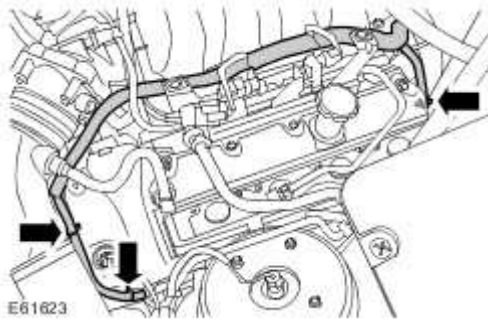


6 . Remove the engine cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Position the bracket aside.

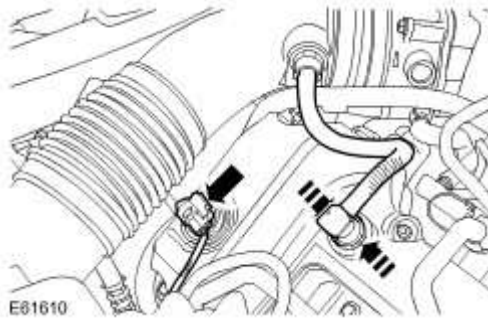


7 . Release the 3 wiring harness clips.



8 . Disconnect the variable camshaft timing (VCT) oil solenoid electrical connector.

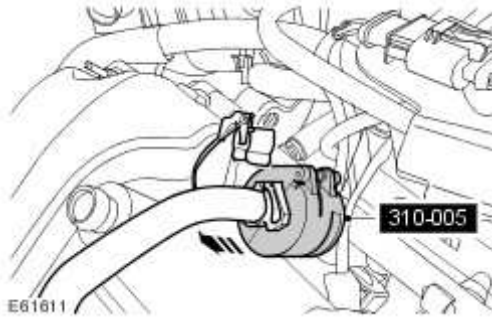
9 . Disconnect the valve cover breather hose.



10 . Using the special tool, disconnect the fuel line.

▶ Release the clip.

▶ Position an absorbent cloth to collect fluid spillage.

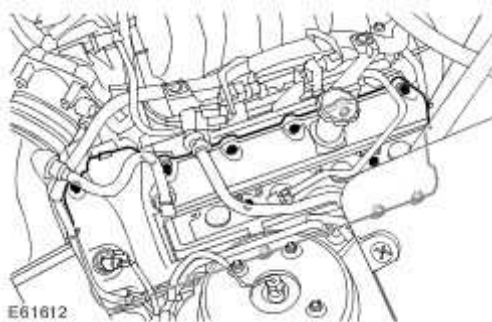


11 . **NOTE:**

Note the fitted position of the retaining bolts prior to removal.

Remove the valve cover assembly.

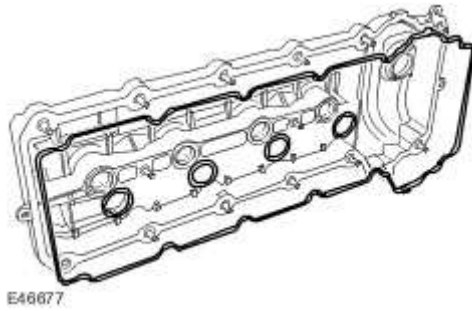
▶ Remove the 14 valve cover retaining bolts.



12 . Remove and discard the valve cover gasket.

▶ Carefully remove the sealant.

13 . Remove the valve cover plug aperture seals.



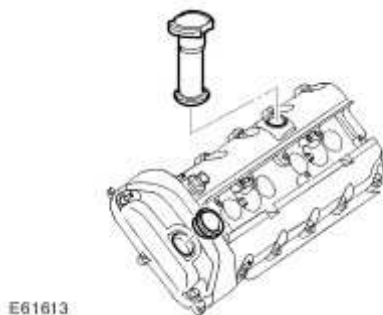
14 . Remove the VCT control solenoid seal.

15 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the oil filler pipe.

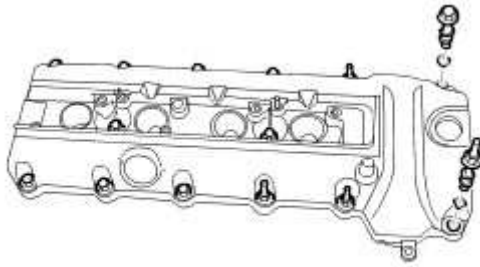
 Remove and discard the O-ring seal.



16 . **NOTE:**

Note the fitted position.

Remove the bolts, remove and discard the seals.



E61614

Installation

1 . NOTE:

Install the components to their original fitted positions.

Install the seals and bolts.

2 . Install the oil filler pipe.

▶ Install a new O-ring seal.

3 . Install new valve cover plug aperture seals.

4 . Install a new valve cover gasket.

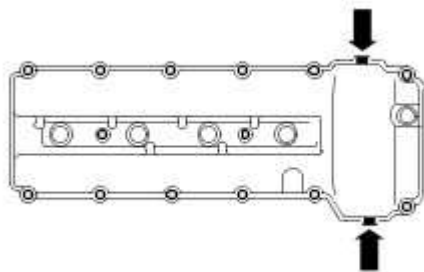
5 . Install the VCT control solenoid seal.

6 NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

Install the valve cover.

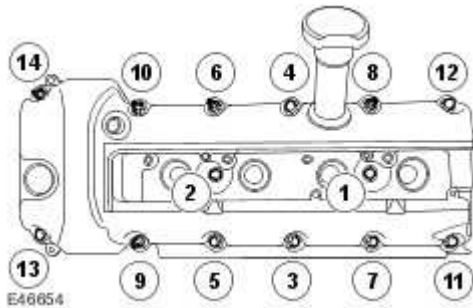
- ▶ Clean the component mating faces.



E49922

7 . Install the valve cover retaining bolts.

- ▶ Complete the tightening sequence as illustrated.
- ▶ Tighten the bolts to 12 Nm (9 lb.ft).



E46654


8 . Install the engine cover mounting bracket.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).


9 . Connect the purge line.

10 . Install the oil level indicator and tube.

 Install a new O-ring seal.

 Tighten the nuts to 6 Nm (4 lb.ft).

11 . Connect the fuel line.

 Secure the clip.

12 . Connect the VCT oil solenoid electrical connector.

13 . Install the ignition coil-on-plug.

For additional information, refer to Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 (18.20.40)

14 . Install the remaining ignition coil-on-plugs.

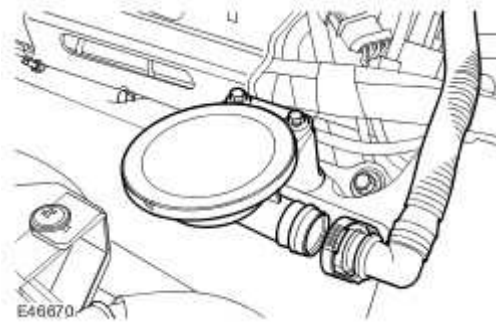
15 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

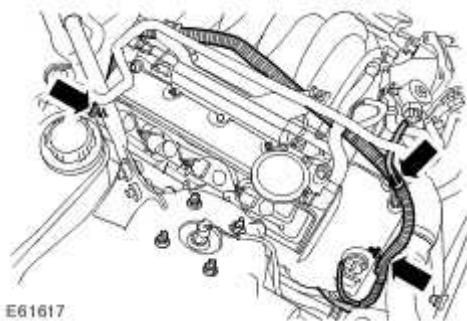
Valve Cover RH (12.29.44)

Removal

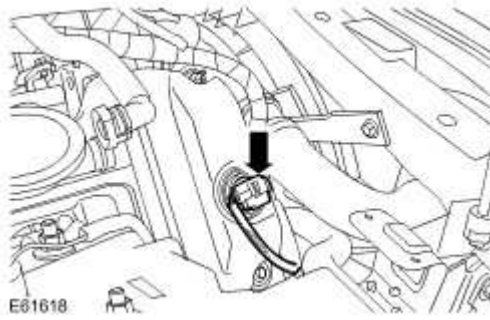
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the ignition coil-on-plug.
For additional information, refer to Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 (18.20.40)
- 3 . Remove the remaining ignition coil-on-plugs.
- 4 . Disconnect the positive crankcase ventilation (PCV) line.



- 5 . Release the 3 wiring harness clips.



- 6 . Disconnect the variable camshaft timing (VCT) oil solenoid electrical connector.



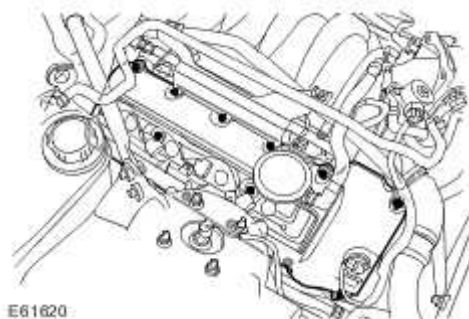
7 . Remove the engine cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Position the bracket aside.



8 . Remove the valve cover assembly.

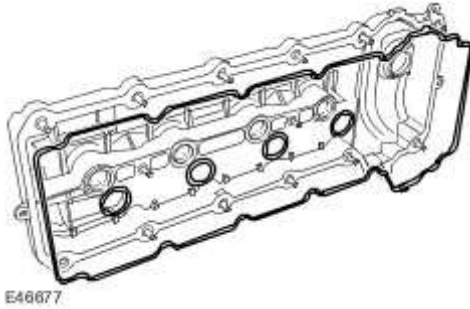
- ▶ Remove the 14 valve cover retaining bolts.



9 . Remove and discard the valve cover gasket.

▶ Carefully remove the sealant.

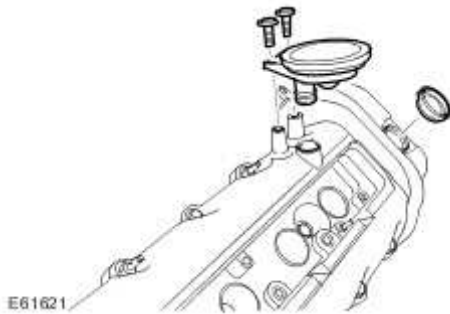
10 . Remove the valve cover plug aperture seals.



11 . Remove the VCTcontrol solenoid seal.

12 . Remove the PCV valve.

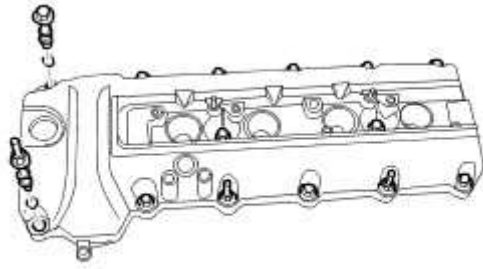
▶ Remove the 2 Torx screws.



13 . **NOTE:**

Note the fitted position.

Remove the bolts, remove and discard the seals.



E61627

Installation

1 . NOTE:

Install the components to their original fitted positions.

Install the seals and bolts.

2 . Install the PCV valve.

- ▶ Clean the component mating faces.
- ▶ Tighten the Torx screws.

3 . Install the VCT control solenoid seal.

4 . Install new valve cover plug aperture gaskets.

5 . Install a new valve cover gasket.

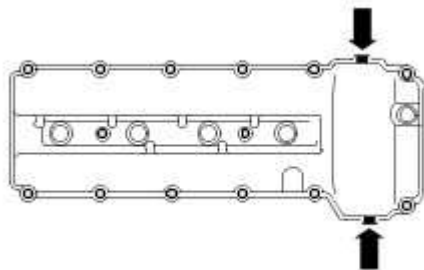
6 NOTE:

Apply two beads of silicone gasket sealant as shown on the illustration. The application of the sealant must be 3mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing

the sealant or the seals.

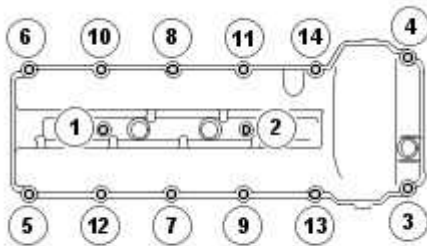
Install the valve cover.

▶ Clean the component mating faces.



E49922

7 . Evenly and progressively tighten the bolts in the sequence shown to 12 Nm (9 lb.ft).



E46679


8 . Connect the VCT oil solenoid electrical connector.

9 . Install the ignition coil-on-plugs.

For additional information, refer to Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 (18.20.40)

10 . Install the remaining ignition coil-on-plugs.

11 . Install the engine cover mounting bracket.

 Tighten the nuts to 10 Nm (7 lb.ft).

12 . Connect the PCV line.

13 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Oil Filter Housing

Special Service Tools



Wrench, Oil filter
303-752

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)
- 4 Drain the coolant.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8
- 5 . Disconnect the engine oil temperature sensor electrical connector.



6 . Disconnect the engine oil pressure (EOP) sensor electrical connector.



7 . **NOTE:**

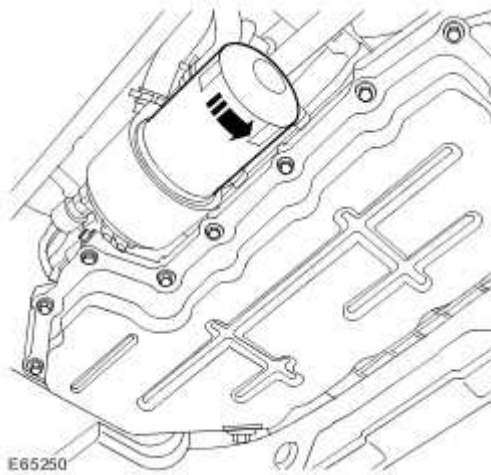
Some oil spillage is inevitable during this operation.

NOTE:

Clean the components general area prior to dismantling.

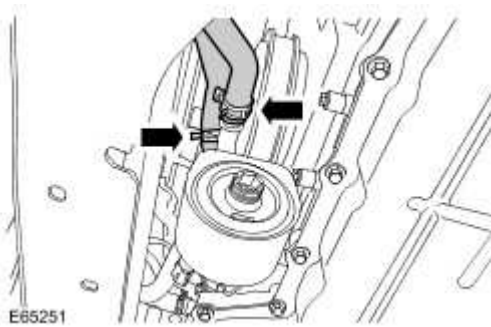
Remove the oil filter.

▶ Position a container to collect the fluid.



8 . Disconnect the 2 oil cooler hoses.

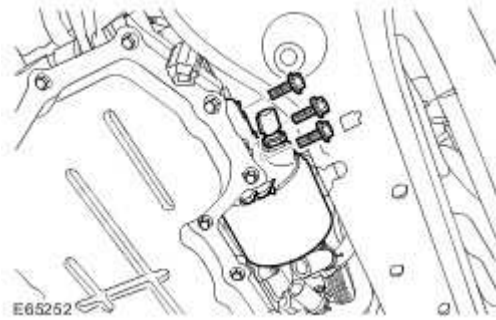
▶ Release the 2 clips.



9 . Remove the oil filter housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seal.



10 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the engine oil temperature sensor.

11 . Remove the EOP sensor.



Installation

1 . Install the EOP sensor.

- ▶ Clean the components.
- ▶ Apply sealant of the correct specification to the sensor thread.
- ▶ Tighten the sensor to 15 Nm (11 lb.ft).

2 . Install the engine oil temperature sensor.

- ▶ Clean the components.
- ▶ Apply sealant of the correct specification to the sensor thread.
- ▶ Tighten the sensor to 15 Nm (11 lb.ft).

3 . Install the oil filter housing.

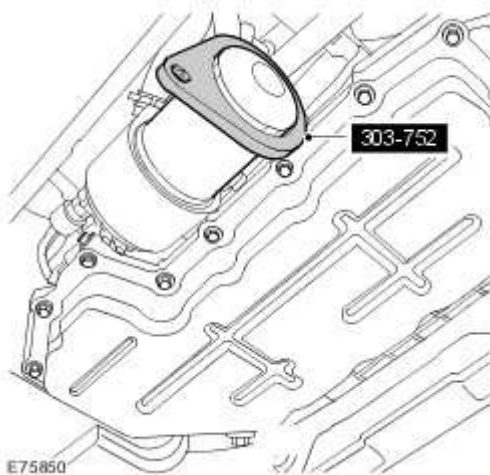
- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 20 Nm (15 lb.ft).

4 . Connect the oil cooler hoses.

- ▶ Secure with the clips.

5 Using the special tool, install the oil filter.

- ▶ Lubricate the oil filter seal with clean engine oil and tighten to 18 Nm (13 lb.ft).



6 . Connect the EOP sensor electrical connector.

7 . Connect the engine oil temperature sensor electrical connector.

8 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

9 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

10 . Check and top-up the engine oil.

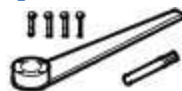
11 Top-up and bleed the coolant.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

Disassembly

Engine

Special Service Tools



303-191

Crankshaft locking, main tool

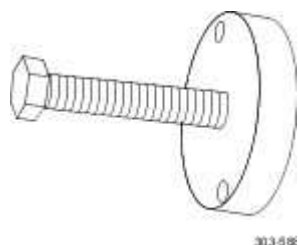
303-191



303-191-02

Adapter

303-191-02



303-588

Crankshaft pulley/damper remover

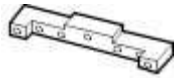
303-588



303-645

Crankshaft setting, main tool

303-645



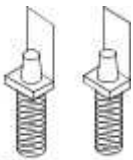
303-530

Camshaft setting
303-530



303D055

Crankshaft damper holding tool
303-D055

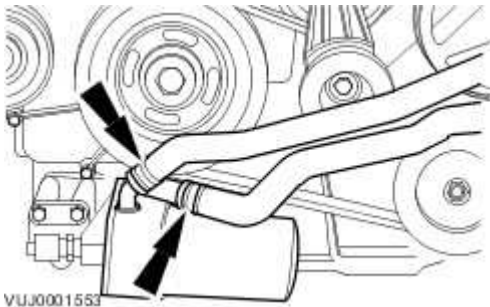


303535

Cylinder Bore Protectors
303-535

Disassembly

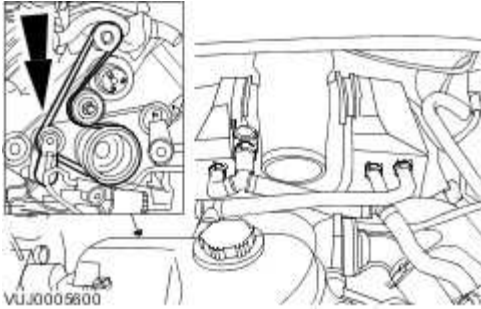
- 1 . Disconnect the oil cooler hoses.



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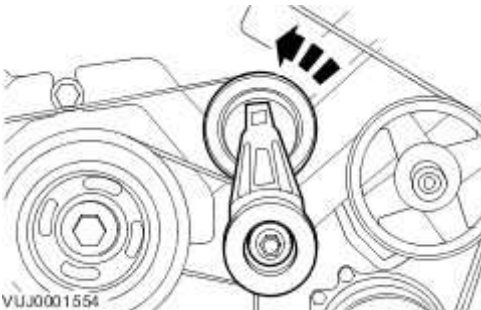
2 . Detach the supercharger belt.

- Use a 1/2 inch square drive bar to rotate the supercharger belt tensioner.
- Detach the supercharger belt.



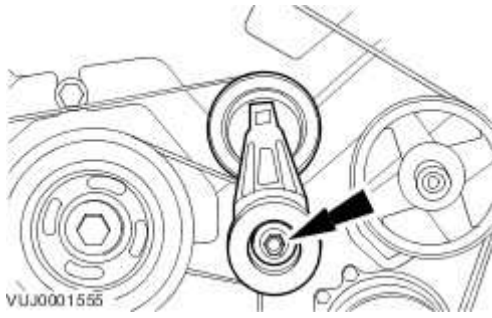
3 . Release the accessory drive belt tension.

- Use a 3/8 inch square drive bar to rotate the drive belt tensioner.
- Detach the accessory drive belt.

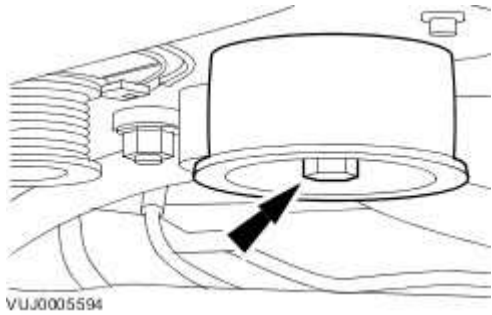


4 . Remove the accessory drive belt tensioner.

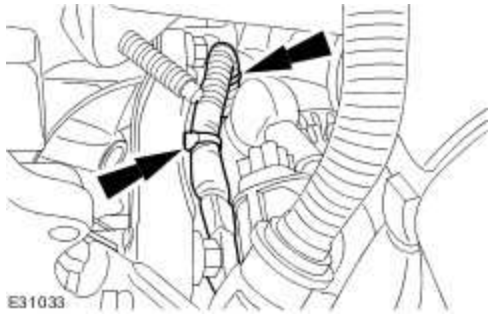
- Remove the accessory drive belt.



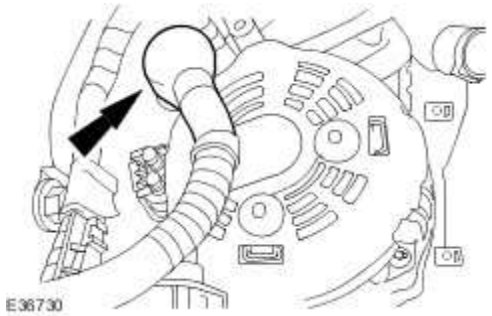
5 . Remove the accessory drive belt idler pulley.



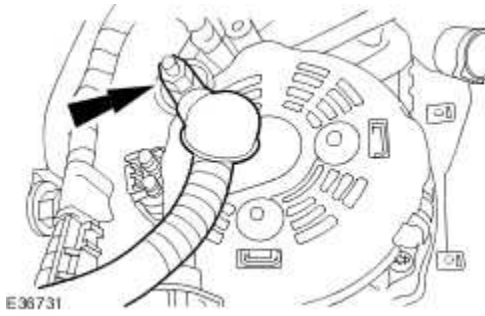
6 . Detach the wiring harness.



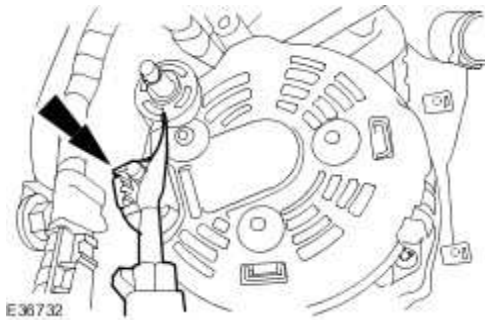
7 . Detach the generator battery positive cable protective cover.



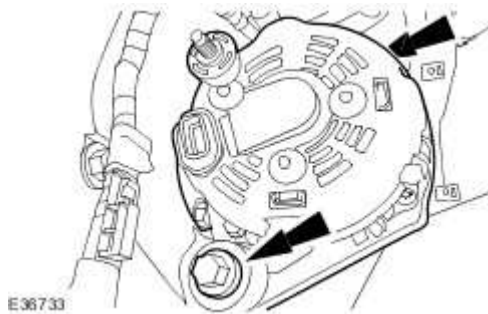
8 . Disconnect the generator battery positive cable.



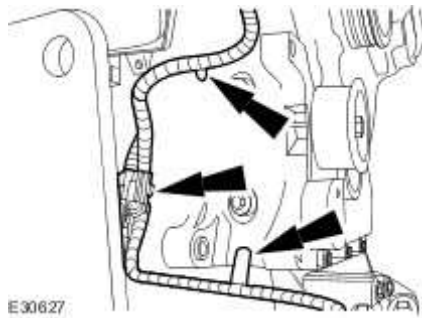
9 . Disconnect the generator electrical connector.



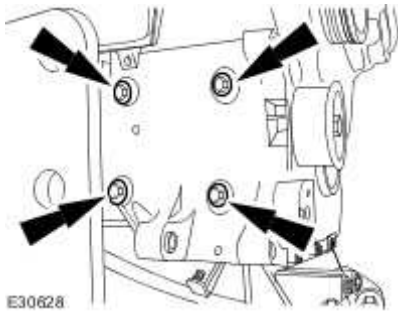
10 . Remove the generator.



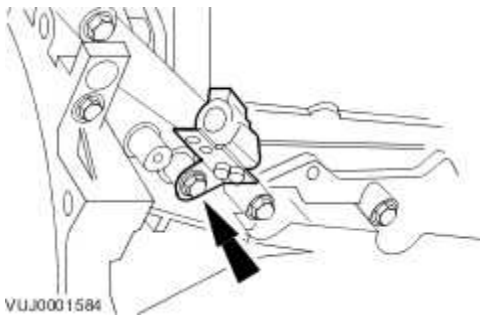
11 . Detach the engine wiring harness.



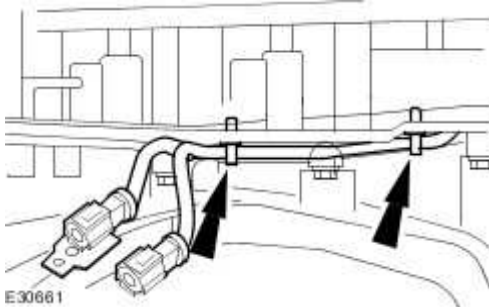
12 . Remove the generator mounting bracket.



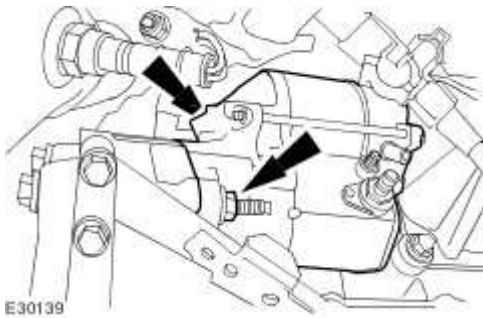
13 . Detach the right-hand oxygen sensor retaining bracket.



14 . Detach the engine wiring harness.



15 . Remove the starter motor.

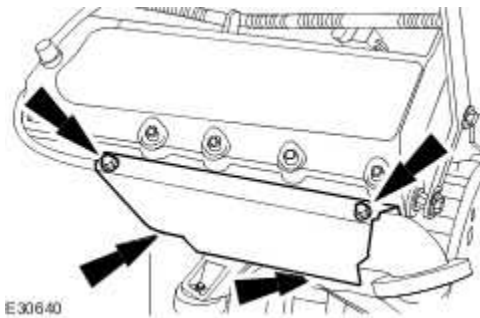


16 . Remove the oil level indicator and tube.

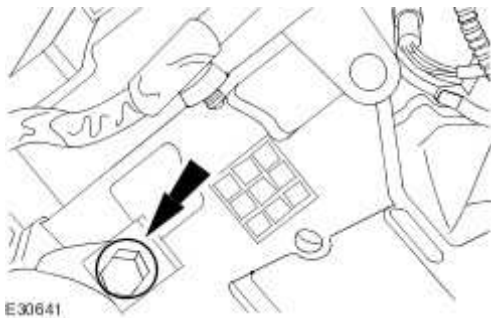
- Remove and discard the O-ring seal.



17 . Remove the heat shield.

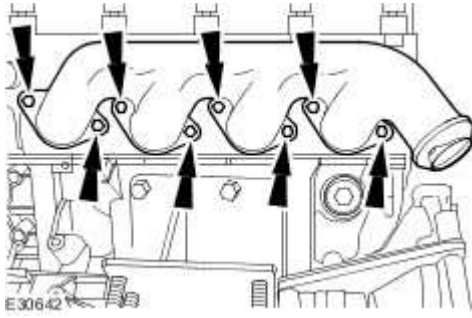


18 . Remove the heat shield retaining bolt.

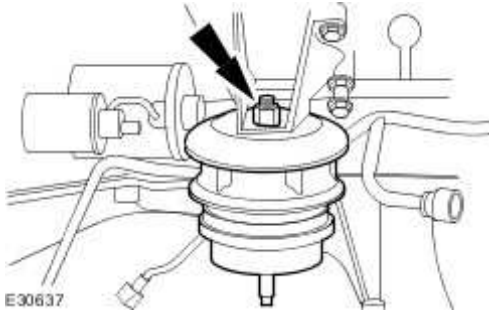


19 . Remove the left-hand exhaust manifold.

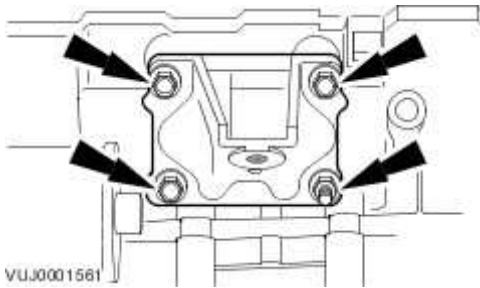
- Remove and discard the gasket.



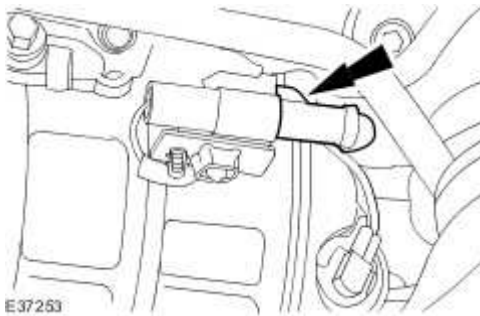
20 . Remove the left-hand engine mount.



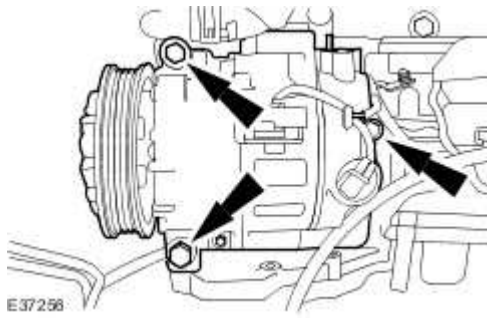
21 . Remove the left-hand engine mounting bracket.



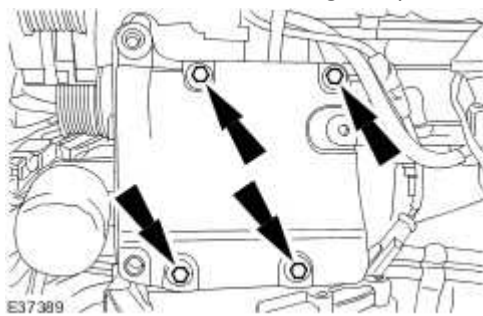
22 . Disconnect the A/C compressor electrical connector.



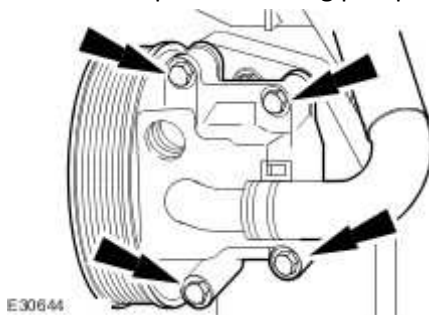
23 . Remove the A/C compressor.



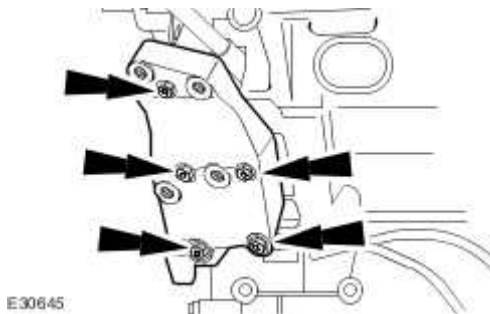
24 . Remove the air conditioning compressor mounting bracket.



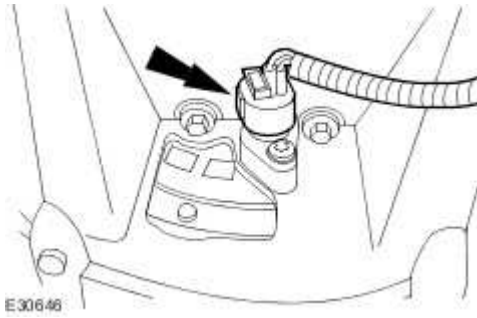
25 . Remove the power steering pump.



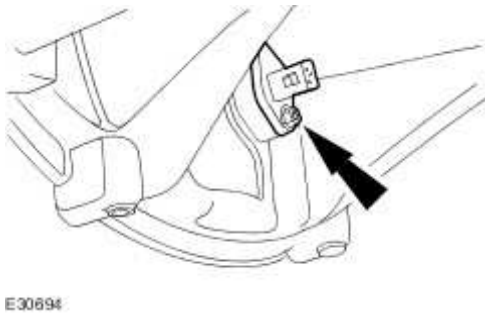
26 . Remove the power steering pump mounting bracket.



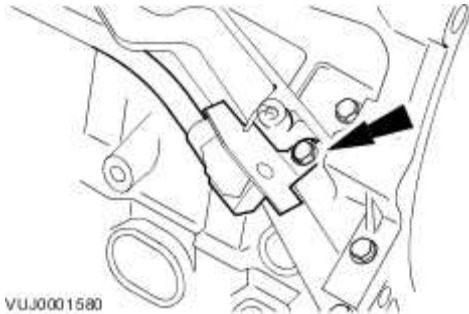
27 . Disconnect the crankshaft position sensor electrical connector.



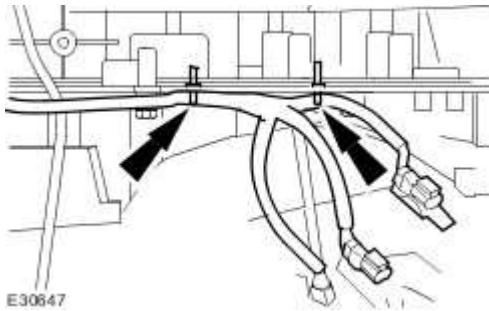
28 . Remove the crankshaft position sensor.



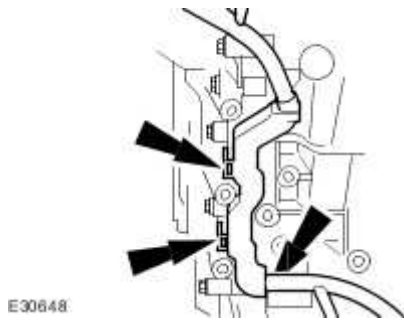
29 . Detach the engine wiring harness.



30 . Detach the engine wiring harness.

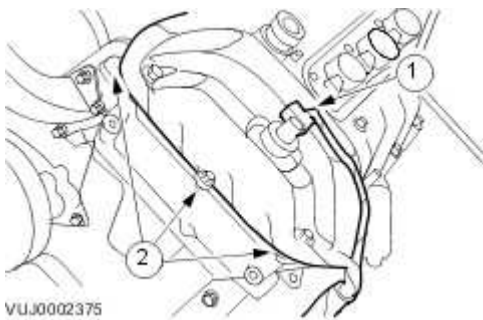


31 . Detach the engine wiring harness.

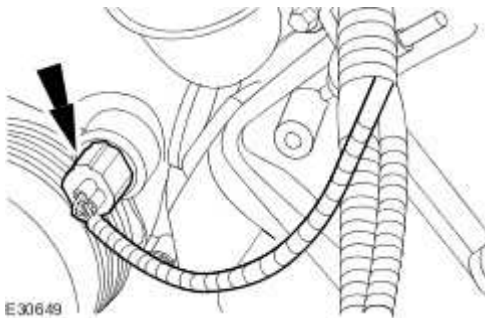


32 . Detach the engine wiring harness.

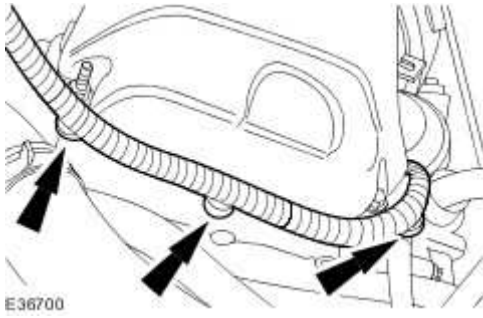
1. Disconnect the variable valve timing (VVT) solenoid electrical connector.
2. Detach the engine wiring harness.



33 . Disconnect the coolant temperature sensor electrical connector.

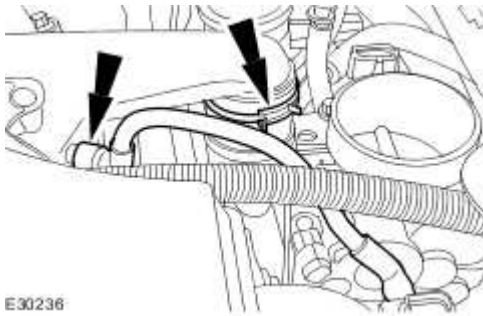


34 . Detach the engine wiring harness.



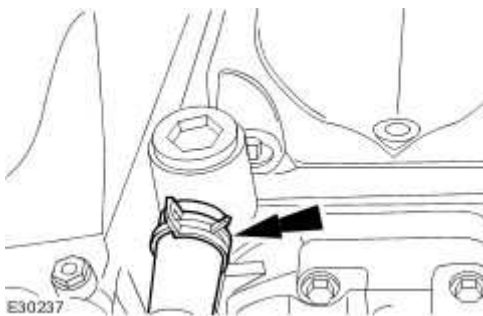
35 . Detach the hoses.

- Reposition the hose retaining clip.



36 . Detach the supercharger outlet pipe coolant hose.

- Cap the coolant ports.

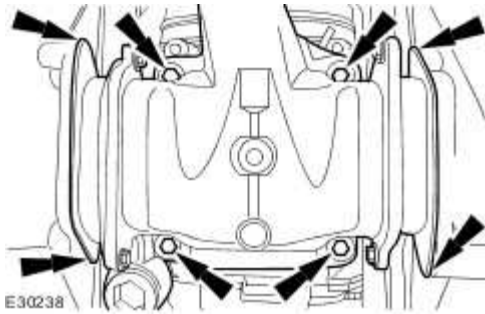


37 .



CAUTION: Make sure no foreign matter enters the supercharger.

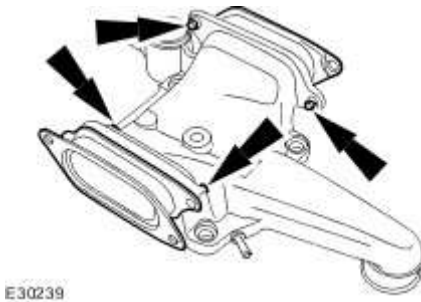
Remove the supercharger outlet pipe



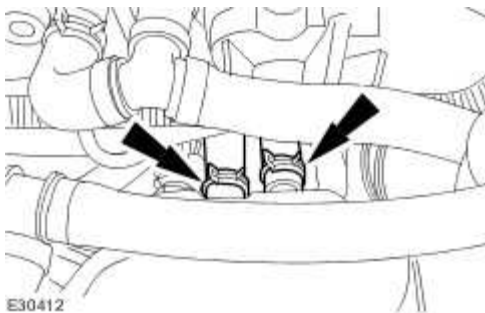
38 . Remove and discard the supercharger outlet pipe gasket.

39 . Remove and discard the supercharger outlet pipe retaining bolt seals.

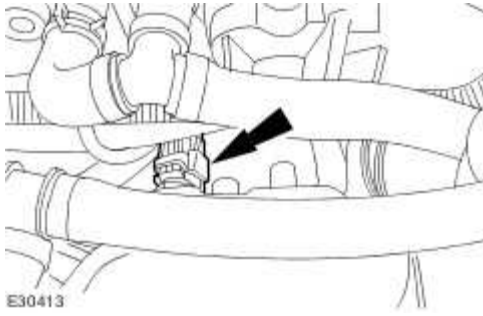
40 . Remove and discard the supercharger outlet pipe to charge air coolers ducts.



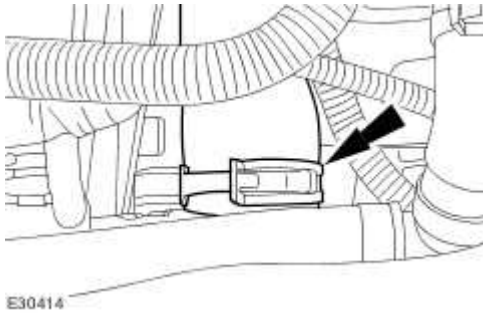
41 . Disconnect the thermostat housing hoses



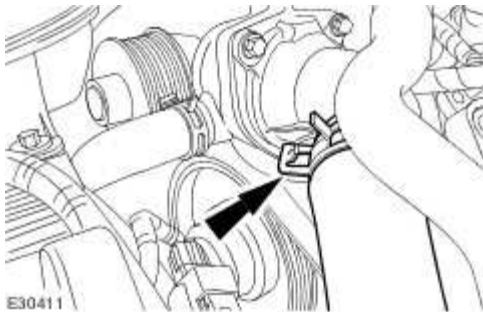
42 . Disconnect the coolant temperature sensor electrical connector.



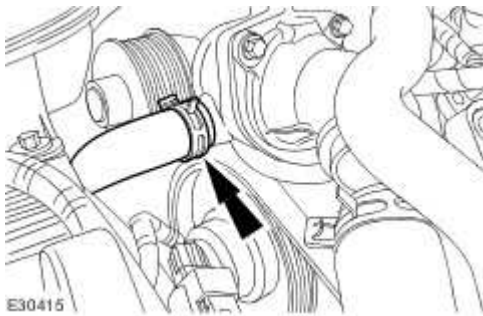
43 . Reposition the thermostat housing hose retaining clip.



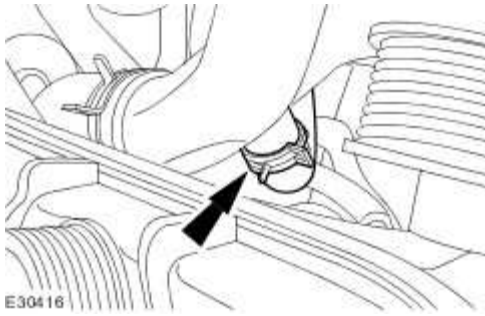
44 . Disconnect the hose.



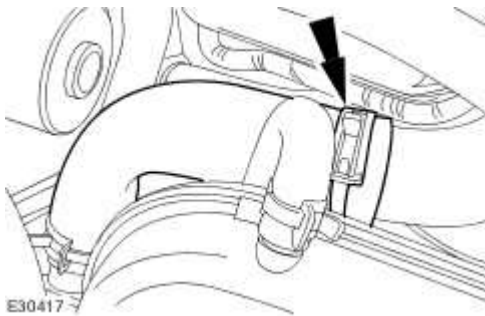
45 . Disconnect the hose.



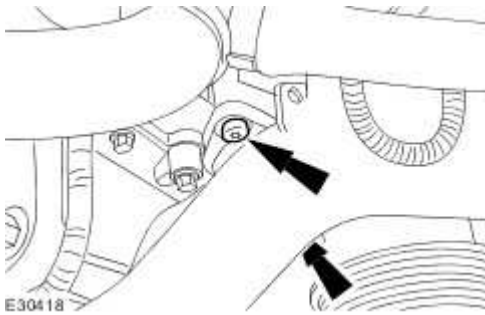
46 . Disconnect the hose.



47 . Disconnect the hose.

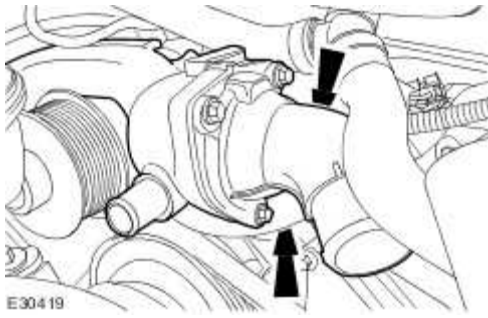


48 . Remove the thermostat housing retaining bolts.

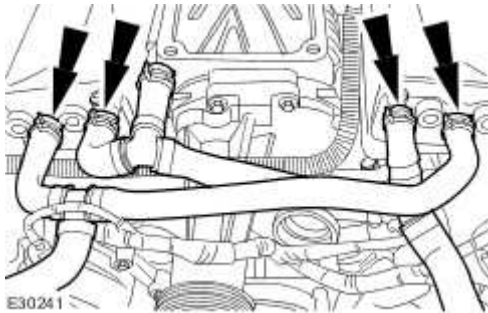


49 . Remove the thermostat housing.

- Remove and discard the thermostat housing O-ring seals.



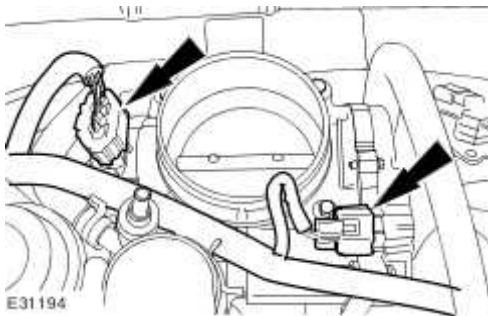
50 . Disconnect the charge air cooler coolant pipes.



51 . Disconnect the intake air temperature (IAT) sensor electrical connector.



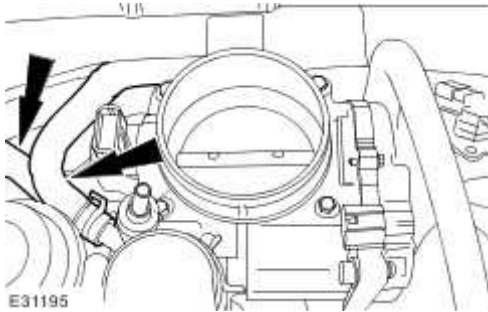
52 . Disconnect the electrical connectors.



53 . **NOTE:**

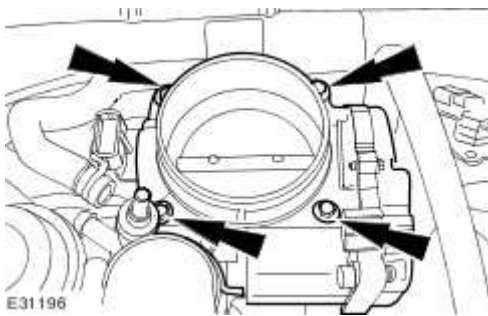
Cap the exposed ports.

Detach the coolant hose from the throttle body.

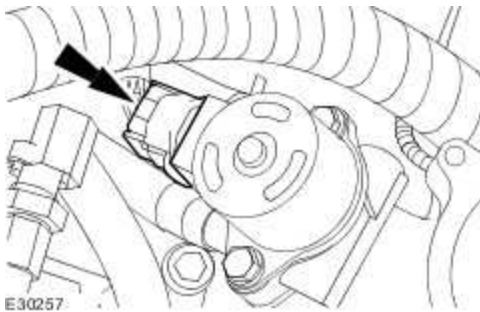


54 . Remove the throttle body.

- Remove and discard the gasket.



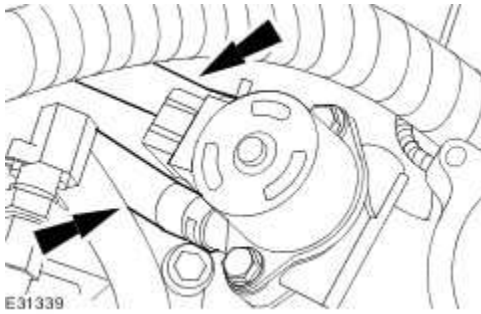
55 . Disconnect the exhaust gas recirculation (EGR) valve electrical connector.



56 . **NOTE:**

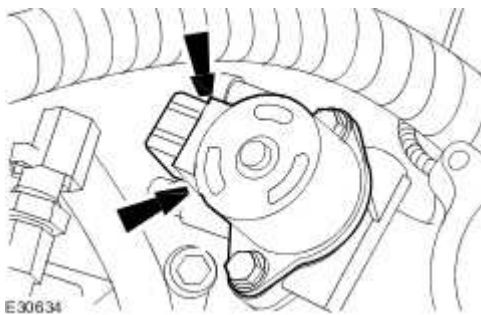
Cap the exposed ports.

Disconnect the coolant hoses.

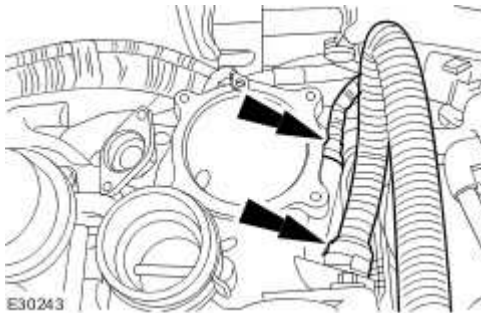


57 . Remove the EGR valve and the exhaust manifold to EGR valve tube.

- Remove the retaining bolts.
- Remove and discard the exhaust manifold to EGR valve tube gasket.
- Remove and discard the EGR valve to air intake elbow gasket.



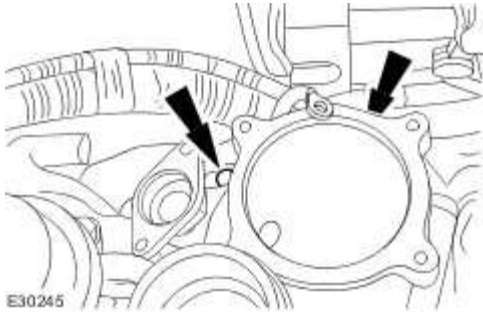
58 . Disconnect the air intake elbow pipes.



59 . **NOTE:**

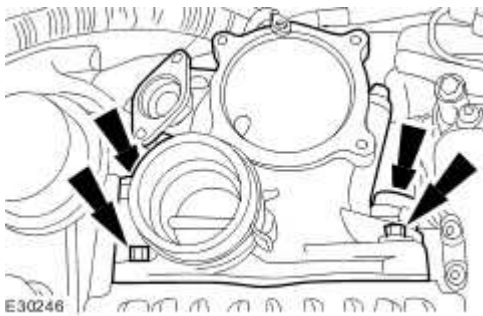
Make sure correct location of the ground strap is noted.

Remove the air intake elbow retaining bracket lower retaining bolts.



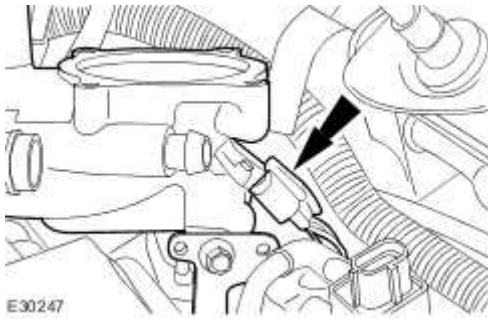
60 . Detach the air intake elbow.

- Remove and discard the gasket.
- Remove and discard the retaining bolt seals.

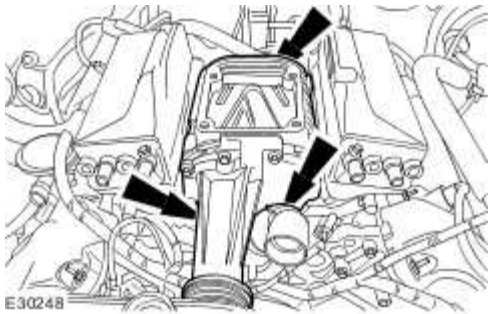


61 . Remove the air intake elbow.

- Disconnect the manifold absolute pressure (MAP) sensor.



62 . Remove the supercharger.



63 .  **CAUTION:** Make sure no foreign matter enters the cylinder head ports.

NOTE:

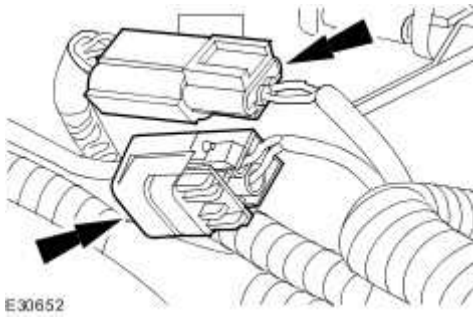
Right-hand shown, left-hand similar.

Remove the charge air coolers.

- Remove and discard the charge air cooler gasket.



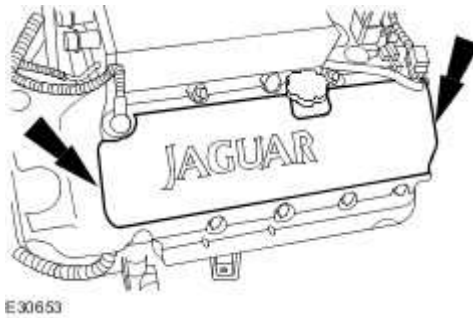
64 . Disconnect the knock sensor electrical connectors.



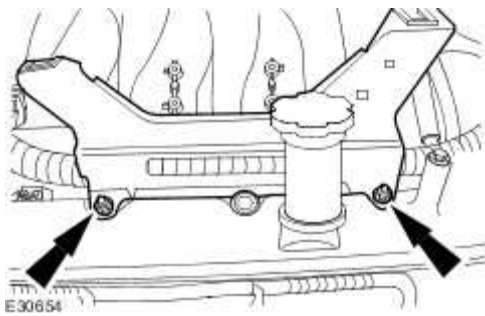
65 . **NOTE:**

Left-hand shown, right-hand similar.

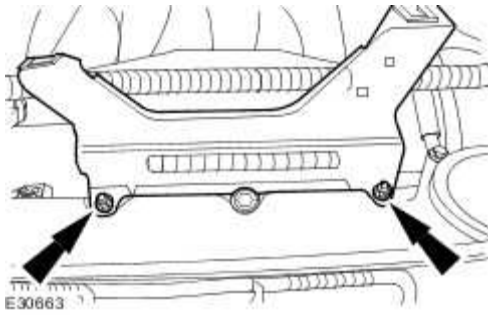
Remove the ignition coil cover.



66 . Remove the engine cover retaining bracket.



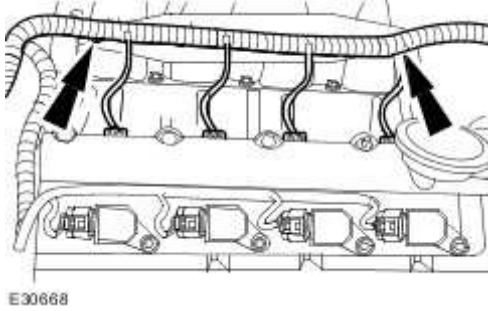
67 . Remove the engine cover retaining bracket.



68 . **NOTE:**

Right-hand shown, left-hand similar.

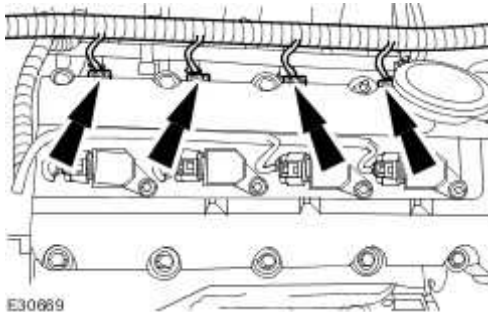
Detach the engine wiring harness.



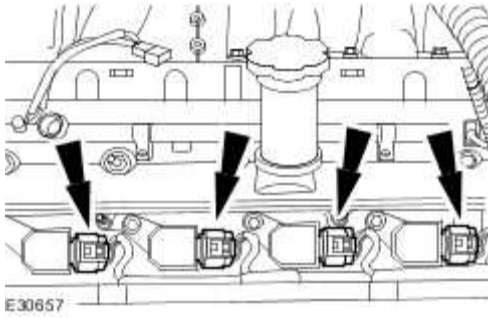
69 . **NOTE:**

Right-hand shown, left-hand similar.

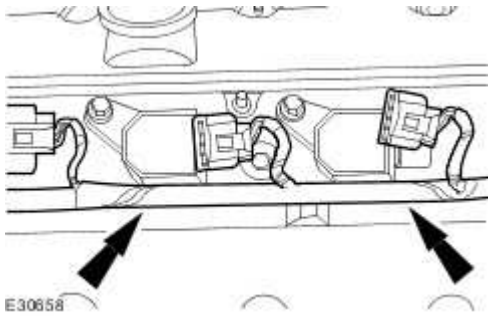
Disconnect the fuel injector electrical connectors.



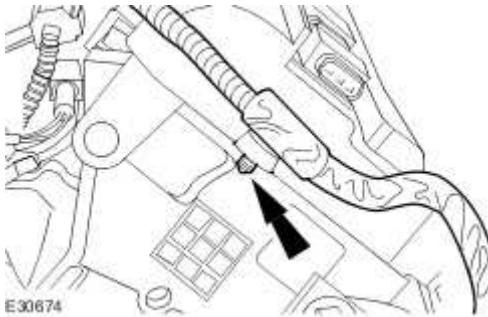
70 . Disconnect the ignition on-plug coil electrical connectors.



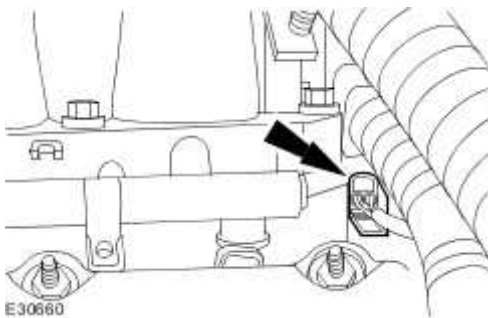
71 . Detach the engine wiring harness.



72 . Detach the engine wiring harness.



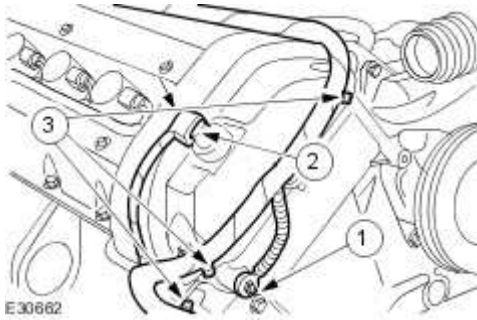
73 . Disconnect the camshaft position sensor electrical connector.



74 . Detach the engine wiring harness.

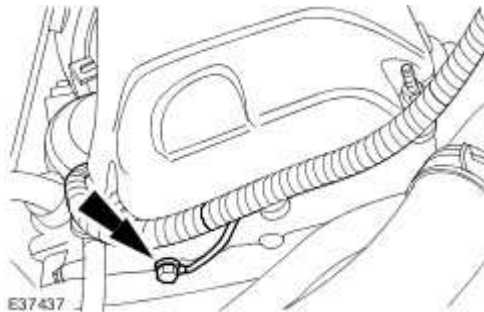
- Detach the ground cable.
- Disconnect the variable valve timing (VVT) solenoid electrical connector.

3. Detach the engine wiring harness.

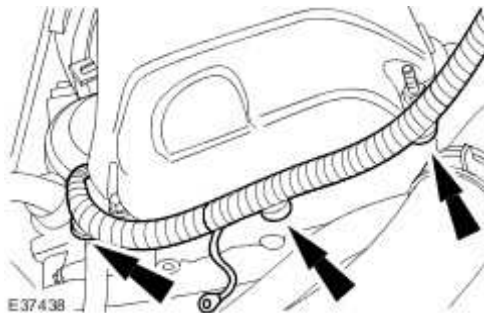


75 . Detach the engine wiring harness.

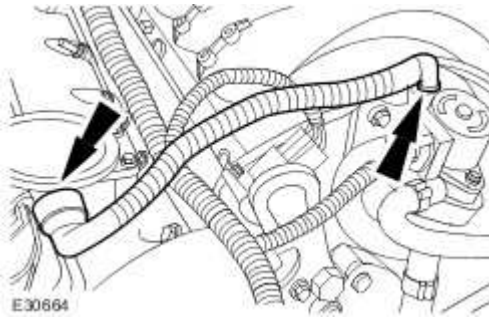
- Remove the retaining bolt.



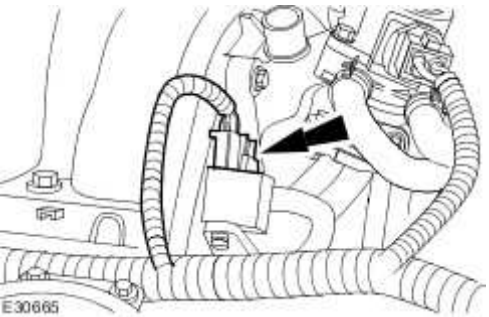
76 . Detach the engine wiring harness.



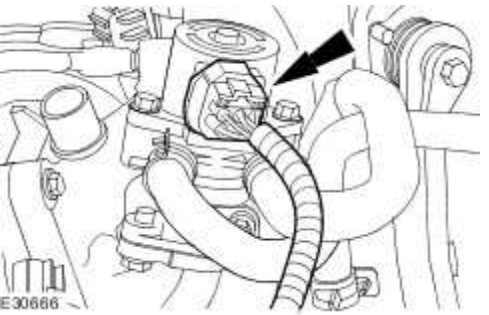
77 . Disconnect the positive crankcase ventilation pipe.



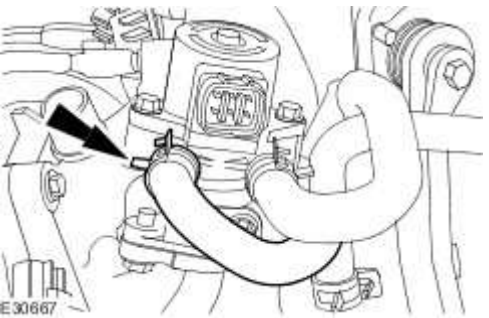
78 . Disconnect the fuel pressure regulator electrical connector.



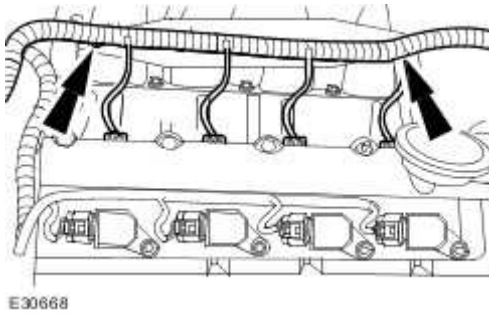
79 . Disconnect the exhaust gas recirculation valve electrical connector.



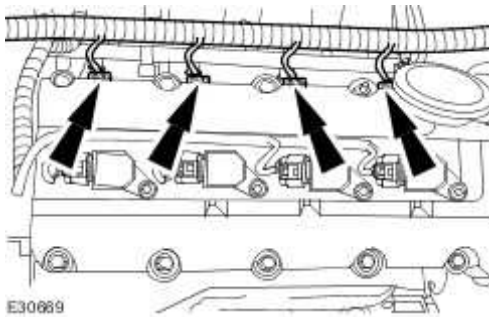
80 . Disconnect the exhaust gas recirculation valve coolant hose.



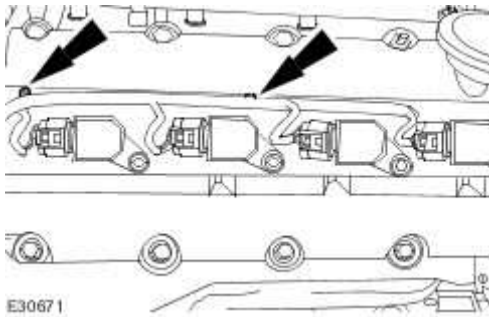
81 . Detach the engine wiring harness.



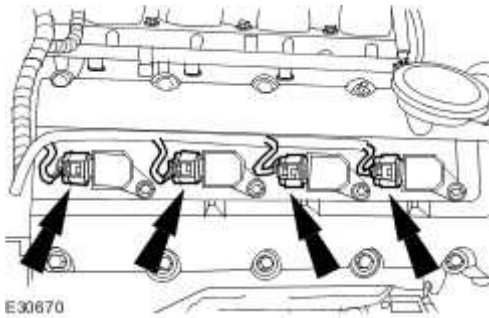
82 . Disconnect the fuel injector electrical connectors.



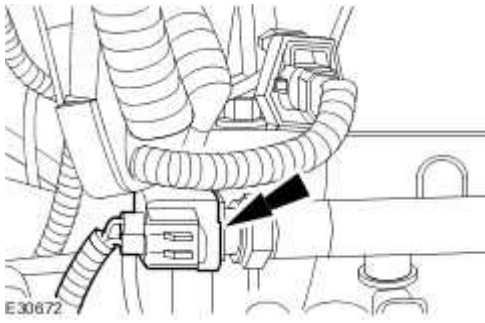
83 . Detach the engine wiring harness.



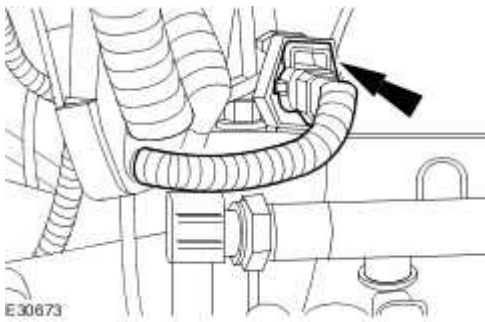
84 . Disconnect the ignition on-plug coil electrical connectors.



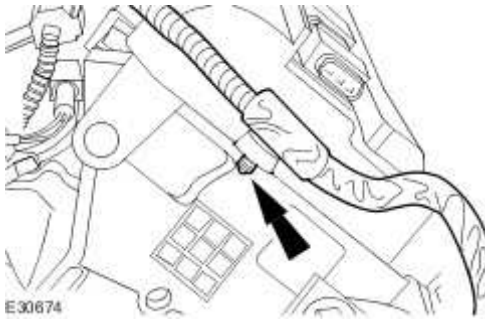
85 . Disconnect the fuel temperature sensor electrical connector.



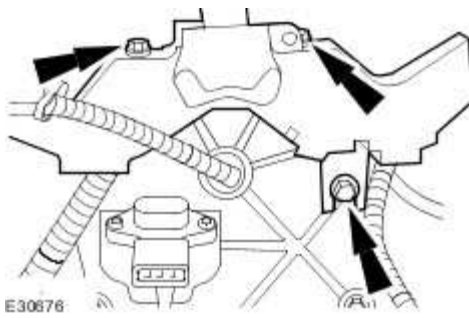
86 . Disconnect the camshaft position sensor electrical connector.



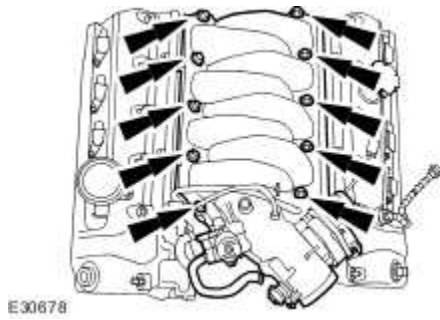
87 . Detach the engine wiring harness



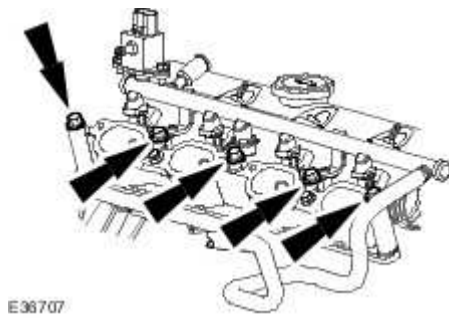
88 . Detach the engine wiring harness.



89 . Remove the intake manifold.



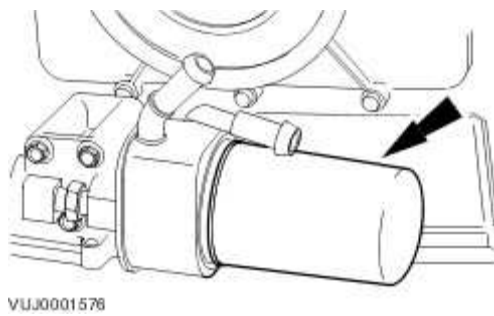
90 . Remove the lower intake manifold.



91 . **NOTE:**

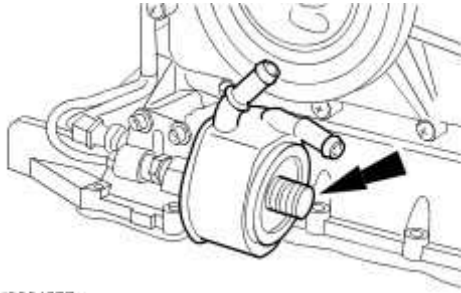
Place a suitable container underneath the filter to prevent oil spillage.

Remove the oil filter element.



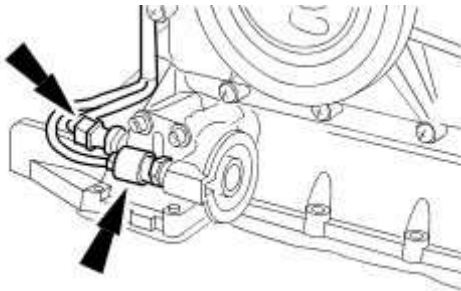
92 . Remove the oil cooler.

- Remove and discard the O-ring seal.



VUJ0001577

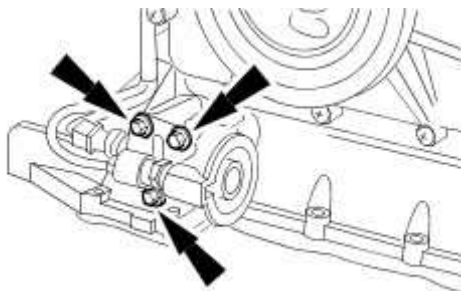
93 . Disconnect the oil pressure switch and oil temperature sensor electrical connectors.



VUJ0001578

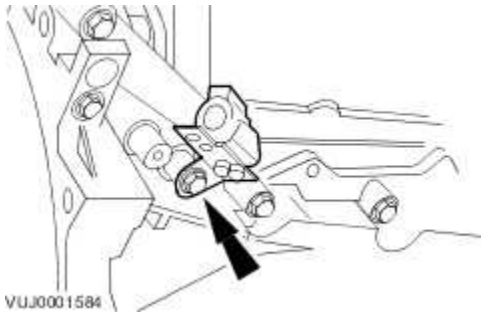
94 . Remove the oil filter housing.

- Remove and discard the O-ring seal.

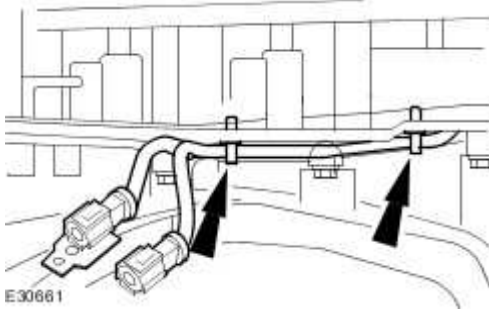


VUJ0001579

95 . Detach the right-hand oxygen sensor.

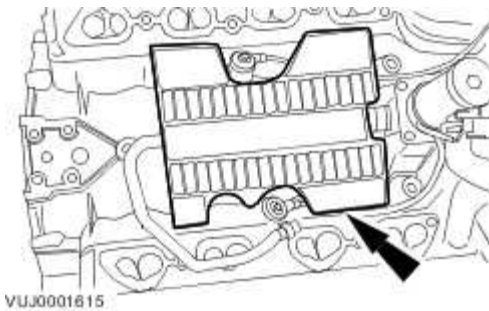


96 . Detach the engine wiring harness retaining clips.



97 . Remove the engine wiring harness

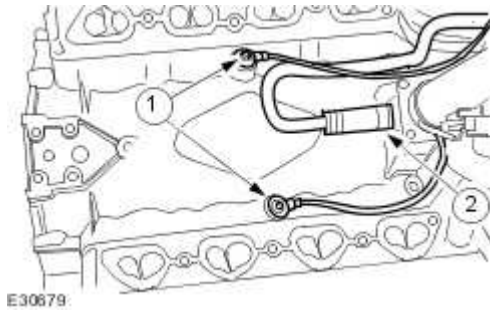
98 . Remove the noise and vibration insulating pad.



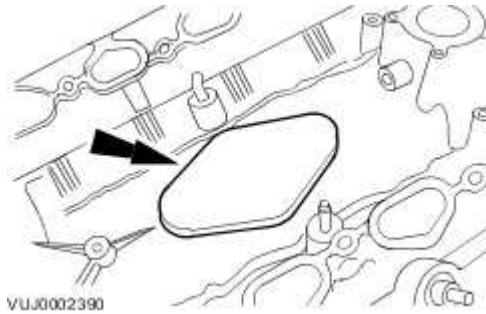
99 . Remove the intake manifold heater coolant hose.

4. Remove the knock sensors.

5. Remove the intake manifold heater coolant hose.

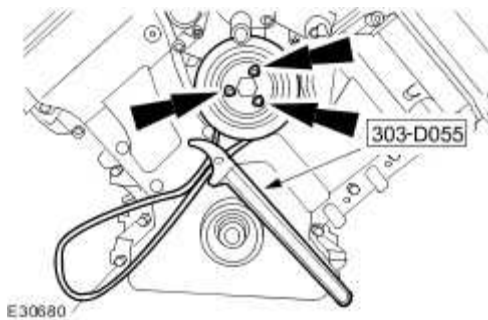


100 . Remove the engine block insulation grommet.



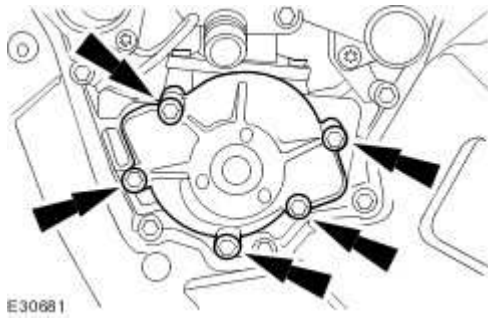
101 . Remove the water pump pulley.

- Using the special tool, retain the water pump pulley.



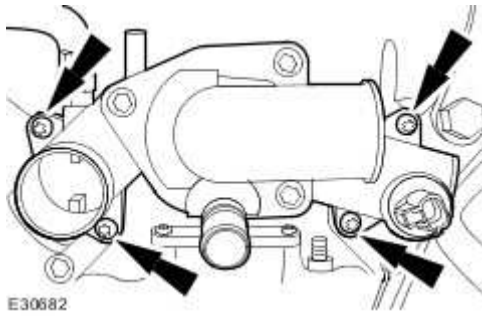
102 . Remove the water pump.

- Remove and discard the gasket.
- Remove and discard the O-ring seal.



103 . Remove the thermostat housing.

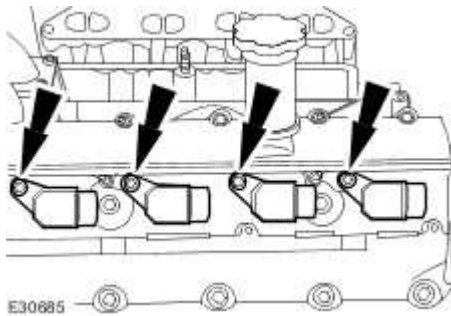
- Remove and discard the O-ring seals.



104 . **NOTE:**

Left-hand shown, right-hand similar

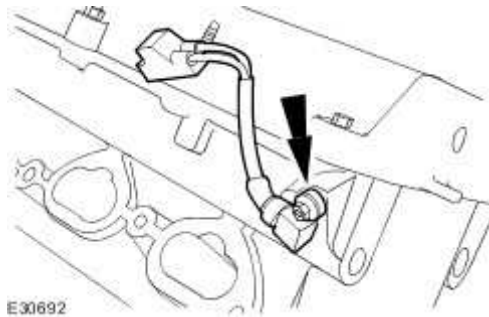
Remove the ignition coils.



105 . Remove the spark plugs.

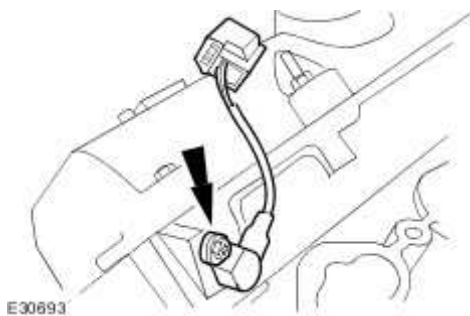
106 . Remove the right-hand camshaft position (CMP) sensor.

- Remove and discard the O-ring seal.



107 . Remove the left-hand camshaft position (CMP) sensor.

- Remove and discard the O-ring seal.



108



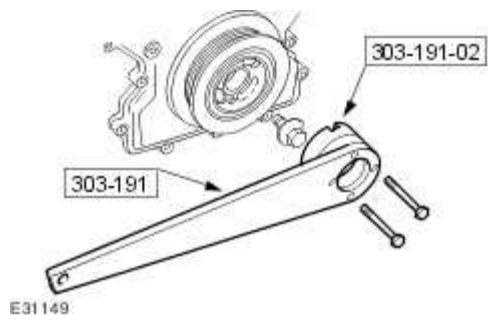
CAUTION: Under no circumstances should the crankshaft setting peg 303-645 be used in the following operations to lock the crankshaft.

NOTE:

The crankshaft retaining bolt will be very tight.

Using special tools, retain the crankshaft pulley.

- Remove and discard the crankshaft pulley bolt.



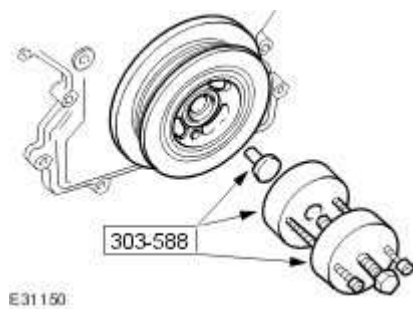
109 . Remove the special tools.

110 . **NOTE:**

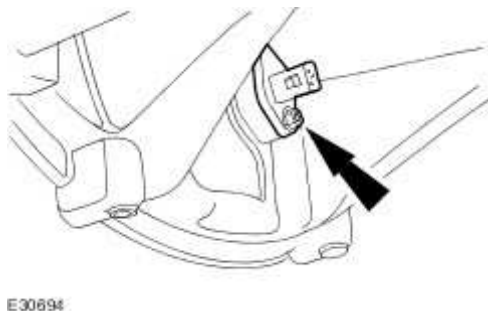
The crankshaft pulley will be very tight.

Using special tools, remove the crankshaft pulley.

- Collect the locking ring.
- Remove and discard the O-ring seal.



111 . Remove the crankshaft position (CKP) sensor.



112



CAUTION: Make sure the spark plugs are removed to enable the engine to rotate freely.

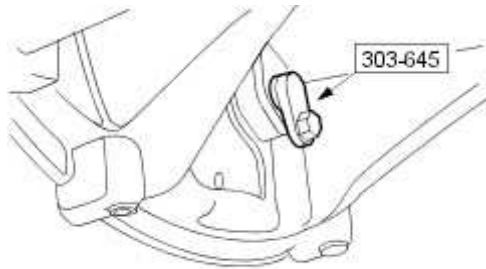


CAUTION: Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.



CAUTION: Rotate the crankshaft clockwise to position the engine to top dead center (TDC) No. 1 cylinder.

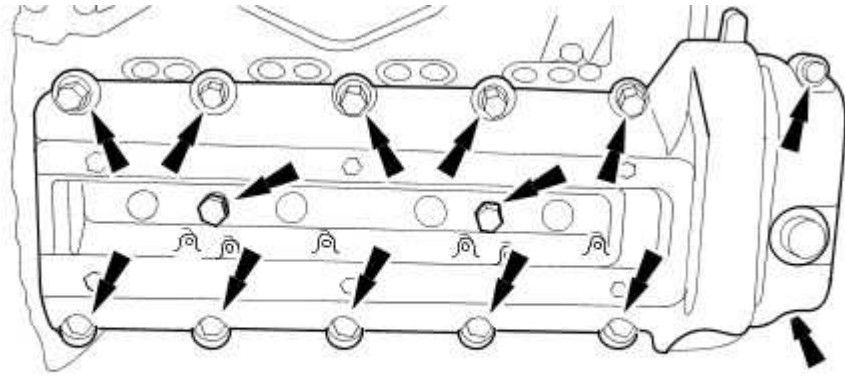
Install the special tool 303-645.



VUJ0002400

113 . Remove the right-hand valve cover.

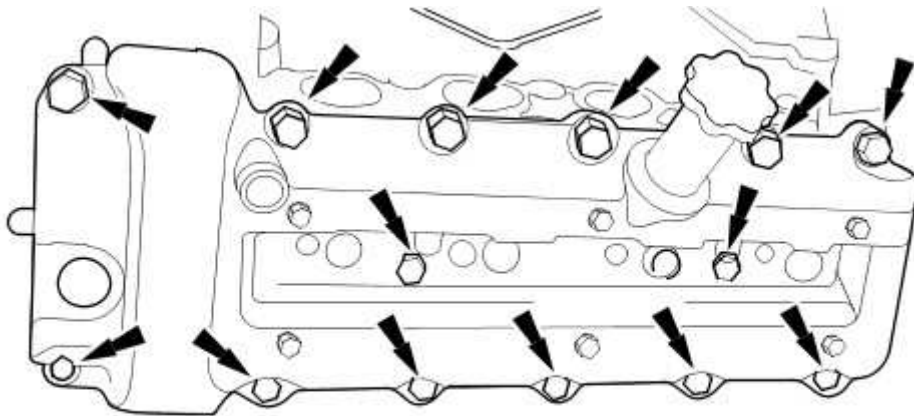
- Discard the valve cover gaskets.



E30696

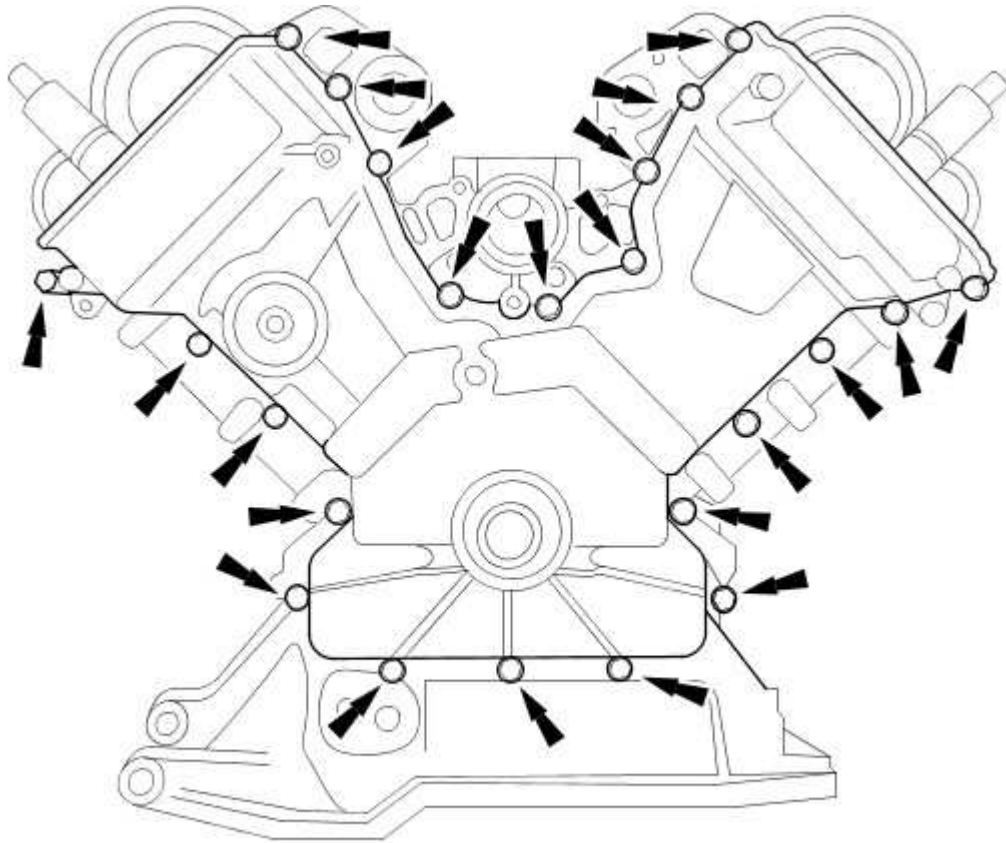
114 . Remove the left-hand valve cover.

- Discard the valve cover gaskets.



E30697

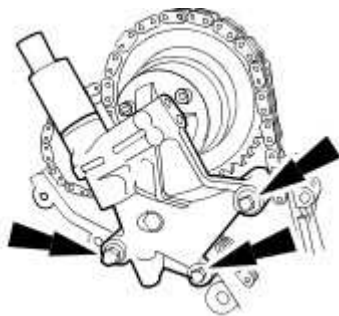
115 . Remove the engine front cover.



VUJ0002398

116 . Remove the right-hand variable camshaft timing oil control unit housing.

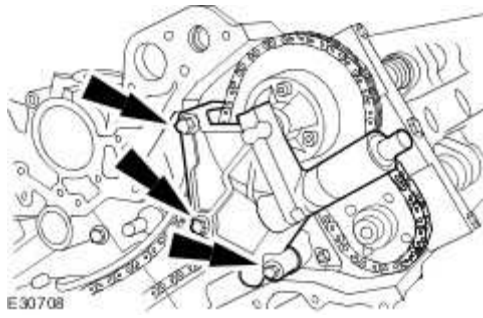
- Remove and discard the O-ring seals.



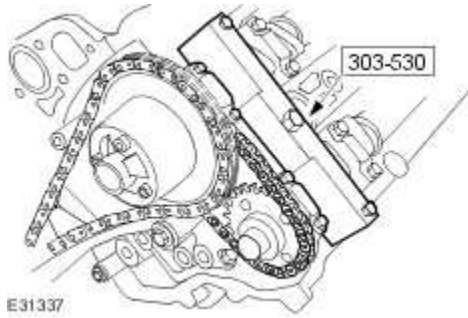
E30699

117 . Remove the left-hand variable camshaft timing oil control unit housing.

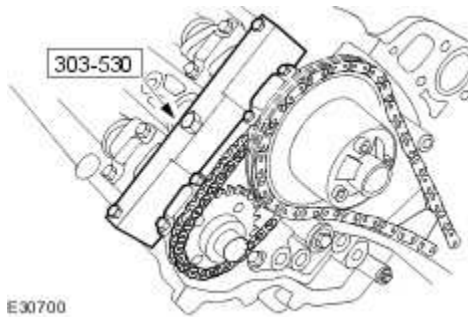
- Remove and discard the O-ring seals.



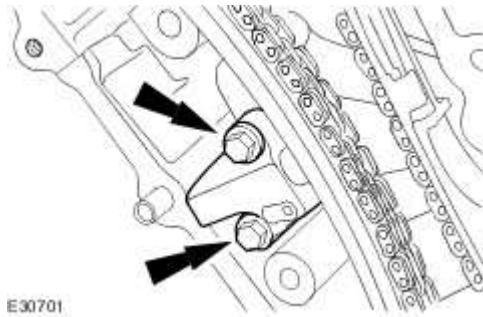
118 . Install the special tool to the left-hand cylinder head.



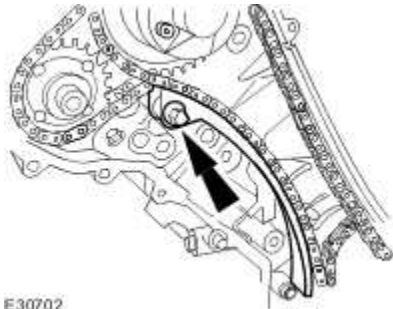
119 . Install the special tool to the right-hand cylinder head.



120 . Remove the primary timing chain tensioner assembly.

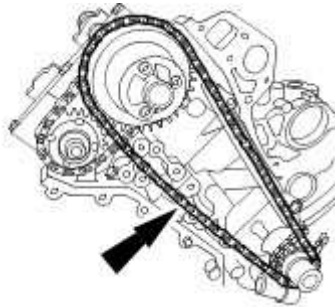


121 . Remove the primary timing chain tensioner guide.



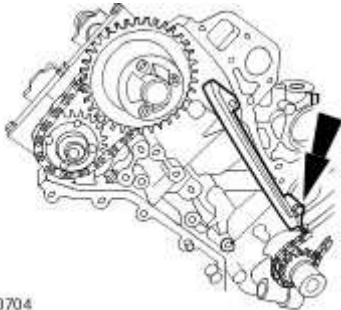
E30702

122 . Remove the primary timing chain.



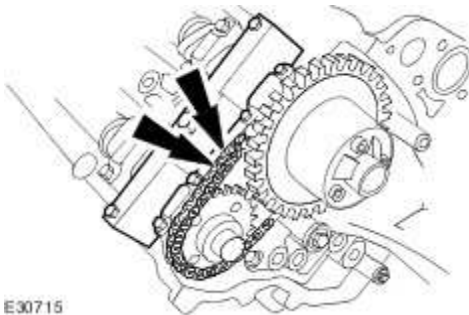
E30703

123 . Remove the primary timing chain guide.



E30704

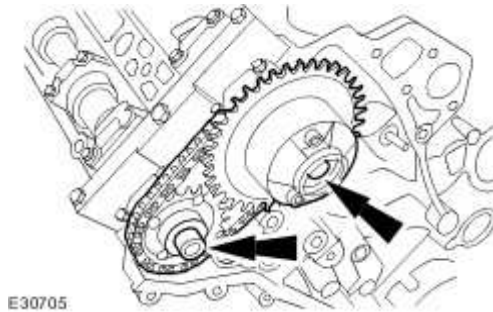
124 . Remove the secondary timing chain tensioner retaining bolts.



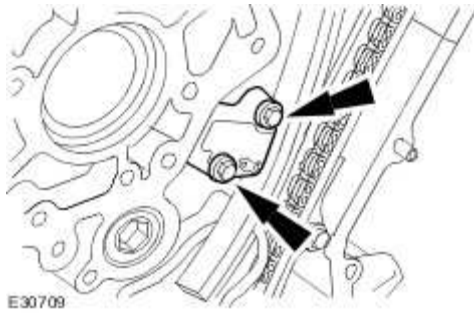
E30715

125 Remove the camshaft sprockets.

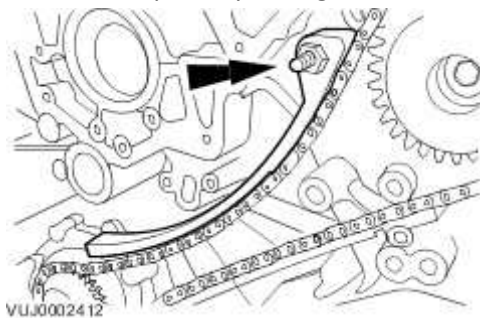
- Remove the secondary timing chain tensioner and secondary timing chain from the camshaft sprockets.



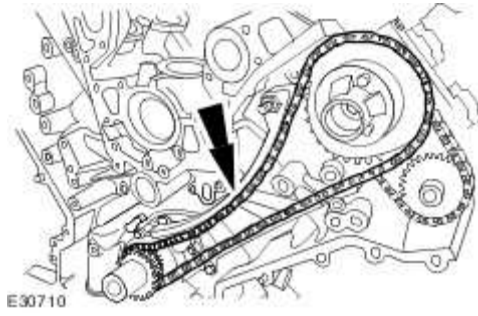
126 . Remove the primary timing chain tensioner assembly.



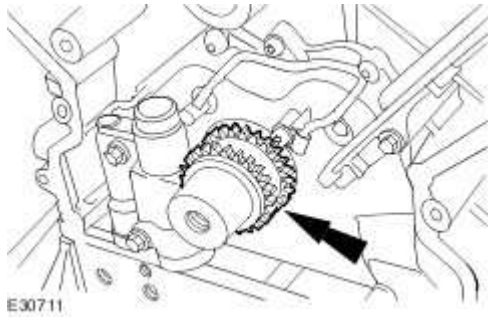
127 . Remove the primary timing chain tensioner guide.



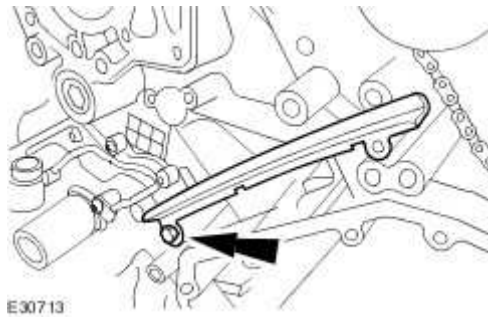
128 . Remove the primary timing chain.



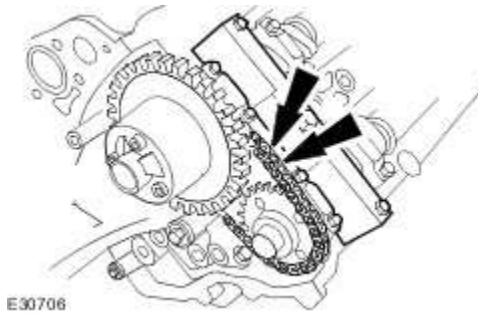
129 . Remove the crankshaft sprocket.



130 . Remove the primary timing chain tensioner guide.

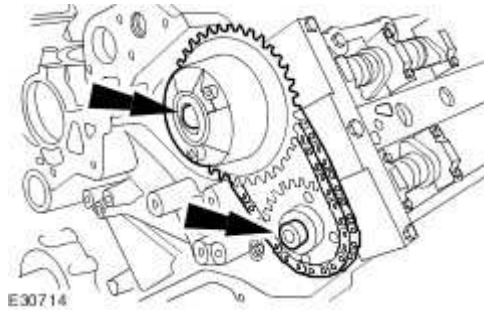


131 . Remove the secondary timing chain tensioner retaining bolts.

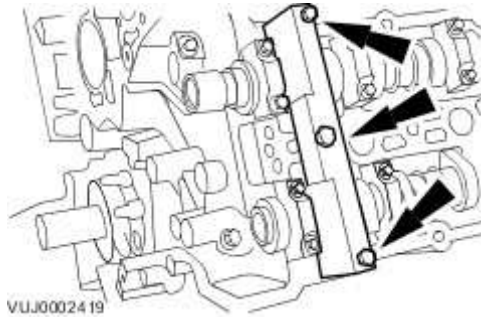


132 Remove the camshaft sprockets.

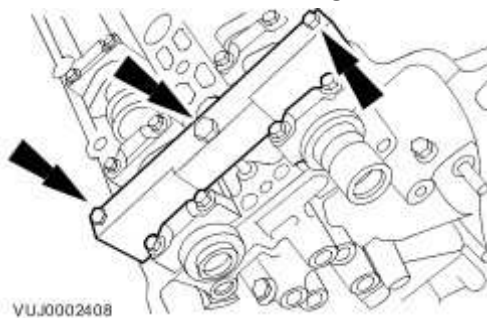
- Remove the secondary timing chain tensioner and secondary timing chain from the camshaft sprockets.



133 . Remove the camshaft setting tool.



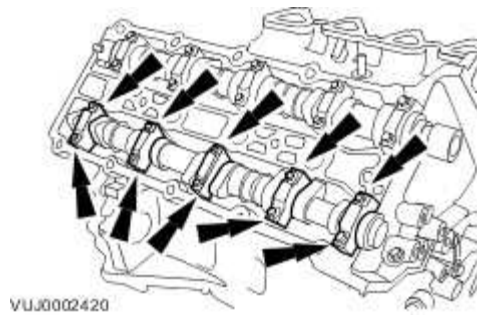
134 . Remove the camshaft setting tool.



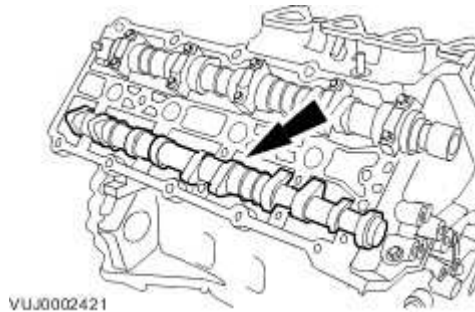
135 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is

marked with its position (a number) and orientation (an arrow).

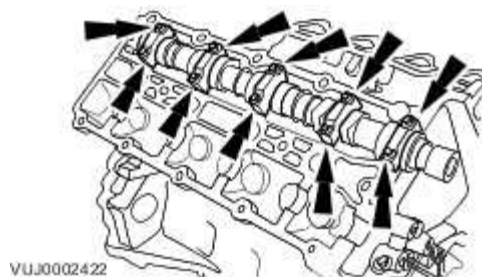


136 . Remove the right-hand exhaust camshaft.

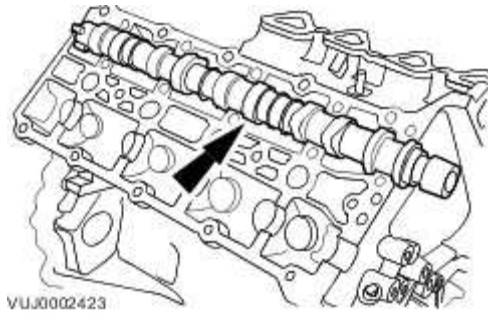


137 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is marked with its position (a number) and orientation (an arrow).

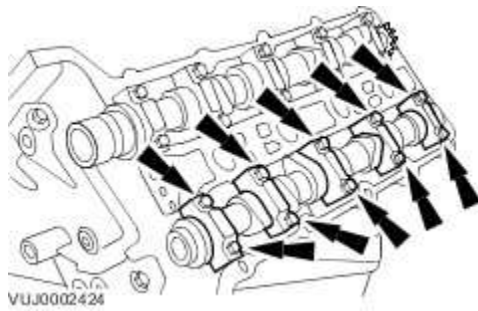


138 . Remove the right-hand intake camshaft.

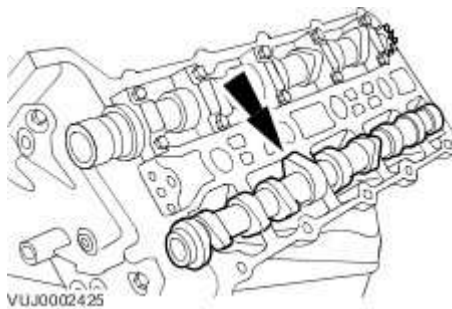


139 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is marked with its position (a number) and orientation (an arrow).



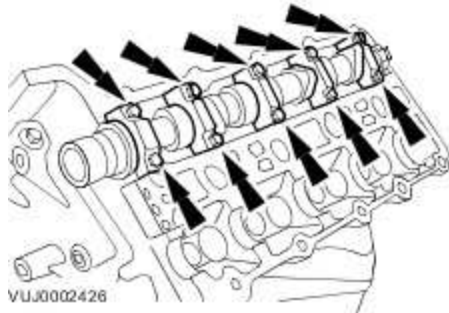
140 . Remove the left-hand exhaust camshaft.



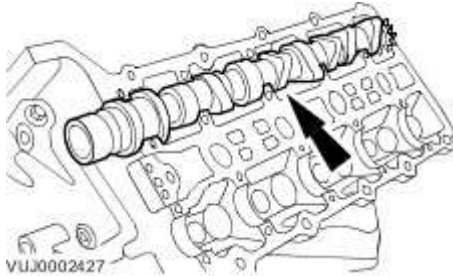
141 Remove the camshaft bearing caps.

- Remove the camshaft bearing cap retaining bolts evenly and in stages.
- Remove the camshaft bearing caps. Note their orientation and markings, each is

marked with its position (a number) and orientation (an arrow).



142 . Remove the left-hand inlet camshaft.



143



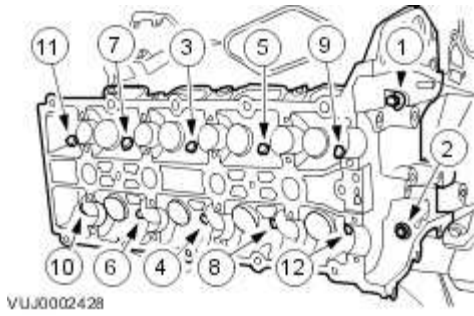
CAUTION: The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.



CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

Remove the right-hand cylinder head.

- Remove the bolts in the indicated sequence.
- Remove and discard the gasket.



144



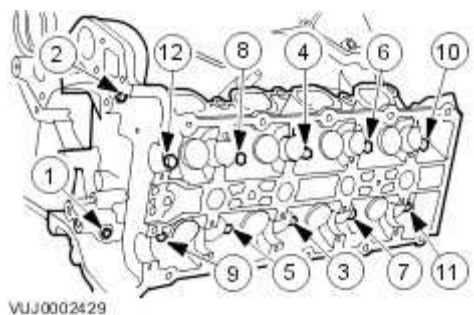
CAUTION: The bolts can only be used twice, mark the bolts with a center punch. If two punch marks are visible, discard the bolts.



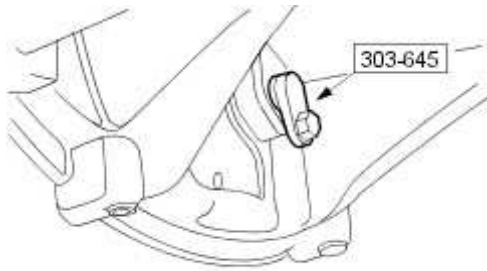
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be removed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.

Remove the left-hand cylinder head.

- Remove the bolts in the indicated sequence.
- Remove and discard the gasket.



145 . Remove the crankshaft setting peg 303-645 from the crankshaft position sensor location.

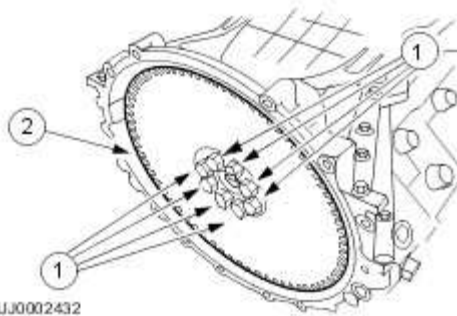


VUJ0002400

146 . Remove the flexplate.

6. Remove the flexplate retaining bolts.

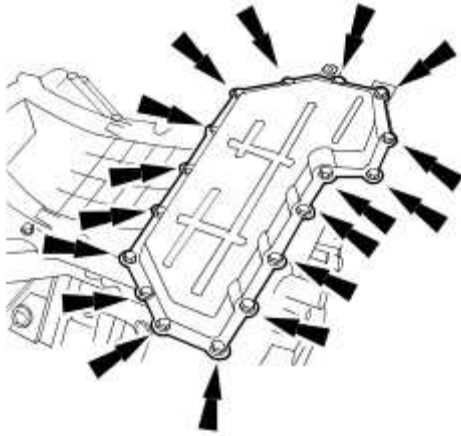
7. Remove the flexplate.



VUJ0002432

147 . Remove the lower oil pan.

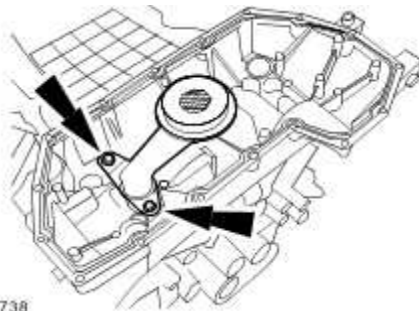
- Remove and discard the gasket.



VUJ0002433

148 . Remove the oil strainer.

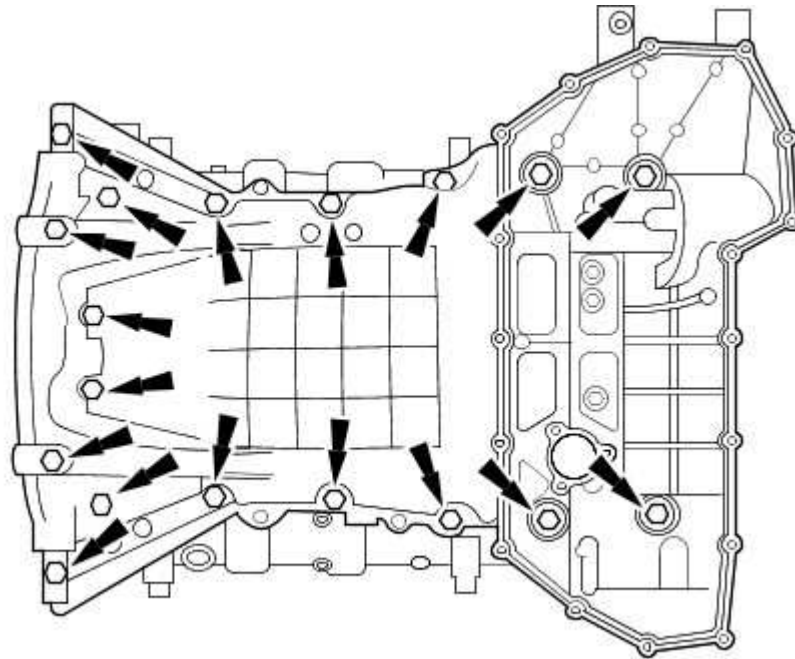
- Remove and discard the O-ring seal.



E30738

149 . Remove the upper oil pan.

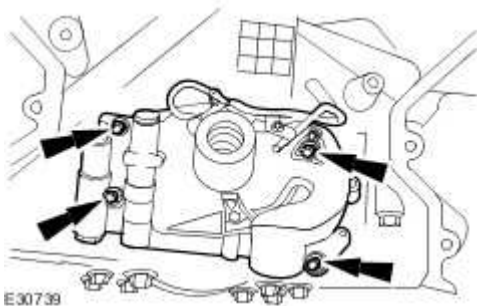
- Remove and discard the gasket.



VUJ0002435

150 . Remove the oil pump.

- Remove and discard the gasket.



E30739

151 Inspect the tops of the cylinder bores. As necessary remove ridge and carbon build up from each cylinder.

152 . Remove the piston cooling jets.

153



CAUTION: Pistons, connecting rods and connecting rod bearings should be

numbered to make sure they are reassembled in the same position.

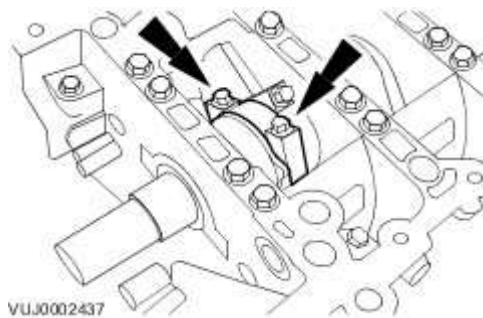
NOTE:

Mark the position of the connecting rod caps to the connecting rods to make sure of correct installation.

NOTE:

Discard the connecting rod bolts after removal.

Remove the connecting rod bolts, the connecting rod caps and the lower connecting rod bearings.

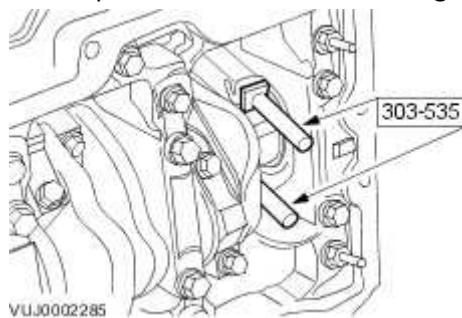


154



CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.



155



CAUTION: Care should be taken not to damage the connecting rod and cap joint

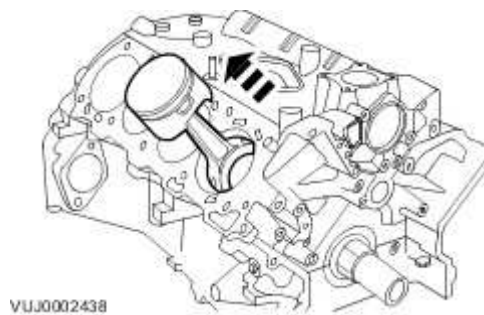
face surfaces or possible engine damage may occur. Avoid contaminating the fractured joint surfaces with dirt or grease.

NOTE:

Attach the connecting rods and caps after removal to avoid mismatch.

Remove the pistons.

- Rotate the crankshaft to locate pistons at the bottom of travel.
- Push the piston, connecting rod and upper bearing through the top of the cylinder.



156 . **NOTE:**

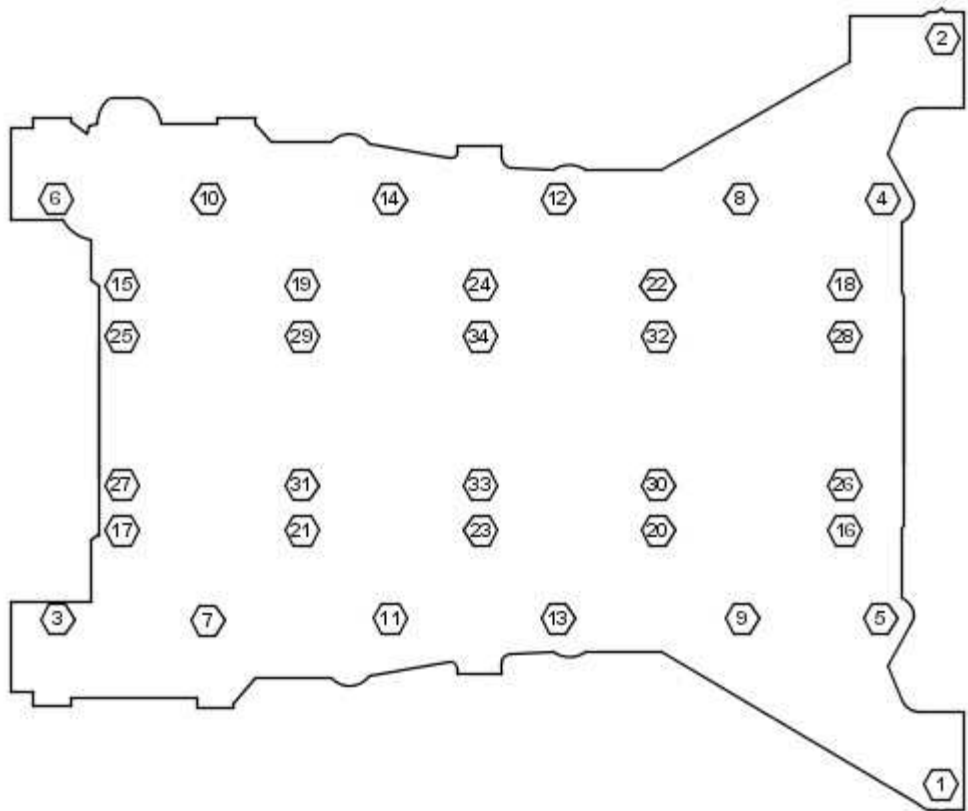
Remove the lower cylinder block bolts in the indicated sequence.

NOTE:

Mark the position of the upper and lower crankshaft main bearings for reassembly.

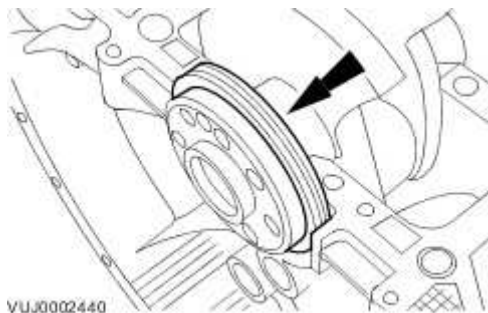
Remove the lower cylinder block.

- Remove the lower cylinder block retaining bolts in the indicated sequence.



VUJ0002439

157 . Discard the crankshaft rear main oil seal.



VUJ0002440

158

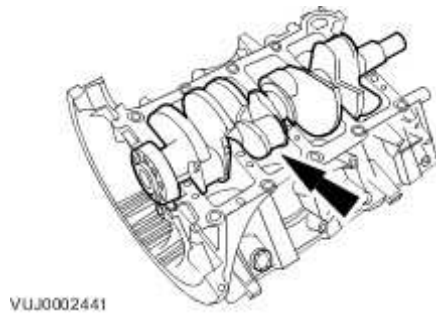


CAUTION: Avoid damage to any crankshaft bearing surfaces.

NOTE:

Never remove any pipe, plugs or dowels unless they are to be newly installed or the cylinder block is to be washed.

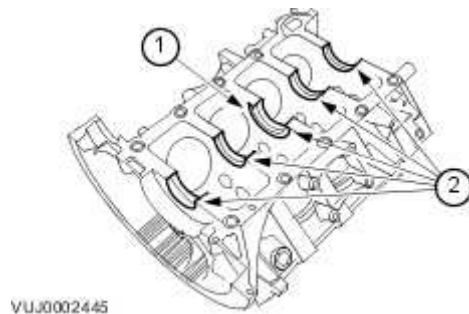
Remove the crankshaft.



159 . Remove the upper crankshaft main bearings.

8. Remove the upper crankshaft thrust washers.

9. Remove the upper crankshaft main bearings.



160 Clean the cylinder block with a soap and water solution. Dry the cylinder block completely with compressed air.

Cylinder Head (12.29.22)

Special Service Tools



303252

Valve Spring Compressor
303-252

Disassembly

1



CAUTION: Do not use a magnet to remove shims. Failure to follow these instructions may result in damage to the vehicle.



CAUTION: If the cylinder head valve components are to be reused, mark the position of the valve components to make sure they are reassembled in the same position.

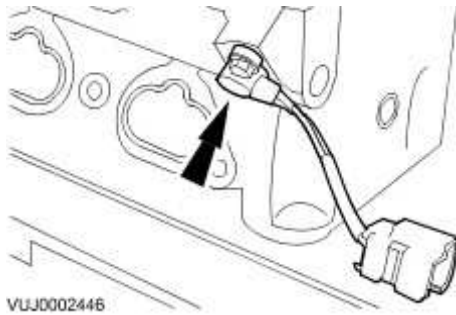
Remove the bucket tappet and shim assemblies.



VUJ0002442

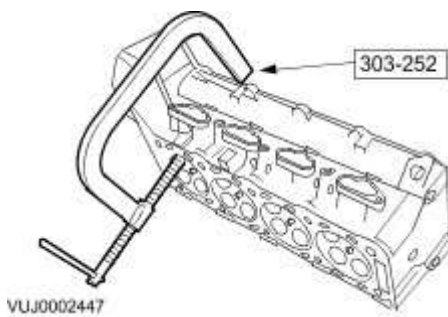
2 . Remove the camshaft position (CMP) sensor.

- Remove and discard the 'O' ring seal.



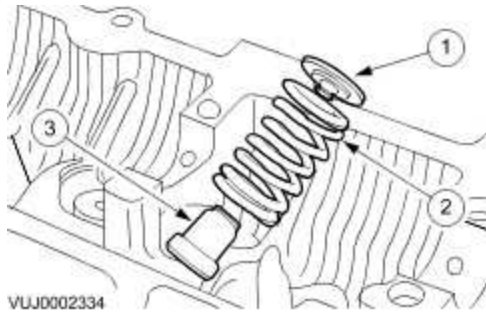
3 . Using the special tool, compress the valve springs.

- Remove the valve collets.



4 . Remove the valve spring retainers and valve springs.

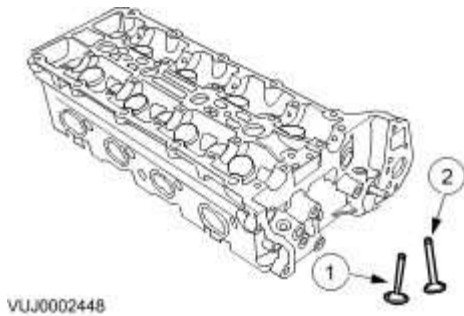
1. Remove the valve spring retainers.
2. Remove the valve springs.
3. Remove the valve stem oil seals.



5 . Remove the valves from the cylinder head.

4. Remove the intake valves.

5. Remove the exhaust valves.



6 Inspect the cylinder heads and related components. For additional information, refer to . <<303-00>>

7 . Remove the pipe plugs and alignment dowels as necessary to clean the cylinder heads.

Assembly

1



· **WARNING: Eye protection is required during use of compressed air. Failure to follow**

these instructions may result in personal injury.



CAUTION: The cylinder head surface finish is measured in microns. For correct head gasket sealing, avoid any contact of finish with metallic objects.

Clean gasket material, dirt and foreign material from cylinder heads. Wash with a suitable soap and water solution and dry the cylinder head completely using compressed air if pipe plugs have been removed.

2 . Install the pipe plugs and alignment dowels to cylinder heads.

- Apply pipe sealant to plugs prior to installation.

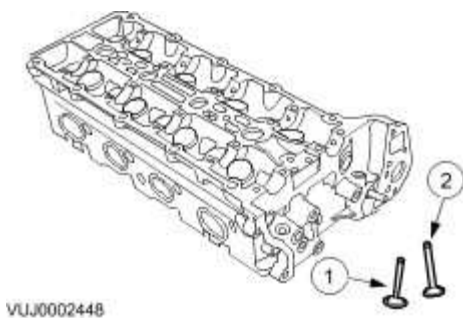
3 . **NOTE:**

Lubricate the valve stems before assembly.

Install the valves into the cylinder heads.

6. Install the intake valves.

7. Install the exhaust valves.

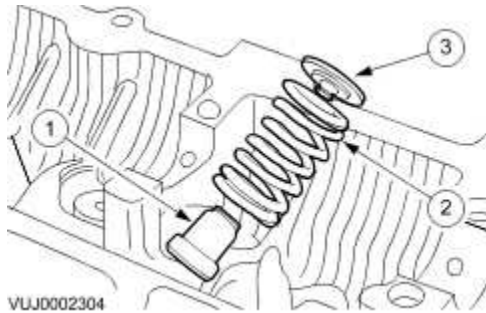


4 . Install the valve spring retainers and valve springs.

8. Install the valve stem oil seals.

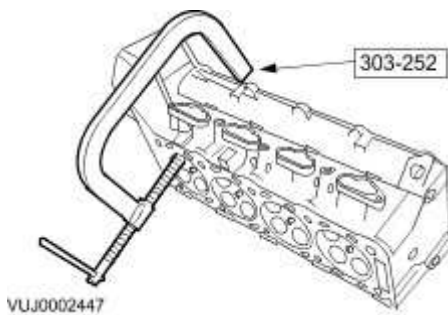
9. Install the valve springs.

10. Install the valve spring retainers.



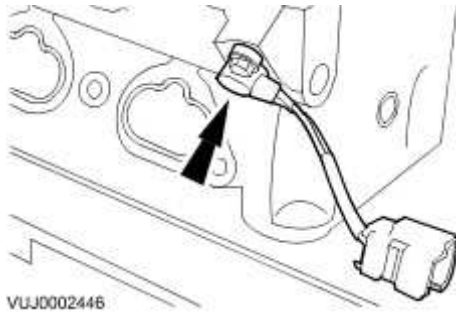
5 . Using the special tool, compress the valve springs.


- Install the valve collets.



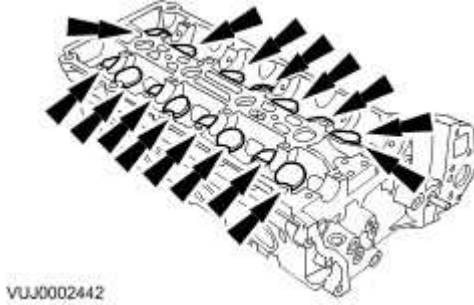
6 . Install the camshaft position (CMP) sensor.

- Install a new 'O' ring seal.
- Tighten to 7 Nm.



- 7
-  **CAUTION: Do not use a magnet to install shims. Failure to follow these instructions may result in damage to the vehicle.**

Install the bucket tappet and shim assemblies.



Engine

Special Service Tools



303-191

Crankshaft locking, main tool
303-191



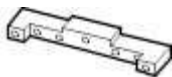
303-191-02

Adapter
303-191-02



303-645

Crankshaft setting, main tool
303-645



303-530

Camshaft setting
303-530



303-532

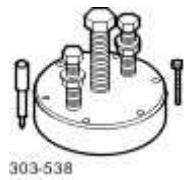
Timing chain tensioning tool
303-532



Cylinder Bore Protectors
303-535



Piston Ring Compressor
303-372



Crankshaft rear oil seal remover/replacer
303-538



Crankshaft front seal installer
303-538



303D055

Crankshaft damper holding tool
303-D055

Assembly

1



• **CAUTION: Use only a plastic scraper when removing old gasket material.**

Clean all the mating faces and reusable parts thoroughly and check for damage.

- If gasket material remains on the cylinder head after cleaning, use a plastic tipped scraper to remove remaining material.

2 . **NOTE:**

Never remove pipe plugs or alignment dowels unless they are to be serviced.

Reseal oil passage blanking plugs, as necessary.

3 . **NOTE:**

The main bearings are precision selective fit.

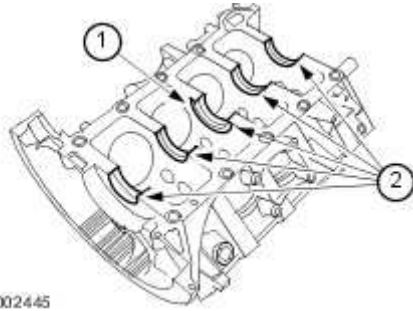
NOTE:

Lubricate the upper crankshaft main bearings and thrust washers.

Install the upper crankshaft main bearings.

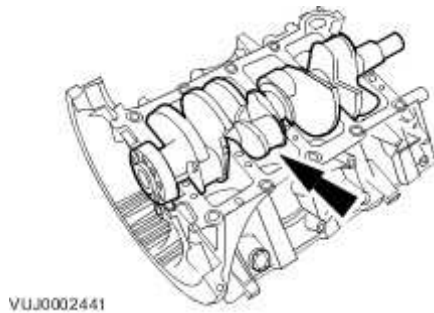
For additional information, refer to Camshaft Bearing Journal Clearance

1. Install the upper crankshaft thrust washers.
2. Install the upper crankshaft main bearings.



4.  **CAUTION: Avoid damage to any crankshaft bearing surfaces.**

Install the crankshaft.



5 **NOTE:**

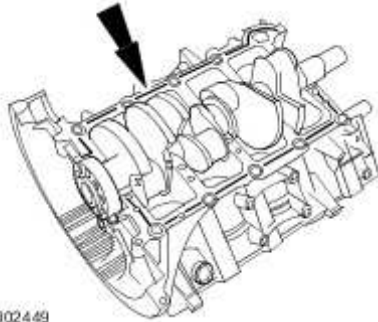
The main bearings are precision selective fit.

NOTE:

Install lower cylinder block and tighten bolts to specification within twenty minutes of applying sealer.

Apply a bead of sealant to the cylinder block housing.

- Use WSS-M4G320-A3-RTV sealant.



6



CAUTION: Make sure all dowels are fully seated into lower cylinder block prior to tightening the bolts.



CAUTION: Do not lubricate the lower cylinder block bolts.



CAUTION: Do not rotate crankshaft until all bolts are tightened to specification.



CAUTION: Bolts must be tightened within twenty minutes of applying sealer.

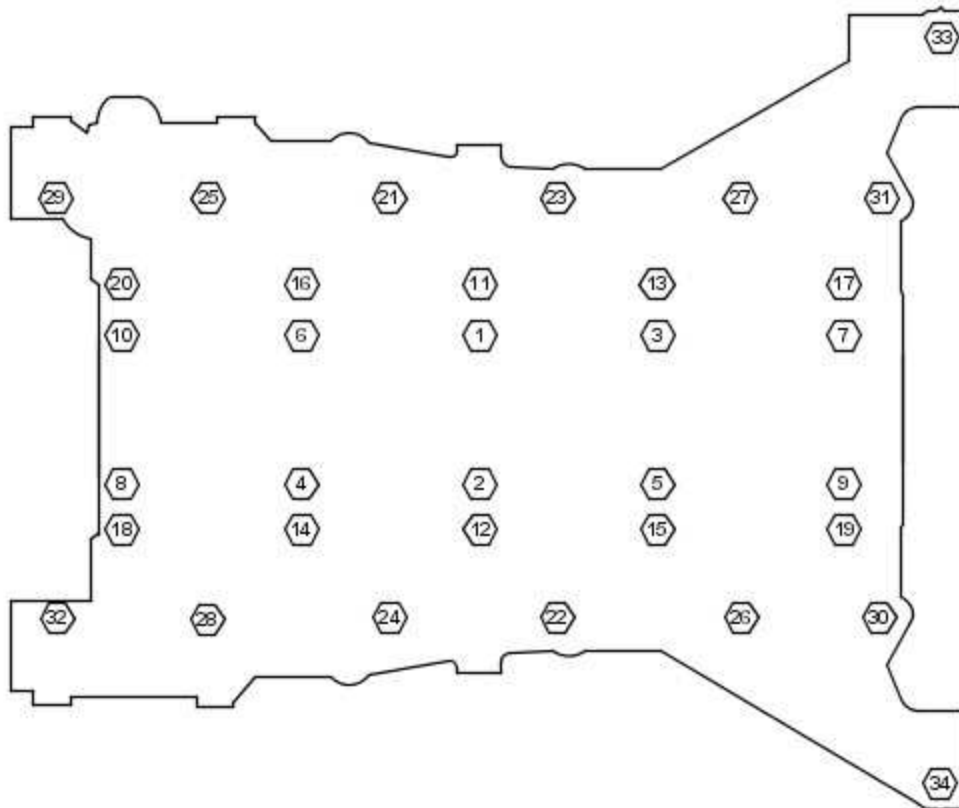


CAUTION: Tighten the bolts in the sequence shown.

Install the lower cylinder block to the upper cylinder block.

3. Tighten bolts 21 to 32 to 15 Nm
4. Tighten bolts 33 to 34 to 15 Nm
5. Tighten bolts 1 to 10 to 25 Nm


6. Tighten bolts 11 to 20 to 15 Nm
7. Tighten bolts 1 to 10 to 35 Nm +135°
8. Tighten bolts 11 to 20 to 20 Nm +150°
9. Tighten bolts 21 to 32 to 20 Nm +90°
10. Tighten bolts 33 to 34 to 20 Nm +150°



VUJ0002450

- 7 . Rotate the crankshaft to check correct operation.
- 8 . Remove excess sealant which may squeeze out at the front cover sealing surfaces.

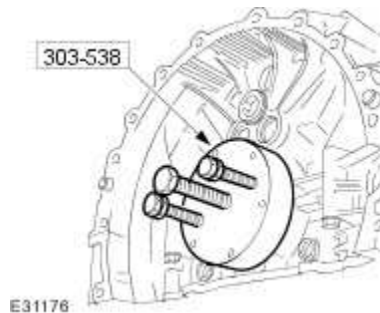
9.  **CAUTION: Do not use any lubricant on the seal, the transit sleeve or the crankshaft.**

-  **CAUTION: Make sure all components are clean and dry.**

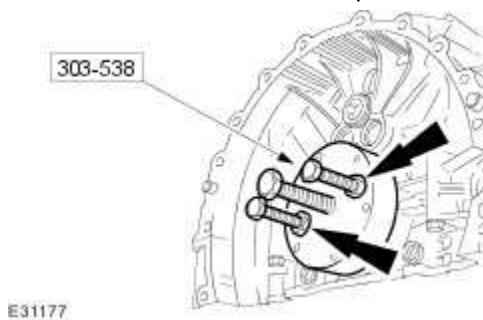
Make sure the transit sleeve is correctly in place and install the new seal over the crankshaft.

10. Carefully remove the transit sleeve, leaving the seal in place.

11. Install the special tool to the crankshaft.

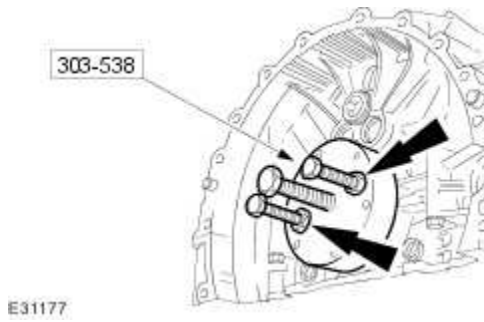


12. Reposition the nuts to hold the special tool against the crankshaft rear seal. Check that the crankshaft rear seal and the special tool are parallel to the rear of the engine.



13.  **CAUTION: Alternate nut tightening to correctly seat the crankshaft rear seal.**

Using the special tool, install the crankshaft rear seal.



14 . Remove the special tool from the crankshaft.

- Check that the seal is located correctly.

15



CAUTION: Use appropriate protection to prevent damage to the crankshaft bearing journals and cylinder bore surfaces.

Install special tools to the connecting rods.

- Position the crankshaft journal at the bottom of the stroke.

16



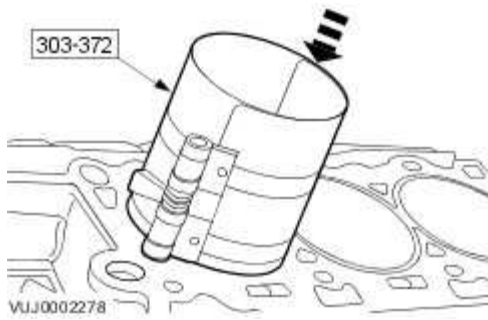
CAUTION: Make sure the piston rings are positioned at different positions opposite the thrust side of the piston before installation.



CAUTION: Install pistons with arrow to front of engine.

Using the special tool compress the rings and install the piston and connecting rod.

- Lubricate all piston components.



17



CAUTION: When assembling the connecting rods and connecting rod caps it is imperative that bearing slots and tangs be located on the same side of the connecting rods.



CAUTION: Connecting rod bolts are torqued to yield and must be replaced.



CAUTION: Bolts must be tightened equally.

NOTE:

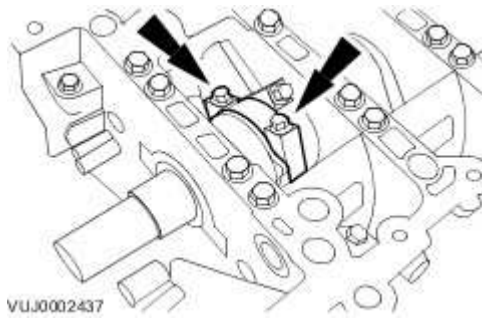
Remove the special tools from the connecting rods.

Position the connecting rod cap on the appropriate connecting rod.

11. Tighten to 10 Nm

12. Tighten to 30 Nm

13. Tighten to 90°



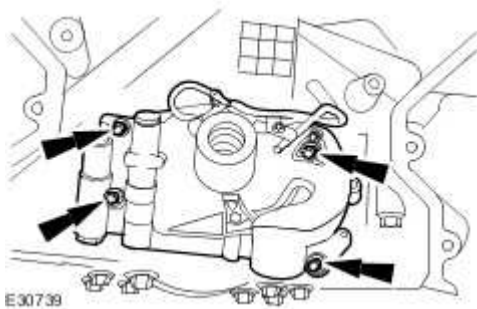
18 . Rotate the crankshaft to check correct operation.

19 . Install the piston cooling jets.

- Tighten to 9 Nm

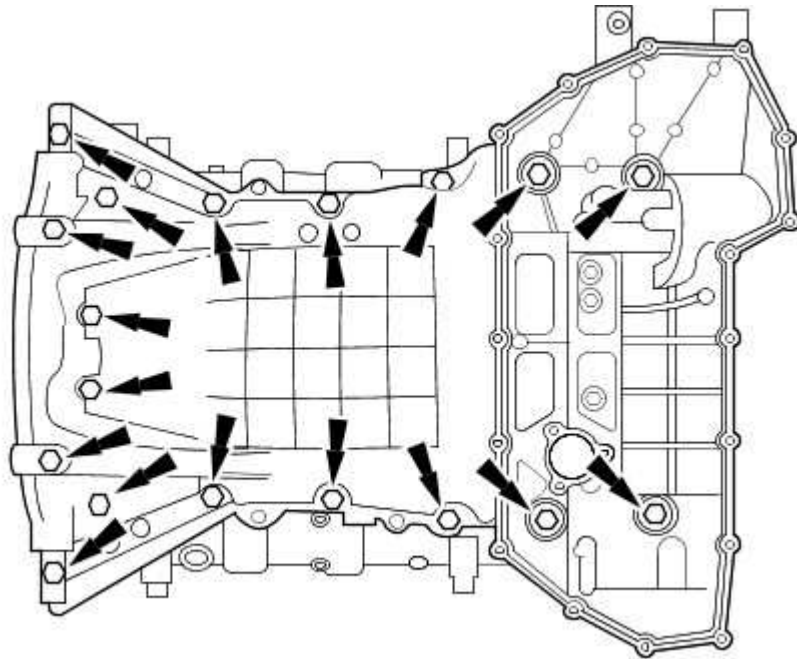
20 . Install the oil pump.

- Install a new gasket.
- Tighten to 12 Nm.



21 . Install the upper oil pan.

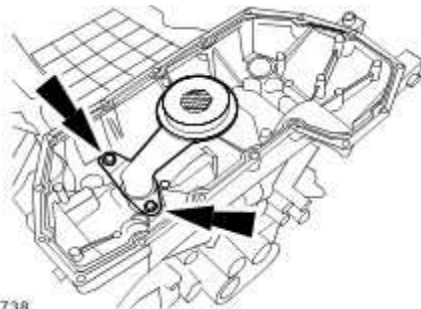
- Install a new gasket.
- Tighten to 21 Nm.



VUJ0002435

22 . Install the oil strainer.

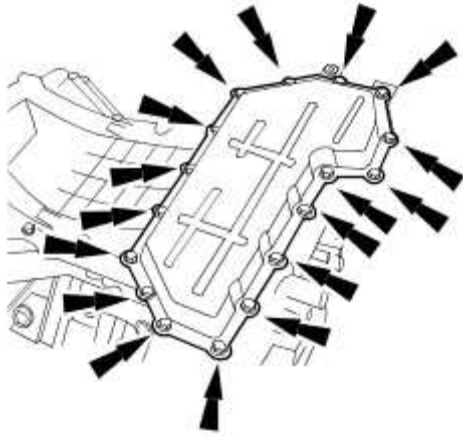
- Install a new O-ring seal.
- Tighten to 12 Nm.



E30738

23 . Install the oil pan.

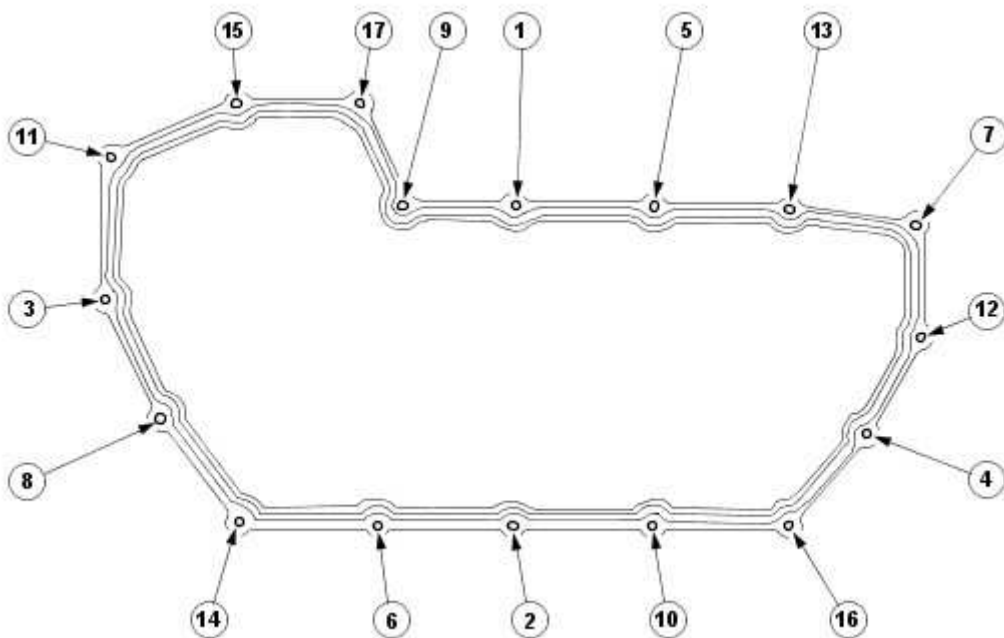
- Install a new gasket.
- Install, but do not fully tighten the retaining bolts.



VUJ0002433

24 Tighten to 12 Nm.

- Tighten in the sequence shown.
- A new oil pan is supplied with the drain plug installed. Check that the drain plug is tightened to 25 Nm.



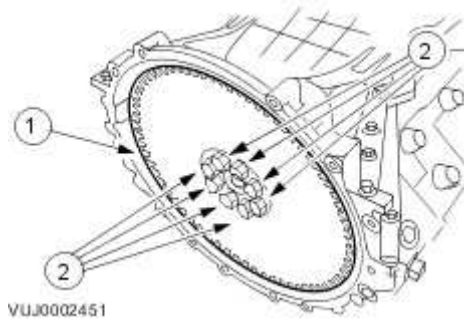
E36705

25 . Install the flexplate.

14. Install the flexplate.

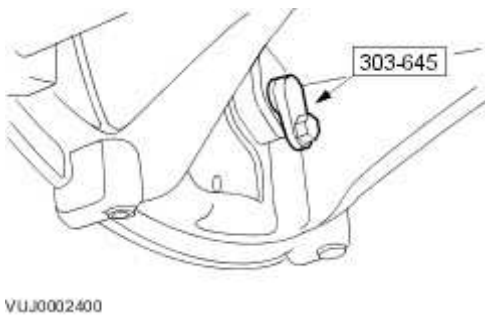
15. Install the flexplate retaining bolts.

- Tighten to 15 Nm.
- Tighten to 110 Nm.



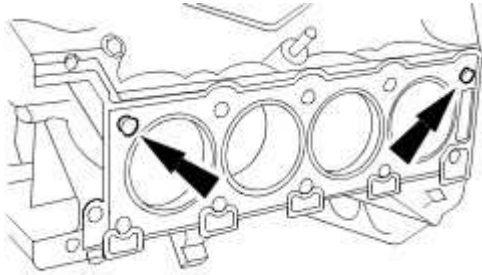
26 . Reposition the crankshaft.

- Install the crankshaft setting peg 303-645 to the crankshaft position sensor location.



27 . Install a new left-hand cylinder head gasket.

- Make sure the cylinder head dowels are correctly located.



E31267

28



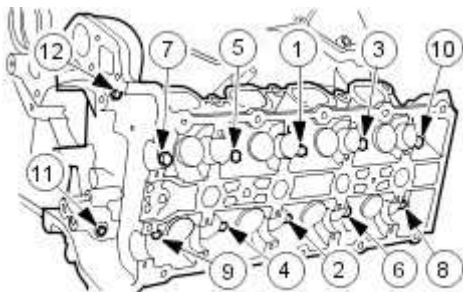
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be installed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.



CAUTION: Tighten the bolts 1 to 10 in the sequence shown.

Install the left-hand cylinder head.

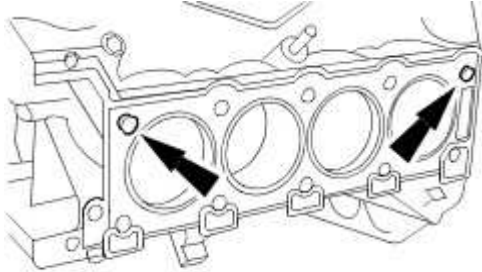
16. Tighten bolts 1 to 10 to 20 Nm.
17. Tighten bolts 1 to 10 to 35 Nm.
18. Tighten bolts 1 to 10 to 90°.
19. Tighten bolts 1 to 10 to 90°.
20. Tighten bolts 11 to 12 to 25 Nm.



VJJ0002452

29 . Install a new right-hand cylinder head gasket.

- Make sure the cylinder head dowels are correctly located.



E31267

30



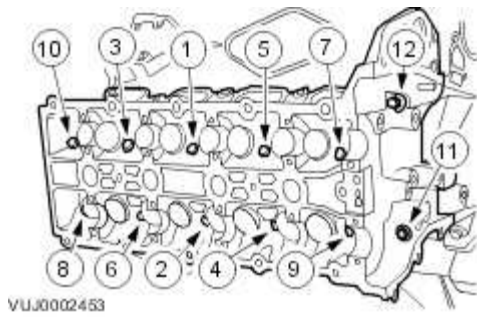
CAUTION: Vehicles fitted with Polydrive cylinder head bolts, the cylinder head bolts must be installed using a 10 mm Polydrive socket or a 10 mm Allen key. Failure to follow this instruction may result in damage to the component.



CAUTION: Tighten the bolts 1 to 10 in the sequence shown.

Install the right-hand cylinder head.

21. Tighten bolts 1 to 10 to 20 Nm.
22. Tighten bolts 1 to 10 to 35 Nm.
23. Tighten bolts 1 to 10 to 90°.
24. Tighten bolts 1 to 10 to 90°.
25. Tighten bolts 11 to 12 to 25 Nm.

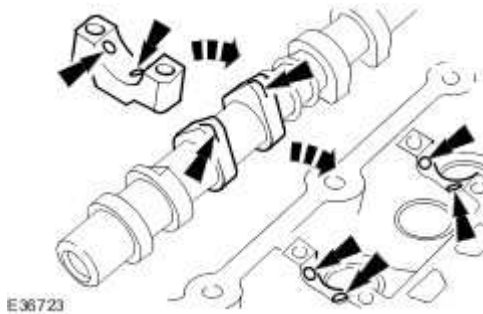


31 . NOTE:

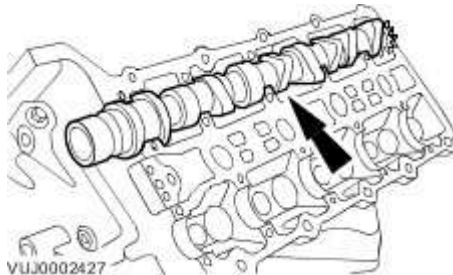
Make sure all components are clean.

Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.



32 . Install the left-hand inlet camshaft.



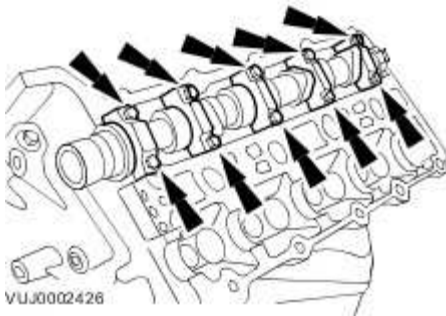
33 .



CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

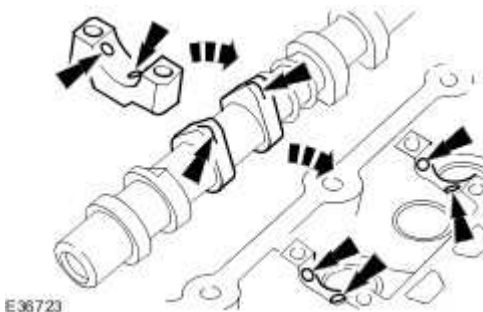


34 . **NOTE:**

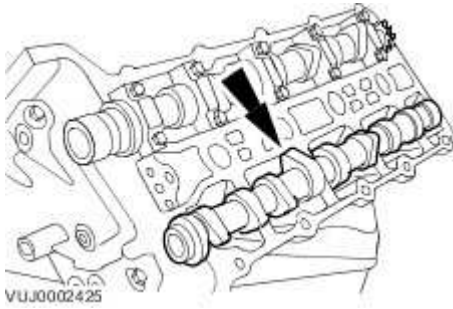
Make sure all components are clean.

Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes **ONLY**, not on the base circle area.



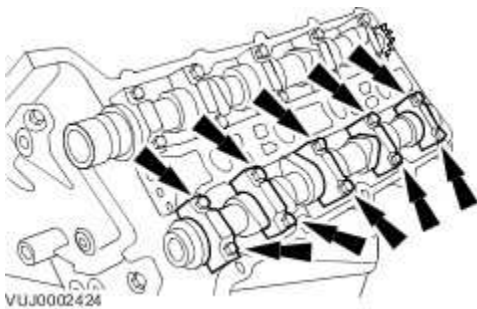
35 . Install the left-hand exhaust camshaft.



- 36 .  **CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.**

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

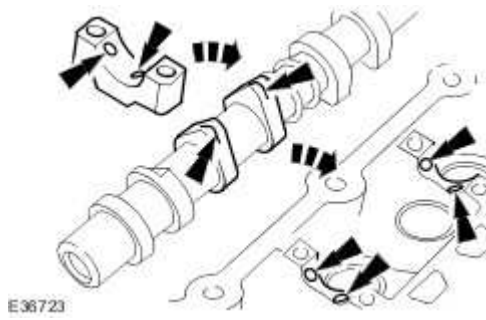


- 37 . **NOTE:**

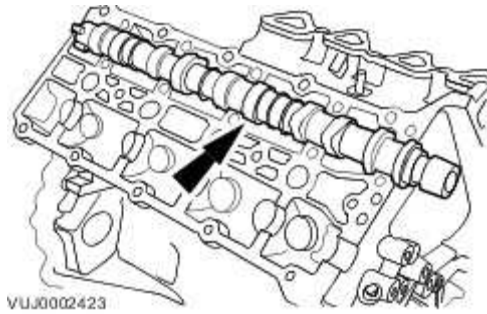
Make sure all components are clean.


Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes **ONLY**, not on the base circle area.



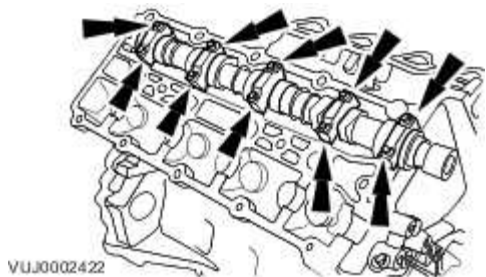
38 . Install the right-hand inlet camshaft.



39 .  **CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.**

Install the camshaft bearing cap bolts evenly.

- Tighten to 10 Nm.

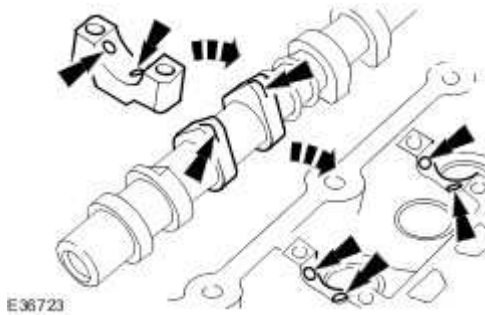


40 . **NOTE:**

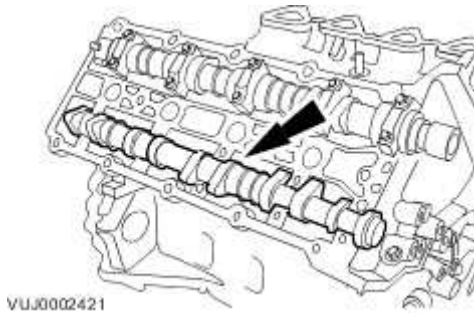
Make sure all components are clean.

Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface in the cylinder head.
- To the upper face of each bearing surface in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.



41 . Install the right-hand exhaust camshaft.



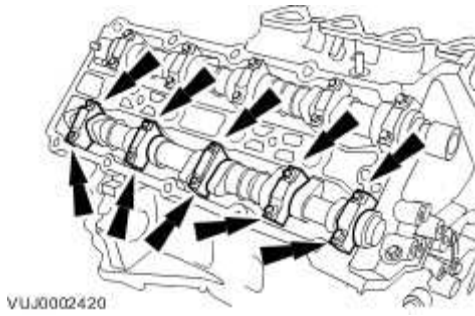
42 .



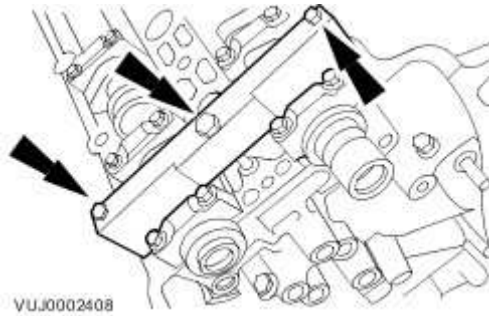
CAUTION: Alternate bolt tightening to correctly seat the camshaft bearing caps.

Install the camshaft bearing cap bolts evenly.

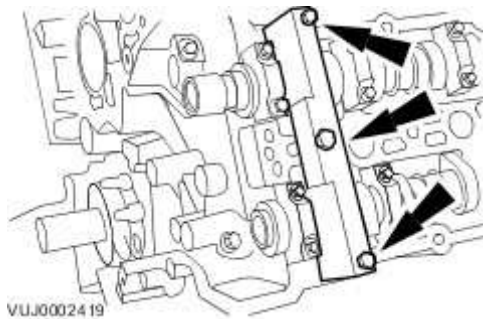
- Tighten to 10 Nm.



43 . Install the camshaft setting tool.



44 . Install the camshaft setting tool.



45



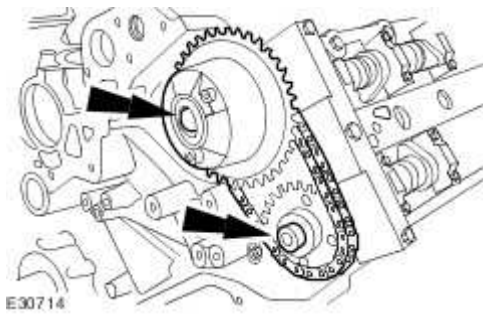
CAUTION: Do not tighten the camshaft sprocket retaining bolts.



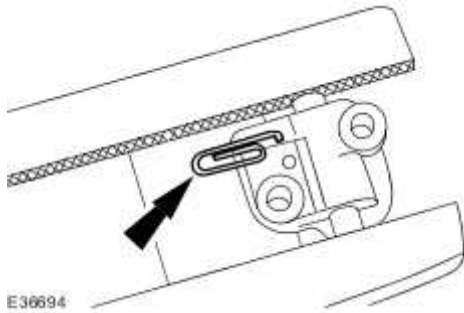
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the camshaft sprockets.

- Install the secondary timing chain tensioner and secondary timing chain to the camshaft sprockets.



- 46 . Using a suitable tool, retain the left-hand timing chain tensioner piston.

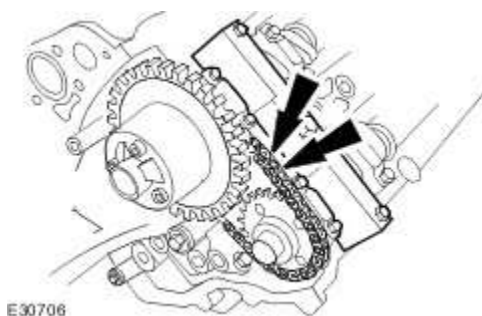


- 47 . Release the tension in the left-hand timing chain tensioner.

- Remove the retaining tool.

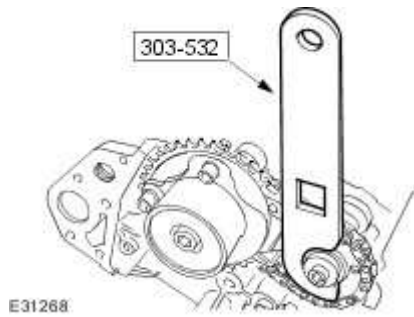
- 48 . Install the secondary timing chain tensioner.

- Tighten to 12 Nm.



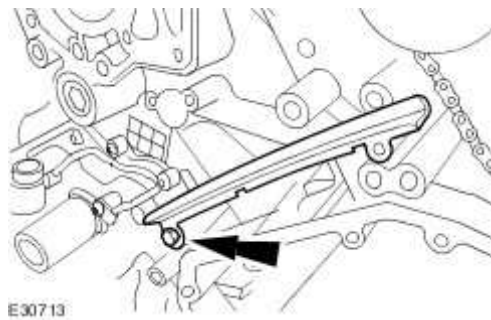
49 . Install the timing chain tensioning tool 303-532 to the exhaust camshaft sprocket.

- Reposition the camshaft sprockets for the most advantageous position for use of the tool.

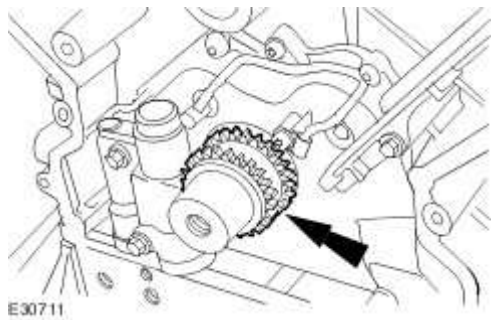


50 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.



51 . Install the crankshaft sprocket.



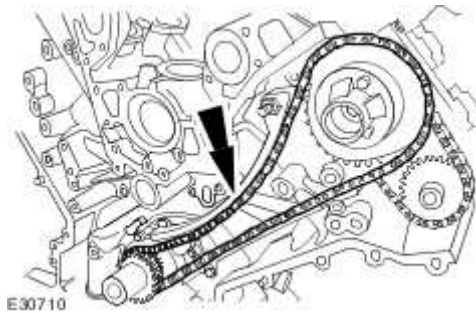
52



CAUTION: Make sure the timing chain slack is on the tensioned side of the timing chain.

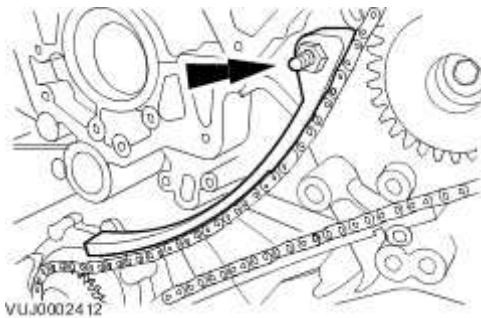
Install the primary timing chain.

- Install the primary chain over the crankshaft sprocket and the intake sprocket.



53 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.

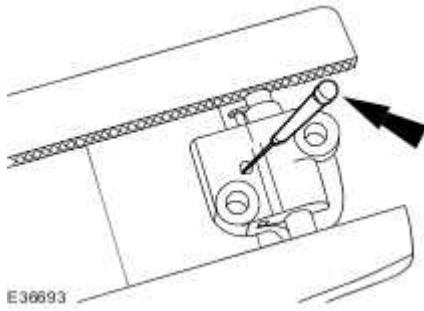


54



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Using a suitable tool, hold the left-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.



55 NOTE:

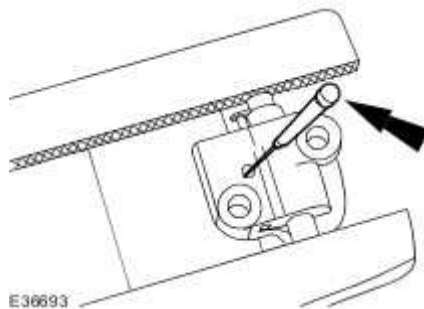
The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the left-hand timing chain tensioner.

56 NOTE:

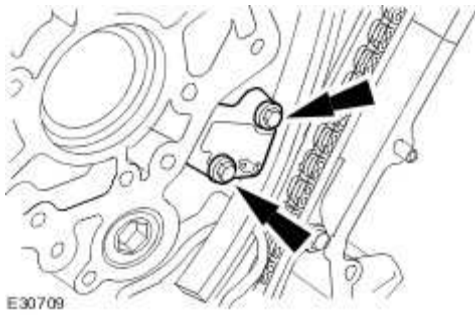
The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the left-hand timing chain tensioner piston.



57 . Install the primary timing chain tensioner assembly.

- Tighten to 12 Nm.



58 . Release the tension in the left-hand timing chain tensioner.

- Remove the retaining tool.

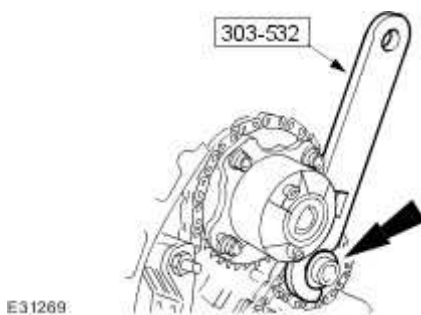
59



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.

- Tighten to 20 Nm + 90 deg.



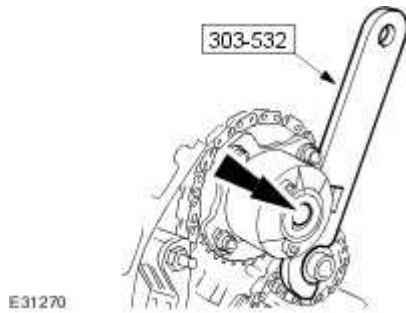
60



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction.

- Tighten to 20 Nm + 90 deg.



61



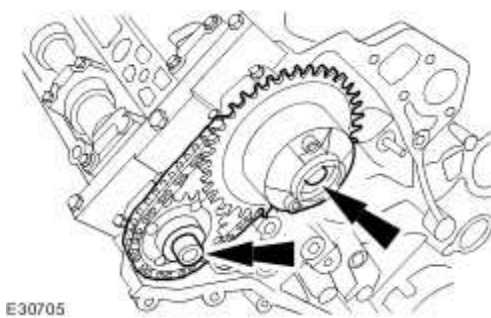
CAUTION: Do not tighten the camshaft sprocket retaining bolts.



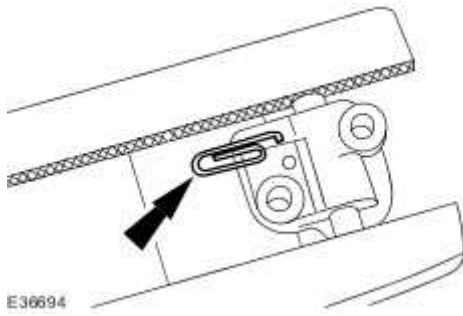
CAUTION: Make sure the secondary timing chain and camshaft sprockets are free to rotate.

Install the camshaft sprockets.

- Install the secondary timing chain tensioner and secondary timing chain to the camshaft sprockets.

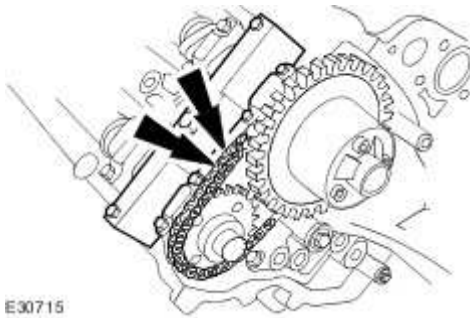


62 . Using a suitable tool, retain the right-hand timing chain tensioner piston.



63 . Install the secondary timing chain tensioner retaining bolts.

- Tighten to 12 Nm.

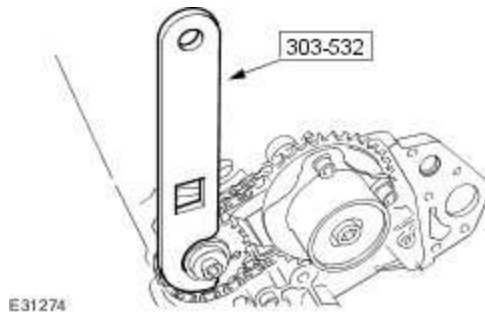


64 . Release the tension in the right-hand timing chain tensioner.

- Remove the retaining tool.

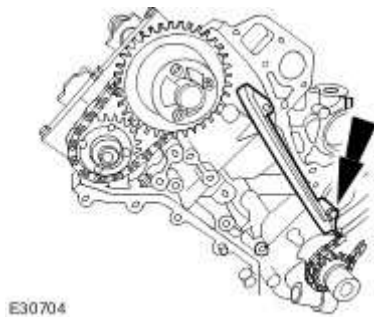
65 Install the timing chain tensioning tool 303-532 to the exhaust camshaft sprocket.

- Reposition the camshaft sprockets for the most advantageous position for use of the tool.



66 . Install the primary timing chain guide.

- Tighten to 12 Nm.



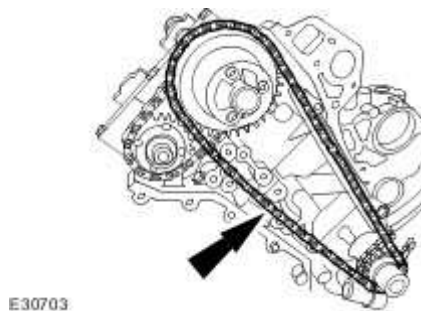
67



CAUTION: Make sure the timing chain slack is on the tensioned side of the timing chain.

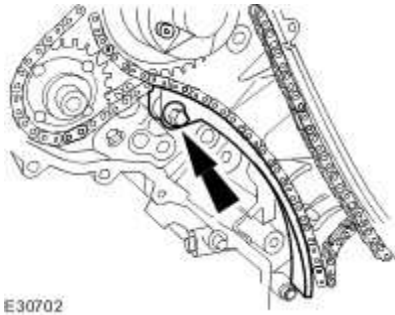
Install the primary timing chain.

- Install the primary chain over the crankshaft sprocket and the intake sprocket.



68 . Install the primary timing chain tensioner guide.

- Tighten to 12 Nm.

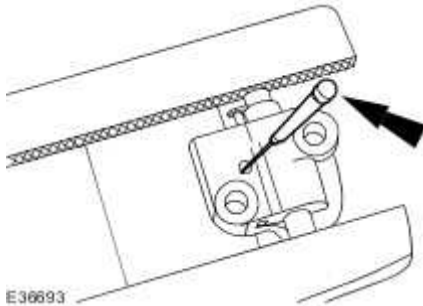


69



CAUTION: During timing chain tensioner compression, do not release the ratchet stem until the timing chain tensioner piston is fully bottomed in its bore or damage to the ratchet stem will result.

Using a suitable tool, hold the right-hand timing chain tensioner ratchet lock mechanism away from the ratchet stem.



70 **NOTE:**

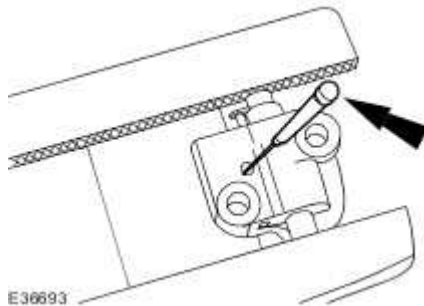
The timing chain tensioner piston should retract with minimal force. If binding occurs, reposition the timing chain tensioner to eliminate side loading.

Slowly compress the right-hand timing chain tensioner.

71 **NOTE:**

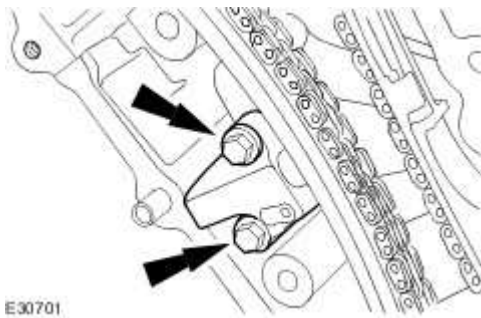
The retaining tool must remain in the timing chain tensioner until the timing chain tensioner is installed to the engine with the piston bottomed in the bore.

Using a suitable tool, retain the right-hand timing chain tensioner piston.



72 . Install the primary timing chain tensioner assembly.

- Tighten to 12 Nm.



73 . Release the tension in the right-hand timing chain tensioner.

- Remove the retaining tool.

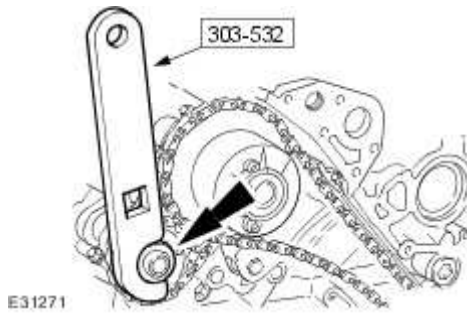
74



CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction to tension the primary timing chain on its drive side.

- Tighten to 20 Nm + 90 deg.



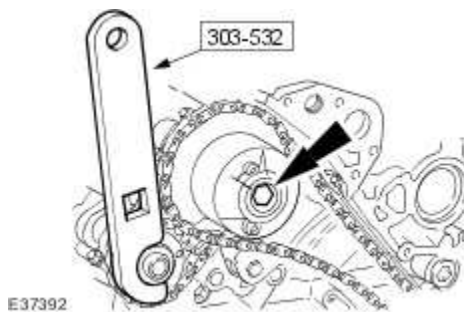
75



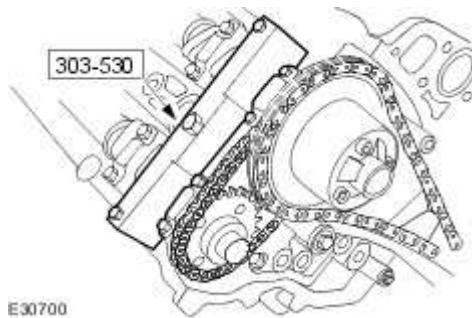
CAUTION: While applying the opposing force to sprocket and chain, tighten the sprocket bolt.

Using the special tool apply force to the tool in an anti-clockwise direction.

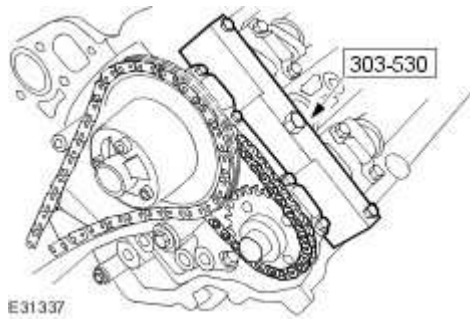
- Tighten to 20 Nm + 90 deg.



76 . Remove the special tool from the right-hand cylinder head.

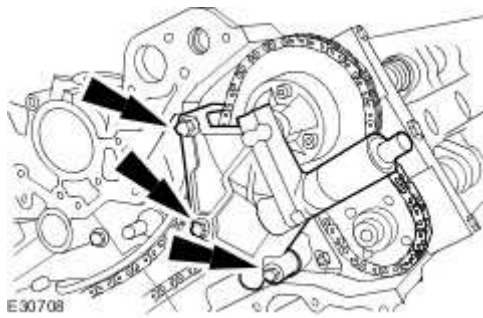


77 . Remove the special tool from the left-hand cylinder head.



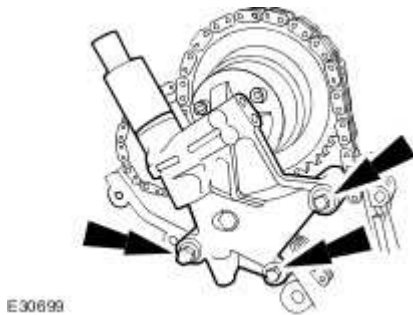
78 . Install the left-hand variable camshaft timing oil control unit housing.

- Install new O-ring seals.
- Tighten to 22 Nm.

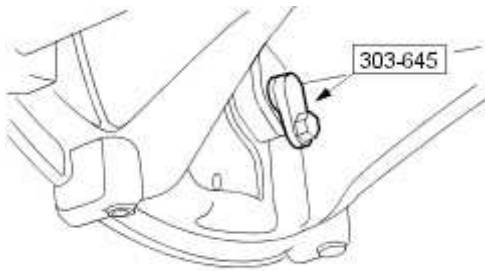


79 . Install the right-hand variable camshaft timing oil control unit housing.

- Install new O-ring seals.
- Tighten to 22 Nm.



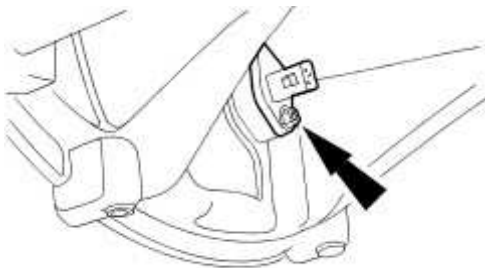
80 . Remove the special tool.



VUJ0002400

81 . Install the crankshaft position sensor.

- Tighten to 10 Nm.

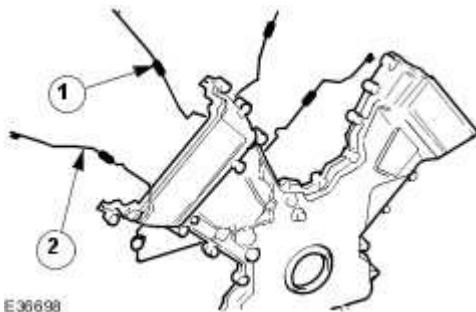


E30694

82 . Install new seals to the timing cover.

26. Install the new seal to the inner groove on the face of the timing cover.

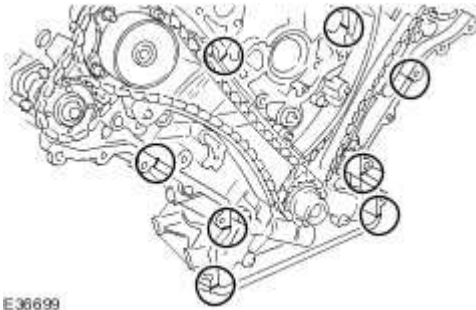
27. Install the new seal to the outer groove on the face of the timing cover.



E36698

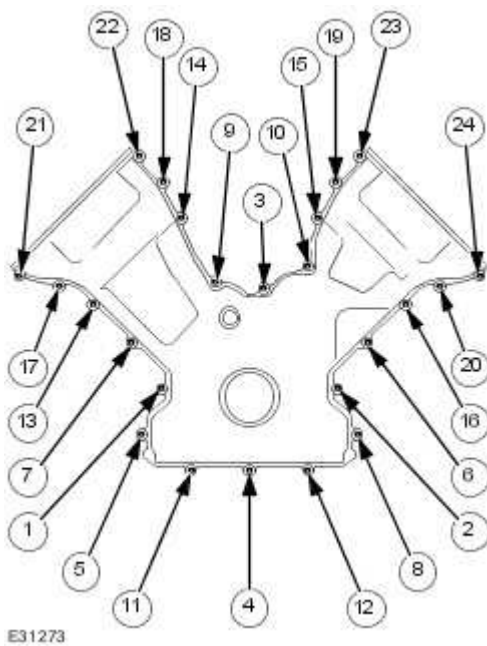
83 Apply sealant to the eight joints on the engine face.

- Sealant beads to be 3mm diameter and 12mm long. Cut the nozzle of the sealant tube to produce a 3 mm bead. (Install and tighten the securing bolts within twenty minutes of sealant application).



84 . Install the timing cover.

- Tighten in the sequence shown.
- Tighten to 13 Nm.



85 .

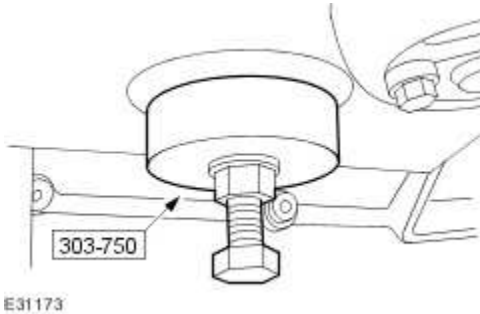


CAUTION: Make sure the crankshaft front seal mating faces are clean and dry.

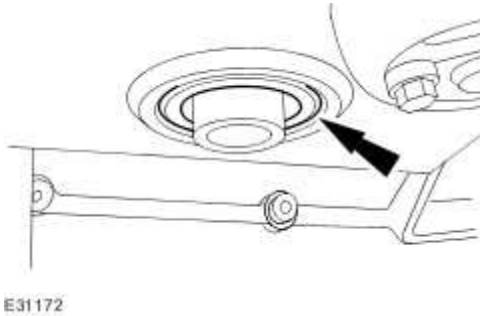


CAUTION: Do not remove the crankshaft front seal protector.

Using the special tool, install a new crankshaft front seal.



86 . Remove the crankshaft seal protector.



87 . Install a new O-ring seal to the crankshaft pulley.

- Lubricate the new O-ring.

88



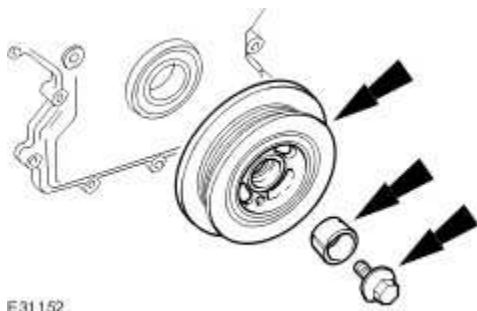
CAUTION: The screw thread in the crankshaft must be cleaned out before a new crankshaft pulley bolt is installed.



CAUTION: A new crankshaft pulley bolt must be used.

Install, but do not tighten, a new crankshaft pulley retaining bolt.

- Install the crankshaft pulley and locking ring to the crankshaft.



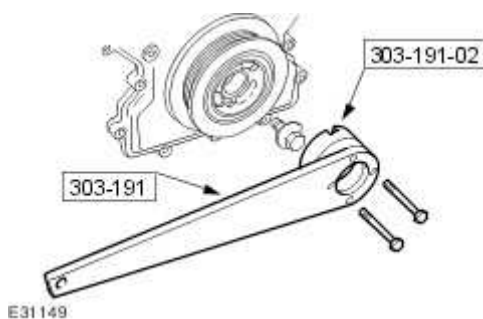
89



CAUTION: Under no circumstances should the crankshaft setting peg 303-645 be used in the following operations to lock the crankshaft.

Using special tools, retain the crankshaft pulley.

- Tighten the crankshaft pulley retaining bolt to 375 Nm.



90 . Remove the special tools.

91 . Carry out a valve clearance check.

For additional information, refer to Valve Clearance Check (12.29.47)

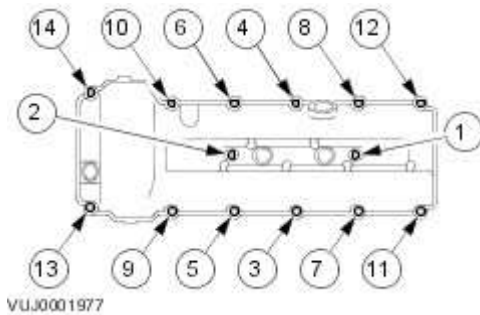
92 **NOTE:**

Apply an 8mm diameter bead of silicone gasket sealant on the two places where the

cylinder head and front cover join.

Install the left-hand valve cover.

- Install new valve cover gaskets.
- Tighten in the sequence shown.
- Tighten to 10 Nm.

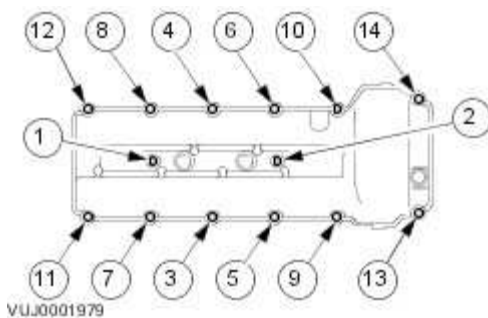


93 **NOTE:**

Apply an 8mm diameter bead of silicone gasket sealant on the two places where the cylinder head and front cover join.

Install the right-hand valve cover.

- Install new valve cover gaskets.
- Tighten in the sequence shown.
- Tighten to 10 Nm.

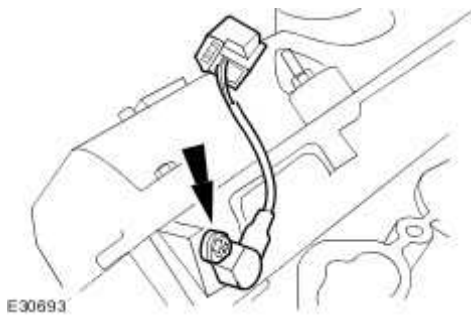


94 . Install the spark plugs.

- Tighten to 27 Nm.

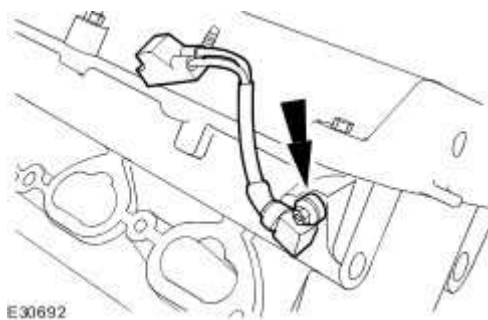
95 . Install the left-hand camshaft position (CMP) sensor.

- Install a new O-ring seal.
- Tighten to 7 Nm.



96 . Install the right-hand camshaft position (CMP) sensor.

- Install a new O-ring seal.
- Tighten to 7 Nm.

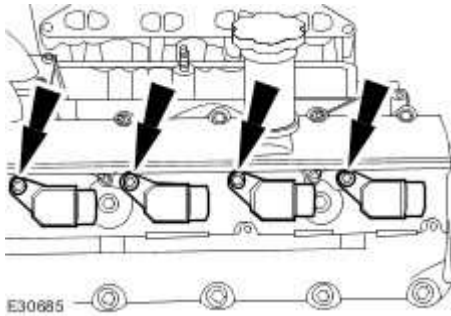


97 . **NOTE:**

Left-hand shown, right-hand similar

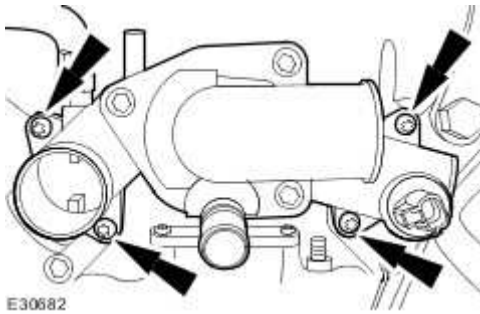
Install the ignition coils.

- Tighten to 5 Nm.



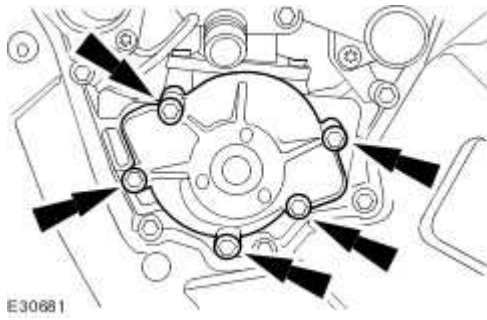
98 . Install the thermostat housing.

- Install new O-ring seals.
- Tighten to 10 Nm.



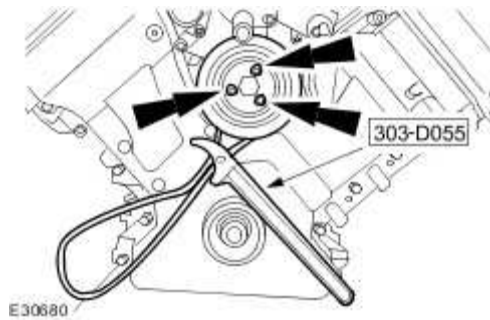
99 . Install the water pump.

- Install new O-ring seals and gaskets.
- Tighten to 12 Nm.

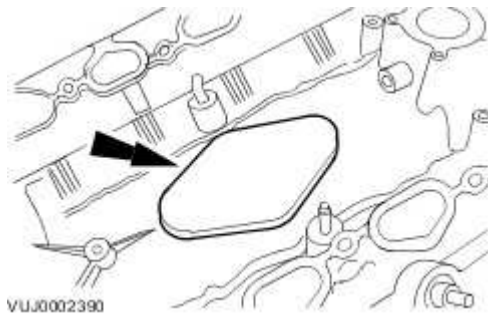


100 . Install the water pump pulley.

- Using special tool, retain the water pump pulley.
- Tighten to 10 Nm + 45°.



101 . Install the engine block insulation grommet.

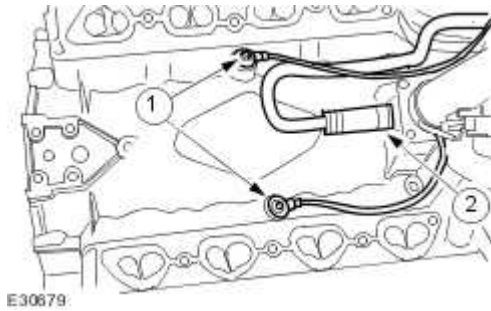


102 . Install the intake manifold heater coolant hose.

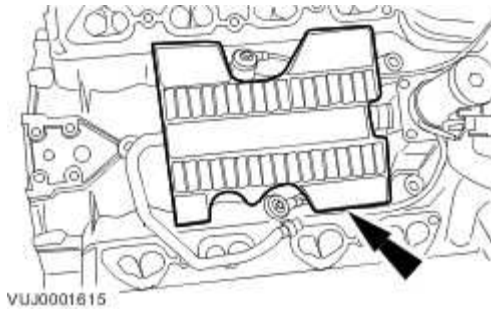
28. Install the knock sensors.

- Tighten to 20 Nm.

29. Install the intake manifold heater coolant hose.

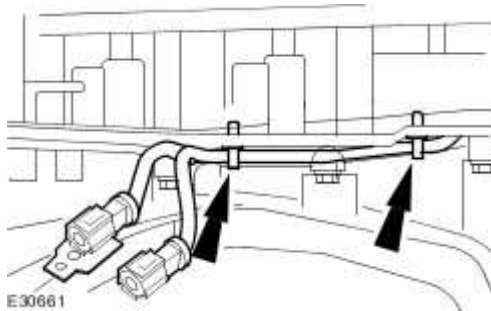


103 . Install the noise and vibration insulating pad.



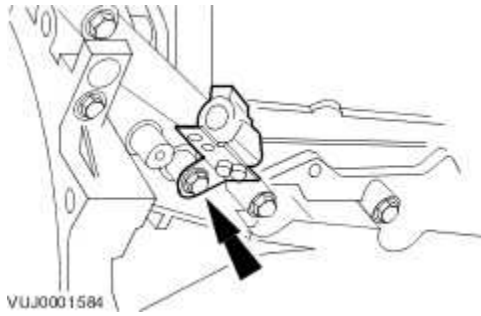
104 . Install the engine wiring harness.

105 . Attach the engine wiring harness retaining clips.



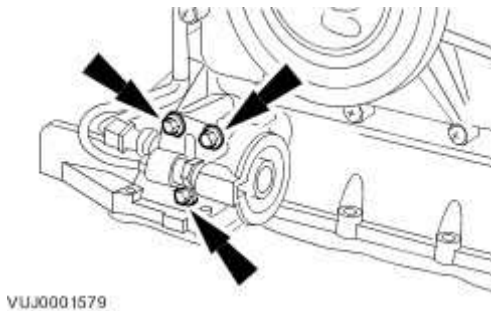
106 . Attach the right-hand oxygen sensor.

- Tighten to 10 Nm.

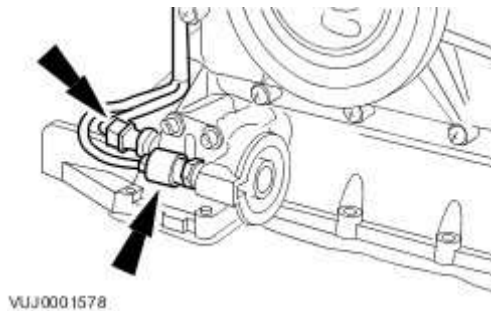


107 . Install the oil filter housing.

- Install a new O-ring seal.
- Tighten to 21 Nm.

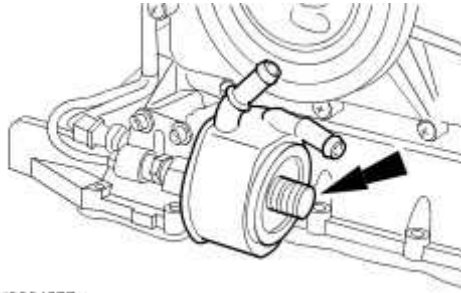


108 . Connect the oil pressure switch and oil temperature sensor electrical connectors.



109 . Install the oil cooler.

- Install a new O-ring seal.
- Tighten to 55 Nm.



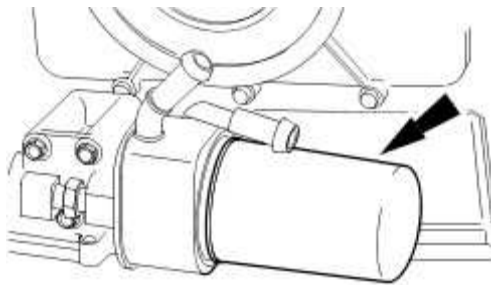
VUJ0001577

110 . NOTE:

Apply a suitable amount of clean engine oil to lubricate the oil filter O-ring seal.

Install a new oil filter.

- Tighten to 18 Nm.

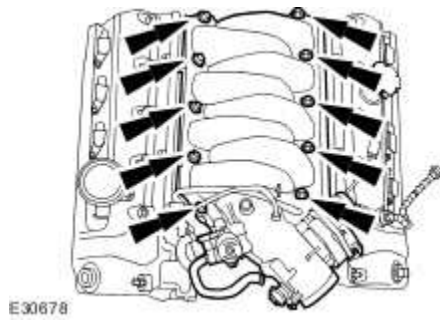


VUJ0001578

111 .

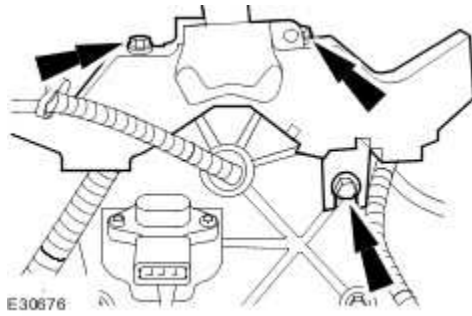
112 . Install the intake manifold.

- Tighten to 22 Nm.



113 . Attach the engine wiring harness.

- Tighten to 10 Nm.

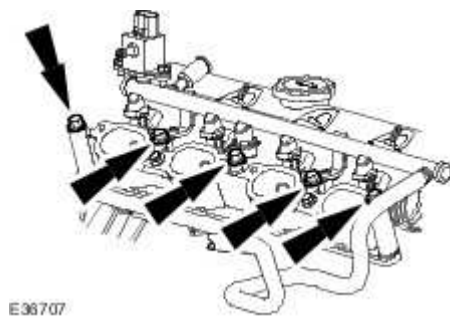


114 . **NOTE:**

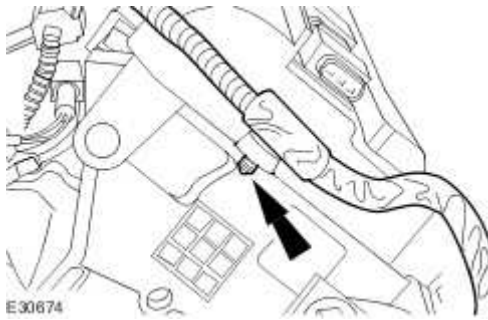
Left-hand shown, right-hand similar.

Install the lower intake manifold.

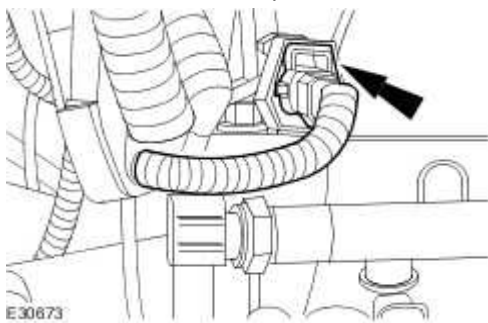
- Tighten to 22 Nm.



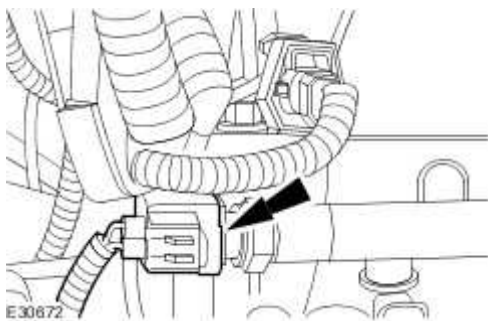
115 . Attach the engine wiring harness.



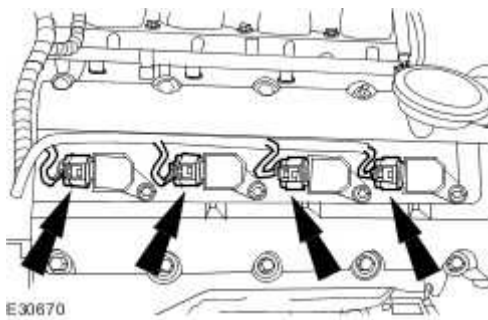
116 . Connect the camshaft position sensor electrical connector.



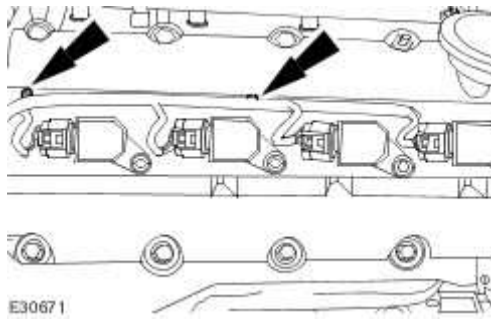
117 . Connect the fuel temperature sensor electrical connector.



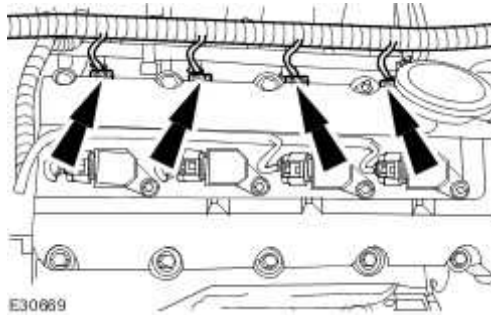
118 . Connect the ignition on-plug coil electrical connectors.



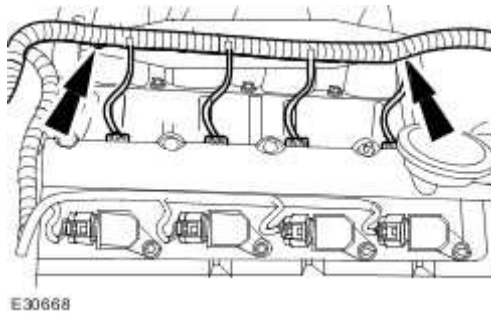
119 . Attach the engine wiring harness.



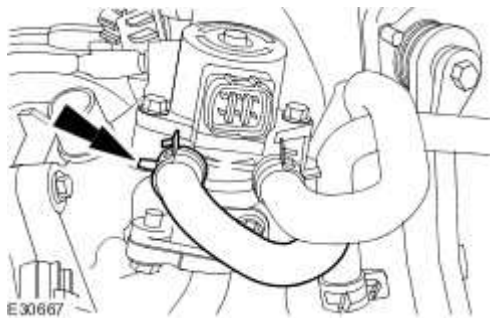
120 . Connect the fuel injector electrical connectors.



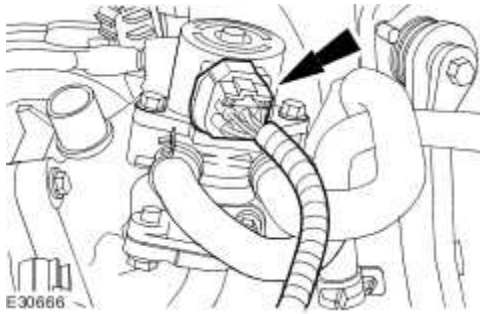
121 . Attach the engine wiring harness.



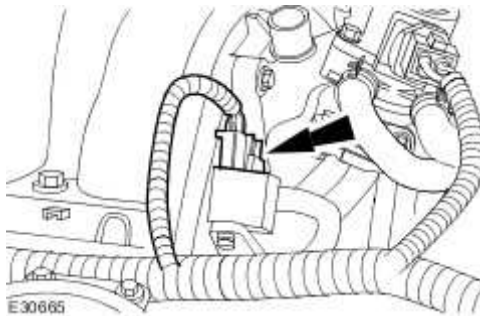
122 . Connect the exhaust gas recirculation valve coolant hose.



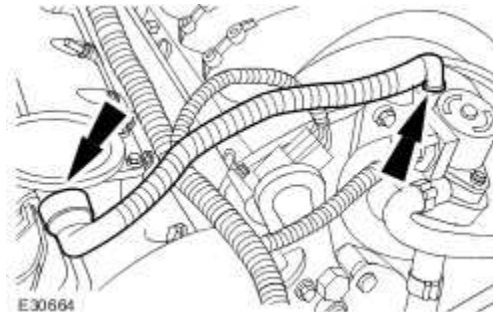
123 . Connect the exhaust gas recirculation valve electrical connector.



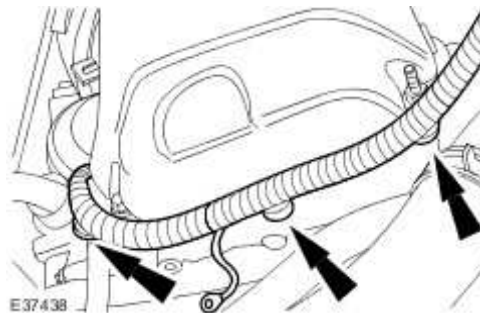
124 . Connect the fuel pressure regulator electrical connector.



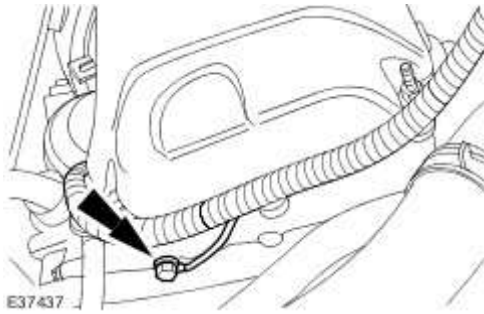
125 . Connect the positive crankcase ventilation pipe.



126 . Attach the engine wiring harness.



127 . Attach the engine wiring harness.

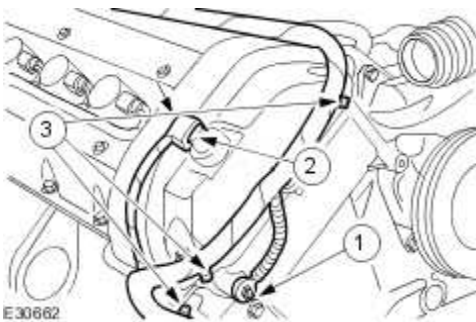


128 . Attach the engine harness.

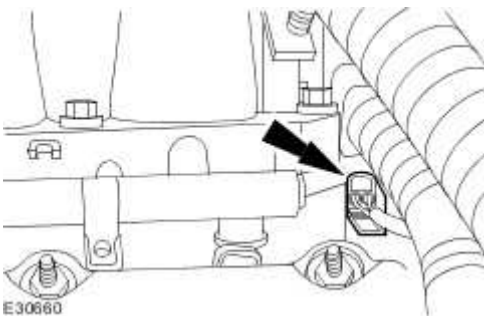
30. Connect the earth wire.

31. Connect the variable valve timing (VVT) solenoid electrical connector.

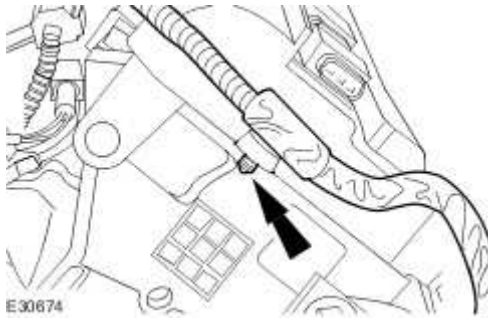
• Attach the engine harness.



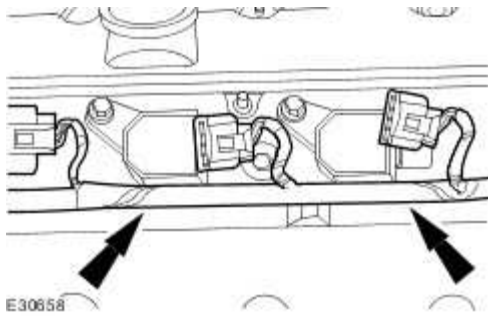
129 . Connect the camshaft position sensor electrical connector.



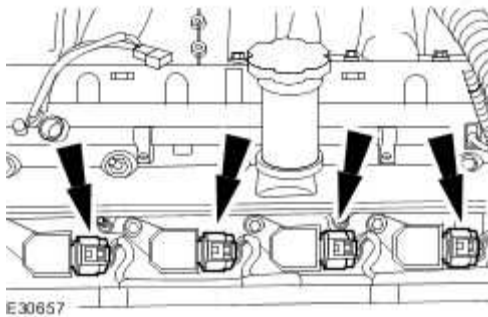
130 . Attach the engine wiring harness.



131 . Attach the engine wiring harness.



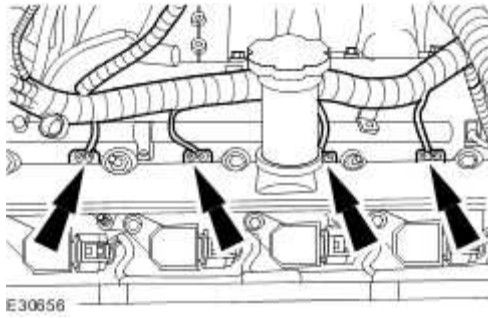
132 . Connect the ignition on-plug coil electrical connectors.



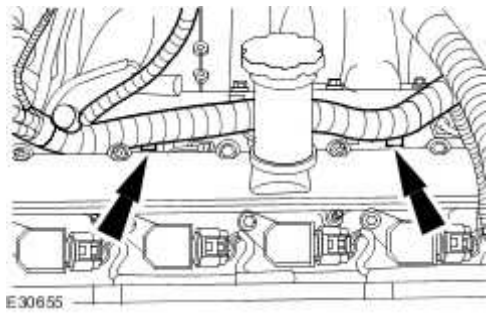
133 . **NOTE:**

Left-hand shown, right hand similar.

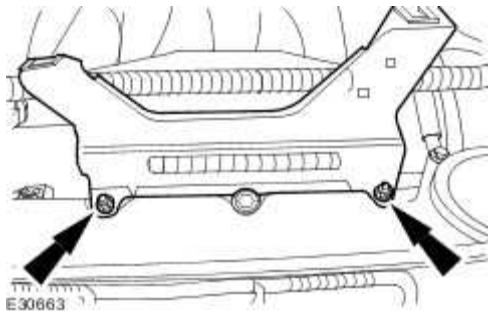
Connect the fuel injector electrical connectors.



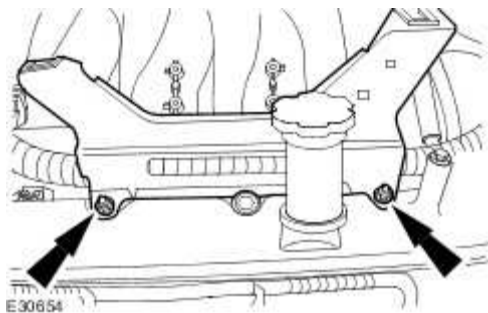
134 . Attach the engine wiring harness.



135 . Install the engine cover retaining bracket.



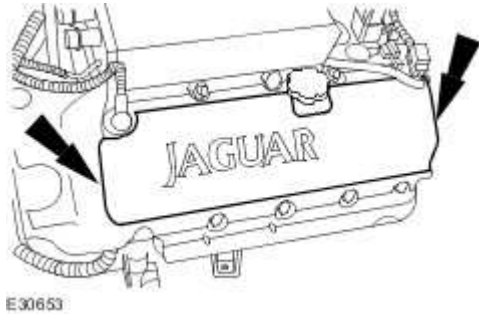
136 . Install the engine cover retaining bracket.



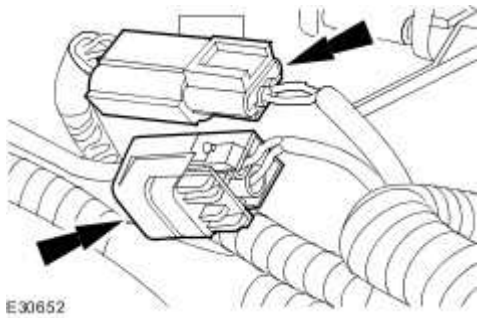
137 . **NOTE:**

Left-hand shown, right-hand similar.

Install the ignition coil cover.



138 . Connect the knock sensor electrical connectors.

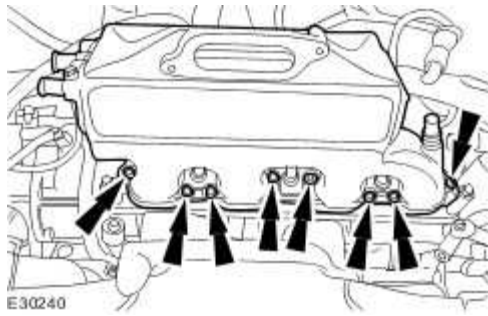


139 . **NOTE:**

Right-hand shown, left-hand similar.

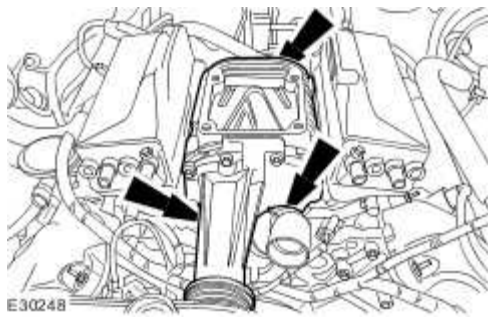
Install the charge air coolers.

- Install a new charge air cooler gasket.
- Tighten to 13 Nm.

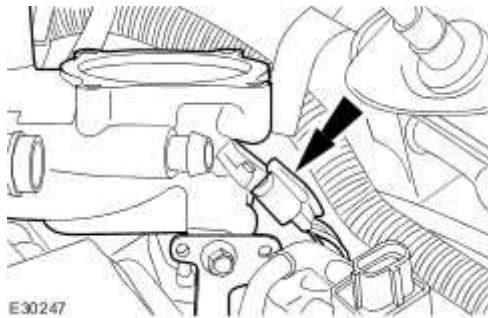


140 . Install the supercharger.

- Tighten to 24 Nm.

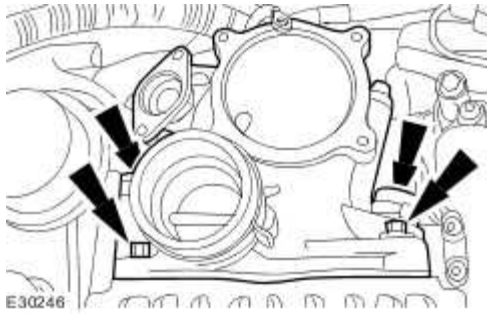


141 . Connect the manifold absolute pressure (MAP) sensor.



142 . Install the air intake elbow.

- Install a new gasket.
- Install new retaining bolt seals.
- Tighten to 24 Nm.

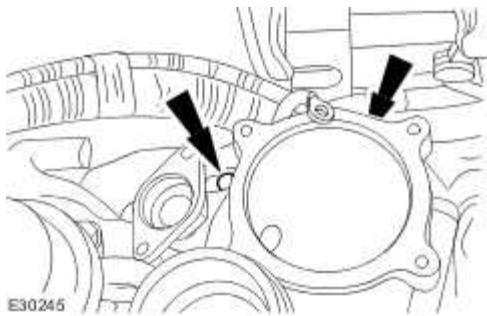


143 . **NOTE:**

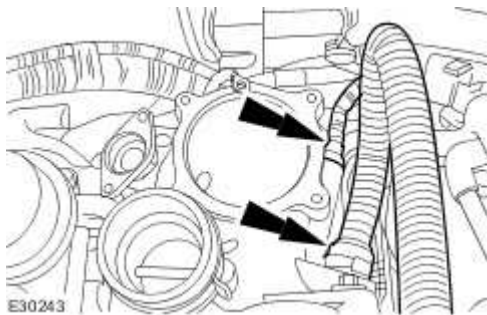
Make sure ground strap is correctly installed to the location noted.

Install the air intake elbow retaining bracket lower retaining bolts.

- Tighten to 20 Nm.



144 . Connect the air intake elbow pipes.



145

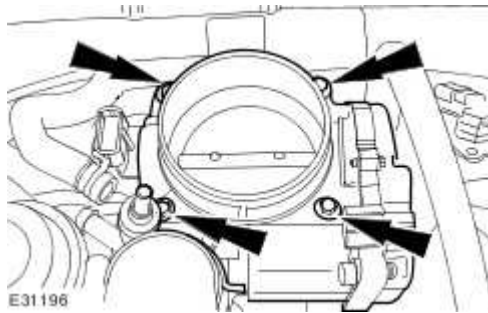


CAUTION: Do not attempt to clean the throttle body. The bore and the throttle

plate has a special coating applied during manufacture which should not be removed.

Install the throttle body.

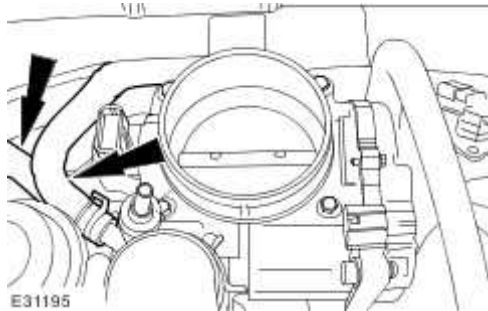
- Install a new throttle body gasket.
- Tighten to 10 Nm.



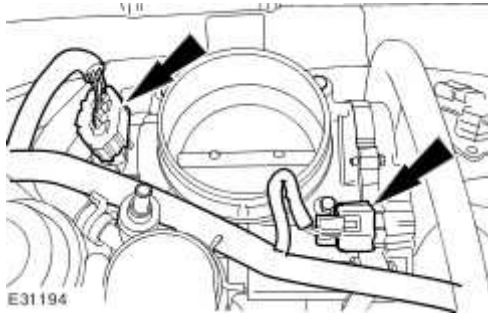
146 . **NOTE:**

Un-cap the coolant hose.

Attach the coolant hose to the throttle body.

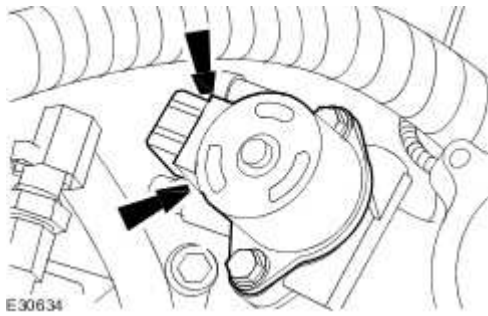


147 . Connect the electrical connectors.

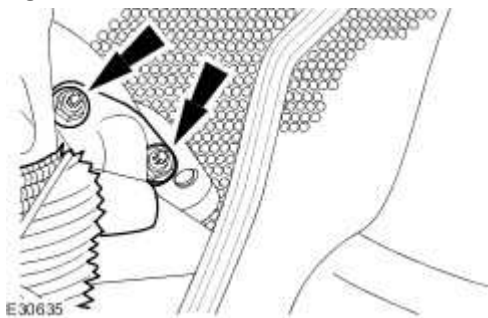


148 . Install the EGR valve and the exhaust manifold to EGR valve tube.

- Install a new exhaust manifold to EGR valve tube gasket.
- Install a new EGR valve to air intake elbow gasket.
- Tighten to 10 Nm.



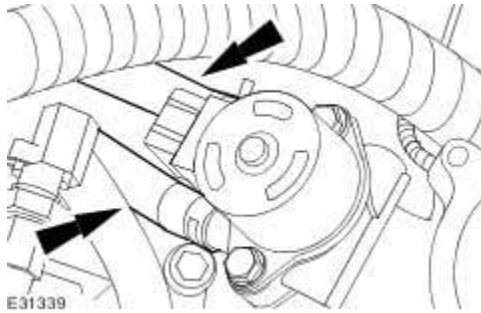
149 . Tighten to 21 Nm.



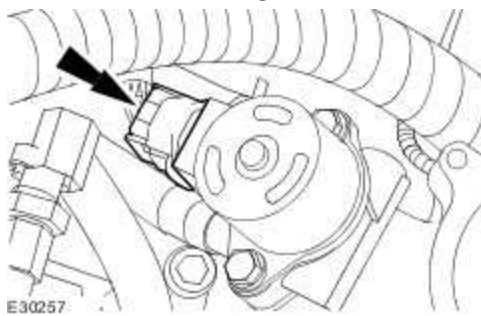
150 . **NOTE:**

Un-cap the exposed ports.

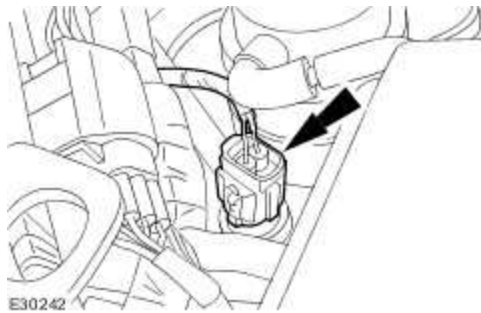
Connect the coolant hoses.



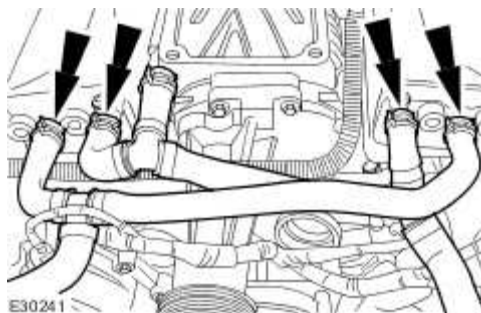
151 . Connect the exhaust gas recirculation (EGR) valve electrical connector.



152 . Connect the IAT sensor electrical connector.



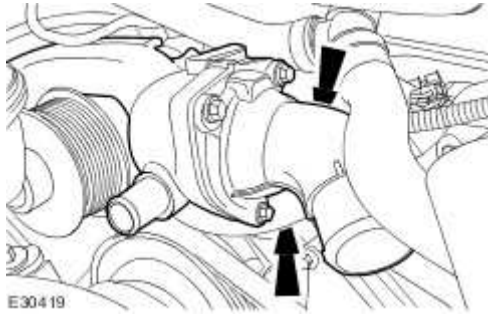
153 . Connect the charge air cooler coolant pipes.



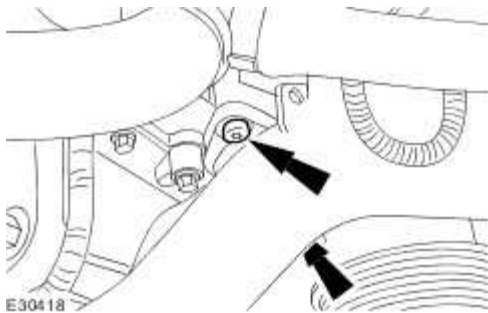
154 . Install new O-ring seals to the thermostat housing.

155 . Install thermostat housing.

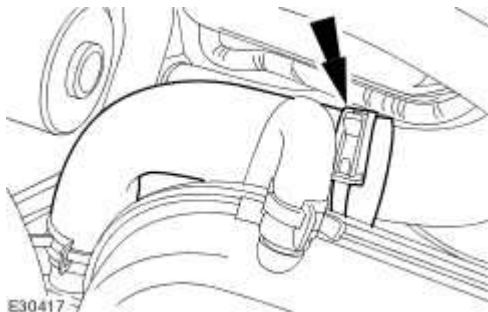
156 . Tighten to 10 Nm.



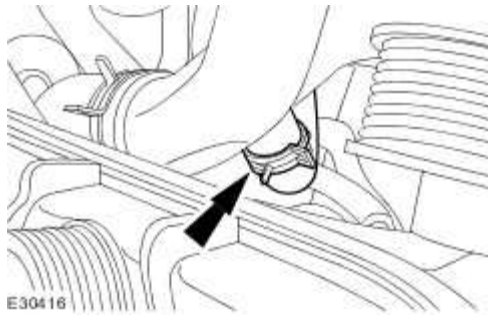
157 . Tighten to 10 Nm.



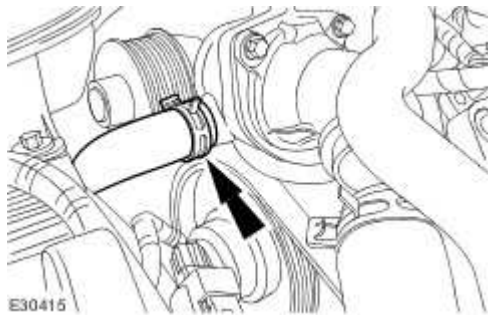
158 . Connect the hose.



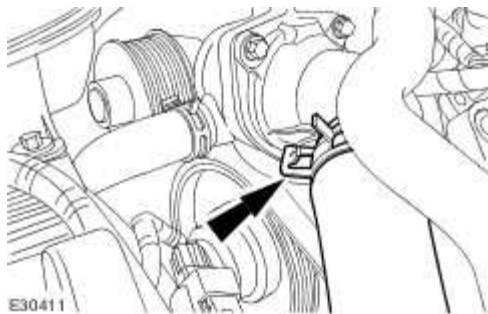
159 . Connect the hose.



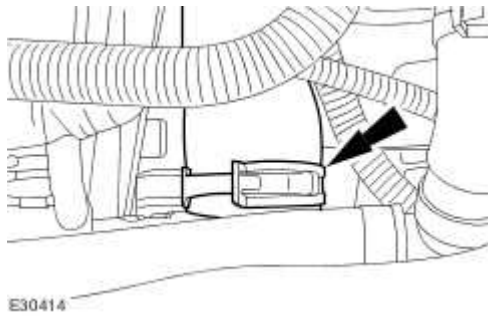
160 . Connect the hose.



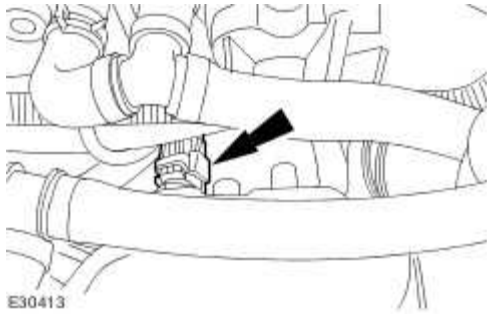
161 . Connect the hose.



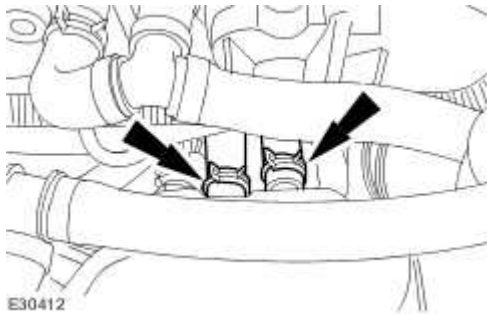
162 . Reposition the thermostat housing hose retaining clip.



163 . Connect the coolant temperature sensor electrical connector.

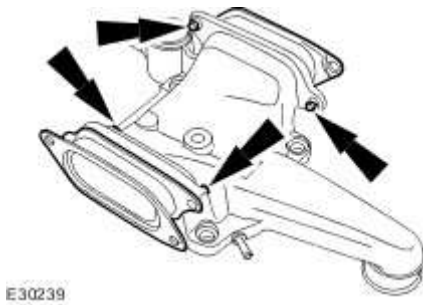


164 . Connect the thermostat housing hoses




165 . Install new supercharger outlet pipe to charge air coolers ducts.

- Tighten to 8 Nm.

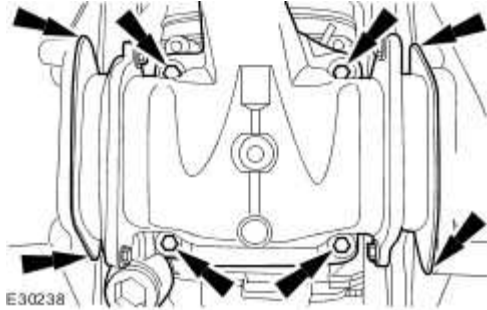


166 . Install a new supercharger outlet pipe gasket.

167 . Install new seals to the supercharger outlet pipe retaining bolts

- 168 .  **CAUTION:** Make sure no foreign matter enters the supercharger.

Install the supercharger outlet pipe



- 169 . **NOTE:**

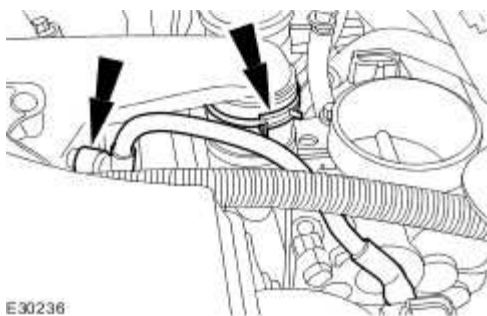
Un-cap the coolant ports.

Attach the supercharger outlet pipe coolant hose.

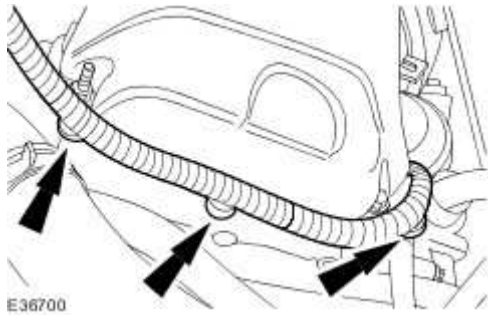


- 170 . Attach the hoses.

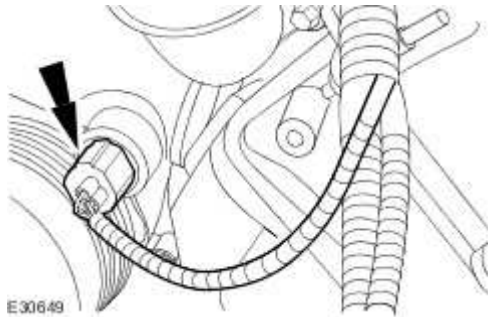
- Reposition the hose retaining clip.



171 . Attach the engine wiring harness.



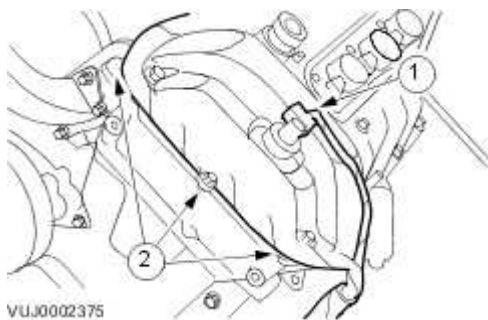
172 . Connect the coolant temperature sensor electrical connector.



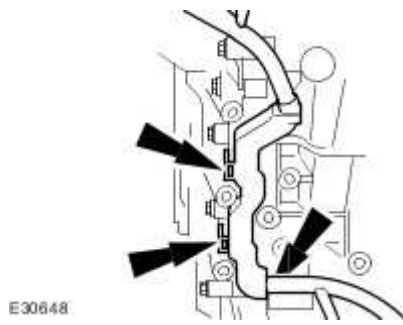
173 . Attach the engine wiring harness.

32. Connect the variable valve timing (VVT) solenoid electrical connector.

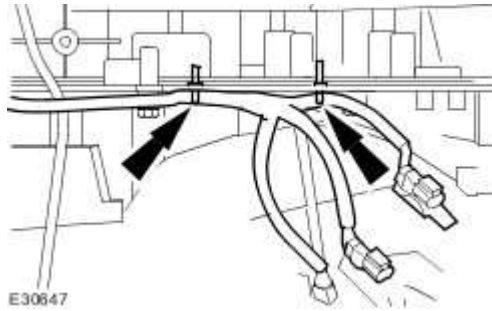
33. Attach the engine wiring harness.



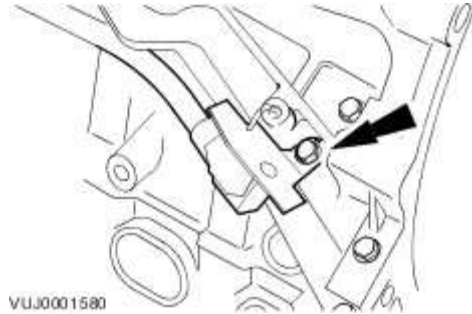
174 . Attach the engine wiring harness.



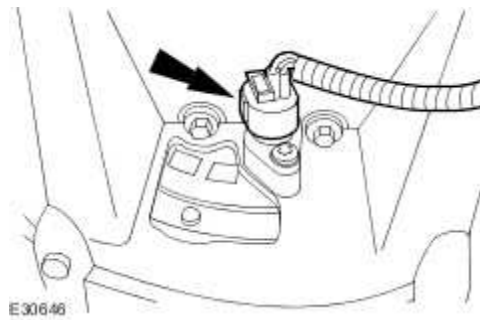
175 . Attach the engine wiring harness.



176 . Attach the engine wiring harness.

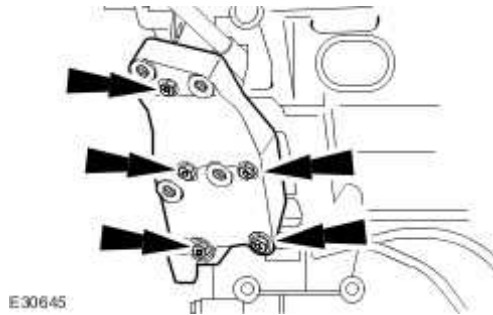


177 . Connect the crankshaft position sensor electrical connector.



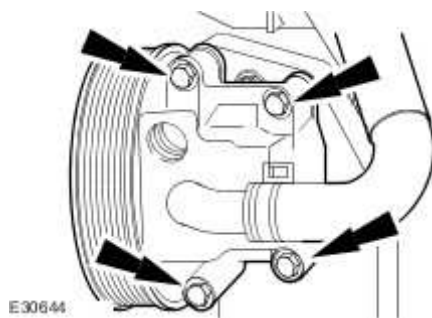
178 . Install the power steering pump mounting bracket.

- Tighten to 25 Nm.



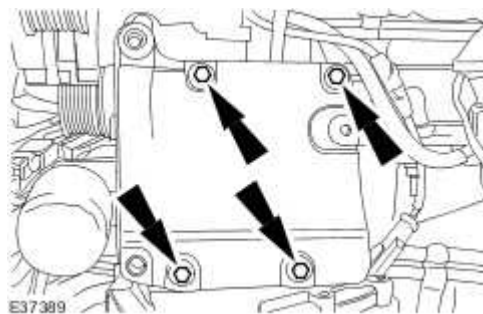
179 . Install the power steering pump.

- Tighten to 25 Nm.



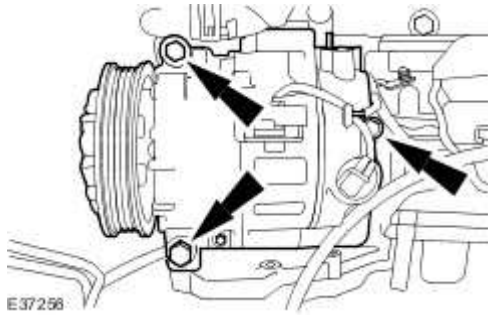
180 . Install the air conditioning compressor mounting bracket.

- Tighten to 25 Nm.

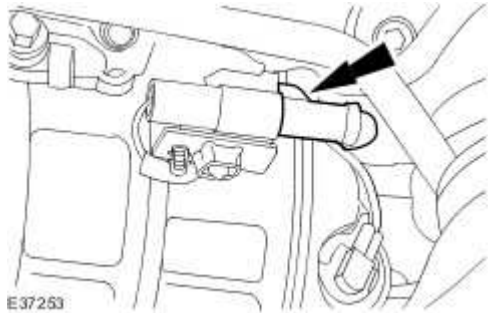


181 . Install the A/C compressor.

- Tighten to 25 Nm.

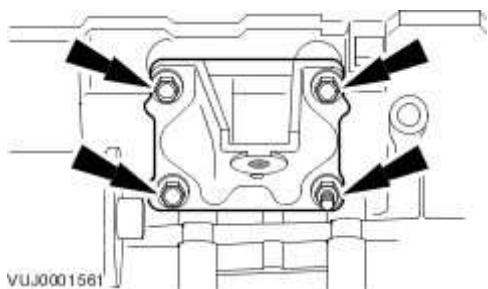


182 . Connect the air conditioning compressor electrical connector.



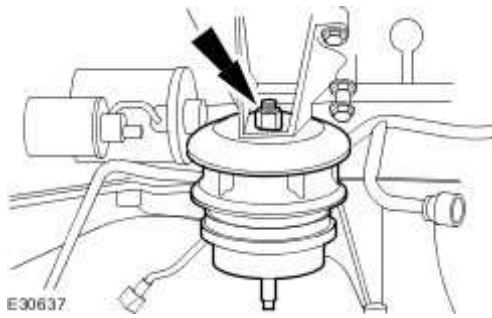
183 . Install the left-hand engine mounting bracket.

- Tighten to 25 Nm.



184 . Install the left-hand engine mount.

- Tighten to 43 Nm.



185



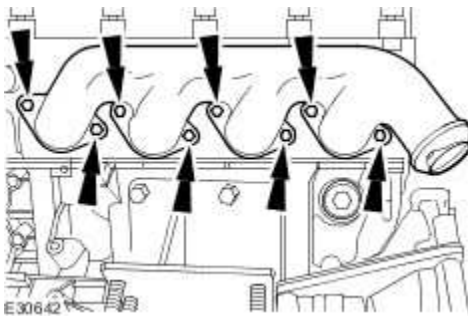
CAUTION: Make sure the exhaust manifold and gasket are correctly aligned to the cylinder head.



CAUTION: Make sure the exhaust manifold torque is checked after initial tighten.

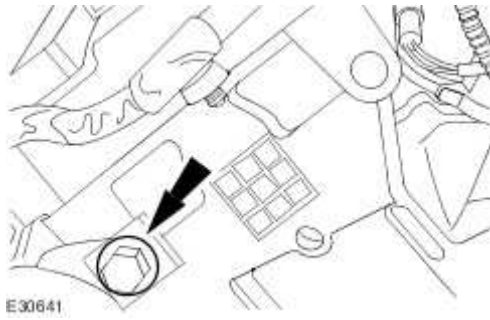
Install the left-hand exhaust manifold.

- Install a new gasket.
- Tighten to 20 Nm.



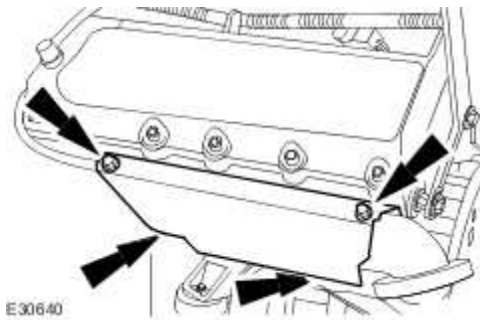
186 . Install the heat shield retaining bolt.

- Tighten to 50 Nm.



187 . Install the heat shield.

- Tighten to 3 Nm.



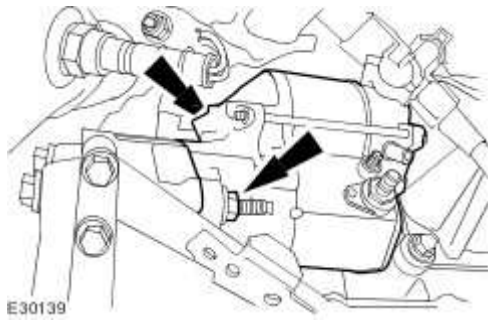
188 . Install the oil level indicator and tube.

- Install a new O-ring seal.
- Tighten to 6 Nm.

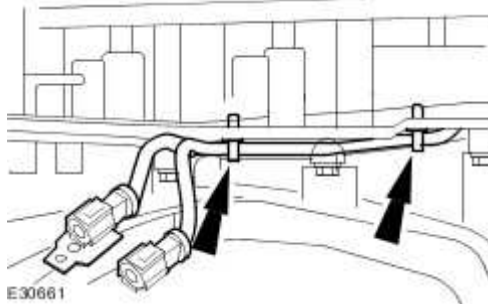


189 . Install the starter motor.

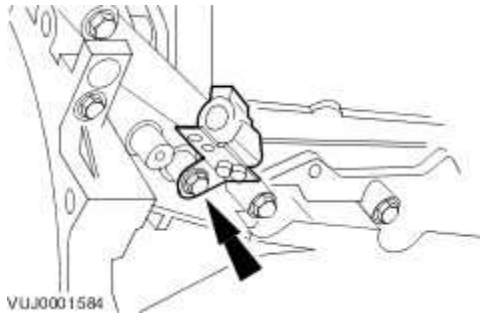
- Tighten to 45 Nm.



- 190 . Attach the engine wiring harness.

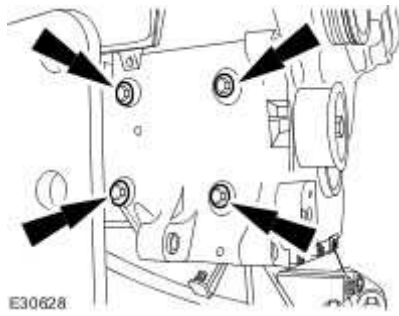


- 191 . Attach the right hand oxygen sensor retaining bracket.

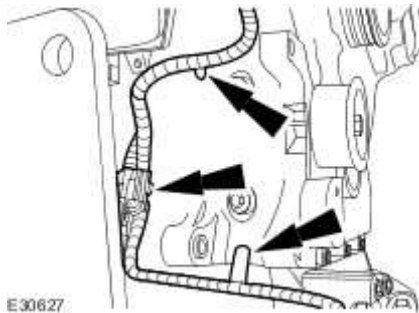


- 192 . Install the generator mounting bracket.

- Tighten to 45 Nm.

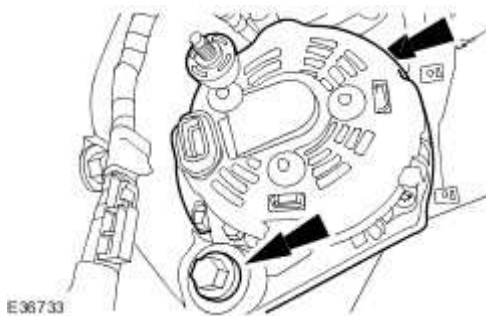


193 . Attach the engine wiring harness.

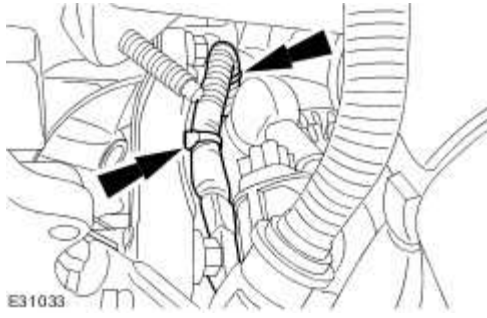


194 . Install the generator.

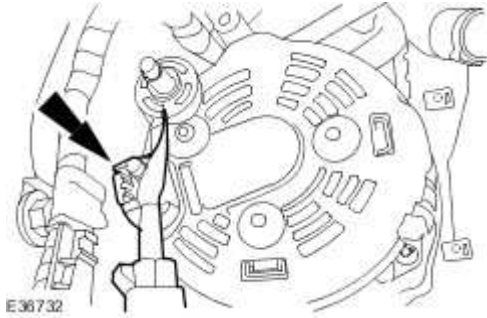
- Tighten the generator upper retaining bolt to 21 Nm.
- Tighten the generator lower retaining bolt to 40 Nm.



195 . Attach the wiring harness.

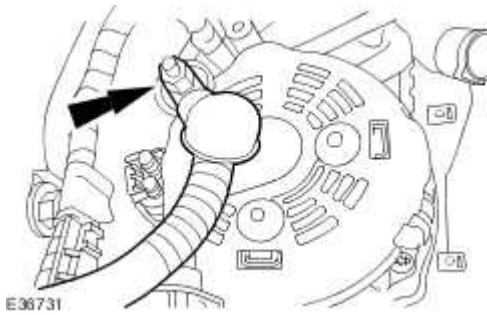


196 . Connect the generator electrical connector.

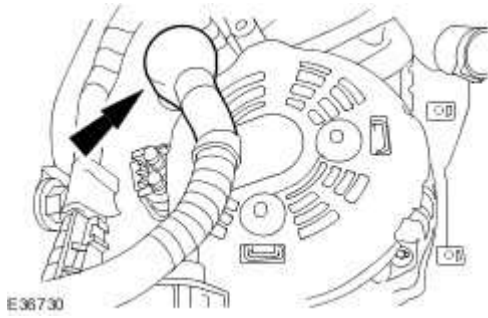


197 . Attach the generator battery positive cable.

- Tighten to 12 Nm

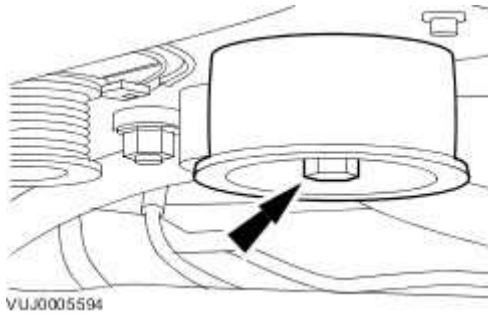


198 . Attach the generator battery positive cable protective cover.



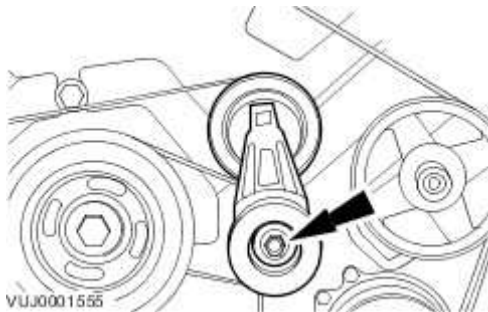
199 . Install the accessory drive belt idler pulley.

- Tighten to 25 Nm.



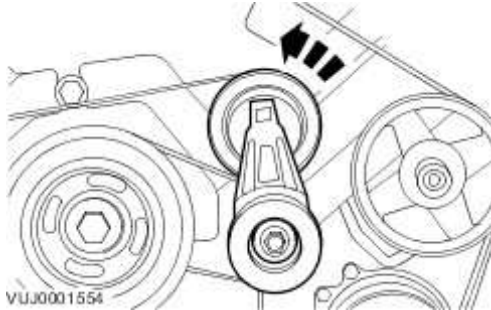
200 . Install the accessory drive belt tensioner.

- Install the accessory drive belt.
- Tighten to 45 Nm.



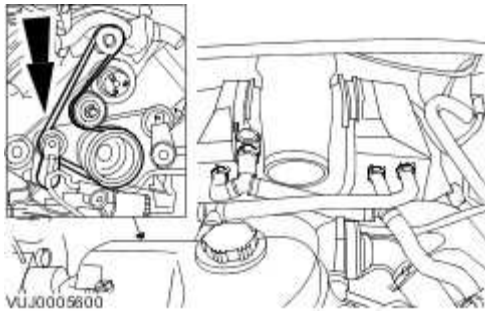
201 . Attach the accessory drive belt.

- Use a 3/8 inch square drive bar to rotate the drive belt tensioner.
- Attach the accessory drive belt.

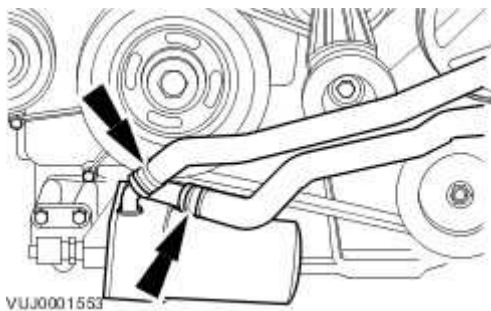


202 . Install the supercharger belt.

- Use a 1/2 inch square drive bar to rotate the supercharger belt tensioner.



203 . Connect the oil cooler hoses.



303-03A : Engine Cooling – 4.2L NA V8 – AJV8/4.2L SC V8 – AJV8

Specifications

Specifications

Capacities

	Liters
Naturally aspirated models	9.5
Supercharged models	11.5

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Coolant fluid	WSS M97B44-D
Coolant concentration - will provide frost protection to -40°C (-40°F)	50%
Specific gravity of coolant at 20°C (68°F), to protect against frost down to -40°C (-40°F)	1.068

NOTE:

The coolant is of the Organic Acid Technology (OAT) type and must not be mixed with other types of coolant.

General Specifications

Item	Specification
Cooling system type	Pressurised, thermostatically controlled with remote header tank
Radiator	Cross flow with integral transmission fluid cooler
Expansion tank	Remote - fitted with a bleed screw and low coolant level sensor
Pressure cap rating	1.2 bar (120 kPa) (17 lbf/in ²)
Thermostat:	
Starts to open	88° C (190° F)
Fully open	95° C (203° F)

Cooling fan	Electronically controlled
Coolant pump	Centrifugal flow impellor, belt driven from crankshaft
Low temperature radiator (Intercooler circuit)	Cross flow, single pass, located in front of A/C condenser
Auxiliary water pump (Intercooler circuit)	Centrifugal type, 35w 12V DC electric motor
Engine oil cooler (Supercharged models)	Twin oil-air coolers, connected in series

Torque Specifications

Item	Nm	lb-ft	lb-in
Block heater	56	41	-
Coolant drain in engine block - plug M10 x 16	25	18	-
Coolant expansion tank - bolt	7	5	62
Coolant inlet housing to engine - bolt	9	7	80
Coolant pump - bolt	8 + 90°	6 + 90°	71 + 90°
Coolant pump pulley - bolt	10 + 45°	7 + 45°	88 + 45°
Radiator upper mounting bracket - bolt - Naturally aspirated models	27	20	-
Radiator upper mounting bracket - bolt - Supercharged models	30	22	-
Thermostat to coolant outlet pipe assembly - bolt	4	3	35
Thermostat and coolant outlet pipe assembly to engine - bolt	9	7	80
Engine oil cooler support brackets	7	5	62
Oil cooler feed tubes	7	5	62
Oil cooler return tubes	7	5	62
Auxiliary water pump (Intercooler circuit) securing bolt	5	4	44

Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8



WARNING: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.



WARNING: To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.



CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine



CAUTION: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

1. Open the hood.

2.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3.



WARNING: Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

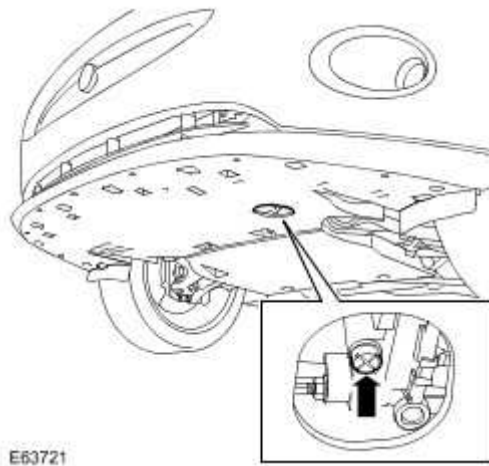
Release the cooling system pressure.

- Remove the coolant expansion tank cap.



4. Drain the coolant.

- Position a container to collect the fluid.
- Remove the drain plug.



5. Install the drain plug.

6. Loosen the coolant expansion tank bleed screw.



7.



CAUTION: Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.

8. Install the coolant expansion tank cap.

9. Set the heater controls to maximum.

10. Start the engine and idle until hot air is emitted at the face registers.

11. Switch the engine off and allow to cool.

12. Check and top-up the coolant if required.

13. Close the hood.

Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8



WARNING: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.



WARNING: To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.



CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine



CAUTION: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

1. Open the hood.

2.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3.



WARNING: Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

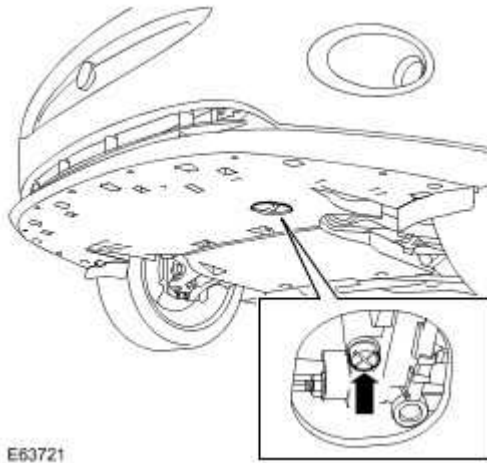
Release the cooling system pressure.

- Remove the coolant expansion tank cap.



4. Drain the coolant.

- Position a container to collect the fluid.
- Remove the drain plug.



5. Install the drain plug.

6. Loosen the coolant expansion tank bleed screw.



7.



CAUTION: Anti-freeze concentration must be maintained at 50%.

Refill the cooling system.

- When coolant runs from the expansion tank bleed point bubble-free, tighten the bleed screw.

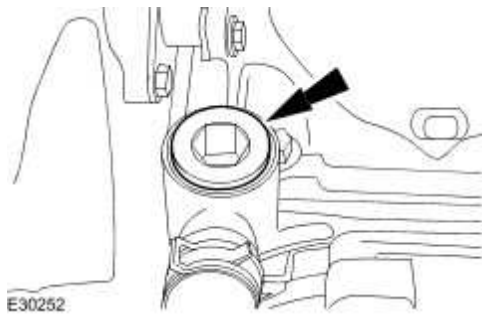
8. Install the coolant expansion tank cap.

9. Remove the engine cover.

[Engine Cover \(76.11.35\)](#)

10. Remove the supercharger coolant filler plug.

- Remove and discard the sealing washer.



11.



CAUTION: Coolant may spill from the supercharger fill port when the ignition is switched on.

Switch the ignition on.

12.



CAUTION: Do not allow the supercharger coolant pump to run dry for more than one minute. Failure to follow this instruction may result in damage to the vehicle.

Allow the supercharger pump to run and top-up the coolant through the supercharger fill port.

- Switch the ignition off.

13. Install the supercharger coolant fill plug and tighten to 45 Nm (33 lb.ft).

- Clean the components.
- Install a new sealing washer.

14. Install the engine cover.

[Engine Cover \(76.11.35\)](#)

15. Set the heater controls to maximum.
16. Start the engine and idle until hot air is emitted at the face registers.
17. Switch the engine off and allow to cool.
18. Check and top-up the coolant if required.
19. Close the hood.

Cooling System Draining and Vacuum Filling



WARNING: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury.



WARNING: To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.



CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the engine.



CAUTION: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

NOTE:

Vehicles fitted with supercharged engines shown, V8 NA and V6 engines similar.

1. Set the heater controls to maximum HOT.
2. Open the hood.
- 3.



WARNING: Relieve the cooling system pressure by unscrewing the coolant pressure cap. Failure to follow this instruction may result in personal injury.

Remove the coolant expansion tank cap.



4.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

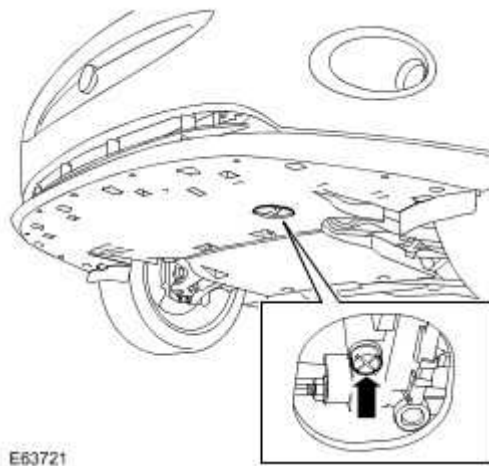
5. Remove the radiator undertray.
[Radiator Splash Shield \(76.22.90\)](#)

6. **NOTE:**

Remove and discard the O-ring seal.

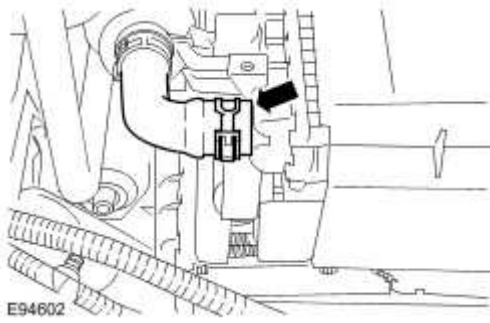
Remove the coolant drain plug.

- Drain the coolant into a suitable container.



7. Disconnect the coolant lower hose from the supercharger radiator.

- Release the clip.
- Allow the coolant to drain.



8.



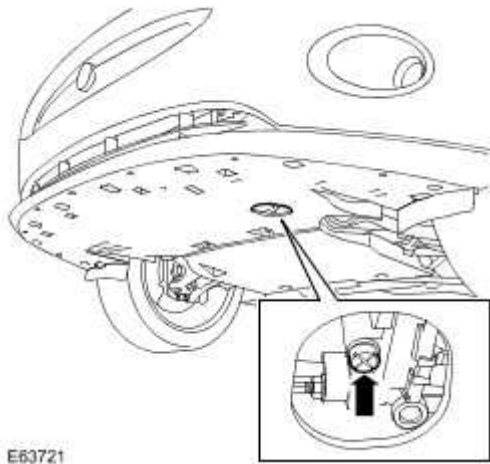
CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

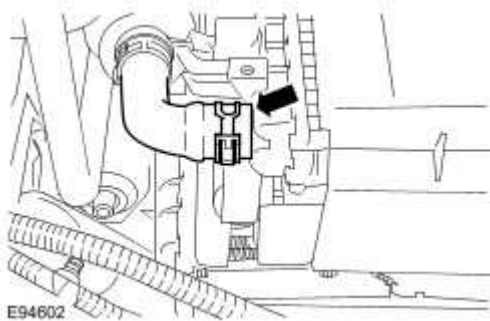
Install a new O-ring seal.

Install the drain plug.

- Remove the drain tray.



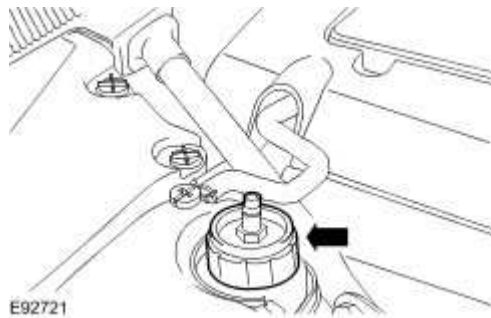
9. Connect the supercharger radiator lower coolant hose.



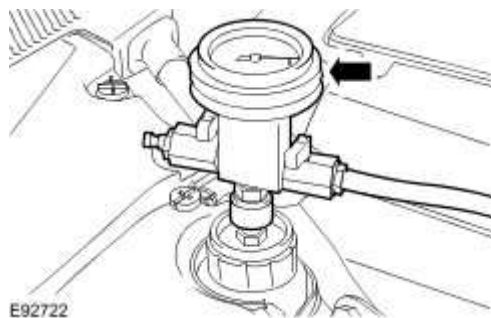
10. Install the radiator undertray.

Radiator Splash Shield (76.22.90)

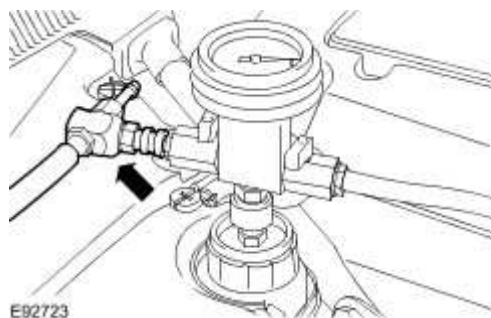
11. Lower the vehicle.
12. Prepare a sufficient amount of coolant to the specified concentration.
13. Install the cooling system vacuum refill adaptor to the expansion tank.



14. Install the vacuum filler gauge to the cooling system vacuum refill adaptor.



15. Install the venturi tube assembly to the vacuum filler gauge.



16. **NOTE:**

Make sure both valves are in the closed position on the vacuum filler gauge assembly.

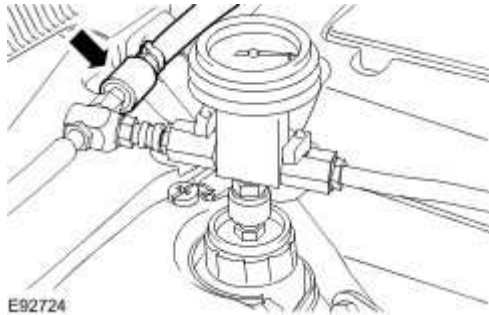
NOTE:

The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.

NOTE:

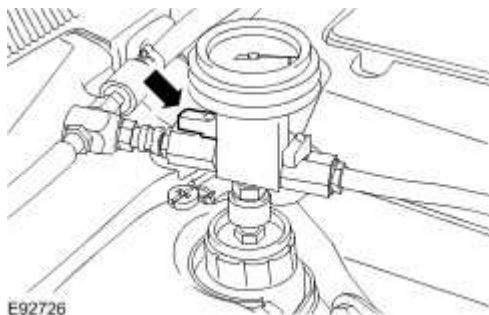
Small diameter or long airlines may restrict airflow to the coolant vacuum fill tool.

Connect a regulated compressed air supply to the venturi tube assembly.



17. Position the evacuated air hose into a container.

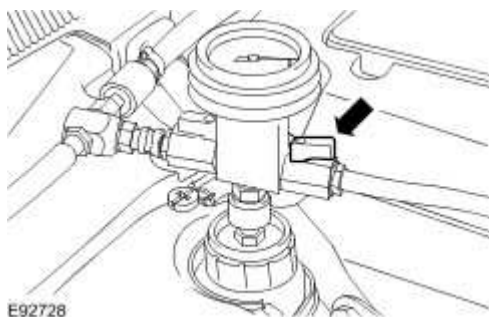
18. Open the air supply valve.



19. **NOTE:**

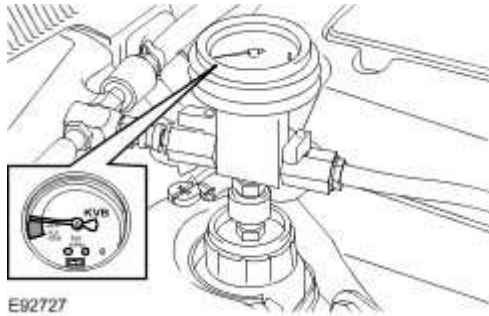
Make sure the coolant supply hose is positioned into a container of fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water. Make sure no air can enter the coolant supply hose.

Open the coolant supply valve for 2 seconds to prime the coolant supply hose.

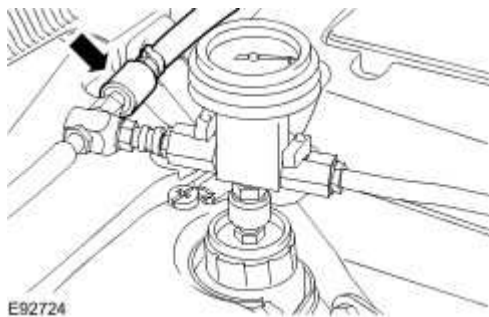


20. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.

- Allow the vacuum to rebuild.
- Close the air supply valve.
- Allow one minute to check the vacuum is held.



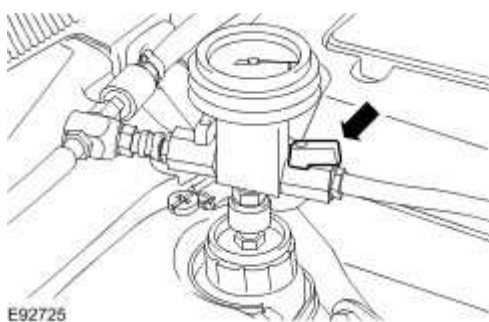
21. Disconnect the compressed air supply line.



22. **NOTE:**

Close the coolant supply valve when the coolant expansion tank MAX mark is reached or coolant movement has ceased.

Open the coolant supply valve and allow the coolant to be drawn into the system.



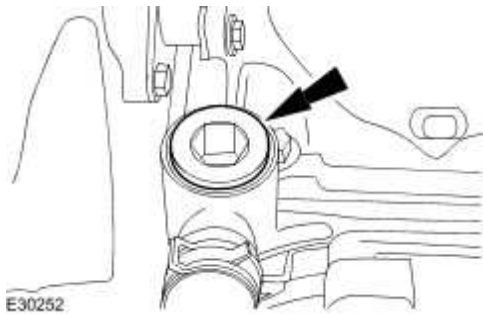
23. Remove the vacuum filler gauge and cooling system vacuum refill adaptor assembly.

24. Install the coolant expansion tank cap.



25. Remove the engine cover.
[Engine Cover \(76.11.35\)](#)

26. Remove the supercharger coolant fill plug.
- Remove and discard the sealing washer.



27.



CAUTION: Coolant may spill from the supercharger fill port when the ignition is switched on.

Switch the ignition on.

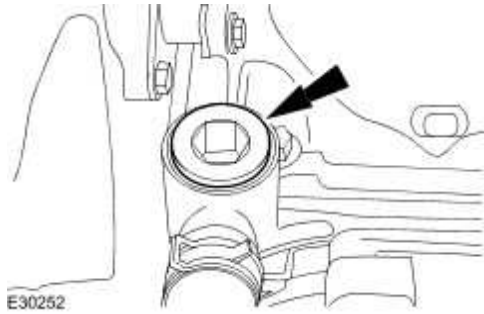
28.



CAUTION: Do not allow the supercharger coolant pump to run dry for more than one minute. Failure to follow this instruction may result in damage to the vehicle.

Allow the supercharger pump to run and top-up the coolant through the supercharger fill port.

- Switch the ignition off.
29. Install the supercharger coolant fill plug.
- Clean the components.
 - Install a new sealing washer.
 - Tighten to 45 Nm (33 lb.ft).



30. Install the engine cover.
[Engine Cover \(76.11.35\)](#)

31.



CAUTION: Observe the engine temperature gauge. If the engine starts to over-heat switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle.

Start the engine and idle until hot air is emitted at the face registers.

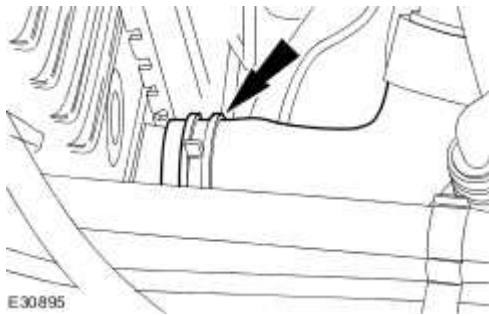
32. Switch the engine off and allow to cool.

33. Check and top-up the coolant if required.

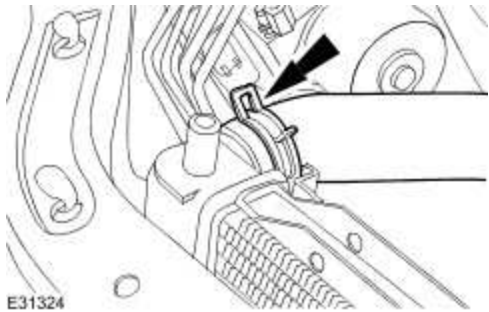
34. Close the hood.

Cooling System Flushing

1. Remove the air cleaner. <<303-12A>>
2. Remove the air cleaner. <<303-12B>>
3. Remove the thermostat.
4. Detach the lower coolant hose from the radiator and position to one side.



5. Detach the upper coolant hose from the radiator.



NOTE:

To remove rust, sludge and other foreign material from the cooling system, use Premium Cooling System flush, meeting Jaguar specification EGR-M14P7-A, which is safe for use with aluminium cooling systems. This cleaning restores cooling system efficiency and helps prevent overheating.

NOTE:

In severe cases where cleaning solvents will not properly clean the cooling system, it will be necessary to use the pressure flushing method using Cooling System Flusher, 164-R3670 to restore efficient operation.

NOTE:

A pulsating or reversed direction of flushing water will loosen sediment more quickly than a steady flow in the normal coolant flow direction.

NOTE:

Dispose of old coolant and flushing water contaminated with coolant and cleaning chemicals in accordance with local, state and federal laws.

6. Connect a hose pipe to the radiator upper coolant hose connection using a suitable connector.

7.



CAUTION: Radiator internal pressure must not exceed 100 kPa (14.5 psi). Failure to follow this instruction may cause damage to the radiator.

Flush the radiator using the hose pipe until the coolant flowing from the radiator lower coolant hose connection is clear.

8. Remove the hose pipe from the radiator upper coolant hose connection.

9. Connect a hose pipe to the upper coolant hose using a suitable connector.

10. Flush the engine using the hose pipe until the coolant flowing from the radiator lower coolant hose is clear.

11. Remove the hose pipe from the upper coolant hose connection.

12. Connect the upper coolant hose to the radiator.

13. Connect the lower coolant hose to the radiator.

14. Install the thermostat.

15. Fill the cooling system.

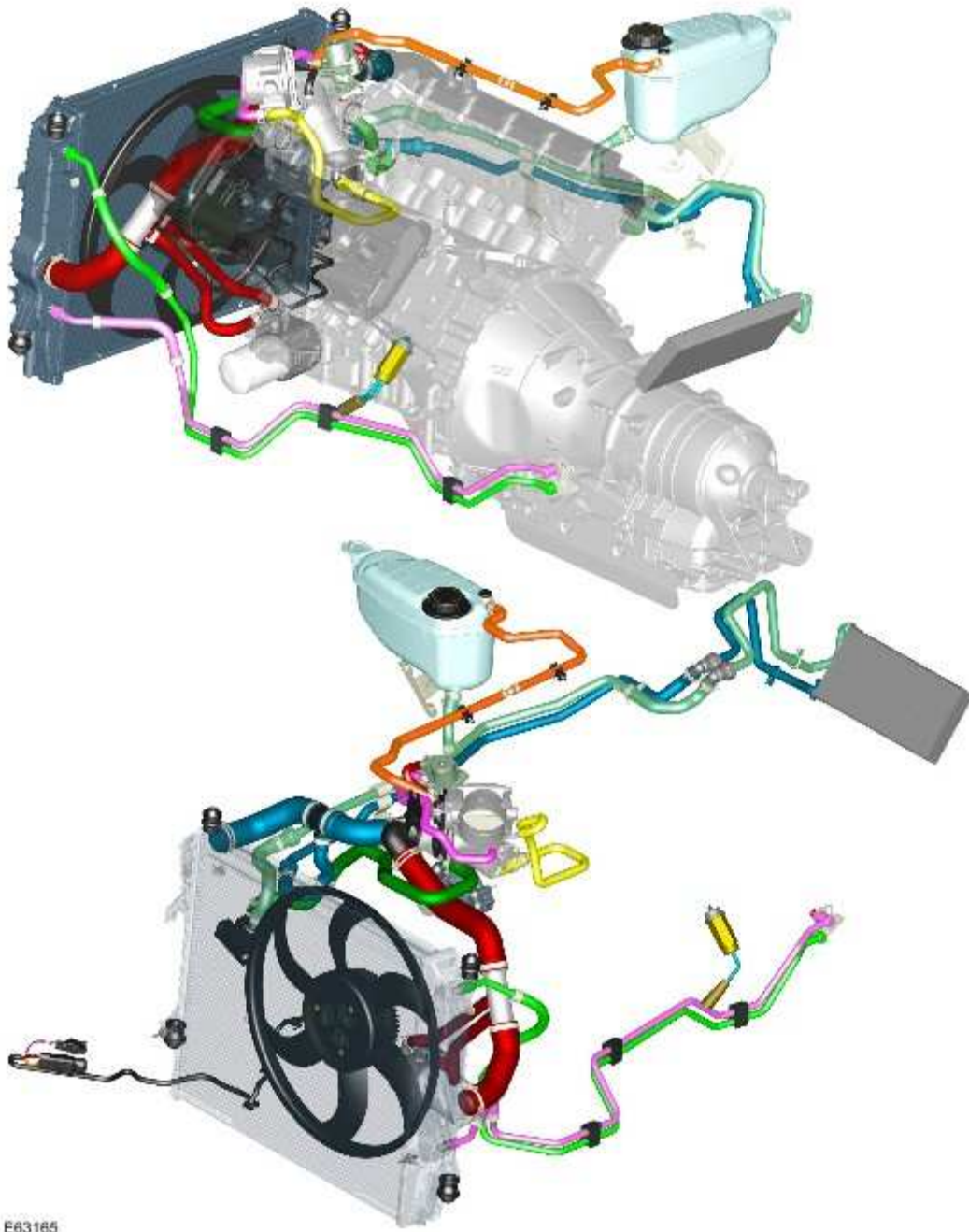
16. Install the air cleaner. <<303-12A>>

17. Install the air cleaner. <<303-12B>>

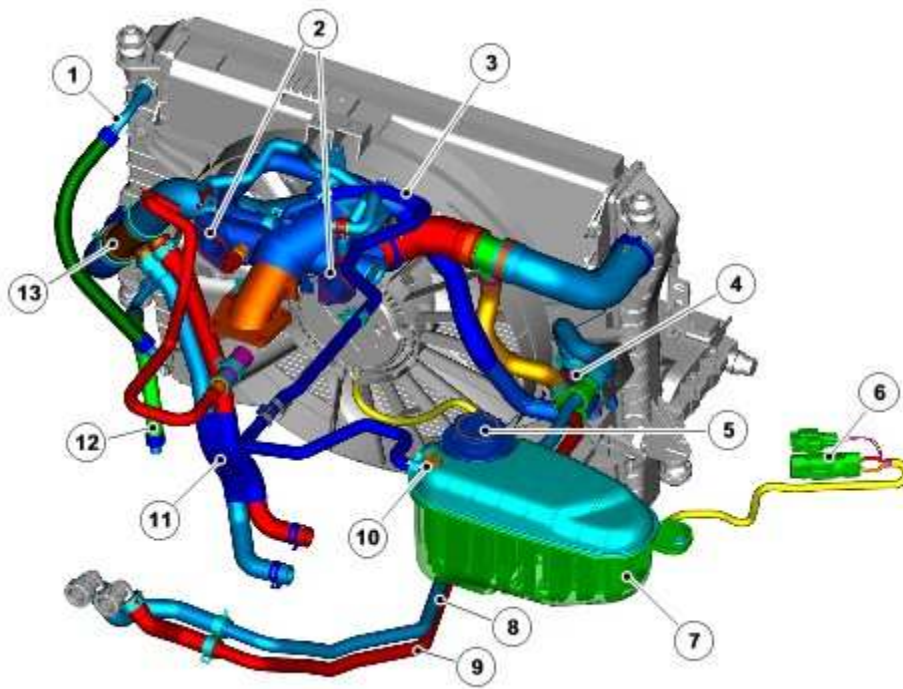
Description and operation

Engine Cooling - 4.2L NA V8 - AJV8

COMPONENT LOCATION



E63165



E77017

Item	Part Number	Description
1		Transmission oil cooler inlet
2		Engine coolant outlet
3		Vent hose
4		Auxiliary coolant flow pump
5		Cap
6		Fan harness connector
7		Expansion tank
8		Heater return pipe
9		Heater feed pipe
10		Bleed screw
11		Engine oil cooler connections
12		Transmission oil cooler outlet

13		Engine coolant inlet
----	--	----------------------

INTRODUCTION



WARNING: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in personal injury. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the coolant pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant pressure cap and turn it slowly until the pressure begins to release. Step back while the pressure is released from the system. When certain all the pressure has been released turn and remove the coolant pressure cap (still with a cloth) from the coolant expansion tank. Failure to follow these instructions may result in personal injury.



WARNING: To avoid the possibility of personal injury, do not operate the engine with the hood open until the fan blades have been examined for cracks and separation. Failure to follow this instruction may result in personal injury.



WARNING: Remove fuse 38 from the Battery Junction Box (BJB) prior to performing any under hood service in the area of the cooling fan when the engine is hot, since the cooling fan motor could operate if the engine has been switched OFF. Failure to follow this instruction may result in personal injury.



CAUTION: The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage.



CAUTION: Never remove the coolant pressure cap under any circumstances while the engine is operating. Failure to follow this instruction may result in damage to the engine.

Engine cooling is via a low volume, high velocity system, which achieves a very fast warm up. The temperature of the combustion chambers is reduced along with a more even temperature distribution.

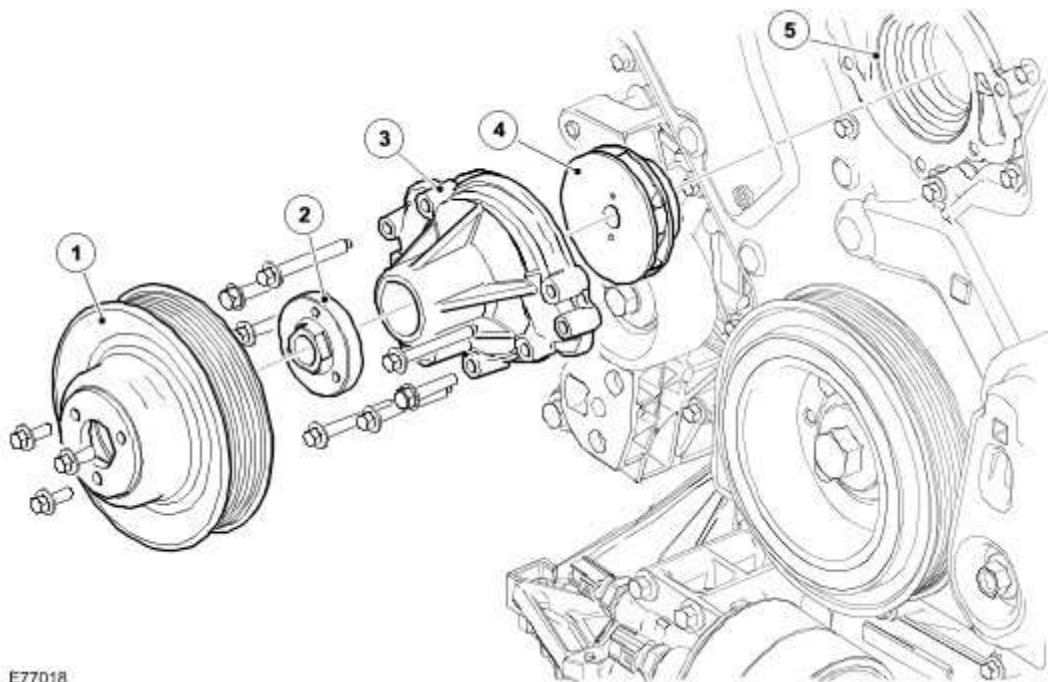
The coolant expansion tank has an integral bleed screw and coolant-level sensor. The auxiliary coolant-flow pump is fitted as standard.

The cooling-fan speed is controlled directly by the Engine Control Module (ECM) based on input data measured by the Engine Coolant Temperature (ECT) sensor, the climate control pressure-transducer and the transmission oil temperature sensor. The ECM processes this input data and outputs a Pulse Width Modulated (PWM) signal, which determines the fan speed. Should the output signal fall outside predetermined parameters, maximum fan-speed is initiated to protect the engine. High engine temperature is indicated by the illumination of the engine over-temperature warning light, located in the instrument cluster.

Where appropriate, to provide an extended period of engine cooling, the ECM continues to control the fan speed after the ignition has been turned off. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

A coolant drain plug is located at the rear of the cylinder block behind the starter motor.

COOLANT PUMP



Item	Part Number	Description
1		Pulley
2		Hub
3		Pump body

4		Impeller
5		Adapter casting

The coolant pump is fitted between the 2 cylinder banks, on the front face of the cylinder block.

The pump consists of a housing containing a shaft, with a shrouded plastic impeller on one end and a drive pulley on the other.

A pair of roller bearings supports the shaft in the housing. A seal behind the impeller prevents coolant from contaminating the bearings. Should this seal fail, coolant escapes from a witness hole in the housing indicating that immediate action is required.

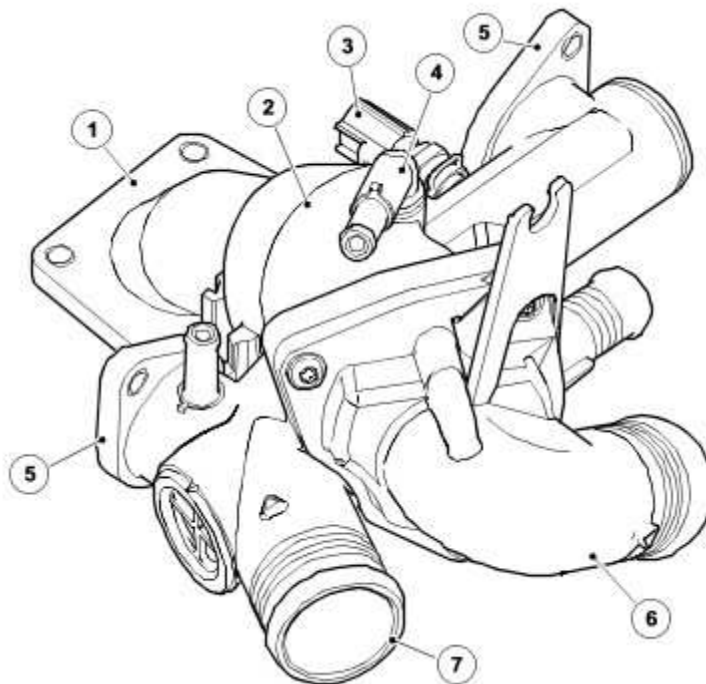
An O-ring and an aluminum-alloy gasket, seal the ports between the pump and the cylinder banks.

From the pump, coolant flows into each bank of the cylinder block. In each bank, approximately 50% of the coolant cools the cylinder bores and the remainder is diverted through the bypass gallery to the cylinder head.

With the thermostat closed, coolant returns directly to the pump through the bypass on the thermostat housing.

With the thermostat open, coolant returns to the pump via the radiator.

COOLANT OUTLET ASSEMBLY

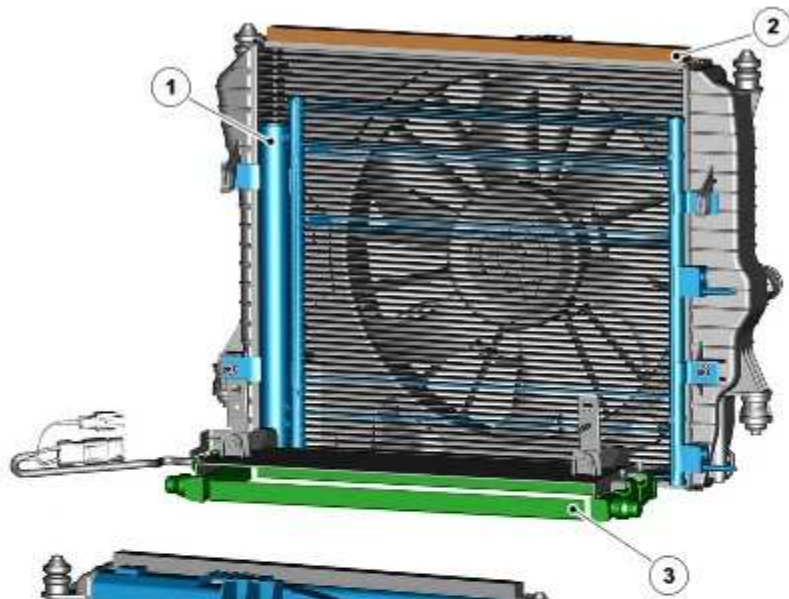


Item	Part Number	Description
1		Bypass to coolant pump
2		Thermostat housing
3		ECT sensor
4		Vent to expansion tank
5		Engine coolant outlet
6		Thermostat cover
7		Bottom hose connection

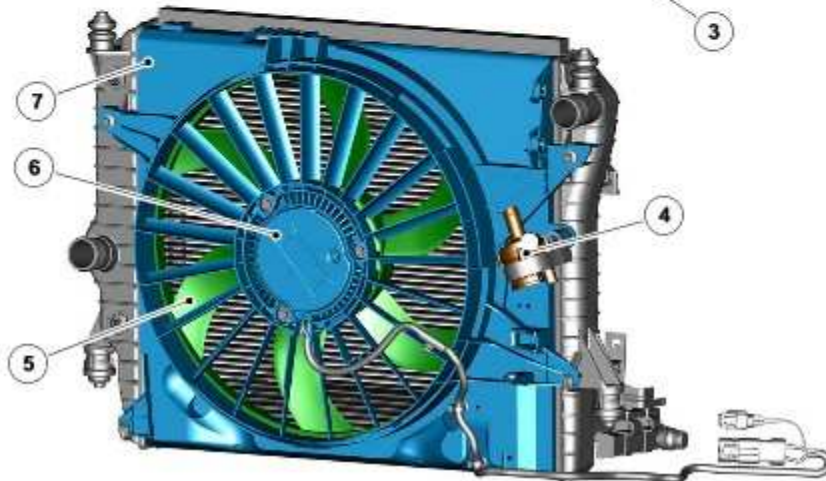
A coolant outlet plastic pipe connects to the outlet port of each cylinder head to provide a common connection point for the radiator top hose. It also incorporates the ECT sensor, which provides a signal representing coolant temperature at the cylinder heads. Controlling the coolant flow through the radiator, the thermostat starts to open at 80°C (176°F) to 84°C (183°F) and is fully open at 96°C (205°F). The outlet pipe has connections to supply the heater core and the bypass flow to the thermostat housing. An in-groove gasket seals each of the outlet-to-cylinder head joints. An aluminium gasket seals the ECT sensor to thermostat housing.

RADIATOR

A



B



E77020

Item	Part Number	Description
A		Front view
B		Rear view
1		Receiver dryer (condenser assembly)
2		Radiator assembly
3		Auxiliary radiator
4		Auxiliary coolant flow pump
5		Fan

6		Fan motor
7		Shroud

The cooling pack incorporates the radiator assembly with integral transmission oil cooler (located in the radiator outlet tank), an air conditioning condenser, and the twin fan and motor assembly.

The radiator is mounted on 4 rubber mounts, one on each end of the upper and lower face. A closing panel, which retains the radiator assembly, fits over the top of the radiator and is secured to the vehicle body.

COOLING FANS

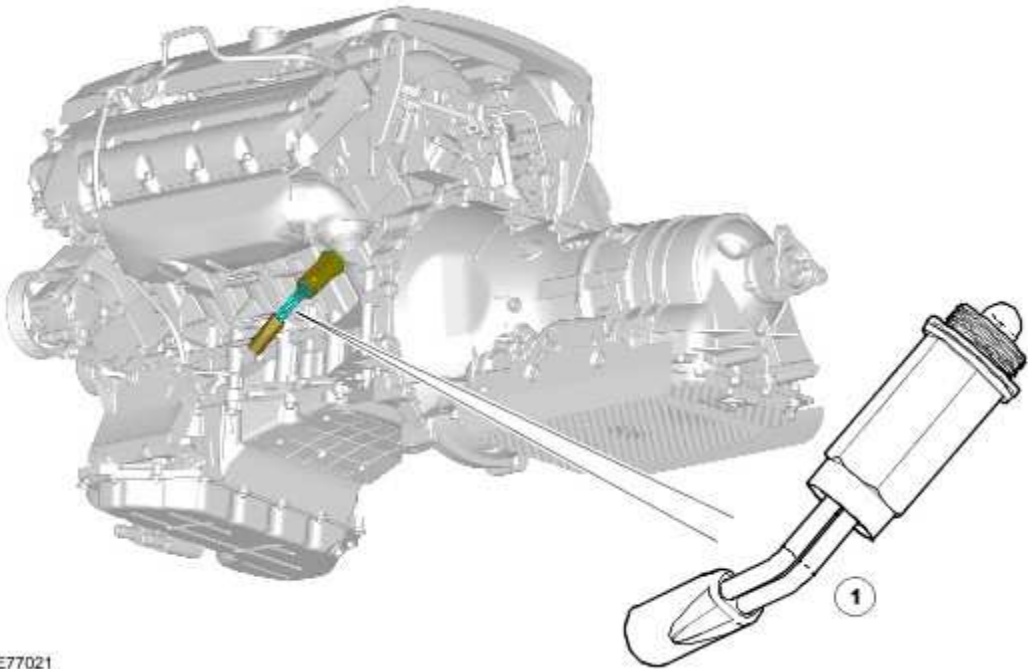
The 2 radiator cooling fans are mounted in a twin fan and motor assembly between the radiator and the engine.

The fan control module controls the fans dependent on the demand from the cooling system (temperature) or the air conditioning system (pressure).

The fan control module is located on the twin fan and motor shroud. The variable PWM module controls the fan speeds.

Under hot operating conditions, the fans may continue to operate for some time after the engine has been switched off, but will stop automatically when the coolant temperature has been sufficiently reduced. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

ENGINE BLOCK HEATER

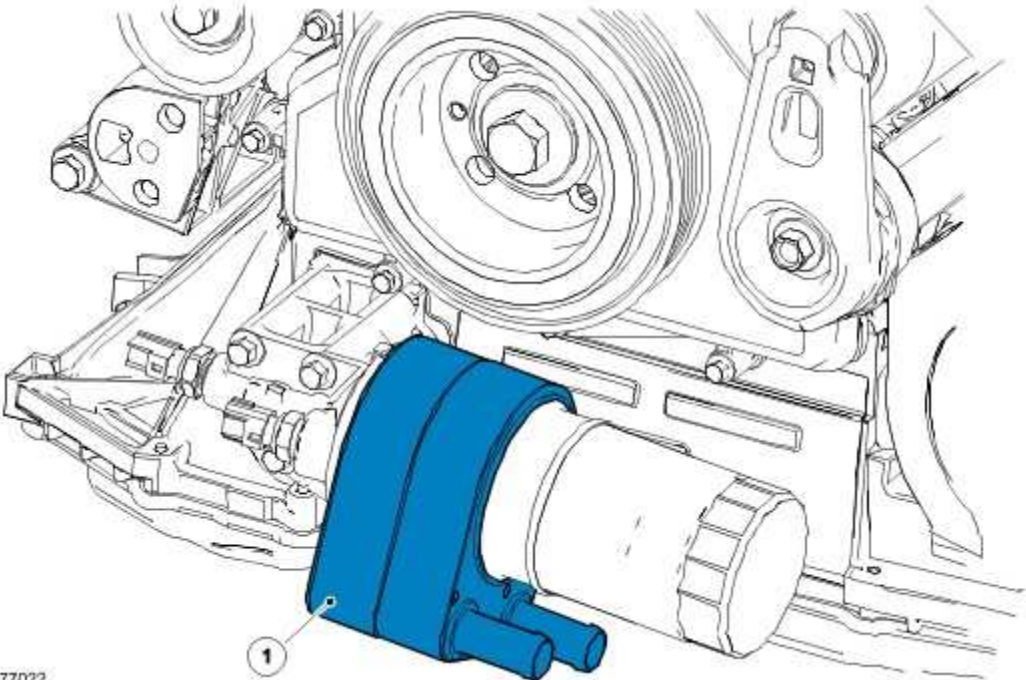


E77021

Item	Part Number	Description
1		Engine block heater

For vehicle markets subject to very cold climate conditions, an engine block heater for connection to an external mains power supply, is fitted in place of the engine block drain plug.

ENGINE OIL COOLER



E77022

Item	Part Number	Description
1		Engine oil cooler

The engine oil cooler is a Modine oil to water type. The oil cooler is located at the front of the engine and is fitted between the oil filter housing and the oil filter.

The coolant supply for the engine oil cooler is through the radiator bottom hose.

COOLANT RECOVERY SYSTEM

A pressurized coolant expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through the coolant expansion tank outlet hose, attached to the heater return hose.

A continuous vent from the engine and radiator to the coolant expansion tank prevents air locks from forming in the cooling system.

Manual bleed points are provided on the coolant reservoir.

The coolant expansion tank serves as the location for:

- Service fill
- Coolant expansion during warm-up
- Air separation during operation
- System pressurization by the coolant pressure cap
- The coolant expansion tank is designed to have approximately 0.5 to 1 liter of air when cold to allow for coolant expansion

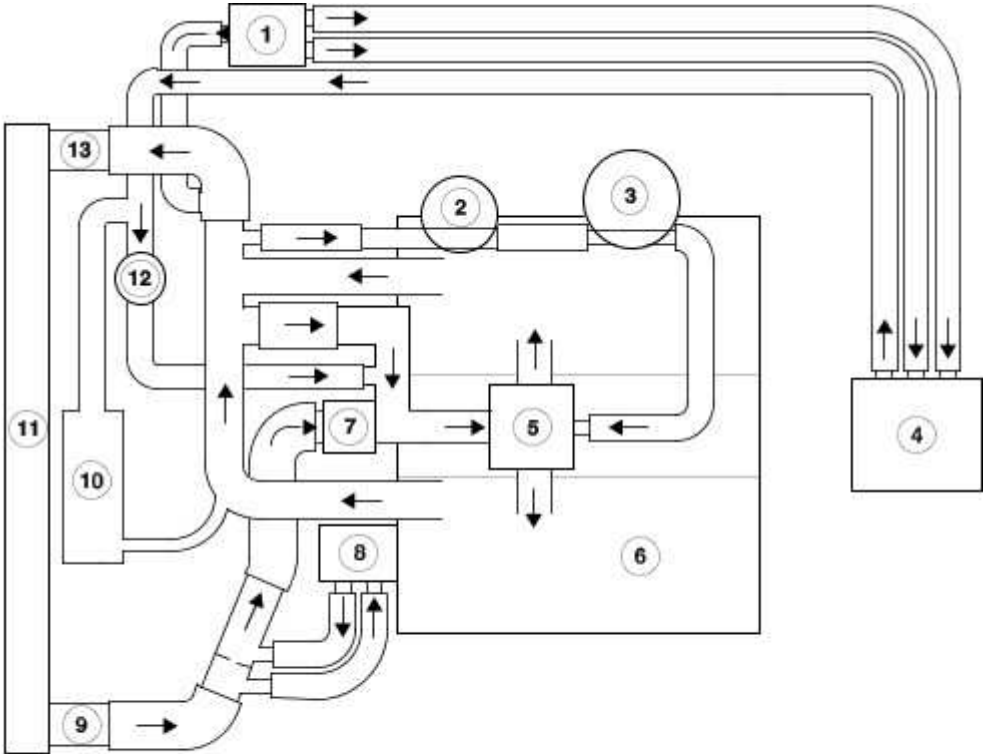
ENGINE COOLANT TEMPERATURE (ECT) SENSOR

The ECT sensor is located in the coolant outlet pipe and reacts to engine coolant temperature changes, providing an input to the ECM. The sensor is a Negative Temperature Coefficient (NTC) thermistor, decreasing in resistance as the temperature rises. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

ENGINE COOLANT

The long life engine coolant is formulated to last for 5 years or 240,000 km (150,000 miles). The coolant is silicate free and orange in color. The long life engine coolant must not be mixed with conventional engine coolant.

COOLANT FLOW



E30953

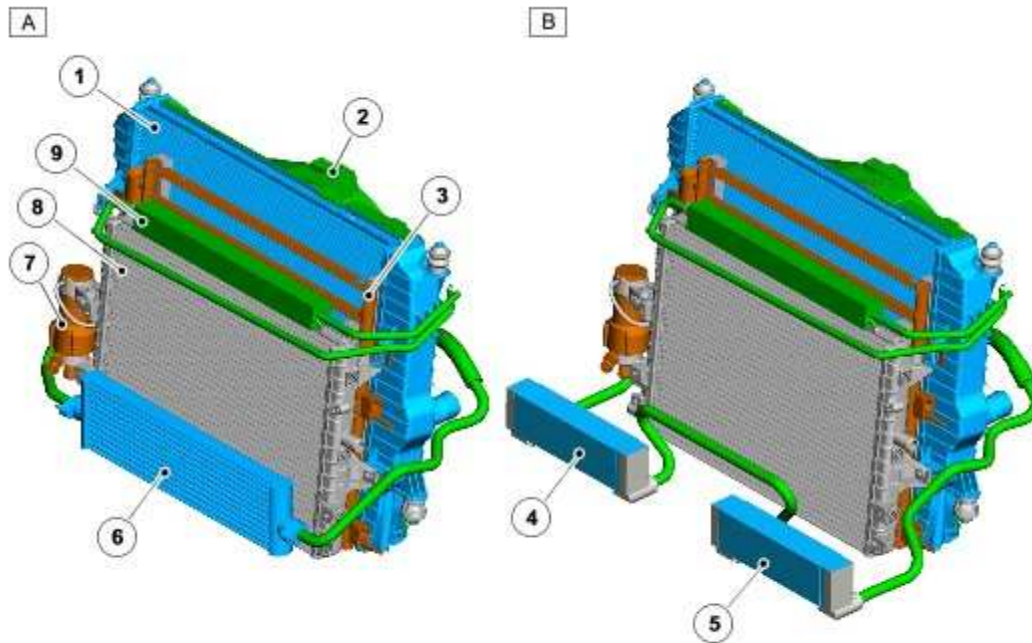
Item	Part Number	Description
1		Dual coolant flow valve
2		EGR valve
3		Throttle body
4		Heater core
5		Water pump
6		Engine bank (left-hand)
7		Thermostat
8		Engine oil cooler
9		Lower hose

10		Coolant expansion tank
11		Radiator
12		Auxiliary coolant flow pump
13		Upper hose

Engine Cooling - 4.2L SC V8 - AJV8

Authoring Template

COMPONENT LOCATION



E85539

Item	Part Number	Description
A		Single engine oil cooler variant
B		Twin engine oil cooler variant
1		Radiator assembly
2		Cooling fan shroud
3		Condenser
4		Right Hand (RH) engine oil cooler
5		Left Hand (LH) engine oil cooler
6		Engine oil cooler
7		Intercooler pump
8		Intercooler

OVERVIEW

The cooling system employed for the supercharged engine is very similar to the normally aspirated engine. The system is of the pressure relief by-pass type, which allows coolant to circulate around the engine and the heater circuit while the thermostat main valve is closed. The primary function of the cooling system is to maintain the engine within an optimum temperature range under changing ambient and engine operating conditions. Secondary functions are to provide heating for the passenger compartment and cooling for the transmission fluid and engine oil.

The cooling system comprises:

- A cooling module including common radiator, condenser, transmission oil cooler with additional water cooled, intake charge air radiator
- A passenger compartment heater matrix
- An engine driven coolant pump
- An electric coolant pump
- A thermostat
- An degas tank
- An electro-viscous cooling fan
- Transmission oil pipes
- Single or twin engine oil coolers
- Two charge air cooler assemblies (heat exchangers)
- Connecting hoses and pipes

ENGINE COOLING SYSTEM

A centrifugal pump mounted on the front of the engine and driven by an ancillary drive 'polyvee' belt circulates the coolant. The engine driven coolant pump circulates coolant through the cylinder block and cylinder heads via a chamber located in the 'vee' of the engine. Having passed through the engine the coolant returns to the thermostat housing. The coolant then progresses down the 'top hose' to the heater pipe. The heater pipes lead to the bulkhead and return to the engine side of the thermostat.

The engine contains a conventional thermostat, which is positioned such that the wax's temperature is controlled by both the coolant from the radiator and the bypass. This results in the thermostat being able to vary its opening temperature dependant on ambient conditions. The thermostat housing also contains a sprung loaded valve, which limits the amount flow using the bypass. This means that the engine can run without coolant flowing through the bypass temporarily, to improve heater performance.

The engine radiator is a cross-flow type with an aluminium matrix and has a drain tap on the lower RH rear face. There is an additional charge air radiator, located in front of the engine radiator, to support the water charge air coolers (heat exchangers) on the engine.

The coolant for the charge air cooling is driven by an electric pump at constant speed and is mounted

on the engine radiator end tank. This circuit shares the engine coolant via a vortex connection, in the engine to radiator hose. The lower engine radiator mountings are located part way up the end tanks. The mountings are fitted with rubber bushes, which sit on the upper chassis rails. The radiator upper is mounted by pins, which are pushed through rubber bushes mounted in the front end carrier above the radiator. The radiator also incorporates 2 connections for the transmission oil pipes.

The top and bottom hoses are mounted to the inlet and outlet sides of the thermostat housing.

The degas tank is fitted forward of the LH suspension turret in the engine compartment. The degas tank allows for the expansion of the coolant as the engine gets hot and also supplies the engine with coolant as the coolant in the engine contracts. The tank also allows any air trapped in the coolant to be removed.

The liquid cooled transmission fluid cooler is located behind the engine cooling radiator and is connected to the transmission via flexible hoses and metal pipes

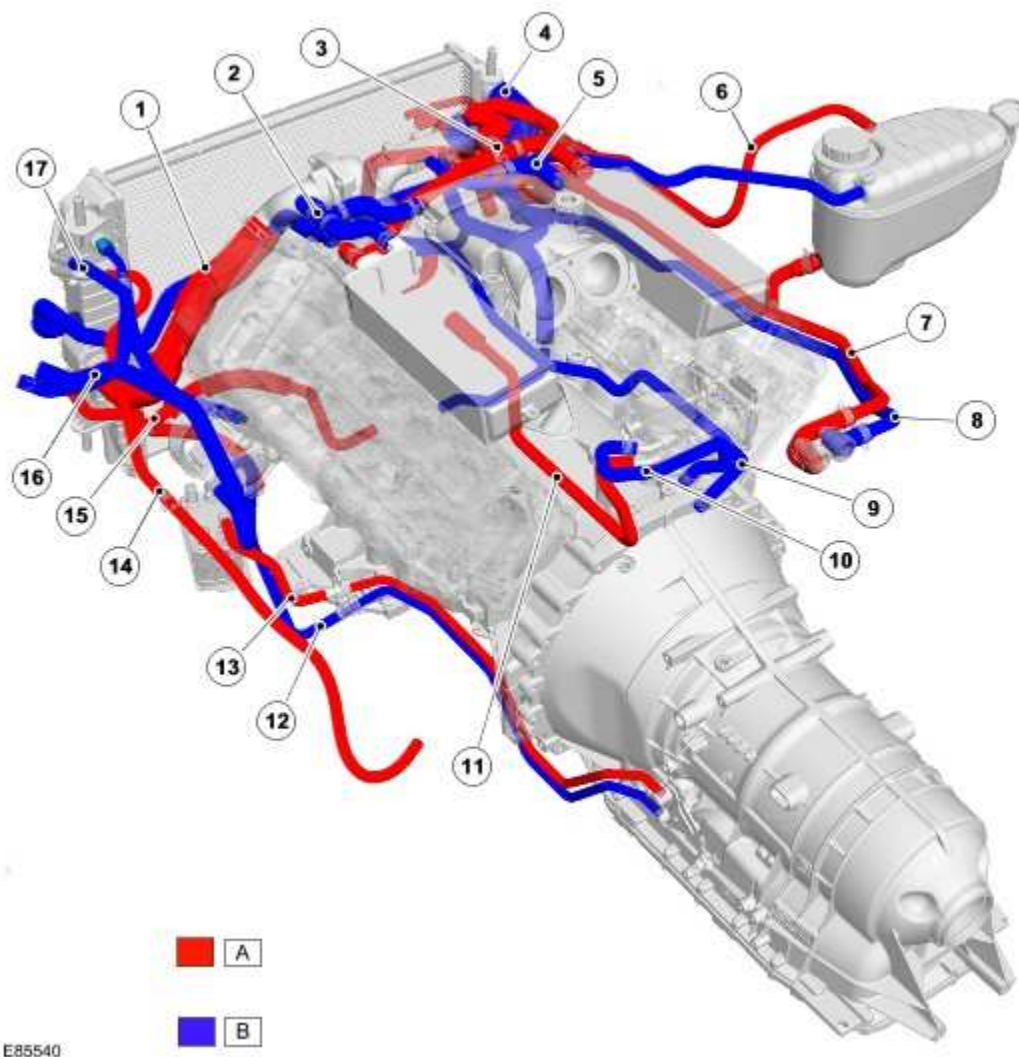
There are 2 variations of engine oil coolers available. One variant uses a single cooler located in front of the intercooler, whereas the second variant utilizes 2 coolers, 1 for each cylinder bank, also located in front of the intercooler.

The viscous fan unit is electronically controlled by the ECM to optimise fan speed for all operating conditions.

NOTE:

If the electrical connections to the viscous fan are disconnected the fan will 'idle' and overheating may result. The ECM stores the appropriate fault codes in this case.

ENGINE COOLING SYSTEM OPERATION



Item	Part Number	Description
A		Hot coolant
B		Cold coolant
1		Radiator bottom hose
2		Hose assembly - Feed from intercooler radiator to LH and RH intercoolers
3		Hose assembly - Return from LH and RH intercoolers to intercooler radiator, via electric pump
4		Radiator top hose

5		Hose - Feed from RH intercooler to supercharger
6		Hose - Return from degas tank to intercooler radiator
7		Heater return pipe
8		Heater feed pipe
9		Hose - EGR coolant inlet
10		Hose - Feed to throttle heating assembly
11		Hose - Return from throttle heating assembly
12		Transmission oil cooler feed pipe
13		Transmission oil cooler return pipe
14		Hose - Power steering cooler return
15		Transmission oil cooler return pipe
16		Hose - Power steering cooler to reservoir feed
17		Hose - Power steering pump feed

When the engine is running the coolant pump is driven by the ancillary drive belt. This forces coolant to circulate around the engine and heater, while the thermostat and bypass valve are shut. As the temperature and pressure increases the bypass valve is forced open allowing coolant to circulate through the bypass valve. When the temperature reaches 82°C (180°F) the main thermostat begins to open allowing coolant to circulate through the main radiator. As the thermostat progressively opens (fully open at 95°C (203°F)), the bypass valve progressively closes forcing any coolant through the heater or radiator. Once coolant is allowed to circulate through the radiator, the transmission fluid and the engine oil coolers begin to receive coolant flow.

The increased coolant volume, created by heat expansion, is directed to the expansion tank through a bleed hose from the top of the radiator. The expansion tank has an outlet hose, which is connected into the coolant circuit. This outlet hose returns the coolant to the system when the engine cools.

Coolant flows through the radiator from the top right hand tank to the bottom left hand tank and is cooled by air passing through the matrix. The temperature of the cooling system is monitored by the ECM via the Engine Coolant temperature (ECT) sensor located in the cylinder head. The ECM uses signals from this sensor to control the cooling fan operation and adjust fuelling according to engine temperature.

To control the cooling fan, the ECM sends a Pulse Width Modulated (PWM) signal to the cooling fan module (integral to the ECM). The frequency of the PWM signal is used by the cooling fan module to determine the output voltage supplied to the fan motor.

The ECM varies the duty cycle of the PWM signal between 0 and 100% to vary the fan speed. If the PWM signal is outside the 0 to 100% range, the cooling fan module interprets the signal as an open or short circuit and runs the fans at maximum speed to ensure the engine and gearbox do not overheat.

The ECM operates the fan in response to inputs from the ECT sensor, the transmission oil temperature sensor, the A/C switch and the A/C pressure sensor.

The speed of the cooling fan is also influenced by vehicle road speed. The ECM adjusts the speed of the cooling fans, to compensate for the ram effect of vehicle speed, using the Controller Area Network (CAN) road speed signal received from the Anti-lock Braking System (ABS) module.

Engine Cooling

Principle of Operation

For a detailed description of the cooling system operation, refer to the relevant Description and Operation section of the workshop manual.

Engine Cooling - 4.2L NA V8 - AJV8

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Leaks • Coolant expansion tank • Electric fan • Radiator 	<ul style="list-style-type: none"> • Fuse • Wiring harness • Loose or corroded connector(s) • Engine Coolant Temperature (ECT) sensor

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If there are clear symptoms refer to the table below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	<ul style="list-style-type: none"> • Hoses • Hose connections • Radiator • Coolant pump • Heater core • Gaskets • Engine casting cracks • Engine block core plugs 	<ul style="list-style-type: none"> • GO to Pinpoint Test G552274p1.
Engine overheating	<ul style="list-style-type: none"> • Engine coolant (level/condition) • Thermostat • Fan motor 	<ul style="list-style-type: none"> • GO to Pinpoint Test G552274p2.

	<ul style="list-style-type: none"> • Fan motor fuses and/or circuits • ECT sensor • Engine control module (ECM) • Fan speed module 	
Engine not reaching normal operating temperature	<ul style="list-style-type: none"> • Thermostat • Electric fan • Fan speed module 	<ul style="list-style-type: none"> • GO to Pinpoint Test G552274p3.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P011623	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011624	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant

			Temperature (ECT) Sensor (18.30.10)
P011629	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011700	Engine Coolant Temperature (ECT) sensor circuit - low input	<ul style="list-style-type: none"> • ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected • ECT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011800	Engine Coolant Temperature (ECT) sensor circuit - high input	<ul style="list-style-type: none"> • Engine overheat condition/cooling fan failure • ECT sensor sensing circuit - short to ground • ECT sensor failure 	<ul style="list-style-type: none"> • Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index • Carry out any

			<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P012500	Insufficient coolant temperature for closed loop fuel control	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P012800	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> • Low/contaminated coolant • Thermostat • Cooling fan circuit(s)/module 	GO to Pinpoint Test G552274p3.
P048023	Electric fan control circuit low	<ul style="list-style-type: none"> • Electric fan control circuit - short to ground, high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P048024	Electric fan control circuit high	<ul style="list-style-type: none"> • Electric fan control circuit - short to power 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048309	Fan rationality check	<ul style="list-style-type: none"> • Cooling fan obstructed • Fan/motor damaged 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CLEAR any obstruction and INSTALL a new fan as necessary. Cooling Fan Motor and Shroud - Vehicles Without: Supercharger (26.25.25)
P048316	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage less than nine volts 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the battery condition • CHECK the charging system and fan circuits
P048317	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage greater than 18 volts 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the charging system

			and fan circuits
P048397	Fan rationality check	<ul style="list-style-type: none"> Cooling fan jammed 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system CLEAR any obstruction and INSTALL a new fan as necessary. Cooling Fan Motor and Shroud - Vehicles Without: Supercharger (26.25.25)

Pinpoint Tests

PINPOINT TEST G552274p1 : LOSS OF COOLANT

G552274t2 : VISUAL INSPECTION

1. Visually inspect for loss of coolant. 2. Carry out a system pressure test. See component tests in this section.

- Is the engine cooling system leaking?

-> **Yes**

Rectify the leak as indicated by the test result. Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary.

Specifications

Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8 TEST the system for correct operation.

-> **No**

Verify the customer complaint.

PINPOINT TEST G552274p2 : THE ENGINE OVERHEATS

G552274t3 : CHECK COOLANT

1. Check the coolant level and condition.

- **Does the system contain sufficient coolant of the correct specification?**

-> **Yes**

GO to Pinpoint Test G552274t1.

-> **No**

Top-up and fill the cooling system to the correct level with the correct specification fluid as necessary.

Specifications

Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8 Check for coolant loss. GO to Pinpoint Test G552274p1.

G552274t1 : CHECK COOLANT EXPANSION TANK PRESSURE CAP

1. Check the coolant expansion tank pressure cap for damage/correct operation. REFER to the coolant expansion tank pressure cap pressure test in this section.

- **Is the coolant expansion tank pressure cap operating correctly?**

-> **Yes**

GO to Pinpoint Test G552274t4.

-> **No**

INSTALL a new coolant expansion tank pressure cap. TEST the system for correct operation.

G552274t4 : CHECK THERMOSTAT

1. Check the thermostat for correct operation. REFER to the thermostat component test in this section.

- **Is the thermostat operating correctly?**

-> **Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.

Electronic Engine Controls

-> **No**

INSTALL a new thermostat.

Thermostat - Vehicles Without: Supercharger (26.45.07) TEST the system for correct operation.

PINPOINT TEST G552274p3 : THE ENGINE DOES NOT REACH NORMAL OPERATING TEMPERATURE

G552274t5 : CHECK THERMOSTAT

1. Check the thermostat for correct operation. REFER to the thermostat component test in this section.

- **Is the thermostat operating correctly?**

-> **Yes**

Check for correct operation of cooling fans, circuits, sensors, modules, etc.
Electronic Engine Controls

-> **No**

INSTALL a new thermostat.

Thermostat - Vehicles Without: Supercharger (26.45.07) TEST the system for correct operation.

Component Tests

Cooling System Pressure Test



WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1 . Switch the engine off.

2 . Open the hood and install protective fender covers.

3 . Carefully remove the coolant expansion tank pressure cap from the coolant expansion tank to relieve pressure in the cooling system. Add coolant to coolant expansion tank as necessary.

4 . Install the pressure tester equipment to the cooling system following manufacturers instructions. Reinstall the coolant expansion tank pressure cap (if pressure test equipment is not installed to the coolant expansion tank).

5 . Pressurize the cooling system to the coolant expansion tank pressure cap lower limit.

6 . Observe the gauge reading for approximately two minutes. Pressure should not drop during this time.

▶ If system holds pressure, continue from step 8.

If the pressure drops, check the complete cooling system for leaks. Also refer to engine system

▶ checks if a leak cannot be located in the cooling system. Correct any leaks found and recheck the system.

7 . Release the system pressure and remove the pressure test equipment. Check the coolant level. Replenish as necessary with the correct coolant solution.
Specifications

8 . Check the radiator overflow hose for any obstructions which may block the flow of coolant either to or from the coolant expansion tank.

9 . Conduct the coolant expansion tank pressure cap pressure test in this section.

Coolant Expansion Tank Pressure Cap Pressure Test



WARNING: Never, under any circumstances, remove the coolant expansion tank pressure cap while the engine is operating. To avoid having scalding hot water or steam blow out of the cooling system, use extreme care when removing the coolant expansion tank pressure cap from a hot cooling system. Wait until the engine has cooled, then wrap a thick cloth around the coolant expansion tank pressure cap and turn it slowly until the pressure begins to release, step back while the pressure is released from the system. When certain all the pressure has been released (still with a cloth) turn and remove the coolant expansion tank pressure cap. Failure to follow these instructions may result in damage to the cooling system, engine and/or cause personal injury.

1 . Remove the expansion tank pressure cap from the coolant expansion tank.

2 . Use water to clean cap in area of rubber seal and vacuum relief valve. Following manufacturers instructions, install the coolant expansion tank pressure cap to the pressure tester.

3 . **NOTE:**

If the pressure tester is pressurised too quickly, an erroneous pressure reading may result.

Slowly pressurise the system until the pressure gauge reading stops increasing, and note highest pressure reading obtained.

4 . Release pressure and repeat Step 3 at least twice to make sure the pressure test reading is repeatable and within specification.

5 . If the pressure test gauge readings are not within specification, install a new coolant expansion tank pressure cap.

Thermostat Test

Remove the thermostat

Thermostat - Vehicles Without: Supercharger (26.45.07) Inspect for visible damage, note its opening temperature and immerse it in water. Heat the water until this temperature is reached. The thermostat should begin to open. If it does not begin to open, install a new thermostat.

Thermostat - Vehicles Without: Supercharger (26.45.07) If thermostat begins to open, continue to heat the water until the thermostat fully opens, 5.8 mm (0.2 in) or more off the seat. If it does not fully open, install a new thermostat.

Thermostat - Vehicles Without: Supercharger (26.45.07)

Radiator Leak Test - Removed from the Vehicle



CAUTION: Do not leak test an aluminium radiator in the same water that is used to leak test copper/brass radiators. Flux and caustic cleaners may be present in the test water which will corrode aluminium. If a separate tank is not available, drain and rinse the test tank before testing an aluminium radiator.

Clean the radiator before leak testing to prevent contamination of the test tank. Leak test the radiator in clean water with 138 kPa (20 psi) air pressure.

Coolant Expansion Tank (26.15.01)

Removal



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.



CAUTION: Anti-freeze concentration must be maintained at 50%.



CAUTION: Correct installation of the coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.

1



- **WARNING:** Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

Remove the coolant expansion tank cap.

- 2 . Clamp the relevant hoses, to minimise the coolant loss.

3



- **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

NOTE:

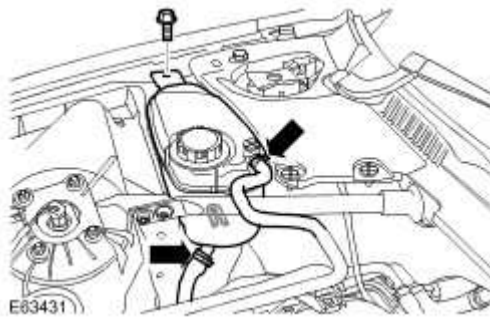
Some fluid spillage is inevitable during this operation.

Disconnect the 2 hoses from the coolant expansion tank.

- ▶ Position a container to collect spillage.
- ▶ Release the clips.

4 . Remove the coolant expansion tank.

- ▶ Remove the bolt.



Installation

1 . Install the coolant expansion tank.

- ▶ Install the bolt and tighten to 7 Nm (5 lb.ft).

2 . Disconnect the 2 hoses from the coolant expansion tank.

- ▶ Remove the container.
- ▶ Position and secure the clips.

3 . Remove the coolant hose clamps.

4 . Top-up the coolant.

5



- **CAUTION: Correct installation of the coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.**

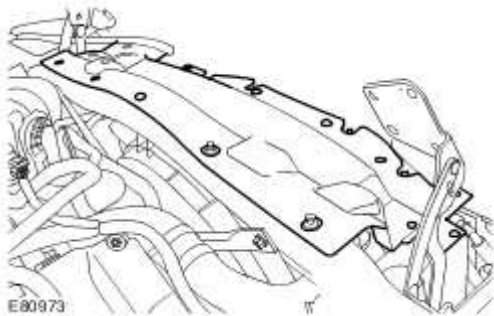
Install the coolant expansion tank cap.

Cooling Fan Motor and Shroud - Vehicles With: Supercharger (26.25.25)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Raise and support the vehicle.
- 3 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator
- 4 . Remove the hood.
For additional information, refer to Hood (76.16.01)
- 5 . Remove the fan cowl.

▶ Remove the 15 clips.



- 6 . Release the power steering fluid reservoir.

▶ Remove the 2 bolts.

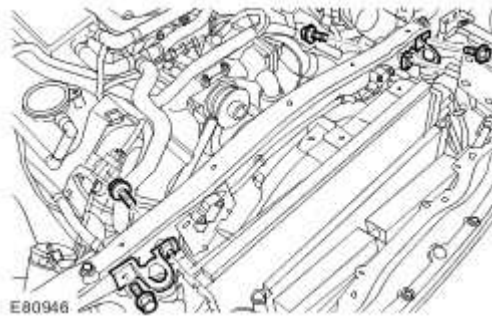


7 . Disconnect the 2 front impact sensor electrical connectors.



8 . Remove the radiator upper mountings.

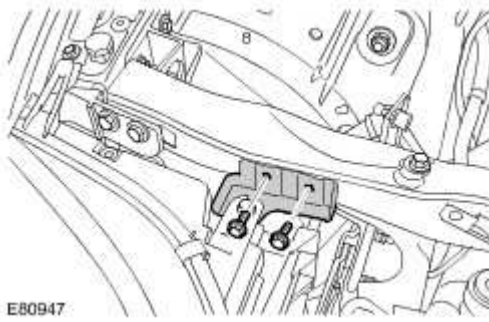
▶ Remove the 4 bolts.



9 . Release the headlamp to front crossmember bracket.

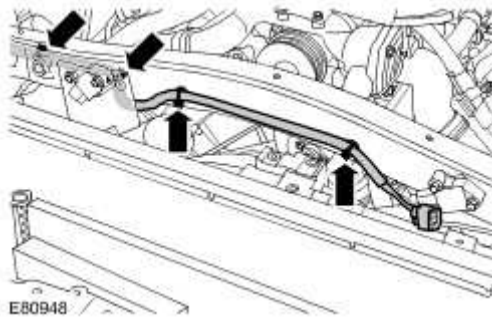
▶ Remove the 2 bolts.

▶ Repeat the above procedure for the other side.



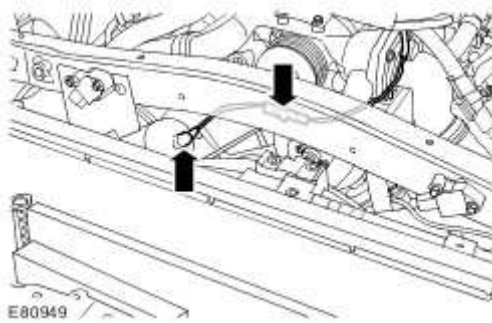
10 . Release the wiring harness.

▶ Release the 4 clips.



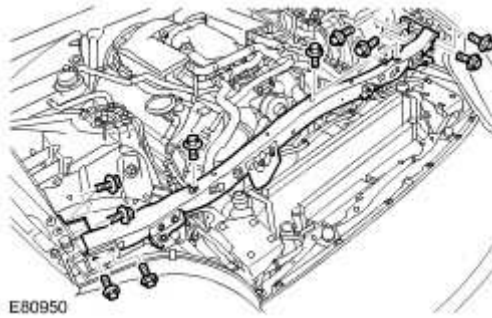
11 . Disconnect the secondary air injection (AIR) reservoir vacuum line.

▶ Release the clip.



12 . Remove the front crossmember.

▶ Remove the 10 bolts.



13 Drain the coolant.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

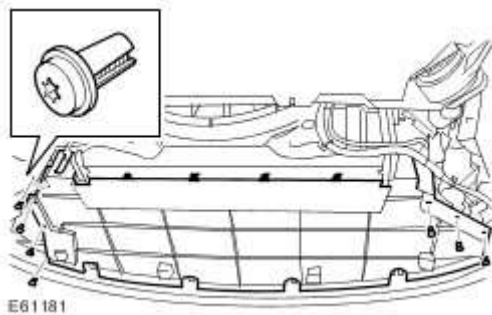
14 . Remove the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

15 . Remove the front bumper air ducting.

▶ Remove the 7 clips.

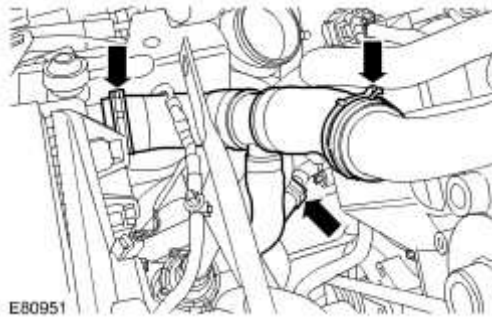
▶ Release the 4 clips.



16 . Remove the radiator top hose.

▶ Release the 2 clips.

▶ Disconnect the quick release connector.



17 . Release the auxiliary coolant pump.

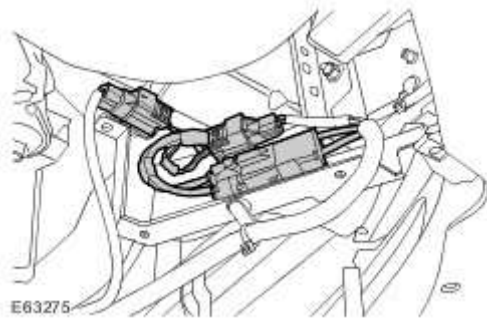
▶ Disconnect the electrical connector.

▶ Release from the rubber mounting.



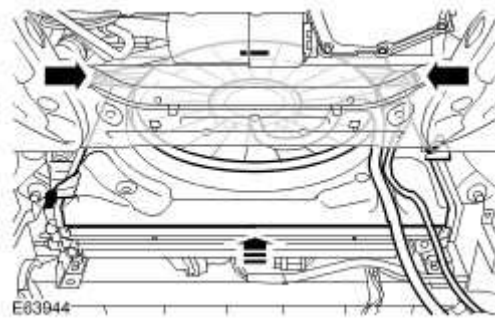
18 . Release the cooling fan motor and shroud.

▶ Disconnect the electrical connectors.



19 . Remove the cooling fan motor and shroud.

- ▶ Remove the 2 bolts.
- ▶ Release from the 3 retainers.



Installation

1 . Install the cooling fan motor and shroud.

- ▶ Secure in the retainers.
- ▶ Tighten the bolts.

2 . Secure the cooling fan motor and shroud.

- ▶ Connect the electrical connectors.

3 . Install the auxiliary coolant pump.

- ▶ Secure in the rubber mounting.
- ▶ Connect the electrical connector.

4 . Install the front bumper air ducting.

- ▶ Secure with the clips.

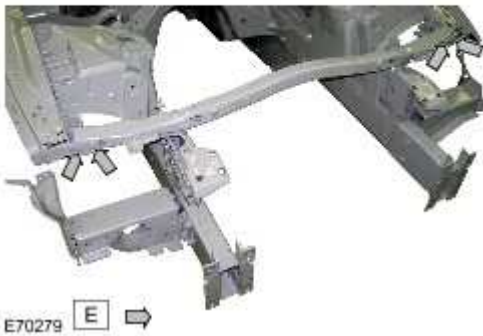
5 . Install the radiator top hose.

- ▶ Connect the quick release connector.
- ▶ Secure with the clips.

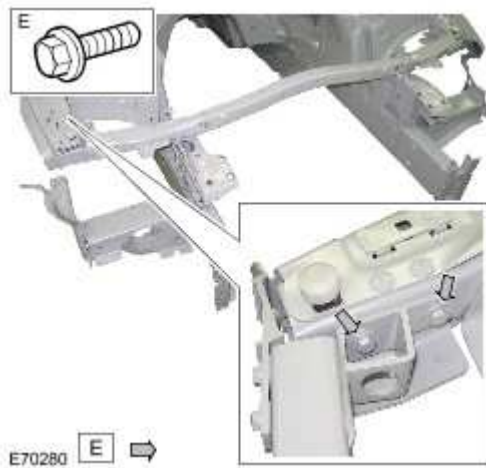
6 . Install the front crossmember.

- ▶ Install the bolts, but do not tighten fully at this stage.

7 . Tighten the front crossmember to apron panel front extension bolts to 20 Nm (15 lb.ft).



8 . Tighten the front crossmember to fender apron panel reinforcement bolts to 30 Nm (22 lb.ft).



9 . Tighten the front crossmember to front side member extension bolts to 25 Nm (18 lb.ft).



10 . Secure the headlamps.

▶ Tighten the bolts to 10 Nm (7 lb.ft).



11 . Connect the AIR reservoir vacuum line.

12 . Install the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

13 . Attach the wiring harness.

▶ Secure the clips.

14 . Install the radiator upper mountings.

▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).

15 . Connect the 2 front impact sensor electrical connectors.

16 . Secure the power steering fluid reservoir.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

17 . Install the fan cowl.

 Secure with the clips.

18 . Install the hood.

For additional information, refer to Hood (76.16.01)

19 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

20 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

21 Top-up and bleed the coolant.

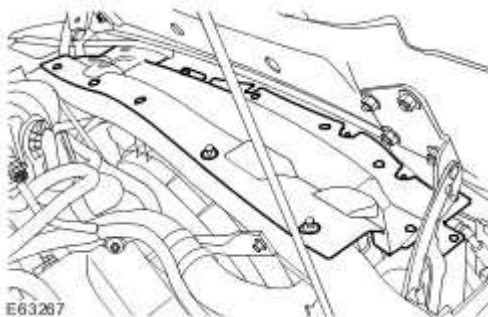
- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

Radiator - Vehicles Without: Supercharger (26.40.01)

Removal

- 1 . Raise and support the vehicle.
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 3 . Remove the fan cowl.

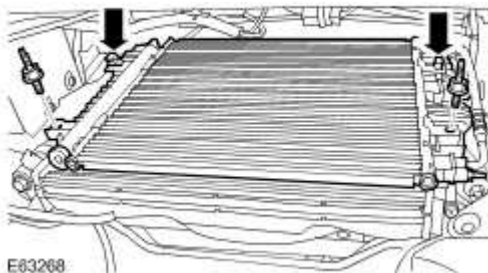
▶ Remove the 15 clips.



- 4 . Release the A/C condenser.

▶ Remove the 2 bolts.

▶ Release from the 2 retainers and tie aside.



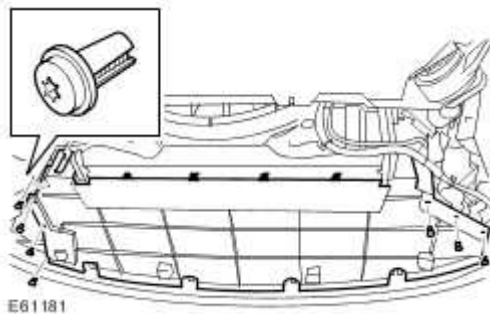
5 . Remove the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

6 . Remove the front bumper air ducting.

▶ Remove the 7 clips.

▶ Release the 4 clips.



7



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

8 . Remove the air intake duct.

▶ Release the breather hose.

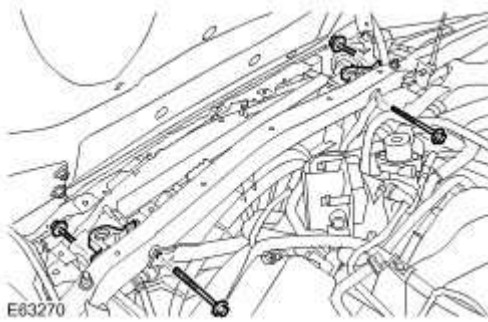
▶ Release the 2 clips.

▶ Remove the bolt.



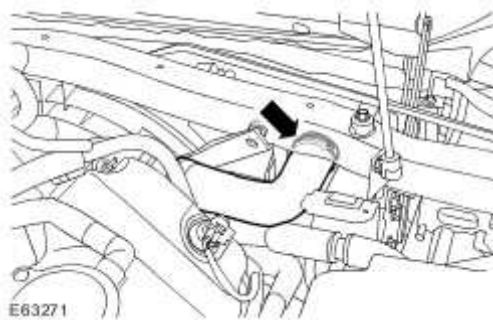
9 . Remove the radiator upper mountings.

▶ Remove the 4 bolts.



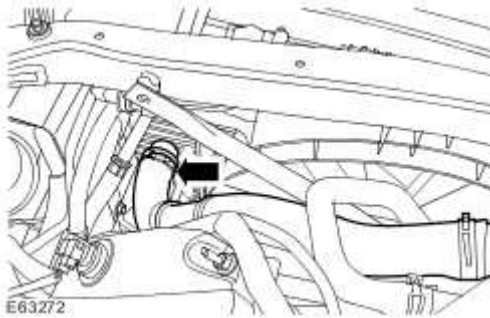
10 . Disconnect the radiator upper hose.

▶ Release the clip.



11 . Disconnect the radiator lower hose.

- ▶ Release the clip.



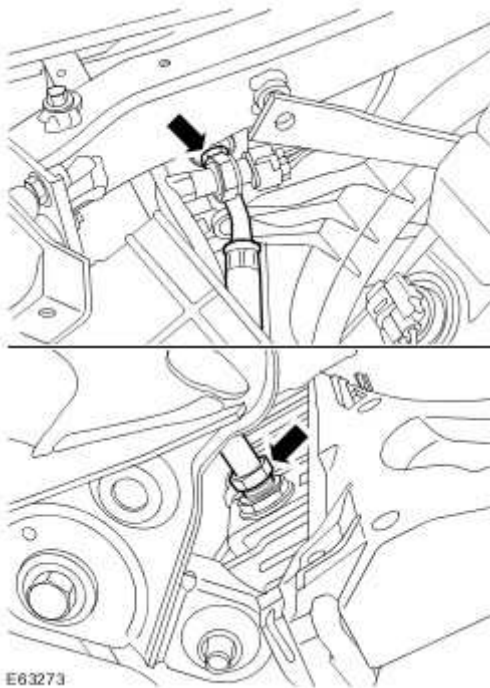
12.



CAUTION: Always plug any open connections to prevent contamination.

Disconnect the transmission cooler hoses.

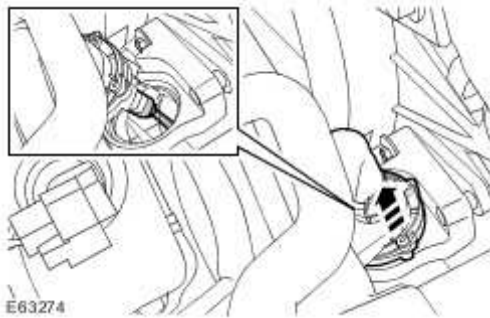
- ▶ Position a container to collect the fluid.
- ▶ Disconnect the 2 unions.
- ▶ Remove and discard both O-ring seals.



13 . Release the auxiliary coolant pump.

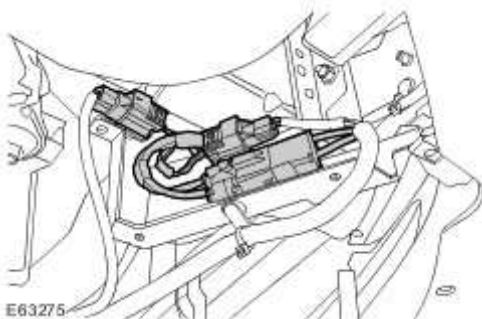
▶ Disconnect the electrical connector.

▶ Release from the rubber mounting.



14 . Release the radiator assembly.

▶ Disconnect the electrical connectors.



15 . **NOTE:**

Do not disassemble further if the component is removed for access only.

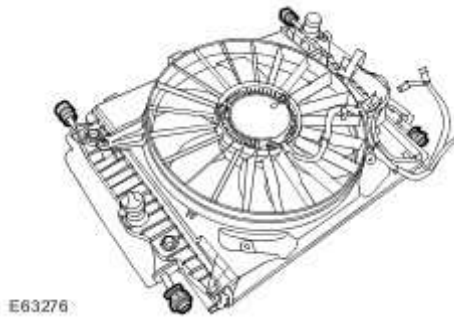
NOTE:

The radiator is removed from beneath the vehicle.

Remove the radiator assembly.

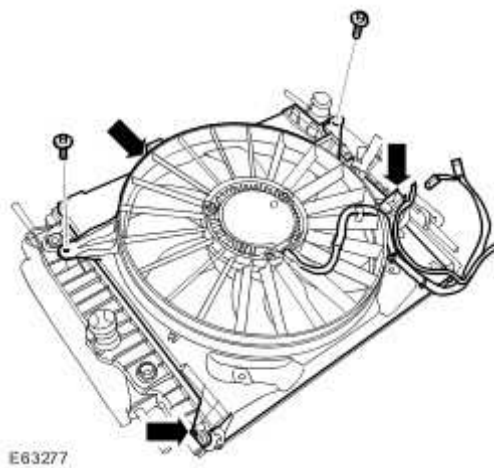
- ▶ Protect the elements from damage.
- ▶ Lift the radiator clear of its mountings.

16 . Remove the radiator rubber mountings



17 . Remove the cooling fan.

- ▶ Remove the 2 bolts.
- ▶ Release from the 3 retainers.



Installation

1 . Install the cooling fan.

- ▶ Secure in the retainers.

- ▶ Tighten the bolts.

2 . Install the radiator rubber mountings

3 . Install the radiator assembly.

- ▶ Protect the elements from damage.

- ▶ Lift the radiator onto its mountings.

4 . Secure the radiator assembly.

- ▶ Connect the electrical connectors.

5 . Install the auxiliary coolant pump.

- ▶ Secure in the rubber mounting.

- ▶ Connect the electrical connector.

6 . Connect the transmission cooler hoses.

- ▶ Install new O-ring seals.

- ▶ Tighten the unions to 20 Nm (15 lb.ft).

7 . Connect the radiator lower hose.

- ▶ Secure with the clip.

8 . Connect the radiator upper hose.

▶ Secure with the clip.

9 . Install the radiator upper mountings.

▶ Tighten the Torx bolts to 23 Nm (17 lb.ft).

10 . Install the air intake duct.

▶ Secure with the clips.

▶ Connect the breather hose.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

11 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

12 . Install the front bumper air ducting.

▶ Secure with the clips.

13 . Install the radiator splash shield.


For additional information, refer to Radiator Splash Shield (76.22.90)

14 . Secure the A/C condenser.

▶ Secure in the retainers.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

15 . Install the fan cowl.

 Secure with the clips.

16 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

17 . Check and top-up the transmission fluid level.
For additional information, refer to Transmission Fluid Level Check

Radiator - Vehicles With: Supercharger (26.40.01)

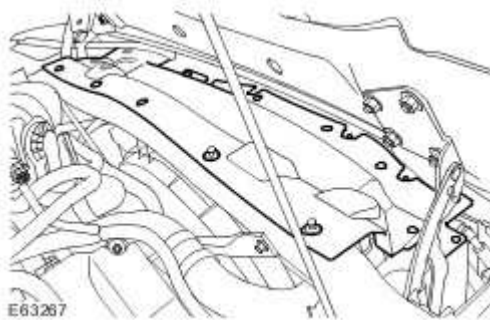
Removal

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

3 . Remove the fan cowl.

▶ Remove the 15 clips.

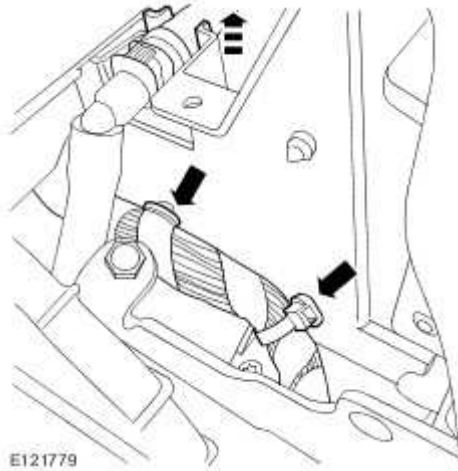


4 . Release the trim panel.

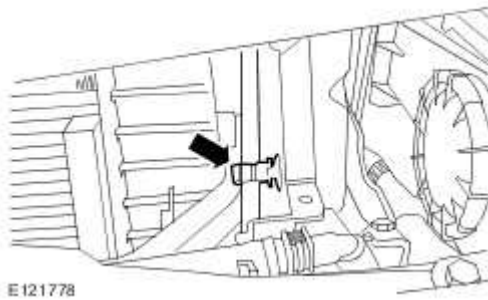
▶ Release the LH headlamp washer hose.

▶ Release the 2 wiring harness retaining clips.

▶ Remove the scrivet.



5 . Release the clip.



6 . Raise and support the vehicle.

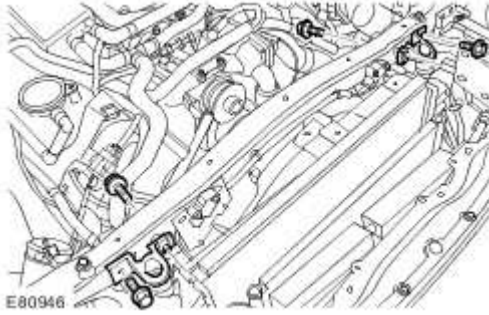
7 . Remove the air conditioning (A/C) condenser.

For additional information, refer to Condenser Core - 4.2L SC V8 - AJV8 (82.15.07)

8 . Lower the vehicle.

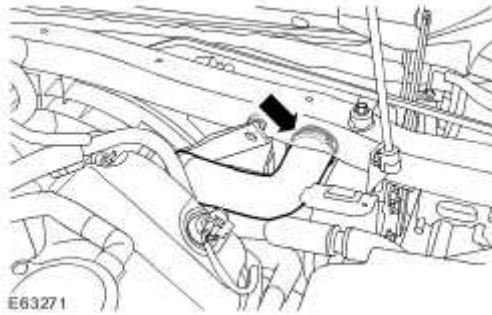
9 . Remove the radiator upper mountings.

▶ Remove the 4 bolts.



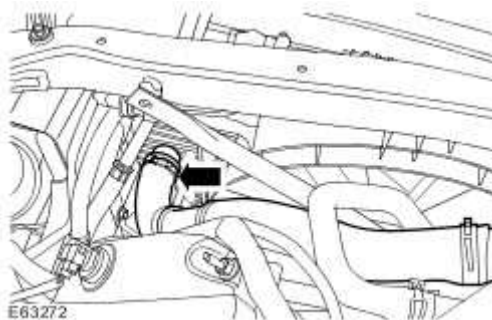
10 . Disconnect the radiator upper hose.

▶ Release the clip.



11 . Disconnect the radiator lower hose.

▶ Release the clip.



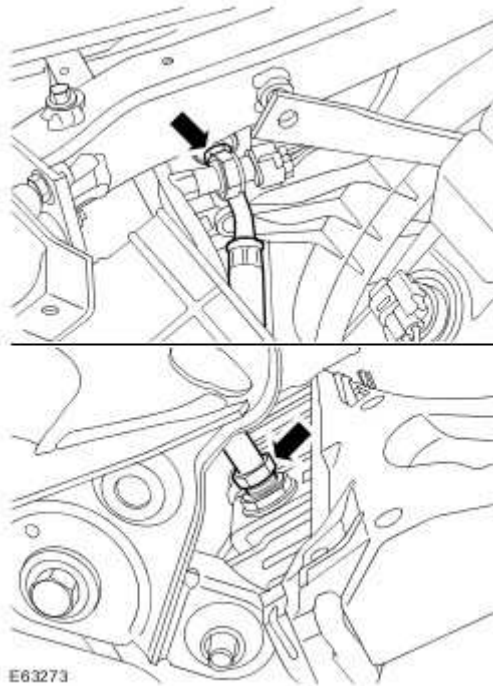
12 .



CAUTION: Always plug any open connections to prevent contamination.

Disconnect the 2 transmission cooler lines.

- ▶ Position a container to collect the fluid.
- ▶ Disconnect the 2 unions.
- ▶ Remove and discard both O-ring seals.



13 . Release the auxiliary coolant pump.

- ▶ Disconnect the electrical connector.
- ▶ Release from the rubber mounting.

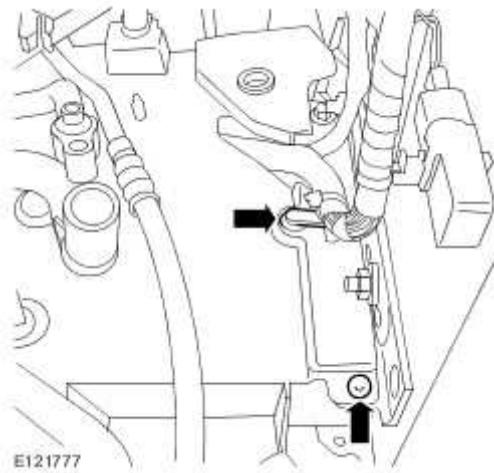


14 . Raise the vehicle.

15 . Remove the trim panel.

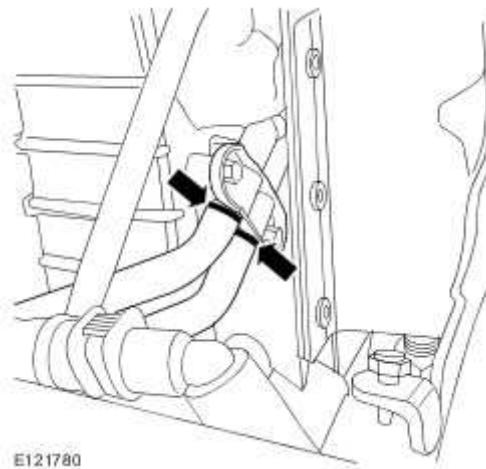
▶ Remove the scrivet.

▶ Release the wiring harness fir tree clip.



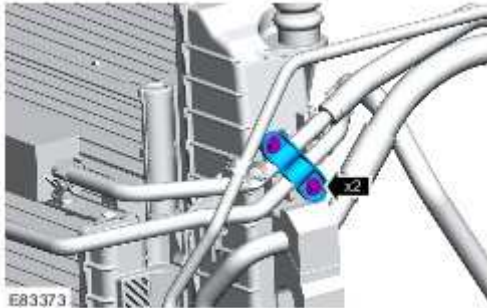
16 . Lower the vehicle.

17 . Mark the position of the power steering fluid cooler pipes.



18 . Release the power steering fluid cooler.

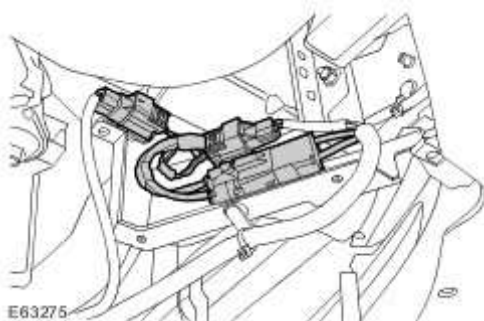
▶ Remove the 2 bolts.



19 . Raise the vehicle.

20 . Release the radiator assembly.

▶ Disconnect the 3 electrical connectors.



21 . **NOTE:**

The radiator is removed from beneath the vehicle.

Remove the radiator assembly.

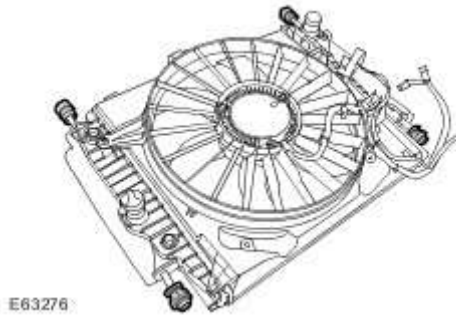
▶ Protect the elements from damage.

▶ Lift the radiator clear of its mountings.

22 . **NOTE:**

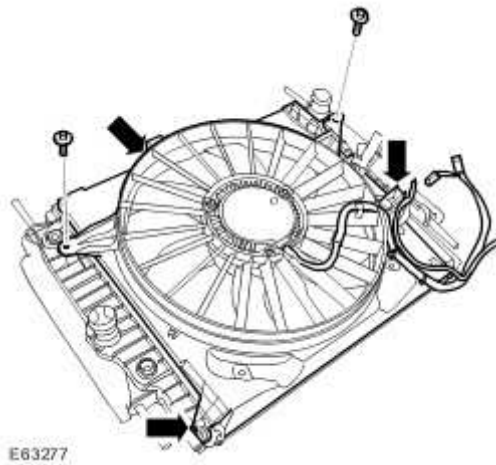
Do not disassemble further if the component is removed for access only.

Remove the radiator rubber mountings



23 . Remove the cooling fan.

- ▶ Remove the 2 bolts.
- ▶ Release from the 3 retainers.



Installation

- 1 . Install the cooling fan.

- ▶ Secure in the retainers.

- ▶ Tighten the bolts.

2 . Install the radiator rubber mountings

3 . Install the radiator assembly.

- ▶ Protect the elements from damage.

- ▶ Lift the radiator onto its mountings.

- ▶ Connect the electrical connectors.

4 . Lower the vehicle.

5 Attach the power steering fluid cooler.

- ▶ Align the power steering fluid cooler pipes clamp to the marks made previously.

- ▶ Tighten the bolts to 7 Nm (5 lb.ft).

6 . Install the auxiliary coolant pump.


- ▶ Secure in the rubber mounting.

- ▶ Connect the electrical connector.


7 . Connect the transmission cooler lines.

- ▶ Clean the components.


- ▶ Install new O-ring seals.

 Tighten the unions to 20 Nm (15 lb.ft).


8 . Connect the radiator lower hose.

 Secure with the clip.

9 . Connect the radiator upper hose.


 Secure with the clip.


10 . Install the radiator upper mountings.

 Tighten the Torx bolts to 23 Nm (17 lb.ft).

11 . Raise the vehicle.

12 . Install the trim panel.

 Install the scrivet.


 Secure the wiring harness.


13 . Install the A/C condenser.


For additional information, refer to Condenser Core - 4.2L SC V8 - AJV8 (82.15.07)

14 . Lower the vehicle.


15 . Secure the trim panel.

 Install the scrivet.

 Secure the 2 wiring harness clips.

 Secure the LH headlamp washer hose.

16 . Install the fan cowl.

 Secure with the clips.

17 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

18 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

19 . Check and top-up the transmission fluid level.

For additional information, refer to Transmission Fluid Level Check

Thermostat - Vehicles With: Supercharger (26.45.07)

Removal

1 . Remove the cover and disconnect the battery ground cable.

2



· **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

3 Drain the coolant.

· For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

4 . Disconnect the thermostat housing coolant hose.

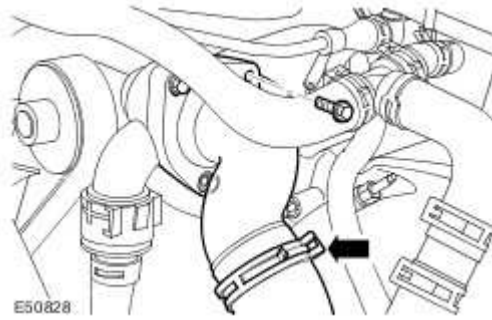
▶ Position an absorbent cloth to collect fluid spillage.

▶ Release the clip.

5 . Remove the thermostat housing.

▶ Remove the 3 bolts.

▶ Remove and discard the O-ring seal.




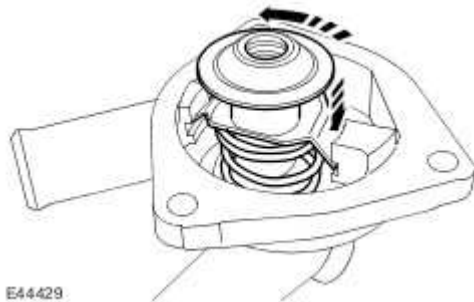
6.  **WARNING: Eye protection must be worn.**

NOTE:

Do not disassemble further if the component is removed for access only.


Release and remove the thermostat.

-  Position the thermostat housing in a vice.



Installation

- 1 . Install the thermostat.

-  Clean the components.

- 2 . Install the thermostat housing.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

3 . Connect the thermostat housing coolant hose.

- ▶ Secure with the clip.

4 . Connect the battery ground cable and install the cover.

5 Top-up and bleed the coolant.

- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

6 **NOTE:**

- . For NAS vehicles only.

If required, carry out a long drive cycle.

For additional information, refer to Powertrain Control Module (PCM) Long Drive Cycle Self-Test

Thermostat - Vehicles Without: Supercharger (26.45.07)


Removal



CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.



CAUTION: Anti-freeze concentration must be maintained at 50%.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)
- 3 .  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

Drain the cooling system.

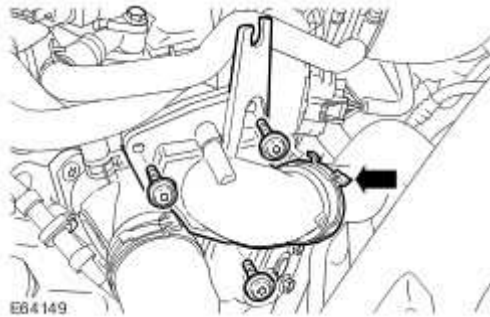
For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8
- AJV8

- 4 . Disconnect the thermostat housing coolant hose.

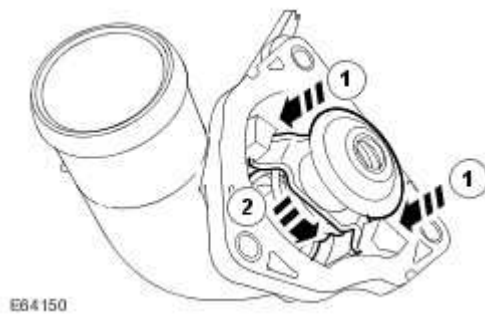
 Release the clip.

- 5 . Remove the thermostat housing.

- ▶ Remove the 3 Torx screws.
- ▶ Remove and discard the O-ring seal.




6 . Release and remove the thermostat.



Installation

- 1 . Install the thermostat.
- 2 . Install the thermostat housing.
 - ▶ Clean the component mating faces.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx screws to 4 Nm (3 lb.ft).
- 3 . Connect the thermostat housing coolant hose.

 Secure with the clip.

4 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

5 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

6 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

7 **NOTE:**

.

For NAS vehicles only.

If required, carry out a long drive cycle.

For additional information, refer to Powertrain Control Module (PCM) Long Drive Cycle Self-Test

Thermostat Housing - Vehicles Without Supercharger

Removal



CAUTION: Anti-freeze concentration must be maintained at 50%.



CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to Specifications

2



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

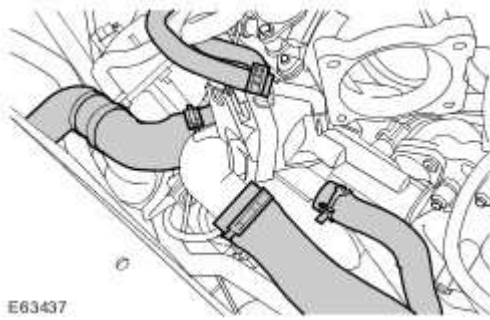
Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

- 3 . Remove the throttle body.

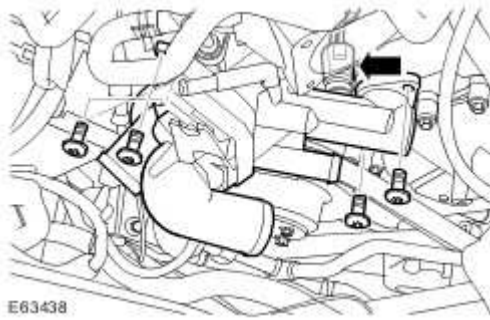
For additional information, refer to Throttle Body (19.70.04)

- 4 . Release the clips and disconnect the 5 coolant hoses.



5 . Remove the thermostat housing.

- ▶ Remove the 4 Torx bolts.
- ▶ Disconnect the ECT sensor electrical connector.

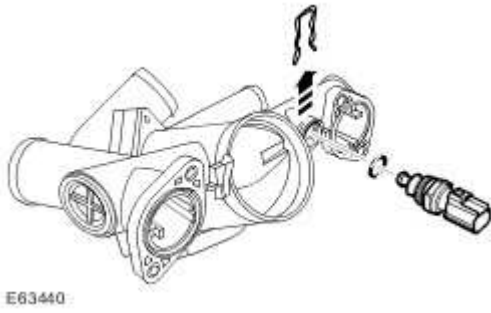


6 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the ECT sensor.

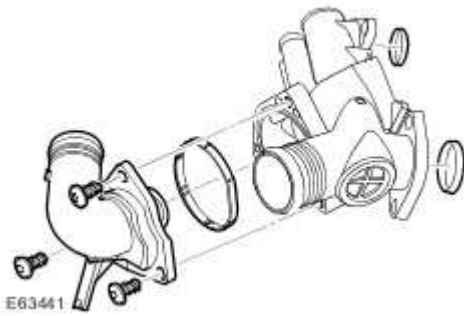
- ▶ Remove the retaining clip.



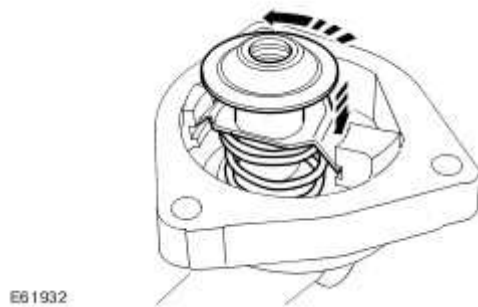
7 . Remove the thermostat.

▶ Remove the 3 screws.

8 . Remove and discard the 3 O-ring seals.



9 . Release and remove the thermostat.




Installation

1 . Install the O-ring seals.


2 . Install the thermostat.


 Tighten the Torx screws to 4 Nm (3 lb.ft).

3 . Install the ECT sensor.

 Install the retaining clip.

4 . Install the thermostat housing.

 Connect and secure the electrical connector.

 Install the bolts and tighten to 10 Nm (7 lb.ft).

 Connect and secure the coolant hoses.

5 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)

6 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8
- AJV8

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications


Coolant Manifold - Vehicles With: Supercharger

Removal




CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

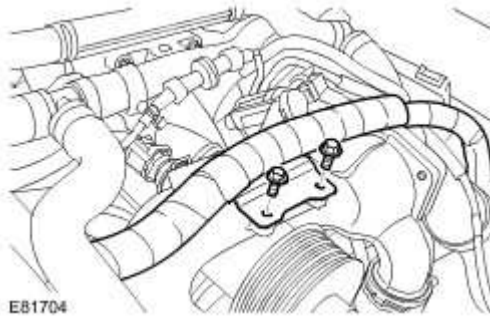
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 Drain the cooling system.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8
- 4 . Remove the supercharger belt.
For additional information, refer to Supercharger Belt (18.50.08)
- 5 . Release the engine wiring harness.

 Remove the 2 bolts.



6 . Disconnect the coolant manifold to radiator hose.

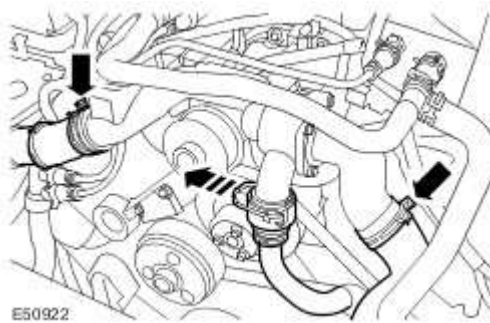
▶ Remove the clip.

7 . Disconnect the thermostat housing to radiator hose.

▶ Release the clip.

8 . Disconnect the coolant manifold to coolant reservoir hose.

▶ Release the clip.



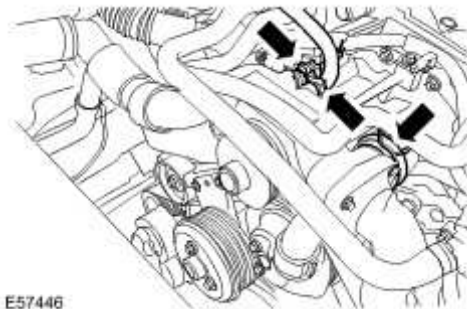
9 . Disconnect the coolant manifold bleed hose.

▶ Release the clip.

10 . Disconnect the engine coolant temperature (ECT) sensor electrical connector.

11 . Disconnect the cylinder block coolant hose.

▶ Release the clip.



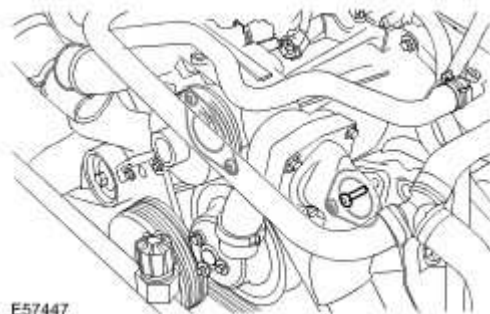
12



CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Release the coolant manifold.

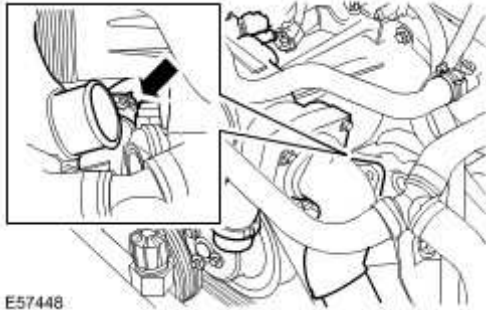
- ▶ Remove the 4 Torx screws.
- ▶ Position the wiring harness bracket aside.
- ▶ Remove and discard the 2 O-ring seals.



13 . Disconnect the coolant manifold rear hose.

▶ Rotate the coolant manifold.

▶ Release the clip.



14 . Remove the coolant manifold.

15 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the ECT sensor.

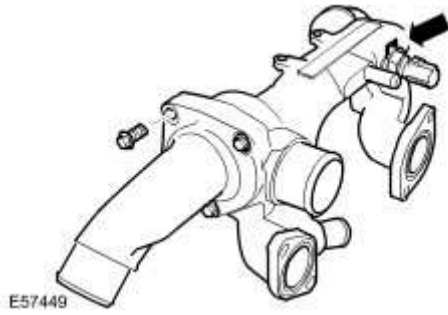
▶ Remove the clip.

▶ Remove and discard the O-ring seal.

16 . Remove the thermostat housing.

▶ Remove the 3 bolts.

▶ Discard the O-ring seal.



Installation

1 . Install the thermostat housing.


- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

2 . Install the ECT sensor.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Secure with the clip.

3 . Install the coolant manifold.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Connect the rear hose and secure with the clip.
- ▶ Connect the cylinder block hose and secure with the clip.
- ▶ Attach the wiring harness bracket.


 Tighten the Torx screws to 10 Nm (7 lb.ft).

4 . Connect the remaining coolant hoses.

 Secure with the clips.

5 . Connect the ECT sensor electrical connector.

6 . Attach the engine wiring harness.

 Tighten the bolts to 6 Nm (4 lb.ft).

7 . Install the supercharger belt.

For additional information, refer to Engine Cover (76.11.35)

8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications


9 Refill and bleed the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8
- AJV8

Coolant Pump - Vehicles Without: Supercharger

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.**

Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8
- AJV8


- 3 . Remove the thermostat housing.
For additional information, refer to Thermostat Housing - Vehicles Without: Supercharger

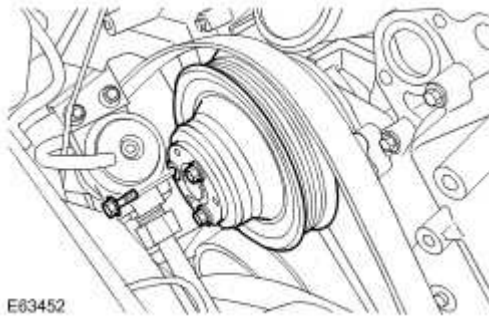
- 4 . Loosen the 3 coolant pump pulley bolts.

- 5 . Release the accessory drive belt.

 Release the tension from the belt.

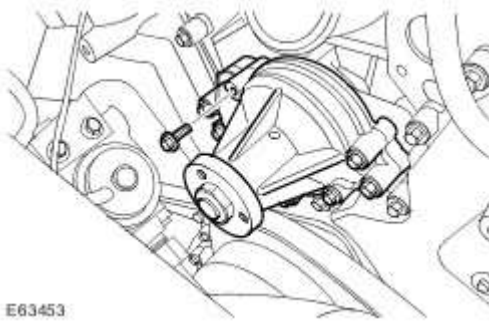
- 6 . Remove the coolant pump drive pulley.

 Remove the 3 bolts.



7 . Remove the coolant pump.

- ▶ Remove the 5 bolts.
- ▶ Discard the gasket.



Installation

1 . Install the coolant pump.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Tighten the 5 bolts to 8 Nm (6 lb.ft), then a further 90 degrees.

2 . Install the coolant pump drive pulley.

- ▶ Install, and lightly tighten the bolts.

3 . Install the accessory drive belt.

4 . Tighten the pulley bolts to 10 Nm (7 lb.ft), then a further 45 degrees.

5 . Install the thermostat housing.

For additional information, refer to Thermostat Housing - Vehicles Without: Supercharger

6 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8
- AJV8


7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications


Coolant Pump - Vehicles With: Supercharger

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

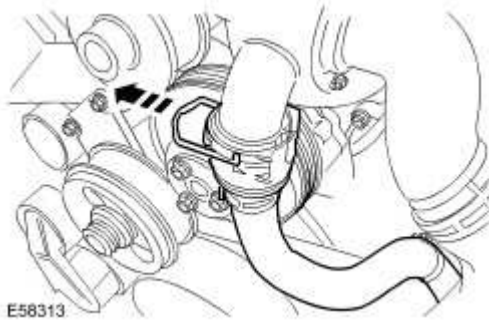
- 3  **WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.**

Drain the cooling system.

For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

- 4 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)
- 5 . Disconnect the coolant manifold to coolant reservoir hose.

 Release the clip.

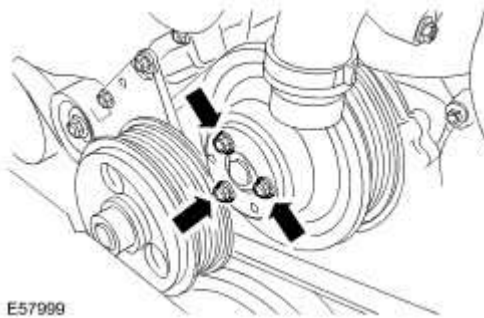


6 . **NOTE:**

Restrain the pulley to aid the removal of the bolts.

Remove the coolant pump pulley.

▶ Remove and discard the 3 bolts.



7



CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

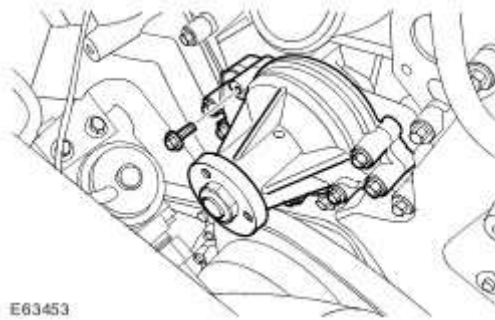
NOTE:

Some fluid spillage is inevitable during this operation.

Remove the coolant pump.

▶ Remove the 5 bolts.

- ▶ Discard the gasket.



Installation

1 . Install the coolant pump.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Stage 1: Tighten the bolts to 8 Nm (6 lb.ft).
- ▶ Stage 2: Tighten a further 90 degrees.

2 . Install the coolant pump pulley.

- ▶ Stage 1: Tighten the bolts to 10 Nm (7 lb.ft).
- ▶ Stage 2: Tighten a further 45 degrees.

3 . Connect and secure the coolant hose.

- ▶ Clean the component mating faces.

4 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)

5 Refill the cooling system.

- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

6 . Connect the battery ground cable and install the cover.


For additional information, refer to Specifications

303-03B : Supercharged Cooling – 4.2L NA V8 – AJV8/4.2L SC V8 – AJV8

Removal and installation

Coolant Pump


Removal

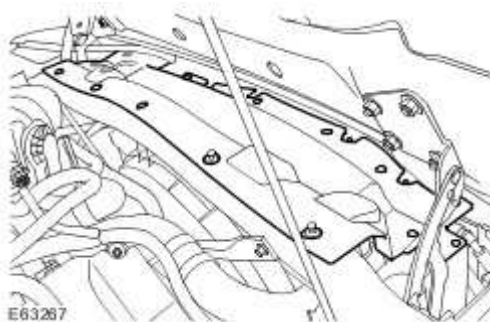
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Drain the coolant.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

- 3 . Remove the fan cowl.

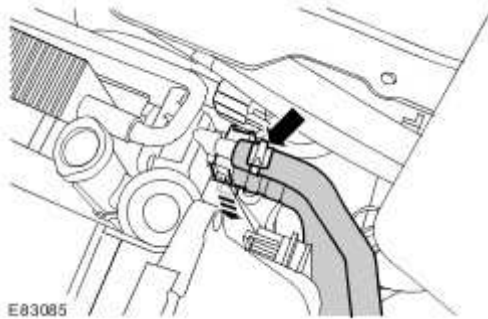
 Remove the 15 clips.



- 4 . Disconnect the 2 coolant hoses.

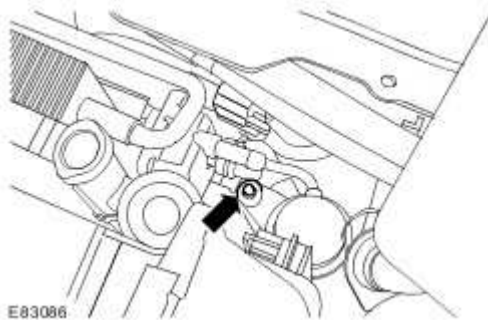
▶ Release the clip.

▶ Disconnect the quick release connector.



5 . Release the coolant pump.

▶ Remove the bolt.



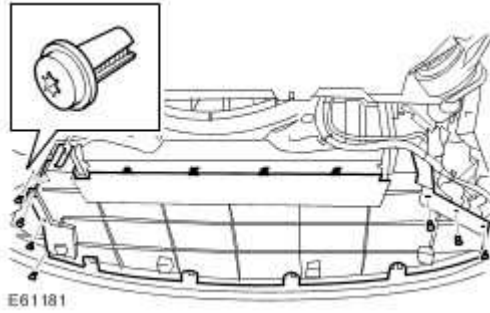
6 . Remove the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

7 . Remove the front bumper air ducting.

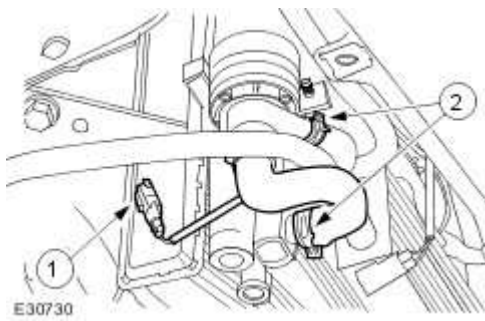
▶ Remove the 7 clips.

▶ Release the 4 clips.



8 . Remove the coolant pump.

- ▶ Disconnect the electrical connector.
- ▶ Release the clips and disconnect the 2 coolant hoses.



Installation

1 . Install the coolant pump.

- ▶ Clean the components.
- ▶ Connect the coolant hoses and secure with the clips.
- ▶ Connect the electrical connector.


2 . Install the front bumper air ducting.

- ▶ Secure with the clips.


3 . Install the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)


4 . Secure the coolant pump.

 Tighten the bolt to 5 Nm (4 lb.ft).

5 . Connect the coolant hoses.

 Secure with the clips.

6 . Install the fan cowl.

 Secure with the clips.

7 Refill and bleed the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

8 **NOTE:**


. For NAS vehicles only.

If required, carry out a long drive cycle.

For additional information, refer to Powertrain Control Module (PCM) Long Drive Cycle Self-Test


Radiator

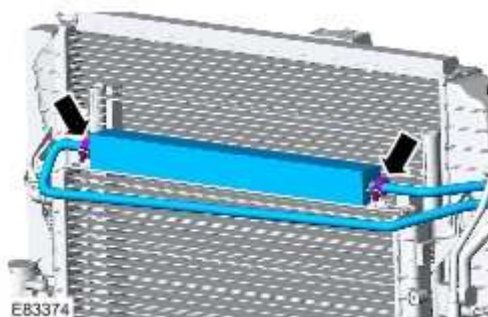
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 Drain the coolant.
 - . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8
- 3 . Vehicles with single oil cooler: Remove the oil cooler.
 - For additional information, refer to Oil Cooler (12.60.68)
- 4 . Vehicles with twin oil coolers: Remove the twin oil coolers.
 - For additional information, refer to Twin Oil Coolers
- 5 . Release the power steering fluid cooler.

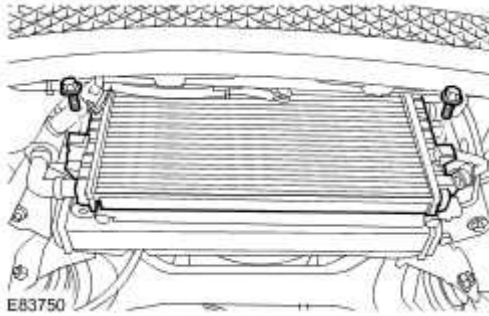
 Release the 2 clips.



6.  **CAUTION: Protect the surrounding components.**

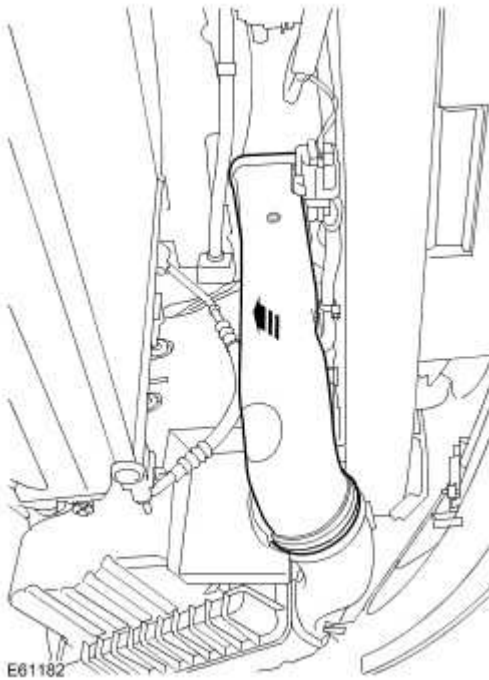
Release the supercharger radiator.

- ▶ Remove the 2 bolts.
- ▶ Tie the A/C condenser aside.



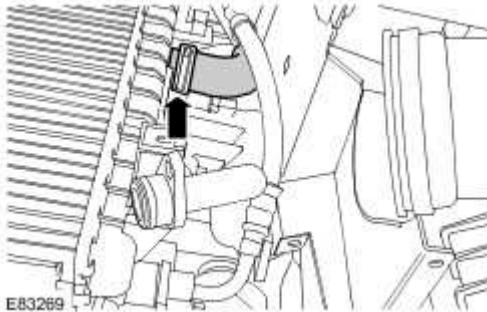
- 7 . Remove the intake air duct.

- ▶ Release the clip.



8 . LH side: Disconnect the supercharger radiator hose.

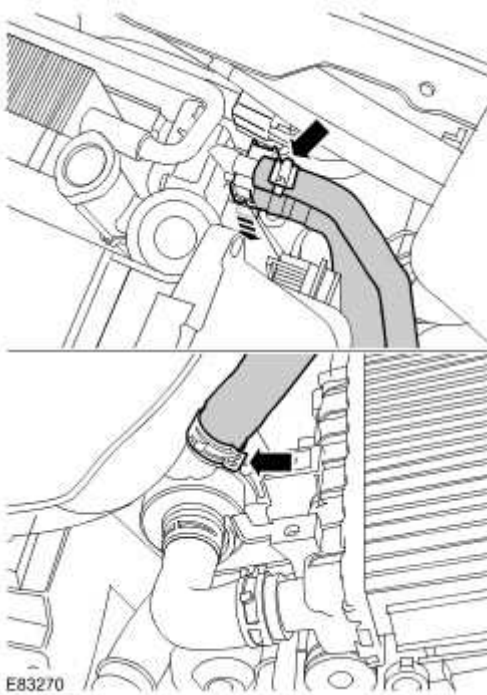
▶ Release the clip.



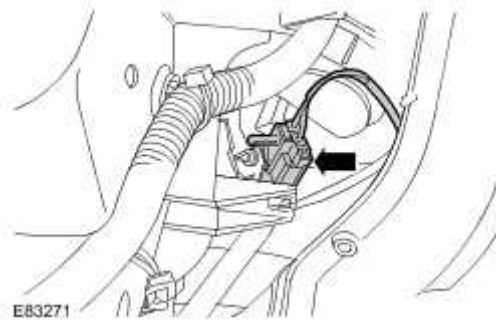
9 . RH side: Disconnect the 3 supercharger radiator hoses.

▶ Release the 2 clips.

▶ Disconnect the quick release connector.



10 . Disconnect the coolant pump electrical connector.



11 . Remove the supercharger radiator.

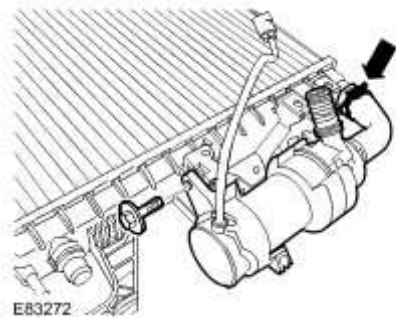
12 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the coolant pump.

▶ Release the clip and disconnect the hose.

▶ Remove the bolt.



Installation

1 . Install the coolant pump.

▶ Connect the hose and secure with the clip.

▶ Tighten the bolt to 5 Nm (4 lb.ft).

2 . Install the supercharger radiator.

- ▶ Connect the electrical connector.
- ▶ Connect the hoses and secure with the clips.

3 . Install the intake air duct.

- ▶ Secure the clip.

4 . Secure the supercharger radiator and A/C condenser.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

5 . Attach the power steering fluid cooler.

- ▶ Secure with the clips.

6 . Vehicles with twin oil coolers: Install the twin oil coolers.

For additional information, refer to Twin Oil Coolers

7 . Vehicles with single oil cooler: Install the oil cooler.

For additional information, refer to Oil Cooler (12.60.68)

8 Top-up and bleed the coolant.

- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

303-04A : Fuel charging and controls – 4.2L SC V8 – AJV8

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Fuel rail bolts (NA models)	10	7	88
Fuel rail bolts (SC models)	21	15	-
Fuel rail pressure sensor	5	4	44
Fuel temperature sensor	7	5	62
Throttle body bolts	10	7	88

Fuel Charging and Controls

No Data Available

Fuel Injection Supply Manifold (19.60.13)


Special Service Tools




Fuel spring lock decoupling tool
310-D005


Removal

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2.  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

3.  **WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**

 **WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.**



WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Using the special tool, disconnect the fuel line.

For additional information, refer to Spring Lock Couplings

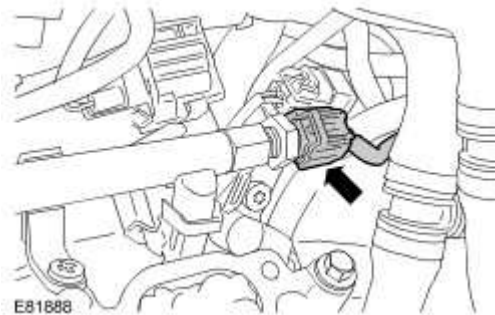
4 . Remove the LH charge air cooler.

For additional information, refer to Charge Air Cooler LH (18.50.19)


5 . Remove the RH charge air cooler.

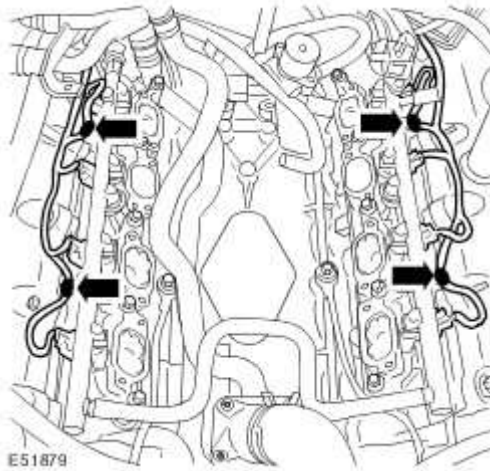
For additional information, refer to Charge Air Cooler RH (18.50.18)

6 . Disconnect the fuel temperature sensor electrical connector.



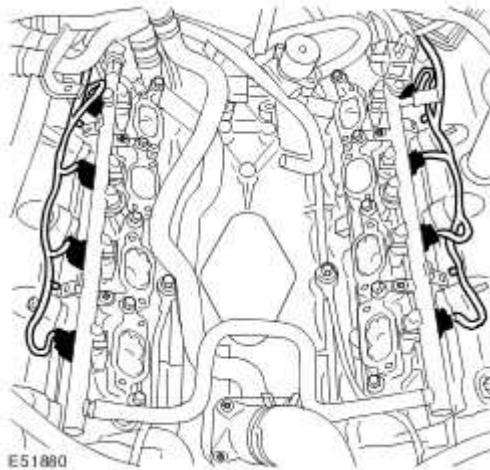
7 . Release the fuel injector wiring harness.

 Release the 4 clips.



8 . Disconnect the fuel injector electrical connectors.

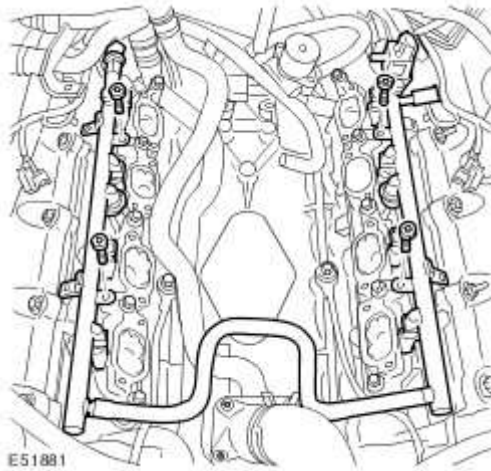
▶ Release the 8 clips.



9 . Remove the fuel injection supply manifold.

▶ Remove the 4 Torx screws.

▶ Remove and discard the fuel injector O-ring seals.

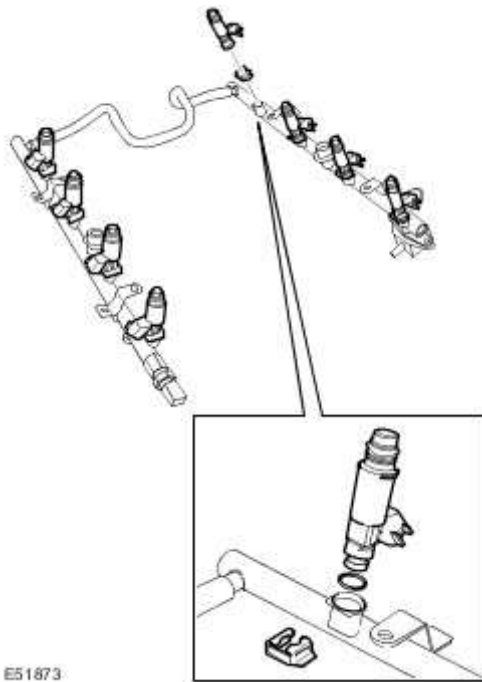


10 . **NOTE:**

Do not disassemble further if the component is removed for access only.

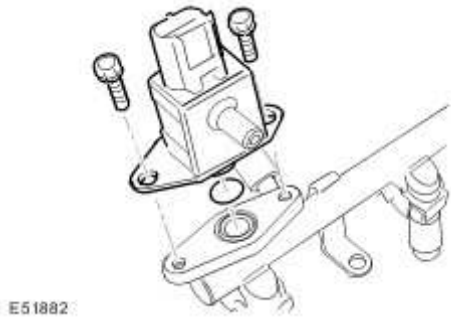
Release and remove the fuel injectors.

- ▶ Remove the 8 clips.
- ▶ Discard the O-ring seals.



11 . Remove the fuel pressure sensor.

- ▶ Remove the 2 bolts.
- ▶ Discard the O-ring seals.

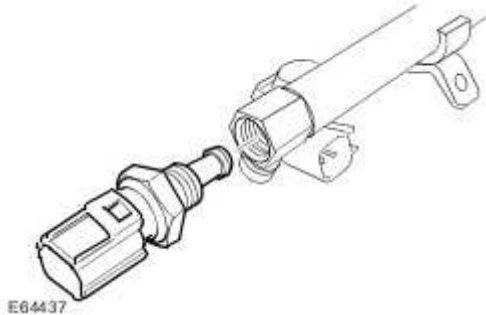


12



CAUTION: To prevent damage to components, use an additional wrench when loosening or tightening unions.

Remove the fuel temperature sensor.



Installation

1 . Install the fuel temperature sensor.

- ▶ Clean the component mating faces.
- ▶ Apply sealant to the sensor thread.
- ▶ Tighten the sensor to 7 Nm (5 lb.ft).

2 . Install the fuel pressure sensor.

- ▶ Clean the component mating faces.
- ▶ Install new O-ring seals.
- ▶ Tighten the bolts to 6 Nm (4 lb.ft).

3 . Install the fuel injectors.

- ▶ Clean the component mating faces.
- ▶ Install new O-ring seals.
- ▶ Secure with the clips.

4 . Install the fuel injection supply manifold.

- ▶ Clean the component mating faces.
- ▶ Install new O-ring seals.
- ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).

5 . Attach the fuel injector wiring harness.

- ▶ Secure the clips.
- ▶ Connect the electrical connectors.

6 . Connect the fuel temperature sensor electrical connector.

7 . Install the RH charge air cooler.

For additional information, refer to Charge Air Cooler RH (18.50.18)

8 . Install the LH charge air cooler.

For additional information, refer to Charge Air Cooler LH (18.50.19)

9 . Connect the fuel line to the fuel rail.

For additional information, refer to Spring Lock Couplings

10 . Connect the battery ground cable and install the cover.

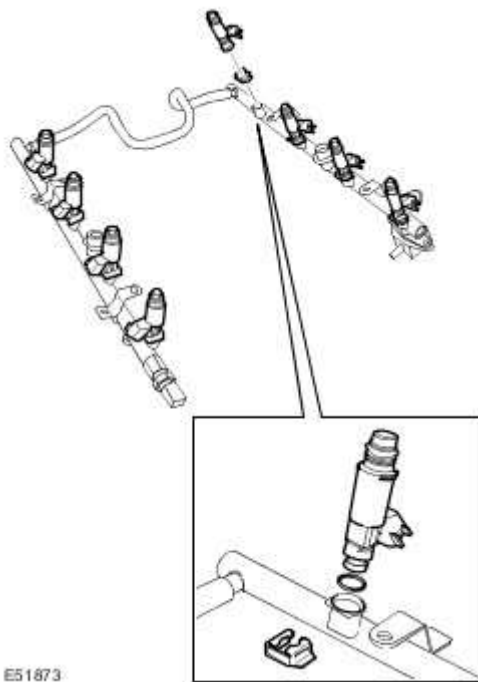
For additional information, refer to Specifications

Fuel Injector (18.10.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the fuel injection supply manifold.
For additional information, refer to Fuel Injection Supply Manifold (19.60.13)
- 3 . Remove the fuel injector.

- ▶ Remove the clip.
- ▶ Discard the O-ring seal.



Installation

- 1 . Install the fuel injector.
 - ▶ Clean the component mating faces.

▶ Install a new O-ring seal.

▶ Secure with the clip.

2 . Install the fuel injection supply manifold.

For additional information, refer to Fuel Injection Supply Manifold (19.60.13)

3 . Connect the battery ground cable and install the cover.

Throttle Body (19.70.04)


Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

- 3 . Disconnect the throttle position (TP) sensor electrical connector.



- 4  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

 **CAUTION:** Always plug any open connections to prevent contamination.

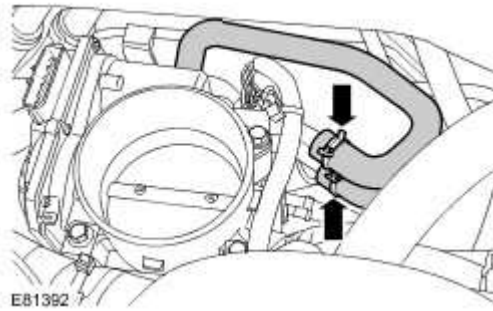
NOTE:


Position cloth to collect fluid spillage.

Disconnect the coolant hoses from the throttle body.

 Clamp the throttle body coolant hoses to minimize coolant loss.

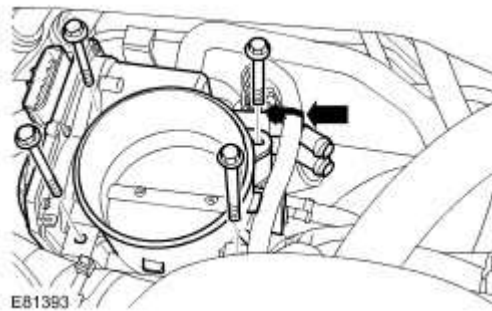
- ▶ Release the throttle body hose clips



5.  **CAUTION: Always plug any open connections to prevent contamination.**

Remove the throttle body.

- ▶ Release the wiring harness.
- ▶ Remove the 4 bolts.
- ▶ Remove and discard the throttle body gasket.



Installation

1. Install the throttle body.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.

▶ Tighten the 4 bolts to 10 Nm (7 lb.ft).

▶ Attach the wiring harness.

2 . Connect the coolant hoses and secure with the clips.

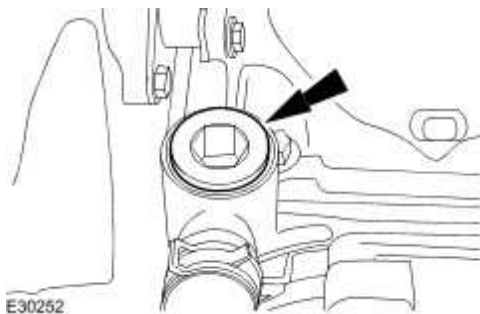
▶ Remove the hose clamps from the throttle body hoses.


3 . Connect the TP sensor electrical connector.

4 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

5 . Remove the supercharger coolant fill plug.

▶ Remove and discard the sealing washer.



6 .  **CAUTION: Coolant may spill from the supercharger fill port when the ignition is switched on.**

Switch the ignition on.

7



- **CAUTION: Do not allow the supercharger coolant pump to run dry for more than one minute. Failure to follow this instruction may result in damage to the vehicle.**

Allow the supercharger pump to run and top-up the coolant through the supercharger fill port.

- ▶ Switch the ignition off.

8 . Install the supercharger coolant fill plug and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the components.
- ▶ Install a new sealing washer.

9 . Switch the ignition off.

10 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

11 . Check and top-up the coolant.

303-04B : Fuel Charging and Controls – 4.2L NA V8 – AJV8

Specifications

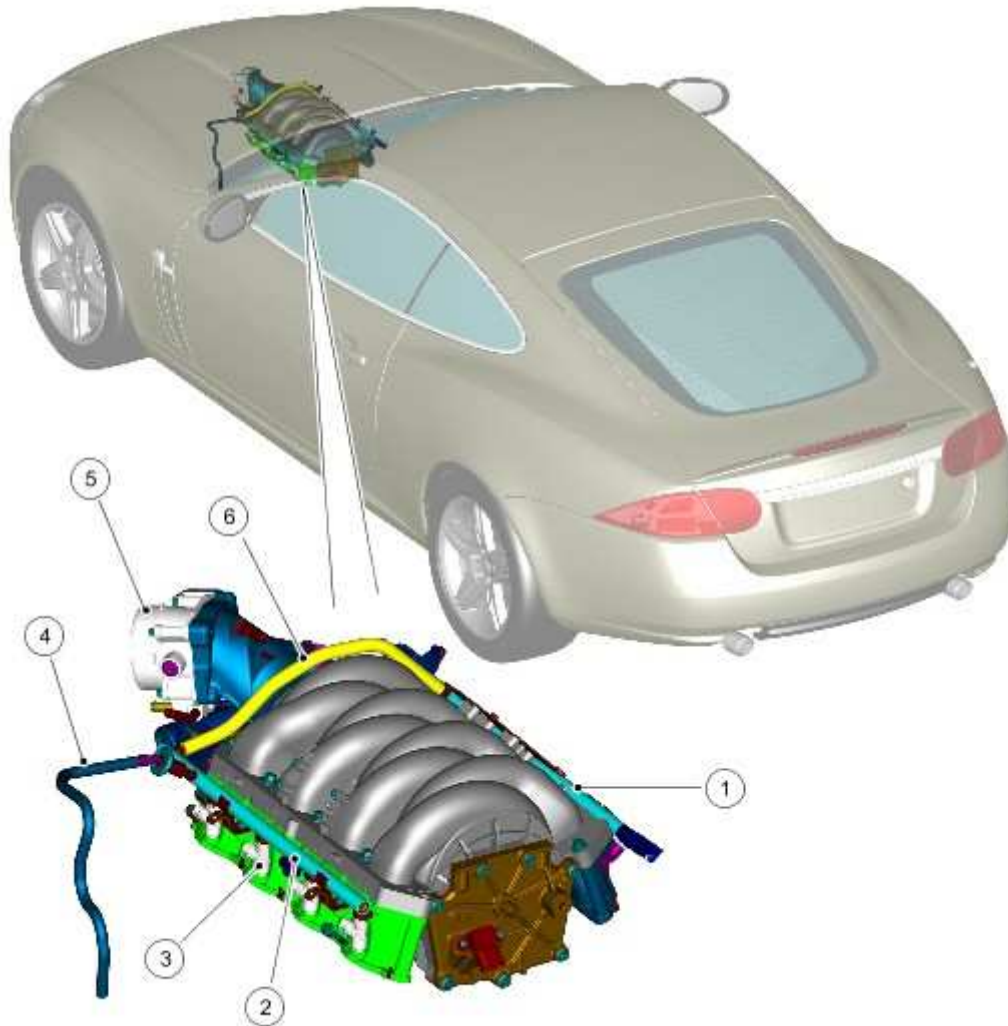
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Fuel rail - bolt	10	7	88
Fuel rail pressure sensor	5	4	44
Fuel temperature sensor	7	5	62
Throttle body - bolt	10	7	88

Fuel Charging and Controls

COMPONENT LOCATIONS



E62629

Item	Part Number	Description
1		RH (right-hand) fuel rail
2		LH (left-hand) fuel rail
3		Injectors (8 off)
4		Fuel supply pipe

5		Electric throttle body
6		Fuel supply cross over pipe

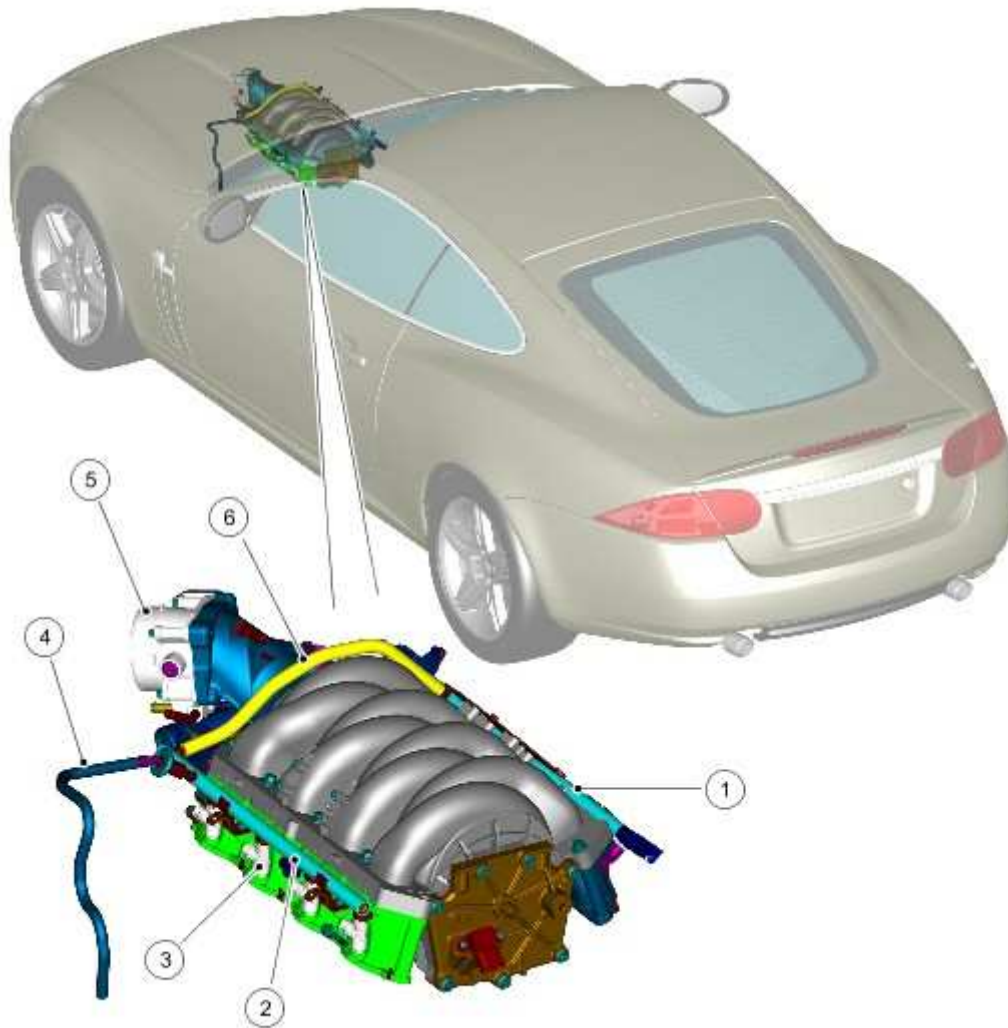
INTRODUCTION

The major components of the fuel charging and control system comprise a fuel pump and FPDM (fuel pump driver module) , fuel rails and eight injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the side of the transmission, to the fuel rail. The fuel rail distributes the fuel equally to each of the 8 injectors. The fuel injectors, which are controlled by the Engine Management System (EMS), are installed in the fuel rails on each side of the air intake manifold. A cross over pipe connects the 2 fuel rails together at the front of the engine. For additional information, refer to Fuel Tank and Lines (310-01)

For additional information, refer to Electronic Engine Controls (303-14)

Fuel Charging and Controls

COMPONENT LOCATIONS



E62629

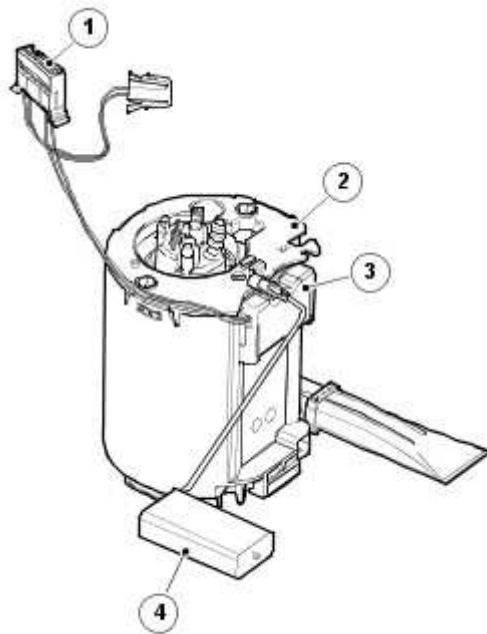
Item	Part Number	Description
1		RH fuel rail
2		LH fuel rail
3		Injectors (8 off)
4		Fuel supply pipe
5		Electric throttle body
6		Fuel supply cross over pipe

INTRODUCTION

The major components of the fuel charging and control system comprise a fuel pump and Fuel Pump Driver Module (FPDM), fuel rails and eight injectors. The fuel pump supplies fuel from the tank, via a pipe routed along the side of the transmission, to the fuel rail. The fuel rail distributes the fuel equally to each of the 8 injectors. The fuel injectors, which are controlled by the Engine Management System (EMS), are installed in the fuel rails on each side of the air intake manifold. A cross over pipe connects the 2 fuel rails together at the front of the engine. For additional information, refer to Fuel Tank and Lines (310-01 Fuel Tank and Lines)

For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

FUEL PUMP



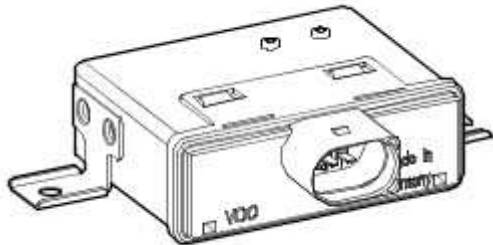
E74571

Item	Part Number	Description
1		Electrical connector
2		Fuel pump module
3		Fuel level sensor
4		Fuel level float

The fuel pump module is mounted in the RH side of the saddle type fuel tank and delivers fuel at

variable flow and pressure to the fuel rails, which supply fuel to all fuel injectors. The fuel pump operation is regulated by the FPDM, which is controlled by the EMS. For additional information, refer to Fuel Tank and Lines (310-01)

FUEL PUMP DRIVER MODULE



The Fuel Pump Driver Module (FPDM) is used to control the speed of the fuel pump based upon the fuel demand of the engine. The ECM controls the FPDM in response to inputs from the fuel rail pressure sensor, MAP and the Mass Air Flow (MAF)/Intake Air Temperature (IAT) sensor. The FPDM is located on the RH end of the charcoal cannister and is attached by 2 scrivet fasteners.

The ECM sends a PWM signal to the FPDM, the frequency of the signal determines the duty cycle of the pump. The PWM signal to the pump represents half the ON time of the pump. If the ECM transmits a 50% on time the drives the pump at 100%. If the ECM transmits a 5% ON time the FPDM drives the pump at 10%. The FPDM will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When The ECM requires the fuel pump to be turned OFF the ECM transmits a duty cycle signal of 75%.

The status of the FPDM is monitored by the ECM. Any errors can be retrieved from The ECM using Integrated Diagnostic System (IDS). The FPDM cannot be interrogated for diagnostic purposes.

INJECTORS

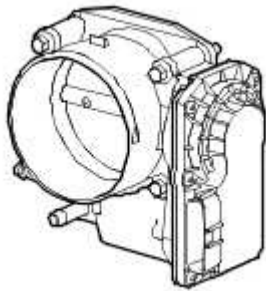


Eight, top fed, 12 hole, fuel injectors are installed in the fuel rails. Two 'O' rings seal each injector to the fuel rails and should be renewed whenever an injector is refitted to an engine. A small amount of engine oil can be applied to the 'O' rings to aid installation. No other form of lubrication should be used. The fuel jets from the injectors are directed onto the back of the intake valves.

The injectors are electromagnetic solenoid valves controlled by the ECM. Each injector contains a solenoid-operated needle valve, which is closed while the solenoid winding is de-energized. The solenoid winding is connected to a power feed from the main relay and to an earth through the ECM. The ECM switches the earth to control the opening and closing of the needle valve. While the needle valve is open, fuel is sprayed into the cylinder intake tract onto the back of the intake valves. The ECM meters the amount of fuel injected by adjusting the time that the needle valve is open.

The injectors have a resistance of $13.8 \text{ Ohms} \pm 0.7 \text{ Ohms @ } 20 \text{ Degrees Celsius}$.

ELECTRIC THROTTLE

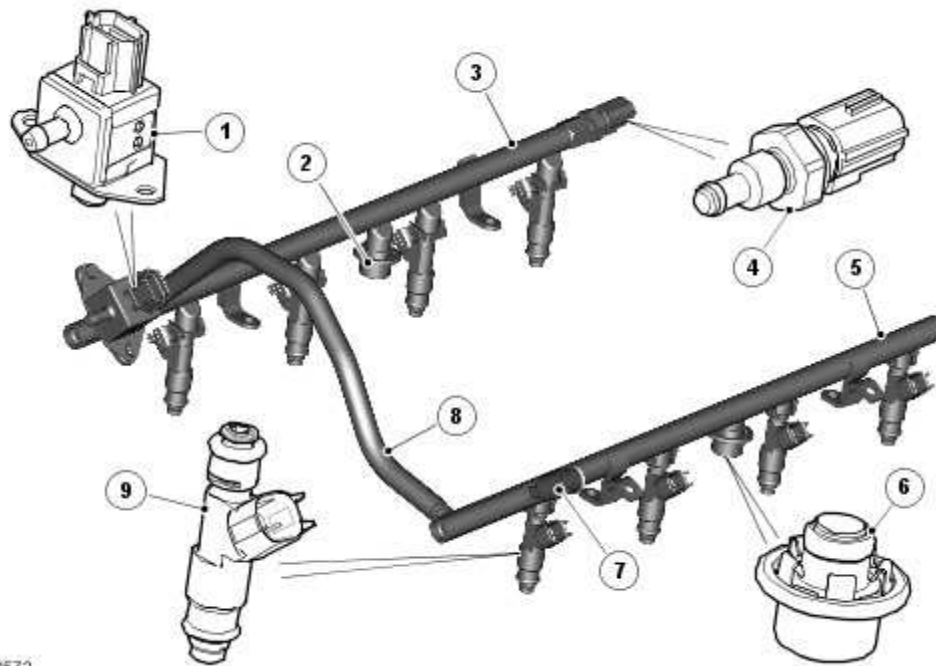


E47298

The electronic throttle body controls the engine torque and is located on the induction elbow at the rear of the engine. Its main components are an electronic throttle control valve, Accelerator Pedal Position (APP) sensor and the Engine Control Module (ECM).

The APP sensor determines the driver demand to control throttle opening. This value is received by the ECM and the throttle is then opened to the correct angle by means of an integral electric motor. Sensors in the throttle body are used to determine the position of the throttle plate and the rate of change in its angle. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

FUEL RAILS

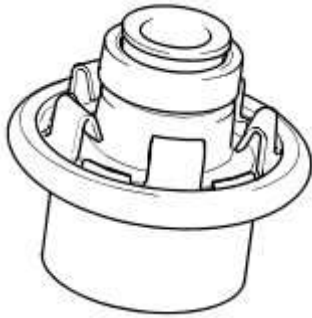


E74572

Item	Part Number	Description
1		Fuel rail pressure sensor
2		Fuel rail pressure damper
3		Fuel rail
4		Fuel rail temperature sensor
5		Fuel rail
6		Fuel rail pressure damper
7		Fuel rail inlet
8		Fuel rail connection pipe
9		Fuel injector

Each fuel rail maintains a fuel pressure of typically 4.5bar (65 psi), however, this pressure will vary depending on engine requirements; lower at idle, higher at full load. Four fuel injectors are installed in each cylinder head and are connected to the fuel rail. 'O' ring seals are used to seal the injectors to the fuel rails.

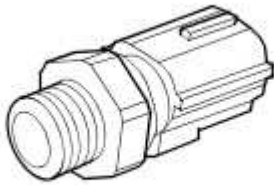
FUEL PRESSURE DAMPER



E74573

A fuel pressure damper is attached centrally to each of the fuel rails. The damper acts to damp pressure pulses from the fuel pump.

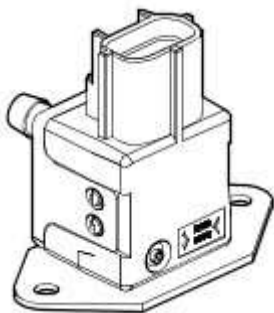
FUEL TEMPERATURE SENSOR



E47606

The fuel temperature sensor is located in the rear of the RH fuel rail. The sensor is an NTC sensor, which is connected to the ECM by two wires. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

FUEL RAIL PRESSURE SENSOR



E58945

The fuel pressure sensor continuously monitors the fuel pressure in the fuel rail, this value is used by the ECM to calculate the injector pulse-width required to deliver the correct mass of fuel per injection.

The ECM also uses this information to demand a specific fuel flow-rate from the fuel pump via the FPDM For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine

Controls - 4.2L)

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Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

Principle of Operation

For a detailed description of fuel charging and controls, refer to the relevant Description and Operation section of the workshop manual.

Fuel Charging and Controls

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> Fuel level Fuel leaks Damaged fuel lines Damaged push connect fittings Fuel contamination/grade/quality Throttle body Damaged fuel tank filler pipe cap Damaged fuel tank filler pipe 	<ul style="list-style-type: none"> Fuses Loose or corroded electrical connectors Harnesses Sensor(s) Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident and there are clear symptoms refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> Engine breather system disconnected/restricted Ignition system Fuel system Electronic engine control 	<ul style="list-style-type: none"> Ensure the engine breather system is free from restriction and is correctly installed For ignition system tests. Engine Ignition

		<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition system 	<ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition
Difficult cold start	<ul style="list-style-type: none"> • Engine coolant level/anti-freeze content • Battery • Electronic engine controls • Exhaust Gas Recirculation (EGR) valve stuck open • Fuel pump • Purge valve 	<ul style="list-style-type: none"> • Check the engine coolant level and condition. Specifications • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For EGR system tests. Engine Emission Control • For fuel system tests. Fuel Tank and Lines • For purge valve tests. Evaporative Emissions
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system • EGR valve stuck open 	<ul style="list-style-type: none"> • Check for injector leak, install new injector as necessary. Fuel Injector (18.10.01) • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls

		<ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition • For EGR system tests. Engine Emission Control
<p>Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)</p>	<ul style="list-style-type: none"> • Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system • EGR valve stuck open 	<ul style="list-style-type: none"> • Check for injector leak, install new injector as necessary. Fuel Injector (18.10.01) • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition • For EGR system tests. Engine Emission Control
<p>Engine stalls soon after start</p>	<ul style="list-style-type: none"> • Breather system disconnected/restricted • ECM relay • Electronic engine control • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition • Check for blockage in air filter element and air intake system

		<ul style="list-style-type: none"> • Check for air leakage in air intake system • For fuel system tests. Fuel Tank and Lines
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine control • Throttle motor • Restricted accelerator pedal travel (carpet, etc) • Ignition system • EGR valve stuck open • Transmission malfunction 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for injector leak, install new injector as necessary. Fuel Injector (18.10.01) • Check for air leakage in air intake system • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • Read DTCs and refer to the DTC Index in this section for throttle motor tests • Ensure accelerator pedal is free from restriction • For ignition system tests. Engine Ignition • For EGR system tests. Engine Emission Control • For transmission tests. Diagnostic Strategy
Engine backfires	<ul style="list-style-type: none"> • Fuel pump/lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) hub 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for air leakage in intake air system • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition • Read DTCs and refer

		<p>to DTC Index for VCT tests.</p> <p>Electronic Engine Controls</p>
Engine surges	<ul style="list-style-type: none"> • Fuel pump/lines • Electronic engine controls • Throttle motor • Ignition system 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • Read DTCs and refer to DTC Index in this section for throttle motor tests. • For ignition system tests. Engine Ignition
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump/lines • Air leakage • Sticking VCT hub 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For fuel system tests. Fuel Tank and Lines • Check for air leakage in intake air system • Read DTCs and refer to DTC Index for VCT tests. Electronic Engine Controls
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls • Throttle motor 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • Read DTCs and refer to DTC Index in this section for throttle motor tests.
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted 	<ul style="list-style-type: none"> • Ensure the engine breather system is

	<ul style="list-style-type: none"> • Electronic engine control • Transmission malfunction • Traction control event • Air leakage 	<p>free from restriction and is correctly installed</p> <ul style="list-style-type: none"> • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For transmission system tests. Diagnostic Strategy • Check for air leakage in intake air system
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DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module/component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines that involve pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel rail/system pressure - too low	<ul style="list-style-type: none"> • Fuel rail pressure (FRP) sensor, sensing circuit - short to ground, open circuit • FRP sensor supply circuit - high resistance • FRP sensor failure • Fuel pump failure • Fuel line leak, restriction 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P008800	Fuel rail/system pressure - too high	<ul style="list-style-type: none"> • FRP sensor supply/sensing circuits - short to each other • FRP sensor sensing circuit - short to power • FRP sensor ground circuit - high resistance • FRP sensor failure • Restricted fuel line • Fuel pump short circuit to power 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests

		catalytic converter)	<ul style="list-style-type: none"> • Check and rectify any exhaust leak prior to catalytic converter
P017200	System too rich (bank 1)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) • Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling • Read DTCs and refer to DTC Index in this section for MAF sensor tests
P017400	System too lean (bank 2)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests • Check and rectify any exhaust leak prior to catalytic converter
P017500	System too rich (bank 2)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) • Check for contaminated engine oil, drain and refill engine oil as

			<p>necessary. Engine Oil Draining and Filling</p> <ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for MAF sensor tests
P020100	Cylinder 1 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020200	Cylinder 2 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020300	Cylinder 3 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020400	Cylinder 4 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector

			(18.10.01)
P020500	Cylinder 5 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020600	Cylinder 6 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020700	Cylinder 7 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020800	Cylinder 8 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P131500	Persistent misfire	<ul style="list-style-type: none"> • ECM to ignition coil primary circuit fault (cylinder misfire detected) 	<ul style="list-style-type: none"> • Check for cylinder misfire, ignition and injector DTCs and refer

		<p>DTC also flagged)</p> <ul style="list-style-type: none"> • Fuel injector circuit fault(s) (injector DTCs also flagged) • Fuel delivery pressure low • Spark plug failure/fouled/incorrect gap • Cylinder compression low 	<p>to the DTC Index</p> <ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • For spark plug tests. Engine Ignition • For cylinder compression tests. Engine
P131600	Misfire rate exceeds emissions thresholds	<ul style="list-style-type: none"> • Misfire rate exceeds emissions thresholds 	<ul style="list-style-type: none"> • Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P210129	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> • Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> • Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210164	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> • Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle actuator motor control circuit range/performance	<ul style="list-style-type: none"> • Throttle blade stuck open • Intake air system leak 	<ul style="list-style-type: none"> • Check for throttle related DTCs and refer to DTC Index in this section • Check intake air

			system for leaks
P210329	Throttle actuator motor control circuit high	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of DTC Index
P210364	Throttle actuator motor control circuit high - signal plausibility failure	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of DTC Index
P210500	Throttle actuator control system - forced engine shutdown	<ul style="list-style-type: none"> • Throttle MIL request due to fuel cut 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P210629	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> • Signal invalid 	<ul style="list-style-type: none"> • Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index
P210664	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> • Signal plausibility failure 	<ul style="list-style-type: none"> • Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index

P211800	Throttle actuator motor control current range/performance	<ul style="list-style-type: none"> • Throttle motor control circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211900	Throttle actuator control throttle body range/performance	<ul style="list-style-type: none"> • Throttle spring faulty 	<ul style="list-style-type: none"> • Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index

Fuel Injection Supply Manifold (19.60.13)

Special Service Tools



Fuel spring lock decoupling tool
310-D005

Removal



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

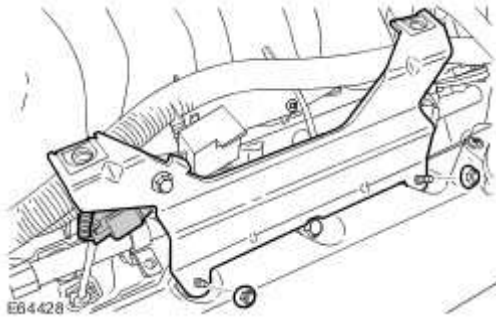


WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)

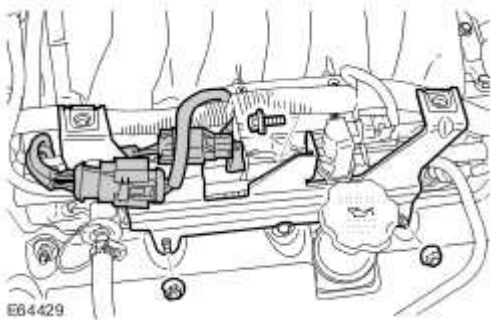
3 . Remove the engine RH cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Disconnect the electrical connector.



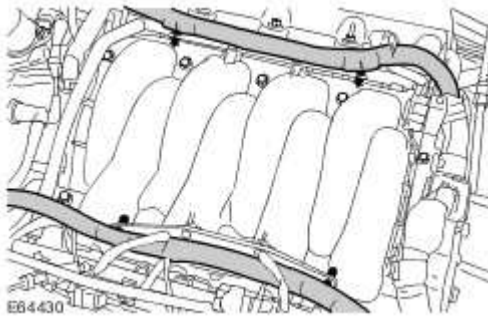
4 . Remove the engine LH cover bracket.

- ▶ Remove the 2 nuts.
- ▶ Release the 2 electrical connectors.
- ▶ Remove the purge valve bolt.



5 . Release the engine wiring harness.

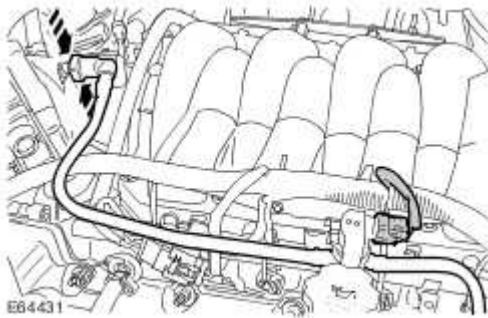
- ▶ Release the 4 clips.



6 . Release the purge valve.

▶ Disconnect the quick release connector.

▶ Disconnect the electrical connector.

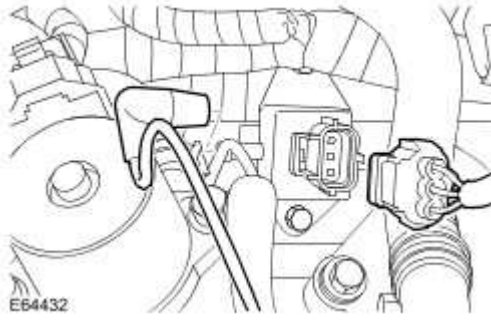


7 . Using the special tool, disconnect the fuel line.

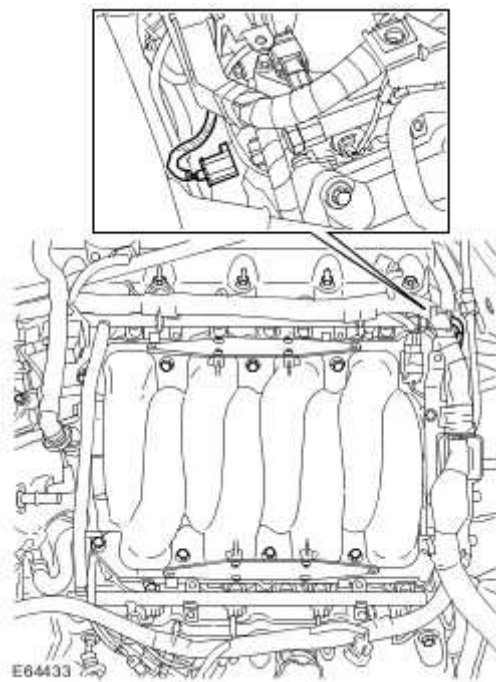
For additional information, refer to Spring Lock Couplings

8 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.

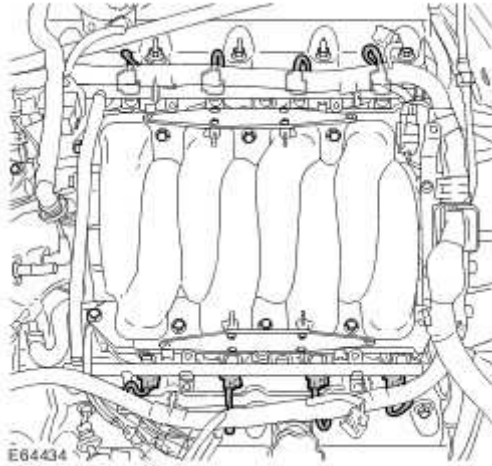
9 . Disconnect the FRP sensor vacuum line.



10 . Disconnect the fuel temperature sensor electrical connector.



11 . Disconnect the 8 fuel injector electrical connectors.



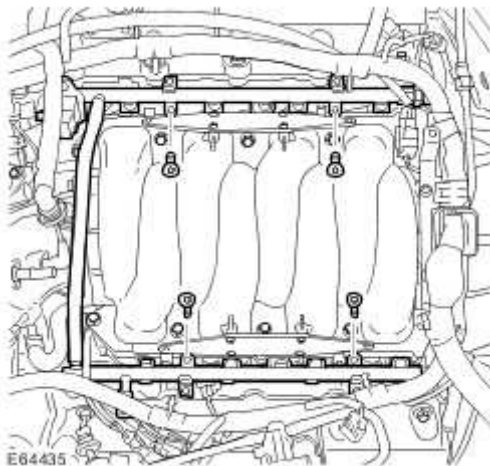
12



CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Remove the fuel injection supply manifold.

- Remove the 4 Torx bolts.
- Remove and discard the 8 O-ring seals.

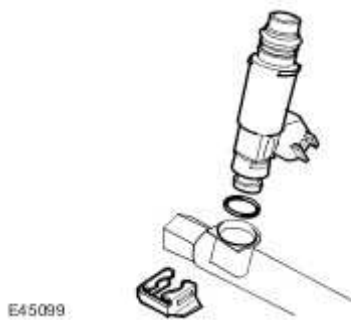


13 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the fuel injector.

- ▶ Remove the clip.
- ▶ Remove and discard the O-ring seal.
- ▶ Repeat the above procedure for the remaining injectors.

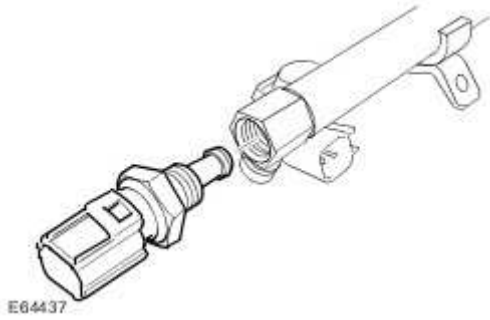


14 . Remove the FRP sensor.

- ▶ Remove the 2 bolts.
- ▶ Remove and discard the O-ring seal.



15 . Remove the fuel temperature sensor.



Installation

1 . Install the fuel temperature sensor.

- ▶ Clean the components.
- ▶ Tighten the sensor to 7 Nm (5 lb.ft).

2 . Install the FRP sensor.


- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten the bolts to 5 Nm (4 lb.ft).

3 . Install the fuel injectors.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Install the clips.

4 . Install the fuel injection supply manifold.

- ▶ Clean the components.
- ▶ Install new O-ring seals.

 Tighten the Torx bolts to 10 Nm (7 lb.ft).

5 . Connect the fuel injector electrical connectors.

6 . Connect the fuel temperature sensor electrical connector.


7 . Connect the FRP sensor vacuum line.

8 . Connect the FRP sensor electrical connector.

9 . Connect the fuel line.


For additional information, refer to Spring Lock Couplings

10 . Attach the purge valve.


 Connect the electrical connector.

 Connect the quick release connector.


11 . Attach the engine wiring harness.

 Secure the clips.


12 . Install the LH engine cover bracket.


 Attach the purge valve, align the peg and tighten the bolt to 6 Nm (4 lb.ft).

 Secure the electrical connectors.

 Tighten the nuts to 6 Nm (4 lb.ft).

13 . Install the RH engine cover bracket.

 Connect the electrical connector.

 Tighten the nuts to 6 Nm (4 lb.ft).

14 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

15 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Fuel Injector (18.10.01)

Removal



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



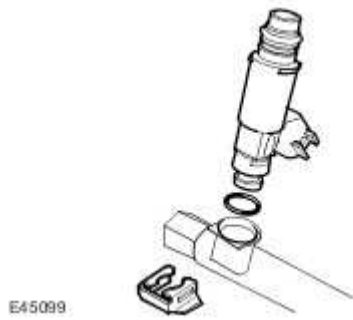
WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Remove the fuel injection supply manifold.
For additional information, refer to Fuel Injection Supply Manifold (19.60.13)

- 3 . Remove the fuel injector.
 - Remove the clip.

 - Remove and discard the O-ring seal.



Installation

1 . Install the fuel injector.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Install the clip.

2 . Install the fuel injection supply manifold.

For additional information, refer to Fuel Injection Supply Manifold (19.60.13)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Throttle Body (19.70.04)

Removal

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)

3 . Remove the air intake duct.

▶ Remove the bolt.

▶ Release the 2 clips.



4 . Disconnect the throttle position (TP) sensor electrical connector.



5



· **WARNING:** Since injury such as scalding could be caused by escaping steam or

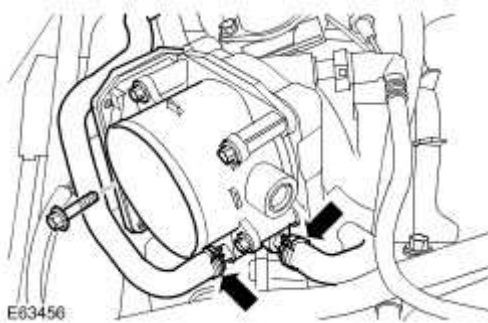
coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

Disconnect the coolant hoses from the throttle body.

- ▶ Clamp the throttle body coolant hoses to minimize coolant loss.
- ▶ Release the throttle body hose clips

6 . Remove the throttle body.

- ▶ Remove the 4 bolts.
- ▶ Remove and discard the throttle body gasket.



Installation

1 . Install the throttle body.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Tighten the 4 bolts to 10 Nm (7 lb.ft).


2 . Connect the coolant hoses to the throttle body.


- ▶ Remove the hose clamps from the throttle body hoses.

 Secure the throttle body hoses clips.

3 . Connect the TP sensor electrical connector.

4 . Install the air intake duct.

 Tighten the clips.

 Tighten the bolt to 10 Nm (7 lb.ft).

5 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

6 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

7 . Check and top-up the coolant.

303-05 : Accessory Drive – 4.2L NA V8 – AJV8/4.2L SV V8 – AJV8

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Accessory drive belt, tensioner - bolt	40	30	-
Accessory drive belt, idler pulley - bolt	25	18	-
Accessory drive belt - bolt (Supercharged models)	40	30	-

Accessory Drive - 4.2L NA V8 - AJV8

COMPONENT LOCATION



Item	Part Number	Description
1		Engine coolant pump
2		Power steering pump
3		Air Conditioning (A/C) compressor
4		Automatic tensioner
5		Crankshaft damper
6		Idler
7		Generator

INTRODUCTION

A single belt drives the following primary engine mounted accessories:

- Engine coolant pump
- Power steering pump
- Air Conditioning (A/C) compressor
- Generator.

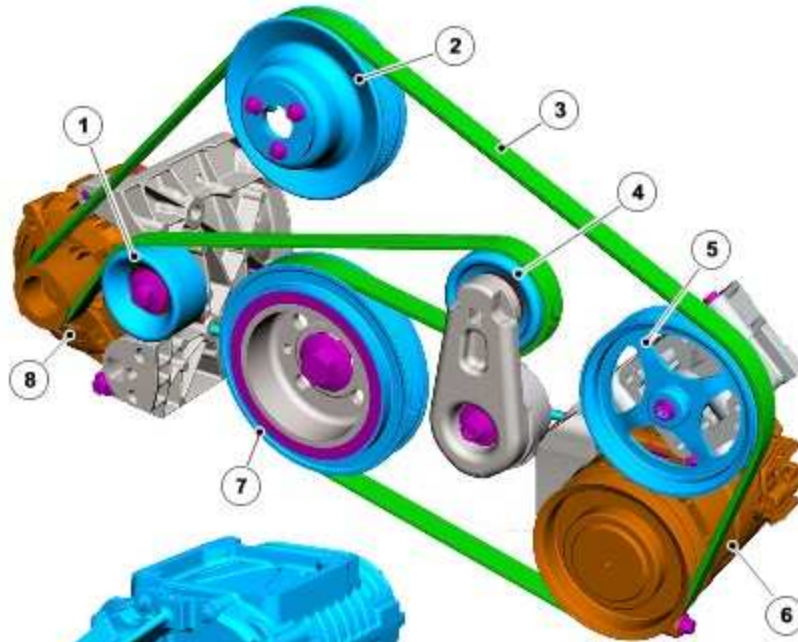
A secondary belt drives the engine driven cooling fan.

Both the primary and secondary belts are crankshaft driven with an automatic tensioner keeping the belt at the correct tension. The crankshaft incorporates a torsional vibration damper to absorb vibration and shock loads.

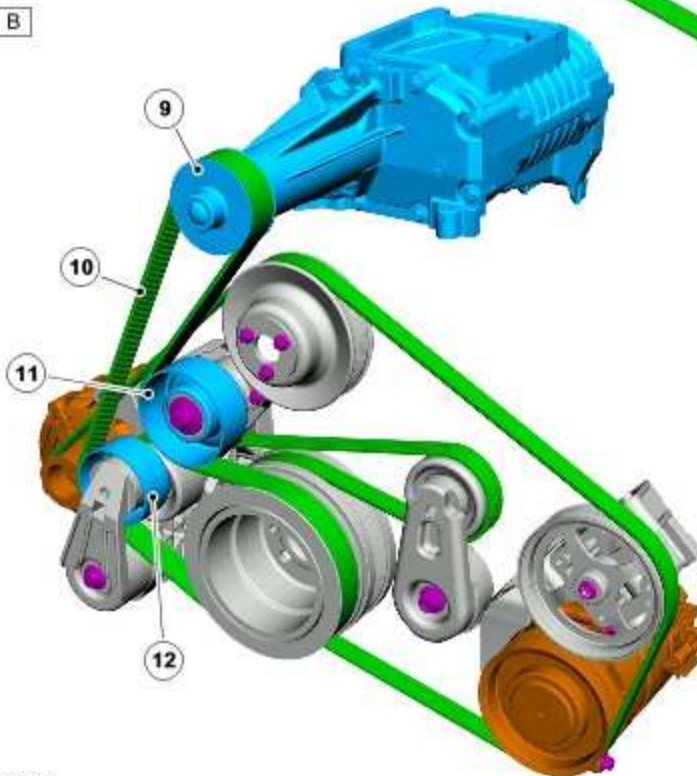
Accessory Drive - 4.2L SC V8 - AJV8

COMPONENT LOCATION

A



B



E64945

Item	Part Number	Description
A		Primary accessory drive
B		Secondary accessory drive
1		Routing idler
2		Coolant pump

3		Primary accessory drive belt
4		Primary tensioner assembly
5		Power steering pump
6		Air Conditioning (AC) compressor
7		Crankshaft pulley
8		Generator
9		Supercharger pulley
10		Secondary accessory drive belt
11		Routing idler
12		Secondary tensioner assembly

OVERVIEW

A single six-ribbed belt drives all the primary engine mounted accessories and a secondary single eight-ribbed belt drives the supercharger.

Both the primary and secondary belts are crankshaft driven via the torsional vibration damper.

An automatic tensioner, located on the Left Hand (LH) accessory-mounting bracket, keeps the primary accessory belt at the correct tension. A routing idler on the Right Hand (RH) accessory-mounting bracket increases the wrap angle around the generator pulley.

A second automatic tensioner, located on the generator mounting bracket, keeps the secondary accessory belt at the correct tension. A routing idler located on a timing cover mounting bracket increases the wrap angle around the supercharger pulley.

The automatic tensioner's consist of a routing idler on the end of a spring loaded pivot arm. The pivot arm can be turned counter-clockwise (viewed from the front of the engine) for removal and installation of the belt.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to absorb vibration and shock loads.

Accessory Drive

Principle of Operation

For a detailed description of the Front End Accessory Drive (FEAD), refer to the relevant Description and Operation section in the workshop manual.

[Accessory Drive - 4.2L NA V8 - AJV8](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of mechanical damage and system integrity.

Mechanical
<ul style="list-style-type: none">• FEAD belt• FEAD belt tension• FEAD belt tensioner• FEAD belt pulleys

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

FEAD belt noise or squeal

Possible Source(s):

- FEAD belt pulley(s)
- Lubricant or other contamination
- FEAD belt

Action(s) to take:

- DETERMINE where the noise is coming from. CHECK for pulley alignment, freedom of rotation and damage. REPAIR or INSTALL new parts as necessary.
[Accessory Drive Belt Idler Pulley - 4.2L NA V8 - AJV8 \(12.10.43\)](#)

- CHECK FEAD belt for contamination. If contaminated, INSTALL a new belt.
[Accessory Drive Belt - 4.2L NA V8 - AJV8 \(12.10.40\)](#)
- CHECK FEAD belt for correct application

FEAD belt does not hold tension

Possible Source(s):

- FEAD belt cracking or damaged
- Tensioner worn or damaged

Action(s) to take:

- INSPECT FEAD belt for cracking or damage. INSTALL a new belt as necessary.
[Accessory Drive Belt - 4.2L NA V8 - AJV8 \(12.10.40\)](#)
- CHECK FEAD belt tensioner for damage and correct operation. INSTALL a new FEAD belt tensioner as necessary.
[Accessory Drive Belt Tensioner - 4.2L NA V8 - AJV8 \(12.10.41\)](#)

Component Tests

FEAD belt tensioner

Static

The only checks required for the FEAD belt tensioner are for stick, grab or bind.

- 1 . Remove the drive belt in the area of the tensioner.
- 2 . Using the correct tool, rotate the tensioner from its relaxed position through its full stroke and back to the relaxed position to make sure there is no stick, grab or bind, and to make sure that there is tension on the tensioner spring.
- 3 . If the tensioner meets the above criteria, proceed to the dynamic test. If the tensioner does not meet the above criteria install a new tensioner.
[Accessory Drive Belt Tensioner - 4.2L NA V8 - AJV8 \(12.10.41\)](#)

Dynamic

The FEAD belt tensioner can be checked dynamically as follows:

- 1 . With the engine running, observe drive belt tensioner movement, the FEAD belt tensioner should move (respond) when the air conditioning clutch cycles (if equipped), the FEAD belt tensioner should move (respond) when the engine speed is increased rapidly. If the drive belt tensioner movement is erratic without air conditioning clutch cycling or engine acceleration, a

pulley or shaft may be bent, or distorted. Excessive drive belt rideout (uneven depth of grooves in the drive belt) can also cause excessive drive belt tensioner movement. Check condition by installing a known good belt.

[Accessory Drive Belt - 4.2L NA V8 - AJV8 \(12.10.40\)](#)

FEAD belt

1 . With the engine off, check routing of the drive belt.

[Accessory Drive - 4.2L NA V8 - AJV8](#)


2 . Inspect the drive belt tensioner wear indicator to confirm the drive belt is within operating range. Install a new drive belt as necessary .

[Accessory Drive Belt - 4.2L NA V8 - AJV8 \(12.10.40\)](#)

Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

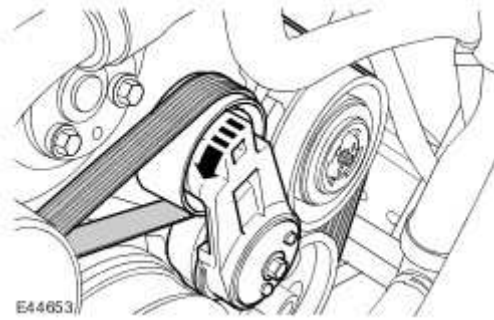
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 4 . Remove the air deflector.
For additional information, refer to [Air Deflector \(76.11.41\)](#)
- 5 . Remove the air intake duct.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.



- 6 Release the accessory drive belt.
 - ▶ Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



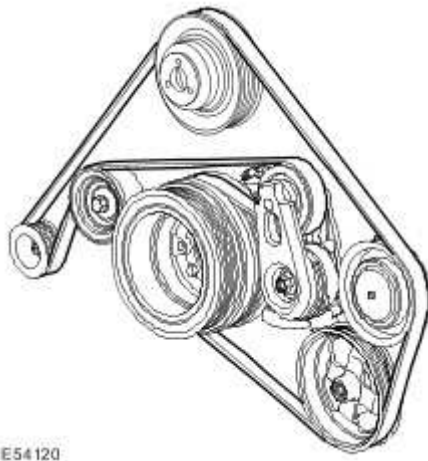
7 . NOTE:

Note the fitted position.

Remove the accessory drive belt.

Installation

- 1 . Install the accessory drive belt.



- 2 . Install the air intake duct.

- ▶ Tighten the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

- 3 . Install the air deflector.

For additional information, refer to [Air Deflector \(76.11.41\)](#)

- 4 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)

Removal

1 . Remove the cover and disconnect the battery ground cable.

2




· **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

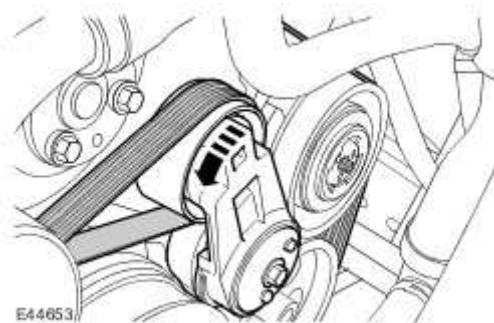
Raise and support the vehicle.

3 . Remove the supercharger belt.

For additional information, refer to [Supercharger Belt \(18.50.08\)](#)

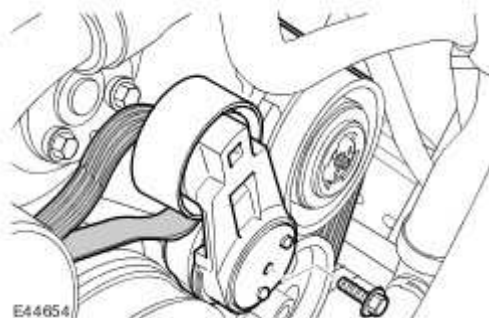
4 Release the accessory drive belt.

-  Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



5 . Remove the accessory drive belt tensioner.

-  Remove the bolt.



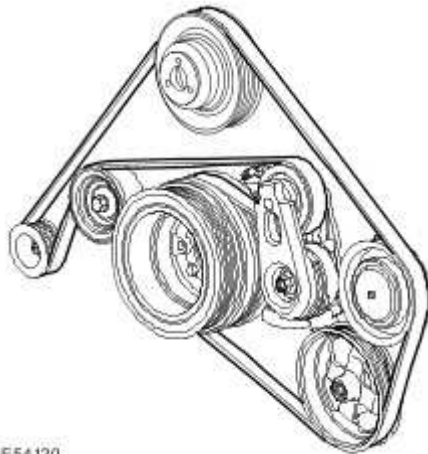
6 . NOTE:

Note the fitted position.

Remove the accessory drive belt.

Installation

- 1 . Install the accessory drive belt.



E54120

- 2 . Install the accessory drive belt tensioner.

- ▶ Clean and inspect the drive pulleys for damage.
- ▶ Tighten the tensioner bolt to 40 Nm (30 lb.ft).

- 3 . Install the supercharger belt.


For additional information, refer to [Supercharger Belt \(18.50.08\)](#)

- 4 . Connect the battery ground cable and install the cover.

Accessory Drive Belt Tensioner - 4.2L NA V8 - AJV8 (12.10.41)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

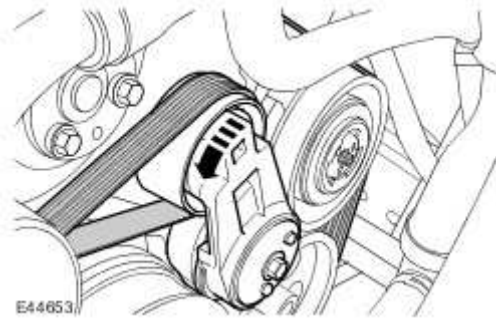
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 4 . Remove the air intake duct.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.

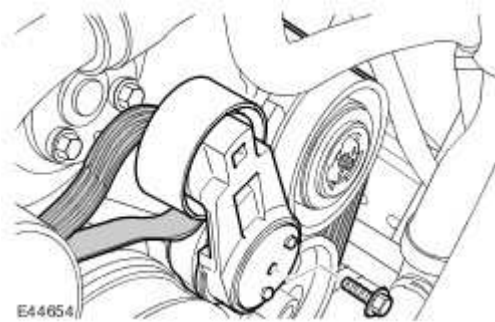


- 5 Release the accessory drive belt.
 - ▶ Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



6 . Remove the accessory drive belt tensioner.

- ▶ Remove the bolt.

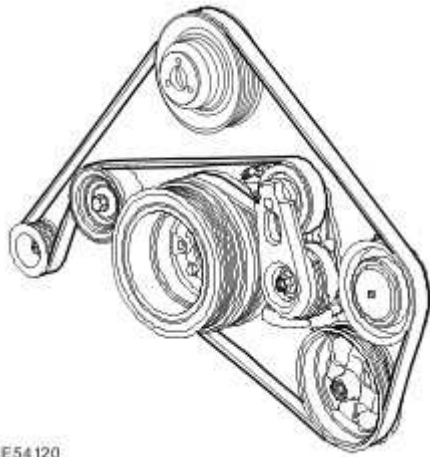


Installation

1 . Install the accessory drive belt tensioner.

- ▶ Clean and inspect the drive pulleys for damage.
- ▶ Tighten the tensioner bolt to 40 Nm (30 lb.ft).

2 . Install the accessory drive belt.



3 . Install the air intake duct.

- ▶ Tighten the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

4 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Accessory Drive Belt Tensioner - 4.2L SC V8 - AJV8 (12.10.41)

Removal

1 . Remove the cover and disconnect the battery ground cable.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the engine cover.

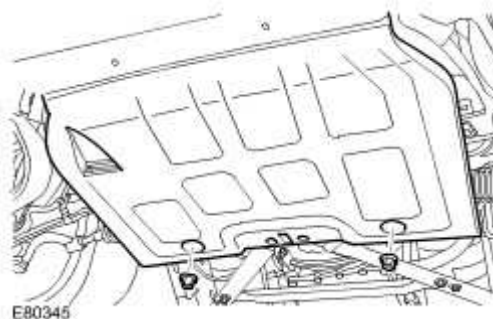
For additional information, refer to [Engine Cover \(76.11.35\)](#)

4 . Remove the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Remove the air deflector.

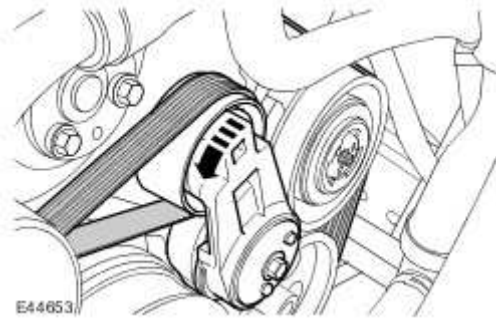
▶ Remove the 2 nuts.



6 Release the accessory drive belt.

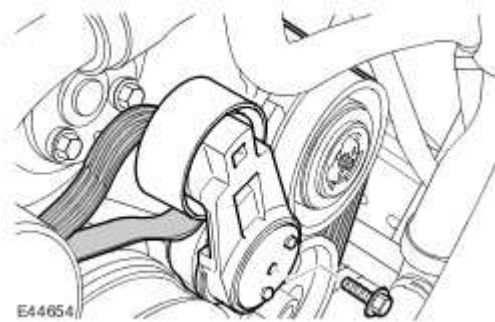


Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



7 . Remove the accessory drive belt tensioner.

- ▶ Remove the bolt.

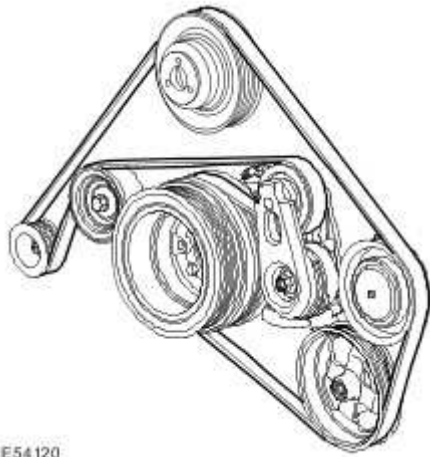


Installation

1 . Install the accessory drive belt tensioner.

- ▶ Clean and inspect the drive pulleys for damage.
- ▶ Tighten the tensioner bolt to 40 Nm (30 lb.ft).

2 . Attach the accessory drive belt.



E54120

3 . Install the air deflector.

▶ Tighten the nuts.

4 . Install the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)


6 . Connect the battery ground cable and install the cover.

Accessory Drive Belt Idler Pulley - 4.2L NA V8 - AJV8 (12.10.43)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

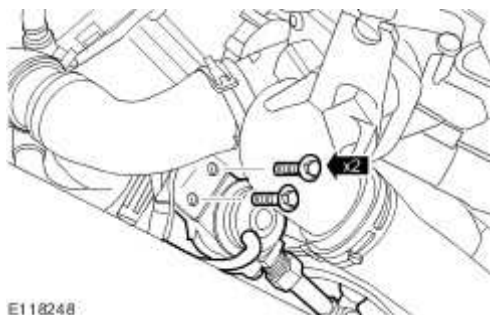
Raise and support the vehicle.

- 3 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)

Vehicles with secondary air injection (AIR)

- 4 . Release the AIR control valve.

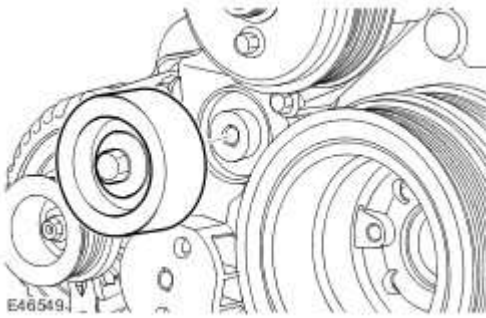
 Remove the 2 bolts.



All vehicles

- 5 . Remove the accessory drive belt idler pulley.

▶ Remove the bolt.



Installation

All vehicles

- 1 . Install the accessory drive belt idler pulley.

▶ Tighten the bolt to 25 Nm.

Vehicles with secondary air injection (AIR)

- 2 . Secure the AIR control valve.

▶ Tighten the 2 bolts to 25 Nm.

All vehicles

- 3 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)

- 4 . Connect the battery ground cable and install the cover.


For additional information, refer to Specifications

Accessory Drive Belt Idler Pulley - 4.2L SC V8 - AJV8 (12.10.43)

Removal

All vehicles

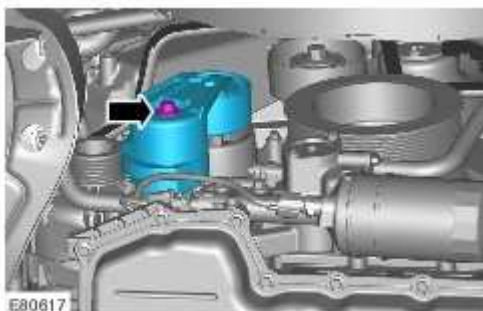
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 3 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)
- 4 . Release the supercharger belt tensioner.

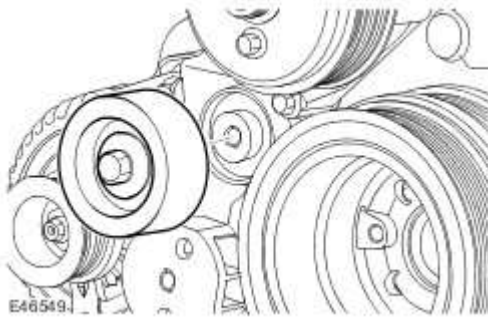
 Loosen the bolt.



Vehicles without secondary air injection (AIR)

- 5 . Remove the accessory drive belt idler pulley.

 Remove the bolt.

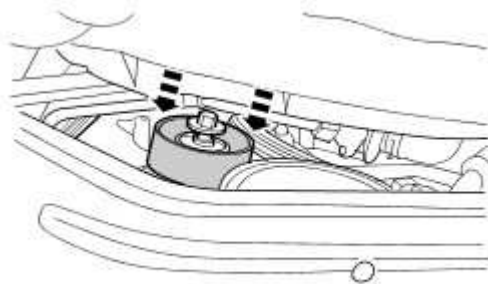


Vehicles with secondary air injection (AIR)

- 6
-  **CAUTION: Take care when removing the idler pulley, as damage to the secondary air injection pipes may occur.**

Remove the accessory drive belt idler pulley.

- ▶ Loosen the bolt and pulley assembly by approximately 15 mm.
- ▶ Using suitable tools, apply gentle pressure to the pulley assembly until the pulley separates from the bolt.
- ▶ Remove the bolt.



E105114

Installation

Vehicles without secondary air injection (AIR)

- 1 . Install the accessory drive belt idler pulley.

- ▶ Tighten the bolt to 25 Nm (18 lb.ft).

Vehicles with secondary air injection (AIR)

2



- **CAUTION: Make sure that the pulley is correctly centred on the bolt prior to tightening the bolt, failure to follow this instruction may result in damage to the vehicle.**

Install the accessory drive belt idler pulley.

- ▶ Using a suitable tool, release the bolt from the new pulley assembly.
- ▶ Loosely install the pulley and bolt.
- ▶ Check that the pulley is correctly centered on the bolt.
- ▶ Tighten the bolt to 25 Nm (18 lb.ft).

All vehicles

3 . Secure the supercharger belt tensioner.

- ▶ Tighten the bolt to 40 Nm (30 lb.ft).

4 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)


5 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Supercharger Belt (18.50.08)

Removal

1 . Remove the cover and disconnect the battery ground cable.

- 2
-  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

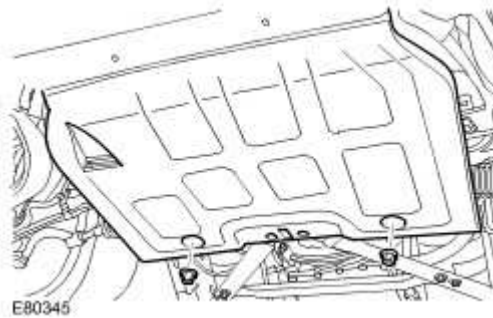
Raise and support the vehicle.

3 . Remove the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

4 . Remove the air deflector.

- ▶ Remove the 2 nuts.

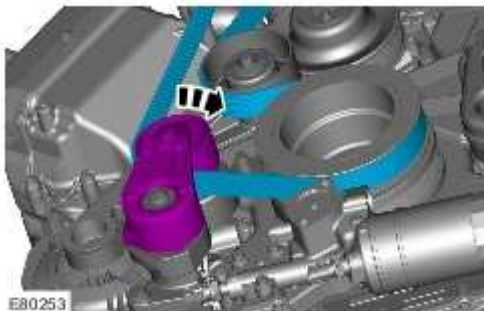


5 **NOTE:**

- Note the fitted position.

Release the supercharger belt.

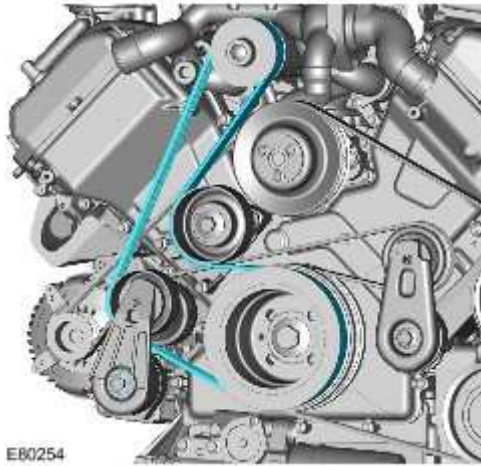
- ▶ Rotate the supercharger belt tensioner clockwise, using a 1/2 " drive wrench.



6 . Remove the supercharger belt.

Installation

1 . Install the supercharger belt.



2 . Install the air deflector.

▶ Tighten the nuts.

3 . Install the radiator splash shield.


For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

4 . Connect the battery ground cable and install the cover.

Supercharger Belt Tensioner (18.50.24)

Removal

1 . Remove the cover and disconnect the battery ground cable.

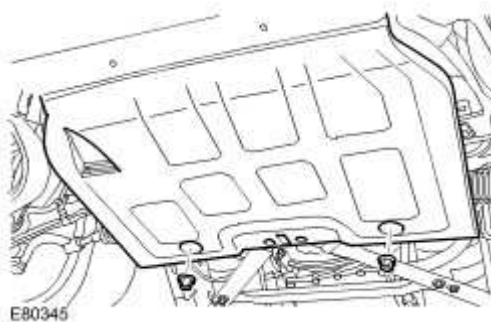
2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

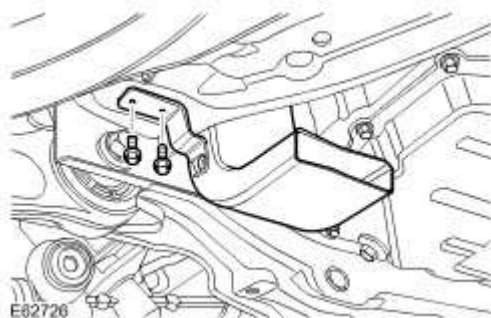
3 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)

4 . Remove the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Remove the air deflector.
 Remove the 2 nuts.

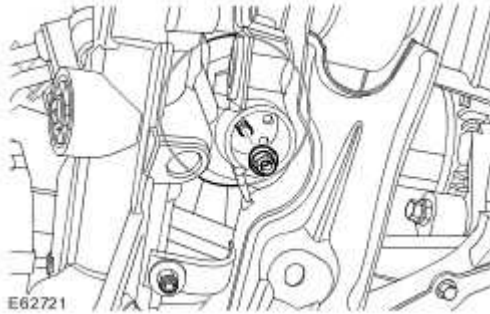


6 . Remove the generator cooling duct.
 Remove the 2 screws.



7 . Release the engine mounts.

- ▶ Support the engine.
- ▶ Remove and discard the 2 nuts.

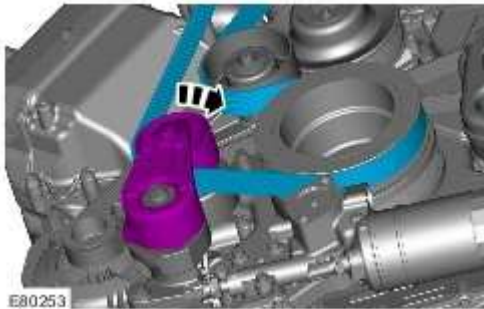


8 **NOTE:**

- Note the fitted position.

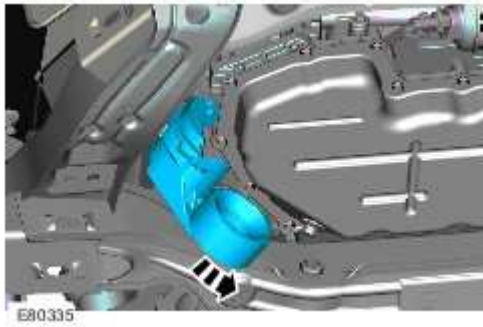
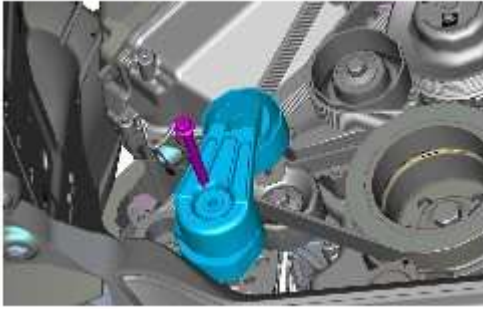
Release the supercharger belt.

- ▶ Rotate the supercharger belt tensioner clockwise, using a 1/2 " drive wrench.



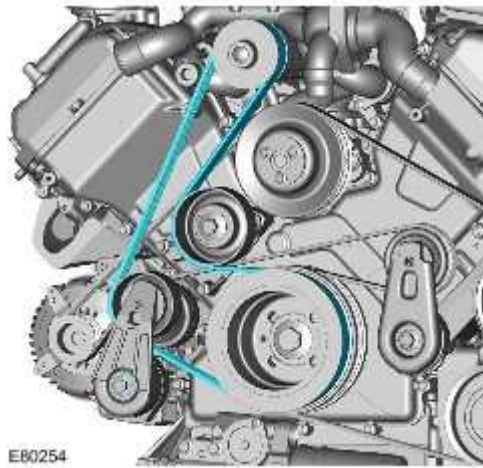
9 . Remove the supercharger belt tensioner.

- ▶ Raise the engine.
- ▶ Remove the bolt.
- ▶ Remove the O-ring seal.



Installation

- 1 . Install the supercharger belt tensioner.
 - ▶ Install the O-ring seal.
 - ▶ Tighten the bolt to 40 Nm (30 lb.ft).
 - ▶ Lower the engine onto its mounts.
- 2 . Secure the engine mounts.
 - ▶ Tighten the new nuts to 55 Nm (41 lb.ft).
- 3 . Attach the supercharger belt.



4 . Install the generator cooling duct.

▶ Tighten the screws.

5 . Install the air deflector.

▶ Tighten the nuts.

6 . Install the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

7 . Install the intake air resonator.


For additional information, refer to [Intake Air Resonator](#)

8 . Connect the battery ground cable and install the cover.

Supercharger Belt Idler Pulley (18.50.09)

Removal

1 . Remove the cover and disconnect the battery ground cable.

2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


3 . Remove the engine cover.

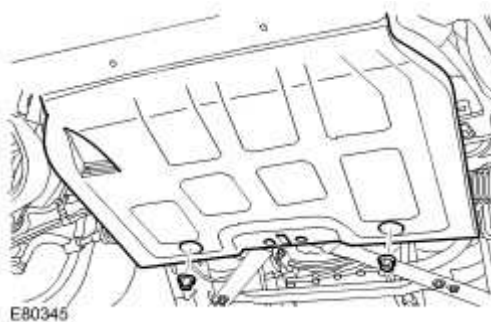
For additional information, refer to [Engine Cover \(76.11.35\)](#)

4 . Remove the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Remove the air deflector.


 Remove the 2 nuts.

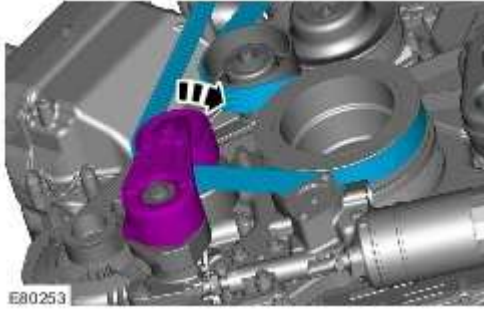


6 **NOTE:**

· Note the fitted position.

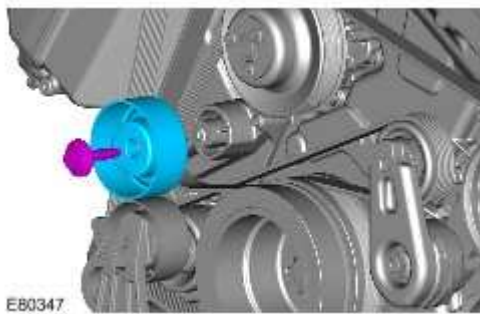
Release the supercharger belt.

 Rotate the supercharger belt tensioner clockwise, using a 1/2 " drive wrench.



7 . Remove the supercharger belt idler pulley.

▶ Remove the bolt.

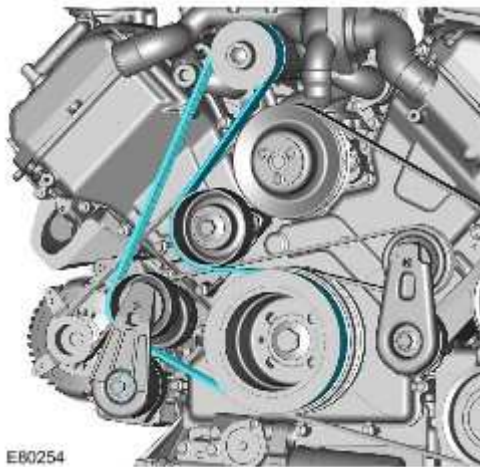


Installation

1 . Install the supercharger belt idler pulley.

▶ Tighten the bolt to 40 Nm (30 lb.ft).

2 . Attach the supercharger belt.



3 . Install the air deflector.

 Tighten the nuts.

4 . Install the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

6 . Connect the battery ground cable and install the cover.

303-06 : Starting System – 4.2L NA V8 – AJV8/4.2L SV V8 – AJV8

Specifications

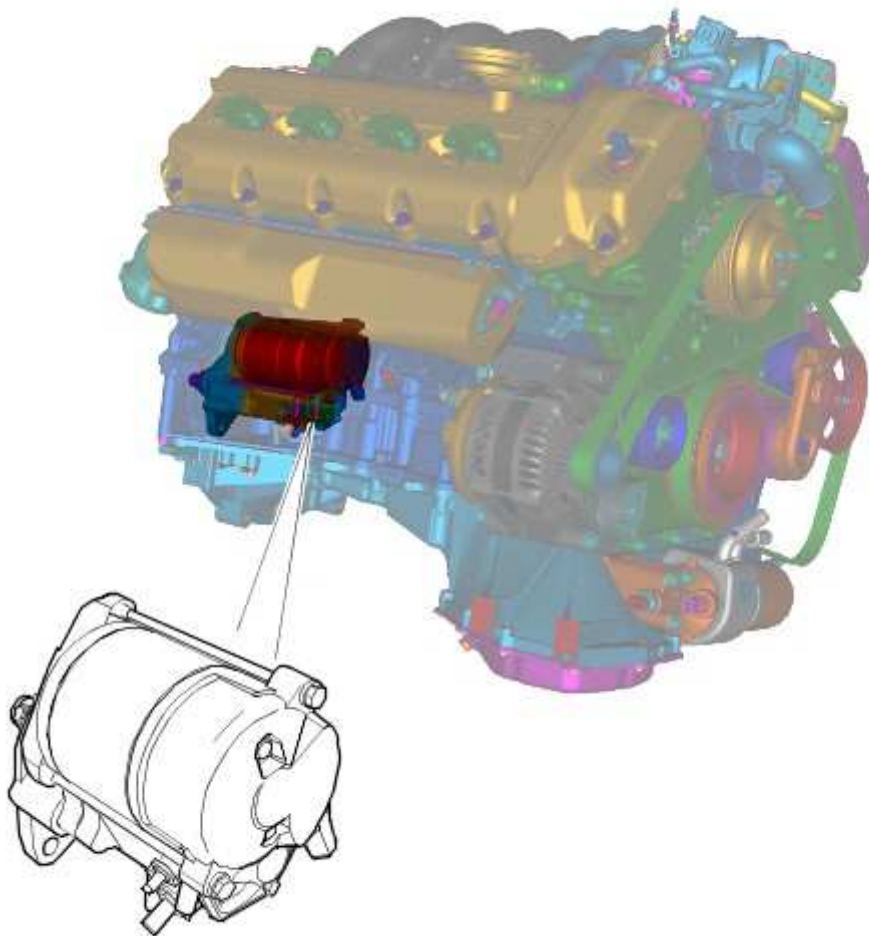
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Keyless start control module to floor console bracket - screw	6	4	53
Keyless start control module, trim to floor console bracket - screw	6	4	53
Starter motor - bolt/stud	43	32	-
Solenoid terminal connector - nut	7	5	62

Starting System

COMPONENT LOCATION



E63812

INTRODUCTION

The starter motor is rated at 1.8kW and is a Denso level three-sealed unit. It is an RA type starter motor, which is of the offset design with the solenoid being directly behind the pinion to give a more positive engagement to the ring gear. The motor is geared directly to the pinion. Each starter motor is of the pre-engaged type and comprises a series wound motor and an overrunning clutch.

The starter solenoid is energised by a signal from the Engine Control Module (ECM) when

the starter switch is pressed. When engine cranking is requested, the ECM checks that a valid mobilisation code has been received before granting the crank request. For additional information, refer to [Anti-Theft - Active](#) (419-01A Anti-Theft - Active)

Power for starter operation is supplied on a substantial single cable connected direct from the battery positive terminal. The cable is connected to the solenoid via a copper threaded stud with an anti-rotational device and secured with a nut.

The starter motor is located on the rear right hand side of the engine block. The motor is secured to the block and protrudes through an aperture to drive the flywheel via a ring gear.

Starting System

Principle of Operation

For a detailed description of the starting system, refer to the relevant Description and Operation section in the workshop manual.

[Starting System](#)

[Anti-Theft - Passive](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Gear selector lever cable adjustment • Starter Motor • Battery 	<ul style="list-style-type: none"> • Battery • Fuses • Wiring harness • Damaged, loose or corroded connectors • Starter relay • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the concern is not visually evident, verify the symptom and refer to the symptom chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
The engine does not crank (starter motor does not turn)	<ul style="list-style-type: none"> • Gear selector not in P or N position • Battery • Harness/Connectors • Starter motor • Starter relay • Start switch • Transmission control module (TCM) 	Make sure the gear selector is in the P or N position and correctly adjusted. Selector Lever Cable Adjustment (44.15.07) Check the battery condition and state of charge. Battery Check the starter motor and harness. Check for DTCs and refer to the DTC Index

	<ul style="list-style-type: none"> • Engine control module (ECM) • Engine seized 	
The engine does not crank (starter motor does turn)	<ul style="list-style-type: none"> • Starter motor installation • Starter motor • Ring gear 	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the ring gear teeth for damage, foreign objects, etc.
Engine cranks too slowly	<ul style="list-style-type: none"> • Battery • Harness/Connectors • Starter motor • Engine oil incorrect grade 	Check the battery condition and state of charge. Battery Refer to the electrical circuit diagrams and test the starter motor and starter motor circuits
Engine cranks too fast	<ul style="list-style-type: none"> • Low engine compression 	Check the engine compressions. Engine
Excessive starter motor noise	<ul style="list-style-type: none"> • Starter motor • Starter motor installation/casing • Ring gear 	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the ring gear teeth for damage, foreign objects, etc.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to 3 decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, the fault is not present, an

intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P081700	Starter relay circuit (break wire)	<ul style="list-style-type: none"> Starter relay control circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081A00	Starter relay circuit low	<ul style="list-style-type: none"> Starter relay control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081B00	Starter relay circuit high	<ul style="list-style-type: none"> Starter relay control circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100951	Ignition authorisation	<ul style="list-style-type: none"> Faulty instrument cluster Target SID re-synchronisation error following programming CAN fault 	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition authorisation signal compare failure	<ul style="list-style-type: none"> Low speed CAN fault CJB fault Instrument cluster fault Incorrect module installed (CJB/Instrument cluster) Target SID synchronisation error following re-programming Noise/EMC related error 	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100963	Ignition authorisation time-out	<ul style="list-style-type: none"> CJB fault Low speed CAN fault Instrument cluster fault Low battery voltage <9V 	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual

B100964	Ignition authorisation signal plausibility failure	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Instrument cluster fault 	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B100987	Ignition authorisation	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage <9V 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster. Check battery is fully charged and in serviceable condition, refer to the battery care manual
B100A51	Fuel pump authorisation target ID not stored	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault 	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel pump authorisation signal compare failure	<ul style="list-style-type: none"> • Low speed CAN fault • RJB fault • Instrument cluster fault • Incorrect module installed (RJB/Instrument cluster) • Write target SID synchronisation error following re-programming • Noise/EMC related error 	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation Time Out	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage <9V 	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100A64	Fuel Pump authorisation	<ul style="list-style-type: none"> • Write target SID synchronisation error following re-programming • RJB fault • Low speed CAN fault 	Re-synchronise ID by re-configuring the RJB as a new module. Check ignition, power and ground supplies to RJB and instrument cluster. Check CAN network

			between RJB and instrument cluster
B100A87	Fuel pump authorisation	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage < 9 volts 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster. Check battery is fully charged and in serviceable condition, refer to the battery care manual
B100B67	Column lock ground authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • RJB fault • Vehicle speed present when attempting to power steering column lock • Engine speed present when attempting to power steering column lock • Power mode status > four when attempting to perform lock action 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster. Check ABS, ECM and CJB for DTCs and refer to the relevant DTC Index
B100B87	Column lock ground authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • RJB fault 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster
B100C67	Column lock supply authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • CJB fault • Vehicle speed present when attempting to power steering column lock • Engine speed present when attempting to power steering column lock • Power mode status > four when attempting to perform lock action 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster. Check ABS, ECM and CJB for DTCs and refer to the relevant DTC Index
B100C87	Column lock supply authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • CJB fault 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster

B100D51	Column lock authorisation	<ul style="list-style-type: none"> • Not programmed 	Check ignition, power and ground supplies to steering column lock and instrument cluster. Re-synchronise ID by re-configuring the steering column lock as a new module
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Incorrect module installed (Steering column lock/Instrument cluster) • Target ID synchronisation error following re-programming • Noise/EMC related error 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault 	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Low voltage at steering column lock < 8V 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster
B100D96	Column lock authorisation	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Low temperature < -30 ° • Low voltage at steering column lock < 8 volts • Restricted bolt movement 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Check there is no torque applied to the steering column/wheel
B102611	Steering column lock power circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test steering column lock power circuit for short to ground
B102612	Steering column lock ground circuit short to power	<ul style="list-style-type: none"> • Steering column lock ground circuit - short to power 	Refer to the electrical circuit diagrams and test steering column lock ground circuit for short to power

B102613	Steering column lock power circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test steering column lock power circuit for high resistance
B102B67	Passive key authorisation signal incorrect after event	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Remote Keyless Entry (RKE) module fault • Write target SID synchronisation error following re-programming 	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module
B102B87	Passive key authorisation missing message	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • RKE module fault • Key fob battery low/battery contact issue • Interference from other RF signal • EMC/noise • Receiver fault • Receiver not programmed correctly • Serial communications fault (between receiver and RKE module) • Key fault • Passive antenna fault • Confirm placement of key within vehicle 	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then re-connect - confirm operation by re-programming keys. Check serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108A23	Start button stuck	<ul style="list-style-type: none"> • Signal stuck low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B108A29	Start button fault	<ul style="list-style-type: none"> • Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B114011	Engine crank authorisation circuit short to ground or over temperature	<ul style="list-style-type: none"> • Engine crank authorisation circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B114013	Engine crank authorisation circuit open load	<ul style="list-style-type: none"> • Engine crank authorisation circuit high 	Carry out any pinpoint tests associated with this DTC using the manufacturer

		resistance	approved diagnostic system
B1B0100	Key transponder - number of keys stored below minimum number required	<ul style="list-style-type: none"> • Operator only cycles one key during programming • Instrument cluster, start control unit or key loses power or circuit failure during programming • Faulty key • Unable to programme key due to noise/EMC related issues 	Ensure all keys to be programmed are available. Check power and ground supplies to all relevant modules. Replace faulty key. Check CAN network for noise/EMC related issues
B1B0105	Key transponder - start control unit already programmed	<ul style="list-style-type: none"> • Error following start control unit replacement • Start control unit fault • LIN fault • Instrument cluster fault 	Re-synchronize ID by re-configuring the start control unit as new module. Check power and ground supplies to start control unit and instrument cluster. Check LIN circuit between start control unit and instrument cluster
B1B0151	Key transponder - start control unit programming error	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Faulty key • Start control unit fault • Attempted to programme a non-default key 	Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster. Ensure new keys are from a known good source
B1B0155	Key transponder - transponder not programmed	<ul style="list-style-type: none"> • Un-programmed key inserted in start control unit • Non-default key inserted during key programming 	Confirm correct keys are being used
B1B0162	Key transponder - start control unit challenge response error	<ul style="list-style-type: none"> • Instrument cluster fault • Start control unit fault • Incorrect module installed (instrument cluster/start control unit) • Error during or following the write target SID routine • Noise/EMC related issues 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check power and ground supplies to start control unit and instrument cluster. Check correct modules are installed. Re-synchronize ID by re-configuring the start control unit as a new module. Check CAN network for

			interference/EMC related issues
B1B0164	Key transponder - transponder challenge response error	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Key fault • Start control unit fault • Error occurred during key programming 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster. Confirm correct key operation. Re-run key programming
B1B0167	Key transponder - start control unit invalid response	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Key fault • Start control unit fault • Another key in close proximity • Attempted to programme a non default key • IPK Cold initialisation whilst in Ignition On state, without key being present in the SCU • Race condition caused by closing driver door and pressing start button within a small time window • Passive Key search function from last door closed and key inserted in the SCU 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check ignition, power and ground supplies to start control unit and instrument cluster. Confirm correct key operation. Confirm single key operation. Ensure new keys are from a known good source. Check for intermittent power and ground at instrument cluster. Design condition - advise customer of correct starting sequence. Design condition - determine customer transponder key usage
B1B0187	Key transponder - timer expired	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Start control unit fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster
B1B3305	Target I.D. transfer - system	<ul style="list-style-type: none"> • CAN fault • ECM fault 	Check CAN network between ECM and


	programming failures	<ul style="list-style-type: none"> Instrument cluster fault ECM or instrument cluster incorrectly configured 	instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Re-synchronise ID by re-configuring the instrument cluster as a new module
B1B3362	Target I.D. transfer - signal compare failure	<ul style="list-style-type: none"> CAN fault ECM fault Instrument cluster fault Incorrect module installed (ECM/instrument cluster) Synchronisation error following re-programming Noise/EMC related error 	Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B1B3364	Target I.D. transfer - signal plausibility failure	<ul style="list-style-type: none"> CAN fault ECM fault Instrument cluster fault Steering column lock status incomplete Race condition caused by closing driver door and pressing start button within a small time window 	Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check steering column lock operation. Design condition - advise customer of correct start sequence
B1B3387	Target I.D. transfer - missing message	<ul style="list-style-type: none"> CAN fault ECM fault Instrument cluster fault Low battery voltage 	Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
U000188	High speed CAN communication bus	<ul style="list-style-type: none"> Vehicle CAN bus off condition 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the

			DTC and retest. If the DTC is still logged suspect the steering column lock, refer to the new module installation note at the top of the DTC Index
U300049	Control Module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new steering column lock, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check steering column lock for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index

Starter Motor (86.60.01)

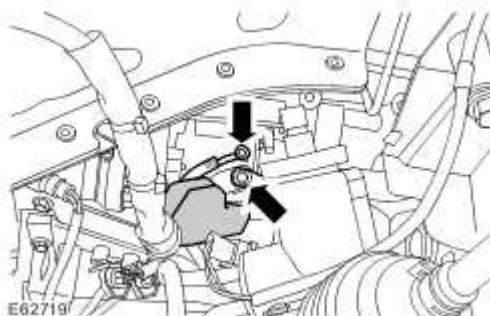
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

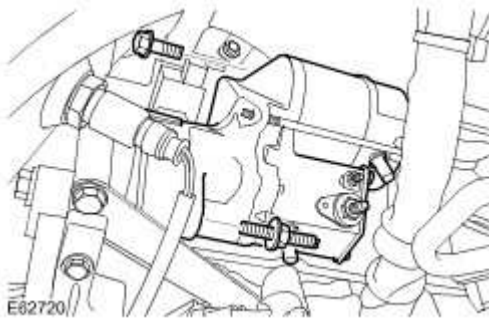
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the RH engine mount.
- 4 . Disconnect the battery positive and generator cables.
 - ▶ Release the cover.
 - ▶ Remove the nut.



- 5 . Disconnect the starter motor solenoid electrical connector.
 - ▶ Remove and discard the nut.
- 6 . Remove the starter motor.
 - ▶ Remove the 2 bolts.



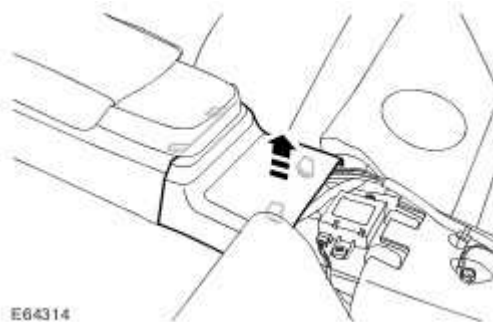
Installation

- 1 . Install the starter motor.
 - ▶ Clean the component mating faces.
 - ▶ Tighten the bolts to 45 Nm (33 lb.ft).
- 2 . Connect the starter motor solenoid electrical connector.
 - ▶ Tighten the new nut to 7 Nm (5 lb.ft).
- 3 . Connect the battery positive and generator cables.
 - ▶ Tighten the nut to 10 Nm (7 lb.ft).
 - ▶ Secure the cover.
- 4 . Install the RH engine mount.
- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

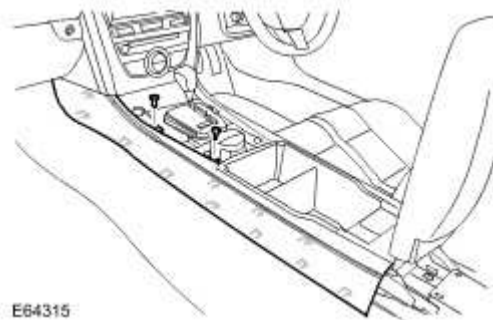
Start Control Unit

Removal

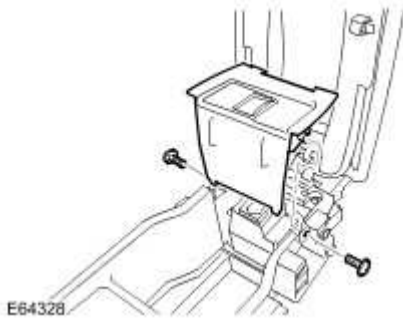
- 1 . Remove the rear seat armrest.
For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)
- 2 . Remove the floor console veneer trim panel.
For additional information, refer to [Floor Console Finish Panel \(76.47.26\)](#)
- 3 . Remove the floor console rear panel.
 - ▶ Carefully release the 2 clips.



- 4 . Remove the floor console side panel trim.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Carefully release 11 clips.
 - ▶ Repeat the procedure and remove the opposite hand.

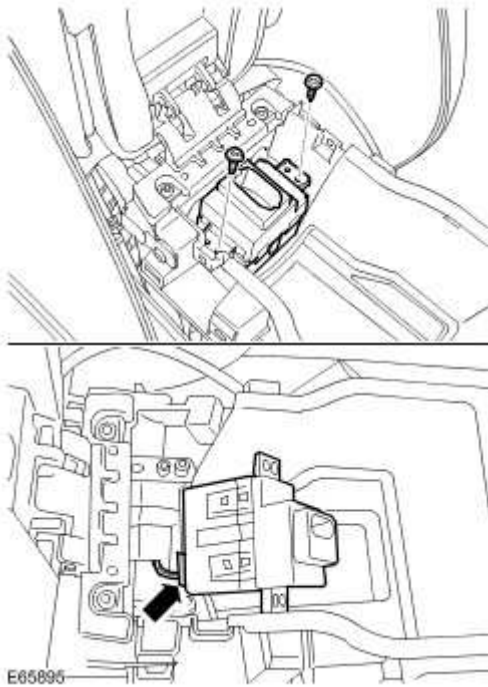


- 5 . Remove the keyless start control module trim cover.
 - ▶ Remove the 2 Torx screws.



6 . Remove the keyless start control module.

- ▶ Remove the 2 Torx screws.
- ▶ Disconnect the electrical connector.



Installation

1 . Install the keyless start control module.

- ▶ Connect the electrical connector.
- ▶ Install the Torx screws.

2 . Install the keyless start control module trim cover.

- ▶ Install the Torx screws.

- 3 . Install the floor console side panel trim.
 - ▶ Carefully align and secure the clips.
 - ▶ Tighten the Torx screws to 6 Nm (4 lb.ft).
 - ▶ Install the opposite hand.

- 4 . Install the floor console rear panel.
 - ▶ Align the lugs and secure the clips.

- 5 . Install the floor console veneer trim panel.
For additional information, refer to [Floor Console Finish Panel \(76.47.26\)](#)

- 6 . Install the rear seat armrest.
For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)

- 7 . Connect WDS to the vehicle and configure a new module.

303-07 : Engine Ignition – 4.2L NA V8 – AJV8/4.2L SC V8 – AJV8

Specifications

Specifications

Engine Firing Order

Firing Order

1 : 2 : 7 : 3 : 4 : 5 : 6 : 8

General Specifications

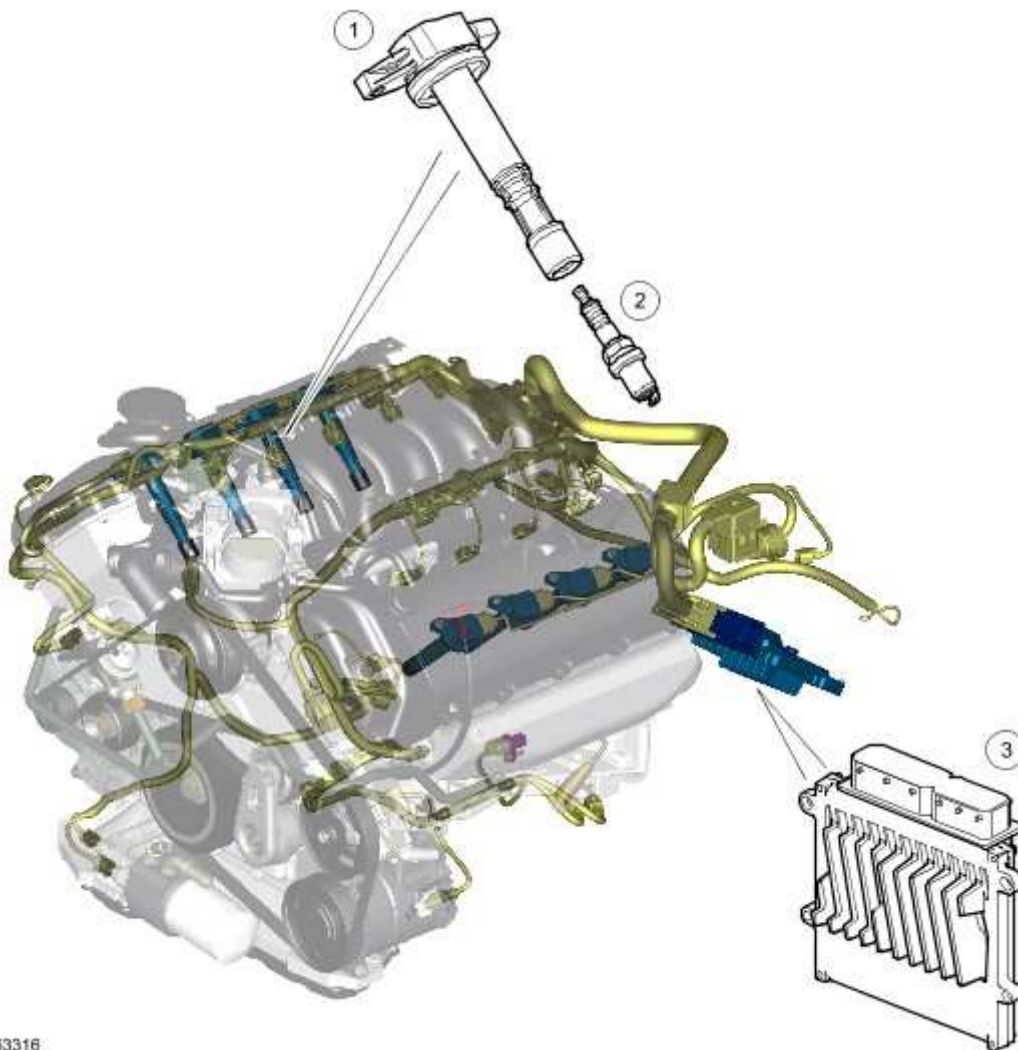
Item	Specification
Spark plug	AJ8 4575
Spark plug gap	0.9 - 1.0 mm

Torque Specifications

Item	Nm	lb-ft	lb-in
Ignition coil - bolt	5	4	44
Spark plug	28	21	-

Engine Ignition

COMPONENT LOCATION



E63316

Item	Part Number	Description
1	-	Ignition coils (8 off)
2	-	Spark plugs (8 off)
3	-	ECM

INTRODUCTION

The 4.2L engine ignition system has a single iridium tipped spark plug per cylinder, with each spark plug powered by an on-plug ignition coil. The ignition coils are directly driven by the ECM.

IGNITION COILS

Power for the ignition coils is supplied from the main relay and a fuse in the BJB. A capacitor is connected in parallel with the power supplies to the ignition coils to suppress RFI (radio frequency interference).

Each ignition coil contains a power stage to switch the current in the primary circuit. The ECM controls the switching with a signal to the power stage. The ECM monitors operation of the ignition coils using a feedback signal from each of the power stages. If a fault is detected the ECM stores an appropriate fault code.

The ECM varies the dwell time of the ignition coils depending on battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures a good spark is always produced by the spark plug without excessive primary current flow, thus avoiding overheating or damage to the ignition coils.

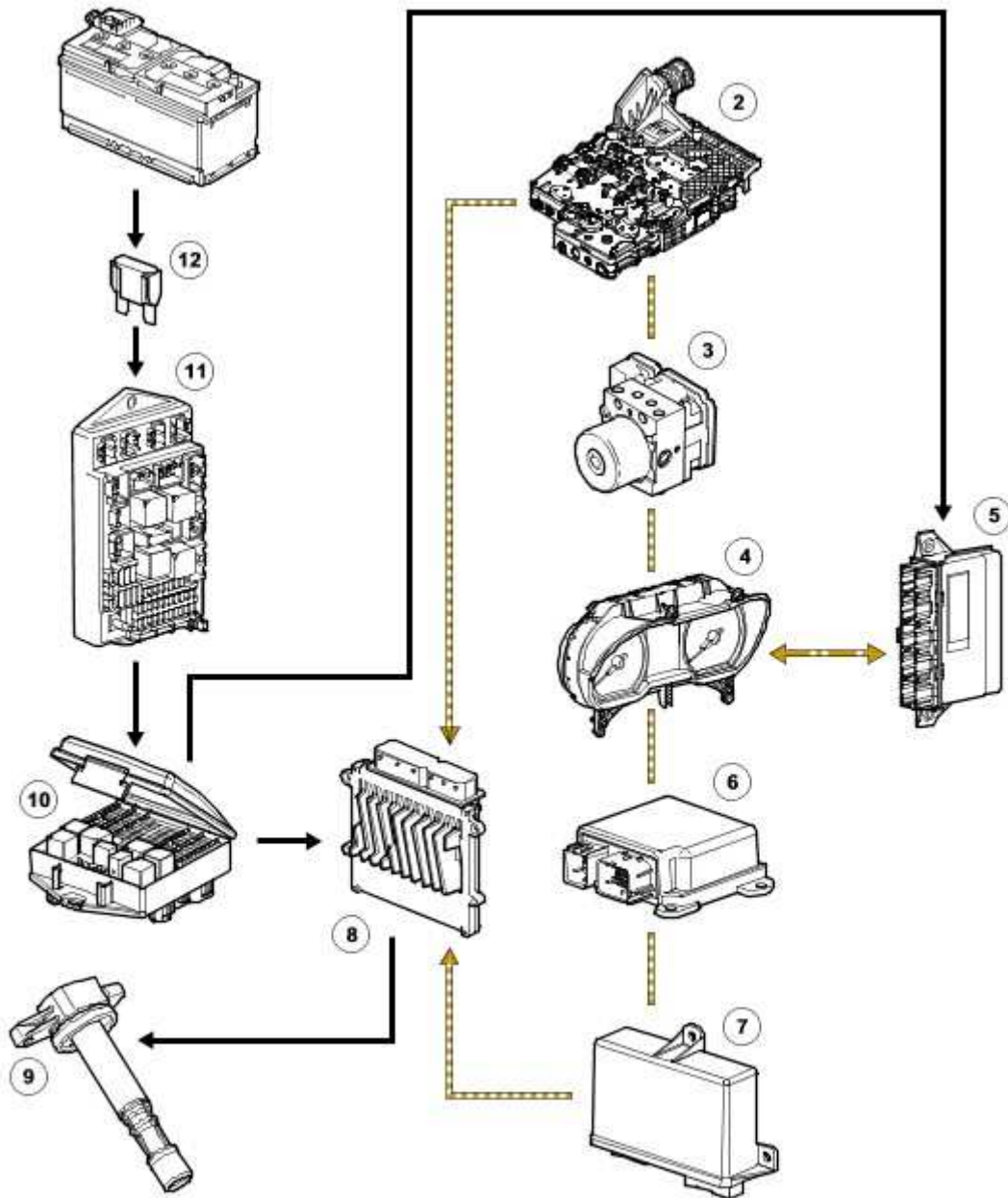
The ECM calculates the ignition timing for individual cylinders from:

- Engine speed.
- Camshaft position.
- Engine load.
- Engine temperature.
- The knock control function.
- The shift control function.
- The idle speed control function.

CONTROL DIAGRAM

NOTE:

A = Hardwired connections; D = High speed CAN bus; N=Medium speed CAN bus



E63317



Item	Part Number	Description
1	-	Battery
2		TCM
3		ABS control module
4		Instrument cluster
5		Keyless vehicle module
6		RCM
7		Park brake module
8	-	ECM

9	-	Ignition coils (8 off)
10	-	Auxiliary junction box
11	-	CJB
12	-	Mega fuse

Engine Ignition

Principle of Operation

For a detailed description of the Engine Ignition System, refer to the relevant Description and Operation section of the workshop manual.

[Engine Ignition](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded electrical connectors • Ignition coils • Sensor(s) • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Engine ignition system • Fuel system • Electronic engine controls 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index in this section for engine ignition system tests

		<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to the DTC Index for electronic engine controls. Electronic Engine Controls
<p>Engine cranks and fires, but will not start</p>	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition coil failure(s) 	<ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For spark plug tests, GO to Pinpoint Test G553827p2. • For engine ignition coil circuit tests, check for DTCs and refer to the DTC Index
<p>Difficult cold start</p>	<ul style="list-style-type: none"> • Engine coolant level-anti-freeze content • Battery • Electronic engine controls • Exhaust gas recirculation (EGR) valve stuck open • Fuel pump • Purge valve 	<ul style="list-style-type: none"> • Check the engine coolant level and anti-freeze content. Specifications • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index for electronic engine controls. Electronic Engine Controls • For EGR system tests. Engine Emission Control • For fuel system tests. Fuel Tank and

		<p>Lines</p> <ul style="list-style-type: none"> For purge valve tests. <p>Evaporative Emissions</p>
Difficult hot start	<ul style="list-style-type: none"> Injector leak Electronic engine controls Purge valve Fuel pump Engine ignition system EGR valve stuck open 	<ul style="list-style-type: none"> Check for leaking injectors Read DTCs and refer to the DTC Index for electronic engine controls. <p>Electronic Engine Controls</p> <ul style="list-style-type: none"> For purge valve tests. <p>Evaporative Emissions</p> <ul style="list-style-type: none"> For fuel system tests. <p>Fuel Tank and Lines</p> <ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for engine ignition system tests For EGR valve tests. <p>Engine Emission Control</p>
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> Injector leak Electronic engine controls Purge valve Fuel pump Engine ignition system EGR valve stuck open 	<ul style="list-style-type: none"> Check for leaking injectors Read DTCs and refer to DTC Index for electronic engine control tests. <p>Electronic Engine Controls</p> <ul style="list-style-type: none"> For purge valve tests. <p>Evaporative Emissions</p> <ul style="list-style-type: none"> For fuel system tests. <p>Evaporative Emissions</p> <ul style="list-style-type: none"> Read DTCs and refer to DTC Index

		<p>in this section for engine ignition system tests</p> <ul style="list-style-type: none"> • For EGR valve tests. Engine Emission Control
<p>Engine stalls soon after start</p>	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine control • Engine ignition system • Air intake system restricted • Air leakage • Fuel lines 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control. Electronic Engine Controls • Read DTCs and refer to DTC Index in this section for engine ignition system tests • Check for blockage in air filter element and air intake system • For fuel system tests. Fuel Tank and Lines
<p>Engine hesitates/poor acceleration</p>	<ul style="list-style-type: none"> • Fuel pressure, pump and lines • Injector leak • Air leakage • Electronic engine controls • Engine ignition system • EGR valve stuck open • Transmission malfunction • Restricted pedal travel (carpet, etc) 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for injector leak • Check for leakage from air intake system • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • Read DTCs and refer to DTC Index

		<p>in this section for engine ignition system tests</p> <ul style="list-style-type: none"> • For EGR system tests. Engine Emission Control • For transmission tests. Diagnostic Strategy • Ensure accelerator pedal is free from restriction
Engine backfires	<ul style="list-style-type: none"> • Fuel pump and lines • Air leakage • Electronic engine controls • Engine ignition system • Sticking Variable Camshaft Timing (VCT) hub 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for leakage in air intake system • Read DTCs and refer to DTC Index for electronic engine controls. Electronic Engine Controls • Read DTCs and refer to DTC Index in this section for engine ignition system tests • Read DTCs and refer to DTC Index for VCT tests. Electronic Engine Controls
Engine surges	<ul style="list-style-type: none"> • Fuel pump and lines • Electronic engine controls • Engine ignition system 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index for electronic engine controls. Electronic Engine Controls • Read DTCs and refer to DTC Index

		in this section for engine ignition system tests
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump and lines • Air leakage • Sticking VCT hub 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index for electronic engine controls • For fuel system tests. Fuel Tank and Lines • Check for leakage from air intake system • Read DTCs and refer to DTC Index for VCT tests. Electronic Engine Controls
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index for electronic engine control tests
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine control • Transmission malfunction • Traction control event • Air leakage 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index for electronic engine control tests. Electronic Engine Controls • For transmission tests. Diagnostic Strategy • Check for leakage from air intake system

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P035100	Cylinder 1 ignition coil primary/secondary circuit	<ul style="list-style-type: none">Engine ignition coil circuit - short to ground, power, open circuit	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035200	Cylinder 2 ignition coil primary/secondary circuit	<ul style="list-style-type: none">Engine ignition coil circuit - short to ground, power, open circuit	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035300	Cylinder 3 ignition coil primary/secondary circuit	<ul style="list-style-type: none">Engine ignition coil circuit - short to ground, power, open circuit	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P035400	Cylinder 4 ignition coil primary/secondary circuit	<ul style="list-style-type: none"> Engine ignition coil circuit - short to ground, power, open circuit 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035500	Cylinder 5 ignition coil primary/secondary circuit	<ul style="list-style-type: none"> Engine ignition coil circuit - short to ground, power, open circuit 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035600	Cylinder 6 ignition coil primary/secondary circuit	<ul style="list-style-type: none"> Engine ignition coil circuit - short to ground, power, open circuit 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035700	Cylinder 7 ignition coil primary/secondary circuit	<ul style="list-style-type: none"> Engine ignition coil circuit - short to ground, power, open circuit 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035800	Cylinder 8 ignition coil primary/secondary circuit	<ul style="list-style-type: none"> Engine ignition coil circuit - short to ground, power, open circuit 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P131500	Persistent misfire	<ul style="list-style-type: none"> ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged) Fuel injector circuit fault(s) (injector DTCs 	<ul style="list-style-type: none"> Check for cylinder mis-fire, ignition and injector DTCs and refer to the DTC Index For fuel system

		also flagged) <ul style="list-style-type: none"> Fuel delivery pressure low Spark plug failure/fouled/incorrect gap Cylinder compression low 	tests. Fuel Tank and Lines <ul style="list-style-type: none"> For spark plug tests. Engine Ignition <ul style="list-style-type: none"> For cylinder compression tests. Engine
P136700	Ignition amplifier group A	<ul style="list-style-type: none"> Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P136800	Ignition amplifier group B	<ul style="list-style-type: none"> Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Pinpoint Tests

PINPOINT TEST G553827p2 : CHECK SPARK PLUG RESISTANCE

G553827t9 : CHECK SPARK PLUG RESISTANCE

1. Remove the suspect spark plug(s). 2. Measure the resistance between:

Spark plug	Spark plug
Center electrode tip	HT contact

- Is the resistance between 8,000 and 12,000 ohms? (nominal 10,000 ohms)

-> Yes

Check ignition coil and circuits. Refer to the DTC Index for ignition coil and circuit tests.

-> **No**

INSTALL new spark plug(s). CLEAR the DTC and test the system for normal operation.

Spark Plugs - 4.2L NA V8 - AJV8 (18.20.02)

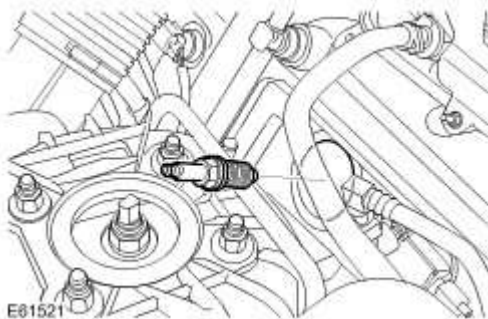
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 Remove the ignition coil-on-plugs.
For additional information, refer to [Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 \(18.20.40\)](#)
- 3 . Remove the remaining ignition coil-on-plugs.


- 4 .  **WARNING: Eye protection must be worn.**

Clean the area surrounding the spark plugs.

- 5 . Remove the spark plugs.



Installation

- 1 . Install the spark plugs.
 Tighten the spark plugs to 28 Nm (21 lb.ft).
- 2 . Install the remaining coil-on-plugs.
- 3 Install the ignition coil-on-plug.
For additional information, refer to [Ignition Coil-On-Plug - 4.2L NA V8 - AJV8](#)

(18.20.40)

- 4 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Spark Plugs - 4.2L SC V8 - AJV8 (18.20.02)

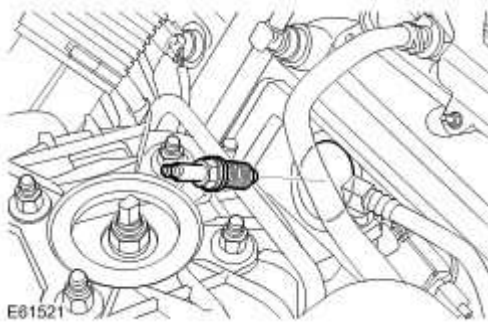
Removal

- 1 Remove the ignition coil-on-plugs.
 - For additional information, refer to [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 \(18.20.40\)](#)
- 2 . Remove the remaining ignition coil-on-plugs.

- 3 .  **WARNING: Eye protection must be worn.**

Clean the area surrounding the spark plugs.

- 4 . Remove the spark plugs.



Installation

- 1 . Install the spark plugs.
 - ▶ Tighten the spark plugs to 25 Nm (18 lb.ft).
- 2 . Install the remaining coil-on-plugs.
- 3 Install the ignition coil-on-plug.
 - For additional information, refer to [Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 \(18.20.40\)](#)

Ignition Coil-On-Plug - 4.2L NA V8 - AJV8 (18.20.40)

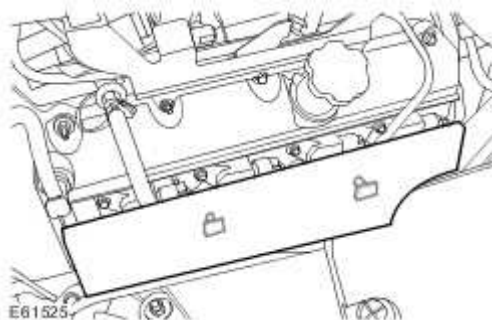
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . **NOTE:**
Left hand engine bank only.

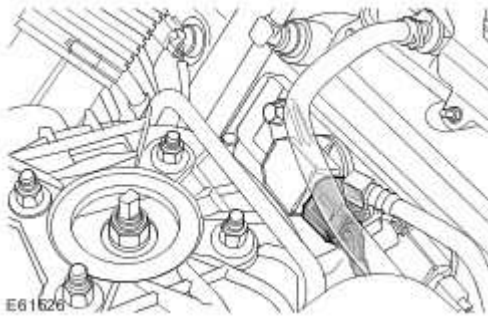
Remove the dipstick.



- 4 . Remove the ignition coil cover.
▶ Release from the 2 clips.

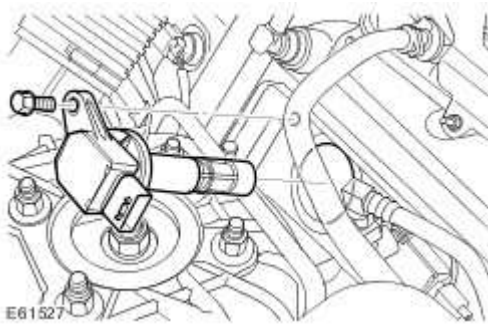


- 5 . Disconnect the ignition coil-on-plug electrical connector.



6 . Remove the ignition coil-on-plug.

▶ Remove the bolt.



Installation

1 . Install the ignition coil-on-plug.

▶ Tighten the bolt to 6 Nm (4 lb.ft).

2 . Connect and secure the electrical connector.

3 . Install the ignition coil-on-plug cover.

▶ Position and secure the clips.

4 . **NOTE:**

Left hand engine bank only.

Install the dipstick.

5 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

6 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Ignition Coil-On-Plug - 4.2L SC V8 - AJV8 (18.20.40)

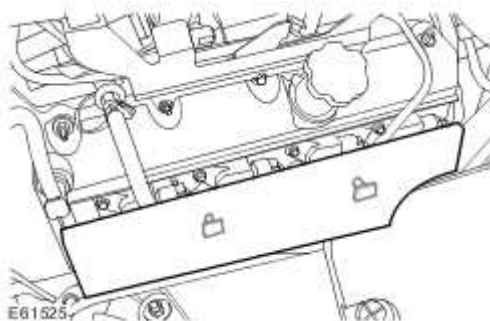
Removal

- 1 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 2 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 3 . **NOTE:**
Left hand engine bank only.

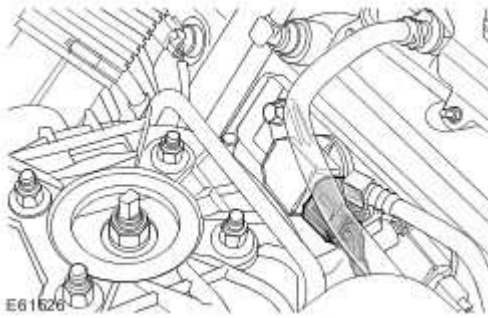
Remove the oil level indicator.



- 4 . Remove the ignition coil cover.
▶ Release from the 2 clips.

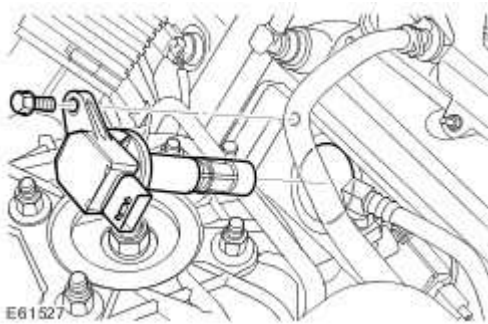


- 5 . Disconnect the ignition coil-on-plug electrical connector.



6 . Remove the ignition coil-on-plug.

- ▶ Remove the bolt.



Installation

1 . Install the ignition coil-on-plug.

- ▶ Tighten the bolt to 6 Nm (4 lb.ft).
- ▶ Connect the electrical connector.

2 . Install the ignition coil-on-plug cover.

- ▶ Position and secure the clips.

3 . **NOTE:**

Left hand engine bank only.

Install the oil level indicator.

4 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)

5 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

303-08A : Engine Emission Control – 4.2L SC V8 – AJV8

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) tube to EGR valve - bolt	21	15	-
EGR tube to exhaust manifold - nut	21	15	-
EGR valve to throttle body elbow - bolt	10	7	88
Positive crankcase ventilation (PCV) valve - screw	5	4	44
Secondary air injection, air pipe - union nut	35	26	-
Secondary air injection, blanking plug	35	26	-
Secondary air injection, control valve bracket to engine - bolt	8	6	71
Secondary air injection, manifold absolute pressure sensor to bonnet hinge panel - bolt	11	8	-
Secondary air injection, pump to bracket - nut	8	6	71

Engine Emission Control

For additional information, refer to [Engine Emission Control](#) (303-08 Engine Emission Control - Vehicles Without: Supercharger)

Engine Emission Control


No Data Available

Exhaust Gas Recirculation (EGR) Valve (17.45.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the throttle body.
For additional information, refer to [Throttle Body \(19.70.04\)](#)
- 3 . Disconnect the EGR valve electrical connector.

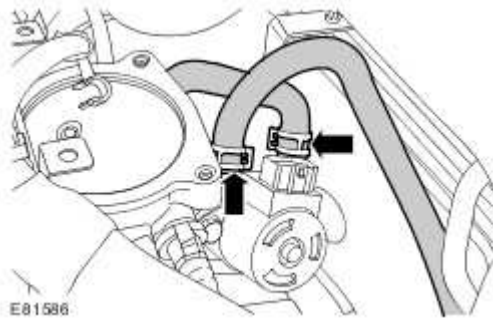


- 4  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

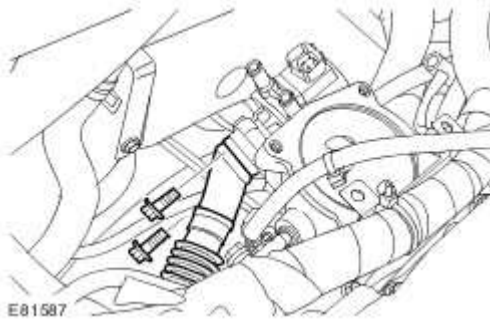
 **CAUTION:** Always plug any open connections to prevent contamination.

Disconnect the 2 EGR valve coolant hoses.

- Clamp the EGR coolant hose to minimize coolant loss.
- Release the 2 clips.

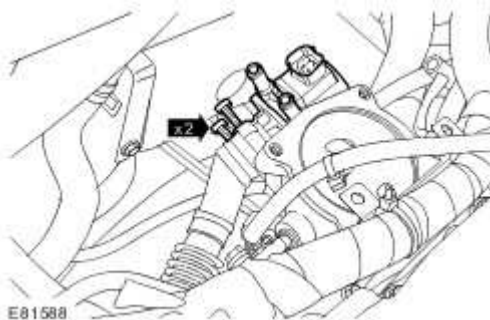


- 5 . Release the EGR valve to exhaust manifold pipe.
- ▶ Remove the 2 bolts.
 - ▶ Remove and discard the gasket.



- 6 . **NOTE:**
The bolts will remain captive.

- Remove the EGR valve.
- ▶ Remove the 2 Torx bolts.
 - ▶ Remove and discard the gasket.



Installation

- 1 . Install the EGR valve.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).

- 2 . Attach the EGR valve to exhaust manifold pipe.
 - ▶ Install a new gasket.
 - ▶ Tighten the bolts to 21 Nm (15 lb.ft).

- 3 . Connect the coolant hoses and secure with the clips.
 - ▶ Remove the coolant hose clamps.

- 4 . Connect the EGR valve electrical connector.

- 5 . Install the throttle body.
For additional information, refer to [Throttle Body \(19.70.04\)](#)

- 6 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

- 7 **NOTE:**
 - For NAS vehicles only.

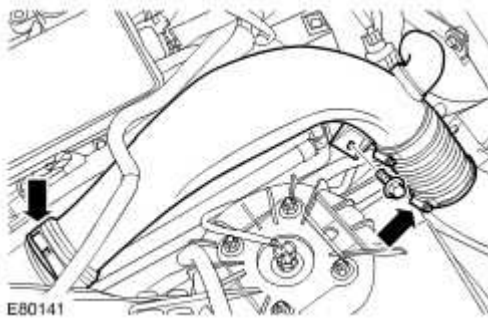
If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

Positive Crankcase Ventilation (PCV) Valve

Removal

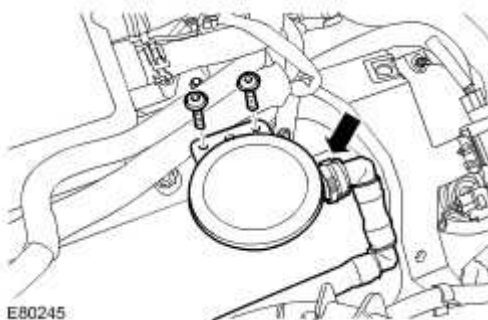
- 1 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 2 . RH side: Remove the intake air resonator.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.



- 3 .  **CAUTION: Always plug any open connections to prevent contamination.**

Remove the positive crankcase ventilation (PCV) valve.

- ▶ Disconnect the PCV hose.
- ▶ Remove the 2 Torx screws.



Installation

- 1 . Install the PCV valve.

- ▶ Clean the components.
- ▶ Lubricate the seal with clean engine oil.
- ▶ Tighten the Torx screws.
- ▶ Connect the hose.

2 . Install the intake air resonator.

- ▶ Secure with the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

3 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

Special Service Tools




Engine lifting brackets
303-749



Engine support bracket
303-021

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 Drain the coolant.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8
- 4 . Remove the hood.
For additional information, refer to Hood (76.16.01)

5 . Remove the front wheels and tires.
For additional information, refer to Wheel and Tire (74.20.05)

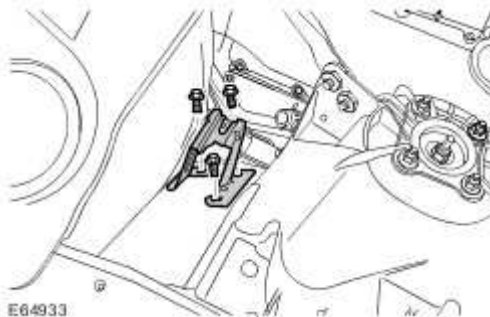
6 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

7 . Remove the engine undershield.
For additional information, refer to Air Deflector (76.11.41)

8 . Remove the coolant expansion tank.
For additional information, refer to Coolant Expansion Tank (26.15.01)

9 . Remove the coolant expansion tank support bracket.

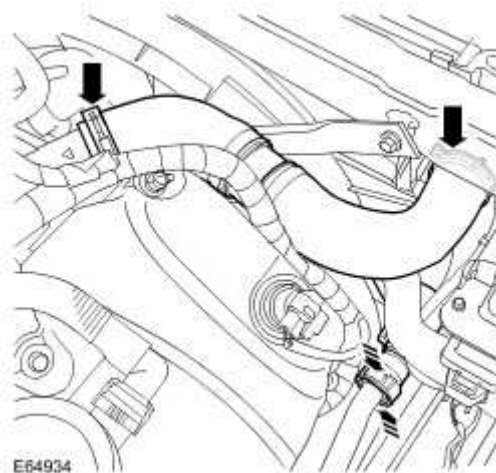
▶ Remove the 3 nuts.



10 . Remove the radiator top hose.

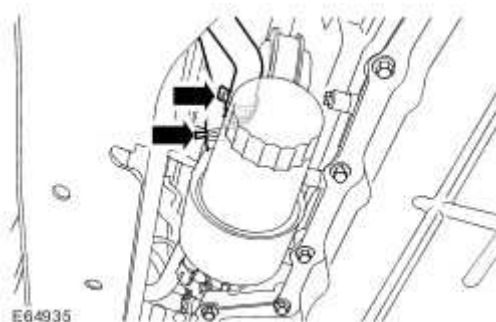
▶ Release the 2 clips.

▶ Disconnect the quick release connector.



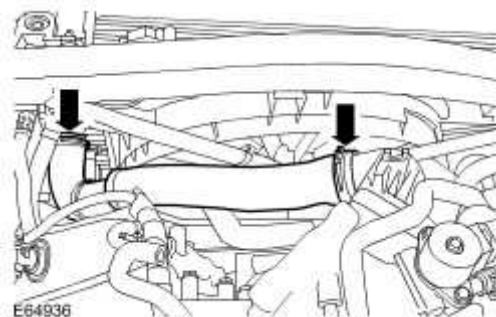
11 . Disconnect the coolant hoses from the engine oil cooler.

▶ Release the 2 clips.



12 . Remove the radiator bottom hose.

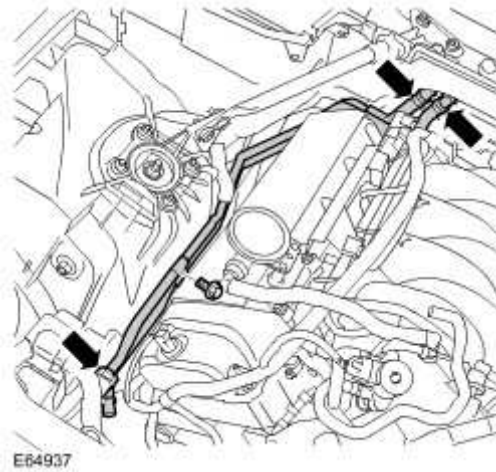
▶ Release the 2 clips.



13 . Remove the coolant rail.

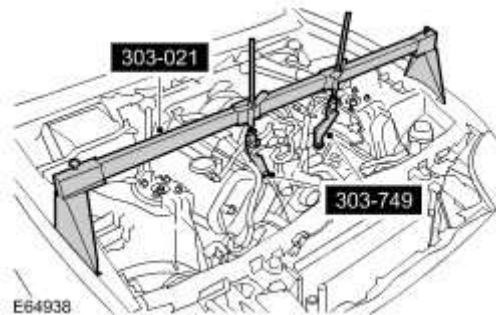
▶ Remove the bolt.

▶ Disconnect the 3 quick release connectors.



14 .  **CAUTION: Protect the paintwork during this operation.**

Using the special tools, support the engine.



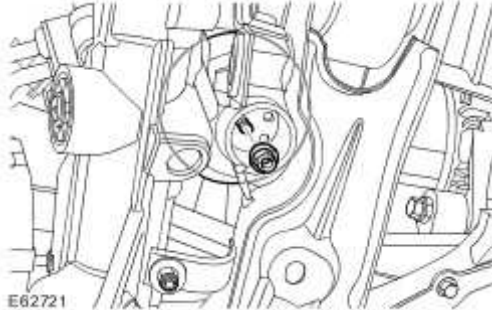
15 . **NOTE:**

RH illustration shown, LH is similar

Release the engine mounts.

▶ Remove and discard the 2 nuts.

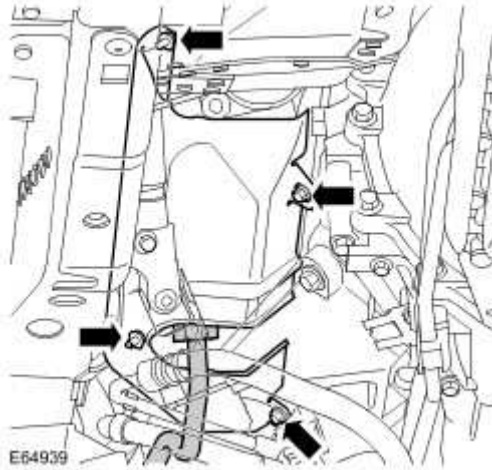
▶ Raise the engine.



16 . Release the RH exhaust manifold heat shield.

▶ Remove the 4 screws.

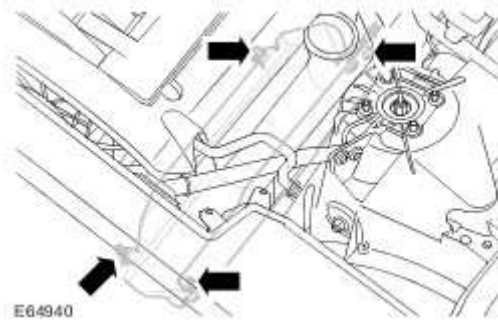
17 . Release the AIR tube from the RH exhaust manifold.



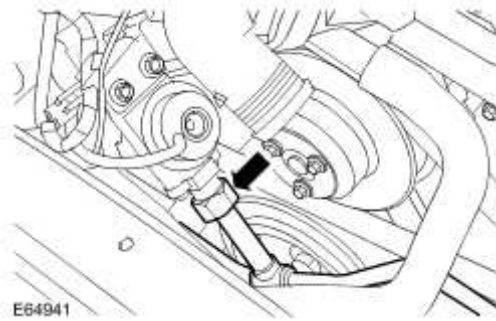
18 . Release the LH exhaust manifold heat shield.

▶ Remove the 4 screws.

19 . Release the AIR tube from the LH exhaust manifold.



20 . Release the AIR tube from the AIR control valve.



21 . Remove the AIR tube.

Installation

1 . Install the AIR tube.

2 . Attach the AIR tube to the exhaust manifolds.

▶ Tighten the unions to 35 Nm (26 lb.ft).

3 . Attach the AIR tube to the AIR control valve.

▶ Tighten the union to 35 Nm (26 lb.ft).

4 . Install the LH exhaust manifold heat shield.

▶ Tighten the screws.

5 . Install the RH exhaust manifold heat shield.

▶ Tighten the screws.

6 . Lower the engine onto its mounts.

▶ Tighten the new nuts to 63 Nm (46 lb.ft).

▶ Remove the special tools.

7 . Install the coolant rail.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

▶ Connect the quick release connectors.

8 . Install the radiator bottom hose.

▶ Secure with the clips.

9 . Install the radiator top hose.


▶ Secure with the clips.

▶ Connect the quick release connector.

10 . Connect the engine oil cooler, coolant hoses.

▶ Secure with the clips.

11 . Install the coolant expansion tank support bracket.

 Tighten the nuts to 10 Nm (7 lb.ft).

12 . Install the coolant expansion tank.

For additional information, refer to Coolant Expansion Tank (26.15.01)

13 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

14 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

15 . Install the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

16 . Install the hood.

For additional information, refer to Hood (76.16.01)

17 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

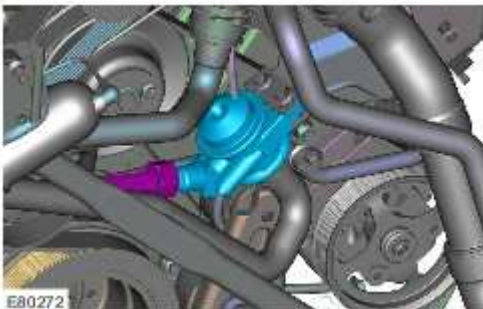
18 Top-up and bleed the coolant.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8
- AJV8

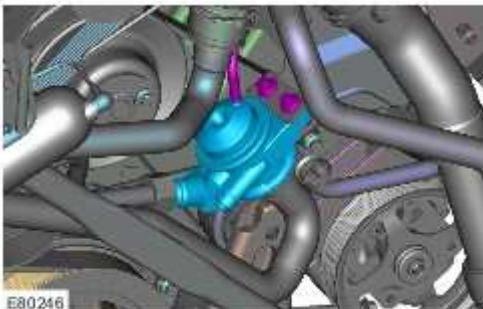
Secondary Air Injection (AIR) Control Valve

Removal

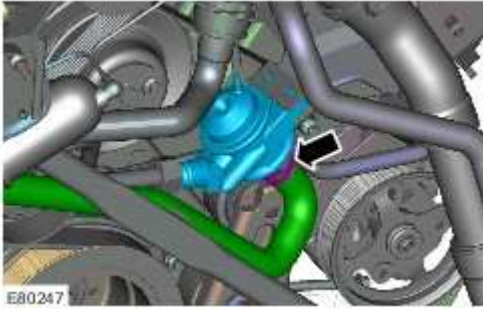
- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 3 . Release the AIR tube from the AIR control valve.



- 4 . Release the AIR control valve.
 - ▶ Disconnect the vacuum hose.
 - ▶ Remove the 2 bolts.



- 5 . Remove the AIR control valve.
 - ▶ Release the clip and disconnect the hose.



Installation




- 1 . Attach the AIR control valve hose.
 - ▶ Secure with the clip.
- 2 . Secure the AIR control valve.
 - ▶ Tighten the bolts to 25 Nm (18 lb.ft).
 - ▶ Connect the vacuum hose.
- 3 . Attach the AIR tube to the AIR control valve.
 - ▶ Tighten the union to 35 Nm (26 lb.ft).
- 4 . Install the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 5 . Connect the battery ground cable and install the cover.
- 6 **NOTE:**
 - For NAS vehicles only.

If required, carry out a long drive cycle.

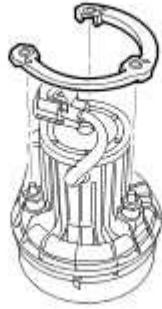
For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

Secondary Air Injection (AIR) Pump

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the RH headlamp assembly.
For additional information, refer to [Headlamp Assembly \(86.41.33\)](#)
- 3 . Release the washer jet hose.
 -  Remove the clip.
- 4 . Disconnect the AIR pump hose.
- 5 . Release the AIR pump.
 -  Remove the 3 nuts.
- 6 . Remove the AIR pump.
 -  Disconnect the electrical connector.
- 7 . **NOTE:**
 - Do not disassemble further if the component is removed for access only.
 - Remove the AIR pump bracket.

E64923



Installation

- 1 . Install the AIR pump bracket.
- 2 . Install the AIR pump.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the hose.
- 3 . Attach the washer jet hose.
 - ▶ Secure with the clip.
- 4 . Install the RH headlamp assembly.
For additional information, refer to [Headlamp Assembly \(86.41.33\)](#)
- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)
- 6 **NOTE:**
 - For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

Secondary Air Injection Manifold Absolute Pressure Sensor

No Data Available

303-08B : Engine Emission Control – 4.2L NA V8 – AJV8

Specifications

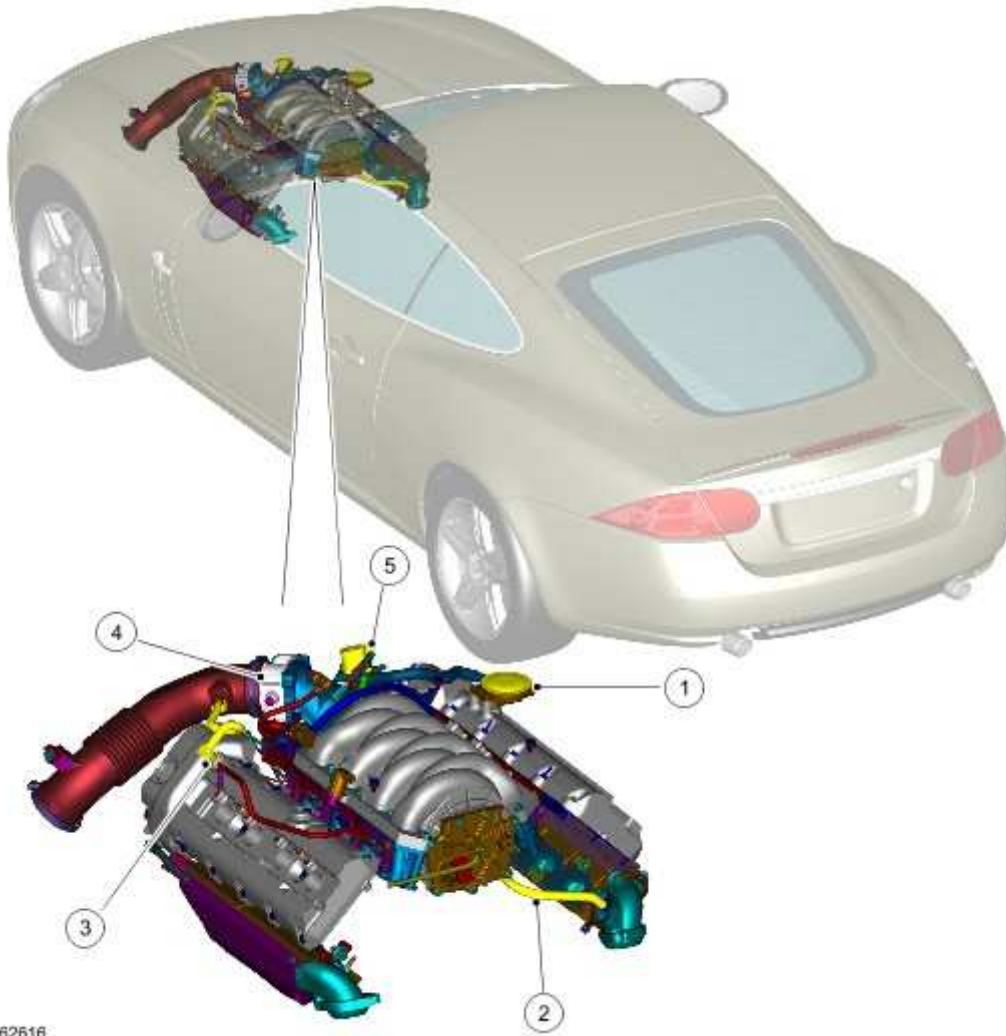
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) tube to EGR valve - bolt	21	15	-
EGR tube to exhaust manifold - nut	21	15	-
EGR valve to throttle body elbow - bolt	10	7	88
Positive crankcase ventilation (PCV) valve - screw	5	4	44
Secondary air injection, air pipe - union nut	35	26	-
Secondary air injection, blanking plug	35	26	-
Secondary air injection, control valve bracket to engine - bolt	8	6	71
Secondary air injection, manifold absolute pressure sensor to bonnet hinge panel - bolt	11	8	-
Secondary air injection, pump to bracket - nut	8	6	71

Engine Emission Control

COMPONENT LOCATION



Item	Part Number	Description
1		PCV (positive crankcase ventilation) valve
2		EGR (exhaust gas recirculation) gas transfer pipe
3		Part load valve
4		Electric throttle
5		EGR (exhaust gas recirculation) valve

INTRODUCTION

The engine emission control system comprises:

- EGR (exhaust gas recirculation) system
- Crankcase ventilation system

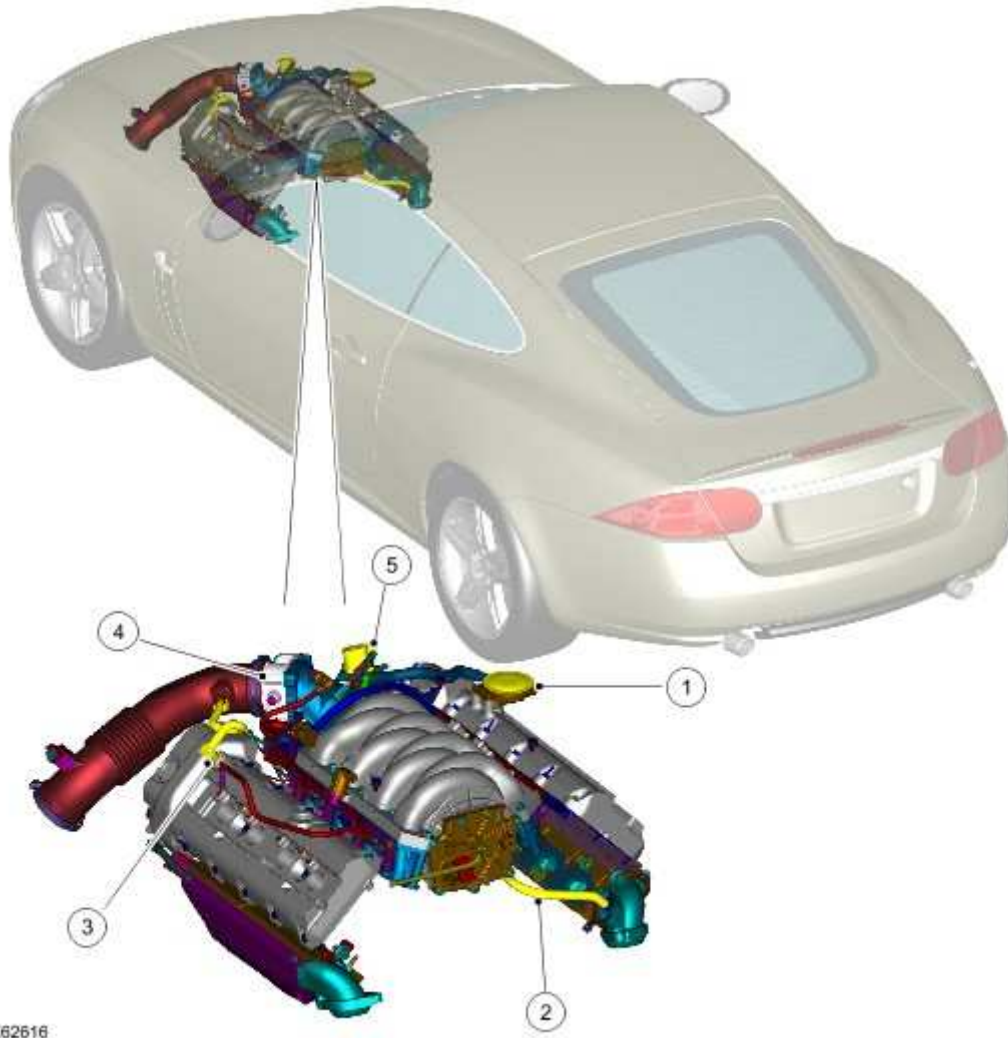
The EGR (exhaust gas recirculation) system is controlled by a PWM (pulse width modulation) signal from the ECM (engine control module) . The system comprises an EGR (exhaust gas recirculation) valve and a gas transfer pipe.

The crankcase ventilation system is ventilated through a part load and a full load breather. The part load breather is connected through a PCV (positive crankcase ventilation) valve, which prevents air flow back into the engine.

The engine emission control system also features a Secondary Air Injection (SAI) system, comprising a pump, solenoid control valve and associated pipes. The pumps operation is controlled by the engine management system. For additional information, refer to [Electronic Engine Controls](#) (303-14)

Engine Emission Control

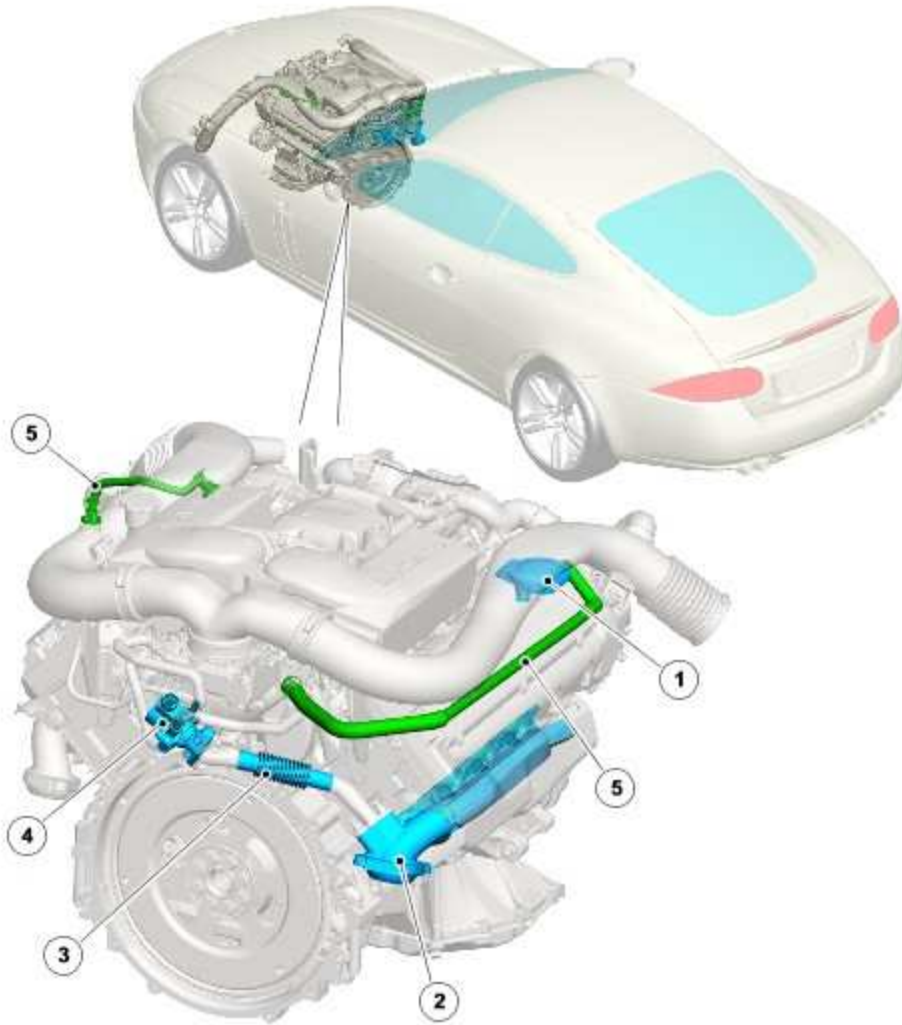
COMPONENT LOCATION (NA)



E62616

Item	Part Number	Description
1		PCV valve
2		EGR gas transfer pipe
3		Part load valve
4		Electric throttle
5		EGR valve

COMPONENT LOCATION (SC)



E84462

Item	Part Number	Description
1		PCV valve
2		Exhaust manifold
3		EGR gas transfer pipe
4		EGR valve
5		Crankcase ventilation pipes

INTRODUCTION

The engine emission control system comprises:

- EGR system
- Crankcase ventilation system
- Secondary Air Injection (SAI) system

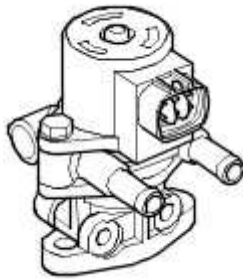
The EGR system is controlled by a PWM signal from the ECM. The system comprises an EGR valve and a gas transfer pipe.

The crankcase ventilation system is ventilated through a part load and a full load breather. The part load breather is connected through a PCV valve, which prevents air flow back into the engine.

The engine emission control system also features a Secondary Air Injection (SAI) system, comprising a pump, solenoid control valve and associated pipes. The pumps operation is controlled by the engine management system.

EGR SYSTEM

The EGR (exhaust gas recirculation) system is controlled by a PWM signal from the ECM (engine control module) . The system comprises an EGR (exhaust gas recirculation) valve and a gas transfer pipe.



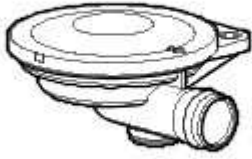
E48518

The EGR (exhaust gas recirculation) valve is a 4 pole 60 point stepper motor with an integral cooler unit which is mounted on the side of the induction elbow. The EGR (exhaust gas recirculation) valve receive four 12 Volt signals from the ECM (engine control module) . The EGR (exhaust gas recirculation) valve is cooled by the return coolant flow from the electric throttle.

The EGR (exhaust gas recirculation) valve is connected to the LH exhaust manifold via the gas transfer pipe.

CRANKCASE VENTILATION

The engine is ventilated through a part load and a full load breather. The part load breather is a flexible composite hose connected between the PCV (positive crankcase ventilation) valve mounted above the oil separator in the bank A camshaft cover and the induction elbow. The PCV (positive crankcase ventilation) valve prevents reverse flow into the crankcase.



E48519

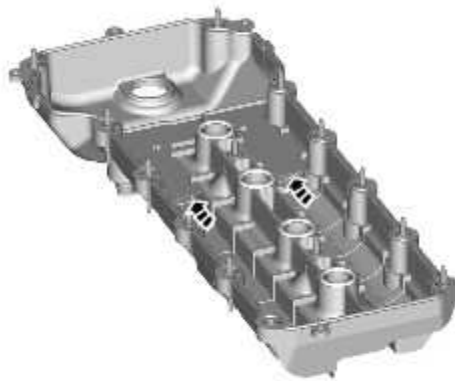
The full load breather is a flexible hose connected between the oil separator in the bank B camshaft cover and the air intake duct.

The ends of the breather hoses incorporate quick release connectors.

A



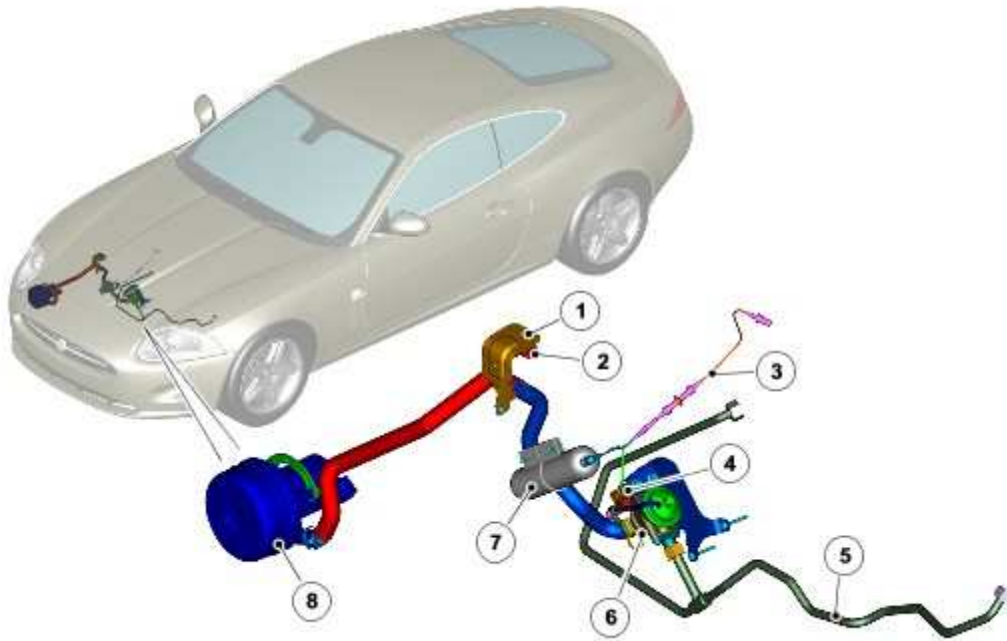
B



E50604

The oil separators consist of wire gauze packed into an open ended enclosure below the breather outlet in each camshaft cover.

SECONDARY AIR INJECTION COMPONENT LOCATION (NA SHOWN SC SIMILAR)



E75932

Item	Part Number	Description
1		SAI hose bracket
2		SAI pressure sensor (NAS only)
3		Vacuum pipe
4		SAI vacuum control valve
5		SAI to exhaust manifold pipe
6		SAI control valve
7		SAI Vacuum reservoir
8		SAI pump

SECONDARY AIR INJECTION

Secondary Air Injection (SAI) is fitted to the vehicle to reduce exhaust emissions to meet European Union (EU) Stage 4 and Federal Petrol Emission standards. The SAI system comprises:

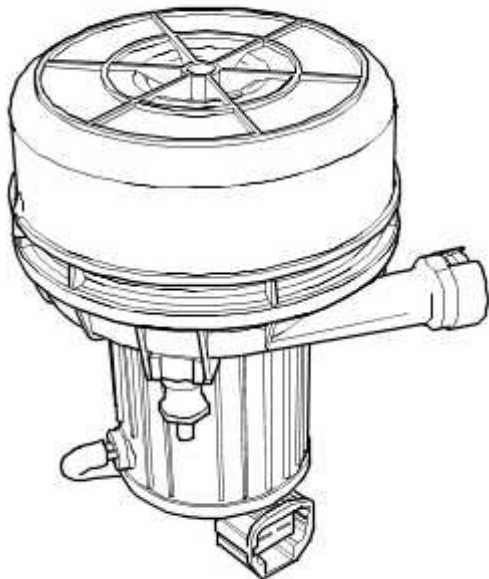
- SAI pump
- SAI valve
- Associated pipes
- SAI Absolute Pressure (MAP) sensor (NAS only)

The SAI pump is used to provide a supply of air into the exhaust manifolds during the cold start period of the engine. The SAI cycle lasts for up to 65 seconds. The hot unburnt fuel particles leaving the combustion chamber mix with the air injected into the exhaust manifolds and immediately combust.

This subsequent combustion of the unburnt and partially burnt carbon monoxide (CO) and hydrocarbon (HC) particles help to reduce the emission of these pollutants from the exhaust system. The additional heat generated in the exhaust manifold also provides rapid heating of the exhaust system catalytic converters. The additional oxygen which is delivered to the catalytic converters also generates an exothermic reaction which causes the catalytic converters to reach their optimum operating temperature and 'light off' quickly.

The catalytic converters only start to provide effective treatment of emission pollutants when they reach an operating temperature of approximately 250°C (482°F) and need to be between temperatures of 400°C (752°F) and 800°C (1472°F) for optimum efficiency. Consequently, the heat produced by the SAI 'afterburning' reduces the time delay before the catalysts reach an efficient operating temperature.

SAI Pump



E62274

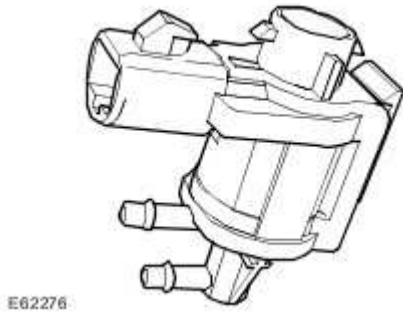
The sai pump is located behind the right-hand side of the front bumper cover. The pump is fitted on rubber mountings to help prevent noise which is generated by SAI pump operation. The SAI pump is powered from the vehicle battery by a dedicated relay and supplies approximately 10 to 15 kg/hr (22 to 33 lb/hr) of air when the engine is at idle speed and the ambient temperature is below 20°C (68°F).

Air is drawn into the SAI pump through vents in its front cover and is then passed through a non serviceable paper element filter. The air is delivered to the exhaust manifold on each side of the engine through a combination of plastic pipes and stainless steel tubes.

One second after the SAI pump is energized, the ECM switches on the SAI switching valve, which opens to allow vacuum from the SAI vacuum reservoir to be applied to the vacuum operated SAI control valve. When the vacuum is applied to the SAI control valve, it opens to allow the air from the SAI pump through to the exhaust manifolds.

When the ECM switches off the SAI switching valve, the vacuum supply to the SAI control valve is cut-off and the valve closes to prevent further air being injected into the exhaust manifolds. With an approximate five second delay after as the SAI switching valve is closed, the ECM removes power from the SAI pump relay, and this in turn stops the SAI pump from operating.

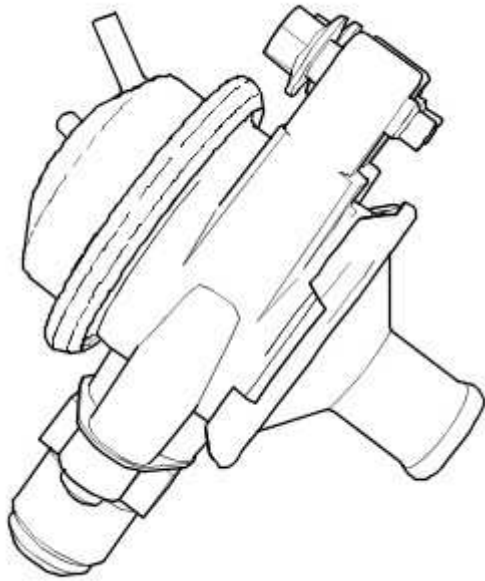
SAI Switching Valve



The ECM switches on the SAI switching valve with a one second delay after initiating SAI pump operation. When the SAI switching valve is open, a steady vacuum supply is allowed through to open the vacuum operated SAI control valve. When the ECM switches off the SAI switching valve, the valve closes and immediately shuts off the vacuum supply to the SAI control valve. The pump continues to operate for a further five seconds for system diagnostic purposes.

When the SAI switching valve is switched off, the vacuum supply line opens to atmosphere, and this causes the SAI switching valve to close automatically to prevent any further injection of air.

SAI control Valve



E62275

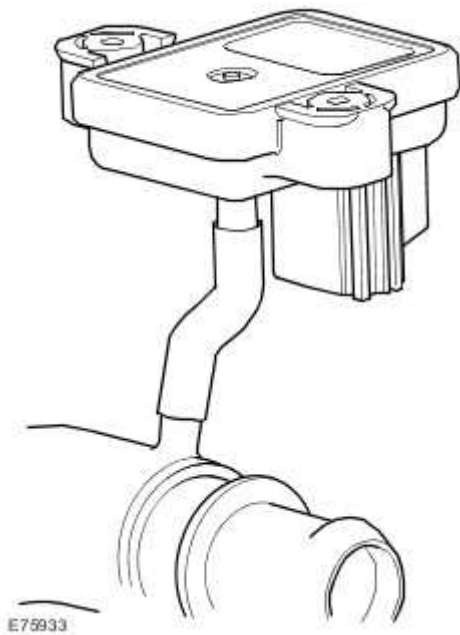
The injected air from the SAI pump is controlled by the SAI control valve. This allows the correct amount of air to be injected directly into the exhaust manifolds via tuned restrictors on each bank of cylinders. The SAI control valve prevents exhaust gasses from blowing back into the SAI pump.

The SAI control valve is assisted in operation by a vacuum source from the SAI vacuum reservoir located in the left hand side at the front of the engine. This assistance allows the actuation of the SAI control valve independently from the intake manifold vacuum levels available.

When the pressure in the exhaust system is higher than in the SAI system, the SAI control valve closes the circuit, and this protects the SAI system from exhaust gasses blowing back into the SAI system.

Vacuum to the SAI switching valve is provided from the intake manifold vacuum by the SAI vacuum reservoir. A small bore vacuum hose provides the vacuum route between the SAI vacuum reservoir and SAI switching valve. A further small bore vacuum hose is used to connect the SAI switching valve to the SAI control valve.

SAI Pressure Sensor - NAS only



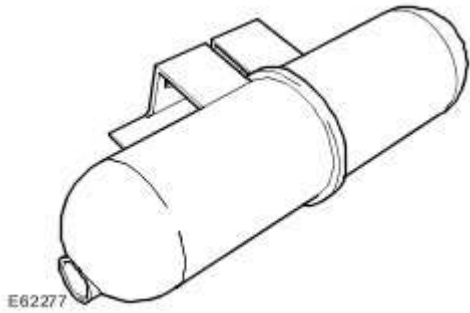
The SAI system is monitored by measuring the system pressure by using the SAI pressure sensor at several instances during its cycle of operation.

The SAI system pressure is measured before operation of the SAI pump. The SAI pump is then switched on and with a one second delay, the SAI switching valve is opened. After a stabilizing period, the system pressure is measured again, this time by taking the average of a one second duration of readings, and normalizing for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough with respect to the initial SAI pressure reading then a failure will be flagged.

A second pressure measurement is made after the requirement for SAI into the exhaust system has expired, but continuing on from the same period of SAI pump operation, i.e. the pump is left running, against a closed SAI switching valve. Again this pressure measurement is the average of a one second duration of readings normalized for variations in battery voltage and atmospheric pressure. If the system pressure measured at this time has not risen enough or has risen too much with respect to the system pressure during normal operation of SAI then a failure will be flagged.

A final pressure reading is taken after the SAI system has been switched off to ensure the system shuts down.

SAI Vacuum Reservoir



The SAI vacuum reservoir is located on the LH side of the engine at the front.

The SAI vacuum reservoir is included in the vacuum supply line between the intake manifold and the SAI switching valve.

The SAI vacuum reservoir contains a one-way valve to stop vacuum leaking back towards the intake manifold side. The SAI vacuum reservoir holds a constant vacuum so that the SAI control valve opens as soon as the SAI switching valve is switched on.

Engine Emission Control

Principle of Operation

For a detailed description of the Engine Emission Control system, refer to the relevant Description and Operation section in the workshop manual.

[Engine Emission Control](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine breather hoses • Cyclone separator • Exhaust gas recirculation (EGR) pipes (check for cracks) • EGR valve 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded electrical connectors • Sensor(s) • Stepper motor(s) • Secondary air injection (AIR) pump • Secondary air injection (AIR) valve • Engine control module (ECM)

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly

		installed
Difficult to start cold	<ul style="list-style-type: none"> Exhaust gas recirculation (EGR) valve stuck open 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for EGR valve tests
Engine stalls soon after start	<ul style="list-style-type: none"> Breather system disconnected/restricted 	<ul style="list-style-type: none"> Ensure the engine breather system is free from restriction and is correctly installed
Engine stops/stalls	<ul style="list-style-type: none"> EGR valve stuck open 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for EGR valve tests
Poor idle quality	<ul style="list-style-type: none"> EGR valve stuck open 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for EGR valve tests
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> EGR valve stuck open 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for EGR valve tests
Poor throttle response	<ul style="list-style-type: none"> Breather system disconnected/restricted 	<ul style="list-style-type: none"> Ensure the engine breather system is free from restriction and is correctly installed
<ul style="list-style-type: none"> Excessive fuel consumption Excessive black smoke Excessive emissions 	<ul style="list-style-type: none"> EGR valve stuck open EGR system not operating Engine breather system restricted 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for EGR system tests Ensure the engine breather system is free from restriction and is correctly installed
Loud 'ticking' noise with engine running	<ul style="list-style-type: none"> EGR pipes cracked 	<ul style="list-style-type: none"> Inspect the EGR pipes, paying particular attention to the ribbed sections. Replace as necessary
Engine oil leaks	<ul style="list-style-type: none"> Engine breather system restricted 	<ul style="list-style-type: none"> Ensure the engine breather system is free from restriction and is correctly installed

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after the pinpoint tests have been carried out, the fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P040100	EGR flow insufficient	<ul style="list-style-type: none">EGR valve incorrectly installed or looseEGR valve stuck closed, blockedEGR valve mechanical failureEGR pipe blocked	<ul style="list-style-type: none">Check the installation and for restriction/mechanical failure of the EGR valve. Exhaust Gas Recirculation (EGR) Valve (17.45.01)Check the EGR pipework for restriction
P041300	Secondary Air Injection (AIR) switching valve circuit open	<ul style="list-style-type: none">AIR check valve control circuit high	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P041400	Secondary Air Injection (AIR) switching valve circuit	<ul style="list-style-type: none">AIR check valve control circuit low	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the

	shorted		manufacturer approved diagnostic system
P048900	Exhaust Gas Recirculation (EGR) control circuit low	<ul style="list-style-type: none"> EGR valve power supply circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P049000	Exhaust Gas Recirculation (EGR) control circuit high	<ul style="list-style-type: none"> EGR valve control circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243100	Secondary air injection manifold absolute pressure sensor circuit range/performance	<ul style="list-style-type: none"> Secondary air injection system leaks Secondary air injection pump Secondary air injection valve 	<ul style="list-style-type: none"> Check the secondary air injection system for leaks Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243200	Secondary air injection manifold absolute pressure sensor circuit low	<ul style="list-style-type: none"> Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243300	Secondary air injection manifold absolute pressure sensor circuit high	<ul style="list-style-type: none"> Secondary air injection manifold pressure (MAP) sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P244400	Secondary air injection system pump stuck ON	<ul style="list-style-type: none"> Secondary air injection pump control circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P244500	Secondary air injection system pump stuck OFF	<ul style="list-style-type: none"> Secondary air injection pump control circuit - 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved


		short to power	diagnostic system
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Exhaust Gas Recirculation (EGR) Valve (17.45.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the EGR valve electrical connector.

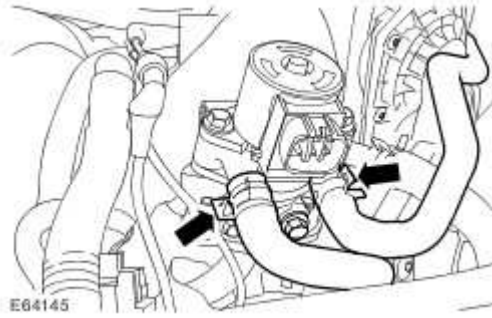


- 4 .  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

 **CAUTION:** Always plug any open connections to prevent contamination.

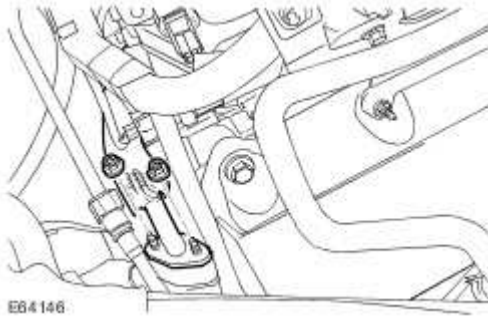
Disconnect the 2 EGR valve coolant hoses.

- Clamp the EGR coolant hoses to minimize coolant loss.
- Release the 2 clips.



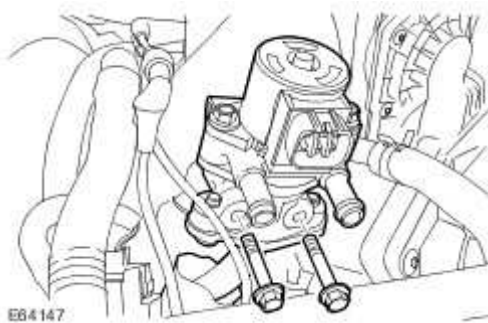
5 . Release the EGR valve to exhaust manifold pipe.

- ▶ Remove the 2 nuts.
- ▶ Remove and discard the gasket.



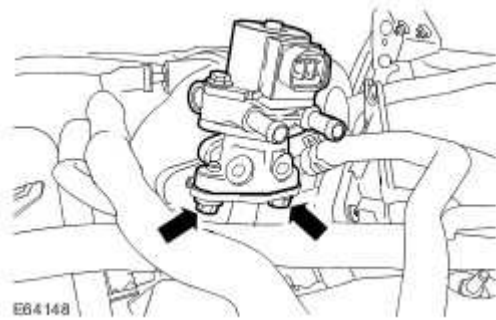
6 . Release the EGR valve from the throttle body elbow.

- ▶ Remove the 2 bolts.
- ▶ Remove and discard the gasket.



7 . Remove the EGR valve.

- ▶ Remove the 2 bolts.
- ▶ Remove and discard the gasket.



Installation

- 1 . Attach the EGR valve to the EGR valve pipe.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.
 - ▶ Tighten the bolts to 21 Nm (15 lb.ft).

- 2 . Attach the EGR valve to the throttle body elbow.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).

- 3 . Attach the EGR valve to exhaust manifold pipe.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.
 - ▶ Tighten the nuts to 25 Nm (18 lb.ft).

- 4 . Connect the coolant hoses.
 - ▶ Secure with the clips.

- 5 . Connect the electrical connector.

- 6 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)

- 7 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

- 8 . Check and top-up the coolant.

Positive Crankcase Ventilation (PCV) Valve

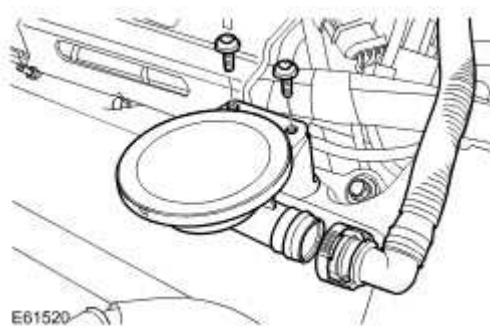
Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)

- 3 .  **CAUTION: Always plug any open connections to prevent contamination.**

Remove the positive crankcase ventilation (PCV) valve.

- ▶ Disconnect the PCV hose.
- ▶ Remove the 2 Torx screws.
- ▶ Release the PCV valve.



Installation

- 1 . Install the PCV valve.
 - ▶ Clean the components.
 - ▶ Lubricate the seal with clean engine oil.
 - ▶ Tighten the Torx screws.
- 2 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Connect the battery ground cable.
For additional information, refer to [Specifications](#)

Secondary Air Injection (AIR) Control Valve to Exhaust Manifold Tube

Special Service Tools




Engine lifting brackets
303-749



Engine support bracket
303-021

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 Drain the coolant.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8
- 4 . Remove the hood.
For additional information, refer to Hood (76.16.01)

5 . Remove the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

6 . Remove the throttle body.

For additional information, refer to Throttle Body (19.70.04)

7 . Remove the engine undershield.

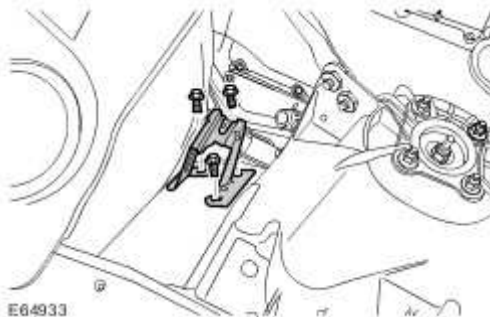
For additional information, refer to Air Deflector (76.11.41)

8 . Remove the coolant expansion tank.

For additional information, refer to Coolant Expansion Tank (26.15.01)

9 . Remove the coolant expansion tank support bracket.

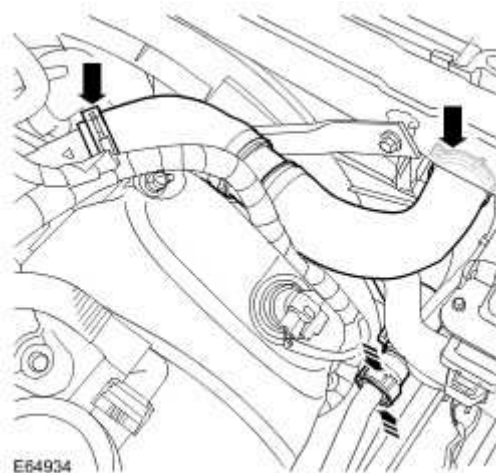
▶ Remove the 3 nuts.



10 . Remove the radiator top hose.

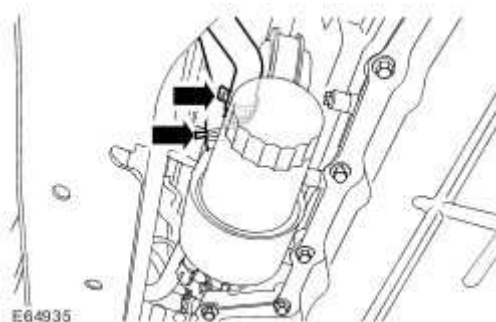
▶ Release the 2 clips.

▶ Disconnect the quick release connector.



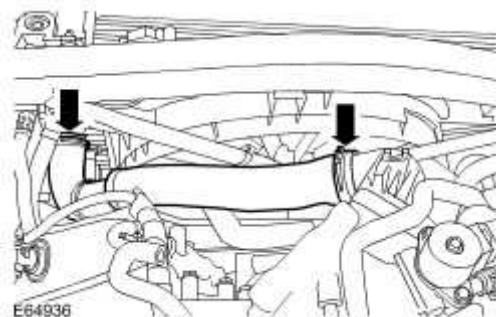
11 . Disconnect the coolant hoses from the engine oil cooler.

▶ Release the 2 clips.



12 . Remove the radiator bottom hose.

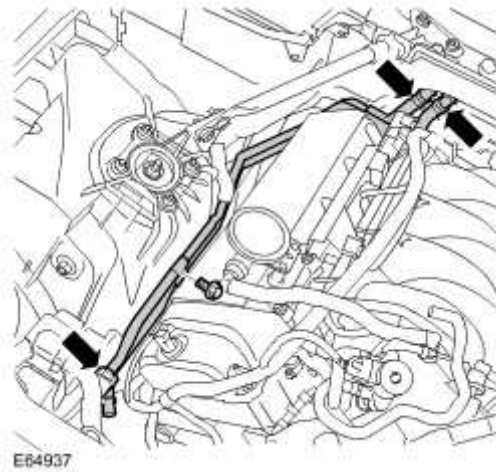
▶ Release the 2 clips.




13 . Remove the coolant rail.

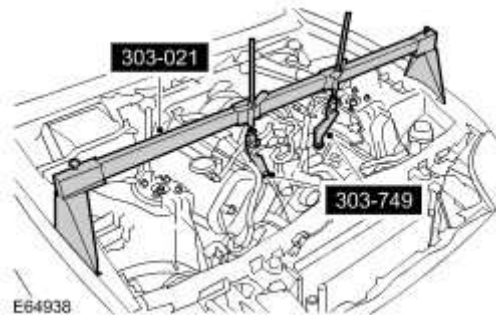
▶ Remove the bolt.

▶ Disconnect the 3 quick release connectors.



14 .  **CAUTION: Protect the paintwork during this operation.**

Using the special tools, support the engine.



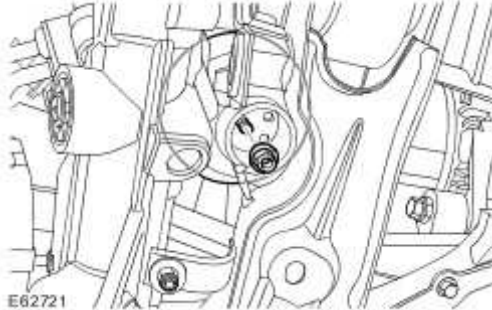
15 . **NOTE:**

RH illustration shown, LH is similar

Release the engine mounts.

▶ Remove and discard the 2 nuts.

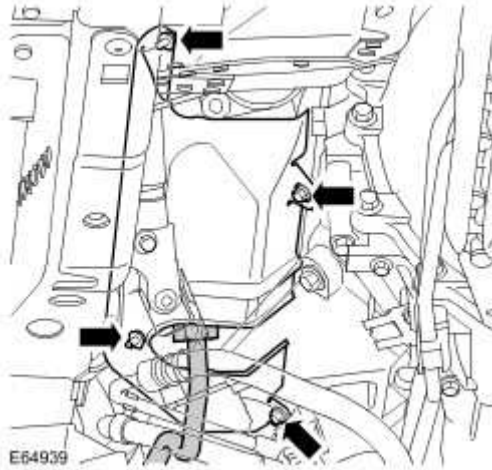
▶ Raise the engine.



16 . Release the RH exhaust manifold heat shield.

▶ Remove the 4 screws.

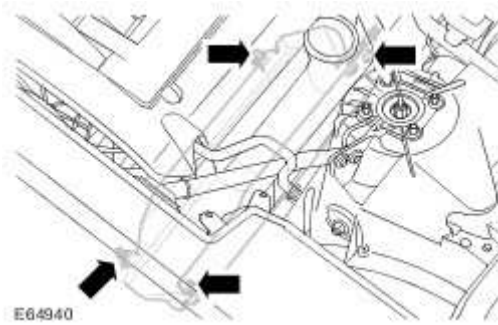
17 . Release the AIR tube from the RH exhaust manifold.



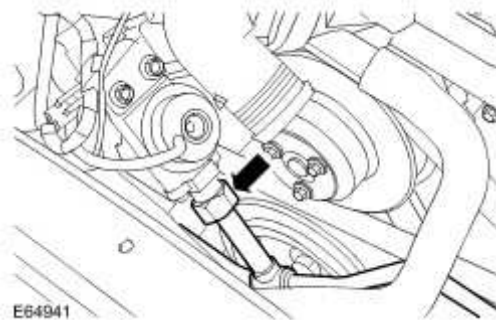
18 . Release the LH exhaust manifold heat shield.

▶ Remove the 4 screws.

19 . Release the AIR tube from the LH exhaust manifold.



20 . Release the AIR tube from the AIR control valve.



21 . Remove the AIR tube.

Installation

1 . Install the AIR tube.

2 . Attach the AIR tube to the exhaust manifolds.

▶ Tighten the unions to 35 Nm (26 lb.ft).

3 . Attach the AIR tube to the AIR control valve.

▶ Tighten the union to 35 Nm (26 lb.ft).

4 . Install the LH exhaust manifold heat shield.

▶ Tighten the screws.

5 . Install the RH exhaust manifold heat shield.

▶ Tighten the screws.

6 . Lower the engine onto its mounts.

▶ Tighten the new nuts to 63 Nm (46 lb.ft).

▶ Remove the special tools.

7 . Install the coolant rail.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

▶ Connect the quick release connectors.

8 . Install the radiator bottom hose.

▶ Secure with the clips.

9 . Install the radiator top hose.


▶ Secure with the clips.

▶ Connect the quick release connector.

10 . Connect the engine oil cooler, coolant hoses.

▶ Secure with the clips.

11 . Install the coolant expansion tank support bracket.

 Tighten the nuts to 10 Nm (7 lb.ft).

12 . Install the coolant expansion tank.

For additional information, refer to Coolant Expansion Tank (26.15.01)

13 . Install the engine undershield.

For additional information, refer to Air Deflector (76.11.41)

14 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)

15 . Install the front wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

16 . Install the hood.

For additional information, refer to Hood (76.16.01)

17 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

18 Top-up and bleed the coolant.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

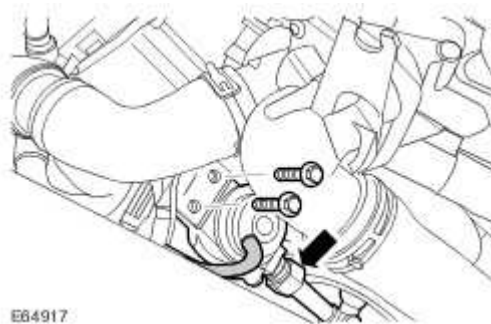
Secondary Air Injection (AIR) Control Valve

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Remove the air intake duct.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.

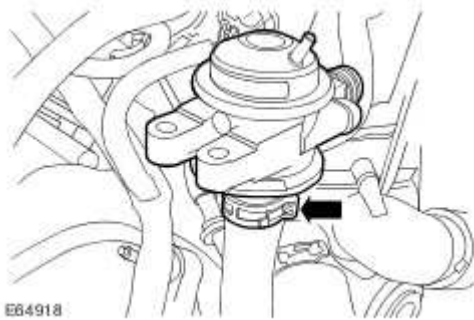


- 4 . Release the AIR tube from the AIR control valve.
- 5 . Release the AIR control valve.
 - ▶ Disconnect the vacuum hose.
 - ▶ Remove the 2 bolts.



- 6 . Remove the AIR control valve.

- ▶ Release the clip and disconnect the hose.



Installation


- 1 . Attach the AIR control valve hose.
 - ▶ Secure with the clip.
- 2 . Secure the AIR control valve.
 - ▶ Tighten the bolts to 25 Nm (18 lb.ft).
 - ▶ Connect the vacuum hose.
- 3 . Attach the AIR tube to the AIR control valve.
 - ▶ Tighten the union to 35 Nm (26 lb.ft).
- 4 . Install the air intake duct.
 - ▶ Tighten the clips.
 - ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- 5 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 6 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)
- 7 **NOTE:**
 - For NAS vehicles only.

If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

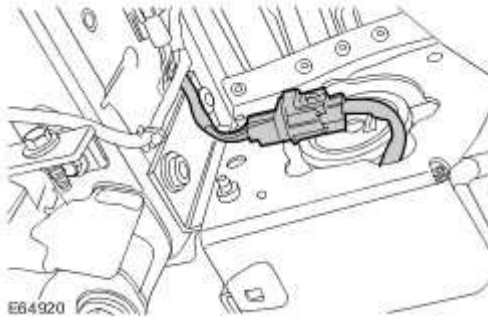
Secondary Air Injection (AIR) Pump

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

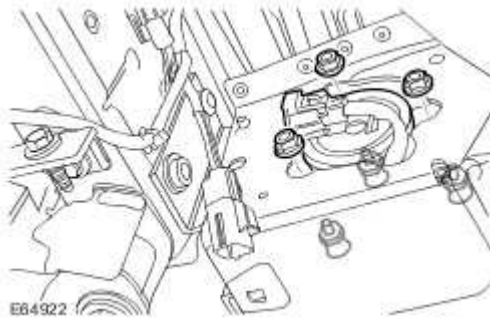
- 2 . Remove the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 3 . Disconnect the AIR pump electrical connector.



- 4 . Disconnect the AIR pump hose.



- 5 . Remove the AIR pump.
 Remove the 3 nuts.



6 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the AIR pump bracket.



Installation

1 . Install the AIR pump bracket.

2 . Install the AIR pump.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).
- ▶ Connect the hose.
- ▶ Connect the electrical connector.

3 . Install the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

4 NOTE:

- For NAS vehicles only.

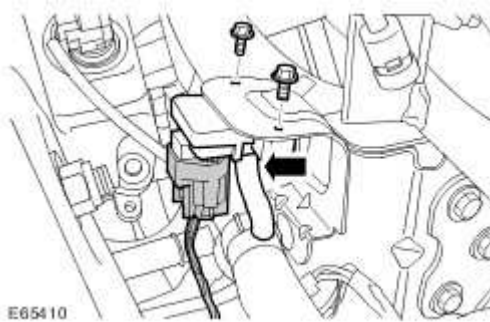
If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

Secondary Air Injection Manifold Absolute Pressure Sensor

Removal

- 1 . Remove the secondary air injection manifold absolute pressure sensor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 2 screws.
 - ▶ Disconnect the hose.



Installation

- 1 . To install, reverse the removal procedure.

303-12A : Intake Air Distribution and Filtering – 4.2L SC V8 – AJV8

Specifications

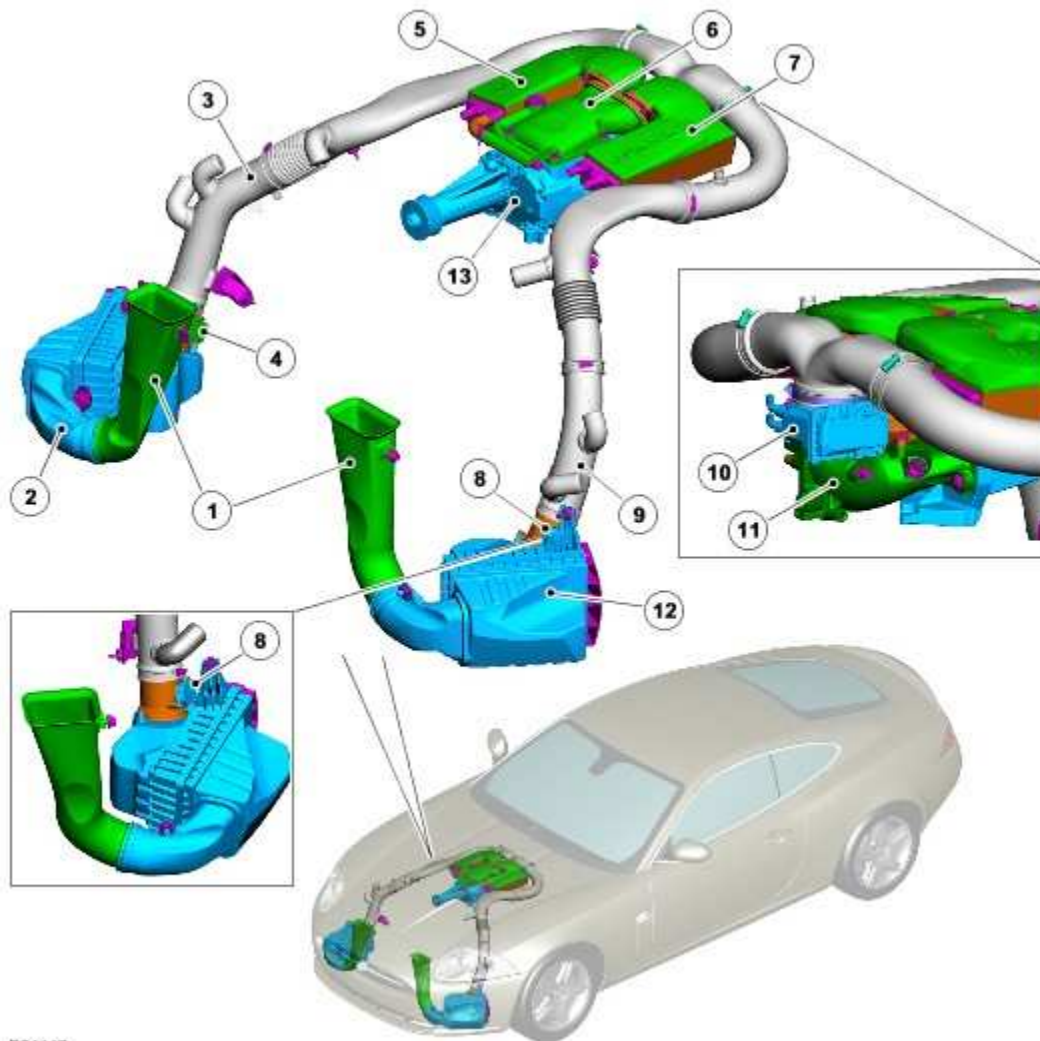
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Air cleaner and MAF duct assy bracket to front crash structure	8	6	71
Air ducting band clamps	4	3	35
Air intake and resonator tube assy to engine	8	6	71
Air cleaner front support bracket	8	6	71
Resonator to dash and cowl panel	9	7	80

Intake Air Distribution and Filtering

COMPONENT LOCATION



E84147

Item	Part Number	Description
1		Dirty air intake
2		Air cleaner box
3		Clean air duct
4		Mass air flow sensor
5		RH bank charge air cooler
6		Supercharger outlet manifold
7		LH bank charge air cooler

8		Mass air flow sensor
9		Clean air duct
10		Electric throttle
11		Induction elbow
12		Air cleaner box
13		Supercharger

OVERVIEW

The engine air intake and distribution system comprises:

- Two air cleaner boxes
- Two air intakes
- Electric throttle
- A supercharger
- Two Mass Air Flow (MAF) sensors
- Two supercharger charge air coolers

Air is supplied to the supercharger via the 2 air cleaners, air cleaner outlet pipes, throttle body intake pipe, throttle body and induction elbow. The supercharger delivers pressurized air to two separate charge air cooler units mounted onto the cylinder bank it supplies. Pressurized cooled air is fed from the charge air coolers directly into each inlet port. The supercharger is attached to the three mounting bosses between the two cylinder heads. The supercharger has a filled for life internal lubrication system. The supercharger is positively aligned with the drive belt by a doweled mounting bracket.

A Mass Air flow sensor is fitted at the outlet of each air cleaner box. The sensor provides an input to the engine control module (ECM). The intake elbow directs the metered airflow from the throttle body outlet (underside of the throttle body) into the intake of the supercharger.

A supercharger by-pass valve assembly is located between the supercharger outlet and the induction elbow. A butterfly valve inside the assembly is opened by a diaphragm actuator operated by vacuum feed from the elbow. At closed or partially open throttle positions, the butterfly valve opens, allowing the airflow from the two charge air cooler inlets to be directed back to the supercharger inlet. This action inhibits the supercharging effect and reduces engine torque. Progressive opening of the throttle causes the by-pass valve to gradually close.

Each cylinder bank is fitted with a charge air cooler which supplies pressurized air to the four cylinders. The inlet ports to the two charge air coolers are connected to the supercharger via the supercharger outlet pipe consisting of adjustable metal ducts with bonded rubber seals. The charge air coolers are water cooled via a radiator and water pump.

Intake Air Distribution and Filtering


No Data Available

Air Cleaner (19.10.05)

Removal

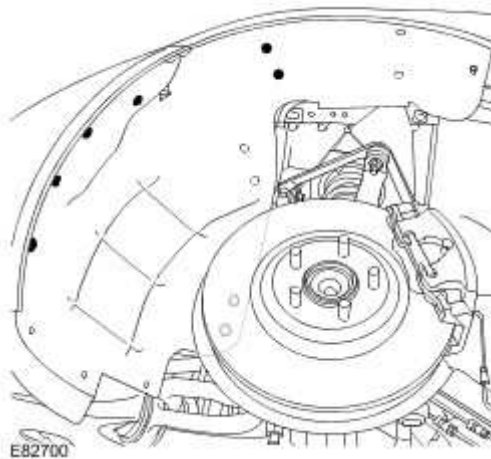
NOTE:

LH air cleaner procedure shown, RH is similar.

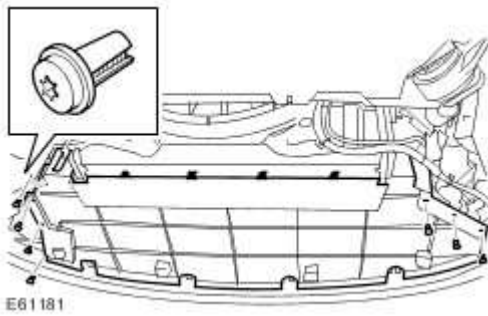
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the LH front wheel and tire.
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)
- 3 . Remove the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 4 . Release the front of the LH fender splash shield.
 - ▶ Remove the 8 Torx bolts.
 - ▶ Tie the splash shield aside.



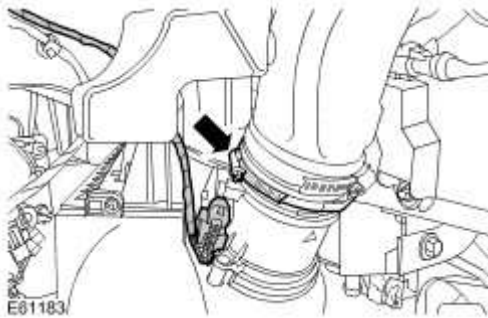
- 5 . Remove the front bumper air ducting.
 - ▶ Remove the 7 clips.
 - ▶ Release the 4 clips.



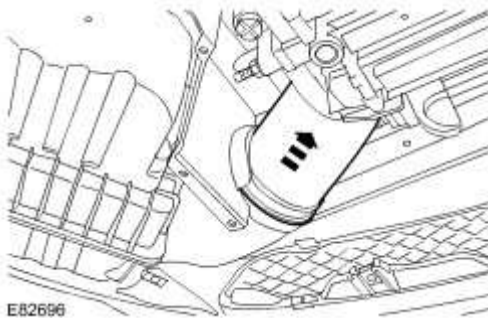
6 . Disconnect the intake air resonator.

▶ Release the clip.

7 . Disconnect the mass air flow (MAF) sensor electrical connector.



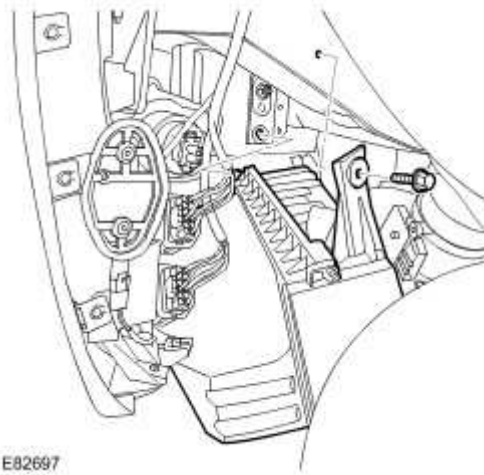
8 . Disconnect the intake air duct.



9 . Remove the air cleaner housing.

▶ Remove the bolt.

▶ Release from the locating grommet.

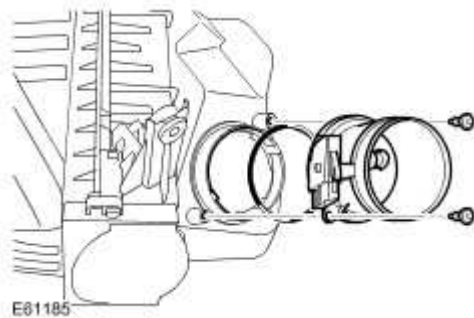


10 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the mass air flow (MAF) sensor assembly.

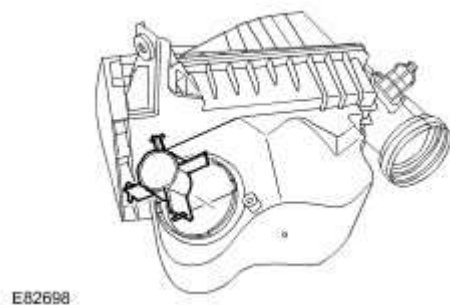
- ▶ Remove the 2 screws.
- ▶ Remove and discard the O-ring seal.



11 . NOTE:

Make sure that this component is installed to the noted removal position.

Remove the air cleaner insert.



Installation


- 1 . Install the air cleaner insert.
- 2 . Install the MAF sensor assembly.
 - ▶ Clean the components.
 - ▶ Install the O-ring seal.
 - ▶ Tighten the screws.
- 3 . Install the air cleaner housing.
 - ▶ Clean the components.
 - ▶ Secure in the grommet.
 - ▶ Tighten the bolt to 8 Nm (6 lb.ft)
- 4 . Connect the intake air duct.
- 5 . Connect the MAF sensor electrical connector.
- 6 . Connect the intake air resonator.
 - ▶ Clean the components.
 - ▶ Secure with the clip.
- 7 . Install the air ducting.
 - ▶ Install the clips.
 - ▶ Secure the clips.
- 8 . Secure the fender splash shield.
 - ▶ Tighten the Torx bolts.
- 9 . Install the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 10 . Install the wheel and tire.
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

Air Cleaner Element (19.10.08)

Removal

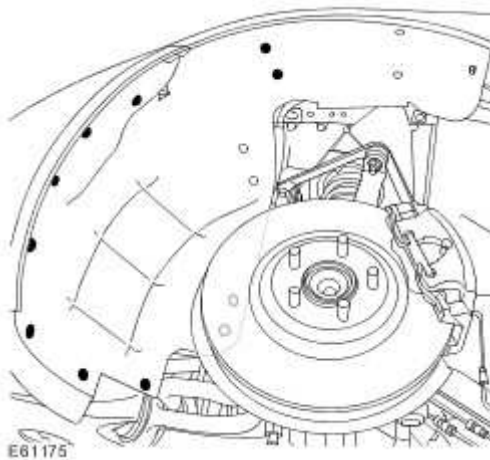
NOTE:

LH air cleaner element procedure shown, RH is similar.

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

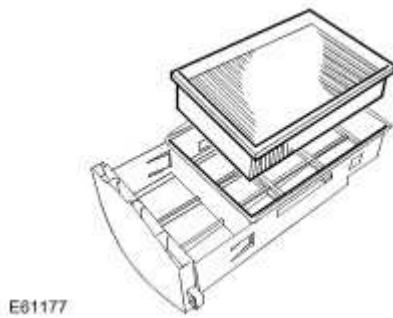
- 2 . Remove the LH front wheel and tire.
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)
- 3 . Release the front of the fender splash shield.
 - ▶ Remove the 11 Torx bolts.
 - ▶ Tie the splash shield aside.



- 4 . Remove the air cleaner housing.
 - ▶ Remove the 2 screws.



5 . Remove the air cleaner element.



Installation

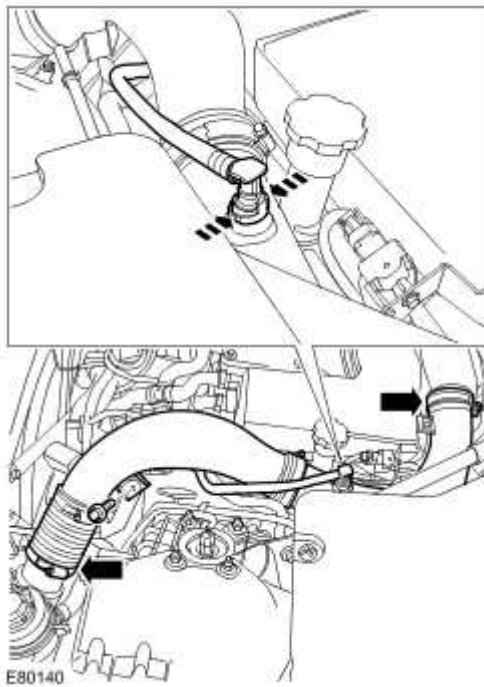
- 1 . Install the air cleaner element.
 - ▶ Clean the components.
- 2 . Install the air cleaner housing.
 - ▶ Tighten the Torx screws.
- 3 . Install the fender splash shield.
 - ▶ Tighten the Torx bolts.
- 4 . Install the wheel and tire.

For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

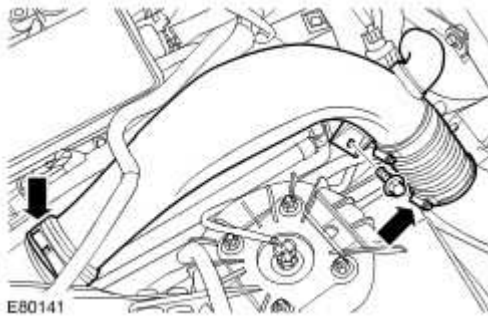
Intake Air Resonator

Removal

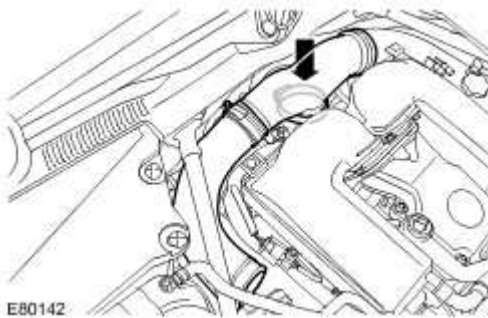
- 1 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 2 . LH side: Release the intake air resonator.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the engine breather line.



- 3 . RH side: Release the intake air resonator.
 - ▶ Remove the bolt.
 - ▶ Release the 2 clips.



- 4 . Remove the intake air resonator.
 - ▶ Release the clip.



Installation


- 1 . Install the intake air resonator.
 - ▶ Secure with the clips.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the engine breather line.
- 2 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

Charge Air Cooler LH (18.50.19)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

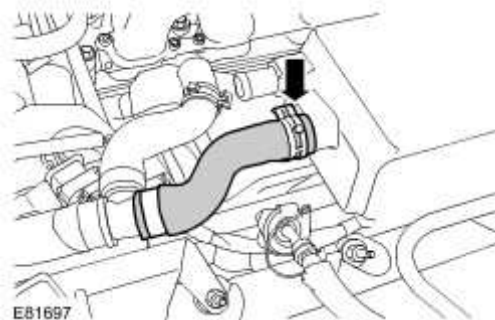
Raise and support the vehicle.

- 3 . Remove the supercharger.
For additional information, refer to [Supercharger \(18.50.15\)](#)

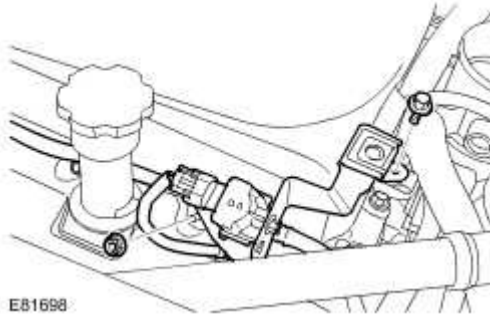
- 4  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Disconnect the charge air cooler, coolant hose.

- ▶ Position an absorbent cloth to collect fluid spillage.
- ▶ Release the clip.

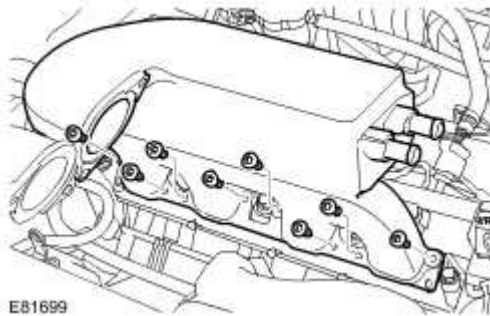


- 5 . Release the purge valve assembly.
 - ▶ Remove the nut.
 - ▶ Remove the bolt.



6 . Remove the charge air cooler.

- ▶ Remove the 8 Torx screws.
- ▶ Discard the gasket.



Installation

1 . Install the charge air cooler.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).

2 . Attach the purge valve.

- ▶ Tighten the bolt to 6 Nm (4 lb.ft).
- ▶ Tighten the nut to 6 Nm (4 lb.ft).

3 . Connect the charge air cooler, coolant hose.

- ▶ Secure with the clip.

4 . Install the supercharger.


For additional information, refer to [Supercharger \(18.50.15\)](#)

- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)


Supercharger (18.50.15)

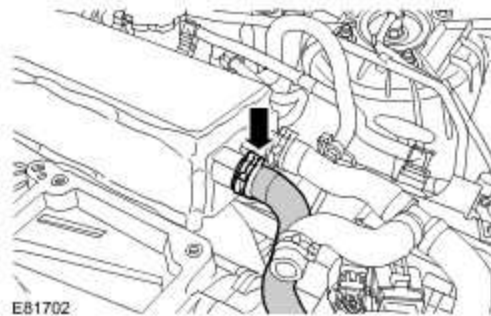
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

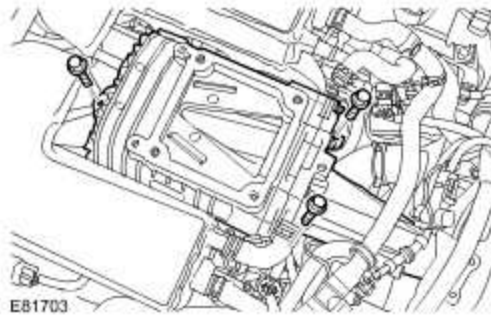
- 3 . Remove the coolant manifold.
For additional information, refer to [Coolant Manifold - Vehicles With: Supercharger](#)
- 4 . Remove the throttle body elbow.
For additional information, refer to [Throttle Body Elbow \(19.70.28\)](#)
- 5 . Remove the supercharger outlet pipe.
For additional information, refer to [Supercharger Outlet Pipe \(18.50.16\)](#)
- 6 . Disconnect the charge air cooler, coolant hose.
 Release the clip.



- 7 . **NOTE:**
This step requires the aid of another technician.

Remove the supercharger.

-  Remove the 3 bolts.



Installation

- 1 . Install the supercharger.
 - ▶ Clean the component mating faces.
 - ▶ Clean the locating dowels.
 - ▶ Tighten the bolts to 21 Nm (15 lb.ft).
- 2 . Connect the charge air cooler, coolant hose.
 - ▶ Secure with the clip.
- 3 . Install the supercharger outlet pipe.
For additional information, refer to [Supercharger Outlet Pipe \(18.50.16\)](#)
- 4 . Install the throttle body elbow.
For additional information, refer to [Throttle Body Elbow \(19.70.28\)](#)
- 5 . Install the coolant manifold.
For additional information, refer to [Coolant Manifold - Vehicles With: Supercharger](#)
- 6 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)
- 7 . Refill and bleed the cooling system.

Supercharger Outlet Pipe (18.50.16)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)

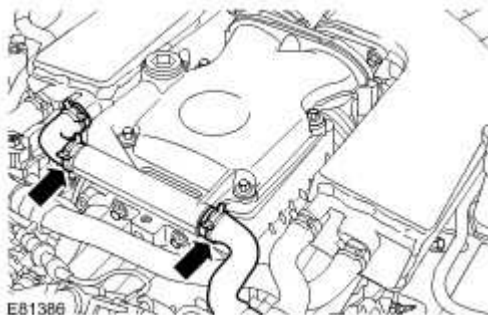
- 3 .  **CAUTION: Always plug any open connections to prevent contamination.**

NOTE:

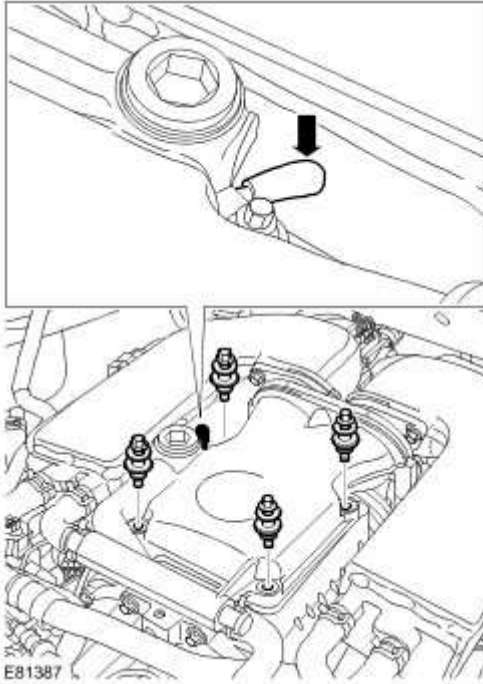
Position cloth to collect fluid spillage.


Disconnect the 2 supercharger outlet pipe coolant hoses.

- ▶ Clamp the hoses to minimize coolant loss.
- ▶ Release the 2 clips.



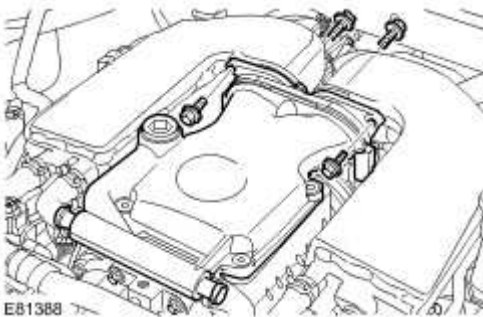
- 4 . Release the supercharger outlet pipe.
 - ▶ Remove the 4 bolts.
 - ▶ Remove and discard the 4 O-ring seals.
 - ▶ Disconnect the vacuum hose.



5.  **CAUTION: Always plug any open connections to prevent contamination.**

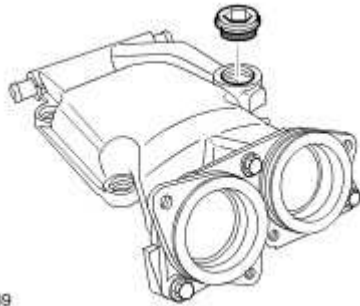
Remove the supercharger outlet pipe.

- ▶ Remove the 4 bolts.
- ▶ Remove and discard the gasket.



6. Remove the supercharger coolant filler plug.

- ▶ Remove and discard the sealing washer.



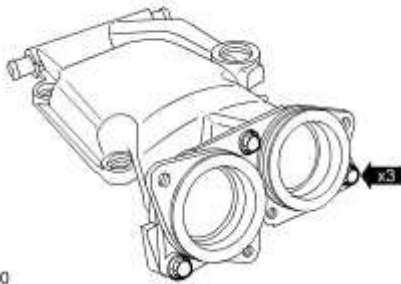
E81389

7 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the spacer.

- ▶ Remove the 3 bolts.
- ▶ Remove and discard the 2 O-ring seals.



E81390

Installation

1 . Install the spacer.

- ▶ Clean the component mating faces.
- ▶ Install the new O-ring seals.
- ▶ Tighten the bolts to 16 Nm (12 lb.ft).

2 . Install the supercharger outlet pipe.

- ▶ Clean the component mating faces.
- ▶ Install a new gasket.
- ▶ Install new seals.
- ▶ Tighten the bolts to 9 Nm (7 lb.ft).
- ▶ Connect the vacuum hose.

3 . Connect the coolant hoses and secure with the clips.

▶ Remove the hose clamps.

4 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

6



- **CAUTION: Coolant may spill from the supercharger fill port when the ignition is switched on.**

Switch the ignition on.

7



- **CAUTION: Do not allow the supercharger coolant pump to run dry for more than one minute. Failure to follow this instruction may result in damage to the vehicle.**

Allow the supercharger pump to run and top-up the coolant through the supercharger fill port.

▶ Switch the ignition off.

8 . Install the supercharger coolant fill plug and tighten to 45 Nm (33 lb.ft).

▶ Clean the components.

▶ Install a new sealing washer.

9 . Switch the ignition off.

10 . Check and top-up the coolant.

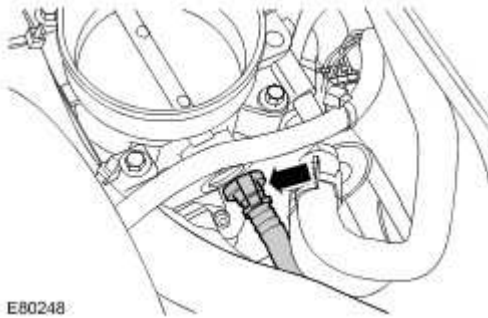
Throttle Body Elbow (19.70.28)

Removal

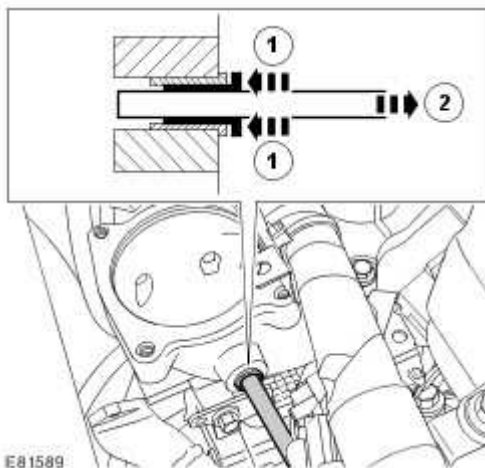


CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 Remove the EGR valve.
For additional information, refer to [Exhaust Gas Recirculation \(EGR\) Valve \(17.45.01\)](#)
- 3 . Disconnect the purge outlet line.

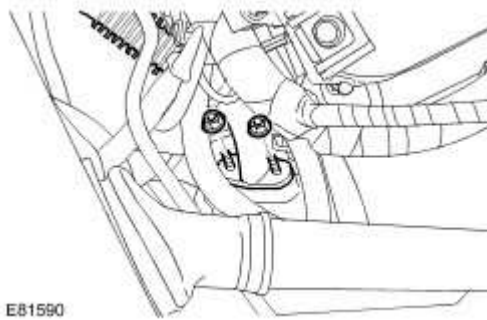


- 4 . Disconnect the brake booster vacuum hose quick release connector.

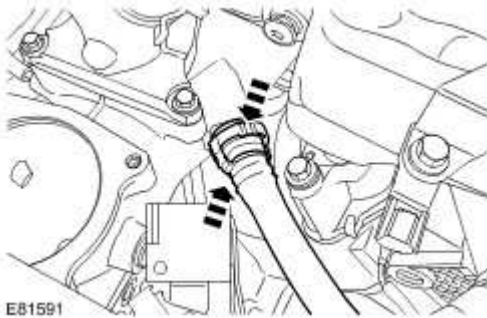


- 5 . Remove the EGR valve transfer pipe.
▶ Remove the 2 nuts.

- ▶ Remove and discard the gasket.



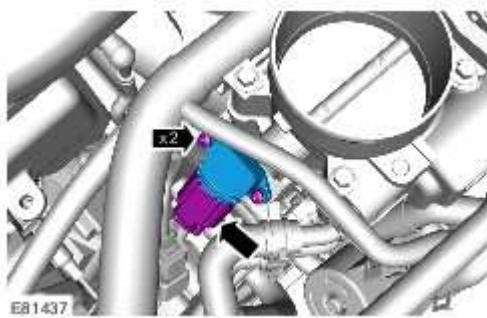
- 6 . Release the engine breather line.



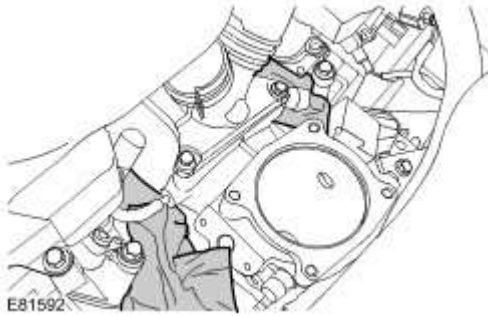
- 7 . Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

- 8 . Remove the MAP sensor.

- ▶ Remove the 2 Torx screws.
- ▶ Remove and discard the O-ring seal.

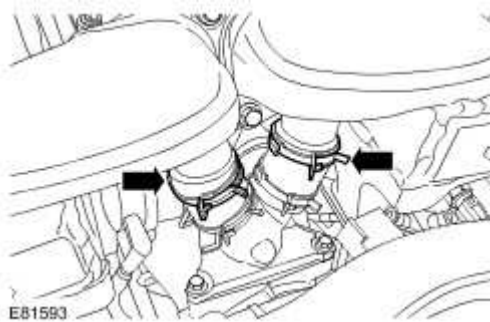


- 9 . Remove the NVH pads from each cylinder bank.



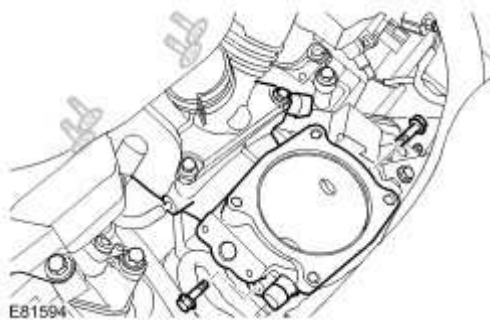
10 . Release the charge air coolers from the throttle body elbow.

- ▶ Release the 2 clips.



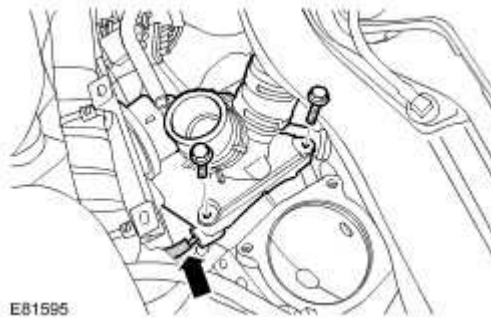
11 . Release the throttle body elbow.

- ▶ Remove the 4 Torx screws.
- ▶ Remove the 2 bolts.
- ▶ Remove and discard the gasket.



12 . Remove the supercharger pressure relief actuator.

- ▶ Disconnect the vacuum line.
- ▶ Remove the 2 bolts.
- ▶ Discard the O-ring seal.



13 . Remove the throttle body elbow.

Installation

- 1 . Install the throttle body elbow.
 - ▶ Clean the component mating faces.
- 2 . Install the supercharger pressure relief actuator.
 - ▶ Clean the component mating faces.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the vacuum line.
- 3 . Secure the throttle body elbow.
 - ▶ Install a new gasket.
 - ▶ Tighten the Torx screws to 25 Nm (18 lb.ft).
 - ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- 4 . Secure the charge air coolers to the throttle body elbow.
 - ▶ Secure with the clips.
- 5 . Install the NVH pads on the cylinder banks.
- 6 . Install the MAP sensor.
 - ▶ Clean the component mating faces.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx screws.
 - ▶ Connect the electrical connector.

- 7 . Connect the engine breather line.
- 8 . Install the EGR valve transfer pipe.
 - ▶ Clean the component mating faces.
 - ▶ Install a new gasket.
 - ▶ Tighten the nuts to 25 Nm (18 lb.ft).
- 9 . Connect the brake booster vacuum hose quick release connector.
- 10 . Connect the purge outlet line.
- 11 Install the EGR valve.
 - . For additional information, refer to [Exhaust Gas Recirculation \(EGR\) Valve \(17.45.01\)](#)
- 12 . Connect the battery ground cable and install the cover.
 - For additional information, refer to [Specifications](#)

303-12B : Intake Air Distribution and Filtering – 4.2L NA V8 – AJV8

Specifications

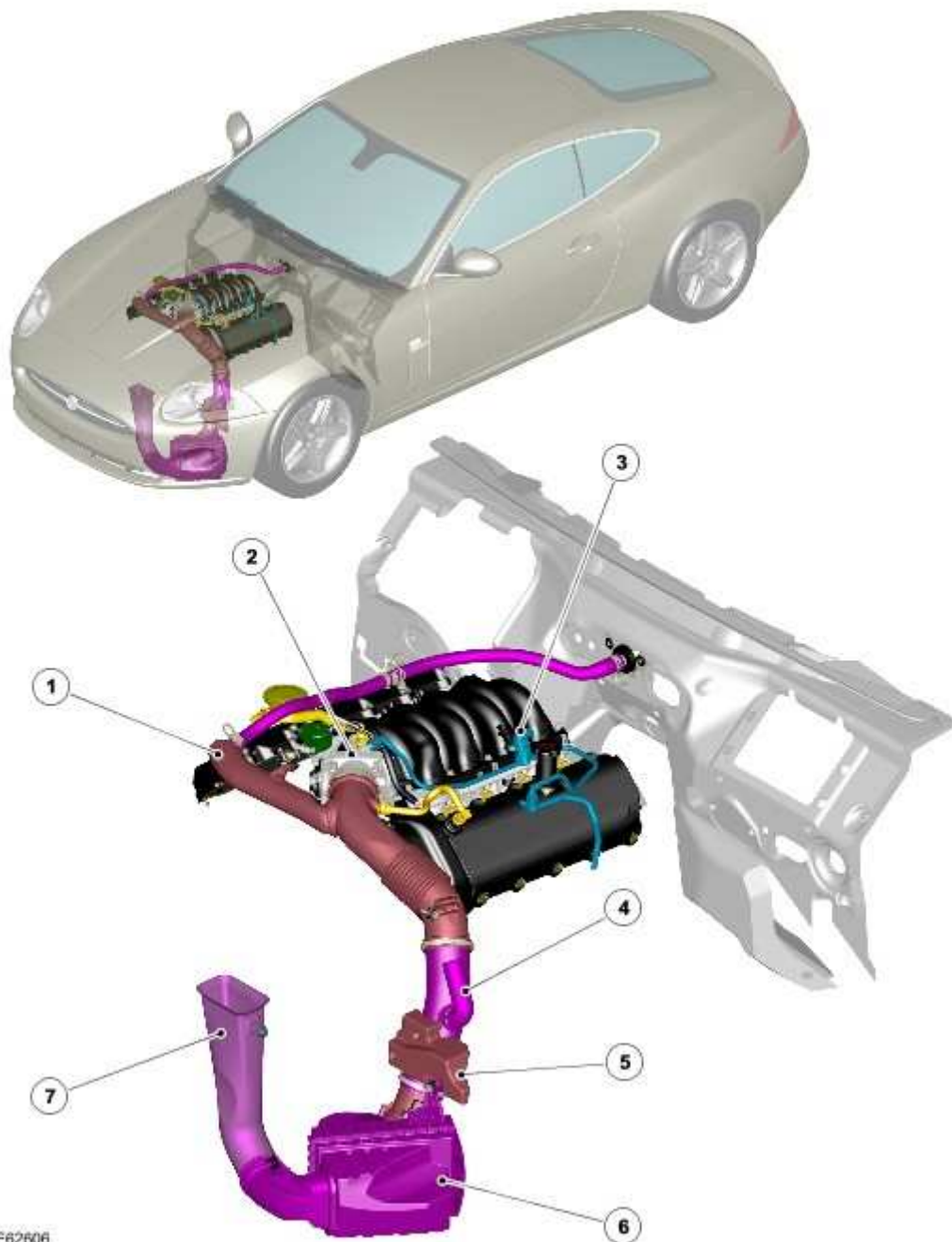
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Air cleaner housing bracket - bolt	8	6	71
Air cleaner intake pipe bracket - bolt	8	6	71
Air cleaner outlet pipe bracket - bolt	8	6	71
Band clamp	4	3	35
Resonator to bulkhead - nut	9	7	80

Intake Air Distribution and Filtering

COMPONENT LOCATION



Item	Part Number	Description
1		Intake noise tube

2		Electric throttle
3		Air intake manifold
4		Resonator
5		Resonator
6		Air filter box
7		Clean air intake

INTRODUCTION

The 4.2 Liter V8 engine air intake and distribution system comprises:

- Air filter box
- Air intake
- Intake manifold
- Electronic throttle

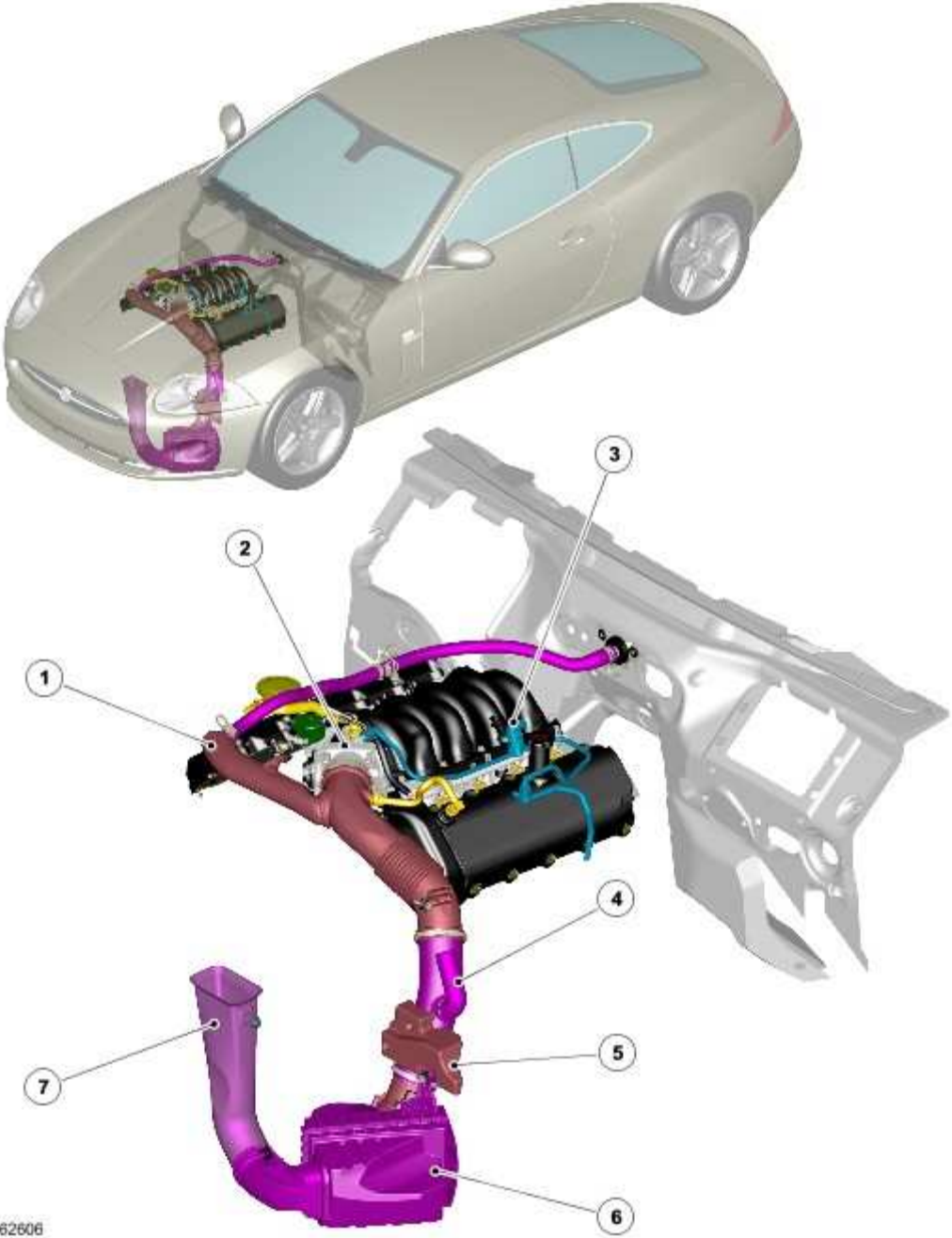
The air filter box is located in front of the LH (left-hand) front wheel, behind the wheel arch liner and contains a replaceable paper filter element.

Dirty air is drawn through the air intake which is located behind the radiator grill on the LH (left-hand) side and into the air filter box past the paper filter element. Clean air is then passed over the MAF (mass air flow) sensor located in the ducting directly behind the air filter box, through the electric throttle and up to the air intake manifold where it is distributed to the individual cylinders.

The intake manifold is located on top of the engine between the two engine banks. The manifold is manufactured from a composite material with metal insert fixings. The intake manifold comprises a central chamber with eight tracts leading to the inlet ports on the engine.

Intake Air Distribution and Filtering

COMPONENT LOCATION



E62606

Item	Part Number	Description
1		Intake noise tube
2		Electric throttle
3		Air intake manifold
4		Resonator

5		Resonator
6		Air filter box
7		Clean air intake

INTRODUCTION

The 4.2 Liter V8 engine air intake and distribution system comprises:

- Air filter box
- Air intake
- Intake manifold
- Electronic throttle

The air filter box is located in front of the LH front wheel, behind the wheel arch liner and contains a replaceable paper filter element.

Dirty air is drawn through the air intake which is located behind the radiator grill on the LH side and into the air filter box past the paper filter element. Clean air is then passed over the MAF sensor located in the ducting directly behind the air filter box, through the electric throttle and up to the air intake manifold where it is distributed to the individual cylinders.

The intake manifold is located on top of the engine between the two engine banks. The manifold is manufactured from a composite material with metal insert fixings. The intake manifold comprises a central chamber with eight tracts leading to the inlet ports on the engine.

Intake Air Distribution and Filtering

Principle of Operation

For a detailed description of the Intake Air Distribution and Filtering system, refer to the relevant Description and Operation section in the workshop manual.

[Intake Air Distribution and Filtering](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Hoses and ducts (damage/connections) • Air cleaner element (contaminated/blocked) • Restricted air intake • Seals and gaskets 	<ul style="list-style-type: none"> • Mass Air Flow (MAF) sensor • Secondary Air Injection (AIR) Manifold Absolute Pressure (MAP) sensor • Throttle body • Harness (security/damage) • Connections (security/damage)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Vehicle does not start/hard starting/poor performance	<ul style="list-style-type: none"> • Restricted/blocked air intake • Restricted/blocked air cleaner element 	<ul style="list-style-type: none"> • Ensure the air intake system is free from blockage and is correctly installed • Install a new air cleaner element as necessary. Air Cleaner Element (19.10.08)

Excessive intake noise	<ul style="list-style-type: none"> • Intake pipe disconnected/damaged after the air cleaner • Air cleaner assembly incorrectly assembled/damaged 	<ul style="list-style-type: none"> • Check for correct installation and integrity of air intake system • Check for correct installation and integrity of the air cleaner assembly. <p>Air Cleaner (19.10.05)</p>
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DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are logged and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
P010100	Mass Air Flow (MAF) circuit - range/performance	<ul style="list-style-type: none"> • Blocked air cleaner element • Leakage from air intake system • Engine breather leak • MAF sensor sensing circuit - high resistance, intermittent short to ground 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leak from air intake system, rectify as necessary • Ensure the engine breather system is

		<ul style="list-style-type: none"> • MAF sensor supply circuit - high resistance • MAF sensor failure 	<p>correctly installed and in serviceable condition</p> <ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P010200	Mass Air Flow (MAF) circuit - low input	<ul style="list-style-type: none"> • MAF sensor supply circuit - short to ground, high resistance • MAF sensor ground circuit - high resistance • MAF sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P010300	Mass Air Flow (MAF) circuit - high input	<ul style="list-style-type: none"> • MAF sensor sensing circuit - short to power • MAF sensor ground circuit - high resistance • MAF sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P010600	Manifold Absolute Pressure (MAP) sensor - range/performance	<ul style="list-style-type: none"> • Intake manifold air leak (loose or missing component) • MAP sensor signal circuit fault • MAP sensor failure 	<ul style="list-style-type: none"> • Check for correct installation and serviceability of intake manifold and associated components • Carry out any

			<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> Install a new MAP sensor as necessary. Manifold Absolute Pressure (MAP) Sensor (18.30.86)
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> Air intake leak between MAF sensor and cylinder head Fuel filter, injector, system restriction MAF sensor fault (low intake air flow) Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> Check for leak from air intake system For fuel system tests. Fuel Tank and Lines Read DTCs and refer to DTC Index in this section for MAF sensor tests Check and rectify any exhaust leak prior to catalytic converter
P017200	System too rich (bank 1)	<ul style="list-style-type: none"> Restricted air cleaner Leaking fuel injector(s) Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> Check air cleaner element is free from restriction Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling Read DTCs and refer to DTC Index in this section for

			MAF sensor tests
P017400	System too lean (bank 2)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests • Check and rectify any exhaust leak prior to catalytic converter
P017500	System too rich (bank 2)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) • Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling • Read DTCs and refer to DTC Index in this section for MAF sensor tests
P050600	Idle air control system RPM lower than expected	<ul style="list-style-type: none"> • Air intake restriction • Front End Accessory Drive (FEAD) overload (defective/seized component) 	<ul style="list-style-type: none"> • Ensure the air intake system is free from restriction • Check the FEAD belt and components. Accessory Drive

P050700	Idle air control system RPM higher than expected	<ul style="list-style-type: none">• Intake air leak between MAF sensor and engine• Engine crankcase breather leak	<ul style="list-style-type: none">• Check for leakage and correct installation of air intake system• Check for leakage and correct installation of engine crankcase breather system
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Air Cleaner (19.10.05)

Removal

1 . Disconnect the battery ground cable.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the LH front wheel and tire.

For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

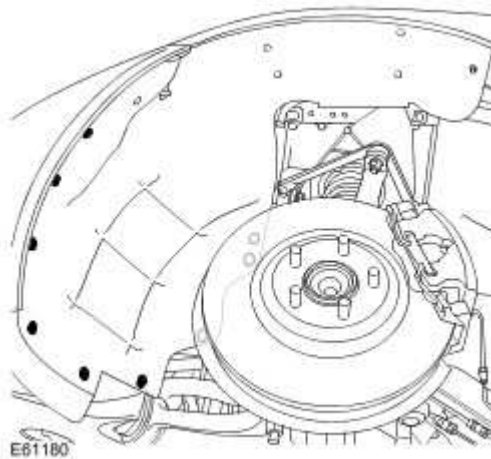
4 . Remove the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

5 . Release the front of the LH fender splash shield.

▶ Remove the 8 Torx bolts.

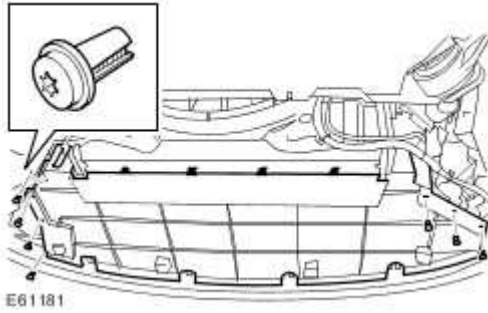
▶ Tie the splash shield aside.



6 . Remove the front bumper air ducting.

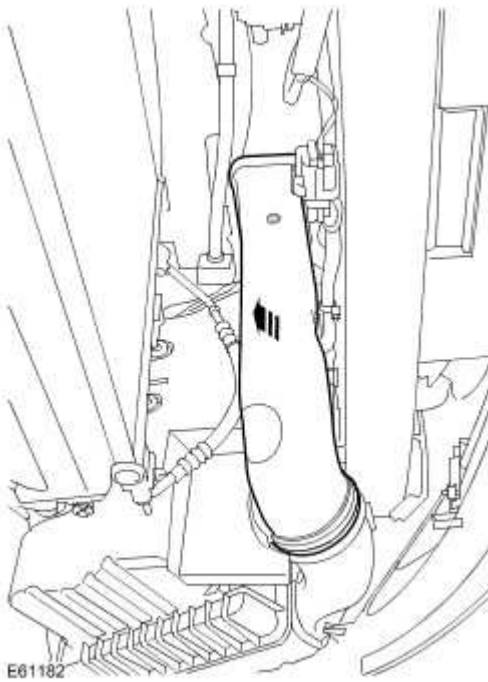
▶ Remove the 7 clips.

▶ Release the 4 clips.



7 . Remove the air intake duct.

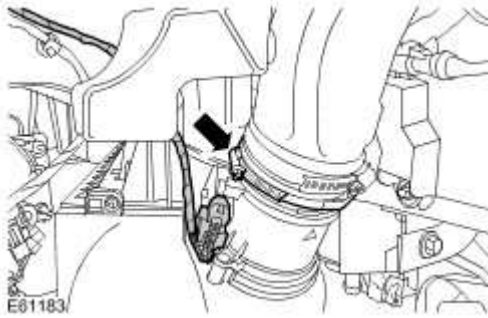
▶ Release the clip.



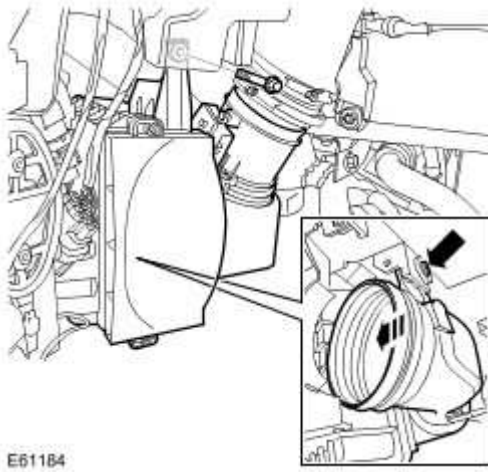
8 . Disconnect the mass air flow (MAF) sensor.

▶ Disconnect the electrical connector.

▶ Release the clip.



- 9 . Remove the air cleaner housing.
- ▶ Remove the bolt.
 - ▶ Release the clip.

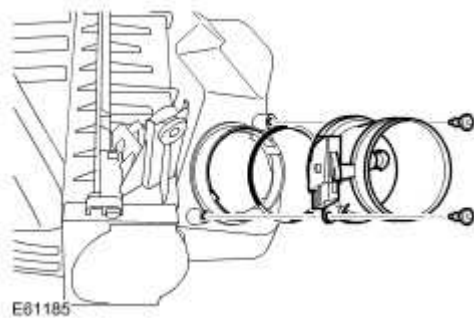


10 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the mass air flow (MAF) sensor.

- ▶ Remove the 2 screws.
- ▶ Remove and discard the O-ring seal.



Installation

- 1 . Install the MAF sensor.
 - ▶ Clean the component mating faces.
 - ▶ Tighten the screws.
 - ▶ Install the new O-ring seals.

- 2 . Install the air cleaner housing.
 - ▶ Secure in the clip.
 - ▶ Tighten the bolt to 8 Nm (6 lb.ft)

- 3 . Install the air intake duct.
 - ▶ Secure in the clip.

- 4 . Connect the MAF sensor electrical connector.

- 5 . Install the air ducting.
 - ▶ Install the clips.
 - ▶ Secure the clips.

- 6 . Install the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)


- 7 . Install the fender splash shield.
 - ▶ Tighten the Torx bolts.

- 8 . Install the wheel and tire.
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

- 9 . Connect the battery ground cable.

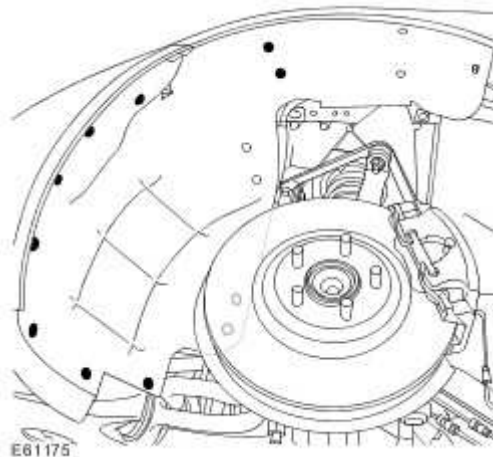
Air Cleaner Element (19.10.08)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

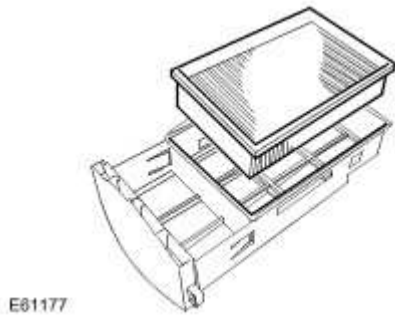
- 2 . Remove the LH front wheel and tire.
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)
- 3 . Release the front of the fender splash shield.
 - ▶ Remove the 11 Torx bolts.
 - ▶ Tie the splash shield aside.



- 4 . Remove the air cleaner housing.
 - ▶ Remove the 2 screws.



5 . Remove the air cleaner element.



Installation

- 1 . Install the air cleaner element.
 - ▶ Clean the components.
- 2 . Install the air cleaner housing.
 - ▶ Tighten the Torx screws.
- 3 . Install the fender splash shield.
 - ▶ Tighten the Torx bolts.
- 4 . Install the wheel and tire.

For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

Air Cleaner Outlet Pipe (19.10.31)

Removal

- 1 . Disconnect the battery ground cable.

For additional information, refer to [Specifications](#)

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . Remove the LH front wheel and tire.

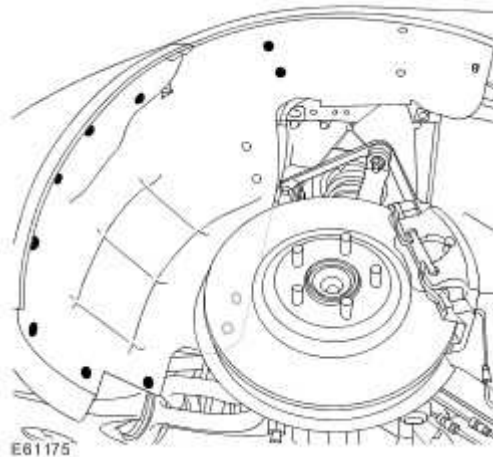
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

- 4 . Open the hood.

- 5 . Release the front of the fender splash shield.

▶ Remove the 11 Torx bolts.

▶ Tie the splash shield aside.



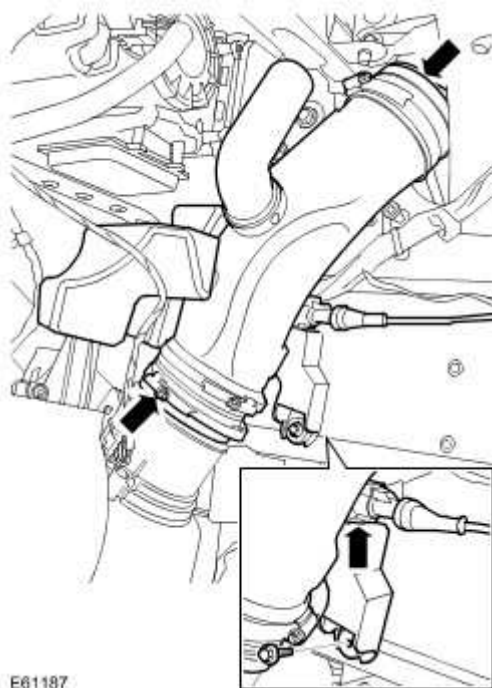
- 6 . Release and tie aside the power steering reservoir.

▶ Remove the 2 bolts.



7 . Remove the air cleaner outlet pipe.

- ▶ Remove the bolt.
- ▶ Release the 2 clips.
- ▶ Release the electrical connector.




Installation


1 . Install the air cleaner outlet pipe.

- ▶ Tighten the bolt to 8 Nm (6 lb.ft)
- ▶ Carefully secure the clips.
- ▶ Install the electrical connector.

2 . Install the power steering fluid reservoir.

 Tighten the bolts to 10 Nm (7 lb.ft).

3 . Install the fender splash shield.

 Tighten the Torx bolts.

4 . Install the wheel and tire.

For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

5 . Connect the battery ground cable.

For additional information, refer to [Specifications](#)

303-13 : Evaporative Emission – 4.2L NA V8 – AJV8/4.2L SC V8 – AJV8

Specifications

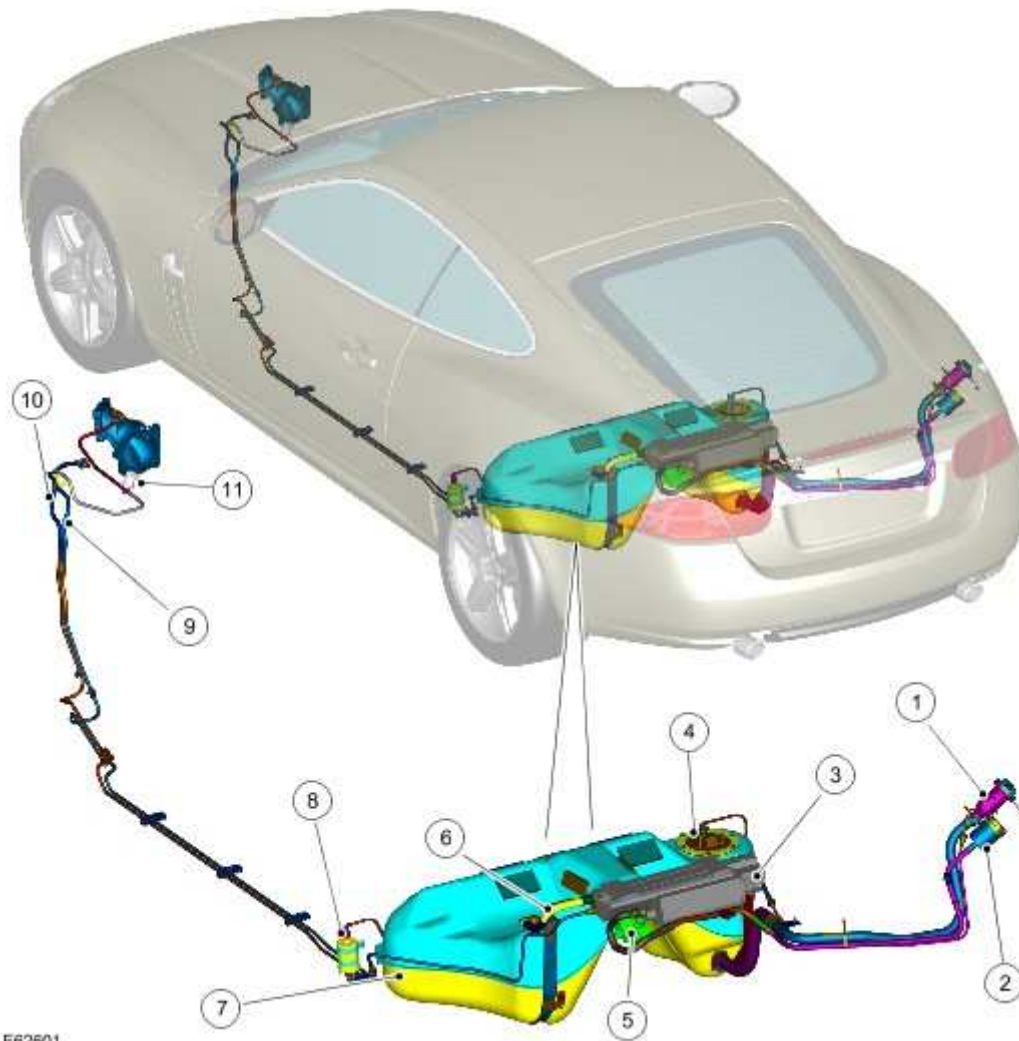
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Evaporative emission, canister bracket to vehicle - nut	7	5	62
Purge valve to engine cover bracket - bolt	4	3	35
Vapour/fuel tube bracket to vehicle - bolt	9	7	80

Evaporative Emissions - 4.2L NA V8 - AJV8

COMPONENT LOCATION



E62601

Item	Part Number	Description
1	-	Fuel filler pipe/cap
2	-	DMTL pump filter (NAS only)
3	-	Charcoal canister
4	-	Fuel pump
5	-	DMTL pump (NAS only)

6	-	Breather hose from tank
7	-	Fuel tank
8		Fuel filter
9	-	Charcoal canister vent hose (All except NAS) or DMTL pump vent hose (NAS)
10	-	Fuel delivery hose
11	-	Purge valve

INTRODUCTION

The evaporative emission (EVAP) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses. The vent pipes are connected to the system components using quick release connectors.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister via a 'Y' piece mounted on the filler pipe.

On NAS vehicles the vapor generated in the fuel tank during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

DMTL

The DMTL system is a legislative requirement for NAS vehicles. The DMTL system periodically checks the EVAP system and the fuel tank for leaks when the ignition is switched off. The DMTL system comprises the previously described components of the EVAP system with the following additional components; a DMTL pump and a DMTL filter.

DMTL Pump



The DMTL pump is connected to the atmospheric vent of the charcoal canister and incorporates a Positive Temperature Co-efficient (PTC) heating element, a normally open valve and a reference orifice. The DMTL pump is only operated when the ignition is switched off and is controlled by the ECM. The ECM also monitors the electric air pump operation and the normally open valve for faults

The DMTL filter protects the pump from dust being drawn into the system when the pump is being operated. The filter is located on the fuel filler head and is connected to the DMTL pump by a hose.

The DMTL test is performed after the engine has stopped following a 10 minute run, providing that the vehicle fuel tank is between 15 and 85 percent full, the ambient temperature is above 0°C (32°F) and less than 40°C (104°F) and the vehicle was not started for at least 3hrs prior to this run.

The DMTL pump is driven to pressurize the fuel tank and the current is measured with the change-over valve in different states.

A comparison of the current draw in each state indicates the degree of any leak, and the ECM then sets the appropriate DTC.

DMTL Operation

To check the fuel tank and the EVAP system for leaks, the ECM operates the DMTL pump and monitors the current draw. Initially, the ECM establishes a reference current by pumping air through the reference orifice and back to atmosphere. Once the reference current is determined, the ECM closes the normally open valve which seals the EVAP system. The purge valve remains de-energized and is therefore closed. The output from the air pump is diverted from the reference orifice and into the EVAP system.

When the normally open valve is closed, the load on the air pump falls to zero. Providing there are no leaks, the air pump will begin to pressurize the EVAP system and the load and current draw in the pump increases. By monitoring the rate and level of the current increase, the ECM can determine if there is a leak in the EVAP system.

During normal vehicle operation, 15 seconds after the engine has started, the ECM energizes the heating element in the pump to prevent condensation formation and possible incorrect readings. The heater remains energized until either the engine and ignition are off (if no DMTL test is running) or until after the DMTL test is completed."

Leaks are classified as:

- Minor - equivalent to a hole diameter of 0.5 to 1.0 mm (0.02 to 0.04 in)
- Major - equivalent to hole diameter of 1.0 mm (0.04 in) or greater.

The ECM performs a check for major leaks each time the ignition is switched off, providing the following conditions are met:

- The vehicle speed is zero
- The engine speed is zero
- The pressure altitude (70 kPa (10.15 lbf/in²) derived from engine load calculations) is below 3047 m (10000 feet)
- The ambient temperature is between 0 and 40°C (32 and 104°F)
- The charcoal canister load factor is 2.5 or less (where the load factor is a measure, between -1 and +30, of the fuel vapor stored in the charcoal canister. Where -1 is 0% fuel vapor, 0 is stoichiometric fuel vapor level and +30 is 100% saturated with fuel vapor.
- The fuel tank level is valid and between 15 and 85% of nominal capacity
- The engine running time during the previous cycle was more than 10 minutes
- The battery voltage is between 10 and 15 volts
- The last engine off time was more than 180 minutes
- No errors are detected with the EVAP components, the ambient air temperature and the fuel level.

NOTE:

A leak test can be performed using IDS. This overrides the above conditions and is useful for checking correct system and component operation.

The ECM performs a check for minor leaks after every 2nd major leak check or after refueling is detected.

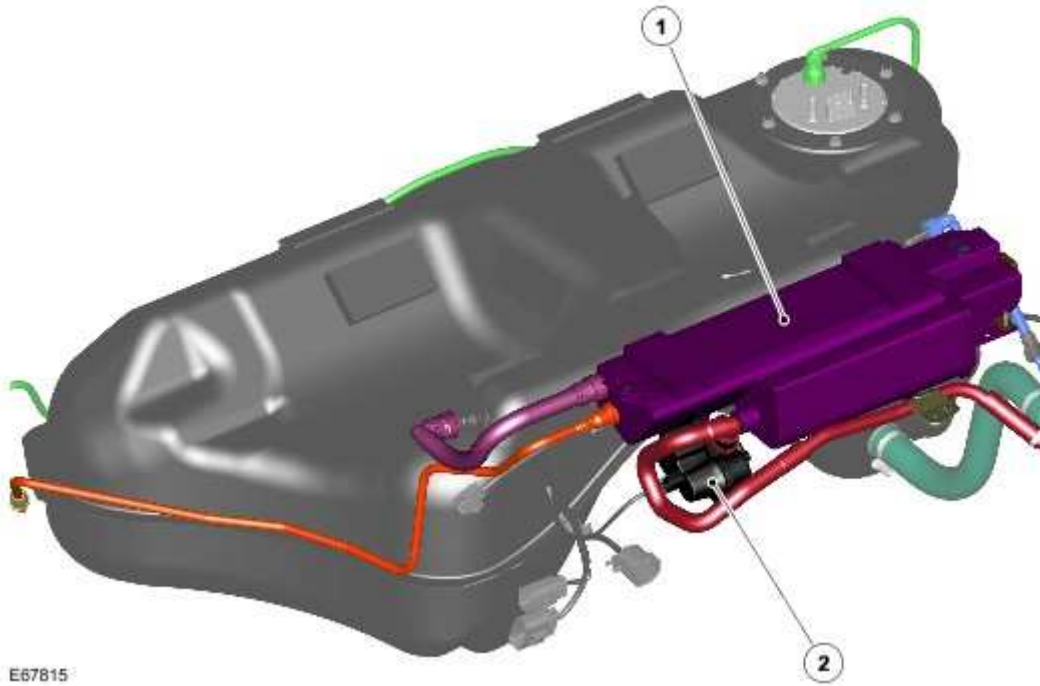
When the leak check is complete, the ECM stops the DMTL pump and opens (de-energizes) the normally open valve.

If the fuel filler cap is opened or refueling is detected during the leak check, by a sudden drop in the current draw or a rise in the fuel level, the ECM aborts the leak check.

If a leak is detected during the check, the ECM stores an appropriate fault code in its memory. If a leak is detected on two consecutive checks, the ECM illuminates the Malfunction Indicator Lamp (MIL) in the instrument cluster on the next drive cycle.

The duration of a leak check can be between 60 and 600 seconds depending on the results and fuel tank level.

CHARCOAL CANNISTER



Item	Part Number	Description
1		Charcoal cannister
2		DMTL pump

The charcoal canister is located in a central position, forward of the spare wheel. It is attached at the rear with two bolts which screw into the spare wheel carrier. At the front, the canister has two lugs which locate in the parking brake module support bracket.

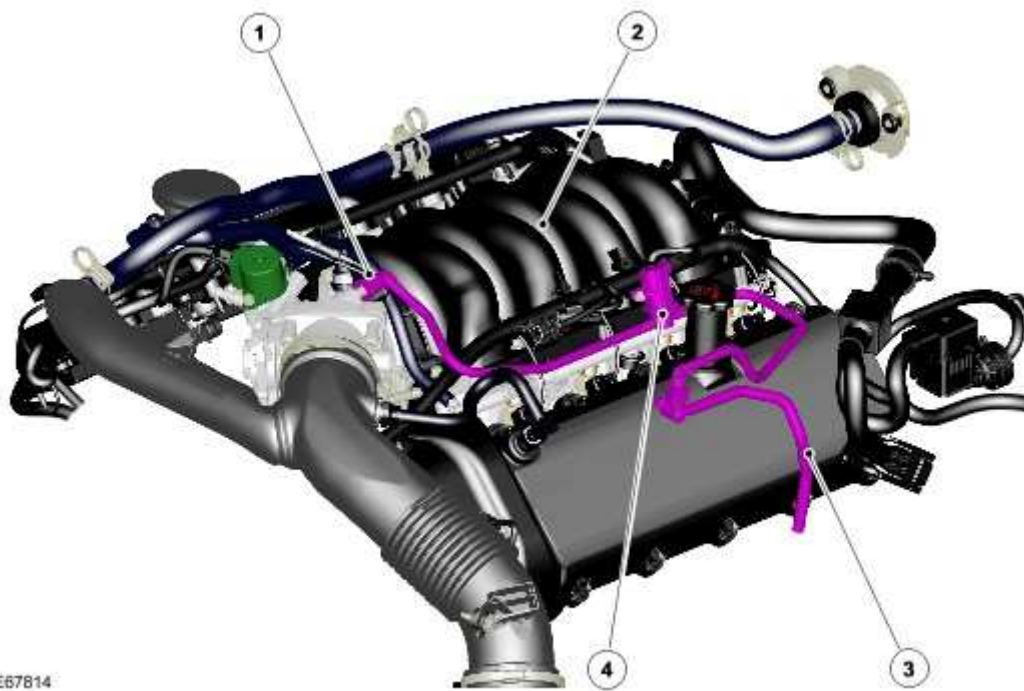
The canister on ROW vehicles has a capacity of 1400cc (85.4 in³).

The canister on NAS vehicles has a capacity of 3000cc (183 in³).

The canister has three ports which allow for the attachment of the atmospheric vent hose, the purge hose and the tank vent hose. On NAS vehicles the atmospheric vent hose connection allows for the attachment of the DMTL pump.

The canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of LEV2 emission regulations.

PURGE VALVE



E67814

Item	Part Number	Description
1		Hose and connection-purge valve to electric throttle
2		Air intake manifold
3		Hose-charcoal cannister to purge valve
4		Purge valve

The purge valve is located LH side of the engine, on a bracket which is attached to the cylinder block. The purge hose is routed from the purge valve, along the left hand side of the air intake manifold, to the elbow assembly which locates the electric throttle. The purge valve is controlled by the Engine Control Module (ECM) and is operated when engine operating conditions are correct to allow purging of the charcoal canister. The purge valve is a solenoid operated valve which is closed when de-energized.

The purge hose is connected, at the right hand rear of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line along the top of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is Pulse Width Modulated (PWM) at 10Hz by the ECM. At this high frequency, the pulses of purge gas flow into the inlet manifold in an almost a continuous flow. The valve operates between 7% and 100% duty or mark space ratio (% open time).

The atmospheric pressure at the air intake vent of the system is higher than the inlet manifold

pressure under all throttled engine running conditions. It is this pressure differential across the system that causes the air to flow through the air intake, through the purge system, and in to the engine.

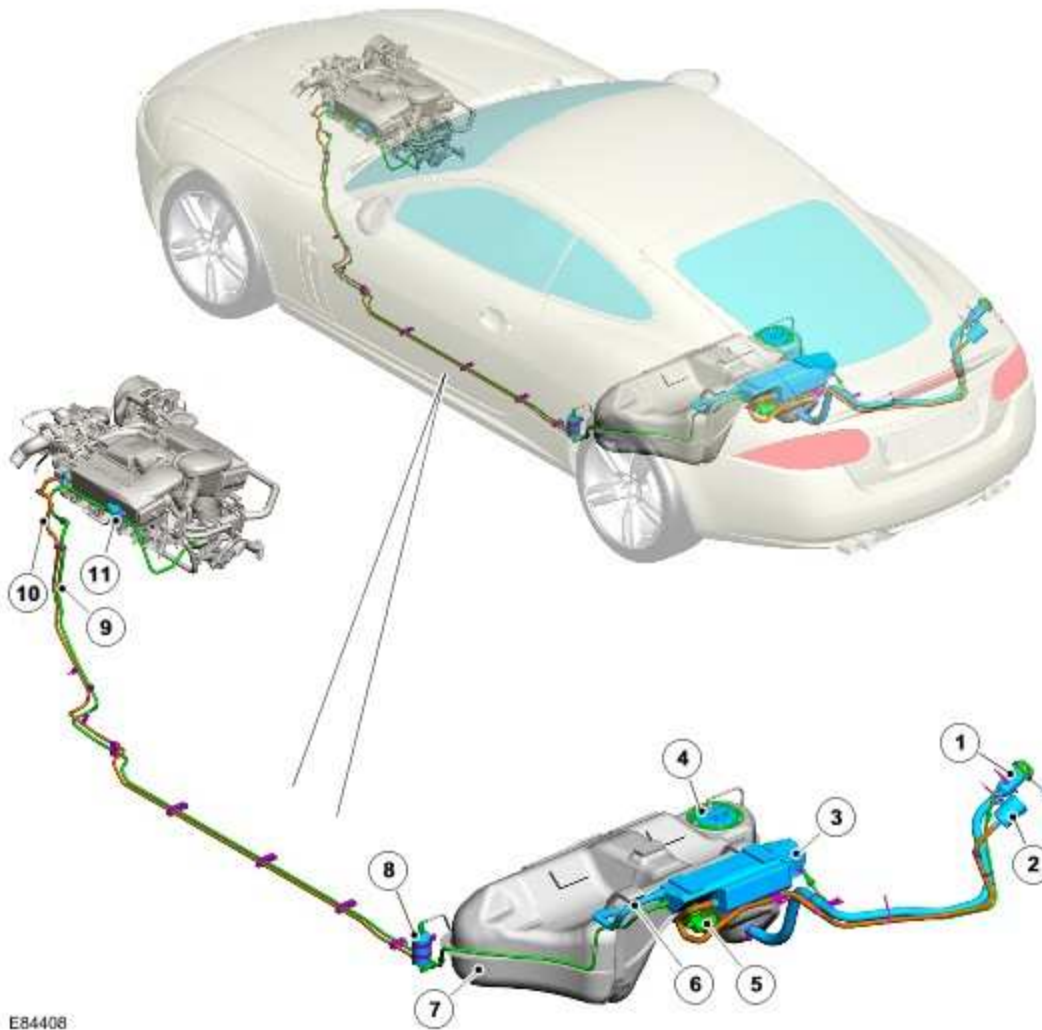
The ECM waits until the engine is running above 40°C (104°F) coolant temperature with closed loop fuel operational before the purging process is activated. Under these conditions the engine should be running smoothly with no warm up enrichment. The purge valve duty (and flow) is initially ramped slowly because the vapor concentration is unknown (a sudden increase in purge could cause unstable engine running or cause it to stall due to an extremely "rich" air/fuel mixture.). The concentration is then determined from the amount of adjustment that the closed loop fueling is required to make to achieve the target Air Fuel Ratio (AFR). Once the concentration has been determined, the purge flow can be increased rapidly and the injected fuel can be proactively adjusted to compensate for the known purge vapor and the target AFR control is maintained.

When the purging process is active, fresh air is drawn into the charcoal canister via the DMTL valve atmospheric vent connection and its filter on NAS vehicles or, via the vent hose connection and the spider trap on non NAS vehicles.

On NAS vehicles the system does not include a pressure test point. Pressure testing of the purge valve hose is achieved by disconnecting the purge valve joint on the underside of the vehicle, forward of the fuel tank and connecting a special tool to allow the system to be pressure tested. The test performs a pressure test on the purge hose connection forward of the fuel tank back to the charcoal canister. The special tool is then connected to the purge hose connection forward of the fuel tank to perform a pressure test on the purge hose to the purge valve.

Evaporative Emissions - 4.2L SC V8 - AJV8

COMPONENT LOCATION



E84408

Item	Part Number	Description
1		Fuel filler pipe/cap
2		fuel tank leakage monitoring pump filter (NAS only)
3		Charcoal canister
4		Fuel pump
5		fuel tank leakage monitoring pump (NAS only)
6		Breather hose from tank
7		Fuel tank
8		Fuel filter

9		Charcoal canister vent hose (All except NAS) or fuel tank leakage monitoring pump vent hose (NAS)
10		Fuel delivery hose
11		Purge valve

OVERVIEW

The evaporative emission (EVAP) control system reduces the level of hydrocarbons released into the atmosphere by fuel vapor venting from the fuel tank. The system comprises a charcoal canister, purge valve and interconnecting vent pipes and hoses. The vent pipes are connected to the system components using quick release connectors.

Fuel vapor is generated by the fuel in the tank and the amount of vapor produced increases as the fuel heats up. Fuel vapor can flow freely to the charcoal canister via the tank venting system. The venting system consists of roll over valves and a liquid vapor separator mounted internally in the tank and then externally via a breather line. The breather line allows the fuel vapor to flow to the charcoal canister via a 'Y' piece mounted on the filler pipe.

On NAS vehicles the vapor generated in the fuel tank during refueling flows without restriction to the charcoal canister.

On all vehicles except NAS, the vapor is restricted in its path to the charcoal canister but can flow freely during the refueling operation to atmosphere, via the filler opening.

The vapor passes into the charcoal canister where it is absorbed and stored by the charcoal. Because there is a limit to the amount of vapor the canister can contain, the fuel vapor is purged from the canister when the engine is running and burned in the engine.

FUEL TANK LEAKAGE MONITORING

The fuel tank leakage monitoring system is a legislative requirement for NAS vehicles. The fuel tank leakage monitoring system periodically checks the EVAP system and the fuel tank for leaks when the ignition is switched off. The fuel tank leakage monitoring system comprises the previously described components of the EVAP system with the additional of a fuel tank leakage monitoring pump and a fuel tank leakage monitoring filter.

Fuel Tank Leakage Monitoring Pump



The fuel tank leakage monitoring pump is connected to the atmospheric vent of the charcoal canister and incorporates a Positive Temperature Co-efficient (PTC) heating element, a normally open valve and a reference orifice. The fuel tank leakage monitoring pump is only operated when the ignition is switched off and is controlled by the ECM. The ECM also monitors the electric air pump operation and the normally open valve for faults.

The fuel tank leakage monitoring filter protects the pump from dust being drawn into the system when the pump is being operated. The filter is located on the fuel filler head and is connected to the fuel tank leakage monitoring pump by a hose.

The fuel tank leakage monitoring test is performed after the engine has stopped following a 10 minute run, providing that the vehicle fuel tank is between 15 and 85 percent full, the ambient temperature is above 0°C (32°F) and less than 40°C (104°F) and the vehicle was not started for at least 3hrs prior to this run.

The fuel tank leakage monitoring pump is driven to pressurize the fuel tank and the current is measured with the change-over valve in different states. A comparison of the current draw in each state indicates the degree of any leak, and the ECM then sets the appropriate DTC.

Fuel Tank Leakage Monitoring Operation

To check the fuel tank and the EVAP system for leaks, the ECM operates the fuel tank leakage monitoring pump and monitors the current draw. Initially, the ECM establishes a reference current by pumping air through the reference orifice and back to atmosphere. Once the reference current is determined, the ECM closes the normally open valve which seals the EVAP system. The purge valve remains de-energized and is therefore closed. The output from the air pump is diverted from the reference orifice and into the EVAP system.

When the normally open valve is closed, the load on the air pump falls to zero. Providing there are no leaks, the air pump will begin to pressurize the EVAP system and the load and current draw in the pump increases. By monitoring the rate and level of the current increase, the ECM can determine if there is a leak in the EVAP system.

During normal vehicle operation, 15 seconds after the engine has started, the ECM energizes the heating element in the pump to prevent condensation formation and possible incorrect readings. The heater remains energized until either the engine and ignition are off (if no fuel tank leakage monitoring test is running) or until after the fuel tank leakage monitoring test is completed.

Leaks are classified as:

- Minor - equivalent to a hole diameter of 0.5 to 1.0 mm (0.02 to 0.04 in)
- Major - equivalent to hole diameter of 1.0 mm (0.04 in) or greater.

The ECM performs a check for major leaks each time the ignition is switched off, providing the following conditions are met:

- The vehicle speed is zero
- The engine speed is zero
- The altitude is below 2500 m (8200 feet)
- The ambient temperature is between 4 and 35°C (32 and 104°F)
- The charcoal canister load factor is 2.5 or less (where the load factor is a measure, between -1 and +30, of the fuel vapor stored in the charcoal canister. Where -1 is 0% fuel vapor, 0 is stoichiometric fuel vapor level and +30 is 100% saturated with fuel vapor.
- The fuel tank level is valid and between 15 and 85% of nominal capacity
- The engine running time during the previous cycle was more than 20 minutes
- The battery voltage is between 11 and 14.5 volts
- The last engine off time was more than 20 minutes
- No errors are detected with the EVAP components, the ambient air temperature and the fuel level.

NOTE:

A leak test can be performed using the Jaguar recommended diagnostic tool. This overrides the above conditions and is useful for checking correct system and component operation.

The ECM performs a check for minor leaks after every 14 major leak check or after refueling is not detected.

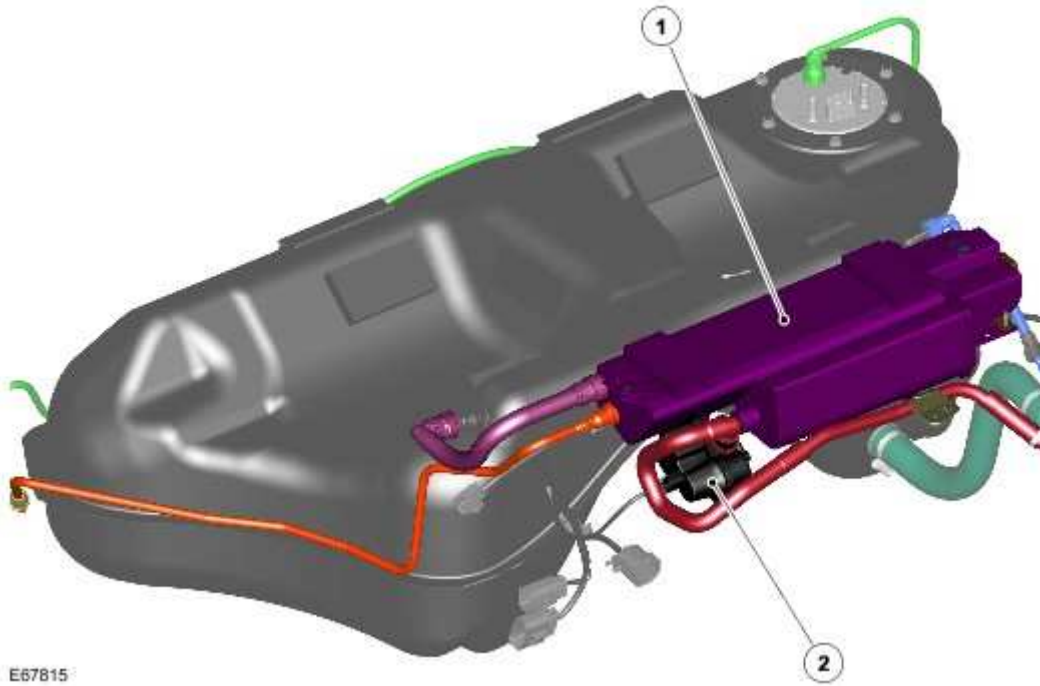
When the leak check is complete, the ECM stops the fuel tank leakage monitoring pump and opens (de-energizes) the normally open valve.

If the fuel filler cap is opened or refueling is detected during the leak check, by a sudden drop in the current draw or a rise in the fuel level, the ECM aborts the leak check.

If a leak is detected during the check, the ECM stores an appropriate fault code in its memory. If a leak is detected on two consecutive checks, the ECM illuminates the Malfunction Indicator Lamp (MIL) in the instrument cluster on the next drive cycle.

The duration of a leak check can be between 60 and 600 seconds depending on the results and fuel tank level.

CHARCOAL CANNISTER



Item	Part Number	Description
1		Charcoal cannister
2		Fuel tank leakage monitoring pump

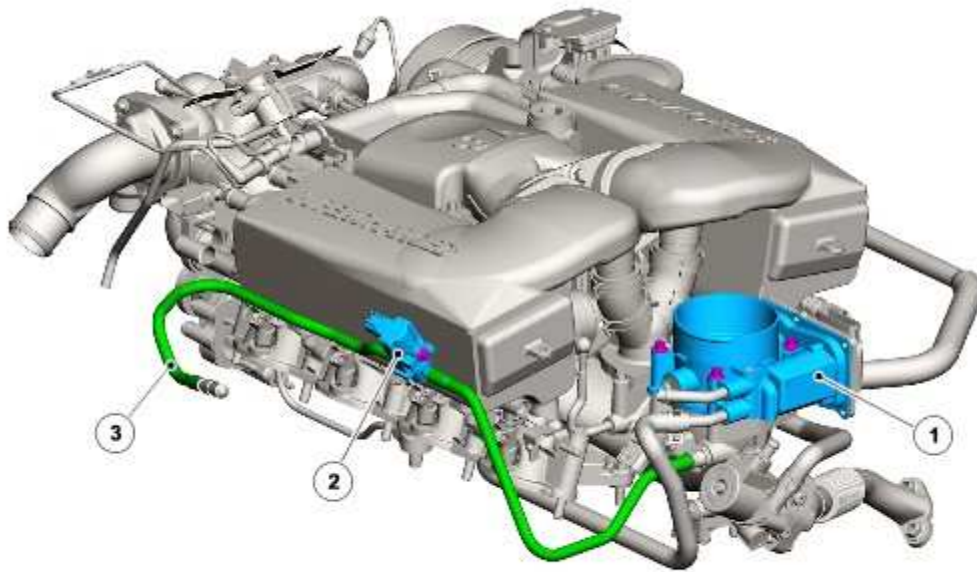
The charcoal canister is located in a central position, forward of the spare wheel. It is attached at the rear with two bolts which screw into the spare wheel carrier. At the front, the canister has two lugs which locate in the parking brake module support bracket.

Variant	Capacity
NAS	3000cc (183 in ³)
ROW	1400cc (85.4 in ³)

The canister has three ports which allow for the attachment of the atmospheric vent hose, the purge hose and the tank vent hose. On NAS vehicles the atmospheric vent hose connection allows for the attachment of the fuel tank leakage monitoring pump.

The canister contains a bed of activated charcoal or carbon. The charcoal is produced using special manufacturing techniques to treat the charcoal with oxygen. The oxygen treatment opens up millions of pores between the carbon atoms resulting in a highly porous charcoal with a very large effective surface area which is capable of absorbing large quantities of fuel vapor. Once treated the charcoal is known as 'activated' carbon or charcoal. The charcoal canister on NAS vehicles uses a higher grade charcoal to meet the requirements of LEV2 emission regulations.

PURGE VALVE



E84409

Item	Part Number	Description
1		Electric throttle
2		Purge valve
3		Hose-charcoal canister to purge valve

The purge valve is located LH side of the engine, on a bracket which is attached to the cylinder block. The purge hose is routed from the purge valve, along the left hand side of the air intake manifold, to the elbow assembly which locates the electric throttle. The purge valve is controlled by the Engine Control Module (ECM) and is operated when engine operating conditions are correct to allow purging of the charcoal canister. The purge valve is a solenoid operated valve which is closed when de-energized.

The purge hose is connected, at the right hand rear of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line along the top of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is Pulse Width Modulated (PWM) at 10Hz by the ECM. At this high frequency, the pulses of purge gas flow into the inlet manifold in an almost a continuous flow. The valve operates between 7% and 100% duty or mark space ratio (% open time).

The atmospheric pressure at the air intake vent of the system is higher than the inlet manifold pressure under all throttled engine running conditions. It is this pressure differential across the system that causes the air to flow through the air intake, through the purge system, and in to

the engine.

The ECM waits until the engine is running above 40°C (104°F) coolant temperature with closed loop fuel operational before the purging process is activated. Under these conditions the engine should be running smoothly with no warm up enrichment. The purge valve duty (and flow) is initially ramped slowly because the vapor concentration is unknown (a sudden increase in purge could cause unstable engine running or cause it to stall due to an extremely "rich" air/fuel mixture.). The concentration is then determined from the amount of adjustment that the closed loop fueling is required to make to achieve the target Air Fuel Ratio (AFR). Once the concentration has been determined, the purge flow can be increased rapidly and the injected fuel can be proactively adjusted to compensate for the known purge vapor and the target AFR control is maintained.

When the purging process is active, fresh air is drawn into the charcoal canister via the fuel tank leakage monitoring valve atmospheric vent connection and its filter on NAS vehicles or, via the vent hose connection and the spider trap on non NAS vehicles.

On NAS vehicles the system does not include a pressure test point. Pressure testing of the purge valve hose is achieved by disconnecting the purge valve joint on the underside of the vehicle, forward of the fuel tank and connecting a special tool to allow the system to be pressure tested. The test performs a pressure test on the purge hose connection forward of the fuel tank back to the charcoal canister. The special tool is then connected to the purge hose connection forward of the fuel tank to perform a pressure test on the purge hose to the purge valve.

Evaporative Emissions

Principle of Operation

For a detailed description of the Evaporative emissions system, refer to the relevant Description and Operation section of the workshop manual.

[Evaporative Emissions - 4.2L NA V8 - AJV8](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel filler cap and seal • Fuel filler neck • Diagnostic Monitoring of Tank Leakage (DMTL) fresh air filter (restriction, etc) • Fuel tank (leaks, damage, etc) • Fuel lines and joints, etc • Carbon canister • Purge valve • DMTL pump module 	<ul style="list-style-type: none"> • Fuses • Connectors • Harnesses • Purge valve • DMTL pump

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, and there are clear symptoms, refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) then proceed to the DTC Index.

5 . NOTE:

On all vehicles equipped with Diagnostic Monitor Tank Leakage (DMTL), there is a requirement to blank off the ventilation port (large diameter stub pipe) of the DMTL module, to prevent mis-diagnosis when carrying out a smoke test.

Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilised to assist with Evaporative Emissions System leak diagnosis.

Symptom Chart

Symptom	Possible Cause	Action
Difficulty in filling fuel tank	<ul style="list-style-type: none"> Restriction in the vapor line between the fuel tank and the carbon canister outlet/atmospheric port 	<ul style="list-style-type: none"> Check for restrictions/damage, etc (see visual inspection)
Fuel smell	<ul style="list-style-type: none"> System leak Purge valve inoperative 	<ul style="list-style-type: none"> Check for leaks, check the purge valve operation. GO to Pinpoint Test G556798p1.
'Check Fuel Filler Cap' displayed on Message Center	<ul style="list-style-type: none"> Fuel filler cap missing/not tightened after refuelling 	<ul style="list-style-type: none"> Check the fuel filler cap and seal

DTC Index



CAUTION: When probing connectors to take measurements in the course of the diagnostic tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the module is suspect and the vehicle remains under the manufacturer warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P044100	Incorrect purge flow	<ul style="list-style-type: none"> • Evaporative canister purge pipe restricted, leaking, disconnected • Evaporative canister vent restricted • Evaporative canister purge valve to engine pipe(s) restricted, leaking, disconnected • Evaporative canister purge valve failure 	<p>For basic checks. GO to Pinpoint Test G556798p1.</p> <p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p>
P044700	Evaporative Emission (EVAP) system vent control circuit open	<ul style="list-style-type: none"> • DMTL COV circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P044800	Evaporative Emission (EVAP) system vent control circuit shorted	<ul style="list-style-type: none"> • DMTL COV circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P045600	Evaporative Emission (EVAP) system leak detected (very small leak)	<ul style="list-style-type: none"> • DMTL system has detected a leak 	Check the fuel system integrity (see visual inspection). Carry out K line or Vacutec tests to identify the leak
P045800	Evaporative Emission (EVAP) canister purge valve circuit low	<ul style="list-style-type: none"> • EVAP canister purge valve control circuit - short to ground, high resistance • EVAP canister purge valve failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EVAP canister purge valve as necessary. Evaporative Emission Canister Purge Valve - 4.2L NA V8 - AJV8 (17.15.30)
P045900	Evaporative Emission (EVAP) canister purge valve circuit high	<ul style="list-style-type: none"> • EVAP canister purge valve control circuit - 	Carry out any pinpoint tests associated with this DTC using the

		short to power	manufacturer approved diagnostic system
P240100	Evaporative emission (EVAP) system leak detection pump control circuit low	<ul style="list-style-type: none"> DMTL pump circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240200	Evaporative emission (EVAP) system leak detection pump control circuit high	<ul style="list-style-type: none"> DMTL pump circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240429	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance	<ul style="list-style-type: none"> DMTL reference leak DMTL pump circuit - short to ground, power, high resistance DMTL pipework blocked/leaking 	Check the DMTL pipework. For DMTL pump tests, GO to Pinpoint Test G556798p4 .
P24042F	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance - signal erratic	<ul style="list-style-type: none"> DMTL reference leak DMTL pump circuit - short to ground, power, high resistance DMTL pipework blocked/leaking 	Check the DMTL pipework. For DMTL pump tests, GO to Pinpoint Test G556798p4 .
P240500	Evaporative emission (EVAP) system leak detection pump sensing circuit low	<ul style="list-style-type: none"> DMTL pump circuit - short to ground, power, high resistance 	For DMTL pump tests, GO to Pinpoint Test G556798p4 .
P240600	Evaporative emission (EVAP) system leak detection pump sensing circuit high	<ul style="list-style-type: none"> DMTL pump circuit - short to ground, power, high resistance 	For DMTL pump tests, GO to Pinpoint Test G556798p4 .
P240B00	Evaporative emission (EVAP) system leak detection pump heater circuit low	<ul style="list-style-type: none"> DMTL heater control circuit low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240C00	Evaporative emission (EVAP) system leak detection pump heater circuit high	<ul style="list-style-type: none"> DMTL heater control circuit high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P245000	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck open	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P245100	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck closed	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Pinpoint Tests

PINPOINT TEST G556798p1 : EVAPORATIVE SYSTEM INCORRECT PURGE FLOW

G556798t1 : CHECK FUEL FILLER CAP INSTALLATION AND CONDITION OF CANISTER, PIPES AND CONNECTORS

1. Make sure that the fuel filler cap is correctly installed and tightened. 2. Check the condition of the carbon canister. 3. Check the condition of all accessible pipes and connectors in the vapor line.

- Are the canister and all pipes and connectors in good condition?

-> Yes

GO to Pinpoint Test [G556798t2](#).

-> No

REPAIR as necessary. CLEAR the DTC, test the system for normal operation.

G556798t2 : CHECK THAT THE PURGE VALVE IS OPERATING

1. Disconnect the vapor pipe from the inlet port of the evaporative purge valve. 2. **RUN** the engine for 2 minutes, making sure that the engine reaches normal operating temperature. 3. Check that the evaporative purge valve is operating, by touch or by sound (using a stethoscope, it will be possible to hear the valve operating).

- **Is the valve operating?**

-> **Yes**

CHECK for related DTCs. Refer to the DTC Index above.

-> **No**

CHECK the purge valve circuits. GO to Pinpoint Test [G556798p3](#).

PINPOINT TEST G556798p2 : CHANGE-OVER VALVE (COV) CONTROL CIRCUIT

G556798t3 : CHECK THE COV CONTROL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Set ignition status to OFF. 2. Disconnect the DMTL electrical connector, CV011. 3. Measure the resistance between:

DMTL connector CV011, harness side	Battery
Pin 03	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t4](#).

G556798t4 : CHECK THE COV CONTROL CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

DMTL connector CV011, harness side	Battery
Pin 03	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t5](#).

G556798t5 : CHECK THE COV CONTROL CIRCUIT FOR HIGH RESISTANCE

1. Disconnect the ECM electrical connector, FL072. 2. Measure the resistance between:

DMTL connector CV011, harness side	ECM connector FL072, harness side
Pin 03	Pin 48

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

INSTALL a new DMTL assembly. If the DTC is repeated, refer to the new ECM installation notes at the top of the DTC Index.

PINPOINT TEST G556798p3 : PURGE VALVE CONTROL CIRCUIT

G556798t6 : CHECK THE POWER SUPPLY TO THE PURGE VALVE

1. Disconnect the purge valve connector, PI304. 2. Set ignition status to ON, engine OFF. 3. Measure the voltage between:

Purge valve connector PI304, harness side	Battery
Pin 01	Negative terminal

- **Is the voltage less than 10 volts?**

-> **Yes**

REPAIR the circuit between the purge valve and battery. This circuit includes harness splices and fuse 14 of the engine junction box. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t7](#).

G556798t7 : CHECK THE PURGE VALVE CONTROL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Set ignition status to OFF. 2. Measure the resistance between:

Purge valve connector PI304, harness side	Battery
Pin 02	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t8](#).

G556798t8 : CHECK THE PURGE VALVE CONTROL CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

Purge valve connector PI304, harness side	Battery
Pin 02	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t9](#).

G556798t9 : CHECK THE PURGE VALVE CONTROL CIRCUIT FOR HIGH RESISTANCE

1. Disconnect the ECM electrical connector, PI300. 2. Measure the resistance between:

Purge valve connector PI304, harness side	ECM connector PI300, harness side
Pin 02	Pin 92

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

INSTALL a new purge valve. Clear the DTC, test the system for normal operation. If the DTC is repeated, refer to the new ECM installation notes at the top of the DTC Index.

PINPOINT TEST G556798p4 : DIAGNOSTIC MONITORING OF FUEL TANK LEAKAGE (DMTL) PUMP CONTROL CIRCUIT

G556798t10 : CHECK THE POWER SUPPLY TO THE DMTL PUMP

1. Set the ignition status to OFF. 2. Disconnect the DMTL pump electrical connector, CV011.
3. Set ignition status to ON, engine OFF. 4. Measure the voltage between:

DMTL pump connector CV011, harness side	Battery
Pin 04	Negative terminal

- **Is the voltage less than 10 volts?**

-> **Yes**

REPAIR the circuit between the DMTL pump and battery. This circuit includes harness splice FLS05 and fuse 14 of the engine junction box. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t11](#).

G556798t11 : CHECK THE DMTL PUMP CONTROL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Set ignition status to OFF. 2. Measure the resistance between:

DMTL pump connector CV011, harness side	Battery
Pin 01	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t12](#).

G556798t12 : CHECK THE DMTL PUMP CONTROL CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

DMTL pump connector CV011, harness side	Battery
Pin 01	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t13](#).

G556798t13 : CHECK THE DMTL PUMP CONTROL CIRCUIT FOR HIGH RESISTANCE

1. Disconnect the ECM electrical connector, FL072. 2. Measure the resistance between:

DMTL pump connector CV011, harness side	ECM connector FL072, harness side
Pin 01	Pin 33

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams.

Clear the DTC, test the system for normal operation.

-> **No**

INSTALL a new DMTL pump. Clear the DTC, test the system for normal operation. If the DTC is repeated, refer to the new ECM installation note at the top of the DTC Index.

PINPOINT TEST G556798p5 : DIAGNOSTIC MONITORING OF FUEL TANK LEAKAGE (DMTL) HEATER CIRCUIT

G556798t14 : CHECK THE POWER SUPPLY TO THE DMTL PUMP

1. Set ignition status to OFF. 2. Disconnect the DMTL pump electrical connector, CV011. 3. Set ignition status to ON, engine OFF. 4. Measure the voltage between:

DMTL pump connector CV011, harness side	Battery
Pin 04	Negative terminal

- **Is the voltage less than 10 volts?**

-> **Yes**

REPAIR the circuit between the DMTL pump and battery. This circuit includes harness splice FLS05 and fuse 14 of the engine junction box. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t15](#).

G556798t15 : CHECK THE DMTL HEATER CONTROL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Set ignition status to OFF. 2. Measure the resistance between:

DMTL pump connector CV011, harness side	Battery
Pin 02	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t16](#).

G556798t16 : CHECK THE DMTL HEATER CONTROL CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

DMTL pump connector CV011, harness side	Battery
Pin 02	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test [G556798t17](#).

G556798t17 : CHECK THE DMTL HEATER CONTROL CIRCUIT FOR HIGH RESISTANCE

1. Disconnect the ECM electrical connector, FL072. 2. Measure the resistance between:

DMTL pump connector CV011, harness side	ECM connector FL072, harness side
Pin 02	Pin 23

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. Clear the DTC, test the system for normal operation.


-> **No**


INSTALL a new DMTL pump. Clear the DTC, test the system for normal operation. If the DTC is repeated, refer to the new ECM installation note at the top of the DTC Index.

Removal and installation

Evaporative Emission Canister - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (17.15.13)

Removal

 **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- 1  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 2 Remove the rear differential.
 - For additional information, refer to [Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug \(51.25.13\)](#)

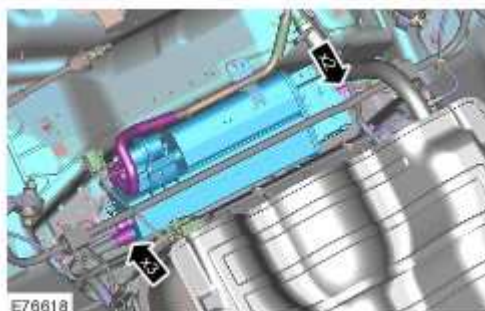
- 3  **CAUTION:** Always plug any open connections to prevent contamination.

NOTE:

Sub-frame shown removed for clarity.

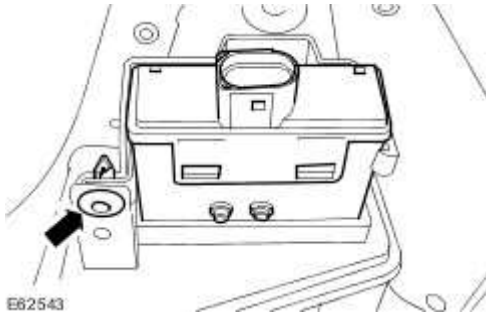
Disconnect the evaporative emissions canister.

- ▶ Disconnect the 3 lines.
- ▶ Disconnect the 2 electrical connectors.



4 . Remove the fuel pump driver module.

▶ Remove the clip.

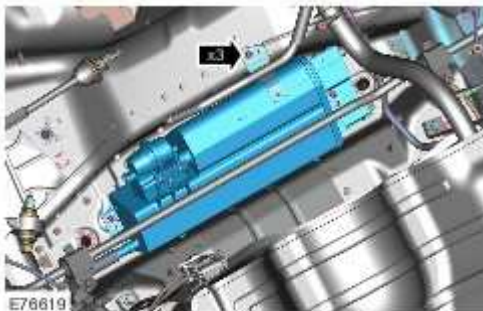


5 . **NOTE:**

Sub-frame shown removed for clarity.

Remove the evaporative emissions canister.

▶ Remove the 3 nuts.



Installation

1 . Install the evaporative emissions canister.

▶ Torque: 10 Nm (7 lb.ft)

2 . Install the fuel pump driver module.

3 . Connect the evaporative emissions canister.

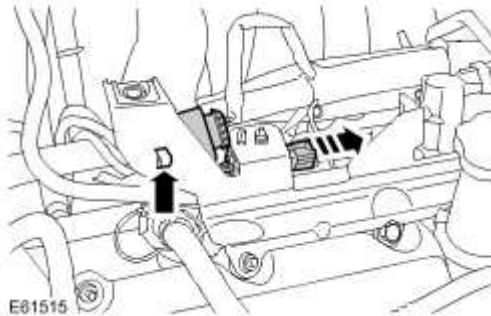
4 Install the rear differential.


. For additional information, refer to [Axle Assembly - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8, Vehicles Without: Differential Drain Plug \(51.25.13\)](#)

Evaporative Emission Canister Purge Valve - 4.2L NA V8 - AJV8 (17.15.30)

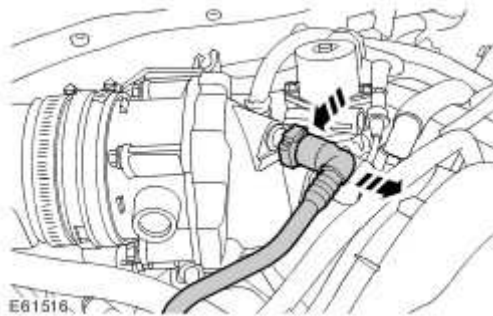
Removal


- 1 . Disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Release the 2 electrical connectors.



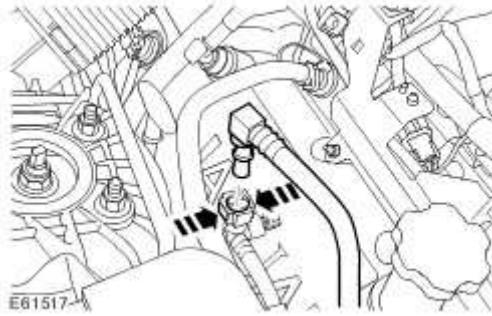
- 4  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Release the clip and disconnect purge outlet line at the intake elbow.



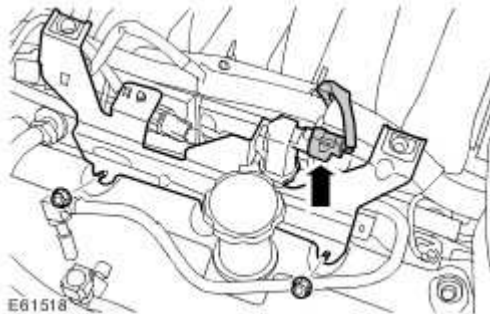
- 5  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Release the clip and disconnect the purge inlet line.



6 . Remove the purge valve assembly.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 nuts.



7 . **NOTE:**

Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

Remove the purge valve.

- ▶ Remove the bolt.



Installation

- 1 . Install the purge valve, align the peg and tighten the bolt to 6 Nm (4 lb.ft).
- 2 . Install the purge valve.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
- 3 . Connect the purge lines.
 - ▶ Clean the component mating faces.
- 4 . Secure the electrical connectors.
- 5 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 6 . Connect the battery ground cable.
For additional information, refer to [Specifications](#)

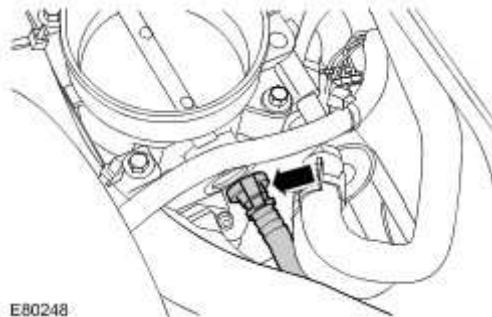
Evaporative Emission Canister Purge Valve - 4.2L SC V8 - AJV8 (17.15.30)

Removal

- 1 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)

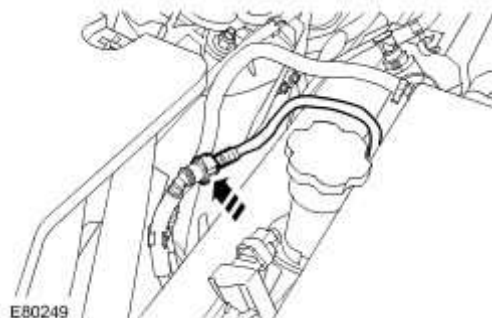
- 2  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Disconnect the purge outlet line.



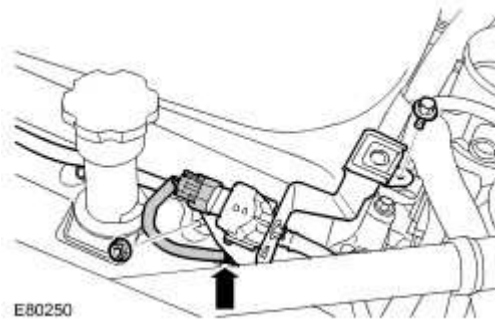
- 3  **CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.**

Disconnect the purge inlet line.



- 4 . Remove the purge valve assembly.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the nut.

- ▶ Remove the bolt.
- ▶ Release the wiring harness.



5 . NOTE:

Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

Remove the purge valve.

- ▶ Remove the bolt.



Installation

- 1 . Install the purge valve, align the peg and tighten the bolt to 6 Nm (4 lb.ft).
- 2 . Install the purge valve.
 - ▶ Attach the wiring harness.
 - ▶ Tighten the bolt to 6 Nm (4 lb.ft).
 - ▶ Tighten the nut to 6 Nm (4 lb.ft).
 - ▶ Connect the electrical connector.

3 . Connect the purge lines.

 Clean the component mating faces.

4 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)

303-14A : Electronic Engine Controls – 4.2L SC V8 – AJV8

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Camshaft position sensor - bolt	7	5	62
Catalyst monitor sensor	45	33	-
Crankshaft position sensor - screw	7	5	62
Engine control module	10	7	88
Fuel rail pressure sensor	5	4	44
Fuel temperature sensor	7	5	62
Heated oxygen sensor	45	33	-
Knock sensor - nut	20	15	-
Knock sensor - stud	10	7	88
Oil pressure sensor	15	11	-
Oil temperature sensor	15	11	-
Variable camshaft timing, oil control solenoid - bolt	10	7	88

Powertrain Control Module (PCM) Long Drive Cycle Self-Test



WARNING: Where possible, all road tests should be on well surfaced and dry roads. Always comply with speed limits and local traffic regulations.

NOTE:

This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

NOTE:

The vehicle must exceed 50mph (80 km/h) during the road test.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Disconnect the diagnostic equipment from the vehicle.
5. **NOTE:**
Make sure cruise control is not engaged.

Carry out a road test and perform the following operations.

- Accelerate to 55 mph (88 km/h) in 5th gear and cruise for 2 minutes with the engine speed at or above 1800rpm.
- Lift off the throttle and allow the vehicle to decelerate until the engine speed is less than 1000 rpm.
- Stop the vehicle.
- Release brake, allow the vehicle to move with no throttle for 1 minute.
- Road test is now complete.

6. Connect the diagnostic equipment to the vehicle.

7. **NOTE:**

If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

Follow on screen prompts and check for engine management fault codes.

8. Disconnect the diagnostic equipment from the vehicle.

Powertrain Control Module (PCM) Short Drive Cycle Self-Test

NOTE:

This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Start the engine.
 - Allow the engine to idle for 30 seconds.
 - Raise the engine speed to 1500 rpm and hold for 3 minutes until a temperature of 70°C (158 °F) is achieved.
 - Allow the engine to idle for 30 seconds.
 - Switch off the engine.
5. **NOTE:**

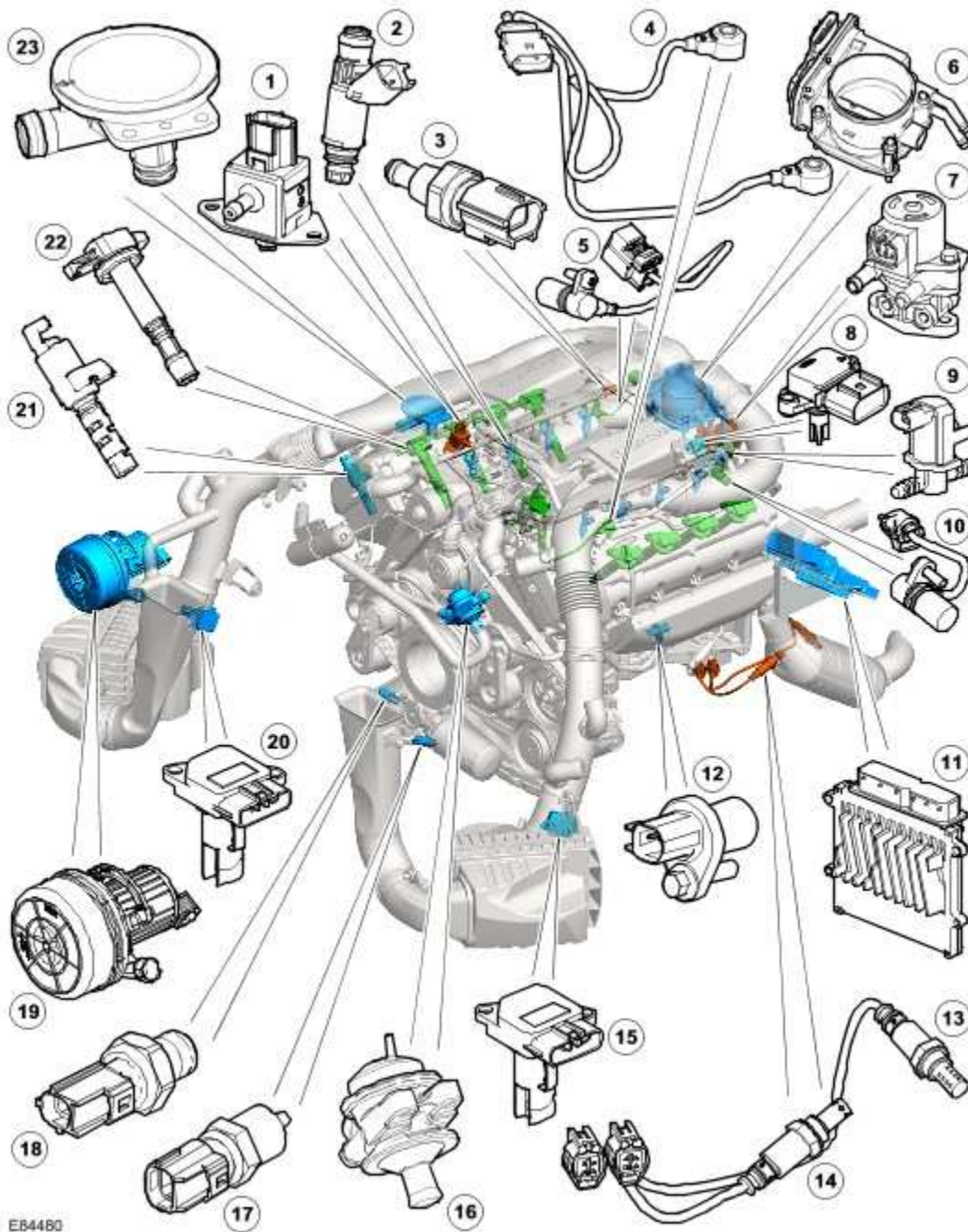
If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

Follow on screen prompts and check for engine management fault codes.

6. Disconnect the diagnostic equipment from the vehicle.

Electronic Engine Controls

COMPONENT LOCATION SHEET 1 of 2

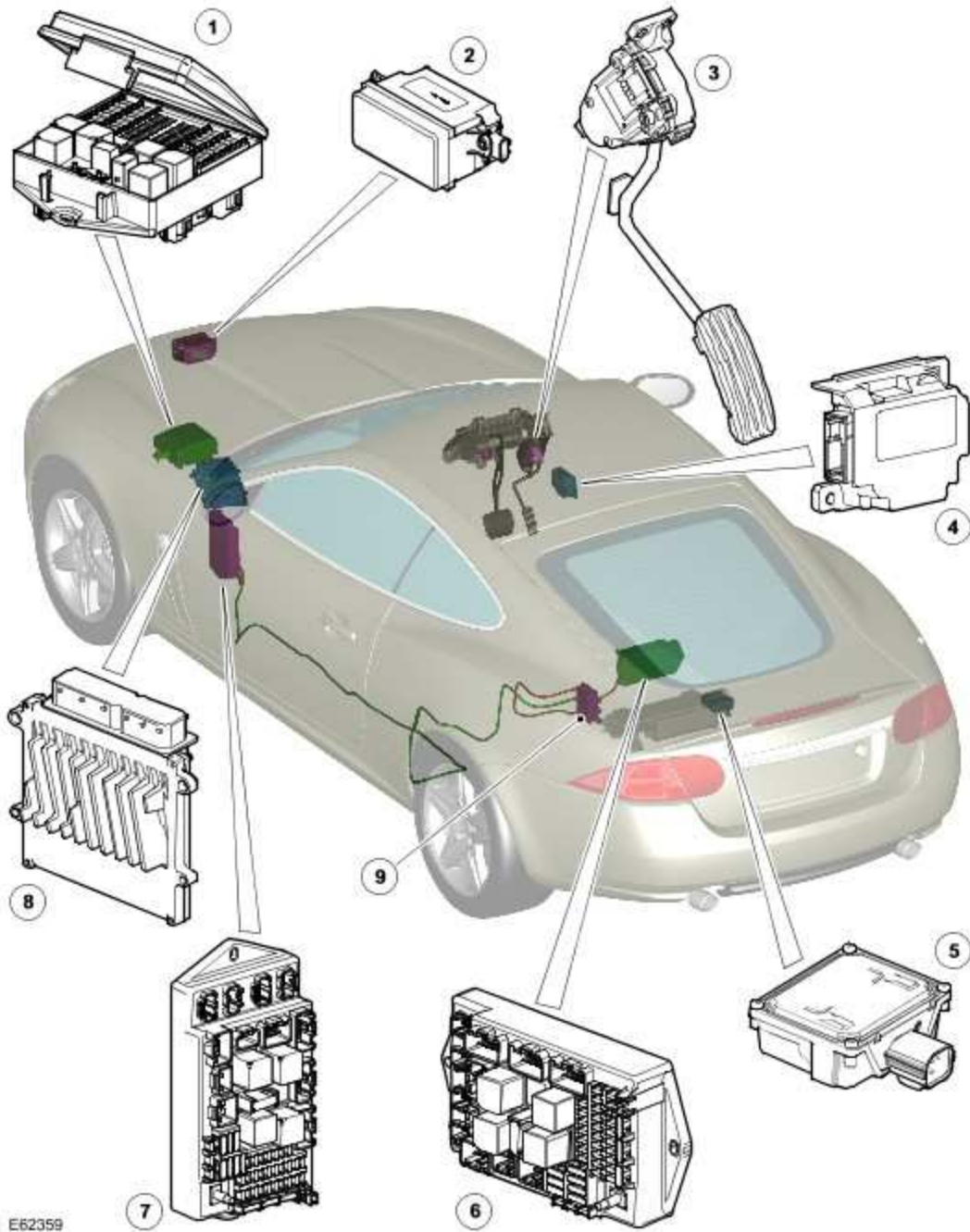


EB4460

Item	Part Number	Description
1		Fuel rail pressure sensor

2		Injector
3		Fuel rail temperature sensor
4		Knock sensor
5		Camshaft Position (CMP) sensor
6		Electric throttle
7		Exhaust Gas Recirculation (EGR) valve
8		Manifold Absolute Pressure sensor
9		Purge valve
10		Camshaft Position (CMP) sensor
11		Engine Control Module (ECM)
12		Crankshaft Position (CKP) sensor
13		Downstream Heated Oxygen Sensor (HO2S)
14		Upstream Heated Oxygen Sensor (HO2S)
15		Mass Air Flow(MAF)/Intake Air Temperature (IAT) sensor
16		Secondary air injection valve
17		Oil temperature sensor
18		Oil pressure sensor
19		Secondary air injection pump
20		Mass Air Flow(MAF)/Intake Air Temperature (IAT) sensor
21		Variable valve timing solenoid
22		Ignition coil
23		Positive Crankcase Ventilation (PCV) valve

COMPONENT LOCATION SHEET 2 of 2



E62359

Item	Part Number	Description
1		Power distribution box
2		Adaptive speed control sensor (where fitted)
3		Accelerator Pedal Position (APP) sensor
4		Adaptive speed control module (where fitted)
5		Fuel Pump Driver Module (FPDM)
6		Auxiliary junction box
7		Central Junction Box (CJB)
8		Engine Control Module (ECM)

OVERVIEW

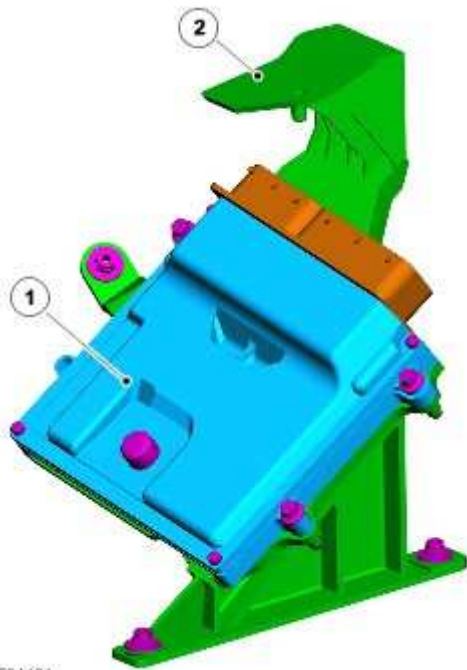
The V8 supercharged engine is controlled by an ECM. The Engine Management System (EMS) controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- On Board Diagnostic (OBD)
- Interface with the immobilization system
- Speed control

The ECM controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The ECM is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The ECM uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the CAN bus, to obtain additional information (e.g. road speed from the ABS control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

ENGINE CONTROL MODULE (ECM)



E84481

Item	Part Number	Description
1		ECM
2		Mounting bracket

The ECM and bracket assembly are attached to the vehicle on the left hand side in the secondary bulkhead area using 3 m6 nuts, 2 off onto the longitudinal and 1 off to the wheel arch apron panel.

System ECM has the following inputs:

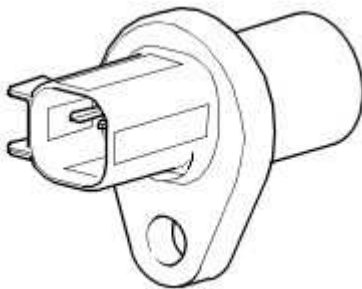
- RCM
- Park/neutral switch
- Ignition coil feedback x8
- Fuel rail temperature
- Fuel rail pressure
- Supercharger inlet pressure
- Mass air flow
- Engine speed
- Camshaft position x2
- Driver demand
- Brake pedal position switch
- Speed control switches
- Generator load
- Oxygen sensors pre catalyst x2
- Oxygen sensors post catalyst x2
- Throttle position
- Cooling fan speed
- Ignition switch position
- Knock sensors x2

- Manifold Absolute pressure (MAP)
- Intercooler temperature
- Coolant temperature
- Engine oil temperature

The ECM outputs to the following:

- Electric throttle Actuator
- Brake vacuum pump relay
- Ignition coils (x8)
- Oxygen sensor heaters (4)
- Fuel injectors (8)
- Purge Valve
- Engine Cooling Fan
- Fuel pump relay
- Starter Relay
- EMS Main Relay
- Electric Fan Control
- Generator Control
- Fuel tank leakage monitoring (NAS Only)
- Fuel Pump Driver Module (FPDM)

CRANKSHAFT POSITION SENSOR (CKP)



E46331

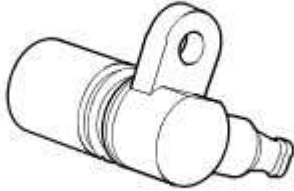
The crankshaft position sensor is mounted at the rear underside of the engine near the transmission bell housing. Connection between the sensor and the harness is via a link harness and a two-way connector. Both wires go directly to the ECM. The sensor produces the signal which enables the ECM to determine the angle of the crankshaft, and the engine rpm. From this, the point of ignition, fuel injection, etc. is calculated. If the signal wires are reversed a 3 degrees advance in timing will occur, as the electronics within the ECM uses the falling edge of the signal waveform as its reference / timing point for each tooth.

The reluctor is pressed into the flywheel and has a "tooth" pattern based on 36 teeth at 10° intervals and approximately 5° wide: one of the teeth is removed to provide a hardware reference mark which is 30 degrees BTDC No.1 cylinder. Because of the crankshaft sensor's orientation, the target wheel uses windows stamped into the face, rather than actual teeth.

The sensor operates by generating an output voltage caused by the change in magnetic field that occurs as the windows pass in front of the sensor. The output voltage varies with the speed of the windows passing the sensor, the higher the engine speed, the higher the output

voltage. Note that the output is also dependent on the air gap between the sensor and the teeth (the larger the gap, the weaker the signal, the lower the output voltage). The ECM transmits the engine speed to other vehicle control modules on CAN.

CAMSHAFT POSITION SENSOR (CMP)



E46332

Two sensors are located at the rear of the engine, in the cylinder head (one per bank), above the rear cylinders. The sensors are Variable Reluctor Sensor (VRS) type, producing four pulses for every two engine crankshaft revolutions. The sensing element is positioned between 0 and 2mm from the side of the cam gear wheel.

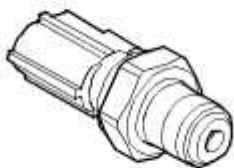
The camshaft timing wheel is a sintered component which has four teeth on it to enable the EMS to detect cylinder identification. The signal is used for:

- Cylinder recognition
- Enabling sequential fuel injection
- Knock control
- Cylinder identification for diagnostic purposes.

Failure symptoms include:

- Ignition timing reverting to the base mapping, with no cylinder correction.
- Active knock control is disabled, along with its diagnostic (Safe ignition map - loss of performance).
- Quick cam/crank synchronisation on start disabled.

ENGINE OIL TEMPERATURE SENSOR

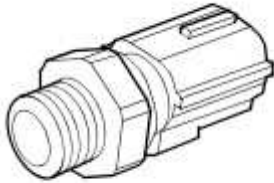


E46333

Oil temperature is monitored through a temperature sensor mounted in the oil system. This

component is a NTC. The sensor is mounted next to the oil pressure sensor at the front of the engine and locates into the oil filter bracket.

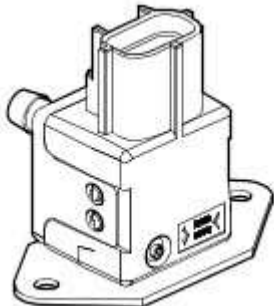
FUEL RAIL TEMPERATURE SENSOR



E47806

The fuel rail temperature sensor measures the temperature of the fuel in the fuel rail. This input is then used to deliver the correct quantity of fuel to the engine. The sensors operating range is -40 Degrees Celsius to 150 Degrees Celsius. The fuel rail temperature sensor is fitted on the rear of the right hand bank fuel rail.

FUEL RAIL PRESSURE SENSOR

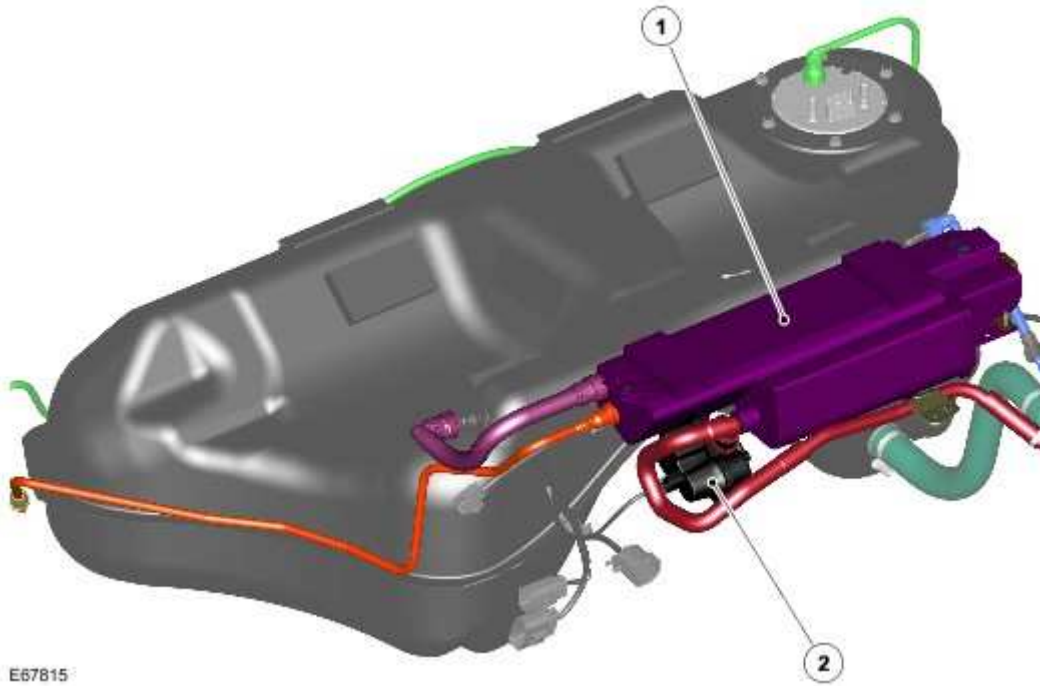


E58945

The fuel rail pressure sensor is located on top of the fuel rail adjacent to the fuel inlet. The fuel rail pressure sensor measures the pressure of the fuel in the fuel rail. This input is then used by the fuel pump control module to control the amount of fuel delivered to the fuel rail.

FUEL TANK LEAKAGE MONITORING - NAS ONLY

**Charcoal Canister with fuel tank leakage monitoring
Pump (NAS only)**



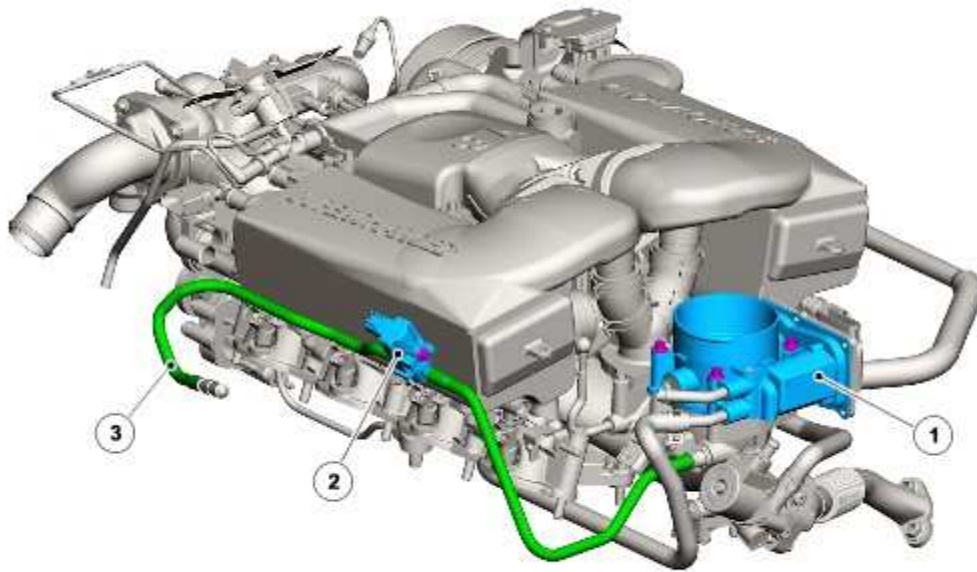
E67815

Item	Part Number	Description
1		Charcoal cannister
2		Fuel tank leakage monitoring pump

The fuel tank leakage monitoring system periodically checks the evaporative system and the fuel tank for leaks when the ignition is switched off. The fuel tank leakage monitoring pump is connected to the atmospheric vent of the charcoal cannister and incorporates a PTC heating element a normally open valve and a reference orifice. The fuel tank leakage monitoring pump is only operated when the ignition is switched off and is controlled by the ECM. The ECM also monitors the electric air pump operation and the normally open valve for faults. To check the fuel tank and EVAP system for leaks the ECM operates the fuel tank leakage monitoring pump and monitors the current draw. This is compared to a referenced figure established from the current draw when air is pumped through the reference orifice. For additional information, refer to [Evaporative Emissions - Vehicles With: Supercharger](#) (303-13 Evaporative Emissions)

PURGE VALVE

Purge Valve and Hoses location

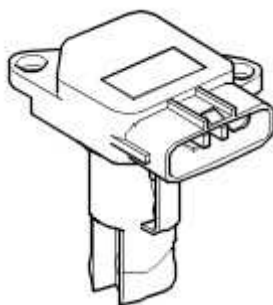


E84409

Item	Part Number	Description
1		Purge hose
2		Purge valve
3		Electric throttle

The purge valve is located on the LH side of the engine on a bracket which is attached to the cylinder head. The purge valve is a solenoid operated valve which is closed when de-energized. The purge valve is controlled by a 10Hz PWM signal from the ECM. When the engine operating conditions are correct, the ECM opens the purge valve which causes fuel vapor and fresh air to be drawn through the charcoal cannister. The fresh air is drawn through the charcoal cannister via the fuel tank leakage monitoring pump fresh air vent. For additional information, refer to [Evaporative Emissions - Vehicles With: Supercharger](#) (303-13 Evaporative Emissions)

MASS AIR FLOW/INLET AIR TEMPERATURE SENSOR (MAF/IAT)



E47308

Two MAF/IAT sensors are located in the clean air duct immediately after the air cleaner box.

The air mass flow is determined by the cooling effect of inlet air passing over a “hot film” element contained within the device. The higher the air flow the greater the cooling effect and the lower the electrical resistance of the “hot film” element. The ECM then uses this signal from the MAF to calculate the air mass flowing into the engine.

The measured air mass flow is used in determining the fuel quantity to be injected in order to maintain the stoichiometric air/fuel mixture required for correct operation of the engine and exhaust catalysts. Should the device fail there is a software backup strategy that will be evoked once a fault has been diagnosed.

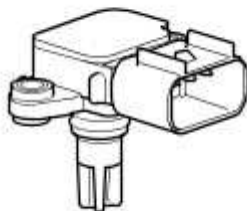
The following symptoms may be observed if the sensor fails:

- During driving the engine RPM might dip, before recovering.
- Difficulty in starting or start - stall.
- Poor throttle response / engine performance.
- Lambda control and idle speed control halted.
- Emissions incorrect.
- AFM signal offset

The sensor is integrated into the MAF meter. It is a temperature dependent resistor (thermistor), i.e. the resistance of the sensor varies with temperature. This thermistor is a NTC type element meaning that the sensor resistance decreases as the sensor temperature increases. The sensor forms part of a voltage divider chain with an additional resistor in the ECM. The voltage from this sensor changes as the sensor resistance changes, thus relating the air temperature to the voltage measured by the ECM.

The ECM stores a 25 Degrees Celsius default value for air temperature in the event of a sensor failure.

MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)- SUPERCHARGER INLET PRESSURE



E47588

The MAP sensor is located in the LH side of the throttle elbow.

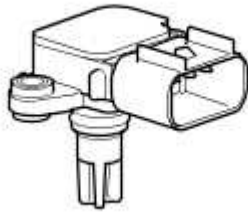
The MAP sensor provides a voltage proportional to the absolute pressure in the supercharger intake. This signal allows the load on the engine to be calculated and used within the internal calculations of the MAP. The sensor is located below the electric throttle on the induction

elbow.

The output signal from the MAP sensor, together with the CKP and IAT sensors, is used by the ECM to calculate the amount of air induced into the cylinders. This enables the ECM to determine ignition timing and fuel injection duration values.

If the MAP signal is missing, the ECM will substitute a default manifold pressure reading based on crankshaft speed and throttle angle. The engine will continue to run with reduced drivability and increased emissions, although this may not be immediately apparent to the driver. The ECM will store fault codes which can be retrieved using Land Rover recommended diagnostic tool.

MANIFOLD ABSOLUTE PRESSURE AND TEMPERATURE SENSOR (MAPT)

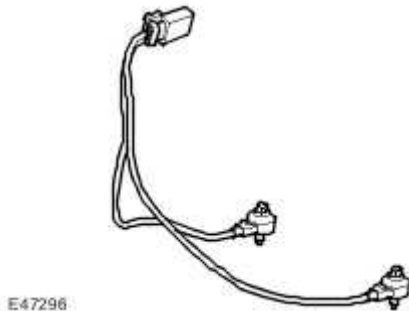


The MAPT is located to the front of the RH engine bank intercooler and is secured with a single bolt. The sensor measures the pressure and temperature of the inducted air prior to it entering the cylinders.

The sensor fits and seals using a radial 'O' ring seal directly to the inlet manifold.

The MAPT signal is used to retard the ignition timing relative to boost pressure. The intercooler temperature is used for air charge density calculations and for intercooler diagnostic purposes.

KNOCK SENSORS



The V8 EMS has two knock sensors located in the V of the engine, one per cylinder bank. The sensors are connected to the ECM via a twisted pair.

The knock sensors produce a voltage signal in proportion to the amount of mechanical vibration generated at each ignition point. Each sensor monitors the related cylinder bank.

The knock sensors incorporate a piezo-ceramic crystal. This crystal produces a voltage whenever an outside force tries to deflect it, (i.e. exerts a mechanical load on it). When the engine is running, the compression waves in the material of the cylinder block, caused by the combustion of the fuel/air mixture within the cylinders, deflect the crystal and produce an output voltage signal. The signals are supplied to the ECM, which compares them with 'mapped' signals stored in memory. From this, the ECM can determine when detonation occurs on individual cylinders. When detonation is detected, the ECM retards the ignition timing on that cylinder for a number of engine cycles, then gradually returns it to the original setting.

Care must be taken at all times to avoid damaging the knock sensors, but particularly during removal and fitting procedures. The recommendations regarding torque and surface preparation must be adhered to. The torque applied to the sensor and the quality of the surface preparation both have an influence over the transfer of mechanical noise from the cylinder block to the crystal.

The ECM uses the signals supplied by the knock sensors, in conjunction with the signal it receives from the camshaft sensor, to determine the optimum ignition point for each cylinder. The ignition point is set according to preprogrammed ignition maps stored within the ECM. The ECM is programmed to use ignition maps for 98 RON premium specification fuel. It will also function on 91 RON regular specification fuel and learn new adaptations. If the only fuel available is of poor quality, or the customer switches to a lower grade of fuel after using a high grade for a period of time, the engine may suffer slight pre-ignition for a short period. This amount of pre-ignition will not damage the engine. This situation will be evident while the ECM learns and then modifies its internal mapping to compensate for the variation in fuel quality. This feature is called adaptation. The ECM has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The ECM will cancel closed loop control of the ignition system if the signal received from either knock sensor becomes implausible. In these circumstances the ECM will default to a safe ignition map. This measure ensures the engine will not become damaged if low quality fuel is used. The MIL will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

When a knock sensor fault is stored, the ECM will also store details of the engine speed, engine load and the coolant temperature.

ELECTRONIC THROTTLE



The V8 EMS incorporates an electric throttle control system. The electronic throttle body is located on the air intake manifold in the engine compartment. The system comprises three main components:

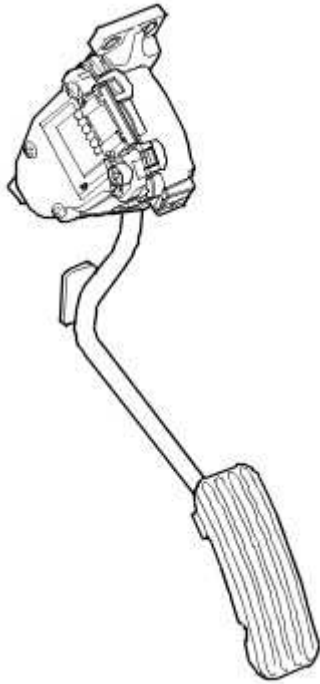
- Electronic throttle control valve
- APP
- ECM

When the accelerator pedal is depressed the APP sensor provides a change in the monitored signals. The ECM compares this against an electronic “map” and moves the electronic throttle valve via a PWM control signal which is in proportion to the EAPP angle signal. The system is required to:

- Regulate the calculated intake air load based on the accelerator pedal sensor input signals and programmed mapping.
- Monitor the drivers input request for cruise control operation.
- Automatically position the electronic throttle for accurate cruise control.
- Perform all dynamic stability control throttle control interventions.
- Monitor and carry out maximum engine and road speed cut out.
- Provide differing responses for differing Terrain response modes.

A software strategy within the ECM enables the throttle position to be calibrated each ignition cycle. When the ignition is turned ON, the ECM performs a self test and calibration routine on the electronic throttle by closing the throttle full, then opening again. This tests the default position springs.

Accelerator Pedal Position Sensor (APP)



E75881

The APP sensors are located on the accelerator pedal assembly.

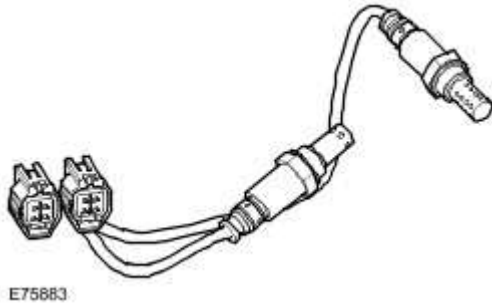
The APP sensors are used to determine the driver's request for vehicle speed, acceleration and deceleration. This value is used by the ECM and the throttle is opened to the correct angle by an electric motor integrated into the throttle body.

The APP sensor signals are checked for range and plausibility. Two separate reference voltages are supplied to the pedal. Should one sensor fail, the other is used as a 'limp – home' input. In limp home mode due to an APP signal failure the ECM will limit the maximum engine speed to 2000 rpm.

OXYGEN SENSORS

There are four oxygen sensors located in the exhaust system. Two upstream before the catalytic converter and two down stream after the catalytic converter. The sensor monitors the level of oxygen in the exhaust gases and is used to control the fuel/air mixture. Positioning a sensor in the stream of exhaust gasses from each bank enables the ECM to control the fueling on each bank independently of the other, allowing much closer control of the air / fuel ratio and catalyst conversion efficiency.

Oxygen Sensors



The oxygen sensors need to operate at high temperatures in order to function correctly. To achieve the high temperatures required, the sensors are fitted with heater elements that are controlled by a PWM signal from the ECM. The heater elements are operated immediately following engine start and also during low load conditions when the temperature of the exhaust gases is insufficient to maintain the required sensor temperatures. A non-functioning heater delays the sensor's readiness for closed loop control and influences emissions. The PWM duty cycle is carefully controlled to prevent thermal shock to cold sensors.

Heated oxygen sensors also known as Linear or "Wide Band" sensors produces a constant voltage, with a variable current that is proportional to the oxygen content. This allows closed loop fueling control to a target lambda, i.e. during engine warm up (after the sensor has reached operating temperature and is ready for operation). This improves emission control.

The heated oxygen sensor uses Zirconium technology that produces an output voltage dependant upon the ratio of exhaust gas oxygen to the ambient oxygen. The device contains a Galvanic cell surrounded by a gas permeable ceramic, the voltage of which depends upon the level of O₂ defusing through. Nominal output voltage of the device for $\lambda = 1$ is 300 to 500m volts. As the fuel mixture becomes richer ($\lambda < 1$) the voltage tends towards 900m volts and as it becomes leaner ($\lambda > 1$) the voltage tends towards 0 volts. Maximum tip temperature is 1,000 Degrees Celsius for a maximum of 100 hours.

Sensors age with mileage, increasing their response time to switch from rich to lean and lean to rich. This increase in response time influences the ECM closed loop control and leads to progressively increased emissions. Measuring the period of rich to lean and lean to rich switching monitors the response rate of the upstream sensors.

Diagnosis of electrical faults is continually monitored in both the upstream and downstream sensors. This is achieved by checking the signal against maximum and minimum threshold, for open and short circuit conditions.

Oxygen sensors must be treated with the utmost care before and during the fitting process. The sensors have ceramic material within them that can easily crack if dropped / banged or over-torqued. The sensors must be torqued to the required figure with a calibrated torque wrench For additional information, refer to [Specifications](#) (303-14)

. Care should be taken not to contaminate the sensor tip when anti-seize compound is used on the thread. Heated sensor signal pins are tinned and universal are gold plated. Mixing up sensors could contaminate the connectors and affect system performance.

Failure Modes

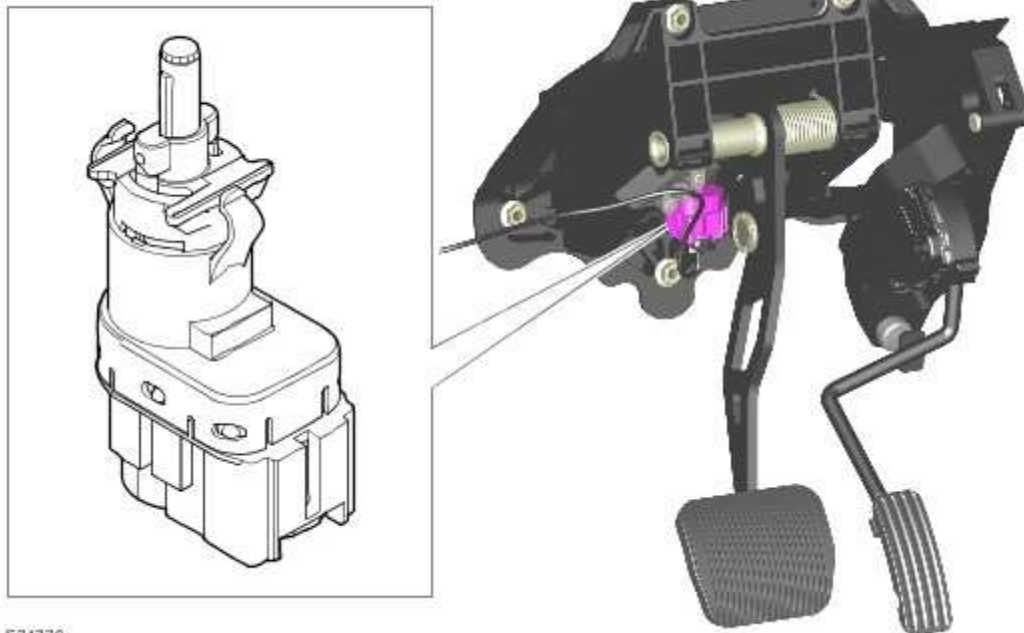
- Mechanical fitting & integrity of the sensor.
- Sensor open circuit / disconnected.
- Short circuit to vehicle supply or ground.
- Lambda ratio outside operating band.
- Crossed sensors bank A & B.
- Contamination from leaded fuel or other sources.
- Change in sensor characteristic.
- Harness damage.
- Air leak into exhaust system.

Failure Symptoms

- Default to Open Loop fueling for the particular cylinder bank
- High CO reading.
- Strong smell of H₂S (rotten eggs) till default condition.
- Excess Emissions.

It is possible to fit front and rear sensors in their opposite location. However the harness connections are of different gender and color to ensure that the sensors cannot be incorrectly connected. In addition to this the upstream sensors have fewer holes in the protection tube than the down stream sensors.

STOPLAMP SWITCH

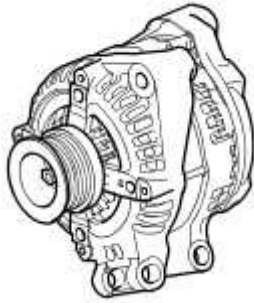


E71776

The stoplamp switch is mounted on the brake pedal bracket and is connected to the vehicle harness via a 4 pin multiplug.

When the brake pedal is pressed, the switch contacts close allowing a hard wired signal feed to be sent to the ECM. A stoplamp switch status message is then sent from the ECM to the ABS module on the high speed CAN bus.

GENERATOR



E47591

The Generator has a multifunction voltage regulator for use in a 14V charging system with 6÷12 zener diode bridge rectifiers.

The ECM monitors the load on the electrical system via PWM signal and adjusts the generator output to match the required load. The ECM also monitors the battery temperature to determine the generator regulator set point. This characteristic is necessary to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximize any rechargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing of the battery with consequent water loss.

The Generator has a smart charge capability that will reduce the electrical load on the Generator reducing torque requirements, this is implemented to utilize the engine torque for other purposes. This is achieved by monitoring three signals to the ECM:

- Generator sense (A sense), measures the battery voltage at the CJB.
- Generator communication (Alt Com) communicates desired Generator voltage set point from ECM to Generator.
- Generator monitor (Alt Mon) communicates the extent of Generator current draw to ECM. This signal also transmits faults to the ECM which will then sends a message to the instrument cluster on the CAN bus to illuminate the charge warning lamp.

FUEL INJECTORS



E47305

The engine has 8 fuel injectors (one per cylinder), each injector is directly driven by the ECM. The injectors are fed by a common fuel rail as part of a 'return less' fuel system. The fuel rail pressure is regulated to 4.5 bar by a fuel pressure regulator which is integral to the fuel pump module, within the fuel tank. The injectors can be checked by resistance checks. There is a

fuel pressure test Schrader valve attached to the fuel rail on the front LH. The ECM monitors the output power stages of the injector drivers for electrical faults.

The injectors have a resistance of $13.8 \text{ Ohms} \pm 0.7 \text{ Ohms}$ @ 20 Degrees Celsius

IGNITION COILS



E47306

The engine is fitted with eight plug-top coils that are driven directly by the ECM. This means that the ECM, at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The ECM sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the ECM to store a fault code appropriate to the failure.

The ECM calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load.
- Engine temperature.
- Knock control.
- Auto gearbox shift control.
- Idle speed control.

FUEL PUMP CONTROL MODULE



The fuel pump control module is located in the rear LH quarter adjacent to the parking aid control module.

The fuel pump is control by the ECM. The ECM sends a PWM signal to the fuel pump control module from pin B20 of the ECM, the frequency of the signal determines the duty cycle of the pump. the PWM signal to the pump represents half the ON time of the pump. If the ECM transmits a 50% on time the fuel pump control module drives the pump at 100%. If the ECM transmits a 5% ON time the fuel pump control module drives the pump at 10%. The fuel pump control module will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When The ECM requires the fuel pump to be turned OFF the ECM transmits a duty cycle signal of 75%.

The status of the fuel pump control module is monitored by the ECM. Any errors can be retrieved from the ECM by the Jaguar recommended diagnostic tool. The fuel pump control module cannot be interrogated for diagnostic purposes.

The MAP controls the fuel pump control module in response to inputs from the fuel rail pressure sensor, MAP and the MAF/IAT sensor.

FUEL PUMP RELAY

The ECM controls the fuel pump relay which in turn controls the power supply to the fuel pump control module. The ECM energizes the relay ON with ignition ON.

COOLING FAN CONTROL

The ECM controls an electric cooling fan via a control module to provide engine cooling. The ECM supplies the fan with a PWM signal that controls the duty cycle of the fan, providing the correct amount of cooling fan speed and airflow.

VARIABLE VALVE TIMING (VVT)

Variable valve timing is used on the V8 engine to enhance low and high speed engine performance and idle speed quality.

For each inlet camshaft the VVT system comprises:

- VVT unit
- Valve timing solenoid

The VVT system alters the phase of the intake valves relative to the fixed timing of the exhaust valves, to alter:

- The mass of air flow to the cylinders.
- The engine torque response.
- Emissions.

The VVT unit uses a vane type device to control the camshaft angle. The system operates over a range of 48 degrees and is advanced or retarded to its optimum position within this range.

The VVT system is controlled by the ECM based on engine load and speed along with engine oil temperature to calculate the appropriate camshaft position.

The VVT system provides the following advantages:

- Reduced engine emissions and improved fuel consumption which in turn improves the engines internal EGR effect over a wider operating range.
- Enhanced full load torque characteristics.
- Improved fuel economy through optimized torque over the engine speed range.

Variable Valve Timing Unit



E47303

The VVT unit is a hydraulic actuator mounted on the end of the inlet camshaft. The unit advances or retards the camshaft timing to alter the camshaft to crankshaft phase. The ECM controls the VVT timing unit via a oil control solenoid. The oil control solenoid routes oil pressure to the advance or retard chambers either side of the vanes within the VVT unit.

The VVT unit is driven by the primary drive chain and rotates relative to the exhaust camshaft. When the ECM requests a retard in camshaft timing the oil control solenoid is energized which moves the shuttle valve in the solenoid to the relevant position allowing oil pressure to flow out of the advance chambers in the VVT unit whilst simultaneously allowing oil pressure into the retard chambers.

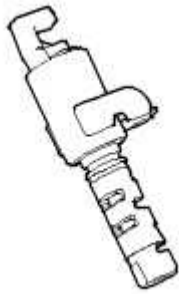
The ECM controls the advancing and retarding of the VVT unit based on engine load and speed. The ECM sends an energize signal to the oil control solenoid until the desired VVT position is achieved. When the desired VVT position is reached, the energizing signal is reduced to hold the oil control solenoid position and consequently desired VVT position. This function is under closed loop control and the ECM can sense any variance in shuttle valve oil pressure via the camshaft position sensor and can adjust the energizing signal to maintain the

shuttle valve hold position.

VVT operation can be affected by engine oil temperature and properties. At very low oil temperatures the movement of the VVT mechanism will be slow due to the high viscosity of the oil. While at high oil temperatures the low oil viscosity may impair the VVT operation at low oil pressures. The oil pump has the capacity to cope with these variations in oil pressure while an oil temperature sensor is monitored by the ECM to provide oil temperature feedback. At extremely high oil temperatures the ECM may limit the amount of VVT advance in order to prevent the engine from stalling when returning to idle speed.

VVT does not operate when engine oil pressure is below 1.25 bar. This is because there is insufficient pressure to release the VVT units internal stopper pin. This occurs when the engine is shut down and the VVT unit has returned to the retarded position. The stopper pin locks the VVT unit to the camshaft to ensure camshaft stability during the next start up.

Valve Timing Solenoid



E47302

Valve Timing Solenoid

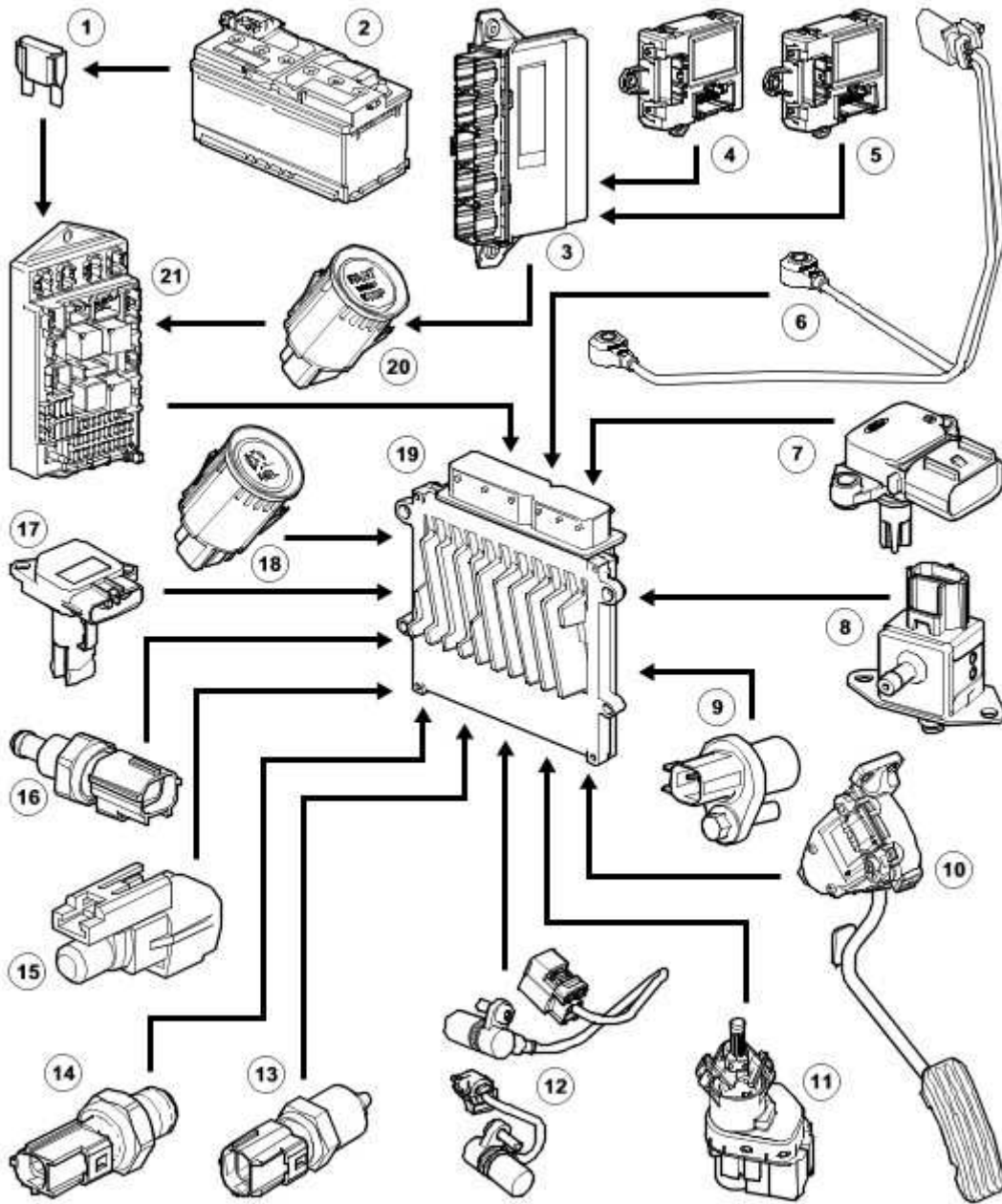
The valve timing solenoid controls the position of the shuttle valve in the bush carrier. A plunger on the solenoid extends when the solenoid is energized and retracts when the solenoid is de-energized.

When the valve timing solenoids are de-energized, the coil springs in the bush carriers position the shuttle valves to connect the valve timing units to drain. In the valve timing units, the return springs hold the ring pistons and gears in the retarded position. When the valve timing solenoids are energized by the ECM, the solenoid plungers position the shuttle valves to direct engine oil to the valve timing units. In the valve timing units, the oil pressure overcomes the force of the return springs and moves the gears and ring pistons to the advanced position. System response times are 1.0 second maximum for advancing and 0.7 second maximum for retarding. While the valve timing is in the retarded mode, the ECM produces a periodic lubrication pulse. This momentarily energizes the valve timing solenoids to allow a spurt of oil into the valve timing units. The lubrication pulse occurs once every 5 minutes.

CONTROL DIAGRAM SHEET 1 of 3

NOTE:

A = Hardwired connection



E62360

A →

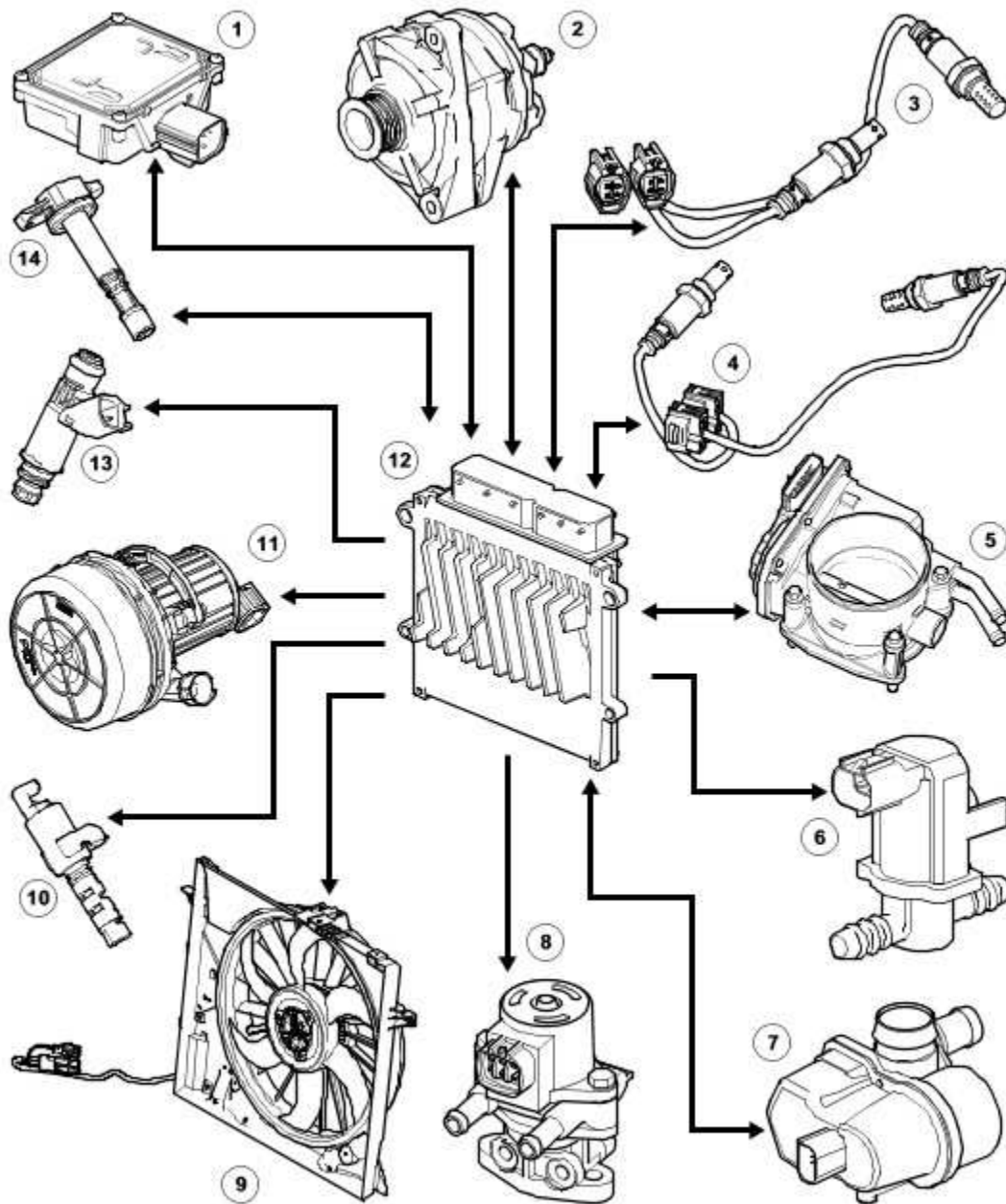
Item	Part Number	Description
1		Fuse
2		Battery
3		Keyless vehicle module
4		Door module
5		Door module
6		knock sensors
7		MAP sensor
8		Fuel rail pressure sensor

9		CKP sensor
10		APP
11		Stop lamp switch
12		CMP sensor
13		Engine coolant temperature sensor
14		Oil pressure sensor
15		Air temperature sensor
16		Fuel rail temperature sensor
17		MAF/IAT sensor
18		Automatic Speed Limiter switch
19		ECM
20		Start/Stop switch
21		Central Junction Box (CJB)

CONTROL DIAGRAM SHEET 2 of 3

NOTE:

A = Hardwired connection



EB4462



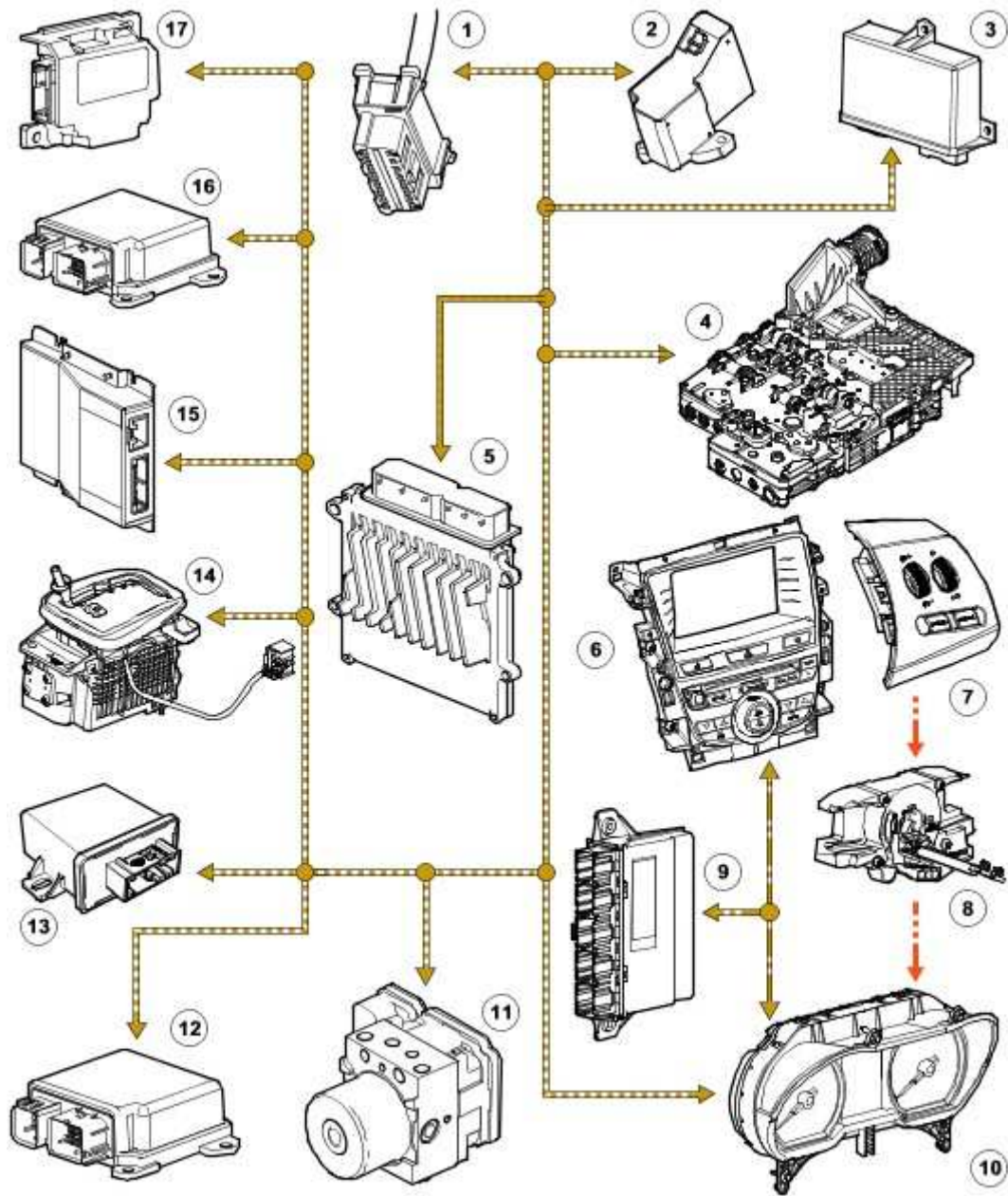
Item	Part Number	Description
1		FPDM
2		Generator
3		HO2S (upstream)
4		HO2S (downstream)
5		Electric throttle
6		Purge valve
7		fuel tank leakage monitoring pump
8		EGR valve

9		Engine cooling fan
10		VCT solenoid
11		Secondary air injection pump
12		ECM
13		Injector (8 off)
14		Ignition coil (8 off)

CONTROL DIAGRAM SHEET 3 of 3

NOTE:

D = High speed CAN bus; N=Medium speed CAN bus; O = LIN (local interconnect network) bus



E65886



Item	Part Number	Description
1		Diagnostic socket
2		Steering column lock
3		Park brake module
4		TCM
5		ECM
6		Integrated control panel
7		Steering wheel speed control switches
8		Rotary coupler

9		Keyless vehicle module
10		Instrument cluster
11		ABS control module
12		RCM
13		Adaptive front lighting system control module
14		Gear shift module
15		Adaptive Damping Control Module (ADCM)
16		Pedestrian protection module
17		Adaptive speed control module

ECM ADAPTIONS

The ECM has The ability to adapt The values it uses to control certain outputs. This capability ensures the EMS can meet emissions legislation and improve The refinement of The engine throughout its operating range.

The components which have adaptions associated with them are:

- The APP sensor
- The HO2S
- The MAF/IAT sensor
- The CKP sensor
- Electric throttle body.

Oxygen and MAF/AT Sensor

There are several adaptive maps associated with the fueling strategy. Within the fueling strategy the ECM calculates short-term adaptions and long term adaptions. The ECM will monitor the deterioration of the oxygen sensors over a period of time. It will also monitor the current correction associated with the sensors.

The ECM will store a fault code in circumstances where an adaption is forced to exceed its operating parameters. At the same time, the ECM will record the engine speed, engine load and intake air temperature.

Crankshaft Position Sensor

The characteristics of the signal supplied by the CKP are learned by the ECM. This enables the ECM to set an adaption and support the engine misfire detection function. Due to the small variation between different flywheels and different CKP sensors, the adaption must be reset if either component is renewed, or removed and refitted. It is also necessary to reset the flywheel adaption if the ECM is renewed or replaced. The ECM supports four flywheel

adaptions for the CKP sensor. Each adaption relates to a specific engine speed range. The engine speed ranges are detailed in the table below:

Adaptions	Engine Speed, rev/min
1	1800 - 3000
2	3001 - 3800
3	3801 - 4600
4	4601 - 5400

Misfire Detection

Legislation requires that the ECM must be able to detect the presence of an engine misfire. It must be able to detect misfires at two separate levels. The first level is a misfire that could lead to the vehicle emissions exceeding 1.5 times the Federal Test Procedure (FTP) requirements for the engine. The second level is a misfire that may cause catalyst damage.

The ECM monitors the number of misfire occurrences within two engine speed ranges. If the ECM detects more than a predetermined number of misfire occurrences within either of these two ranges, over two consecutive journeys, the ECM will record a fault code and details of the engine speed, engine load and engine coolant temperature. In addition, the ECM monitors the number of misfire occurrences that happen in a 'window' of 200 engine revolutions. The misfire occurrences are assigned a weighting according to their likely impact on the catalysts. If the number of misfires exceeds a certain value, the ECM stores catalyst-damaging fault codes, along with the engine speed, engine load and engine coolant temperature.

The signal from the crankshaft position sensor indicates how fast the poles on the flywheel are passing the sensor tip. A sine wave is generated each time a pole passes the sensor tip. The ECM can detect variations in flywheel speed by monitoring the sine wave signal supplied by the crankshaft position sensor.

By assessing this signal, the ECM can detect the presence of an engine misfire. At this time, the ECM will assess the amount of variation in the signal received from the CKP and assigns a roughness value to it. This roughness value can be viewed within the real time monitoring feature, using T4. The ECM will evaluate the signal against a number of factors and will decide whether to count the occurrence or ignore it. The ECM can assign a roughness and misfire signal for each cylinder, (i.e. identify which cylinder is misfiring).

T4 Diagnostics

The ECM stores faults as DTC, referred to as 'P' codes. The 'P' codes are defined by OBD legislation and, together with their associated environmental and freeze frame data, can be read using a third party scan tool or T4. T4 can also read real time data from each sensor, the adaptive values currently being employed and the current fueling, ignition and idle settings.

Electronic Engine Controls

Principle of Operation

For a detailed description of electronic engine controls, refer to the relevant Description and Operation section of the workshop manual.

[Electronic Engine Controls](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Throttle body • Poly-vee belt 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine Control Module (ECM) • Transmission Control Module (TCM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4 . If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine non-start		
Engine does not crank	<ul style="list-style-type: none"> • Security system /Immobilizer engaged • Engine in shut-down mode • ECM relay • Battery • Park/Neutral switch • Starting system 	<ul style="list-style-type: none"> • Check that the security system is disarmed • Read DTCs and refer to DTC Index in this section for ECM relay tests • Ensure the battery is in fully charged and

	<ul style="list-style-type: none"> • Engine seized 	<ul style="list-style-type: none"> • serviceable condition • For Park/Neutral switch tests. External Controls • For starting system tests. Starting System • For engine system tests. Engine
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine controls 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests. Engine Ignition • For fuel system tests. Fuel Charging and Controls • Read DTCs and refer to DTC Index in this section for electronic engine control tests
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • Ignition coil failure(s) 	<ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition
Difficult to start		
Difficult cold start	<ul style="list-style-type: none"> • Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Exhaust gas recirculation (EGR) valve stuck open • Fuel pump • Evaporative emissions purge valve 	<ul style="list-style-type: none"> • Check the engine coolant level and condition. Specifications • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For EGR valve tests. Engine Emission Control

		<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • For purge valve tests. Evaporative Emissions
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system • EGR valve stuck open 	<ul style="list-style-type: none"> • Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system • EGR valve stuck open 	<ul style="list-style-type: none"> • Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For purge valve tests. Evaporative Emissions • For fuel system tests. Fuel Tank and Lines • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control
Engine cranks too fast/slow	<ul style="list-style-type: none"> • Compressions high/low • Battery • Starting system 	<ul style="list-style-type: none"> • Carry out compression tests. Engine • Ensure battery is in a

		<p>fully charged and serviceable condition</p> <ul style="list-style-type: none"> • For starting system tests. <p>Starting System</p>
Engine stalls		
Engine stalls soon after start	<ul style="list-style-type: none"> • Breather system disconnected/restricted • ECM relay • Electronic engine controls • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index in this section for ECM relay tests • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. <p>Engine Ignition</p> <ul style="list-style-type: none"> • Check for blockage in air cleaner element and air intake system • Check for leakage in air intake system • For fuel system tests. <p>Fuel Tank and Lines</p>
Engine stalls on overrun	<ul style="list-style-type: none"> • ECM relay • Throttle position (TP) sensors 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay tests • Read DTCs and refer to DTC Index in this section for TP sensor tests
Engine stalls at steady speed	<ul style="list-style-type: none"> • ECM relay • CKP sensor • TP sensors 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay, CKP, and TP sensor tests
Engine stalls with speed control enabled	<ul style="list-style-type: none"> • ECM relay 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay

		tests
Engine stalls when manoeuvring	<ul style="list-style-type: none"> • ECM relay • TP sensors • Additional engine loads (PAS, air conditioning, etc) • Transmission malfunction • CAN malfunction 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay, and TP sensor tests • Check for excessive loads being placed on the engine from PAS, air conditioning systems etc. • For transmission system tests. Diagnostic Strategy • For CAN network tests. Communications Network
Poor driveability		
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine controls • Ignition system • EGR valve stuck • Transmission malfunction • Restricted pedal travel (carpet, etc) 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Carry out fuel injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • Check for leakage from air intake system • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control • For transmission system tests. Diagnostic Strategy • Ensure accelerator pedal is free from restriction
Engine backfires	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Air leakage • Electronic engine 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for leakage from

	<p>controls</p> <ul style="list-style-type: none"> • Ignition system • Sticking variable camshaft timing (VCT) hub 	<p>air intake system</p> <ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition • Read DTCs and refer to DTC Index in this section for VCT system tests
Engine surges	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Electronic engine controls • Ignition system 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump, fuel lines, fuel quality • Air leakage • Sticking VCT hub 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For fuel system tests. Fuel Tank and Lines • Check for leakage from air intake system • Read DTCs and refer to DTC Index in this section for VCT system tests
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests
Speed control inhibited or disabled	<ul style="list-style-type: none"> • Default mode enabled • Speed control, brake switch • Electronic engine controls • CAN fault 	<ul style="list-style-type: none"> • Check message center for default message, read DTCs and refer to DTC Index • For speed control, and brake switch tests. Speed Control

		<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For CAN network tests. Communications Network
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine controls • Transmission malfunction • Traction control event • Air leakage 	<ul style="list-style-type: none"> • Ensure engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For transmission system tests. Diagnostic Strategy • Check for leakage in air intake system
Engine defaults, warning light and messages. Refer to the owner handbook	<ul style="list-style-type: none"> • Park/Neutral switch • Electronic engine controls 	<ul style="list-style-type: none"> • For Park/Neutral switch tests. External Controls • Read DTCs and refer to DTC Index in this section for electronic engine control tests

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the module/component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to

identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
C003100	Left front wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - left front wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
C003400	Right front wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - right front wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
C003700	Left rear wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - left rear wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control -

			Stability Assist
C003A00	Right rear wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - right rear wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
P001100	Intake camshaft position - timing over-advanced (bank 1)	<ul style="list-style-type: none"> Variable Camshaft Timing (VCT) circuit fault Valve timing incorrectly set Timing chain has slipped 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the valve timing. Timing Drive Components (12.65.13)
P001200	Intake camshaft position - timing over-retarded (bank 1)	<ul style="list-style-type: none"> Variable Camshaft Timing (VCT) circuit fault Valve timing incorrectly set Timing chain has slipped 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the valve timing. Timing Drive Components (12.65.13)
P001600	Crankshaft position (CKP)/Camshaft position (CMP) sensor correlation, right hand bank	<ul style="list-style-type: none"> The relative positions of the CKP and CMP teeth are not correct Sensors incorrectly aligned on rebuild 	<ul style="list-style-type: none"> Reset the sensor positions. Camshaft Position (CMP) Sensor LH

			<p>(18.31.12) Camshaft Position (CMP) Sensor RH (18.31.11) Crankshaft Position (CKP) Sensor (18.30.12)</p>
P001800	Crankshaft position (CKP)/Camshaft position (CMP) sensor correlation, left hand bank	<ul style="list-style-type: none"> The relative positions of the CKP and CMP teeth are not correct Sensors incorrectly aligned on rebuild 	<ul style="list-style-type: none"> Reset the sensor positions. Camshaft Position (CMP) Sensor LH (18.31.12) Camshaft Position (CMP) Sensor RH (18.31.11) Crankshaft Position (CKP) Sensor (18.30.12) Timing Drive Components (12.65.13)
P002100	Intake camshaft position - timing over-advanced (bank 2)	<ul style="list-style-type: none"> Variable Camshaft Timing (VCT) circuit fault Valve timing incorrectly set Timing chain has slipped 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the valve timing. Timing Drive Components (12.65.13)
P002200	Intake camshaft position - timing over-retarded (bank 2)	<ul style="list-style-type: none"> Variable Camshaft Timing (VCT) circuit fault Valve timing incorrectly set 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the

		<ul style="list-style-type: none"> • Timing chain has slipped 	<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check the valve timing. <p>Timing Drive Components (12.65.13)</p>
P002672	Variable Camshaft Timing (VCT) control solenoid (bank 1) circuit range/performance - actuator stuck open	<ul style="list-style-type: none"> • VCT solenoid fault • Oil contamination • VCT oil flow fault • VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the oil condition and flow • Check for mechanical failure of components
P002677	Variable Camshaft Timing (VCT) control solenoid (bank 1) circuit range/performance - commanded position not achievable	<ul style="list-style-type: none"> • VCT solenoid fault • Oil contamination • VCT oil flow fault • VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the oil condition and flow • Check for mechanical failure of components
P002872	Variable Camshaft Timing (VCT) control solenoid (bank 2) circuit range/performance - actuator stuck open	<ul style="list-style-type: none"> • VCT solenoid fault • Oil contamination • VCT oil flow fault • VCT/Camshaft 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the

		mechanical failure	<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check the oil condition and flow • Check for mechanical failure of components
P002877	Variable Camshaft Timing (VCT) control solenoid (bank 2) circuit range/performance - commanded position not achievable	<ul style="list-style-type: none"> • VCT solenoid fault • Oil contamination • VCT oil flow fault • VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the oil condition and flow • Check for mechanical failure of components
P003100	HO2S heater control circuit low (bank 1)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P003200	HO2S heater control circuit high (bank 1)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the

			<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P003600	Catalyst monitor sensor heater control circuit (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater circuit - circuit fault • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P005100	HO2S heater control circuit low (bank 2)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P005200	HO2S heater control circuit high (bank 2)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved

			<p>diagnostic system</p> <ul style="list-style-type: none"> • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P005600	Catalyst monitor sensor heater control circuit (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater circuit - circuit fault • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P006900	Manifold absolute pressure (MAP)/Barometric pressure correlation	<ul style="list-style-type: none"> • MAP sensor failure • BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> • Check for MAP sensor related DTCs and refer to the DTC Index in this section • Install a new ECM. Refer to new module/component installation Note at top of DTC Index
P007100	Ambient air temperature sensor range/performance	<ul style="list-style-type: none"> • Ambient temperature value missing from CAN bus 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

P007200	Ambient air temperature sensor circuit low	<ul style="list-style-type: none"> • Ambient air temperature sensor circuit - high resistance • Ambient air temperature sensor circuit - short to ground 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007300	Ambient air temperature sensor circuit high	<ul style="list-style-type: none"> • Ambient air temperature sensor circuit - short to power 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007500	Variable Camshaft Timing (VCT) control circuit (bank 1)	<ul style="list-style-type: none"> • VCT control solenoid circuit - high resistance, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P007600	Variable Camshaft Timing (VCT) control circuit low (bank 1)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to ground, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P007700	Variable Camshaft Timing (VCT) control circuit high (bank 1)	<ul style="list-style-type: none"> VCT control solenoid circuit - short to power VCT solenoid failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008100	Variable Camshaft Timing (VCT) control circuit (bank 2)	<ul style="list-style-type: none"> VCT control solenoid circuit - high resistance, disconnected VCT solenoid failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid

			(18.30.90)
P008200	Variable Camshaft Timing (VCT) control circuit low (bank 2)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to ground, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008300	Variable Camshaft Timing (VCT) control circuit high (bank 2)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to power • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008700	Fuel rail/system pressure - too low	<ul style="list-style-type: none"> • Fuel rail pressure (FRP) sensor, sensing circuit - short to ground, open circuit • FRP sensor supply circuit - high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved

		<ul style="list-style-type: none"> • FRP sensor failure • Fuel pump failure • Fuel line leak, restriction 	<p>diagnostic system</p> <ul style="list-style-type: none"> • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P008800	Fuel rail/system pressure - too high	<ul style="list-style-type: none"> • FRP sensor supply/sensing circuits - short to each other • FRP sensor sensing circuit - short to power • FRP sensor ground circuit - high resistance • FRP sensor failure • Restricted fuel line • Fuel pump short circuit to power 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P009623	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> • Intercooler air temperature sensor circuit - short to ground 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Intercooler air temperature

			sensor circuit for short to ground
P009624	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> Intercooler air temperature sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Intercooler air temperature sensor circuit for short to power
P009629	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> Intercooler air temperature sensor circuit - high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Intercooler air temperature sensor circuit for high resistance
P009700	Intake Air Temperature Sensor 2 Circuit Low Input	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> Intercooler air 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer

		temperature sensor circuit - short to ground, high resistance	to electrical circuit diagrams and check primary MAP sensor intercooler air temperature sensor circuit for short to ground, high resistance
P009800	Intake Air Temperature Sensor 2 Circuit High Input	<p>NOTE:</p> <p>Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> Intercooler air temperature sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to the electrical circuit diagrams and check primary MAP sensor intercooler air temperature sensor circuit for short to power
P010100	Mass Air Flow (MAF) circuit - range/performance	<ul style="list-style-type: none"> Blocked air cleaner element Leakage from air intake system Engine breather leak MAF sensor sensing circuit - high resistance, intermittent short to ground MAF sensor supply circuit - high resistance MAF sensor failure 	<ul style="list-style-type: none"> Check air cleaner element is free from restriction Check for leak from air intake system, rectify as necessary Ensure the engine breather system is correctly installed and in serviceable condition Carry out the pinpoint tests

			<p>associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010200	Mass Air Flow (MAF) circuit - low input	<ul style="list-style-type: none"> • MAF sensor supply circuit - short to ground, high resistance • MAF sensor ground circuit - high resistance • MAF sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010300	Mass Air Flow (MAF) circuit - high input	<ul style="list-style-type: none"> • MAF sensor sensing circuit - short to power • MAF sensor ground circuit - high resistance • MAF sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010600	Manifold Absolute Pressure (MAP) sensor - range/performance	<ul style="list-style-type: none"> • Intake manifold air leak (loose or missing component) 	<ul style="list-style-type: none"> • Check for correct installation and

		<ul style="list-style-type: none"> • MAP sensor signal circuit fault • MAP sensor failure 	<p>serviceability of intake manifold and associated components</p> <ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAP sensor as necessary. Manifold Absolute Pressure (MAP) Sensor (18.30.86)
P010700	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<ul style="list-style-type: none"> • MAP sensor signal circuit - short to ground 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010800	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<ul style="list-style-type: none"> • MAP sensor signal circuit - short to power 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P010B00	Mass or Volume Air Flow B Circuit Range/Performance	<ul style="list-style-type: none"> • Blocked air cleaner element • Leakage from air intake system • Engine breather leak • MAF sensor 2 sensing circuit - high 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leak from air intake system, rectify

		<p>resistance, intermittent short to ground</p> <ul style="list-style-type: none"> • MAF sensor 2 supply circuit - high resistance • MAF sensor 2 failure 	<p>as necessary</p> <ul style="list-style-type: none"> • Ensure the engine breather system is correctly installed and in serviceable condition • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010C00	Mass or Volume Air Flow Circuit 2 Low Input	<ul style="list-style-type: none"> • MAF sensor 2 supply circuit - short to ground, high resistance • MAF sensor 2 ground circuit - high resistance • MAF sensor 2 failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010D00	Mass or Volume Air Flow Circuit 2 High Input	<ul style="list-style-type: none"> • MAF sensor 2 sensing circuit - short to power • MAF sensor 2 ground circuit - high resistance • MAF sensor 2 failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011123	Intake Air Temperature (IAT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011124	Intake Air Temperature (IAT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011129	Intake Air Temperature (IAT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new

			<p>MAF sensor as necessary.</p> <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P011200	Intake Air Temperature (IAT) sensor circuit - low input	<ul style="list-style-type: none"> • IAT sensor sensing circuit - high resistance, disconnected • IAT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P011300	Intake Air Temperature (IAT) sensor circuit - high input	<ul style="list-style-type: none"> • IAT sensor sensing circuit - short to ground, short to power • IAT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. <p>Mass Air Flow (MAF) Sensor (18.30.15)</p>
P011623	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. <p>Specifications</p> <ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the

			<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check and install new engine thermostat as necessary. Thermostat - Vehicles With: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011624	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles With: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant

			Temperature (ECT) Sensor (18.30.10)
P011629	<p>Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal invalid</p>	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles With: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011700	<p>Engine Coolant Temperature (ECT) sensor circuit - low input</p>	<ul style="list-style-type: none"> • ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected • ECT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new ECT sensor as necessary. Engine Coolant

			Temperature (ECT) Sensor (18.30.10)
P011800	Engine Coolant Temperature (ECT) sensor circuit - high input	<ul style="list-style-type: none"> • Engine overheat condition/cooling fan failure • ECT sensor sensing circuit - short to ground • ECT sensor failure 	<ul style="list-style-type: none"> • Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P012100	Throttle Position (TP) sensor circuits TP 1 and TP 2 - range/performance	<ul style="list-style-type: none"> • TP sensor sensing circuits TP 1 and TP 2 - short to battery, high resistance • TP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body as necessary. Throttle Body (19.70.04)
P012200	Throttle Position (TP) sensor circuit TP 1 - low input	<ul style="list-style-type: none"> • TP sensor sensing circuit TP 1 - short to ground, high resistance • TP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer

			<p>approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new throttle body as necessary. Throttle Body (19.70.04)
P012300	Throttle Position (TP) sensor circuit TP 1 - high input	<ul style="list-style-type: none"> • TP sensor sensing circuit TP1 - short to power • TP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body as necessary. Throttle Body (19.70.04)
P012500	Insufficient coolant temperature for closed loop fuel control	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles With: Supercharger (26.45.07) • Install a new

			ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P012800	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> • Low/contaminated coolant • Thermostat • Cooling fan circuit(s)/module 	<ul style="list-style-type: none"> • Drain and re-fill cooling system to correct level and specification. Specifications Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8 • Check and install a new engine thermostat as necessary. Thermostat - Vehicles With: Supercharger (26.45.07) • Check for correct operation of cooling fan, check for DTCs and refer to DTC Index
P01311A	Heated Oxygen Sensor (H02S) circuit - low voltage (bank 1)	<ul style="list-style-type: none"> • Exhaust gas leakage • H02S variable/constant circuit - circuit fault, disconnected • H02S failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • Carry out the pinpoint tests associated with

			<p>this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new HO2S as necessary. <p>Heated Oxygen Sensor (HO2S)</p>
P01321B	Heated Oxygen Sensor (HO2S) circuit - high voltage (bank 1)	<ul style="list-style-type: none"> • Exhaust gas leakage • HO2S variable/constant circuit - circuit fault, disconnected • HO2S failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. <p>Heated Oxygen Sensor (HO2S)</p>
P013300	Heated Oxygen Sensor (HO2S) circuit - slow response (bank 1)	<ul style="list-style-type: none"> • HO2S to ECM wiring shield high resistance • Exhaust leak • Fuel control system fault • HO2 sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check for and rectify any exhaust leak

			<p>between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.)</p> <ul style="list-style-type: none"> • For fuel charging and controls tests. Fuel Charging and Controls • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P013400	Heated Oxygen Sensor (HO2S) circuit - no activity detected (bank 1)	<ul style="list-style-type: none"> • HO2S slow activation 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P013700	Catalyst monitor sensor circuit - low voltage (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor sensing circuit - short to ground, high resistance, disconnected • Catalyst monitor sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P013800	Catalyst monitor sensor circuit - high voltage (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor sensing circuit - short to power • Catalyst monitor 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using

		<p>sensor ground braided shield - high resistance</p> <ul style="list-style-type: none"> • Catalyst monitor sensor failure 	<p>the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P013900	Catalyst monitor sensor circuit - slow response (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor slow response 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P014000	Catalyst monitor sensor circuit - no activity detected (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensing circuit - short to ground, short to power, high resistance, disconnected • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor - mechanical damage 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P014100	Catalyst monitor heater circuit (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater control circuit - high resistance • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P01511A	Heated Oxygen Sensor (HO2S) circuit - low voltage (bank 2)	<ul style="list-style-type: none"> HO2S sensing circuit - short to ground, short to power, high resistance HO2S failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P01521B	Heated Oxygen Sensor (HO2S) circuit - high voltage (bank 2)	<ul style="list-style-type: none"> HO2S sensing circuit - short to ground, short to power, high resistance HO2S failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P015300	Heated Oxygen Sensor (HO2S) circuit - slow response (bank 2)	<ul style="list-style-type: none"> HO2S to ECM wiring shield high resistance Exhaust leak Fuel control system fault HO2 sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check for and rectify any

			<p>exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.)</p> <ul style="list-style-type: none"> For fuel system and controls tests. Fuel Charging and Controls Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P015400	Heated Oxygen Sensor (HO2S) circuit - no activity detected (bank 2)	<ul style="list-style-type: none"> HO2S slow activation 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P015700	Catalyst monitor sensor circuit - low voltage (bank 2)	<ul style="list-style-type: none"> Catalyst monitor sensor sensing circuit - short to ground, high resistance, disconnected Catalyst monitor sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P015800	Catalyst monitor sensor circuit - high voltage (bank 2)	<ul style="list-style-type: none"> Catalyst monitor sensor sensing circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with

		<ul style="list-style-type: none"> • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor failure 	<p>this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P015900	Catalyst monitor sensor circuit - slow response (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensor slow response 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P016000	Catalyst monitor sensor circuit - no activity detected (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensing circuit - short to ground, short to power, high resistance, disconnected • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor - mechanical damage 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P016100	Catalyst monitor sensor heater circuit (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater control circuit malfunction 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests • Check and rectify any exhaust leak prior to catalytic converter
P017200	System too rich (bank 1)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) • Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling • Read DTCs and refer to DTC Index in this section for MAF sensor tests

P017400	System too lean (bank 2)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests • Check and rectify any exhaust leak prior to catalytic converter
P017500	System too rich (bank 2)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) • MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) • Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling • Read DTCs and refer to DTC Index in this section for MAF sensor tests
P018123	Engine Fuel Temperature (EFT) sensor circuit -	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to 	<ul style="list-style-type: none"> • Carry out the pinpoint tests

	range/performance - signal stuck low	<p>ground, short to power, high resistance</p> <ul style="list-style-type: none"> • EFT sensor ground circuit - high resistance • EFT sensor failure 	<p>associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new EFT sensor as necessary. <p>Fuel Temperature Sensor (18.30.99)</p>
P018124	Engine Fuel Temperature (EFT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground, short to power, high resistance • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. <p>Fuel Temperature Sensor (18.30.99)</p>
P018129	Engine Fuel Temperature (EFT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground, short to power, high resistance • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. <p>Fuel Temperature Sensor (18.30.99)</p>

P018200	Engine Fuel Temperature (EFT) sensor circuit - low input	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground • EFT sensor ground circuit - short circuit • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. Fuel Temperature Sensor (18.30.99)
P018300	Engine Fuel Temperature (EFT) sensor circuit - high input	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to power, high resistance, disconnected • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. Fuel Temperature Sensor (18.30.99)
P019100	Fuel Rail Pressure (FRP) sensor circuit - range/performance	<ul style="list-style-type: none"> • FRP sensor range and performance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P019200	Fuel Rail Pressure (FRP) sensor circuit - low input	<ul style="list-style-type: none"> • FRP sensor sensing circuit - short to ground, high resistance, disconnected 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the

		<ul style="list-style-type: none"> • FRP sensor 5V supply circuit - high resistance • FRP sensor failure 	<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new FRP sensor as necessary. <p>Fuel Rail Pressure (FRP) Sensor (18.30.98)</p>
P019300	Fuel Rail Pressure (FRP) sensor circuit - high input	<ul style="list-style-type: none"> • FRP sensor supply/sensing circuits - short circuit to each other • FRP sensor sensing circuit - short to power • FRP sensor ground circuit - high resistance • FRP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new FRP sensor as necessary. <p>Fuel Rail Pressure (FRP) Sensor (18.30.98)</p>
P019623	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • EOT sensor sensing circuit - intermittent high resistance • EOT sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019624	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal	<ul style="list-style-type: none"> • EOT sensor sensing circuit - intermittent high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with

	stuck high	<ul style="list-style-type: none"> EOT sensor failure 	<p>this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019629	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> EOT sensor sensing circuit - intermittent high resistance EOT sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019700	Engine Oil Temperature (EOT) sensor circuit - low input	<ul style="list-style-type: none"> EOT sensor sensing circuit - short to ground EOT sensor failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019800	Engine Oil Temperature	<ul style="list-style-type: none"> EOT sensor sensing 	<ul style="list-style-type: none"> Carry out the

	(EOT) sensor circuit - high input	<p>circuit - short to power, high resistance, disconnected</p> <ul style="list-style-type: none"> • EOT sensor failure 	<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P020100	Cylinder 1 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020200	Cylinder 2 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020300	Cylinder 3 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with

		<p>disconnected</p> <ul style="list-style-type: none"> • Injector failure 	<p>this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020400	Cylinder 4 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020500	Cylinder 5 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020600	Cylinder 6 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved

			<p>diagnostic system</p> <ul style="list-style-type: none"> • Install a new injector as necessary. Fuel Injector (18.10.01)
P020700	Cylinder 7 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020800	Cylinder 8 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P022200	Throttle Position (TP) sensor circuit TP 2 - low input	<ul style="list-style-type: none"> • TP sensor sensing circuit TP 2 - short to ground, high resistance • TP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body as

			necessary. Throttle Body (19.70.04)
P022300	Throttle Position (TP) sensor circuit TP 2 - high input	<ul style="list-style-type: none"> • TP sensor sensing circuit TP 2- short to power • TP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body as necessary. Throttle Body (19.70.04)
P022700	Accelerator Pedal Position (APP) sensor circuit APP 1 - low input	<ul style="list-style-type: none"> • APP sensor circuit APP 1 - short to ground, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P022800	Accelerator pedal position (APP) sensor circuit APP 1 high input	<ul style="list-style-type: none"> • APP sensor circuit APP 1 - short to power 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P023700	Turbocharger/Supercharger Boost Sensor A Circuit Low	<ul style="list-style-type: none"> • Post supercharger MAP sensor circuit - short to ground, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer

			to electrical circuit diagrams and check Post supercharger MAP sensor circuit for short to ground, high resistance
P023800	Turbocharger/Supercharger Boost Sensor A Circuit High	<ul style="list-style-type: none"> Post supercharger MAP sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Post supercharger MAP sensor circuit for short to power
P023B13	Charge Air Cooler Coolant Pump Control Circuit Low	<ul style="list-style-type: none"> Charge air cooler coolant pump relay control circuit - open circuit 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P023C12	Charge Air Cooler Coolant Pump Control Circuit High	<ul style="list-style-type: none"> Charge air cooler coolant pump relay control circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P030000	Random/multiple cylinder misfire detected	<ul style="list-style-type: none"> ECM to ignition coil primary circuit faults 	<ul style="list-style-type: none"> If specific cylinder misfire

		<p>(cylinder misfire detected DTCs also logged)</p> <ul style="list-style-type: none"> • Fuel injector circuit fault(s) (injector DTCs also logged) • Ignition coil failure • Spark plug failure/fouled/incorrect gap • Fuel delivery pressure (low/high) • Fuel contamination • Fuel injectors restricted, leaking, continuously open • Cylinder compression low • Worn camshaft/broken valve springs • Valve clearance adjustment 	<p>or injector DTCs are also logged refer to the tests associated to those DTCs first</p> <ul style="list-style-type: none"> • For ignition coil test. Engine Ignition • Check and install new sparkplugs as necessary. Spark Plugs - 4.2L SC V8 - AJV8 (18.20.02) • For fuel system tests. Fuel Tank and Lines • For injector tests. Fuel Charging and Controls • Check cylinder compressions. Engine • Check for worn/broken engine components and valve clearance adjustment. Engine Valve Clearance Adjustment (12.29.48)
P030100	Cylinder 1 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> • Refer to P030000 actions
P030200	Cylinder 2 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> • Refer to P030000

			actions
P030300	Cylinder 3 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P030400	Cylinder 4 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P030500	Cylinder 5 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P030600	Cylinder 6 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P030700	Cylinder 7 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P030800	Cylinder 8 misfire detected	Refer to P030000 possible causes	<ul style="list-style-type: none"> Refer to P030000 actions
P031300	Misfire detected with low fuel	<ul style="list-style-type: none"> Misfire detected during low fuel level condition 	<ul style="list-style-type: none"> Check for fuel level sensor DTCs and refer to DTC Index Add fuel, clear the DTC and test for normal operation
P031600	Engine misfire detected on startup	<ul style="list-style-type: none"> Misfire detected on first 1000 revs 	<ul style="list-style-type: none"> Check for specific cylinder misfire DTCs and refer to the DTC Index
P032700	Knock sensor (KS) 1 circuit - low input (bank 1)	<ul style="list-style-type: none"> Poor sensor contact with the cylinder block KS circuit - short to ground 	<ul style="list-style-type: none"> Ensure a good electrical contact with the cylinder block Carry out the

		<ul style="list-style-type: none"> • KS failure 	<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P032800	Knock sensor (KS) 1 circuit - high input (bank 1)	<ul style="list-style-type: none"> • Poor sensor contact with the cylinder block • KS circuit - high resistance, short to power • KS failure 	<ul style="list-style-type: none"> • Ensure a good electrical contact with the cylinder block • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P033200	Knock sensor (KS) 2 circuit - low input (bank 2)	<ul style="list-style-type: none"> • Poor sensor contact with the cylinder block • KS circuit - short to ground • KS failure 	<ul style="list-style-type: none"> • Ensure a good electrical contact with the cylinder block • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new

			<p>KS as necessary. Knock Sensor (KS) (18.30.69)</p>
P033300	Knock sensor (KS) 2 circuit - high input (bank 2)	<ul style="list-style-type: none"> • Poor sensor contact with the cylinder block • KS circuit - high resistance, short to power • KS failure 	<ul style="list-style-type: none"> • Ensure a good electrical contact with the cylinder block • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P033592	Crankshaft Position (CKP) sensor circuit - performance or incorrect operation	<ul style="list-style-type: none"> • CKP sensor circuit - short to ground, short to power, high resistance, disconnected • CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor • CKP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) • Install a new CKP sensor as necessary. Crankshaft Position (CKP)

			Sensor (18.30.12)
P033594	Crankshaft Position (CKP) sensor circuit - unexpected operation	<ul style="list-style-type: none"> • CKP sensor circuit - short to ground, short to power, high resistance, disconnected • CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor • CKP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) • Install a new CKP sensor as necessary. Crankshaft Position (CKP) Sensor (18.30.12)
P033600	Crankshaft Position (CKP) sensor circuit - range/performance	<ul style="list-style-type: none"> • CKP sensor circuit - short to ground, short to power, high resistance, disconnected • CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor • CKP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) • Install a new CKP sensor as

			necessary. Crankshaft Position (CKP) Sensor (18.30.12)
P034092	Camshaft Position (CMP) sensor circuit (bank 1) - performance or incorrect operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor RH (18.31.11)
P034094	Camshaft Position (CMP) sensor circuit (bank 1) - unexpected operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor RH

			(18.31.11)
P034100	Camshaft Position (CMP) sensor circuit (bank 1) - range/performance	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor RH (18.31.11)
P034592	Camshaft Position (CMP) sensor circuit (bank 2) - performance or incorrect operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor LH (18.31.12)
P034594	Camshaft Position (CMP) sensor circuit (bank 2) - unexpected operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with

		<p>resistance, disconnected</p> <ul style="list-style-type: none"> • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<p>this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. <p>Camshaft Position (CMP) Sensor LH (18.31.12)</p>
P034600	Camshaft Position (CMP) sensor circuit (bank 2) - range/performance	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. <p>Camshaft Position (CMP) Sensor LH (18.31.12)</p>
P035100	Ignition coil 1 primary/secondary circuit	<ul style="list-style-type: none"> • Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
P035200	Ignition coil 2 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035300	Ignition coil 3 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035400	Ignition coil 4 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035500	Ignition coil 5 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035600	Ignition coil 6 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
P035700	Ignition coil 7 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035800	Ignition coil 8 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P040100	Exhaust Gas Recirculation (EGR) flow insufficient detected	<ul style="list-style-type: none"> EGR valve incorrectly installed or loose EGR pipe blocked EGR valve stuck closed, blocked EGR valve failure 	<ul style="list-style-type: none"> For EGR system tests. Engine Emission Control
P041300	Secondary Air Injection (AIR) switching valve circuit open	<ul style="list-style-type: none"> AIR check valve control circuit high 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P041400	Secondary Air Injection (AIR) switching valve circuit shorted	<ul style="list-style-type: none"> AIR check valve control circuit low 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P042000	Catalyst system efficiency below threshold (bank 1)	<ul style="list-style-type: none"> • Catalyst failure due to overheating damage caused by misfire and/or lean combustion • Catalyst failure due to poisoning caused by excessive oil consumption and/or contaminated fuel 	<ul style="list-style-type: none"> • Check for misfire/lean combustion DTCs and refer to DTC Index in this section • Check the oil and fuel condition/level. Check the catalytic converter for damage
P043000	Catalyst system efficiency below threshold (bank 2)	<ul style="list-style-type: none"> • Catalyst failure due to overheating damage caused by misfire and/or lean combustion • Catalyst failure due to poisoning caused by excessive oil consumption and/or contaminated fuel 	<ul style="list-style-type: none"> • Check for misfire/lean combustion DTCs and refer to DTC Index in this section • Check the oil and fuel condition/level. Check the catalytic converter for damage
P044100	Evaporative Emission (EVAP) system incorrect purge flow	<ul style="list-style-type: none"> • Purge valve - range/performance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P044700	Evaporative Emission (EVAP) system vent control circuit open	<ul style="list-style-type: none"> • DMTL COV circuit - short to ground 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P044800	Evaporative Emission (EVAP) system vent control circuit shorted	<ul style="list-style-type: none"> DMTL COV circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P045600	Evaporative Emission (EVAP) system leak detected (very small leak)	<ul style="list-style-type: none"> DMTL system has detected a leak 	<ul style="list-style-type: none"> For evaporative emissions tests. Evaporative Emissions
P045800	Evaporative Emission (EVAP) canister purge valve circuit low	<ul style="list-style-type: none"> EVAP canister purge valve control circuit - short to ground, high resistance EVAP canister purge valve failure 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EVAP canister purge valve as necessary. Evaporative Emissions
P045900	Evaporative Emission (EVAP) canister purge valve circuit high	<ul style="list-style-type: none"> EVAP canister purge valve control circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P046129	Fuel level sensor A circuit - range/performance - stuck	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC.

			Fuel Tank and Lines
P04612F	Fuel level sensor A circuit - range/performance - signal erratic	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P046200	Fuel level sensor A circuit - low input	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P046300	Fuel level sensor A circuit - high input	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P048023	Fan 1 control circuit low	<ul style="list-style-type: none"> Electric fan control circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048024	Fan 1 control circuit high	<ul style="list-style-type: none"> Electric fan control circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048309	Fan rationality check	<ul style="list-style-type: none"> Cooling fan difficult to turn/obstructed Fan/Motor damaged 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using

			<p>the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • CLEAR any obstruction and INSTALL a new fan as necessary. <p>Cooling Fan Motor and Shroud - Vehicles With: Supercharger (26.25.25)</p>
P048316	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage less than nine volts 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the battery condition • CHECK the charging system and fan circuits
P048317	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage greater than 18 volts 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the charging system and fan circuits

P048397	Fan rationality check	<ul style="list-style-type: none"> Cooling fan jammed 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system CLEAR any obstruction and INSTALL a new fan as necessary. Cooling Fan Motor and Shroud - Vehicles With: Supercharger (26.25.25)
P048900	Exhaust Gas Recirculation (EGR) control circuit low	<ul style="list-style-type: none"> EGR valve power supply circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P049000	Exhaust Gas Recirculation (EGR) control circuit high	<ul style="list-style-type: none"> EGR valve control circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050082	Vehicle speed sensor malfunction	<ul style="list-style-type: none"> Vehicle speed - invalid signal received over CAN 	<ul style="list-style-type: none"> Check ABS for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist

P050086	Vehicle speed sensor malfunction	<ul style="list-style-type: none"> Vehicle speed - invalid signal received over CAN 	<ul style="list-style-type: none"> Check ABS for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
P050162	Vehicle speed sensor - range/performance - signal plausibility failure	<ul style="list-style-type: none"> Vehicle speed - range performance 	<ul style="list-style-type: none"> Check for ABS/TCM DTCs and refer to DTC Index for speed sensor tests. Anti-Lock Control - Stability Assist Diagnostic Strategy
P050400	Brake switch A/B correlation	<ul style="list-style-type: none"> The brake pressure reading does not agree with the brake light switch value 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050401	Brake switch A/B correlation	<ul style="list-style-type: none"> Brake switch high fault: Brake lights stuck on Gearshift interlock inoperative Speed control inoperative Brake switch low fault: Brake lights inoperative Gearshift stuck in Park Reduced engine braking 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050600	Idle air control system RPM lower than expected	<ul style="list-style-type: none"> Air intake restriction Front End Accessory Drive (FEAD) overload (defective/seized component) 	<ul style="list-style-type: none"> Ensure the air intake system is free from restriction Check the FEAD belt and components.

			Accessory Drive
P050624	Idle air control system RPM lower than expected	<ul style="list-style-type: none"> • Air intake restriction • Front End Accessory Drive (FEAD) overload (defective/seized component) 	<ul style="list-style-type: none"> • Ensure the air intake system is free from restriction • Check the FEAD belt and components. Accessory Drive
P050700	Idle air control system RPM higher than expected	<ul style="list-style-type: none"> • Intake air leak between MAF sensor and engine • Engine crankcase breather leak 	<ul style="list-style-type: none"> • Check for leakage and correct installation of air intake system • Check for leakage and correct installation of engine crankcase breather system
P050723	Idle air control system RPM higher than expected	<ul style="list-style-type: none"> • Intake air leak between MAF sensor and engine • Engine crankcase breather leak 	<ul style="list-style-type: none"> • Check for leakage and correct installation of air intake system • Check for leakage and correct installation of engine crankcase breather system
P050B84	Cold start ignition timing performance	<ul style="list-style-type: none"> • Cold start emission reduction strategy engine spark timing too retarded 	<ul style="list-style-type: none"> • Check for any engine ignition related DTCs also logged and refer to the DTC Index

P050B85	Cold start ignition timing performance	<ul style="list-style-type: none"> • Cold start emission reduction strategy engine spark timing too advanced 	<ul style="list-style-type: none"> • Check for any engine ignition related DTCs also logged and refer to the DTC Index
P05120C	Starter request circuit	<ul style="list-style-type: none"> • Crank request circuit - high input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P05120E	Starter request circuit	<ul style="list-style-type: none"> • Crank request circuit - low input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P051300	Incorrect immobilizer key	<ul style="list-style-type: none"> • Security key invalid 	<ul style="list-style-type: none"> • Check for CAN network interference/E MC related error. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
P056013	System voltage	<ul style="list-style-type: none"> • Battery back-up malfunction 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
P056100	System voltage unstable	<ul style="list-style-type: none"> • System voltage comparison 	<ul style="list-style-type: none"> • Check for sensor 5 volt supply related DTCs and refer to DTC Index in this section
P056200	System voltage low	<ul style="list-style-type: none"> • Sensor 5 volt power supply circuit - low input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P056300	System voltage high	<ul style="list-style-type: none"> • Sensor 5 volt power supply circuit - high input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P057501	Speed control cancel button fault	<ul style="list-style-type: none"> • Speed control cancel button fault 	<ul style="list-style-type: none"> • Check speed control system for DTCs and refer to DTC Index
P059000	Speed control multi-function input B circuit stuck	<ul style="list-style-type: none"> • Active speed limiter fault 	<ul style="list-style-type: none"> • Check speed control system for DTCs and refer to DTC Index
P060143	Internal control module memory check sum error - special memory failure	<ul style="list-style-type: none"> • CPU communication - sub 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index

P060145	Internal control module memory check sum error - program memory failure	<ul style="list-style-type: none"> • CPU communication 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060442	Internal control module Random Access Memory (RAM) error - general memory failure	<ul style="list-style-type: none"> • Initial RAM test 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060443	Internal control module Random Access Memory (RAM) error - special memory failure	<ul style="list-style-type: none"> • Shut off RAM test 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060444	Internal control module Random Access Memory (RAM) error - data memory failure	<ul style="list-style-type: none"> • RAM check sum 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060445	Internal control module Random Access Memory (RAM) error - program memory failure	<ul style="list-style-type: none"> • Initial RAM test 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060500	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> • EEPROM/flash checksum error 	<ul style="list-style-type: none"> • Configure the module using the Jaguar approved diagnostic system
P060529	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> • ROM error 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060542	Internal control module Read Only Memory (ROM) error - general memory failure	<ul style="list-style-type: none"> • ROM check sum 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of

			DTC Index
P060543	Internal control module Read Only Memory (ROM) error - special memory failure	<ul style="list-style-type: none"> Shut off ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060544	Internal control module Read Only Memory (ROM) error - data memory failure	<ul style="list-style-type: none"> Initial ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060545	Internal control module Read Only Memory (ROM) error - program memory failure	<ul style="list-style-type: none"> Continuous ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060546	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> Continuous ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060548	Internal control module Read Only Memory (ROM) error - supervision software failure	<ul style="list-style-type: none"> Shut off ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060564	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> ROM error - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060600	ECM/PCM processor fault	<ul style="list-style-type: none"> Watchdog error 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060601	ECM/PCM processor fault - general electrical failure	<ul style="list-style-type: none"> Controller test - sub 	<ul style="list-style-type: none"> Refer to new module/component installation

			Note at top of DTC Index
P060604	ECM/PCM processor fault	<ul style="list-style-type: none"> System internal failures 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060605	ECM/PCM processor fault - system programming failures	<ul style="list-style-type: none"> Throttle return spring failure (throttle body failure) 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060641	ECM/PCM processor fault - general checksum failure	<ul style="list-style-type: none"> Watch dog timer fault - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060642	ECM/PCM processor fault - general memory failure	<ul style="list-style-type: none"> Error capturing instructions 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060643	ECM/PCM processor fault - special memory failure	<ul style="list-style-type: none"> Duplication memory fault 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060644	ECM/PCM processor fault - data memory failure	<ul style="list-style-type: none"> Duplication memory fault - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060645	ECM/PCM processor fault - program memory failure	<ul style="list-style-type: none"> Detection of write to internal ROM 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060646	ECM/PCM processor fault - calibration/parameter	<ul style="list-style-type: none"> Detection of write to 	<ul style="list-style-type: none"> Configure the module using

	memory failure	internal ROM - sub	the Jaguar approved diagnostic system
P060647	ECM/PCM processor fault	<ul style="list-style-type: none"> • Watch dog timer fault 	<ul style="list-style-type: none"> • Configure the module using the Jaguar approved diagnostic system
P060648	ECM/PCM processor fault - supervision software failure	<ul style="list-style-type: none"> • Scheduling sequence check 	<ul style="list-style-type: none"> • Configure the module using the Jaguar approved diagnostic system
P060649	ECM/PCM processor fault - internal electronic failure	<ul style="list-style-type: none"> • Controller test 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060700	Control module performance	<ul style="list-style-type: none"> • Sub - CPU watch dog 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index
P060D00	Internal control module accelerator pedal position performance	<ul style="list-style-type: none"> • APS Communication 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P060E62	Internal control module throttle position performance - signal compare failure	<ul style="list-style-type: none"> • Throttle motor amplifier failure for valve sensor malfunction 	<ul style="list-style-type: none"> • Refer to new module/component installation Note at top of DTC Index

P060E64	Internal control module throttle position performance - signal plausibility failure	<ul style="list-style-type: none"> TPS Communication 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060A64	Internal control module monitoring processor performance	<ul style="list-style-type: none"> Internal control module monitoring processor performance 	<ul style="list-style-type: none"> Clear the DTC and retest. If the DTC resets, refer to new module/component installation Note at top of DTC Index
P060A67	Internal control module monitoring processor performance	<ul style="list-style-type: none"> Internal control module monitoring processor performance 	<ul style="list-style-type: none"> Clear the DTC and retest. If the DTC resets, refer to new module/component installation Note at top of DTC Index
P061000	Control module vehicle options error	<ul style="list-style-type: none"> Car configuration data mismatch 	<ul style="list-style-type: none"> Re-configure the RJB using the manufacturer approved diagnostic system
P061A00	Internal control module torque performance	<ul style="list-style-type: none"> Pedal follower error 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061A29	Internal control module torque performance - signal invalid	<ul style="list-style-type: none"> Absolute engine torque calculation failure - sub-processor 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061A64	Internal control module torque performance - signal plausibility failure	<ul style="list-style-type: none"> Absolute engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of

			DTC Index
P061B29	Internal control module torque calculation performance - signal invalid	<ul style="list-style-type: none"> Absolute and dynamic engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061B64	Internal control module torque calculation performance - signal plausibility failure	<ul style="list-style-type: none"> Absolute and dynamic engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P062700	Fuel pump A control circuit/open	<ul style="list-style-type: none"> Fuel pump control circuit fault (FPDM to fuel pump) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the FPDM to Fuel Pump circuit for short to ground, power, open circuit
P062A00	Fuel pump A control circuit range/performance	<ul style="list-style-type: none"> Invalid fuel pump duty requested by the ECM 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the ECM to FPDM monitor circuit for short to ground, power, open circuit
P063000	VIN not programmed or incompatible - ECM/PCM	<ul style="list-style-type: none"> CCF to CAN VIN mismatch 	<ul style="list-style-type: none"> Configure the module using the Jaguar approved diagnostic system, clear DTC and re-test, if DTC remains suspect the ECM. Refer to the new module/component installation note at the top

			of the DTC Index
P068773	EMS control relay control circuit high	<ul style="list-style-type: none"> EMS control relay malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P072186	Output speed sensor circuit range/performance	<ul style="list-style-type: none"> TCM Output shaft speed sensor error received 	<ul style="list-style-type: none"> For transmission tests. Diagnostic Strategy
P08170D	Starter relay circuit (break wire)	<ul style="list-style-type: none"> Starter relay circuit (break wire) 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081A0B	Starter relay circuit low	<ul style="list-style-type: none"> Starter relay circuit low 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081B0C	Starter relay circuit high	<ul style="list-style-type: none"> Starter relay circuit high 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
P08510E	Park/Neutral switch input circuit low	<ul style="list-style-type: none"> • Park/Neutral switch input circuit - low 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P08520C	Park/Neutral switch input circuit high	<ul style="list-style-type: none"> • Park/Neutral switch input circuit - high 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P114723	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> • Intercooler air temperature sensor circuit - short, open circuit 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Intercooler air temperature sensor circuit for short, open circuit
P114724	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> • Intercooler air 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

		temperature sensor circuit - short, open circuit	system. Refer to electrical circuit diagrams and check Intercooler air temperature sensor circuit for short, open circuit
P114729	Intake Air Temperature Sensor 2 Circuit Range/Performance	<p>NOTE: Intercooler air temperature sensor is integral to primary MAP sensor</p> <ul style="list-style-type: none"> Intercooler air temperature sensor circuit - short, open circuit 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check Intercooler air temperature sensor circuit for short, open circuit
P125900	Immobilizer to ECM signal error	<ul style="list-style-type: none"> Incorrect ID received from instrument cluster 	<ul style="list-style-type: none"> Re-configure the instrument cluster using the manufacturer approved diagnostic system
P131500	Persistent misfire	<ul style="list-style-type: none"> ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged) Fuel injector circuit fault(s) (injector DTCs also flagged) Fuel delivery pressure low Spark plug failure/fouled/incorrect 	<ul style="list-style-type: none"> Check for cylinder misfire, ignition and injector DTCs and refer to the DTC Index For fuel system tests. Fuel Tank and Lines For spark plug

		<ul style="list-style-type: none"> • t gap • Cylinder compression low 	<ul style="list-style-type: none"> • tests. Engine Ignition • For cylinder compression tests. Engine
P131600	Misfire rate exceeds emissions thresholds	<ul style="list-style-type: none"> • Misfire rate exceeds emissions thresholds 	<ul style="list-style-type: none"> • Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P136700	Ignition amplifier group A	<ul style="list-style-type: none"> • Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P136800	Ignition amplifier group B	<ul style="list-style-type: none"> • Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P160300	EEPROM error	<ul style="list-style-type: none"> • ECM fault 	<ul style="list-style-type: none"> • Refer to new module/component installation note at top of DTC Index
P162600	ECM electronic throttle monitoring/self test - torque monitoring problem	<ul style="list-style-type: none"> • Dynamic torque monitoring error 	<ul style="list-style-type: none"> • Suspect the ECM, refer to new module/component installation note at top of

			DTC Index
P209600	Fuel trim too lean, bank 1	<ul style="list-style-type: none"> • Heated Oxygen Sensor (HO2S) fuel adaption - lean 	<ul style="list-style-type: none"> • Check integrity and correct installation of air intake system • Check for any HO2S codes also logged and refer to DTC Index in this section
P209700	Fuel trim too rich, bank 1	<ul style="list-style-type: none"> • Heated Oxygen Sensor (HO2S) fuel adaption - rich 	<ul style="list-style-type: none"> • Check integrity and correct installation of air intake system • Check for any HO2S codes also logged and refer to DTC Index in this section
P209800	Fuel trim too lean, bank 2	<ul style="list-style-type: none"> • Heated Oxygen Sensor (HO2S) fuel adaption - lean 	<ul style="list-style-type: none"> • Check integrity and correct installation of air intake system • Check for any HO2S codes also logged and refer to DTC Index in this section
P209900	Fuel trim too rich, bank 2	<ul style="list-style-type: none"> • Heated Oxygen Sensor (HO2S) fuel adaption - rich 	<ul style="list-style-type: none"> • Check integrity and correct installation of air intake system • Check for any HO2S codes also logged and refer to DTC Index in this section

			section
P210129	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Compare throttle position sensor 1 and 2 datalogger signals, if signals are comparable install a new throttle body. Throttle Body (19.70.04)
P210164	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved

			<p>diagnostic system</p> <ul style="list-style-type: none"> • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle actuator motor control circuit range/performance	<ul style="list-style-type: none"> • Throttle blade stuck open • Intake air system leak 	<ul style="list-style-type: none"> • Check for throttle related DTCs and refer to DTC Index in this section • Check intake air system for leaks
P210329	Throttle actuator motor control circuit high	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of DTC Index
P210364	Throttle actuator motor control circuit high - signal plausibility failure	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of

			DTC Index
P210500	Throttle actuator control system - forced engine shutdown	<ul style="list-style-type: none"> Throttle MIL request due to fuel cut 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P210629	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> Signal invalid 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index
P210664	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> Signal plausibility failure 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index
P211800	Throttle actuator motor control current range/performance	<ul style="list-style-type: none"> Throttle motor control circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211900	Throttle actuator control throttle body range/performance	<ul style="list-style-type: none"> Throttle spring faulty 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to new module/compo

			<p>ment installation note at top of DTC Index</p>
P212200	Accelerator pedal position (APP) sensor D circuit low input	<ul style="list-style-type: none"> • APP sensor circuit 2 - low input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P212300	Accelerator pedal position (APP) sensor D circuit high input	<ul style="list-style-type: none"> • APP sensor circuit 2 - high input 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P213528	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> • APP sensor circuit 1 and 2 range performance - sub-processor 	<ul style="list-style-type: none"> • Check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213529	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> • APP sensor - excessive difference between raw values of circuit 1 and 2 - sub-processor 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P213562	Accelerator pedal position	<ul style="list-style-type: none"> • APP sensor circuit 1 	<ul style="list-style-type: none"> • Check APP

	(APP) sensor 1 and 2 voltage correlation	and 2 range performance - sub-processor	sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213564	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P222800	Barometric pressure circuit low input	<ul style="list-style-type: none"> BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> Refer to new module/component installation note at top of DTC Index
P222900	Barometric pressure circuit high input	<ul style="list-style-type: none"> BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> Refer to new module/component installation note at top of DTC Index
P240100	Evaporative emission (EVAP) system leak detection pump control circuit low	<ul style="list-style-type: none"> DMTL pump circuit - short to ground 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240200	Evaporative emission (EVAP) system leak detection pump control circuit high	<ul style="list-style-type: none"> DMTL pump circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using

			the manufacturer approved diagnostic system
P240429	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance	<ul style="list-style-type: none"> • DMTL reference leak • DMTL pump circuit - short to ground, power, high resistance • DMTL pipework blocked/leaking 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P24042F	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance - signal erratic	<ul style="list-style-type: none"> • DMTL reference leak • DMTL pump circuit - short to ground, power, high resistance • DMTL pipework blocked/leaking 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240500	Evaporative emission (EVAP) system leak detection pump sensing circuit low	<ul style="list-style-type: none"> • DMTL pump circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240600	Evaporative emission (EVAP) system leak detection pump sensing circuit high	<ul style="list-style-type: none"> • DMTL pump circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240B00	Evaporative emission (EVAP) system leak detection pump heater circuit low	<ul style="list-style-type: none"> • DMTL heater control circuit low 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240C00	Evaporative emission (EVAP) system leak detection pump heater circuit high	<ul style="list-style-type: none"> • DMTL heater control circuit high 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
P243100	Secondary air injection manifold absolute pressure sensor circuit range/performance	<ul style="list-style-type: none"> • Secondary air injection system leaks • Secondary air injection pump • Secondary air injection valve 	<ul style="list-style-type: none"> • Check the secondary air injection system for leaks • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243200	Secondary air injection manifold absolute pressure sensor circuit low	<ul style="list-style-type: none"> • Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243300	Secondary air injection manifold absolute pressure sensor circuit high	<ul style="list-style-type: none"> • Secondary air injection manifold pressure (MAP) sensor circuit - short to power 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P244400	Secondary air injection system pump stuck ON	<ul style="list-style-type: none"> • Secondary air injection pump control circuit - short to ground 	<ul style="list-style-type: none"> • Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
P244500	Secondary air injection system pump stuck OFF	<ul style="list-style-type: none"> Secondary air injection pump control circuit - short to power 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P245000	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck open	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P245100	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck closed	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P260100	Coolant Pump Control Circuit Range/Performance	<ul style="list-style-type: none"> Coolant Pump Control Circuit Range/Performance 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check coolant pump control circuit for short, open

			circuit
P261064	ECM/PCM Internal engine off timer performance	<ul style="list-style-type: none"> ECT sensor fault Ambient temperature sensor fault Body processor module fault (time) CAN error 	<ul style="list-style-type: none"> Check for DTCs indicating a fault with any of the components listed, and refer to relevant DTC Index
P261087	ECM/PCM Internal engine off timer performance	<ul style="list-style-type: none"> ECT sensor fault Ambient temperature sensor fault Body processor module fault (time) CAN error 	<ul style="list-style-type: none"> Check for DTCs indicating a fault with any of the components listed, and refer to relevant DTC Index
U007300	Control module communication bus off	<ul style="list-style-type: none"> CAN Link circuit malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010100	Lost communication with TCM	<ul style="list-style-type: none"> CAN Link ECM/TCM network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010300	Lost communication with gear shift control module	<ul style="list-style-type: none"> CAN Link ECM/gear shift network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
U010400	Lost communication with speed control module	<ul style="list-style-type: none"> CAN Link ECM/speed control module network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012100	Lost communication with anti-lock brake system (ABS) control module	<ul style="list-style-type: none"> CAN Link ECM/ABS module network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012800	Lost communication with electronic parking brake control module	<ul style="list-style-type: none"> CAN Link ECM/Electronic parking brake signal missing network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015100	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - CAN or hardwired 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U01511F	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - SRS fault 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using

			the manufacturer approved diagnostic system
U015157	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - CAN fault 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> CAN Link ECM/instrument cluster network malfunction 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U016700	Lost communication with vehicle immobilizer	<ul style="list-style-type: none"> Security challenge response timeout 	<ul style="list-style-type: none"> Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U040208	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040264	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Actual gear position status 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy

U040267	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Selector lever position status 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040281	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Output shaft speed signal 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040282	Invalid Data Received From Transmission Control Module - TCM engine speed control monitor - plausibility (TCM alive counter)	<ul style="list-style-type: none"> CAN Bus circuit fault Circuit fault in supply voltage to transmission control module 	Check the transmission control module for related stored DTCs. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network to the transmission control module. Refer to the electrical circuit diagrams and check the power and ground circuit to the transmission control module
U040283	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor - plausibility 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040286	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor - rationality 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040581	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index.

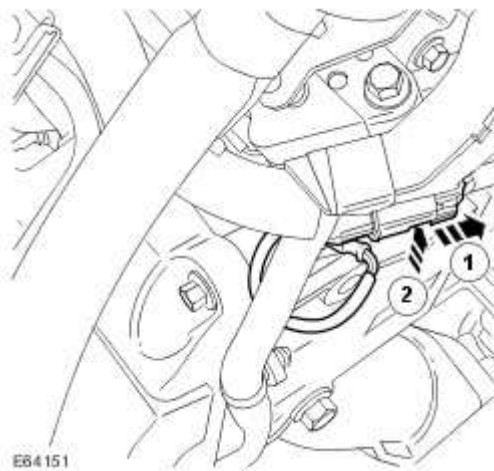
			Speed Control
U040583	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index. Speed Control
U04058F	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index. Speed Control
U041500	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> Brake Position Switch 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U041564	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> Engine drag torque control monitoring - plausibility 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U041567	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> Engine drag torque control monitoring - rationality 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U042386	Invalid data received from instrument cluster - signal	<ul style="list-style-type: none"> Battery voltage level 	<ul style="list-style-type: none"> Check instrument

	invalid		cluster for DTCs and refer to DTC Index. Instrument Cluster
U042481	Invalid data received from instrument cluster	<ul style="list-style-type: none"> External ambient temperature 	<ul style="list-style-type: none"> Check instrument cluster for DTCs and refer to DTC Index. Instrument Cluster
U042600	Invalid data received from vehicle immobilizer	<ul style="list-style-type: none"> Security code mismatch 	<ul style="list-style-type: none"> Check CAN network between ECM and instrument cluster. Check power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
U206400	Warning indicator requested by another control module	<ul style="list-style-type: none"> Fuel Cut 	<ul style="list-style-type: none"> Set ignition to ON, then OFF (wait 30 seconds), then ON (wait 4 seconds)
Removal and installation			

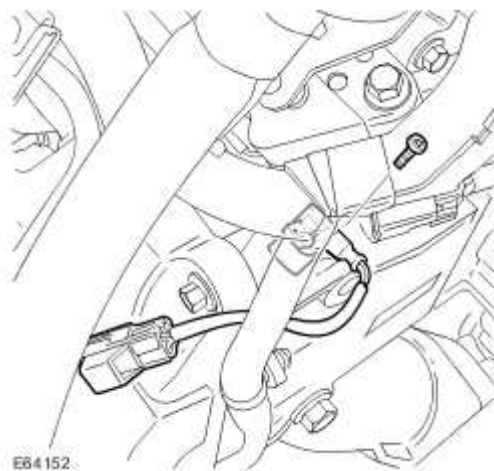
Camshaft Position (CMP) Sensor LH (18.31.12)

Removal

- 1 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 2 . Disconnect the CMP sensor electrical connector.
 - ▶ Slide the red connector latch to one side.



- 3 . Remove the CMP sensor.
 - ▶ Remove the Torx bolt.
 - ▶ Remove and discard the O-ring seal.



Installation

1 . Install the CMP sensor.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).
- ▶ Connect and secure the electrical connector.

2 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)

Camshaft Position (CMP) Sensor RH (18.31.11)

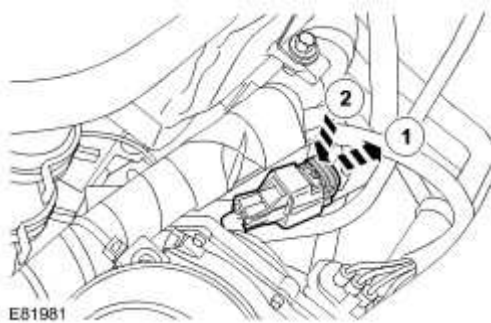
Removal

- 1 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)

- 2 . Release the engine wiring harness.
▶ Remove the 2 bolts.



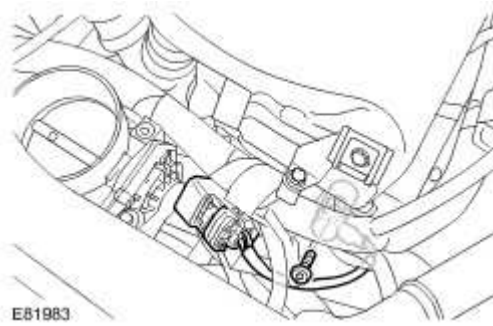
- 3 . Disconnect the CMP sensor electrical connector.
▶ Slide the red connector latch to one side.



- 4 . Release the CMP sensor electrical connector.
▶ Release the clip.

- 5 . Remove the CMP sensor.
▶ Remove the Torx bolt.

- ▶ Remove and discard the O-ring seal.



Installation


- 1 . Install the CMP sensor.
 - ▶ Clean the components.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).
 - ▶ Connect and secure the electrical connector.
- 2 . Attach the engine wiring harness.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- 3 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)

Catalyst Monitor Sensor (18.30.66)

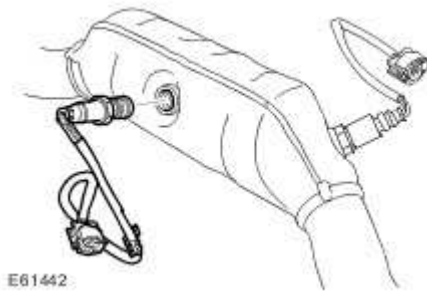
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

- 3 . Remove the exhaust system.
For additional information, refer to [Catalytic Converter \(17.50.05\)](#)
- 4 . Remove the catalyst monitor sensor.



Installation

- 1  **WARNING: Make sure the H02S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.**

 **CAUTION: Make sure the anti-seize compound does not contact the catalyst monitor sensor tip.**

Install the catalyst monitor sensor and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the component mating faces.
- ▶ Apply an anti-seize compound to the thread of the sensor.

2 . Install the exhaust system.

For additional information, refer to [Catalytic Converter \(17.50.05\)](#)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

4 **NOTE:**

· For NAS vehicles only.


If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

Crankshaft Position (CKP) Sensor (18.30.12)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

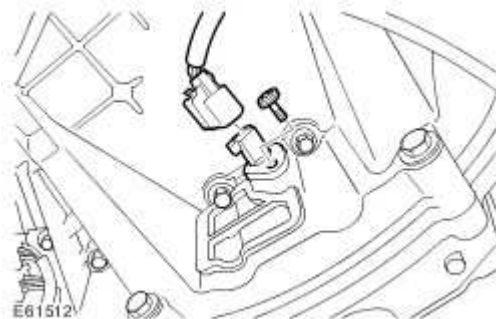
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . **NOTE:**
Clean the components general area prior to dismantling.

Remove the crankshaft position (CKP) sensor.

- ▶ Disconnect the electrical connector.
- ▶ Remove the Torx screw.



Installation

- 1 . Install the CKP sensor.
 - ▶ Clean the component mating faces.
 - ▶ Tighten the Torx screw to 8 Nm (6 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Engine Control Module (ECM) (18.30.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2 . Remove the air intake cover.

▶ Remove the 4 clips.



- 3 . Release the power distribution box and position aside.

▶ Remove the 2 Torx bolts.

- 4 . Disconnect the engine harness electrical connector.

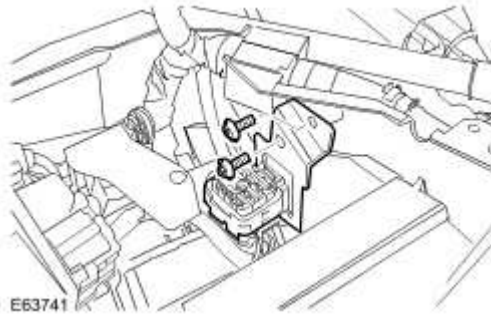
▶ Loosen the bolt.



- 5 . Release the electrical connector.

▶ Remove the 2 Torx screws.

▶ Carefully tie the harness aside.

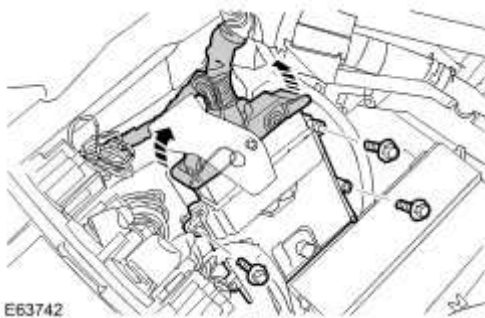


6 . NOTE:

RH illustration shown, LH is similar

Remove the engine control module (ECM).

- ▶ Remove the 3 bolts.
- ▶ Release and disconnect the 2 engine harness electrical connectors.



Installation

1 . Install the ECM.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- ▶ Connect the ECM electrical connectors.

2 . Install the electrical connector.

- ▶ Tighten the Torx screws.


3 . Connect and secure the electrical connector.

- ▶ Tighten the center bolt.

4 . Position and install the power distribution box.

- ▶ Tighten the Torx bolts to 8 Nm (6 lb.ft).

5 . Install the air intake cover.

 Carefully secure the clips.


6 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

7 . Using WDS, configure a new ECM.


Engine Coolant Temperature (ECT) Sensor (18.30.10)

Removal

 **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

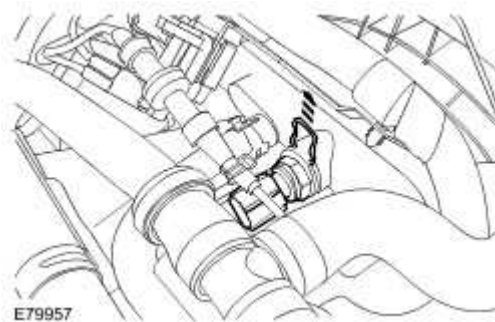
 **CAUTION:** Anti-freeze concentration must be maintained at 50%.

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the ECT sensor electrical connector.

- 4  **WARNING:** Since injury such as scalding could be caused by escaping steam or coolant, allow the vehicle cooling system to cool prior to carrying out this procedure.

Remove the ECT sensor.

- ▶ Position an absorbent cloth to collect fluid spillage.
- ▶ Remove the retaining clip.
- ▶ Remove and discard the O-ring seal.



Installation

1 . Install the ECT sensor.

- ▶ Install the O-ring seal.
- ▶ Install the retaining clip.
- ▶ Connect the electrical connector.

2 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

3 . Top-up the coolant.

4 . Connect the battery ground cable and install the cover.

Fuel Rail Pressure (FRP) Sensor (18.30.98)

Removal



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.



4



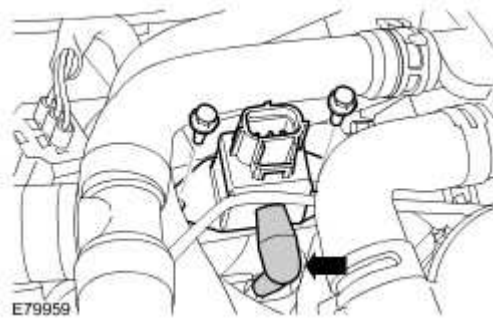
WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.




CAUTION: Always plug any open connections to prevent contamination.

Remove the FRP sensor.

- ▶ Disconnect the vacuum line.
- ▶ Position an absorbent cloth to collect fluid spillage.
- ▶ Remove the 2 bolts.
- ▶ Remove and discard the 2 O-ring seals.



Installation

- 1  **WARNING:** After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

Install the FRP sensor.

- ▶ Clean the components.
- ▶ Install new O-ring seals.
- ▶ Tighten the bolts to 5 Nm (4 lb.ft).
- ▶ Connect the electrical connector.
- ▶ Connect the vacuum line.


- 2 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Connect the battery ground cable and install the cover.

Fuel Temperature Sensor (18.30.99)


Removal

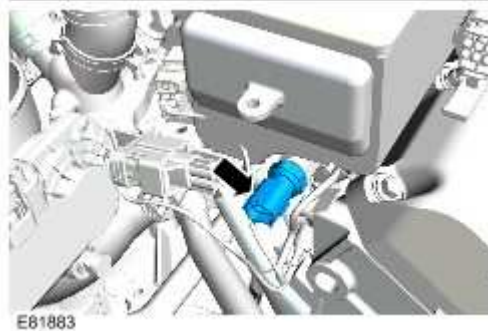
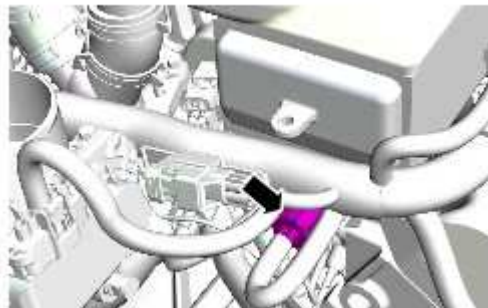
1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

2 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)

3 .  **WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.**

Remove the fuel temperature sensor.


 Disconnect the electrical connector.



Installation

1 . Install the fuel temperature sensor.

 Clean the component mating faces.

 Apply sealant to the sensor thread.

▶ Tighten the sensor to 7 Nm (5 lb.ft).

▶ Connect the electrical connector.

2 . Install the intake air resonator.

For additional information, refer to [Intake Air Resonator](#)


3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Heated Oxygen Sensor (HO2S)

Removal

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

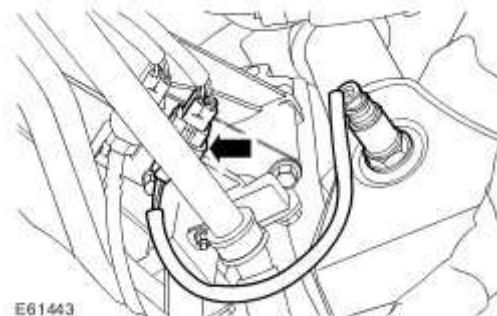
2.  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


3. Release and disconnect the heated oxygen sensor (HO2S) electrical connector.


4.  **WARNING: Do not twist the HO2S wiring harness on removal. Failure to follow this instruction may result in damage to the component.**

Remove the HO2S.




Installation

1.  **WARNING: Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.**

 **CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.**

Install the HO2S to the catalytic converter and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the component mating faces.

 Apply an anti-seize compound to the thread of the sensor.

2 . Connect and secure the electrical connector.

3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

4 **NOTE:**

· For NAS vehicles only.


If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

Knock Sensor (KS) (18.30.69)

Removal

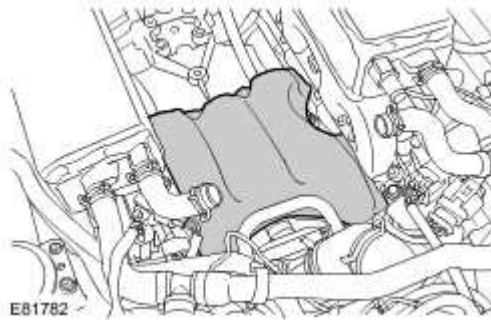
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

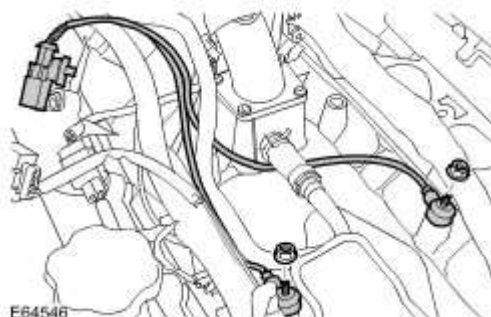
Raise and support the vehicle.

- 3 . Remove the supercharger.
For additional information, refer to [Supercharger \(18.50.15\)](#)

- 4 . Remove the NVH pad.





- 5 . Remove the KS.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 2 nuts.



Installation

1 . Install the KS.

 Tighten the nuts to 20 Nm (15 lb.ft).

 Connect the electrical connector.

2 . Install the NVH pad.

3 . Install the supercharger.

For additional information, refer to [Supercharger \(18.50.15\)](#)

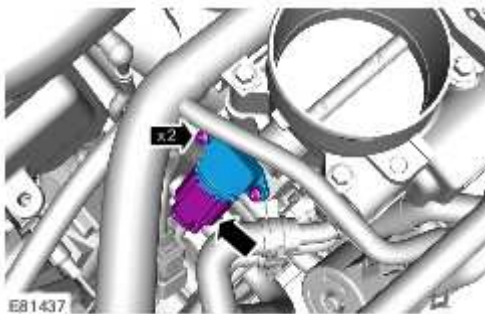
4 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Manifold Absolute Pressure (MAP) Sensor (18.30.86)

Removal

- 1 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 2 . Remove the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 3 . Disconnect the MAP sensor electrical connector.
- 4 . Remove the MAP sensor.
 - ▶ Remove the 2 Torx screws.
 - ▶ Remove and discard the O-ring seal.



Installation

- 1 . Install the MAP sensor.
 - ▶ Clean the component mating faces.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx screws.
 - ▶ Connect the electrical connector.
- 2 . Install the intake air resonator.
For additional information, refer to [Intake Air Resonator](#)
- 3 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)

4 NOTE:

- For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

Mass Air Flow (MAF) Sensor (18.30.15)

Removal

NOTE:

LH MAF sensor procedure shown, RH is similar.

1



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

2 . Remove the air cleaner.

For additional information, refer to [Air Cleaner \(19.10.05\)](#)

Installation

1 . Install the air cleaner.

For additional information, refer to [Air Cleaner \(19.10.05\)](#)

2 **NOTE:**

- For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

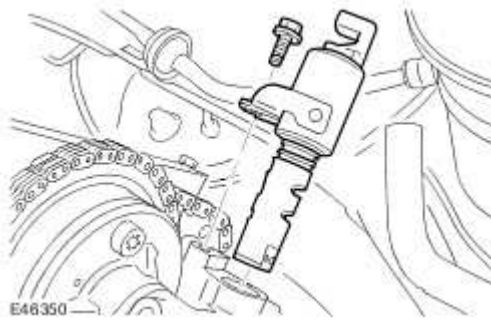
Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)

Removal

NOTE:

Removal of the RH is similar to this procedure.

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the LH valve cover.
For additional information, refer to [Valve Cover LH \(12.29.43\)](#)
- 3 . Remove the VCT oil control solenoid.
 - ▶ Remove the bolt.



Installation

- 1 . Install the VCT oil control solenoid.
 - ▶ Clean the components.
 - ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- 2 . Install the LH valve cover.
For additional information, refer to [Valve Cover LH \(12.29.43\)](#)
- 3 . Connect the battery ground cable and install the cover.
- 4 **NOTE:**
 - For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)


Brake Pedal Position (BPP) Switch

No Data Available

Oil Temperature Sensor (18.31.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 4 . Remove the oil temperature sensor.
 - ▶ Disconnect the electrical connector.



Installation


- 1 . Install the oil temperature sensor.
 - ▶ Clean the components.
 - ▶ Apply sealant of the correct specification to the sensor thread.
 - ▶ Tighten the sensor to 15 Nm (11 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Engine Oil Pressure (EOP) Sensor

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 4 . Remove the EOP sensor.
 - ▶ Disconnect the electrical connector.

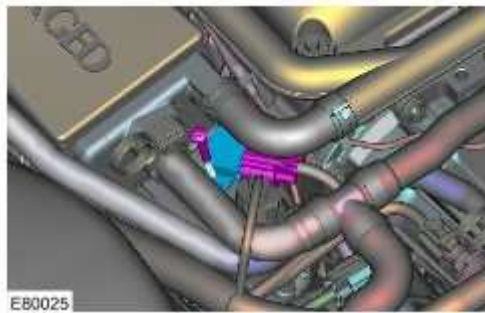
Installation

- 1 . Install the EOP sensor.
 - ▶ Clean the components.
 - ▶ Apply sealant of the correct specification to the sensor thread.
 - ▶ Tighten the sensor to 15 Nm (11 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Intake Air Temperature (IAT) Sensor (18.30.52)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the intake air temperature (IAT) sensor electrical connector.
- 4 . Remove the IAT sensor.
 - ▶ Remove the Torx screw.
 - ▶ Remove and discard the O-ring seal.



Installation

- 1 . Install the IAT sensor.
 - ▶ Clean the component mating faces.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx screw.
 - ▶ Connect the electrical connector.
- 2 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Connect the battery ground cable and install the cover.

303-14B : Electronic Engine Controls – 4.2L NA V8 – AJV8

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Camshaft position sensor - bolt	7	5	62
Catalyst monitor sensor	45	33	-
Crankshaft position sensor - screw	7	5	62
Engine control module	10	7	88
Fuel rail pressure sensor	5	4	44
Fuel temperature sensor	7	5	62
Heated oxygen sensor	45	33	-
Knock sensor - nut	20	15	-
Knock sensor - stud	10	7	88
Oil pressure sensor	15	11	-
Oil temperature sensor	15	11	-
Variable camshaft timing, oil control solenoid - bolt	10	7	88

Powertrain Control Module (PCM) Long Drive Cycle Self-Test



WARNING: Where possible, all road tests should be on well surfaced and dry roads. Always comply with speed limits and local traffic regulations.

NOTE:

This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

NOTE:

The vehicle must exceed 50mph (80 km/h) during the road test.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Disconnect the diagnostic equipment from the vehicle.
5. **NOTE:**
Make sure cruise control is not engaged.

Carry out a road test and perform the following operations.

- Accelerate to 55 mph (88 km/h) in 5th gear and cruise for 2 minutes with the engine speed at or above 1800rpm.
- Lift off the throttle and allow the vehicle to decelerate until the engine speed is less than 1000 rpm.
- Stop the vehicle.
- Release brake, allow the vehicle to move with no throttle for 1 minute.
- Road test is now complete.

6. Connect the diagnostic equipment to the vehicle.

7. **NOTE:**

If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

Follow on screen prompts and check for engine management fault codes.

8. Disconnect the diagnostic equipment from the vehicle.

Powertrain Control Module (PCM) Short Drive Cycle Self-Test

NOTE:

This procedure is an overcheck only. If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

1. Connect the diagnostic equipment to the vehicle.
2. Follow on screen prompts and check for engine management fault codes.
3. Clear the fault codes following the on screen procedure.
4. Start the engine.
 - Allow the engine to idle for 30 seconds.
 - Raise the engine speed to 1500 rpm and hold for 3 minutes until a temperature of 70°C (158 °F) is achieved.
 - Allow the engine to idle for 30 seconds.
 - Switch off the engine.
5. **NOTE:**

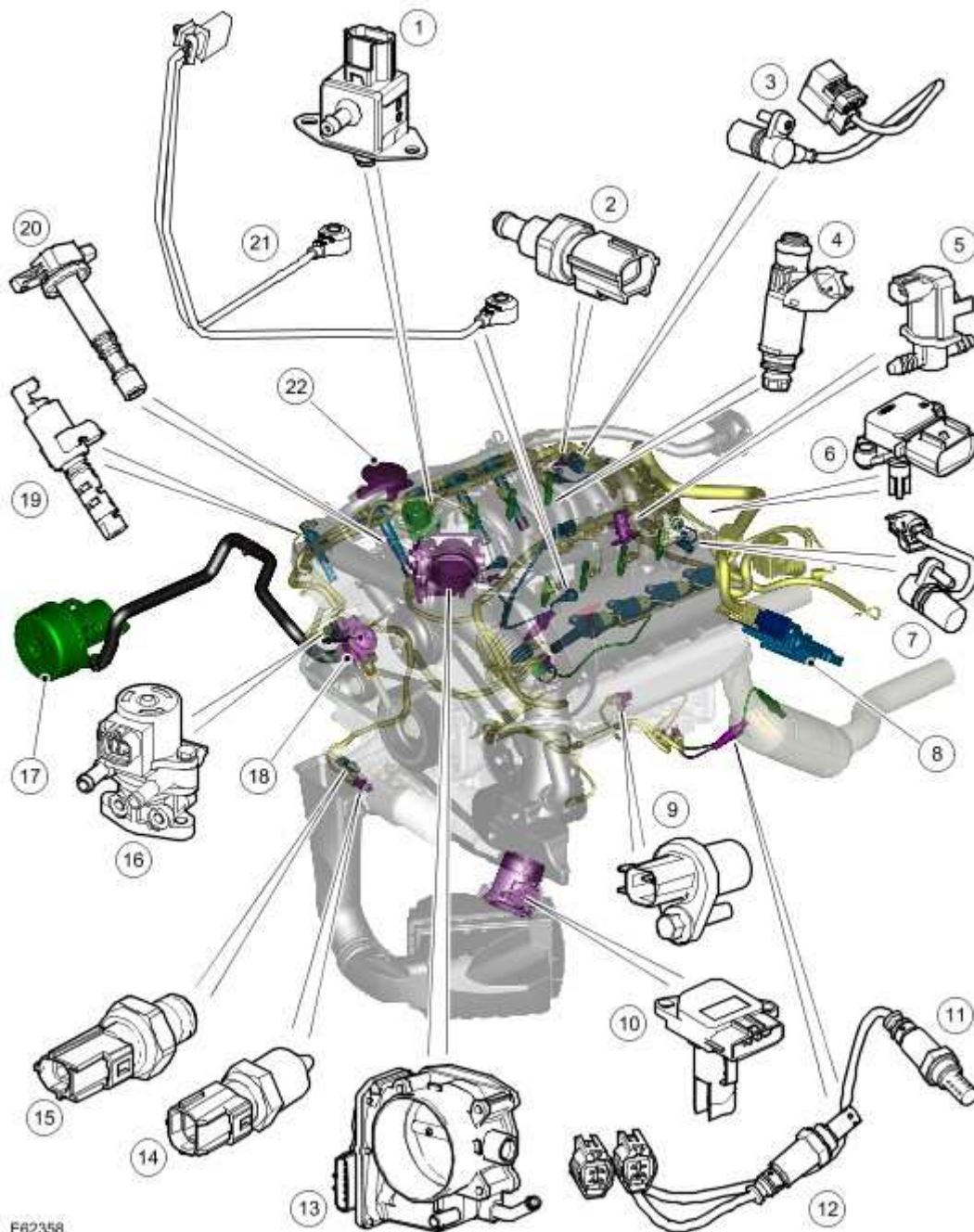
If fault codes are found, interrogation of the relevant system must be carried out and claimed against.

Follow on screen prompts and check for engine management fault codes.

6. Disconnect the diagnostic equipment from the vehicle.

Electronic Engine Controls

COMPONENT LOCATION SHEET 1 of 2

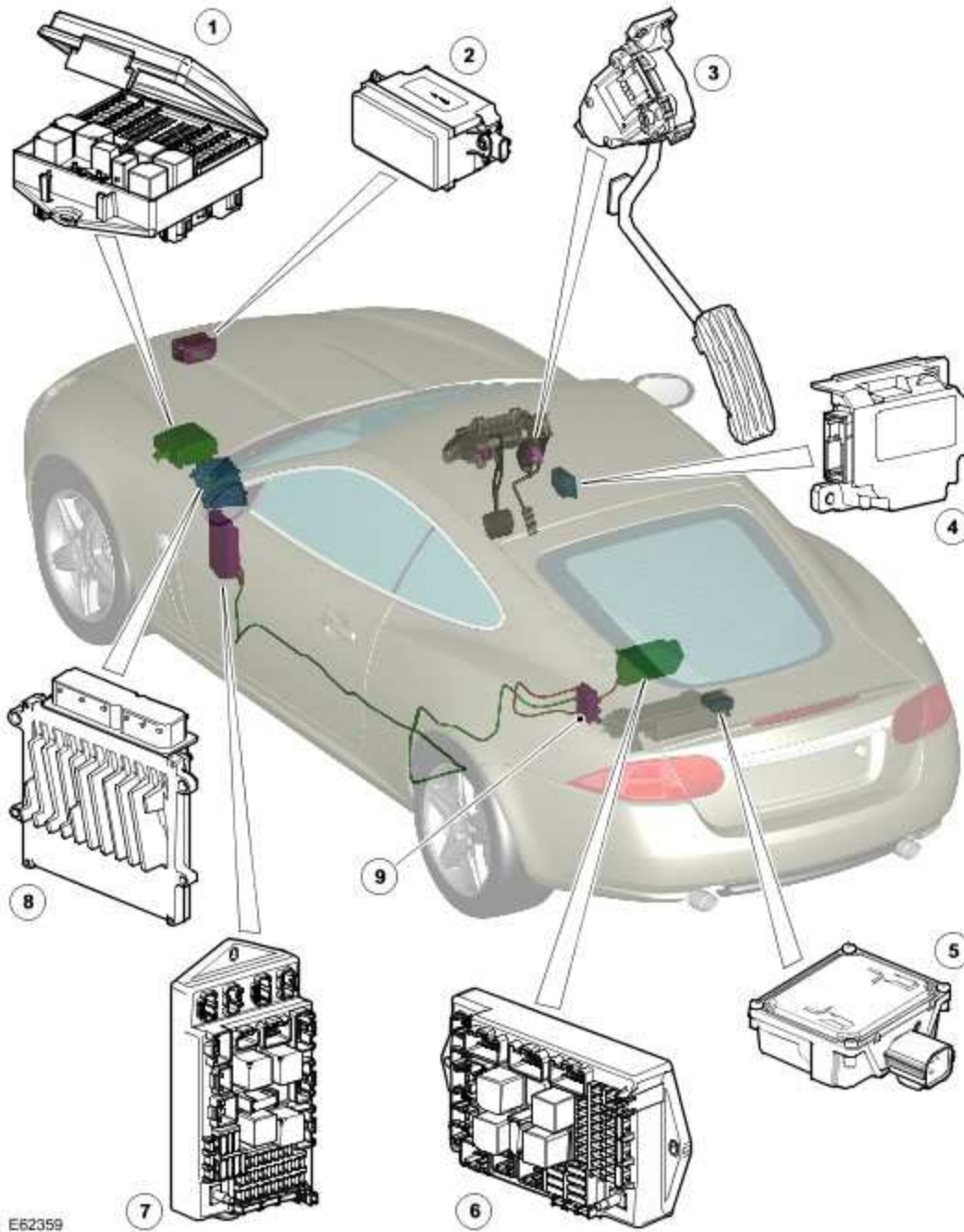


E62358

Item	Part Number	Description
1		Fuel rail pressure sensor

2		Fuel rail temperature sensor
3		CMP (camshaft position) sensor
4		Injector
5		Purge valve
6		MAP (manifold absolute pressure) sensor
7		CMP (camshaft position) sensor
8		ECM (engine control module)
9		CKP (crankshaft position) sensor
10		MAF (mass air flow) /IAT (intake air temperature) sensor
11		Downstream HO2S (heated oxygen sensor)
12		Upstream HO2S (heated oxygen sensor)
13		Electric throttle
14		Oil temperature sensor
15		Oil pressure sensor
16		EGR (exhaust gas recirculation) valve
17		Secondary air injection pump
18		Secondary air injection valve
19		Variable Valve timing solenoid
20		Ignition coil
21		Knock sensor
22		PCV (positive crankcase ventilation) valve

COMPONENT LOCATION SHEET 2 of 2



E62359

Item	Part Number	Description
1		Power distribution box
2		Adaptive speed control sensor (where fitted)
3		APP (accelerator pedal position) sensor
4		Adaptive speed control module (where fitted)
5		FPDM (fuel pump driver module)
6		Auxiliary junction box
7		CJB (central junction box)
8		ECM (engine control module)

INTRODUCTION

The V8 4.2 Liter naturally aspirated engine is controlled by an ECM (engine control module) manufactured by DENSO. The Engine Management System (EMS) controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- On Board Diagnostic
- Interface with the immobilization system
- Speed control

The ECM (engine control module) controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The ECM (engine control module) is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The ECM (engine control module) uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the CAN (controller area network) bus, to obtain additional information (e.g. road speed from the ABS (anti-lock brake system) control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

The EMS comprises the following inputs:

- CMP (camshaft position) sensor
- CKP (crankshaft position) sensor
- Fuel rail pressure sensor
- MAF (mass air flow) sensor
- Knock sensors
- Fuel rail temperature sensor
- ECT (engine coolant temperature) sensor
- Engine oil temperature sensor
- MAP (manifold absolute pressure) sensor
- Electric throttle feedback sensor
- Secondary Air Injection (SAI) MAP (manifold absolute pressure) sensor
- APP (accelerator pedal position) sensor
- DMTL (NAS only)
- Cooling fan speed feedback.

- Heated Exhaust Gas Oxygen (HEGO) sensors
- Universal Heated Exhaust Gas Oxygen (UHEGO) sensors
- Brake switch
- Speed control cancel/suspend switch
- Automatic speed limiter switch
- Crank request signal
- IAT (intake air temperature) sensor
- External air temperature sensor

The EMS comprises the following outputs:

- Fuel injectors
- Ignition coils
- Engine cooling fan
- Electric throttle
- Electric fuel pump driver module
- VCT (variable camshaft timing) solenoids
- Purge valve
- EGR (exhaust gas recirculation) valve
- Secondary air injection pump
- Starter relay control

IGNITION MODES

The vehicle has a possible 4 ignition modes. The modes and systems that are active in each mode are detailed in the following table.

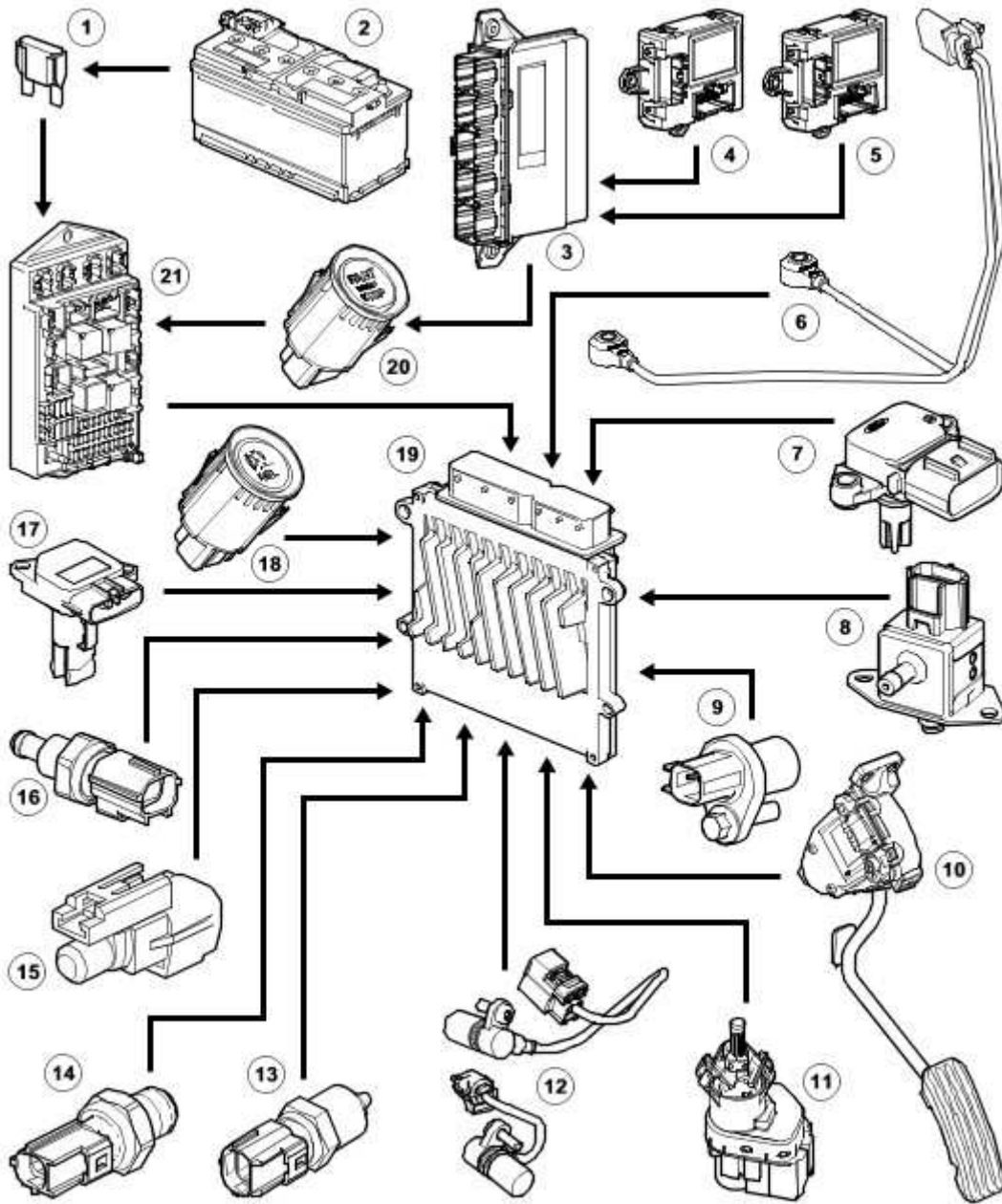
Ignition Mode	Off	Accessory (convenience)	On	Crank
Exterior lamps headlamps (dip only), approach lamps	Memory functions - Seat, steering column etc	Exterior lamps, fog lamps, direction indicator lamps	Stability controls	
Interior lighting	Manual seat adjustment, steering column	Convertible hood	Heated/cooled seats	
Preheat - timed in	Interior lighting	Wash/wipe	Adaptive speed control	
Electric park brake - On	Brake lights	HEVAC	Adaptive damping	
Instrument cluster - Standby, Clock, Odometer	Exterior lighting auto headlamps, reversing lamps, side lamps, tail lamps	EMS	TPMS	
Hazard warning lamps	Infotainment previous condition (Preset volume), radio standby, phone standby, steering	Instrument cluster – dials and warnings, fuel gauge temperature gauge, lamp check	Pedestrian protection system	

	wheel switches		
Locking and Unlocking	Instrument cluster – message center, trip computer	Electric windows	Gearshift control & TCM (transmission control module)
Security system	Horn	EPB – power to disengage (foot on break)	EPB – power to disengage
	Cigar lighter/power socket	Restraints system check	

CONTROL DIAGRAM SHEET 1 of 3

NOTE:

A = Hardwired connection



E62360

A →

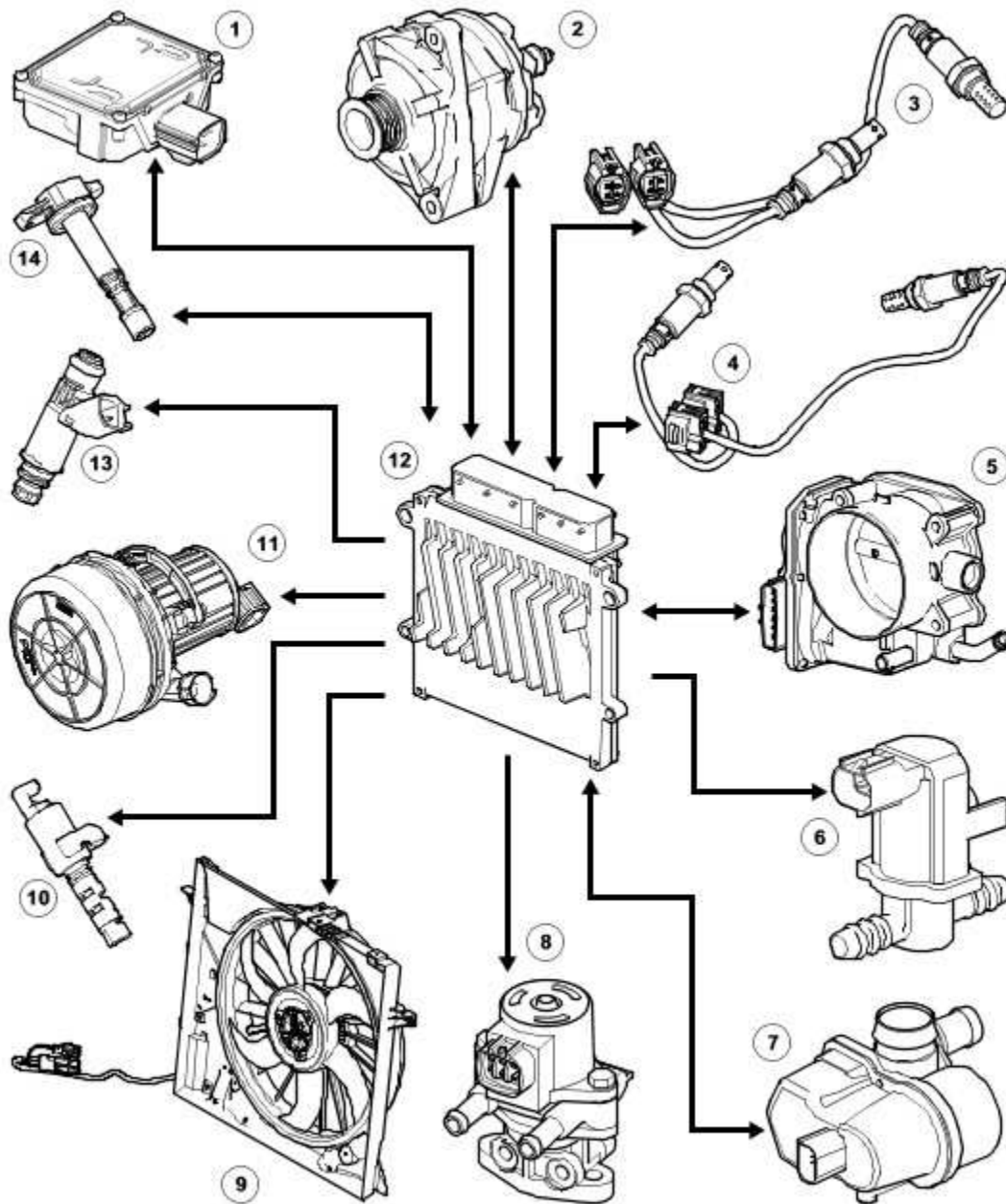
Item	Part Number	Description
1		Fuse
2		Battery
3		Keyless vehicle module
4		Door module
5		Door module
6		knock sensors
7		MAP (manifold absolute pressure) sensor
8		Fuel rail pressure sensor

9		CKP (crankshaft position) sensor
10		Stop lamp switch
11		Air temperature sensor
12		CMP (camshaft position) sensor
13		Engine coolant temperature sensor
14		Oil pressure sensor
15		APP (accelerator pedal position)
16		Fuel rail temperature sensor
17		MAF (mass air flow) /IAT (intake air temperature) sensor
18		Automatic Speed Limiter switch
19		ECM (engine control module)
20		Start/Stop switch

CONTROL DIAGRAM SHEET 2 of 3

NOTE:

A = Hardwired connection



E62361

A →

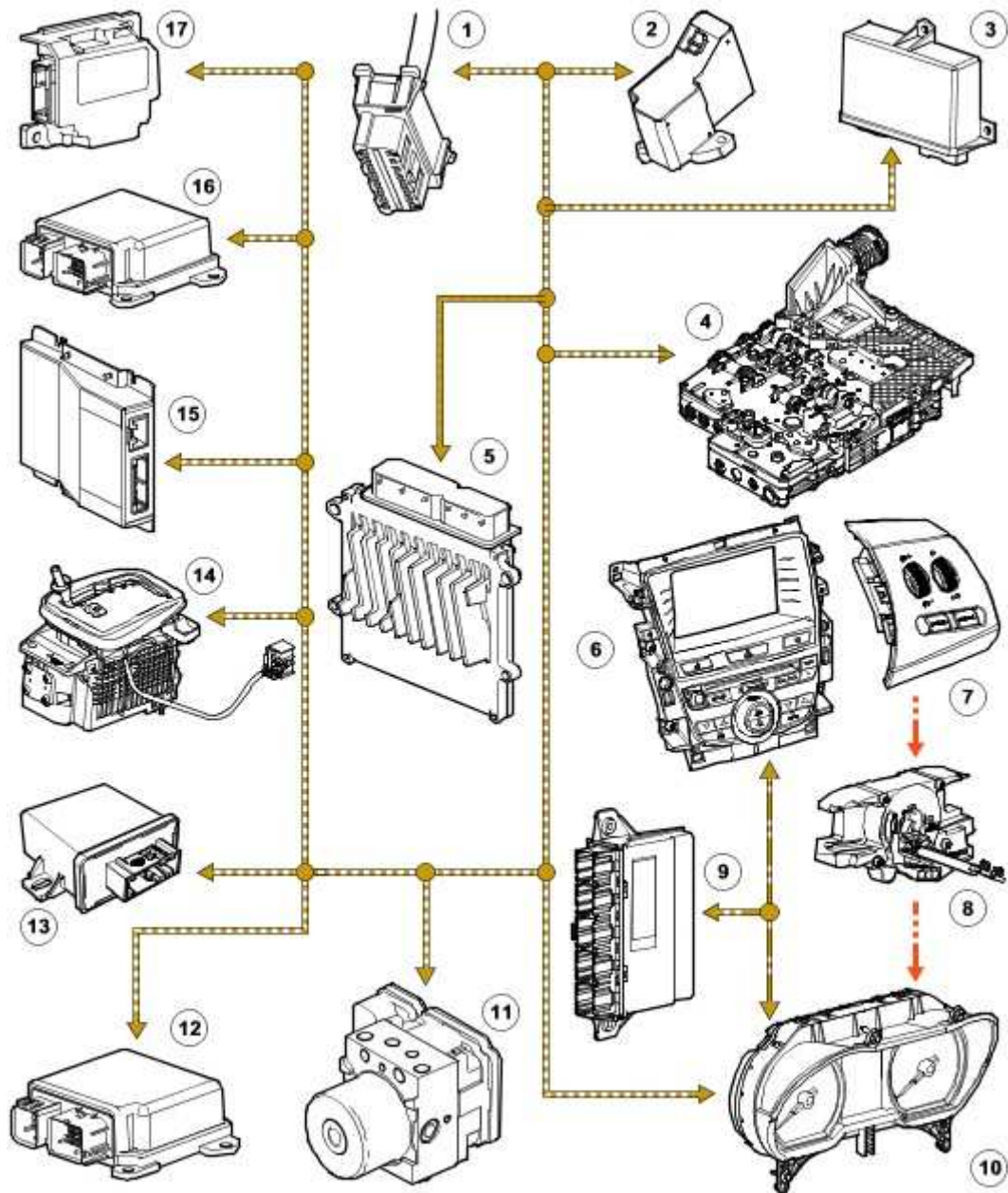
Item	Part Number	Description
1		FPDM (fuel pump driver module)
2		Generator
3		HO2S (heated oxygen sensor) (upstream)
4		HO2S (heated oxygen sensor) (downstream)
5		Electric throttle
6		Purge valve
7		DMTL pump
8		EGR (exhaust gas recirculation) valve

9		Engine cooling fan
10		VCT (variable camshaft timing) solenoid
11		Secondary air injection pump
12		ECM (engine control module)
13		Injector (8 off)
14		Ignition coil (8 off)

CONTROL DIAGRAM SHEET 3 of 3

NOTE:

D = High speed CAN (controller area network) bus; N=Medium speed CAN (controller area network) bus; O = LIN (local interconnect network) bus



E65886

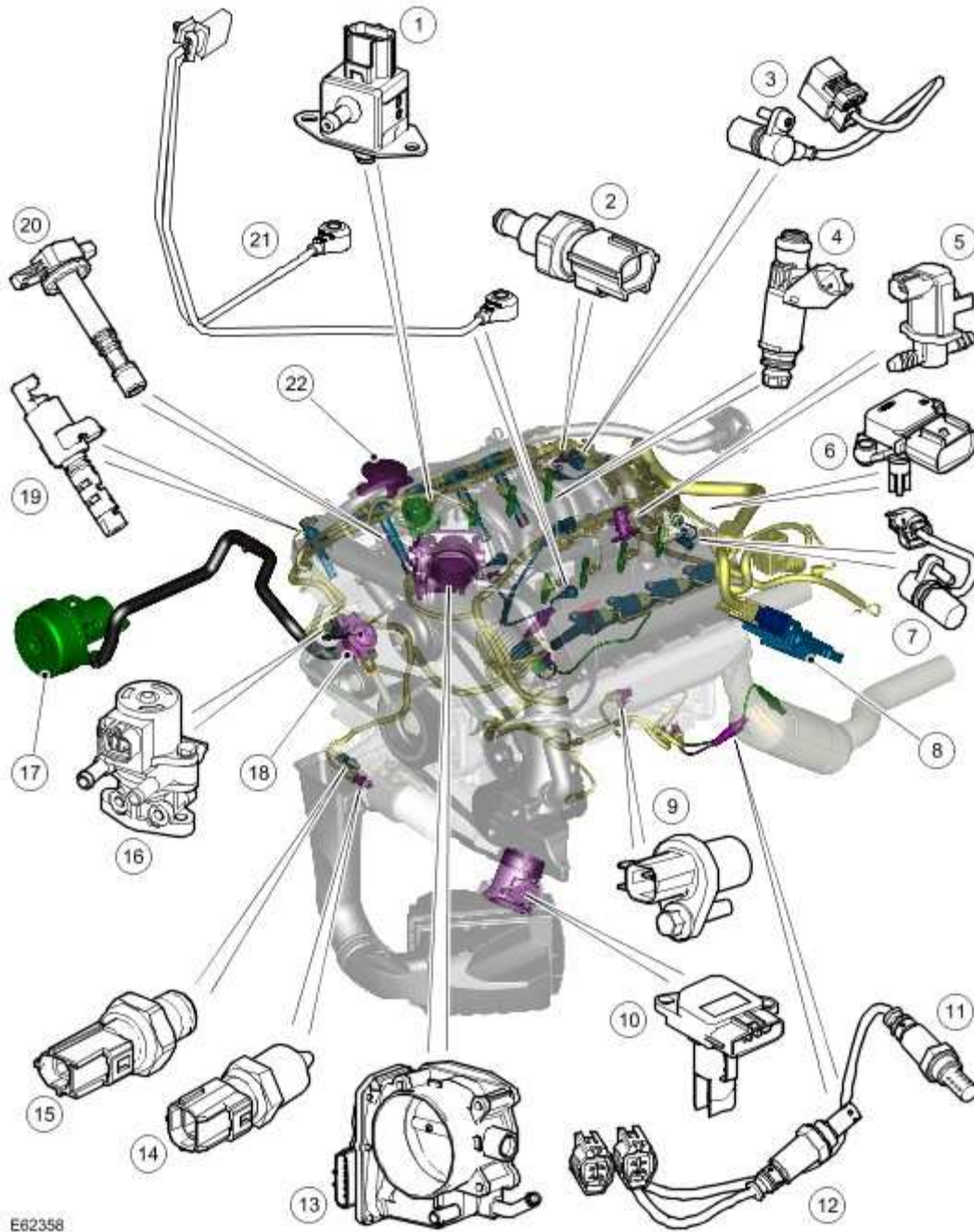


Item	Part Number	Description
1		Diagnostic socket
2		Steering column lock
3		Park brake module
4		TCM (transmission control module)
5		ECM (engine control module)
6		Integrated control panel
7		Steering wheel speed control switches
8		Rotary coupler

9		Keyless vehicle module
10		Instrument cluster
11		ABS (anti-lock brake system) control module
12		RCM (restraints control module)
13		Adaptive front lighting system control module
14		Gear shift module
15		Adaptive Damping Control Module (ADCM)
16		Pedestrian protection module
17		Adaptive speed control module

Electronic Engine Controls

COMPONENT LOCATION SHEET 1 of 2

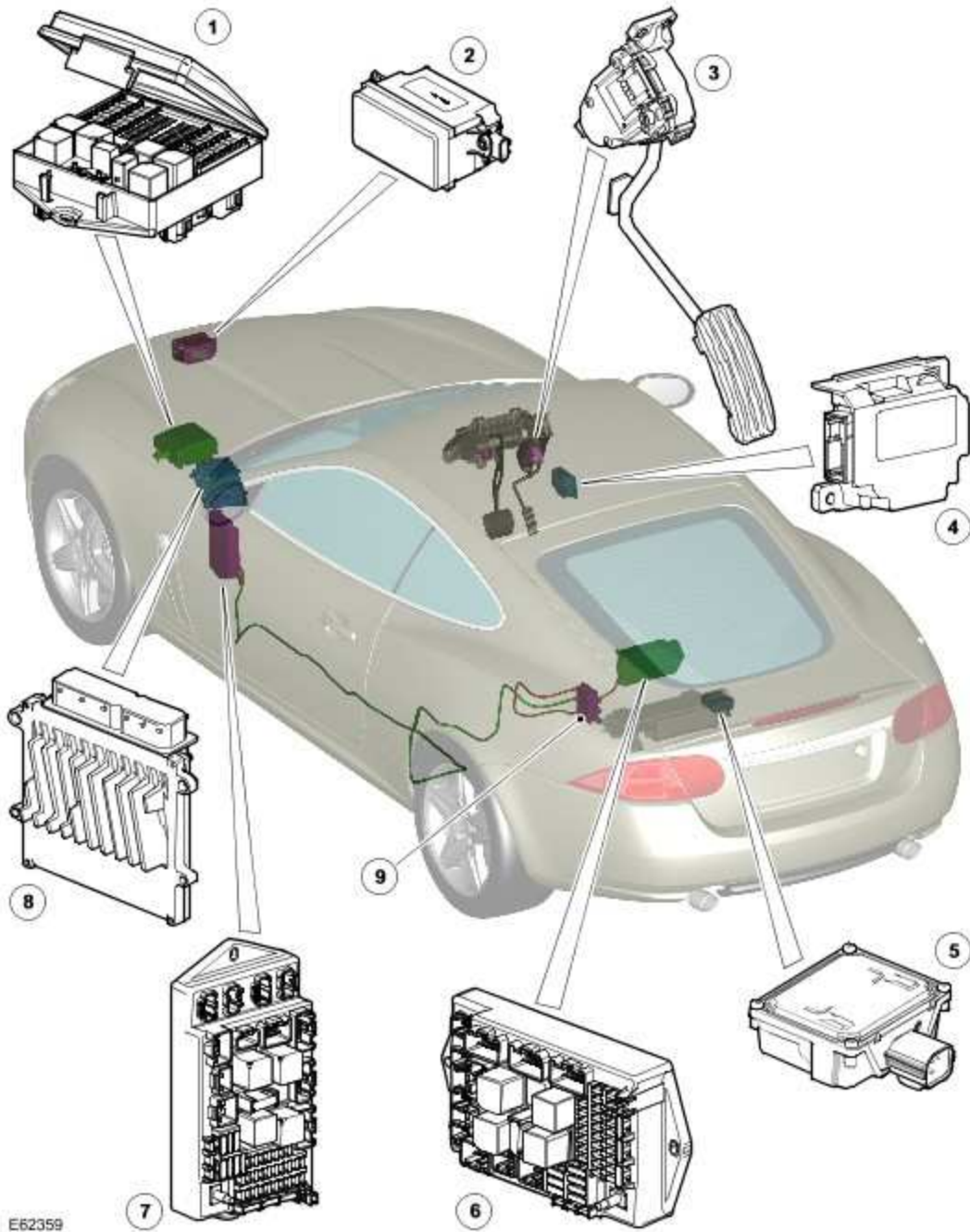


E62358

Item	Part Number	Description
1		Fuel rail pressure sensor
2		Fuel rail temperature sensor
3		Camshaft Position (CMP) sensor
4		Injector

5		Purge valve
6		Manifold Absolute Pressure sensor
7		Camshaft Position (CMP) sensor
8		Engine Control Module (ECM)
9		Crankshaft Position (CKP) sensor
10		Mass Air Flow(MAF)/Intake Air Temperature (IAT) sensor
11		Downstream Heated Oxygen Sensor (HO2S)
12		Upstream Heated Oxygen Sensor (HO2S)
13		Electric throttle
14		Oil temperature sensor
15		Oil pressure sensor
16		Exhaust Gas Recirculation (EGR) valve
17		Secondary air injection pump
18		Secondary air injection valve
19		Variable Valve timing solenoid
20		Ignition coil
21		Knock sensor
22		Positive Crankcase Ventilation (PCV) valve

COMPONENT LOCATION SHEET 2 of 2



E62359

Item	Part Number	Description
1		Power distribution box
2		Adaptive speed control sensor (where fitted)
3		Accelerator Pedal Position (APP) sensor
4		Adaptive speed control module (where fitted)
5		Fuel Pump Driver Module (FPDM)
6		Auxiliary junction box
7		Central Junction Box (CJB)
8		Engine Control Module (ECM)

INTRODUCTION

The V8 4.2 Liter naturally aspirated engine is controlled by an electronic Engine Management System (EMS). The EMS controls the following:

- Engine fueling
- Ignition timing
- Closed loop fueling
- Knock control
- Idle speed control
- Emission control
- On Board Diagnostic
- Interface with the immobilization system
- Speed control

The ECM controls the engine fueling by providing sequential fuel injection to all cylinders. Ignition is controlled by a direct ignition system, provided by eight plug top coils. The ECM is able to detect and correct for ignition knock on each cylinder and adjust the ignition timing for each cylinder to achieve optimum performance.

The ECM uses a torque-based strategy to generate the torque required by the driver and other vehicle control modules. The EMS uses various sensors to determine the torque required from the engine. The EMS also interfaces with other vehicle electronic control modules's, via the CAN bus, to obtain additional information (e.g. road speed from the ABS control module). The EMS processes these signals and decides how much torque to generate. Torque is then generated by using various actuators to supply air, fuel and spark to the engine (electronic throttle, injectors, coils, etc.).

The EMS comprises the following inputs:

- CMP sensor
- CKP sensor
- Fuel rail pressure sensor
- MAF sensor
- Knock sensors
- Fuel rail temperature sensor
- ECT sensor
- Engine oil temperature sensor
- MAP sensor
- Electric throttle feedback sensor
- Secondary Air Injection (SAI) MAP sensor
- APP sensor
- DMTL (NAS only)
- Cooling fan speed feedback.
- Heated Exhaust Gas Oxygen (HEGO) sensors
- Universal Heated Exhaust Gas Oxygen (UHEGO) sensors

- Brake switch
- Speed control cancel/suspend switch
- Automatic speed limiter switch
- Crank request signal
- IAT sensor
- External air temperature sensor

The EMS comprises the following outputs:

- Fuel injectors
- Ignition coils
- Engine cooling fan
- Electric throttle
- Electric fuel pump driver module
- VCT solenoids
- Purge valve
- EGR valve
- Secondary air injection pump
- Starter relay control

IGNITION MODES

The vehicle has a possible 4 ignition modes. The modes and systems that are active in each mode are detailed in the following table.

Ignition Mode	Off	Accessory (convenience)	On	Crank
Exterior lamps headlamps – Dip only approach lamps	Memory functions seat, column etc	Exterior lamps fog lamps directional Indicators	Stability controls	
Interior lighting	Manual adjust seat column etc	Convertible hood	Heated/cooled Seat	
Preheat - timed in	Interior lighting	Wash/wipe	Adaptive speed control	
Electric park brake - On	Brake lights	HVAC	Adaptive damping	
Instrument cluster - stand by, clock, odometer	Exterior lighting auto headlamps, reversing lamps, side lamps, tail lamps	EMS	TPMS	
Hazard warning lamps	Auto infotainment previous condition (preset volume), radio standby, phone standby, steering wheel switches	Instrument cluster – dials and warnings fuel gauge temperature gauge lamp check	Pedestrian Protection system	
Locking and	Instrument cluster –	Windows	Gearshift	

unlocking	message center, trip computer		control & TCM
Security	Horn	EPB – power to disengage (foot on break)	EPB – power to disengage
	Cigar lighter/power socket	Restraints check	

COMPONENTS

Engine Control Module (ECM)

The ECM is located in the plenum area on the passenger side of the engine compartment attached to the bulkhead.

The ECM has the following inputs:

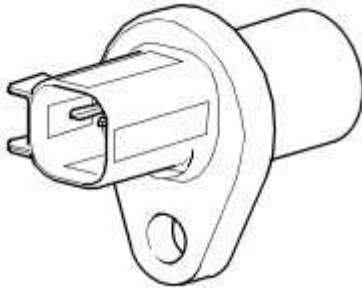
- RCM
- Park/neutral switch
- Ignition coil feedback x2
- Fuel rail temperature
- Mass air flow
- Engine speed
- Camshaft position x2
- Driver demand
- Brake pedal position switch
- Speed control switches
- Generator load
- Oxygen sensors pre catalyst x2
- Oxygen sensors post catalyst x2
- Throttle position
- Cooling fan speed
- Ignition switch position
- Knock sensors x2
- MAP
- Coolant temperature
- Engine oil temperature

The ECM outputs to the following:

- Throttle Actuator
- Brake vacuum pump relay
- Ignition coils (x8)
- Oxygen sensor heaters (4)
- Fuel injectors (8)
- Purge Valve
- Engine Cooling Fan

- Fuel pump relay
- Starter Relay
- EMS Main Relay
- Viscous Fan Control
- Generator Control
- Diagnostic Monitoring of Tank Leakage (DMTL) (NAS Only)
- E box fan

Crankshaft Position Sensor (CKP)



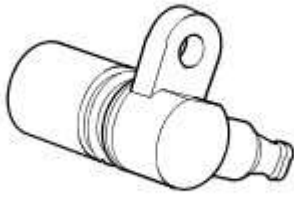
E46331

The crankshaft position sensor is mounted at the rear underside of the engine near the transmission bell housing. Connection between the sensor and the harness is via a link harness and a two-way connector. Both wires go directly to the ECM. The sensor produces the signal which enables the ECM to determine the angle of the crankshaft, and the engine rpm. From this, the point of ignition, fuel injection, etc. is calculated. If the signal wires are reversed a 3 degrees advance in timing will occur, as the electronics within the ECM uses the falling edge of the signal waveform as its reference / timing point for each tooth.

The reluctor is pressed into the flywheel and has a "tooth" pattern based on 36 teeth at 10° intervals and approximately 5° wide: one of the teeth is removed to provide a hardware reference mark which is 30 degrees BTDC (before top dead center) No.1 cylinder. Because of the crankshaft sensor's orientation, the target wheel uses windows stamped into the face, rather than actual teeth.

The sensor operates by generating an output voltage caused by the change in magnetic field that occurs as the windows pass in front of the sensor. The output voltage varies with the speed of the windows passing the sensor, the higher the engine speed, the higher the output voltage. Note that the output is also dependent on the air gap between the sensor and the teeth (the larger the gap, the weaker the signal, the lower the output voltage). The ECM transmits the engine speed to other vehicle control modules on CAN.

Camshaft Position Sensor (CMP)



E46332

Two sensors are located at the rear of the engine, in the cylinder head (one per bank), above the rear cylinders. The sensors are Variable Reluctor Sensor (VRS) type, producing four pulses for every two engine revolutions. The sensing element is positioned between 0 and 2mm from the side of the cam gear wheel.

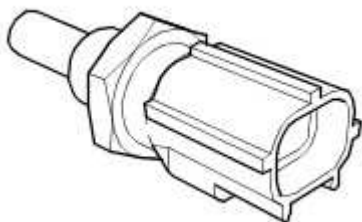
The camshaft timing wheel is a sintered component which has four teeth on it to enable the EMS to detect cylinder identification. The signal is used for:

- Cylinder recognition
- Enabling sequential fuel injection
- Knock control
- Cylinder identification for diagnostic purposes.

Failure symptoms include:

- Ignition timing reverting to the base mapping, with no cylinder correction.
- Active knock control is disabled, along with its diagnostic (Safe ignition map - loss of performance).
- Quick cam/crank synchronisation on start disabled.

Engine Coolant Temperature Sensor (ECT)



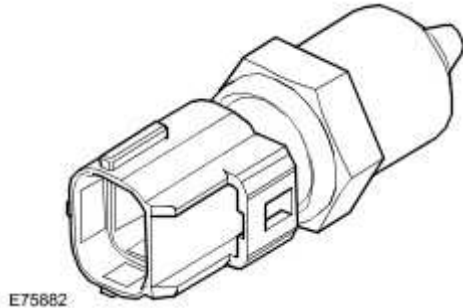
E47309

The sensor is located at the front of the engine in the water pipe below the throttle body. The ECT (engine coolant temperature) sensor is a thermistor used to monitor the engine coolant temperature. The engine coolant temperature sensor is vital to the correct running of the engine as a richer mixture is required at lower block temperatures for good quality starts and smooth running, leaning off as the temperature rises to maintain emissions and performance.

The sensor has an operating temperature range of -30 Degrees Celsius to 125 Degrees Celsius.

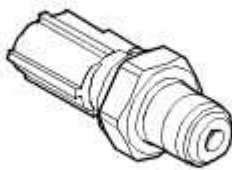
When a defective coolant sensor is detected, the ECM defaults to the oil temperature sensor value.

Engine Oil Temperature Sensor



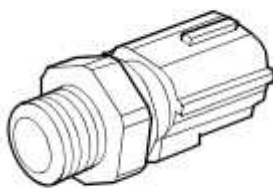
Oil temperature is monitored through a temperature sensor mounted in the oil system. This component is a NTC (negative temperature coefficient) type. The sensor is mounted next to the oil pressure sensor at the front of the engine and locates into the oil filter bracket.

Oil Pressure Sensor



The oil pressure sensor is located in the oil filter bracket adjacent to the oil temperature sensor. The sensor is hardwired to the instrument cluster and is used to illuminate the oil pressure warning indicator. The sensor switches on at pressures below 24.5kPa and is closed circuit at zero oil pressure.

Fuel Rail Temperature Sensor

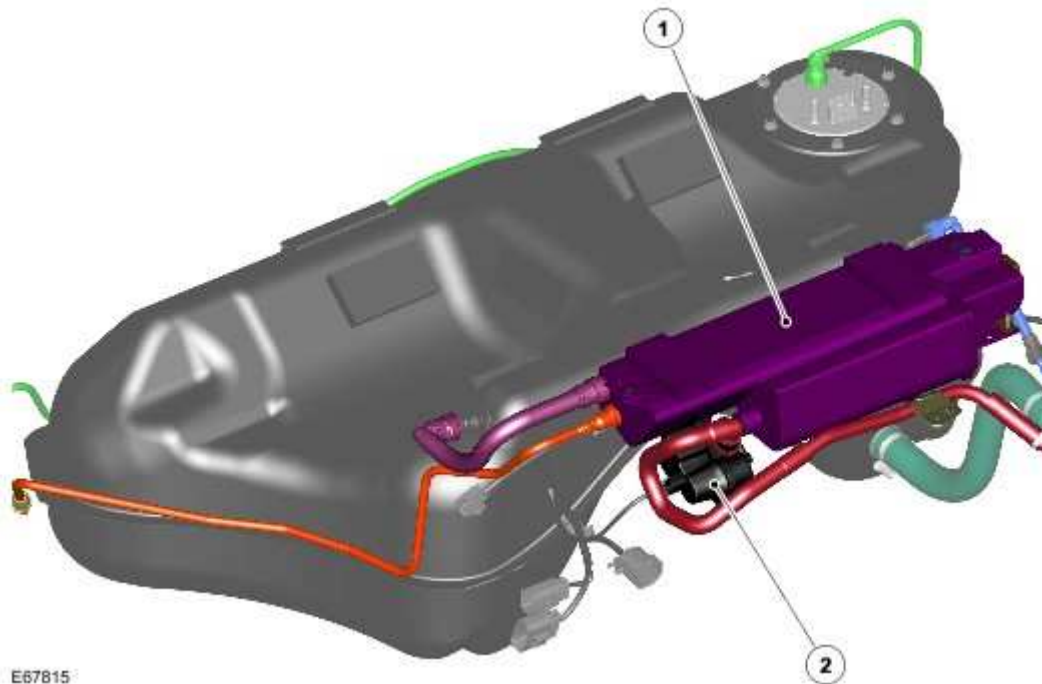


The fuel rail temperature sensor measures the temperature of the fuel in the fuel rail. This

input is then used to deliver the correct quantity of fuel to the engine. Operating Range -40 Degrees Celsius to 150 Degrees Celsius. The fuel rail temperature sensor is fitted on the rear of the right hand bank (bank A) fuel rail.

Diagnostic Monitoring of Tank Leakage (DMTL) - NAS ONLY

Charcoal Canister with DMTL Pump (NAS only)

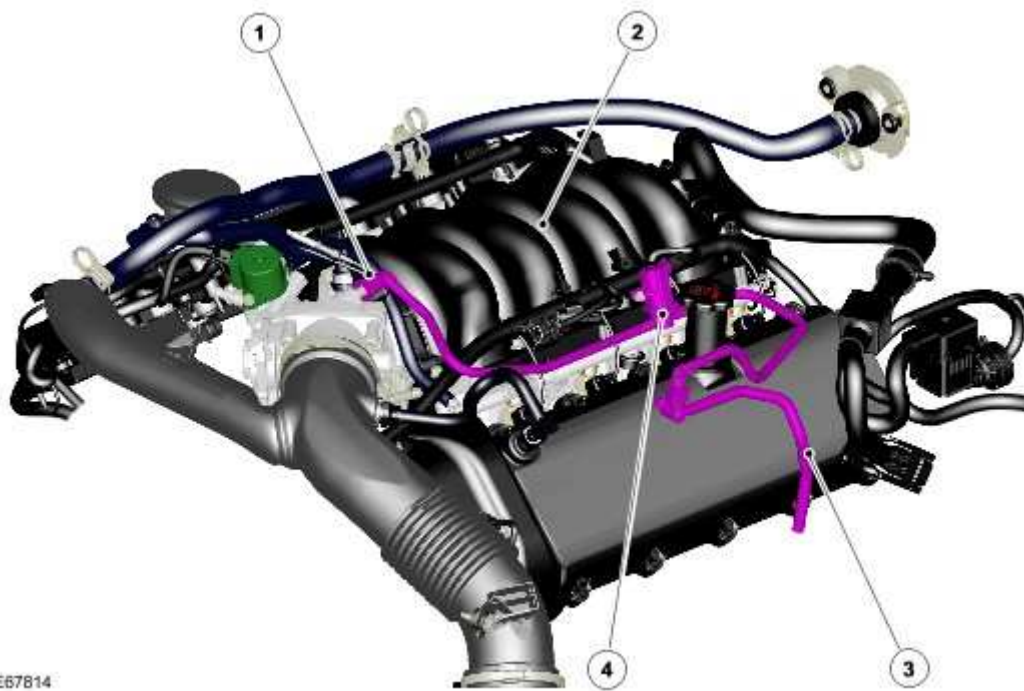


Item	Part Number	Description
1		Charcoal cannister
2		DMTL pump

The DMTL system periodically checks the evaporative system and the fuel tank for leaks when the ignition is switched off. The DMTL pump is connected to the atmospheric vent of the charcoal cannister and incorporates a PTC heating element a normally open valve and a reference orifice. The DMTL pump is only operated when the ignition is switched off and is controlled by the ECM. The ECM also monitors the electric air pump operation and the normally open valve for faults. To check the fuel tank and EVAP system for leaks the ECM operates the DMTL pump and monitors the current draw. This is compared to a referenced figure established from the current draw when air is pumped through the reference orifice.

Purge Valve

Purge Valve and Hoses location



E67814

Item	Part Number	Description
1		Hose and connection-purge valve to electric throttle
2		Air intake manifold
3		Hose-charcoal cannister to purge valve
4		Purge valve

The purge valve is located LH side of the engine, on a bracket which is attached to the cylinder block. The purge hose is routed from the purge valve, along the left hand side of the air intake manifold, to the elbow assembly which locates the electric throttle.

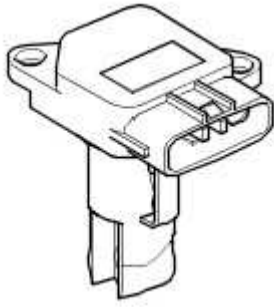
The purge hose is connected, at the right hand rear of the engine, with a quick release coupling to the purge line which runs parallel with the fuel feed line and around the rear of the fuel tank to the charcoal canister.

The purge hose continues from the purge valve and is routed to a connection on the air intake elbow assembly. The hose is connected to the elbow with a quick release connector.

The purge valve is a solenoid operated valve which is closed when de-energized. The purge valve is controlled by a 10Hz PWM signal from the ECM. When the engine operating conditions are correct, the ECM opens the purge valve which causes fuel vapor and fresh air to be drawn through the charcoal cannister. The fresh air is drawn through the charcoal cannister via the DMTL pump fresh air vent. For additional information, refer to [Evaporative Emissions](#) (303-13 Evaporative Emissions)

Mass Air Flow/Intake Air Temperature Sensor (MAF/IAT)

E47308



The air flow meter is located in the clean air duct immediately after the air filter box.

The air mass flow is determined by the cooling effect of inlet air passing over a “hot film” element contained within the device. The higher the air flow the greater the cooling effect and the lower the electrical resistance of the “hot film” element. The ECM then uses this signal from the MAF meter to calculate the air mass flowing into the engine.

The measured air mass flow is used in determining the fuel quantity to be injected in order to calculate the required air/fuel mixture required for correct operation of the engine and exhaust catalysts. Should the device fail there is a software backup strategy that will be evoked once a fault has been diagnosed.

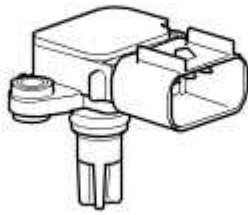
The following symptoms may be observed if the sensor fails:

- During driving the engine RPM might dip, before recovering.
- Difficulty in starting or start - stall.
- Poor throttle response / engine performance.
- Lambda control and idle speed control halted.
- Emissions incorrect.
- AFM signal offset

The IAT sensor is integrated into the MAF meter. It is a temperature dependent resistor (thermistor), i.e. the resistance of the sensor varies with temperature. This thermistor is a NTC type element meaning that the sensor resistance decreases as the sensor temperature increases. The sensor forms part of a voltage divider chain with an additional resistor in the ECM. The voltage from this sensor changes as the sensor resistance changes, thus relating the air temperature to the voltage measured by the ECM.

The ECM stores a 25°C default value for air temperature in the event of a sensor failure.

Manifold Absolute Pressure Sensor (MAP)



E47588

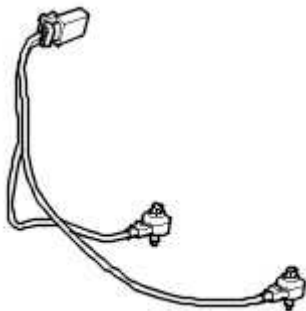
The MAP sensor provides a voltage proportional to the absolute pressure in the intake manifold. This signal allows the load on the engine to be calculated and used within the internal calculations of the ECM. The sensor is located on the rear of the air intake manifold.

The output signal from the MAP sensor, together with the CKP and IAT sensors, is used by the ECM to calculate the amount of air induced into the cylinders. This enables the ECM to determine ignition timing and fuel injection duration values.

The MAP sensor receives a 5V supply voltage from ECM and provides an analogue signal to the ECM, which relates to the absolute manifold pressure and allows the ECM to calculate engine load. The ECM provides a ground for the sensor.

If the MAP signal is missing, the ECM will substitute a default manifold pressure reading based on crankshaft speed and throttle angle. The engine will continue to run with reduced drivability and increased emissions, although this may not be immediately apparent to the driver. The ECM will store fault codes which can be retrieved using the Integrated Diagnostic System (IDS).

Knock Sensors



E47296

The V8 EMS has two knock sensors located in the V of the engine, one per cylinder bank. The sensors are connected to the ECM via a twisted pair.

The knock sensors produce a voltage signal in proportion to the amount of mechanical vibration generated at each ignition point. Each sensor monitors the related cylinder bank.

Care must be taken at all times to avoid damaging the knock sensors, but particularly during removal and fitting procedures. The recommendations regarding torque and surface preparation must be adhered to. The torque applied to the sensor and the quality of the surface preparation both have an influence over the transfer of mechanical noise from the cylinder

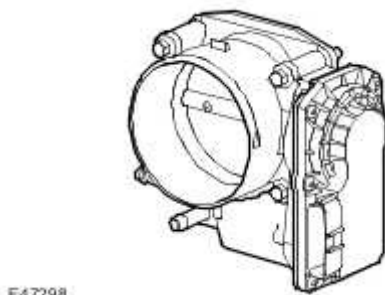
block to the crystal.

The knock sensors incorporate a piezo-ceramic crystal. This crystal produces a voltage whenever an outside force tries to deflect it, (i.e. exerts a mechanical load on it). When the engine is running, the compression waves in the material of the cylinder block, caused by the combustion of the fuel/air mixture within the cylinders, deflect the crystal and produce an output voltage signal. The ECM uses the signals supplied by the knock sensors, in conjunction with the signal it receives from the camshaft sensor, to determine the optimum ignition point for each cylinder. The ignition point is set according to preprogrammed ignition maps stored within the ECM. The ECM is programmed to use ignition maps for 98 RON premium specification fuel. It will also function on 91 RON regular specification fuel and learn new adaptations. If the only fuel available is of poor quality, or the customer switches to a lower grade of fuel after using a high grade for a period of time, the engine may suffer slight pre-ignition for a short period. This amount of pre-ignition will not damage the engine. This situation will be evident while the ECM learns and then modifies its internal mapping to compensate for the variation in fuel quality. This feature is called adaptation. The ECM has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The ECM will cancel closed loop control of the ignition system if the signal received from either knock sensor becomes implausible. In these circumstances the ECM will default to a safe ignition map. This measure ensures the engine will not become damaged if low quality fuel is used. The MIL will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

When a knock sensor fault is stored, the ECM will also store details of the engine speed, engine load and the coolant temperature.

Electric Throttle



The V8 EMS incorporates an electric throttle control system. The electronic throttle body is located on the air intake manifold in the engine compartment. The system comprises three main components:

- Electronic throttle control valve
- APP sensor
- ECM

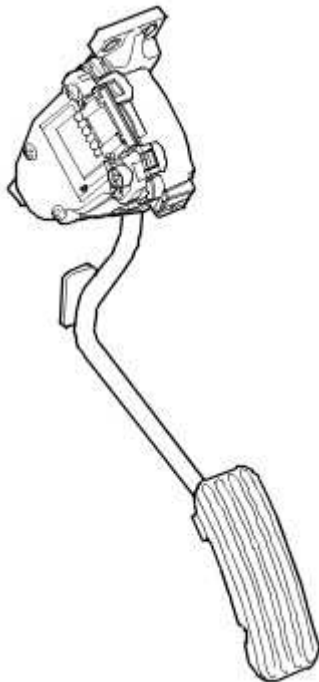
When the accelerator pedal is depressed the APP sensor provides a change in the monitored signals. The ECM compares this against an electronic “map” and moves the electronic throttle

valve via a PWM control signal which is in proportion to the APP angle signal. The system is required to:

- Regulate the calculated intake air load based on the accelerator pedal sensor input signals and programmed mapping.
- Monitor the drivers input request for cruise control operation.
- Automatically position the electronic throttle for accurate speed control.
- Perform all dynamic stability control throttle control interventions.
- Monitor and carry out maximum engine and road speed cut out.
- Provide differing responses for differing Terrain response modes.

A software strategy within the ECM enables the throttle position to be calibrated each ignition cycle. When the ignition is turned ON, the ECM performs a self test and calibration routine on the electronic throttle by closing the throttle full, then opening again. This tests the default position springs.

Accelerator Pedal Position Sensor (APP)



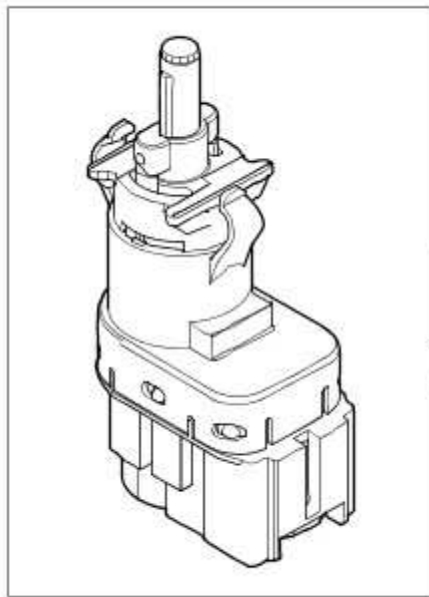
E75881

The APP sensors are located on the accelerator pedal assembly.

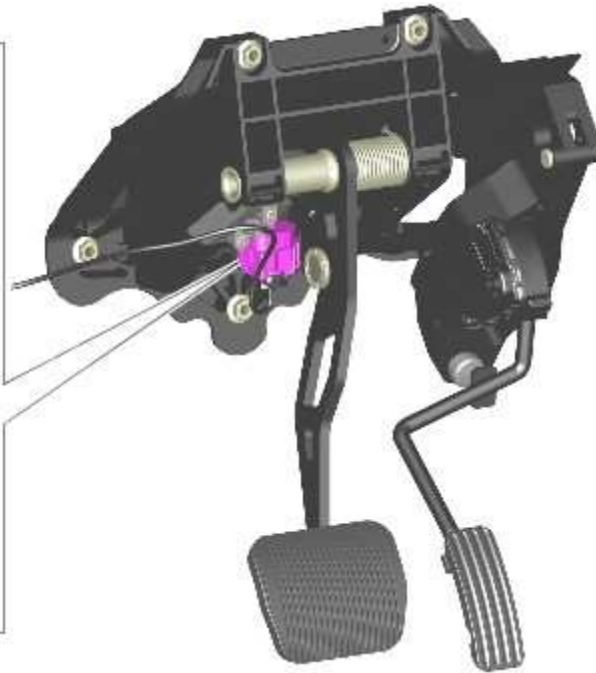
The APP sensors are used to determine the driver's request for vehicle speed, acceleration and deceleration. This value is used by the ECM and the throttle is opened to the correct angle by an electric motor integrated into the throttle body.

The APP sensor signals are checked for range and plausibility. Two separate reference voltages are supplied to the pedal. Should one sensor fail, the other is used as a 'limp – home' input. In limp home mode due to an APP signal failure the ECM will limit the maximum engine speed to 2000 rpm.

Stoplamp Switch



E71776



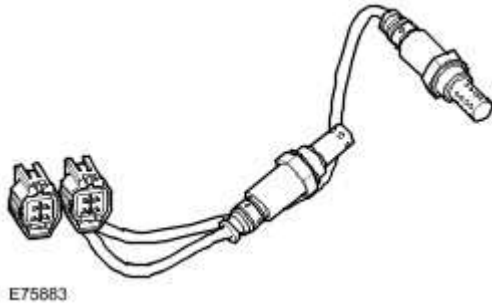
The stoplamp switch is mounted on the brake pedal bracket and is connected to the vehicle harness via a 4 pin multiplug.

When the brake pedal is pressed, the switch contacts close allowing a hard wired signal feed to be sent to the ECM. A stoplamp switch status message is then sent from the ECM to the ABS module on the high speed CAN bus.

Oxygen Sensors

There are four oxygen sensors located in the exhaust system. Two upstream before the catalytic converter and two down stream after the catalytic converter. The sensor monitors the level of oxygen in the exhaust gases and is used to control the fuel/air mixture. Positioning a sensor in the stream of exhaust gasses from each bank enables the ECM to control the fueling on each bank independently of the other, allowing much closer control of the air / fuel ratio and catalyst conversion efficiency.

Oxygen Sensors



The oxygen sensors need to operate at high temperatures in order to function correctly. To achieve the high temperatures required, the sensors are fitted with heater elements that are controlled by a PWM signal from the ECM. The heater elements are operated immediately following engine start and also during low load conditions when the temperature of the exhaust gases is insufficient to maintain the required sensor temperatures. A non-functioning heater delays the sensor's readiness for closed loop control and influences emissions. The PWM duty cycle is carefully controlled to prevent thermal shock to cold sensors.

UHEGO (Universal Heated Exhaust Gas Oxygen) sensors also known as Linear or "Wide Band" sensors produces a constant voltage, with a variable current that is proportional to the oxygen content. This allows closed loop fueling control to a target lambda, i.e. during engine warm up (after the sensor has reached operating temperature and is ready for operation). This improves emission control.

The HEGO sensor uses Zirconium technology that produces an output voltage dependant upon the ratio of exhaust gas oxygen to the ambient oxygen. The device contains a Galvanic cell surrounded by a gas permeable ceramic, the voltage of which depends upon the level of O₂ defusing through. Nominal output voltage of the device for $\lambda = 1$ is 300 to 500m volts. As the fuel mixture becomes richer ($\lambda < 1$) the voltage tends towards 900m volts and as it becomes leaner ($\lambda > 1$) the voltage tends towards 0 volts.

Sensors age with mileage, increasing their response time to switch from rich to lean and lean to rich. This increase in response time influences the ECM closed loop control and leads to progressively increased emissions. Measuring the period of rich to lean and lean to rich switching monitors the response rate of the upstream sensors.

Diagnosis of electrical faults is continually monitored in both the upstream and downstream sensors. This is achieved by checking the signal against maximum and minimum threshold, for open and short circuit conditions.

Oxygen sensors must be treated with the utmost care before and during the fitting process. The sensors have ceramic material within them that can easily crack if dropped / banged or over-torqued. The sensors must be torqued to the required figure, (40-50Nm), with a calibrated torque wrench. Care should be taken not to contaminate the sensor tip when anti-seize compound is used on the thread. The heater pins of HEGO and UHEGO sensor electrical connections are tinned and the signal pins are gold plated. Mixing up sensors could contaminate the connectors and affect system performance.

Failure Modes

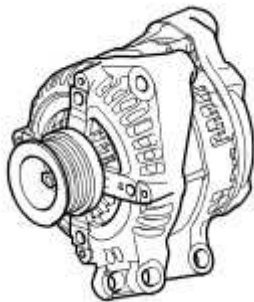
- Mechanical fitting & integrity of the sensor.
- Sensor open circuit / disconnected.
- Short circuit to vehicle supply or ground.
- Lambda ratio outside operating band.
- Crossed sensors bank A & B.
- Contamination from leaded fuel or other sources.
- Change in sensor characteristic.
- Harness damage.
- Air leak into exhaust system.

Failure Symptoms

- Default to Open Loop fueling for the particular cylinder bank
- High CO reading.
- Strong smell of H₂S (rotten eggs) till default condition.
- Excess Emissions.

It is possible to fit front and rear sensors in their opposite location. However the harness connections are of different gender and color to ensure that the sensors cannot be incorrectly connected. In addition to this the upstream sensors have holes around the end of the shroud, whereas the down stream sensors have holes arranged along the length the shroud.

Generator



E47591

The Generator has a multifunction voltage regulator for use in a 14V charging system with 6÷12 zener diode bridge rectifiers.

The ECM monitors the load on the electrical system via PWM signal and adjusts the generator output to match the required load. The ECM also monitors the battery temperature to determine the generator regulator set point. This characteristic is necessary to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximize any rechargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing of the battery with consequent water loss.

The Generator has a smart charge capability that will reduce the electrical load on the Generator reducing torque requirements, this is implemented to utilize the engine torque for other purposes. This is achieved by monitoring three signals to the ECM:

- Generator sense (A sense), measures the battery voltage at the CJB.

- Generator communication (Alt Com) communicates desired Generator voltage set point from ECM to Generator.
- Generator monitor (Alt Mon) communicates the extent of Generator current draw to ECM. This signal also transmits faults to the ECM which will then sends a message to the instrument pack on the CAN bus to illuminate the charge warning lamp.

Fuel Injectors



E47305

The engine has 8 fuel injectors (one per cylinder), each injector is directly driven by the ECM. The injectors are fed by a common fuel rail as part of a 'returnless' fuel system. The fuel rail pressure is regulated to 4.5 bar by a fuel pressure regulator which is integral to the fuel pump module, within the fuel tank. The injectors can be checked by resistance checks. There is a fuel pressure test Schrader valve attached to the fuel rail on the front LH side for fuel pressure testing purposes. The ECM monitors the output power stages of the injector drivers for electrical faults.

The injectors have a resistance of $13.8 \text{ Ohms} \pm 0.7 \text{ Ohms}$ @ 20 Degrees Celsius.

Ignition Coils



E47306

The V8 engine is fitted with eight plug-top coils that are driven directly by the ECM. This means that the ECM, at the point where sufficient charge has built up, switches the primary circuit of each coil and a spark is produced in the spark plug. The positive supply to the coil is fed from a common fuse. Each coil contains a power stage to trigger the primary current. The ECM sends a signal to each of the coils power stage to trigger the power stage switching. Each bank has a feedback signal that is connected to each power stage. If the coil power stage has a failure the feedback signal is not sent, causing the ECM to store a fault code appropriate to the failure.

The ECM calculates the dwell time depending on battery voltage and engine speed to ensure constant secondary energy. This ensures sufficient secondary (spark) energy is always available, without excessive primary current flow thus avoiding overheating or damage to the coils.

The individual cylinder spark timing is calculated from a variety of inputs:

- Engine speed and load.
- Engine temperature.
- Knock control.
- Auto gearbox shift control.
- Idle speed control.

Fuel Pump Relay

The V8 engine has a returnless fuel system. The system pressure is maintained at a constant 4 bar (59 Psi), with no reference to intake manifold pressure. The fuel is supplied to the injectors from a fuel pump fitted within the fuel tank. The electrical supply to this fuel pump is controlled by the ECM via a relay and an Inertia Switch which will turn the fuel off upon a vehicle impact. The fuel system is pressurized as soon as the ECM is powered up, the pump is then switched off until engine start has been achieved.

Cooling Fan Control

The ECM controls an electric fan to provide engine cooling. The ECM supplies the fan with a PWM signal that controls the speed of the fan, thus providing the correct amount of cooling fan speed and airflow. The EMS uses a Hall effect sensor to determine the fan speed.

Variable Valve Control (VVC)

Variable valve timing is used on the V8 engine to enhance low and high speed engine performance and idle speed quality.

For each inlet camshaft the VVC system comprises:

- VVC unit
- Valve timing solenoid

The VVC system alters the phase of the intake valves relative to the fixed timing of the exhaust valves, to alter:

- The mass of air flow to the cylinders.
- The engine torque response.
- Emissions.

The VVC unit uses a vane type device to control the camshaft angle. The system operates over a range of 48 degrees and is advanced or retarded to its optimum position within this

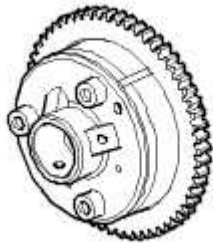
range.

The VVC system is controlled by the ECM based on engine load and speed along with engine oil temperature to calculate the appropriate camshaft position.

The VVC system provides the following advantages:

- Reduced engine emissions and improved fuel consumption which in turn improves the engines internal EGR effect over a wider operating range.
- Enhanced full load torque characteristics.
- Improved fuel economy through optimized torque over the engine speed range.

Variable Valve Timing Unit



E47303

The VVC unit is a hydraulic actuator mounted on the end of the inlet camshaft. The unit advances or retards the camshaft timing to alter the camshaft to crankshaft phase. The ECM controls the VVC timing unit via a oil control solenoid. The oil control solenoid routes oil pressure to the advance or retard chambers either side of the vanes within the VVC unit.

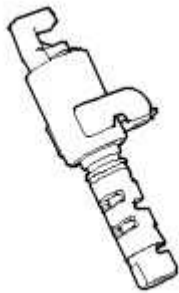
The VVC unit is driven by the primary drive chain and rotates relative to the exhaust camshaft. When the ECM requests a retard in camshaft timing the oil control solenoid is energized which moves the shuttle valve in the solenoid to the relevant position allowing oil pressure to flow out of the advance chambers in the VVC unit whilst simultaneously allowing oil pressure into the retard chambers.

The ECM controls the advancing and retarding of the VVC unit based on engine load and speed. The ECM sends an energize signal to the oil control solenoid until the desired VVC position is achieved. When the desired VVC position is reached, the energizing signal is reduced to hold the oil control solenoid position and consequently desired VVC position. This function is under closed loop control and the ECM can sense any variance in shuttle valve oil pressure via the camshaft position sensor and can adjust the energizing signal to maintain the shuttle valve hold position.

VVC operation can be affected by engine oil temperature and properties. At very low oil temperatures the movement of the VVC mechanism will be slow due to the high viscosity of the oil. While at high oil temperatures the low oil viscosity may impair the VVC operation at low oil pressures. The oil pump has the capacity to cope with these variations in oil pressure while an oil temperature sensor is monitored by the ECM to provide oil temperature feedback. At extremely high oil temperatures the ECM may limit the amount of VVC advance in order to prevent the engine from stalling when returning to idle speed.

VVC does not operate when engine oil pressure is below 1.25 bar. This is because there is insufficient pressure to release the VVC units internal stopper pin. This occurs when the engine is shut down and the VVC unit has returned to the retarded position. The stopper pin locks the VVC unit to the camshaft to ensure camshaft stability during the next start up.

Valve Control Solenoid



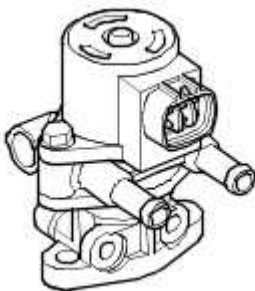
E47302

Valve Timing Solenoid

The valve timing solenoid controls the position of the shuttle valve in the bush carrier. A plunger on the solenoid extends when the solenoid is energized and retracts when the solenoid is de-energized.

When the valve timing solenoids are de-energized, the coil springs in the bush carriers position the shuttle valves to connect the valve timing units to drain. In the valve timing units, the return springs hold the ring pistons and gears in the retarded position. When the valve timing solenoids are energized by the ECM, the solenoid plungers position the shuttle valves to direct engine oil to the valve timing units. In the valve timing units, the oil pressure overcomes the force of the return springs and moves the gears and ring pistons to the advanced position. System response times are 1.0 second maximum for advancing and 0.7 second maximum for retarding. While the valve timing is in the retarded mode, the ECM produces a periodic lubrication pulse. This momentarily energizes the valve timing solenoids to allow a spurt of oil into the valve timing units. The lubrication pulse occurs once every 5 minutes.

Exhaust Gas Recirculation (EGR) Valve



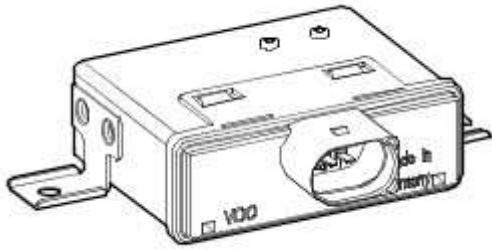
E47299

The EGR valve is an electrically controlled valve that allows burned exhaust gas to be

recirculated back into the engine. The EGR valve consists of a stepper motor that opens and closes the valve in steps. Since exhaust gas has much less oxygen than air, it is basically inert. It takes the place of air in the cylinder and reduces combustion temperature. As the combustion temperature is reduced, so are the oxides of nitrogen (NOx).

The EGR valve is located on the intake manifold with a pipe connecting the exhaust manifold to the valve. Connection between the sensor and the harness is via a six-way connector.

Fuel Pump Driver Module



E58398

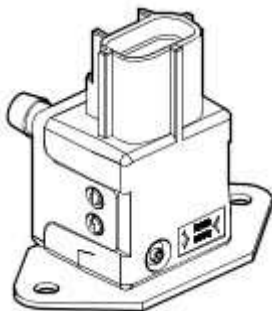
The Fuel Pump Driver Module (FPDM) is located in the rear LH quarter adjacent to the parking aid control module.

The fuel pump is control by the ECM. The ECM sends a PWM signal to the FPDM, the frequency of the signal determines the duty cycle of the pump. The PWM signal to the pump represents half the ON time of the pump. If the ECM transmits a 50% on time the FPDM drives the pump at 100%. If the ECM transmits a 5% ON time the FPDM drives the pump at 10%. The FPDM will only turn the fuel pump ON if it receives a valid signal between 4% and 50%. When The ECM requires the fuel pump to be turned OFF the ECM transmits a duty cycle signal of 75%.

The status of the FPDM is monitored by the ECM. Any errors can be retrieved from the ECM using IDS. The FPDM cannot be interrogated for diagnostic purposes.

The MAP controls The FPDM in response to inputs from the fuel rail pressure sensor, MAP and the MAF/IAT sensor.

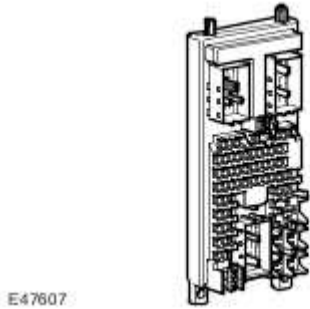
Fuel Rail Pressure Sensor



E58945

The fuel rail pressure sensor is located on top of the fuel rail adjacent to the fuel inlet. The fuel rail pressure sensor measures the pressure of the fuel in the fuel rail. This input is then used by the FPDM to control the amount of fuel delivered to the fuel rail. The fuel rail pressure sensor is a pressure transducer device. A vacuum pipe connects to the intake manifold for manifold pressure. The ECM receives a voltage from the FRP sensor which is proportional to the fuel pressure in the fuel injection supply manifold.

Central Junction Box



The ECM is connected to ignition switch I and II. When the ignition is turned on 12V is applied to the Ignition Sense input. The ECM then starts its power up routines and turns on the ECM main relay; the main power to the ECM and it's associated system components. When the ignition is turned OFF the ECM will maintain its powered up state for up to 20 minutes while it initiates its power down routine and on completion will turn off the ECM main relay. The ECM will normally power down in approximately 60 seconds, do not disconnect the battery until the ECM is completely powered down.

Secondary Air Injection

The secondary air injection system comprises:

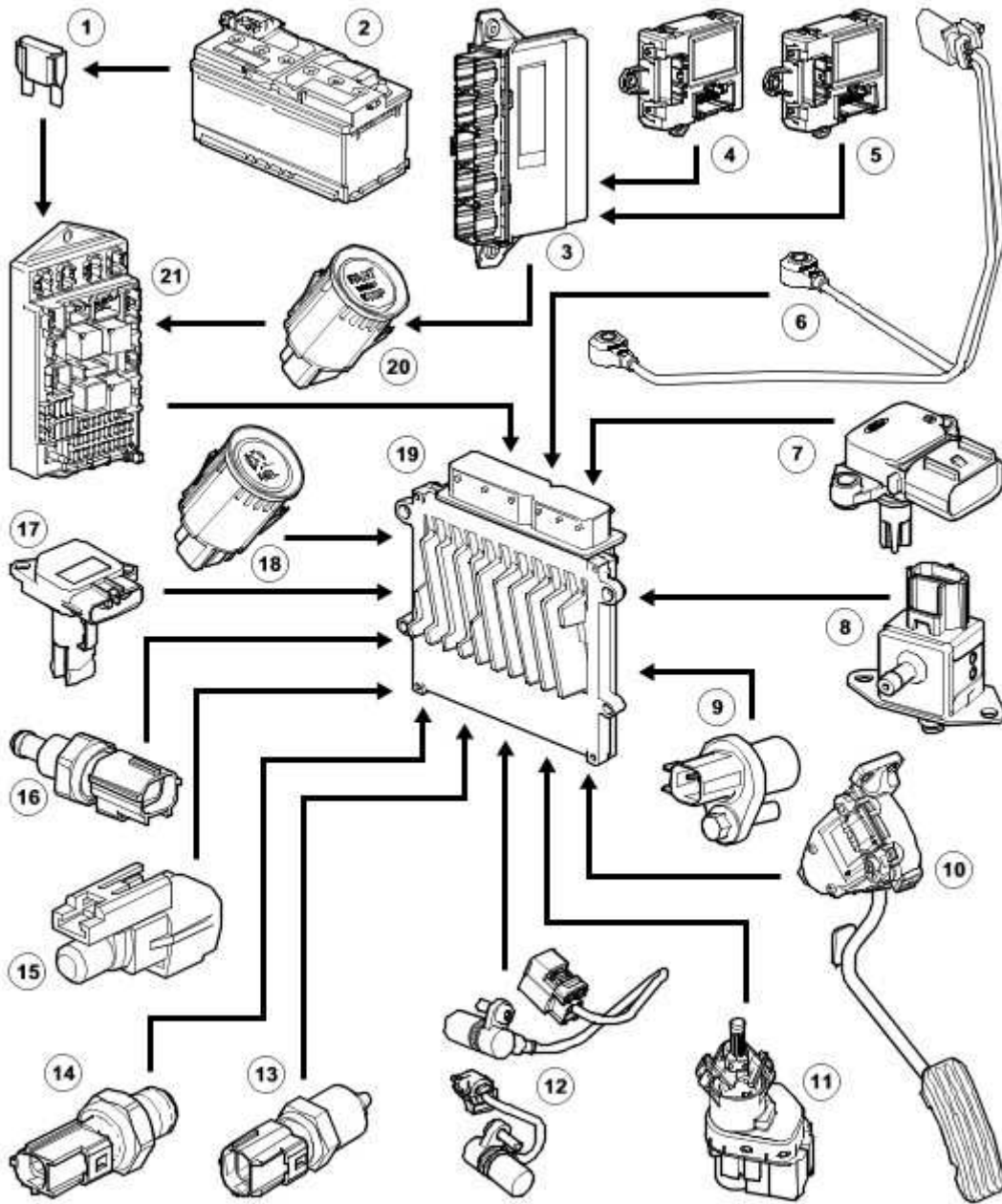
- SAI pump
- SAI valve
- Associated pipes
- SAI Manifold Absolute Pressure (MAP) sensor (NAS only)

The ECM controls the SAI pump and SAI valve with a PWM signal and on NAS vehicles measures the system pressure via the MAP sensor. For additional information, refer to [Engine Emission Control](#) (303-08 Engine Emission Control)

CONTROL DIAGRAM SHEET 1 of 3

NOTE:

A = Hardwired connection



E62360

A →

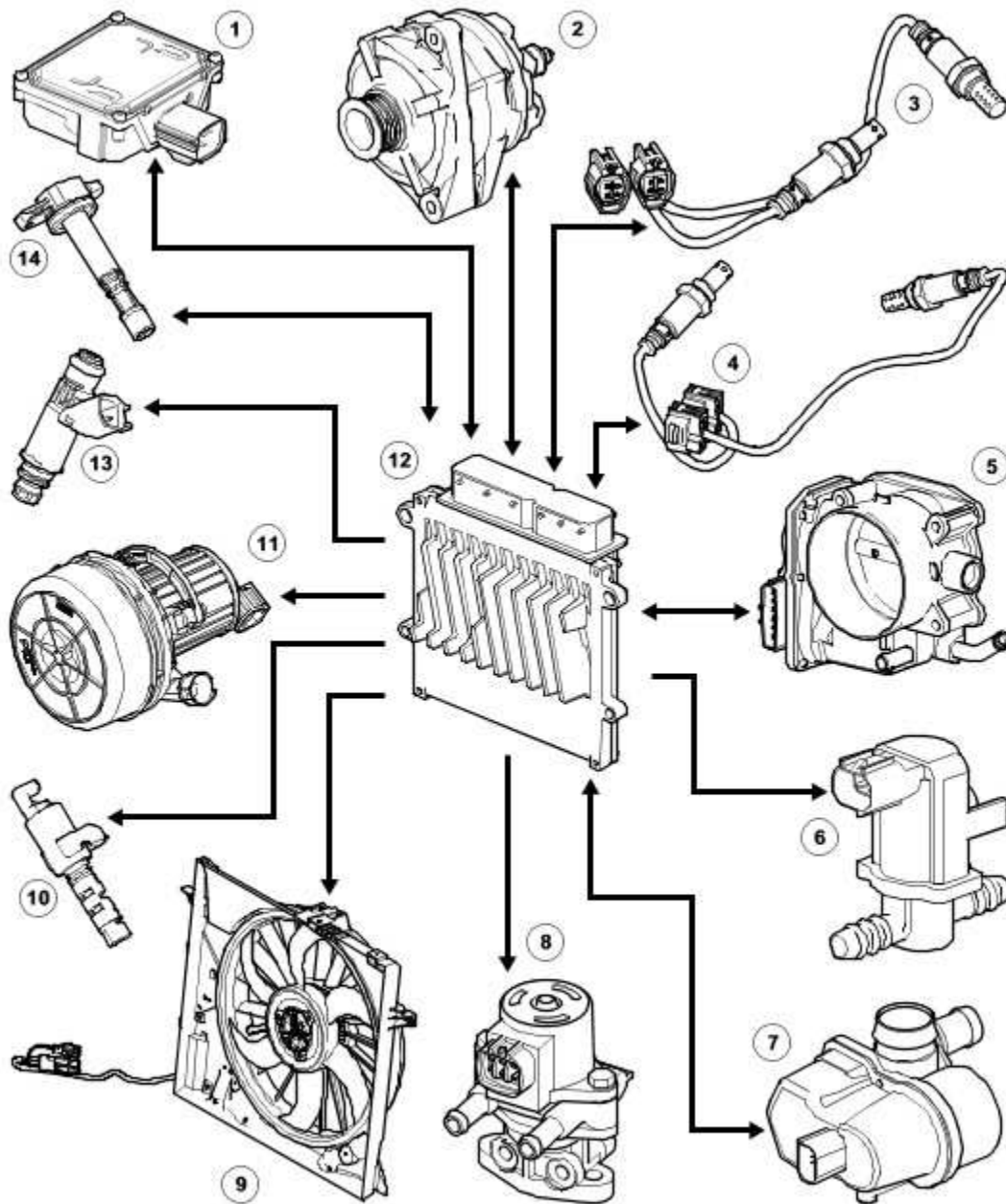
Item	Part Number	Description
1		Fuse
2		Battery
3		Keyless vehicle module
4		Door module
5		Door module
6		knock sensors
7		MAP sensor
8		Fuel rail pressure sensor

9		CKP sensor
10		APP
11		Stop lamp switch
12		CMP sensor
13		Engine coolant temperature sensor
14		Oil pressure sensor
15		Air temperature sensor
16		Fuel rail temperature sensor
17		MAF/IAT sensor
18		Automatic Speed Limiter switch
19		ECM
20		Start/Stop switch
21		Central Junction Box (CJB)

CONTROL DIAGRAM SHEET 2 of 3

NOTE:

A = Hardwired connection



E62361

A →

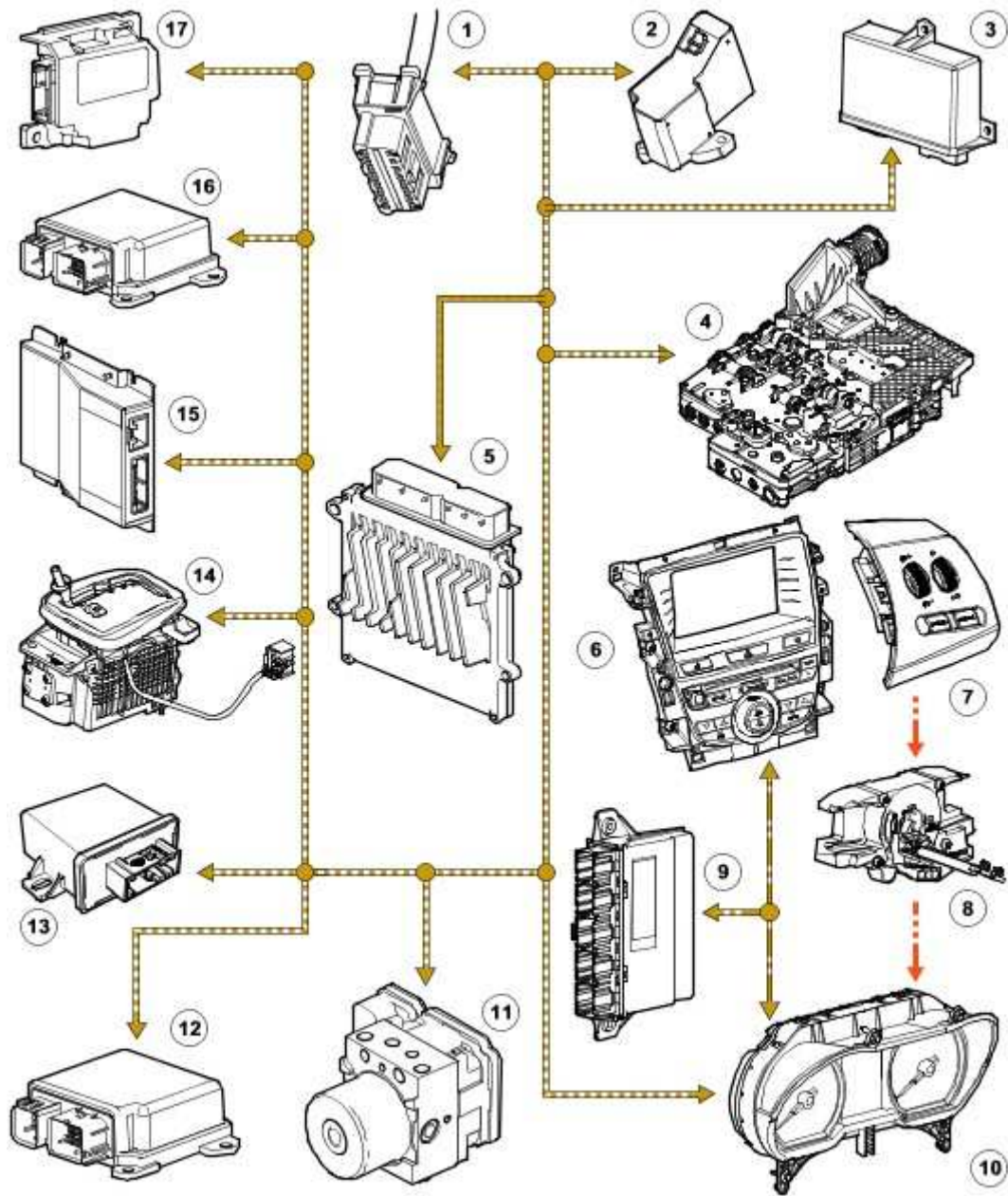
Item	Part Number	Description
1		FPDM
2		Generator
3		HO2S (upstream)
4		HO2S (downstream)
5		Electric throttle
6		Purge valve
7		DMTL pump
8		EGR valve

9		Engine cooling fan
10		VCT solenoid
11		Secondary air injection pump
12		ECM
13		Injector (8 off)
14		Ignition coil (8 off)

CONTROL DIAGRAM SHEET 3 of 3

NOTE:

D = High speed CAN bus; N=Medium speed CAN bus; O = LIN (local interconnect network) bus



E65886



Item	Part Number	Description
1		Diagnostic socket
2		Steering column lock
3		Park brake module
4		TCM
5		ECM
6		Integrated control panel
7		Steering wheel speed control switches
8		Rotary coupler

9		Keyless vehicle module
10		Instrument cluster
11		ABS control module
12		RCM
13		Adaptive front lighting system control module
14		Gear shift module
15		Adaptive Damping Control Module (ADCM)
16		Pedestrian protection module
17		Adaptive speed control module

PRINCIPLES OF OPERATION

ECM Adaptions

The ECM has the ability to adapt the values it uses to control certain outputs. This capability ensures the EMS can meet emissions legislation and improve the refinement of the engine throughout its operating range.

The components which have adaptions associated with them are:

- The APP sensor
- The H02S
- The MAF/IAT sensor
- The CKP sensor
- Electric throttle body.

UHEGO/HEGO and MAF/IAT Sensor

There are several adaptive maps associated with the fueling strategy. Within the fueling strategy the ECM calculates short-term adaptions and long term adaptions. The ECM will monitor the deterioration of the oxygen sensors (HEGO and UHEGO) over a period of time. It will also monitor the current correction associated with the sensors.

The ECM will store a fault code in circumstances where an adaption is forced to exceed its operating parameters. At the same time, the ECM will record the engine speed, engine load and intake air temperature.

CKP Sensor

The characteristics of the signal supplied by the CKP sensor are learned by the ECM. This enables the ECM to set an adaption and support the engine misfire detection function. Due to the small variation between different flywheels and different CKP sensors, the adaption must

be reset if either component is renewed, or removed and refitted. It is also necessary to reset the flywheel adaption if the ECM is renewed or replaced. The ECM supports four flywheel adaptations for the CKP sensor. Each adaptation relates to a specific engine speed range. The engine speed ranges are detailed in the table below:

Adaptions	Engine Speed, rev/min
1	1800 - 3000
2	3001 - 3800
3	3801 - 4600
4	4601 - 5400

Misfire Detection

Legislation requires that the ECM must be able to detect the presence of an engine misfire. It must be able to detect misfires at two separate levels. The first level is a misfire that could lead to the vehicle emissions exceeding 1.5 times the Federal Test Procedure (FTP) requirements for the engine. The second level is a misfire that may cause catalyst damage.

The ECM monitors the number of misfire occurrences within two engine speed ranges. If the ECM detects more than a predetermined number of misfire occurrences within either of these two ranges, over two consecutive journeys, the ECM will record a fault code and details of the engine speed, engine load and engine coolant temperature. In addition, the ECM monitors the number of misfire occurrences that happen in a 'window' of 200 engine revolutions. The misfire occurrences are assigned a weighting according to their likely impact on the catalysts. If the number of misfires exceeds a certain value, the ECM stores catalyst-damaging fault codes, along with the engine speed, engine load and engine coolant temperature.

The signal from the crankshaft position sensor indicates how fast the poles on the flywheel are passing the sensor tip. A sine wave is generated each time a pole passes the sensor tip. The ECM can detect variations in flywheel speed by monitoring the sine wave signal supplied by the crankshaft position sensor.

By assessing this signal, the ECM can detect the presence of an engine misfire. At this time, the ECM will assess the amount of variation in the signal received from the CKP and assigns a roughness value to it. This roughness value can be viewed within the real time monitoring feature, using IDS. The ECM will evaluate the signal against a number of factors and will decide whether to count the occurrence or ignore it. The ECM can assign a roughness and misfire signal for each cylinder, (i.e. identify which cylinder is misfiring).

IDS Diagnostics

The ECM stores faults as DTC, referred to as 'P' codes. The 'P' codes are defined by OBD legislation and, together with their associated environmental and freeze frame data, can be read using a third party scan tool or IDS. IDS can also read real time data from each sensor,

the adaptive values currently being employed and the current fueling, ignition and idle settings.

Electronic Engine Controls

Principle of Operation

For a detailed description of electronic engine controls, refer to the relevant Description and Operation section of the workshop manual.

[Electronic Engine Controls](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Throttle body • Poly-vee belt 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine Control Module (ECM) • Transmission Control Module (TCM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4 . If the cause is not visually evident, verify the customer concern and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine non-start		
Engine does not crank	<ul style="list-style-type: none"> • Security system /Immobilizer engaged • Engine in shut-down mode • ECM relay • Battery • Park/Neutral switch • Starting system 	<ul style="list-style-type: none"> • Check that the security system is disarmed • Read DTCs and refer to DTC Index in this section for ECM relay tests • Ensure the battery is in fully charged and

	<ul style="list-style-type: none"> • Engine seized 	<p>serviceable condition</p> <ul style="list-style-type: none"> • For Park/Neutral switch tests. • External Controls • For starting system tests. • Starting System • For engine system tests. • Engine
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine controls 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests. • Engine Ignition • For fuel system tests. • Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 • Read DTCs and refer to DTC Index in this section for electronic engine control tests
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • Ignition coil failure(s) 	<ul style="list-style-type: none"> • For purge valve tests. • Evaporative Emissions • For fuel system tests. • Fuel Tank and Lines • For ignition system tests. • Engine Ignition
Difficult to start		
Difficult cold start	<ul style="list-style-type: none"> • Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Exhaust gas recirculation (EGR) valve stuck open • Fuel pump • Evaporative emissions 	<ul style="list-style-type: none"> • Check the engine coolant level and condition. • Specifications • Ensure the battery is in a fully charged and serviceable condition • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For EGR valve tests.

	purge valve	<p>Engine Emission Control</p> <ul style="list-style-type: none"> For fuel system tests. Fuel Tank and Lines For purge valve tests. Evaporative Emissions
Difficult hot start	<ul style="list-style-type: none"> Injector leak Electronic engine controls Evaporative emissions purge valve Fuel pump Ignition system EGR valve stuck open 	<ul style="list-style-type: none"> Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) Read DTCs and refer to DTC Index in this section for electronic engine control tests For purge valve tests. Evaporative Emissions For fuel system tests. Fuel Tank and Lines For ignition system tests. Engine Ignition For EGR valve tests. Engine Emission Control
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> Injector leak Electronic engine controls Evaporative emissions purge valve Fuel pump Ignition system EGR valve stuck open 	<ul style="list-style-type: none"> Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) Read DTCs and refer to DTC Index in this section for electronic engine control tests For purge valve tests. Evaporative Emissions For fuel system tests. Fuel Tank and Lines For ignition system tests. Engine Ignition For EGR valve tests. Engine Emission Control
Engine cranks too fast/slow	<ul style="list-style-type: none"> Compressions high/low Battery 	<ul style="list-style-type: none"> Carry out compression tests.

	<ul style="list-style-type: none"> Starting system 	<p>Engine</p> <ul style="list-style-type: none"> Ensure battery is in a fully charged and serviceable condition For starting system tests. <p>Starting System</p>
Engine stalls		
Engine stalls soon after start	<ul style="list-style-type: none"> Breather system disconnected/restricted ECM relay Electronic engine controls Ignition system Air intake system restricted Air leakage Fuel lines 	<ul style="list-style-type: none"> Ensure the engine breather system is free from restriction and is correctly installed Read DTCs and refer to DTC Index in this section for ECM relay tests Read DTCs and refer to DTC Index in this section for electronic engine control tests For ignition system tests. <p>Engine Ignition</p> <ul style="list-style-type: none"> Check for blockage in air cleaner element and air intake system Check for leakage in air intake system For fuel system tests. <p>Fuel Tank and Lines</p>
Engine stalls on overrun	<ul style="list-style-type: none"> ECM relay Throttle position (TP) sensors 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for ECM relay tests Read DTCs and refer to DTC Index in this section for TP sensor tests
Engine stalls at steady speed	<ul style="list-style-type: none"> ECM relay CKP sensor TP sensors 	<ul style="list-style-type: none"> Read DTCs and refer to DTC Index in this section for ECM relay, CKP, and TP sensor tests

<p>Engine stalls with speed control enabled</p>	<ul style="list-style-type: none"> • ECM relay 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay tests
<p>Engine stalls when manoeuvring</p>	<ul style="list-style-type: none"> • ECM relay • TP sensors • Additional engine loads (PAS, air conditioning, etc) • Transmission malfunction • CAN malfunction 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for ECM relay, and TP sensor tests • Check for excessive loads being placed on the engine from PAS, air conditioning systems etc. • For transmission system tests. Diagnostic Strategy • For CAN network tests. Communications Network
<p>Poor driveability</p>		
<p>Engine hesitates/poor acceleration</p>	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine controls • Ignition system • EGR valve stuck • Transmission malfunction • Restricted pedal travel (carpet, etc) 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Carry out fuel injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • Check for leakage from air intake system • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control • For transmission system tests. Diagnostic Strategy • Ensure accelerator pedal is free from restriction

Engine backfires	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) hub 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Check for leakage from air intake system • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition • Read DTCs and refer to DTC Index in this section for VCT system tests
Engine surges	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Electronic engine controls • Ignition system 	<ul style="list-style-type: none"> • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For ignition system tests. Engine Ignition
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump, fuel lines, fuel quality • Air leakage • Sticking VCT hub 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests • For fuel system tests. Fuel Tank and Lines • Check for leakage from air intake system • Read DTCs and refer to DTC Index in this section for VCT system tests
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC Index in this section for electronic engine control tests
Speed control inhibited or disabled	<ul style="list-style-type: none"> • Default mode enabled • Speed control, brake switch • Electronic engine 	<ul style="list-style-type: none"> • Check message center for default message, read DTCs and refer to DTC Index

	<ul style="list-style-type: none"> controls CAN fault 	<ul style="list-style-type: none"> For speed control, and brake switch tests. Speed Control Read DTCs and refer to DTC Index in this section for electronic engine control tests For CAN network tests. Communications Network
Poor throttle response	<ul style="list-style-type: none"> Breather system disconnected/restricted Electronic engine controls Transmission malfunction Traction control event Air leakage 	<ul style="list-style-type: none"> Ensure engine breather system is free from restriction and is correctly installed Read DTCs and refer to DTC Index in this section for electronic engine control tests For transmission system tests. Diagnostic Strategy Check for leakage in air intake system
Engine defaults, warning light and messages. Refer to the owner handbook	<ul style="list-style-type: none"> Park/Neutral switch Electronic engine controls 	<ul style="list-style-type: none"> For Park/Neutral switch tests. External Controls Read DTCs and refer to DTC Index in this section for electronic engine control tests

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the module/component is suspect and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Causes	Action
C003100	Left front wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - left front wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
C003400	Right front wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - right front wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
C003700	Left rear wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - left rear wheel speed signal 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
C003A00	Right rear wheel speed sensor	<ul style="list-style-type: none"> Invalid data received from ABS - right rear 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for

		wheel speed signal	DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
P001100	Intake camshaft position - timing over-advanced (bank 1)	<ul style="list-style-type: none"> • Variable Camshaft Timing (VCT) circuit fault • Valve timing incorrectly set • Timing chain has slipped 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the valve timing. Timing Drive Components (12.65.13)
P001200	Intake camshaft position - timing over-retarded (bank 1)	<ul style="list-style-type: none"> • Variable Camshaft Timing (VCT) circuit fault • Valve timing incorrectly set • Timing chain has slipped 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the valve timing. Timing Drive Components (12.65.13)
P001600	Crankshaft position (CKP)/Camshaft position (CMP) sensor correlation, right hand bank	<ul style="list-style-type: none"> • The relative positions of the CKP and CMP teeth are not correct Sensors incorrectly aligned on rebuild 	Reset the sensor positions. Camshaft Position (CMP) Sensor RH (18.31.11) Crankshaft Position (CKP) Sensor (18.30.12)
P001800	Crankshaft position (CKP)/Camshaft position (CMP) sensor correlation, left hand bank	<ul style="list-style-type: none"> • The relative positions of the CKP and CMP teeth are not correct Sensors incorrectly aligned on rebuild 	Reset the sensor positions. Camshaft Position (CMP) Sensor LH (18.31.12) Crankshaft Position (CKP) Sensor (18.30.12)
P002100	Intake camshaft position - timing over-advanced (bank 2)	<ul style="list-style-type: none"> • Variable Camshaft Timing (VCT) circuit fault • Valve timing incorrectly set 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer

		<ul style="list-style-type: none"> Timing chain has slipped 	<p>approved diagnostic system</p> <ul style="list-style-type: none"> Check the valve timing. Timing Drive Components (12.65.13)
P002200	Intake camshaft position - timing over-retarded (bank 2)	<ul style="list-style-type: none"> Variable Camshaft Timing (VCT) circuit fault Valve timing incorrectly set Timing chain has slipped 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the valve timing. Timing Drive Components (12.65.13)
P002672	Variable Camshaft Timing (VCT) control solenoid (bank 1) circuit range/performance - actuator stuck open	<ul style="list-style-type: none"> VCT solenoid fault Oil contamination VCT oil flow fault VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the oil condition and flow Check for mechanical failure of components
P002677	Variable Camshaft Timing (VCT) control solenoid (bank 1) circuit range/performance - commanded position not achievable	<ul style="list-style-type: none"> VCT solenoid fault Oil contamination VCT oil flow fault VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check the oil condition and flow Check for mechanical failure of components
P002872	Variable Camshaft	<ul style="list-style-type: none"> VCT solenoid fault 	<ul style="list-style-type: none"> Carry out any

	Timing (VCT) control solenoid (bank 2) circuit range/performance - actuator stuck open	<ul style="list-style-type: none"> • Oil contamination • VCT oil flow fault • VCT/Camshaft mechanical failure 	<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check the oil condition and flow • Check for mechanical failure of components
P002877	Variable Camshaft Timing (VCT) control solenoid (bank 2) circuit range/performance - commanded position not achievable	<ul style="list-style-type: none"> • VCT solenoid fault • Oil contamination • VCT oil flow fault • VCT/Camshaft mechanical failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check the oil condition and flow • Check for mechanical failure of components
P003100	HO2S heater control circuit low (bank 1)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P003200	HO2S heater control circuit high (bank 1)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)

P003600	Catalyst monitor sensor heater control circuit (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater circuit - circuit fault • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P005100	HO2S heater control circuit low (bank 2)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P005200	HO2S heater control circuit high (bank 2)	<ul style="list-style-type: none"> • HO2S heater circuit - circuit fault • HO2S heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P005600	Catalyst monitor sensor heater control circuit (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater circuit - circuit fault • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. Catalyst Monitor

			Sensor (18.30.66)
P006900	Manifold absolute pressure (MAP)/Barometric pressure correlation	<ul style="list-style-type: none"> MAP sensor failure BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> Check for MAP sensor related DTCs and refer to the DTC Index in this section Install a new ECM. Refer to new module/component installation Note at top of DTC Index
P007100	Ambient air temperature sensor range/performance	<ul style="list-style-type: none"> Ambient temperature value missing from CAN bus 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007200	Ambient air temperature sensor circuit low	<ul style="list-style-type: none"> Ambient air temperature sensor circuit - high resistance Ambient air temperature sensor circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007300	Ambient air temperature sensor circuit high	<ul style="list-style-type: none"> Ambient air temperature sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007500	Variable Camshaft Timing (VCT) control circuit (bank 1)	<ul style="list-style-type: none"> VCT control solenoid circuit - high resistance, disconnected VCT solenoid failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new VCT control solenoid as necessary. Variable Camshaft

			Timing (VCT) Oil Control Solenoid (18.30.90)
P007600	Variable Camshaft Timing (VCT) control circuit low (bank 1)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to ground, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P007700	Variable Camshaft Timing (VCT) control circuit high (bank 1)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to power • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008100	Variable Camshaft Timing (VCT) control circuit (bank 2)	<ul style="list-style-type: none"> • VCT control solenoid circuit - high resistance, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)

P008200	Variable Camshaft Timing (VCT) control circuit low (bank 2)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to ground, disconnected • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008300	Variable Camshaft Timing (VCT) control circuit high (bank 2)	<ul style="list-style-type: none"> • VCT control solenoid circuit - short to power • VCT solenoid failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new VCT control solenoid as necessary. Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)
P008700	Fuel rail/system pressure - too low	<ul style="list-style-type: none"> • Fuel rail pressure (FRP) sensor, sensing circuit - short to ground, open circuit • FRP sensor supply circuit - high resistance • FRP sensor failure • Fuel pump failure • Fuel line leak, restriction 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P008800	Fuel rail/system	<ul style="list-style-type: none"> • FRP sensor 	<ul style="list-style-type: none"> • Carry out any

	pressure - too high	<p>supply/sensing circuits - short to each other</p> <ul style="list-style-type: none"> • FRP sensor sensing circuit - short to power • FRP sensor ground circuit - high resistance • FRP sensor failure • Restricted fuel line • Fuel pump short circuit to power 	<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) • For fuel system tests. Fuel Tank and Lines
P010100	Mass Air Flow (MAF) circuit - range/performance	<ul style="list-style-type: none"> • Blocked air cleaner element • Leakage from air intake system • Engine breather leak • MAF sensor sensing circuit - high resistance, intermittent short to ground • MAF sensor supply circuit - high resistance • MAF sensor failure 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leak from air intake system, rectify as necessary • Ensure the engine breather system is correctly installed and in serviceable condition • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010200	Mass Air Flow (MAF) circuit - low input	<ul style="list-style-type: none"> • MAF sensor supply circuit - short to ground, high resistance • MAF sensor ground circuit - high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved

		<ul style="list-style-type: none"> MAF sensor failure 	<p>diagnostic system</p> <ul style="list-style-type: none"> Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010300	Mass Air Flow (MAF) circuit - high input	<ul style="list-style-type: none"> MAF sensor sensing circuit - short to power MAF sensor ground circuit - high resistance MAF sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P010600	Manifold Absolute Pressure (MAP) sensor - range/performance	<ul style="list-style-type: none"> Intake manifold air leak (loose or missing component) MAP sensor signal circuit fault MAP sensor failure 	<ul style="list-style-type: none"> Check for correct installation and serviceability of intake manifold and associated components Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAP sensor as necessary. Manifold Absolute Pressure (MAP) Sensor (18.30.86)
P011123	Intake Air Temperature (IAT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011124	Intake Air Temperature (IAT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011129	Intake Air Temperature (IAT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance IAT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011200	Intake Air Temperature (IAT) sensor circuit - low input	<ul style="list-style-type: none"> IAT sensor sensing circuit - high resistance, disconnected IAT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)

P011300	Intake Air Temperature (IAT) sensor circuit - high input	<ul style="list-style-type: none"> • IAT sensor sensing circuit - short to ground, short to power • IAT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new MAF sensor as necessary. Mass Air Flow (MAF) Sensor (18.30.15)
P011623	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011624	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer

			<p>approved diagnostic system</p> <ul style="list-style-type: none"> • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011629	Engine Coolant Temperature (ECT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. Specifications • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Install a new ECT sensor as necessary. Engine Coolant Temperature (ECT) Sensor (18.30.10)
P011700	Engine Coolant Temperature (ECT) sensor circuit - low input	<ul style="list-style-type: none"> • ECT sensor sensing circuit - short to power, high resistance, open circuit, disconnected • ECT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			<p>diagnostic system</p> <ul style="list-style-type: none"> Install a new ECT sensor as necessary. <p>Engine Coolant Temperature (ECT) Sensor (18.30.10)</p>
P011800	Engine Coolant Temperature (ECT) sensor circuit - high input	<ul style="list-style-type: none"> Engine overheat condition/cooling fan failure ECT sensor sensing circuit - short to ground ECT sensor failure 	<ul style="list-style-type: none"> Check for cooling fan circuit DTCs and refer to relevant action specified in DTC Index Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new ECT sensor as necessary. <p>Engine Coolant Temperature (ECT) Sensor (18.30.10)</p>
P012100	Throttle Position (TP) sensor circuits TP 1 and TP 2 - range/performance	<ul style="list-style-type: none"> TP sensor sensing circuits TP 1 and TP 2 - short to battery, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. <p>Throttle Body (19.70.04)</p>
P012200	Throttle Position (TP) sensor circuit TP 1 - low input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 1 - short to ground, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new

			<p>throttle body as necessary.</p> <p>Throttle Body (19.70.04)</p>
P012300	Throttle Position (TP) sensor circuit TP 1 - high input	<ul style="list-style-type: none"> • TP sensor sensing circuit TP1 - short to power • TP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body as necessary. <p>Throttle Body (19.70.04)</p>
P012500	Insufficient coolant temperature for closed loop fuel control	<ul style="list-style-type: none"> • Low coolant level • ECT sensor sensing circuit - intermittent high resistance • Engine thermostat failure • ECT sensor failure 	<ul style="list-style-type: none"> • Fill cooling system to correct level and specification. <p>Specifications</p> <ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check and install new engine thermostat as necessary. <p>Thermostat - Vehicles Without Supercharger (26.45.07)</p> <ul style="list-style-type: none"> • Install a new ECT sensor as necessary. <p>Engine Coolant Temperature (ECT) Sensor (18.30.10)</p>
P012800	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<ul style="list-style-type: none"> • Low/contaminated coolant • Thermostat • Cooling fan 	<ul style="list-style-type: none"> • Drain and re-fill cooling system to correct level and specification. <p>Specifications</p>

		circuit(s)/module	<p>Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8</p> <ul style="list-style-type: none"> • Check and install a new engine thermostat as necessary. Thermostat - Vehicles Without: Supercharger (26.45.07) • Check for correct operation of cooling fan, check for DTCs and refer to DTC Index
P01311A	Heated Oxygen Sensor (H02S) circuit - low voltage (bank 1)	<ul style="list-style-type: none"> • Exhaust gas leakage • H02S variable/constant circuit - circuit fault, disconnected • H02S failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P01321B	Heated Oxygen Sensor (H02S) circuit - high voltage (bank 1)	<ul style="list-style-type: none"> • Exhaust gas leakage • H02S variable/constant circuit - circuit fault, disconnected • H02S failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • Carry out any pinpoint tests associated with this DTC using the

			<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P013300	Heated Oxygen Sensor (HO2S) circuit - slow response (bank 1)	<ul style="list-style-type: none"> • HO2S to ECM wiring shield high resistance • Exhaust leak • Fuel control system fault • HO2 sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • For fuel charging and controls tests. Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 • Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P013400	Heated Oxygen Sensor (HO2S) circuit - no activity detected (bank 1)	<ul style="list-style-type: none"> • HO2S slow activation 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P013700	Catalyst monitor sensor circuit - low voltage (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor sensing circuit - short to ground, high resistance, disconnected • Catalyst monitor sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst

			<p>monitor sensor as necessary.</p> <p>Catalyst Monitor Sensor (18.30.66)</p>
P013800	Catalyst monitor sensor circuit - high voltage (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor sensing circuit - short to power • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install new catalyst monitor sensor as necessary. <p>Catalyst Monitor Sensor (18.30.66)</p>
P013900	Catalyst monitor sensor circuit - slow response (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor slow response 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P014000	Catalyst monitor sensor circuit - no activity detected (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensing circuit - short to ground, short to power, high resistance, disconnected • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor - mechanical damage 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new catalyst monitor sensor as necessary. <p>Catalyst Monitor Sensor (18.30.66)</p>
P014100	Catalyst monitor heater circuit (bank 1)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater control circuit - high resistance • Catalyst monitor sensor heater failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new

			<p>catalyst monitor sensor as necessary.</p> <p>Catalyst Monitor Sensor (18.30.66)</p>
P01511A	<p>Heated Oxygen Sensor (HO2S) circuit - low voltage (bank 2)</p>	<ul style="list-style-type: none"> • HO2S sensing circuit - short to ground, short to power, high resistance • HO2S failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. <p>Heated Oxygen Sensor (HO2S)</p>
P01521B	<p>Heated Oxygen Sensor (HO2S) circuit - high voltage (bank 2)</p>	<ul style="list-style-type: none"> • HO2S sensing circuit - short to ground, short to power, high resistance • HO2S failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new HO2S as necessary. <p>Heated Oxygen Sensor (HO2S)</p>
P015300	<p>Heated Oxygen Sensor (HO2S) circuit - slow response (bank 2)</p>	<ul style="list-style-type: none"> • HO2S to ECM wiring shield high resistance • Exhaust leak • Fuel control system fault • HO2 sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check for and rectify any exhaust leak between cylinder head and catalytic converter (e.g. manifolds, EGR system etc.) • For fuel system and controls tests. <p>Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L</p>

			<p>SC V8 - AJV8</p> <ul style="list-style-type: none"> Install a new HO2S as necessary. Heated Oxygen Sensor (HO2S)
P015400	Heated Oxygen Sensor (HO2S) circuit - no activity detected (bank 2)	<ul style="list-style-type: none"> HO2S slow activation 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P015700	Catalyst monitor sensor circuit - low voltage (bank 2)	<ul style="list-style-type: none"> Catalyst monitor sensor sensing circuit - short to ground, high resistance, disconnected Catalyst monitor sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P015800	Catalyst monitor sensor circuit - high voltage (bank 2)	<ul style="list-style-type: none"> Catalyst monitor sensor sensing circuit - short to power Catalyst monitor sensor ground braided shield - high resistance Catalyst monitor sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P015900	Catalyst monitor sensor circuit - slow response (bank 2)	<ul style="list-style-type: none"> Catalyst monitor sensor slow response 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P016000	Catalyst monitor sensor circuit - no activity detected (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensing circuit - short to ground, short to power, high resistance, disconnected • Catalyst monitor sensor ground braided shield - high resistance • Catalyst monitor sensor - mechanical damage 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new catalyst monitor sensor as necessary. Catalyst Monitor Sensor (18.30.66)
P016100	Catalyst monitor sensor heater circuit (bank 2)	<ul style="list-style-type: none"> • Catalyst monitor sensor heater control circuit malfunction 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> • Air intake leak between MAF sensor and cylinder head • Fuel filter, injector, system restriction • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> • Check for leak from air intake system • For fuel system tests. Fuel Tank and Lines • Read DTCs and refer to DTC Index in this section for MAF sensor tests • Check and rectify any exhaust leak prior to catalytic converter
P017200	System too rich (bank 1)	<ul style="list-style-type: none"> • Restricted air cleaner • Leaking fuel injector(s) • Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for 	<ul style="list-style-type: none"> • Check air cleaner element is free from restriction • Check for leaking injectors, install new injector(s) as necessary. Fuel Injector

		<ul style="list-style-type: none"> long enough) MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> (18.10.01) Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling Read DTCs and refer to DTC Index in this section for MAF sensor tests
P017400	System too lean (bank 2)	<ul style="list-style-type: none"> Air intake leak between MAF sensor and cylinder head Fuel filter, injector, system restriction MAF sensor fault (low intake air flow) Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> Check for leak from air intake system For fuel system tests. Fuel Tank and Lines Read DTCs and refer to DTC Index in this section for MAF sensor tests Check and rectify any exhaust leak prior to catalytic converter
P017500	System too rich (bank 2)	<ul style="list-style-type: none"> Restricted air cleaner Leaking fuel injector(s) Engine oil contaminated with fuel (too many cold starts with vehicle subsequently not getting hot enough for long enough) MAF sensor fault (high intake air flow) 	<ul style="list-style-type: none"> Check air cleaner element is free from restriction Check for leaking injectors, install new injector(s) as necessary. Fuel Injector (18.10.01) Check for contaminated engine oil, drain and refill engine oil as necessary. Engine Oil Draining and Filling Read DTCs and refer to DTC Index

			in this section for MAF sensor tests
P018123	Engine Fuel Temperature (EFT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground, short to power, high resistance • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. Fuel Temperature Sensor (18.30.99)
P018124	Engine Fuel Temperature (EFT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground, short to power, high resistance • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. Fuel Temperature Sensor (18.30.99)
P018129	Engine Fuel Temperature (EFT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground, short to power, high resistance • EFT sensor ground circuit - high resistance • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EFT sensor as necessary. Fuel Temperature Sensor (18.30.99)
P018200	Engine Fuel Temperature (EFT) sensor circuit - low input	<ul style="list-style-type: none"> • EFT sensor sensing circuit - short to ground • EFT sensor ground circuit - short circuit • EFT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			<p>diagnostic system</p> <ul style="list-style-type: none"> Install a new EFT sensor as necessary. <p>Fuel Temperature Sensor (18.30.99)</p>
P018300	Engine Fuel Temperature (EFT) sensor circuit - high input	<ul style="list-style-type: none"> EFT sensor sensing circuit - short to power, high resistance, disconnected EFT sensor ground circuit - high resistance EFT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EFT sensor as necessary. <p>Fuel Temperature Sensor (18.30.99)</p>
P019100	Fuel Rail Pressure (FRP) sensor circuit - range/performance	<ul style="list-style-type: none"> FRP sensor range and performance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P019200	Fuel Rail Pressure (FRP) sensor circuit - low input	<ul style="list-style-type: none"> FRP sensor sensing circuit - short to ground, high resistance, disconnected FRP sensor 5V supply circuit - high resistance FRP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new FRP sensor as necessary. <p>Fuel Rail Pressure (FRP) Sensor (18.30.98)</p>
P019300	Fuel Rail Pressure (FRP) sensor circuit - high input	<ul style="list-style-type: none"> FRP sensor supply/sensing circuits - short circuit to each other FRP sensor sensing circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

		<ul style="list-style-type: none"> • FRP sensor ground circuit - high resistance • FRP sensor failure 	<p>diagnostic system</p> <ul style="list-style-type: none"> • Install a new FRP sensor as necessary. <p>Fuel Rail Pressure (FRP) Sensor (18.30.98)</p>
P019623	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal stuck low	<ul style="list-style-type: none"> • EOT sensor sensing circuit - intermittent high resistance • EOT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019624	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal stuck high	<ul style="list-style-type: none"> • EOT sensor sensing circuit - intermittent high resistance • EOT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019629	Engine Oil Temperature (EOT) sensor circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • EOT sensor sensing circuit - intermittent high resistance • EOT sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019700	Engine Oil	<ul style="list-style-type: none"> • EOT sensor sensing 	<ul style="list-style-type: none"> • Carry out any

	Temperature (EOT) sensor circuit - low input	<p>circuit - short to ground</p> <ul style="list-style-type: none"> EOT sensor failure 	<p>pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P019800	Engine Oil Temperature (EOT) sensor circuit - high input	<ul style="list-style-type: none"> EOT sensor sensing circuit - short to power, high resistance, disconnected EOT sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EOT sensor as necessary. <p>Oil Temperature Sensor (18.31.01)</p>
P020100	Cylinder 1 injector circuit - malfunction	<ul style="list-style-type: none"> Injector circuit - short to ground, high resistance, disconnected Injector failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new injector as necessary. <p>Fuel Injector (18.10.01)</p>
P020200	Cylinder 2 injector circuit - malfunction	<ul style="list-style-type: none"> Injector circuit - short to ground, high resistance, disconnected Injector failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new injector as necessary. <p>Fuel Injector</p>

			(18.10.01)
P020300	Cylinder 3 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020400	Cylinder 4 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020500	Cylinder 5 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new injector as necessary. Fuel Injector (18.10.01)
P020600	Cylinder 6 injector circuit - malfunction	<ul style="list-style-type: none"> • Injector circuit - short to ground, high resistance, disconnected • Injector failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> Install a new injector as necessary. Fuel Injector (18.10.01)
P020700	Cylinder 7 injector circuit - malfunction	<ul style="list-style-type: none"> Injector circuit - short to ground, high resistance, disconnected Injector failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new injector as necessary. Fuel Injector (18.10.01)
P020800	Cylinder 8 injector circuit - malfunction	<ul style="list-style-type: none"> Injector circuit - short to ground, high resistance, disconnected Injector failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new injector as necessary. Fuel Injector (18.10.01)
P022200	Throttle Position (TP) sensor circuit TP 2 - low input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 2 - short to ground, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. Throttle Body (19.70.04)
P022300	Throttle Position (TP) sensor circuit TP 2 - high input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 2- short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this

		<ul style="list-style-type: none"> TP sensor failure 	<p>DTC using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> Install a new throttle body as necessary. Throttle Body (19.70.04)
P022700	Accelerator Pedal Position (APP) sensor circuit APP 1 - low input	<ul style="list-style-type: none"> APP sensor circuit APP 1 - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P022800	Accelerator pedal position (APP) sensor circuit APP 1 high input	<ul style="list-style-type: none"> APP sensor circuit APP 1 - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P030000	Random/multiple cylinder misfire detected	<ul style="list-style-type: none"> ECM to ignition coil primary circuit faults (cylinder misfire detected DTCs also logged) Fuel injector circuit fault(s) (injector DTCs also logged) Ignition coil failure Spark plug failure/fouled/incorrect gap Fuel delivery pressure (low/high) Fuel contamination Fuel injectors restricted, leaking, continuously open Cylinder compression low Worn camshaft/broken valve springs Valve clearance 	<ul style="list-style-type: none"> If specific cylinder misfire or injector DTCs are also logged refer to the tests associated to those DTCs first For ignition coil test. Engine Ignition Check and install new sparkplugs as necessary. Spark Plugs - 4.2L NA V8 - AJV8 (18.20.02) For fuel system tests. Fuel Tank and Lines For injector tests. Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L

		adjustment	SC V8 - AJV8 <ul style="list-style-type: none"> Check cylinder compressions. Engine <ul style="list-style-type: none"> Check for worn/broken engine components and valve clearance adjustment. Engine Valve Clearance Adjustment (12.29.48)
P030100	Cylinder 1 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030200	Cylinder 2 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030300	Cylinder 3 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030400	Cylinder 4 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030500	Cylinder 5 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030600	Cylinder 6 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030700	Cylinder 7 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P030800	Cylinder 8 misfire detected	Refer to P030000 possible causes	Refer to P030000 actions
P031300	Misfire detected with low fuel	<ul style="list-style-type: none"> Misfire detected during low fuel level condition 	<ul style="list-style-type: none"> Check for fuel level sensor DTCs and refer to DTC Index Add fuel, clear the DTC and test for normal operation
P031600	Engine misfire detected on startup	<ul style="list-style-type: none"> Misfire detected on first 1000 revs 	<ul style="list-style-type: none"> Check for specific cylinder misfire DTCs and refer to the DTC Index
P032700	Knock sensor (KS) 1 circuit - low input (bank 1)	<ul style="list-style-type: none"> Poor sensor contact with the cylinder block KS circuit - short to 	<ul style="list-style-type: none"> Ensure a good electrical contact with the cylinder

		<ul style="list-style-type: none"> ground KS failure 	<ul style="list-style-type: none"> block Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P032800	Knock sensor (KS) 1 circuit - high input (bank 1)	<ul style="list-style-type: none"> Poor sensor contact with the cylinder block KS circuit - high resistance, short to power KS failure 	<ul style="list-style-type: none"> Ensure a good electrical contact with the cylinder block Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P033200	Knock sensor (KS) 2 circuit - low input (bank 2)	<ul style="list-style-type: none"> Poor sensor contact with the cylinder block KS circuit - short to ground KS failure 	<ul style="list-style-type: none"> Ensure a good electrical contact with the cylinder block Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P033300	Knock sensor (KS) 2 circuit - high input (bank 2)	<ul style="list-style-type: none"> Poor sensor contact with the cylinder block KS circuit - high resistance, short to 	<ul style="list-style-type: none"> Ensure a good electrical contact with the cylinder block

		<ul style="list-style-type: none"> power KS failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new KS as necessary. Knock Sensor (KS) (18.30.69)
P033592	Crankshaft Position (CKP) sensor circuit - performance or incorrect operation	<ul style="list-style-type: none"> CKP sensor circuit - short to ground, short to power, high resistance, disconnected CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor CKP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) Install a new CKP sensor as necessary. Crankshaft Position (CKP) Sensor (18.30.12)
P033594	Crankshaft Position (CKP) sensor circuit - unexpected operation	<ul style="list-style-type: none"> CKP sensor circuit - short to ground, short to power, high resistance, disconnected CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor CKP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) Install a new CKP sensor as

			necessary. Crankshaft Position (CKP) Sensor (18.30.12)
P033600	Crankshaft Position (CKP) sensor circuit - range/performance	<ul style="list-style-type: none"> • CKP sensor circuit - short to ground, short to power, high resistance, disconnected • CKP sensor gap incorrect, foreign matter on sensor face, damaged teeth on rotor • CKP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CKP sensor for damage and check air gap (check at 90° intervals, should be no greater than 4.5mm) • Install a new CKP sensor as necessary. Crankshaft Position (CKP) Sensor (18.30.12)
P034092	Camshaft Position (CMP) sensor circuit (bank 1) - performance or incorrect operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor RH (18.31.11)
P034094	Camshaft Position (CMP) sensor circuit (bank 1) - unexpected operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer

		<ul style="list-style-type: none"> • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<p>approved diagnostic system</p> <ul style="list-style-type: none"> • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. <p>Camshaft Position (CMP) Sensor RH (18.31.11)</p>
P034100	Camshaft Position (CMP) sensor circuit (bank 1) - range/performance	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. <p>Camshaft Position (CMP) Sensor RH (18.31.11)</p>
P034592	Camshaft Position (CMP) sensor circuit (bank 2) - performance or incorrect operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. <p>Camshaft Position (CMP) Sensor LH (18.31.12)</p>

P034594	Camshaft Position (CMP) sensor circuit (bank 2) - unexpected operation	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor LH (18.31.12)
P034600	Camshaft Position (CMP) sensor circuit (bank 2) - range/performance	<ul style="list-style-type: none"> • CMP sensor circuit - short to ground, short to power, high resistance, disconnected • CMP sensor gap incorrect, foreign matter on sensor face, damaged rotor • CMP sensor failure 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Check CMP sensor for correct installation and damage • Install a new CMP sensor as necessary. Camshaft Position (CMP) Sensor LH (18.31.12)
P035100	Ignition coil 1 primary/secondary circuit	<ul style="list-style-type: none"> • Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035200	Ignition coil 2 primary/secondary circuit	<ul style="list-style-type: none"> • Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
P035300	Ignition coil 3 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035400	Ignition coil 4 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035500	Ignition coil 5 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035600	Ignition coil 6 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035700	Ignition coil 7 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P035800	Ignition coil 8 primary/secondary circuit	<ul style="list-style-type: none"> Ignition module/coil circuits - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
P040100	Exhaust Gas Recirculation (EGR) flow insufficient detected	<ul style="list-style-type: none"> • EGR valve incorrectly installed or loose • EGR pipe blocked • EGR valve stuck closed, blocked • EGR valve failure 	<ul style="list-style-type: none"> • For EGR system tests. Engine Emission Control
P041300	Secondary Air Injection (AIR) switching valve circuit open	<ul style="list-style-type: none"> • AIR check valve control circuit high 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P041400	Secondary Air Injection (AIR) switching valve circuit shorted	<ul style="list-style-type: none"> • AIR check valve control circuit low 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P042000	Catalyst system efficiency below threshold (bank 1)	<ul style="list-style-type: none"> • Catalyst failure due to overheating damage caused by misfire and/or lean combustion • Catalyst failure due to poisoning caused by excessive oil consumption and/or contaminated fuel 	<ul style="list-style-type: none"> • Check for misfire/lean combustion DTCs and refer to DTC Index in this section • Check the oil and fuel condition/level. Check the catalytic converter for damage
P043000	Catalyst system efficiency below threshold (bank 2)	<ul style="list-style-type: none"> • Catalyst failure due to overheating damage caused by misfire and/or lean combustion • Catalyst failure due to poisoning caused by excessive oil consumption and/or 	<ul style="list-style-type: none"> • Check for misfire/lean combustion DTCs and refer to DTC Index in this section • Check the oil and fuel condition/level.

		contaminated fuel	Check the catalytic converter for damage
P044100	Evaporative Emission (EVAP) system incorrect purge flow	<ul style="list-style-type: none"> Purge valve - range/performance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P044700	Evaporative Emission (EVAP) system vent control circuit open	<ul style="list-style-type: none"> DMTL COV circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P044800	Evaporative Emission (EVAP) system vent control circuit shorted	<ul style="list-style-type: none"> DMTL COV circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P045600	Evaporative Emission (EVAP) system leak detected (very small leak)	<ul style="list-style-type: none"> DMTL system has detected a leak 	<ul style="list-style-type: none"> For evaporative emissions tests. Evaporative Emissions
P045800	Evaporative Emission (EVAP) canister purge valve circuit low	<ul style="list-style-type: none"> EVAP canister purge valve control circuit - short to ground, high resistance EVAP canister purge valve failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new EVAP canister purge valve as necessary. Evaporative Emission Canister Purge Valve - 4.2L NA V8 - AJV8

			(17.15.30)
P045900	Evaporative Emission (EVAP) canister purge valve circuit high	<ul style="list-style-type: none"> EVAP canister purge valve control circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P046129	Fuel level sensor A circuit - range/performance - stuck	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P04612F	Fuel level sensor A circuit - range/performance - signal erratic	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P046200	Fuel level sensor A circuit - low input	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P046300	Fuel level sensor A circuit - high input	<ul style="list-style-type: none"> Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor pinpoint tests for this DTC. Fuel Tank and Lines
P048023	Fan 1 control circuit low	<ul style="list-style-type: none"> Electric fan control circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P048024	Fan 1 control circuit high	<ul style="list-style-type: none"> Electric fan control circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
P048309	Fan rationality check	<ul style="list-style-type: none"> • Cooling fan difficult to turn/obstructed • Fan/Motor damaged 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CLEAR any obstruction and INSTALL a new fan as necessary. Cooling Fan Motor and Shroud - Vehicles Without Supercharger (26.25.25)
P048316	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage less than nine volts 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the battery condition • CHECK the charging system and fan circuits
P048317	Fan rationality check	<ul style="list-style-type: none"> • Fan control module reports battery voltage greater than 18 volts 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • CHECK the charging system and fan circuits
P048397	Fan rationality check	<ul style="list-style-type: none"> • Cooling fan jammed 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the

			<p>manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • CLEAR any obstruction and INSTALL a new fan as necessary. Cooling Fan Motor and Shroud - Vehicles Without: Supercharger (26.25.25)
P048900	Exhaust Gas Recirculation (EGR) control circuit low	<ul style="list-style-type: none"> • EGR valve power supply circuit - short to ground, high resistance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P049000	Exhaust Gas Recirculation (EGR) control circuit high	<ul style="list-style-type: none"> • EGR valve control circuit - short to power 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050082	Vehicle speed sensor malfunction	<ul style="list-style-type: none"> • Vehicle speed - invalid signal received over CAN 	<ul style="list-style-type: none"> • Check ABS for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
P050086	Vehicle speed sensor malfunction	<ul style="list-style-type: none"> • Vehicle speed - invalid signal received over CAN 	<ul style="list-style-type: none"> • Check ABS for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
P050162	Vehicle speed sensor - range/performance - signal plausibility failure	<ul style="list-style-type: none"> • Vehicle speed - range performance 	<ul style="list-style-type: none"> • Check for ABS/TCM DTCs and refer to DTC Index for speed sensor tests. Anti-Lock Control - Stability Assist

			Diagnostic Strategy
P050400	Brake switch A/B correlation	<ul style="list-style-type: none"> The brake pressure reading does not agree with the brake light switch value 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050401	Brake switch A/B correlation	<ul style="list-style-type: none"> Brake switch high fault: Brake lights stuck on Gearshift interlock inoperative Speed control inoperative Brake switch low fault: Brake lights inoperative Gearshift stuck in Park Reduced engine braking 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P050600	Idle air control system RPM lower than expected	<ul style="list-style-type: none"> Air intake restriction Front End Accessory Drive (FEAD) overload (defective/seized component) 	<ul style="list-style-type: none"> Ensure the air intake system is free from restriction Check the FEAD belt and components. Accessory Drive
P050624	Idle air control system RPM lower than expected	<ul style="list-style-type: none"> Air intake restriction Front End Accessory Drive (FEAD) overload (defective/seized component) 	<ul style="list-style-type: none"> Ensure the air intake system is free from restriction Check the FEAD belt and components. Accessory Drive
P050700	Idle air control system RPM higher than expected	<ul style="list-style-type: none"> Intake air leak between MAF sensor and engine Engine crankcase breather leak 	<ul style="list-style-type: none"> Check for leakage and correct installation of air intake system Check for leakage and correct installation of engine crankcase

			breather system
P050723	Idle air control system RPM higher than expected	<ul style="list-style-type: none"> • Intake air leak between MAF sensor and engine • Engine crankcase breather leak 	<ul style="list-style-type: none"> • Check for leakage and correct installation of air intake system • Check for leakage and correct installation of engine crankcase breather system
P050B84	Cold start ignition timing performance	<ul style="list-style-type: none"> • Cold start emission reduction strategy engine spark timing too retarded 	<ul style="list-style-type: none"> • Check for any engine ignition related DTCs also logged and refer to the DTC Index
P050B85	Cold start ignition timing performance	<ul style="list-style-type: none"> • Cold start emission reduction strategy engine spark timing too advanced 	<ul style="list-style-type: none"> • Check for any engine ignition related DTCs also logged and refer to the DTC Index
P05120C	Starter request circuit	<ul style="list-style-type: none"> • Crank request circuit - high input 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P05120E	Starter request circuit	<ul style="list-style-type: none"> • Crank request circuit - low input 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P051300	Incorrect immobilizer key	<ul style="list-style-type: none"> • Security key invalid 	Check for CAN network interference/EMC related error. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules
P056013	System voltage	<ul style="list-style-type: none"> • Battery back-up 	<ul style="list-style-type: none"> • Carry out any

		malfunction	pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P056100	System voltage unstable	<ul style="list-style-type: none"> System voltage comparison 	<ul style="list-style-type: none"> Check for sensor 5 volt supply related DTCs and refer to DTC Index in this section
P056200	System voltage low	<ul style="list-style-type: none"> Sensor 5 volt power supply circuit - low input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P056300	System voltage high	<ul style="list-style-type: none"> Sensor 5 volt power supply circuit - high input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P057501	Speed control cancel button fault	<ul style="list-style-type: none"> Speed control cancel button fault 	<ul style="list-style-type: none"> Check speed control system for DTCs and refer to DTC Index
P059000	Speed control multi-function input B circuit stuck	<ul style="list-style-type: none"> Active speed limiter fault 	<ul style="list-style-type: none"> Check speed control system for DTCs and refer to DTC Index
P060143	Internal control module memory check sum error - special memory failure	<ul style="list-style-type: none"> CPU communication - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060145	Internal control module memory check sum error - program	<ul style="list-style-type: none"> CPU communication 	<ul style="list-style-type: none"> Refer to new module/component installation Note at

	memory failure		top of DTC Index
P060442	Internal control module Random Access Memory (RAM) error - general memory failure	<ul style="list-style-type: none"> Initial RAM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060443	Internal control module Random Access Memory (RAM) error - special memory failure	<ul style="list-style-type: none"> Shut off RAM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060444	Internal control module Random Access Memory (RAM) error - data memory failure	<ul style="list-style-type: none"> RAM check sum 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060445	Internal control module Random Access Memory (RAM) error - program memory failure	<ul style="list-style-type: none"> Initial RAM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060500	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> EEPROM/flash checksum error 	<ul style="list-style-type: none"> Configure the module using the Jaguar approved diagnostic system
P060529	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> ROM error 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060542	Internal control module Read Only Memory (ROM) error - general memory failure	<ul style="list-style-type: none"> ROM check sum 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060543	Internal control module Read Only Memory (ROM) error - special memory failure	<ul style="list-style-type: none"> Shut off ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060544	Internal control module Read Only Memory (ROM) error - data memory failure	<ul style="list-style-type: none"> Initial ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at

			top of DTC Index
P060545	Internal control module Read Only Memory (ROM) error - program memory failure	<ul style="list-style-type: none"> Continuous ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060546	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> Continuous ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060548	Internal control module Read Only Memory (ROM) error - supervision software failure	<ul style="list-style-type: none"> Shut off ROM test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060564	Internal control module Read Only Memory (ROM) error	<ul style="list-style-type: none"> ROM error - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060600	ECM/PCM processor fault	<ul style="list-style-type: none"> Watchdog error 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060601	ECM/PCM processor fault - general electrical failure	<ul style="list-style-type: none"> Controller test - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060604	ECM/PCM processor fault	<ul style="list-style-type: none"> System internal failures 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060605	ECM/PCM processor fault - system programming failures	<ul style="list-style-type: none"> Throttle return spring failure (throttle body failure) 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060641	ECM/PCM processor fault - general checksum failure	<ul style="list-style-type: none"> Watch dog timer fault - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index

P060642	ECM/PCM processor fault - general memory failure	<ul style="list-style-type: none"> Error capturing instructions 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060643	ECM/PCM processor fault - special memory failure	<ul style="list-style-type: none"> Duplication memory fault 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060644	ECM/PCM processor fault - data memory failure	<ul style="list-style-type: none"> Duplication memory fault - sub 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060645	ECM/PCM processor fault - program memory failure	<ul style="list-style-type: none"> Detection of write to internal ROM 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060646	ECM/PCM processor fault - calibration/parameter memory failure	<ul style="list-style-type: none"> Detection of write to internal ROM - sub 	Configure the module using the Jaguar approved diagnostic system
P060647	ECM/PCM processor fault	<ul style="list-style-type: none"> Watch dog timer fault 	Configure the module using the Jaguar approved diagnostic system
P060648	ECM/PCM processor fault - supervision software failure	<ul style="list-style-type: none"> Scheduling sequence check 	Configure the module using the Jaguar approved diagnostic system
P060649	ECM/PCM processor fault - internal electronic failure	<ul style="list-style-type: none"> Controller test 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060700	Control module performance	<ul style="list-style-type: none"> Sub - CPU watch dog 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060D00	Internal control module accelerator pedal position performance	<ul style="list-style-type: none"> APS Communication 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P060E62	Internal control module throttle position performance - signal compare failure	<ul style="list-style-type: none"> Throttle motor amplifier failure for valve sensor malfunction 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060E64	Internal control module throttle position performance - signal plausibility failure	<ul style="list-style-type: none"> TPS Communication 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P060A64	Internal control module monitoring processor performance	<ul style="list-style-type: none"> Internal control module monitoring processor performance 	<ul style="list-style-type: none"> Clear the DTC and retest. If the DTC resets, refer to new module/component installation Note at top of DTC Index
P060A67	Internal control module monitoring processor performance	<ul style="list-style-type: none"> Internal control module monitoring processor performance 	<ul style="list-style-type: none"> Clear the DTC and retest. If the DTC resets, refer to new module/component installation Note at top of DTC Index
P061000	Control module vehicle options error	<ul style="list-style-type: none"> Car configuration data mismatch 	<ul style="list-style-type: none"> Re-configure the RJB using the manufacturer approved diagnostic system
P061A00	Internal control module torque performance	<ul style="list-style-type: none"> Pedal follower error 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061A29	Internal control module torque performance - signal invalid	<ul style="list-style-type: none"> Absolute engine torque calculation failure - sub-processor 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061A64	Internal control module torque performance - signal plausibility failure	<ul style="list-style-type: none"> Absolute engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index

P061B29	Internal control module torque calculation performance - signal invalid	<ul style="list-style-type: none"> Absolute and dynamic engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P061B64	Internal control module torque calculation performance - signal plausibility failure	<ul style="list-style-type: none"> Absolute and dynamic engine torque calculation failure 	<ul style="list-style-type: none"> Refer to new module/component installation Note at top of DTC Index
P062700	Fuel pump A control circuit/open	<ul style="list-style-type: none"> Fuel pump control circuit fault (FPDM to fuel pump) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the FPDM to Fuel Pump circuit for short to ground, power, open circuit
P062A00	Fuel pump A control circuit range/performance	<ul style="list-style-type: none"> Invalid fuel pump duty requested by the ECM 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the ECM to FPDM monitor circuit for short to ground, power, open circuit
P063000	VIN not programmed or incompatible - ECM/PCM	<ul style="list-style-type: none"> CCF to CAN VIN mismatch 	<ul style="list-style-type: none"> Configure the module using the Jaguar approved diagnostic system, clear DTC and re-test, if DTC remains suspect the ECM. Refer to the new module/component installation note at the top of the DTC Index
P068773	EMS control relay control circuit high	<ul style="list-style-type: none"> EMS control relay malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

P072186	Output speed sensor circuit range/performance	<ul style="list-style-type: none"> TCM Output shaft speed sensor error received 	<ul style="list-style-type: none"> For transmission tests. Diagnostic Strategy
P08170D	Starter relay circuit (break wire)	<ul style="list-style-type: none"> Starter relay circuit (break wire) 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081A0B	Starter relay circuit low	<ul style="list-style-type: none"> Starter relay circuit low 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P081B0C	Starter relay circuit high	<ul style="list-style-type: none"> Starter relay circuit high 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P08510E	Park/Neutral switch input circuit low	<ul style="list-style-type: none"> Park/Neutral switch input circuit - low 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P08520C	Park/Neutral switch input circuit high	<ul style="list-style-type: none"> Park/Neutral switch input circuit - high 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P125900	Immobilizer to ECM signal error	<ul style="list-style-type: none"> Incorrect ID received from instrument cluster 	<ul style="list-style-type: none"> Re-configure the instrument cluster using the

			manufacturer approved diagnostic system
P131500	Persistent misfire	<ul style="list-style-type: none"> ECM to ignition coil primary circuit fault (cylinder misfire detected DTC also flagged) Fuel injector circuit fault(s) (injector DTCs also flagged) Fuel delivery pressure low Spark plug failure/fouled/incorrect gap Cylinder compression low 	<ul style="list-style-type: none"> Check for cylinder mis-fire, ignition and injector DTCs and refer to the DTC Index For fuel system tests. Fuel Tank and Lines For spark plug tests. Engine Ignition For cylinder compression tests. Engine
P131600	Misfire rate exceeds emissions thresholds	<ul style="list-style-type: none"> Misfire rate exceeds emissions thresholds 	<ul style="list-style-type: none"> Check for individual cylinder misfire DTCs and refer to DTC Index in this section
P136700	Ignition amplifier group A	<ul style="list-style-type: none"> Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P136800	Ignition amplifier group B	<ul style="list-style-type: none"> Ignition module/coil monitoring circuit - short to ground, short to power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P160300	EEPROM error	<ul style="list-style-type: none"> ECM fault 	<ul style="list-style-type: none"> Refer to new module/component installation note at top of DTC Index
P162600	ECM electronic	<ul style="list-style-type: none"> Dynamic torque 	<ul style="list-style-type: none"> Suspect the ECM,

	throttle monitoring/self test - torque monitoring problem	monitoring error	refer to new module/component installation note at top of DTC Index
P209600	Fuel trim too lean, bank 1	<ul style="list-style-type: none"> Heated Oxygen Sensor (HO2S) fuel adaption - lean 	<ul style="list-style-type: none"> Check integrity and correct installation of air intake system Check for any HO2S codes also logged and refer to DTC Index in this section
P209700	Fuel trim too rich, bank 1	<ul style="list-style-type: none"> Heated Oxygen Sensor (HO2S) fuel adaption - rich 	<ul style="list-style-type: none"> Check integrity and correct installation of air intake system Check for any HO2S codes also logged and refer to DTC Index in this section
P209800	Fuel trim too lean, bank 2	<ul style="list-style-type: none"> Heated Oxygen Sensor (HO2S) fuel adaption - lean 	<ul style="list-style-type: none"> Check integrity and correct installation of air intake system Check for any HO2S codes also logged and refer to DTC Index in this section
P209900	Fuel trim too rich, bank 2	<ul style="list-style-type: none"> Heated Oxygen Sensor (HO2S) fuel adaption - rich 	<ul style="list-style-type: none"> Check integrity and correct installation of air intake system Check for any HO2S codes also logged and refer to DTC Index in this section
P210129	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

			<ul style="list-style-type: none"> • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> • Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Compare throttle position sensor 1 and 2 datalogger signals, if signals are comparable install a new throttle body. Throttle Body (19.70.04)
P210164	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> • Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle actuator motor control circuit range/performance	<ul style="list-style-type: none"> • Throttle blade stuck open • Intake air system leak 	<ul style="list-style-type: none"> • Check for throttle related DTCs and refer to DTC Index in this section • Check intake air system for leaks

P210329	Throttle actuator motor control circuit high	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of DTC Index
P210364	Throttle actuator motor control circuit high - signal plausibility failure	<ul style="list-style-type: none"> • Throttle motor control circuit - short to power • ECM fault 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system • Refer to new module/component installation note at top of DTC Index
P210500	Throttle actuator control system - forced engine shutdown	<ul style="list-style-type: none"> • Throttle MIL request due to fuel cut 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P210629	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> • Signal invalid 	<ul style="list-style-type: none"> • Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index
P210664	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> • Signal plausibility failure 	<ul style="list-style-type: none"> • Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at

			top of DTC Index
P211800	Throttle actuator motor control current range/performance	<ul style="list-style-type: none"> Throttle motor control circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211900	Throttle actuator control throttle body range/performance	<ul style="list-style-type: none"> Throttle spring faulty 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to new module/component installation note at top of DTC Index
P212200	Accelerator pedal position (APP) sensor D circuit low input	<ul style="list-style-type: none"> APP sensor circuit 2 - low input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P212300	Accelerator pedal position (APP) sensor D circuit high input	<ul style="list-style-type: none"> APP sensor circuit 2 - high input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P213528	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance - sub-processor 	<ul style="list-style-type: none"> Check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213529	Accelerator pedal position (APP) sensor 1 and 2 voltage	<ul style="list-style-type: none"> APP sensor - excessive difference between raw values of circuit 1 and 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this

	correlation	2 - sub-processor	DTC using the manufacturer approved diagnostic system
P213562	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance - sub-processor 	<ul style="list-style-type: none"> Check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213564	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P222800	Barometric pressure circuit low input	<ul style="list-style-type: none"> BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> Refer to new module/component installation note at top of DTC Index
P222900	Barometric pressure circuit high input	<ul style="list-style-type: none"> BARO sensor failure (internal ECM fault) 	<ul style="list-style-type: none"> Refer to new module/component installation note at top of DTC Index
P240100	Evaporative emission (EVAP) system leak detection pump control circuit low	<ul style="list-style-type: none"> DMTL pump circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240200	Evaporative emission (EVAP) system leak detection pump control circuit high	<ul style="list-style-type: none"> DMTL pump circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P240429	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance	<ul style="list-style-type: none"> • DMTL reference leak • DMTL pump circuit - short to ground, power, high resistance • DMTL pipework blocked/leaking 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P24042F	Evaporative emission (EVAP) system leak detection pump sensing circuit range/performance - signal erratic	<ul style="list-style-type: none"> • DMTL reference leak • DMTL pump circuit - short to ground, power, high resistance • DMTL pipework blocked/leaking 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240500	Evaporative emission (EVAP) system leak detection pump sensing circuit low	<ul style="list-style-type: none"> • DMTL pump circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240600	Evaporative emission (EVAP) system leak detection pump sensing circuit high	<ul style="list-style-type: none"> • DMTL pump circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> • For evaporative emissions system tests. Evaporative Emissions
P240B00	Evaporative emission (EVAP) system leak detection pump heater circuit low	<ul style="list-style-type: none"> • DMTL heater control circuit low 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P240C00	Evaporative emission (EVAP) system leak detection pump heater circuit high	<ul style="list-style-type: none"> • DMTL heater control circuit high 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243100	Secondary air injection manifold absolute pressure	<ul style="list-style-type: none"> • Secondary air injection system leaks • Secondary air injection 	<ul style="list-style-type: none"> • Check the secondary air injection system for

	sensor circuit range/performance	<p>pump</p> <ul style="list-style-type: none"> Secondary air injection valve 	<p>leaks</p> <ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243200	Secondary air injection manifold absolute pressure sensor circuit low	<ul style="list-style-type: none"> Secondary air injection manifold absolute pressure sensor circuit - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P243300	Secondary air injection manifold absolute pressure sensor circuit high	<ul style="list-style-type: none"> Secondary air injection manifold pressure (MAP) sensor circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P244400	Secondary air injection system pump stuck ON	<ul style="list-style-type: none"> Secondary air injection pump control circuit - short to ground 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P244500	Secondary air injection system pump stuck OFF	<ul style="list-style-type: none"> Secondary air injection pump control circuit - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P245000	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck open	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
P245100	Evaporative emission (EVAP) system change-over valve (COV) performance/stuck closed	<ul style="list-style-type: none"> DMTL system circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P261064	ECM/PCM Internal engine off timer performance	<ul style="list-style-type: none"> ECT sensor fault Ambient temperature sensor fault Body processor module fault (time) CAN error 	<ul style="list-style-type: none"> Check for DTCs indicating a fault with any of the components listed, and refer to relevant DTC Index
P261087	ECM/PCM Internal engine off timer performance	<ul style="list-style-type: none"> ECT sensor fault Ambient temperature sensor fault Body processor module fault (time) CAN error 	<ul style="list-style-type: none"> Check for DTCs indicating a fault with any of the components listed, and refer to relevant DTC Index
U007300	Control module communication bus off	<ul style="list-style-type: none"> CAN Link circuit malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010100	Lost communication with TCM	<ul style="list-style-type: none"> CAN Link ECM/TCM network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010300	Lost communication with gear shift control module	<ul style="list-style-type: none"> CAN Link ECM/gear shift network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
U010400	Lost communication with speed control module	<ul style="list-style-type: none"> CAN Link ECM/speed control module network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012100	Lost communication with anti-lock brake system (ABS) control module	<ul style="list-style-type: none"> CAN Link ECM/ABS module network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012800	Lost communication with electronic parking brake control module	<ul style="list-style-type: none"> CAN Link ECM/Electronic parking brake signal missing network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015100	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - CAN or hardwired 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U01511F	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - SRS fault 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015157	Lost communication with restraints control module/inertia switch	<ul style="list-style-type: none"> Lost communication - CAN fault 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> CAN Link ECM/instrument cluster network malfunction 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U016700	Lost communication with vehicle immobilizer	<ul style="list-style-type: none"> Security challenge response timeout 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U040208	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040264	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Actual gear position status 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040267	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Selector lever position status 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040281	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> Output shaft speed signal 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040282	Invalid Data Received From Transmission Control Module - TCM engine speed control monitor -	<ul style="list-style-type: none"> CAN Bus circuit fault Circuit fault in supply voltage to transmission control module 	Check the transmission control module for related stored DTCs. Using the manufacturer approved diagnostic system,

	plausibility (TCM alive counter)		complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network to the transmission control module. Refer to the electrical circuit diagrams and check the power and ground circuit to the transmission control module
U040283	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor - plausibility 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040286	Invalid data received from Transmission Control Module (TCM)	<ul style="list-style-type: none"> TCM engine speed control monitor - rationality 	<ul style="list-style-type: none"> Check TCM for DTCs and refer to DTC Index. Diagnostic Strategy
U040581	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index. Speed Control
U040583	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index. Speed Control
U04058F	Invalid data received from speed control module	<ul style="list-style-type: none"> Invalid data received from speed control module 	<ul style="list-style-type: none"> Check speed control module for DTCs and refer to DTC Index. Speed Control
U041500	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> Brake Position Switch 	<ul style="list-style-type: none"> Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control

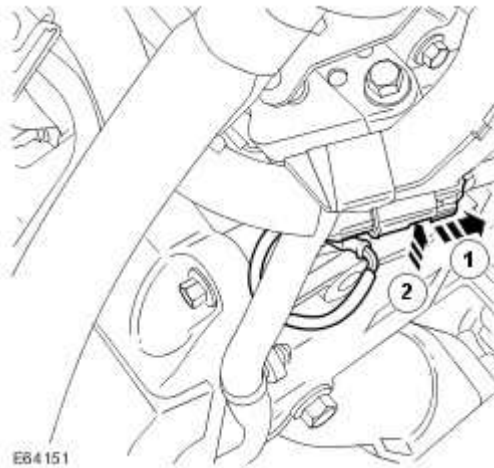
			- Stability Assist
U041564	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> • Engine drag torque control monitoring - plausibility 	<ul style="list-style-type: none"> • Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U041567	Invalid data received from Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> • Engine drag torque control monitoring - rationality 	<ul style="list-style-type: none"> • Check anti-lock control - stability assist module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U042386	Invalid data received from instrument cluster - signal invalid	<ul style="list-style-type: none"> • Battery voltage level 	<ul style="list-style-type: none"> • Check instrument cluster for DTCs and refer to DTC Index. Instrument Cluster
U042481	Invalid data received from instrument cluster	<ul style="list-style-type: none"> • External ambient temperature 	<ul style="list-style-type: none"> • Check instrument cluster for DTCs and refer to DTC Index. Instrument Cluster
U042600	Invalid data received from vehicle immobilizer	<ul style="list-style-type: none"> • Security code mismatch 	<ul style="list-style-type: none"> • Check CAN network between ECM and instrument cluster. Check power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the ECM and instrument cluster as new modules

U206400	Warning indicator requested by another control module	<ul style="list-style-type: none"><li>• Fuel Cut	<ul style="list-style-type: none"><li>• Set ignition to ON, then OFF (wait 30 seconds), then ON (wait 4 seconds)
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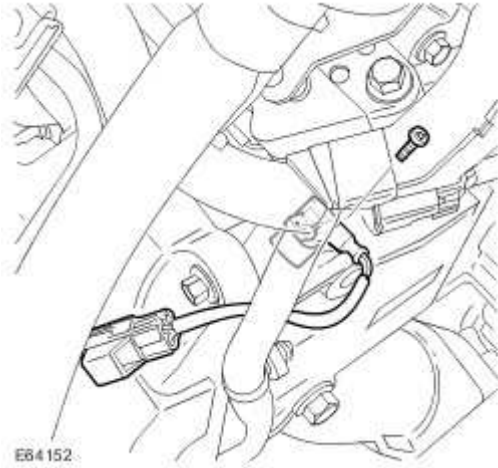
Camshaft Position (CMP) Sensor LH (18.31.12)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the CMP sensor electrical connector.
 - ▶ Slide the red connector latch to one side.



- 4 . Remove the CMP sensor.
 - ▶ Remove the Torx bolt.
 - ▶ Remove and discard the O-ring seal.



Installation

- 1 . Install the CMP sensor.
 - ▶ Clean the components.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).
 - ▶ Connect and secure the electrical connector.

- 2 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

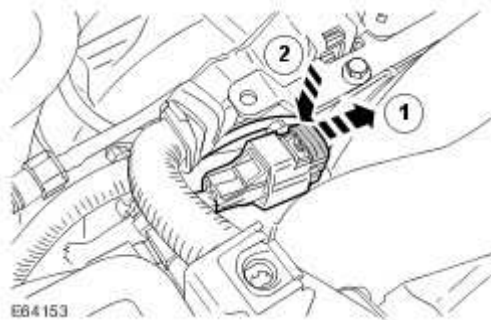
- 3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

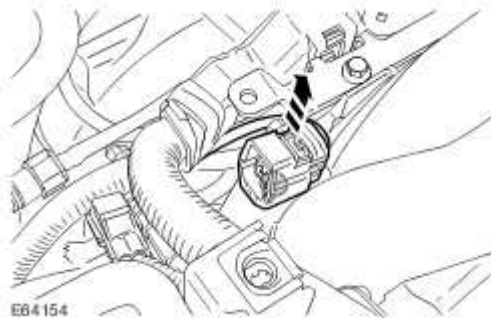
Camshaft Position (CMP) Sensor RH (18.31.11)

Removal

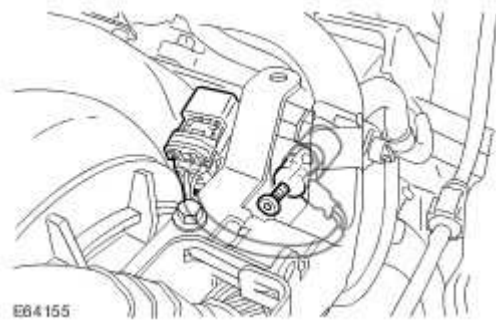
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the CMP sensor electrical connector.
 - ▶ Slide the red connector latch to one side.



- 4 . Release the CMP sensor electrical connector.



- 5 . Remove the CMP sensor.
 - ▶ Remove the Torx bolt.
 - ▶ Remove and discard the O-ring seal.



Installation

- 1 . Install the CMP sensor.
 - ▶ Clean the components.
 - ▶ Install a new O-ring seal.
 - ▶ Tighten the Torx bolt to 7 Nm (5 lb.ft).
 - ▶ Connect and secure the electrical connector.

- 2 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)


- 3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Catalyst Monitor Sensor (18.30.66)

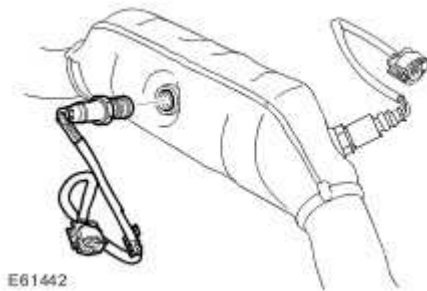
Removal

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)


2.  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

3. Remove the exhaust system.
For additional information, refer to [Catalytic Converter \(17.50.05\)](#)
4. Remove the catalyst monitor sensor.



Installation

1.  **WARNING: Make sure the H02S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.**

 **CAUTION: Make sure the anti-seize compound does not contact the catalyst monitor sensor tip.**

Install the catalyst monitor sensor and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the component mating faces.
- ▶ Apply an anti-seize compound to the thread of the sensor.

2 . Install the exhaust system.

For additional information, refer to [Catalytic Converter \(17.50.05\)](#)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

4 **NOTE:**

· For NAS vehicles only.


If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)

Crankshaft Position (CKP) Sensor (18.30.12)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

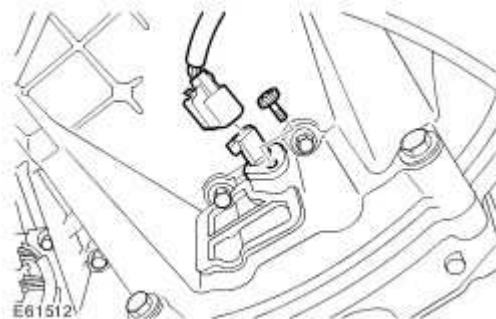
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . **NOTE:**
Clean the components general area prior to dismantling.

Remove the crankshaft position (CKP) sensor.

- ▶ Disconnect the electrical connector.
- ▶ Remove the Torx screw.



Installation

- 1 . Install the CKP sensor.
 - ▶ Clean the component mating faces.
 - ▶ Tighten the Torx screw to 8 Nm (6 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Engine Control Module (ECM) (18.30.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2 . Remove the air intake cover.

▶ Remove the 4 clips.



- 3 . Release the power distribution box and position aside.

▶ Remove the 2 Torx bolts.

- 4 . Disconnect the engine harness electrical connector.

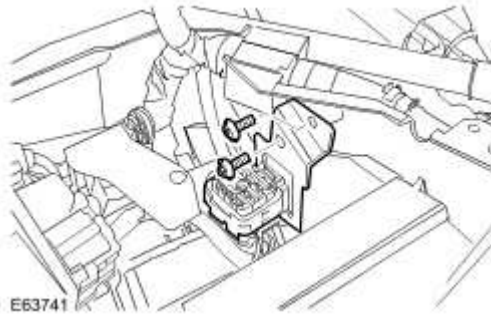
▶ Loosen the bolt.



- 5 . Release the electrical connector.

▶ Remove the 2 Torx screws.

▶ Carefully tie the harness aside.

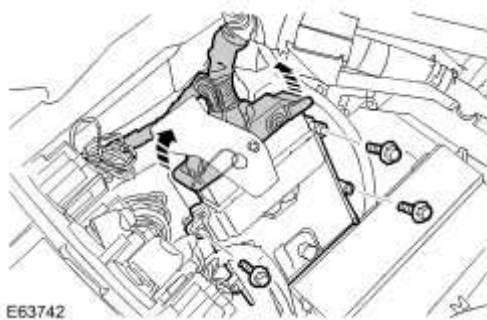


6 . NOTE:

RH illustration shown, LH is similar

Remove the engine control module (ECM).

- ▶ Remove the 3 bolts.
- ▶ Release and disconnect the 2 engine harness electrical connectors.



Installation

1 . Install the ECM.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- ▶ Connect the ECM electrical connectors.

2 . Install the electrical connector.

- ▶ Tighten the Torx screws.


3 . Connect and secure the electrical connector.

- ▶ Tighten the center bolt.

4 . Position and install the power distribution box.

- ▶ Tighten the Torx bolts to 8 Nm (6 lb.ft).

5 . Install the air intake cover.

 Carefully secure the clips.

6 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

7 . Using WDS, configure a new ECM.

Engine Coolant Temperature (ECT) Sensor (18.30.10)

Removal



CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.



CAUTION: Anti-freeze concentration must be maintained at 50%.

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

2



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

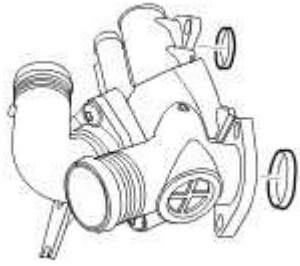
Drain the cooling system.

For additional information, refer to [Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8](#)

- 3 Remove the thermostat housing.
For additional information, refer to [Thermostat Housing - Vehicles Without: Supercharger](#)
4. Remove the ECT sensor.
 - ▶ Remove the retaining clip.
 - ▶ Remove and discard the O-ring seal.



5. Remove and discard the 2 O-ring seals.



E64335

Installation

- 1 . Install the O-ring seals.
- 2 . Install the ECT sensor.
 - ▶ Install the new O-ring seals.
 - ▶ Install the retaining clip.
- 3 Install the thermostat housing.
 - . For additional information, refer to [Thermostat Housing - Vehicles Without: Supercharger](#)
 - ▶ Connect and secure the electrical connector.
 - ▶ Install the bolts and tighten to 10 Nm (7 lb.ft).
- 4 Refill the cooling system.
 - . For additional information, refer to [Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8](#)
- 5 . Connect the battery ground cable and install the cover.
 - For additional information, refer to [Specifications](#)

Fuel Rail Pressure (FRP) Sensor (18.30.98)

Removal



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.



4



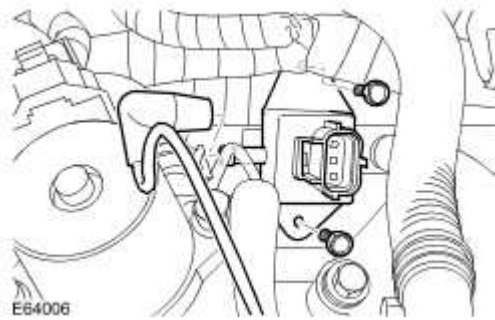
WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



CAUTION: Always plug any open connections to prevent contamination.

Remove the FRP sensor.

- ▶ Disconnect the vacuum line.
- ▶ Position an absorbent cloth to collect fluid spillage.
- ▶ Remove the 2 bolts.
- ▶ Remove and discard the 2 O-ring seals.



Installation

- 1  **WARNING:** After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

Install the FRP sensor.

- ▶ Clean the components.
 - ▶ Install new O-ring seals.
 - ▶ Tighten the bolts to 5 Nm (4 lb.ft).
 - ▶ Connect the electrical connector.
 - ▶ Connect the vacuum line.
- 2 . Install the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
 - 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Fuel Temperature Sensor (18.30.99)

Removal



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

2. Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)

3



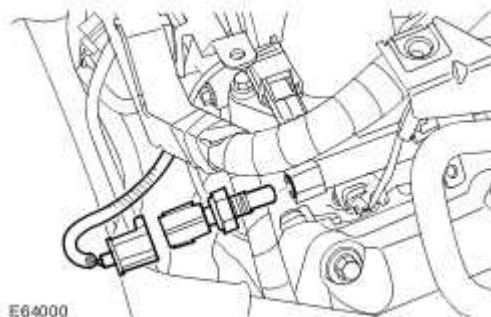
WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



CAUTION: Always plug any open connections to prevent contamination.

Remove the fuel temperature sensor.

- ▶ Disconnect the electrical connector.
- ▶ Position an absorbent cloth to collect fluid spillage.



Installation

1



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

Install the fuel temperature sensor.

- ▶ Clean the components.
- ▶ Tighten the sensor to 7 Nm (5 lb.ft).
- ▶ Connect the electrical connector.

2 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)


3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Heated Oxygen Sensor (HO2S)

Removal

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

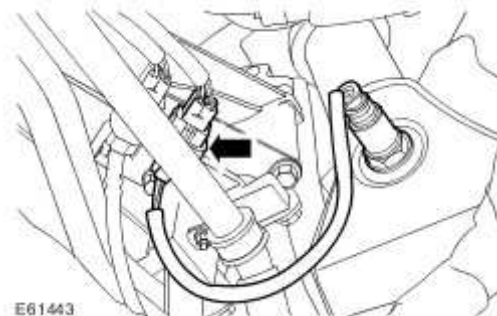
2.  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


3. Release and disconnect the heated oxygen sensor (HO2S) electrical connector.

4.  **WARNING: Do not twist the HO2S wiring harness on removal. Failure to follow this instruction may result in damage to the component.**

Remove the HO2S.




Installation

1.  **WARNING: Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.**

 **CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.**

Install the HO2S to the catalytic converter and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the component mating faces.

 Apply an anti-seize compound to the thread of the sensor.

2 . Connect and secure the electrical connector.

3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

4 **NOTE:**


· For NAS vehicles only.

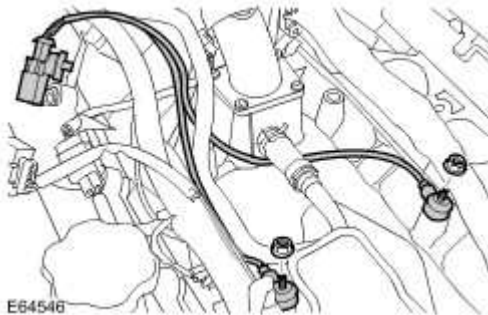
If required, carry out a long drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Long Drive Cycle Self-Test](#)


Knock Sensor (KS) (18.30.69)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the intake manifold.
For additional information, refer to
- 3 . Remove the KS.
 Remove the 2 nuts.



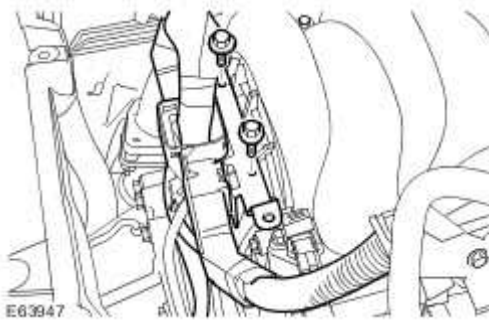
Installation

- 1 . Install the KS.
 Tighten the nuts to 20 Nm (15 lb.ft).
- 2 . Install the intake manifold.
For additional information, refer to
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

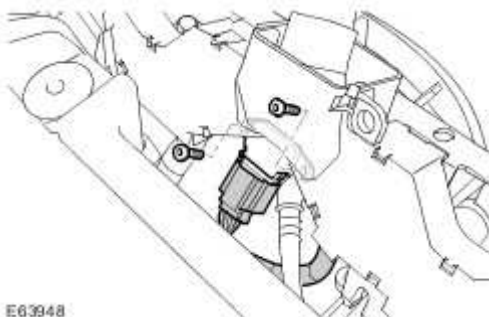
Manifold Absolute Pressure (MAP) Sensor (18.30.86)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)
- 3 . Release the wiring harness from the rear of the engine.
▶ Remove the 2 bolts.



- 4 . Disconnect the MAP sensor electrical connector.
- 5 . Remove the MAP sensor.
▶ Remove the 2 Torx screws.
▶ Remove and discard the O-ring seal.



Installation

1 . Install the MAP sensor.

- ▶ Clean the component mating faces.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx screws.
- ▶ Connect the electrical connector.

2 . Attach the wiring harness.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

3 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

4 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

5 **NOTE:**

- For NAS vehicles only.


If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

Mass Air Flow (MAF) Sensor (18.30.15)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the air cleaner assembly.
For additional information, refer to [Air Cleaner \(19.10.05\)](#)

Installation

- 1 . Install the air cleaner assembly.
For additional information, refer to [Air Cleaner \(19.10.05\)](#)
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

- 3 **NOTE:**
 - For NAS vehicles only.

If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

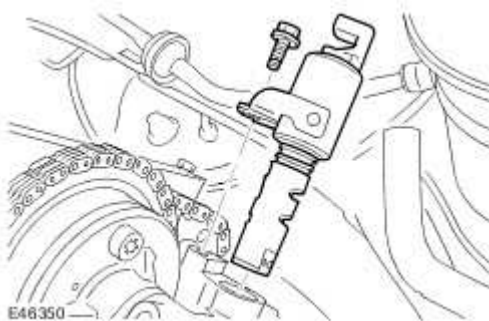
Variable Camshaft Timing (VCT) Oil Control Solenoid (18.30.90)

Removal

NOTE:

Removal of the RH is similar to this procedure.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Remove the LH valve cover.
For additional information, refer to [Valve Cover LH \(12.29.43\)](#)
- 3 . Remove the VCT oil control solenoid.
 - ▶ Remove the bolt.



Installation

- 1 . Install the VCT oil control solenoid.
 - ▶ Clean the components.
 - ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- 2 . Install the LH valve cover.
For additional information, refer to [Valve Cover LH \(12.29.43\)](#)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

4 NOTE:

.

For NAS vehicles only.


If required, carry out a short drive cycle.

For additional information, refer to [Powertrain Control Module \(PCM\) Short Drive Cycle Self-Test](#)

Engine Oil Pressure (EOP) Sensor

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 4 . Remove the EOP sensor.
 - ▶ Disconnect the electrical connector.


Installation

- 1 . Install the EOP sensor.
 - ▶ Clean the components.
 - ▶ Apply sealant of the correct specification to the sensor thread.
 - ▶ Tighten the sensor to 15 Nm (11 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

Oil Temperature Sensor (18.31.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 4 . Remove the oil temperature sensor.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the oil temperature sensor.
 - ▶ Clean the components.
 - ▶ Apply sealant of the correct specification to the sensor thread.
 - ▶ Tighten the sensor to 15 Nm (11 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the engine undershield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 3 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Brake Pedal Position (BPP) Switch

Removal

NOTE:

The brake pedal position switch also functions as the speed control deactivator switch.

- 1 . Remove the BPP switch.

For additional information, refer to [Speed Control Deactivator Switch \(19.75.20\)](#)

Installation

- 1 . Install the BPP switch.

For additional information, refer to [Speed Control Deactivator Switch \(19.75.20\)](#)

307 : Automatic Transmission/Transaxle

307-01 : Automatic Transmission/Transaxle

Specifications

Specifications

Lubricants, Fluids, Sealers and Adhesives

	Specifications
High temperature grease	Molecote FB180 / Jaguar 8309
Transmission fluid	Shell M1375.4

Capacities

	Liters
Transmission fluid	9.5
Transmission fluid (Supercharged models)	10.0
Service fill	6.0

Torque Specifications

Item	Nm	lb-ft	lb-in
Crossmember to vehicle body - bolt	48	35	-
Fluid pan, gasket and filter - screw	8	6	71
Mass damper to crossmember - bolt	10	7	-
Output shaft flange - nut*	60	44	-
Selector lever to transmission - nut	12	9	-
Support insulator to crossmember - bolt	25	18	-
Support insulator to transmission - bolt	48	35	-
Flexplate to torque converter - screw	55	41	-
Torque converter housing to engine - bolt	48	35	-
Transmission control module (TCM) and Main control valve body - screw	8	6	71
Transmission fluid - drain plug	8	6	71

Transmission fluid - fill plug	A		-
Transmission heat shield	10	7	-

NOTE:

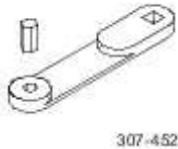
* New nut/bolt must be installed.

NOTE:

A = refer to the procedure for correct torque sequence.

Transmission Fluid Drain and Refill (44.24.02)

Special Service Tools



Adaptor
307-452



WARNING: Observe due care when draining, as the fluid can be very hot.



WARNING: Observe due care when working near a hot exhaust system.

1.

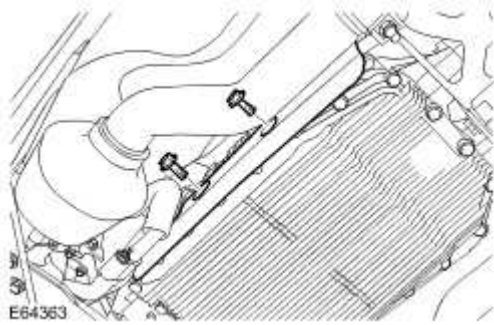


WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the RH transmission heat shield.

- Remove the 2 bolts.



3. Clean the area around the transmission fluid drain and filler plugs.

4. Place a container under the transmission.

5.



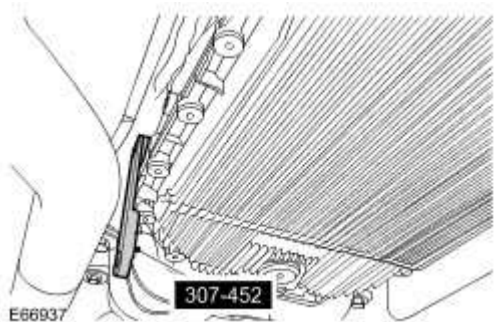
WARNING: Observe due care when draining, as the fluid can be very hot.



WARNING: Observe due care when working near a hot exhaust system.

Using the special tool, remove the transmission fluid filler/level plug.

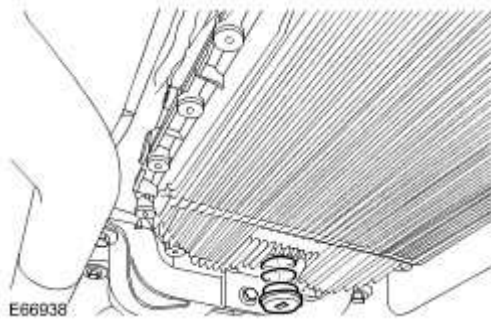
- Remove and discard the sealing washer.



6. Remove the transmission fluid drain plug.

- Remove and discard the sealing washer.

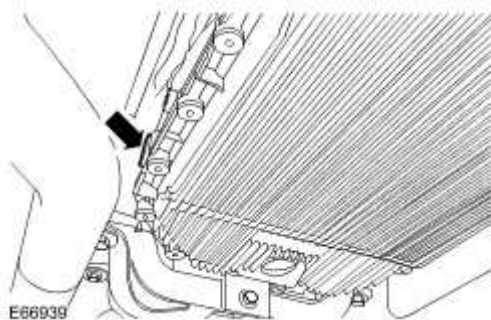
- Allow the fluid to drain.



7. Install the transmission fluid drain plug and tighten to 8 Nm (6 lb.ft).

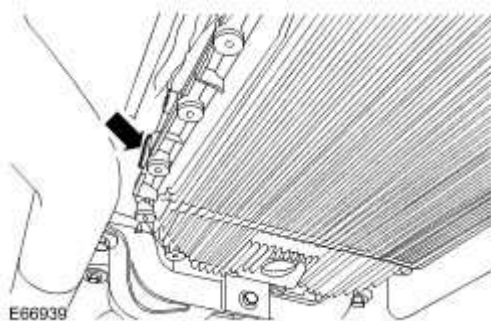
- Install a new sealing washer.

8. Add the correct transmission fluid, until a small thread of fluid runs from the filler/level hole.



9. Start and run the engine.

10. Add the correct transmission fluid, until a small thread of fluid runs from the filler/level hole.

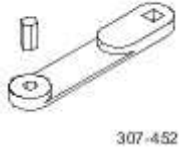


11. Check and top-up the transmission fluid level.

Transmission Fluid Level Check

Transmission Fluid Level Check

Special Service Tools



Adaptor
307-452



WARNING: Observe due care when draining, as the fluid can be very hot.



WARNING: Observe due care when working near a hot exhaust system.



CAUTION: The gearbox fluid level must only be checked when the temperature of the fluid is between 30 degrees and 50 degrees. The fluid level obtained will be incorrect if the reading is outside this temperature range.

1. The following steps must be observed before starting the transmission fluid level check and top-up.
 - The vehicle must be on a horizontal ramp.
 - The parking brake must be applied.
 - The wheels must be chocked.

2.



CAUTION: Make sure the transmission fluid temperature is below 30 degrees before starting the fluid level check.

Connect WDS to the on-board diagnostic connector, to monitor the transmission fluid temperature.

3. Start the engine. Move the selector lever from 'P' through all gear positions, pausing in each gear position for 2-3 seconds and return to the 'P' position.

4.

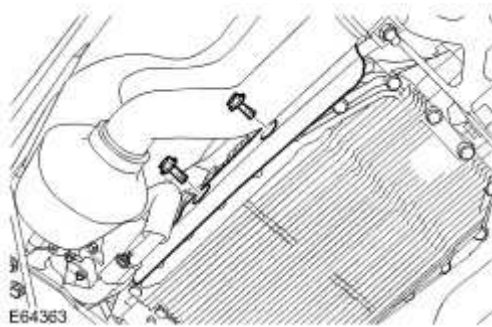


WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

5. Remove the RH transmission heat shield.

- Remove the 2 bolts.



6. Place a container under the transmission.

7.



WARNING: Observe due care when draining, as the fluid can be very hot.



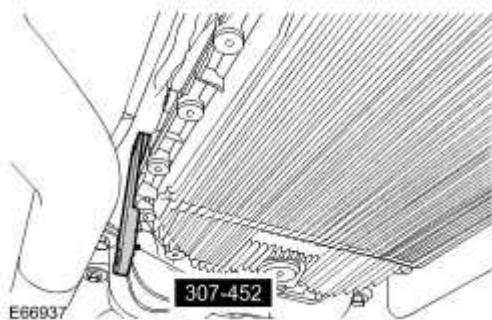
WARNING: Observe due care when working near a hot exhaust system.



CAUTION: The gearbox fluid level must only be checked when the temperature of the fluid is between 30 degrees and 50 degrees. The fluid level obtained will be incorrect if the reading is outside this temperature range.

Using the special tool, remove the transmission fluid filler/level plug.

- Clean the area around the filler/level plug.
- Remove and discard the sealing washer.



8. If no fluid loss is apparent when the filler/level plug is removed, with the engine at idle, continue to fill the transmission until a small thread of oil runs from oil filler/level hole.

9.

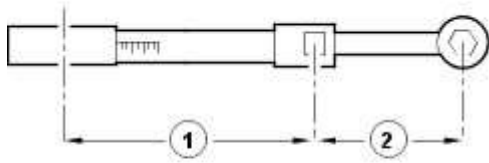


WARNING: Make sure the transmission fluid filler plug is tightened to the correct specification. The torque correction formula below must be followed to prevent damage to the transmission case.

Install the transmission fluid filler/level plug and tighten to 35 Nm (26 lb.ft).

- Install a new sealing washer.
- Step 1. Multiply 35 Nm by the effective length of the torque wrench (1).
- Step 2. Add the effective length of the special tool (2) to the effective length of the torque wrench (2).
- Step 3. Divide the total of step 1 by the total of step 2.

- Step 4. Set the torque wrench to the figure arrived at in step 3.



E37107

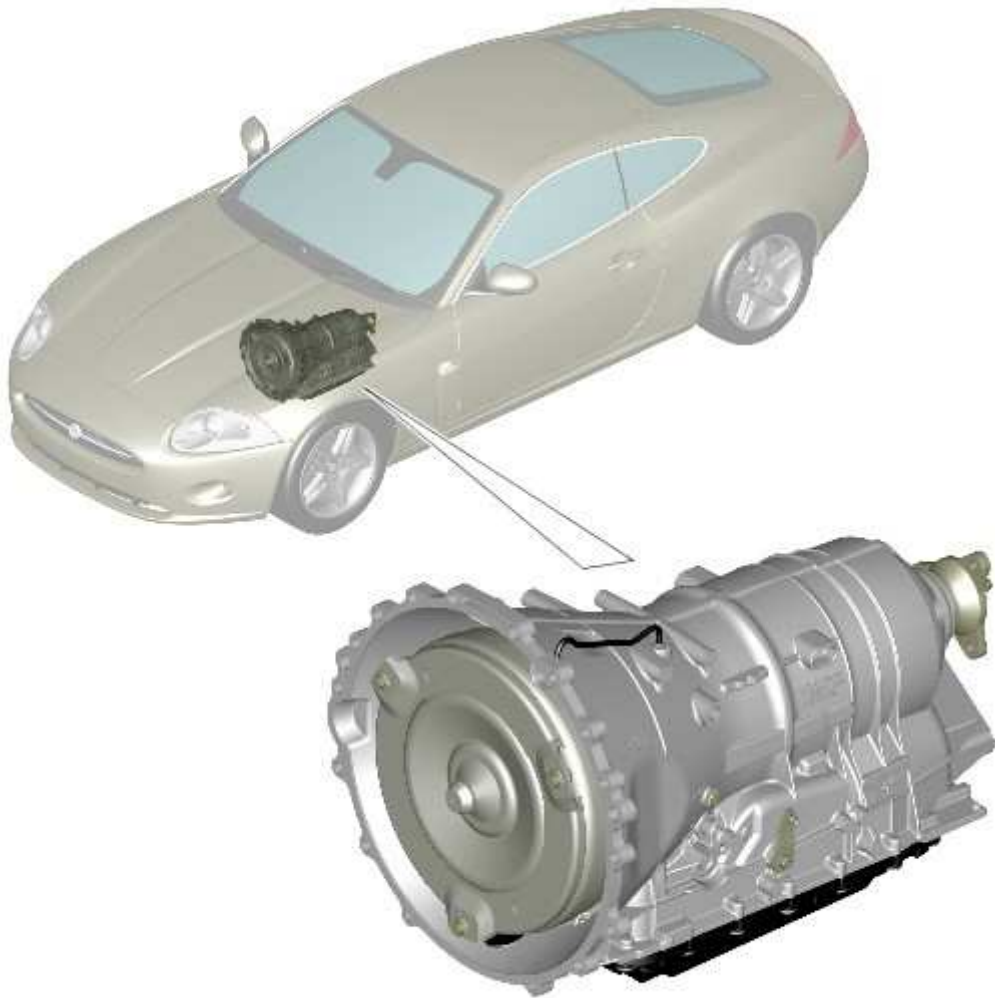
10. Install the transmission heat shield.

- Tighten the bolts to 10 Nm (7 lb.ft).

11. Disconnect WDS from the vehicle.

Transmission Description

COMPONENT LOCATION



E68066

INTRODUCTION

The ZF 6HP26 transmission is an electronically controlled, six speed unit. The transmission is manufactured by ZF Transmissions GmbH in Saarbrücken, Germany. This transmission represents the latest in automatic transmission technology and incorporates new features to enhance the transmission functionality:

- The hydraulic and electronic control elements of the transmission are now incorporated in a single unit located inside the transmission and is known as 'Mechatronic'

- Another new strategy is Adaptive Shift Strategy (ASIS). ASIS represents the continuous adaptation of shift changes to suit the driving style of the driver which can vary from sporting to economical. Further details of the ASIS function are contained in the 'Driving Modes' section.

On supercharged models, the transmission used is an updated derivative of the 6HP26 transmission used in the 4.2L naturally aspirated model. The updated transmission includes additional clutch plates to enable the transmission to manage the additional power output of the supercharged engine.

The transmission is controlled by a Transmission Control Module (TCM) which contains software to provide operation as a semi-automatic 'Jaguar Sequential Shift' transmission. The TCM allows the transmission to be operated as a conventional automatic unit by selecting P, R, N, D on the selector lever. Movement of the selector lever across the gate to the 'S' position puts the transmission into electronic 'Sport' mode. Two steering wheel paddles, when operated, puts the transmission into electronic manual 'Jaguar Sequential Shift' mode.

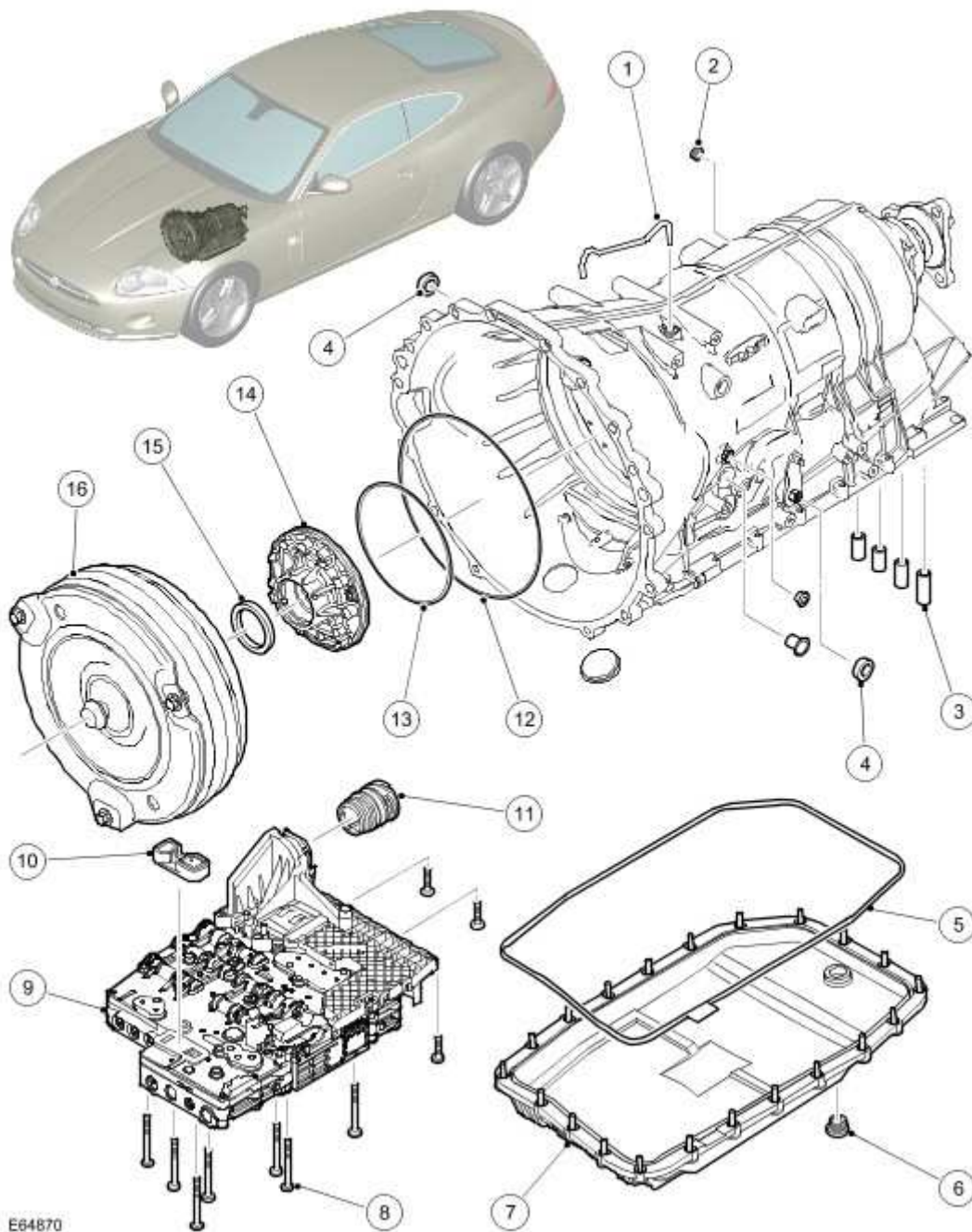
The 6HP26 transmission has the following features:

- Designed to be maintenance free
- Transmission fluid is 'fill for life'
- The torque converter features a controlled slip feature with electronically regulated control of lock-up, creating a smooth transition to the fully locked condition
- Shift programs controlled by the TCM
- Connected to the Engine Control Module (ECM) via the high speed Controller Area Network (CAN) bus for communications
- Default mode if major faults occur
- Diagnostics available from the TCM via the CAN

ZF 6HP26 Automatic Transmission – Exploded View

NOTE:

The transmission shown is exploded to the extent of the serviceable items



E64870

Item	Part Number	Description
1		Breather tube
2		Plug
3		Seal sleeves
4		Selector shaft seal
5		Gasket
6		Drain plug
7		Fluid pan and filter assembly
8		Torx screws

9		Mechatronic valve block
10		Element seal
11		Electrical connector – guide sleeve
12		O-ring
13		O-ring
14		Pump housing
15		Input shaft seal
16		Torque converter

The transmission comprises the main casing which houses all of the transmission components. The main case also incorporates an integral bell housing.

A fluid pan is attached to the lower face of the main case and is secured with bolts. The fluid pan is sealed to the main case with a gasket. Removal of the fluid pan allows access to the Mechatronic valve block. The fluid pan has a magnet located around the drain plug which collects any metallic particles present in the transmission fluid.

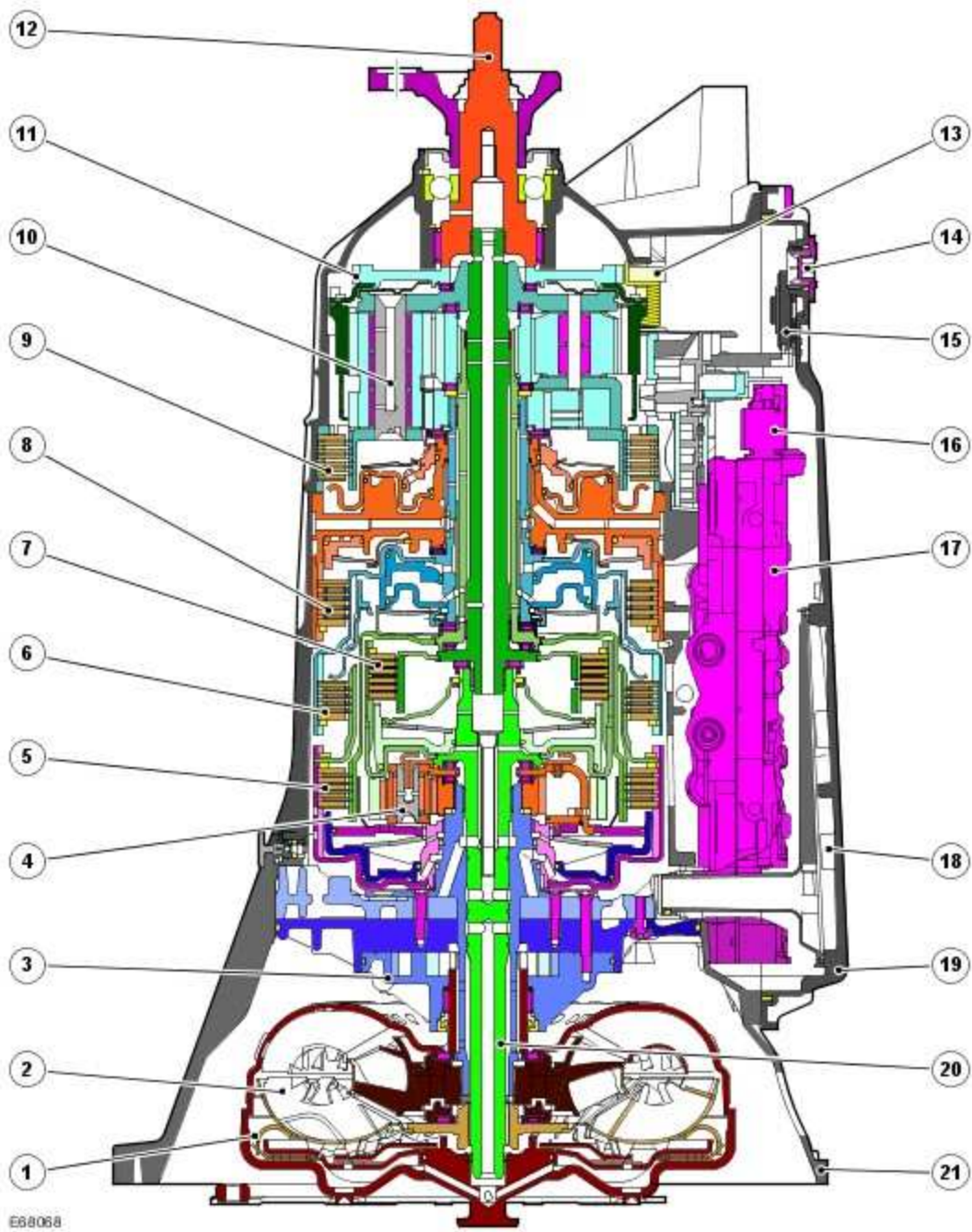
A fluid filter is located inside the fluid pan. If the transmission fluid becomes contaminated or after any service work, the fluid pan with integral filter must be replaced.

The integral bell housing provides protection for the torque converter assembly and also provides the attachment for the gearbox to the engine cylinder block. The torque converter is a non-serviceable assembly which also contains the lock-up clutch mechanism. The torque converter drives a crescent type pump via drive tangs. The fluid pump is located in the main case, behind the torque converter.

The main case contains the following major components:

- Input shaft
- Output shaft
- Mechatronic valve block which contains the solenoids, speed sensors and the TCM
- 3 rotating multiplate drive clutches
- 2 fixed multiplate brake clutches
- A single planetary gear train and a double planetary gear train.

ZF 6HP26 Automatic Transmission – Sectional View

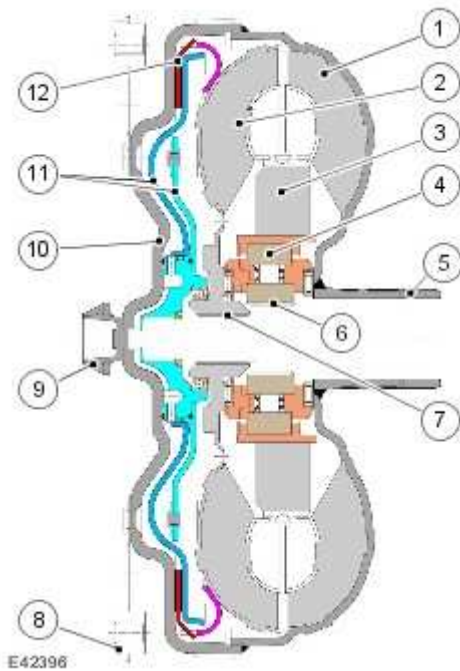


E68068

Item	Part Number	Description
1		Torque converter lock-up clutch
2		Torque converter
3		Fluid pump
4		Single planetary gearset
5		Clutch A
6		Clutch B
7		Clutch E
8		Brake C

9		Brake D
10		Double planetary gearset
11		Park lock gear
12		Output shaft
13		Park lock pawl
14		Drain plug
15		Magnet
16		Pressure regulator
17		Mechatronic valve block
18		Fluid filter
19		Fluid pan
20		Input shaft
21		Bell housing

TORQUE CONVERTER



Item	Part Number	Description
1		Impeller
2		Turbine
3		Stator
4		Freewheel
5		Torque converter hub

6		Stator shaft
7		Turbine shaft
8		Drive plate
9		Journal - Drive plate/crankshaft location
10		Torque converter cover
11		Lock-up clutch piston
12		Lock-up clutch plate

The torque converter is the coupling element between the engine and the transmission and is located in the bell housing, on the engine side of the transmission. The driven power from the engine crankshaft is transmitted hydraulically and mechanically through the torque converter to the transmission. The torque converter is connected to the engine by a drive plate.

The torque converter comprises an impeller, a stator and a turbine. The torque converter is a sealed unit with all components located between the converter housing cover and the impeller. The two components are welded together to form a sealed, fluid filled housing. With the impeller welded to the converter housing cover, the impeller is therefore driven at engine crankshaft speed.

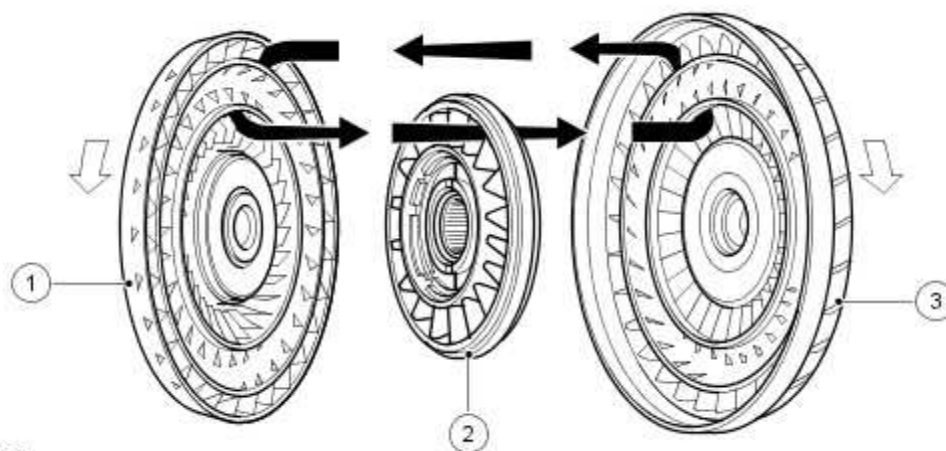
The converter housing cover has 4 threaded bosses which provide for attachment of the engine drive plate which is connected to the engine crankshaft. The threaded bosses also provide for location of special tools which are required to remove the torque converter from the bell housing.

Impeller

Fluid Flow

NOTE:

Typical torque converter shown



Item	Part Number	Description
------	-------------	-------------

1		Turbine
2		Stator
3		Impeller

When the engine is running the rotating impeller acts as a centrifugal pump, picking up fluid at its centre and discharging it at high velocity through the blades on its outer rim. The design and shape of the blades and the curve of the impeller body cause the fluid to rotate in a clockwise direction as it leaves the impeller. This rotation improves the efficiency of the fluid as it contacts the outer row of blades on the turbine.

The centrifugal force of the fluid leaving the blades of the impeller is passed to the curved inner surface of the turbine via the tip of the blades. The velocity and clockwise rotation of the fluid causes the turbine to rotate.

Turbine

The turbine is similar in design to the impeller with a continuous row of blades. Fluid from the impeller enters the turbine through the tip of the blades and is directed around the curved body of the turbine to the root of the blades. The curved surface redirects the fluid back in the opposite direction to which it entered the turbine, effectively increasing the turning force applied to the turbine from the impeller. This principle is known as torque multiplication.

When engine speed increases, turbine speed also increases. The fluid leaving the inner row of the turbine blades is rotated in an anti-clockwise direction due to the curve of the turbine and the shape of the blades. The fluid is now flowing in the opposite direction to the engine rotation and therefore the impeller. If the fluid was allowed to hit the impeller in this condition, it would have the effect of applying a brake to the impeller, eliminating the torque multiplication effect. To prevent this, the stator is located between the impeller and the turbine.

Stator

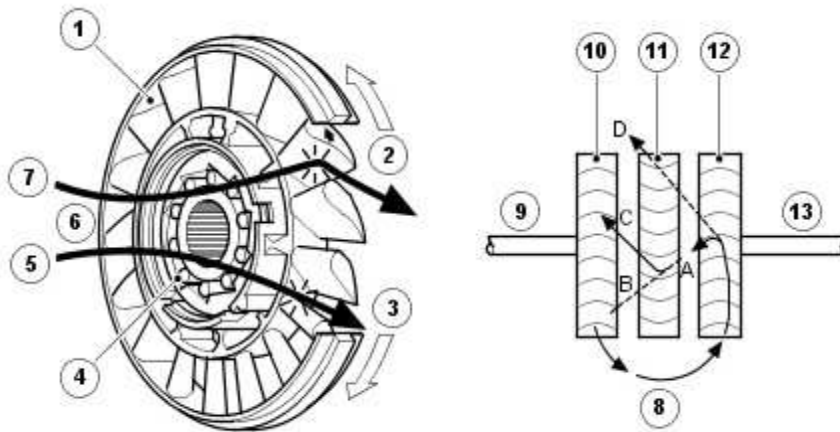
The stator is located on the splined transmission input shaft via a freewheel clutch. The stator comprises a number of blades which are aligned in an opposite direction to those of the impeller and turbine. The main function of the stator is to redirect the returning fluid from the turbine, changing its direction to that of the impeller.

The redirected fluid from the stator is directed at the inner row of blades of the impeller, assisting the engine in turning the impeller. This sequence increases the force of the fluid emitted from the impeller and thereby increases the torque multiplication effect of the torque converter.

Stator Functions

NOTE:

Typical stator shown



E42398

Item	Part Number	Description
1		Blades
2		Stator held – fluid flow redirected
3		Stator rotates freely
4		Roller
5		Converter at coupling speed
6		Fluid flow from turbine
7		Converter multiplying
8		Fluid flow from impeller
9		Drive from engine
10		Impeller
11		Stator
12		Turbine
13		Output to transmission

Refer to the 'Stator Functions' illustration

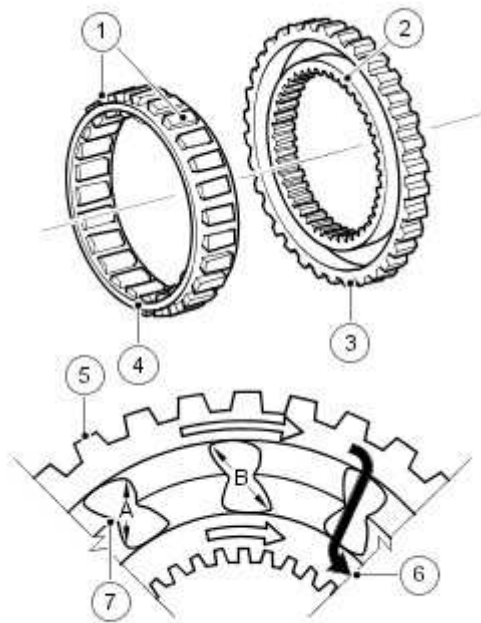
Fluid emitted from the impeller acts on the turbine. If the turbine is rotating at a slower speed than the fluid from the impeller, the fluid will be deflected by the turbine blades in the path 'A'. The fluid is directed at and deflected by the stator blades from path 'B' to path 'C'. This ensures that the fluid is directed back to the pump in the optimum direction. In this condition the sprag clutch is engaged and the force of the fluid on the stator blades assists the engine in rotating the impeller.

As the rotational speed of the engine and therefore the turbine increases, the direction of the fluid leaving the turbine changes to path 'D'. The fluid is now directed from the turbine to the opposite side of the stator blades, rotating the stator in the opposite direction. To prevent the stator from resisting the smooth flow of the fluid from the turbine, the sprag clutch releases, allowing the stator to rotate freely on its shaft.

When the stator becomes inactive, the torque converter no longer multiplies the engine torque. When the torque converter reaches this operational condition it ceases to multiply the engine torque and acts solely as a fluid coupling, with the impeller and the turbine rotating at approximately the same speed.

The stator uses a sprag type, one way, freewheel clutch. When the stator is rotated in a clockwise direction the sprags twist and are wedged between the inner and outer races. In this condition the sprags transfer the rotation of the outer race to the inner race which rotates at the same speed.

One Way Free Wheel Clutch – Typical



E42712

Item	Part Number	Description
1		Sprags
2		Inner race
3		Outer race
4		Sprag and cage assembly
5		Sprag outer race
6		Sprag inner race
7		Retaining ring

The free wheel clutch can perform three functions; hold the stator stationary, drive the stator and free wheel allowing the stator to rotate without a drive output. The free wheel clutch used in the 6HP26 transmission is of the sprag type and comprises an inner and outer race and a sprag and cage assembly. The inner and outer races are pressed into their related components with which they rotate. The sprag and cage assembly is located between the inner and outer races.

The sprags are located in a cage which is a spring which holds the sprags in the 'wedge' direction and maintains them in contact with the inner and outer races.

Referring to the illustration, the sprags are designed so that the dimension 'B' is larger than the distance between the inner and outer race bearing surfaces. When the outer race rotates in a clockwise direction, the sprags twist and the edges across the dimension 'B' wedge between the races, providing a positive drive through each sprag to the inner race. The dimension 'A' is smaller than the distance between the inner and outer race bearing surfaces. When the outer race rotates in an anti-clockwise direction, the dimension 'A' is too small to allow the sprags to wedge between the races, allowing the outer race to rotate freely.

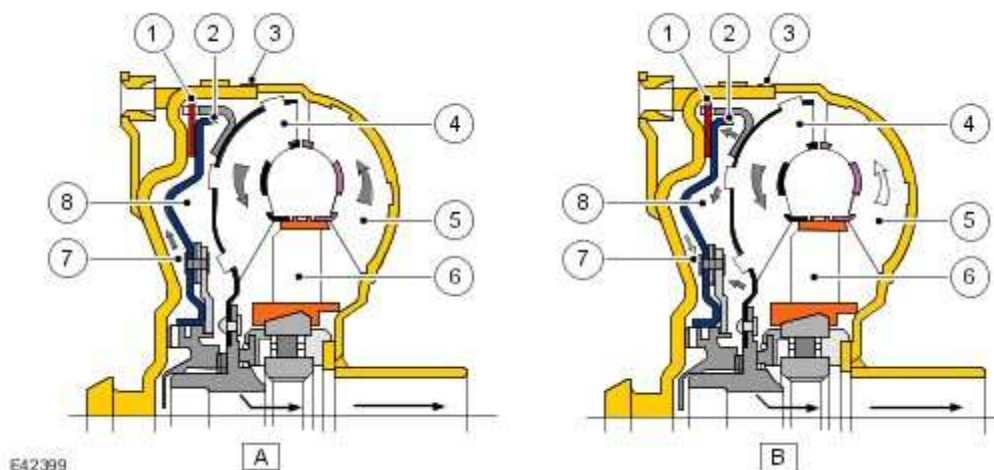
On the illustration shown, when the outer race is rotated in a clockwise direction, the sprags twist and are 'wedged' between the inner and outer races. The sprags then transfer the rotation of the outer race to the inner race, which rotates at the same speed.

Lock-Up Clutch Mechanism

The Torque Converter Clutch (TCC) is hydraulically controlled by an electronic pressure regulating solenoid (EPRS6) which is controlled by the TCM. This allows the torque converter to have 3 states of operation as follows:

- Fully engaged
- Controlled slip variable engagement
- Fully disengaged.

The TCC is controlled by two hydraulic spool valves located in the valve block. These valves are actuated by pilot pressure supplied via a solenoid valve which is also located in the valve block. The solenoid valve is operated by PWM signals from the TCM to give full, partial or no lock-up of the torque converter.



Item	Part Number	Description
A		Unlocked condition
B		Locked condition

1		Clutch plate
2		Clutch piston
3		Torque converter body
4		Turbine
5		Impeller
6		Stator
7		Piston chamber
8		Turbine chamber

The lock-up clutch is a hydro-mechanical device which eliminates torque converter slip, improving fuel consumption. The engagement and disengagement is controlled by the TCM to allow a certain amount of controlled 'slip'. This allows a small difference in the rotational speeds of the impeller and the turbine which results in improved shift quality. The lock-up clutch comprises a piston and a clutch friction plate.

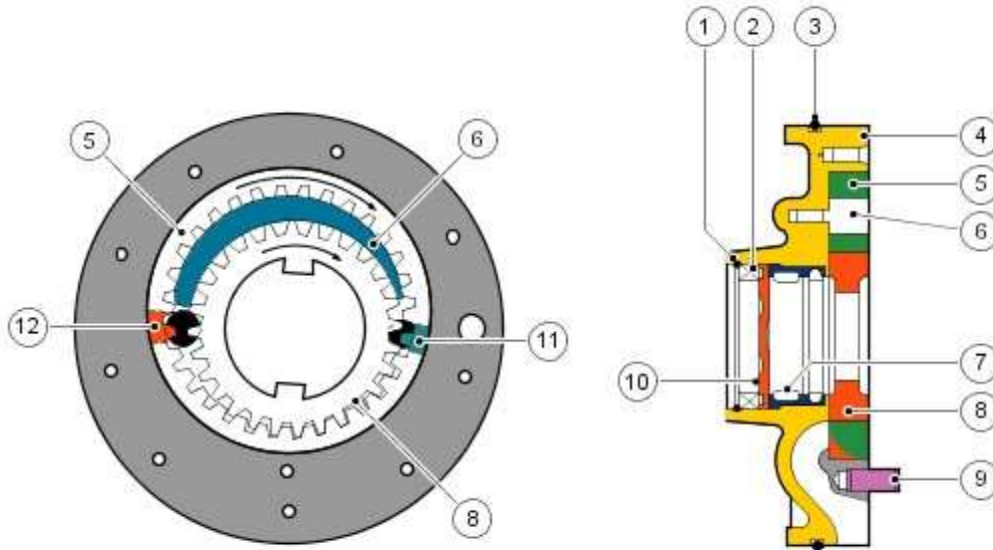
In the unlocked condition, the oil pressure supplied to the piston chamber and the turbine chamber is equal. Pressurized fluid flows through a drilling in the turbine shaft and through the piston chamber to the turbine chamber. In this condition the clutch plate is held away from the torque converter body and torque converter slip is permitted.

In the locked condition, the TCC spool valves are actuated by the electronic pressure regulating solenoid (EPRS6). The fluid flow in the unlocked condition is reversed and the piston chamber is vented. Pressurized fluid is directed into the turbine chamber and is applied to the clutch piston. The piston moves with the pressure and pushes the clutch plate against the torque converter body. As the pressure increases, the friction between the clutch plate and the body increases, finally resulting in full lock-up of the clutch plate with the body. In this condition there is direct mechanical drive from the engine crankshaft to the transmission planetary gear train.

FLUID PUMP

The fluid pump is an integral part of the transmission. The fluid pump is used to supply hydraulic pressure for the operation of the control valves and clutches, to pass the fluid through the transmission cooler and to lubricate the gears and shafts.

The 6HP26 fluid pump is a crescent type pump and is located between the intermediate plate and the torque converter. The pump has a delivery rate of 16 cm³ per revolution.



E42400

Item	Part Number	Description
1		Securing ring
2		Shaft oil seal
3		O-ring seal
4		Pump housing
5		Ring gear
6		Crescent spacer
7		Roller bearing
8		Impeller
9		Centring pin
10		Spring washer
11		Outlet port (high pressure)
12		Inlet port (low pressure)

The pump comprises a housing, a crescent spacer, an impeller and a ring gear. The housing has inlet and outlet ports to direct flow and is located in the intermediate plate by a centring pin. The pump action is achieved by the impeller, ring gear and crescent spacer.

The crescent spacer is fixed in its position by a pin and is located between the ring gear and the impeller. The impeller is driven by drive from the torque converter hub which is located on a needle roller bearing in the pump housing. The impeller teeth mesh with those of the ring gear. When the impeller is rotated, the motion is transferred to the ring gear which rotates in the same direction.

The rotational motion of the ring gear and the impeller collects fluid from the intake port in

the spaces between the teeth. When the teeth reach the crescent spacer, the oil is trapped in the spaces between the teeth and is carried with the rotation of the gears. The spacer tapers near the outlet port. This reduces the space between the gear teeth causing a build up of fluid pressure as the oil reaches the outlet port. When the teeth pass the end of the spacer the pressurized fluid is released into the outlet port.

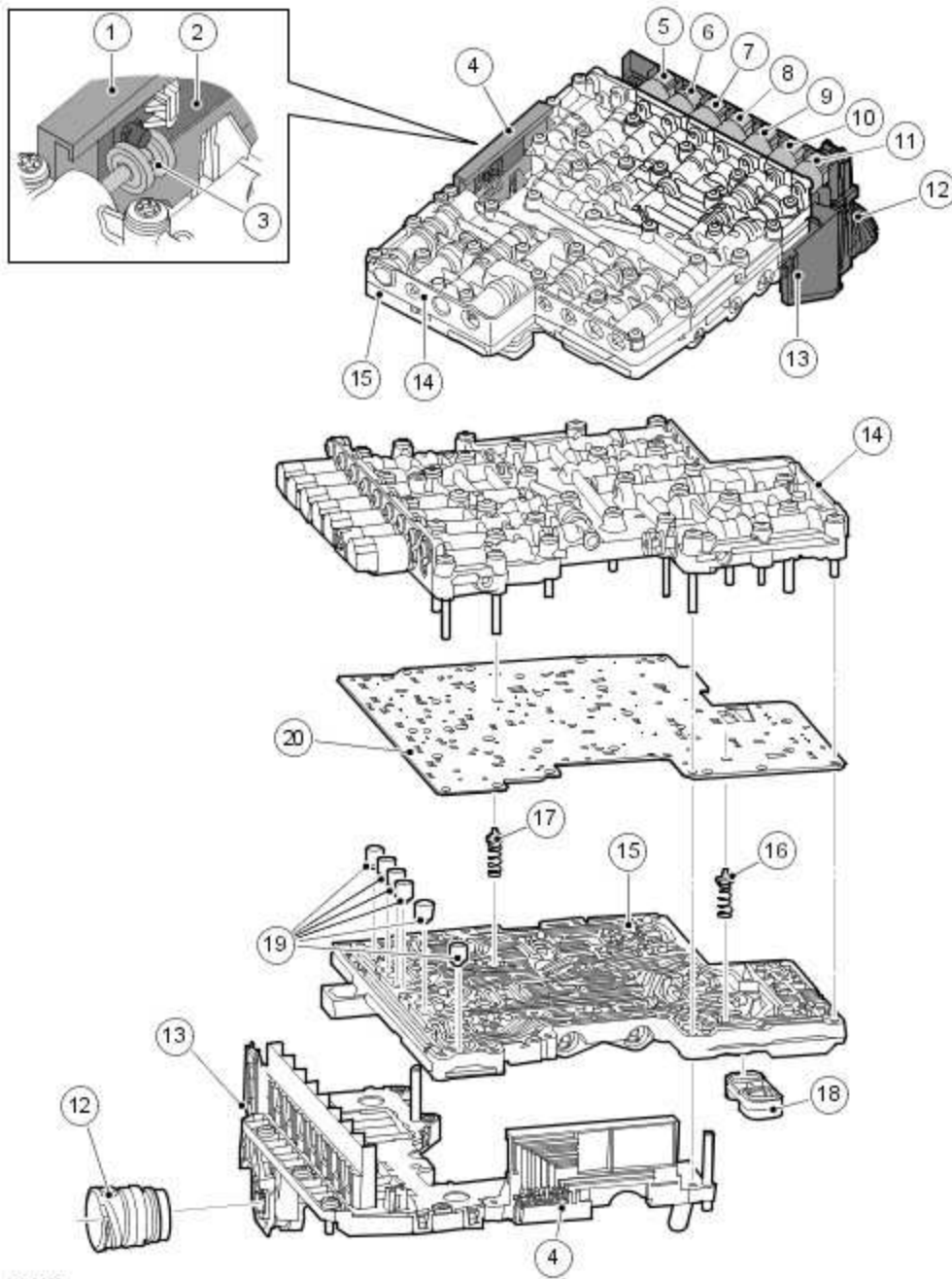
The fluid emerging from the outlet port is passed through the fluid pressure control valve. At high operating speeds the pressure control valve maintains the output pressure to the gearbox at a predetermined maximum level. Excess fluid is relieved from the pressure control valve and is directed, via the main pressure valve in the valve block, back to the pump inlet port. This provides a pressurized feed to the pump inlet which prevents cavitation and reduces pump noise.

MECHATRONIC VALVE BLOCK

The Mechatronic valve block is located in the bottom of the transmission and is covered by the fluid pan. The valve block houses the TCM, electrical actuators, speed sensors and control valves which provide all electro-hydraulic control for all transmission functions. The Mechatronic valve block comprises the following components:

- TCM
- 6 pressure regulator solenoids
- 1 shift control solenoid
- 1 damper
- 21 hydraulic spool valves
- Manually operated selector valve
- Temperature sensor
- Turbine speed sensor
- Output shaft speed sensor.

ZF 6HP26 Automatic Transmission – Mechatronic Valve Block

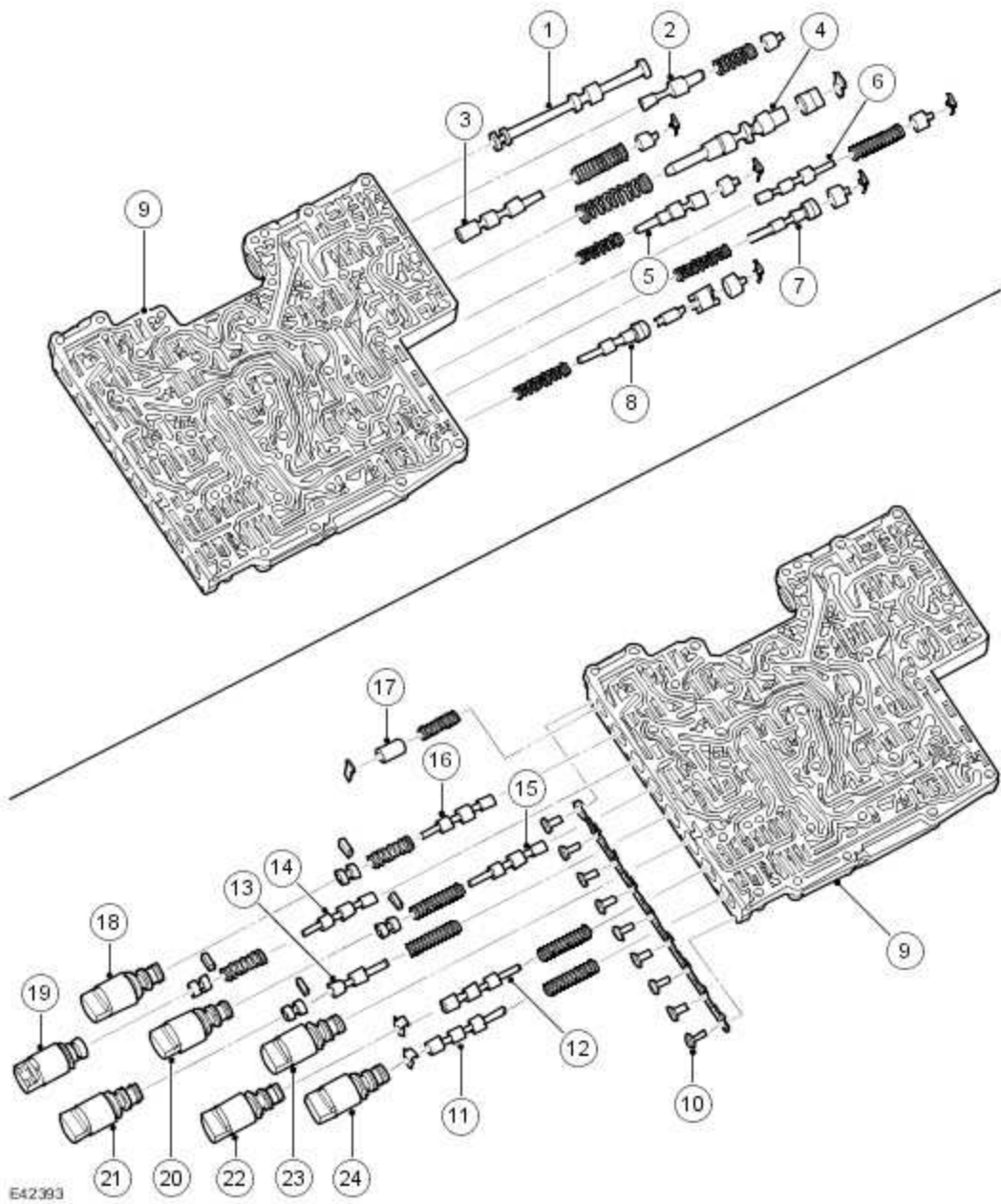


E42392

Item	Part Number	Description
1		Position switch
2		Sliding block
3		Selector spool valve
4		Position switch assembly
5		Electronic Pressure Regulator Solenoid (EPRS) 6
6		Solenoid valve 1
7		EPRS 4
8		EPRS 5

9		EPRS 3
10		EPRS 2
11		EPRS 1
12		Electrical connector
13		Transmission Control Module (TCM)
14		Valve housing
15		Valve plate
16		Torque converter retaining valve
17		Clutch return valve
18		Element seal
19		Pressure regulator dampers
20		Intermediate plate

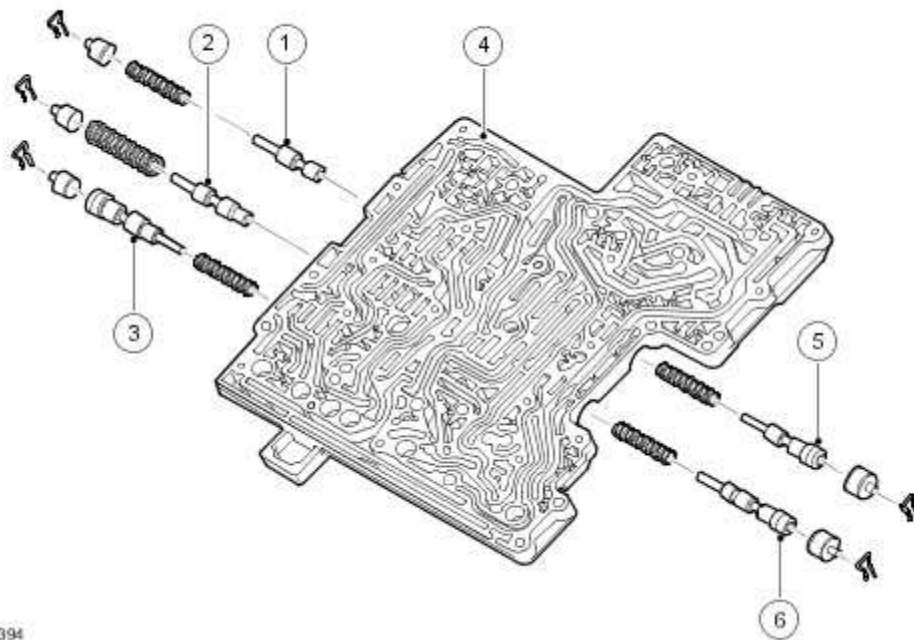
ZF 6HP26 Automatic Transmission – Valve Housing Components



Item	Part Number	Description
1		Selector spool valve
2		Lubricating valve
3		Torque converter pressure valve
4		System pressure valve
5		Torque converter clutch valve
6		Retaining valve – Clutch E
7		Clutch valve E
8		Clutch valve A

9		Valve housing
10		Bolts
11		Retaining valve – Clutch A
12		Retaining valve – Clutch B
13		Pressure reducing valve
14		Shift valve 1
15		Retaining valve – Brake D
16		Shift valve 2
17		Damper
18		Electronic Pressure Regulator Solenoid (EPRS) 6
19		Solenoid valve 1
20		EPRS 4
21		EPRS 5
22		EPRS 2
23		EPRS 3
24		EPRS 1

ZF 6HP26 Automatic Transmission – Valve Plate Components

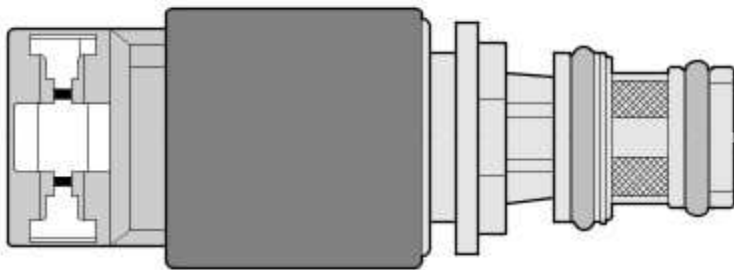


E42394

Item	Part Number	Description
1		Retaining valve – Brake D2

2		Clutch valve – Brake D2
3		Clutch valve B
4		Valve plate
5		Clutch valve – Brake D1
6		Clutch valve – Brake C

Electronic Pressure Regulator Solenoids (EPRS)



E42713

Six Electronic Pressure Regulator Solenoids (EPRS) are located in the valve block. The solenoids are controlled by Pulse Width Modulation (PWM) signals from the TCM. The solenoids convert the electrical signals into hydraulic control pressure proportional to the signal to actuate the spool valves for precise transmission operation.

The following table shows EPRS and their associated functions:

EPRS	Function
1	Clutch A
2	Clutch B
3	Clutch C
4	Brake clutches D and E
5	System pressure control
6	Torque converter lock-up control

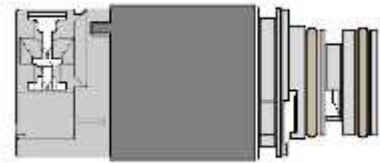
Solenoids EPRS 1, 3 and 6 supply a lower control pressure as the signal amperage increases and can be identified by a black connector cap. The TCM operates the solenoids using PWM signals. The TCM monitors engine load and clutch slip and varies the solenoid duty cycle accordingly. The solenoids have a 12 V operating voltage and a pressure range of 0 - 4.6 bar (0 - 67 lbf.in²).

Solenoids EPRS 2, 4 and 5 supply a higher control pressure as the signal amperage increases

and can be identified by a green connector cap. The solenoids are normally open, regulating flow solenoid valves. The TCM operates the solenoids using a PWM ground proportional to the required increasing or decreasing clutch pressures. The solenoids have a 12 V operating voltage and a pressure range of 4.6 - 0 bar (67 - 0 lbf.in²).

The resistance of the coil winding for the EPRS solenoids is 5.05 ohms at 20°C (68°F).

Control Solenoid



E42714

A shift control Solenoid Valve (SV) is located in the valve block. The solenoid is controlled by the TCM and converts electrical signals into hydraulic control signals to control clutch application.

The shift control solenoid is an open/closed, on/off solenoid which is controlled by the TCM switching the solenoid to earth. The TCM also supplies power to the solenoid. The TCM energises the solenoid in a programmed sequence for clutch application for gear ratio changes and shift control.

The resistance of the solenoid coil winding within the solenoid is between 26 to 30.4 ohms at 20°C (68°F).

Sensors

Speed Sensors

The turbine speed sensor and the output shaft speed sensor are Hall effect type sensors located in the Mechatronic valve block and are not serviceable items. The TCM monitors the signals from each sensor to determine the input (turbine) speed and the output shaft speed.

The turbine speed is monitored by the TCM to calculate the slip of the torque converter clutch and internal clutch slip. This signal allows the TCM to accurately control the slip timing during shifts and adjust clutch application or release pressure for overlap shift control.

The output shaft speed is monitored by the TCM and compared to engine speed signals received on the CAN bus from the ECM. Using a comparison of the two signals the TCM calculates the transmission slip ratio for plausibility and maintains adaptive pressure control.

Temperature Sensor

The temperature sensor is also located in the Mechatronic valve block. The TCM uses the temperature sensor signals to determine the temperature of the transmission fluid. These signals are used by the TCM to control the transmission operation to promote faster warm-up in cold conditions or to assist with fluid cooling by controlling the transmission operation when high fluid temperatures are experienced. If the sensor fails, the TCM will use a default value and a fault code will be stored in the TCM.

Damper

There is one damper located in the valve housing. The damper is used to regulate and dampen the regulated pressure supplied via EPRS 5. The damper is load dependent through modulation of the damper against return spring pressure.

The damper comprises a piston, a housing bore and a spring. The piston is subject to the pressure applied by the spring. The bore has a connecting port to the function to which it applies. Fluid pressure applied to the applicable component (i.e. a clutch) is also subjected to the full area of the piston, which moves against the opposing force applied by the spring. The movement of the piston creates an action similar to a shock absorber, momentarily delaying the build up of pressure in the circuit. This results in a more gradual application of clutches improving shift quality.

Spool Valves

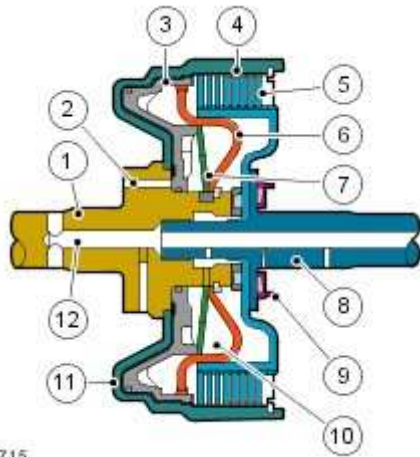
The valve block contains twenty one spool valves which control various functions of the transmission. The spool valves are of conventional design and are operated by fluid pressure.

Each spool valve is located in its spool bore and held in a default (unpressurized) position by a spring. The spool bore has a number of ports which allow fluid to flow to other valves and clutches to enable transmission operation. Each spool has a piston which is waisted to allow fluid to be diverted into the applicable ports when the valve is operated.

When fluid pressure moves a spool, one or more ports in the spool bore are covered or uncovered. Fluid is prevented from flowing or is allowed to flow around the applicable waisted area of the spool and into another uncovered port. The fluid is either passed through galleries to actuate another spool, operate a clutch or is returned to the fluid pan.

DRIVE CLUTCHES

Multiplate Drive or Brake Clutch – Typical



E42715

Item	Part Number	Description
1	-	Input shaft
2	-	Main pressure supply port
3	-	Piston
4	-	Cylinder – External plate carrier
5	-	Clutch plate assembly
6	-	Baffle plate
7	-	Diaphragm spring
8	-	Output shaft
9	-	Bearing
10	-	Dynamic pressure equalisation chamber
11	-	Piston chamber
12	-	Lubrication channel

There are 3 drive clutches and 2 brake clutches used in the 6HP26 transmission. Each clutch comprises one or more friction plates dependent on the output controlled. A typical clutch consists of a number of steel outer plates and inner plates with friction material bonded to each face.

On supercharged models, the uprated transmission includes additional clutch plates to enable the transmission to manage the additional power output of the supercharged engine.

The clutch plates are held apart mechanically by a diaphragm spring and hydraulically by dynamic pressure. The pressure is derived from a lubrication channel which supplies fluid to the bearings etc. The fluid is passed via a drilling in the output shaft into the chamber between the baffle plate and the piston. To prevent inadvertent clutch application due to pressure build up produced by centrifugal force, the fluid in the dynamic pressure equalisation chamber overcomes any pressure in the piston chamber and holds the piston off the clutch plate assembly.

When clutch application is required, main pressure from the fluid pump is applied to the piston chamber from the supply port. This main pressure overcomes the low pressure fluid

present in the dynamic pressure equalisation chamber. The piston moves, against the pressure applied by the diaphragm spring, and compresses the clutch plate assembly. When the main pressure falls, the diaphragm spring pushes the piston away from the clutch plate assembly, disengaging the clutch.

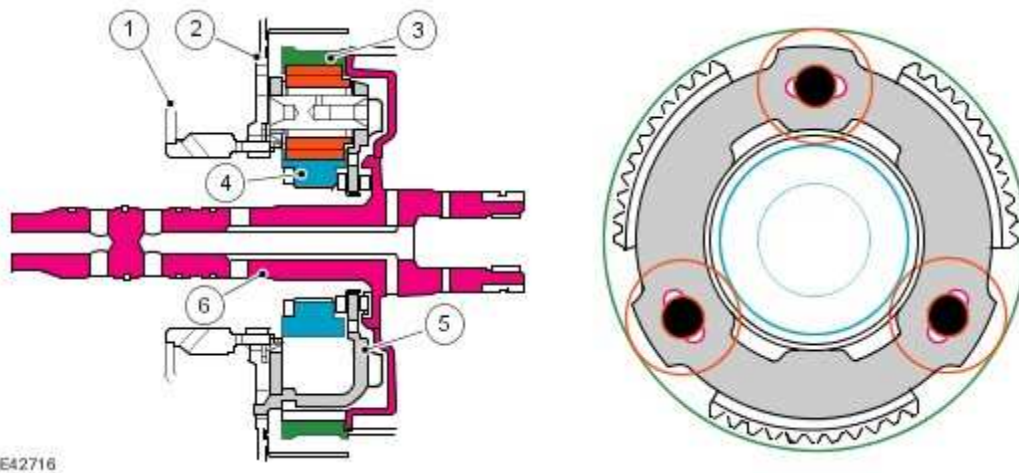
PLANETARY GEAR TRAINS

The planetary gear trains used on the 6HP26 transmission comprise a single web planetary gear train and a double web planetary gear train. These gear trains are known as Lepelletier type gear trains and together produce the 6 forward gears and the 1 reverse gear.

Single Web Planetary Gear Train

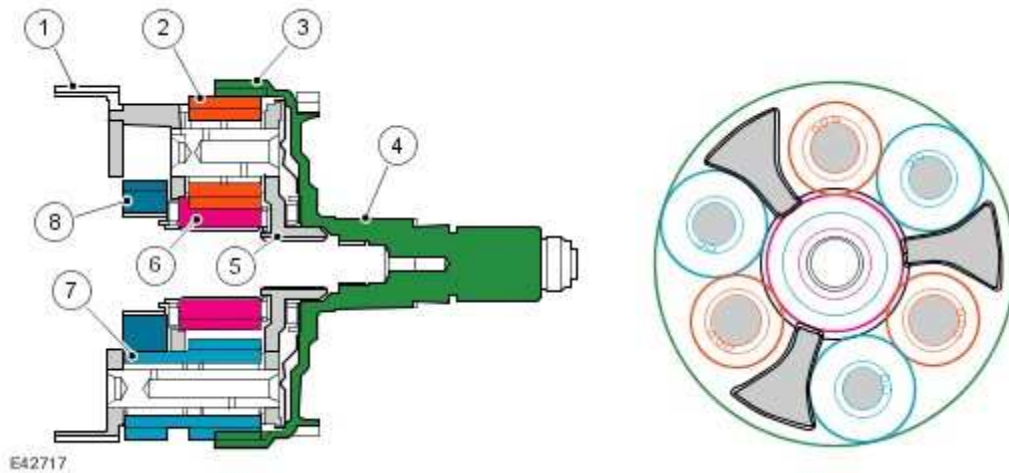
The single web planetary gear train comprises:

- 1 sunwheel
- 3 planetary gears
- 1 planetary gear carrier (spider)
- 1 ring gear or annulus



Item	Part Number	Description
1	-	Cylinder
2	-	Baffle plate
3	-	Ring gear
4	-	Sun gear
5	-	Planetary gear spider
6	-	Torque converter input shaft

Double Web Planetary Gear Train



E42717

Item	Part Number	Description
1	-	Planetary gear spider
2	-	Planetary gears (short)
3	-	Ring gear
4	-	Output shaft
5	-	Planetary gear carrier
6	-	Sunwheel
7	-	Double planetary gears (long)
8	-	Sunwheel

The double planetary gear train comprises:

- 2 sunwheels
- 3 short planetary gears
- 3 long planetary gears
- 1 planetary gear carrier
- 1 ring gear or annulus

POWER FLOWS

Operation of the transmission is controlled by the TCM which electrically activates various solenoids to control the transmission gear selection. The sequence of solenoid activation is based on programmed information in the module memory and physical transmission operating conditions such as vehicle speed, throttle position, engine load and selector lever position.

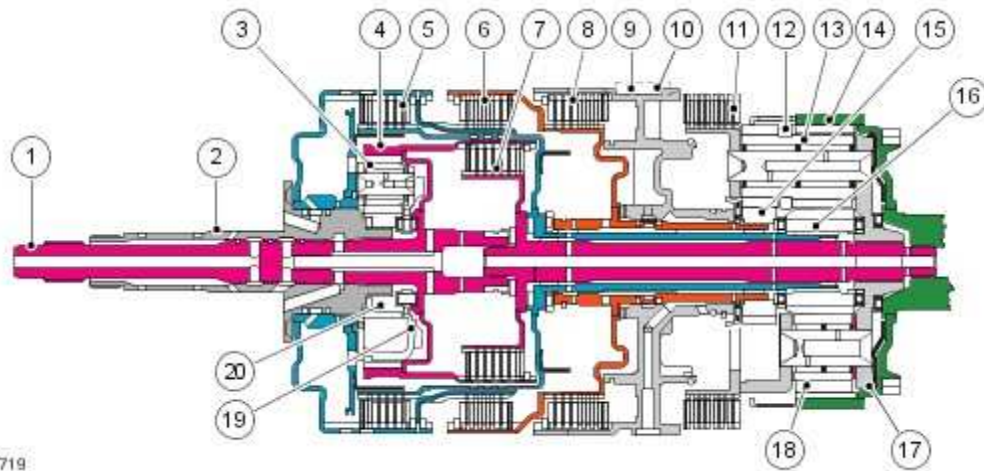
Powerflow Schematic

Lever Position	Solenoid Valve	Regulator Solenoids (EPRS)						
P	-	-	-	-	ON	-	-	
R	-	-	ON	-	ON	-	-	
N	-	-	-	-	ON	-	-	
D 1	-	ON	-	-	ON	-	-	
D 2	-	ON	-	ON	-	-	-	
D 3	-	ON	ON	-	-	-	-	
D 4	ON	ON	-	-	ON	-	-	
D 5	ON	-	ON	-	ON	-	-	
D 6	ON	-	-	ON	ON	-	-	
ON = Active (pressure build up)								
OFF = Inactive								
-ON- = Inactive (pressure drain)								

The following table shows which clutches are operating for selected gear ratios to produce the required torque output from the transmission.

Gear Selector Lever Position	Shift Control Solenoid Valve	Clutch	Brake	A	B	E	WK	C	D
P	-	-	-	-	-	-	X		
R	-	-	X	-	-	-	X		
N	-	-	-	-	-	-	X		
D 1	-	X	-	-	X	-	X		
D 2	-	X	-	-	X	X	-		
D 3	-	X	X	-	X	-	-		
D 4	ON	X	-	X	X	-	-		
D 5	ON	-	X	X	X	-	-		
D 6	ON	-	-	X	X	X	-		
X = clutch applied									

Shift Elements

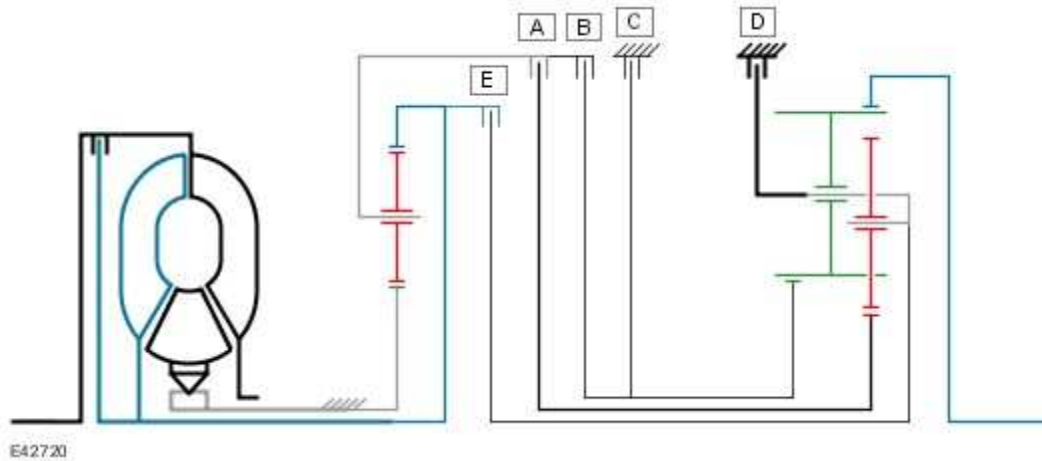


E42719

Item	Part Number	Description
1	-	Turbine shaft
2	-	Stator shaft
3	-	Single web planetary gear train
4	-	Ring gear 1
5	-	Clutch A
6	-	Clutch B
7	-	Clutch E
8	-	Brake clutch C
9	-	Fixed connection to transmission housing
10	-	Shaft key
11	-	Brake clutch D
12	-	Double web planetary gear train
13	-	Planetary gears - Long
14	-	Ring gear 2
15	-	Sunwheel 2
16	-	Sunwheel 3
17	-	Double web planetary gear carrier
18	-	Planetary gears - short
19	-	Single web planetary gear carrier
20	-	Sunwheel 1

The shift elements are 3 rotating multiplate clutches (A, B and E) and 2 fixed multiplate brakes © and D). All shifts from 1st to 6th gears are power-on overlapping shifts. Overlapping shifts can be described as one of the clutches continuing to transmit drive at a lower main pressure until the next required clutch is able to accept the input torque.

The shift elements, clutches and brakes are actuated hydraulically. Fluid pressure is applied to the required clutch and/or brake, pressing the plates together and allowing drive to be transmitted through the plates. The purpose of the shift elements is to perform power-on shifts with no interruption to traction and smooth transition between gear ratios.



Power Flow 1st Gear

The gear selector lever and the manual selector valve spool are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

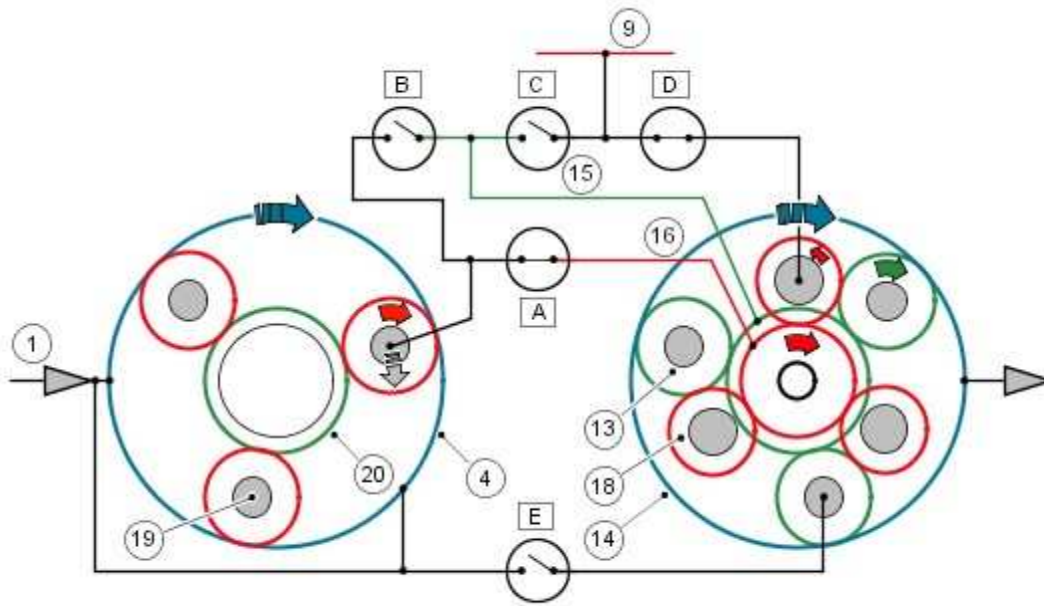
Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

The double web planetary gear train is locked against the transmission housing by brake 'D'. This allows ring gear 2 (output shaft) to be driven in the same direction as the engine via the long planetary gears.

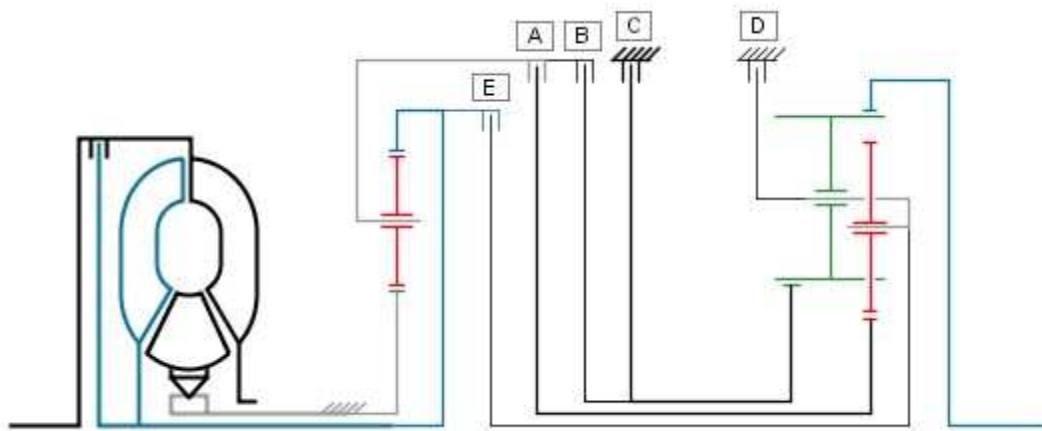
NOTE:

Refer to 'Shift Elements' illustration for key



E42721

Power Flow 2nd Gear



E42722

The gear selector lever and the manual selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

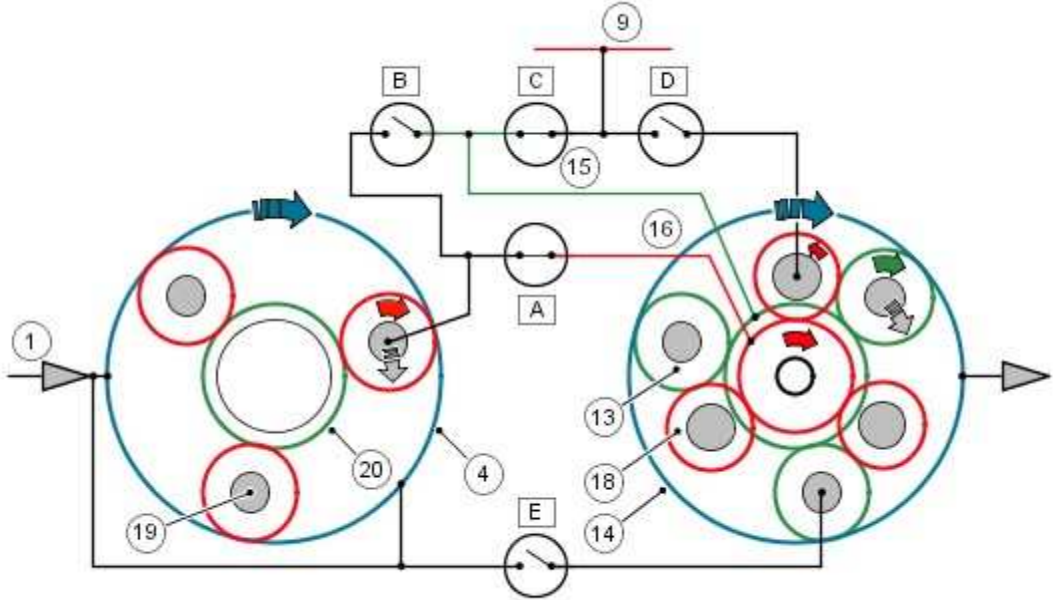
When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

Sunwheel 2 is locked to the transmission housing by brake clutch 'C'. The long planetary

gears, which are also meshed with the short planetary gears, roll around the fixed sunwheel 2 and transmit drive to the double web planetary gear train carrier and ring gear 2 in the direction of engine rotation.

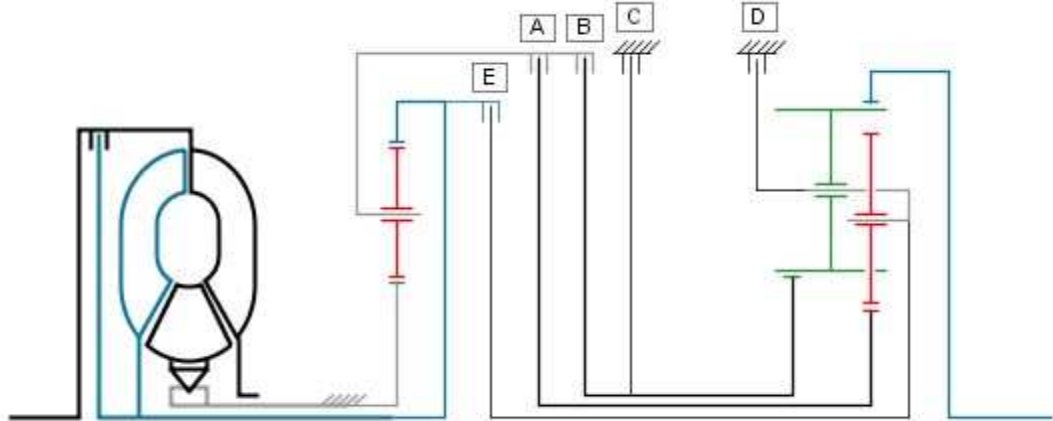
NOTE:

Refer to 'Shift Elements' illustration for key



E42723

Power Flow 3rd Gear



E42724

The gear selector lever and the manual selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to the ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier

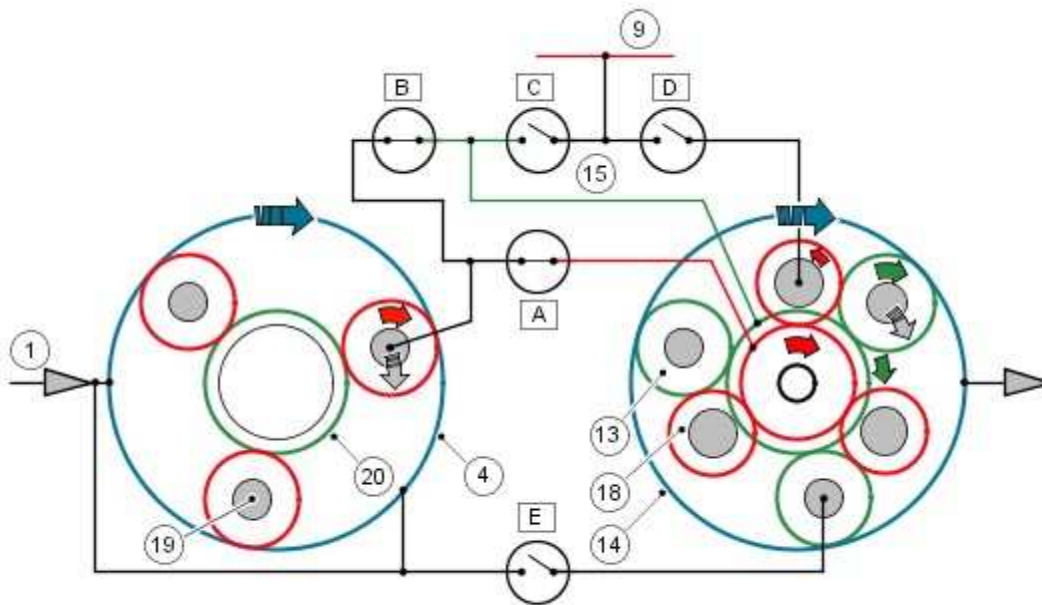
of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

Sunwheel 2 is driven via clutch 'B' which is engaged. The long planetary gears, which are also meshed with the short planetary gears, cannot roll around the fixed sunwheel 2 and transmit drive to the locked double web planetary gear train carrier in the direction of engine rotation.

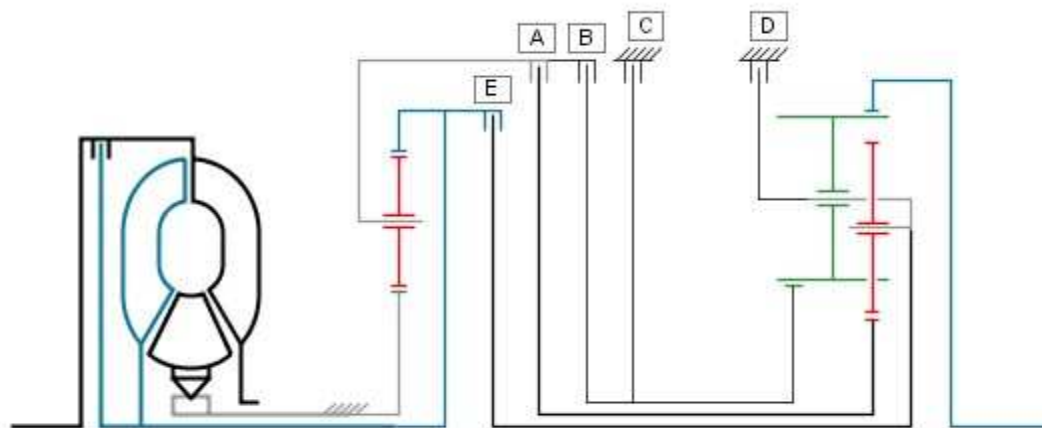
NOTE:

Refer to 'Shift Elements' illustration for key



E42725

Power Flow 4th Gear



E42726

The gear selector lever and the manual selector spool valve are in the 'D' position. Engine

torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

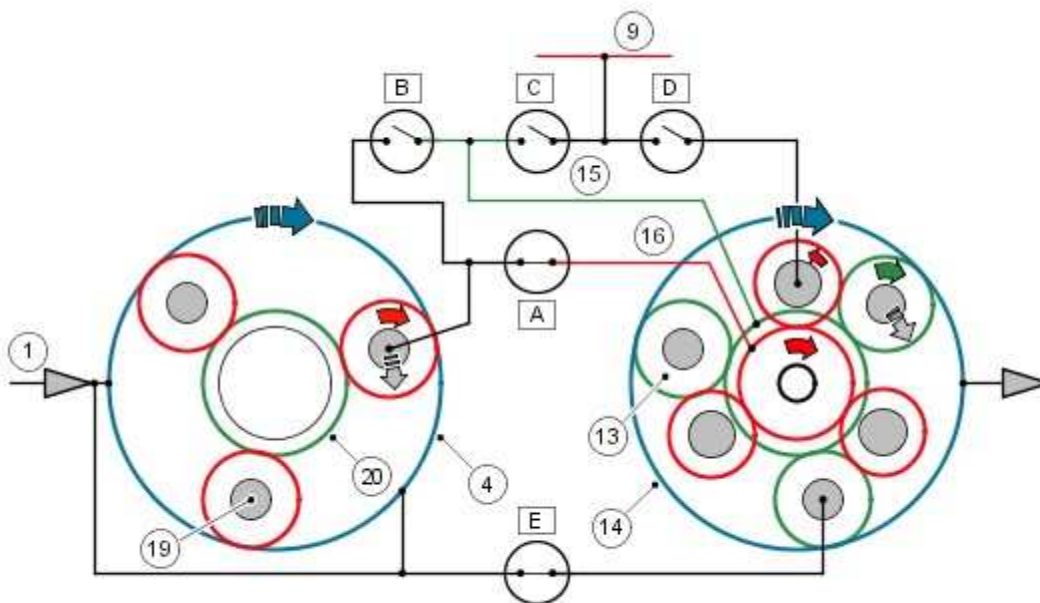
Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

The double web planetary gear carrier is driven via clutch 'E' which is engaged. The long planetary gears, which are also meshed with the short planetary gears, and the double web planetary gear carrier, drive ring gear 2 in the direction of engine rotation.

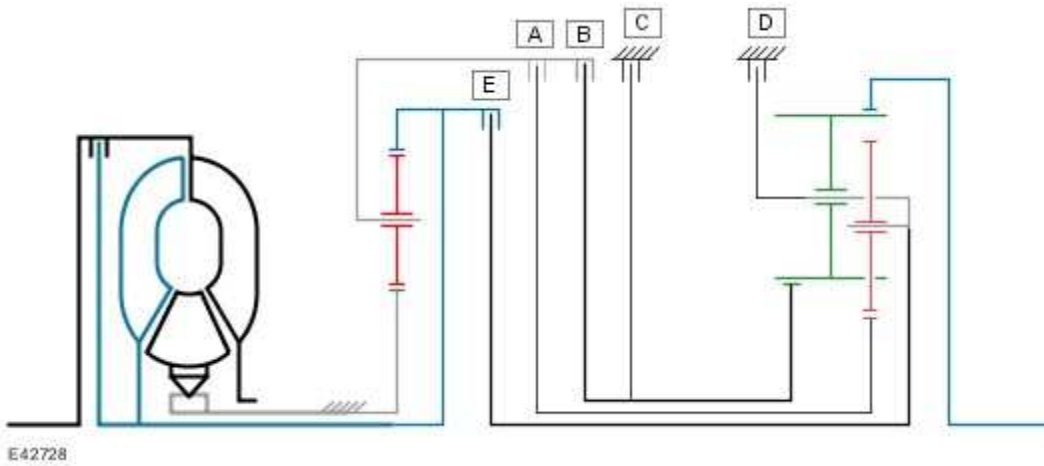
NOTE:

Refer to 'Shift Elements' illustration for key



E42727

Power Flow 5th Gear



The gear selector lever and the manual selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

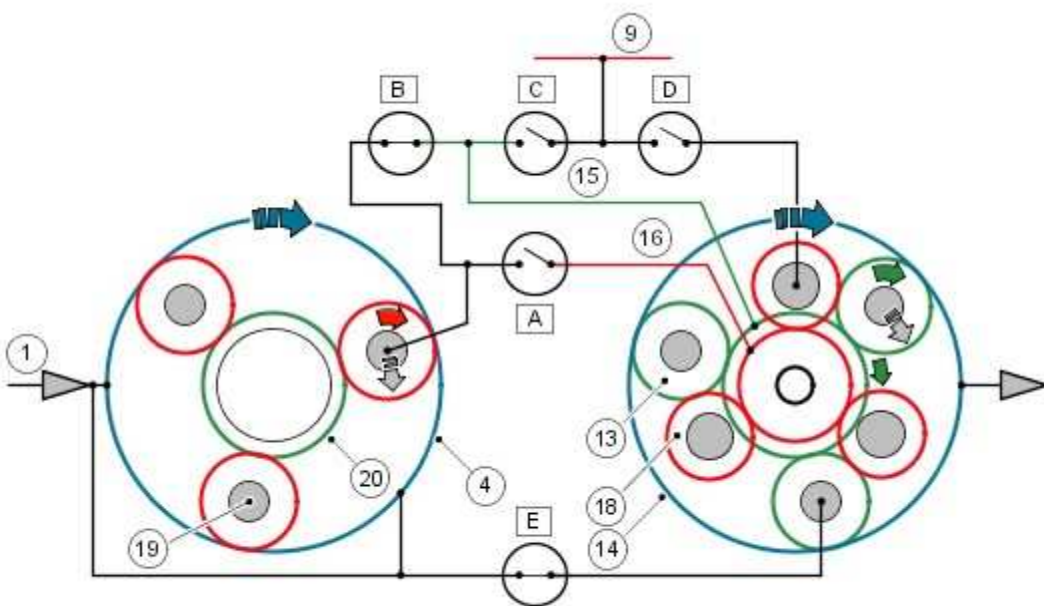
Ring gear 1 drives the planetary gears which rotate around sunwheel 1. This drives the planetary gear carrier 1 and also the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

When clutch 'A' is engaged, sunwheel 3 in the double web planetary gear train is driven and meshes with the short planetary gears.

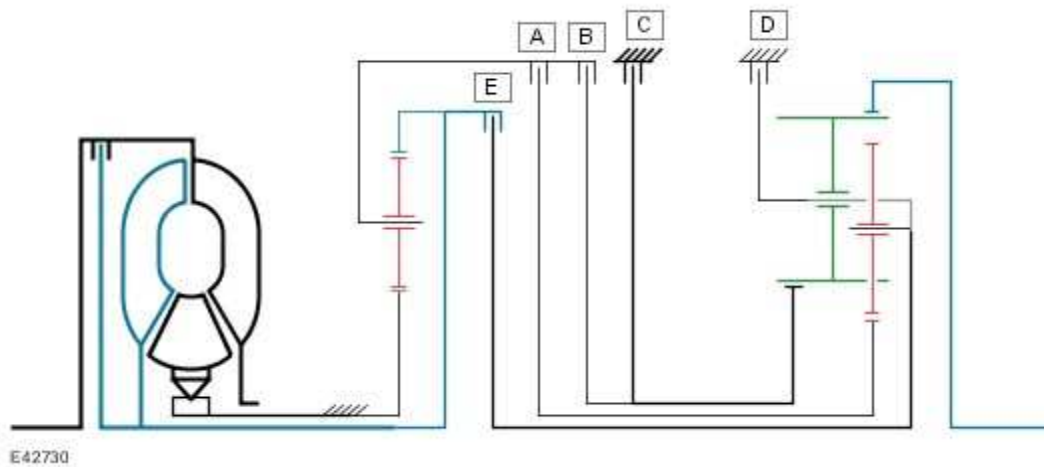
The long planetary gears, which are also meshed with the short planetary gears and the double web planetary gear carrier, drive ring gear 2 in the direction of engine rotation.

NOTE:

Refer to 'Shift Elements' illustration for key



Power Flow 6th Gear



The gear selector lever and the manual selector spool valve are in the 'D' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

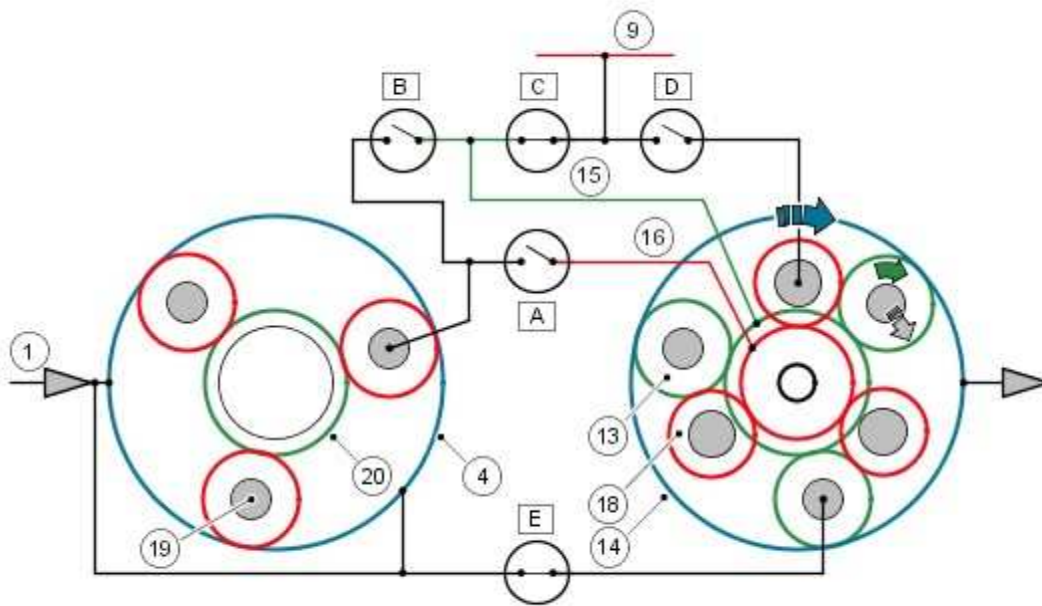
Clutches 'A' and 'B' are released, removing the effect of the single web planetary gear train.

Clutch brake 'C' is applied which locks sunwheel 2 to the transmission housing.

Clutch 'E' is engaged and drives the double web planetary gear carrier. This causes the long planetary gears to rotate around the fixed sunwheel 2 and transmit drive to ring gear 2 which is driven in the direction of engine rotation.

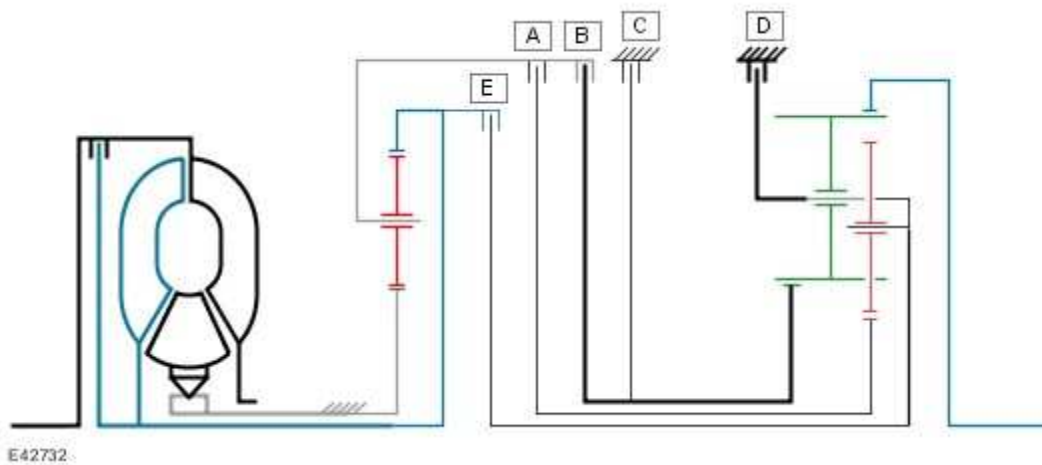
NOTE:

Refer to 'Shift Elements' illustration for key



E42731

Power Flow Reverse Gear



E42732

The gear selector lever and the manual selector spool valve are in the 'R' position. Engine torque is transmitted from the torque converter turbine shaft to ring gear 1 of the single web planetary gear train and the outer plate carrier of clutch 'E'.

Ring gear 1 drives the planetary gears of the single web planetary gear train which rotate around the fixed sunwheel 1. This transmits the drive to the single web planetary gear carrier, the outer plate carrier of clutch 'A' and the inner plate carrier of clutch 'B'.

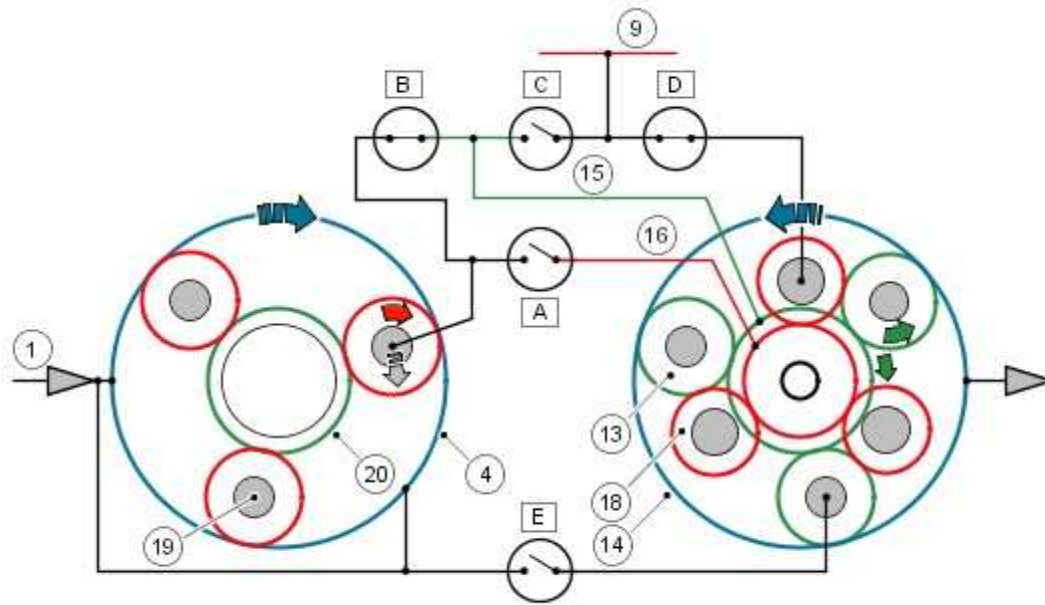
With clutch 'B' applied, sunwheel 2 in the double web planetary gear train is driven and meshes with the long planetary gears.

The double web planetary gear carrier is locked to the transmission housing by brake clutch

'D'. This allows ring gear 2 to be driven in the opposite direction to engine rotation by the long planetary gears.

NOTE:

Refer to 'Shift Elements' illustration for key



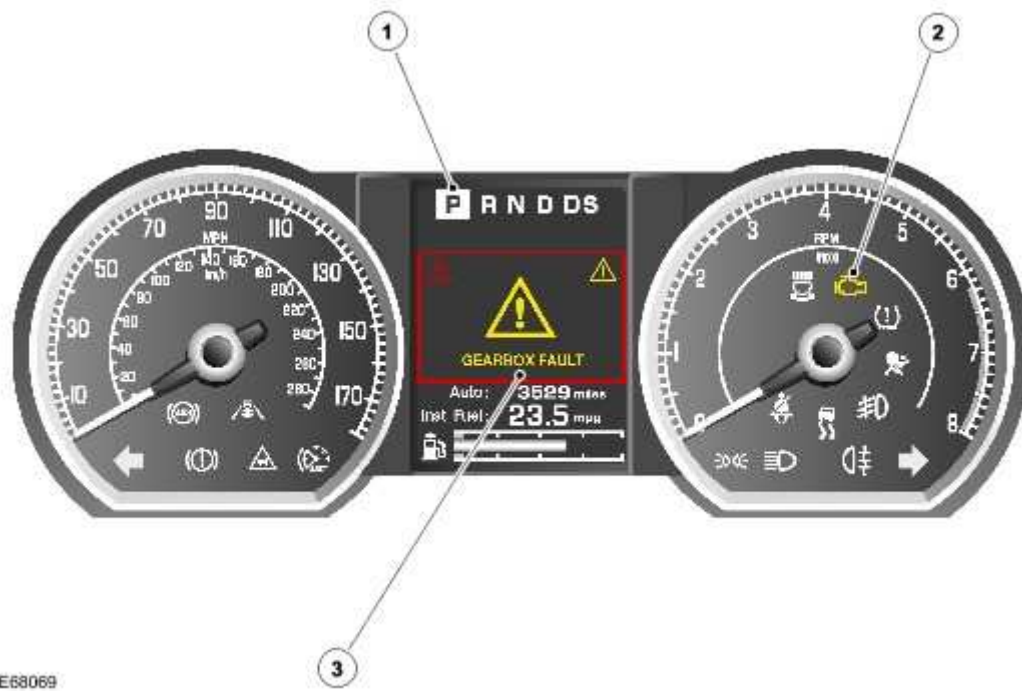
E42733

SELECTOR POSITION SWITCH

The Mechatronic valve block contains a position switch which is mechanically connected to the selector spool valve. The selector spool valve is connected by a selector shaft to the selector lever via a 'Bowden' selector cable.

The signals from the position switch are used by the TCM to determine the P, R, N or D selection made by the driver.

INSTRUMENT CLUSTER



E68069

Item	Part Number	Description
1	-	Transmission selected gear status
2	-	Malfunction Indicator Lamp (MIL)
3	-	Message centre

The instrument cluster is connected to the TCM via the high speed CAN bus. Transmission status is transmitted by the TCM and displayed to the driver in one of 2 displays in the instrument cluster. For additional information, refer to [Instrument Cluster](#) (413-01 Instrument Cluster)

Malfunction Indicator Lamp (MIL)

The MIL is located in the tachometer in the instrument cluster. Transmission related faults which may affect the vehicle emissions output will illuminate the MIL.

The MIL is illuminated by the ECM on receipt of a relevant fault message from the TCM on the high speed CAN. The nature of the fault can be diagnosed using the Integrated Diagnostic System (IDS) which reads the fault codes stored in the TCM memory.

Transmission Status Display

The transmission status display is located in a Liquid Crystal Display (LCD) at the top of the instrument cluster, between the speedometer and the tachometer. The LCD shows the selector lever position or the selected gear when in manual 'Jaguar Sequential Shift' mode.

The following table shows the displays and their descriptions.

Symbol	Description
P	Park selected
R	Reverse selected
N	Neutral selected
D	Drive selected
DS	Sport mode selected
1	1st gear selected (Manual 'Jaguar Sequential Shift' mode)
2	2nd gear selected (Manual 'Jaguar Sequential Shift' mode)
3	3rd gear selected (Manual 'Jaguar Sequential Shift' mode)
4	4th gear selected (Manual 'Jaguar Sequential Shift' mode)
5	5th gear selected (Manual 'Jaguar Sequential Shift' mode)
6	6th gear selected (Manual 'Jaguar Sequential Shift' mode)

Message Centre Display

The message centre is located in the lower centre of the instrument cluster. The message centre is a LCD to relay vehicle status and operating information to the driver and can display messages relating to a number of the vehicle systems. If a transmission fault occurs, the message centre will display the message 'GEARBOX FAULT'.

TRANSMISSION CONTROL MODULE (TCM)

The TCM is an integral part of the Mechatronic valve block which is located at the bottom of the transmission, within the fluid pan. The TCM is the main controlling component of the transmission.

The TCM processes signals from the transmission speed and temperature sensors, ECM and other vehicle systems. From the received signal inputs and pre-programmed data, the module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

The TCM outputs signals to control the shift control solenoid valve and the Electronic Pressure Regulator Solenoids (EPRS) to control the hydraulic operation of the transmission.

The ECM supplies the engine management data on the high speed CAN bus system. The TCM requires engine data to efficiently control the transmission operation, for example; flywheel torque, engine speed, accelerator pedal angle, engine temperature etc.

The steering angle sensor and the ABS module also supply data to the TCM on the high speed CAN bus system. The TCM uses data from these systems to suspend gear changes when the vehicle is cornering and/or the ABS module is controlling braking or traction control.

The selector lever is connected to the automatic transmission and the position switch in the transmission by a Bowden cable. Movement of the selector lever moves the position switch

via the cable and the switch position informs the TCM of the selected position. The sport switch passes the sport selection to the TCM. 'Jaguar Sequential Shift' selections are sensed when the driver operates the steering wheel paddle switches. An additional switch provides a selector lever 'not in park' position signal. Once the selector lever position is confirmed, the TCM outputs appropriate information which is received by the instrument cluster to display the gear selection information in the message centre.

The Mechatronic valve block also contains the speed and temperature sensors. These are integral with the Mechatronic valve block and cannot be serviced individually. The speed sensors measure the transmission input and output speeds and pass signals to the TCM. The fluid temperature sensor is also located in the valve block and measures the fluid temperature of the transmission fluid in the fluid pan.

A 'not in park' switch is located in the selector lever mechanism. The switch is connected to the instrument cluster, Central Junction Box (CJB) and the ECM. The instrument cluster uses the park switch status to display the selector position. The ECM uses the status to allow starter motor operation only when the selector lever is in the Park or Neutral positions. The signal is also passed from the CJB to the TCM.

CONTROLLER AREA NETWORK (CAN)

The high speed CAN bus is used to connect the powertrain modules. The CAN bus is connected between the following electronic units:

High Speed CAN Bus

- TCM
- Instrument cluster
- Adaptive Damping Control Module (ADCM) - if fitted
- Steering angle sensor
- Electric park brake module
- Restraints control module
- Engine Control Module (ECM)
- ABS control module
- Adaptive front lighting control module - if fitted
- Adaptive cruise control module - if fitted
- Diagnostic socket.

The CAN bus allows a fast exchange of data between modules. The CAN bus comprises 2 wires which are identified as CAN high (H) and CAN low (L). The 2 wires are coloured yellow/black (H) and yellow/brown (L) and are twisted together to minimise electromagnetic interference (noise) produced by the CAN bus messages. For additional information, refer to [Communications Network](#) (418-00 Module Communications Network)

In the event of CAN bus failure, the following symptoms may be observed:

- Transmission operates in default (limp home) mode
- Torque converter lock-up clutch control is disabled

- Gear position indication in instrument cluster message centre inoperative (this will also occur with any transmission fault).

DRIVING MODES

There are a number of different driving modes of operation. Some can be selected by the driver and some are automatically initiated by the TCM during driving:

- Normal mode
- Sport mode
- Manual ('Jaguar Sequential Shift') mode
- Adaptive Shift Strategy (ASIS)
- Cruise mode
- Hill mode
- Default (Limp home) mode
- Reverse lock-out mode
- Cooling strategy
- Curve recognition mode
- Fast off recognition.

Normal Mode

Normal mode is automatically selected by the TCM on power up. In this mode all automatic and adaptive modes are active. Normal mode uses gear shift and lock-up maps to allow for vehicle operation which offers fuel consumption and emissions or driveability depending on the driving style. If the transmission is operated in sport or manual mode and the selector lever is moved to the 'D' position, normal mode is automatically resumed.

Sport Mode

The sport mode provides enhanced acceleration and responsiveness. In sport mode the TCM uses shift maps which allow the transmission to downshift more readily, hold gears for longer at higher engine speeds, and limits the transmission to the first five gears (6th gear is not used).

Sport mode is selected by moving the selector lever across the 'L' gate into the 'S' position. When the sport mode is first selected, if 6th gear is currently engaged, the TCM downshifts to 5th.

Manual ('Jaguar Sequential Shift') Mode

Manual mode allows the transmission to operate as a semi-automatic 'Jaguar Sequential Shift' unit. The driver can change up and down the 6 forward gears with the freedom of a manual transmission.

Shift maps are provided for manual mode to protect the engine at high engine speeds. The TCM will automatically change up to a higher gear ratio to prevent engine overspeed and change down to a lower gear ratio to avoid engine labouring and stalling.

When kickdown is requested the TCM downshifts at least 2 gears.

When the vehicle is stationary, to drive off the driver can select 1st , 2nd or 3rd gear. Any other gear selection will be rejected by the TCM.

When driving off, upshifts can be pre-selected by making + selections with the appropriate steering wheel upshift or downshift paddle for the number of upshifts required. The TCM then automatically performs a corresponding number of upshifts when the appropriate shift points are reached. So, for example, when starting off in 1st gear, if three upshift (+) selections are made in quick succession, the TCM will automatically change up through the box to 4th gear as the vehicle accelerates, without any further selections being made.

In manual mode a low gear can be selected to provide engine braking for descending a slope or continuous use of the brake pedal. The driver can prepare for the end of the descent by moving the selector lever to D. The TCM will maintain the low gear and only revert to automatic shift control when the throttle is opened and vehicle speed increases.

Adaptive Shift Strategy (ASIS)

The ASIS system is a new feature on automatic transmissions. With the TCM linked via the CAN bus to other vehicle systems, signals are received which can allow the TCM to calculate the way in which the vehicle is being driven. The type of signals include the following:

- Longitudinal and lateral acceleration
- Engine speed
- Engine torque
- Oil temperature
- Accelerator pedal position
- Wheel speed.

Using these signals, additional transmission control can be obtained. The TCM can calculate when the vehicle is cornering, all wheels are gripping, the driver is braking or if the driver is accelerating. This is the conventional 'Adaptive' transmission control. ASIS uses this system but adds the continuous adaptation of the gear changes to suit the individual driving style of the driver.

Cruise Mode

When speed control is activated, the TCM receives a cruise active message on the CAN bus. The TCM activates a speed control map which prevents locking and unlocking of the torque converter clutch and minimises up and down shifts.

Hill Mode

Hill mode is initiated by the TCM when the engine torque, received via ECM signals on the CAN bus, exceeds the theoretical load curve for normal operation. The TCM monitors this signal to determine when the vehicle is travelling up or down a steep gradient.

In hill mode the TCM adopts one of four shift maps, three uphill and one downhill. The shift map chosen depends on the severity of the slope as determined from the engine signals and the appropriate gear is selected to assist with the ascent or descent.

Hill mode can also be initiated when the vehicle is at very high altitudes or ambient temperatures.

Default (Limp Home) Mode

If a transmission fault is detected by the TCM, the TCM adopts a limp home mode strategy. 'GEARBOX FAULT' is displayed in the message centre and, if the fault has an effect on engine emissions, the MIL will also be illuminated.

In default mode, P, R and N functions operate normally (if the fault allows these selections) and the TCM locks the transmission in 3rd or 5th gear to allow the driver to take the vehicle to the nearest dealer. The torque converter lock-up clutch is disabled and reverse lock-out will not function.

If the vehicle is stopped and subsequently restarted in the default mode condition, the TCM operates normally until the fault which caused the condition is detected again.

If electrical power is lost and the transmission is operating in mechanical limp home mode, the selector lever will be locked in the 'N' or 'P' position by the shift interlock solenoid if moved from the 'D' position.

Reverse Lock-Out Mode

When the vehicle is travelling forwards, selecting reverse could cause transmission damage. To protect against this, reverse gear is prohibited if the vehicle is travelling forwards at a road speed of 5 mph (8 km/h) or higher.

Cooling Strategy

The purpose of the cooling strategy is to reduce engine and transmission temperatures during high load conditions. Under these conditions the engine and transmission may generate excessive heat.

If the transmission fluid temperature increases to 125°C (257°F) or higher, the TCM employs the cooling strategy. No message is displayed in the message centre for transmission overheat.

The strategy uses a specific shift and torque converter lock-up clutch map. This map allows torque converter clutch lock-up and gear shifts to operate outside of their normal operation. This will reduce the engine speed and/or slip in the torque converter, therefore reducing heat generated by the engine and the transmission.

If the transmission fluid temperature increases to 137°C (278°F) or higher, the transmission will use the default (limp home mode). If the temperature exceeds 140°C (284°F), CAN bus transmission is disabled.

The cooling strategy is cancelled when the transmission fluid temperature decreases to less than 120°C (248°F) or below.

Curve Recognition

Curve recognition is activated when high levels of lateral acceleration and/or steering angle are detected via the ABS module and steering angle sensor signals on the CAN bus. When this condition is detected, the TCM prevents the transmission from changing to a higher gear to assist with cornering. When the vehicle completes its manoeuvre, the transmission will shift to the correct ratio.

Fast Off Recognition

Fast off recognition is activated when the TCM detects that the driver has backed off the accelerator pedal quickly in a 'change of mind' manoeuvre. This is detected by monitoring for a high level of negative pedal angle from the engine control module signal on the CAN bus. If this condition is detected, the TCM holds the current gear ratio to allow the driver to complete his original action without the need for a downshift. The mode remains active for a predetermined time period or if the driving style remains passive.

TRANSMISSION FAULT STATUS

If the TCM detects a fault with the transmission system, it will enter a default mode to prevent further damage to the transmission and allow the vehicle to be driven.

When a fault is detected a CAN message is sent from the TCM and is received by the instrument cluster. The instrument cluster illuminates the MIL, if an emissions related fault occurs, and displays 'GEARBOX FAULT' in the message centre.

Some transmission faults may not illuminate the MIL or display a fault message, but the driver may notice a reduction in shift quality. For additional information, refer to [Transmission Description](#) (307-01 Automatic Transmission/Transaxle)

ENGINE SPEED AND TORQUE MONITORING

The ECM constantly supplies the TCM with information on engine speed and torque through messages on the CAN bus. The TCM uses this information to calculate the correct and appropriate timing of shift changes.

If the messages are not received by the ECM, the TCM will implement a back-up strategy to protect the transmission from damage and allow the vehicle to be driven.

In the event of an engine speed or torque signal failure, the transmission will adopt the electrical limp home mode with the transmission operating in a fixed gear.

TOWING FOR RECOVERY

The following procedure must be used to ensure that the vehicle is towed in a safe condition and damage to the vehicle transmission systems is prevented.

- Secure the towing attachment from the recovery vehicle to the towing eye of the vehicle to be recovered.
- Make sure that the parking brake is on. Press the start/stop button to switch the ignition on.
- Apply the footbrake and move the automatic transmission selector lever to the neutral position. If electrical power is not available, use the manual interlock release tab on the selector lever to move the lever to the neutral (N) position.
- Make sure that the Smart Key is placed in the start control module to ensure that the electric steering lock is disengaged and, if the stop lamps and turn signal indicators are required, the start/stop button is pressed and the ignition is on.
- Make sure that the parking brake is released before the vehicle is towed.
- The vehicle can only be towed for a maximum of 0.5 miles (0.8 km) at a maximum speed of 30 mph (48 km/h).

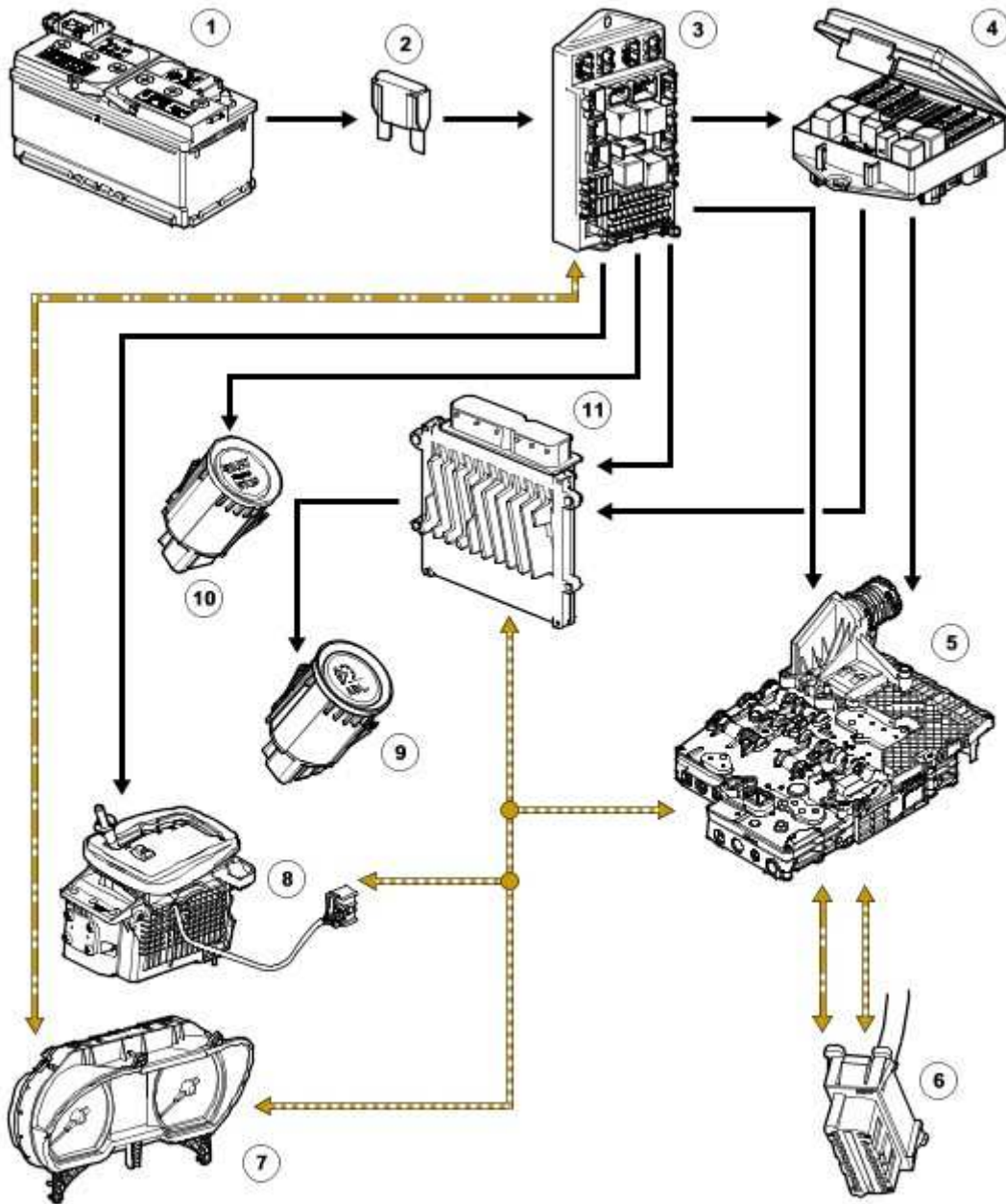


WARNING: Do not remove the Smart Key from the vehicle when the vehicle is being towed. The electric steering lock will be engaged preventing the steering from being turned. With the engine not running, the brake booster and power steering pump will be inoperative. Care must be taken to ensure the vehicle is manoeuvred and driven accordingly.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN Bus; **N** = Medium speed CAN Bus



E64871



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		CJB
4		Power distribution box
5		TCM
6		Diagnostic socket
7		Instrument cluster
8		Transmission selector lever assembly

9		Automatic speed limiter switch
10		Stop/Start switch
11		ECM

Diagnostic Strategy

Principle of Operation

For a detailed description of the automatic transmission/transaxle, refer to the relevant Description and Operation section in the workshop manual.

Transmission Description

Fluid Level and Condition Check



CAUTION: The vehicle should not be driven if the fluid level is low as internal failure can result.

NOTE:

The transmission fluid temperature must not be allowed to exceed 50°C (122°F) whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission fluid to cool to below 30°C (86°F).

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and could result in transmission damage. To correctly check and add fluid to the transmission.

Transmission Fluid Level Check

High Fluid Level

A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission damage. If an overfill condition is identified, with the engine at idle ensure the fluid temperature is within the specified range and allow the excess fluid to drain until a small thread of fluid runs from the filler/level plug hole.

Low Fluid Level

A low fluid level could result in poor transmission engagement, slipping, or damage. This could also indicate a leak in one of the transmission seals or gaskets.

Transmission Fluid Level Check

Adding Fluid



CAUTION: The use of any other type of transmission fluid other than that specified can result in transmission damage.

If fluid needs to be added, add fluid in 0.50 liter increments through the fill hole opening. Do not overfill the fluid. For fluid type, refer to the General Specification chart in this section.
Specifications

Fluid Condition Check

1 . Check the fluid level.

Transmission Fluid Level Check

2 . Observe the color and the odour of the fluid. The color under normal circumstances should be like honey, not brown or black.

3 . Allow the fluid to drip onto a facial tissue and examine the stain.

4 . If evidence of solid material is found, the transmission fluid pan should be removed for further inspection.

NOTE: In the event of a transmission unit replacement for internal failure, the oil cooler and pipes must also be replaced.

Inspection and Verification

1 . Verify the customer concern.

2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical	Hydraulic
<ul style="list-style-type: none"> Damaged shift mechanism/linkages Damaged automatic transmission casing Check the transmission selector lever cable for correct adjustment. Selector Lever Cable Adjustment (44.15.07) 	<ul style="list-style-type: none"> Blown fuse(s) Damaged, loose or corroded connectors Wiring harness 	<ul style="list-style-type: none"> Fluid level too high/low Poor condition of fluid Fluid leak

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident check for diagnostic trouble codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint

tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module/transmission is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/transmission.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P071100	Transmission Fluid	<ul style="list-style-type: none">• Transmission fluid temperature sensor	Install a new transmission control

	Temperature Sensor A Circuit Range/Performance	pins short circuit or fluid temperature rise rate too low	module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P093800	Transmission fluid temperature sensor range/performance	<ul style="list-style-type: none"> • Transmission fluid temperature compared with module temperature fault 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P071300	Transmission fluid temperature sensor circuit high input	<ul style="list-style-type: none"> • Both transmission fluid temperature sensor pins signal voltage too high 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P071200	Transmission fluid temperature sensor circuit low input	<ul style="list-style-type: none"> • Both transmission fluid temperature sensor pins signal voltage too low 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P071000	Transmission fluid temperature sensor circuit open	<ul style="list-style-type: none"> • Open circuit transmission fluid temperature sensor 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P070000	Transmission control system (MIL Request)	<ul style="list-style-type: none"> No wheel speed information on CAN TCM failure 	<p>Check for wheel speed related DTCs and refer to DTC Index.</p> <p>Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index.</p> <p>Transmission Control Module (TCM) and Main Control Valve Body</p>
P062F00	Internal control module EEPROM error	<ul style="list-style-type: none"> EEPROM communication error 	<p>Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index.</p> <p>Transmission Control Module (TCM) and Main Control Valve Body</p>
P060100	Internal control module memory checksum error	<ul style="list-style-type: none"> Software error TCM failure 	<p>Re-configure the transmission using the manufacturer approved diagnostic system, clear DTC and re-test. If DTC remains, Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index.</p> <p>Transmission Control Module (TCM) and Main Control Valve Body</p>
P072000	Output shaft speed sensor circuit	<ul style="list-style-type: none"> Transmission output shaft speed sensor circuit short to power 	<p>Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index.</p> <p>Transmission Control Module (TCM) and Main Control Valve Body</p>
P072122	Output shaft speed sensor circuit	<ul style="list-style-type: none"> Transmission output shaft speed sensor 	<p>Install a new transmission control module and main control valve body assembly, refer to the new</p>

	range/performance	signal out of range	module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P021900	Engine overspeed condition	<ul style="list-style-type: none"> Engine speed signal received over CAN is too high 	Check engine management DTCs and refer to DTC Index. Electronic Engine Controls
P071700	Turbine/input shaft speed sensor A circuit - short to power	<ul style="list-style-type: none"> Turbine/input shaft speed sensor A circuit - short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P071600	Turbine/input shaft speed sensor A circuit failure or sensor out of range	<ul style="list-style-type: none"> Circuit short to ground, power, open circuit or signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P089700	Transmission fluid requires replacement due to excessive running time at maximum operating temperatures	<ul style="list-style-type: none"> Low transmission fluid level Blocked or damaged transmission fluid cooler 	Drain and re-fill transmission fluid to correct level. Transmission Fluid Drain and Refill (44.24.02) Check for blocked or damaged transmission fluid cooler
P012100	Throttle/pedal position sensor A circuit range/performance	<ul style="list-style-type: none"> Pedal assembly faulty or does not have full range of movement 	Ensure the accelerator pedal is free from restriction, check 'Accelerator Pedal Position received on CAN' datalogger signal (should be 100% when pedal fully depressed). Check for throttle/pedal position related DTCs and refer to DTC Index. Electronic Engine Controls

P070500	Transmission range sensor A circuit (PRNDL input)	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P178300	Transmission over temperature condition	<ul style="list-style-type: none"> Low transmission fluid level Blocked or damaged transmission fluid cooler 	Drain and re-fill transmission fluid to correct level. Transmission Fluid Drain and Refill (44.24.02) Check for blocked or damaged transmission fluid cooler
P056200	TCM supply voltage low	<ul style="list-style-type: none"> Low battery charge Harness fault 	Ensure battery is in a fully charged and serviceable condition, refer to the battery care manual. Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Also check for additional DTCs that could be associated to loss of power or ground feed and refer to DTC Index
P065700	Actuator supply voltage A - open circuit, range/performance	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P065900	Actuator supply voltage A circuit high	<ul style="list-style-type: none"> Actuator (pressure control valves etc) supply voltage short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve

			Body
P065800	Actuator supply voltage A circuit low	<ul style="list-style-type: none"> Actuator (pressure control valves etc) supply voltage short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P061300	TCM processor	<ul style="list-style-type: none"> Microprocessor control failure 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P074100	Torque converter clutch solenoid circuit range/performance or stuck off	<ul style="list-style-type: none"> Signal out of range 	Install a new torque converter, refer to the new module/transmission installation note at the top of the DTC Index. Transmission (44.20.01)
P096200	Pressure control solenoid A control circuit low	<ul style="list-style-type: none"> Pressure control solenoid A short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096014	Pressure control solenoid A control circuit low	<ul style="list-style-type: none"> Pressure control solenoid A short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P074800	Pressure control solenoid A current out of range	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096300	Pressure control solenoid A control circuit high	<ul style="list-style-type: none"> Pressure control solenoid A control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096013	Pressure control solenoid A open circuit	<ul style="list-style-type: none"> Pressure control solenoid A open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096600	Pressure control solenoid B control circuit low	<ul style="list-style-type: none"> Pressure control solenoid B short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096414	Pressure control solenoid B control circuit low	<ul style="list-style-type: none"> Pressure control solenoid B short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P077800	Pressure control solenoid B current out of range	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096700	Pressure control solenoid B control circuit high	<ul style="list-style-type: none"> • Pressure control solenoid B control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096413	Pressure control solenoid B open circuit	<ul style="list-style-type: none"> • Pressure control solenoid B open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P097000	Pressure control solenoid C control circuit low	<ul style="list-style-type: none"> • Pressure control solenoid C short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096814	Pressure control solenoid C control circuit low	<ul style="list-style-type: none"> • Pressure control solenoid C short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P079800	Pressure control solenoid C current out of range	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P097100	Pressure control solenoid C control circuit high	<ul style="list-style-type: none"> Pressure control solenoid C control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P096813	Pressure control solenoid C open circuit	<ul style="list-style-type: none"> Pressure control solenoid C open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P272000	Pressure control solenoid D control circuit low	<ul style="list-style-type: none"> Pressure control solenoid D short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P271814	Pressure control solenoid D control circuit low	<ul style="list-style-type: none"> Pressure control solenoid D short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P271600	Pressure control solenoid D current out of range	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P272100	Pressure control solenoid D control circuit high	<ul style="list-style-type: none"> Pressure control solenoid D control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P271813	Pressure control solenoid D control circuit open circuit	<ul style="list-style-type: none"> Pressure control solenoid D control circuit open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P272900	Pressure control solenoid E control circuit low	<ul style="list-style-type: none"> Pressure control solenoid E short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P272714	Pressure control solenoid E control circuit low	<ul style="list-style-type: none"> Pressure control solenoid E short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P272500	Pressure control solenoid E current out of range	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P273000	Pressure control solenoid E control circuit high	<ul style="list-style-type: none"> Pressure control solenoid E control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P272713	Pressure control solenoid E control circuit open circuit	<ul style="list-style-type: none"> Pressure control solenoid E control circuit open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P276400	Pressure control solenoid F control circuit low	<ul style="list-style-type: none"> Pressure control solenoid F short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P276100	Pressure control solenoid F control circuit low	<ul style="list-style-type: none"> Pressure control solenoid F short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P275900	Pressure control solenoid F current out of range (high)	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P276200	Pressure control solenoid F current out of range (low)	<ul style="list-style-type: none"> Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P276300	Pressure control solenoid F control circuit high	<ul style="list-style-type: none"> Pressure control solenoid F control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P074000	Pressure control solenoid F control circuit open circuit	<ul style="list-style-type: none"> Pressure control solenoid F control circuit open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P075200	Solenoid valve A control circuit low	<ul style="list-style-type: none"> Solenoid valve A control circuit short to ground 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body

P075114	Solenoid valve A control circuit low	<ul style="list-style-type: none"> Solenoid valve A control circuit short to ground, open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P075300	Solenoid valve A control circuit high	<ul style="list-style-type: none"> Solenoid valve A control circuit short to power 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P075113	Solenoid valve A control circuit open circuit	<ul style="list-style-type: none"> Solenoid valve A control circuit open circuit 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index. Transmission Control Module (TCM) and Main Control Valve Body
P073000	Slip too high between input and output shaft speeds in any gear	<ul style="list-style-type: none"> Low transmission fluid level Worn clutches 	Check and set transmission fluid to correct level. Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index
P073100	Slip too high between input and output shaft speeds in 1st gear	<ul style="list-style-type: none"> Low transmission fluid level Worn clutches 	Check and set transmission fluid to correct level. Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index

P073200	Slip too high between input and output shaft speeds in 2nd gear	<ul style="list-style-type: none"> • Low transmission fluid level • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P073300	Slip too high between input and output shaft speeds in 3rd gear	<ul style="list-style-type: none"> • Low transmission fluid level • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P073400	Slip too high between input and output shaft speeds in 4th gear	<ul style="list-style-type: none"> • Low transmission fluid level • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P073500	Slip too high between input and output shaft speeds in 5th gear	<ul style="list-style-type: none"> • Low transmission fluid level • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P072900	Slip too high between input and output shaft speeds in 6th gear	<ul style="list-style-type: none"> • Low transmission fluid level • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>

P078000	Shift monitoring fault - input/output shaft speed ratio out of range during a shift (any gear). Relevant clutch does not open or close	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078162	1-2 Shift - Comparison of input and output speed during a shift 1 to 2 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078164	1-2 Shift - Comparison of input and output speed during a shift 1 to 2 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078262	2-3 Shift - Comparison of input and output speed during a shift 2 to 3 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>

P078264	2-3 Shift - Comparison of input and output speed during a shift 2 to 3 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078362	3-4 Shift - Comparison of input and output speed during a shift 3 to 4 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078364	3-4 Shift - Comparison of input and output speed during a shift 3 to 4 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078462	4-5 Shift - Comparison of input and output speed during a shift 4 to 5 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>

P078464	4-5 Shift - Comparison of input and output speed during a shift 4 to 5 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P082962	5-6 Shift - Comparison of input and output speed during a shift 5 to 6 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P082964	5-6 Shift - Comparison of input and output speed during a shift 5 to 6 (relevant clutch does not open or close)	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078123	2-1 Shift - Comparison of input and output speeds during gear shift 2 to 1. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>

P078200	3-2 Shift - Comparison of input and output speeds during gear shift 3 to 2. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078300	4-3 Shift - Comparison of input and output speeds during gear shift 4 to 3. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078323	4-3 Shift - Comparison of input and output speeds during gear shift 4 to 3. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P078423	5-4 Shift - Comparison of input and output speeds during gear shift 5 to 4. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>

P072164	Output speed against turbine speed and wheel speed fault	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new Transmission Control Module. Refer to the new module/transmission installation note at the top of the DTC Index</p> <p>Transmission Control Module (TCM) and Main Control Valve Body</p>
P082923	6-5 Shift - Comparison of input and output speeds during gear shift 6 to 5. Clutch does not open	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P056100	Power supply voltage out of range when engine running	<ul style="list-style-type: none"> • Low battery charge • Harness fault 	<p>Ensure battery is in a fully charged and serviceable condition, refer to the battery care manual. Check 'Battery Voltage at TCM' datalogger signal. Check for DTCs that could be associated to loss of power or ground feeds at TCM and refer to DTC Index</p>
P085000	Starter inhibit signal fault	<ul style="list-style-type: none"> • Park/neutral switch input circuit fault • TCM failure 	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. After pinpoint test complete, re-test and if fault remains install a new transmission control module and main control valve body assembly, refer to the new</p>

			module/transmission installation note at the top of the DTC Index
P060500	EPROM/FLASH checksum error	<ul style="list-style-type: none"> • Software fault • TCM failure 	Re-configure the TCM using the manufacturer approved diagnostic system, re-test. If DTC remains, install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P066900	TCM internal temperature high	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P066800	TCM internal temperature low	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P064300	Sensor supply voltage fault high	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P064200	Sensor supply voltage fault low	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P060300	Loss of data in RAM fault	<ul style="list-style-type: none"> • Battery discharged • Transit relay installed • Battery isolation device installed • Harness fault 	Ensure battery is fully charged and in a serviceable condition, refer to the battery care manual. Remove transit relay or any battery isolation device installed. Clear DTCs and re-test, if DTC remains check for additional

			DTCs and refer to DTC Index
P082600	Manual shift CAN request error	<ul style="list-style-type: none"> Shift paddles not working. Instrument cluster LIN/CAN gateway failure Shift paddle(s) failure 	<p>Check availability of speed control. If speed control is also inoperative, check instrument cluster for related DTCs and refer to DTC Index.</p> <p>Instrument Cluster If speed control is available, check the shift paddle functionality using the datalogger application on the manufacturer approved diagnostic system</p>
P061300	Micro controller component faults	<ul style="list-style-type: none"> Signal out of range 	<p>Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index</p>
P050000	Vehicle speed signal not detected	<ul style="list-style-type: none"> Wheel speed sensor fault 	<p>Check anti-lock control - stability assist module and ECM for wheel speed sensor related DTCs and refer to DTC Index.</p> <p>Electronic Engine Controls</p>
P050100	Vehicle speed sensor A range/performance	<ul style="list-style-type: none"> Wheel speed sensor fault 	<p>Check anti-lock control - stability assist module and ECM for wheel speed sensor related DTCs and refer to DTC Index.</p> <p>Electronic Engine Controls</p>
P056300	Battery voltage too high when engine running	<ul style="list-style-type: none"> High battery charge, alternator fault 	<p>Check 'Battery Voltage at TCM' datalogger signal. Check for alternator/over charging related DTCs and refer to relevant DTC Index</p>
P072127	Output shaft speed out of range	<ul style="list-style-type: none"> Signal out of range 	<p>Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation</p>

			note at the top of the DTC Index
P073600	Slip too high between input and output shaft speeds in reverse gear	<ul style="list-style-type: none"> • Low transmission fluid level • Blocked transmission fluid cooler • Worn clutches 	<p>Check and set transmission fluid to correct level.</p> <p>Transmission Fluid Level Check Ensure transmission fluid cooler is free from restriction. Clear DTC and re-test. If DTC remains, install a new transmission. Refer to the new module/transmission installation note at the top of the DTC Index</p>
P061B61	TCM positive torque signal not valid	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
P061B65	TCM positive torque signal not valid	<ul style="list-style-type: none"> • Signal out of range 	Install a new transmission control module and main control valve body assembly, refer to the new module/transmission installation note at the top of the DTC Index
U040186	Invalid data received from ECM	<ul style="list-style-type: none"> • Engine speed value invalid 	<p>Check ECM for DTCs and refer to DTC Index.</p> <p>Electronic Engine Controls</p>
U030055	Internal control module software incompatibility	<ul style="list-style-type: none"> • Mis-match between vehicle and TCM software levels 	Re-configure the TCM with the latest level software using the manufacturer approved diagnostic system
U000188	High speed CAN communication Bus	<ul style="list-style-type: none"> • Vehicle CAN Bus off condition 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U202386	Fault received from external node	<ul style="list-style-type: none"> • Engine torque information 	<p>Check ECM for DTCs and refer to DTC Index.</p> <p>Electronic Engine Controls</p>
U010387	Lost communications	<ul style="list-style-type: none"> • Missing message from 	Carry out any pinpoint tests associated with this DTC using

	with gear selector lever	gear selector lever	the manufacturer approved diagnostic system
U015587	Lost communication with instrument cluster	<ul style="list-style-type: none"> CAN timeout instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012887	Lost communication with parking brake module	<ul style="list-style-type: none"> CAN timeout parking brake module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010087	Lost communication with ECM	<ul style="list-style-type: none"> Missing message from ECM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012287	Lost communication with stability control module	<ul style="list-style-type: none"> CAN timeout stability control module (instrument cluster Off Bus) 	Check instrument cluster for DTCs and refer to DTC Index
U041686	Invalid data received from Anti-lock control - stability assist module	<ul style="list-style-type: none"> Brake information 	Check the anti-lock - stability assist system for DTCs and refer to the DTC Index.
U30004A	Control module	<ul style="list-style-type: none"> Mis-match between configuration data and calibrated data values 	Re-configure the TCM using the manufacturer approved diagnostic system
U040462	Invalid data received from the gear selector lever - implausible position	<ul style="list-style-type: none"> Gear selector cable out of adjustment. Gear selector lever assembly fault 	Check gear selector cable adjustment. Selector Lever Cable Adjustment (44.15.07)
U040464	Invalid data received from the gear selector lever - implausible signal	<ul style="list-style-type: none"> Gear selector cable out of adjustment. Gear selector lever assembly fault 	Check gear selector cable adjustment. Selector Lever Cable Adjustment (44.15.07)
U040486	Invalid data received from the gear selector	<ul style="list-style-type: none"> Gear selector cable out of adjustment. Gear selector lever 	Check gear selector cable adjustment. Selector Lever Cable Adjustment

	lever - general failure	assembly fault	(44.15.07)
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Transmission (44.20.01)

Special Service Tools



Torque converter seal installer
308-246




Torque converter handles
307-139

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2 . Recover the A/C refrigerant.

- 3  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 4 Remove the driveshaft.
For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8

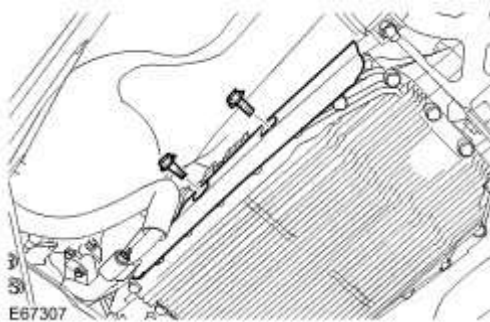
(47.15.01)

5 . **NOTE:**

LH illustration shown, RH is similar.

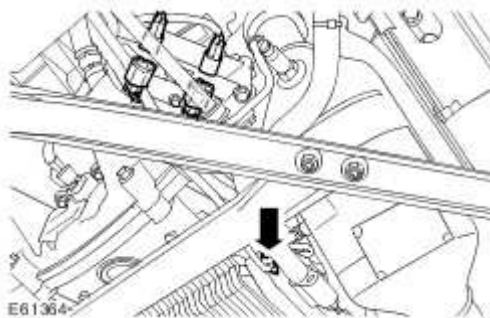
Remove the 2 transmission heat shields.

▶ Remove the 4 bolts.



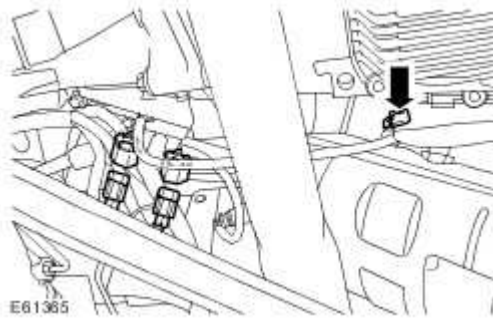
6 . Release and disconnect the 2 LH HO2S electrical connectors.

▶ Release the clip.



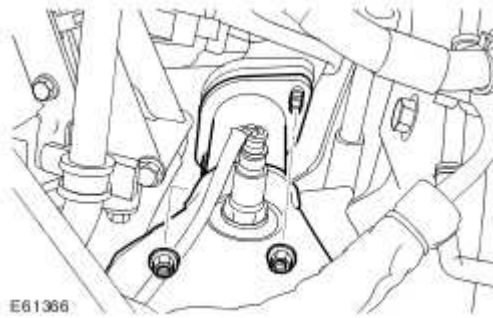
7 . Release and disconnect the 2 RH HO2S electrical connectors.

▶ Release the clip.



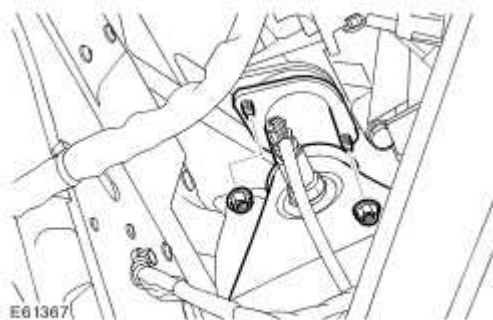
8 . Remove the LH catalytic converter.

▶ Remove and discard the 2 nuts.



9 . Remove the RH catalytic converter.

▶ Remove and discard the 2 nuts.



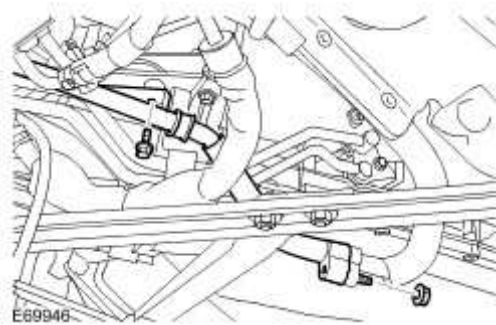
10



CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Remove the A/C pipe.

- ▶ Remove the bolt.
- ▶ Remove the nut.
- ▶ Remove and discard the 2 O-ring seals.



11 .



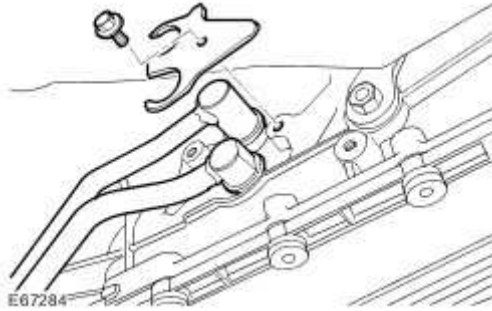
CAUTION: Always plug any open connections to prevent contamination.

NOTE:

Position cloth to collect fluid spillage.

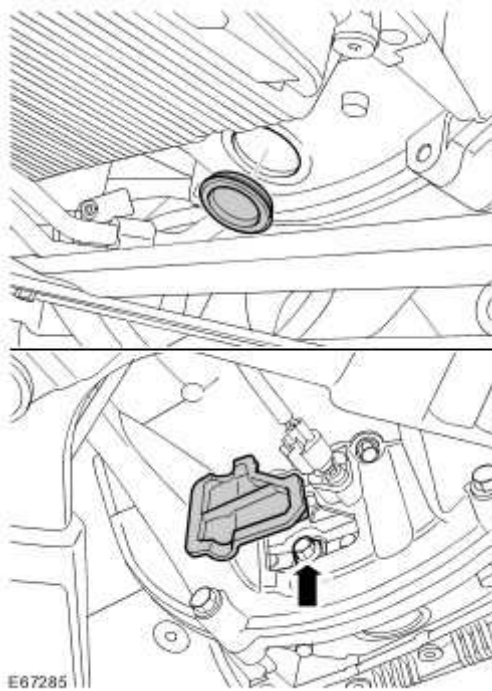
Release the transmission fluid lines.

- ▶ Remove the bolt.
- ▶ Remove and discard both O-ring seals.



12 . Release the flexplate.

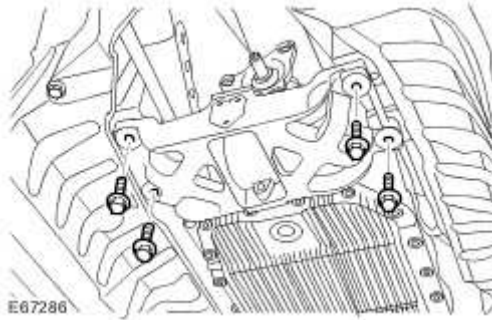
- ▶ Remove the access plugs.
- ▶ Rotate the crankshaft to access the retaining bolts.
- ▶ Remove the 3 bolts.



13 . Using a transmission jack, support the transmission.

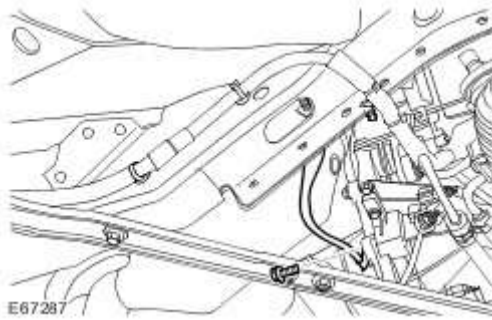
14 . Release the transmission support insulator.

▶ Remove the 4 bolts.



15 . Release the engine ground cable.

▶ Remove the bolt.



16



WARNING: Secure the transmission to the transmission jack.



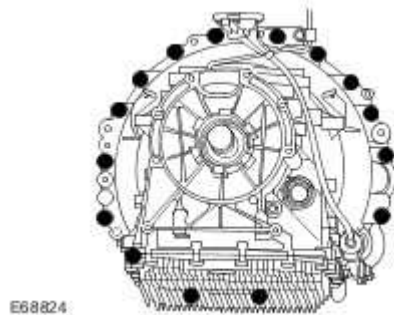
WARNING: Support the engine. The engine will fall forward when the transmission is removed.



CAUTION: Make sure the torque converter remains connected to the transmission.

With assistance, release the transmission.

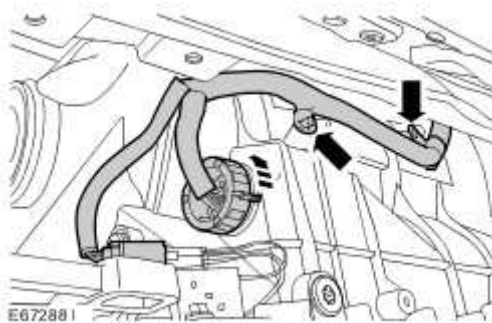
▶ Remove the 15 bolts.



17 . Release the wiring harness from the RH side of the transmission.

▶ Disconnect the 2 electrical connectors.

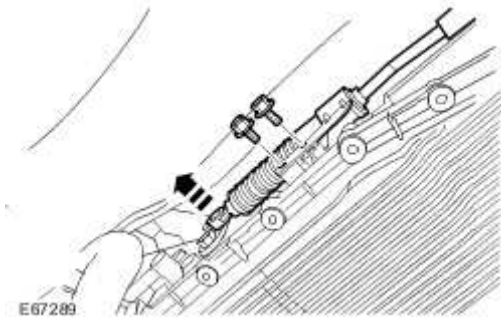
▶ Carefully release the 2 clips.



18 . Release the selector cable.

▶ Release the clip.

▶ Remove the 2 bolts.



19 . Install the torque converter retainer.

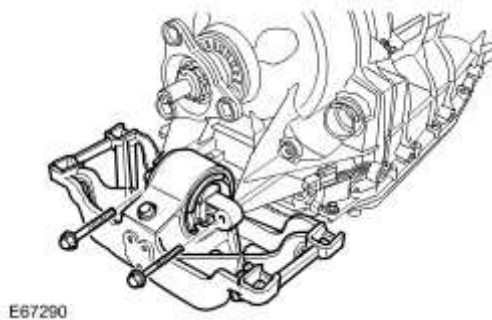
20 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the transmission from the transmission jack.

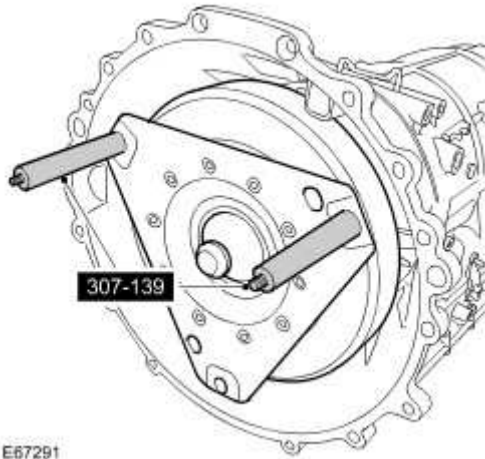
21 . Remove the transmission support insulator.

▶ Remove the 2 bolts.




22 . Remove the torque converter retainer.

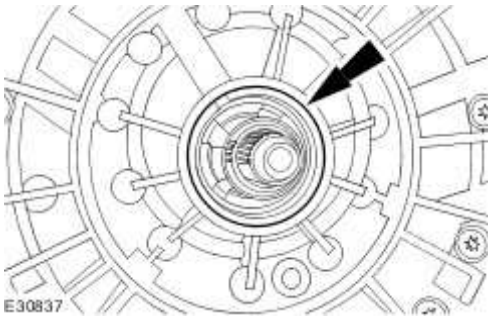
23 . Using the special tools, remove the torque converter.



E67291


- 24  **CAUTION:** Care must be taken to avoid damage to the seal register and running surface.

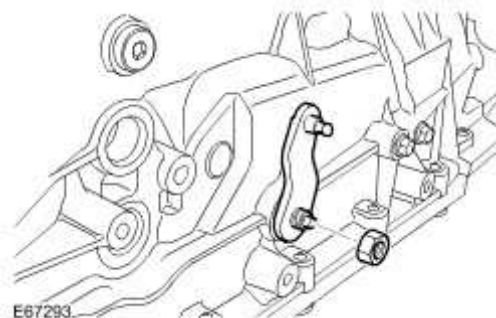
Carefully remove and discard the torque converter fluid seal.



E30837

- 25 . Remove the selector lever.

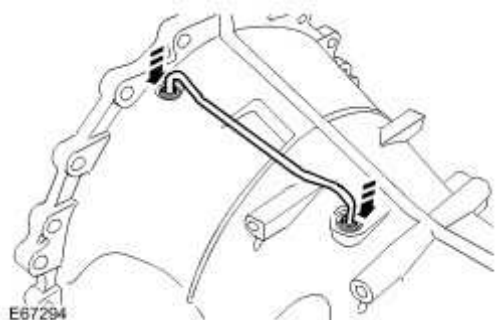
 Remove the nut.



E67293

26 . Remove the transmission breather line.

▶ Carefully release the 2 clips.



Transmission (44.20.01)

Special Service Tools



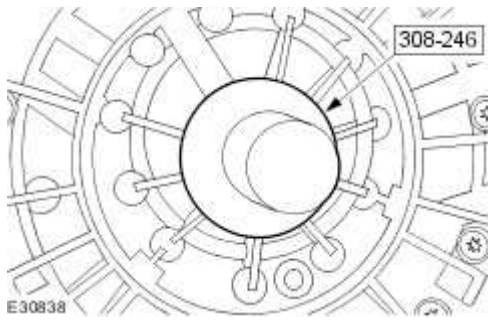
Torque converter seal installer
308-246



Torque converter handles
307-139

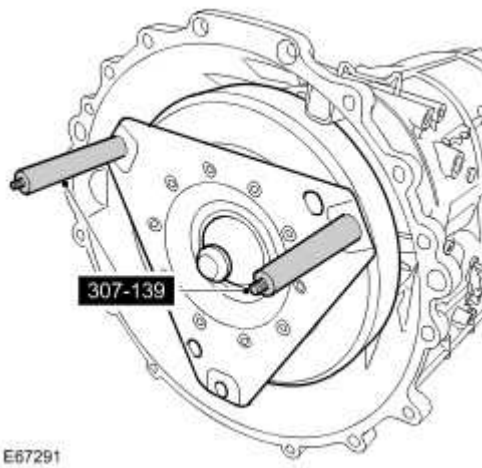
Installation

- 1 . Attach the transmission breather line.
- 2 . Attach the selector lever.
 - ▶ Tighten the nut to 12 Nm (9 lb.ft).
- 3 . Using the special tool, install a new torque converter fluid seal.
 - ▶ Clean the seal register.



4 . Install the torque converter.

- ▶ Clean the seal contact area.
- ▶ Remove the special tools.



5 . Install the torque converter retainer.

6 . Install the transmission support insulator.

- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

7 .  **WARNING: Secure the transmission to the transmission jack.**

Position the transmission to the transmission jack.

8 . Remove the torque converter retainer.

9 .  **CAUTION: Apply grease of the correct specification to the torque converter spigot.**

With assistance, install the transmission.

- ▶ Clean the component mating faces.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

10 . Install the ground cable.

- ▶ Tighten the bolt to 45 Nm (33 lb.ft).

11 . Secure the transmission support insulator.

- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

12 . Attach the wiring harness.

- ▶ Tighten the Torx screws.
- ▶ Connect the electrical connector.

13 . **NOTE:**

Do not fully tighten the locking nut at this stage.

Connect the selector cable to the transmission.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

▶ Secure in the clip.

14 . Attach the flexplate to the torque converter.

▶ Rotate the crankshaft to access the retaining bolts.

▶ Tighten the bolts to 45 Nm (33 lb.ft).

▶ Install the access plugs.

15 . Attach the transmission fluid lines.

▶ Clean the components.

▶ Install the new O-ring seals.

▶ Secure with the clip.

▶ Tighten the bolt to 10 Nm (7 lb.ft).

16 . Install the 2 transmission heat shields.

▶ Tighten the bolts to 6 Nm (4 lb.ft).


17 . Install the RH catalytic converter.

▶ Install and lightly tighten the nuts.

18 . Install the LH catalytic converter.

▶ Install and lightly tighten the nuts.

19 . Connect and secure the HO2S electrical connectors.

 Secure the 2 clips.

20 Install the driveshaft.

- . For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

21 . Tighten the catalytic converter to exhaust manifold clamps to 40 Nm (30 lb.ft).

22 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

23 . Check and top-up the transmission fluid level.

For additional information, refer to Transmission Fluid Level Check

24 . Fill the A/C system.

Extension Housing Seal (44.20.18)

Special Service Tools



303D121

Crankshaft damper remover
303-D121



205053

Output shaft flange holding tool
205-053



308-375

Seal remover input and output
308-375



100012

Slide hammer
100-012



204-264

Pinion seal replacer
204-264




Slide hammer adaptor
100-012-01



Transmission output flange socket
205-789

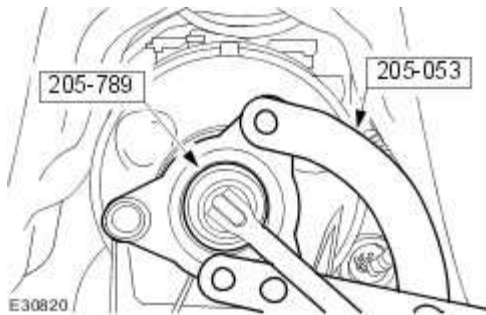
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

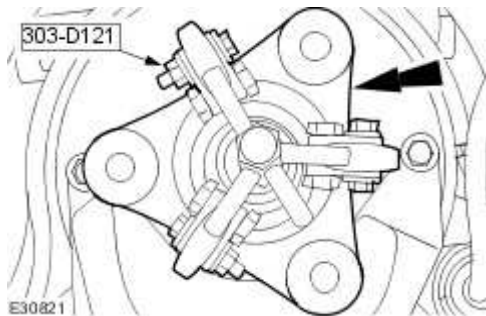
Raise and support the vehicle.

- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 Remove the driveshaft.
 - . For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)
- 4 . Release the transmission support insulator.
- 5 . Using the special tool, to hold the output flange, remove the retaining nut.

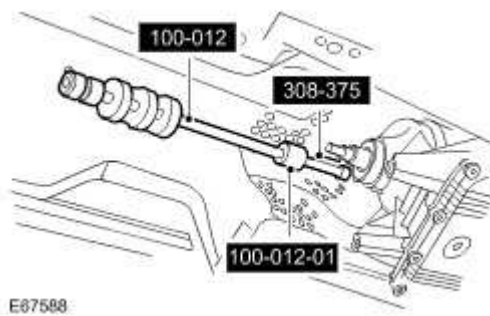
► Discard the nut.



6 . Using the special tool, remove the output flange.



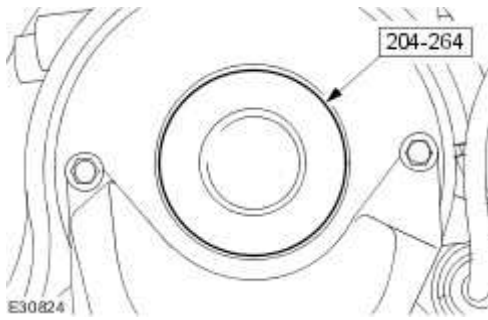
7 . Using the special tools, remove the extension housing seal.



Installation

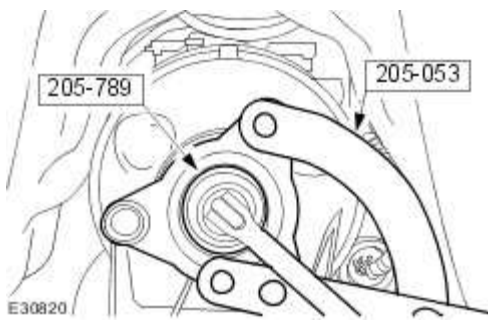
1 . Using the special tool, install a new extension housing seal.

► Clean the component mating faces.



2 . Using the special tools, install the output flange.

▶ Tighten the new nut to 60 Nm (44 lb.ft).



3 Install the driveshaft.

. For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

4 . Connect the battery ground cable and install the cover.


For additional information, refer to

5 . Install the transmission support insulator.

Transmission Fluid Pan, Gasket and Filter (44.24.07)

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

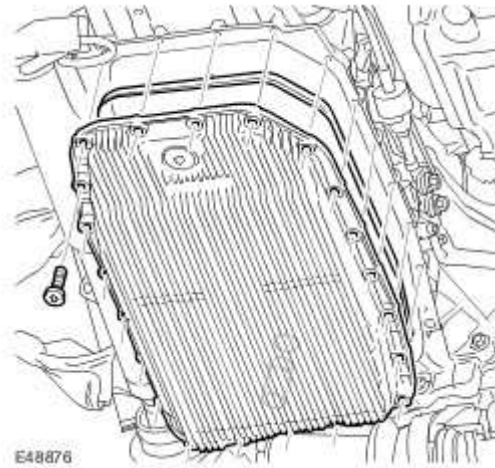
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Drain the transmission.
For additional information, refer to Transmission Fluid Drain and Refill (44.24.02)

- 4 . Remove the fluid pan.

- ▶ Position a container to collect the fluid spillage.
- ▶ Remove the 21 Torx screws.
- ▶ Remove and if necessary, discard the seal.
- ▶ Discard the O-ring seal.



Installation

1 . Install the fluid pan.

- ▶ Clean the components.
- ▶ Install the seal.
- ▶ Install a new O-ring seal.
- ▶ Tighten the Torx screws to 8 Nm (6 lb.ft).

2 . Connect the battery ground cable.

For additional information, refer to Specifications

3 . Refill the transmission with fluid.

For additional information, refer to Transmission Fluid Drain and Refill (44.24.02)


Transmission Control Module (TCM) and Main Control Valve Body

Removal

NOTE:

The transmission control module (TCM) is part of the main control valve body and cannot be serviced separately.

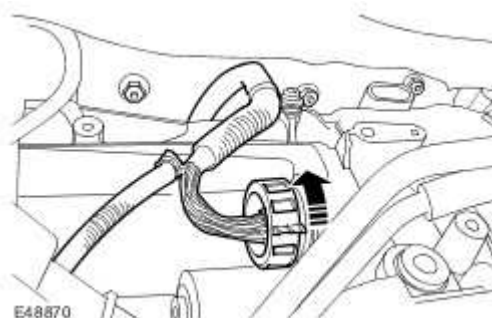
- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

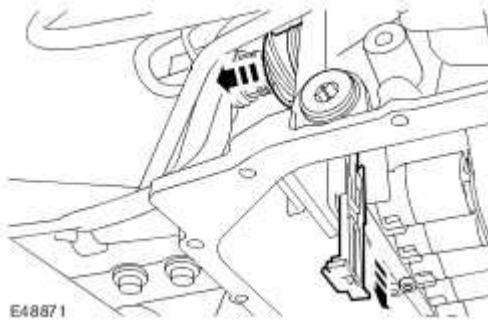
- 3 . Remove the fluid pan.
For additional information, refer to Transmission Fluid Pan, Gasket and Filter (44.24.07)

- 4 . Disconnect the electrical connector.



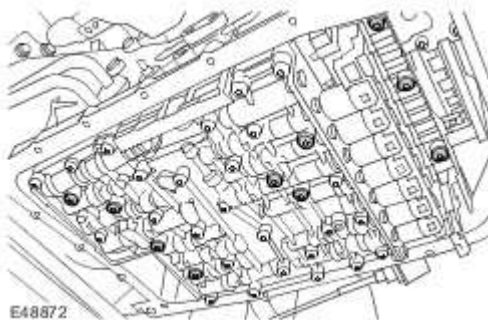
- 5 . Remove and discard the electrical connector sleeve.

- ▶ Release the retainer.

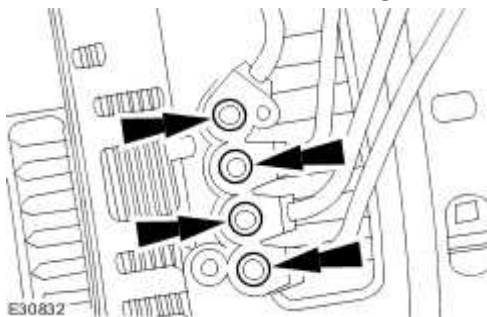


- 6 . Remove the TCM and valve body.

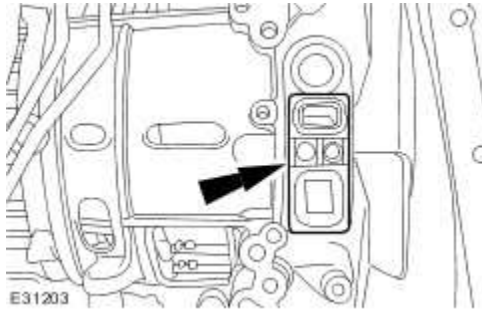
- ▶ Position a container to collect spillage.
- ▶ Remove the 10 Torx screws.



- 7 . Remove and discard the 4 O-ring seals.



- 8 . Remove the seal block.



Installation

1.



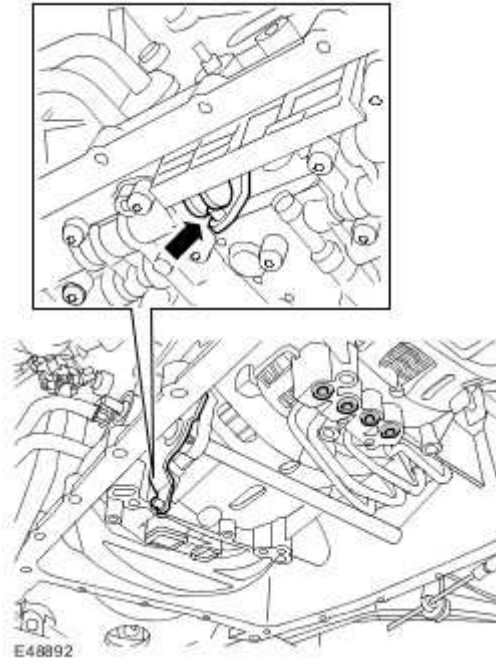
CAUTION: Make sure that when fully fitted, all seals protrude by the same amount.



CAUTION: Engage the selector lever with the groove in the piston rod.

Install the valve body.

- ▶ Clean the component mating faces.
- ▶ Install new seals.
- ▶ Install a new seal block.
- ▶ Tighten the Torx screws to 8 Nm (6 lb.ft).



2 . Install a new electrical connector sleeve.

▶ Secure with retainer.

3 . Connect the electrical connector.

4 . Install the fluid pan.

For additional information, refer to Transmission Fluid Pan, Gasket and Filter (44.24.07)


5 . Connect the battery ground cable.

For additional information, refer to Specifications

6 . Using WDS, calibrate a new TCM and valve body.


Transmission Support Insulator (12.45.04)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

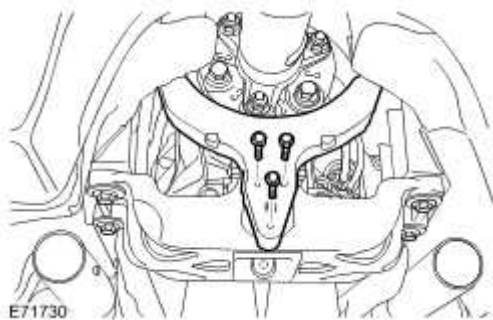
- 2 . Remove the exhaust system.
For additional information, refer to Exhaust System

- 3  **CAUTION: During this procedure the transmission crossmember is removed, make sure the transmission is correctly supported to avoid damaging associated components.**


Using a transmission jack, support the transmission.

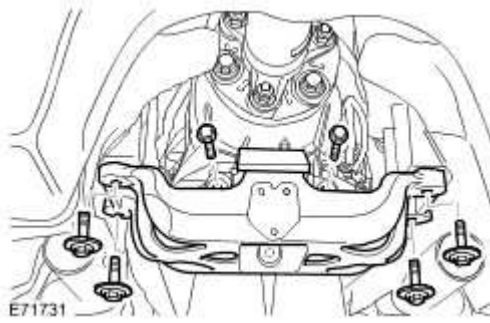
- 4 . Remove the transmission support crossmember damper.

 Remove the 3 bolts.



- 5 . Remove the transmission support crossmember.

 Remove the 6 bolts.



6 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the transmission support insulator.

▶ Remove the 2 bolts.



Installation


1 . Install the transmission support insulator.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

2 . Install the transmission support crossmember.

▶ Tighten the bolts to 48 Nm (35 lb.ft).

3 . Install the transmission support crossmember damper.

 Tighten the bolts to 10 Nm (7 lb.ft).

4 . Remove the transmission jack.

5 . Install the exhaust system.

For additional information, refer to Exhaust System

Selector Shaft Seal

Special Service Tools



Seal extractor
307-509-1(LRT-44-033/1)




Seal extractor
307-509-2(LRT-44-033/2)



Seal installer
307-509-3(LRT-44-033/3)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

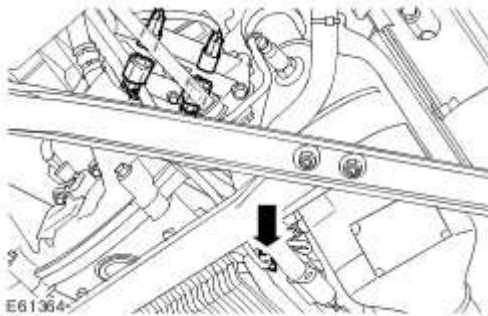
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the exhaust system.
For additional information, refer to Exhaust System

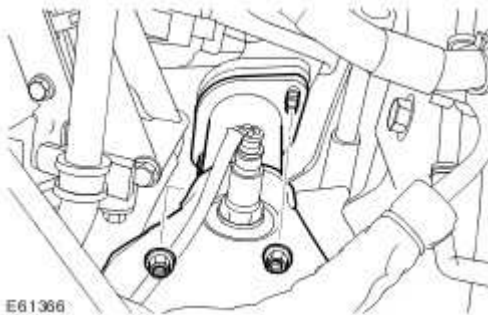
- 4 . Release and disconnect the 2 LH HO2S electrical connectors.

▶ Release the clip.



- 5 . Remove the LH catalytic converter.

▶ Remove and discard the 2 nuts.



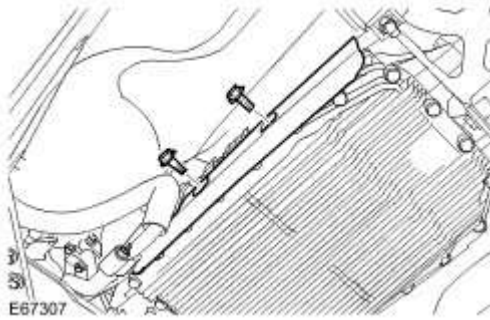
- 6 . Remove the LH catalyst heat shield.

▶ Remove the 2 bolts.

▶ Remove the nut.

- 7 . Remove the transmission casing LH heat shield.

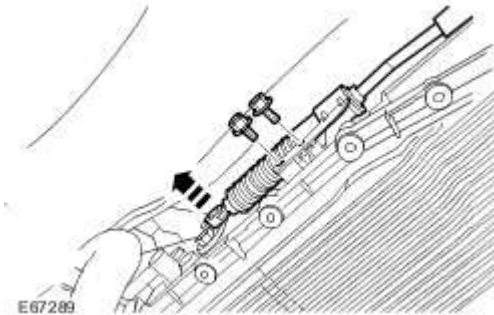
▶ Remove the 2 bolts.



8 . Release the selector cable.

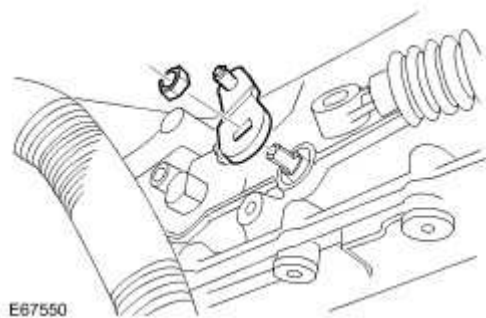
▶ Release the clip.

▶ Remove the 2 bolts.



9 . Remove the selector lever.

▶ Remove the nut.



10

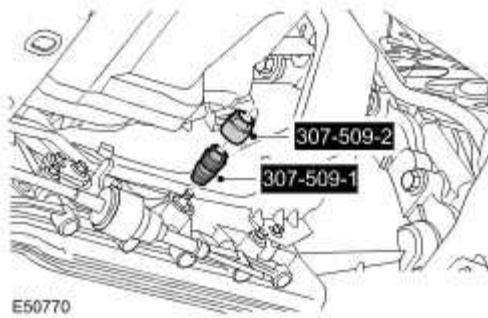


CAUTION: Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Remove the selector shaft seal.

▶ Install 307-509-1 to the seal.

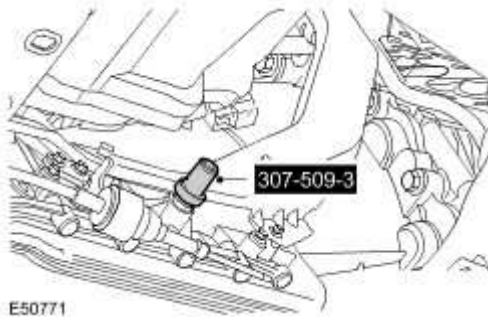
▶ Install 307-509-2 to 307-509-1 and extract the seal.



Installation

1 . Using 307-509-3, install the selector shaft seal.

▶ Clean the components.



2 . Install the selector lever.

▶ Tighten the nut to 12 Nm (9 lb.ft).

3 . Install the selector cable.

▶ Secure with the clip.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

4 . Install the transmission heat shield.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

5 . Install the LH catalyst heat shield.

▶ Install the nut and two bolts and tighten to 10 Nm (7 lb.ft).

6 . Install the LH catalytic converter.

▶ Install and lightly tighten the nuts.

7 . Connect and secure the HO2S electrical connectors.

▶ Carefully secure the clips.

8 . Install the exhaust system.

For additional information, refer to Exhaust System

9 . Tighten the catalytic converter to exhaust manifold clamps to 40 Nm (30 lb.ft).

10 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

307-02 : Transmission/Transaxle Cooling

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Fluid cooler tubes to radiator - union nuts	20	15	-
Fluid cooler tubes to transmission - bolt	23	17	-
Fluid cooler tubes support bracket - nut	10	7	88

Transmission Cooling



E66330

Item	Part Number	Description
1		Engine cooling radiator
2		Return pipe (to transmission)
3		Feed pipe (from transmission)

INTRODUCTION

The transmission cooler is integrated into the left hand end tank of the engine cooling radiator. The transmission fluid is cooled by the temperature differential between the transmission fluid and the engine coolant.

The fluid cooler is an aluminium cooler comprising louvred fins and plates. The plates allow a cross-flow of transmission fluid through the cooler. The fins are immersed in engine coolant on the 'cold' side of the radiator which provides cooling of the transmission fluid via heat transfer.

This fluid cooler design provides an advantage over an air-cooled cooler in that the fluid cooling is controlled with engine coolant temperature. Fluid temperature control is also improved when the vehicle is moving slowly or is stationary with the engine running.

Fluid is supplied from the transmission fluid pump into the lower connection of the cooler. After passing through the cooler, the fluid passes out of the upper connection and is returned to transmission fluid pan.

Transmission Cooling

Principle of Operation

For a detailed description of the automatic transmission cooling system, refer to the relevant Description and Operation section in the workshop manual.

Transmission Cooling

Inspection and Verification

- 1 . Verify the customer concern by operating the system.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical
<ul style="list-style-type: none"> • Feed and return tubes • Connections to the automatic transmission and the automatic transmission fluid cooler • Automatic transmission fluid level

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Condition	Possible Cause	Action
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid cooler	<ul style="list-style-type: none"> • Flush out the automatic transmission fluid cooler with new automatic transmission fluid • If the flushing is unsuccessful, install a new radiator. Radiator - Vehicles Without: Supercharger (26.40.01)
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid tubes	<ul style="list-style-type: none"> • Flush out the automatic transmission fluid cooler tubes with new automatic transmission fluid • If the flushing is unsuccessful install new automatic transmission fluid cooler tubes.

Loss of automatic transmission fluid	Connections to the automatic transmission and the automatic transmission fluid cooler	<ul style="list-style-type: none"> • Check the integrity of tubes, connections and seals • Check the torque of the tube fixings. Specifications
Loss of automatic transmission fluid	Leak at oil cooler	<ul style="list-style-type: none"> • Check the integrity of tubes, connections and seals • Check the torque of the tube fixings. Specifications • Check for automatic transmission fluid contamination of the engine coolant. INSTALL new radiator as necessary. Radiator - Vehicles Without: Supercharger (26.40.01)

307-05 : Automatic Transmission/Transaxle External Controls

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Paddle switch to steering wheel - bolt	3	2	27
Selector lever to floor console bracket - screw	7	5	62
Selector lever, cable bracket to transmission - bolt	8	6	71
Selector cable to selector lever abutment bracket - adjustment nut	23	17	-

Selector Lever Cable Adjustment (44.15.07)

1. Remove the rear seat armrest.

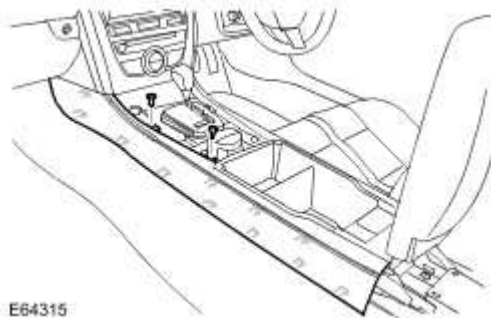
Rear Seat Armrest (76.70.39)

2. Remove the floor console veneer trim panel.

Floor Console Finish Panel (76.47.26)

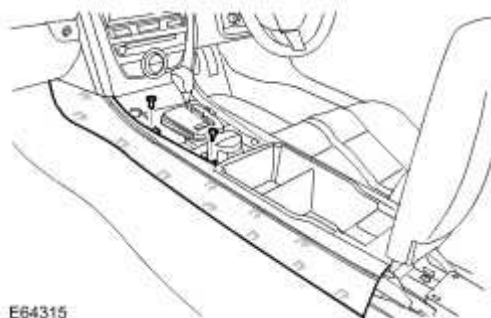
3. Remove the floor console rear panel.

- Carefully release the 2 clips.



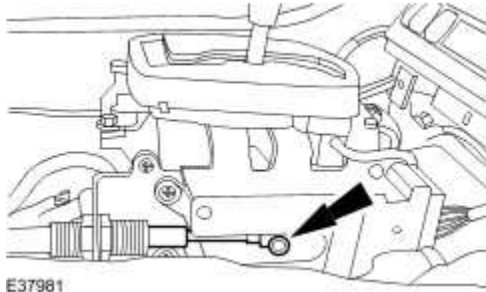
4. Remove the floor console side panel trim.

- Remove the 2 Torx bolts.
- Carefully release 11 clips.
- Repeat the procedure and remove the opposite hand.



5. Carefully disconnect the selector cable ball joint.

- Apply gentle pressure.

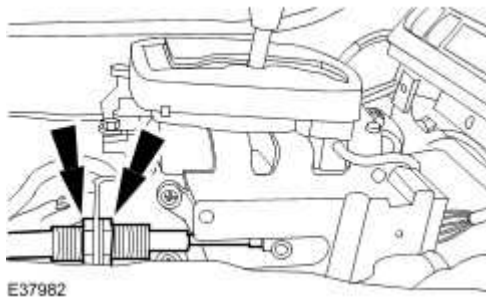


6. **NOTE:**

Use an additional wrench to prevent the component from rotating.

Release the gear selector cable at the abutment.

- Loosen the 2 locknuts.

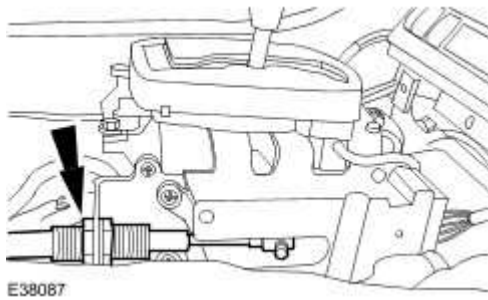


7. Fully extend the inner cable while supporting the outer, then retract the inner cable one detent.

8. Using the transmission selector lever, position to the REVERSE detent.

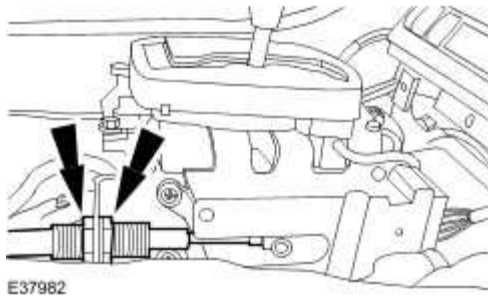
9. Install the gear selector cable to the floor console abutment.

- Position and lightly tighten the adjusting nuts.



10. Connect the selector cable ball joint.

- Adjust the cable, until the ball joint socket aligns with the ball, on the transmission selector lever.



11. **NOTE:**

Use an additional wrench to prevent the component from rotating.

Check the operation of the transmission selector lever through the gate and detents.

- If the adjustment is correct, tighten the locknuts to 20 Nm (14 lb.ft).

12. Install the floor console side panel trim.

- Carefully align and secure the clips.
- Tighten the Torx screws to 6 Nm (4 lb.ft).
- Install the opposite hand.

13. Install the floor console rear panel.

- Align the lugs and secure the clips.

14. Install the floor console veneer trim panel.

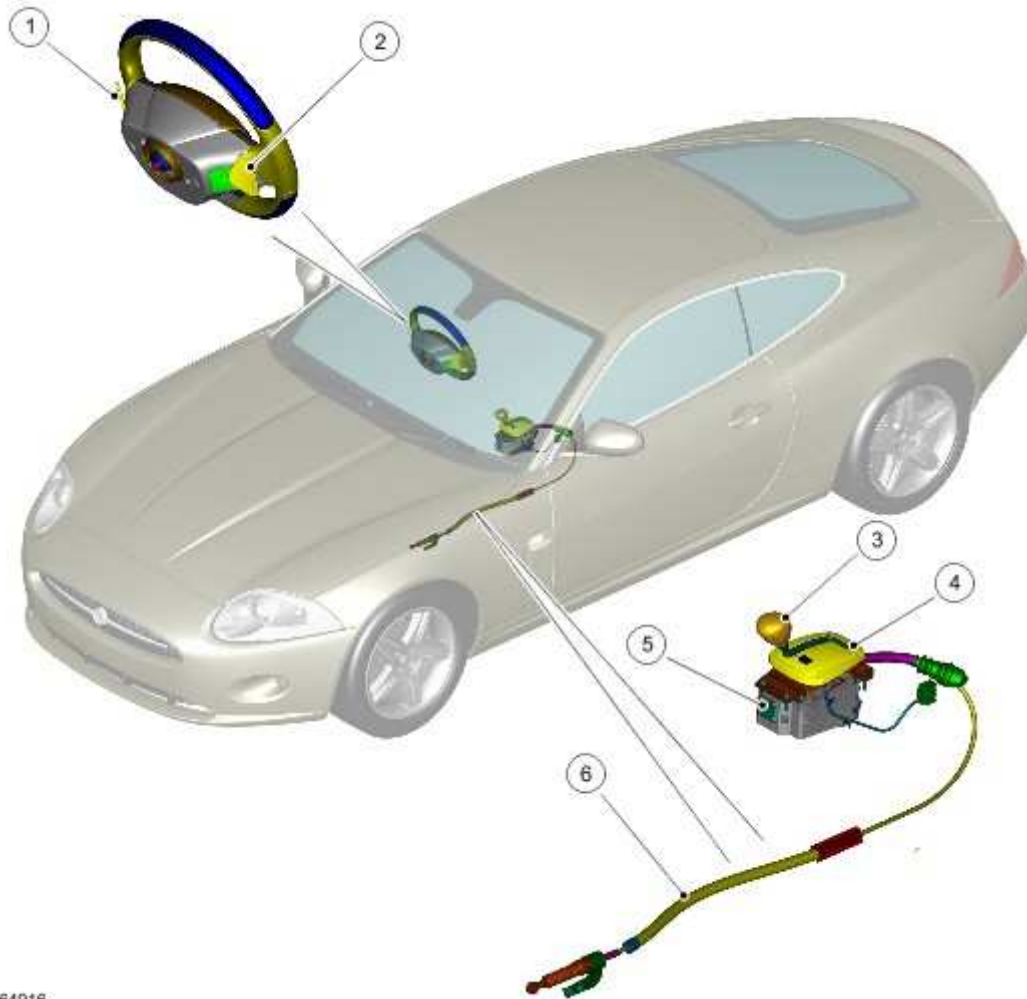
Floor Console Finish Panel (76.47.26)

15. Install the rear seat armrest.

Rear Seat Armrest (76.70.39)

External Controls

COMPONENT LOCATION



E64916

Item	Part Number	Description
1		Right Hand (RH) + gear change upshift paddle switch
2		Left Hand (LH) - gear change downshift paddle switch
3		Selector lever and gear knob
4		'L' gate
5		Selector lever mechanism assembly
6		Selector cable

INTRODUCTION

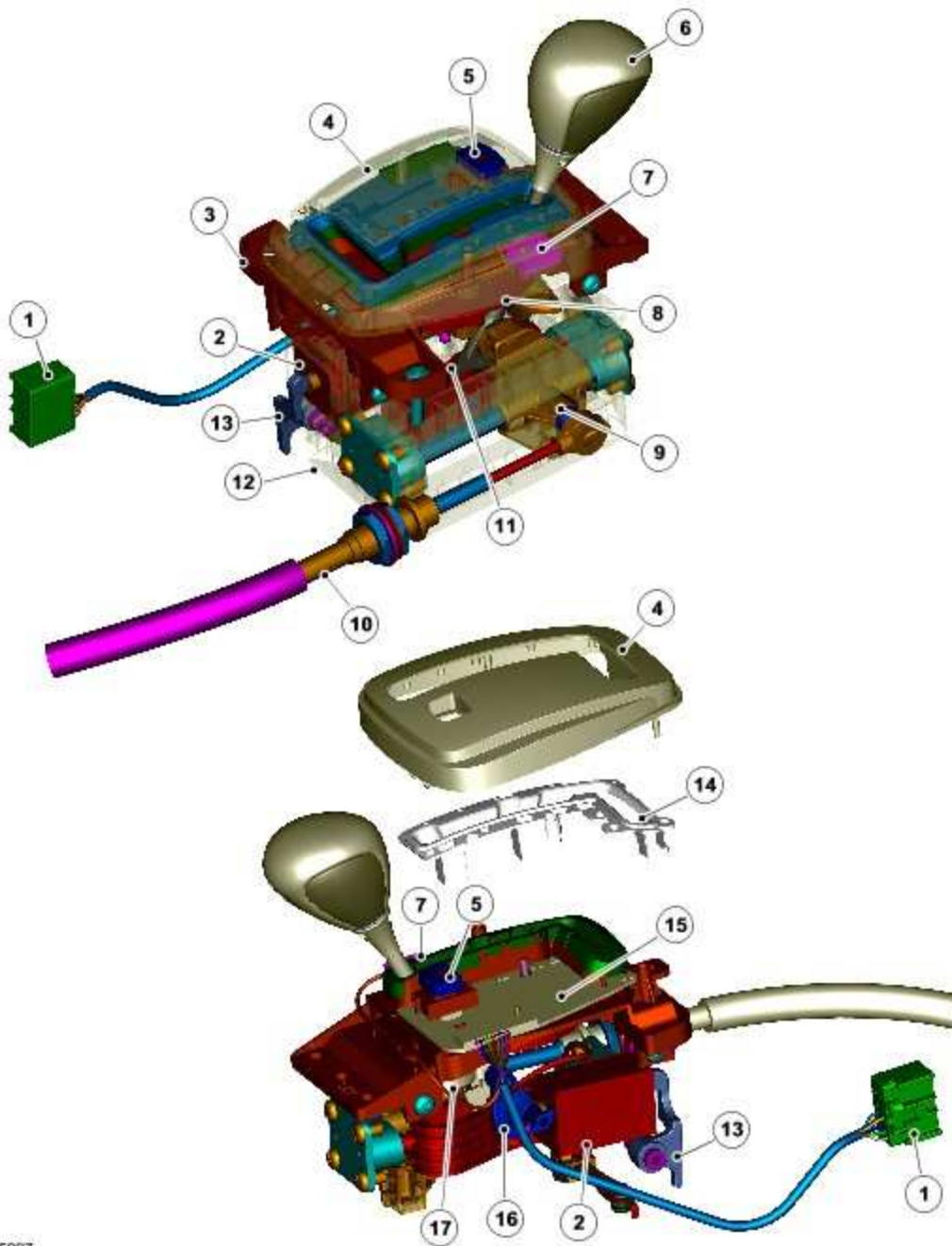
The Transmission Control Module (TCM) contains software to provide operation as a semi-automatic 'Jaguar Sequential Shift' transmission.

The TCM allows the transmission to be operated as a conventional automatic unit by selecting P, R, N, D on the selector lever. In this mode, the selector lever is linked, via the selector cable, to the transmission to provide a mechanical interface.

Movement of the selector lever across the 'L' gate to the 'S' position is sensed by a Hall effect proximity sensor located within the selector mechanism assembly, and puts the transmission into electronic 'Sport' mode.

Two gear change 'paddle' switches are fitted at the rear of the steering wheel and allow the driver to operate the transmission as a semi-automatic manual gearbox using the Jaguar Sequential Shift feature.

Selector Lever



E75097

Item	Part Number	Description
1		Electrical connector
2		Interlock solenoid
3		Module top housing
4		Cover
5		DSC/TRAC DSC button
6		Selector lever
7		Park switch
8		Disc

9		Sliding block
10		Selector cable
11		Rotation bracket
12		Housing
13		Rocker
14		'L' gate chrome finisher
15		Selector Printed Circuit Board (PCB)
16		Solenoid interlock lever
17		Selector interlock lever

The transmission selector assembly is located in a central position in the floor console. The assembly is attached to a moulding in the floor console with four screws.

A park switch is located to the right of the lever and is operated when the lever is moved to the 'P' Park position. The lever is located in a slot in a rotary disc. The disc rotates with movement of the lever in the forward or back directions. The disk movement is detected by Hall sensors located on the selector PCB which correspond with the different selector positions.

Movement of the selector lever is passed to the transmission Mechatronic valve block via a lever located on the side of the transmission casing. The lever, in turn, moves a manually operated selector valve within the transmission valve block.

An interlock solenoid is located in the selector lever assembly. When energized, the solenoid engages an interlock lever preventing the selector lever from being moved. When the footbrake is applied, a signal from the brake switch de-energises the solenoid allowing the selector lever to be moved from the 'P' or 'N' position. This prevents the selector from being moved to the 'D' or 'R' position unintentionally and the application of the brakes also prevents the vehicle 'creeping' when the gear is engaged.

If electrical power to the selector lever is lost, the selector lever will be locked in the 'N' or 'P' position by the shift interlock solenoid if moved from the 'D' position. The selector lever will remain locked until electrical power to the selector lever is restored. There is no emergency interlock solenoid release mechanism on the selector lever.

Selections made using the selector lever are passed to the TCM in high speed Controller Area Network (CAN) bus messages. The park switch is hardwired to the instrument cluster and the Central Junction Box (CJB).

Paddle Switches

Each paddle switch has 3 connections; ground, illumination Pulse Width Modulation (PWM) supply and switch signal.

Pulling the LH downshift paddle (-) provides down changes and pulling the RH upshift (+) paddle provides up changes. The first operation of either paddle, after Sport mode is selected, puts the transmission into permanent manual 'Jaguar Sequential Shift' mode. Movement of the

selector lever back to the 'D' position, returns the transmission to conventional automatic operation. To reselect Sport mode from Manual mode, the selector lever must be first moved to the 'D' position and then returned to the 'S' position.

Temporary operation of manual mode can also be operated with the selector lever in the 'D' position. Operation of either the upshift or downshift paddles activates the manual mode operation. The current selected gear will displayed in the instrument cluster message center. If continued use of manual mode is required, move the selector lever to the 'S' position.

With the selector lever in the 'D' position, temporary manual mode will be maintained whilst the driver is accelerating, decelerating, cornering or continuing to request shifts via the paddles. The transmission will revert to automatic operation after a short period of driving at steady speed. Alternatively the RH upshift (+) paddle may be held for approximately one second to return directly to automatic operation in 'D'.

PRINCIPLES OF OPERATION

Selector Lever

The selector lever is located in a slot in the rotary disc which rotates with movement of the lever in the forward or back directions. The disc movement positions magnets located on the disc which are detected by Hall sensors located on the selector PCB which correspond with the different selector positions. The Hall sensors produce a signal relative to the lever position which is passed as a high speed CAN bus message to other system modules.

Paddle Switches

When the switch is operated, a ground for the switch contacts is completed via a resistor. The completed ground signal is passed via a hardwired connection to the steering wheel module. The module converts the switch signal into a Local Interconnect Network (LIN) bus message which in turn is passed to the instrument cluster, via the steering wheel clockspring. The instrument cluster converts the LIN message into a high speed CAN bus message which is broadcast to the TCM and other system modules.

External Controls

Principle of Operation

For a detailed description of the automatic transmission controls, refer to the relevant Description and Operation section in the workshop manual.

External Controls

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Check for correct gear selector lever cable adjustment. Selector Lever Cable Adjustment (44.15.07) • Visibly damaged or worn components. • Loose or missing fasteners. 	<ul style="list-style-type: none"> • Fuse(s). • Loose or corroded electrical connector(s).

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system, or pinpoint tests below.

Pinpoint Tests

PINPOINT TEST G561950p1 : GEAR SELECTOR LEVER ASSEMBLY CIRCUIT CHECKS

G561950t1 : CHECK FOR IGNITION SUPPLY TO THE GEAR SELECTOR LEVER ASSEMBLY

1. Disconnect the gear selector lever assembly electrical connector IP027. 2. Set the ignition status to ON, engine OFF. 3. Measure the voltage at IP027 Pin 1.

- **Is the voltage greater than 10 Volts?**

-> **Yes**

GO to Pinpoint Test G561950t2.

-> **No**

Repair the electrical circuit between the gear selector lever assembly electrical connector IP027 Pin 1 and the Central Junction Box (CJB). For additional information, refer to the electrical circuit diagrams. TEST the system for normal operation.

G561950t2 : CHECK THE GROUND SUPPLY TO THE GEAR SELECTOR LEVER ASSEMBLY

1. Set the ignition status to OFF. 2. Measure the resistance between the gear selector lever assembly electrical connector IP027 Pin 2 and GROUND.

- **Is the resistance less than 5 Ohms?**

-> **Yes**

GO to Pinpoint Test G561950t3.

-> **No**

Repair the circuit between the gear selector lever assembly electrical connector IP027 Pin 2 and GROUND. For additional information, refer to the electrical circuit diagrams. TEST the system for normal operation.

G561950t3 : CHECK FOR IGNITION SUPPLY TO THE PARK POSITION SWITCH

1. Set the ignition status to ON, engine OFF 2. Measure the voltage at IP027 Pin 4.

- **Is the voltage greater than 10 Volts?**

-> **Yes**

No fault has been identified with the gear selector lever assembly circuits. Check all connections for damaged and corroded pins. Check CAN network using manufacturer approved diagnostic system. TEST the system for normal operation.

-> **No**

Repair the electrical circuit between the gear selector lever assembly electrical connector IP027 Pin 4 and the Central Junction Box (CJB). For additional information, refer to the electrical circuit diagrams. TEST the system for normal operation.

PINPOINT TEST G561950p2 : GEAR SELECTOR PADDLE SWITCH TESTS

G561950t4 : GEAR SELECTOR PADDLE SWITCH TESTS

1. Check steering wheel speed control switches are functioning correctly.

- **Are the steering wheel speed control switches functioning correctly?**

-> **Yes**

Refer to the electrical circuit diagrams and test circuit between gear selector paddle switches and steering wheel audio switch.

-> **No**

Check the TCM and Instrument Cluster for related DTCs and refer to relevant DTC Index. Check the steering wheel speed and audio control switch circuits.

Speed Control

Audio System Refer to the electrical circuit diagrams and test the LIN circuit between the steering wheel audio switch and the instrument cluster.

Downshift Paddle Switch

Removal

- 1 . Remove the paddle gear selector lever.
For additional information, refer to Upshift Paddle Switch

Installation

- 1 . To install, reverse the removal procedure.

Selector Lever Assembly (44.15.04)

Removal

- 1 . Remove the rear seat armrest.

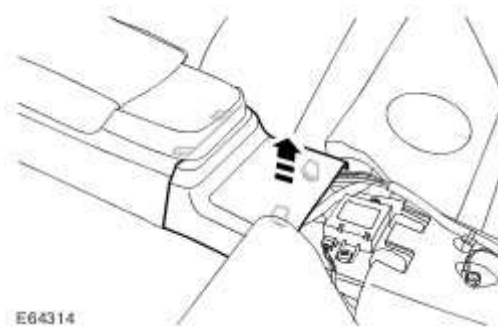
For additional information, refer to Rear Seat Armrest (76.70.39)

- 2 . Remove the floor console veneer trim panel.

For additional information, refer to Floor Console Finish Panel (76.47.26)

- 3 . Remove the floor console rear panel.

▶ Carefully release the 2 clips.

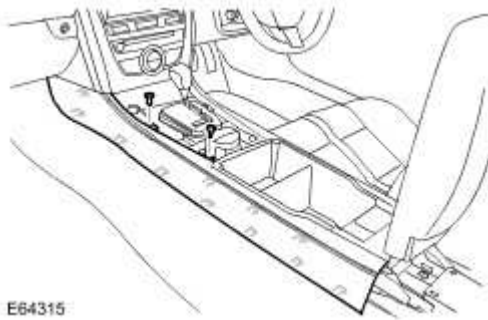


- 4 . Remove the floor console side panel trim.

▶ Remove the 2 Torx bolts.

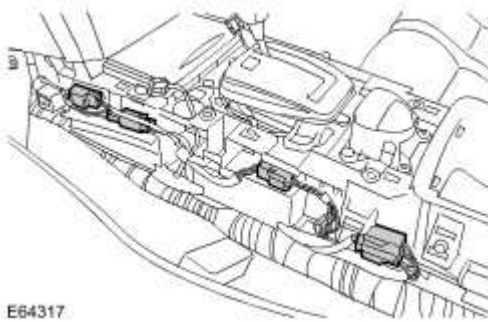
▶ Carefully release 11 clips.

▶ Repeat the procedure and remove the opposite hand.



5 . Release the LH side floor console electrical harness connector blocks.

▶ Carefully release the 4 clips.



6 . Disconnect the gear selector assembly electrical connector.

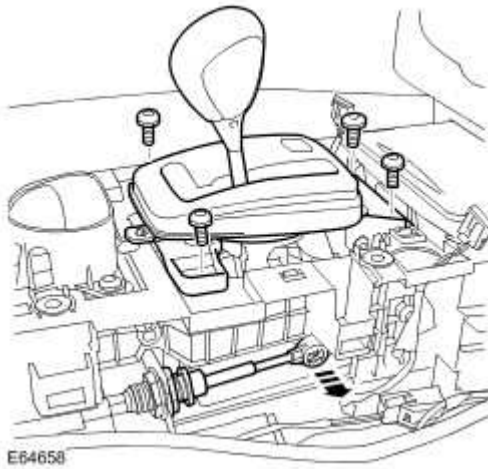


7 . Remove the gear selector assembly.

▶ Carefully disconnect the selector cable ball joint.


▶ Remove the 4 Torx bolts.

- ▶ Release the electrical harness.




Installation

- 1 . Install the gear selector assembly.
 - ▶ Position the electrical harness.
 - ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).
 - ▶ Connect the selector cable ball joint.
- 2 . Connect the gear selector assembly electrical connector.
- 3 . Install the LH side floor console electrical harness connector blocks.
 - ▶ Carefully align and secure the clips.
- 4 . Install the floor console side panel trim.
 - ▶ Carefully align and secure the clips.
 - ▶ Tighten the Torx screws to 6 Nm (4 lb.ft).

 Install the opposite hand.

5 . Install the floor console rear panel.

 Align the lugs and secure the clips.

6 . Install the floor console veneer trim panel.

For additional information, refer to Floor Console Finish Panel (76.47.26)

7 . Install the rear seat armrest.

For additional information, refer to Rear Seat Armrest (76.70.39)

Selector Lever Cable and Bracket (44.15.08)

Removal

- 1 . Remove the floor console.

For additional information, refer to Floor Console (76.25.01)

- 2 . **NOTE:**

Connect a line to the transmission selector cable to aid installation.

Release the transmission selector lever cable.

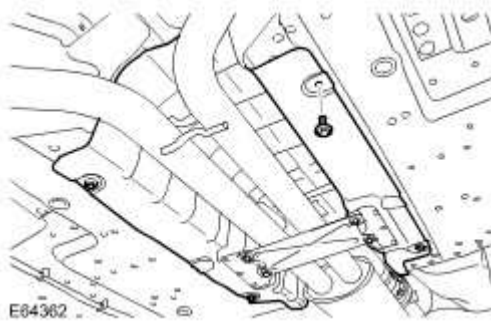
- ▶ Release the gaiter.
- ▶ Pass the gear selector cable through the vehicle floor.
- ▶ Tie the recovery line to the floor console ground nut.



- 3 . Raise and support the vehicle.

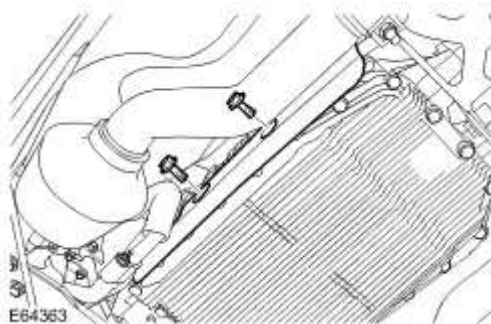
- 4 . Release the exhaust heat shield for access.

- ▶ Remove the 4 bolts.



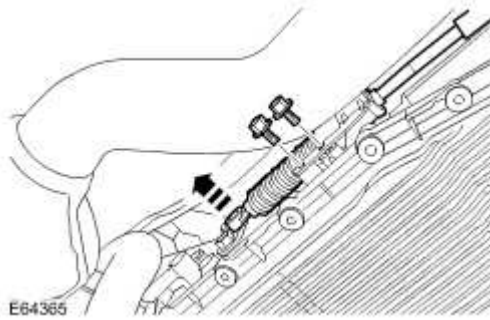
5 . Position the LH side transmission casing heat shield aside.

- ▶ Remove the 2 bolts.



6 . Remove the selector cable and bracket.

- ▶ Carefully disconnect the selector cable ball joint.
- ▶ Remove the 2 bolts.
- ▶ Withdraw the cable.
- ▶ Disconnect the recovery line.



Installation

1 . Install the selector cable and bracket.

- ▶ Connect the recovery line to the transmission selector cable.
- ▶ Install the bolts and tighten to 10 Nm (7 lb.ft).
- ▶ Connect the selector cable ball joint.

2 . Install the LH side transmission casing heat shield.

- ▶ Install the bolts and tighten to 10 Nm (7 lb.ft).

3 . Install the exhaust heat shield.

- ▶ Install the bolts and tighten to 10 Nm (7 lb.ft).

4 . Install the transmission selector cable gaiter.

- ▶ Disconnect the recovery line.

5 . Install the floor console.

For additional information, refer to Floor Console (76.25.01)

Selector Lever Knob (44.15.06)

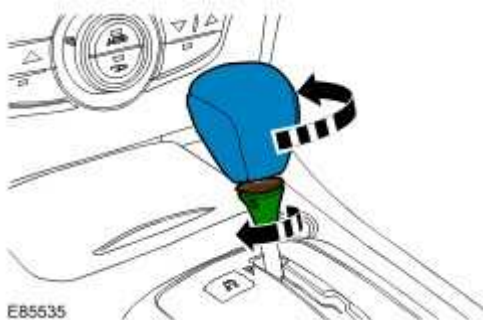
Removal

Vehicles without supercharger

- 1  **CAUTION: Protect the surrounding trim from damage when changing the component.**

Remove the selector lever knob.

- ▶ Carefully loosen the locking collar.
- ▶ Unscrew the knob.
- ▶ Remove the spacer.
- ▶ Remove the locking collar.



Vehicles with supercharger

- 2 . Remove the selector lever knob.



Installation

Vehicles with supercharger

1 . Install the selector lever knob.

- ▶ Clean the components.
- ▶ Apply threadlock if the selector lever knob is to be reused.

Vehicles without supercharger

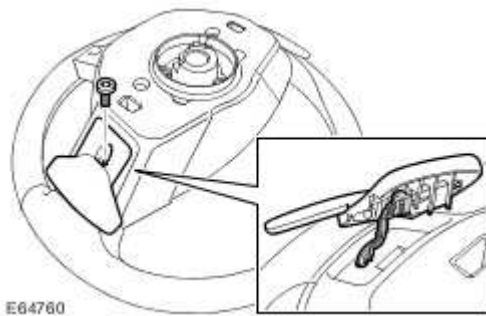
2 . Install the selector lever knob.

- ▶ Install the locking collar.
- ▶ Install the spacer.
- ▶ Align the knob and tighten the locking collar.

Upshift Paddle Switch

Removal

- 1 . Remove the paddle gear selector lever.
 - ▶ Remove the Torx bolt.
 - ▶ Release the assembly.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the paddle gear selector lever.
 - ▶ Connect and secure the electrical connector.
 - ▶ Tighten the Torx bolt to 3 Nm (2 lb.ft).

309 : Exhaust System

309-00 : Exhaust System

Specifications

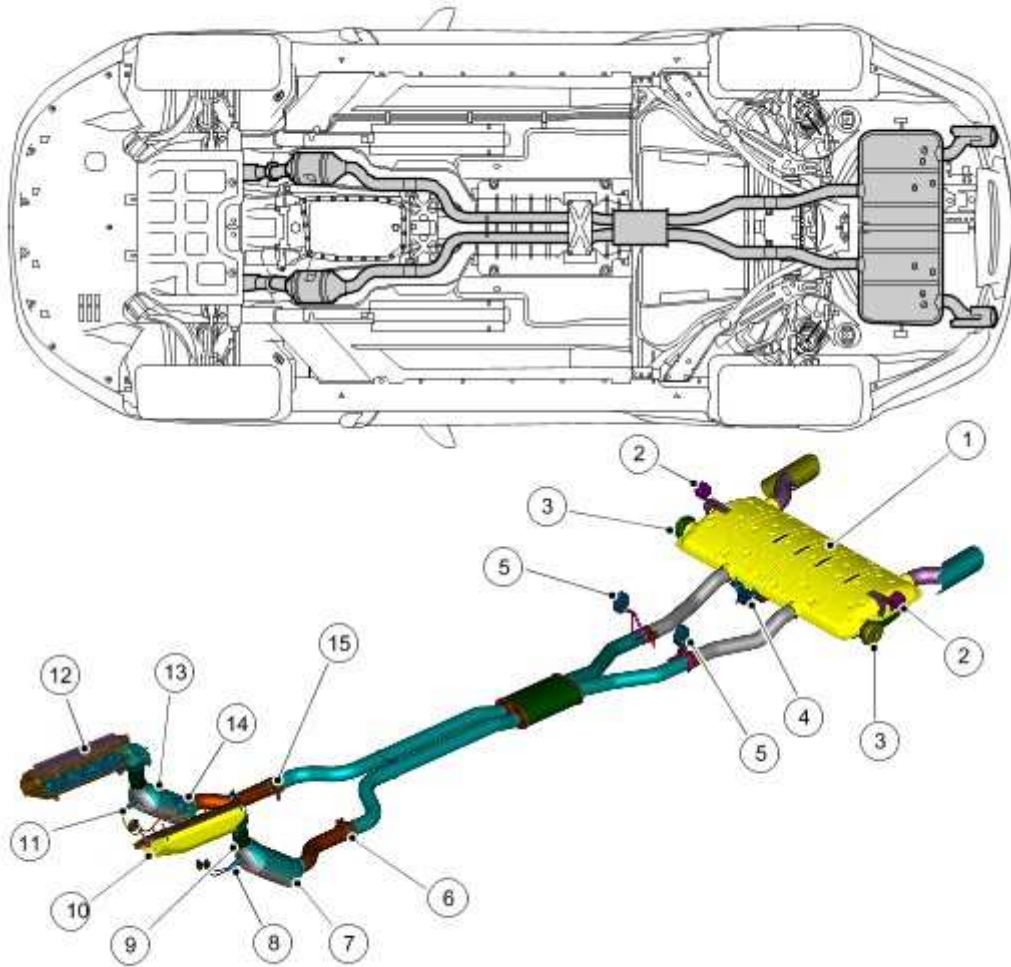
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Catalytic converter to exhaust manifold - nut	40	30	-
Catalytic converter to exhaust manifold - stud	40	30	-
Catalytic converter to resonator pipe - clamp nut/bolt	50	37	-
Front muffler pipe to rear muffler pipe - clamp nut/bolt	50	37	-
Rear muffler front-hanger bracket to vehicle - bolt	25	18	-

Exhaust System - 4.2L NA V8 - AJV8

COMPONENT LOCATION



E62612

Item	Part Number	Description
1		Muffler
2		Mounting rubber
3		Semi Active Muffler (SAM) valve
4		Mounting rubber
5		Mounting rubber
6		LH front to rear section joint
7		LH catalyst

8		LH Down stream HO2S
9		LH Upstream HO2S
10		LH exhaust manifold
11		RH Upstream HO2S
12		RH exhaust manifold
13		RH catalyst
14		RH Downstream HO2S
15		RH front to rear section joint

INTRODUCTION

The 4.2L V8 exhaust system is fabricated from stainless steel and is supplied as four separate assemblies:

- A LH front section incorporating a catalytic converter
- A RH front section incorporating a catalytic converter
- A center section incorporating a silencer
- A rear section Including the main silencer box.

Each section of the exhaust system is available as a service replacement.

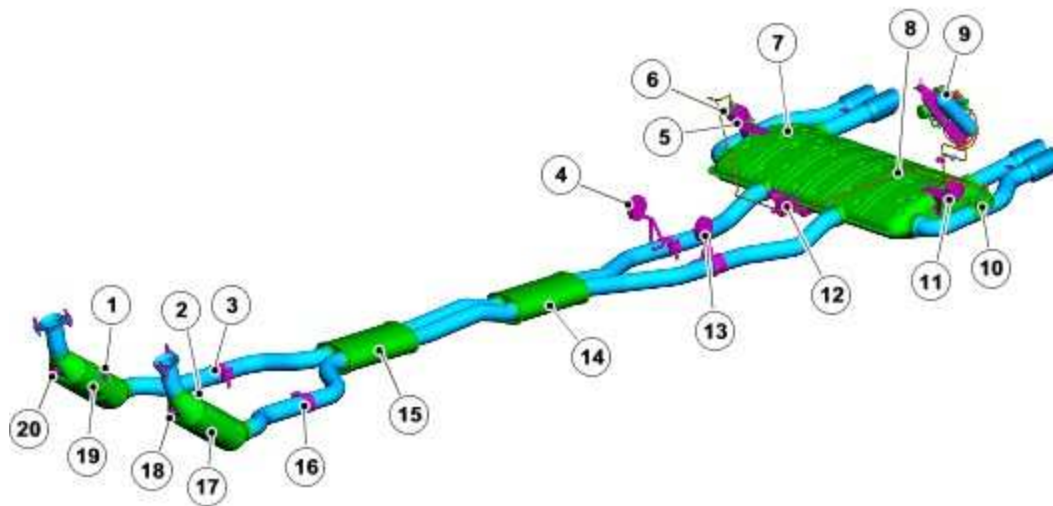
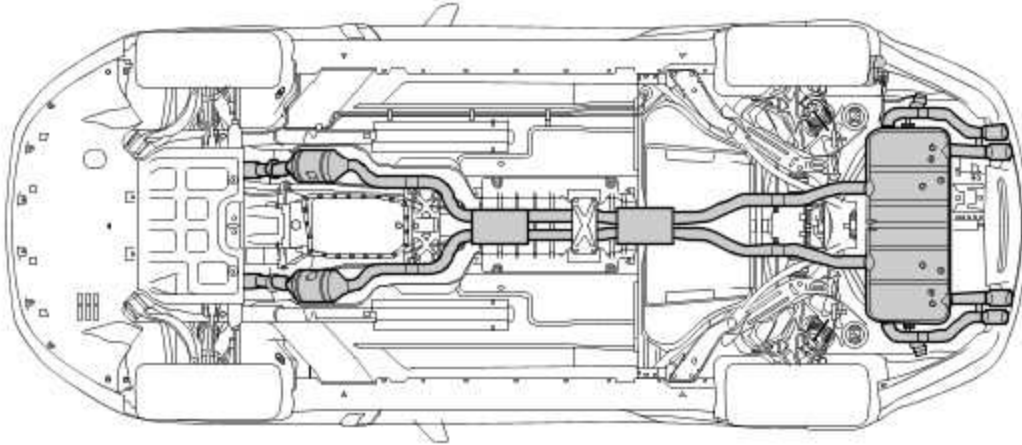
The exhaust system is attached to the underside of the body with five mounting rubbers, two on the center section and three on the rear muffler. The mounting rubbers attach to the exhaust system via stainless steel hangers and brackets. The mounting rubbers locate on corresponding hangers which are attached to the underside of the vehicle body. The system is routed along the center of the chassis before splitting near the rear differential prior to entering the main exhaust silencer at the rear of the vehicle.

To reduce the carbon monoxide and hydrocarbons content of the exhaust gases, a catalytic converter is integrated into each of the front pipes of the exhaust system.

The rear muffler unit includes a Semi Active Muffler (SAM) valve. This valve is operated by the pressure in the exhaust system. At low engine speed the valve is partially closed to provide a more refined noise quality. At higher engine speed the increased pressure within the exhaust system opens the valve to provide a more sporting noise. The SAM valve is non serviceable and the rear muffler is replaced as a complete assembly.

Exhaust System - 4.2L SC V8 - AJV8

COMPONENT LOCATION



EB4047

Item	Part Number	Description
1		RH Post catalyst H02 sensor
2		LH Post catalyst H02 sensor
3		RH joint
4		RH rear hanger
5		RH muffler hanger bracket
6		RH active exhaust valve
7		Muffler
8		Vacuum control lines
9		Vacuum pump and reservoir
10		LH active exhaust valve

11		LH muffler hanger bracket
12		Muffler center hanger
13		LH rear hanger
14		Center silencer
15		Center silencer
16		LH joint
17		LH catalyst
18		LH pre catalyst H02 sensor
19		RH catalyst
20		RH Pre catalyst H02 sensor

OVERVIEW

The exhaust system is fabricated from stainless steel and is supplied as four separate assemblies:

- A LH front section incorporating a catalytic converter
- A RH front section incorporating a catalytic converter
- A center section incorporating 2 silencers
- A rear section including the main silencer box.

Each section of the exhaust system is available as a service replacement.

The exhaust system is attached to the underside of the body with five mounting rubbers, two on the center section and three on the rear muffler. The mounting rubbers attach to the exhaust system via stainless steel hangers and brackets. The mounting rubbers locate on corresponding hangers which are attached to the underside of the vehicle body. The system is routed along the center of the chassis before splitting near the rear differential prior to entering the main exhaust silencer at the rear of the vehicle.

To reduce the carbon monoxide and hydrocarbons content of the exhaust gases, a catalytic converter is integrated into each of the front pipes of the exhaust system.

ACTIVE EXHAUST SYSTEM

The rear muffler unit incorporates an active exhaust system. The active exhaust system is designed to give a more sporty sound and also reduces the back pressure in the exhaust system by opening a valve in the second exhaust outlet pipe.

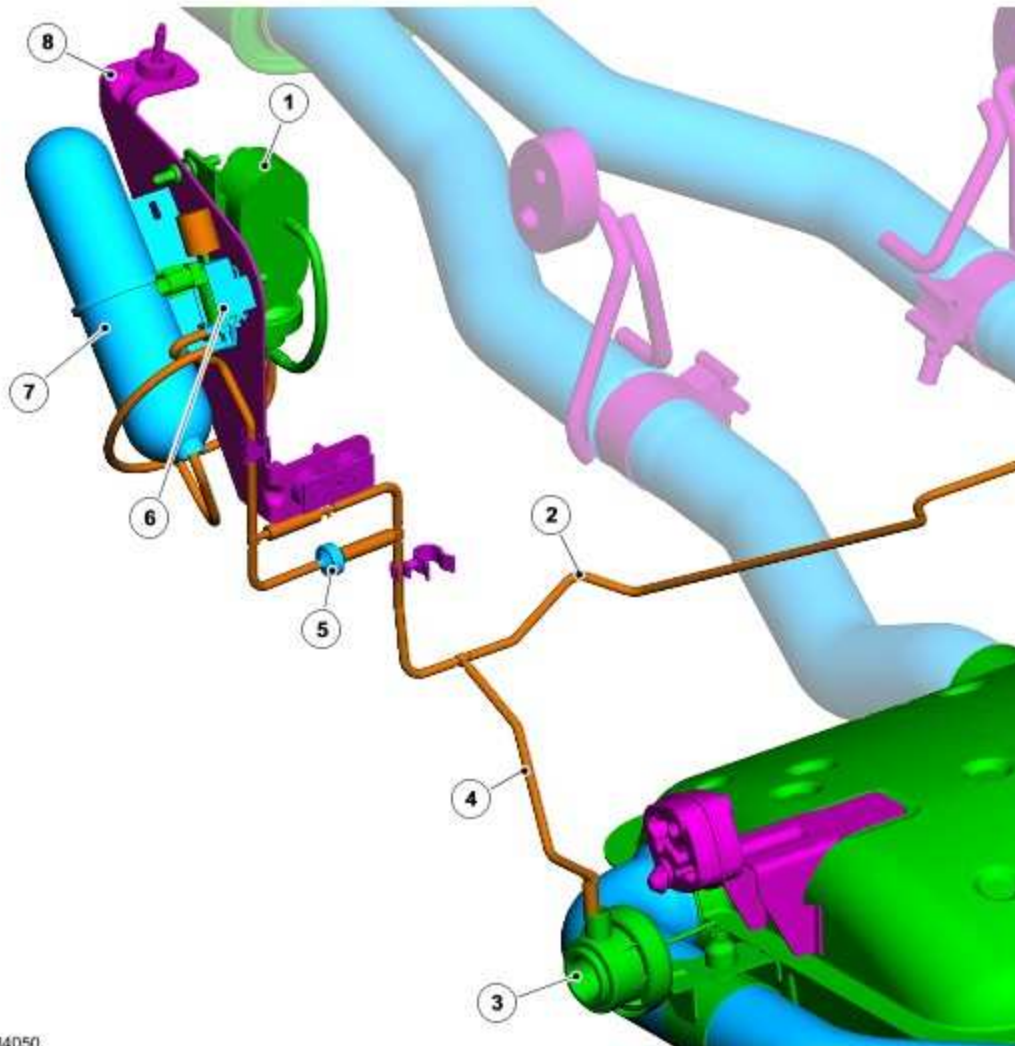
The active exhaust system is controlled by the ECM. The ECM controls a vacuum control valve which in turn applies a vacuum to the active exhaust valves. The vacuum system comprises:

- A vacuum reservoir
- A vacuum pump

- A control solenoid
- A Vacuum check/non return valve
- A vacuum restrictor valve located in the vacuum line just above the check valve

The vacuum restrictor valve allows air back into the vacuum lines to allow the active exhaust valves to open more slowly than they close.

Exhaust System Vacuum Control System



E84050

Item	Part Number	Description
1		Vacuum pump
2		Vacuum lines to RH active exhaust valve
3		Active exhaust valve
4		Vacuum lines to LH active exhaust valve
5		Vacuum check valve
6		Vacuum control valve
7		Vacuum reservoir

8	Mounting bracket
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The active exhaust valves are opened in response to engine speed and throttle angle. At startup the valve is always opened to give an enhanced sound. The following table details when the valves are open and when they are closed.

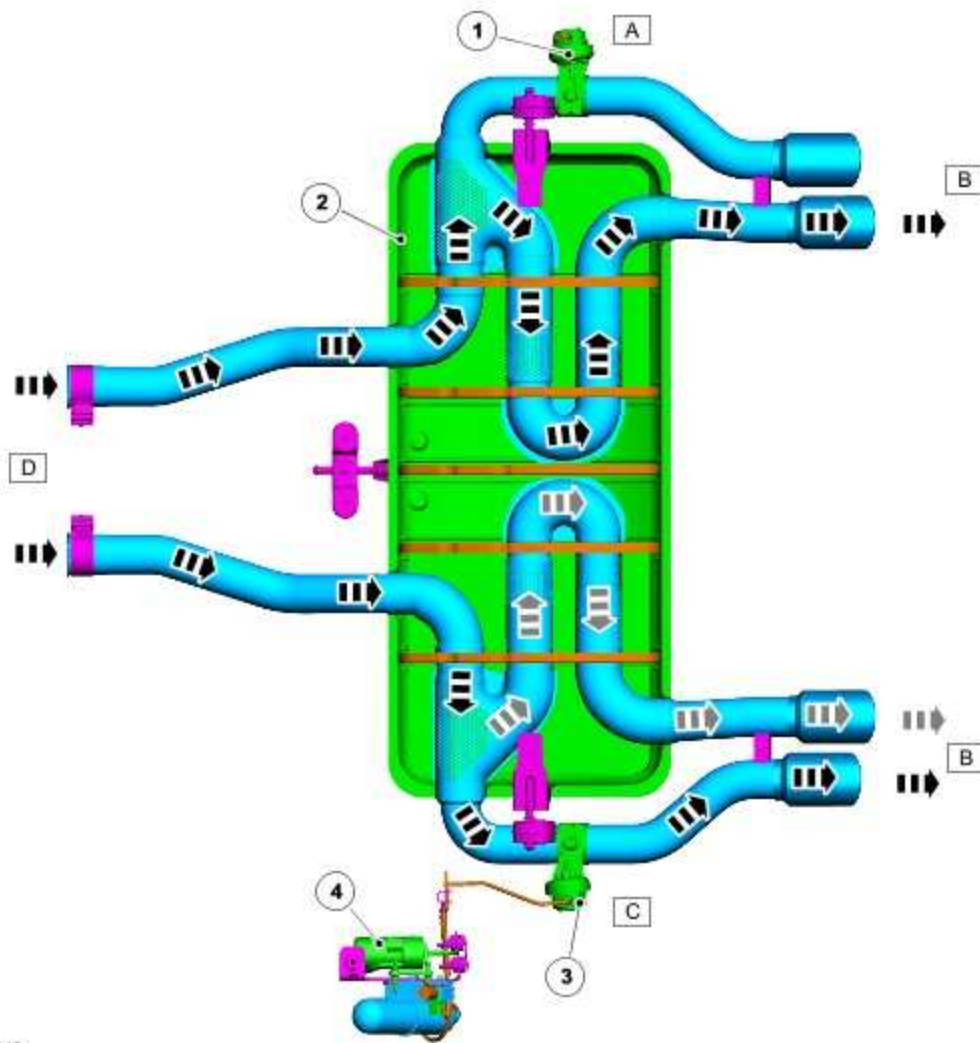
Throttle Angle%	Engine Speed RPM	500	1000	1500	2000	2500	3000	3500	4000>
0	Open	Closed	Closed	Closed	Closed	Closed	Closed	Open	
10	Open	Closed	Closed	Closed	Closed	Closed	Closed	Open	
20	Open	Closed	Closed	Closed	Closed	Closed	Closed	Open	
30	Open	Closed	Closed	Closed	Closed	Closed	Closed	Open	
40	Open	Closed	Closed	Closed	Closed	Closed	Closed	Open	
50	Open	Closed	Closed	Closed	Closed	Closed	Open	Open	
60	Open	Closed	Closed	Closed	Closed	Closed	Open	Open	
70	Open	Closed	Closed	Closed	Closed	Closed	Open	Open	
80	Open	Closed	Closed	Closed	Closed	Closed	Open	Open	
90	Open	Closed	Closed	Closed	Closed	Open	Open	Open	
100	Open	Closed	Closed	Closed	Closed	Open	Open	Open	

NOTE:

At engine speeds above 4000 RPM the valves are open independent of throttle angle.

The active exhaust valves are normally open until a vacuum is applied to them. The active exhaust valves are either open or closed they do not partially open.

Exhaust Gas Flow



E84048

Item	Part Number	Description
1		RH Active exhaust valve
2		Muffler
3		LH Active exhaust valve
4		Vacuum control assembly
A		Valve closed
B		Exhaust gas out
C		Valve open
D		Exhaust gas in

Exhaust System

Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation section in the workshop manual.

Exhaust System - 4.2L NA V8 - AJV8

Inspection and Verification

- 1 . Verify the customer concern by operating the system.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical
<ul style="list-style-type: none"> • Leaks • Metal fatigue • Pipes, mufflers and catalytic converters • Joints • Mountings • Clearance around components

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the concern is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
Excessively noisy/leaking exhaust	<ul style="list-style-type: none"> • Exhaust system/components 	<ul style="list-style-type: none"> • Inspect exhaust system, refer to Visual Inspection above • Rectify leaks or Install new components as necessary. Refer to Removal and Installation instructions in this section
Exhaust excessively noisy at low speed	<ul style="list-style-type: none"> • Exhaust sound enhancement valve stuck open 	<ul style="list-style-type: none"> • Install new muffler and tailpipe assembly. Muffler and Tailpipe (30.10.52)

Loss of power	<ul style="list-style-type: none">• Restricted exhaust system• Exhaust sound enhancement valve stuck closed• Fuel system• Ignition system• Electronic engine control	<ul style="list-style-type: none">• Install new exhaust components as necessary. Refer to Removal and Installation instructions in this section• For fuel system tests. Fuel Tank and Lines• For ignition system tests. Engine Ignition• For electronic engine control tests. Electronic Engine Controls
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Catalytic Converter (17.50.05)

Removal



WARNING: Observe due care when working near a hot exhaust system.


- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

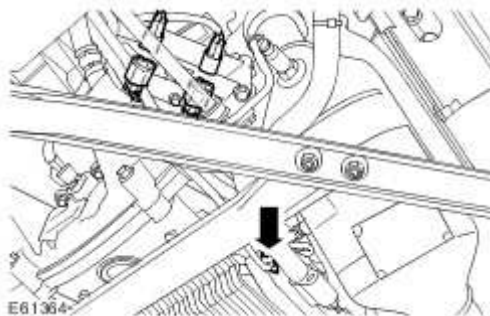
- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the exhaust system.
For additional information, refer to Exhaust System

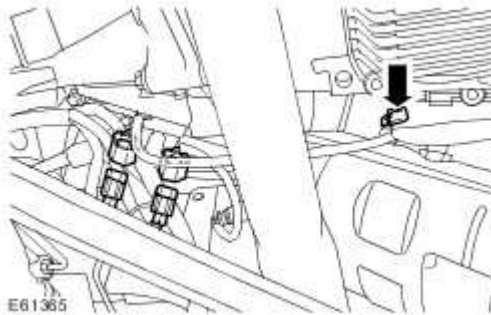
- 4 . Release and disconnect the 2 LH HO2S electrical connectors.

 Release the clip.



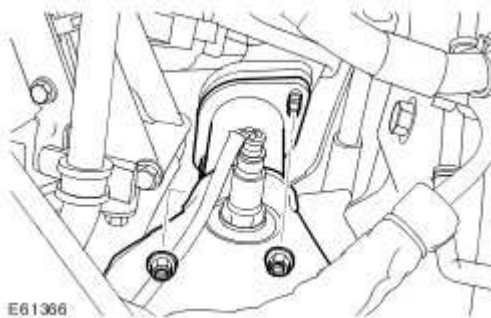
5 . Release and disconnect the 2 RH HO2S electrical connectors.

▶ Release the clip.



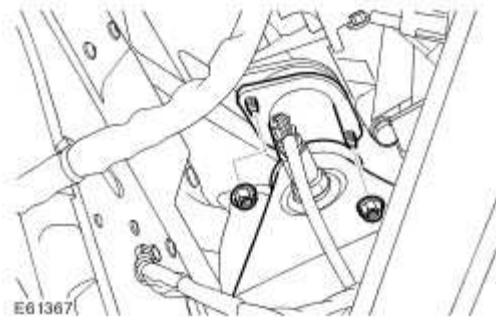
6 . Remove the LH catalytic converter.

▶ Remove and discard the 2 nuts.



7 . Remove the RH catalytic converter.

▶ Remove and discard the 2 nuts.



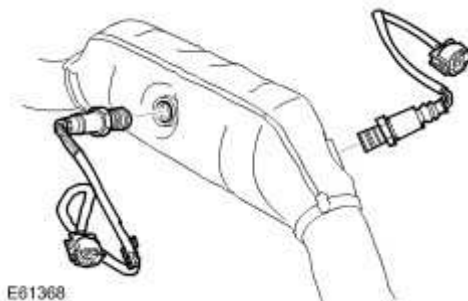
8 . NOTE:

Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

Remove the 4 HO2S from the catalytic converters.



Installation

1



WARNING: Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with the exhaust.



CAUTION: Make sure the anti-seize compound does not contact the HO2S tip.



CAUTION: Make sure the anti-seize compound does not contact the catalyst monitor sensor tip.

Install the HO2S to the catalytic converters and tighten to 45 Nm (33 lb.ft).

- ▶ Clean the components mating faces.
- ▶ Apply anti-seize compound to the sensor threads.

2 . Install the RH catalytic converter.

- ▶ Install and lightly tighten the nuts.

3 . Install the LH catalytic converter.

- ▶ Install and lightly tighten the nuts.

4 . Install the exhaust system.

For additional information, refer to Exhaust System

5 . Connect and secure the HO2S electrical connectors.

- ▶ Secure the 2 clips.

6 . Tighten the catalytic converter to exhaust manifold clamps to 40 Nm (30 lb.ft).

7 . Connect the battery ground cable.

For additional information, refer to Specifications


Exhaust System

Removal




WARNING: Observe due care when working near a hot exhaust system.

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the floor bracket.

 Remove and discard the 4 bolts.

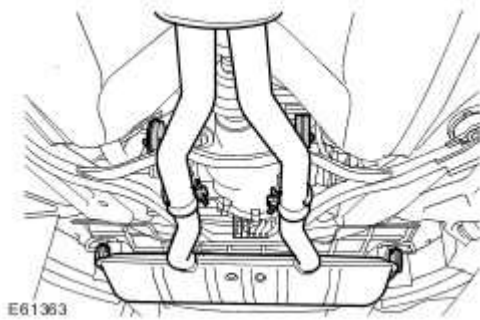


- 4 . Release the LH catalytic converter-to-muffler clamp.
- 5 . Release the RH catalytic converter-to-muffler clamp.



6 . With assistance, remove the exhaust system.

▶ Disconnect the 4 exhaust hangers.



Installation

1 . With assistance, install the exhaust system.

▶ Attach the exhaust hangers.

2 . Tighten the catalyst-to-muffler clamps.

▶ Tighten the nuts to 50 Nm (37 lb.ft).

3 . Install the bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

- 4 . Connect the battery ground cable.
For additional information, refer to Specifications


Front Muffler (30.10.18)

Removal




WARNING: Observe due care when working near a hot exhaust system.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the floor bracket.

 Remove and discard the 4 bolts.



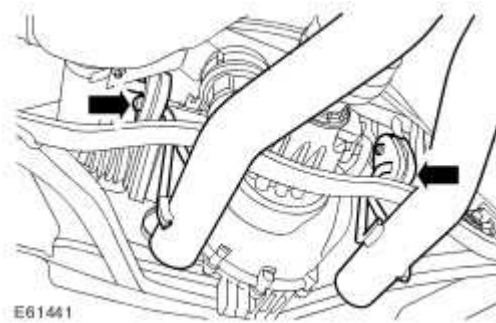
- 4 . Remove the rear muffler.
For additional information, refer to Muffler and Tailpipe (30.10.52)

- 5 . Release the 2 clamps.



6 . With assistance, remove the front muffler.

▶ Release the 2 exhaust hangers.



Installation

1 . Install the front muffler.

▶ Attach the exhaust hangers.

▶ Tighten the nuts to 50 Nm (37 lb.ft).

2 . Install the rear muffler.

For additional information, refer to Muffler and Tailpipe (30.10.52)

3 . Install the bracket.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

- 4 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications


Muffler and Tailpipe (30.10.52)

Removal



WARNING: Observe due care when working near a hot exhaust system.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

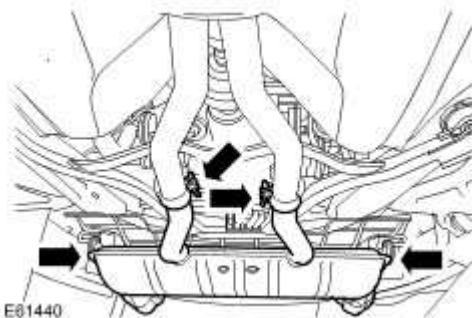
- 2  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . With assistance, remove the rear muffler.

▶ Release the 2 clamps.


▶ Release the 2 exhaust hangers.



Installation

- 1 . Install the rear muffler.


▶ Tighten the nuts to 50 Nm (37 lb.ft).

 Attach the exhaust hangers.

- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Exhaust Sound Enhancement Vacuum Pump

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

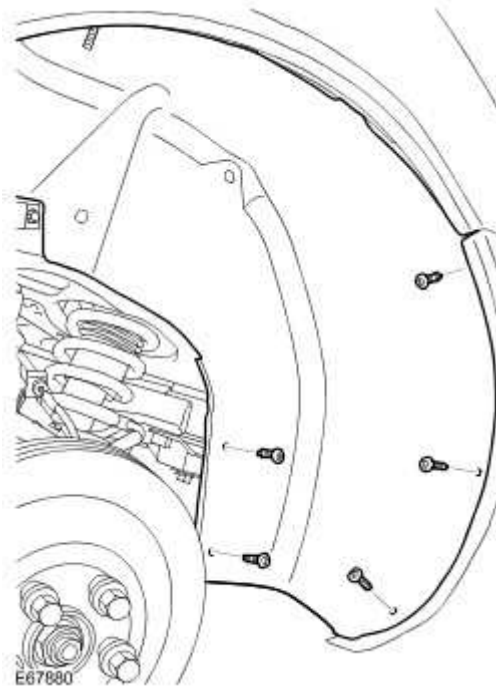
Raise and support the vehicle.

- 2 . Remove the LH rear wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . Release the rear lower edge of the LH fender splash shield.

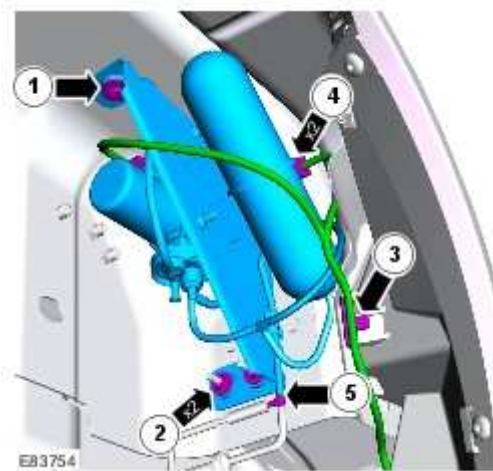
▶ Remove the 5 Torx screws.

▶ Tie the splash shield aside.



4 . Remove the exhaust sound enhancement vacuum pump assembly.

- Remove the bolt.
- Remove the 2 nuts.
- Release the wiring harness clip.
- Disconnect the 2 electrical connectors.
- Disconnect the vacuum line.



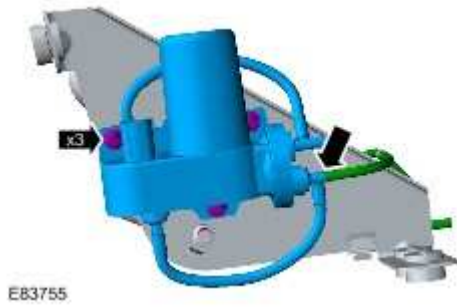
5 .  **CAUTION: Note the fitted position of the component prior to removal.**

NOTE:

Do not disassemble further if the component is removed for access only.

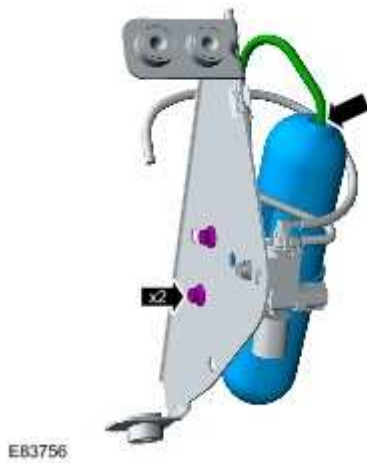
Remove the exhaust sound enhancement vacuum pump.

- Release from the 3 rubber mountings.
- Disconnect the vacuum line.



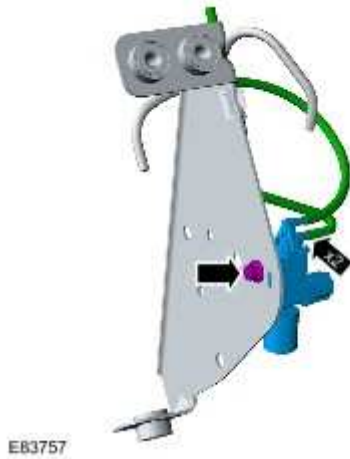
6 . Remove the exhaust sound enhancement vacuum reservoir.

- ▶ Remove the 2 bolts.
- ▶ Disconnect the vacuum line.



7 . Remove the exhaust sound enhancement solenoid.

- ▶ Remove the bolt.
- ▶ Disconnect the 2 vacuum lines.



Installation

1 . Install the exhaust sound enhancement solenoid.

- ▶ Tighten the bolt.
- ▶ Connect the vacuum lines.

2 . Install the exhaust sound enhancement vacuum reservoir.

- ▶ Tighten the bolts to 7 Nm (5 lb.ft).
- ▶ Connect the vacuum line.

3 . Install the exhaust sound enhancement vacuum pump.

- ▶ Connect the vacuum line.
- ▶ Secure with the rubber mountings.

4 . Install the exhaust sound enhancement vacuum pump assembly.

- ▶ Connect the vacuum line.
- ▶ Tighten the nuts to 7 Nm (5 lb.ft).

- ▶ Tighten the bolt to 7 Nm (5 lb.ft)
- ▶ Connect the electrical connectors.
- ▶ Attach the wiring harness.

5 . Secure the fender splash shield.

- ▶ Tighten the Torx bolts.

6 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

310 : Fuel System

310-00 : Fuel System – General Information

Specifications

Specifications



Fuel System Pressure Release (19.50.02)

Special Service Tools



310012

Fuel Pressure Gauge

310-012 (JD209)

1.



WARNING: Place the vehicle in a quarantined area and arrange "No Smoking/Petrol Fumes" signs about the vehicle.



WARNING: Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



WARNING: If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



WARNING: If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.



WARNING: Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Disconnect the battery ground cable.

2. Remove the fuel system pressure relief valve cap.

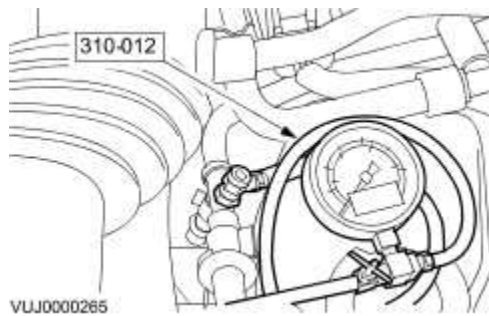


3.



WARNING: Make sure the tap of the special tool is rotated fully clockwise before installing the special tool to the fuel system pressure relief valve. Failure to follow these instructions may result in personal injury.

Install the special tool to the fuel system pressure relief valve.

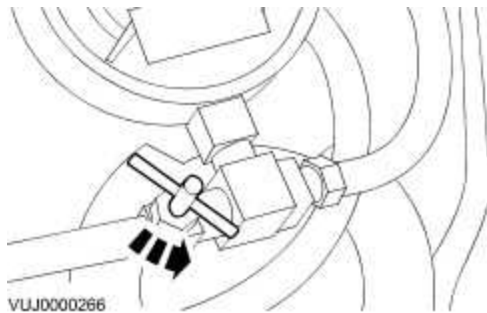


4. NOTE:

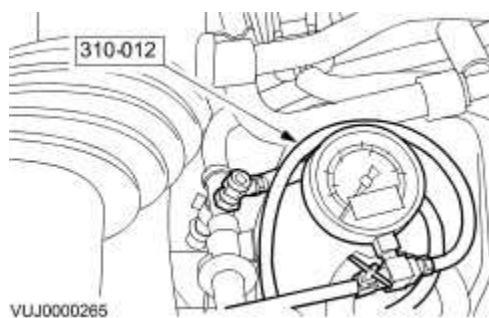
When relieving the fuel system pressure, catch any displaced fuel in a suitable container.

Relieve the fuel system pressure.

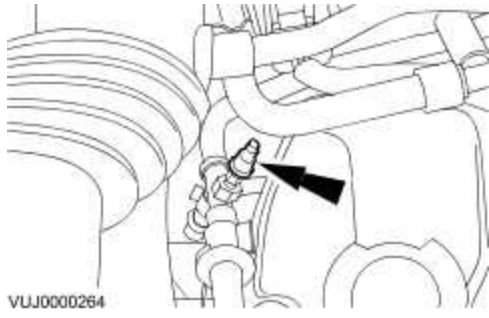
- Rotate the tap of the special tool fully counterclockwise.



5. Remove the special tool from the fuel system pressure relief valve.



6. Install the fuel system pressure relief valve cap.



7. Connect the battery ground cable.

Fuel Tank Draining

Special Service Tools



Fuel drain adaptor
310-154



WARNING: Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



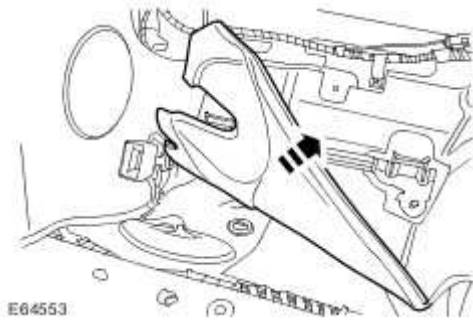
CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

1. Remove the cover and disconnect the battery ground cable.

2. Remove the rear RH seat cushion cover.

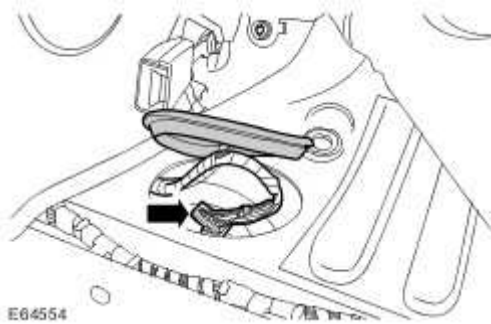
- Release the 2 clips.

3. Position the underseat sound deadner, to gain access to the fuel tank grommet.



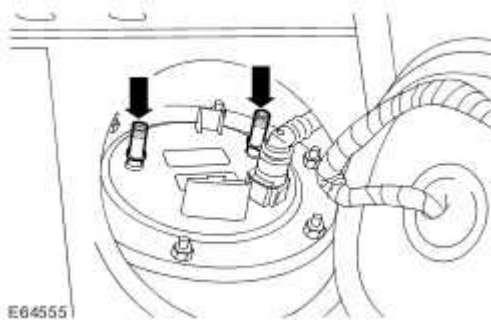
4. Remove the rubber grommet.

- Disconnect the electrical connector.



5. Cut the sealing plug from the top of the 2 drain ports.

- Disconnect the electrical connector.



6. Connect the fuel tank drain equipment ground cable to the vehicle.

7. Remove the fuel from the tank, via the 2 drain ports, to drain the left and right sides of the fuel tank.

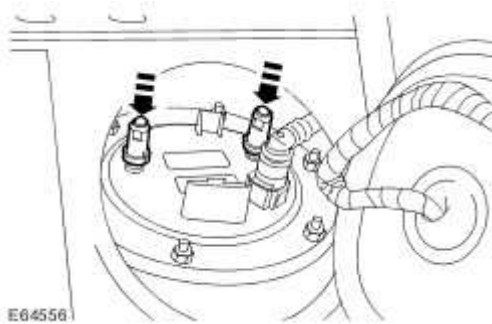
8. Remove the fuel drain equipment.

9.



WARNING: After the fuel tank drain is complete always fit the sealing covers over the drain ports. Failure to do so will mean that fuel vapour can escape.

Install the drain port sealing covers.



10. Install the grommet.

- Connect and secure the electrical connector.

11. Position the sound deadner.

12. Install the RH rear seat cushion.

- Carefully secure the clips.

13. Refill the fuel tank.

14. Connect the battery ground cable and install the cover.

Quick Release Coupling

Disconnect

1.



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WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



WARNING: If taken internally do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



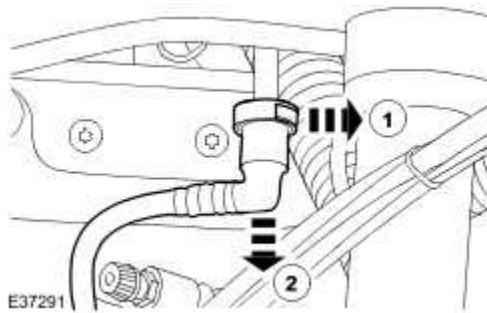
WARNING: If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.



WARNING: Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Relieve the fuel system pressure.

2. Disconnect the quick release fitting.
 1. Release the retaining clip.
 2. Disconnect the quick release fitting.



Connect

1. To connect, reverse the disconnect procedure.

Quick Release Coupling - Push Connect

Disconnect

1.



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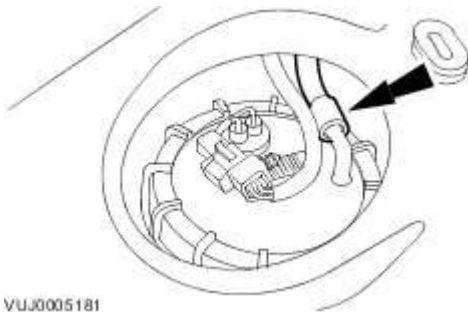
WARNING: If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention.



WARNING: Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Relieve the fuel system pressure.

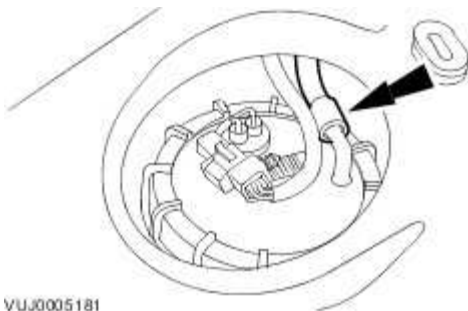
2. Disconnect the push connect fitting.
 - Press the collar.
 - Disconnect the push connect fitting.



VUJ0005181

Connect

1. To connect.
 - Support the male stub.
 - Push the connector fitting onto the stub until an audible click can be heard.
 - Check the connection by a gentle tug test.



VUJ0005181

Spring Lock Couplings

Special Service Tools



Fuel spring lock decoupling tool 310-D005



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WARNING: Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: The fuel system remains pressurized for a long time after the ignition is switched off. The fuel pressure must be relieved before attempting any repairs. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times

and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



WARNING: If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



WARNING: If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



WARNING: Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

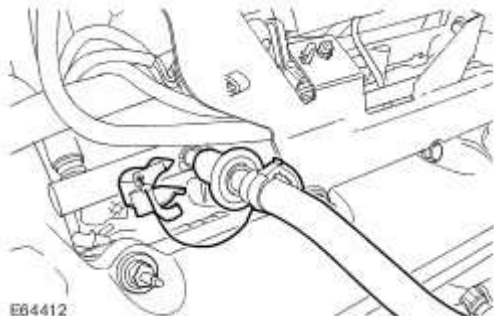


WARNING: Make sure the garter spring snaps over the male end of the spring lock coupling.

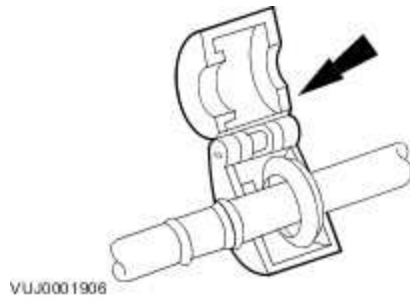


CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

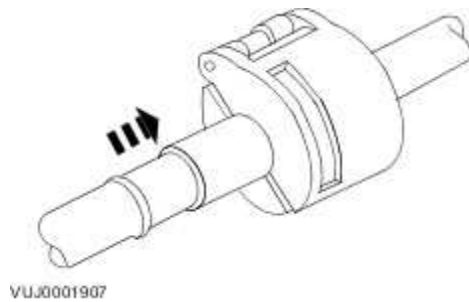
1. Release the fuel line safety clip.



2. Install the special tool.

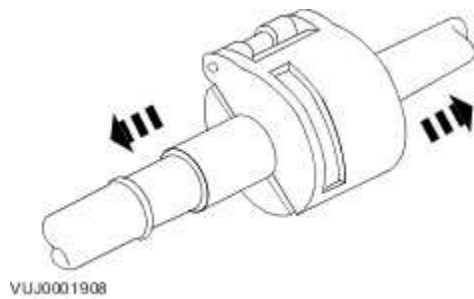


3. Close the special tool and push it into the female end of the spring lock coupling.

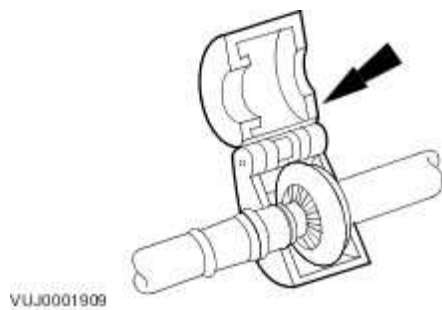


4. Disconnect the spring lock coupling.

- Position an absorbent cloth to collect fluid spillage.

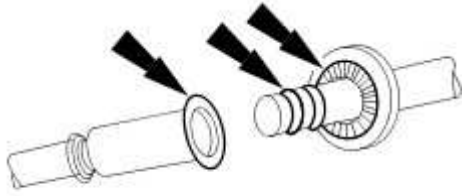


5. Remove the special tool.



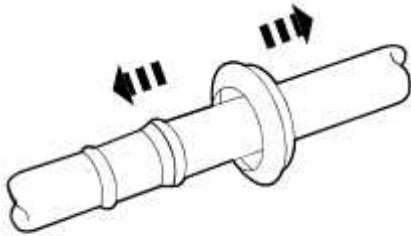
6. Connect the spring lock coupling.

- Clean the components.
- Install new O-ring seals.
- Install a new garter spring.



VUJ0001910

7. Check the spring lock coupling, to make sure it is correctly connected.



E31440

8. Attach the fuel line safety clip.

310-01 : Fuel Tank and Lines

Specifications

Specifications

General Specifications

Item	
Fuel system type	Electronic - returnless
Fuel tank construction	Stainless steel pressings
Fuel filter	Located in the fuel delivery line, forward of the fuel tank
Fuel tank sender unit	Mounted on the body of the fuel pump
Fuel Pump:	
Type/location	Electric - submersible - located in the fuel tank
Operating pressure	3.8 bar - 55 lbf/in ²
Maximum output at 11.5 volts	4.8 bar - 69 lbf/in ²

Capacities

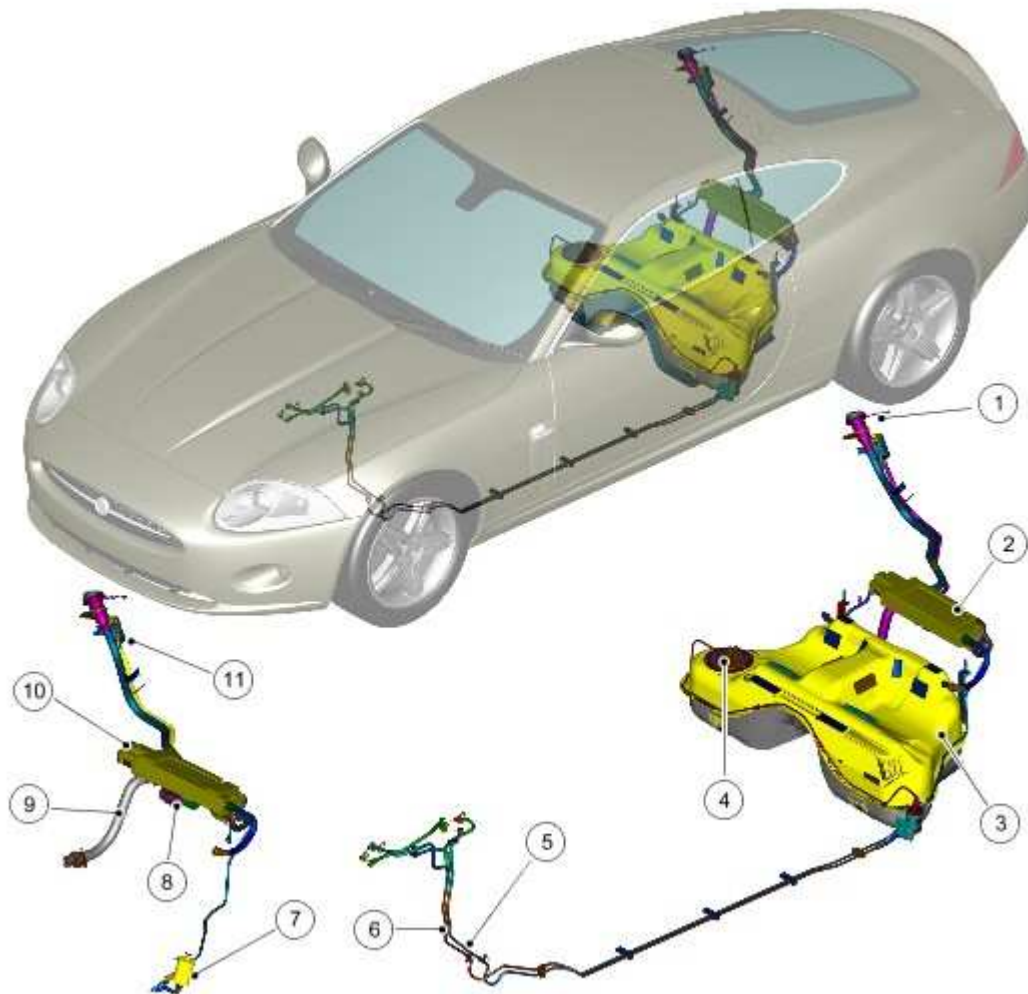
	Liters
Fuel tank capacity	71.1 (total) / 70.6 (useable)

Torque Specifications

Item	Nm	lb-ft	lb-in
Fuel filter to bracket - bolt	7	5	62
Fuel filter bracket to vehicle - nut	7	5	62
Fuel tank filler pipe bracket to vehicle	7	5	62
Fuel tank strap to vehicle - bolt	35	26	-
Fuel/vapor tube bracket to vehicle - bolt	9	7	80

Fuel Tank and Lines

COMPONENT LOCATION



E64956

Item	Part Number	Description
1		Filler cap and lanyard
2		Charcoal cannister assembly
3		Fuel tank
4		Fuel pump module assembly

5		Pipe - Fuel pump to engine (feed)
6		Pipe - EVAP charcoal canister to purge valve
7		Fuel filter
8		DMTL Pump (NAS only)
9		Fuel filler pipe
10		FPDM
11		DMTL filter

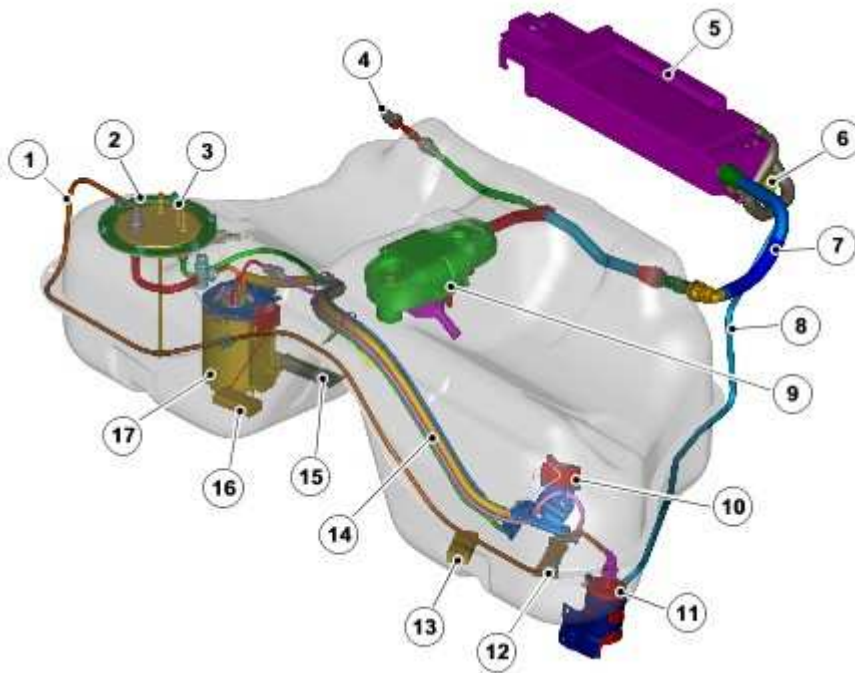
INTRODUCTION

The major components of the 4.2L V8 fuel system comprise

- Stainless steel saddle type fuel tank
- Fuel pump
- Fuel filler pipes
- Fuel level sensors
- Fuel delivery pipes.

The fuel system uses an electronic returnless fuel system which comprises a pump module mounted in the fuel tank to deliver fuel at variable flow and pressure to the fuel rails which supply fuel to all fuel injectors. The fuel pump operation is regulated by a Fuel Pump Driver Module (FPDM) which is controlled by the engine management system. The control module regulates the flow and pressure supplied by controlling the operation of the fuel pump using a PWM output. For additional information, refer to Fuel Charging and Controls (303-04 Fuel Charging and Controls - 4.2L)
For additional information, refer to Evaporative Emissions (303-13 Evaporative Emissions)
For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - 4.2L)

FUEL TANK



E75934

Item	Part Number	Description
1		Fuel supply to engine
2		Fuel pump flange
3		Fuel pump flange electrical connection
4		Liquid vapor separator vent hose
5		Charcoal cannister
6		DMTL pump
7		EVAP hose
8		Purge valve hose
9		Liquid vapor separator (including Roll Over Valve)
10		LH fuel level sensor
11		Fuel filter
12		LH jet pump

13		LH fuel level sensor float
14		Internal fuel transfer pipes
15		RH jet pump
16		RH fuel level sensor float
17		Fuel pump module

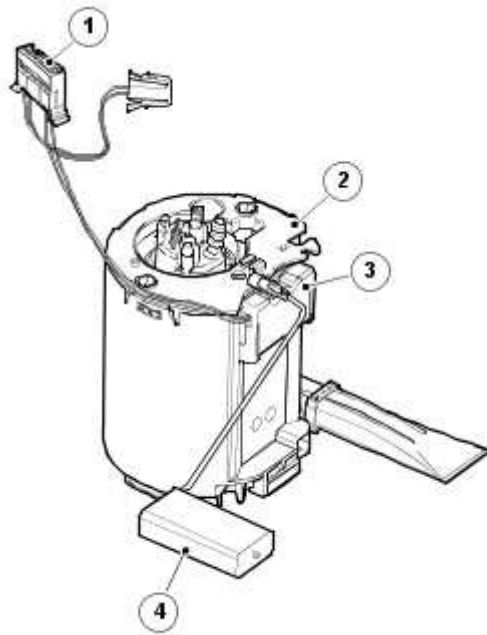
The fuel tank is a saddle type tank made of stainless steel pressings. The tank is located forward of the rear suspension and is mounted using two metal straps. The tank is a sealed unit with the only internal access being via the pump module flange aperture on the top of the tank.

The flange assembly comprises a pump module flange which contains all external pipe and electrical connections for the tank internal components, a collar and a clamp. The flange is fitted with a seal which locates in the tank aperture. An arrow on the flange must be aligned between two molded lines on the tank, adjacent to the pump module flange aperture, to obtain the correct orientation. The collar is located over the flange and is secured with the clamp. The flange, seal, collar and clamp arrangement meets the sealing requirements of LEV2 emissions.

The flange has a five pin external connector which provides for electrical connections for the level sensors, a common ground for the sensors and the fuel pump. This connector is wired to three push fit connectors on the underside of the flange. A quick release connector provides for the connection of the fuel feed pipe and breather.

The fuel pump module is mounted on a bayonet fitting at the base of the fuel tank. The module locks into position by rotating the module clockwise into the bayonet. The module comprises the fuel pump, the RH jet pump, the pump inlet filter, a second fine mesh filter which mounts into the carrier and an over pressure valve (PRV). The pump module, fuel filter and level sensors are available as serviceable components, the individual assembly components are not available separately.

FUEL PUMP MODULE



Item	Part Number	Description
1		Electrical connector
2		Fuel pump module
3		Fuel level sensor
4		Level sensor float

The fuel pump module is attached to the base of the fuel tank by the bayonet fitting. The pump module flange has three electrical connectors; one for the fuel pump motor and one for each of the fuel level sensors. All are connected to the external electrical connector via the connectors on the underside of the fuel pump module flange.

The pump module has a maximum rated flow of 180 liters/hour (47.55 US gallons/hour) and an output pressure of 5.0 bar (72.5 lbf/in²).

The fuel pump is energized by the fuel pump relay which is located in the Battery Junction Box (BJB) and the fuel pump control module which is located in the left hand side of the luggage compartment. The relay and control module are controlled by the engine control module. The relay is energized at all times when the ignition switch is in ignition position II.

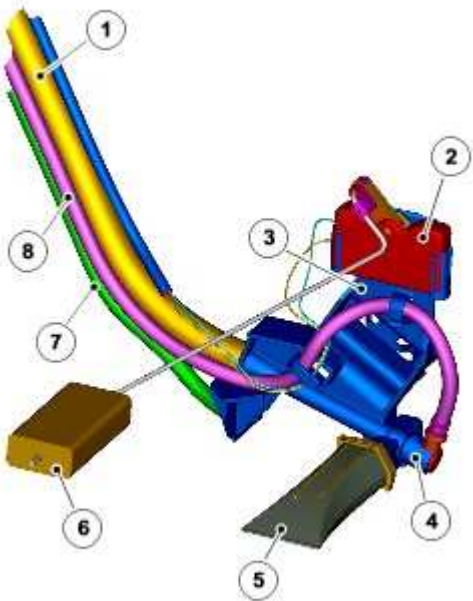
A 60 micron fine mesh, pump inlet filter is attached to the pump inlet port at the bottom of the pump. The filter is located vertically at the side of the pump to ensure that a portion of the filter is

off the base of the swirl pot to prevent premature blocking of the filter.

A second, serviceable fine mesh filter is located in-line. This provides additional filtration to the fuel before it is passed to the fuel rail. The filter has an electrical connection which is attached to ground to prevent electrostatic build-up.

FUEL LEVEL SENSORS

Left Hand Fuel Level Sensor



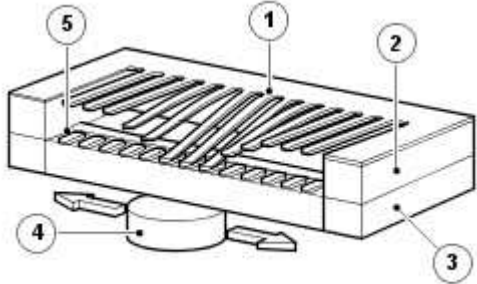
E75936

Item	Part Number	Description
1		Fuel transfer pipe
2		Fuel level sensor
3		Sensor mounting bracket
4		Jet pump
5		Filter
6		Fuel level sensor float
7		Fuel drain transfer pipe
8		Fuel transfer pipe

Two fuel level sensors are installed in either side of the saddle tank. One is mounted on the fuel pump module, the other is mounted on a separate bracket in the other side of the fuel tank. The sensors are a Magnetic Passive Position Sensor (MAPPS) which provide a variable resistance to ground for the output from the fuel gage. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The front and rear fuel level sensors are connected to the external electrical connector on the flange via the connectors on the underside of the fuel pump module flange.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.

Sensor Operating Principle



E44504

Item	Part Number	Description
1		Magnetic foil
2		Spacer
3		Ceramic surface
4		Magnet
5		Resistance film

The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is output proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gage pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is at or below 10 liters (2.64 US gallons).

The fuel level sender signal is converted into a CAN message by the instrument cluster as a direct interpretation of the fuel tank contents in liters. The ECM uses the CAN message to store additional OBD P Codes for misfire detection when the fuel level is below a predetermined capacity.

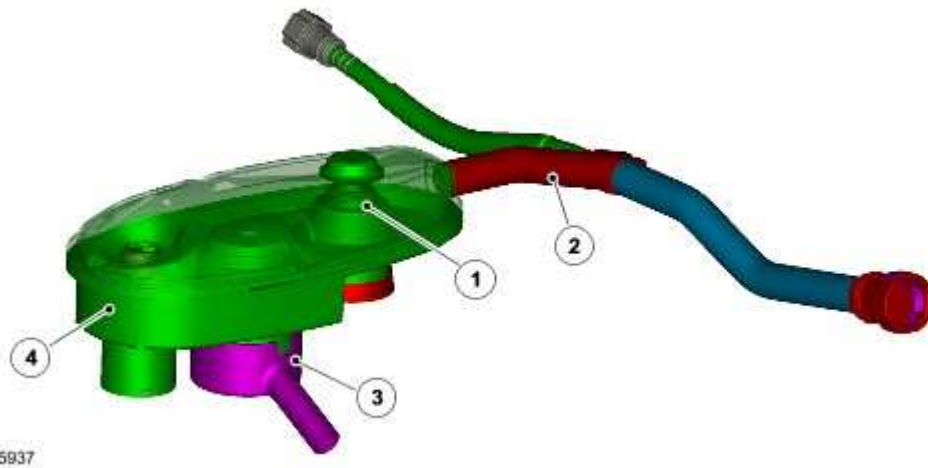
JET PUMPS

The fuel system incorporates two jet pumps. The LH jet pump is located on the fuel level sensor carrier on the LH side of the fuel tank. The RH jet pump is located in the swirl pot below the fuel pump. Both jet pumps operate on a venturi effect created by the fuel at pump output pressure passing through the jet pump. This draws additional fuel from the tank through ports in the jet pump body, delivering additional fuel to the swirl pot.

The jet pump is connected via a pipe from a three-way connection in the fuel pump. The LH jet pump collects fuel from the LH side of the tank and transfers it into the swirl pot, ensuring a constant supply of fuel to the pump. The jet pump has a jet nozzle of 0.5 mm diameter.

The RH jet pump operates at pump output pressure and delivers some of the fuel at pump pressure from the LH side of the tank. The jet pump has a jet nozzle of 0.5 mm diameter.

LIQUID VAPOR SEPARATOR (LVS)



Item	Part Number	Description
1		Roll over valve
2		Fuel vapor vent hoses
3		Fuel Level Vent Valve (FLVV)

4		Liquid Vapor Separator (LVS)
---	--	------------------------------

The Liquid Vapor Separator (LVS) separates any liquid from the vapor and drains back into the tank via the Fuel Level Vent Valve (FLVV) which is located on the underside of the LVS.

A single Roll Over Valve (ROV) is located in the liquid vapor separator. The separator is attached to the upper half of the fuel tank and is connected via a pipe and T piece to the charcoal canister breather outlet and the tank vent breather outlet. The ROV contains a non-return valve which closes in the event of the vehicle overturning, preventing liquid fuel escaping from the tank via the breather pipe.

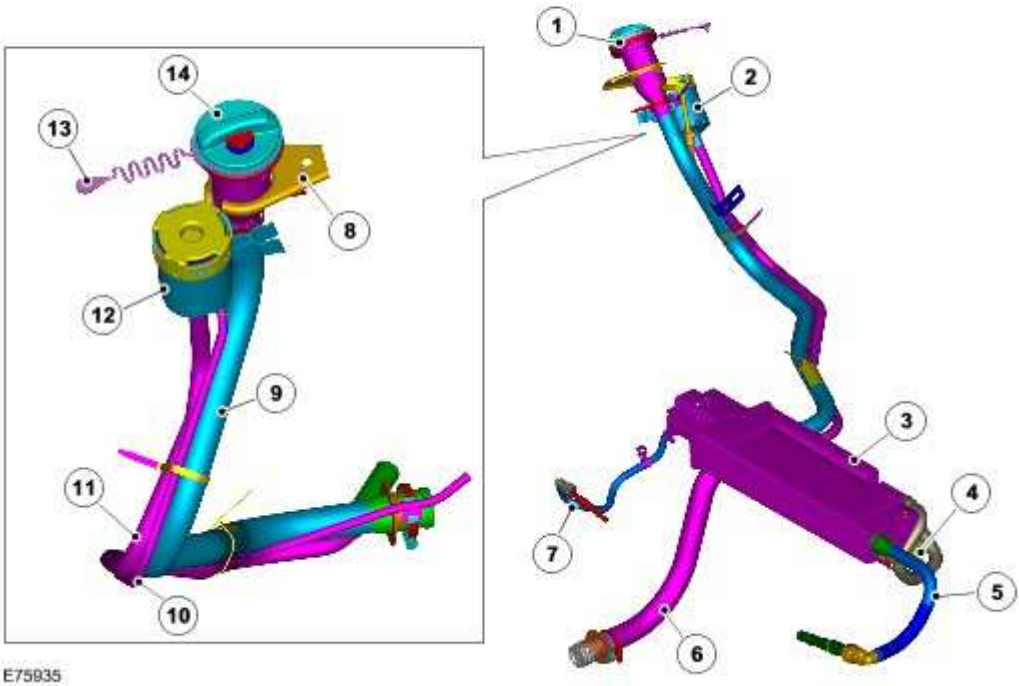
FUEL LEVEL VENT VALVE (FLVV)

The main purpose of the FLVV is to control the fill volume of the tank. During filling, vapor is passed via the FLVV to the LVS. The vapor then passes from the LVS to the vent connection via a corrugated tube. The vent connection is connected to the charcoal canister which stores the fuel vapor. During filling, when the tank reaches its full level, the FLVV closes and prevents fuel vapor passing through to the LVS. This causes the pressure in the tank to rise which in turn causes the pump filling nozzle to turn off.

FUEL FILTER

The fuel filter is located on a bracket on the LH side of the fuel tank. The bracket is secured by a single bolt.

FUEL FILLER PIPE ASSEMBLY



Item	Part Number	Description
1		Fuel filter
2		DMTL fresh air filter
3		Charcoal cannister
4		DMTL pump
5		LVS breather hose
6		Fuel filler pipe
7		Fuel tank vent hose
8		Bracket

9		Fuel filler pipe
10		FLVV pipe
11		DMTL fresh air pipe
12		DMTL fresh air filter
13		Filler cap lanyard
14		Filler cap

The fuel filler head is positioned at the rear of the vehicle, above the right hand rear wheel. The filler head is covered by a molded plastic cover which is electrically locked when the vehicle is locked. The filler cap is a conventional screw in type which is secured to the vehicle with a lanyard.

The filler head is a stainless steel fabrication which is secured to the vehicle body by a bracket.

Connections on the rear of the filler head allow for the connection of the fuel tank breather pipe from the fuel tank flange, the fuel filler pipe to the tank and the charcoal canister breather pipe.

The fuel tank breather pipe has a quick release fitting and connects to the breather pipe from the fuel tank flange.

The fuel filler pipe locates in a short flexible hose attached to the tank and is secured with worm drive clamps. The canister breather pipe is routed alongside the fuel filler pipe and attaches to the canister with a quick release coupling.

A fourth pipe is also routed alongside the fuel filler pipe and provides air ventilation for the charcoal canister. On all petrol vehicles, except NAS vehicles, the pipe is connected to the air pump port on the charcoal canister with a quick release coupling and connects to an insect trap at the fuel filler head. On NAS vehicles fitted with a DMTL pump, the pipe connects to the pump vent port and is also connected to a filter which is attached to the filler head.

FUEL LINES

The fuel lines are single piece construction from the fuel filter to the fuel rails in the engine compartment.

Fuel Tank and Lines

Principle of Operation

For a detailed description of the fuel tank and lines, refer to the relevant Description and Operation section in the workshop manual.

Fuel Tank and Lines

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel level • Fuel contamination/grade/quality • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe 	<ul style="list-style-type: none"> • Fuses • Loose or corroded electrical connectors • Harnesses • Fuel Pump Driver Module (FPDM) • Rear Junction Box (RJB) • Fuel pump relay • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported symptom is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the symptom and refer to the Symptom Chart below, alternatively, check for Diagnostic Trouble Codes (DTCs) and proceed to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine controls 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests. Engine Ignition • For fuel system tests. Read DTCs and refer to DTC Index in this section • For electronic engine control tests.

		Electronic Engine Controls
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • Ignition coil failure(s) 	<ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel pump tests. Check for DTCs and refer to DTC Index in this section • For ignition system tests. Engine Ignition
Difficult cold start	<ul style="list-style-type: none"> • Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Exhaust gas recirculation (EGR) valve stuck open • Fuel pump • Evaporative emissions purge valve 	<ul style="list-style-type: none"> • Check the engine coolant level and condition. Specifications • Ensure the battery is in a fully charged and serviceable condition • For electronic engine control tests. Electronic Engine Controls • For EGR valve tests. Engine Emission Control • For fuel system tests. Read DTCs and refer to DTC Index in this section • For purge valve tests. Evaporative Emissions
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system • EGR valve stuck open 	<ul style="list-style-type: none"> • Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • For electronic engine control tests. Electronic Engine Controls • For purge valve tests. Evaporative Emissions • For fuel system tests. Read DTCs and refer to DTC Index in this section • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump 	<ul style="list-style-type: none"> • Carry out injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • For electronic engine control tests.

	<ul style="list-style-type: none"> • Ignition system • EGR valve stuck open 	<p>Electronic Engine Controls</p> <ul style="list-style-type: none"> • For purge valve tests. Evaporative Emissions • For fuel system tests. Read DTCs and refer to DTC Index in this section • For ignition system tests. Engine Ignition • For EGR valve tests. Engine Emission Control
<p>Engine stalls soon after start</p>	<ul style="list-style-type: none"> • Breather system disconnected/restricted • ECM relay • Electronic engine controls • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • For ECM relay tests. Electronic Engine Controls • For electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition • Check for blockage in air cleaner element and air intake system • Check for leakage in air intake system • For fuel line tests. GO to Pinpoint Test G830073p9.
<p>Engine hesitates/poor acceleration</p>	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine controls • Ignition system • EGR valve stuck • Transmission malfunction • Restricted pedal travel (carpet, etc) 	<ul style="list-style-type: none"> • For fuel pressure tests. GO to Pinpoint Test G830073p8. For fuel line tests. GO to Pinpoint Test G830073p9. For fuel pump tests. Read DTCs and refer to DTC Index in this section • Carry out fuel injector leak tests, install new injectors as necessary. Fuel Injector (18.10.01) • Check for leakage from air intake system • For electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition • For EGR valve tests.

		<p>Engine Emission Control</p> <ul style="list-style-type: none"> • For transmission system tests. <p>Diagnostic Strategy</p> <ul style="list-style-type: none"> • Ensure accelerator pedal is free from restriction
Engine backfires	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) hub 	<ul style="list-style-type: none"> • For fuel pump tests. Read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test G830073p9. • Check for leakage from air intake system • For electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition • For VCT system tests. Electronic Engine Controls
Engine surges	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Electronic engine controls • Ignition system 	<ul style="list-style-type: none"> • For fuel pump tests. Read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test G830073p9. • For electronic engine control tests. Electronic Engine Controls • For ignition system tests. Engine Ignition
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump, fuel lines, fuel quality • Air leakage • Sticking VCT hub 	<ul style="list-style-type: none"> • For electronic engine control tests. Electronic Engine Controls • For fuel pump tests. Read DTCs and refer to DTC Index in this section. For fuel line tests. GO to Pinpoint Test G830073p9. • Check for leakage from air intake system • For VCT system tests. Electronic Engine Controls

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P008700	Fuel rail/system pressure - too low	<ul style="list-style-type: none">Fuel rail pressure (FRP) sensor, sensing circuit - short to ground, open circuit	<ul style="list-style-type: none">Carry out any pinpoint tests associated with this DTC using the manufacturer

		<ul style="list-style-type: none"> FRP sensor supply circuit - high resistance FRP sensor failure Fuel pump failure Fuel line leak, restriction 	<p>approved diagnostic system</p> <ul style="list-style-type: none"> Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) Check for logged fuel pump DTCs and refer to DTC index Check for fuel line leaks/restrictions and rectify as necessary. GO to Pinpoint Test G830073p9.
P008800	Fuel rail/system pressure - too high	<ul style="list-style-type: none"> FRP sensor supply/sensing circuits - short to each other FRP sensor sensing circuit - short to power FRP sensor ground circuit - high resistance FRP sensor failure Restricted fuel line Fuel pump short circuit to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new FRP sensor as necessary. Fuel Rail Pressure (FRP) Sensor (18.30.98) Check for fuel leaks/restrictions and rectify as necessary. GO to Pinpoint Test G830073p9. Check for logged fuel pump DTCs and refer to DTC index
P017100	System too lean (bank 1)	<ul style="list-style-type: none"> Air intake leak between MAF sensor and cylinder head Fuel filter, injector, system restriction MAF sensor fault (low intake air flow) Exhaust leak (forward of catalytic converter) 	<ul style="list-style-type: none"> Check for leak from air intake system Check fuel system is free from restriction For MAF sensor tests. Electronic Engine Controls Check and rectify any exhaust leak prior to catalytic converter
P017400	System too lean (bank 2)	<ul style="list-style-type: none"> Air intake leak between MAF sensor and cylinder head Fuel filter, injector, system restriction 	<ul style="list-style-type: none"> Check for leak from air intake system Check fuel system is free from restriction For MAF sensor tests.

		<ul style="list-style-type: none"> • MAF sensor fault (low intake air flow) • Exhaust leak (forward of catalytic converter) 	<p>Electronic Engine Controls</p> <ul style="list-style-type: none"> • Check and rectify any exhaust leak prior to catalytic converter
P030000	Random/multiple cylinder misfire detected	<ul style="list-style-type: none"> • ECM to ignition coil primary circuit faults (cylinder misfire detected DTCs also logged) • Fuel injector circuit fault(s) (injector DTCs also logged) • Ignition coil failure • Spark plug failure/fouled/incorrect gap • Fuel delivery pressure (low/high) • Fuel contamination • Fuel injectors restricted, leaking, continuously open • Cylinder compression low • Worn camshaft/broken valve springs • Valve clearance adjustment 	<ul style="list-style-type: none"> • If specific cylinder misfire or injector DTCs are also logged refer to the tests associated to those DTCs first. Electronic Engine Controls • For ignition coil test. Electronic Engine Controls • Check and install new spark plugs as necessary. Spark Plugs - 4.2L NA V8 - AJV8 (18.20.02) • Check for logged fuel system DTCs and refer to relevant DTC Index. Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 Electronic Engine Controls Fuel Tank and Lines • For injector tests. Fuel Charging and Controls - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 • Check cylinder compressions. Engine • Check for worn/broken engine components and valve clearance adjustment. Valve Clearance Check (12.29.47)
P046129	Fuel level sensor A circuit - range/performance - signal invalid	<ul style="list-style-type: none"> • Fuel level sensor A circuits - intermittent short circuit, high resistance • Fuel level sensor failure 	<ul style="list-style-type: none"> • For fuel level sensor tests. GO to Pinpoint Test G830073p3.

P04612F	Fuel level sensor A circuit range/performance - signal erratic	<ul style="list-style-type: none"> Fuel level sensor circuits - intermittent short circuit, high resistance Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor tests. GO to Pinpoint Test G830073p3.
P046200	Fuel level sensor A circuit - low input	<ul style="list-style-type: none"> Fuel level sensor circuits - intermittent short to ground, high resistance Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor tests. GO to Pinpoint Test G830073p3.
P046300	Fuel level sensor A circuit - high input	<ul style="list-style-type: none"> Fuel level sensor circuits - intermittent short to power Fuel level sensor failure 	<ul style="list-style-type: none"> For fuel level sensor tests. GO to Pinpoint Test G830073p3.
P062700	Fuel pump A control circuit/open	<ul style="list-style-type: none"> Fuel pump control circuit fault (FPDM to fuel pump) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the FPDM to Fuel Pump circuit for short to ground, power, open circuit
P062A00	Fuel pump A control circuit range/performance	<ul style="list-style-type: none"> Invalid fuel pump duty requested by the ECM 	<ul style="list-style-type: none"> For ECM to FPDM circuit tests. GO to Pinpoint Test G830073p5.

Pinpoint Tests

PINPOINT TEST G830073p3 : FUEL LEVEL SENDER(S) CIRCUIT RANGE/PERFORMANCE

G830073t6 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'A' FOR SHORT CIRCUIT TO GROUND

1. Disconnect the fuel pump module electrical connector, CA127. 2. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 02	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t7.

G830073t7 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'A' FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 02	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t8.

G830073t8 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'B' FOR SHORT CIRCUIT TO GROUND

1. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 06	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t9.

G830073t9 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'B' FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 06	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t10.

G830073t10 : CHECK THE SIGNAL RETURN CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDERS FOR SHORT CIRCUIT TO GROUND

1. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 5	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t11.

G830073t11 : CHECK THE SIGNAL RETURN CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDERS FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

Fuel pump module connector CA127, harness side	Battery
Pin 5	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t12.

G830073t12 : CHECK THE FUEL LEVEL SENDER 'B' RESISTANCE AT EMPTY

1. Drain the fuel tank.

Fuel Tank Draining 2. Measure the resistance between:

Fuel pump module connector CA127, component side	Fuel pump module connector CA127, component side
Pin 05	Pin 06

- **Is the resistance 51 ± 2 ohms?**

-> **Yes**

GO to Pinpoint Test G830073t13.

-> **No**

INSTALL a new fuel tank.

Fuel Tank (19.55.01) CLEAR the DTC, test the system for normal operation.

G830073t13 : CHECK THE FUEL LEVEL SENDER 'B' RESISTANCE AT FULL

1. Remove the fuel tank. 2. Invert fuel tank to set sensor float to it's highest position. 3. Measure the resistance between:

Fuel pump module connector CA127, component	Fuel pump module connector CA127, component
--	--

side	side
Pin 05	Pin 06

- **Is the resistance 1000±8 ohms?**

-> **Yes**

GO to Pinpoint Test G830073t14.

-> **No**

INSTALL a new fuel tank.

Fuel Tank (19.55.01) CLEAR the DTC, test the system for normal operation.

G830073t14 : CHECK THE FUEL LEVEL SENDER 'A' RESISTANCE AT EMPTY

1. Correct fuel tank orientation. 2. Remove the fuel pump module.

Fuel Pump Module (19.45.08) 3. Move the sender float to it's lowest position. 4. Measure the resistance between:

Fuel pump module connector CA127, component side	Fuel pump module connector CA127, component side
Pin 01	Pin 02

- **Is the resistance 51±2 ohms?**

-> **Yes**

GO to Pinpoint Test G830073t15.

-> **No**

INSTALL a new fuel level sender.

Fuel Level Sender CLEAR the DTC, test the system for normal operation.

G830073t15 : CHECK THE FUEL LEVEL SENDER 'A' RESISTANCE AT FULL

1. Move the sender float to it's highest position. 2. Measure the resistance between:

Fuel pump module connector CA127, component side	Fuel pump module connector CA127, component side
Pin 01	Pin 02

- Is the resistance 1000±8 ohms?

-> **Yes**

GO to Pinpoint Test G830073t16.

-> **No**

INSTALL a new fuel level sender.

Fuel Level Sender CLEAR the DTC, test the system for normal operation.

G830073t16 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'A' FOR HIGH RESISTANCE

1. Disconnect the RJB electrical connector, CA070. 2. Measure the resistance between:

RJB connector CA070, harness side	Fuel pump module connector CA127, harness side
Pin 13	Pin 02

- Is the resistance greater than 5 ohms?

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t17.

G830073t17 : CHECK THE SIGNAL CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'B' FOR HIGH RESISTANCE

1. Measure the resistance between:

RJB connector CA070, harness side	Fuel pump module connector CA127, harness side
Pin 12	Pin 06

- Is the resistance greater than 5 ohms?

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the

DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t45.

G830073t45 : CHECK THE SIGNAL RETURN CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'A' FOR HIGH RESISTANCE

1. Measure the resistance between:

RJB connector CA070, harness side	Fuel pump module connector CA127, harness side
Pin 04	Pin 01

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t18.

G830073t18 : CHECK THE SIGNAL RETURN CIRCUIT BETWEEN THE RJB AND FUEL LEVEL SENDER 'B' FOR HIGH RESISTANCE

1. Measure the resistance between:

RJB connector CA070, harness side	Fuel pump module connector CA127, harness side
Pin 04	Pin 05

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

CHECK for DTCs indicating another cause of the complaint.

Electronic Engine Controls

PINPOINT TEST G830073p5 : ECM TO FPDM MONITOR AND CONTROL CIRCUITS

G830073t22 : CHECK THE ECM TO FPDM MONITOR CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Set ignition status to OFF. 2. Disconnect the FPDM electrical connector, CA125. 3. Measure the resistance between:

FPDM connector CA125, harness side	Battery
Pin 04	Negative terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t23.

G830073t23 : CHECK THE ECM TO FPDM MONITOR CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

FPDM connector CA125, harness side	Battery
Pin 04	Positive terminal

- Is the resistance less than 10,000 ohms?

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t24.

G830073t24 : CHECK THE ECM TO FPDM CONTROL CIRCUIT FOR SHORT CIRCUIT TO GROUND

1. Measure the resistance between:

FPDM connector CA125, harness side	Battery
Pin 03	Negative terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t25.

G830073t25 : CHECK THE ECM TO FPDM CONTROL CIRCUIT FOR SHORT CIRCUIT TO POWER

1. Measure the resistance between:

FPDM connector CA125, harness side	Battery
Pin 03	Positive terminal

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t26.

G830073t26 : CHECK THE ECM TO FPDM MONITOR CIRCUIT FOR HIGH RESISTANCE

1. Disconnect the ECM electrical connector, FL072. 2. Measure the resistance between:

FPDM connector CA125, harness side	ECM connector FL072, harness side
---	--

Pin 04	Pin 21
--------	--------

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t27.

G830073t27 : CHECK THE ECM TO FPDM CONTROL CIRCUIT FOR HIGH RESISTANCE

1. Measure the resistance between:

FPDM connector CA125, harness side	ECM connector FL072, harness side
Pin 03	Pin 20

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC, test the system for normal operation.

-> **No**

CHECK for DTCs indicating a module fault.

Electronic Engine Controls

PINPOINT TEST G830073p8 : CHECK THE FUEL SYSTEM PRESSURE

G830073t39 : CHECK THE PUMP ACTIVITY

1. Remove the rear seat cushion.

Rear Seat Cushion (76.70.37) 2. Set ignition status to ON, engine OFF. 3. Listen for pump noise.

- **Can the fuel pump be heard running?**

-> **Yes**

GO to Pinpoint Test G830073t40.

-> **No**

CHECK for DTCs.

Electronic Engine Controls

G830073t40 : CHECK THE FUEL SYSTEM PRESSURE

1.



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Make sure the vehicle is in **Park** and apply the parking brake. 2. Set ignition status to OFF 3. **NOTE:**

Place suitable absorbent material around the Schraeder valve to absorb any spillage when connecting the gauge set.

Connect adapter and gauge assembly 310-116 to the fuel Schraeder valve. Remove the absorbent material and dispose of safely. 4.



Disconnect and plug the vacuum hose from the pressure regulator. 5. Open the valve on the fuel pressure gauge 310-116. 6. Set ignition status to ON, engine OFF. 7. Record the fuel pressure reading.

- **Is the fuel pressure 3.8 bar (55.11 lb/in²). A slow decay to approximately 3 bar should occur over one minute.**

-> **Yes**

GO to Pinpoint Test G830073t41.

-> **No**

CHECK for DTCs.

Electronic Engine Controls

G830073t41 : CHECK THE FUEL SYSTEM PRESSURE WITH THE ENGINE CRANKING

1. Apply footbrake and press start button. 2. Record the fuel pressure reading when engine cranking.

- **Is the fuel pressure 3.8 bar (55.11 lb/in²) nominal.**

-> **Yes**

GO to Pinpoint Test G830073t42.

-> **No**

CHECK for DTCs.

Electronic Engine Controls

G830073t42 : CHECK THE FUEL SYSTEM PRESSURE WITH THE ENGINE IDLING (WHERE POSSIBLE)

1. With engine running.

- **Is the fuel pressure 3.8 bar (55.11 lb/in²)**

-> **Yes**

CHECK for DTCs and symptoms indicating another cause of the problem.

Electronic Engine Controls

-> **No**

CHECK the fuel pump module power and ground circuits.

PINPOINT TEST G830073p9 : CHECK THE FUEL LINES

G830073t43 : CHECK THE FUEL LINES FOR RESTRICTIONS

1.



WARNING: This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

Detach the fuel line from the fuel rail and from the fuel pump module. 2. Using an air line gently blow through the line checking for blockages or restrictions.

- **Is a blockage or restriction evident?**

-> **Yes**

CLEAR/REPAIR the blocked or restricted fuel line and test the system for normal operation.

-> **No**

GO to Pinpoint Test G830073t44.

G830073t44 : CHECK THE FUEL TANK LINES FOR RESTRICTIONS

1. Remove the fuel pump module locking ring.

Fuel Pump Module (19.45.08) 2. Detach the fuel lines from the fuel pump module. 3. Using an air line gently blow through the tank lines checking for blockages or restrictions.

- **Is a blockage or restriction evident?**

-> **Yes**

CLEAR/REPAIR the blocked or restricted fuel line and test the system for normal operation.

-> **No**

CHECK for DTCs and symptoms indicating another cause for the problem.

Electronic Engine Controls

Fuel Filter (19.25.02)

Removal



WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3



- **WARNING:** The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



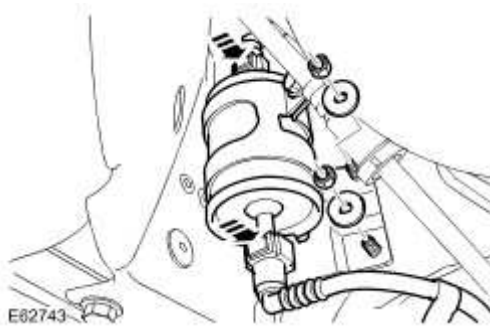
CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTE:

Note the fitted position.

Remove the fuel filter.

- ▶ Position a container to collect spillage.
- ▶ Remove the nut.
- ▶ Disconnect the 2 fuel lines.



4 . Remove the fuel filter bracket.

- ▶ Remove the bolt.



Installation

1 . Attach the fuel filter support bracket.

▶ Install the bolt and tighten to 10 Nm (7 lb.ft).

2 . Install the fuel filter.

▶ Clean the component mating faces.

▶ Connect the fuel lines.

▶ Tighten the nut to 10 Nm (7 lb.ft).

3 . Connect the battery ground cable and install the cover.

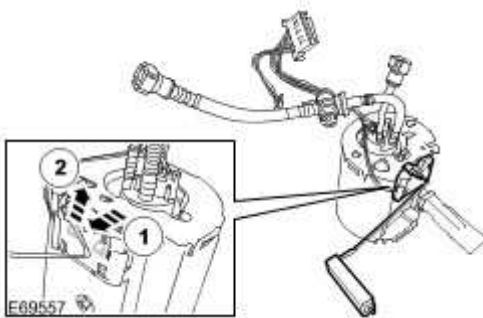
For additional information, refer to Specifications

Fuel Level Sender

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the fuel pump module.
For additional information, refer to Fuel Pump Module (19.45.08)
- 3 . Remove the fuel level sender unit.

▶ Carefully release the 2 clips.



Installation

- 1 . Install the fuel level sender unit.
- 2 . Install the fuel pump module.
For additional information, refer to Fuel Pump Module (19.45.08)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Fuel Pump Module (19.45.08)

Removal



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- 3 . With assistance, remove the fuel tank.
For additional information, refer to Fuel Tank (19.55.01)
- 4 . Remove the fuel pump and sender cover locking ring.

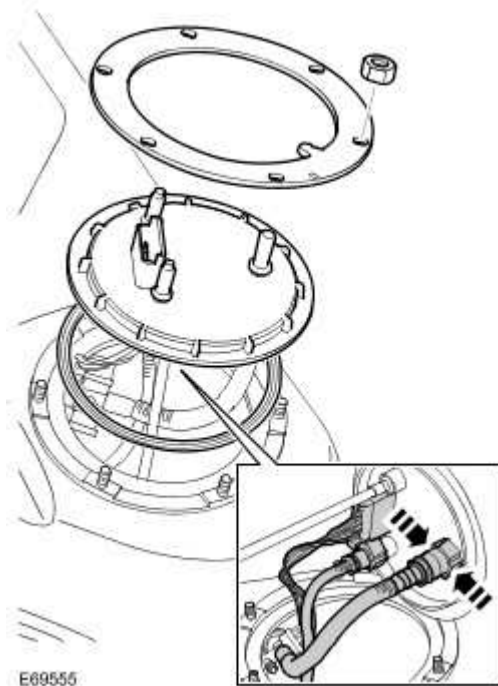
▶ Remove the 6 nuts.

5 . Remove the fuel pump and sender cover.

▶ Disconnect the electrical connector.

▶ Disconnect the 2 fuel lines.

6 . Remove and discard the seal.



7



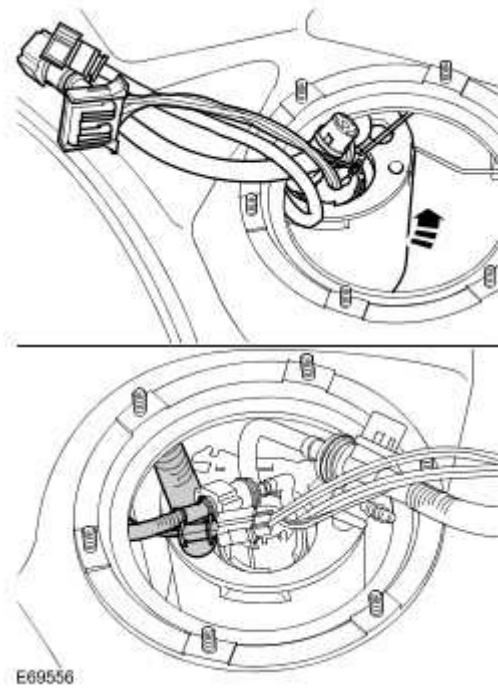
WARNING: The fuel tank is manufactured from stainless steel. Hand and arm protection must be used when removing parts from the inside of the tank, to prevent any injury.



WARNING: Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Remove the fuel pump module.

- ▶ Rotate the pump module counter-clockwise.
- ▶ Disconnect the 2 fuel lines.
- ▶ Disconnect the electrical connector.

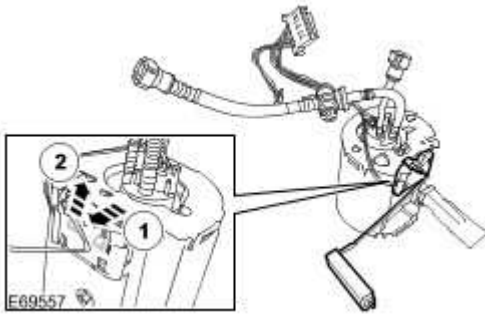


8 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the fuel level sender unit.

- ▶ Carefully release the 2 clips.



Installation

1 . Install the fuel level sender unit.

2



WARNING: The fuel tank is manufactured from stainless steel. Hand and arm protection must be used when removing parts from the inside of the tank, to prevent any injury.



WARNING: Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

Install the fuel pump module.

- ▶ Connect the hoses.
- ▶ Connect and secure the electrical connector.

3 . Install the new O-ring seals.

- ▶ Clean the components mating faces.

4 . Install the fuel pump and sender cover.

- ▶ Disconnect the electrical connector.

▶ Disconnect the 2 fuel lines.

5 . Install the fuel pump and sender cover locking ring.

▶ Tighten the nut to 10 Nm (7 lb.ft).

6 . With assistance, install the fuel tank.

For additional information, refer to Fuel Tank (19.55.01)

7 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Fuel Tank (19.55.01)

Removal



WARNING: Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2 . Drain the fuel tank.
For additional information, refer to Fuel Tank Draining

3

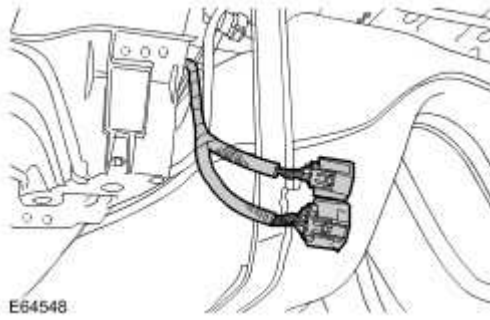



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


4 . Remove the rear sub-frame assembly.
For additional information, refer to Rear Subframe (64.25.01)

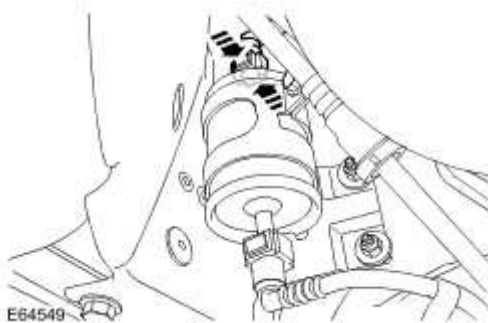
5 . Release the 2 electrical connectors.



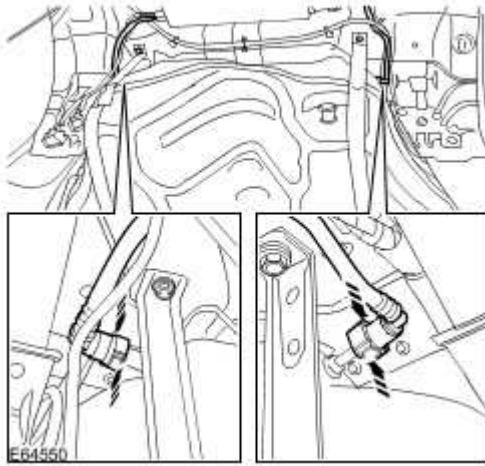
- 6  **WARNING:** The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Disconnect the fuel filter.

-  Release the fuel supply line.

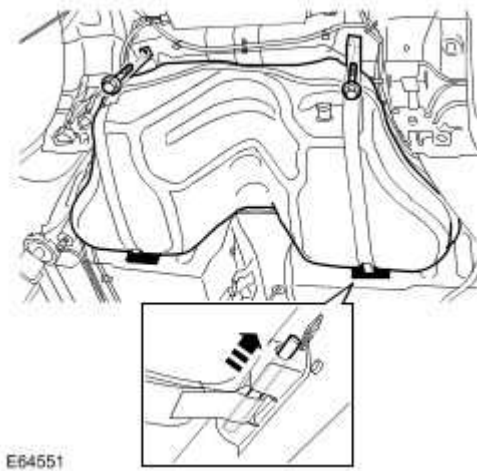


- 7 . Release the fuel filler neck and the evaporative emissions breather hoses.



8 . Using a transmission jack, support the fuel tank.

- ▶ Remove the 2 bolts.
- ▶ Remove the 2 retaining pins.



9 . Remove the fuel tank.

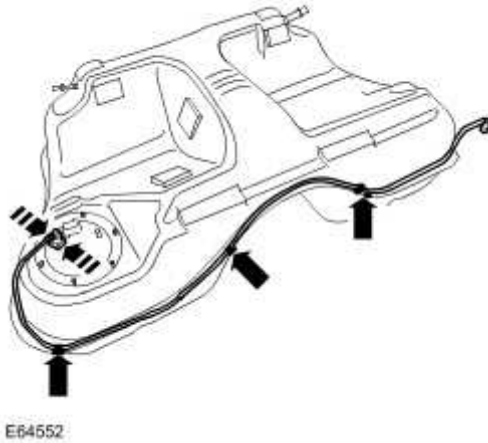
10 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the fuel line.

▶ Release the 3 clips.

▶ Disconnect the fuel line.



Installation

1 . Install the fuel line.

▶ Carefully secure the clips.

2 . Install the fuel tank.

▶ Using a transmission jack, position and support the fuel tank.

3 . Install the fuel tank straps.

▶ Install the retaining pins.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

4 . Install the fuel filler neck and the evaporative emissions breather hoses.

- 5 . Secure the electrical connectors.

- 6 . Connect the fuel filter.

- 7 . Install the rear sub-frame.
For additional information, refer to Rear Subframe (64.25.01)

- 8 . Refill the fuel tank.
For additional information, refer to Fuel Tank Draining

- 9 . Connect the battery ground cable and install the cover.
For additional information, refer to Specifications

Fuel Tank Filler Pipe (19.55.33)

Removal



WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



WARNING: Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



WARNING: After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Open the fuel filler door and remove the cap.

3



- **WARNING:** Do not work on or under a vehicle supported only by a jack. Always

support the vehicle on safety stands.

Raise and support the vehicle.

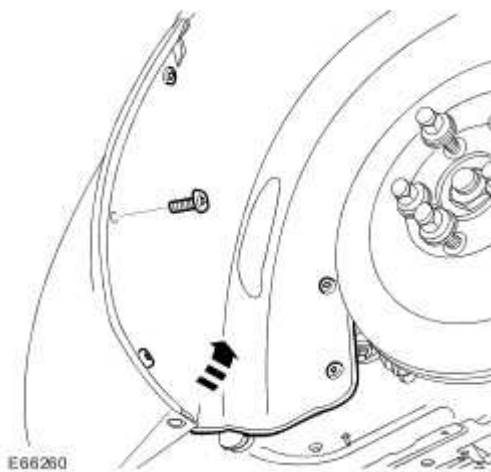
4 . Remove the LH rear wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

5 . Release the rear lower edge of the rear fender splash shield.

▶ Remove the 5 Torx bolts.

▶ Tie the splash shield aside.



6 . Release the fuel tank filler pipe.

▶ Release the clip.

7 . Release the breather hose.

▶ Release the clip.

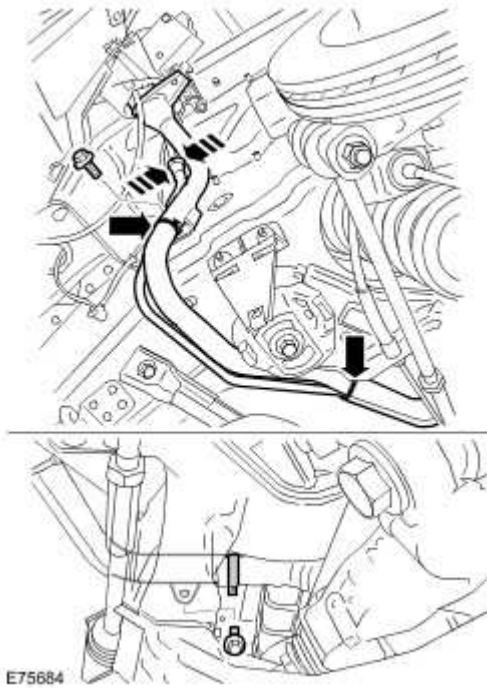
8 . **NOTE:**

Note the fitted position of the locating pegs.

Remove the fuel filler neck assembly.

➤ Remove the 2 bolts.

➤ Remove the 2 clips.



Installation

1 . NOTE:


Align to the position noted on removal.

Install the fuel filler neck assembly.


➤ Tighten the bolts to 10 Nm (7 lb.ft).

➤ Install the clips.


2 . Install the breather pipes.

 Release the clip.

3 . Install the fuel tank filler pipe.

 Secure the clip.

4 . Install the fender splash shield.

 Tighten the Torx bolts.

5 . Install the wheel and tire assembly.

For additional information, refer to Wheel and Tire (74.20.05)

6 . Install the fuel filler cap and close the fuel filler door.

7 . Connect the battery ground cable.

For additional information, refer to Specifications

310-02 : Acceleration Control

Specifications

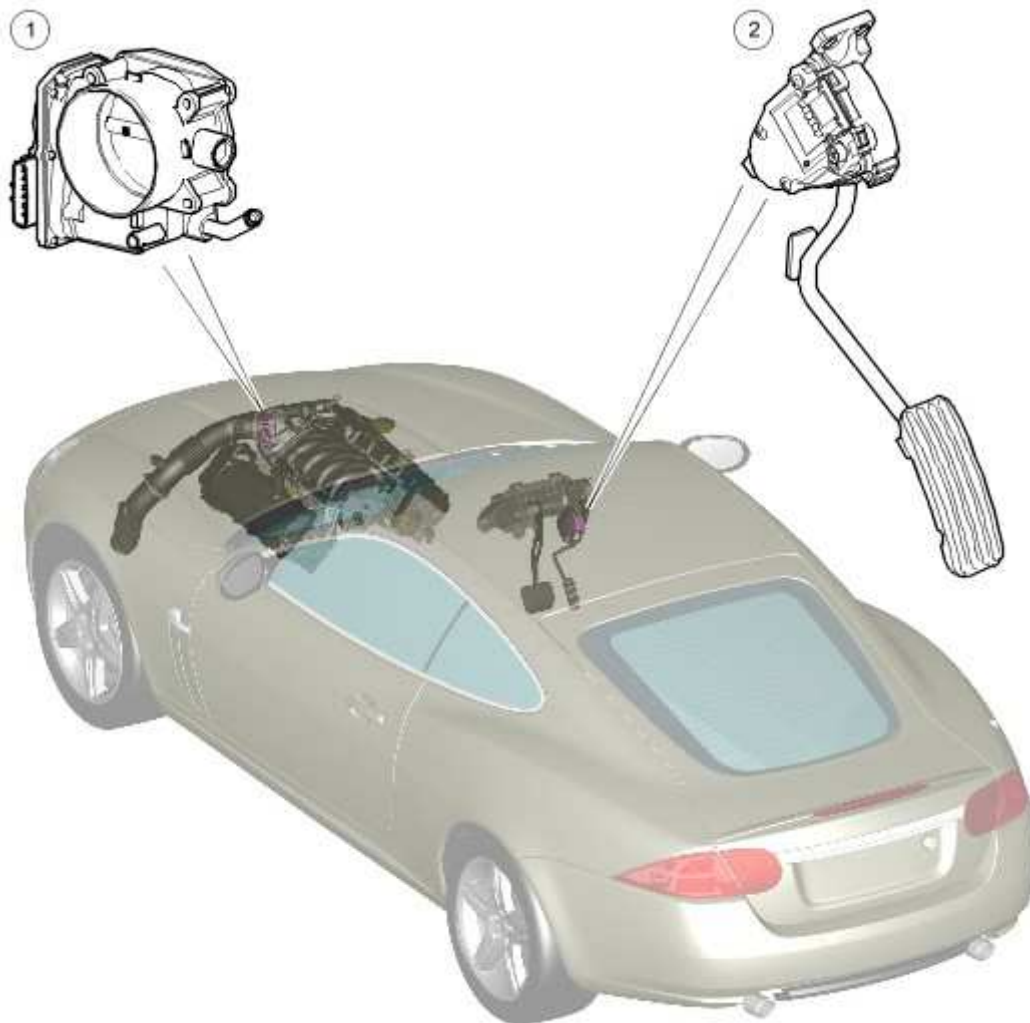
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Accelerator pedal to bracket - screw	10	7	-

Acceleration Control

COMPONENT LOCATION



E62624

Item	Part Number	Description
1		Electric throttle
2		APP sensor

INTRODUCTION

Acceleration control for the 4.2 Liter engine is achieved via an electronic throttle drive by wire system. The throttle is electronically connected to the ECM and the ECM then controls the fueling for the relevant throttle demand signal from the APP sensor.

Acceleration Control

Principle of Operation

For a detailed description of the acceleration control systems, refer to the relevant Description and Operation section in the workshop manual.

Acceleration Control

Inspection and Verification

- 1 . Verify the customer concern by operating the system.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Accelerator pedal • Throttle body 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the concern is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P012100	Throttle Position (TP) sensor circuits TP 1 and TP 2 - range/performance	<ul style="list-style-type: none"> TP sensor sensing circuits TP 1 and TP 2 - short to power, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. Throttle Body (19.70.04)
P012200	Throttle Position (TP) sensor circuit TP 1 - low input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 1 - short to ground, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. Throttle Body (19.70.04)
P012300	Throttle Position (TP) sensor circuit TP 1 - high input	<ul style="list-style-type: none"> TP sensor sensing circuit TP1 - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

		<ul style="list-style-type: none"> TP sensor failure 	<ul style="list-style-type: none"> Install a new throttle body as necessary. Throttle Body (19.70.04)
P022200	Throttle Position (TP) sensor circuit TP 2 - low input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 2 - short to ground, high resistance TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. Throttle Body (19.70.04)
P022300	Throttle Position (TP) sensor circuit TP 2 - low input	<ul style="list-style-type: none"> TP sensor sensing circuit TP 2- short to power TP sensor failure 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body as necessary. Throttle Body (19.70.04)
P022700	Accelerator Pedal Position (APP) sensor circuit APP 1 - low input	<ul style="list-style-type: none"> APP sensor circuit APP 1 - short to ground, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P022800	Accelerator pedal position (APP) sensor circuit APP 1 high input	<ul style="list-style-type: none"> APP sensor circuit APP 1 - short to power 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P210129	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210162	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test throttle actuator control motor circuit for short to ground, power, high resistance. Compare throttle position sensor 1 and 2 datalogger signals, if signals are comparable install a new throttle body.

			Throttle Body (19.70.04)
P210164	Throttle actuator control motor circuit range/performance	<ul style="list-style-type: none"> Jammed throttle blade, gearing or motor 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Install a new throttle body. Refer to the new module/component installation note at the top of the DTC Index
P210177	Throttle actuator motor control circuit range/performance (commanded position not reachable)	<ul style="list-style-type: none"> Throttle blade stuck open Intake air system leak 	<ul style="list-style-type: none"> Check for throttle related DTCs and refer to DTC Index in this section Check intake air system for leaks
P210329	Throttle actuator motor control circuit high	<ul style="list-style-type: none"> Throttle motor control circuit - short to power ECM fault 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to new module installation Note at top of DTC Index
P210364	Throttle actuator motor control circuit high - signal plausibility failure	<ul style="list-style-type: none"> Throttle motor control circuit - short to power ECM fault 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system Refer to new module installation Note at top of DTC Index
P210500	Throttle actuator control system - forced engine shutdown	<ul style="list-style-type: none"> Throttle MIL request due to fuel cut 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P210629	Throttle actuator control system - forced limited power	<ul style="list-style-type: none"> Signal invalid 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to the new module/component installation note at the top of the DTC Index
P210664	Throttle actuator control system - forced	<ul style="list-style-type: none"> Signal plausibility 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer

	limited power	failure	to the new module/component installation note at the top of the DTC Index
P211800	Throttle actuator motor control current range/performance	<ul style="list-style-type: none"> Throttle motor control circuit - short to ground, power, high resistance 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P211900	Throttle actuator control throttle body range/performance - spring	<ul style="list-style-type: none"> Throttle spring faulty 	<ul style="list-style-type: none"> Install a new throttle body. Throttle Body (19.70.04) Refer to the new module/component installation note at the top of the DTC Index
P212200	Accelerator pedal position (APP) sensor D circuit low input	<ul style="list-style-type: none"> APP sensor circuit 2 - low input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P212300	Accelerator pedal position (APP) sensor D circuit high input	<ul style="list-style-type: none"> APP sensor circuit 2 - high input 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P213528	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance - sub-processor 	<ul style="list-style-type: none"> Check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the APP sensor
P213529	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor - excessive difference between raw values of circuit 1 and 2 - sub-processor 	<ul style="list-style-type: none"> Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P213562	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> APP sensor circuit 1 and 2 range performance - sub-processor 	<ul style="list-style-type: none"> Check APP sensor circuits 1 and 2 for short to ground, power and high resistance. Clear the DTCs and retest. If the code remains, replace the

			APP sensor
P213564	Accelerator pedal position (APP) sensor 1 and 2 voltage correlation	<ul style="list-style-type: none"> • APP sensor circuit 1 and 2 range performance 	<ul style="list-style-type: none"> • Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

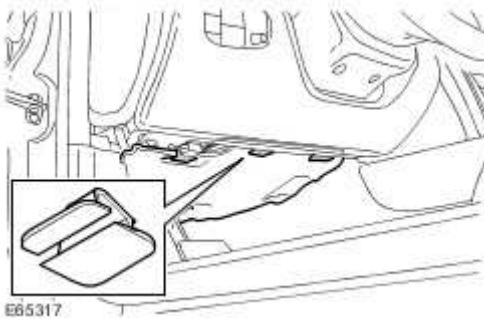
Accelerator Pedal (19.20.01)

Removal

- 1  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

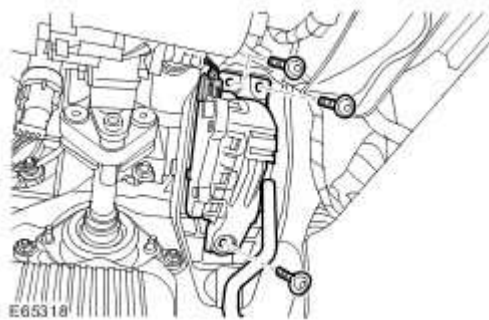
Remove the driver's side footwell trim panel.

- ▶ Carefully release the 3 clips.



- 2 . Remove the throttle pedal assembly.

- ▶ Remove the 3 Torx screws.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the throttle pedal assembly.

▶ Connect the electrical connector.

▶ Install the Torx screws.

2 . Install the driver's side footwell trim panel.

▶ Carefully align and secure the clips.

310-03 : Speed Control

Specifications

Specifications

General Specifications

Speed control sensor - vertical alignment	$90^{\circ} \pm 0.75^{\circ}$
---	-------------------------------

Torque Specifications

Item	Nm	lb-ft	lb-in
Speed control module - nut	5	4	44
Speed control sensor - bolt	5	4	44
Speed control sensor, adjustment - lock nut	5	4	44
Speed control switch.	-	-	-

Speed Control Sensor Adjustment

Special Service Tools



Inclinometer
501-F007

1.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the front bumper cover.
Front Bumper Cover (76.22.78)

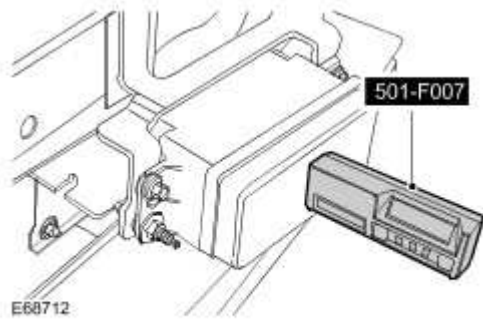
3.



CAUTION: Drive the vehicle on to a flat, level surface.

Position the vehicle on a smooth level surface and settle the suspension.

4. Using the special tool, check the speed sensor is level, (+/- 0.5 degree).



5. NOTE:

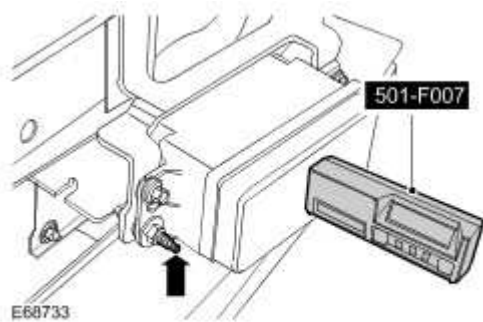
The speed sensor has no mechanical horizontal adjustment.

NOTE:

Do not release the lock nut.

Using the special tool, set the speed control sensor.

- Rotate the vertical adjuster.
- Adjust using an internal Torx Bit.



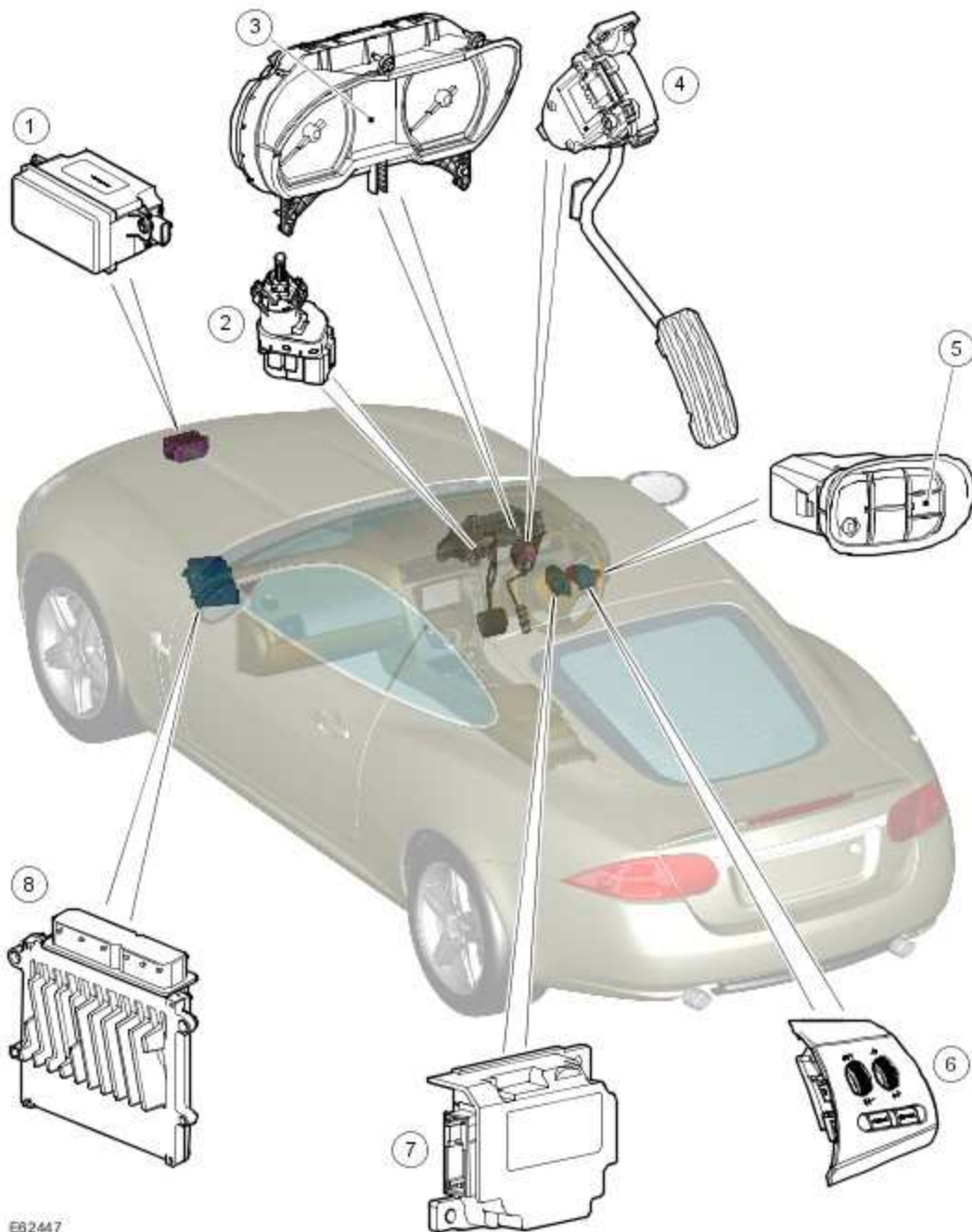
6. Install the front bumper cover.
Front Bumper Cover (76.22.78)

Control

COMPONENT LOCATION

NOTE:

RHD shown, LHD similar



Item	Part Number	Description
1		Adaptive speed control sensor (Adaptive speed control only)
2		Brake switch
3		Instrument cluster warning lamps and icons
4		APP sensor
5		Forward alert switch (adaptive speed control system only)
6		Steering wheel mounted speed control switches
7		Adaptive speed control module (adaptive speed control system only)
8		ECM

INTRODUCTION

There are two variants of speed control available, a standard system and an adaptive system. The standard system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the ECM. The adaptive system includes the same functionality as the standard system, but also has the ability to:

- Reduce vehicle speed, to less than the set speed, in order to maintain a selected distance behind a slower moving vehicle
- Accelerate the vehicle back to the set speed, once the way ahead is clear, after reducing the set speed because of a slower moving vehicle
- Alert the driver when the vehicle comes within a given distance of a slower moving vehicle

The standard system and the adaptive system both have the following components:

- A set +/- switch
- A RESUME switch
- A CANCEL switch

Both systems also use:

- The ECM.
- The brake switch.
- The APP sensor.

The adaptive system incorporates the following additional components:

- An adaptive speed control module
- An adaptive speed control sensor
- A forward alert switch
- A Time gap switch

SPEED CONTROL

The speed control system is integrated with the engine management system and uses fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- Resume/Suspend switch
- '+' and '-' (set/accelerate and decelerate)
- Clock spring

The speed control system also uses inputs from the brake pedal switch, the APP sensor, the ECM and the ABS Control Module.

The speed control is operated by the driver using only the steering wheel switches. When speed control is active, the ECM controls the electronic throttle to adjust the fuel supply as required to maintain the set speed.

The minimum set speed for speed control is 20 mph (32 (km/h). Speed control is automatically suspended if the following conditions apply:

- Vehicle speed falls below 20 mph (32 km/h).
- The brake pedal is pressed.
- The cancel button is pressed.
- Neutral, park or reverse gear is selected.
- The difference between actual speed and the set speed is too great.
- When the vehicle speed reaches a maximum speed of 120 mph (192 kph).
- If the accelerator pedal is used to accelerate beyond the set speed for too long.

SPEED CONTROL SWITCHES



E75641

Item	Part Number	Description
1		Set speed adjustment
2		Cancel switch
3		Resume switch

There are three speed control switches:

- Speed adjustment
- Cancel
- Resume

The speed control switches are located on the RH (Right-hand) side of the steering wheel. The switches are connected via fly leads to the clock spring. The speed control switches are resistive ladder type switches which vary the resistance of a 5 volt signal sent to them. The signal is returned along a Lin bus to the instrument cluster. The instrument cluster routes the control signals to the ECM on the MS CAN.

Speed control is engaged by rotating the speed adjustment switch to the + or - positions. Once engaged the speed can be varied by the speed adjustment switches. Each press of the speed adjustment switch will increase or decrease the set speed in steps of 1 mph (2 kph).

ADAPTIVE SPEED CONTROL

The adaptive speed control system comprises the following components:

- Adaptive Speed Control Sensor
- Adaptive Speed Control module
- Steering wheel control switches
- ECM
- Electric throttle
- ABS module and pump
- Adaptive Speed Control warning lamp (in the instrument cluster)

The adaptive speed control system uses a forward looking radar sensor to scan the road ahead, looking for objects that are moving at a different rate to itself. When a target is identified the adaptive speed control system will monitor the time gap between it and the target vehicle. When that gap falls below a set driver selected level the adaptive speed control system will intervene slowing the vehicle by backing off the throttle and/ or applying the brakes, until the correct gap is attained. The driver can chose between four gap settings, 1, 1.4, 1.8 and 2.2 seconds.

The system will detect but not react to the following:

- Vehicles in the oncoming lane
- Stationary vehicles
- Pedestrians
- Vehicles not in the same lane

Adaptive speed control is active when the vehicle is moving. Adaptive Speed Control only functions when a set speed is entered in normal speed control mode. The adaptive speed control system only intervenes with the set speed when it detects a target vehicle, and then only if the minimum time gap is breached.

It is important to note that the system is intended for use in limited driving situations, does not remove control and responsibility from the driver, and at all times can be quickly overridden. The adaptive speed control system is not a collision warning system and will not react to stationary objects. The system does not operate below a minimum speed of approximately 32 km/h (20 mph) since it is unsuitable for use in cities or congested traffic. The system is best suited to main roads/ highways with gradual bends.

The ECM, throttle body and throttle control are unchanged from those used for non Adaptive Speed Control variants.

RADAR SENSING

The adaptive speed control system is based on the use of a front mounted radar sensor. The sensor transmits a 1.5° wide beam forward of the vehicle and detects the returning signals reflected off other vehicles and objects ahead.

The 1.5° wide radar beam is mechanically scanned at a rate of 10 sweeps/second across a total arc of 15° centered on the longitudinal axis of the vehicle. The radar operates at millimetric wavelengths (76 - 77 GHz) and transmits a frequency modulated continuous wave signal at a relatively low power level (no high power pulses).

With the ignition switched ON, the adaptive speed control module is powered up but no radar transmissions are emitted until the vehicle is in motion.

The radar sensor detects three primary parameters of objects within the scanned arc. These are:

- Range
- Relative velocity
- Angle

Range

the radar sensor detects the presence and ranges of different vehicles and objects within the scanned arc up to a distance of approximately 130 meters. The transmitted signal frequency changes continuously in a cyclic pattern (modulation). This means that, in the time taken for the signal wave front, to travel to and from a target vehicle (or other object), the transmission frequency will have changed. The difference between the received signal frequency and the new transmission frequency is proportional to the distance between the transmitting vehicle and the target vehicle.

Relative Velocity

when the signal is reflected off a vehicle moving at a different speed (opening or closing gap) an effect known as the Doppler shift causes an extra frequency modulation to be imposed on the signal. This Doppler frequency varies with the relative speed of the vehicle being followed, enabling the system to differentiate between vehicles traveling at different speeds and also between moving vehicles and stationary objects.

Angle

Using a narrow angle beam to scan horizontally enables the system to distinguish between vehicles in different lanes and between vehicles and roadside objects.

FOLLOW MODE

A set speed is selected in the normal speed control manner and this speed is maintained until a slower vehicle is encountered in the lane ahead. When the vehicle ahead comes within the effective range of the radar sensor, the system identifies it as a target vehicle and an icon is illuminated on the instrument cluster to indicate that the system is in "follow mode". When the distance between the two vehicles closes to a set time gap, the adaptive speed control system closes the throttle and if necessary applies the brakes to maintain the set time gap. Follow mode is effectively a closed loop system. If several vehicles are ahead, the closest vehicle is chosen as the target to follow. If the target vehicle moves out of radar range, or if either vehicle changes lane or drops below the minimum operating speed, the system exits follow mode and the follow mode icon is extinguished. The adaptive speed control system will only raise its speed to the originally set speed, it will not accelerate past this speed to maintain a time gap.

Driver operation of the foot brake or control switches will immediately cancel adaptive speed control.

When the vehicle is in follow mode the follow mode warning indicator is illuminated in the instrument cluster and the current gap setting will be displayed in the message center.



Item	Part Number	Description
1		Follow mode warning indicator

SYSTEM RESTRICTIONS

The adaptive speed control system is only intended to provide enhanced speed control as described above in certain restricted conditions.

The following points should be noted:

- Automatic braking is limited to approximately 30% of full pressure (0.3G deceleration) and is intended to provide a smooth, gradual deceleration in follow mode conditions. Harsh braking by the target vehicle or following the target vehicle down to very low speeds or to a halt will require driver override of the brakes.
- While the radar sensor detects moving and stationary targets for assessment of the environment ahead, the system does not react to or provide any control in situations other than follow mode conditions. Stationary or slow moving vehicles (below 10 km/h), pedestrians, objects on the road and oncoming vehicles in the same lane are not recognized.



WARNING: It must be emphasized that the adaptive speed control system is not a collision warning or avoidance system and that, other than the limited conditions of follow mode, driver intervention will be necessary to control the vehicle speed.

In follow mode, some situations may cause target ambiguities for the detection system. These situations include:

- The nearby presence of a third vehicle when driving on a line slightly offset to the target vehicle
- Vehicles edging into the lane ahead which are not detected by the system until they have moved into the radar beam.

On the approach to, or exit from a bend, a target vehicle may be lost or a new target acquired as vehicles ahead change their angular position with respect to the radar sensor. On a straight road, if the sensing vehicle is in follow mode below its selected set speed, losing the target vehicle will cause the sensing vehicle to accelerate to this set speed. This acceleration is undesirable either on, or entering a bend when the target is suddenly lost, and in this situation the system inhibits the resumption of the set speed.

The speed control system compares vehicle speed data from the ABS system with the relative speed of an external object as detected by the radar sensor to ascertain whether the object is stationary or not.

NOTE:

If tires are fitted which are different in diameter from those specified for the vehicle, the vehicle speed calculated by the ABS will not be the true road speed. This situation may cause stationary objects to be falsely identified as moving vehicles and result in automatic

deceleration on a clear road.

ADAPTIVE SPEED CONTROL SWITCHES



Item	Part Number	Description
1		Set speed adjustment switch
2		Time gap switch
3		Cancel switch
4		Resume switch

The Adaptive Speed control system is controlled from the steering wheel switches. The switches are the same as used for normal speed control with the addition of an extra time gap setting switch. The time gap setting switch allows the driver to adjust the time gap to one of four pre-set time gaps. The selected time gap is displayed in the vehicle message center.

The time gap will return to the default gap (the third setting) each time the ignition is cycled.

ADAPTIVE SPEED CONTROL MODULE

The Adaptive Speed Control module, located on the bottom of the RH (right-hand) A pillar. The control module is connected to the other vehicle systems via the high speed CAN bus. Signals from the Adaptive Speed Control forward looking radar sensor are received on a dedicated CAN bus between the two modules.

ADAPTIVE SPEED CONTROL RADAR SENSOR

The adaptive speed control radar sensor is mounted centrally behind the front bumper. The sensor is connected to the Adaptive Speed Control, module via a private CAN bus. If the unit is replaced in service the unit must be re-aligned vertically.

Horizontal alignment is achieved by putting the sensor in service mode via IDS. The vehicle is then driven for a short period while the sensor calibrates itself. Calibration is complete when the 'follow' icon in the instrument cluster stops flashing.

FORWARD ALERT

The forward alert system utilizes the Adaptive Speed Control system components. Forward alert is turned on and off independently of Adaptive Speed Control, via a switch mounted in the lower outboard knee bolster switchpack. Forward alert will notify the driver by means of a chime, and warning indicator in the instrument cluster and indication in the message center, when a target vehicle comes into range. The system will NOT use throttle or brake intervention to slow the vehicle.



Item	Part Number	Description
1		Forward alert switch

The forward alert switch is connected to the instrument cluster in a resistive ladder with the luggage compartment opening switch and the fuel filler flap switch. The instrument cluster sends the forward alert information to the Adaptive speed control module on the CAN bus.

NOTE:

This system is intended as a driver aid and should be used as such. The system is NOT a

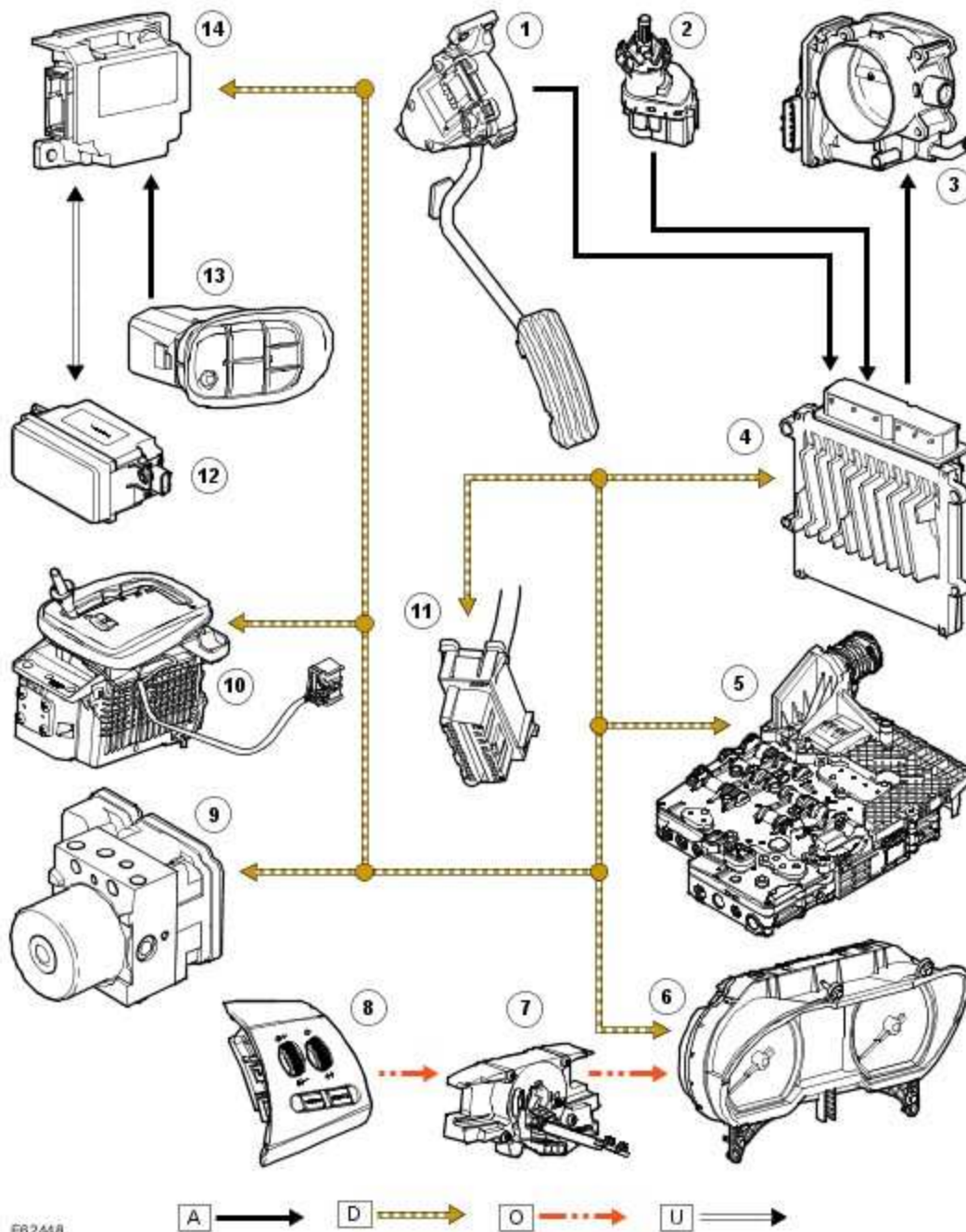
collision warning or avoidance device.

The system sensitivity can be adjusted in the same manner as the Adaptive Speed Control, via the steering wheel mounted switches. Each adjustment is accompanied by a message in the message center.

CONTROL DIAGRAM

NOTE:

A = Hardwired connection; D = High speed CAN bus; O = LIN (local interconnect network) bus; U = Private CAN



Item	Part Number	Description
1		APP sensor
2		Brake switch
3		Electric throttle
4		ECM
5		TCM
6		Instrument cluster
7		Clock spring
8		Steering wheel speed control switches
9		ABS module
10		Transmission selector lever
11		Diagnostic socket
12		Adaptive speed control sensor (adaptive speed control system only)
13		Forward alert switch (adaptive speed control system only)
14		Adaptive speed control module (adaptive speed control system only)

Speed Control

Principles of Operation

There are two options of speed control available, adaptive speed control and non-adaptive speed control. For a detailed description of the speed control systems, refer to the relevant Description and Operation section in the workshop manual.

Speed Control

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Speed control sensor • Ensure the speed control sensor is free from obstructions • Speed control module 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Steering wheel switches • Brake switch • Speed control sensor • Speed control module • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Speed Control Sensor Adjustment (vehicles with adaptive system installed)

An incorrectly aligned speed control sensor can cause incorrect system operation. Before starting any repair work on the speed control system, on vehicles with the adaptive system installed, check the adjustment of the speed control sensor.

Speed Control Sensor Adjustment

Symptom Chart

Symptom	Possible Cause	Action
Speed control inhibited	<ul style="list-style-type: none"> • Default mode enabled 	<ul style="list-style-type: none"> • Check for Network related DTCs that could be caused by power failure to

or disabled	<ul style="list-style-type: none"> • Supply voltage to speed control module • Supply voltage to speed control sensor • Steering wheel speed control switch(s) • Steering wheel speed control switch circuit • Throttle sensors • Brake switch 	<p>the module or sensor and refer to DTC Index.</p> <p>Communications Network</p> <ul style="list-style-type: none"> • For steering wheel speed control switch and circuit tests. GO to Pinpoint Test G831824p9. • For engine throttle position sensor tests. <p>Electronic Engine Controls Electronic Engine Controls</p> <ul style="list-style-type: none"> • For brake switch tests. GO to Pinpoint Test G831824p10.
Unable to regulate/adjust vehicle speed	<ul style="list-style-type: none"> • Steering wheel switch malfunction 	<ul style="list-style-type: none"> • For speed control switch circuit tests. GO to Pinpoint Test G831824p9.
Unable to cancel speed control from steering wheel	<ul style="list-style-type: none"> • Steering wheel switch malfunction 	<ul style="list-style-type: none"> • For speed control switch circuit tests. GO to Pinpoint Test G831824p9.
Unable to cancel speed control from brake pedal	<ul style="list-style-type: none"> • Brake switch malfunction 	<ul style="list-style-type: none"> • For brake switch tests. GO to Pinpoint Test G831824p10.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If a module or component is suspect, and the vehicle remains under the Manufacturers warranty, refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic

system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A84-81	Car configuration data	<ul style="list-style-type: none">RJB reporting invalid car configuration parameters	Re-configure RJB using manufacturer approved diagnostic system and re-test.
C1A67-54	Speed control sensor alignment angle - out of range	<ul style="list-style-type: none">Speed control sensor out of alignment	Carry out speed control sensor adjustment procedure. Speed Control Sensor Adjustment
C1A67-81	Speed control sensor - Yaw rate sensor	<ul style="list-style-type: none">Yaw rate voltage - out of range	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A67-87	Speed control sensor - Missing data	Incorrect or missing data from speed control sensor	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C1A67-96	Speed control sensor - Internal sensor failure	<ul style="list-style-type: none">Internal hardware failure	Install a new speed control sensor. Speed Control Sensor

C1A67-97	Speed control sensor - reduced visibility	<ul style="list-style-type: none"> • Sensor reduced visibility 	This DTC will be cleared automatically when environmental conditions allow
C1A67-98	Speed control sensor - temperature high	<ul style="list-style-type: none"> • Speed control sensor internal temperature exceeded threshold 	This DTC will be cleared automatically when environmental conditions allow
P174E-81	ABS wheel speed correlation - active speed output error	<ul style="list-style-type: none"> • Follow speed is miscalculated to too high a value 	Using the manufacturer approved diagnostic system, clear the DTC and re-test. If the DTC is logged contact Dealer Technical Support.
U0001-88	High speed CAN communication Bus	<ul style="list-style-type: none"> • Vehicle CAN Bus off condition 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0100-00	Lost communications with ECM	<ul style="list-style-type: none"> • ECM missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0101-00	Lost communications with TCM	<ul style="list-style-type: none"> • TCM missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0121-00	Lost communication with ABS	<ul style="list-style-type: none"> • ABS missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0128-00	Lost communications with parking brake module	<ul style="list-style-type: none"> • Parking brake missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0155-00	Lost communications with instrument cluster	<ul style="list-style-type: none"> • Instrument cluster missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U0300-	Internal control module software	<ul style="list-style-type: none"> • Invalid configuration 	Re-configure the RJB using the manufacturer approved diagnostic

00	incompatibility	message is received	system. Clear DTCs and re-test. If DTC still logged, suspect speed control module. Refer to new module installation note at top of DTC Index
U0300-55	Control module software incompatibility - module configuration failure	<ul style="list-style-type: none"> RJB - at least one of the car configuration parameters is not configured 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test.
U0401-00	Invalid data received from ECM - ECM cancel fault	<ul style="list-style-type: none"> ECM did not respond properly to speed control cancel or auto brake cancel request 	Check ECM for DTCs and refer to DTC Index. Electronic Engine Controls Electronic Engine Controls
U0401-67	Invalid data received from ECM - ECM resume fault	<ul style="list-style-type: none"> ECM did not respond properly to speed control resume request 	Check ECM for DTCs and refer to DTC Index. Electronic Engine Controls Electronic Engine Controls
U0401-81	Invalid data received from ECM - speed control inhibited by ECM	<ul style="list-style-type: none"> Speed control inhibited by ECM 	Check ECM for DTCs and refer to DTC Index. Electronic Engine Controls Electronic Engine Controls
U0415-81	Invalid data received from ABS	<ul style="list-style-type: none"> Stability assist fault 	Check ABS module for DTCs and refer to DTC Index. Anti-Lock Control - Stability Assist
U0417-67	Invalid data received from parking brake module - parking brake apply acknowledge	<ul style="list-style-type: none"> Parking brake module did not respond properly to apply request 	Check parking brake module for DTCs and refer to DTC Index. Parking Brake
U0417-81	Invalid data received from parking brake module	<ul style="list-style-type: none"> Speed control inhibited by parking brake module 	Check parking brake module for DTCs and refer to DTC Index. Parking Brake
U0422-00	Invalid data received from CJB	<ul style="list-style-type: none"> CJB message not updated 	Check CJB for DTCs and refer to DTC Index. Communications Network
U0423-	Invalid data received	<ul style="list-style-type: none"> Instrument cluster not 	Check instrument cluster for DTCs

81	from instrument cluster	enabled for adaptive speed control	and refer to DTC Index. Instrument Cluster
U0443-00	Invalid data received from RJB	<ul style="list-style-type: none"> RJB message not updated 	Check RJB for DTCs and refer to DTC Index. Communications Network
U1A00-88	Private CAN Bus circuit	<ul style="list-style-type: none"> Private CAN Bus off condition 	Refer to wiring diagrams and test Private CAN Bus circuit between speed control module and speed control sensor for circuit faults
U1A14-49	CAN initialisation failure	<ul style="list-style-type: none"> Internal electronic failure 	Install a new speed control module, refer to the new module installation note at the top of the DTC Index. Speed Control Module - Vehicles Without: Adaptive Speed Control (19.75.26)
U2101-00	Control module configuration incompatible	<ul style="list-style-type: none"> Data sent from RJB is invalid 	Re-configure RJB using manufacturer approved diagnostic tool, clear DTC and re-test. If DTC remains check RJB for DTCs and refer to DTC Index. Communications Network
U3000-41	Control module	<ul style="list-style-type: none"> Internal micro controller error Checksum fault 	Install a new speed control module, refer to new module installation note at top of DTC Index
U3000-42	Control module	<ul style="list-style-type: none"> Internal RAM test fault 	Install a new speed control module, refer to new module installation note at top of DTC Index
U3000-49	Control module	<ul style="list-style-type: none"> Internal control module failure 	Install a new speed control module, refer to the new module installation note at the top of the DTC Index

Pinpoint Tests

PINPOINT TEST G831824p9 : SPEED CONTROL SWITCH CIRCUIT TESTS

G831824t29 : CHECK THE STEERING WHEEL SPEED CONTROL SWITCH FOR OPEN CIRCUIT

1. Disconnect the battery negative terminal.

Battery (86.15.01) 2. Wait two minutes for the system to become safe. 3. Disconnect the speed control switch connector SW009. 4. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side

- **Is the resistance 4310 ohms?**

-> **Yes**

GO to Pinpoint Test G831824t23.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t23 : CHECK THE STEERING WHEEL SPEED CONTROL RESUME SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **RESUME** switch.

- **Does the resistance switch between 4310 ohms and 2110 ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t24.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t24 : CHECK THE STEERING WHEEL SPEED CONTROL SET+ SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **SET+** switch.

- **Does the resistance switch between 4310 ohms and 1110 ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t25.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t25 : CHECK THE STEERING WHEEL SPEED CONTROL HEADWAY REDUCTION SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **HEADWAY REDUCTION** switch.

- **Does the resistance switch between 4310 ohms and 600 ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t26.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t26 : CHECK THE STEERING WHEEL SPEED CONTROL HEADWAY INCREASE SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **HEADWAY INCREASE** switch.

- **Does the resistance switch between 4310 ohms and 300 ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t27.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t27 : CHECK THE STEERING WHEEL SPEED CONTROL SET- SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **SET-** switch.

- **Does the resistance switch between 4310 ohms and 120 ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t28.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t28 : CHECK THE STEERING WHEEL SPEED CONTROL CANCEL SWITCH CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, component side

speed control switch connector SW009, pin 03, component side 2. Operate the **CANCEL** switch.

- **Does the resistance switch between 4310 ohms and zero ohms when the switch is operated?**

-> **Yes**

GO to Pinpoint Test G831824t30.

-> **No**

INSTALL a new speed control switch assembly.

Speed Control Switch (19.75.25) TEST the system for normal operation.

G831824t30 : CHECK THE STEERING WHEEL SPEED CONTROL SWITCH CIRCUIT FOR OPEN CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 02, harness side

steering wheel audio control switch connector SW004, pin 02, harness side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit speed control switch connector SW009, pin 02 to clockspring connector SW004, pin 02. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G831824t1.

G831824t1 : CHECK THE STEERING WHEEL SPEED CONTROL SWITCH FOR OPEN CIRCUIT

1. Measure the resistance between:

speed control switch connector SW009, pin 03, harness side

steering wheel audio control switch connector SW004, pin 03, harness side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit speed control switch connector SW009, pin 02 to clockspring connector SW004, pin 02. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

No fault has been identified with the speed control switch or circuit, check integrity of connections. Refer to the electrical circuit diagrams and test the LIN circuit between the steering wheel audio switch and the instrument cluster. Test the steering wheel audio switch.

Audio System

PINPOINT TEST G831824p10 : BRAKE SWITCH CIRCUIT TEST

G831824t33 : CHECK THE BRAKE SWITCH FUNCTION, WITH THE BRAKE PEDAL RELEASED

1. Set ignition status to OFF. 2. Disconnect the brake switch connector CA142. 3. Measure the resistance between:

Brake switch connector CA142, pin 02 component side

Brake switch connector CA142, pin 03 component side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

INSTALL a new brake switch.

Speed Control Deactivator Switch (19.75.20) TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G831824t34.

G831824t34 : CHECK THE BRAKE SWITCH FUNCTION, WITH THE BRAKE PEDAL DEPRESSED

1. Measure the resistance between:

Brake switch connector CA142, pin 02 component side

Brake switch connector CA142, pin 03 component side

- **Is the resistance greater than 10,000 ohms?**

-> **Yes**

GO to Pinpoint Test G831824t35.

-> **No**

INSTALL a new brake switch.

Speed Control Deactivator Switch (19.75.20) TEST the system for normal operation.

G831824t35 : CHECK THE BRAKE SWITCH GROUND CIRCUIT FOR OPEN CIRCUIT

1. Measure the resistance between:

Brake switch connector CA142, pin 03

GROUND

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit between the brake switch connector CA142, pin 03 and GROUND. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G831824t36.

G831824t36 : CHECK THE ECM TO BRAKE SWITCH CIRCUIT FOR OPEN CIRCUIT

1. Disconnect the ECM connector, FL072. 2. Measure the resistance between:

ECM connector FL072, pin 40

Brake switch connector CA142, pin 02

- **Is the resistance greater than 5 ohms?**

-> **Yes**

GO to Pinpoint Test G831824t4.

-> **No**

No fault is indicated with the brake switch or circuit. Check the integrity of all connections and TEST the system for normal operation.

G831824t4 : CHECK THE ECM TO BRAKE SWITCH CIRCUIT FOR OPEN CIRCUIT

1. Disconnect intermediate electrical connector FL002. 2. Measure the resistance between:

ECM connector FL072, pin 40

Intermediate electrical connector FL002, pin 13

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit between the ECM connector FL072, pin 40 and intermediate electrical connector FL002, pin 13. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G831824t5.

G831824t5 : CHECK THE ECM TO BRAKE SWITCH CIRCUIT FOR OPEN CIRCUIT

1. Measure the resistance between:

Brake switch connector CA142, pin 02

Intermediate electrical connector FL002, pin 13

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit between the brake switch connector CA142, pin 02 and intermediate electrical connector FL002, pin 13. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

No fault is indicated with the brake switch or circuit. Check the integrity of all connections and TEST the system for normal operation.

Speed Control Deactivator Switch (19.75.20)

Removal

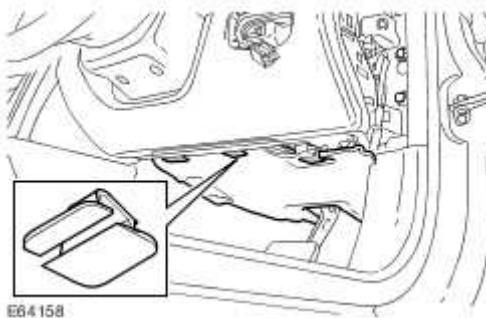
NOTE:

This component also functions as the brake pedal switch.

- 1  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

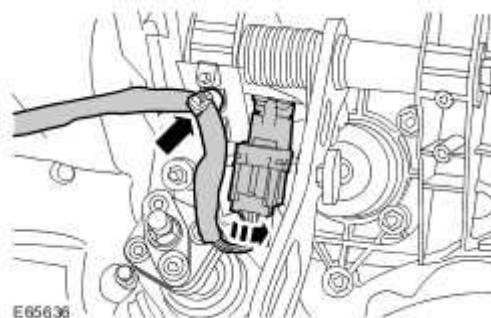
Remove the driver's side footwell trim panel.

- ▶ Carefully release the 3 clips.



- 2 . Release the brake switch.

- ▶ Rotate clockwise approximately 30 degrees.
- ▶ Carefully release the clip.
- ▶ Disconnect the electrical connector.



Installation



CAUTION: During installation of the brake switch, make sure the brake pedal is not depressed at any time. Depressing the pedal may cause: poor operation of the brake light switch and brake lights, diagnostic trouble codes to be logged and/or failure of the vehicle to start.

- 1 . Install the brake switch.
 - ▶ Connect the electrical connector.
 - ▶ Secure the clip.

- 2 . Install the driver's side footwell trim panel.
 - ▶ Carefully align and secure the clips.

Speed Control Module - Vehicles Without: Adaptive Speed Control (19.75.26)

Removal

NOTE:

The speed control module is part of the ECM.

- 1 . Remove the ECM.

For additional information, refer to Engine Control Module (ECM) (18.30.01)

Installation

- 1 . Install the ECM.

For additional information, refer to Engine Control Module (ECM) (18.30.01)

Speed Control Module - Vehicles With: Adaptive Speed Control (19.75.26)

Removal

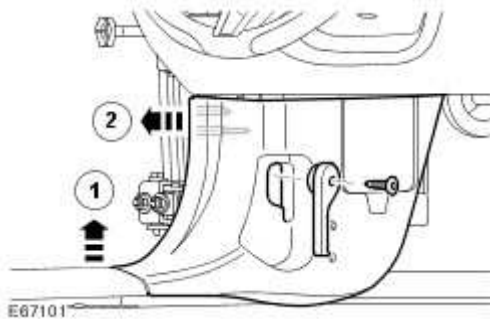
NOTE:

This component is mounted to the rear of the RH A-pillar.

1 . NOTE:

LH illustration shown, RH is similar.

Remove the RH cowl side trim panel.



2 . Remove the adaptive speed control module.



Installation

1 . To install, reverse the removal procedure.

Speed Control Sensor

Removal

1 . Connect WDS to the vehicle and up-load the relevant data.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the front bumper cover.

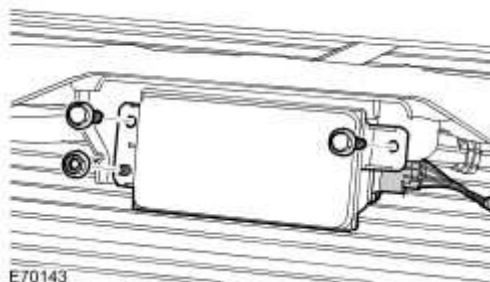
For additional information, refer to Front Bumper Cover (76.22.78)

4 . Remove the speed control sensor.

➤ Remove the 2 bolts.

➤ Remove the nut.

➤ Disconnect the electrical connector.



Installation

1 Install the speed control sensor.

- ▶ Tighten the bolts to 5 Nm (4lb.ft).
- ▶ Install the speed sensor level adjustment lock nut and tighten to 5 Nm (4lb.ft).
- ▶ Connect the electrical connector.

2 . Check and adjust the speed sensor leveling.

For additional information, refer to Speed Control Sensor Adjustment

3 . With assistance, install the front bumper cover.

For additional information, refer to Front Bumper Cover (76.22.78)

4 . Using WDS download the data previously up-loaded.

Speed Control Switch (19.75.25)

Removal

NOTE:

Removal and installation of the speed control switch is shown in the steering wheel procedure.

- 1 . Remove the steering wheel.

For additional information, refer to Steering Wheel (57.60.01)

Installation

- 1 . Install the steering wheel.

For additional information, refer to Steering Wheel (57.60.01)

4. ELECTRICAL

412 : Climate Control System

412-00 : Climate Control System – General Information

Specifications

Specifications

General Specification

Item	Description
Automatic temperature control, heating, ventilation and air conditioning unit	Dual zone with side to side temperature control
Compressor	Clutchless, belt driven from engine with electronically controlled outputs

Air Conditioning (A/C) System Flushing

1.



WARNING: Use extreme care and observe all safety precautions related to the use of refrigerants. Due to refrigerant hazards, always wear safety goggles and non-penetrable gloves when working on or flushing air conditioning (A/C) systems. Failure to follow this instruction may result in personal injury.



WARNING: When flushing the A/C system, refer to the manufacturers equipment instructions for additional information. Failure to do so may result in system damage or personal injury.



WARNING: The A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts shop bulk refrigerant at risk of contamination. If the vehicle A/C refrigerant is contaminated, refer the customer to return to the repair facility that performed the last A/C repair. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For additional information, refer to the manufacturers equipment instructions. Failure to follow this instruction may result in personal injury.



WARNING: Prior to using the A/C flushing equipment for the first time, follow the operating instructions. Failure to follow this instruction may result in personal injury.



CAUTION: Prior to flushing, remove and discard the desiccant sack. Depending on the equipment used, other A/C components may have to be removed prior to flushing. For additional information, refer to the manufacturers equipment instructions before flushing the A/C system.

Recover the refrigerant.

2. Remove the desiccant sack. <<412-03>>

3. Flush the system. For additional information, refer to the manufacturers equipment

instructions.

4. Install new refrigerant lines if blocked with debris.
5. Install a new desiccant sack. <<412-03>>
6. Add the required amount of oil to the A/C system depending on the repair procedure.
7. Evacuate and charge the A/C system.
8. Carry out fluorescent dye leak detection test.
[Fluorescent Dye Leak Detection](#)
9. Check the A/C system for correct operation.

Air Conditioning (A/C) System Recovery, Evacuation and Charging (82.30.30)

1.



WARNING: Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

NOTE:

The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure), the system is leaking and refrigerant has been lost to atmosphere, or the refrigerant circuit has been open more than 24 hours, due to repair.

Refrigerant recovery.

2. Remove the dust covers from the high and low pressure connections.
3. Connect the high and low pressure lines to the appropriate connections.
4. Open the valves on the connections.
5. Turn the valves on the station to the correct positions.
6. Turn the process switch to the correct position.
7. Turn the main switch to 'ON'.

8.



WARNING: Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerant is high enough for safe use in the air conditioning system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SEA J1991. Other equipment may not recycle refrigerant to the required level of purity. R143a Refrigerant Recover Recycling Recharging station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicles air

conditioning systems.

Allow the system to recover the refrigerant from the system.

9. Close the valves on the refrigerant station.
10. Turn the main switch 'OFF'.
11. Close the valves on the connections.
12. Disconnect the high and low pressure connections.
13. Install the dust covers to the connectors.
14. Open the tap at the rear of the station to drain the refrigerant oil.
15. Measure and record the quantity of refrigerant oil recovered from the system.
16. Close the tap at the rear of the station.
17. Evacuation.
18. Remove the dust covers from the high and low pressure connections.
19. Connect the high and low pressure lines to the appropriate connections.
20. Open the valves on the connections.
21. Turn the valves on the station to the correct positions.
22. Turn the process switch to the correct position.
23. Turn the main switch to 'ON'.

24. Allow the station to evacuate the A/C system.

25.



CAUTION: The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted

Recharging

26. Close the valves on the refrigerant station.

27. Close the valve on the oil charger.

28. Disconnect the yellow line from the refrigerant station.

29. Remove the cover from the oil charger.

30. Pour the correct quantity of refrigerant oil into the oil charger.

31. Install the cover to the oil charger.

32. Connect the yellow line to the refrigerant station.

33. Open the valve on the oil charger.

34. Move the pointer on the refrigerant gauge to mark the position of the refrigerant drop.

35. Slowly open the correct valve on the refrigerant to allow the vacuum to pull the refrigerant into the system.

36. Close the valve on the refrigerant station when the correct amount of refrigerant has been drawn into the air conditioning system.

37. Turn the main switch 'OFF'.
38. Close the valves on the connections.
39. Disconnect the high and low pressure connections.

Contaminated Refrigerant Handling

1. If contaminated refrigerant is detected DO NOT recover the refrigerant into your R-134a OR R-12 recovery/recycling equipment. Take the follow actions:

1. Repeat the test to verify contaminated refrigerant is present.
 2. Advise the customer of the contaminated A/C system and any additional cost to repair the system. The customer may wish to return to the repair facility performing the last A/C repair.
 3. Recover the contaminated refrigerant using suitable recovery only equipment designed for capturing and storing contaminated refrigerant. This equipment must only be used to recover contaminated refrigerant to prevent the spread to other vehicles. As an alternative, contact an A/C repair facility in your area with the proper equipment to perform the repair.
- On completion of the recovery of the contaminated refrigerant, it will be necessary to carry out the A/C system flushing procedure.

[Air Conditioning \(A/C\) System Flushing](#)

Electronic Leak Detection

1.



WARNING: Good ventilation is necessary in the area where A/C leak testing is to be carried out. If the surrounding air is contaminated with refrigerant gas, the leak detector will indicate this gas all the time. Odors from other chemicals such as antifreeze, diesel fuel, disc brake cleaner, or other cleaning solvents can cause the same problem. A fan, even in a well ventilated area, is very helpful in removing small traces of contamination from the air that might affect the leak detector. Failure to follow this instruction may result in personal injury.

Attach an R-134a manifold gauge set or use a UL-approved recovery/recycling device such as an R-134a A/C refrigerant center (which meets SAE Standard J 1991). For additional information, refer to the manufacturers equipment instructions.

- Both gauges should indicate 413-551 kPa (60-80 psi) at 24°C (75°F) with the engine off.
- If little or no pressure is indicated, carry out the air conditioning (A/C) system recovery, evacuation and charging procedure.

2. Use an R134-a Automatic calibration halogen leak detector to leak test the refrigerant system. For additional information, refer to the manufacturers equipment instructions.

3. If a leak is found, carry out the air conditioning (A/C) system recovery procedure.

Refrigerant Oil Adding



CAUTION: Make sure when disconnecting air conditioning (A/C) connections, that the exposed ports are capped immediately. Make sure you do not leave the A/C system open to the atmosphere. Failure to follow this instruction may result damage to the vehicle.

NOTE:

A new replacement A/C compressor is pre-filled with ND8 oil.

1. Drain the oil from the old compressor and measure the quantity of oil drained.

2. Drain the oil from the new compressor into a clean container.

3.



CAUTION: If less than 30 cc of oil was drained from the old compressor, then 30 cc of oil must be refilled into the new compressor. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

Use the new compressor oil to refill to the required quantity.

Refill the new compressor with the same amount of oil which was measured from the old compressor.

Refrigerant System Tests

1.



WARNING: Use extreme care and observe all safety precautions related to the use of refrigerants. Failure to follow this instruction may result in personal injury.



WARNING: The A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts shop bulk refrigerant at risk of contamination. If the vehicle A/C refrigerant is contaminated, refer the customer to return to the repair facility that carried out the last A/C repair. If the customer wishes to pay the additional cost, use the A/C recovery equipment that is designated for recovering contaminated A/C refrigerant. All contaminated A/C refrigerant must be disposed of as hazardous waste. For all equipment, follow the equipment manufacturers procedures and instructions. Failure to follow this instruction may result in personal injury.

NOTE:

Jaguar Cars Ltd. supports the efficient usage, recovery and recycling of the refrigerant used in passenger car air conditioners. Jaguar Cars Ltd. recommends the use of UL-approved recovery/recycling device such as R-134a A/C refrigerant center (which meets SAE Standard J 1991) during any A/C system repair and recharge procedure which requires that the system be evacuated.

Use R-134a A/C Refrigerant Centre to evacuate and recover the A/C system.

- Follow the equipment manufactures procedures and instructions for use of equipment.

Climate Control System

Inspection and Verification

NOTE:

All Air Conditioning (A/C) related tests should be run in an ambient temperature of at least 10°C (50°F).

- 1 . Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Coolant level• Refrigerant leaks (UV lamp)• Drive belt• Compressor• Cooling fan• Control flap(s)• Duct(s)• Register(s)• Cabin air filter• Hose(s)• Coolant pump	<ul style="list-style-type: none">• Fuse(s)• Circuit• Blower motor• Electrical connector(s)• Compressor• Cooling fan• Actuators• Climate control assembly

- 3 . Listen for any unusual noises during climate control system operation.
- 4 . Inspect the refrigerant system with an ultraviolet (UV) lamp for traces of UV sensitive leak trace dye.
- 5 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 6 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

412-01 : Air Distribution and Filtering

Specifications

Specifications

Torque Specifications

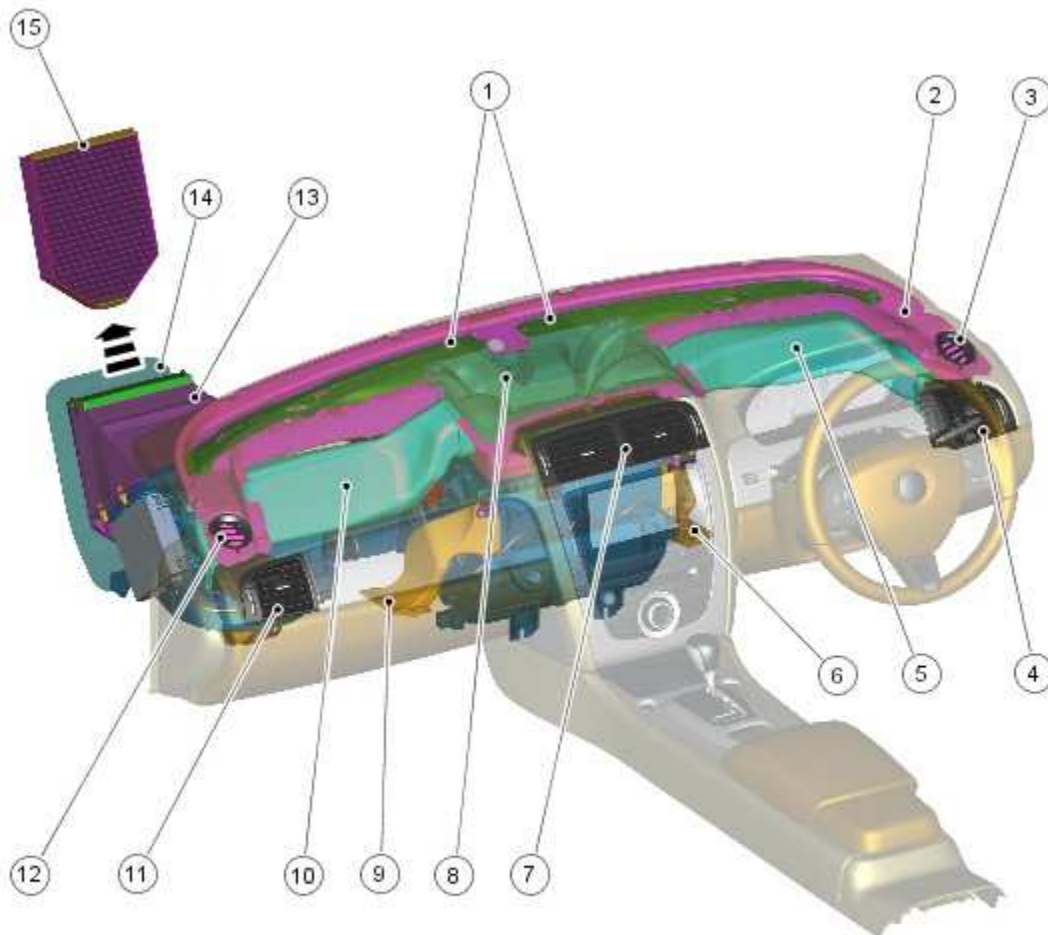
Item	Nm	lb-ft	lb-in

Air Distribution and Filtering

COMPONENT LOCATION

NOTE:

Right-Hand Drive (RHD) shown, Left-Hand Drive (LHD) similar



E62523

Item	Part Number	Description
1		Windshield vents
2		Windshield and side window air duct

3		Driver side window vent
4		Driver instrument panel register
5		Driver instrument panel air duct
6		Driver footwell air duct
7		Center instrument panel register
8		Air deflector nozzle
9		Passenger footwell air duct
10		Passenger instrument panel air duct
11		Passenger instrument panel register
12		Passenger side window vent
13		Air intake
14		Water shield
15		Cabin air filter

INTRODUCTION

The air distribution and filtering system controls the distribution and quality of air supplied to the vehicle interior. The system consists of:

- Air ducts
- Air registers and vents
- A cabin air filter

AIR DUCTS

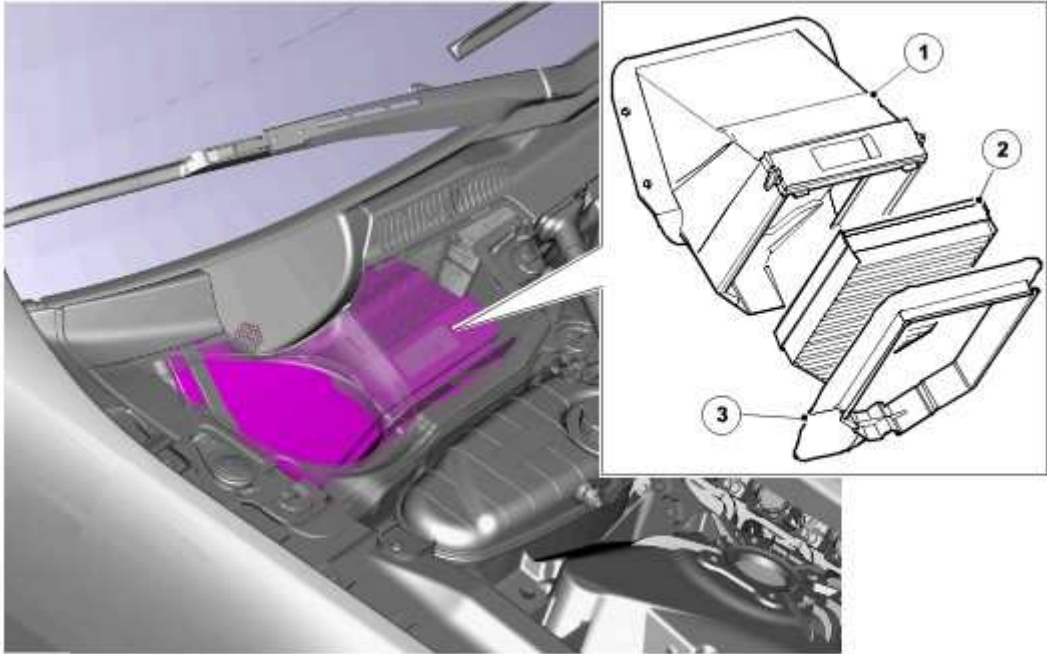
The air ducts distribute air from the heater assembly to the various registers and vents in the instrument panel. The windshield and side window air duct, the driver instrument panel air duct, and the passenger instrument panel air duct all form part of the structure of the instrument panel.

AIR REGISTERS AND VENTS

The air registers allow occupants to control the flow and direction of air from the air ducts. The instrument panel contains 4 air registers; 1 mounted at each end of the panel, and 2 mounted centrally above the Touch Screen Display (TSD).

The air vents are fixed outlets. The instrument panel contains 4 air vents; 1 mounted at each end of the panel, and 2 mounted along the top edge of the panel, below the windshield.

CABIN AIR FILTER



E73075

Item	Part Number	Description
1		Filter housing
2		Cabin air filter
3		Water shield

The cabin air filter is located in a plastic housing on the passenger side of the engine compartment. The filter removes odours and fine particles, including pollen, from air entering the blower assembly.

The filter housing also contains a shield to prevent water from contaminating the filter element and entering the heating and ventilation system.

Air Distribution and Filtering

For additional information, refer to [412-00](#).

Center Registers (82.20.38)

Removal

- 1 . Remove the information and entertainment module.

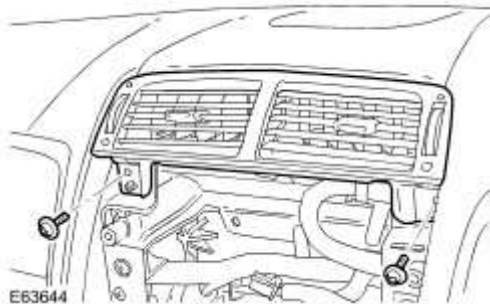
For additional information, refer to Information and Entertainment Module (86.53.48)

- 2 . **NOTE:**

The Torx screws may not be fitted.

Remove the center register.

- ▶ Remove the 2 Torx screws.
- ▶ Carefully release the component.



Installation

- 1 . **NOTE:**

The Torx screws may not be fitted.

Carefully install the center register.

- ▶ Install the Torx screws.

2 . Install the information and entertainment module.

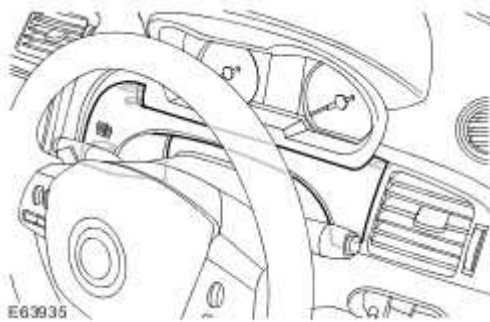
For additional information, refer to Information and Entertainment Module (86.53.48)


Driver Side Register (82.20.39)

Removal

- 1 . Remove the instrument panel driver's side reinforcement trim panel.

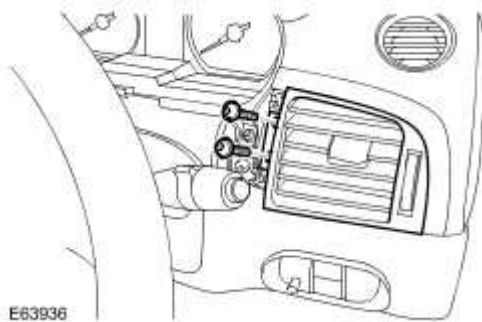
▶ Carefully release the 4 clips.



- 2 .  **CAUTION:** Care must be taken to avoid damage to the mating surfaces.

Remove the driver side register trim panel.

▶ Remove the 2 Torx screws.




Installation

- 1 . Install the driver side register trim panel.

▶ Install the Torx screws.

2 . Install the instrument panel driver's side reinforcement trim panel.

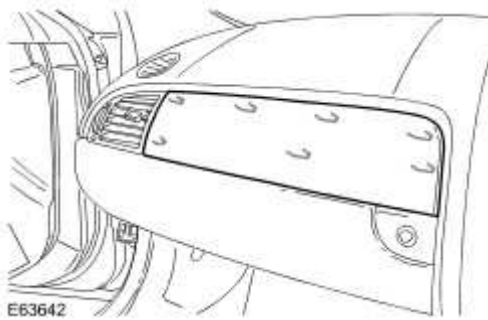
 Align the pegs and secure with the clips.

Passenger Side Register (82.20.40)

Removal

- 1 . Remove the instrument panel passenger side reinforcement trim panel.

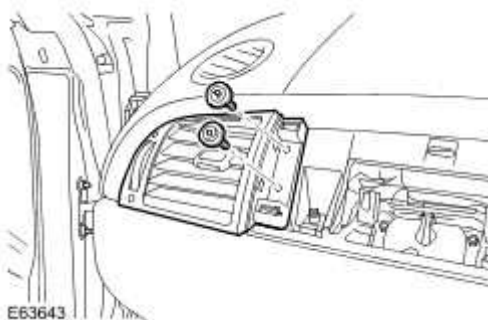
▶ Carefully release the 7 clips.



- 2 . Remove the passenger side register.

▶ Remove the 2 Torx screws.

▶ Carefully release the component.




Installation

- 1 . Install the passenger side register.

▶ Install the Torx screws.

2 . Install the instrument panel passenger side reinforcement trim panel.

 Align the pegs and secure with the clips.

Pollen Filter (76.10.09)

Removal

1 . Open the hood.

2 . Remove the air intake cover.


▶ Remove the 3 clips.



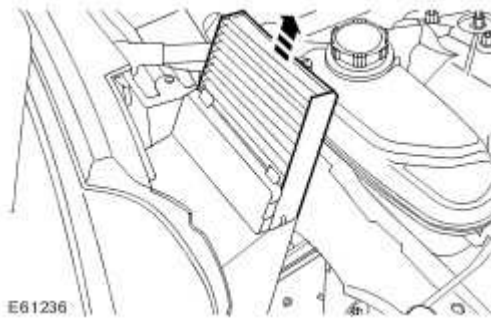
3 . Release the pollen filter housing cover.

▶ Release from the 2 clips.



4 .  **CAUTION: Remove any debris from the filter aperture.**

Remove the pollen filter.



Installation

- 1 . Install the pollen filter.
- 2 . Secure the pollen filter housing cover.
- 3 . Install the air intake cover.
 - ▶ Carefully secure the clips.
- 4 . Close the hood.

412-02 : Heating and Ventilation

Specifications

Specifications

Torque Specifications

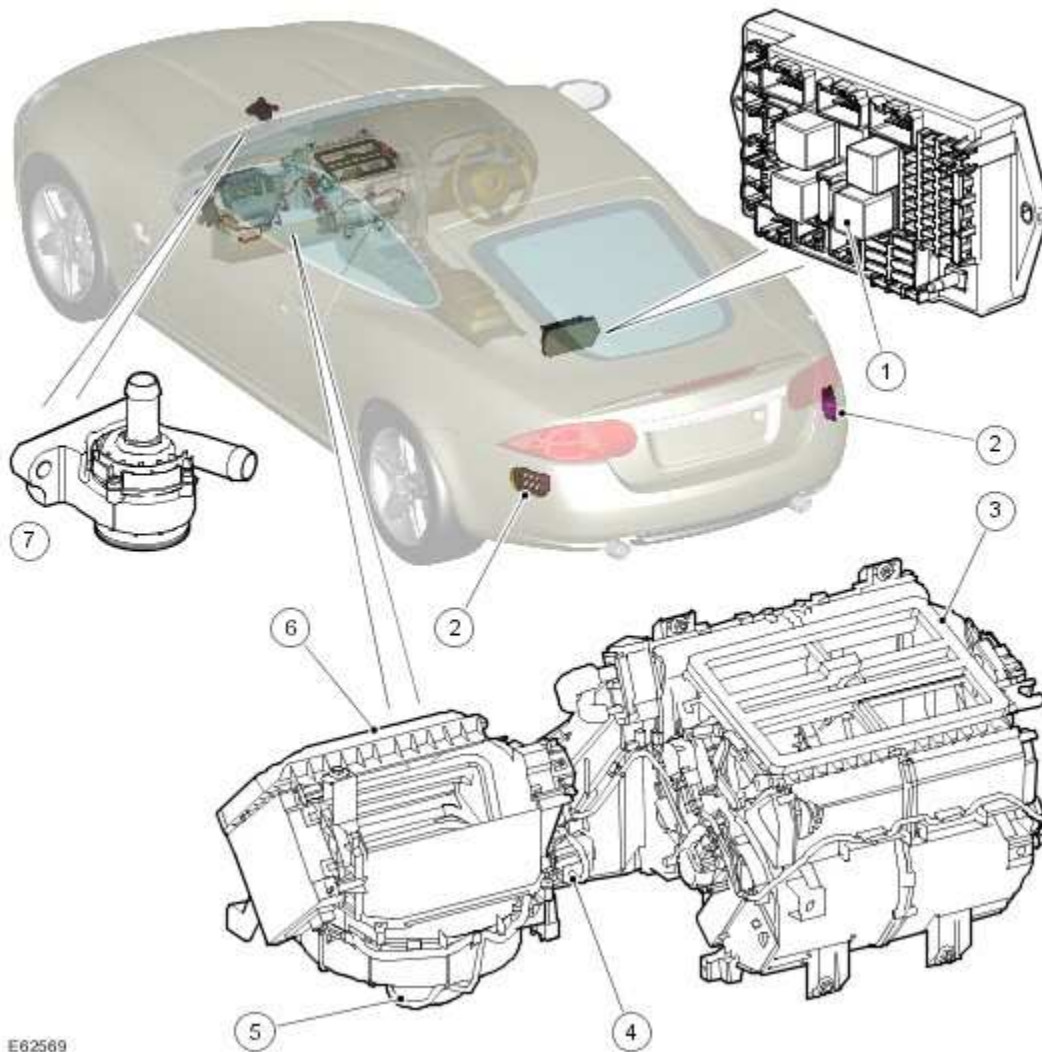
Item	Nm	lb-ft	lb-in

Heating and Ventilation

COMPONENT LOCATION

NOTE:

RHD (right-hand drive) shown, LHD (left-hand drive) similar



E62569

Item	Part Number	Description
1		Blower relay
2		Ventilation outlets (2 off)

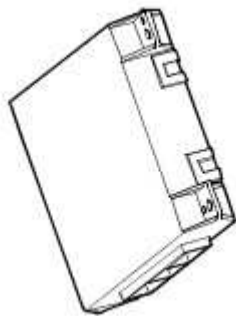
3		Heater assembly
4		Blower motor control module
5		Blower
6		Air inlet
7		Heater coolant pump

INTRODUCTION

The heating and ventilation system controls the temperature and flow of air supplied to the vehicle interior. The system is dual zone, and can provide different temperature settings for the Left Hand (LH) and Right Hand (RH) side of the cabin. The system can be operated in 'Automatic' or 'Manual' mode, with temperature settings being selected using the control switches located below the TSD.

For information on how to operate the heating and ventilation system, refer to the Owner's Handbook.

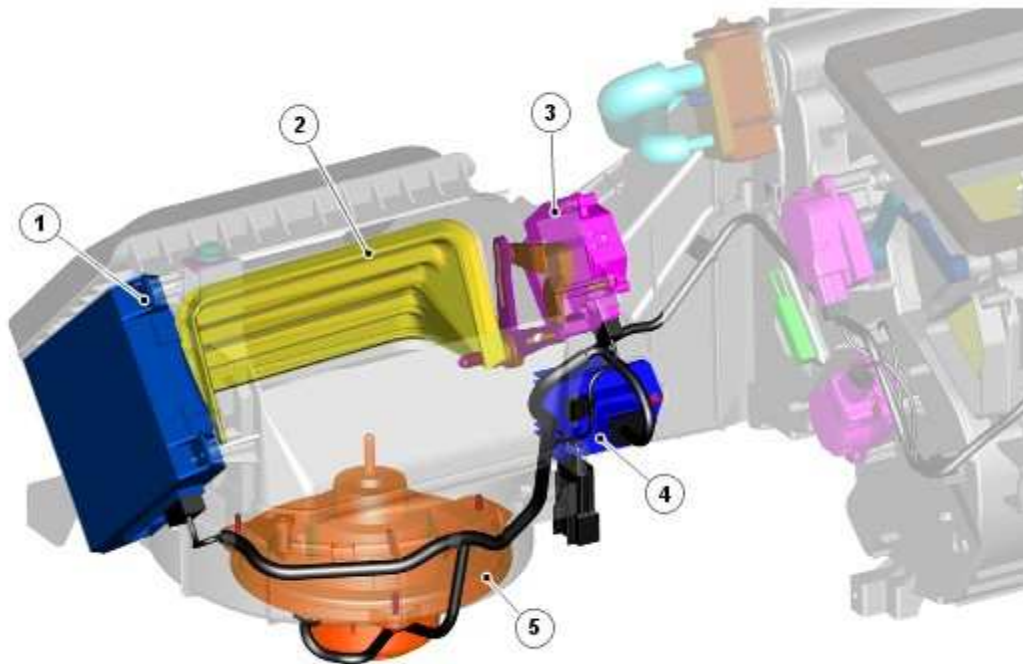
AUTOMATIC TEMPERATURE CONTROL MODULE



E71889

Many of the features and operations of the heating and ventilation system are controlled by the Automatic Temperature Control (ATC) module, which is located on the end of the air inlet duct casing. For additional information, refer to Control Components (412-04)

AIR INLET DUCT



E73138

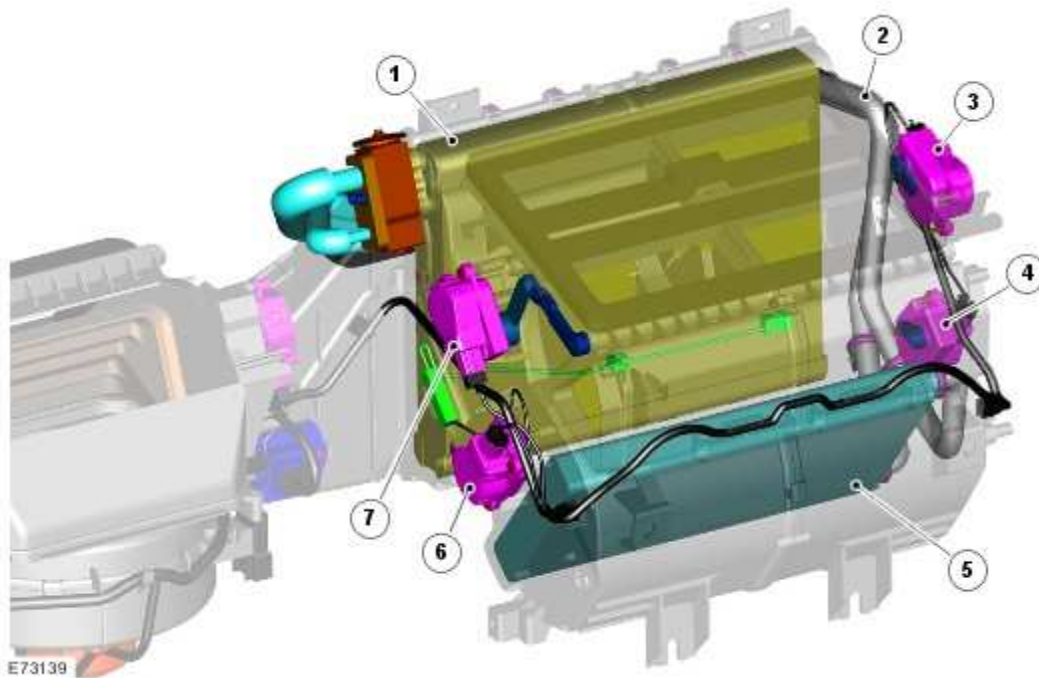
Item	Part Number	Description
1		ATC module
2		Fresh/recirculated air door
3		Fresh/recirculated air door motor
4		Blower motor control module
5		Blower motor and fan assembly

The air inlet duct is installed behind the instrument panel on the passenger side. Inlet air passes through the cabin filter and into the air inlet duct where it enters the blower. A servo motor mounted on the air inlet duct allows fresh or recirculated air to be selected. Operation of the fresh/recirculated door is controlled by the ATC module.

BLOWER

The blower is contained within the air inlet duct assembly and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the blower is controlled by the ATC module using a relay located in the auxiliary junction box and the blower motor control module. The blower motor control module is installed in the air inlet duct downstream of the blower, where any heat generated during operation is dissipated by the air flow.

HEATER ASSEMBLY



Item	Part Number	Description
1		A/C evaporator
2		Heater coolant pipes
3		Windshield distribution door motor
4		RH temperature blend motor
5		Heater core
6		LH temperature blend motor
7		Face and feet distribution door motor

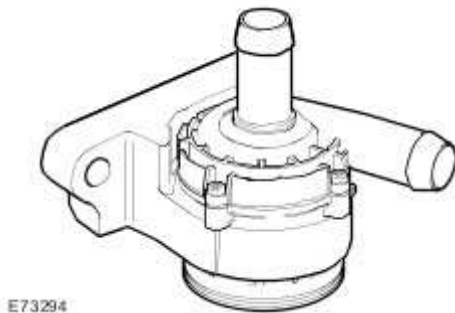
The heater assembly controls the temperature of the air supplied to the air distribution ducts, as directed by the ATC module. The heater assembly is installed on the vehicle center line, between the instrument panel and the engine bulkhead.

The heater assembly consists of a casing which contains the Air Conditioning (A/C) evaporator, the heater core, 2 air distribution control doors, and 2 temperature blend control doors.

The A/C evaporator is controlled as part of the A/C system. For additional information, refer to Air Conditioning (412-03)

The heater core provides the heat source to warm the air being supplied to the cabin. The heater core is an aluminium 2 pass, fin and tube heat exchanger, and is installed across the width of the heater housing. Two aluminium tubes attached to the heater core extend through the engine bulkhead and connect to the engine cooling system. When the engine is running, coolant is constantly circulated through the heater core by the coolant pump. For additional information, refer to Engine Cooling (303-03)

HEATER COOLANT PUMP



A heater coolant pump is mounted on the RH rear face of the radiator housing. The pump is electrically driven and provides the necessary flow rate of engine coolant to the heater core. Operation of the pump is controlled by the Central Junction Box (CJB) on receipt of medium speed Controller Area Network (CAN) bus signals from the ATC module.

The pump will run when the engine is running and operates at a single speed. The CJB broadcasts pump status over the medium speed CAN bus for use by other vehicle systems.

NOTE:

The pump can be forced to run when the engine is not running if required. For additional information, refer to Engine Cooling (303-03)

VENTILATION OUTLETS

The ventilation outlets allow the free flow of air through the passenger compartment. The outlets are installed in the LH and RH rear quarter panels, below the tail lamps.

Each ventilation outlet consists of a grille covered by a soft rubber flap, and is effectively a non-return valve. The flaps open and close automatically depending on the differential between cabin and outside air pressures.

PRINCIPLES OF OPERATION

Operation of the heating and ventilation system is controlled by the ATC module. For additional information, refer to Control Components (412-04)

Heating and Ventilation

<<412-00>>

Auxiliary Coolant Flow Pump - 4.2L NA V8 - AJV8 (82.25.59)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to


2




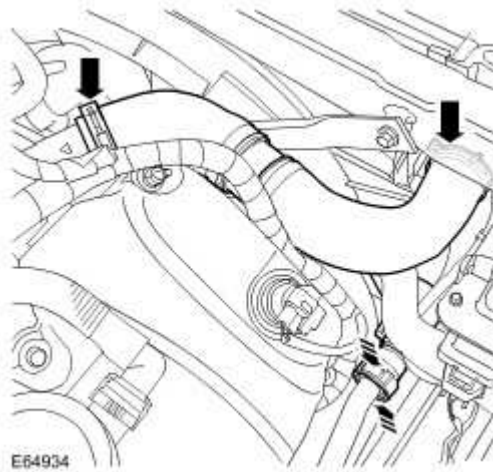
- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 Drain the cooling system.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8
- 4 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)
- 5 . Remove the radiator top hose.

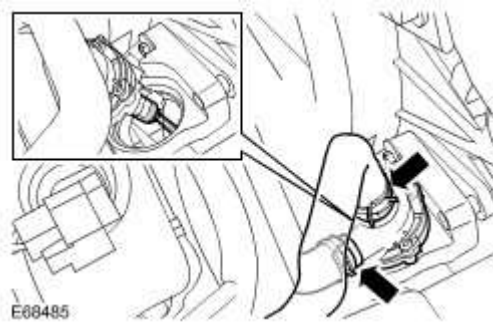
 Release the 2 clips.

 Disconnect the quick release connector.



6 . Remove the auxiliary coolant flow pump.

- ▶ Release the clips and disconnect the 2 coolant hoses.
- ▶ Disconnect the electrical connector.




Installation

1 . Install the auxiliary coolant flow pump.

- ▶ Connect the electrical connector.
- ▶ Connect the coolant hoses and secure with the clips.

2 . Install the radiator top hose.

 Secure with the clips.

 Connect the quick release connector.

3 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

4 . Connect the battery ground cable and install the cover.

For additional information, refer to

5 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8
- AJV8

Auxiliary Coolant Flow Pump - 4.2L SC V8 - AJV8 (82.25.59)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

2




- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**


Raise and support the vehicle.

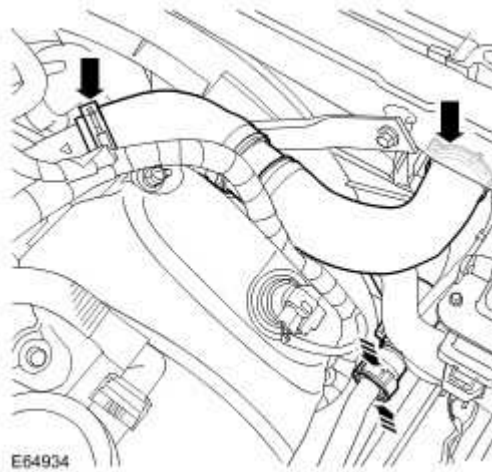
- 3 Drain the cooling system.
 - For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

- 4 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator

- 5 . Remove the radiator top hose.

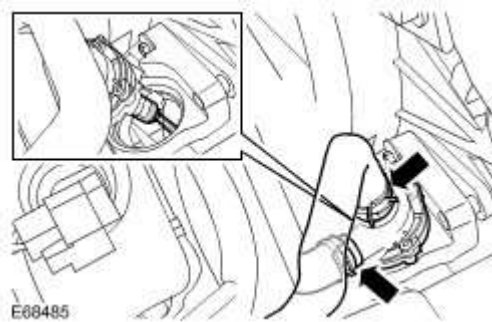
 Release the 2 clips.

 Disconnect the quick release connector.



6 . Remove the auxiliary coolant flow pump.

- ▶ Release the clips and disconnect the 2 coolant hoses.
- ▶ Disconnect the electrical connector.




Installation

1 . Install the auxiliary coolant flow pump.

- ▶ Connect the electrical connector.
- ▶ Connect the coolant hoses and secure with the clips.

2 . Install the radiator top hose.

 Secure with the clips.

 Connect the quick release connector.

3 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

4 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

5 Refill the cooling system.

. For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8
- AJV8

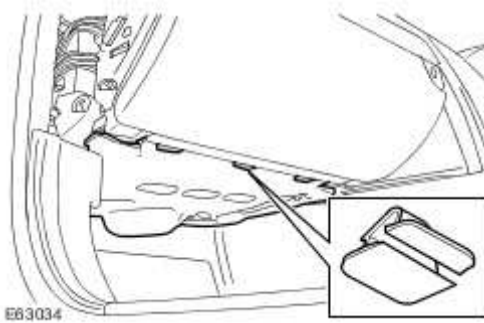
Blower Motor (82.25.66)

Removal

- 1  **CAUTION:** Removal of the clips is a delicate procedure, damage will occur if any force is used.

Remove the passenger side footwell trim panel.

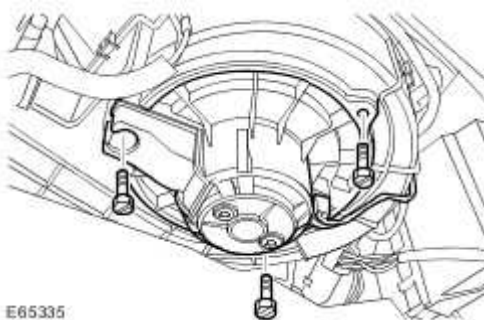
- ▶ Remove the 3 clips.



- 2 . Remove the blower motor.


- ▶ Disconnect the electrical connector.

- ▶ Remove the 3 screws.




Installation

- 1 . Install the blower motor.
- 2 . Install the passenger side footwell trim panel.

 Carefully secure the clips.

Heater Core (80.20.29)

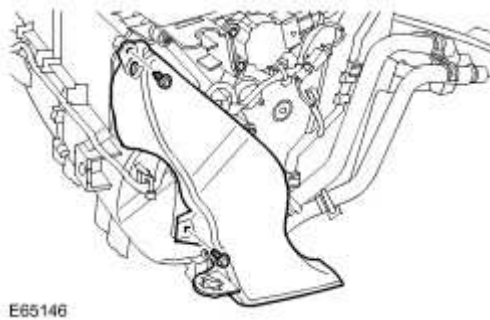
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

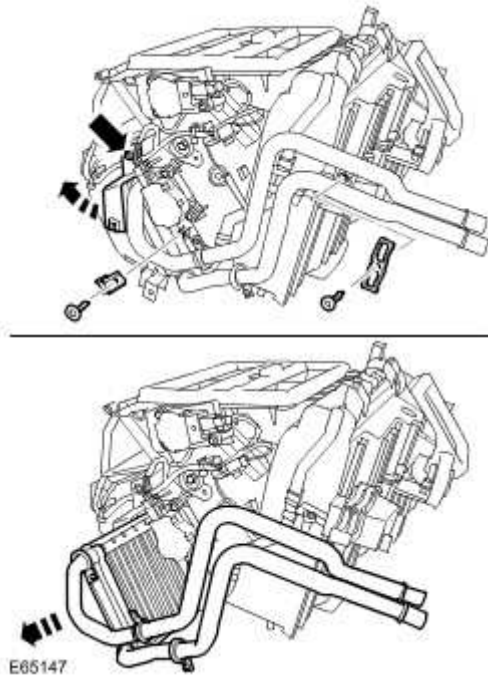
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 . Remove the heater and evaporator core housing.
For additional information, refer to Heater Core and Evaporator Core Housing (82.25.21)
- 4 . Remove the RH side footwell heater duct.

- ▶ Remove the 2 screws.



- 5 . Remove the heater core.
 - ▶ Remove the coolant pipe clamp.
 - ▶ Remove the screw.
 - ▶ Remove the heater core retaining bracket.

- ▶ Remove the screw.
- ▶ Position the RH footwell duct mounting bracket aside for access.
- ▶ Loosen the screw.



6 . NOTE:

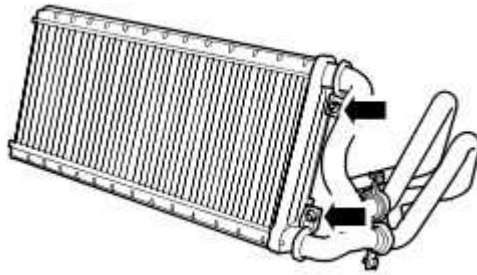
Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

Remove the heater core, inlet and outlet pipes.

- ▶ Release the 2 clamps.
- ▶ Remove and discard both O-ring seals.



E65148

Installation

1 . NOTE:

Lubricate the seals with coolant.

Install the heater core, inlet and outlet pipes.

- Install new O-ring seals.
- Install the clamps and tighten the screws.

2 . Install the heater core.

- Secure the heater core retaining bracket.
- Install the screw.
- Install the coolant pipe clamp.
- Install the screw.
- Align the footwell duct mounting bracket and tighten the screw.

3 . Install the RH side footwell heater duct.

- Install the screws.

4 . Install the heater and evaporator core housing.

For additional information, refer to Heater Core and Evaporator Core Housing (82.25.21)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to

Heater Core and Evaporator Core Housing (82.25.21)

Removal

All vehicles

1



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to Specifications

- 3 . Remove the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

- 4 . Recover the A/C refrigerant.

Vehicles without supercharger

- 5 Drain the coolant.

- For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

Vehicles with supercharger

- 6 Drain the coolant.

- For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

All vehicles

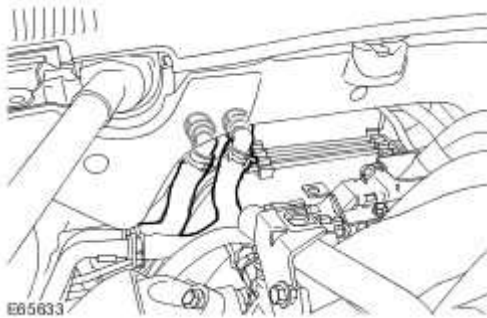
7.



CAUTION: Always plug any open connections to prevent contamination.

Disconnect the heater supply and return hoses.

- ▶ Position a container to collect the fluid.
- ▶ Carefully release the clips.



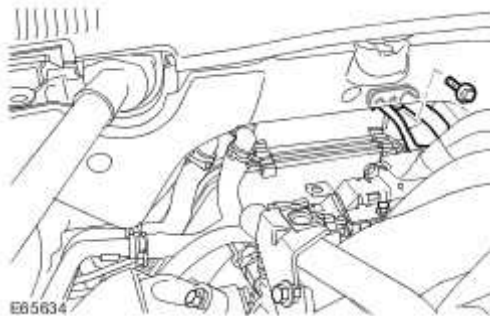
8



CAUTION: Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

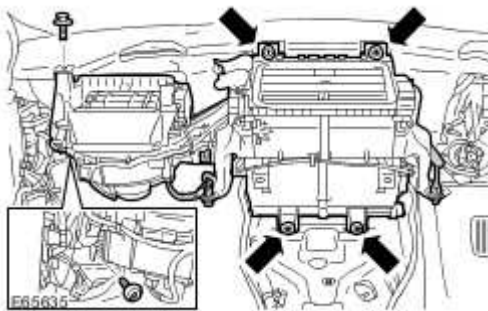
Disconnect the A/C lines.

- ▶ Remove the bolt.
- ▶ Remove and discard both O-ring seals.



9 . Remove the heater and evaporator core housing.

- ▶ Position the carpet aside for access.
- ▶ Release both footwell lamp holders.
- ▶ Disconnect the 2 electrical connectors.
- ▶ Remove the 5 nuts.
- ▶ Remove the bolt.



Installation

All vehicles

1 . Install the heater and evaporator core housing.


2 . **NOTE:**

Lubricate the O-ring seals with clean refrigerant oil.

Connect the A/C lines.

- ▶ Install new O-ring seals.
- ▶ Tighten the bolt to 6 Nm (4 lb.ft).

3 . Connect the heater supply and return hoses.

 Secure the clips.

4 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

Vehicles with supercharger

6 Refill and bleed the cooling system.

- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L SC V8 - AJV8

Vehicles without supercharger

7 Refill and bleed the cooling system.

- . For additional information, refer to Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8

All vehicles

8 . Fill the A/C system.

412-03 : Air conditionning

Specifications

Specifications

General Specification

Item	Specification
Compressor	Clutchless, belt driven from engine with electronically controlled outputs
make	Denso
type	7SEU17

Lubricants, Fluids, Sealers and Adhesives

	Specifications
Refrigerant	R134A
Compressor oil	JLM 12260

Capacities

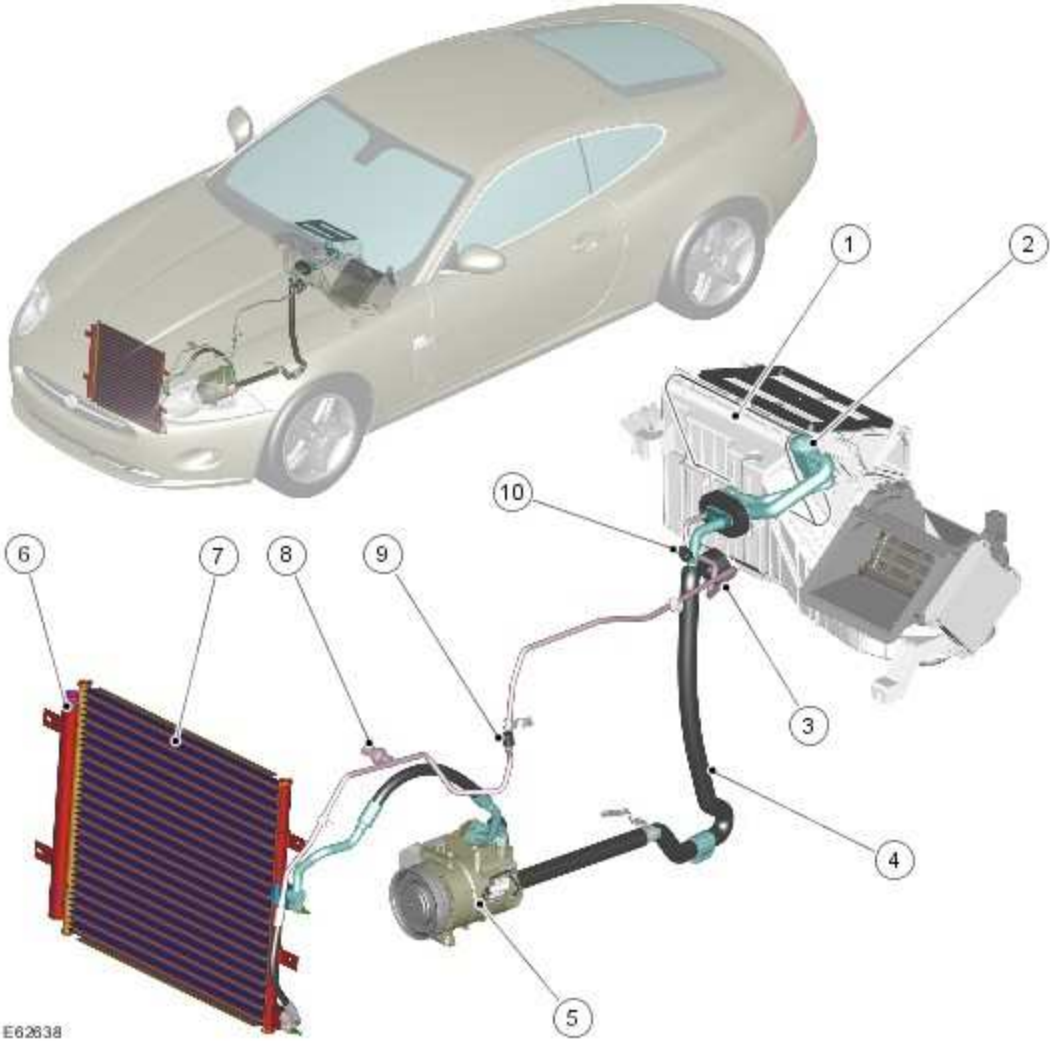
Item	Specification
Refrigerant charge weight	700g ± 25g
Compressor oil capacity	130 ml

Torque Specifications

Item	Nm	lb-ft	lb-in
Compressor to mounting bracket - bolt	25	18	-
Compressor mounting bracket to engine - bolt	25	18	-
Condenser core to bracket - bolt	10	7	88
Pressure cutoff switch to refrigerant pipe	10	7	88
Refrigerant pipes to compressor - bolt	9	7	80
Refrigerant pipes to condenser - nut	10	7	88
Thermostatic expansion valve to evaporator - bolt	6	4	53

Air Conditioning

COMPONENT LOCATION



E62838

Item	Part Number	Description
1		Evaporator
2		Thermostatic expansion valve
3		High pressure line
4		Low pressure line

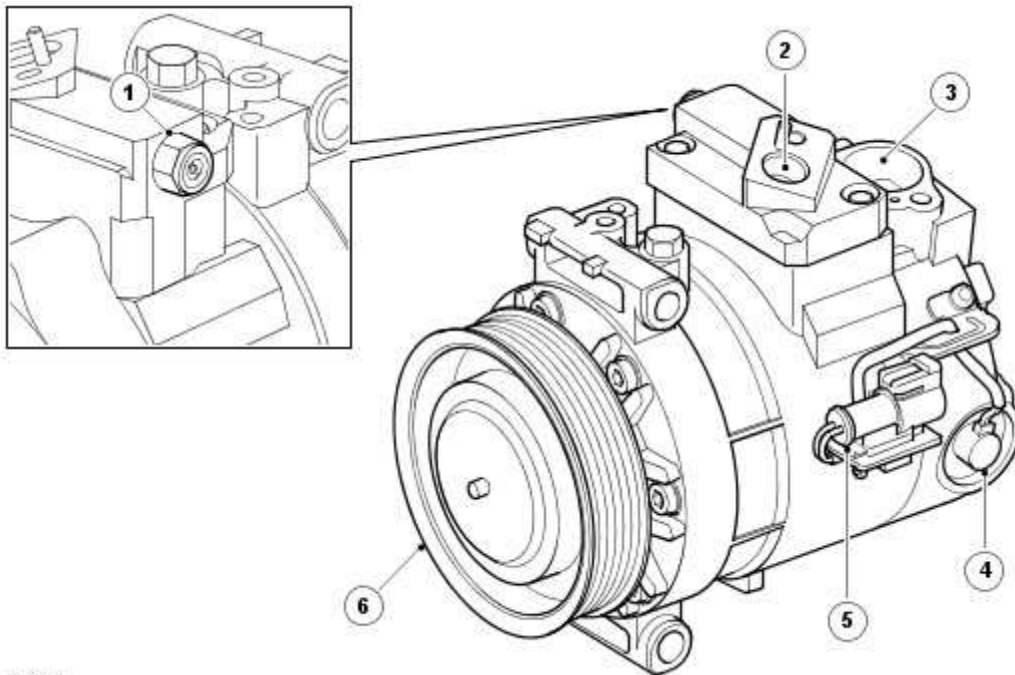
5		Air Conditioning (A/C) compressor
6		Receiver/Drier
7		Condenser
8		Refrigerant pressure sensor
9		High pressure servicing connection
10		Low pressure servicing connection

INTRODUCTION

The A/C system transfers heat from the vehicle interior to the outside atmosphere to provide the heater assembly with dehumidified cool air. The A/C system is a sealed, closed loop system, filled with a charge weight of R134a refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the A/C compressor.

Operation of the A/C system is controlled by the Automatic Temperature Control (ATC) module. For additional information, refer to Control Components (412-04)

A/C COMPRESSOR



E46918

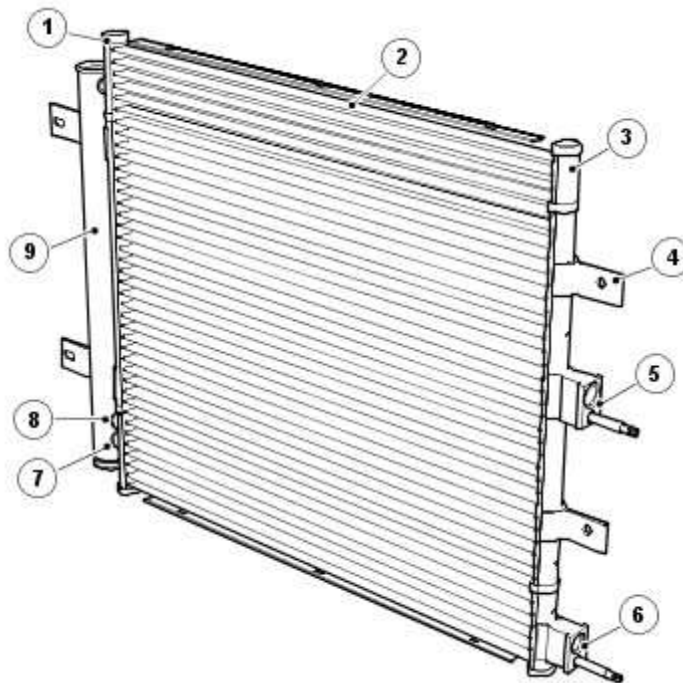
Item	Part Number	Description

1		Pressure relief valve
2		Outlet port
3		Inlet port
4		Solenoid valve
5		Electrical connector
6		Pulley

The A/C compressor circulates refrigerant around the system by compressing low pressure, low temperature vapour from the evaporator and discharging the resultant high pressure, high temperature vapour to the condenser.

The A/C compressor is a permanently engaged variable displacement unit which is driven by the engine accessory drive belt. To protect the system from excessive pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve vents excess pressure into the engine compartment.

CONDENSER



E72963

Item	Part Number	Description
1		Right Hand (RH) end tank

2		Condenser core
3		Left Hand (LH) end tank
4		Mounting brackets (4 off)
5		Low pressure line connector block
6		High pressure line connector block
7		Receiver drier outlet pipe
8		Receiver drier inlet pipe
9		Receiver drier

The condenser transfers heat from the refrigerant to the surrounding air to convert the high pressure vapour from the compressor into a liquid. The condenser is installed immediately in front of the radiator. Two brackets on each end tank attach the condenser to the end tanks of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between 2 end tanks. Divisions in the end tanks separate the heat exchanger into a 4 pass upper (condenser) section and a 2 pass lower (sub-cooler) section.

The LH end tank provides the connections to the high pressure line from the A/C compressor and the low pressure line to the evaporator.

The RH end tank provides the connections to the receiver drier.

RECEIVER DRIER

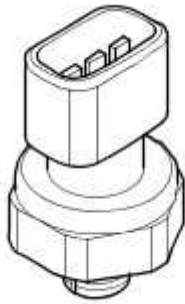
The receiver drier is mounted on the condenser RH end tank and removes solid impurities and moisture from the refrigerant. It also provides a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

NOTE:

The receiver drier is part of the condenser assembly and is not serviceable separately.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet pipe back to the condenser.

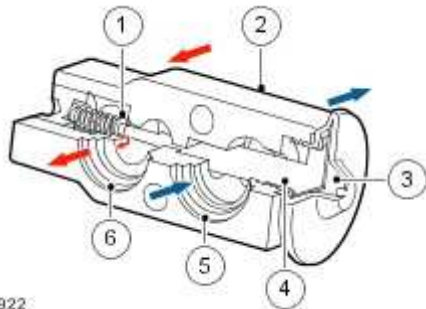
REFRIGERANT PRESSURE SENSOR



E43581

The refrigerant pressure sensor is located in the high pressure/temperature refrigerant line between the condenser and the thermostatic expansion valve. For additional information, refer to Control Components (412-04)

THERMOSTATIC EXPANSION VALVE



E46922

Item	Part Number	Description
1		Metering valve
2		Housing
3		Diaphragm
4		Temperature sensor
5		Outlet passage from evaporator
6		Inlet passage to evaporator

The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

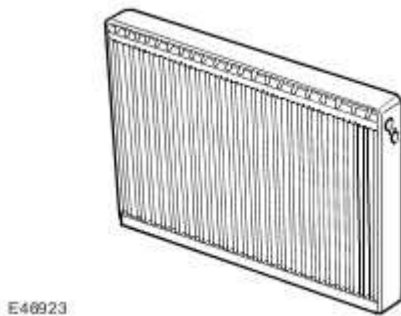
The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of

an aluminium housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by the evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporise and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator acts on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater volume of refrigerant allowed through the metering valve.

EVAPORATOR



The evaporator is installed in the heater assembly, between the blower and the heater matrix, to absorb heat from the exterior or recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapour in the evaporator, absorbing large quantities of heat as it changes state.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the vehicle by passing through a drain tube to the underside of the vehicle.

REFRIGERANT LINES

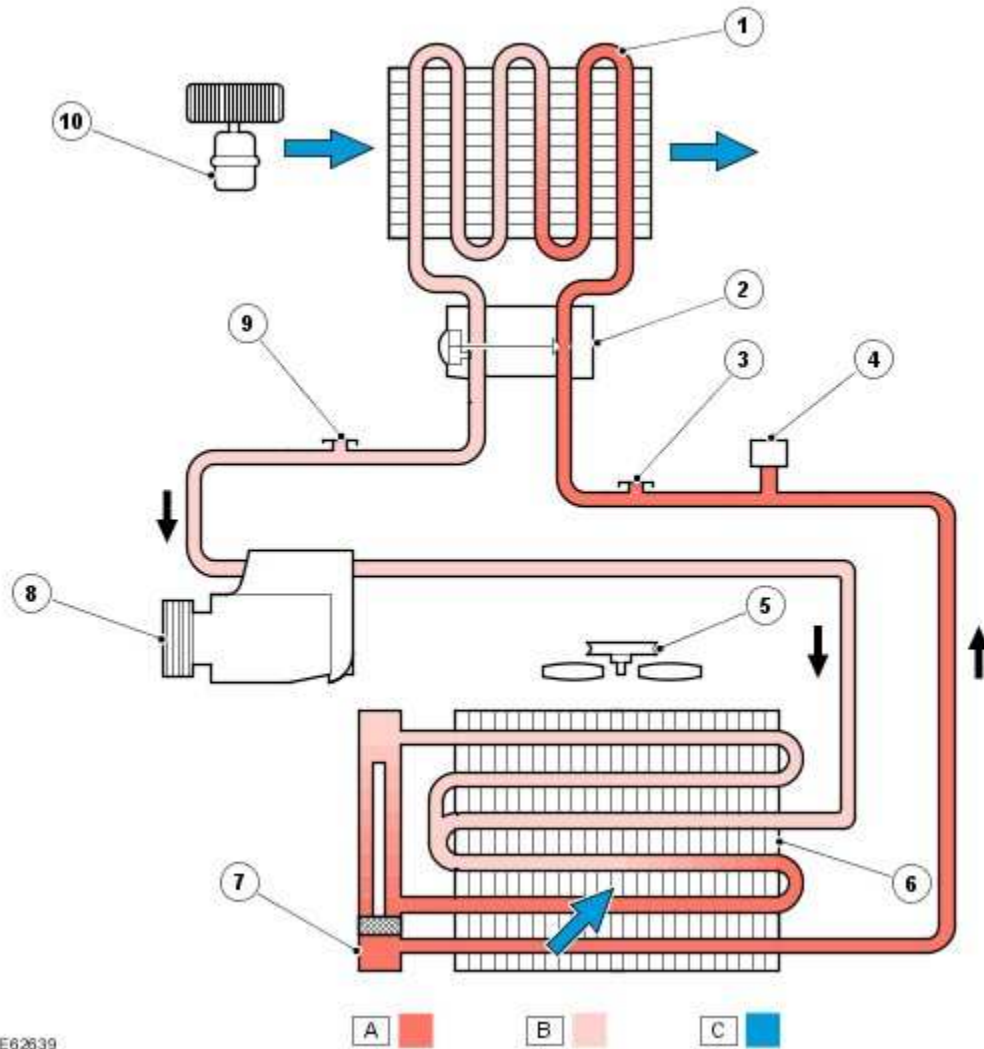
To maintain similar flow velocities around the A/C system, the diameter of the refrigerant lines varies to suit the 2 pressure/temperature regimes. Larger diameter pipes are installed in the low pressure/temperature regime and smaller diameter pipes are installed in the high pressure/temperature regime.

Low and high pressure charging connections are incorporated into the refrigerant lines for system servicing.

CONTROL DIAGRAM

NOTE:

A = Refrigerant liquid; B = Refrigerant vapour; C = Air flow



E62639

Item	Part Number	Description
1		Evaporator
2		Thermostatic expansion valve
3		High pressure servicing connection
4		Refrigerant pressure sensor
5		Engine cooling fan

6		Condenser
7		Receiver/Drier
8		Variable displacement A/C compressor
9		Low pressure servicing connection
10		Blower

PRINCIPLES OF OPERATION

To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through 2 pressure/temperature regimes. In each of the regimes the refrigerant changes state, during which process maximum heat absorption or dissipation occurs.

The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the compressor. The refrigerant decreases in pressure and temperature at the thermostatic expansion valve then changes state from a liquid to a vapour in the evaporator to absorb heat.

The high pressure/temperature regime is from the compressor, through the condenser and receiver drier assembly to the thermostatic expansion valve. The refrigerant increases in pressure and temperature as it passes through the compressor, then releases heat and changes state from a vapour to a liquid in the condenser.

Operation of the A/C system is controlled by the Automatic Temperature Control (ATC) module. For additional information, refer to Control Components (412-04)

The A/C system works in conjunction with the heating and ventilation system, and the air distribution and filtering system. For additional information, refer to Heating and Ventilation (412-02)
For additional information, refer to Air Distribution and Filtering (412-01)

Air Conditioning

For additional information refer to <<[412-00](#)>>

Air Conditioning (A/C) Compressor - 4.2L NA V8 - AJV8 (82.10.20)

Special Service Tools



303-021

Engine support bracket
303-021



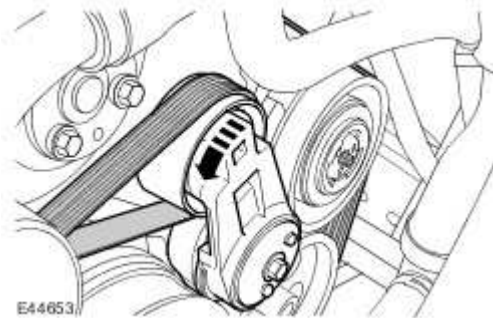
303-749


Engine lifting brackets
303-749

Removal

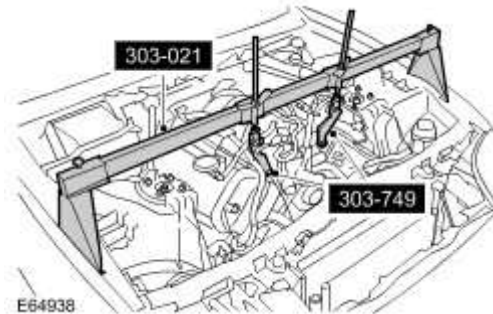
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Raise and support the vehicle.
- 3 . Recover the A/C refrigerant.
- 4 . Release the throttle body.
For additional information, refer to Throttle Body (19.70.04)
- 5 Release the accessory drive belt.

- ▶ Rotate the accessory drive belt tensioner counter-clockwise, using a 3/8 " drive wrench.



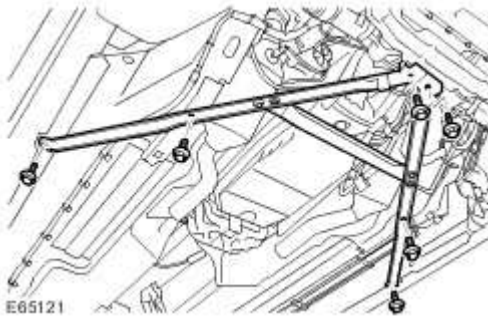
- 6.  **CAUTION: Protect the paintwork during this operation.**

Using the special tools, support the engine.



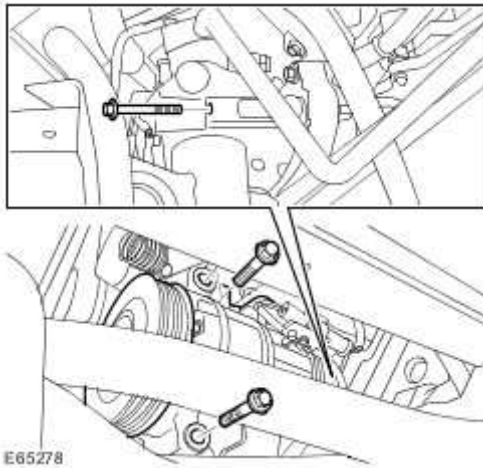
- 7 . Remove the LH heated oxygen sensor (HO2S).
For additional information, refer to Heated Oxygen Sensor (HO2S)
- 8 . Remove the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)
- 9 . With assistance, remove the A-frame.

- ▶ Remove the 6 bolts.



10 . Release the A/C compressor.

▶ Remove the 3 bolts.



11

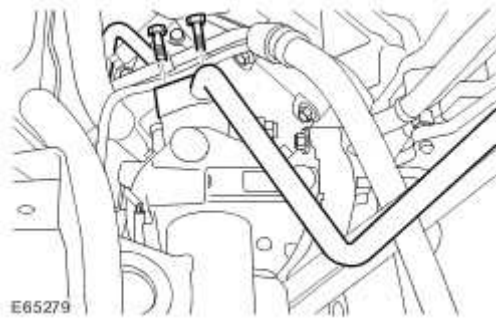


CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

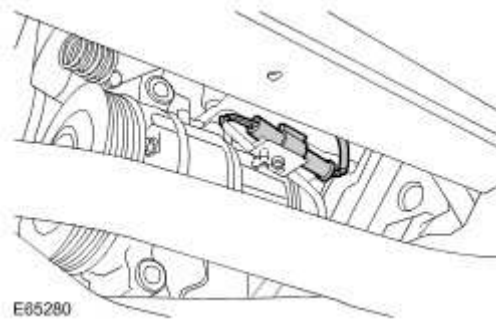
▶ Remove the 2 bolts.

▶ Remove and discard the 2 O-ring seals.



12 . Remove the A/C compressor.

- ▶ Disconnect the electrical connector.



Installation

1 . Install the A/C compressor.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- ▶ Connect the electrical connector.

2 .



CAUTION: Lubricate the new seals with clean refrigerant oil.

Connect the refrigerant lines.

- ▶ Clean the component mating faces.

▶ Install the new O-ring seals.

▶ Tighten the bolts to 9 Nm (7 lb.ft).

3 . With assistance, install the A-frame.

▶ Tighten the bolts to 55 Nm (40 lb.ft).

4 . Install the LH engine mount.

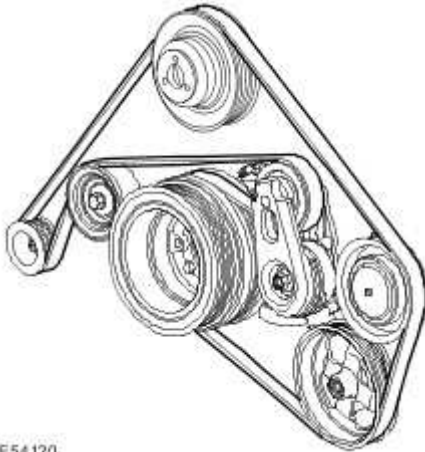
For additional information, refer to Engine Mount LH (12.45.01)

5 . Install the HO2S.

For additional information, refer to Heated Oxygen Sensor (HO2S)

6 . Remove the special tools.

7 . Install the accessory drive belt.



E54120

8 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)

9 . Connect the battery ground cable and install the cover.
For additional information, refer to

10 . Recharge the A/C system.

Air Conditioning (A/C) Compressor - 4.2L SC V8 - AJV8 (82.10.20)

Special Service Tools



303-021

Engine support bracket

303-021




303-749

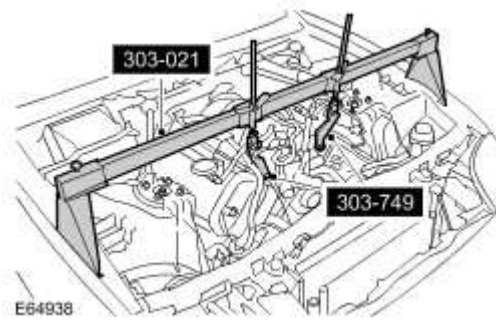
Engine lifting brackets

303-749

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Raise and support the vehicle.
- 3 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)
- 4 . Recover the A/C refrigerant.
- 5 .  **CAUTION: Protect the paintwork during this operation.**

Using the special tools, support the engine.

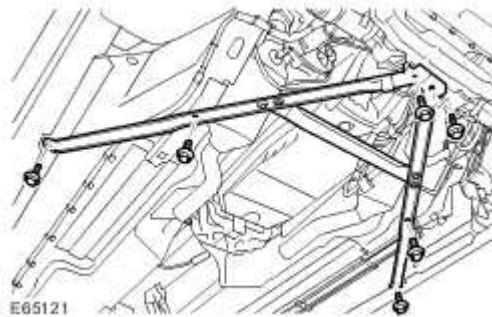


6 . Remove the LH heated oxygen sensor (HO2S).
For additional information, refer to Heated Oxygen Sensor (HO2S)

7 . Remove the LH engine mount.
For additional information, refer to Engine Mount LH (12.45.01)

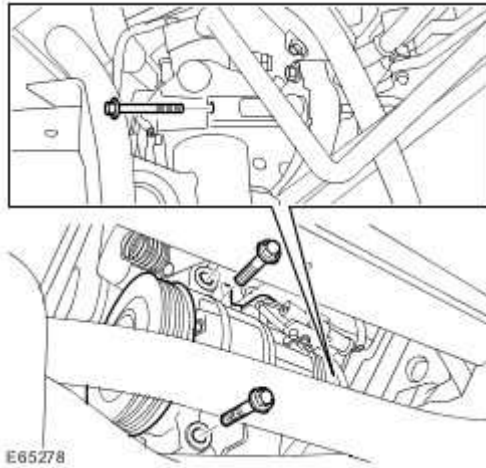
8 . With assistance, remove the A-frame.

▶ Remove the 6 bolts.



9 . Release the A/C compressor.

▶ Remove the 3 bolts.



10

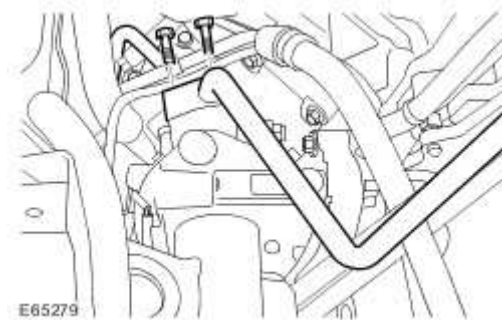


CAUTION: Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Disconnect the refrigerant lines from the A/C compressor.

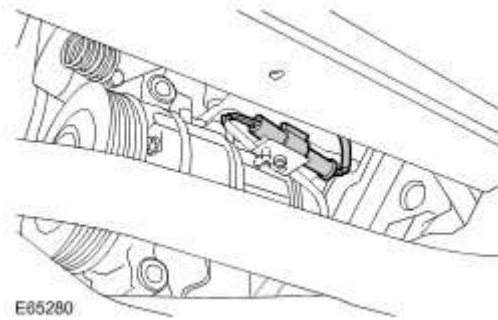
▶ Remove the 2 bolts.

▶ Remove and discard the 2 O-ring seals.



11 . Remove the A/C compressor.

▶ Disconnect the electrical connector.



Installation

1 . Install the A/C compressor.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- ▶ Connect the electrical connector.

2 .



CAUTION: Lubricate the new seals with clean refrigerant oil.

Connect the refrigerant lines.

- ▶ Clean the component mating faces.
- ▶ Install the new O-ring seals.
- ▶ Tighten the bolts to 9 Nm (7 lb.ft).

3 . With assistance, install the A-frame.

- ▶ Tighten the bolts to 55 Nm (40 lb.ft).

4 . Install the LH engine mount.

For additional information, refer to Engine Mount LH (12.45.01)

5 . Install the HO2S.

For additional information, refer to Heated Oxygen Sensor (HO2S)

6 . Remove the special tools.

7 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)

8 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

9 . Recharge the A/C system.

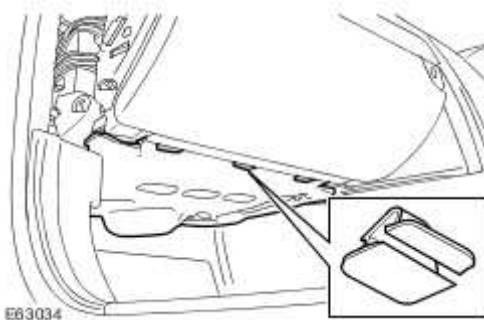
Blower Motor Resistor

Removal

- 1  **CAUTION:** Removal of the clips is a delicate procedure, damage will occur if any force is used.

Remove the passenger side footwell trim panel.

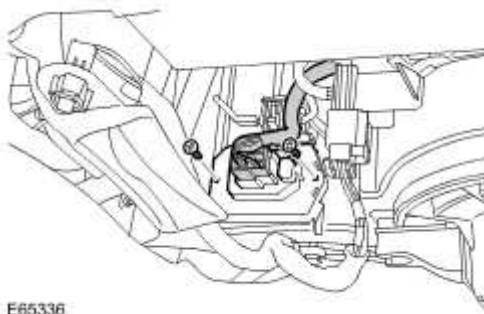
- ▶ Remove the 3 clips.



- 2 . Remove the blower motor resistor.

- ▶ Disconnect the electrical connector.

- ▶ Remove the 2 screws.



Installation

1 . Install the blower motor resistor.

- ▶ Install the screws.
- ▶ Connect the electrical connector.


2 . Install the passenger side footwell trim panel.

- ▶ Carefully secure the clips.

Condenser Core - 4.2L NA V8 - AJV8 (82.15.07)

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

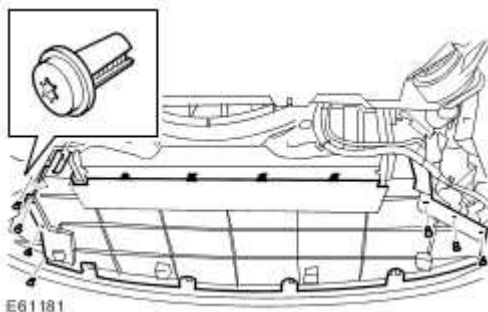
Raise and support the vehicle.

- 3 . Remove the radiator splash shield.
For additional information, refer to Radiator Splash Shield (76.22.90)

- 4 . Remove the front bumper air ducting.

▶ Remove the 7 clips.

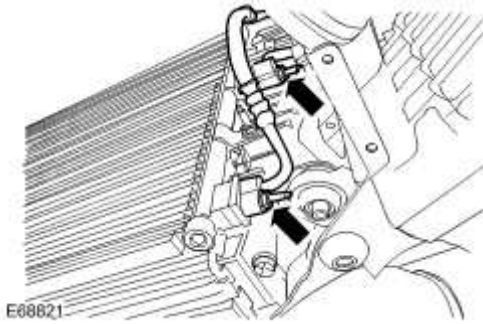
▶ Release the 4 clips.



- 5 . Recover the A/C refrigerant.

6 . Disconnect the A/C pipes.

- ▶ Remove the 2 nuts.
- ▶ Discard the O-ring seals.
- ▶ Install blanking caps to the exposed ports.



7 . Remove the condenser core.

- ▶ Remove the 2 bolts.
- ▶ Release from the 2 clips.



Installation

1 . Install the condenser core.

- ▶ Secure in the clips.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

2 . Connect the A/C pipes.

- ▶ Remove the blanking caps from the ports.
- ▶ Install a new O-ring seal.
- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

3 . Fill the A/C system.

4 . Install the front bumper air ducting.

- ▶ Install the clips.
- ▶ Secure the clips.

5 . Install the radiator splash shield.


For additional information, refer to Radiator Splash Shield (76.22.90)

6 . Connect the battery ground cable.

For additional information, refer to

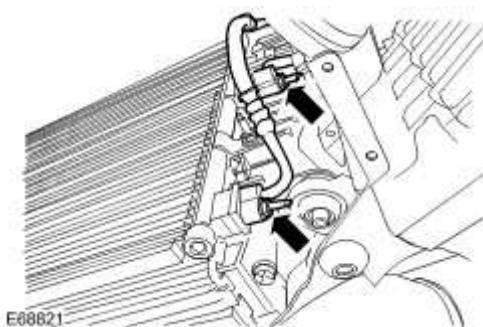
Condenser Core - 4.2L SC V8 - AJV8 (82.15.07)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the supercharger radiator.
For additional information, refer to Radiator
- 3 . Recover the A/C refrigerant.
- 4 . Disconnect the A/C pipes.
 - ▶ Remove the 2 nuts.
 - ▶ Discard the O-ring seals.
 - ▶ Install blanking caps to the exposed ports.



- 5 . Remove the condenser core.

Installation

1 . Install the condenser core.

2 . Connect the A/C pipes.

- ▶ Remove the blanking caps from the ports.

- ▶ Install a new O-ring seal.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

3 . Install the supercharger radiator.


For additional information, refer to Radiator

4 . Fill the A/C system.

Evaporator Core (82.25.20)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 .  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

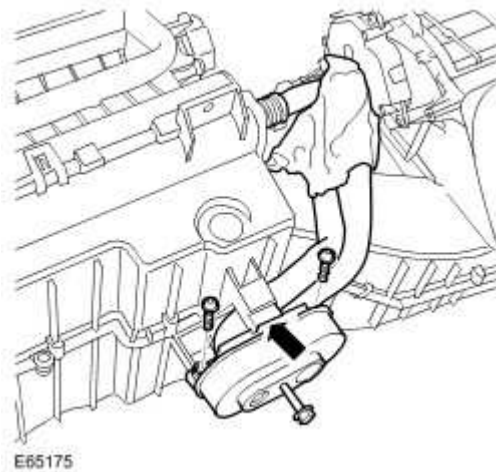
Raise and support the vehicle.

- 3 . Remove the TXV assembly.
For additional information, refer to Thermostatic Expansion Valve (82.25.01)

- 4 .  **CAUTION: Always plug any open connections to prevent contamination.**

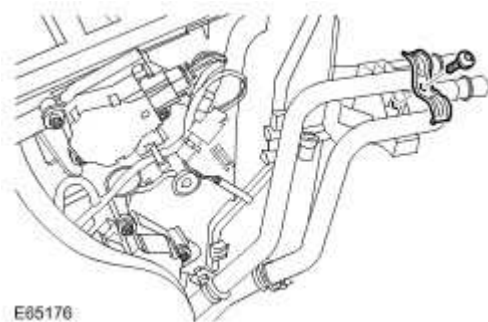
Remove the A/C pipes.

- ▶ Release the clamp.
- ▶ Remove the 2 screws.
- ▶ Release the clip.
- ▶ Release the foam pad and the upper section of the clamp.



5 . Remove the coolant pipe clamp.

▶ Remove the screw.



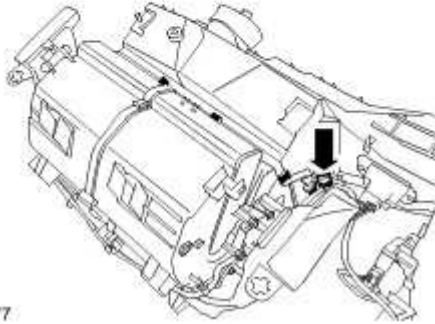
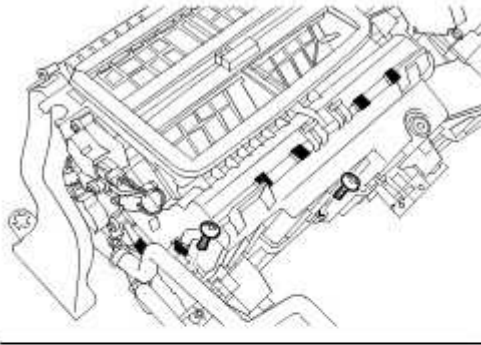
6 . Carefully separate the evaporator housing.

▶ Remove the 4 screws.

▶ Remove the 10 clips.

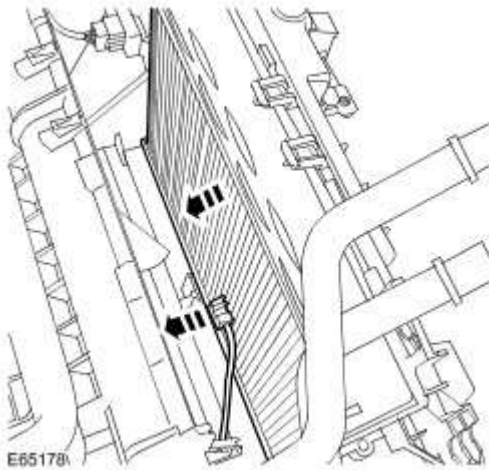
▶ Release the blower motor harness clip.

▶ Release the 2 evaporator housing clips.



7 . Remove the evaporator core.

► Carefully remove the evaporator core temperature sensor.



Installation

1 . **NOTE:**

Make sure all components are clean.

Install the evaporator core.

- ▶ Carefully install the evaporator core temperature sensor.

2



CAUTION: Make sure the evaporator temperature sensor harness does not become trapped.

Install the evaporator housing cover.

- ▶ Install the clips.

- ▶ Install the screws.

3 . Install the coolant pipe clamp.

- ▶ Install the screw.

4 . Install the A/C pipes.

- ▶ Install the foam pad.

- ▶ Install the clamp.

- ▶ Install the screws.

5 . Install the TXV assembly.

For additional information, refer to Thermostatic Expansion Valve (82.25.01)

6 . Connect the battery ground cable and install the cover.

For additional information, refer to

Pressure Cutoff Switch (82.10.32)

Removal

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

2 . Recover the A/C refrigerant.

3 . Remove the engine cover.

For additional information, refer to Engine Cover (76.11.35)

4 . Remove the air intake duct.

▶ Remove the bolt.

▶ Release the 2 clips.



5



CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Remove the pressure cutoff switch.

▶ Disconnect the electrical connector.

▶ Remove and discard the O-ring seal.



Installation

1 . NOTE:

Lubricate the O-ring seals with clean refrigerant oil.

Install the pressure cutoff switch.

- ▶ Clean the components.
- ▶ Install a new O-ring seal.
- ▶ Tighten the cutoff switch to 10 Nm (7 lb.ft).
- ▶ Connect the electrical connector.

2 . Install the air intake duct.

- ▶ Tighten the clips.
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).

3 . Recharge the A/C system.

4 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to

Thermostatic Expansion Valve (82.25.01)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to

2



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the heater and evaporator core housing.

For additional information, refer to Heater Core and Evaporator Core Housing (82.25.21)

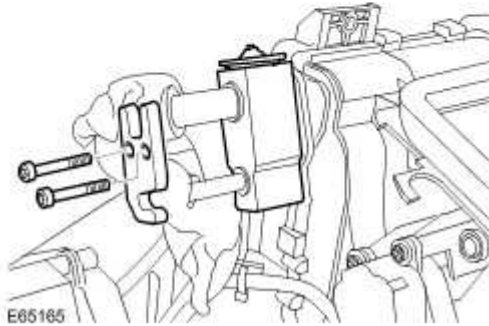
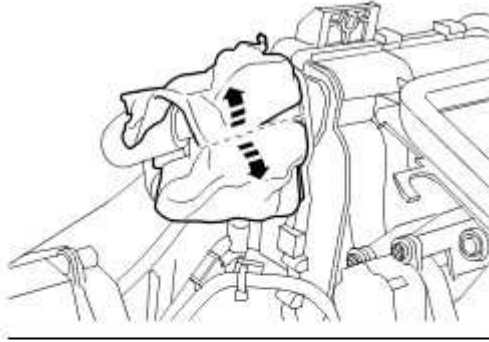
4 .



- **CAUTION: Always plug any open connections to prevent contamination.**

Remove the TXV assembly.

- ▶ Carefully cut and release the insulation for access.
- ▶ Remove the 2 Allen bolts.
- ▶ Remove and discard the 4 O-ring seals.



Installation

1.



CAUTION: Lubricate the new seals with clean refrigerant oil.

NOTE:

Make sure all component mating faces are clean.

Install the TXV assembly.

- ▶ Install the new O-ring seals.
- ▶ Install and tighten the Allen bolts to 6 Nm (4 lb.ft).
- ▶ Replace the TXV insulation.

2 . Install the heater and evaporator core housing.

For additional information, refer to Heater Core and Evaporator Core Housing (82.25.21)

- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to

412-04 : Control Components

Specifications

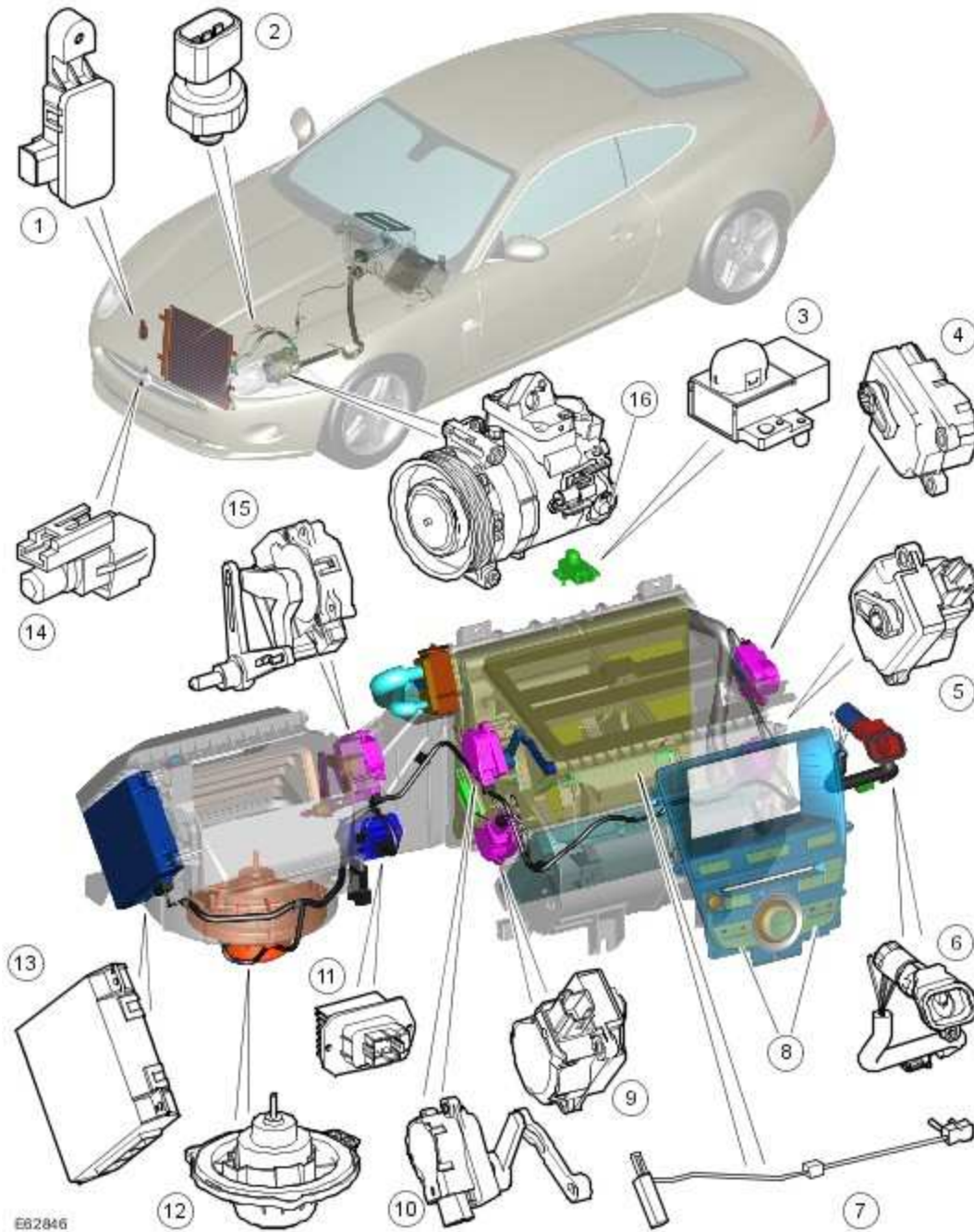
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Climate control module and audio/cd module assembly to instrument panel - bolt	3	-	27
Climate control and audio/cd modules to assembly bracket - bolt	3	-	27
Climate control and audio/cd modules to assembly bracket - screw	2.5	-	22

Control Components

COMPONENT LOCATION



Item	Part Number	Description
1		Pollution sensor (if fitted)

2		Refrigerant pressure sensor
3		Sunload/Light sensor
4		Windshield distribution (defrost) stepper motor
5		Right-Hand (RH) temperature blend stepper motor
6		Cabin humidity and temperature sensor
7		Evaporator temperature sensor
8		Control switches
9		Left-Hand (LH) temperature blend stepper motor
10		Face/feet distribution stepper motor
11		Blower motor control module
12		Blower motor
13		Automatic Temperature Control (ATC) module
14		Ambient air temperature sensor
15		Air intake servo motor
16		Air Conditioning (A/C) compressor solenoid valve

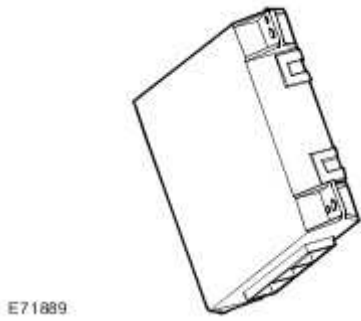
INTRODUCTION

The ATC (automatic temperature control) module controls the A/C (air conditioning) system and the heating and ventilation system to regulate the temperature, volume, and distribution of air into the cabin.

The system is a fully automatic dual zone system capable of maintaining individual temperature levels selected for the LH (left-hand) and RH (right-hand) sides of the cabin. Manual overrides for the system include intake air source, blower speed and air distribution. These selections can be made using either the Touch Screen Display (TSD) or the control switches located below the TSD.

For information on how to operate the A/C (air conditioning) system and the heating and ventilation system, refer to the Owner's Handbook.

AUTOMATIC TEMPERATURE CONTROL MODULE



The ATC (automatic temperature control) module is mounted on the end of the blower motor casing, behind the instrument panel. The ATC (automatic temperature control) module processes inputs from the TSD, the control switches located below the TSD, and the system sensors. In response to these inputs, the ATC (automatic temperature control) module outputs control signals to the A/C (air conditioning) system and the heating and ventilation system.

In addition to controlling the A/C (air conditioning) system and the heating and ventilation system, the ATC (automatic temperature control) module also controls the following:

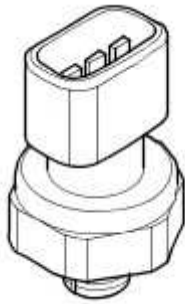
- The seat heaters. For additional information, refer to Seats (501-10 Seating)
- The rear window heater. For additional information, refer to Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms)
- The windshield heater. For additional information, refer to Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms)
- The exterior mirror heaters. For additional information, refer to Rear View Mirrors (501-09 Rear View Mirrors)
- The steering wheel heater (if fitted). For additional information, refer to Steering Column Switches (211-05 Steering Column Switches)

Two electrical connectors provide the interface between the ATC (automatic temperature control) module, and the vehicle wiring. The ATC (automatic temperature control) module uses hardwired inputs from the system sensors, the LIN (local interconnect network) bus to communicate with the stepper motors and the medium speed CAN (controller area network) bus to communicate with other control modules on the vehicle.

AIR CONDITIONING COMPRESSOR SOLENOID VALVE

The A/C (air conditioning) compressor solenoid valve is integral with the A/C (air conditioning) compressor. Operation of the solenoid valve is controlled by the ATC (automatic temperature control) module using a hardwired drive current of differing values. By controlling the flow of refrigerant through the compressor, the solenoid valve can control the A/C (air conditioning) system pressure and the evaporator operating temperature.

REFRIGERANT PRESSURE SENSOR



E43581

The refrigerant pressure sensor provides the ATC (automatic temperature control) module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.

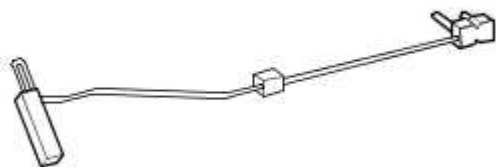
The ATC (automatic temperature control) module supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage, between 0 V and 5 V, related to system pressure.

The ATC (automatic temperature control) module uses the signal from the pressure sensor to protect the refrigerant system from extremes of pressure. The ATC (automatic temperature control) module transmits the A/C (air conditioning) pressure, along with the compressor drive current value, to the instrument cluster on the medium speed CAN (controller area network) bus. These signals are broadcast to the ECM (engine control module) on the high speed CAN (controller area network) bus to allow it to calculate the torque being applied to the engine by the compressor.

To protect the system from extremes of pressure, the ATC (automatic temperature control) module sets the A/C (air conditioning) compressor to the minimum flow position if the pressure:

- Decreases to 2.1 ± 0.2 bar (31.5 ± 3 lbf/in²); the ATC (automatic temperature control) module loads the A/C (air conditioning) compressor again when the pressure increases to 2.3 ± 0.2 bar (33.4 ± 3 lbf/in²)
- Increases to 31 ± 1 bar (450 ± 14.5 lbf/in²); the ATC (automatic temperature control) module loads the A/C (air conditioning) compressor again when the pressure decreases to 26 ± 1 bar (377 ± 14.5 lbf/in²)

EVAPORATOR TEMPERATURE SENSOR

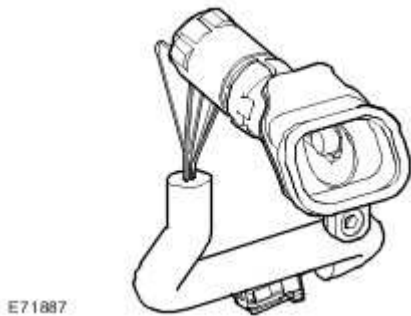


E71888

The evaporator temperature sensor is a NTC (negative temperature coefficient) thermistor that provides the ATC (automatic temperature control) module with a temperature signal from the downstream side of the evaporator. The evaporator temperature sensor is mounted directly onto the evaporator matrix fins.

The ATC (automatic temperature control) module uses the input from the evaporator temperature sensor to control the load of the A/C (air conditioning) compressor and thus the operating temperature of the evaporator.

CABIN HUMIDITY AND TEMPERATURE SENSOR

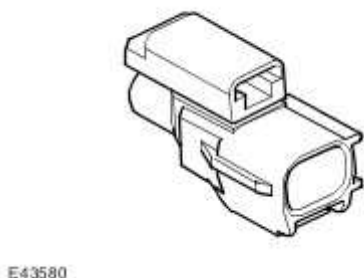


The cabin humidity and temperature sensor is installed behind a grill on the drivers side of the instrument panel. The temperature inside the cabin is measured by a NTC (negative temperature coefficient) thermistor. A motor within the sensor assembly draws cabin air in through the grill and over the thermistor. The motor is provided a battery voltage feed by a relay located within the CJB (central junction box) .

Humidity inside the cabin is measured by a sensor element made up of film capacitors on different substrates. The dielectric is a polymer which absorbs or releases water proportional to the relative humidity of the air being drawn through the sensor and thus changes the capacitance of the capacitor. For protection, the sensor element is contained in a nylon mesh cover.

Humidity within the cabin is controlled by raising and lowering the evaporator temperature. An increase in evaporator temperature increases the moisture content in the air entering the cabin. Lowering the evaporator temperature reduces the moisture content in the air entering the cabin.

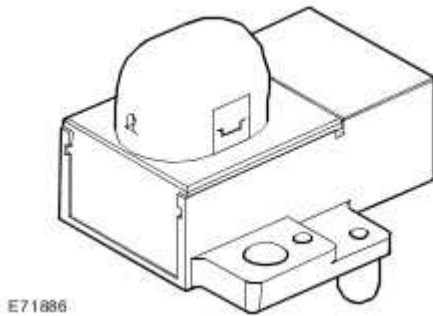
AMBIENT AIR TEMPERATURE SENSOR



The ambient air temperature sensor is a NTC (negative temperature coefficient) thermistor that

provides the ATC (automatic temperature control) module with an input of external air temperature. The sensor is hard wired to the ECM (engine control module) and its signal is transmitted to the instrument cluster on the high speed CAN (controller area network) bus. The instrument cluster acts as a gateway and transmits the ambient air temperature signal to the ATC (automatic temperature control) module on the medium speed CAN (controller area network) bus. The sensor is mounted on the vehicle center line behind the lower front grill, and can be accessed from underneath the vehicle.

SUNLOAD/LIGHT SENSOR



The sunload/light sensor consists of 2 photoelectric cells that provide the ATC (automatic temperature control) module with inputs of light intensity; one as sensed coming from the left of the vehicle and one as sensed coming from the right. The inputs are a measure of the solar heating effect on vehicle occupants, and are used by the ATC (automatic temperature control) module to adjust blower speed, temperature and distribution to improve comfort.

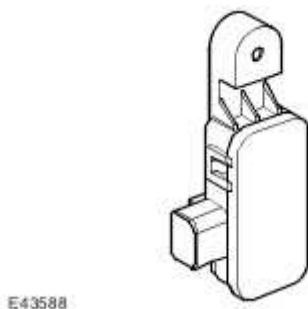
NOTE:

The solar sensor is also used as part of the Autolamp feature and also contains the active anti-theft alarm indicator LED (light emitting diode) . For additional information, refer to Exterior Lighting (417-01 Exterior Lighting)

For additional information, refer to Anti-Theft - Active (419-01 Anti-Theft - Active)

The sensor is installed in the center of the instrument panel upper surface and is powered by a 5 V feed from the instrument cluster.

POLLUTION SENSOR



Up to 2009 MY, a pollution sensor was installed only on Japanese specification vehicles. From 2009

MY, the pollution sensor is a standard fit in all markets.

The pollution sensor allows the ATC (automatic temperature control) module to monitor the ambient air for the level of hydrocarbons and oxidised gases such as nitrous oxides, sulphur oxides and carbon monoxide. The sensor is mounted in the RH (right-hand) front corner of the engine compartment.

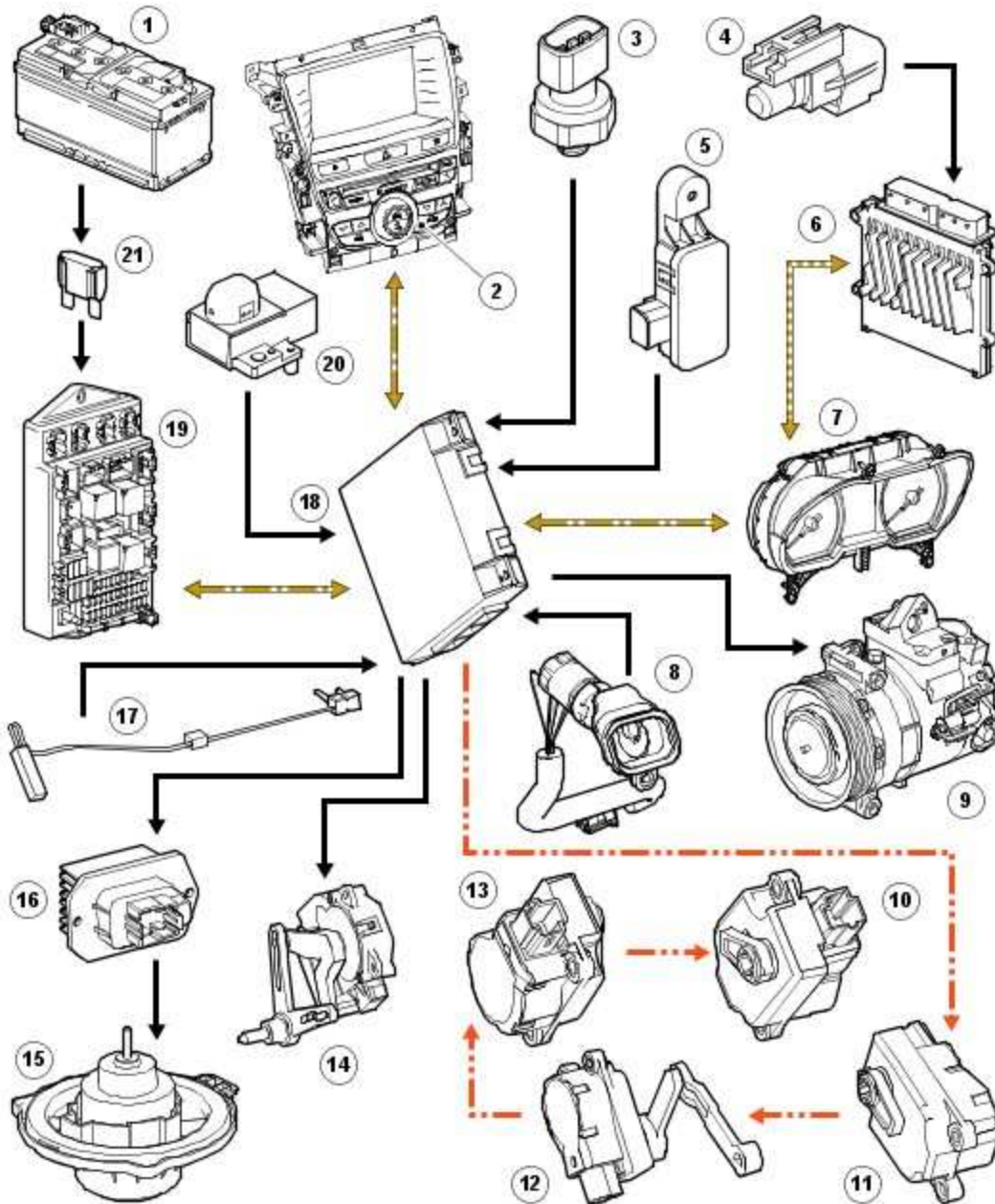
The pollution sensor is powered by an ignition controlled voltage feed from the CJB (central junction box) and provides the ATC (automatic temperature control) module with separate signals of hydrocarbon and oxidised gases. With a pollution sensor fitted, the ATC (automatic temperature control) module can control the air intake source to reduce the amount of contaminants entering the cabin. This function is fully automatic, but can be overridden by manual selection of the air source using the recirculation control switch below the TSD.

If there is a fault with the sensor, the ATC (automatic temperature control) module disables automatic operation of the recirculation door.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN (controller area network) bus; **O** = LIN (local interconnect network) bus



E62847



Item	Part Number	Description
1		Battery
2		Control switches
3		Refrigerant pressure sensor
4		Ambient air temperature sensor

5		Pollution sensor
6		Engine Control Module (ECM)
7		Instrument cluster
8		Cabin humidity and temperature sensor
9		A/C compressor solenoid
10		RH temperature blend stepper motor
11		Windshield distribution (defrost) stepper motor
12		Face/feet distribution stepper motor
13		LH temperature blend stepper motor
14		Air intake servo motor
15		Blower motor
16		Blower motor control module
17		Evaporator temperature sensor
18		ATC module
19		CJB
20		Sunload/Light sensor
21		Megafuse (175A)

PRINCIPLES OF OPERATION

Air Intake Control

The source of intake air is automatically controlled unless overridden by pressing the air recirculation switch located below the TSD. Under automatic control, the ATC (automatic temperature control) module determines the required position of the recirculation door from its 'comfort' algorithm and, if fitted, the pollution sensor.

The recirculation door is operated by an electric motor. The ATC (automatic temperature control) module provides analogue signals to the motor along a hardwired connection. A potentiometer in

the motor supplies the ATC (automatic temperature control) module with a position feedback signal for closed loop control.

Air Temperature Control

Cooled air from the evaporator enters the heater assembly, where temperature blend doors direct a proportion of the air through the heater core to produce the required output air temperature.

The 2 temperature blend doors operate independently to enable individual temperature settings for the left and right sides of the cabin. The temperature blend doors are operated by stepper motors, which are controlled by the ATC (automatic temperature control) module using LIN (local interconnect network) bus messages.

The ATC (automatic temperature control) module calculates the temperature blend stepper motor positions required to achieve the selected temperature and compares it against the current position. If there is any difference, the ATC (automatic temperature control) module signals the stepper motors to adopt the new position.

Air temperature is controlled automatically unless maximum heating (HI) or maximum cooling (LO) is selected. When maximum heating or cooling is selected, a 'comfort' algorithm in the ATC (automatic temperature control) module adopts an appropriate strategy for air distribution, blower speed, and air source.

Temperature control of one side of the cabin can be compromised by the other side of the cabin being set to a high level of heating or cooling. True maximum heating or cooling (displayed as 'HI' or 'LO' on the TSD) can only be selected from the driver's side temperature control button. If 'HI' or 'LO' is selected from the driver's side, the passenger side temperature will be automatically set to match the driver's side.

When economy mode is selected by pressing the 'Econ' TSD soft button, no cooling of the intake air will take place. The minimum output air temperature from the system will be ambient air temperature plus any heat pick up in the air intake path.

Blower Motor Control

Operation of the blower motor is controlled by the ATC (automatic temperature control) module. The ATC (automatic temperature control) module monitors a feedback voltage from the blower motor control module. In response to the feedback voltage, the ATC (automatic temperature control) module provides a drive signal back to the blower motor control module which is used to regulate the voltage flow across the blower motor and hence regulate blower speed. The blower motor is provided with a battery voltage feed from the blower motor relay, which is located within the auxiliary junction box.

When the A/C (air conditioning) system is in automatic mode, the ATC (automatic temperature control) module determines the blower speed required from its 'comfort' algorithm. When the A/C (air conditioning) system is in manual mode, the ATC (automatic temperature control) module operates the blower at the speed selected using either the rotary control switch or the '+/-' soft

buttons on the TSD.

The ATC (automatic temperature control) module also controls blower motor speed to compensate for the ram effect on intake air produced by forward movement of the vehicle. As vehicle speed, and consequently the ram effect increases, blower motor speed is reduced.

Air Distribution Control

Two air distribution doors are used to direct air into the cabin. The doors are operated by stepper motors, which are controlled by the ATC (automatic temperature control) module using LIN (local interconnect network) bus messages.

When the A/C (air conditioning) system is in automatic mode, the ATC (automatic temperature control) module automatically controls air distribution into the cabin in line with its 'comfort' algorithm. Automatic control is overridden if any of the TSD air distribution soft buttons are selected. Air distribution in the cabin will remain as selected until the 'Auto' switch is pressed or a different manual selection is made.

Programmed Defrost

When the 'DEF' button is pressed, the ATC (automatic temperature control) module instigates the programmed defrost function. When selected, the ATC (automatic temperature control) module configures the system as follows:

- Automatic mode off
- Selected temperature unchanged
- Air inlet set to fresh air
- Air distribution set to windshield
- Blower speed set to level 6
- Windshield and rear screen heaters on.

The programmed defrost function can be cancelled by one of the following:

- Selecting any air distribution switch on the TSD
- Pressing the 'AUTO' switch below the TSD
- A second press of the 'DEF' button
- Switching the ignition OFF

NOTE:

The blower speed can be adjusted without terminating the programmed defrost function.

A/C Compressor Control

When A/C (air conditioning) is selected ('Econ' off) the ATC (automatic temperature control) module maintains the evaporator at an operating temperature that varies with the cabin cooling requirements. If the requirement for cooled air decreases, the ATC (automatic temperature control) module raises the evaporator operating temperature by reducing the flow of refrigerant provided by

the A/C (air conditioning) compressor.

NOTE:

The ATC (automatic temperature control) module closely controls the rate of temperature increase to avoid introducing moisture into the cabin.

If the requirement for cooled air increases, the ATC (automatic temperature control) module lowers the evaporator operating temperature by increasing the flow of refrigerant provided by the A/C (air conditioning) compressor.

When economy mode is selected by pressing the 'Econ' TSD soft button, the compressor current signal supplied by the ATC (automatic temperature control) module holds the A/C (air conditioning) compressor solenoid valve in the minimum flow position, effectively switching off the A/C (air conditioning) function.

The ATC (automatic temperature control) module incorporates limits for the operating pressure of the refrigerant system. When the system approaches the high pressure limit the compressor current signal is progressively reduced until the system pressure decreases. When the system pressure falls below the low pressure limit the compressor current signal is held at its lowest setting so that the A/C (air conditioning) compressor is maintained at its minimum stroke. This avoids depletion of the lubricant from the A/C (air conditioning) compressor.

A/C Compressor Torque

The ATC (automatic temperature control) module transmits refrigerant pressure and A/C (air conditioning) compressor current values to the ECM (engine control module) over the medium speed then high speed CAN (controller area network) bus, using the instrument cluster as a gateway. The ECM (engine control module) uses these values to calculate the torque being used to drive the A/C (air conditioning) compressor. The ECM (engine control module) compares the calculated value with its allowable value and if necessary forces the ATC (automatic temperature control) module to inhibit the A/C (air conditioning) compressor by transmitting the 'ACClutchInhibit' CAN (controller area network) message. This forces the ATC (automatic temperature control) module to reduce the drive current to the A/C (air conditioning) compressor solenoid valve, which reduces refrigerant flow. This in turn reduces the torque required to drive the A/C (air conditioning) compressor.

By reducing the maximum A/C (air conditioning) compressor torque, the ECM (engine control module) is able to reduce the load on the engine when it needs to maintain vehicle performance or cooling system integrity.

Cooling Fan Control

The ATC (automatic temperature control) module determines the amount of condenser cooling required from the refrigerant pressure sensor, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is broadcast to the ECM (engine control module) on the medium speed CAN (controller area network) bus. The ECM (engine control module) then controls the temperature of the condenser using the cooling fan. For additional

information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

Windshield Heater

The ATC (automatic temperature control) module controls operation of the windshield heater using 2 relays in the power distribution box. When a request is made for windshield heater operation, the ATC (automatic temperature control) module broadcasts a message to the CJB (central junction box) on the medium speed CAN (controller area network) bus. On receipt of this message, the CJB (central junction box) energises the relays by providing a ground path for both relay coils. This allows a battery feed to flow across the relays to power the left and right heater elements.

NOTE:

Windshield heater operation is only enabled when the engine is running.

There are 2 modes of windshield heater operation; manual and automatic.

Manual operation is activated by pressing the windshield heater control switch. When the switch is pressed, the ATC (automatic temperature control) module illuminates a LED (light emitting diode) in the switch and powers the heater elements for 6.5 minutes.

The switch LED (light emitting diode) remains illuminated until the windshield heater switch is pressed a second time (to switch the system off), the heating phase is completed, or the engine stops. If the engine is re-started within 30 seconds the windshield heater resumes the previous heating phase.

There are 2 variants of automatic operation; automatic operation at the start of a journey and automatic operation during a journey.

Automatic operation at the start of a journey is initiated if the ambient air temperature is below 5 °C (41 °F) at the start of a journey. In this instance, the ATC (automatic temperature control) module will automatically power the windshield heater elements and illuminate the switch LED (light emitting diode) for 6.5 minutes. The windshield heater can be switched off during this period by pressing the control switch or stopping the engine.

Automatic operation during a journey is initiated when low ambient air temperatures are experienced and the vehicle has been travelling for a set period of time above a threshold speed. In this instance, no feedback is given to the driver to inform him the windshield heater is operational (the switch LED (light emitting diode) is not illuminated) and the duration of operation is variable depending upon the ambient air temperature, vehicle speed and the amount of time the vehicle has been travelling.

Rear Window Heater

The ATC (automatic temperature control) module controls operation of the rear window heater using a relay in the auxiliary junction box. When a request is made for rear window heater operation, the ATC (automatic temperature control) module broadcasts a message to the auxiliary junction box on the medium speed CAN (controller area network) bus. On receipt of this message, the auxiliary junction box energises the relay by providing a ground path for the relay coil. This allows a battery feed to flow across the relay to power the rear window heater element.

NOTE:

Rear window heater operation is only enabled when the engine is running.

There are 2 modes of rear window heater operation; manual and automatic.

Manual operation is activated by pressing the rear window heater control switch. When the switch is pressed, the ATC (automatic temperature control) module illuminates a LED (light emitting diode) in the switch and powers the heater element for 21 minutes.

The switch LED (light emitting diode) remains illuminated until the rear window heater switch is pressed a second time (to switch the system off), the heating phase is completed, or the engine stops. If the engine is re-started within 30 seconds the rear window heater resumes the previous heating phase.

There are 2 variants of automatic operation; automatic operation at the start of a journey and automatic operation during a journey.

Automatic operation at the start of a journey is initiated if the ambient air temperature is below 5 °C (41 °F) at the start of a journey. In this instance, the ATC (automatic temperature control) module will automatically power the rear window heater element and illuminate the switch LED (light emitting diode) for 21 minutes. The rear window heater can be switched off during this period by pressing the control switch or stopping the engine.

Automatic operation during a journey is initiated when low ambient air temperatures are experienced and the vehicle has been travelling for a set period of time above a threshold speed. In this instance, no feedback is given to the driver to inform him the rear window heater is operational (the switch LED (light emitting diode) is not illuminated) and the duration of operation is variable depending upon the ambient air temperature, vehicle speed and the amount of time the vehicle has been travelling.

Exterior Mirror Heaters

Exterior mirror heater operation is determined by ambient air temperature and windshield wiper status. When ambient air temperature reaches a pre-determined level, the ATC (automatic temperature control) module broadcasts an exterior mirror heating request to the door modules over the medium speed CAN (controller area network) bus. On receipt of this message, the door

modules provide feed and ground connections to both exterior mirror heater elements.

NOTE:

Operation of the exterior mirror heaters is fully automatic and not controllable by the driver.

The amount of time the exterior mirror heaters are operational increases if the windshield wipers are switched on. This ensures the mirrors remain mist free in damp and wet conditions, where there is an increased risk of misting.

Seat Heaters

There are 4 seat heater settings available; Off, 1, 2 or 3, which can be set through the TSD. The heat setting is relayed to the vehicle occupants through a graduated display on the TSD.

Operation of the heated seats is controlled by the ATC (automatic temperature control) module. When the ATC (automatic temperature control) module receives a heating request from the TSD, it broadcasts a message to the CJB (central junction box) over the medium speed CAN (controller area network) bus. The CJB (central junction box) then provides a hardwired 12 V supply to the 3 heater elements contained within each seat. The 3 heater elements, 2 in the seat cushion and 1 in the seat squab, are wired in series.

The ATC (automatic temperature control) module monitors seat temperature using a temperature sensor located in each seat cushion. The CJB (central junction box) provides the temperature sensors with a 5 V supply. The level of the returned voltage back to the CJB (central junction box) is proportional to the seat temperature. The value of the return signal is broadcast to the ATC (automatic temperature control) module over the medium speed CAN (controller area network) bus which it then converts into a temperature value to allow it to control seat temperature to the required level.

The ATC (automatic temperature control) module will suspend or disable operation of the seat heaters if any of the following occur:

- Battery voltage exceeds 16.5 ± 0.3 V for more than 5 seconds. Seat heating is re-enabled when battery voltage decreases to 16.2 ± 0.3 V
- If a short or open circuit is detected
- If the seat heat temperature rises significantly above the target temperature setting.

The graduated display on the TSD remains illuminated until the seat heaters are turned off or the engine stops. If the engine is restarted within 30 seconds the seat heater resumes the previous heating level.

Steering Wheel Heater

The steering wheel heater has 1 heat setting and can be turned on and off by pressing the soft button located on the seat heater TSD screen. The on/off status of the steering wheel heater is relayed to the vehicle occupants through the TSD. When the ignition is switched off, the heater will

reset to off.

Power for the heater element is supplied by the CJB (central junction box) on receipt of a request from the ATC (automatic temperature control) module over the medium speed CAN (controller area network) bus. Temperature control for the heater element is provided by the steering wheel heater control module which receives a temperature feedback signal from a NTC (negative temperature coefficient) thermistor located within the steering wheel.

Control Components

Principle of Operation

For a detailed description of the climate control system, refer to the relevant Description and Operation section in the workshop manual.

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Refrigerant• Heater control flaps• Ducting	<ul style="list-style-type: none">• Fuse(s)• Harness• Electrical connectors• Switch(s)

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B105A01	Aspirator fan fault	<ul style="list-style-type: none"> Aspirator fan circuit - short to ground, open circuit Aspirator fan component fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A5911	Recirculation servo motor actuator - sensor 5 volt supply	<ul style="list-style-type: none"> Sensor 5 volt supply - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A5913	Air conditioning pressure sensor - sensor 5 volt supply	<ul style="list-style-type: none"> Air conditioning pressure sensor 5 volt supply - open circuit 	Refer to electrical circuit diagrams and test air conditioning pressure sensor circuit for open circuit
B1A6111	In car temperature sensor circuit - short to ground	<ul style="list-style-type: none"> In car temperature sensor circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
B1A6115	In car temperature sensor circuit - short to power, open circuit	<ul style="list-style-type: none"> In car temperature sensor circuit - short to power, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A6211	Air conditioning pressure sensor - short to ground	<ul style="list-style-type: none"> Air conditioning pressure sensor circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A6215	Air conditioning pressure sensor - short to power, open circuit	<ul style="list-style-type: none"> Air conditioning pressure sensor circuit - short to power, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A6311	Right hand sun load sensor - short to ground	<ul style="list-style-type: none"> Right hand sun load sensor circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A6411	Left hand sun load sensor - short to ground	<ul style="list-style-type: none"> Left hand sun load sensor circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A6713	Vehicle sensor ground - open circuit	<ul style="list-style-type: none"> Vehicle sensor ground - open circuit 	Refer to electrical circuit diagrams and test vehicle sensor ground circuit for open circuit
B1A6901	Humidity sensor fault	<ul style="list-style-type: none"> Humidity sensor circuit - short to power, ground, open circuit Sensor component fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A7001	Compressor fault	<ul style="list-style-type: none"> Over current detection 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A9815	Stepper motor actuator LIN Bus fault, or power	<ul style="list-style-type: none"> No response from ALL steppers for 20 seconds - LIN 	Refer to electrical circuit diagrams and test stepper motor actuator LIN Bus for

	supply - open circuit	network fault	open circuit
B1B6013	Recirculation servo motor actuator - sensor 5 volt supply	<ul style="list-style-type: none"> • Sensor 5 volt supply - open circuit 	Refer to electrical circuit diagrams and test sensor 5 volt supply for open circuit
B1B6111	Pollution sensor HC input - short to ground	<ul style="list-style-type: none"> • Pollution sensor HC input - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B6211	Pollution sensor Nox input - short to ground	<ul style="list-style-type: none"> • Pollution sensor Nox input - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B6313	Recirculation servo motor actuator - ground circuit	<ul style="list-style-type: none"> • Recirculation servo motor actuator ground - open circuit 	Refer to electrical circuit diagrams and test recirculation servo motor actuator ground for open circuit
B1B6711	Recirculation servo potentiometer - short to ground	<ul style="list-style-type: none"> • Recirculation servo potentiometer circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B6715	Recirculation servo potentiometer - short to power, open circuit	<ul style="list-style-type: none"> • Recirculation servo potentiometer circuit - short to power, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B6801	Recirculation servo motor fault	<ul style="list-style-type: none"> • Recirculation servo potentiometer circuit - short to power, ground, open circuit • Recirculation door/linkage broken 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7111	Evaporator temperature sensor - short to ground	<ul style="list-style-type: none"> • Evaporator temperature sensor circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system


B1B7115	Evaporator temperature sensor - short to power, open circuit	<ul style="list-style-type: none"> Evaporator temperature sensor circuit - short to power, open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7211	Stepper motor actuator LIN Bus power supply - short to ground	<ul style="list-style-type: none"> Stepper motor actuator LIN Bus power supply - short to ground 	Refer to electrical circuit diagrams and test stepper motor actuator LIN Bus power supply for short to ground
B1B7400	Defrost stepper motor actuator fault	<ul style="list-style-type: none"> Internal or external fault - under/over voltage 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7449	Defrost stepper motor actuator fault	<ul style="list-style-type: none"> Internal electronic fault - motor over temperature 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7500	Panel/foot stepper motor actuator fault	<ul style="list-style-type: none"> Internal or external fault - under/over voltage 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7549	Panel/foot stepper motor actuator fault	<ul style="list-style-type: none"> Internal electronic fault - motor over temperature 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7600	Front left air blend stepper motor actuator fault	<ul style="list-style-type: none"> Internal or external fault - under/over voltage 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7649	Front left air blend stepper motor actuator fault	<ul style="list-style-type: none"> Internal electronic fault - motor over temperature 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7700	Front right air blend stepper motor actuator fault	<ul style="list-style-type: none"> Internal or external fault - under/over voltage 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B1B7749	Front right air blend stepper motor actuator fault	<ul style="list-style-type: none"> Internal electronic fault - motor over temperature 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B7884	Air conditioning system under pressure	<ul style="list-style-type: none"> Signal below allowable range System leak Incorrect refrigerant charge weight 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check system for leaks. Charge system with correct weight of refrigerant
B1B7885	Air conditioning system over pressure	<ul style="list-style-type: none"> Signal above allowable range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U001088	Medium speed CAN communication	<ul style="list-style-type: none"> Bus off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the climate control module, refer to the new module installation note at the top of the DTC Index
U1A1449	Failed to initialise CAN	<ul style="list-style-type: none"> Internal electronic failure 	Install a new climate control module, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the climate control module, refer to the new module installation note

			at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check climate control module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index

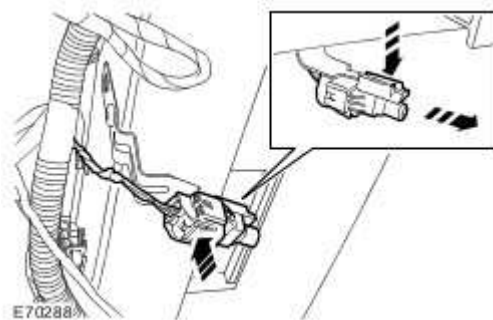
Ambient Air Temperature Sensor (82.20.02)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the radiator splash shield.
For additional information, refer to Radiator Splash Shield (76.22.90)
- 3 . Remove the ambient air temperature sensor.
 - ▶ Disconnect the electrical connector.
 - ▶ Carefully release the clip.



Installation

- 1 . Install the ambient air temperature sensor.

▶ Secure the clip.

▶ Connect the electrical connector.

2 . Install the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

Removal

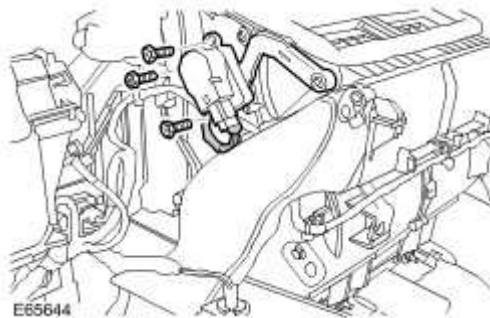
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)

3 . NOTE:

Note the relationship between the servo motor drive and the vent flap.

Remove the servo motor assembly.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 3 screws.



Installation

- 1 . Install the servo motor assembly.
 - ▶ Align the servo motor drive.
 - ▶ Install the screws.
 - ▶ Connect the electrical connector.

2 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to

Defrost Vent/Register Blend Door Actuator RH

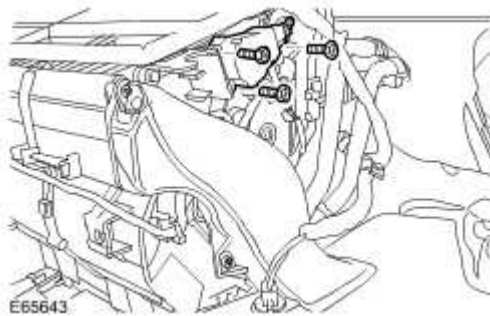
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)
- 3 . **NOTE:**

Note the relationship between the servo motor drive and the vent flap.


Remove the servo motor assembly.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 3 screws.



Installation

- 1 . Install the servo motor assembly.
 - ▶ Align the servo motor drive.
 - ▶ Install the screws.

 Connect the electrical connector.

2 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

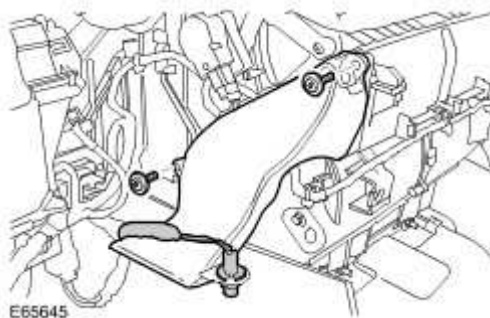
3 . Connect the battery ground cable and install the cover.

For additional information, refer to

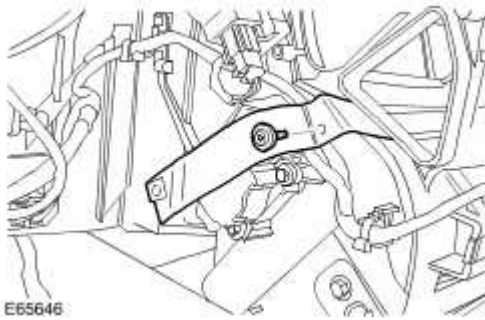
Footwell Vent/Duct Blend Door Actuator LH

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)
- 3 . Remove the LH side footwell heater duct.
 - ▶ Release the lampholder.
 - ▶ Remove the 2 screws.



- 4 . Remove the support bracket.
 - ▶ Remove the screw.

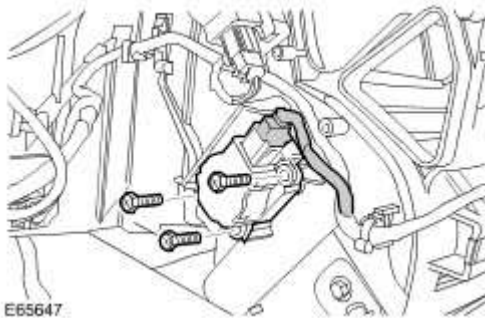


5 . NOTE:

Note the relationship between the servo motor drive and the vent flap.

Remove the servo motor assembly.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 3 screws.




Installation


1 . Install the servo motor assembly.

- ▶ Align the servo motor drive.
- ▶ Install the screws.
- ▶ Connect the electrical connector.

2 . Install the support bracket.

 Install the screw.

3 . Install the LH side footwell heater duct.

 Install the screws.

4 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

5 . Connect the battery ground cable and install the cover.

For additional information, refer to

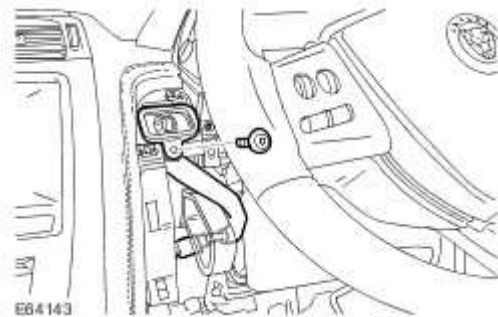
In-Vehicle Temperature Sensor (82.20.03)

Removal

- 1 . Remove the instrument panel, lower trim panel.
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

- 2 . Remove the in-vehicle temperature sensor.

- ▶ Remove the Torx screw.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the in-vehicle temperature sensor.

- ▶ Position the electrical harness.
- ▶ Connect and secure the electrical connector.
- ▶ Install the Torx screw.

- 2 . Install the instrument panel, lower trim panel.
For additional information, refer to Instrument Panel Lower Trim Panel (76.46.11)

Recirculation Blend Door Actuator (82.20.67)

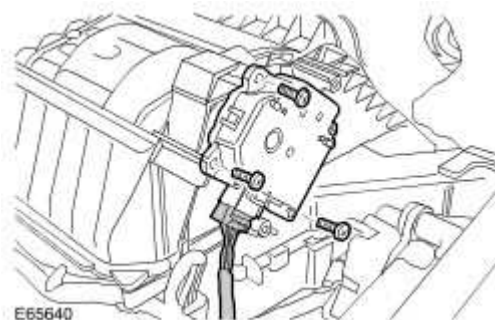
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)
- 3 . **NOTE:**

Note the relationship between the servo motor drive and the vent flap.


Remove the servo motor assembly.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 3 screws.



Installation

- 1 . Install the servo motor assembly.
 - ▶ Align the servo motor drive.
 - ▶ Install the screws.

 Connect the electrical connector.

2 . Install the instrument panel.

For additional information, refer to Instrument Panel (76.46.01)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to

Sunload Sensor (82.20.70)

Removal

1

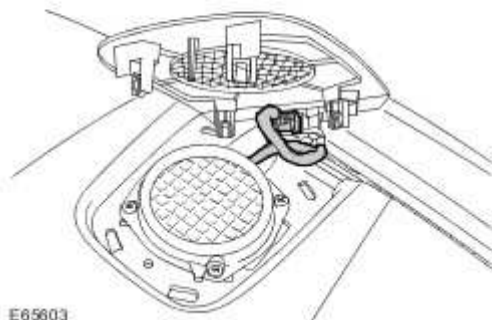
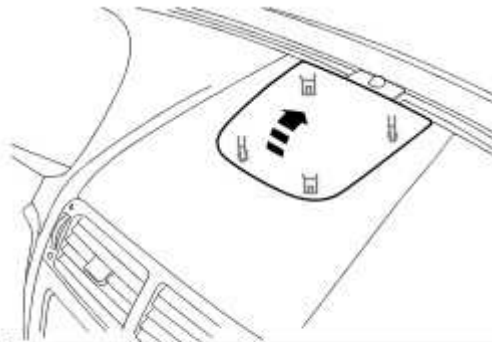


CAUTION: Protect the surrounding trim from damage when changing the component.

Remove the center speaker grille.

▶ Carefully release the 4 clips.

▶ Disconnect the electrical connector.



2 . Remove the sunload sensor.

▶ Remove the 2 screws.



Installation

1 . Install the sunload sensor.

▶ Install the screws.

2 . Install the center speaker grille.

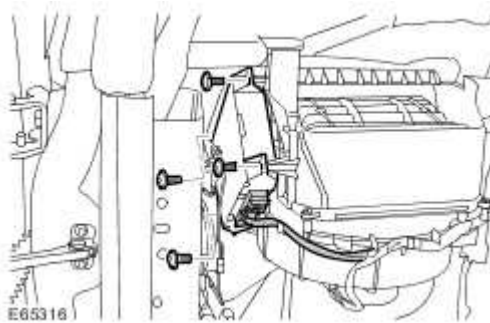
▶ Connect the electrical connector.

▶ Secure the clips.

Climate Control Module

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)
- 3 . Remove the A/C control module.
 - ▶ Remove the 4 Torx screws.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the A/C control module.
 - ▶ Install the Torx screws.
 - ▶ Connect the electrical connector.
- 2 . Install the instrument panel.
For additional information, refer to Instrument Panel (76.46.01)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to

4 . Connect WDS to the vehicle and configure a new module.

Climate Control Assembly (82.20.07)

Removal

NOTE:

Removal of this component is part of the audio removal procedure.

- 1 . Disconnect the battery ground cable.
- 2 . Remove the audio unit.
For additional information, refer to Audio Unit (86.50.03)

Installation

- 1 . Install the audio unit.
For additional information, refer to Audio Unit (86.50.03)
- 2 . Connect the battery ground cable.

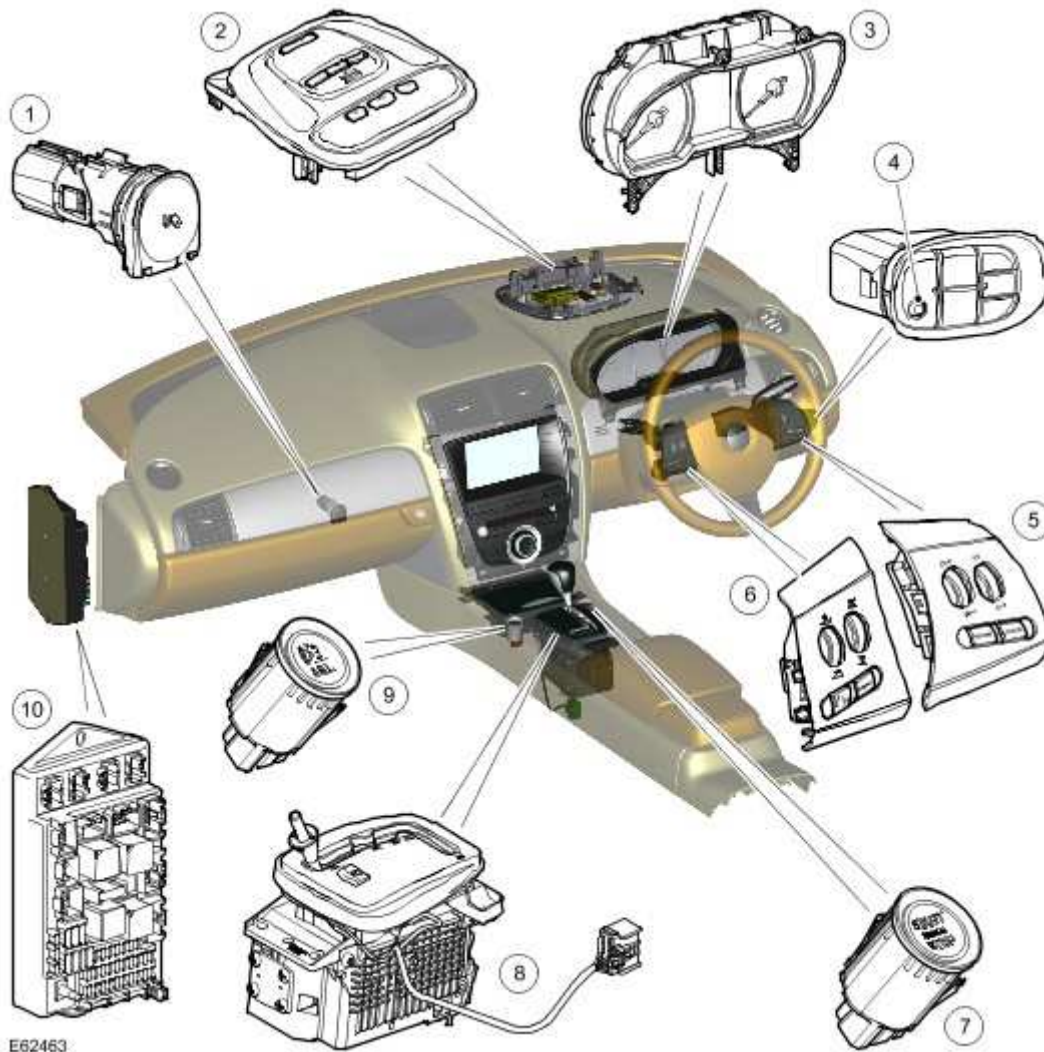
413 : Instrumentation and Warning Systems

413-00 : Instrumentation Cluster and Panel Illumination

Description and operation

Instrument Cluster and Panel Illumination

COMPONENT LOCATION



Item	Part Number	Description
------	-------------	-------------

1		Accessory power socket
2		Overhead console
3		Instrument cluster
4		Illumination switch
5		Right-Hand (RH) steering column multifunction switch
6		Left-Hand (LH) steering column multifunction switch
7		Start/stop switch
8		Gear shift module
9		Automatic speed limiter switch
10		Central Junction Box (CJB)

INTRODUCTION

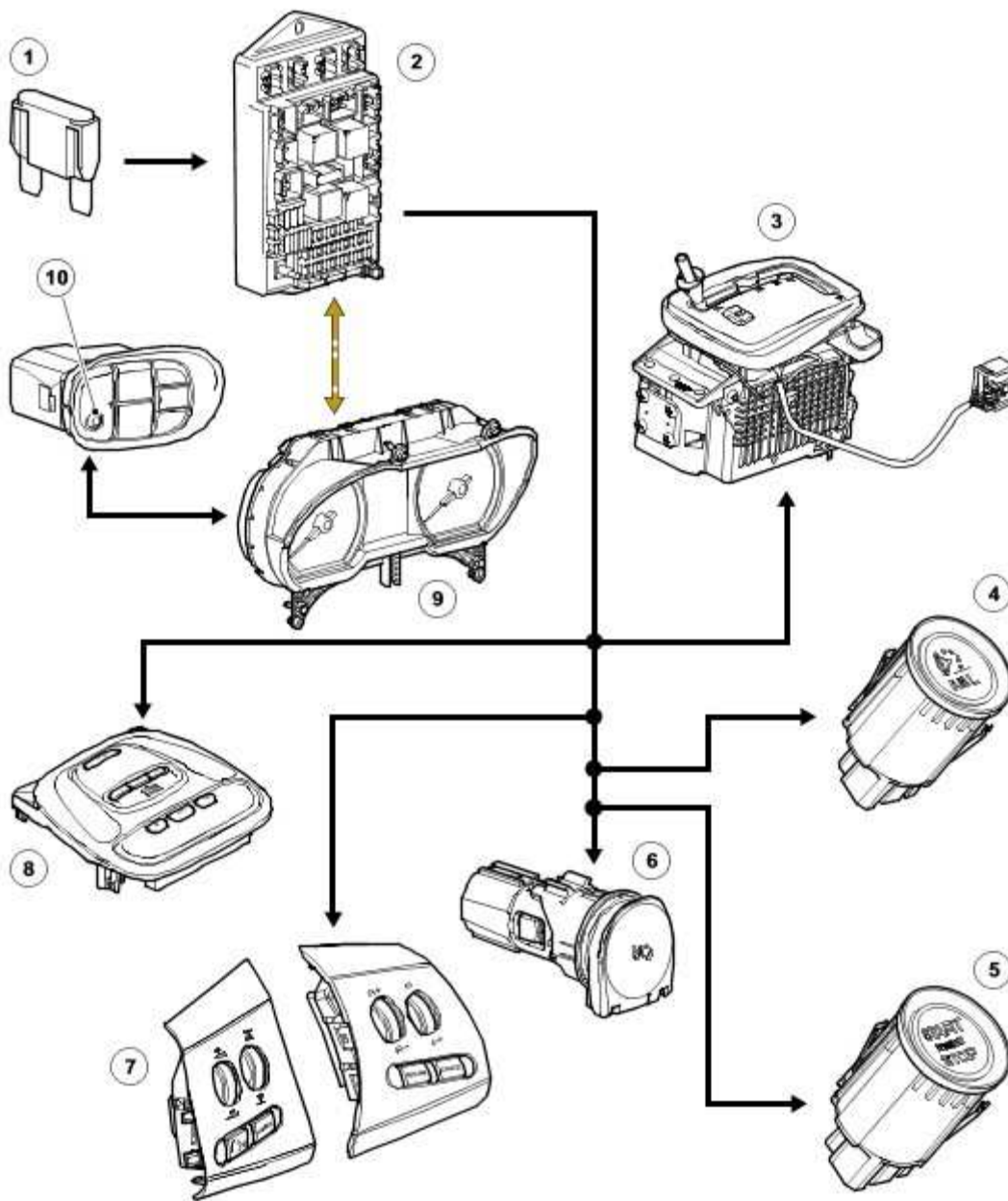
Instrument cluster and panel illumination is achieved through a series of Light Emitting Diodes (LED's) located throughout the interior of the vehicle. The intensity of illumination can be controlled by the driver through a rotary control located on the lower drivers side of the instrument panel. The rotary control is integral with the auxiliary lighting switch.

The rotary control is a variable resistor which is used as a potential divider to provide a high or low voltage according to its set position. The voltage returned to the instrument cluster is converted into a dimmer control positional message and transmitted to the CJB over the medium speed Controller Area Network (CAN) bus. The CJB converts the illumination intensity message into a Pulse Width Modulation (PWM) signal which it supplies to the instrument panel and switch illumination LED.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **N** = Medium speed CAN bus



E62464



Item	Part Number	Description
1		Megafuse (175A)
2		CJB
3		Gear shift module
4		Automatic speed limiter switch

5		Start/stop switch
6		Accessory power socket
7		Steering column multifunction switches
8		Overhead console
9		Instrument cluster
10		Illumination switch

Instrument Cluster and Panel Illumination

Principle of Operation

For a detailed description of the Instrument Cluster and Panel Illumination, refer to the relevant Description and Operation section in the workshop manual.

Instrument Cluster and Panel Illumination

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical	Electrical
<ul style="list-style-type: none">• Fluid level(s)• Accessory installations	<ul style="list-style-type: none">• Bulbs(s)• Fuse(s)• Wiring harness• Electrical connector(s)• Engine compartment components• Underbody components• Instrument cluster• Dimmer switch• Headlamp switch• Autolamp sensor

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

413-01 Instrumentation Cluster

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Instrument cluster surround - screw	1	-	9
Instrument cluster - screw	1.5	-	13

Instrument Cluster

COMPONENT LOCATION



E63299

Item	Part Number	Description
1		Speedometer
2		Message center
3		Tachometer

INTRODUCTION

The instrument cluster is located in the instrument panel, above the steering column. The instrument cluster comprises analogue gauges, an Liquid Crystal Display (LCD) message center to provide vehicle operation details to the driver and a number of indicator lamps to display system status.

The message center is a LCD located in a central position in the cluster. The message center displays system status information including fuel quantity remaining.

The instrument cluster also functions as an intelligent controller for a number of other vehicle systems, for example column adjust positions, steering column multifunction switch inputs, steering Servotronic control.

The instrument cluster is the gateway for the high speed and medium speed Controller Area Network (CAN) and is also connected to the Local Interconnect Network (LIN) bus to the start control unit and the steering wheel module.

ANALOGUE GAGES

Speedometer

The speedometer is located on the Left Hand (LH) side of the cluster and is available in three market variants:

- major scale Miles Per Hour (MPH), minor scale kilometers per hour (km/h)
- major scale km/h, minor scale MPH
- major scale km/h only.

The speedometer is driven by high speed CAN signals transmitted by the Anti-lock Brake System (ABS) module. The wheel speeds are measured by sensors reading the rotational speed of the rear wheels from toothed targets on the hubs. An average of the two wheel speeds are passed from the sensors to the ABS module in the form of pulsed signals. The ABS module converts these signals into a speed output on the high speed CAN to the instrument cluster.

The same speed outputs from the wheel speed sensors are also used to calculate the distance the vehicle has travelled.

Tachometer

The tachometer is located on the Right Hand (RH) side of the instrument cluster and displays engine speeds up to 8000 Revolutions Per Minute (RPM) on naturally aspirated models and 7000 RPM on supercharged models.

The tachometer is driven by an engine speed signal transmitted on the high speed CAN from the Engine Control Module (ECM). The signal is derived from the Crankshaft Position (CKP) sensor. The signal is received by the instrument cluster microprocessor and the output from the microprocessor drives the tachometer.

LCD DISPLAY

In the area above and below the message center is a LCD display. The area below the message center displays a linear fuel gage, odometer, trip distance and trip computer readouts. The area above the message center displays the transmission gear position information and speed control related information.

NOTE:

There is no engine coolant temperature gage displayed. If the engine coolant temperature increases to above a predetermined threshold, a warning message is displayed in the message center. The message is sent from the ECM in a high speed CAN message to the instrument cluster.

Fuel Gage

The linear fuel gage has a colored bar which moves left or right depending on the tank contents. As the bar moves to the left the fuel tank contents displayed is decreasing. A warning message is displayed in the message center when the fuel tank contents fall to below the reserve level.

The fuel gage is controlled by CAN messages from the Auxiliary Junction Box (AJB). The AJB reads the values output by the fuel level sensors every 131 ms and transmits a fuel tank contents value, corrected for battery voltage, in a CAN message to the instrument cluster.

A fuel pump symbol is displayed to the left of the linear gage. An arrow above the symbol shows the driver on which side of the vehicle the fuel filler cap is located.

Above the linear fuel gage, is a LCD area which displays odometer and trip readouts. When a trip computer function is selected, these are replaced by a trip computer display for the trip function selected.

Transmission Gear Position Display

The gear position display shows selector lever position or selected gear when using the 'Jaguar Sequential Shift'.

The gear selector module transmits a CAN message to the instrument cluster for gear selector lever position. The module also outputs a 'not in park' signal to the instrument cluster.

The Transmission Control Module (TCM) transmits a high speed CAN message to the instrument cluster with data containing the selected gear when in Jaguar Sequential Shift mode.

Message Center

The message center displays system status and warning messages to the driver. For additional information, refer to Information and Message Center (413-08 Information and Message Center)

WARNING INDICATORS



Item	Part Number	Description
1		Anti-lock Braking System (ABS) indicator (USA only)
2		ABS indicator - (Canada/Mexico)
3		ABS indicator - (Rest of World (ROW))
4		Adaptive speed control indicator
5		Adaptive Front lighting System (AFS) indicator
6		Malfunction Indicator Lamp (MIL)
7		Tire Pressure Monitoring System (TPMS) indicator
8		Airbag indicator
9		Front fog lamp indicator
10		RH turn signal indicator
11		Rear fog lamp indicator
12		Dynamic Stability Control (DSC) indicator
13		High beam indicator
14		Side lamp indicator
15		Seat belt indicator

16		Message center
17		Automatic speed limiter
18		Forward alert indicator
19		Brake indicator (USA only)
20		Brake indicator (ROW)
21		LH turn signal indicator

The warning indicators are located in various positions in the instrument cluster. The indicators can be split into two groups; instrument cluster controlled and externally controlled.

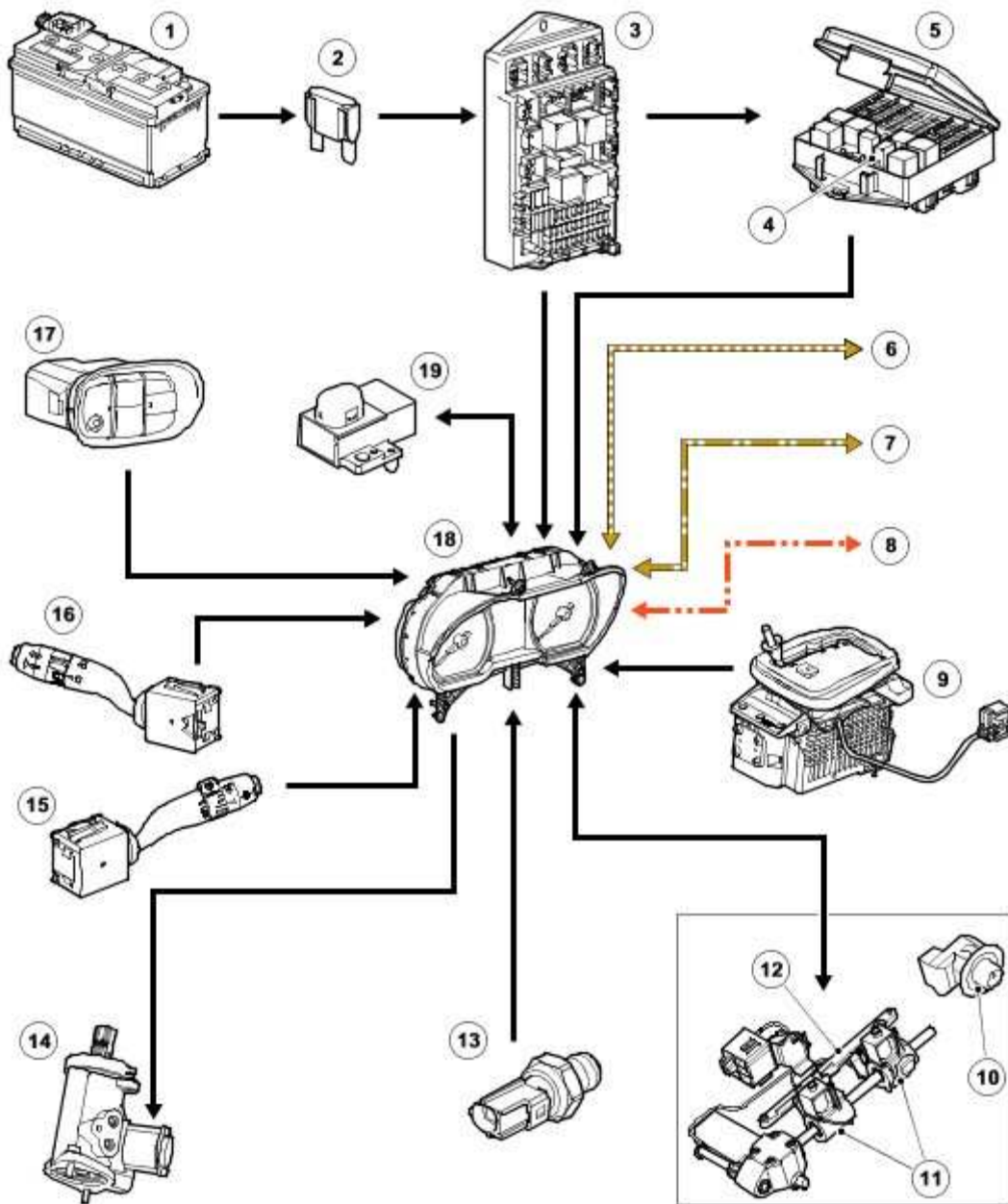
Instrument cluster controlled warning indicators are dependant on software logic within the instrument cluster for activation. The cluster software controls the indicator illumination check at ignition on.

Externally controlled indicators are supplied with current from another vehicle system control module or illuminated by the instrument cluster software on receipt of a bus message from another vehicle sub-system. The indicator illumination check at ignition on is also controlled by the sub-system module on these indicators.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus



E63300



Item	Part Number	Description
1		Battery
2		Megafuse (175 A)
3		Central Junction Box (CJB)
4		Ignition relay

5		Power distribution box
6		High speed CAN bus to other vehicle systems
7		Medium speed CAN bus to other vehicle systems
8		LIN bus to start control module and steering wheel module
9		Gear selector module
10		Column adjustment switch
11		Column reach and rake adjustment motors
12		Column position potentiometer
13		Oil pressure sensor
14		Steering gear Servotronic valve
15		Steering column RH multifunction switch
16		Steering column LH multifunction switch
17		Auxiliary lighting switch
18		Instrument cluster
19		Light sensor (with integral alarm Light Emitting Diode (LED))

PRINCIPLES OF OPERATION

Warning Indicator Functionality



E74038

Item	Part Number	Description
1		LH turn signal
2		RH turn signal
3		Brake warning
4		Forward alert
5		Automatic speed limiter
6		Adaptive speed control
7		ABS warning
8		AFS warning
9		MIL
10		TPMS warning
11		Airbag warning
12		Front fog lamps
13		DSC warning
14		Seat belt warning

15		Side lamp warning
16		High beam
17		Rear fog lamps

The functionality for each of the above warning indicators is described in the following section.

1 and 2. Turn Signal Indicators

The turn signal indicators are controlled by the Central Junction Box (CJB) on receipt of medium speed CAN signals from the instrument cluster.

The instrument cluster outputs a voltage to the turn signal indicator switch. The switch contains resistors of different values. When the switch is operated in either the LH or RH direction, the voltage is passed to a ground connection in the instrument cluster which detects the reduced voltage supplied via the resistors. When the turn signal indicator switch is operated in the LH or RH direction, the instrument cluster detects the ground voltage and determines whether a LH or RH selection is made.

The instrument cluster transmits a medium speed CAN message to the CJB for operation of the applicable turn signal indicators. The message can contain a number of states for each possible switch position and also an out of range low and high state for circuit faults and an initial value for the switch neutral position. The turn signal indicators are not subject to the 3 second indicator check when the ignition is switched on.

The AJB software controls the flash rate of the warning indicator which sends 'ON' and 'OFF' signals to the instrument cluster which flashes the indicators in a green color. During normal operation, the warning indicator flashes slowly, accompanied simultaneously by a sound from the instrument cluster sounder. If a fault exists, the CJB transmits a message to the instrument cluster which responds by flashing the warning indicator and operating the sounder at double speed to indicate a bulb failure and also displays an appropriate message and vehicle graphic in the message center.

The hazard warning indicators are controlled by the CJB on receipt of a completed ground path from the hazard warning indicator switch. The CJB outputs a medium speed CAN message to the instrument cluster which operates both the LH and RH turn signal indicators simultaneously. The hazard warning indicators can operate with the ignition switched off, therefore the CAN message from the CJB will also carry a 'wake-up' message for the instrument cluster.

3. Brake Warning Indicator

This warning indicator is displayed in a red or amber color (dependant on market) as a brake symbol in all markets except USA which have the word 'BRAKE' in addition to the symbol. The indicator is controlled by high speed CAN messages from the ABS module and the parking brake control module. The indicator is illuminated in a red color for a 3 second indicator check when the ignition is switched on.

The ABS module monitors the fluid level in the brake fluid reservoir using a level switch. If the fluid level falls to below a determined level, the switch contact is broken and the ABS module detects the low fluid level condition. The ABS module issues a CAN message which is received by the instrument cluster which illuminates the warning indicator and displays the message 'BRAKE FLUID LOW' in the message center. The warning indicator can also be illuminated by the ABS module if an Electronic Brake Distribution (EBD) fault is detected.

NOTE:

If both the brake warning indicator and the ABS warning indicator illuminate simultaneously, a major fault in the brake system will have occurred.

The warning indicator also displays parking brake status. When the parking brake is applied, the warning indicator will be illuminated by the instrument cluster and, if the vehicle is moving, the message 'PARK BRAKE APPLIED' will be also displayed in the message center in response to a CAN message from the parking brake control module.

If a condition exists where the parking brake cannot be applied, the parking brake control module issues a CAN message to the instrument cluster which illuminates or flashes (dependant on market) the warning lamp on and off and is accompanied with a message 'CANNOT APPLY PARK BRAKE'. If a fault occurs in the parking brake system, the parking brake control module issues a CAN message to the instrument cluster which illuminates the warning indicator and displays the message 'PARK BRAKE FAULT' in the message center.

4. Forward Alert Indicator

The forward alert system uses the components of the adaptive speed control system to alert the driver of the presence of a vehicle ahead. The system can be turned on and off using a switch located in the auxiliary lighting switch when the adaptive speed control system is off. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

The forward alert system is controlled by the adaptive speed control module. When the switch is pressed, the forward alert system is activated and the adaptive speed control module issues a forward alert active message on the high speed CAN bus to the instrument cluster. The forward alert icon in the instrument cluster will illuminate in an amber color and a 'FORWARD ALERT' message will be displayed in the message center. When the button is pressed a second time, the module issues a forward alert off CAN message. The forward alert system will be deactivated, the forward alert icon will go off and a message 'FORWARD ALERT OFF' will be displayed in the message center.

5. Automatic Speed Limiter (ASL) Indicator

The ASL is controlled by the ECM. An ASL switch is located in the floor console, adjacent to the gear selector lever. When the ASL switch is pressed, this is sensed by the ECM which issues a high speed CAN message to the instrument cluster. The instrument cluster illuminates the ASL warning indicator in an amber color to show the driver that ASL is active. The driver sets the required speed using the speed control SET +/- switches on the steering wheel. The selected speed is shown by the message '

LIMITER SET XXX MPH / K/MH' in the message center. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

ASL can be deselected by pressing the ASL switch, by depressing the throttle pedal initiating kick-down or by pressing the 'cancel' switch on the steering wheel. The ASL indicator will go off and the message center will display the message 'limiter cancelled' for 4 seconds.

If a fault occurs in the ASL system, the ECM will send a message to the instrument cluster to illuminate the ASL indicator and display the message 'LIMITER NOT AVAILABLE'.

6. Adaptive Speed Control Indicator

The adaptive speed control system is controlled by the adaptive speed control module. Operation of the SET +/- switches on the steering wheel will activate the system. Operation of the switches is detected by the adaptive speed control module. The module issues a high speed CAN message to the instrument cluster which illuminates the adaptive speed control indicator, when the system is in 'follow mode', in an amber color and displays a 'SETSPEED XXX MPH / KM/H' message in the message center. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

7. Anti-lock Braking system (ABS) Warning Indicator

The ABS warning indicator is controlled by the ABS module. If a fault in the ABS system is detected by the ABS module, the module issues a high speed CAN message to the instrument cluster to illuminate the ABS warning indicator in an amber color and display the message 'ABS FAULT' in the instrument cluster. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on. If a fault is present when the ignition is on the bulb will remain illuminated after the 3 second indicator check period.

NOTE:

The 'ABS FAULT' message is not displayed in NAS markets.

NOTE:

If both the ABS warning indicator and the brake warning indicator illuminate simultaneously, a major fault in the brake system will have occurred.

On all vehicles except NAS, the ABS warning indicator is also used for parking brake faults. The indicator in these markets illuminates in an amber color and displays a brake symbol without the text 'ABS' in the icon.

On NAS vehicles, the ABS warning indicator is only used for ABS. The warning indicator has 'ABS' on the icon and will illuminate in an amber color for ABS faults only.

8. Adaptive Front light System (AFS) Warning Indicator

The AFS warning indicator is controlled by the AFS control module. The AFS warning indicator illuminates in an amber color if a fault in the AFS system is detected by the control module. If a fault in another system occurs which prevents AFS operation, the warning indicator will flash. The indicator is illuminated by the instrument cluster on receipt of a high speed CAN message from the AFS control module. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

9. Engine Malfunction Indicator Lamp (MIL)

The MIL warning indicator is controlled by the ECM and illuminated by the instrument cluster on receipt of a message on the high speed CAN bus from the Engine Control Module (ECM). The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

If the MIL remains illuminated after the engine is started or illuminates when driving, a fault is present and must be investigated at the earliest opportunity. Illumination of the MIL warning indicator alerts the driver to an On-Board Diagnostic (OBD) fault which will cause excessive emissions output. This may relate to either an engine management system fault or a transmission fault.

10. Tire Pressure Monitoring System (TPMS) Warning Indicator

The TPMS warning indicator is illuminated by the instrument cluster on receipt of a medium speed CAN message from the TPMS module. The indicator is illuminated in an amber color for a 3 second indicator check when the ignition is switched on.

If the indicator illuminates and is accompanied by the message 'TYRE PRESSURE SYSTEM FAULT' in the message center, then a TPMS fault has occurred. If the indicator illuminates and accompanied by a different message, then a low tire pressure has been detected, a spare wheel has been fitted or a TPMS sensor has failed.

11. Airbag Warning Indicator

The airbag warning indicator is controlled by the instrument cluster. The indicator is illuminated in an amber color for the 3 second indicator check when the ignition is switched on. The indicator remains illuminated after the 3 second period has expired until the instrument cluster receives a turn off message on the high speed CAN bus from the Restraints Control Module (RCM).

12. Front Fog Lamp Indicator

The green colored front fog lamp indicator is controlled by the CJB and illuminated by the instrument cluster on receipt of a front fog lamp on message on the medium speed CAN bus from the CJB. The indicator is illuminated for as long as the front fog lamps are active. The front fog lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

13. Dynamic Stability Control (DSC) Indicator

The DSC warning lamp is controlled by the ABS module and illuminated by the instrument cluster in response to messages received on the high speed CAN bus. The indicator is illuminated in an amber color for the 3 second indicator check when the ignition is switched on.

The DSC warning indicator, are permanently illuminated in an amber color if the instrument cluster receives a high speed CAN message from the ABS module relating to one of the following faults:

- Traction control fault
- Yaw control fault
- Engine drag torque control fault
- Panic Brake Assist (PBA) fault
- Signal missing relating to either traction control active, yaw control active or DSC switch input.

The above faults will also generate an applicable DSC and ABS warning message in the message center.

The DSC warning indicator will flash at 2 Hz for if the traction control or yaw control is active when the DSC system is enabled.

If the DSC system is switched off, the warning indicator will be permanently illuminated until the DSC system is subsequently re-activated.

14. Safety Belt Warning Indicator

The safety belt warning indicator operates for both the driver and passenger safety belts. The warning indicator is controlled by the RCM and illuminated by the instrument cluster on receipt of high speed CAN bus messages. The safety belt warning indicator is not subject to the 3 second indicator check when the ignition is switched on.

The operation of the passenger seat buckle switch is as described below with the exception that the instrument cluster must receive a hardwired signal from the belt minder control module to indicate that a passenger is occupying the seat.

The safety belt warning indicator is subject to a timer. The warning indicator is activated when the following conditions exist:

- Ignition is switched on
- One of the front seat belts is unbuckled
- USA market only - 75 seconds has elapsed after ignition on mode is selected
- Vehicle is not in reverse gear
- Vehicle speed is more than 8 km/h (5 mph).

Once the above parameters are met, the instrument cluster flashes the warning indicator at 2 Hz for 10 seconds accompanied by a simultaneous chime. After 10 seconds the chime ceases and the warning indicator is permanently illuminated for 20 seconds. This sequence is repeated every 30 seconds until one of the following events occurs:

- 300 seconds has elapsed
- The safety belt of the occupied front seats is fastened
- The ignition is switched to off mode

- The vehicle speed decreases to below 5 km/h (3 mph).

NOTE:

On USA market vehicles, the warning indicator is not permanently illuminated.

In certain markets the belt minder function can be enabled and disabled using the driver safety belt switch. For additional information, refer to Safety Belt System (501-20A Safety Belt System)

15. Side Lamp Indicator

The instrument cluster controls the green colored side lamp indicator on receipt of a side lamp status message on the medium speed CAN bus from the CJB and the AJB. The lighting switch on the Left Hand (LH) steering column multifunction switch is connected to the instrument cluster. Selections using this switch are detected by the cluster which requests the side or headlamp operation via a CAN message to the CJB and the AJB. The CJB and the AJB responds with a side lamp active message and the cluster illuminates the side lamp indicator. The side lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

16. High Beam Indicator

The instrument cluster controls the blue colored high beam indicator on receipt of a high beam status message on the medium speed CAN bus from the CJB. The lighting switch on the Left Hand (LH) steering column multifunction switch is connected to the instrument cluster. High beam or flash selections using this switch are detected by the cluster which requests the light operation via a CAN message to the CJB. The CJB responds with a high beam active message and the cluster illuminates the high beam indicator. The high beam indicator is not subject to the 3 second indicator check when the ignition is switched on.

17. Rear Fog Lamp Indicator

The amber colored rear fog lamp indicator is controlled by the AJB and illuminated by the instrument cluster on receipt of a rear fog lamp on message on the medium speed CAN bus from the AJB. The indicator is illuminated for as long as the rear fog lamps are active. The rear fog lamp indicator is not subject to the 3 second indicator check when the ignition is switched on.

Instrument Cluster

Principle of Operation

For a detailed description of the instrument cluster, refer to the relevant Description and Operation section in the workshop manual.

Instrument Cluster

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Fluid level(s) • Accessory installations 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harness • Electrical connector(s) • Instrument cluster • Central Junction Box (CJB) • Engine Junction Box (EJB) • Driver Door Module (DDM) • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for DTCs and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100811	Wiper mode switch	<ul style="list-style-type: none">• Circuit short to ground	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100815	Wiper mode switch	<ul style="list-style-type: none">• Circuit short to battery or open	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100951	Ignition authorisation	<ul style="list-style-type: none">• Faulty instrument cluster• Target SID re-synchronisation error following programming• CAN fault	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN

			communications between instrument cluster and tester
B100962	Ignition authorisation signal compare failure	<ul style="list-style-type: none"> • Low speed CAN fault • CJB fault • Instrument cluster fault • Incorrect module installed (CJB/Instrument cluster) • Target SID synchronisation error following re-programming • Noise/EMC related error 	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues
B100987	Ignition authorisation	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage <9V 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster. Check battery is fully charged and in serviceable condition, refer to the battery care manual
B104611	Front fog lamp control switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B104615	Front fog lamp control switch	<ul style="list-style-type: none"> • Circuit short to battery or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100A62	Fuel pump authorisation signal compare failure	<ul style="list-style-type: none"> • Low speed CAN fault • RJB fault • Instrument cluster fault • Incorrect module installed (RJB/Instrument cluster) • Write target SID synchronisation error following re-programming • Noise/EMC related error 	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues

B100A64	Fuel Pump authorisation	<ul style="list-style-type: none"> • Write target SID synchronisation error following re-programming • RJB fault • Low speed CAN fault 	Re-synchronise ID by re-configuring the RJB as a new module. Check ignition, power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster
B100A87	Fuel pump authorisation	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage < 9 volts 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster. Check battery is fully charged and in serviceable condition, refer to the battery care manual
B100B67	Column lock ground authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • RJB fault • Vehicle speed present when attempting to power steering column lock • Engine speed present when attempting to power steering column lock • Power mode status > four when attempting to perform lock action 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster. Check ABS, ECM and CJB for DTCs and refer to the relevant DTC Index
B100B87	Column lock ground authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • RJB fault 	Check power and ground supplies to RJB and instrument cluster. Check CAN network between RJB and instrument cluster
B100C67	Column lock supply authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • CJB fault • Vehicle speed present when attempting to power steering column lock • Engine speed present when attempting to power steering column lock • Power mode status > four when attempting to perform 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster. Check ABS, ECM and CJB for DTCs and refer to the relevant DTC Index

		lock action	
B100C87	Column lock supply authorisation	<ul style="list-style-type: none"> • Instrument cluster fault • Low speed CAN fault • CJB fault 	Check power and ground supplies to CJB and instrument cluster. Check CAN network between CJB and instrument cluster
B100D62	Column lock authorisation - signal compare failure	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Incorrect module installed (Steering column lock/Instrument cluster) • Target ID synchronisation error following re-programming • Noise/EMC related error 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Confirm the correct modules are installed. Re-synchronize ID by re-configuring the steering column lock as new. Check CAN network for interference/EMC related issues
B100D64	Column lock authorisation - signal plausibility failure	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault 	Check CAN network to steering column lock. Check power and ground supplies to steering column lock and instrument cluster
B100D87	Column lock authorisation - missing message	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Low voltage at steering column lock < 8V 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster
B100D96	Column lock authorisation	<ul style="list-style-type: none"> • CAN fault • Steering column lock fault • Instrument cluster fault • Low temperature < -30 ° • Low voltage at steering column lock < 8 volts • Restricted bolt movement 	Check CAN network between steering column lock and instrument cluster. Check power and ground supplies to steering column lock and instrument cluster. Check there is no torque applied to the steering column/wheel
B10A011	Wiper/washer switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
B10A015	Wiper/washer switch	<ul style="list-style-type: none"> • Circuit short to battery or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10A611	Main light switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10A615	Main light switch	<ul style="list-style-type: none"> • Circuit short to battery or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B115C7A	Transfer fuel pump	<ul style="list-style-type: none"> • Fluid leak or seal failure 	For fuel system tests. Fuel Tank and Lines
B1A8511	Ambient light sensor	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A8515	Ambient light sensor	<ul style="list-style-type: none"> • Circuit short to battery or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B0100	Key transponder - number of keys stored below minimum number required	<ul style="list-style-type: none"> • Operator only cycles one key during programming • Instrument cluster, start control unit or key loses power or circuit failure during programming • Faulty key • Unable to programme key due to noise/EMC related issues 	Ensure all keys to be programmed are available. Check power and ground supplies to all relevant modules. Replace faulty key. Check CAN network for noise/EMC related issues
B1B0105	Key transponder - start control unit already programmed	<ul style="list-style-type: none"> • Error following start control unit replacement • Start control unit fault • LIN fault • Instrument cluster fault 	Re-synchronize ID by re-configuring the start control unit as new module. Check power and ground supplies to start control unit and

			instrument cluster. Check LIN circuit between start control unit and instrument cluster
B1B0151	Key transponder - start control unit programming error	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Faulty key • Start control unit fault • Attempted to programme a non-default key 	Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster. Ensure new keys are from a known good source
B1B0155	Key transponder - transponder not programmed	<ul style="list-style-type: none"> • Un-programmed key inserted in start control unit • Non-default key inserted during key programming 	Confirm correct keys are being used
B1B0162	Key transponder - start control unit challenge response error	<ul style="list-style-type: none"> • Instrument cluster fault • Start control unit fault • Incorrect module installed (instrument cluster/start control unit) • Error during or following the write target SID routine • Noise/EMC related issues 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check power and ground supplies to start control unit and instrument cluster. Check correct modules are installed. Re-synchronize ID by re-configuring the start control unit as a new module. Check CAN network for interference/EMC related issues
B1B0164	Key transponder - transponder challenge response error	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Key fault • Start control unit fault • Error occurred during key programming 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster. Confirm correct key operation. Re-run key programming
B1B0167	Key transponder - start control unit	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Key fault • Start control unit fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

	invalid response	<ul style="list-style-type: none"> • Another key in close proximity • Attempted to programme a non default key • IPK Cold initialisation whilst in Ignition On state, without key being present in the SCU • Race condition caused by closing driver door and pressing start button within a small time window • Passive Key search function from last door closed and key inserted in the SCU 	<p>diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check ignition, power and ground supplies to start control unit and instrument cluster. Confirm correct key operation. Confirm single key operation. Ensure new keys are from a known good source. Check for intermittent power and ground at instrument cluster. Design condition - advise customer of correct starting sequence. Design condition - determine customer transponder key usage</p>
B1B0187	Key transponder - timer expired	<ul style="list-style-type: none"> • LIN fault • Instrument cluster fault • Start control unit fault 	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Check LIN circuit between start control unit and instrument cluster. Check power and ground supplies to start control unit and instrument cluster</p>
B1B3305	Target I.D. transfer - system programming failures	<ul style="list-style-type: none"> • CAN fault • ECM fault • Instrument cluster fault • ECM or instrument cluster incorrectly configured 	<p>Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Re-synchronise ID by re-configuring the instrument cluster as a new module</p>
B1B3362	Target I.D. transfer - signal compare failure	<ul style="list-style-type: none"> • CAN fault • ECM fault • Instrument cluster fault • Incorrect module installed (ECM/instrument cluster) • Synchronisation error following re-programming • Noise/EMC related error 	<p>Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check correct ECM and instrument cluster installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for</p>

			interference/EMC related issues
B1B3364	Target I.D. transfer - signal plausibility failure	<ul style="list-style-type: none"> • CAN fault • ECM fault • Instrument cluster fault • Steering column lock status incomplete • Race condition caused by closing driver door and pressing start button within a small time window 	Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check steering column lock operation. Design condition - advise customer of correct start sequence
B1B3387	Target I.D. transfer - missing message	<ul style="list-style-type: none"> • CAN fault • ECM fault • Instrument cluster fault • Low battery voltage 	Check CAN network between ECM and instrument cluster. Check ignition, power and grounds to ECM and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B1C3277	Steering column tilt solenoid	<ul style="list-style-type: none"> • Commanded position not reachable 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3294	Steering column tilt solenoid	<ul style="list-style-type: none"> • Unexpected operation 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3312	Steering column tilt feedback signal	<ul style="list-style-type: none"> • Circuit shorted to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3314	Steering column tilt feedback signal	<ul style="list-style-type: none"> • Circuit short to ground or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3477	Steering column telescope solenoid	<ul style="list-style-type: none"> • Commanded position not reachable 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B1C3494	Steering column telescope solenoid	<ul style="list-style-type: none"> • Unexpected operation 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3512	Steering column telescope feedback signal	<ul style="list-style-type: none"> • Circuit shorted to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3514	Steering column telescope feedback signal	<ul style="list-style-type: none"> • Circuit short to ground or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C3611	Steering column tilt/telescope switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C4811	Flash to pass switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C4815	Flash to pass switch	<ul style="list-style-type: none"> • Circuit short to power or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C5311	Front wiper intermittent data	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C5315	Front wiper intermittent data	<ul style="list-style-type: none"> • Circuit short to power or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D3611	Turn indicator switch	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B1D3615	Turn indicator switch	<ul style="list-style-type: none"> • Circuit short to power or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D3711	Wiper switch connection circuit	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D3715	Wiper switch connection circuit	<ul style="list-style-type: none"> • Circuit short to power or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C111064	Power steering calibration data	<ul style="list-style-type: none"> • Signal plausibility failure 	Using the manufacturer approved diagnostic system, re-configure the instrument cluster as new
P063511	Power steering control circuit	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P063512	Power steering control circuit	<ul style="list-style-type: none"> • Circuit short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P063513	Power steering control circuit	<ul style="list-style-type: none"> • Circuit open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P063522	Power steering control circuit	<ul style="list-style-type: none"> • First received speed value above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P063544	Power steering control circuit	<ul style="list-style-type: none"> • Internal Fault - Wrong reply from VAPS driver or NVM checksum error (after ~500ms) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

U000188	High speed CAN communication Bus	<ul style="list-style-type: none"> • Bus off, break in connection to bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U001088	Medium speed CAN communication Bus	<ul style="list-style-type: none"> • Bus off, break in connection to bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost communication with ECM	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010100	Lost communication with TCM	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010300	Lost communication with 'L' gate	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010400	Lost communication with speed control module	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012100	Lost communication with Anti-lock Brake System (ABS) control module	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012600	Lost communication with Passenger Seat Module (PSM)	<ul style="list-style-type: none"> • Missing message 	Check PSM for DTCs and refer to DTC Index. Seats
U012700	Lost communication	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using

	with Tire Pressure Monitor System (TPMS) module		the manufacturer approved diagnostic system
U012800	Lost communication with Parking Brake control module	<ul style="list-style-type: none"> Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U013900	Lost communication with adaptive damping control module	<ul style="list-style-type: none"> Missing message 	Check adaptive damping module for DTCs and refer to DTC Index. Vehicle Dynamic Suspension
U014000	Lost communication with CJB	<ul style="list-style-type: none"> Missing message 	Check CJB for DTCs and refer to DTC Index. Communications Network
U014200	Lost communication with RJB	<ul style="list-style-type: none"> Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015100	Lost communication with Supplemental Restraints System (SRS) module	<ul style="list-style-type: none"> Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015600	Lost communication with Information and Entertainment Module	<ul style="list-style-type: none"> Missing message 	Check information and entertainment module for DTCs and refer to DTC Index
U016400	Lost communication with climate control module	<ul style="list-style-type: none"> Missing message 	Check climate control module for DTCs and refer to DTC Index

U019900	Lost communication with Driver Door Module (DDM)	<ul style="list-style-type: none"> Missing message 	Check DDM for DTCs and refer to DTC Index
U020000	Lost communication with Passengers Door Module (PDM)	<ul style="list-style-type: none"> Missing message 	Check PDM for DTCs and refer to DTC Index
U020600	Lost communication with Convertible Top control module	<ul style="list-style-type: none"> Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost communication With Driver Seat Module (DSM)	<ul style="list-style-type: none"> Missing message 	Check DSM for DTCs and refer to DTC Index
U021400	Lost communication with Remote Keyless Entry Module	<ul style="list-style-type: none"> Missing message 	Check Remote Keyless Entry module for DTCs and refer to DTC Index
U024100	Lost communication with Active Front Lighting system	<ul style="list-style-type: none"> Missing message 	Check lighting control module for DTCs and refer to DTC Index
U025000	Lost communication with Pedestrian Protection system module	<ul style="list-style-type: none"> Missing message 	Check Pedestrian Protection system module for DTCs and refer to DTC Index
U025600	Lost communication with Integrated Control Panel	<ul style="list-style-type: none"> Missing message 	Check Integrated Control Panel for DTCs and refer to DTC Index

U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> RJB car configuration data is not compatible with the instrument cluster 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, suspect the instrument cluster. Refer to the new module installation note at the top of the DTC Index
U200411	Auxiliary switch pack	<ul style="list-style-type: none"> Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U200415	Auxiliary switch pack	<ul style="list-style-type: none"> Circuit short to power or open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300046	Control module	<ul style="list-style-type: none"> Calibration/parameter memory failure 	Install a new instrument cluster. Refer to the new module installation note at the top of the DTC Index
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new instrument cluster, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the instrument cluster, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check instrument cluster for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved

			diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300316	Battery voltage	<ul style="list-style-type: none"> Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300362	Battery voltage	<ul style="list-style-type: none"> Signal compare failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Instrument Cluster (88.20.01)

Removal

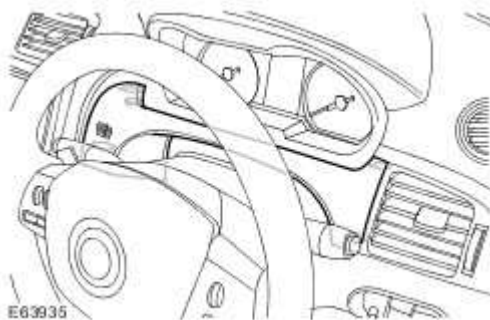
1 NOTE:

Make sure all smart keys are available before a new instrument cluster is installed.

If a new instrument cluster is being installed, all smart keys must be cleared from the passive anti-theft system (PATS), using the Jaguar approved diagnostic equipment prior to the instrument cluster removal.

2 . Remove the instrument panel driver's side reinforcement trim panel.

▶ Carefully release the 4 clips.



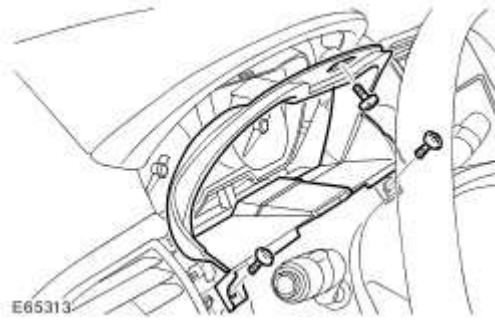
3



CAUTION: Protect the surrounding trim from damage when changing the component.

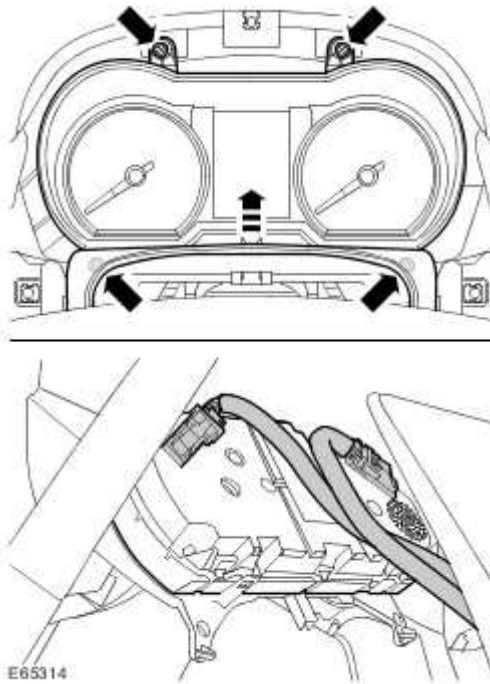
Remove the instrument cluster surround.

▶ Remove the 3 screws.



4 . Remove the instrument cluster.

- ▶ Raise the steering column finisher for access to the lower screws.
- ▶ Remove the 4 screws.
- ▶ Disconnect the 2 electrical connectors.



Installation

1 . Install the instrument cluster.

▶ Connect and secure the electrical connectors.

▶ Install the screws.

2 . Install the instrument cluster surround.

▶ Install the screws.

3 . Install the instrument panel driver's side reinforcement trim panel.

▶ Align the pegs and secure with the clips.

4 **NOTE:**

Make sure all smart keys are available before the new instrument cluster is installed.

Using the Jaguar approved diagnostic equipment, programme the new instrument cluster and reprogram all of the smart keys to the vehicle.

413-06 : Horn

Specifications

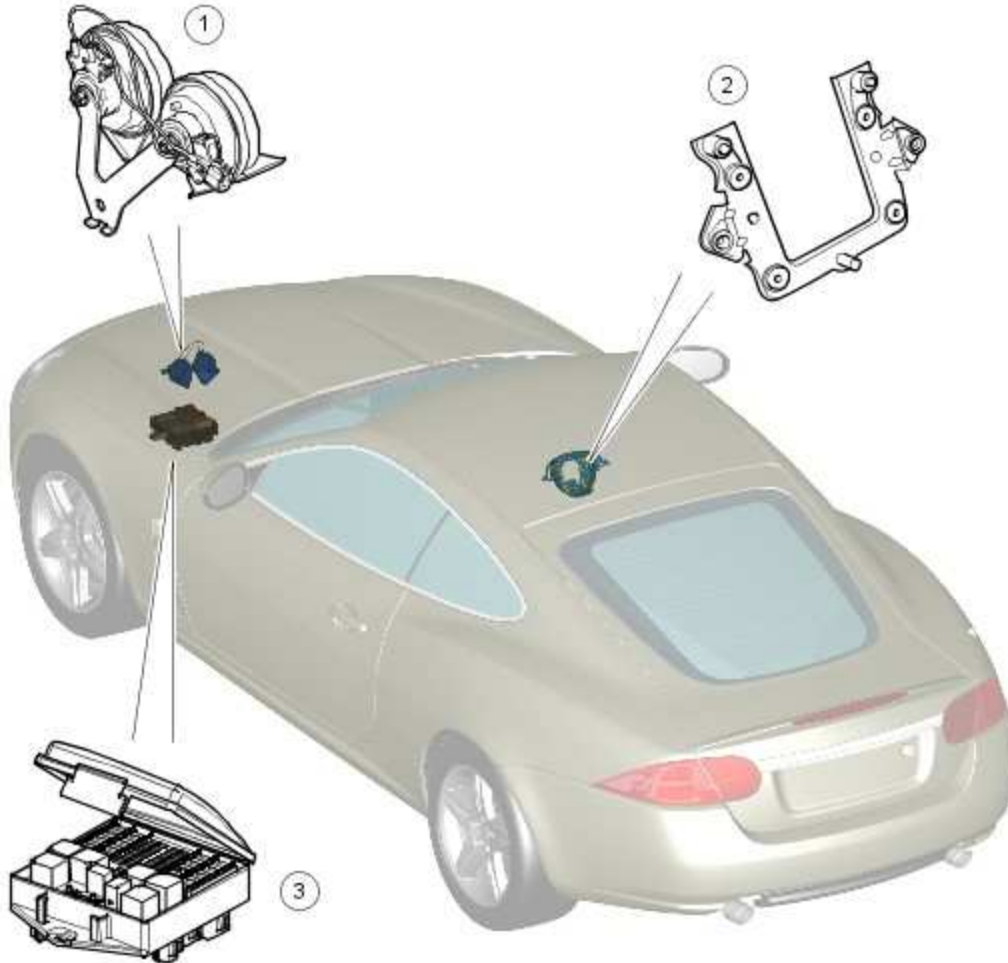
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Horn - stud	25	18	-

Horn

COMPONENT LOCATION



E62425

Item	Part Number	Description
1		Horns
2		Horn switch
3		Horn relay and fuse (15A)

INTRODUCTION

The vehicle horns are operated by pressing the center of the steering wheel. Two horns are fitted to the vehicle; a high tone horn and a low tone horn. Voltage supply to the horns is controlled by the horn relay, which is energised when the horn switch is pressed.

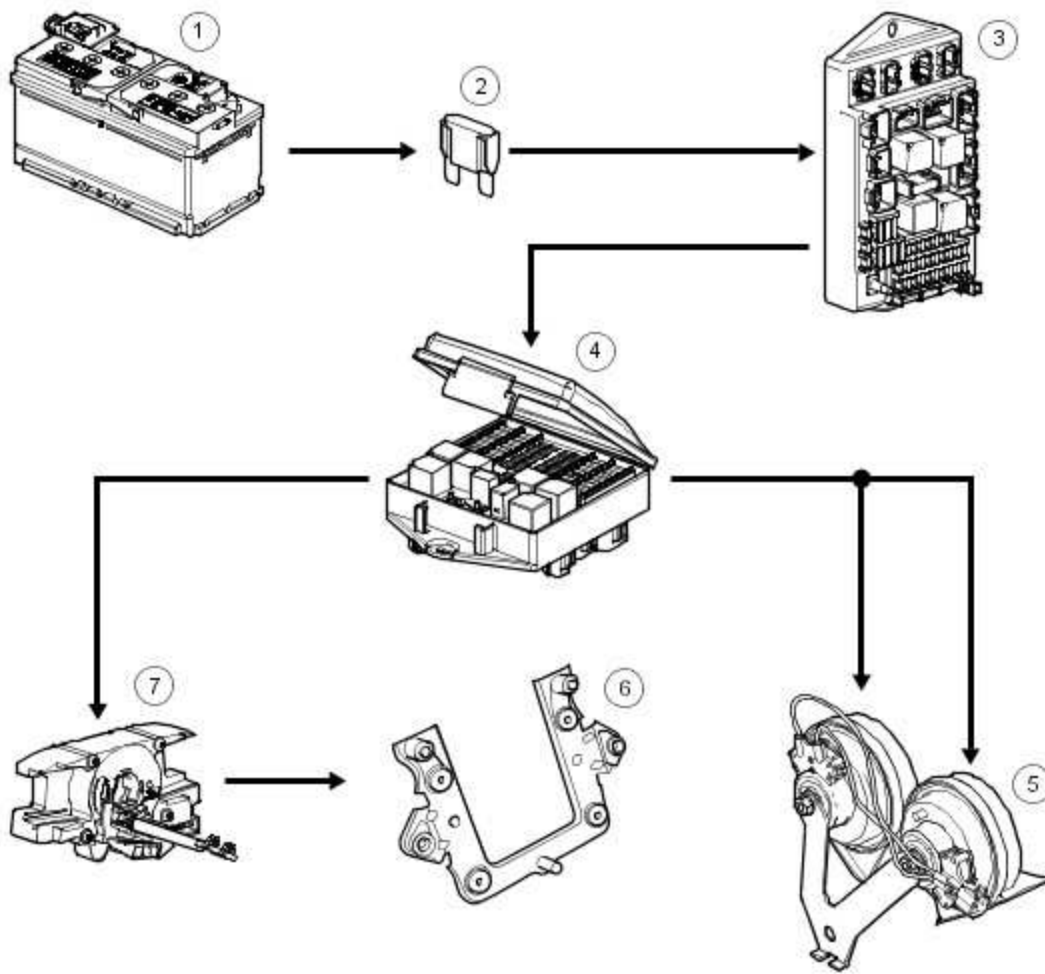
The horn relay is incorporated within the Battery Junction Box (BJB) and when energised provides a supply to both horns simultaneously. Circuit protection is provided by fuse 10 (15A), which is located in the BJB.

The horns are mounted on a bracket, which is secured to the center of the front bumper beam, and form part of the anti-theft system. For additional information, refer to Anti-Theft - Active (419-01A Anti-Theft - Active)

CONTROL DIAGRAM

NOTE:

A = Hardwired



E62428

A →

Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Central Junction Box (CJB)
4		Horn relay
5		Horns
6		Horn switch
7		Clock spring

Horn

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of electrical damage.

Visual Inspection Chart

Electrical
<ul style="list-style-type: none">• Fuse(s)• Wiring Harness• Electrical connector(s)• Horn(s)• Relay• Horn switch• Clockspring


- 1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 2 . If the cause is not visually evident, verify the symptom and refer to the Jaguar Approved Diagnostic System.

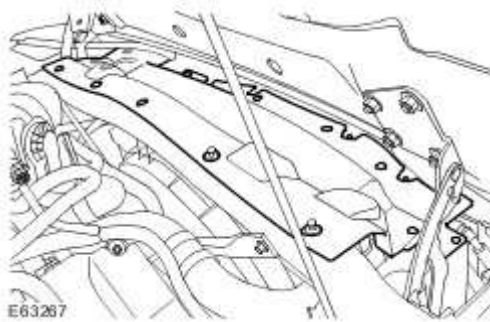
Horn (86.30.02)

Removal

Vehicles without supercharger

- 1 . Open the hood.
- 2 . Remove the fan cowl.

 Remove the 15 clips.



Vehicles with supercharger

3



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

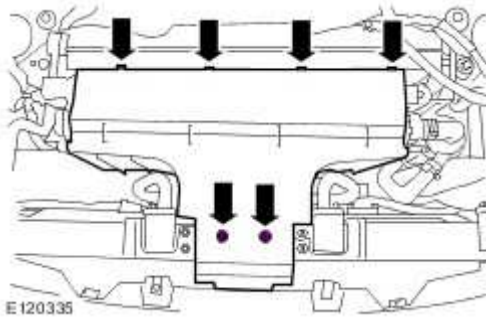
Raise and support the vehicle.

- 4 . Remove the radiator splash shield.
For additional information, refer to Radiator Splash Shield (76.22.90)

- 5 . Remove the radiator air deflector.

▶ Remove the 2 scrivenets.

▶ Release the 4 clips.



All vehicles

6 . NOTE:

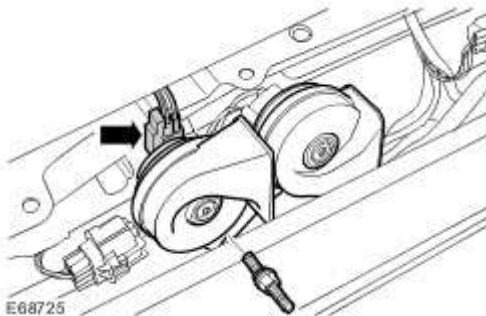
Note the fitted position.

Remove the horn assembly.

▶ Release the clip and position the wiring harness aside for access.

▶ Disconnect the electrical connector.

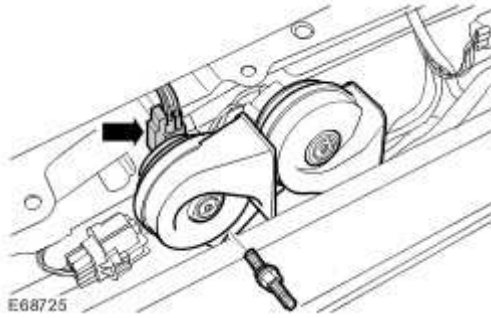
▶ Remove the stud.



Installation

1 . To install, reverse the removal procedure.

- ▶ Connect the electrical connector.
- ▶ Tighten the stud to 25 Nm (18 lb.ft).
- ▶ Secure the electrical harness with the clip.



413-08 : Information and Message Center

Description and operation

Information and Message Center

COMPONENT LOCATION



E63318

Item	Part Number	Description
1		Message center

INTRODUCTION

The message center is a Liquid Crystal Display (LCD) located in a central position in the instrument cluster.

The message center displays system information, vehicle status and trip computer information to the driver. The message center is controlled by the instrument cluster and displays system information using CAN and hard wired signals received from other vehicle system control modules.

MESSAGE CENTER

The message center LCD display has a viewable area of 240 pixels horizontal and 315 pixels vertical. It is divided into five information display zones as follows, starting from the top:

- Transmission position
- Set speed
- Warning /message display
- Odometer/Trip computer information
- Fuel level.

The message center is active at all times when the ignition is on and can also be active when the ignition is off, dependant on the information to be displayed.

The message center LCD is displayed at its full brightness when the ignition is on and the exterior lights are off. If the exterior lights have been activated by the AUTO windshield wipers feature, the illumination will remain at full brightness. If the exterior lights are on in any position other than AUTO, then the LCD will be illuminated at a brightness controlled by the illumination dimmer which is located in the auxiliary lighting switch.

If more than one message is active, each message is displayed in turn in the order of priority. Once all messages have been displayed, they are again displayed in turn for 2 seconds each. Warning messages can be displayed when the ignition is in convenience mode which is the initial ignition state when a door is opened.

Message Priority

Messages are assigned priorities which are defined by the effect on driving safety and functional ability of the vehicle. When new messages are displayed they may be accompanied by a chime from the instrument cluster sounder.

A new message will be displayed immediately, providing the currently displayed message (if there is one) has been displayed for at least 4 seconds. A warning indicator will be activated simultaneously with the message being displayed. If more than one fault warning message is being displayed, the messages will cycle, in priority order, with each message being displayed for 2 seconds.

INFORMATION DISPLAY

Transmission Display

The transmission display is located in the upper section of the LCD. The transmission position information is sent from the Transmission Control Module (TCM) in a high speed CAN message to the instrument cluster.

The transmission has three modes of operation:

- Conventional automatic operation (selector in 'D' position)
- Sport automatic operation (selector lever in 'S' position)
- Manual gear operation - Jaguar Sequential Shift

The following table shows the selector lever position and the highlighted indication displayed in the transmission display.

The following table shows the Jaguar Sequential Shift display. Selections are made using the steering wheel mounted paddle switches.

Selector Lever Position	Transmission Display
(P) Park	P
(R) Reverse	R
(N) Neutral	N
(D) Drive	D
(S) Sport	DS

Jaguar Sequential Shift Gear Selection	Transmission Display
First	1
Second	2
Third	3
Fourth	4
Fifth	5
Sixth	6

The transmission may inhibit a requested up or down shift if the requested gear is outside the normal engine speed operating range. If this occurs, the transmission display will briefly display the gear requested by the driver but will then change to display the actual gear selection.

Set Speed Display

The following table shows the possible messages which can be displayed, other visual or audible warnings and a description of the message.

Message	Other Warnings	Reason	Action
LIMITER SET XXX MPH (km/h)	None	Displays new speed setting for the ASL	None
LIMITER STANDBY	None	Displayed when ASL is activated and speed control is selected	None
LIMITER CANCELLED	None	Displayed for 4 seconds when driver deselects ASL	None
OVERLIMIT XXX MPH (km/h)	<ul style="list-style-type: none"> Amber ASL warning indicator illuminated at +4.8 km/h (+3 mph) above limit Amber ASL warning indicator flashing at +24 km/h (+15 mph) above limit Amber ASL warning indicator flashing and chime emitted at +24 km/h (+15 mph) for a certain time period 	Displayed when vehicle speed exceeds the ASL set speed	Reduce vehicle speed to ASL set limit
LIMITER NOT AVAILABLE	None	Displayed when ECM has detected a fault	Use the Integrated Diagnostic System to diagnose fault
SETSPEED XXX MPH (km/h)	None	Displays the new speed input for the speed control	None

DRIVER INTERVENE	None	Immediate action required by the driver to apply the brakes if required	<ul style="list-style-type: none"> • Apply brakes if required. • May also be displayed if speed control system loses CAN messages when active.
CRUISE NOT AVAILABLE	None	Speed control cannot be engaged	A fault has occurred in the speed control system. Diagnose fault using IDS.
GAP	None	Displays the current set or default adaptive speed control distance. Displayed along with a vehicle graphic in the LCD.	If required, adjust distance using the steering wheel switches.
RADAR SENSOR BLOCKED	None	The adaptive speed control radar sensor has become dirty or obstructed.	Remove obstruction or clean the radar sensor.
FORWARD ALERT OFF	None	Forward alert has been switched off. No warning will be given for objects in the vehicles forward direction.	None
FORWARD ALERT	None	Forward alert has been switched on or the gap settings have changed.	None
CRUISE OVERRIDE	None	Driver has pressed the accelerator pedal, overriding the speed control system. Message will go off when accelerator pedal is released and speed control is active.	WARNING: Adaptive cruise braking will be disabled when this message is displayed.
CRUISE CANCELLED	None	Driver has cancelled speed control or the brake pedal has been pressed.	Re-activate the speed control system or press the 'Resume' switch on the steering wheel.

CRUISE STANDBY	None	Displayed when speed control is activated and ASL is selected	None
CRUISE ENGAGED	None	Displayed when speed control is active	None
TOO FAST TO RESUME	None	Displayed when 'Resume' switch is pressed but vehicle speed is 30 km/h (18 mph) above the set speed.	Reduce vehicle speed to set speed then press 'Resume' switch.

Warning/Message Display

Warning and information messages are displayed in the central area of the LCD. When no messages are required, an analogue clock is present on the display.

The message display language can be changed by the driver using a selection menu on the Touch Screen Display (TSD).

The following table shows the possible messages which can be displayed, other visual or audible warnings and a description of the message.

Message	Other Warnings	Reason	Action
FUEL LEVEL LOW	Amber warning triangle illuminated in LCD.	Fuel level has reached 1/16 of tank capacity - Fuel range approximately 48 -64 km/h (30 to 40 miles).	Refuel vehicle at earliest opportunity.
FUEL PUMP SYSTEM FAULT	Amber warning triangle illuminated in LCD.	Fuel system fault detected by the instrument cluster checking the signals from the auxiliary junction box. Only detected if the left hand fuel level sensor shows nearly full and the right hand fuel level sensor shows nearly empty.	A fault has occurred in the fuel system. Check fuel pump operation.
WASHER FLUID LOW	Amber warning triangle illuminated in LCD.	Washer fluid level has become low and activated low level switch.	Refill washer fluid reservoir.

DOOR OPEN	Red warning triangle illuminated in LCD. Vehicle graphic displayed showing open door(s).	Door(s) open.	Close door(s).
BOOT OPEN	Red warning triangle illuminated in LCD. Vehicle graphic displaying open liftgate.	Liftgate open.	Close liftgate.
BONNET OPEN	Red warning triangle illuminated in LCD. Vehicle graphic showing open hood.	Hood open.	Close hood.
COLUMN ADJUST	None	Column adjust switch has been moved to the column position.	None
COLUMN ADJUST AUTO	None	Column is operating in auto adjust memory mode.	None
MEMORY 1 RECALLED	None	Memory 1 button pressed or Smart Key assigned to memory 1 sensed in vehicle by Keyless Vehicle Module.	None
MEMORY 2 RECALLED	None	Memory 2 button pressed or Smart Key assigned to memory 1 sensed in vehicle by Keyless Vehicle Module.	None
MEMORY 3 RECALLED	None	Memory 3 button pressed or Smart Key assigned to memory 1 sensed in vehicle by Keyless Vehicle Module.	None
MEMORY 1 SETTINGS SAVED	None	New memory settings assigned to memory 1.	None
MEMORY 2 SETTINGS SAVED	None	New memory settings assigned to memory 2.	None

MEMORY 3 SETTINGS SAVED	None	New memory settings assigned to memory 3.	None
CHECK PEDESTRIAN SYSTEM	Red warning triangle illuminated in LCD.	A fault is present in the pedestrian protection system when no accident or deployment has occurred.	A fault has occurred in the pedestrian protection system. Interrogate pedestrian protection system control module for faults and diagnose fault using IDS.
INERTIA SWITCH TRIPPED	Amber warning triangle illuminated in LCD.	Vehicle may have been involved in an impact which has caused the Restraints Control Module to activate the inertia switch.	Check for fuel system leaks. Perform the inertia switch reset procedure. For additional information, refer to Electronic Engine Controls (303-14B Electronic Engine Controls - Vehicles Without: Supercharger)
VALET MODE	None	Valet Mode has been selected by the driver to secure the luggage compartment and the glovebox.	Use TSD to exit the valet mode.
VEHICLE ARMED	None	Displayed when the vehicle is locked and is displayed simultaneously with the visual and audible locking confirmation.	None
SMART KEY NOT FOUND. PLEASE INSERT IN SLOT	None	The Smart Key has not been detected by the Keyless Vehicle Module.	Insert Smart Key into the slot in the start control module. This may be caused by Smart Key low battery voltage or local RF interference.
CHECK SMART KEY	None	Keyless Vehicle Module has not detected a Smart Key in the vehicle.	Ensure that the Smart Key is in range of the vehicle LF antennae.
REMOVE SMART KEY	None	Smart Key has been detected by the start control module.	Remove Smart Key from slot.

PRESS BRAKE WHEN STARTING	None	Driver has pressed the Start/Stop button for a second time without pressing on the brake pedal.	Press brake pedal to start engine.
GEAR SELECTOR NOT IN PARK	None	Transmission selector lever is not the 'PARK' position when a request to start or stop the engine is made.	Move transmission selector lever to the 'PARK' position.
SMART KEY BATTERY LOW	None	The Keyless Vehicle Module has detected that the Smart Key battery is low on power.	Replace Smart Key battery.
STEERING COLUMN LOCKED	None	The Electric steering column lock has failed to unlock the steering and the engine is prevented from starting.	Turn off the ignition, move the steering wheel gently from side to side and try again to start the engine. If this fails a fault has occurred which must be rectified.
LIGHTS ON	Chime from the instrument cluster.	The vehicle side lamps are switched on and the driver's door has been opened.	Turn off side lamps or close driver's door.
TAIL LAMP FAILURE	Amber warning triangle illuminated in LCD. Vehicle graphic displaying failed tail lamp displayed.	A LH or RH tail lamp bulb has failed.	Replace defective bulb.
BRAKE LAMP FAILURE	Amber warning triangle illuminated in LCD. Vehicle graphic displaying failed brake lamp displayed.	A LH or RH brake lamp bulb has failed.	Replace defective bulb.
INDICATOR LAMP FAILURE	Amber warning triangle illuminated in LCD. Vehicle graphic displaying failed turn signal indicator	A LH or RH, front or rear turn signal indicator bulb has failed.	Replace defective bulb.

	displayed.		
DSC ON	DSC warning indicator flashes for a short time.	Displayed for a short time when the DSC switch is operated to activate the DSC system.	None
DSC OFF	DSC warning indicator illuminated.	Displayed for a short time when the DSC switch is operated to de-activate the DSC system.	None
TRAC DSC	DSC warning indicator illuminated.	Displayed for a short time when TRAC DSC has been selected by the driver using the DSC switch.	None
DSC NOT AVAILABLE	DSC warning indicator illuminated.	A fault is present in the DSC system.	A fault has occurred in the DSC system. Interrogate ABS module for faults and diagnose fault using IDS.
BRAKE FLUID LOW	<ul style="list-style-type: none"> • Brake warning indicator illuminated. • Red warning triangle illuminated in LCD. 	Brake fluid level has become low and activated low level switch.	Investigate fluid loss and check brake system for leaks. Repair system as required and replenish brake fluid reservoir.
ABS FAULT	<ul style="list-style-type: none"> • ABS warning indicator illuminated. • Amber warning triangle illuminated in LCD. 	A fault is present in the ABS system. Braking system will operate but ABS will not be available.	A fault has occurred in the ABS system. Interrogate ABS module for faults and diagnose fault using IDS.
BRAKE ASSIST FAULT	Amber warning triangle illuminated in LCD.	A fault is present in the braking system preventing brake assist operation. Braking system will operate but brake assist will not be available and increased effort on the brake pedal	A fault has occurred in the brake assist system. Interrogate ABS module for faults and diagnose fault using IDS.

		may be required.	
CATS SYSTEM FAULT	Amber warning triangle illuminated in LCD.	A fault is present in the Computer Active Technology Suspension (CATS). Suspension will default to the 'hard' setting.	A fault has occurred in the CATS system. Interrogate the CATS module for faults and diagnose using IDS.
PARK BRAKE APPLIED	None	Parking brake has been applied when the vehicle moving at a speed 5 km/h (3 mph) or above.	None
PARK BRAKE FAULT	<ul style="list-style-type: none"> • Brake warning indicator illuminated. • Red warning triangle illuminated in LCD. 	A fault is present in the parking brake system.	A fault has occurred in the parking brake system. Interrogate the parking brake module for faults and diagnose using IDS.
APPLY FOOT AND PARK BRAKE	Amber warning triangle illuminated in LCD.	The battery has been disconnected or power supply interrupted to the parking brake module.	Apply foot brake and parking brake to reset the parking brake module.
CANNOT APPLY PARK BRAKE	<ul style="list-style-type: none"> • Brake warning indicator flashing. • Red warning triangle illuminated in LCD. • NOTE: In certain markets the brake warning indicator does not flash. 	A fault is present in the parking brake system and the parking brake cannot be applied.	A fault has occurred in the parking brake system. Interrogate the parking brake module for faults and diagnose using IDS.
CHECK TYRE PRESSURE	<ul style="list-style-type: none"> • Tire Pressure Monitoring System (TPMS) warning indicator illuminated. • Vehicle 	A tire pressure has decreased to below the warning threshold.	Check tires for punctures and re-inflate to correct pressures.

	<p>graphic displaying tire location.</p>		
CHECK ALL TYRE PRESSURES	<ul style="list-style-type: none"> • Tire Pressure Monitoring System (TPMS) warning indicator illuminated. • Amber warning triangle illuminated in LCD. • Vehicle graphic displaying tire location. 	<p>One or more tire pressures have decreased to below the warning threshold.</p>	<ul style="list-style-type: none"> • Check tires for punctures and re-inflate to correct pressures. • Message may be displayed when TPMS is learning position of a new sensor.
TYRE NOT MONITORED	<ul style="list-style-type: none"> • Tire Pressure Monitoring System (TPMS) warning indicator illuminated. • Vehicle graphic displaying tire location. 	<ul style="list-style-type: none"> • One or more tire pressure sensors have developed a fault. • A temporary spare wheel or a wheel without a sensor has been fitted at the displayed position. • An unapproved accessory may be interfering with the TPMS. 	<ul style="list-style-type: none"> • Check for local RF interference. • A wheel has been fitted without a TPMS sensor fitted (space saver spare wheel). • TPMS sensor has developed a fault or the battery voltage is low. • A fault has occurred in the TPMS. Interrogate the TPMS module for faults and diagnose using IDS.
TYRE PRESSURE SYSTEM FAULT	<ul style="list-style-type: none"> • Tire Pressure Monitoring System (TPMS) warning indicator illuminated. • Amber warning triangle illuminated in LCD. 	<ul style="list-style-type: none"> • Wheels and tires without sensors have been fitted to the vehicle. • TPMS sensors have become defective. • An unapproved accessory may be interfering with the TPMS. • A fault is present in the TPMS system and the tire pressures cannot 	<p>A fault has occurred in the TPMS. Interrogate the TPMS module for faults and diagnose using IDS.</p>

		be monitored.	
ENGINE TEMPERATURE HIGH	Amber warning triangle illuminated in LCD at temperatures of between 118.0°C (244.4°F) and 119.3°C (246.8°F).	Engine coolant temperature has exceeded threshold for normal operation.	<ul style="list-style-type: none"> • Stop vehicle and allow engine to idle for 5 minutes. Switch off engine and allow to stand for not less than 10 minutes. Check coolant level. • If message re-appears, investigate coolant system for leakage.
ENGINE OVERHEATING	Red warning triangle illuminated in LCD at temperatures of 119.4°C (247°F) or above.	Engine coolant temperature has exceeded threshold for normal engine operation.	<ul style="list-style-type: none"> • Stop vehicle and allow engine to idle for 5 minutes. Switch off engine and allow to stand for not less than 10 minutes. Check coolant level. • If message re-appears, investigate coolant system for leakage.
ENGINE OIL PRESSURE LOW	Red warning triangle illuminated in LCD.	Engine oil pressure has fallen below the threshold for normal operation.	Stop the engine immediately. Check engine oil level. If oil level correct, do not restart engine until oil pressure loss has been identified and corrected.
RESTRICTED PERFORMANCE	Red or Amber warning triangle illuminated in LCD depending on nature of power loss.	A fault has occurred which has reduced engine power output.	Investigate cause of engine power loss. Interrogate control modules for faults and diagnose using IDS.
ENGINE SYSTEMS FAULT	<ul style="list-style-type: none"> • MIL illuminated for certain faults. • Red or Amber warning triangle illuminated in LCD. 	<ul style="list-style-type: none"> • A fault has occurred in the engine management system or, if the MIL is illuminated, an emissions related fault is present which has been detected by 	<ul style="list-style-type: none"> • Investigate cause of fault. Interrogate ECM and TCM for faults and diagnose using IDS. • Check start/stop switch for correct operation or short circuits.

		<p>the On-Board Diagnostic systems in the ECM and TCM.</p> <ul style="list-style-type: none"> • A fault has occurred with the start/stop switch. 	
CHECK FUEL FILLER CAP	<ul style="list-style-type: none"> • (NAS Only) • Red warning triangle illuminated in LCD. 	Diagnostic Monitoring of Tank Leakage (DMTL) system has detected fuel filler cap has not been correctly installed.	Check fuel filler cap to ensure it is correctly installed and secure.
ENGINE TEMPERATURE INDICATION FAULT	Red warning triangle illuminated LCD.	A fault has occurred in the engine management system and the engine temperature signal is no longer being received.	Investigate cause of engine temperature failure. Interrogate ECM for faults and diagnose using IDS.
GEARBOX FAULT	Red warning triangle illuminated in LCD.	TCM has detected a fault in the transmission. Transmission may default to 'limp home' mode and only allow operation of one forward gear and reverse.	Investigate transmission fault. Interrogate TCM and diagnose fault using IDS.
BATTERY NOT CHARGING	Red warning triangle illuminated in LCD.	Charge output from generator not detected by ECM.	Investigate cause of generator failure.
OVER 120 km/h	<ul style="list-style-type: none"> • (GULF States Only) • Amber warning triangle illuminated in LCD. 	Vehicle has exceeded the preset 120 km/h speed value.	Reduce vehicle speed.
HOOD NOT LATCHED	Red warning triangle illuminated in LCD.	The convertible top is not correctly latched.	Ensure convertible top is correctly latched and secured.
HOOD OUT OF POSITION	Amber warning triangle illuminated in LCD.	The convertible top is incorrectly positioned.	Open or close the convertible top again and ensure it is correctly positioned.

LUGGAGE COVER OUT OF POSITION	Amber warning triangle illuminated in LCD.	The luggage separator is incorrectly positioned.	Check the positioning of the luggage separator and it is correctly engaged.
LISTENING	None	Telephone voice system is active.	None.

Odometer Display

The odometer displays the total distance which the vehicle has travelled. This is calculated by the instrument cluster using wheel speed signals from the ABS module.

The odometer can show 6 characters and distances up to 999,999 miles or kilometers. The total distance travelled is stored in a Electronically Erasable Programmable Read Only Memory (EEPROM) and the Random Access Memory (RAM). This ensures that the total distance is not lost if the battery is disconnected.

The odometer value is passed to other vehicle system modules on the medium speed and high speed CAN bus. This is used to record the total vehicle mileage for diagnostic purposes and when storing Diagnostic Trouble Codes (DTC).

Trip computer Information Display

The instrument cluster contains software which controls the trip computer. The computer allows the driver to access information for current fuel usage, current journey length, average speed and estimated vehicle range of fuel remaining.

The information is calculated from CAN messages from other vehicle systems, for example wheel speed signals from the ABS module and fuel injector operating data from the ECM.

A 'Trip' button is located on the end of the LH multifunction switch and allows the driver to access, in sequence, the available trip information by repeatedly pressing the button. The trip information is displayed in the following order:

- Trip distance The trip distance since the last reset is displayed.
- Average speed The average speed since the last reset is displayed.
- Average fuel consumption The average fuel consumption since the last reset is displayed.
- Range The range is displayed showing the distance which can be travelled until the fuel gage reads empty. If the range display shows dashes (-), this indicates a failure with one or both of the fuel level sensors.

The trip computer has three independent memories; A, B and Auto. Memories A and B can be set independently. The Auto memory is reset after each ignition cycle and therefore only contains information relating the current journey.

The trip information can also be accessed from the TSD located in the center console. The TSD allows

the same information available with the trip button on the multifunction switch to be displayed on the TSD, with the addition of the option to reset the values in the A and B memories.

If the battery is disconnected, all trip data in memories A, B and Auto are erased.

Fuel Level Display

The fuel level display is a linear LCD display to show the usable fuel tank contents. The level display is active at all times when the ignition is on. Low fuel level is displayed as a LOW FUEL LEVEL message and an amber warning triangle in the message center.

The fuel level is obtained by fuel level sensors in the fuel tank. These are monitored by the auxiliary junction box software and their output resistance values, corresponding fuel quantity, are transmitted to the instrument cluster on the medium speed CAN bus. The instrument cluster uses the two level sensor signals to calculate the fuel tank contents. This calculation takes into account fuel movement in the tank to display a steady fuel quantity in the LCD.

The fuel level information is transmitted on the medium speed and high speed CAN bus for use by other vehicle system modules.

AUDIBLE WARNINGS

The instrument cluster can generate audible warnings to alert the driver to a displayed message and change of vehicle operating condition. The audible warning is generated by a sounder located within the instrument cluster.

The audible warnings can be generated for the warnings and are listed in order of priority, with the first being the highest priority.

- Seatbelt reminder
- EPB (High Pitch)
- ACC Driver Intervene 1
- Airbag fault
- Key in ignition switch
- ASL overspeed
- ACC Driver Intervene 2
- EPB (Low Pitch)
- Vehicle armed (entry delay)
- Gear selector not in park
- Valet mode
- Lights on reminder
- Hood operation
- Passive Entry / Passive Start (PEPS)
- Memory set
- Turn signal indicators
- Seat Belt Minder.

The audible warnings can take the form of a single chime, a number of chimes or a continuous chime. The audible warnings are initiated by a CAN message request from the requesting sub-system control module or by the instrument cluster software.

Information and Message Center

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">• Fluid level(s)• Accessory installations	<ul style="list-style-type: none">• Fuse(s)• Wiring harness• Electrical connector(s)• Engine compartment components• Underbody components• Instrument cluster• Door switches• Electronic modules• Boot/bonnet switch

- 1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 2 . If the cause is not visually evident, verify the symptom and refer to the Jaguar approved diagnostic system.

413-09 : Warning Devices

Diagnosis and testing

Warning Devices

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
<ul style="list-style-type: none">• Door ajar switch(es)• Safety belt buckle and pretensioner• Headlamp switch• Fuel gauge• Inertia switch	<ul style="list-style-type: none">• Fuse(s)• Wiring harness• Electrical connector(s)• Switch(es)• Sensor(s)

- 1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 2 . If the cause is not visually evident, verify the symptom and refer to the Jaguar approved diagnostic system.

Low Washer Fluid Warning Indicator Switch (84.10.17)

Removal

1




- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 2 . Remove the RH fender splash shield.

For additional information, refer to Fender Splash Shield (76.10.90)

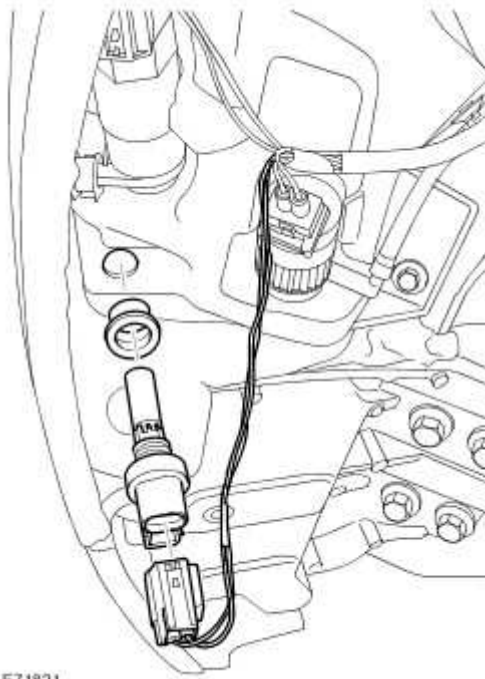
- 3 . Drain the washer reservoir fluid.

 Position a container to collect the fluid.

- 4 . Remove the low washer fluid warning indicator switch.

 Disconnect the electrical connector.

- 5 . Remove and discard the seal.



E71821

Installation

- 1 . Install a new seal.
- 2 . Install the low washer fluid warning indicator switch.
 - ▶ Connect and secure the electrical connector.
- 3 . Install the fender splash shield.
For additional information, refer to Fender Splash Shield (76.10.90)
- 4 . Refill the washer reservoir.

413-13 : Parking Aid

Specifications

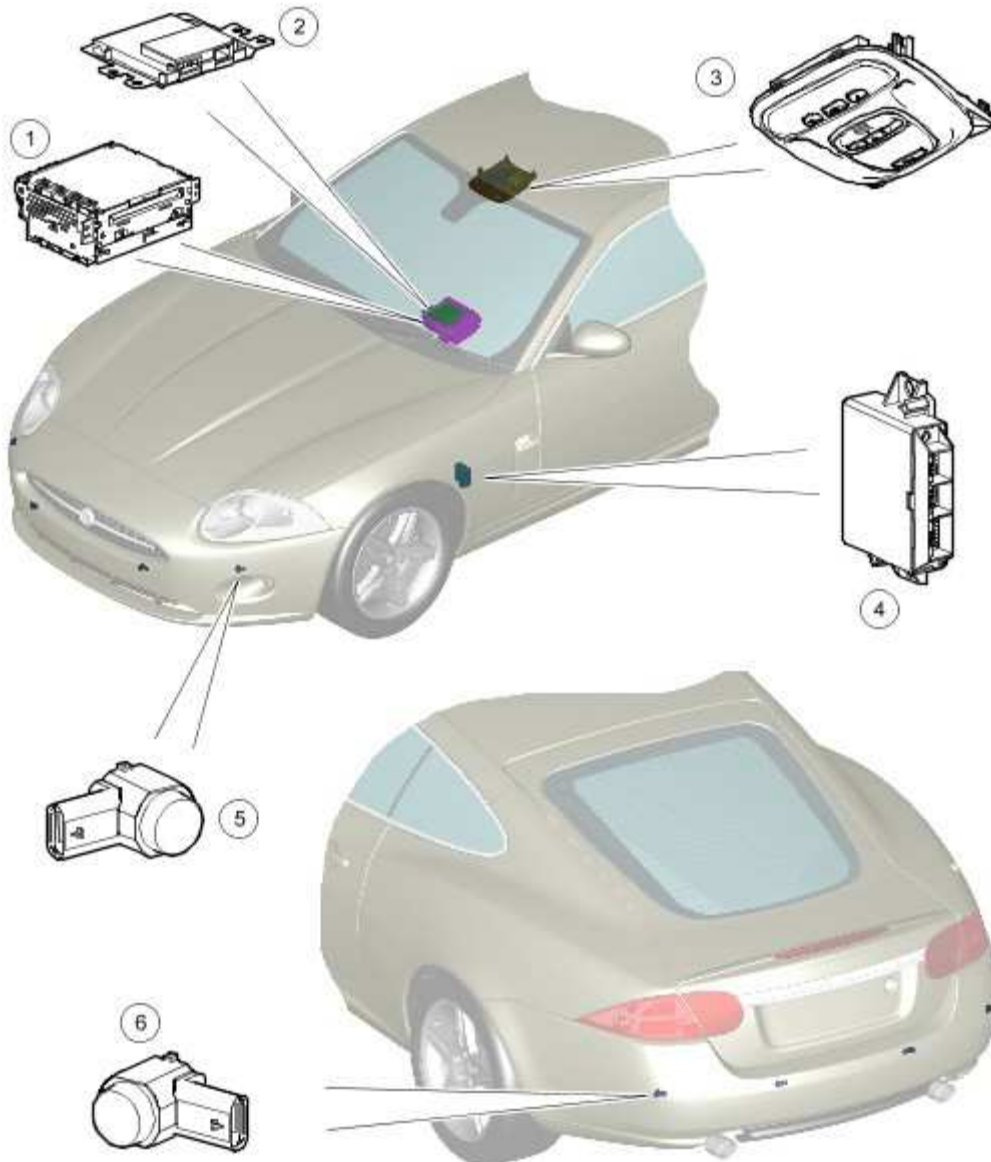
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Parking aid module - nut	2	-	18

Parking Aid

COMPONENT LOCATION



E62362

Item	Part Number	Description
1		Audio head unit

2		Gateway module
3		Control switch
4		Control module
5		Front parking aid sensors (4 off)
6		Rear parking aid sensors (4 off)

INTRODUCTION

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during a forward (if front sensors fitted) or reversing manoeuvre. The purpose of the system is to assist the driver when parking or manoeuvring in restricted space. It is not designed as a crash avoidance system or a replacement for visual interpretation by the driver.

All vehicles are fitted with rear parking aid sensors. Higher specification vehicles may be fitted with both front and rear sensors.

Audible warnings to the driver are given by the entertainment system speakers. A visual representation is shown on the Touch Screen Display (TSD).

The control module controls operation of the speakers via the audio head unit. A gateway module is incorporated into the system to convert medium speed Controller Area Network (CAN) bus messages from the control module into Media Orientated System Transport (MOST) messages for use by the audio head unit. For additional information, refer to Audio System (415-01 Audio Unit)

If an obstacle is sensed by the rear parking aid sensors, the rear audio system speakers will sound. If an obstacle is sensed by the front parking aid sensors (if fitted), the front audio system speakers will sound.

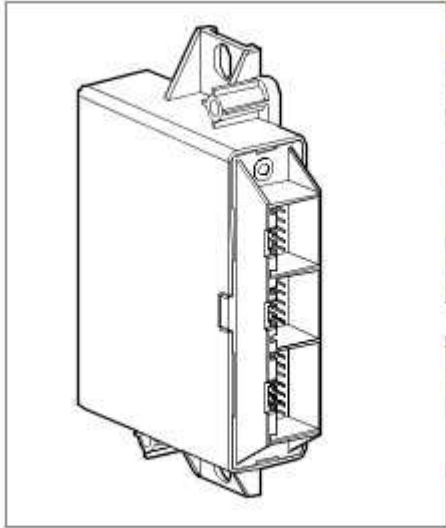
The parking aid system operates using ultrasonic signals which are transmitted by the sensors. The reflected echo from this output is received by the sensors and used by the control module to calculate the distance from an object.

The roof console mounted control switch allows the driver to deactivate the parking aid system if operation is not required.

NOTE:

The control switch is only fitted to vehicles with front parking aid sensors.

CONTROL MODULE



E67781



The parking aid control module is located in the passenger footwell, behind a protective panel. The control module uses a single microprocessor to perform the following tasks:

- Control of the ultrasonic sensors
- Monitoring of the sensors
- Evaluation of received echo signals from the sensors
- Noise and disturbance suppression
- Control of the audio system speakers
- Control and monitoring of the switch status Light Emitting Diode (LED) and associated wiring
- Evaluation and monitoring of the control inputs
- Management of diagnostic and test functions
- Monitoring of power supply
- Communication via diagnostic link.

The control module is connected to the vehicle electrical system by either 3 (vehicles fitted with front and rear sensors) or 2 (vehicles fitted with rear sensors only) multiplug connectors.

Inputs and Outputs

The table below shows control module inputs and outputs

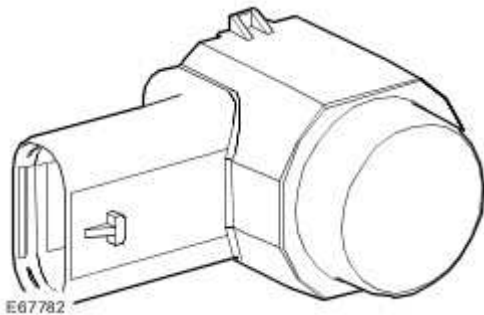
Component	Description	Input/Output
Transmission Control Module (TCM)	Medium speed CAN bus message - reverse gear selected	Input

TCM	Medium speed CAN bus message - forward gear selected	Input
Control switch	Status - On/Off	Input
Parking brake module	Medium speed CAN bus message via the gateway module - parking brake applied	Input
Auxiliary junction box	Electrical power supply	Input
Parking aid sensors	Electrical power and ground	Output
Parking aid sensors	Digital transmit and receive signals	Output
Audio system speakers	Varying frequency outputs	Output
Control switch	LED illumination	Output

Diagnostics

The control module has a diagnostic connection via the medium speed CAN bus to enable faults to be retrieved using the Integrated Diagnostic System (IDS). Additionally an on-board diagnostic routine within the control module constantly monitors the system and alerts the driver to a system fault by emitting a 5 second continuous tone through the audio system speakers when the ignition is switched on and a gear is selected. If front parking aid sensors are fitted, the control switch LED will also illuminate.

PARKING AID SENSORS



Four sensors are positioned in the rear bumper and four in the front bumper (if fitted). The front sensor housings are glued into position; the rear sensor housings are welded into position. The sensor bodies are then clipped into the housings from the rear.

Each sensor has a 3 pin connector which connects into a common harness linking all 4 sensors. The 3 pins of each connector provide the sensor a negative feed, a positive feed and a signal line. The rear parking aid harness connects to the main vehicle body harness. The front parking aid harness connects to the Left-Hand (LH) engine compartment harness.

Each sensor comprises a plastic housing which contains a piezoelectric disc. The disc resonates at a frequency of approximately 50 kHz, producing an ultrasonic signal output. The disc also receives the reflected echo signal.

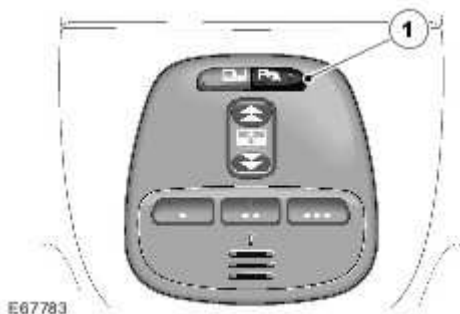
Each sensor has 2 modes of operation; combined transmitter and receiver mode or receiver mode only. The control module controls the operating mode of each sensor by the output of a digital signal on the signal line.

In the combined mode, the sensor emits a series of ultrasonic impulses and then switches to receiver mode to receive the echo reflected by an obstacle in the detection range. These echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is then transmitted to the control module and compared with preprogrammed data stored in an Electrically Erasable Programmable Read Only Memory (EEPROM) within the module.

The module receives this data via the signal line from the sensor and calculates the distance to the obstacle according to the elapses time between the transmitted and received impulse. The duration of the impulse transmission is determined by the control module. The frequency of the impulse is determined by the sensor.

In the receiver mode, the sensor will receive impulses that were emitted by adjacent sensors. The control module uses this information to precisely determine position and distance of the obstacle.

CONTROL SWITCH



Item	Part Number	Description
1		Control switch

The control switch is located in the roof console. The switch is non-latching with an integral LED. The switch receives a 12 V output from the control module, and is also connected to ground. When the switch is operated, a momentary ground is completed. This is interpreted by the control module as a signal to enable or disable the parking aid system.

The switch also receives a 12 V output from the control module to drive the LED when the parking aid system is on.

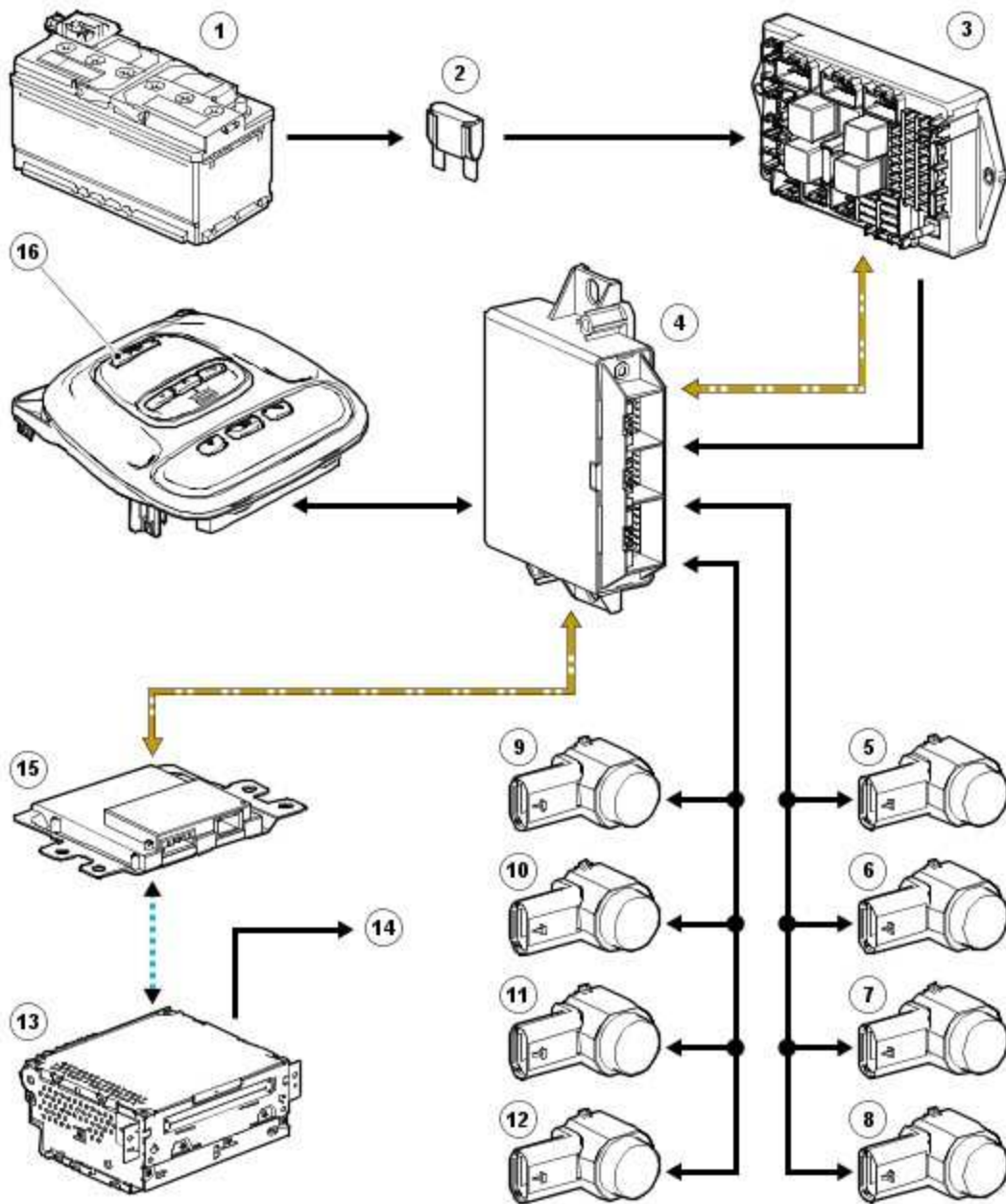
NOTE:

The control switch will only switch off the front parking aid sensors. The rear parking aid sensors will remain operational.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **N** = Medium Speed CAN bus; **P** = MOST



E62363



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Auxiliary junction box
4		Control module

5		Right outer front sensor
6		Right inner front sensor
7		Left inner front sensor
8		Left outer front sensor
9		Right outer rear sensor
10		Right inner rear sensor
11		Left inner rear sensor
12		Left outer rear sensor
13		Audio head unit
14		To audio system speakers
15		Gateway module
16		Control switch

PRINCIPLES OF OPERATION

If a forward drive gear is selected when the vehicle ignition is first switched on, the front parking aid sensors (if fitted) will not be operational. If reverse (R) is the first gear selected after the ignition is switched on, both the front and rear parking aid sensors will become operational. If a forward drive gear is subsequently selected, the rear parking aid sensors be switched off by the control module but the front parking aid sensors will remain operational until vehicle speed increases above 16 km/h (10 mph).

Parking aid will only become active if the following conditions exist:

Front and rear sensors fitted

- Ignition on
- 'Park' is not selected
- Parking brake is released
- Vehicle speed drops below 7 km/h (4.5 mph) - rear sensors only
- Vehicle speed drops below 7 km/h (4.5 mph) and control switch pressed - front sensors only.

Rear sensors only

- Ignition on

- Reverse gear selected for more than 1 second.

Audible and Visual Warnings

The control module processes the distance readings from the ultrasonic parking aid sensors to determine if there are any objects within the detection areas. If there are no objects no audible warning is produced. If an object is detected, repeated audible warnings are produced via the audio system speakers. The time delay between the audible warnings decreases as the distance between the detected object and the vehicle decreases until eventually a continuous tone is emitted from the speakers.



A visual interpretation of the detection areas is given in the TSD.

The detection ranges of the sensors are shown in the table below.

Sensors	Maximum Detection Range	Continuous Tone
Front	800 mm (31 inches)	250 mm (10 inches)
Rear	1600 mm (63 inches)	300 mm (12 inches)

After the initial detection of an object, if there is no decrease in the distance between an object and the central sensors, the time delay between the audible warnings remains constant. If an object is detected by one of the corner sensors only, the audible warnings stop after approximately 5 seconds if there is no change in the distance between an object and the corner sensor.

Detection Calculation

When operating in the combined transmitter and receiver mode, the sensor outputs a number of ultrasonic pulses and receives the reflected echo signal. The control module amplifies the received echo signals and compares them with a preprogrammed threshold to calculate the distance to the object. This is achieved by determining the elapsed time between the transmission and reception of the ultrasonic signal.

When operating in receiver mode, the sensor receives echo signals transmitted by an adjacent sensor. This mode is used to improve the accuracy of the system.

The detection cycle consists of the control module operating 1 sensor in the combined transmitter and receiver mode and transmitting a number of pulses. The control module then switches the transmitting sensor and the adjacent sensor(s) to receiver mode. After a short time delay this sequence is repeated using a different sensor to transmit the ultrasonic signal. This sequence is completed in 100 ms. The control module uses several measurements of the same sensors to remove errors from the calculation.

If the detected object is directly behind a sensor, the distance is calculated using the time between the transmission and reception of the ultrasonic signal. If the object is positioned between 2 sensors, the control module uses both signals to determine the correct distance using triangulation.

To perform the triangulation calculation, the control module must know the distance between the individual sensors in the bumper. This information is stored in the control module memory. From the received distance signal from each sensor and using the known distance between adjacent sensors, the control module can calculate the minimum distance from the vehicle to the detected object.

When approaching several objects, the control module recognises the distance from the vehicle to the nearest object.

Parking Aid

Principle of Operation

For a detailed description of the parking aid system, refer to the relevant Description and Operation section in the workshop manual.

Parking Aid

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

NOTE:

Particular attention should be paid to the following items where DTCs may not be logged:

- Check for contamination (e.g. dirt, grime, frosting, ice) around the parking aid sensors, if so refer to the parking aid section in the vehicle handbook.
- Check for the correct installation and alignment of the sensors to the bumper
- Spurious detection of the ground may occur during front system operation on an up-slope

Electrical

- Fuse(s)
- Relay(s)
- Wiring Harness
- Electrical connector(s)
- Front parking aid sensor(s) and holders
- Rear parking aid sensor(s) and holders
- Audio system
- Touch screen display unit
- Parking aid switch and LED
- Reversing lamp switch

- Parking aid module

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1B3601	Front right outer sensor	<ul style="list-style-type: none">• Front right outer sensor signal circuit - short to ground, high resistance• Front right outer sensor power supply circuit - high resistance	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B3612	Front right outer sensor	<ul style="list-style-type: none">• Front right outer sensor signal circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B3696	Front right outer sensor	<ul style="list-style-type: none">• Front right outer sensor ground circuit - open circuit• Front right outer sensor internal failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Front Outer Parking Aid Sensor (86.54.22)
B1B3801	Front right inner sensor	<ul style="list-style-type: none">• Front right inner sensor signal circuit - short to ground, high resistance• Front right inner sensor power supply circuit - high resistance	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B3812	Front right inner sensor	<ul style="list-style-type: none">• Front right inner sensor signal circuit - short to power	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B3896	Front right inner sensor	<ul style="list-style-type: none">• Front right inner sensor ground circuit - open circuit• Front right inner sensor internal failure	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary.

			Front Inner Parking Aid Sensor (86.54.21)
B1B4001	Front left outer sensor	<ul style="list-style-type: none"> • Front left outer sensor signal circuit - short to ground, high resistance • Front left outer sensor power supply circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4012	Front left outer sensor	<ul style="list-style-type: none"> • Front left outer sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4096	Front left outer sensor	<ul style="list-style-type: none"> • Front left outer sensor ground circuit - open circuit • Front left outer sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Front Outer Parking Aid Sensor (86.54.22)
B1B4201	Front left inner sensor	<ul style="list-style-type: none"> • Front left inner sensor signal circuit - short to ground, high resistance • Front left inner sensor power supply circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4212	Front left inner sensor	<ul style="list-style-type: none"> • Front left inner sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4296	Front left inner sensor	<ul style="list-style-type: none"> • Front left inner sensor ground circuit - open circuit • Front left inner sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Front Inner Parking Aid Sensor (86.54.21)
B1B4401	Rear right outer sensor	<ul style="list-style-type: none"> • Rear right outer sensor signal circuit - short to ground, high resistance • Rear right outer sensor power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

		supply circuit - high resistance	
B1B4412	Rear right outer sensor	<ul style="list-style-type: none"> Rear right outer sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4496	Rear right outer sensor	<ul style="list-style-type: none"> Rear right outer sensor ground circuit - open circuit Rear right outer sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Rear Parking Aid Sensor (86.54.14)
B1B4601	Rear right inner sensor	<ul style="list-style-type: none"> Rear right inner sensor signal circuit - short to ground, high resistance Rear right inner sensor power supply circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4612	Rear right inner sensor	<ul style="list-style-type: none"> Rear right inner sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4696	Rear right inner sensor	<ul style="list-style-type: none"> Rear right inner sensor ground circuit - open circuit Rear right inner sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Rear Parking Aid Sensor (86.54.14)
B1B4801	Rear left outer sensor	<ul style="list-style-type: none"> Rear left outer sensor signal circuit - short to ground, high resistance Rear left outer sensor power supply circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B4812	Rear left outer sensor	<ul style="list-style-type: none"> Rear left outer sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B1B4896	Rear left outer sensor	<ul style="list-style-type: none"> • Rear left outer sensor ground circuit - open circuit • Rear left outer sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B5001	Rear left inner sensor	<ul style="list-style-type: none"> • Rear left inner sensor signal circuit - short to ground, high resistance • Rear left inner sensor power supply circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B5012	Rear left inner sensor	<ul style="list-style-type: none"> • Rear left inner sensor signal circuit - short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1B5096	Rear left inner sensor	<ul style="list-style-type: none"> • Rear left inner sensor ground circuit - open circuit • Rear left inner sensor internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new sensor as necessary. Rear Parking Aid Sensor (86.54.14)
B1B5411	Parking aid status LED	<ul style="list-style-type: none"> • Parking aid status LED - short to ground (detected if driven only) 	Refer to the electrical circuit diagrams and test status LED circuit for short to ground
B1B5412	Parking aid status LED	<ul style="list-style-type: none"> • Parking aid status LED - short to power (detected if not driven only) 	Refer to the electrical circuit diagrams and test status LED circuit for short to power
B1B5711	Front sensors power supply circuit	<ul style="list-style-type: none"> • Front sensors power supply circuit - short to ground 	Refer to the electrical circuit diagrams and test front sensor power supply circuit for short to ground
B1B5811	Rear sensors power supply circuit	<ul style="list-style-type: none"> • Rear sensors power supply circuit - short to ground 	Refer to the electrical circuit diagrams and test rear sensor power supply circuit for short to ground
B1C3073	Disable switch	<ul style="list-style-type: none"> • Disable switch stuck closed • Disable switch circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
U001000	Medium speed CAN communication Bus	<ul style="list-style-type: none"> Medium speed CAN communication Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U007300	Control module communication Bus "A" Off	<ul style="list-style-type: none"> Control module communication Bus "A" Off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> Logged when subscribed CAN message missing from CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost communication with RJB	<ul style="list-style-type: none"> Logged when subscribed CAN message missing from RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> Logged when subscribed CAN message missing from instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> RJB car configuration data is not compatible with the parking aid module 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, install a new parking aid module. Refer to the new module installation note at the top of the DTC Index
U042200	Invalid data received from CJB	<ul style="list-style-type: none"> Logged when subscribed CAN message invalid data from CJB 	Check CJB for DTCs and refer to DTC Index. Communications Network
U042300	Invalid data received from instrument cluster	<ul style="list-style-type: none"> Logged when subscribed CAN message invalid data from Instrument Cluster 	Check instrument cluster for DTCs and refer to DTC Index. Instrument Cluster

U044300	Invalid data received from RJB	<ul style="list-style-type: none"> • Logged when subscribed CAN message invalid data from RJB 	Check RJB for DTCs and refer to DTC Index. Communications Network
U210000	Initial configuration not complete	<ul style="list-style-type: none"> • No configuration has been previously set 	Re-configure RJB using manufacturer approved diagnostic tool, clear DTC and re-test. If DTC remains check CAN network. Communications Network
U210100	Control module configuration incompatible	<ul style="list-style-type: none"> • Data sent from RJB is invalid 	Re-configure RJB using manufacturer approved diagnostic tool, clear DTC and re-test. If DTC remains check Check RJB for DTCs and refer to DTC Index. Communications Network
U300049	Control module	<ul style="list-style-type: none"> • Internal control module failure 	Install a new parking aid control module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for parking aid related DTCs and refer to DTC Index. If DTC remains suspect parking aid module, refer to new module installation note at top of DTC Index
U300316	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300362	Battery voltage	<ul style="list-style-type: none"> • Mis-match of battery voltage, of 2 volts or lower, between 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

		parking aid module and RJB	diagnostic system
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Parking Aid Module (86.80.39)

Removal

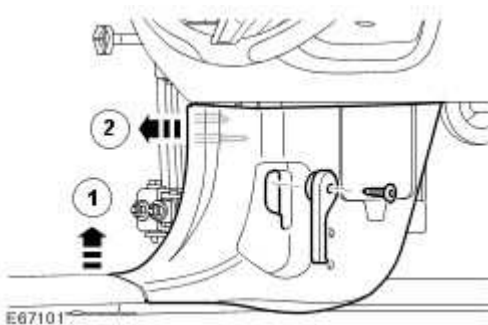
NOTE:


The park control module is situated in the LH footwell and does not change position with the hand of drive.

1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

2 . LH side: Remove the cowl side trim panel.

- ▶ Remove the Torx screw.
- ▶ Remove the hood release lever.
- ▶ Release the forward edge of the scuff plate trim panel.
- ▶ Carefully release the clips.



3  **CAUTION: Make sure the wiring harness and electrical connectors are not damaged during the carpet release.**

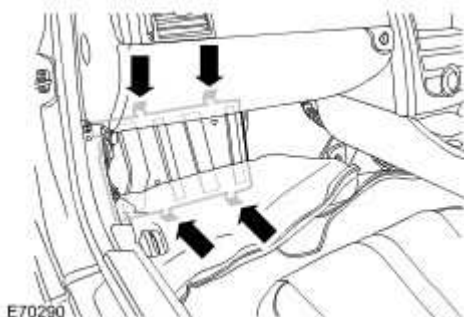
Carefully release the carpet for access.

- ▶ Carefully release the forward edge of the floor console side trim panel.



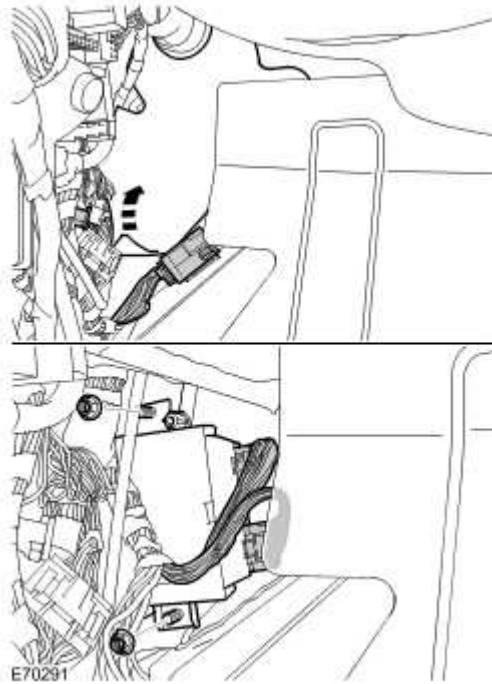
4 . Release the subwoofer cover.

- ▶ Remove the 4 bolts.
- ▶ Position aside.



5 . Remove the parking aid module.

- ▶ Position the acoustic pad aside.
- ▶ Release 2 electrical harness clips from the body and position aside.
- ▶ Remove the 2 nuts.
- ▶ Disconnect the 2 electrical connectors.



Installation

1 . Install the parking aid module.

- ▶ Connect the electrical connectors.
- ▶ Tighten the nuts to 3 Nm (2 lb.ft).
- ▶ Secure the electrical harness.
- ▶ Align the acoustic pad.

2 . Install the subwoofer cover.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

3



CAUTION: Make sure the carpet is correctly installed and that no foul-condition exists when the accelerator pedal is depressed.

Install the carpet.

- ▶ Install the floor console side panel trim.


4 . Install the cowl side trim panel.

- ▶ Carefully align and secure the clips.
- ▶ Secure the scuff plate trim panel.

5 . Connect the battery ground cable and install the cover.
For additional information, refer to

Rear Parking Aid Sensor (86.54.14)

Removal

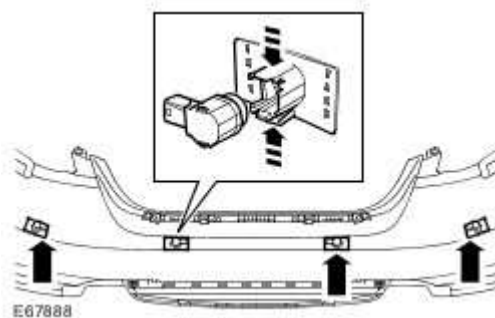
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.


- 2 . Remove the rear bumper cover.
For additional information, refer to Rear Bumper Cover (76.22.74)

- 3 . Remove the parking aid sensor.

- ▶ Disconnect the electrical connector.
- ▶ Release the 2 clips.
- ▶ Repeat the above for the other 3 sensors.



Installation

- 1  **CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.**

Install the parking aid sensor.

- ▶ Carefully secure the clips.
- ▶ Connect the electrical connector.
- ▶ Repeat the above procedure for the remaining 3 sensors.


2 . Install the rear bumper cover.

For additional information, refer to Rear Bumper Cover (76.22.74)

Front Inner Parking Aid Sensor (86.54.21)

Removal

All vehicles

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

Vehicles with 4.2L engine

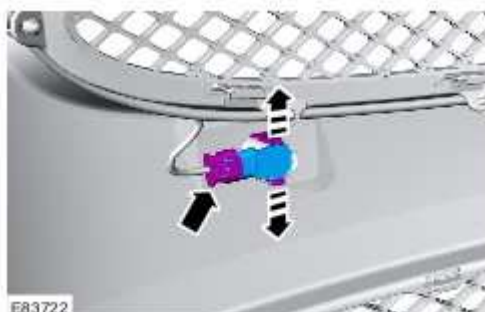
- 2 . Remove the front bumper cover.
For additional information, refer to Front Bumper Cover (76.22.78)

Vehicles with 5.0L engine

- 3 . Remove the front bumper cover.
For additional information, refer to

All vehicles

- 4 . Remove the parking aid sensor.
 - ▶ Disconnect the electrical connector.
 - ▶ Release the 2 clips.



Installation

1




- **CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.**

To install, reverse the removal procedure.

Front Outer Parking Aid Sensor (86.54.22)

Removal


- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the headlamp assembly.
For additional information, refer to Headlamp Assembly (86.41.33)
- 3 . Remove the parking aid sensor.
 - ▶ Disconnect the electrical connector.
 - ▶ Release the 2 clips.



Installation

- 1  **CAUTION: If a new sensor is installed, only the front face must be painted. Failure to follow this instruction may result in the component malfunctioning.**

To install, reverse the removal procedure.

414 : Battery and Charging System

414-00 : Charging System – General Information

General procedure

Battery Charging

1. Before charging a discharged battery inspect and repair the following conditions, if necessary:

- Loose accessory drive belt.
- Pinched or grounded wiring harness to the generator or voltage regulator.
- Loose wiring harness connections at the generator or voltage regulator.
- Loose or corroded connections at battery, headlamp panel junction wire or engine ground.
- Carry out generator charging checks.
- Excessive battery quiescent drain due to:
engine compartment, load space, glove compartment and courtesy lamps remaining on (switch damaged or out of adjustment, glove compartment left open).

Battery Charging - Maintenance-Free Batteries



WARNING: KEEP BATTERIES OUT OF REACH OF CHILDREN. BATTERIES CONTAIN SULPHURIC ACID, AVOID CONTACT WITH SKIN, EYES OR CLOTHING. SHIELD YOUR EYES WHEN WORKING NEAR THE BATTERY TO PROTECT AGAINST POSSIBLE SPLASHING OF THE ACID SOLUTION. IN CASE OF ACID CONTACT WITH SKIN OR EYES, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF 15 MINUTES AND SEEK PROMPT MEDICAL ATTENTION. IF ACID IS SWALLOWED, CALL A PHYSICIAN IMMEDIATELY. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.



WARNING: BATTERIES NORMALLY PRODUCE EXPLOSIVE GASES WHICH CAN CAUSE PERSONAL INJURY, THEREFORE DO NOT ALLOW FLAMES, SPARKS, OR LIGHTED SUBSTANCES TO COME NEAR THE

BATTERY. WHEN CHARGING OR WORKING NEAR A BATTERY ALWAYS SHIELD YOUR FACE AND PROTECT YOUR EYES . ALWAYS PROVIDE ADEQUATE VENTILATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

1. Cold batteries will not readily accept a charge. Therefore, batteries should be allowed to warm up approximately to 15 degrees centigrade (59 degrees Fahrenheit) before charging. This may require 12 hours at room temperature depending on the initial temperature and battery size.
2. A battery which has been completely discharged may be slow to accept a charge initially, and in some cases may not accept a charge at the normal charger setting. When batteries are in this condition, charging can be started by use of the 'dead battery' switch which is fitted to certain types of battery chargers. Follow the manufacturer's instructions when carrying out this procedure.
3. To determine whether a battery is accepting a charge, follow the manufacturer's instructions for the charger.
4. After releasing dead battery switch and with the charger still operating, measure battery voltage. If the voltage is 12 volts or higher, the battery may be accepting a charge and may be capable of being recharged. If the temperature of the battery is below 15 degrees centigrade (59 degrees Fahrenheit) the battery may require charging for up to two hours before the charge rate is high enough to show on the charger ammeter. It has been found that all undamaged batteries can be charged by this procedure. If a battery cannot be charged by this procedure, it should be replaced.
5. A rapid recharge procedure has been developed for recharging batteries that have passed the 'No-Load Test' and only need a recharge. This can be due to non start battery failures or battery discharged in vehicle due to key-off loads.
6. The battery can be rapidly recharged by using either of the following methods:
 - Perform a two hour charge using a constant current of 20 amps (manual setting on the charger).
 - Perform a two hour charge using a constant voltage (automatic setting on the charger).

Quiescent Current Measurement

1. NOTE:

The following quiescent current measurement does not apply to vehicles with the Tracker system installed. If the vehicle is installed with the tracker system the quiescent current may be up to 14 milliamps higher. If non-jaguar approved accessories are installed the

following measurements may not apply.

Disconnect the battery ground cable.

2. Check the vehicle off-load battery voltage. If below 12.5 volts, install a fully charged slave battery for the tests and recharge the vehicle battery.

3. Connect a 'shorting' link lead between the negative battery terminal and the negative battery lead, before connecting a suitable ammeter to the battery (with the negative test lead clip to the negative battery terminal, and the positive test lead clip to the battery negative lead).

4. **NOTE:**

Make sure that all electrical accessories are switched off.

Operate the key fob unlock button to disarm the vehicle security system.

- Select ignition mode (without starting the engine) for around 10 seconds.
- Deselect ignition mode, close doors, hood & luggage compartment lid latch.
- Lock vehicle.
- After 15 minutes on vehicles with TPMS installed or 4 minutes on vehicles without TPMS installed, remove shorting link & note ammeter reading.
- The quiescent current should be less than 35mA.
- Replace Shorting link.
- Unlock the vehicle.
- Superlock the vehicle.
- After 15 minutes, on vehicles with TPMS installed, or 4 minutes, on vehicles without TPMS installed, remove shorting link & note ammeter reading.
- The quiescent current should be less than 35mA.

5. **NOTE:**

In the unlocked state, the vehicle will take 30mins to shut down to its min quiescent current.

If intermittent wake-ups are suspected, monitor battery current continuously

6. Disconnect the ammeter. Reconnect the battery ground cable.

Charging System

Principle of Operation

For a detailed description of the charging system, refer to the relevant Description and Operation section in the workshop manual.

Battery and Cables

Generator

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage and system integrity.

NOTE:

Check the vehicle battery condition and state of charge before condemning any of the charging system components. For additional information, refer to the battery care manual.

Mechanical	Electrical
<ul style="list-style-type: none"> • Generator • Drive belt • Drive belt tensioner • Generator pulley • Check the security of the generator fixings 	<ul style="list-style-type: none"> • Generator • Battery • Fuse 5 Rear Junction Box (RJB) • Engine/generator ground connection • Circuit(s) • Electrical connector(s) • Engine Control Module (ECM)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident verify the symptom and refer to the Symptom Chart. Alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Battery Not Charging warning displayed	<ul style="list-style-type: none"> • Fuse 5 RJB • Front End 	Check Fuse 5 RJB. Check the battery condition and state of charge. Refer to the battery care

on message center	<p>Accessory Drive (FEAD) belt tension</p> <ul style="list-style-type: none"> • Generator fault • ECM • Instrument cluster fault • Controller Area Network (CAN) fault 	<p>manual. Check the FEAD belt tension.</p> <p>Accessory Drive Check ECM and instrument cluster for DTCs and refer to relevant DTC Index.</p> <p>Electronic Engine Controls</p> <p>Instrument Cluster</p> <p>Communications Network</p>
Battery keeps discharging, no warning message displayed on message center	<ul style="list-style-type: none"> • No ignition power from CJB • Battery quiescent drain • Battery fault • FEAD belt tension • Generator pulley fault • Generator failure 	<p>For ignition power circuit tests. GO to Pinpoint Test G834532p1.</p> <p>Check the quiescent drain. Check the battery condition and state of charge, refer to the battery care manual.</p> <p>Battery Charging Check the FEAD belt tension.</p> <p>Accessory Drive Check RJB for DTCs B2A9016, B2A9116, Note: if battery requires replacing and these DTCs were logged, complete and return the battery report form listing the DTCs, see battery care manual. Check ECM for DTCs and refer to relevant DTC Index.</p> <p>Electronic Engine Controls Check the generator pulley does not turn independently of the generator</p>
Generator noisy	<ul style="list-style-type: none"> • FEAD belt tension • FEAD belt • FEAD belt tensioner • FEAD belt idler pulleys • Generator failure 	<p>For noisy generator tests. GO to Pinpoint Test G834532p7.</p>
Radio interference	<ul style="list-style-type: none"> • Generator • Wiring harness 	<p>For radio interference tests. GO to Pinpoint Test G834532p8.</p>

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
P163200	Generator faults sensor/circuit	<ul style="list-style-type: none"> Charging system fault 	GO to Pinpoint Test G834532p4.
B2A9016	Battery low	<ul style="list-style-type: none"> Circuit voltage below threshold 	Check battery is in fully charged and serviceable condition (if battery requires replacing and this DTC is logged, complete and return battery report form listing this DTC), refer to the battery care manual
B2A9116	Battery	<ul style="list-style-type: none"> Circuit voltage 	Check battery is in fully charged and serviceable condition (if battery requires

	discharged	below threshold	replacing and this DTC is logged, complete and return battery report form listing this DTC), refer to the battery care manual
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Pinpoint Tests

PINPOINT TEST G834532p4 : P163200 CHARGING SYSTEM FAULT

G834532t9 : CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING

1. Connect a suitable voltmeter across the battery terminals. 2. Start the engine and allow to idle with no electrical loads applied. 3. Measure the maximum voltage achieved at the battery after start.

- **Is the voltage greater than 13 volts?**

-> **Yes**

GO to Pinpoint Test G834532t10.

-> **No**

INSTALL a fully charged battery. GO to Pinpoint Test G834532t13.

G834532t10 : CHECK THE GENERATOR 'S' TERMINAL FOR BATTERY VOLTAGE

1. Set ignition status to OFF. 2. DISCONNECT generator electrical connector PI048. 3. MEASURE the voltage at generator electrical connector PI048 pin 3.

- **Is the voltage greater than 10 volts?**

-> **Yes**

GO to Pinpoint Test G834532t13.

-> **No**

GO to Pinpoint Test G834532t11.

G834532t11 : CHECK FUSE 5 IN REAR JUNCTION BOX (RJB)

1. Check fuse 5 in the RJB.

- **Is the fuse OK?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 3 and fuse 5 in the RJB.
CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t12.

G834532t12 : CHECK THE GENERATOR 'S' TERMINAL FOR SHORT TO GROUND

1. MEASURE the resistance between generator electrical connector PI048 pin 3 and ground.

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 3 and fuse 5 of the RJB.
INSTALL a new fuse, CLEAR the DTC, test the system for normal operation.

-> **No**

INSTALL a new fuse, CLEAR the DTC, test the system for normal operation.

G834532t13 : CHECK FOR BATTERY VOLTAGE AT THE GENERATOR 'L' TERMINAL

1. Set ignition status to OFF. 2. Disconnect generator electrical connector PI048. 3. Set ignition status to ON. 4. Measure the voltage at generator electrical connector PI048 pin 1.

- **Is the voltage greater than 10 volts?**

-> **Yes**

INSTALL a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02) CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t14.

G834532t14 : CHECK THE GENERATOR 'L' LINE FOR SHORT TO GROUND

1. Set ignition status to OFF. 2. Disconnect battery. 3. MEASURE the resistance between the generator electrical connector PI048 pin 1 and ground.

- **Is the resistance less than 1,000 ohms?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 1 and the Engine Control Module (ECM). CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t15.

G834532t15 : CHECK THE GENERATOR 'L' LINE FOR SHORT TO POWER

1. MEASURE the resistance between the generator electrical connector PI048 pin 1 and battery positive.

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 1 and the Engine Control Module (ECM). CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t16.

G834532t16 : CHECK THE GENERATOR 'L' LINE FOR OPEN CIRCUIT

1. Disconnect the ECM electrical connector PI300. 2. MEASURE the resistance between the generator electrical connector PI048 pin 1 and ECM electrical connector PI300 pin 16.

- **Is the resistance less than 5 ohms?**

-> **Yes**

Install a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02) CLEAR the DTC, test the system for normal operation.

-> **No**

REPAIR the circuit between the generator electrical connector PI048 pin 1 and the ECM electrical connector PI300 pin 16. CLEAR the DTC, test the system for normal operation.

PINPOINT TEST G834532p1 : IGNITION POWER CIRCUIT TESTS

G834532t1 : CHECK FOR IGNITION POWER AT GENERATOR

1. Set ignition status to OFF. 2. Disconnect generator electrical connector PI048. 3. Set ignition status to ON. 4. Measure the voltage at generator electrical connector PI048 pin 2.

- **Is the voltage greater than 10 volts?**

-> **Yes**

Check for quiescent current fault, check battery condition. Refer to the Battery Care Manual.

-> **No**

GO to Pinpoint Test G834532t2.

G834532t2 : CHECK THE IGNITION POWER CIRCUIT FOR SHORT TO GROUND

1. Set the ignition status to OFF. 2. Disconnect the battery. 3. Check the resistance between generator electrical connector PI048 pin 2 and GROUND.

- **Is the resistance less than 400 ohms?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 2 and the CJB. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t3.

G834532t3 : CHECK THE IGNITION POWER CIRCUIT FOR SHORT TO POWER

1. Check the resistance between generator electrical connector PI048 pin 2 and battery positive.

- **Is the resistance less than 10,000 ohms?**

-> **Yes**

REPAIR the circuit between the generator electrical connector PI048 pin 2 and the CJB. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t4.

G834532t4 : CHECK THE IGNITION POWER CIRCUIT FOR OPEN CIRCUIT

1. Disconnect CJB electrical connector FL048. 2. Check the resistance between CJB electrical connector FL048 pin 12 and generator electrical connector PI048 pin 2.

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit between CJB electrical connector FL048 pin 12 and generator electrical connector PI048 pin 2. CLEAR the DTC, test the system for normal operation.

-> **No**

GO to Pinpoint Test G834532t5.

G834532t5 : CHECK CJB IGNITION POWER OUTPUT DRIVE

1. Connect the battery. 2. Set ignition status to ON. 3. Check the voltage at CJB electrical connector FL048, component side, pin 12.

- **Is the voltage greater than 10 volts?**

-> **Yes**

Check no other modules connected to this circuit are pulling to GROUND. Clear the DTC, test the system for normal operation.

-> **No**

Install a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02)

PINPOINT TEST G834532p7 : GENERATOR NOISY

G834532t23 : CHECK THE GENERATOR FOR SECURITY

1. Inspect the generator fixings.

- **Is the generator secure?**

-> **Yes**

GO to Pinpoint Test G834532t24.

-> **No**

SECURE the generator. TEST the system for normal operation.

G834532t24 : CHECK THE FEAD BELT

1. Remove and inspect the FEAD belt.

Accessory Drive Belt - 4.2L NA V8 - AJV8 (12.10.40)

- **Is the FEAD belt in good condition?**

-> **Yes**

GO to Pinpoint Test G834532t25.

-> **No**

INSTALL a new FEAD belt. TEST the system for normal operation.

G834532t25 : CHECK THE FEAD BELT TENSIONER

1. Remove and inspect the FEAD belt tensioner.

Accessory Drive Belt Tensioner - 4.2L NA V8 - AJV8 (12.10.41)

- **Is the FEAD belt tensioner in good condition?**

-> **Yes**

GO to Pinpoint Test G834532t26.

-> **No**

INSTALL a new FEAD belt tensioner. TEST the system for normal operation.

G834532t26 : CHECK THE GENERATOR FOR MECHANICAL NOISE

1. Rotate the generator pulley by hand.

- **Does the generator rotor shaft rotate smoothly and quietly?**

-> **Yes**

GO to Pinpoint Test G834532t27.

-> **No**

INSTALL a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02) TEST the system for normal operation.

G834532t27 : CHECK THE FEAD BELT IDLER PULLEYS

1. Rotate the FEAD belt idler pulleys by hand.

- **Do the FEAD belt idler pulleys rotate smoothly and quietly?**

-> **Yes**

GO to Pinpoint Test G834532t28.

-> **No**

INSTALL new FEAD belt idler pulleys as necessary.

Accessory Drive Belt Idler Pulley - 4.2L NA V8 - AJV8 (12.10.43) TEST the system for normal operation.

G834532t28 : CHECK THE GENERATOR FOR ELECTRICAL NOISE

1. Install the FEAD belt pulleys and belt. 2. Start and run the engine at 1500 rpm. Apply a high electrical load to the battery.

- **Is the noise only heard with the high electrical load applied?**

-> **Yes**

GO to Pinpoint Test G834532t29.

-> **No**

CHECK the air conditioning compressor.

Air Conditioning (A/C) Compressor - 4.2L NA V8 - AJV8 (82.10.20) CHECK the power steering pump.

Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14) TEST the system for normal operation.

G834532t29 : ELIMINATE THE GENERATOR AS THE CAUSE OF ELECTRICAL NOISE

1. Disconnect generator electrical connector PI048. 2. Start and run the engine at 1500 rpm.

- **Is the noise still present?**

-> **Yes**

CHECK the air conditioning compressor.

Air Conditioning (A/C) Compressor - 4.2L NA V8 - AJV8 (82.10.20) CHECK the power steering pump.

Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14) TEST the system for normal operation.

-> **No**

INSTALL a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02) TEST the system for normal operation.

PINPOINT TEST G834532p8 : RADIO INTERFERENCE

G834532t30 : CHECK IF THE GENERATOR IS THE CAUSE OF THE RADIO INTERFERENCE

1. Start and run the engine at 1500 rpm. 2. Turn the radio to the **ON** position, and select the affected station.

- **Is the radio interference present?**

-> **Yes**

GO to Pinpoint Test G834532t32.

-> **No**

GO to Pinpoint Test G834532t31.

G834532t31 : CHECK IF THE GENERATOR IS THE CAUSE OF THE RADIO INTERFERENCE WITH A HIGH ELECTRICAL LOAD APPLIED TO THE BATTERY

1. Start and run the engine at 1500 rpm. 2. Apply a high electrical load to the battery. 3. Turn the radio to the **ON** position, and select the affected station.

- **Is the radio interference present?**

-> **Yes**

GO to Pinpoint Test G834532t32.

GO to Pinpoint Test G834532t32.

-> **No**

DIAGNOSE the entertainment system.

Audio System

G834532t32 : ELIMINATE THE GENERATOR AS THE CAUSE OF RADIO INTERFERENCE

1. Disconnect generator electrical connector PI048. 2. Start and run the engine at 1500 rpm. 3. Turn the radio to the **ON** position, and select the affected station.

- **Is the radio interference present?**

-> **Yes**

DIAGNOSE the entertainment system.

Audio System

-> **No**

CLEAN and tighten all mounting points, positive and negative cable connections (including the hood, luggage compartment lid and engine GROUND straps). INSTALL fuse 5 to the RJB. TEST the system for normal operation. If interference is still present, INSTALL a new generator.

Generator - 4.2L NA V8 - AJV8 (86.10.02)

414-01 : Battery, Mounting and Cables

Specifications

Specifications

Battery Specification



WARNING: Batteries produce explosive gases which may cause personal injury. Do not expose the battery to a naked flame. When charging or working near a battery wear protective clothing and eye protectors. Always provide adequate ventilation. Failure to follow these instructions may result in personal injury.



WARNING: Batteries contain sulphuric acid, avoid contact with skin, eyes and clothing. Shield your eyes when working near the battery to protect against possible contact of the acid solution. In case of contact with the skin or eyes, flush immediately for a minimum of 15 minutes and seek prompt medical attention. If swallowed call a physician immediately. Failure to follow these instructions may result in personal injury.



CAUTION: Make sure all electrical systems are off before connecting the battery ground cable. Failure to follow these instructions may result in damage to the electrical system.

Engine Specification	Battery	
	Battery Information	
	Battery type	Specification
Vehicles fitted with 4.2L NA and SC engine	Varta T8	90 Ah

Battery Cold Cranking Specification

Item	Specification
90 Ah Battery Cold Cranking	800 Amps

Battery Disconnect/Connect Procedures



WARNING: The backup power supply energy must be depleted before any supplementary restraint system repairs are carried out. To deplete the backup supply energy, first disconnect the battery ground cable, then disconnect the battery positive cable and wait ten minutes to avoid accidental deployment and personal injury. Failure to follow this instruction may result in personal injury.



CAUTION: Disconnecting the battery cables will cause all of the electronic control modules to lose all stored data/fault codes.

NOTE:

Following reconnecting of the battery, the engine should be allowed to idle as the stored idle and drive values contained within the engine control module (ECM) will have been lost. This may cause driveability concern if the following procedure is not carried out.

Battery disconnect procedure	Battery connect procedure
1. If possible, apply parking brake or alternatively, chock wheels.	1. Connect the battery cables and tighten to 5 Nm. Ground cable must be connected last
2. If required, record any customer audio and climate control settings. This also applies to all electronic control module stored information.	2. Install the battery cover and close the luggage compartment lid.
3. Switch off ignition.	3. Start the engine and allow to idle until the engine reaches normal operating temperature.
4. Open the luggage compartment lid.	4. Switch the engine off.
5. Release the cover and disconnect the battery ground cable.	5. Restart the engine and allow to idle for approximately two minutes (this will allow the ECM to learn the idle values).
6. If required, disconnect the battery positive cable.	6. Apply and hold the brake pedal, select drive and allow the engine to idle for a further two minutes.
	7. Drive the vehicle for approximately five miles/eight kilometers of varied driving to enable the ECM to complete it's learning strategy.
	8. Reset the audio unit and climate control assembly to original customer settings.
	9. Reset the door window motors.

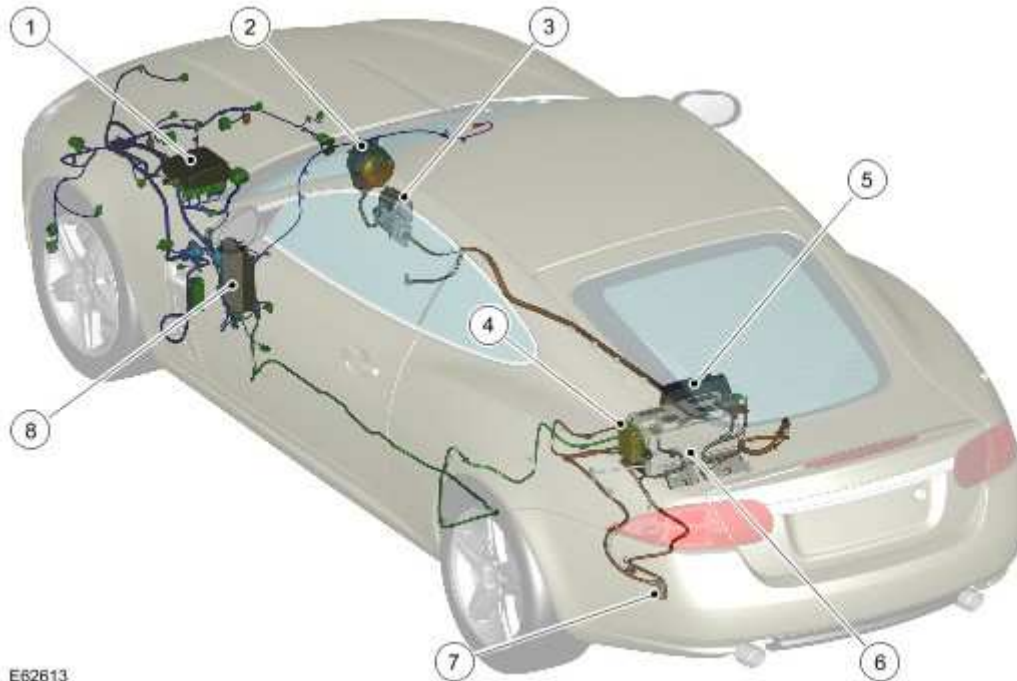
Torque Specifications

Description	Nm	lb-ft	lb-in
Battery positive cable terminal retaining nut	5	4	-

Battery negative cable terminal retaining nut	5	4	-
Battery clamp nuts	9	7	-

Battery and Cables

COMPONENT LOCATION



Item	Part Number	Description
1		Power distribution box
2		Generator
3		Starter motor
4		Battery Junction Box (BJB)
5		Auxiliary junction box
6		Battery
7		Remote jump start terminal
8		Central Junction Box (CJB)

INTRODUCTION

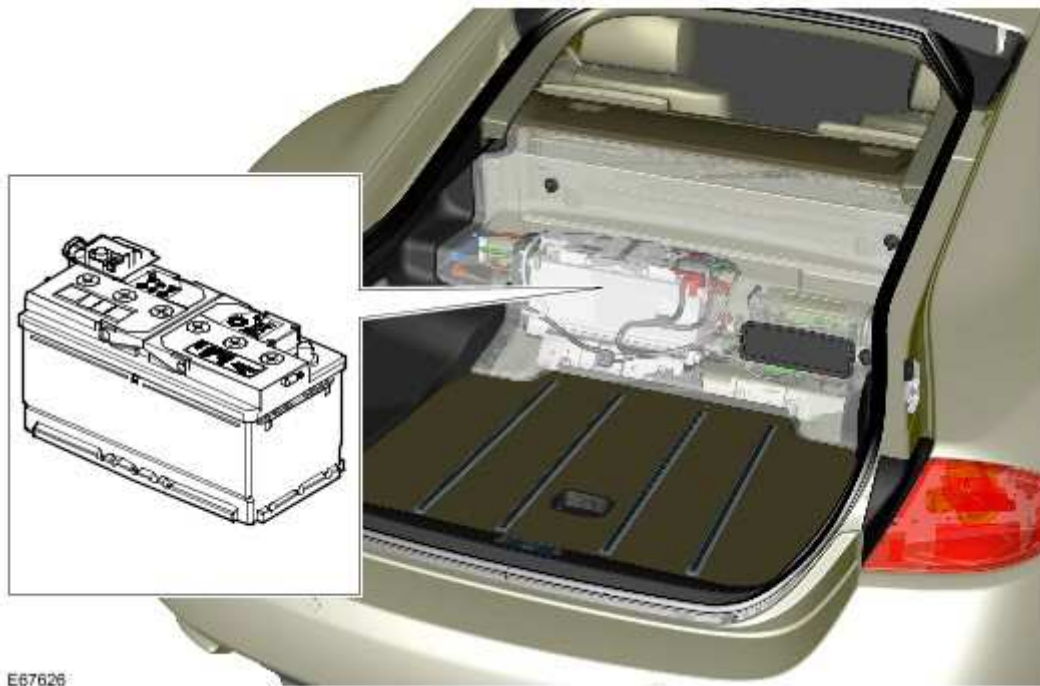
Electrical power from the battery and generator is distributed throughout the vehicle through a series of junction boxes.

IGNITION MODES

The vehicle has a possible 4 ignition modes. The modes and systems that are active in each mode are detailed in the following table.

Ignition Mode	Off	Accessory (convenience)	On	Crank
Exterior lamps headlamps – Dip only approach lamps	Memory functions seat, column etc	Exterior lamps fog lamps directional Indicators	Stability controls	
Interior lighting	Manual adjust seat column etc	Convertible hood	Heated/cooled Seat	
Preheat - timed in	Interior lighting	Wash/wipe	Adaptive speed control	
Electric park brake - On	Brake lights	HVAC	Adaptive damping	
Instrument cluster - stand by, clock, odometer	Exterior lighting auto headlamps, reversing lamps, side lamps, tail lamps	EMS	TPMS	
Hazard warning lamps	Auto infotainment previous condition (preset volume), radio standby, phone standby, steering wheel switches	Instrument cluster – dials and warnings fuel gauge temperature gauge lamp check	Pedestrian Protection system	
Locking and unlocking	Instrument cluster –message center, trip computer	Windows	Gearshift control & TCM	
Security	Horn	EPB – power to disengage (foot on break)	EPB – power to disengage	
	Cigar lighter/power socket	Restraints check		

BATTERY



The battery is located behind a cover at the front of the luggage compartment. The cover is held in place by 4 retainers. The battery sits in a tray and is secured with a clamp plate and 2 nuts.

The positive and negative battery cables are fitted with Service loops. The Service loops add extra length to the cables and allow the battery to be slid rearward in the luggage compartment without disconnection.

Remote Jump Start Terminal

The positive battery cable is also connected to a remote jump start terminal. The remote jump start terminal is located in the Left-Hand (LH) rear corner of the luggage compartment and can be accessed by removing the air vent trim. Although also fitted to coupe vehicles, the terminal has been specifically designed to allow a convertible vehicle to be jump started if a drained battery is experienced when the top is in the stowed condition.

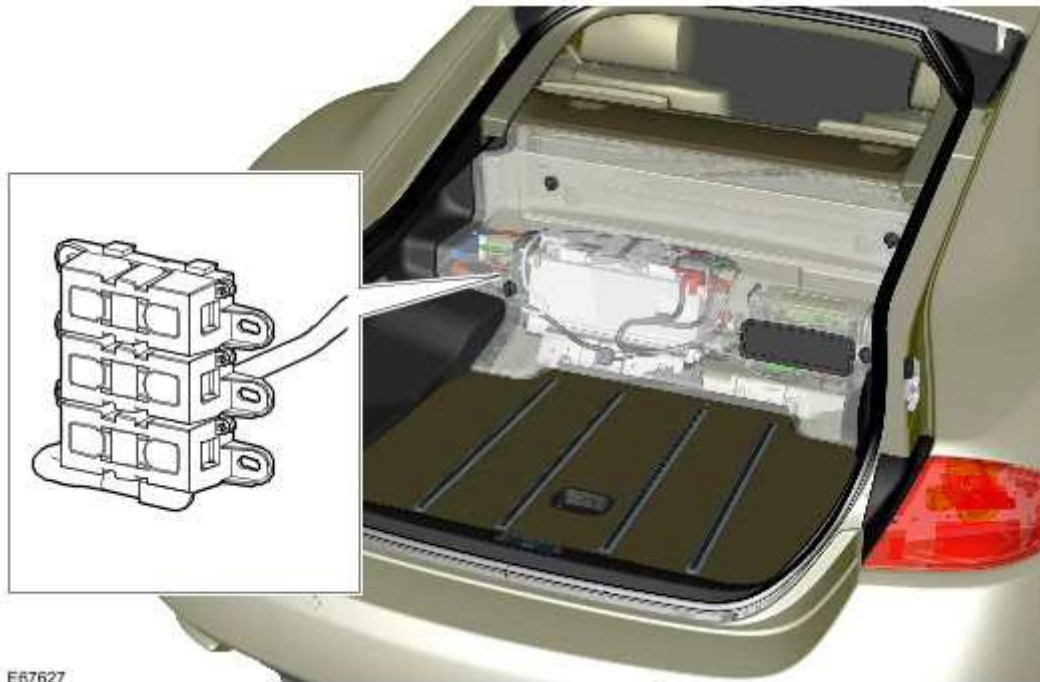
The starter motor power lead is also connected to the remote jump start terminal and is insulated from the battery jump start cable and the vehicle body by a nylon washer.

The negative jump start connection is a stud located in the spare wheel well. For more information on jump start procedure, refer to the Owners Handbook.

Transit Relay

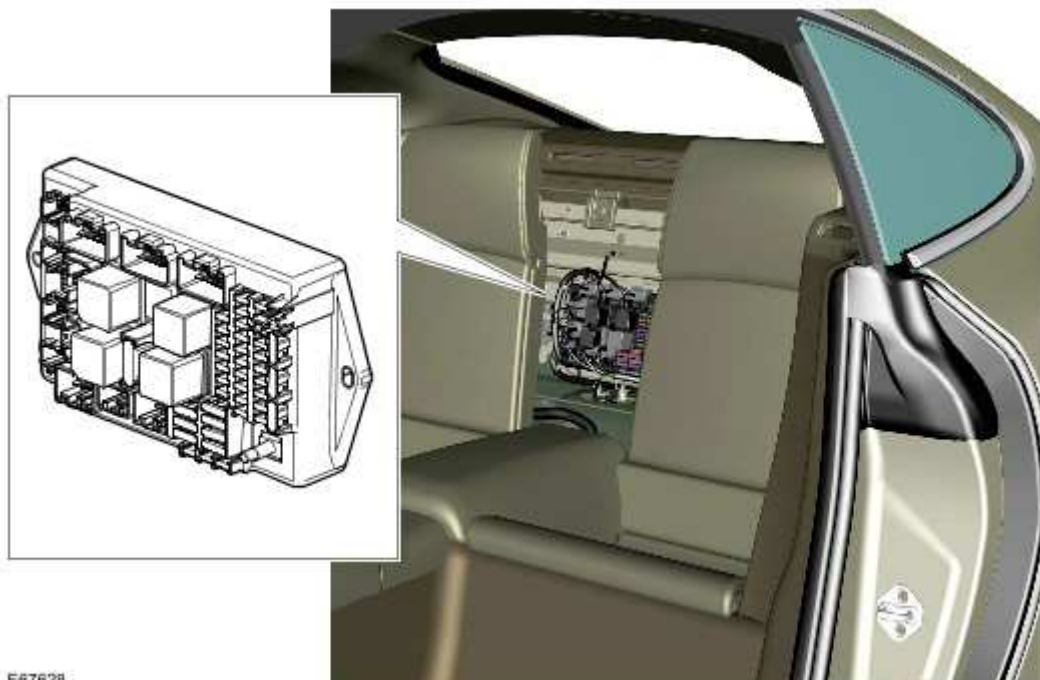
The vehicle is also fitted with a transit relay. This is a disposable device and not for use by the customer. This relay is fitted in series with the battery and ground. It disconnects the battery from the vehicles ground and thus eliminates quiescent current drain during delivery. The relay must be removed before delivery to the customer. For more information, refer to the Pre-Delivery Inspection (PDI) manual.

BATTERY JUNCTION BOX (BJB)



Mounted on the LH side of the battery is the BJB. The BJB contains 3 megafuses delivering battery power to; the starter motor (400A); the auxiliary junction box (175A) and the CJB (175A). For more information, refer to the Electrical Guide.

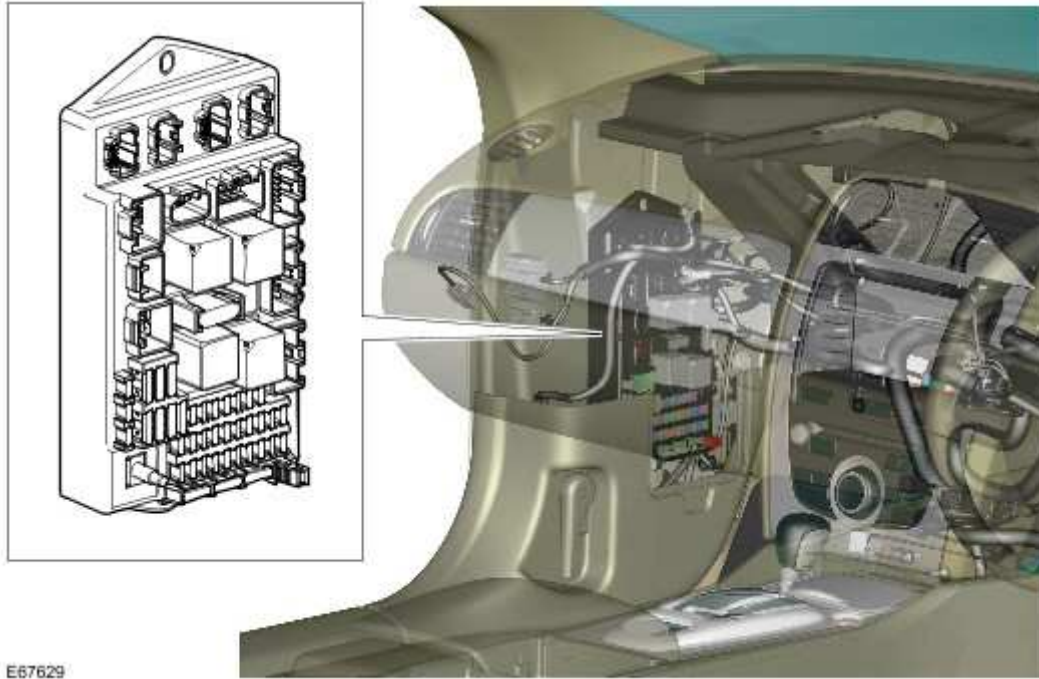
AUXILIARY JUNCTION BOX



The auxiliary junction box is mounted on the passenger compartment rear bulkhead and secured by 2 nuts/studs. The junction box can be accessed by opening the center panel of the rear seat back. The center panel is secured in position by a single stud at the top, and hinged at the bottom.

The auxiliary junction box receives electrical power from the BJB via a 175A megafuse. For more information on the circuits and systems served by the auxiliary junction box, refer to the Electrical Guide.

CENTRAL JUNCTION BOX (CJB)



The CJB is mounted at the base of the LH A pillar and secured by 2 nuts/studs. Access to the CJB can be gained through a removable panel located below the LH side of the instrument panel.

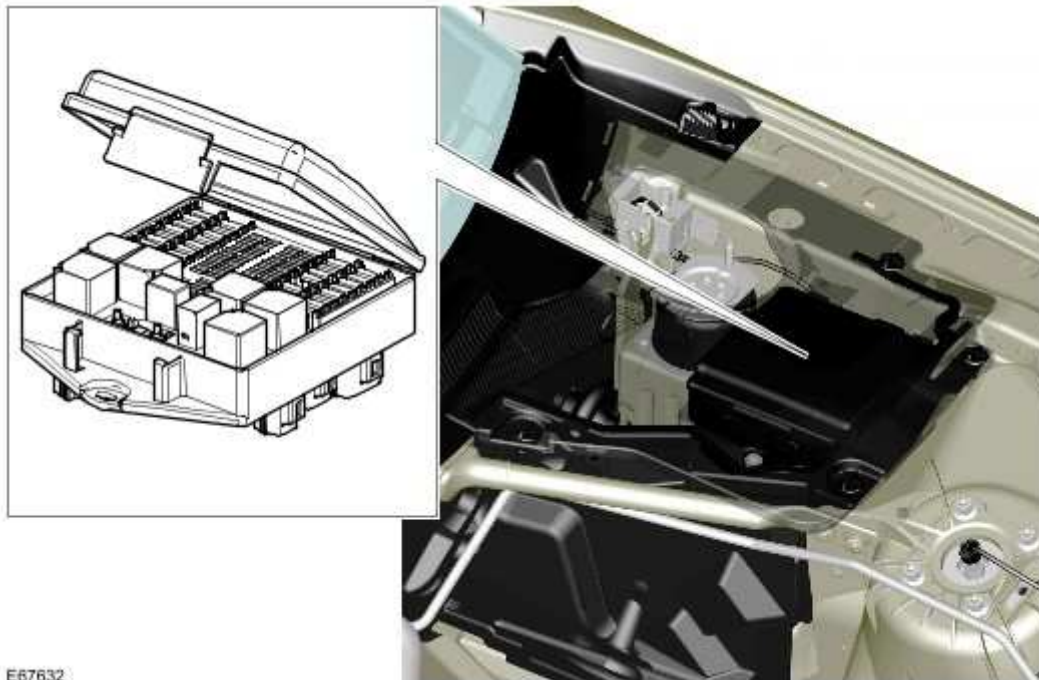
The CJB receives electrical power from the BJB via a 175A megafuse. A second power supply lead 'daisy chains' off the CJB, providing electrical power to the power distribution box. For more information on the circuits and systems served by the CJB, refer to the Electrical Guide.

The CJB also controls the functionality of a number of vehicle systems. These include:

- Electric steering column lock. For additional information, refer to Steering Column (211-04 Steering Column)
- Instrument cluster and panel illumination. For additional information, refer to Instrument Cluster and Panel Illumination (413-00 Instrument Cluster and Panel Illumination)
- Exterior lighting systems. For additional information, refer to Exterior Lighting (417-01 Exterior Lighting)
For additional information, refer to Daytime Running Lamps (DRL) (417-04 Daytime Running Lamps (DRL))
- Interior lighting systems. For additional information, refer to Interior Lighting (417-02 Interior Lighting)
- Active anti-theft alarm system. For additional information, refer to Anti-Theft - Active (419-01 Anti-Theft - Active)
- Passive anti-theft alarm system. For additional information, refer to Anti-Theft - Passive (419-01 Anti-Theft - Passive)

- Passive start. For additional information, refer to Handles, Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems)
- Electric seats. For additional information, refer to Seats (501-10 Seating)
- Electric windows. For additional information, refer to Glass, Frames and Mechanisms (501-11 Glass, Frames and Mechanisms)
- Wipers and washers. For additional information, refer to Wipers and Washers (501-16 Wipers and Washers)

POWER DISTRIBUTION BOX



E67632

The power distribution box is located in the LH rear of the engine compartment, beneath a closing panel. The power distribution box is supplied electrical power from the BJB, via the CJB. For more information on the circuits and systems served by the power distribution box, refer to the Electrical Guide.

Battery

For additional information, <<414-00>>

Battery (86.15.01)

Removal



CAUTION: It is imperative that the battery ground cable is disconnected from the battery terminal and not the body.

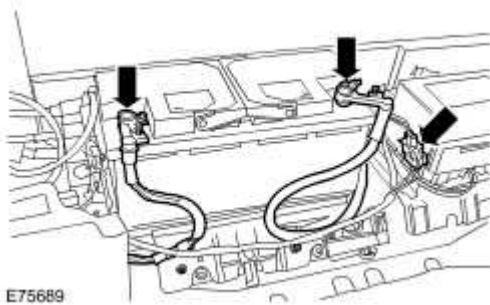
1 . Remove the cover and disconnect the battery ground cable.

2 . Disconnect the battery positive cable.

▶ Loosen the nut.

3 . Release the harness.

▶ Release the electrical connector from the clip.

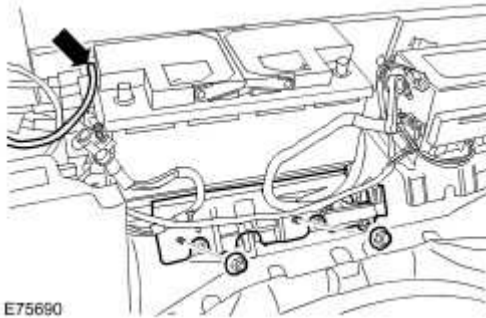


4 . Release the battery clamp.

▶ Remove the 2 nuts.

5 . Remove the battery.

- ▶ Disconnect the vent tube.



Installation

- 1 . Install the battery.

- ▶ Connect the vent tube.

- 2 . Install the battery clamp.

- ▶ Tighten the nuts to 6 Nm (4 lb.ft).

- 3 . Secure the wiring harness.

- ▶ Attach the electrical connector to the clip.

- 4 . Connect the battery positive cable.

- ▶ Tighten the nut to 5 Nm (4 lb.ft).

- 5 . Connect the battery ground cable and install the cover.

414-02 : Generator and Regulator – 4.2L NA V8 – AJV8/4.2L SC V8 – AJV8

Specifications

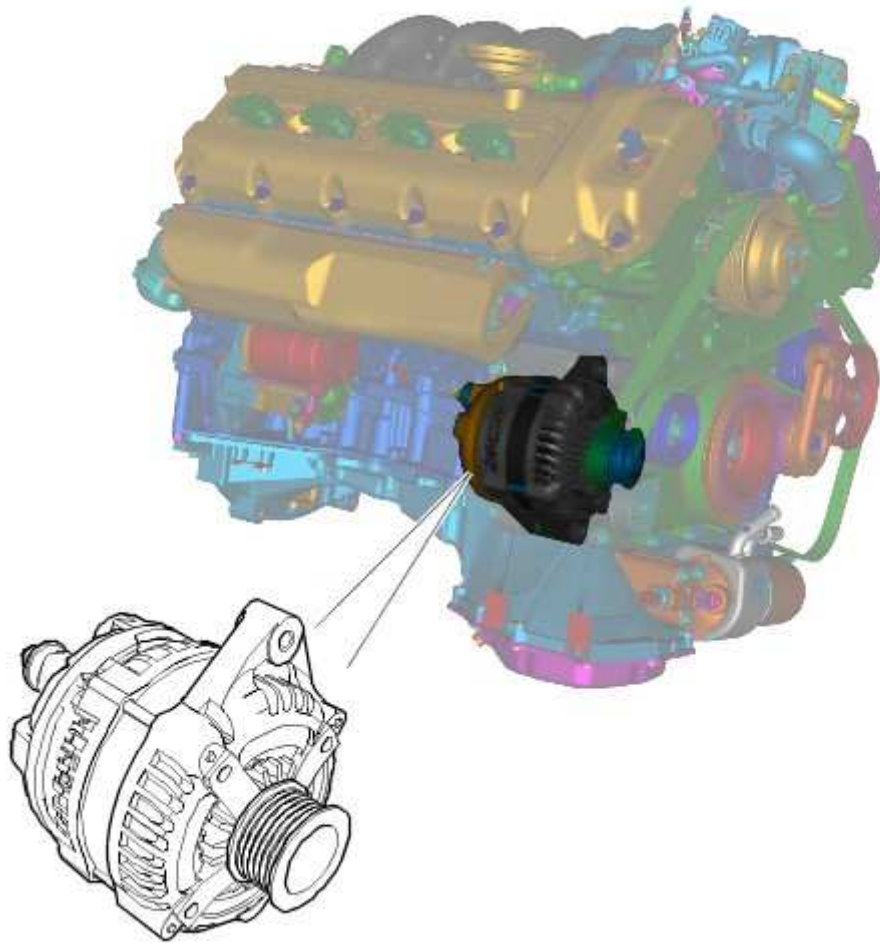
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Electrical connector to generator - nut	12	9	-
Generator to mounting bracket - upper nut	25	18	-
Generator to mounting bracket - lower nut/bolt	40	30	-
Generator mounting bracket to engine - bolt	40	30	-

Generator

COMPONENT LOCATION



E63792

INTRODUCTION

The generator is located at the front Right-Hand (RH) side of the engine, on the cylinder block. The generator has an output of 85/130 Amps and is manufactured by Denso. A six-ribbed polyvee belt drives the generator pulley, which in turn is driven from the engine crankshaft pulley. The generator comprises a stator, a rotor, a rectifier pack and a regulator.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The iron core has extensions at each end, which form North and South poles as current flows through the field winding. The rotor is located inside the stator and is mounted on bearings for smooth running and to support the rotor due to the high side loading applied by the drive belt tension.

The stator has three sets of coils made from copper wire. The three coil windings are connected in a 'dual star' connection, where one end of the winding is connected to the other two windings. The output current is supplied from the opposite end of each winding. Rotation of the rotor causes ac current to be produced in the coils.

The rectifier converts the ac current produced in the stator coils into dc (rectified) current required by the vehicle electrical system. The rectifier comprises 12 semi-conductor diodes mounted on a heatsink to dissipate heat. An equal number of the diodes are on the negative and positive side. An additional diode in the regulator controls feedback through the battery voltage signal line. The rectifier also prevents current flow from the battery to the generator when the output voltage is less than the battery voltage.

Initially, the ignition supply provides an excitation current to the rotor at low generator speeds via brushes, which contact slip rings at the end of the rotor shaft. As the generator speed increases the generator becomes self-exciting.

The charge warning lamp function is transmitted to the engine management system and then on to the high speed Controller Area Network (CAN) bus to the instrument cluster.

Generator

For additional information, refer to section [414-00](#)

Generator - 4.2L NA V8 - AJV8 (86.10.02)

Removal

All vehicles

1 . Remove the cover and disconnect the battery ground cable.

2



· **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

3 . Remove the accessory drive belt.

4 . Remove the RH HO2S.

5 . Remove the RH engine mount.

Right-hand drive vehicles

6 . Disconnect the steering gear electrical connector.



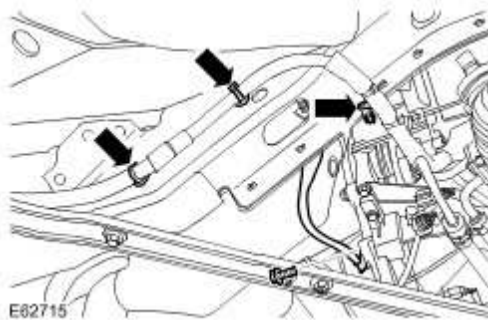
All vehicles

7 . Release the battery positive cable from the body.

▶ Release the 3 clips.

8 . Disconnect the ground cable from the transmission.

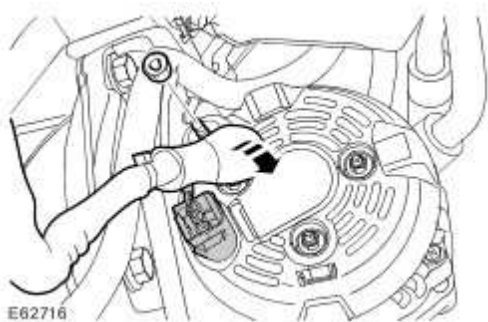
▶ Remove the bolt.



9 . Disconnect the generator electrical connectors.

▶ Release the cover.

▶ Remove the nut.

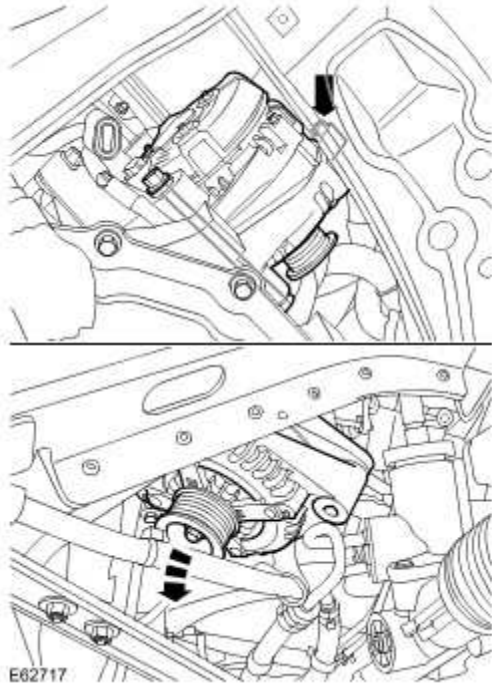


10 . Remove the generator.

▶ Remove the nut.

▶ Remove the nut and bolt.

▶ Rotate the generator.



Installation

All vehicles


1 . Install the generator.

- ▶ Tighten the nut to 25 Nm (18 lb.ft).
- ▶ Tighten the nut and bolt to 40 Nm (30 lb.ft).


2 . Connect the generator electrical connectors.

- ▶ Tighten the nut to 12 Nm (9 lb.ft).
- ▶ Secure the cover.

3 . Connect the ground cable.

 Tighten the bolt to 48 Nm (35 lb.ft).

4 . Secure the battery positive cable.

 Attach the clips.

Right-hand drive vehicles

5 . Connect the steering gear electrical connector.

All vehicles

6 . Install the RH engine mount.

7 . Install the RH HO2S.

8 . Install the accessory drive belt.


9 . Connect the battery ground cable and install the cover.

Generator - 4.2L SC V8 - AJV8 (86.10.02)

Removal

All vehicles

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 3 . Remove the accessory drive belt.
For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)
- 4 . Remove the RH HO2S.
For additional information, refer to Heated Oxygen Sensor (HO2S)
- 5 . Remove the RH engine mount.
For additional information, refer to Engine Mount RH (12.45.03)

Right-hand drive vehicles

- 6 . Disconnect the steering gear electrical connector.



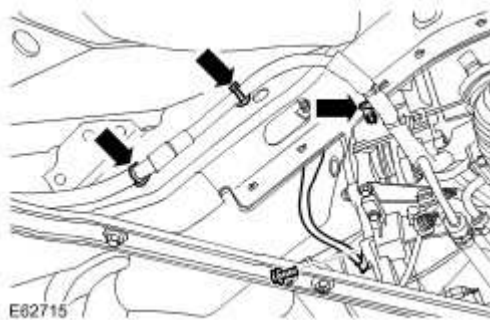
All vehicles

7 . Release the battery positive cable from the body.

▶ Release the 3 clips.

8 . Disconnect the ground cable from the transmission.

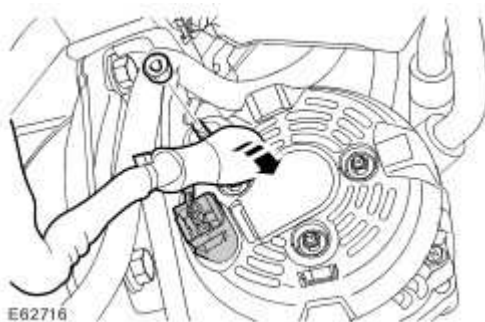
▶ Remove the bolt.



9 . Disconnect the generator electrical connectors.

▶ Release the cover.

▶ Remove the nut.

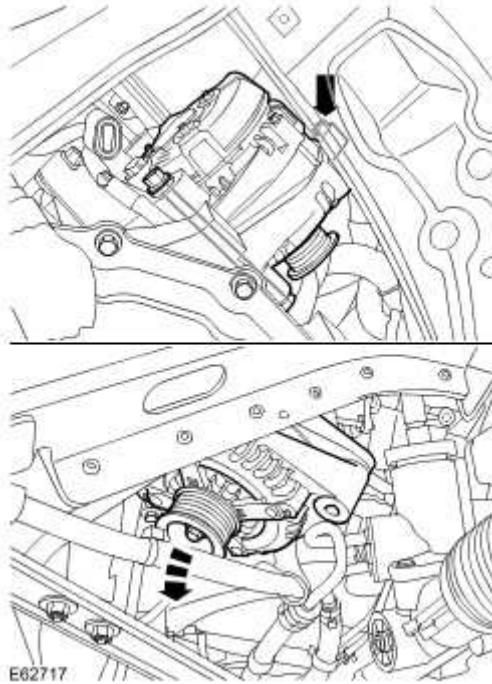


10 . Remove the generator.

▶ Remove the nut.

▶ Remove the nut and bolt.

▶ Rotate the generator.



Installation

All vehicles


1 . Install the generator.

- ▶ Tighten the nut to 25 Nm (18 lb.ft).
- ▶ Tighten the nut and bolt to 40 Nm (30 lb.ft).


2 . Connect the generator electrical connectors.

- ▶ Tighten the nut to 12 Nm (9 lb.ft).
- ▶ Secure the cover.

3 . Connect the ground cable.

 Tighten the bolt to 48 Nm (35 lb.ft).

4 . Secure the battery positive cable.

 Attach the clips.

Right-hand drive vehicles

5 . Connect the steering gear electrical connector.

All vehicles

6 . Install the RH engine mount.

For additional information, refer to Engine Mount RH (12.45.03)

7 . Install the RH HO2S.

For additional information, refer to Heated Oxygen Sensor (HO2S)

8 . Install the accessory drive belt.

For additional information, refer to Accessory Drive Belt - 4.2L SC V8 - AJV8 (12.10.40)

9 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

415 : Information and Entertainment Systems

415-00 : Information and Entertainment – General Information

Diagnosis and testing

Audio System

Principle of Operation

For a detailed description of the Information and Entertainment System, refer to the relevant Description and Operation section in the workshop manual.

Audio System

Antenna

Speakers

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Integrated audio module• Information and entertainment module• Audio amplifier• Compact disc player jammed, not loading• Scratched/dirty compact discs• Speakers	<ul style="list-style-type: none">• Fuses• Loose or corroded connector(s)• Integrated audio module• Information and entertainment module• Audio amplifier• Speakers

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

Information and Entertainment Module



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A59-	Sensor 5 Volt supply	<ul style="list-style-type: none">Internal electronic failure	Install a new information and entertainment control module,

49			refer to the new module installation note at the top of the DTC Index
B1D21-15	Remote control switch	<ul style="list-style-type: none"> Steering wheel audio switch circuit - short to power, high resistance 	For steering wheel audio control switch tests. GO to Pinpoint Test G834560p1.
U0010-00	Medium speed CAN communication Bus	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0127-00	Lost communication with Tire Pressure Monitor System (TPMS) module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0140-00	Lost communication with CJB	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0142-00	Lost communication with RJB	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0155-00	Lost communication with instrument cluster	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0159-00	Lost communication with parking aid module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0164-00	Lost communication with climate control module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0184-	Lost communication	<ul style="list-style-type: none"> General failure No sub type 	Carry out the pinpoint test associated with this DTC using

00	with audio module	information	the manufacturer approved diagnostic system
U0186-00	Lost communication with audio amplifier	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0193-00	Lost communication with satellite radio tuner	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0197-00	Lost communication with telephone module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0199-00	Lost communication with driver door module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0200-00	Lost communication with passenger door module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0206-00	Lost communication with convertible top module	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0214-00	Lost communication with remote function actuation	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0256-00	Lost communication with integrated control panel	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0245-	Lost communication with multimedia	<ul style="list-style-type: none"> General failure No sub type 	Carry out the pinpoint test associated with this DTC using

00	module	information	the manufacturer approved diagnostic system
U0257-00	Lost communication with touch screen display	<ul style="list-style-type: none"> General failure No sub type information 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U0300-00	Internal control module software incompatibility	<ul style="list-style-type: none"> RJB car configuration data is not compatible with the information and entertainment control module 	Re-configure the RJB using the manufacturer approved diagnostic system, clear DTCs and re-test. If DTC still logged, suspect the information and entertainment control module and refer to the new module installation note at top of DTC Index
U0300-51	Internal control module software incompatibility	<ul style="list-style-type: none"> System program failure 	Re-configure the information and entertainment control module using the manufacturer approved diagnostic system
U1A15-87	Incomplete MOST ring reported by Information and Entertainment control module	<ul style="list-style-type: none"> Missing message 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U3000-55	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the information and entertainment module, refer to the new module installation note at the top of the DTC Index
U3000-87	Control module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check information and entertainment module for DTCs and refer to

			the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U3002-81	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U3003-62	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between information and entertainment module and RJB 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system

Audio Amplifier (vehicles with premium audio)



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A01-13	Speaker #1 - circuit open	<ul style="list-style-type: none">• Front passenger speaker circuits - high resistance	Refer to the electrical circuit diagrams and test front passenger speaker circuits for high resistance
B1A02-13	Speaker #2 - circuit open	<ul style="list-style-type: none">• Front driver speaker circuits - high resistance	Refer to the electrical circuit diagrams and test front driver speaker circuits for high resistance
B1A03-13	Speaker #3 - circuit open	<ul style="list-style-type: none">• Rear left speaker circuit - high resistance	Refer to the electrical circuit diagrams and test rear left speaker circuit for high resistance
B1A04-13	Speaker #4 - circuit open	<ul style="list-style-type: none">• Rear right speaker circuit - high resistance	Refer to the electrical circuit diagrams and test rear right speaker circuit for high resistance
B1A05-13	Speaker #5 - circuit open	<ul style="list-style-type: none">• Front center speaker circuit - high resistance	Refer to the electrical circuit diagrams and test front center speaker circuit for high resistance
B1A06-13	Speaker #6 - circuit open	<ul style="list-style-type: none">• Sub-woofer speaker circuit - high resistance	Refer to the electrical circuit diagrams and test sub-woofer speaker circuit for high resistance
B1A01-01	Speaker#1 - general electrical failure	<ul style="list-style-type: none">• General electrical failure	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A02-	Speaker #2 - general	<ul style="list-style-type: none">• General electrical	Carry out the pinpoint test associated with this DTC using the manufacturer

01	electrical failure	failure	approved diagnostic system
B1A03-01	Speaker #3 - general electrical failure	<ul style="list-style-type: none"> General electrical failure 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A04-01	Speaker #4 - general electrical failure	<ul style="list-style-type: none"> General electrical failure 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A05-01	Speaker #5 - general electrical failure	<ul style="list-style-type: none"> General electrical failure 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A06-01	Speaker #6 - general electrical failure	<ul style="list-style-type: none"> General electrical failure 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A09-11	Short circuit of one or both front speaker output - circuit short to ground	<ul style="list-style-type: none"> Short to ground 	Check for additional front speaker DTCs and refer to DTC Index
B1A10-11	Short circuit of one or both rear speaker output - circuit short to ground	<ul style="list-style-type: none"> Short to ground 	Check for additional rear speaker DTCs and refer to DTC Index
B1A11-12	Speaker#11 - circuit short to battery	<ul style="list-style-type: none"> Short to power 	Refer to the electrical circuit diagrams and check all speaker circuits for short to power
U2003-98	Fibre optic communication Bus - component or system over temperature	<ul style="list-style-type: none"> Component or system over temperature 	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition
U3000-05	Control module - system programming failures	<ul style="list-style-type: none"> Software incompatibility The version of the Local Configuration file does not match that expected 	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system

U3000-42	Control module - general memory failure	<ul style="list-style-type: none"> • General memory failure 	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module installation note at the top of the DTC Index
U3000-44	Control module - data memory failure	<ul style="list-style-type: none"> • Data memory failure 	Re-configure the audio amplifier as an existing control module, using the manufacturer approved diagnostic system. Clear DTC, cycle ignition and read DTCs. If DTC returns, suspect audio amplifier module and install a new module. Refer to the new module installation note at the top of the DTC Index
U3000-55	Stored vehicle configuration data does not match - not configured	<ul style="list-style-type: none"> • Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the audio amplifier, refer to the new module installation note at the top of the DTC Index
U3000-87	Control module - missing message	<ul style="list-style-type: none"> • Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check audio amplifier for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U3000-98	Control module - component or system over temperature	<ul style="list-style-type: none"> • Component or system over temperature 	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition
U3003-16	Battery voltage - circuit voltage below threshold	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system

U3003-17	Battery voltage - circuit voltage above threshold	<ul style="list-style-type: none"> • Circuit voltage above threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
U3006-12	Control module - circuit short to battery	<ul style="list-style-type: none"> • Short to power 	Install a new audio amplifier module, refer to the new module installation note at the top of the DTC Index
U3006-16	Control module - circuit voltage below threshold	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Install a new audio amplifier module, refer to the new module installation note at the top of the DTC Index

Integrated Audio Module



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1B69-15	12 Volt supply circuit	<ul style="list-style-type: none">• Antenna power supply circuit - short to battery, high resistance	Refer to the electrical circuit diagrams and test the antenna power supply circuit for short to battery and high resistance
B1B69-11	12 Volt supply circuit	<ul style="list-style-type: none">• Antenna power supply circuit - short to ground	Refer to the electrical circuit diagrams and test the antenna power supply circuit for short to ground
B1D19-16	Compact disc unit	<ul style="list-style-type: none">• Circuit voltage below threshold	Install a new integrated audio module, refer to the new module installation note at the top of the DTC Index
B1D19-77	Compact disc unit	<ul style="list-style-type: none">• Commanded position not reachable	Install a new integrated audio module, refer to the new module installation note at the top of the DTC Index
B1D19-93	Compact disc unit	<ul style="list-style-type: none">• No operation	Install a new integrated audio module, refer to the new module installation note at the top of the DTC Index
B1A01-11	Speaker #1	<ul style="list-style-type: none">• Front driver speaker circuits - short to ground	Refer to the electrical circuit diagrams and test front driver speaker circuits for short to ground
B1A01-12	Speaker #1	<ul style="list-style-type: none">• Front driver speaker circuits - short to power	Refer to the electrical circuit diagrams and test front driver speaker circuits for short to power
B1A01-1A	Speaker #1	<ul style="list-style-type: none">• Front driver speaker circuits - resistance below threshold	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A01-	Speaker #1	<ul style="list-style-type: none">• Front driver speaker circuits - resistance above	Carry out the pinpoint test associated with this DTC using the manufacturer

1B		threshold	approved diagnostic system
B1A01-1C	Speaker #1	<ul style="list-style-type: none"> Front driver speaker circuits - voltage out of range 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A02-11	Speaker #2	<ul style="list-style-type: none"> Front passenger speaker circuits - short to ground 	Refer to the electrical circuit diagrams and test front passenger speaker circuits for short to ground
B1A02-12	Speaker #2	<ul style="list-style-type: none"> Front passenger speaker circuits - short to power 	Refer to the electrical circuit diagrams and test front passenger speaker circuits for short to power
B1A02-1A	Speaker #2	<ul style="list-style-type: none"> Front passenger speaker circuits - resistance below threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A02-1B	Speaker #2	<ul style="list-style-type: none"> Front passenger speaker circuits - resistance above threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A02-1C	Speaker #2	<ul style="list-style-type: none"> Front passenger speaker circuits - voltage out of range 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A03-11	Speaker #3	<ul style="list-style-type: none"> Rear left speaker circuits - short to ground 	Refer to the electrical circuit diagrams and test rear left speaker circuits for short to ground
B1A03-12	Speaker #3	<ul style="list-style-type: none"> Rear left speaker circuits - short to power 	Refer to the electrical circuit diagrams and test rear left speaker circuits for short to power
B1A03-1A	Speaker #3	<ul style="list-style-type: none"> Rear left speaker circuits - resistance below threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A03-1B	Speaker #3	<ul style="list-style-type: none"> Rear left speaker circuits - resistance above threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A03-1C	Speaker #3	<ul style="list-style-type: none"> Rear left speaker circuits - voltage out of range 	Carry out the pinpoint test associated with this DTC using the manufacturer

			approved diagnostic system
B1A04-11	Speaker #4	<ul style="list-style-type: none"> Rear right speaker circuits - short to ground 	Refer to the electrical circuit diagrams and test rear right speaker circuits for short to ground
B1A04-12	Speaker #4	<ul style="list-style-type: none"> Rear right speaker circuits - short to power 	Refer to the electrical circuit diagrams and test rear right speaker circuits for short to power
B1A04-1A	Speaker #4	<ul style="list-style-type: none"> Rear right speaker circuits - resistance below threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A04-13	Speaker #4	<ul style="list-style-type: none"> Rear right speaker circuits - resistance above threshold 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1A04-1C	Speaker #4	<ul style="list-style-type: none"> Rear right speaker circuits - voltage out of range 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system
B1D78-11	Auxiliary input	<ul style="list-style-type: none"> Auxiliary input circuit - short to ground 	Refer to the electrical circuit diagrams and test Auxiliary input circuits for short to ground
B1D78-12	Auxiliary input	<ul style="list-style-type: none"> Auxiliary input circuit - short to power 	Refer to the electrical circuit diagrams and test Auxiliary input circuits for short to power
B1D78-13	Auxiliary input	<ul style="list-style-type: none"> Auxiliary input circuit - high resistance 	Refer to the electrical circuit diagrams and test Auxiliary input circuits for high resistance
B1D79-11	Microphone input	<ul style="list-style-type: none"> Microphone input circuit - short to ground 	Refer to the electrical circuit diagrams and test microphone input circuits for short to ground
B1D79-12	Microphone input	<ul style="list-style-type: none"> Microphone input circuit - short to power 	Refer to the electrical circuit diagrams and test microphone input circuits for short to power
B1D79-13	Microphone input	<ul style="list-style-type: none"> Microphone input circuit - high resistance 	Refer to the electrical circuit diagrams and test microphone input circuits for

			high resistance
B1134-11	Phone input	<ul style="list-style-type: none"> Phone input circuit - short to ground 	Refer to the electrical circuit diagrams and test phone input circuits for short to ground
B1134-12	Phone input	<ul style="list-style-type: none"> Phone input circuit - short to power 	Refer to the electrical circuit diagrams and test phone input circuits for short to power
B1134-13	Phone input	<ul style="list-style-type: none"> Phone input circuit - high resistance 	Refer to the electrical circuit diagrams and test phone input circuits for high resistance
U3000-49	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Suspect the integrated audio module, refer to the new module installation note at the top of the DTC Index
U3000-55	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the integrated audio module, refer to the new module installation note at the top of the DTC Index
U3000-87	Control module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check integrated audio module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U3000-98	Control module	<ul style="list-style-type: none"> Component or system over temperature 	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition
U3003-62	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between integrated audio module and RJB 	Carry out the pinpoint test associated with this DTC using the manufacturer approved diagnostic system

Pinpoint Tests

PINPOINT TEST G834560p1 : STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT TESTS

G834560t1 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Disconnect the battery negative terminal.
Battery (86.15.01) 2. Wait one minute for the supplemental restraints system back-up power to dissipate. 3. Disconnect the information and entertainment module connector, IP087. 4. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 5036.71 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t2.

-> **No**

GO to Pinpoint Test G834560t8.

G834560t2 : CHECK THE STEERING WHEEL AUDIO CONTROL MUTE SWITCH CIRCUIT

1. PRESS and HOLD the MUTE switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 2036.7 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t3.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t3 : CHECK THE STEERING WHEEL AUDIO CONTROL SOURCE SWITCH CIRCUIT

1. PRESS and HOLD the SOURCE switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 1036.7 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t4.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t4 : CHECK THE STEERING WHEEL AUDIO CONTROL SEEK DOWN SWITCH CIRCUIT

1. OPERATE and HOLD the SEEK DOWN switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 561.7 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t5.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t5 : CHECK THE STEERING WHEEL AUDIO CONTROL SEEK UP SWITCH CIRCUIT

1. OPERATE and HOLD the SEEK UP switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 300.7 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t6.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t6 : CHECK THE STEERING WHEEL AUDIO CONTROL VOLUME + SWITCH CIRCUIT

1. OPERATE and HOLD the VOLUME + switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 146.7 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t7.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t7 : CHECK THE STEERING WHEEL AUDIO CONTROL VOLUME - SWITCH CIRCUIT

1. OPERATE and HOLD the VOLUME - switch 2. Measure the resistance between:

Information and entertainment module connector, IP087 pin 07, harness side

GROUND

- **Is the resistance 53.6 ohms?**

-> **Yes**

No fault is indicated with the steering wheel audio control switches or circuit. Check the integrity of all connections, TEST the system for normal operation.

-> **No**

Install a new steering wheel audio control switch assembly.

Steering Wheel Audio Controls (86.50.42)

G834560t8 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Disconnect the clockspring connector IP042. 2. Measure the resistance between:

Clockspring connector IP042, pin 03, component side

Clockspring connector IP042, pin 06, component side

- **Is the resistance 5036.71 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t13.

-> **No**

GO to Pinpoint Test G834560t9.

G834560t9 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Disconnect the clockspring connector SW001. 2. Measure the resistance between:

Clockspring connector SW001, pin 04, harness side

Clockspring connector SW001, pin 01, harness side

- **Is the resistance 5036.71 ohms?**

-> **Yes**

INSTALL a new clockspring.

Clockspring TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G834560t10.

G834560t10 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Disconnect the steering wheel audio control switch connector SW003. 2. Measure the resistance between:

Audio control switch connector SW003, pin 04, component side

Audio control switch connector SW003, pin 01, component side

- **Is the resistance 5036.71 ohms?**

-> **Yes**

GO to Pinpoint Test G834560t11.

-> **No**

Install a new steering wheel audio control switch.

Steering Wheel Audio Controls (86.50.42)

G834560t11 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Measure the resistance between:

Clockspring connector SW001, pin 01, harness side

Audio control switch connector SW003, pin 01, harness side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit - audio control switch connector SW003, pin 01 to clockspring connector SW001, pin 01. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G834560t12.

G834560t12 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Measure the resistance between:

Clockspring connector SW001, pin 04, harness side

Audio control switch connector SW003, pin 04, harness side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit - audio control switch connector SW003, pin 04 to clockspring connector SW001, pin 04. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

No fault is indicated with the steering wheel audio control switches or circuit. Check integrity of all connections and TEST system for normal operation.

G834560t13 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Measure the resistance between:

Clockspring connector IP042, pin 03, harness side

Information and entertainment module connector IP087, pin 07, harness side

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit - clockspring connector IP042, pin 03 to information and entertainment module connector IP087, pin 07. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

GO to Pinpoint Test G834560t14.

G834560t14 : CHECK THE STEERING WHEEL AUDIO CONTROL SWITCH CIRCUIT

1. Measure the resistance between:

Clockspring connector IP042, pin 06, harness side

GROUND point G40AR/1

- **Is the resistance greater than 5 ohms?**

-> **Yes**

REPAIR the circuit - clockspring connector IP042, pin 06 to GROUND point G40AR/1. For additional information, refer to the wiring diagrams. TEST the system for normal operation.

-> **No**

No fault is indicated with the steering wheel audio control switches or circuit. Check integrity of all connections and TEST system for normal operation.

PINPOINT TEST G834560p2 : MOST NETWORK TESTS

G834560t15 : CHECK HLDF DISPLAY

1. Check HLDF display

- **Is the HLDF showing a flashing Jaguar leaper, or a blank screen?**

-> **Yes**

GO to Pinpoint Test G834560t16.

-> **No**

No ring break fault has occurred. Suspect invalid Car Configuration File parameter faults, check modules on MOST Network for related DTCs and refer to the relevant DTC Index.

G834560t16 : CHECK INTEGRITY OF MOST RING TEST CONNECTOR OPTICAL LOOP AND FUSE RL2

1. Check the MOST ring test connector optical loop IP090 is not disconnected or open circuit and free from damage, and fuse RL2 in the RJB is not disconnected or open circuit.

- **Is the MOST ring test connector optical loop IP090 disconnected, open circuit or damaged, or fuse RL2 in the RJB disconnected or open circuit.**

-> **Yes**

Rectify the fault condition and re-test.

-> **No**

GO to Pinpoint Test G834560t17.

G834560t17 : INITIATE RING BREAK DIAGNOSTIC (RBD) & READ DTCs

1. Ensure fuse RL2 is installed in RJB and is in serviceable condition. 2. Set ignition status from 'OFF' to 'ON'. 3. Clear all DTCs. 4. Remove fuse RL2 from RJB and wait for at least 10 seconds, then replace fuse RL2 in RJB and wait for at least 30 seconds for RBD to initiate and complete. 5. Read DTCs

- **Is DTC U1A1587 logged?**

-> **Yes**

GO to Pinpoint Test G834560t18.

-> **No**

Check HLDF for additional DTCs and refer to relevant DTC Index.

G834560t18 : CHECK FOR FAILURE AT INTERMEDIATE CONNECTOR TM071 PIN 1 FROM INFORMATION AND ENTERTAINMENT MODULE

1. Disconnect the MOST network intermediate connector TM071.

- **Is the bright red light visible at the connector TM071, pin 1 female?**

-> **Yes**

GO to Pinpoint Test G834560t19.

-> **No**

GO to Pinpoint Test G834560t20.

G834560t19 : CHECK FOR FAILURE AT FIRST HALF OF MOST NETWORK

1. Connect the Optical Bus Tester (OBT) to intermediate connector TM071, from information and entertainment module. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDf screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

On Low Line vehicles, check integrity of optical loop installed at intermediate connector TM071. On High Line vehicles, fault is in second half of MOST Network. Disconnect OBT and re-connect intermediate connector TM071. GO to Pinpoint Test G834560t21.

-> **No**

GO to Pinpoint Test G834560t23.

G834560t20 : CHECK FOR FAILURE OF OPTICAL FIBRE FROM INFORMATION AND ENTERTAINMENT MODULE

1. Disconnect MOST connector IP088 from information and entertainment module.

- **Is the bright red light visible at the connector IP088 pin 2, module side?**

-> **Yes**

Fault is in optical fibre harness between intermediate connector TM071, pin 1 female and information and entertainment module connector IP088, pin 2.

-> **No**

Install a new information and entertainment module and re-test.

G834560t21 : CHECK FOR FAILURE OF OPTICAL FIBRE BETWEEN INTERMEDIATE CONNECTORS TM071 AND TM075

1. Disconnect intermediate connector TM075.

- **Is the bright red light visible at the intermediate connector TM075, pin 2 female.**

-> **Yes**

GO to Pinpoint Test G834560t22.

-> **No**

Fault is in optical fibre harness between intermediate connectors TM071 pin 1 and TM075 pin 2, rectify the fault and re-test the vehicle.

G834560t22 : CHECK FOR FAILURE OF OPTICAL FIBRE BETWEEN INTERMEDIATE CONNECTORS TM071 AND TM075

1. Connect the Optical Bus Tester (OBT) to intermediate connector TM075. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Fault is in second half of MOST network. GO to Pinpoint Test G834560t48.

-> **No**

Fault is in optical fibre harness between intermediate connectors TM071 pin 2 and TM075 pin 1, rectify the fault and re-test the vehicle.

G834560t23 : CHECK FOR FAILURE OF OPTICAL FIBRE TO HLDF

1. Disconnect MOST connector IP065 from HLDF.

- **Is the bright red light visible at connector IP065 pin 1, harness side?**

-> **Yes**

GO to Pinpoint Test G834560t24.

-> **No**

Fault is in optical fibre harness between intermediate connector TM071 pin 2 and HLDF connector IP065 pin 1, rectify the fault and re-test the vehicle.

G834560t24 : CHECK FOR FAILURE AT HLDF

1. Connect the Optical Bus Tester (OBT) to HLDF connector IP065. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying blank screen?**

-> **Yes**

Check/repair power feed and ground lines to HLDF. If power feed and ground lines ok, install a new

HLDF.

-> **No**

GO to Pinpoint Test G834560t25.

G834560t25 : CHECK FOR INSTALLATION OF AUDIO AMPLIFIER

1. Check for installation of audio amplifier.

- **Is there an audio amplifier installed to the vehicle?**

-> **Yes**

GO to Pinpoint Test G834560t26.

-> **No**

GO to Pinpoint Test G834560t29.

G834560t26 : CHECK FOR FAILURE OF OPTICAL FIBRE TO AUDIO AMPLIFIER

1. Disconnect MOST connector CA117 from audio amplifier.

- **Is the bright red light visible at the connector CA117 pin 1, harness side?**

-> **Yes**

GO to Pinpoint Test G834560t28.

-> **No**

GO to Pinpoint Test G834560t27.

G834560t27 : CHECK FOR FAILURE AT INTERMEDIATE CONNECTOR CA119

1. Disconnect intermediate connector CA119.

- **Is the bright red light visible at the intermediate connector CA119, pin 1 female?**

-> **Yes**

Fault is in optical fibre harness between intermediate connector CA119 pin 1 and audio amplifier connector CA117 pin 1, rectify the fault and re-test the vehicle.

-> **No**

Fault is in optical fibre harness between intermediate connector CA119 pin 1 and HLDF connector IP065 pin 2, rectify the fault and re-test vehicle.

G834560t28 : CHECK FOR FAILURE AT AUDIO AMPLIFIER

1. Connect the Optical Bus Tester (OBT) to audio amplifier connector CA117. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Check/repair power feed and ground lines to audio amplifier. If power feed and ground lines ok, install a new audio amplifier.

-> **No**

GO to Pinpoint Test G834560t29.

G834560t29 : CHECK FOR FAILURE OF OPTICAL FIBRE TO INTEGRATED AUDIO MODULE

1. Disconnect MOST connector IP059 at integrated audio module.

- **Is the bright red light visible at the connector IP059 pin 1 harness side?**

-> **Yes**

GO to Pinpoint Test G834560t31.

-> **No**

If no audio amplifier is installed, the fault is in the optical fibre harness between HLDF connector IP065 pin 2 and integrated audio module connector IP059 pin 1, rectify the fault and re-test the vehicle. If audio module is installed. GO to Pinpoint Test G834560t30.

G834560t30 : CHECK FOR FAILURE AT INTERMEDIATE CONNECTOR CA119 PIN 2

1. Disconnect intermediate connector CA119.

- **Is the bright red light visible at the intermediate connector CA119 pin 2 male?**

-> **Yes**

Fault is in the optical fibre harness between intermediate connector CA119 pin 2 and integrated audio module connector IP059 pin 1, rectify the fault and re-test the vehicle.

-> **No**

Fault is in the optical fibre harness between intermediate connector CA119 pin 2 and audio amplifier connector CA117 pin 2, rectify the fault and re-test the vehicle.

G834560t31 : CHECK FOR FAILURE AT INTEGRATED AUDIO MODULE

1. Connect the Optical Bus Tester (OBT) to integrated audio module connector IP059. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Check/repair power feed and ground lines to integrated audio module. If power feed and ground lines ok, install a new integrated audio module.

-> **No**

GO to Pinpoint Test G834560t32.

G834560t32 : CHECK FOR FAILURE OF OPTICAL FIBRE TO MOST TEST CONNECTOR

1. Disconnect MOST test connector IP090.

- **Is the bright red light visible at the connector IP090 pin 1 harness side?**

-> **Yes**

GO to Pinpoint Test G834560t33.

-> **No**

Fault is in the optical fibre harness between integrated audio module connector IP059 pin 2 and MOST test connector IP090 pin 1, rectify the fault and re-test the vehicle.

G834560t33 : CHECK FOR FAILURE AT MOST TEST CONNECTOR OPTICAL LOOP

1. Connect the Optical Bus Tester (OBT) to MOST test connector IP090. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Install a new MOST test connector optical loop.

-> **No**

GO to Pinpoint Test G834560t34.

G834560t34 : CHECK FOR FAILURE OF OPTICAL FIBRE TO INFORMATION AND ENTERTAINMENT CONTROL MODULE

1. Disconnect MOST connector IP088 from information and entertainment control module.

- **Is the bright red light visible at connector IP088 pin 1, harness side?**

-> **Yes**

No fault identified with the MOST network. Check integrity of all MOST network connections, and re-test vehicle.

-> **No**

Fault is in the optical fibre harness between MOST test connector IP090 pin 2 and information and entertainment module connector IP088 pin 1, rectify the fault and re-test the vehicle.

G834560t48 : CHECK FOR INSTALLATION OF NAVIGATION MODULE

1. Check for installation of navigation control module.

- **Is a navigation control module installed to the vehicle?**

-> **Yes**

GO to Pinpoint Test G834560t35.

-> **No**

GO to Pinpoint Test G834560t36.

G834560t35 : CHECK FOR FAILURE OF OPTICAL FIBRE TO NAVIGATION MODULE

1. Disconnect MOST connector TM084 from navigation module.

- **Is the bright red light visible at connector TM084 pin 1, harness side?**

-> **Yes**

GO to Pinpoint Test G834560t35.

-> **No**

Fault is in the optical fibre harness between MOST intermediate connector TM075 pin 2 and navigation module connector TM084 pin 1, rectify the fault and re-test the vehicle.

G834560t45 : CHECK FOR FAILURE AT NAVIGATION MODULE

1. Connect the Optical Bus Tester (OBT) to navigation module connector TM084. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Check/repair power feed and ground lines to navigation module. If power feed and ground lines ok, install a new navigation module.

-> **No**

GO to Pinpoint Test G834560t36.

G834560t36 : CHECK FOR INSTALLATION OF SATELLITE RADIO MODULE

1. Check for installation of satellite radio module.

- **Is a satellite radio module installed to the vehicle?**

-> **Yes**

GO to Pinpoint Test G834560t37.

-> **No**

GO to Pinpoint Test G834560t39.

G834560t37 : CHECK FOR FAILURE OF OPTICAL FIBRE TO SATELLITE RADIO MODULE

1. Disconnect MOST connector TM100 from satellite radio module.

- **Is the bright red light visible at connector TM100 pin 1 , harness side?**

-> **Yes**

GO to Pinpoint Test G834560t38.

-> **No**

If navigation module is installed to the vehicle - the fault is in the optical fibre harness between navigation module connector TM084 pin 2 and satellite radio module connector TM100 pin 1. If navigation module is not installed to the vehicle - the fault is in the optical fibre harness between intermediate connector TM075 pin 2 and satellite radio module connector TM100 pin 1.

G834560t38 : CHECK FOR FAILURE AT SATELLITE RADIO MODULE

1. Connect the Optical Bus Tester (OBT) to satellite radio module connector TM100. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Check/repair power feed and ground lines to satellite radio module. If power feed and ground lines ok, install a new satellite radio module.

-> **No**

GO to Pinpoint Test G834560t39.

G834560t39 : CHECK FOR INSTALLATION OF BLUETOOTH MODULE

1. Check for installation of bluetooth module.

- **Is a bluetooth module installed to the vehicle?**

-> **Yes**

GO to Pinpoint Test G834560t40.

-> **No**

If satellite radio module is not installed. GO to Pinpoint Test G834560t43.

If satellite radio module is installed. GO to Pinpoint Test G834560t44.

G834560t40 : CHECK FOR FAILURE OF OPTICAL FIBRE TO BLUETOOTH MODULE

1. Disconnect MOST connector TM023 from bluetooth module.

- **Is the bright red light visible at connector TM023 pin 1, harness side?**

-> **Yes**

GO to Pinpoint Test G834560t41.

-> **No**

If satellite radio module is installed to vehicle - fault is in optical fibre harness between bluetooth module connector TM023 pin 1 and satellite radio module connector TM100 pin 2, rectify the fault and re-test the vehicle. If satellite radio module is not installed - fault is in optical fibre harness between bluetooth module connector TM023 pin 1 and navigation module TM084 pin 2, rectify the fault and re-test vehicle.

G834560t41 : CHECK FOR FAILURE AT BLUETOOTH MODULE

1. Connect the Optical Bus Tester (OBT) to satellite bluetooth module connector TM023. 2. Switch OBT 'ON' and set to 2+0 option. 3. Select the visible LED option.

- **Is the Rx lamp/LED permanently 'ON' and the HLDF screen permanently displaying 'Home menu screen' or Jaguar leaper?**

-> **Yes**

Check/repair power feed and ground lines to bluetooth module. If power feed and ground lines ok, install a new bluetooth module.

-> **No**

GO to Pinpoint Test G834560t42.

G834560t42 : CHECK FOR FAILURE OF OPTICAL FIBRE FROM BLUETOOTH MODULE

1. Disconnect MOST intermediate connector TM075.

- **Is the bright red light visible at connector TM075 pin 1 male?**

-> **Yes**

No fault is identified with the MOST network. Check integrity of all MOST connectors and re-test the vehicle.

-> **No**

Fault is in the optical fibre harness between bluetooth module connector TM023 pin 2 and intermediate connector TM075 pin 1, rectify the fault and re-test the vehicle.

G834560t43 : CHECK FOR FAILURE OF OPTICAL FIBRE FROM NAVIGATION MODULE

1. Disconnect MOST intermediate connector TM075.

- **Is the bright red light visible at the intermediate connector TM075 pin 1 male?**

-> **Yes**

No fault is identified with the MOST network. Check integrity of all MOST connectors and re-test the vehicle.

-> **No**

Fault is in optical fibre harness between intermediate connector TM075 pin 1 and navigation module connector TM084 pin 2, rectify the fault and re-test the vehicle.

G834560t44 : CHECK FOR FAILURE OF OPTICAL FIBRE FROM SATELLITE RADIO MODULE

1. Disconnect MOST intermediate connector TM075.

- **Is the bright red light visible at the intermediate connector TM075 pin 1 male?**

-> **Yes**

No fault is identified with the MOST network. Check integrity of all MOST connectors and re-test the vehicle.

-> **No**

Fault is in optical fibre harness between intermediate connector TM075 pin 1 and satellite radio module connector TM100 pin 2, rectify the fault and re-test the vehicle.

Cellular Phone

Principle of Operation

For a detailed description of the telephone system, refer to the relevant Description and Operation section in the workshop manual.

Cellular Phone

Inspection and Verification

NOTE:

Prior to starting any diagnostics, ensure that the customer handset is on the Jaguar Approved Phone List (as found in the vehicle technology information on the external Jaguar website). If the customer handset is not on the approved phone list it should NOT be used when carrying out these diagnostics, the technician should test using an approved handset only.

- 1 . Verify the customer concern by operating the telephone.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Microphone• Bluetooth antenna	<ul style="list-style-type: none">• Electrical connectors• Wiring harness for damage or corrosion• Fuses

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

System/Carrier Concerns - All Systems

Dropped calls, bad connections, noisy audio and other intermittent symptoms usually indicate a system or cellular carrier concern, and are not the fault of the phone itself. Such symptoms may occur in situations such as the following:

- In certain geographic areas (for example: areas of excessive foliage or hills) or at the edge of coverage areas
- At the same place each day
- At the same time each day
- Under bridges, tunnels, in lower freeways, or in congested downtown areas

If the customer phone exhibits any of the above symptoms or symptoms occur under the above conditions, the customer or the dealer should contact customer assistance at their particular cellular provider/carrier.

Symptom Chart

Symptom	Action
Unable to pair	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p1.
Not Auto Connecting	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p2.
Poor Quality Audio	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p3.
No Audio to 3rd Party	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p4.
No Audio from 3rd Party	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p5.
No Audio	<ul style="list-style-type: none">GO to Pinpoint Test G1296535p6.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing

resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A5613	Bluetooth antenna	<ul style="list-style-type: none"> Open circuit 	Refer to the electrical circuit diagrams and test blue tooth antenna circuit for open circuit
B1D7984	Microphone input	<ul style="list-style-type: none"> Signal amplitude < minimum 	Refer to the electrical circuit diagrams and test microphone input circuit for short/open circuit. Check integrated audio module for DTCs and refer to DTC Index
U1A0088	Private Bus circuit	<ul style="list-style-type: none"> BT chipset communications failure 	Install a new telephone module, refer to the new module installation note at the top of the DTC Index
U210000	Control module	<ul style="list-style-type: none"> Initial configuration not complete 	Re-configure the RJB using the manufacturer approved diagnostic system. If DTC remains, carry out CAN network tests
U210100	Control module	<ul style="list-style-type: none"> Configuration incompatible 	Re-configure the RJB using the manufacturer approved diagnostic system. If DTC remains, suspect the telephone module, refer to the new

			module installation note at the top of the DTC Index
U300044	Control module	<ul style="list-style-type: none"> Data memory failure 	Re-configure the telephone module. If the DTC remains install a new telephone module, refer to the new module installation note at the top of the DTC Index
U300045	Control module	<ul style="list-style-type: none"> Program memory failure 	Re-configure the telephone module. If the DTC remains install a new telephone module, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the telephone module, refer to the new module installation note at the top of the DTC Index
U300087	Control module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check telephone module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300098	Control module	<ul style="list-style-type: none"> Component or system over temperature 	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition for re-occurrence
U300362	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between telephone module and RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Pinpoint Tests

PINPOINT TEST G1296535p1 : Unable to Pair

G1296535t1 : 'No Phone Fitted' Display

1. Carry out checks to determine if 'No Phone Fitted' is shown on vehicle display.

- **Is 'No Phone Fitted' displayed?**

-> **Yes**

GO to Pinpoint Test G1296535t2.

-> **No**

Locate the connected telephone and if not Customer telephone, disconnect from the system.

G1296535t2 : Telephone Bluetooth Device Search

1. Carry out Bluetooth device search using Customer handset.

- **Is 'Jaguar' identified in Bluetooth device list?**

-> **Yes**

Select device from list, then continue with diagnosis. GO to Pinpoint Test G1296535t3.

-> **No**

Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Jaguar' still not identified in Bluetooth device list, set ignition status to OFF, wait approximately 30 seconds and set ignition status to ON. Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Jaguar' still not identified in Bluetooth device list, contact your local in market support for further assistance.

G1296535t3 : Telephone Handset Error

1. Check for any error shown on the telephone handset when 'Jaguar' is selected from the Bluetooth device list.

- **Was an error immediately shown on the telephone handset?**

-> **Yes**

Wait approximately 10 seconds then re-attempt selection, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If error still being displayed, contact your local in market support for assistance.

-> **No**

Enter PIN '1313' then continue with diagnosis. GO to Pinpoint Test G1296535t4.

G1296535t4 : PIN Entry Status

1. Check for successful PIN entry.

- **Was PIN entry successful?**

-> **Yes**

GO to Pinpoint Test G1296535t5.

-> **No**

Wait approximately 10 seconds then re-attempt PIN entry, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If PIN entry is still un-successful, contact your local in market support for assistance.

G1296535t5 : 'No Phone Fitted' Display

1. Carry out checks to determine if 'No Phone Fitted' is still shown on vehicle display.

- **Is 'No Phone Fitted' still displayed?**

-> **Yes**

From the telephone handset, select the connect option for the 'Land Rover' device identified in the Bluetooth device list. If 'No Phone Fitted' is still displayed, suspect a telephone handset fault. Carry out Pinpoint test again using known good telephone handset.

-> **No**

The telephone is paired and connected to the system. No further action is required for this symptom.

PINPOINT TEST G1296535p2 : Not Automatically Connecting

G1296535t6 : Bluetooth Module Paired Device List

1. Carry out checks to determine if the Customer telephone is shown in the Bluetooth Module paired device list.

- **Is the Customer telephone in the Bluetooth Module paired device list?**

-> **Yes**

GO to Pinpoint Test G1296535t7.

-> **No**

Carry out Unable to Pair Pinpoint Test. GO to Pinpoint Test G1296535p1.

G1296535t7 : Customer Handset Paired Device List

1. Carry out checks to determine if the Bluetooth Module is shown in the Customer telephone paired device list.

- **Is the Bluetooth Module in the Customer telephone paired device list?**

-> **Yes**

GO to Pinpoint Test G1296535t8.

-> **No**

Carry out Unable to Pair Pinpoint Test. GO to Pinpoint Test G1296535p1.

G1296535t8 : Customer Telephone in Position 1

1. Carry out checks to determine if the Customer telephone is in position 1 in the Bluetooth Module paired device list.

- **Is the Customer telephone in position 1?**

-> **Yes**

GO to Pinpoint Test G1296535t9.

-> **No**

Advise Customer that auto connection will only be attempted with the device that is shown in position 1 in Bluetooth Module paired device list.

G1296535t9 : Check for DTC B1A56-13

1. Using Manufacturer approved diagnostic system, check for DTC B1A56-13.

- **Is DTC B1A56-13 logged?**

-> **Yes**

Carry out remedial actions as outlined in DTC Index. If symptom remains, contact your local in market support for assistance.

-> **No**

GO to Pinpoint Test G1296535t10.

G1296535t10 : Bluetooth Connection

1. Carry out checks to determine if Bluetooth connection icon is shown on Customer Bluetooth telephone screen but shows 'No Phone Fitted' on vehicle screen.

- **Is Bluetooth connection icon shown on the Customer handset but 'No Phone Fitted' displayed on vehicle screen?**

-> **Yes**

GO to Pinpoint Test G1296535t14.

-> **No**

GO to Pinpoint Test G1296535t11.

G1296535t11 : 'Land Rover' Authorisation

1. Carry out checks to determine if 'Land Rover' is authorised in the Customer Bluetooth telephone device list menu.

- **Is 'Land Rover' authorised in the Customer Bluetooth telephone device list menu?**

-> **Yes**

GO to Pinpoint Test G1296535t12.

-> **No**

Advise customer that 'Land Rover' needs to be authorised in the Customer Bluetooth telephone device list menu, or operator intervention may be required to manually authorise connection.

G1296535t12 : Search for Devices Screen

1. Select the search for devices button on the vehicle display.

- **Does pressing the search for devices button bring up the searching screen on the vehicle display?**

-> **Yes**

Contact your local in market support for assistance.

-> **No**

GO to Pinpoint Test G1296535t13.

G1296535t13 : Cycle Ignition and Check Search for Devices Screen

1. Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON.

- **Does pressing the search for devices button bring up the searching screen on the vehicle display?**

-> **Yes**

No further action required for this Symptom. Possible intermittent fault.

-> **No**

Contact your local in market support for assistance.

G1296535t14 : Paired Device

1. Check Customer telephone paired device list to establish which device the Customer telephone is connected to.

- **Is the Customer telephone connected to the vehicle?**

-> **Yes**

Lock vehicle (wait 60s) before unlocking and turning Ignition status back to ON. If Not Automatically Connecting, contact you local in market support for assistance.

-> **No**

Using the Customer telephone controls, disconnect from the currently connected device and delete from paired device list. Lock vehicle (wait for 60s) before unlocking and turning ignition status to ON. If Not Automatically Connecting, contact your local in market support for assistance.

PINPOINT TEST G1296535p3 : Poor Quality Audio

G1296535t15 : Microphone Installation

1. Check that the microphone is installed in the correct location/orientation.

- **Is the microphone installed in the correct location/orientation?**

-> **Yes**

GO to Pinpoint Test G1296535t16.

-> **No**

Install microphone to correct location/orientation.

G1296535t16 : Signal Strength

1. Check the signal strength displayed on the telephone handset.

- **Are at least two signal strength bars shown on the telephone handset display?**

-> **Yes**

GO to Pinpoint Test G1296535t17.

-> **No**

Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls.

G1296535t17 : Poor Audio From Third Party Only

1. Establish from Customer feedback/symptom if there is poor audio from the Third Party only.

- **Is the poor audio from the Third Party only?**

-> **Yes**

Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls.

-> **No**

GO to Pinpoint Test G1296535t18.

G1296535t18 : Poor Audio To Third Party Only

1. Establish from Customer feedback/symptom if there is poor audio to the Third Party only.

- **Is the poor audio to the Third Party only?**

-> **Yes**

Check and install a new microphone as necessary.

-> **No**

GO to Pinpoint Test G1296535t19.

G1296535t19 : Poor Audio with Vehicle Stationary

1. Establish from Customer feedback/symptom if there is poor audio when the vehicle is stationary only.

- **Is the poor audio when the vehicle is stationary only?**

-> **Yes**

Check and install a new microphone as necessary.

-> **No**

GO to Pinpoint Test G1296535t20.

G1296535t20 : Third Party Moving Vehicle

1. Establish from Customer feedback/symptom if the Third Party is in a moving vehicle.

- **Is the Third Party in a moving vehicle?**

-> **Yes**

There are limitations to the way the system can improve audio, and in this situation it is not possible to determine the source of the audio degradation.

-> **No**

GO to Pinpoint Test G1296535t21.

G1296535t21 : Customer Hearing Echo

1. Establish from Customer feedback/symptom if the Customer is hearing an echo.

- **Is the Customer hearing an echo?**

-> **Yes**

Echo from the Third Party is not vehicle failure, it is the Third Party set-up. No further action is required for this symptom.

-> **No**

Contact your local in market support for assistance.

PINPOINT TEST G1296535p4 : No Audio To Third Party

G1296535t22 : Microphone Diagnostic Trouble Codes (DTCs)

1. Using the Manufacturer approved diagnostic system, check for any logged microphone DTCs in Audio Front Control module.

- **Is DTC B1D79-01 logged?**

-> **Yes**

Carry out diagnosis of electrical failure as advised in Action column of DTC Index.

-> **No**

Contact your local in market support for assistance.

PINPOINT TEST G1296535p5 : No Audio From Third Party

G1296535t23 : 'In Call' Display

1. Carry out checks to determine if 'In Call' is shown on the vehicle display.

- **Is vehicle display showing 'In Call'?**

-> **Yes**

Contact your local in market support for assistance.

-> **No**

Call has ended. No further action is required for this symptom.

PINPOINT TEST G1296535p6 : No Audio

G1296535t24 : Audio From Third Party

1. Establish from Customer feedback/symptom if there is Audio from the Third Party.

- **Is there Audio from the Third Party?**

-> **Yes**

GO to Pinpoint Test G1296535t25.

-> **No**

Refer to the 'No Audio From Third Party' Pinpoint test. GO to Pinpoint Test G1296535p5.

G1296535t25 : Audio To Third Party

1. Establish from Customer feedback/symptom if there is Audio to the Third Party.

- **Is there Audio to the Third Party?**

-> **Yes**

GO to Pinpoint Test G1296535t26.

-> **No**

Refer to the 'No Audio To Third Party' Pinpoint test. GO to Pinpoint Test G1296535p4.

G1296535t26 : CD or Radio Audio

1. Establish from Customer feedback/symptom if there is Audio from the CD or Radio.

- **Is there Audio from the CD or Radio?**

-> **Yes**

GO to Pinpoint Test G1296535t27.

-> **No**

Suspect MOST ring fault, refer to electrical circuit diagrams and check/rectify MOST ring as necessary.

G1296535t27 : Telephone Handset Audio

1. Establish from Customer feedback/symptom if there is Audio from the telephone handset.

- **Is there Audio from the telephone handset?**

-> **Yes**

Ensure vehicle is parked. Disconnect and reconnect handset. If issue not resolved, contact your local in market support for assistance.

-> **No**

Contact you local in market support for assistance.

415-01 : Audio Unit

Specifications

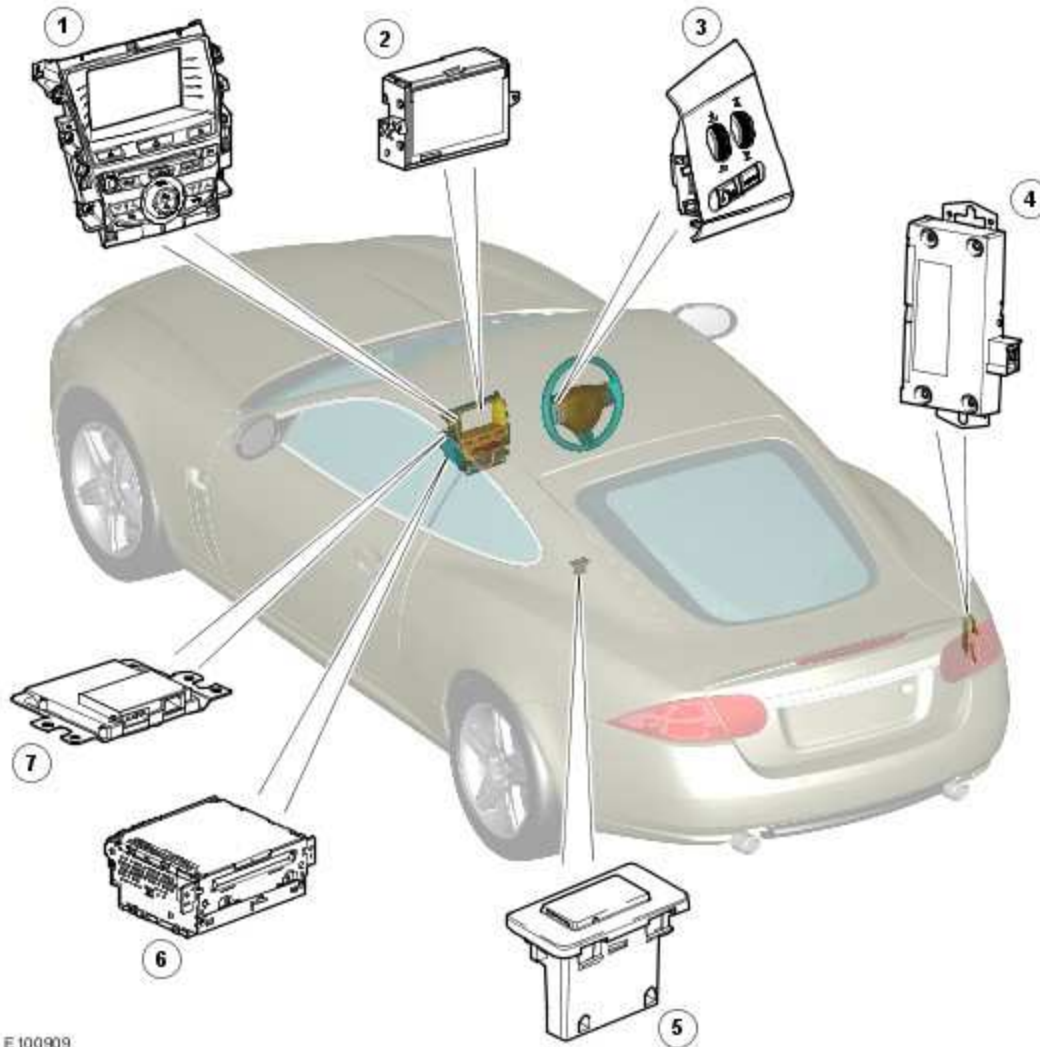
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Amplifier to bracket - screw	2.5	-	22
Audio/CD module and climate control module assembly to instrument panel - bolt	3	-	27
Audio/CD and climate control modules to assembly bracket - bolt	3	-	27
Audio/CD and climate control modules to assembly bracket - screw	2.5	-	22
Radio frequency interference suppressor to engine cover bracket - bolt	10	7	88
Steering wheel audio controls - bolt	3.5	2.5	31

Audio System

COMPONENT LOCATION



E 100909

Item	Part Number	Description
1		Integrated control panel
2		Touch Screen Display (TSD)
3		Remote audio switches
4		Auxiliary Universal Serial Bus (USB) unit (from 2009 Model Year (MY))

5		Auxiliary input panel (from 2009 MY)
6		Integrated audio module
7		Information and entertainment Module

INTRODUCTION

The audio system contains the following functions:

- Six disc CD autochanger.
- AM/FM tuner.
- Interface Protocol Option Devices (iPod) and USB connectivity (from 2009 MY).

The audio system is available in two versions, standard and premium. The standard audio system uses an internal amplifier to drive the system speakers. The premium system uses an external amplifier and subwoofer assembly to drive the speakers. For additional information, refer to Speakers (415-03 Speakers)

Control of the audio system is via the integrated control panel and the TSD, located in the center of the instrument panel, and the remote audio switches on the steering wheel.

Control signals from the integrated control panel are relayed on the medium speed CAN (controller area network) bus to the information and entertainment module. The information and entertainment module relays the control signals to the rest of the audio system on the Media Orientated System Transport (MOST) ring. The information and entertainment module is the timing master for the MOST ring and also hosts a gateway function between the medium speed CAN (controller area network) bus and the MOST ring. On premium audio systems the audio signals are sent on the MOST ring from the integrated audio module to the amplifier. The control signal from the remote audio switches to the information and entertainment module consists of an analogue voltage from a resistive ladder.

The iPod and USB connectivity allows audio files on portable media players and mass storage devices (i.e. portable audio devices) to be played through the speakers of the audio system. The audio system supports portable audio devices with a storage capacity up to 256 GB (approximately 65,000 music tracks).

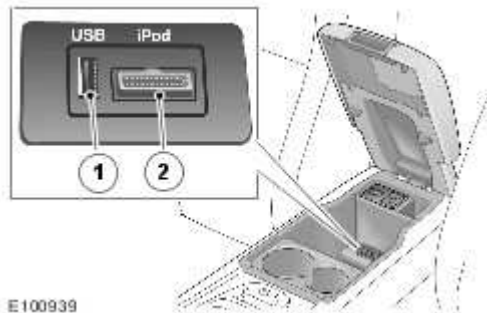
The iPod and USB connectivity is provided by:

- An auxiliary input panel, installed in the cubby box of the floor console.
- An auxiliary USB unit, attached to the RH rear quarter panel, behind the trim of the luggage compartment.

The auxiliary input panel provides the interface between the portable audio device and the vehicle's audio system. An iPod port and a USB port are located in the top of the auxiliary input panel, underneath a protective rubber cover. An iPod connector lead is supplied with the vehicle. Portable audio devices can be connected to both ports at the same time.

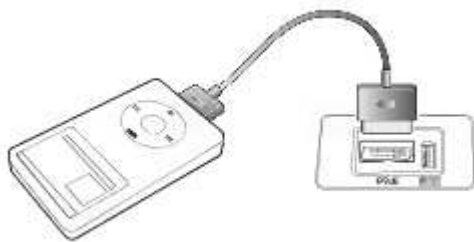
The iPod and USB ports both incorporate a charging function. The maximum charging current supplied is 500 ma.

Auxiliary Input Panel



Item	Part Number	Description
1		USB port
2		iPod port

iPod Connector Lead



The auxiliary USB unit translates the electronic signals from the auxiliary input panel into optical signals and transmits them on the MOST ring.

Operation of the portable audio device is controlled from the TSD via the integrated audio module. For road safety reasons, the normal control interface of the portable device is disabled when it is plugged into the auxiliary input panel, and it can only be controlled from the TSD.

Portable Audio Device Selection on TSD



E 100941

Some MP3 players have a file system that is not supported by the audio system. To use one of these MP3 players with the audio system, the MP3 player must be set to USB Removable Device mode or Mass Storage Device mode (see the MP3 player manufacturer's information for further details). Only files that have been added to the MP3 player in these modes can be played on the audio system.

A number of other vehicle systems are operated from the TSD and the integrated control panel, or have inputs into the audio system. These include:

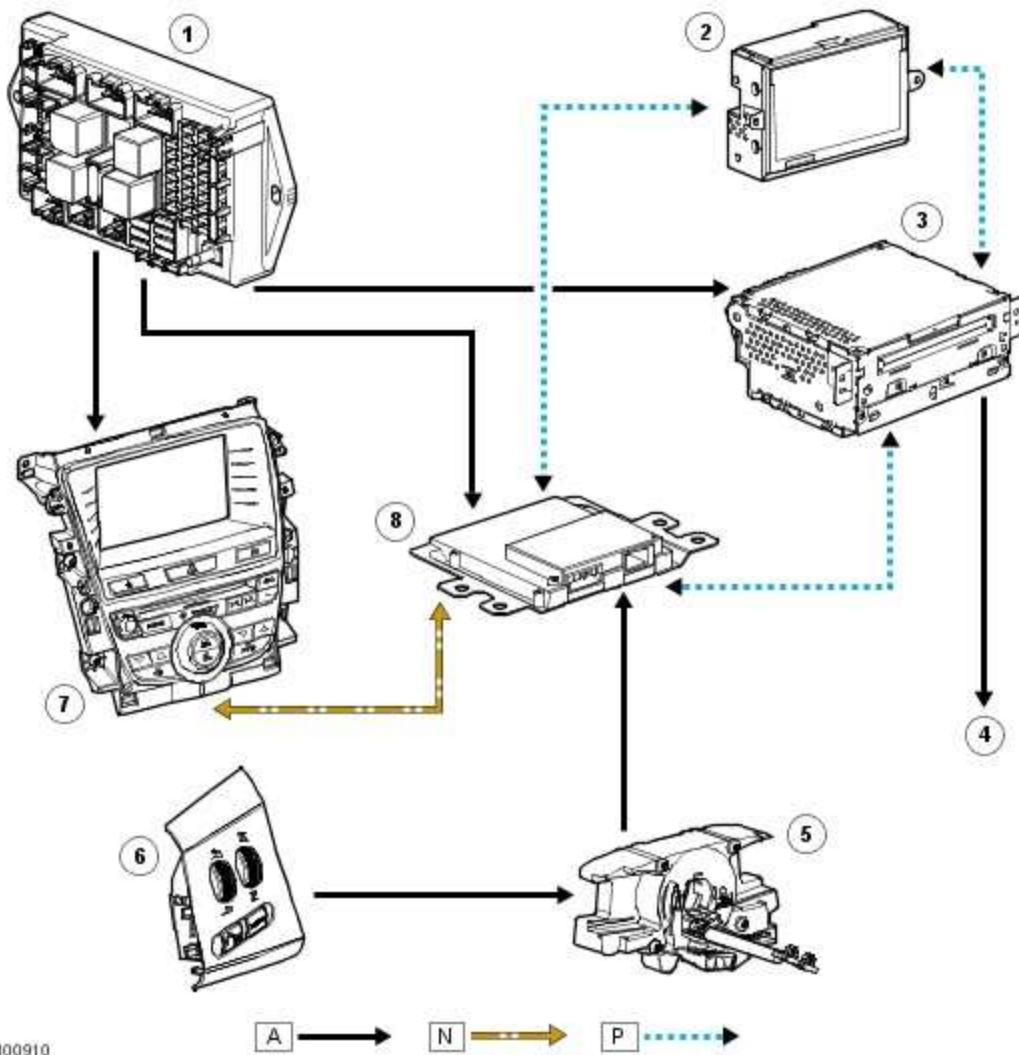
- Air conditioning system. For additional information, refer to Air Conditioning (412-03 Air Conditioning)
- Navigation. For additional information, refer to Navigation System (419-07 Navigation System)
- Parking aid. For additional information, refer to Parking Aid (413-13 Parking Aid)
- Telephone. For additional information, refer to Cellular Phone (419-08 Cellular Phone)

Software in the information and entertainment module generates the graphics for the TSD.

CONTROL DIAGRAM - STANDARD AUDIO SYSTEM (UP TO 2009 MY)

NOTE:

A = Hardwired; N = Medium speed CAN (controller area network) bus; P = MOST ring



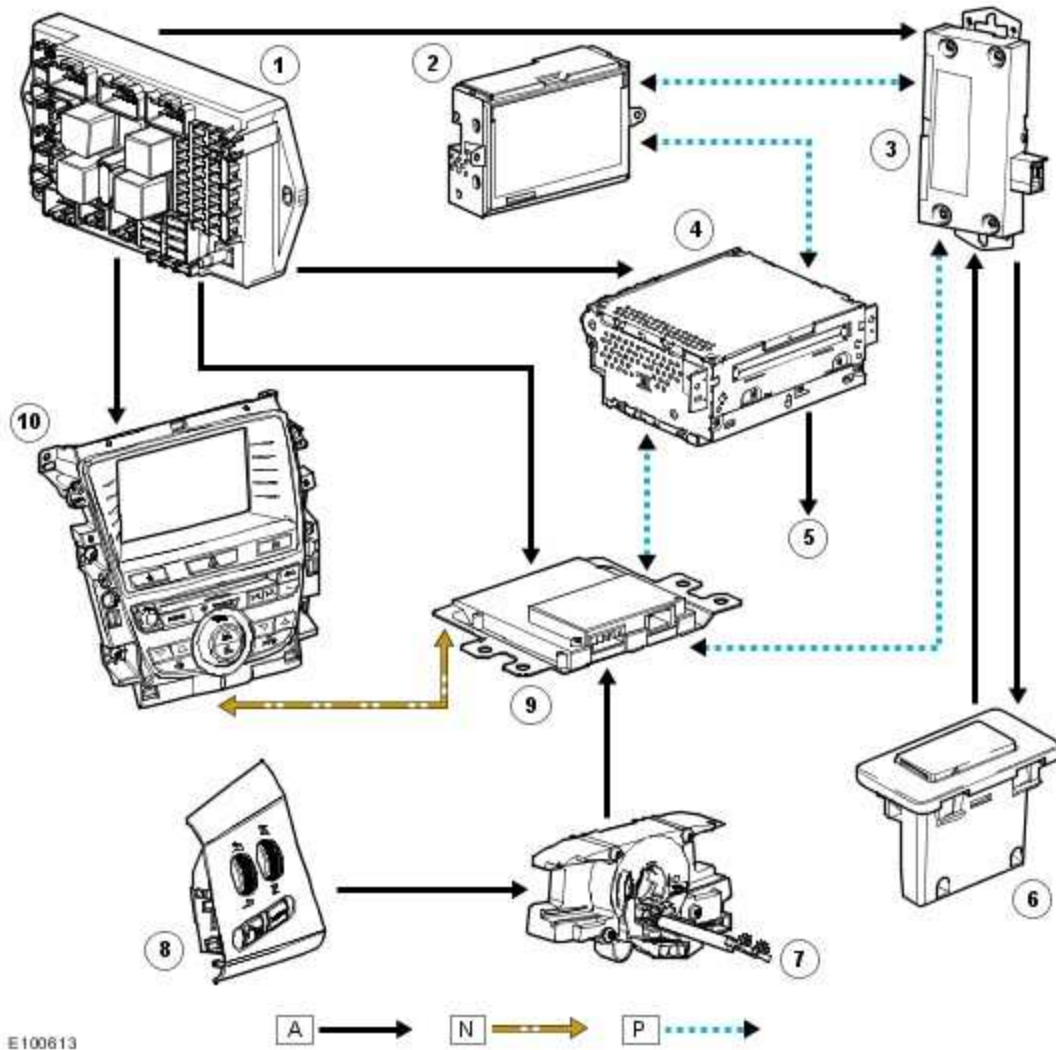
Item	Part Number	Description
1		Auxiliary Junction Box (AJB)
2		TSD
3		Integrated audio module
4		To speakers
5		Clock spring
6		Remote audio switches
7		Integrated control panel

8		Information and entertainment module
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CONTROL DIAGRAM - STANDARD AUDIO SYSTEM (FROM 2009 MY)

NOTE:

A = Hardwired; N = Medium speed CAN (controller area network) bus; P = MOST ring



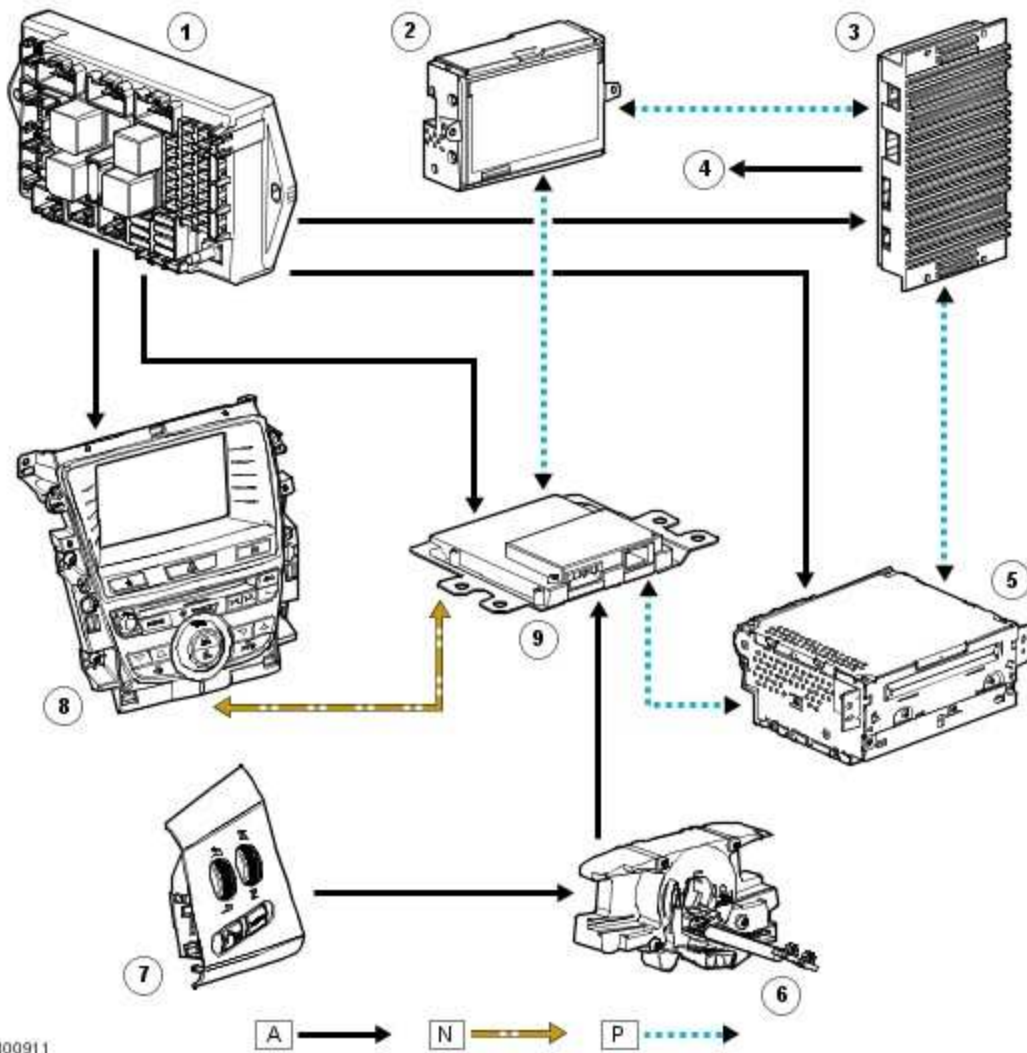
Item	Part Number	Description
1		AJB
2		TSD
3		Auxiliary USB unit

4		Integrated audio module
5		To speakers
6		Auxiliary input panel
7		Clock spring
8		Remote audio switches
9		Information and entertainment module
10		Integrated control panel

CONTROL DIAGRAM - PREMIUM AUDIO SYSTEM (UP TO 2009 MY)

NOTE:

A = Hardwired; N = Medium speed CAN (controller area network) bus; P = MOST ring



E 100911

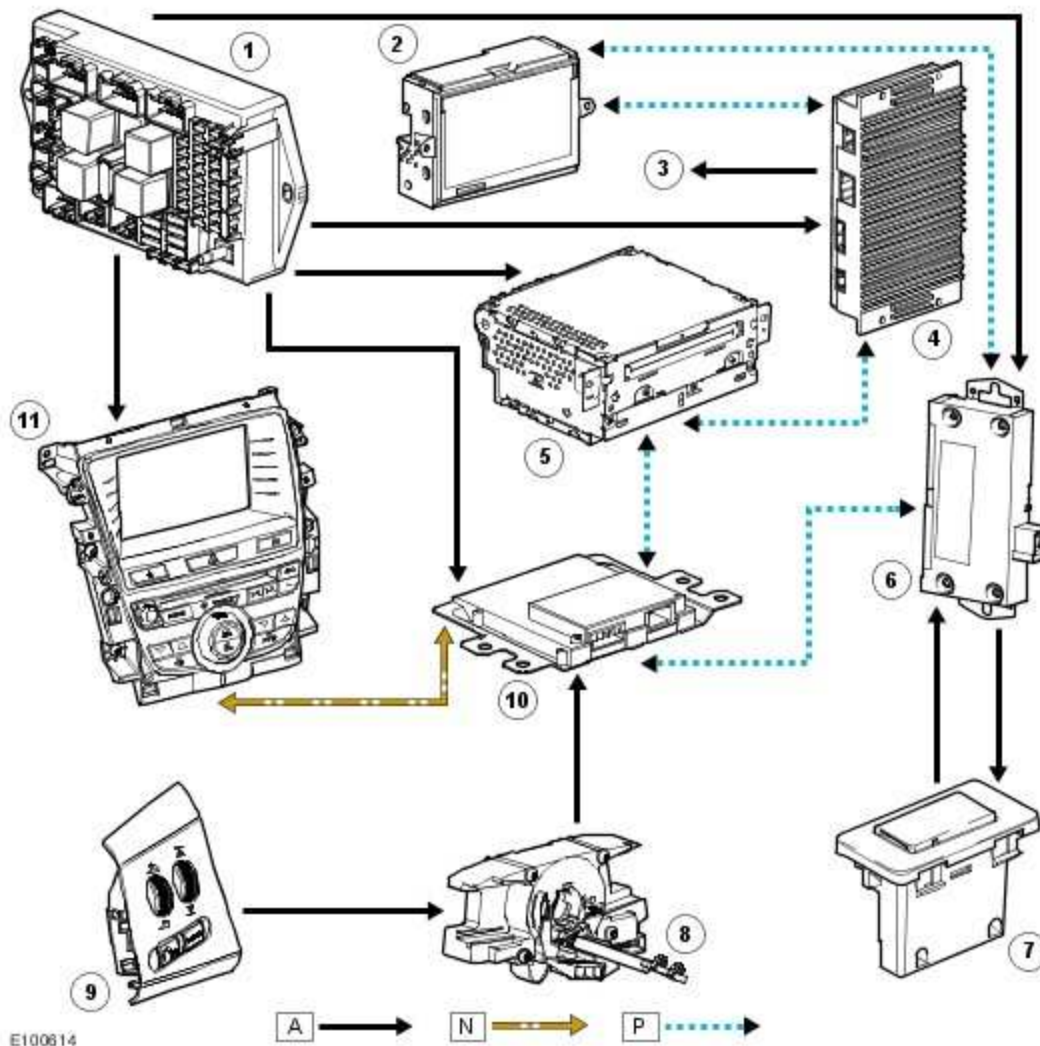
Item	Part Number	Description
1		AJB
2		TSD
3		Audio amplifier
4		To speakers
5		Integrated audio module
6		Remote audio switches
7		Clock spring

8		Integrated control panel
9		Information and entertainment module

CONTROL DIAGRAM - PREMIUM AUDIO SYSTEM (FROM 2009 MY)

NOTE:

A = Hardwired; N = Medium speed CAN (controller area network) bus; P = MOST ring



Item	Part Number	Description
1		AJB
2		TSD

3		To speakers
4		Audio amplifier
5		Integrated audio module
6		Auxiliary USB unit
7		Auxiliary input panel
8		Clock spring
9		Remote audio switches
10		Information and entertainment module
11		Integrated control panel

Audio System

For additional information, refer to <<415-00>>

Amplifier (86.50.10)

Removal

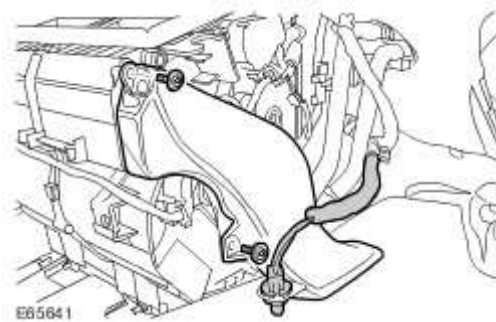
NOTE:


The component is situated in the passenger footwell. LHD is illustrated the procedure to remove the component on a RHD vehicle is similar.

- 1 . Remove the instrument panel assembly.
For additional information, refer to Instrument Panel (76.46.01)

- 2 . Remove the heater duct.
 - ▶ Remove the 2 Torx screws.

 - ▶ Release the lampholder.

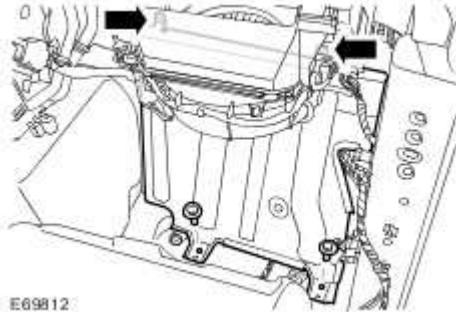



- 3  **CAUTION: Make sure the wiring harness and electrical connectors are not damaged during the carpet release.**

Carefully release the carpet for access.

4 . Remove the subwoofer cover.

▶ Remove the 4 bolts.



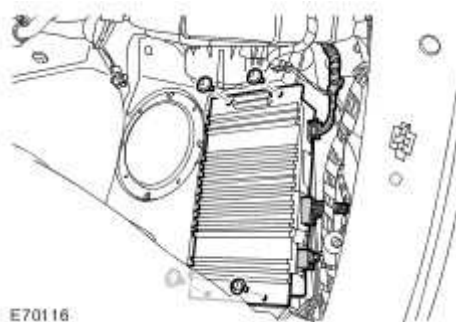
5  **CAUTION: Cover fibre optic cable connectors to minimise dust ingress and avoid bending the cables in a radius of less than 30 mm.**

Disconnect the 2 electrical connectors.

▶ Carefully disconnect the MOST connector.

6 . Remove the amplifier.

▶ Remove the 4 Torx screws.



Installation

1 . Install the amplifier.

2 . Connect the electrical connectors.

▶ Connect the MOST connector.

3 . Install the subwoofer cover.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

4



· **CAUTION: Make sure the carpet is correctly installed and that no foul-condition exists when the accelerator pedal is depressed.**

Install the carpet.

5 . Install the heater duct.

▶ Install the Torx screws.

▶ Install the lampholder.

6 . Install the instrument panel assembly.

For additional information, refer to Instrument Panel (76.46.01)

Audio Unit (86.50.03)

Removal

NOTE:

This component is easily recognised as a CD multichanger, it is however an audio module and links to the MOST.

- 1 . Disconnect the battery ground cable.

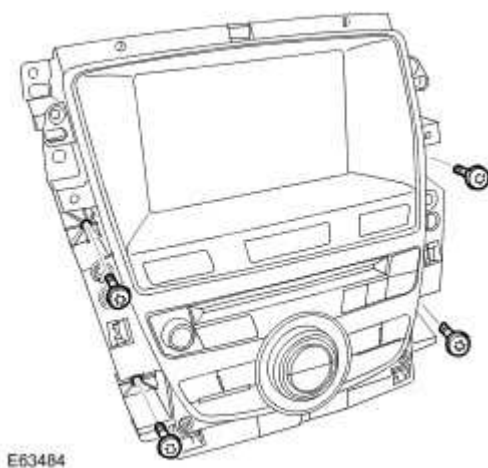
For additional information, refer to

- 2 . Remove the navigation screen module.

For additional information, refer to Navigation System Display Module (86.62.07)

- 3 . Release the audio/CD module and climatic control assembly.

▶ Remove the 4 module bracket Torx bolts.



4

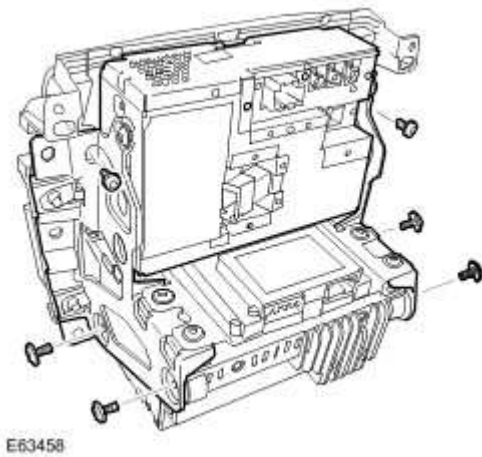


CAUTION: Care must be taken to avoid damage to the mating surfaces.

Separate the climatic control and audio/CD module from the module bracket.

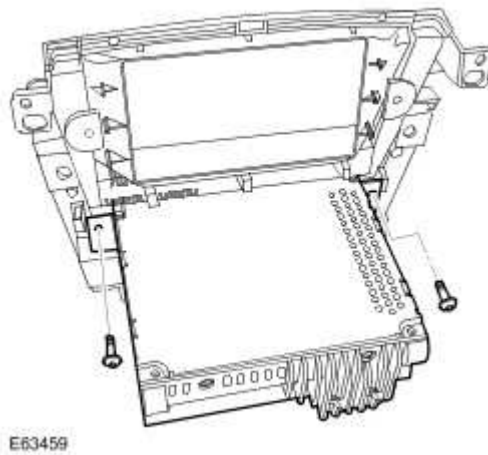
▶ Remove 2 Torx screws securing the navigation screen to the climatic control assembly.

▶ Remove the 4 Torx bolts.



5 . Remove the CD unit.

▶ Remove the 2 Torx screws.




Installation


1 NOTE:

Carefully check the CD access slot in the climatic control assembly is aligned to the CD unit after tightening the screws. This is a visual check only, do not attempt to probe the CD unit with a sharp object or load a CD .


Carefully install the audio/CD module to the climatic control assembly.

 Tighten the Torx screws.

2 . Install the climatic control assembly and audio/CD module to the module bracket.

 Install and tighten the navigation screen Torx screws.

 Install the CD module bracket Torx bolts and tighten to 6 Nm (4 lb.ft).

 Install the climatic control assembly Torx bolts and tighten to 6 Nm (4 lb.ft).

3 . Install the navigation screen module.

For additional information, refer to Navigation System Display Module (86.62.07)

4 . Connect the battery ground cable.

For additional information, refer to

5 . Connect WDS to the vehicle and configure a new module.

Steering Wheel Audio Controls (86.50.42)

Removal

NOTE:

This procedure is identical to the removal of the steering wheel speed control switch.

- 1 . Remove the steering wheel switch assembly.
For additional information, refer to Speed Control Switch (19.75.25)

Installation

- 1 . To install, reverse the removal procedure.
For additional information, refer to Speed Control Switch (19.75.25)

415-02 : Antenna

Specifications

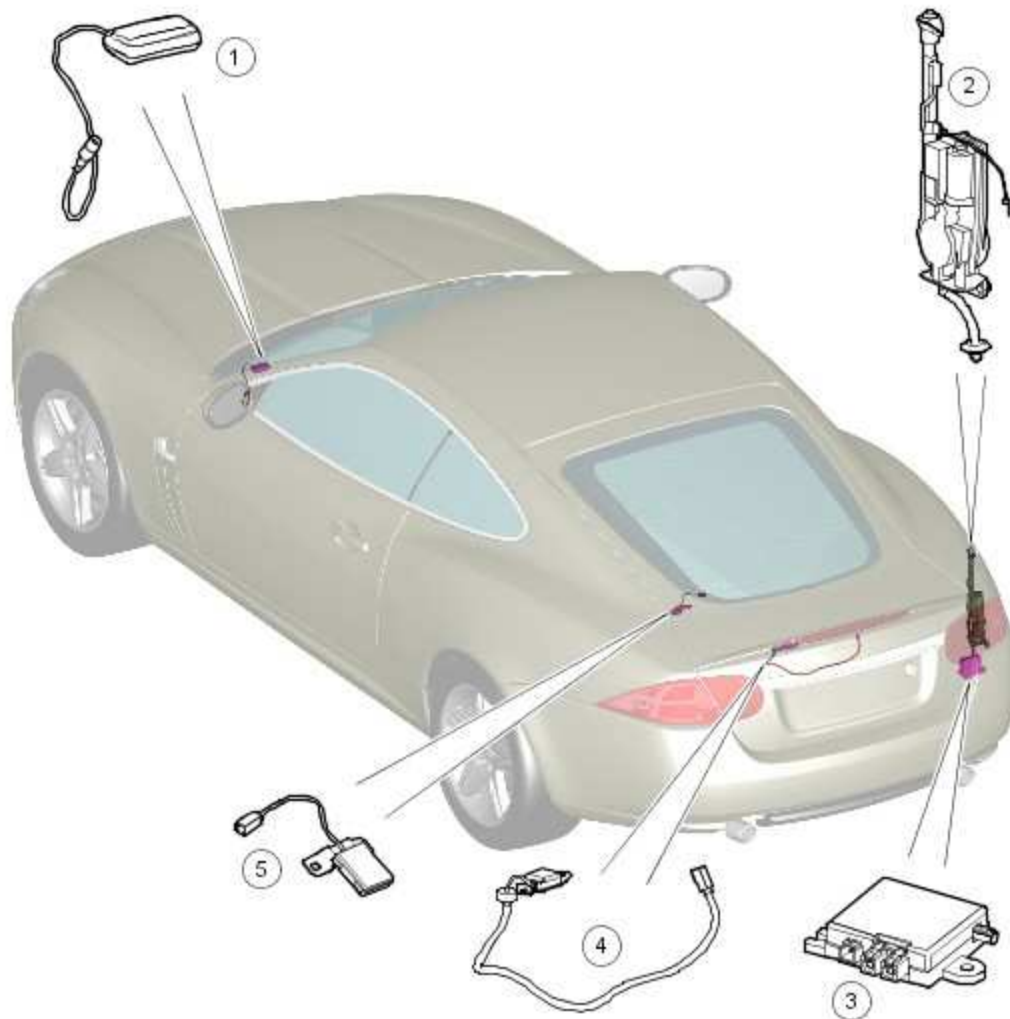
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Body earth point - nut	9	7	80
Electric AM/FM antenna	9	7	80
FM ariel splitter module - nut	7	5	62

Antenna

COMPONENT LOCATION



E62784

Item	Part Number	Description
1		VICS beacon antenna (Japan only)
2		Amplitude Modulation (AM)/Frequency Modulation (FM) electric antenna
3		FM antenna signal splitter
4		GPS antenna

INTRODUCTION

The antenna systems on the vehicle cover the following functions:

- AM/FM radio reception
- Bluetooth connection with the Telephone Control Module
- FM reception for the VICS/TMC function of the navigation system
- Global Positioning System (GPS) signals.

GPS ANTENNA

The GPS antenna is located in the rear liftgate spoiler.

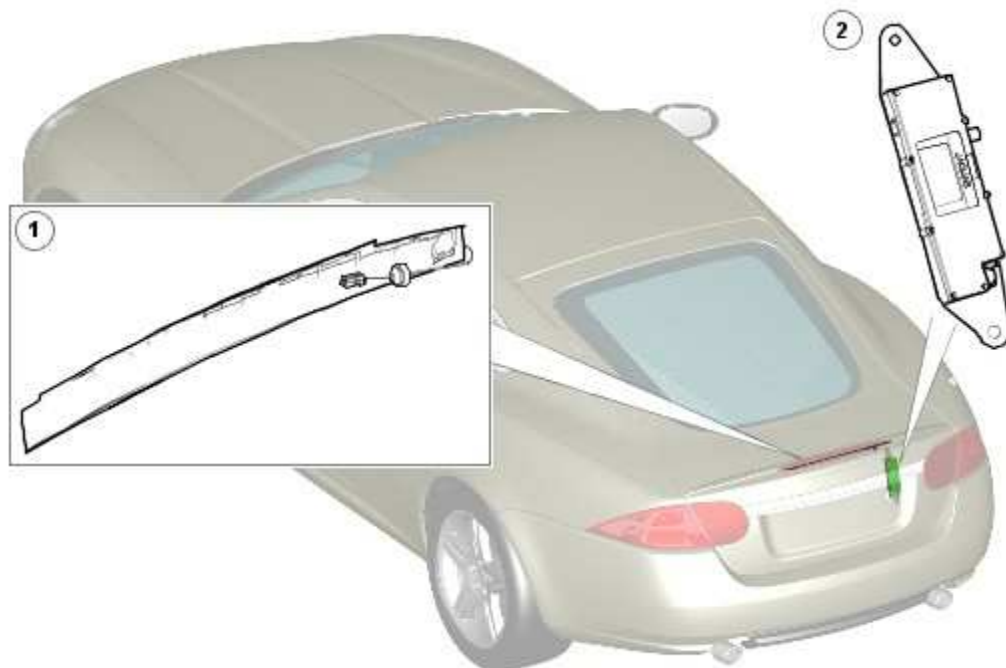
BLUETOOTH ANTENNA

The Bluetooth Antenna is located centrally behind the rear seat. The antenna is used to connect the telephone control module to a Bluetooth compatible phone. The vehicle audio system can then be used for making and receiving telephone calls hands free. For additional information, refer to Cellular Phone (419-08 Cellular Phone)

ELECTRIC AM/FM ANTENNA

The electric AM/FM antenna is located on the rear RH quarter of the vehicle. The antenna is controlled by the Integrated Audio Module, which supplies power to the antenna motor. The antenna is extended when the radio is switched on and retracted when the system is switched off or the ignition is switched off.

AM/FM ANTENNA AND AMPLIFIER - 08 MODEL YEAR ONWARDS



E94652

Item	Part Number	Description
1		Antenna
2		FM amplifier

On all vehicles from 08MY, the AM/FM antenna is located in the rear spoiler. The antenna has a hardwire connection to the amplifier which is mounted on the inner Left-Hand (LH) side of the lift gate, behind the trim panel. The amplifier is held in place by a steel strap. The amplifier is connected to the integrated audio module, via the FM antenna signal splitter, by a coaxial cable.

On coupe models, ground for the antenna amplifier is provided by a strap connected to the lift gate hinge. On convertible models a block connected directly to the amplifier provides the ground through the vehicle body.

FM ANTENNA SIGNAL SPLITTER

The FM antenna signal splitter is located in the luggage compartment just below the RH rear lamp cluster. The splitter divides the received FM signal between the Integrated Audio Module and the navigation computer. The navigation computer uses the FM signal for TMC information. For additional information, refer to Navigation System (419-07 Navigation System)

VICS BEACON ANTENNA (Japan only)

The VICS beacon antenna is located on the passenger side of the instrument panel adjacent to the windshield. The antenna receives infra red and microwave data transmissions from roadside transmitters.

SDARS ANTENNA

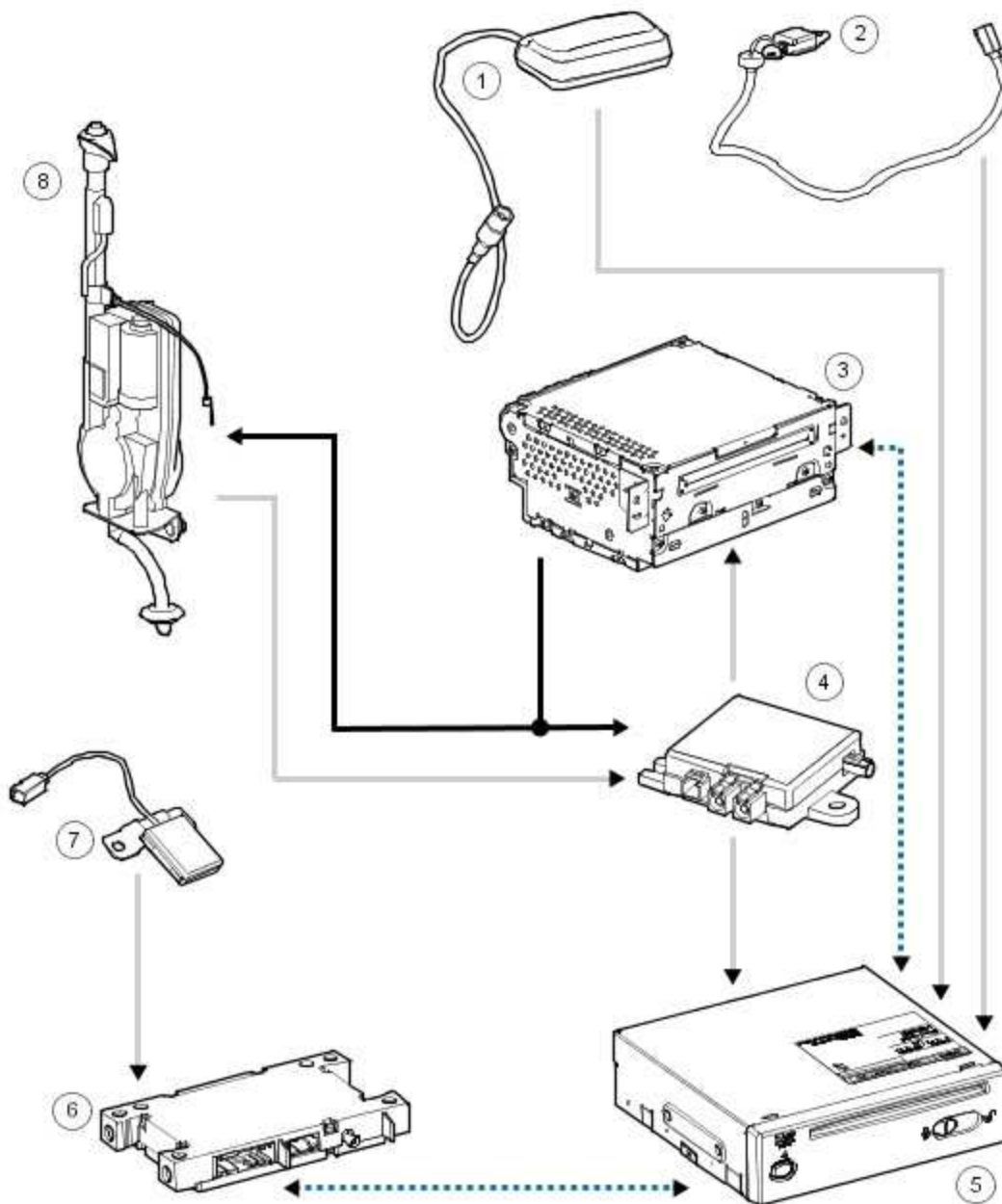
Where fitted the SDARS antenna is located in the center of the liftgate just in front of the spoiler. The antenna receives satellite radio transmissions.

CONTROL DIAGRAM

Upto 08 Model Year

NOTE:

A=Hardwired; P=MOST; T=Coaxial



E02785



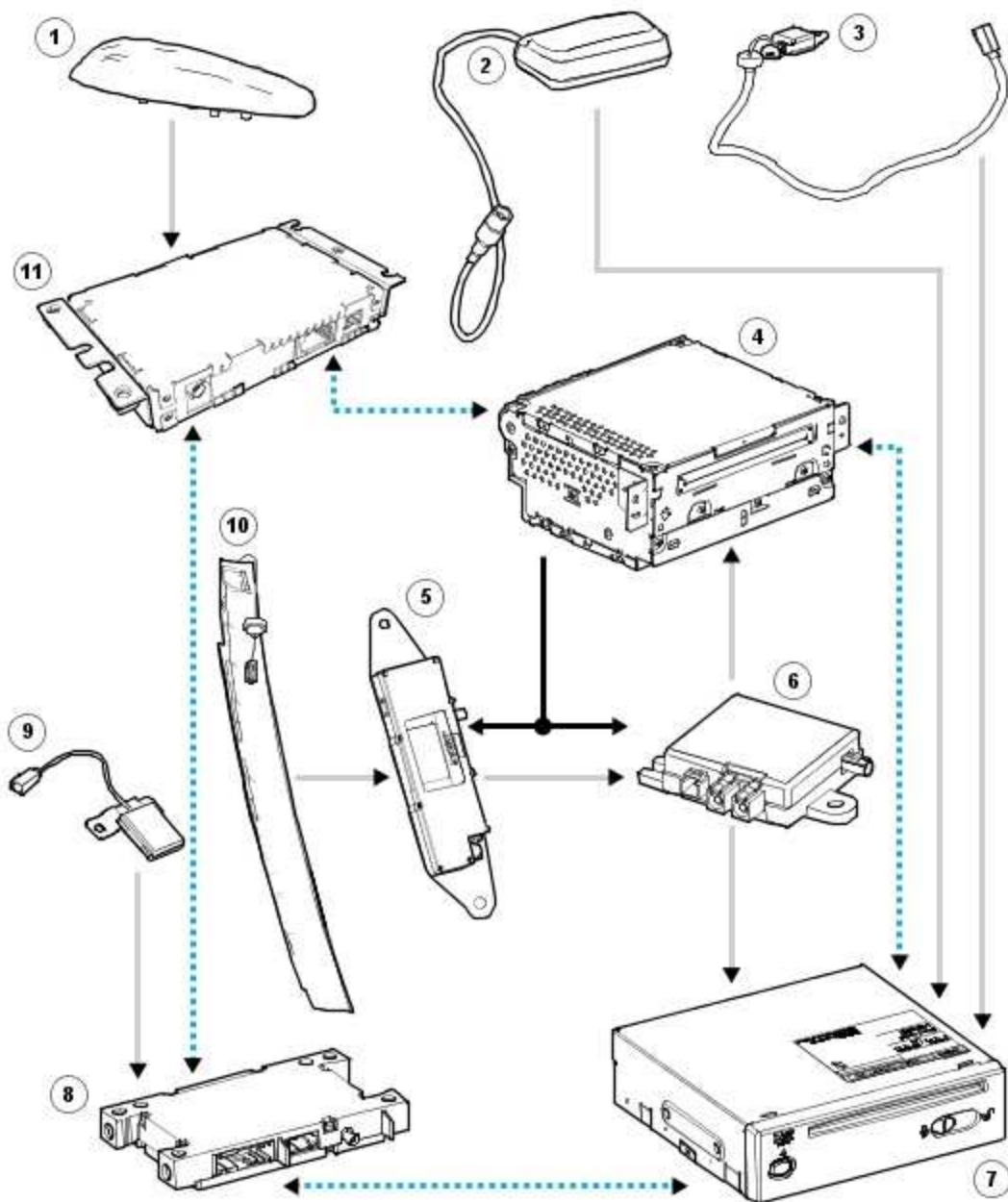
Item	Part Number	Description
1		SDARS Antenna (where fitted)
2		VICS beacon antenna (Japan)
3		GPS antenna
4		Integrated audio module

5		AM/FM electric antenna
6		FM antenna signal splitter
7		Navigation computer
8		Telephone control module
9		Bluetooth antenna
10		SDARS module

From 08 Model Year

NOTE:

A=Hardwired; P=MOST; T=Coaxial



E94672



Item	Part Number	Description
1		SDARS Antenna (where fitted)
2		VICS beacon antenna (Japan)
3		GPS antenna
4		Integrated audio module

5		AM/FM antenna amplifier
6		FM antenna signal splitter
7		Navigation computer
8		Telephone control module
9		Bluetooth antenna
10		AM/FM antenna
11		SDARS module

Antenna

For diagnosis and testing information.

[Audio System](#)

Antenna (86.51.17.60)

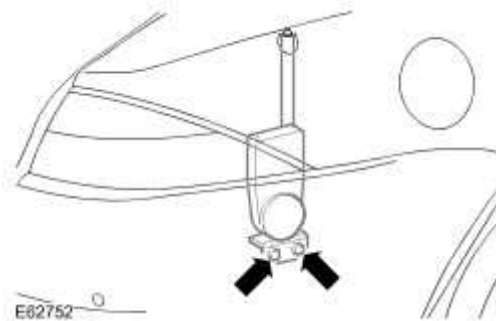
Removal

1 . Remove the RH rear quarter trim panel.

2 . Raise the vehicle on the lift.

3 . Release the antenna.

▶ Remove the 2 nuts.



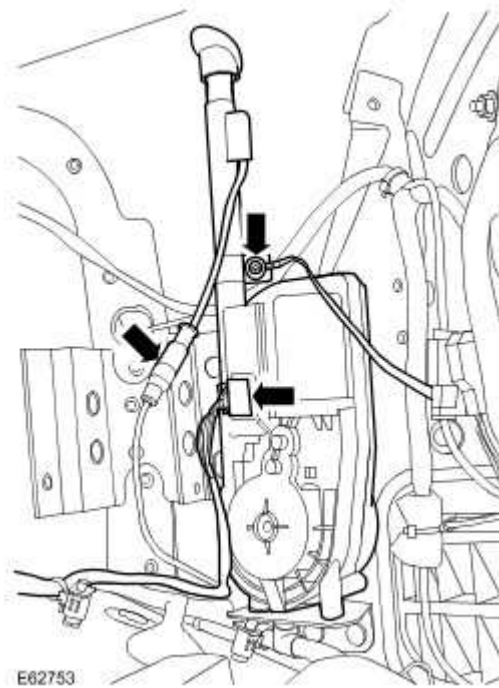
4 . Lower the vehicle.

5 . Remove the antenna.

▶ Disconnect the antenna cable.

▶ Disconnect the electrical connector.

▶ Disconnect the antenna earth strap.



Installation

1 . Install the antenna.

- ▶ Connect the antenna cable.
- ▶ Connect the electrical connector.
- ▶ Connect the antenna earth strap.

2 . Raise the vehicle on the lift.

3 . Secure the antenna.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

4 . Lower the vehicle.

5 . Install the RH rear quarter trim panel.

415-03 : Speakers

Specifications

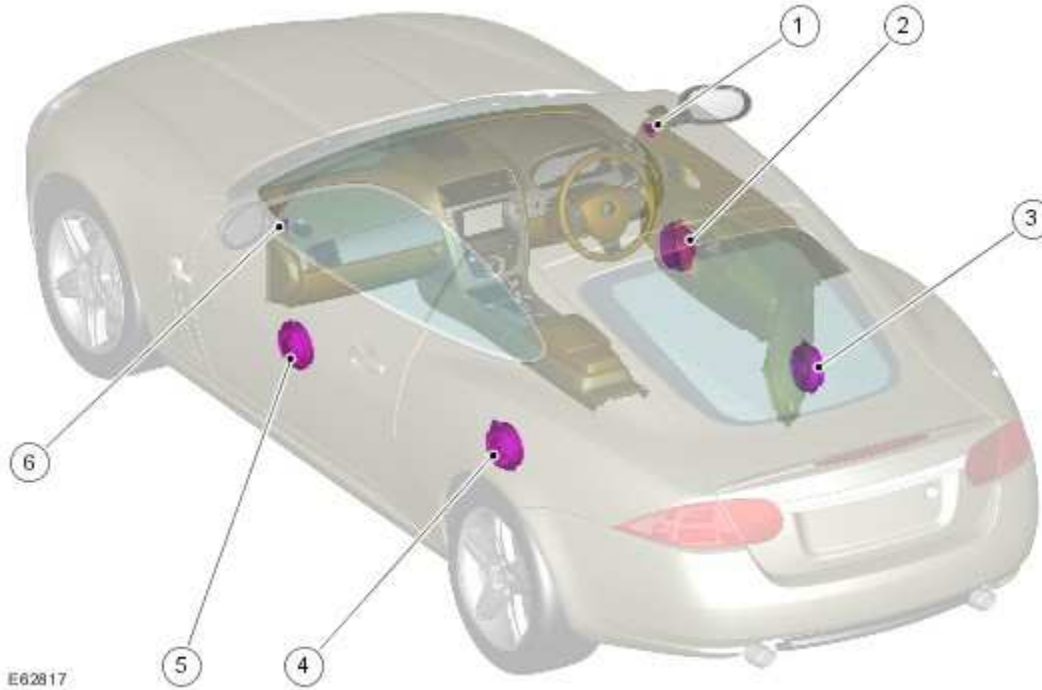
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Front door speaker - screw	2	-	18
Subwoofer speaker - screw	5	4	44
Subwoofer speaker cover - bolt	5	4	44
Subwoofer speaker housing - bolt	5	4	44
Subwoofer speaker housing - nut	5	4	44
Subwoofer speaker housing - screw	5	4	44
Quarter panel speaker - screw	2	-	18

Speakers

COMPONENT LOCATION-STANDARD AUDIO SYSTEM



Item	Part Number	Description
1		Front RH high range speaker
2		Front RH mid/low range speaker
3		Rear RH mid/low range speaker
4		Rear LH mid/low range speaker
5		Front LH mid/low range speaker
6		Front LH high range speaker

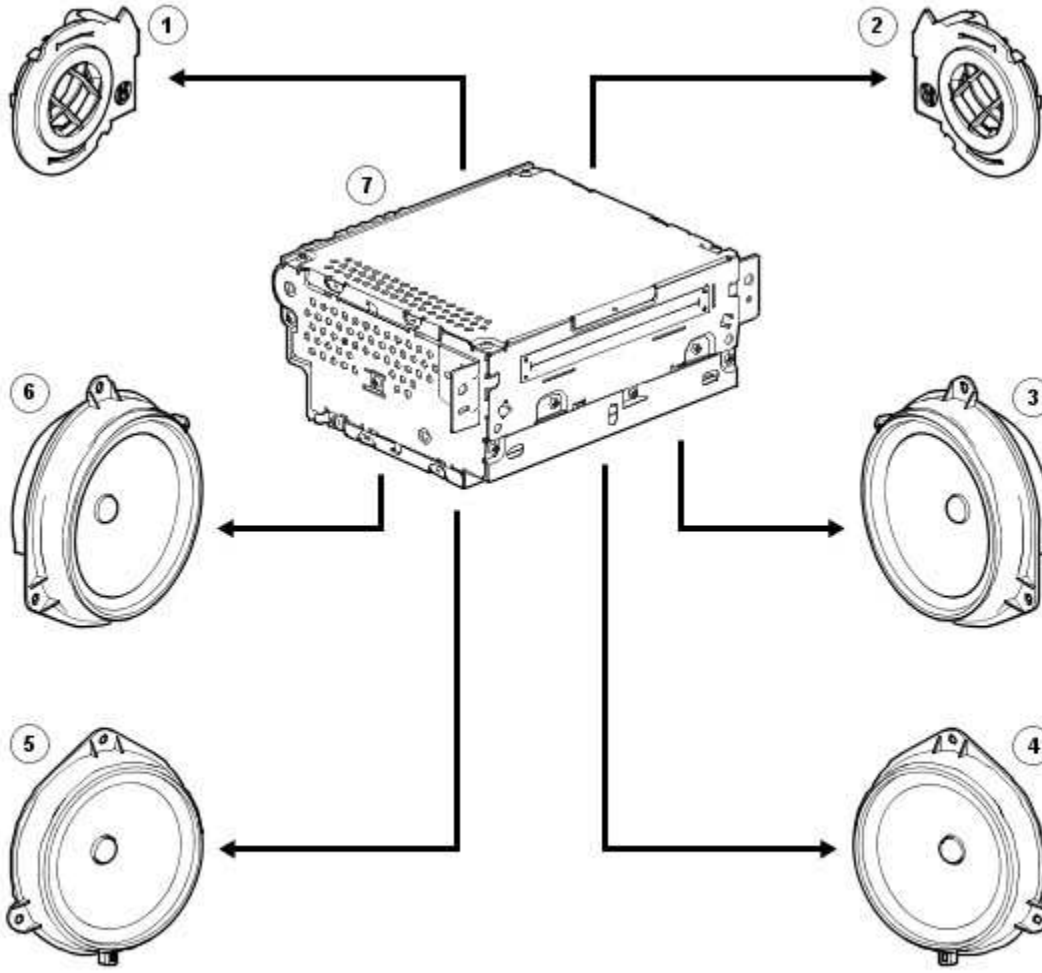
INTRODUCTION

The standard speaker system comprises 6 speakers that are driven by the Integrated Audio Modules internal amplifier.

CONTROL DIAGRAM-STANDARD AUDIO SYSTEM

NOTE:

A=Hardwired



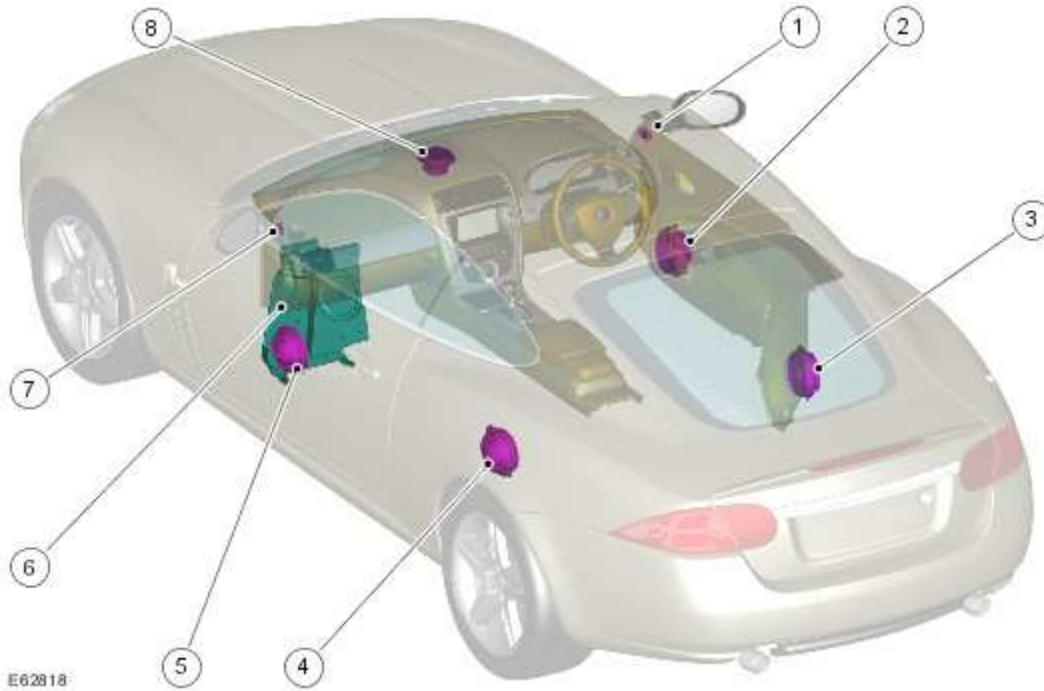
E62819

A →

Item	Part Number	Description
1		Front LH high range speaker
2		Front RH high range speaker
3		Front RH mid/low range speaker
4		Rear RH mid/low range speaker
5		Rear LH mid/low range speaker

6		Front LH mid/low range speaker
7		Integrated Audio Module

COMPONENT LOCATION-PREMIUM AUDIO SYSTEM



Item	Part Number	Description
1		Front RH high range speaker
2		Front RH mid/low range speaker
3		Rear RH mid/low range speaker
4		Rear LH mid/low range speaker
5		Front LH mid/low range speaker
6		Subwoofer and power amplifier assembly
7		Front LH high range speaker
8		Center speaker

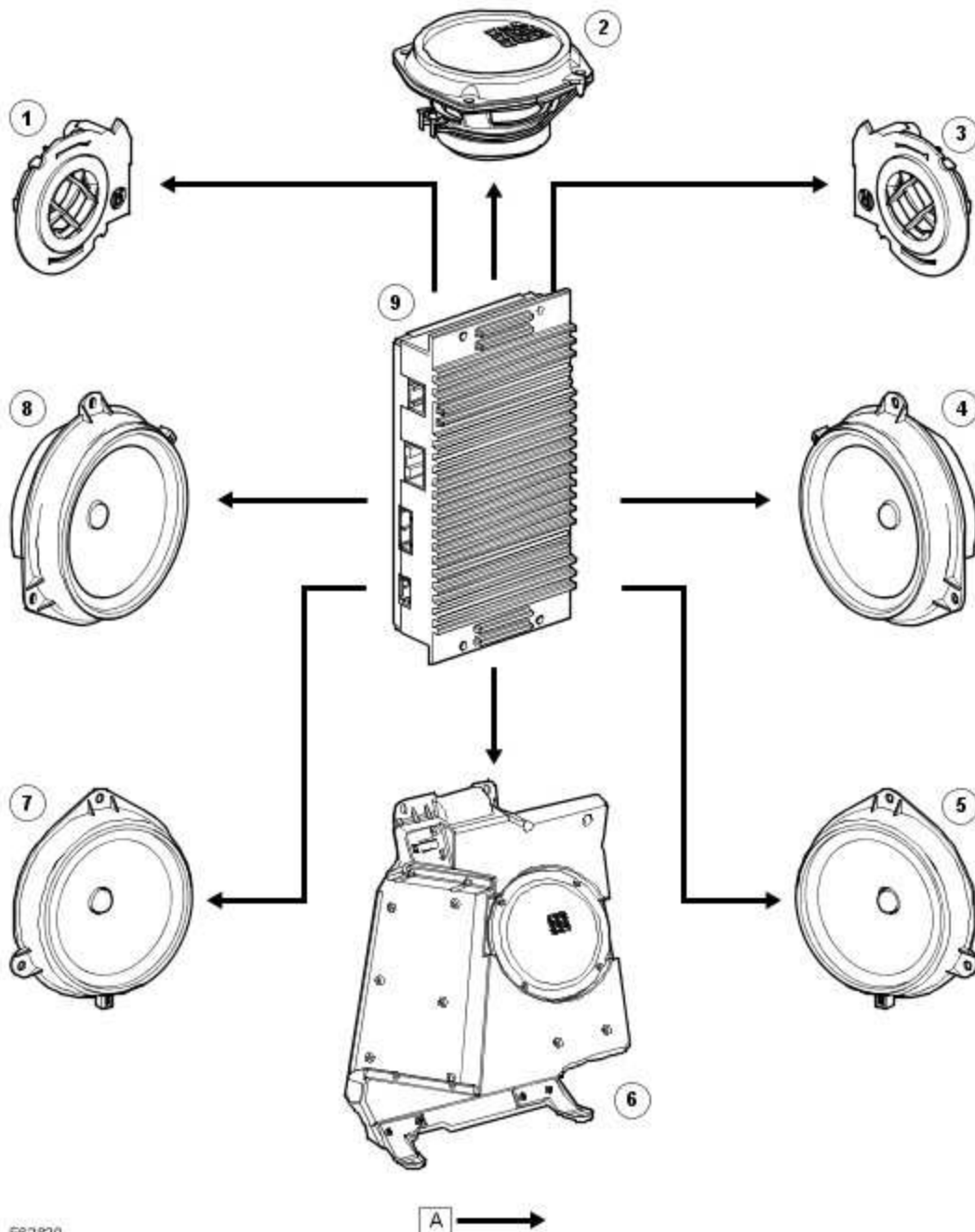
INTRODUCTION

Premium audio system is a 7 speaker system which is driven by a Dolby Prologic II Audio amplifier. The subwoofer is located in the passenger footwell behind a false panel inside its own enclosure. The Dolby Prologic II amplifier is attached to the front of the subwoofer enclosure.

CONTROL DIAGRAM-PREMIUM AUDIO SYSTEM

NOTE:

A=Hardwired



Item	Part Number	Description
1		Front LH high range speaker
2		Center speaker
3		Front RH high range speaker
4		Front RH mid/low range speaker
5		Rear RH mid/low range speaker
6		Subwoofer
7		Rear LH mid/low range speaker
8		Front LH mid/low range speaker
9		Power amplifier

Speakers

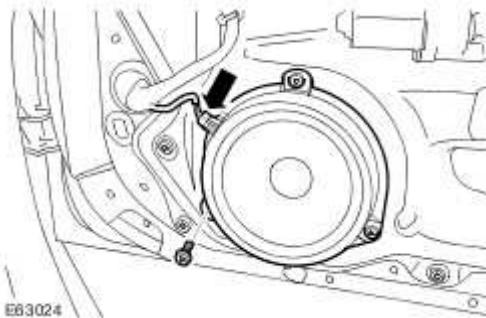
For diagnosis and testing information.

[Audio System](#)

Front Door Speaker (86.50.13)

Removal

- 1 . Remove the front door trim panel.
For additional information, refer to Front Door Trim Panel (76.34.01)
- 2 . Remove the front door speaker.
 - ▶ Remove the 3 Torx bolts.
 - ▶ Disconnect the electrical connector.



Installation

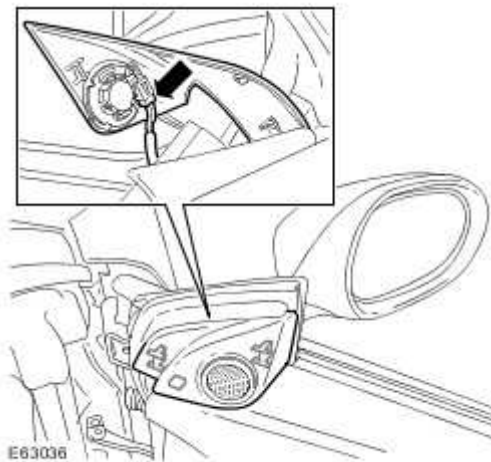
- 1 . Install the front door speaker.
 - ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the front door trim panel.
For additional information, refer to Front Door Trim Panel (76.34.01)

Front Door Tweeter Speaker (86.50.63)

Removal

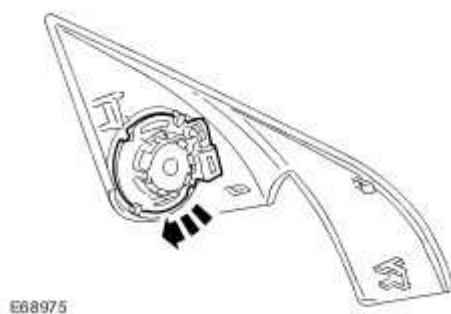
1 . Remove the exterior mirror trim panel.

- ▶ Release the 3 clips.
- ▶ Disconnect the electrical connector.




2 . Release the speaker tweeter.

- ▶ Release from the clips.





Installation

1 . Install the speaker tweeter.

 Release from the clips.

2 . Install the exterior mirror trim panel.

 Connect the electrical connector.

 Secure with the clips.

Subwoofer Speaker (86.51.05)

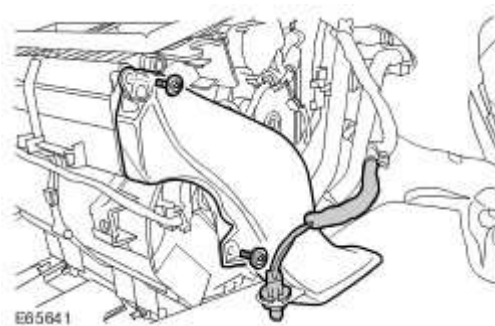
Removal


- 1 . Remove the instrument panel assembly.
For additional information, refer to Instrument Panel (76.46.01)

- 2 . Remove the heater duct.

▶ Remove the 2 Torx screws.

▶ Release the lampholder.

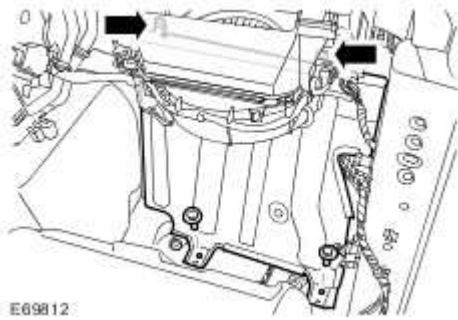


- 3  **CAUTION: Make sure the wiring harness and electrical connectors are not damaged during the carpet release.**

Carefully release the carpet for access.

- 4 . Remove the subwoofer cover.

▶ Remove the 4 bolts.

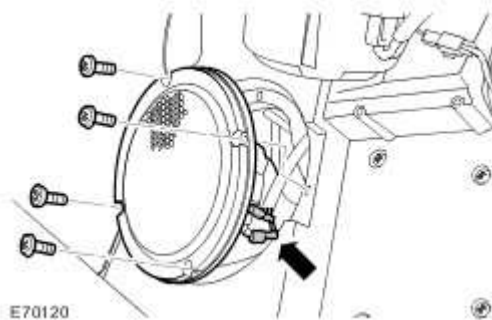


5 . NOTE:

Do not disassemble further if the component is removed for access only.

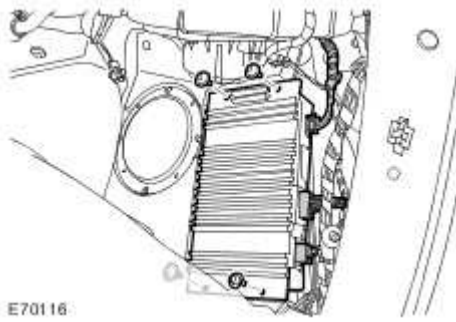
Remove the subwoofer.

- ▶ Remove the 4 screws.
- ▶ Disconnect the 2 electrical connectors.



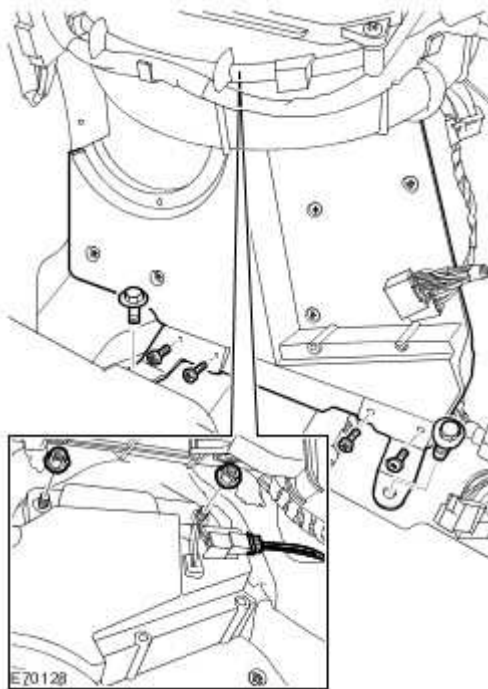
6 . Remove the amplifier.

- ▶ Remove the 4 Torx screws.



7 . Release the subwoofer speaker housing

- ▶ Remove the 2 nuts.
- ▶ Remove the 2 bolts.
- ▶ Remove both speaker housing support brackets.



8



CAUTION: Cover fibre optic cable connectors to minimise dust ingress and avoid bending the cables in a radius of less than 30 mm.

Remove the subwoofer speaker housing.

- ▶ Carefully disconnect the MOST connector.
- ▶ Disconnect the 3 electrical connectors.

Installation

1 . Install the subwoofer speaker housing.

- ▶ Install the brackets.
- ▶ Install the screws.
- ▶ Tighten the nuts to 5 Nm (4 lb.ft).
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

2 . Connect the subwoofer speaker housing electrical connectors.

- ▶ Connect the MOST connector.

3 . Install the amplifier.

4 . Install the subwoofer.

- ▶ Connect the electrical connectors.
- ▶ Install the screws.

5 . Install the subwoofer cover.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

6



- **CAUTION: Make sure the carpet is correctly installed and that no foul-condition exists when the accelerator pedal is depressed.**

Install the carpet.

7 . Install the heater duct.

▶ Install the Torx screws.

▶ Install the lampholder.

8 . Install the instrument panel assembly.

For additional information, refer to Instrument Panel (76.46.01)

Quarter Panel Speaker - 2-Door (86.50.12)

Removal

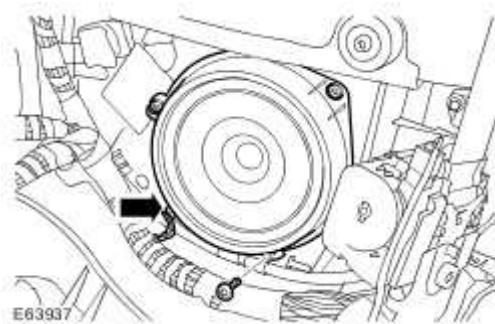
- 1 . Remove the rear quarter trim panel.

For additional information, refer to Rear Quarter Trim Panel - 2-Door (76.13.73)

- 2 . Remove the quarter panel speaker.

▶ Remove the 3 Torx screws.

▶ Disconnect the electrical connector.



Installation

- 1 . Install the quarter panel speaker.

▶ Connect the electrical connector.

▶ Install and tighten the Torx screws.

- 2 . Install the rear quarter trim panel.

For additional information, refer to Rear Quarter Trim Panel - 2-Door (76.13.73)

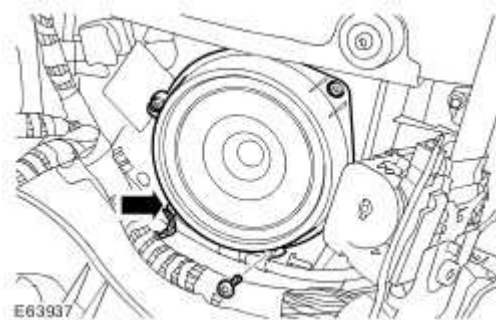
Quarter Panel Speaker - Convertible (86.50.12)

Removal

- 1 . Remove the rear quarter trim panel.
For additional information, refer to Rear Quarter Trim Panel - Convertible (76.13.73)

- 2 . Remove the quarter panel speaker.

- ▶ Remove the 3 Torx screws.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the quarter panel speaker.
 - ▶ Connect the electrical connector.
 - ▶ Install and tighten the Torx screws.
- 2 . Install the rear quarter trim panel.
For additional information, refer to Rear Quarter Trim Panel - Convertible (76.13.73)

417 : Lighting

417-01 : Exterior Lightning

Specifications

Specifications

Bulbs

Lamp	Bulb Type
Number plate lamp	W5WL
Reverse lamp	LED (non-serviceable)
Side repeater indicator	WY5W
Headlamp unit:	
Cornering lamp	H8
Dip and main beam projector unit	D1S35W
Direction indicator	PY21W
Side lamp	W5W
Side marker	WY5W
Rear lamp unit:	
Direction indicator	PY21W Silver Vision
Side marker	W5W
Stop and tail	P21/5W
Tail lamp	W5W
Fog lamps:	
Front fog lamp	H11 55W
Rear fog lamp	LED (non-serviceable)

Adjustment

Item	Adjustment Setting
Headlamp aim (ROW)	-1% +/- 0.1%
Headlamp aim (NAS)	-0.7%
Fog lamp aim	-2% +/- 0.5%

Torque Specifications

Item	Nm	lb-ft	lb-in
Headlamp assembly - bolt	6	4	53
Headlamp leveling, front sensor - bolt	20	15	-
Headlamp leveling module - bolt	4	3	35
Headlamp leveling, rear sensor - bolt	20	15	-
High-mounted stop lamp - screw	2	-	18
Rear lamp assembly to gate/lid - nut	2.5	-	22
Rear lamp assembly to fender - nut	2	-	18

Front Fog Lamp Adjustment

1. Align the beam setting equipment to one fog lamp.

2. **NOTE:**

The fog lamp beam should be set at 1.2% below the horizontal and parallel.

Check the fog lamp beam alignment.

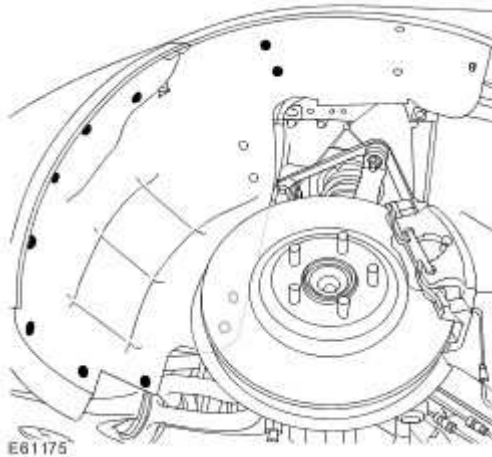
3. Turn the steering on to full lock for access.

4. **NOTE:**

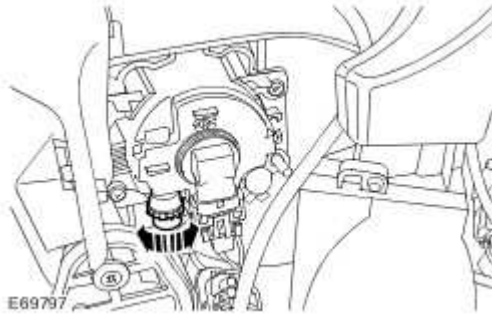
Wheel shown removed for clarity.

Release the front of the fender splash shield.

- Remove the 7 Torx bolts.
- Tie the splash shield aside.



5. Adjust the fog lamp using the thumb wheel.



6. Install the fender splash shield.
 - Tighten the Torx bolts.

7. To adjust the second fog lamp, repeat the above procedure.

Headlamp Adjustment (86.40.18)

1. Align the headlamp beam setting equipment to one headlamp.

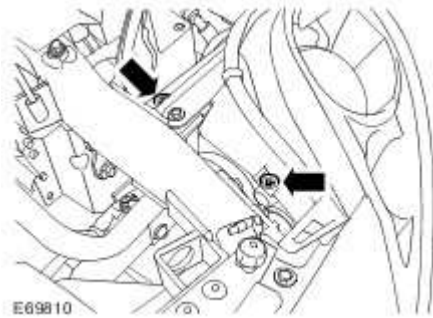
2. **NOTE:**

The headlamp setting is 1.2 % below horizontal and parallel.

Check the headlamp beam alignment.

3. Open the hood.

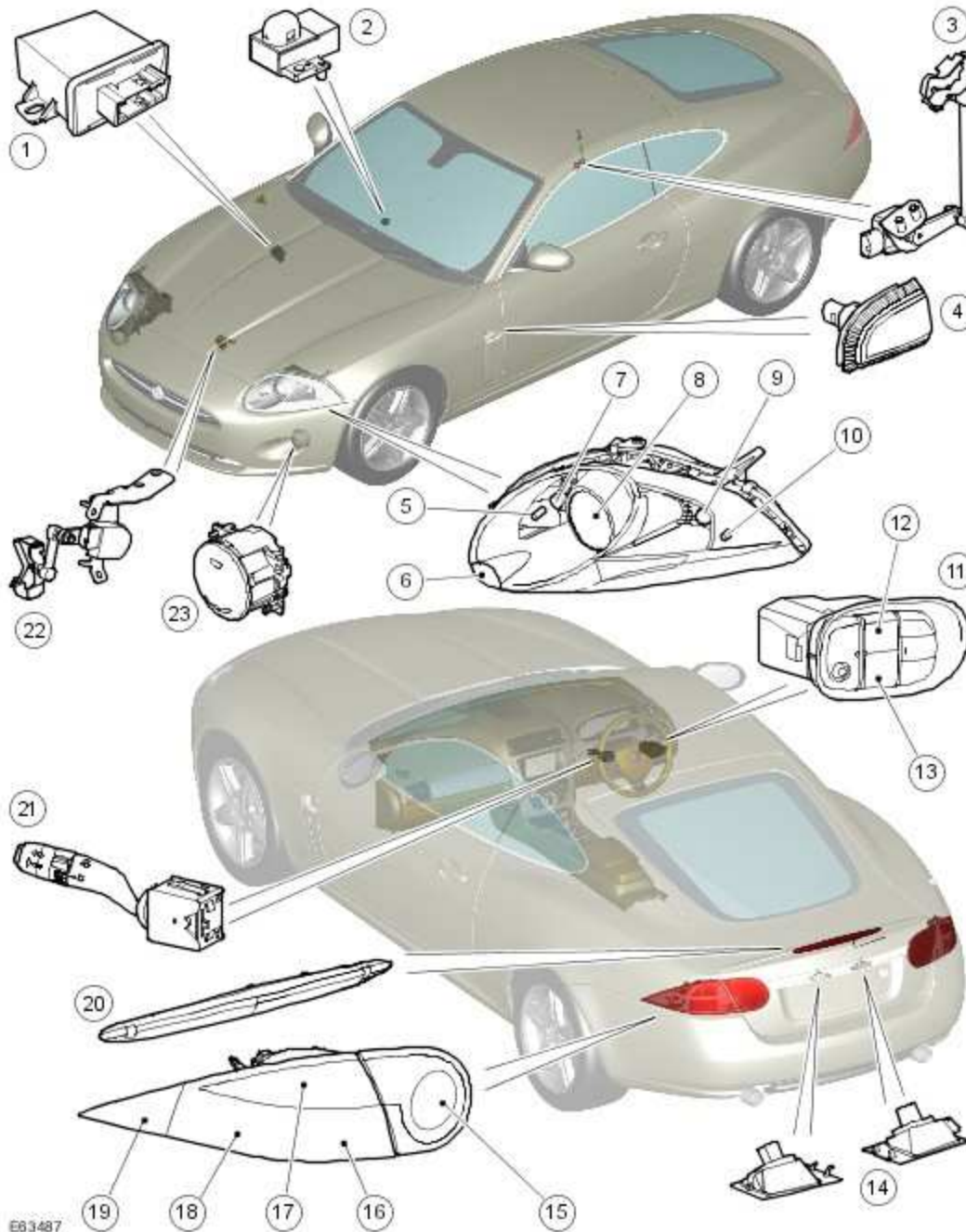
4. Adjust the headlamps with an Allen Key.



5. To adjust the second headlamp, repeat the above procedure.

Exterior Lighting

COMPONENT LOCATION



E63487

Item	Part Number	Description
1		Headlamp leveling/AFS control module

2		Light sensor
3		Rear height sensor
4		Turn signal indicator repeater lamp (2 off)
5		Cornering lamp
6		Headlamp power washer
7		Front side lamp
8		Xenon headlamp module
9		Front turn signal indicator
10		Side marker lamp
11		Auxiliary lighting switch
12		Front fog lamp switch
13		Rear fog lamp switch
14		License plate lamps
15		Reverse or rear fog lamp
16		Side lamp
17		Rear turn signal indicator
18		Side lamp/Stop lamp
19		Rear side marker lamp
20		High mounted stop lamp
21		Lighting switch
22		Front height sensor
23		Front fog lamp (2 off)

INTRODUCTION

The lighting systems are controlled by the Auxiliary Junction Box (AJB) and the CJB (central junction box) . The two boxes contain fuses, relays and microprocessors to control the power supply and functionality of the lighting systems.

Driver lighting selections using the LH (left-hand) steering column multifunction switch or the auxiliary lighting switch are passed to the CJB (central junction box) via the instrument cluster.

The lighting system has an 'auto' lights function which is controlled by the CJB (central junction box) on receipt of signals from the light sensor. The exterior lights are turned on or off in response to ambient light signals from the light sensor via the instrument cluster.

Two levels of headlamp are available; Bi-xenon or Bi-xenon with Adaptive Front lighting System (AFS). The AFS headlamp has a swiveling projector module which moves the headlamp beam in the direction of travel. The AFS headlamp also features a cornering/static bending lamp which illuminates the area at the side of the vehicle when turning into driveways for example.

The tail lamp is in two parts. The turn signal indicator, side and stop lamps are located in each rear fender. The reverse and rear fog lamps are located in separate units attached to the liftgate. The locations of the fog and reverse lamps changes depending if the vehicle is LHD (left-hand drive) or RHD (right-hand drive) . The turn signal indicator, side and stop lamps use conventional glass filament bulbs. The rear fog and reverse lamp use colored LED (light emitting diode) .

EXTERIOR BULB TYPE/RATING

The following table shows the bulbs used for the exterior lighting system and their type and specification.

Bulb	Type	Rating
Xenon Headlamps - Low/High beam	Xenon D1S	35W
Front fog lamps - Naturally aspirated	Halogen H11	55W
Front fog lamps - Supercharged	Halogen H3	55W
Rear fog lamp	LED (light emitting diode)	Not applicable
Turn signal indicator lamps - Front - Rest of World (ROW)	Bayonet PY21W	21W
Turn signal indicator lamps - Front - North American Specification (NAS)	Wedge S8W 3457K	27/7W
Turn signal indicator repeater lamps	Capless W5W	5W

Turn signal indicator lamps - Rear	Bayonet PY21W	21W
Side lamps - Front	Wedge W5W	5W
Stop / Side lamps	Bayonet - Twin filament - P21/5	21W/5W
High mounted stop lamp	LED (light emitting diode)	Not applicable
Licence plate lamps	Capless W5W	5W
Reverse lamp	LED (light emitting diode)	Not applicable
Cornering lamp	Halogen H8	35W
Side marker lamps (front/rear)	Capless W3W	3W

CENTRAL JUNCTION BOX AND AUXILIARY JUNCTION BOX

The CJB (central junction box) is an integrated unit located in the passenger compartment LH (left-hand) side on the 'A' pillar.

The Auxiliary Junction Box (AJB) is located in a central position, behind the rear seat.

CJB (central junction box) Control

The CJB (central junction box) receives inputs from the following switches via the instrument cluster and the medium speed CAN (controller area network) bus:

- LH (left-hand) steering column multifunction switch Side lamp position Headlamp position Automatic (AUTO) position Timer delay positions Turn signal indicators Headlamp flash and high beam
- Stop lamp switch
- Hazard flasher switch
- Sunload/Light sensor.

The following lamps are controlled by the CJB (central junction box) :

- Front side lamps
- Front side marker lamps
- Headlamps
- Cornering lamps
- Front fog lamps.

AJB Control

The following lamps are controlled by the AJB:

- Rear fog lamp
- Reverse lamp
- Stop lamps
- High mounted stop lamp
- Rear side lamps
- Rear side marker lamps
- Licence plate lamps
- Front and rear turn signal indicators and side repeaters

The AJB is also connected via a hardwired connection to the hazard flasher switch.

Circuit Protection

The AJB and the CJB (central junction box) provide circuit protection for all exterior lighting circuits. The exterior lighting circuits are protected by Field Effect Transistors (FETs). Operation of the exterior lighting circuits is protected by the FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit.

On a normal circuit this would cause the fuse to blow. The FETs respond to the heat increase and disconnect the power supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally. If the fault persists the FET will cycle, disconnecting and reconnecting the power supply.

The CJB (central junction box) and the AJB store fault codes which can be retrieved using a Jaguar approved diagnostic system. The fault code will identify that there is a fault on a particular output which will assist with fault detection.

Alarm Indications

The exterior lighting system is used for alarm arm and disarm requests.

When the driver locks and arms the vehicle, a visual indication of a successful lock and arm request is displayed to the driver by a single flash of the hazard flashers. If the vehicle is superlocked then the hazard flashers will flash a second time (200ms off and 200ms on) to confirm the superlock request.

When the driver unlocks the vehicle, a visual indication of a successful lock and disarm request is displayed to the driver by the hazard flashers operating twice (200ms off and 200ms on).

If the alarm is triggered, the hazard flashers are operated for ten 30 second cycles of 200ms on and 200ms off with a 10 second delay between each cycle.

NOTE:

On NAS vehicles the delay between cycle when the alarm is triggered is 60 seconds. The alarm triggered hazard flasher operation varies depending on market.

Lights on Warning Chime

When the ignition is in the off mode or accessory mode conditions and the lighting switch is in the side lamp or headlamp position, a warning chime will sound if the driver's door is opened. This indicates to the driver that the exterior lights have been left switched on.

The chime is generated from the instrument cluster sounder on receipt of a lights on signal, a driver's door open signal and an ignition off or accessory mode signal via a medium speed CAN (controller area network) bus signal from the CJB (central junction box) .

Crash Signal Activation

When a crash signal is transmitted from the restraints control module, the AJB activates the hazard flashers. The hazard flashers continue to operate until the ignition is in the off or accessory modes and then returned to the ignition on mode. Once this condition has occurred, the restraints control module will cease transmission of the crash signal.

Headlamp Timer

The AJB controls a headlamp timer function which allows the headlamps to remain on for a period of time after leaving the vehicle. This is a driver convenience feature which illuminates the driveway after leaving the vehicle.

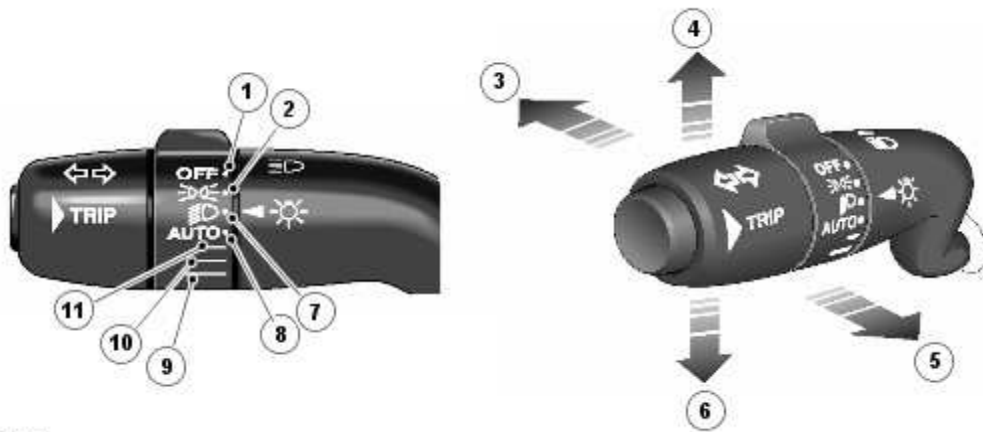
To select this feature, the lighting control switch on the steering column multifunction switch must be in one of the three headlamp timer positions when the ignition mode is changed from ignition on mode to off mode. The timer function will then be initiated and the low beam headlamps will be illuminated for the selected timer period.

NOTE:

If the lighting switch is in the AUTO position, the headlamp timer will not function when the ignition mode is changed to off.

The timer period can be adjusted using one of the 3 positions on the lighting control switch on the LH (left-hand) steering column multifunction switch. The 3 switch positions correspond to timer values of 30, 60 and 120 seconds.

LIGHTING CONTROL SWITCH



E82943

Item	Part Number	Description
1		Off position
2		Side lamp position
3		High beam position
4		RH (right-hand) turn signal indicator position
5		Headlamp flash/high beam off position
6		LH (left-hand) turn signal indicator position
7		Headlamp position
8		AUTO headlamp position
9		Headlamp timer 120 second delay position
10		Headlamp timer 60 second position
11		Headlamp timer 30 second position

The lighting control switch is located on the LH (left-hand) steering column multifunction switch. The switch is a rotary control with positions for the following lighting selections:

- Off
- Side lamps
- Headlamps
- AUTO headlamps

- Headlamp timer (3 time period selections).

The steering column multifunction switch also provides for the selection of low and high beam headlamps and also the headlamp flash function.

The steering column multifunction switch is connected to the instrument cluster by 3 wires. Two wires supply a signal voltage to the lighting switch and the headlamp timer positions. The third wire is a common ground. Each switch position is connected to the ground return via resistors which vary the return voltage to the instrument cluster. The instrument cluster senses the voltage returning and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the AJB and the CJB (central junction box) on the medium speed CAN bus for activation of the selected exterior lamps.

The steering column multifunction switch also provides the control for the turn signal indicators. The switch can be pushed down to select the LH (left-hand) turn signal indicators or pushed up to select the RH (right-hand) turn signal indicators. The switch has 2 positions. If the switch is pushed up or down gently and held, the turn signal indicators will operate until the switch is released, if the switch is pushed past a detent, the switch can be released and the selected position will automatically be cancelled when the manoeuvre is completed. If a turn signal indicator bulb fails, the green turn signal indicator warning indicator in the instrument cluster will flash at twice the normal rate and the audible ticking will also be at twice the normal rate.

The steering column multifunction switch also has a lane change function. If the switch is gently pushed to either turn signal indicator direction and then released, the turn signal indicators will flash 3 times and then automatically cancel.

AUXILIARY LIGHTING SWITCH



Item	Part Number	Description
1		Front fog lamp switch
2		Rear fog lamp switch

The auxiliary lighting switch is located in the instrument panel, adjacent to the steering column. The switch has 2 buttons which select the front and rear fog lamps. The buttons are non-latching

momentary switches.

The auxiliary lighting switch is connected to the instrument cluster by 3 wires. Two wires supply a signal voltage to the each fog lamp switch. The third wire is a common ground. Each switch position is connected to the ground return via a series of resistors which vary the supply voltage from the instrument cluster. The instrument cluster senses the voltage and determines the switch position selected. The instrument cluster then generates an applicable message which is sent to the AJB and the CJB (central junction box) on the medium speed CAN bus for activation of the selected fog lamps.

The front fog lamps can only be activated when the ignition is in the ignition power mode and side lamps or headlamps are active. The rear fog lamps can only be activated if the low beam headlamps are on or if the sidelamps and front fog lamps are on. A second press of each fog lamp button will switch of the selected fog lamps. If the lighting control switch or the ignition is changed to the off mode, then both fog lamps will be switched off and will need to be re-selected if required.

HEADLAMP ASSEMBLY

Two types of headlamp are available; Bi-Xenon and Adaptive Front lighting System (AFS). The headlamps are located with a locating dowel through the upper front bumper bracket and secured with 3 bolts to the front body structure. Bulb replacement requires the removal of the complete headlamp assembly.

The rear of the headlamp unit has removable access panels which allow access to the bulbs for replacement. A large cover, which is rotated anti-clockwise to remove allows access to the Xenon D1S bulb. Another removable cover provides access to the cornering lamp bulb and the side lamp bulb, which is retained with a spring clip. A smaller cover can be rotated anti-clockwise to provide access to the turn signal indicator bulb and the side marker lamp bulb.

The headlamps have two adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment.

On NAS vehicles the headlamp is regarded as 'Visual Optically Left' aiming. The adjustment screws have to turned equal amounts to maintain the correlation in the vertical axis only. There is no horizontal adjustment. Refer to the Service Repair Procedures manual for headlamp alignment data and procedures.

Each headlamp has an integral 16 pin connector which provides inputs and outputs for the various functions of the headlamp assembly.

The low beam headlamps are switched on when the ignition is in the ignition mode and:

- the lighting control switch is in the headlamp position
- the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB (central junction box) from a 'lights on' message generated by the AJB.

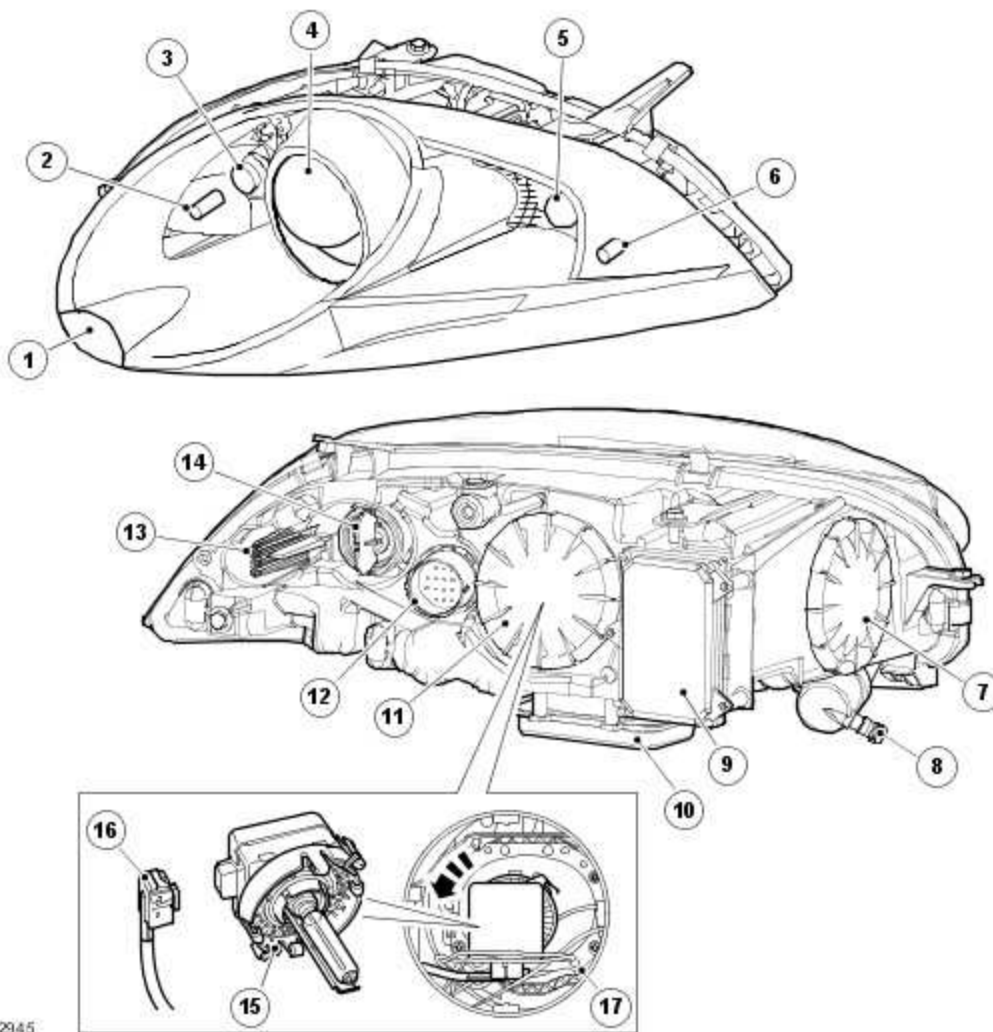
The low beam headlamps can also be operated by the headlamp timer function.

The high beam headlamps are switched on when the ignition is in the ignition mode and:

- The low beam headlamps are selected on or activated via the AUTO feature and the LH (left-hand) steering column multifunction switch is pushed forward, away from the driver

The high beam lamps will be switched off when:

- The LH (left-hand) steering column multifunction switch is moved rearwards, towards the driver.
- The low beam headlamps are switched off
- The ignition mode is changed to accessory or off mode.



E82945

Item	Part Number	Description
1		Headlamp power washer jet

2		Side lamp bulb
3		Cornering lamp (if fitted)
4		Xenon projector module
5		Turn signal indicator bulb
6		Side marker lamp bulb
7		Cover - Side lamp and cornering lamp
8		Powerwash hose connection
9		AFS power module (if fitted)
10		Xenon control module
11		Cover - Xenon bulb
12		Electrical connector
13		Side marker lamp bulb and holder
14		Turn signal indicator bulb and holder
15		Igniter electrical connector
16		Igniter unit and bulb
17		Mounting collar



WARNING: The Xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be followed when working on the Xenon headlamp system:

- **DO NOT** attempt any procedures on the Xenon headlamps when the lights are switched on.
- Handling of the D1S Xenon bulb must be performed using suitable protective equipment, for example gloves and goggles. The glass part of the bulb must not be touched.
- Xenon bulbs must be disposed of as hazardous waste.
- Only operate the lamp in a mounted condition in the reflector.

The Xenon headlamp is known as Bi-Xenon because it operates as both a low and high beam unit. The Xenon lamp or High Intensity Discharge (HID) lamp as they are sometimes called, comprise an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam.

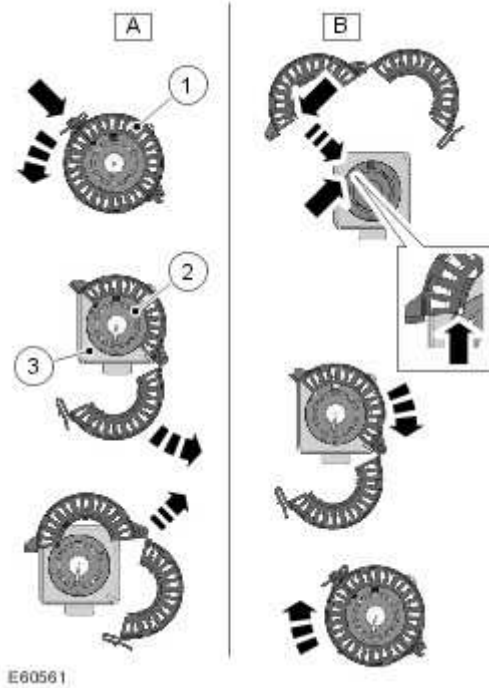
NOTE:

If the lighting control switch is in the OFF position, the Xenon lamps operate when the high beam 'flash' function is operated.

The Xenon headlamp system is controlled by the CJB (central junction box) using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the Xenon bulbs through their start-up phases of operation.

Xenon Headlamp Construction

Xenon Bulb Replacement



Item	Part Number	Description
A		Locking Ring Removal
B		Locking Ring Replacement
1		Mounting ring
2		Xenon bulb

3		Igniter
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The Xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the xenon bulb, which together is an assembly known as the projector module.

The reflector is curved and provides the mounting for the Xenon bulb. The bulb locates in a keyway to ensure correct alignment in the reflector and is secured by a plastic mounting ring. The bulb is an integral part of the igniter and is electrically connected by a connector located in the igniter unit.

The shutter controller is a solenoid which operates the shutter mechanism via a lever. The shutter is used to change the beam projection from low beam to high beam and visa versa.

The Xenon bulbs illuminate when an arc of electrical current is established between 2 electrodes within the bulb. The Xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow to produce the characteristic blue/white light.

To operate at full efficiency, the Xenon bulb goes through 3 full stages of operation before full output for continuous operation is achieved. The 3 phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of up to 30000 volts to establish the arc. This is produced by the igniter. The warm-up phase begins once the arc is established. The Xenon control module regulates the supply to the bulb to 2.6A which gives a lamp output of 75W. During this phase, the Xenon gas begins to illuminate brightly and the environment within the bulb stabilizes, ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the Xenon control module changes to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W. The process from start-up to continuous phase is completed in a very short time.

The Xenon control modules (one per headlamp) receive an operating voltage from the CJB (central junction box) when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the Xenon bulbs are operating, the igniters provide a closed circuit for the regulated power supply from the control modules.

Turn Signal Indicator Lamp

The turn signal indicator lamp is incorporated into the outer part of the headlamp assembly, outboard of the projector module. The turn signal indicator lamp uses a PY21W bayonet orange colored bulb in Rest Of World (ROW) markets. A S8W 27/7W wedge bulb is used in NAS markets.

The bulb is fitted into a holder which connects with contacts in the headlamp housing. The holder is fitted into an aperture in the headlamp housing and is rotated to lock in position. Access to the turn signal indicator bulb requires removal of the headlamp assembly.

The turn signal indicator lamps are operated by the LH (left-hand) steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active when the ignition is the ignition mode. The hazard flasher switch is active at all times. When active, the turn signal indicator lamps flash at a frequency cycle of 400 ms on and 400 ms off.

If a bulb fails, the remaining turn signal indicator lamps continue to flash at the normal speed. The applicable turn signal indicator in the instrument cluster will flash at double speed to indicate the failure to the driver.

Side Lamp

The side lamp is incorporated into the outer part of the headlamp assembly, above the cornering lamp. The side lamp shares the same housing and reflector as the cornering lamp.

The side lamp uses a W5W wedge fitting, orange colored bulb which is fitted in a holder and connected by wires to the main headlamp connector. The holder is a push fit into a receptacle in the headlamp housing. The bulb is accessible by removal of the cover on the side of the headlamp. Access to the bulb and the cover requires removal of the headlamp assembly.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition mode. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB (central junction box) from a 'lights on' message generated by the AJB.

Side Marker Lamp

The side marker lamp is located on the outer part of the headlamp, adjacent to the turn signal indicator bulb. The side marker lamp uses an orange colored W3W wedge fitting bulb, which is fitted in a holder which connects with contacts in the headlamp housing. The holder is fitted into an aperture in the headlamp housing and is rotated to lock in position. Access to the side marker bulb requires removal of the headlamp assembly.

The side marker lamp is active at all times when the side lamps are selected on using the lighting control switch. The side marker lamps will also be illuminated when the lighting control switch is in the 'AUTO' position and a 'lights on' signal is received by the CJB (central junction box) from a 'lights on' message generated by the AJB.

Cornering Lamp - Vehicles without AFS

The cornering lamp functionality differs between vehicles with or without the AFS system. The cornering lamps are designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis.

The cornering lamp is incorporated into the inner part of the headlamp assembly, below the side lamp. The cornering lamp uses a 35W Halogen H8 bulb which is permanently fitted in an integral holder which is located in the headlamp housing. The holder is connected by a removable harness connector and the holder can be removed from the housing by rotating to unlock. The bulb is accessible by removal of a cover on the side of the headlamp. Access to the bulb and over requires removal of the headlamp assembly.

The cornering lamps are controlled by the LH (left-hand) steering column multifunction switch, when the lighting control switch is in the headlamps position and the ignition is in the ignition on mode. The cornering lamps are controlled by the CJB (central junction box) which uses turn signal indicator active and vehicle speed to operate the cornering lamps. The cornering lamps are deactivated if the vehicle speed exceeds 25 mph (40 km/h) with the turn signal indicators selected on or if the headlamp high beam is active.

Only one cornering lamp will illuminate at any one time. If the LH (left-hand) turn signal indicators are active, the LH (left-hand) cornering lamp will be illuminated and visa versa, providing the vehicle speed and the lighting control switch positions are correct.

Cornering Lamp - Vehicles with AFS

The cornering lamps fitted to vehicles with the AFS system functions differently to those fitted to vehicle with non AFS headlamps. The construction and light distribution of the cornering lamp with AFS is as described previously for cornering lamp without AFS.

The cornering lamps operate using high speed CAN (controller area network) signals from the steering angle sensor which are received by the CJB (central junction box) and the AFS control module. The AFS control module transmits a cornering lamp on request to the CJB (central junction box) which, if all operating conditions are correct, activates the cornering lamp.

When the operating parameters of the cornering lamp is achieved, the CJB (central junction box) fades the cornering lamp on using a PWM (pulse width modulation) voltage over a period of approximately 2 seconds. When the lamp is switched off, the CJB (central junction box) fades the bulb off by decreasing the PWM (pulse width modulation) voltage in a linear manner depending on vehicle speed and steering angle.

ADAPTIVE FRONT LIGHTING SYSTEM (AFS)

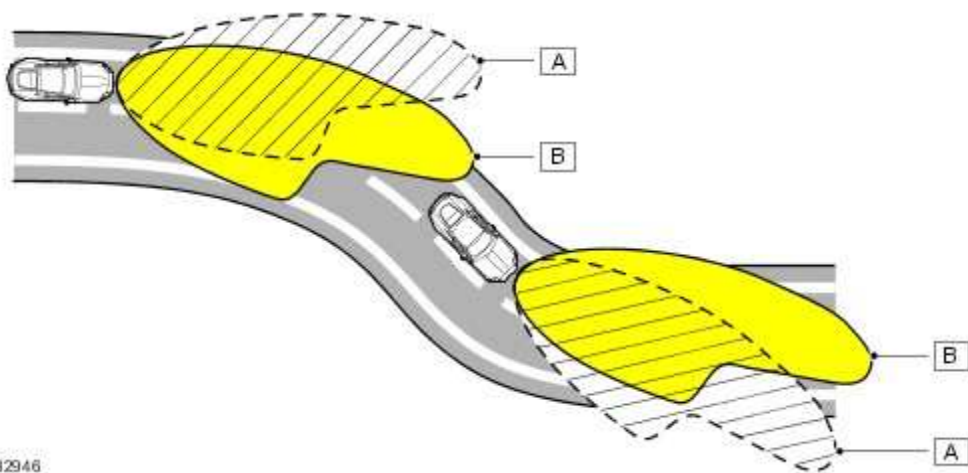
The AFS headlamp is similar in its construction to the Xenon, non-AFS headlamp. The projector module is constructed and functions as described for the Xenon headlamp but with the addition of the AFS system which allows the projector module to be moved vertically and horizontally. The AFS system is controlled by a AFS control module which is integral with the headlamp levelling module.

The AFS headlamp assembly contains an additional carrier frame which provides location for the AFS actuators. The remaining lamps are as described previously. The carrier frame is attached to the AFS vertical actuator. The projector module has a central pivot point which allows the module to move horizontally in response to operation of the AFS horizontal actuator.

The AFS actuators are bi-polar (2 phase) dc stepper motors which are driven by a power output from the AFS power module located on the rear of the headlamp assembly. Each stepper motor receives its position information from the AFS control module via the applicable AFS power module. When the actuators are powered to their requested positions, a holding current is applied to maintain the actuator position.

The actuators do not supply a positional feedback signal to the AFS control module. Each stepper motor requires referencing each time the AFS system becomes active. When the AFS system is active, each vertical actuator is driven to the low beam position and each horizontal actuator is driven to an inboard position until a mechanical stop in the actuator is reached. Once the stop is reached a step counter in the AFS control module is set to zero and the actuator is then powered to the operating position as determined by the AFS control module software.

The AFS control module receives front and rear vehicle height data from the height sensors to provide headlamp levelling adjustment via the vertical actuator motor. The AFS control module also receives vehicle speed signals from the ABS module to adjust the projector module vertically to increase the beam range as the vehicle speed increases.



Item	Part Number	Description
A		Conventional headlamp beam distribution
B		AFS swivel headlamp beam distribution

AFS Control Module

The AFS control module is located on the bulkhead, at the bottom of the RH (right-hand) 'A' pillar. The AFS control module is a dual functionality unit which also incorporates software to control the headlamp leveling. The AFS control module is connected to the high speed CAN (controller area network) bus and receives inputs from other vehicle systems on the status of the following parameters:

- Steering angle
- Vehicle speed
- Headlamp status
- Engine running
- Reverse gear selected
- AUTO lights on.

The AFS will only operate when the AFS control module receives an engine running signal on the high speed CAN (controller area network) bus from the ECM (engine control module) . When the engine running signal is received the AFS control module performs its initialisation routine.

The AFS will also function when the lighting control switch is in the AUTO position and the AFS control module receives a lights on signal from the light sensor and an engine running signal.

The AFS control module then monitors the inputs from the other vehicle systems to control the AFS functionality according to cornering angles and vehicle speed.

The AFS control module is connected to each AFS power module on a private Local Interconnect Network (LIN) bus. The power modules read operating values supplied from the AFS control module and control the output drivers for the stepper motor actuators inside the headlamp assembly.

AFS Operation

The AFS controls the swiveling angle of each projector module using speed and steering angle signals. The angles of each projector module differ to give the correct spread of light, for example, when turning left, the LH (left-hand) projector module will have a greater swiveling angle than the RH (right-hand) projector module.

Initialisation Procedure

When the AFS control module receives an ignition mode on signal, the control module performs the initialisation procedure which ensures that the headlamps are correctly aligned on both their vertical and horizontal axes.

The headlamp leveling motors are powered from their current position, which can be either the upper or lower limit or somewhere in between, to their lower position and then back to the 0 degrees position.

The AFS swivel initialisation starts less than 1 second after the headlamp leveling initialisation is activated to ensure that the headlamps are at or below the 0 degree position in the vertical axis, thus preventing glare to oncoming vehicles. The AFS swivel initialisation is completed in less than 2.5 seconds. The LH (left-hand) and RH (right-hand) AFS actuator motors are powered from the 0 degree position to their fully inboard position, then to their fully outboard position and then back to the 0 degree position.

Failure Mode

In the event of a failure of the AFS system, a warning indicator in the instrument cluster is illuminated to warn the driver. The AFS warning indicator illuminates when the ignition is in the ignition on mode

and will flash continuously until the fault is rectified. The AFS warning indicator will also be illuminated if a failure of the steering angle sensor or the vehicle speed signal is detected.

Illumination of the warning indicator does not necessarily mean that there is a fault with the AFS system. The fault may be caused by a failure of another system preventing the AFS system from operating correctly.

The AFS control module performs a diagnostic routine every time AFS is requested. If any fault is found, the AFS control module will suspend the operation of the AFS function.

If the AFS leveling system has failed with the projector module in a position other than the correct straight ahead position, the AFS control module will attempt to drive the projector module to a position a small amount lower than the standard position. If the swivel function has failed, the AFS control module will lower the projector module using the leveling actuator to a position much lower than standard to prevent excess glare to oncoming vehicles.

The AFS control module software can detect an internal failure of the control module control circuits. The control module will power the projector modules to the zero position and prevent further operation.

Faults can be investigated by interrogating the AFS control module using an approved Jaguar diagnostic system to check for fault codes.

AUTOMATIC HEADLAMP OPERATION

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active. The automatic headlamp system uses a light sensor and the AJB, which is connected to the instrument cluster, via the medium speed CAN (controller area network) bus, to control 'AUTO' headlamp functionality.

The light sensor is located in the centre of the instrument panel upper surface. The sensor has three functions; houses the alarm system LED (light emitting diode) , auto lamp function for AUTO headlamps and sun load sensor for the A/C (air conditioning) system.

The sensor is hardwired to the instrument cluster which supplies a 5V current via a pull-up resistor to 2 photodiode light sensors within the sensor housing. The ambient light signals are returned to the instrument cluster by the light sensor varying the current drawn from the 5V output, hence varying the voltage at the 'pull-up' resistor. The instrument cluster then outputs a message relating to the ambient light level on the medium speed CAN (controller area network) bus. The AJB receives the message and determines if AUTO lamps are required to be activated.

Operation of the 'AUTO' headlamps requires the ignition to be in the ignition mode and the lighting control switch must be in the AUTO position. The AJB will only activate the AUTO headlamps on receipt of a valid ambient light signal on the medium speed CAN (controller area network) bus from the instrument cluster.

HEADLAMP LEVELING

Headlamp leveling provides for the automatic adjustment of the vertical aim of the headlamps. The leveling system is required to minimise glare to other road users when the vehicle attitude changes due to braking or acceleration.

Headlamp leveling is controlled by a headlamp leveling module which is located on the bulkhead, at the bottom of the RH (right-hand) 'A' pillar.

NOTE:

On vehicles with the AFS system, the headlamp leveling software is incorporated into the AFS control module and the module is known as the AFS control module.

The headlamp leveling system comprises the following components and information from other vehicle systems:

- Front and rear vehicle height sensors
- Two headlamp leveling, vertical adjustment motors
- Headlamp leveling module (or AFS control module if vehicle is fitted with AFS)
- Ignition in on mode
- Vehicle speed information from ABS (anti-lock brake system) module.

When the ignition is in the ignition power mode, power is supplied via the ignition relay in the battery junction box to the headlamp leveling module (or AFS control module if vehicle is fitted with AFS).

NOTE:

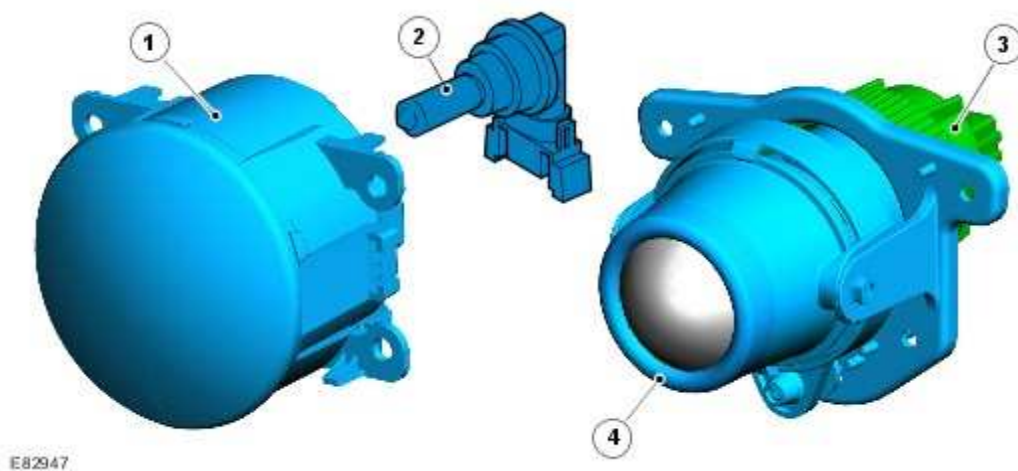
When the headlamp leveling module receives a power supply from the ignition relay, the module performs an initialization procedure to correctly align the vertical aim of the headlamps and to determine if the leveling motors are functioning correctly.

The headlamp leveling module receives information relating to vehicle attitude from the front and rear height sensors. The headlamp leveling module processes these signals and provides an output to the headlamp leveling motors to adjust the headlamp vertical aim according to vehicle speed and attitude.

DAYTIME RUNNING LAMPS

Refer to the DRL (daytime running lamps) section for details. For additional information, refer to Daytime Running Lamps (DRL) (417-04)

FRONT FOG LAMP



Item	Part Number	Description
1		Fog lamp - Naturally aspirated vehicles
2		Bulb H11
3		Bulb H3
4		Fog lamp - Supercharged vehicles

Two front fog lamps are located in apertures in the front bumper. The fog lamps are different in design between the naturally aspirated and supercharged vehicles.

Front Fog Lamp - Naturally Aspirated Vehicles

The front fog lamp is a conventional design with a clear lens and smooth surface reflector. An H11 55W halogen bulb is located at the rear of the fog lamp. The bulb has an integral holder and can be removed by rotating counter clockwise to remove from the lamp housing.

Fog lamp beam adjustment is provided by a rotary adjuster located on the underside of the lamp and is accessible from the rear of the bumper.

The front fog lamps are controlled by the auxiliary lighting switch and the CJB (central junction box) . Refer to the Auxiliary Lighting Switch section for switch operation.

Front Fog Lamp - Supercharged Vehicles

The front fog lamp is projector module, similar in design to the projector module used in the Xenon headlamp. A halogen H3 bulb is located in the rear of the lamp and secured with a spring clip. The bulb has a power lead which is secured to the rear of the lamp connector socket.

Fog lamp beam adjustment is provided by a screw at the top of the lamp. The screw is accessible

from the front of the lamp.

Front fog lamp control and operation is as described for 'Front Fog Lamp - Naturally Aspirated Vehicles.

Front Fog Lamp Functionality (NAS and Canadian Markets Only)

The front fog lamps operate as described previously but with the following differences which cover local laws governing lamp usage.

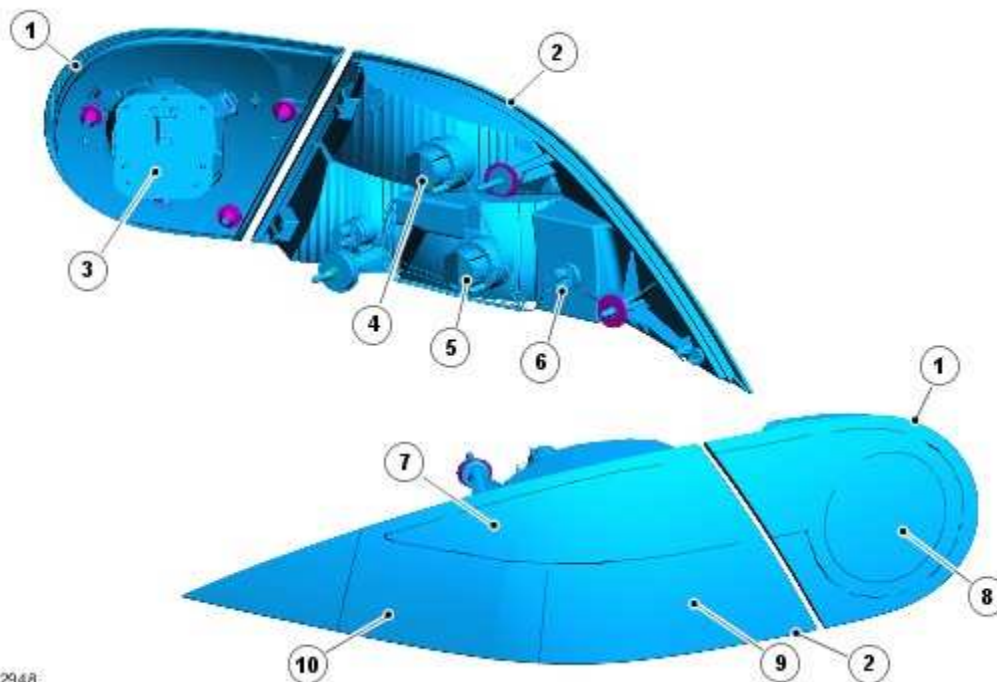
If the low beam headlamps and the front fog lamps are on at the same time, when the high beam headlamps are switched on, the front fog lamps will be automatically switched off. When the high beam headlamps are subsequently switched off, the front fog lamps will be switched on automatically.

NOTE:

The front fog lamps will also be switched off if the high beam 'flash' function is operated.

REAR LAMP ASSEMBLY

The rear lamp assembly is a 2 piece unit, with one part being located in the rear quarter panel and the second part being attached to the liftgate. The outer rear lamp assembly is located in a recess in the vehicle body and is secured with 2 nuts which screw onto studs in the lamp assembly. The inner rear lamp assembly is located in a recess in the liftgate and is secured with 3 nuts.



E82948

Item	Part Number	Description
1		Inner rear lamp assembly
2		Outer rear lamp assembly
3		Rear fog lamp or reverse lamp LED (light emitting diode) (market dependant)
4		Turn signal indicator bulb and holder
5		Stop lamp and Tail lamp bulb and holder
6		Side marker bulb and holder
7		Turn signal indicator
8		Rear fog lamp or reverse lamp (market dependant)
9		Stop lamp and tail lamp
10		Side marker lamp

Rear Stop and Side Lamp

The stop and side lamp are located in the lower section of the outer rear lamp assembly. A combined, twin filament 21W/5W bayonet fitting bulb is used. The stop lamp uses the 21W bulb filament and the side lamp uses the 5W bulb filament. The bulb is located in a holder which connects with contacts in the rear lamp housing. The holder can be released by rotating and pulling from the aperture.

The stop lamps are active when the ignition is in the ignition mode and the stop lamp switch is activated by pressing the brake pedal. The high mounted stop lamp will also be activated when the brake pedal is pressed. Operation of the stop lamp switch is sensed by the CJB (central junction box) which sends a message on the high speed CAN (controller area network) bus to the AJB which activates the stop lamps.

The stop lamps can also be activated by the adaptive speed control system. A signal from the adaptive speed control module is sent via the high speed CAN (controller area network) bus to the AJB which activates the stop lamps until an off message is received.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition mode. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB (central junction box) from the light sensor.

Turn Signal Indicator Lamp

The turn signal indicator lamp is located in the upper section of the outer rear lamp assembly and uses a PY21W bayonet fitting bulb. The bulb is located in a holder which connects with contacts in the rear lamp housing. The holder can be released by rotating and pulling from the aperture.

The turn signal indicator lamps are operated by the LH (left-hand) steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active when the ignition is in the ignition mode. The hazard flasher switch is active at all times. When active, the turn signal indicator lamps flash at a frequency cycle of 400 ms on and 400 ms off.

If a bulb fails, the remaining turn signal indicator lamps continue to flash at the normal speed. The applicable turn signal indicator in the instrument cluster will flash at double speed to indicate the failure to the driver.

Reversing Lamp

The reversing lamp is located in the inner rear lamp assembly. The reversing lamp uses 3 LED (light emitting diode). Only one reversing lamp is fitted and is located in the LH (left-hand) inner lamp assembly on RHD (right-hand drive) vehicles and in the RH (right-hand) inner lamp assembly on LHD (left-hand drive) vehicles.

The reversing lamp is activated on receipt of reverse selected message sent on the medium speed CAN signal from the TCM (transmission control module) to the AJB.

Rear Fog Lamp

The rear fog lamp is located in the inner rear lamp assembly. The fog lamp uses 3 LED (light emitting diode) 's. Only one fog lamp is fitted and is located in the RH (right-hand) inner lamp assembly on RHD (right-hand drive) vehicles and in the LH (left-hand) inner lamp assembly on LHD (left-hand drive) vehicles.

The rear fog lamp is controlled by the auxiliary lighting switch and the CJB (central junction box). The rear fog lamp switch receives a power supply from the instrument cluster. When the rear fog lamp switch is pressed, a ground path is completed through a resistor. The current flow is monitored by the instrument cluster which determines that the switch has been pressed. The instrument cluster transmits a rear fog lamp on request message on the medium speed CAN (controller area network) bus to the AJB which activates the power supplies to the fog lamp provided the lighting switch is in the correct position and the ignition mode is correct.

When the ignition is in ignition on mode and the lighting control switch is in the side lamp or headlamp position and the front fog lamps are on, pressing the rear fog lamp switch on the auxiliary lighting switch will activate the rear fog lamp. Pressing the rear fog lamp switch for a second time will switch the rear fog lamp off. The rear fog lamp will also be deactivated if the lighting control switch is moved to the off position or the ignition mode is changed to off mode.

LICENCE PLATE LAMPS

Two licence plate lamps are located in the underside of the liftgate (hardtop) or luggage compartment lid (convertible) exterior trim finisher. Each lamp uses a W5W capless bulb which is located in a holder at the rear of the lamp.

The lamp can be removed from the finisher by using a wide flat blade screwdriver or similar tool, inserting it in the slot between the lamp lens and the finisher and gently levering the lamp from the surround. The bulb is pushed into a holder which in turn is a press fit in the lamp housing.

The licence plate lamps are illuminated at all times when the side lamps are active.

HIGH MOUNTED STOP LAMP

The high mounted stop lamp is located in the rear spoiler on the upper edge of the liftgate or luggage compartment lid. The lamp comprises 24 separate LED (light emitting diode) 's which illuminate through a red colored lens. The high mounted stop lamp functionality is the same as that described for the stop lamps.

TURN SIGNAL INDICATOR REPEATER LAMP

The turn signal indicator repeater lamps are located in each front fender and can be removed by sliding the lamp assembly rearwards and releasing the front edge from the fender. The lamps use a 5W capless bulb which is located in a holder in the rear of the lamp housing.

The repeater lamps have the same functionality as described for the turn signal indicators and the hazard flashers.

HAZARD FLASHERS

The hazard flashers are controlled by a non-latching switch located in the centre of the instrument panel. The hazard flashers operate at all times when selected and are not dependant on an ignition mode to be selected.

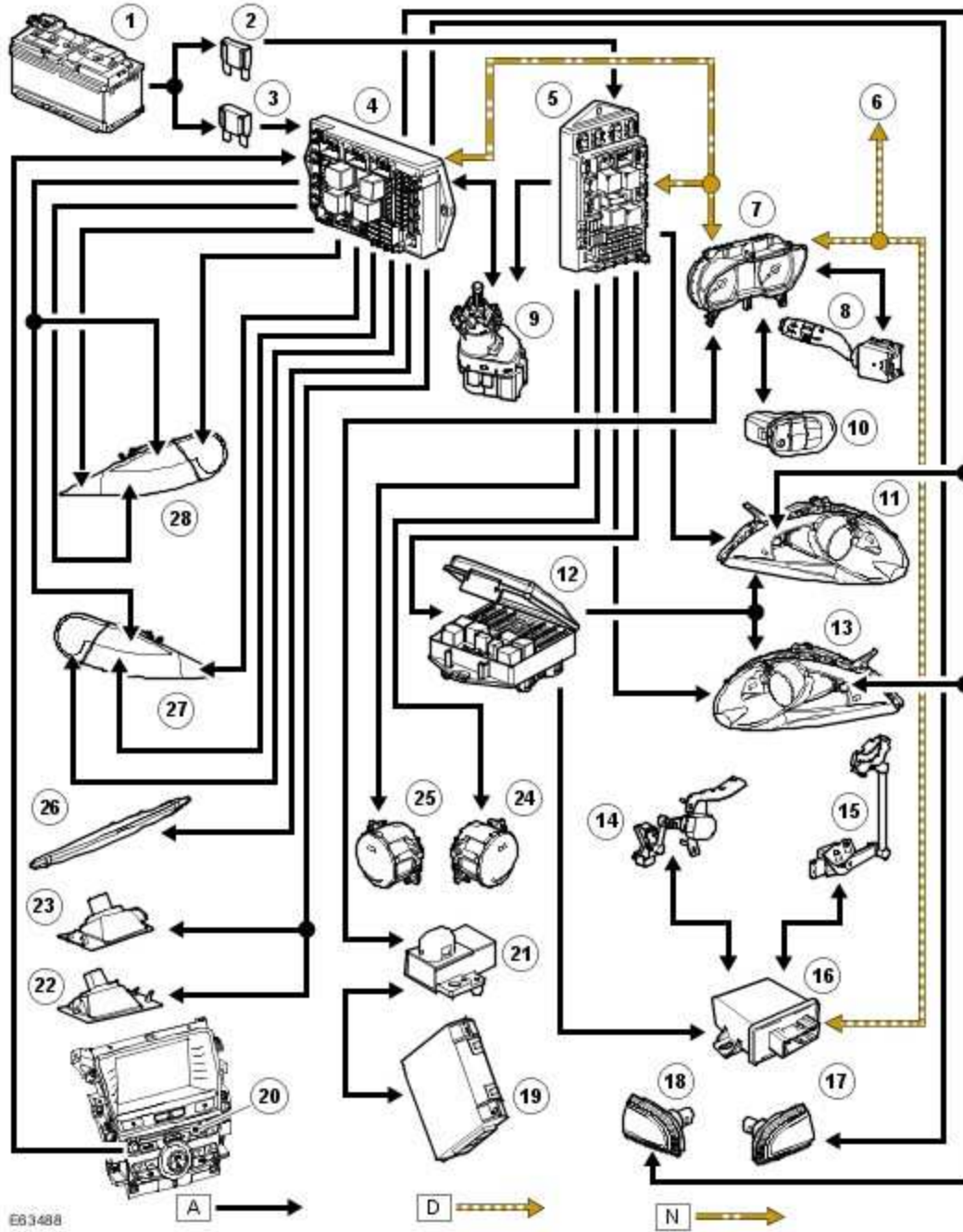
When the hazard flashers are selected on by the driver, a ground path is momentarily completed to the AJB which activates the front and rear and side repeater turn signal indicators. A second press of the switch is again sensed by the AJB and the hazard flasher will be deactivated. When the hazard flasher are active, they override any request for turn signal indicator operation.

The hazard flashers can also be activated by a crash signal from the RCM (restraints control module) . The signal is received on the medium speed CAN (controller area network) bus from the instrument cluster by the AJB which activates the hazard flashers. The hazard flasher can be cancelled by changing the ignition mode to accessory or off mode and then changing it to ignition on mode on or the crash mode signal is removed by the RCM (restraints control module) .

CONTROL DIAGRAM

NOTE:

A = Hardwired; D = High speed CAN bus



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)

4		Auxiliary Junction Box (AJB)
5		CJB (central junction box)
6		High speed CAN (controller area network) bus to other vehicle systems
7		Instrument cluster
8		LH (left-hand) steering column multifunction switch
9		Stop lamp switch
10		Auxiliary lighting switch
11		LH (left-hand) headlamp
12		Power distribution box
13		RH (right-hand) headlamp
14		Rear height sensor
15		Front height sensor
16		Headlamp leveling/AFS control module
17		LH (left-hand) side repeater
18		RH (right-hand) side repeater
19		A/C (air conditioning) control module
20		Hazard warning switch
21		Light sensor
22		LH (left-hand) license plate lamp
23		RH (right-hand) license plate lamp
24		LH (left-hand) front fog lamp
25		RH (right-hand) front fog lamp
26		High mounted stop lamp

27		RH (right-hand) tail lamp assembly
28		LH (left-hand) tail lamp assembly

Headlamps

Principles of Operation

For a detailed description of the exterior lighting system, refer to the Description and Operation section 417-00 - Exterior Lighting of the workshop manual.

Safety Information



WARNING: The Xenon Headlamp System generates up to 28,000 volts. Make sure that the headlamps are switched off before working on the system. Failure to follow this instruction may lead to fatality.



WARNING: The following safety precautions must be followed when working on the Xenon Headlamp System:

- **DO NOT** attempt any procedures on the Xenon Headlamps or circuits when the system is energized.
- Handling of the Xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Only operate the lamp in a mounted condition in the reflector.
- All safety procedures and precautions must be followed to prevent personal injury.



CAUTION: Xenon bulbs must be disposed of as hazardous waste.

There are instructions on the correct procedures for Xenon Headlamp System repairs in the manual, refer to section 100-00 - General Information, Standard Workshop Practices of the workshop manual.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

- 1 . Verify the customer concern.

2 . Visually inspect for obvious signs of damage and system integrity.

Electrical
<ul style="list-style-type: none"> • Headlamp Leveling Module (HLM) • Bulb(s) • Photocell(s) • Ballast • Wiring harness/electrical connectors • Fuse(s)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Low beam lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Circuit fault • Lighting control switch fault 	Check the bulb and fuse condition (see visual inspection). Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Refer to the electrical guides. Check for DTCs indicating a headlamp or related circuit fault.
High beam lamp(s) inoperative	<ul style="list-style-type: none"> • Left-hand steering column multifunction switch fault 	
Low beam lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Tourist lever set in the wrong position • Circuit fault • Lighting control switch fault 	Check the bulb condition and rating. Check the tourist lever is set correctly. Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Refer to the electrical guides.
High beam lamp(s) dim	<ul style="list-style-type: none"> • Left-hand steering column multifunction switch fault 	
Low beam lamp(s) stuck on	<ul style="list-style-type: none"> • Circuit fault • Lighting control switch fault 	Check the headlamp circuits. Check the lighting control switch function. Check the left-hand steering column multifunction switch operation. Check the headlamp timer function. Refer to the electrical guides. Check for DTCs indicating a
High beam lamp(s) stuck on	<ul style="list-style-type: none"> • Left-hand steering column multifunction switch fault • Headlamp timer 	

	function fault	headlamp circuit fault
Headlamp low/high beam switching function inoperative	<ul style="list-style-type: none"> • Circuit fault • Left-hand steering column multifunction switch fault • Xenon lamp shutter mechanism fault 	Check the headlamp circuits. Check the left-hand steering column multifunction switch operation. Check the xenon lamp shutter mechanism operation. Refer to the electrical guides. Check for DTCs indicating a headlamp circuit fault
Warning lamp(s) inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Lighting control switch fault • Left-hand steering column multifunction switch inoperative • Circuit fault • Instrument cluster fault 	Check the fuse(s) (see visual inspection). Check the lighting control switch function. Check the left-hand steering column multifunction switch function. Check the warning lamp circuits. Refer to the electrical guides. Check for DTCs indicating an instrument cluster or CAN system fault.
Headlamp Wet - Internal	<ul style="list-style-type: none"> • Condensation • Water Ingress 	Check for outstanding Technical Service Bulletins (TSBs) relating to 'Headlamp Internal Condensation'. Carry out the instructions in the service bulletin to determine if the fault is related to condensation or water ingress.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the Control Module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

NOTE:

Prior to installation/replacement of the Headlamp assembly carry out all relevant internal visual and mechanical checks for correct cable location and termination including: checks for corroded, bent or backed out pins or terminals, incorrectly inserted connectors and harness damage due to chaffing or incorrect routing.

NOTE:

If the control module has been removed and reinstalled, carry out a DTC code clear, cycle the ignition state to off, then on. This will erase any DTCs that have been logged during the module installation procedure.

DTC	Description	Possible Cause	Action
B1A59-11	Front or Rear Height Sensors - Circuit short to ground	<ul style="list-style-type: none">• Front or Rear Height Sensors 5 volt supply short to ground	Refer to the electrical circuit diagrams, and check Front and Rear Height Sensors 5 volt supply circuit for short to ground
B1A59-12	Front or Rear Height Sensors - Circuit short to power	<ul style="list-style-type: none">• Front or Rear Height Sensors 5 volt supply short to power	Refer to the electrical circuit diagrams, and check Front and Rear Height Sensor 5 volt supply circuit for short to

			power
C1A04-11	Front Right Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> Front Right Height Sensor signal circuit short to ground 	Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for short to ground
C1A04-15	Front Right Height Sensor - Circuit short to power or open circuit	<ul style="list-style-type: none"> Front Right Height Sensor signal circuit short to power or open circuit 	Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for short to power or open circuit
C1A04-64	Front Right Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Sensor (PWM) Signal out of range 	<p>NOTE:</p> <p>This DTC may be logged if the vehicles wheels have been raised from the floor</p> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for fault</p>
C1A06-11	Rear Right Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> Rear right Height Sensor signal circuit short to ground 	Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for short to ground
C1A06-15	Rear Right Height Sensor - Circuit short to power or open circuit	<ul style="list-style-type: none"> Rear right Height Sensor signal circuit short to power or open circuit 	Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for short to power or open circuit
C1A06-64	Rear Right Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Sensor (PWM) Signal out of range 	<p>NOTE:</p> <p>This DTC may be logged if the vehicles wheels have been raised from the floor</p> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for fault</p>

B1A57-01	Left Headlamp Leveling Motor - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	<p>Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the swiveling feedback sensor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
B1A58-01	Right Headlamp Leveling Motor - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	<p>Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the swiveling feedback sensor. If no mechanical or circuit faults are evident, suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
U0121-00	Lost communication with Anti-lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Lost communication with the Anti-lock Brake System Module • CAN network fault 	<p>Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Anti-lock</p>

			Brake System Module
U0121-86	Lost communication with Anti-lock Brake System (ABS) Control Module - Signal invalid	<ul style="list-style-type: none"> Invalid signal from the Anti-lock Brake System Module CAN network fault 	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Anti-lock Brake System Module
U0100-00	Lost communication with ECM - No sub type information	<ul style="list-style-type: none"> Lost communication with the Engine Control Module CAN network fault 	Check the Engine Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Engine Control Module
U0101-00	Lost communication with TCM - No sub type information	<ul style="list-style-type: none"> Lost communication with the Transmission Control Module CAN network fault 	Check the Transmission Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Transmission Control Module
U0443-00	Invalid data from Body Control Module B - No sub type information	<ul style="list-style-type: none"> Invalid signal from the Auxiliary Junction Box Auxiliary Junction Box fault 	Check the Auxiliary Junction Box for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Headlamp Leveling Module and the Auxiliary Junction Box
U0001-49	High speed CAN communication Bus - Internal electronic failure	<ul style="list-style-type: none"> Adaptive Front Lighting System (AFS) Control Module internal electronic failure 	Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network to the Headlamp

			Leveling Module. If no CAN Bus circuit faults are evident suspect Headlamp Leveling Module internal fault. Refer to the new module/component installation note at the top of the DTC Index
U0300-62	Internal Control Module software incompatibility - Signal Compare Failure.	<ul style="list-style-type: none"> Configuration data received over the CAN BUS is different from the stored configuration data 	Check the correct Headlamp Leveling Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> CAN Bus Off CAN Bus Circuit fault 	Check other modules for stored DTCs. Carry out the CAN Network Integrity test using the manufacturer approved diagnostic system
U3002-81	Vehicle Identification Number (VIN) - Invalid Serial Data received	<ul style="list-style-type: none"> The stored Vehicle Identification Number is not the same as the Central Broadcast Vehicle Identification Number The Headlamp Leveling Module has previously been installed to another vehicle 	Check the correct Headlamp Leveling Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U3000-54	Control Module - Missing Calibration	<ul style="list-style-type: none"> Height Sensors not calibrated to vehicle 	<p>NOTE:</p> <p>Sensor calibration routine must be carried out with the vehicle unladen</p> <p>Calibrate the Headlamp Leveling sensors using the manufacturer approved diagnostic system, carry the out routine 'Headlamp and Axle Sensor Calibration' from the 'Module programming and configuration - Setup and Configuration - Lighting'</p>
U3000-	Control Module -	<ul style="list-style-type: none"> Internal electronic 	Install a new Headlamp Leveling

49	Internal electronic failure	failure	Module, refer to the new module installation note at the top of the DTC Index
U3000-55	Control Module - Not Configured	<ul style="list-style-type: none"> Incorrect Car Configuration File (CCF) data received 	<p>NOTE:</p> <p>The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light)</p> <p>Re-configure the Car Configuration File (CCF) File (CCF) as required using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the Headlamp Leveling Module, refer to the new module installation note at the top of the DTC Index</p>
U3003-17	Battery voltage	<ul style="list-style-type: none"> The power supply to the Module has been above 16 Volts for more than 1000 milliseconds 	Suspect Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section
U3003-16	Battery voltage	<ul style="list-style-type: none"> The power supply to the Module has been below 9 Volts for more than 1000 milliseconds 	Suspect Battery or Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section. Clear the DTC, cycle ignition state to off then on, if DTC returns refer to the electrical circuit diagrams and check power and ground circuit to the Headlamp Leveling Module

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTE:

If the Control Module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give extra information read by the manufacturer-approved diagnostic system).

NOTE:

When performing voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

NOTE:

Prior to installation/replacement of the Headlamp assembly carry out all relevant internal visual and mechanical checks for correct cable location and termination including: checks for corroded, bent or backed out pins or terminals, incorrectly inserted connectors and harness damage due to chaffing or incorrect routing.

NOTE:

If the control module has been removed and reinstalled, carry out a DTC code clear, cycle the

ignition state to off, then on. This will erase any DTCs that have been logged during the module installation procedure

NOTE:

The **Headlamp Power Module** is referenced as the **AFS ECU + Motors** in the circuit diagrams.

DTC	Description	Possible Cause	Action
B1A59-11	Front or Rear Height Sensors - Circuit short to ground	<ul style="list-style-type: none"> Front or Rear Height Sensors 5 volt supply short to ground 	Refer to the electrical circuit diagrams, and check Front and Rear Height Sensors 5 volt supply circuit for short to ground
B1A59-12	Front or Rear Height Sensors - Circuit short to power	<ul style="list-style-type: none"> Front or Rear Height Sensors 5 volt supply short to power 	Refer to the electrical circuit diagrams, and check Front and Rear Height Sensor 5 volt supply circuit for short to power
C1A04-11	Front Right Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> Front Right Height Sensor signal circuit short to ground 	Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for short to ground
C1A04-15	Front Right Height Sensor - Circuit short to power or open circuit	<ul style="list-style-type: none"> Front Right Height Sensor signal circuit short to power or open circuit 	Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for short to power or open circuit
C1A04-64	Front Right Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Sensor (PWM) Signal out of range 	<p>NOTE:</p> <p>This DTC may be logged if the vehicles wheels have been raised from the floor</p> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Front Right Height Sensor signal circuit for fault</p>

C1A06-11	Rear Right Height Sensor - Circuit short to ground	<ul style="list-style-type: none"> Rear Right Height Sensor signal circuit short to ground 	Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for short to ground
C1A06-15	Rear Right Height Sensor - Circuit short to power or open circuit	<ul style="list-style-type: none"> Rear Right Height Sensor signal circuit short to power or open circuit 	Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for short to power or open circuit
C1A06-64	Rear Right Height Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Sensor (PWM) Signal out of range 	<p>NOTE:</p> <p>This DTC may be logged if the vehicles wheels have been raised from the floor</p> <p>Check the location, security and mechanical operation of the Height Sensor. Refer to the electrical circuit diagrams, and check Rear Right Height Sensor signal circuit for fault</p>
B1D66-00	Left Headlamp Power Module - No sub type information	<ul style="list-style-type: none"> Headlamp Power Module internal fault Headlamp Power Module circuit fault 	<p>NOTE:</p> <p>The power module is a service item</p> <p>This DTC is logged if the Headlamp Power Module supply voltage is above 16 volts / below 9.5 volts or the module suffers an internal failure. Record then clear the stored DTC, cycle the ignition state and check headlamp operation, if the DTC returns refer to the electrical circuit diagrams and check the power, ground and signal circuit of the Power Module for circuit fault. If no circuit faults are evident suspect the Headlamp Power Module has an internal</p>

			<p>fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
B1D67-00	Right Headlamp Power Module - No sub type information	<ul style="list-style-type: none"> • Headlamp Power Module internal fault • Headlamp Power Module circuit fault 	<p>NOTE:</p> <p>The power module is a service item</p> <p>This DTC is logged if the Headlamp Power Module supply voltage is above 16 volts / below 9.5 volts or the module suffers an internal failure. Record then clear the stored DTC, cycle the ignition state and check headlamp operation, if the DTC returns refer to the electrical circuit diagrams and check the power, ground and signal circuit of the Power Module for circuit fault. If no circuit faults are evident suspect the Headlamp Power Module has an internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
B1D66-46	Left Headlamp Power Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> • The parameter set of the power module does not match the Adaptive Front Lighting System (AFS) Control Module parameter set 	<p>NOTE:</p> <p>The power module is a service item</p> <p>Clear the DTC. Turn the Headlamp Switch on, cycle the ignition state to start the engine, check for stored DTCs, if DTC returns suspect the Headlamp Power Module has an internal fault, replace as required. Refer to the new module/component</p>

			installation note at the top of the DTC Index
B1D67-46	Right Headlamp Power Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> The parameter set of the power module does not match the Adaptive Front Lighting System (AFS) Control Module parameter set 	<p>NOTE:</p> <p>The power module is a service item</p> <p>Clear the DTC. Turn the Headlamp Switch on, cycle the ignition state to start the engine, check for stored DTCs, if DTC returns suspect the Headlamp Power Module has an internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
B1D68-01	Left Headlamp Swiveling Feedback Sensor circuit - General Electrical Failure	<ul style="list-style-type: none"> Internal Headlamp Sensor Fault Internal Headlamp Circuit Fault 	<p>Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Headlamp Swiveling Feedback Sensor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
B1D69-01	Right Headlamp Swiveling Feedback Sensor circuit - General	<ul style="list-style-type: none"> Internal Headlamp Sensor Fault Internal Headlamp Circuit Fault 	<p>Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement</p>

	Electrical Failure		(compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Headlamp Swiveling Feedback Sensor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D64-01	Left Headlamp Swiveling Motor circuit - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Headlamp Swiveling Motor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1D65-01	Right Headlamp Swiveling Motor circuit - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, and check headlamp operation, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation

			(ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Headlamp Swiveling Motor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B10A3-71	Left Headlamp Swivel Actuator - Actuator stuck	<ul style="list-style-type: none"> • Internal Headlamp Actuator Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Swiveling Feedback Actuator. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B10A4-71	Right Headlamp Swivel Actuator - Actuator stuck	<ul style="list-style-type: none"> • Internal Headlamp Actuator Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and

			the Swiveling Feedback Actuator. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1A57-01	Left Headlamp Leveling motor - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Leveling motor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
B1A58-01	Right Headlamp Leveling motor - General Electrical Failure	<ul style="list-style-type: none"> • Internal Headlamp Motor Fault • Internal Headlamp Circuit Fault 	Turn the Headlamp Switch on, cycle the ignition state to start the engine, look for any errors in the Headlamp Beam movement (compare with other headlamp) and visually inspect the lamp for internal damage or dislocation (ball joints out). If no faults are evident refer to the electrical circuit diagrams and check for circuit fault between the Headlamp Power Module and the Leveling motor. If no mechanical or circuit faults are evident suspect headlamp internal fault, replace as required. Refer to the new

			module/component installation note at the top of the DTC Index
B1C98-11	Left Corner Lamp circuit defect - Circuit short to ground	<ul style="list-style-type: none"> Left Corner Lamp circuit short to ground 	<p>NOTE:</p> <p>On Adaptive Front Lighting System (AFS) equipped vehicles the power feed to the Corner Lamp is supplied via the Headlamp Power Module</p> <p>Refer to the electrical circuit diagrams, and check Left Corner Lamp circuit for short to ground</p>
B1C98-13	Left Corner Lamp circuit defect - Circuit open	<ul style="list-style-type: none"> Left Corner Lamp circuit open 	<p>NOTE:</p> <p>On Adaptive Front Lighting System (AFS) equipped vehicles the power feed to the Corner Lamp is supplied via the Headlamp Power Module</p> <p>Refer to the electrical circuit diagrams, and check Left corner lamp circuit for open circuit</p>
B1C99-11	Right Corner Lamp circuit defect - Circuit short to ground	<ul style="list-style-type: none"> Right Corner Lamp circuit short to ground 	<p>NOTE:</p> <p>On Adaptive Front Lighting System (AFS) equipped vehicles the power feed to the Corner Lamp is supplied via the Headlamp Power Module</p> <p>Refer to the electrical circuit diagrams, and check Right corner lamp circuit for short to ground</p>

B1C99-13	Right Corner Lamp circuit defect - Circuit open	<ul style="list-style-type: none"> Right Corner Lamp circuit open 	<p>NOTE:</p> <p>On Adaptive Front Lighting System (AFS) equipped vehicles the power feed to the Corner Lamp is supplied via the Headlamp Power Module</p> <p>Refer to the electrical circuit diagrams, and check Right corner lamp circuit for open circuit</p>
U1A39-00	Lost communication with Right Headlamp Power Module - No sub type information	<ul style="list-style-type: none"> Communication Circuit fault Headlamp Power Module internal fault Headlamp Power Module Power or Ground supply fault 	<p>NOTE:</p> <p>This circuit uses shielded cable</p> <p>NOTE:</p> <p>The power module is a service item</p> <p>Refer to the electrical circuit diagrams, and check the power/ground supply and Communication circuit to the Headlamp Power Module. Using the manufacturer approved diagnostic system, clear stored DTCs in the Adaptive Front Lighting System (AFS) Control Module. Cycle the ignition state to off, then return to on and check for stored DTCs. If DTCs U1A39-00 and U1A38-00 return suspect Adaptive Front Lighting System (AFS) Control Module internal fault, If only DTC U1A39-00 returns suspect Headlamp Power Module internal fault. Replace as required. Refer to the</p>

			new module/component installation note at the top of the DTC Index
U1A38-00	Lost communication with Left Headlamp Power Module - No sub type information	<ul style="list-style-type: none"> • Communication Circuit fault • Headlamp Power Module internal fault • Headlamp Power Module Power or Ground supply fault 	<p>NOTE:</p> <p>This circuit uses shielded cable</p> <p>NOTE:</p> <p>The power module is a service item</p> <p>Refer to the electrical circuit diagrams, and check the power/ground supply and Communication circuit to the Headlamp Power Module. Using the manufacturer approved diagnostic system, clear stored DTCs in the Adaptive Front Lighting System (AFS) Control Module. Cycle the ignition state to off, then return to on and check for stored DTCs. If DTCs U1A39-00 and U1A38-00 return suspect Adaptive Front Lighting System (AFS) Control Module internal fault, If only DTC U1A38-00 returns suspect Headlamp Power Module internal fault. Replace as required. Refer to the new module/component installation note at the top of the DTC Index</p>
U0126-00	Lost communication with Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> • Lost communication with the Steering Angle Sensor Module • CAN network fault 	<p>Check the Steering Angle Sensor Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit</p>

			diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Steering Angle Sensor Module
U0126-86	Lost communication with Steering Angle Sensor Module - Invalid signal	<ul style="list-style-type: none"> Invalid signal from the Steering Angle Sensor Module CAN network fault 	Check the Steering Angle Sensor Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Steering Angle Sensor Module
U0121-00	Lost communication with Anti-lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> Lost communication with the Anti-lock Brake System Module CAN network fault 	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Anti-lock Brake System Module
U0121-86	Lost communication with Anti-lock Brake System (ABS) Control Module - Signal invalid	<ul style="list-style-type: none"> Invalid signal from the Anti-lock Brake System Module CAN network fault 	Check the Anti-lock Brake System Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Anti-lock Brake System Module
U0100-	Lost communication with	<ul style="list-style-type: none"> Lost communication 	Check the Engine Control

00	ECM - No sub type information	<p>with the Engine Control Module</p> <ul style="list-style-type: none"> • CAN network fault 	<p>Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Engine Control Module</p>
U0101-00	Lost communication with TCM - No sub type information	<ul style="list-style-type: none"> • Lost communication with the Transmission Control Module • CAN network fault 	<p>Check the Transmission Control Module for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Transmission Control Module</p>
U0443-00	Invalid data from Body Control Module B - no sub type information	<ul style="list-style-type: none"> • Invalid signal from the Auxiliary Junction Box • Auxiliary Junction Box fault 	<p>Check the Auxiliary Junction Box for stored DTCs. Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network between the Adaptive Front Lighting System (AFS) Control Module and the Auxiliary Junction Box</p>
U0001-49	High speed CAN communication Bus - Internal electronic failure	<ul style="list-style-type: none"> • CAN network fault • Adaptive Front Lighting System (AFS) Control Module internal electronic failure 	<p>Using the manufacturer approved diagnostic system, complete the CAN Network Integrity test. Refer to the electrical circuit diagrams and check the CAN network to the Headlamp Leveling Module. If no CAN Bus circuit faults are evident suspect Adaptive Front Lighting System (AFS) Control</p>

			Module internal fault, replace as required. Refer to the new module/component installation note at the top of the DTC Index
U0300-62	Internal Control Module software incompatibility - Signal Compare Failure.	<ul style="list-style-type: none"> • Configuration data received over the CAN BUS is different from the stored configuration data • The Headlamp Leveling Module has previously been installed to another vehicle 	Check the correct Adaptive Front Lighting System (AFS) Control Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • CAN Bus Off • CAN Bus Circuit fault 	Carry out the CAN Network Integrity test using the manufacturer approved diagnostic system
U3002-81	Vehicle Identification Number (VIN) - Invalid Serial Data received	<ul style="list-style-type: none"> • The stored Vehicle Identification Number is not the same as the Central Broadcast Vehicle Identification Number • The Adaptive Front Lighting System (AFS) Control Module has previously been installed to another vehicle 	Check the correct Adaptive Front Lighting System (AFS) Control Module is installed to vehicle specification. Refit original or replace the module as required. Refer to the new module/component installation note at the top of the DTC Index
U3000-54	Control Module - Missing Calibration	<ul style="list-style-type: none"> • Height sensors not calibrated to vehicle 	<p>NOTE:</p> <p>Sensor calibration routine must be carried out with the vehicle unladen</p> <p>Calibrate the Headlamp Leveling sensors using the manufacturer approved diagnostic system, carry the out routine 'Headlamp and Axle Sensor Calibration' from the 'Module programming and configuration - Setup and</p>

			Configuration - Lighting'
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Internal electronic failure 	Suspect an internal fault, replace the Adaptive Front Lighting System (AFS) Control Module as required, refer to the new module installation note at the top of the DTC Index
U3000-55	Control Module - Not Configured	<ul style="list-style-type: none"> Incorrect Car Configuration File (CCF) data received 	<p>NOTE:</p> <p>The Car Configuration File (CCF) parameters required are (Vehicle type)(Headlamp type)(Gearbox type) and (Dayrunning light)</p> <p>Re-configure the Car Configuration File (CCF) as required using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the Adaptive Front Lighting System (AFS) Control Module, replace as required. Refer to the new module installation note at the top of the DTC Index</p>
U3003-17	Battery voltage	<ul style="list-style-type: none"> The power supply to the Module has been above 16 Volts for more than 1000 milliseconds 	Suspect Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section
U3003-16	Battery voltage	<ul style="list-style-type: none"> The power supply to the Module has been below 9 Volts for more than 1000 milliseconds 	Suspect Battery or Charging fault. Check the battery condition and state of charge. Check the vehicle charging system. Refer to the relevant workshop manual section. Clear the DTC, cycle ignition state to

			off then on, if DTC returns refer to the electrical circuit diagrams and check power and ground circuit to the Adaptive Front Lighting System (AFS) Control Module
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Front Fog Lamp (86.40.96)

Removal

NOTE:

Left-hand shown, right-hand similar.


- 1 . Disconnect the battery ground cable.
For additional information, refer to


- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

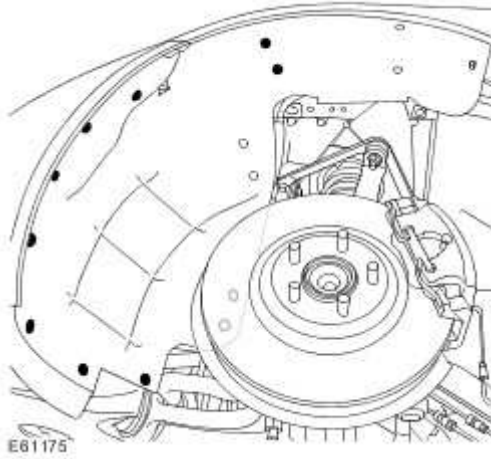
Raise and support the vehicle.

- 3 . Remove the front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 4 . Release the front of the fender splash shield.

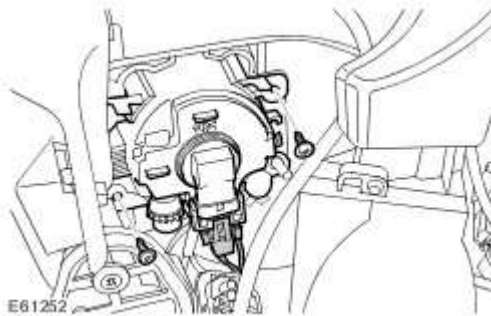
 Remove the 11 Torx bolts.

 Tie the splash shield aside.



5 . Remove the front fog lamp.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 Torx screws.




Installation

1 . Install the front fog lamp.

- ▶ Tighten the Torx screws.
- ▶ Connect and secure the electrical connector.

2 . Install the fender splash shield.

 Tighten the Torx bolts.

3 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

4 . Connect the battery ground cable.

For additional information, refer to

5 . **NOTE:**

The fog lamp beam should be set at 1.2% below the horizontal and parallel.

Check the fog lamp beam alignment.

Headlamp Assembly (86.41.33)

Removal



WARNING: Vehicles fitted with Xenon headlamps, the following precautions must be observed. Failure to comply may result in exposure to ultra violet rays, severe electric shock, burns or the risk of explosion. Ensure the headlamps are switched off at all times. Eye and hand protection must be worn. Never switch on the lamps or test the bulbs with the lamp holder released from the headlamp.

1 . Disconnect the battery ground cable.

2 . Open the hood.

3



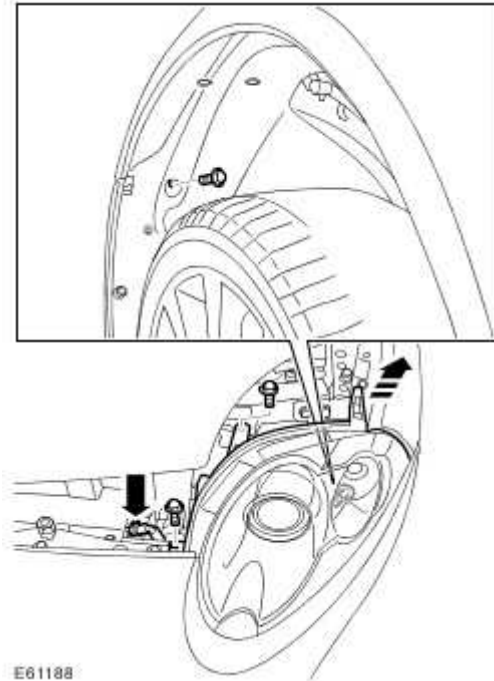
CAUTION: Always protect paintwork and glass when removing exterior components.

Release the headlamp assembly.

▶ Remove the 3 bolts.

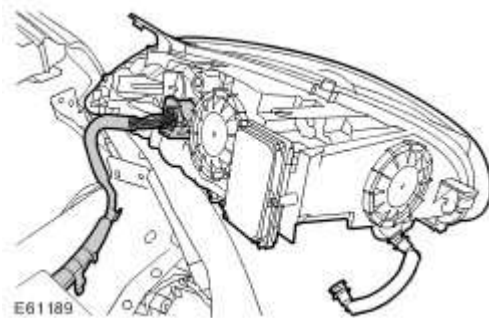
▶ Release the locating pegs.

4 . Disconnect the washer jet hose.



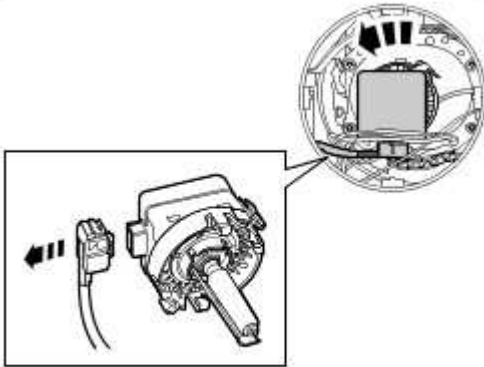
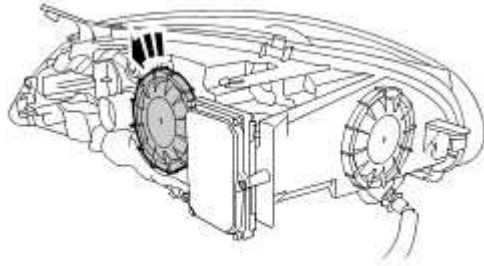
5 . Remove the LH headlamp assembly.

- ▶ Disconnect the electrical connector.



6 . Remove the headlamp bulb.

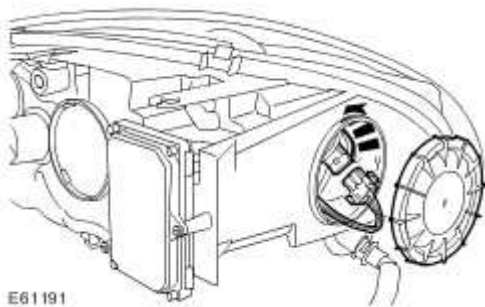
- ▶ Remove the cover.
- ▶ Disconnect the electrical connector.
- ▶ Release the clip.



E61190

7 . Remove the headlamp inner bulb.

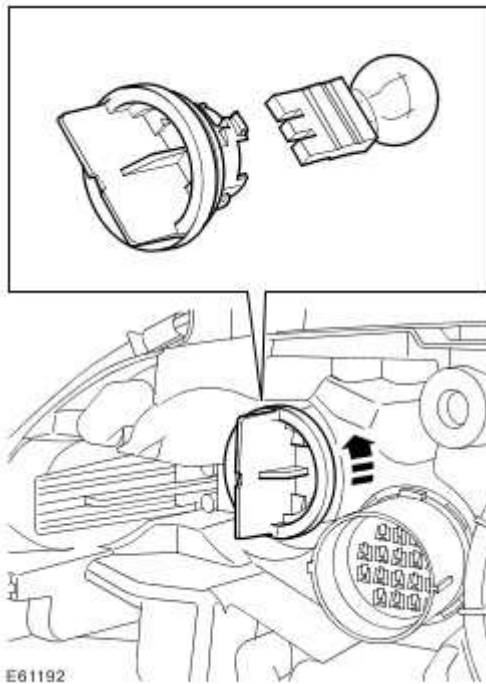
- Remove the cover.
- Disconnect the electrical connector.
- Release the clip.



E61191

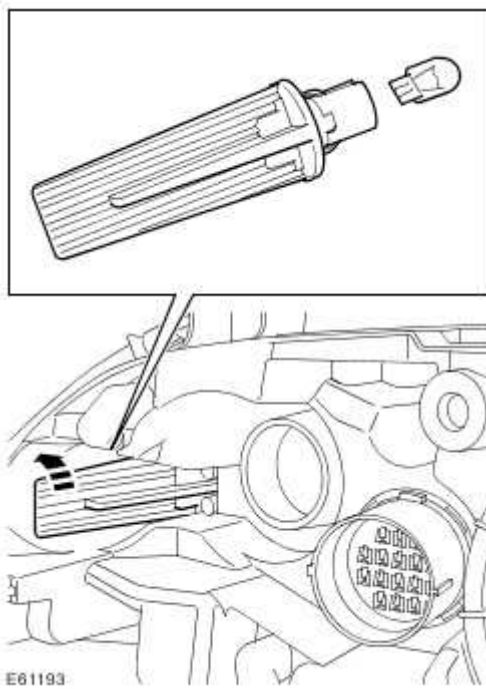
8 . Remove the turn signal indicator bulb.

- Release the bulb holder.



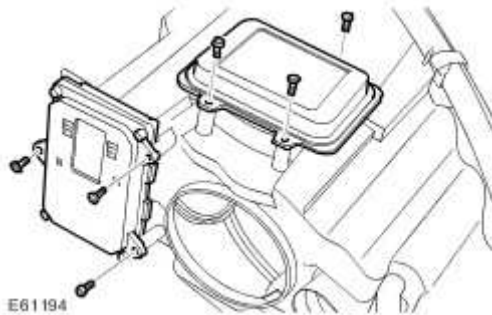
9 . Remove the side marker bulb.

▶ Release the bulb holder.



10 . Remove the gas discharge modules.

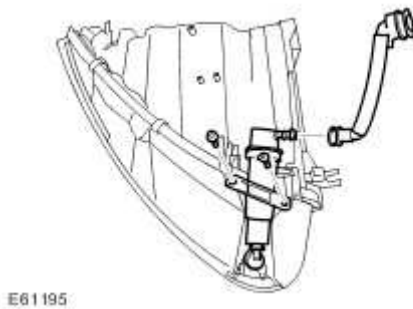
▶ Remove the 6 Torx screws.



11 . Remove the headlamp washer jet.

▶ Disconnect the washer jet hose.

▶ Remove the 2 Torx screws.



Installation

1 . Install the headlamp washer jet.

▶ Tighten the Torx screws.

▶ Connect the washer jet hose.

2 . Install the gas discharge modules.

▶ Tighten the Torx screws.

3 . Install the side marker bulb.

▶ Install the bulb holder.

4 . Install the turn signal indicator bulb.

▶ Install the bulb holder.

5 . Install the headlamp inner bulb.

▶ Connect and secure the electrical connector.

▶ Install the cover.

6 . Install the headlamp bulb.

▶ Connect and secure the electrical connector.

▶ Install the cover.

7 . Install the headlamp assembly.

▶ Connect and secure the electrical connector.

▶ Position the locating pegs.

8 . Connect the washer jet hose.

9 . Secure the headlamp assembly.

▶ Tighten the bolts.

10 . Close the hood.

11 . Connect the battery ground cable.

Headlamp Bulb - Vehicles With: High Intensity Discharge Headlamps (86.42.14)

Removal

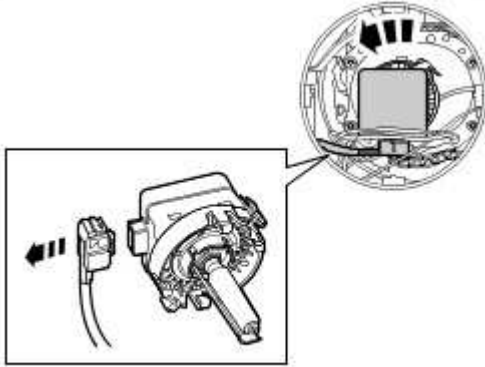
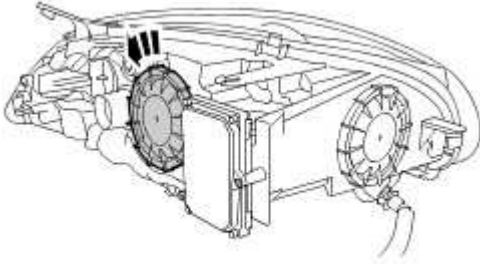


WARNING: Vehicles fitted with Xenon headlamps, the following precautions must be observed. Failure to comply may result in exposure to ultra violet rays, severe electric shock, burns or the risk of explosion. Ensure the headlamps are switched off at all times. Eye and hand protection must be worn. Never switch on the lamps or test the bulbs with the lamp holder released from the headlamp.

- 1 . Disconnect the battery ground cable.

- 2 . Remove the headlamp assembly.
For additional information, refer to Headlamp Assembly (86.41.33)

- 3 . Remove the headlamp bulb.
 - ▶ Remove the cover.
 - ▶ Release the clip.
 - ▶ Disconnect the electrical connector.



E61190

4 . Remove the headlamp bulb retainer.

▶ Release the clip.





E60953


Installation

1 . Attach the headlamp bulb retainer.

2 . Install the headlamp bulb.

 Connect the electrical connector.

 Secure with the clip.

 Install the cover.

3 . Install the headlamp assembly.

For additional information, refer to Headlamp Assembly (86.41.33)

4 . Connect the battery ground cable.

Headlamp Leveling Module

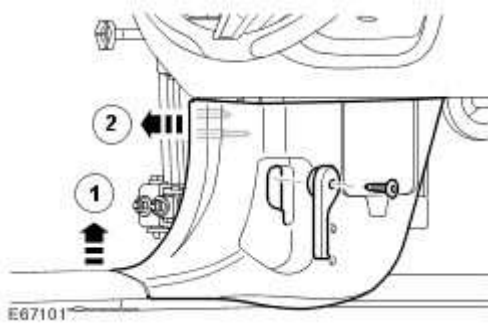
Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications
- 2 . Remove the blower motor.
For additional information, refer to Blower Motor (82.25.66)

3 . NOTE:

LH illustration shown, RH is similar.

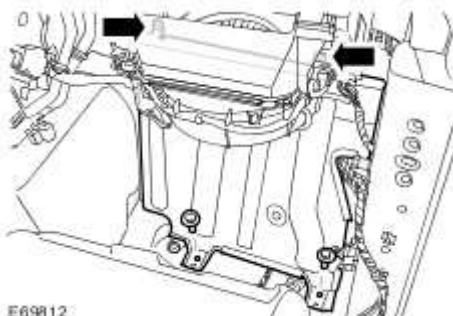
Remove the RH cowl side trim panel.



- 4 . Remove the subwoofer cover.

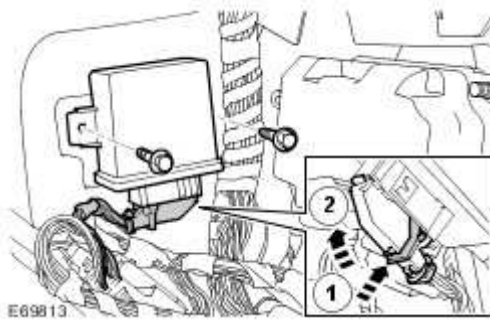
▶ Reposition the carpet for access.

▶ Remove the 4 bolts.



5 . Remove the headlamp leveling module.

- ▶ Remove the 2 bolts.
- ▶ Disconnect the electrical connector.



Installation

1 . To install, reverse the removal procedure.

2 . Install the headlamp leveling module.


- ▶ Tighten the bolts to 3 Nm (2 lb.ft).

3 . Install the subwoofer cover.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

Headlamp Leveling Front Sensor

Removal

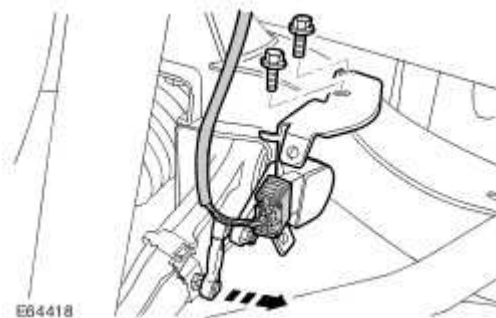
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the LH front wheel and tire.
For additional information, refer to Wheel and Tire (74.20.05)

- 3 . Remove the headlamp levelling sensor.

- ▶ Disconnect the height sensor link.
- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 bolts.



- 4 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the height sensor link.

5 . **NOTE:**

Note the fitted position.

Remove the bracket.

- ▶ Remove the 2 Allen bolts.



Installation

1 . **NOTE:**

Align to the position noted on removal.

Install the bracket.

- ▶ Tighten the Allen bolts to 5 Nm (4 lb.ft).

2 . Install the height sensor link.

3 . Install the headlamp levelling sensor.


- ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- ▶ Connect and secure the electrical connector.
- ▶ Connect the height sensor link.

4 . Install the wheel and tire.

For additional information, refer to Wheel and Tire (74.20.05)

Headlamp Leveling Rear Sensor

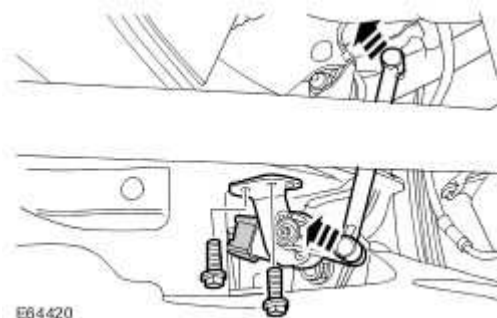
Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the headlamp levelling sensor.

- ▶ Disconnect the height sensor link.
- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 bolts.



- 3 . **NOTE:**

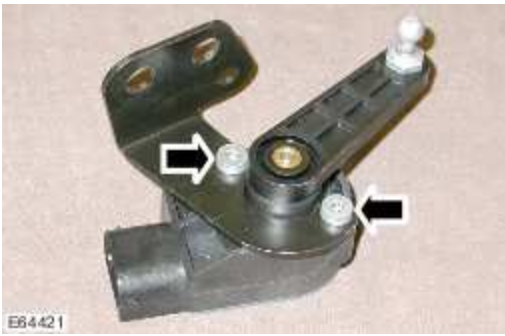
Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

Remove the bracket.

- ▶ Remove the 2 Allen bolts.



Installation

1 . NOTE:

Align to the position noted on removal.

Install the bracket.

- ▶ Tighten the Allen bolts to 5 Nm (4 lb.ft).

2 . Install the headlamp levelling sensor.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- ▶ Connect and secure the electrical connector.
- ▶ Install the height sensor link.

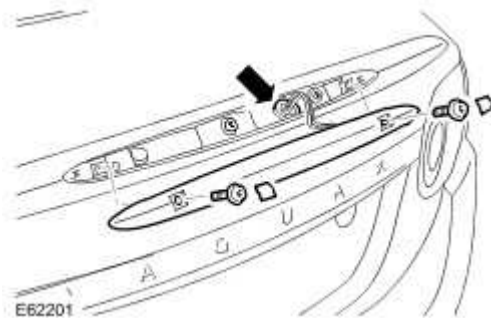
High Mounted Stoplamp (86.41.01)

Removal

- 1 . Remove the liftgate lower trim panel.
For additional information, refer to Liftgate Lower Trim Panel
- 2 . Disconnect the high mounted stoplamp electrical connector.



- 3 . Remove the high mounted stoplamp.
 - ▶ Carefully release the Torx bolt covers.
 - ▶ Remove the 2 Torx bolts.



Installation

- 1 . Install the high mounted stoplamp.
 - ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

 Install the Torx bolt covers.

2 . Connect the high mounted stoplamp electrical connector.

3 . Install the liftgate lower trim panel.

For additional information, refer to Liftgate Lower Trim Panel

Rear Lamp Assembly (86.40.70)

Removal

NOTE:

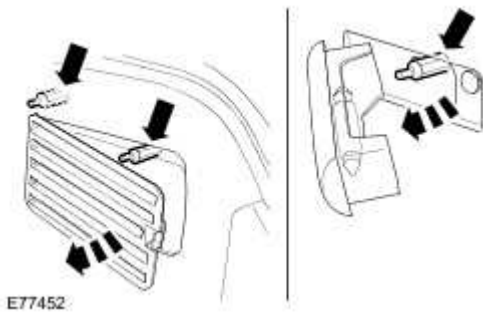
Take great care when removing the rear lamp assembly as the forward point of the lens can be easily damaged.

- 1 . Remove the luggage compartment grille.

▶ Release the clip.

- 2 . If installed, remove the loadspace lamp.

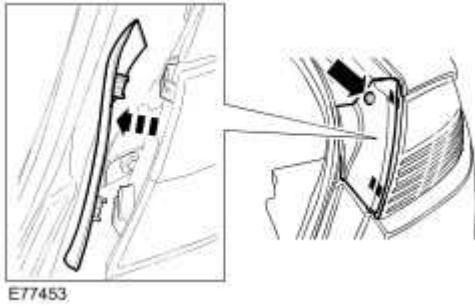
▶ Disconnect the electrical connector.




- 3 .  **CAUTION: Note the fitted position of the component prior to removal.**

Remove the rear lamp assembly trim panel.

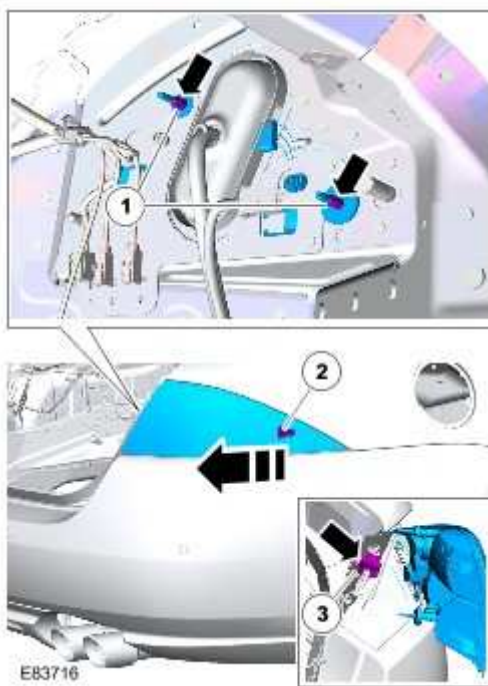
▶ Release the 3 clips.



- 4  **CAUTION:** Take great care when removing the rear lamp assembly as the forward point of the lens can be easily damaged.

Remove the rear lamp assembly.

- ▶ Remove the 2 nuts.
- ▶ Carefully release the clip.
- ▶ Disconnect the electrical connector.

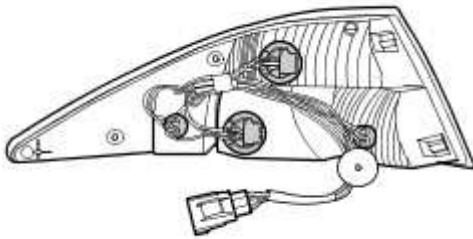


5 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the wiring harness.

- ▶ Release the 4 bulb holders.



E77455

Installation

- 1 . Install the wiring harness

- ▶ Install the bulb holders.

2 . NOTE:

Align to the position noted on removal.


Install the rear lamp assembly.

- ▶ Secure with the clip.
- ▶ Tighten the nuts to 2 Nm (1.5 lb.ft).
- ▶ Connect the electrical connector.

3 NOTE:

Position the rear lamp assembly trim panel upper edge behind the rear quarter panel lip.

Install the rear lamp assembly trim panel.

 Secure with the clips.

4 . Install the loadspace lamp.

5 . Install the grille.

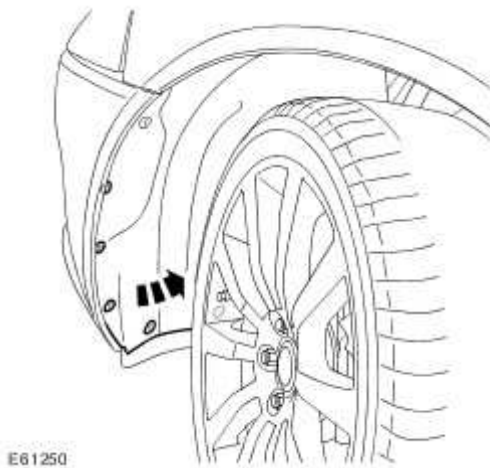
Fog Lamp Bulb

Removal

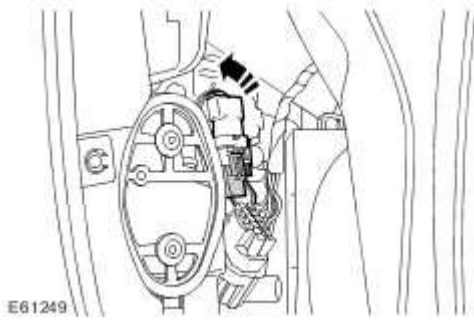
NOTE:

Left-hand shown, right-hand similar.

- 1 . Disconnect the battery ground cable.
For additional information, refer to
- 2 . Turn the steering on to full lock for access.
- 3 . Release the front of the fender splash shield.
 - ▶ Remove the 5 Torx bolts.
 - ▶ Tie the splash shield aside.



- 4 . Remove the front fog lamp bulb.
 - ▶ Release and disconnect the electrical connector.



Installation

1 . Install the fog lamp bulb.

▶ Connect and secure the electrical connector.

2 . Install the fender splash shield.

▶ Tighten the Torx bolts.

3 . Connect the battery ground cable.
For additional information, refer to

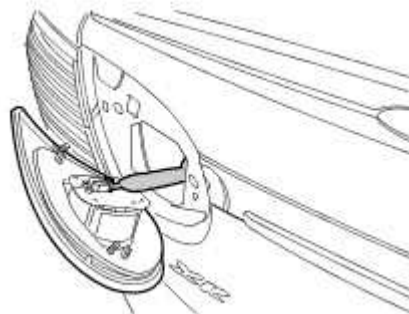
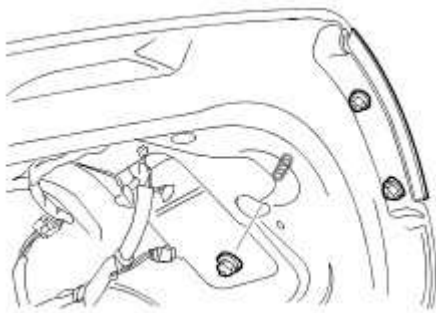
Rear Fog and Reversing Lamp - 2-Door

Removal

- 1 . Remove the liftgate lower trim panel.
For additional information, refer to Liftgate Lower Trim Panel

- 2 . Remove the fog and reversing lamp.

- ▶ Remove the 3 plastic nuts.
- ▶ Disconnect the electrical connector.



Installation

- 1 . Install the fog and reversing lamp.
 - ▶ Connect the electrical connector.
 - ▶ Install the plastic nuts.

2 . Install the liftgate lower trim panel.

For additional information, refer to Liftgate Lower Trim Panel

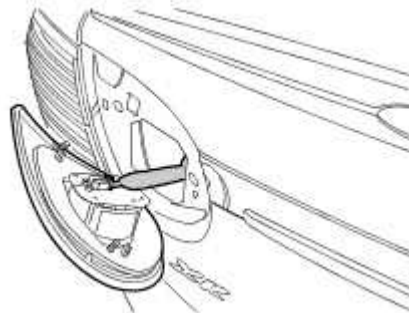
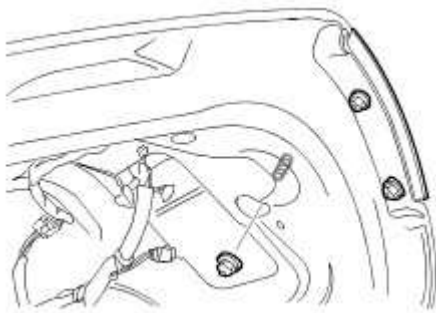
Rear Fog and Reversing Lamp - Convertible

Removal

- 1 . Remove the luggage compartment lid trim panel.
For additional information, refer to Luggage Compartment Lid Trim Panel (76.19.05)

- 2 . Remove the reverse/fog lamp.

- ▶ Remove the 3 plastic nuts.
- ▶ Disconnect the electrical connector.



E63144

Installation

- 1 . Install the reverse/fog lamp.
 - ▶ Connect the electrical connector.
 - ▶ Install the plastic nuts.

2 . Install the luggage compartment lid trim panel.

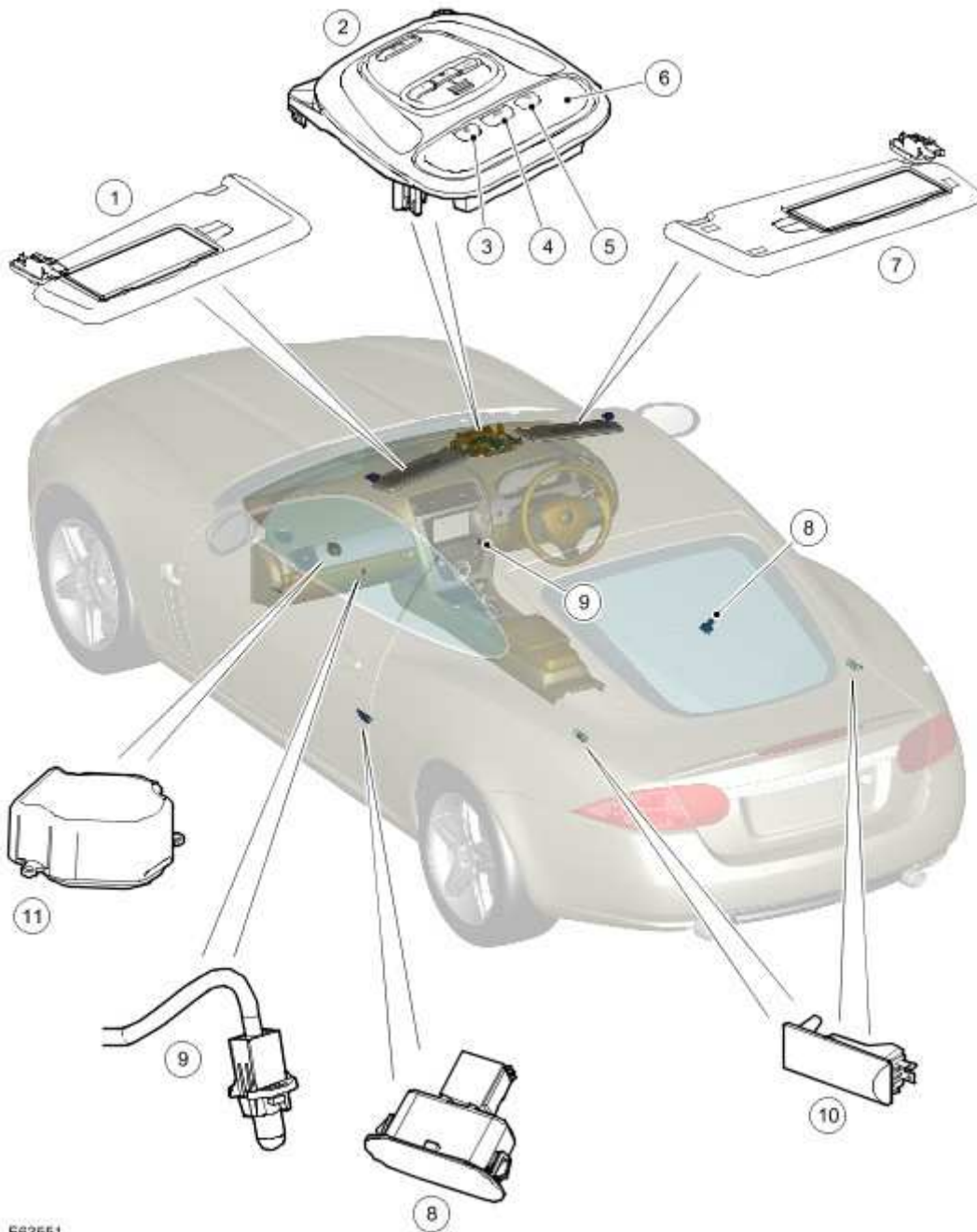
For additional information, refer to Luggage Compartment Lid Trim Panel (76.19.05)

417-02 : Interior Lighting

Description and operation

Interior Lighting

COMPONENT LOCATION



Item	Part Number	Description
1		Left Hand (LH) vanity mirror
2		Overhead console (Coupe version shown)
3		LH map reading lamp switch
4		Interior lamp switch
5		Right Hand (RH) map reading lamp switch
6		Map and interior lamps
7		RH vanity mirror
8		LH and RH door puddle lamps
9		LH and RH footwell lamps
10		LH and RH luggage compartment lamps
11		Glovebox lamp

INTRODUCTION

The interior lamps are controlled by the Central Junction Box (CJB) and have two modes of operation: manual and automatic. In the manual mode the interior lamps can be switched on and off using the momentary switches adjacent to each lamp or disabled completely using the same switches. In the automatic mode the interior lamp functionality is controlled by the CJB on receipt of various input signals.

The CJB receives the following inputs which affect the operation of the interior lamps:

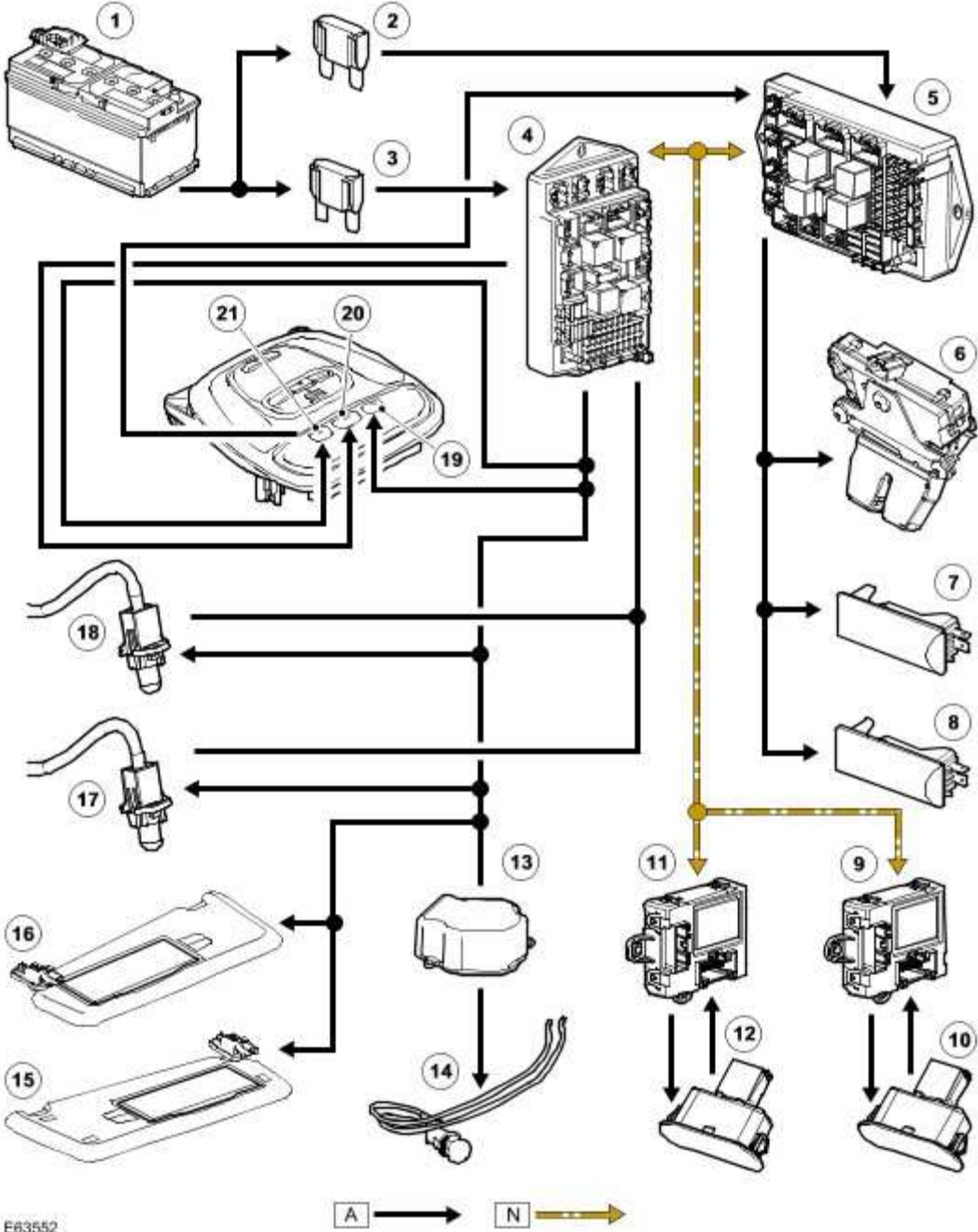
- Ignition switch
- Door latch switches
- Liftgate latch switch
- Glovebox lamp switch
- Unlock signal
- Main interior lamp switch
- Map reading lamp switches
- Delayed power off relay
- Vanity mirror lamp switches.

The driver's and passenger door puddle lamps are controlled by the driver's door module and the passenger door module respectively on receipt of Controller Area Network (CAN) signals from the CJB.

CONTROL DIAGRAM

NOTE:

A = Hardwired; N = Medium speed CAN bus



E63552

Item	Part Number	Description
------	-------------	-------------

1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		CJB
5		Auxiliary junction box
6		Liftgate latch switch
7		Luggage compartment lamp
8		Luggage compartment lamp
9		Passenger door module
10		Passenger door puddle lamp
11		Driver's door module
12		Driver's door puddle lamp
13		Glovebox lamp switch
14		Glovebox lamp
15		Driver's vanity mirror
16		Passenger vanity mirror
17		Driver's footwell lamp
18		Passenger footwell lamp
19		Driver's map reading lamp
20		Interior lamp
21		Passenger map reading lamp

Interior Lighting

Principle of Operation

For a detailed description of the interior lighting system, refer to the relevant Description and Operation section in the workshop manual.

Interior Lighting

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of electrical damage and system integrity.

Electrical
<ul style="list-style-type: none">• Fuse(s)• Bulb(s)• Wiring harness• Loose or corroded connector(s)• Accessories• Switch(es)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

417-04 : Daytime Running Lamps (DRL)

Description and operation

Daytime Running Lamps (DRL)

INTRODUCTION

Daytime Running Lamps (DRL) use the full intensity low beam headlamps which are permanently illuminated when the vehicle is being driven. DRL are used in a number of markets and there are two systems to cover these markets.

For additional information, refer to Exterior Lighting (417-01 Exterior Lighting)

DRL CANADIAN MARKET

DRL for this market use full intensity low beam headlamps. The side marker lamps, tail lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- PARK is not selected on automatic transmission selector lever
- Power mode 6 (ignition on) detected by the auxiliary junction box
- The Central Junction Box (CJB) receives an engine running signal
- The lighting control switch is in the off or side lamps position.

NOTE:

If the lighting control switch is moved to the headlamp position, DRL are deactivated and normal side lamp and headlamp functionality is operational.

NOTE:

Adaptive Front lighting System (AFS) (where fitted) is non-functional when the DRL are active.

NOTE:

When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally.

The high beam headlamp function using the left hand steering column stalk switch will be deactivated. When the selector lever is in the PARK position on automatic transmission vehicles, DRL are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate

conditions. When the selector lever is moved from the PARK position, normal DRL functionality is restored.

DRL DENMARK, HOLLAND, NORWAY, SWEDEN, FINLAND AND POLAND

DRL for these markets use full intensity low beam headlamps. Side lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Power mode 6 (ignition on) detected by the auxiliary junction box
- The CJB receives an engine running signal
- The lighting control switch is in the off position.

NOTE:

When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column stalk switch will be deactivated.

If the lighting control switch is moved to the side lamp or headlamp positions, DRL are deactivated and normal side lamp and headlamp functionality is operational.

Daytime Running Lamps (DRL)

Principle of Operation

For a detailed description of the daytime running lamps, refer to the relevant Description and Operation section in the workshop manual.

Daytime Running Lamps (DRL)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of electrical damage and system integrity.

Electrical
<ul style="list-style-type: none">• Fuse(s)• Bulb(s)• Switch(es)• Electrical connector(s)• Wiring Harness

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

418 : Electrical Distribution

418-00 : Module Communications Network

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Junction box - nut/screw	4	3	35

Communications Network

INTRODUCTION

A number of different types of communication network are incorporated into the vehicle wiring harnesses for the transmission of commands and information between control modules. The configuration installed on a particular vehicle depends on the model and equipment level.

The communication networks available on the vehicle are:

- Medium speed Controller Area Network (CAN) bus
- High speed CAN bus
- Media Orientated System Transport (MOST) ring
- Local Interconnect Network (LIN) bus
- Private CAN bus

Bus	Baud Rate
Medium speed CAN bus	125 kbits/s
High speed CAN bus	500 kbits/s
MOST ring	24 mbits/s
LIN bus	9.6 kbits/s

CONTROLLER AREA NETWORK (CAN) BUS

The CAN bus is a high speed broadcast network where control modules automatically transmit information every few microseconds. Information is broadcast down a pair of twisted wires, known as 'CAN high' and 'CAN low'. Information is transmitted on the CAN bus as a voltage difference between the two wires.

Two CAN bus networks are used on the vehicle; medium speed and high speed, with the instrument cluster acting as a gateway between the two networks. The table below shows the wire colours used on both networks.

Network	High	Low
Medium Speed	White (W)	Blue (U)

High Speed	Yellow (Y)	Green (G)
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Private CAN bus

The private CAN bus networks used on the vehicle can be either medium or high speed depending on which vehicle system they are being used. All private CAN bus networks are proprietary systems and cannot be interrogated using the Integrated Diagnostic System (IDS).

Diagnostic Socket

The diagnostic socket allows the transfer of information between the vehicle electronic control modules and the IDS. The diagnostic socket is connected directly to both the medium speed CAN bus and the high speed CAN bus and is located below the drivers side of the instrument panel.

MEDIA ORIENTATED SYSTEM TRANSPORT (MOST) RING

The MOST ring uses a fibre optic cable to transport data and audio around the information and entertainment system. The fibre optic cable is arranged in a ring, with each unit on the ring having a 'MOST in' and 'MOST out' connection.

MOST is a synchronous network. A timing master supplies the clock and all other components on the ring synchronize their operation to this clock. The timing master for the MOST ring is the Information and Entertainment control module.

When handling MOST fibre optic cables the following precautions should be observed.

- After disconnection of any cables, carefully install appropriate dust caps to protect the mating faces of the connectors from damage or contamination.
- Avoid introducing bends of less than 25 mm (0.98 inches) radius or kinks into the fibre optic cable during service or repair. Tight bends or kinks could impair operation, cause immediate system failure, or future system failure.
- Avoid excessive force, strain or stress on the fibers and connectors, especially permanent stress after reinstallation.

Software Download Socket

The MOST software download socket is located below the drivers side of the instrument panel. A service loop is fitted to the end of the socket to complete the MOST ring. If the service loop is removed the MOST ring will be broken and all components on the ring will stop operating.

NOTE:

The software download socket is used for engineering purposes only and must not be used in service.

Ring Break Diagnostics

Incorporated into the Auxiliary Junction Box (AJB) is a Ring Break Diagnostics (RBD) link. The RBD link houses a copper link which when removed initiates the ring break diagnostics mode. The ring break diagnostics mode allows the technician to locate an optical fiber break in the MOST ring. To initiate the ring break diagnostics mode, carry out the following process:

- Connect the Jaguar approved diagnostic system.
- Ensure the vehicle is in power mode 4 or greater.
- Remove the RBD link for the length of time specified by the Jaguar approved diagnostic system.
- Replace the RBD link.

After approximately 30 seconds a Diagnostic Trouble Code (DTC) will be logged in the Information and Entertainment Control Module, identifying the location of the fault. The DTC can be read and interrogated using the Jaguar approved diagnostic system.

LOCAL INTERCONNECT NETWORK (LIN) BUS

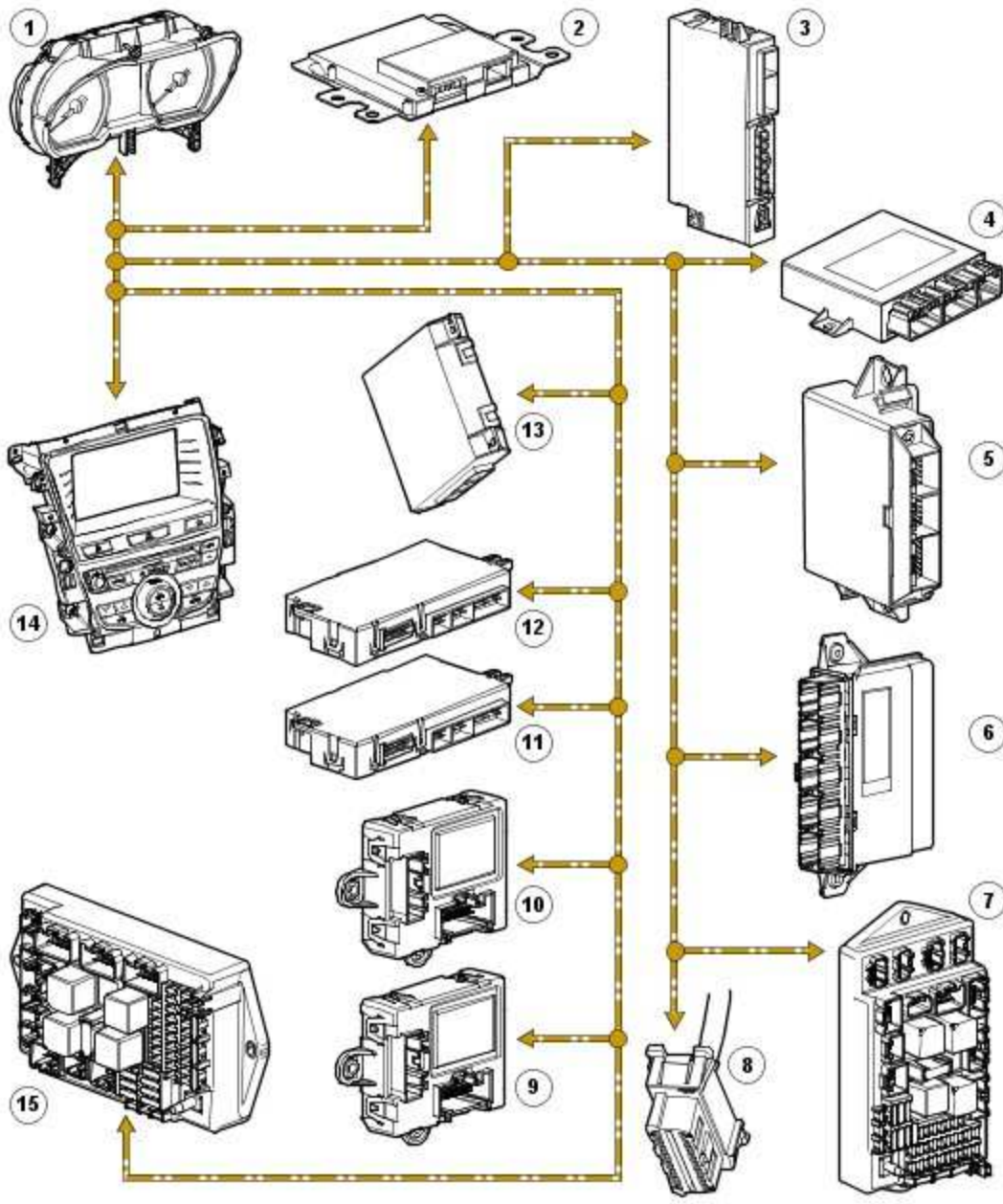
The LIN bus is a low speed broadcast network that employs master and slave components. The master component transmits a message to the slave components identifying which slave is to respond. This message has a header (slave identifier) and an empty data field. The identified slave component fills the data field with the relevant information and returns the message to the master component.

Unlike the CAN bus networks, the LIN bus utilizes a single wire network.

CONTROL DIAGRAM - MEDIUM SPEED CAN BUS

NOTE:

N = Medium speed CAN bus



EG2480



Item	Part Number	Description
1		Instrument cluster
2		Information and Entertainment control module
3		Convertible top control module
4		Tire pressure monitoring control module

5		Parking aid module
6		Keyless vehicle module
7		Central Junction Box (CJB)
8		Diagnostic socket
9		Passenger door control module
10		Drivers door control module
11		Passenger seat module
12		Drivers seat module
13		Automatic Temperature Control (ATC) module
14		Integrated control panel
15		Auxiliary junction box

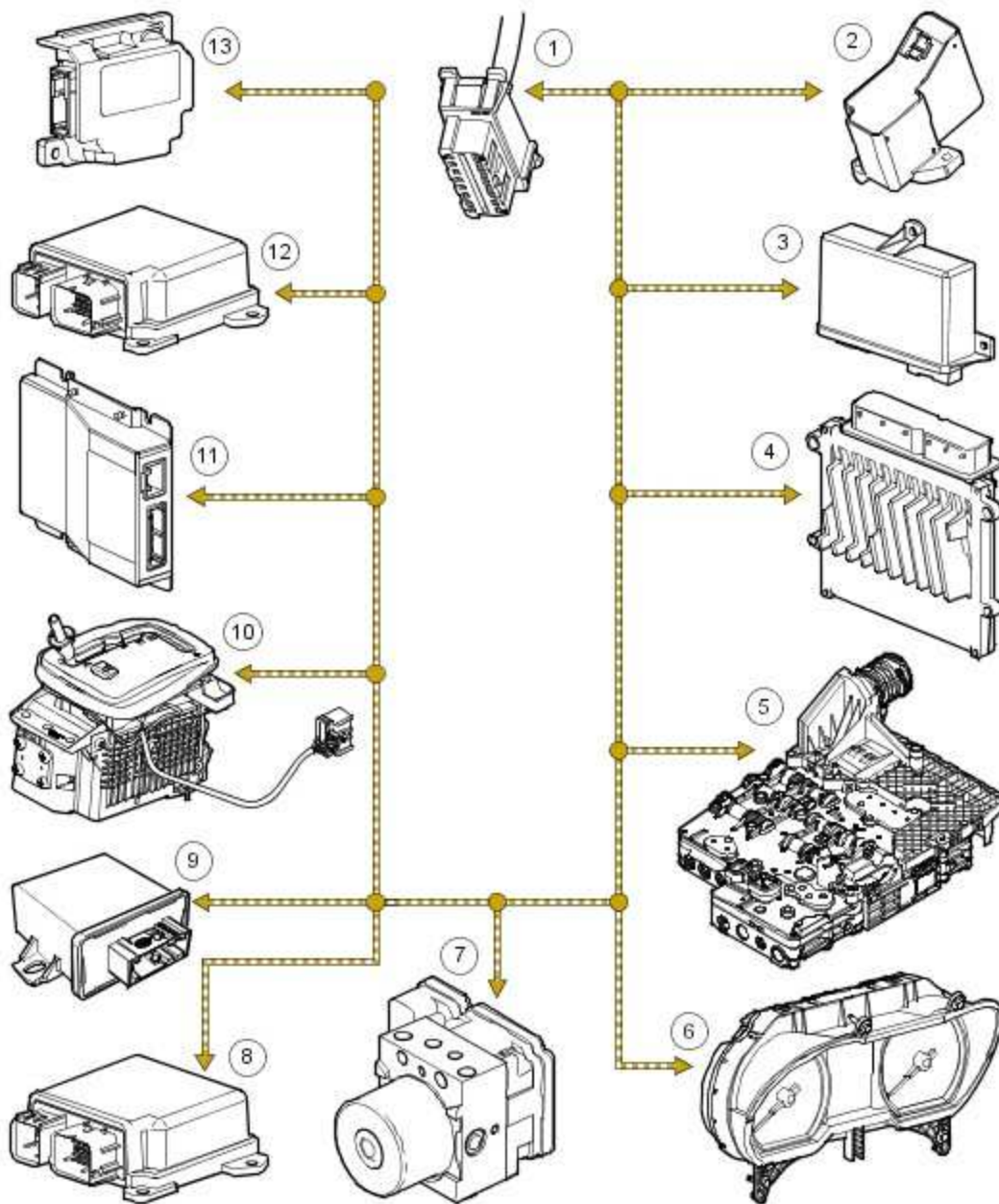
NOTE:

Only the buttons of the Integrated control panel are connected to the medium speed CAN bus.
The Touch Screen Display (TSD) is connected to the MOST ring.

CONTROL DIAGRAM - HIGH SPEED CAN BUS

NOTE:

D = High speed CAN bus



EG2481



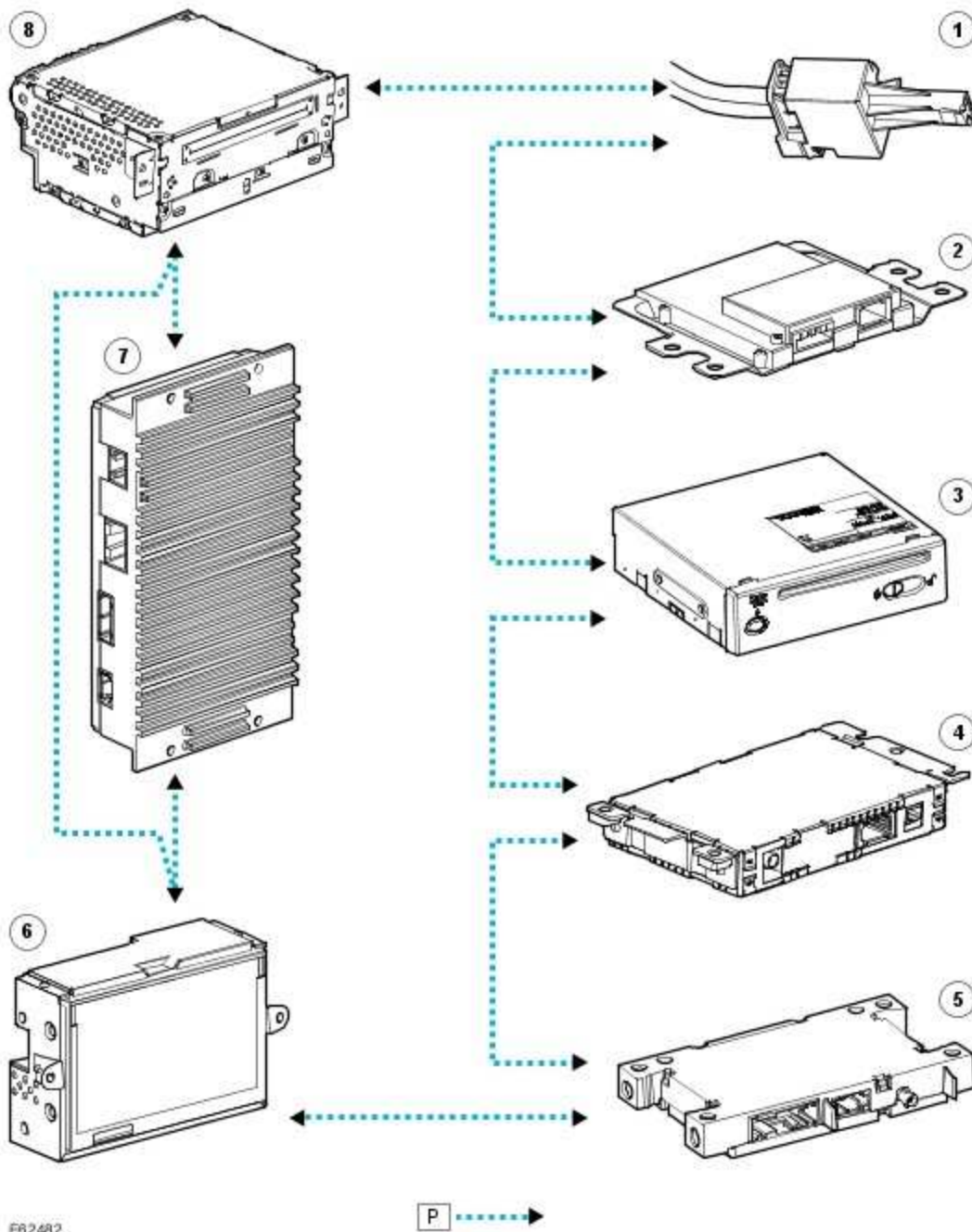
Item	Part Number	Description
1		Diagnostic socket
2		Electric steering column lock
3		Park brake module
4		Engine Control Module (ECM)

5		Transmission Control Module (TCM)
6		Instrument cluster
7		Anti-lock Brake System (ABS) module
8		Restraints control module
9		Adaptive front lighting system control module
10		Gear shift module
11		Adaptive Damping Control Module (ADCM)
12		Pedestrian protection module
13		Adaptive speed control module

CONTROL DIAGRAM - MOST RING (UP TO 2009 MY)

NOTE:

P = MOST ring



EG2482

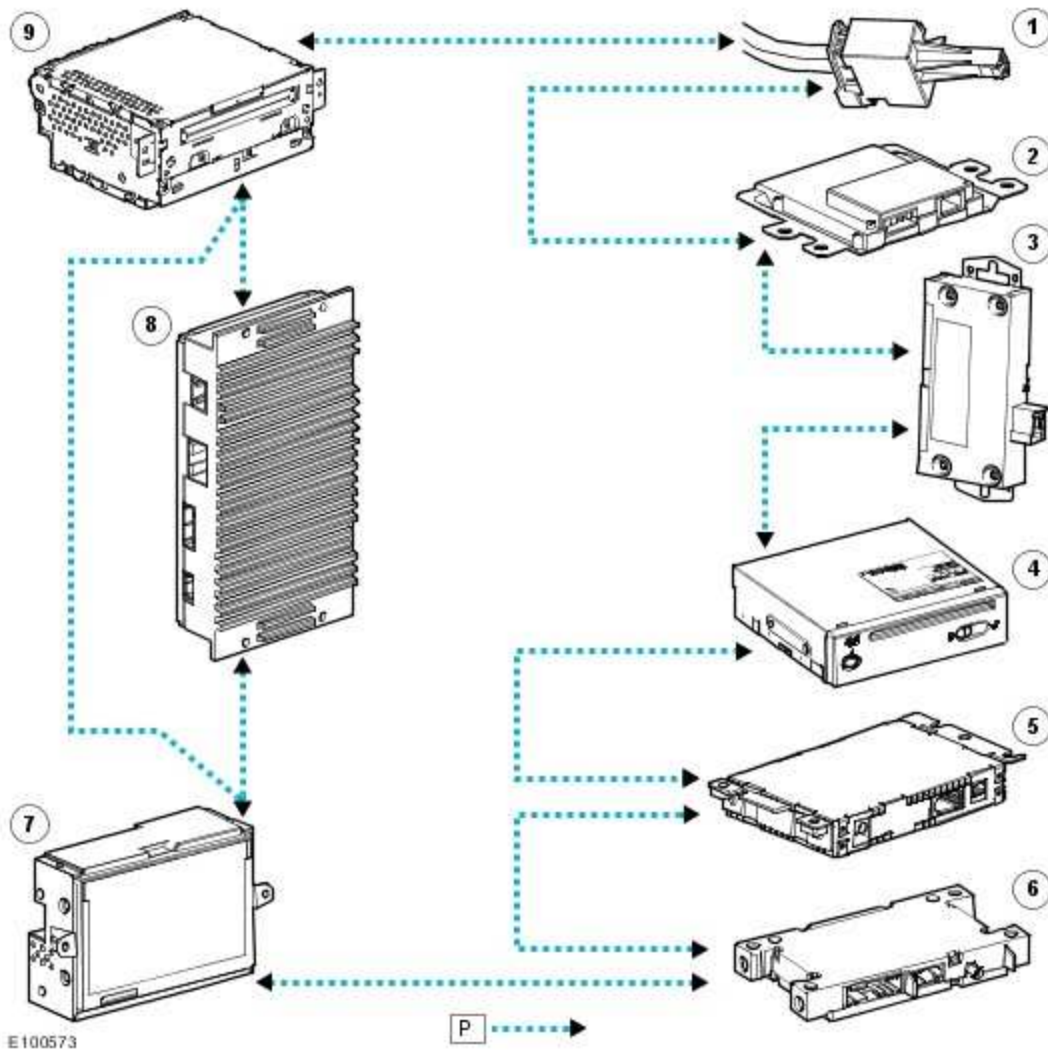
Item	Part Number	Description
1		Software download socket
2		Information and entertainment module
3		Multi-media module
4		DAB/SDARS receiver

5		Bluetooth® phone module
6		TSD
7		Audio system amplifier
8		Integrated audio module

CONTROL DIAGRAM - MOST RING (FROM 2009 MY)

NOTE:

P = MOST ring



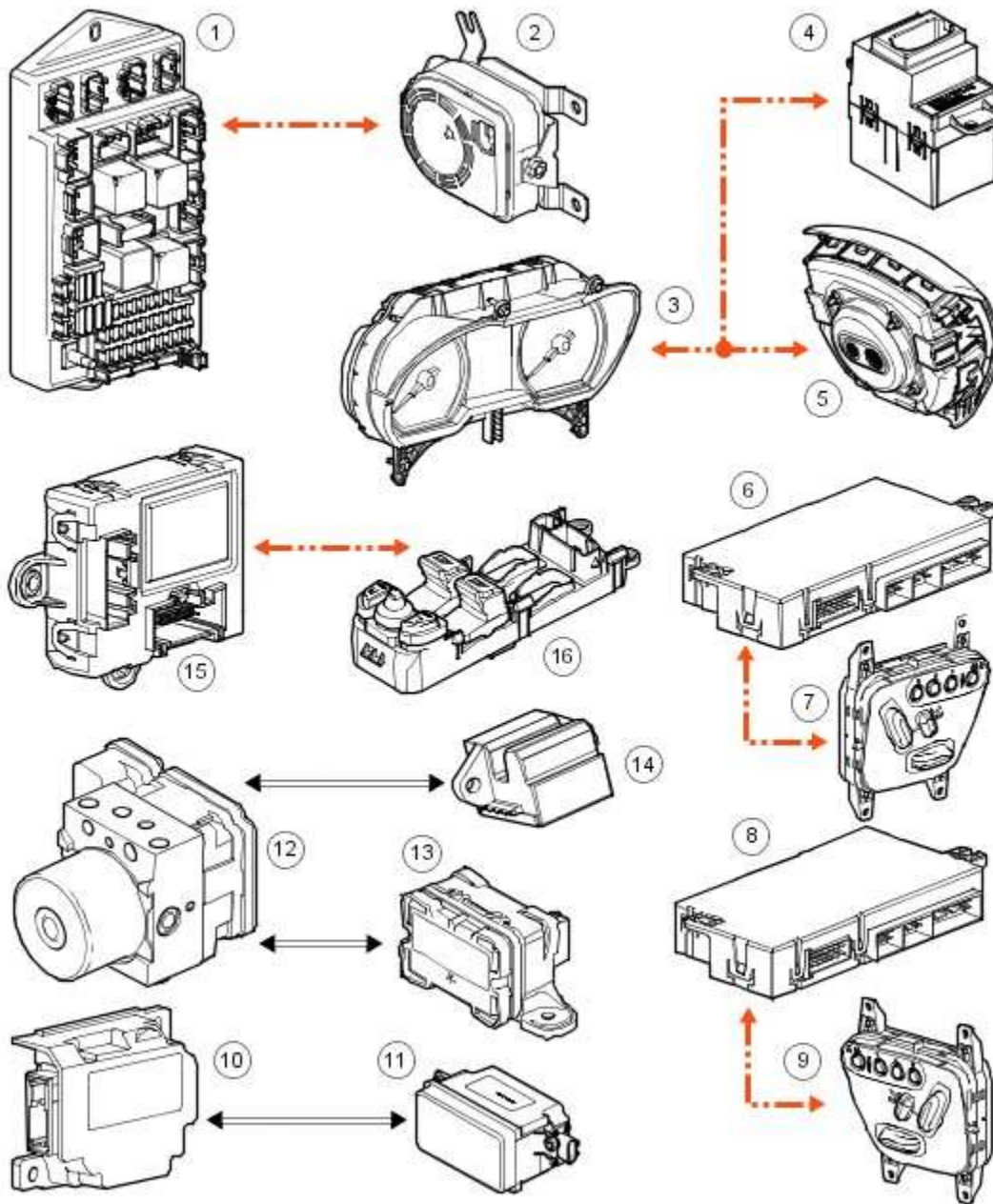
Item	Part Number	Description
------	-------------	-------------

1		Software download socket
2		Information and entertainment module
3		Auxiliary USB unit
4		Multi-media module
5		DAB/SDARS receiver
6		Bluetooth® phone module
7		TSD
8		Audio system amplifier
9		Integrated audio module

CONTROL DIAGRAM - LIN BUS AND PRIVATE CAN BUS

NOTE:

O = LIN bus; **U** = Private CAN bus



E62483



Item	Part Number	Description
1		CJB
2		Active anti-theft sounder
3		Instrument cluster

4		Engine start control module
5		Steering wheel module
6		Passenger seat module
7		Passenger seat switch module
8		Drivers seat module
9		Drivers seat switch module
10		Adaptive speed control module
11		Adaptive speed control radar
12		ABS module
13		Yaw rate/acceleration sensor
14		Steering angle sensor
15		Drivers door control module
16		Drivers door switch module

Communications Network

Principles of Operation

For a detailed description of the communications network, refer to the relevant Description and Operation section in the workshop manual.

Communications Network

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



CAUTION: Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of electrical damage and system integrity.

Electrical

- Fuses (refer to electrical guide)
- Wiring harness
- Correct engagement of electrical connectors
- Loose or corroded connections
- Routing of fibre optic harnesses
- Correct engagement of optical connectors
- Correct placement of optical connectors (ring order)
- Correct assembly of optical connectors (backout, etc)
- Damage to fibre (chafing, abrasion, kinking, cuts, etc)

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident check for diagnostic trouble codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

Rear Junction Box (RJB)

DTC	Description	Possible Cause	Action
B100A51	Fuel pump authorisation target ID not stored	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault 	Check power and ground supplies to RJB. Check CAN communications between RJB and instrument cluster. Check power and ground supplies to instrument cluster
B100A62	Fuel pump authorisation signal compare failure	<ul style="list-style-type: none"> • Low speed CAN fault • RJB fault • Instrument cluster fault • Incorrect module installed (RJB/Instrument cluster) • Write target SID synchronisation error following re-programming • Noise/EMC related error 	Check CAN communications between RJB and instrument cluster. Check power and ground supplies to RJB and instrument cluster. Confirm correct module installed. Re-synchronise ID by re-configuring the RJB as a new module. Check CAN network for interference/EMC related issues
B100A63	Fuel Pump Authorisation Time Out	<ul style="list-style-type: none"> • RJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage <9V 	Check power and ground supplies to RJB and instrument cluster. Check CAN communications between RJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B102612	Steering column lock ground circuit short to power	<ul style="list-style-type: none"> • Steering column lock ground circuit - short to power 	Refer to the electrical circuit diagrams and test steering column lock ground circuit for short to power
B10AF12	Blower fan relay short to power	<ul style="list-style-type: none"> • Blower fan relay circuit - short to power 	Refer to the electrical circuit diagrams and test blower fan relay circuit for short to power
B10AF14	Blower fan relay open load or short to ground	<ul style="list-style-type: none"> • Blower fan relay circuit - short to ground, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B10DD12	Air bag deployed circuit short to ground	<ul style="list-style-type: none"> Air bag deployed circuit - short to ground 	Refer to the electrical circuit diagrams and test air bag deployed circuit for short to ground
B10DD15	Air bag deployed circuit open circuit, short to power or no signal	<ul style="list-style-type: none"> Air bag deployed circuit - short to power, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10DD38	Air bag deployed circuit signal out of specification	<ul style="list-style-type: none"> Signal frequency incorrect 	Refer to the electrical circuit diagrams and test air bag deployed circuit between RCM, ECM and RJB for short to power, ground and open circuit
B111211	Parking aid ignition supply short to ground or over temperature	<ul style="list-style-type: none"> Parking aid ignition supply circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111213	Parking aid ignition supply open load	<ul style="list-style-type: none"> Parking aid ignition supply circuit - high resistance 	Refer to the electrical circuit diagrams and test parking aid ignition supply circuit for high resistance
B111311	Left front comfort solenoid short to ground or over temperature	<ul style="list-style-type: none"> Left front comfort solenoid circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111313	Left front comfort solenoid open load	<ul style="list-style-type: none"> Left front comfort solenoid circuit - high resistance 	Refer to the electrical circuit diagrams and test left front comfort solenoid circuit for high resistance
B111411	Right front comfort solenoid short to ground or over temperature	<ul style="list-style-type: none"> Right front comfort solenoid circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111413	Right front comfort solenoid open load	<ul style="list-style-type: none"> Right front comfort solenoid circuit - high resistance 	Refer to the electrical circuit diagrams and test right front comfort solenoid circuit for high

			resistance
B111511	High mounted stop lamp control short to ground or over temperature	<ul style="list-style-type: none"> High mounted stop lamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111513	High mounted stop lamp control open load	<ul style="list-style-type: none"> High mounted stop lamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test high mounted stop lamp control circuit for high resistance
B111611	Left rear lamp assembly control circuit short to ground or over temperature	<ul style="list-style-type: none"> Left rear lamp assembly control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111613	Left rear lamp assembly control circuit open load	<ul style="list-style-type: none"> Left rear lamp assembly control circuit - high resistance 	Refer to the electrical circuit diagrams and test left rear lamp assembly control circuit for high resistance
B111711	Right rear lamp assembly control circuit short to ground or over temperature	<ul style="list-style-type: none"> Right rear lamp assembly control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111713	Right rear lamp assembly control circuit open load	<ul style="list-style-type: none"> Right rear lamp assembly control circuit - high resistance 	Refer to the electrical circuit diagrams and test right rear lamp assembly control circuit for high resistance
B111811	Left rear side marker control circuit short to ground or over temperature	<ul style="list-style-type: none"> Left rear side marker control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111813	Left rear side marker control circuit open load	<ul style="list-style-type: none"> Left rear side marker control circuit - high resistance 	Refer to the electrical circuit diagrams and test left rear side marker control circuit for high resistance

B111911	Right rear side marker control circuit short to ground or over temperature	<ul style="list-style-type: none"> Right rear side marker control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111913	Right rear side marker control circuit open load	<ul style="list-style-type: none"> Right rear side marker control circuit - high resistance 	Refer to the electrical circuit diagrams and test right rear side marker control circuit for high resistance
B111A11	License plate lamps control circuit short to ground or over temperature	<ul style="list-style-type: none"> License plate lamps control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111A13	License plate lamps control circuit open load	<ul style="list-style-type: none"> License plate lamps control circuit - high resistance 	Refer to the electrical circuit diagrams and test license plate lamps control circuit for high resistance
B111D11	Luggage compartment lid open motor control circuit short to ground or over temperature	<ul style="list-style-type: none"> Luggage compartment lid open motor control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111D13	Luggage compartment lid open motor control circuit open load	<ul style="list-style-type: none"> Luggage compartment lid open motor control circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111E11	Luggage compartment lid lamps power supply circuit short to ground or over temperature	<ul style="list-style-type: none"> Luggage compartment lid lamps power supply circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B111E13	Luggage compartment lid lamps power supply circuit open	<ul style="list-style-type: none"> Luggage compartment lid lamps power supply circuit - high resistance 	Refer to the electrical circuit diagrams and test luggage compartment lid lamps power supply circuit for high resistance

	load		
B112311	Restraints ignition relay short to ground	<ul style="list-style-type: none"> Restraints ignition relay circuit - short to ground 	Refer to the electrical circuit diagrams and test restraints ignition supply relay circuit for short to ground
B112312	Restraints ignition relay short to power	<ul style="list-style-type: none"> Restraints ignition relay circuit - short to power 	Refer to the electrical circuit diagrams and test restraints ignition supply relay circuit for short to power
B113E23	External luggage compartment lid release switch stuck	<ul style="list-style-type: none"> Signal stuck low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A751C	Fuel sender No.1 fault	<ul style="list-style-type: none"> Fuel sender No.1 circuit - voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A761C	Fuel sender No.2 fault	<ul style="list-style-type: none"> Fuel sender No.2 circuit - voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A7911	Right fog lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> Right fog lamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A7913	Rear fog lamp control circuit open load	<ul style="list-style-type: none"> Rear fog lamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test rear fog lamp control circuit for high resistance
B1C5512	Horn relay short to power	<ul style="list-style-type: none"> Horn relay circuit - short to power 	Refer to the electrical circuit diagrams and test horn control relay circuit for short to power
B1C5514	Horn relay open load or short to ground	<ul style="list-style-type: none"> Horn relay circuit - short to ground, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
B1C8312	Heated rear window relay coil short to power	<ul style="list-style-type: none"> • Heated rear window relay circuit - short to power 	Refer to the electrical circuit diagrams and test heated rear window relay circuit for short to power
B1C8314	Heated rear window relay coil open load or short to ground	<ul style="list-style-type: none"> • Heated rear window relay circuit - short to ground, high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C9111	Fuel filler door lock motor control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Fuel filler door lock motor control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C9113	Fuel filler door lock motor control circuit open load	<ul style="list-style-type: none"> • Fuel filler door lock motor control circuit - high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D0611	Left turn signal lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Left turn signal lamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D0613	Left turn signal lamp control circuit open load	<ul style="list-style-type: none"> • Left turn signal lamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test left turn signal lamp control circuit for high resistance
B1D0711	Right turn signal lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Right turn signal lamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D0713	Right turn signal lamp control circuit open load	<ul style="list-style-type: none"> • Right turn signal lamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test right turn signal lamp control circuit for high resistance
B1D3523	Hazard switch stuck	<ul style="list-style-type: none"> • Signal stuck low 	Carry out any pinpoint tests associated with this DTC using

			the manufacturer approved diagnostic system
B2A9016	Battery low	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Check battery is in fully charged and serviceable condition, refer to the battery care manual
B2A9116	Battery discharged	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Check battery is in fully charged and serviceable condition, refer to the battery care manual
C111A11	Right stoplamp short to ground or over temperature	<ul style="list-style-type: none"> • Right stoplamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C111A13	Right stoplamp control circuit open load	<ul style="list-style-type: none"> • Right stoplamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test right stoplamp control circuit for high resistance
C111B11	Left stoplamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Left stoplamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C111B13	Left stoplamp control circuit open load	<ul style="list-style-type: none"> • Left stoplamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test left stoplamp control circuit for high resistance
C112011	Reversing lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Reversing lamp control circuit - short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
C112013	Reversing lamp control circuit open load	<ul style="list-style-type: none"> • Reversing lamp control circuit - high resistance 	Refer to the electrical circuit diagrams and test reversing lamp control circuit for high resistance
P123011	Fuel pump relay short to ground	<ul style="list-style-type: none"> • Fuel pump relay circuit - short to ground 	Refer to the electrical circuit diagrams and test fuel pump relay circuit for short to ground

P123012	Fuel pump relay short to power	<ul style="list-style-type: none"> Fuel pump relay circuit - short to power 	Refer to the electrical circuit diagrams and test fuel pump relay circuit for short to power
U001088	Medium Speed CAN Communication Bus	<ul style="list-style-type: none"> bus off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication CJB	<ul style="list-style-type: none"> Lost communication CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> Lost communication with instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U016400	Lost communication with climate control module	<ul style="list-style-type: none"> Lost communication with climate control module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020600	Lost communication with convertible top module	<ul style="list-style-type: none"> Lost Communication with HDM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U021400	Lost communication with remote keyless entry module	<ul style="list-style-type: none"> Lost communication with remote keyless entry module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030046	Internal control module software incompatibility	<ul style="list-style-type: none"> Calibration parameter failure 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains, suspect the RJB, refer to the new module installation note at the top of the DTC Index
U1A1449	CAN initialisation	<ul style="list-style-type: none"> Internal electronic failure 	Install a new RJB, refer to the new module installation note at

	failure		the top of the DTC Index
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new RJB, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the RJB, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index

Central Junction Box (CJB)

DTC	Description	Possible Cause	Action
B100951	Ignition authorisation	<ul style="list-style-type: none"> Faulty instrument cluster Target SID re-synchronisation error following programming CAN fault 	Check ignition, power and ground supplies to CJB and instrument cluster. Re-synchronize ID by re-configuring the instrument cluster as a new module. Check CAN communications between instrument cluster and tester
B100962	Ignition authorisation signal compare failure	<ul style="list-style-type: none"> Low speed CAN fault CJB fault Instrument cluster fault Incorrect module installed (CJB/Instrument cluster) Target SID synchronisation error following re-programming Noise/EMC related error 	Check CAN communications between CJB and instrument cluster. Check ignition, power and ground supplies to CJB and instrument cluster. Confirm correct module is installed. Re-synchronise ID by re-configuring the instrument cluster as a new module. Check CAN network for interference/EMC related issues

B100963	Ignition authorisation time-out	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Instrument cluster fault • Low battery voltage <9V 	Check Power and Ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster. Check battery is in fully charged and serviceable condition, refer to the battery care manual
B100964	Ignition authorisation signal plausibility failure	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Instrument cluster fault 	Check power and ground supplies to CJB and instrument cluster. Check CAN communications between CJB and instrument cluster
B102611	Steering column lock power circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test steering column lock power circuit for short to ground
B102613	Steering column lock power circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test steering column lock power circuit for high resistance
B102B67	Passive key authorisation signal incorrect after event	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • Remote Keyless Entry (RKE) module fault • Write target SID synchronisation error following re-programming 	Check power and ground supplies to CJB and RKE module. Check CAN communications between CJB and RKE module. Re-synchronise ID by re-configuring the RKE module as a new module
B102B87	Passive key authorisation missing message	<ul style="list-style-type: none"> • CJB fault • Low speed CAN fault • RKE module fault • Key fob battery low/battery contact issue • Interference from other RF signal • EMC/noise • Receiver fault • Receiver not programmed correctly • Serial communications fault (between receiver and RKE module) 	Check power and ground supplies to CJB, RKE module and receiver. Check CAN communications between CJB and instrument cluster. Check key fob battery. Confirm vehicle surroundings, move vehicle. Check CAN network for interference/EMC related issues. Disconnect battery, then re-connect - confirm operation by re-programming keys. Check

		<ul style="list-style-type: none"> • Key fault • Passive antenna fault • Confirm placement of key within vehicle 	serial circuit between receiver and RKE module. Confirm spare key works. Refer to the electrical circuit diagrams and test circuits to all 3 antennas. Check whereabouts of key
B108A23	Start button stuck	<ul style="list-style-type: none"> • Signal stuck low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B108A29	Start button fault	<ul style="list-style-type: none"> • Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B109511	Wiper On Off relay control circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test wiper On Off relay control circuit for short to ground
B109512	Wiper On Off relay control circuit short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test wiper On Off relay control circuit for short to power
B109612	Wiper speed relay control circuit short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test wiper speed relay control circuit for short to power
B109614	Wiper speed relay control circuit open load or short to ground	<ul style="list-style-type: none"> • Circuit short to ground or open 	Refer to the electrical circuit diagrams and test wiper speed relay control circuit for high resistance or short to ground
B109712	Heated front windshield relay control circuit short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test heated front windshield relay control circuit for short to power
B109714	Heated front windshield relay control circuit	<ul style="list-style-type: none"> • Circuit short to ground or open 	Refer to the electrical circuit diagrams and test heated front windshield relay control circuit

	open load or short to ground		for high resistance or short to ground
B109F11	Intrusion sensor module power circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test intrusion sensor module power circuit for short to ground
B10AD11	Rain sensor power circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test rain sensor power circuit for short to ground
B10AD13	Rain sensor power circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test rain sensor power circuit for high resistance
B10AD49	Rain sensor internal fault	<ul style="list-style-type: none"> • Internal electronic failure 	Install a new rain sensor. Rain Sensor (84.12.10)
B10DB23	Front left global close	<ul style="list-style-type: none"> • Signal stuck low 	Refer to the electrical circuit diagrams and test Front left global close circuit for short to ground
B10DC23	Front right global close	<ul style="list-style-type: none"> • Signal stuck low 	Refer to the electrical circuit diagrams and test Front right global close circuit for short to ground
B10E511	ECM wake-up signal short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test ECM wake-up signal for short to ground
B10F111	Key In switch circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test Key In switch circuit for short to ground
B10F311	Front left side lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front left side lamp control circuit for short to ground
B10F313	Front left side lamp control circuit	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front left side

	open load		lamp control circuit for high resistance
B10F411	Front right side lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front right side lamp control circuit for short to ground
B10F413	Front right side lamp control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front right side lamp control circuit for high resistance
B10F812	Cigar lighter relay control circuit short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test cigar lighter relay control circuit for short to power
B10F814	Cigar lighter relay control circuit open load or short to ground	<ul style="list-style-type: none"> • Circuit short to ground or open 	Refer to the electrical circuit diagrams and test cigar lighter relay control circuit for high resistance or short to ground
B10F912	Accessory socket 'B' relay short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test Accessory socket 'B' relay for short to power
B10F914	Accessory socket 'B' relay open load or short to ground	<ul style="list-style-type: none"> • Circuit short to ground or open 	Refer to the electrical circuit diagrams and test Accessory socket 'B' relay for high resistance or short to ground
B10FA12	Delayed power off relay power output circuits short to power	<ul style="list-style-type: none"> • Circuit short to power 	Refer to the electrical circuit diagrams and test delayed power off relay power output circuits for short to power
B10FA14	Delayed power off relay power output circuits open load or short to ground	<ul style="list-style-type: none"> • Circuit short to ground or open 	Refer to the electrical circuit diagrams and test delayed power off relay power output circuits for high resistance or short to ground

B10FF11	Engine Junction Box (EJB) and ECM ignition relay control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test EJB and ECM ignition relay control circuits for short to ground
B10FF13	Engine Junction Box (EJB) and ECM ignition relay control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test EJB and ECM ignition relay control circuits for high resistance
B110011	O2 sensor heater relay control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test O2 sensor heater relay control circuit for short to ground
B110013	O2 sensor heater relay control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test O2 sensor heater relay control circuit for high resistance
B113F12	Intruder detection arm/disarm control circuit short to power	<ul style="list-style-type: none"> • Circuit short to power 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B114011	Engine crank authorisation circuit short to ground or over temperature	<ul style="list-style-type: none"> • Engine crank authorisation circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B114013	Engine crank authorisation circuit open load	<ul style="list-style-type: none"> • Engine crank authorisation circuit high resistance 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B114211	Ignition supply status circuits 1 short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test ignition supply status circuits 1 for short to ground

B114213	Ignition supply status circuits 1 open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test ignition supply status circuits 1 for high resistance
B114311	Ignition supply status circuits 2 short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test ignition supply status circuits 2 for short to ground
B114313	Ignition supply status circuits 2 open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test ignition supply status circuits 2 for high resistance
B114411	Steering wheel heater supply circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test steering wheel heater supply circuit for short to ground
B114413	Steering wheel heater supply circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test steering wheel heater supply circuit for high resistance
B114611	Passive sounder supply circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test passive sounder supply circuit for short to ground
B114613	Passive sounder supply circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test passive sounder supply circuit for high resistance
B114711	Front left fog lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front left fog lamp control circuit for short to ground
B114713	Front left fog lamp control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front left fog lamp control circuit for high

			resistance
B114811	Front right fog lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front right fog lamp control circuit for short to ground
B114813	Front right fog lamp control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front right fog lamp control circuit for high resistance
B115A11	Front passenger seat heater supply circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front passenger seat heater supply circuit for short to ground
B115A13	Front passenger seat heater supply circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front passenger seat heater supply circuit for high resistance
B115B11	Front driver seat heater supply circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front driver seat heater supply circuit for short to ground
B115B13	Front driver seat heater supply circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front driver seat heater supply circuit for high resistance
B1A9801	LIN Bus short to ground or power	<ul style="list-style-type: none"> • General electrical failure 	Refer to the electrical circuit diagrams and test LIN Bus for short to ground or power
B1A9881	LIN Bus header error	<ul style="list-style-type: none"> • Invalid serial data received 	Refer to the electrical circuit diagrams and test LIN circuit to battery backed sounder for short to ground, power, high resistance

B1A9883	LIN Bus checksum error	<ul style="list-style-type: none"> Value of signal protection calculation incorrect 	Install a new CJB, refer to the new module installation note at the top of the DTC Index
B1B651C	Front left seat heater temperature sensor fault	<ul style="list-style-type: none"> Circuit voltage out of range 	Refer to the electrical circuit diagrams and test front left seat heater temperature sensor circuit for short to ground, power, high resistance
B1B661C	Front right seat heater temperature sensor fault	<ul style="list-style-type: none"> Circuit voltage out of range 	Refer to the electrical circuit diagrams and test front left seat heater temperature sensor circuit for short to ground, power, high resistance
B1C4323	Master light switch stuck	<ul style="list-style-type: none"> Signal stuck low 	Refer to the electrical circuit diagrams and test master light switch circuit for short to ground
B1C4523	Front wiper park position stuck	<ul style="list-style-type: none"> Signal stuck low 	Refer to the electrical circuit diagrams and test wiper park position switch circuit for short to ground
B1C7812	Powerwash relay control circuit short to power	<ul style="list-style-type: none"> Circuit short to power 	Refer to the electrical circuit diagrams and test powerwash relay control circuit for short to power
B1C7814	Powerwash relay control circuit open load or short to ground	<ul style="list-style-type: none"> Circuit short to ground or open 	Refer to the electrical circuit diagrams and test powerwash relay control circuit for high resistance or short to ground
B1C7911	Windshield washer pump control circuit short to ground or over temperature	<ul style="list-style-type: none"> Circuit short to ground 	Refer to the electrical circuit diagrams and test windshield washer pump control circuit for short to ground
B1C7913	Windshield washer pump control circuit open load	<ul style="list-style-type: none"> Circuit open 	Refer to the electrical circuit diagrams and test windshield washer pump control circuit for

			high resistance
B1C9811	Front left cornering lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front left cornering lamp control circuit for short to ground
B1C9813	Front left cornering lamp control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front left cornering lamp control circuit for high resistance
B1C9911	Front right cornering lamp control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front right cornering lamp control circuit for short to ground
B1C9913	Front right cornering lamp control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front right cornering lamp control circuit for high resistance
B1D0011	Front left low beam control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front left low beam control circuit for short to ground
B1D0013	Front left low beam control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front left low beam control circuit for high resistance
B1D0111	Front right low beam control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front right low beam control circuit for short to ground
B1D0113	Front right low beam control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front right low beam control circuit for high resistance

B1D0211	Front left high beam control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front left high beam control circuit for short to ground
B1D0213	Front left high beam control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front left high beam control circuit for high resistance
B1D0311	Front right high beam control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test front right high beam control circuit for short to ground
B1D0313	Front right high beam control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test front right high beam control circuit for high resistance
B1D1711	Battery backed sounder power circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test battery backed sounder power circuit for short to ground
B1D1787	Battery backed sounder reply failure	<ul style="list-style-type: none"> • Missing message 	Refer to the electrical circuit diagrams and test LIN Bus for short to ground, power or high resistance
B1D2711	Heater coolant pump control circuit short to ground or over temperature	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test heater coolant pump control circuit for short to ground
B1D2713	Heater coolant pump control circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test heater coolant pump control circuit for high resistance
P080111	Reverse inhibit to rear view mirror	<ul style="list-style-type: none"> • Circuit short to ground 	Refer to the electrical circuit diagrams and test reverse inhibit

	circuit short to ground or over temperature		to rear view mirror circuit for short to ground
P080113	Reverse inhibit to rear view mirror circuit open load	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test reverse inhibit to rear view mirror circuit for open load
U001088	Medium speed CAN communication Bus	<ul style="list-style-type: none"> • Bus Off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost communication with RJB	<ul style="list-style-type: none"> • Lost communication with RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with instrument cluster	<ul style="list-style-type: none"> • Lost communication with instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015600	Lost communication with Information and Entertainment module	<ul style="list-style-type: none"> • Lost Communication with Information and Entertainment module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U016400	Lost communication with climate control module	<ul style="list-style-type: none"> • Lost communication with climate control module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U019900	Lost communication with Driver Door Module (DDM)	<ul style="list-style-type: none"> • Lost communication with DDM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020000	Lost communication with Passenger Door Module	<ul style="list-style-type: none"> • Lost communication with PDM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

	(PDM)		
U020600	Lost communication with convertible top module	<ul style="list-style-type: none"> Lost communication with convertible top module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U021400	Lost communication with remote keyless entry module	<ul style="list-style-type: none"> Lost communication with remote keyless entry module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the CJB module, refer to the new module installation note at the top of the DTC Index
U030046	Internal control module software incompatibility	<ul style="list-style-type: none"> Calibration parameter failure 	Re-calibrate the CJB using the manufacturer approved diagnostic system
U1A1449	CAN initialisation failure	<ul style="list-style-type: none"> Internal electronic failure 	Install a new CJB, refer to the new module installation note at the top of the DTC Index
U201011	Switch illumination supply circuit short to ground or over temperature	<ul style="list-style-type: none"> Circuit short to ground 	Refer to the electrical circuit diagrams and test switch illumination supply circuit for short to ground
U201013	Switch illumination supply circuit open load	<ul style="list-style-type: none"> Circuit open 	Refer to the electrical circuit diagrams and test switch illumination supply circuit for high resistance
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new CJB, refer to the new module installation note at the top of the DTC Index

U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> • Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the CJB, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> • Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check CJB for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300316	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Auxiliary Junction Box (AJB) (86.70.55)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 . Release the auxiliary junction box access cover.

▶ Release from the clip.



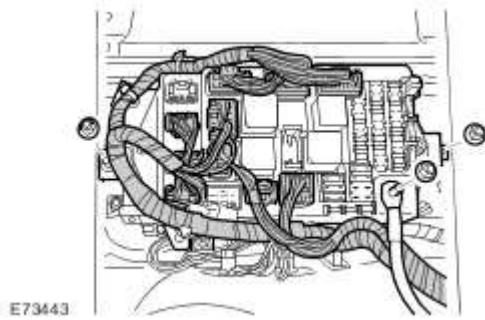
- 3 . Release the auxiliary junction box.

▶ Disconnect the 10 electrical connectors.

▶ Disconnect the battery positive cable.

- 4 . Remove the auxiliary junction box.

▶ Remove the 2 nuts.



Installation

1 . Install the auxiliary junction box.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

2 . Secure the auxiliary junction box.

▶ Connect the electrical connectors.

▶ Tighten the battery positive lead nut to 10 Nm (7 lb.ft).

3 . Secure the auxiliary junction box access cover.

▶ Secure in the clip.

4 . Connect the battery ground cable and install the cover.

For additional information, refer to

Central Junction Box (CJB) (86.70.72)

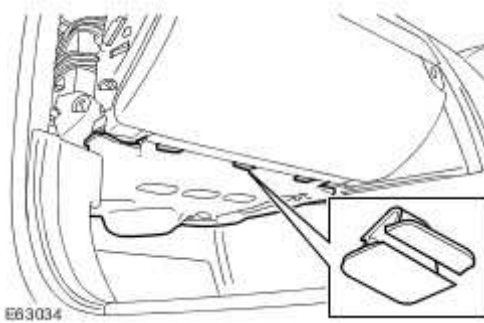
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

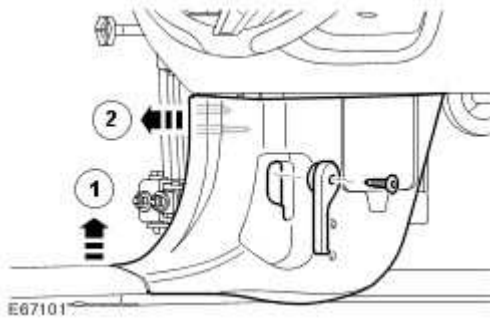
Remove the passenger side footwell trim panel.

- ▶ Remove the 3 clips.



- 3 . Remove the cowl side trim panel.

- ▶ Remove the Torx screw.
- ▶ Remove the hood release lever.
- ▶ Release the forward edge of the scuff plate trim panel.
- ▶ Carefully release the clips.

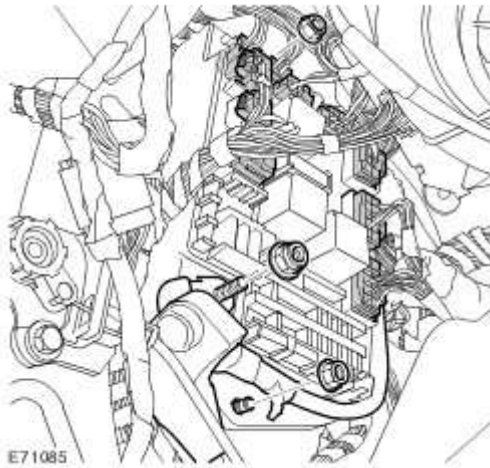


4 . Release the CJB.

- ▶ Release the battery positive cables.

5 . Remove the CJB.

- ▶ Disconnect the 10 electrical connectors.
- ▶ Remove the 2 nuts.



Installation

1 . Install the CJB.

- ▶ Disconnect the electrical connectors.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

2 . Secure the CJB.

▶ Attach the battery positive cables.

▶ Tighten the nut to 25 Nm (18 lb.ft).

3 . Install the cowl side trim panel.

▶ Align the pegs and secure the clip.

▶ Install the scuff plate trim panel.

▶ Install the hood release lever and secure with the screw.

4 . Install the passenger side footwell trim panel.

▶ Carefully secure the clips.

5 . Connect the battery ground cable and install the cover.

For additional information, refer to

6 . Using WDS, configure a new CJB.

418-01 : Module Configuration

Diagnosis and testing

Module Configuration

Principles of Operation

Module Configuration

There are two modes of configuration data. The first type requires configuration information so that the module can interact with the vehicle correctly. This information will be transferred to the new module using the manufacturer approved diagnostic system, so that it will contain the same settings as the old module.

New modules which require configuration after installation are:

- Anti-lock control - stability assist module
- Speed control module
- Climate control module
- Adaptive damping module
- Headlamp levelling module
- Driver door module (DDM)
- Driver seat module (DSM)
- Engine control module (ECM)
- Parking brake module
- Central Junction Box (CJB)
- Navigation system display module
- Integrated audio module (CD player)
- Information and entertainment module
- Integrated control panel
- Audio amplifier
- Instrument cluster
- Remote keyless entry (RKE) module
- Multimedia (navigation) module
- Parking aid module
- Passenger door module (PDM)
- Pedestrian protection system module
- Passenger seat module (PSM)
- Restraints control module (RCM)
- Rear Junction Box (RJB)
- Steering column lock
- Transmission control module (TCM)
- Telephone control module
- Tire pressure monitoring system

Customer Driven Preferences

The second type of configuration data is customer preference driven. These are items that the customer may or may not want to have enabled. Typically, customer preference items can be toggled on or off by the use of a compatible scan tool. You may need to ask the customer which preferences they had enabled prior to installation of a new module, although after installation they will automatically learn the settings by receiving information from existing modules.

To carry out the customer preference configuration process, use the manufacturer approved diagnostic system. Refer to the configuration menu and select 'Vehicle Configuration'. Customer options can be selected or de-selected by modifying the 'Car Configuration File'.

418-02 : Wiring Harnesses

Removal and installation

Engine Wiring Harness - 4.2L NA V8 - AJV8

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to


2

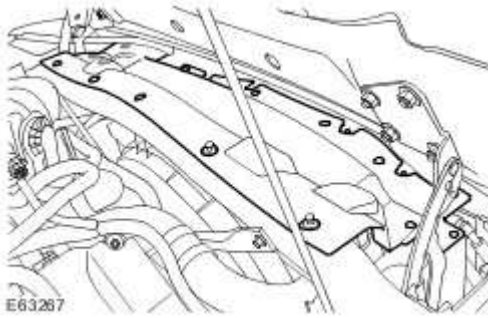


- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

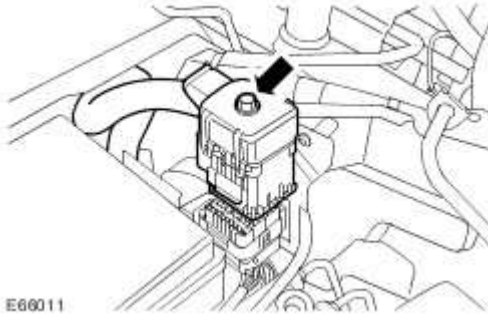
- 3 . Remove the engine cover.
For additional information, refer to Engine Cover (76.11.35)
- 4 . Remove the engine control module (ECM).
For additional information, refer to Engine Control Module (ECM) (18.30.01)
- 5 . Recover the A/C refrigerant.
- 6 . Remove the fan cowl.

 Remove the 15 clips.



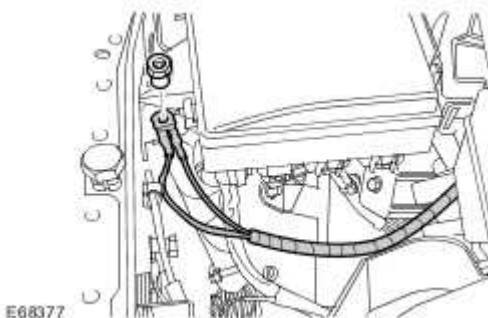
7 . Release and disconnect the engine wiring harness electrical connector.

▶ Fully loosen the bolt.



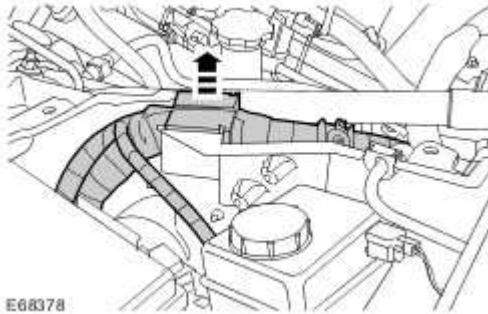
8 . Release the ground cable from the power distribution box bracket.

▶ Remove the nut.



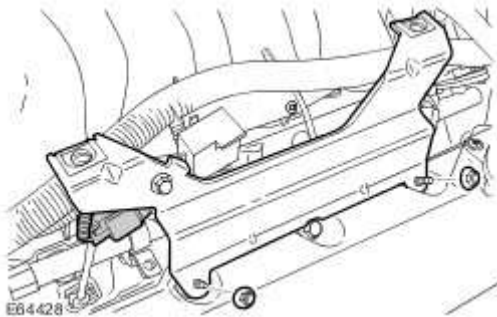
9 . Release the engine wiring harness from the engine compartment side wall.

- ▶ Release the grommet.



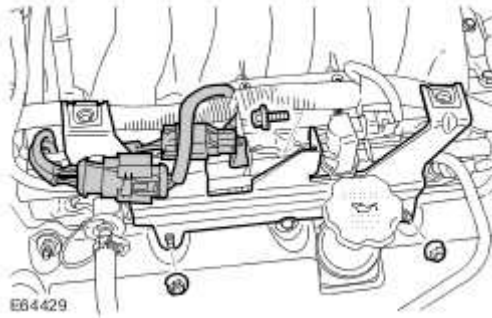
10 . Remove the engine cover RH bracket.

- ▶ Remove the 2 nuts.
- ▶ Disconnect the electrical connector.



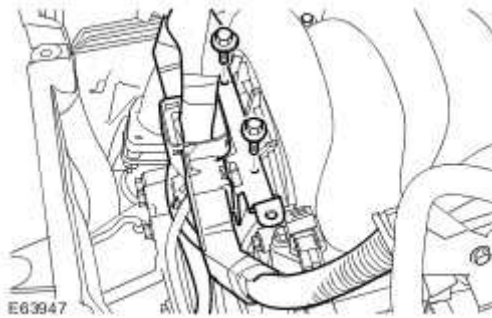
11 . Remove the engine cover LH bracket.

- ▶ Remove the 2 nuts.
- ▶ Release the 2 electrical connectors.
- ▶ Remove the purge valve bolt.



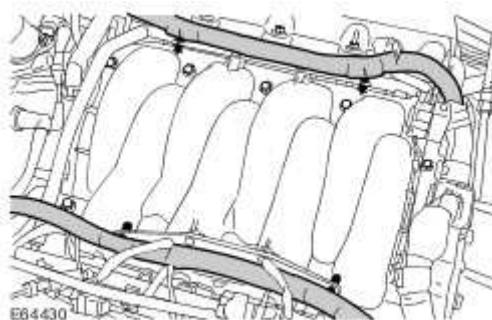
12 . Release the engine wiring harness from the rear of the engine.

▶ Remove the 2 bolts.

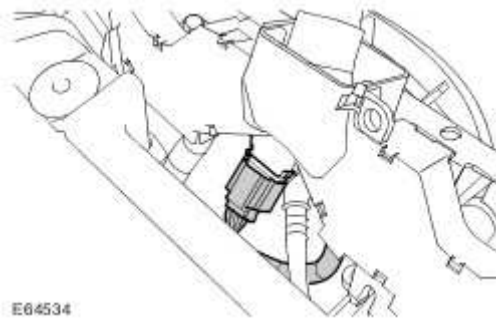


13 . Release the engine wiring harness from the intake manifold.

▶ Release the 4 clips.



14 . Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

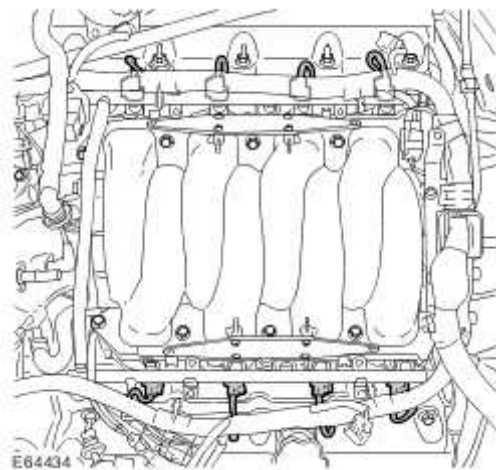


15 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.

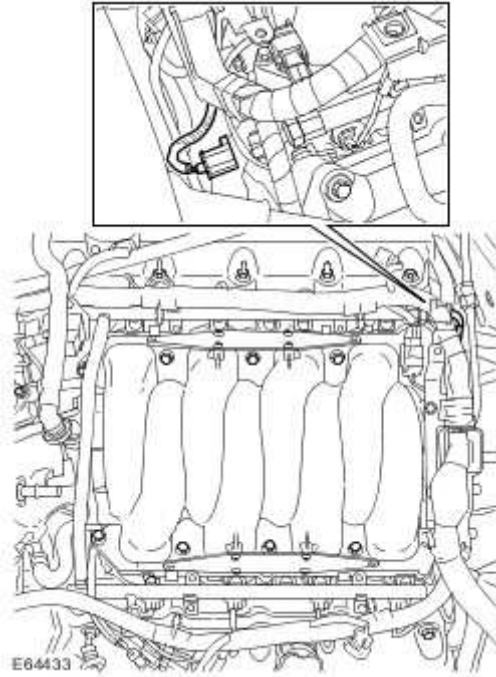
16 . Disconnect the knock sensors (KS) electrical connector.



17 . Disconnect the 8 fuel injector electrical connectors.



18 . Disconnect the fuel temperature sensor electrical connector.



19 . Disconnect the throttle position (TP) sensor electrical connector.



20 . Disconnect the exhaust gas recirculation (EGR) valve electrical connector.

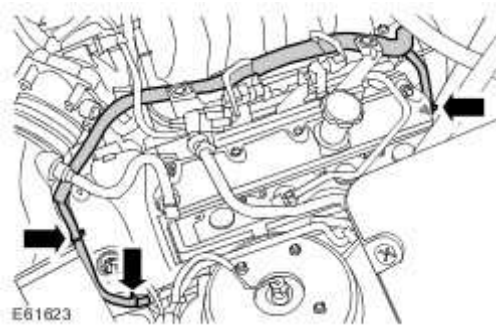


21 . **NOTE:**

LH illustration shown, RH is similar.

Release the engine wiring harness from the LH valve cover.

- ▶ Release the 3 clips.
- ▶ Repeat the above procedure for the RH side.

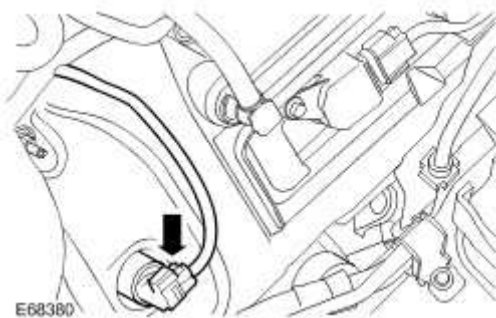


22 . **NOTE:**

LH illustration shown, RH is similar.

Disconnect the LH variable camshaft timing (VCT) oil solenoid electrical connector.

- ▶ Repeat the above procedure for the RH side.

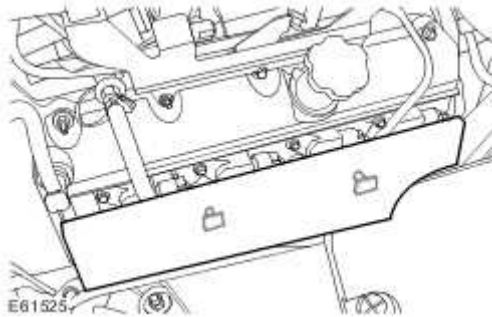


23 . **NOTE:**

LH illustration shown, RH is similar.

Remove the LH ignition coil-on-plug cover.

- ▶ Release from the 2 clips.
- ▶ Repeat the above procedure for the RH side.

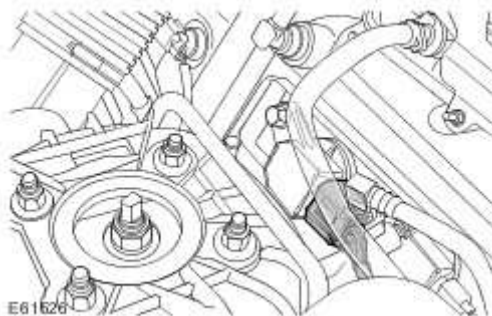


24 . NOTE:

LH illustration shown, RH is similar.

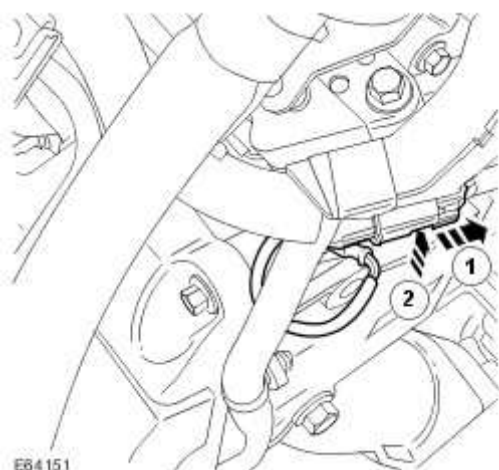
Disconnect the ignition coil-on-plug electrical connector.

- ▶ Repeat the above procedure for the remaining 7 coil-on- plugs.



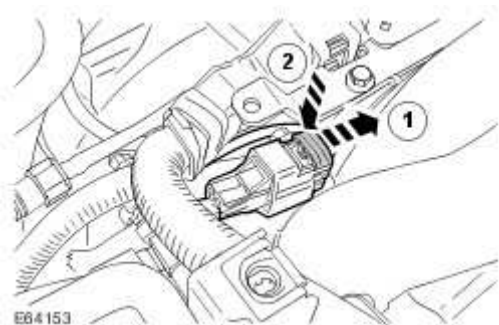
25 . Disconnect the LH camshaft position CMP sensor electrical connector.

- ▶ Slide the red connector latch to one side.

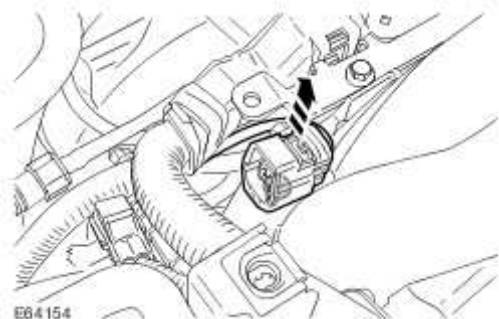


26 . Disconnect the RH CMP sensor electrical connector.

▶ Slide the red connector latch to one side.

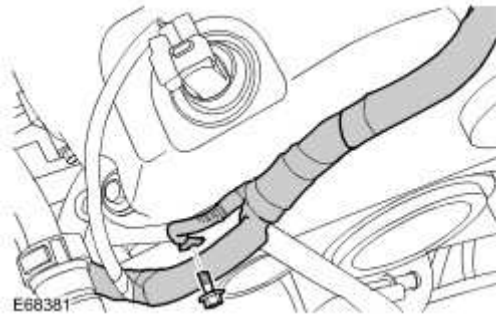


27 . Release the RH CMP sensor electrical connector.



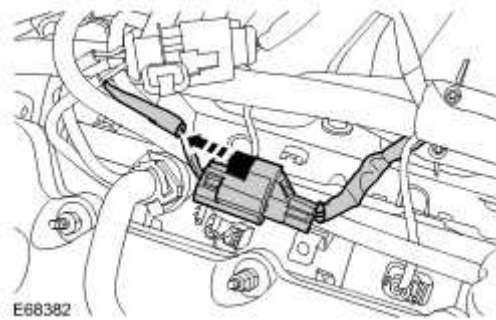
28 . Disconnect the engine front cover ground cable.

▶ Remove the bolt.



29 . Disconnect the engine coolant temperature (ECT) sensor electrical connector.

▶ Slide the red connector latch to one side.

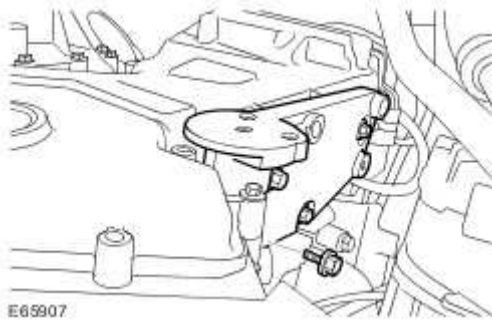


30 . Remove the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)

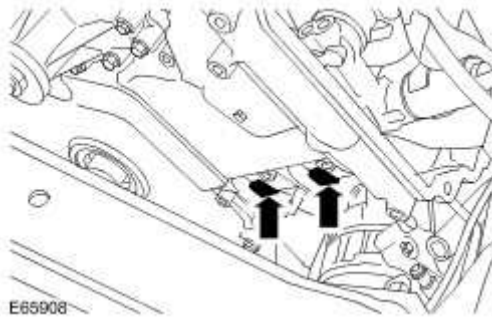
31 . Remove the power steering pump mounting bracket.

▶ Remove the 4 bolts.

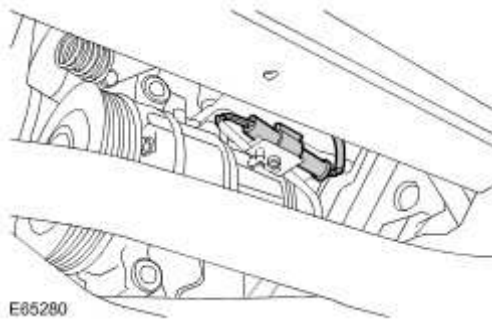


32 . LH side: Release the engine wiring harness.

▶ Release the 2 clips.

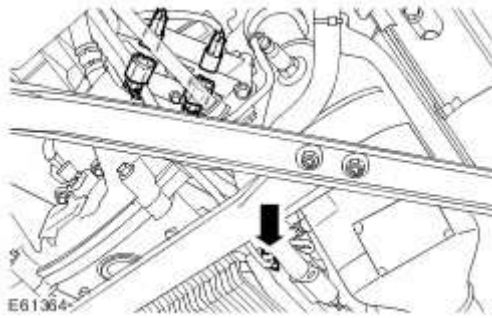


33 . Disconnect the A/C compressor electrical connector.



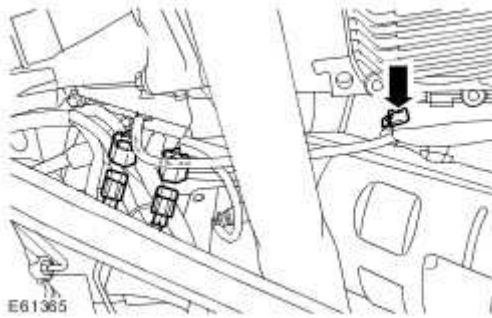
34 . Release and disconnect the 2 LH HO2S electrical connectors.

▶ Release the clip.



35 . Release and disconnect the 2 RH HO2S electrical connectors.

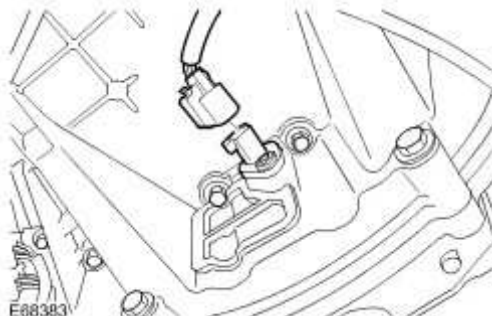
▶ Release the clip.



36 . **NOTE:**

Clean the components general area prior to dismantling.

Disconnect the crankshaft position (CKP) sensor electrical connector.



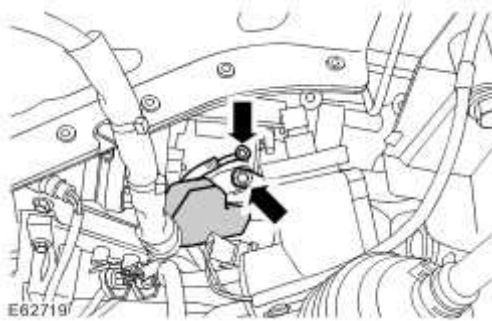
37 . Disconnect the starter motor battery positive and generator cables.

▶ Release the cover.

▶ Remove the nut.

38 . Disconnect the starter motor solenoid electrical connector.

▶ Remove and discard the nut.



39 . Disconnect the engine oil pressure (EOP) sensor electrical connector.

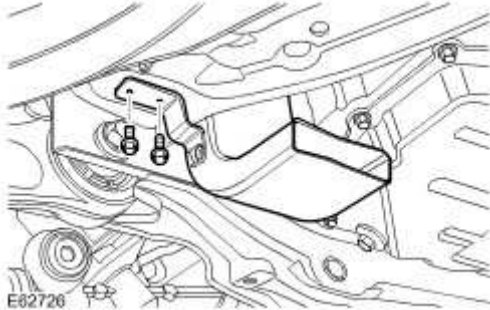


40 . Disconnect the engine oil temperature sensor electrical connector.



41 . Remove the generator cooling duct.

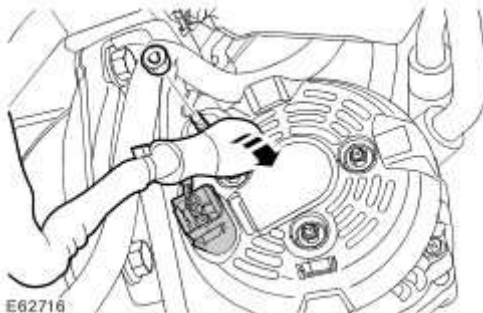
▶ Remove the 2 screws.



42 . Disconnect the generator electrical connectors.

▶ Release the cover.

▶ Remove the nut.

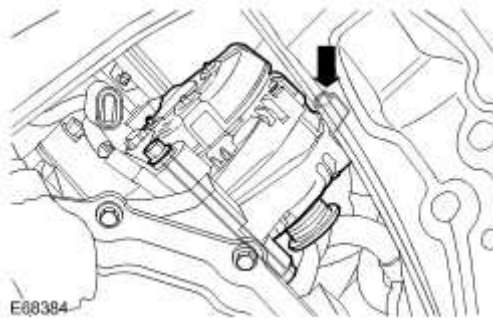


43 . Release the generator.

▶ Remove the nut.

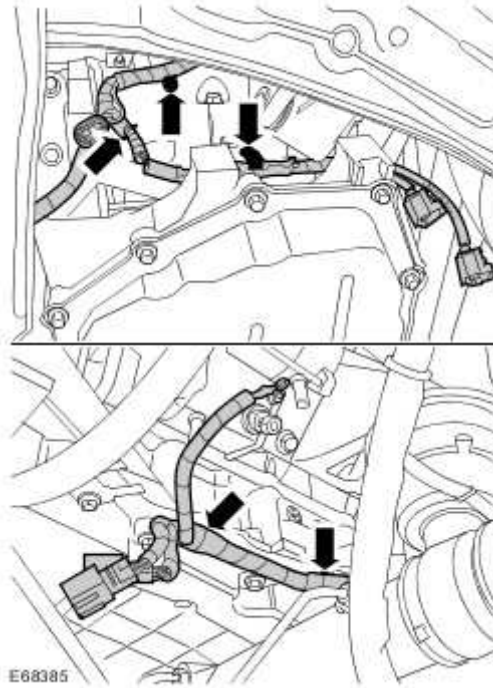
▶ Remove the nut and bolt.

▶ Position the generator aside to access the engine wiring harness clips.



44 . RH side: Release the engine wiring harness.

▶ Release the 5 clips.



45 . Remove the engine wiring harness.

Installation

1 . Install the engine wiring harness.

2 . RH side: Attach the wiring harness.

▶ Secure the clips.

3 . Install the generator.

▶ Tighten the nut to 25 Nm (18 lb.ft).

▶ Tighten the nut and bolt to 40 Nm (30 lb.ft).

4 . Connect the generator electrical connectors.

▶ Tighten the nut to 12 Nm (9 lb.ft).

▶ Secure the cover.

5 . Install the generator cooling duct.

▶ Tighten the screws.

6 . Connect the engine oil temperature sensor electrical connector.

7 . Connect the EOP sensor electrical connector.

8 . Connect the starter motor solenoid electrical connector.

▶ Tighten the new nut to 7 Nm (5 lb.ft).


9 . Connect the starter motor battery positive and generator cables.

▶ Tighten the nut to 10 Nm (7 lb.ft).

▶ Secure the cover.


10 . Connect the CKP sensor electrical connector.

11 . Connect and secure the HO2S electrical connectors.


 Secure the 2 clips.

12 . Connect the A/C compressor electrical connector.

13 . LH side: Attach the wiring harness.

 Secure the clips.

14 . Install the power steering pump mounting bracket.

 Tighten the bolts to 25 Nm (18 lb.ft).

15 . Install the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L NA V8 - AJV8 (57.20.14)

16 . Connect and secure the ECT sensor electrical connector.


17 . Connect the engine front cover ground cable.

 Tighten the bolt to 10 Nm (7 lb.ft).

18 . Connect and secure the CMP sensor electrical connectors.


19 . Connect the ignition coil-on-plug electrical connectors.

20 . Install the ignition coil-on-plug covers.

 Position and secure the clips.

21 . Connect the VCT solenoid electrical connectors.

22 . Attach the engine wiring harness to the valve covers.

 Secure with the clips.

23 . Connect the EGR valve electrical connector.

24 . Connect the TP sensor electrical connector.

25 . Connect the fuel temperature sensor electrical connector.


26 . Connect the fuel injector electrical connectors.

27 . Connect the KS electrical connector.

28 . Connect the FRP sensor electrical connector.

29 . Connect the MAP sensor electrical connector.

30 . Attach the engine wiring harness to the intake manifold.

 Secure with the clips.

31 . Attach the engine wiring harness to the rear of the engine.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

32 . Install the engine cover LH bracket.

▶ Attach the purge valve, align the peg and tighten the bolt to 6 Nm (4 lb.ft).

▶ Secure the electrical connectors.

▶ Tighten the nuts to 6 Nm (4 lb.ft).

33 . Install the engine cover RH bracket.

▶ Connect the electrical connector.

▶ Tighten the nuts to 6 Nm (4 lb.ft).

34 . Attach the ground cable to the power distribution box bracket.

▶ Tighten the nuts to 25 Nm (18 lb.ft).


35 . Attach the engine wiring harness to the engine compartment side wall.

▶ Position and secure the grommet.

36 . Connect the engine wiring harness electrical connector and secure with the captive bolt.

37 . Recharge the A/C system.

38 . Install the fan cowl.

 Secure with the clips.

39 . Install the ECM.

For additional information, refer to Engine Control Module (ECM) (18.30.01)

40 . Install the engine cover.

For additional information, refer to Engine Cover (76.11.35)

41 . Connect the battery ground cable and install the cover.

For additional information, refer to

Engine Wiring Harness - 4.2L SC V8 - AJV8

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications


2

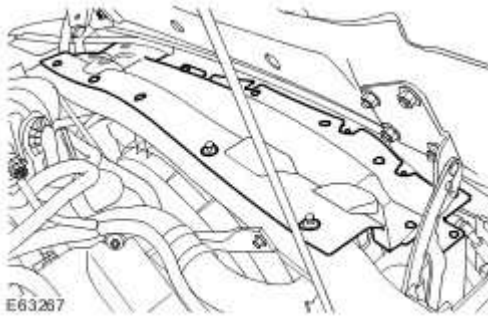


WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

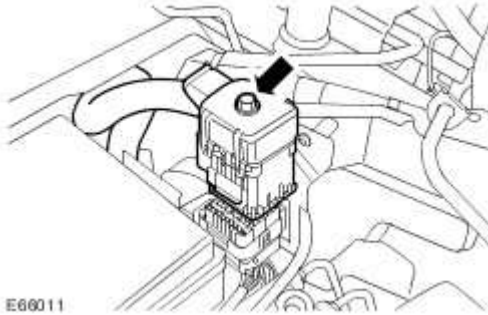
- 3 . Remove the intake air resonator.
For additional information, refer to Intake Air Resonator
- 4 . Remove the engine control module (ECM).
For additional information, refer to Engine Control Module (ECM) (18.30.01)
- 5 . Recover the A/C refrigerant.
- 6 . Remove the fan cowl.

 Remove the 15 clips.



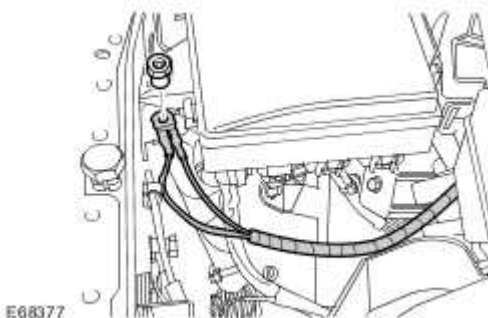
7 . Release and disconnect the engine wiring harness electrical connector.

▶ Fully loosen the bolt.



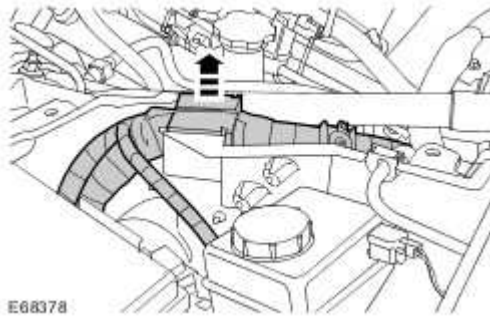
8 . Release the ground cable from the power distribution box bracket.

▶ Remove the nut.



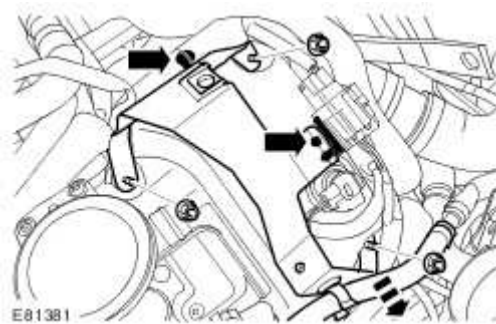
9 . Release the engine wiring harness from the engine compartment side wall.

- ▶ Release the grommet.



- 10 . Remove the engine cover RH bracket.

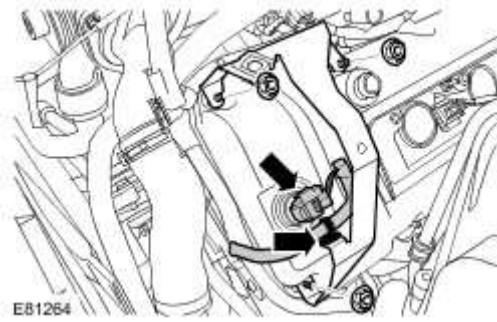
- ▶ Remove the 3 nuts.
- ▶ Release the 2 wiring harness clips.
- ▶ Release the hose.



- 11 . Disconnect the LH variable camshaft timing (VCT) oil control solenoid electrical connector.

- 12 . Remove the engine cover LH bracket.

- ▶ Remove the 3 nuts.
- ▶ Release the wiring harness.

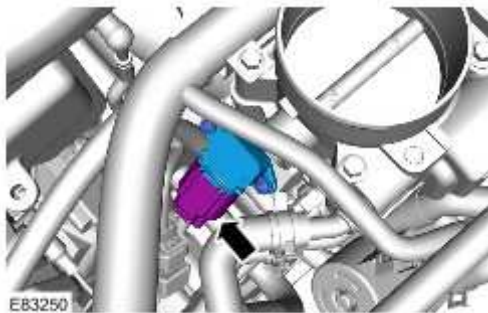


13 . Release the wiring harness from the rear of the engine.

▶ Remove the 2 bolts.



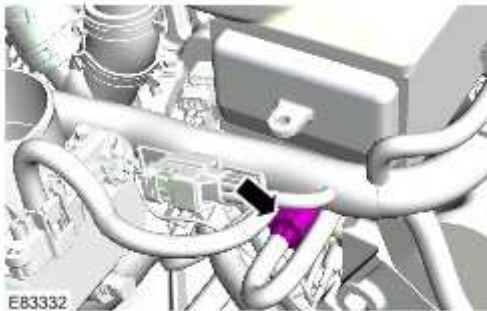
14 . Disconnect the manifold absolute pressure (MAP) sensor electrical connector.



15 . Disconnect the knock sensors (KS) electrical connector.



16 . Disconnect the fuel temperature sensor electrical connector.



17 . Disconnect the throttle position (TP) sensor electrical connector.



18 . Disconnect the exhaust gas recirculation (EGR) valve electrical connector.



19 . Disconnect the purge control valve (PCV) electrical connector.

▶ Release the wiring harness.



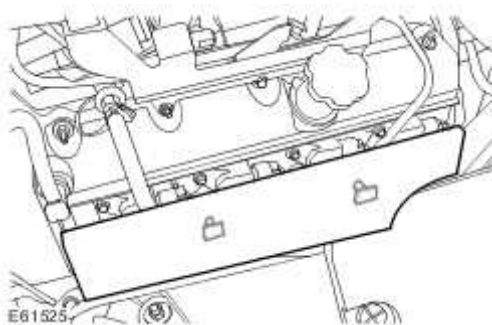
20 . **NOTE:**

LH illustration shown, RH is similar.

Remove the ignition coil-on-plug cover.

▶ Release from the 2 clips.

▶ Repeat the above procedure for the RH side.

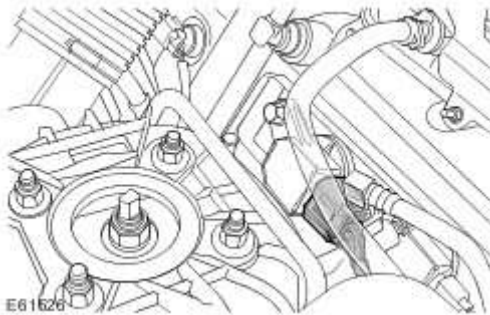


21 . **NOTE:**

LH illustration shown, RH is similar.

Disconnect the ignition coil-on-plug electrical connector.

- ▶ Repeat the above procedure for the remaining 7 coil-on-plugs.

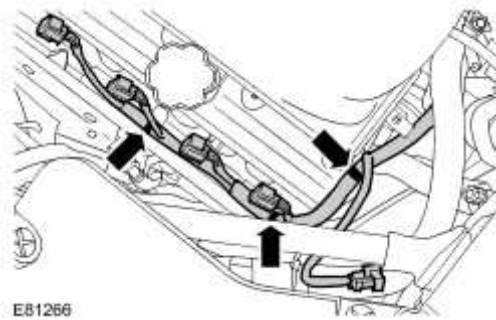


22 . NOTE:

LH illustration shown, RH is similar.

Release the coil-on-plug wiring harness.

- ▶ Release the 3 clips.
- ▶ Repeat the above procedure for the RH side.



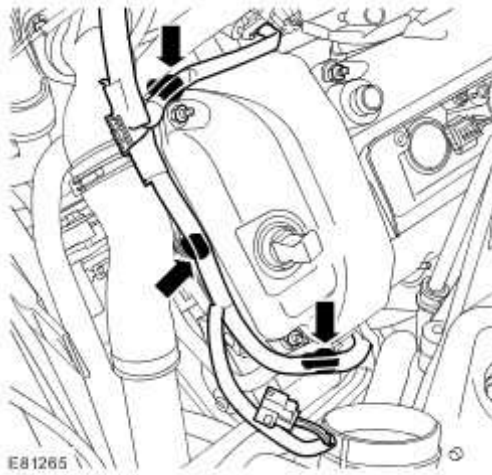
23 . NOTE:

LH illustration shown, RH is similar.

Release the engine wiring harness from the valve cover.

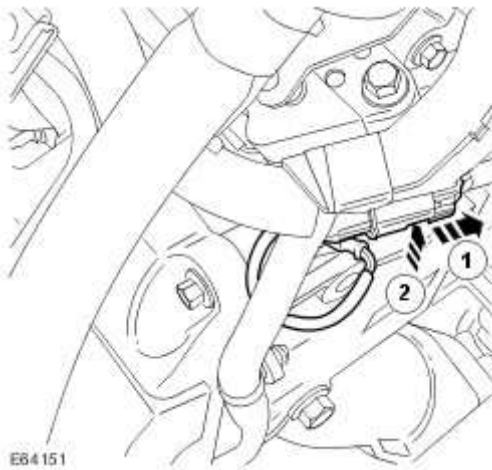
▶ Release the 3 clips.

▶ Repeat the above procedure for the RH side.



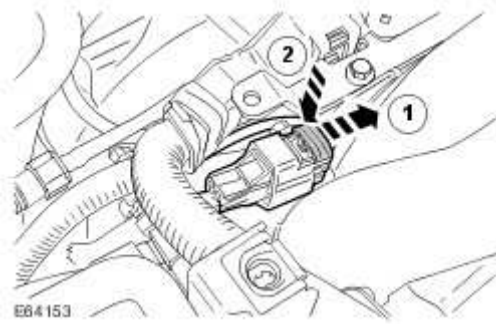
24 . Disconnect the LH camshaft position CMP sensor electrical connector.

▶ Slide the red connector latch to one side.



25 . Disconnect the RH CMP sensor electrical connector.

▶ Slide the red connector latch to one side.



26 . Disconnect the LH fuel injector wiring harness electrical connector.

▶ Slide the red connector latch to one side.

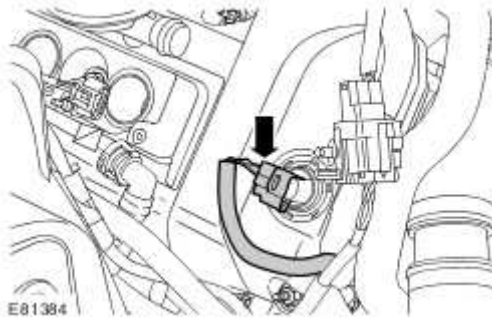


27 . Disconnect the RH fuel injector wiring harness electrical connector.

▶ Slide the red connector latch to one side.



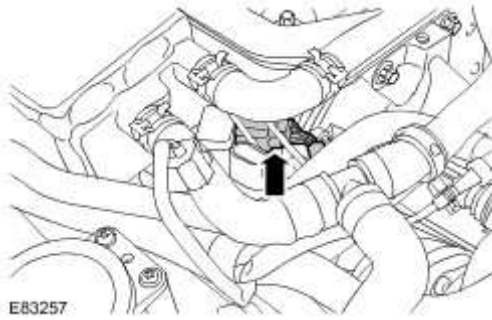
28 . Disconnect the variable camshaft timing (VCT) oil control solenoid electrical connector.



29 . Disconnect the fuel rail pressure (FRP) sensor electrical connector.



30 . Disconnect the intake air temperature (IAT) sensor electrical connector.



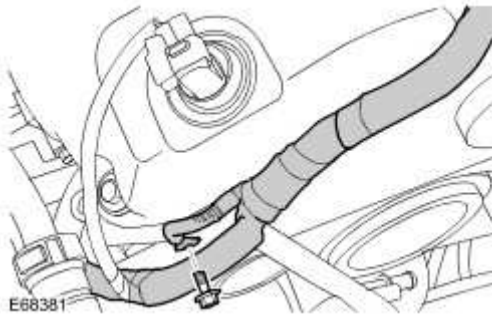
31 . Disconnect the RH mass air flow (MAF) sensor electrical connector.

▶ Slide the red connector latch to one side.



32 . Disconnect the engine front cover ground cable.

▶ Remove the bolt.



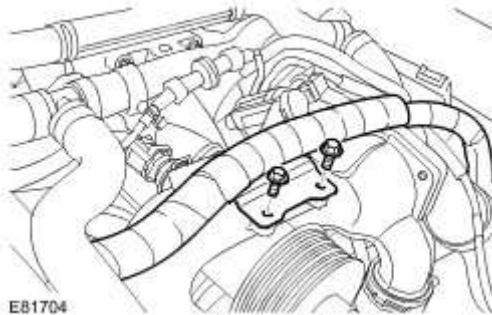
33 . Disconnect the secondary air injection switching valve electrical connector.



34 . Disconnect the engine coolant temperature (ECT) sensor electrical connector.

35 . Release the engine wiring harness from the coolant manifold.

▶ Remove the 2 bolts.



36 . Remove the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L SC V8 - AJV8 (57.20.14)

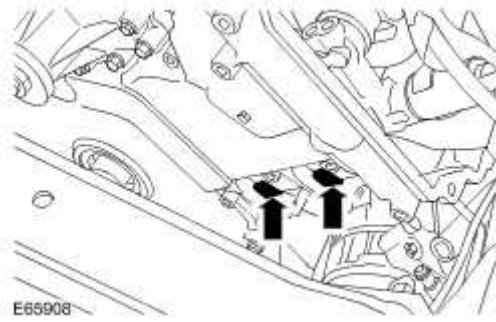
37 . Remove the power steering pump mounting bracket.

▶ Remove the 4 bolts.

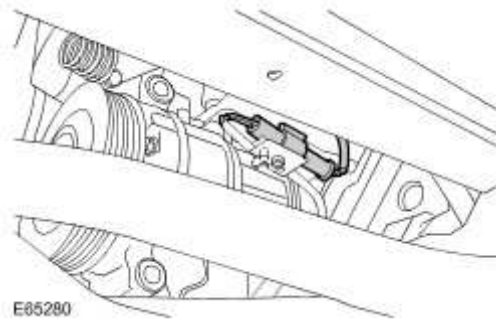


38 . LH side: Release the engine wiring harness.

▶ Release the 2 clips.

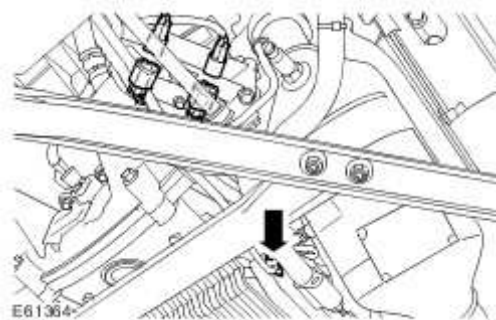


39 . Disconnect the A/C compressor electrical connector.



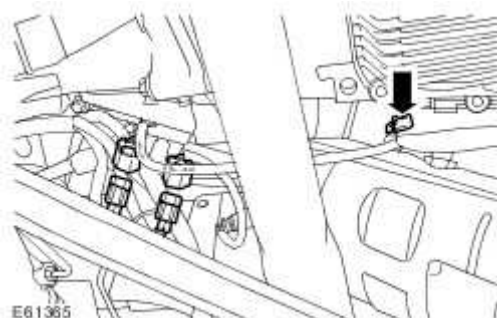
40 . Release and disconnect the 2 LH HO2S electrical connectors.

▶ Release the clip.



41 . Release and disconnect the 2 RH HO2S electrical connectors.

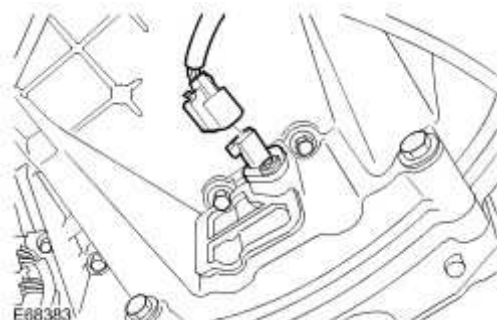
▶ Release the clip.



42 . **NOTE:**

Clean the components general area prior to dismantling.

Disconnect the crankshaft position (CKP) sensor electrical connector.



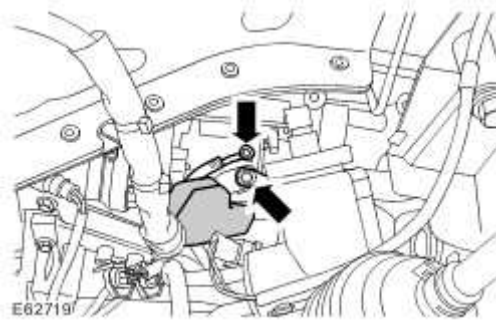
43 . Disconnect the starter motor battery positive and generator cables.

▶ Release the cover.

▶ Remove the nut.

44 . Disconnect the starter motor solenoid electrical connector.

▶ Remove and discard the nut.



45 . Disconnect the engine oil pressure (EOP) sensor electrical connector.

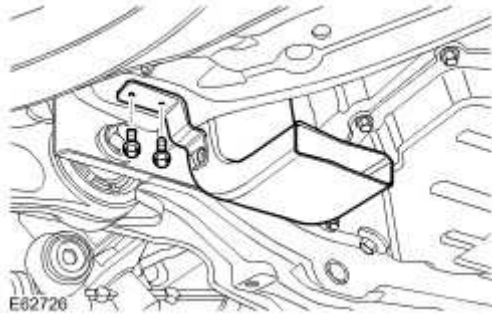


46 . Disconnect the engine oil temperature sensor electrical connector.



47 . Remove the generator cooling duct.

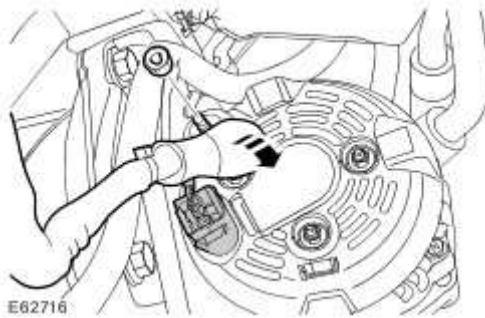
▶ Remove the 2 screws.



48 . Disconnect the generator electrical connectors.

▶ Release the cover.

▶ Remove the nut.

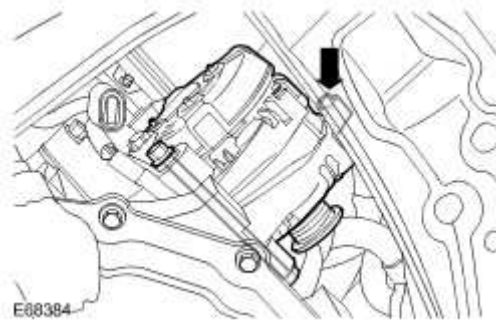


49 . Release the generator.

▶ Remove the nut.

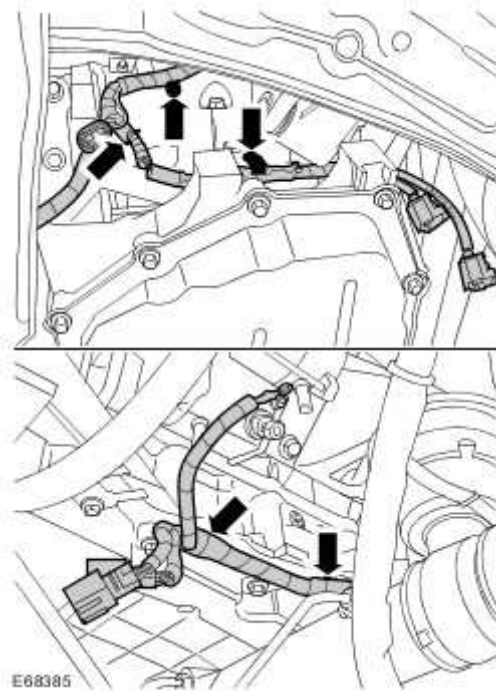
▶ Remove the nut and bolt.

▶ Position the generator aside to access the engine wiring harness clips.



50 . RH side: Release the engine wiring harness.

▶ Release the 5 clips.



51 . Remove the engine wiring harness.

Installation

1 . Install the engine wiring harness.

2 . RH side: Attach the wiring harness.

▶ Secure the clips.

3 . Install the generator.

▶ Tighten the nut to 25 Nm (18 lb.ft).

▶ Tighten the nut and bolt to 40 Nm (30 lb.ft).

4 . Connect the generator electrical connectors.

▶ Tighten the nut to 12 Nm (9 lb.ft).

▶ Secure the cover.

5 . Install the generator cooling duct.

▶ Tighten the screws.

6 . Connect the engine oil temperature sensor electrical connector.

7 . Connect the EOP sensor electrical connector.

8 . Connect the starter motor solenoid electrical connector.

▶ Tighten the new nut to 7 Nm (5 lb.ft).


9 . Connect the starter motor battery positive and generator cables.

▶ Tighten the nut to 10 Nm (7 lb.ft).

▶ Secure the cover.


10 . Connect the CKP sensor electrical connector.

11 . Connect and secure the HO2S electrical connectors.


 Secure the 2 clips.

12 . Connect the A/C compressor electrical connector.

13 . LH side: Attach the wiring harness.

 Secure the clips.


14 . Install the power steering pump mounting bracket.

 Tighten the bolts to 25 Nm (18 lb.ft).

15 . Install the power steering pump.

For additional information, refer to Power Steering Pump - 4.2L SC V8 - AJV8 (57.20.14)


16 . Attach the engine wiring harness to the coolant manifold.

 Tighten the bolts to 6 Nm (4 lb.ft).

17 . Connect and secure the ECT sensor electrical connector.

18 . Connect the secondary air injection switching valve electrical connector.

19 . Connect the engine front cover ground cable.

 Tighten the bolt to 10 Nm (7 lb.ft).

20 . Connect the MAF sensor electrical connector.

21 . Connect the IAT sensor electrical connector.


22 . Connect the FRP sensor electrical connector.

23 . Connect and secure the fuel injector wiring harness electrical connectors.


24 . Connect and secure the CMP sensor electrical connectors.

25 . Connect the ignition coil-on-plug electrical connectors.


26 . Attach the coil-on-plug wiring harness.

 Secure with the clips.


27 . Attach the engine wiring harness to the valve covers.

 Secure with the clips.

28 . Connect the PCV electrical connector.

 Secure the wiring harness.

29 . Install the ignition coil-on-plug covers.

 Position and secure the clips.

30 . Connect the VCT solenoid electrical connectors.

31 . Connect the EGR valve electrical connector.

32 . Connect the TP sensor electrical connector.


33 . Connect the fuel temperature sensor electrical connector.

34 . Connect the KS electrical connector.


35 . Connect the FRP sensor electrical connector.


36 . Connect the MAP sensor electrical connector.

37 . Attach the engine wiring harness to the rear of the engine.


 Tighten the bolts to 10 Nm (7 lb.ft).


38 . Install the engine cover LH bracket.


 Tighten the nuts to 6 Nm (4 lb.ft).

 Attach the wiring harness.


39 . Install the engine cover RH bracket.

 Tighten the nuts to 6 Nm (4 lb.ft).

 Secure the wiring harness.

 Secure the hose.

40 . Attach the ground cable to the power distribution box bracket.

 Tighten the nuts to 25 Nm (18 lb.ft).


41 . Attach the engine wiring harness to the engine compartment side wall.

 Position and secure the grommet.

42 . Connect the engine wiring harness electrical connector and secure with the captive bolt.

43 . Recharge the A/C system.

44 . Install the fan cowl.

 Secure with the clips.

45 . Install the ECM.

For additional information, refer to Engine Control Module (ECM) (18.30.01)

46 . Install the intake air resonator.

For additional information, refer to Intake Air Resonator

47 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

419 : Electronic Feature Group

419-01A : Anti-theft - Active

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Antenna - bolt	5	-	44
Anti-theft alarm horn - nut	8	-	71
Battery backed sounder to bracket - nut	6	-	53
Battery backed sounder bracket to body - nut	8	-	71
Intrusion sensors - nut/screw	2	-	18
Keyless vehicle module - nut	5	-	44

Description and operation

Anti-Theft - Active

Authoring Template

COMPONENT LOCATION

Item	Part Number	Description
1		Keyless vehicle module
2		Left Hand (LH) and Right Hand (RH) door latch micro switches
3		Central Door Locking (CDL) RF receiver
4		Liftgate latch micro switch
5		Slave intrusion detection module
6		Intrusion detection module
7		Hood ajar switch
8		Passive anti-theft alarm horn (if fitted)
9		Battery backed sounder (if fitted) or battery backed sounder with tilt sensor (if fitted)
10		Vehicle horns

INTRODUCTION

The active anti-theft system monitors the hinged panels for unauthorized opening. In some markets the anti-theft system also incorporates monitoring of the vehicle interior and vehicle tilt sensing.

The active anti-theft alarm system is controlled by the following body system control modules:

- Central Junction Box (CJB)
- LH door module
- RH door module

- Auxiliary junction box
- Keyless vehicle module
- Instrument cluster.

The CJB is the main controller in the system. The CJB controls the following security functions, in addition to other vehicle functions:

- Locking, double locking and unlocking
- Monitoring of hinged panel microswitches and panel ajar states
- Microwave intrusion detection modules
- Anti-theft horns or battery backed sounder
- Passive arming and disarming
- Panic alarm function
- Transceiver coil and transponder reading
- Valet function (via Touch Screen Display (TSD))
- Interior lighting.

Two levels of vehicle locking are available; perimeter mode locks all opening panels and volumetric mode (if fitted) monitors the vehicle interior for intrusion and incorporates a tilt sensor to monitor if the vehicle is being moved.

Door Modules

The door modules provide the interface between the door latch motors, the door and latch microswitches and the CJB. The door modules provide door microswitch switch status information and enable the door motors on request from the CJB or the keyless vehicle module. Additionally, the door modules also control the exterior mirror functions. For additional information, refer to Rear View Mirrors (501-09)

Auxiliary Junction Box and Central Junction Box (CJB)

The auxiliary junction box controls, in conjunction with the CJB:

- the horns
- the liftgate latch motors and microswitches (including the liftgate external release switch)
- the liftgate ajar switch
- the turn signal indicators
- the fuel filler flap operation

The auxiliary junction box is also has a connection to the Restraints Control Module (RCM) for automatic operation of the interior lights and the turn signal indicators in the event of an accident.

The CJB and auxiliary junction box are both fitted with an anti-theft sense line. If the auxiliary junction box is disconnected when the alarm system is active, the full alarm will be activated by the CJB. If the CJB is disconnected when the alarm system is active, the auxiliary junction box takes control of the security system and sounds the full alarm. The alarm will also be activated if the instrument cluster is disconnected when the active anti-theft alarm system is active.

NOTE:

If the CJB is replaced, the new module will require configuring to the master car configuration using the Integrated Diagnostic System (IDS).

The CJB automatically arms and disarms the active anti-theft system when the vehicle is locked and unlocked after successful confirmation that a valid remote handset/smart key has been used.

Keyless Vehicle Module

The keyless vehicle module interfaces with the CDL RF receiver and collects RF signal information which is transmitted from the Smart Key. This information is translated into commands which are passed on the medium speed Controller Area Network (CAN) bus to the CJB, auxiliary junction box, the door modules and the instrument cluster.

The keyless vehicle module also monitors the liftgate external release switch, 2 interior antennae, 1 luggage compartment antenna and an additional rear bumper antenna and 2 door handle antennae if the passive entry system is fitted.

On vehicles with passive entry, the additional fast latch motors are controlled via the keyless vehicle module and the locking status is passed to the CJB on the medium speed CAN bus.

Instrument Cluster

The instrument cluster controls the alarm indicator which is incorporated into the sunload/light sensor mounted on the instrument panel.

The instrument cluster also controls, in conjunction with the Engine Control Module (ECM), the engine immobilization. The ECM controls the engine crank and fuel functions and the instrument cluster processes the valid transponder information.

Alarm Indicator

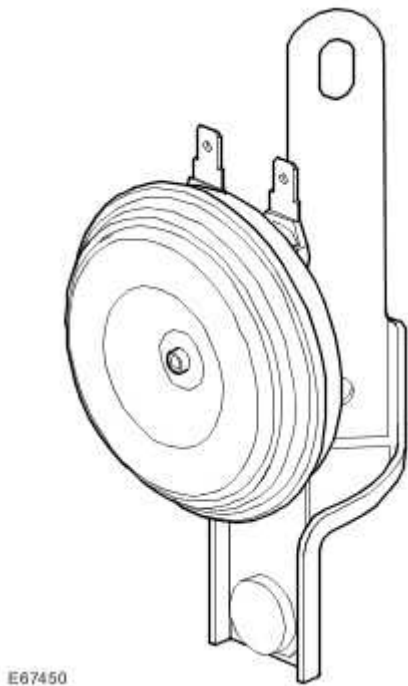
The alarm indicator is a Light Emitting Diode (LED) located in the body of the sunload/light sensor. When the ignition is off the indicator gives a visual indication of the active anti-theft system to show if the alarm system set or unset.

When the ignition is on, the indicator provides a visual indication of the status of the passive anti-theft (engine immobilization) system. If the immobilization system is operating correctly, the LED will be illuminated for 3 seconds at ignition on and then extinguish.

If a fault exists in the immobilization system, the LED will be either permanently illuminated or flashing for 60 seconds. This indicates that a fault exists and fault code has been recorded. After the 60 second period the LED will flash at different frequencies which indicate the nature of the fault. For additional information, refer to Anti-Theft - Active (419-01A)

Operation of the alarm indicator is controlled by the instrument cluster which varies the flash rate of the LED to indicate the system status of the alarm and the immobilization systems.

Passive Anti-Theft Horn (if fitted)



The passive anti-theft horn is located in the RH rear corner of the engine compartment and attached to the bulkhead. The anti-theft horn is connected directly to the CJB which activates the anti-theft horn when the alarm is triggered.

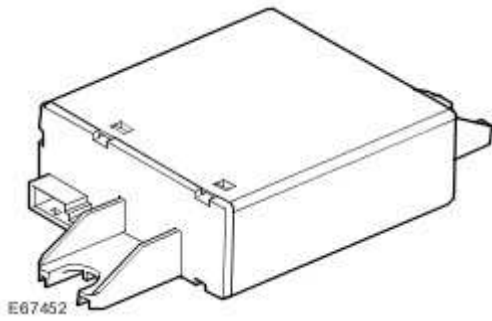
Battery Backed Sounder (if fitted)

The battery backed sounder is located in the RH rear corner of the engine compartment and attached to the bulkhead.

On vehicles with a battery backed sounder, a tilt sensor can be incorporated which monitors the vehicle attitude. The CJB monitors the tilt sensor and can detect if the vehicle is being moved, towed or raised and activate the alarm system. The type of battery backed sounder can be identified by a suffix change to the part number; sounders without a tilt sensor have the suffix AA and sounders incorporating a tilt sensor have the suffix BA.

Operation of the sounder is controlled by the CJB on a Local Interconnect Network (LIN) bus. The sounder is also connected with a permanent battery supply via the CJB. An integral, rechargeable battery powers the sounder if the battery power supply from the CJB is interrupted.

Intrusion Detection Modules



The intrusion detection modules are an optional fitment in some markets and are not available in other markets. Two intrusion detection modules are fitted. One module is located on the front of the floor console and monitors the front seat area, the second module is fitted at the rear of the floor console and monitors the rear seat area. The modules are wired together in parallel with the forward module being the master and the rearward module being the slave module.

Each intrusion detection module comprises two microwave sensors which allow the interior of the vehicle to be monitored. The intrusion detection modules also monitor the vehicle interior on soft top models when the soft top is down.

The intrusion detection modules are activated with the volumetric mode which in turn is enabled when the vehicle is double locked. The vehicle can be locked and alarmed with the module de-activated if a pet is to be left in the vehicle for example by single locking the active anti-theft system. The intrusion detection modules can also be de-activated by deselecting the 'Intrusion/Tilt' option in the 'Vehicle Settings' screen on the Touch Screen Display (TSD).

NOTE:

The TSD method of de-activation of the intrusion detection modules is only for one arm cycle. They will revert to active once the vehicle is subsequently unlocked and then locked.

When the volumetric mode is active, if the vehicle battery voltage falls to below 9 volts, the CJB will ignore any inputs from the modules to prevent false alarm activation.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN Bus

Item	Part	Description
------	------	-------------

	Number	
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Steering column lock
5		CJB
6		Power distribution box
7		Vehicle horns
8		Liftgate latch ajar switch
9		Intrusion detection module
10		Slave intrusion detection module
11		Keyless vehicle module
12		Hood ajar switch
13		CDL RF receiver
14		Instrument cluster
15		Light sensor (security LED)
16		RH door module
17		LH door module
18		LH door latch ajar switch
19		RH door latch ajar switch
20		Battery backed sounder (if fitted) or battery backed sounder with tilt sensor (if fitted)
21		Passive anti-theft alarm horn (if fitted)

PRINCIPLES OF OPERATION

The CJB automatically arms and disarms the active anti-theft system when it operates the Central Locking System (CLS).

On vehicles without intrusion detection modules, only the perimeter mode is available to monitor the hinged panels and the validity of the Smart key.

When perimeter mode is active, the CJB monitors panel ajar micro switches located in the latch mechanisms of the driver and passenger doors and the liftgate. A separate hood ajar micro switch, located in the engine compartment, monitors the hood status.

When volumetric mode is active, the CJB monitors the interior of the vehicle for movement using 2 microwave intrusion detection modules located within the center console.

Arming

On vehicles without intrusion detection modules and a tilt sensor, the active anti-theft system is armed in the perimeter mode when the vehicle is either locked or double locked.

On vehicles fitted with intrusion detection modules, the system has 2 modes of operation; perimeter mode and volumetric mode.

Perimeter Mode

- Perimeter mode only monitors the hinged panels and validity of the remote handset/smart key in the start control module. Perimeter mode is activated by a single press of the lock button on either the Smart key or the door handle lock button on vehicles with the Passive Entry system.

Volumetric Mode

- Volumetric mode monitors the vehicle interior for intrusion. If the vehicle is fitted with a battery backed sounder, which incorporates a tilt sensor, the vehicle attitude is also monitored when volumetric mode is active. Volumetric mode is activated by a second press of the lock button on either the Smart Key or the door handle lock button on vehicles with the Passive Entry system. The second press of either lock button must occur within 3 seconds of the first press. The second press of the lock button also activates the perimeter mode double locking feature.

The CJB arms the active anti-theft system when it locks or double locks the vehicle providing the following conditions are met:

- All doors, liftgate and hood are closed
- The Smart key is not sensed inside the vehicle

- With no valid Smart Key outside of the vehicle
- The CJB is not in transit mode.

When the vehicle has successfully completed its locking routine, confirmation will be given by a long single flash of the turn signal indicators to indicate the locked condition. If double locking is activated then confirmation will be given by a double flash of the turn signal indicators, one flash for locked and one long flash for double locked. In certain markets an audible warning is emitted to confirm arming or double locking.

Mislock

If any doors, liftgate or hood is open when a lock or double lock request is received, the anti-theft alarm system remains disarmed and the CJB generates a short mislock sound on the vehicle horns, battery backed sounder or passive anti-theft horn and the turn signal indicators will not flash. Each attempt to lock will be confirmed by two audible chimes being emitted.

When the CJB arms the active anti-theft alarm system, it first enables perimeter mode and monitors the status of the hinged panels. If the vehicle is double locked and the vehicle is fitted with a battery backed sounder, an arming signal is sent from the CJB to enable the sounder. If the vehicle is fitted with intrusion detection modules, the CJB then sends an arming signal to the modules and the tilt sensor when double locked. The CJB ignores the signals from the intrusion detection modules for the first 30 seconds to allow time for the vehicle interior to settle and prevent false alarm activation.

If the liftgate is opened via the Smart Key or external mechanical lock the intrusion detection modules and the tilt sensor are inhibited until the liftgate is closed.

Disarming

The CJB will disarm the active anti-theft system when it receives an unlock request from the Smart Key or, on vehicles with Passive Entry, when the Smart Key is sensed and the driver's or passenger door handles are pulled.

The CJB can selectively disarm parts of the active anti-theft system to prevent false alarm activation under certain conditions as follows:

- When the vehicle active anti-theft alarm system is armed in volumetric mode, if the vehicle battery voltage decreases to less than 9 V, the CJB will disable the volumetric mode and remain in the perimeter mode only. This prevents false alarm activation because the intrusion detection modules do not operate below 9 volts.
- On vehicles fitted with a battery backed sounder, if the vehicle battery voltage decreases from 9.5 to 9 V in more than a 30 minute period, the CJB de-activates the battery backed sounder and if required, will use the vehicle horns to sound an audible alarm trigger warning. This prevents false alarm activation. At voltages below 9 volts, the CJB will not generate the 'heartbeat' signal to the battery backed sounder. If the sounder fails to receive the 'heartbeat' signal, it interprets this as the CJB has been tampered with and self activates its sounder. If the battery voltage subsequently rises above 9.5 V, the CJB will re-arm the battery backed sounder.
- If the vehicle is unlocked using the unlock button on the smart key and within 45 seconds a hinged panel is not opened, the CJB automatically re-locks the vehicle and re-arms the active

anti-theft system (if 'auto re-lock' feature is enabled). This prevents leaving the vehicle unlocked and disarmed by accidental operation of the Smart Key unlock button.

Alarm

When the alarm is triggered, the CJB activates audible and visual warnings. The audible warnings are produced by the vehicles horns, the passive anti-theft horn or the battery backed sounder or a combination of the audible devices. Visible indications are produced using the turn signal indicator.

The CJB activates the vehicle horns, passive anti-theft horn or battery backed sounder for 30 seconds or a combination of the audible devices. The activation is stopped for 5 second and, if the alarm trigger is still present, the CJB will cycle again for 30 seconds. This will be repeated for up to a maximum of 10 cycles (3 cycles in some markets) of 30 seconds for any one arming period. The CJB will deactivate the alarm if the 10 cycles (3 cycles in some markets) have been completed and the alarm trigger is still present or until it receives a disarm signal.

NOTE:

If the battery backed sounder is triggered due tamper detection, the visual indication using the turn signal indicators is not activated.

The alarm can be triggered by any of the hinged panels being opened, an intrusion detection module detects a movement inside the vehicle, the tilt sensor detects vehicle movement, the CJB is disconnected or an ignition tamper is detected (invalid Smart Key).

Battery Backed Sounder

When the CJB arms the active anti-theft system, in either the perimeter mode or the volumetric mode, the CJB sends an arming signal to the sounder on the LIN bus. When the system is armed in the volumetric mode, the CJB also sends an arming signal to the tilt sensor (if fitted).

On receipt of the arming signals, the sounder and the tilt sensor respond with a status message. If the CJB does not receive the status signals within 12 seconds, the CJB assumes there is a fault and responds with a disarm signal to either the sounder and/or the tilt sensor and stores a related fault code. If the sounder is disarmed when the active anti-theft system is armed and the system is subsequently triggered, the CJB instructs the auxiliary junction box to energize the horn relay and use the vehicle horns to sound the audio warning in place of the sounder.

When the sounder is armed, the CJB sends a periodic (heartbeat) signal to the sounder which prompts the sounder to monitor the vehicle battery supply and the LIN bus link with the CJB. The sounder will operate if:

- it receives an alarm signal from the CJB or the tilt sensor
- the power supply or the LIN bus link from the CJB is disrupted.

The tilt sensor measures the longitudinal and lateral angle of the vehicle over a range of $\pm 16^\circ$ from the horizontal. When the active anti-theft system is armed in volumetric mode, the tilt sensor stores

the current vehicle angles in its memory and monitors the tilt sensor readings. If the vehicle angle changes in either direction by more than the alarm limit, the tilt sensor activates the sounder.

If the alarm system is active and the battery or battery backed sounder is disconnected, the battery backed sounder will operate without the visual indication of the turn signal indicators flashing.

Customer Programmable Security Features

A number of security features can be programmed to the customers requirements by use of the Touch Screen Display (TSD).

Global Open/Close

The global open/ close feature allows the driver to fully raise/lower the driver and passenger windows with a single press of a Smart Key button. The button must be pressed and held for more than 2 seconds. Either or both of the open/close functions can be disabled from the TSD.

NOTE:

Remote global close is not available in some markets, i.e. NAS market.

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security button will be highlighted as the default selection. Scroll the screen until the 'Global Open' and 'Global Close' selections are displayed. Global open and/or global close can be switched on or off by touching the applicable button on the TSD.

Valet Mode

Valet mode allows the liftgate to be inhibited when in valet mode. When in valet mode, if either the switch pack or exterior luggage compartment release button is pressed, an audible warning chime is emitted to warn that the liftgate is inhibited.

Enabling Valet Mode

Using the emergency key from the Smart Key, lock the glovebox. From the 'Home' screen, select the 'Valet' button'. The valet mode screen is displayed and requires a four digit Personal Identification Number (PIN) for access. Enter the PIN using the digits on the TSD and press 'OK'. When the PIN is accepted the screen displays 'Valet On'. The glovebox and the liftgate are now locked in valet mode. On leaving the vehicle, only give the attendant the Smart Key without the emergency key installed.

Disabling Valet Mode

After entering the vehicle, access the valet mode screen and enter the four digit PIN number and touch the 'OK' button. When the PIN is accepted, the screen displays 'Valet Off'. Unlock the glovebox using the emergency key and replace the emergency key in its stowage slot in the Smart Key.

Single Point Entry

The single point entry feature only unlocks one door, all other panels remain locked.

On vehicles with the remote Central Locking system (CLS), a single press of the unlock button on the

Smart key unlocks only the driver's door and the liftgate. A second press will unlock the passenger door.

On vehicles with the passive entry system, the first door handle which is pulled will only open that door to gain access to the vehicle. The remaining door and the liftgate will revert to central locking. The locked door can be unlocked by operating the interior door release lever and the liftgate can be released using the liftgate release button in the auxiliary lighting switch, the Smart Key liftgate release button or the exterior liftgate release button.

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security' button will be highlighted by default. Select '2 stage unlock' and touch the on or off button to enable or disable the single point entry feature.

Changing from central locking to single point entry and back again can also be carried out by pressing the lock and unlock buttons on the Smart Key simultaneously. The turn signal indicators will flash for 4 seconds to confirm that the change has been performed.

Drive Away Locking

The drive away door locking feature locks the doors and the liftgate if they are unlocked when the transmission selector lever is not in 'P' and the vehicle speed is more than 7 km/h (5 mph).

From the 'Home' screen, select the 'Vehicle' screen and select 'Veh. Settings'. The 'Security' button will be highlighted by default. Scroll the screen until the 'Drive away locking' section is displayed. Select the drive away locking feature on or off by touching the applicable button on the TSD.

Smart Key Additional Features

The Smart Key has convenience buttons in addition to the lock/unlock buttons.

Panic alarm

A panic alarm feature allows the driver to activate the vehicle alarm system using the Smart Key. The 'panic' button, identified by a triangle symbol, can be pressed 3 times or pressed and held for more than 3 seconds to activate the panic alarm.

Global Open/Close

A global open and close feature can be operated from the Smart Key. This feature allows the vehicle windows to be opened/closed by a single press of the lock or unlock button. The button must be pressed and held for more than 2 seconds to activate the global open/close feature.

NOTE:

Remote global close is not available in some markets, i.e. NAS market.

Liftgate Release

A liftgate release button can be pressed to open the liftgate. This will operate with car locked and alarmed or unlocked. If the vehicle is locked and alarmed, when the liftgate release button is pressed, the liftgate can be opened without triggering the alarm system. When the liftgate is subsequently closed, the alarm will be re-activated.

Headlamp Convenience

A headlamp convenience button can be pressed to operate the headlamp to assist departure or approach to the vehicle. A single press of the button will operate the headlamps for approximately 25 seconds after which they will automatically turn off. A second press of the button will turn off the headlamps if the 25 second period has not been reached. Pressing the Stop/Start button within the 25 second period will also turn off the headlamp convenience feature.

Convenience Mode

When a door is opened, for a vehicle with either remote RF central locking or passive entry, the vehicle's electrical system initiates the convenience mode. The following systems become active:

- Memory - seat adjustment and steering column
- Interior and exterior lighting
- TSD and Audio
- Instrument cluster message centre
- Horn
- Cigar lighter and power socket.

Anti-Theft - Active

The complexity of the electronics involved with the anti-theft system, and the multiplexed communication network which are connected to it, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the manufacturer approved diagnostic system for detailed instructions on testing the anti-theft system.

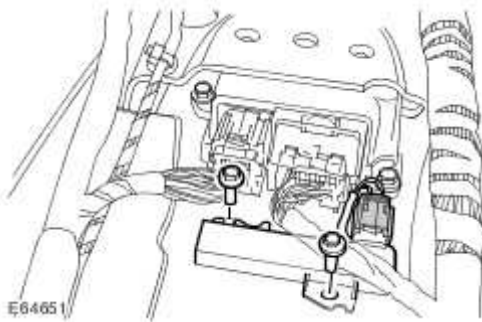
The manufacturer approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

Where a fault is indicated, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged before installing a new component.

Antenna

Removal

- 1 . Remove the floor console.
For additional information, refer to Floor Console (76.25.01)
- 2 . Remove the keyless vehicle antenna.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the keyless vehicle antenna.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolts to 3 Nm (2 lb.ft).
- 2 . Install the floor console.
For additional information, refer to Floor Console (76.25.01)

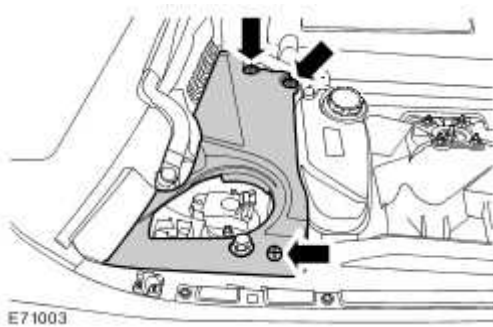
Anti-Theft Alarm Horn (86.52.03)

Removal

- 1 . Make the pedestrian protection system safe.
For additional information, refer to

- 2 . Remove the air intake cover.

- ▶ Remove the 3 clips.



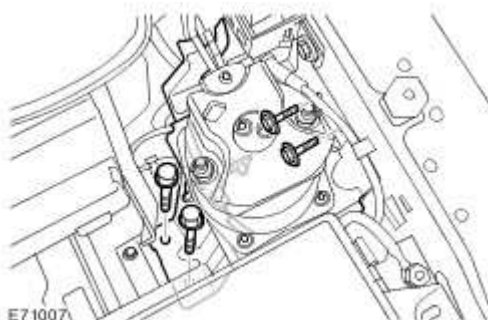
- 3 . Release the pedestrian protection actuator bracket.

- ▶ Release the 3 wiring harness clips.

- ▶ Remove the 4 bolts.

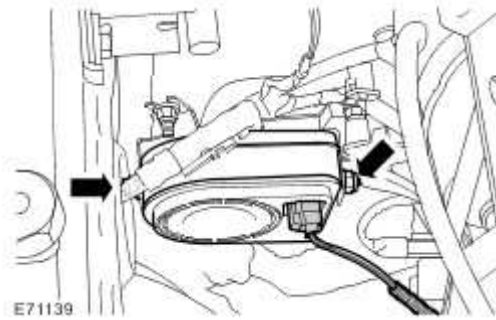
- 4 . Remove the pedestrian protection actuator and bracket.

- ▶ Disconnect the electrical connector.



5 . Remove the anti-theft alarm horn.

- ▶ Loosen but do not remove the 2 nuts.
- ▶ Disconnect the electrical connector.



Installation

1 . Install the anti-theft alarm horn.

- ▶ Connect the electrical connector.
- ▶ Tighten the nuts to 10 Nm (7 lb.ft).


2 . Install the pedestrian protection actuator and bracket.

- ▶ Connect the electrical connector.

3 . Secure the pedestrian protection actuator bracket.

- ▶ Attach the wiring harness clips.
- ▶ Tighten the bolts to 8 Nm (6 lb.ft).

4 . Install the air intake cover.

 Install the 3 clips.

Rear Intrusion Sensor

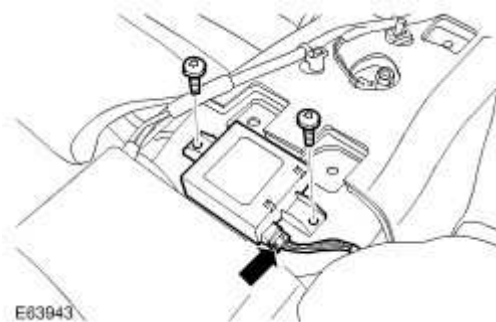
Removal

- 1 . Remove the rear seat armrest.
For additional information, refer to Rear Seat Armrest (76.70.39)

- 2 . Remove the rear intrusion sensor.

▶ Disconnect the electrical connector.

▶ Remove the 2 Torx bolts.



Installation

- 1 . Install the rear intrusion sensor.

▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

▶ Connect the electrical connector.

- 2 . Install the rear seat armrest.

For additional information, refer to Rear Seat Armrest (76.70.39)

419-01B : Anti-Theft - Passive

General procedures

Anti-Theft Security Access

1. The complexity of the electronics involved with the passive anti-theft system of which the security access is a part, and the multiplexed communication network which are connected to it preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Jaguar approved diagnostic system for detailed instructions on security access . The Jaguar approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

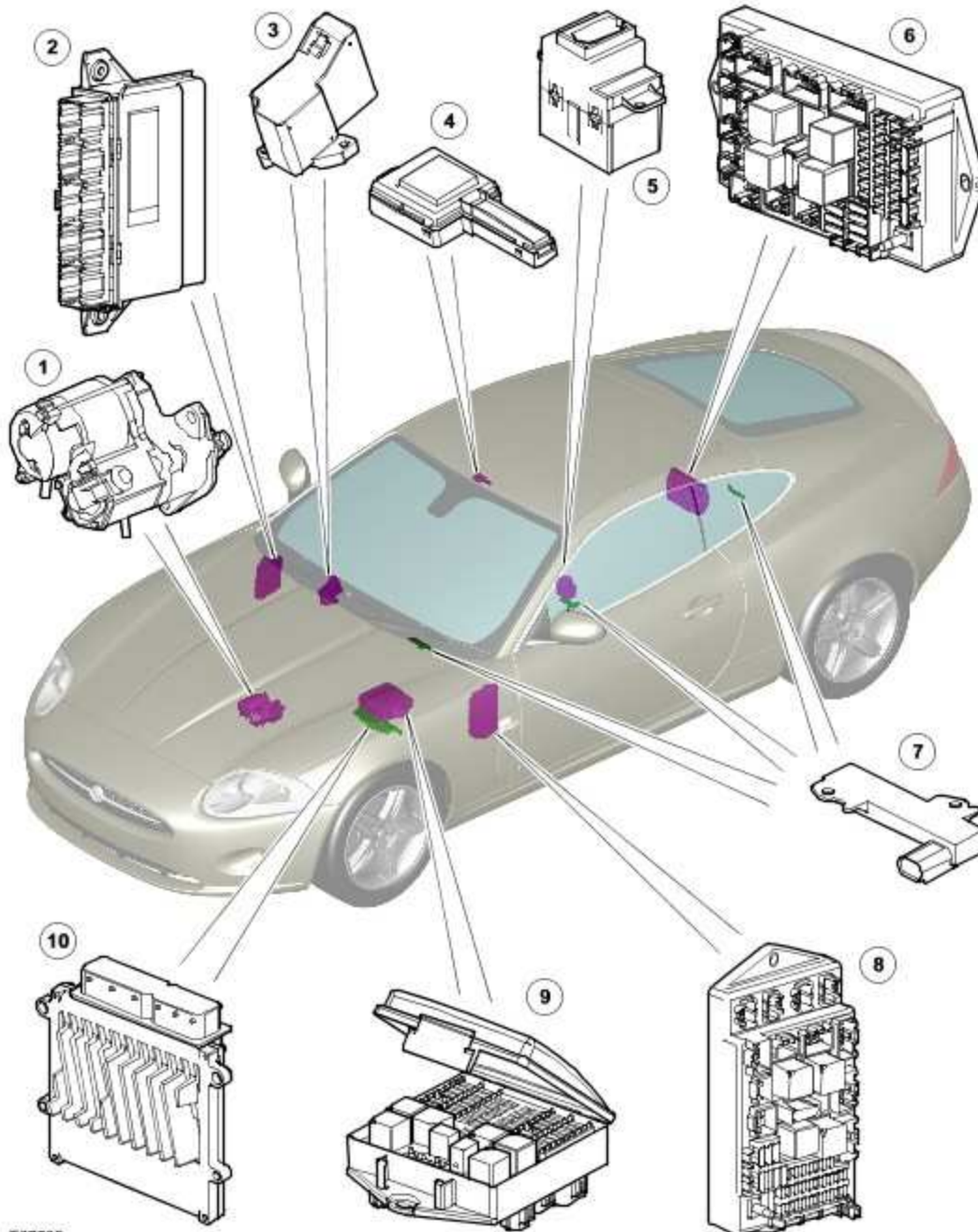
Key Programming Using Diagnostic Equipment

1. The complexity of the electronics involved with the anti-theft, of which the key programming is a part, and the multiplexed communication network which are connected to it preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the Jaguar Approved Diagnostic System for detailed instructions on key programming . The Jaguar approved diagnostic system systematically tests and analyses all functions and the various systems affected by it.

All new keys must be programmed using IDS. When using IDS to programme new key(s), the lost or obsolete key(s) will cease to function.

Anti-Theft - Passive

COMPONENT LOCATION



E67539

Item	Part Number	Description
1		Starter motor and solenoid

2		Keyless vehicle module
3		Electric steering column lock (Not NAS)
4		RF receiver
5		Start control module
6		Auxiliary junction box
7		Low Frequency (LF) antennae - Passive start system (3 off)
8		Central Junction Box (CJB)
9		Power distribution box
10		Engine Control Module (ECM)

INTRODUCTION

The Passive Anti-Theft System (PATS) prevents the vehicle from being driven away by unauthorized persons. This is achieved by having uniquely coded keys (both passive and transponder) and an encoded data exchange between multiple control modules. Unauthorized starting is prevented by inhibiting the fuel, engine (spark, injectors and crank) and ignition systems from operating.

The PATS is a function of the 'Passive Start' system. The system uses the following components:

- 'Smart Key'
- LF antennae - 3 off
- RF receiver
- Keyless vehicle module
- Start control module
- CJB
- ECM
- Instrument cluster.

The system is automatic and requires no input from the driver. The engine start system is initiated when the start/stop switch and the brake pedal are pressed simultaneously. Refer to Engine Controls for details of the ignition modes. For additional information, refer to Electronic Engine Controls (303-14 Electronic Engine Controls - Vehicles Without: Supercharger)

The engine management system will only allow engine crank, spark and injector functions when the following conditions are met:

- A hardwired Park/Neutral signal is received from the Transmission Control Module (TCM)

- A hardwired ignition signal is received from the CJB
- A hardwired crank request signal is received from the CJB
- Encrypted data exchange between the instrument cluster and the ECM is verified.

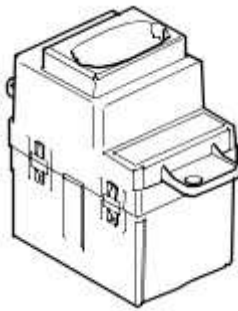
Before the CJB will send the hardwired ignition signal, it must satisfactorily complete the following:

- Exchange encrypted data with the keyless vehicle module to validate the smart key
- Exchange encrypted data with the instrument cluster to authorize the ignition status.

Additionally, before the CJB will send the hardwired crank request signal it must receive the following signals:

- Brake pressure signal from the ABS module which must be greater than a pre-determined threshold
- Hardwired transmission in 'Park' (P) signal from the selector lever.

START CONTROL MODULE



The start control module is located in the floor console, at the rear of the arm rest. The start control module is used if the keyless vehicle module is unable to authorise the Smart Key.

If the keyless vehicle module is unable to identify the Smart Key for any reason, for example if the Smart Key battery voltage is low or there is local RF interference, the transponder within the Smart Key can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND, PLEASE INSERT IN SLOT'. The Smart Key can be inserted into the start control module.

To insert the Smart Key, lift the arm rest on the floor console and slide back the spring loaded access cover on the start control module. Insert the Smart Key, with the key fob loop uppermost, into the slot. The start control module is motorized and will draw the Smart Key into the slot once inserted.

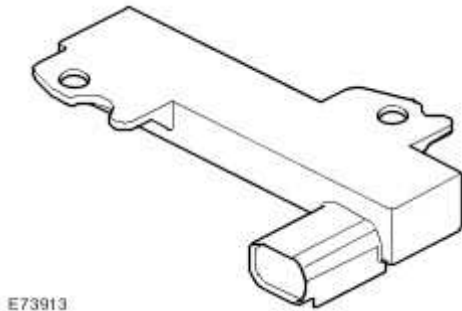
The start control module will then read the transponder within the Smart Key and, if the transponder identification is valid, pass authorization to the instrument cluster on the Local Interconnect Network (LIN) bus.

NOTE:

Inserting the Smart Key into the start control module will not charge the Smart Key battery. The battery is non-chargeable and must be replaced with a new CR2032 battery if defective.

A message 'REMOVE SMART KEY' will be displayed if the Smart Key is still in the start control module and the driver's door is opened. The Smart Key can be removed by pushing downwards on the key fob loop and releasing. The start control unit motor will then drive the Smart Key out from the slot.

LF ANTENNA



Three Low Frequency (LF) antennae for the passive start system are positioned in specific locations in the vehicle. The LF antennae are positioned in the following locations:

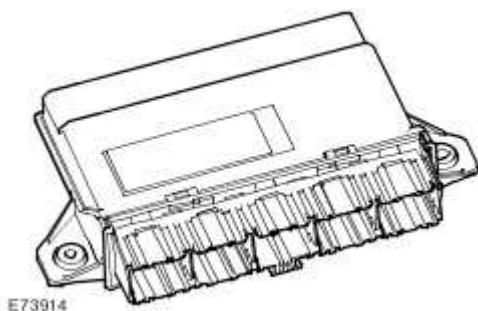
- Behind center console, below heater assembly and audio modules.
- In floor console between the driver and passenger seats, below start control module.
- On the battery tray.

NOTE:

On vehicles with the passive entry system, three additional antennae are used; one integrated into the rear bumper and one in each door handle assembly. These are only used by the passive entry system and have no function in the passive start system.

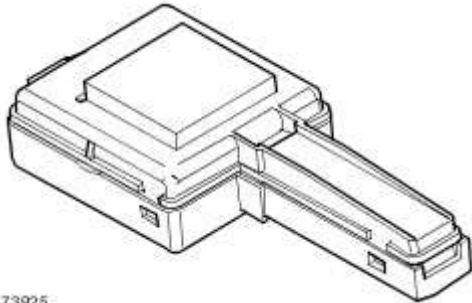
The keyless vehicle module transmits an LF signal via the antennae which is received by the Smart Key. The Smart Key then responds by transmitting a Radio Frequency (RF) signal which is received by the RF receiver and passed to the keyless vehicle module for authorization.

KEYLESS VEHICLE MODULE



The keyless vehicle module is located on the Right Hand (RH) 'A' pillar. The module controls signal transmissions to and from the Smart Key and provides authorization to allow the vehicle to be entered and started. The module has a medium speed Controller Area Network (CAN) connection to the Central Junction Box (CJB) for authorizing vehicle unlocking and starting.

RF RECEIVER



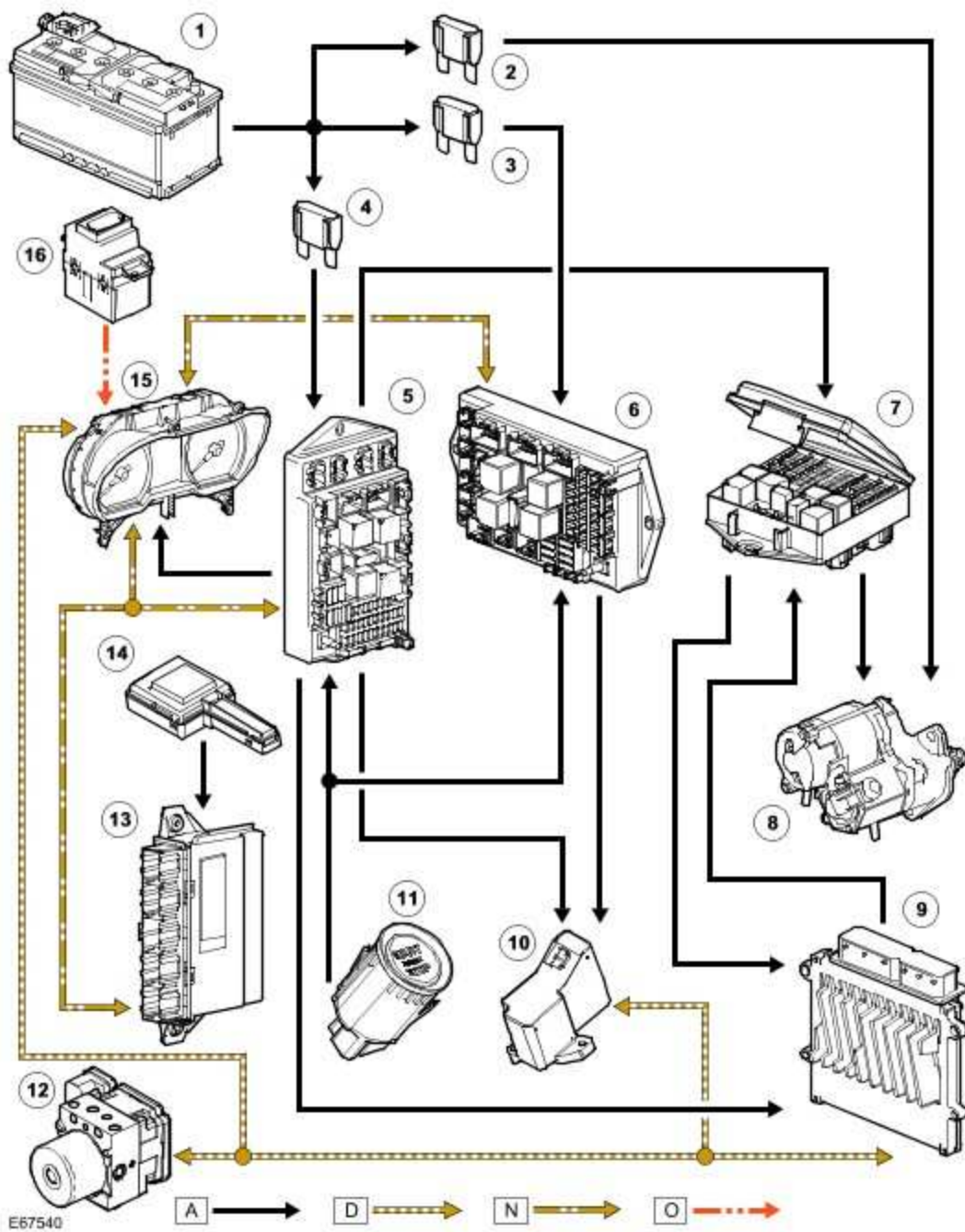
E73925

The RF receiver is located behind the overhead console. The receiver is available in two variants; 315 Mhz or 433 Mhz depending on market requirements. Transmissions are received from the Smart Key for key identification and remote lock/unlock requests or requests for operation of additional features.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **D** = High speed CAN bus; **N** = Medium speed CAN bus; **O** = LIN bus



Item	Part Number	Description
1		Battery
2		Megafuse (400 A)
3		Megafuse (175 A)
4		Megafuse (175 A)

5		CJB
6		Auxiliary junction box
7		Power distribution box
8		Starter motor and solenoid
9		ECM
10		Electric steering column lock (Not NAS)
11		Start/Stop switch
12		ABS module
13		Keyless vehicle module
14		RF receiver
15		Instrument cluster
16		Start control module

PRINCIPLES OF OPERATION

At the request of the CJB, the keyless vehicle module prompts each of the LF antennae to output a LF signal. When the Smart Key is within range, it detects the LF signals and responds with an RF identification signal. The RF signal is detected by the RF receiver and passed to the keyless vehicle module.

NOTE:

The LF antenna located in the rear bumper and in each door handle are only fitted if the vehicle has the Passive Entry option.

The keyless vehicle module authorizes the Smart Key and passes this information to the CJB via the medium speed CAN bus. Once the CJB receives the authorization and confirms response with internal calculation, it passes the result to the instrument cluster on the medium speed CAN bus. Once the CJB receives the authorization and confirms the response, it allows the ignition to be activated when the start/stop switch is pressed.

On receipt of the authorization message, the instrument cluster initiates the unlocking of the electric steering column lock (if fitted). Once the electric steering column lock is unlocked and power has

been removed, the instrument cluster will set its internal key status to valid. The instrument cluster will pass this key valid authorization to the auxiliary junction box. Once the auxiliary junction box receives the authorization and confirms the response with an internal calculation, it will enable the Fuel Pump Driver Module (FPDM).

The CJB also controls the engine crank request. If the transmission selector lever is in the park position and the driver presses the brake pedal and simultaneously presses the start/stop switch, the CJB interprets this as an engine crank request.

Before the engine crank request is allowed, the CJB compares a brake pressure signal received from the ABS module. The brake pressure signal is compared to an internally stored threshold value within the CJB. If the signal is greater than the stored threshold value, a crank request signal is sent to the ECM on the high speed CAN bus.

NOTE:

If the Smart Key is not in the vehicle and an attempt is made to start the engine by pressing the start/stop switch, a message 'SMART KEY NOT FOUND, PLEASE INSERT IN SLOT' is displayed in the instrument cluster message center.

If the keyless vehicle module is unable to identify the Smart Key for any reason, the Smart Key can be inserted into the start control module. The start control unit will then read the transponder within the Smart Key and, if the transponder identification is valid, pass authorization to the instrument cluster on the Local Interconnect Network (LIN) bus.

If a replacement Smart Key is required, 2 Integrated Diagnostic System (IDS) diagnostic procedures are required to synchronize the passive start/entry and transponder functions of the Smart Key. If any module, which is involved in the Smart Key authorization process, require replacement, an IDS diagnostic procedure is also required to synchronize the replacement module into the system.

Anti-Theft - Passive

Principle of Operation

For a detailed description of the Anti-Theft - Passive system, refer to the relevant Description and Operation section in the workshop manual.

Anti-Theft - Passive

Inspection and Verification

Anti-theft - Passive

The best method to confirm the correct operation of the Passive Anti-Theft System (PATS) is to check the LED (located in the center of the instrument panel). The LED should illuminate solid for 3 seconds, when the ignition status is set to ON, and then extinguish. This validates all PATS functions (i.e. the key transponder matches a stored key code, the challenge/response sequence between the respective modules was successful resulting in the EMS being enabled).

Ignition fails to operate

Check that the smart key is located within the vehicle interior, and that it is the correct one for the vehicle. Insert the smart key into the start control unit (located in floor console cubby box), this is an alternative method to allow Ignition On/Engine Start.

Check that the start button circuit to the CJB is not open circuit or short circuit to power.

Check that the CAN network is not malfunctioning, i.e. open circuit or short circuit. This would mean that the remote keyless entry module, Central Junction Box (CJB) and instrument cluster would be unable to communicate.

Engine fails to crank

If a PATS fault is detected, the LED will flash for 60 seconds at 4Hz with a 50% duty cycle. At the end of this period, the LED will flash a 2 digit code; this code is repeated 10 times. The meaning of these fault codes along with the frequency of flashing is given in the accompanying table. As a general rule a fault code of 16 or less will cause the vehicle not to crank. Additionally, the manufacturer approved diagnostic system should be used to check the instrument cluster, CJB & ECM for Diagnostic Trouble Codes (DTCs).

One potential occurrence for failing to crank could be due to the 'Not In Park' switch (input to the CJB) or the P & N start switch (input to the ECM).

Check the Crank Request output from the CJB to ECM is not short circuit to ground or open circuit.

Check the Starter Relay circuit.

NOTE:

Due to Smart Start both sides of Relay Coil are switched directly from ECM (If conditions correct)

Check that the Steering Column Lock correctly operates and the steering wheel can turn freely.

Check that the CAN network is not malfunctioning, i.e. the CAN circuit is open or short circuit. This would mean that the instrument cluster and ECM would be unable to communicate resulting in no Challenge being performed to enable the ECM. This would be supported by LED Flash Code 24, see PATS Fault Code Table.

Also check the CAN network between the ABS module and the CJB. The CJB uses the CAN_BrakePressureTMC signal to determine if the brake pedal has been pressed in order to allow an engine crank. The CJB uses a value of 0x03, if the CJB sees a value less than this, it will not enable the Crank Request Output.

Engine cranks but will not start

If the Engine is cranking it means that the ECM has passed the authorisation required with the Instrument Cluster. If this authorisation failed, the ECM would not engage the starter relay. This could be confirmed by verifying the PATS LED prove out (illuminated solid for 3 seconds) or by reading DTCs from the instrument cluster and ECM.

In this case, the fuel pump circuit should be verified. The Fuel Pump Delivery Module (FPDM), which is supplied via the RJB (authentication required with the instrument cluster) and controlled by the ECM, supplies the fuel pump.

In all cases of suspected non-start issues, the most logical failure modes should be eliminated first. i.e.

- Check all relevant supplies and grounds to the relevant modules listed herein.
- Note any unusual behaviour from other systems/functionality.
- Note any functions that are not operating as expected.

PATS Fault Codes

For the various PATS modes/faults listed in the table, the instrument cluster will store a DTC and indicate this to the customer during the detection period defined in the 'when logged' column, by illuminating the indicator as described for 60 seconds and then flashing the LED 10 times as appropriate. The indication will stop immediately the ignition status is set to OFF any time during the fault indication sequence. Up to 4 DTCs could be stored per key read sequence (1-10 read attempts). No DTCs will be stored until all retry attempts are complete. Only the highest priority fault code will be flashed.

To determine the fault code from the LED: The LED will flash initially ten times with 1.5 seconds between. The LED will remain OFF for 2.5 seconds then flash a number of times with 0.5 seconds

between (the number of times the LED flashes represents the first digit of the code), the LED will remain OFF for 1.5 seconds then flash a number of times with 1.5 seconds between (the number of times the LED flashes represents the second digit of the code).

The PATS LED will be commanded on as shown under 'indication'. Normal PATS operations are complete within 400ms of the ignition switch transition from OFF to ON or START, worst case for ECM communication problems will be less than 2 seconds. If PATS is not complete during the 2 seconds the ECM will terminate PATS and await the next ignition ON or START event. PATS faults will be indicated via the LED as soon as possible and will terminate the LED prove out. At ignition OFF all previous flashing will cease and the perimeter anti-theft system will control the LED when the vehicle is locked and armed.

Mode of Operation/Fault	When Logged	Ignition Status	DTC	LED Fault Code	Indication
Prove out	N/A	Transition from OFF to ON	N/A	N/A	3 Seconds of steady illumination
Perimeter Anti-theft Control	N/A	OFF - Vehicle locked and armed	N/A	N/A	Off or 0.5Hz flashing at 5% duty cycle \pm 20% until Off
Start Control Unit already programmed	Key Insert	Any	B1B0105	N/A	No Indication
Start Control Unit status = invalid response	Key Insert	Any	B1B0167	N/A	No Indication
Start Control Unit programming error	Key Insert	Any	B1B0151	N/A	No Indication
Start Control Unit challenge response error	Key Insert	OFF	B1B0162	N/A	No Indication
Key Programming timer expired or Key Auth Timer expired	Key Insert	Any	B1B0187	N/A	No Indication
Transponder challenge response error	Key Insert	Any	B1B0164	N/A	No Indication
Transponder keys stored below minimum number required	B&A/Dealer	Any	B1B0100	N/A	No Indication

Transponder not programmed	B&A/Dealer	Any	B1B0155	N/A	No Indication
If the instrument cluster sends a 'theft' key status to the ECM or the ECM returns a status message containing the data 'Disabled/Theft', the instrument cluster will set this DTC	EMS CAN communication	OFF to ON	B1B3364	16	60 seconds of 4Hz flashing at 50% duty cycle followed by fault code 16 flashing 10 times
During manufacturing a Target ID is transferred from the ECM when requested by the instrument cluster. The instrument cluster stores this unique vehicle number in EEPROM. If this ID fails to store in EEPROM correctly, the instrument cluster will set this DTC	B&A/Dealer	OFF to ON	B1B3305	22	60 seconds of steady indication followed by fault code 22 flashing 10 times
If the status message received from the ECM contains the data challenge response error, the instrument cluster will set this DTC	Challenge/Response	OFF to ON	B1B3362	23	60 seconds of steady indication followed by fault code 23 flashing 10 times
After the instrument cluster has transmitted its first PATS idle message, it will start a 2 second timer running. If the PATS sequence does not complete (Cluster received the Enable msg) within this time period the instrument cluster will set this DTC	Idle message missing	OFF to ON	B1B3387	24	60 seconds of steady indication followed by fault code 24 flashing 10 times

1 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

2 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

419-02 : Remote Convenience

General procedures

Universal Transmitter Programming



WARNING: A garage door opening system that cannot stop or reverse itself after detecting an object in its path does not meet current federal safety standards. To decrease the risk of serious injury or death, do not use this HomeLink[®] transmitter with a door opening system that lacks stop and reverse features as required by federal standards. This includes any garage door opening system manufactured before April 1, 1982. For more information, call HomeLink[®] customer assistance at 1-800-355-3515.

1.



CAUTION: During this procedure, the system that you are programming will be made to operate. Make sure that people or objects are clear of the garage door or gate being programmed.

Verify the hand-held transmitter is operative.

2. Prepare for programming the universal transmitter by erasing all three channels by holding down the two outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.



VUJ0004177

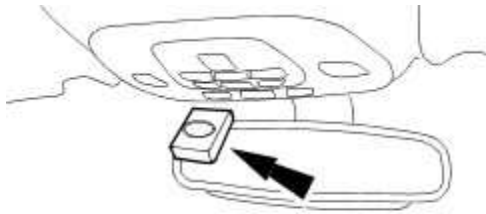
3. Select one of the three universal transmitter channels to be programmed by pressing the desired button.

4. Hold the end of the hand-held transmitter 50-150mm (2-6 in) from the front surface of the universal transmitter so that the red light can still be seen.

5. **NOTE:**

During programming, the hand-held transmitter may automatically stop transmitting after two seconds, which may not be long enough to program the universal transmitter. If programming this type of hand-held transmitter, continue to hold the button on the universal transmitter while re-pressing the hand-held transmitter button every two seconds (Canada only).

Use both hands to press the hand-held transmitter button and the desired button on the universal transmitter. Do not release either button.



VUJ0004178

6. Hold down both buttons until the red light on the universal transmitter flashes, first slowly and then rapidly. Release both buttons when the rapid flashing begins. The universal transmitter has successfully learned the new frequency signal and can be used in place of the hand-held transmitter(s).

7. NOTE:

If the hand-held transmitter appears to program the universal transmitter but does not open the garage door, the garage door opener may have a 'code protected' or 'rolling code' feature.

To operate, simply press the appropriate button on the universal transmitter. The red light is on while the signal is being transmitted.

Training a Garage Door Opener Equipped With ' Rolling Codes'

1. Program the hand-held transmitter to the universal transmitter.
2. Train the garage door opener receiver to recognize the universal transmitter.
 1. Remove the cover panel from the garage door opener receiver.
 2. Locate the training button on the garage door opener receiver. Location and color of the button may vary by garage door opener manufacturer. Refer to the garage door opener instruction manual or call HomeLink customer assistance at 1-800-355-3515.
 3. Press the training button on the garage door opener receiver for 1-2 seconds.

4. Press the programmed universal transmitter button for as long as the universal transmitter red light flashes (1-2 seconds). Release the button and re-press the button to confirm that the universal transmitter is trained to the receiver.
5. The garage door opener should recognize the universal transmitter.

Erasing Channels

1. **NOTE:**

Individual channels cannot be erased, but can be reprogrammed using the procedures for programming.

To erase all three programmed channels, hold down the two outside buttons until the red light begins to flash (20-30 seconds). Release both buttons.

Universal Transmitter

Inspection and Verification

- 1 . Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of mechanical damage.

Mechanical
<ul style="list-style-type: none"> • Damaged universal transmitter • Damaged receiver

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the concern is not visually evident, verify the concern and refer to the Symptom Chart. Refer to the electrical circuit diagrams for schematic and connector information.

Symptom Chart

Symptom	Possible Cause	Action
The universal transmitter is inoperative	<ul style="list-style-type: none"> • Universal transmitter • Receiver unit 	GO to Pinpoint Test G92661p1.

Pinpoint Tests

PINPOINT TEST G92661p1 : THE UNIVERSAL TRANSMITTER IS INOPERATIVE

G92661t1 : CHECK THE ROOF CONSOLE ASSEMBLY OPERATION

1. Check the illumination of the interior lamp.
 - Does the interior lamp illuminate?

-> **Yes**

GO to Pinpoint Test G92661t2.

.

-> **No**

Check and rectify fault with interior lamp circuit. TEST the system for normal operation.

G92661t2 : PROGRAM HAND-HELD TRANSMITTER INTO UNIVERSAL TRANSMITTER

1. NOTE:

If the garage door is equipped with rolling codes, refer to Training a Garage Door Opener Equipped With "Rolling Codes."

Program the universal transmitter.

Universal Transmitter Programming

- **Did the universal transmitter program successfully?**

-> **Yes**

The universal transmitter is OK. VERIFY receiver operation.

-> **No**

REPLACE the roof console assembly. TEST the system for normal operation.

419-07 : Navigation System

Specifications

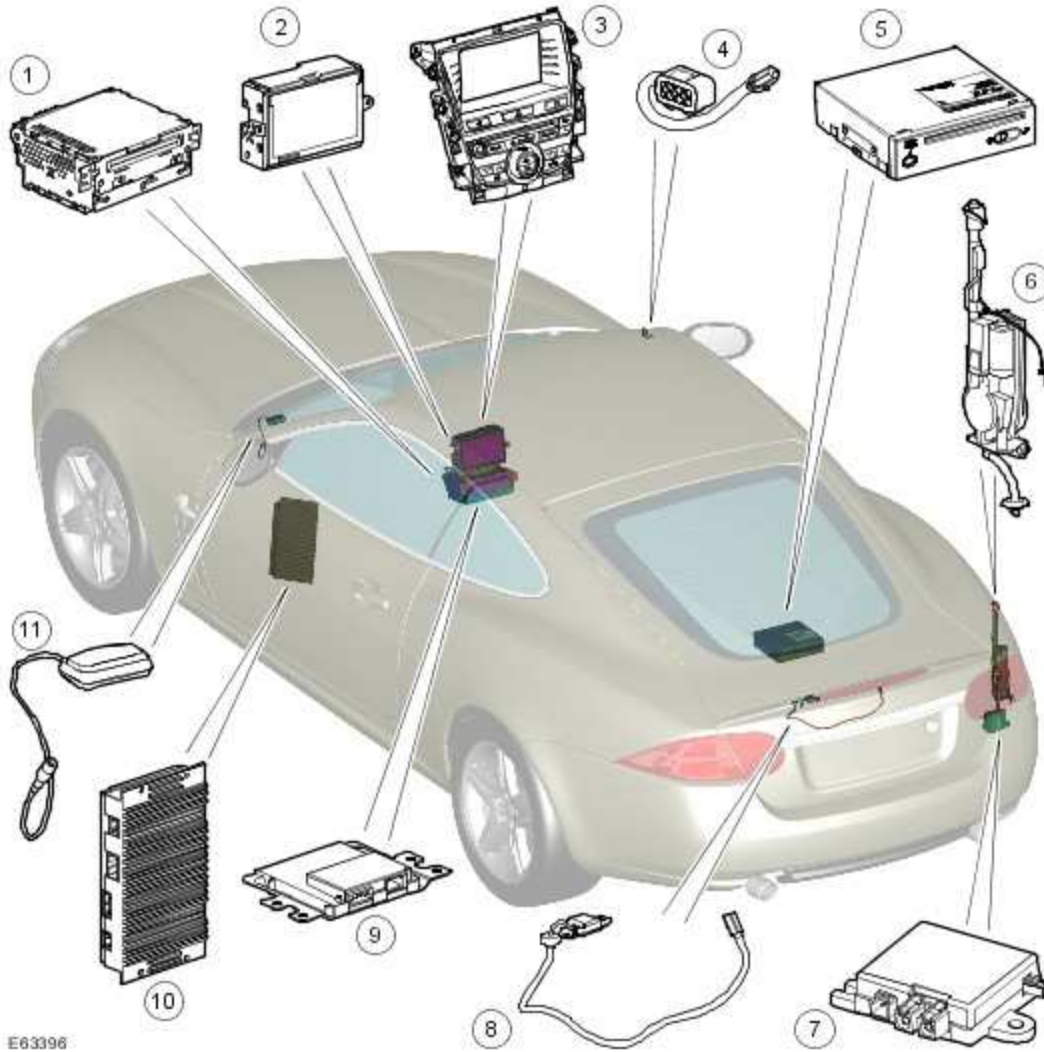
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Antenna - bolt	1.5	-	13
Display module to module bracket - bolt	3	-	26
Display module to module bracket - screw	2.5	-	22
Navigation system module to bracket - bolt	2	-	18

Navigation System

COMPONENT LOCATION



E63396

Item	Part Number	Description
1		Integrated Audio Module
2		Touch Screen Display
3		Integrated Control Panel
4		Microphone

5		Navigation computer
6		AM/FM antenna
7		FM antenna signal splitter
8		GPS antenna
9		Information and entertainment control module
10		Audio amplifier
11		Vehicle Information and Communication Systems (VICS) beacon antenna (Japan only)

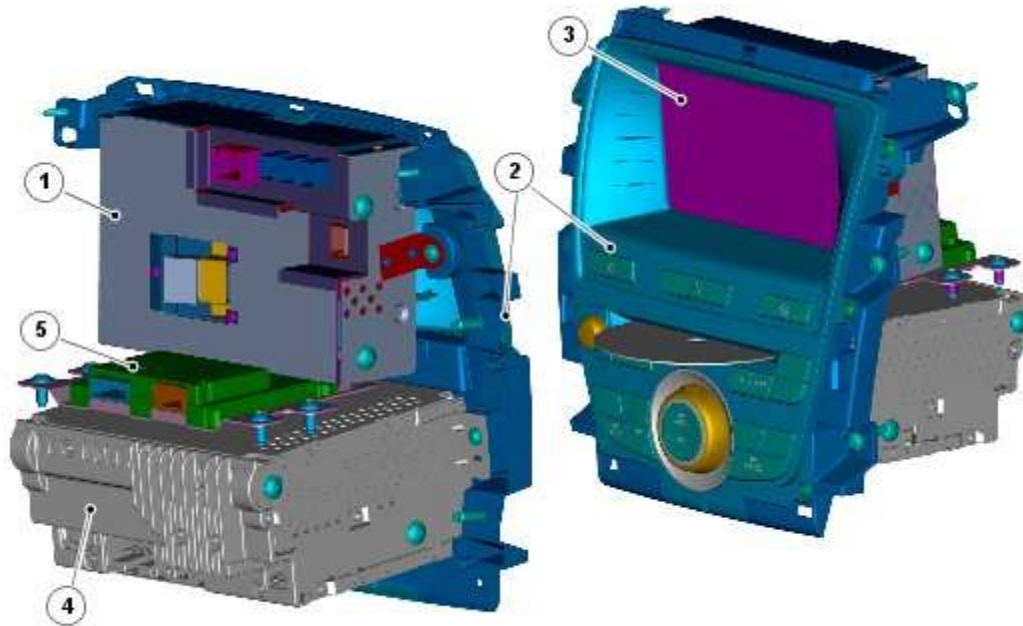
INTRODUCTION

The navigation system provides audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the desired route using minor or major roads or motorways and the quickest or shortest route. Directions to hospitals, museums, monuments and hotels are also available. The computer uses map information stored on a DVD-ROM to determine the best route for the journey and provide the driver with details of directions and approaching junctions.

The navigation system is controlled from the integrated control panel and the Touch Screen Display (TSD). Control signals from the touch screen display are sent on the MOST ring to the navigation computer. The navigation computer uses a dedicated GVIF bus to transmit its video signals to the TSD.

Vehicles with navigation systems also incorporate additional traffic information systems. These are market dependant and are as follows:

- Japan-Voice recognition and VICS
- Europe-TMC
- NAS-No TMC, VICS or voice rrecognition

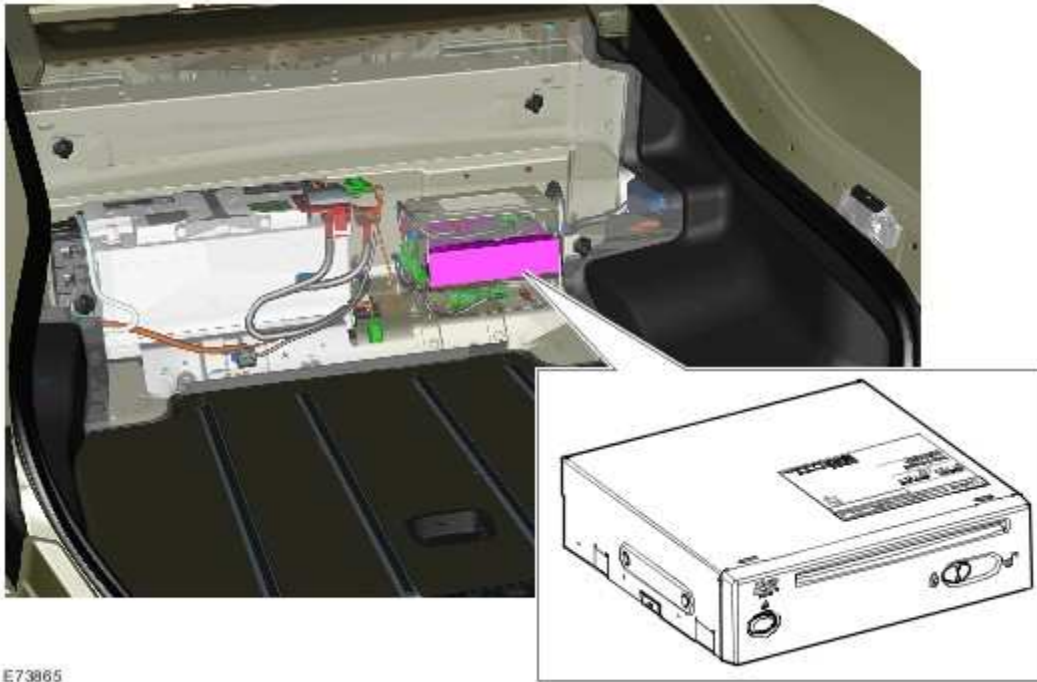


E73869

Item	Part Number	Description
1		TSD (rear)
2		ICP
3		TSD (front)
4		IAM
5		ICM

NAVIGATION COMPUTER

The navigation computer is located in the rear loadspace next to the battery.



E73865

The navigation computer incorporates the following:

- GPS receiver
- VICS receiver (Japan only)
- Traffic Message Channel (TMC) receiver

The navigation computer is connected to the MOST bus. The navigation computer generates its own graphics and transmits them to the TSD on a dedicated GVIF (Gigabyte video Interface) bus.

The navigation computer contains a solid state piezo gyro which measures the motion of the vehicle around its vertical axis. The gyro operates on the principle known as the Coriolis force. The Coriolis force is the force that appears to accelerate a body moving away from its rotational axis against the direction of rotation of the axis.

Using inputs from the ABS module, the GPS antenna and the gyro sensor, the computer calculates the vehicle's current position, direction and speed.

The navigation computer houses the DVD-ROM drive. The drive is used to read map data from region specific DVD's. The regions are as follows:

- Europe (3 discs)
- NAS (2 discs)
- Japan, Middle east and Australia (1disc)

A button, located adjacent to the DVD slot, is provided to eject the DVD from the unit. Prior to ejecting the disc the slot protection has to be slid to the side. If the ignition is on, or the Entertainment System is in 1-hour mode, one press of the button will eject the DVD.

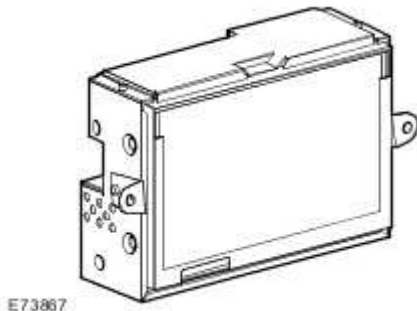
The GPS receiver receives information from between 1 and 8 satellites at any one time. This information is received from the GPS antenna. The built in GPS receiver is used for calculating the position (i.e. Latitude, longitude and height), direction and speed.

The navigation computer uses non-volatile memory to store settings and configuration information when it is powered down. This process takes place just before the computer turns off.

For the Japanese market the navigation computer incorporates a VICS receiver. The VICS receiver, receives information from the beacon antenna in the center of the instrument panel and the electric FM antenna. The VICS system receiver allows the vehicle to receive information about traffic conditions from roadside transmitters and adjust the navigation instructions accordingly.

For certain European markets the navigation computer incorporates the Traffic Message Channel (TMC) receiver. The TMC receiver decodes TMC data. The navigation computer then displays this information on the TSD and also re-routes the navigation guidance around any traffic hold ups. The TMC data is received via the electric FM (frequency modulation) antenna via the antenna signal splitter.

TOUCH SCREEN DISPLAY (TSD)



The Touch Screen Display (TSD) is located in the center of the instrument panel. TSD is a touch sensitive 7 inch LCD (liquid crystal display) VGA screen containing 800 x 480 pixels in a 15:9 format. The TSD is connected to the Information and Entertainment system on the Media Oriented Systems Transport (MOST) ring. The MOST ring is a fibre optic communications data bus that allows high speed transfer of control instructions and audio around the system.

The TSD processes its own video for system operation but receives the navigation graphics from the navigation computer on a dedicated serial link called GVIF (Gigabit Video Interface).

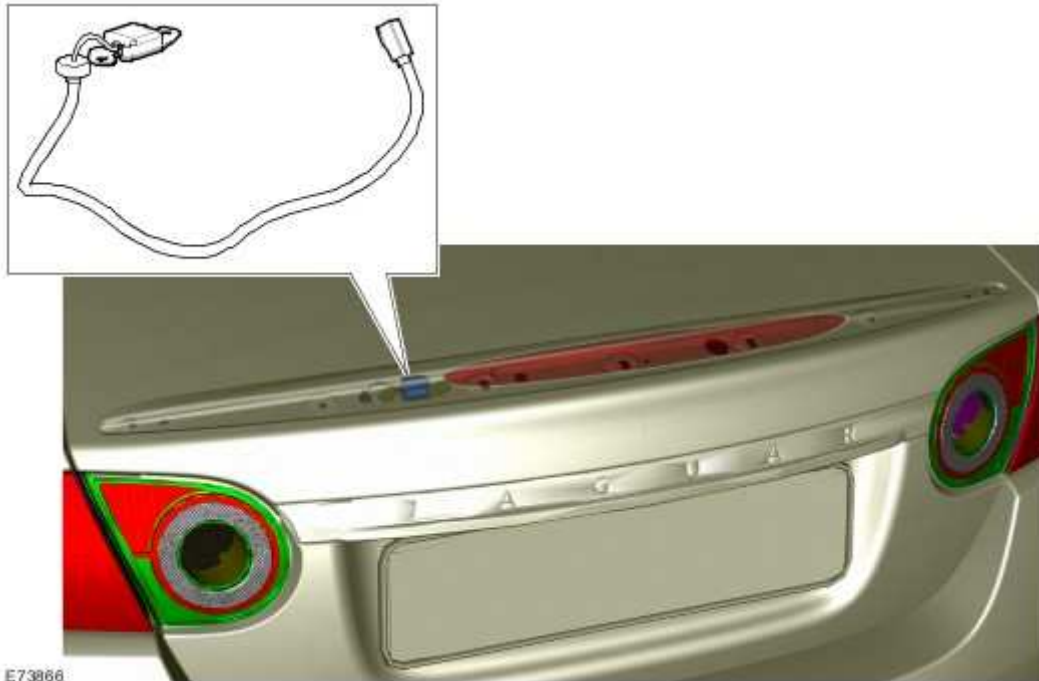
The TSD is also the control interface for the following vehicle systems:

- Climate control
- Audio system
- Heated seats
- Customer programmable security features

- Cellular phone
- Vehicle settings

The TSD navigation control signals are sent on the MOST ring to the navigation computer,

GPS ANTENNA



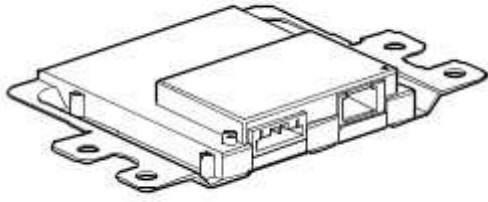
The GPS (global positioning system) antenna is located in the rear liftgate spoiler. The GPS antenna is connected to the GPS computer by a single co-axial cable and passes signals from the GPS satellites to the navigation computers built in receiver for processing.

It is possible for the GPS antenna to lose the signal from the GPS satellites:

- In hilly or tree lined areas
- Built up areas with tall buildings
- In multi storey car parks
- In garages
- In tunnels
- In bridges
- During heavy rain or thunderstorms.

When the signal is lost the navigation computer will continue to give guidance using memory mapped data from the DVD (digital versatile disc) map until the signal is restored.

INFORMATION AND ENTERTAINMENT CONTROL MODULE



E73868

The Information and Entertainment Control Module (ICM) is located between the TSD and the IAM. The ICM is mounted in the vehicle using four M6 bolts.

The ICM is the gateway between the vehicle MS CAN bus and the Information and Entertainment system MOST bus.

INFORMATION AND ENTERTAINMENT CONTROL PANEL



E73872

The Information and Entertainment Control Panel is connected to the MS CAN bus. The ICP incorporates switches for audio system control, climate control hazard warning lamps and the navigation system. The navigation system is operated from the TSD via signals on the MOST ring. Hard switches on the ICP send CAN signals to the ICM which transfers signals to the relevant module on the MOST ring.

VICS BEACON ANTENNA (JAPAN ONLY)

VICS Beacon Antenna

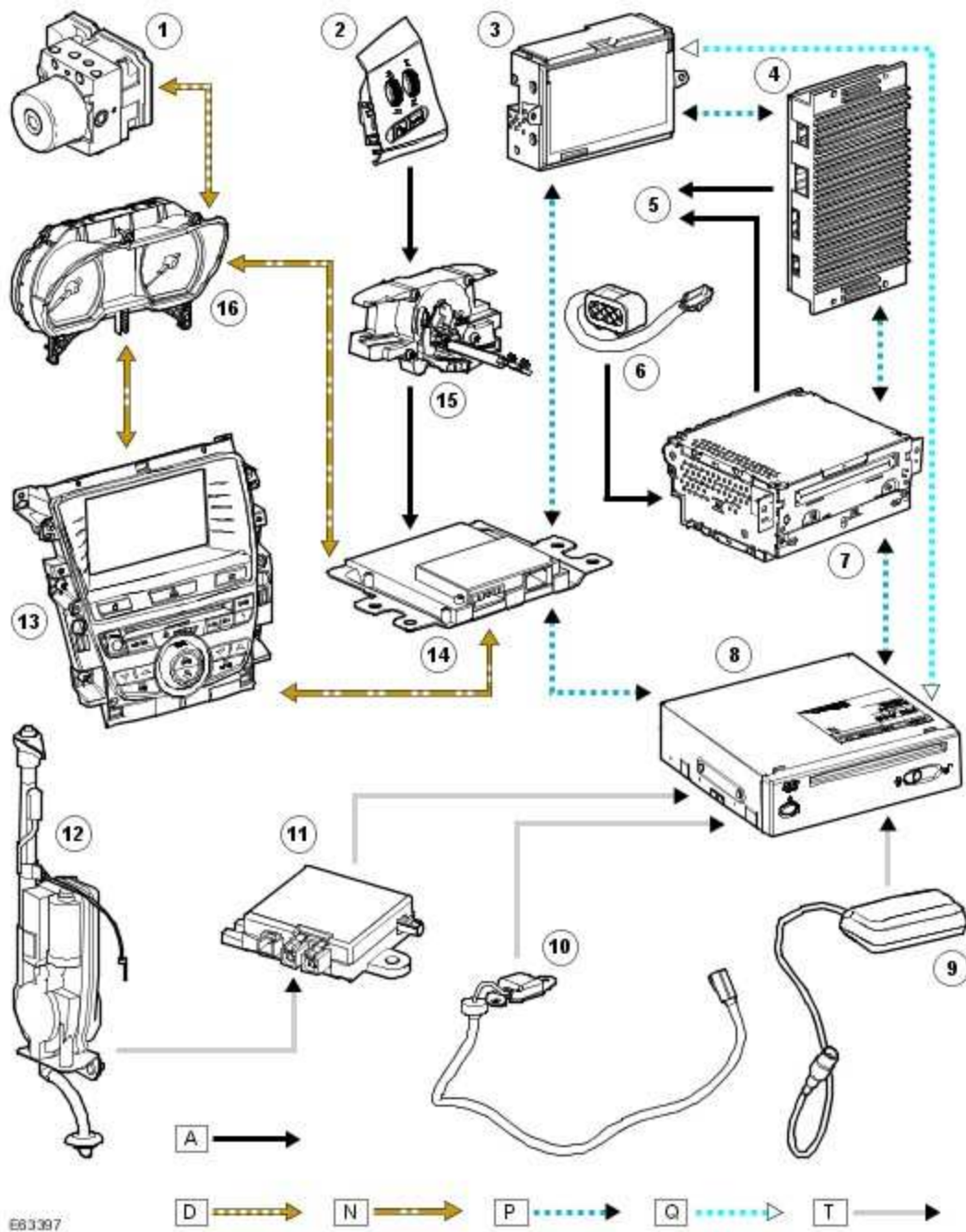


The VICS beacon antenna is located on top of the instrument panel. The antenna receives infra red and RF signals from road side transmitters. The Antenna is connected to the navigation computer which incorporates a VICS receiver.

CONTROL DIAGRAM

NOTE:

A = Hardwired; D = High speed CAN bus; N = Medium speed CAN; P = MOST ring; Q = GVIF; T = Coaxial



E63397

Item	Part Number	Description
1		ABS control module
2		Steering wheel controls
3		Touch Screen Display (TSD)

4		Audio amplifier
5		Speakers
6		Microphone
7		Integrated Audio Module
8		Navigation computer
9		Vehicle Information and Communication Systems (VICS) beacon antenna (Japan only)
10		GPS Antenna
11		AM/FM antenna splitter
12		AM/FM antenna
13		Integrated Control Panel
14		Information and entertainment control module
15		Clock spring
16		Instrument cluster

PRINCIPLES OF OPERATION

The system used to calculate the current position of the vehicle is called the GPS (global positioning system). The system utilizes satellites which are owned by the United States Department of Defense (DoD). A total of 24 satellites orbit the earth every 12 hours at a height of 20,000 km (12500 miles), and between 5 and 11 of these satellites can be seen from a single point at any given time. The orbits are tilted to the earth's equator by 55 degrees to ensure coverage of polar regions. Each satellite transmits radio signals to provide information about the satellite position i.e. latitude, longitude, altitude, almanac data and an accurate time signal generated by an on-board atomic clock. Each satellite contains four atomic clocks.

The vehicle needs to receive data from at least four different satellites to give a three dimensional fix on its current position.

As the vehicle moves, this information is continually being updated. The computer determines which satellites are 'visible' to the system and their current position and relationship to each other. Using this information the computer can account for positional deviations of the satellites and compensate to enhance the accuracy of the navigation system.

The GPS (global positioning system) signal is also known as the Precision Positioning Signal (PPS).

PPS predictable accuracy is:

- 22 meters horizontal accuracy
- 27.7 meters vertical accuracy
- 200 nanoseconds time accuracy.

The navigation system provides computer generated audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the desired route using minor or major roads or highways and the quickest or shortest route. Directions to hospitals, museums, monuments and hotels are also available. The computer uses map information stored on a DVD-ROM to determine the best route for the journey and provide the driver with details of directions and approaching junctions.

The navigation system receives GPS (global positioning system) information via the GPS antenna. The GPS signals are used by the navigation computer to calculate the vehicles position. Once the driver has input a desired destination the navigation computer can calculate a route, based on the drivers pre-determined preferences or the default settings in the navigation computer.

The navigation system is accessed by pressing the navigation soft key on the TSD.

Navigation is initiated by the driver inputting a destination. This can be achieved by:

- Entering in an address using the TSD.
- Entering a post code.
- Choosing a previous destination.
- Choosing a point of interest from the map disc database.
- Choosing the home location
- Choosing a memory stored location.

The driver is then guided to the destination by a scrolling map display and voice guidance. The display can be varied by scale and display type.

In addition to the standard navigation system there are two market dependant systems that supply extra information to the navigation system and the driver. These are:

- Traffic Message Channel (TMC)
- Vehicle Information and Communication System (VICS) (Japan only).

Traffic Message Channel (TMC)

The Traffic Message Channel (TMC) is a function of the FM (frequency modulation) Radio Data System (RDS). The system broadcasts real-time traffic and weather information. Data messages are received and decoded by the TMC receiver and passed onto the navigation system, which then delivers them via the navigation system interface. TMC messages can be filtered by the navigation computer so that only those relevant to the current journey are displayed, allowing the navigation

system to offer dynamic route guidance - alerting the driver of a problem on the planned route and calculating an alternative route to avoid the incident. All TMC events on the map can be viewed not just the ones on the calculated route.

TMC traffic information systems conform to a global standard that has been adopted by traffic data gatherers, information service providers, broadcasters and vehicle/receiver manufacturers. TMC information is received via the normal FM (frequency modulation) radio antenna.

All TMC receivers use the same list of event codes, while the location database (on the map disc) contains both a country-specific set of location codes for the strategic European road network.

TMC traffic data is currently broadcast in many European countries.

Vehicle Information and Communication System (VICS)

The VICS system supplies the navigation computer with information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. Information is provided to the system through three routes:

- RF transmission
- Infra-red transmission
- FM (frequency modulation) multiplex transmissions.

The RF transmissions are generally transmitted from road side beacons mainly on expressways. The information transmitted is as follows:

- Traffic congestion
- Travel time to next intersection
- Traffic conditions in surrounding areas and expressway turn offs
- Traffic accidents
- Speed limits
- Lane regulations
- Tire change
- Parking availability at expressway service areas and parking areas.

The Infra-Red transmissions are received by the beacon antenna mounted on the top of the instrument panel.

Infra-Red transmissions are transmitted from road side beacons on major trunk roads. The information transmitted is:

- Traffic congestion and travel time
- Traffic accidents
- Breakdowns
- Road works restrictions
- Parking availability.

FM (frequency modulation) transmissions are broadcast as part of the normal RDS FM (frequency modulation) transmission. Information transmitted is:

- Traffic congestion and travel time for wide areas
- Traffic accidents, road works, speed limits and lane restrictions for a wide area
- Parking availability information.

FM transmissions are received via the FM antenna and split from the normal FM transmissions by the FM signal splitter.

Navigation System

Principle of Operation

For a detailed description of the navigation system, refer to the relevant Description and Operation section in the workshop manual.

Navigation System

Inspection and Verification

- 1 . Verify the customer concern.

- 2 . Visually inspect for obvious signs of damage, water ingress and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Navigation system DVD player Mechanism 	<ul style="list-style-type: none"> • Navigation system display • Navigation system module • GPS antenna • Wiring harness for damage and corrosion • ABS Module • Electrical connector(s) • Audio unit

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Poor satellite reception	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • No reception from satellite 	GO to Pinpoint Test G841057p1.
Map disc will not insert/eject	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	GO to Pinpoint Test G841057p2.

	<ul style="list-style-type: none"> • Map disc failure 	
Black screen (navigation map screen does not display)	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • GVIF cable 	GO to Pinpoint Test G841057p3.
Navigation map screen color is abnormal	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • GVIF cable 	GO to Pinpoint Test G841057p4.
Vehicle's current position mark turns independently	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • Vehicle on a turntable in a parking building 	GO to Pinpoint Test G841057p5.
Car current position not stable	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	GO to Pinpoint Test G841057p6.
Map display is incomplete	<ul style="list-style-type: none"> • Map disc contaminated/damaged • Electrical harness open/short circuit, disconnected • Incorrect market map disc • Component failure 	GO to Pinpoint Test G841057p7.
No navigation voice guidance	<ul style="list-style-type: none"> • Voice guidance soft key set to OFF position • Volume level set too low • Component failure 	GO to Pinpoint Test G841057p8.
No response to pressing navigation menu	<ul style="list-style-type: none"> • Interruption during map disc update • Electrical harness open/short circuit, disconnected • Incorrect Navigation Control Module (NCM) installed • Incorrect car configuration 	GO to Pinpoint Test G841057p9.

	data received	
'NO DVD PLEASE INSERT MAP DVD' message is displayed	<ul style="list-style-type: none"> • A disc other than the map disc is inserted 	Insert the correct map disc
'UNABLE TO READ DATA CONSULT YOUR DEALER' message is displayed	<ul style="list-style-type: none"> • DVD player abnormality 	Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.
'UNABLE TO READ DATA TEMPERATURE IS TOO HIGH' message is displayed	<ul style="list-style-type: none"> • Operating temperature has been exceeded • Navigation Control Module (NCM) internal temperature is high 	Move the vehicle to a cool location, and turn the engine OFF. Wait for a while, then verify conditions again. If the temperature around the Navigation Control Module (NCM) is high, take measures to lower temperature
'UNABLE TO READ DVD CORRECTLY CHECK IF THE DVD IS DAMAGED OR DIRTY' message is displayed	<ul style="list-style-type: none"> • Check map disc for contamination, deformation, cracks, scratches or non-genuine disc 	Clean the map disc and retest, replace the map disc
'UNABLE TO READ DATA CHECK IF MAP DVD IS CORRECT' message is displayed	<ul style="list-style-type: none"> • Incorrect DVD map disc is inserted 	Insert a map disc with the correct part number

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1A8911	Satellite antenna	<ul style="list-style-type: none"> Satellite antenna circuit - short to ground 	Check satellite antenna connections. Refer to the electrical circuit diagrams and test satellite antenna circuit for short to ground
B1A8913	Satellite antenna	<ul style="list-style-type: none"> Satellite antenna circuit - open circuit 	Check satellite antenna connections. Refer to the electrical circuit diagrams and test satellite antenna circuit for open circuit
B1A891B	Satellite antenna	<ul style="list-style-type: none"> Satellite antenna - circuit resistance above threshold 	Install a new navigation system module, refer to the new module installation note at the top of the DTC Index
B1D5514	Antenna #2	<ul style="list-style-type: none"> TMC/VICS FM antenna circuit - 	Check TMC/VICS FM antenna connections. Refer to the electrical circuit diagrams and

	Circuit	open	test TMC/VICS FM antenna circuit for open circuit
B1D5614	Antenna #3 Circuit	<ul style="list-style-type: none"> VICS antenna circuit - open 	Check VICS antenna connections. Refer to the electrical circuit diagrams and test VICS antenna circuit for open circuit
U200531	Control Module	<ul style="list-style-type: none"> Missing vehicle speed message 	Check ABS module and Instrument Cluster for speed related DTCs and refer to relevant DTC Index. Anti-Lock Control - Stability Assist Instrument Cluster
U300049	Control Module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new navigation system module, refer to the new module installation note at the top of the DTC Index
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Using the manufacturer approved diagnostic system check/amend the Car Configuration File parameter in block 2, byte 127 to match vehicle market/specification. If the DTC remains check navigation system module part number and ensure the correct component is installed to vehicle market/specification
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check navigation module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300098	Control module	<ul style="list-style-type: none"> Component or system over temperature 	Check for additional DTCs and refer to DTC Index. Clear DTC and re-test/monitor condition for re-occurrence
U300362	Battery voltage	<ul style="list-style-type: none"> Circuit voltage mismatch with navigation control module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Pinpoint Tests

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.

NOTE:

Navigation Diagnostic Screen Access

- 1. With the vehicle at rest, place the ignition switch in either "ACC", "ON", or start the engine.
- 2. On the "Menu" screen, press the top center of the screen for more than three seconds.
- 3. Enter the PIN code, and then touch "OK". 660: Diagnosis Menu screen 661: System Check screen (DTC code verification screen) 662: GPS Information screen.
- 4. The diagnostics screen will be displayed.

PINPOINT TEST G841057p1 : Poor satellite reception

G841057t1 : SYSTEM CHECK FOR DTCs

1. Check the system for DTCs which may be logged.

- **Are any system DTCs logged?**

-> **Yes**

Carry out repair actions to correct the DTCs logged.

Check satellite reception. GO to Pinpoint Test G841057t3.

-> **No**

GO to Pinpoint Test G841057t2.

G841057t2 : RETRO-INSTALL INSTALLATIONS CHECK

1. Check to see if there are any retro-install installations (anti-theft, radar, etc.)

- **Are there any retro-install installations?**

-> **Yes**

Aftermarket items may cause either electrical or radio frequency interference that can cause satellite reception to deteriorate.

Remove the power supply (including backup power supplies) from any aftermarket items installed. If reception returns to normal after disconnection of aftermarket items, carry out the following. Alter the installation position of any aftermarket items. Check satellite reception. GO to Pinpoint Test G841057t3.

-> **No**

GO to Pinpoint Test G841057t3.

G841057t3 : SATELLITE RECEPTION CHECKS

1. Check the 'ST' column of the navigation diagnostics GPS information screen (PIN code 662) after 10 minutes have passed. There must be more than 4 'P's displayed for accurate positioning. Check the 'HDOP' value, this must be less than 5.

- **Are there more than 4 'P's displayed and is HDOP less than 5?**

-> **Yes**

Satellite reception is normal.

-> **No**

Confirm the GPS antenna is connected to the navigation module.

Refer to the electrical circuit wiring diagrams and check the integrity of the coaxial cable and connectors from the Navigation Control Module (NCM) to the GPS antenna.

Install a new GPS antenna or coaxial cable as required.

Re-check satellite reception.

PINPOINT TEST G841057p2 : Map disc will not insert/eject

G841057t4 : CHECK NAVIGATION DISC SLOT SHUTTER

1. Check the navigation map disc slot shutter is open.

- **Is the navigation map disc slot shutter is open?**

-> **Yes**

GO to Pinpoint Test G841057t5.

-> **No**

Open the map disc slot shutter.

GO to Pinpoint Test G841057t5.

G841057t5 : CHECK NAVIGATION MAP DISC WILL INSERT/EJECT

1. Check that it is possible to insert/eject navigation map disc.

- **Is it possible to insert/eject navigation map disc?**

-> **Yes**

Operation is normal.

-> **No**

Refer to the electrical circuit diagrams and check power supply and ground connections to the Navigation Control Module (NCM). If power supply and ground connections are good, install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G841057p3 : Black screen (navigation map screen does not display)

G841057t6 : CHECK SCREEN SAVER FUNCTION

1. Check the screen saver function operation.

- **Does the screen saver function operate?**

-> **Yes**

Press the display panel button. GO to Pinpoint Test G841057t8.

-> **No**

GO to Pinpoint Test G841057t8.

G841057t8 : CHECK DISPLAY BACKLIGHT

1. Check the display backlight operation.

- **Does the display backlight operate?**

-> **Yes**

Refer to the electrical circuit diagrams and check the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected.

If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected, check and install a new GVIF cable as required. Refer to the new module/component installation note at top of DTC Index.

If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected and **NOT** damaged, check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

Re-check the system.

-> **No**

Check the HLDF display.

Re-check the system.

PINPOINT TEST G841057p4 : Navigation map screen colour is abnormal

G841057t9 : COLOUR BAR CHECK

1. Carry out the display diagnostics 'colour bar check' (PIN code 660).

- **Are the results of the display diagnostics 'colour bar check' normal?**

-> **Yes**

Check the HLDF display.

Re-check the system.

-> **No**

Check the condition of the map disc for dirt or scratches.

Refer to the electrical circuit diagrams and check the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected.

If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected, check and install a new GVIF cable as required. Refer to the new module/component installation note at top of DTC Index.

If the GVIF cable between Navigation Control Module (NCM) and HLDF screen is properly connected and **NOT** damaged, check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

Re-check the system.

PINPOINT TEST G841057p5 : Vehicle's current position mark turns independently

G841057t10 : VEHICLES CURRENT POSITION MARK TURNS INDEPENDENTLY

1. Determine if the ignition status was turned to Auxiliary or On, while the vehicle was in motion with steering turned such as after an engine stall.

- **Was ignition status set to Auxiliary or On?**

-> **Yes**

The angular speed of the vehicle at the time of the ignition status change will be logged as the standard value. To re-set the standard value, turn ignition status to 'OFF' then to 'Auxiliary' or 'On' with the vehicle stationary.

Re-test the vehicle.

-> **No**

Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G841057p6 : Car current position not stable

G841057t11 : SYSTEM CHECK FOR DTCs

1. Check the system for DTCs which may be logged.

- **Are any system DTCs logged?**

-> **Yes**

Carry out repair actions to correct the DTCs logged.

Re-check the system for car current position not stable.

-> **No**

GO to Pinpoint Test G841057t12.

G841057t12 : VEHICLE SPEED INPUT CHECK

1. Select Vehicle Sensor from the navigation diagnostic menu screen (PIN code 660), check Current speed. The current speed must match the speedometer.

- **From the Vehicle Sensor screen, does the current speed must match the speedometer?**

-> **Yes**

GO to Pinpoint Test G841057t13.

-> **No**

Carry out MOST ring circuit checks.

Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index.

Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required.

G841057t13 : CHECK NUMBER OF SATELLITES

1. From the navigation diagnostic GPS information screen (PIN code 662), check the number of satellites displayed.

- **Is the number of satellites displayed on the screen 0?**

-> **Yes**

Carry out pinpoint test A "Poor Satellite Reception"

-> **No**

GO to Pinpoint Test G841057t14.

G841057t14 : CHECK IF SYMPTOMS ARE OCCURRING IN PARTICULAR LOCATIONS

1. Confirm if the 'car current position not stable' symptom is occurring in particular locations.

- **Is the 'car current position not stable' symptom occurring in particular locations?**

-> **Yes**

Signal reflections from buildings or a particular location may be responsible.

-> **No**

Carry out pinpoint test A "Poor Satellite Reception"

PINPOINT TEST G841057p7 : Map display is incomplete

G841057t15 : SYSTEM CHECK FOR DTCs

1. Check the system for DTCs which may be logged.

- **Are any system DTCs logged?**

-> **Yes**

Carry out repair actions to correct the DTCs logged.

Re-check the system for 'Map display is incomplete'.

-> **No**

GO to Pinpoint Test G841057t16.

G841057t16 : CHECK MAP DISC

1. Check map disc for contamination, deformation, cracks, scratches or non-genuine disc and correct market.

- **Has a fault been identified with the map disc?**

-> **Yes**

Replace the map disc.

Re-check the system for 'Map display is incomplete'.

-> **No**

Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G841057p8 : No navigation voice guidance

G841057t17 : CHECK ALL AUDIO OUTPUT SYSTEMS

1. Check audio output across all systems.

- **Is there sound output across all systems?**

-> **Yes**

GO to Pinpoint Test G841057t18.

-> **No**

GO to Pinpoint Test G841057t19.

G841057t18 : CHECK VOICE GUIDANCE SOFT KEY

1. Check navigation screen menu, voice guidance soft key is not set to OFF position.

- **Is the voice guidance soft key set to OFF position?**

-> **Yes**

Set the voice guidance soft key to ON position.

Re-check the system

-> **No**

GO to Pinpoint Test G841057t19.

G841057t19 : VOLUME LEVEL CHECK

1. Check the volume level is not set too low.

- **Is the volume level set too low?**

-> **Yes**

Increase the volume level and re-test vehicle.

-> **No**

Refer to electrical circuit diagrams and check integrity of amplifier and speaker system wiring harness and connectors.

GO to Pinpoint Test G841057t20.

G841057t20 : NAVIGATION VOICE ONLY NOT AUDIBLE

1. Press the 'Navigation voice repeat' soft key.

- **After the navigation voice repeat soft key is pressed, can voice still not be heard even though it has become louder?**

-> **Yes**

Check and install a new Navigation Control Module (NCM) as required. Refer to the new module/component installation note at top of DTC Index.

-> **No**

Operation is normal.

PINPOINT TEST G841057p9 : No response to pressing navigation menu

G841057t21 : NO RESPONSE TO PRESSING NAVIGATION MENU

1. Check that the engine was not turned 'OFF' during a navigation software update.

- **Was the engine turned 'OFF' during a navigation software update?**

-> **Yes**

Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutes Turn the engine 'OFF', and then start the engine again. Verify that the navigation screen displays. Navigation was in the program update mode.

-> **No**

GO to Pinpoint Test G841057t23.

G841057t22 : NO RESPONSE TO PRESSING NAVIGATION MENU

1. Check that the engine was not turned 'OFF' after inserting the new map disc.

- **Was the engine turned 'OFF' after inserting the new map disc?**

-> **Yes**

Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutes Turn the engine 'OFF', and then start the engine again.

-> **No**

GO to Pinpoint Test G841057t23.

G841057t23 : NO RESPONSE TO PRESSING NAVIGATION MENU

1. Check the "Loading" button on the navigation diagnostics screen (PIN code 660) has been pressed, and "YES" has been selected.

- **Has the "Loading" button on the navigation diagnostics screen been pressed, and has "YES" been selected?**

-> **Yes**

Check the correct map disc is inserted into the Navigation Control Module (NCM). Start the engine and allow to idle for 15 minutes Turn the engine 'OFF', and then start the engine again.

-> **No**

Refer to electrical circuit diagrams and check integrity of navigation system wiring harness and connectors.

GO to Pinpoint Test G841057t24.

G841057t24 : SYSTEM CHECK FOR DTCs

1. Check the system for DTCs which may be logged.

- **Is DTC U300055 logged?**

-> **Yes**

Using the manufacturer approved diagnostic system check/amend the Car Configuration File parameter in block 2, byte 127 to match vehicle market/specification. If the DTC remains check navigation system module part number and ensure the correct component is installed to vehicle market/specification.

-> **No**

GO to Pinpoint Test G841057t25.

G841057t25 : NO RESPONSE TO PRESSING NAVIGATION MENU

1. Turn the engine 'OFF', wait for a moment, and then turn the engine 'ON' again.

- **Does the navigation screen fail to display even if the navigation button is pressed?**

-> **Yes**

Check the HLDF is installed correctly.

Check the Navigation Control Module (NCM) is installed correctly.

-> **No**

Operation is normal.

Navigation System Antenna (86.62.06)

Removal

- 1 . Remove the rear spoiler.

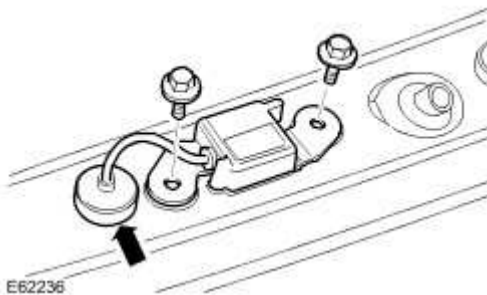
For additional information, refer to Rear Spoiler (76.19.86.60)

- 2 . Disconnect the electrical connector.



- 3 . Remove the navigation system antenna.


▶ Remove the 2 bolts.



Installation

- 1 . Install the navigation system antenna.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

 Connect the electrical connector.

2 . Install the rear spoiler.

For additional information, refer to Rear Spoiler (76.19.86.60)

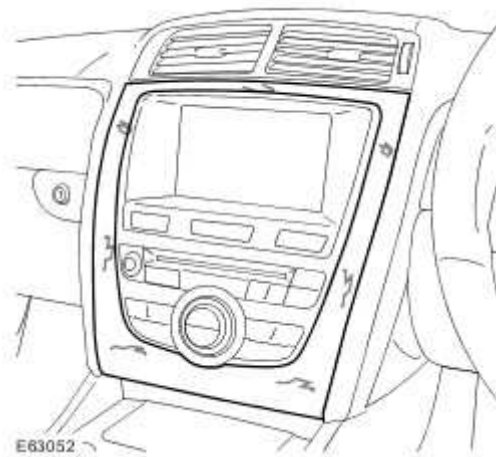
Navigation System Display Module (86.62.07)

Removal

- 1 . Disconnect the battery ground cable.
For additional information, refer to

- 2 . Remove the instrument panel center reinforcement trim panel.

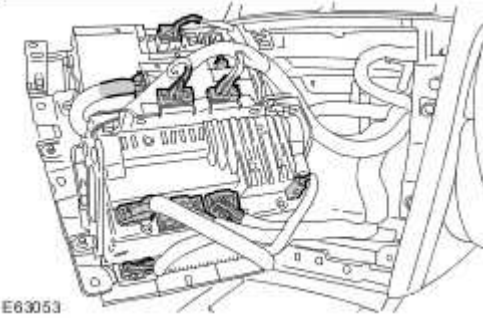
▶ Release from the 5 clips.



- 3  **CAUTION: Protect the surrounding trim from damage when changing the component.**

Release the navigation system module bracket.

- ▶ Remove the 4 Torx screws.
- ▶ Disconnect the 10 electrical connectors.
- ▶ Release the assembly.

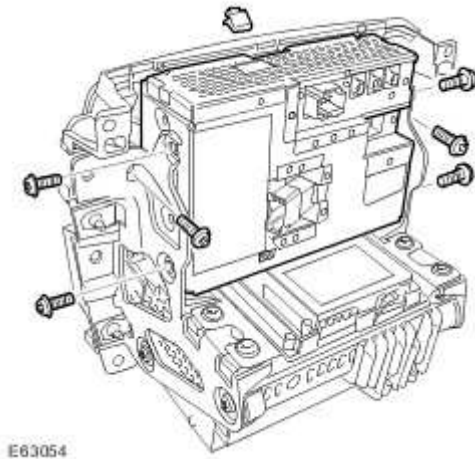


4 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the navigation screen module.

- ▶ Remove the trim panel veneer upper retaining clip.
- ▶ Remove the 2 Torx screws.
- ▶ Remove the 4 Torx bolts.



E63054

Installation

1 . Install the navigation screen module.

- ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).
- ▶ Tighten the Torx screws.
- ▶ Install the clip.

2 . Install the navigation system module bracket.

- ▶ Connect the electrical connectors.
- ▶ Tighten the Torx screws.

3 . Install the instrument panel center reinforcement trim panel.

- ▶ Align the pegs and secure with the clips.

4 . Connect the battery ground cable.

For additional information, refer to

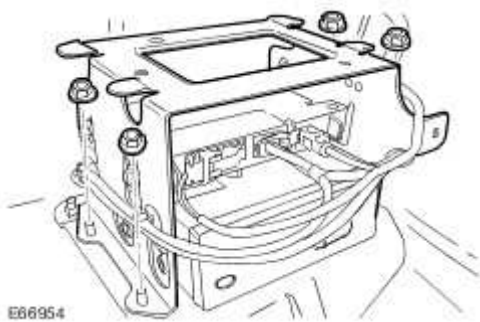
Navigation System Module (86.62.05)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 . Release the navigation system module bracket.

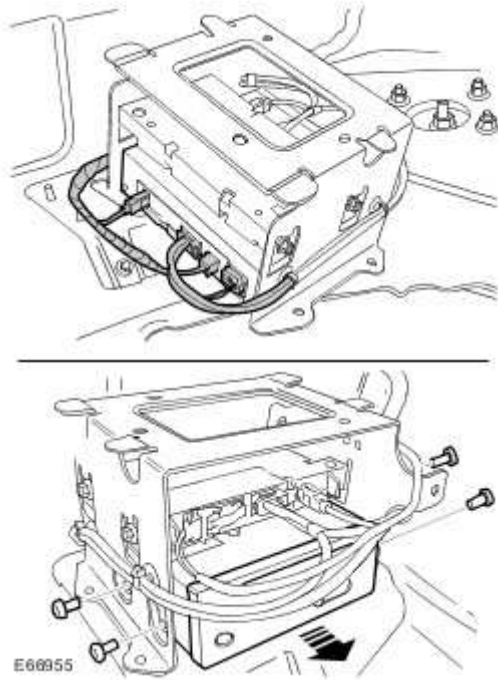
- ▶ Remove the 4 nuts.



- 3 . Remove the navigation system module.

- ▶ Disconnect the 4 electrical connectors.

- ▶ Remove the 4 Torx bolts.



Installation

- 1 . Install the navigation system module.
 - ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).
 - ▶ Connect the electrical connectors.
- 2 . Install the navigation system module bracket.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to

419-08 : Cellurar Phone

Specifications

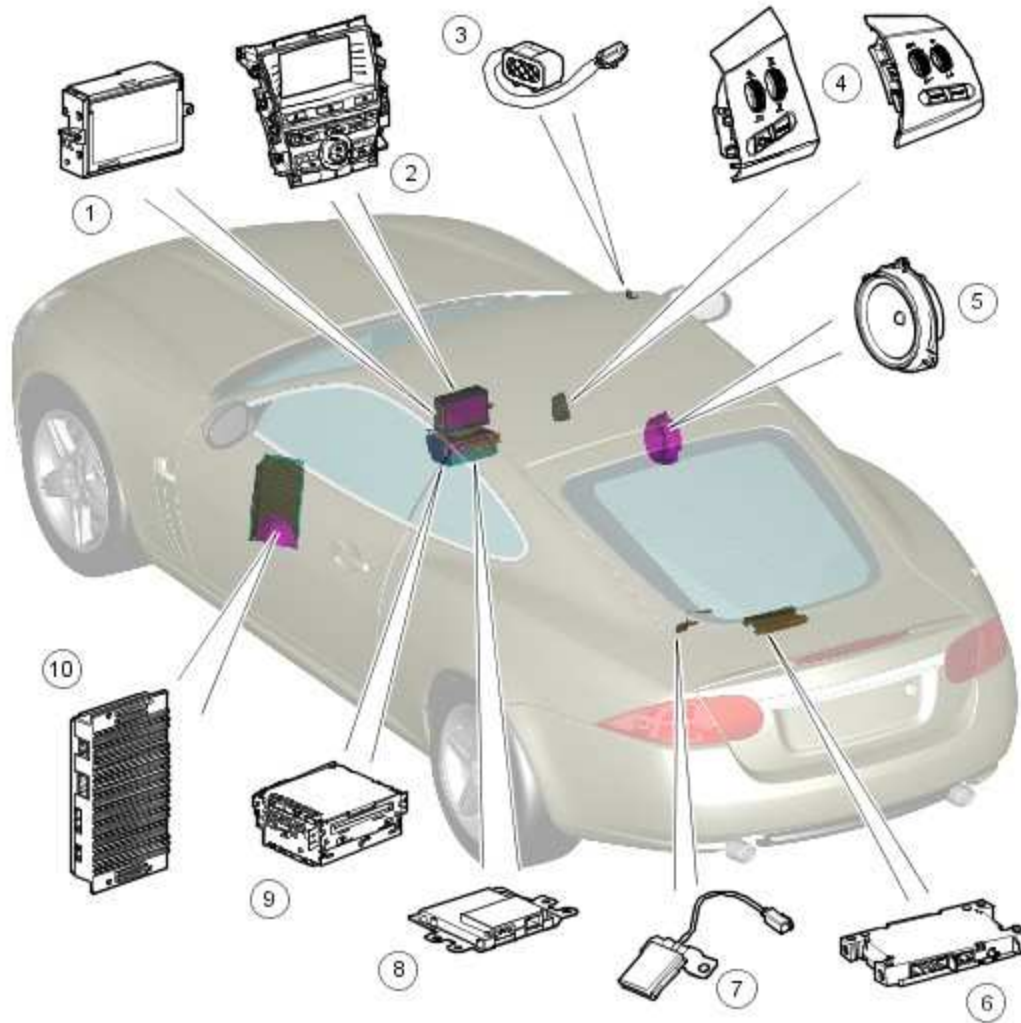
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Cellular (Bluetooth) phone antenna	7	5	62
Transceiver module	6	4	53

Cellular Phone

COMPONENT LOCATION



E63432

Item	Part Number	Description
1		Touch Screen Display (TSD)
2		Integrated control panel
3		Microphone
4		Steering wheel controls

5		Speakers
6		Telephone control module
7		Bluetooth antenna
8		Information and entertainment module
9		Integrated Audio Module
10		Audio amplifier

INTRODUCTION

The cellular phone system is based on using the customers own Bluetooth capable handset with the vehicle Information and Entertainment system.

NOTE:

There is no physical connection (cradle) between the phone handset and the Telephone Control Module. Communications between the two components are purely Bluetooth. This can limit the available functions dependant on the handset used.

The cellular phone system comprises the following components:

- Telephone Control Module
- Microphone
- Bluetooth antenna

The system allows the driver to send, receive and end phone calls using the Touch Screen Display (TSD), steering wheel switches and voice recognition system.

Phone dialing is achieved using one of the following methods:

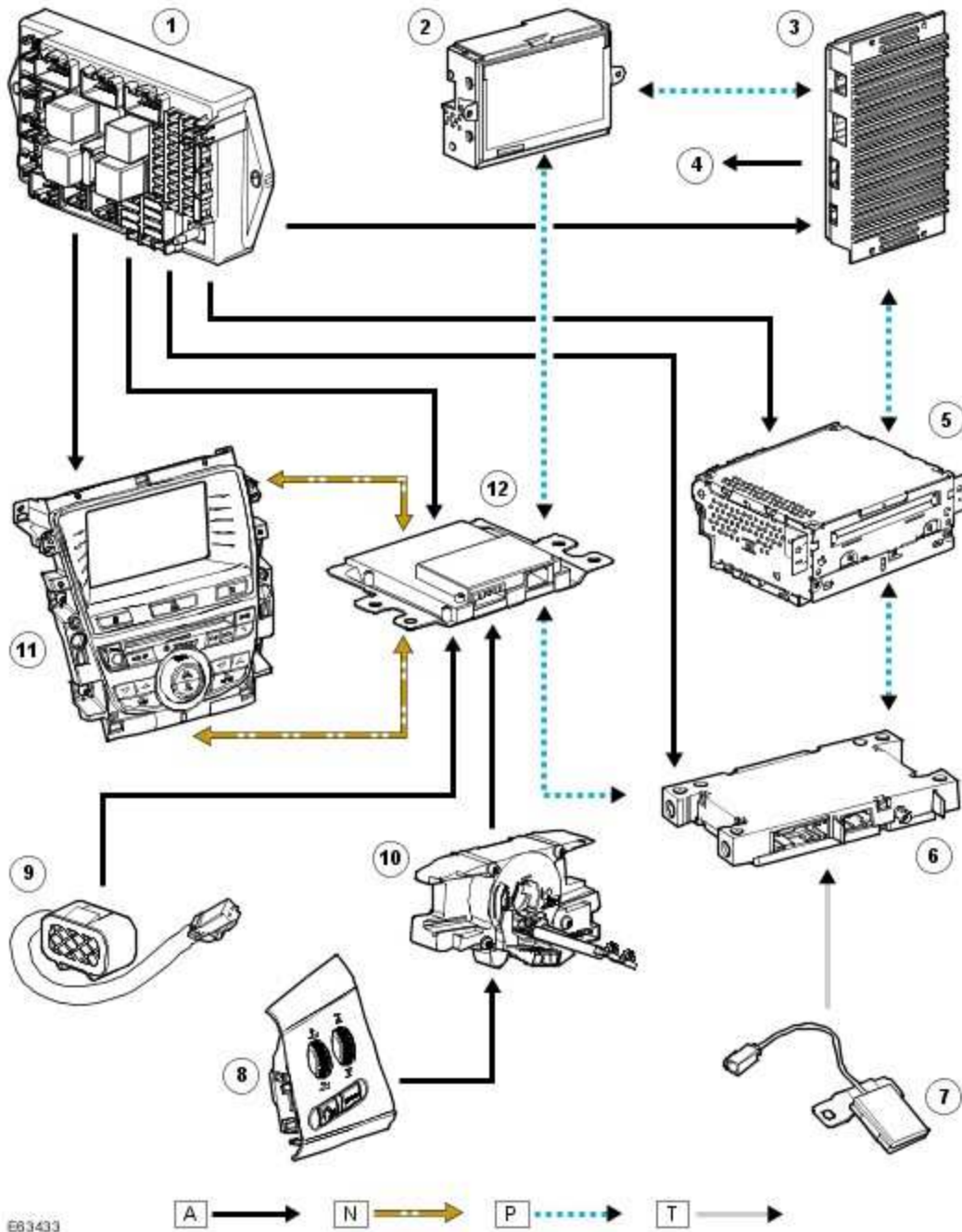
- Dialing a number using the TSD keypad
- Selecting a number from the handsets phonebook
- Selecting from the handsets call register, typically the last 10 calls made, received and missed.

The Telephone Control Module is connected to the Information and Entertainment system on the MOST ring. This allows audio and control signals to be routed to and from the Telephone Control Module.

CONTROL DIAGRAM

NOTE:

A=Hardwired; N=Medium speed CAN; P=MOST; T=Coaxial



E63433

Item	Part Number	Description
1		Auxiliary junction box
2		Touch Screen Display (TSD)
3		Audio amplifier

4		Speakers
5		Integrated audio module
6		Telephone control module
7		Bluetooth antenna
8		Steering wheel controls
9		Microphone
10		Clock spring
11		Integrated control panel
12		Information and entertainment module

Cellular Phone Antenna (86.51.17)

Removal

- 1 . Remove the rear seat armrest.
For additional information, refer to Rear Seat Armrest (76.70.39)
- 2 . Release the auxiliary junction box access cover.

▶ Release from the clip.



- 3 . Remove the cellular phone antenna.

▶ Remove the 2 nuts.

▶ Disconnect the electrical connector.



Installation

1 . Install the cellular phone antenna.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

▶ Connect the electrical connector.

2 . Secure the auxiliary junction box access cover.

▶ Secure in the clip.

3 . Install the rear seat armrest.

For additional information, refer to Rear Seat Armrest (76.70.39)

Transceiver Module

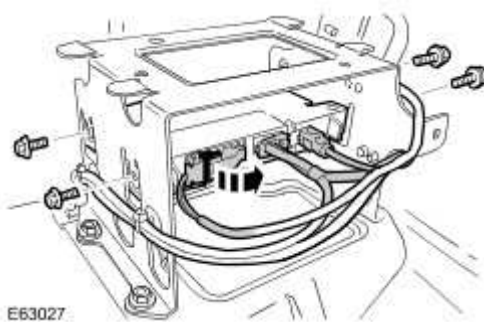
Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

- 2 . Remove the transceiver module.

▶ Disconnect the 3 electrical connectors.

▶ Remove the 4 bolts.



Installation

- 1 . Install the transceiver module.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

▶ Connect the electrical connectors.

- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to

419-10 : Multifonction Electronic Modules

Specifications

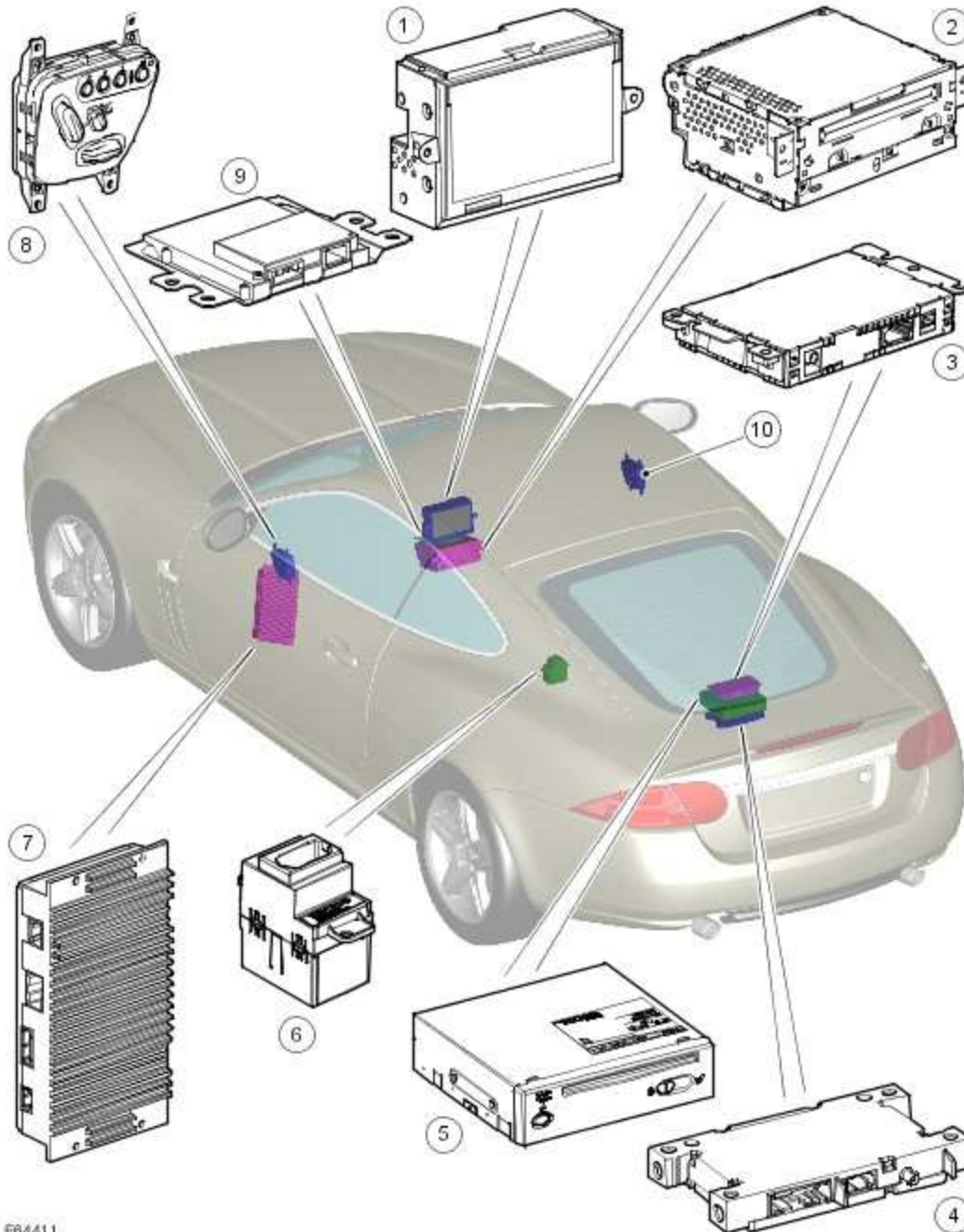
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in

Module Controlled Functions

COMPONENT LOCATION-MOST/LIN

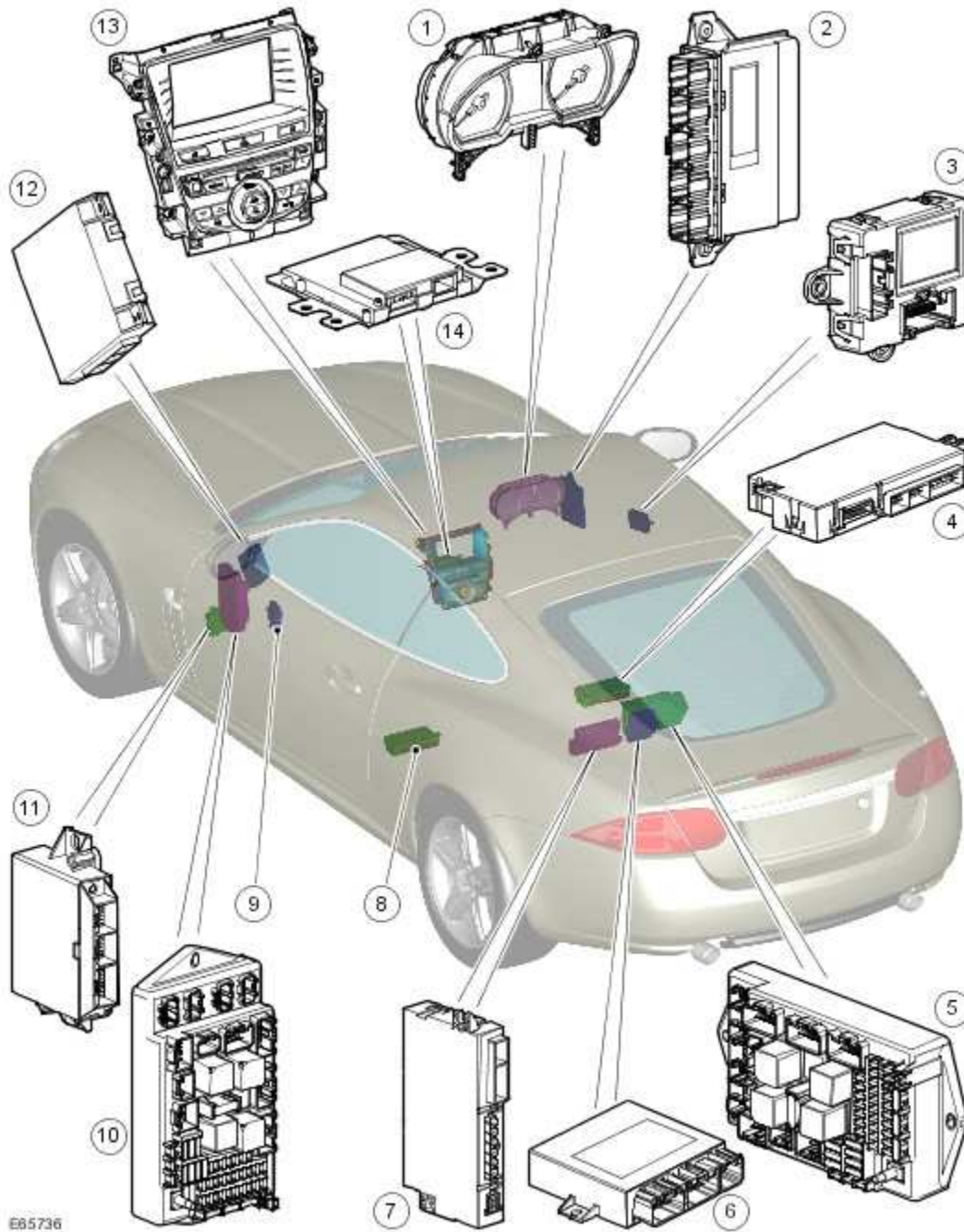


EB4411

Item	Part Number	Description
1		Touch Screen Display (TSD)

2		Integrated audio module
3		Bluetooth® phone module
4		SDARS/DAB module (where fitted)
5		Navigation computer
6		Engine start control module
7		Audio amplifier
8		Passenger door module
9		Information and entertainment control module
10		Drivers door module

COMPONENT LOCATION-MEDIUM SPEED CAN

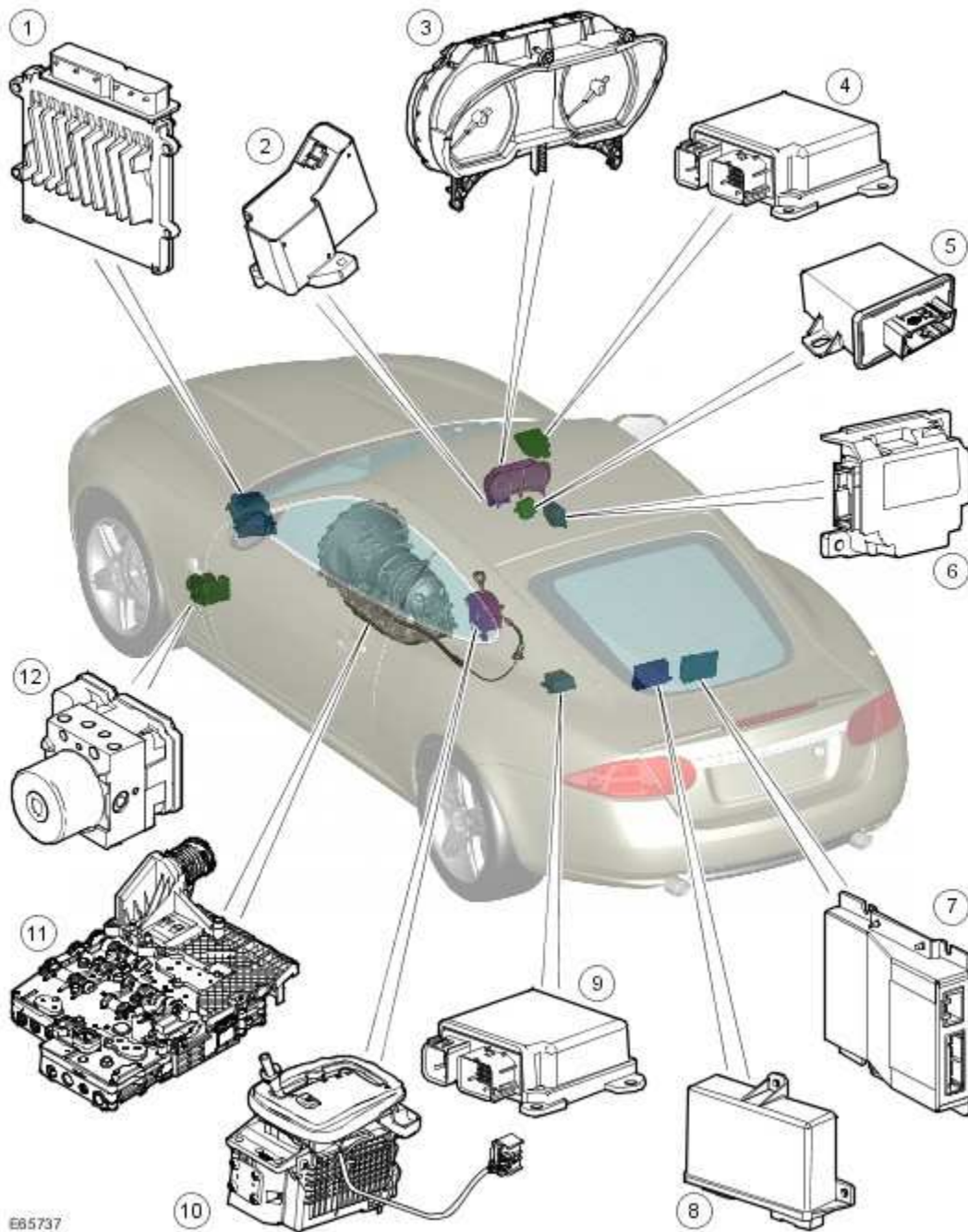


E65736

Item	Part Number	Description
1		Instrument cluster
2		Keyless vehicle module
3		Drivers door control module
4		Drivers seat module

5		Auxiliary junction box
6		Tire Pressure Monitoring System (TPMS) module
7		Convertible top control module (convertible vehicle only)
8		Passenger seat module
9		Passenger door control module
10		CJB
11		Parking aid control module
12		ATC control module
13		Integrated control panel
14		Information and entertainment control module

COMPONENT LOCATION-HIGH SPEED CAN



E65737

Item	Part Number	Description
1		ECM
2		Steering column lock
3		Instrument cluster
4		Pedestrian Protection System module

5		Headlamp leveling/adaptive front lighting module
6		Adaptive speed control module
7		Active Damping Control Module (ADCM)
8		Electric park brake module
9		RCM
10		L Gate
11		TCM
12		ABS control module

INTRODUCTION

The vehicle electrical system consists of a number of control modules connected via two multiplexed CAN busses For additional information, refer to Communications Network (418-00 Module Communications Network)

. The Instrument cluster acts as a gateway between the two CAN bus systems.

Lower speed control modules use a Local Interconnect (LIN) Bus. Control modules on the LIN bus are generally configured to be master/slave i.e. one module controls other module(s).

The vehicle entertainment system uses a fibre optic bus system which uses the MOST protocol for transmission of data and audio to the relevant components of the audio system.

Module	Bus System	Function	Location
ECM	HS CAN	Controls the engine in response to various sensor inputs.	Front LH side in engine compartment adjacent to bulkhead.
ABS	HS CAN	Controls the braking force applied to the road wheels.	In the engine compartment next to the ECM.
Instrument cluster	HS CAN and MS CAN LIN Bus.	Gateway between High speed and Medium speed CAN, Gateway between the CAN busses and the LIN bus	On the drivers side in the instrument panel.

Parking aid control module	MS CAN.	Control of parking sensors and routing of audio feedback to driver	Lower LH A post below the CJB.
Navigation computer	MOST, GVIF	Route guidance output based on inputs from GPS satellites and driver destination.	In the luggage compartment to the right of battery.
RCM	MS CAN.	Controls the deployment of supplementary restraint components.	On the transmission tunnel between the seats under the trim.
Tire Pressure Monitoring System (TPMS) module	MS CAN.	Monitors the vehicle tires to warn of deflation.	Behind the rear seats next to the Auxiliary Junction Box.
TCM	MS CAN.	Electronic control of the automatic gear change.	In the sump of the transmission.
Steering column lock	MS CAN.	Inhibits the steering from being turned without the proper security parameters being met.	On the steering column.
Headlamp leveling/adaptive front lighting module	HS CAN.	Controls headlamp levels and adaptive front lighting system.	RH foot well mounted against inner bulk head.
Adaptive speed control module	HS CAN.	Controls vehicle road speed in relation to other vehicles when in speed control mode.	At the bottom of the RH A post.
CJB	MS CAN.	Controls body functions and power distribution.	In the passenger compartment LH side on the A post.
Auxiliary junction box	MS CAN.	Controls body functions and power distribution.	In the center behind the backrest of the rear passenger seat.
Active Damping Control Module (ADCM)	HS CAN.	Controls the adjustment of the dampers.	Behind the backrest of the RH rear passenger seat.
Electric park brake module	HS CAN.	Controls the application and release of the parking brake.	Behind the auxiliary junction box.

Air conditioning control module	MS CAN.	Controls the operation of the climate control/air-conditioning system.	Attached to the side of Air conditioning unit.
Information and entertainment control module	MS CAN.	Gateway between the MOST and CAN systems for information and control distribution.	Behind the Touch Screen Display and above the integrated audio unit.
Drivers door module	MS CAN.	Memory/adjustment functions for seats, steering column and mirrors and security functions.	In the drivers door behind the trim.
Passenger door module	MS CAN.	Memory/adjustment functions for seats, steering column and mirrors and security functions.	In the passenger door behind the trim.
Integrated control panel	MS CAN.	Contains controls for entertainment system and air conditioning system	Center of the instrument panel surrounding the Touch Screen Display.
Drivers seat module	MS CAN.	Controls seat positioning and memory seat functions.	Under the drivers seat.
Passenger seat module	MS CAN.	Controls seat positioning and memory seat functions.	Under the front passenger seat.
Keyless vehicle module	MS CAN.	Allows the vehicle to be opened and started without the use of a key.	Right hand 'A' Post.
L Gate	MS CAN.	Electronic control of the selected gear/driving mode.	On top of the transmission tunnel.
Key Start Control Module	LIN Bus		In the center consol.
Pedestrian Protection System module	HS CAN.	Control and monitoring of Pedestrian Protection System	On the RH side under the wheel arch liner at the top of the wheel arch.

Multifunction Electronic Module

Description and Operation

For a detailed description of the multifunction electronic control modules, refer to the relevant Description and Operation section in the workshop manual.

Module Controlled Functions

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of electrical damage.

Electrical
<ul style="list-style-type: none">• Fuse(s)• Electrical connector(s)• Wiring Harness

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, check for DTCs and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

The DTC Index in this section shows information for DTCs that could be logged in the Driver Door Module (DDM) or Passenger Door Module (PDM). For diagnosis and testing information for: Driver/Passenger Seat module.

Seats Information and Entertainment module.
Audio System Remote Keyless Entry module.
Locks, Latches and Entry Systems

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B109C15	Front Courtesy Light	<ul style="list-style-type: none">Short to power or open circuit	Refer to the electrical circuit diagrams and test front courtesy light circuit for short to power or open circuit
B109D11	Front Courtesy	<ul style="list-style-type: none">Short to ground	Refer to the electrical circuit diagrams and test front

	Light		courtesy light circuit for short ground
B10EB11	Driver door double locking motor	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short ground
B10EB15	Driver door double locking motor	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver door double locking motor circuit for short to power or open circuit
B10EC11	Passenger door double locking motor	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short ground
B10EC15	Passenger door double locking motor	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger door double locking motor circuit for short to power or open circuit
B110811	Driver door central locking motor	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short ground
B110815	Driver door central locking motor	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver door central locking motor circuit for short to power or open circuit
B110911	Passenger door central locking motor	<ul style="list-style-type: none"> • Short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B110915	Passenger door central locking motor	<ul style="list-style-type: none"> • Short to power or open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
B116311	Left Mirror Heater Output short to ground	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to ground
B116315	Left Mirror Heater Output short to power	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to power or open circuit
B116411	Right Mirror Heater Output short to ground	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to ground
B116415	Right Mirror Heater Output short to power	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to power or open circuit
B116511	Left Front Puddle Lamp Output short to ground	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to ground
B116515	Left Front Puddle Lamp Output open load or short to power	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test left front puddle lamp output circuit for short to power or open circuit
B116611	Right Front Puddle Lamp Output short to ground	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to ground
B116615	Right Front Puddle Lamp Output open load or short to battery	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test right front puddle lamp output circuit for short to power or open circuit
B117E72	Front Power Window up	<ul style="list-style-type: none"> • Actuator stuck open 	Install a new DDM/PDM, refer to the new module installation note at the top of

			the DTC Index
B117E73	Front Power Window up	<ul style="list-style-type: none"> • Actuator stuck closed 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F72	Front Power Window down	<ul style="list-style-type: none"> • Actuator stuck open 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F73	Front Power Window down	<ul style="list-style-type: none"> • Actuator stuck closed 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B118929	Front Window Position Sensor	<ul style="list-style-type: none"> • Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	<ul style="list-style-type: none"> • Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1A9411	Driver Mirror	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to ground
B1A9415	Driver Mirror	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to power or open circuit
B1A9511	Passenger Mirror	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to ground
B1A9515	Passenger Mirror	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for

			short to power or open circuit
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> Value of signal protection calculation incorrect 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> Signal Invalid 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> Missing Message 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
B1C0911	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> Short to ground 	<p>Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to ground</p>
B1C0915	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> Short to power or open circuit 	<p>Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to power or open circuit</p>
B1C1011	Driver Up/Down Mirror Motor	<ul style="list-style-type: none"> Short to ground 	<p>Refer to the electrical circuit diagrams and test driver</p>

	Circuit		up/down mirror motor circuit for short to ground
B1C1015	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to power or open circuit
B1C1111	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1115	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1211	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1215	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power or open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to

			ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power or open circuit
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power or open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power or open circuit
C1B1411	Sensor Supply #1	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test window sensor supply circuit for short to ground
C1B1415	Sensor Supply #1	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test window sensor supply circuit for short to power or open circuit
U001000	Medium speed CAN communication	<ul style="list-style-type: none"> • Medium speed CAN communication Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

	Bus		diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> • Logged when subscribed CAN message missing from CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost communication With Driver Seat Module (DSM)	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> • Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U200224	Switch	<ul style="list-style-type: none"> • Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new passenger side window switch
U201011	Switch illumination	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201012	Switch illumination	<ul style="list-style-type: none"> • Circuit short to battery 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201208	Car Configuration Parameter(s)	<ul style="list-style-type: none"> • Bus signal/message failures 	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	<ul style="list-style-type: none"> • Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new driver side window switch pack. Window Control Switch (86.25.08)

U201444	Control module hardware	<ul style="list-style-type: none"> Data Memory Failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U210000	Initial configuration not complete	<ul style="list-style-type: none"> No sub type information 	Re-configure the DDM/PDM using the manufacturer approved diagnostic system
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U300255	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Not configured 	Re-configure the relevant module as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between DDM/PDM and RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Driver Seat Module (DSM) (86.75.28)

Removal

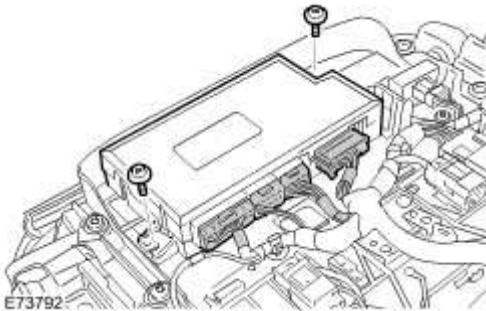
- 1 . Remove the front seat.

For additional information, refer to Front Seat (76.70.01)

- 2 . Remove the front seat control module.

▶ Disconnect the 4 electrical connectors.

▶ Remove the 2 Torx bolts.



Installation

- 1 . Install the front seat control module.

▶ Connect the electrical connectors.

▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).

- 2 . Install the front seat.

For additional information, refer to Front Seat (76.70.01)

Information and Entertainment Module (86.53.48)

Removal

- 1 . Disconnect the battery ground cable.

For additional information, refer to

- 2 . Remove the instrument panel center reinforcement trim panel.

▶ Release from the 5 clips.



3

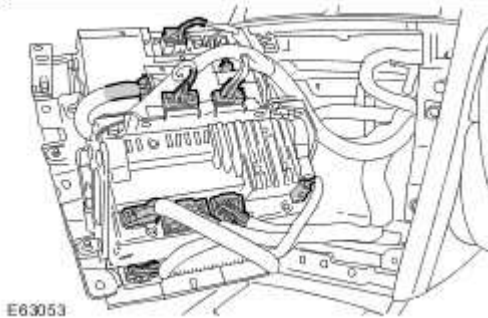
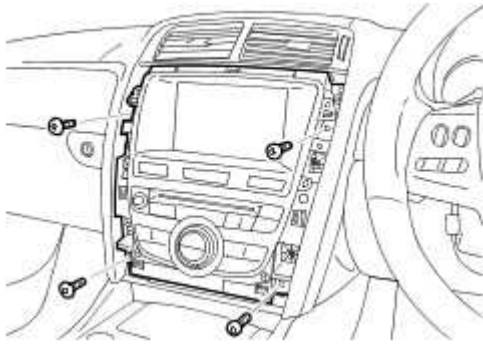


CAUTION: Protect the surrounding trim from damage when changing the component.

Release the navigation system module bracket.

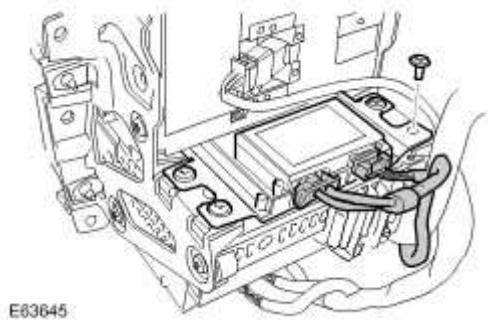
▶ Remove the 4 Torx screws.

▶ Release the assembly.



4 . Remove the information and entertainment module.

- ▶ Remove the 4 Torx bolts.
- ▶ Disconnect the 2 electrical connectors.




Installation

1 . Install the information and entertainment module.


- ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

 Connect the electrical connectors.

2 . Install the navigation system module bracket.

 Tighten the Torx screws.

3 . Install the instrument panel center reinforcement trim panel.

 Align the pegs and secure with the clips.

4 . Connect the battery ground cable.
For additional information, refer to

5 . Connect WDS to the vehicle and configure a new module.

Remote Keyless Entry (RKE) Module

Removal

NOTE:

This module is installed on the inside of the RH A-pillar above the footwell and does not change with the hand of drive.

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to

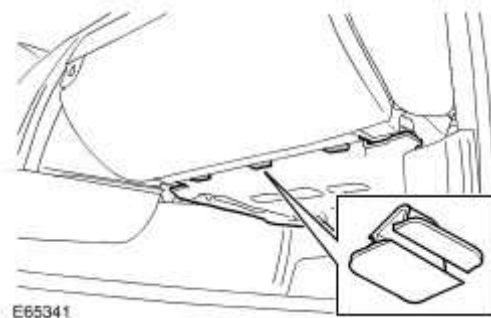
2



CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

Remove the RH side footwell trim panel.

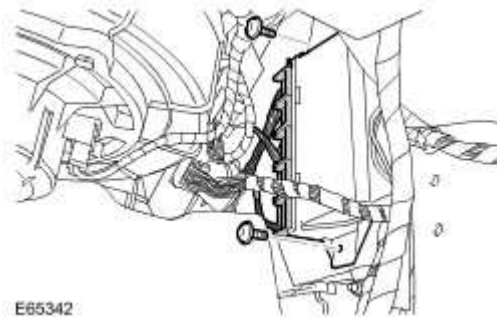
▶ Remove the 3 clips.



- 3 . Remove the keyless entry module.

▶ Remove the 2 Torx screws.

▶ Disconnect the 5 electrical connectors.



Installation

- 1 . Install the keyless entry module.
 - ▶ Connect the electrical connectors.
 - ▶ Install the screws.
- 2 . Install the RH side footwell trim panel.
 - ▶ Carefully secure the clips.
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to
- 4 . Connect WDS to the vehicle and configure a new module.

5. BODY AND PAINT

501 : Body and Paint

501-02 : Front End Body Panels

Removal and installation

Air Deflector (76.11.41)

Removal

1 . Disconnect the battery ground cable.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

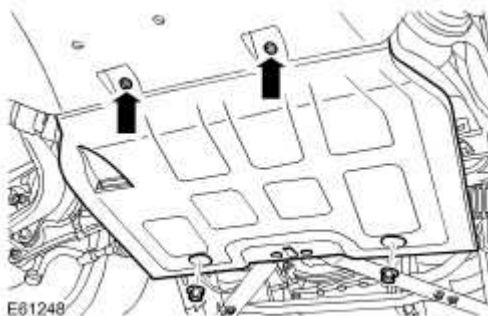
3 . **NOTE:**

Note the fitted position of the washers.

Remove the air deflector.

▶ Loosen the 2 screws.

▶ Remove the 2 nuts.



Installation

- 1 . Install the air deflector.
 - ▶ Tighten the nuts.
 - ▶ Tighten the screws.
- 2 . Connect the battery ground cable.

Cowl Vent Screen (76.10.01)

Removal



CAUTION: Always protect paintwork and glass when removing exterior components.

1 . Remove the air intake cover.

▶ Remove the 3 clips.



2 . Remove the brake master cylinder cover.

▶ Remove the 4 clips.



3 . Remove the windshield wiper arms.

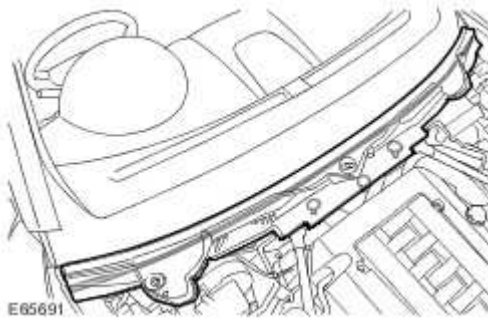
For additional information, refer to [Wiper Pivot Arm \(84.15.03\)](#)

4 . Remove the plenum chamber panel.

▶ Release the retaining clip.

▶ Release the 3 clips.

▶ Disconnect the washer jet hose.



Installation

- 1 . Install the plenum chamber panel.
 - ▶ Connect the washer jet hose.
 - ▶ Carefully secure the clips.
- 2 . Install the air intake cover.
 - ▶ Carefully secure the clips.
- 3 . Install the brake master cylinder cover.
 - ▶ Carefully secure the clips.
- 4 . Install the windshield wiper arms.
For additional information, refer to [Wiper Pivot Arm \(84.15.03\)](#)

Fender Splash Shield (76.10.90)

Removal

1 . Disconnect the battery ground cable.

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the LH front wheel and tire.

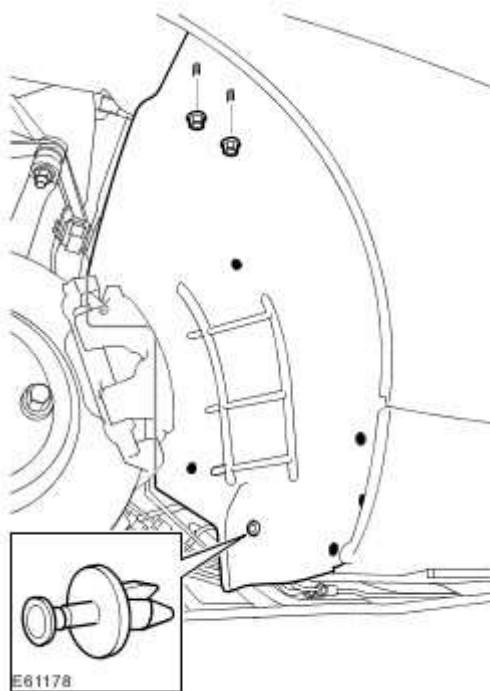
For additional information, refer to [Wheel and Tire \(74.20.05\)](#)

4 . Remove the fender splash shield, rear section.

▶ Remove the 6 Torx bolts.

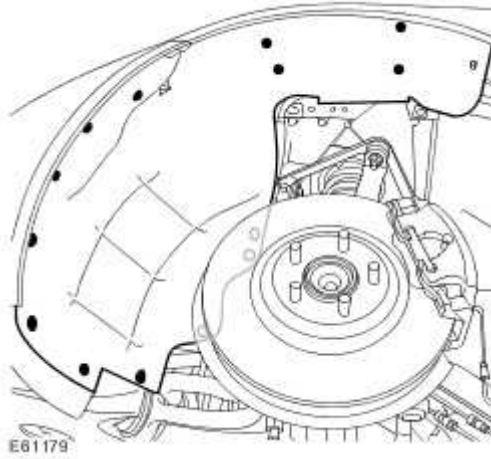
▶ Remove the clip.

▶ Remove the 2 nuts.



5 . Remove the fender splash shield, front section.

▶ Remove the 13 Torx bolts.



Installation

- 1 . Install the fender splash shield, front section.
 - ▶ Tighten the Torx bolts.
- 2 . Install the fender splash shield, rear section.
 - ▶ Tighten the Torx bolts.
 - ▶ Tighten the nuts.
 - ▶ Install the clip.
- 3 . Install the wheel and tire.

For additional information, refer to [Wheel and Tire \(74.20.05\)](#)
- 4 . Connect the battery ground cable.

Radiator Splash Shield (76.22.90)

Removal

1



- **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

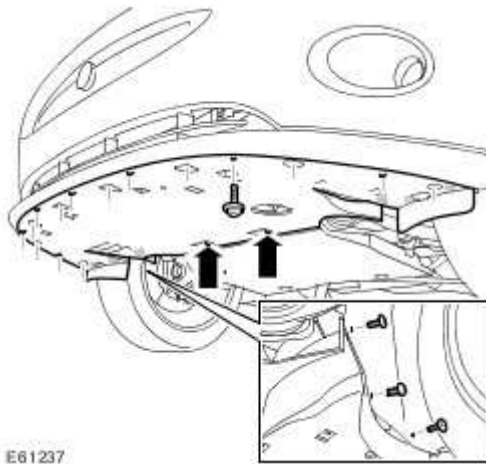
Raise and support the vehicle.

2 . **NOTE:**

Note the fitted position of the washers.

Remove the radiator splash shield.

- ▶ Remove the 21 Torx bolts.
- ▶ Remove the 2 screws.



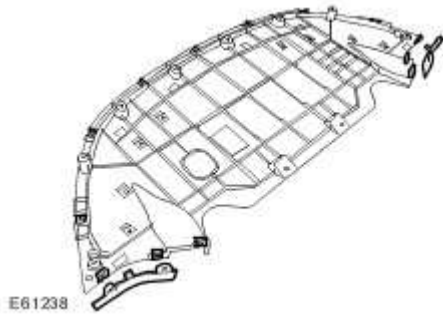
3 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the 13 clips.

4 . Remove the 2 air deflectors.

- ▶ Release the 2 clips.



Installation

- 1 . Install the air deflectors.
 - ▶ Carefully secure the clips.
- 2 . Install the clips.
- 3 . Install the radiator splash shield.
 - ▶ Tighten the Torx bolts.
 - ▶ Tighten the screws.

501-03 : Body Closures

Specifications

Specifications

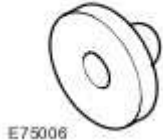
Torque Specifications

Item	Nm	lb-ft	lb-in
Door check strap to body - bolt	12	9	-
Door check strap to door - nut	12	9	-
Door hinge - pin bolt	25	18	-
Hood to hinge - nut	23	17	-
Hood hinge to body - bolt	23	17	-
Lift-gate to hinge - bolt	23	17	-
Lift-gate hinge to body - nut	23	17	-
Luggage compartment lid to hinge - nut	23	17	-
Luggage compartment lid hinge to body - bolt	23	17	-

Hood Alignment (76.16.02)

Special Service Tools

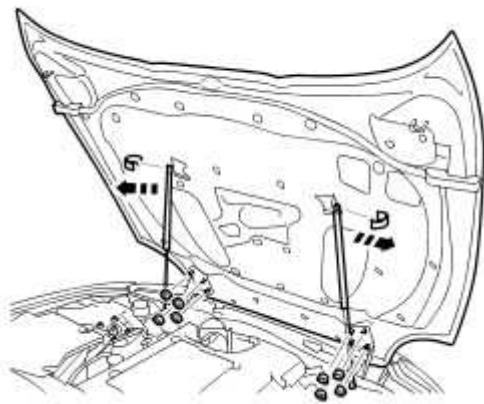
501-119



E75006

Actuator Aligners - Pedestrian Protection Hood Stops
501-119

1. With assistance, loosen the 8 nuts securing the hood to the hinges.
2. Release the hood support struts.



E69380

3. Lower the hood and check for alignment.
Body and Frame

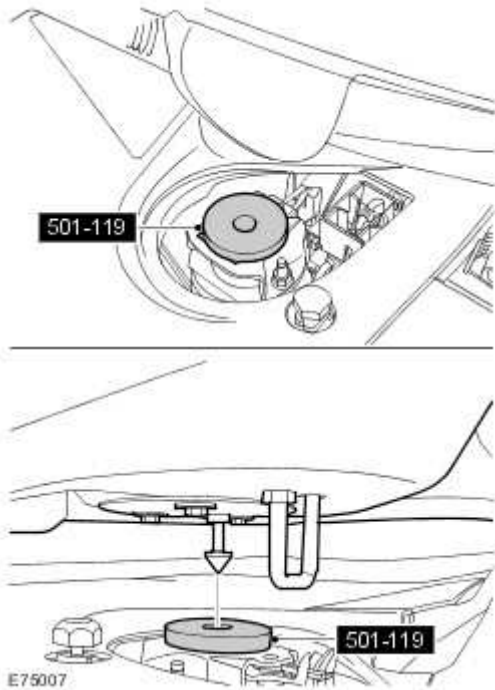
- Adjust as necessary.

4. Raise the hood.

- Tighten the nuts to 25 Nm (18 lb.ft).
Connect the hood support struts.

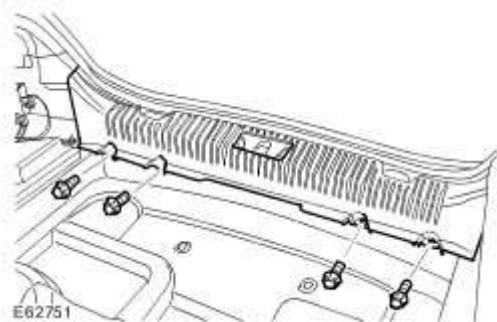
5. Align the hood to the pedestrian protection actuators using special tools 501-119.

- Insert special tools 501-119, into the pedestrian protection actuators.
- Loosen the 8 bolts securing the pedestrian protection actuator stops to the hood.
- Gently close the hood so that the pedestrian protection hood stops are aligned to the actuators.
- Open the hood.
- Tighten the bolts to 10 Nm (7 lb.ft).



Luggage Compartment Lid Alignment (76.19.03)

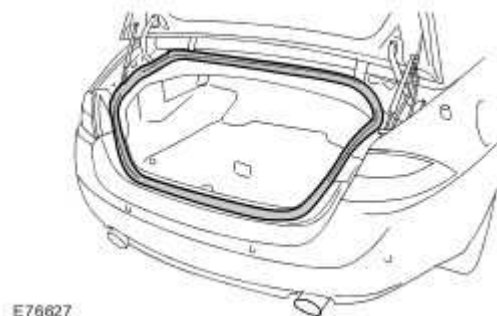
1. Remove the luggage compartment floor panel.
2. Remove the luggage compartment lid striker panel.
 - Remove the 4 Torx screws.



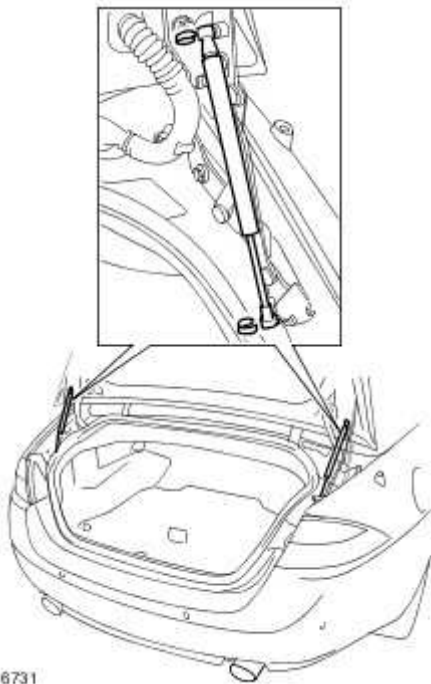
3. Remove the luggage compartment striker.
 - Remove the 2 Torx bolts.



4. Remove the luggage compartment aperture seal.



5. Remove the luggage compartment lid struts.
 - Release the 4 clips.



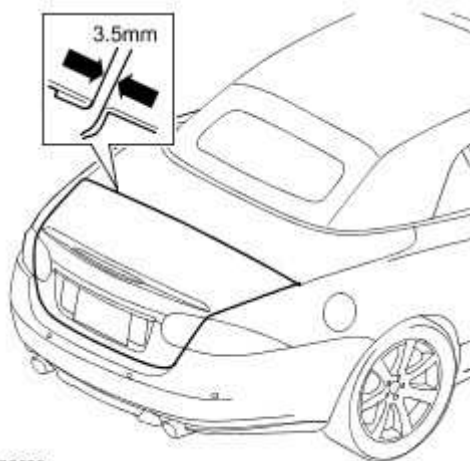
E76731

6. Loosen the luggage compartment lid hinge fixings.
 - Loosen but do not remove the 4 nuts.



E76628

7. Make sure the gaps between the luggage compartment lid are all 3.5 mm.



E76629

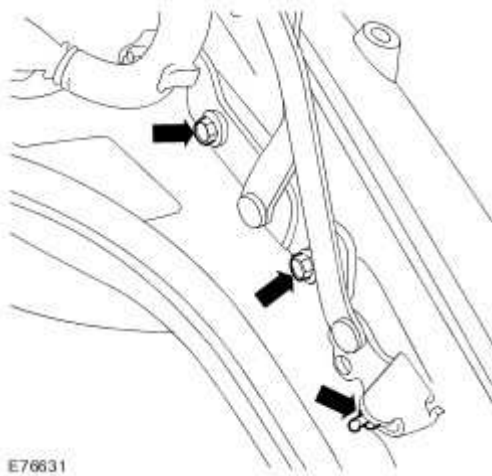
8. Make sure the luggage compartment lid to rear bumper gap is 6.8 mm.



9. Tighten the luggage compartment lid hinge nuts to 23 Nm (17 lb.ft).

10. Loosen the luggage compartment lid hinge to body fixings.

- Loosen the 6 bolts.



11. Make sure the gaps between the luggage compartment lid are all 3.5 mm.

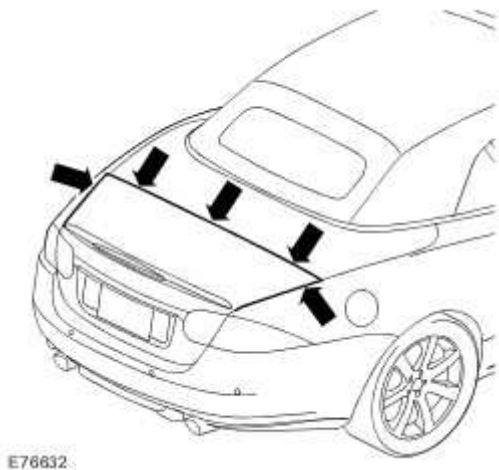
12. Tighten the luggage compartment lid hinge to body bolts, to 23 Nm (17 lb.ft).

13. Install the luggage compartment lid support struts.

- Secure the 4 clips.

14. With the luggage compartment lid closed, check the profile of the luggage compartment lid to convertible top compartment lid, and luggage compartment lid to rear body side is flush;

adjust as necessary.



E76832

15. Install the luggage compartment lid aperture seal.
16. Install the luggage compartment lid striker.
17. Install the luggage compartment lid striker trim panel.
 - Install the 4 Torx screws
18. Install the luggage compartment floor panel.

Liftgate Alignment (76.19.54.60)

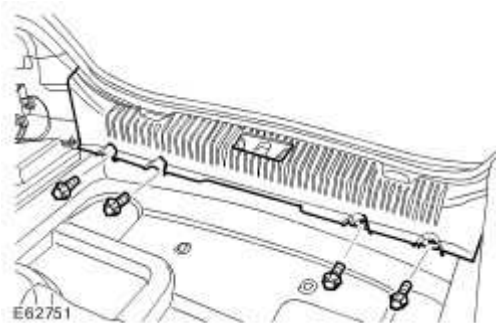
1. Check the gap and profiles of the liftgate are correct.

Body and Frame

2. Remove the loadspace floor panel.

3. Remove the scuff plate trim panel.

- Remove the 4 Torx bolts.



4. Remove the liftgate hinge cover.

- Remove the 8 clips.

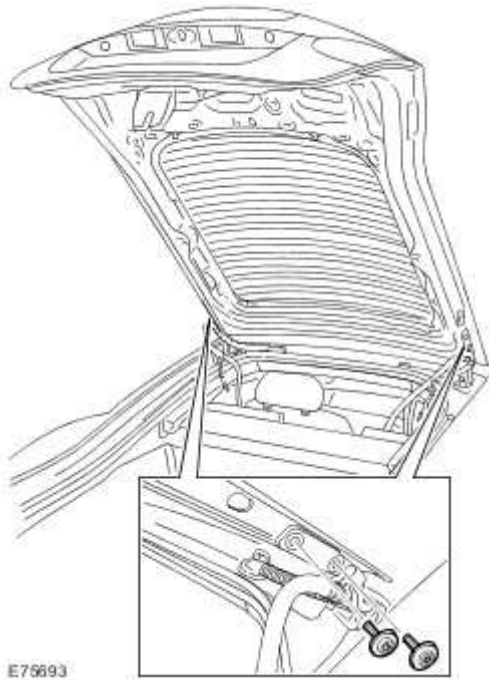


5. Loosen the liftgate striker.

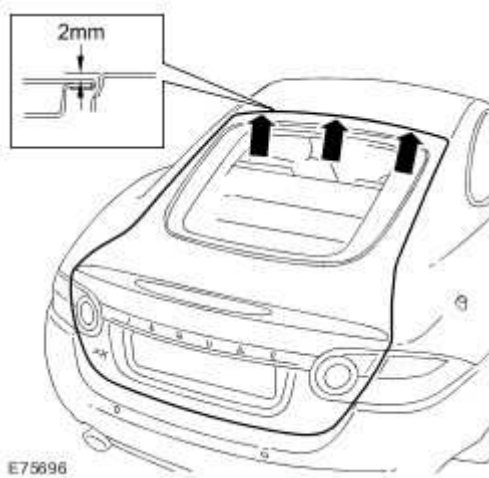
- Loosen the 2 Torx bolts.



6. Loosen the liftgate to hinge Torx bolts.

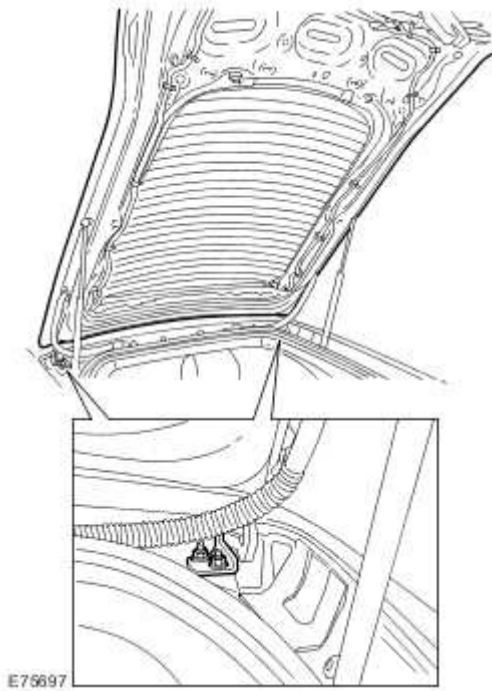


7. With the liftgate closed, check the alignment of the liftgate to the roof panel. Profile of the liftgate to roof panel should be 2 mm below flush.

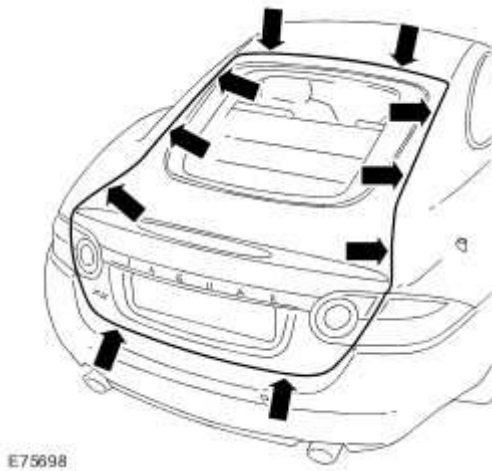


8. Tighten the liftgate to hinge Torx bolts to 25 Nm (18 lb.ft).

9. Loosen the liftgate hinge to body nuts.



10. With the liftgate closed, check the alignment of the liftgate to the roof panel and bodyside panel. The liftgate should be central in its aperture.



11. Tighten the liftgate hinge to body nuts to 25 Nm (18 lb.ft).

12. Secure the liftgate striker.

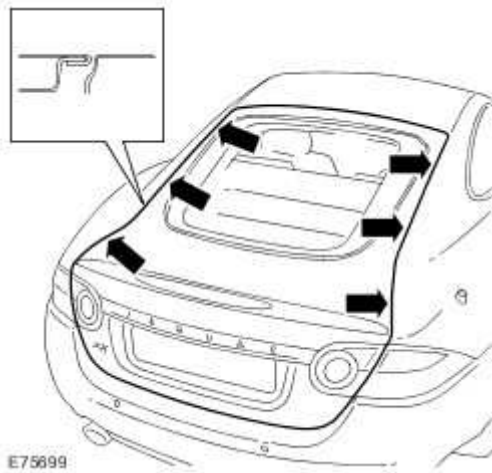
- Tighten the Torx bolts to 25 Nm (18 lb.ft).

13. Install the scuff plate trim panel.

- Install the 4 Torx screws

14. With the liftgate closed, check the profile of the liftgate to the bodyside panel. Adjust as

required.



15. Install the liftgate hinge cover.

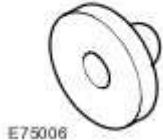
- Secure with the clips.

16. Install the loadspace floor panel.

Hood (76.16.01)

Special Service Tools

501-119



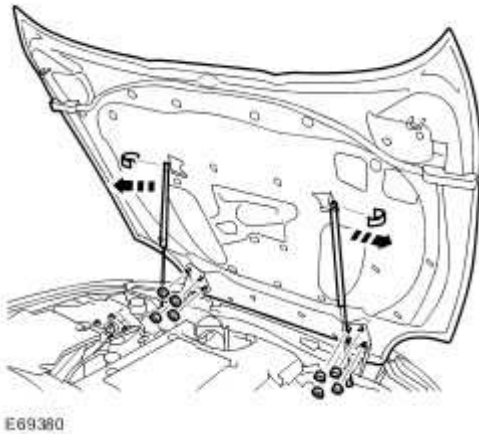
Actuator Aligners - Pedestrian Protection Hood Stops
501-119

Removal

1 . With assistance, remove the hood.

▶ Release the clips and disconnect the struts.

▶ Remove the 8 nuts.



2 . **NOTE:**

Do not disassemble further if the component is removed for access only.

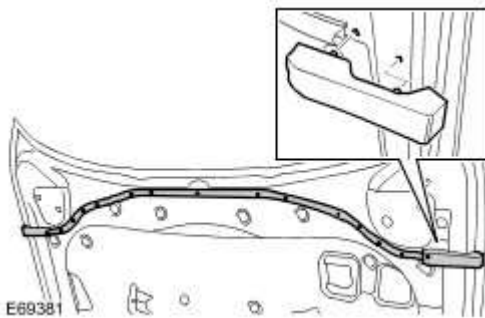
Remove the hood seal end caps.

▶ Release from the 4 clips.

3 . Remove the hood seal.

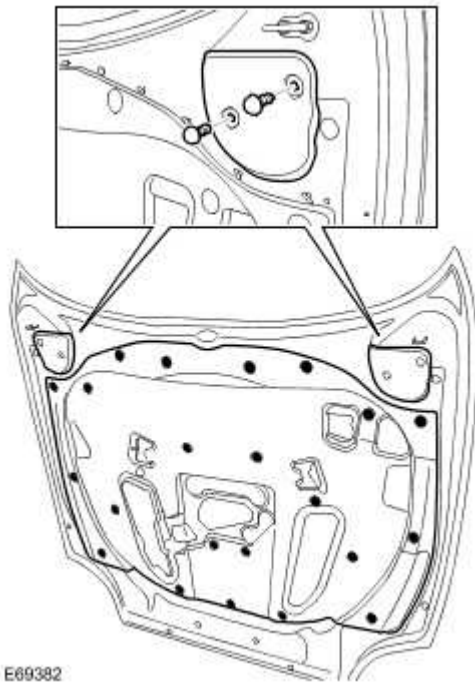
▶ Release the hood seal.

▶ Remove the 17 clips.



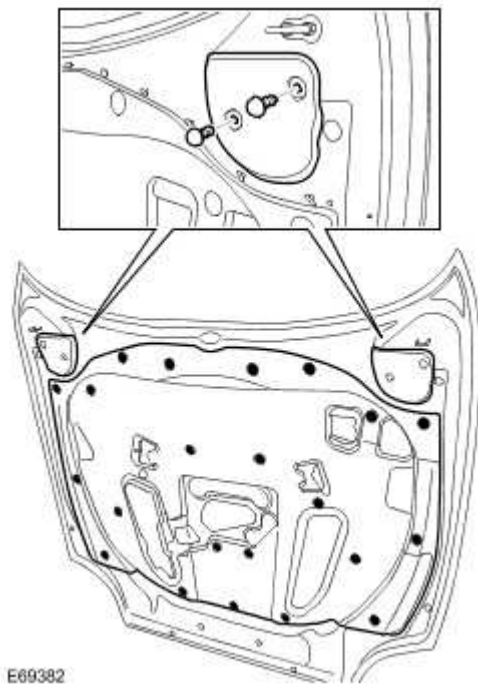
4 . Remove the hood pad.

▶ Remove the 23 clips.



5 . Remove the 2 secondary hood pads.

▶ Remove the 4 clips.



Installation

1 . Install the secondary hood pads.

- ▶ Secure with the clips.

2 . Install the hood pad.

- ▶ Secure with the clips.

3 . Install the hood seal.

- ▶ Install the clips.

- ▶ Attach the hood seal.

4 . Install the hood seal end caps.

- ▶ Secure with the clips.

5 . With assistance install and align the hood.

- ▶ Tighten the nuts to 25 Nm (18 lb.ft).

- ▶ Connect the struts and secure with the clips.

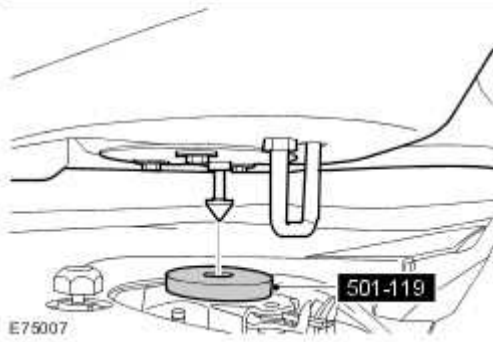
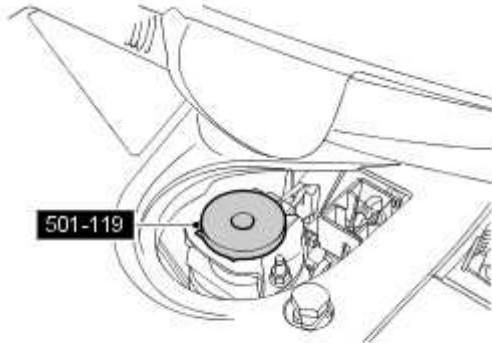
6 Align the hood to the pedestrian protection actuators using special tools 501-119.

- ▶ Insert special tools 501-119 into the pedestrian protection actuators.

- ▶ Loosen the 8 bolts securing the pedestrian protection actuator stops to the hood.

- ▶ Gently close the hood so that the pedestrian protection hood stops are aligned to the actuators.

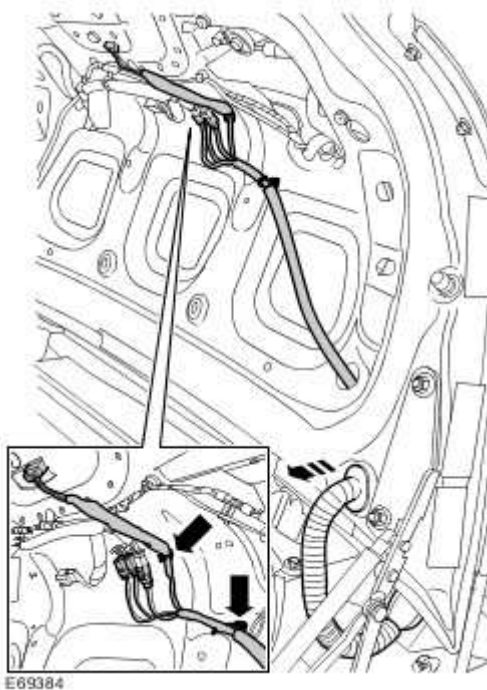
- ▶ Open the hood.
- ▶ Tighten the bolts to 10 Nm (7 lb.ft).



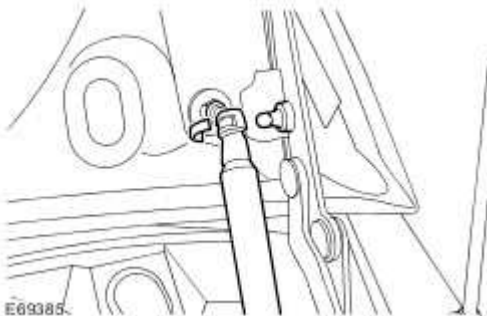
Luggage Compartment Lid (76.19.01)

Removal

- 1 . Remove the luggage compartment lid trim panel.
- 2 . Disconnect the 4 luggage compartment lid harness electrical connectors.
- 3 . Release the wiring harness.
 - ▶ Remove the electrical harness clip.

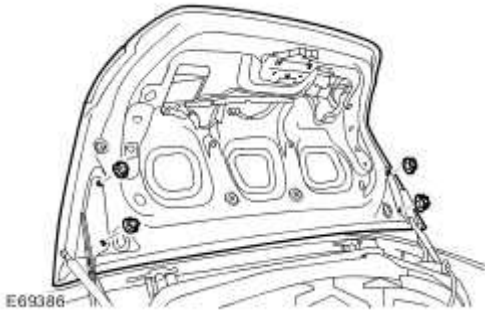


- 4 . Release the electrical harness.
 - ▶ Release the electrical harness clip.
- 5 . Release the clips and disconnect the struts.



6 . With assistance, remove the luggage compartment lid.

▶ Remove the 4 nuts.

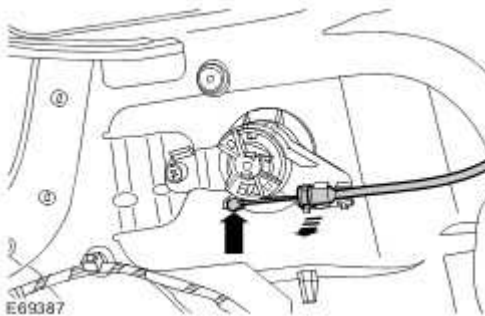


7 . **NOTE:**

Do not disassemble further if the component is removed for access only.

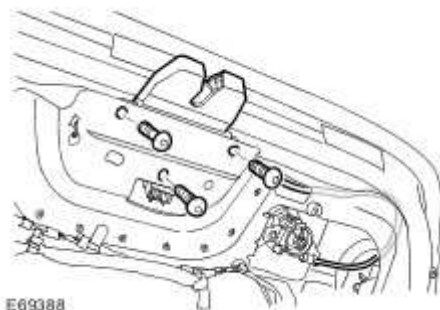
Remove the luggage compartment lid latch operating cable from the lock cylinder.

▶ Release the cable from the clip.



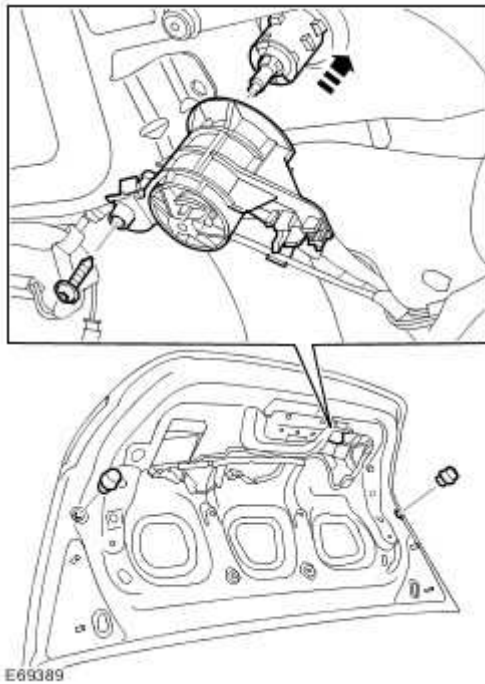
8 . Remove the luggage compartment lid latch assembly.

▶ Remove the 3 Torx bolts.



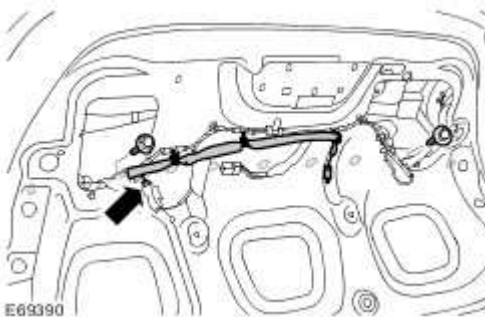
9 . Remove the bump stops.

10 . Remove the luggage compartment lid lock cylinder.



11 . Remove the rear spoiler.

- ▶ Disconnect the electrical connector.
- ▶ Release the 3 wiring harness clips.
- ▶ Remove the 2 bolts.
- ▶ Release the 9 clips.

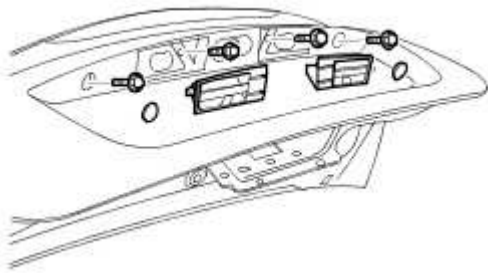


12 . Remove the license plate lamp housing.

13 . Remove the luggage compartment lid finisher.

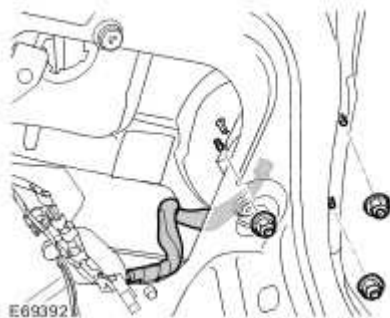
- ▶ Disconnect the license plate lamp electrical connector.
- ▶ Remove the grommets.
- ▶ Remove the 4 bolts.
- ▶ Release the 4 clips.

- ▶ Release the 4 clips.



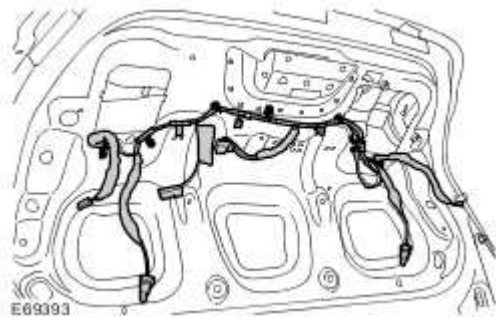
- 14 . Remove both rear lamp assemblies.

- ▶ Remove the 6 nuts.
- ▶ Disconnect the 2 electrical connectors.



- 15 . Remove the luggage compartment lid wiring harness.

- ▶ Release the 8 wiring harness securing clips.



16 Remove the luggage compartment lid decals.

- ▶ Wipe the luggage compartment lid to remove all traces of the adhesive.
- ▶ Polish the area to remove any bleaching.

Installation

1 . Install the luggage compartment lid decal.

- ▶ Remove the backing from the decal.
- ▶ Remove the protective cover from the decal.
- ▶ Secure the decal to the luggage compartment lid.
- ▶ Position and align the decal on the luggage compartment lid.

2 . Install the luggage compartment lid wiring harness.

3 . Install both of the rear lamp assemblies.

- ▶ Install the nuts.
- ▶ Connect the electrical connectors.

4 . Install the luggage compartment lid finisher.

- ▶ Connect the license plate lamp electrical connector.
- ▶ Secure the 4 clips.
- ▶ Install the 4 bolts.
- ▶ Install the grommets.
- ▶ Install the license plate lamp housing.

5 . Install the wiring harness.

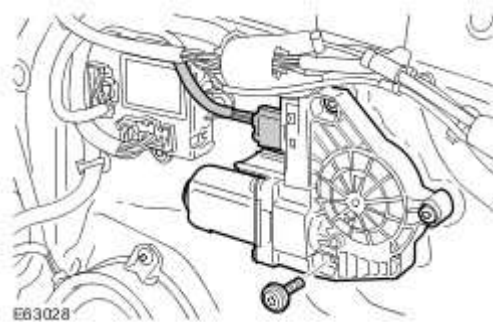
- ▶ Install the 2 bolts.
- ▶ Secure in the 9 clips.

- ▶ Connect the electrical connectors.
- 6 . Install the luggage compartment lid lock cylinder.
- ▶ Tighten the Torx bolt to 3 Nm (2 lb.ft).
- 7 . Install the bump stops.
- 8 . Install the luggage compartment lid latch assembly.
- ▶ Install the 3 Torx bolts.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the bolts to 20 Nm (15 lb.ft).
- 9 . Connect the luggage compartment lid latch operating cable to the lock cylinder.
- ▶ Install the cable.
- 10 . With assistance, install the luggage compartment lid.
- ▶ Install the 4 nuts.
 - ▶ Tighten the nuts to 23 Nm (17 lb.ft).
- 11 . Install the luggage compartment lid support struts.
- ▶ Secure in the 2 clips.
- 12 . Install the wiring harness.
- ▶ Secure the electrical harness with the clip.
- 13 . Connect the 4 electrical connectors.
- 14 . Install the luggage compartment lid trim panel.

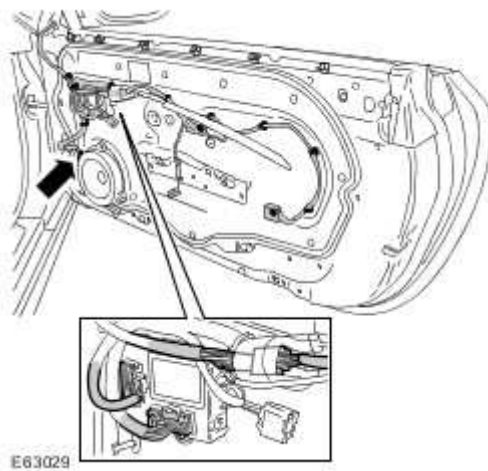
Door (76.28.04)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 3 . Remove the window regulator motor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx screws.

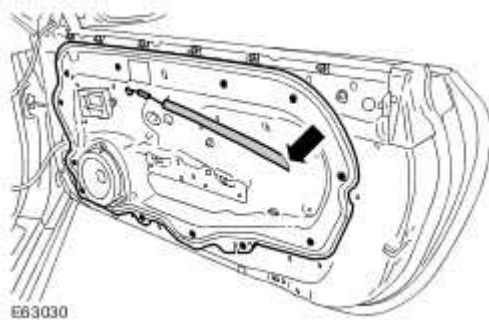


- 4 . Release the front door inner weathershield.
 - ▶ Disconnect the 3 electrical connectors.
 - ▶ Release the 9 wiring harness clips.



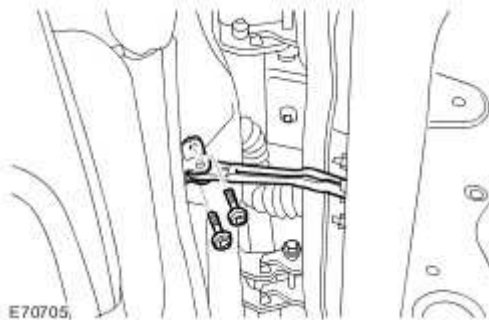
- 5 . Remove the front door inner weathershield.

- ▶ Remove the 12 Torx bolts.
- ▶ Release the front door interior handle cable.



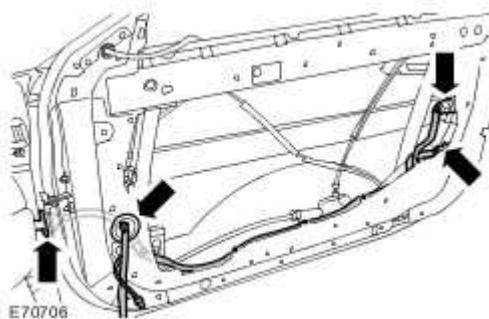
6 . Release the door check strap from the body.

- ▶ Remove the 2 Torx screws.



7 . Release the door harness from the door.

- ▶ Release the 5 clips.
- ▶ Disconnect the 2 electrical connectors.
- ▶ Release from the locating grommet.

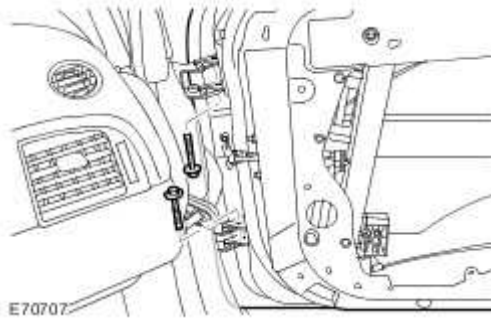


8 . **NOTE:**

With assistance remove the component.

Remove the door.

- ▶ Remove the 2 hinge bolts.



Installation

- 1 . With assistance, install the door assembly.
 - ▶ Lubricate the hinges and bolts tighten to 25 Nm (18 lb.ft).
- 2 . Install the door wiring harness.
 - ▶ Secure in the grommets.
 - ▶ Connect the electrical connectors.
 - ▶ Secure the clips.
- 3 . Install the door check strap.
 - ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).
- 4 . Install the front door inner weathershield.
 - ▶ Attach the front door interior handle cable.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
- 5 . Secure the front door inner weathershield.
 - ▶ Secure the wiring harness clips.
 - ▶ Connect the electrical connectors.
- 6 . Install the window regulator motor.
 - ▶ Install and tighten the Torx screws.
 - ▶ Connect the electrical connector.
- 7 . Install the front door trim panel.

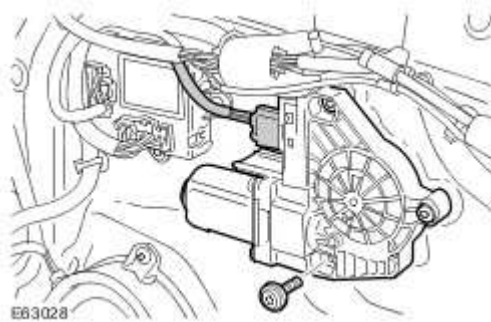
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

- 8 . Connect the battery ground cable and install the cover.
For additional information, refer to

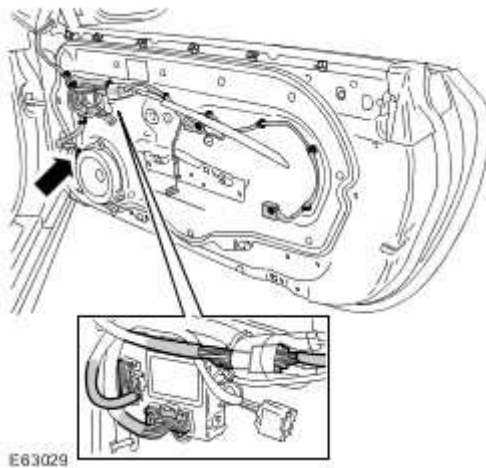
Door Check Arm

Removal

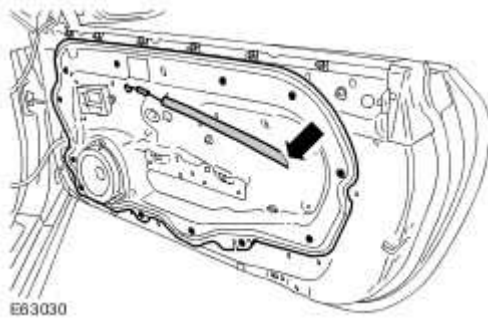
- 1 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 2 . Remove the window regulator motor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx screws.



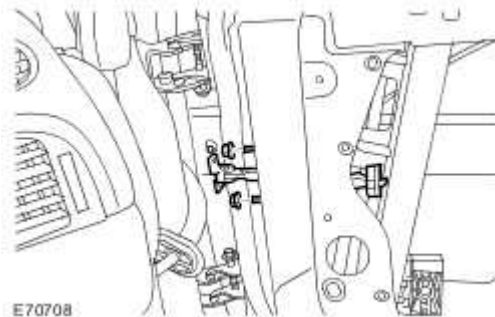
- 3 . Release the front door inner weathershield.
 - ▶ Disconnect the 3 electrical connectors.
 - ▶ Release the 9 wiring harness clips.



- 4 . Remove the front door inner weathershield.
 - ▶ Remove the 12 Torx bolts.
 - ▶ Release the front door interior handle cable.



- 5 . Remove the door check-strap.
 - ▶ Remove the 2 Torx screws.
 - ▶ Remove the 2 nuts.



Installation

- 1 . Install the door check strap.
 - ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).
 - ▶ Tighten the nuts to 25 Nm (18 lb.ft).
- 2 . Install the front door inner weathershield.
 - ▶ Attach the front door interior handle cable.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
- 3 . Secure the front door inner weathershield.
 - ▶ Secure the wiring harness clips.
 - ▶ Connect the electrical connectors.
- 4 . Install the window regulator motor.
 - ▶ Install and tighten the Torx screws.
 - ▶ Connect the electrical connector.

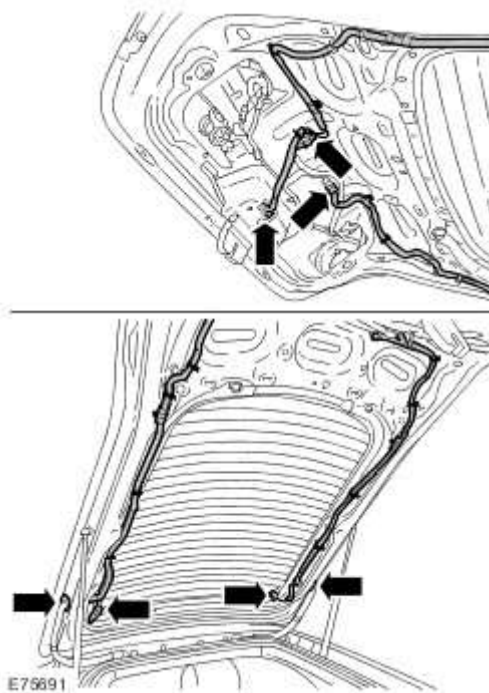
5 . Install the front door trim panel.

For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

Liftgate

Removal

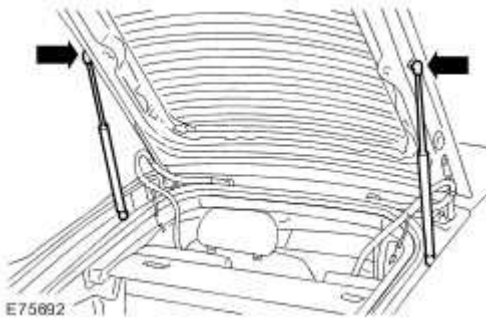
- 1 . Remove the liftgate lower trim panel.
For additional information, refer to [Liftgate Lower Trim Panel](#)
- 2 . Disconnect the rear screen electrical connectors.
- 3 Release the body harness from the liftgate.
 - ▶ Release the 15 clips.
 - ▶ Disconnect the 5 electrical connectors.
 - ▶ Release the 2 harness grommets and withdraw the harness from liftgate.



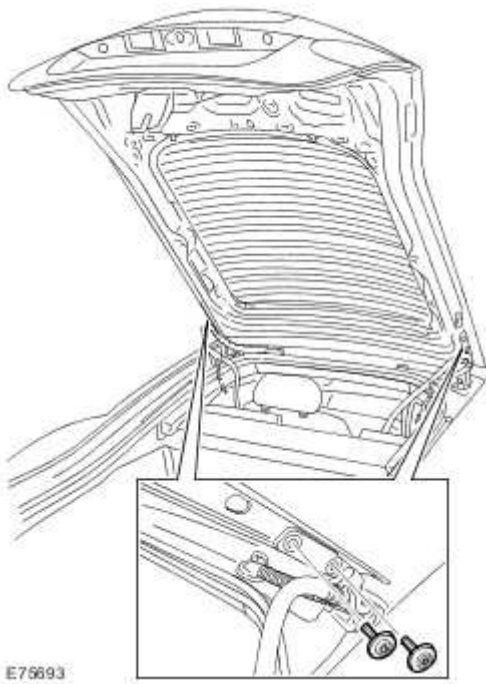
- 4 . **NOTE:**
Support the liftgate as necessary.

Release the liftgate support struts.

- ▶ Release the 2 clips.



- 5 . With assistance, remove the liftgate.
 - ▶ Remove the 4 Torx bolts.



Installation

- 1 . With assistance, install the liftgate.
 - ▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).
- 2 . **NOTE:**
 - Support the liftgate as necessary.
 - Attach the liftgate support struts.
 - ▶ Secure with the clips.

3 . Attach the body harness to the liftgate.

▶ Secure with the clips.

▶ Connect the electrical connectors.

▶ Secure the harness grommets into the liftgate.

4 . Disconnect the rear screen electrical connectors.

5 . Install the liftgate lower trim panel.

For additional information, refer to [Liftgate Lower Trim Panel](#)

6 . Check and adjust the liftgate.

For additional information, refer to [Liftgate Alignment \(76.19.54.60\)](#)

501-05 : Interior Trim and Ornamentation

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
B-pillar trim panel - screw	3	2	26
Door trim panel - screw	3	2	26
Parcel shelf - bolt	6	4	53
Door scuff-plate - screw	6	4	53
Luggage compartment scuff plate - bolt	4	3	35
Rear quarter trim panel - screw	3	2	26
Sun visor - screw	1	-	9

A-Pillar Trim Panel (76.13.31)

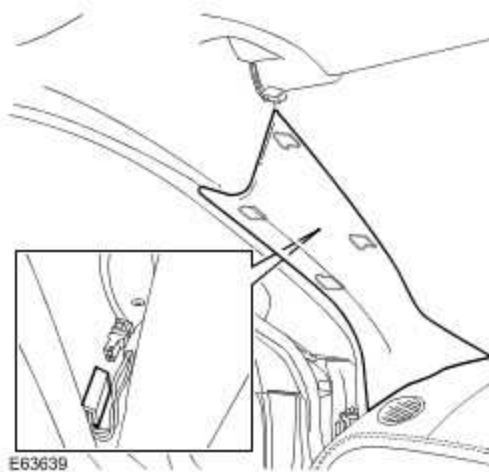
Removal

1 . NOTE:

Do not disassemble further if the component is removed for access only.

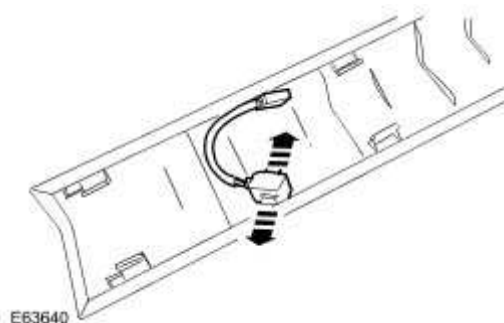
Remove the A-pillar trim panel.

- ▶ Release from the 4 clips.
- ▶ Disconnect the electrical connector.



2 . Remove the cellular phone microphone.

- ▶ Release from the 2 clips.



Installation

1 . Install the cellular phone microphone.

▶ Secure in the clips.

2 . Install the A-pillar trim panel.

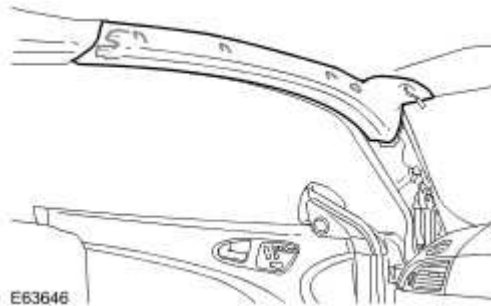
▶ Connect the electrical connector.

▶ Secure in the clips.

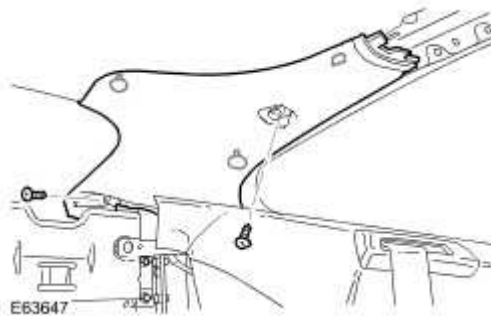
B-Pillar Trim Panel (76.13.28)

Removal

- 1 . Remove the parcel tray.
For additional information, refer to [Parcel Shelf \(76.67.06\)](#)
- 2 . Remove the sun visor.
For additional information, refer to [Sun Visor \(76.10.48\)](#)
- 3 . Remove the roof moulding.
▶ Release the 3 clips.



- 4 . Release the B-pillar trim panel.
▶ Remove the 2 Torx screws.



- 5 . Remove the B-pillar trim panel.
▶ Release from the 3 clips.

Installation

- 1 . Attach the B-pillar trim panel.
 - ▶ Secure with the clips.
- 2 . Secure the B-pillar trim panel.
 - ▶ Tighten the Torx screws.
- 3 . Install the roof moulding.
 - ▶ Secure in the clips.
- 4 . Install the sun visor.
 - For additional information, refer to [Sun Visor \(76.10.48\)](#)
- 5 . Install the parcel tray.
 - For additional information, refer to [Parcel Shelf \(76.67.06\)](#)

Engine Cover (76.11.35)

Removal

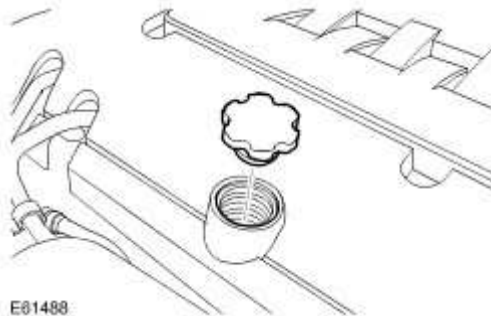


CAUTION: Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.

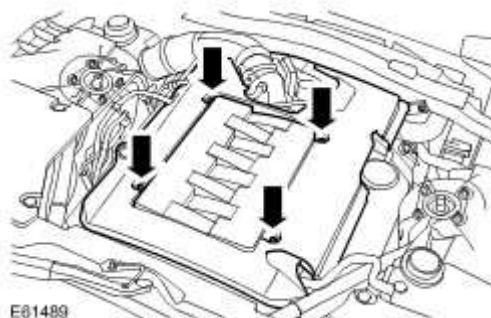
NOTE:

Naturally aspirated engine shown, supercharged engine is similar.

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Open the hood.
- 3 . Remove the oil filler cap.



- 4 . Remove the engine cover.
▶ Release the 4 clips.



Installation

- 1 . Install the engine cover.

▶ Position and secure the clips.

2



· **CAUTION: Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.**

Install the oil filler cap.

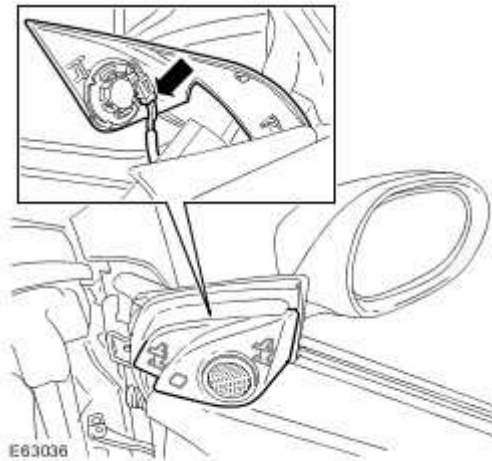
3 . Close the hood.

4 . Connect the battery ground cable and install the cover.

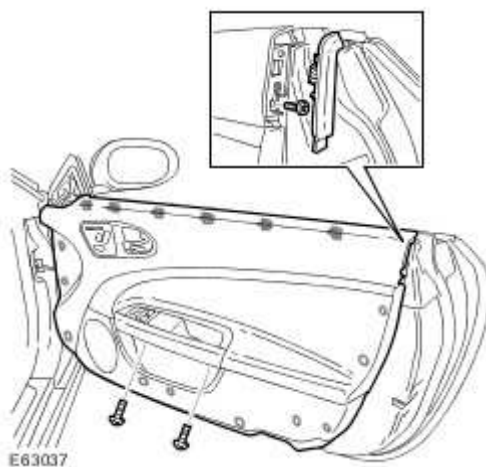
Front Door Trim Panel (76.34.01)

Removal

- 1 . Remove the exterior mirror trim panel.
 - ▶ Release the 3 clips.
 - ▶ Disconnect the electrical connector.



- 2 . Release the front door trim panel.
 - ▶ Remove the bolt cover.
 - ▶ Remove the 3 Torx bolts.
 - ▶ Release the 16 clips.

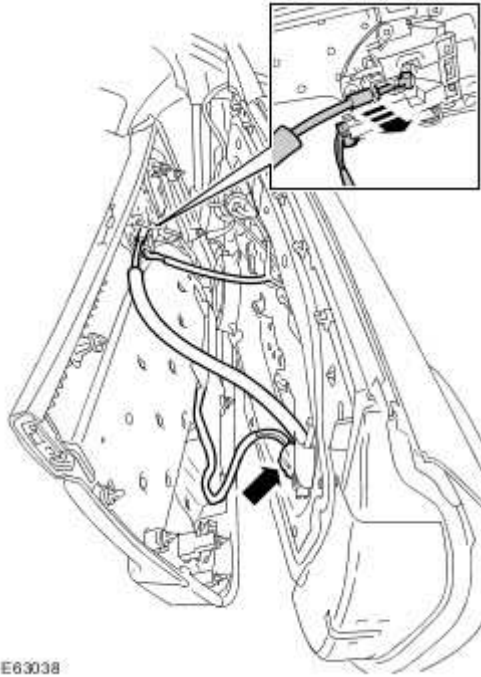


- 3 . **NOTE:**

Do not disassemble further if the component is removed for access only.

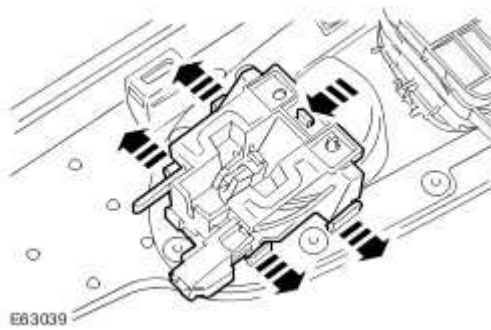
Remove the front door trim panel.

- ▶ Release the front door interior handle cable.
- ▶ Disconnect the 2 electrical connectors.



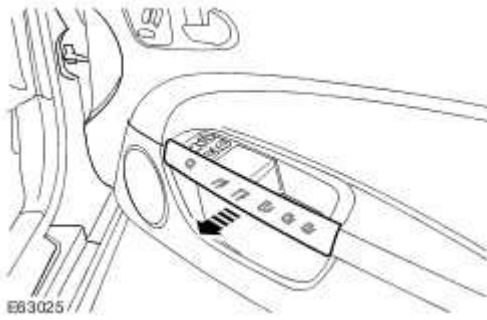
4 . Remove the front door latch remote control handle.

- ▶ Release from the 5 clips.



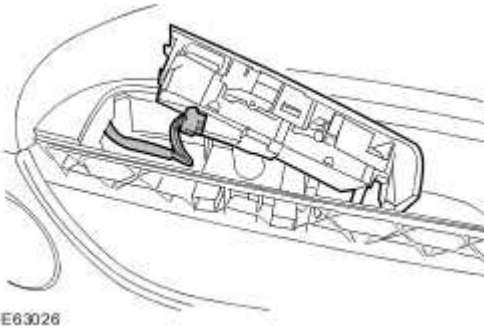
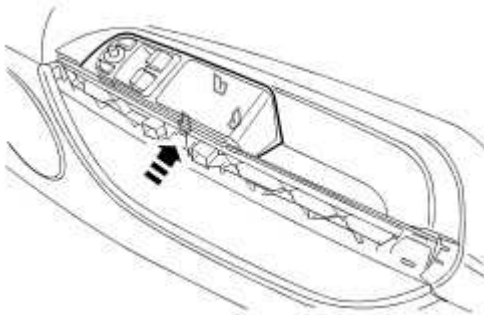
5 . Remove the grab handle cover.

- ▶ Release from the 6 clips.



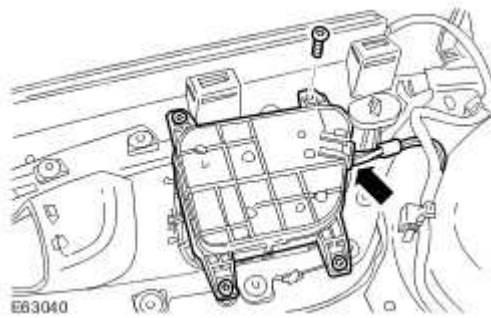
6 . Remove the window control switch.

- ▶ Release from the 3 clips.
- ▶ Disconnect the electrical connector.



7 . Remove the seat control switch.

- ▶ Remove the 4 Torx screws.
- ▶ Disconnect the electrical connector.




Installation

- 1 . Install the seat control switch.
 - ▶ Connect the electrical connector.
 - ▶ Install and tighten the Torx screws.

- 2 . Install the window control switch.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.

- 3 . Install the grab handle cover.
 - ▶ Secure in the clips.

- 4 . Install the front door latch remote control handle.
 - ▶ Secure in the clips.

- 5  **CAUTION: Make sure that the cable remains correctly installed to the front door trim panel.**

- Install the front door trim panel.
 - ▶ Attach the front door interior handle cable.
 - ▶ Connect the electrical connectors.

- 6 . Secure the front door trim panel.
 - ▶ Secure in the clips.
 - ▶ Tighten the Torx bolts to 10 Nm.
 - ▶ Install the bolt cover.

- 7 . Install the exterior mirror trim panel.

- ▶ Connect the electrical connector.

- ▶ Secure with the clips.

8 Check the operation of the door latch remote control handle.

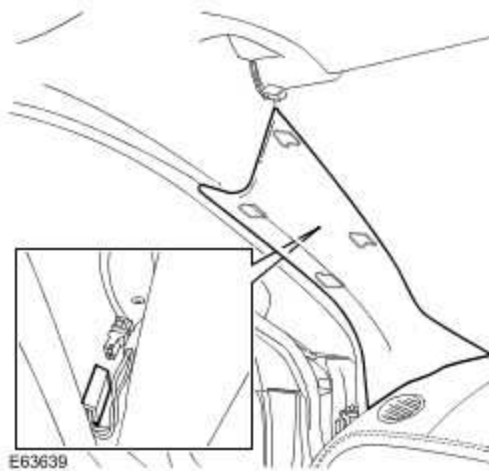
- ▶ With the door closed, check the latch operation of the door latch remote control handle.

- ▶ With the door closed, check the lock operation of the door latch remote control handle.

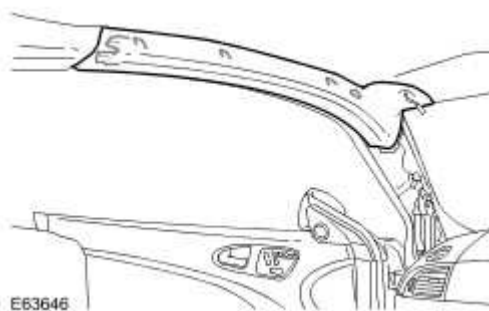
Headliner (76.64.01)

Removal

- 1 . Remove the LH A-pillar upper trim panel.
For additional information, refer to [A-Pillar Trim Panel \(76.13.31\)](#)
- 2 . Remove the RH A-pillar upper trim panel.
 - ▶ Release from the 4 clips.
 - ▶ Disconnect the electrical connector.



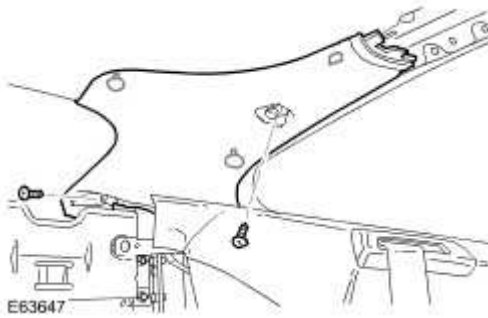
- 3 . Remove the roof mouldings.
 - ▶ Release the 6 clips.



- 4 . Remove the LH B-pillar upper trim panel.
For additional information, refer to [B-Pillar Trim Panel \(76.13.28\)](#)
- 5 . Release the RH B-pillar upper trim panel.
 - ▶ Remove the 2 Torx screws.

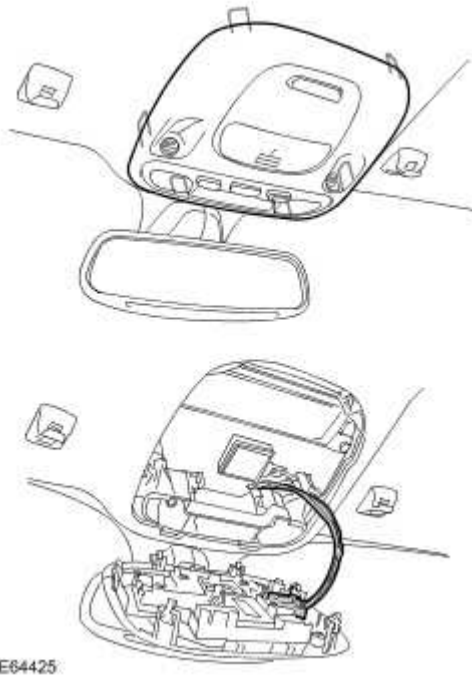
6 . Remove the RH B-pillar upper trim panel.

- ▶ Release from the 3 clips.



7 . Remove the front overhead console.

- ▶ Release from the 6 clips.
- ▶ Disconnect the electrical connector.

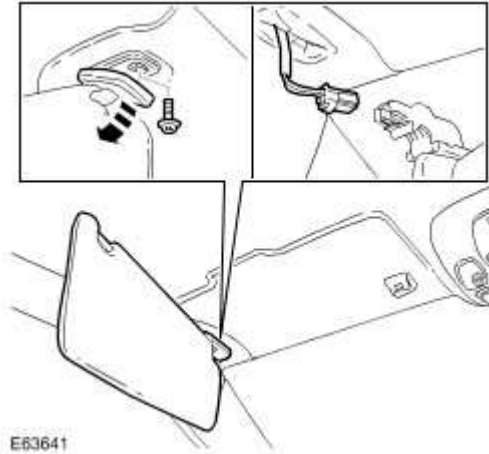


8 . Remove the LH sun visor.

For additional information, refer to [Sun Visor \(76.10.48\)](#)

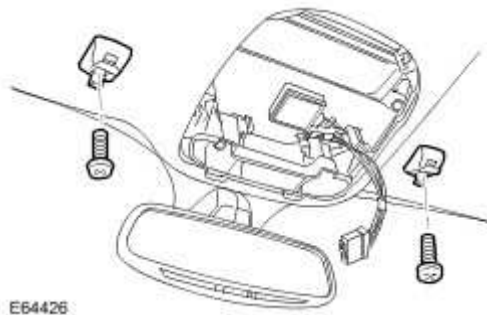
9 . Remove the RH sun visor.

- ▶ Remove the bolt cover.
- ▶ Remove the Torx bolt.
- ▶ Disconnect the electrical connector.



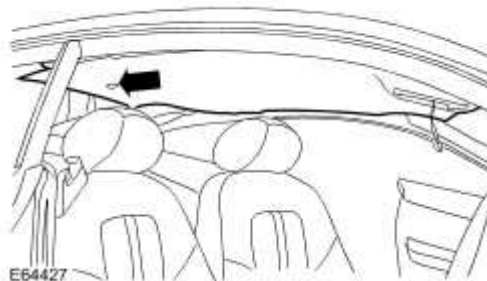
E63641

- 10 . Remove the sun visor retaining clips.
 - ▶ Release the screw covers.
 - ▶ Remove the screws.



E64426

- 11 . Remove the headliner.
 - ▶ Release the clip.



E64427

Installation

- 1 . Install the headliner.
 - ▶ Secure with the clip.
- 2 . Install the sun visor retaining clips.
 - ▶ Install the screws.
 - ▶ Install the screw covers.
- 3 . Install the RH sun visor.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
 - ▶ Install the bolt cover.
- 4 . Install the LH sun visor.

For additional information, refer to [Sun Visor \(76.10.48\)](#)
- 5 . Install the front overhead console.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.
- 6 . Attach the RH B-pillar upper trim panel.
 - ▶ Secure with the clips.
- 7 . Secure the RH B-pillar upper trim panel.
 - ▶ Tighten the Torx screws.
- 8 . Install the LH B-pillar upper trim panel.

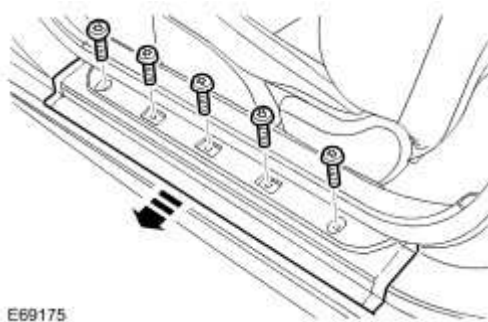
For additional information, refer to [B-Pillar Trim Panel \(76.13.28\)](#)
- 9 . Install the roof mouldings.
 - ▶ Secure with the clips.
- 10 . Install the RH A-pillar upper trim panel.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.
- 11 . Install the LH A-pillar upper trim panel.

For additional information, refer to [A-Pillar Trim Panel \(76.13.31\)](#)

Front Scuff Plate Trim Panel (76.13.81)

Removal

- 1 . Remove and discard the scuff plate decal.
 - ▶ Release the adhesive strip.
- 2 . Remove the front scuff plate trim panel.
 - ▶ Remove the 5 Torx screws.
 - ▶ Carefully release horizontally.



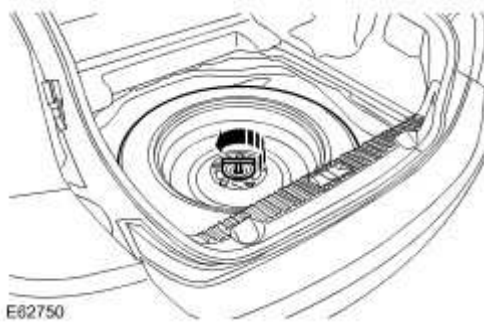
Installation

- 1 . Install the front scuff plate trim panel.
 - ▶ Align the component.
 - ▶ Tighten the Torx screws to 6 Nm (4 lb.ft).
- 2 . Install the scuff plate decal.
 - ▶ Remove backing tape from adhesive strip.
 - ▶ Clean the adhesive contact area.

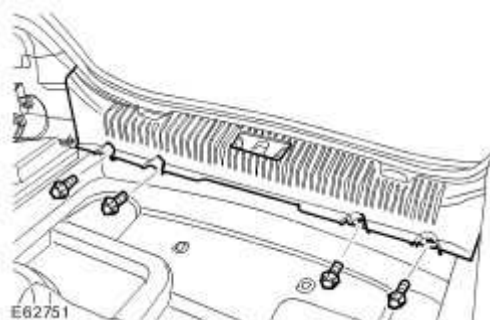
Scuff Plate Trim Panel (76.13.81)

Removal

- 1 . Remove the luggage compartment floor panel.
- 2 . Remove the tool kit tray.
- 3 . Remove the spare wheel and tire.
 - ▶ Remove the bolt.



- 4 . Remove the scuff plate trim panel.
 - ▶ Remove the 4 Torx bolts.



Installation

- 1 . Install the scuff plate trim panel.
 - ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
- 2 . Install the spare wheel and tire.
 - ▶ Install the bolt.

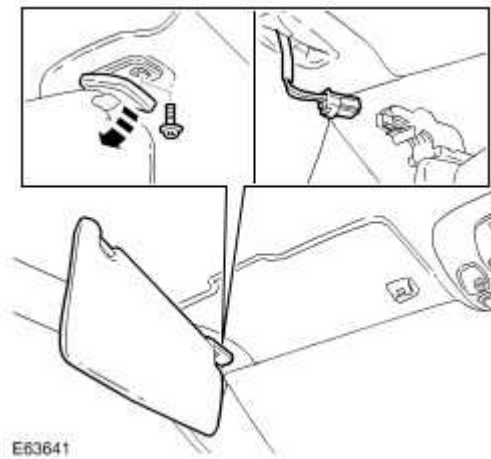
3 . Install the tool kit tray.

4 . Install the luggage compartment floor panel.

Sun Visor (76.10.48)

Removal

- 1 . Remove the sun visor.
 - ▶ Remove the bolt cover.
 - ▶ Remove the Torx bolt.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the sun visor.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
 - ▶ Install the bolt cover.

Liftgate Upper Trim Panel (76.34.11)

Removal

- 1 . Remove the liftgate upper trim panel.
 - ▶ Release from the 12 clips.



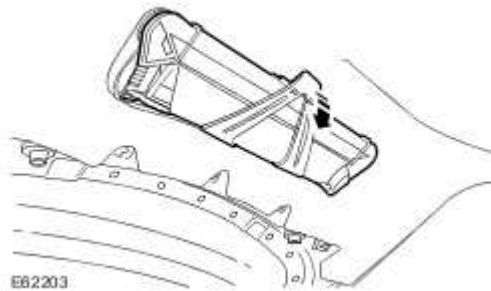
Installation

- 1 . Install the liftgate upper trim panel.
 - ▶ Secure in the clips.

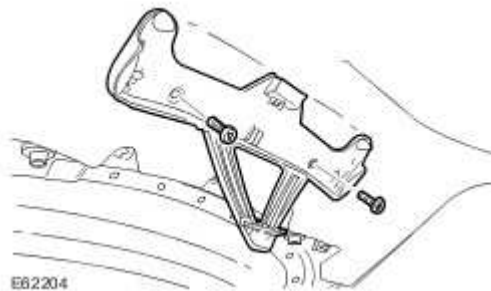
Liftgate Lower Trim Panel

Removal

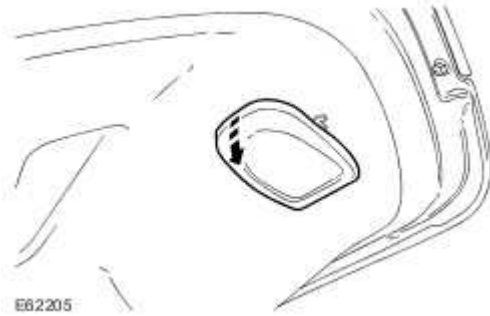
- 1 . Remove the liftgate upper trim panel.
For additional information, refer to [Liftgate Upper Trim Panel \(76.34.11\)](#)
- 2 . Remove the warning triangle.
▶ Release the clip.



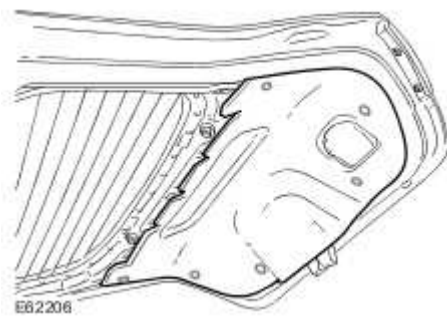
- 3 . Remove the warning triangle retaining bracket.
▶ Remove the 2 Torx bolts.



- 4 . Remove the liftgate grab handle.
▶ Release the 2 clips.



- 5 . Remove the liftgate lower trim panel.
 - ▶ Release the 6 clips.



Installation

- 1 . Install the liftgate lower trim panel.
 - ▶ Secure with the clips.
- 2 . Install the liftgate grab handle.
 - ▶ Secure with the clips.
- 3 . Install the warning triangle retaining bracket.
 - ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
- 4 . Install the warning triangle.
 - ▶ Secure with the clip.
- 5 . Install the liftgate upper trim panel.
 - For additional information, refer to [Liftgate Upper Trim Panel \(76.34.11\)](#)

Rear Quarter Trim Panel - 2-Door (76.13.73)

Removal

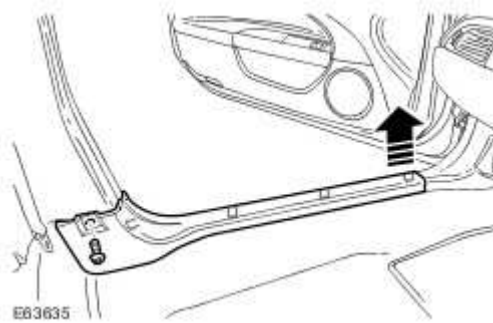
1 . Remove the rear seat backrest.

2 . **NOTE:**

Release the forward edge first.

Remove the scuff plate trim panel.

▶ Release from the 4 clips.



3 . Release the rear safety belt lower anchor.

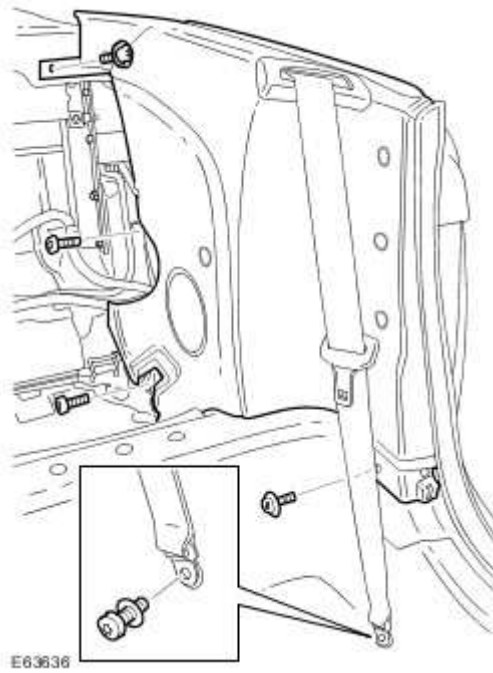
▶ Remove and discard the Torx bolt.

4 . Remove the rear quarter trim panel.

▶ Remove the 3 Torx bolts.

▶ Release from the 4 clips.

▶ Release the safety belt from the trim panel.



Installation

- 1 . Install the rear quarter trim panel.
 - ▶ Position the safety belt through the trim panel.
 - ▶ Secure with the clips.
 - ▶ Tighten the Torx bolts to 3 Nm (2.2 lb.ft).
- 2 . Secure the rear safety belt lower anchor.
 - ▶ Tighten the new Torx bolt to 45 Nm (33 lb.ft).
- 3 . Install the scuff plate trim panel.
 - ▶ Secure in the clips.
- 4 . Install the rear seat backrest.

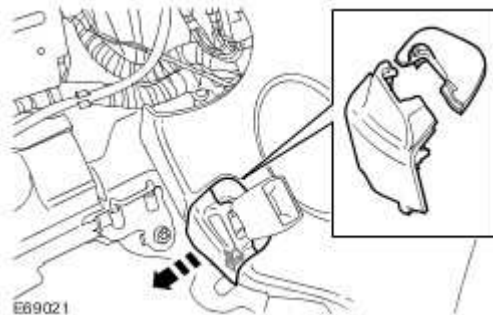
Rear Quarter Trim Panel - Convertible (76.13.73)

Removal

- 1 . Remove the rear seat backrest.
For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)

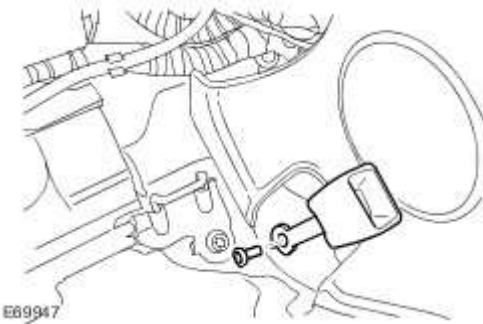
- 2 . Remove the rear safety belt stalk trim panel.

▶ Release from the clip.



- 3 . Remove the rear safety belt stalk.

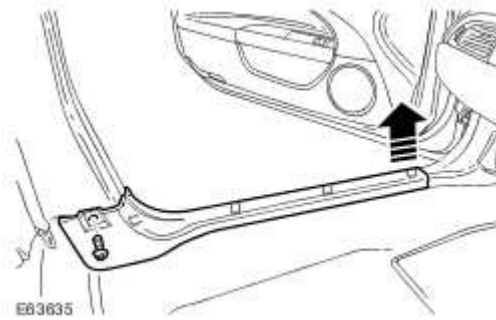
▶ Remove the Torx bolt.



- 4 . Remove the scuff plate trim panel.

▶ Remove the Torx bolt.

▶ Release from the 4 clips.

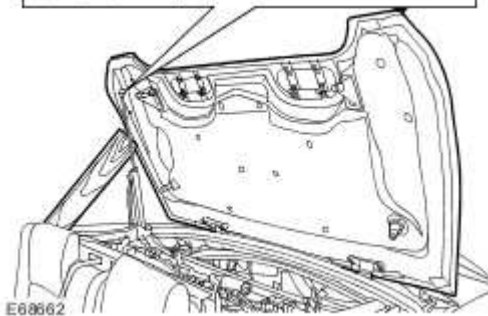
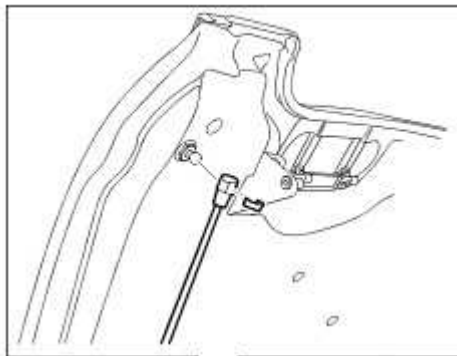


5 . NOTE:

Support the convertible top lid.

Open the convertible top to the position shown.

▶ Depress the switch.

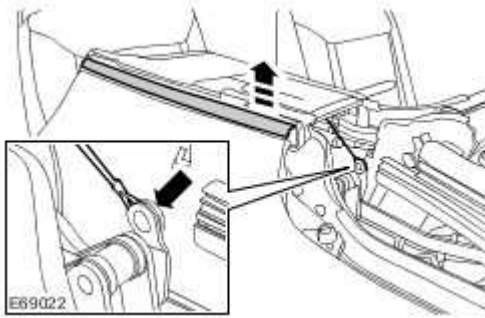


6 . Release the convertible top hinge cover tension strap.

▶ Release from the convertible top mechanism.

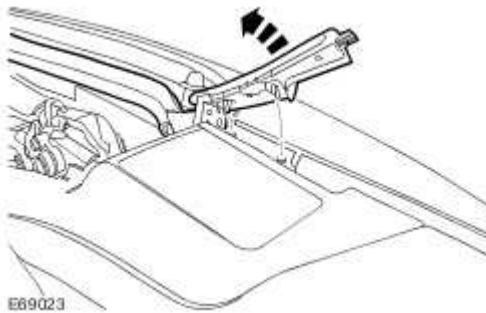
7 . Carefully remove the outer waist seal.

▶ Release each end of the seal from the body.



8 . Release the convertible top lid seal.

- ▶ Release from the 2 clips.

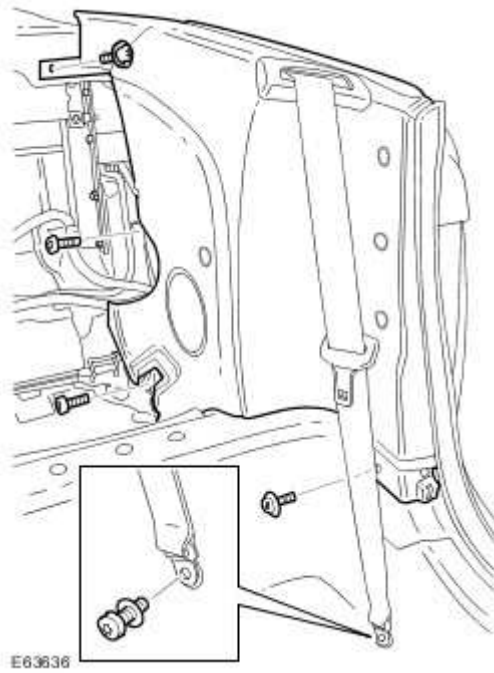


9 . Release the front safety belt lower anchor.

- ▶ Remove and discard the Torx bolt.

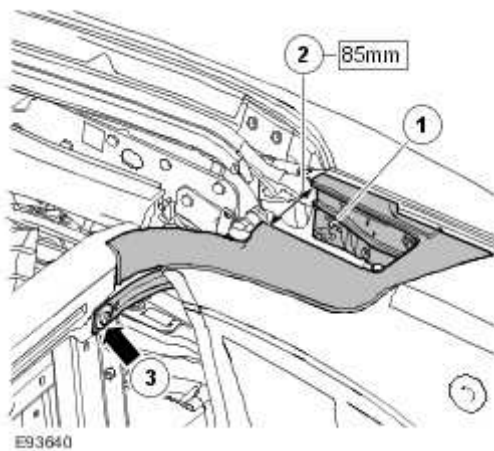
10 . Remove the rear quarter trim panel.

- ▶ Remove the 4 Torx bolts.
- ▶ Release from the 4 clips.
- ▶ Release the safety belt from the trim panel.



Installation

- 1 Install the rear quarter trim panel.
 - ▶ Position the safety belt through the trim panel.
 - ▶ Secure with the clips (1).
 - ▶ Check the illustrated trim dimension (2), before tightening the Torx bolt (3) to 3 Nm (2.2 lb.ft).



- 2 . Secure the front safety belt lower anchor.

- ▶ Tighten the new Torx bolt to 45 Nm (33 lb.ft).
- 3 . Attach the convertible top lid seal.
 - ▶ Secure with the clips.
- 4 . Install the outer waist seal.
 - ▶ Attach the outer waist seal to the body.
- 5 . Attach the convertible top hinge cover tension strap.
 - ▶ Attach to the convertible top mechanism.
- 6 . Close the convertible top.
 - ▶ Depress the switch.
- 7 . Install the scuff plate trim panel.
 - ▶ Secure in the clips.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
- 8 . Install the safety belt stalk.
 - ▶ Tighten the Torx bolt to 45 Nm (33 lb.ft).
- 9 . Install the rear safety belt stalk trim panel.
 - ▶ Secure with the clip.
- 10 . Install the rear seat backrest.
For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)

Rear Quarter Trim Sliding Panel

No Data Available

Loadspace Trim Panel - 2-Door (76.13.73.60)

Removal

1 . Remove the battery cover.

▶ Remove the 4 retainers.



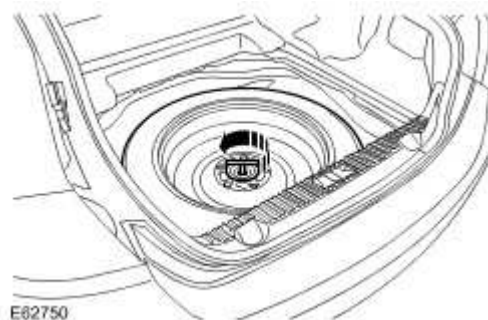
2 . Remove the loadspace floor panel.



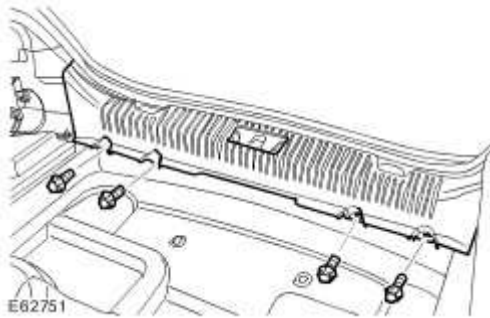
3 . Remove the tool kit tray.

4 . Remove the spare wheel and tire.

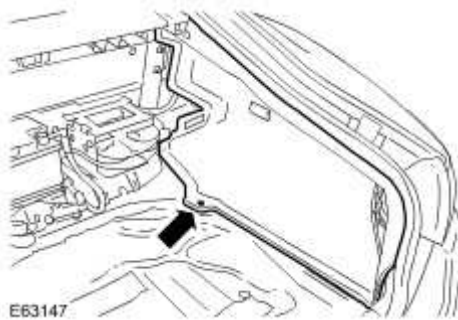
▶ Remove the bolt.



- 5 . Remove the scuff plate trim panel.
 - ▶ Remove the 4 Torx bolts.




- 6 . Remove the loadspace trim panel.
 - ▶ Remove the clip.



Installation

- 1 . Install the loadspace trim panel.
 - ▶ Install the clip.
- 2 . Install the scuff plate trim panel.
 - ▶ Remove the 4 Torx bolts.
 - ▶ Tighten the Torx screws to 10 Nm (7 lb.ft).
- 3 . Install the spare wheel and tire.
 - ▶ Install the retaining bolt.
- 4 . Install the tool kit tray.
- 5 . Install the loadspace floor panel.

6 . Install the battery cover.

 Install the 4 retainers.

Loadspace Trim Panel - Convertible (76.13.73.60)

Removal

1 . Remove the battery cover.

▶ Remove the 4 retainers.

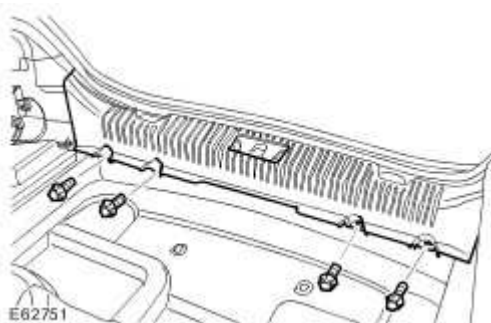


2 . Remove the loadspace floor panel.



3 . Remove the scuff plate trim panel.

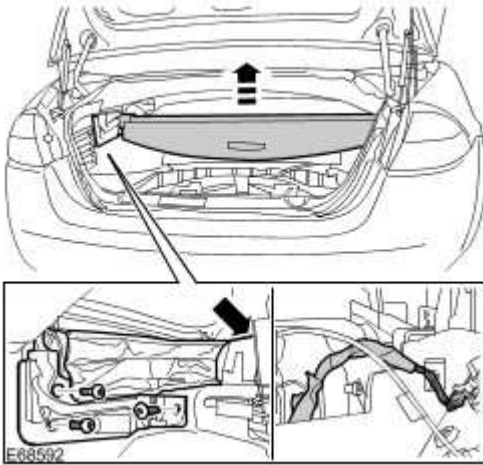
▶ Remove the 4 Torx bolts.



4 . Remove the luggage compartment retractable cover.

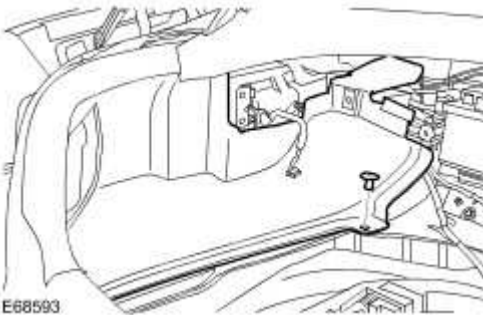
5 . Remove the luggage compartment retractable cover track.

- ▶ Release the fabric cover.
- ▶ Remove the 3 Torx bolts.
- ▶ Disconnect the 2 electrical connectors.



6 . Remove the loadspace trim panel.

- ▶ Remove the clip.



Installation


1 . Install the loadspace trim panel.

- ▶ Install the clip.

2 . Install the luggage compartment retractable cover track.


- ▶ Connect and secure the electrical connectors.
- ▶ Tighten the Torx bolts to 4 Nm (3 lb.ft).
- ▶ Secure the fabric cover.

3 . Install the scuff plate trim panel.

 Tighten the Torx bolts to 5 Nm (4 lb.ft).

4 . Install the loadspace floor panel.

5 . Install the battery cover.

 Install the 4 retainers.

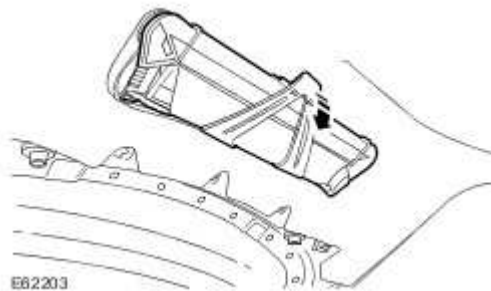
6 . Install the luggage compartment retractable cover.

Luggage Compartment Lid Trim Panel (76.19.05)

Removal

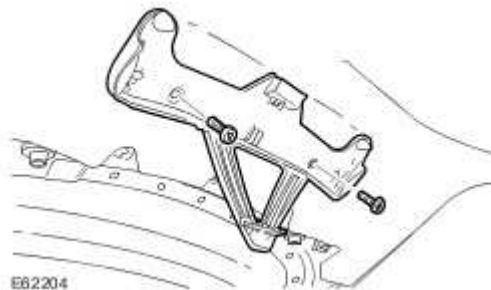
1 . Remove the warning triangle.

▶ Release the clip.



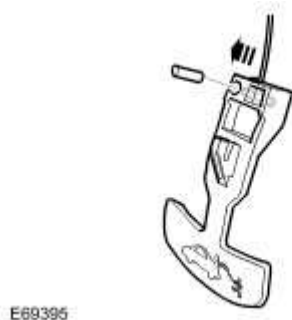
2 . Remove the warning triangle retaining bracket.

▶ Remove the 2 Torx bolts.



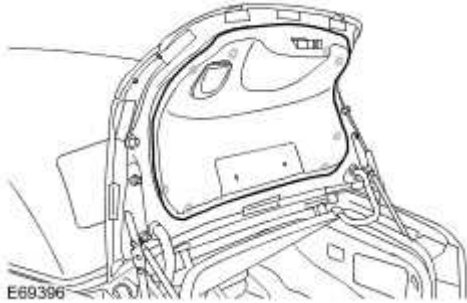
3 . Remove the luggage compartment lid latch handle.

▶ Remove the locking pin.



4 . Remove the luggage compartment lid trim panel.

▶ Release the 8 clips.

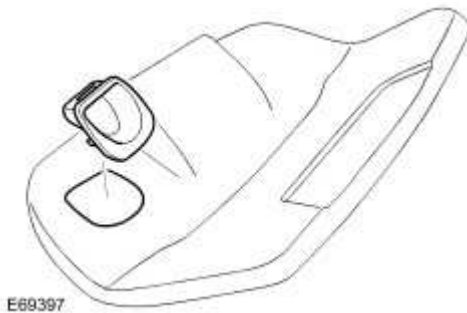


5 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the luggage compartment lid grab handle.

▶ Release the 2 clips.



Installation

1 . Install the luggage compartment lid grab handle.

▶ Secure the clips.


2 . Install the luggage compartment lid trim panel.

▶ Secure in the clips.


3 . Install the luggage compartment lid latch handle.

▶ Install the pin.

4 . Install the warning triangle retaining bracket.

 Tighten the Torx bolts to 10 Nm (7 lb.ft).

5 . Install the warning triangle.

 Secure with the clip.

501-08 : Exterior Trim and Ornamentation

Specifications

Specifications

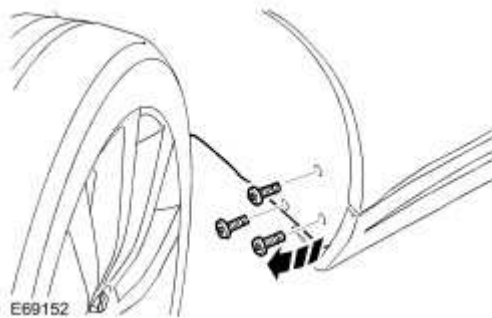
Torque Specifications

Item	Nm	lb-ft	lb-in
A-post outer finisher (convertible) - screw	2	-	18
Luggage compartment lid finisher - screw	1.5	-	13
Sill applique to body - screw	4	3	35
Spoiler to luggage compartment lid - nut	5	4	44
Spoiler to luggage compartment lid - screw	5	4	44

Front Fender Moulding (76.10.48)

Removal

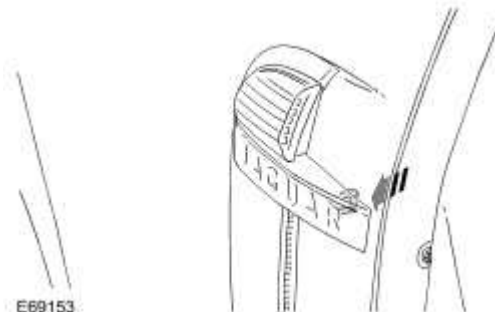
- 1 . Turn the steering on to full lock for access.
- 2 . Release the rear lower edge of the fender splash shield for access.
 - ▶ Remove the 3 Torx screws.



- 3  **CAUTION: Always protect paintwork and glass when removing exterior components.**

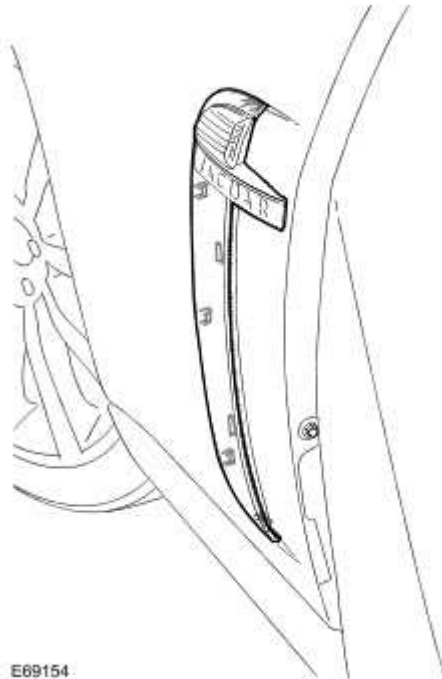
Release the rear fender moulding clip.

- ▶ Open the front door for access.
- ▶ Carefully release the clip with a small screwdriver; access is through the small aperture in the fender.



- 4 Release the fender moulding assembly.
 - ▶ Working from behind the fender splash shield, carefully release the 5

clips.



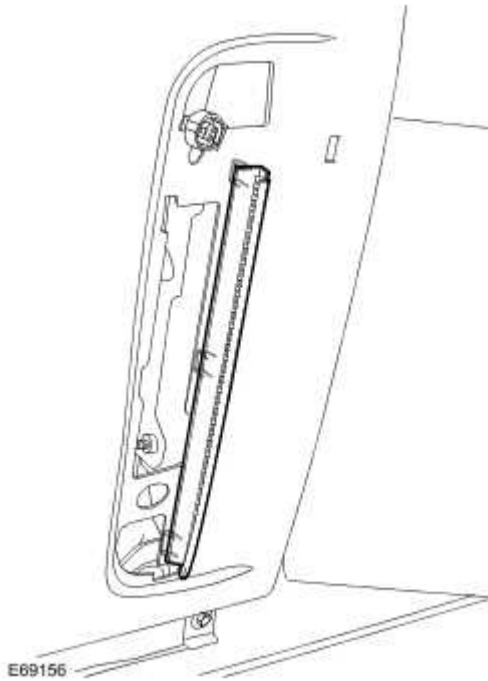
5 . Remove the fender moulding assembly.

▶ Disconnect the electrical connector.



6 . Remove the inner grille.

▶ Carefully release the 3 clips.

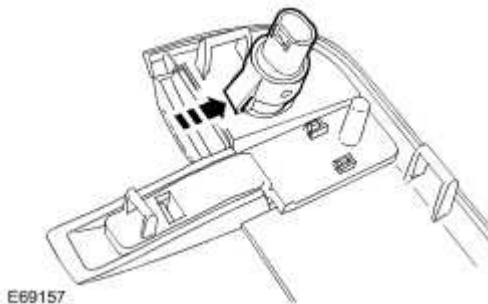


7 . NOTE:

Do not disassemble further if the component is removed for access only.

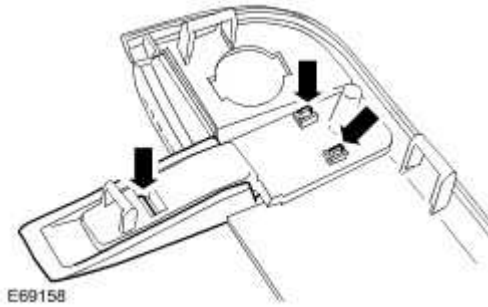
Remove the side repeater lamp.

▶ Carefully release the clip.



8 . Carefully remove the decal.

▶ Release the 3 clips.



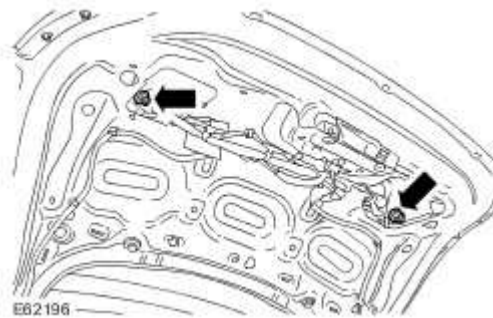
Installation

- 1 . Install the decal.
 - ▶ Secure with the clips.
- 2 . Install the side repeater lamp.
 - ▶ Secure the clip.
- 3 . Install the inner grille.
 - ▶ Secure the clips.
- 4 . Install the fender moulding assembly.
 - ▶ Secure the clips.
- 5 . Secure the fender splash shield.
 - ▶ Install the Torx screws.

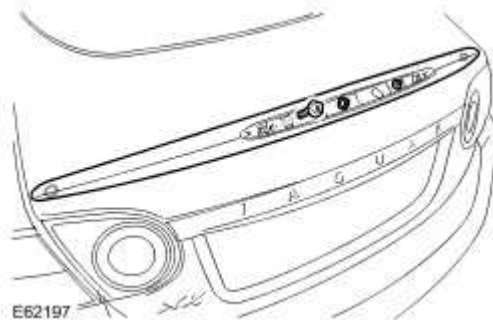
Rear Spoiler (76.19.86.60)

Removal

- 1 . Remove the high mounted stoplamp.
For additional information, refer to [High Mounted Stoplamp \(86.41.01\)](#)
- 2 . Release the rear spoiler.
 - ▶ Remove the 2 nuts.



- 3 . Remove the rear spoiler.
 - ▶ Remove the 3 Torx screws.
 - ▶ Release the 2 clips.



Installation


- 1 . Install the rear spoiler.
 - ▶ Secure with the clips.
 - ▶ Fit and tighten the Torx screws.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).

2 . Install the high mounted stoplamp.


For additional information, refer to [High Mounted Stoplamp \(86.41.01\)](#)

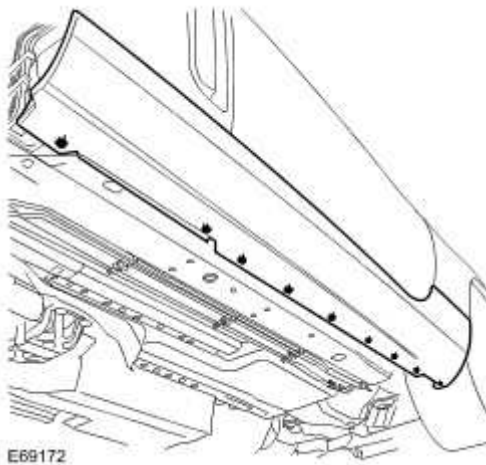
Rocker Panel Moulding (76.11.36)

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the front scuff plate trim panel.
For additional information, refer to [Front Scuff Plate Trim Panel \(76.13.81\)](#)
- 3 . Release the rocker panel moulding lower edge.
 Remove the 9 clips.




- 4  **CAUTION: Always protect paintwork and glass when removing exterior components.**

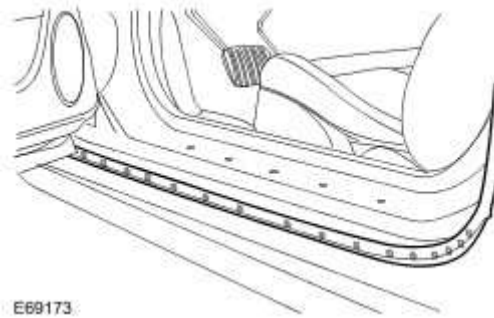
 **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

NOTE:

When removing the seal, some clips may remain attached to the component.
These clips can be recovered and returned to their original fitted positions.

Release the rocker panel door seal lower for access.

-  Release the 16 clips.



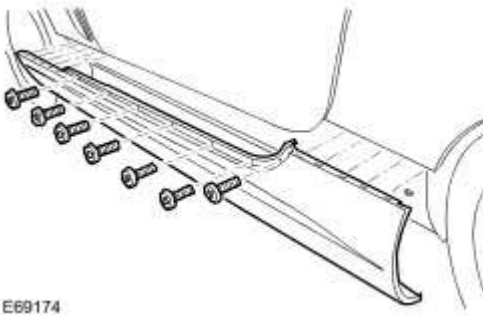
5.  **CAUTION: Protect the paintwork during this operation.**

NOTE:

Apply a sharp horizontal force to release the clips.

Remove the rocker panel moulding.

- ▶ Remove the 7 Torx screws.
- ▶ Release the front and rear clips.



Installation

- 1 . Install the rocker panel moulding.
 - ▶ Align and secure the front and rear rocker panel clips.
 - ▶ Tighten the Torx screws to 6 Nm (4 lb.ft).
- 2 . Install the aperture seal.
 - ▶ Carefully align and secure the clips.
- 3 . Secure the rocker panel lower edge.
 - ▶ Install the clips.

4 . Install the front scuff plate trim panel.

For additional information, refer to [Front Scuff Plate Trim Panel \(76.13.81\)](#)

501-09 : Rear View Mirrors

Specifications

Specifications

Torque Specifications

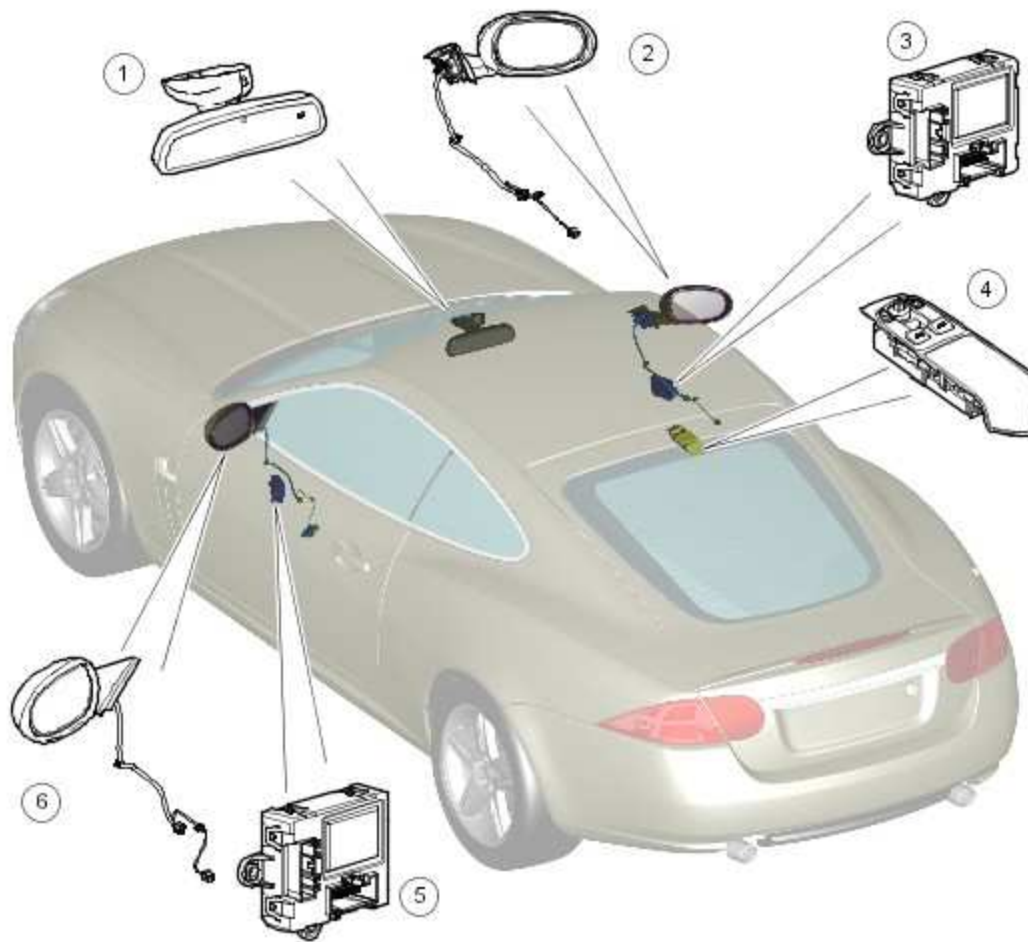
Item	Nm	lb-ft	lb-in
Exterior mirror - bolt	8	6	71

Rear View Mirrors

COMPONENT LOCATION

NOTE:

RHD (right-hand drive) shown, LHD (left-hand drive) mirror image.



E62404

Item	Part Number	Description
1		Interior mirror
2		Driver's door mirror
3		Driver's door module
4		Door mirror switches
5		Passenger door module

INTRODUCTION

Movement of the door mirrors is controlled from a switch pack located on the drivers door. The switch pack contains 2 non-latching mirror select buttons labelled 'L' and 'R' and a 4-way mirror movement switch. Door mirror movement commands are transmitted to the driver's door module over the LIN (local interconnect network) bus. The drivers door module transmits any mirror movement commands to the passenger door module over the medium speed CAN (controller area network) bus.

Movement of the door mirrors is carried out by the respective door module. The door modules provide supply and ground paths to the mirror motors and monitor mirror position via potentiometers located in the mirror housings.

An electrochromic interior mirror is mounted on the windshield and contains a forward and a rearward facing light sensor. The light sensors control the auto dimming feature of the interior mirror to reduce glare from the headlights of following vehicles.

When auto-dimming of the interior mirror is required, a supply is provided by the interior mirror to both door mirrors to initiate the door mirror auto-dimming sequence.

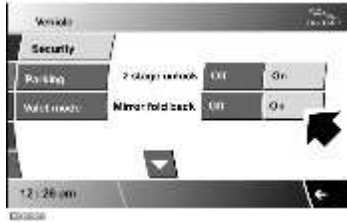
Some vehicles may be fitted with an interior mirror featuring an electronic compass with LED (light emitting diode) display. The compass is a self contained unit and does not interface with any other vehicle system or electronic control module. Details of how to set and calibrate the compass can be found in the 'Mirrors' section of the Owner's Handbook.

Up to 2009 Model Year (MY), some vehicles have door mirrors with an electric foldback feature. From 2009 MY, the mirror foldback feature is a standard fit in all markets. Where fitted, mirror foldback can be operated manually or automatically.

Manual operation of mirror foldback is initiated with the vehicle stationary or moving at 20 km/h (12 mph) or less, by pressing then releasing the L and R mirror select buttons at the same time. The first press of the mirror select buttons causes the two door mirrors to turn inwards to the folded position and stop. A further press of the mirror select buttons causes the door mirrors to turn outwards to the unfolded position and stop. If the mirror select buttons are pressed while the door mirrors are moving, they stop and reverse direction until they reach their original position. If one of the door mirrors has been manually folded, the two door mirrors can be re-synchronized by an inward and outward operating cycle.

Automatic mirror foldback is selected and deselected on the vehicle settings menu of the Touch Screen Display (TSD). Automatic operation is synchronised with the exterior locking and unlocking of the vehicle (it does not work with interior locking and drive away locking). If automatic operation is selected, the door mirrors fold when the vehicle is locked and unfold when unlocked. However, the door mirrors will not unfold automatically if they have been folded manually, even though automatic mode is selected on the TSD.

Automatic Mirror Foldback Selection on TSD

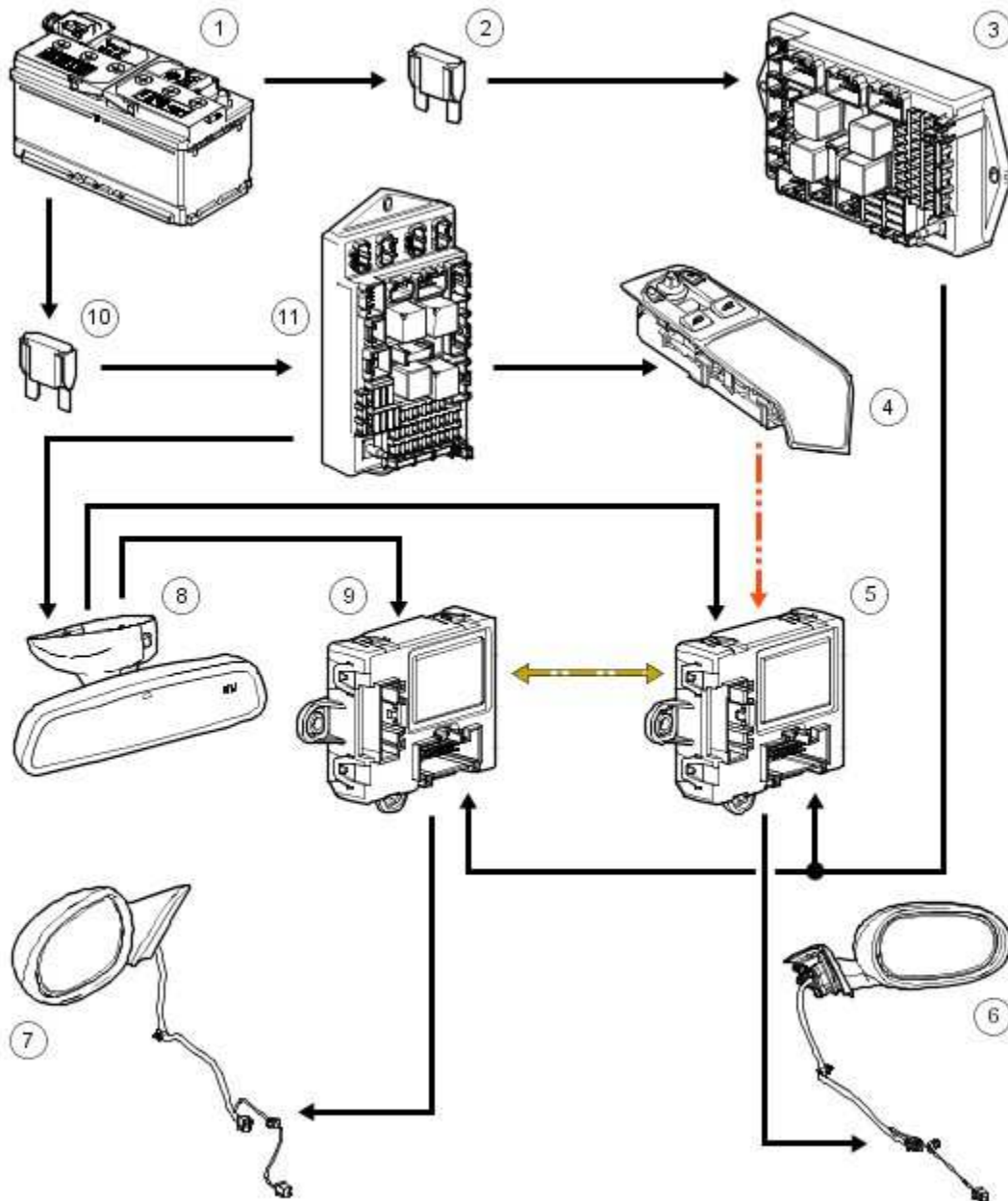


A thermal cut-out feature is incorporated to protect the mirror foldback motors. Thermal cut-out only occurs with the door mirrors in the unfolded position, and resets after 5 minutes.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **N** = Medium Speed CAN (controller area network) bus; **O** = LIN (local interconnect network) bus



E62405



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Auxiliary junction box
4		Door mirror switches
5		Driver's door module
6		Driver's door mirror
7		Passenger door mirror
8		Interior mirror

9		Passenger door module
10		Mega fuse
11		Central Junction Box (CJB)

Rear View Mirrors

Principle of Operation

For a detailed description of the rear view mirrors, refer to the relevant Description and Operation section in the workshop manual.

[Rear View Mirrors](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Exterior mirror(s) 	<ul style="list-style-type: none"> • Fuse(s) • Relay • Electrical connector(s) • Switch

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, Check DDM/PDM for rear view mirror related DTCs and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer

approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B116311	Left Mirror Heater Output short to ground	<ul style="list-style-type: none">• Short to ground	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to ground
B116315	Left Mirror Heater Output short to power	<ul style="list-style-type: none">• Short to power or open circuit	Refer to the electrical circuit diagrams and test left mirror heater output circuit for short to power or open circuit
B116411	Right Mirror Heater Output short to ground	<ul style="list-style-type: none">• Short to ground	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to ground
B116415	Right Mirror Heater Output short to power	<ul style="list-style-type: none">• Short to power or open circuit	Refer to the electrical circuit diagrams and test right mirror heater output circuit for short to power or open circuit
B1A9411	Driver Mirror	<ul style="list-style-type: none">• Short to ground	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to ground
B1A9415	Driver Mirror	<ul style="list-style-type: none">• Short to power or open circuit	Refer to the electrical circuit diagrams and test driver mirror fold motor circuit for short to power

			or open circuit
B1A9511	Passenger Mirror	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to ground
B1A9515	Passenger Mirror	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger mirror fold motor circuit for short to power or open circuit
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> • Value of signal protection calculation incorrect 	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. Window Control Switch (86.25.08)
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> • Signal Invalid 	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. Window Control Switch (86.25.08)
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> • Missing Message 	Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack. Window Control Switch (86.25.08)
B1C0911	Driver Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver left/right mirror motor circuit for short to ground
B1C0915	Driver Left/Right Mirror Motor	<ul style="list-style-type: none"> • Short to power or open 	Refer to the electrical circuit diagrams and test

	Circuit	circuit	driver left/right mirror motor circuit for short to power or open circuit
B1C1011	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to ground
B1C1015	Driver Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver up/down mirror motor circuit for short to power or open circuit
B1C1111	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1115	Passenger Left/Right Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1211	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1215	Passenger Up/Down Mirror Motor Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1C1311	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to ground
B1C1315	Driver Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver up/down mirror motor feedback circuit for short to power or open circuit
B1C1411	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test driver left/right mirror

			motor feedback circuit for short to ground
B1C1415	Driver Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test driver left/right mirror motor feedback circuit for short to power or open circuit
B1C1511	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to ground
B1C1515	Passenger Up/Down Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger up/down mirror motor feedback circuit for short to power or open circuit
B1C1611	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to ground 	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to ground
B1C1615	Passenger Left/Right Mirror Motor Feedback Circuit	<ul style="list-style-type: none"> • Short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger left/right mirror motor feedback circuit for short to power or open circuit
U001000	Medium speed CAN communication Bus	<ul style="list-style-type: none"> • Medium speed CAN communication Bus 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> • Logged when subscribed CAN message missing from CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020800	Lost communication With Driver Seat Module (DSM)	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software	<ul style="list-style-type: none"> • Invalid configuration 	Re-configure the RJB using the manufacturer

	incompatibility	message is received	approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U200224	Switch	<ul style="list-style-type: none"> Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new passenger side window switch
U201011	Switch illumination	<ul style="list-style-type: none"> Circuit short to ground 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201012	Switch illumination	<ul style="list-style-type: none"> Circuit short to battery 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201208	Car Configuration Parameter(s)	<ul style="list-style-type: none"> Bus signal/message failures 	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	<ul style="list-style-type: none"> Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new driver side window switch pack. Window Control Switch (86.25.08)
U201444	Control module hardware	<ul style="list-style-type: none"> Data Memory Failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U210000	Initial configuration not complete	<ul style="list-style-type: none"> No sub type information 	Re-configure the DDM/PDM using the manufacturer approved diagnostic system
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U300255	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Not configured 	Re-configure the relevant module as new using the manufacturer approved

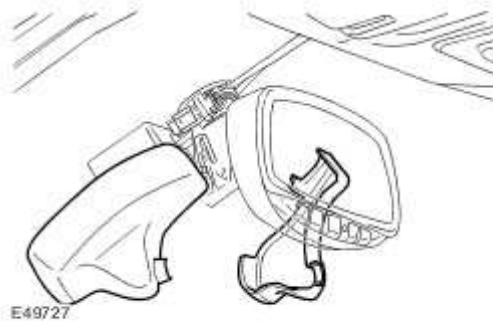
			diagnostic system and re-test. If DTC remains install a new module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> • Mis-match of battery voltage, of 2 volts or lower, between DDM/PDM and RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Auto-Dimming Interior Mirror (76.10.56)

Removal

- 1 . Remove the 2 interior mirror covers.

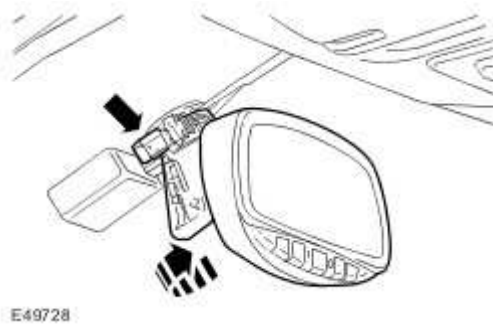
- ▶ Release the 2 clips.



- 2 . Remove the interior mirror.

- ▶ Disconnect the electrical connector.

- ▶ Rotate the mirror stem at its base to release from the windshield.




Installation

- 1 . Install the interior mirror.

- ▶ Rotate the mirror stem at its base to secure to the windshield.

- ▶ Connect the electrical connector.

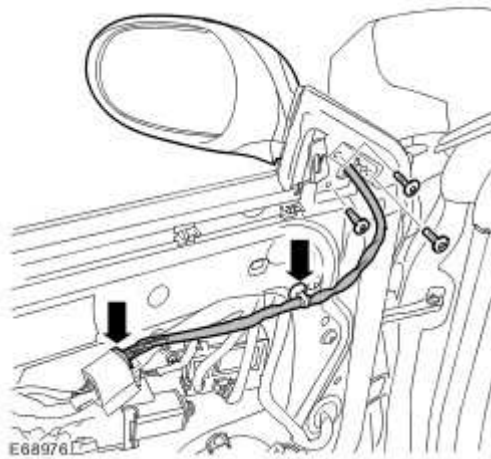
2 . Install the interior mirror covers.

 Secure with the clips.

Exterior Mirror (76.10.52)

Removal

- 1 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 2 . Remove the exterior mirror.
 - ▶ Disconnect the 2 electrical connectors.
 - ▶ Release the 2 wiring harness clips.
 - ▶ Remove the 3 Torx bolts.



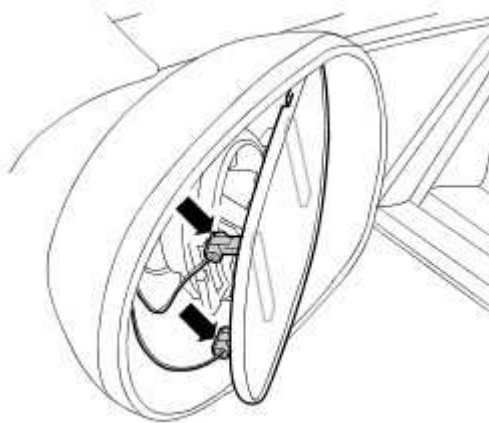
Installation

- 1 . Install the exterior mirror.
 - ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
 - ▶ Secure the wiring harness in the clips.
 - ▶ Connect the electrical connectors.
- 2 . Install the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

Exterior Mirror Glass (76.10.53)

Removal

- 1 Remove the exterior mirror glass.
 - ▶ Carefully apply pressure to the outer edge of the glass, to release the 2 clips.
 - ▶ Disconnect the 2 electrical connectors.



E67917

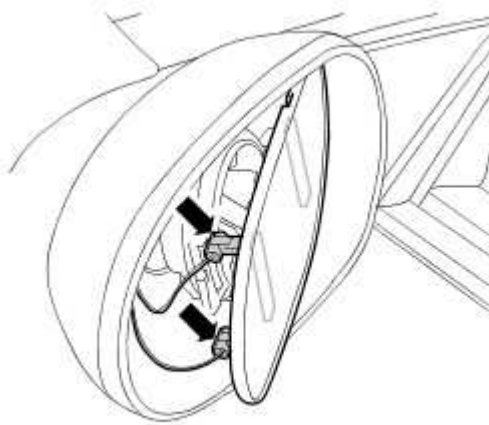
Installation

- 1 . Install the exterior mirror glass.
 - ▶ Connect the electrical connectors.
 - ▶ Align the glass to the motor.
 - ▶ Apply an even pressure to secure glass to the clips.
- 2 . Check the operation of the exterior mirror.

Exterior Mirror Motor (76.10.57)

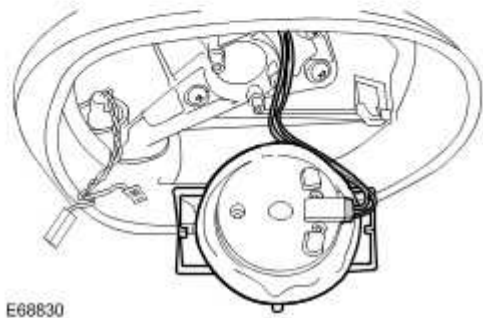
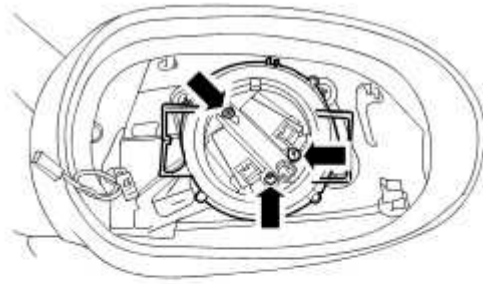
Removal

- 1 Remove the exterior mirror glass.
 - ▶ Carefully apply pressure to the outer edge of the glass, to release the 2 clips.
 - ▶ Disconnect the 2 electrical connectors.



E67917

- 2 . Remove the exterior mirror motor.
 - ▶ Remove the 3 Torx screws.
 - ▶ Disconnect the electrical connector.



E68830

Installation

- 1 . Install the exterior mirror motor.
 - ▶ Connect the electrical connector.
 - ▶ Install and tighten the Torx screws.

- 2 . Install the exterior mirror glass.
 - ▶ Connect the electrical connectors.
 - ▶ Align the glass to the motor.
 - ▶ Apply an even pressure to secure glass to the clips.

- 3 . Check the operation of the exterior mirror.

501-10 : Seating

Specifications

Specifications

Torque Specifications

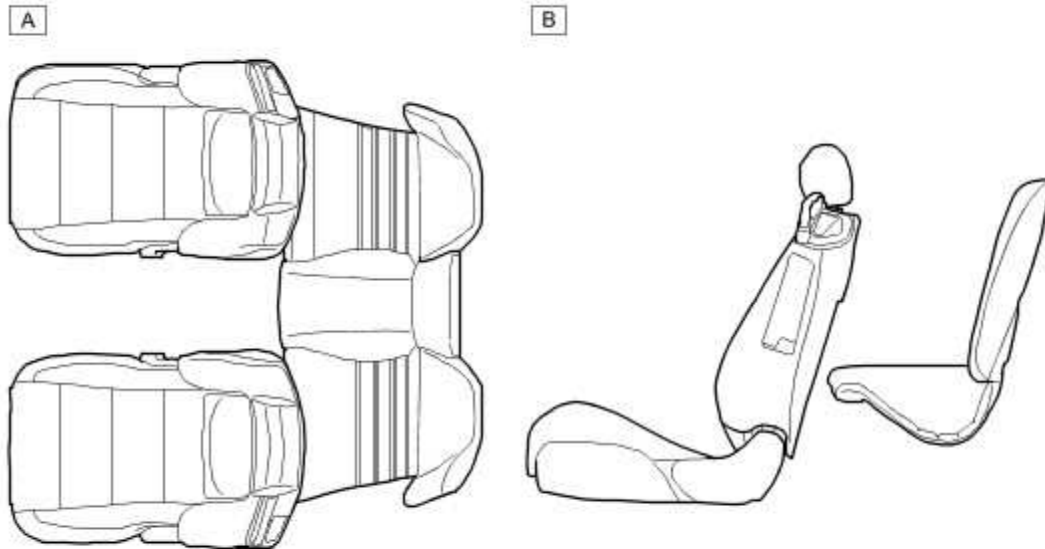
Item	Nm	lb-ft	lb-in
Front seat track to vehicle floor - bolt*	48	35	-
Rear seat support bracket - nut/screw	9	7	80

NOTE:

*New nut/bolt must be installed.

Seats

COMPONENT LOCATION



E73155

Item	Part Number	Description
A		Plan view
B		Side view

INTRODUCTION

Front Seat Sport Variant



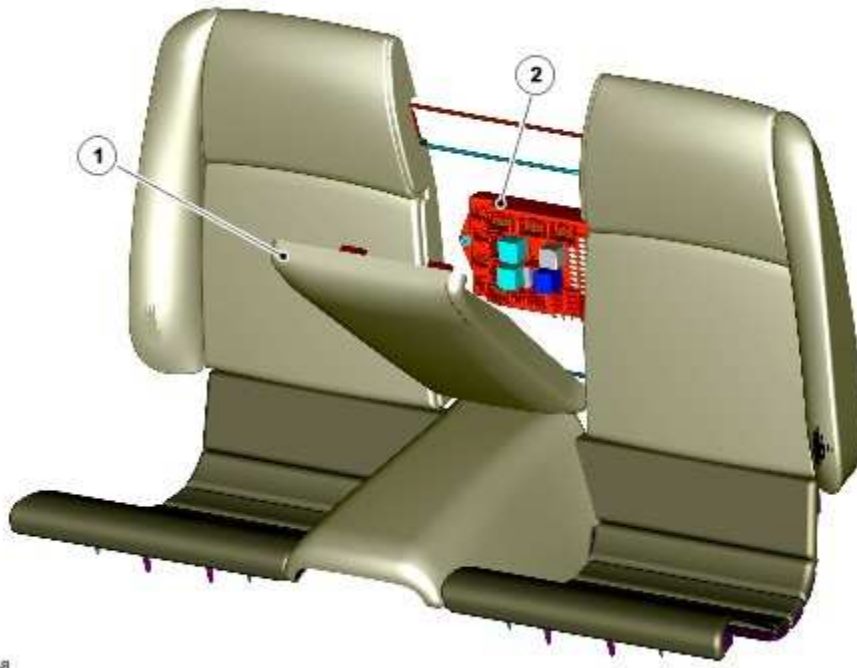
E73156

Front Seat Luxury Variant



E73157

Rear Seats



E73168

Item	Part Number	Description
1		Removable center panel
2		Auxiliary junction box

Two variants of driver and passenger seat are available; 10-way sports and 16-way luxury. The front seat frames are common to both the coupe and convertible and are equipped with the following:

- Seat control switches (door mounted)
- Front seat cushion front height adjustment
- Front seat cushion rear height adjustment
- Front seat backrest adjustment
- Front seat head restraint adjustment
- Lumbar adjustment
- Front seat forward and backward adjustment
- Side air bag module
- Front seat backrest heating
- Front seat cushion heating
- Extendible seat-cushion (luxury variant only)
- Adjustable side bolsters (luxury variant only)



WARNING: Prior to removal of the front seats and before disconnecting the front seat wiring harness electrical connectors (which includes the side air bag module electrical connectors), the battery ground cable should be disconnected and a period of at least 1 minute allowed to elapse. The same amount of care should be taken when handling and storing the front seats, as would be taken when handling and storing air bag modules.

The driver and passenger front seats, although almost identical, have some unique components. The front driver seat has a seat position sensor and the front passenger seat has an occupancy sensing system. In both instances the components form an integral part of the air bag Supplemental Restraint System (SRS). For additional information, refer to [Air Bag Supplemental Restraint System \(SRS\) \(501-20B\)](#)

The rear seat squabs are conventionally trimmed over a wire frame with a removable center panel allowing access to the auxiliary junction box.

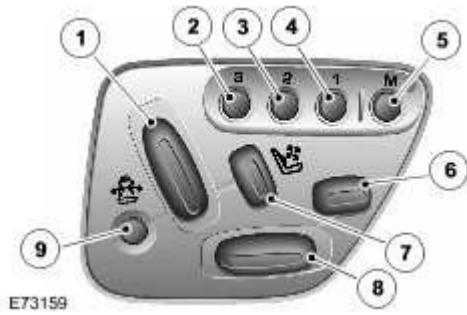
FRONT SEAT CONTROL SWITCHES

Sport Variant (10-way Adjustment)



Item	Part Number	Description
1		Backrest adjustment
2		Stored memory position button 3
3		Stored memory position button 2
4		Stored memory position button 1
5		Seat position memory store button
6		Lumbar adjustment, 2-way
7		Forward and backward adjustment, cushion front height and rear height adjustment

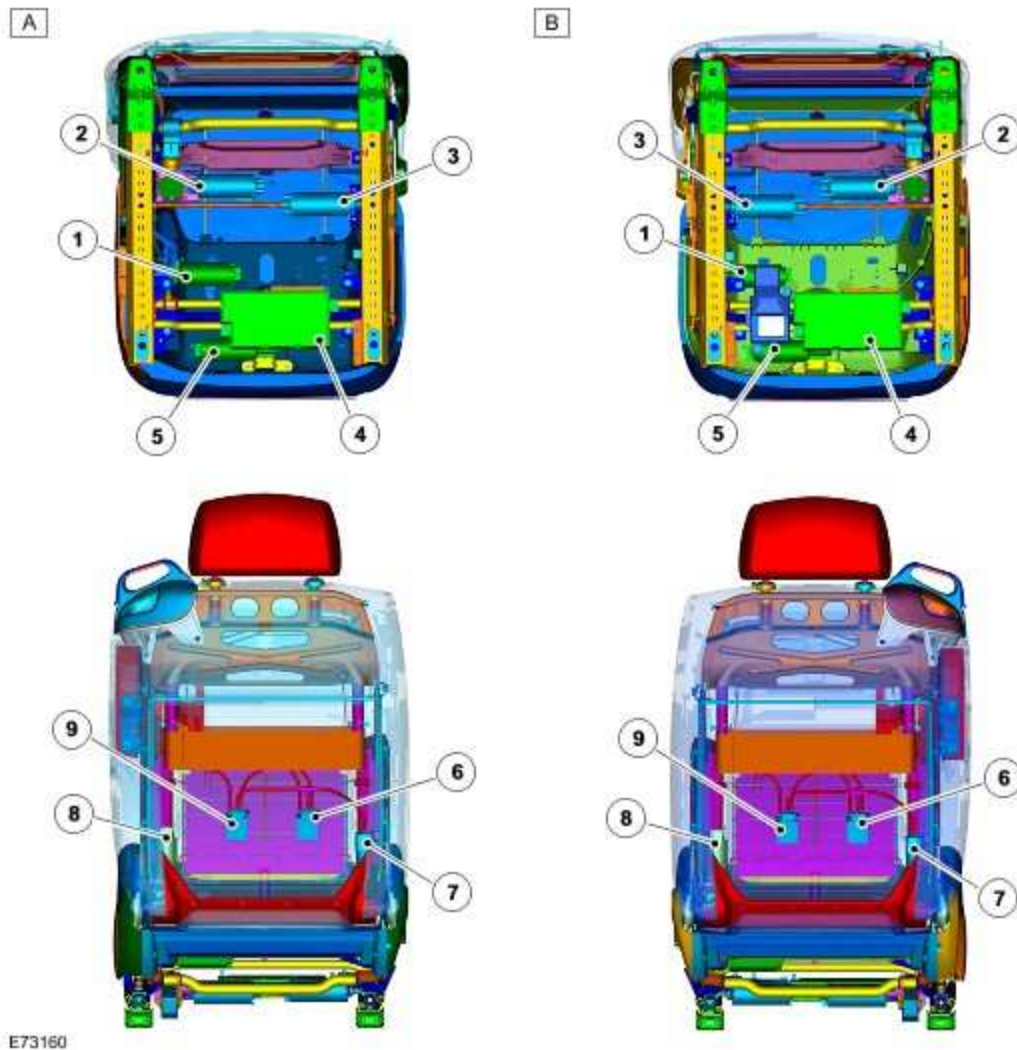
Luxury Variant (16-way Adjustment)



Item	Part Number	Description
1		Backrest adjustment
2		Stored memory position button 3
3		Stored memory position button 2
4		Stored memory position button 1
5		Seat position memory store button
6		Seat cushion extension adjustment
7		Lumbar adjustment, 4-way
8		Forward and backward adjustment, cushion front height and rear height adjustment
9		Bolster adjustment

The front seat control switches are installed in the driver and passenger door casings.

FRONT SEAT CONTROL COMPONENTS



E73160

Item	Part Number	Description
A		Drivers seat
B		Passenger seat
1		Cushion front height and rear height adjustment motor
2		Height adjustment motor
3		Forward and rearward adjustment motor
4		Memory control module
5		Seat cushion extension motor (luxury variant only)
6		Lumbar pump solenoid
7		Lumbar/bolster pump
8		Backrest adjustment motor
9		Bolster pump solenoid

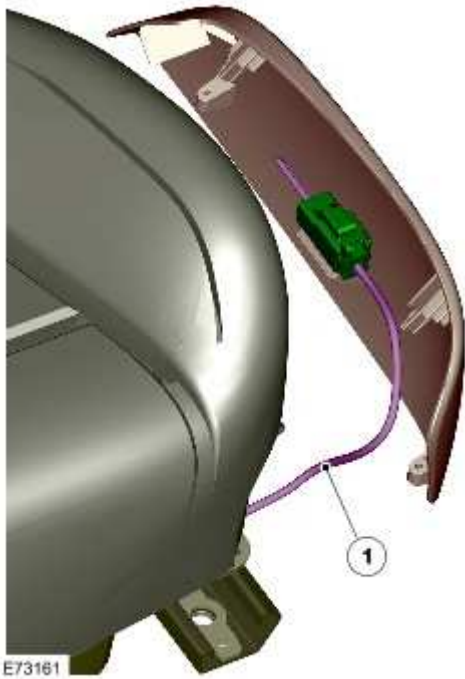
Seat position is monitored by the individual seat modules using seat track position Hall sensors incorporated into the motors. This prevents the seat from being adjusted to a position that will contact the surrounding interior trim or a rear seat passenger causing injury (clash

avoidance). Seat memory is standard on both drivers and passenger seats. Each seat memory can be configured for 3 personality positions, which are set using the seat memory switch and stored in the individual seat module.

The switches for electrically adjusting the seats are wired directly to the appropriate control module, which controls the movement of the seat via Local Interconnect Network (LIN) serial communication protocol.

NOTE:

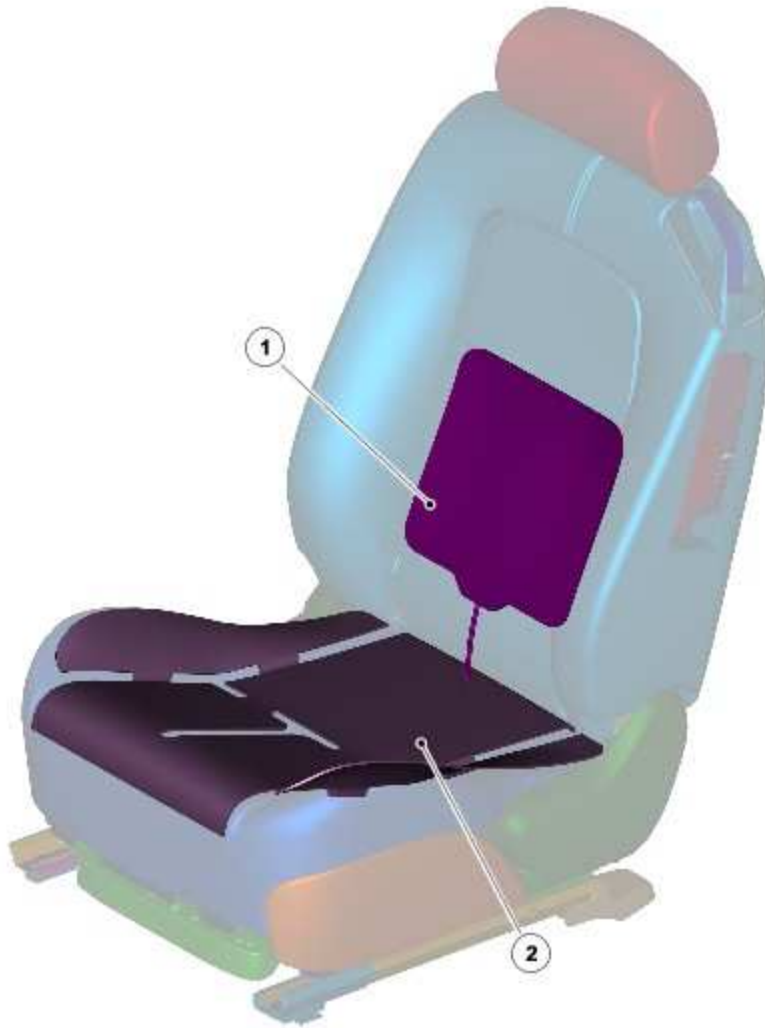
In the event of a control module failure a fly lead behind the seat valance can be used to connect a power source directly to the seat slide motor. This enables the seat to be moved to gain access to the front and rear seat fixings. The seat can then be removed from the vehicle in order to access the control module.



Item	Part Number	Description
1		Fly lead

As part of the Pre-Delivery Inspection (PDI) each seat needs to perform a clash avoidance check. This procedure is to ensure there is no contact between the seat trim and rear quarter casing. If there is any contact between the seat trim and rear quarter casing the affected seat must be recalibrated via the seat calibration routine in the Integrated Diagnostic System (IDS). For more information refer to the PDI manual.

FRONT SEAT HEATING

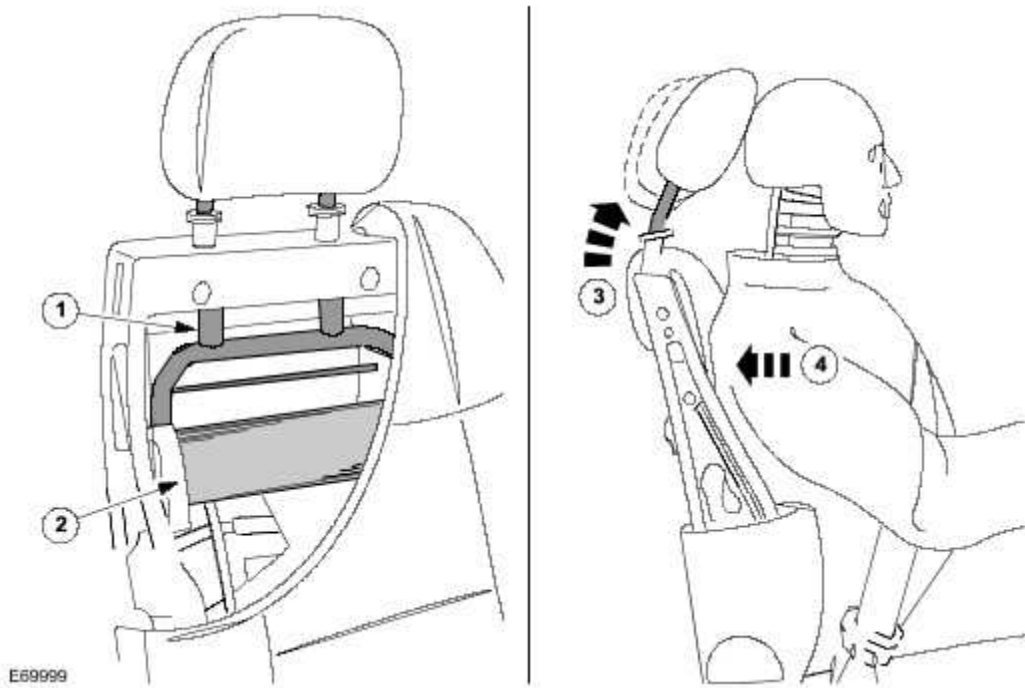


E73162

Item	Part Number	Description
1		Seat back heater
2		Seat cushion heater

Operation of the heated seats is controlled by the Automatic Temperature Control (ATC) module. The ATC module receives a request from the Touch Screen Display (TSD) and sends a message to the Central Junction Box (CJB), which then provides a feed to the seat heater elements. For additional information, refer to [Control Components \(412-04\)](#)

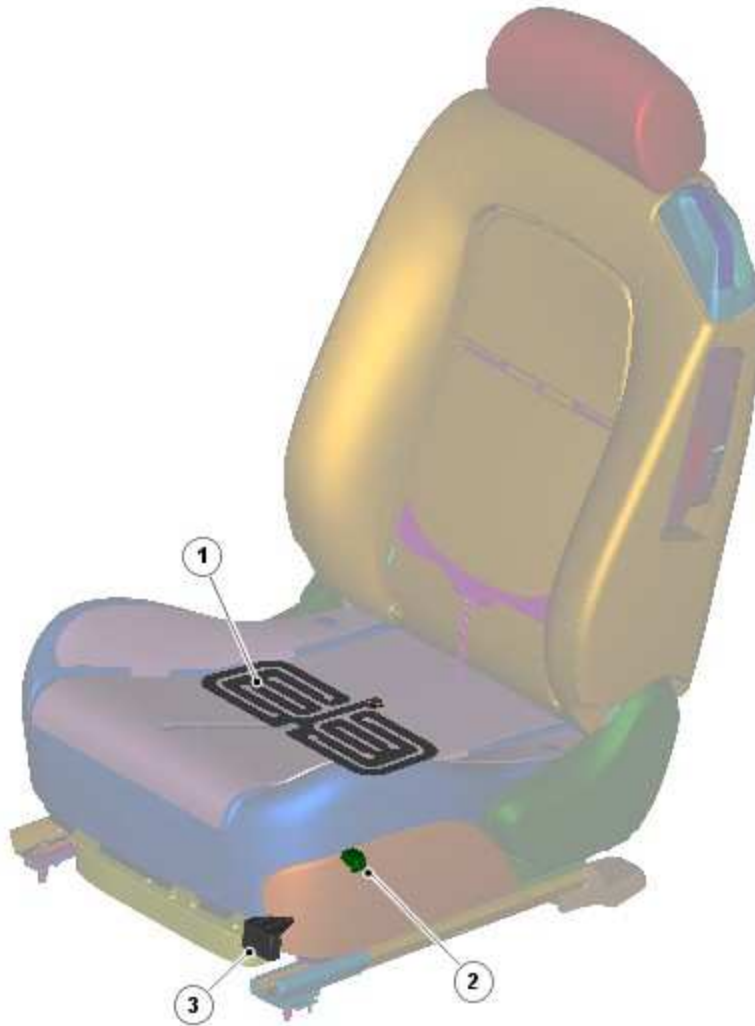
ACTIVE FRONT HEAD RESTRAINTS



Item	Part Number	Description
1		Head restraint support
2		Fabric tape
3		Headrest movement during rear end collision
4		Occupant movement during rear end collision

Both front seats are fitted with mechanical active head restraints that reduce injuries to the spinal column and possible whiplash in the event of a rear collision. The 2 supports of the head restraints inside the seat backrest are joined together with fabric tape. As the seat occupant's back and body weight presses against the fabric tape the head restraint moves upwards and forwards mechanically by means of a pivot point. The movement of the headrest cushions the occupant's head, altering the posture and reducing the relative motion between the body and the head. The head restraint then returns to its original position using a spring return mechanism.

PASSENGER SEAT OCCUPANCY SENSOR



E73163

Item	Part Number	Description
1		Occupancy sensor pad
2		Harness connector
3		Control module

Occupant monitoring provides the Restraints Control Module (RCM) with the occupancy status of the front passenger seat.

The occupant detection system determines if the front passenger seat is occupied or unoccupied. The system consists of a pressure sensor installed between the foam padding and the cover of the front passenger seat cushion. From the occupancy status, and the status of the front passenger safety belt, the instrument cluster determines the seat belt minder status. For additional information, refer to [Air Bag Supplemental Restraint System \(SRS\) \(501-20B\)](#)

FRONT SEAT BACK TILT



E73164

Item	Part Number	Description
1		Release cable
2		Release lever

The front seats tilt forward to allow access to the rear seats. To tilt the seat forward remove the seat belt from the seat belt guide. Lift the lever and push the seat back forwards. The seat back will latch when returned to the normal position. Ensure that the seat belt is returned to the seat belt guide.

AUDIBLE AND VISUAL CONFIRMATIONS

A single chime audible confirmation is generated by the instrument cluster to provide confirmation to the driver that the memory store operation has been successfully completed.

In addition to audible confirmation there is also a visual confirmation via the instrument cluster message center. For additional information, refer to [Instrument Cluster and Panel Illumination](#) (413-00)

STEERING COLUMN ADJUST



Item	Part Number	Description
1		Rotary joystick control switch

The instrument cluster controls the electric adjustable steering column in a rake (up and down) and reach (in and out). The steering column can be adjusted for rake and reach by operating the rotary joystick control switch on the LH side of the steering column.

Easy Entry Exit

The 'Easy Entry Exit' mode provides automatic movement of the steering column to allow easier entry to or exit from the vehicle.

This mode is selected by setting the steering column adjustment switch to the 'AUTO' position.

If the 'Easy Entry Exit' feature fails to function, it can be activated as follows:

- Rotate the steering column adjust switch to the 'AUTO' position
- The instrument cluster will now display 'Column Adjust Auto' in the message center

For more information refer to the owners handbook.

Steering Column Control

Adjustment of the steering column is achieved by a single Direct Current (DC) motor. Each adjustment movement is transmitted through a solenoid actuated clutch; 1 clutch for reach movement and 1 for rake movement.

When engaged, a clutch can be released only if the system is unstressed. As the clutches are mounted on the same motor spindle, the sequence for position adjustment is as follows:

- Engage the selected clutch by powering the appropriate solenoid
- After a time period (approximately 0.1 of a second), the motor is powered in the desired direction. When the motor reaches the stop position the solenoid and motor is released/unpowered. The clutch remains engaged under stress

- At the start of the next adjustment the motor is powered in the opposite direction to enable the clutch to disengage when the stress is released.

Simultaneous rake and reach movements are not possible since the motor must reverse direction as soon as the first axis has reached its required position.

Steering column rake and reach is controlled via potentiometer feedback.

MEMORY CONTROL MODULE



E73165

Item	Part Number	Description
1		Memory control module

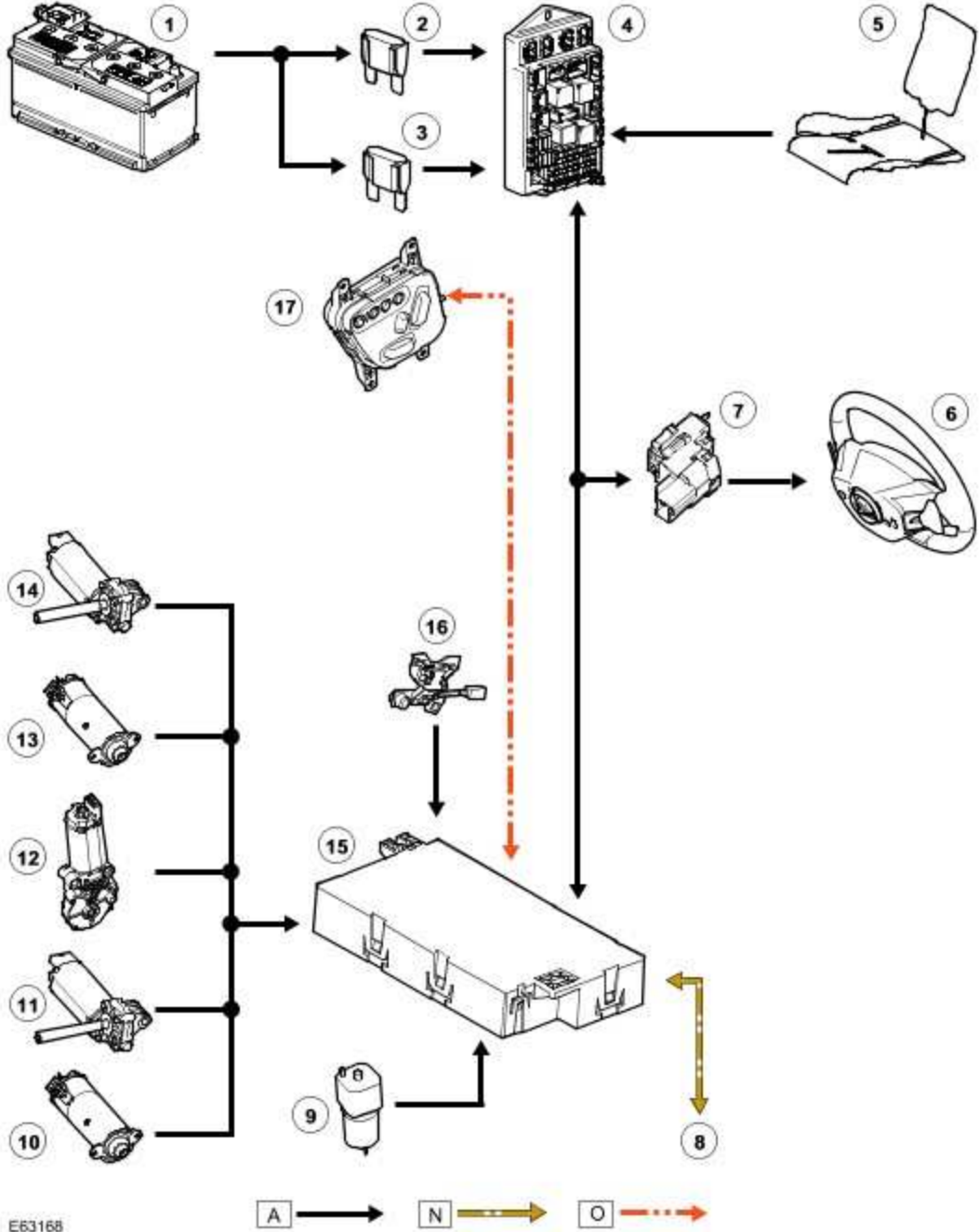
The memory control module, located under the drivers and passengers seat, relies upon a number of inputs to control various outputs. As with all electronic control modules, the unit needs information regarding the current operating conditions of the engine and other related systems before it can make calculations, which determine the appropriate outputs.

CONTROL DIAGRAMS

Driver Seat

NOTE:

A = Hardwired; N = CAN bus; O = LIN bus



E63168

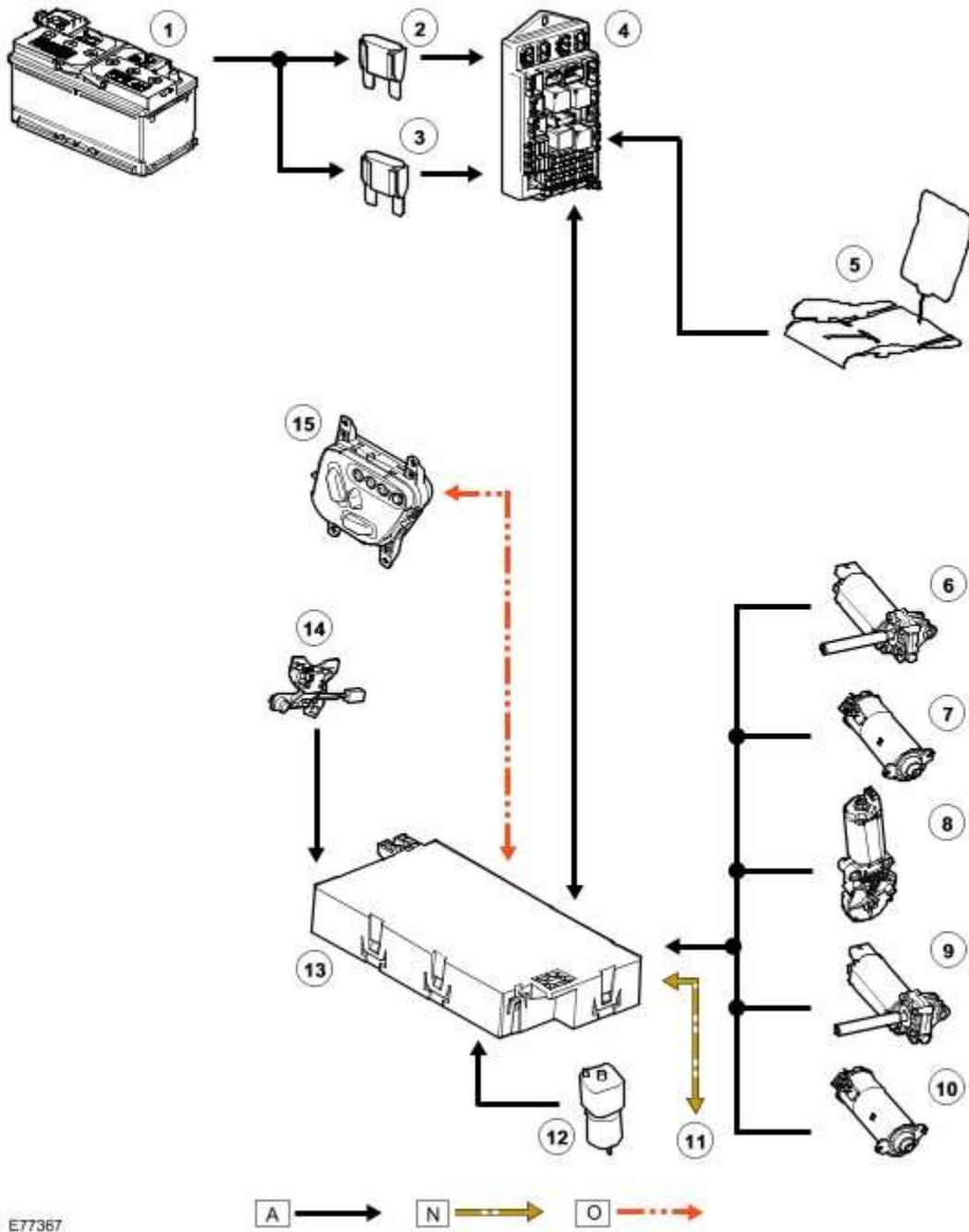
Item	Part Number	Description
1		Battery

2		Megafuse (175A)
3		Megafuse (175A)
4		Central Junction Box (CJB)
5		Driver seat heating elements
6		Heated steering wheel
7		Heated steering wheel module
8		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
9		Driver lumbar pump
10		Driver cushion extend motor
11		Driver fore/aft adjustment motor
12		Driver recline adjustment motor
13		Driver height adjustment motor
14		Driver rake adjustment motor
15		Driver Seat Module (DSM)
16		Driver seat Hall sensor (seat position)
17		Driver seat switch pack

Passenger Seat

NOTE:

A = Hardwired; **N** = CAN bus; **O** = LIN bus



E77367

Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Central Junction Box (CJB)
5		Passenger seat heating elements
6		Passenger rake adjustment motor
7		Passenger height adjustment motor

8		Passenger recline adjustment motor
9		Passenger fore/aft adjustment motor
10		Passenger cushion extend motor
11		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
12		Passenger lumbar pump
13		Passenger Seat Module
14		Passenger seat Hall sensor (seat position)
15		Passenger seat switch pack

PRINCIPLES OF OPERATION

Drivers Memory Seat

The memory control module can store up to 3 different driver seating, mirror and steering column positions. The numbered memory and single memory store switches control memory storage and recall operations. Each switch is a momentary action push switch.



E73168

Memory Store

Drivers Seat

Once the driver's seat, steering column and exterior mirrors have been adjusted, the vehicle is able to memorise these settings for future use by using the following procedure:

- Push the memory button M, the red Light Emitting Diode (LED) will illuminate for five seconds
- Whilst the LED is illuminated, press button 1, 2 or 3 to memorise the current settings

The LED will extinguish, and a chime will sound to confirm that the settings have been memorised. If the ignition is in the 'ON' mode, the message centre will display a confirmation message.

Passenger Seat

The procedure to memorise a passenger seat position is the same as that for the driver's seat with two exceptions. There will be no chime or message to confirm the settings.

Memory Recall

Memory recall has 3 memory positions stored for the seats, steering column and exterior mirrors. The switches for this function are located on driver and passenger door side trim panel. Pressing the appropriate numbered memory switch allows the seat to start moving to the position appropriate to that memory. When the switch is released the system will operate in manual mode. This means that when the switch is released, the seat will stop moving. In order to reach the intended memory position, the switch must not be released until all movement has stopped.

When a memory recall is initiated, to limit the overall current consumption, only 2-seat axis will move towards their intended position at any one time.

Both mirrors move simultaneously about the vertical axis first (left/right), and then, once all vertical axis movements are complete, about the horizontal axis (up/down). To minimise the number of mirror drives required, a method of sharing is implemented, which dictates that all movement about 1 axis is complete before movement about the other axis commences.

Immediate Adjustment

Pressing one of the manual adjustment switches will initiate the corresponding motor for that axis until the switch is released.

Only 2 seat motors can be driven at any one time.

Stall Detection

Seat, steering column and mirror motors are deemed to have stalled if there is no change in the inputs that are received from the corresponding feedback sensors for 200 ms (seat).

If a stall condition is detected then the drive to that axis is cancelled for the remainder of that memory operation (memory recall) or until the switch is re-selected (manual movement).

If the motor movement has stopped due to loss of sensor feedback, either stall or sensor failure, then that axis may be activated again, to move past the stall position, by re-selecting the appropriate switch and pressing for longer than 2 seconds. This allows control of the motor to be maintained if sensor feedback is lost.

Upon re-selection of movement, if sensor pulses are detected then the motor will continue to be driven until the switch is released or another stall condition is detected. If sensor feedback is not detected then the motor is only driven for 0.5 second and then stops until the switch is released and then pressed again, when a further 0.5 second of activation is permitted, and so on, this is known as inch mode.

For all seat motor manual movements, whenever a motor is driven and a stall occurs, the memory control module records the position at which the stall occurred. If movement occurs

beyond a stall position, then that position is erased from the control modules memory. This will always allow movement past a previously recorded stall position once movement has been registered beyond that position. This is the case for both manual and memory movement.

Initialisation

When a replacement memory control module is fitted to a seat it should be calibrated via IDS diagnostic tester so that the control module can learn the seats absolute position.

Battery Monitor

If the battery voltage drops below 10.5 Volts, then the memory control module ignores all requests for a memory recall until the battery voltage has reached 11.5 Volts. This will conserve as much power in the vehicle battery as possible to enable engine cranking.

Stand-by Mode

The memory control module supports a stand-by mode to keep power consumption to a minimum.

If the control module is being prevented from entering stand-by mode due to motor movement, memory recall or switch operation, then it will enter stand-by mode when the current function has terminated.

NOTE:

In the case of a memory recall, all memory recall operations should be carried out before entering stand-by mode, not just the current motor movement.

The control module will exit stand-by mode if there is any CAN bus activity.

The exchange of information between the diagnostic unit and the memory control module is via the medium-speed CAN bus. There is a non-volatile Electronic Erasable Programmable Read Only Memory (EEPROM) for saving detected errors. Its contents are not lost when the power supply is disconnected. Only the IDS diagnostic tester can erase the error memory.

Seats

Principle of Operation

For a detailed description of the seats and seat operation, refer to the relevant Description and Operation section in the workshop manual.

[Seats](#)

Inspection and Verification

NOTE:

Prior to carrying out any diagnosis, ensure the vehicle battery is in a good serviceable condition, refer to the battery care manual.

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Security, condition and correct installation of seat components and fixings 	<ul style="list-style-type: none"> • Fuses • Harnesses for damage/corrosion • Electrical connectors • Damaged/corroded pins

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

4 . If the cause is not visually evident, verify the concern and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
No seat movement from switch-pack (including no memory recall)	<ul style="list-style-type: none"> • Seat module has gone into sleep mode • Seat switch-pack LIN, power or ground circuit - 	Set ignition ON. Re-check seat function from switch-pack. Check for DTC B1A9887 and refer to DTC Index. Check for DTC B1A9888 and refer to DTC Index

	<ul style="list-style-type: none"> open circuit Seat switch-pack LIN circuit - short to power, ground 	
Seat movement from switch-pack occurs in inch mode (after 2 second delay from switch operation) - When seat axis movement is requested from the seat switch-pack the requested seat axis moves a short distance (after a 2 second delay from switch operation) then stops. This behaviour could occur on any seat axis (slide, height, squab, tilt or cushion)	<ul style="list-style-type: none"> Motor Hall sensor on affected axis is not connected or not receiving expected signals 	Check for DTCs, B1B8731, B1B9131, B1B8931, B1B9331, B106331 and refer to DTC Index. Re-calibrate affected seat
Seat movement from switch-pack occurs in inch mode - When seat axis movement is requested from the seat switch-pack the requested seat axis moves a short distance then stops. This behaviour will occur on ALL seat axis (slide, height, squab, tilt and cushion)	<ul style="list-style-type: none"> MS CAN fault 	Check Instrument Cluster and DDM/PDM for DTCs, U020800, U012600, U015500, U019900, U014200 and refer to relevant DTC Index. Check CAN network integrity using manufacturer approved diagnostic system. Re-calibrate affected seat
Seat moves forward/rearwards via the slide axis when the seat squab is tipped forwards/rearwards	<ul style="list-style-type: none"> Seat module is in manufacturing mode 	Re-configure the affected seat module as a 'New Module' using the manufacturer approved diagnostic system
When seat squab axis is moved to its maximum recline position the squab makes contact with the rear quarter casing causing the squab to twist and bend	<ul style="list-style-type: none"> Seat is out of calibration 	Re-calibrate the affected seat. Check for DTC U300146 and refer to DTC Index
Front seat fore/aft movement not functioning	<ul style="list-style-type: none"> Carry out the pinpoint test associated to this Symptom 	GO to Pinpoint Test G841635p1 .
Front seat excessive fore/aft free play	<ul style="list-style-type: none"> Carry out the pinpoint test associated to this Symptom 	GO to Pinpoint Test G841635p2 .
Front seat fore/aft movement noisy	<ul style="list-style-type: none"> Carry out the 	GO to Pinpoint Test

	pinpoint test associated to this Symptom	G841635p3.
Front seat height, tilt and/or seat extension motor movement not functioning	<ul style="list-style-type: none"> Carry out the pinpoint test associated to this Symptom 	GO to Pinpoint Test G841635p4.
Front seat height, tilt and/or extension movement noisy	<ul style="list-style-type: none"> Carry out the pinpoint test associated to this Symptom 	GO to Pinpoint Test G841635p5.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B1C02-24	Memory Store Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1C03-24	Memory #1 Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1C04-24	Memory #2 Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1C05-24	Memory #3 Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B94-24	Seat Height Up Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B95-24	Seat Height Down Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B96-24	Seat Slide Forward Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B97-24	Seat Slide Backward Switch - signal stuck high	<ul style="list-style-type: none"> Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.

B1C00-24	Seat Recline Up Switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1C01-24	Seat Recline Down Switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B98-24	Seat Tilt Up Switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B99-24	Seat Tilt Down Switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1065-24	Cushion extend switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1066-24	Cushion retract switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1067-24	Lumbar in switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1068-24	Lumbar out switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1069-24	Lumbar up switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B106A-24	Lumbar down switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with

			this DTC using the manufacturer approved diagnostic system.
B106B-24	Bolster inflate switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B106C-24	Bolster deflate switch - signal stuck high	<ul style="list-style-type: none"> • Signal stuck high 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B86-15	Seat Height Motor Relay - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B86-11	Seat Height Motor Relay - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B88-15	Seat Slide Motor Relay - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B88-11	Seat Slide Motor Relay - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B90-15	Seat Tilt Motor Relay - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B90-11	Seat Tilt Motor Relay - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B92-15	Seat Recline Motor Relay - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system.
B1B92-11	Seat Recline Motor Relay - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B105F-15	Seat Cushion Extension Motor Output - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B105F-11	Seat Cushion Extension Motor Output - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1D94-15	Lumbar Motor Relay - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1D94-11	Lumbar Motor Relay - circuit short to ground	<ul style="list-style-type: none"> • Circuit Short to Ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B87-31	Seat Height Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> • No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B91-31	Seat Tilt Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> • No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B89-31	Seat Slide Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> • No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1B93-31	Seat Recline Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> • No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.

B1063-31	Seat Cushion Extension Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1064-31	Seat Headrest Motor Speed/Position Sensor - no signal	<ul style="list-style-type: none"> No Signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B113A-00	General failure on seat lumbar - no sub type information	<ul style="list-style-type: none"> General failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B113B-00	Multiple failure on lumbar 4W - no sub type information	<ul style="list-style-type: none"> Multiple failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1138-11	Lumbar control C - circuit short to ground	<ul style="list-style-type: none"> Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1138-12	Lumbar control C - circuit short to battery	<ul style="list-style-type: none"> Circuit short to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1138-13	Lumbar control C - circuit open	<ul style="list-style-type: none"> Circuit open 	Refer to the electrical circuit diagrams and test lower lumbar inflate control circuit for open circuit.
B1139-11	Lumbar control D - circuit short to ground	<ul style="list-style-type: none"> Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1139-12	Lumbar control D - circuit short to battery	<ul style="list-style-type: none"> Circuit short to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1139-13	Lumbar control D - circuit open	<ul style="list-style-type: none"> Circuit open 	Refer to the electrical circuit diagrams and

			test lower lumbar deflate control circuit for open circuit.
B1136-11	Lumbar control A - circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1136-12	Lumbar control A - circuit short to battery	<ul style="list-style-type: none"> • Circuit short to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1136-13	Lumbar control A - circuit open	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test upper lumbar deflate control circuit for open circuit.
B1137-11	Lumbar control B - circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1137-12	Lumbar control B - circuit short to battery	<ul style="list-style-type: none"> • Circuit short to battery 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1137-13	Lumbar control B - circuit open	<ul style="list-style-type: none"> • Circuit open 	Refer to the electrical circuit diagrams and test upper lumbar inflate control circuit for open circuit.
B105D-11	Seat Bolster Inflate Output - circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B105D-15	Seat Bolster Inflate Output - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B105E-11	Seat Bolster Deflate Output - circuit short to ground	<ul style="list-style-type: none"> • Circuit short to ground 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system.
B105E-15	Seat Bolster Deflate Output - circuit short to battery or open	<ul style="list-style-type: none"> • Circuit Short to Battery or Open 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1A98-86	LIN Bus Circuit #1 - signal invalid	<ul style="list-style-type: none"> • Signal Invalid 	Check LIN network for interference/EMC related issues.
B1A98-88	LIN Bus Circuit #1 - bus off	<ul style="list-style-type: none"> • Bus off 	Refer to electrical circuit diagrams and test LIN Bus between seat switch pack and control module for short to ground or power.
B1A98-83	LIN Bus Circuit #1 - value of signal protection calculation incorrect	<ul style="list-style-type: none"> • Value of signal protection calculation incorrect 	Check LIN network for interference/EMC related issues.
B1A98-87	LIN Bus Circuit #1 - missing message	<ul style="list-style-type: none"> • Missing Message 	Refer to electrical circuit diagrams and test LIN Bus between seat switch-pack and control module for open circuit, check power and ground supplies to switch-pack.
U1A14-49	CAN Initialisation failure - internal electronic failure	<ul style="list-style-type: none"> • Internal electronic failure 	Install a new DSM/PSM, refer to the new module installation note at the top of the DTC Index.
U0010-88	Medium speed Can communication Bus - bus off	<ul style="list-style-type: none"> • Bus off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0140-00	Lost communication with CJB - no sub type information	<ul style="list-style-type: none"> • Lost communication with CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0142-00	Lost communication with RJB - no sub type information	<ul style="list-style-type: none"> • Lost communication with RJB 	Carry out any pinpoint tests associated with this DTC using the

			manufacturer approved diagnostic system.
U0155-00	Lost communications with instrument cluster - no sub type information	<ul style="list-style-type: none"> • Lost communications with instrument cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0199-00	Lost communication with Driver Door Module (DDM) - no sub type information	<ul style="list-style-type: none"> • Lost communication with DDM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U3002-81	Vehicle Identification Number (VIN) - invalid serial data received	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index.
U0300-00	Internal control module software incompatibility - no sub type information	<ul style="list-style-type: none"> • Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DSM/PSM, refer to the new module installation note at the top of the DTC Index.
U3000-55	Stored vehicle configuration data does not match - not configured	<ul style="list-style-type: none"> • Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the DSM/PSM, refer to the new module installation note at the top of the DTC Index.
U3000-87	Control Module - missing message	<ul style="list-style-type: none"> • Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system. Check DSM/PSM for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic

			system.
U1A4C-68	Build/end of line mode active - event information	<ul style="list-style-type: none"> Manufacturing mode has not been removed 	Place DSM/PSM in to customer mode using manufacturer approved diagnostic system.
U3000-49	Control module - internal electronic failure	<ul style="list-style-type: none"> Internal electronic failure 	Install a new DSM/PSM, refer to the new module installation note at the top of the DTC Index.
U3001-46	Control module improper shutdown - calibration/parameter memory failure	<ul style="list-style-type: none"> Calibration/parameter memory failure 	Check for DTCs that could indicate power failure to the module and refer to the DTC Index.
U3003-16	Battery voltage - circuit voltage below threshold	<ul style="list-style-type: none"> Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U3003-17	Battery voltage - circuit voltage above threshold	<ul style="list-style-type: none"> Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10B9-13	Blower Control - circuit open	<ul style="list-style-type: none"> • LH fans pwr circuit, open circuit • LH fans rtn circuit, open circuit • Connectors disconnected • Connector pin damage • Blower motor assembly open circuit • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check LH fans pwr circuit for open circuit. Check LH fans rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check blower motor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B10B9-4B	Blower Control - over temperature	<ul style="list-style-type: none"> • Mechanical restriction in blower motor assembly • LH fans pwr circuit, short to ground • LH fans rtn circuit, short to ground • Blower motor assembly, short to 	<p>Check for mechanical restriction or debris in blower motor assembly. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check LH fans pwr circuit for</p>

		<ul style="list-style-type: none"> ground Climate Control Seat Module failure 	<p>short to ground. Check LH fans rtn circuit for short to ground. Check blower motor assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B1157-13	Blower Control "B" - circuit open	<ul style="list-style-type: none"> RH fans pwr circuit, open circuit RH fans rtn circuit, open circuit Connectors disconnected Connector pin damage Blower motor assembly open circuit Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check RH fans pwr circuit for open circuit. Check RH fans rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check blower motor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B1157-4B	Blower Control "B" - over temperature	<ul style="list-style-type: none"> Mechanical restriction in blower motor assembly RH fans pwr circuit, short to ground RH fans rtn circuit, short to ground Blower motor assembly, short to ground Climate Control Seat 	<p>Check for mechanical restriction or debris in blower motor assembly. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check RH fans pwr circuit for short to ground. Check RH fans rtn circuit for short to ground. Check blower motor assembly</p>

		Module failure	for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B120E-13	Right Thermal Electric Device Control - circuit open	<ul style="list-style-type: none"> • RH seat back thermal electric device + circuit, open circuit • RH seat back thermal electric device - circuit, open circuit • RH seat cushion thermal electric device + circuit, open circuit • RH seat cushion thermal electric device - circuit, open circuit • Connectors disconnected • Connector pin damage • Climate seat backrest thermal electric device assembly, open circuit • Climate seat cushion thermal electric device assembly, open circuit • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat back thermal electric device + circuit for open circuit. Check RH seat back thermal electric device - circuit for open circuit. Check RH seat cushion thermal electric device + circuit for open circuit. Check RH seat cushion thermal electric device - circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check climate seat backrest thermal electric device assembly for open circuit. Check climate seat cushion thermal electric device assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B120E-19	Right Thermal Electric Device Control - circuit current above threshold	<ul style="list-style-type: none"> • RH seat back thermal electric device + circuit, short to ground • RH seat back thermal electric device - circuit, short to ground 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat</p>

		<ul style="list-style-type: none"> • RH seat cushion thermal electric device + circuit, short to ground • RH seat cushion thermal electric device - circuit, short to ground • Climate seat backrest thermal electric device assembly, short to ground • Climate seat cushion thermal electric device assembly, short to ground • Climate Control Seat Module failure 	<p>back thermal electric device + circuit for short to ground. Check RH seat back thermal electric device - circuit for short to ground. Check RH seat cushion thermal electric device + circuit for short to ground. Check RH seat cushion thermal electric device - circuit for short to ground. Check climate seat backrest thermal electric device assembly for short to ground. Check climate seat cushion thermal electric device assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B120E-4B	Right Thermal Electric Device Control - over temperature	<ul style="list-style-type: none"> • Restriction in thermal electric device airpath • RH seat back thermal electric device + circuit, short to ground • RH seat back thermal electric device - circuit, short to ground • RH seat cushion thermal electric device + circuit, short to ground • RH seat cushion thermal electric device - circuit, short to ground • Climate seat backrest thermal electric device assembly, short to ground • Climate seat cushion thermal electric device 	<p>Check for blockage or restriction in thermal electric device airpath. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat back thermal electric device + circuit for short to ground. Check RH seat back thermal electric device - circuit for short to ground. Check RH seat cushion thermal electric device + circuit for short to ground. Check RH seat cushion thermal electric device - circuit for short to ground. Check climate seat backrest thermal electric device assembly for short to ground. Check climate seat cushion thermal electric</p>

		<p>assembly, short to ground</p> <ul style="list-style-type: none"> Climate Control Seat Module failure 	<p>device assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B120F-98	Left Seat Cushion - component or system over temperature	<ul style="list-style-type: none"> The Climate Control Seat Module LH cushion sensor input circuit temperature exceeds 65 Degrees C continuously for more than 4 seconds during cooling The Climate Control Seat Module LH cushion sensor input circuit temperature is greater than 110 Degrees C for more than 4 seconds during heating Blocked or restricted thermal electric device fan exhaust vent Restricted thermal electric fan movement 	<p>Check for blockage or restriction in thermal electric device fan exhaust vent. Check for restricted thermal electric fan movement. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B1223-13	Right Seat Cushion Temperature Sensor - circuit open	<ul style="list-style-type: none"> RH seat cushion sensor circuit, open circuit RH seat cushion sensor rtn circuit, open circuit Connectors disconnected Connector pin damage Climate seat cushion temperature sensor assembly, open circuit Climate Control Seat 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat cushion sensor circuit for open circuit. Check RH seat cushion sensor rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check Climate seat cushion</p>

		Module failure	temperature sensor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1224-13	Left Thermal Electric Device Control - circuit open	<ul style="list-style-type: none"> • LH seat back thermal electric device + circuit, open circuit • LH seat back thermal electric device - circuit, open circuit • LH seat cushion thermal electric device + circuit, open circuit • LH seat cushion thermal electric device - circuit, open circuit • Connectors disconnected • Connector pin damage • Climate seat backrest thermal electric device assembly, open circuit • Climate seat cushion thermal electric device assembly, open circuit • Climate Control Seat Module failure 	Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back thermal electric device + circuit for open circuit. Check LH seat back thermal electric device - circuit for open circuit. Check LH seat cushion thermal electric device + circuit for open circuit. Check LH seat cushion thermal electric device - circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check climate seat backrest thermal electric device assembly for open circuit. Check climate seat cushion thermal electric device assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
B1224-	Left Thermal	<ul style="list-style-type: none"> • LH seat back thermal 	Carry out On Demand Self Test

19	Electric Device Control - circuit current above threshold	<p>electric device + circuit, short to ground</p> <ul style="list-style-type: none"> • LH seat back thermal electric device - circuit, short to ground • LH seat cushion thermal electric device + circuit, short to ground • LH seat cushion thermal electric device - circuit, short to ground • Climate seat backrest thermal electric device assembly, short to ground • Climate seat cushion thermal electric device assembly, short to ground • Climate Control Seat Module failure 	<p>(ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back thermal electric device + circuit for short to ground. Check LH seat back thermal electric device - circuit for short to ground. Check LH seat cushion thermal electric device + circuit for short to ground. Check LH seat cushion thermal electric device - circuit for short to ground. Check climate seat backrest thermal electric device assembly for short to ground. Check climate seat cushion thermal electric device assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B1224-4B	Left Thermal Electric Device Control - over temperature	<ul style="list-style-type: none"> • Restriction in thermal electric device airpath • LH seat back thermal electric device + circuit, short to ground • LH seat back thermal electric device - circuit, short to ground • LH seat cushion thermal electric device + circuit, short to ground • LH seat cushion thermal electric device - circuit, short to ground • Climate seat backrest 	<p>Check for blockage or restriction in thermal electric device airpath. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back thermal electric device + circuit for short to ground. Check LH seat back thermal electric device - circuit for short to ground. Check LH seat cushion thermal electric device + circuit for short to ground. Check LH seat cushion thermal electric device - circuit</p>

		<p>thermal electric device assembly, short to ground</p> <ul style="list-style-type: none"> • Climate seat cushion thermal electric device assembly, short to ground • Climate Control Seat Module failure 	<p>for short to ground. Check climate seat backrest thermal electric device assembly for short to ground. Check climate seat cushion thermal electric device assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B1225-13	Right Seat Back Temperature Sensor - circuit open	<ul style="list-style-type: none"> • RH seat back sensor circuit, open circuit • RH seat back sensor rtn circuit, open circuit • Connectors disconnected • Connector pin damage • Climate seat back temperature sensor assembly, open circuit • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat back sensor circuit for open circuit. Check RH seat back sensor rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check Climate seat back temperature sensor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B1229-13	Left Seat Back Temperature Sensor - circuit	<ul style="list-style-type: none"> • LH seat back sensor circuit, open circuit • LH seat back sensor 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to</p>

	open	<p>rtn circuit, open circuit</p> <ul style="list-style-type: none"> • Connectors disconnected • Connector pin damage • Climate seat back temperature sensor assembly, open circuit • Climate Control Seat Module failure 	<p>confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back sensor circuit for open circuit. Check LH seat back sensor rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check Climate seat back temperature sensor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.</p>
B122A-11	Right Seat Cushion Blower Speed Sensor - circuit short to ground - circuit short to ground	<ul style="list-style-type: none"> • RH cushion fan speed, circuit short to ground • Blower motor assembly, short to ground • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH cushion fan speed for circuit short to ground. Check blower motor assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B122A-12	Right Seat Cushion Blower Speed Sensor - circuit short to battery	<ul style="list-style-type: none"> • RH cushion fan speed, circuit short to power • Blower motor assembly, short to power • Climate Control Seat 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH cushion fan speed for circuit short to</p>

		Module failure	power. Check blower motor assembly for short to power. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B122B-11	Right Seat Back Blower Speed Sensor - circuit short to ground	<ul style="list-style-type: none"> • RH seat back fan speed, circuit short to ground • Blower motor assembly, short to ground • Climate Control Seat Module failure 	Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat back fan speed for circuit short to ground. Check blower motor assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B122B-12	Right Seat Back Blower Speed Sensor - circuit short to battery	<ul style="list-style-type: none"> • RH seat back fan speed, circuit short to power • Blower motor assembly, short to power • Climate Control Seat Module failure 	Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, RH seat back fan speed for circuit short to power. Check blower motor assembly for short to power. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B122C-11	Left Seat Cushion Blower Speed	<ul style="list-style-type: none"> • LH cushion fan speed, circuit short to ground 	Carry out On Demand Self Test (ODST) using manufacturer

	Sensor - circuit short to ground	<ul style="list-style-type: none"> • Blower motor assembly, short to ground • Climate Control Seat Module failure 	<p>approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH cushion fan speed for circuit short to ground. Check blower motor assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B122C-12	Left Seat Cushion Blower Speed Sensor - circuit short to battery	<ul style="list-style-type: none"> • LH cushion fan speed, circuit short to power • Blower motor assembly, short to power • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH cushion fan speed for circuit short to power. Check blower motor assembly for short to power. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B122D-11	Left Seat Back Blower Speed Sensor - circuit short to ground	<ul style="list-style-type: none"> • LH seat back fan speed, circuit short to ground • Blower motor assembly, short to ground • Climate Control Seat Module failure 	<p>Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back fan speed for circuit short to ground. Check blower motor assembly for short to ground. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using</p>

			manufacturer approved diagnostic system to confirm rectification.
B122D-12	Left Seat Back Blower Speed Sensor - circuit short to battery	<ul style="list-style-type: none"> • LH seat back fan speed, circuit short to power • Blower motor assembly, short to power • Climate Control Seat Module failure 	Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat back fan speed for circuit short to power. Check blower motor assembly for short to power. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B122E-98	Right Seat Cushion - component or system over temperature	<ul style="list-style-type: none"> • The Climate Control Seat Module RH cushion sensor input circuit temperature exceeds 65 Degrees C continuously for more than 4 seconds during cooling • The Climate Control Seat Module RH cushion sensor input circuit temperature is greater than 110 Degrees C for more than 4 seconds during heating • Blocked or restricted thermal electric device fan exhaust vent • Restricted thermal electric fan movement 	Check for blockage or restriction in thermal electric device fan exhaust vent. Check for restricted thermal electric fan movement. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B122F-98	Right Seat Back - component or system over temperature	<ul style="list-style-type: none"> • The Climate Control Seat Module RH seat back sensor input circuit temperature exceeds 65 Degrees C continuously for more 	Check for blockage or restriction in thermal electric device fan exhaust vent. Check for restricted thermal electric fan movement. Carry out On Demand Self Test (ODST) using

		<p>than 4 seconds during cooling</p> <ul style="list-style-type: none"> • The Climate Control Seat Module RH seat back sensor input circuit temperature is greater than 110 Degrees C for more than 4 seconds during heating • Blocked or restricted thermal electric device fan exhaust vent • Restricted thermal electric fan movement 	<p>manufacturer approved diagnostic system to confirm rectification.</p>
B1230-98	Left Seat Back - component or system over temperature	<ul style="list-style-type: none"> • The Climate Control Seat Module LH seat back sensor input circuit temperature exceeds 65 Degrees C continuously for more than 4 seconds during cooling • The Climate Control Seat Module LH seat back sensor input circuit temperature is greater than 110 Degrees C for more than 4 seconds during heating • Blocked or restricted thermal electric device fan exhaust vent • Restricted thermal electric fan movement 	<p>Check for blockage or restriction in thermal electric device fan exhaust vent. Check for restricted thermal electric fan movement. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.</p>
B1231-7A	Right Seat - fluid leak or seal failure	<ul style="list-style-type: none"> • The Climate Control Seat Module has detected an input temperature difference greater than expected between RH seat back sensor and RH cushion sensor • Climate seat back assembly airpath leaking 	<p>Check for blockage or restriction in seat back thermal electric device fan ducts. Check seat back thermal electric device fan exhaust vent is clear. Check for blockage or restriction in seat cushion thermal electric device fan ducts. Check seat cushion thermal electric device fan exhaust vent is clear. Carry out On Demand Self Test</p>

		<ul style="list-style-type: none"> Climate seat cushion assembly airpath leaking Seat assembly damaged 	(ODST) using manufacturer approved diagnostic system to confirm rectification.
B1232-7A	Left Seat - fluid leak or seal failure	<ul style="list-style-type: none"> The Climate Control Seat Module has detected an input temperature difference greater than expected between LH seat back sensor and LH cushion sensor Climate seat back assembly airpath leaking Climate seat cushion assembly airpath leaking Seat assembly damaged 	Check for blockage or restriction in seat back thermal electric device fan ducts. Check seat back thermal electric device fan exhaust vent is clear. Check for blockage or restriction in seat cushion thermal electric device fan ducts. Check seat cushion thermal electric device fan exhaust vent is clear. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
B1235-13	Left Seat Cushion Temperature Sensor - circuit open	<ul style="list-style-type: none"> LH seat cushion sensor circuit, open circuit LH seat cushion sensor rtn circuit, open circuit Connectors disconnected Connector pin damage Climate seat cushion temperature sensor assembly, open circuit Climate Control Seat Module failure 	Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm the fault is present. Refer to the electrical circuit diagrams and check, LH seat cushion sensor circuit for open circuit. Check LH seat cushion sensor rtn circuit for open circuit. Check for any disconnected connectors or damaged connector pins. Check Climate seat cushion temperature sensor assembly for open circuit. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system.
U0010-88	Medium Speed CAN Communication Bus - bus off	<ul style="list-style-type: none"> • Medium Speed CAN communication bus off 	Refer to the electrical circuit diagrams and check the power and ground connections to the module. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check the CAN network. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0140-00	Lost Communication With Body Control Module - no sub type information	<ul style="list-style-type: none"> • CAN harness link between Climate Control Seat Module and Central Junction Box malfunction • The Climate Control Seat Module has not received the expected CAN signal from the Central Junction Box within the specified time interval 	Using the manufacturer approved diagnostic system, check Central Junction Box for DTCs and refer to the relevant DTC Index. Using the manufacturer approved diagnostic system, carry out network integrity test. Refer to the electrical circuit diagrams and check Central Junction Box power and ground circuits for open circuit. Check CAN harness between Climate Control Seat Module and Central Junction Box, repair as necessary. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0142-00	Lost Communication With Body Control Module "B" - no sub type information	<ul style="list-style-type: none"> • CAN harness link between Climate Control Seat Module and Rear Junction Box malfunction • The Climate Control Seat Module has not received the expected CAN signal from the Rear Junction Box within the specified time interval 	Using the manufacturer approved diagnostic system, check Rear Junction Box for DTCs and refer to the relevant DTC Index. Using the manufacturer approved diagnostic system, carry out network integrity test. Refer to the electrical circuit diagrams and check Rear Junction Box power and ground circuits for open circuit. Check CAN harness between Climate Control Seat Module and Rear Junction Box, repair as

			necessary. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - no sub type information	<ul style="list-style-type: none"> • CAN harness link between Climate Control Seat Module and Instrument Cluster network malfunction • The Climate Control Seat Module has not received the expected CAN signal from the Instrument Cluster within the specified time interval 	Using the manufacturer approved diagnostic system, check Instrument Cluster for DTCs and refer to the relevant DTC Index. Using the manufacturer approved diagnostic system, carry out network integrity test. Refer to the electrical circuit diagrams and check Instrument Cluster power and ground circuits for open circuit. Check CAN harness between Climate Control Seat Module and Instrument Cluster, repair as necessary. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0156-00	Lost Communication With Information Center "A" - no sub type information	<ul style="list-style-type: none"> • CAN harness link between Climate Control Seat Module and Information and Entertainment Control Module network malfunction • The Climate Control Seat Module has not received the expected CAN signal from the Information and Entertainment Control Module within the specified time interval 	Using the manufacturer approved diagnostic system, check Information and Entertainment Control Module for DTCs and refer to the relevant DTC Index. Using the manufacturer approved diagnostic system, carry out network integrity test. Refer to the electrical circuit diagrams and check Information and Entertainment Control Module power and ground circuits for open circuit. Check CAN harness between Climate Control Seat Module and Information and Entertainment Control Module, repair as necessary. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
U0300-	Internal Control	<ul style="list-style-type: none"> • Incorrect or invalid 	Using the manufacturer

00	Module Software Incompatibility - no sub type information	software has been installed	approved diagnostic system, re-configure the Climate Control Seat Module and the Rear Junction Box. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification. Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect.
U0401-00	Invalid Data Received From ECM/PCM - no sub type information	<ul style="list-style-type: none"> The Engine Control Module has transmitted engine speed quality factor CAN signal at a specific value for a greater than expected time period. 	Using the manufacturer approved diagnostic system, check Engine Control Module for DTCs and refer to the relevant DTC Index.
U2101-00	Control Module Configuration Incompatible - no sub type information	<ul style="list-style-type: none"> Calibration incomplete/corrupt 	Using the manufacturer approved diagnostic system, re-configure the Climate Control Seat Module and the Rear Junction Box. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm rectification.
U3000-04	Control Module - system internal failures	<ul style="list-style-type: none"> Climate Control Seat Module failure Climate Control Seat Module microprocessor failed internal ROM and/or RAM checksum test 	Refer to the new module/component installation note at the top of the DTC Index if the Climate Control Seat Module is suspect.
U3003-62	Battery Voltage - signal compare failure	<ul style="list-style-type: none"> Mismatch in battery voltage of 2 volts or more between the measured battery voltage at the Climate Control Seat Module and the battery voltage signal sent from the Rear Junction Box 	Refer to the electrical circuit diagrams and check that power supply voltage at Climate Control Seat Module and Rear Junction Box is not different by more than 2 volts. Rectify as required. Carry out On Demand Self Test (ODST) using manufacturer approved diagnostic system to confirm

			rectification. Alternatively carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system.
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Pinpoint Tests

PINPOINT TEST G841635p1 : Front seat fore/aft movement not functioning

G841635t1 : Check for front seat forward-rearward seat motor operation

1.



WARNING: Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.

Set ignition status to 'ON'. 2. From the switch pack, operate the front seat forward-rearward seat motor switch and listen for evidence of the motor operating.

- **Does the motor operate?**

-> **Yes**

GO to Pinpoint Test [G841635t2](#).

-> **No**

GO to Pinpoint Test [G841635t3](#).

G841635t2 : Check front seat forward-rearward seat motor drive bar

1. Check front seat drive bar for correct installation and condition

- **Is the front seat drive bar correctly installed and in a serviceable condition?**

-> **Yes**

Re-check for correct front seat forward-rearward movement. Remove seat to allow for further investigation if required.

-> No

Correctly install front seat forward-rearward seat motor drive bar, or replace if required.

G841635t3 : Check front seat forward-rearward seat motor

1. Set ignition status to 'OFF'. 2. Disconnect front seat forward-rearward seat motor connector. 3. **NOTE:**

It may be that the seat has been driven to the limit of travel along the relevant axis, and when the link harness is connected, the seat will remain in the same position. If this is the case, a jolt may be felt from the motor. To confirm the motor operation, swap the link harness to alternate motor pin connections and the seat should travel in the opposite direction.

Using a locally made fused link harness and power supply, connect power and ground to forward-rearward seat motor.

Battery positive terminal	Battery negative terminal
forward-rearward seat motor pin 1	forward-rearward seat motor pin 2

- **Does the motor operate?**

-> Yes

Using manufacturer approved diagnostic system, check for related Diagnostic Trouble Codes (DTCs) and carry out the repair operations specified. Alternatively, refer to the electrical circuit diagrams and check front seat forward-rearward seat motor circuits.

-> No

Replace front seat forward-rearward seat motor. Refer to relevant section of workshop manual.

PINPOINT TEST G841635p2 : Front seat excessive forward-rearward free play

G841635t4 : Check front seat for excessive forward-rearward free play

1.



WARNING: Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.

Check all accessible front seat frame fixings are installed and to the correct torque.

- **Are all accessible front seat frame fixings installed and to the correct torque?**

-> **Yes**

GO to Pinpoint Test [G841635t5](#).

-> **No**

Install and tighten all accessible front seat frame fixings to correct torque and re-check for excessive free play.

G841635t5 : Compare the front seat forward-rearward free play against a similar seat

1. Compare the front seat forward-rearward free play against a similar seat.

- **Is the front seat forward-rearward free play excessive when compared to a similar seat?**

-> **Yes**

GO to Pinpoint Test [G841635t6](#).

-> **No**

The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.

G841635t6 : Check remaining front seat frame fixings

1. Remove front seat and/or any seat covers/trim to allow access to check remaining front seat frame fixings are all installed and to the correct torque.

- **Are all remaining front seat frame fixings installed and to the correct torque?**

-> **Yes**

Replace front seat frame. Refer to the relevant section of the workshop manual.

-> **No**

Install and tighten all remaining front seat frame fixings to correct torque and re-check for excessive free play.

PINPOINT TEST G841635p3 : Front seat forward-rearward movement noisy

G841635t7 : Compare front seat forward-rearward movement noise to other front seat

1.



WARNING: Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.

Compare the front seat forward-rearward movement noise to other front seat.

- **Is the front seat forward-rearward movement noise excessive when compared to other front seat?**

-> **Yes**

GO to Pinpoint Test [G841635t8](#).

-> **No**

GO to Pinpoint Test [G841635t9](#).

G841635t8 : Compare front seat forward-rearward movement noise to front seat in other vehicle

1. Compare the front seat forward-rearward movement noise to front seat in other vehicle.

- **Is the front seat forward-rearward movement noise excessive when compared to front seat in other vehicle?**

-> **Yes**

GO to Pinpoint Test [G841635t9](#).

-> **No**

The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.

G841635t9 : Check for debris obstructing seat movement

1. Check for debris obstructing seat movement.

- **Is the front seat forward-rearward movement obstructed by debris?**

-> **Yes**

Remove obstruction and re-check for noisy forward-rearward seat movement.

-> **No**

GO to Pinpoint Test [G841635t10](#).

G841635t10 : Re-align front seat frame

1. Loosen front seat frame fixings. 2. Set ignition status to 'ON'. 3. Using the front seat switch pack drive the front seat fully forward then fully rearward. 4. Tighten front seat frame fixings to the correct torque. 5. Re-check for noisy seat movement.

- **Is the front seat forward-rearward movement still noisy?**

-> **Yes**

GO to Pinpoint Test [G841635t11](#).

-> **No**

The front seat frame is now operating correctly.

G841635t11 : Check front seat forward-rearward seat motor drive bar

1. Check front seat drive bar for correct installation and condition.

- **Is the front seat drive bar correctly installed and in a serviceable condition?**

-> **Yes**

Replace front seat forward-rearward seat motor. Refer to relevant section of workshop manual.

-> **No**

Correctly install front seat forward-rearward seat motor drive bar, or replace if required.

PINPOINT TEST G841635p4 : Front seat height, tilt and/or seat extension motor movement not functioning

G841635t12 : Check front seat height, tilt or extension motor

1. Set ignition status to 'OFF'. 2. Disconnect front seat height, tilt or extension motor connector. 3. **NOTE:**

It may be that the seat has been driven to the limit of travel along the relevant axis, and when the link harness is connected, the seat will remain in the same position. If this is the case, a jolt may be felt from the motor. To confirm the motor operation, swap the link harness to alternate motor pin connections and the seat should travel in the opposite direction.

Using a locally made fused link harness and power supply, connect power and ground to relevant motor.

Battery positive terminal	Battery negative terminal
motor pin 1	motor pin 2

- **Does the motor operate?**

-> **Yes**

Using manufacturer approved diagnostic system, check for related Diagnostic Trouble Codes (DTCs) and carry out the repair operations specified. Alternatively, refer to the electrical circuit diagrams and check relevant motor circuits.

-> **No**

Replace the relevant motor. Refer to relevant section of workshop manual.

PINPOINT TEST G841635p5 : Front seat height, tilt and/or extension movement noisy

G841635t13 : Compare the height, tilt or extension movement noise with the other front seat

1.



WARNING: Before work is carried out, make the air bag supplemental restraint system safe. For additional information, refer to Standard Workshop Practices section of workshop manual.

Compare the front seat movement noise to other front seat.

- **Is the front seat height, tilt or extension movement noise excessive when compared to other front seat?**

-> **Yes**

GO to Pinpoint Test [G841635t14](#).

-> **No**

GO to Pinpoint Test [G841635t15](#).

G841635t14 : Compare front seat height, tilt or extension movement noise to front seat in other vehicle

1. Compare the front seat height, tilt or extension movement noise to front seat in other vehicle.

- **Is the front seat height, tilt or extension movement noise excessive when compared to front seat in other vehicle?**

-> **Yes**

GO to Pinpoint Test [G841635t15](#).

-> **No**

The front seat frame is operating correctly. Submit Electronic Product Quality Report (EPQR) with any further query.

G841635t15 : Check for debris obstructing seat movement

1. Check for debris obstructing seat movement.

- **Is the front seat height, tilt or extension movement obstructed by debris?**

-> **Yes**

Remove obstruction and re-check for noisy height, tilt or extension seat movement. If still noisy GO to Pinpoint Test [G841635t16](#).

-> **No**

GO to Pinpoint Test [G841635t16](#).

G841635t16 : Check for height, tilt or extension movement mechanism lubrication

1. Check and apply manufacturer approved lubrication to seat height, tilt or extension movement mechanism and re-test for noise.

- **Is the front seat height, tilt or extension noise still apparent?**

-> **Yes**

Replace the relevant motor. Refer to relevant section of workshop manual.

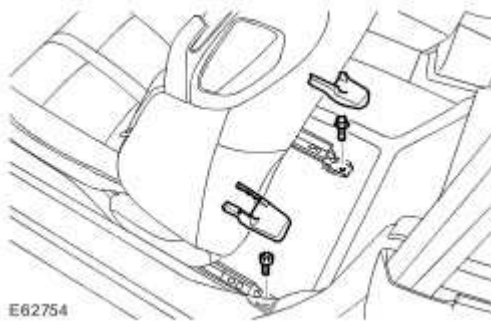
-> **No**

The front seat height, tilt or extension motor is operating correctly.

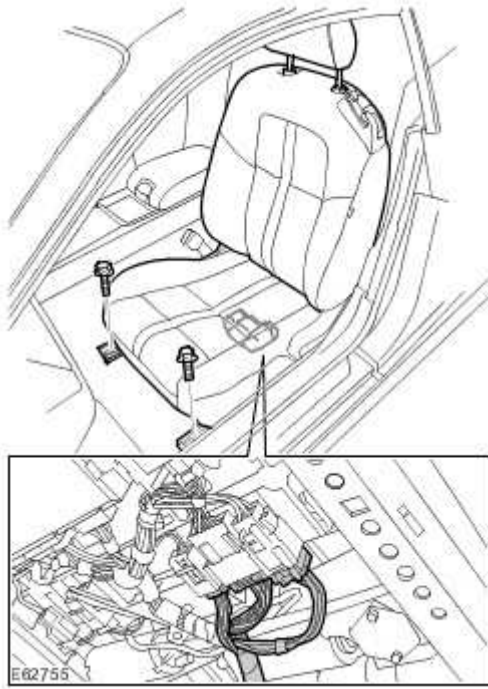
Front Seat (76.70.01)

Removal

- 1 . Release the front seat.
 - ▶ Position the front seat fully forwards.
 - ▶ Remove the bolt covers.
 - ▶ Remove and discard the 2 rear bolts.



- 2 . Position the front seat fully rearwards.
- 3 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 4 . With assistance, remove the front seat.
 - ▶ Remove and discard the front 2 Torx bolts.
 - ▶ Disconnect the 3 electrical connectors.



Installation

- 1 . With assistance, install the front seat.
 - ▶ Connect the electrical connectors.
 - ▶ Install the new bolts and tighten to 40 Nm (30 lb.ft).

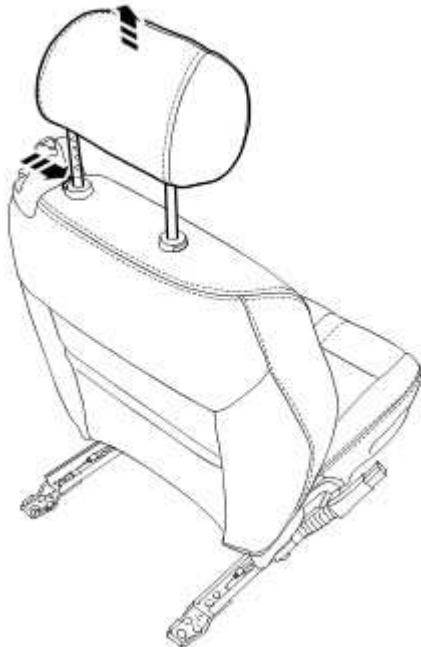
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to

- 3 . Secure the front seat.
 - ▶ Position the front seat fully forwards.
 - ▶ Install the new bolts and tighten to 40 Nm (30 lb.ft).
 - ▶ Install the bolt covers.

Front Seat Backrest Cover (76.70.15)

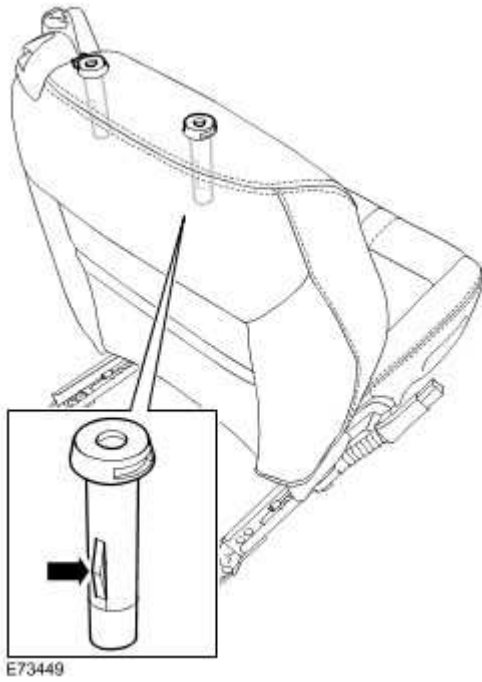
Removal

- 1 . Make the SRS system safe.
For additional information, refer to
- 2 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 3 . Remove the front seat head restraint.
▶ Depress the 2 clips.



E73448

- 4 . Remove the front seat head restraint guide tubes.
▶ Release from the seat frame.



E73449

5 . Remove the front seat backrest tilt handle.

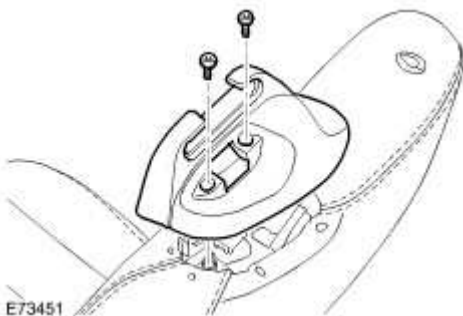
▶ Remove the screw.



E73450

6 . Remove the front seat backrest tilt handle trim panel.

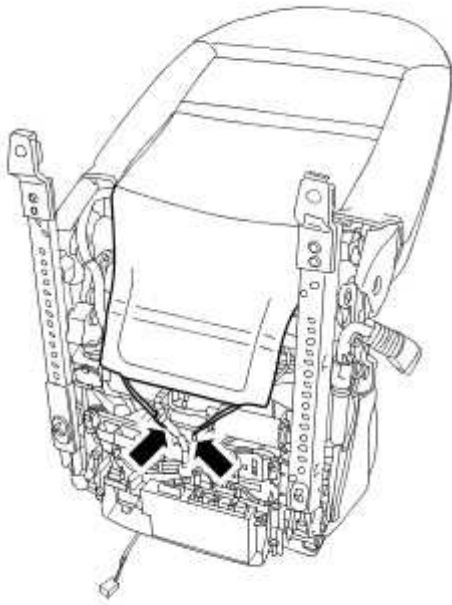
▶ Remove the 2 Torx screws.



E73451

7 . Release the front seat backrest cover lower tension straps.

▶ Release from the seat frame.

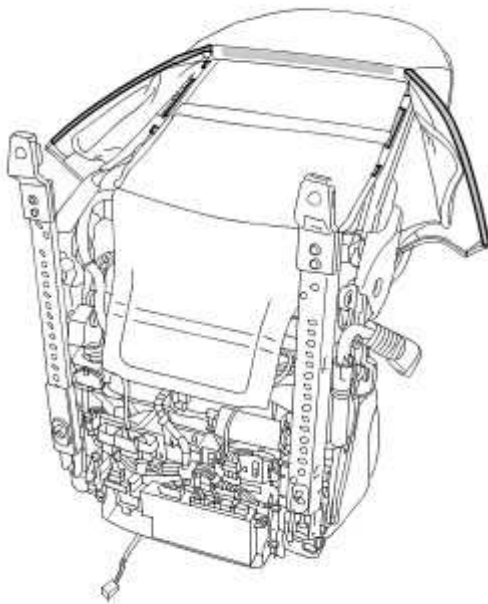


E73452

8 . Release the 9 front seat backrest cover rear panel retaining clips.

▶ Release from the backrest cover.

▶ Release from the seat frame.



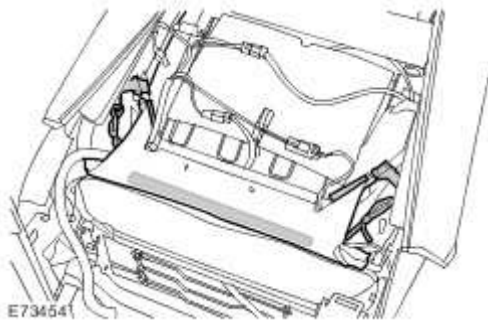
E73453

9 . Release the 5 front seat backrest cover lower retaining clips.

- ▶ Release from the seat frame.

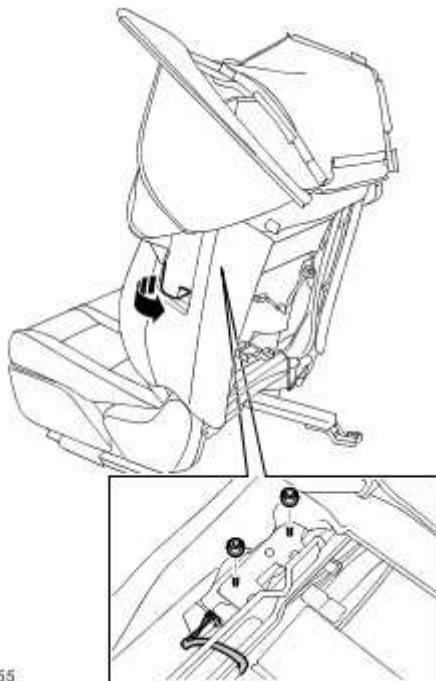
10 . Release the front seat backrest cover central tension straps.

- ▶ Release from the seat frame.



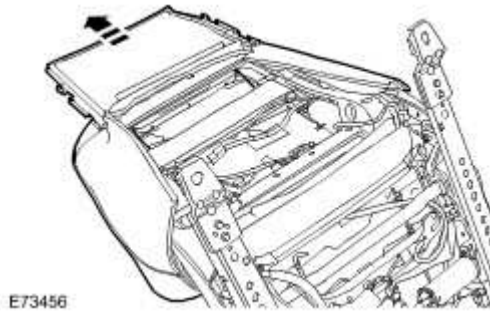
11 . Remove the side air bag module.

- ▶ Remove and discard the 2 nuts.
- ▶ Disconnect the electrical connector.
- ▶ Release the backrest cover.



12 . Release the front seat backrest cover upper tension straps.

- ▶ Release from the seat frame.
- ▶ Withdraw from the backrest pad.



- 13 . Remove the front seat backrest cover.
 - ▶ Remove the 16 hog rings.



Installation

- 1 . Install the front seat backrest cover.
 - ▶ Install the 16 hog rings.
- 2 . Secure the front seat backrest cover upper tension straps.
 - ▶ Pass through the backrest pad.
 - ▶ Attach to the seat frame.
- 3 . Install the side air bag module.
 - ▶ Attach the backrest cover.
 - ▶ Tighten the new nuts to 7 Nm (5 lb.ft).
 - ▶ Connect the electrical connector.
- 4 . Secure the front seat backrest cover central tension straps.
 - ▶ Attach to the seat frame.
- 5 . Secure the front seat backrest cover lower retaining clips.

▶ Attach to the seat frame.

6 . Secure the front seat backrest cover rear panel retaining clips.

▶ Attach to the seat frame.

▶ Attach to the backrest cover.

7 . Secure the front seat backrest cover lower tension straps.

▶ Attach to the seat frame.

8 . Install the front seat backrest tilt handle trim panel.

▶ Install and tighten the Torx screws.

9 . Install the front seat backrest tilt handle.

▶ Install the screw.

10 . Install the front seat head restraint guide tube.

▶ Release from the seat frame.

▶ Secure in the seat frame.

11 . Install the front seat head restraint.

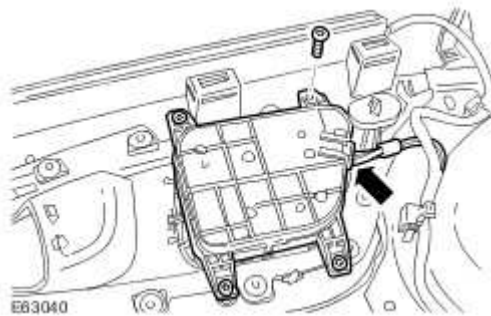
12 . Install the front seat.

For additional information, refer to [Front Seat \(76.70.01\)](#)

Front Seat Control Switch (86.75.46)

Removal

- 1 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 2 . Remove the front seat control switch.
 - ▶ Remove the 4 Torx screws.
 - ▶ Disconnect the electrical connector.



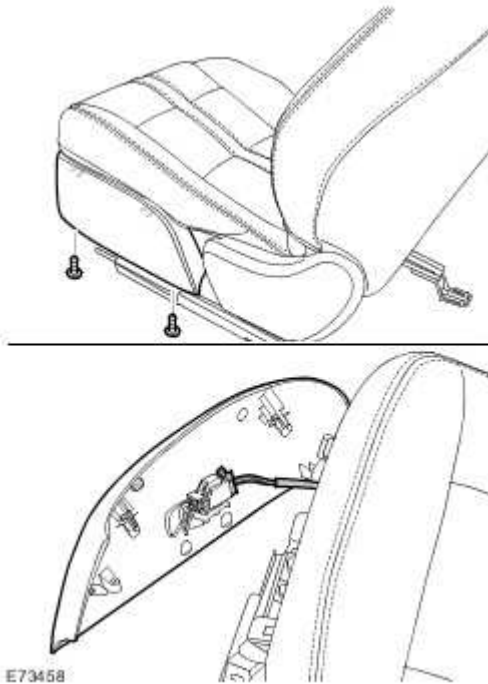
Installation

- 1 . Install the front seat control switch.
 - ▶ Connect the electrical connector.
 - ▶ Fit and tighten the Torx screws.
- 2 . Install the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

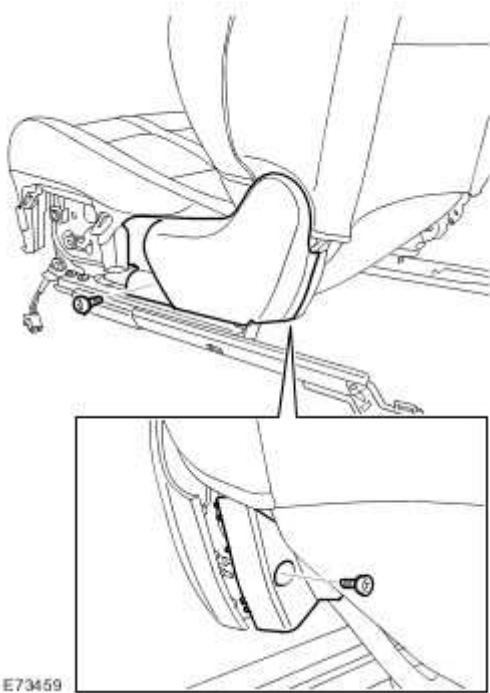
Front Seat Cushion Cover (76.70.33)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat cushion outer trim panel.
 - ▶ Remove the 2 Torx screws.
- 5 . Remove the front seat cushion outer trim panel.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the electrical connector.

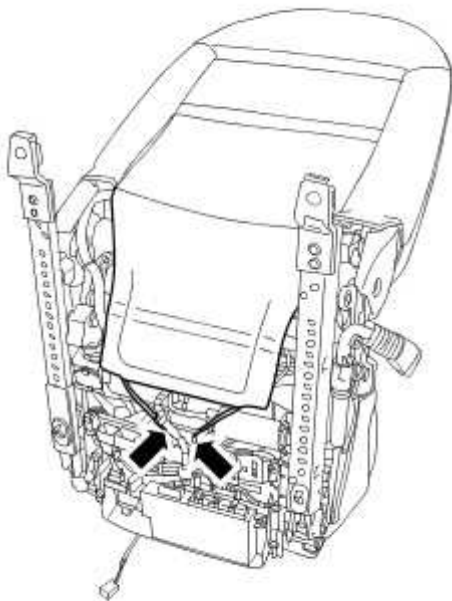


- 6 . Remove the front seat hinge covers.
 - ▶ Remove the 2 Torx screws.
 - ▶ Remove the hinge cover retainers.



E73459

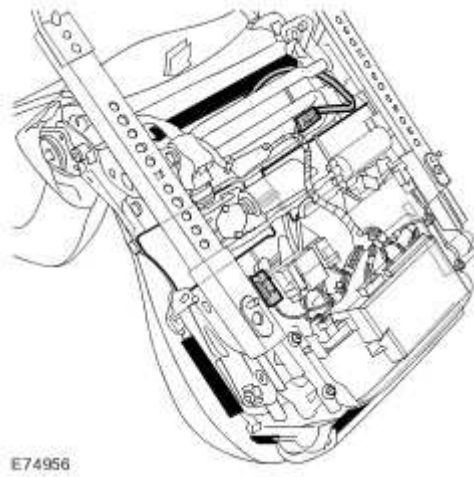
7 . Release the front seat backrest cover lower tension straps.



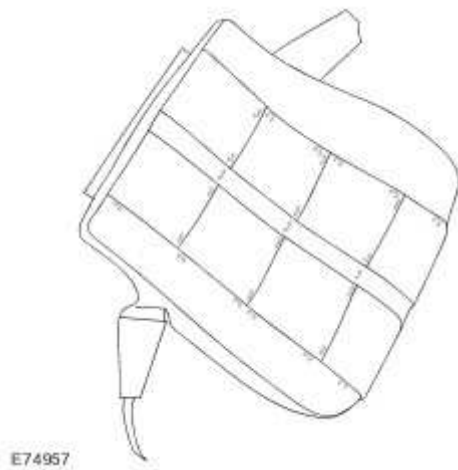
E73452

8 . Remove the front seat cushion assembly.

- ▶ Release and disconnect the 2 electrical connectors.
- ▶ Release the Velcro strap.
- ▶ Release the 5 clips.



- 9 . Remove the front seat cushion cover.
 - ▶ Remove the 27 hog rings.



- 10 . Using WDS, calibrate a new front seat cushion cover.

Installation

- 1 . Install the front seat cushion cover.
- 2 . Secure the front seat cushion assembly.
 - ▶ Connect and secure the electrical connectors.
 - ▶ Secure the Velcro strap.
 - ▶ Attach the clips.

3 . Secure the front seat backrest cover lower tension straps.

4 . Install the front seat cushion outer trim panel.

▶ Connect the electrical connector.

▶ Secure in the clips.

5 . Secure the front seat cushion outer trim panel.

▶ Tighten the Torx screws.

6 . Install the front seat hinge covers.

▶ Attach the hinge cover retainers.

▶ Tighten the Torx screws.

7 . Install the front seat.

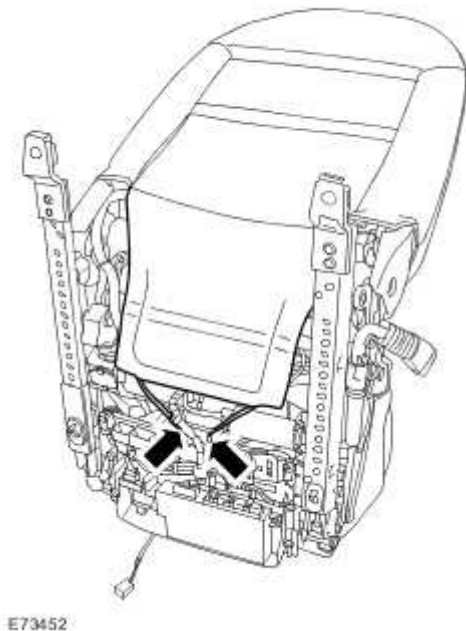
For additional information, refer to [Front Seat \(76.70.01\)](#)

8 . Connect the battery ground cable and install the cover.

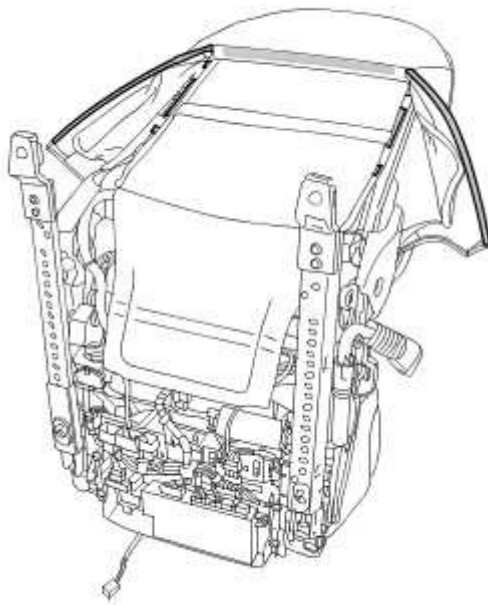
Front Seat Lumbar Motor (86.75.44)

Removal

- 1 . Make the SRS system safe.
For additional information, refer to
- 2 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 3 . Release the front seat backrest cover lower tension straps.
 - ▶ Release from the seat frame.



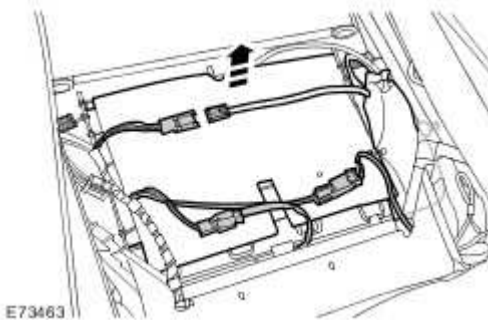
- 4 . Release the 9 front seat backrest cover rear panel retaining clips.
 - ▶ Release from the backrest cover.
 - ▶ Release from the seat frame.



E73453

5 . Release the front seat lumbar assembly.

- ▶ Release the 3 electrical connectors.
- ▶ Remove the clip.
- ▶ Disconnect the electrical connector.



E73463

6 . Remove the front seat lumbar assembly.

Installation

1 . Install the front seat lumbar assembly.

2 . Secure the front seat lumbar assembly.

- ▶ Install the clip.

- ▶ Connect the electrical connector.
- ▶ Secure the electrical connectors.

3 . Secure the front seat backrest cover rear panel retaining clips.

- ▶ Attach to the seat frame.
- ▶ Attach to the backrest cover.

4 . Secure the front seat backrest cover lower tension straps.

- ▶ Attach to the seat frame.

5 . Install the front seat head restraint.

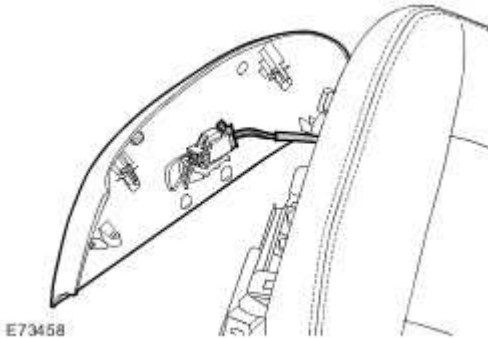
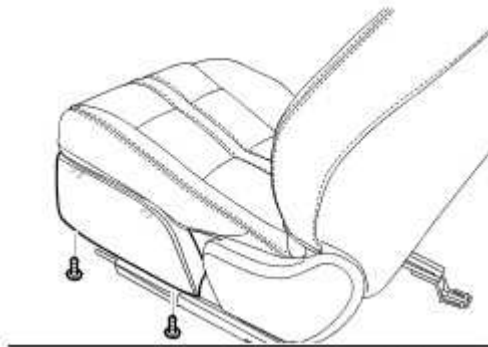
6 . Install the front seat.

For additional information, refer to [Front Seat \(76.70.01\)](#)

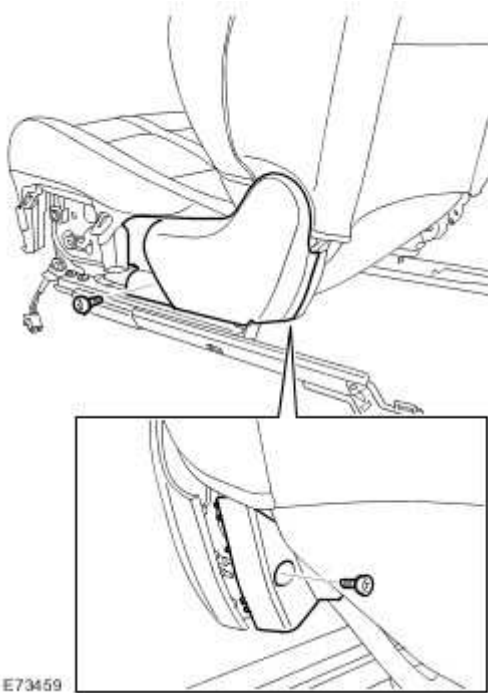
Front Seat Recliner Motor (86.75.04)

Removal

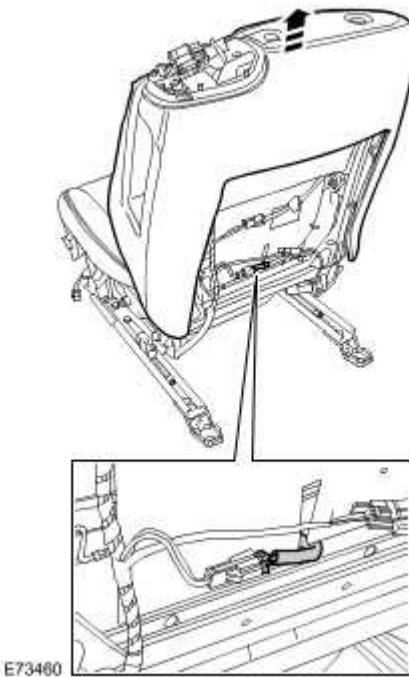
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Release the front seat cushion outer trim panel.
 - ▶ Remove the 2 Torx screws.
- 4 . Remove the front seat cushion outer trim panel.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the electrical connector.



- 5 . Remove the front seat hinge cover.
 - ▶ Remove the 2 Torx screws.
 - ▶ Remove the hinge cover retainer.

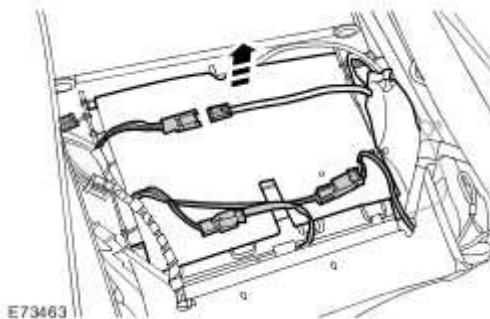


- 6 . Remove the front seat backrest cover.
For additional information, refer to [Front Seat Backrest Cover \(76.70.15\)](#)
- 7 . Remove the front seat backrest pad.
▶ Disconnect the electrical connector.



- 8 . Release the front seat lumbar assembly.

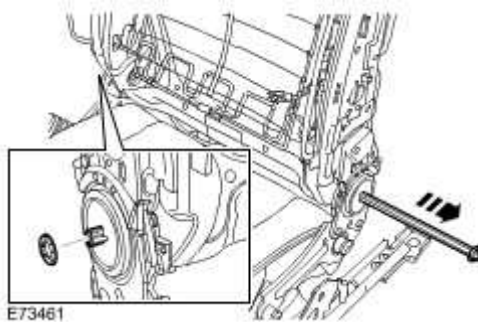
- ▶ Release the 3 electrical connectors.
- ▶ Remove the clip.
- ▶ Disconnect the electrical connector.



9 . Remove the front seat lumbar assembly.

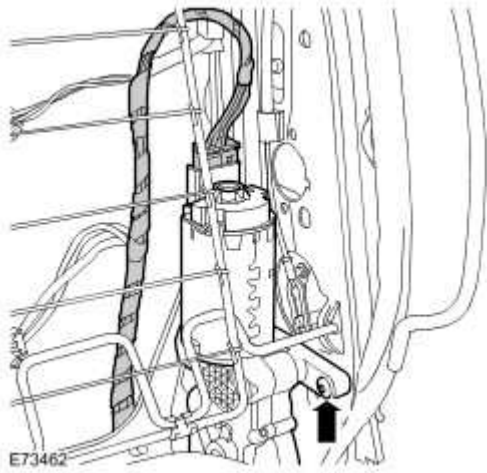
10 . Release the front seat recliner motor.

- ▶ Remove the front seat backrest shaft clip.
- ▶ Remove the front seat backrest shaft.



11 . Remove the front seat recliner motor.

- ▶ Disconnect the electrical connector.
- ▶ Drill out the rivet.



Installation

- 1 . To install, reverse the removal procedure.

Rear Seat Armrest (76.70.39)

Removal

- 1 . Remove the rear seat armrest.
 - ▶ Release from the 4 clips.



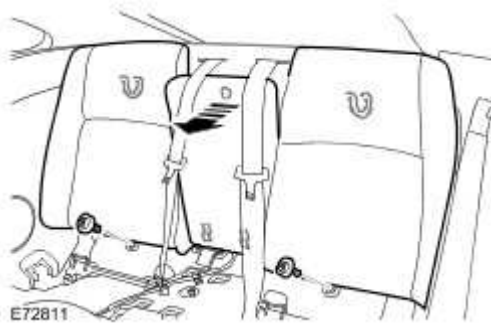
Installation

- 1 . Install the rear seat armrest.
 - ▶ Secure with the clips.

Rear Seat Backrest (76.70.38)

Removal

- 1 . Remove the LH rear seat cushion.
For additional information, refer to [Rear Seat Cushion \(76.70.37\)](#)
- 2 . Repeat the above procedure for the RH seat cushion.
- 3 . Remove the auxiliary junction box access cover.
 - ▶ Release the clip.
- 4 . Remove the rear seat backrest.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Release from the 2 retainers.



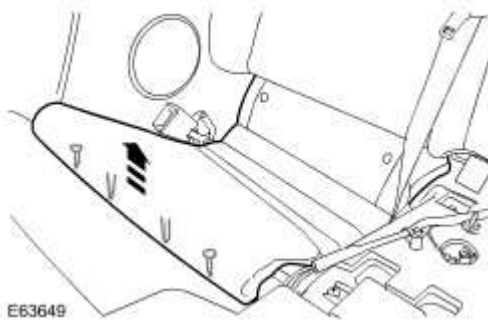
Installation

- 1 . Install the rear seat backrest.
 - ▶ Secure in the retainers.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).
- 2 . Install the auxiliary junction box access cover.
 - ▶ Align the pegs and secure the clip.
- 3 . Install the LH rear seat cushion.
For additional information, refer to [Rear Seat Cushion \(76.70.37\)](#)
 - ▶ Secure with the clips.
- 4 . Install the RH rear seat cushion.

Rear Seat Cushion (76.70.37)

Removal

- 1 . Remove the rear seat armrest.
For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)
- 2 . Remove the rear seat cushion.
▶ Release from the 2 clips.



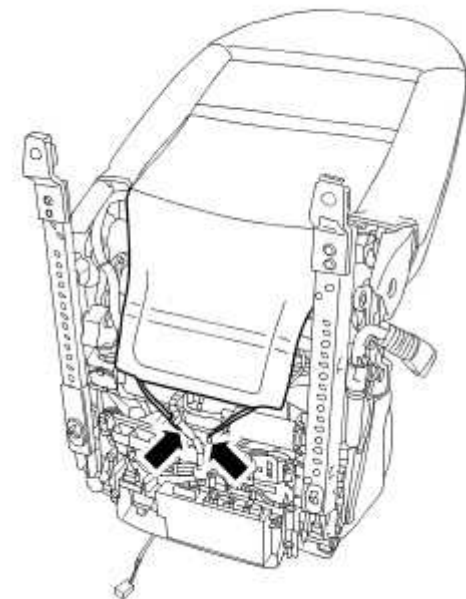
Installation

- 1 . Install the rear seat cushion.
▶ Secure with the clips.
- 2 . Install the rear seat armrest.
For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)

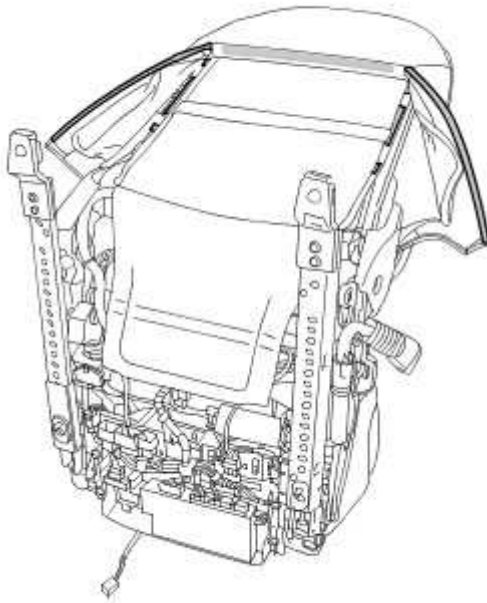
Front Seat Backrest Heater Mat (86.75.14)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat backrest cover lower tension straps.
 - ▶ Release from the seat frame.



- 5 . Release the 9 front seat backrest cover rear panel retaining clips.
 - ▶ Release from the backrest cover.
 - ▶ Release from the seat frame.



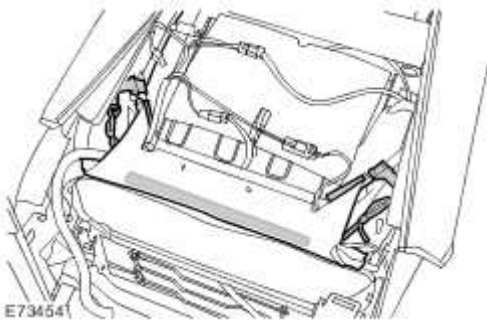
E73453

6 . Release the 5 front seat backrest cover lower retaining clips.

▶ Release from the seat frame.

7 . Release the front seat backrest cover central tension straps.

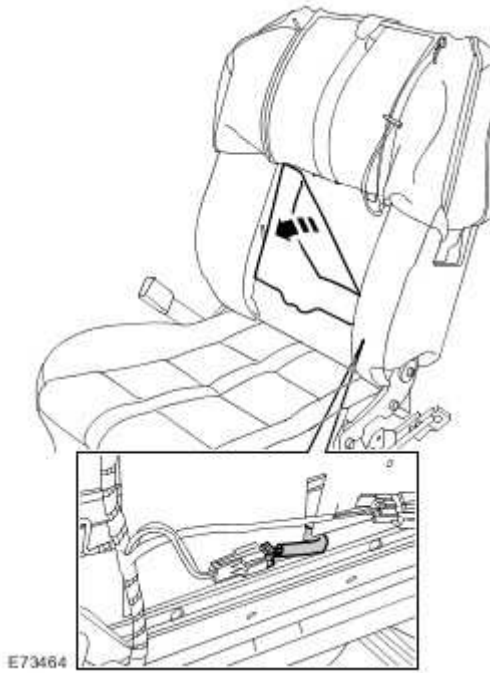
▶ Release from the seat frame.



E73454

8 . Remove the front seat backrest heater mat.

▶ Disconnect the electrical connector.



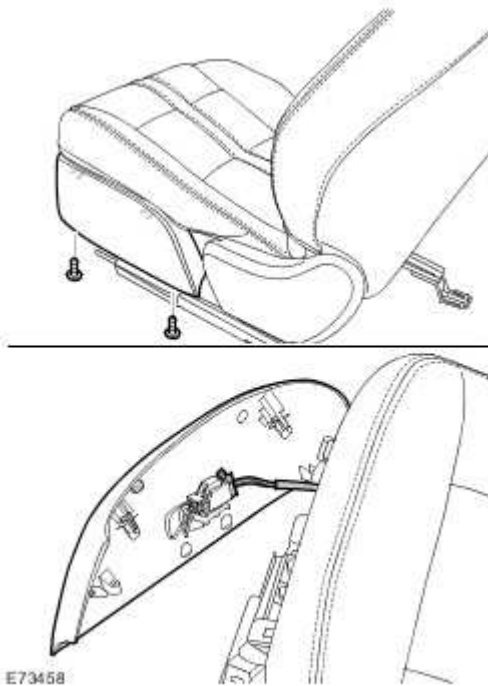
Installation

- 1 . Install the front seat backrest heater mat.
- 2 . Secure the front seat backrest cover central tension straps.
 - ▶ Attach to the seat frame.
- 3 . Secure the front seat backrest cover lower retaining clips.
 - ▶ Attach to the seat frame.
- 4 . Secure the front seat backrest cover rear panel retaining clips.
 - ▶ Attach to the seat frame.
 - ▶ Attach to the backrest cover.
- 5 . Secure the front seat backrest cover lower tension straps.
 - ▶ Attach to the seat frame.
- 6 . Connect the battery ground cable and install the cover.
For additional information, refer to

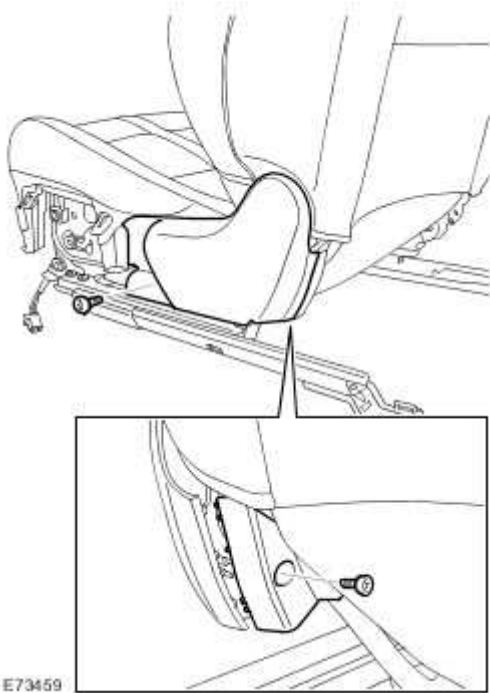
Front Seat Cushion Heater Mat (86.75.13)

Removal

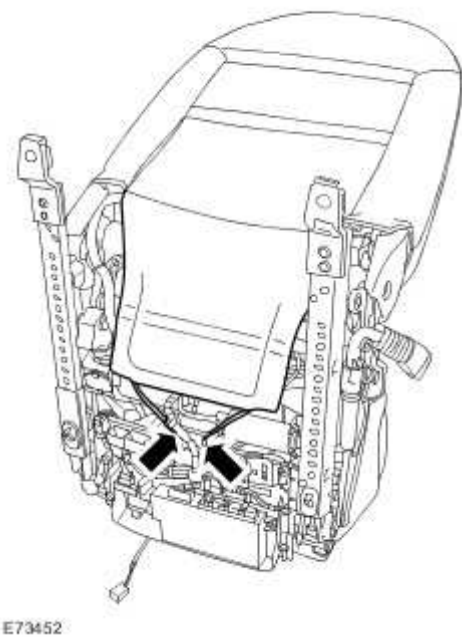
- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat cushion outer trim panel.
 - ▶ Remove the 2 Torx screws.
- 5 . Remove the front seat cushion outer trim panel.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the electrical connector.



- 6 . Remove the front seat hinge covers.
 - ▶ Remove the 2 Torx screws.
 - ▶ Remove the hinge cover retainers.

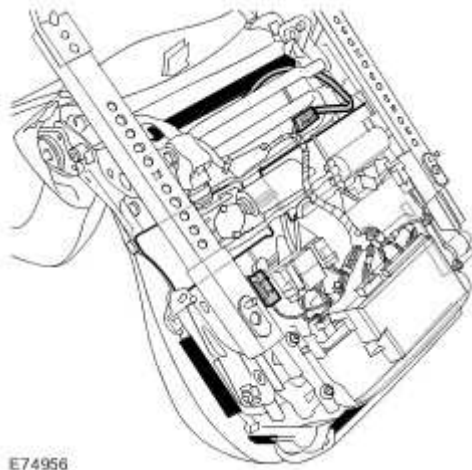


7 . Release the front seat backrest cover lower tension straps.



8 . Remove the front seat cushion assembly.

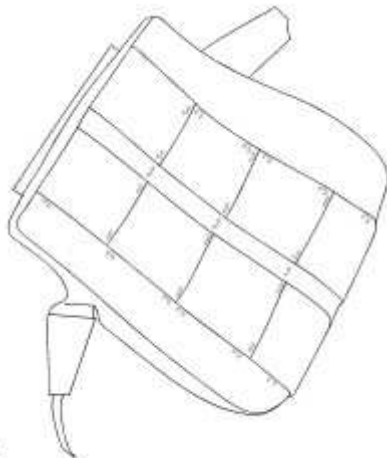
- ▶ Release and disconnect the 2 electrical connectors.
- ▶ Release the Velcro strap.
- ▶ Release the 5 clips.



E74956

9 . Remove the front seat cushion cover.

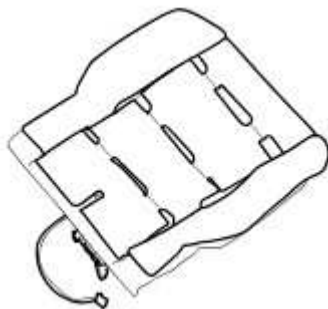
▶ Remove the 27 hog rings.



E74957

10 . Remove the front seat cushion heater mat.

▶ Carefully release from the seat cushion pad.



E74958

Installation

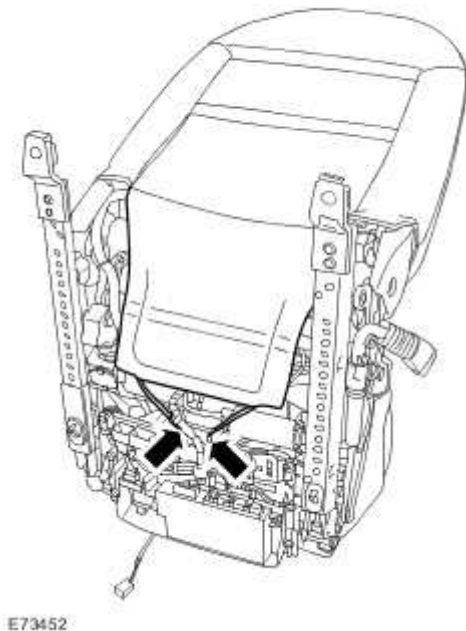
- 1 . Install the front seat cushion heater mat.
 - ▶ Secure to the seat cushion pad.
- 2 . Install the front seat cushion cover.
- 3 . Secure the front seat cushion assembly.
 - ▶ Connect and secure the electrical connectors.
 - ▶ Secure the Velcro strap.
 - ▶ Attach the clips.
- 4 . Secure the front seat backrest cover lower tension straps.
- 5 . Install the front seat cushion outer trim panel.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.
- 6 . Secure the front seat cushion outer trim panel.
 - ▶ Tighten the Torx screws.
- 7 . Install the front seat hinge covers.
 - ▶ Attach the hinge cover retainers.
 - ▶ Tighten the Torx screws.
- 8 . Install the front seat.

For additional information, refer to [Front Seat \(76.70.01\)](#)
- 9 . Connect the battery ground cable and install the cover.

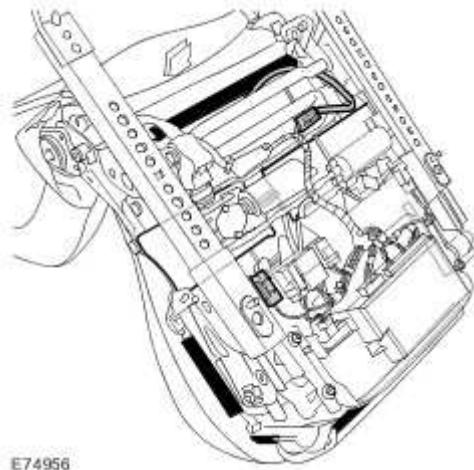
Seat Track

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat backrest cover lower tension straps.



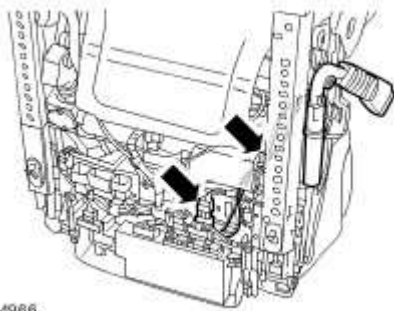
- 5 . Remove the front seat cushion assembly.
 - ▶ Release and disconnect the 2 electrical connectors.
 - ▶ Release the Velcro strap.
 - ▶ Release the 5 clips.



E74956

6 . Remove the front seat safety belt pretensioner.

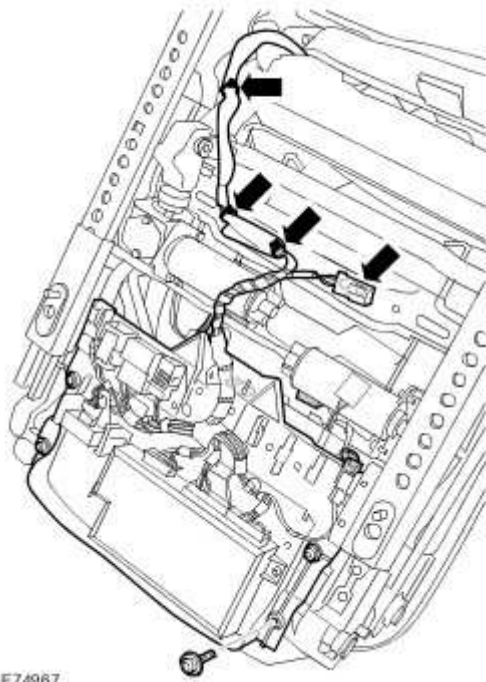
- ▶ Remove and discard the Torx bolt.
- ▶ Release and disconnect the electrical connector.



E74966

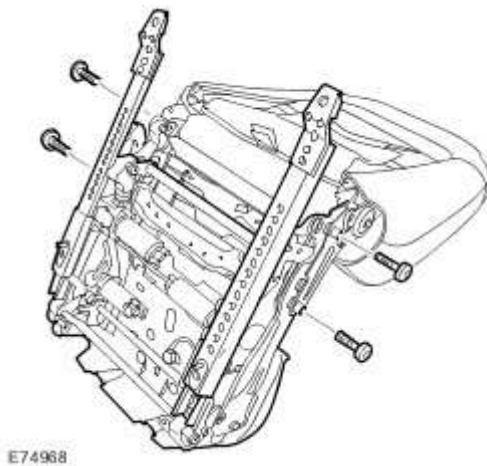
7 . Release the seat module bracket.

- ▶ Disconnect the 4 electrical connectors.
- ▶ Release the 3 wiring harness clips.
- ▶ Remove and discard the cable tie.
- ▶ Remove the 4 Torx bolts.



8 . Remove the seat track assembly.

▶ Remove and discard the 4 Torx bolts.



Installation

1 . Install the seat track assembly.

▶ Tighten the new Torx bolts to 45 Nm (33 lb.ft).

2 . Secure the seat module bracket.

- ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
- ▶ Secure the harness with a cable tie.
- ▶ Attach the wiring harness clips.
- ▶ Connect the electrical connectors.

3 . Install the front seat safety belt pretensioner.

- ▶ Connect and secure the electrical connector.
- ▶ Tighten the new Torx bolt to 45 Nm (33 lb.ft).

4 . Secure the front seat cushion assembly.

- ▶ Connect and secure the electrical connectors.
- ▶ Secure the Velcro strap.
- ▶ Attach the clips.

5 . Secure the front seat backrest cover lower tension straps.

6 . Install the front seat.

For additional information, refer to [Front Seat \(76.70.01\)](#)

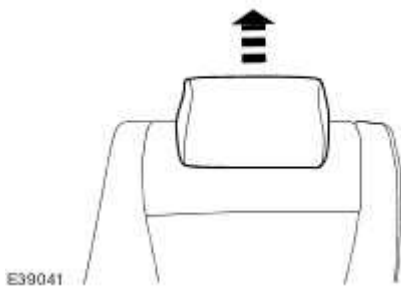
7 . Connect the battery ground cable and install the cover.

For additional information, refer to

Rear Seat Backrest - Vehicles With: 40/20/40 Split Seat (76.70.48)

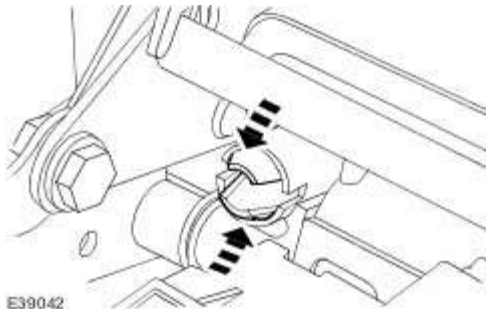
Disassembly

- 1 . Remove the rear outer seat backrest.
For additional information, refer to
- 2 . Remove the rear seat head restraint.



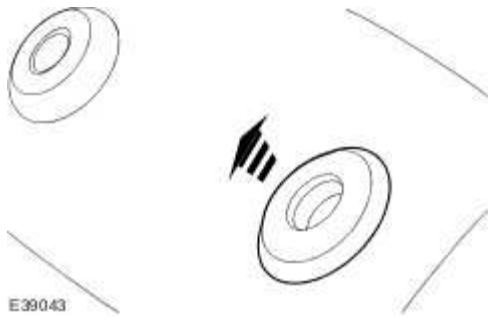
- 3 . **NOTE:**
Left-hand shown, right-hand similar.

Detach the rear seat head restraint retaining post.

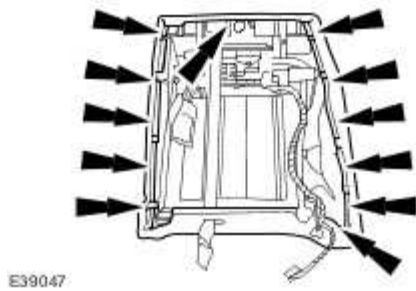


- 4 . **NOTE:**
Left-hand shown, right-hand similar.

Remove the rear seat head restraint retaining post.



5 . Detach the rear seat outer backrest cover.

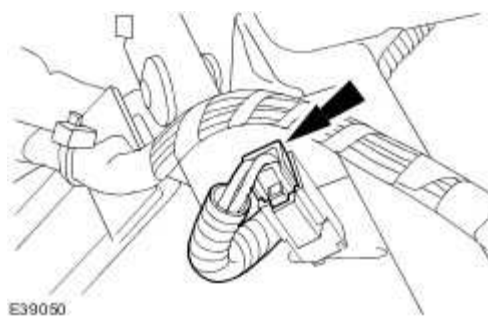


6 . Detach the rear seat backrest cover and cushion.

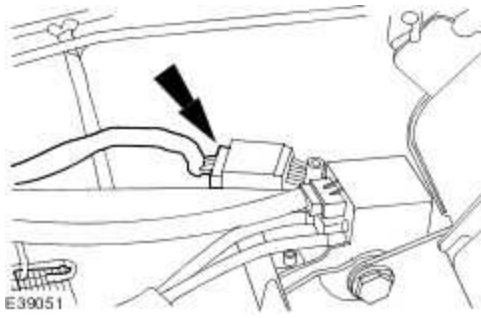


7 . Remove the rear seat backrest cover and cushion.

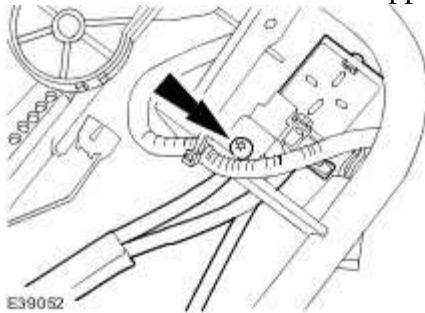
- Disconnect the rear seat backrest heater pad electrical connector.



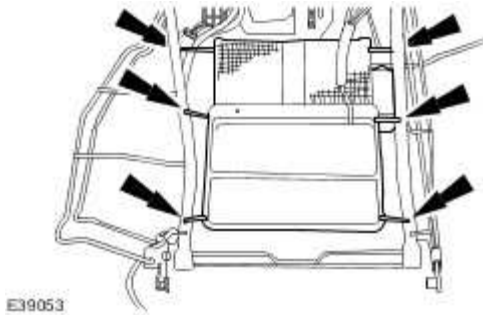
8 . Disconnect the rear seat lumbar support electrical connector.



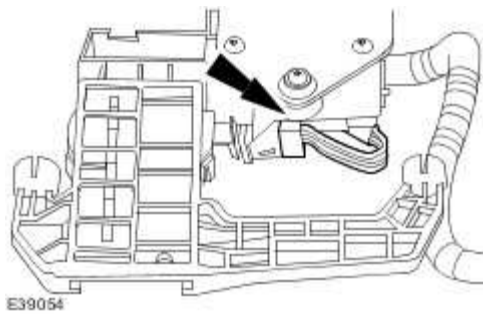
9 . Detach the rear seat lumbar support control valve.



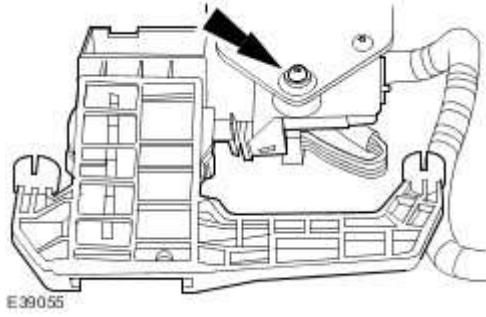
10 . Remove the rear seat lumbar support.



11 . Disconnect the rear seat head restraint motor electrical connector.



12 . Remove the rear seat head restraint motor.



Assembly

- 1 . To install, reverse the removal procedure.

501-11 : Glass, Frames and Mechanisms

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Door glass into clamp - bolt	8	-	71
Door glass regulator motor to door - screw	4	-	35
Door glass regulator to door - nut/bolt	8	-	71
Door glass regulator to door - screw	4	-	35
Rear quarter glass, seal-carrier (coupe) - screw	4	-	35
Rear quarter glass, regulator motor (convertible) - nut	9	-	80

Door Window Motor Initialization

1. **NOTE:**

After the battery has been disconnected it is necessary to initialize each door window motor separately to operate the 'one-touch' up function.

Operate the window control switch until the door window glass is in the fully closed position, continue to operate the window control switch for a further two seconds.

2. Release the window control switch.

3. Operate the window control switch in the closed position and continue to operate the window control switch for a further two seconds.

4. Operate the window control switch until the door window glass is in the fully open position ('one-touch' down).

5. **NOTE:**

If the door window motor initialization has been completed correctly, when the window control switch is operated, the door window glass should move to the fully closed position ('one-touch' up) automatically.

NOTE:

If the door window glass does not fully close automatically ('one-touch' up), repeat the complete procedure.

Operate the window control switch once to the close position.

6. Repeat the door window motor initialization for each door window motor.

Door Window Glass Adjustment (76.31.03)



CAUTION: Protect the surrounding components.

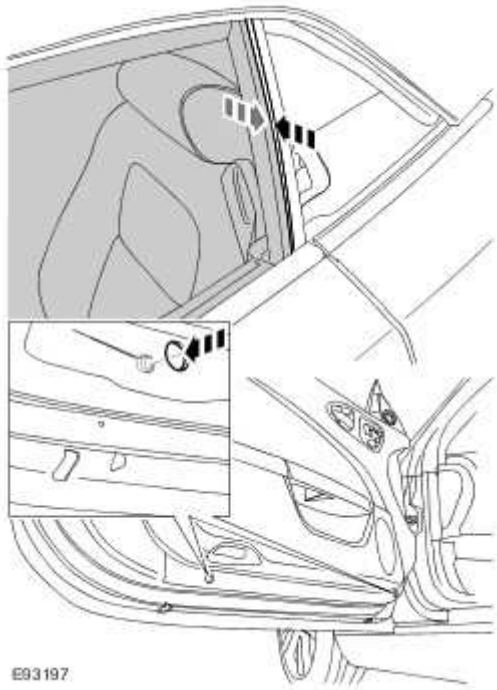
NOTE:

Final door glass alignment or adjustment, can be carried out without the need to remove the interior door trim panel.

1. Check the alignment of the front door glass.
2. Open the door.
3. Remove the 4 screw covers.



4. Using a 4mm Allen key, rotate the side adjusters to achieve lateral alignment with the rear quarter glass.



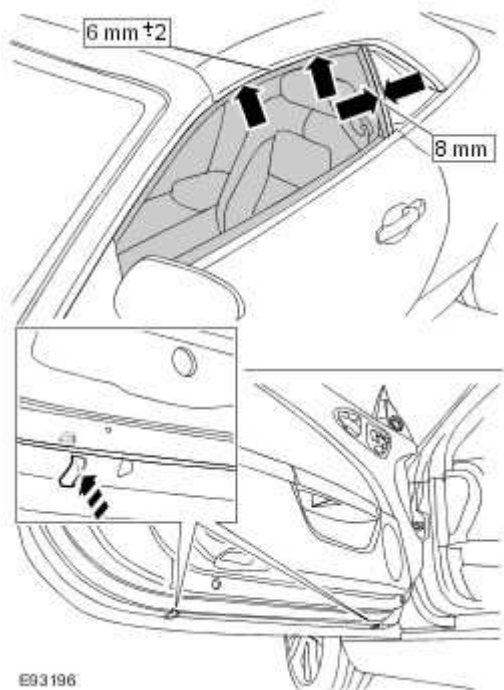
5. NOTE:

The glass must be in the lowered position to access the adjusters.

NOTE:

The glass should have 6mm +/- 2mm engagement into the upper seal, the glass may not have equal engagement when the 8mm door to rear quarter glass is set.

Using a extended 5mm Allen key, rotate the lower adjusters to adjust the glass height and achieve a parallel 8mm gap between the rear quarter and the door.



6. Install the screw covers.

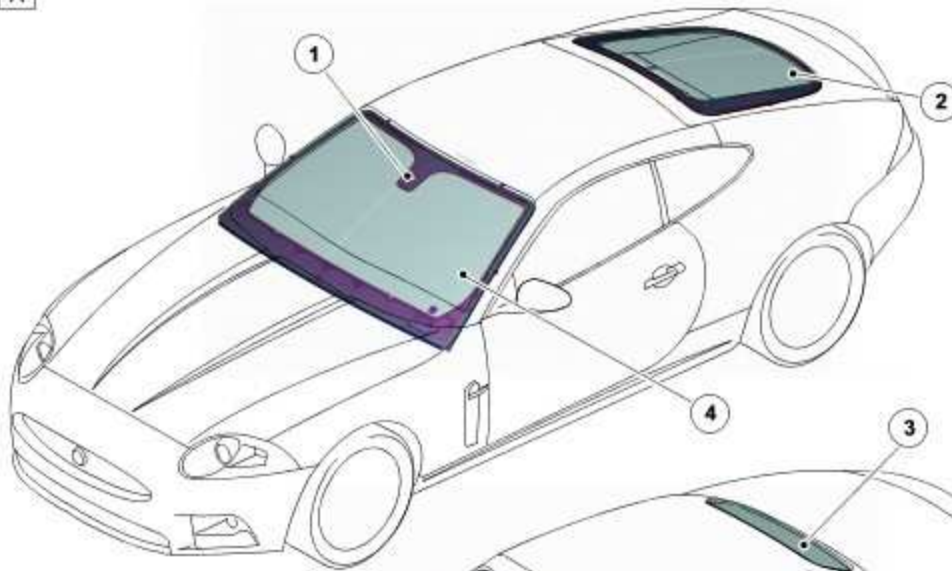
7. Check the alignment of the front door glass.

8. When the window glass adjustment is complete the window motor will need to be calibrated, to do this power the window fully up and continue to hold the switch for a further 3 seconds.

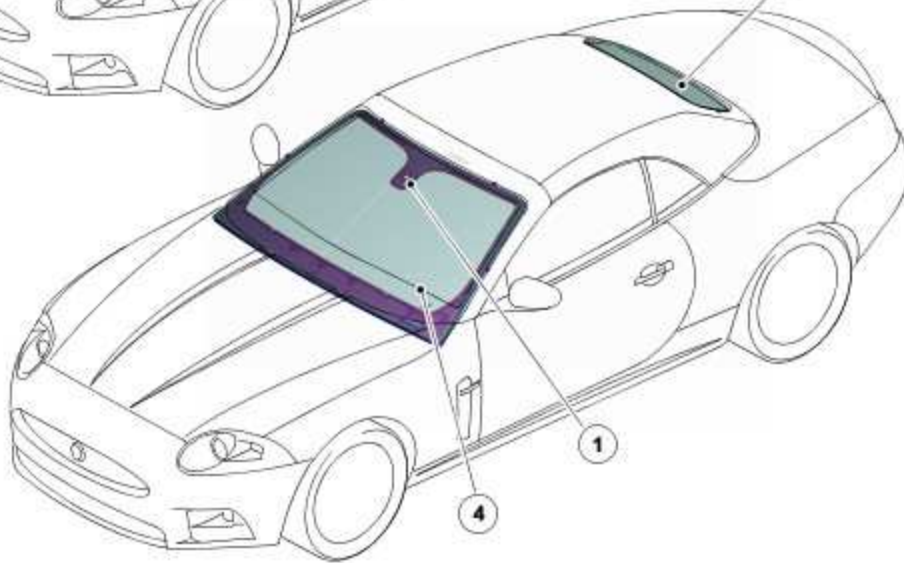
Glass, Frames and Mechanisms

COMPONENT LOCATION - WINDSHIELD AND BACKLIGHT

A



B



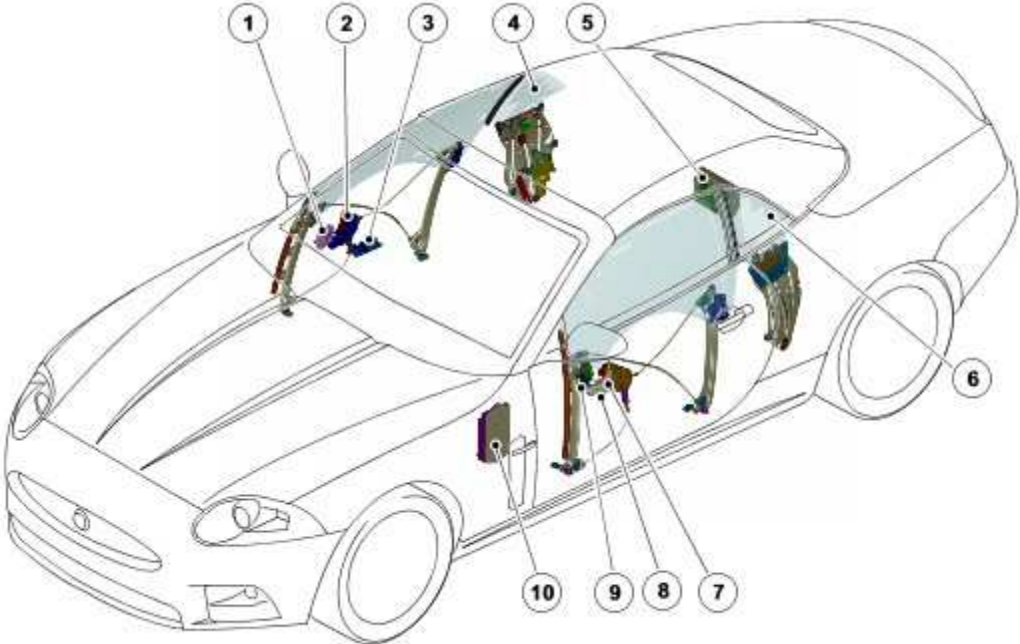
E74024

Item	Part Number	Description
A		Coupe
B		Convertible
1		Rain sensor mounting boss and interior mirror mounting button
2		Coupe backlight
3		Convertible backlight
4		Windshield

COMPONENT LOCATION - DOOR GLASS AND REAR QUARTER GLASS MECHANISMS

NOTE:

Convertible shown, coupe similar.



E74025

Item	Part Number	Description
1		Passenger door module
2		Passenger window motor
3		Passenger door switch pack
4		RH quarter glass assembly (convertible only)
5		Auxiliary junction box
6		LH quarter glass assembly (convertible only)
7		Driver window motor
8		Driver door switch pack
9		Driver door module
10		Central Junction Box (CJB)

INTRODUCTION

The windshield, which is constructed of 5.5 mm laminated glass with a black obscuration band, is bonded and sealed to the body aperture using Polyurethane (PU) adhesive. The

mounting boss for the rain sensor is also PU bonded to the inner surface of the screen and is common to the coupe and convertible. The mounting button for the interior mirror is attached to the windshield using adhesive. A vertical fine-wire multi-strand element, located between the glass laminations, is available as an option, except for North American Specification (NAS) vehicles, to de-ice and demist the windshield and is controlled from the Touch Screen Display (TSD). The backlight is 4 mm tempered glass, green tinted and heated and bonded to the liftgate using PU adhesive. The windshield and backlight, except for the convertible model, are direct glazed to the body.

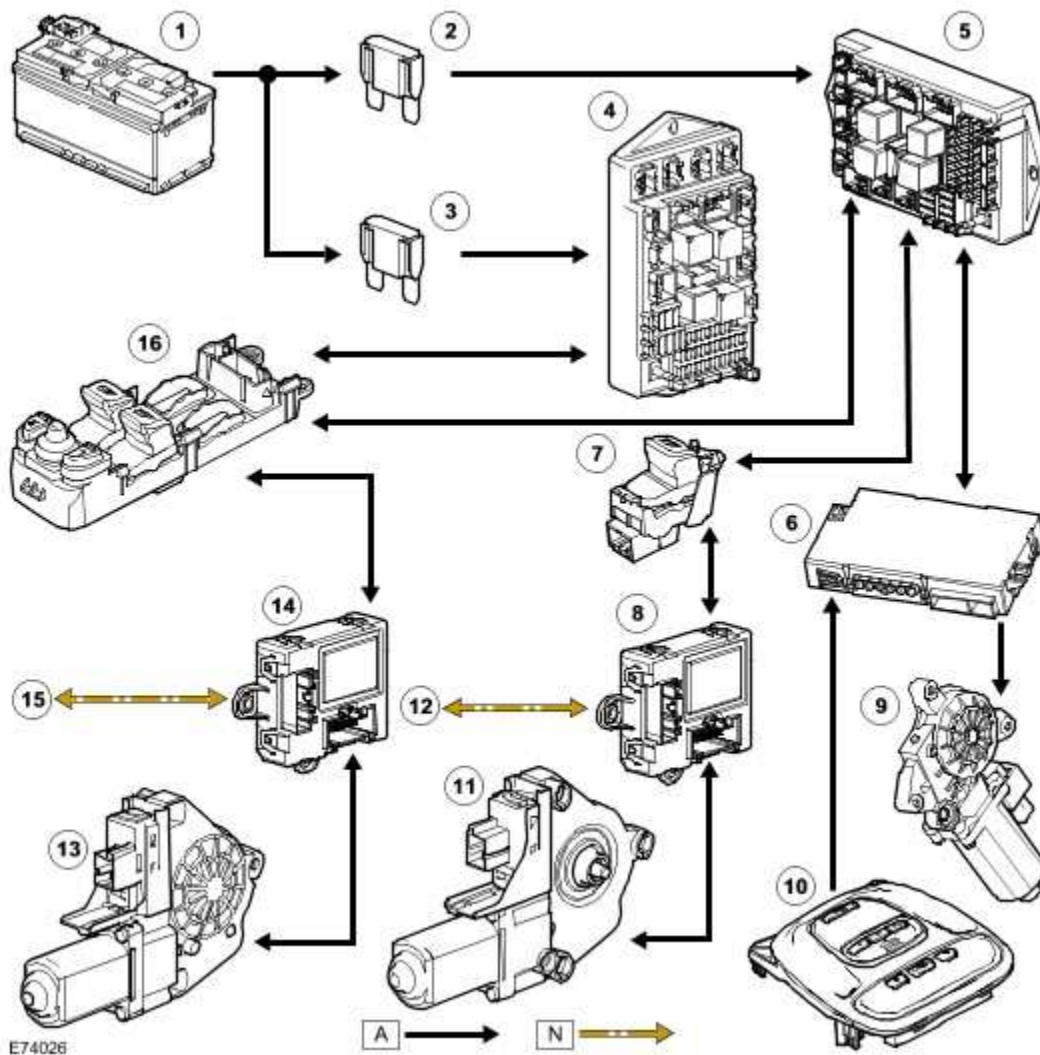
The door glass on both models is a frameless system with 5 mm green tempered glass. Both the driver and passenger window glass is operated electrically and raised and lowered by a Bowden cable mechanism.

Each door glass automatically drops when the door is opened or when the convertible top is raised or lowered, and raises when either the door is shut or the top is fully raised and latched in position (glass drops fully on hood operation). The door glass can be closed via the Smart Key. Glass operation is internally controlled from switch packs located in the driver and passenger door arm rests via their respective control modules. The switch packs are illuminated when the sidelights are on.

CONTROL DIAGRAM

NOTE:

A = Hardwired; **N** = CAN bus



E74026

Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		Central Junction Box (CJB)
5		Auxiliary junction box
6		Convertible top control module (convertible only)
7		Passenger door switch
8		Passenger door module
9		Rear quarter lift motors (convertible only)
10		Convertible top switch (convertible only)
11		Passenger window motor
12		Controller Area Network (CAN) input and output signals to and from various other vehicle systems

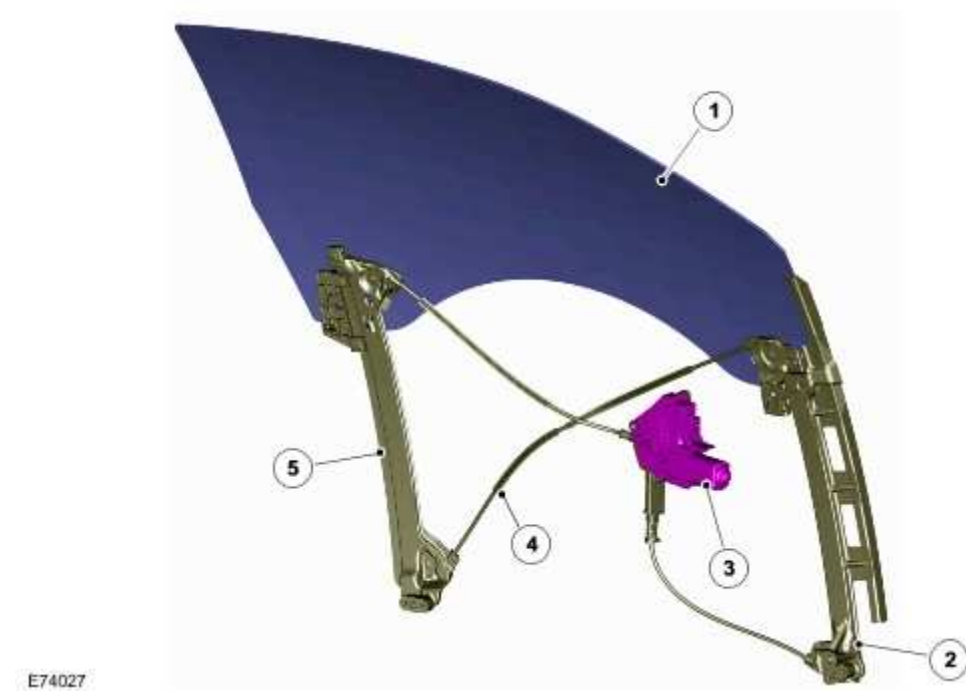
13		Driver window motor
14		Driver door module
15		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
16		Driver door switch pack

PRINCIPLES OF OPERATION

The windshield and coupe backlight are supplied as assemblies complete with trim, which is directly bonded to the glass.

The convertible backlight is high frequency welded to the canopy and the outer seal is stitched and bonded to the top. On both models, the heated backlight remains on for 21 minutes after being switched on unless it is manually switched off before the time delay expires.

Front Door Glass Assembly



Item	Part Number	Description
1		Front door glass
2		'A' pillar guide rail
3		Window motor
4		Bowden cables
5		'B' pillar guide rail

One-touch up operation causes the door glass to fully close unless an object is detected ('Anti-

trap') or the glass is within 45 mm of top of travel when the door is opened. If the 'Anti-trap' regulator detects an object, the glass will drop fully open or to 200 mm below the obstruction. All door glass operates with the ignition in either 'Accessory' mode or 'On' mode and after the ignition enters 'Off' mode, until either door is opened.

The front windows must be programmed for one-touch operation in order for the convertible top to operate correctly. Failure to program the windows results in a 10 second opening delay once the top is unlatched. The windows can be manually programmed for one-touch operation using the following procedure:

- Engine running
- Raise window up to the top seal and release switch
- Raise again until window stops moving
- Release switch
- Raise again
- Lower window fully
- Release switch
- Press lower for a further 0.5 seconds until a relay is heard to CLICK

NOTE:

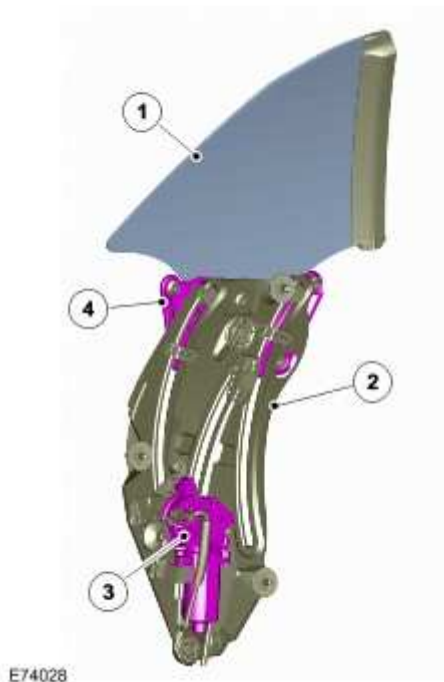
Before commencing work within a door interior, all Warnings and Notes within the appropriate Removal and Installation procedures must be read and fully understood.

To re-learn the glass operating characteristics, the associated door must be closed (door ajar switch inactive). The glass must then be driven fully down and held stalled at the bottom of its travel for a minimum of 1 second. The glass is finally driven to the fully up position and held stalled for a minimum of 1 second. The re-learning procedure must also be accomplished to regain the automatic glass closing sequence.

REAR QUARTER GLASS

The coupe rear quarter glass is a fixed 4 mm, tempered, green-tinted unit fitted by a single bolt fixing on the lower front corner of the glass assembly, and a pin into the body at the rear.

Convertible Rear Quarter Glass Assembly



Item	Part Number	Description
1		Convertible rear quarter glass
2		Base plate
3		Window motor
4		Lift plate

The rear quarter glass of the convertible is 5 mm, tempered, semi-flush and green tinted. A drum and wire system provides automatic full glass drop when the top is lowered. Rear glass control is incorporated in the convertible top switch, which is located in the roof console.

When lowering the rear quarters of the convertible at vehicle speeds up to 24 km/h (15 mph), failure to release the switch on operation of the audible alarm will result in lowering of the top.

Rear quarter glass is automatically powered to the bottom position when the top is lowered and further operation is inhibited until the top is raised and latched.

The rear quarters are operated automatically, up or down, when raising or lowering the convertible top. If the door glass is in the raised position when a request to close the top is made, the door glass and the rear quarters will be powered to the bottom of their travel. When the top is fully raised all glass will be powered up to close, rear quarters first followed by the door glass, forming a seal with the top.

If the front glass has been either fully or partially lowered manually, the rear quarters only will be powered up. If the power supply to the driver or passenger door module is

disconnected (battery disconnected, module unplugged or fuse removed) then the glass/system must re-learn the glass operating characteristics. The last known glass position is regarded as top of travel by one touch operation until re-learning has taken place. One touch down, manual up and down control and the automatic lowering of the glass for door opening are unaffected.

Glass, Frames and Mechanisms

Principle of Operation

For a detailed description of the Glass, Frames and Mechanisms, refer to the relevant Description and Operation section in the workshop manual.

[Glass, Frames and Mechanisms](#)

Inspection and Verification

- 1 . Verify the customer concern by operating the system.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Window glass • Window regulator 	<ul style="list-style-type: none"> • Fuse(s) • Window motor • Loose or corroded electrical connector(s) • Switch • Circuit(s)

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the concern is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to

identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B117E72	Front Power Window up	<ul style="list-style-type: none"> Actuator stuck open 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117E73	Front Power Window up	<ul style="list-style-type: none"> Actuator stuck closed 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F72	Front Power Window down	<ul style="list-style-type: none"> Actuator stuck open 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B117F73	Front Power Window down	<ul style="list-style-type: none"> Actuator stuck closed 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
B118929	Front Window Position Sensor	<ul style="list-style-type: none"> Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B118A29	Rear Window Position Sensor	<ul style="list-style-type: none"> Signal invalid 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
B1A9883	LIN Bus Circuit #1	<ul style="list-style-type: none"> Value of signal protection calculation incorrect 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
B1A9886	LIN Bus Circuit #1	<ul style="list-style-type: none"> Signal Invalid 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
B1A9887	LIN Bus Circuit #1	<ul style="list-style-type: none"> Missing Message 	<p>Refer to the electrical circuit diagrams and test LIN circuit between driver switch pack and DDM for short/open circuits, clear DTC and re-test. If DTC remains install a new switch pack.</p> <p>Window Control Switch (86.25.08)</p>
C1B1411	Sensor Supply #1	<ul style="list-style-type: none"> Short to ground 	<p>Refer to the electrical circuit diagrams and test window sensor supply circuit for short to ground</p>
C1B1415	Sensor Supply #1	<ul style="list-style-type: none"> Short to power or open circuit 	<p>Refer to the electrical circuit diagrams and test window sensor supply circuit for short to power or open circuit</p>
U001000	Medium speed CAN communication Bus	<ul style="list-style-type: none"> Medium speed CAN communication Bus 	<p>Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system</p>
U014000	Lost communication with CJB	<ul style="list-style-type: none"> Logged when subscribed CAN message missing from 	<p>Carry out any pinpoint tests associated with this DTC using the</p>

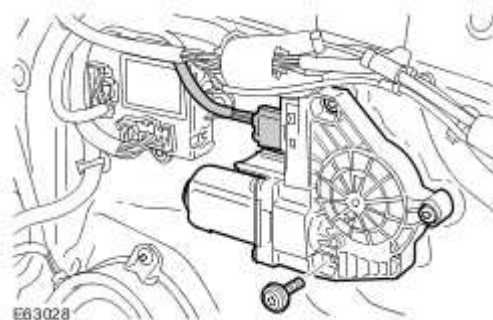
		CJB	manufacturer approved diagnostic system
U020800	Lost communication with Driver Seat Module (DSM)	<ul style="list-style-type: none"> Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the DDM/PDM, refer to the new module installation note at the top of the DTC Index
U200224	Switch	<ul style="list-style-type: none"> Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new passenger side window switch
U201011	Switch illumination	<ul style="list-style-type: none"> Circuit short to ground 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201012	Switch illumination	<ul style="list-style-type: none"> Circuit short to battery 	Carry out CAN network tests using the manufacturer approved diagnostic system
U201208	Car Configuration Parameter(s)	<ul style="list-style-type: none"> Bus signal/message failures 	Cycle the ignition status and re-test. If DTC remains, re-configure the RJB using the manufacturer approved diagnostic system
U201324	Switch Pack	<ul style="list-style-type: none"> Signal stuck high 	Clear DTC and re-test. If DTC remains, install a new driver side window switch pack. Window Control Switch (86.25.08)
U201444	Control module hardware	<ul style="list-style-type: none"> Data Memory Failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U210000	Initial configuration not	<ul style="list-style-type: none"> No sub type information 	Re-configure the DDM/PDM using the

	complete		manufacturer approved diagnostic system
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new DDM/PDM, refer to the new module installation note at the top of the DTC Index
U300255	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Not configured 	Re-configure the relevant module as new using the manufacturer approved diagnostic system and re-test. If DTC remains install a new module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between DDM/PDM and RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

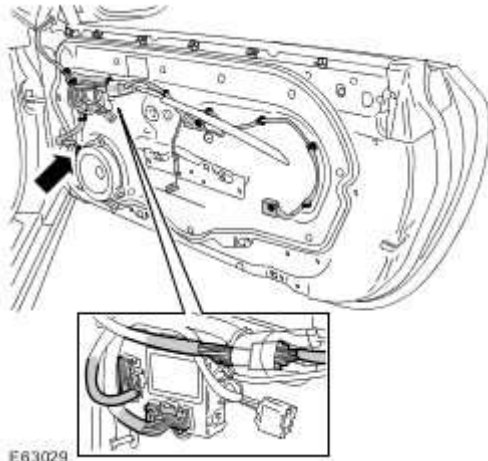
Front Door Window Glass (76.31.01)

Removal

- 1 . Raise the window glass.
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 3 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 4 . Remove the window regulator motor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx screws.

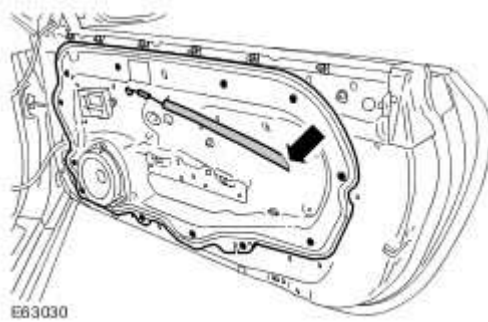


- 5 . Release the front door inner weathershield.
 - ▶ Disconnect the 3 electrical connectors.
 - ▶ Release the 9 wiring harness clips.



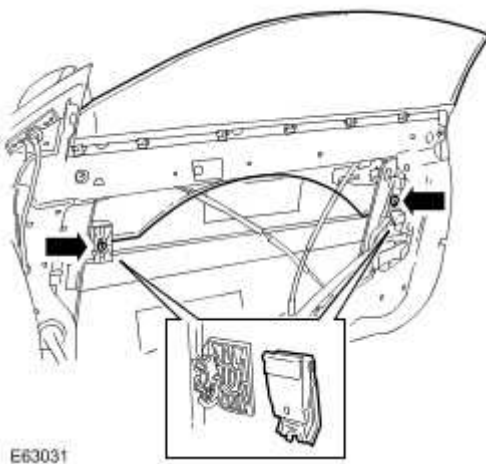
6 . Remove the front door inner weathershield.

- ▶ Remove the 12 Torx bolts.
- ▶ Release the front door interior handle cable.



7 . Remove the front door window glass.

- ▶ Remove the 2 Torx bolts.
- ▶ Collect the clamp and rubber washer.



Installation

1 . Install the front door window glass.

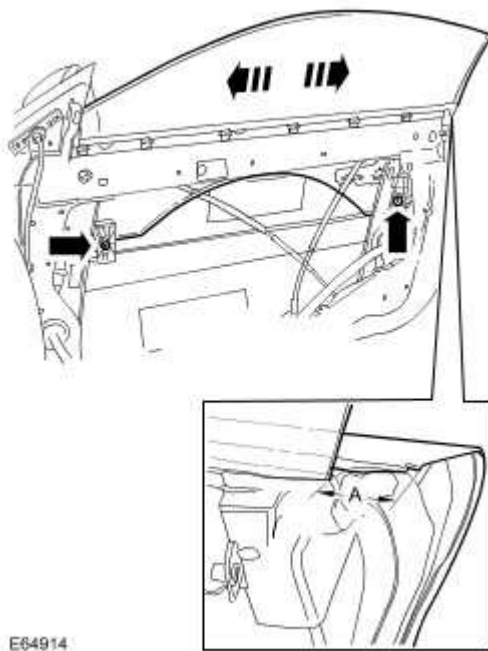
- ▶ Attach the clamp and rubber washer.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.

2 NOTE:

- The window must be fully raised when carrying out measurements.

Align the front door window glass longitudinally.

- ▶ Position the window, forwards or rearwards, glass edge should be 44mm from edge of door as shown in dimension 'A'.
- ▶ Tighten the Torx bolts to 8 Nm (6 lb.ft).

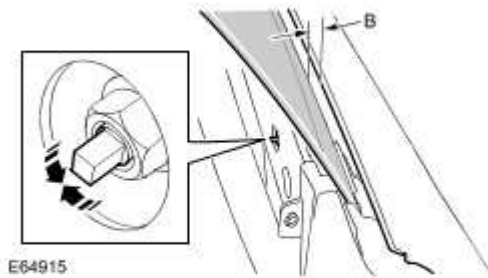


3 NOTE:

- To adjust the window hold the locknut and turn the centre spindle.

Align the front door window glass horizontally.

- ▶ Release the retaining nut.
- ▶ Align the glass to door, glass should be 12mm from door as shown in dimension 'B'.
- ▶ Tighten the retaining nut to 10 Nm (7 lb.ft).



- 4 . Install the front door inner weathershield.
 - ▶ Attach the front door interior handle cable.
 - ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).

- 5 . Secure the front door inner weathershield.
 - ▶ Secure the wiring harness clips.
 - ▶ Connect the electrical connectors.

- 6 . Install the window regulator motor.
 - ▶ Install and tighten the Torx screws.
 - ▶ Connect the electrical connector.

- 7 . Install the front door trim panel.

For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

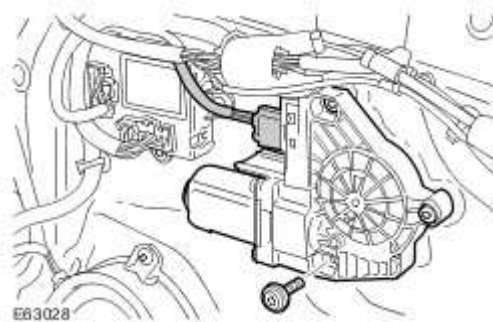
- 8 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

Front Door Window Regulator Motor (76.31.45)

Removal

- 1 . Raise the window glass.
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 3 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 4 . Remove the window regulator motor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx screws.



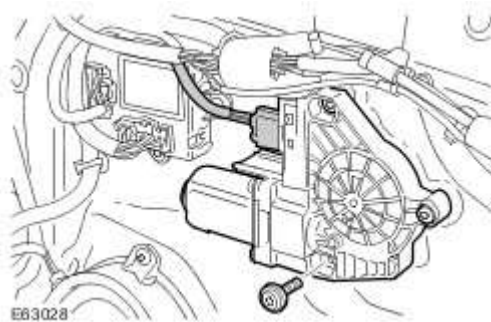
Installation

- 1 . Install the window regulator motor.
 - ▶ Install and tighten the Torx screws.
 - ▶ Connect the electrical connector.
- 2 . Install the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

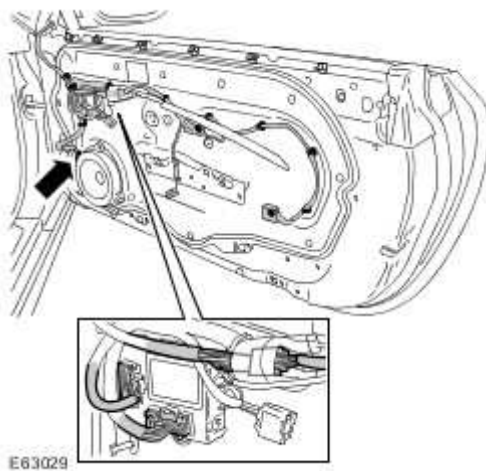
Front Door Window Regulator

Removal

- 1 . Raise the window glass.
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 . Remove the front door trim panel.
For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)
- 4 . Remove the window regulator motor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx screws.

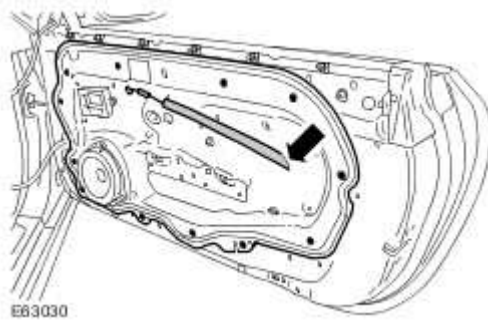


- 5 . Release the front door inner weathershield.
 - ▶ Disconnect the 3 electrical connectors.
 - ▶ Release the 9 wiring harness clips.



6 . Remove the front door inner weathershield.

- ▶ Remove the 12 Torx bolts.
- ▶ Release the front door interior handle cable.

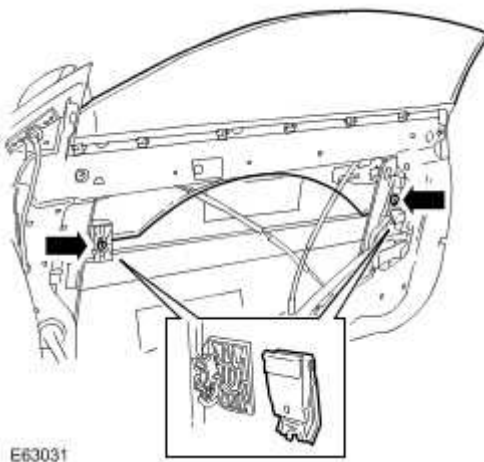


7 . Carefully remove the outer waist seal.

- ▶ Release each end of the seal from the door frame.

8 . Remove the front door window glass.

- ▶ Remove the 2 Torx bolts.
- ▶ Collect the clamp and rubber washer.



9 . Remove the window regulator assembly.

- ▶ Release the rubber lining from the glass channel.
- ▶ Remove the 4 Torx screws.
- ▶ Remove the bolt.
- ▶ Remove the nut.

Installation

1 . Install the window regulator assembly.

- ▶ Tighten the nut to 10 Nm (7 lb.ft).
- ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- ▶ Install and tighten the Torx screws.
- ▶ Install the rubber lining to the glass channel.

2 . Install the front door window glass.

- ▶ Attach the clamp and rubber washer.
- ▶ Install the Torx bolts, but do not tighten fully at this stage.

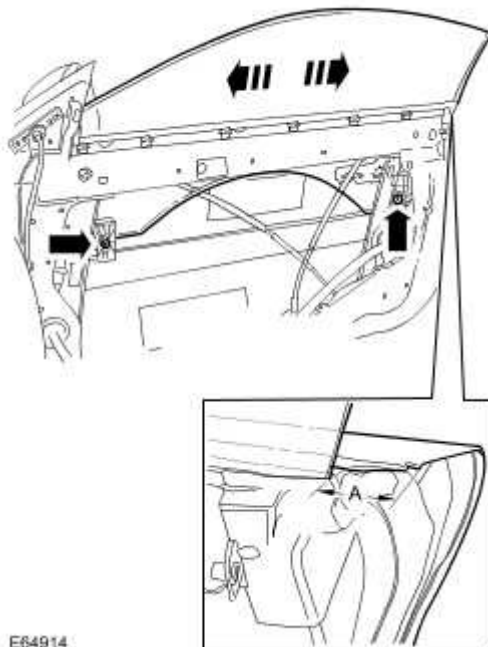
3 . Install the outer waist seal.

4 NOTE:

- The window must be fully raised when carrying out measurements.

Align the front door window glass longitudinally.

- ▶ Position the window, forwards or rearwards, glass edge should be 44mm from edge of door as shown in dimension 'A'.
- ▶ Tighten the Torx bolts to 8 Nm (6 lb.ft).

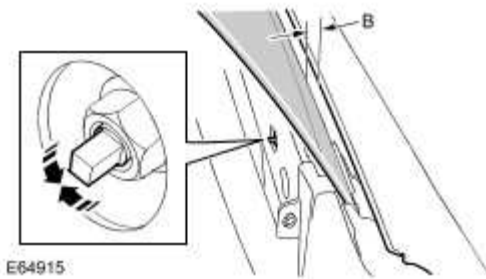


5 NOTE:

- To adjust the window hold the locknut and turn the centre spindle.

Align the front door window glass horizontally.

- ▶ Release the retaining nut.
- ▶ Align the glass to door, glass should be 12mm from door as shown in dimension 'B'.
- ▶ Tighten the retaining nut to 10 Nm (7 lb.ft).



6 . Install the front door inner weathershield.

- ▶ Attach the front door interior handle cable.
- ▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).

7 . Secure the front door inner weathershield.

- ▶ Secure the wiring harness clips.
- ▶ Connect the electrical connectors.

8 . Install the window regulator motor.

- ▶ Install and tighten the Torx screws.
- ▶ Connect the electrical connector.

9 . Install the front door trim panel.

For additional information, refer to [Front Door Trim Panel \(76.34.01\)](#)

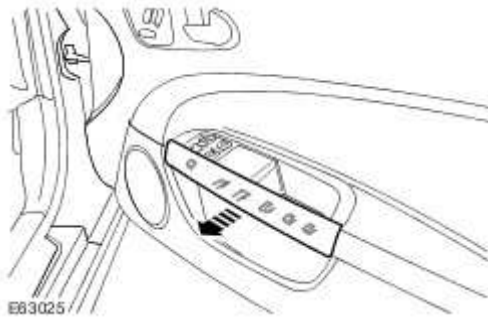
10 . Connect the battery ground cable and install the cover.

For additional information, refer to

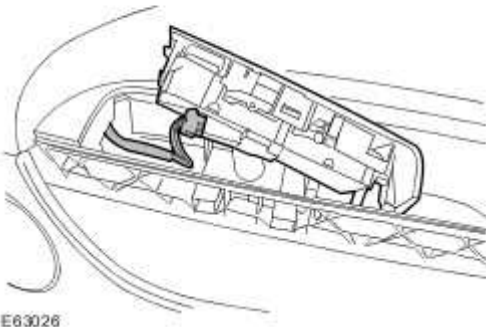
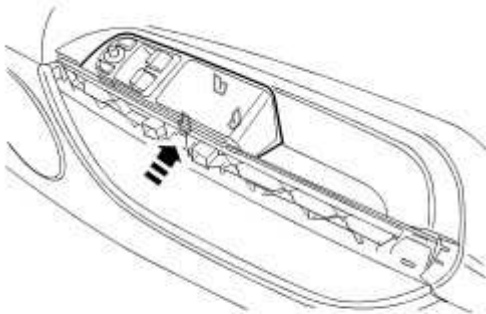
Window Control Switch (86.25.08)

Removal

- 1 . Remove the grab handle cover.
 - ▶ Release from the 6 clips.



- 2 . Remove the window control switch.
 - ▶ Release from the 3 clips.
 - ▶ Disconnect the electrical connector.



Installation

1 . Install the window control switch.

▶ Connect the electrical connector.

▶ Secure in the clips.

2 . Install the grab handle cover.

▶ Secure in the clips.

Rear Quarter Window Glass - Convertible (76.31.31)

Removal

NOTE:

The procedure to remove and install the rear quarter window glass is shown in the rear quarter window regulator motor procedure.

- 1 . Remove the rear quarter window glass.
For additional information, refer to [Rear Quarter Window Regulator Motor \(86.25.11\)](#)

Installation

- 1 . Install the rear quarter window glass.
For additional information, refer to [Rear Quarter Window Regulator Motor \(86.25.11\)](#)

Windshield Glass (76.81.40)

Removal



CAUTION: Always protect paintwork and glass when removing exterior components.



CAUTION: Always protect the interior components when removing body glass.



CAUTION: Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.

NOTE:

The following equipment is required: 1 Cutting wire and handles 1 Kent knife 1 Glazing knife 1 Windshield replacement kit 1 Sealant applicator gun 1 Suction cups 1 A felt covered table or stand to support glass

- 1 . Remove the plenum chamber panel.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

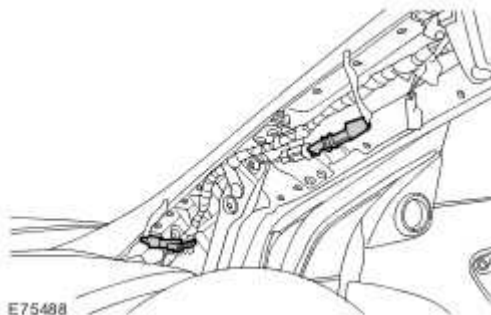
- 2 . Remove both A-pillar trim panels.

For additional information, refer to [A-Pillar Trim Panel \(76.13.31\)](#)

- 3 . **NOTE:**

LH illustration shown, RH is similar.

Disconnect the heated windshield electrical connectors.



- 4 . Remove the rain sensor.

For additional information, refer to [Rain Sensor \(84.12.10\)](#)

5



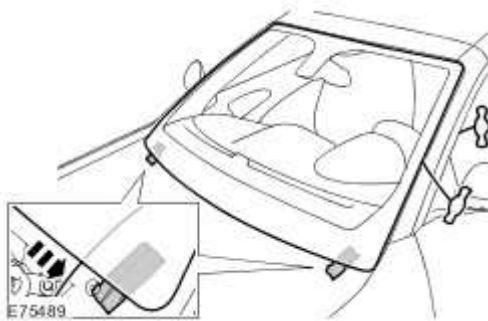
WARNING: Eye protection must be worn.



CAUTION: The two shaded areas in the graphic indicate the position of a body patch, that covers a body joint. Take care not to trap the cutting tool in the body joint.

With assistance, remove the windshield glass.

- ▶ Carefully cut through the sealant using a glazing knife or cutting wire.
- ▶ Attach the suction cups.



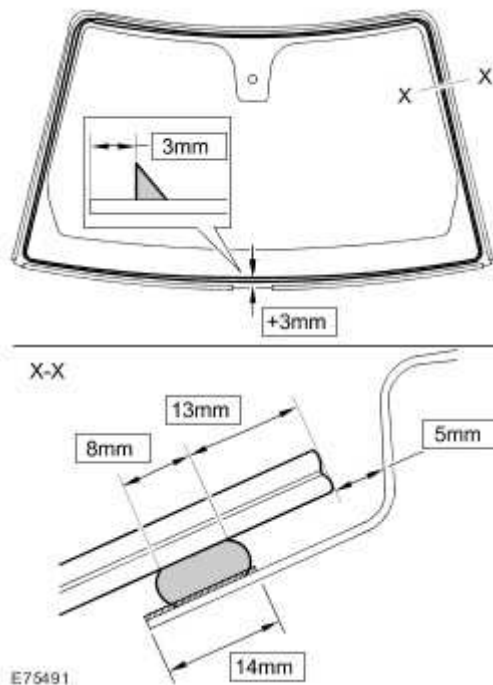
Installation

- 1 . Carefully remove the sealant from the body to leave a smooth surface.
- 2 . Install the windshield glass.
 - ▶ Use masking tape to establish reference marks as an alignment aid.



- 3 . Remove the windshield glass.
 - ▶ Clean the component mating faces.

- 4 . Apply etch primer to any bare metal.
- 5 . Apply primer over the etch primer.
- 6 . Apply glass primer to the sealant face on the windshield glass and allow to cure.
- 7 . Apply activator over the old sealant on the windshield glass and allow to cure.
- 8 Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
 - ▶ Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.
- 9 . Apply a continuous bead of sealant to the windshield glass as shown.



- 10 . With assistance, install the window glass.
 - ▶ Lightly press the window glass to seat the sealer.
 - ▶ Connect the electrical connectors.
- 11 Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.
- 12 . Install the rain sensor.

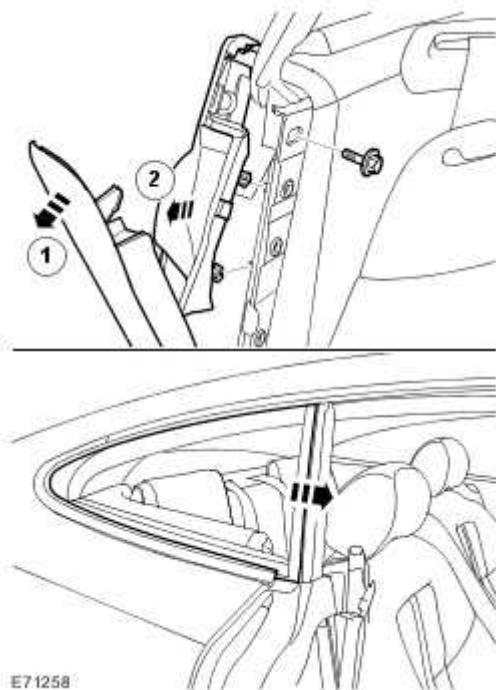
For additional information, refer to [Rain Sensor \(84.12.10\)](#)

- 13 . Connect the heated windshield electrical connectors.
- 14 . Install the A-pillar trim panels.
For additional information, refer to [A-Pillar Trim Panel \(76.13.31\)](#)
- 15 . Install the plenum chamber panel.
For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

Rear Quarter Window Glass - 2-Door (76.31.31)

Removal

- 1 . Release the door aperture seal.
 - ▶ Release from the 2 clips.
- 2 . Remove the rear quarter window glass.
 - ▶ Remove the bolt.



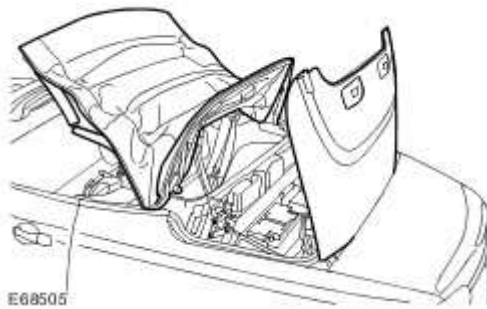
Installation

- 1 . Install the rear quarter window glass.
 - ▶ Tighten the bolt to 10 Nm (7 lb.ft).
- 2 . Attach the door aperture seal.
 - ▶ Release from the 2 clips.
 - ▶ Secure in the clips.

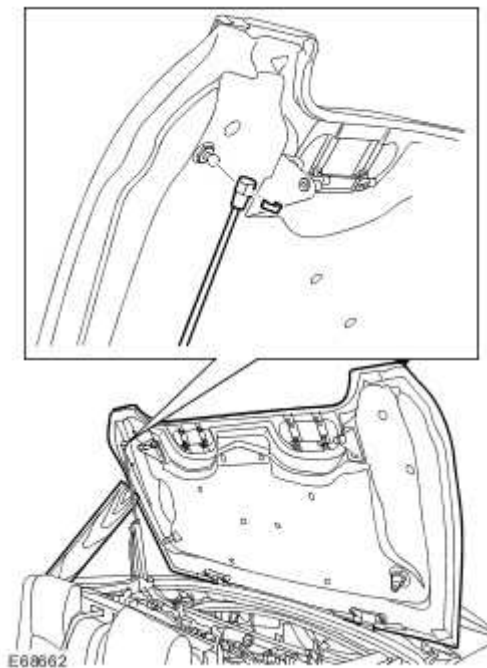
Rear Quarter Window Regulator Motor (86.25.11)

Removal

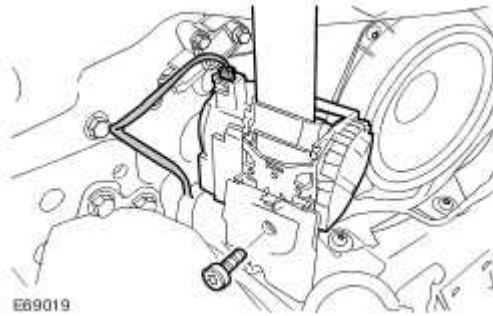
- 1 . Remove the rear quarter trim panels.
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)
- 2 . Close the convertible top to the position shown.



- 3 . Open the convertible top to the position shown.



- 4 . Remove the safety belt retractor assembly.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove and discard the Torx bolt.



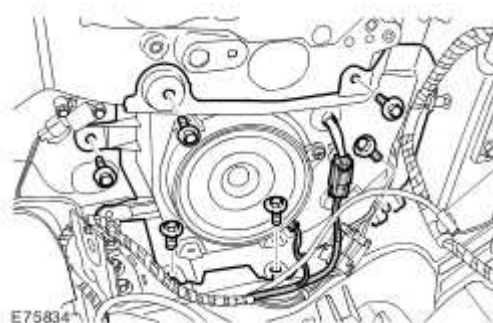
5 . Release the rear speaker housing.

- ▶ Release the 3 wiring harness clips.
- ▶ Release the 2 electrical connectors.



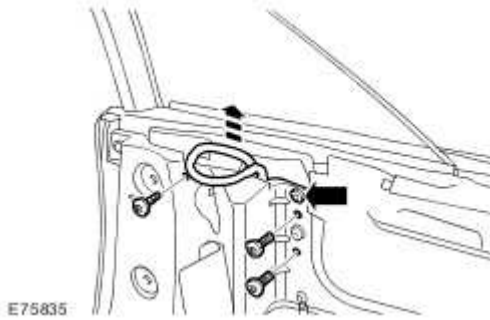
6 . Remove the rear speaker housing.

- ▶ Disconnect the 2 electrical connectors.
- ▶ Remove the 6 bolts.



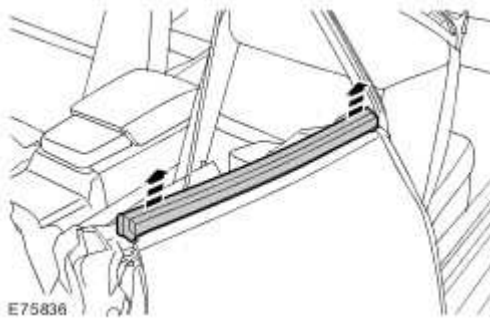
7 . Remove the safety belt guide.

- ▶ Remove the 3 Torx bolts.
- ▶ Loosen the Torx bolt.



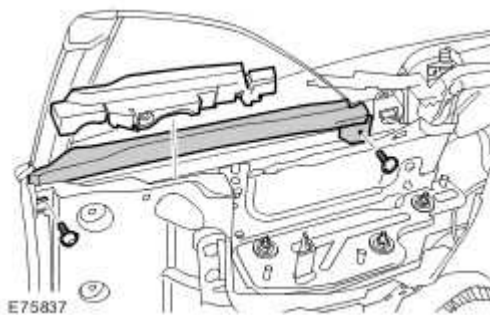
8 . Carefully remove the outer waist seal.

▶ Release each end of the seal from the body.



9 . Remove the rear quarter window glass inner seal.

▶ Remove the 2 Torx bolts.

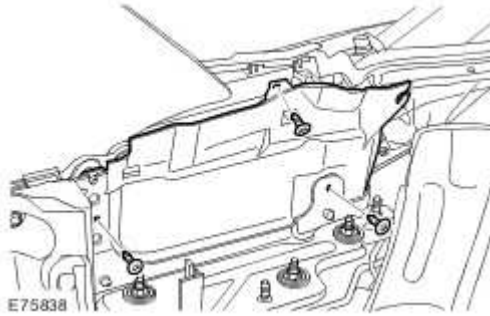


10 . **NOTE:**

Convertible top frame assembly show removed for clarity.

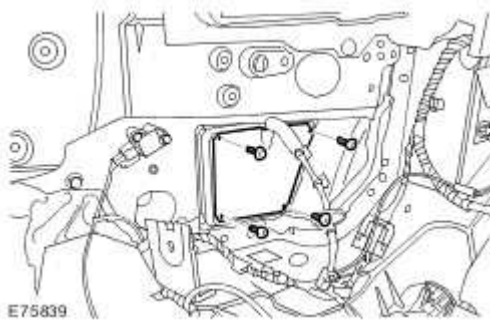
Remove the rear quarter closing panel.

▶ Remove the 3 Torx bolts.



11 . Remove the rear quarter window glass motor cover.

▶ Remove the 4 screws.



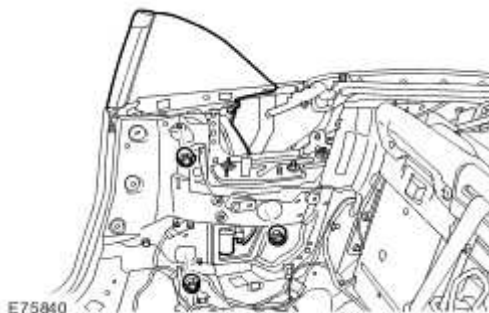
12



CAUTION: Make sure rear quarter is covered and protected, failure to follow this instruction may result in damage to the vehicle.

Remove the rear quarter window glass motor.

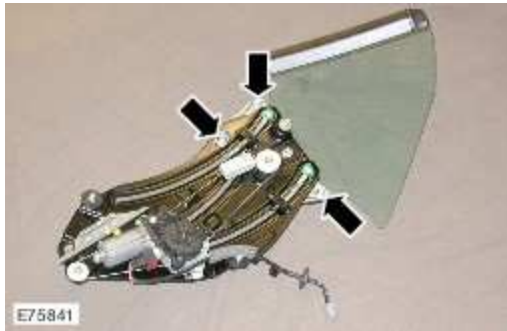
▶ Remove the 3 nuts.



13 . Remove the rear quarter window glass.

▶ Remove the 2 bolts.

▶ Remove the nut.



Installation

1 . Install the rear quarter window glass.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

▶ Tighten the nut to 25 Nm (18 lb.ft).

2



· **CAUTION: Make sure rear quarter is covered and protected, failure to follow this instruction may result in damage to the vehicle.**

Install the rear quarter window glass motor.

▶ Install the nuts but do not fully tighten at this stage.

3 . Install the rear quarter window glass motor cover.

▶ Tighten the screws.

4 . Install the rear quarter closing panel.

▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).

5 . Install the rear quarter window glass inner seal.

▶ Remove the 2 Torx bolts.

▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).

6 . Install the outer waist seal.

▶ Attach the outer waist seal to the body.

7 . Install the safety belt guide.

▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).

▶ Tighten the Torx bolt to 10 Nm (7 lb.ft).

8 . Install the rear speaker housing.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- ▶ Connect the electrical connectors.

9 . Secure the wiring harness.

- ▶ Secure the electrical connectors.
- ▶ Attach the wiring harness clips.

10 . Install the safety belt retractor assembly.

- ▶ Install a new Torx bolt and tighten to 45 Nm (33 lb.ft).
- ▶ Connect the electrical connector.

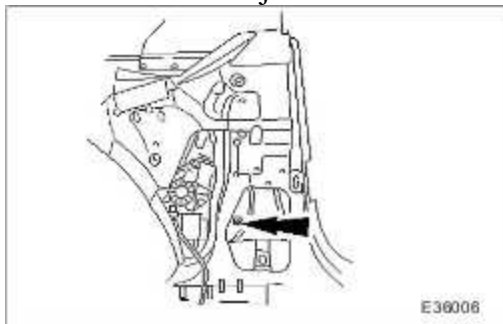
11 . Close the convertible top.

12 . Raise the rear quarter glass and check seal penetration.

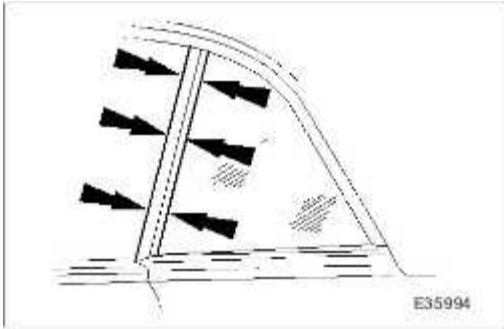


13 Carefully close the adjacent door ensuring that the glass does not contact the rear quarter glass.

14 . Loosen the lower adjuster locknut.

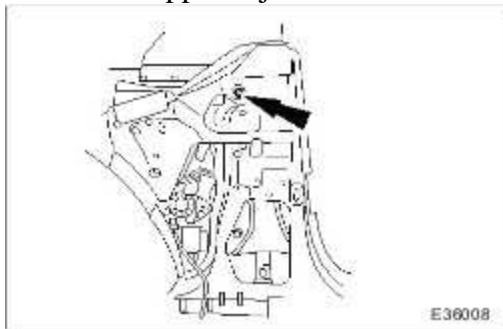


15 Move the rear quarter glass to achieve a parallel 8mm gap, between the front edge of the rear quarter glass and rear edge of the door glass.

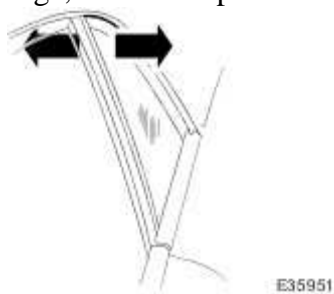


16 . Tighten the lower adjuster locknut to 9 Nm (7 lb.ft).

17 . Loosen the upper adjuster locknut.

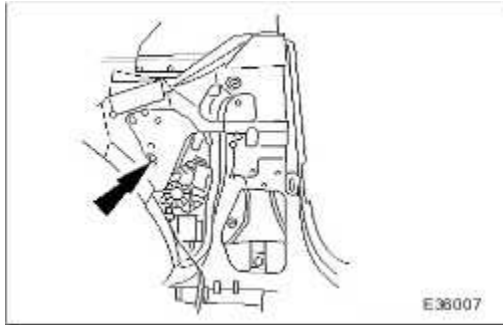


18 Turn the upper adjuster to achieve, lateral alignment of the rear quarter glass upper edge, with the top seal.

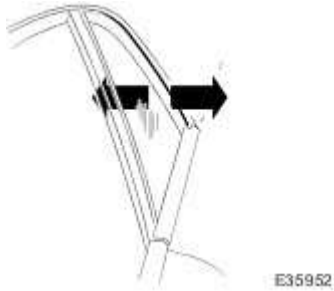


19 . Tighten the upper adjuster locknut to 9 Nm (7 lb.ft).

20 . Loosen the rear adjuster locknut.



- 21 Turn the rear adjuster to achieve, lateral alignment of the rear quarter glass rear edge, with the top seal.



- 22 . Tighten the rear adjuster locknut to 9 Nm (7 lb.ft).
- 23 . Install the rear quarter trim panels.
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)

501-12 : Instrumentation Panel and Console

Specifications

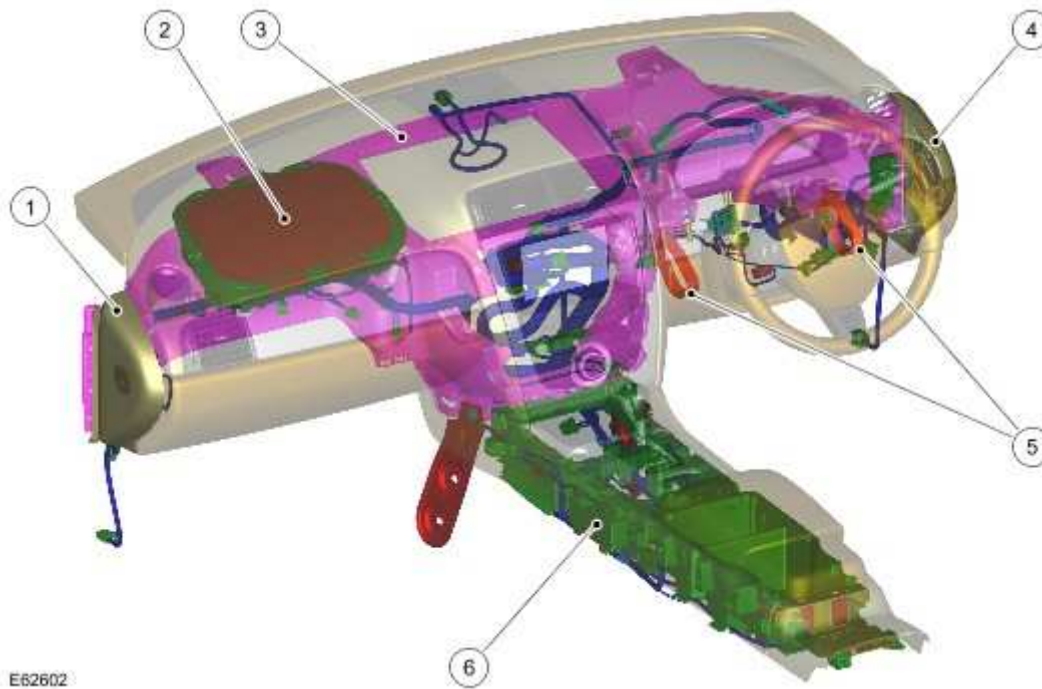
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Armrest to console - screw	6	4	53
Center console installation fixing points - screw	6	4	53
Centre console, side trim panel to console - screw	6	4	53
Instrument panel to A-post - bolt	20	15	-
Instrument panel upper retainers - bolt	20	15	-
Instrument panel bracket to console - bolt	9	7	80

Instrument Panel

COMPONENT LOCATION



E62602

Item	Part Number	Description
1		Instrument panel end cap
2		Passenger airbag
3		Cross car beam
4		Instrument panel end cap
5		Energy absorbing brackets (2 off)
6		Floor console

INTRODUCTION

The instrument panel incorporates a magnesium cross car beam and 2 deformable, energy absorbing brackets. The brackets are rivetted to the cross car beam and are not serviceable items.

The instrument panel electrical harness is mounted along the cross car beam and connects into the main vehicle harness via 4 connectors, 2 located either end of the instrument panel. To

access the connectors the instrument panel end covers can be removed by releasing a series of spring clips.

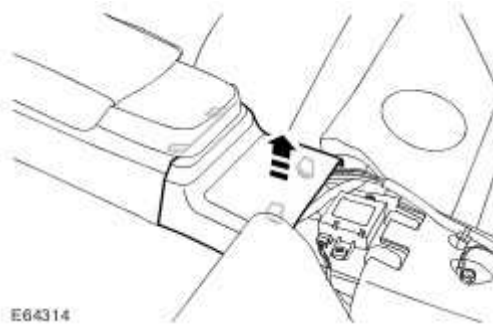
A further 3 connectors, located below the instrument panel, are used to connect the instrument panel harness to the Left Hand (LH) and Right Hand (RH) front end harnesses. Finally, 2 connectors located below the floor console connect the instrument panel harness to the telematics harness.

The floor console provides a location for the selector lever and the parking brake module. The floor console is secured to the transmission tunnel and to the cross car beam by a series of M6 bolts and trim fixings. The floor console electrical harness connects into the telematics harness via a single connector.

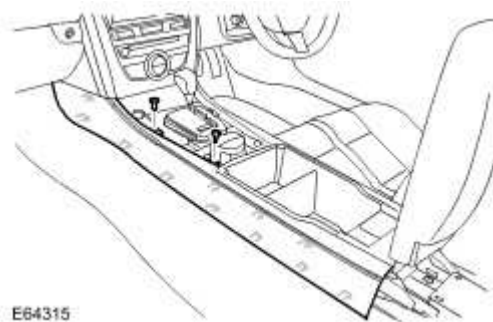
Floor Console (76.25.01)

Removal

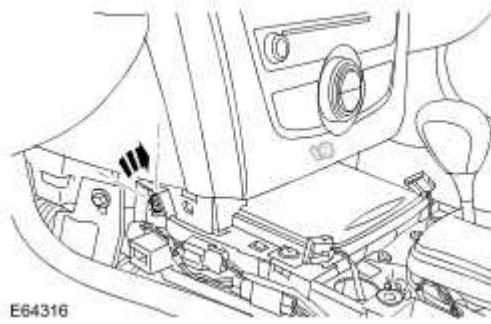
- 1 . Remove the rear seat armrest.
For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)
- 2 . Remove the floor console veneer trim panel.
For additional information, refer to [Floor Console Finish Panel \(76.47.26\)](#)
- 3 . Remove the floor console rear panel.
 - ▶ Carefully release the 2 clips.



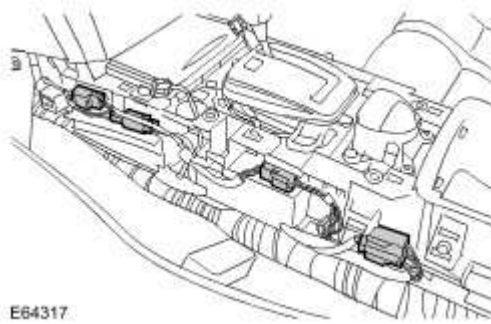
- 4 . Remove the floor console side panel trim.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Carefully release 11 clips.
 - ▶ Repeat the procedure and remove the opposite hand.



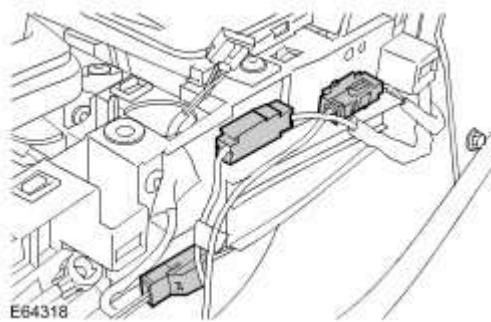
- 5 . Release the 2 Torx latches.



- 6 . Release the LH side floor console electrical harness connector blocks.
▶ Carefully release the 4 clips.



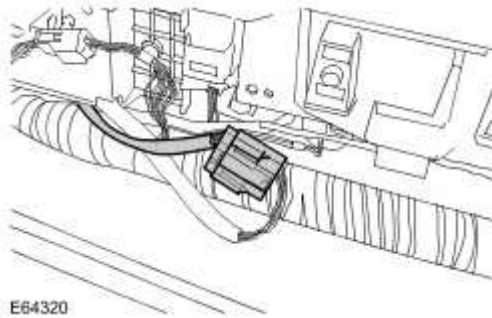
- 7 . Release the RH side floor console electrical harness connector blocks.
▶ Carefully release the 3 clips.



- 8 . Release the wiring harness clip.



9 . Disconnect the gear selector assembly electrical connector.



10 . Remove the gear selector assembly.

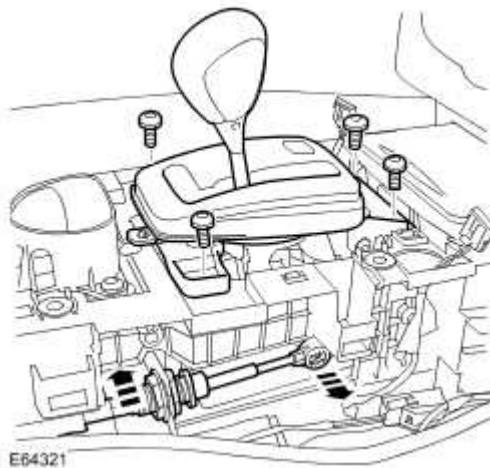
- ▶ Carefully disconnect the selector cable ball joint.
- ▶ Remove the 4 Torx bolts.
- ▶ Release the electrical harness.

11 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

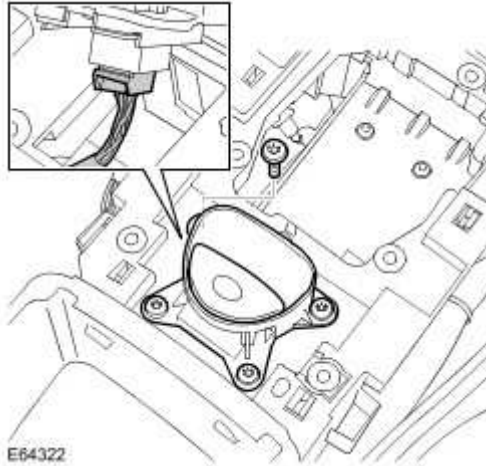
Release the gear selector cable at the abutment.

- ▶ Loosen the locknut.



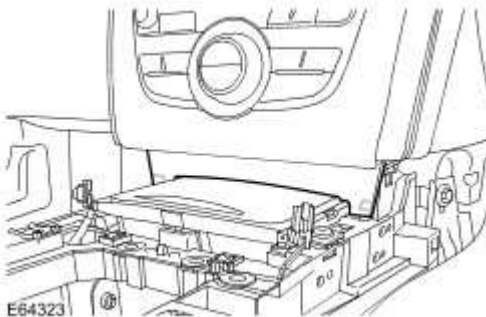
12 . Remove the parking brake switch.

- ▶ Remove the 4 Torx bolts.
- ▶ Disconnect the electrical connector.



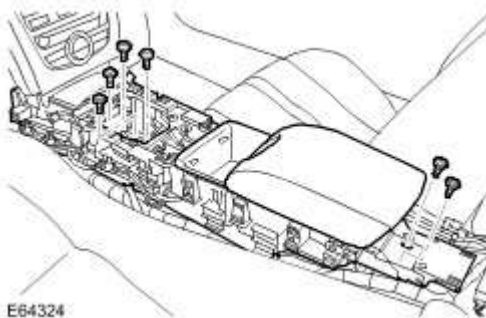
13 . Remove the ashtray trim panel.

- ▶ Release the 2 clips.



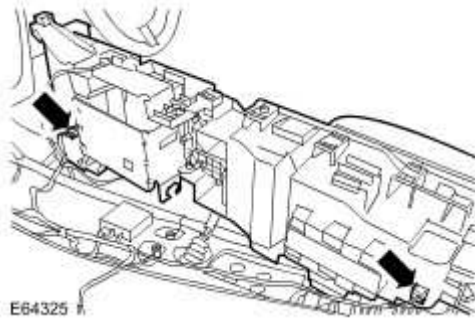
14 . Release the floor console.

- ▶ Remove the 6 Torx bolts.
- ▶ Lift and carefully withdraw from the instrument panel.



15 . Remove the floor console.

- ▶ Disconnect the cigar lighter electrical connector.
- ▶ Disconnect the keyless vehicle module electrical connector.



16 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the ashtray.

- ▶ Remove the 4 Torx bolts.
- ▶ Remove the ashtray insert.

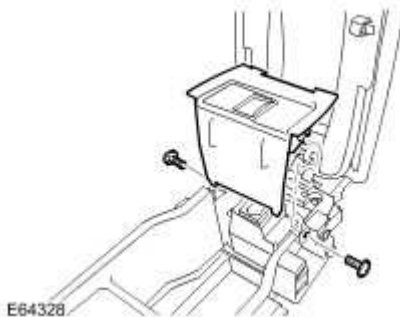


17 . Remove the cigar lighter.



18 . Remove the keyless start control module trim cover.

➤ Remove the 2 Torx screws.



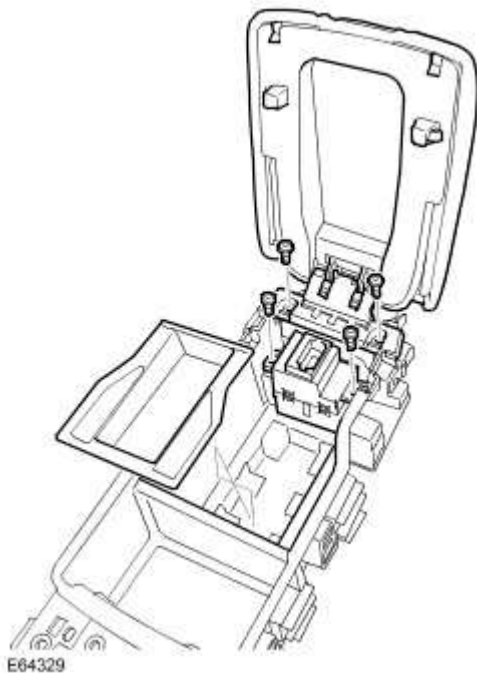
19 . Remove the floor console lid.

➤ Remove the 2 Torx bolts.

20 . Remove the keyless start control module.

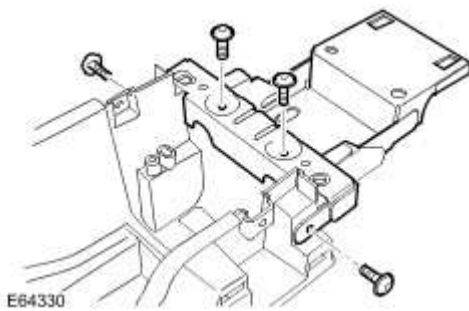
➤ Remove the 2 Torx screws.

21 . Remove the cubby box liner.



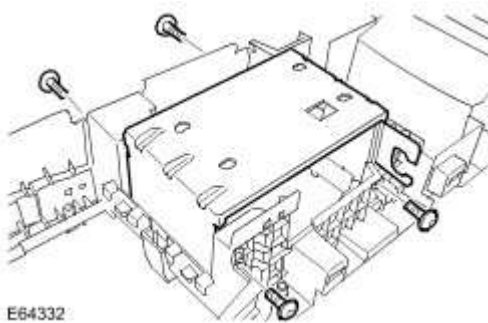
22 . Remove the floor console rear extension bracket.

▶ Remove the 4 Torx bolts.



23 . Remove the floor console central mounting bracket.

▶ Remove the 4 Torx bolts.



Installation

- 1 . Install the floor console central mounting bracket.
 - ▶ Install the Torx bolts, but do not tighten fully at this stage.
- 2 . Install the floor console rear extension bracket.
 - ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).
- 3 . Install the keyless start control module.
 - ▶ Install the Torx screws.
- 4 . Install the cubby box liner.
- 5 . Install the floor console lid.
 - ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).
- 6 . Install the keyless start control module trim cover.
 - ▶ Install the Torx screws.
- 7 . Install the cigar lighter assembly.
- 8 . Install the ashtray.
 - ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).
- 9 . Install the floor console.
 - ▶ Connect the cigar lighter electrical connector.
 - ▶ Connect the keyless vehicle module electrical connector.
 - ▶ Align the floor console with the Torx latch spigots and secure the latches.
 - ▶ Install the Torx bolts, tighten the M6 bolts to 10 Nm (7 lb.ft) and the M8 bolts to 25 Nm (18 lb.ft).
- 10 . Install the ashtray trim panel.
 - ▶ Carefully secure the clips.
- 11 . Install the parking brake switch.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

12 . **NOTE:**

Use an additional wrench to prevent the component from rotating.

Install the gear selector cable to the floor console abutment.

- ▶ Tighten the locknut to 15 Nm (11 lb.ft).

13 . Install the gear selector assembly.

- ▶ Position the electrical harness.
- ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).
- ▶ Connect the selector cable ball joint.

14 . Connect the gear selector assembly electrical connector.

15 . Install the RH side floor console electrical harness connector blocks.

- ▶ Carefully align and secure the clips.

16 . Install the LH side floor console electrical harness connector blocks.

- ▶ Carefully align and secure the clips.

17 . Secure the Torx latches.

18 . Install the floor console side panel trim.

- ▶ Carefully align and secure the clips.
- ▶ Tighten the Torx screws to 6 Nm (4 lb.ft).
- ▶ Install the opposite hand.

19 . Install the floor console rear panel.

- ▶ Align the lugs and secure the clips.

20 . Install the floor console veneer trim panel.

For additional information, refer to [Floor Console Finish Panel \(76.47.26\)](#)

21 . Install the rear seat armrest.

For additional information, refer to [Rear Seat Armrest \(76.70.39\)](#)

Floor Console Finish Panel (76.47.26)

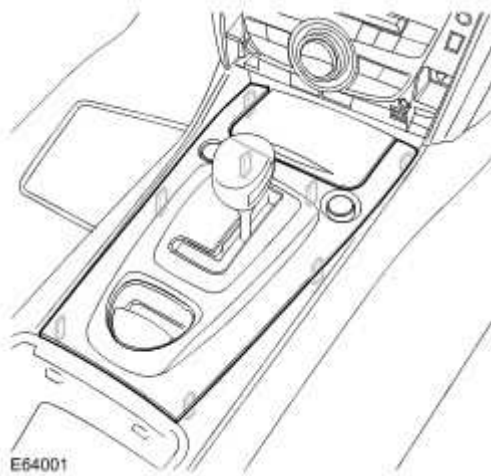
Removal

1 . Depress the footbrake and move the gear selector lever to NEUTRAL.

2 .  **CAUTION: Care must be taken to avoid damage to the mating surfaces.**

Release the floor console veneer trim panel.

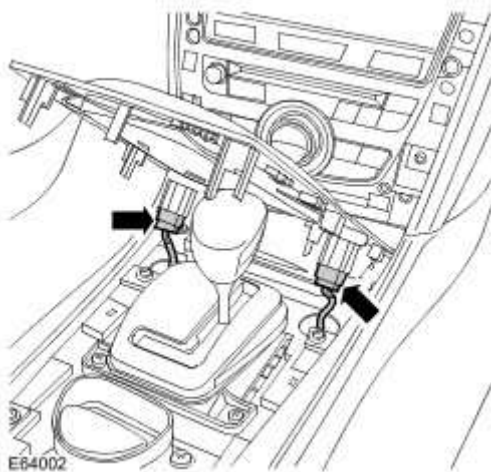
▶ Carefully release the 8 clips.



3 Remove the floor console veneer trim panel.

▶ Disconnect the engine START/STOP switch electrical connector.

▶ Disconnect the automatic speed limiter (ASL) switch electrical connector.



4 . NOTE:

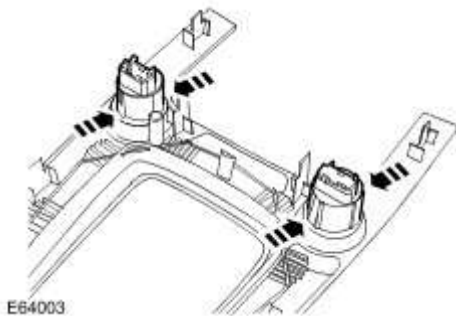
Do not disassemble further if the component is removed for access only.

NOTE:

Note the fitted position.

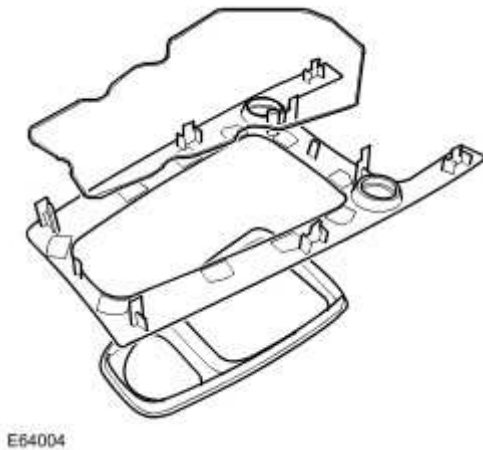
Remove the switches.

▶ Depress the 2 retaining clips.



5 . Remove the gear selector lever surround trim panel.

▶ Remove the wire clip.



Installation

1 . Install the gear selector lever surround trim panel.

▶ Install the wire clip.

2 . Install the switches.

3 . Install the floor console veneer trim panel.

▶ Connect the electrical connectors.

▶ Carefully align and secure the clips.

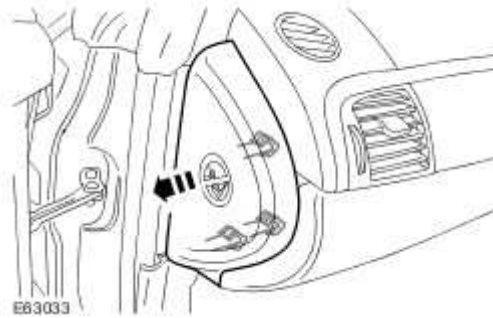
4 . Return the gear selector lever to PARK.

Glove Compartment (76.52.03)

Removal

1 . Remove the instrument panel end trim panel.

▶ Release the 3 clips.



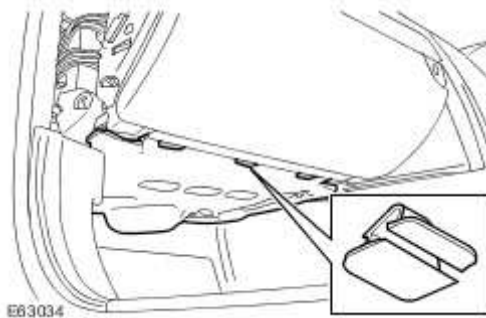
2



CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.

Remove the passenger side footwell trim panel.

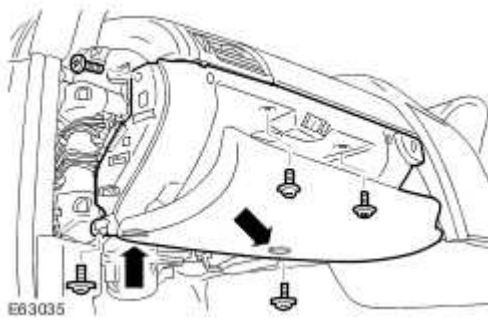
▶ Remove the 3 clips.



3 . Release the glove compartment.

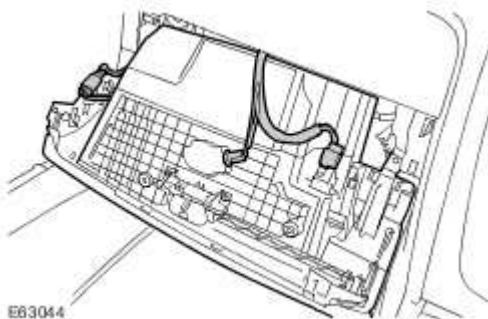
▶ Remove the 5 Torx screws.

▶ Release the 2 clips.



4 . Remove the glove compartment.

- ▶ Disconnect the 2 electrical connectors.
- ▶ Release the glove compartment lamp assembly.



Installation

1 . Install the glove compartment.

- ▶ Install the lamp assembly.
- ▶ Connect and secure the electrical connectors.
- ▶ Tighten the Torx screws.

2 . Install the passenger side footwell trim panel.

- ▶ Carefully secure the clips.

3 . Install the instrument panel end trim panel.

- ▶ Release the door aperture seal.
- ▶ Carefully secure the clips.
- ▶ Install the aperture seal.

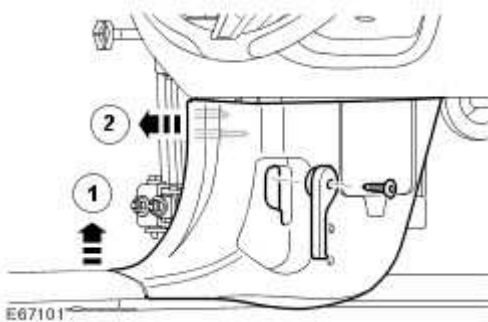
Instrument Panel (76.46.01)

Removal

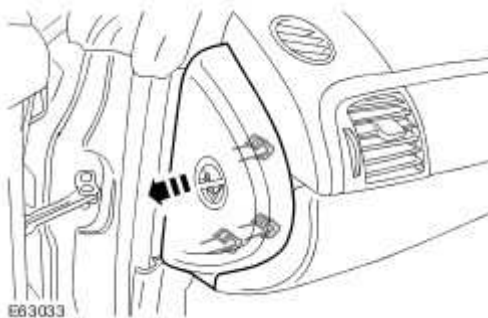
NOTE:

Some variation in the illustrations may occur, but the essential information is always correct.

- 1 . Disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the floor console.
For additional information, refer to
- 3 . Remove both cowl side trim panels.
 - ▶ LH side only: Remove the screw and remove hood release lever.
 - ▶ Release the leading edge of the scuff plate.

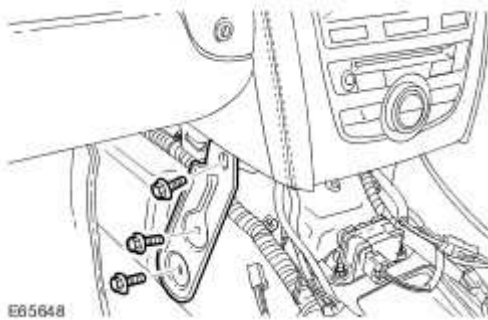


- 4 . Remove the instrument panel end trim panel.
 - ▶ Open the front door for access.
 - ▶ Carefully release the 3 clips.
 - ▶ Repeat the procedure and remove the opposite hand.



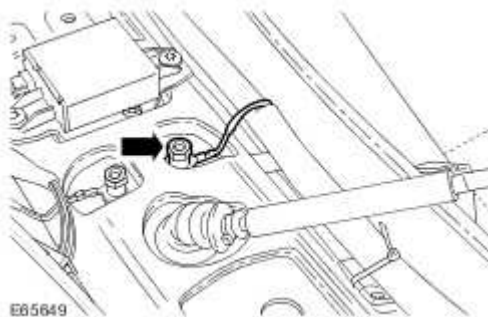
5 Remove both instrument panel support brackets.

- ▶ Remove the self-tapping hexagonal screw from the instrument panel carrier.
- ▶ Remove the 2 bolts.
- ▶ Repeat the procedure and remove the opposite hand.

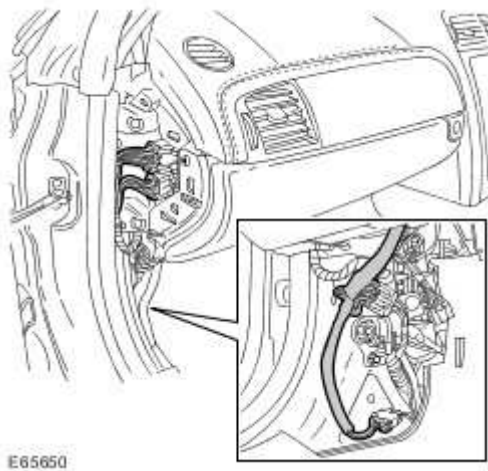


6 . Disconnect the instrument panel harness ground cable.

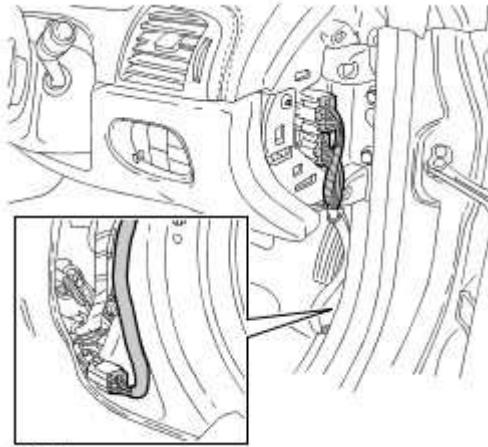
- ▶ Remove the nut.



7 . Disconnect the 4 instrument panel LH side electrical connectors.



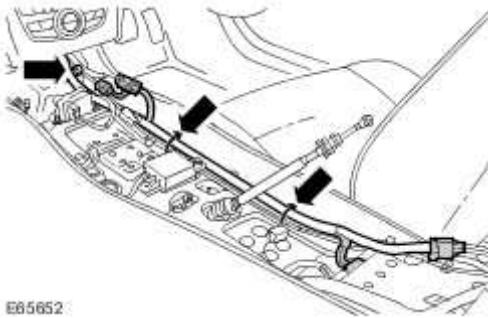
8 . Disconnect the 3 instrument panel RH side electrical connectors.



E65651

9 Release the instrument panel electrical harness from the RH side of the transmission tunnel.

- ▶ Remove the nut and disconnect the ground cable.
- ▶ Remove and discard the 2 cable ties.
- ▶ Disconnect the 4 electrical connectors.



E65652

10 . Disconnect the steering column intermediate shaft from the steering column.

- ▶ Remove the bolt.



E65653

11 . Carefully remove the instrument panel windshield register trim.

- ▶ Release the 2 clips.
- ▶ Repeat the procedure and remove the opposite hand.



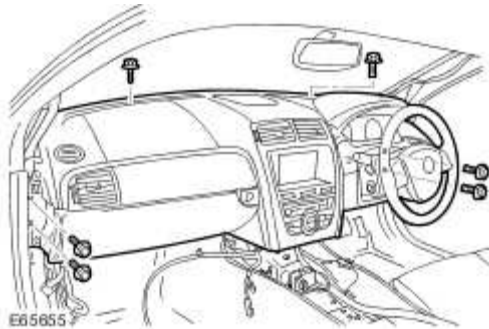
12 . Remove the 2 instrument panel carrier bolts, accessed through the upper trim panel.

- 13
-  **CAUTION: Protect the surrounding trim from damage when changing the component.**

 **CAUTION: Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.**

Remove the instrument panel assembly.

- ▶ Remove the 4 A-pillar instrument panel carrier bolts.
- ▶ With assistance, release and remove.



Installation

- 1
-  **CAUTION: Make sure the the electrical harness is not trapped during the installation.**

With assistance, install the instrument panel assembly.

- ▶ Align the pegs and install the bolts.
- ▶ Evenly and progressively tighten the bolts to 20 Nm (15 lb.ft).

2



CAUTION: Make sure that the self tapping screw engages in the previously cut groove. Damage to the instrument panel carrier may result if this process is not followed.

Install the instrument panel carrier bolts, access through the upper trim panel.

- ▶ Tighten the bolts to 20 Nm (15 lb.ft).

3 . Install the instrument panel windshield register trim.

- ▶ Carefully secure the clips.
- ▶ Repeat the above procedure on the opposite hand.

4 . Connect the instrument panel RH electrical connections

5 . Connect the instrument panel LH side electrical connectors.

6 . Install the instrument panel electrical harness to the RH side of the transmission tunnel.

- ▶ Connect the electrical connectors.
- ▶ Install the ground cable.
- ▶ Tighten the nut to 10 Nm (7 lb.ft).
- ▶ Install new cable ties.

7 . Connect the steering column intermediate shaft to the steering column.

- ▶ Tighten the bolt to 25 Nm (18 lb.ft).

8 . Install the instrument panel harness ground cable.

- ▶ Clean the component mating faces.
- ▶ Tighten the nut to 10 Nm (7 lb.ft).

9



CAUTION: Make sure that the self tapping screw engages in the previously cut groove. Damage to the instrument panel carrier may result if this process is not followed.

Install both instrument panel support brackets.

- ▶ Tighten the bolts to 9 Nm (7 lb.ft).

▶ Tighten the self-tapping hexagonal headed screw to 9 Nm (7 lb.ft).

10 . Install the instrument panel end trim panel.

- ▶ Release the door aperture seal.
- ▶ Carefully align and secure the clips.
- ▶ Install the aperture seal.
- ▶ Repeat the above procedure on the opposite hand.

11 . Install the cowl side trim panels.

- ▶ Align the pegs and secure the clip.
- ▶ Install the rocker panel scuff plate.
- ▶ LH side only: Install the hood release lever and secure with the screw.

12 . Install the floor console.

For additional information, refer to

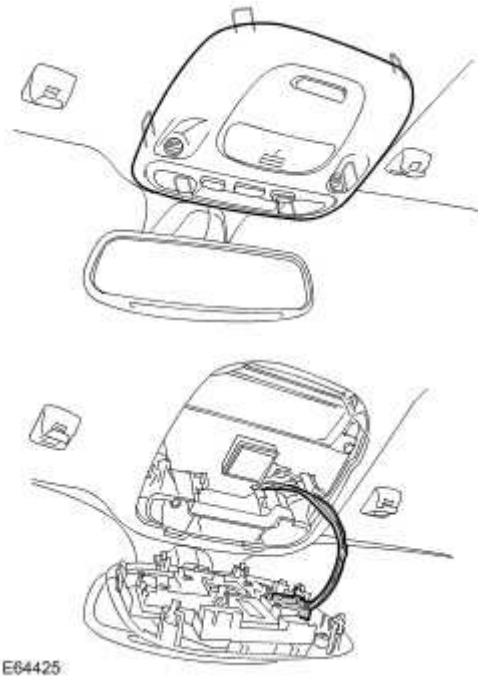
13 . Reconnect the battery ground cable.

For additional information, refer to

Overhead Console (76.13.69)

Removal

- 1 . Remove the front overhead console.
 - ▶ Release from the 6 clips.
 - ▶ Disconnect the electrical connector.



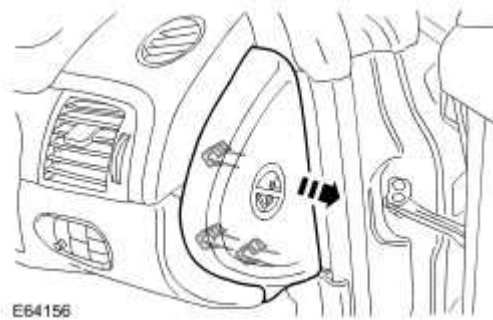
Installation

- 1 . Install the front overhead console.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.

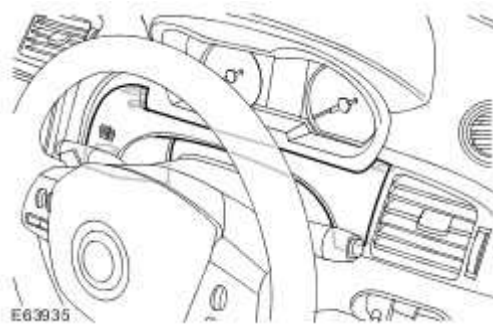
Instrument Panel Lower Trim Panel (76.46.11)

Removal

- 1 . Remove the instrument panel end trim panel.
 - ▶ Open the front door for access.
 - ▶ Carefully release the 3 clips.



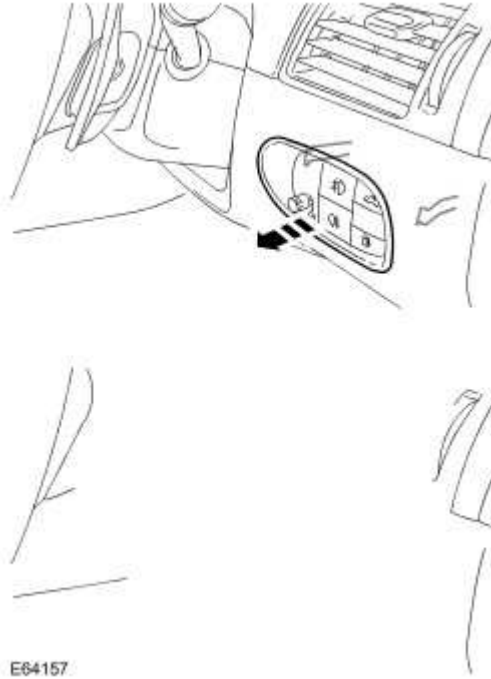
- 2 . Remove the instrument panel driver's side reinforcement trim panel.
 - ▶ Carefully release the 4 clips.



- 3 .  **CAUTION: Care must be taken to avoid damage to the mating surfaces.**

Carefully release and remove the rheostat switch assembly.

- ▶ Disconnect the electrical connector.

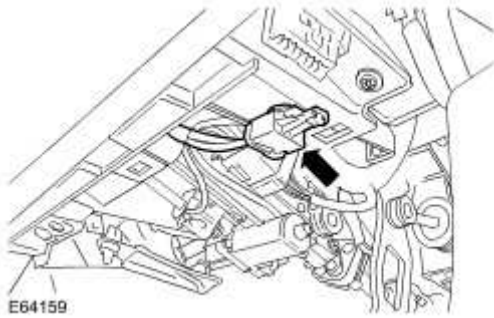


- 4  **CAUTION: Removal of the clips is a delicate procedure, damage will occur if any force is used.**

Remove the driver's side footwell trim panel.
▶ Carefully release the 3 clips.

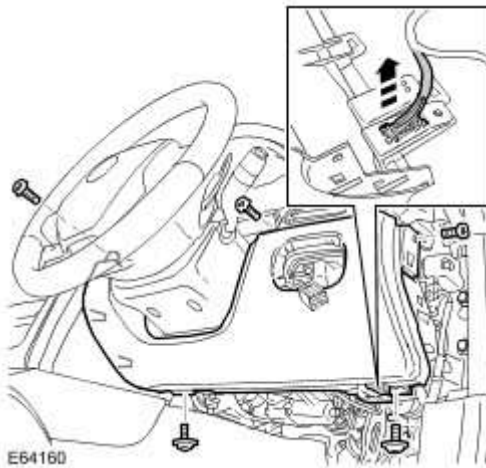


- 5 . Release the MOST diagnostic port.
▶ Carefully release the clip.



6 . Remove the instrument panel, lower trim panel.

- ▶ Remove the 3 Torx bolts.
- ▶ Remove the 2 Torx screws.
- ▶ Release the 2 clips.
- ▶ Release the vehicle diagnostic port.



Installation

1 . Install the rheostat switch assembly and align the instrument panel lower trim panel.

- ▶ Secure the switch assembly clips.
- ▶ Connect the switch assembly electrical connector.

2 . Install the instrument panel, lower trim panel.

- ▶ Install and secure the diagnostic socket.
- ▶ Align the clips.
- ▶ Install the Torx screws.
- ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).

3 . Install the MOST diagnostic port.

▶ Secure the clip.

4 . Install the driver's side footwell trim panel.

▶ Carefully align and secure the clips.

5 . Install the instrument panel driver's side reinforcement trim panel.

▶ Align the pegs and secure with the clips.

6 . Install the instrument panel end trim panel.

▶ Release the door aperture seal.

▶ Carefully align and secure the clips.

▶ Install the aperture seal.

501-14 : Handles, Locks, Latches and Entry Systems

Specifications

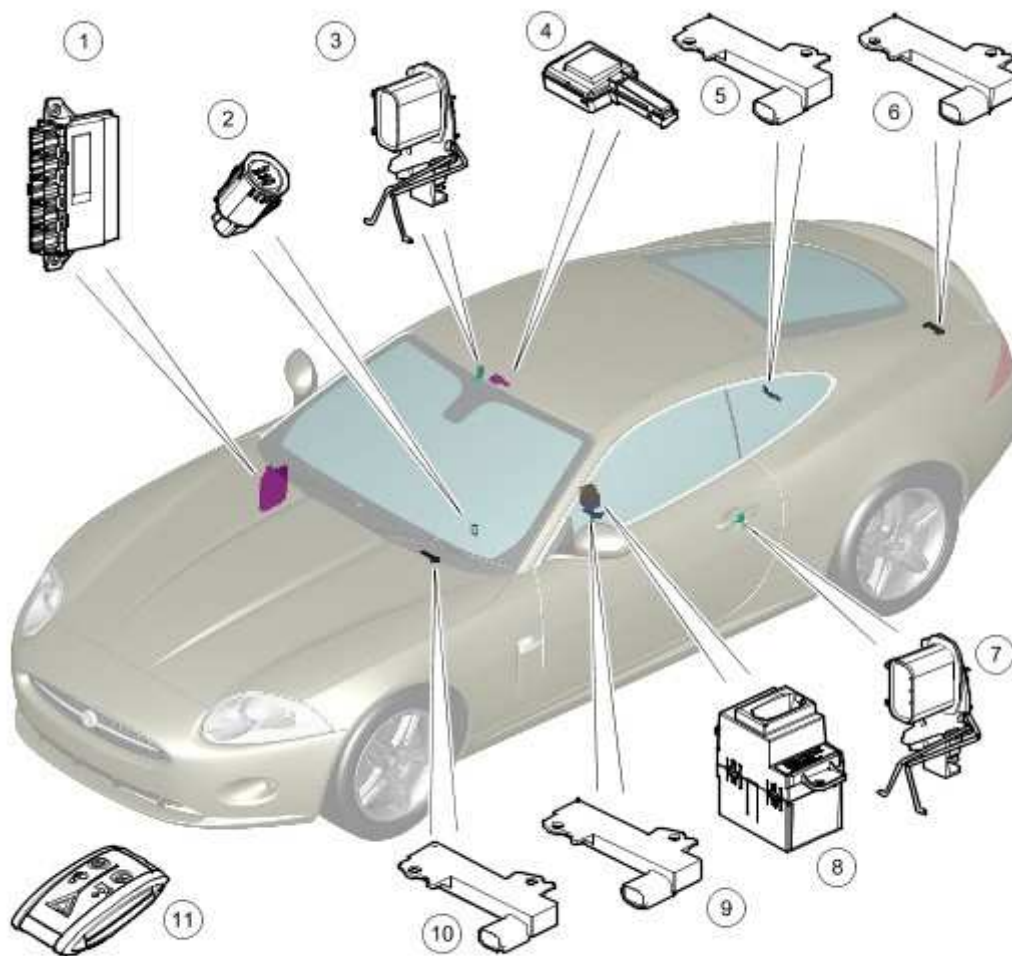
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Door, exterior handle bezel - screw	6	-	53
Door lock cylinder - screw	6	-	53
Door lock actuator to door rear panel - screw	7	-	62
Door striker to B-post - screw	9	-	80
Hood release mechanism to A-post - bolt	9	-	80
Hood release handle to mechanism	3	-	27
Luggage compartment lid, latch actuator to lid - screw	20	15	-
Luggage compartment lid, lock cylinder - screw	3	-	26
Luggage compartment lid, striker to back panel - screw	25	18	-
Liftgate, latch actuator to lid - screw	20	15	-
Liftgate, lock cylinder - screw	3	-	26
Liftgate, striker to back panel - screw	25	18	-

Handles, Locks, Latches and Entry Systems

COMPONENT LOCATION - CENTRAL LOCKING SYSTEM (Sheet 1 of 2)

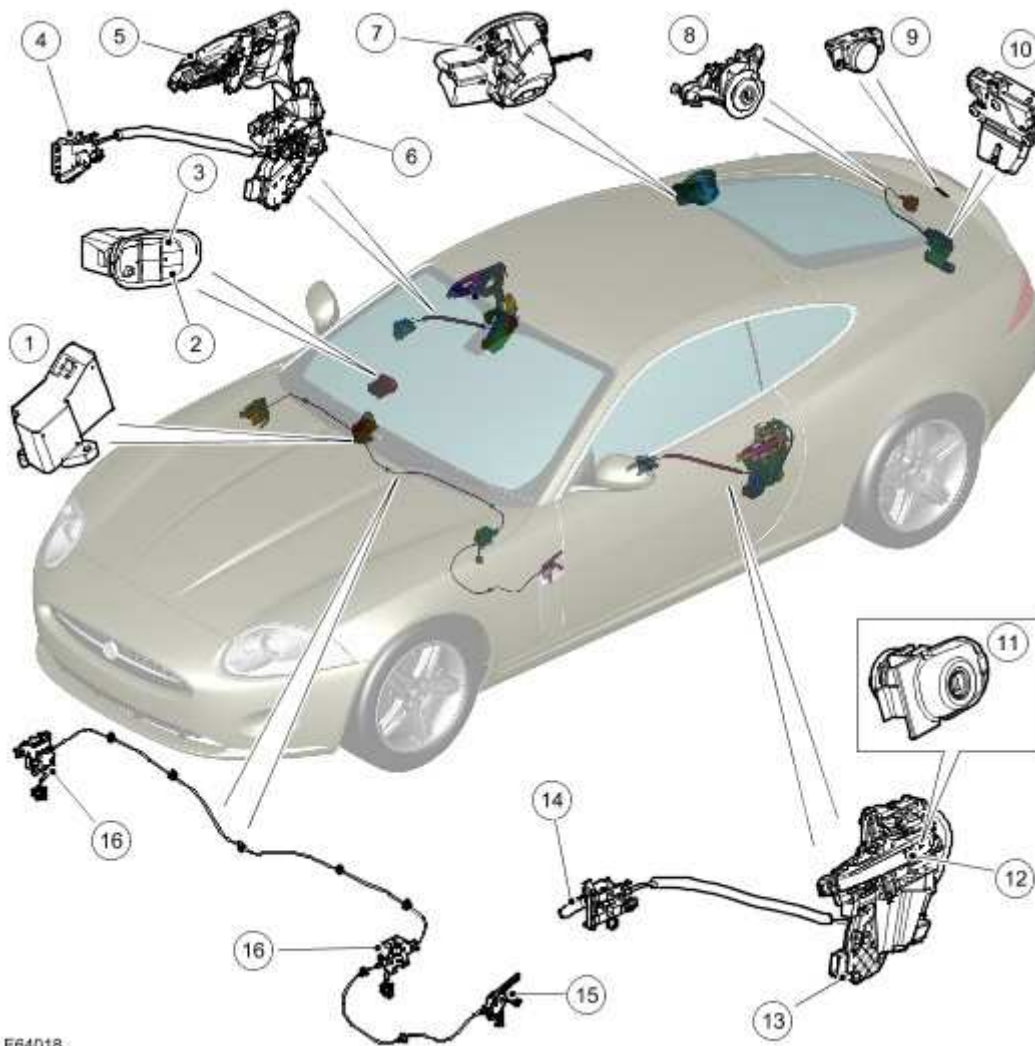


E64017

Item	Part Number	Description
1		Keyless vehicle module
2		Start/Stop button
3		Right Hand (RH) door handle keyless LF antenna (only with passive entry option fitted)

4		Central locking RF receiver
5		LF antenna (located on battery bracket)
6		LF antenna (located in rear bumper - only with passive entry option fitted)
7		Left Hand (LH) door handle keyless LF antenna (only with passive entry option fitted)
8		Start control module
9		LF antenna (center console)
10		LF antenna (instrument panel)
11		Smart Key

COMPONENT LOCATION - CENTRAL LOCKING SYSTEM (Sheet 2 of 2)



E64018

Item	Part Number	Description
------	-------------	-------------

1		Electric steering column lock
2		Fuel flap release switch
3		Liftgate release switch
4		RH interior door handle
5		RH exterior door handle
6		RH door latch and motor
7		Fuel flap release motor
8		Liftgate emergency key barrel
9		Liftgate external release switch
10		Liftgate latch and motor
11		Door emergency key barrel (LH door only)
12		LH exterior door handle
13		LH door latch and motor
14		LH interior door handle
15		Hood release lever
16		Hood latches and hood ajar switch

INTRODUCTION

The hinged panels are secured with latches and strikers. A remotely operated Central Locking System (CLS) controls the locking and unlocking of the door latches.

Two levels of CLS are available; remote central locking and an optional passive entry system.

CENTRAL LOCKING SYSTEM (CLS)

A Radio Frequency (RF) Smart Key, without an integrated key, is a standard fitment allowing the vehicle to be locked and unlocked by pressing the appropriate handset buttons. The Smart Key is available in three variants depending on market requirements. These can be identified by a suffix change to the base part number as follows:

- AA = 315 MHz
- BA = 433 MHz
- CA = 315 MHz Low power.

A new Passive Entry and Passive Start system is introduced. This system allows the driver to unlock and start the vehicle without using a vehicle key in a door lock or ignition switch. The passive entry system is an optional fitment. The passive start system is a standard fitment on all vehicles and allows the driver to start the vehicle without the use of a vehicle key. The system is combined with the passive anti-theft immobilization system. For additional information, refer to [Anti-Theft - Passive](#) (419-01B)

Emergency access to the vehicle is provided by a concealed key barrel located in the LH door handle only and in the liftgate. An emergency, removable key is fitted into the Smart Key. Operation of either key barrel unlocks the vehicle but does not disarm the alarm system. On European market vehicles, the emergency liftgate key barrel is concealed behind the license plate. The key barrel in the LH door is covered by a plastic cover which can be removed by inserting the blade of the emergency key into a slot in the underside of the cover.

The vehicle can be centrally locked and unlocked using the emergency key barrel. If the alarm is not armed the vehicle can be centrally unlocked. If the alarm is armed only the LH door can be opened using the emergency key and the alarm will be triggered. The vehicle cannot be double locked or the alarm system armed using the emergency key.

The vehicle can be centrally locked and unlocked from inside using the interior door handle release levers. Central locking and unlocking can also be performed using lock and unlock buttons on the Touch Screen Display (TSD).

The driver can select locking options, single point entry or drive away locking for example, from a menu available on the TSD.

Central Locking - RF Remote System

The RF CLS provides locking and unlocking of the vehicle from inside and outside of the vehicle. The system provides additional security by double locking the doors and liftgate from outside the vehicle.

The system is operated using buttons on the Smart Key. RF signals from the Smart Key are received by a RF receiver located in the overhead console, above the windshield. The RF receiver is available in two variants depending on market requirements. These can be identified by a suffix change to the base part number as follows:

- AA = 315 MHz
- BA = 433 MHz.

Additional buttons on the Smart Key provide for the convenience operation of the liftgate release, headlamp delay and panic alarm functions. A global open or close feature is also available in certain markets using the lock/unlock buttons.

Passive Start

The passive start system, which is standard on all vehicles, uses the Smart Key as a driver identification and authorisation device. The system is controlled by a keyless vehicle module located on the RH 'A' pillar. Three Low Frequency (LF) antennae (six if passive entry option is fitted) are positioned in specific locations in the vehicle and transmit a LF signal to the Smart Key.

On receipt of the LF signals, the Smart Key transmits a RF signal which is received by the remote receiver. Once the keyless vehicle module has approved the Smart Key, the ignition status is changed to 'accessory' by the Central Junction Box (CJB). The ignition can be switched on by pressing the 'start/stop' button, located in the center console. Starting of the

vehicle is achieved by simultaneously depressing the brake pedal and pressing the 'start/stop' button. The engine can be switched off by pressing the start/stop button for a second time.

NOTE:

The Smart Key does not need to be in the vicinity of the vehicle to switch the engine off.

In the event that the passive start system is unable to authorize the Smart Key, a start control unit is located in the center armrest. The start control unit allows the Smart Key to be inserted into a slot and allows the Smart Key transponder data to be exchanged in a conventional manner. Once the transponder data is authorized, the CJB permits the ignition to be switched on.

Passive Entry

On vehicles fitted with the optional passive entry system, the vehicle can be unlocked without the use of a key or pressing buttons on the Smart Key. The Smart Key operates for the passive entry system in addition to the passive start system.

The passive entry system is controlled by the keyless vehicle module and the six LF antennae. When the Smart Key is within one meter of the vehicle it receives the LF signals from the keyless vehicle module and the LF antennae and responds with an RF transmission of its authorization code. The RF signal is received by the RF receiver and passed to the keyless vehicle module which checks and approves the code as valid. The keyless vehicle module transmits this information to the CJB. The CJB then passes an unlock request to the door modules. When a door handle is pulled or the exterior liftgate release button is pressed, the applicable door module will allow the doors or the liftgate to be unlocked and opened.

Locking of the vehicle is performed by pressing a button located on each exterior door handle with the Smart Key within a one meter range of the vehicle. When the button is pressed, the Smart Key transmits a RF signal which is verified by the keyless vehicle module and allows the doors to be locked or double locked and the alarm system to be armed.

To double lock the vehicle, the button on the exterior door handle must be pressed twice within three seconds with the Smart Key in a one meter range of the vehicle.

If a door, liftgate or hood is ajar when an attempt to lock the vehicle is made, an error tone is emitted and the ajar panel will not lock. For additional information, refer to [Anti-Theft - Active](#) (419-01A)

LATCHES

Two hood latches are located on the bulkhead, below the windscreen. A hood release lever is located below the instrument panel on the LH 'A' pillar and is connected with a Bowden cable to the latches. A hood ajar switch is integrated in the LH hood latch.

The door latches are located at the rear of each door and engage with a striker on the 'B' pillar. Each door latch motor assembly contains microswitches for lock and unlock and door ajar. Two motors provide for the central door locking and the double locking feature. The electrical

control for the door latch components is provided by the CJB and auxiliary junction box via the driver's and passenger door modules.

The interior door handles are connected by a cable to the latch release mechanisms. The interior door handles also incorporate a locking facility to allow the doors to be locked from inside the vehicle, when the doors are closed and activate the central locking system. If a door is ajar the locking feature is inhibited.

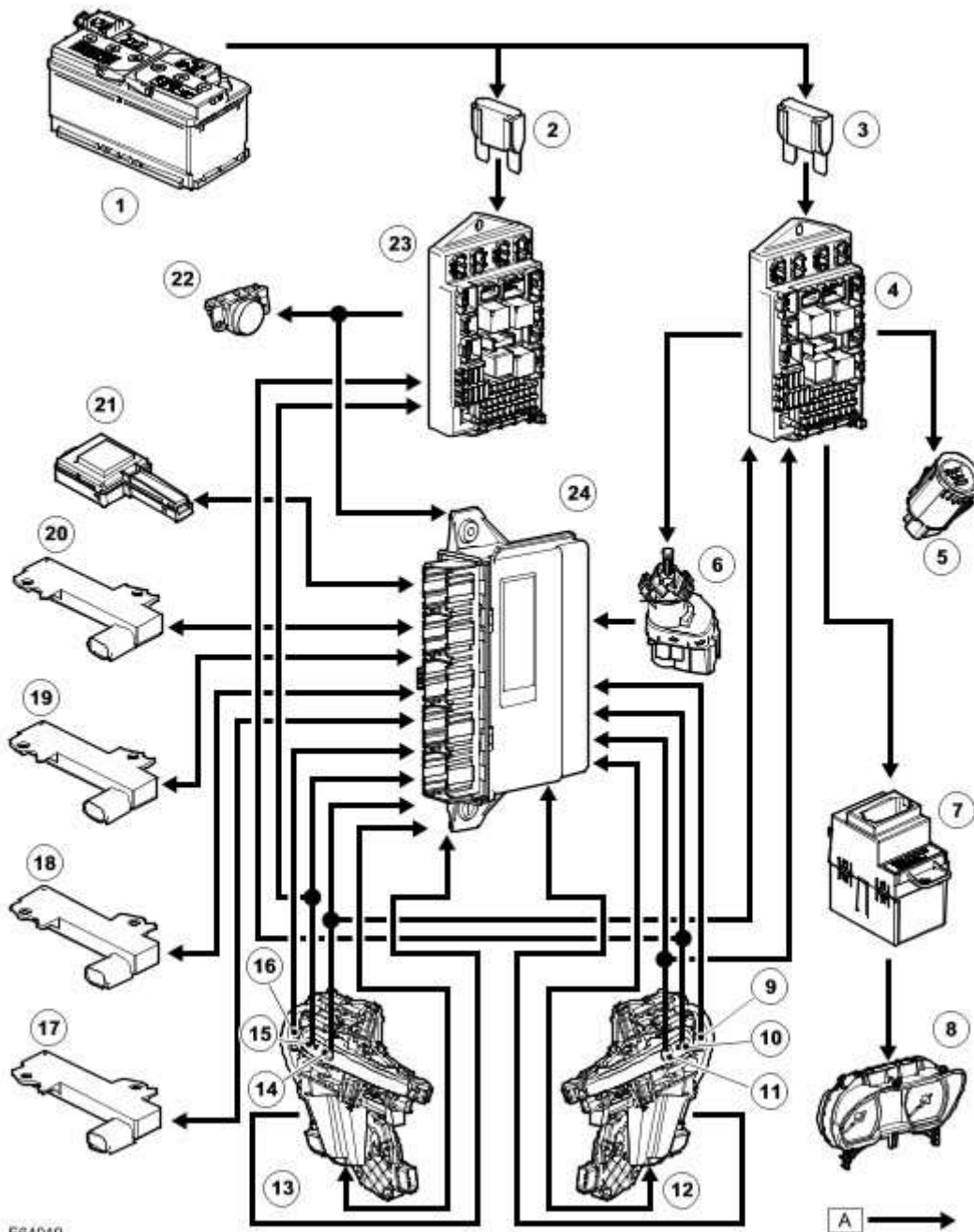
The liftgate latch is attached to the bottom of the liftgate. The latch can be released electrically by pressing the interior release button located in the auxiliary lighting switch, the exterior release button located in the licence plate finisher or the liftgate release button on the Smart Key. On North American Specification (NAS) vehicles an emergency release cable is attached to the latch. This allows the latch to be manually opened by pulling a handle located in the liftgate interior trim.

The fuel filler is electrically locked by a motor located on the fuel flap housing. The flap is locked when the vehicle is locked and alarmed and can be released by pressing the fuel flap release switch located in the auxiliary lighting switch.

CONTROL DIAGRAM - PASSIVE ENTRY SYSTEM

NOTE:

A = Hardwired



E64019

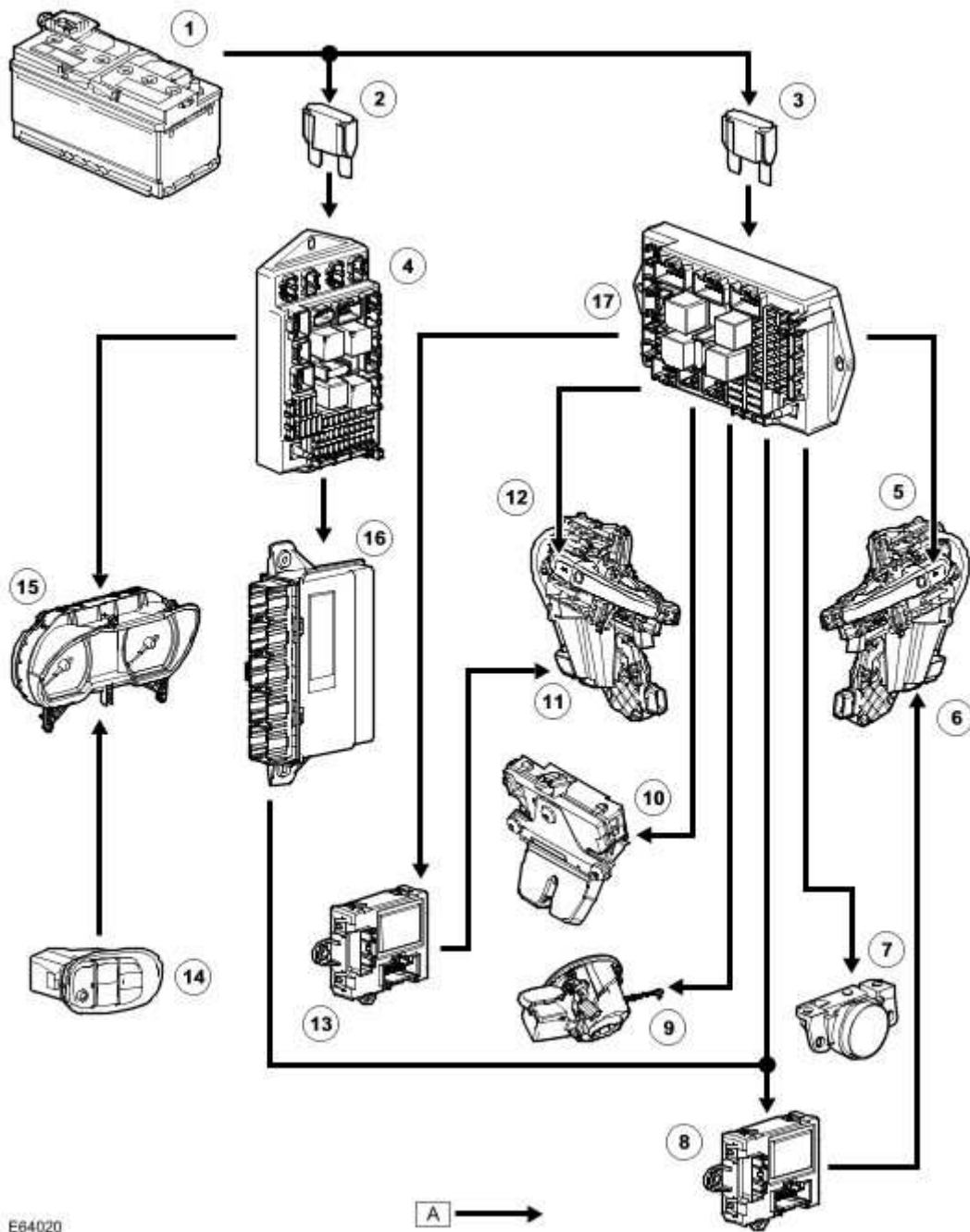
Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		CJB
5		Start/Stop switch
6		Stop lamp switch
7		Start control module

8		Instrument cluster
9		LF antenna (LH exterior door handle - only with passive entry option fitted)
10		Unlock pull switch
11		Lock push switch
12		LH Door handle, latch motor and clutch
13		RH door handle, latch motor and clutch
14		Lock push switch
15		Unlock pull switch
16		LF antenna (RH exterior door handle - only with passive entry option fitted)
17		LF antenna (rear bumper - only with passive entry option fitted)
18		LF antenna (battery bracket)
19		LF antenna (center console)
20		LF antenna (Instrument panel)
21		RF remote receiver
22		Exterior liftgate release switch
23		Auxiliary junction box
24		Keyless vehicle module

CONTROL DIAGRAM - CENTRAL LOCKING SYSTEM

NOTE:

A = Hardwired



E64020

Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Megafuse (175A)
4		CJB
5		LH door handle pull switch
6		LH door latch motor assembly
7		Liftgate external release switch
8		LH door module

9		Fuel flap motor
10		Liftgate motor assembly
11		RH door latch motor assembly
12		RH door handle pull switch
13		RH door module
14		Auxiliary lighting switch (Liftgate and fuel flap release switches)
15		Instrument cluster
16		Keyless vehicle module
17		Auxiliary junction box

Locks, Latches and Entry Systems

Principle of Operation

For a detailed description of handles, locks, latches and entry systems, refer to the relevant Description and Operation section in the workshop manual.

[Handles, Locks, Latches and Entry Systems](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Misaligned door(s), hood or luggage compartment lid • Door latch(s) • Actuating rod(s) • Exterior door handle(s) • Interior door handle(s) • Door lock cylinder • Cable(s) • Luggage compartment lid exterior release switch 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harness • Electrical connector(s) • Door lock actuator(s) • Remote transmitter batteries • Vehicle battery • Remote transmitter • Door lock switch(s)

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B10C100	FL unlock pull switch defect	<ul style="list-style-type: none"> No subtype information 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C124	FL unlock pull switch error	<ul style="list-style-type: none"> Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C300	FR unlock pull switch defect	<ul style="list-style-type: none"> No subtype information 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C324	FR unlock pull switch error	<ul style="list-style-type: none"> Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C524	TR unlock pull switch error	<ul style="list-style-type: none"> Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system


B10C61F	Exterior Trunk Antenna - general electrical error	<ul style="list-style-type: none"> • Circuit intermittent 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C71F	Interior Trunk Antenna - general electrical error	<ul style="list-style-type: none"> • Circuit intermittent 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C81F	Interior Center Antenna - general electrical error	<ul style="list-style-type: none"> • Circuit intermittent 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10C91F	Interior Front Antenna - general electrical error	<ul style="list-style-type: none"> • Circuit intermittent 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10CC24	FL Latch Switch Clutch error	<ul style="list-style-type: none"> • Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10CE24	FR Latch Switch Clutch error	<ul style="list-style-type: none"> • Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10D124	FL lock button error	<ul style="list-style-type: none"> • Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10D324	FR lock button error	<ul style="list-style-type: none"> • Signal stuck high - button stuck in active position 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U001000	Medium speed CAN communication Bus	<ul style="list-style-type: none"> • No subtype information 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication with CJB	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost communication with RJB	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication	<ul style="list-style-type: none"> • Missing message 	Carry out any pinpoint tests associated with this DTC

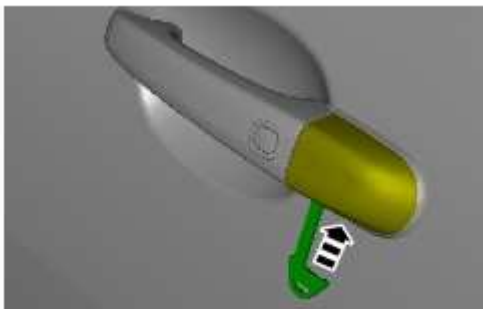
	with instrument cluster		using the manufacturer approved diagnostic system
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the remote keyless entry module, refer to the new module installation note at the top of the DTC Index
U201F00	Receiver communication error	<ul style="list-style-type: none"> No subtype information 	Install a new RF receiver, refer to the new module/component installation note at top of DTC Index
U201F13	Receiver communication error	<ul style="list-style-type: none"> Line open 	Refer to the electrical circuit diagrams and test RF receiver communication circuit to remote keyless entry module for short to ground or open circuit
U201F87	Receiver communication error	<ul style="list-style-type: none"> Transmission error 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U210000	Control Module/ECU not configured	<ul style="list-style-type: none"> No subtype information 	Configure the Remote Keyless Entry module using the manufacturer approved diagnostic system
U210100	Control Module/ECU unexpected data values	<ul style="list-style-type: none"> No subtype information 	Re-configure the RJB using the manufacturer approved diagnostic system
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new remote keyless entry module, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U300362	Battery voltage	<ul style="list-style-type: none"> Mis-match of battery voltage, of 2 volts or lower, between remote 	Carry out any pinpoint tests associated with this DTC using the manufacturer

		keyless entry module and RJB	approved diagnostic system
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Door Lock Cylinder Cover

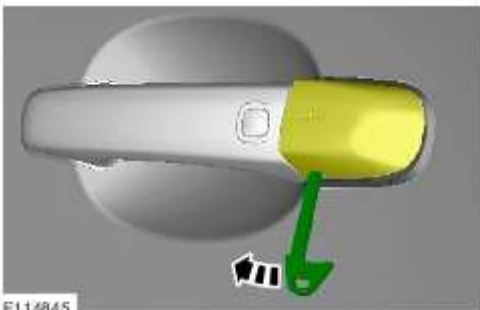
Removal

- 1  **CAUTION: Make sure that excessive force is not used. Failure to follow this instruction may result in damage to the vehicle.**



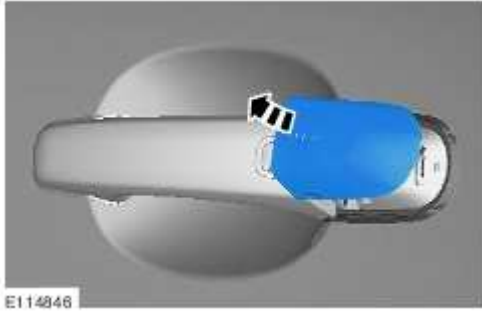
E114844

2.




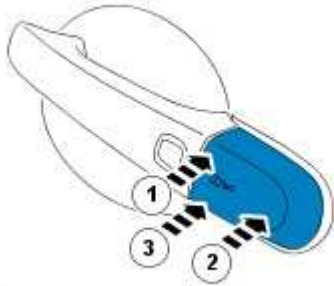
E114845

3.



Installation

- 1  **CAUTION:** Make sure that the door lock cylinder cover is pushed firmly in the sequence shown to install all 3 clips, and that the door lock cylinder cover is securely attached to the vehicle. Failure to follow this instruction may result in damage to the vehicle.



Exterior Door Handle (76.58.07)

Removal

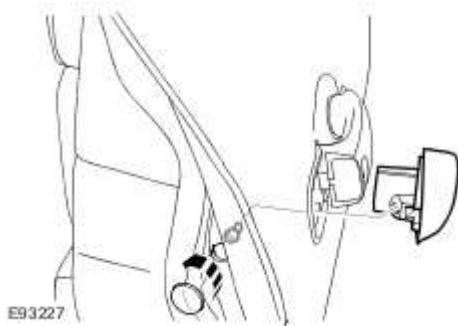
All vehicles

1 . NOTE:

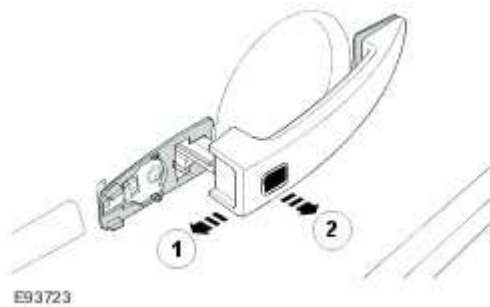
Remove the screw sufficiently, only to release the component.

Remove the door lock cylinder.

- ▶ Position the door seal aside for access.
- ▶ Remove the screw cover.
- ▶ Loosen the Torx screw to release the lock.



2 . Release the front door exterior handle.



Vehicles with keyless entry

3



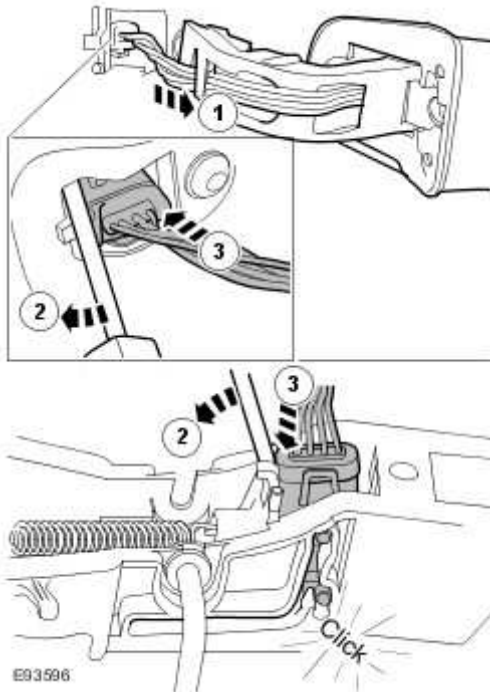
CAUTION: Take extra care not to damage the wiring harnesses.



CAUTION: Make sure the electrical connector is securely in the service position, before disconnection. If the connector springs back after disconnection the internal door trim panel will have to be removed for access.

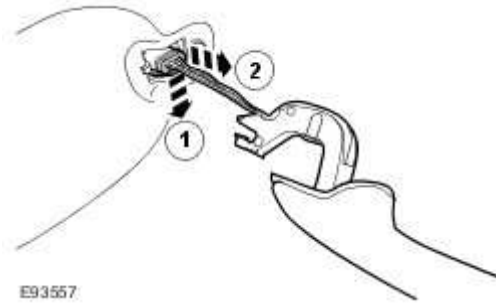
Position the electrical connector in the service position.

- ▶ Carefully pull on the harness to position the electrical connector at the door panel (1).
- ▶ Use a small screwdriver to align the electrical connector with its service location (2).
- ▶ While retaining its alignment, push on the electrical connector to 'click' it into its service location (3).



Vehicles with keyless entry

- 4 . Disconnect the electrical connector.

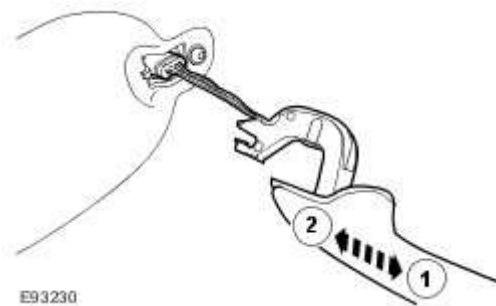


Installation

Vehicles with keyless entry

- 1 . Connect and secure the electrical connector.

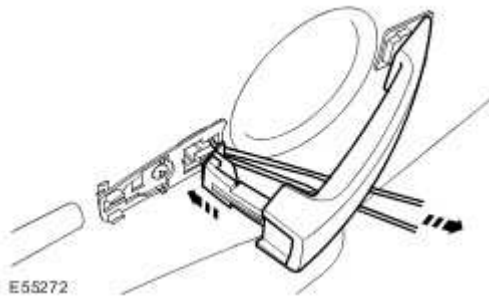
► Release the electrical connector from the service position.



All vehicles

- 2 Install the exterior door handle.

► Use a length of cord to hold the lock lever against spring pressure, while engaging the outside handle.



3 . Install the door lock cylinder.

- ▶ Tighten the Torx screw to 6 Nm (4 lb.ft).
- ▶ Install the screw cover.
- ▶ Re-position the seals if required.

Front Door Lock Actuator (76.37.74)

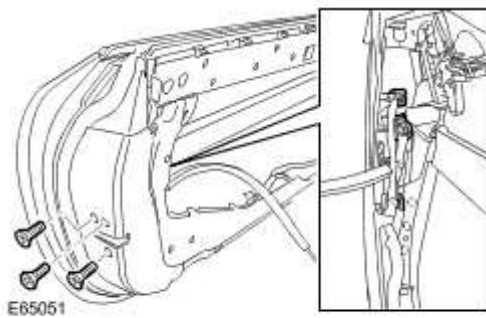
Removal

- 1 . Remove the window regulator.

For additional information, refer to [Front Door Window Regulator](#)

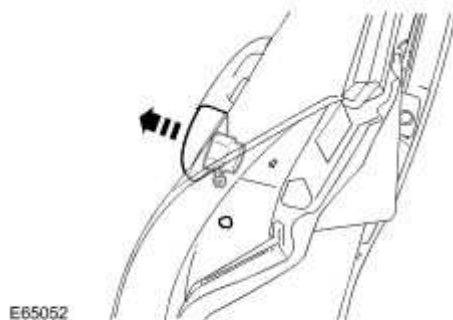
- 2 . Release the door latch.

- ▶ Remove the 3 Torx bolts.
- ▶ Disconnect the 3 electrical connectors.



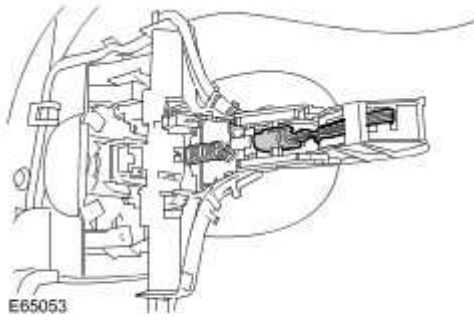
- 3 . Remove the door lock cylinder.

- ▶ Remove the Torx screw.



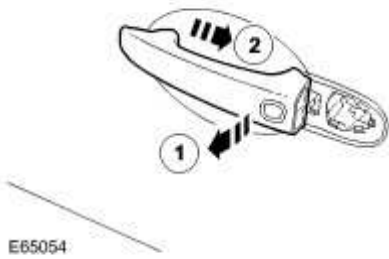
- 4 . Release the front door exterior handle.

- ▶ Disconnect the electrical connector.



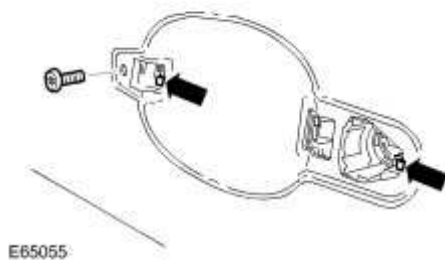
5 . Remove the front door exterior handle.

- ▶ Release from the door handle mechanism.



6 . Remove the door handle mechanism and latch assembly.

- ▶ Remove the Torx screw.
- ▶ Release the retainer.

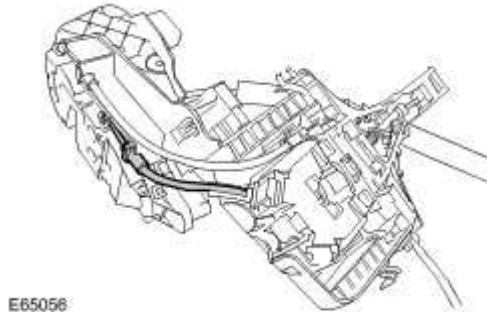


7 . **NOTE:**

Do not disassemble further if the component is removed for access only.

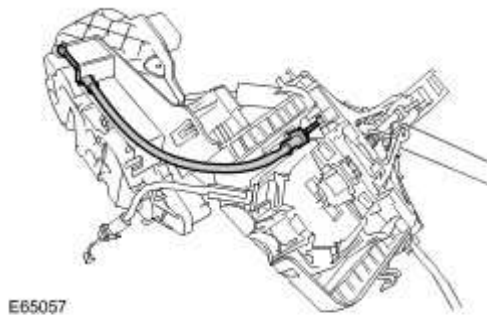
Detach the door release cable from the door handle mechanism.

▶ Carefully release the clips.



8 . Detach the door lock cable from the door latch.

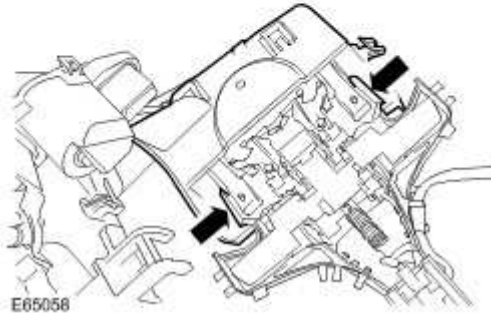
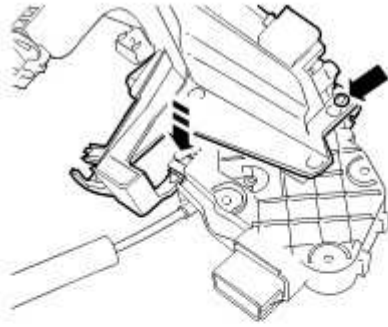
▶ Carefully release the clips.



9 . Remove the door handle mechanism and latch assembly security panel.

▶ Drill out the rivet.

▶ Release the 2 clips.



Installation

- 1 . Install the door handle mechanism and latch assembly security panel.
 - ▶ Secure in the clips.
 - ▶ Install the new rivet.
- 2 . Attach the door lock cable to the door latch.
 - ▶ Secure in the clips.
- 3 . Attach the door release cable to the door handle mechanism.
 - ▶ Secure in the clips.
- 4 . Install the door handle mechanism and latch assembly.
- 5 . Install the front door exterior handle.
 - ▶ Attach to the door handle mechanism.
- 6 . Secure the front door exterior handle.
 - ▶ Connect the electrical connector.
- 7 . Install the door lock cylinder.
 - ▶ Tighten the Torx screw to 6 Nm (4 lb.ft).

8 . Secure the door latch.

▶ Tighten the Torx bolts to 7 Nm (5 lb.ft).

▶ Connect the electrical connectors.

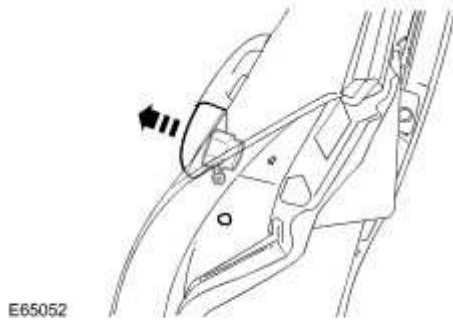
9 . Install the window regulator.

For additional information, refer to [Front Door Window Regulator](#)

Front Door Lock Cylinder (76.37.71)

Removal

- 1 . Remove the door lock cylinder.
 - ▶ Remove the Torx screw.



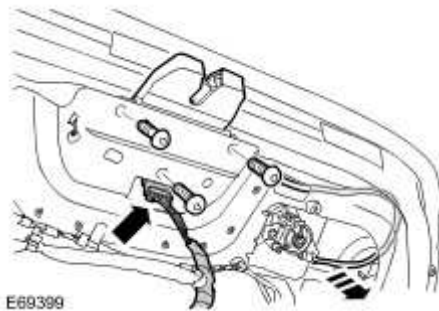
Installation

- 1 . Install the door lock cylinder.
 - ▶ Tighten the Torx screw to 6 Nm (4 lb.ft).

Luggage Compartment Lid Latch Actuator (76.19.25)

Removal

- 1 . Remove the luggage compartment lid trim panel.
- 2 . Remove the luggage compartment lid latch operating cable from the lock cylinder.
 - ▶ Release the cable from the clip.
- 3 . Remove the luggage compartment lid latch assembly.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 Torx bolts.



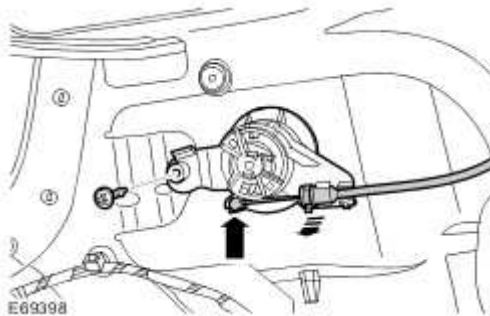
Installation

- 1 . Install the luggage compartment lid latch assembly.
 - ▶ Install the 3 Torx bolts.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the bolts to 20 Nm (15 lb.ft).
- 2 . Connect the luggage compartment lid latch operating cable to the lock cylinder.
 - ▶ Install the cable.
- 3 . Install the luggage compartment lid trim panel.

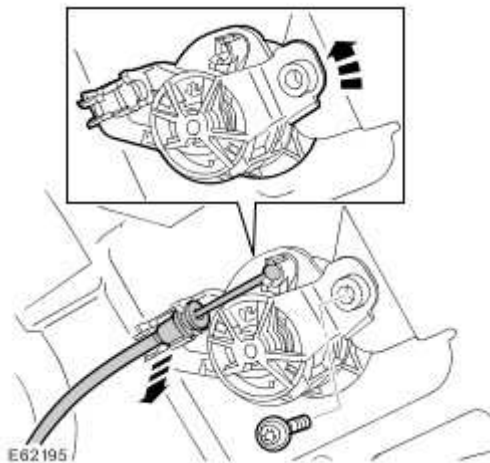
Luggage Compartment Lid Lock Cylinder (76.19.19)

Removal

- 1 . Remove the luggage compartment lid trim panel.
- 2 . Remove the luggage compartment lid latch operating cable from the lock cylinder.
▶ Release the cable from the clip.




- 3 . Remove the luggage compartment lid lock cylinder.
▶ Remove the bolt.




Installation

- 1 . Install the luggage compartment lid lock cylinder.
▶ Install the bolt.

 Tighten the Torx bolt to 3 Nm (2 lb.ft).

2 . Connect the luggage compartment lid latch operating cable to the lock cylinder.

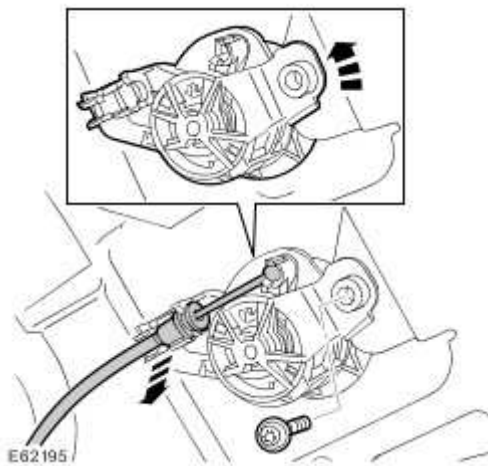
 Install the cable.

3 . Remove the luggage compartment lid trim panel.

Liftgate Lock Cylinder

Removal

- 1 . Remove the liftgate lower trim panel.
For additional information, refer to [Liftgate Lower Trim Panel](#)
- 2 . Remove the liftgate lock cylinder.
 - ▶ Remove the Torx screw.
 - ▶ Release the liftgate lock cylinder cable.
 - ▶ Remove the liftgate lock cylinder housing.



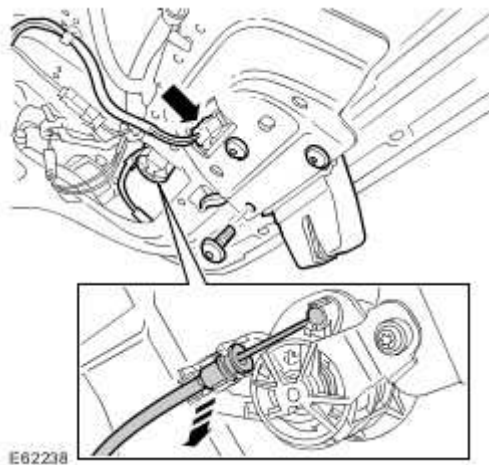
Installation

- 1 . Install the liftgate lock cylinder.
 - ▶ Install the liftgate lock cylinder housing.
 - ▶ Fit and tighten the Torx screw.
 - ▶ Attach the liftgate lock cylinder cable.
- 2 . Install the liftgate lower trim panel.
For additional information, refer to [Liftgate Lower Trim Panel](#)

Liftgate Latch Actuator (86.25.65.60)

Removal

- 1 . Remove the liftgate lower trim panel.
For additional information, refer to [Liftgate Lower Trim Panel](#)
- 2 . Remove the liftgate latch.
 - ▶ Release the liftgate latch cable.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 3 bolts.



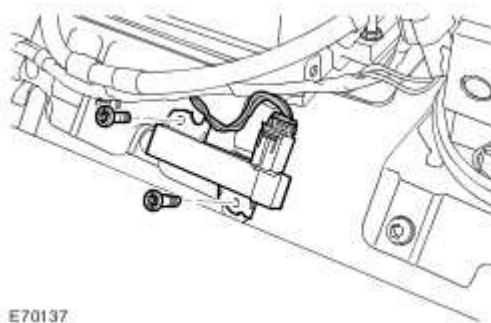
Installation

- 1 . Install the liftgate latch.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
 - ▶ Attach the liftgate latch cable.
- 2 . Install the liftgate lower trim panel.
For additional information, refer to [Liftgate Lower Trim Panel](#)

Radio Frequency (RF) Receiver

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Remove the keyless vehicle antenna.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Disconnect the electrical connector.



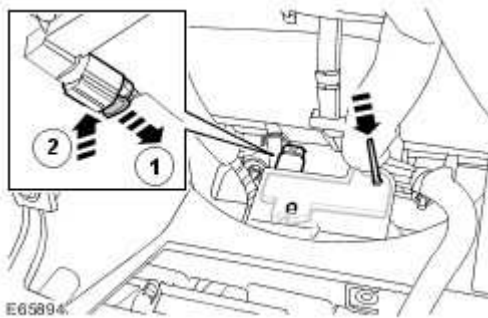
Installation

- 1 . Install the keyless vehicle antenna.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolts to 3 Nm (2 lb.ft).
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to

Keyless Vehicle Front Antenna

Removal

- 1 . Remove the navigation system display module.
For additional information, refer to [Navigation System Display Module \(86.62.07\)](#)
- 2 . Remove the keyless vehicle antenna.
 - ▶ Remove and collect the center of the clips.
 - ▶ Disconnect the electrical connector.



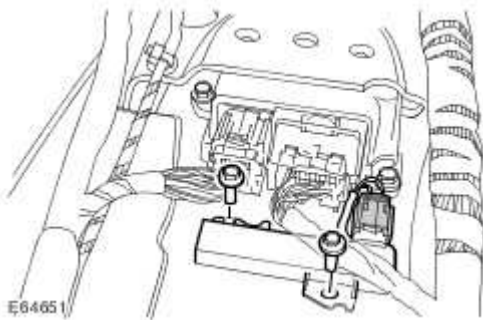
Installation

- 1 . Install the keyless vehicle antenna.
 - ▶ Connect the electrical connector.
 - ▶ Carefully align and secure the clips.
- 2 . Install the navigation system display module.
For additional information, refer to [Navigation System Display Module \(86.62.07\)](#)

Keyless Vehicle Center Antenna

Removal

- 1 . Remove the floor console.
For additional information, refer to [Floor Console \(76.25.01\)](#)
- 2 . Remove the keyless vehicle antenna.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Disconnect the electrical connector.



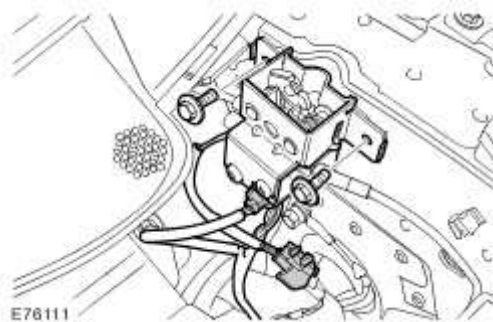
Installation

- 1 . Install the keyless vehicle antenna.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the Torx bolts to 3 Nm (2 lb.ft).
- 2 . Install the floor console.
For additional information, refer to [Floor Console \(76.25.01\)](#)

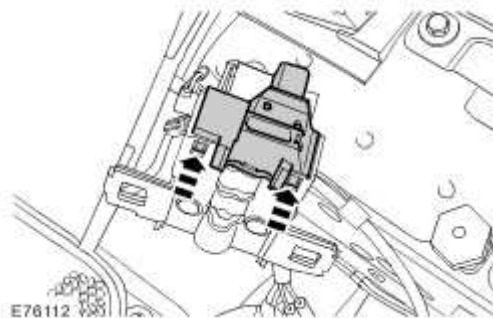
Hood Latch

Removal

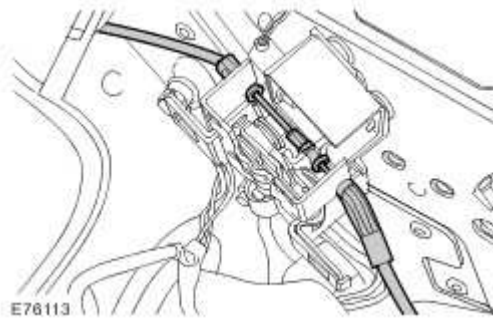
- 1 . Remove the pedestrian protection actuator and bracket.
For additional information, refer to [Pedestrian Protection Hood Actuator LH](#)
For additional information, refer to [Pedestrian Protection Hood Actuator RH](#)
- 2 . Release the hood latch.
 - ▶ Remove the 2 bolts.
 - ▶ Disconnect the 2 electrical connectors.



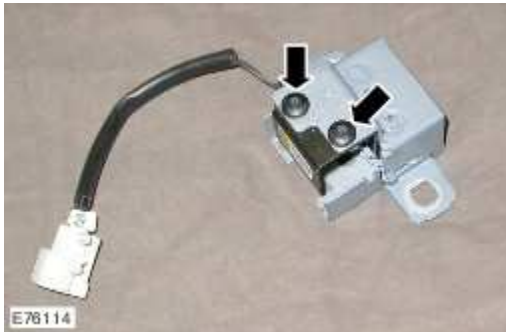
- 3 . Remove the hood switch.
 - ▶ Release the 2 clips.



- 4 . Remove the hood latch.
 - ▶ Release the latch cable.



- 5 . Remove the pedestrian protection latch actuator.
 - ▶ Remove and discard the 2 Torx bolts.
 - ▶ Disconnect the 2 electrical connectors.



Installation

- 1 . Install the pedestrian protection latch actuator.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the new Torx bolts to 9 Nm (7 lb.ft).
- 2 . Install the hood latch.
 - ▶ Attach the latch cable.
- 3 . Install the hood switch.
 - ▶ Secure in the clips.
- 4 . Secure the hood latch.
 - ▶ Connect the electrical connectors.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- 5 . Install the pedestrian protection actuator and bracket.

For additional information, refer to [Pedestrian Protection Hood Actuator LH](#)
For additional information, refer to [Pedestrian Protection Hood Actuator RH](#)

501-16 : Wipers and Washers

Specifications

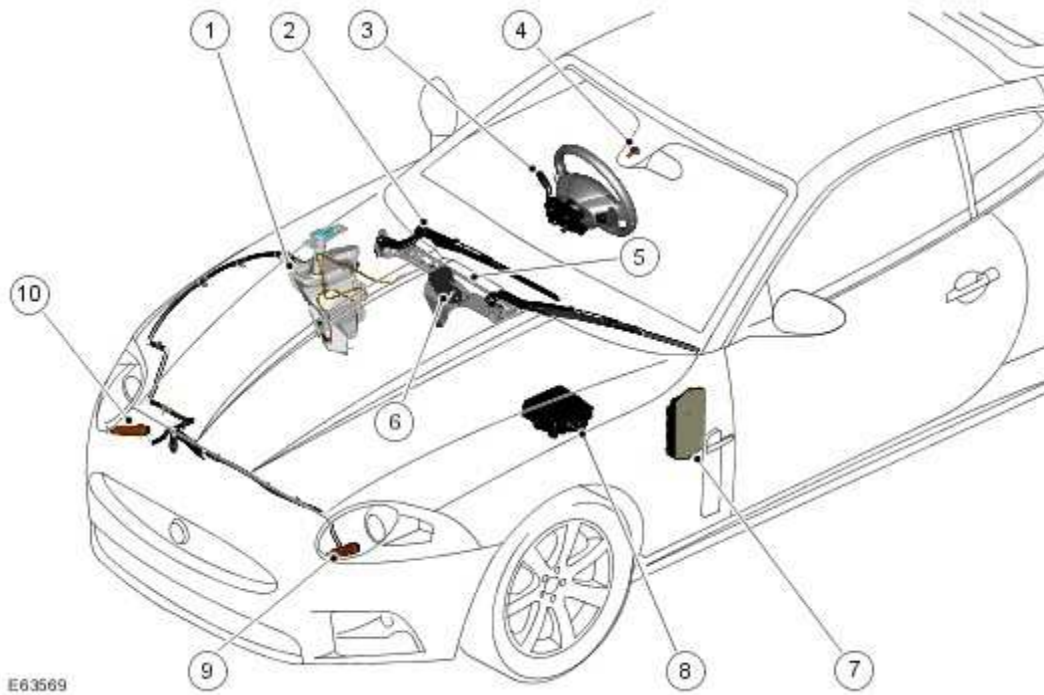
Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Windshield washer reservoir - screw	9	-	79
Windshield wiper arm to spindle - nut	23	17	-
Windshield wiper motor and wiper spindles to bulkhead - screw	9	-	79

Wipers and Washers

COMPONENT LOCATION



Item	Part Number	Description
1		Washer reservoir bottle and filler neck
2		Wiper arms/blades (2 off)
3		Wiper/washer control switch
4		Rain sensor
5		Mounting arm and pivot shaft
6		Wiper motor
7		Central Junction Box (CJB)
8		Power distribution box
9		RH headlamp power wash jet
10		LH headlamp power wash jet

INTRODUCTION

The wipers have two speed controls, low and high, and an intermittent wipe mode. The wipers will park automatically irrespective of their position, when the ignition is in power mode 3

(OFF) or the control switch is selected.

A timed jet function eliminates the trail of washer fluid left on the windshield after a wiping action and reduces fluid consumption by only operating the washer jets on the up stroke of the wiper arms.

Within the wiper and washer system the following features can be attained:

- Adjustable interval intermittent wiping
- Speed dependant wiping
- Programmable wash and wipe sequencing
- Automatic moisture sensitive wiping (rain sensor).

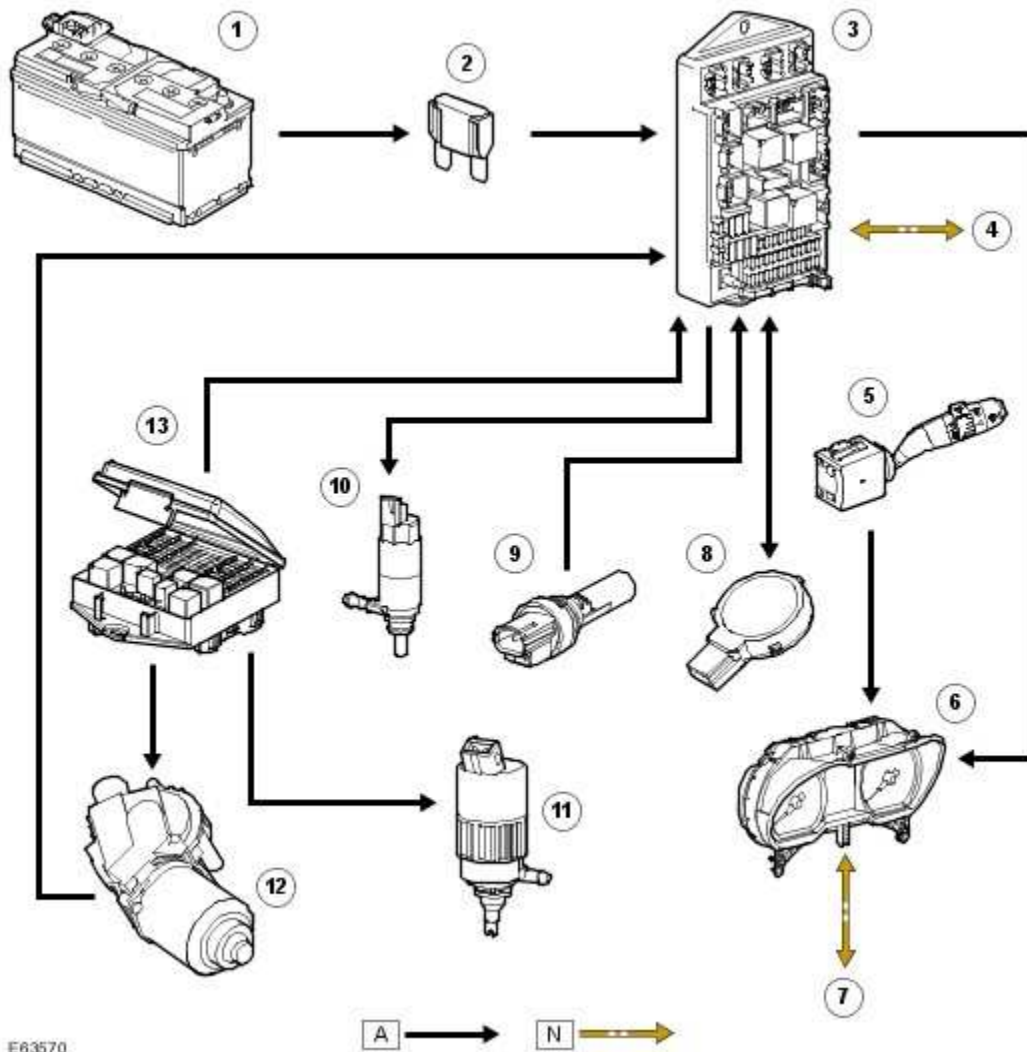
Moisture sensitive wiping will be initiated when the vehicle is running and not in the PARK or NEUTRAL gear selection. The wiper switch must be in the AUTO position.

The system and features are controlled by the Central Junction Box (CJB).

CONTROL DIAGRAM

NOTE:

A = Hardwired: **N** = CAN bus



E63570

Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Central Junction Box (CJB)
4		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
5		Column switch
6		Instrument cluster
7		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
8		Rain sensor
9		Reservoir fluid level sensor
10		Windshield washer pump
11		Headlamp powerwash pump

12		Wiper motor
13		Power distribution box

Wipers and Washers

Principle of Operation

For a detailed description of the wipers and washers, refer to the relevant Description and Operation section in the workshop manual.

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none">• Wiper blade(s)• Wiper pivot arm shaft• Washer reservoir• Hose(s)• Washer jet(s)	<ul style="list-style-type: none">• Fuse(s)• Wiring harness• Electrical connector(s)• Washer pump(s)• Wiper motor

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, verify the symptom and refer to the manufacturer approved diagnostic system.

Headlamp Washer Jet (84.20.08)

Removal



WARNING: Vehicles fitted with Xenon headlamps, the following precautions must be observed. Failure to comply may result in exposure to ultra violet rays, severe electric shock, burns or the risk of explosion. Ensure the headlamps are switched off at all times. Eye and hand protection must be worn. Never switch on the lamps or test the bulbs with the lamp holder released from the headlamp.

- 1 . Disconnect the battery ground cable.
For additional information, refer to

- 2 . Open the hood.

3

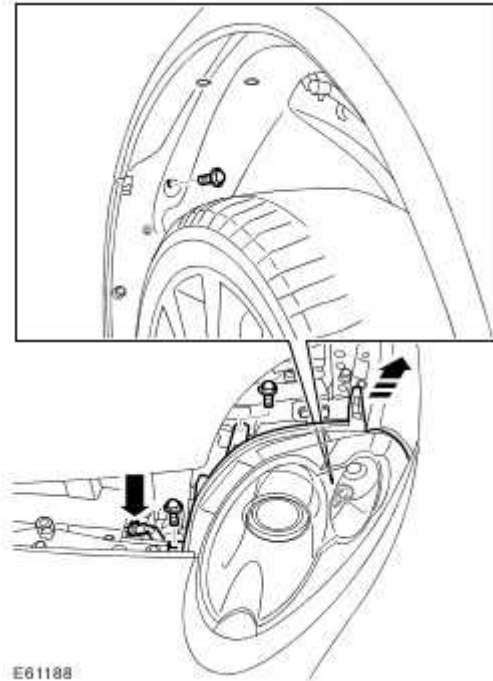


CAUTION: Always protect paintwork and glass when removing exterior components.

Release the headlamp assembly.

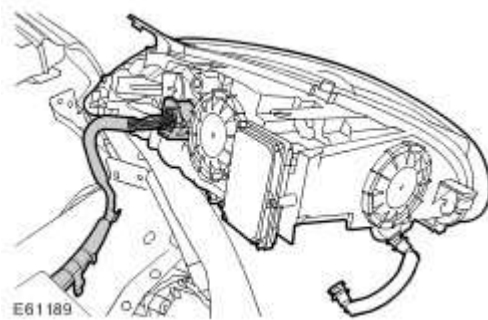
- ▶ Remove the 3 bolts.
- ▶ Release the locating pegs.

- 4 . Disconnect the washer jet hose.



5 . Remove the LH headlamp assembly.

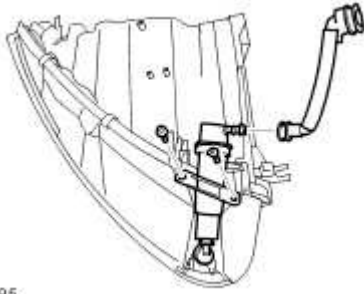
- ▶ Disconnect the electrical connector.



6 . Remove the headlamp washer jet.

- ▶ Disconnect the washer jet hose.
- ▶ Remove the 2 Torx screws.

E61195



Installation

- 1 . Install the headlamp washer jet.
 - ▶ Tighten the Torx screws.
 - ▶ Connect the washer jet hose.

- 2 . Install the headlamp assembly.
 - ▶ Connect and secure the electrical connector.
 - ▶ Position the locating pegs.

- 3 . Connect the washer jet hose.


- 4 . Secure the headlamp assembly.
 - ▶ Tighten the bolts.

- 5 . Close the hood.

- 6 . Connect the battery ground cable.
For additional information, refer to

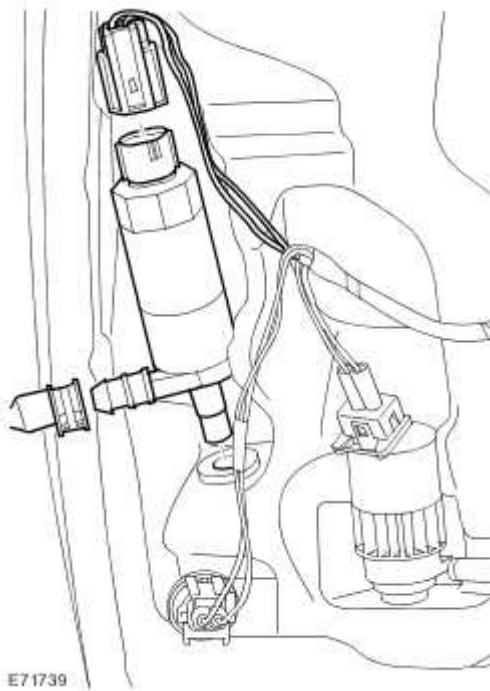
Headlamp Washer Pump (84.20.21)

Removal

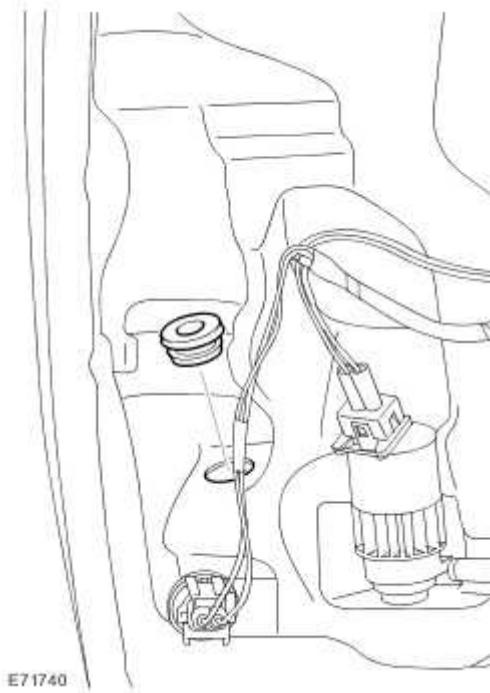
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the RH fender splash shield.
For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 3 . Drain the washer reservoir fluid.
 - ▶ Position a container to collect the fluid.
- 4 . Remove the headlamp washer pump.
 - ▶ Disconnect the washer jet hose.
 - ▶ Disconnect the electrical connector.



- 5 . Remove and discard the seal.



Installation

- 1 . Install a new seal.
- 2 . Install the windshield washer pump.
 - ▶ Connect and secure the electrical connector.
 - ▶ Connect the washer jet hose.
- 3 . Install the fender splash shield.

For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 4 . Refill the washer reservoir.
- 5 . Install the windshield washer pump.
 - ▶ Connect and secure the electrical connector.
 - ▶ Connect the washer jet hose.

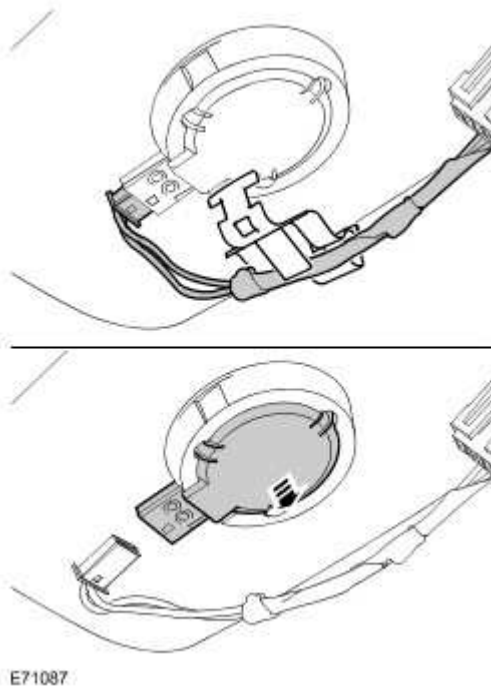
Rain Sensor (84.12.10)

Removal

- 1 . Remove the interior mirror.
For additional information, refer to [Auto-Dimming Interior Mirror \(76.10.56\)](#)
- 2 . **NOTE:**
Note the fitted position.

Remove the rain sensor.

- ▶ Remove the clip.
- ▶ Disconnect the electrical connector.



Installation

- 1 . **NOTE:**
Align to the position noted on removal.

Install the rain sensor.


- ▶ Install the clip.
- ▶ Connect and secure the electrical connector.

2 . Install the interior mirror.

For additional information, refer to [Auto-Dimming Interior Mirror \(76.10.56\)](#)

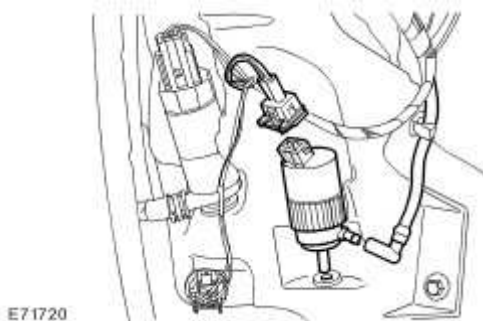
Windshield Washer Pump (84.10.21)

Removal

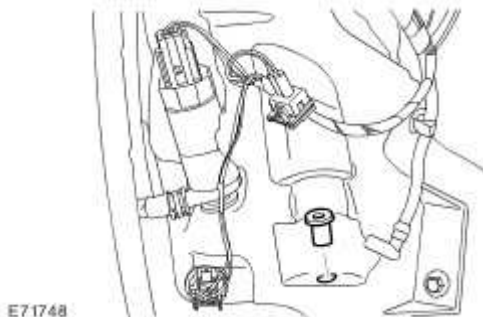
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.



- 2 . Remove the RH fender splash shield.
For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 3 . Drain the washer reservoir fluid.
 - ▶ Position a container to collect the fluid.
- 4 . Remove the windshield washer pump.
 - ▶ Disconnect the washer jet hose.
 - ▶ Disconnect the electrical connector.



- 5 . Remove and discard the seal.



Installation


- 1 . Install a new seal.
- 2 . Install the windshield washer pump.
 -  Connect and secure the electrical connector.
 -  Connect the washer jet hose.
- 3 . Install the fender splash shield.
For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 4 . Refill the washer reservoir.

Windshield Washer Reservoir (84.10.01)


Removal

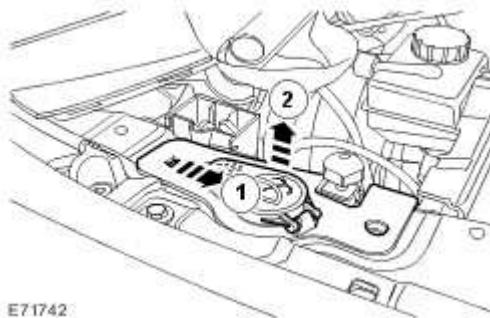
NOTE:


Some fluid spillage is inevitable during this operation.

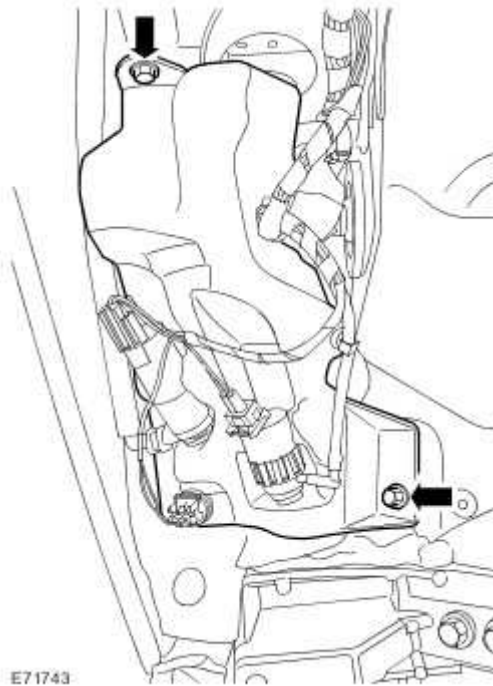
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the RH fender splash shield.
For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 3 . Remove the windshield washer reservoir filler neck.
 Release the clip.



- 4 . Release the washer reservoir.
 Remove the 2 bolts.

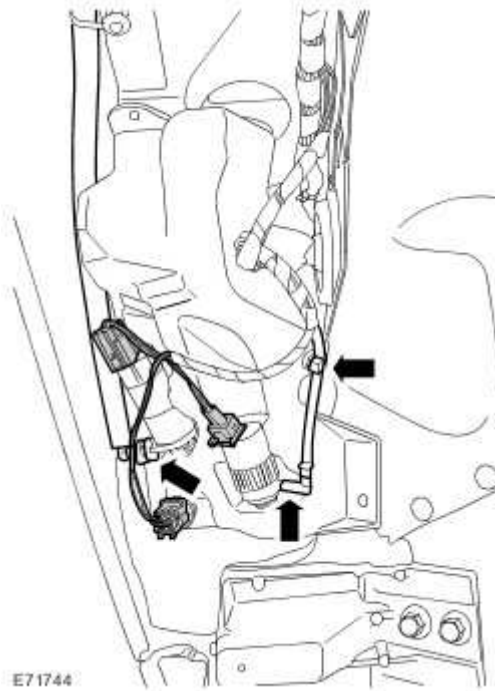


5 . NOTE:

Note the fitted position.

Remove the windshield washer reservoir.

- ▶ Position a container to collect spillage.
- ▶ Disconnect the 3 electrical connectors.
- ▶ Carefully release the clip.
- ▶ Disconnect the 2 washer jet hoses.



6 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the washer reservoir low level sensor.

▶ Remove and discard the seal.

7 . Remove the headlamp washer pump.

▶ Remove and discard the seal.

8 . Remove the windshield washer pump.

▶ Remove and discard the seal.

9 . Remove the filler neck seal.

10 . Remove the rubber mount.



Installation

1 . Install the rubber mount.

2 . Install the filler neck seal.

3 . Install the windshield washer pump.

▶ Install a new seal.

4 . Install the headlamp washer pump.

▶ Install a new seal.

5 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Install the washer reservoir low level sensor.

▶ Install a new seal.

6 . **NOTE:**

Align to the position noted on removal.


Install the windshield washer reservoir.

▶ Connect the washer jet hoses.

▶ Connect and secure the electrical connectors.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

7 . Install the windshield washer reservoir filler neck.

 Release the clip.

8 . Install the fender splash shield.


For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)

9 . Refill the washer reservoir.

Windshield Wiper Motor - LHD RWD (84.15.13)

Removal


- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)

- 2  **WARNING: Do not work on or near the engine if the engine is hot. Failure to follow these instructions may result in personal injury.**

Remove the cowl vent screen.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

- 3 . Remove the engine cover.
For additional information, refer to [Engine Cover \(76.11.35\)](#)

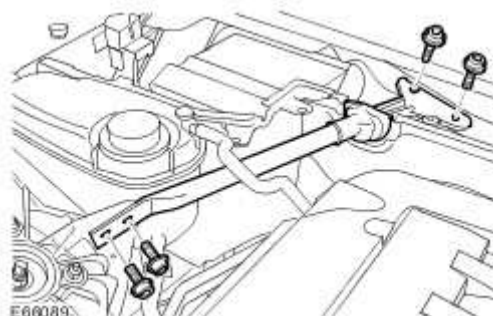
- 4  **CAUTION: Care must be taken whilst removing the engine compartment bolts. Failure to follow this instruction may result in damage to the A/C pipes.**

NOTE:

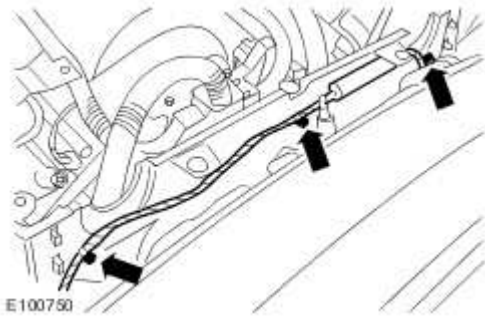
Right-hand shown, left-hand similar.

Remove the engine compartment braces.

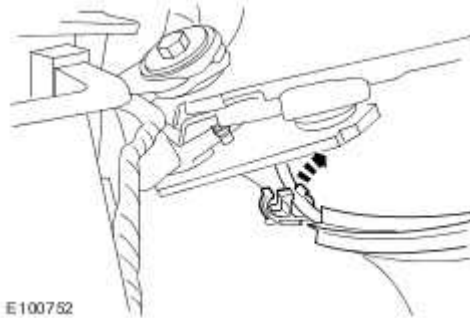
- ▶ Release the grommet.
- ▶ Remove the 4 Torx bolts.
- ▶ Repeat the above procedure for the other side.



- 5 . Detach the wiring harness.
 - ▶ Release the 3 clips.

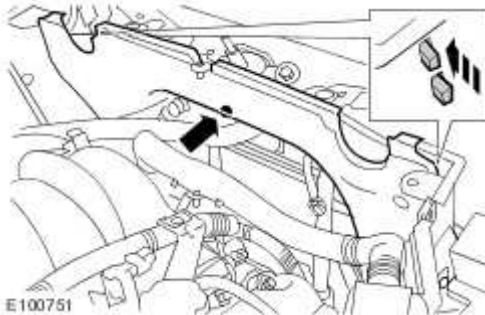


6 . Using a suitable tool, remove the hood release cable clip.



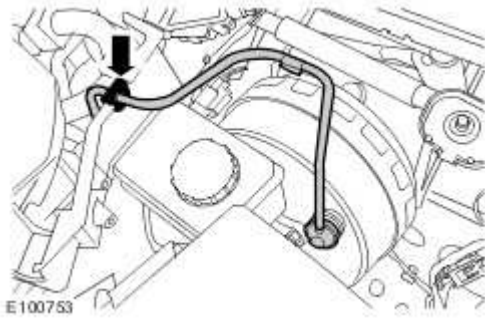
7 . Remove the secondary bulkhead center panel.

- ▶ Remove the nut.
- ▶ Release the 4 clips.



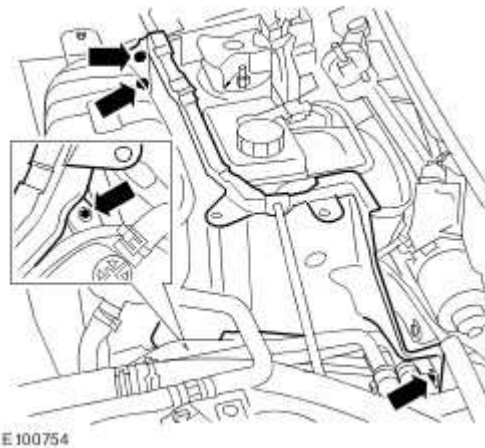
8 . Release the brake booster vacuum hose.

- ▶ Release the grommet.



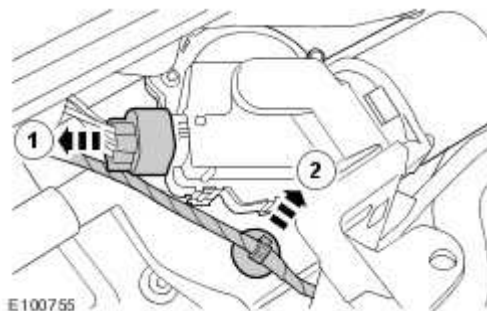
9 . Release the secondary bulkhead RH panel.

- ▶ Remove the air conditioning (A/C) pipe bracket bolt.
- ▶ Remove the coolant expansion tank mounting bracket bolt.
- ▶ Remove the remaining 2 bolts.



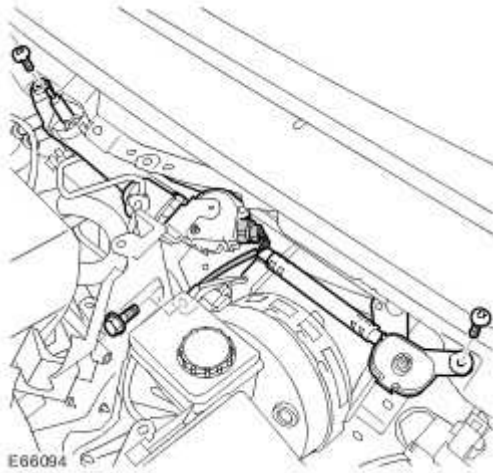
10 . Disconnect the windshield wiper motor electrical connector.

- ▶ Detach the wiring harness clip.

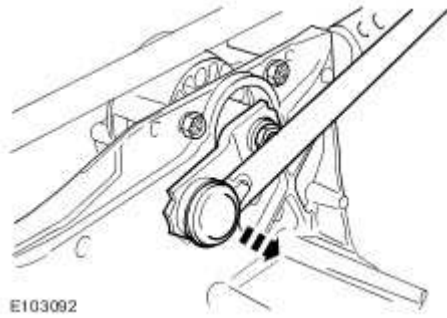


11 . Remove the windshield wiper motor and linkage mechanism.

- ▶ Remove the 3 bolts.



12 . Disconnect the connecting rod.

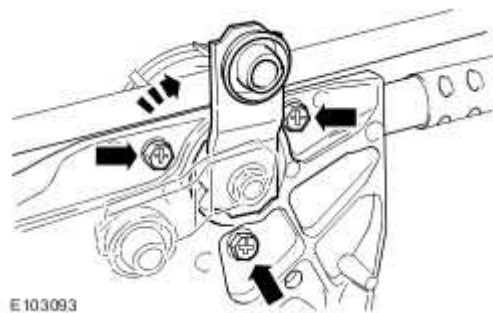


13 . **NOTE:**

Note the original position of the windshield wiper motor crank arm.

Remove the windshield wiper motor.

- ▶ Rotate the windshield wiper motor crank arm 90 degrees clockwise.
- ▶ Remove the 3 bolts.



Installation

1 . NOTE:

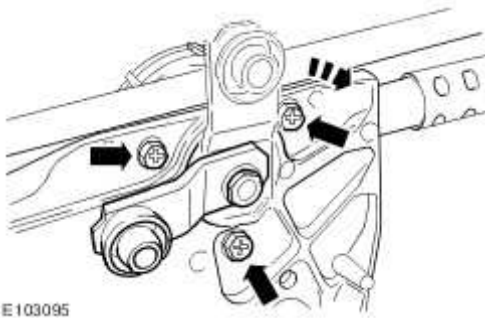
Note the original position of the windshield wiper motor crank arm.

Rotate the windshield wiper motor crank arm 90 degrees clockwise.



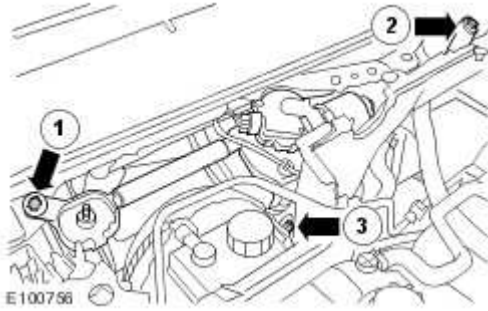
2 Install the windshield wiper motor.

- ▶ Tighten the 3 bolts to 5 Nm.
- ▶ Rotate the windshield wiper motor crank arm 270 degrees clockwise to the original position.



3 . Install the windshield wiper motor and linkage mechanism.

- ▶ Loosely install the 3 bolts.
- ▶ Tighten bolt 1 to 9 Nm.
- ▶ Tighten bolt 2 to 9 Nm.
- ▶ Tighten bolt 3 to 9 Nm.
- ▶ Connect and secure the electrical connector.



- 4 . Install the secondary bulkhead RH panel.
 - ▶ Tighten the 4 bolts to 4 Nm.

- 5 . Install the secondary bulkhead center panel.
 - ▶ Attach the hood release cable clip.
 - ▶ Attach the 3 wiring harness clips.
 - ▶ Secure the 4 clips.
 - ▶ Tighten the nut to 4 Nm.

- 6 . Position the brake booster vacuum hose to one side.
 - ▶ Position and secure the grommet.

- 7 . Install the engine compartment braces.
 - ▶ Tighten the Torx bolts to 55 Nm.
 - ▶ Install the grommet.
 - ▶ Repeat the above procedure for the other side.

- 8 . Install the engine cover.

For additional information, refer to [Engine Cover \(76.11.35\)](#)

- 9 . Connect the battery ground cable and install the cover.

For additional information, refer to [Specifications](#)

- 10 Carry out the windshield wiper motor park operation.
 - ▶ Switch the ignition on.
 - ▶ Turn on the windshield wipers and make sure that the wiper spindles perform a full cycle.
 - ▶ Turn off the windshield wipers.
 - ▶ Switch the ignition off.

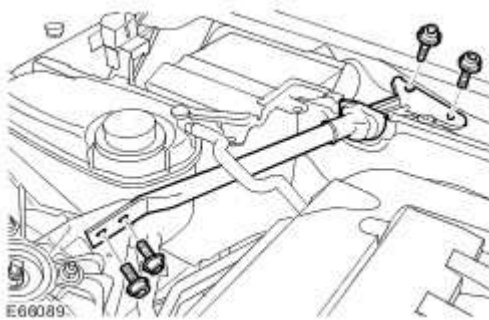
- 11 . Install the cowl vent screen.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

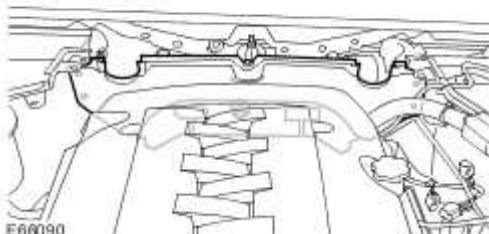
Windshield Wiper Motor - RHD RWD (84.15.13)

Removal

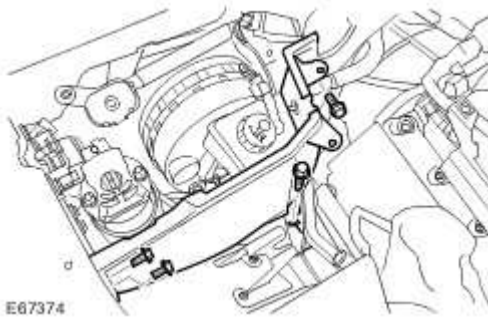
- 1 . Remove the plenum chamber panel.
For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)
- 2 . Remove the coolant expansion tank.
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)
- 3 . Remove the engine compartment braces.
 - ▶ Release the grommet.
 - ▶ Remove the 4 Torx bolts.
 - ▶ Repeat the above procedure for the other side.



- 4 . Remove the secondary bulkhead panel.
 - ▶ Remove the nut.
 - ▶ Release the 4 clips.

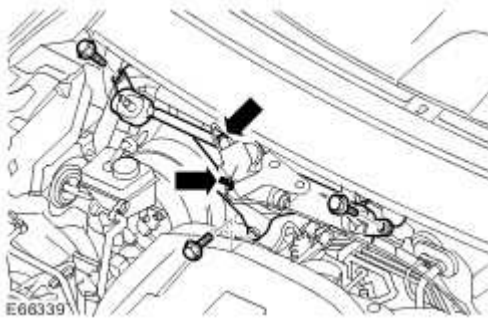


- 5 . Release the engine compartment RH side wall.
 - ▶ Remove the 4 bolts.



6 . Remove the windshield wiper motor.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 3 bolts.



Installation

1 . Install the windshield wiper motor.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- ▶ Connect and secure the electrical connector.

2 . Install the engine compartment RH side wall.

- ▶ Tighten the bolts to 6 Nm (4 lb.ft).

3 . Install the secondary bulkhead panel.

- ▶ Carefully secure the clips.
- ▶ Tighten the nut to 4 Nm (3 lb.ft).

4 . Install the engine compartment braces.

- ▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).
- ▶ Install the grommet.

 Repeat the above procedure for the other side.

5 . Install the coolant expansion tank.

For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)

6 . Remove the plenum chamber panel.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

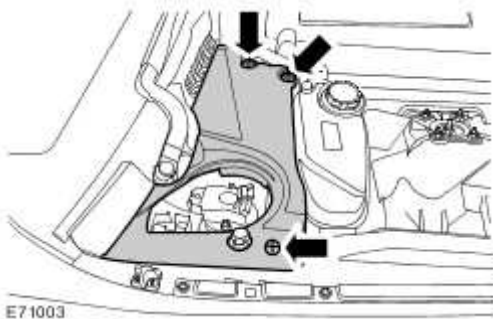
Wiper Pivot Arm (84.15.03)


Removal



CAUTION: Always protect paintwork and glass when removing exterior components.

- 1 . Open the hood.
- 2 . Remove the RH air intake cover.
 - ▶ Remove the 3 clips.



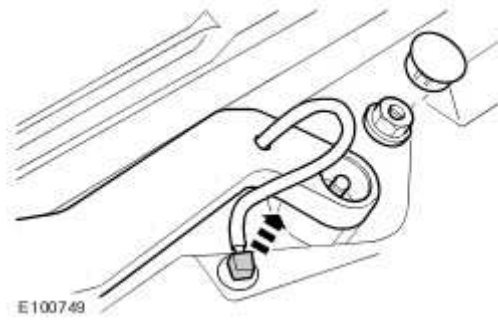
- 3  **CAUTION:** Wipers arms do not lock in the upright position. Windshield damage may occur if the wiper pivot arms are allowed to drop against the glass.

NOTE:

RH illustration shown, LH is similar

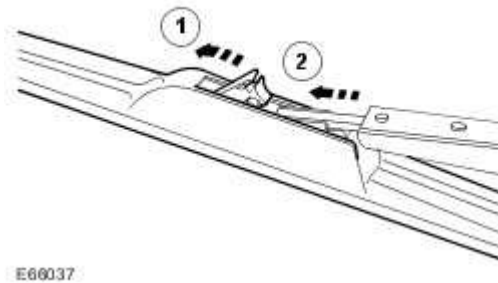
Remove the windshield wiper arms.

- ▶ Remove the 2 access plugs.
- ▶ Remove the 2 nuts.
- ▶ Disconnect the 2 washer jet blocks from the cowl vent screen.



4 . Remove the wiper blades.

- ▶ Release the 2 clips.



Installation

1 . Install the wiper blades.

- ▶ Position the locating clip in the upright position.
- ▶ Position the blade at the end of the arm.
- ▶ Secure the clip.
- ▶ Repeat for the other side

2



CAUTION: Incorrect fitting of the wiper pivot arms will result in damage to the bonnet on closure.

NOTE:

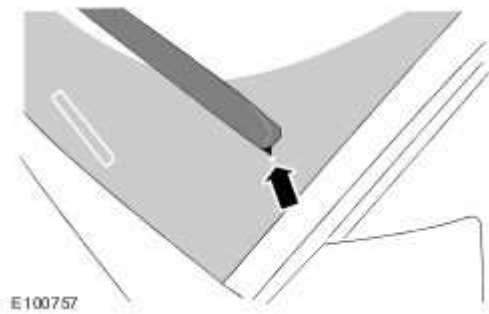
Align the wiper with the mark on the windscreen.

NOTE:

LH illustration shown, RH is similar.

Install the windshield wiper arm.

- ▶ Make sure the spindle is free from contamination.
- ▶ Apply gentle pressure on the pivot arm hinge to make sure the pivot arm is located evenly.
- ▶ Lightly tighten the nut.
- ▶ Align the tip of the wiper blade with the mark on the windshield.
- ▶ Tighten the nut to 23 Nm (17 lb.ft).
- ▶ Install the covers.
- ▶ Connect the washer jet hose block.
- ▶ Repeat for the other side.



3 . Install the RH air intake cover.

501-18 : Convertible Top

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Convertible top, base plate to BIW - nut	25	18	-
Convertible top to base plate - nut	25	18	-
Convertible top, compartment lid striker - bolt	9	-	80
Convertible top, compartment lid trim panel - screw	1	-	9
Convertible top, compartment lid moulding - screw/nut	4	-	35
Convertible top striker to body - bolt	23	17	-
Convertible top header rail - screw	1	-	9
Hydraulic system, lift cylinder and motor - bolt	8	6	71
Luggage separator mounting bracket - bolt	4	-	35

Convertible Top Compartment Lid Alignment

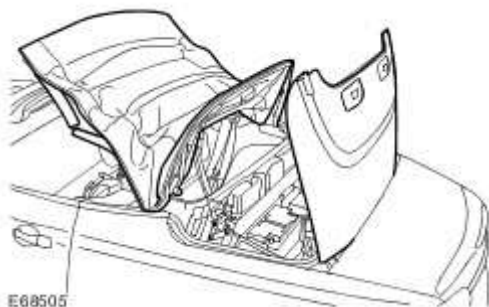
1. Check the alignment of the convertible top lid. Adjust, if required, using the steps below.

2. **NOTE:**

Support as necessary.

Open the convertible top to the position shown.

- Depress the switch.

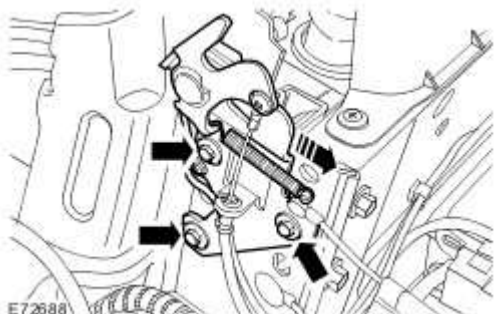


3. **NOTE:**

LH illustration shown, RH is similar.

Release the convertible top lid latches.

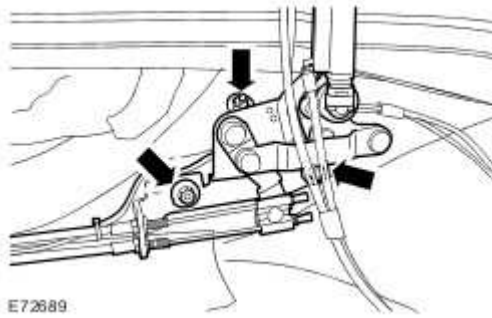
- Loosen the 6 bolts.
- Tighten the 6 bolts to 1 Nm (1 lb.ft).



4. Release the convertible top lid lift cylinder bracket.

- Loosen the 3 nuts.
- Push the convertible top lift cylinder bracket fully rearwards.

- Tighten the 3 nuts to 1 Nm (1 lb.ft).



5. Close the convertible top compartment lid.

- Depress the switch.

6. With the convertible top compartment lid closed, check the alignment of the lid to the body. The lid should be central in its aperture. The profile of the lid to the body should be flush.

7. Install the convertible lid cylinder bracket lower nuts.

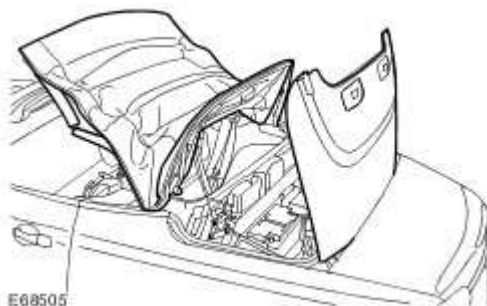
- Tighten the nuts to 10 Nm (7 lb.ft).

8. **NOTE:**

Support as necessary.

Open the convertible top to the position shown.

- Depress the switch.



9. Secure the convertible top lid latches.

- Tighten the bolts to 10 Nm (7 lb.ft).

10. Install the convertible lid cylinder bracket upper nut.

- Tighten the nut to 10 Nm (7 lb.ft).

11. Close the convertible top compartment lid.

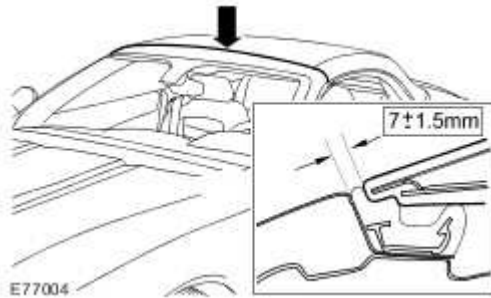
- Depress the switch.

Convertible Top Alignment

NOTE:

This procedure details how to align a new convertible top assembly.

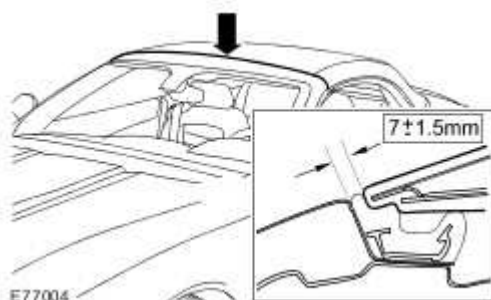
1. Align the convertible top to the dimensions shown using the procedure below.



2. With assistance, install the convertible top assembly.
 - Install and lightly tighten the nuts.
3. Close the convertible top compartment lid.
4. Close the convertible top.
 - Using an Allen key, manually latch the convertible top.



5. Ensure the forward edge of the convertible top has an equal 7mm gap to the header panel.



6. Open the convertible top.

- Using an Allen key, manually release the convertible top latches.

7. Open the convertible top compartment lid.

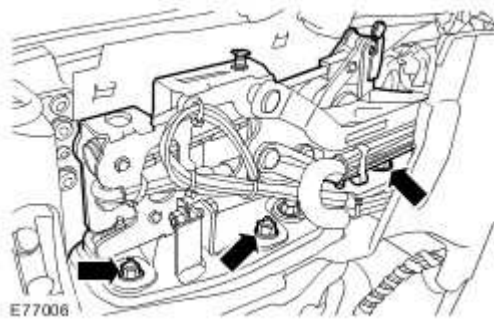
8.



CAUTION: Under no circumstances must the base plate fixing nuts be loosened or removed. Each base plate fixing nut can be identified by a large aluminium spacer.

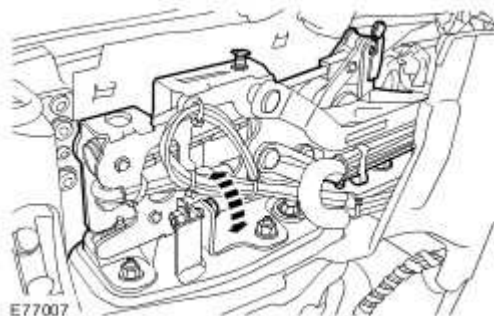
Release the convertible top assembly.

- Loosen the 6 nuts.



9. Adjust the convertible top.

- Loosen the 2 locknuts.
- Adjust the convertible top as necessary.
- Tighten the locknuts to 25 Nm (18 lb.ft).



10. Secure the convertible top assembly.

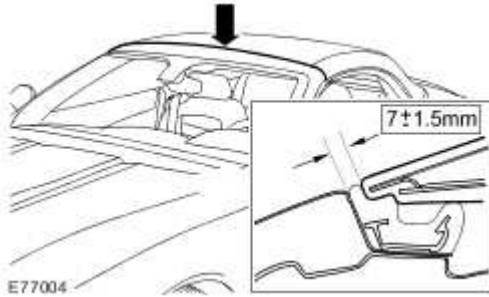
- Lightly tighten the nuts.

11. Close the convertible top compartment lid.

12. Close the convertible top.

- Using an Allen key, manually latch the convertible top.

13. Ensure the forward edge of the convertible top has an equal 7mm gap to the header panel.



14. Open the convertible top.

- Using an Allen key, manually release the convertible top latches.

15. Open the convertible top compartment lid.

16. Secure the convertible top assembly.

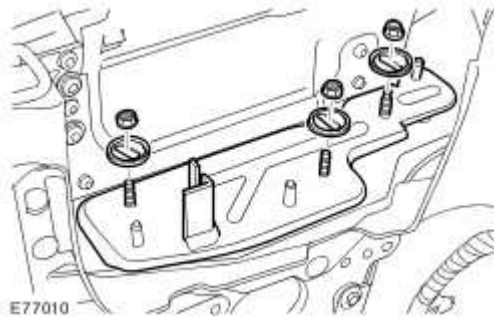
- Tighten the nuts to 25 Nm (18 lb.ft).

Convertible Top Base Plate Adjustment

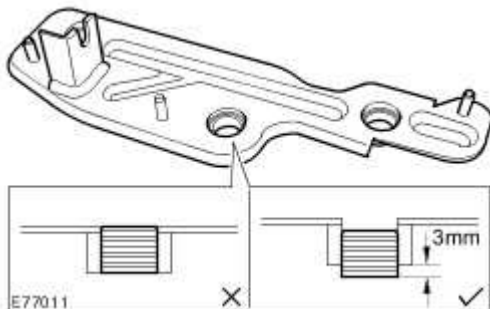
1. Remove the convertible top assembly.
[Convertible Top Assembly \(76.86.15\)](#)

2. Remove the convertible top base plates.

- Remove the 6 nuts.
- Collect the washers.



3. Adjust the 6 base plate height adjustment washers, so they are 3mm below the underside of the base plates.



4. Install the convertible top base plates.

- Make sure the base plates are installed central to the studs.
- Install the washers.
- Lightly tighten the nuts.

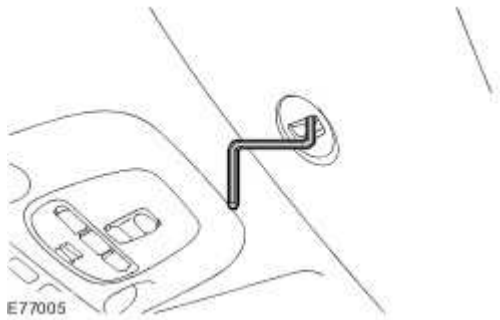
5. With assistance, install the convertible top assembly.

- Install and lightly tighten the nuts.

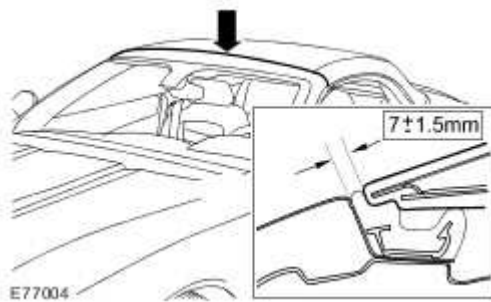
6. Close the convertible top compartment lid.

7. Close the convertible top.

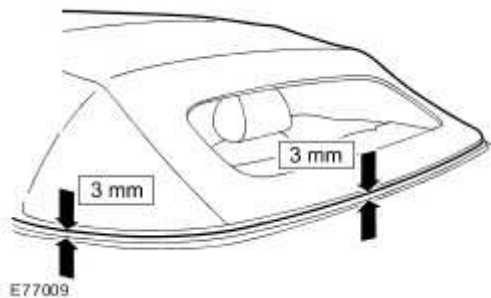
- Using an Allen key, manually latch the convertible top.



8. Ensure the forward edge of the convertible top has an equal 7mm gap to the header panel.



9. Ensure the rear edge of the convertible top has an equal 3mm gap to the convertible top compartment lid and rear quarter glass outer seal seal.



10. Open the convertible top.
 - Using an Allen key, manually release the convertible top latches.
11. Open the convertible top compartment lid.
12. With assistance, remove the convertible top assembly.
 - Remove the 6 nuts.
13. Remove the convertible top base plates.

- Remove the 6 nuts.
- Collect the washers.

14. Adjust the 6 base plate adjustment washers to the necessary height.

15. Install the convertible top base plates.

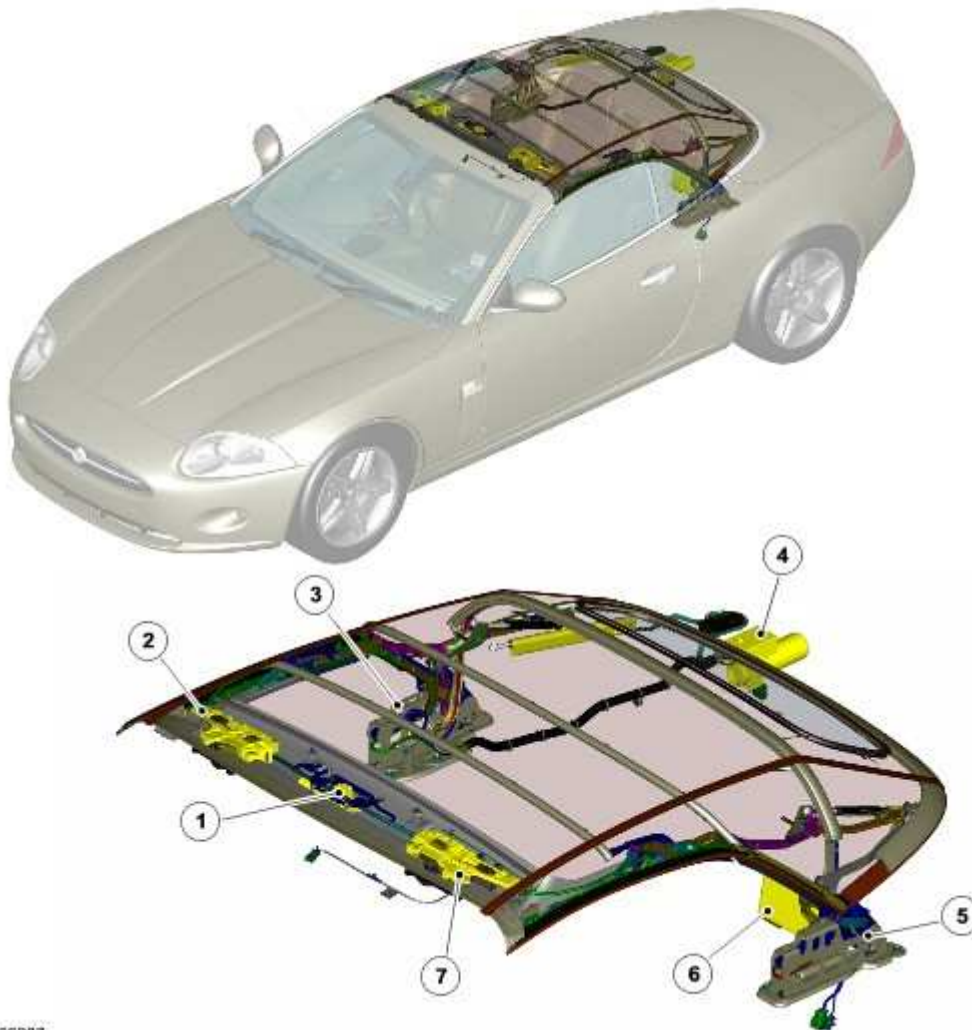
- Align the base plates to the studs as necessary.
- Install the washers.
- Tighten the nuts to 25 Nm (18 lb.ft).

16. Install the convertible top assembly.

[Convertible Top Assembly \(76.86.15\)](#)

Convertible Top

COMPONENT LOCATION



E66287

Item	Part Number	Description
1		Front latch motor
2		RH front latch plate
3		RH actuation lever assembly
4		Valve block and motor
5		LH actuation lever assembly
6		Convertible top control module
7		LH front latch plate

INTRODUCTION

The power-operated convertible top consists of a fabric canopy with a 'Thinsulate' inner liner, which is fitted to a steel frame with cast linkages.

The fully automatic flush mounted aluminum tonneau panel conceals the stowed top and incorporates the Roll-over Protection System doors in its trim panel. The top has a low-stack height of 200 mm (7.9 in) and manual roller blind luggage separator to optimize the luggage compartment volume. The open and close time of the top is approximately 17 seconds depending on ambient temperature and battery voltage.

A heated glass backlight is high frequency welded to the canopy.

A pump motor and valve block provides hydraulic power to open and close the top while an electric motor controls a tension bow system to latch and unlatch the top. A single hold-down switch located in the roof console operates the top. This switch also operates the rear quarter glass.

In the event that the top cannot be powered to the raised or lowered position, provision is made for manual operation.

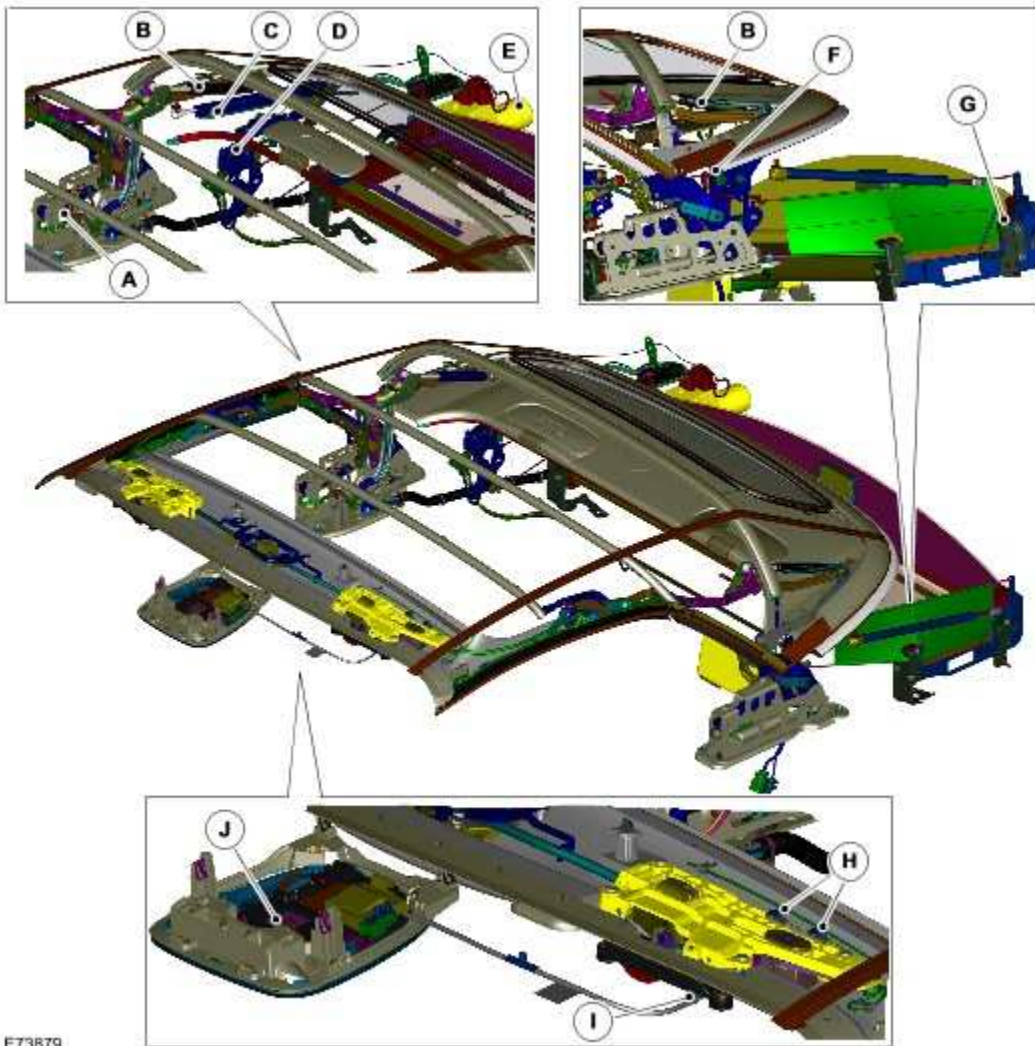
For information regarding convertible top operation, manual operation and the removal and installation of the luggage separator, refer to the Owner's Handbook.



CAUTION: The convertible top frame is located on the vehicle body accurately using a steel adjuster plate; under no circumstances must the top steel adjuster plates be released. For more information refer to the adjuster plate section.

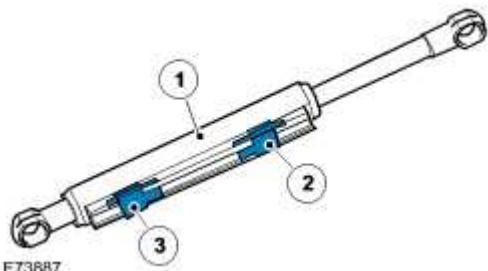
COMPONENTS

A control module, located behind the LH rear seat, controls the power-operated convertible top. The control module operates the top based on data received on the Controller Area Network (CAN) bus and from the hardwired components described below:



E73879

A - Tension Bow Sensors

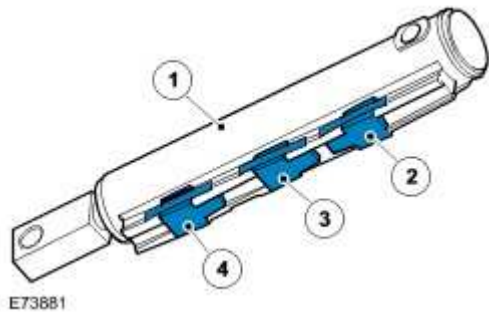


E73887

Item	Part Number	Description
1		Tension bow piston tube assembly
2		Tension bow 'In' sensor
3		Tension bow 'Out' sensor

The tension bow sensors are Hall effect sensors located in the tension bow piston tube assembly. The piston tube assembly is located next to the LH tension bow linkage. These sensors inform the control module as to the position of the convertible top tension bow assembly.

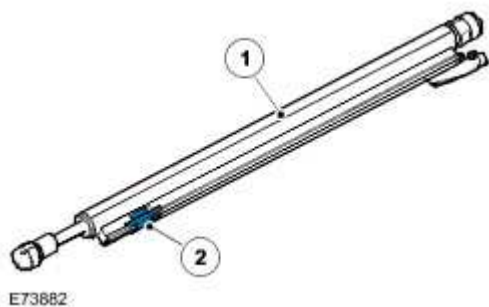
B - Main Bow Sensors



Item	Part Number	Description
1		Main bow piston tube assembly
2		Main bow 'In' sensor
3		Main bow 'Center' sensor
4		Main bow 'Out' sensor

The main bow sensors are Hall effect sensors located in the main bow piston tube assembly. The piston tube assembly is located on the RH main bearing bracket assembly. These sensors sense the position of the main bow piston so the control module knows the exact position of the convertible top.

C - Tonneau Panel Open Sensor



Item	Part Number	Description
1		Tonneau panel piston tube assembly
2		Tonneau panel open sensor

The tonneau panel open sensor is a Hall effect sensor located in the tonneau panel piston tube

assembly. The piston tube assembly is located between the RH base latch plate and the lever assembly. This sensor informs the control module of when the tonneau panel is in the open position so the convertible top can be stowed.

D - Tonneau Panel Switch 1

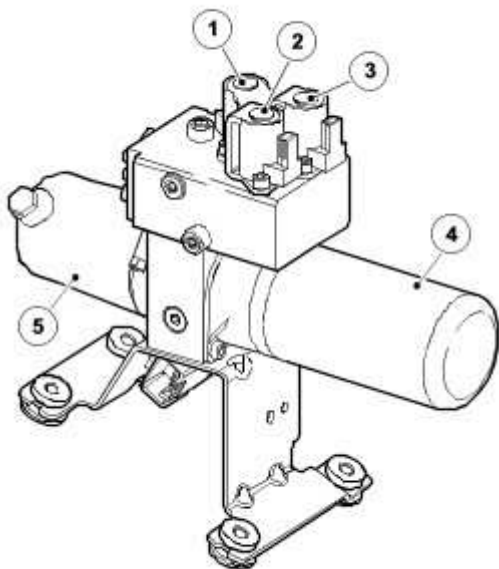


E73883

Item	Part Number	Description
1		Emergency release cable
2		Tonneau panel switch

Tonneau panel switch 1 is located on the RH lever assembly. This switch is a normally open microswitch that, when switched to ground, informs the control module that the RH side of the tonneau panel is closed.

E - Pump Motor Temperature Sensor



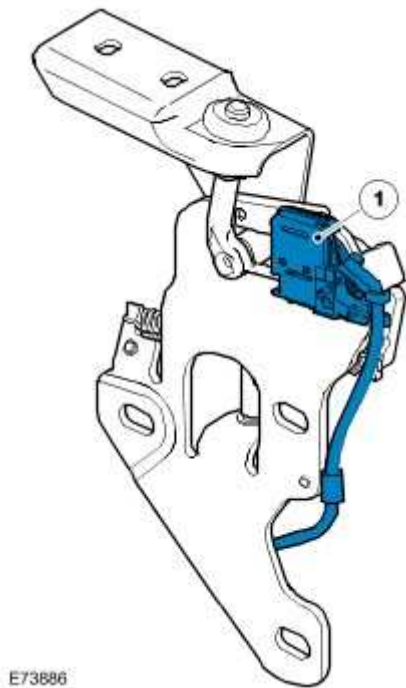
E73884

Item	Part Number	Description
------	-------------	-------------

1		Tension bow up solenoid valve
2		Tension bow down solenoid valve
3		Tonneau panel solenoid valve
4		Hydraulic pump
5		Hydraulic fluid reservoir

The hydraulic fluid temperature sensor is a Negative Temperature Coefficient (NTC) sensor, which is integral to the pump assembly. The sensor informs the control module as to the temperature of the hydraulic fluid. If the fluid temperature exceeds a predetermined value, the control module will stop pump operation to prevent the valve block from overheating. Once the fluid temperature decreases below the predetermined value, the control module will then resume pump operation.

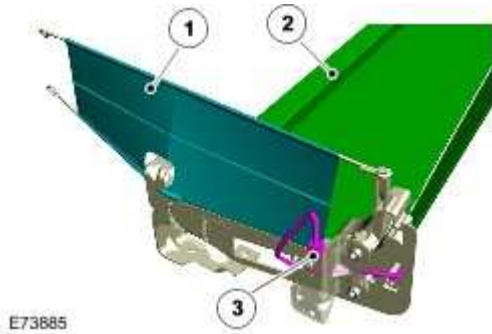
F - Tonneau Panel Switch 2



Item	Part Number	Description
1		Tonneau panel switch

Tonneau panel switch 2 is located on the LH latch base plate assembly. This switch is a normally open microswitch that, when switched to ground, informs the control module that the LH side of the tonneau panel is closed.

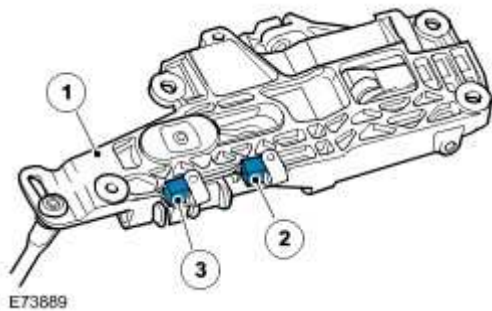
G- Luggage Separator Position Sensor



Item	Part Number	Description
1		Cargo net
2		Luggage separator (roller blind)
3		Luggage separator position sensor

The Luggage separator position sensor is a Hall effect sensor located on the LH luggage separator housing bracket. The sensor informs the control module of when the separator is in the correct position. When the separator is in the correct position there is enough space in the luggage compartment to stow the convertible top when open.

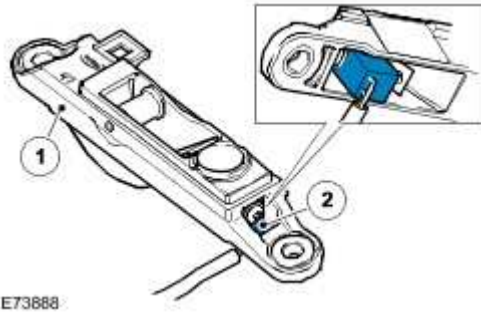
H - Front Latch Open and Close Sensors



Item	Part Number	Description
1		Latch plate
2		Front latch open sensor
3		Front latch closed sensor

The front latch open and closed sensors are Hall effect sensors located in the LH front latch plate. These sensors inform the control module of when the latch is in the open or closed position.

I - Convertible Top Latched Sensor



E73888

Item	Part Number	Description
1		Latching bracket
2		Hall sensor

The convertible top latched sensor is a Hall effect sensor located in the LH latching bracket. The sensors function is to inform the control module of when the convertible top is in the closed position.

J - Convertible Top Open and Close Switch



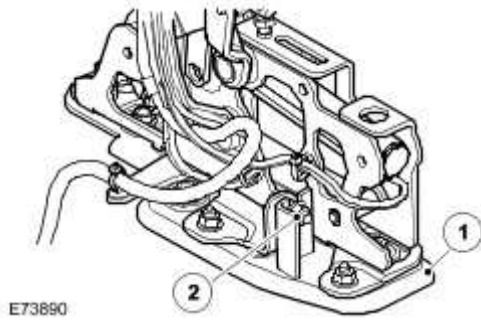
E73880

Item	Part Number	Description
1		Open and Close switch
2		Overhead console

The convertible top open and close switch is located in the overhead console. The switch is a momentary switch that is normally open. When switched to ground the convertible top will start its open or close motion depending on which operation has been requested.

Adjuster Plate

The convertible top frame, actuation levers and main bow hydraulic cylinder assembly is located on the vehicle body accurately using a steel adjuster plate, which is set to the body using adjustable shims.



Item	Part Number	Description
1		Steel adjuster plate
2		Adjuster



CAUTION: Under no circumstances must the top steel adjuster plates be released, as they are set and adjusted to the body during manufacture, providing an accurate location for the convertible top frame. Service action and special tools will be required to reset the plate if this area of the vehicle requires service.

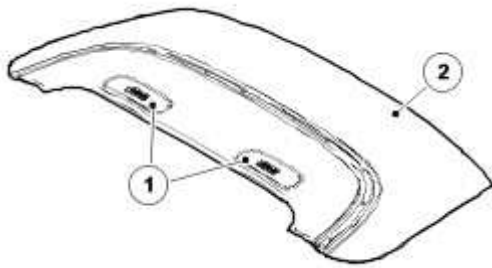
Tonneau Panel Cover

A fully automatic flush mounted aluminum tonneau cover panel protects the stowed top.



WARNING: Special care must be taken when carrying out maintenance in the area underneath the aluminum tonneau cover. After approximately five minutes the hydraulic pressure is lost due to the release of the spool valves to prevent the valves overheating. A suitable support must be used to prevent the aluminum tonneau cover falling when the hydraulic pressure is released.

The aluminum tonneau cover panel trim also incorporates Roll Over Protection hoop doors. The roll over protection system is deployed through the hoop doors and rear screen in the event of a vehicle roll over situation. For additional information, refer to [Air Bag Supplemental Restraint System \(SRS\)](#) (501-20 Supplemental Restraint System)



E73891

Item	Part Number	Description
1		Hoop doors
2		Aluminum tonneau cover panel

The hydraulic pump, motor and valve block assembly is located in the RH luggage area. The fluid reservoir is filled with Pentosin hydraulic oil. Two fluid levels are marked on the pump reservoir body, the upper mark denotes the fluid level when the top is fully lowered and the lower mark denotes the level when the top is fully raised. The hydraulic pump supplies a maximum pressure of approximately 140 bar during convertible top operation. When the pump is idle the system pressure is approximately 0.1 bar.

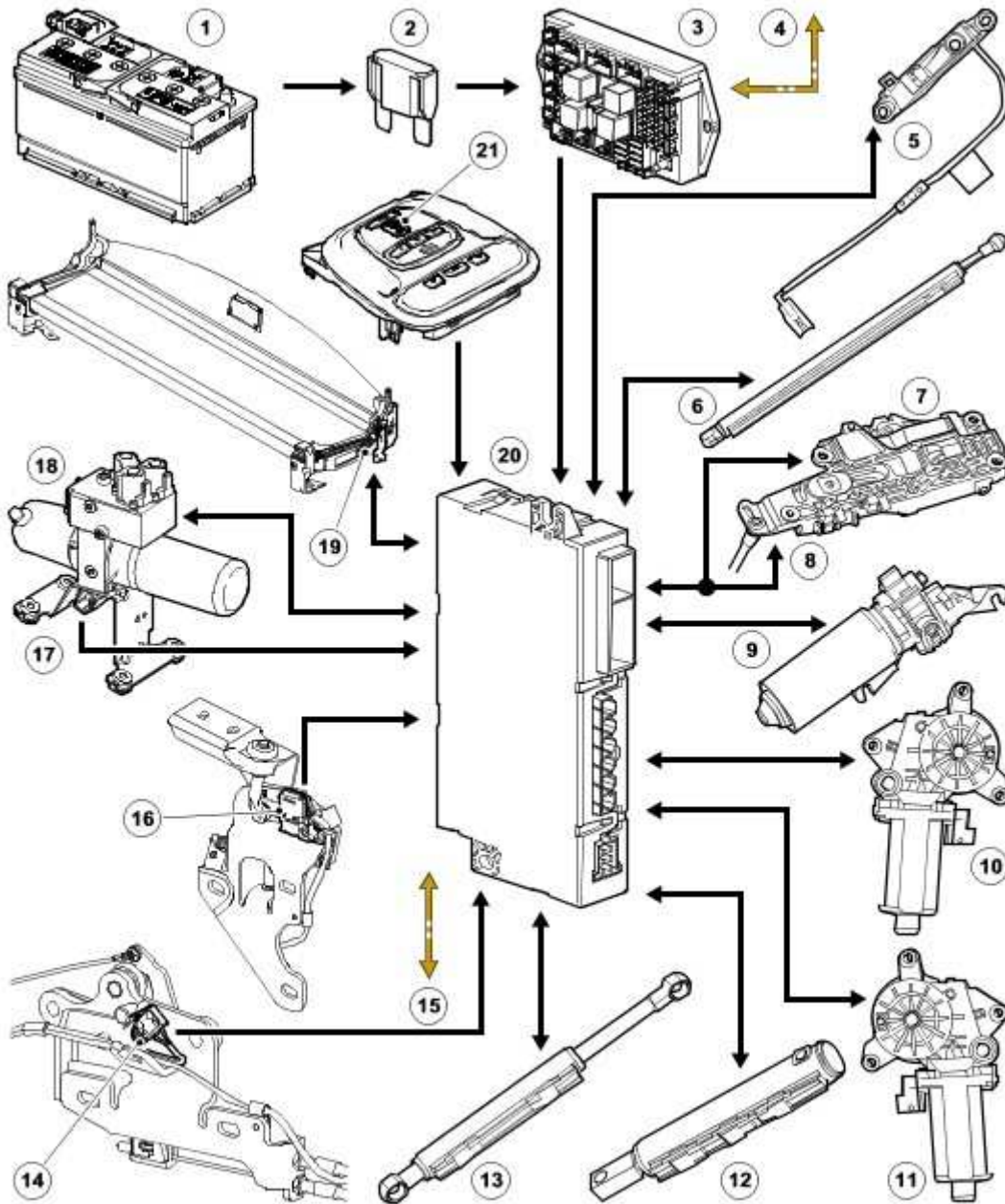
NOTE:

The convertible top hydraulic system is 'self-bleeding' and does not require action to expel trapped air.

CONTROL DIAGRAM

NOTE:

A = Hardwired; N = CAN bus



E66288



Item	Part Number	Description
1		Battery
2		Megafuse (175A)
3		Auxiliary junction box
4		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
5		Convertible top latched sensor
6		Tonneau panel sensor

7		Front latch open sensor
8		Front latch close sensor
9		Front latch motor
10		RH quarter glass motor
11		LH quarter glass motor
12		Main bow sensors (3 off)
13		Tension bow sensors (2 off)
14		Tonneau panel switch 1
15		Controller Area Network (CAN) input and output signals to and from various other vehicle systems
16		Tonneau panel switch 2
17		Pump motor temperature sensor
18		Pump motor
19		Luggage separator position sensor
20		Convertible top control module
21		Convertible top open and close switch

PRINCIPLES OF OPERATION

The convertible top is opened and closed using four hydraulically controlled pistons. Two main bow pistons in the top frame are fixed to the body and lift the complete top assembly into and out of the stowage area. Two tension bow pistons open and close the tension bow at the rear of the convertible top. This allows clearance for the tonneau cover panel to be opened when the top is being retracted in to the luggage compartment. It also seals the rear of the top with the tonneau cover panel when the top is opened.

The top and rear quarter glasses are operated using a hold-down switch located in the overhead console. The convertible top will only open if:

- The vehicle speed is below 24km/h (15mph)
- The tonneau panel is closed
- The luggage separator is in position
- The hydraulic fluid temperature sensor confirms pump is not overheated

The front windows must be programmed for one-touch operation in order for the convertible top to operate correctly. Failure to program the windows results in a ten second opening delay once the top is unlatched. The windows can be manually programmed for one-touch operation using this procedure:

- Ignition ON
- Raise window up to the top seal and release
- Raise again until window stops moving
- Release
- Raise again

- Lower window fully
- Release
- Press lower for a further 0.5 seconds until a relay is heard to CLICK

A luggage compartment separator prevents items from moving into the area in which the convertible top is stowed. The luggage separator incorporates a Hall effect proximity sensor, which prevents the convertible top from operating unless the separator is in the fully deployed position.

The aluminum tonneau cover is secured in the closed position by a mechanically controlled cable operated latching system. The cables are tensioned using a mechanical lever assembly operated by the movement of the covers hydraulic piston. The latches are released by spring tension when the covers hydraulic piston releases the tension in the cables.

The aluminum tonneau cover is raised and lowered hydraulically by a single piston.

The convertible top incorporates a fully automatic latch and unlatch tension rod system, which uses an electric motor with a gearbox and flexible shafts to latch and unlatch the top. Failure of a tension rod, motor gearbox or latch motor will prevent the top from unlatching. In the event of either of these failures it is possible to release each of the top latches manually.

OPERATION LOGIC

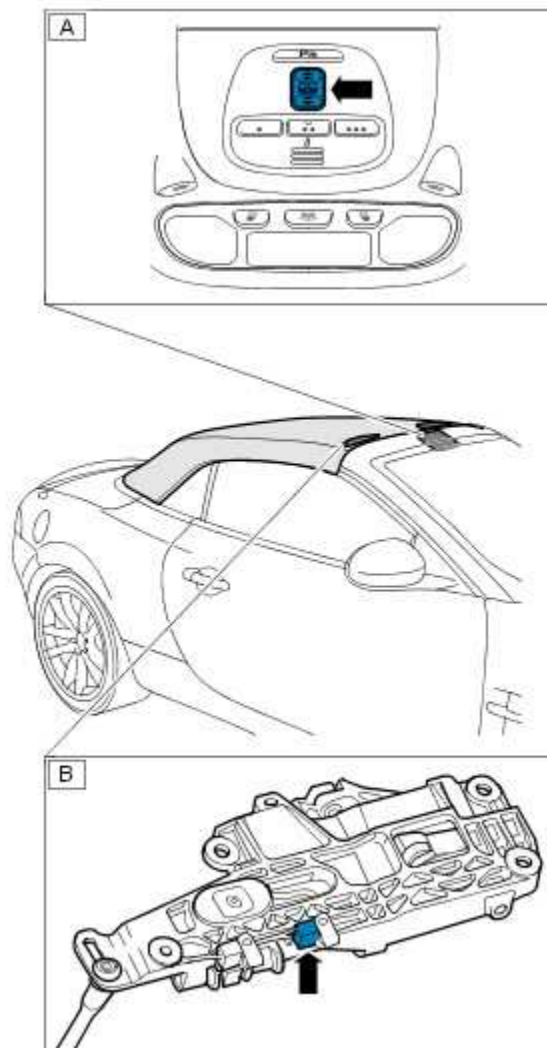
CONVERTIBLE TOP - CLOSED TO OPEN PROCESS

Each stage of the convertible top 'closed-to-open' process is described below. This is accompanied with the corresponding 'Data-Logger' values which can be monitored using Jaguar Approved Diagnostic Equipment. These values can be found in the 'Body Modules' area of the diagnostic equipment.

Stage 1: Convertible Top - fully closed

NOTE:

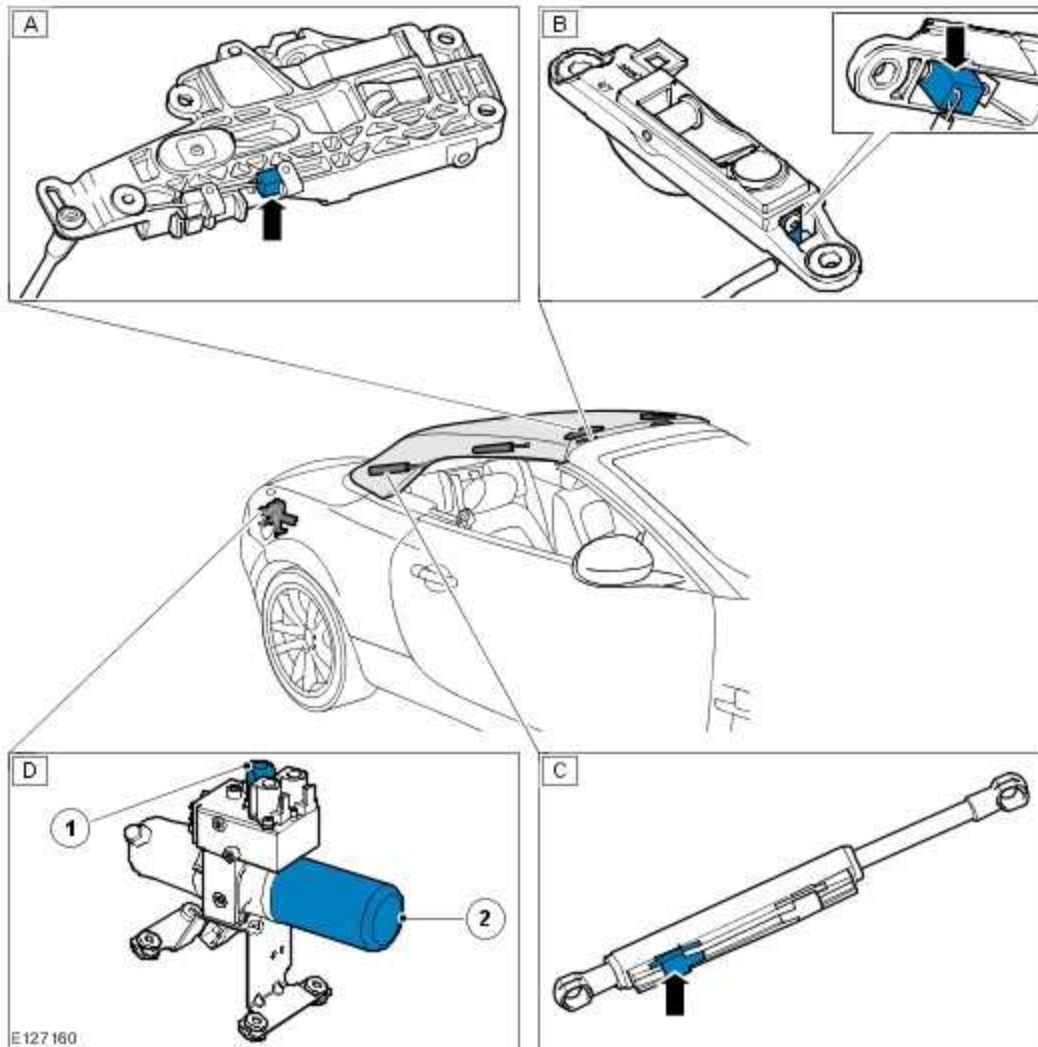
The luggage compartment lid must be closed and latched.



E127 159

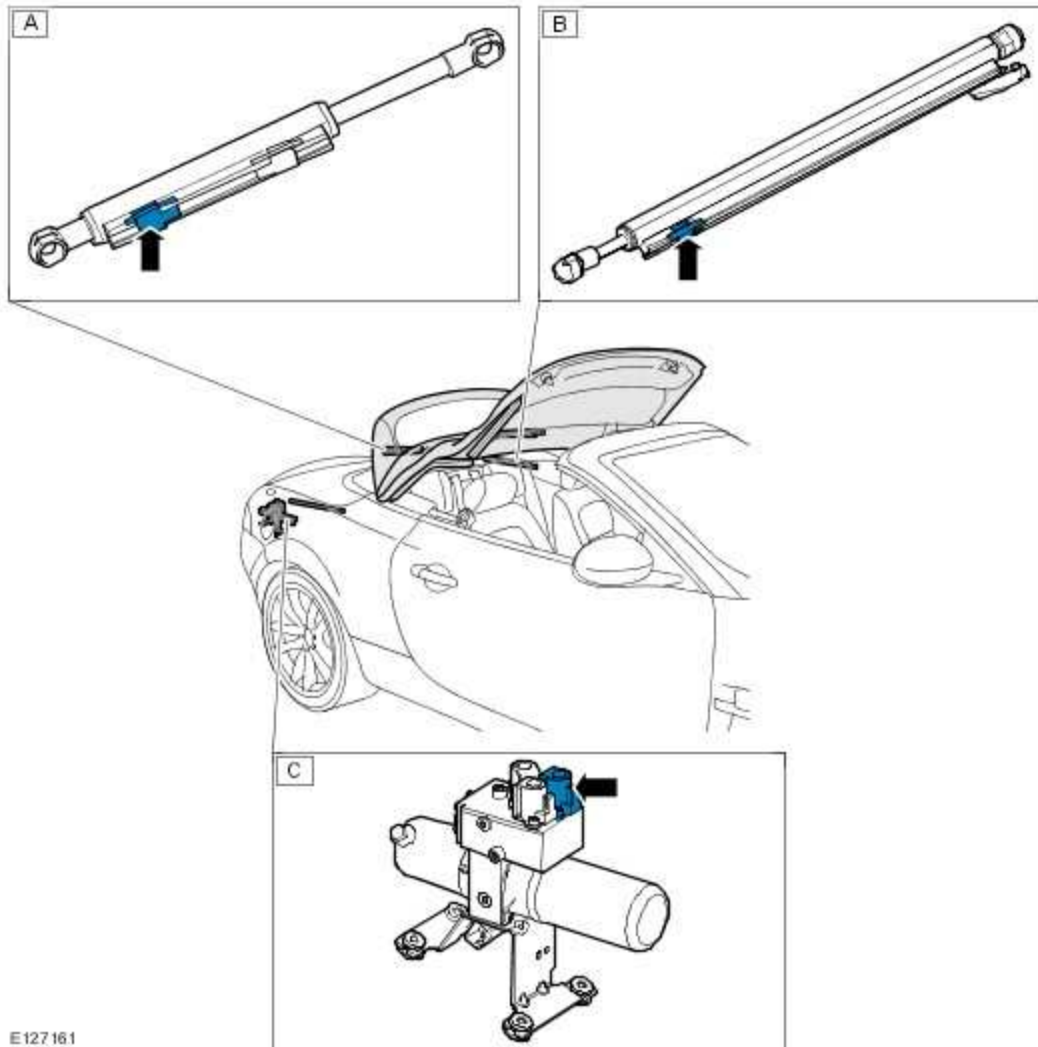
- Press and hold the open switch (A), this will signal the convertible top control module to commence the opening process. (Data-Logger: Convertible Top Switch inputs – Convertible top DOWN switch – **ON**).
- The control module will signal the door glass and rear quarter glass to be powered for 4 seconds to the lowered position. (Data-Logger: Convertible Top motor outputs – Rear Quarter down - **ON**).
- An audible chime will confirm the start of the convertible top opening process.
- The control module will confirm that the ‘open’ sensor in the front latch (B) is not transmitting a signal; verifying the front latch is closed. (Data-Logger: Convertible Top position sensor inputs – Front latch open sensor - **INACTIVE**).
- Once this is confirmed the front latch motor is powered to release the roof latches from the header strikers. (Data-Logger: Convertible Top module motor outputs - Latch motor open – **ON**).

Stage 2: Convertible Top - unlatched from header



- The control module will confirm the ‘open’ sensor in the front latch (A) is transmitting a ‘front latch open’ signal; verifying the front latch has opened. (Data-Logger: Convertible Top position sensor inputs – Front latch open sensor - **ACTIVE**).
- The control module will confirm the sensor in the top latch (B) is not transmitting a ‘latched’ signal; verifying the front latch has opened. (Data-Logger: Convertible Top position sensor inputs - Convertible Top latched sensor - **INACTIVE**)
- The control module will confirm the ‘in’ sensor in the tension bow cylinder (C) is not transmitting a ‘tension bow up’ signal. (Data-Logger: Convertible Top position sensor inputs – Tension bow piston IN sensor - **INACTIVE**).
- Once confirmed the control module energizes the ‘tension bow up’ solenoid valve (D-1) and powers the hydraulic pump (D-2) in the raise direction. (Data-Logger: Convertible Top module motor outputs – tension bow valve 2 - **ON**).

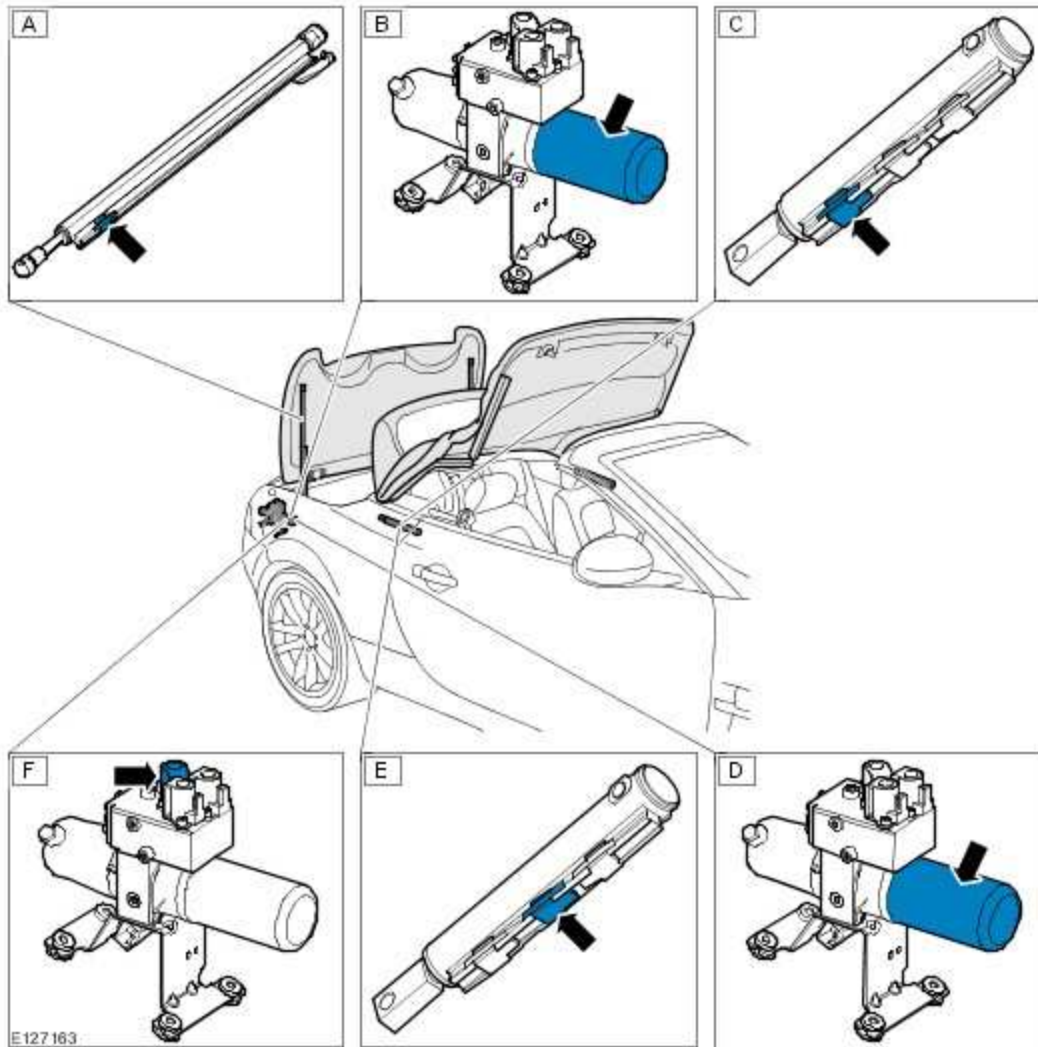
Stage 3: Tension Bow - raised



E127161

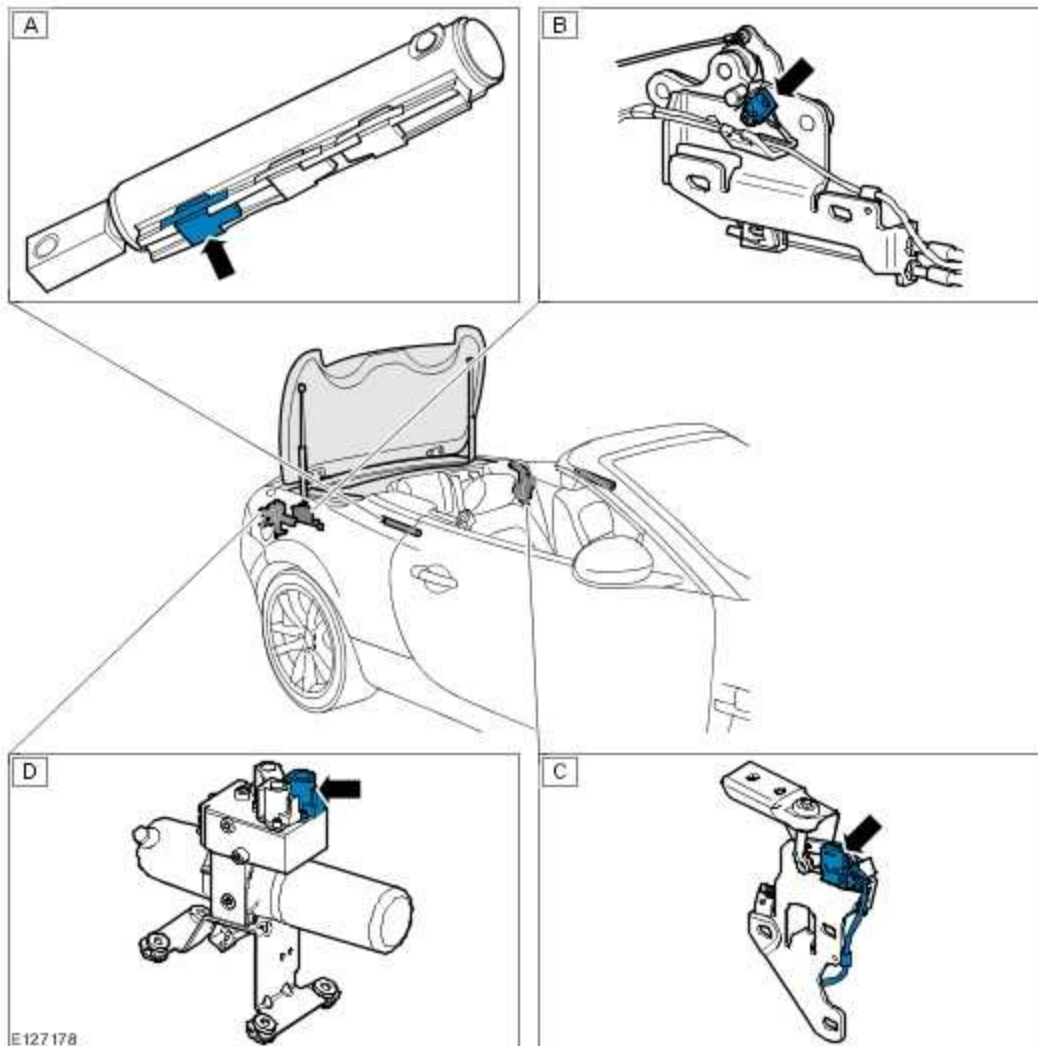
- The control module will confirm the 'in' sensor in the tension bow cylinder (A) is transmitting a 'tension bow up' signal. (Data-Logger: Convertible Top position sensor inputs – Tension bow piston IN sensor - **ACTIVE**).
- The control module will confirm the 'open' sensor in the tonneau panel cylinder (B) is not transmitting a 'tonneau open' signal; verifying the tonneau panel is closed. (Data-Logger: Convertible Top position sensor inputs – Convertible top lid compartment cover piston out sensor - **INACTIVE**).
- Once confirmed the control module energizes the tonneau panel solenoid valve (C). (Data-Logger: Convertible Top module motor outputs – Compartment cover valve 1 – **ON**).

Stage 4: Tonneau Panel and Convertible Top - raised



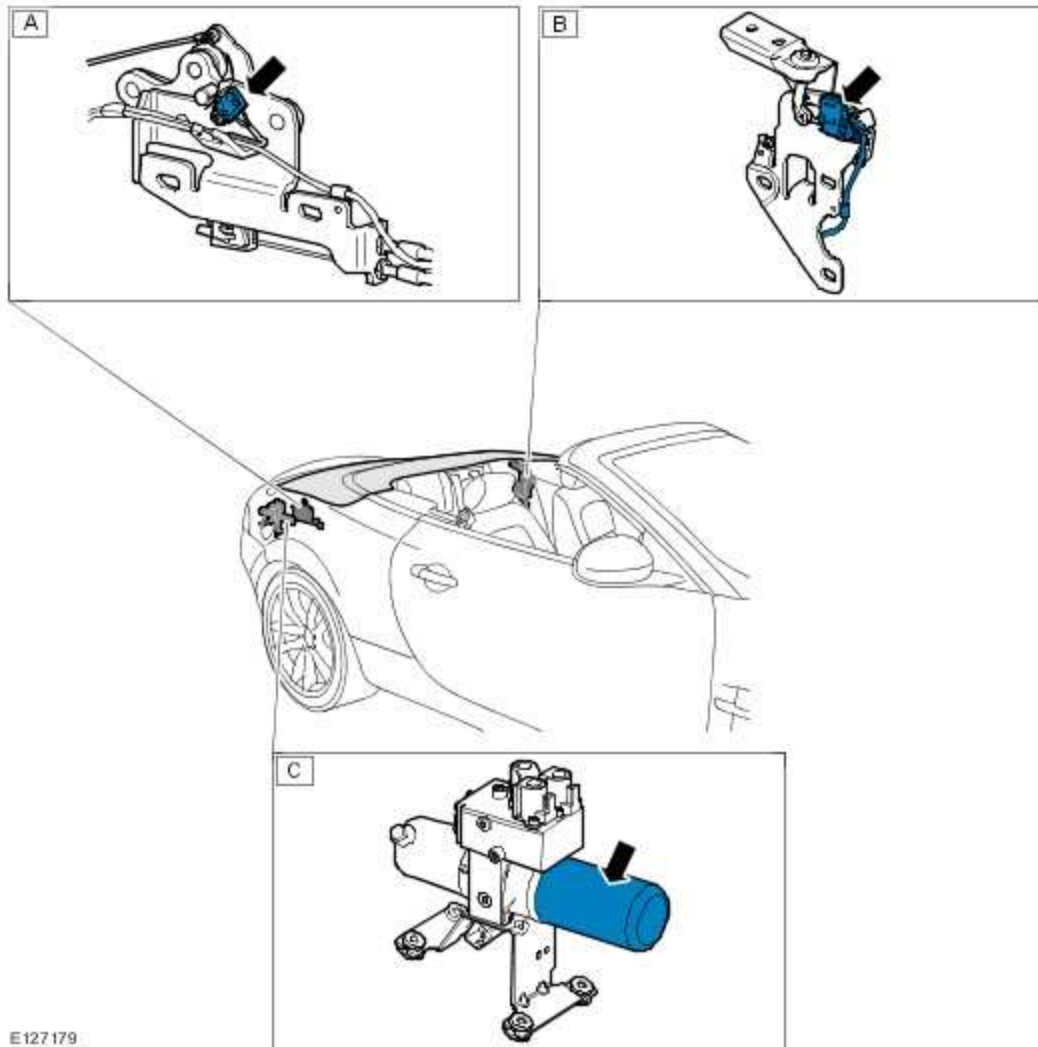
- The control module will confirm the ‘open’ sensor in the tonneau panel cylinder (A) is transmitting a ‘tonneau panel open’ signal. (Data-Logger: Convertible Top position sensor inputs – Convertible top lid compartment cover piston out sensor – **ACTIVE**).
- Once confirmed the control module powers the hydraulic pump (B) in the raise direction. (Data-Logger: Convertible Top module motor outputs - Convertible top right pump - **ON**).
- The control module will confirm the ‘out’ sensor in the main bow cylinder (C) is not transmitting a signal; verifying the convertible top is not open. (Data-Logger: Convertible Top position sensor inputs - Main bow piston OUT sensor - **INACTIVE**).
- Once confirmed the control module powers the hydraulic pump (D) in the lower direction. (Data-Logger: Convertible Top module motor outputs - Convertible top left pump - **ON**).
- The control module will confirm the ‘center’ sensor in the main bow cylinder (E) transmits a momentary signal; verifying the convertible top is opening. (Data-Logger: Convertible Top position sensor inputs - Main bow piston CENTER sensor - **ACTIVE**).
- Once confirmed the control module de-energizes the ‘tension bow up’ solenoid valve (F). (Data-Logger: Convertible Top module motor outputs – Tension bow valve 2 - **OFF**).

Stage 5: Tonneau Panel - raised, and Convertible Top - lowered



- The control module will confirm the 'out' sensor in the main bow cylinder (A) is transmitting a signal; verifying the convertible top is open. (Data-Logger: Convertible Top position sensor inputs - Main bow piston OUT sensor - **ACTIVE**).
- The control module will confirm the tonneau panel switches (B) and (C), which are wired in series, are not transmitting a signal; verifying the tonneau panel is not latched. (Data-Logger: Convertible Top Switch inputs – Convertible top lid compartment cover latch status - **OFF**).
- Once confirmed the control module de-energizes the tonneau panel solenoid valve (D), powering the tonneau panel closed. (Data-Logger: Convertible Top module motor outputs – Compartment cover valve 1 – **OFF**).

Stage 6: Convertible Top - fully open



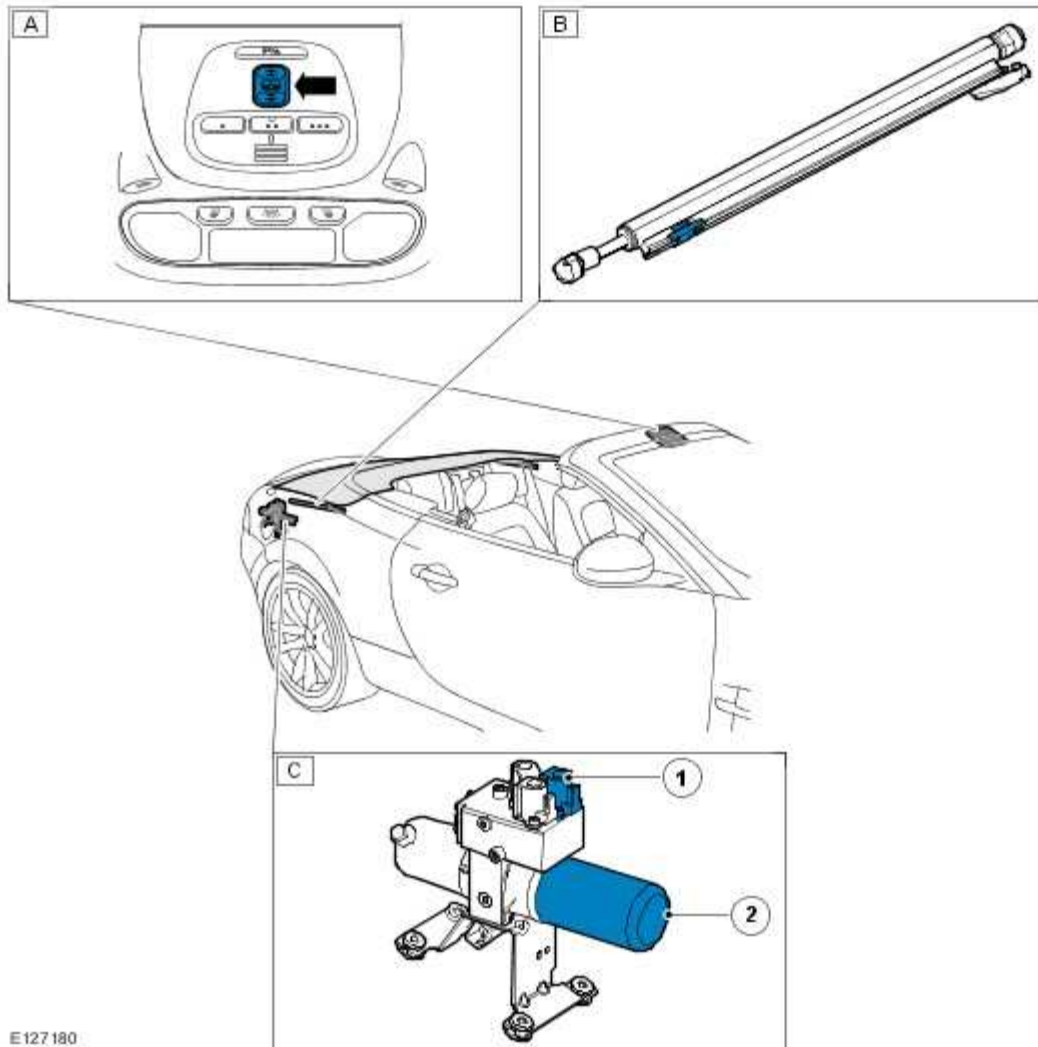
E127179

- The control module will confirm the tonneau panel switches (A) and (B) which are wired in series are transmitting a signal; verifying the tonneau panel is latched. (Data-Logger: Convertible Top Switch inputs – Convertible top lid compartment cover latch status - **ON**).
- Once confirmed the control module powers the hydraulic pump (C) off. (Data-Logger: Convertible Top module motor outputs - Convertible top left pump - **OFF**).
- An audible chime will confirm the completion of the convertible top opening cycle.

CONVERTIBLE TOP - OPEN TO CLOSE PROCESS

Each stage of the convertible top 'open-to-close' process is described below. This is accompanied with the corresponding 'Data-Logger' values which can be monitored using Jaguar Approved Diagnostic Equipment. These values can be found in the 'Body Modules' area of the diagnostic equipment.

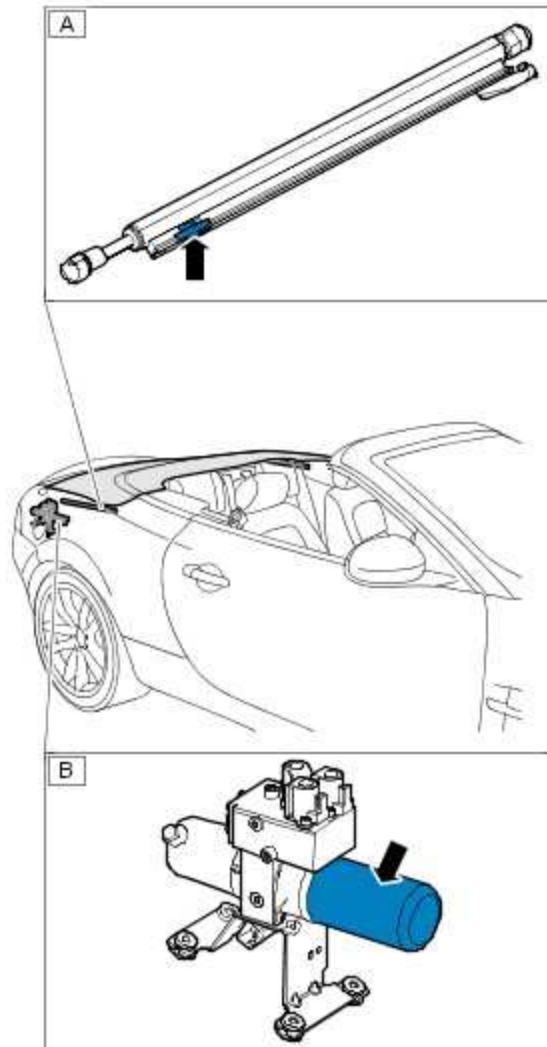
Stage 7: Convertible Top - fully open



E127180

- Press and hold the open switch (A), this will signal the convertible top control module to commence the closing process. (Data-Logger: Convertible Top Switch inputs – Convertible top UP switch - **ON**).
- The control module will confirm the 'open' sensor in the tonneau panel cylinder (B) is not transmitting a 'tonneau panel open' signal; verifying the tonneau panel is closed. (Data-Logger: Convertible Top position sensor inputs – Convertible top lid compartment cover piston out sensor – **INACTIVE**).
- Once confirmed the control module will: Transmit a signal to the door control module to lower the door glass, if required. Energize the tonneau panel 'open' solenoid (C-1). (Data-Logger: Convertible Top module motor outputs – Compartment cover valve 1 – **ON**) Power the hydraulic pump (C-2) in the lower direction. (Data-Logger: Convertible Top module motor outputs - Convertible top left pump - **ON**).
- An audible chime will confirm the beginning of the convertible top closing process.

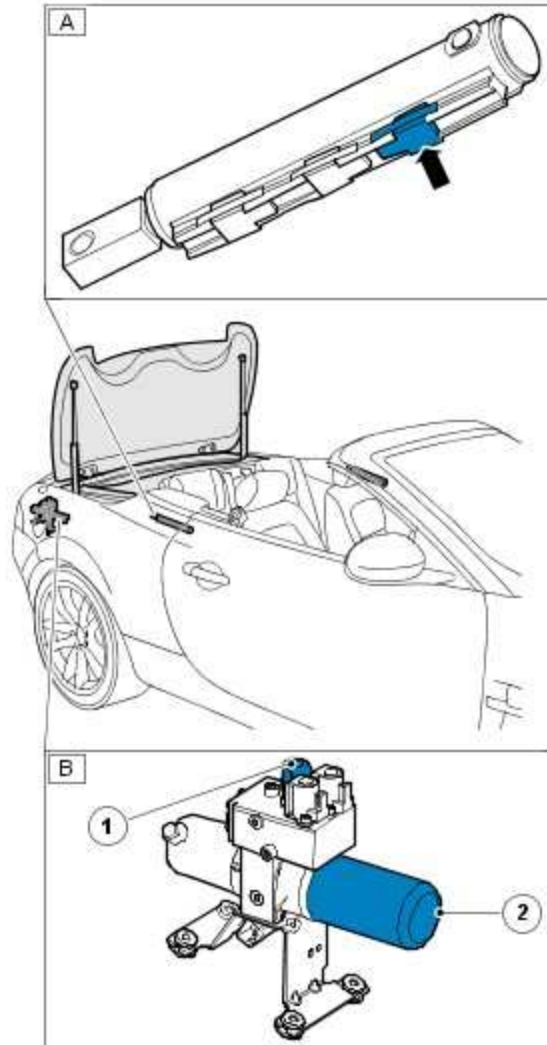
Stage 8: Tonneau Panel - primed for opening



E127184

- As the tonneau panel is powered open the 'open' sensor in the tonneau panel cylinder (A) will transmit a 'tonneau open' confirmation signal to the control module. (Data-Logger: Convertible Top position sensor inputs – Convertible top lid compartment cover piston out sensor – **ACTIVE**).
- Once confirmed the control module will power the hydraulic pump (B) in the lower direction. (Data-Logger: Convertible Top module motor outputs - Convertible top left pump - **ON**).

Stage 9: Tonneau Panel - open



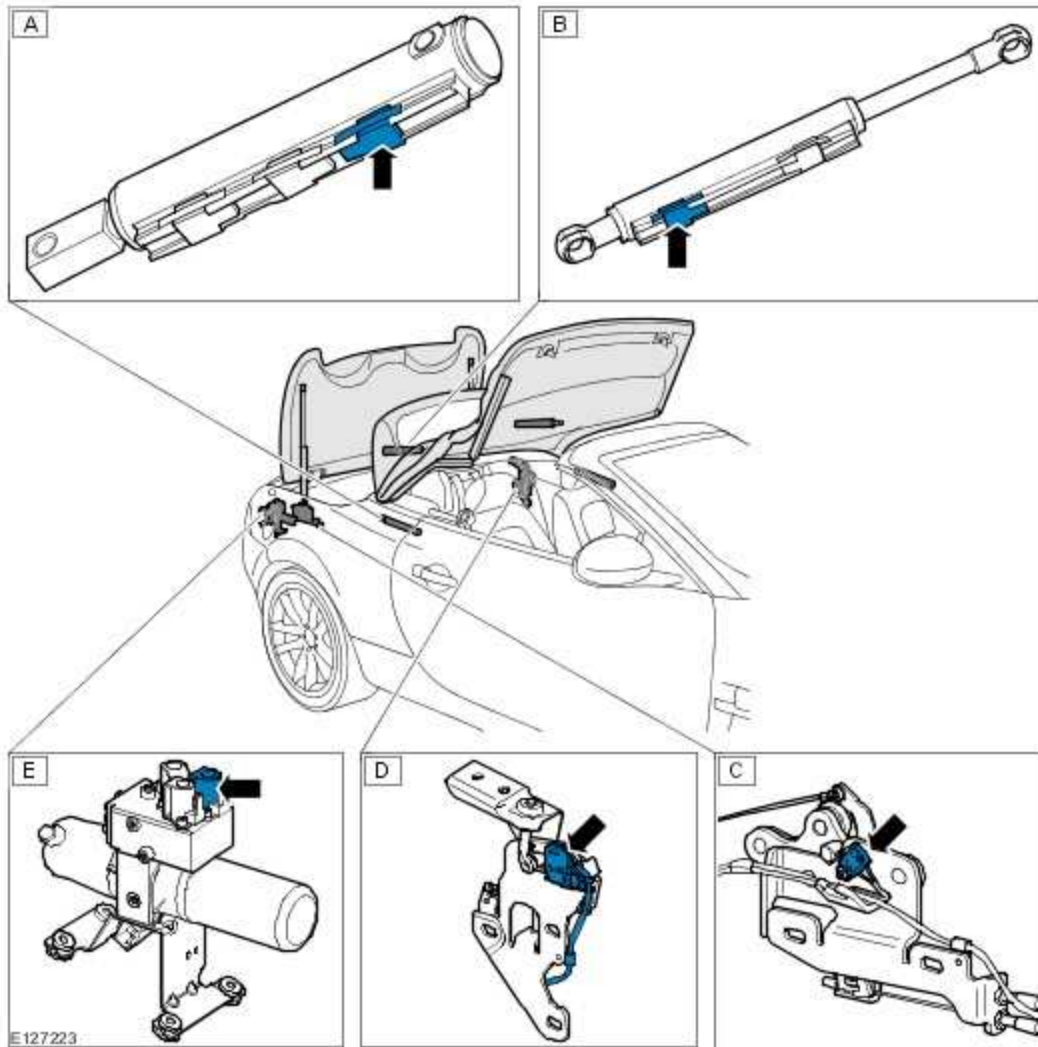
E127190

- The control module will confirm the 'in' sensor in the main bow cylinder (A) is not transmitting a convertible top raised signal. (Data-Logger: Convertible Top position sensor inputs - Main bow piston IN sensor - **INACTIVE**).
- Once confirmed the control module energizes the 'tension bow up' solenoid valve (B-1) and powers the hydraulic pump (B-2) in the raise direction. (Data-Logger: Convertible Top module motor outputs – Tension bow valve 2 – **ON**). (Data-Logger: Convertible Top module motor outputs - Convertible top left pump - **OFF**). (Data-Logger: Convertible Top module motor outputs - Convertible top right pump - **ON**).

NOTE:

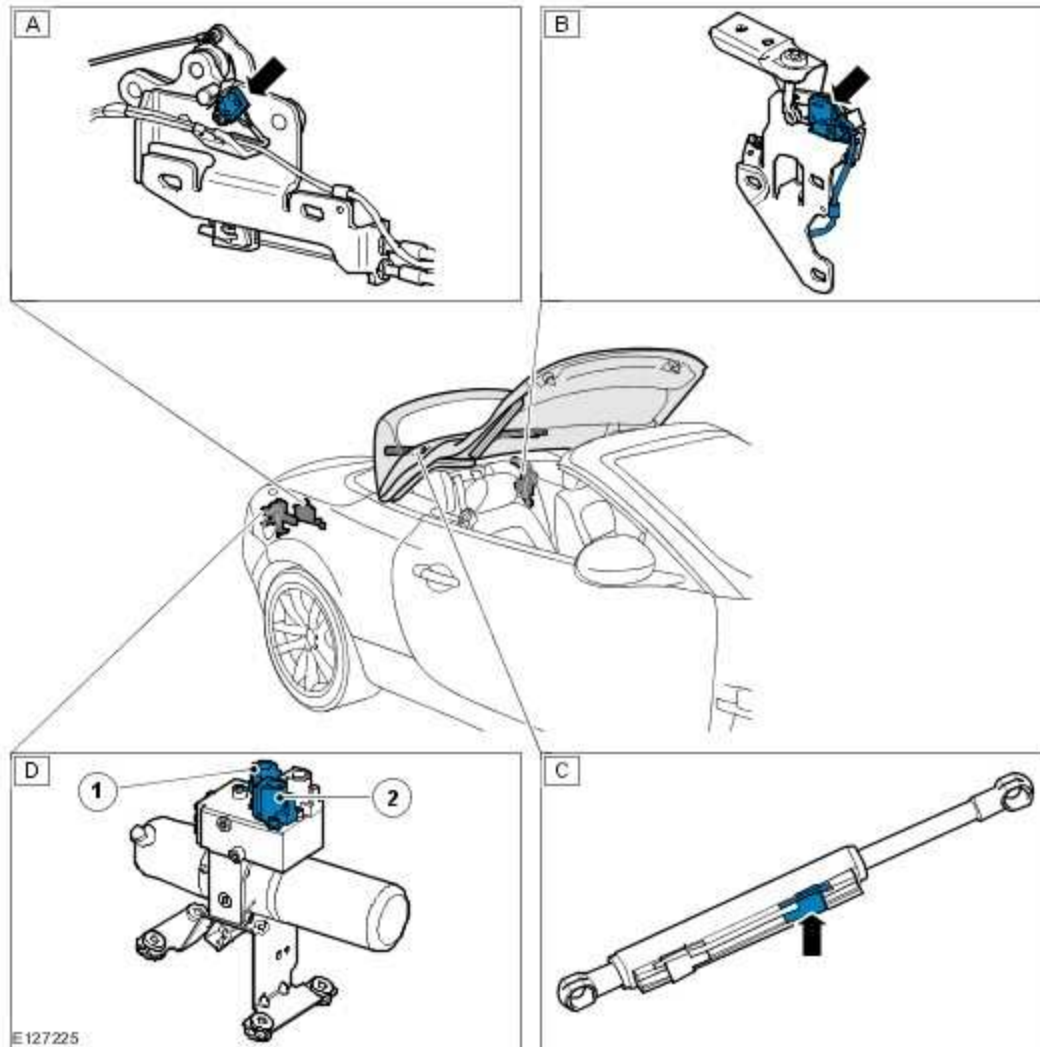
The 'tension bow up' solenoid valve (B-1) remains energized.

Stage 10: Convertible Top and Tension Bow - raised



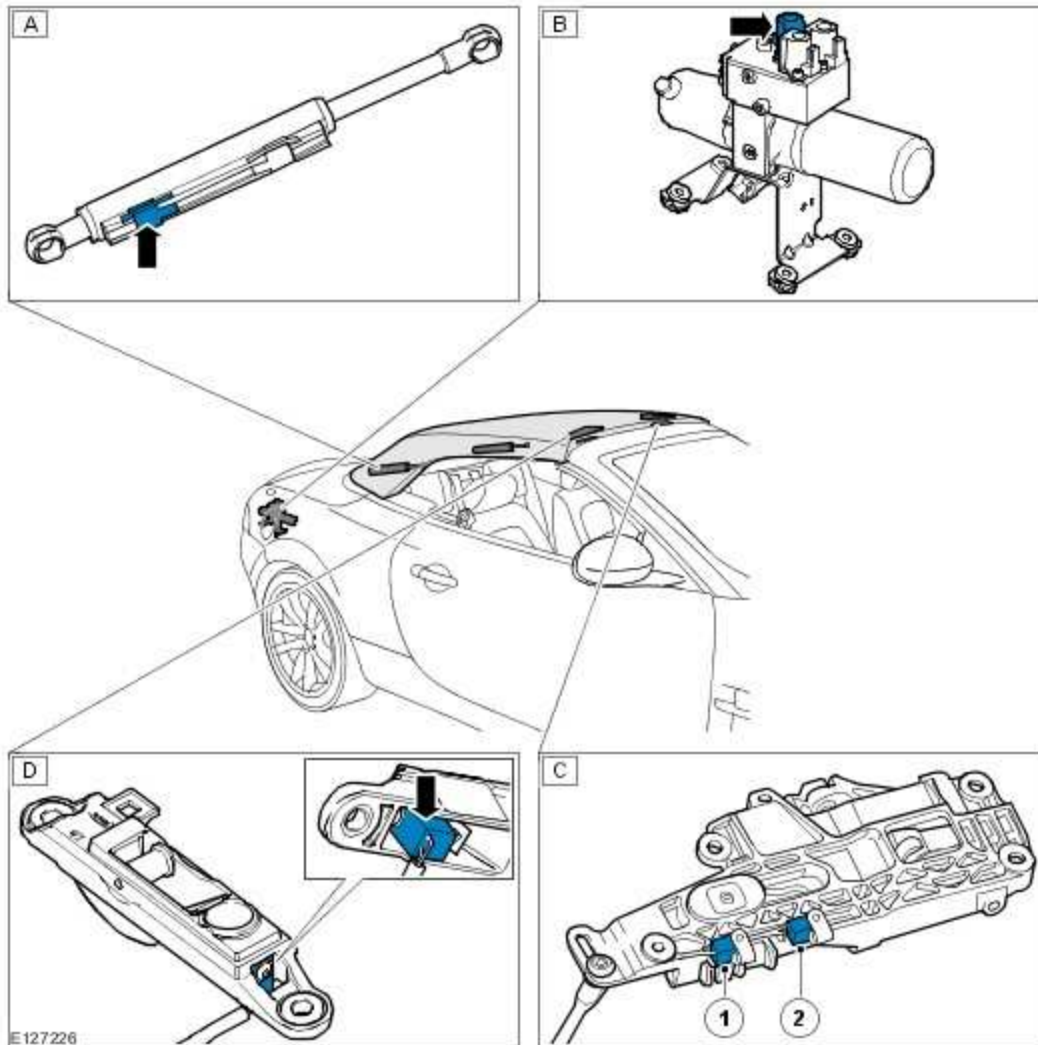
- The control module will confirm the 'in' sensor in the main bow cylinder (A) is transmitting a signal to indicate the convertible top is raised. (Data-Logger: Convertible Top position sensor inputs - Main bow piston IN sensor - **ACTIVE**).
- The control module will confirm the 'in' sensor in the tension bow cylinder (B) is transmitting a 'tension bow up' signal; verifying the tension bow is in the raised position. (Data-Logger: Convertible Top position sensor inputs – Tension bow piston IN sensor - **ACTIVE**).
- The control module will confirm the tonneau panel switches (C) and (D) which are wired in series are not transmitting a signal; verifying the tonneau panel is not latched. (Data-Logger: Convertible Top Switch inputs – Convertible top lid compartment cover latch status - **OFF**).
- Once confirmed the control module de-energizes the tonneau panel solenoid valve (E), powering the tonneau panel closed. (Data-Logger: Convertible Top module motor outputs – Compartment cover valve 1 – **OFF**).

Stage 11: Tonneau Panel - closed



- The control module will confirm the tonneau panel switches (A) and (B) which are wired in series are transmitting a tonneau panel closed signal. (Data-Logger: Convertible Top Switch inputs – Convertible top lid compartment cover latch status - **ON**).
- The control module will confirm the ‘out’ sensor in the tension bow cylinder (C) is not transmitting a signal; verifying the tension bow is in the raised position. (Data-Logger: Convertible Top position sensor inputs – Tension bow piston OUT sensor - **INACTIVE**).
- Once confirmed the control module de-energizes the ‘tension bow up’ solenoid valve (D-1), and energizes the ‘tension bow down’ solenoid valve (D-2), causing the tension bow to lower. (Data-Logger: Convertible Top module motor outputs – Tension bow valve 2 – **OFF**). (Data-Logger: Convertible Top module motor outputs – Tension bow valve 3 – **ON**).

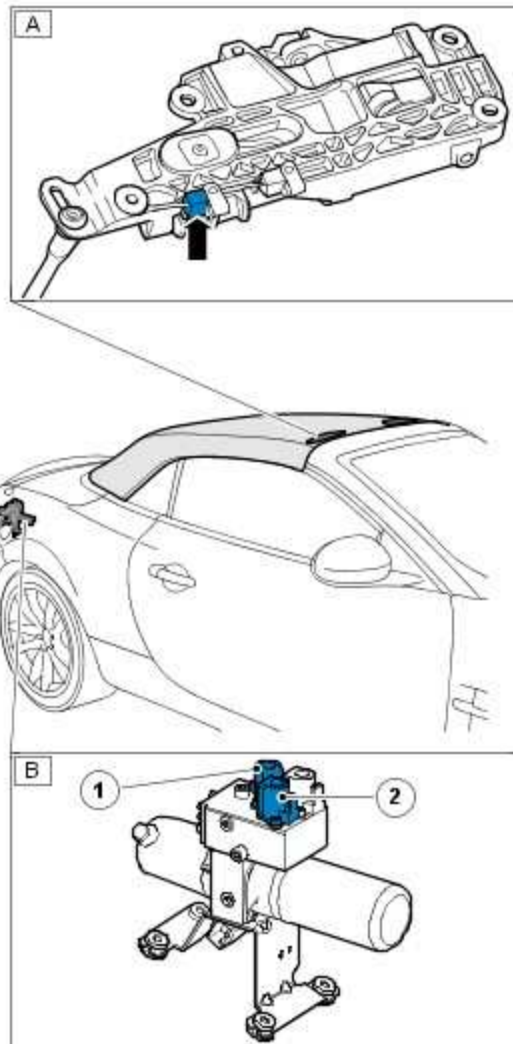
Stage 12: Tension Bow - lowered



- The control module will confirm the 'out' sensor in the tension bow cylinder (A) is transmitting a signal; verifying the tension bow is in the lowered position. (Data-Logger: Convertible Top position sensor inputs – Tension bow piston OUT sensor - **ACTIVE**).
- Once confirmed the control module switches off the hydraulic pump, and energizes the 'tension bow up' solenoid valve (B). (Data-Logger: Convertible Top module motor outputs - Convertible top right pump - **OFF**). (Data-Logger: Convertible Top module motor outputs – Tension bow valve 2 – **ON**).
- The control module will confirm that the 'close' sensor in the front latch (C-1) is not transmitting a signal; verifying the latches are open. (Data-Logger: Convertible Top position sensor inputs – Front latch closed sensor – **INACTIVE**).
- Once confirmed control module powers the front latch motor to pull the convertible top down and direct the convertible top's latch claws to latch onto the header strikers. (Data-Logger: Convertible Top module motor outputs - Latch motor close - **ON**).
- When the convertible top is fully latched, the 'open' latch sensor (C-2) signal is lost, and the sensor (C-1) and convertible top latched sensor (D) signals are supplied. (Data-Logger: Convertible Top position sensor inputs – Front latch open sensor – **INACTIVE**). (Data-Logger: Convertible Top position sensor inputs – Front latch closed sensor – **ACTIVE**). (Data-Logger: Convertible Top position sensor inputs – Convertible top latched sensor – **ACTIVE**).

- The control module will confirm the sensor in the top latch (D) is transmitting a signal. (Data-Logger: Convertible Top position sensor inputs – Convertible top latched sensor – **ACTIVE**).
- Once confirmed the control module switches off the latch motor. (Data-Logger: Convertible Top module motor outputs - Latch motor close - **OFF**).

Stage 13: Convertible Top - latched



E127228

- The control module will confirm the 'close' sensor (A) in the front latch is transmitting a signal. (Data-Logger: Convertible Top position sensor inputs – Convertible top latched sensor – **ACTIVE**).
- Once confirmed the control module de-energizes the 'tension bow up' solenoid valve (B-1), and the 'tension bow down' solenoid valve (B-2). (Data-Logger: Convertible Top module motor outputs – Tension bow valve 2 – **OFF**). (Data-Logger: Convertible Top module motor outputs – Tension bow valve 3 – **OFF**).
- The control module powers for 4 seconds: both rear quarter glass windows to the raised position, followed by the door glass windows to the raised position. (Data-Logger: Convertible Top module motor outputs - Rear quarter up - **ON**).
- The control module will confirm that all windows are fully closed.
- An audible chime will confirm the completion of the convertible top closing process.

Convertible Top

Principles of Operation

For a detailed description of the Convertible Top operation, refer to the relevant Description and Operation section in the workshop manual.

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Luggage separator position • Luggage compartment lid is closed • Latching assemblies/mechanisms 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections

3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4 . If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
There is a ten second delay in convertible top movement when switch is operated	<ul style="list-style-type: none"> • Door window glass upper and lower parameters have not been set 	Carry out the 'Door Window Motor Initialization' procedure. Door Window Motor Initialization
Rear quarter window glass is not fully closed/raised when convertible top close cycle is complete	<ul style="list-style-type: none"> • Glass sticking in seals • Battery voltage low 	Press and hold convertible top switch in close position. The door window glass will be driven down, then the rear quarter window glass will be driven up for four seconds, followed by the door window glass to fully closed. Check

		battery is in fully charged and serviceable condition. Refer to the battery care manual
Glass will not raise after the convertible top has been raised manually	<ul style="list-style-type: none"> Latched signal is not being seen 	Manually latch the convertible top compartment lid by pushing the convertible top compartment lid cylinder forward until the latch has travelled over center
Glass will not raise	<ul style="list-style-type: none"> Latched signal is not being seen 	Carry out the convertible top compartment lid latch over center bracket setting procedure
Excessive gap between front edge of convertible top and windshield header when manually closed	<ul style="list-style-type: none"> Convertible top header latch not in fully open position when latched with convertible top 	Manually open the latch when pushing the front of the convertible top upwards until the fork is seen to locate on the pin - the top can then be re-latched manually
Convertible top module memory lost	<ul style="list-style-type: none"> Ignition set to OFF when convertible top is mid cycle 	Move convertible top to fully open position, this is recognised by the module as a safe start position which will allow cycle to be re-started

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B107923	Convertible top up switch	<ul style="list-style-type: none"> Signal Stuck Low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107A23	Convertible top down switch	<ul style="list-style-type: none"> Signal Stuck Low 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107B15	Convertible top pump motor	<ul style="list-style-type: none"> Convertible top pump motor circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test convertible top pump motor circuit for short to power, high resistance
B107B11	Convertible top pump motor	<ul style="list-style-type: none"> Convertible top pump motor circuit - short to ground 	Refer to the electrical circuit diagrams and test convertible top pump motor circuit for short to ground
B107C15	Convertible top rear quarter motor	<ul style="list-style-type: none"> Convertible top rear quarter motor circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test convertible top rear quarter motor circuit for short to power, high resistance
B107C11	Convertible top rear quarter motor	<ul style="list-style-type: none"> Convertible top rear quarter motor circuit - short to ground 	Refer to the electrical circuit diagrams and test convertible top rear quarter motor circuit for short to ground
B107D15	Convertible top latch motor	<ul style="list-style-type: none"> Convertible top latch motor circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test convertible top latch motor circuit for short to power, high resistance
B107D11	Convertible top latch motor	<ul style="list-style-type: none"> Convertible top latch motor circuit - short to 	Refer to the electrical circuit diagrams and test convertible top latch motor circuit for

		ground	short to ground
B107E15	Convertible top compartment lid valve 1	<ul style="list-style-type: none"> Convertible top compartment lid valve 1 circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test convertible top compartment lid valve 1 circuit for short to power, high resistance
B107E11	Convertible top compartment lid valve 1	<ul style="list-style-type: none"> Convertible top compartment lid valve 1 circuit - short to ground 	Refer to the electrical circuit diagrams and test convertible top compartment lid valve 1 circuit for short to ground
B107F15	Tension bow valve 2	<ul style="list-style-type: none"> Tension bow valve 2 circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test tension bow valve 2 circuit for short to power, high resistance
B107F11	Tension bow valve 2	<ul style="list-style-type: none"> Tension bow valve 2 circuit - short to ground 	Refer to the electrical circuit diagrams and test tension bow valve 2 circuit for short to ground
B108015	Tension bow valve 3	<ul style="list-style-type: none"> Tension bow valve 3 circuit - short to power, high resistance 	Refer to the electrical circuit diagrams and test tension bow valve 3 circuit for short to power, high resistance
B108011	Tension bow valve 3	<ul style="list-style-type: none"> Tension bow valve 2 circuit - short to ground 	Refer to the electrical circuit diagrams and test tension bow valve 2 circuit for short to ground
B107031	Convertible top compartment lid piston out sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107131	Tension bow piston in sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107231	Tension bow piston out sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107331	Main bow piston in sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107431	Main bow piston out sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
B107531	Main bow piston centre sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107631	Front latch open sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107731	Front latch close sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B107831	Convertible top latched sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B113531	Convertible top compartment lid switch	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U001088	Medium speed CAN communication Bus	<ul style="list-style-type: none"> Bus off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014000	Lost communication CJB	<ul style="list-style-type: none"> Lost communication CJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U014200	Lost communication with RJB	<ul style="list-style-type: none"> Lost communication with RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015500	Lost communication with Instrument Cluster	<ul style="list-style-type: none"> Lost communication with Instrument Cluster 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U019900	Lost communication with Driver Door Module (DDM)	<ul style="list-style-type: none"> Lost communication with Driver Door Module (DDM) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U020000	Lost communication with Passenger Door Module (PDM)	<ul style="list-style-type: none"> Lost communication with Passenger Door Module (PDM) 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

U030000	Control module software incompatibility	<ul style="list-style-type: none"> RJB car configuration data is not compatible with the convertible top module 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTCs and re-test. If DTC still logged, suspect convertible top module. Refer to new module installation note at top of DTC Index
U049A67	Invalid data received from Driver Door Module (DDM)	<ul style="list-style-type: none"> Signal incorrect after event 	Check DDM for DTCs and refer to DTC Index
U050167	Invalid data received from Passenger Door Module (PDM)	<ul style="list-style-type: none"> Signal incorrect after event 	Check PDM for DTCs and refer to DTC Index
U1A1449	CAN initialisation failure	<ul style="list-style-type: none"> Internal electronic failure 	Install a new convertible top module, refer to the new module installation note at the top of the DTC Index
U1A4C68	Build/end of line mode active	<ul style="list-style-type: none"> Manufacturing mode has not been removed 	Set convertible top to customer mode using manufacturer approved diagnostic system
U300316	Battery voltage	<ul style="list-style-type: none"> Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

Convertible Top Compartment Lid Latch, Over Center Bracket Setting Procedure

- 1 . Set hydraulic pump to manual override.
- 2 . Set ignition status to OFF.
- 3 . Open the convertible top compartment lid to access the top fixing nut of the latch bracket on the right hand wheelhouse and slacken the nut.
- 4 . Slacken the two lower fixing nuts of the latch bracket on the right hand wheel house, these can be accessed through the luggage compartment.


5 . Position the mechanism to the fully over center position, then push the bracket forward until the cylinder is at it's shortest length, then release.

6 . Tighten the two lower fixing nuts to 9Nm, open the convertible top compartment lid and tighten the top fixing nut to 9Nm.

Convertible Top Assembly (76.86.15)

Removal

- 1 . Remove the rear quarter trim panels.
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)
- 2 . Remove the RH loadspace trim panel.
For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

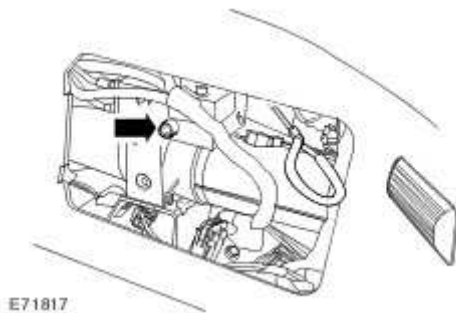
- 3  **CAUTION: Do not loosen the Allen bolt more than 2 complete turns. Failure to follow this instruction may result in damage to the vehicle.**

NOTE:

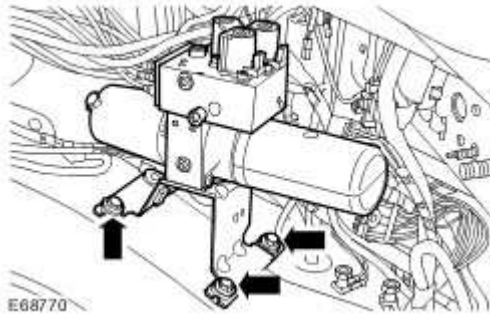
The ignition must be switched off.

Release the convertible top system pressure.

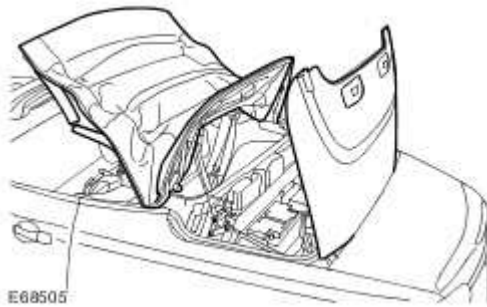
- ▶ Loosen the Allen bolt up to a maximum of 2 complete turns.



- 4 . Disconnect the convertible top hydraulic pump electrical connectors.
- 5 . Release the convertible top hydraulic pump.
 - ▶ Remove the 3 bolts.

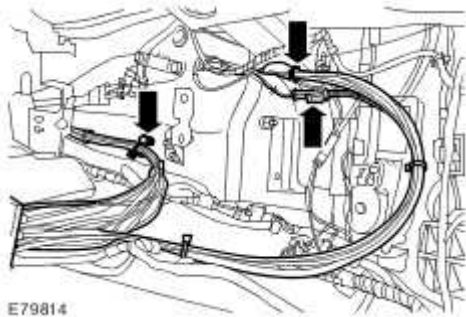


6 . Close the convertible top to the position shown.



7 . Release the convertible top fluid lines and harness.

- ▶ Disconnect the electrical connector.
- ▶ Release the 2 fluid line and harness clips.

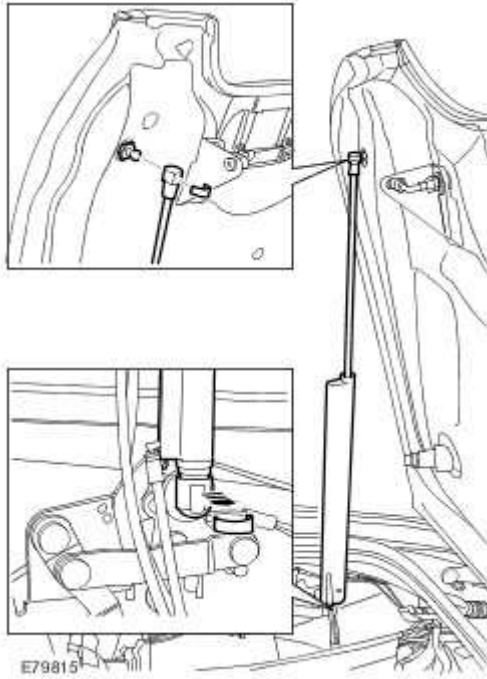


8 . **NOTE:**

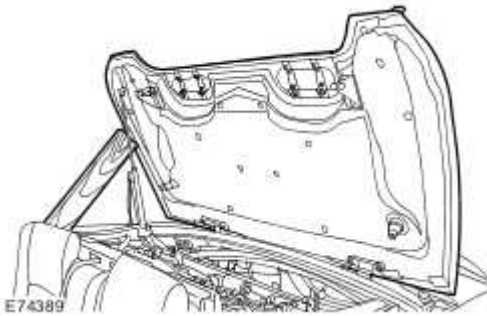
Support the convertible top compartment lid.

Release the convertible top compartment lid RH lift cylinder.

- ▶ Release the 2 clips.



9 . Open the convertible top to the position shown.



10



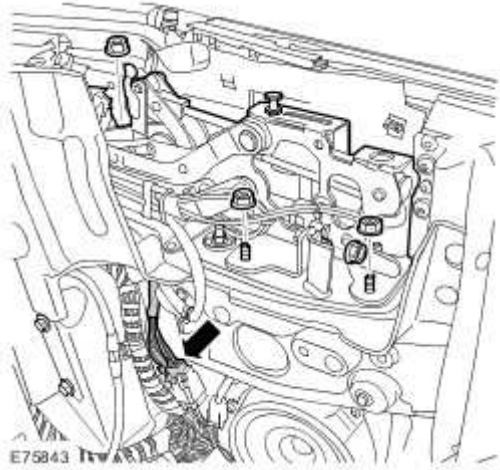
CAUTION: Under no circumstances must the base plate fixing nuts be loosened or removed. Each base plate fixing nut can be identified by a large aluminium spacer.

NOTE:

This step requires the aid of other technicians.

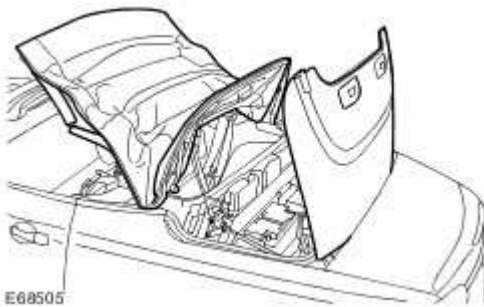
Remove the convertible top assembly.

- ▶ Disconnect the 2 electrical connectors.
- ▶ Remove the 8 nuts.



Installation

- 1 . Install the convertible top assembly.
 - ▶ Tighten the nuts to 25 Nm.
 - ▶ Connect the electrical connectors.
- 2 . Align the convertible top assembly.
For additional information, refer to [Convertible Top Alignment](#)
- 3 . Close the convertible top to the position shown.

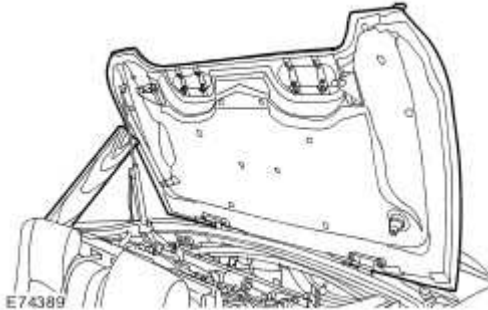


- 4 . **NOTE:**
Support the convertible top compartment lid.

Attach the convertible top compartment lid RH lift cylinder.
 - ▶ Secure with the clips.
- 5 . Secure the convertible top fluid lines and harness.
 - ▶ Secure the fluid line and harness clips.

- ▶ Connect the electrical connector.
- ▶ Install new cable ties.

6 . Open the convertible top to the position shown.



7 . Secure the convertible top hydraulic pump.

- ▶ Tighten the bolts to 8 Nm.

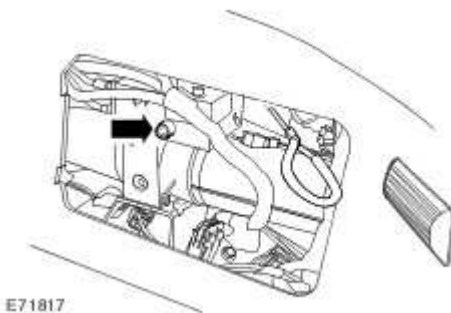
8 . Connect the convertible top hydraulic pump electrical connectors.

9 . **NOTE:**

The ignition must be switched off.

Tighten the convertible top system pressure Allen bolt.

- ▶ Tighten to 2 Nm.



10 Install the RH loadspace trim panel.

- For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

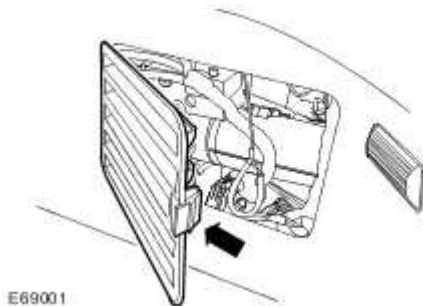
11 . Install the rear quarter trim panels.


- For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)

Convertible Top Headliner (76.86.16)

Removal

- 1 . Remove the header rail upper trim panel.
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)
- 2 . Remove the convertible top hydraulic pump access panel
▶ Release the clip.



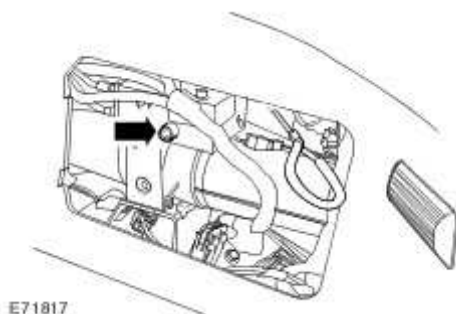
- 3 .  **CAUTION: Do not loosen the Allen bolt more than 2 complete turns. Failure to follow this instruction may result in damage to the vehicle.**

NOTE:

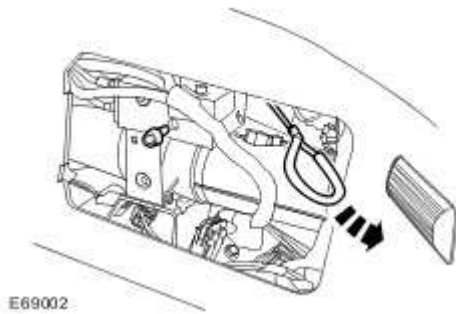
The ignition must be switched off.

Release the convertible top system pressure.

- ▶ Loosen the Allen bolt up to a maximum of 2 complete turns.



- 4 . Release the convertible top compartment lid.
▶ Release using the cable.



5 . NOTE:

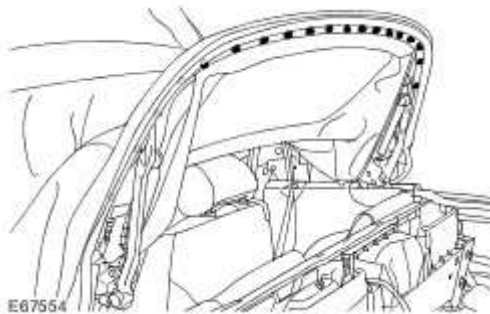
Support as necessary.

Open the convertible top to the position shown.

- ▶ Raise the rear of the convertible top.

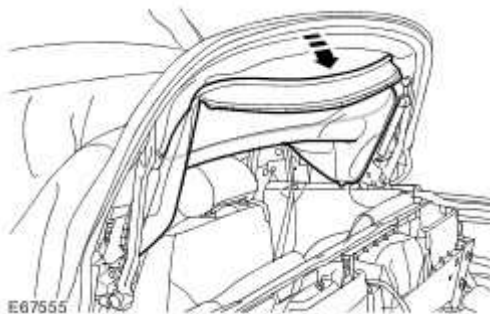
6 . Release the rear edge of the convertible top headliner.

- ▶ Remove the 21 Torx screws.
- ▶ Remove the securing bracket.



7 . Release the headliner from the rear window.

- ▶ Release from the Velcro strip.



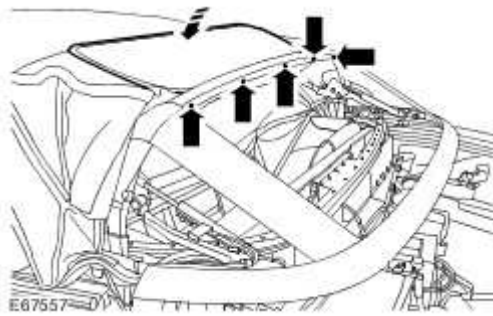
8 . Release the heated rear window wires from the headliner.

- ▶ Disconnect both heated rear window electrical connectors.
- ▶ Release the heated rear window wires from the headliner.



9 Reposition the rear window

- ▶ Fold over the rear window to allow access to the headliner retaining screws.



10 . **NOTE:**

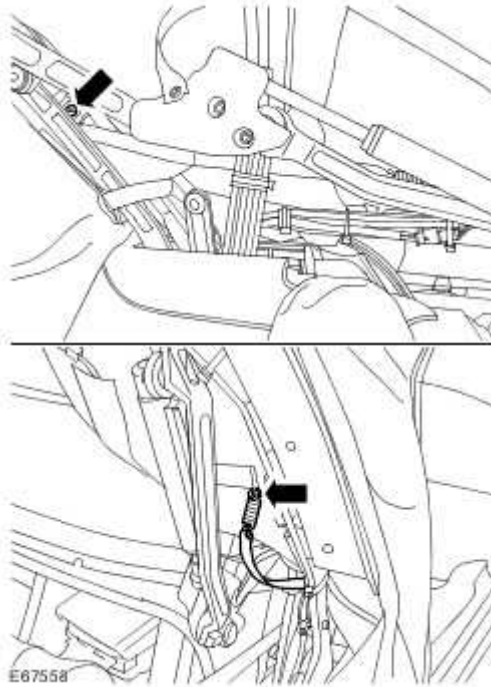
Take note of the routing.

NOTE:

Note the fitted position.

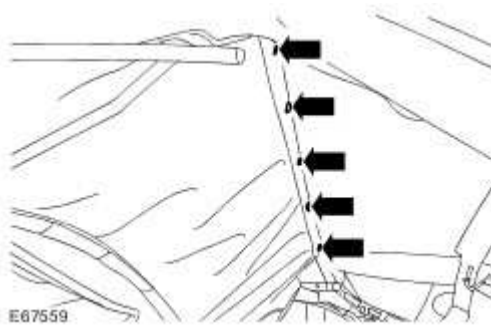
Release the headliner rear tension straps.

- ▶ Remove the 2 Torx bolts.
- ▶ Release the 2 springs.



11 . Release the headliner from the rear of the convertible top frame.

▶ Remove the 5 screws.

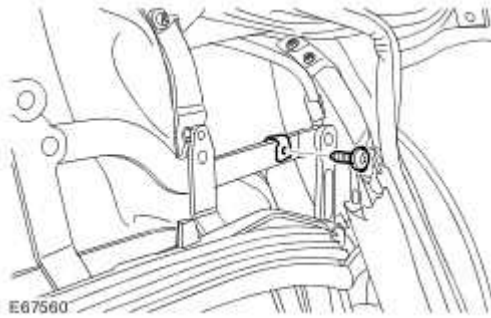


12 . **NOTE:**

Note the fitted position.

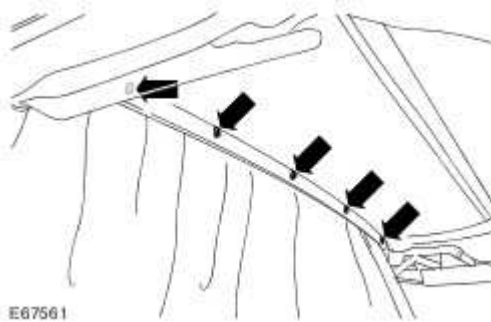
Release the headliner central tension straps.

▶ Remove the 2 Torx bolts.



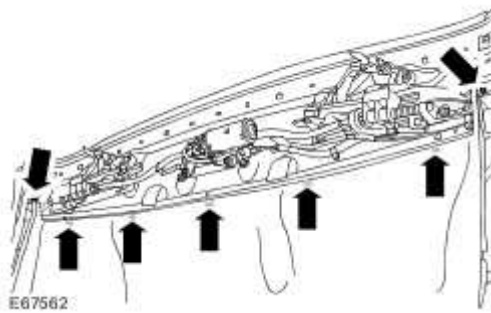
13 . Release the headliner from the center of the convertible top frame.

- ▶ Remove the 5 screws.



14 . Release the headliner from the front of the convertible top frame.

- ▶ Remove the 5 screws.
- ▶ Remove the 2 bolts.
- ▶ Collect the retaining bracket.



15 . Remove the headliner.

Installation

- 1  **CAUTION: Ensure grease from latching mechanisms does not contact the headliner.**

Secure the headliner to the front of the convertible top frame.

- ▶ Position the the retaining bracket.
- ▶ Install and tighten the screws.
- ▶ Tighten the bolts to 10 Nm.

- 2 . Secure the headliner to the center of the convertible top frame.

- ▶ Remove the 5 screws.
- ▶ Install and tighten the screws.

- 3 . **NOTE:**

Note the fitted position.

Attach the headliner central tension straps.

- ▶ Tighten the Torx bolts to 4 Nm.

- 4 . Secure the headliner to the rear of the convertible top frame.

- ▶ Install and tighten the screws.

- 5 . **NOTE:**

Take note of the routing.

NOTE:

Note the fitted position.

Attach the headliner rear tension straps.

- ▶ Tighten the Torx bolts to 4 Nm.
- ▶ Attach the springs.

- 6 Reposition the rear window

- ▶ Fold over the rear window to allow access to the headliner retaining screws.
- ▶ Fold the rear window into fitted position.

- 7 . Secure the heated rear window wires to the headliner.

- ▶ Attach the heated rear window wires to the headliner.
- ▶ Connect the electrical connectors.

- 8 . Secure the rear edge of the converible top headliner.

- ▶ Position the securing bracket.
- ▶ Install and tighten the Torx screws.

9 . **NOTE:**

Support as necessary.

Close the convertible top compartment lid.

- ▶ Raise the rear of the convertible top.

10 . Install the header rail upper trim panel.

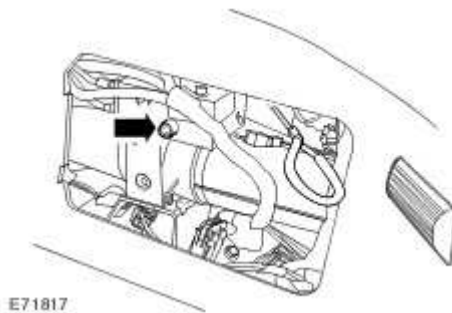
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)

11 . **NOTE:**

The ignition must be switched off.

Tighten the convertible top system pressure Allen bolt.

- ▶ Tighten to 2 Nm.



12 . Install the convertible top hydraulic pump access panel

- ▶ Secure in the clip.

13 . Operate the convertible top fully in each direction.

- ▶ Depress the switch.

Convertible Top Latch (76.86.19)

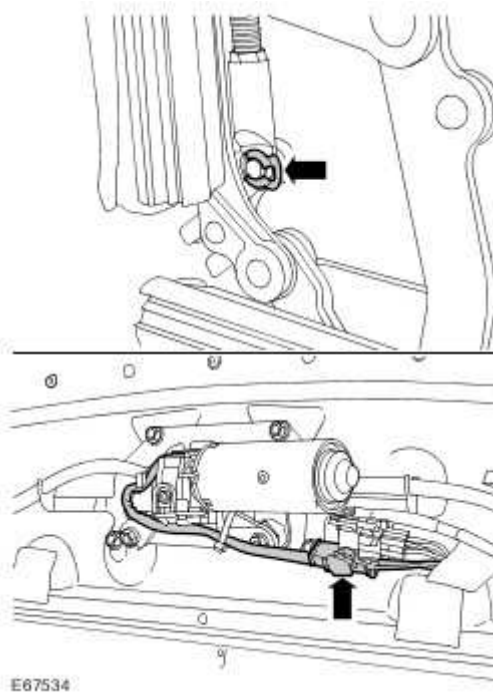
Removal

- 1 . Remove the header rail upper trim panel.
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)

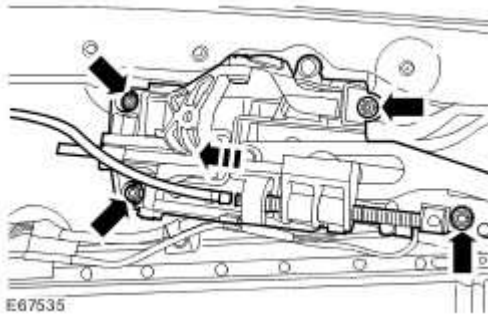
- 2 . Release the convertible top locking mechanism rod.
▶ Remove the retaining clip.

- 3 . **NOTE:**
Electrical connector is installed on the LH latch only.

- Release the convertible top latch assembly.
▶ Disconnect the electrical connector.



- 4 . Remove the convertible top latch assembly.
▶ Remove the 4 nuts.
▶ Release the drive cable.



Installation

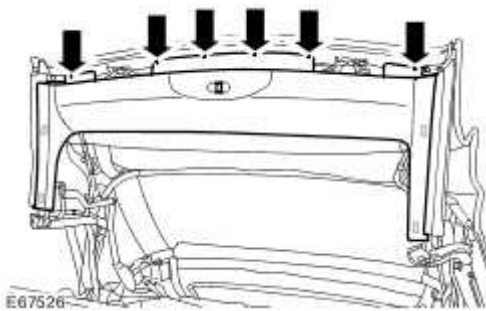
- 1 . Install the convertible top latch assembly.
 - ▶ Attach the drive cable.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Attach the convertible top locking mechanism rod.
 - ▶ Install the retaining clip.
- 3 . Install the header rail upper trim panel.

For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)

Header Rail Upper Trim Panel (76.86.20)

Removal

- 1 . Release the convertible top front latches.
 - ▶ Depress the switch.
- 2 . Remove the header rail upper trim panel.
 - ▶ Remove the 6 screws.
 - ▶ Release the 4 clips.



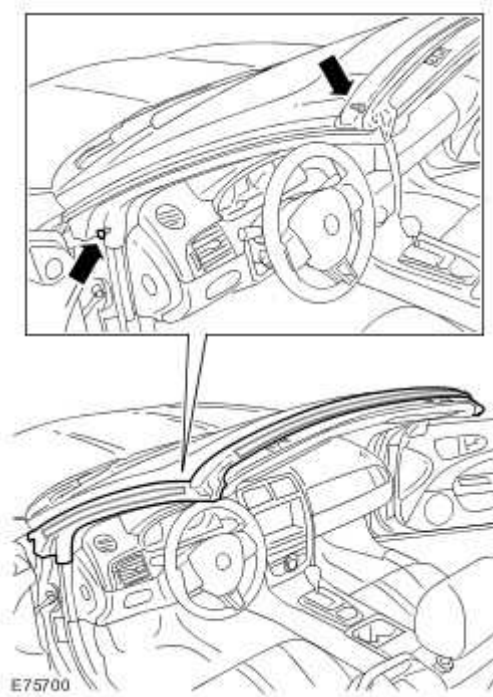
Installation

- 1 . Install the header rail upper trim panel.
 - ▶ Secure with the clips.
 - ▶ Install and tighten the screws.
- 2 . Close the the convertible top.
 - ▶ Depress the switch.

Header Rail Weatherstrip

Removal


- 1 . Open the convertible top.
 - ▶ Depress the switch.
- 2 . Release the header rail weatherstrip.
 - ▶ Remove the 4 clips.



- 3 . Remove the header rail weatherstrip.
 - ▶ Release from the header rail.

Installation

- 1 . Install the header rail weatherstrip.
 - ▶ Attach to the header rail.
- 2 . Secure the header rail weatherstrip.
 - ▶ Install the clips.
- 3 . Close the convertible top.

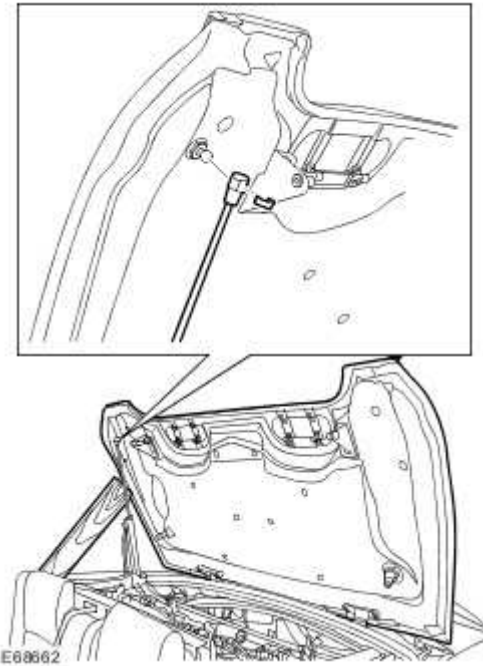
 Depress the switch.

Convertible Top Compartment Lid

Removal

1 . Open the convertible top to the position shown.

- ▶ Depress the switch.
- ▶ Support as necessary.

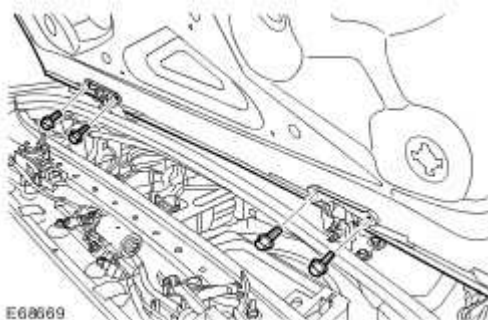


2 . Release the convertible top compartment lid lift cylinder.

- ▶ Release the clip.

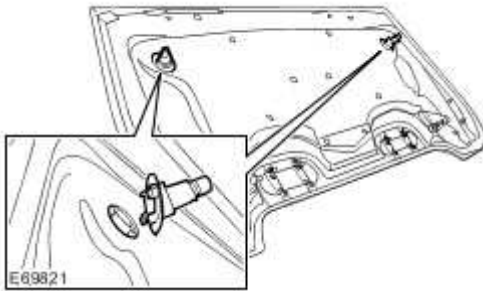
3 . With assistance, remove the convertible top compartment lid.

- ▶ Remove the 4 bolts.



4 . Remove the convertible top compartment lid buffers.

▶ Release the clips.

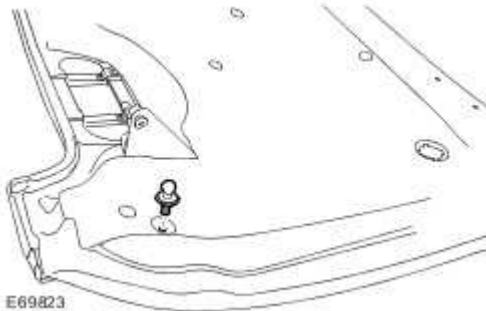


5 . Remove the convertible top compartment lid pad.

▶ Remove the 11 clips.

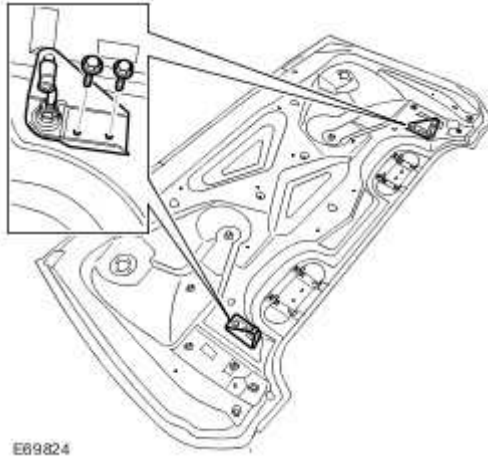


6 . Remove the convertible top compartment lid lift cylinder spigot.

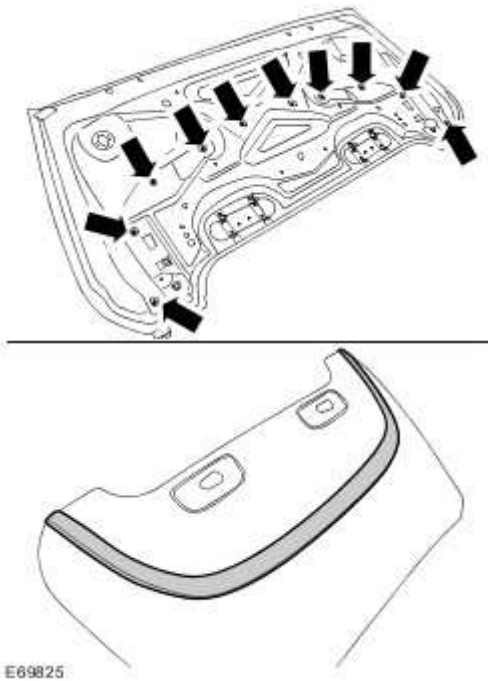


7 . Remove the convertible top compartment lid strikers.

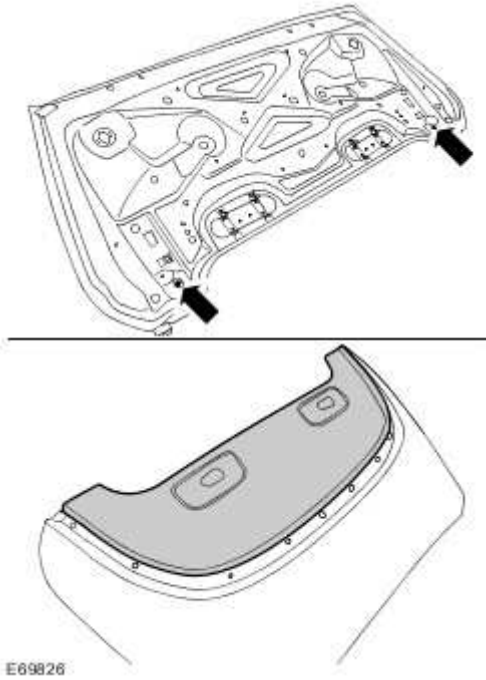
▶ Remove the 4 bolts.



- 8 . Remove the convertible top compartment moulding.
▶ Remove the 10 nuts.



- 9 . Remove the convertible top compartment trim panel.
▶ Remove the 2 Torx bolts.
▶ Release from the 8 clips.



Installation

- 1 . Install the convertible top compartment trim panel.
 - ▶ Install and tighten the Torx screws.
 - ▶ Secure with the clips.
- 2 . Install the convertible top compartment moulding.
 - ▶ Tighten the nuts to 4 Nm (3 lb.ft).
- 3 . Install the convertible top compartment lid strikers.
 - ▶ Tighten the bolts to 9 Nm (7 lb.ft).
- 4 . Install the convertible top compartment lid lift cylinder spigot.
- 5 . Install the convertible top compartment lid pad.
 - ▶ Secure with the clips.
- 6 . Install the convertible top compartment lid buffers.
 - ▶ Release the clips.
 - ▶ Secure in the clips.
- 7 . Check the convertible top compartment lid profile.

- ▶ Loosen the locknut.
- ▶ Adjust the striker.
- ▶ Check the convertible top compartment lid profile.

8 . With assistance, install the convertible top compartment lid.

- ▶ Tighten the bolts to 25 Nm (18 lb.ft).

9 . Attach the convertible top compartment lid lift cylinder.

- ▶ Secure with the clip.

10 . Close the convertible top compartment lid.

- ▶ Remove the support.
- ▶ Depress the switch.

11 . If required, adjust the convertible top compartment lid.

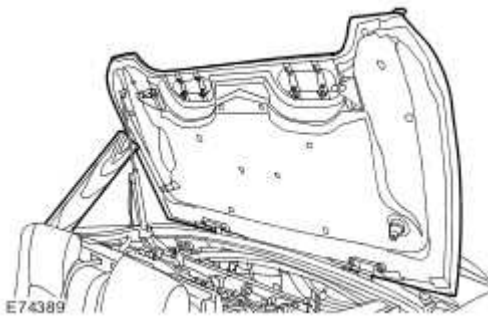
Convertible Top Compartment Lid Trim Panel

Removal

1 . Open the convertible top to the position shown.

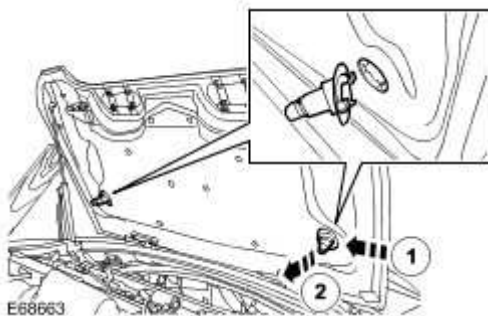
▶ Depress the switch.

▶ Support as necessary.



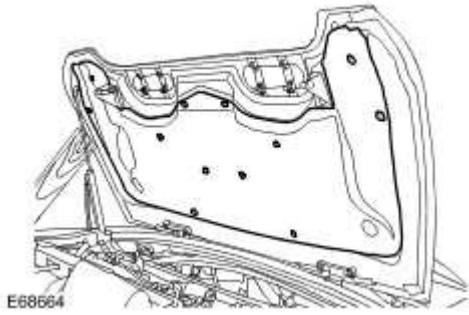
2 . Remove the convertible top compartment lid buffers.

▶ Release the clips.



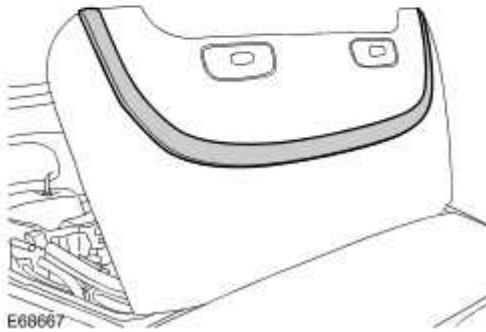
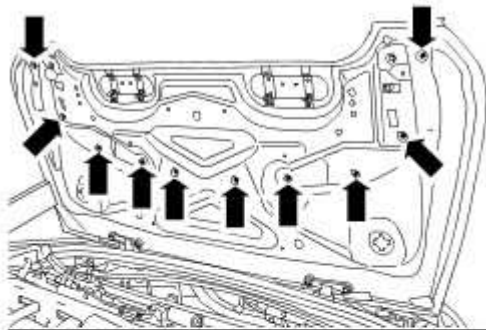
3 . Remove the convertible top compartment lid pad.

▶ Remove the 11 clips.



4 . Remove the convertible top compartment moulding.

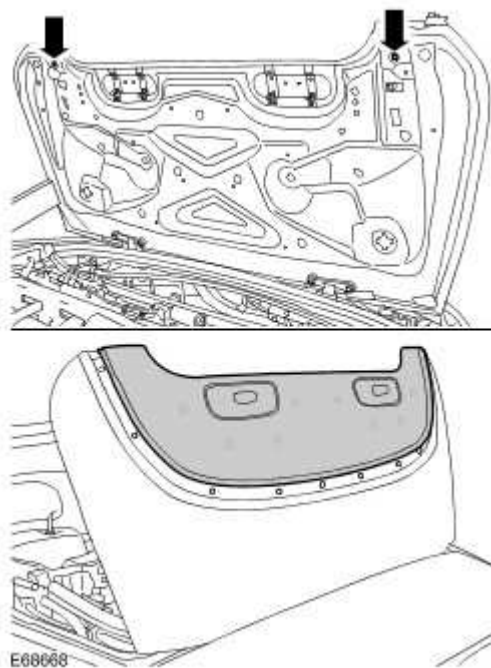
▶ Remove the 10 nuts.



5 . Remove the convertible top compartment trim panel.

▶ Remove the 2 Torx bolts.

▶ Release from the 8 clips.



Installation

- 1 . Install the convertible top compartment trim panel.
 - ▶ Install and tighten the Torx screws.
 - ▶ Secure with the clips.
- 2 . Install the convertible top compartment moulding.
 - ▶ Tighten the nuts to 4 Nm (3 lb.ft).
- 3 . Install the convertible top compartment lid pad.
 - ▶ Secure with the clips.
- 4 . Install the convertible top compartment lid buffers.
 - ▶ Release the clips.
 - ▶ Secure in the clips.
- 5 . Close the convertible top compartment lid.
 - ▶ Remove the support.
 - ▶ Depress the switch.

Convertible Top Compartment Lid Hinge

Removal

- 1 . Remove the convertible top compartment lid.
For additional information, refer to [Convertible Top Compartment Lid](#)
- 2 . Remove the convertible top compartment lid hinge.
 - ▶ Remove the 3 bolts.
 - ▶ Remove and discard the gasket.



Installation

- 1 . Install the convertible top compartment lid hinge.
 - ▶ Install a new gasket.
 - ▶ Tighten the bolts to 25 Nm (18 lb.ft).
- 2 . Install the convertible top compartment lid.
For additional information, refer to [Convertible Top Compartment Lid](#)

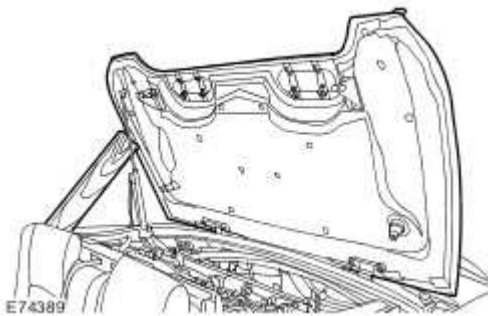
Convertible Top Compartment Lid Moulding

Removal

1 . Open the convertible top to the position shown.

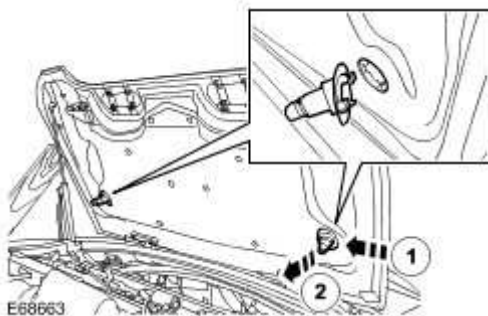
▶ Depress the switch.

▶ Support as necessary.



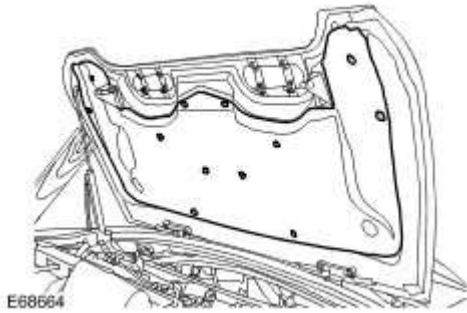
2 . Remove the convertible top compartment lid buffers.

▶ Release the clips.



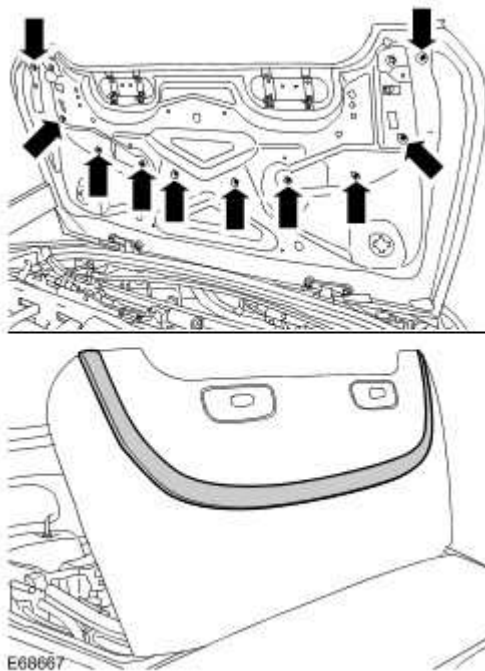
3 . Remove the convertible top compartment lid pad.

▶ Remove the 11 clips.



4 . Remove the convertible top compartment moulding.

▶ Remove the 10 nuts.



Installation

1 . Install the convertible top compartment moulding.

▶ Tighten the nuts to 4 Nm (3 lb.ft).

2 . Install the convertible top compartment lid pad.

▶ Secure with the clips.

3 . Install the convertible top compartment lid buffers.

▶ Release the clips.

▶ Secure in the clips.

4 . Close the convertible top compartment lid.

▶ Remove the support.

▶ Depress the switch.

Convertible Top Compartment Lid Latch

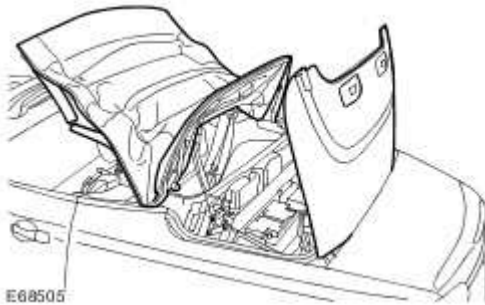
Removal

1 . NOTE:

Support as necessary.

Open the convertible top to the position shown.

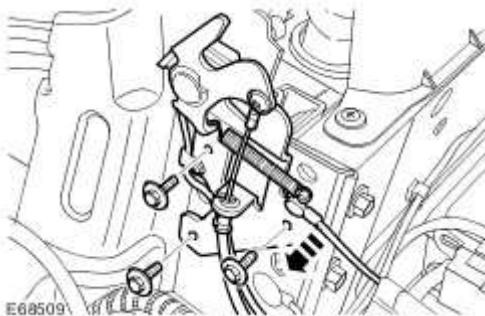
▶ Depress the switch.



2 . Release the luggage compartment retractable cover rail upper tension strap.

3 . Release the convertible top lid latch.

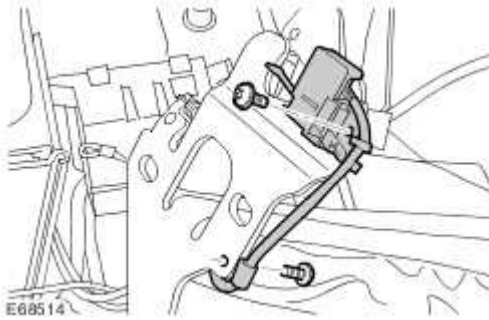
▶ Remove the 3 bolts.



4 . Release the convertible top lid position switch

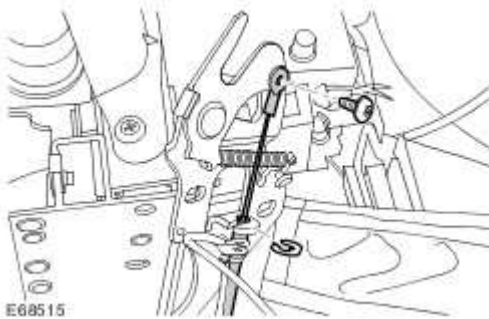
▶ Remove the 2 Torx bolts.

▶ Release the switch.



5 . Release the convertible top latch release cable.

- ▶ Remove the Torx bolt.
- ▶ Carefully release the clip.



Installation

1 . Attach the convertible top latch release cable.

- ▶ Tighten the Torx bolt.
- ▶ Install the clip.

2 . Secure the convertible top lid position switch.

- ▶ Attach the switch.
- ▶ Tighten the Torx bolts.

3 . Secure the convertible top lid latch.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

4 . **NOTE:**

Support as necessary.

Close the convertible top compartment lid.

Convertible Top Compartment Lid Release Cables

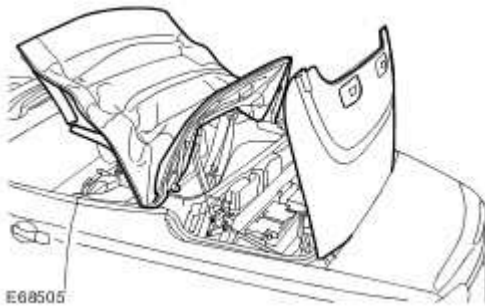
Removal

1 . NOTE:

Support as necessary.

Open the convertible top to the position shown.

▶ Depress the switch.



2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

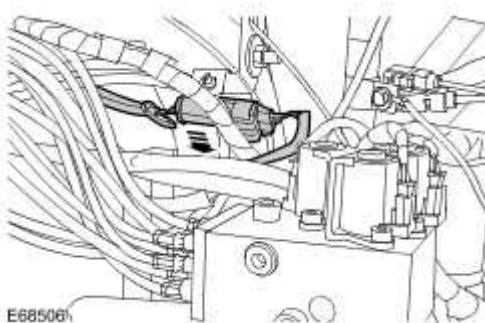
3 . Remove the RH loadspace trim panel.

For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

4 . Release the convertible top electrical connector

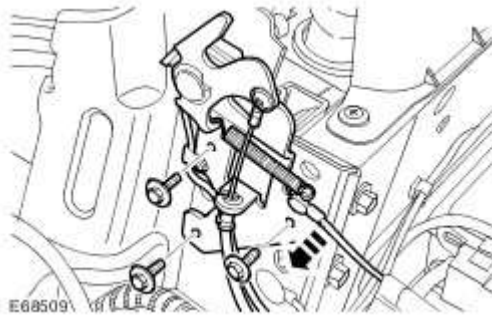
▶ Release from the clip.

▶ Disconnect the electrical connector.



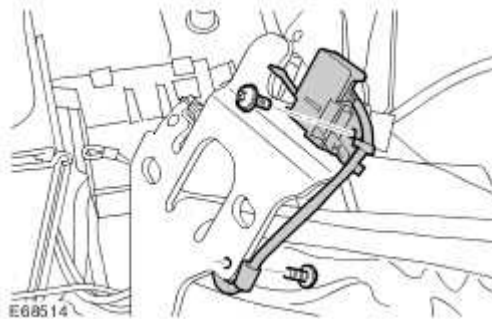
5 . Release the LH convertible top lid latch.

▶ Remove the 3 bolts.



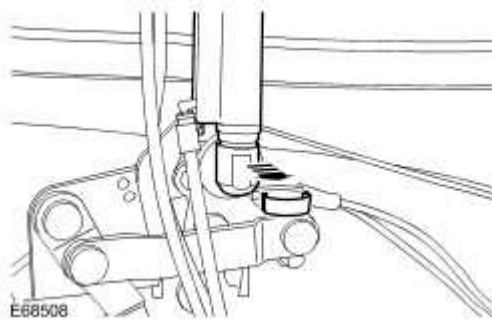
6 . Release the convertible top lid position switch

- ▶ Remove the 2 Torx bolts.



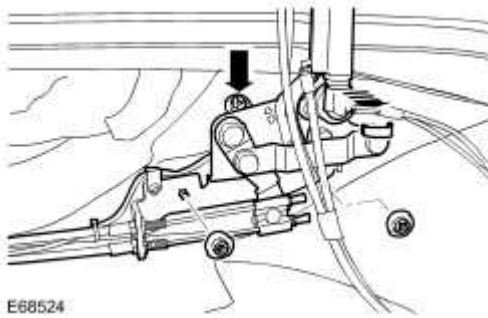
7 . Release the convertible top lid lift cylinder.

- ▶ Release the clip.



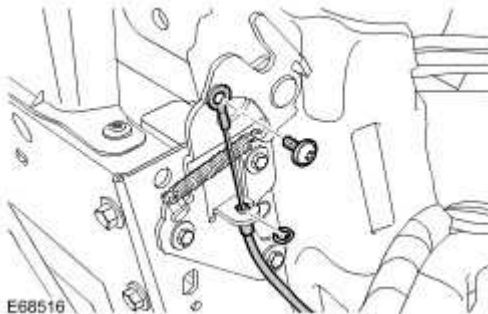
8 . Release the convertible top lid lift cylinder bracket.

- ▶ Remove the 2 lower nuts.
- ▶ Loosen the upper retaining nut.



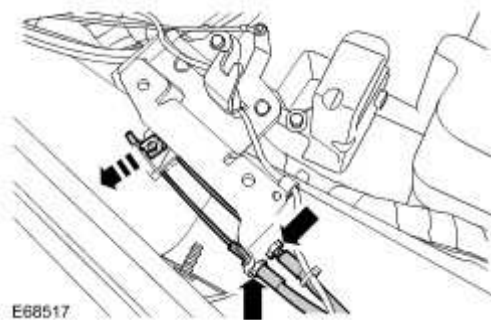
9 . Release the convertible top latch release cables.

- ▶ Remove the 2 Torx bolts.
- ▶ Carefully release the 2 clips.



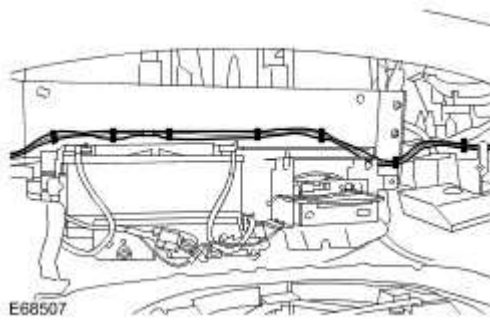
10 . Release the convertible top lid lift cylinder bracket release cables.

- ▶ Loosen the 2 locknuts.
- ▶ Remove the clip.



11 . Remove the convertible top lid release latch cables.

- ▶ Release from the 7 clips.



Installation

- 1 . Install the convertible top lid release latch cables.
 - ▶ Release from the 7 clips.
- 2 . Attach the convertible top lid lift cylinder bracket release cables.
 - ▶ Loosen the 2 locknuts.
 - ▶ Remove the clip.
- 3 . Attach the convertible top latch release cables.
 - ▶ Secure with the clips.
 - ▶ Tighten the Torx bolts.
- 4 . Attach the convertible top lid lift cylinder.
 - ▶ Secure with the clip.
- 5 . Secure the convertible top lid lift cylinder bracket.
 - ▶ Remove the 2 lower nuts.
 - ▶ Loosen the upper retaining nut.
- 6 . Secure the convertible top lid position switch.
 - ▶ Tighten the Torx bolts.
- 7 . Secure the LH convertible top lid latch.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
- 8 . Secure the convertible top electrical connector.
 - ▶ Connect the electrical connector.
 - ▶ Secure with the clip.

9 . Install the RH loadspace trim panel.

For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

10 . Connect the battery ground cable and install the cover.

For additional information, refer to

11 . Close the convertible top compartment lid.

12 . If required, adjust the convertible top compartment lid.

Convertible Top Compartment Lid Latch and Cable Assembly

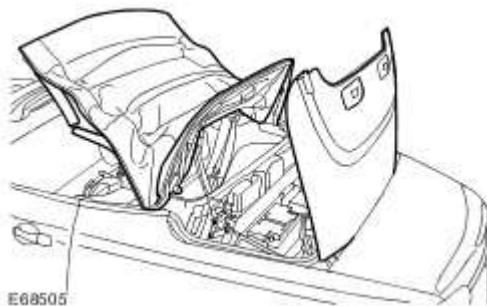
Removal

1 . NOTE:

Support as necessary.

Open the convertible top to the position shown.

▶ Depress the switch.



2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to

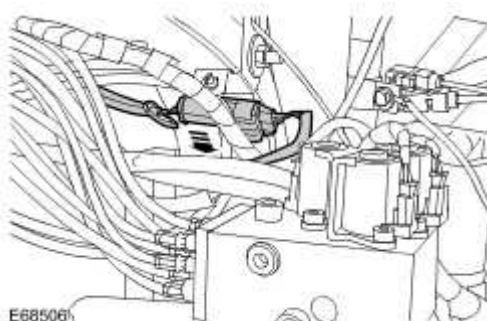
3 . Remove the RH loadspace trim panel.

For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

4 . Release the convertible top electrical connector

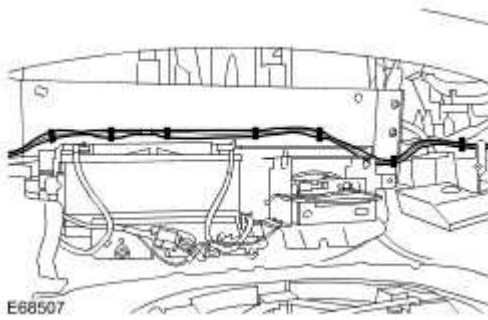
▶ Release from the clip.

▶ Disconnect the electrical connector.



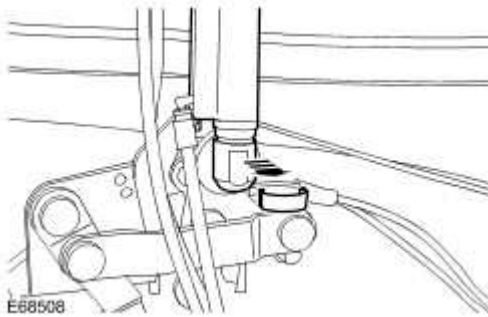
5 . Release the convertible top lid latch and cable assembly.

▶ Release the cables from the 7 clips.



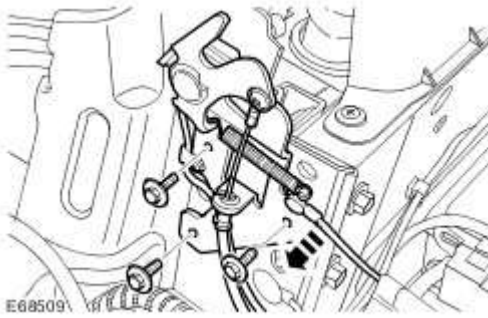
6 . Release the convertible top lid lift cylinder.

▶ Release the clip.



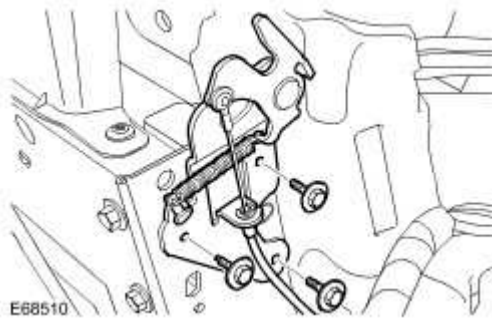
7 . Release the LH convertible top lid latch.

▶ Remove the 3 bolts.



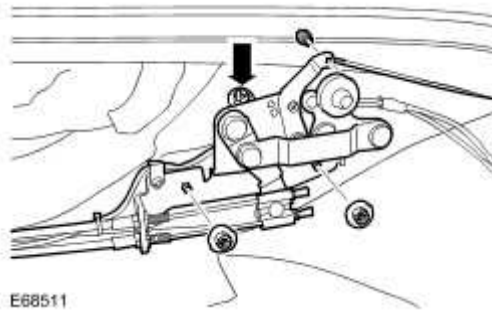
8 . Release the convertible top lid RH latch.

▶ Remove the 3 bolts.



9 . Remove the convertible top lid latch and cable assembly.

- ▶ Remove the 2 lower nuts.
- ▶ Loosen the upper retaining nut.
- ▶ Release the emergency release cable.



Installation

1 . Install the convertible top latch and cable assembly.

- ▶ Attach the emergency release cable.
- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

2 . Secure the convertible top lid RH latch.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

3 . Secure the LH convertible top lid latch.

- ▶ Tighten the bolts to 10 Nm (7 lb.ft).

4 . Attach the convertible top lid lift cylinder.

- ▶ Secure with the clip.

5 . Secure the convertible top lid latch and cable assembly.

- ▶ Connect the electrical connector.
- ▶ Secure the cables in the clips.

6 . Secure the convertible top electrical connector.

- ▶ Connect the electrical connector.
- ▶ Secure with the clip.

7 . Install the RH loadspace trim panel.

For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

8 . Connect the battery ground cable and install the cover.

For additional information, refer to

9 . **NOTE:**

Support as necessary.

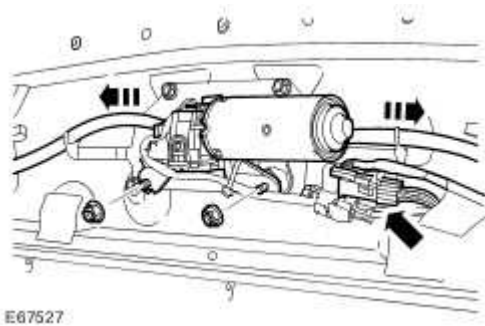
Close the convertible top compartment lid.

- ▶ Raise the rear of the convertible top.

Convertible Top Motor

Removal

- 1 . Remove the header rail upper trim panel.
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)
- 2 . Release the convertible top latch motor.
 - ▶ Disconnect the electrical connector.
- 3 . Remove the convertible top latch motor.
 - ▶ Remove the 2 nuts.
 - ▶ Release the latch motor drive cables.




Installation

- 1 . Install the convertible top latch motor.
 - ▶ Attach the drive cables.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the header rail upper trim panel.
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)

Hydraulic System, Lift Cylinder and Motor

Removal

- 1 . Remove the RH loadspace trim panel.
For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

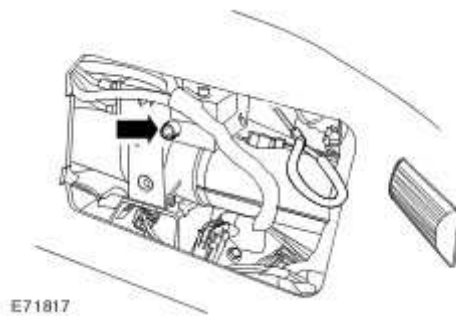
- 2  **CAUTION: Do not loosen the Allen bolt more than 2 complete turns. Failure to follow this instruction may result in damage to the vehicle.**

NOTE:

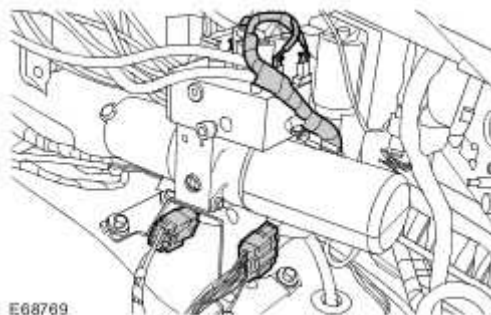
The ignition must be switched off.

Release the convertible top system pressure.

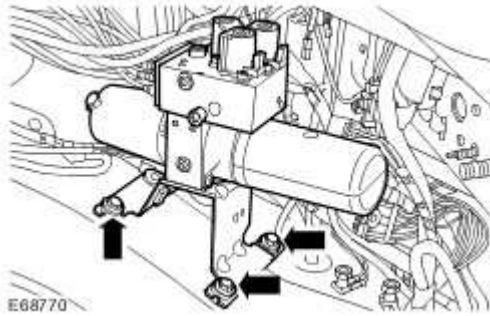
- ▶ Loosen the Allen bolt up to a maximum of 2 complete turns.



- 3 Disconnect the convertible top hydraulic pump electrical connectors.
 - ▶ Release the 2 electrical connectors from the convertible top pump bracket.



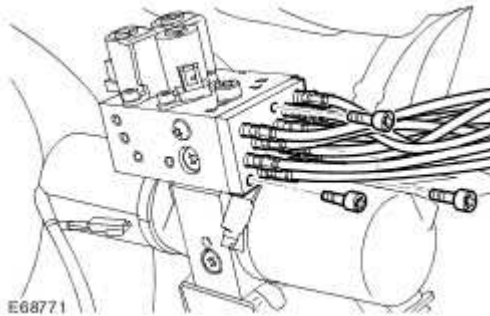
- 4 . Release the convertible top hydraulic pump.
 - ▶ Remove the 3 bolts.



5.  **CAUTION: Always plug any open connections to prevent contamination.**

Disconnect the convertible top hydraulic pump hoses.

- ▶ Remove the 3 Allen bolts.
- ▶ Release the hose retaining clamp.
- ▶ Remove and discard the O-ring seals.



- 6 . Remove the convertible top hydraulic pump.

Installation

- 1 . Install the convertible top hydraulic pump.
- 2 . Connect the convertible top hydraulic pump hoses.
 - ▶ Install new O-ring seals.
 - ▶ Attach the hoses and position the retaining clamp.
 - ▶ Tighten the Allen bolts to 10 Nm.
- 3 . Secure the convertible top hydraulic pump.
 - ▶ Tighten the bolts to 8 Nm.

- 4 . Connect the convertible top hydraulic pump electrical connectors.
 - ▶ Secure the electrical connectors to the convertible top pump bracket.

- 5 . Fill the convertible top pump with the correct amount of fluid.
 - ▶ Remove the convertible top fluid filler plug.
 - ▶ Top-up the convertible top fluid.
 - ▶ Install the convertible top fluid filler plug.

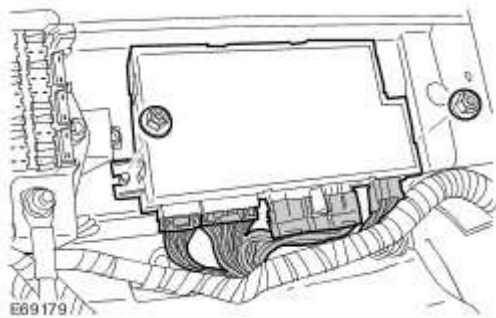
- 6 . Install the RH loadspace trim panel.
For additional information, refer to [Loadspace Trim Panel - Convertible \(76.13.73.60\)](#)

- 7 . Cycle the convertible top to bleed the hydraulic system.

Convertible Top Module

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the LH roll over protection unit.
For additional information, refer to [Rollover Protection Unit](#)
- 4 . Remove the convertible top module.
 - ▶ Disconnect the 4 electrical connectors.
 - ▶ Remove the 2 nuts.



Installation

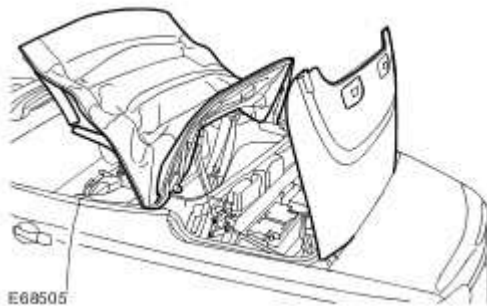
- 1 . Install the convertible top module.
 - ▶ Tighten the nuts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connectors.
- 2 . Install the LH roll over protection unit.
For additional information, refer to [Rollover Protection Unit](#)
- 3 . Connect the battery ground cable and install the cover.
For additional information, refer to

Convertible Top Rear Panel Lower Weatherstrip

Removal

1 . Open the convertible top to the position shown.

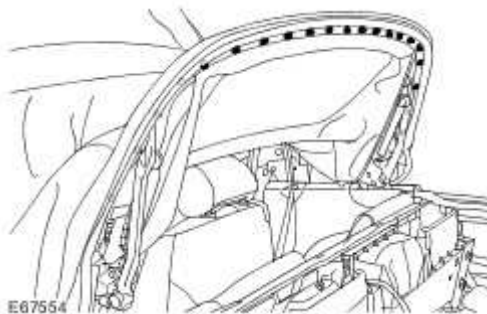
▶ Depress the switch.



2 . Release the rear edge of the convertible top rear panel lower weatherstrip.

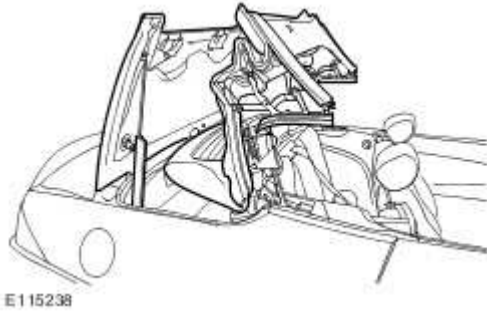
▶ Remove the 21 Torx screws.

▶ Remove the main carrier.



3 . Open the convertible top to the position shown.



▶ Depress the switch.

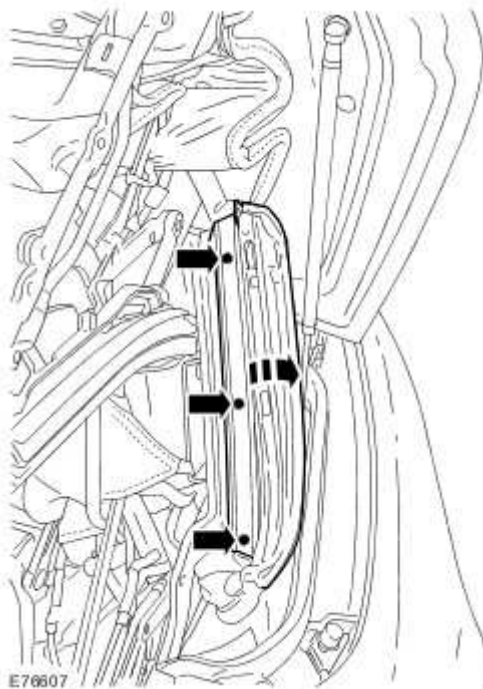


4.  **CAUTION: Make sure that filings and swarf do not enter the component.**

 **CAUTION: LH illustration shown, RH is similar.**


Remove the convertible top rear panel lower weatherstrip C-post carriers.

-  Release the seal.
-  Drill out the 6 rivets.

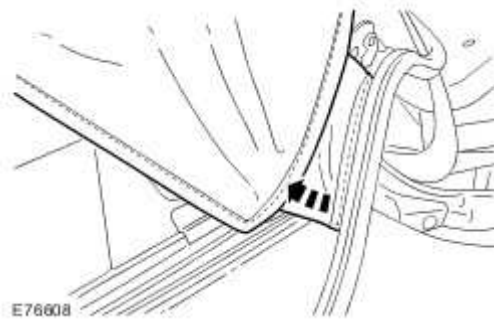


5.  **CAUTION: LH illustration shown, RH is similar.**



Remove the convertible top rear panel lower weatherstrip.


-  Carefully release the convertible top rear panel lower weatherstrip

from the outer material.





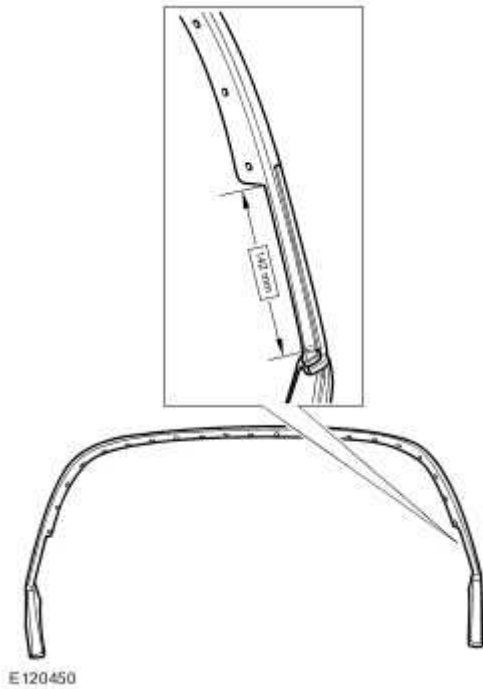
Installation

- 1 Install the convertible top rear panel lower weatherstrip carriers.
 -  Install the convertible top rear panel lower weatherstrip C-post carrier to the seal.
 -  Install the convertible top rear panel lower weatherstrip seal to the main carrier.

- 2  **CAUTION: Make sure that the seal is correctly positioned and does not move during installation. Failure to follow this instruction may result in damage to the vehicle.**

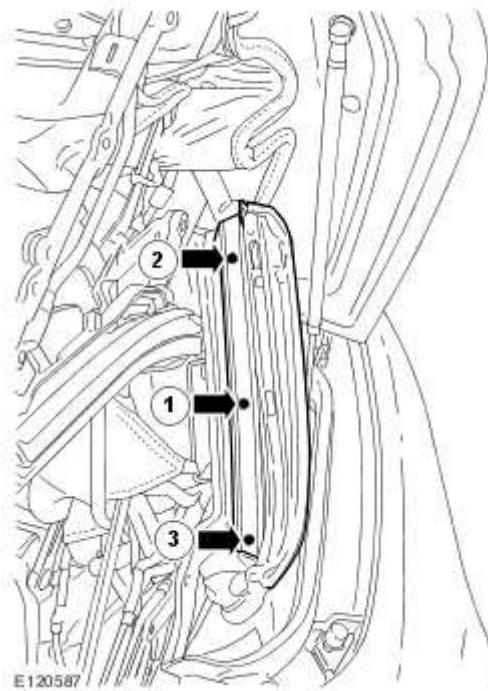
Make sure that the seal is correctly positioned.

-  Make sure that the datum mark is positioned 142mm from the edge of the main carrier.
-  Repeat the operation for the other side.



E120450

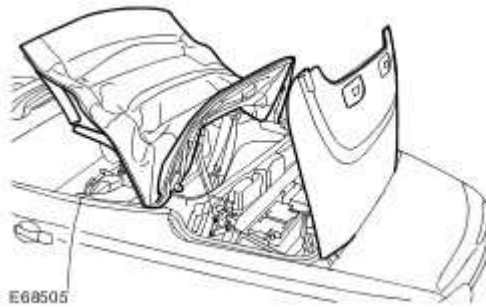
- 3 Install the convertible top rear panel lower weatherstrip and carriers assembly.
 - ▶ Clamp the convertible top outer material between the convertible top rear lower weatherstrip seal and the roof frame.
 - ▶ Install and secure the rivets in the sequence shown.



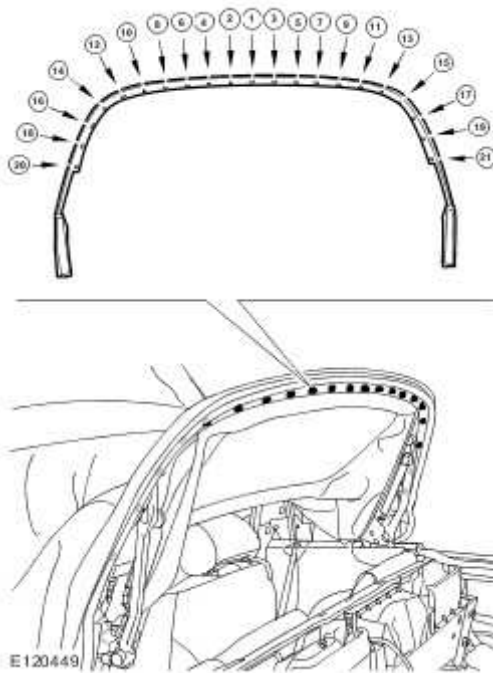
E120587

- 4 . Close the convertible top to the position shown.

- ▶ Depress the switch.



- 5 Secure the rear edge of the convertible top rear panel lower weatherstrip.
 - ▶ Install the Torx screws and tighten to 4 Nm in the sequence shown.
 - ▶ Make sure that the datum marks are still positioned 142mm from the edge of the main carrier.

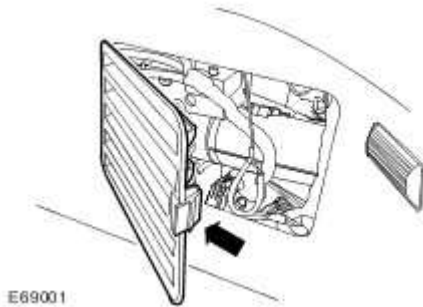



- 6 . Operate the convertible top fully in each direction.
 - ▶ Depress the switch.

Convertible Top Tension Cylinder

Removal

- 1 . Release the convertible top front latches.
 - ▶ Depress the switch.
- 2 . Remove the convertible top hydraulic pump access panel
 - ▶ Release the clip.



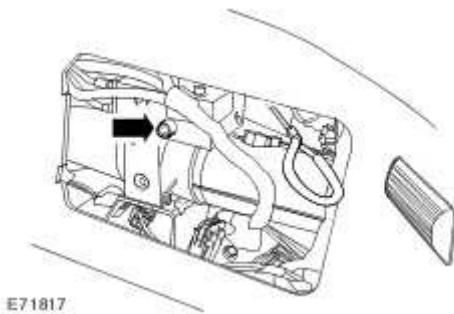
- 3  **CAUTION: Do not loosen the Allen bolt more than 2 complete turns. Failure to follow this instruction may result in damage to the vehicle.**

NOTE:

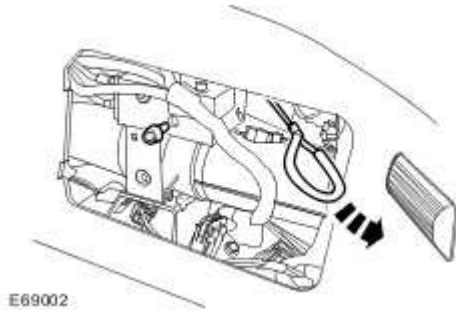
The ignition must be switched off.

Release the convertible top system pressure.

- ▶ Loosen the Allen bolt up to a maximum of 2 complete turns.



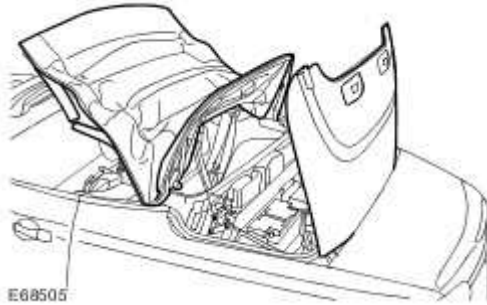
- 4 . Release the convertible top compartment lid.
 - ▶ Release using the cable.



5 . NOTE:

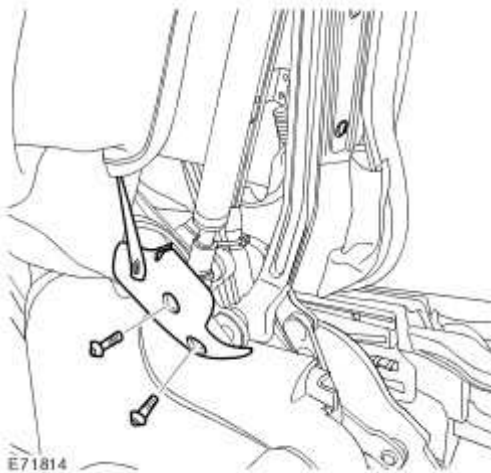
Support as necessary.

Open the convertible top to the position shown.



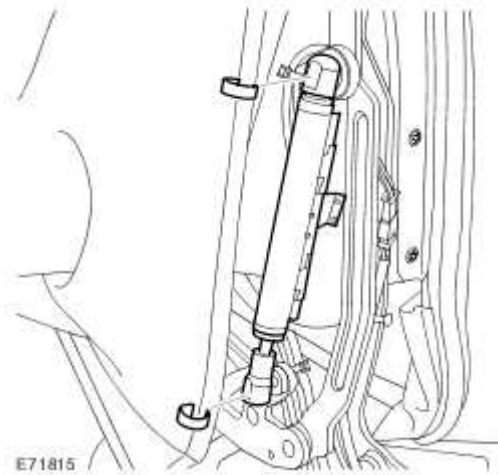
6 . Release the cylinder cover.

▶ Remove the 2 Torx screws.



7 . Release the hydraulic cylinder.

▶ Release the 2 clips.



8



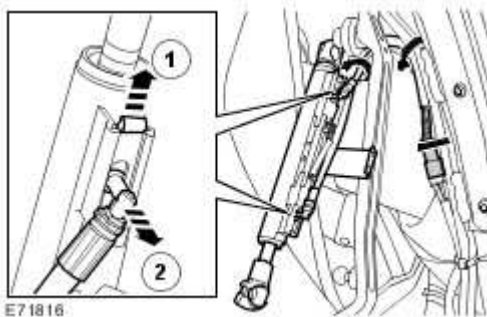
CAUTION: Fluid loss is unavoidable care must be taken to protect the interior of the vehicle.

Disconnect the hydraulic cylinder lines.

- ▶ Carefully release the 2 clips.
- ▶ Withdraw the hydraulic lines from the cylinder, remove and discard the O-rings.

9 . Remove the hydraulic cylinder.

- ▶ Remove and discard the 3 cable ties.
- ▶ RH hydraulic cylinder only: Disconnect the electrical connector.



Installation

1 . Connect the hydraulic cylinder lines.

- ▶ Lubricate and install the new O-rings.
- ▶ Connect the hydraulic lines to the cylinder.

▶ Secure with the clips.

2 . Install the hydraulic cylinder.

▶ RH hydraulic cylinder only: Connect the electrical connector.

▶ Secure with cable ties.

▶ Secure with the clips.

3 . Install the cylinder cover.

▶ Tighten the Torx screws.

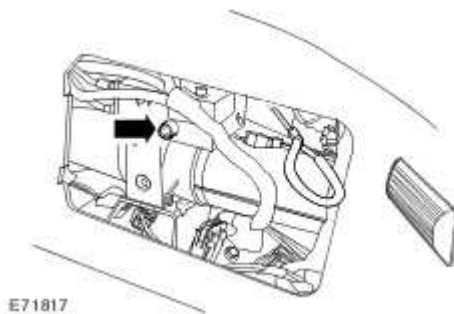
4 . Close the convertible top.

5 . **NOTE:**

The ignition must be switched off.

Tighten the convertible top system pressure Allen bolt.

▶ Tighten to 2 Nm.



6 . Install the convertible top hydraulic pump access panel

▶ Secure in the clip.

7 . Operate the convertible top fully in each direction.

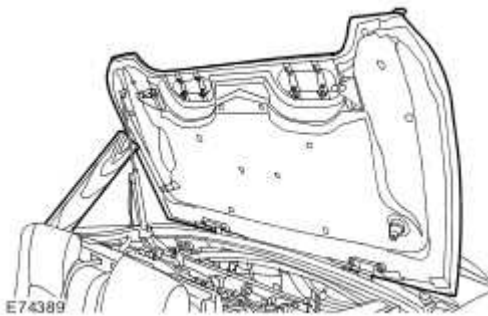
▶ Depress the switch.

Convertible Top Compartment Lid Lift Cylinder

Removal

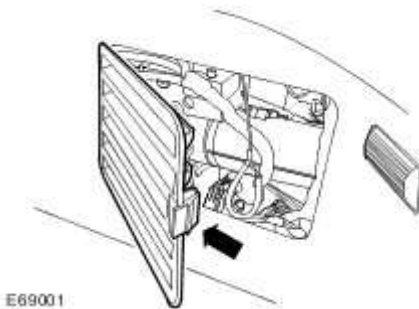
1 . Open the convertible top to the position shown.

- ▶ Depress the switch.
- ▶ Support as necessary.



2 . Remove the convertible top hydraulic pump access panel

- ▶ Release the clip.



3



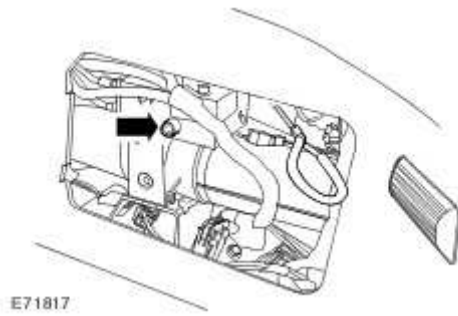
CAUTION: Do not loosen the Allen bolt more than 2 complete turns. Failure to follow this instruction may result in damage to the vehicle.

NOTE:

The ignition must be switched off.

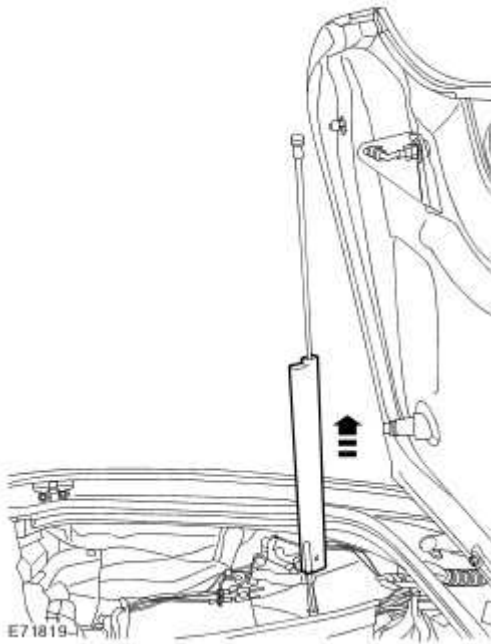
Release the convertible top system pressure.

- ▶ Loosen the Allen bolt up to a maximum of 2 complete turns.



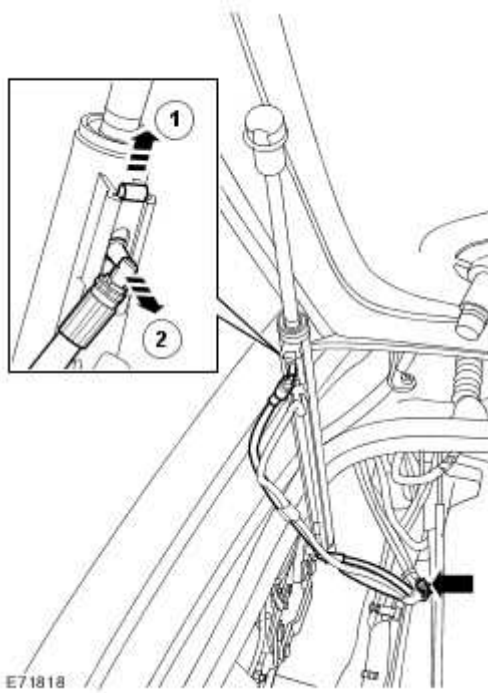
4 . Remove the convertible top compartment lid lift cylinder cover.

- ▶ Release the clip.
- ▶ Release the lift cylinder

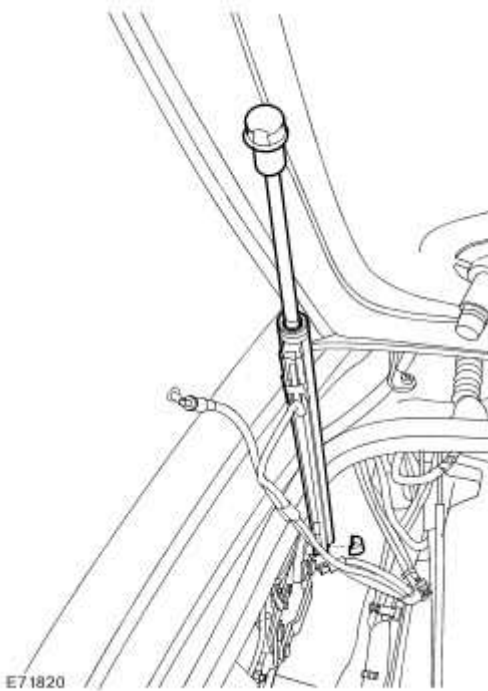


5 . Release the convertible top compartment lid lift cylinder.

- ▶ Disconnect the 2 fluid lines.
- ▶ Disconnect the electrical connector.



- 6 . Remove the convertible top compartment lid lift cylinder.
▶ Release the clip.



Installation

- 1 . Install the convertible top compartment lid lift cylinder.
 - ▶ Secure with the clip.

- 2 . Install the convertible top compartment lid lift cylinder cover.
 - ▶ Attach the lift cylinder.
 - ▶ Secure with the clip.

- 3 . Secure the convertible top compartment lid lift cylinder.
 - ▶ Connect the 2 fluid lines.
 - ▶ Connect the electrical connector.

- 4 . **NOTE:**
 - Support as necessary.

 - Close the convertible top compartment lid.
 - ▶ Raise the rear of the convertible top.

- 5 . **NOTE:**
 - The ignition must be switched off.

 - Tighten the convertible top system pressure Allen bolt.
 - ▶ Tighten to 2 Nm.

- 6 . Cycle the convertible top to bleed the hydraulic system.

- 7 . Check the convertible top fluid level.

- 8 . Install the convertible top hydraulic pump access panel
 - ▶ Secure in the clip.

Convertible Top Material (76.86.12)

Removal

- 1 . Remove the convertible top headliner.

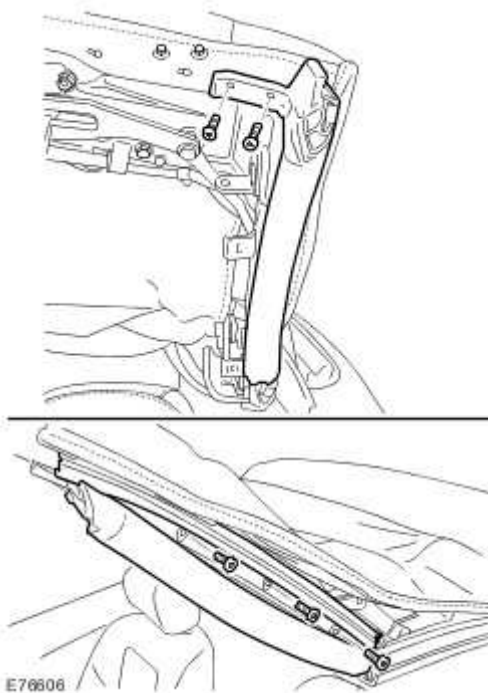
For additional information, refer to [Convertible Top Headliner \(76.86.16\)](#)

- 2 . **NOTE:**

Note the fitted position of the spacers

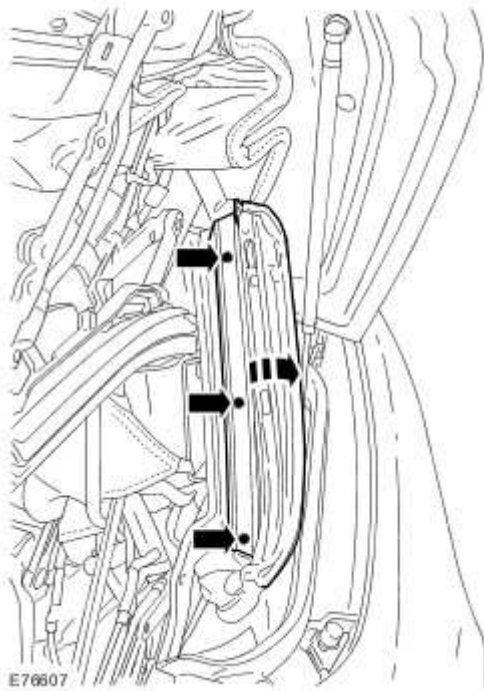
Remove the convertible top front seal carriers.

- ▶ Remove the 4 screws.
- ▶ Release the seal.
- ▶ Remove and discard the 6 Torx bolts.
- ▶ Collect the spacers.

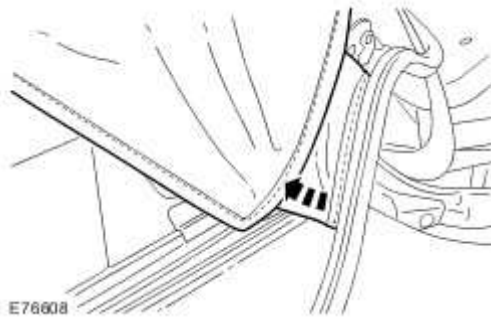


- 3 . Remove the convertible top side seal carriers.

- ▶ Release the seal.
- ▶ Drill out the 6 rivets.



4 . Carefully release the convertible top outer material from the rear seal.

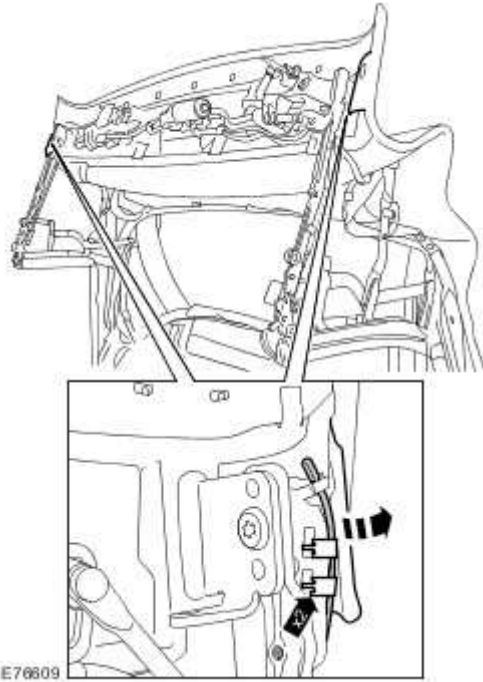


5 . NOTE:

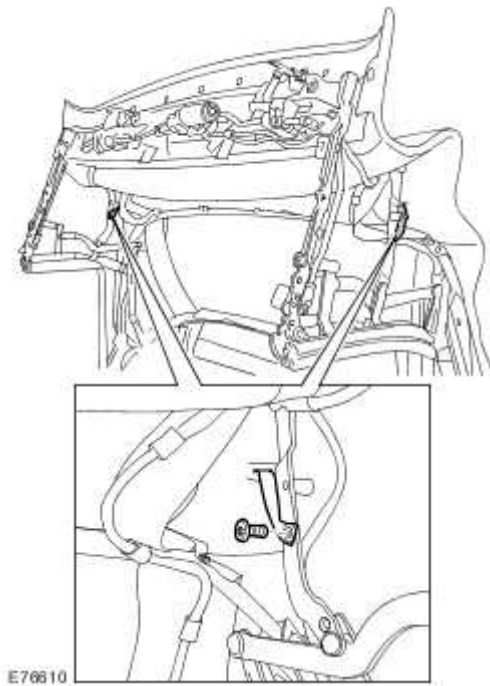
Note the routing of the convertible top tension cables.

Release the convertible top tension cables.

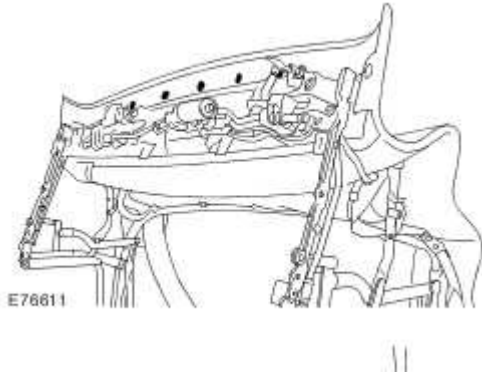
- ▶ Remove and discard the 4 clips.
- ▶ Release the tension cables from the convertible top frame.
- ▶ Withdraw from the convertible top material.



- 6 . Release the convertible top retaining straps.
▶ Remove the 2 Torx bolts.

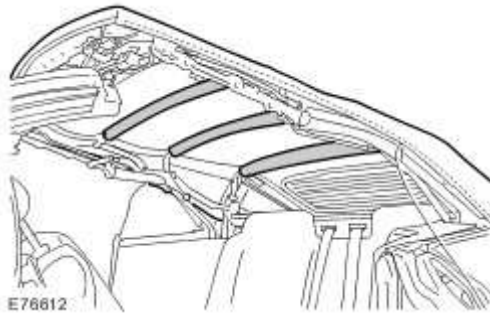


- 7 . Release the front edge of the convertible top material.
▶ Remove the 5 Torx screws.



8 . Remove the convertible top outer material.

- ▶ Release the convertible top material from the frame.



Installation

1 . Install the convertible top outer material.

- ▶ Secure the convertible top material to the frame.

2 . Secure the front edge of the convertible top material.

- ▶ Install the Torx screws.

3 . Secure the convertible top outer material retaining straps.

- ▶ Tighten the Torx bolts to 6 Nm (4 lb.ft).

4 . Feed the tension cables through the convertible top outer material ensuring the correct routing.

- ▶ Attach the tension cables to the convertible top frame.

- ▶ Install new clips.

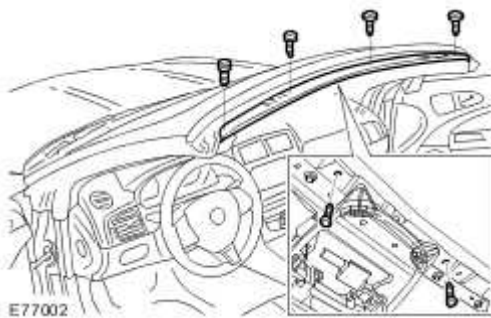
5 . Secure the convertible top to the rear seal.

- ▶ Carefully open the rear seal sufficiently to locate the convertible top outer material.
 - ▶ Attach the convertible top outer material.
 - ▶ Clamp the seal to retain the outer material.
- 6 . Install the convertible top side seal carriers.
- ▶ Install the rivets.
 - ▶ Attach the seal.
- 7 . Install the convertible top front seal carriers.
- ▶ Install the spacers.
 - ▶ Tighten the new Torx bolts to 6 Nm (4 lb.ft).
 - ▶ Attach the seal.
 - ▶ Tighten the Torx screws.
- 8 . Install the convertible top headliner.
- For additional information, refer to [Convertible Top Headliner \(76.86.16\)](#)

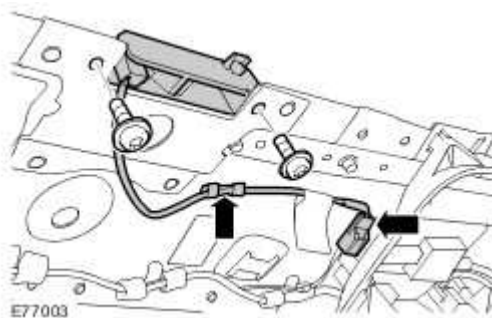
Convertible Top Striker

Removal

- 1 . Open the convertible top.
- 2 . Remove the header rail upper trim panel.
For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)
- 3 . Remove the header rail.
 - ▶ Remove the 6 screws.



- 4 . Remove the convertible to latch striker.
 - ▶ Remove the 2 Torx bolts.
 - ▶ Release the electrical harness clip.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the convertible to latch striker.
 - ▶ Install the Torx bolts, but do not tighten fully at this stage.

▶ Connect the electrical connector.

▶ Secure the wiring harness clip.

2 . Install the header rail.

▶ Tighten the screws.

3 . Secure the convertible to latch striker.

▶ Tighten the Torx bolts to 23 Nm (17 lb.ft).

4 . Install the header rail upper trim panel.

For additional information, refer to [Header Rail Upper Trim Panel \(76.86.20\)](#)

5 . Close the convertible top.

501-19 : Bumpers

Specifications


Specifications

Torque Specifications



Item	Nm	lb-ft	lb-in
Foam to front bumper beam (ROW markets) - screw	6	-	53
Front bumper cover - guide screw	18	13	-
Front bumper cover to vehicle panels - screw	4	-	35
Front bumper undertray to vehicle - screw	4	-	35
Rear bumper beam to crash tubes - bolt	15	11	-
Rear bumper cover to panel brackets - screw	4	-	35
Rear bumper, crash tubes to vehicle - nut	23	17	-

Front Bumper (76.22.08)



Removal

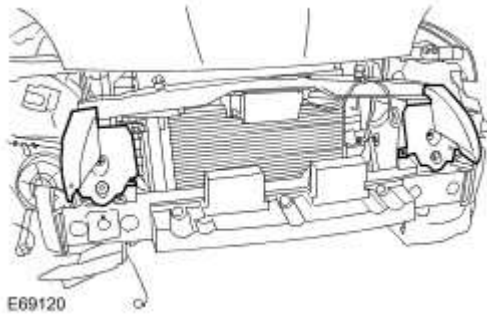
- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 . Remove the front bumper cover.
For additional information, refer to [Front Bumper Cover \(76.22.78\)](#)
- 4 Remove the crush pad.
 -  Remove the 3 clips.
 -  Vehicles with a pedestrian impact sensor only: Remove 2 additional bolts.



- 5 . Remove the air deflector.
 -  Remove the 3 clips.
 -  Repeat the procedure and remove the opposite hand.



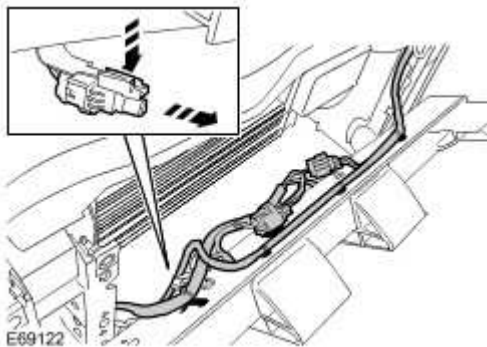
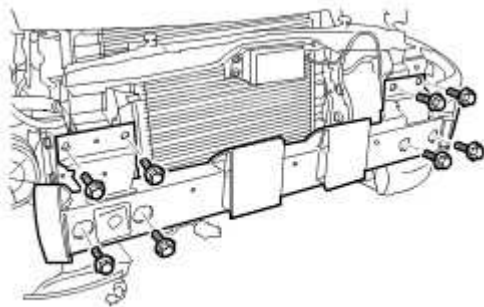
6 . Remove the front bumper.

- ▶ Remove the 8 bolts.
- ▶ Release the 9 clips.
- ▶ Disconnect the electrical connector.

7 . **NOTE:**

Do not disassemble further if the component is removed for access only.

Remove the ambient air temperature sensor.



Installation

1 . Install the ambient air temperature sensor.

2 . Install the front bumper.

- ▶ Secure the wiring harness clips.
- ▶ Connect the electrical connector.
- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

3 . Install the air deflectors.

- ▶ Secure the clips.

4 Install the crush pad.

- ▶ Secure the clips.
- ▶ Vehicles with a pedestrian impact sensor only: Install the additional bolts and tighten to 10 Nm (7 lb.ft).

5 . Install the front bumper cover.

For additional information, refer to [Front Bumper Cover \(76.22.78\)](#)


6 . Connect the battery ground cable and install the cover.

For additional information, refer to

Front Bumper Cover (76.22.78)

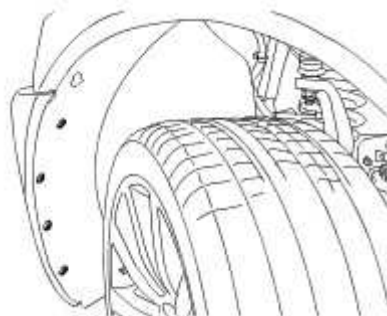
Removal

All vehicles

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the radiator splash shield.
For additional information, refer to Radiator Splash Shield (76.22.90)
- 3 . Remove the headlamps.
For additional information, refer to Headlamp Assembly (86.41.33)
- 4 . Release the front of the fender splash shield.
 - ▶ Remove the 4 Torx screws.
 - ▶ Repeat the above procedure for the other side.



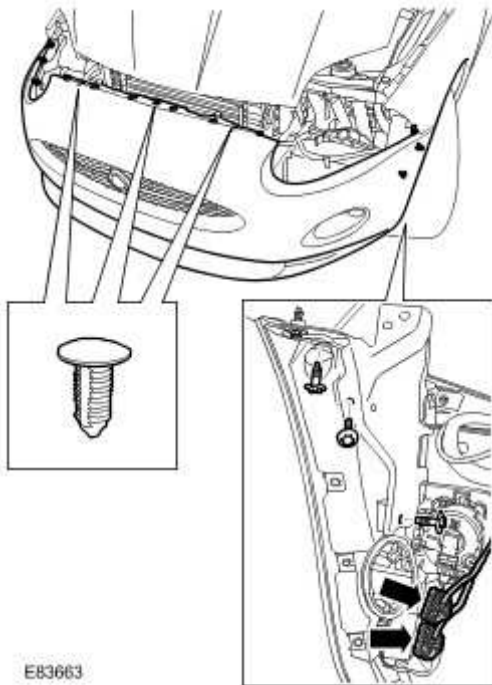
- 5  **CAUTION: Always protect paintwork and glass when removing exterior components.**

NOTE:

This step requires the aid of another technician.

Remove the front bumper cover.

- ▶ Remove the 12 bolts.
- ▶ Release the 3 clips.
- ▶ Disconnect the 2 electrical connectors.



6 . NOTE:

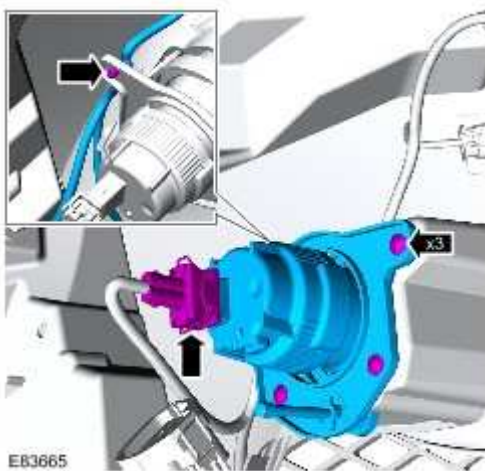
Do not disassemble further if the component is removed for access only.

Remove the towing eye cover.



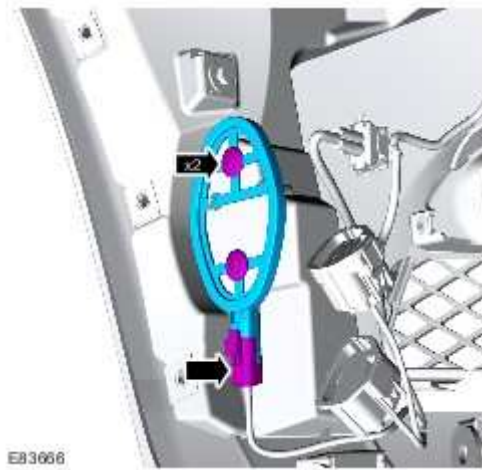
7 . Remove the front fog lamp.

- ▶ Remove the 3 Torx screws.
- ▶ Disconnect the electrical connector.
- ▶ Release the wiring harness.
- ▶ Repeat the above procedure for the other lamp.



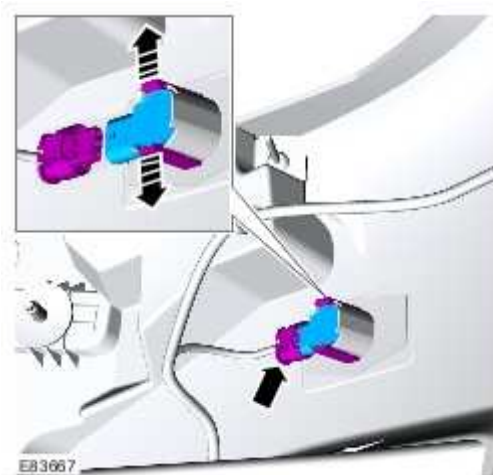
8 . Remove the tire pressure antenna.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 clips.
- ▶ Repeat the above procedure for the other side.



9 . If installed: Remove the parking aid sensor.

- ▶ Disconnect the electrical connector.
- ▶ Release the 2 clips.
- ▶ Repeat the above for the other 3 sensors.



10 . If installed: Remove the license plate.

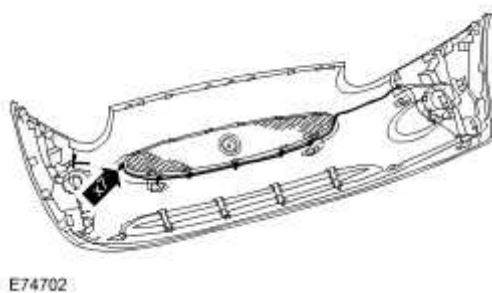
11 . If installed: Remove the license plate panel.

- ▶ Remove the 3 clips.



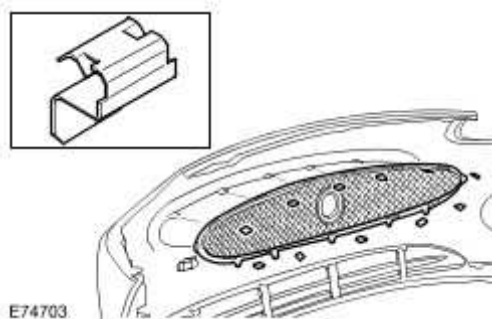
12 . Release the wiring harness.

▶ Release the 7 clips.



13 . Remove the radiator grille.

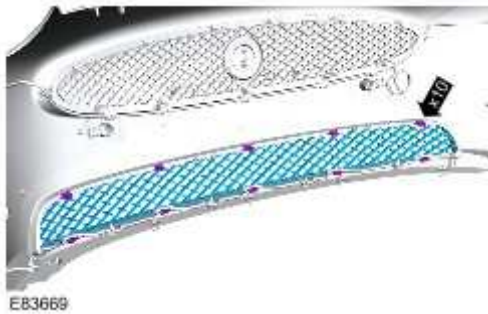
▶ Remove the 11 clips.



Vehicles with supercharger

14 . Remove the radiator lower grille.

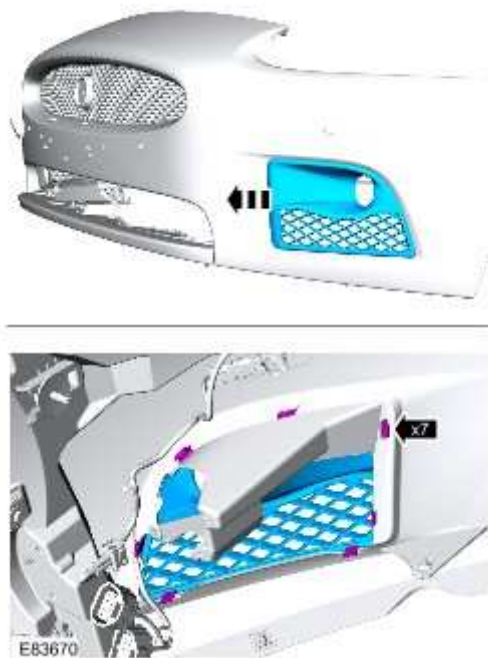
▶ Remove the 10 clips.



15 . Remove the front fog lamp bezel.

▶ Release the 7 clips.

▶ Repeat the above procedure for the other side.

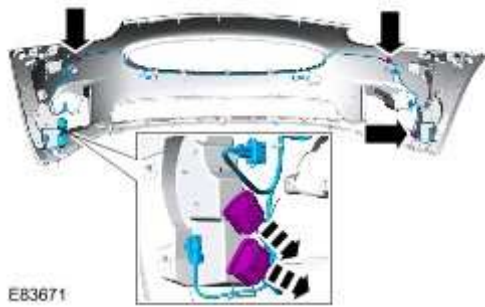


All vehicles

16 . Remove the wiring harness.

▶ Release the 2 electrical connectors.

▶ Release the 3 clips.



Installation

All vehicles

1 . Install the wiring harness.

▶ Secure the electrical connectors.

▶ Secure with the clips.

Vehicles with supercharger

2 . Install the front fog lamp bezels.

▶ Secure the clips.

3 . Install the radiator lower grille.

▶ Secure with the clips.

All vehicles

4 . Install the radiator grille.

- ▶ Secure with the clips.
- ▶ Attach the wiring harness.

5 . Install the license plate panel.

- ▶ Secure with the clips.

6 . Install the license plate.

- ▶ Clean the component mating faces.

7 . Install the parking aid sensors.

- ▶ Secure with the clips.
- ▶ Connect the electrical connectors.

8 . Install the tire pressure antenna.

- ▶ Install the clips.
- ▶ Connect the electrical connectors.

9 . Install the front fog lamps.

- ▶ Install the Torx screws.
- ▶ Connect the electrical connectors.

10 . Install the towing eye cover.

11 **NOTE:**

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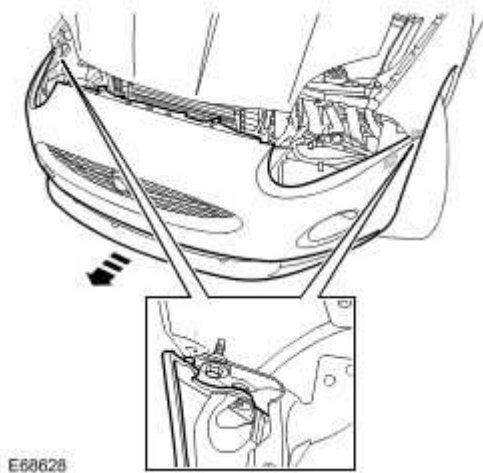
Make sure the bumper cover spigots are aligned with the locating holes in the fenders.

NOTE:

This step requires the aid of another technician.

Install the front bumper cover.

- ▶ Align the spigots and clips.
- ▶ Install and tighten the upper mounting bolts to 5 Nm (4 lb.ft), tighten the remaining bolts to 10 Nm (6 lb.ft).
- ▶ Connect the electrical connectors.



12 . Raise the vehicle.

13 . Install the radiator splash shield.

For additional information, refer to Radiator Splash Shield (76.22.90)

14 . Align and secure both fender splash shields.

- ▶ Install the Torx screws.

15 . Install the headlamps.

For additional information, refer to Headlamp Assembly (86.41.33)

Rear Bumper (76.22.27)

Removal



CAUTION: Always protect paintwork and glass when removing exterior components.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

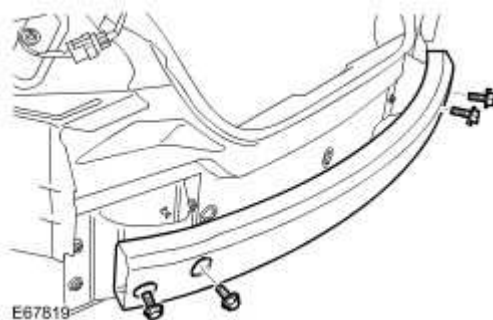
Raise and support the vehicle.

2 . Remove the rear bumper cover.

For additional information, refer to [Rear Bumper Cover \(76.22.74\)](#)

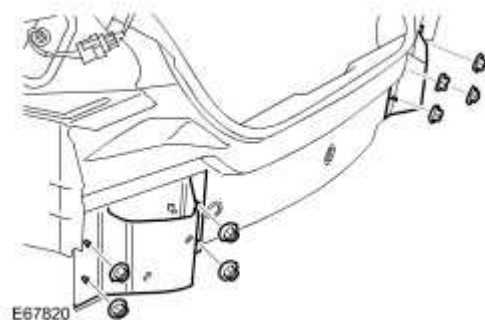
3 . With assistance, remove the bumper.

▶ Remove the 4 bolts.




4 . Remove the 2 crush tubes.

▶ Remove the 8 nuts.




Installation

1 . Install the 2 crush tubes.

 Tighten the nuts to 25 Nm (18 lb.ft).

2 . With assistance, install the bumper.

 Tighten the M8 bolts to 25 Nm (18 lb.ft).


3 . Install the rear bumper cover.

For additional information, refer to [Rear Bumper Cover \(76.22.74\)](#)

Rear Bumper Cover (76.22.74)

Removal

All vehicles

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

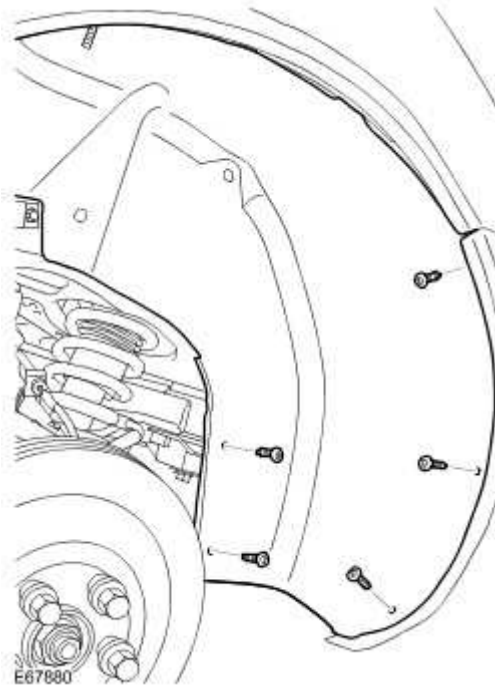
Raise and support the vehicle.


- 2 . Remove both rear wheels and tires.
For additional information, refer to Wheel and Tire (74.20.05)
- 3 . Remove the LH rear quarter trim panel.
For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)
- 4 . Remove the RH rear quarter trim panel.
 - ▶ Remove the clip.
 - ▶ Disconnect the electrical connector.



5 . Release the rear lower edge of the LH fender splash shield.

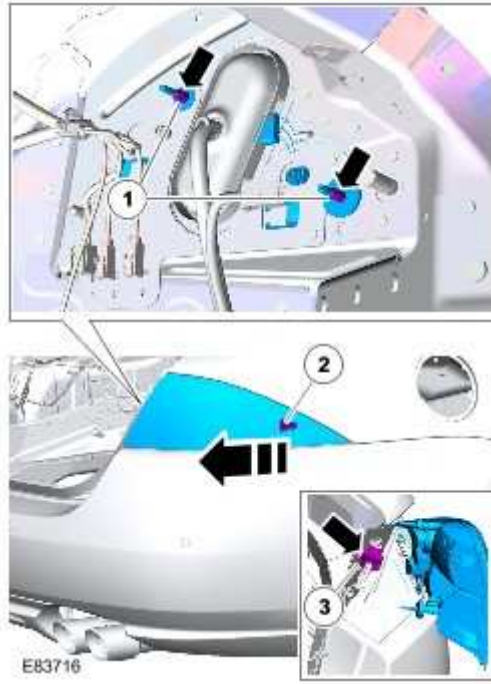
- ▶ Remove the 5 Torx screws.
- ▶ Tie the splash shield aside.
- ▶ Repeat the above procedure for the other side.



6  **CAUTION: Take great care when removing the rear lamp assembly as the forward point of the lens can be easily damaged.**

Remove the rear lamp assembly.

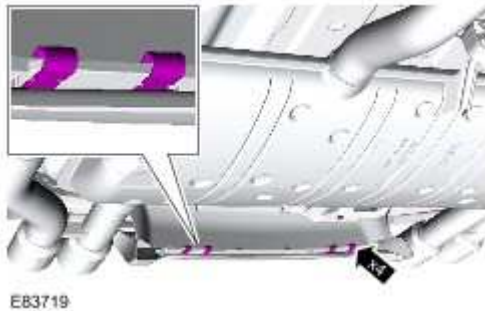
- ▶ Remove the 2 nuts.
- ▶ Carefully release the clip.
- ▶ Disconnect the electrical connector.
- ▶ Repeat the above procedure for the other side.



7 . NOTE:

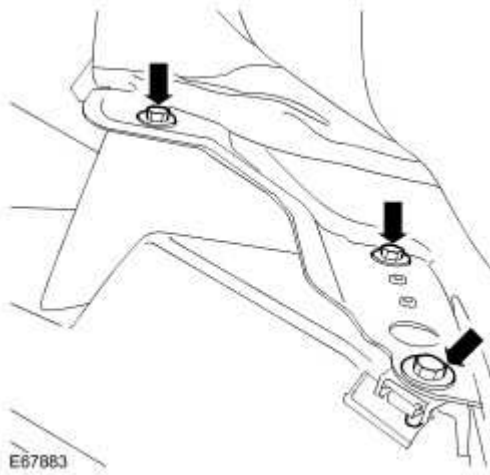
Naturally aspirated graphic shown, supercharged is similar.

Remove 4 clips from the lower edge of the bumper cover.



8 . Remove 3 bolts from the LH rear wheel arch.

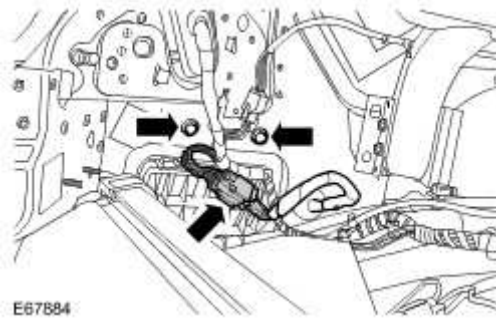
▶ Repeat the above procedure for the other side.



9 . Remove 2 bolts from the LH inner quarter panel.

▶ Repeat the above procedure for the other side.

10 . Disconnect the bumper harness electrical connector.



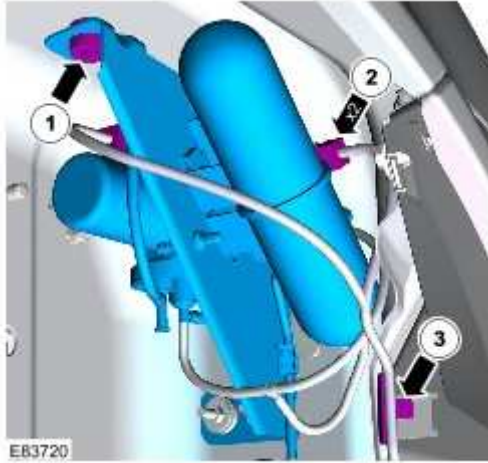
Vehicles with supercharger

11 . Release the exhaust sound enhancement vacuum pump assembly.

▶ Remove the bolt.

▶ Disconnect the 2 electrical connectors.

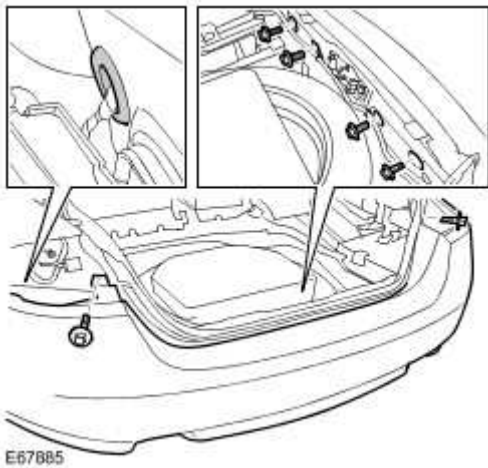
▶ Release the wiring harness clip.



All vehicles

12 . With assistance, remove the rear bumper cover.

- ▶ Remove the 6 bolts.
- ▶ Release the wiring harness grommet.
- ▶ Release the harness.

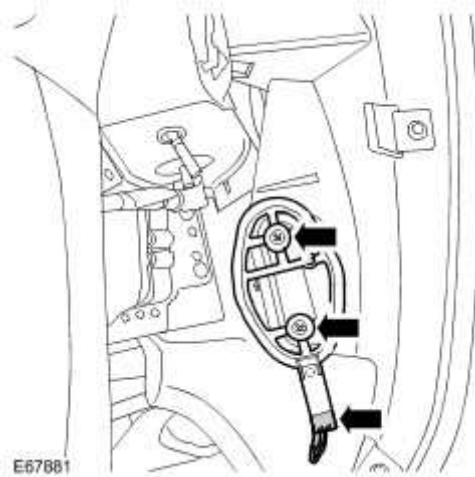


13 . **NOTE:**

Do not disassemble further if the component is removed for access only.

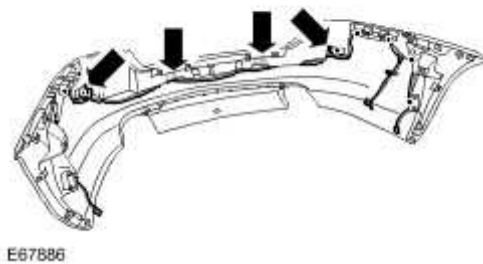
Remove the LH tire pressure antenna.

- ▶ Disconnect the electrical connector.
- ▶ Remove the 2 clips.
- ▶ Repeat the above procedure for the other side.



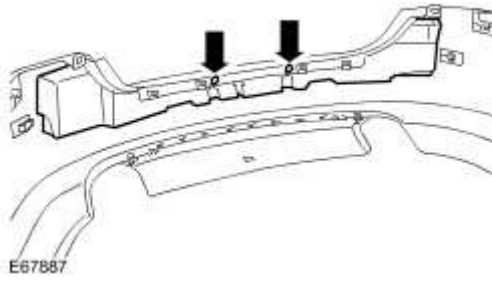
14 . Remove the bumper harness.

- ▶ Disconnect the 4 electrical connectors.
- ▶ Carefully release the 10 clips.



15 . Remove the bumper insert.

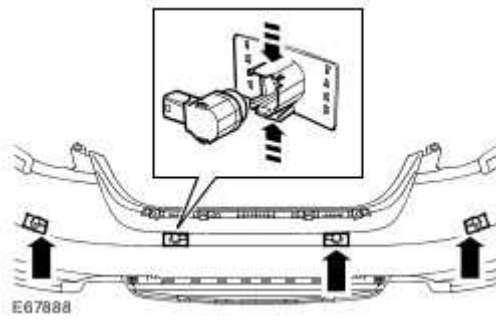
- ▶ Remove the 2 clips.



16 . Remove the parking aid sensor.

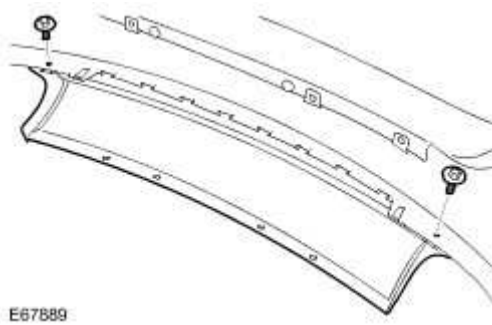
▶ Release the 2 clips.

▶ Repeat the above for the other 3 sensors.

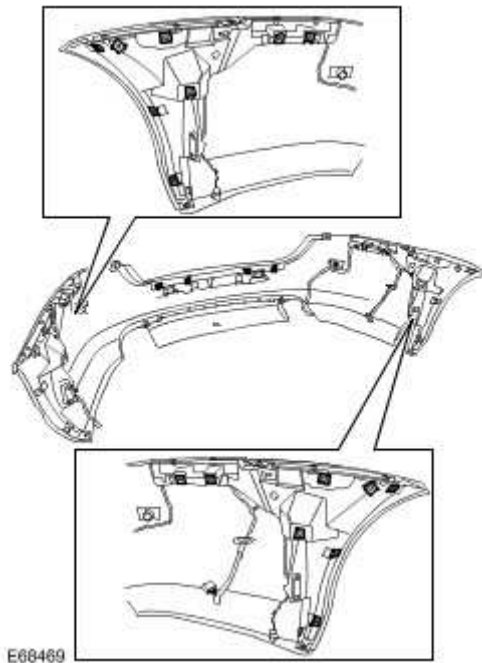


17 . Remove the lower trim panel.

▶ Remove the 2 bolts.



18 . Remove the 20 clips.



Installation

All vehicles

1 . Install the clips.

2 . Install the lower trim panel.

▶ Tighten the bolts to 6 Nm (4 lb.ft).

3 . Install the parking aid sensor.

▶ Carefully secure the clips.

▶ Repeat the above for the other 3 sensors.

4 . Install the bumper insert.

- ▶ Install the clips.

5 . NOTE:

Do not disassemble further if the component is removed for access only.

Install the wiring harness.

- ▶ Connect and secure the electrical connectors.
- ▶ Carefully secure the clips.

6 . Install the tire pressure antenna.

- ▶ Install the clips.
- ▶ Connect the electrical connector.
- ▶ Repeat the above procedure for the other side.

7 . With assistance, install the rear bumper cover.

- ▶ Install the bolts and tighten to 6 Nm (4 lb.ft).
- ▶ Install the wiring harness.

Vehicles with supercharger

8 . Attach the exhaust sound enhancement vacuum pump.

- ▶ Connect the electrical connectors.
- ▶ Tighten the bolt to 7 Nm (5 lb.ft)
- ▶ Secure the wiring harness clip.

All vehicles

9 . Secure the lower edge of the bumper cover.

10 . **NOTE:**

Align to the position noted on removal.

Install the rear lamp assembly.

- ▶ Secure with the clip.
- ▶ Tighten the nuts to 2 Nm (1.5 lb.ft).
- ▶ Connect the electrical connector.
- ▶ Repeat the above procedure for the other side.

11 . Install the fender splash shield.

- ▶ Tighten the Torx bolts.
- ▶ Repeat the above procedure for the other side.

12 . Install the RH rear quarter trim panel.

- ▶ Install the clip.

13 . Install the LH rear quarter trim panel.

For additional information, refer to Loadspace Trim Panel - 2-Door (76.13.73.60)

14 . Install the wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

501-20A : Safety Belt System

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Front safety belt anchorage - bolt*	35	26	-
Front safety belt retractor - bolt*	35	26	-
Rear safety belt anchorage - bolt*	35	26	-
Rear safety belt retractor - bolt*	35	26	-
Rear safety belt buckle - bolt*	35	26	-

* Install new nut/bolt.

Safety Belt System

COMPONENT LOCATION

NOTE:

Seat belts and retractors are a single assembly.



E64888

Item	Part Number	Description
1		RH front seat belt
2		RH front seat belt retractor
3		RH rear seat belt buckle
4		RH rear seat belt retractor
5		LH rear seat belt retractor

6		LH rear seat belt retractor
7		LH front seat belt buckle
8		LH front seat belt
9		LH front seat belt buckle
10		RH front seat belt buckle

INTRODUCTION

A three point safety belt is installed in all seating positions. Each seatbelt has Emergency locking retractor (ELR) functionality.

The ELR function incorporates a lift shaft locking system with webbing sensor and car sensing activating mechanisms. The webbing sensor activates the locking mechanism if the webbing is subjected to a sharp pull. The car sensor activates the locking system if the vehicle is subjected to sudden deceleration or severe tilt angle.

All second row passengers and NAS front Passenger ELR's are enhanced with Automatic Locking Retractors (ALR).

The ALR allows webbing to be extracted to activate a ratchet device. This device allows webbing to be cinched tight to facilitate child seat fitment. With seatbelt webbing tensioned in ALR mode the seatbelt is always locked.

All row 1 driver and passenger ELRs incorporate an electrically activated webbing tension reducer (comfort device). This device is activated at vehicle ignition on and insertion of seatbelt tongue into buckle.

A safety belt warning indicator is installed in the instrument cluster to remind the front seat occupants to fasten their safety belts. The warning indicator illuminates if the safety belt of an occupied front seat is not fastened. On NAS vehicles the belt minder system will ignore the state of the passenger safety belt for the first 75 seconds after ignition on. The warning indicator remains illuminated until the safety belt of each occupied front seat is fastened, or the ignition is switched off.

FRONT SAFETY BELTS

The retractor of each front seatbelt is attached to the related B pillar mounting bracket. The webbing runs from the retractor through a fixed D loop bracket mounted to B pillar upper to an anchor point on the sill.

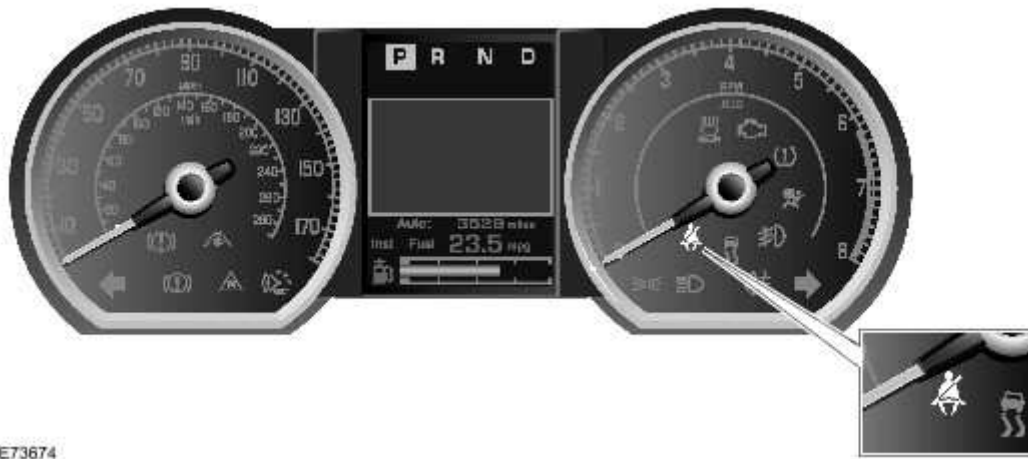
The retractor for each front safety belt incorporates a load limiter that allows the retractor reel to partially unwind when the load on the webbing exceeds a predetermined limit.

The buckle for each front safety belt is attached to a pretensioner secured to the inboard side of the related front seat frame. Each buckle incorporates a safety belt buckle sensor that provides a status input to the RCM (restraints control module) , which uses the input to

determine the air bag and pretensioner activation strategies. The RCM (restraints control module) also relays the status of the safety belts to the instrument cluster on the high speed CAN (controller area network) bus.

Belt Minder Function

Safety Belt Warning Indicator



The belt minder function provides warnings to the driver if the appropriate front safety belts are not fastened when driving. The belt minder function is controlled by the instrument cluster using:

- High speed CAN (controller area network) bus messages, from the RCM (restraints control module) , to monitor the status of the front safety belts.
- An input from the occupant detection system to monitor the status of the front passenger seat.

When the ignition is switched to on, the instrument cluster illuminates the safety belt warning indicator until one of the front safety belts is fastened or the belt minder function is triggered. The belt minder function is triggered when the ignition switch is in accessory/convenience and the following conditions coexist:

- The belt minder function is enabled.
- Vehicle speed is 8 km/h (5 mph) or more.
- The vehicle is not in reverse.
- The driver safety belt or, if the front passenger seat is occupied, the front passenger safety belt, is unfastened.

When the belt minder is triggered, the instrument cluster generates the following warnings for 10 seconds.

- Flashes the safety belt warning indicator at 2 Hz.
- Sounds a repeating chime in sequence with the flashing safety belt warning indicator.

After 10 seconds, the repeating chime is discontinued and the safety belt warning indicator changes from flashing to continuously illuminated for 20 seconds. While the trigger conditions still coexist, the warnings are repeated every 30 seconds until one of the following occurs:

- 5 minutes has elapsed from when the warnings were first triggered.
- The safety belt of each occupied front seat is fastened.
- The ignition mode is position 0.
- The vehicle speed decreases to 5 km/h (3 mph).

For non NAS vehicles the belt minder function can be enabled and disabled using the driver safety belt switch. The instrument cluster changes the state of the belt minder function if, within 60 seconds of first entering ignition mode II, the driver safety belt is fastened and unfastened nine times. Successful completion of the change is indicated by a single chime and the safety belt warning indicator flashing five times, at 2 Hz. The belt minder function can also be enabled and disabled using IDS.

SECOND ROW SAFETY BELTS

The retractor of each second row safety belt is attached to the rear shelf immediately behind the seat. The retractors are located in the center of the shelf. The webbing runs from the retractor, to an anchor point in the center of the vehicle either side of the transmission tunnel. The seat belt buckles are attached to the vehicle body on the outer side of the seat.

Safety Belt System

Principle of Operation

For a detailed description of the safety belt system, refer to the relevant Description and Operation section in the workshop manual.

[Safety Belt System](#)

Inspection and Verification

- 1 . Verify the customer concern by operating the safety belt.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Loose webbing • Damaged/frayed webbing • Safety belt retractor 	<ul style="list-style-type: none"> • Warning indicator bulb

- 3 . If the fault is not visually evident determine the symptom(s) and proceed to the Symptom Chart.

Symptom Chart

Symptom	Possible Cause	Action
Normal Mode - Occupant Restraint System inoperative	<ul style="list-style-type: none"> • Broken tooth on retractor sensor gear. • Loose webbing. 	REFER to the Component Tests in this section.
Automatic Locking Retraction System (ALR) Inoperative.	<ul style="list-style-type: none"> • Broken tooth on retractor sensor gear. • Loose webbing. 	REFER to the Component Tests in this section.

Component Tests

Poor Retraction



WARNING: In the event of an accident in which the air bags have been deployed, the front safety belts that were in use and the rear whether in use or not at the time of the accident must be removed and NEW safety belts MUST be installed. Failure to follow this instruction will result in personal injury and component failure.

If a safety belt does not retract correctly, check that the anchor covers and trim bezels are correctly installed and not rubbing against the safety belt webbing. Where necessary, check the safety belt webbing is not rubbing at one end of the retractor cover slot and if so, correct by loosening the retaining bolt, aligning the retractor to centralize the safety belt webbing and re-tighten the bolt.

The vehicle is equipped with two front and three rear inertia reel safety belts. These safety belts are "dual sensitive" which means that they have:

- a vehicle motion sensor, which locks the safety belt webbing under braking, cornering, on steep hills and in adverse camber conditions.
- a webbing motion sensor, which locks when the safety belt webbing is quickly extracted.

Both systems should be fully operational and can be checked by the tests below:

Vehicle Motion Sensor Test

Either of the following two procedures may be used to check correct operation of the vehicle motion sensor. Both methods require two people but note that people of larger than average build should not be asked to conduct these tests. This is to avoid the possibility of a fully unrolled safety belt webbing being mistaken for a correctly locked safety belt retractor.

Test Method 1 (braking)



WARNING: It is important that during this test, the wearer allows the safety belt to provide the restraint, the wearer should not attempt to anticipate the sudden deceleration and the driver should not brace themselves against the steering wheel. However, both the driver and the passenger must prepare themselves for the possibility that the safety belt will not lock. The passenger should hold their hands in front of him, just clear of the instrument panel or front seat backrest. Depending on which belt is being tested. Failure to follow these procedures will result in personal injury.

- Select for this test a quiet or private stretch of road. Make sure that the road is clear and that full visibility is maintained at all times.
- Both driver and passenger should adopt normal, comfortable seating position. Both occupants should wear the safety belts and the safety belt webbing must be correctly adjusted, with no slack.

- Proceed at a speed of approximately 10 km/h (6 miles/hour), do not exceed 10 km/h (6 miles/hour) for this test.
- Apply the foot brake sharply to stop the vehicle. If the vehicle motion sensitive lock mechanism is operating correctly, the safety belt webbing will lock and restrain the wearer.
- Conduct the test twice in each front and rear passenger seat position.
- Any safety belt retractor which does not restrain the wearer during this test must not be used. A NEW safety belt must be installed.

Test Method 2 (turning circle)

This method requires a flat open area of private road, sufficient for the vehicle to be driven in a continuous circle on full lock.

- The driver should wear the safety belt provided and the belt webbing must be correctly adjusted, with no slack.
- The passenger should occupy a rear seat with the safety belt correctly adjusted.
- Start the engine and, with the steering on full right-hand lock, drive the vehicle in a continuous circle at 16 km/h (10 miles/hour), do not exceed 16 km/h (10 miles/hour).
- When the speed is stable, the passenger should attempt to slowly extract the safety belt webbing from each safety belt retractor in turn. If the vehicle motion sensitive lock mechanism is operating correctly, it will not be possible to extract the webbing.
- Any safety belt retractor from which it is possible to extract the webbing during this test must not be used. A NEW safety belt must be installed.

Safety Belt Webbing Sensor Test

With the vehicle stationary and on level ground take firm hold of the safety belt webbing (on the tongue side of the upper safety belt anchor) and pull out quickly. The retractor should lock within 0.25 metre (10 inches), preventing further webbing pullout. Any safety belt retractor from which it is possible to extract further webbing must not be used. A NEW safety belt must be installed.

Service Installation of Safety Belts

It is possible that the safety belt assemblies installed in service may have been damaged during handling or installation to the vehicle. The damage is contained within the inner workings of the retractor and is therefore, not visible. However, the damage usually causes the retractor to stick or jam. The damage can only occur before installation is completed and is usually in one of the following ways:

- The safety belt webbing is allowed to retract onto the spindle until it jams the locking mechanism in a way that cannot occur when the safety belt is installed in the car. The safety belt webbing prevents the correct locking action and if the safety belt webbing is snatched or jerked out of the retractor, the loads are not taken on this high strength locking mechanism.
- The webbing is snatch loaded by attempted fast extraction or manual testing with the safety belt held in the hand. This can result in deceleration which are much higher than those occurring in accident situations and there is a risk of damage to the mechanism.

When handling safety belt assemblies, adopt the following procedures:



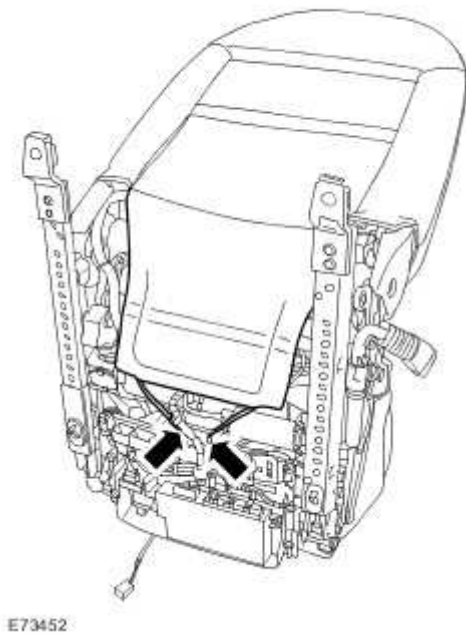
WARNING: If the following procedures are not successful, reject the safety belt assembly. Do not try to jerk or snatch the webbing out of the retractor as this may cause damage. Failure to follow these procedures could and may cause damage or personal injury.

- If the safety belt webbing retracts and will not extract under low webbing tension, install the retractor onto its mounting in the car , which will set it at its correct angle, and the safety belt webbing should extract easily.
- If it does not, feed 5-10 mm (3/16 - 3/8 inch) more safety belt webbing onto the spindle (rotate the spindle using finger pressure if necessary) and the safety belt webbing should then extract.

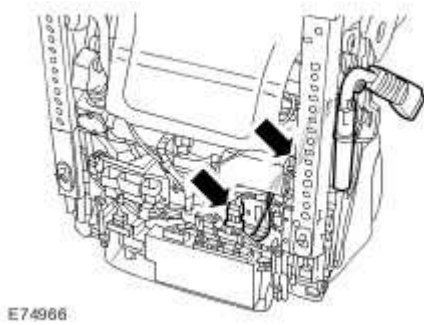
Front Safety Belt Buckle (76.73.49)

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat backrest cover lower tension straps.



- 5 . Remove the front seat safety belt pretensioner.
 - ▶ Remove and discard the Torx bolt.
 - ▶ Release and disconnect the electrical connector.



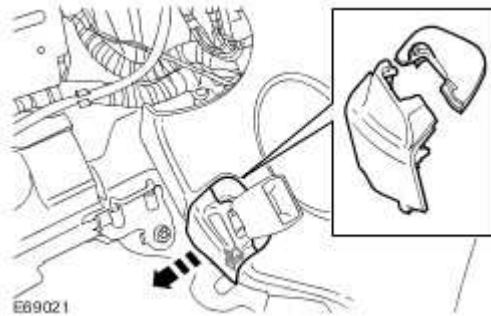
Installation

- 1 . Install the front seat safety belt pretensioner.
 - ▶ Connect and secure the electrical connector.
 - ▶ Tighten the new Torx bolt to 45 Nm (33 lb.ft).
- 2 . Secure the front seat backrest cover lower tension straps.
- 3 . Install the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Connect the battery ground cable and install the cover.

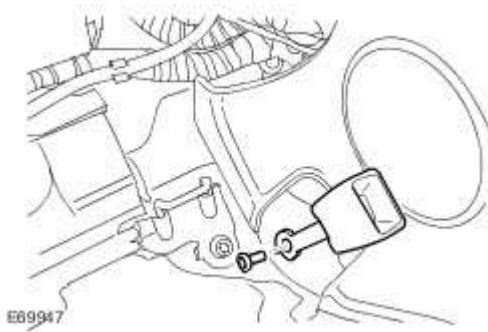
Rear Safety Belt Buckle (76.73.50)

Removal

- 1 . Remove the rear seat cushion.
For additional information, refer to [Rear Seat Cushion \(76.70.37\)](#)
- 2 . Remove the rear safety belt stalk trim panel.
▶ Release from the clip.



- 3 . Remove the rear safety belt stalk.
▶ Remove the Torx bolt.



Installation

- 1 . Install the safety belt stalk.
▶ Tighten the Torx bolt to 45 Nm (33 lb.ft).
- 2 . Install the rear safety belt stalk trim panel.
▶ Secure with the clip.

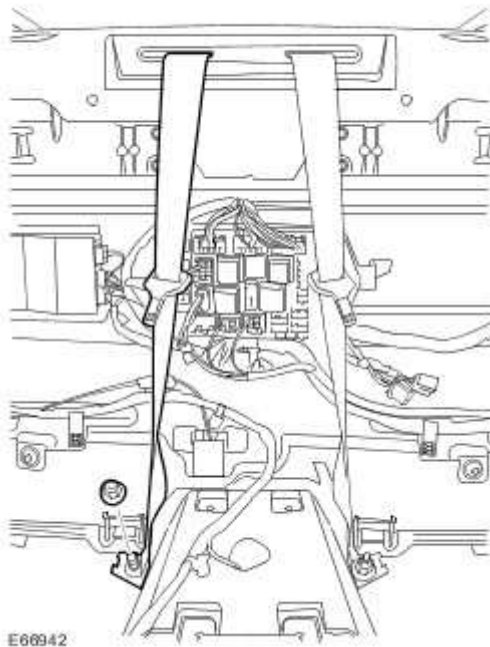
3 . Install the rear seat cushion.

For additional information, refer to [Rear Seat Cushion \(76.70.37\)](#)

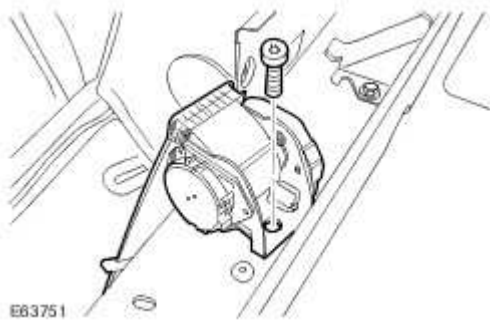
Rear Safety Belt Retractor - 2-Door (76.73.18)

Removal

- 1 . Remove the parcel tray.
For additional information, refer to [Parcel Shelf \(76.67.06\)](#)
- 2 . Release the safety belt.
▶ Remove and discard the safety belt lower anchor nut.



- 3 . Remove the safety belt assembly.
▶ Remove and discard the Torx bolt.



Installation

1 . Install the safety belt assembly.

▶ Install a new Torx bolt and tighten to 45 Nm (33 lb.ft).

2 Secure the safety belt.

▶ Attach the safety belt lower anchor, install a new nut and tighten to 30 Nm (22 lb.ft).

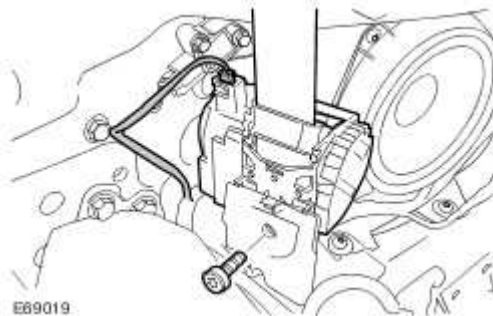
3 . Install the parcel tray.

For additional information, refer to [Parcel Shelf \(76.67.06\)](#)

Front Safety Belt Retractor (76.73.10)

Removal

- 1 . Make the SRS system safe.
For additional information, refer to
- 2 . Remove the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - 2-Door \(76.13.73\)](#)
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)
- 3 . Remove the safety belt retractor assembly.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove and discard the Torx bolt.



Installation

- 1 . Install the safety belt retractor assembly.
 - ▶ Install a new Torx bolt and tighten to 45 Nm (33 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - 2-Door \(76.13.73\)](#)
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)

Rear Safety Belt Retractor - Convertible (76.73.18)

Removal

1 . NOTE:

Support the convertible top lid.

Open the convertible top to the position shown.

▶ Depress the switch.

2 . Remove the rear seat backrest.

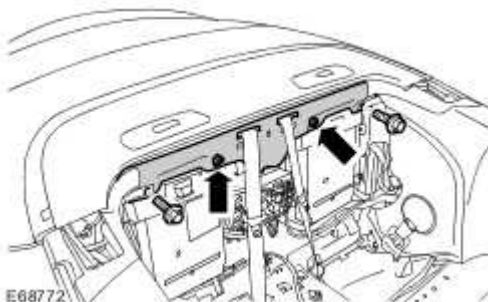
For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)

3 . Release the rear seat backrest trim panel.

▶ Remove the 2 clips.

▶ Remove the 2 bolts.

▶ Position the rear seat backrest trim panel aside.



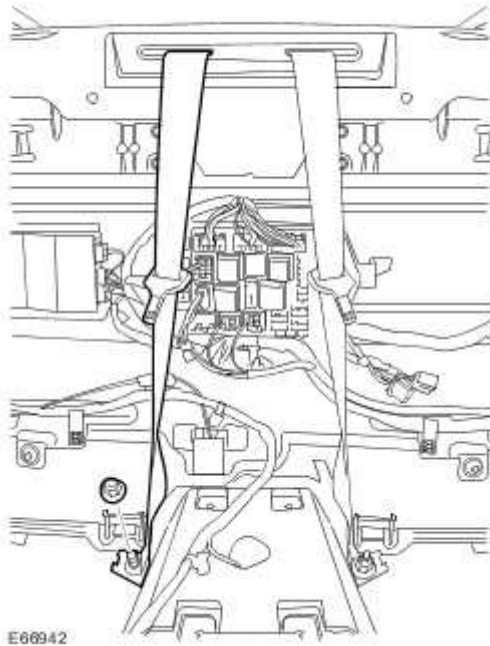
4 . Remove the rear safety belt trim panel.

▶ Release the 2 clips.

▶ Remove the 2 nuts.

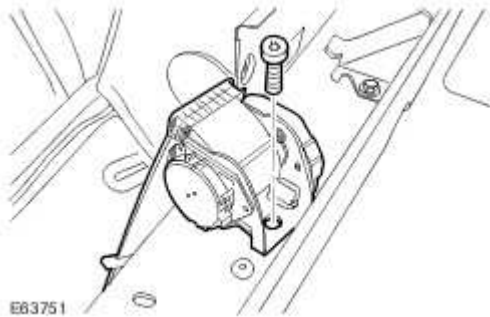
5 . Release the safety belt.

▶ Remove and discard the safety belt lower anchor nut.



6 . Remove the safety belt assembly.

- ▶ Remove and discard the Torx bolt.
- ▶ Release the safety belt.



Installation

1 . Install the safety belt assembly.

- ▶ Install a new Torx bolt and tighten to 45 Nm (33 lb.ft).
- ▶ Position the safety belt through the rear seat backrest trim panel.

2 Secure the safety belt.

- ▶ Attach the safety belt lower anchor, install a new nut and tighten to 30 Nm (22 lb.ft).

3 . Install the rear safety belt trim panel.

▶ Secure with the clips.

▶ Tighten the nuts to 10 Nm (7 lb.ft).

4 . Install the rear seat backrest trim panel.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

▶ Install the clips.

5 . Install the rear seat backrest.

For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)

6 . Close the the convertible top.

▶ Depress the switch.

501-20B : Supplementary Restraint System

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Airbag crash sensor to B-post - bolt	8	-	71
Airbag crash sensor to radiator support - bolt	8	-	71
Child upper anchorage (coupe) - bolt	25	18	-
Roll-over protection unit to back seat panel - bolt	25	18	-
Restraints control module - nut	8	-	71

Air Bag Disposal

Deployed Air Bag

1.



WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.

Deployed air bag modules are to be disposed of as special waste and must comply with local environmental requirements, if in doubt, contact Authority for disposal requirements.

2. **NOTE:**

The storage, transportation, disposal, and/or recycling of air bag module components must be carried out in accordance with all applicable federal, state and local regulations including, but not limited to, those governing building and fire codes, environmental protection, occupational health and safety, and transportation.

Modules removed and deployed by Jaguar service are to be returned to the importer for disposal.

Undeployed Air Bag — Inoperative

1.



WARNING: Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.



WARNING: All inoperative air bag modules have been placed on the Mandatory Return List. All discolored or damaged air bag modules must be treated the same as any inoperative live air bag being returned. Failure to follow this instruction may result in personal injury.

Remove the inoperative driver air bag module or passenger air bag module. For additional information see or in this section.

Undeployed Air Bag — Scrapped Vehicle

1.



WARNING: Always wear safety glasses when repairing an air bag supplemental restraint system (SRS) vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



WARNING: Carry a live air bag module with the air bag and trim cover or deployment door pointed away from your body. This will reduce the risk of injury in the event of an accidental deployment. Failure to follow this instruction may result in personal injury.



WARNING: Remote deployment is to be carried out outdoors with all personnel at least 6.1 meters (20 feet) away to ensure personal safety. Due to the loud report which occurs when the air bag is deployed, hearing protection is required. Failure to follow this instruction may result in personal injury.



WARNING: Do not place the driver or passenger air bag module with the trim cover or deployment door facing down, as the forces of the deploying air bag can cause it to ricochet and cause personal injury. Failure to follow this instruction may result in personal injury.

Equipment required: Universal deployment tool-Part N° 418-S135 and 12V Battery.

2. The deployment procedure should be carried out outdoors away from other personnel.
3. Remove any loose debris from around air bag. Make sure that no flammable liquids are present.
4. Disconnect the battery ground and positive cables.
5. Disconnect the relevant air bag module electrical connector.
6. Connect the appropriate adaptor lead to the restraint device.

7. Connect the deployment lead to the adaptor lead. Pass wire of the deployment tool through window, close all doors, leave window with lead for deployment tool open.

8.



WARNING: Before proceeding, make sure precautions have been taken to warn personnel of a possible loud noise upon activation. Do not allow anybody to approach closer to restraint device than six meters. Failure to follow this instruction may result in personal injury.

Move as far from restraint device as possible and connect the tool clips to a 12V vehicle battery.

9.



WARNING: Do not handle the deployed device immediately after activation - it may be hot. Allow the unit to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not create a fire with spilled liquids or other debris. Failure to follow this instruction may result in personal injury.

Deploy the module by depressing both switches on the tool. If activation does not occur, disconnect battery from tool and seek advice from Jaguar Engineering and wait for further instructions.

10. Repeat procedure for all air bags in vehicle.

11. The vehicle is now to be scrapped in the normal manner with modules installed.

Disposal of live air bag modules for driver air bag module, passenger air bag module and side air bag module, using tyres

1. Equipment required: Deployment tool 418-S135, Battery (12V), Safety goggles to BS2092 grade 2, Rubber gloves to PrEN 374 class 2, Ear protectors that have been measured to BS.EN 24869, Particulate respirator to EN 149 grade FFP2S.

2. The deployment procedure should be carried out outdoors, away from other personnel.

3. Stack four scrap tyres, securing together with heavy gauge wire or cable. While

disconnected from any electrical power source, connect deployment harness and place air bag adaptor portion under tyre stack, ready for connection to air bag.

4.



WARNING: Power must not be connected during this step. Failure to follow this instruction may result in personal injury.



CAUTION: Make sure the connector is not in contact with the inflator or it will be damaged during the test.

Connect air bag to air bag connector, make sure the locking sleeve is fully engaged. Position the air bag with the cover facing upwards.

5. Make sure battery connections of deployment harness are ten meters away from the tyre stack

6. Remove any loose parts from around the air bag. Make sure that no flammable liquids are present.

7.



WARNING: Before proceeding, make sure precautions have been taken to warn personnel of a possible loud noise upon activation. Do not allow anybody to approach closer to restraint device than six meters. Failure to follow this instruction may result in personal injury.

Move as far from restraint device as possible and connect the tool clips to a 12V vehicle battery.

8.



WARNING: Do not handle the deployed device immediately after activation - it may be hot. Allow the unit to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not create a fire with spilled liquids or other debris. Failure to follow this instruction may result in personal injury.

Deploy the module by depressing both switches on the tool. If activation does not occur, disconnect battery from tool and seek advice from Jaguar Engineering and wait for further instructions.

9. Allow the air bag to cool for at least 20 minutes. Cooling modules should be continuously

monitored to make sure heat does not generate a fire with spilled liquids or other debris.

10. Remove the air bag from the tyre stack and seal in a plastic bag, ready for disposal.

11. In the event of any problems or queries arising from this procedure, contact Jaguar Engineering.

Disposal of side curtain air bag module using tyres

1. Equipment required: Deployment tool 418-S135, Battery (12V), Safety goggles to BS2092 grade 2, Rubber gloves to PrEN 374 class 2, Ear protectors that have been measured to BS.EN 24869, Particulate respirator to EN 149 grade FFP2S.

2. The deployment procedure should be carried out outdoors, away from other personnel.

3.



WARNING: Make sure that the tyre stack is stable before and after deployment. Failure to follow this instruction may result in personal injury.

Stack scrap tyres of a sufficient height to mask the side curtain air bag module, securing together with heavy gauge wire or cable. While disconnected from any electrical power source, connect deployment harness and place air bag adaptor portion under tyre stack, ready for connection to air bag.

4.



WARNING: Power must not be connected during this step. Failure to follow this instruction may result in personal injury.



CAUTION: Make sure the connector is not in contact with the inflator or it will be damaged during the test.

Connect air bag to air bag connector, make sure the locking sleeve is fully engaged. Position the air bag into the tyres with the inflator canister at the lowest point.

5. Make sure battery connections of deployment harness are ten meters away from the tyre stack

6. Remove any loose parts from around the air bag. Make sure that no flammable liquids are present.

7.



WARNING: Before proceeding, make sure precautions have been taken to warn personnel of a possible loud noise upon activation. Do not allow anybody to approach closer to restraint device than six meters. Failure to follow this instruction may result in personal injury.

Move as far from restraint device as possible and connect the tool clips to a 12V vehicle battery.

8.



WARNING: Do not handle the deployed device immediately after activation - it may be hot. Allow the unit to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not create a fire with spilled liquids or other debris. Failure to follow this instruction may result in personal injury.

Deploy the module by depressing both switches on the tool. If activation does not occur, disconnect battery from tool and seek advice from Jaguar Engineering and wait for further instructions.

9. Allow the air bag to cool for at least 20 minutes. Cooling modules should be continuously monitored to make sure heat does not generate a fire with spilled liquids or other debris.

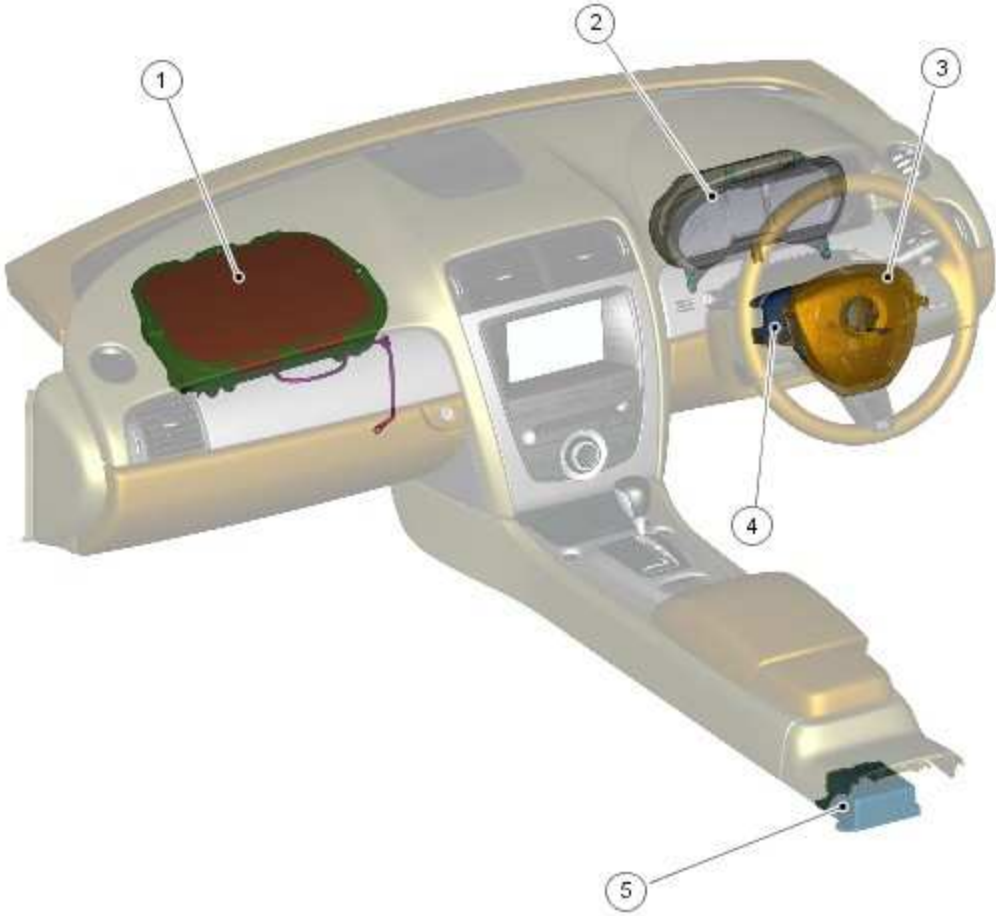
10. Remove the air bag from the tyre stack and seal in a plastic bag, ready for disposal.

11. In the event of any problems or queries arising from this procedure, contact Jaguar Engineering.

Description and operation

Air Bag Supplemental Restraint System (SRS)

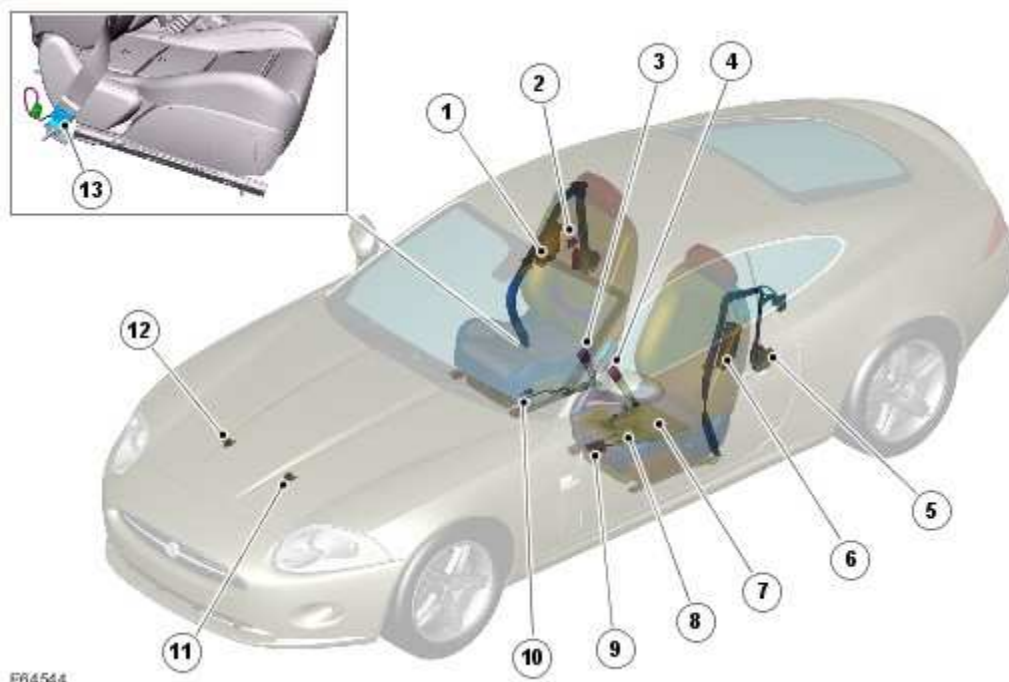
COMPONENT LOCATION - SHEET 1 OF 3



E64543

Item	Part Number	Description
1		Passenger air bag
2		Instrument cluster
3		Drivers air bag
4		Clock spring
5		RCM

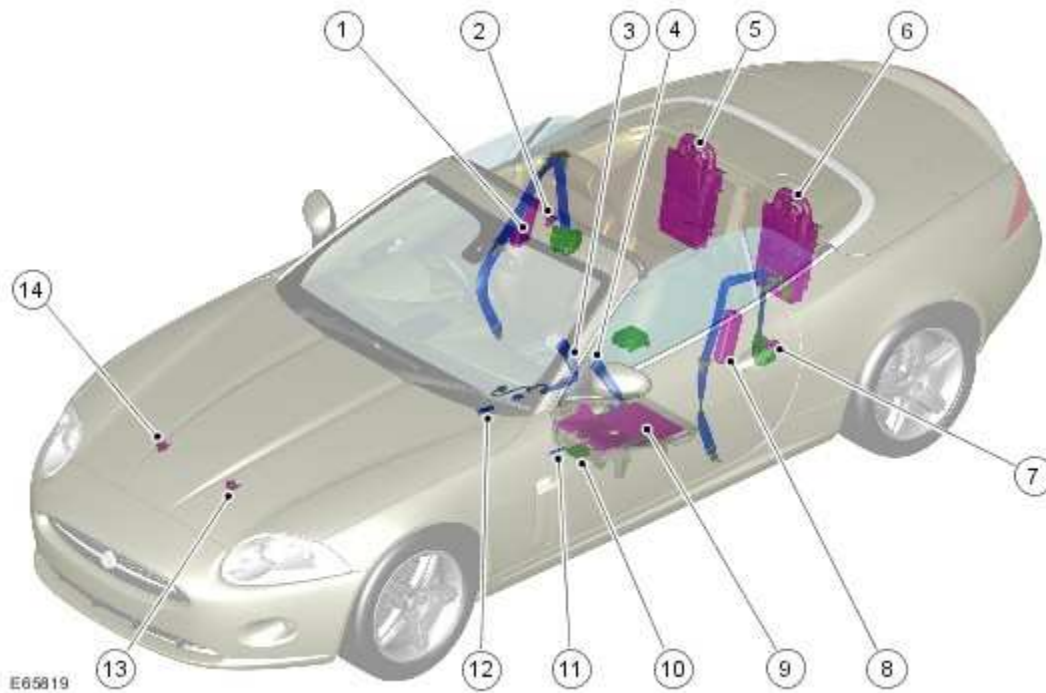
COMPONENT LOCATION - SHEET 2 OF 3



E64544

Item	Part Number	Description
1		RH side air bag
2		Crash sensor
3		RH safety belt pre-tensioner
4		LH safety belt pre-tensioner
5		Crash sensor
6		LH side air bag
7		Seat occupancy/occupant classification sensor
8		Passenger seat position sensor (where fitted)
9		Seat occupancy classification system control module
10		Driver seat position sensor
11		Crash sensor
12		Crash sensor
13		Safety belt tension sensor

COMPONENT LOCATION - SHEET 3 OF 3



Item	Part Number	Description
1		RH side air bag
2		Crash sensor
3		RH safety belt pre-tensioner
4		LH safety belt pre-tensioner
5		Roll over protection system hoop (convertible only)
6		Roll over protection system hoop (convertible only)
7		Crash sensor
8		LH side air bag
9		Seat occupancy/occupant classification sensor
10		Passenger seat position sensor (where fitted)
11		Seat occupancy control module
12		Driver seat position sensor
13		Crash sensor
14		Crash sensor

INTRODUCTION



WARNING: All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the Standard Workshop Practices section of this manual. For additional information, refer to [Standard Workshop Practices \(100-00\)](#)

The SRS (supplemental restraint system) provides additional protection for occupants in certain vehicle accident conditions.

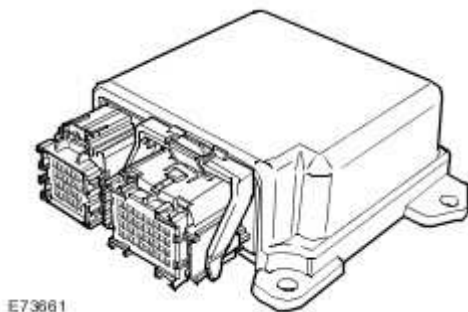
The SRS (supplemental restraint system) comprises the following sub-systems:

- Driver and passenger front air bag system.
- Roll over protection system (convertible only).
- Driver and passenger side air bag system.
- Safety belt pretension system.
- Passenger occupancy detection system
- Passenger occupancy classification system

The SRS (supplemental restraint system) features selective activation of the air bags and safety belt pre-tensioners, and two stage driver and passenger air bags. The RCM (restraints control module) monitors internal and external sensors and activates the required safety belt pre-tensioners, air bags and roll-over protection hoops (convertible only) if the sensors detect an impact or roll-over above preset limits.

The Roll-over Protection System comprises two spring loaded hoops located behind the rear seat. The hoops incorporate a pin to break the rear screen glass as the hoop is released. The hoops are released by a pyrotechnic device when the RCM (restraints control module) detects a roll-over condition.

RESTRAINTS CONTROL MODULE



The RCM (restraints control module) is installed on the top of the transmission tunnel, in line with the B pillars, and controls operation of the SRS (supplemental restraint system) . The main functions of the RCM (restraints control module) include:

- Crash detection and recording.
- Air bag and pre-tensioner firing.
- Self test and system monitoring, with status indication via the air bag warning lamp and non volatile storage of fault information.

The RCM (restraints control module) determines which elements of the SRS are to be deployed by using two internal areas:

Crash severity evaluation

This area evaluates crash severity by using data from the RCM (restraints control module) internal accelerometer, the front crash sensor and the safety belt buckle sensor. Based on this data, the RCM (restraints control module) decides which level of air bag module deployment is required and forwards the information to the second area, the deployment handler.

Deployment handler

The status of the seat track position sensor(s) and safety belt buckle sensors are examined before a decision is made about which restraints should finally be deployed.

Data from the side crash sensors is used by the RCM in conjunction with acceleration data from the RCM (restraints control module) internal accelerometer to make a deployment decision. The RCM (restraints control module) processes the acceleration data and subject to an impact being of high enough severity, decides whether the side air bag module should be deployed.

On board testing of the air bag modules, front safety belt pretensioner firing circuits, warning indicator circuits and module status (the crash and side impact sensors perform basic self-tests) is performed by the RCM (restraints control module) together with the storing of fault codes.

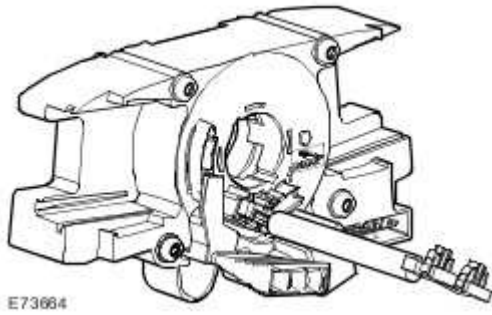
The RCM (restraints control module) drives the SRS (supplemental restraint system) indicator on the instrument pack via a CAN (controller area network) signal. If the warning lamp fails, a fault code is recorded and a warning tone is sounded in place of the lamp if a further fault occurs. It also provides a temporary back-up power supply to operate the air bag modules in the event that in crash conditions, the battery supply is lost. In the event of a crash, it records certain data which can be accessed via the diagnostic connector.

A safing sensor in the RCM provides confirmation of an impact to verify if air bag and pretensioner activation is necessary. A roll-over sensor monitors the lateral attitude of the vehicle. Various firing strategies are employed by the RCM (restraints control module) to ensure that during an accident only the appropriate air bags and pretensioners are fired. The firing strategy used also depends on the inputs from the safety belt switches and the occupant monitoring system.

An energy reserve in the RCM (restraints control module) ensures there is always a minimum of 150 milliseconds of stored energy available if the power supply from the ignition switch is disrupted during a crash. The stored energy is sufficient to produce firing signals for the driver air bag, the passenger air bag and the safety belt pretensioners.

When the ignition is switched on the RCM (restraints control module) performs a self test and then performs cyclical monitoring of the system. If a fault is detected the RCM (restraints control module) stores a related fault code and illuminates the air bag warning indicator. The faults can be retrieved by IDS (Integrated Diagnostic System) over the CAN (controller area network) bus. If a fault that could cause a false fire signal is detected, the disables the respective firing circuit, and keeps it disabled during a crash event

CLOCK SPRING



The clockspring is installed on the steering column to provide the electrical interface between the fixed wiring harness of the steering column and the components that rotate with the steering wheel, i.e. the driver air bag, the horn and the steering wheel switch packs.

The clockspring consists of a plastic cassette which incorporates an outer cover fixed to the steering column and an inner rotor which turns with the steering wheel. Four securing lugs attach the cover to the multifunction switch on the steering column. The rotor is keyed to the steering wheel by a drive peg. A lug on the underside of the rotor operates the self-cancelling feature of the turn signal indicator switch. A ribbon lead, threaded on rollers in the rotor, links two connectors on the cover to two connectors on the rotor. Link leads for the driver air bag are installed in one of the connectors on the rotor.

To prevent damage to the ribbon lead, both the steering and the clockspring must be centralized when removing and installing the clockspring or the steering wheel. The clockspring is centralized when the drive peg is at six o'clock and 50 - 100% of a yellow wheel is visible in the viewing window.

Replacement clocksprings are fitted with a stopper, which locks the cover to the rotor, in the central position. The stopper must be broken off when the replacement clockspring is installed.

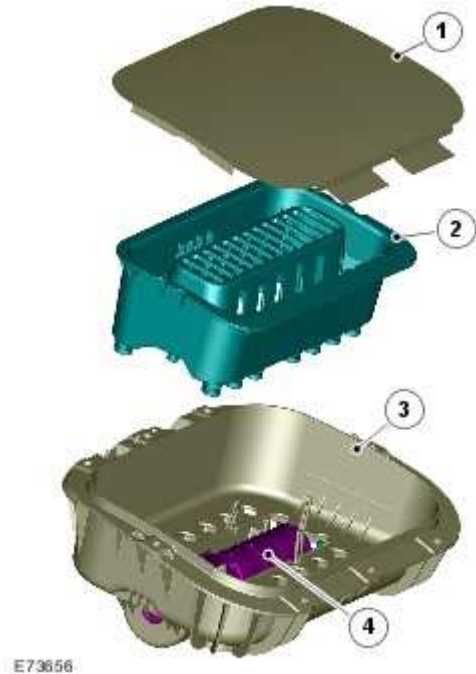
DRIVERS AIR BAG MODULE



The driver air bag module is controlled by the RCM (restraints control module) which chooses between single or dual stage deployment, depending on the occupant position and the crash severity. To reduce the risk of an air bag module induced injury to a driver that is positioned close to the steering wheel, the air bag module deploys radially. It has a non-azide propellant that reduces particulates and effluents. It consists of a two stage inflator with separate chambers for the two inflation stages, each being independently activated by the

RCM. It has two electrical connectors that are color coded and mechanically keyed to the respective connector on the inflator.

PASSENGER AIR BAG MODULE

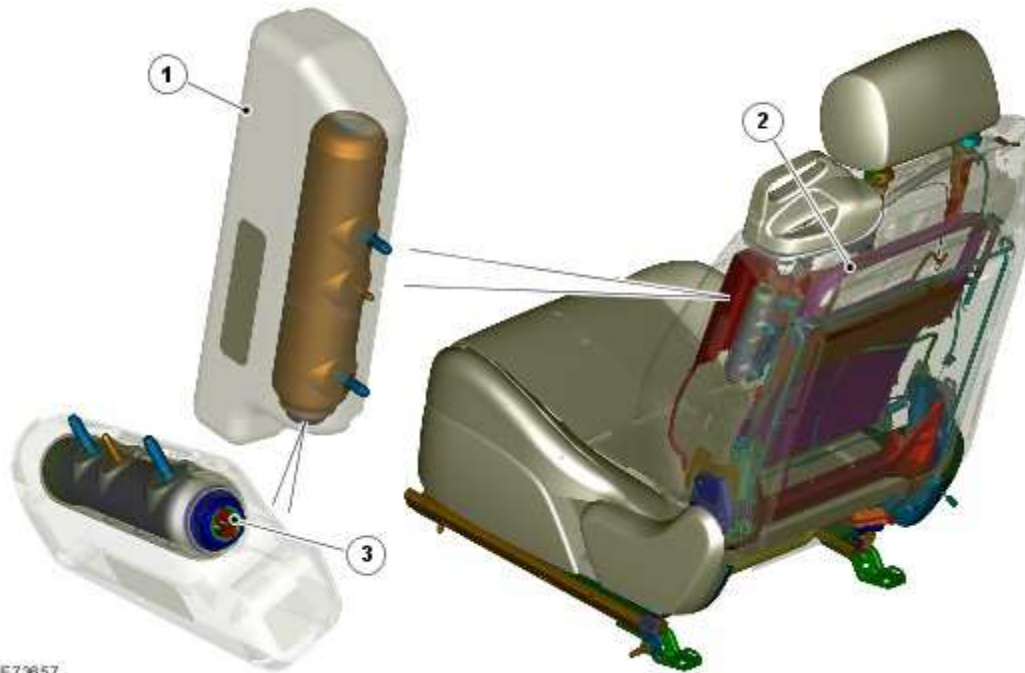


Item	Part Number	Description
1		Passenger air bag module cover
2		Passenger air bag module retainer
3		Passenger air bag module container
4		Passenger air bag module inflator

The passenger air bag module is controlled by the RCM (restraints control module) which chooses between single or dual stage deployment, depending on the occupant status and the crash severity. It consists of a two stage inflator with two air bag electrical connectors to accommodate the two stage inflation.

The heated gas inflator consists of a high-pressure mix of clean air and hydrogen gas, triggered by two separate ignition squibs. It produces a controlled generation of clean gas to rapidly fill the air bag. It is classified as a stored flammable gas (not as an explosive) and as such, has less restrictive storage and transportation requirements. It produces a very clean burn and almost no particulates and is almost free of any toxins, making disposal or recycling much easier.

SIDE AIR BAG MODULE

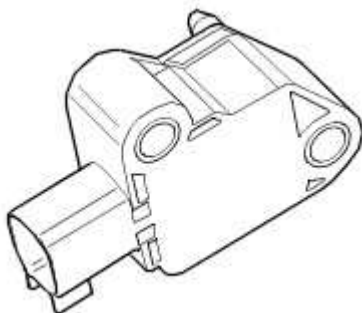


E73657

Item	Part Number	Description
1		Side air bag
2		Seat frame
3		Side air bag electrical connector

The side air bag module is mounted in the outboard bolster of each front seat and uses compressed gas to inflate. It provides protection for the thorax (the part of the trunk between the neck and the abdomen) and the head. In an air bag deployment situation, it deploys through the stitch seam in the side bolster. To ensure the air bag always emerges at the same point, a chute is attached to the inside of the trim cover and wrapped around the air bag module.

IMPACT SENSORS

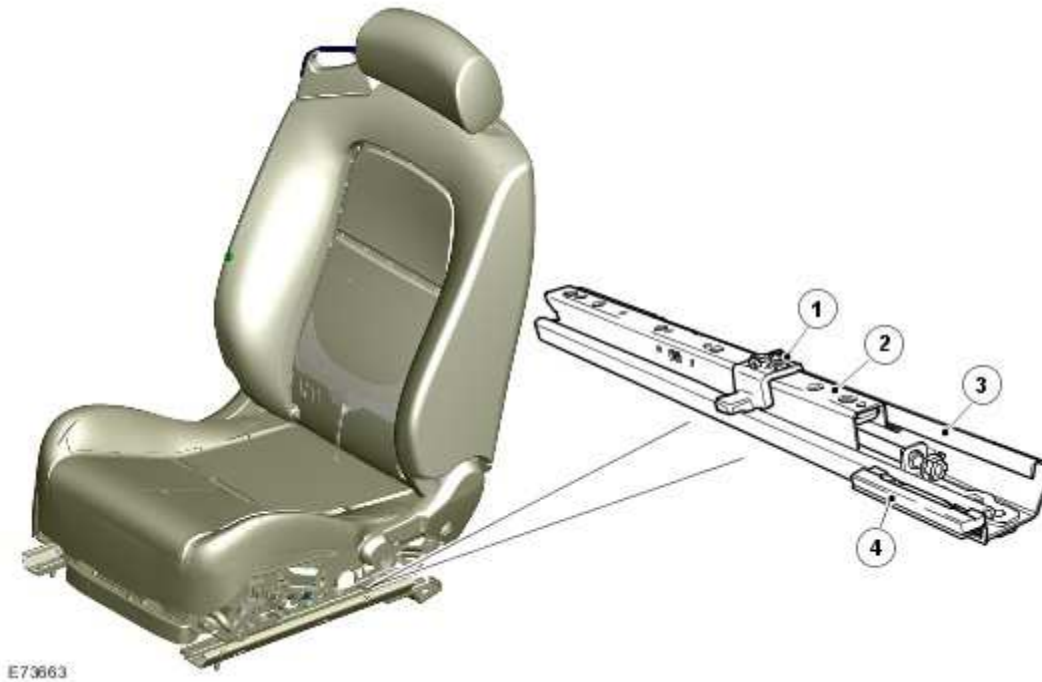


E73662

Two front impact sensors are attached to the body behind the radiator grille. The RCM (restraints control module) processes the crash data sent by the crash sensor against stored data, and deploys the front air bags and pretensioners.

Two side impact sensors are mounted at the base of the B-pillars to facilitate lateral impact sensing. In the event of a side impact, the RCM (restraints control module) processes the crash data against the stored data. The RCM (restraints control module) will deploy the side air bag module on the side the deployment request was initiated.

SEAT POSITION SENSOR(S)



Item	Part Number	Description
1		Seat position sensor
2		Seat rail
3		Floor runner
4		Seat position trigger

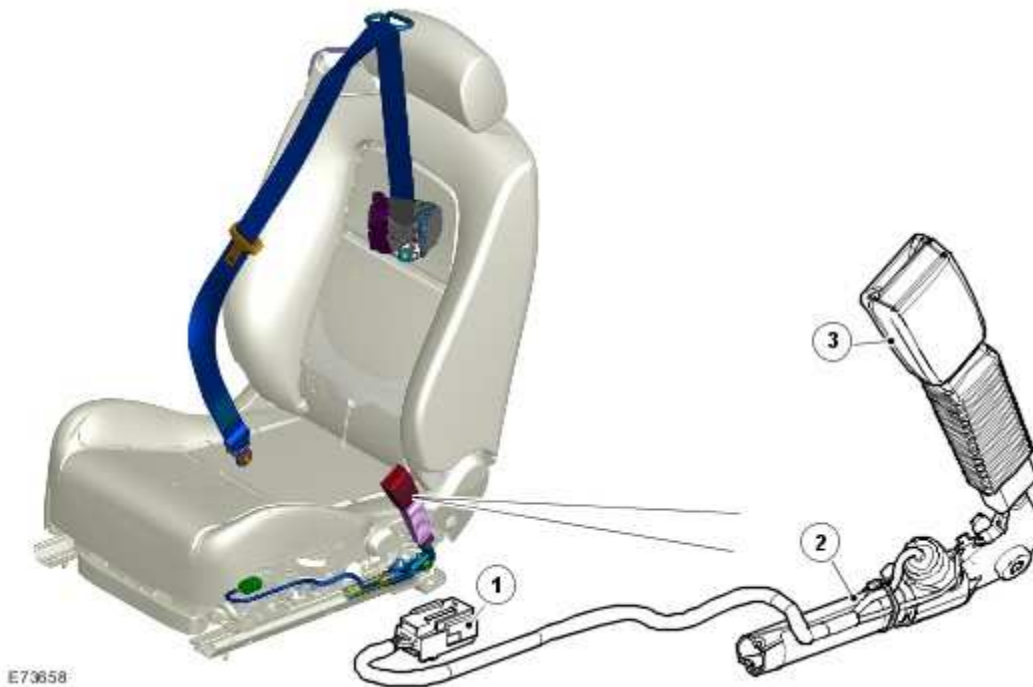
A seat position sensor is installed on the driver seat and, up to VIN (vehicle identification number) B03409, some front passenger seats. The seat position sensor allows the RCM (restraints control module) to detect when the seat is forward of a given point on the seat track. The seat position sensor consists of a Hall effect sensor attached to the seat frame and a target plate on the seat base. While the ignition is on, the RCM (restraints control module) supplies the sensor with a power supply of 12V nominal, and monitors the return voltage. When the seat frame moves forwards, the sensor moves over the target plate, which changes the reluctance of the sensor. The change of voltage is detected by the RCM (restraints control module) and used as a switching point. The switching point is when the center of the sensor is 3 ± 4 mm from the leading edge of the target plate.

When a seat is forward of the switching point, the RCM (restraints control module) increases the time delay between firing the two stages of the inflator in the driver or passenger air bag, as applicable. When the seat is rearward of the switching point, the RCM (restraints control module) uses the normal time delay between firing the two stages.

SAFETY BELT SENSOR

The buckle of each front safety belt incorporates a Hall effect sensor that provides a safety belt status signal to the RCM (restraints control module) . The RCM (restraints control module) broadcasts the status of the two front safety belts on the high speed CAN (controller area network) bus for use by the instrument cluster. In the event of a front impact the RCM (restraints control module) will deploy the pretensioners provided the safety belt buckles are fastened. The safety belt buckle pretensioners have a lower deployment threshold than that required by the air bags. Hence it is possible during a minor collision, which exceeds the deployment threshold, that only the safety belt buckle pretensioners will deploy. For additional information, refer to [Safety Belt System](#) (501-20 Safety Belt System)

PRETENSIONERS



Item	Part Number	Description
1		Electrical connector
2		Pyrotechnic pretensioner
3		Safety belt buckle

The pretensioners are used to tighten the front safety belts during a collision to ensure the occupants are securely held in their seats. A pretensioner is integrated into each front safety belt buckle.

Each pretensioner has a tube containing an inflator and a piston. The inflator is connected to the RCM (restraints control module) . The piston is attached to a steel cable, the opposite end of which is attached to the safety belt buckle.

On receipt of a fire signal from the RCM (restraints control module) , the inflator generates nitrogen gas that rapidly expands to drive the piston along the tube, pulling the cable and drawing the safety belt buckle downwards.

AIR BAG WARNING INDICATOR



The air bag warning indicator consists of a amber LED (light emitting diode) behind a graphic in the tachometer of the instrument cluster.

Operation of the air bag warning indicator is controlled by a high speed CAN (controller area network) bus message from the RCM (restraints control module) to the instrument cluster. The RCM (restraints control module) illuminates the air bag warning indicator if a fault is detected, and for approximately 6 seconds during the indicator check at the beginning of each ignition cycle.

OCCUPANT MONITORING

There are two types of occupant monitoring:

- In all markets except NAS & Australia, vehicles have an occupant detection sensor
- In NAS markets, vehicles have an occupant classification system

For markets which have an occupant detection sensor, this has no interface with the restraints system and only provides the belt reminder function.

For markets that have an occupant classification system, this provides the RCM (restraints control module) with the occupancy status of the front passenger seat. The RCM (restraints control module) uses this and the seat buckle status in the evaluation of the firing strategy for the passenger front air bag, side air bag, and pretensioner.

SAFETY BELT SWITCHES

A safety belt switch is installed in the buckle of each front safety belt to provide the RCM (restraints control module) with status signals of the related safety belts. When a safety belt is

unfastened the switch outputs a low current to the RCM (restraints control module) . When the safety belt is fastened the switch outputs a high current to the RCM (restraints control module) .

OCCUPANT DETECTION SYSTEM



Item	Part Number	Description
1		Seat occupancy sensor pad
2		Harness connector
3		Control module

The occupant detection system can only determine if the front passenger seat is occupied or unoccupied. The occupant detection system consists of a captive sensor mat installed between the foam padding and the cover of the front passenger seat cushion and a control module.

The mat's output is fed to the control module which gives either empty or occupied state signal to the instrument cluster. The instrument cluster illuminates the safety belt minder lamp when it detects that the seat is occupied and the safety belt is not engaged.

OCCUPANT CLASSIFICATION SYSTEM



Item	Part Number	Description
1		Belt tension sensor
2		Pressure pad
3		Occupant classification system control module

The occupant classification system can determine if the front passenger seat is unoccupied, occupied by a small person, or occupied by a large person. The occupant classification system consists of:

- A pressure pad, installed under the cushion of the front passenger seat, which is connected to a pressure sensor
- A safety belt tension sensor, integrated into the anchor point of the front passenger safety belt
- An occupant classification module, installed under the front passenger seat.

The pressure pad is a silicone filled bladder. Any load on the pressure pad is detected by the pressure sensor.

The safety belt tension sensor is a strain gauge that measures the load applied by the safety belt anchor to the anchor bolt. The sensor is located in the lower safety belt anchor point.

Safety Belt Tension Sensor



E84043

The occupant classification module supplies a reference voltage to the pressure sensor and the safety belt tension sensor and, from the returned signals, measures the loads acting on the pressure pad and the safety belt tension sensor. The load measurement from the safety belt tension sensor is used to produce a correction factor for the load measurement from the pressure pad. The tightness of the safety belt affects the load acting on the pressure pad, so without the correction factor the occupant classification module cannot derive an accurate occupancy status.

The occupant classification module translates the load readings into a seat occupancy status and transmits the result to the RCM (restraints control module) , on a dedicated high speed CAN (controller area network) bus link. The occupant classification module incorporates two load limits for the seat cushion: When the load exceeds the lower limit, but is less than the upper limit, the occupant is classified as small; when the upper limit is exceeded, the occupant is classified as large.

The occupant classification system has 4 possible states which are detailed in the following table.

Classification	Seat Status	Passenger Air Bag Status	Air Bag Indicator Status
Empty	Empty	Disabled	Off
Occupied inhibit	The seat is occupied by a small person or child restraint is being used	Passenger air bag/Thorax air bag operation is disabled	On
Occupied allow	The seat is occupied by a large person	Passenger air bag/Thorax air bag operation is enabled	Off
Error	-	Passenger air bag/Thorax air bag operation is disabled	On

ROLL OVER PROTECTION SYSTEM

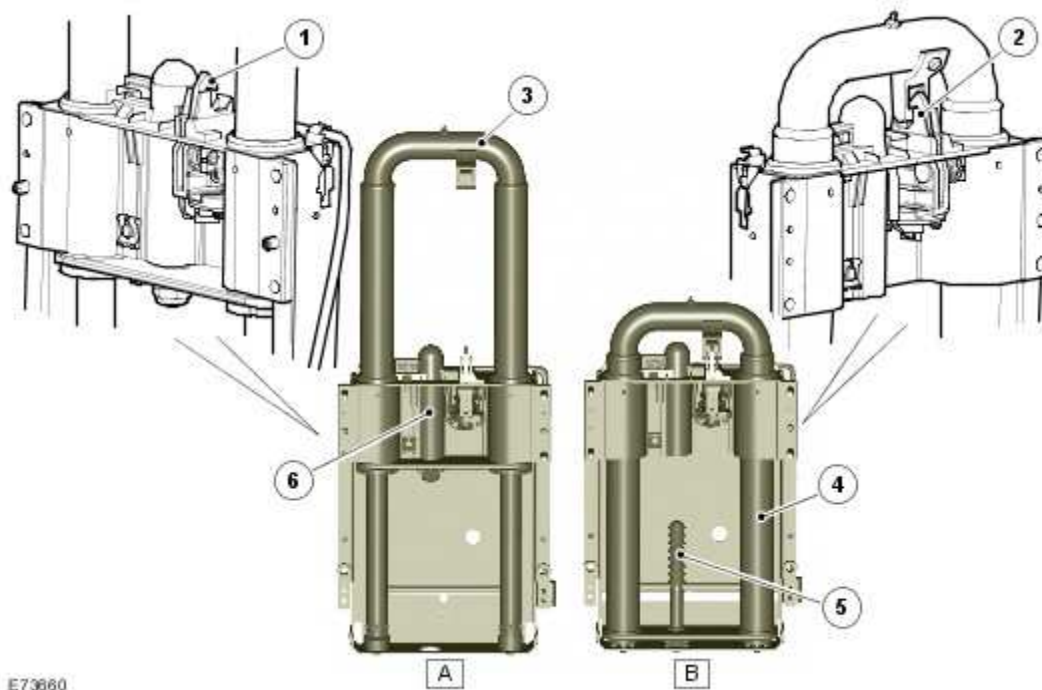
The roll over protection system fitted to the convertible vehicle comprises two roll over protection hoops located behind the rear seat. The roll over protection system is controlled by the RCM (restraints control module) . The RCM (restraints control module) has an internal

roll over sensor which triggers the pyrotechnic latches that hold the roll over protection hoops in place.

Roll Over Protection Hoops

NOTE:

A= Deployed, B= Normal state



Item	Part Number	Description
1		Hoop retaining latch-deployed
2		Hoop retaining latch
3		Roll over protection hoop-deployed
4		roll over protection hoop
5		Roll over protection hoop latch pin
6		Roll over protection hoop latch

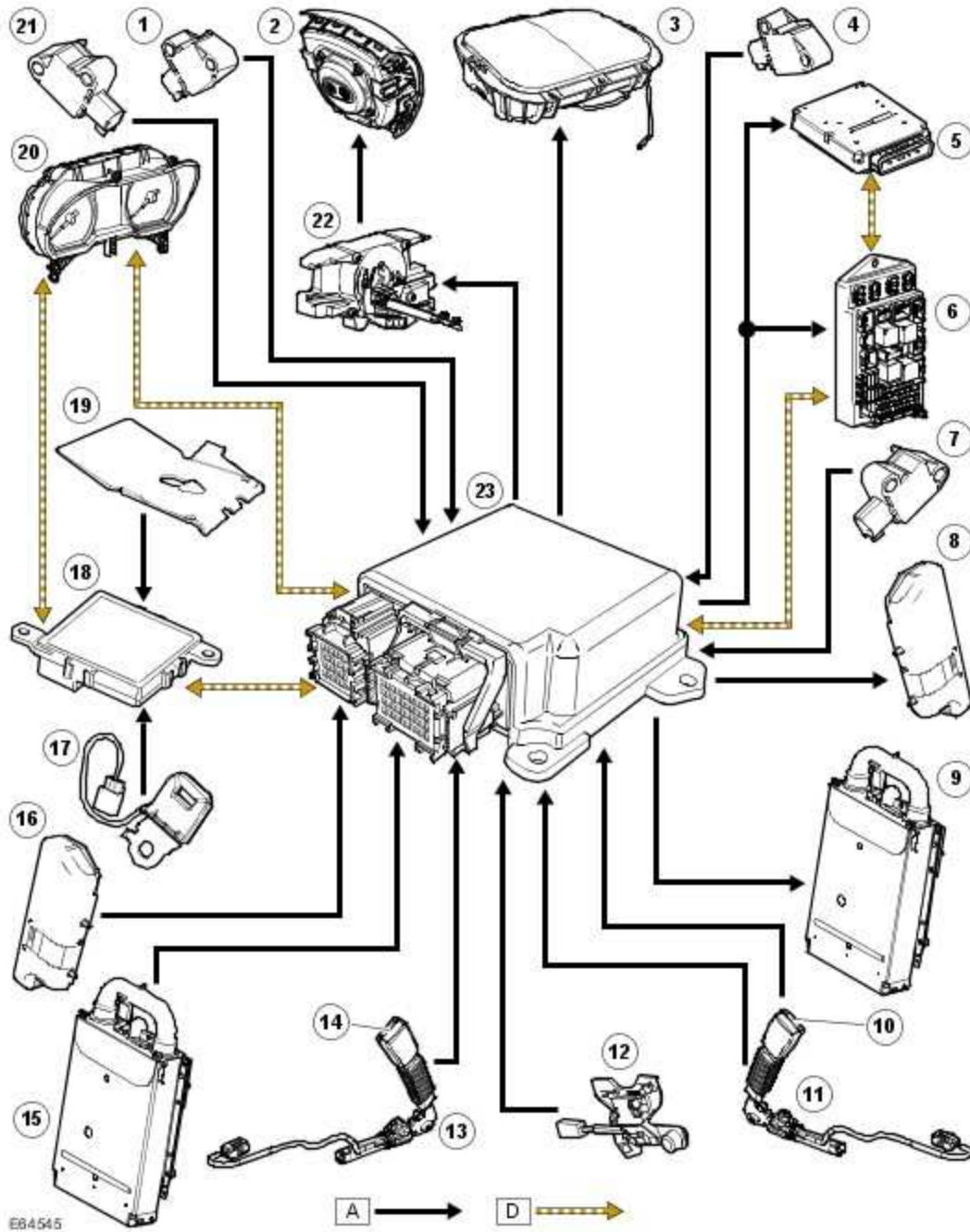
The roll over protection system hoops are located behind the rear seat underneath the tonneau cover. The tonneau cover has two hatches set into it to allow the hoops to break through once triggered. The hoops are spring loaded and held in place by a pyrotechnic latch. The latch is fired in response to a trigger from the RCM (restraints control module) . Once fired the latch opens and the hoops are released. As the hoops move upwards a ratchet in the body of the hoops locks into place and prevents the hoops from being forced back down by the weight of the vehicle. Once deployed the hoops cannot be re-set and should be replaced with new components.

The hoops have a small pin mounted on top which breaks the rear screen if the convertible top is up. This allows clear passage for the roll over protection hoops to operate.

CONTROL DIAGRAM

NOTE:

A = Hardwired connection: D = High speed CAN (controller area network)



Item	Part Number	Description
1		Front crash sensor
2		Drivers air bag
3		Passenger air bag
4		Front crash sensor

5		ECM
6		Auxiliary junction box
7		Side crash sensor
8		Thorax air bag
9		Roll over protection hoop
10		Safety belt buckle switch
11		Safety belt pre-tensioner
12		Seat position sensor(s)
13		Safety belt pre-tensioner
14		Safety belt buckle switch
15		Roll over protection hoop
16		Thorax air bag
17		Driver safety belt tension sensor
18		OCS control module
19		OCS sensor
20		Instrument cluster
21		Side crash sensor
22		Clock spring
23		RCM

PRINCIPLES OF OPERATION

In a collision, the sudden deceleration or acceleration is measured by the safing sensor in the RCM (restraints control module) and by the impact sensors. The RCM (restraints control module) evaluates the readings to determine the impact point on the vehicle and whether the deceleration/acceleration readings exceed the limits for firing any of the air bags or pretensioners. During a collision, the RCM (restraints control module) only fires the air bags and pretensioners if the safing sensor confirms that the data from the remote sensor(s) indicates an impact limit has been exceeded. The RCM (restraints control module) also monitors the vehicle for a roll-over accident using the internal roll-over sensor.

The RCM (restraints control module) incorporates the following impact thresholds to cater for different accident scenarios:

- Front impact, pretensioners.
- Front impact, driver and passenger air bags stage 1, belt unfastened.
- Front impact, driver and passenger air bags stage 2, belt unfastened.
- Front impact, driver and passenger air bags stage 1, belt fastened.
- Front impact, driver and passenger air bags stage 2, belt fastened.
- Rear impact.
- LH (left-hand) side impact.
- RH (right-hand) side impact.

- Roll-over.

The front impact thresholds increase in severity from pretensioners, through to driver and passenger air bag stage 2, belt fastened.

Firing Strategies

The safety belt pretensioners are fired when either the pretensioner impact limit or the roll-over limit is exceeded. The RCM (restraints control module) only fires the pretensioners if the related safety belt is fastened. For the front passenger pretensioner to fire, the seat must also be occupied by a person.

The driver and passenger air bags are only fired in a frontal impact that exceeds the stage 1 threshold. Both stages of the inflator in the driver and passenger air bags are fired. At impacts between the stage 1 and 2 thresholds, the delay between the firing of the two stages varies with the severity of the impact; the more severe the impact the shorter the delay. At stage 2 impact thresholds and above, the two stages of the inflator are fired almost simultaneously. The time delay between firing the two stages of the inflator is increased if the related seat is forward of the seat position sensor switching point.

If a side impact limit is exceeded, the RCM (restraints control module) fires the side air bag on that side of the vehicle.

If multiple impacts occur during a crash event, after responding to the primary impact the RCM (restraints control module) will output the appropriate fire signals in response to any further impacts.

Crash Signal

When the RCM (restraints control module) outputs any of the fire signals, it also outputs a hard wired crash signal to the ECM (engine control module) and changes the high speed CAN (controller area network) bus output message from 'no crash' to 'crash condition'. The high speed CAN (controller area network) bus message is used by the CJB (central junction box) .

On receipt of the crash signals:

- The ECM (engine control module) disables the fuel pump.
- The auxiliary junction box enters the crash mode and: Activates all of the unlock signals of the vehicle locking system, even if the vehicle is already unlocked, repeatedly for 3 seconds, in case a lock button is pressed during the crash. Ignores all locking and superlocking inputs until the crash mode is cancelled, when it returns the locking system to normal operation. Activates all of the courtesy lamps, except for the approach lamps. The activated courtesy lamps remain on until crash mode is cancelled, when they return to normal operation. Activates the hazard warning lamps. The hazard warning lamps remain on until crash mode is cancelled.

The crash mode is cancelled by cycling the ignition mode.

Air Bag Supplemental Restraint System (SRS)

Principle of Operation

For a detailed description of the supplemental restraint system, refer to the relevant Description and Operation section in the workshop manual.

[Air Bag Supplemental Restraint System \(SRS\)](#)

Inspection and Verification



WARNING: TO AVOID ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY, THE BACKUP POWER SUPPLY MUST BE DEPLETED BEFORE REPAIRING OR REPLACING ANY AIR BAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENTS. TO DEplete THE BACKUP POWER SUPPLY ENERGY, DISCONNECT THE BATTERY GROUND CABLE AND WAIT ONE MINUTE. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN PERSONAL INJURY.

NOTE:

Given the legal implications of a restraints system failure, harness repairs to Air Bag module circuits are not acceptable. Where the text refers to "REPAIR the circuit", this will normally mean the replacement of a harness.

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Electrical

- Battery condition, state of charge
- Make sure all electrical connector(s) are engaged correctly on the air bag circuits
- Wiring harness
- Air bag module(s)
- Make sure the restraints control module (RCM) is correctly installed
- Fuse(s)
- Sensor(s)
- Pretensioner(s)
- Warning lamp bulb(s)

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if

possible) before proceeding to the next step.

4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Given the complexity of the system and the potential for damage/injury, the preferred method of diagnosis is via the Manufacturer approved diagnostic system.

If the Manufacturer approved diagnostic system is not available, use a scan tool to extract DTCs and refer to the DTC Index.

DTC Index



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B000111	Driver Frontal Stage 1	<ul style="list-style-type: none">Driver front stage 1 air bag	Refer to electrical

	Deployment Control	circuit - short to ground	circuit diagrams and test driver front stage 1 air bag circuit for short to ground
B000112	Driver Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Driver front stage 1 air bag circuit - short to power 	Refer to electrical circuit diagrams and test driver front stage 1 air bag circuit for short to power
B00011A	Driver Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00011B	Driver Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B000164	Driver Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B000211	Driver Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Driver front stage 2 air bag circuit - short to ground 	Refer to the electrical circuit diagrams and test driver front stage 2 air bag circuit for short to ground
B000212	Driver Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Driver front stage 2 air bag circuit - short to power 	Refer to the electrical circuit diagrams and test driver front stage 2 air bag circuit for short to power
B00021A	Driver Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00021B	Driver Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic

			system
B000264	Driver Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B001011	Passenger Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Passenger front stage 1 air bag circuit - short to ground 	Refer to the electrical circuit diagrams and test passenger front stage 1 air bag circuit for short to ground
B001012	Passenger Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Passenger front stage 1 air bag circuit - short to power 	Refer to the electrical circuit diagrams and test passenger front stage 1 air bag circuit for short to power
B00101A	Passenger Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00101B	Passenger Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B001064	Passenger Frontal Stage 1 Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B001111	Passenger Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Passenger front stage 2 air bag circuit - short to ground 	Refer to the electrical circuit diagrams and test passenger front stage 2 air bag circuit for short to ground
B001112	Passenger Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Passenger front stage 2 air bag circuit - short to power 	Refer to the electrical circuit diagrams and test passenger front stage 2 air bag circuit for short to power
B00111A	Passenger Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer

			approved diagnostic system
B00111B	Passenger Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B001164	Passenger Frontal Stage 2 Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B002011	Left Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Left side air bag circuit - short to ground 	Refer to the electrical circuit diagrams and test left side air bag circuit for short to ground
B002012	Left Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Left side air bag circuit - short to power 	Refer to the electrical circuit diagrams and test left side air bag circuit for short to power
B00201A	Left Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00201B	Left Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B002064	Left Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B002811	Right Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Right side air bag circuit - short to ground 	Refer to the electrical circuit diagrams and test right side air bag circuit for short to ground
B002812	Right Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Right side air bag circuit - 	Refer to the electrical circuit diagrams and

		short to power	test right side air bag circuit for short to power
B00281A	Right Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00281B	Right Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B002864	Right Side Air Bag Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B005011	Driver Safety Belt Sensor	<ul style="list-style-type: none"> • Driver safety belt sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test driver safety belt sensor circuit for short to ground
B005015	Driver Safety Belt Sensor	<ul style="list-style-type: none"> • Driver safety belt sensor circuit - short to power or open circuit 	Refer to the electrical circuit diagrams and test driver safety belt sensor circuit for short to power or open circuit
B00501D	Driver Safety Belt Sensor	<ul style="list-style-type: none"> • Circuit current out of range 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B005064	Driver Safety Belt Sensor	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B005211	Passenger Safety Belt Sensor	<ul style="list-style-type: none"> • Passenger safety belt sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test passenger safety belt sensor circuit for short to ground

B005215	Passenger Safety Belt Sensor	<ul style="list-style-type: none"> • Passenger safety belt sensor circuit - short to power or open circuit 	Refer to the electrical circuit diagrams and test passenger safety belt sensor circuit for short to power or open circuit
B00521D	Passenger Safety Belt Sensor	<ul style="list-style-type: none"> • Circuit current out of range 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B005264	Passenger Safety Belt Sensor	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B007011	Driver Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Driver safety belt pretensioner circuit - short to ground 	Refer to the electrical circuit diagrams and test driver safety belt pretensioner circuit for short to ground
B007012	Driver Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Driver safety belt pretensioner circuit - short to power 	Refer to the electrical circuit diagrams and test driver safety belt pretensioner circuit for short to ground
B00701A	Driver Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00701B	Driver Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B007064	Driver Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B007211	Passenger Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Passenger safety belt pretensioner circuit - short 	Refer to the electrical circuit diagrams and test passenger safety

		to ground	belt pretensioner circuit for short to ground
B007212	Passenger Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Passenger safety belt pretensioner circuit - short to power 	Refer to the electrical circuit diagrams and test passenger safety belt pretensioner circuit for short to power
B00721A	Passenger Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00721B	Passenger Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B007264	Passenger Safety Belt Pretensioner Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B009011	Left Front Impact Sensor Communications Line	<ul style="list-style-type: none"> • Left front impact sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test left front impact sensor circuit for short to ground
B009012	Left Front Impact Sensor Communications Line	<ul style="list-style-type: none"> • Left front impact sensor circuit - short to power 	Refer to the electrical circuit diagrams and test left front impact sensor circuit for short to power
B009064	Left Front Impact Sensor	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B009081	Left Front Impact Sensor Communications Line	<ul style="list-style-type: none"> • Left side impact sensor circuit - open circuit • Sensor fault 	Refer to the electrical circuit diagrams and test left front impact sensor circuit for open circuit fault. Install a new sensor as

			necessary. Front Impact Severity Sensor
B009092	Left Front Impact Sensor	<ul style="list-style-type: none"> Performance or incorrect operation 	Install a new front impact sensor. Front Impact Severity Sensor
B009096	Left Front Impact Sensor	<ul style="list-style-type: none"> Component internal failure 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B009211	Left Side Impact Sensor Communications Line	<ul style="list-style-type: none"> Left side impact sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test left side impact sensor circuit for short to ground
B009212	Left Side Impact Sensor Communications Line	<ul style="list-style-type: none"> Left side impact sensor circuit - short to power 	Refer to the electrical circuit diagrams and test left side impact sensor circuit for short to power
B009264	Left Side Impact Sensor	<ul style="list-style-type: none"> Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B009281	Left Side Impact Sensor Communications Line	<ul style="list-style-type: none"> Left side impact sensor circuit - open circuit Sensor fault 	Refer to the electrical circuit diagrams and test left side impact sensor circuit for open circuit fault. Install a new sensor as necessary. Side Impact Sensor - Convertible (76.73.53) Side Impact Sensor - 2-Door (76.73.53)
B009292	Left Side Impact Sensor	<ul style="list-style-type: none"> Performance or incorrect operation 	Install a new side impact sensor. Side Impact Sensor - Convertible (76.73.53) Side Impact Sensor - 2-Door (76.73.53)

B009296	Left Side Impact Sensor	<ul style="list-style-type: none"> Component internal failure 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B009511	Right Front Impact Sensor Communications Line	<ul style="list-style-type: none"> Right front impact sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test right front impact sensor circuit for short to ground
B009512	Right Front Impact Sensor Communications Line	<ul style="list-style-type: none"> Right front impact sensor circuit - short to power 	Refer to the electrical circuit diagrams and test right front impact sensor circuit for short to power
B009564	Right Front Impact Sensor	<ul style="list-style-type: none"> Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B009581	Right Front Impact Sensor Communications Line	<ul style="list-style-type: none"> Left side impact sensor circuit - open circuit Sensor fault 	Refer to the electrical circuit diagrams and test left front impact sensor circuit for open circuit fault. Install a new sensor as necessary. Front Impact Severity Sensor
B009592	Right Front Impact Sensor	<ul style="list-style-type: none"> Performance or incorrect operation 	Install a new front impact sensor. Front Impact Severity Sensor
B009596	Right Front Impact Sensor	<ul style="list-style-type: none"> Component internal failure 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B009711	Right Side Impact Sensor Communications Line	<ul style="list-style-type: none"> Right side impact sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test right side impact sensor circuit for short to ground
B009712	Right Side Impact Sensor	<ul style="list-style-type: none"> Right side impact sensor 	Refer to the electrical circuit diagrams and

	Communications Line	circuit - short to power	test right side impact sensor circuit for short to power
B009764	Right Side Impact Sensor	<ul style="list-style-type: none"> Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B009781	Right Side Impact Sensor Communications Line	<ul style="list-style-type: none"> Performance or incorrect operation 	Install a new side impact sensor. Side Impact Sensor - Convertible (76.73.53) Side Impact Sensor - 2-Door (76.73.53)
B009792	Right Side Impact Sensor	<ul style="list-style-type: none"> Performance or incorrect operation 	Install a new side impact sensor. Side Impact Sensor - Convertible (76.73.53) Side Impact Sensor - 2-Door (76.73.53)
B009796	Right Side Impact Sensor	<ul style="list-style-type: none"> Component internal failure 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00A049	Occupant Classification System	<ul style="list-style-type: none"> Internal module failure 	Install a new OCS module
B00A054	Occupant Classification System	<ul style="list-style-type: none"> Missing calibration 	Install a new OCS module
B00A064	Occupant Classification System	<ul style="list-style-type: none"> Component is fitted but not configured in equipment set 	Re-configure the RCM using the manufacturer approved diagnostic system
B00A081	Occupant Classification System	<ul style="list-style-type: none"> Invalid serial data received 	Install a new OCS module
B00A088	Occupant Classification System	<ul style="list-style-type: none"> Bus 'OFF' 	Refer to electrical circuit diagrams and check seat harness for open circuit or backed out connector. Carry out CAN network integrity tests using the manufacturer

			approved diagnostic system
B00A092	Occupant Classification System	<ul style="list-style-type: none"> • Performance or incorrect operation 	Install a new OCS module
B00A095	Occupant Classification System	<ul style="list-style-type: none"> • Incorrect assembly 	Install the correct assembly
B00A096	Occupant Classification System	<ul style="list-style-type: none"> • Component internal failure 	Refer to electrical circuit diagrams and check seat harness for open circuit or backed out connector. Install a new OCS module
B00B511	Driver Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Driver seat position sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test driver seat position sensor circuit for short to ground
B00B515	Driver Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Driver seat position sensor circuit - short to power or open circuit 	Refer to the electrical circuit diagrams and test driver seat position sensor circuit for short to power or open circuit
B00B51D	Driver Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Circuit current out of range 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00B564	Driver Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B00C096	Occupant Belt Tension Sensor	<ul style="list-style-type: none"> • Component internal failure 	Refer to electrical circuit diagrams and check safety belt tension sensor circuit for open circuit or backed out connector
B00C511	Passenger Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Passenger seat position sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test passenger seat position sensor circuit for short to ground
B00C515	Passenger Seat Track	<ul style="list-style-type: none"> • Passenger seat position 	Refer to the electrical

	Position Restraints Sensor	sensor circuit - short to power or open circuit	circuit diagrams and test passenger seat position sensor circuit for short to power or open circuit
B00C51D	Passenger Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Circuit current out of range 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00C564	Passenger Seat Track Position Restraints Sensor	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B00DF55	Passenger Air bag Cut Off Switch and Seat Track Position Sensor equipped simultaneously	<ul style="list-style-type: none"> • Not configured 	Re-configure the RCM using the manufacturer approved diagnostic system
B00D268	<ul style="list-style-type: none"> • Restraint System Malfunction Indicator 1 	<ul style="list-style-type: none"> • Events information 	Check CAN network using manufacturer approved diagnostic system
B00D287	Restraint System Malfunction Indicator 1	<ul style="list-style-type: none"> • Missing message 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B00D511	Restraint System Passenger Disable Indicator	<ul style="list-style-type: none"> • Passenger Air bag De-activation (PAD) lamp circuit - short to ground 	Refer to electrical circuit diagrams and test Passenger Air bag De-activation (PAD) lamp circuit for short to ground
B00D515	Restraint System Passenger Disable Indicator	<ul style="list-style-type: none"> • Passenger Air bag De-activation (PAD) lamp circuit - short to power, open circuit 	Refer to electrical circuit diagrams and test Passenger Air bag De-activation (PAD) lamp circuit for short to power or open circuit
B1A0016	Supply voltage	<ul style="list-style-type: none"> • Circuit voltage below 	Refer to electrical circuit diagrams and

		threshold	test RCM ignition supply circuit for short to ground or open circuit
B1A0017	Supply voltage	<ul style="list-style-type: none"> • Circuit voltage above threshold 	Refer to electrical circuit diagrams and test RCM ignition supply circuit for short to power
B1A0049	All internal faults	<ul style="list-style-type: none"> • Internal electronic failure 	Install a new RCM, refer to the new module installation note at top of the DTC Index
B1A1795	Driver Stage 1 Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A1995	Driver Stage 2 Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A2195	Passenger Stage 1 Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A2395	Passenger Stage 2 Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A2595	Driver Safety Belt Pretensioner Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A2795	Passenger Safety Belt Pretensioner Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A2995	Left Side Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are

			installed into correct connector cavities
B1A3195	Right Side Air Bag Squib Short Circuit To Ignition Loop	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1A5514	Air Bag Deployed Signal	<ul style="list-style-type: none"> • Air bag deployed signal circuit - short to ground or open circuit 	Refer to the electrical circuit diagrams and test air bag deployed signal circuit for short to ground or open circuit
B1A5564	Air Bag Deployed Signal	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B1D7611	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Left roll over protection system circuit - short to ground 	Refer to the electrical circuit diagrams and test left roll over protection system circuit - short to ground
B1D7612	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Left roll over protection system circuit - short to power 	Refer to the electrical circuit diagrams and test left roll over protection system circuit - short to power
B1D761A	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D761B	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D7664	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system

B1D7695	Left Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
B1D7711	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Right roll over protection system circuit - short to ground 	Refer to the electrical circuit diagrams and test right roll over protection system circuit for short to ground
B1D7712	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Right roll over protection system circuit - short to power 	Refer to the electrical circuit diagrams and test right roll over protection system circuit for short to power
B1D771A	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Circuit resistance below threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D771B	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Circuit resistance above threshold 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B1D7764	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Signal plausibility failure 	Re-configure the RCM using the manufacturer approved diagnostic system
B1D7795	Right Roll Over Protection System Deployment Control	<ul style="list-style-type: none"> • Incorrect assembly 	Refer to the electrical circuit diagrams and check pins are installed into correct connector cavities
U000188	CAN Bus	<ul style="list-style-type: none"> • Bus off 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost Communication With ECM	<ul style="list-style-type: none"> • Missing message 	Carry out the pinpoint tests associated with

			this DTC using the manufacturer approved diagnostic system
U012100	Lost Communication With Anti-Lock Brake System (ABS) Control Module	<ul style="list-style-type: none"> No subtype information 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U015587	Lost Communication With Instrument Cluster	<ul style="list-style-type: none"> Missing message 	Carry out the pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U030055	Internal control module software incompatibility	<ul style="list-style-type: none"> Mis-match between vehicle and RCM software levels 	Re-configure the RCM with the latest level software using the manufacturer approved diagnostic system
U1A0266	Impact Telegrams reached maximum of 3 stored	<ul style="list-style-type: none"> Signal has too many transitions 	Install a new RCM, refer to the new module installation note at top of the DTC Index
U1A0387	CAN Signal Car Configuration Parameters HS	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer approved diagnostic system
U1A1455	Volcano Initialisation	<ul style="list-style-type: none"> Not configured 	Install a new RCM module, refer to the new module installation note at the top of the DTC Index
U201A51	Control Module Main Calibration Data	<ul style="list-style-type: none"> Not programmed 	Re-configure the RCM with the latest level software using the manufacturer approved diagnostic system
U201B4A	Control Module Calibration Data #2	<ul style="list-style-type: none"> Incorrect component installed 	Install correct RCM, refer to the new module installation note at the top of the

			DTC Index
U201B51	Control Module Calibration Data #2	<ul style="list-style-type: none"> • Not programmed 	Re-configure the RCM using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains install a new RCM, refer to the new module installation note at the top of the DTC Index
U201C4A	Control Module Calibration Data #3	<ul style="list-style-type: none"> • Incorrect component installed 	Install correct RCM, refer to the new module installation note at the top of the DTC Index
U201C51	Control Module Calibration Data #3	<ul style="list-style-type: none"> • Not programmed 	Re-configure the RCM using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains install a new RCM, refer to the new module installation note at the top of the DTC Index
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index

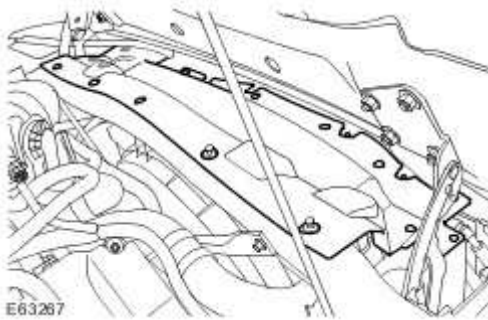
Front Impact Severity Sensor

Removal

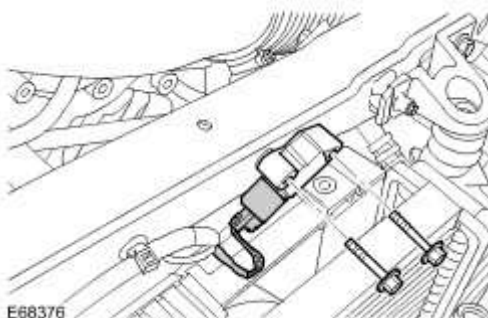
NOTE:

The LH front impact severity sensor is illustrated, removal of the RH sensor is a similar procedure.

- 1 . Open the hood.
- 2 . Remove the fan cowl.
 - ▶ Remove the 15 clips.



- 3 . Remove the front impact severity sensor.
 - ▶ Remove the 2 bolts.
 - ▶ Disconnect the electrical connector.



Installation

1 . Install the front impact severity sensor.

▶ Connect the electrical connector.

▶ Tighten the bolts to 8 Nm (6 lb.ft).

2 . Install the fan cowl.

▶ Secure with the clips.

Driver Air Bag Module (76.73.39)

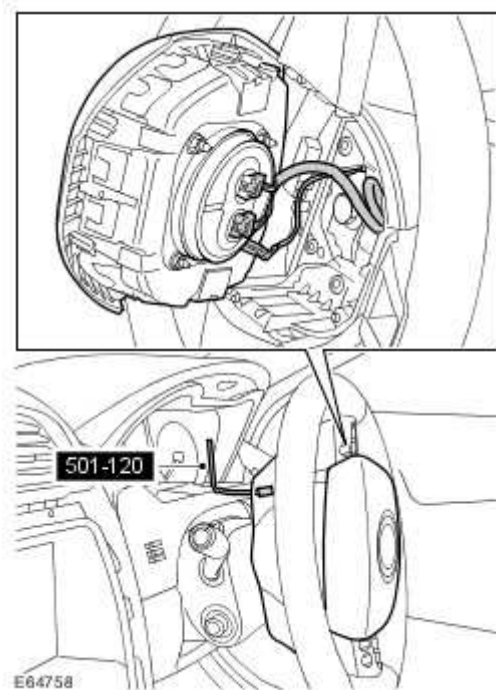
Special Service Tools



Driver air bag module remover
501-120

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Using the special tool remove the driver air bag module.
 - ▶ Rotate the steering wheel for access to slots.
 - ▶ Carefully release the 2 clips.
 - ▶ Disconnect the 3 electrical connectors.



Installation

- 1 . Install the driver air bag module.
 - ▶ Connect the electrical connectors.
 - ▶ Carefully align and secure the clips.
- 2 . Connect the battery ground cable and install the cover.
For additional information, refer to
- 3 . Connect WDS to the vehicle and configure a new module.

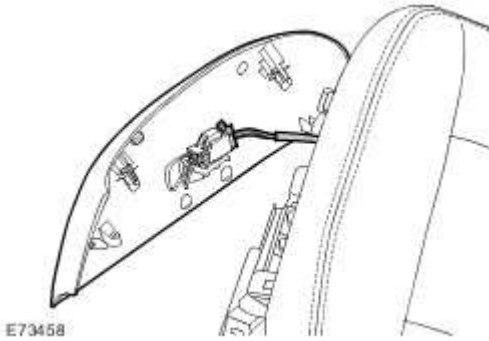
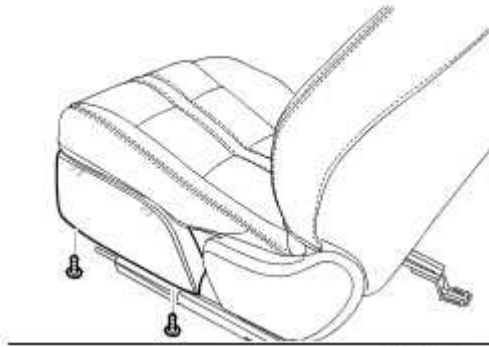
Front Passenger Seat Occupant Classification Sensor (76.73.60)

Removal

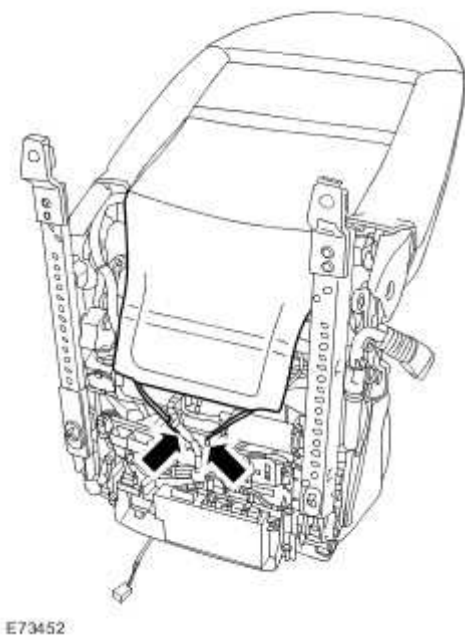


WARNING: The front passenger seat occupant classification sensor is available only as a service kit. No attempt should be made to replace individual components. Failure to follow this instruction may result in personal injury.

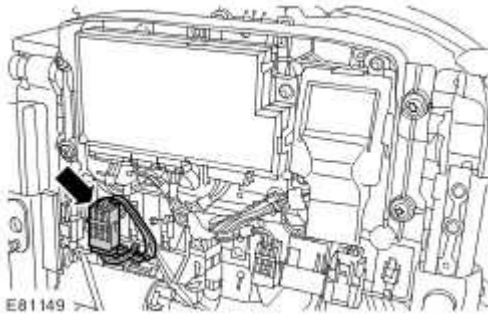
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat cushion outer trim panel.
 - ▶ Remove the 2 Torx screws.
- 5 . Remove the front seat cushion outer trim panel.
 - ▶ Release the 2 clips.
 - ▶ Disconnect the electrical connector.



6 . Release the front seat backrest cover lower tension straps.

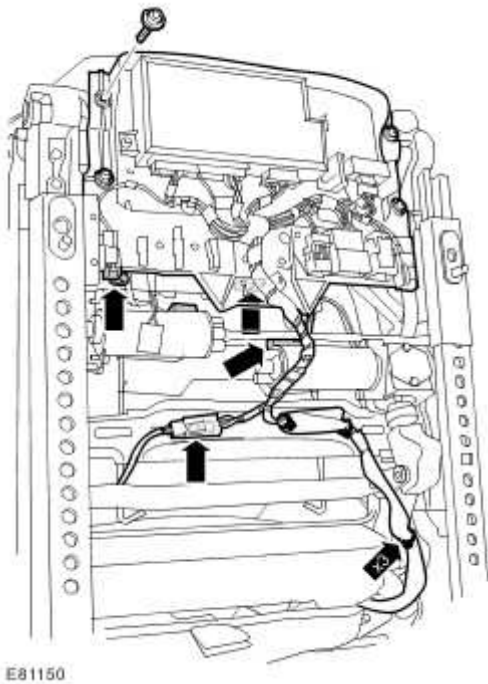


7 . Release the pre-tensioner harness and disconnect the electrical connector.



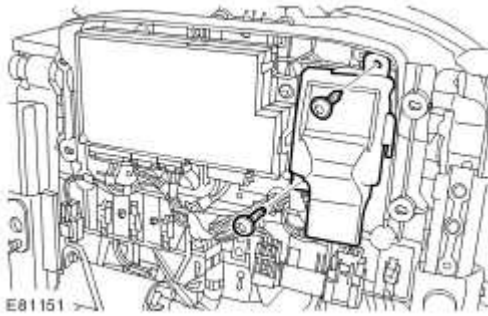
8 . Release the seat module bracket.

- ▶ Disconnect the 4 electrical connectors.
- ▶ Release the 3 wiring harness clips.
- ▶ Remove and discard the cable tie.
- ▶ Remove the 4 Torx bolts.



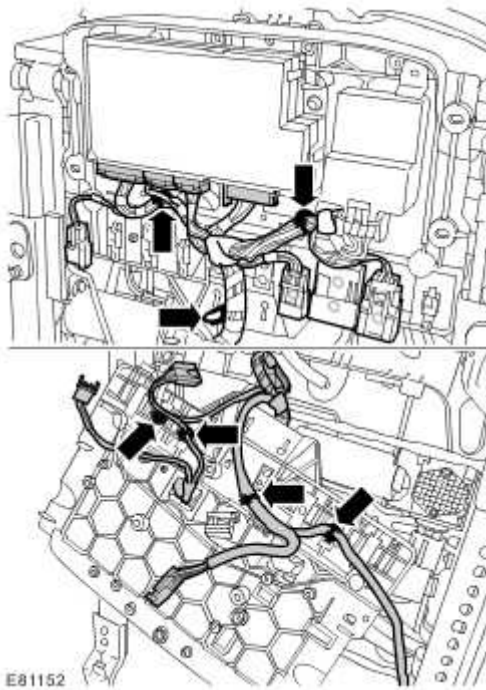
9 . Release the occupant classification module from the seat module bracket.

- ▶ Remove the 2 Torx screws.



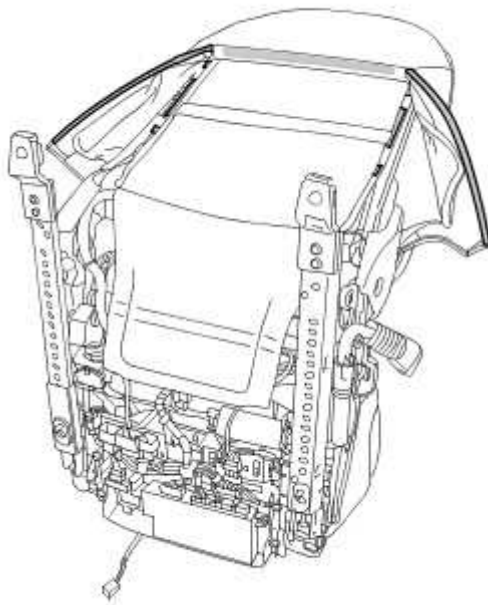
10 . Release the harness assembly from the seat module bracket.

- ▶ Release the 7 wiring harness clips.
- ▶ Release the 4 electrical connectors.
- ▶ Disconnect the 4 electrical connectors.



11 . Release the 9 front seat backrest cover rear panel retaining clips.

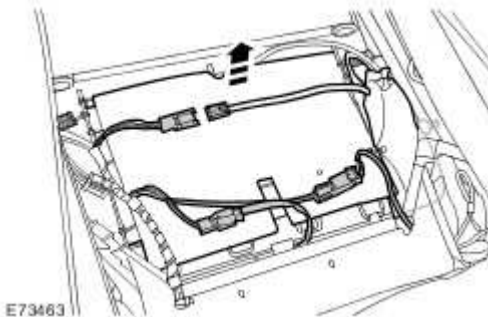
- ▶ Release from the backrest cover.
- ▶ Release from the seat frame.



E73453

12 . Release the harness from the lumbar assembly.

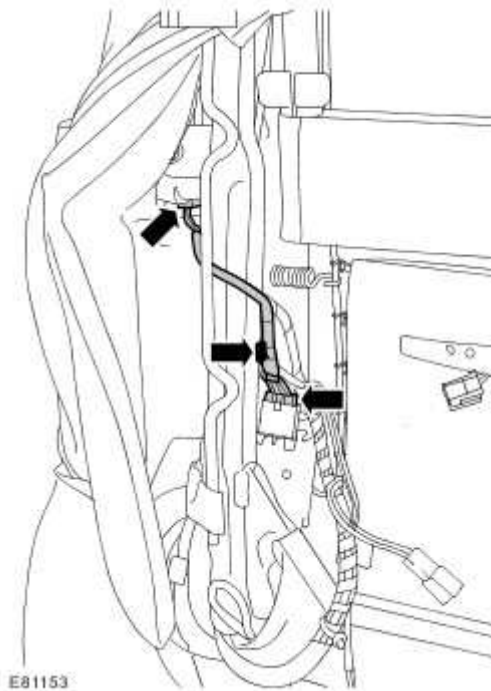
- ▶ Disconnect the 3 electrical connectors.
- ▶ Release the 3 electrical connectors.



E73463

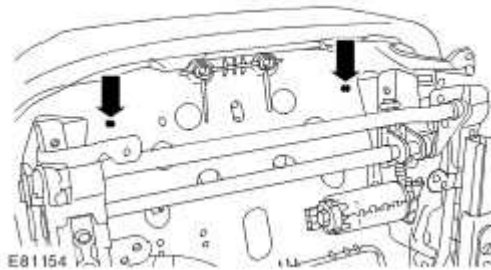
13 . Release the harness from the seat airbag and backrest frame.

- ▶ Disconnect the electrical connector.
- ▶ Release the wiring harness clip.



14 . Release the occupant classification assembly from the seat cushion frame.

- ▶ Release the 2 clips.



15 . **NOTE:**

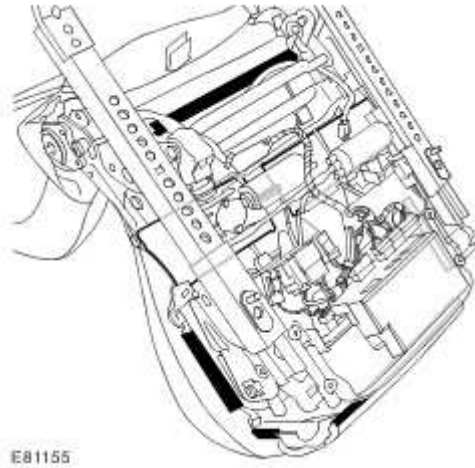
Seat harness is part of the occupant classification sensor assembly.

NOTE:

Note the routing of the seat harness.

Remove the passenger seat cushion and occupant classification sensor assembly.

- ▶ Release and disconnect the electrical connector.
- ▶ Release the Velcro strap.
- ▶ Release the 5 clips.



- 16 . Remove the front seat cushion cover.
 - ▶ Remove the 27 hog rings.



Installation

- 1 . Install the front seat cushion cover.
- 2 . Secure the passenger seat cushion and occupant classification sensor assembly.
 - ▶ Connect and secure the electrical connectors.
 - ▶ Secure the Velcro strap.
 - ▶ Attach the clips.
- 3 . Secure the occupant classification assembly to the seat cushion frame.
 - ▶ Secure with the clips.

- 4 . Secure the harness to the seat airbag and backrest frame.
 - ▶ Connect the electrical connector.
 - ▶ Secure the wiring harness with the clip.
- 5 . Attach the harness to the lumbar assembly.
 - ▶ Connect the electrical connectors.
 - ▶ Secure with the clips.
- 6 . Secure the front seat backrest cover rear panel retaining clips.
 - ▶ Attach to the seat frame.
 - ▶ Attach to the backrest cover.
- 7 . Attach the harness assembly to the module bracket.
 - ▶ Connect the electrical connectors.
 - ▶ Secure the electrical connectors.
 - ▶ Secure the wiring harness in the clips.
 - ▶ Install and tighten the Torx screws.
- 8 . Secure the seat module bracket.
 - ▶ Connect the electrical connectors.
 - ▶ Secure the wiring harness in the clips.
 - ▶ Secure the harness with a cable tie.
 - ▶ Tighten the Torx bolts to 10 Nm (7 lb.ft).
- 9 . Secure the front seat backrest cover lower tension straps.
- 10 . Install the front seat cushion outer trim panel.
 - ▶ Connect the electrical connector.
 - ▶ Secure in the clips.
- 11 . Secure the front seat cushion outer trim panel.
 - ▶ Tighten the Torx screws.
- 12 . Install the front seat hinge covers.
 - ▶ Attach the hinge cover retainers.
 - ▶ Tighten the Torx screws.
- 13 . Install the front seat.

For additional information, refer to [Front Seat \(76.70.01\)](#)

14 . Connect the battery ground cable and install the cover.
For additional information, refer to [Specifications](#)

15 . Using IDS, calibrate a new front seat cushion.

- 1) • Select the 'Vehicle Configuration' tab.
- 2) • Select ' Setup and Configuration'.
- 3) • Select 'Seats'.
- 4) • Select 'Seat Cover Replacement'.

Restraints Control Module (RCM) (76.73.48)

Removal

- 1 . Connect WDS to the vehicle and up-load the relevant data.
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 . Make the SRS system safe.
For additional information, refer to
- 4 . Remove the keyless vehicle antenna.
For additional information, refer to [Radio Frequency \(RF\) Receiver](#)

5 NOTE:

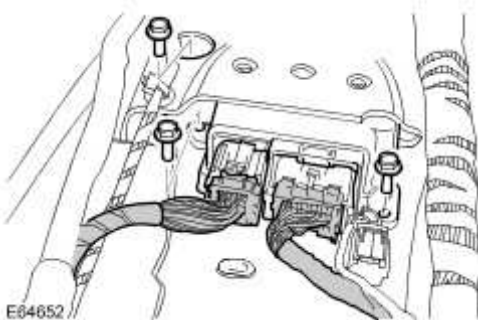
- If the SRS component is to be replaced, the bar code of the new unit must be recorded.

NOTE:

The RCM will record and store impact data. The module must be replaced when three records are noted.

Remove the restraints control module (RCM).

- ▶ Remove the 3 bolts.
- ▶ Disconnect the 2 electrical connectors.



Installation

- 1 . Install the RCM.

▶ Tighten the bolts to 10 Nm (7 lb.ft).

▶ Connect the electrical connectors.

2 . Install the keyless vehicle antenna.

For additional information, refer to [Radio Frequency \(RF\) Receiver](#)

3 . Connect the battery ground cable and install the cover.

For additional information, refer to

4 . Using WDS, configure a new module.

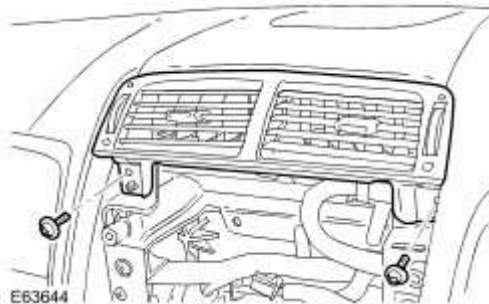
Passenger Air Bag Module (76.73.37)

Removal

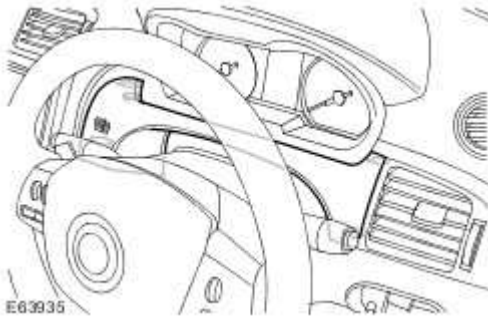
- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the instrument panel.
For additional information, refer to [Instrument Panel \(76.46.01\)](#)
- 4 . Remove the navigation system display module.
For additional information, refer to [Navigation System Display Module \(86.62.07\)](#)
- 5 . **NOTE:**
The Torx screws may not be fitted.

Remove the center register.

- ▶ Remove the 2 Torx screws.
- ▶ Carefully release the component.



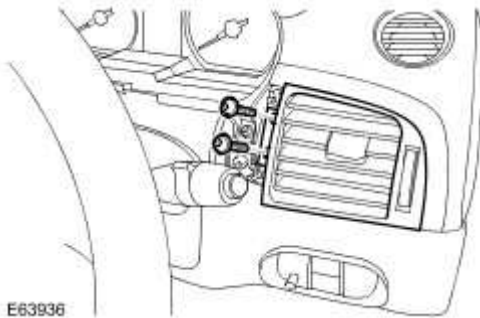
- 6 . Remove the instrument panel driver's side reinforcement trim panel.
▶ Carefully release the 4 clips.



7.  **CAUTION: Care must be taken to avoid damage to the mating surfaces.**

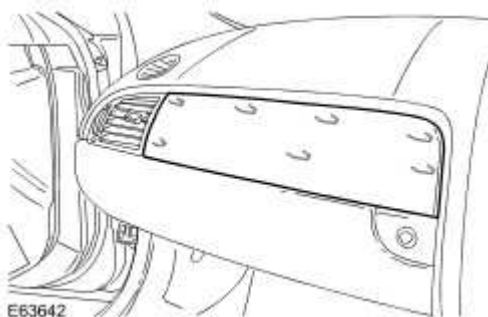
Remove the driver side register trim panel.

- ▶ Remove the 2 Torx screws.



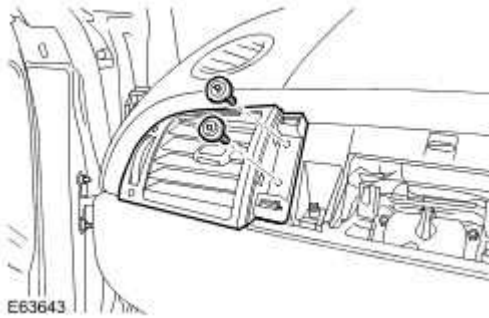
- 8 . Remove the instrument panel passenger side reinforcement trim panel.

- ▶ Carefully release the 7 clips.



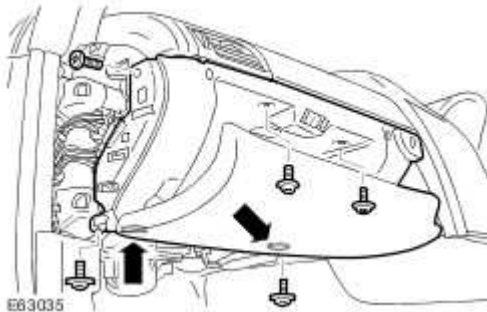
- 9 . Remove the passenger side register.

- ▶ Remove the 2 Torx screws.
- ▶ Carefully release the component.



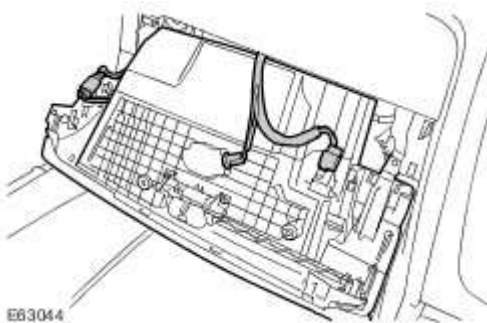
10 . Release the glove compartment.

- ▶ Remove the 5 Torx screws.
- ▶ Release the 2 clips.



11 . Remove the glove compartment.

- ▶ Disconnect the 2 electrical connectors.
- ▶ Release the glove compartment lamp assembly.



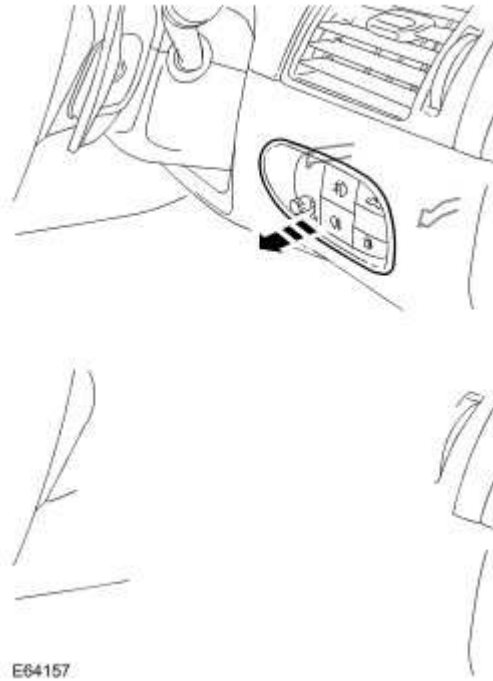
12 .



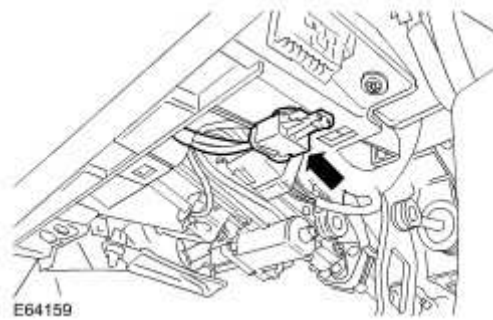
CAUTION: Care must be taken to avoid damage to the mating surfaces.

Carefully release and remove the rheostat switch assembly.

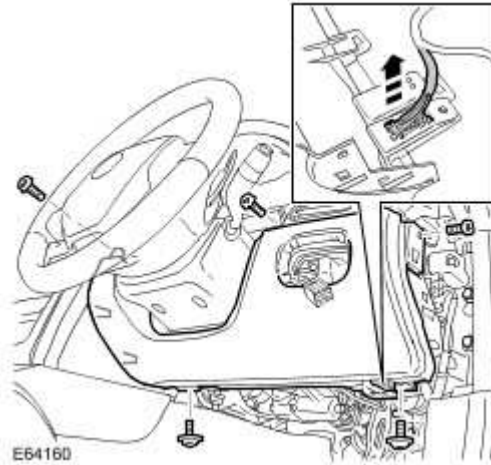
- ▶ Disconnect the electrical connector.



- 13 . Release the MOST diagnostic port.
- ▶ Carefully release the clip.



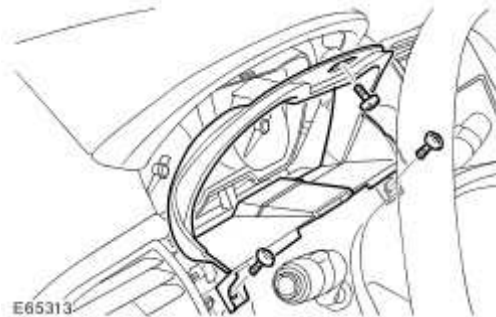
- 14 . Remove the instrument panel, lower trim panel.
- ▶ Remove the 3 Torx bolts.
 - ▶ Remove the 2 Torx screws.
 - ▶ Release the 2 clips.
 - ▶ Release the vehicle diagnostic port.



- 15  **CAUTION: Protect the surrounding trim from damage when changing the component.**

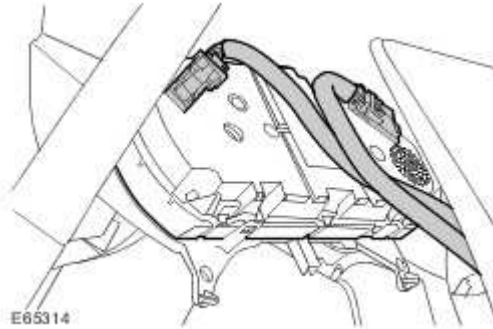
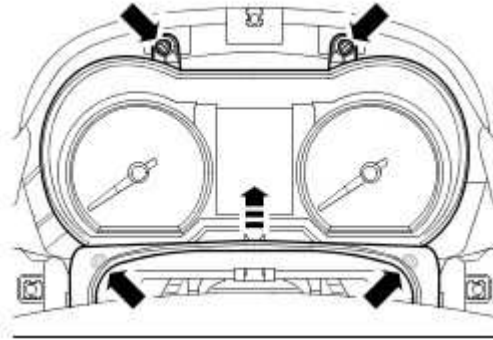
Remove the instrument cluster surround.

- ▶ Remove the 3 screws.



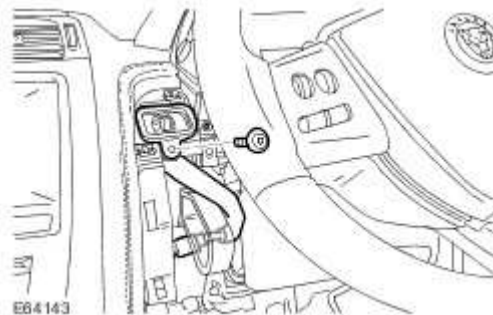
- 16 . Remove the instrument cluster.

- ▶ Raise the steering column finisher for access to the lower screws.
- ▶ Remove the 4 screws.
- ▶ Disconnect the 2 electrical connectors.



17 . Remove the in-vehicle temperature sensor.

- Remove the Torx screw.
- Disconnect the electrical connector.



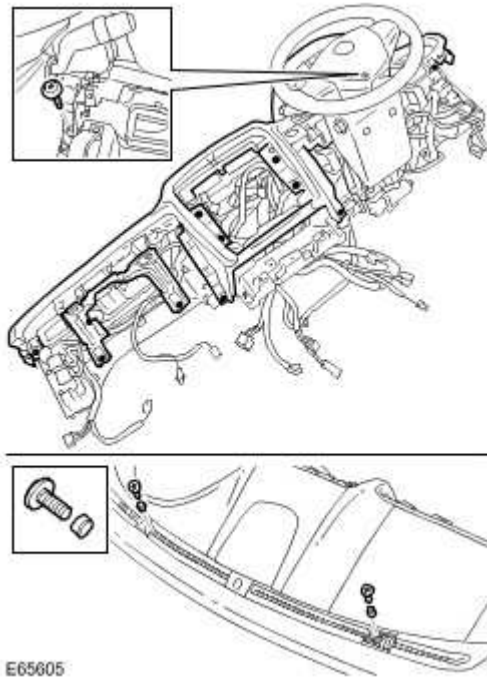
18



CAUTION: Protect the surrounding trim from damage when changing the component.

Release the instrument panel upper trim.

- Remove the 11 Torx screws.
- Collect the compression limiters.
- Release the glove box support bracket.
- Remove the 2 Torx screws.
- With assistance, separate the components.

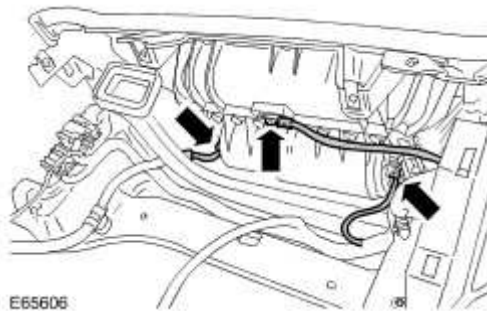


19 . Disconnect the passenger air bag ground cable.

▶ Remove the Torx bolt.

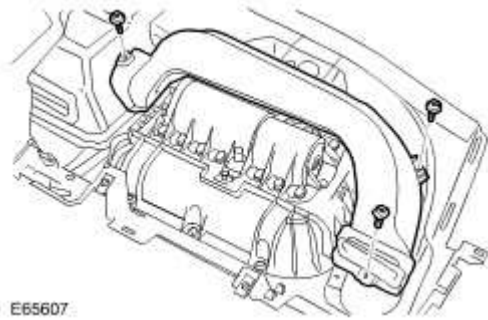
20 . Disconnect the passenger air bag module 2 electrical connectors.

▶ Carefully release the clips.

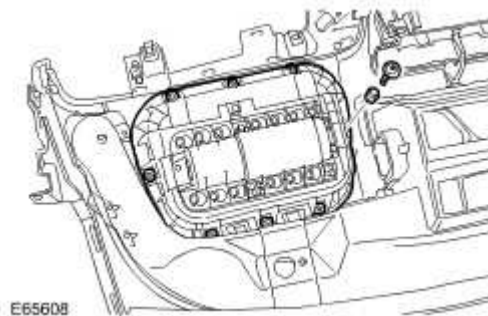


21 . Remove the heater duct.

▶ Remove the 3 Torx screws.



- 22 . Remove the passenger air bag module.
- ▶ Remove the 8 Torx bolts.



Installation

- 1 . Install the passenger air bag module.
 - ▶ Tighten the Torx bolts to 3 Nm (2 lb.ft).
- 2 . Install the heater duct.
 - ▶ Install the Torx screws.
- 3 . Connect the passenger air bag module electrical connectors.
- 4 . Connect the passenger air bag ground cable.
 - ▶ Install the Torx bolt and tighten to 6 Nm (4 lb.ft).
- 5 . Install the instrument panel upper trim.
 - ▶ With assistance, align the components.
 - ▶ Install the compression limiters.
 - ▶ Install and tighten the Torx screws.

- 6 . Install the in-vehicle temperature sensor.
 - ▶ Position the electrical harness.
 - ▶ Connect and secure the electrical connector.
 - ▶ Install the Torx screw.

- 7 . Install the instrument cluster.
 - ▶ Connect and secure the electrical connectors.
 - ▶ Install the screws.

- 8 . Install the instrument cluster surround.
 - ▶ Install the screws.

- 9 . Install the MOST diagnostic port.
 - ▶ Secure the clip.

- 10 . Install the instrument panel, lower trim panel.
 - ▶ Install and secure the diagnostic socket.
 - ▶ Align the clips.
 - ▶ Install the Torx screws.
 - ▶ Install the Torx bolts and tighten to 6 Nm (4 lb.ft).

- 11 . Install the rheostat switch assembly and align the instrument panel lower trim panel.
 - ▶ Secure the switch assembly clips.
 - ▶ Connect the switch assembly electrical connector.

- 12 . Install the glove compartment.
 - ▶ Install the lamp assembly.
 - ▶ Connect and secure the electrical connectors.
 - ▶ Tighten the Torx screws.

- 13 . Install the passenger side register.
 - ▶ Install the Torx screws.

- 14 . Install the instrument panel passenger side reinforcement trim panel.
 - ▶ Align the pegs and secure with the clips.

- 15 . Install the driver side register trim panel.
 - ▶ Install the Torx screws.

- 16 . Install the instrument panel driver's side reinforcement trim panel.

▶ Align the pegs and secure with the clips.

17 . NOTE:

The Torx screws may not be fitted.

Carefully install the center register.

▶ Install the Torx screws.

18 . Install the navigation system display module.

For additional information, refer to [Navigation System Display Module \(86.62.07\)](#)

19 . Install the instrument panel.

For additional information, refer to [Instrument Panel \(76.46.01\)](#)

20 . Connect the battery ground cable and install the cover.

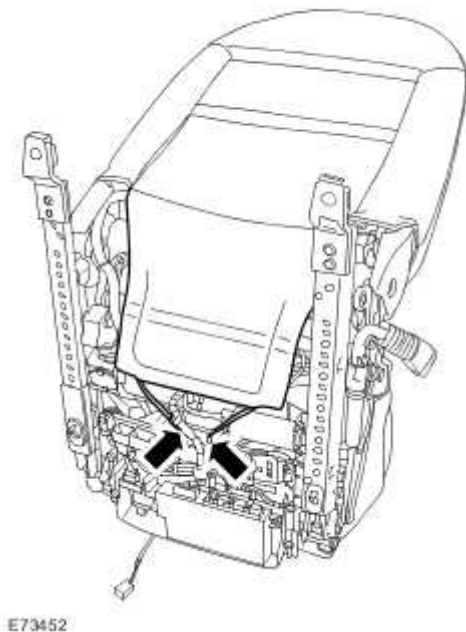
For additional information, refer to

21 . Connect WDS to the vehicle and configure a new module.

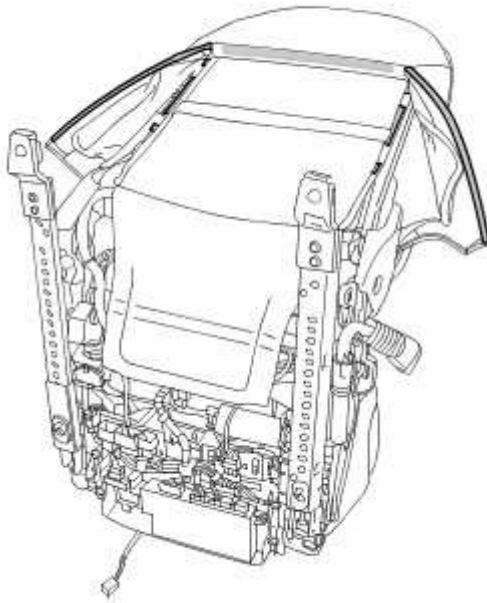
Side Air Bag Module (76.73.47)

Removal

- 1 . Make the SRS system safe.
For additional information, refer to
- 2 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 3 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 4 . Release the front seat backrest cover lower tension straps.
 - ▶ Release from the seat frame.



- 5 . Release the 9 front seat backrest cover rear panel retaining clips.
 - ▶ Release from the backrest cover.
 - ▶ Release from the seat frame.



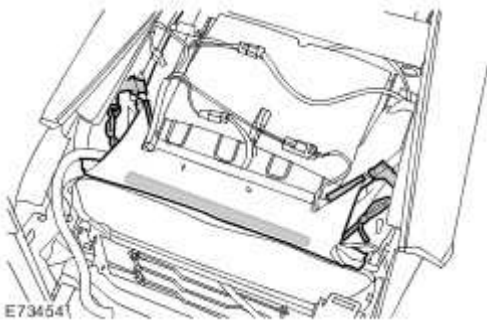
E73453

6 . Release the 5 front seat backrest cover lower retaining clips.

▶ Release from the seat frame.

7 . Release the front seat backrest cover central tension straps.

▶ Release from the seat frame.



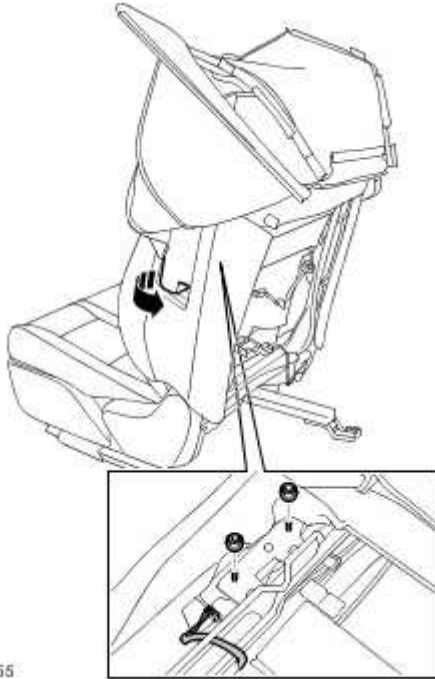
E73454

8 . Remove the side air bag module.

▶ Remove and discard the 2 nuts.

▶ Disconnect the electrical connector.

▶ Release the backrest cover.



E73455

Installation

- 1 . Install the side air bag module.
 - ▶ Attach the backrest cover.
 - ▶ Tighten the new nuts to 7 Nm (5 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Secure the front seat backrest cover central tension straps.
 - ▶ Attach to the seat frame.
- 3 . Secure the front seat backrest cover lower retaining clips.
 - ▶ Attach to the seat frame.
- 4 . Secure the front seat backrest cover rear panel retaining clips.
 - ▶ Attach to the seat frame.
 - ▶ Attach to the backrest cover.
- 5 . Secure the front seat backrest cover lower tension straps.
 - ▶ Attach to the seat frame.
- 6 . Install the front seat.

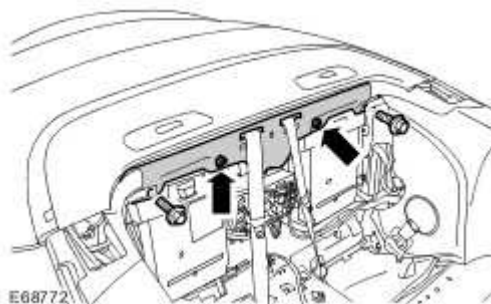
For additional information, refer to [Front Seat \(76.70.01\)](#)

- 7 . Connect the battery ground cable and install the cover.
For additional information, refer to

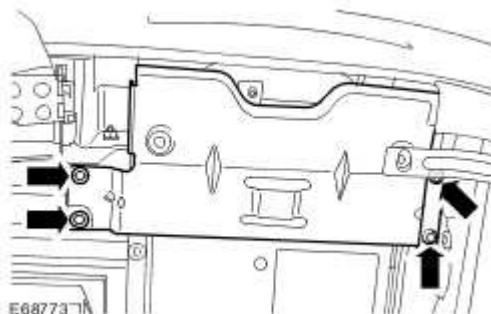
Rollover Protection Unit

Removal

- 1 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to
- 2 . Make the SRS system safe.
For additional information, refer to
- 3 . Remove the rear seat backrest.
For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)
- 4 . Release the rear seat backrest trim panel.
 - ▶ Remove the 2 clips.
 - ▶ Remove the 2 bolts.
 - ▶ Position the rear seat backrest trim panel aside.

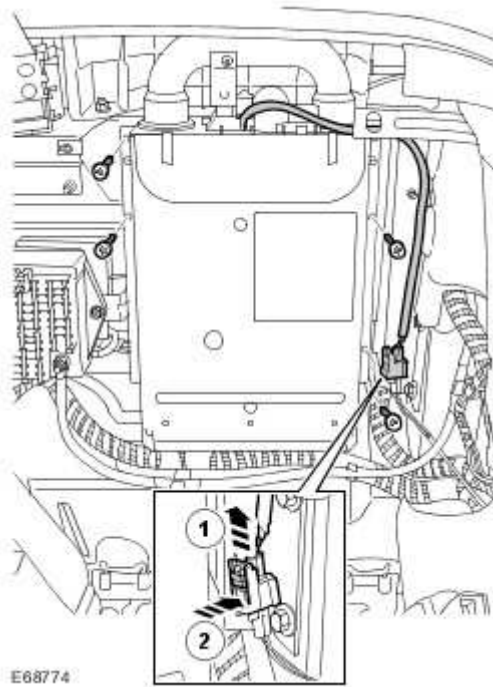


- 5 . Remove the rear seat backrest retaining bracket.
 - ▶ Remove the 2 nuts and 2 bolts.



- 6 . Remove the roll over protection unit.
 - ▶ Disconnect the electrical connector.

- ▶ Remove the 4 Torx bolts.



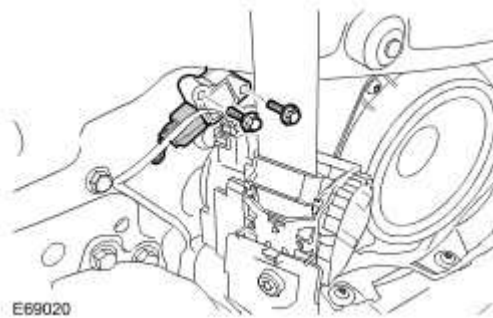
Installation

- 1 . Install the roll over protection unit.
 - ▶ Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the rear seat backrest retaining bracket.
 - ▶ Tighten the nuts and bolts to 10 Nm (7 lb.ft).
- 3 . Install the rear seat backrest trim panel.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Install the clips.
- 4 . Install the rear seat backrest.
For additional information, refer to [Rear Seat Backrest \(76.70.38\)](#)
- 5 . Connect the battery ground cable and install the cover.
For additional information, refer to
- 6 . Connect WDS to the vehicle and configure a new module.

Side Impact Sensor - Convertible (76.73.53)

Removal

- 1 . Remove the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)
- 2 . Remove the side impact sensor.
 - ▶ Remove the 2 bolts.
 - ▶ Disconnect the electrical connector.



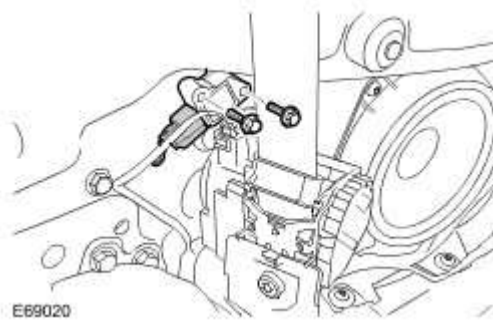
Installation

- 1 . Install the side impact sensor.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - Convertible \(76.13.73\)](#)

Side Impact Sensor - 2-Door (76.73.53)

Removal

- 1 . Remove the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - 2-Door \(76.13.73\)](#)
- 2 . Remove the side impact sensor.
 - ▶ Remove the 2 bolts.
 - ▶ Disconnect the electrical connector.



Installation

- 1 . Install the side impact sensor.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.
- 2 . Install the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - 2-Door \(76.13.73\)](#)

501-20C : Pedestrian Protection System

Specifications

Specifications

Torque Specifications

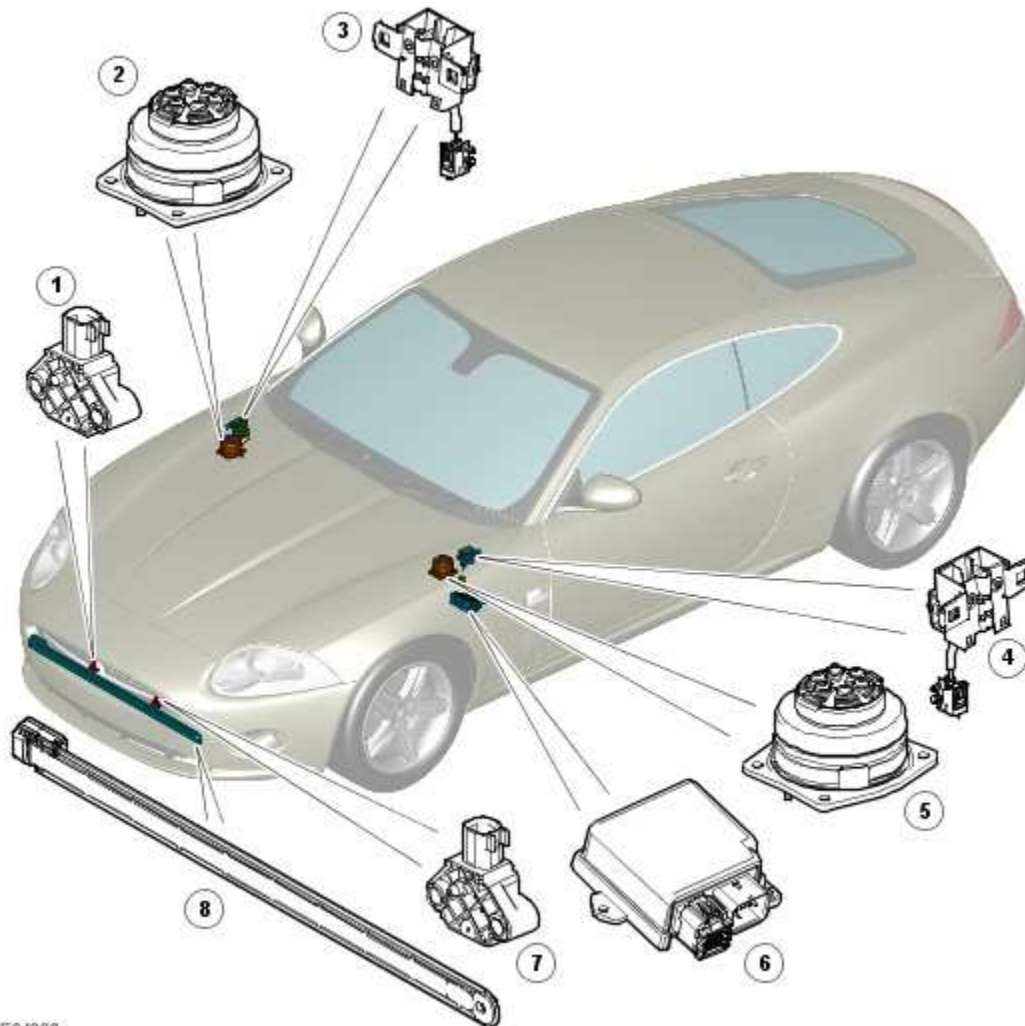
Item	Nm	lb-ft	lb-in
Pedestrian impact sensor strip - screw	6	-	53
Deployable hood, crash sensor to front bumper beam - bolt	8	-	71
Contact sensing system module to front bumper - screw	6	-	53
Hood deployment support bracket to vehicle - bolt*	8	-	71
Hood deployment striker to hood - bolt*	8	-	71
Pyrotechnic device to hood latch - bolt*	9	-	80
Hood deployment actuator bracket to body - screw*	8	-	71
Hood deployment actuator - screw*	8	-	71
Hood secondary latch to deployment actuator - nut*	9	-	80



CAUTION: *Refer to Removal and Installation procedures for important information.

Pedestrian Protection System

COMPONENT LOCATION



E64868

Item	Part Number	Description
1		RH accelerometer
2		RH hood actuator
3		RH hood latch
4		LH hood latch
5		LH hood actuator
6		Pedestrian protection system control module
7		LH accelerometer

INTRODUCTION

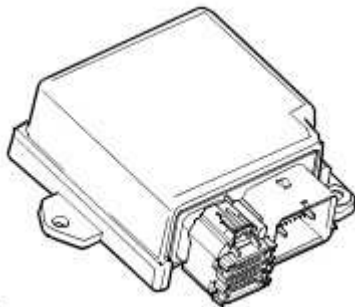


WARNING: All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the Standard Workshop Practices section of this manual. For additional information, refer to [Standard Workshop Practices \(100-00\)](#)

The Pedestrian Protection System control module receives an impact signal from Pedestrian Contact Sensor (PCS) and two accelerometers mounted on the front bumper beam. The control module interprets the signals to determine whether impact is with a pedestrian or other object, such as a traffic cone. When the control module detects a valid impact signal and the vehicle is in the 15 to 45 kph speed range, it fires the two pyrotechnic hood latch release units and two pyrotechnic actuators which opens the hood approximately 130 mm.

The Pedestrian Protection System is factory fit only to non Federal vehicles.

CONTROL MODULE

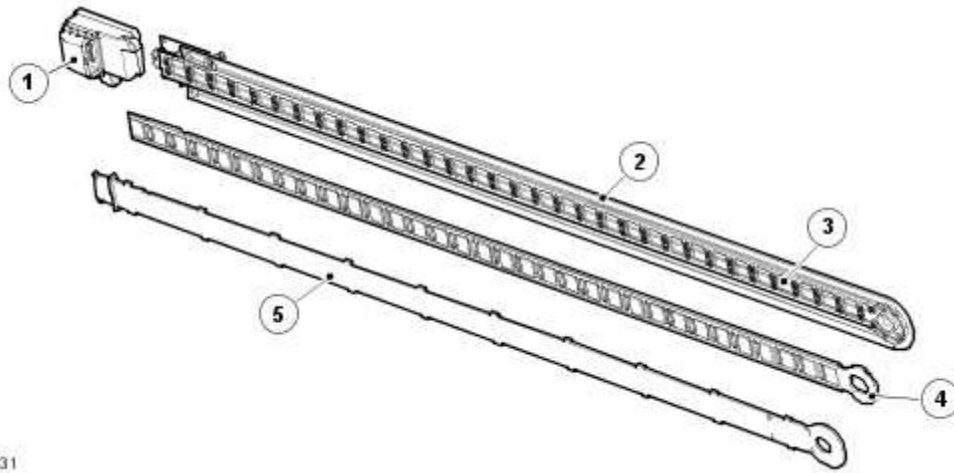


E73030

The control module is secured to the underside of the wing behind the wheelarch liner with two screws. The control module is hardwired to the other system components and is also connected to the High Speed (HS) CAN bus. The control module receives ambient air temperature, Ignition state and vehicle reference speed on the HS CAN bus.

The Control Module uses signals from the Pedestrian Contact Sensor (PCS) and the accelerometers to determine if the impact on the bumper is a pedestrian or an other object. The system will always deploy where the control module determines a pedestrian impact. The system minimizes deployment for other impacts that are similar to pedestrian impact, such as traffic cones.

PEDESTRIAN CONTACT SENSOR (PCS)



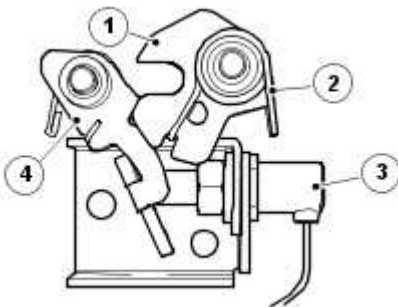
E73031

Item	Part Number	Description
1		Sensor module
2		Sensor backing strip/rear cover
3		Fibre optic cable
4		Foam insert
5		Sensor front cover

The PCS is located in a slot behind the bumper foam on the front bumper beam and is secured with a single fixing.

At the end of the sensor next to the fixing there is a PCB and fibre optic transceiver, which is connected to a fibre optic cable configured in a loop. The PCS uses this fibre optic loop to detect an impact by measuring the amount of light returned to the fibre optic transceiver. A reduction in light levels occurs when the PCS is deformed by an impact. The PCS monitors the level of light returned from the loop, if a reduction of a predetermined magnitude is measured a trigger signal will be sent to the control module.

HOOD LATCH



E73032

Item	Part Number	Description
1		Latch claw
2		Spring

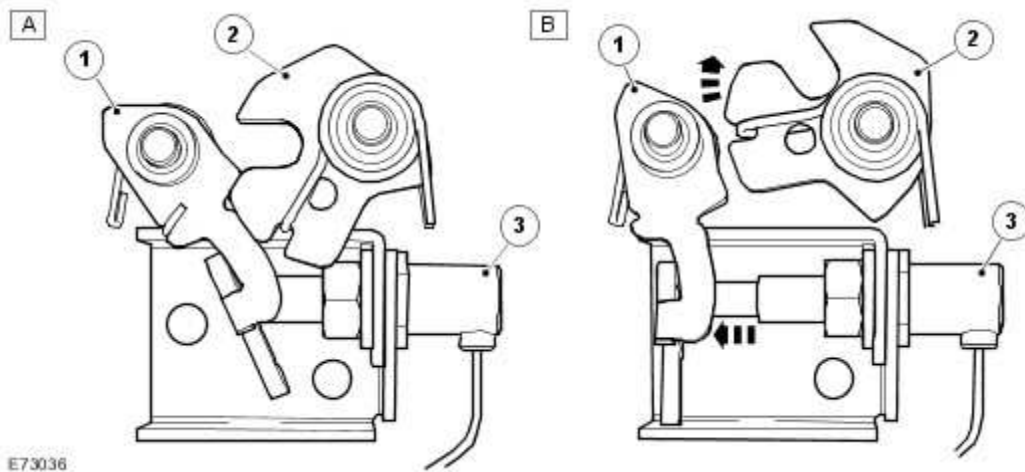
3		Pyrotechnic pin
4		Latch pawl

The hood latches are located at either side of the trailing edge of the hood. Each latch is released by a small pyrotechnic pin, which is fired in response to a signal from the control module. The pyrotechnic pin engages with the latch pawl which is holding the latch claw closed. Once the pawl is moved by the pyrotechnic pin the latch claw is released and the return spring moves the latch claw to the open position allowing the hood to move open under the pressure of the hood actuator.

Hood Latch Deployment

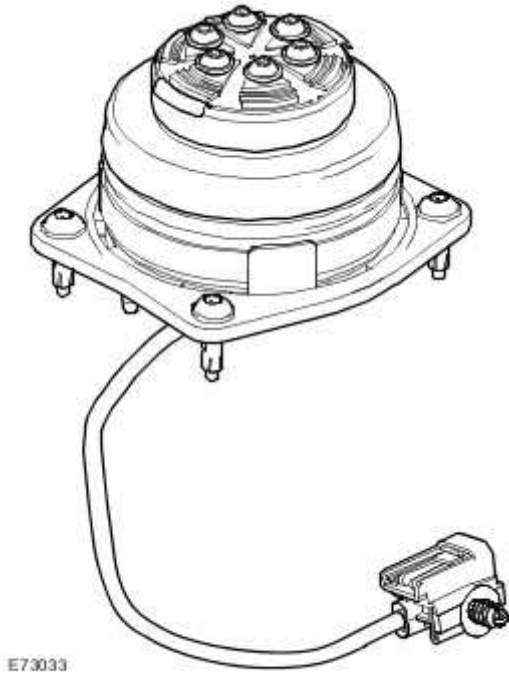
NOTE:

A = Latched; B = Deployed



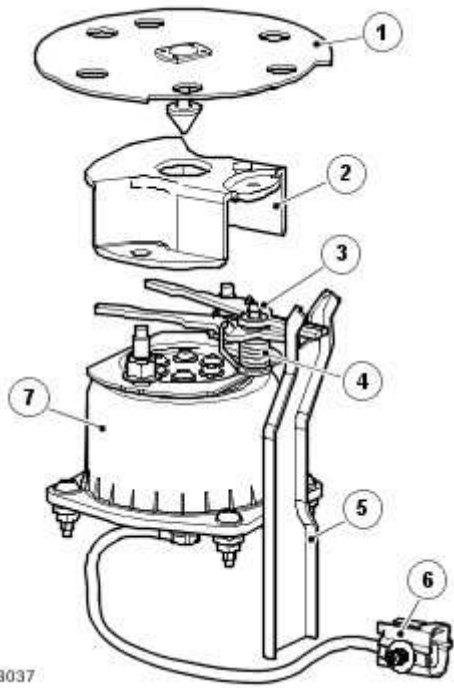
Item	Part Number	Description
1		Latch pawl
2		Latch claw
3		Pyrotechnic pin

HOOD ACTUATOR



The hood actuators are pyrotechnic air bags. The hood actuators are located just forward of the hood latches on either side of the hood. The actuators comprise a pyrotechnic device to raise the hood, a secondary hood latch mechanism and a tether sleeve. Once fired a locking device mounted on top of the actuator couples with the secondary hood latch before the airbag inflates to raise the hood. This ensures that the hood can only deploy to a pre-determined height (approximately 130 mm). As the hood actuator is fired two prongs located in the secondary latch housing are moved out of their retaining clamp. The prongs are spring loaded to grip the secondary hood latch striker securing it to the actuator tether cone.

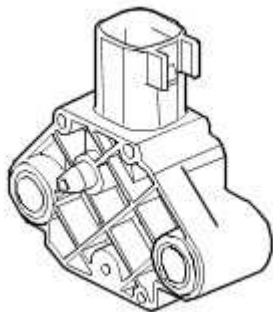
Hood Actuator and Secondary Latch



E73037

Item	Part Number	Description
1		Secondary hood latch striker plate
2		Secondary hood latch body
3		Secondary hood latch
4		Secondary hood latch spring
5		Secondary hood latch retaining bracket
6		Electrical connector
7		Hood actuator assembly

ACCELEROMETER



E73034

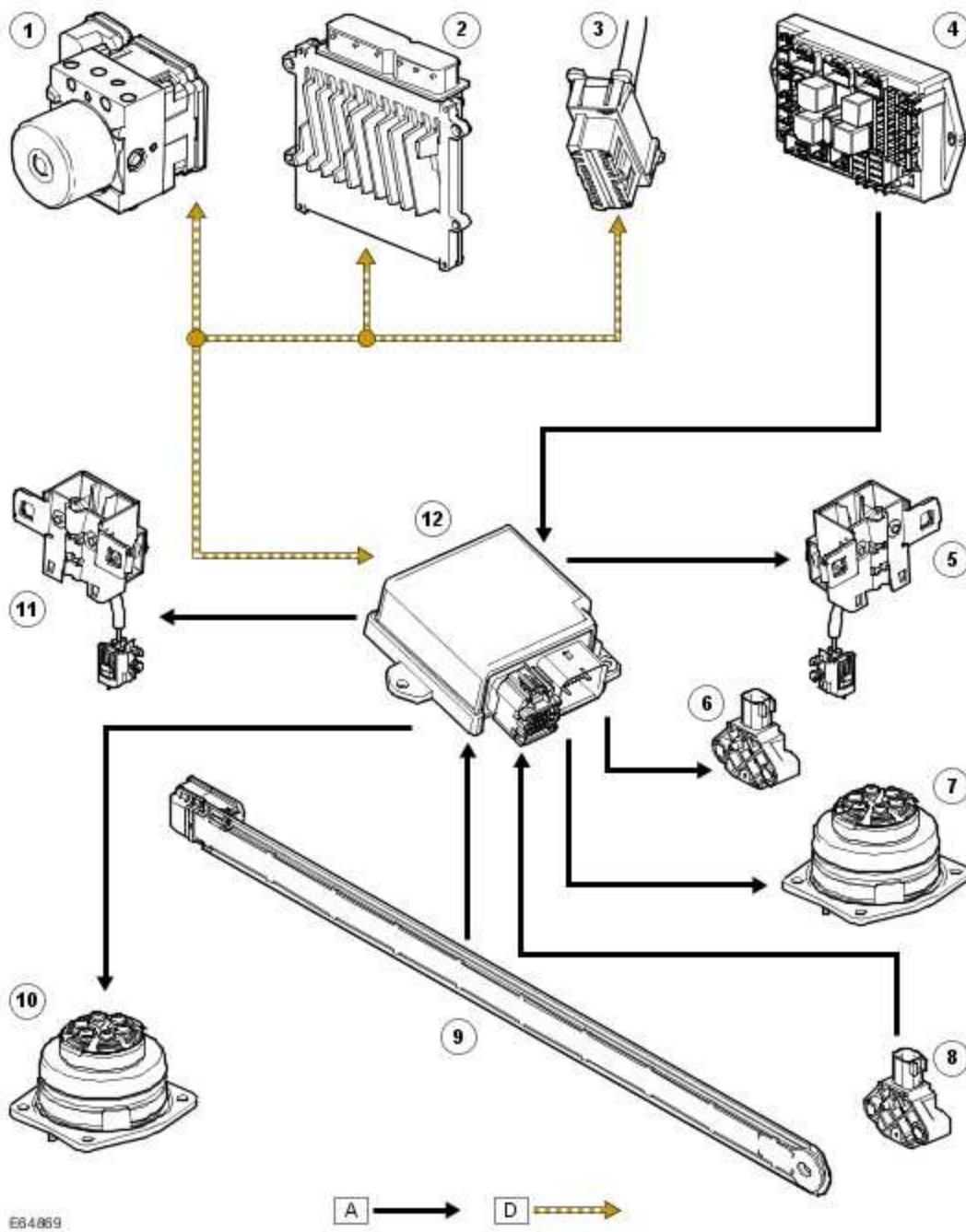
Two accelerometers are mounted on the rear of the bumper beam. The accelerometers measure the amount of inertia when an impact occurs and send a signal to the control module. This signal is used by the control module to calculate the firing of the Pedestrian Protection System. The accelerometers are modified crash sensors. The sensors have a lower detection

range than front/side crash sensors to enable them to detect lower level impacts and therefore assist in the object discrimination process.

CONTROL DIAGRAM

NOTE:

A = Hardwired connection; D = High speed CAN bus



Item	Part Number	Description
1		ABS control module
2		ECM

3		Diagnostic socket
4		CJB
5		Hood latch
6		Accelerometer
7		Hood actuator
8		Accelerometer
9		Pedestrian Contact Sensor (PCS)
10		Hood actuator
11		Hood latch
12		Pedestrian protection system control module

PRINCIPLES OF OPERATION

The system is designed to help reduce head and lower leg injuries when a pedestrian has been hit by a vehicle. This is achieved in two main ways:

- Bumper design
- Pyrotechnic deployment of the hood.

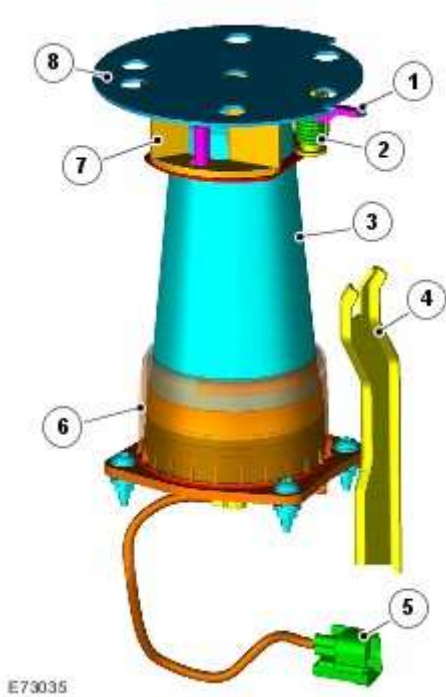
The front bumper of the vehicle has been designed with a profile which encourages the pedestrians lower leg to lift upwards rolling around the front of the bumper surface. The bumper is constructed of energy absorbing foam and plastics and is designed to be softer around the top part of the bumper than the middle. This helps reduce injuries to the pedestrians lower leg.

As the pedestrians leg rolls around the bumper it deforms the bumper and the sensor beneath. If the predetermined parameters are met the Pedestrian Protection System control module fires the pyrotechnic hood latch pins which opens the hood latch claw. This is followed by the pyrotechnic actuator firing to force the hood upwards. As the hood moves upwards the secondary hood latch automatically engages with the secondary hood latch striker plate locking the hood and the body together via the tether cone attached to the hood actuator. This ensures that the hood only rises a set amount. The raising of the hood creates a more cushioned effect between the vehicle and the pedestrian. The hood actuators will deflate within 3 seconds of deployment to improve visibility. The secondary hood latch remains connected to the hood when the hood actuators have deflated and can be released by squeezing the two latch forks together, either by hand or with a pair of pliers.

The hazard warning lights will be activated and can only be switched off by pressing the engine Start/Stop button to turn the engine OFF and ON again (without pressing the brake pedal) to revert to the convenience mode.

A warning message CHECK PEDESTRIAN SYSTEM will appear on the message center and the vehicle must be immediately recovered to the nearest Jaguar Dealer/Authorised Repairer. The vehicle must not be driven once the bonnet has been deployed.

Hood Actuator-Deployed



Item	Part Number	Description
1		Secondary hood latch
2		Secondary hood latch spring
3		Tether cone
4		Secondary hood latch retaining bracket
5		Electrical connector
6		Hood actuator
7		Secondary hood latch body
8		Secondary hood latch striker plate

Function	Value
Operating speed	15-45 kph
Hood deployment height	130mm
Hood deployment time (approx)	30ms

Pedestrian Protection System

Principles of Operation

For a detailed description of the pedestrian protection system, refer to the relevant Description and Operation section in the workshop manual.

[Pedestrian Protection System](#)

Inspection and Verification

- 1 . Verify the customer concern.
- 2 . Visually inspect for obvious signs of damage and system integrity.

Mechanical	Electrical
<ul style="list-style-type: none"> • Damaged, loose, or missing fixings or components 	<ul style="list-style-type: none"> • Ensure dummy electrical connector is installed to the Pedestrian Protection module • Blown fuse(s) • Damaged, loose or corroded connectors • Wiring harness • Damaged Pedestrian Protection module

- 3 . If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
- 4 . If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index



CAUTION: Prior to carrying out any pinpoint tests on the pedestrian protection system the back-up power supply must be depleted. Disconnect the battery and wait two minutes for the back-up power supply to deplete.



CAUTION: When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTE:

If the control module or a component is suspect and the vehicle remains under

manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.

NOTE:

Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer approved diagnostic system).

NOTE:

When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.

NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

NOTE:

Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.

NOTE:

If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

DTC	Description	Possible Cause	Action
B100211	Left hood latch deployment control	<ul style="list-style-type: none"> Left hood latch deployment control circuit - short to ground 	Refer to the electrical circuit diagrams and test left hood latch deployment control circuit for short to ground
B100212	Left hood latch deployment control	<ul style="list-style-type: none"> Left hood latch deployment control circuit - short to power 	Refer to the electrical circuit diagrams and test left hood latch deployment control circuit for short to power
B10021A	Left hood latch deployment control	<ul style="list-style-type: none"> Left hood latch deployment control circuit - circuit resistance below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10021B	Left hood latch deployment control	<ul style="list-style-type: none"> Left hood latch deployment control circuit - circuit 	Carry out any pinpoint tests associated with this

		resistance above threshold	DTC using the manufacturer approved diagnostic system
B10021C	Left hood latch deployment control	<ul style="list-style-type: none"> Left hood latch deployment control circuit - circuit voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10024A	Left hood latch deployment control	<ul style="list-style-type: none"> Incorrect component installed 	Disconnect latch actuator connector, clear DTC and re-test. If DTC remains along with additional DTCs, install a new pedestrian protection module. Pedestrian Protection Module If DTC cleared install a new latch actuator. Pedestrian Protection Latch Actuator
B100011	Right hood latch deployment control	<ul style="list-style-type: none"> Right hood latch deployment control circuit - short to ground 	Refer to electrical circuit diagrams and test right hood latch deployment control circuit for short to ground
B100012	Right hood latch deployment control	<ul style="list-style-type: none"> Right hood latch deployment control circuit - short to power 	Refer to electrical circuit diagrams and test right hood latch deployment control circuit for short to power
B10001A	Right hood latch deployment control	<ul style="list-style-type: none"> Right hood latch deployment control circuit - circuit resistance below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10001B	Right hood latch deployment control	<ul style="list-style-type: none"> Right hood latch deployment control circuit - circuit resistance above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10001C	Right hood latch deployment control	<ul style="list-style-type: none"> Right hood latch deployment control circuit - circuit voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10004A	Right hood latch	<ul style="list-style-type: none"> Incorrect component 	Disconnect latch actuator

	deployment control	installed	connector, clear DTC and re-test. If DTC remains along with additional DTCs, install a new pedestrian protection module. Pedestrian Protection Module If DTC cleared install a new latch actuator. Pedestrian Protection Latch Actuator
B100311	Left hood deployment control	<ul style="list-style-type: none"> Left hood deployment control circuit - short to ground 	Refer to electrical circuit diagrams and test left hood deployment control circuit for short to ground
B100312	Left hood deployment control	<ul style="list-style-type: none"> Left hood deployment control circuit - short to power 	Refer to electrical circuit diagrams and test left hood deployment control circuit for short to power
B10031A	Left hood deployment control	<ul style="list-style-type: none"> Left hood deployment control circuit - circuit resistance below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10031B	Left hood deployment control	<ul style="list-style-type: none"> Left hood deployment control circuit - circuit resistance above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10031C	Left hood deployment control	<ul style="list-style-type: none"> Left hood deployment control circuit - circuit voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10034A	Left hood deployment control	<ul style="list-style-type: none"> Incorrect component installed 	Disconnect hood actuator connector, clear DTC and re-test. If DTC remains along with additional DTCs, install a new pedestrian protection module. Pedestrian Protection Module If DTC cleared install a new hood actuator. Pedestrian Protection

			Hood Actuator LH
B100111	Right hood deployment control	<ul style="list-style-type: none"> Right hood deployment control circuit - short to ground 	Refer to the electrical circuit diagrams and test right hood deployment control circuit for short to ground
B100112	Right hood deployment control	<ul style="list-style-type: none"> Right hood deployment control circuit - short to power 	Refer to the electrical circuit diagrams and test right hood deployment control circuit for short to power
B10011A	Right hood deployment control	<ul style="list-style-type: none"> Right hood deployment control circuit - circuit resistance below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10011B	Right hood deployment control	<ul style="list-style-type: none"> Right hood deployment control circuit - circuit resistance above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10011C	Right hood deployment control	<ul style="list-style-type: none"> Right hood deployment control circuit - circuit voltage out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10014A	Right hood deployment control	<ul style="list-style-type: none"> Incorrect component installed 	Disconnect hood actuator connector, clear DTC and re-test. If DTC remains along with additional DTCs, install a new pedestrian protection module. Pedestrian Protection Module If DTC cleared install a new hood actuator. Pedestrian Protection Hood Actuator RH
B100613	Pedestrian impact sensor	<ul style="list-style-type: none"> Pedestrian impact sensor circuit - open circuit 	Refer to the electrical circuit diagrams and test pedestrian impact sensor circuit for open circuit
B100611	Pedestrian impact sensor	<ul style="list-style-type: none"> Pedestrian impact sensor circuit - short to ground 	Refer to the electrical circuit diagrams and test pedestrian impact sensor circuit for short to

			ground
B100612	Pedestrian impact sensor	<ul style="list-style-type: none"> Pedestrian impact sensor circuit - short to power 	Refer to the electrical circuit diagrams and test pedestrian impact sensor circuit for short to power
B100696	Pedestrian impact sensor	<ul style="list-style-type: none"> Component internal failure 	Install a new pedestrian impact sensor. Pedestrian Impact Sensor
B100684	Pedestrian impact sensor	<ul style="list-style-type: none"> Pedestrian impact sensor circuit - signal below allowable range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10064A	Pedestrian impact sensor	<ul style="list-style-type: none"> Incorrect component installed 	Install a new pedestrian impact sensor. Pedestrian Impact Sensor
B10061D	Pedestrian impact sensor	<ul style="list-style-type: none"> Pedestrian impact sensor circuit - current out of range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10068F	Pedestrian impact sensor	<ul style="list-style-type: none"> Sensor fault 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100631	Pedestrian impact sensor	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100692	Pedestrian impact sensor	<ul style="list-style-type: none"> Performance or incorrect operation 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system. Install new crush pad and air deflectors (even if no damage is apparent). Front Bumper (76.22.08)
B100628	Pedestrian impact sensor	<ul style="list-style-type: none"> Signal bias level out of range/zero adjustment failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system

B100654	Pedestrian impact sensor	<ul style="list-style-type: none"> Missing calibration 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100513	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Left pedestrian protection accelerometer circuit - open circuit 	Refer to the electrical circuit diagrams and test left pedestrian protection accelerometer circuit for open circuit
B100511	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Left pedestrian protection accelerometer circuit - short to ground 	Refer to the electrical circuit diagrams and test left pedestrian protection accelerometer circuit for short to ground
B100512	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Left pedestrian protection accelerometer circuit - short to power 	Refer to the electrical circuit diagrams and test left pedestrian protection accelerometer circuit for short to power
B100596	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Component internal failure 	Install a new left pedestrian protection accelerometer. Pedestrian Protection Accelerometer
B100584	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Signal below allowable range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10054A	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Incorrect component installed 	Install a new left pedestrian protection accelerometer. Pedestrian Protection Accelerometer
B10058F	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> Erratic 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100531	Left pedestrian protection accelerometer	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100413	Right pedestrian protection	<ul style="list-style-type: none"> Right pedestrian protection accelerometer circuit - 	Refer to electrical circuit diagrams and test right

	accelerometer	open circuit	pedestrian protection accelerometer circuit for open circuit
B100411	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Right pedestrian protection accelerometer circuit - short to ground 	Refer to electrical circuit diagrams and test right pedestrian protection accelerometer circuit for short to ground
B100412	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Right pedestrian protection accelerometer circuit - short to power 	Refer to electrical circuit diagrams and test right pedestrian protection accelerometer circuit for short to power
B100496	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Component internal failure 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100484	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Signal below allowable range 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B10044A	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Incorrect component installed 	Install a new right pedestrian protection accelerometer. Pedestrian Protection Accelerometer
B10048F	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> Erratic 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
B100431	Right pedestrian protection accelerometer	<ul style="list-style-type: none"> No signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U012100	Lost communication with ABS module	<ul style="list-style-type: none"> Lost communication with ABS module 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U010000	Lost communication with ECM	<ul style="list-style-type: none"> Lost communication with ECM 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved

			diagnostic system
U014200	Lost communication with RJB	<ul style="list-style-type: none"> Lost communication with RJB 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U000155	High speed CAN communication Bus	<ul style="list-style-type: none"> Not configured 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U000152	High speed CAN communication Bus	<ul style="list-style-type: none"> Not configured 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U000188	High speed CAN communication Bus	<ul style="list-style-type: none"> Bus off 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U1A0266	Permanent memory store full	<ul style="list-style-type: none"> Signal has too many transitions/events 	Install a new pedestrian protection module. Pedestrian Protection Module Install new crush pad and air deflectors (even if no damage is apparent). Front Bumper (76.22.08)
U300055	Stored vehicle configuration data does not match	<ul style="list-style-type: none"> Incorrect car configuration data received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear DTC and re-test. If the DTC remains suspect the pedestrian protection system, refer to the new module installation note at the top of the DTC Index
U300049	Control module	<ul style="list-style-type: none"> Internal electronic failure 	Install a new pedestrian protection module, refer to the new module installation note at the top of the DTC Index
U300087	Control Module	<ul style="list-style-type: none"> Missing message 	Re-configure the RJB using the manufacturer

			approved diagnostic system. Check pedestrian protection module for DTCs and refer to the DTC Index. Check CAN network integrity using the manufacturer approved diagnostic system
U300316	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage below threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U300317	Battery voltage	<ul style="list-style-type: none"> • Circuit voltage above threshold 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P193429	Vehicle speed signal	<ul style="list-style-type: none"> • Invalid signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
P007129	Ambient air temperature sensor range/performance	<ul style="list-style-type: none"> • Invalid signal 	Carry out any pinpoint tests associated with this DTC using the manufacturer approved diagnostic system
U201B4A	Control module calibration data #2	<ul style="list-style-type: none"> • Incorrect component installed 	Install a new pedestrian protection module. Pedestrian Protection Module
U201B51	Control module calibration data #2	<ul style="list-style-type: none"> • Not programmed 	Re-configure the pedestrian protection module using the manufacturer approved diagnostic system. Clear DTC and re-test, if DTC remains install a new pedestrian protection module. Pedestrian Protection Module
U210000	Initial configuration not complete	<ul style="list-style-type: none"> • Module is in Plant mode 	Place module into normal operation mode, by running the new module programming

			application, using the manufacturer approved diagnostic system
U300281	Vehicle Identification Number (VIN)	<ul style="list-style-type: none"> • Vehicle/component mismatch. Corrupt VIN data being transmitted, module previously installed to other vehicle 	Install original module, check for DTCs and refer to relevant DTC Index
U030000	Internal control module software incompatibility	<ul style="list-style-type: none"> • Invalid configuration message is received 	Re-configure the RJB using the manufacturer approved diagnostic system. Clear the DTC and retest. If the DTC is still logged suspect the pedestrian protection module, refer to the new module installation note at the top of the DTC Index

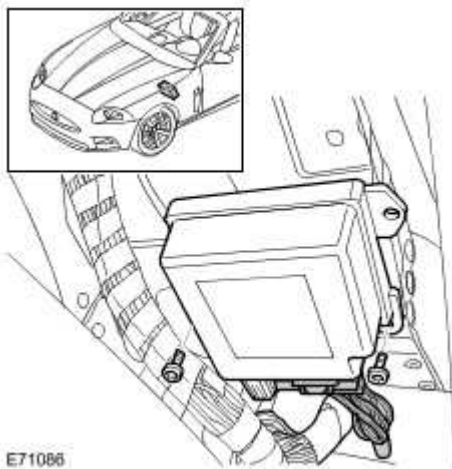
Pedestrian Protection Module

Removal

NOTE:

The pedestrian protection module must be renewed if the system has deployed on 3 occasions.

- 1 . Make the pedestrian protection system safe.
- 2 . Remove the front LH fender splash shield.
For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)
- 3 . Remove the pedestrian protection module.
 - ▶ Remove and discard the 2 Torx bolts.
 - ▶ Disconnect the electrical connector.



Installation


- 1 . Install the pedestrian protection module.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the new Torx bolts to 10 Nm (7 lb.ft).
- 2 . Install the front LH fender splash shield.

For additional information, refer to [Fender Splash Shield \(76.10.90\)](#)

3 . Using WDS, configure a new module.

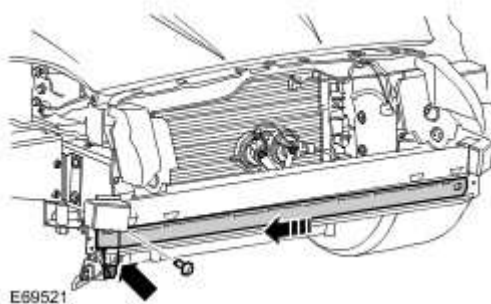
Pedestrian Impact Sensor

Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

- 2 . Remove the front bumper cover.
For additional information, refer to [Front Bumper Cover \(76.22.78\)](#)
- 3 . Remove the pedestrian impact sensor.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the Torx screw.
 - ▶ Carefully release the 3 clips.



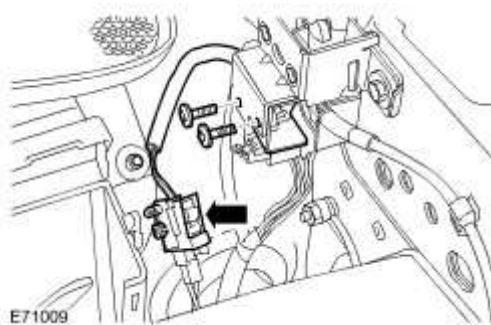
Installation

- 1 . Install the pedestrian impact sensor.
 - ▶ Carefully secure the clips.
 - ▶ Connect the electrical connector.
- 2 . Install the front bumper cover.
For additional information, refer to [Front Bumper Cover \(76.22.78\)](#)

Pedestrian Protection Latch Actuator

Removal

- 1 . Remove the pedestrian protection hood actuator and bracket.
For additional information, refer to [Pedestrian Protection Hood Actuator LH](#)
For additional information, refer to [Pedestrian Protection Hood Actuator RH](#)
- 2 . Remove the pedestrian protection latch actuator.
 - ▶ Remove and discard the 2 Torx bolts.
 - ▶ Disconnect the electrical connector.



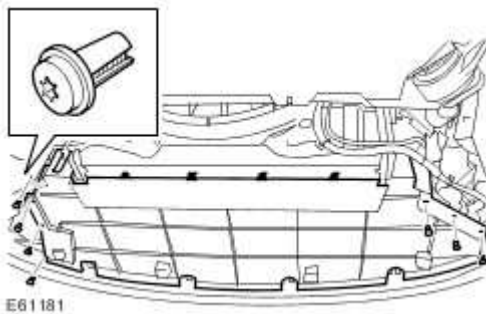
Installation

- 1 . Install the pedestrian protection latch actuator.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the new Torx bolts to 9 Nm (7 lb.ft).
- 2 . Install the pedestrian protection hood actuator and bracket.
For additional information, refer to [Pedestrian Protection Hood Actuator LH](#)
For additional information, refer to [Pedestrian Protection Hood Actuator RH](#)

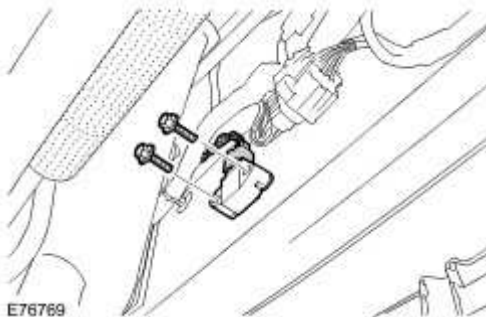
Pedestrian Protection Accelerometer

Removal

- 1 . Remove the radiator splash shield.
For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)
- 2 . Remove the front bumper air ducting.
 - ▶ Remove the 7 clips.
 - ▶ Release the 4 clips.




- 3 . Remove the pedestrian protection accelerometer.
 - ▶ Disconnect the electrical connector.
 - ▶ Remove the 2 bolts.



Installation

- 1 . Install the pedestrian protection accelerometer.
 - ▶ Tighten the 6 bolts to 10 Nm (7 lb.ft).
 - ▶ Connect the electrical connector.

2 . Install the front bumper air ducting.

 Secure with the clips.

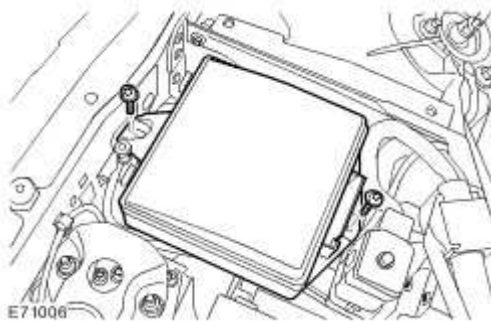
3 . Install the radiator splash shield.

For additional information, refer to [Radiator Splash Shield \(76.22.90\)](#)

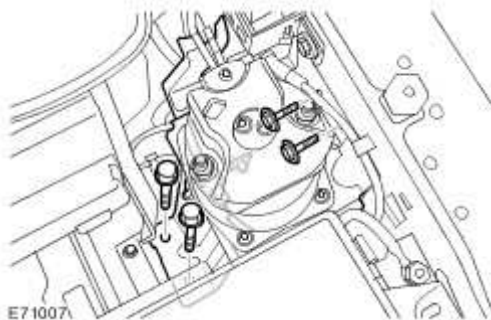
Pedestrian Protection Hood Actuator LH

Removal

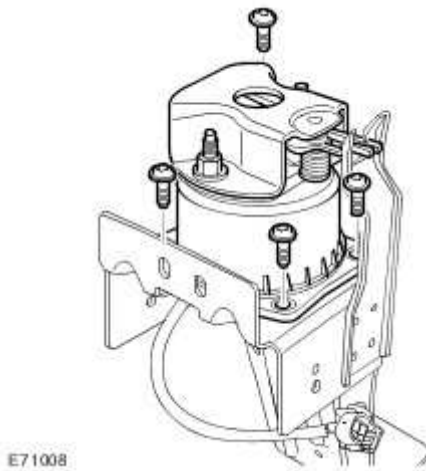
- 1 . Make the pedestrian protection system safe.
- 2 . Remove the pollen filter.
For additional information, refer to [Pollen Filter \(76.10.09\)](#)
- 3 . Release the power distribution box and position aside.
 - ▶ Remove the 2 Torx screws.



- 4 . Release the pedestrian protection actuator bracket.
 - ▶ Release the 3 wiring harness clips.
 - ▶ Remove the 4 bolts.
- 5 . Remove the pedestrian protection actuator and bracket.
 - ▶ Disconnect the electrical connector.



- 6 . Remove the pedestrian protection actuator.
 - ▶ Remove and discard the 4 Torx bolts.



Installation

- 1 . Install the pedestrian protection actuator.
 - ▶ Tighten the new Torx bolts to 8 Nm (6 lb.ft).
- 2 . Install the pedestrian protection actuator and bracket.
 - ▶ Connect the electrical connector.
- 3 . Secure the pedestrian protection actuator bracket.
 - ▶ Attach the wiring harness clips.
 - ▶ Tighten the bolts to 8 Nm (6 lb.ft).
- 4 . Position and install the power distribution box.
 - ▶ Tighten the Torx bolts to 8 Nm (6 lb.ft).
- 5 . Install the pollen filter.

For additional information, refer to [Pollen Filter \(76.10.09\)](#)

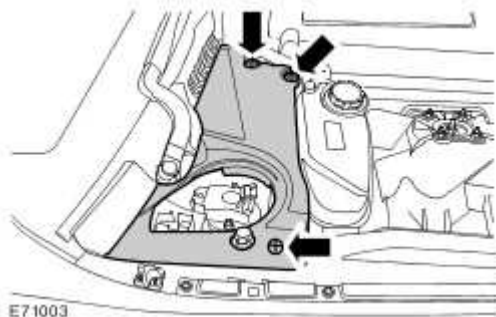
Pedestrian Protection Hood Actuator RH

Removal

- 1 . Make the pedestrian protection system safe.
For additional information, refer to

- 2 . Remove the air intake cover.

▶ Remove the 3 clips.



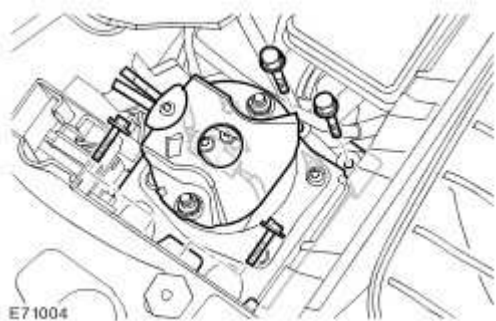
- 3 . Release the pedestrian protection actuator bracket.

▶ Release the 3 wiring harness clips.

▶ Remove the 4 bolts.

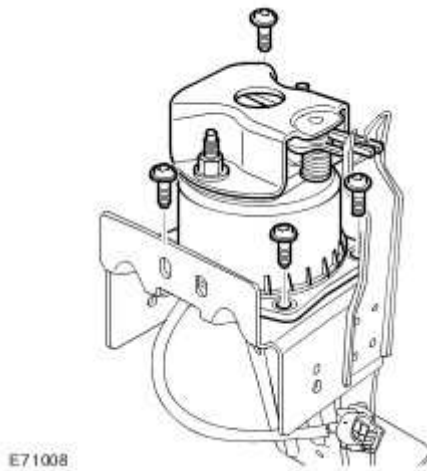
- 4 . Remove the pedestrian protection actuator and bracket.

▶ Disconnect the electrical connector.



- 5 . Remove the pedestrian protection actuator.

▶ Remove and discard the 4 Torx bolts.



Installation

- 1 . Install the pedestrian protection actuator.
 - ▶ Tighten the new Torx bolts to 8 Nm (6 lb.ft).
- 2 . Install the pedestrian protection actuator and bracket.
 - ▶ Connect the electrical connector.
- 3 . Secure the pedestrian protection actuator bracket.
 - ▶ Attach the wiring harness clips.
 - ▶ Tighten the bolts to 8 Nm (6 lb.ft).
- 4 . Install the air intake cover.
 - ▶ Carefully secure the clips

501-25A : Body Repairs – General Information

Description and operation

Body Repairs

General Information

Introduction

The all-new Jaguar XK Aluminium is unique in the industry as a complete Aluminium monocoque body structure, as distinct from an Aluminium spaceframe with separate Aluminium exterior panels. Developed from aircraft industry methods, where strength and light weight are critical, Jaguar's manufacturing process produces a massively strong but very light structure that is both rivetted and epoxy-bonded.

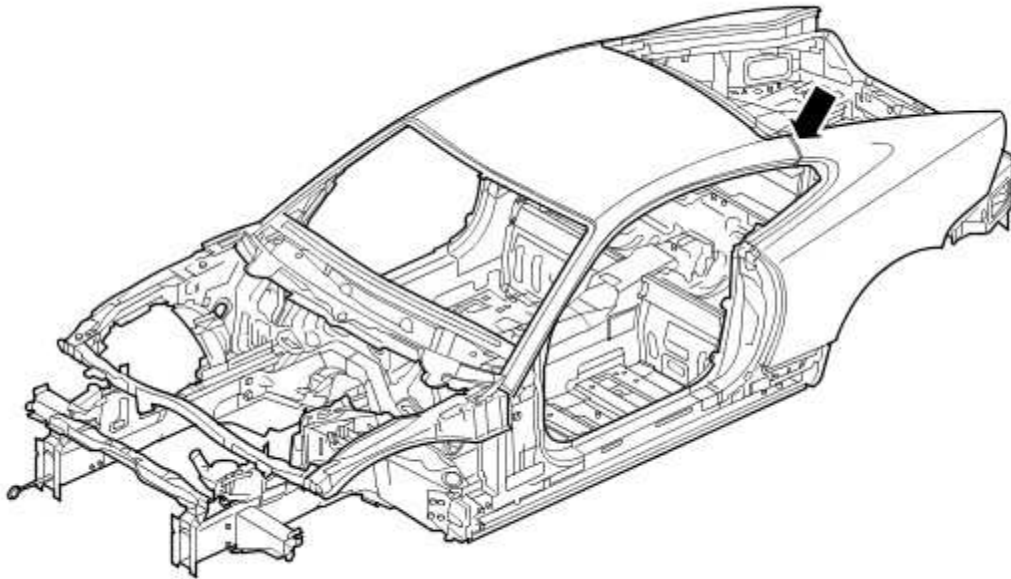
The key to the XK's character is Jaguar's industry-leading bonded and rivetted aluminium monocoque body structure, introduced with the latest XJ saloons. The aluminium body incorporates the latest thinking in epoxy bonding and riveting techniques to produce a chassis that is very safe and very light. In fact, the new XK's aluminium chassis is significantly lighter and stiffer in both coupe and convertible form than the steel model it replaces. The coupe chassis is over 30 percent stiffer than the previous XK, while the convertible is an impressive 50 percent. It also offers a 10 percent improvement in power to weight ratio. The XK Aluminium is up to 90 percent stiffer and 180kg lighter than key rivals, with a kerb weight of just 1595kg.

The XK takes the Lightweight Vehicle concept a step further with extended use of Aluminium castings and extrusions, as well as pressed Aluminium panels. Its remarkable strength and light-weight come from both the way the bodyshell is constructed and the use of new jointing technologies developed by Jaguar and its suppliers.

Jaguar guarantee high quality standards by ensuring that mechanical strength properties are tried and tested in numerous computer simulations, crash tests, by testing materials and by employing sophisticated manufacturing technologies. In the event of repairs it is vital that the production quality standards are upheld. This requires a well-equipped workshop, and places particular emphasis on the qualifications of the workshop technicians. Up-to-date knowledge of current manufacturing technologies and continuous training on new repair methods and techniques are vital for high-quality body repairs. The model-specific repair manuals and the general repair techniques provide valuable support when undertaking body repairs. Always follow the repair instructions published in this manual. Failure to observe this instruction can result in serious impairment of vehicle safety. All specified safety requirements must be met after the work has been carried out.

Vehicle Design

Body



E76363

There is only a single welded joint in the XK coupe body, the one 'cosmetic' joint is on the roof. This has an environmental benefit in that the body construction needs no high electrical current, produces no welding sparks or fumes, and needs no water for cooling. All other joints in the XK shell are formed using self-piecing rivets applied by hydraulic pressure against a fixed tool. Where access to only one side of the joint is possible, as in some of the new extruded box sections, a new riveting process has been developed; and where particularly high stiffness is required in a joint, a combination of riveting and bonding is used - with the adhesive bond in effect creating a continuous joint which is stronger than a similar, rivetted-only joint. All visible exterior panels are bonded to the underlying structure, and a new automated seam-sealing process seals all relevant areas of the shell before painting, to ensure that no gaps are missed.

In the XK, a secondary front bulkhead of aluminium and composite materials help reduce noise transmission from the engine compartment and provides a dry area under the bonnet for accommodating electrical components. The new structure also has the benefits in refinement; castings used for the mounting points for the engine, transmission and suspension make those points significantly stiffer, further reducing transmitted noise and helping to improve suspension dynamics. In terms of long-term strength, Jaguar's all-aluminium shell has durability approaching twice that of a traditional spot-welded steel body.

Another major advantage of this lightweight vehicle technology is that all the necessary stiffness is in the structure of the body shell, with a very large rectangular-section side sills. So the convertible, even without a roof, does not need the traditional stiffening panels seen on many other convertibles - meaning no added weight and no penalty in stiffness or refinement.

The XK's all-aluminium doors are each over 6kg lighter than an equivalent steel door and their mountings are significantly stiffer, which allows for smaller gaps. Mounting the window

glass rails directly to the aluminium castings at the front and rear of the door gives better sealing from the frameless layout, and an impressively solid sound seal.

Passenger Safety Cell

Beyond the exceptional body integrity and built-in deformation zones, the all-new XK Aluminium is also available with a host of other safety solutions for protecting pedestrians as well as car occupants. Those include the shape and construction of the bumpers and bonnet, plus a completely new technology, the pedestrian deployable bonnet, (European Models). This is deployed upwards away from its rear edge, in milliseconds, in the event of a pedestrian impact. This forms a safety zone between the bonnet and the engine and other under-bonnet hard areas to reduce significantly the potential for injuries.

Crumple Zone

Safety is another major benefit of this very strong construction method. That is partly inherent in aluminium as a material, which absorbs significantly more energy per kilogramme of material weight than steel when it is deformed. But the strength advantage does not only apply to high-speed impacts, it also means lower-speed accident repair costs are kept to a minimum. The reduction in the number of joints in the XK further increases strength, and the front of the body is protected by easily replaced 'crush cans' that absorb the energy in impacts up to 15kph.

Contents

This manual includes technical data and information for the Jaguar XK Aluminium range. The information contained within is valid at the time of production and incorporates:

- Who should use this manual?
- Aluminium information
- Category 'A' and 'B' definition
- Equipment
- Panel replacement times
- Fixings
- Bonding
- Tolerances and gap specification
- Body alignment

The methods described for panel replacement operations have been obtained from a study of physical repair operations.

In line with Jaguars continuous improvement programme, information and data contained will be updated periodically.

All activities described within are based on the use of genuine Jaguar Parts, tools and approved materials.

Aluminium

The design of the modern motor vehicle attempts to overcome two conflicting needs:

- Fuel economy - lighter, aerodynamic and fuel sensitive technology.
- High levels of comfort - this often equates to higher specifications and more accessories.

Aluminium alloy is the ideal material to meet these demands; it provides a lighter vehicle body with improved rigidity. Aluminium is different from traditional steel, with the correct knowledge and suitable tools it is easily repaired.

There are two Aluminium alloys discussed in this manual, the attributes detailed in the following table should be considered when deciding to repair or replace:

	6111	5754
Material Description	6000 Series is a Magnesium / Silicon / Copper Aluminium alloy.	5000 Series is an Aluminium alloy with Magnesium content.
Location on Vehicle	This alloy is used mainly in the outer body panels. Thickness: 0.9 - 2.0mm	Internal structural panels Thickness: 1.0 - 3.0mm
Attributes	High dent resistance.	Strength and durability.
Repairability	Yes - Light damage only.	Yes - Light damage only. Limited straightening is acceptable.
Heat During Repair	Yes - caution material sensitive to heat. Range: 140 - 160°C Ideal panel temperature: 150°C	Yes - must be heated to maintain original alloy properties. Ideal panel temperature: 250°C
Notes	Equipment: Hot air gun. Use panel temperature indicator strips.	Equipment: Heat inducer. Use panel temperature indicator strips. Heat must be applied and maintained during the straightening process.

Other materials are used in the construction of the XK Aluminium range, however, repair of these materials is not covered as they fall outside the scope of this manual.

Steel: Used in seat belt anchorages, hinge reinforcements and various small brackets and mountings.

The following illustration shows the panels covered by this manual and the alloys used.

Galvanic Corrosion and Housekeeping

Galvanic corrosion is the 'cross-contamination' of dissimilar metals, in this case Aluminium and steel. Avoidance of galvanic corrosion is an important issue to be considered in the repair of Aluminium bodied vehicles.

Precautions to prevent the contamination of exposed bare Aluminium surfaces should be taken. Good housekeeping / cleanliness should be adopted throughout repairs and especially

prior to welding, pre-treatment and adhesive bonding.

The repair environment requires control and protection from dust and debris from conventional steel body repairs. All equipment must be clearly identified and used solely on Aluminium.

Tools should be kept clean and in good order. Steel fastenings are coated to prevent galvanic corrosion. Fastenings should be examined during repairs and where damaged or suspect must be renewed

The use of graphite, "penetrating" oil, or copper based anti-seize compounds upon the steel fixings is not recommended.

Who Should Use This Information?

The information and repair methods listed are designed as an aid for Jaguar Approved Body Repair Facilities achieving the Jaguar approved Bodyshop Operating Standards. The relevant section should be read completely before commencing any repairs. Only technicians who have successfully completed the approved XK Aluminium range training programme should work on the model. Jaguar Approved Bodyshop Operating Standards require that the skills of technicians be regularly assessed and that any training needs identified are addressed within a reasonable time. This information complements the Jaguar training programme.

Definition of Category 'A' and 'B'

Category 'A'

- **NOTE:**

Specific equipment and facilities are required to carry out Category 'A' repairs, see equipment.

- Damage that requires panel(s) to be replaced with any one or combination of the following procedures:
 - Welded panel
 - Bonded panel
 - Panel secured with fixings
 - The following list identifies Category 'A' procedures

Category 'A' procedures

- Hood. For additional information, refer to [Hood](#) (501-03 Body Closures)
- Front bumper cover. For additional information, refer to [Front Bumper Cover](#) (501-19 Bumpers)
- Front bumper. For additional information, refer to [Front Bumper](#) (501-19 Bumpers)
- Auxiliary front crossmember. For additional information, refer to [Auxiliary Front Crossmember](#) (501-27 Front End Sheet Metal Repairs)

- Front Crossmember. For additional information, refer to [Front Crossmember](#) (501-27 Front End Sheet Metal Repairs)
- Fender apron panel front extension. For additional information, refer to [Fender Apron Panel Front Extension](#) (501-27 Front End Sheet Metal Repairs)
- Side member deformation element. For additional information, refer to [Side Member Deformation Element](#) (501-27 Front End Sheet Metal Repairs)
- Front side member side extension mounting. For additional information, refer to [Front Side Member Side Extension Mounting](#) (501-27 Front End Sheet Metal Repairs)
- Front side member side extension. For additional information, refer to [Front Side Member Side Extension](#) (501-27 Front End Sheet Metal Repairs)
- Front side member to deformation element bracket. For additional information, refer to [Front Side Member To Deformation Element Bracket](#) (501-27 Front End Sheet Metal Repairs)
- Front side member extension. For additional information, refer to [Front Side Member Extension](#) (501-27 Front End Sheet Metal Repairs)
- Suspension top mount. For additional information, refer to [Suspension Top Mount](#) (501-27 Front End Sheet Metal Repairs)
- Front wheel house. For additional information, refer to [Front Wheelhouse](#) (501-27 Front End Sheet Metal Repairs)
- Front side member. For additional information, refer to [Front Side Member](#) (501-27 Front End Sheet Metal Repairs)
- Fender apron panel reinforcement. For additional information, refer to [Fender Apron Panel Reinforcement](#) (501-27 Front End Sheet Metal Repairs)
- Fender apron panel. For additional information, refer to [Fender Apron Panel](#) (501-27 Front End Sheet Metal Repairs)
- Fender apron panel closing panel. For additional information, refer to [Fender Apron Panel Closing Panel](#) (501-27 Front End Sheet Metal Repairs)
- Front fender. For additional information, refer to [Front Fender](#) (501-27 Front End Sheet Metal Repairs)
- Door For additional information, refer to [Door](#) (501-03 Body Closures)
- A-pillar outer panel. For additional information, refer to [A-Pillar Outer Panel](#) (501-29 Side Panel Sheet Metal Repairs)
- A-pillar assembly. For additional information, refer to [A-Pillar Assembly](#) (501-29 Side Panel Sheet Metal Repairs)
- Rocker panel. For additional information, refer to [Rocker Panel](#) (501-29 Side Panel Sheet Metal Repairs)
- Quarter panel assembly. For additional information, refer to [Quarter Panel Assembly - Vehicles Without: Convertible Top](#) (501-30)
For additional information, refer to [Quarter Panel Assembly - Vehicles With: Convertible Top](#) (501-30)
- Rear outer wheelhouse half. For additional information, refer to [Rear Outer Wheelhouse Half](#) (501-30 Rear End Sheet Metal Repairs)
- Rear wheelhouse outer. For additional information, refer to [Rear Wheelhouse Outer](#) (501-30 Rear End Sheet Metal Repairs)
- Rear side member closing panel. For additional information, refer to [Rear Side Member Closing Panel](#) (501-30 Rear End Sheet Metal Repairs)
- Rear side member reinforcement panel. For additional information, refer to [Rear Side Member Reinforcement Panel](#) (501-30 Rear End Sheet Metal Repairs)
- Rear side member (section). For additional information, refer to [Rear Side Member Section](#) (501-30 Rear End Sheet Metal Repairs)

- Spare wheel well. For additional information, refer to [Spare Wheel Well](#) (501-30 Rear End Sheet Metal Repairs)
- Back panel assembly. For additional information, refer to [Back Panel Assembly](#) (501-30 Rear End Sheet Metal Repairs)
- Liftgate.
- Rear bumper cover. For additional information, refer to [Rear Bumper Cover](#) (501-19 Bumpers)
- Rear bumper. For additional information, refer to [Rear Bumper](#) (501-19 Bumpers)
- Roof panel. For additional information, refer to [Roof Panel](#) (501-28 Roof Sheet Metal Repairs)
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Category 'B'

- Damage associated to bolt on panel(s) that are replaced, or light surface damage to exterior cosmetic panels. The following list identifies Category 'B' procedures

Category B procedures

- Hood. For additional information, refer to [Hood](#) (501-03 Body Closures)
- Front bumper cover. For additional information, refer to [Front Bumper Cover](#) (501-19 Bumpers)
- Front bumper. For additional information, refer to [Front Bumper](#) (501-19 Bumpers)
- Auxiliary front crossmember. For additional information, refer to [Auxiliary Front Crossmember](#) (501-27 Front End Sheet Metal Repairs)
- Front Crossmember. For additional information, refer to [Front Crossmember](#) (501-27 Front End Sheet Metal Repairs)
- Fender apron panel front extension. For additional information, refer to [Fender Apron Panel Front Extension](#) (501-27 Front End Sheet Metal Repairs)
- Side member deformation element. For additional information, refer to [Side Member Deformation Element](#) (501-27 Front End Sheet Metal Repairs)
- Front side member side extension mounting. For additional information, refer to [Front Side Member Side Extension Mounting](#) (501-27 Front End Sheet Metal Repairs)
- Front side member side extension. For additional information, refer to [Front Side Member Side Extension](#) (501-27 Front End Sheet Metal Repairs)
- Front fender. For additional information, refer to [Front Fender](#) (501-27 Front End Sheet Metal Repairs)
- Door For additional information, refer to [Door](#) (501-03 Body Closures)
- Liftgate.
- Rear bumper cover. For additional information, refer to [Rear Bumper Cover](#) (501-19 Bumpers)
- Rear bumper. For additional information, refer to [Rear Bumper](#) (501-19 Bumpers)

Equipment

All Jaguar approved body repair facilities are expected to be equipped in line with Jaguar Body and Paint Centre of Excellence Operating Standards.

The approved body equipment for the XK Aluminium range is listed as either:

- Category 'A'
- Category 'B'

All approved equipment is available on a Worldwide basis from:

Country	Phone	Fax
Austria	+800-291714	+800-291694
Belgium (flemish)	00800-36733731	00800-36733292
Belgium (french)	0800-36733732	0800-36733292
Denmark	+800-36733732	+800-36733292
Finland	+800-36733732	+800-36733292
France	0800-904986	0800-901329
Germany	0800-3673373	0800-3673329
Greece	00800-49129046	00800-49129057
Hungary	+800-36733732	+800-36733292
Ireland	1800-409574	1800-409580
Italy	0800-790959	0800-780959
Netherlands	00800-36733732	00800-36733292
Norway	+800-36733732	+800-36733292
Poland	00800-4911241	00800-4911240
Portugal	+800-36733732	+800-36733292
Spain	900-998303	900-998304
Sweden	+800-36733732	+800-36733292
Swiss french	00800-36733732	00800-36733292
Swiss German	00800-36733731	00800-36733291
Turkey	00800-44910087	00800-44910096
UK	0800-214390	0800-281705
All other markets	+49 2203 106199	+49 2203 106241

A copy of the approved equipment standards for category 'A' and 'B' repair facilities is available on request from:

Jaguar Equipment Programme

Unit 6

Wollaston Crescent

Burnt Mills Industrial Estate

Basildon

Essex

SS13 1QD

0800 214390

Alternatively, you can access the programme via their website: www.eqseurope.com

Panel Replacement Times

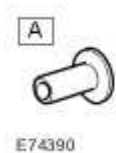
Panel replacement times are available for the following:

- Front end sheet metal. For additional information, refer to [Front End Sheet Metal](#) (501-27 Front End Sheet Metal Repairs)
- Side panel sheet metal. For additional information, refer to [Side Panel Sheet Metal](#) (501-29 Side Panel Sheet Metal Repairs)
- Rear end sheet metal. For additional information, refer to [Rear End Sheet Metal](#) (501-30 Rear End Sheet Metal Repairs)
- Roof sheet metal. For additional information, refer to [Roof](#) (501-28 Roof Sheet Metal Repairs)

Fixings

There are five groups of fixings used on the XK Aluminium range, other than conventional nuts and bolts. It is important that the correct procedures are followed for the removal and replacement of these fixings and, where applicable, the correct tools are used.

Self-Piercing Rivet (SPR)



Self-Piercing Rivets are available in various sizes dependant on the size of the "stack" of panels to which they are fitted. A "stack" refers to the combined gauge of the panels being Rivetted. The following table identifies the sizes and part numbers available:

NOTE:

It is important to identify and select the correct size fixing by referencing this table prior to installation.

Size	Stack	Jaguar Service Number
4.8mm x 5.0mm	3.0mm	C2C 20589
4.8mm x 7.0mm	4.0mm	C2C 20590
4.8mm x 8.0mm	5.0mm	C2C 20591
4.8mm x 8.5mm	5.5mm	C2C 20592

4.8mm x 9.0mm	6.0mm	C2C 20593
4.8mm x 9.5mm	6.5mm	C2C 20594
4.8mm x 11.0mm	8.0mm	C2C 20595

Removal: The ESN50 is the approved removal tool for Self Piercing Fixings. The ESN50 can be used with an optional, larger, 200mm "C" frame for improved access. Where tool access is impossible, remove fixings using approved drill bits.

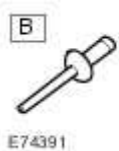
Installation: The ESN50 is the approved installation tool for Self Piercing Fixings. Where the original panel is being refitted, the new fixings should be placed adjacent to the original. Only where the ESN50 cannot be used, or there is insufficient space on the panel, should the fixings be replaced with Hemloks, unless the repair method dictates otherwise.



Using the ESN50: Ensure there is access for the ESN50 on both sides of the fixing to be removed / installed, including the optional "C" frame if required. **Removal:** Align the plunger and anvil over the fixing and depress the trigger. Depressing the trigger will allow the plunger to act on the fixing and remove it from the panel. **Installation:** Note: Prior to replacing a self piercing fixing, a test, using identical materials from waste panels, should be performed, to ensure that all settings are correct and an acceptable joint has been achieved.

Load new fixing into ESN50. Align the ESN50 over the fixing position and depress the trigger. As the trigger is depressed the ESN50 will clamp itself onto the work piece and install the fixing.

Hemlok (rivet)



Hemloks are available in various sizes dependant on the size of the "stack" of panels to which they are fitted. A "stack" refers to the combined gauge of the panels being Rivetted. The following table identifies the sizes and part numbers available:

NOTE:

It is important to identify and select the correct size fixing by referencing this table prior to installation.

Size	Stack	Jaguar Service Number
6.4mm x 13.7mm	1.5mm - 3.0mm	C2S 11487
6.4mm x 15.0mm	2.8mm - 4.8mm	C2C 7792
6.4mm x 17.0mm	4.8mm - 6.8mm	C2C 10349
6.4mm x 19.0mm	6.8mm - 8.8mm	C2C 9818
6.4mm x 20.0mm	7.5mm - 9.5mm	C2C 22613
6.4mm x 21.0mm	8.8mm - 10.8mm	C2C 9966

Removal: Hemloks are not used in production, however, if a previous repair has been carried out they may be present. Remove the centre of the fixing using a 4mm punch - in some instances it may be necessary to loosen the centre using a hardened centre punch. Once the centre has been removed, drill out the remnant using a 6.5mm Cryobit drill bit. Remove all debris.



Installation: The Genesis G4 is the approved installation tool for Hemloks. Prior to replacement ensure the fixing hole has been drilled to 6.5mm, using Cryobit drill bit and all debris has been removed.

Using the Genesis G4: Ensure the fixing hole has been drilled to 6.5mm and all debris has been removed. Check that you have the correct size Hemlok for replacement and insert it into the Genesis G4. Use the weight of the Genesis G4 to apply light pressure as the Hemlok is inserted into its hole. Depress the trigger which will tighten the Hemlok in the hole, the wasted stud will be ejected into the Genesis G4 once a pre-determined pressure is reached.

Monobolt (rivet)



Removal: Remove the centre of the fixing using a 4mm punch - in some instances it may be necessary to loosen the centre using a hardened centre punch. Once the centre has been removed, drill out the remnant using a 6.5mm Cryobit drill bit. Remove all debris.

Installation: The Genesis G4 is the approved installation tool for Monobolts. Prior to

replacement ensure the fixing hole has been drilled to 6.5mm, using Cryobit drill bit and all debris has been removed.



Using the Genesis G4: Ensure the fixing hole has been drilled to 6.5mm and all debris has been removed. Insert a new Monobolt into the Genesis G4, (there is only one size of Monobolt used on the XK Aluminium Range). Use the weight of the Genesis G4 to apply light pressure as the Monobolt is inserted into its hole. Depress the trigger which will tighten the Monobolt in the hole, the wasted stud will be ejected into the Genesis G4 once a pre-determined pressure is reached.

Countersunk Monobolt (rivet)



Countersunk Monobolts are used in replacement where a Self-Piercing Rivet, (SPR), cannot be replicated and where a Hemlok cannot be used because a flush surface is required.

Removal:Countersunk Monobolts are not used in production, however, if a previous repair has been carried out they may be present. Remove the centre of the fixing using a 4mm punch - in some instances it may be necessary to loosen the centre using a hardened centre punch. Once the centre has been removed, drill out the remnant using a 6.5mm Cryobit drill bit. Remove all debris.

Installation:The Genesis G4 is the approved installation tool for Monobolts. Prior to replacement ensure the fixing hole has been drilled to 6.5mm, using Cryobit drill bit, the hole has been countersunk, using a countersink drill bit and all debris has been removed.



Using the Genesis G4: Ensure the fixing hole has been drilled to 6.5mm and all debris has been removed, check Countersunk Monobolt sits flush with panel. Insert a new Countersunk Monobolt into the Genesis G4, (there is only one size of Countersunk Monobolt used on the XK Aluminium Range). Use the weight of the Genesis G4 to apply light pressure as the Countersunk Monobolt is inserted into its hole. Depress the trigger which will tighten the Countersunk Monobolt in the hole, the wasted stud will be ejected into the Genesis G4 once a pre-determined pressure is reached.

Ejot (flow drilled screw)



Removal: Ejots are removed using a T30 Torx driver.

Installation: An Ejot can only be reused where its original thread remains and is intact, Ejots are installed using a T30 Torx Driver. Where new panels have been fitted and no original threaded Ejot hole exists, a Hemlok fixing should be used.

If the Ejot cannot be re-used, and the original thread remains intact, then a Torx screw (C2C 1964) can be used in its place.

Torx Screw and Rivnut



A Torx Screw and Rivnut are used where the fitment of a Hemlok would give a poor cosmetic appearance. There are also occasions where the Torx Screw and Rivnut replaces a Monobolt, where there is no access for the Genesis G4. The Rivnut acts as the thread. The Rivnut is installed using the Wurth HES412 Rivet Nut Thread Setter, (Part No: 964948900).

Description	Jaguar Service Number
Rivnut (G)	C2C 10348
Torx screw (J)	C2G 1964

Removal: The removal of the Torx Screw is carried out using a T30 Torx Driver. The Rivnut

is not an original fixing.



Installation: The Torx Screw is installed using a T30 Torx Driver. The Rivnut is installed using the Wurth HES412 Rivet Nut Thread Setter, (Part No: 964948900).

Bonding

This section provides information on the bonded joints used in repair throughout the XK Aluminium body. The following topics are covered:

- Equipment
- Materials
- Bonding Pre Treatment
- Bonding Application

It is a pre-requisite that any person undertaking any repairs which involve panel bonding has attended Jaguar Approved Training and has achieved the correct skill level to undertake these processes. Bonding is classed as a Category 'A' repair.



Equipment

The approved bonding equipment consists of:

- Pyrosil gas applicator kit
- Approved two-pack adhesive applicator

Materials

The materials listed in this section are those approved to be used on the XK Aluminium range in conjunction with the repairs shown in this manual.

Consumable	Material	Supplier
Weld crack Penetrant	Rocol	Jaguar Equipment Programme
Weld crack Developer	Rocol	Jaguar Equipment Programme
Weld crack Cleaner	Rocol	Jaguar Equipment Programme
Bonding primer	SurAlink GP15	Jaguar Equipment Programme
Bonding adhesive	Structural adhesive DP490	3M
Bonding adhesive	Structural adhesive 8115	3M
Cavity foam	DM4330 foam	3M
Semi rigid sealer	0893 – 2251	Wurth
Seam sealer	Terostat 1K PUR 11272C (4500010)	Teroson
Cleaner/De-greaser	08984	3M
Cleaner/De-greaser	3608S	DuPont
MIG weld wire (6111)	4043 / 4047 filler wire	Fronius dealer network
MIG weld wire (5754)	5554 filler wire	Fronius dealer network
Abrasive discs	Roloc bristle discs 07528	3M
Self-Pierce fixings (all variants)	JEPC	Jaguar Dealer Network
Hemlok fixings (all variants)	JEPC	Jaguar Dealer Network

Bonding Pre Treatment

Pre-treating the panels to be bonded, as described in this section, promotes the improved adhesion of the bonding adhesive.

The pre-treatment is carried out using the approved "Pyrosil kit". The kit contains all of the equipment required to perform the pre-treatment process.



Bonding without pre-treatment will reduce the performance of the joint.

The pre-treatment application is a two stage process:

- Chemical application via a flame
- Coupling Agent

Performing the Pre-treatment Application

- **NOTE:**

Apply caution when using a naked flame. Remove all risk of combustion Do not overheat the alloy Move the flame over the work piece at a constant velocity

-
- Remove any original adhesive, or E-Coat from new panels
- Clean surface to be treated using approved pre-cleaner / degreaser
- Using the Pyrosil torch, pass the flame, (use the blue tip which is the oxidation flame), across the surface of the joint.
- Immediately brush primer onto panel surface and allow to dry

The application is colourless and has no visual indication.

Apply the bonding adhesive immediately after the pre-treatment process.

Bonding Application

The approved bonding adhesive is supplied in a two pack cartridge

A two-pack cartridge gun with a disposable mixing nozzle is used for the application of the adhesive



Apply a 5mm "zig zag" bead directly to either the replacement panel or vehicle structure

Ensure a continuous bead of adhesive surrounds fixing holes

On completion the mixing nozzle must be discarded. Ensure an air tight seal is provided for the cartridges.

NOTE:

The curing process of the adhesive begins once mixed and has a working time of approx 30 minutes

Aluminium Welding

Health and Safety

Refer to equipment manufacturers' manual.

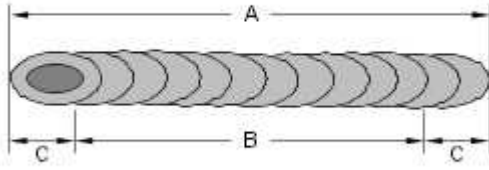
Set Up / Equipment Check

Refer to equipment manufacturers operator's manual.

Weld Process

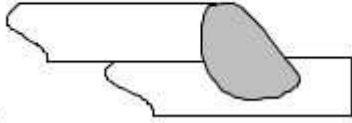
This section provides information on aftermarket Aluminium welding for the XK Aluminium range. It covers the following areas:

- **Equipment:** Metal Inert Gas (MIG)
- **Materials:** Extruded and pressed Aluminium sheet alloy.
- **Weld Structure:** Fusion welding process: Metal Inert Gas (MIG)
- **Weld Procedures:** Pre-weld, test weld, weld and post weld checks.
- **Weld Types:**



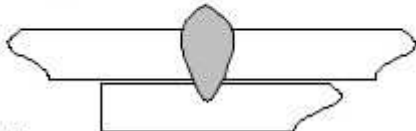
E70247

Lap Weld



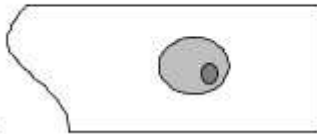
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Butt Weld



E70249

Plug Weld



E70250

It is a pre-requisite that any person undertaking Category 'A' welding on the XK Aluminium range is fully qualified in Aluminium Welding.

Equipment



E70246

Approved equipment obtained from the Jaguar Equipment Programme:

- Fronius Aluminium Edition - Metal Inert Gas (MIG) Welder.
- Speedglas with Adflo face shield / weld mask.
- Approved fume extractor.
- Stainless Steel Brush.
- Personal Protection Equipment (PPE)

Materials

Prior to any welding activity, it is necessary to identify the type of material to be welded. The XK Aluminium range is constructed from a number of Aluminium Alloys, each has different attributes that should be considered prior to the weld process.

Body Materials

The repair methods shown focus on the replacement of:

- Pressed Aluminium Alloy sheet - 6111 - Used in skin-panels.
- Extruded Aluminium Alloy - 5754 - Used in structural panels.

Weld Wire

The approved weld wires for these alloys are:

- 6111 - 4043 or 4047 filler wire.
- 5754 - 5554 filler wire.

Weld Structure

The approved aftermarkets weld process is based on Fusion Welding.:

- Metal Inert Gas (MIG) Welding

The approved MIG welder uses DC current. The Electrode, (filler wire), is Positive Pole and the work piece is Negative Pole. The arc burns between a melting electrode, (which also acts as the filler wire) and the work piece. The shielding gas is :

Inert

- MIG - (Argon, Helium or a mixture of these).

Successful Aluminium welding is partly dependent on the removal of surface Oxidisation.

Oxide MUST be removed prior to welding. The oxide melts at a different temperature:

- Aluminium melting temperature - approximately 660°C.
- Aluminium Oxide melting temperature - approximately 2040°C.

Fronius Pulsed MIG

The 2700 Alu Edition utilises a 100% digitally controlled power source, this produces final weld attributes of:

- Smoothness.
- Refinement.
- Consistency.
- Repeatability.

The accuracy of the approved equipment enables the delivery of one droplet of wire per pulse. This enables welding of incredibly thin parent material, i.e 0.6mm sheet can be welded using a 1.2mm filler wire.

The approved MIG welder uses Direct Current, (DC) and does not produce High Frequency, (HF), at start up, (initial arc).

Safety Precautions

The following safety precautions should always be implemented:

- Disconnect the vehicle battery.
- Isolate the Electronic Control Modules (ECMs).
- Remove any ECMs within 500mm of the weld area.

Weld Procedures

Pre-weld

Prior to starting any weld procedure you should:

- Disconnect the vehicle battery.
- Isolate the ECM.

The Aluminium surfaces **MUST** be cleaned prior to welding. Cleaning will aid penetration and avoid contamination. There are three steps to this process:

1. Clean Surface

- To remove wax and any other contaminants use a chemical surface cleaner, either: Jaguar approved product: DuPont 3608S. Alternatively, an Isopropyl based product.

2. Remove Oxide

- This can be achieved through a number of processes: Stainless Steel brush. 80 Grit abrasive paper. Non-Metallic scuff pad.
- Note, if a Stainless Steel brush is used it should not be contaminated by use on a steel vehicle.

3. Remove Oxide Dust

- Remove dust with a lint free cloth.

Note: Oxide builds up very quickly, therefore, perform steps 2 and 3 immediately prior to welding. If left for a period of time, steps 2 and 3 should be repeated.

Equipment Set Up

The approved welding equipment for the XK Aluminium range is the "Fronius 2700 Alu Edition". The user should always refer to the operators manual for detailed instructions. The following provides an overview of the set-up procedure:

- Health and Safety - read operators manual.
- Check correct power supply.
- Check gas supply.
- Check all equipment parts - safety check.

- Attach power cables, connect to supply.
- Purge gas bottle, attach.
- Attach clamp.

Test Weld

A test weld using identical coupons from waste panels should take place prior to working on the vehicle. The test piece is then visually checked and destructively tested to ensure all settings are correct and an acceptable weld has been achieved.

Prior to starting, the following should be checked:

- Gas - Correct for the type of job.
- Filler Wire - Correct for the type of material to be welded.

An effective weld should demonstrate the following qualities:

- All visible weld surfaces shall be clean, bright and of a uniform profile.
- The weld seam should show uniform height and width over its entire length.
- There shall be complete fusion between the surfaces of the work piece and the weld metal deposit.

Correct level of penetration will be visible at the rear of the coupon as a fine continuous line.

Effective Weld Length

The effective weld length is the weld seam as described in the Body Repair Sections. The effective weld length does not include allowances for the run-in/run-out, or termination defects, (start / stop), of the weld seam. It is permissible that the overall weld length is longer than detailed in the repair section, as the overall weld will include a minimum of 5mm at both the start and the stop of the weld seam, provided the function of the part is not affected, or the weld finishes on the edge of a panel.

Post Weld Checks

Weld inspections take the form of a visual examination and destruction testing.

Visual Examinations

A visual examination of fusion welds should be carried out in accordance with the acceptance criteria detailed in the Imperfections / Defect Levels table.

Defect Imperfection Type	Details	Limits
Burn-through	Burn holes	Not permitted
Seam offset, sides melted away	Incomplete fusion	Not permitted within effective weld length

Cracks	Any form of cracking is not permitted at any position along the entire length of the weld seam	Not permitted
Fused weld spatter		Limited acceptance. Not permitted on visible surfaces or in areas where functional performance of the part is affected, e.g. mating surfaces, sealing surfaces, etc. In such instances spatter is to be removed. All loosely adherent spatters must be removed.
Visible ignition marks	Local melting of parent metal due to arc	Permitted provided functional performance of the component is not affected.
Open end crater	Reduces the cross sectional area of the weld seam	Not permitted
Visual pores		Not permitted
Weld skip	Discontinuity / interruption in weld seam	Not permitted at any position along the entire length of the weld seam

Nominal effective weld lengths are detailed within the appropriate body repair section. Weld lengths may be greater than that specified providing the part remains functional.

Dye penetrate testing **MUST** be used for detection of discontinuities, such as cracks, laps, folds, porosity and lack of fusion that are open to the surface of the material. Typical defects include start, (cold start / incomplete fusion) and stop, (crater cracking), defects within a fusion weld run. In addition to this lack of fusion / coalescence at the weld toe, solidification cracks in the weld bead may also be detected.

Non-destructive Crack Inspection Process

Use the product as listed in the Approved Materials Section, this product is supplied within the Category 'A' tool kit. The product is an aerosol applied dye system. It is designed to penetrate the finest cracks and flaws to facilitate detection, the system includes: Cleaner, Penetrant and Developer.

The process is as follows:

- 1. Use the cleaner to de-grease/clean the test area, then wipe with a lint free cloth.
- 2. When the surface is completely dry apply the penetrant. Cover the test area and allow a minimum contact time of 10 minutes
- 3. Remove excess penetrant from the surface with a lint free cloth wetted with the cleaner.
- Apply a **THIN** film of the developer and leave for a minimum of 10 minutes to draw up the retained dye from flaws or cracks.
- Suspect areas should then be examined under natural or electric light for signs of flaws and/or cracks. Cracks will show up as lines whilst porosity will appear as pin holes.

Destructive Testing

Each test weld should be pulled apart to check the quality and penetration of the weld. Visual examination should be conducted to evaluate and detect all the characteristic/defects detailed in the Imperfection and Defect Levels Table.

Types of Welded Joint

This section identifies the three types of joint used in Category 'A' panel replacement. It is not a guide to welding, as all Category A repairers will have staff who are suitably qualified in welding Aluminium. This section highlights the key points for each weld type.

Lap Joint

Key Points

- Run-In/Out distance of 5mm.
- Minimum overall length of 20mm.
- Must use Start / Finish tabs.

Butt Joint

Key Points

- Run-In/Out distance of 5mm.
- Minimum overall length of 20mm.
- Must use Start/Finish tabs.
- Nominal penetration of fillet required.

Plug Weld

Key Points

- Hole size 10mm.
- Position of MIG nozzle - vertical.

501-25B : Body Repairs – Corrosion Protection

Description and operation

Corrosion Protection

General

The application of additional corrosion protection following body repair is not necessary and not recommended.

However, it is important to be aware of **galvanic corrosion** and take steps to prevent its occurrence.

Galvanic Corrosion

Galvanic corrosion is the 'cross-contamination' of dissimilar metals, in this case Aluminium and Steel. Avoidance of galvanic corrosion is an important issue to be considered in the repair of Aluminium bodied vehicles.

Precautions to prevent the contamination of exposed bare Aluminium surfaces should be taken. Good housekeeping / cleanliness should be adopted throughout repairs and especially prior to welding, pre-treatment, (Pyrosil), and adhesive bonding.

The repair environment requires control and protection from dust and debris from conventional steel body repairs. All equipment must be clearly identified and used solely on Aluminium.

Tools should be kept clean and in good order. Steel fastenings are coated to prevent galvanic corrosion. Fastenings should be examined during repairs and where damaged or suspect must be renewed

The use of graphite, "penetrating" oil, or copper based anti-seize compounds upon the steel fixings is not recommended.

Where the OE surface protection, (paint), is removed, it must be reinstated to the recommended standard.

Only Jaguar Cars Ltd original bodywork components and Jaguar Cars Ltd approved repair materials, (sealer, paint, etc), are to be used for bodywork repairs.

501-25C : Body Repairs – Water Leaks

Description and operation

Water Leaks

General

- If water leaks occur after bodywork repairs, the cause can be established using the checks described below. A systematic and logical procedure is required to locate water leaks. Before beginning extensive checks, a thorough visual inspection must be carried out.
- Visual Inspection The following characteristics may indicate existing leaks: Check the clearance and accurate fit of ancillary components such as the hood, tailgate, liftgate, doors, and so on. Check for correct fit and possible damage to sealing elements such as blanking plugs, rubber door seals, and so on. Check water drain holes for unhindered flow.
- Various tests can be used to provide further information on possible leaks: Water test Washer test Road test Chalk (powder) test

Practical execution of tests and checks

Water test

NOTE:

Never aim a jet of water directly at a rubber seal.

- Carry out the water test with a second person present (in the passenger compartment).
- Use variable washer nozzles (concentrated water jet to fine spray mist).
- Start in the lower section and spray the whole area, working upwards in stages.

Washer test

- Further tests can be carried out in the washer system.
- Some leaks originate here, or only occur here.
- The relevant passenger compartment should be checked using a torch during the wash procedure.

Road test

- If no leaks are located during the tests above, road tests should be carried out on wet roads.

- Road tests under various conditions: At various speeds. On various road surfaces (asphalt to cobbles). With loaded or unloaded vehicle. Driving through puddles (splash water).

Chalk test (powder test)

- In this test, the clamping load and the bearing surface of the seal are checked.
- Performing the test: Dust the door seal with powder or coat with chalk. Coat the bearing surface of the seal with a thin film of vaseline. Slowly close the door and open it again. Check the width and continuity of the imprint on the door seal.

Other test equipment

- Other equipment such as stethoscopes, UV lamps, special mirrors or ultrasound measuring instruments can be used to locate leaks.

Rectifying the leak using recommended tools, auxiliary equipment and materials

- Tools and auxiliary equipment: Dry, absorbent cloths Variable washer nozzle Torch, fluorescent tube Mirror Compressed air Seal lip installer Wet/dry vacuum cleaner Sealing compound compressor Remover for interior trim Cutter blade or pocket knife Wedge (wood or plastic) Hot air blower Special mirror for concealed leaks Air flow checker Sealing compound (tape and plastic compound) Multi-purpose sticker Clinched flange sealer Window sealing compound Water shield (PVC) Double-sided adhesive tape for water shield Methylated spirit (available from trade outlets) PU adhesive Silicone remover Tar remover

Water leaks according to mileage or running time

Increasing mileage has an effect on the problem of leaks in a vehicle. Possible influencing factors are:

- Servicing and maintenance of seals: No maintenance, lack of maintenance or incorrect maintenance Using an incorrect agent
- Damaged seals: As a result of aging, wear or incorrect handling/assembly.
- Heavy soiling of the vehicle: Heavy soiling of a vehicle can seriously impair the function of water drainage channels in particular, and also of rubber seals.
- Age-related factors: Environmental factors UV radiation Extreme climatic conditions
- Corrosion can have a serious impact on bodywork, in particular as a result of: Lightly or heavily rusted seal carriers Rusted body seal welds Perforation corrosion

Water leaks after body repairs

If a vehicle develops a leak after body repairs, the following points must be taken into consideration in particular:

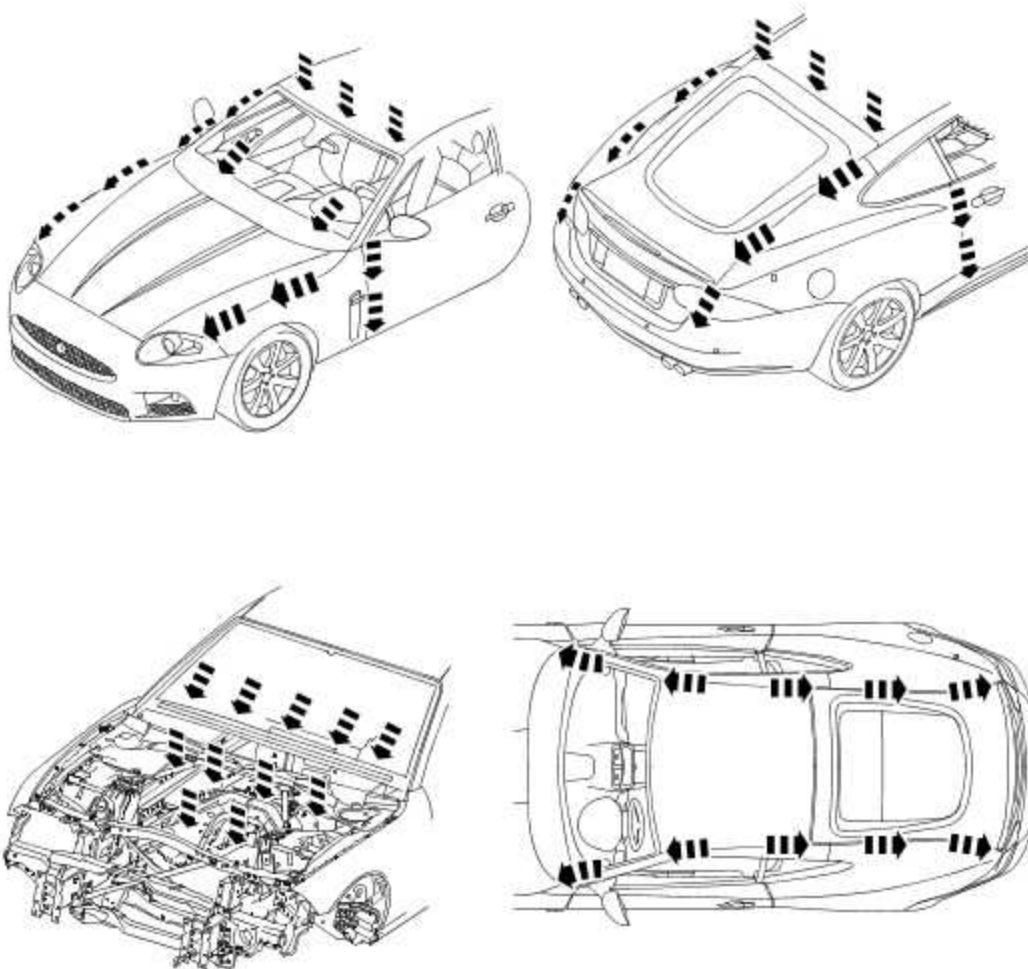
- The correct seating of ancillary components and their seals must be checked.

- The correct alignment of doors/tailgate and liftgate must be checked. The associated seals must not be damaged and must be installed correctly.
- Check that panel seams are correctly sealed.
- The correct seating of rubber grommets must be checked.
- Directly-glazed windows must have correct and complete bonding.

Water drainage system

If a vehicle develops water leaks, then areas into which water is routed or drained should be checked first.

Water drainage system (illustration for reference only)



E102719

Item	Part Number	Description
1		Water drainage, front
2		Water drainage, side and rear
3		Roof drainage

Water leaks, diagnosis and corrective action: Front passenger compartment

Windscreen

- Diagnosis: Ingress of water into A-pillar area or instrument cluster area and rocker panel area.
- Cause: Breaks in adhesive beads
- Corrective action: The breaks in adhesive beads can be located from inside by using compressed air. The leak can be identified from outside by the escaping air. The second test method is by means of a water test. The outer trims must be raised carefully using a plastic wedge. The leak should be located from inside by a second assistant.

Side windows

In the case of side windows, the same problems can arise as for a windscreen. The same corrective actions must therefore be used.

Door seal

- Diagnosis: Water ingress in the lower part of the interior door trim or in the rocker panel area.
- Cause: The water shield fitted behind the interior door trim exists to drain off water that has entered the door via the drainage holes, either downwards or outwards. If the water shield seal is damaged or has been fitted incorrectly, then water can get into the passenger compartment. In addition to this, the drainage holes can become clogged with leaves, dirt or excess cavity protection agents. Water gathers in the door and ingresses into the passenger compartment. Check water shield for damage or correct fitting. If the water shield needs to be re-bonded, then approved seam sealer should be used. Before the water shield is installed, the drainage holes must be checked for unhindered flow.

Door seals

- Diagnosis: Ingress of water into the rocker panel area
- Cause: Insufficient clamping load between seal and door.
- Corrective action: Check clamping load: The easiest way to check the clamping load of a seal to the respective bearing surface is by means of a paper strip test. This consists of trapping strips of paper at various points between the door and the seal, and fully closing the door. If it is possible to pull out the paper with no great resistance, then the clamping load is too low. **NOTE:**

When adjusting the clamping load, the profile alignment of the relevant components must always be taken into consideration.

- Adjust the clamping load: The clamping load is normally adjusted using the striker. When doing so, the edge alignment from the door to the side panel, or from the front door to the rear door must be taken into account. Another setting method is to realign the panel flange for the seal mounting. The clamping load is increased by moving the flange towards the door. **NOTE:**

Do not realign the flange too far in the direction of the door, as this can reduce the bearing surface of the seal to the door.

- Check the bearing surface: Apply chalk evenly to the surface of the seal. Evenly coat the bearing surface of the door with vaseline. Close the door fully, the lock must engage. Open the door. The imprint of the chalk (bearing surface) can be identified in the film of vaseline. The bearing surface should be at least 5mm across at all points.
- Other causes: The door seal must completely seal the door where it meets the bodywork. Water can ingress directly or indirectly into the interior of the vehicle if the seal is damaged at any point.
- Corrective action: A damaged or worn door seal must always be renewed in full. When renewing the seal, the following must be taken into account: Always fit the seal first in the area of the narrow radii (corner points). Next, secure the seal to the flange evenly by tapping lightly with a rubber hammer. The installed seal must not be kinked at any point.

NOTE:

The prescribed length of a seal must not be shortened.

- Other cause: The door seal is attached to the welded flange all the way round. If this welded flange is uneven or damaged at any point (usually in areas with small radii) then this point could be subject to leaks. A stretched seal carrier can also cause a leak. In both cases, water gets into the vehicle interior under the seal carrier.
- Corrective action: Align the deformed welded flange using a hammer and anvil block, prevent and, if necessary, repair any paint damage.

Sliding roof/tilting roof

- Diagnosis: Ingress of water at sliding roof aperture
- Cause: The sliding roof/tilting roof is installed in a water trap. The water drains off via the water trap, water drain holes and drain hoses. The drain hoses lead downwards on both sides via the A-pillar and B-pillar. The drain holes or drain hoses can become clogged with leaves, dirt, underbody protection and so on.
- Corrective action: **NOTE:**

In the case of a sliding or tilting roof, the external rubber seal and the lock actuator or latch mechanism must be checked first of all.

- Check the water trap for leaks. Check the drain hoses for leaks and for correct connection to the water trap. Check the drainage system for unhindered flow, and blow out with compressed air if necessary. Check the external seal and the correct adjustment of the sliding roof.

Liftgate

- Diagnosis: Ingress of water into rear headlining area and luggage area.
- Cause: The leak problems of the tailgate and liftgate correspond to those of the doors. In addition to this, the area to be sealed is much bigger. The routing holes for cables and hoses must also be sealed. The rubber grommets for the routing holes must be checked for damage and correct seating (fully unhooked). The mounting points of the liftgate hinges may leak.
- Corrective action: Check the rubber grommets and renew if necessary. Check the hinge mounting points, and re-seal with sealing compound if necessary.

Forced air extraction

- Diagnosis: Ingress of water into side luggage compartment area
- Cause: The forced air extraction for the vehicle interior is located in the quarter panel lower extension. The rubber flap of the forced air extraction must be able to move freely.
- Corrective action: Remove the forced air extraction. Check the seal area between the bodywork and housing, as well as the rubber flap. Renew seal if necessary.

Rear window

- Diagnosis: Ingress of water into the luggage compartment area
- Cause: Rear window leaking. Check for leak in the same way as for leaking windscreen.

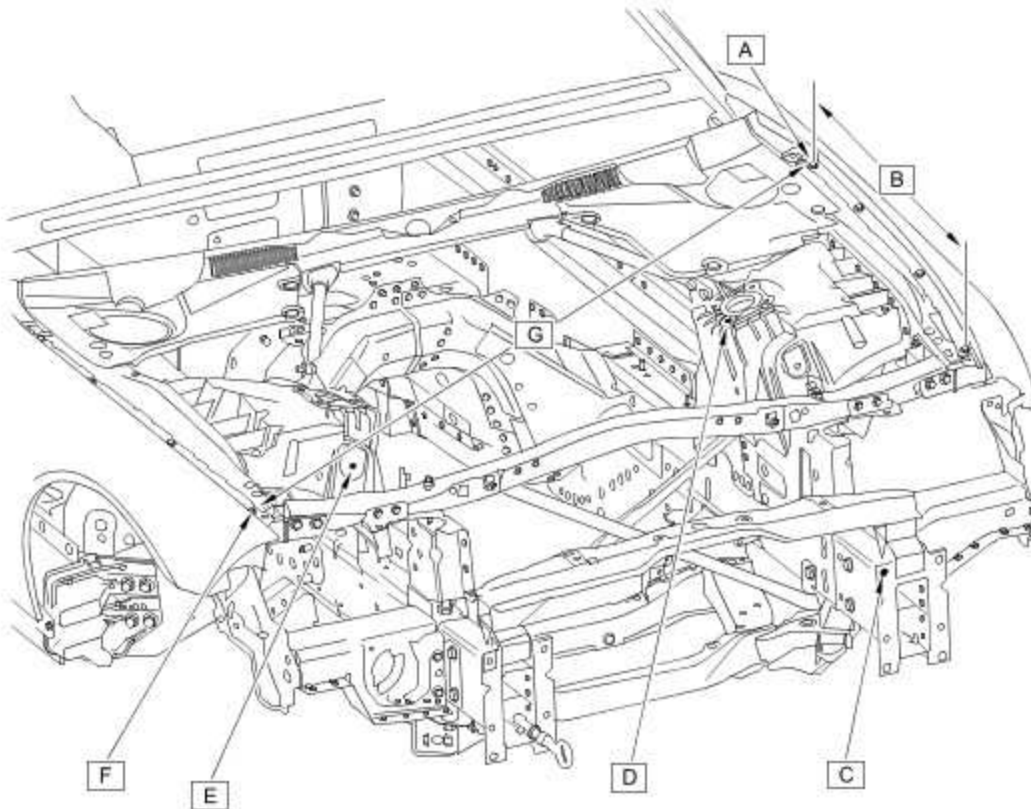
501-26 : Body Repairs – Vehicle Specific Information and Tolerance Checks

Description and operation

Body and Frame

NOTE:

Dimensions are always to the hole center.

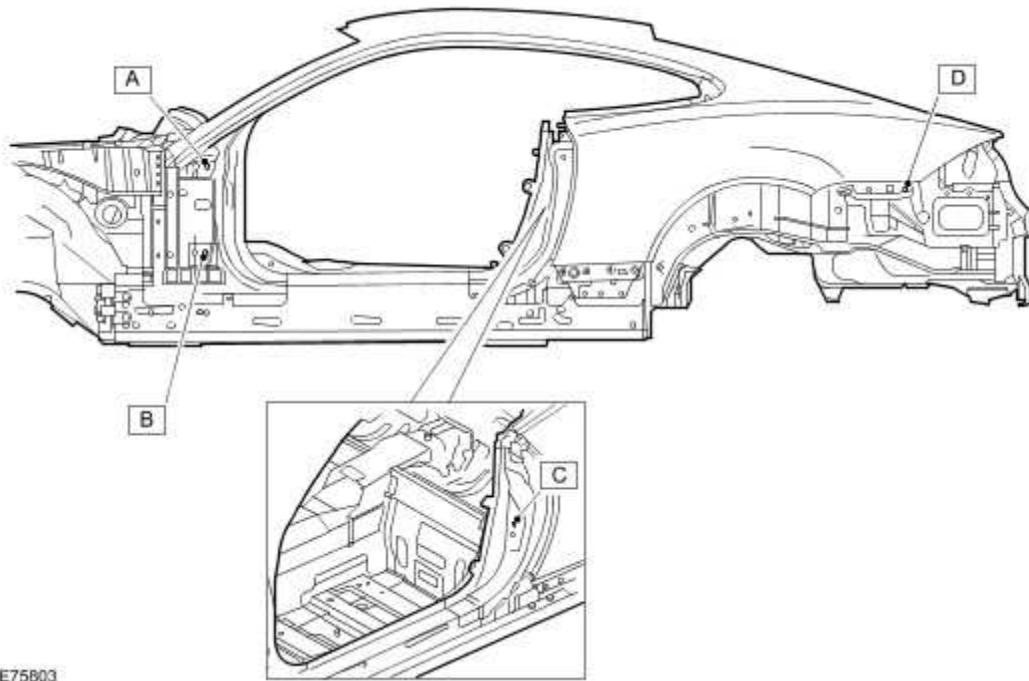


E72361

Front end dimensions The following dimensions are on the front end of the vehicle.

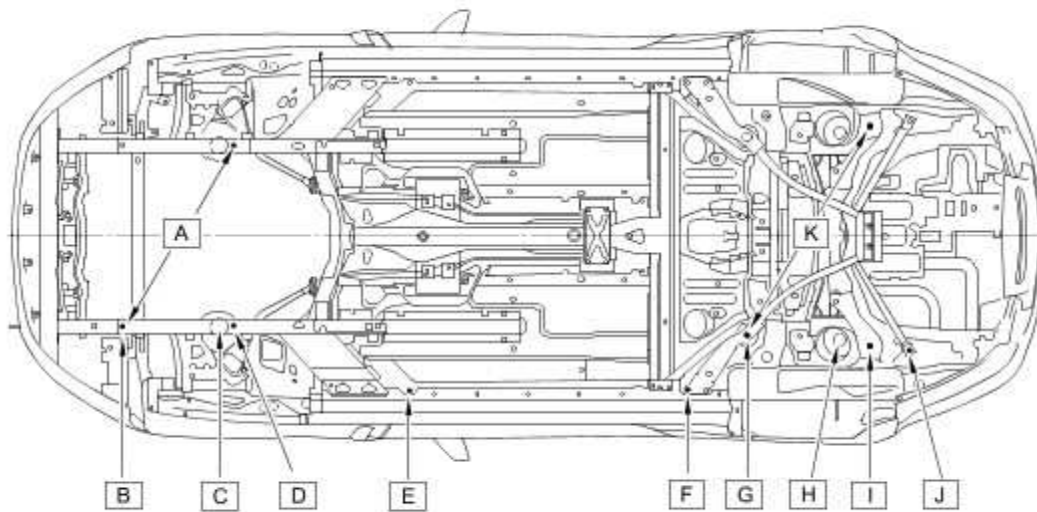
Detail	Dimension
'A' - Rear fender fixing hole	1802.6X, 814.9Y, 964Z

'B' - Rear fender fixing hole to front fender fixing hole	778.7
'C' - Bumper beam top outboard fixing hole	593.5X, 473.7Y, 678.5Z
'D' - Spring mount, forward inboard hole	1304X, 471.4Y, 948.2Z
'E' - Upper arm, top fixing hole	1175.5X, 468.8Y, 862.8Z
'F' - Front fender, fixing hole	1030.4X, 752.6Y, 884.9Z
'G' - Front fender fixing hole to rear fender fixing hole	1749.2



Body side dimensions

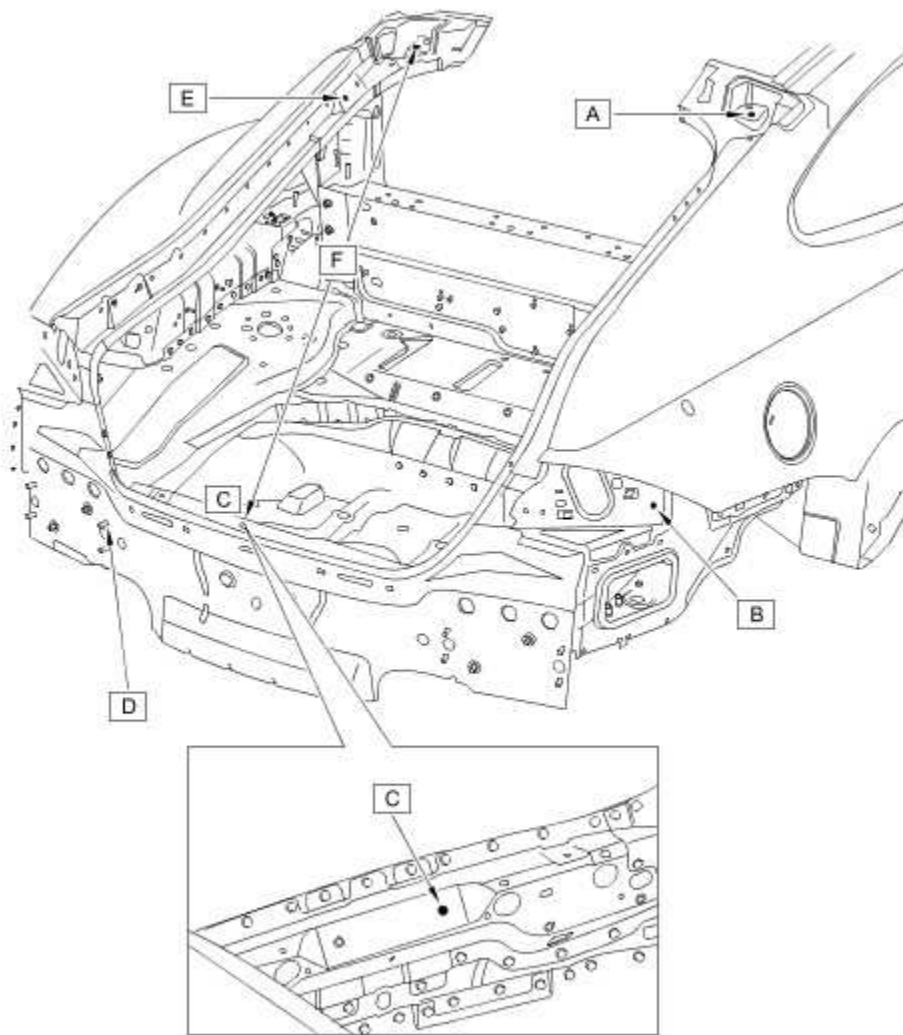
Detail	Dimension
'A' - Top door hinge, rearward fixing hole	2136.05X, 807.4Y, 894.2Z
'B' - Bottom door hinge, rearward fixing hole	2138.7X, 818.2Y, 593.5Z
'C' - Door striker fixing, top hole	3352.4, 792.7Y, 728.7Z
'D' - Body side rear tooling hole	4607.3X, 786.9Y, 819.03Z



E72359

Underbody dimensions

Detail	Dimension
'A' - Front sub-frame front fixing to front sub-frame rear fixing	982.6
'B' - Front sub-frame front fixing	893.1X, 419.5Y, 494Z
'C' - Front spring mount, large hole	1342.9X, 434.4Y, 934.2Z
'D' - Front sub-frame rear fixing	1409.8X, 416.25Y, 493Z
'E' - A-frame rear fixing hole	2237.3X, 703.4Y, 282.2Z
'F' - K-frame front fixing hole	3517X, 704Y, 287.6Z
'G' - Rear sub-frame front fixing hole	3791.7X, 454.5Y, 403.1Z
'H' - Rear spring mounting, large hole	4222.7X, 482.4Y, 755Z
'I' - Rear sub-frame rear fixing hole	4366.5X, 507.6Y, 595Z
'J' - K-frame rear fixing hole	4550X, 528Y, 583.1Z
'K' - Rear sub-frame front fixing to rear sub-frame rear fixing	1120.3

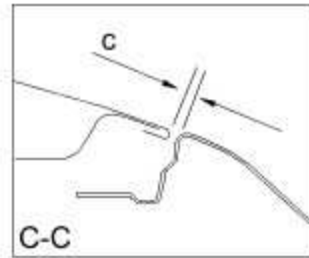
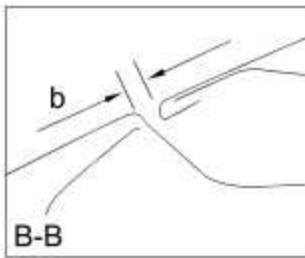
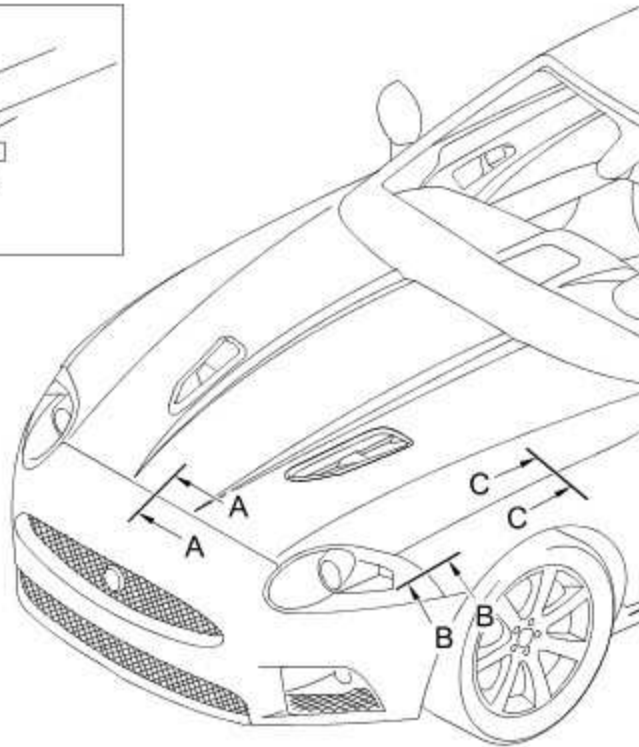
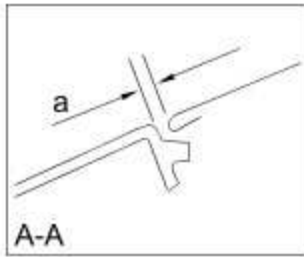


E72360

Rear end body dimensions

Detail	Dimension
'A' - Liftgate, hinge fixing rear hole	3686X, 427Y, 1312.6Z
'B' - Tail lamp, outboard fixing hole	4761.1X, 709.5Y, 881Z
'C' - Liftgate striker fixing hole	4985.5X, 71Y, 712.4Z
'D' - Rear bumper inner fixing hole	4676.2X, 396.3Y, 618Z
'E' - Liftgate spigot strut fixing hole	4268.9X, 445.3Y, 1201.8Z
'F' - Liftgate, hinge fixing rear hole to liftgate striker fixing hole	1475.0

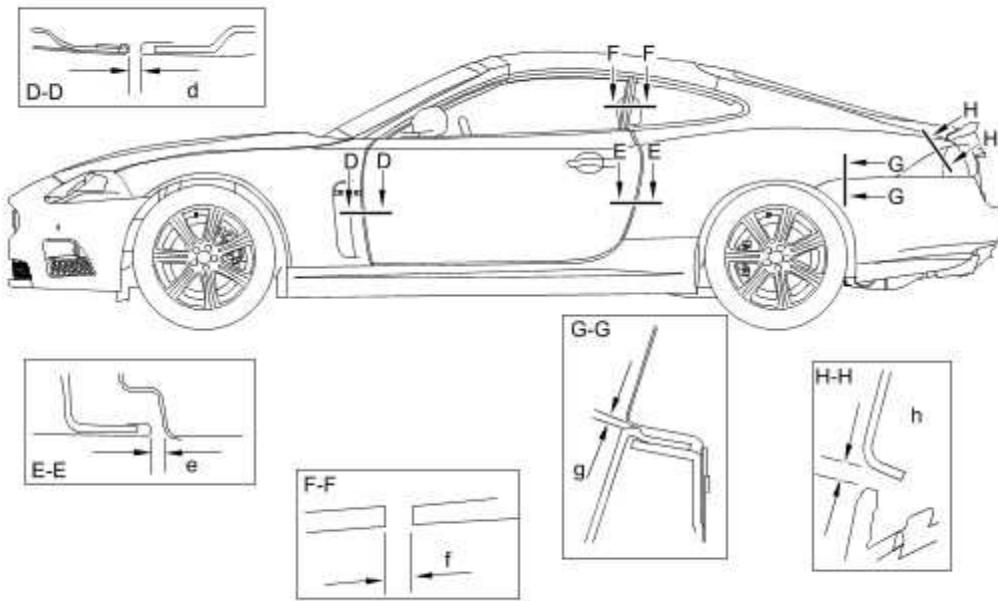
Gap and Profile dimensions



E72355

Gap and profile information on the front end of the vehicle

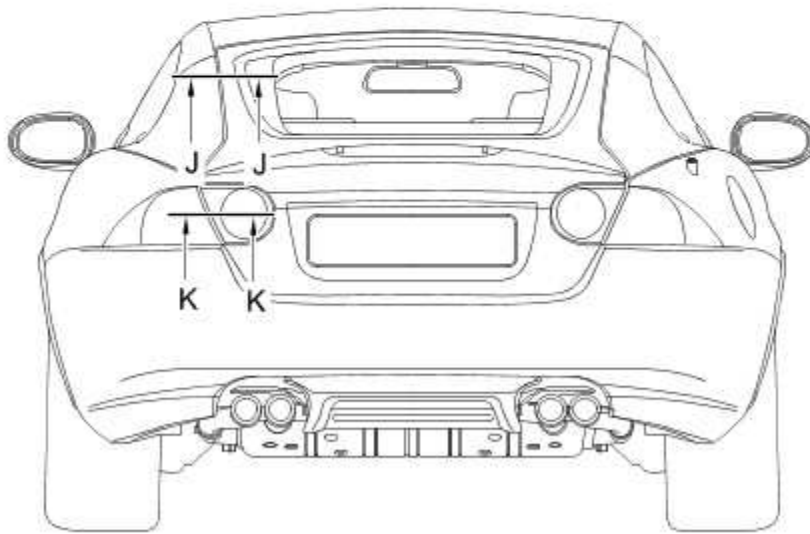
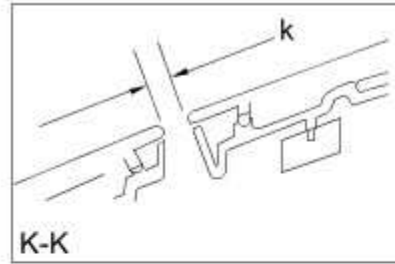
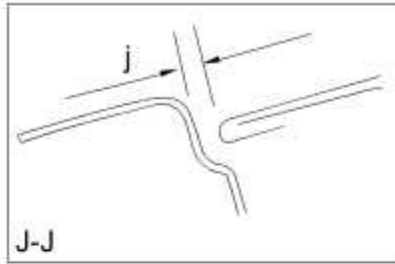
Detail	Gap	Profile
'a' - Hood to front bumper	4.0 ±1.7	-1.0 ±1.1
'b' - Fender to head lamp	2.0 ±1.6	-1.0 ±1.5
'c' - Hood to fender	3.5 ±1.1	-1.0 ±1.0



E72356

Gap and profile information on the side of the vehicle

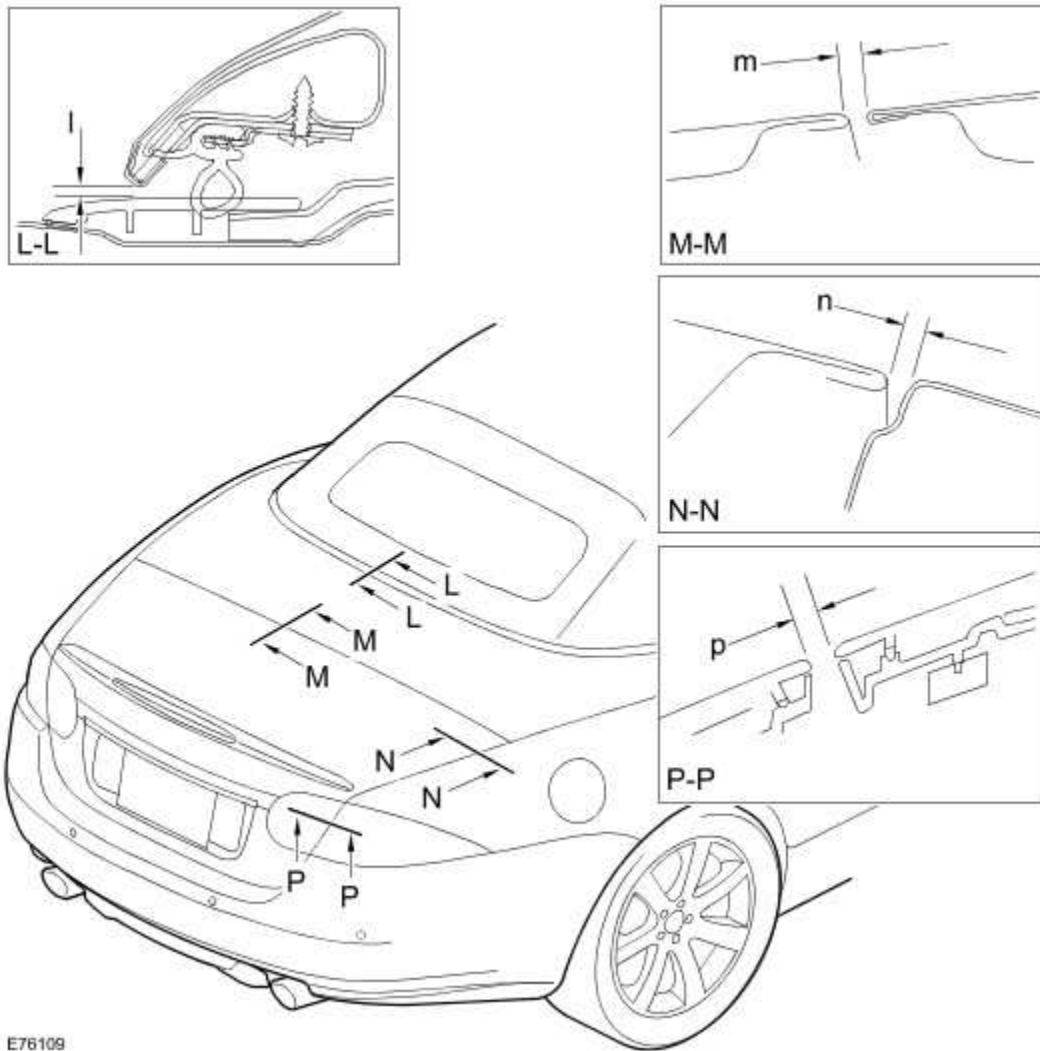
Detail	Gap	Profile
'd' - Door to fender	4.0 ±1.0	0.0 +0.5 -1.5
'e' - Door to bodyside panel	4.0 ±1.0	0.0 ±0.5
'f' - Door glass to rear quarter glass	8.0 ±2.0	0.0 ±1.0
'g' - Bodyside panel to rear bumper	0.0 +0.5 -0.0	0.0
'h' - Rear lamp to bodyside panel	2.0 ±0.5	0.0 ±1.0



E72357

Gap and profile information on the rear end of a Coupe vehicle

Detail	Gap	Profile
'j' - Liftgate to bodyside panel	3.5 ±1.2	-5.0 ±1.2
'k' - Rear lamp to rear fog lamp	4.0 ±1.0	-1.0 ±1.0



Gap and profile information on the rear end of a Cabriolet vehicle

Detail	Gap	Profile
'l' - Convertible hood to convertible hood compartment lid	3.0 ±3.0	N/A
'm' - Convertible hood compartment lid to luggage compartment lid	5.5 ±1.5	0.0 ±1.0
'n' - Luggage compartment lid to body side panel	3.5 ±1.0	-1.0 ±1.0
'p' - Tail lamp to indicator lamp	4.0 ±1.6	0 ±1.7

501-27 : Front End Sheet Metal Repairs

Specifications

Specifications

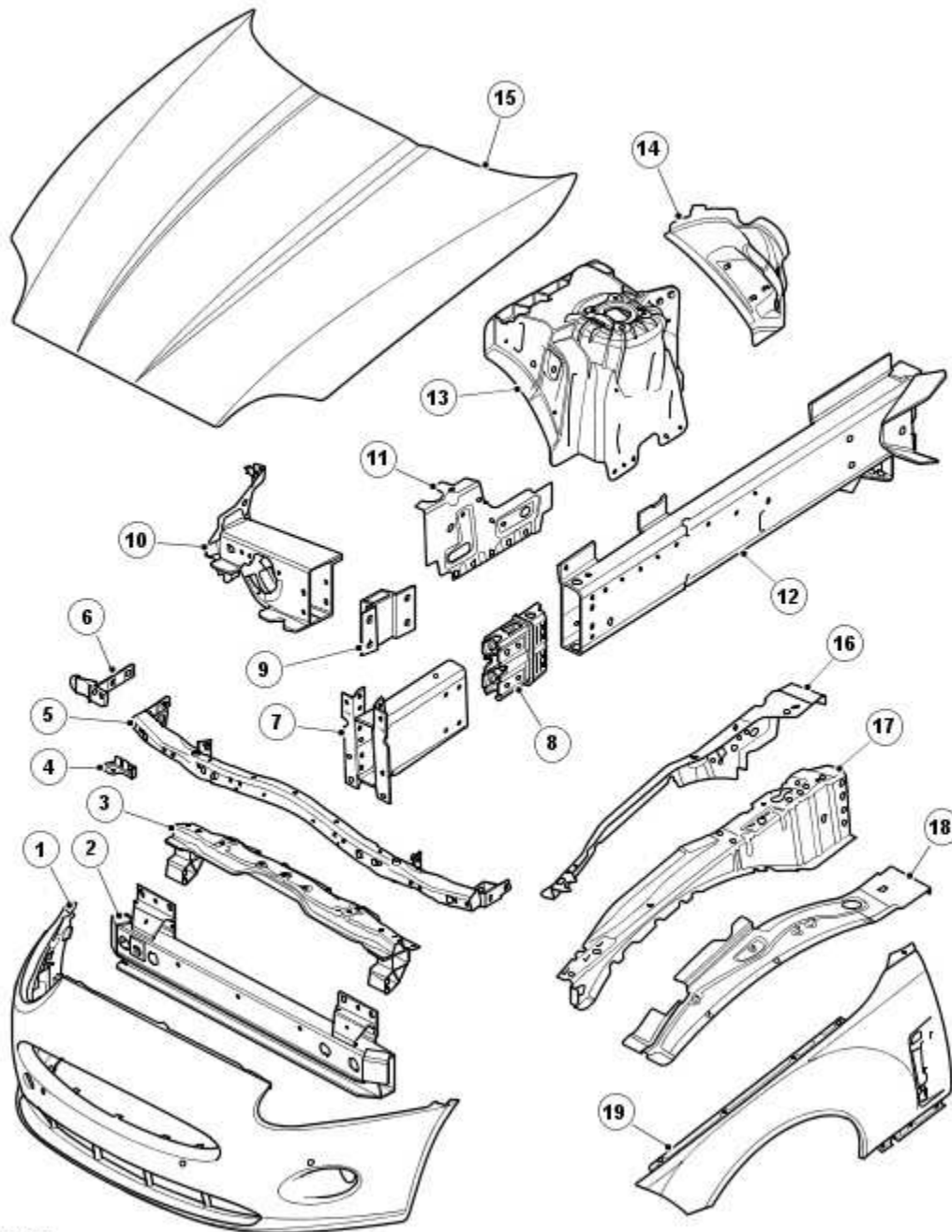
Torque Specifications

Item	Nm	lb-ft	lb-in
Auxiliary front crossmember - bolt	25	18	-
Front fender - bolt	10	7	-
Front crossmember to fender apron panel front extension - bolt	20	15	-
Front crossmember to fender apron panel reinforcement - bolt	30	22	-
Front crossmember to front side member extension- bolt	25	18	-
Front crossmember to headlamp mounting bracket - bolt	9	-	80
Front side member	A	-	-
Front side member, side extension - bolt	25	18	-
Front side member, side extension mounting - bolt	70	52	-
Front side member to deformation element bracket	A	-	-
Side member deformation element - bolt	70	52	-

A = refer to Removal and Installation procedure.

Front End Sheet Metal

Front end service panels



E74552

Item	Description	Service part No
1	Front bumper cover	

2	Front bumper	
3	Auxiliary front crossmember	C2P 8487
4	Headlamp mounting bracket	R/H C2P 5457 L/H C2P 5458
5	Front crossmember	C2P 4831
6	Fender apron panel front extension	R/H C2P 5642 L/H C2P 5643
7	Side member deformation element	R/H C2P 3370 L/H C2P 3370
8	Front side member to deformation element bracket	R/H C2P 4646 L/H C2P 4647
9	Front side member side extension mounting	R/H L/H
10	Front side member side extension	R/H C2P 8095 L/H C2P 8096
11	Front side member extension	R/H L/H
12	Front side member	R/H L/H
13	Suspension top mount	R/H C2P9666 L/H C2P9667
14	Front Wheelhouse	R/H C2P 8474 L/H C2P 8475
15	Hood	
16	Fender apron panel reinforcement	R/H C2P 8489 L/H C2P 8490
17	Fender apron panel	R/H C2P 8097 L/H C2P 8098
18	Fender apron panel closing panel	R/H L/H
19	Front fender	R/H L/H

Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

Panel Description	coupe
Hood	5.6
Front bumper cover	5.9
Front fender L/H	7.0
Front Fender R/H	7.0
Front Crossmember	4.4
Auxiliary front crossmember	5.7
Engine and Suspension assembly remove and install	10.5

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and paint times based on Metallic Clear Over Base Paint process, (blends to adjacent panels are not included).

Panel Description	coupe
Hood	
Front bumper cover	
Front bumper	
Auxiliary front crossmember	
Side member deformation element L/H and R/H	
Front side member side extension mounting	
Front side member side extension	
Front Fender	
Total Time	L/H 21.2 R/H 21.2

Panel Description	coupe
Hood	
Front bumper cover	
Front bumper	
Auxiliary front crossmember	
Side member deformation element L/H and R/H	
Front side member side extension mounting	
Front side member side extension L/H and R/H	
Front Fender L/H and R/H	
Total Time	24.1


Panel Description	coupe
Hood	
Front bumper cover	
Front bumper	
Auxiliary front crossmember	
Side member deformation element L/H and R/H	
Front side member side extension mounting	
Front side member side extension	

Front bumper	
Front side member to deformation element bracket.	
Front side member	
Front Crossmember	
Fender apron panel front extension	
Fender apron panel front reinforcement	
Fender apron panel	
Fender apron panel closing panel	
Front Wheelhouse	
Suspension top mount	
Front Fender	
Engine and suspension assembly remove and install	
Total Time	L/H 45.4 R/H 43.9

Panel Description	coupe
Hood	
Front bumper cover	
Front bumper	
Auxiliary front crossmember	
Side member deformation element L/H and R/H	
Front side member side extension mounting L/H and R/H	
Front side member side extension L/H and R/H	
Front bumper	
Front side member to deformation element bracket L/H and R/H	
Front side member L/H and R/H	
Front Crossmember	
Fender apron panel front extension L/H and R/H	
Fender apron panel front reinforcement L/H and R/H	
Fender apron panel L/H and RH	
Fender apron panel closing panel L/H and R/H	
Front Wheelhouse L/H and R/H	
Suspension top mount L/H and R/H	
Front Fender L/H and R/H	
Engine and suspension assembly remove and install	
Total Time	60.7

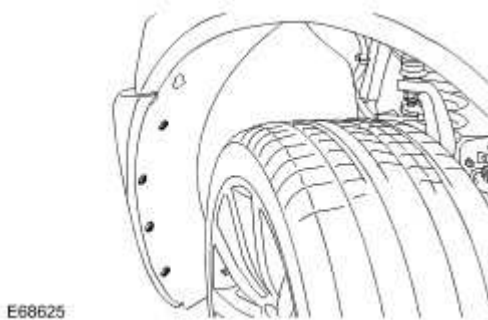
Front Fender


Removal

- 1  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

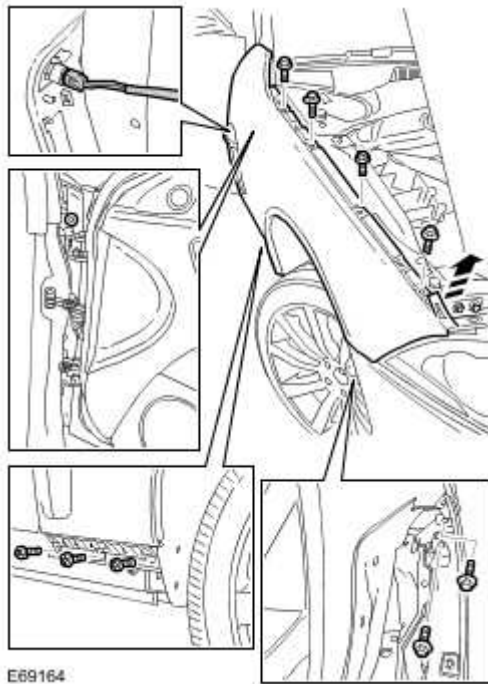
- 2 . Remove the rocker panel moulding.
For additional information, refer to [Rocker Panel Moulding \(76.11.36\)](#)
- 3 . Release the front of the fender splash shield.
 - ▶ Remove the 4 Torx screws.



- 4 . Open the hood.
- 5 . Open the door.
- 6 .  **CAUTION: Protect the paintwork during this operation.**

Remove the front fender.

- ▶ Remove the 12 bolts.
- ▶ Release the headlamp clip.
- ▶ Carefully release the fender.
- ▶ Disconnect the electrical connector.

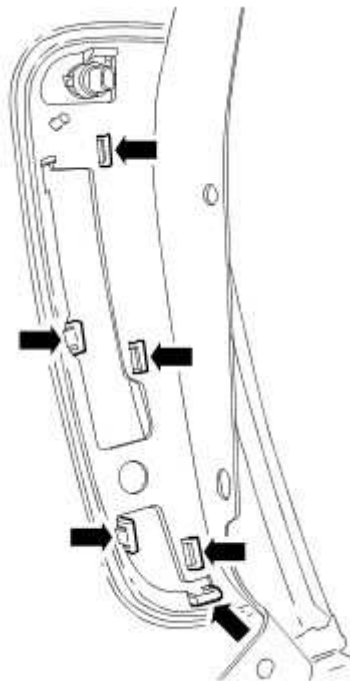


7 . NOTE:

Do not disassemble further if the component is removed for access only.

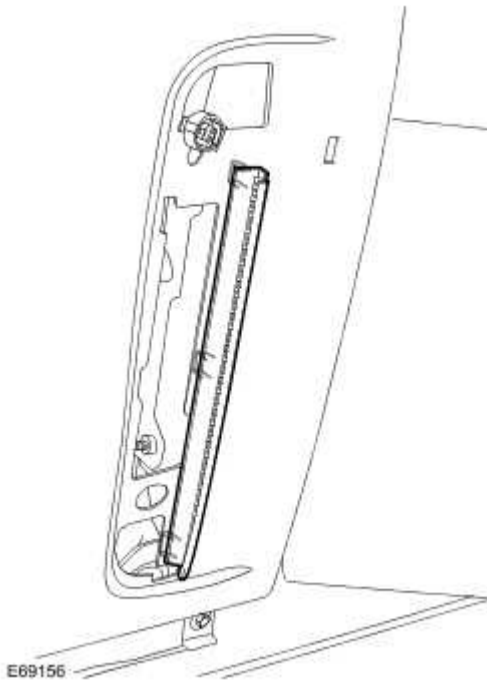
Remove the fender moulding assembly.

▶ Release the 6 clips.



8 . Remove the inner grille.

- ▶ Carefully release the 3 clips.



Installation

- 1 . Install the inner grille.
 - ▶ Secure the clips.
- 2 . Install the fender moulding assembly.
 - ▶ Carefully align and secure the clips.
- 3 . Install the front fender.
 - ▶ Connect the electrical connector.
 - ▶ Tighten the bolts to 10 Nm (7 lb.ft).
 - ▶ Secure the headlamp clip.
- 4 . Install the fender splash shield, front section.
 - ▶ Install the Torx screws.
- 5 . Install the rocker panel moulding.
For additional information, refer to [Rocker Panel Moulding \(76.11.36\)](#)

Front Crossmember

Removal

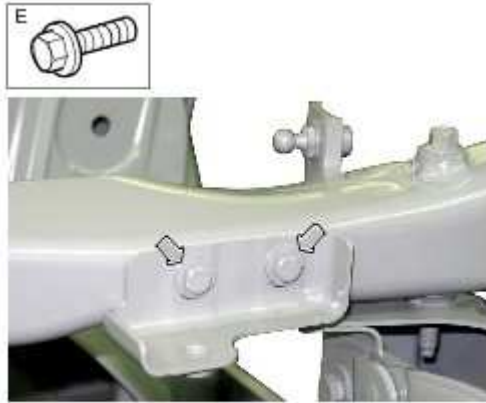
NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the front crossmember is removed and installed without the need to remove any other body panels.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Disconnect the battery.
For additional information, refer to
- 4 . Remove the fan cowl.
- 5 . Release the air intake duct and position it aside.
- 6 . Release the PAS reservoir and position it aside.
- 7 Remove the LH & RH radiator upper mountings, this also releases the support braces.
. If the crossmember is being renewed, completely remove the mountings and save for fitment to the new panel.
- 8 . Release the crossmember wiring harness and position it aside.
- 9 If the panel is being renewed, remove the RH & LH SRS front impact severity sensors
. and save for installation to the new panel.
For additional information, refer to [Front Impact Severity Sensor](#)
- 10 . Remove the 2 headlamp mounting brackets, 2 10mm Bolts on each side.



E72764 **E** ➡

11 . Remove 4 13mm bolts, 2 each side, to the fender apron panel front extension.



E70279 **E** ➡

12 . Remove 4 13mm bolts, 2 each side, to the fender apron panel reinforcement.



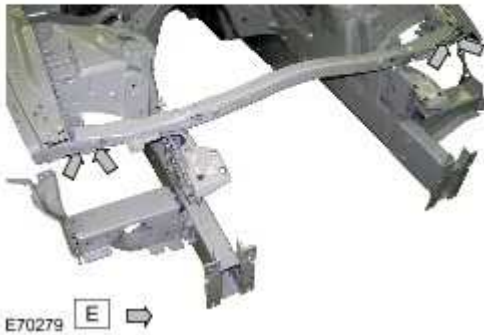
E70280 **E** ➡

13 . Remove 2 10mm bolts, 1 each side, to the front side member extension.

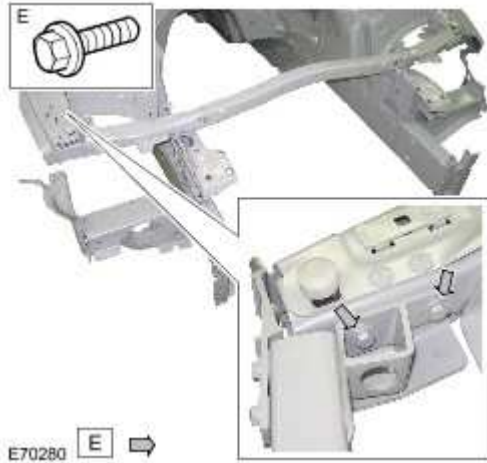


Installation

- 1 . Install is the reversal of removal.
- 2 Tighten the crossmember to fender apron panel front extension bolts to: 20 Nm (15 . lb.ft).



- 3 Tighten the crossmember to fender apron panel reinforcement bolts to: 30 Nm (22 . lb.ft).



4 . Tighten the crossmember to front side member extension bolts to: 25 Nm (18 lb.ft).



5 . Tighten the headlamp mounting bracket to crossmember bolts to: 9 Nm (7 lb.ft).



6 . Check headlamp alignment, adjust as necessary.

For additional information, refer to [Headlamp Adjustment \(86.40.18\)](#)

Fender Apron Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the fender apron panel is replaced in conjunction with the:

- front bumper cover
- front fender
- fender apron panel front extension

1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 . For further information on the methods, tools and fixings used in this procedure, refer to the body repairs - general information section.

For additional information, refer to

3 . Disconnect the battery.

For additional information, refer to

4 . Remove the front fender.

For additional information, refer to [Front Fender](#)

5 . Remove the fender apron panel front extension.

For additional information, refer to [Fender Apron Panel Front Extension](#)

6 . Remove the hood catch.

7 . Remove the cowl vent screen.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

8 . Remove the pedestrian protection hood actuator.

For additional information, refer to [Pedestrian Protection Hood Actuator LH](#)

9 . LH Side: Remove the pedestrian protection module.

For additional information, refer to [Pedestrian Protection Module](#)

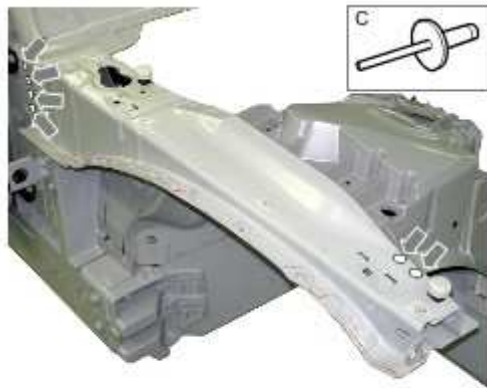
10 . RH Side: Remove the windshield washer reservoir.

For additional information, refer to [Windshield Washer Reservoir \(84.10.01\)](#)

11 . RH Side: Remove the coolant expansion tank.
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)

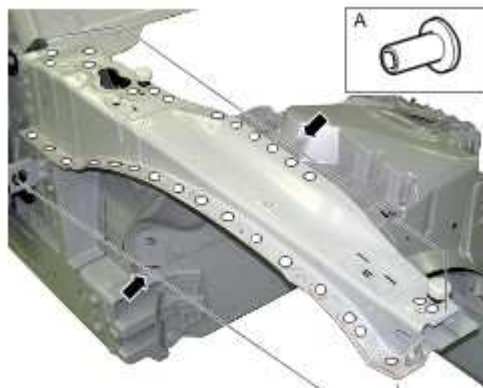
12 . Release the inner wheelhouse wiring harness and position it aside.

13 Remove 6 Monobolts, 4 from the A-Pillar and 2 from the fender apron panel reinforcement.



E72297 **C** →

14 Using a 6.5mm Cryobit drill bit, remove 15 Self Piercing Rivets, upper edge, to the fender apron panel reinforcement. Using the ESN50, remove 16 Self Piercing Rivets, lower edge, to the fender apron panel closing panel.



E72296 **A** →

15 . Separate the joints and remove the panel.

Installation

1 . Remove rivet remnants.

- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 Offer up the new panel, using the fender to aid alignment. When aligned, clamp into position.
- 4 . Remove the fender.
- 5 If re-using the fender apron panel reinforcement, transfer the location of the 13 fixing holes to the new fender apron panel, (avoiding any internal fixings), drill through using a 6.5mm Cryobit Drill Bit.



- 6 . Remove the new panel and deburr the drilled holes.



- 7 . Using a Roloc Bristle Disc, clean and prepare the new panel joint surfaces.
- 8 . Pyrosil the joints.
- 9 . Apply the coupling agent and allow to dry.
- 10 . Apply a 5mm adhesive bead to the body panel joints.
- 11 . Offer up the new panel, align and clamp into position.
- 12 Using the Genesis G4, install 13 Hemloks, part no: C2C 7792, to the fender apron panel reinforcement and install 6 Monobolts, part no: C2P 4773, 2 to the fender apron panel reinforcement and 4 to the A Pillar.



- 13 Using the ESN50, install 18 Self Piercing Rivets, part no: C2C 20590, along the lower edge, to the fender apron panel closing panel.



- 14 . Remove any excess adhesive.
- 15 . Install is the reversal of removal.

Fender Apron Panel Reinforcement

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the fender apron panel reinforcement is replaced in conjunction with the:

- front bumper cover
- front fender
- front crossmember
- fender apron panel
- fender apron panel closing panel
- fender apron panel front extension

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to [Body Repairs](#)

3 Remove the fender apron panel.

For additional information, refer to [Fender Apron Panel](#)

4 Remove the fender apron panel closing panel.

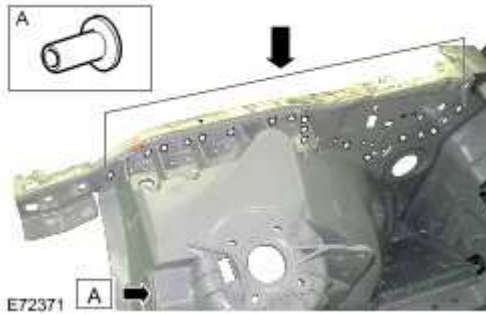
For additional information, refer to [Fender Apron Panel Closing Panel](#)

5 Remove the insulating material from the bulkhead.

6 Remove 3 Monobolts.



7 . Using a 6.5mm Cryobit drill bit, remove 18 Self Piercing Rivets.



8 . Separate joints and remove the panel.

Installation

1 . Remove rivet remnants.

2 . Using a Roloc Bristle Disc, remove adhesive residue.

3 . Offer up the new panel, align and clamp into position.

4 . Mark the position of 10 fixing holes to the suspension top mount.

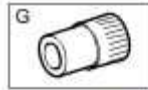
5 . Remove the new panel.

6 Drill 10 pilot holes in the new panel, in the positions marked, then, using a 9.5mm drill bit, enlarge these holes.



7 . Deburr the drilled holes.

8 Using the HES 412 Rivet Nut Tool, insert 10 Rivet Nuts, part no: C2C 10348, into the pre-drilled holes.



E72373 **G** →

9 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.

10 . Pyrosil the joints.

11 . Apply the coupling agent and allow to dry.

12 . Apply a 5mm adhesive bead to the body joints.



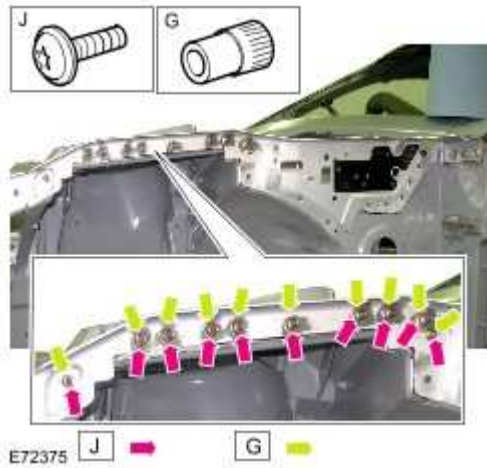
E72374

13 . Offer up the new panel, align and clamp into position.

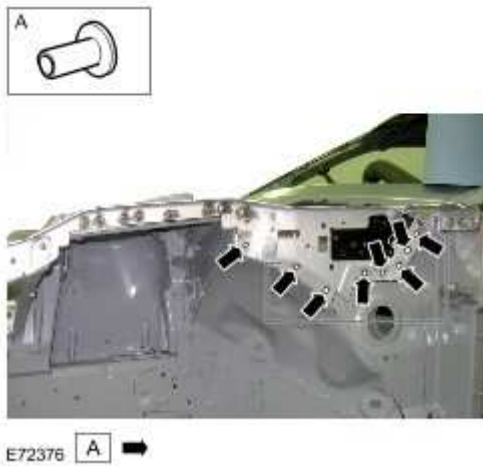
14 . **NOTE:**

The replacement fixings must be Torx screws and not Ejots.

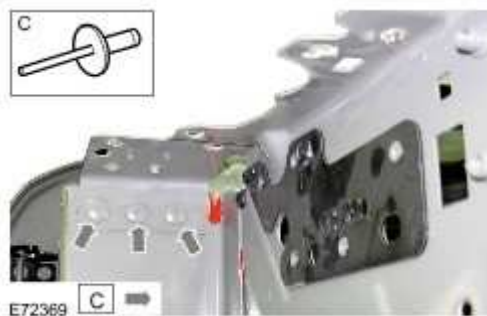
Install 10 T30 Torx screws, part no: C2G 1964, to the suspension top mount.



- 15 Using the ESN50, install 7 Self Piercing Rivets, part no: C2C 20590, 5 to the A-Pillar closing and 2 to the front wheelhouse. Install 1 Self Piercing Rivet, part no: C2C 20591, to the suspension top mount.



- 16 . Using the Genesis G4, install 3 Monobolts, part no: C2P 4773, to the A- Pillar.



- 17 . Remove any excess adhesive.

- 18 . Install is the reverse of removal.

Fender Apron Panel Closing Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the fender apron panel closing panel is replaced in conjunction with the:

- front bumper cover
- front fender
- front crossmember

1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 . Remove the front fender.

For additional information, refer to [Front Fender](#)

4 . Remove the front crossmember.

For additional information, refer to [Front Crossmember](#)

5 . Remove the hood catch.

6 . Remove the cowl vent screen.

For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)

7 . Remove the strut brace.

8 . LH Side: Remove the pedestrian protection module.

For additional information, refer to [Pedestrian Protection Module](#)

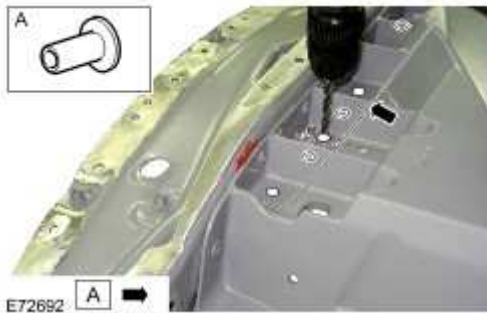
9 . RH Side: Remove the windshield washer reservoir.

For additional information, refer to [Windshield Washer Reservoir \(84.10.01\)](#)

10 . RH Side: Remove the coolant expansion tank.

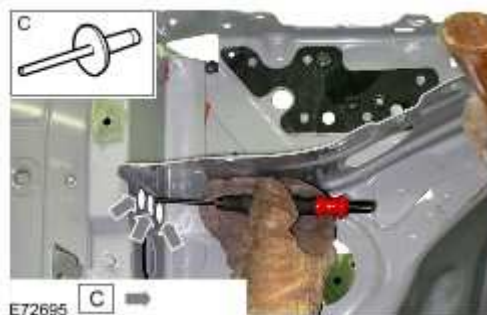
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)

- 11 . LH Side: Remove the air cleaner.
For additional information, refer to [Air Cleaner \(19.10.05\)](#)
- 12 . LH Side: Remove the power distribution box.
- 13 . LH Side: Remove the engine control module, including its bracket.
For additional information, refer to [Engine Control Module \(ECM\) \(18.30.01\)](#)
- 14 . Release the inner wheelhouse wiring harness and position it aside.
- 15 . LH Side: Remove the pollen filter housing.
- 16 . LH Side: Remove the anti-lock brake system (ABS) module.
For additional information, refer to [Anti-Lock Brake System \(ABS\) Module \(70.60.02\)](#)
- 17 . Remove the LH & RH plenum chambers.
- 18 . Remove the pedestrian protection bonnet actuator and its bracket.
- 19 . Using a 6.5mm Cryobit drill bit, remove 6 Self Piercing Rivets, from the suspension top mount.



- 20 . Using a 6.5mm Cryobit drill bit, remove 7 Self Piercing Rivets, from the fender apron panel reinforcement.

- 21 . Remove 3 Monobolts from the A-Pillar.



22 . Separate joints and remove the panel.

Installation

1 . Remove rivet remnants.

2 . Using a Roloc Bristle Disc, remove adhesive residue.

3 . Offer up the new panel, align and clamp into position.

4 . Using a 6.5mm Cryobit drill bit, drill 5 holes to the inner panel.



5 . Mark the position of the 6 fixing holes to the suspension top mount.



6 . Remove the new panel.

7 Using a 6.5mm Cryobit drill bit, drill 6 holes in the new panel, as marked, at the joint
 . with the suspension top mount.

8 . Deburr drilled holes.

9 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.

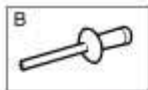
10 . Pyrosil the joints.

11 . Apply the coupling agent and allow to dry.

12 . Apply a 5mm bead of adhesive to the new panel joints.

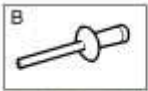
13 . Offer up the new panel, align and clamp into position.

14 Using the Genesis G4, install 6 Hemlocks, part no: C2C 10349, to the suspension top mount.



E73838 B ⇨

15 Using the Genesis G4, install 5 Hemlocks, part no: C2C 10349, to the fender apron panel reinforcement.

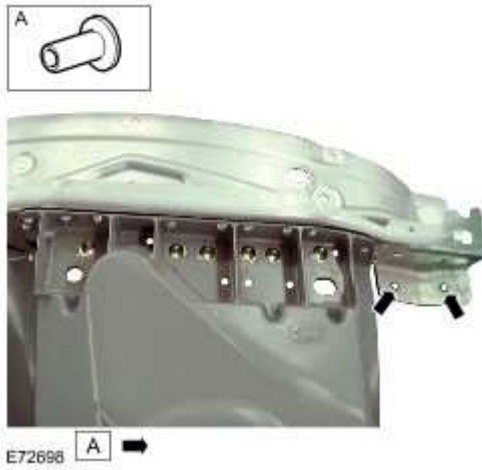


E72699 B ⇨

16 . Using the Genesis G4, install 3 Monobolts, part no: C2P 4773, to the A Pillar.



- 17 . Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20590, to the fender apron panel reinforcement.



- 18 . Remove any excess adhesive.
- 19 . Install is the reversal of removal.

Front Side Member

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the front side member is replaced in conjunction with the:

- front bumper cover
- front bumper
- auxiliary front crossmember
- hood
- front crossmember
- front side member side extension
- suspension top mount
- front side member side extension mounting
- front side member deformation element
- front side member to deformation element bracket

NOTE:

It is necessary to remove the engine and suspension as an assembly.

NOTE:

It is necessary to remove the front side member lower inner and the front side member closing panel assembly to enable the fitment of the front side member. These panels cannot be reused and will require replacement.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Remove the front crossmember.
For additional information, refer to [Front Crossmember](#)
- 4 Remove the front side member to deformation element bracket.
For additional information, refer to [Front Side Member To Deformation Element Bracket](#)
- 5 . Remove the suspension top mount.

For additional information, refer to [Suspension Top Mount](#)

NOTE:

This procedure assumes that the suspension top mount is damaged and has been removed, however, the front side member can be replaced with the suspension top mount in situ.

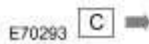
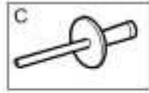
- 6 . Remove the engine and front suspension as an assembly.
- 7 . Remove the cowl vent screen.
For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)
- 8 . LH Side: Remove the junction box.
- 9 . RH Side: Remove the coolant expansion tank.
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)
- 10 . LH Side: Remove the A/C pipe.
- 11 . LH Side: Remove the fuel pipes.
- 12 . LH Side: Remove the Anti-lock Brake System, (ABS), module.
For additional information, refer to [Anti-Lock Brake System \(ABS\) Module \(70.60.02\)](#)
- 13 . LH Side: Remove the engine control module, (ECM) and its mounting bracket.
For additional information, refer to [Engine Control Module \(ECM\) \(18.30.01\)](#)
- 14 . RH Only: Remove the secondary air injection pump.
For additional information, refer to [Secondary Air Injection \(AIR\) Pump](#)
- 15 . LH Side: Remove the pollen filter housing.
- 16 . Remove the steering column lower shaft.
For additional information, refer to [Steering Column Lower Shaft \(57.40.05\)](#)
- 17 . Remove the brake pipes along the side member.
- 18 . Remove the side member exhaust heat shield.
- 19 . Remove the insulating material from the bulkhead.
- 20 . Remove the LH and RH plenum chambers.
- 21 . Remove the heater supply and return hoses.

22 . Remove the brake pipes from the bulkhead.

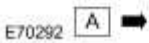
23 . Release the side member wiring harness and position it aside.

24 The following steps identify the procedure for removing the front side member lower inner.

25 . Remove 3 Monobolts.

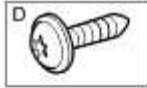


26 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 10 Self Piercing Rivets.



27  **CAUTION: Do not discard the Ejots. They are to be re-used during installation.**

Remove 10 T30 Ejots.



E72475 D →

28 NOTE:

- Take care when making the saw cut, do not cut into the reinforcement under the panel.

Saw cut the old panel along the point shown in the illustration. This allows the panel to be removed without the need to disturb the joint at the bulkhead / floor panel.



E70295

29 . Separate the joints and remove the front side member lower inner.

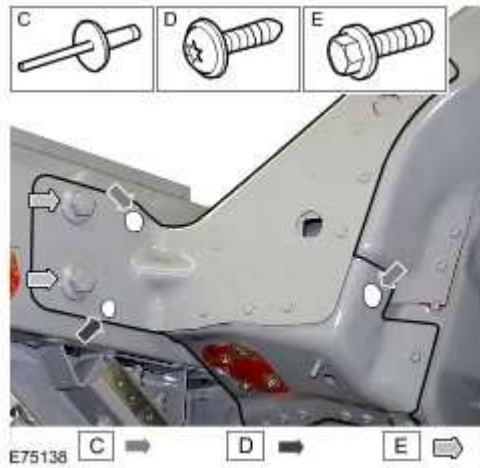
30 . Remove the rivet remnants.

31 Using a Roloc Bristle Disc, remove any adhesive residue and clean and prepare the panel joint surfaces.

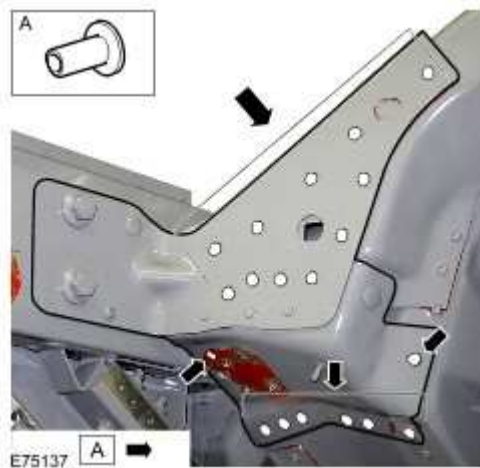
32 The following steps identify the procedure for removing the front side member closing panel assembly.

33  **CAUTION: Do not discard the Ejot. It is to be re-used during installation.**

Remove 2 Monobolts, remove 2 21mm bolts and 1 T30 Ejot.



34 . Using a 6.5mm Cryobit drill bit, remove 18 Self Piercing Rivets, (19 on the LH side).



35 **NOTE:**

- On removal, keep panel damage to a minimum as it will be used as a template for the new panel.

Separate the joints and remove the front side member closing panel assembly. Retain the old panel for use as a template.

36 . Remove the rivet remnants.

37 Using a Roloc Bristle Disc, remove any adhesive residue and clean and prepare the panel joint surfaces.

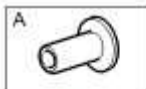
38 . The following steps identify the procedure for removing the front side member.

39 . Remove 2 21mm bolts and 2 13mm bolts.



E72484 **E** ➡

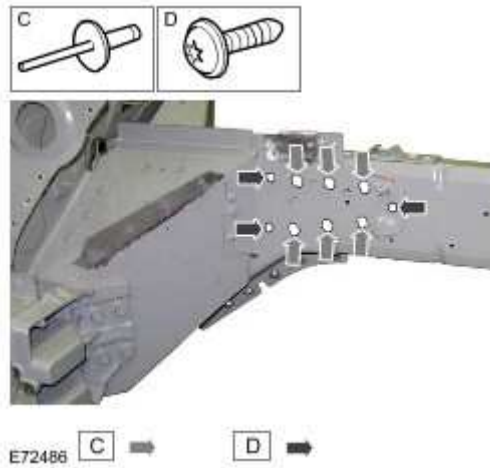
- 40 Using a Belt Sander, remove the "button" heads of 2 Self Piercing Rivets, located at the rear of the side member. Using the ESN50, remove these 2 rivets plus a further 3 Self Piercing Rivets. Using a 6.5mm Cryobit drill bit, remove a further 5 Self Piercing Rivets from the bulkhead reinforcement.



E72485 **A** ➡

- 41  **CAUTION: Do not discard the Ejots. They are to be re-used during installation.**

Remove 6 Monobolts and 3 Ejots.



42 . Separate the joints and remove the front side member.

Installation

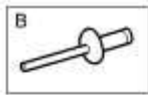
- 1 . Remove the rivet remnants.
- 2 . Using a Roloc Bristle Disc, remove any adhesive residue.
- 3 Offer up the new panel and secure using the 4 21mm and 2 13mm bolts. Check
 . alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 4 When aligned, clamp into position. Using a 6.5mm Cryobit drill bit, drill 3 holes which
 . were Ejot fixings in the original front side member.



- 5 Mark the positions of 10 fixing holes. 5 From underneath, illustrated at 1 and 5 along
 . the top flange, illustrated at 2.

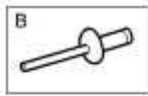


- 6 . Remove the new panel and using a 6.5mm Cryobit drill bit, drill the 10 marked holes.
- 7 . Deburr the drilled holes.
- 8 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.
- 9 . Pyrosil the joints.
- 10 . Apply the coupling agent and allow to dry.
- 11 . Apply a 5mm adhesive bead to the body joints.
- 12 Offer up the new panel and secure using the 4 21mm and 2 13mm bolts. Tighten the
. 21mm bolts to 133 Nm (98 lb.ft).
- 13 Check alignment, if correct proceed to the next step, if not, rectify and recheck before
. proceeding.
- 14 . Using the Genesis G4, install 5 Hemloks, part no: C2C 10349.



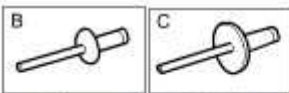
E72489 **B** →

15 . Using the Genesis G4, install 5 Hemloks, part no: C2C 10349.



E72490 **B** →

16 Using the Genesis G4, install 3 Hemloks, part no: C2C 10349 and 6 Monobolts, part no: C2P 4773.



E72491 **B** → **C** →

17 . Remove any excess adhesive.

NOTE:

Allow the adhesive applied to the front side member to cure before installing the front side member closing panel assembly.

18 The following steps identify the procedure for installing the front side member closing panel assembly.

19 . Remove 2 21mm bolts from the front side member.

20 From the old panel, cut a template, as illustrated, to use for alignment of the new panel.



21 . Offer up the new panel to the car and scribe around the inside of the 2 facing holes.



22 Offer up the template to the car and ensure that the scribe marks and original fixing holes are aligned, if not, rectify and recheck before proceeding.


23 Clamp the template to the new panel and using a 6.5mm Cryobit drill bit, drill through the 11 holes, (12 on the LH), into the new panel.

24 Offer up the new panel, align and clamp into position, use the 2 21mm bolts to secure.

25 Using a 6.5mm Cryobit drill bit, drill 1 hole, illustrated at 1, through the new panel into the front side member.



E75141

- 26  **CAUTION: Take care not to drill right through as this will go into the vehicle. Drill only through the new panel and 2 further panel thicknesses.**

Using a 6.5mm Cryobit drill bit, drill 1 hole, illustrated at 2, through the new panel into the tunnel, (there are 2 holes on the LH side).



E75141

- 27 . From inside the vehicle, mark the positions of 5 fixing holes for drilling.



E75142

- 28 . Remove the new panel.
- 29 . Using a 6.5mm Cryobit drill bit, drill the 5 holes in the new panel, as marked.
- 30 . Deburr the drilled holes.
- 31 . Using a Roloc Bristle Disc, clean and prepare the new panel joint surfaces.

32 . Pyrosil the joints.

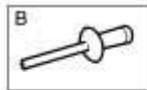
33 . Apply the coupling agent and allow to dry.

34 . Apply a 5mm adhesive bead to the body joints.



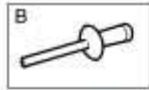
35 . Offer up the new panel and use the 2 21mm bolts to loose fit.

36 . Using the Genesis G4, install 7 Hemloks, part no: C2C 10349.



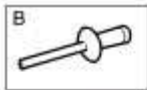
E75145 **B** →

37 . Using the Genesis G4, install 1 Hemlok, part no: C2C 10349.



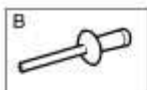
E75209 **B** →

38 . Using the Genesis G4, install 4 Hemloks, part no: C2C 22613.



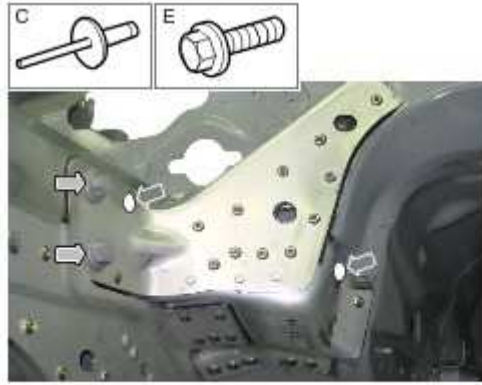
E75208 **B** →

39 . Using the Genesis G4, install 6 Hemloks, (7 on the LH side), part no: C2C 9818.



E75210 **B** →

40 Using the Genesis G4, install 2 Monobolts, part no: C2P 4773. Then, fully tighten the
2 21mm bolts to 133 Nm (98 lb.ft).



E75146 C → E →

41 . Remove any excess adhesive.

42 The following steps identify the procedure for installing the front side member lower inner.

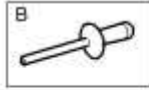
43 Saw cut a section of the new panel corresponding to the part cut from the old panel, as shown in the illustration. Ensure an allowance is made for overlap.



E70296

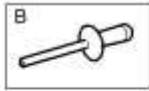
44 . Offer up the new panel, align and clamp into position.

45 Using a 6.5mm Cryobit drill bit, drill 13 holes. Use the existing holes in the body as a guide.



E70299 **B** ⇒

- 46 . Using a 6.5mm Cryobit drill bit, drill 5 holes at the point where the old and new panels overlap.



E72253 **B** ⇒

- 47 . Remove the new panel.

- 48 . Deburr the drilled holes.


- 49 . Pyrosil the joints.



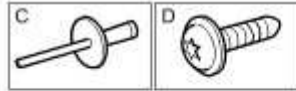
E70297

50 . Apply the coupling agent and allow to dry.

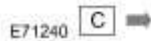
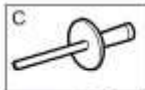
51 . Apply a 5mm adhesive bead to the body joints.

52  **CAUTION: If the original Ejot cannot be re-used, and the original thread remains intact, then a Torx screw (C2C 1964) can be used in its place.**

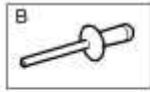
Install 8 original Ejots. Using the Genesis G4, install 1 Monobolt, part no: C2P 4773.



53 . Using the Genesis G4, install 2 Monobolts, part no: C2P 4773.

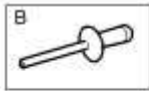


54 . Using the Genesis G4, install 13 Hemloks, part no: C2C 10349.



E70299 **B** ⇨

55 . Using the Genesis G4, install 5 Hemloks, part no: C2C 22613.



E72253 **B** ⇨

56 . Remove any excess adhesive.

57 . Install of mechanical components is the reversal of removal.

Side Member Deformation Element

Removal

NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the side member deformation element is replaced in conjunction with the:

- front bumper cover
- front bumper
- auxiliary front crossmember
- front side member side extension
- front side member side extension mounting

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

NOTE:

Whenever there is damage to the side member deformation element, the front side member to deformation element bracket must always be checked for damage. Where damage is evident or suspected, the bracket must be renewed.

For additional information, refer to [Front Side Member To Deformation Element Bracket](#)

3 . Remove the front bumper.

For additional information, refer to [Front Bumper \(76.22.08\)](#)

4 . Remove the auxiliary front crossmember.

For additional information, refer to [Auxiliary Front Crossmember](#)

5 . Remove the front side member side extension mounting.

For additional information, refer to [Front Side Member Side Extension Mounting](#)

6 Remove the radiator and A/C condenser.

. For additional information, refer to [Radiator - Vehicles Without: Supercharger \(26.40.01\)](#)

7 . RH Side: Remove the fender splash shield.

8 . Release the deformation element wiring harness and position it aside.

9 . Remove 2 T50 Torx bolts, (RH Illustrated).



10 . Remove 4 T50 Torx bolts, (only 2 on LH), RH Illustrated.



Installation

1 Install is the reversal of removal. Tighten the deformation element bolts to 70 Nm (52 lb.ft).

Front Side Member Extension

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the front side member extension is replaced in conjunction with the:

- front bumper
- auxiliary front crossmember
- front crossmember
- hood
- side member deformation element
- side member side extension
- side member side extension mounting

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 . Remove the auxiliary front crossmember to subframe brace.

4 . Remove the exhaust manifold heat shield.

5 Drain the cooling system.

. For additional information, refer to [Cooling System Draining, Filling and Bleeding - 4.2L NA V8 - AJV8](#)

6 . RH Side: Remove the heater pipes.

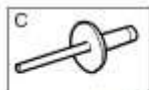
7 . Release the side member wiring harness and position it aside.

8 . LH Side: Release the A/C pipes and position them aside.

NOTE:

In this procedure the engine remains in the vehicle. The mechanical components listed below are removed to allow access for the Genesis G4. If the engine is removed it is not necessary to remove these additional components.

- 9 . LH Side: Remove the radiator bottom hose.
- 10 . RH Side: Remove the radiator top hose.
- 11 LH Side: Remove the PAS pump.
 - . For additional information, refer to [Power Steering Pump - 4.2L NA V8 - AJV8 \(57.20.14\)](#)
- 12 LH Side: Remove the A/C compressor.
 - . For additional information, refer to [Air Conditioning \(A/C\) Compressor - 4.2L NA V8 - AJV8 \(82.10.20\)](#)
- 13 . RH Side: Remove the generator.
 - For additional information, refer to [Generator - 4.2L NA V8 - AJV8 \(86.10.02\)](#)
- 14 . Remove the hood.
 - For additional information, refer to [Hood \(76.16.01\)](#)
- 15 . Remove the front crossmember.
 - For additional information, refer to [Front Crossmember](#)
- 16 . Remove the side member deformation element.
 - For additional information, refer to [Side Member Deformation Element](#)
- 17 . Remove the hood hinge.
- 18 . Remove 5 Monobolts from the side member.



E73237 C →

- 19 Using the ESN50, remove 2 Self Piercing Rivets, from the side member, as shown in the inset. Using a 6.5mm Cryobit Drill Bit remove 2 Self Piercing Rivets, from the suspension top mount.



20 . Separate joints and remove the panel.

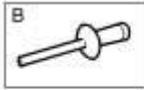
Installation

- 1 . Remove rivet remnants.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.



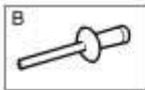
- 3 Offer up the new panel and clamp into position, using the front crossmember to aid . alignment.
- 4 Check alignment, if correct proceed to next step, if not, rectify and recheck before . proceeding.
- 5 Using a 6.5mm Cryobit Drill Bit, drill 4 holes at the points shown; 2 through the side

- member and 2 through the suspension top mount, into the new panel, ready for Hemlok fixings.



E73073 **B** ⇨

- 6 . Remove the new panel.
- 7 . Deburr the drilled holes.
- 8 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.
- 9 . Pyrosil the joints.
- 10 . Apply the coupling agent and allow to dry.
- 11 . Apply a 5mm adhesive bead to the new panel joints.
- 12 . Offer up the new panel, align and clamp into position.
- 13 Using the Genesis G4, install 4 Hemloks; 2 to the suspension top mount and 2 to the side member, part no: C2C 7792.

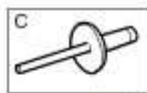


E73073 **B** ⇨

- 14 The illustration shows the Genesis G4 being used with the engine in place. In order to gain access the "catcher" chamber of the Genesis G4 has to be removed. This does not affect the operation or safety of the gun. However, to prevent the remnant being ejected into any engine bay components, a plastic bag should be attached to collect it.



- 15 . Using the Genesis G4, install 5 Monobolts, part no: C2P 4773, to the side member.



- 16 . Remove any excess adhesive.
- 17 . Install is the reversal of removal.

Front Wheelhouse

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the front wheelhouse is replaced in conjunction with the:

- front bumper cover
- front fender
- front crossmember
- fender apron panel
- fender apron panel closing panel
- fender apron panel reinforcement
- fender apron panel front extension

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

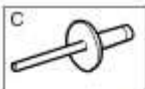
2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.



For additional information, refer to

3 Remove the fender apron panel reinforcement.

For additional information, refer to [Fender Apron Panel Reinforcement](#)

4 Remove 4 Monobolts, from the torque box.



E75009  

- 5 Using a 6.5mm Cryobit Drill Bit, remove 1 Self Piercing Rivet, from the front side member lower outer.



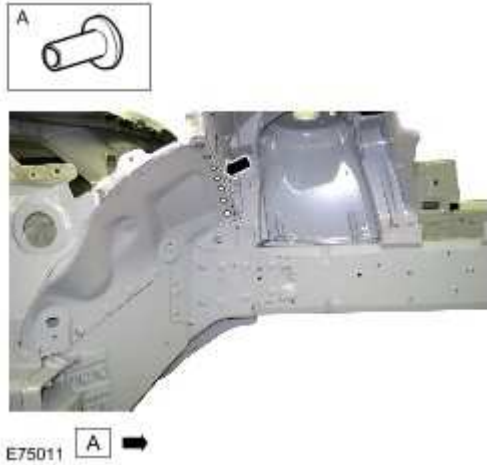
E75010 **A** →

- 6 Using a combination of the ESN50 and 6.5mm Cryobit Drill Bit, remove 6 Self Piercing Rivets, from the A-Pillar closing panel.



E75008 **A** →

- 7 Using a combination of the ESN50 and 6.5mm Cryobit Drill Bit, remove 7 Self Piercing Rivets, from the suspension top mount.



8 . Separate the joints and remove the panel.

Installation

- 1 . Remove rivet remnants.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 . Where necessary, dress the flanges of adjacent panels.
- 4 . Offer up the new panel and clamp into position.
- 5 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 6 . Using a 6.5mm Cryobit Drill Bit, drill 12 holes ready for Hemlok fixings.



- 7 . Remove the new panel.
- 8 . Deburr the drilled holes.

9 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.

10 . Pyrosil the joints.

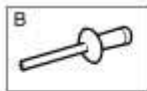
11 . Apply the coupling agent and allow to dry.

12 . Apply a 5mm adhesive bead to the new panel joints.

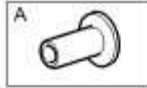


13 . Offer up the new panel, align and clamp into position.

14 Using the Genesis G4, install 12 Hemlocks, part no: C2C 7792, 7 to the suspension top mount, 4 to the A-Pillar closing panel and 1 to the side member lower outer.

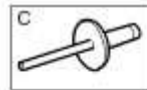


15 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20589 to the A-Pillar closing panel.



E75013 **A** →

16 . Using the Genesis G4, install 4 Monobolts, part no: C2P 4773, to the torque box.



E72628 **C** →

17 . Remove any excess adhesive.

18 . Install is the reversal of removal.

Fender Apron Panel Front Extension

Removal

NOTE:

This is a category 'A' repair

NOTE:

In this procedure the fender apron panel front extension is replaced in conjunction with the:

- front bumper cover
- front fender
- front crossmember

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure, refer to the body repairs - general information section.

For additional information, refer to

3 . Remove the front fender.

For additional information, refer to [Front Fender](#)

4 . Remove the front crossmember.

For additional information, refer to [Front Crossmember](#)

5 . Using the ESN50, remove 1 Self Piercing Rivet to the fender apron panel.



Installation

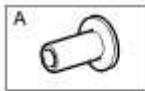
- 1 . Remove the rivet remnant and deburr the hole.



2 NOTE:

- The original Rivet hole should be filled using adhesive.

Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20590, to the fender apron panel.



E72642 **A** →

- 3 . Install is the reversal of removal.

Front Side Member Side Extension

Removal

NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the front side member side extension is replaced in conjunction with the:

- front bumper cover
- front fender

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 Remove the front fender.

For additional information, refer to [Front Fender](#)

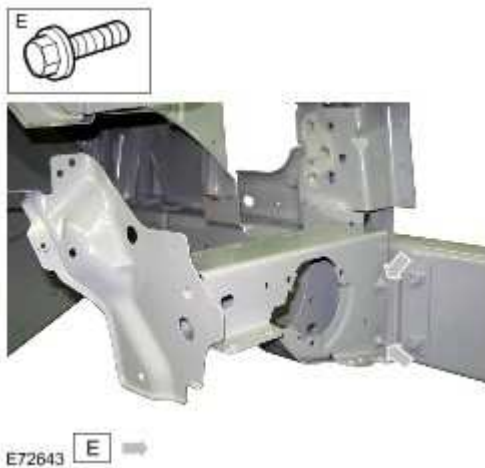
4 LH Only: Remove the air cleaner.

For additional information, refer to [Air Cleaner \(19.10.05\)](#)

5 RH Only: Remove the secondary air injection pump.

For additional information, refer to [Secondary Air Injection \(AIR\) Pump](#)

6 Remove 2 10mm bolts.



Installation

- 1 Offer up the new panel, using the fender for alignment. When aligned tighten bolts to . 25 Nm (18 lb.ft).
- 2 . Install is the reversal of removal.

Auxiliary Front Crossmember

Removal

NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the auxiliary front crossmember is replaced in conjunction with the:

- front bumper cover

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

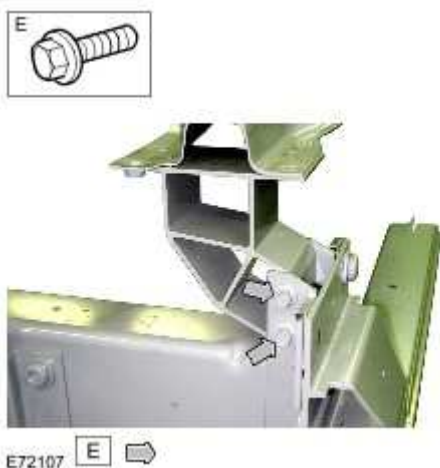
For additional information, refer to

3 Remove the front bumper cover

For additional information, refer to [Front Bumper Cover \(76.22.78\)](#)

4 Remove the fan cowl.

5 Remove 4 10mm bolts, 2 each side, to the side member deformation element and remove the panel.



Installation

1 Offer up new panel, align and secure using the 4 10mm bolts, 2 each side. Tighten the
. bolts to 25 Nm (18 lb.ft).

2 . Install is the reversal of removal.

Front Side Member Side Extension Mounting

Removal

NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the front side member side extension mounting is replaced in conjunction with the:

- front bumper cover
- front fender
- front side member side extension

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

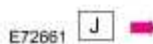
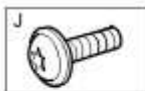
2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 Remove the front side member side extension.

For additional information, refer to [Front Side Member Side Extension](#)

4 Remove 4 T50 Torx bolts.



Installation

- 1 . Offer up the new panel and tighten the bolts to 70 Nm (52 lb.ft).
- 2 . Install is the reversal of removal.

Front Side Member To Deformation Element Bracket

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the front side member to deformation element bracket is replaced in conjunction with the:

- front bumper cover
- front bumper
- auxiliary front crossmember
- side member side extension
- side member side extension mounting
- side member deformation element

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to

NOTE:

Whenever there is damage to the deformation element, the front side member to deformation element bracket must always be checked for damage. Where damage is evident or suspected the bracket must be renewed.

NOTE:

Whenever there is damage to the front side member, the front side member to deformation element bracket must always be renewed. When renewing the bracket and side member in combination, removal of the bracket is not required.

- 3 . Remove the side member deformation element.
For additional information, refer to [Side Member Deformation Element](#)
- 4 . Remove 4 Monobolts.



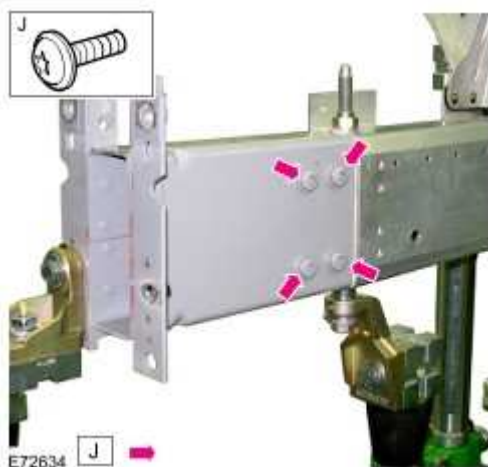
5 NOTE:

- Take care not to damage the side member when removing the bracket.

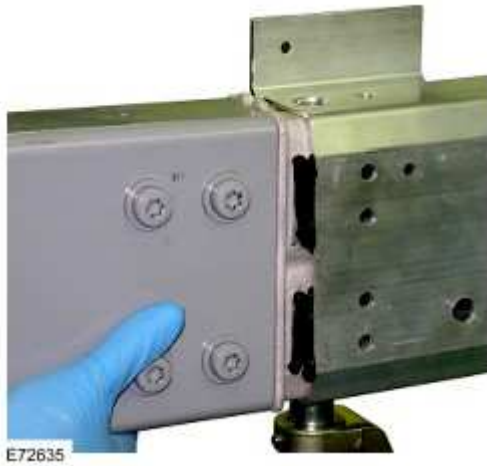
Separate and remove the bracket from the side member. Adhesive is applied in production so the bracket will need to be eased from the side member, use a hammer and chisel on the lip of the bracket to remove.

Installation

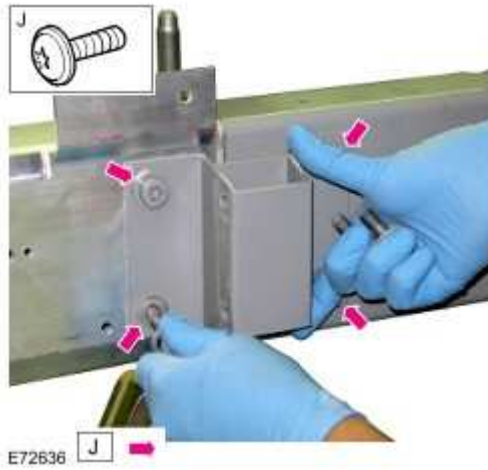
- 1 . Using a belt sander, remove adhesive residue from inside the side member.
- 2 . Bolt the bracket to the side member using 1 subframe bolt and 2 T50 Torx bolts.
- 3 Install the side member deformation element and fix with 6 T50 Torx bolts, (4 on LH . Side).



- 4 Check alignment, if correct, tighten the bolts to the deformation element to 70 Nm (52 lb.ft), if not, rectify and recheck before proceeding.
- 5 Following a successful dry fit, remove the bracket with the deformation element attached.
- 6 Using a Roloc Bristle Disc, clean and prepare the bracket at its joint with the side member, (engine bay side only).
- 7 . Pyrosil the joints.
- 8 . Apply the coupling agent and allow to dry.
- 9 . Apply a 5mm adhesive bead to the bracket on the engine bay side.
- 10 . Slide the bracket into the side member.



- 11 Bolt on the front side member side extension mounting using its 4 T50 Torx bolts.
Check alignment. If alignment is correct, tighten the bolts to 70 Nm (52 lb.ft), if not, rectify and recheck before proceeding.



12 . Using the Genesis G4, renew 4 Monobolts, part no: C2P 4773.



13 . Remove any excess adhesive.

14 . Install is the reversal of removal.

Suspension Top Mount

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the suspension top mount is replaced in conjunction with:

- front bumper cover
- front bumper
- auxiliary front crossmember
- front crossmember
- front fender
- fender apron panel
- side member extension

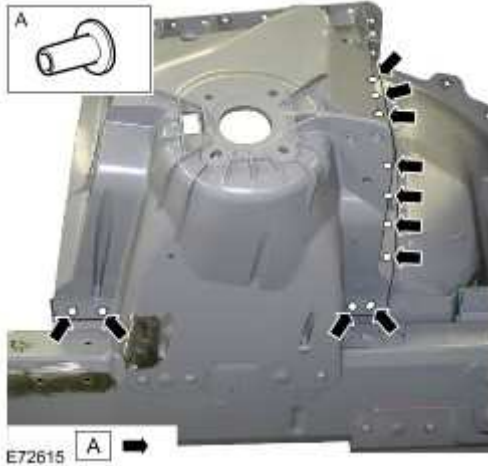
NOTE:

It is also necessary to remove the engine and suspension as an assembly.

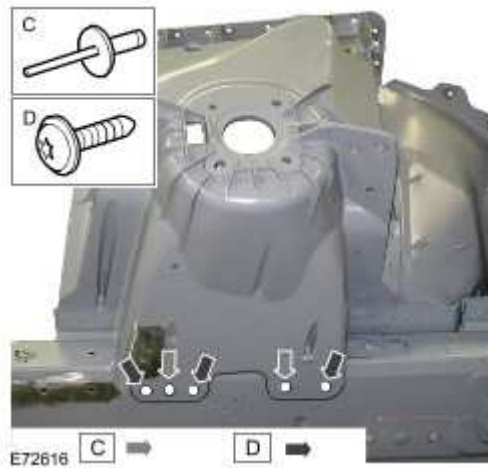
- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the front bumper.
For additional information, refer to [Front Bumper \(76.22.08\)](#)
- 4 . Remove the engine and suspension as an assembly.
- 5 . Remove the cowl vent screen.
For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)
- 6 . Remove the LH & RH plenum chambers.
- 7 . LH Side: Remove the junction box.
- 8 . LH Side: Remove the air cleaner.
For additional information, refer to [Air Cleaner \(19.10.05\)](#)

- 9 . Remove the LH and RH strut braces.
- 10 . Remove the heater supply and return hoses
- 11 . Release the brake pipes at the bulkhead and position them aside.
- 12 . Release the brake pipes at the side member / inner wheelhouse and position them
aside.
- 13 . Remove the insulating material from the bulkhead.
- 14 . LH Side: Remove the A/C lines.
- 15 . LH Side: Remove the upper suspension arm.
For additional information, refer to [Upper Arm LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 \(60.35.41\)](#)
- 16 . RH Side: Remove the upper suspension arm.
For additional information, refer to [Upper Arm RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 \(60.35.42\)](#)
- 17 . RH Side: Remove the windshield washer reservoir.
For additional information, refer to [Windshield Washer Reservoir \(84.10.01\)](#)
- 18 . RH Side: Remove the coolant expansion tank.
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)
- 19 . Release the side member and inner wheelhouse wiring harness and position it aside.
- 20 . LH Side: Remove the engine control module (ECM) and its mounting bracket.
For additional information, refer to [Engine Control Module \(ECM\) \(18.30.01\)](#)
- 21 . LH Side: Remove the pollen filter housing.
- 22 . LH Side: Release the fuel pipes and position them aside.
- 23 . Remove the auxiliary front crossmember.
For additional information, refer to [Auxiliary Front Crossmember](#)
- 24 . Remove the fender apron panel.
For additional information, refer to [Fender Apron Panel](#)
- 25 . Remove the front side member extension.
For additional information, refer to [Front Side Member Extension](#)

- 26 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 11 Self Piercing Rivets.



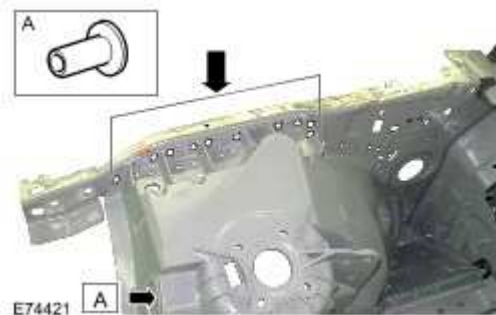
- 27 . Remove 2 Monobolts and 3 Ejots, from the side member.



- 28 Using a 6.5mm Cryobit drill bit, remove 6 Self Piercing Rivets, from the fender apron panel closing panel.



- 29 Using a 6.5mm Cryobit drill bit, remove 10 Self Piercing Rivets, to the fender apron panel reinforcement.



30 . Separate joints and remove the panel.

Installation

- 1 . Remove rivet remnants.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 Offer up new panel and bolt to jig. Use Monobolt holes to aid alignment. If alignment . is correct proceed to next step, if not, rectify and recheck before proceeding.
- 4 Using a 6.5mm Cryobit drill bit, drill 10 holes, through the fender apron panel . reinforcement into the suspension top mount.
- 5 Using a 6.5mm Cryobit drill bit, drill 6 holes, through the fender apron panel closing . panel into the suspension top mount.
- 6 Using a 6.5mm Cryobit drill bit, drill 7 holes, through the front wheelhouse into the . suspension top mount.
- 7 Using a 6.5mm Cryobit drill bit, drill 2 holes, through the front side member into the . suspension top mount.
- 8 Using a 6.5mm Cryobit drill bit, drill 2 holes, through the side member lower outer . into the suspension top mount.
- 9 If a new side member is being fitted: An additional 3 holes will need to be drilled in the . positions of the original Ejots, as these will be replaced with Hemloks, part no: C2C 10349.



10 . Remove the new panel.

11 Using a 9.5mm drill bit, enlarge the 10 holes in the fender apron panel reinforcement.
 . Deburr the drilled holes and then, using the HES 412 Rivet Nut Tool, insert 10 Rivet Nuts into the drilled holes.

12 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.

13 . Pyrosil the joints.

14 . Apply the coupling and allow to dry.

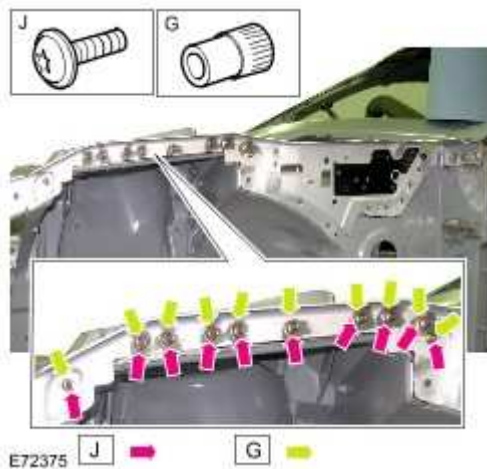
15 . Apply a 5mm adhesive bead to the new panel joints.

16 . Bolt new panel to jig bracket, align and clamp to the side member.

17 . **NOTE:**

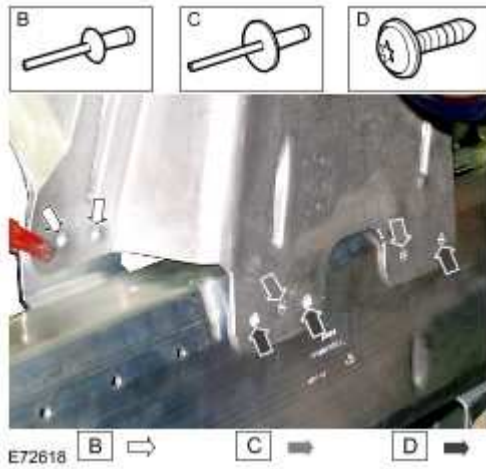
The replacement fixings must be Torx Screws and not Ejots.

Install 10 T30 Torx screws to the suspension top mount.

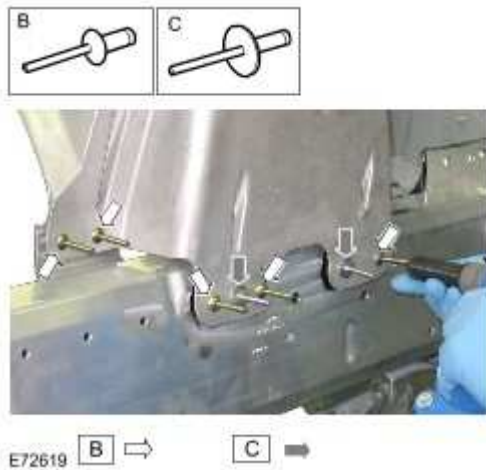


18 . Install 3 Ejots, (not applicable when a new side member is being installed).

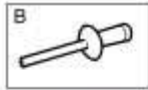
- 19 If the original side member is re-used: Install 3 Ejots and using the Genesis G4, install 2 Hemloks, part no: C2C 10349 and 2 Monobolts, part no: C2P 4773.



- 20 If a new side member is being installed: Using the Genesis G4, install 5 Hemloks, part no: C2C 10349 and 2 Monobolts, part no: C2P 4773.

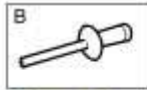


- 21 Using the Genesis G4, install 6 Hemloks, part no: C2C 10349, to the suspension top mount.



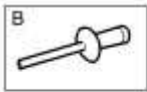
E73838 **B** →

- 22 Using the Genesis G4, install 7 Hemloks, part no: C2C 10349, to the front wheelhouse.



E72620 **B** →

- 23 Using the Genesis G4, install 2 Hemloks, part no: C2C 10349, to the side member lower outer.



E72621 **B** →

24 . Remove any excess adhesive.

25 . Install is the reversal of removal.

Front Side Member and Suspension Top Mount Assembly

Removal

NOTE:

This is a category 'A' repair

NOTE:

In this procedure the front side member and suspension top mount assembly is replaced in conjunction with the:

- front bumper cover
- front bumper
- auxiliary front crossmember
- front fender
- hood
- front crossmember
- front side member side extension
- front side member side extension mounting
- bulkhead lower reinforcement
- fender apron panel
- fender apron panel closing panel
- fender apron panel reinforcement

NOTE:

It is also necessary to remove the engine and suspension as an assembly.

NOTE:

It is necessary to remove the secondary, inner, floor panel and the front side member closing panel to enable the fitment of the front side member and suspension top mount assembly. These panels cannot be reused and will require replacement, the closing panel should be retained for use as a template.

- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Remove the front side member side extension mounting.
For additional information, refer to [Front Side Member Side Extension Mounting](#)
- 4 . Remove the front bumper.
For additional information, refer to [Front Bumper \(76.22.08\)](#)
- 5 . Remove the hood.
- 6 . Remove the auxiliary front crossmember.
For additional information, refer to [Auxiliary Front Crossmember](#)
- 7 . Remove the fender apron panel reinforcement.
For additional information, refer to [Fender Apron Panel Reinforcement](#)
- 8 . Remove the bulkhead lower reinforcement.
For additional information, refer to [Bulkhead Lower Reinforcement](#)
- 9 . Remove the front seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 10 . Remove the RH rear seat cushion.
For additional information, refer to [Rear Seat Cushion \(76.70.37\)](#)
- 11 . Remove the rear quarter trim panel.
For additional information, refer to [Rear Quarter Trim Panel - 2-Door \(76.13.73\)](#)
- 12 . Remove the carpet.
- 13 . Remove the instrument panel.
For additional information, refer to [Instrument Panel \(76.46.01\)](#)
- 14 . Remove the cowl vent screen.
For additional information, refer to [Cowl Vent Screen \(76.10.01\)](#)
- 15 . Remove the LH & RH plenum chambers.
- 16 . LH Side: Remove the junction box.

- 17 . LH Side: Remove the air cleaner.
For additional information, refer to [Air Cleaner \(19.10.05\)](#)
- 18 . Remove the LH and RH strut braces.
- 19 . Remove the heater supply and return hoses.
- 20 . Release the brake pipes at the bulkhead and position them aside.
- 21 . Release the brake pipes at the side member / inner wheelhouse and position them
. aside.
- 22 . RH Side: Remove the coolant expansion tank.
For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)
- 23 . LH Side: Remove the A/C pipe.
- 24 . LH Side: Remove the Anti-lock Brake System, (ABS), module.
. For additional information, refer to [Anti-Lock Brake System \(ABS\) Module \(70.60.02\)](#)
- 25 . LH Side: Remove the engine control module, (ECM) and its mounting bracket.
For additional information, refer to [Engine Control Module \(ECM\) \(18.30.01\)](#)
- 26 . RH Only: Remove the secondary air injection pump.
For additional information, refer to [Secondary Air Injection \(AIR\) Pump](#)
- 27 . LH Side: Remove the pollen filter housing.
- 28 . Remove the steering column lower shaft.
For additional information, refer to [Steering Column Lower Shaft \(57.40.05\)](#)
- 29 . LH Side: Remove the upper suspension arm.
. For additional information, refer to [Upper Arm LH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 \(60.35.41\)](#)
- 30 . RH Side: Remove the upper suspension arm.
. For additional information, refer to [Upper Arm RH - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 \(60.35.42\)](#)
- 31 . RH Side: Remove the windshield washer reservoir.
For additional information, refer to [Windshield Washer Reservoir \(84.10.01\)](#)
- 32 . RH Side: Remove the coolant expansion tank.

For additional information, refer to [Coolant Expansion Tank \(26.15.01\)](#)

33 . Release the side member and inner wheelhouse wiring harness and position it aside.

34 . LH Side: Release the fuel pipes and position them aside.

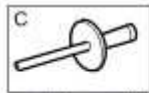
35 . Remove the side member exhaust heat shield.

36 . Remove the insulating material from the bulkhead.

37 . Remove the engine and suspension as an assembly.

38 The following steps identify the procedure for removing the secondary, inner, floor panel.

39 . Remove 17 Monobolts.



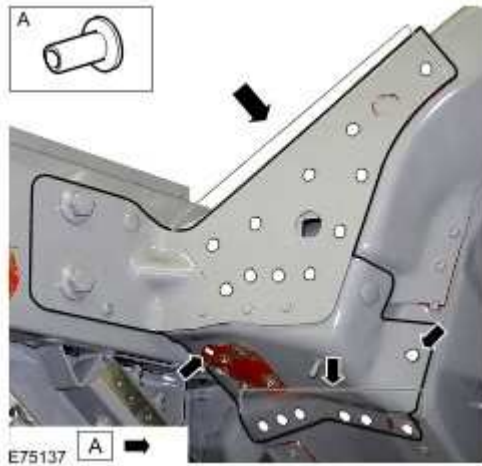
E76744 C →

40 . Separate the joints and remove the secondary, (inner), floor panel.

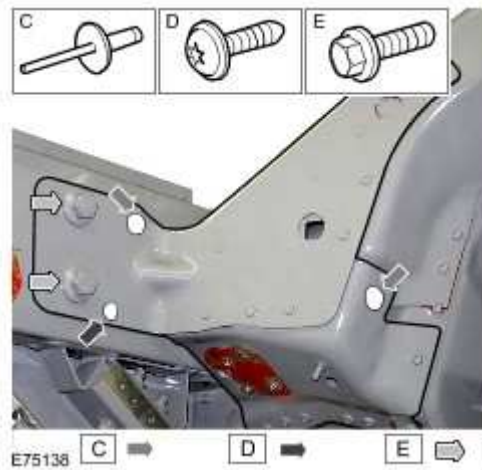
41 The following steps identify the procedure for removing the front side member closing panel.

42 Using a 6.5mm Cryobit Drill Bit, remove 4 Self Piercing Rivets from the front side member lower inner. Separate this joint and bend down to reveal 1 "hidden" self piercing rivet.

43 Using a 6.5mm Cryobit drill bit, remove 18 Self Piercing Rivets, (19 on the LH side). This joint includes the 1 "hidden" rivet. The graphic shows the side member lower inner removed and is for reference only.



- 44 Remove 2 Monobolts, remove 2 21mm bolts and 1 T30 Eject. The illustration shows the side member lower inner removed and is for reference only.

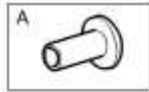


45 **NOTE:**

- On removal, keep panel damage to a minimum as it will be used as a template for the new panel.

Separate the joints and remove the front side member closing panel. Retain the old panel for use as a template.

- 46 Using a combination of the ESN50 and 6.5mm Cryobit Drill Bit, remove 6 Self Piercing Rivets, from the A-Pillar closing panel.



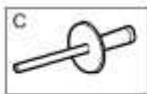
E75008 **A** →

47 . Remove 3 Monobolts from the bulkhead.



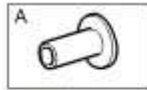
E76745 **C** →

48 . Remove 14 Monobolts from the floor panel.



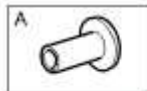
E76848 **C** →

49 Using a 6.5mm Cryobit Drill Bit, remove 18 Self Piercing Rivets from the floor panel.



E76747 **A** →

50 Using a 6.5mm Cryobit Drill Bit, remove 12 Self Piercing Rivets from the floor panel.



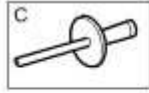
E77097 **A** →

51 From inside the rocker panel, use a belt sander to sand down the heads of 6 Self Piercing Rivets. Use a 6.5mm Cryobit Drill Bit to drill these out from underneath. Remove 6 18mm bolts.



E76746

52 . Remove 3 Monobolts, from inside the vehicle.



E77088 **C** →

- 53 Of the 2 remaining 21mm bolts to the side member, remove the upper one. This will aid the removal of the assembly.



E77099 **E** →

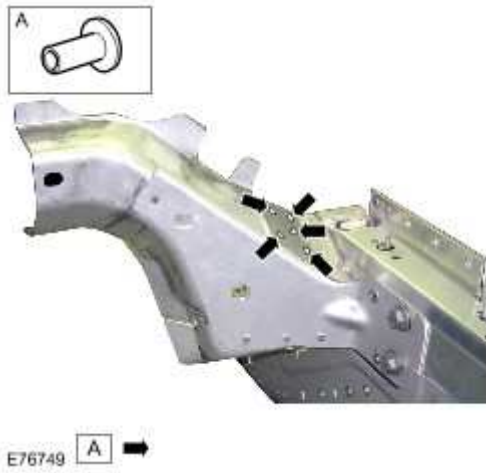
- 54 Separate the joints and with assistance, remove the front side member and suspension top mount assembly.

Installation

NOTE:

The front side member and suspension top mount assembly is fitted less the closing panel and the front side member reinforcement panel. These panels are removed from the new panel prior to its fitment. The following method of removing these panels is specific to the replacement of the front side member and suspension top mount assembly.

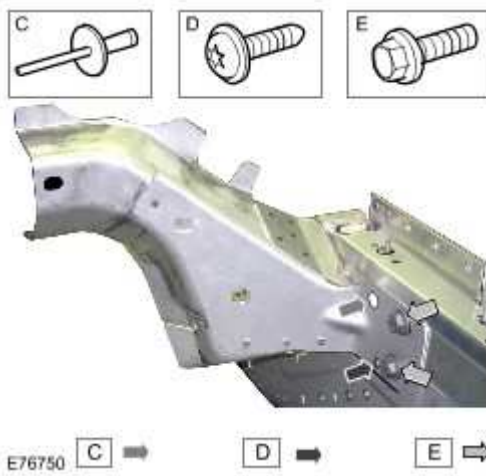
- 1 . Using the ESN50, remove 5 Self Piercing Rivets from the new panel.



2 . Using the ESN50, remove 5 Self Piercing Rivets from the new panel.

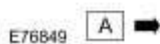
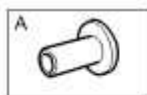


3 . Remove 1 Monobolt, 2 21mm bolts and 1 Eject from the new panel.



4 Separate the joints and remove the closing panel and the front side member . reinforcement panel from the new assembly.

- 5 . Remove rivet remnants from the new panel.
- 6 . Remove rivet remnants from the body.
- 7 . Deburr the drilled holes on the new panel and the body.
- 8 . Using a Roloc Bristle Disc, clean and prepare the body panel joint surfaces.
- 9 Of the 2 remaining 21mm bolts to the side member, remove the upper one. This will
 . aid the offer up and dry fit of the panel.
- 10 With assistance, offer up the new assembly, install 6 18mm bolts from inside the
 . rocker panel, hand tighten and clamp into position.
- 11 Check alignment. If correct proceed to next step, if not, rectify and recheck before
 . proceeding.
- 12 . Tighten the 6 18mm bolts.
- 13 Offer up and clamp into position, the fender apron panel, fender apron panel
 . reinforcement and the fender apron panel closing panel. Bolt on the front side member
 side extension and front side member side extension mounting, the front bumper, the
 hood and the fender.
- 14 Check alignment. If correct proceed to next step, if not, rectify and recheck before
 . proceeding.
- 15 . Using a 6.5mm Cryobit Drill Bit, drill 18 holes through the floor into the new panel.



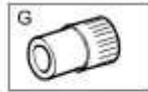
- 16 Using a 6.5mm Cryobit Drill Bit, drill 5 holes into the side member. Use any existing
 . holes that align, where they do not align drill adjacent.




- 17 . Scribe the position of 6 holes through the rocker panel onto the assembly.
- 18 Remove the front bumper, the hood, the fender, the fender apron panel, the fender apron panel reinforcement and the fender apron panel closing panel.
- 19 . With assistance, remove the assembly.
- 20 Using a 6.5mm Cryobit Drill Bit, drill the 6 holes previously marked through the rocker panel.
- 21 . Deburr the drilled holes.
- 22 . Using a 9.5mm Drill Bit, drill the lowermost fixing hole on the torsion box.



- 23 . Using the HES 412 Rivet Nut Tool, insert 1 Rivet Nut into the pre-drilled hole.



E76852  

24 . Using a Roloc Bristle Disc, clean and prepare the new panel joint surfaces.

25 . Pyrosil the joints.

26 . Apply the coupling agent and allow to dry.

27 . Apply a 5mm adhesive bead to the panel joints.



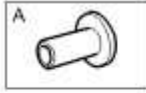
E76753

28 With assistance, offer up the new assembly, install 6 18mm bolts from inside the
. rocker panel, hand tighten and clamp into position.

29 Check alignment. If correct proceed to next step, if not, rectify and recheck before
. proceeding.

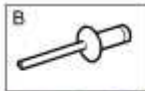
30 . Fully tighten the 6 18mm bolts.

31 Using the Genesis G4, install 18 Hemloks to the floor panel. Use part no: C2C 7792 in
. areas of 2 panel thickness and part no: C2C 10349 in areas of 3 panel thickness. Install
a further 7 Hemloks to the floor panel where it meets the bulkhead, part no: C2C 7792,
(2 panel thickness).



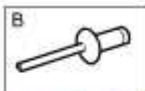
E76849 **A** →

32 . Using the Genesis G4, install 5 Hemloks, part no: C2C 7792, to the floor panel.



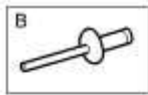
E76751 **B** →

33 Using the Genesis G4, install 6 Hemloks, part no: C2C 9966, to the rocker panel inner.



E76752 **B** →

34 . Using the Genesis G4, install 5 Hemloks, part no: C2C 10349, to the bulkhead.



E72489 **B** →

35 Using the Genesis G4, install 2 Monobolts, part no: C2P 4773, to the bulkhead. Install 1 T30 Torx Screw.



E76754 **C** → **J** →

36 . Using the Genesis G4, install 14 Monobolts, part no: C2P 4773, to the floor panel.



E76848 **C** →

37 From inside the vehicle, using the Genesis G4, install 3 Monobolts, part no: C2P

- 4773, through the bulkhead into the assembly.



E77098 **C** →

- 38 . Install 1 21mm bolt, to the side member. Torque to: 133Nm (98 lb.ft).

- 39 . Remove any excess adhesive.

40 **NOTE:**

- A new closing panel will be required as the original from the vehicle and the one removed from the new front side member and suspension turret assembly, will not be suitable for reuse.

Using a Roloc Bristle Disc, clean and prepare the joint surfaces of the new closing panel.

- 41 Using the original closing panel removed from the vehicle, cut a template, as illustrated, to use for alignment



- 42 Offer up the new closing panel to the assembly and scribe around the inside of the 2 facing holes. Remove the closing panel.

- 43 Offer up the template to the assembly, so that the scribe marks align and ensure that the fixing holes align, if not, rectify and recheck before proceeding. Remove the template.

- 44 Clamp the template to the assembly, then, using a 6.5mm Cryobit Drill Bit, drill through the 11 holes, (12 on the LH).
- 45 Offer up the closing panel to the assembly, align and clamp into position, using the 2 21mm bolts to secure.
- 46 Using a 6.5mm Cryobit Drill Bit, drill 1 hole, illustrated at 1, through the new panel into the side member.



! **CAUTION:** Take care not to drill right through as this will go into the vehicle. Drill only through the new panel and a further 2 panel thicknesses.

- 47 Using a 6.5mm Cryobit Drill Bit, drill 1 hole, illustrated at 2, through the new panel into the tunnel.



- 48 . From inside the vehicle, mark the positions of 5 fixing holes for drilling.



49 . Remove the closing panel.

50 . Using a 6.5mm Cryobit Drill Bit, drill the 5 holes in the closing panel, as marked.

51 . Deburr the drilled holes.

52 . Using a Roloc Bristle Disc, clean and prepare the joint surfaces of the closing panel.

53 . Pyrosil the joints of the closing panel.

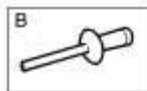
54 . Apply the coupling agent to the closing panel and allow to dry.

55 . Apply a 5mm adhesive bead to the closing panel joints of the assembly.



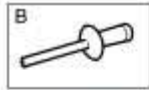
56 . Offer up the closing panel and use the 2 21mm bolts to loose fit.

57 . Using the Genesis G4, install 7 Hemloks, part no: C2C 10349.



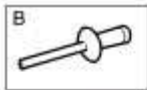
E75145 **B** →

58 . Using the Genesis G4, install 1 Hemlok, part no: C2C 10349.



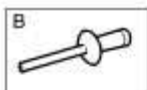
E75209 **B** →

59 . Using the Genesis G4, install 4 Hemloks, part no: C2C 22613.



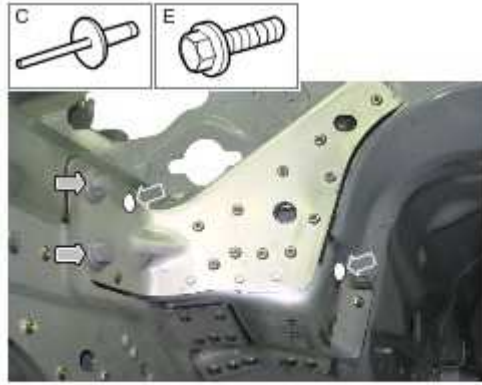
E75208 **B** →

60 . Using the Genesis G4, install 6 Hemloks, (7 on the LH side), part no: C2C 9818.



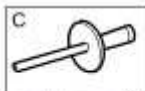
E75210 **B** →

61 Using the Genesis G4, install 2 Monobolts, part no: C2P 4773. Then , fully tighten the
2 21mm bolts to 133 Nm (98 lb.ft).



E75146 **C** ➔ **E** ➔

- 62 . Remove any excess adhesive from the closing panel.
- 63 Using a Roloc Bristle Disc, clean and prepare the joint surfaces of the secondary, (inner), floor panel.
- 64 . Pyrosil the joints of the secondary, (inner), floor panel.
- 65 . Apply coupling agent to the secondary, (inner), floor panel joints and allow to dry.
- 66 . Apply a 5mm adhesive bead to the vehicle joint of the secondary, (inner), floor panel.
- 67 Using the Genesis G4, install 17 Monobolts, part no: C2P 4773 and install the secondary, (inner), floor panel.



E76744 **C** ➔

- 68 . Remove any excess adhesive.
- 69 . The installation of mechanical components is the reversal of removal.

Windshield Frame - Convertible

Removal

NOTE:

This is a category "A" repair.

NOTE:

In this procedure the windshield frame is replaced in conjunction with the:

- Front bumper cover
- Both front fenders
- Both front doors
- Header rail

NOTE:

The windshield glass has to be removed for access.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 Remove the cover and disconnect the battery ground cable.
For additional information, refer to [Specifications](#)
- 4 Remove the windshield glass.
For additional information, refer to [Windshield Glass \(76.81.40\)](#)
- 5 Remove both convertible top strikers.
For additional information, refer to [Convertible Top Striker](#)
- 6 Disconnect the harness at the header rail and A-Pillar and position aside.
- 7 Remove both front fenders.
For additional information, refer to [Front Fender](#)
- 8 Remove both front doors.
For additional information, refer to [Door \(76.28.04\)](#)

9

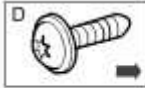


· **CAUTION: Do not discard the Ejots. They are re-used when installing the header rail.**

NOTE:

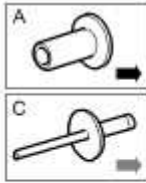
The header rail is bonded as well as bolted, care should be taken not to damage it on removal.

Remove the header rail. Remove 8 T30 Ejots.



E94558

10 Remove 4 Monobolts, 2 each side, and using a 6.5mm Cryobit drill bit, remove 2 Self-Piercing rivets, one each side.



E94559

11 . Using the ESN50, remove 70 Self-Piercing Rivets, 35 each side.



E94560

12 **NOTE:**

· There is an NVH element at the top of the panel, 1 and adhesive applied at the bottom, 2.

Separate the joints and remove the panel.

①



②



E94562

Installation

- 1 . Remove the rivet remnants.
- 2 . Remove any foam / adhesive residue.
- 3 Offer up the new panel, clamp into position and check alignment. If correct, proceed to . next step, if not, rectify and recheck before proceeding.
- 4 . From the inside, using a 6.5mm Cryobit drill bit, drill 1 hole ready for Hemlok fixing.



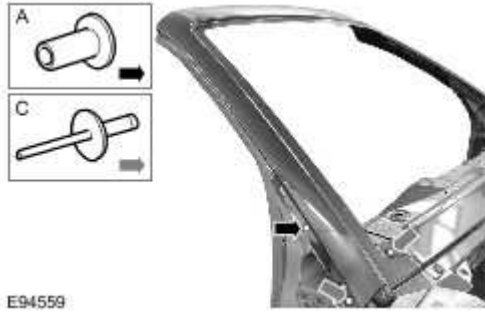
E75191

- 5 . Remove the new panel.
- 6 . Deburr the drilled hole.
- 7 . Using a Roloc Bristle Disc, clean and prepare the panel joints.
- 8 . Pyrosil to the joints.
- 9 . Apply the coupling agent and allow to dry.
- 10 . Apply a 5mm adhesive bead to the body joints.
- 11 . Apply sealer / adhesive to the NVH element.

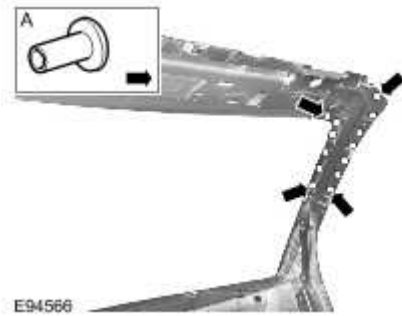


E94563

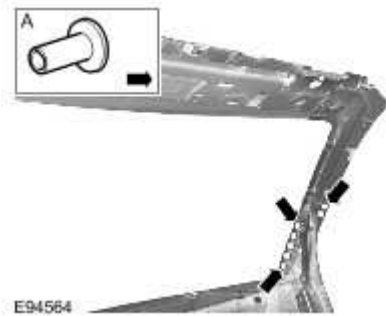
- 12 . Offer up the new panel, align and clamp into position.
- 13 Using the Genesis G4, install 2 Hemlocks, 1 each side, part no: C2C 7792, and 4
· Monobolts, 2 each side, part no: C2P 4773.



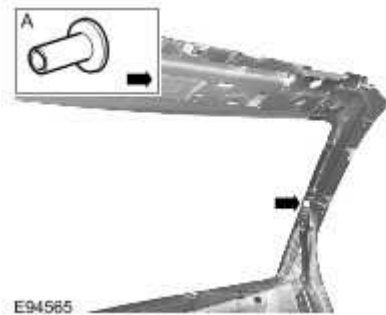
14 . Using the ESN50, install 26 Self-Piercing rivets, 13 each side, part no: C2C 20589.



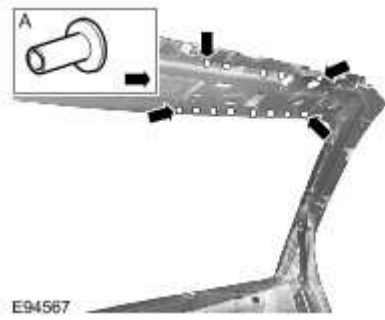
15 . Using the ESN50, install 16 Self-Piercing rivets, 8 each side, part no: C2C 20590.



16 . Using the ESN50, install 2 Self-Piercing rivets, 1 each side, part no: C2C 20593.



17 . Using the ESN50, install 26 Self-Piercing rivets, 13 each side, part no: C2C 20589.

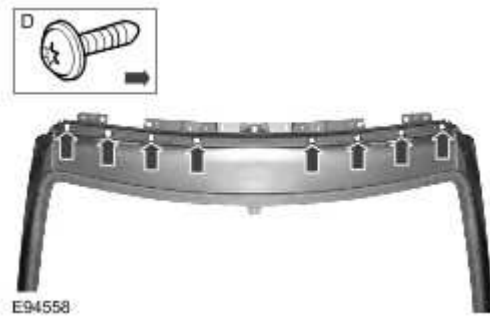


18 . Using a Roloc Bristle Disc, clean and prepare the joints on the header rail.

19 . Apply a sealing adhesive to the front edge of the header rail.



20 . Offer up the header rail and install 8 T30 Ejots.



21 . Apply cavity foam, each side, to the inside of the panel.



22 . When the adhesive has cured, use an air saw to cut off the transportation brace.



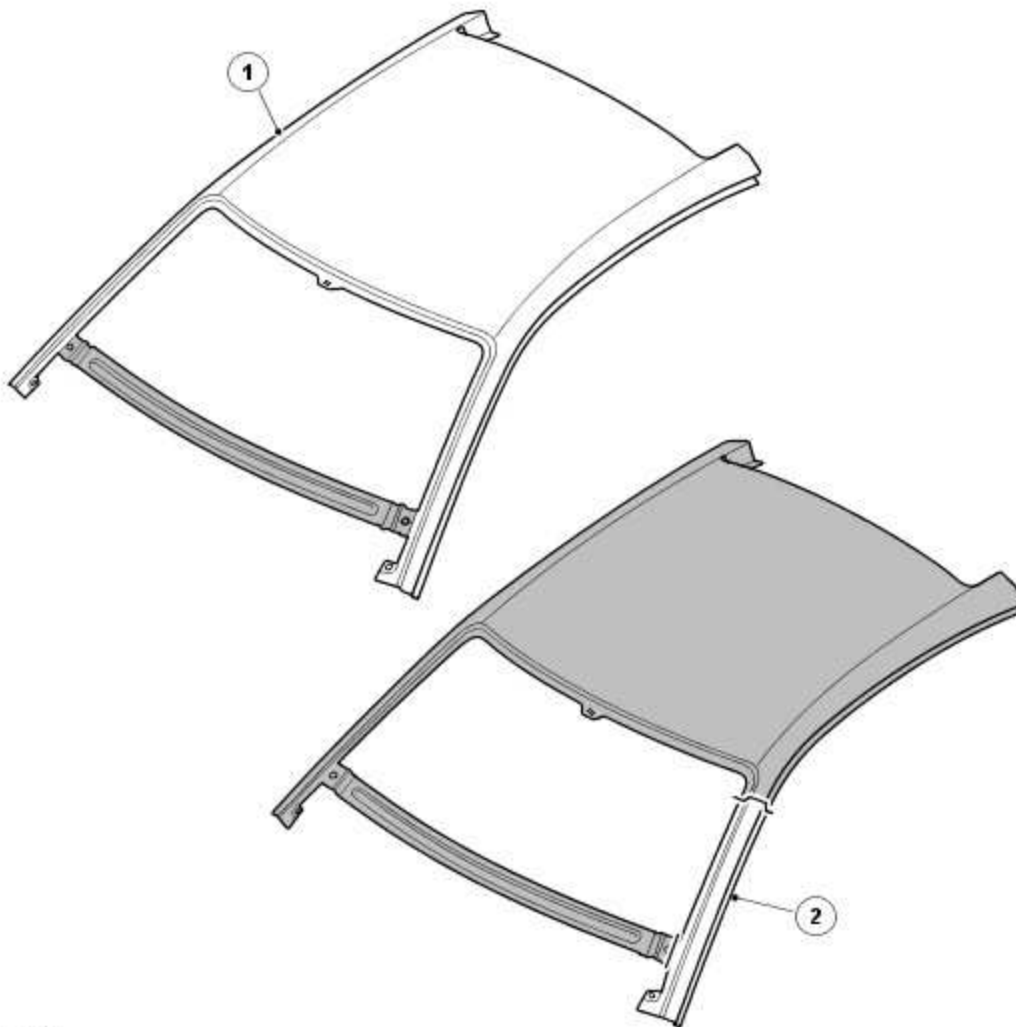
23 The installation of associated panels and mechanical components is the reverse of removal.

501-28 : Roof Sheet Metal Repairs

Description and operation

Roof

Roof service panels



E74553

Item	Description	Service part No
1	Roof panel	
2	A-Pillar outer panel (cut from roof panel)	

Time schedules, roof panels

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends for adjacent panels not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

Panel Description	coupe
Roof panel	25.9
A-Pillar outer panel	14.0

Roof Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the roof panel is replaced in conjunction with the:

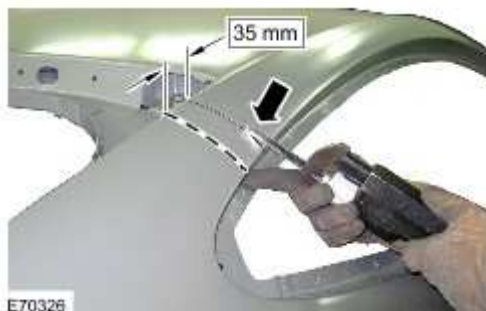
- front bumper cover
- both front fenders
- both doors
- liftgate

NOTE:

The windshield glass has to be removed for access.

- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Disconnect the battery.
For additional information, refer to
- 4 . Disconnect the generator electrical connections.
- 5 . Remove the headliner.
For additional information, refer to [Headliner \(76.64.01\)](#)
- 6 . Remove the front windshield.
For additional information, refer to [Windshield Glass \(76.81.40\)](#)
- 7 . Remove both rear quarter window glasses.
For additional information, refer to [Rear Quarter Window Glass - 2-Door \(76.31.31\)](#)

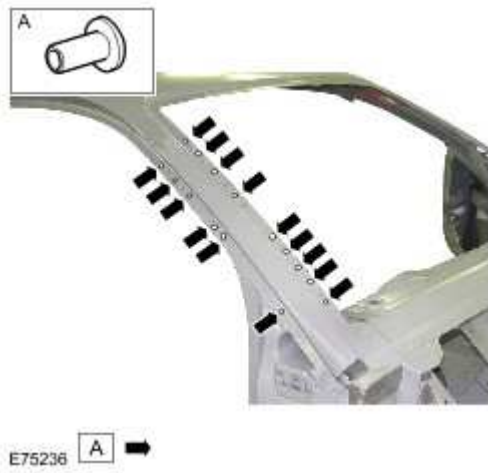
- 8 . Remove both front seats.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 9 . Remove both roof mouldings.
- 10 . Remove the rear drain moulding.
- 11 . Remove both bodyside weatherseals.
- 12 . Disconnect both A-Pillar wiring harnesses and position them aside.
- 13 . Disconnect both cant rail wiring harnesses and position them aside.
- 14 . Remove the liftgate.
- 15 . Remove both fenders.
For additional information, refer to [Front Fender](#)
- 16 . Remove both doors.
For additional information, refer to [Door \(76.28.04\)](#)
- 17 . Saw cut the roof panel at its joints with the rear quarter panels. Make the cut approximately 35mm forward of the roof to quarter panel assembly joint, (illustrated by the dotted line).



- 18 . Remove 4 Monobolts, 2 each side, from the A-Pillar.



19 . Using the ESN50, remove 30 Self Piercing Rivets, 15 each side, from the A-Pillar.



20 . Using the ESN50, remove 16 Self Piercing Rivets, from the front header rail.



21 . Using the ESN50, remove 12 Self Piercing Rivets, from the rear header rail.



22 . Using the ESN50, remove 28 Self Piercing Rivets, 14 each side, from the cantrail.



23 Remove the foil patches, 1 each side, to expose 4 Self Piercing Rivets, 2 each side, to the rear quarter panel / drain channel. Using the ESN50, remove these 4 Self Piercing Rivets.



24 . Separate the roof panel joints.

25 Using a long cutting blade, cut through the foam between the roof and its front and rear header rails.



26 . With assistance, remove the old roof panel.

27 Remove the small remnant of the roof panel that is left, by cutting close to the weld.
 . Using a Belt Sander, sand back to the weld line, illustrated as the dotted line.



Installation

- 1 . Remove foam residue from the header rails.
- 2 . Remove rivet remnants.
- 3 . Dress the body flanges where necessary.
- 4 With assistance, offer up the new roof panel and check alignment. If correct proceed to
 . next step, if not, rectify and recheck before proceeding.
- 5 Using a 6.5mm drill bit, drill 2 holes, 1 each side, from inside, through the A-Pillar
 . into the roof panel.



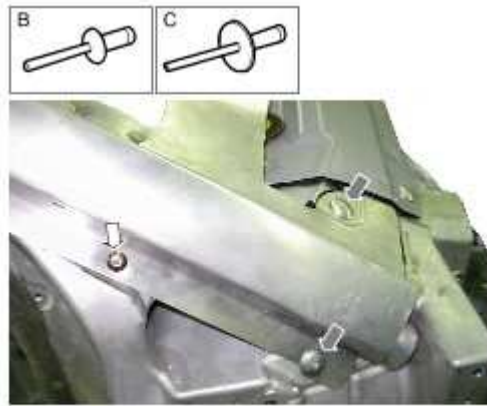
E75191

- 6 . Using assistance, remove the roof panel.
- 7 . Deburr the drilled holes.
- 8 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.
- 9 . Pyrosil the joints.
- 10 . Apply the coupling agent and allow to dry.
- 11 . Apply foam in the same locations as original.
- 12 . Apply a 5mm adhesive bead to the body joints.



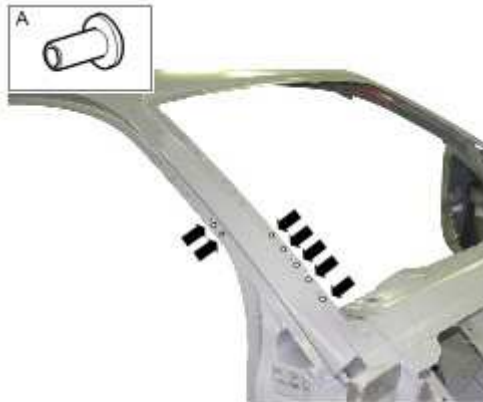
E70332

- 13 . With assistance, fit the new roof panel, align and clamp into position.
- 14 Using the Genesis G4, install 2 Hemloks, 1 each side, part no: C2C 7792 and 4
Monobolts, 2 each side, part no: C2P 4773 into the A-Pillar.



E70334 **B** → **C** →

- 15 Using the ESN50, install 14 Self Piercing Rivets, 7 each side, part no: C2C 20590, to the A-Pillar casting.



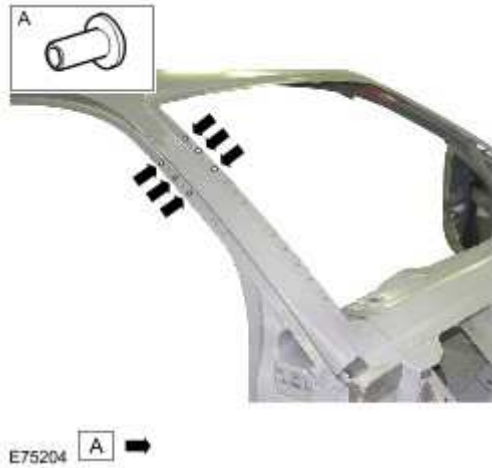
E75206 **A** →

- 16 Using the ESN50, install 2 Self Piercing Rivets, 1 each side, part no: C2C 20593, to the A-Pillar upper.

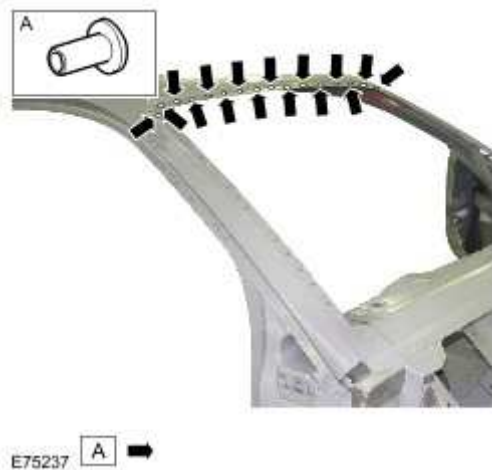


E75205 **A** →

- 17 Using the ESN50, install 12 Self Piercing Rivets, 6 each side, part no: C2C 20589, to the A-Pillar upper.



- 18 Using the ESN50, install 16 Self Piercing Rivets, part no: C2C 20589, to the front header rail.



19 **NOTE:**

- Where a Self Piercing Rivet cannot be installed in an area of 2 panel thickness it may be necessary to install it in an area of 3 panel thickness. The part number of the rivet is the same for both areas.

Using the ESN50, install 26 Self Piercing Rivets, 13 each side, part no: C2C 20591, to the side cant rails.



E75240 **A** →

- 20 The illustration shows the side cant rail joint from inside, where the 2 and 3 thicknesses occur.



E72274 **A** →

- 21 Using the ESN50, install 12 Self Piercing Rivets, part no: C2C 20591, to the rear header rail.



E75239 **A** →

22 . Cut 2 run on / run off tabs from the original panel, or from similar material.

23 . Tack weld the run on / run off tabs into position.

24 . Lap weld the joints between the roof panel and the rear quarter panels.



25 . Remove the run on / run off tabs.

26 Carry out a non destructive crack inspection on the lap weld. If correct proceed to next step, if not, rectify and recheck before proceeding.

27 . Using a belt sander, dress the welded joint.



28 . Remove any excess adhesive.

29 . When adhesive has cured, use an air saw to cut off the transportation brace.



30 . **NOTE:**

Replace the foil patches on the drain channels after the primer application.

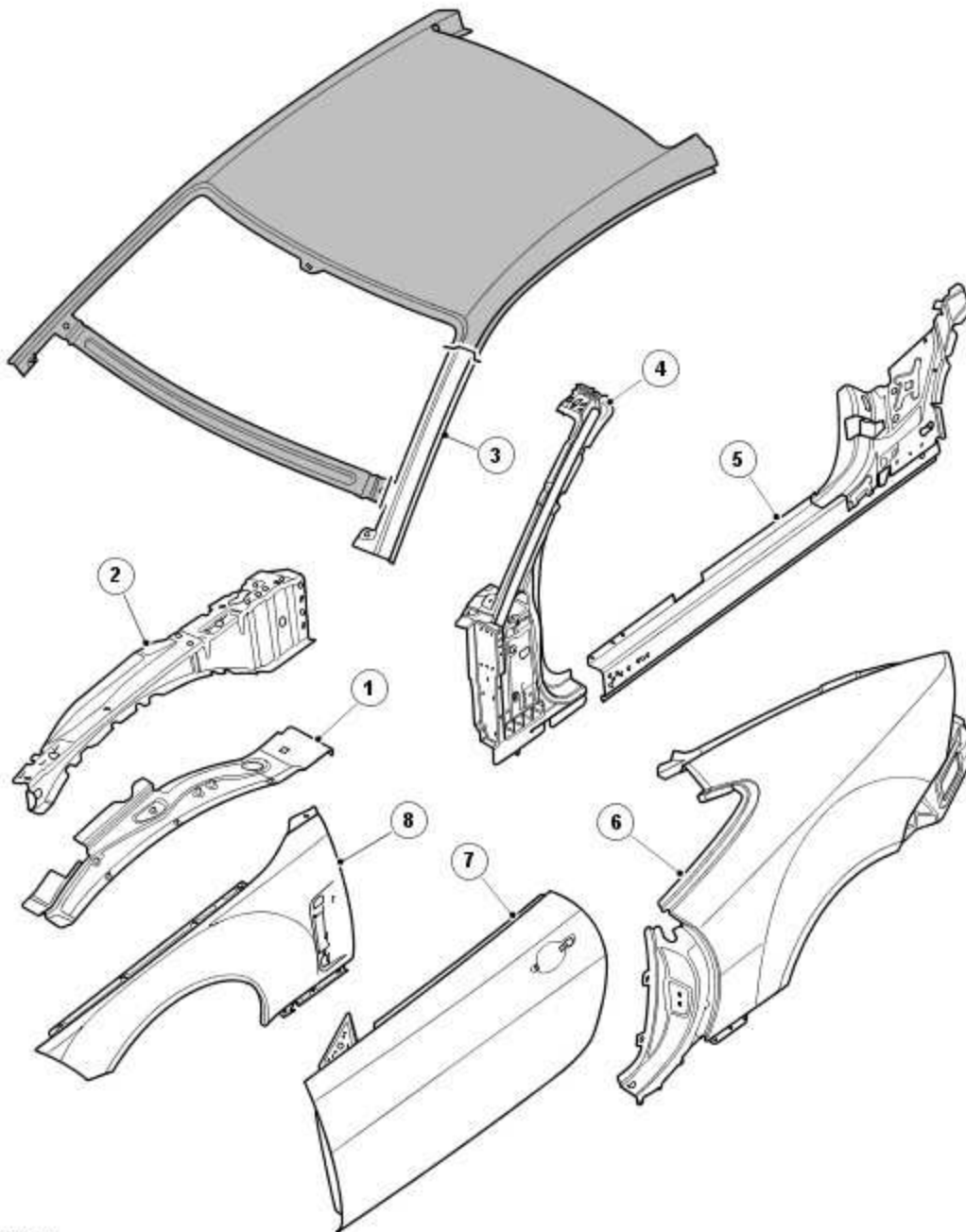
Install is the reverse of removal.

501-29 : Side Panel Sheet Metal Repairs

Description and operation

Side Panel Sheet Metal

Side service panels



Item	Description	Service part No
1	Fender apron panel closing panel	L/H R/H
2	Fender panel apron	L/H R/H
3	A-Pillar outer panel (cut from roof panel)	L/H R/H
4	A-Pillar assembly	L/H R/H
5	Rocker panel	L/H R/H
6	Quarter panel assembly	L/H R/H
7	Door	L/H R/H
8	Front fender	L/H R/H

paragraph

Time schedules, side panels

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included).

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

Panel Description	coupe
A-Pillar outer	14.0
Rocker panel	L/H 37.1 R/H 37.3
Quarter panel assembly	L/H 17.2 R/H 17.2
Door	6.4
Front fender	7.0

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and paint times based on Metallic Clear Over Base Paint process, (blends to adjacent panels are not included).

Panel Description	coupe
Door	
Front fender	
Total Time	L/H 10.1 R/H 10.1

Panel Description	coupe
Door	
Quarter panel assembly	
Total Time	L/H 21.9 R/H 22.1

Panel Description	coupe
A-Pillar outer panel	
A-Pillar assembly	
Door	
Quarter panel assembly	
Rocker panel	
Fender apron panel closing panel	
Fender apron panel.	
Front fender	
Rocker panel moulding	
Headliner remove and install	
Windshield glass remove and install	
Instrument panel remove and install	
Total Time	L/H 52.0 R/H 51.3

Panel Description	coupe
Door	
Quarter panel assembly	
Front fender	
Rocker panel moulding	
Total Time	L/H 25.1 R/H 25.4

Panel Description	coupe
A-Pillar outer panel	
A-Pillar assembly	
Door	
Fender apron panel closing panel	
Fender apron panel	
Front fender	

Headliner remove and Install	
Windshield glass remove and Install	
Instrument panel remove and Install	
Total Time	L/H 35.2 R/H 34.0

Rocker Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rocker panel is replaced in conjunction with the:

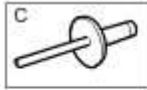
- front bumper cover
- front fender
- fender apron panel
- fender apron panel front extension
- fender apron panel closing panel
- door
- bulkhead lower reinforcement
- A-Pillar assembly
- A-Pillar outer panel
- rear bumper cover
- liftgate
- quarter panel assembly

NOTE:

It is also necessary to remove the windshield glass and the instrument panel to allow for access.

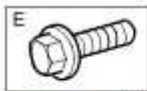
- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 Remove the A-Pillar assembly.
For additional information, refer to [A-Pillar Assembly](#)
- 4 The rear inner wheelhouse half has to be removed from the vehicle to allow access for removing the rocker panel. The new panel is supplied on the rocker panel and is installed as an assembly.
For additional information, refer to [Rear Inner Wheelhouse Half](#)

5 . Remove 4 Monobolts securing the striker plate bracket.



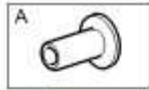
E75161 [C] →

6 Remove 6 13mm bolts, 3 from the inner rocker panel and 3 from the B-Pillar reinforcement.



E72744 [E] →

7 Using a Belt Sander, remove the heads of 11 Self-Piercing Rivets, along the upper flange. Using the ESN50, remove these rivets.



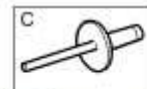
E75155 **A** →

8 Using a Belt Sander, remove the heads of 31 Self-Piercing Rivets, along the lower flange. Using the ESN50, remove these rivets.



E72745 **A** →

9 . Remove 1 Monobolt, from the inner rocker panel.



E75156 **C** →

10 . Separate the joints and remove the panel.

Installation

- 1 . Remove foam residue.
- 2 . Remove rivet remnants.
- 3 . Using a Roloc Bristle Disc, remove adhesive residue.
- 4 . Dress flanges, where applicable.



- 5 . With assistance, offer up the new rocker panel.
- 6 Install 6 fixing bolts, 3 to the inner rocker panel and 3 to the B-Pillar reinforcement, to
 . secure the panel.
- 7 . Offer up the bulkhead lower reinforcement and secure with its 6 fixing bolts.
- 8 . Offer up the A-Pillar assembly.
- 9 Check the alignment of all panels, if correct proceed to next step, if not, rectify and
 . recheck before proceeding.
- 10 . When aligned, clamp into position.
- 11 . Mark the position of 31 holes on the lower flange of the new panel.
- 12 Using a Cryobit drill bit, drill through 5 original holes of the rear wheelhouse outer
 . into the new panel.
- 13 Using a Cryobit drill bit, drill through 7 original holes of the rear outer wheelhouse
 . half into the new panel.

14 . Remove the A-Pillar.

15 Remove 2 fixing bolts from the bulkhead lower reinforcement, leaving the panel on the car.

16 . Remove the new rocker panel.

17 Using a Cryobit drill bit, drill 31 holes at the positions previously marked along the lower flange.



18 . Deburr the drilled holes.

19 . Using a Roloc Bristle Disc, clean and prepare panel joint surfaces.

20 . Pyrosil the joints.



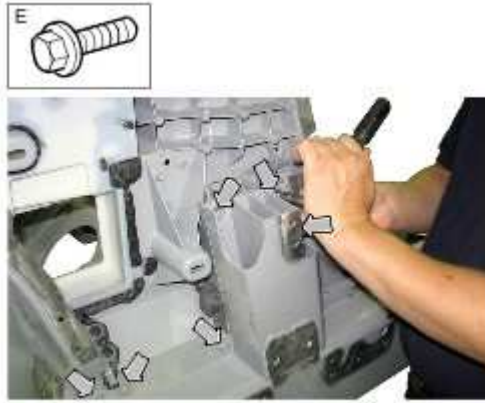
21 . Apply the coupling agent and allow to dry.

22 . Apply foam in the same locations as originally applied.

23 . Apply a 5mm adhesive bead to the body joints.

24 . With assistance, offer up the new rocker panel.

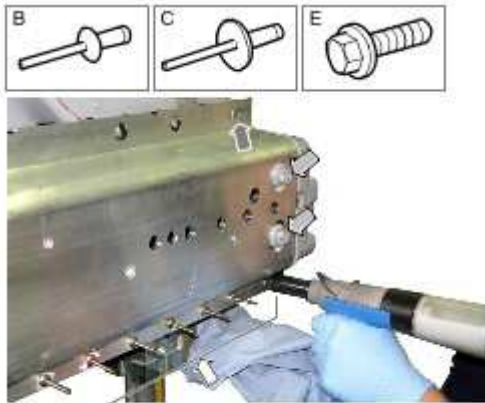
25 Install 6 13mm bolts, 3 to the inner rocker panel and 3 to the B-Pillar reinforcement, (illustration for reference purposes only).



E72744 **E** →

26 . Install 2 18mm bolts, to the bulkhead lower reinforcement.

27 . Using the Genesis G4, install 31 Hemloks, to the lower flange, part no: C2C 10349.



E72751 **B** → **C** → **E** →

28 Using the Genesis G4, install 12 Hemloks, part no: C2C 7792, 5 to the rear wheelhouse outer and 7 to the rear outer wheelhouse half.

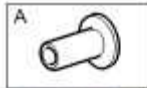


E73148 **B** →

29 Using the Genesis G4, install 1 Monobolt, part no: C2P 4773, to the inner rocker panel, (front).

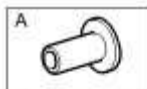
30 Using the Genesis G4, install 1 Monobolt, part no: C2P 4773, to the inner rocker panel, (rear).

31 Using the ESN50, install 11 Self-Piercing Rivets, to the upper flange, part no: C2C 20593.



E72752 **A** →

32 Using the ESN50, install 2 Self-Piercing Rivets, part no: C2C 20591, to the inner B-Pillar.

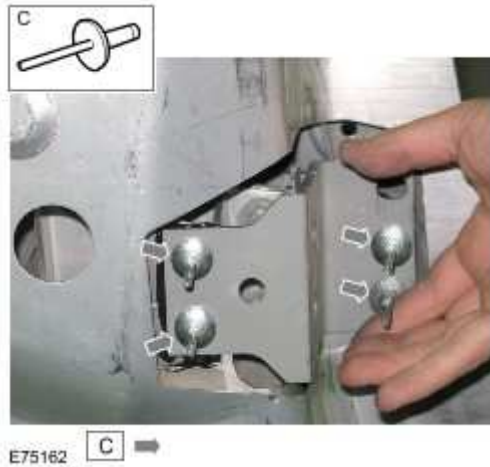


E73149 **A** →

33 Using the ESN50, install 4 Self-Piercing Rivets, part no: C2C 20589, to the quarter panel reinforcement.



- 34 . Using the Genesis G4, install 4 Monobolts, part no: C2P 4773, to secure the striker plate bracket.



- 35 . Remove any excess adhesive.
- 36 . Install is the reversal of removal.

Bulkhead Lower Reinforcement

Removal

NOTE:

This is a category 'B' repair.

NOTE:

In this procedure the bulkhead lower reinforcement is replaced in conjunction with the:

- front bumper cover
- front fender

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 . LH Only: Remove the ABS Hydraulic Control Unit, (HCU).

For additional information, refer to [Hydraulic Control Unit \(HCU\) \(70.60.18\)](#)

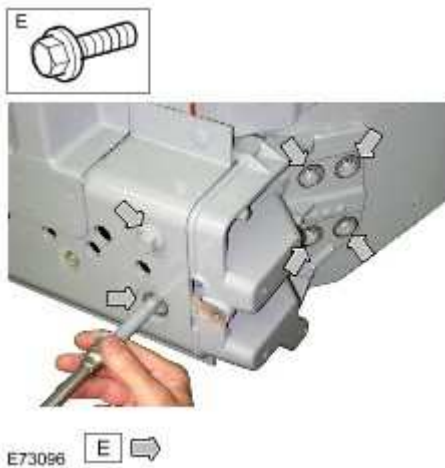
4 . RH Only: Remove the windshield washer reservoir.

For additional information, refer to [Windshield Washer Reservoir \(84.10.01\)](#)

5 . Remove the front fender.

For additional information, refer to [Front Fender](#)

6 . Remove 6 18mm bolts.



7 . Remove the panel.



Installation

- 1 . Offer up and align the new panel, tighten the 6 18mm bolts to 133 Nm (98 lb.ft).
- 2 . Install is the reversal of removal.

A-Pillar Assembly

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the A-Pillar assembly is replaced in conjunction with the:

- front bumper cover
- front fender
- door
- bulkhead lower reinforcement
- fender apron panel
- fender apron panel closing panel

NOTE:

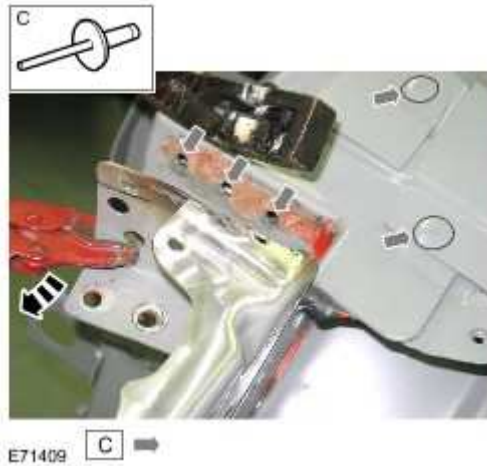
The windshield glass and instrument panel have to be removed for access.

- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the instrument panel.
For additional information, refer to [Instrument Panel \(76.46.01\)](#)
- 4 . Release the front side carpet section and remove.
- 5 . Remove the fender apron panel.
For additional information, refer to [Fender Apron Panel](#)
- 6 . Remove the fender apron panel closing panel.
For additional information, refer to [Fender Apron Panel Closing Panel](#)
- 7 . Remove the A-Pillar outer panel.
For additional information, refer to [A-Pillar Outer Panel](#)
- 8 . Remove the bulkhead lower reinforcement.
For additional information, refer to [Bulkhead Lower Reinforcement](#)

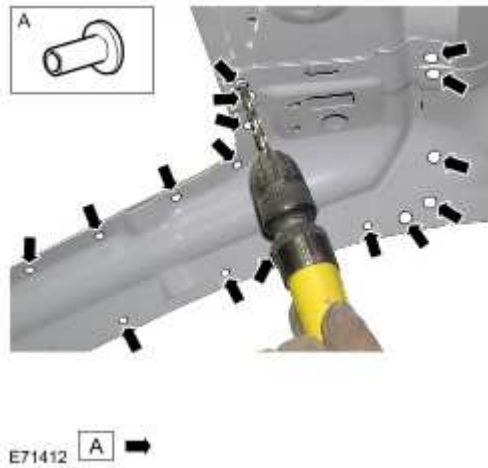
9 NOTE:

- The fender apron panel reinforcement can be left in situ for this procedure, however it has to be part removed to enable the removal of the A-Pillar assembly.

Remove 3 Monobolts from the A-Pillar assembly and separate this joint. Using the induction heater, apply heat to enable the flange to be eased out of the way to allow access for the A-Pillar removal. Remove 1 Monobolt from the windshield aperture panel, (the other Monobolt illustrated is removed with the A-Pillar outer panel).



- 10 Using a 6.5mm Cryobit drill bit, remove 1 Self Piercing Rivet, from the windshield aperture panel.
- 11 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 8 Self Piercing Rivets, from the door aperture.
- 12 Using a 6.5mm Cryobit drill bit, remove 6 Self Piercing Rivets, from the A-Pillar inner. The upper rivet is drilled from inside the vehicle.
- 13 Using a 6.5mm Cryobit drill bit, remove 25 Self Piercing Rivets, from the rocker panel and the rocker panel upper flange.
- 14 Using a 6.5mm Cryobit drill bit, remove 3 Self Piercing Rivets, from the A-Pillar inner.
- 15 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 16 Self Piercing Rivets, from the roof panel and front header rail.



16 . Separate the joints and remove the panel.

Installation

1 . Remove the rivet remnants. See next step.

2 Remove rivet remnants from the roof front header rail: Using the induction heater, heat the area, in the position illustrated and ease down the flange. This will enable access for the removal of 2 remnants. Use a 6.5mm Cryobit drill bit to remove the remnants. Using the induction heater, heat the area and ease the flange back into position.



3 MIG plug weld the 2 drilled remnant holes, after welding use a Belt Sander to dress the 2 welds.

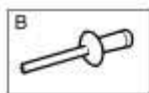


- 4 . Using a Roloc Bristle Disc, remove any adhesive residue.
- 5 . Remove the foam residue.
- 6 . Offer up the new panel, align and clamp into position.
- 7 Bolt on the door hinges and offer up the door. Check gaps and alignment, if correct . proceed to next step, if not, rectify and recheck before proceeding.
- 8 . Remove the door.
- 9 Mark the position of 1 hole from the A-Pillar to the roof side cant rail, (to be drilled . when the panel is removed).
- 10 . Using a 6.5mm Cryobit drill bit, drill 2 holes to the roof panel front header rail.



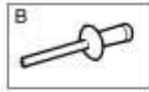
- 11 . Using a 6.5mm Cryobit drill bit, drill 1 hole to the windshield aperture panel.
- 12 Using a 6.5mm Cryobit drill bit, from inside the vehicle, drill 5 holes through the . rocker panel upper flange, into the new A-Pillar assembly.
- 13 Using a 6.5mm Cryobit drill bit, from inside the vehicle, drill 3 holes, through the A- . Pillar inner, into the new A-Pillar assembly.
- 14 Using a 6.5mm Cryobit drill bit, from inside the engine bay, drill 6 holes, through the . A-Pillar inner, into the new A-Pillar assembly.

- 15 Mark the position of 19 holes from inside the rocker panel to the new A-Pillar assembly, (to be drilled when the panel is removed). If the new A-Pillar assembly is to be fitted to a new rocker panel drill 19 new holes.
- 16 . Remove the new panel.
- 17 Using a 6.5mm Cryobit drill bit, drill 1 hole in the new panel, as marked, (to the roof side cant rail).
- 18 Using a 6.5mm Cryobit drill bit, drill 19 holes in the new panel, as marked, (to the rocker panel).
- 19 . Deburr the drilled holes.
- 20 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.
- 21 . Pyrosil the joints.
- 22 . Apply the coupling agent and allow to dry.
- 23 . Apply a 5mm adhesive bead to the new panel joints.
- 24 . Offer up the new panel, align and clamp into position.
- 25 . Using the Genesis G4, install 19 Hemlocks, part no: C2C 9966, to the rocker panel.



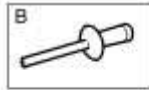
E75280 B ⇨

- 26 Using the Genesis G4, install 2 Hemlocks, part no: C2C 10349, to the rocker panel upper flange.



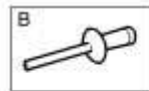
E75283 **B** ⇨

- 27 Using the Genesis G4, install 3 Hemloks, part no: C2C 9966, to the rocker panel upper flange.



E75281 **B** ⇨

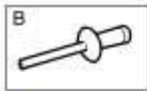
- 28 . Using the Genesis G4, install 9 Hemloks, part no: C2C 7792, to the A-Pillar inner.



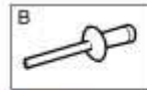
E75282 **B** ⇨

- 29 Using the Genesis G4, install 2 Hemloks, part no: C2S 11487, 1 to the roof panel side

- cant rail and 1 to the roof panel front header rail.



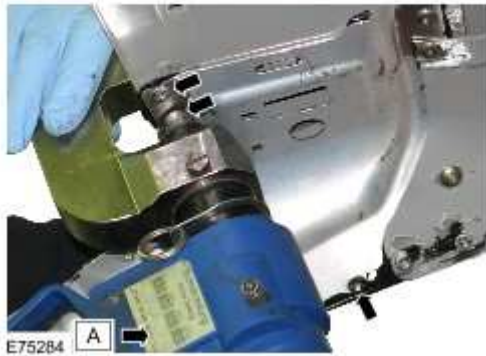
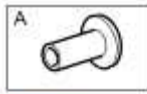
- 30 Using the Genesis G4, install 1 Hemlok, part no: C2C 7792, to the roof panel front header rail.
- header rail.



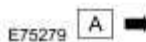
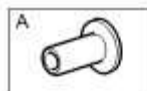
- 31 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20591, to the roof panel side cant rail.
- side cant rail.



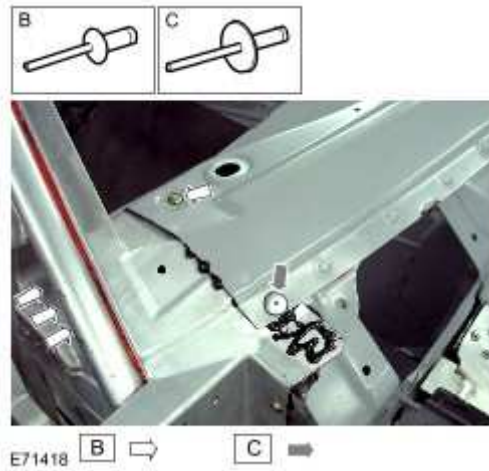
- 32 Using the ESN50, install 8 Self Piercing Rivets. 2, part no: C2C 20591, to the roof front header rail and 6, part number: C2C 20589 to the roof panel, (3 to the screen aperture and 3 to the door aperture).



- 33 Using the ESN50, install 9 Self Piercing Rivets. 8, part no: C2C 20591 to the door aperture and 1, part number: C2C 20595, to the inner rocker panel.



- 34 Using the Genesis G4, install 1 Hemlok, part no: C2C 7792 and 1 Monobolt, part no: C2P 4773, to the windshield aperture panel.



35 . Remove any excess adhesive.

36 If the fender apron panel reinforcement was left in place, use the induction heater to . ease back the flange to its original position. Apply adhesive, then using the Genesis G4, install the 3 Monobolts. Remove any excess adhesive.

37 . Install is the reversal of removal.

A-Pillar Outer Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the A-Pillar outer panel is replaced in conjunction with the:

- front bumper cover
- front fender
- door

NOTE:

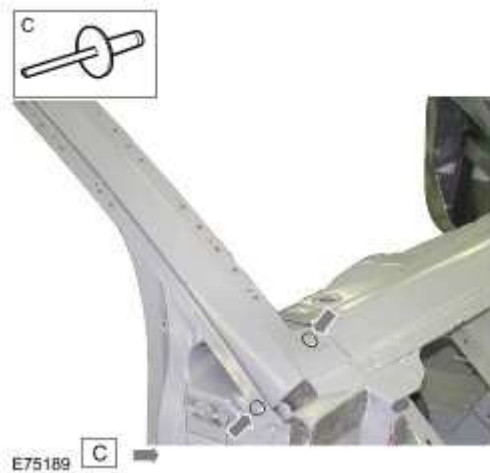
The windshield glass has to be removed for access.

- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Remove the front fender.
For additional information, refer to [Front Fender](#)
- 4 . Remove the door.
For additional information, refer to [Door \(76.28.04\)](#)
- 5 . Remove the headliner.
For additional information, refer to [Headliner \(76.64.01\)](#)
- 6 . Remove the windshield glass.
For additional information, refer to [Windshield Glass \(76.81.40\)](#)
- 7 . Remove the rear quarter window glass.
For additional information, refer to [Rear Quarter Window Glass - 2-Door \(76.31.31\)](#)
- 8 . Remove the seat.
For additional information, refer to [Front Seat \(76.70.01\)](#)
- 9 . Remove the roof moulding.

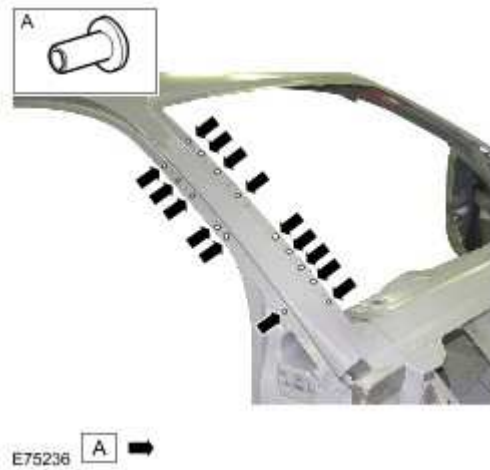
- 10 . Remove the door aperture weatherseal.
- 11 . Remove the bodyside weatherseal.
- 12 . Disconnect the A-Pillar wiring harness and position aside.
- 13 . Disconnect the cantrail wiring harness and position aside.
- 14 . Disconnect the generator electrical connectors.
- 15 Using an air saw, cut through the roof panel at a point 740mm from the bottom of the
outer A-Pillar / roof panel.



- 16 . Remove 2 Monobolts, from the A-Pillar.



- 17 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 15 Self-
Piercing Rivets, from the A-Pillar assembly.



18 . Separate the joints and remove the panel.

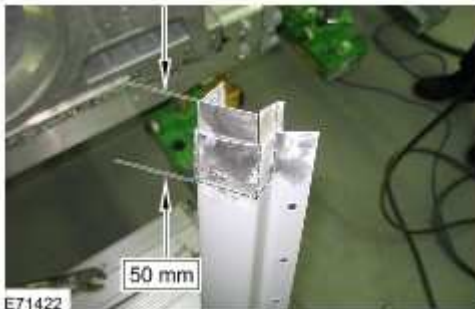
Installation

- 1 . Remove the rivet remnants.
- 2 . Remove any foam residue.
- 3 Measure and cut a 50mm backing plate and 2 run on / run off tabs from the original . panel, or from similar material.
- 4 Using a Roloc Bristle Disc, clean and prepare the backing plates and run-on/run-off . tabs.
- 5 Offer up the new panel, clamp into position and check alignment. If correct proceed to . next step, if not, rectify and recheck before proceeding.
- 6 . From inside, using a 6.5mm Cryobit drill bit, drill 1 hole ready for a Hemlok fixing.



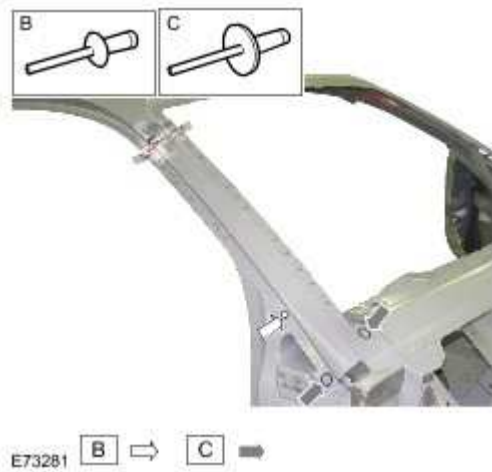
E75191

- 7 . Remove the new panel.
- 8 . Deburr the drilled hole.
- 9 . Using a Roloc Bristle Disc, clean and prepare the panel joints.
- 10 . Weld the backing plates into position on the new panel.

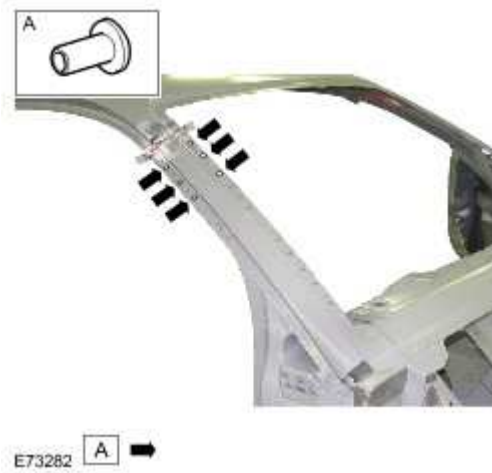


E71422

- 11 . Apply Pyrosil to the joints, avoiding the area of the butt joint.
- 12 . Apply the coupling agent, avoiding the area of the butt joint and allow to dry.
- 13 . Apply a 5mm adhesive bead to the body joints, avoiding the area of the butt joint.
- 14 . Offer up the new panel, align and clamp into position.
- 15 Using the Genesis G4, install 1 Hemlok, part no: C2C 7792 and 2 Monobolts, part no: C2P 4773.



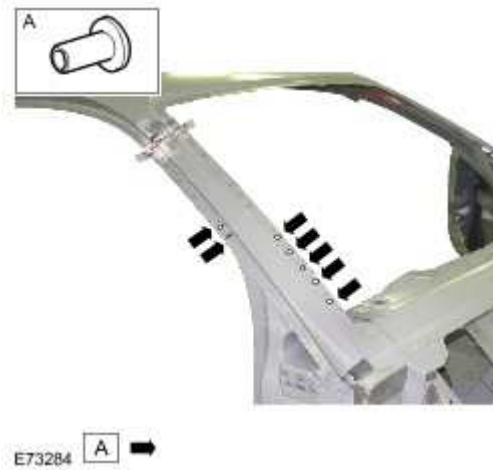
16 . Using the ESN50, install 6 Self-Piercing Rivets, part no: C2C 20589.



17 Using the ESN50, install 1 Self-Piercing Rivet, (through 3 thicknesses), part no: C2C 20593.



18 . Using the ESN50, install 7 Self-Piercing Rivets, part no: C2C 20590.



19 **NOTE:**

- If the original panel is being reused, use adhesive to fill the holes left from the removal of the original Self Piercing Rivets.

Remove any excess adhesive.

20 . Tack Weld the run-on/run-off tabs.

21 . Weld the joint between the A-Pillar and roof panel.



22 . Cut off the run-on/run-off tabs.

- 23 Carry out a non destructive crack inspection on the butt joint. If correct, proceed to next step, if not, rectify and recheck before proceeding.

24 . Using a belt sander, remove the welded joint.

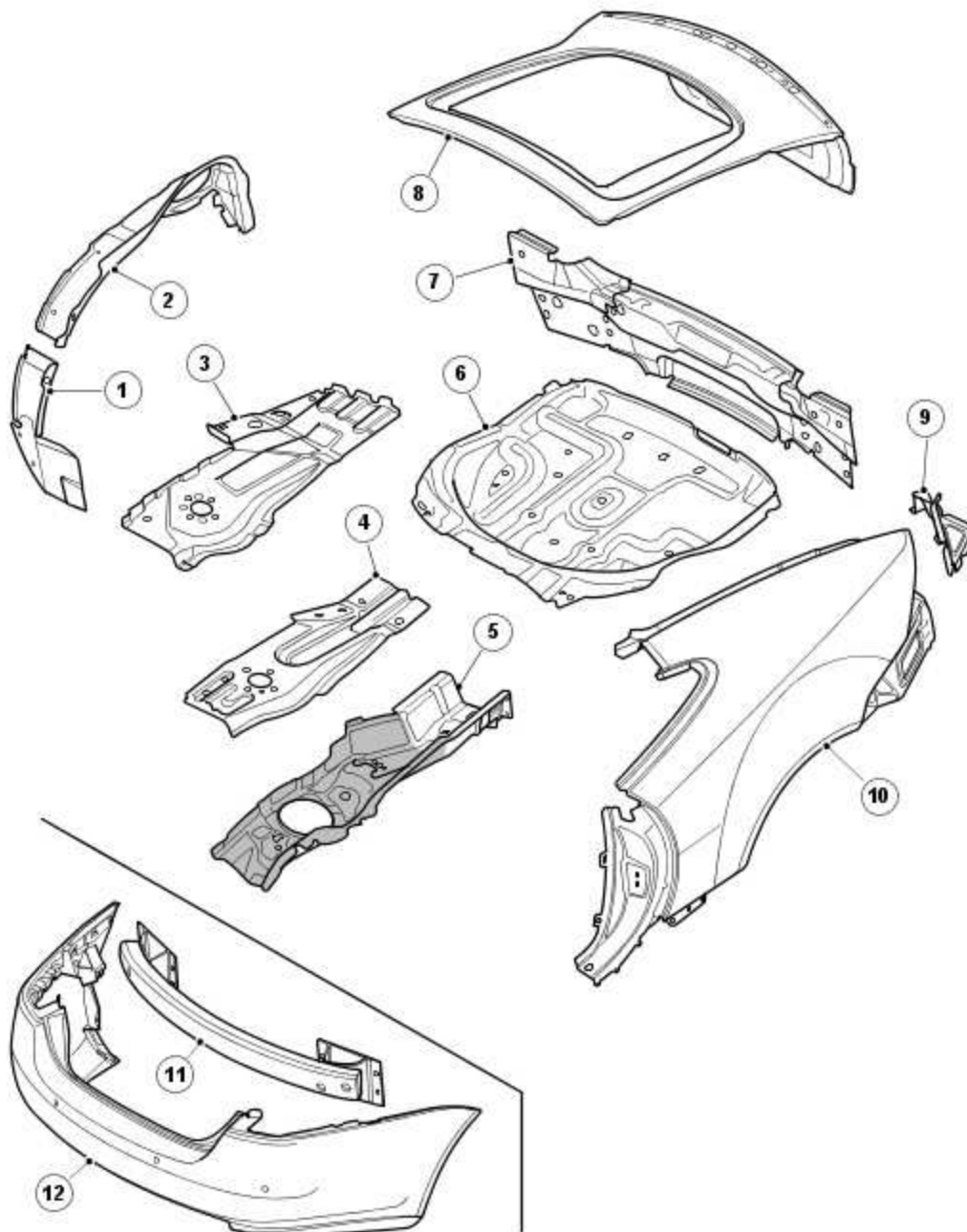
25 . Install is the reversal of removal.

501-30 : Rear End Sheet Metal Repairs

Description and operation

Rear End Sheet Metal

Rear end service panels



E74555

Item	Description	Service part No
1	Rear outer wheelhouse half	R/H = L/H
2	Rear wheelhouse outer	R/H L/H
3	Rear side member closing panel	R/H L/H
4	Rear side member reinforcement panel	R/H L/H
5	Rear side member section, (cut from full rear side member)	R/H L/H
6	Spare wheel well	
7	Back panel assembly	
8	Liftgate	
9	Rear lamp mounting panel	R/H L/H
10	Quarter panel assembly	R/H L/H
11	Rear bumper	
12	Rear bumper cover	

Time schedules, rear end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim, (MET), items, plus paint times based on Metallic Clear Over Base Paint, (blends to adjacent panels are not included)

The times shown were generated by Thatcham, (the Motor Insurance Repair Research Centre), and are to be used as a guide only.

Panel Description	coupe
Liftgate	6.9
Rear lamp mounting panel	4.1
Back panel assembly	25.9
Quarter panel Assembly	L/H 17.2 R/H 17.6
Rear bumper cover	6.5

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and paint times based on Metallic Clear Over Base Paint process, (blends to adjacent panels are not included).

Panel Description	coupe
Back panel assembly	

Liftgate	
Quarter panel assembly	
Rear bumper	
Rear bumper cover	
Headliner remove and install	
Total Time	L/H 29.9 R/H 30.2

Panel Description	coupe
Back panel assembly	
Liftgate	
Quarter panel assembly L/H and R/H	
Rear bumper	
Rear bumper cover	
Headliner remove and install	
Total Time	37.5

Panel Description	coupe
Back panel assembly	
Liftgate	
Quarter panel assembly L/H and R/H	
Rear bumper	
Rear bumper cover	
Rear side member closing panel	
Rear side member reinforcement panel	
Rear side member (section)	
Spare wheel well	
Headliner remove and install	
Rear subframe remove and install	
Fuel tank remove and install	
Total Time	L/H 45.6 R/H 45.8

Panel Description	coupe
Back panel assembly	
Liftgate	

Quarter panel assembly L/H and R/H	
Rear bumper	
Rear bumper cover	
Rear side member closing panel L/H and R/H	
Rear side member reinforcement panel L/H and R/H	
Rear side member (section) L/H and R/H	
Spare wheel well	
Headliner remove and install	
Rear subframe remove and install	
Fuel tank remove and install	
Total Time	59.8

Panel Description	coupe
Back panel assembly	
Rear bumper	
Rear bumper cover	
Spare wheel well	
Rear subframe remove and install	
Total Time	21.1

Rear Wheelhouse Outer

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear wheelhouse outer is replaced in conjunction with the:

- rear bumper cover
- quarter panel assembly
- rear inner wheelhouse half

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

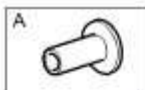
2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.



For additional information, refer to

3 Remove the rear inner wheelhouse half.

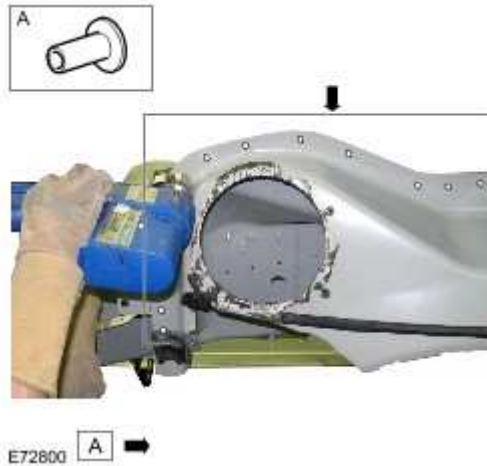
For additional information, refer to [Rear Inner Wheelhouse Half](#)

4 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 3 Self Piercing Rivets, from the rear outer wheelhouse half.



E72799  

- 5 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 18 Self Piercing Rivets, (17 on the LH), from the inner wheelhouse.




- 6 . Separate the joints and remove the panel.

Installation

- 1 . Remove rivet remnants.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 . Offer up the new panel and clamp into position.
- 4 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 5 Mark the positions of 18 holes, 17 on the LH side, on the new panel, ready for installing Self Piercing Rivets, (avoiding the original holes).
- 6 . Remove the new panel.
- 7 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.
- 8 . Pyrosil the joints.
- 9 . Apply the coupling agent and allow to dry.
- 10 . Apply a 5mm adhesive bead to the body joints.

- Using the ESN50, install 21 Self Piercing Rivets. 17 to the inner wheelhouse, (16 on the LH side), part no: C2C 20591, 3 to the rear outer wheelhouse half, part no: C2C 20590 and 1 to the inner wheelhouse, (through 3 thicknesses), part no: C2C 20594.



E72802  →

- Remove any excess adhesive.
- Install is the reversal of removal.

Rear Inner Wheelhouse Half

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear inner wheelhouse half is replaced in conjunction with the:

- rear bumper cover
- quarter panel assembly

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

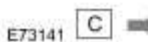
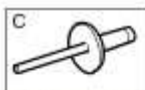
2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 . Remove the quarter panel assembly.

For additional information, refer to [Quarter Panel Assembly - 2-Door](#)

4 . Remove 3 Monobolts, from the rocker panel.



5 . Using the ESN50, remove 2 Self Piercing Rivets, from the inner B-Pillar.



- 6 Using a 6.5mm Cryobit drill bit, remove 28 Self Piercing Rivets. 12 from the rocker panel, 5 from the rear wheelhouse outer, 7 from the rear outer wheelhouse half and 4 from the quarter panel reinforcement.



- 7 . Separate the joints and remove the panel.

Installation

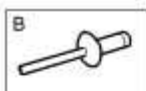
- 1 . Remove foam residue.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 . Remove rivet remnants.
- 4 Mark the position of 12 holes on the new panel, using the original panel as a template.
 - . Using a 6.5mm Cryobit drill bit, drill these 12 holes.



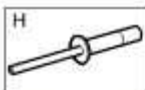
5 Offer up the new panel, check alignment, if correct proceed to next step, if not, rectify
. and recheck before proceeding.

6 . When aligned, clamp into position.

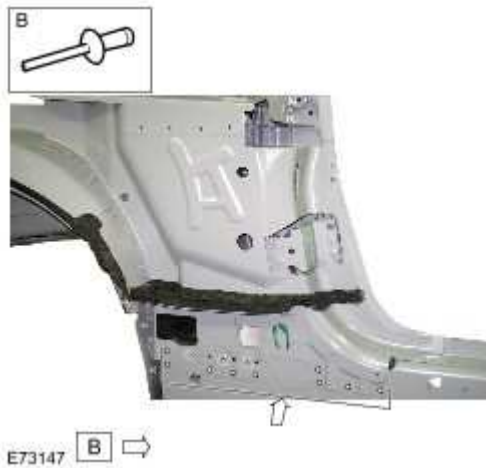
7 Using a 6.5mm Cryobit drill bit, drill through 12 original holes into the new panel,
. (illustration shown for reference).



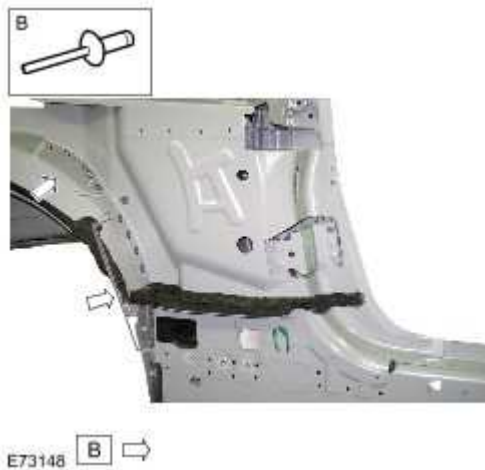
8 Countersink 3 holes in the new panel, in readiness for countersunk Monobolts,
. (illustration shown for reference).



- 9 . Remove the new panel.
- 10 . Deburr the drilled holes.
- 11 . Using a Roloc Bristle Disc, clean and prepare panel joint surfaces.
- 12 . Pyrosil the joints.
- 13 . Apply coupling agent and allow to dry.
- 14 . Apply a 5mm bead of adhesive to the body joints.
- 15 . Offer up the new panel, align and clamp into position.
- 16 . Using the Genesis G4, install 9 Hemloks, part no: C2C 9818, to the rocker panel.



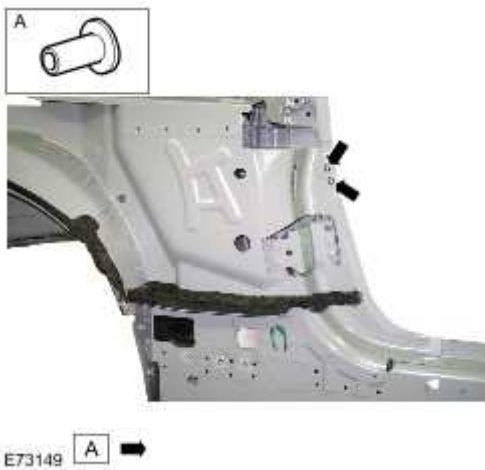
- 17 Using the Genesis G4, install 12 Hemloks, part no: C2C 7792, 7 to the rear outer wheelhouse half and 5 to the rear wheelhouse outer.



18 . Using the Genesis G4, install 3 Monobolts, part no: C2P 4773, to the rocker panel.



19 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20591, to the inner B-Pillar.



20 Using the ESN50, install 4 Self Piercing Rivets, part no: C2C 20589, to the quarter panel reinforcement.



21 . Using the Genesis G4, install 3 Monobolts, part no: C2P 4773, to the rocker panel.



22 . Remove any excess adhesive.

23 . Install is the reversal of removal.

Rear Outer Wheelhouse Half

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear outer wheelhouse half is replaced in conjunction with the:

- rear bumper cover
- quarter panel assembly
- rear wheelhouse outer
- rear inner wheelhouse half

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to

3 Remove the rear wheelhouse outer.

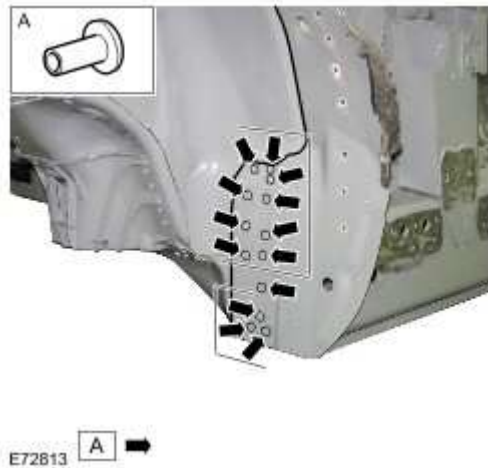
For additional information, refer to [Rear Wheelhouse Outer](#)

4 Using an air saw, bulk cut a section of the old panel to allow access for the ESN50. Then using the ESN50, remove 4 Self Piercing Rivets, from the inner wheelhouse.



E72812 **A** →

5 Using a 6.5mm Cryobit Drill Bit, remove 13 Self Piercing Rivets, 9 from the inner wheelhouse and 4 from the inner rocker panel.



- 6 . Separate the joints and remove the panel.

Installation

- 1 . Remove rivet remnants.
- 2 . Remove any foam residue.
- 3 . Offer up the new panel and clamp into position.
- 4 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 5 . Remove the new panel.
- 6 Using the old panel as a template, mark and drill 13 holes, using a 6.5mm Cryobit Drill Bit.



- 7 . Deburr the drilled holes.

8 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.



9 . Pyrosil the joints.

10 . Apply the coupling agent and allow to dry.

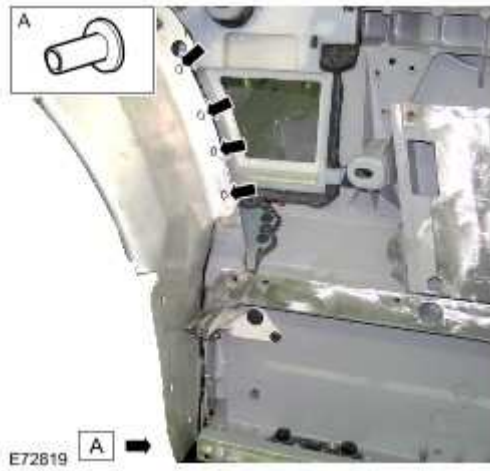
11 . Apply a 5mm adhesive bead to the new panel joints.



12 Using the Genesis G4, install 13 Hemlocks to the inner rocker panel. 9 part no: C2C 10349, (2 panel thickness) and 4 part no: C2C 22613, (3 panel thickness).



13 Using the ESN50, install 4 Self Piercing Rivets, part no: C2C 20591, to the inner wheelhouse.



14 . Remove any excess adhesive.

15 . Install is the reversal of removal.

Rear Lamp Mounting Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear lamp mounting panel is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly

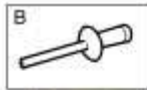
- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the back panel assembly.
For additional information, refer to [Back Panel Assembly](#)
- 4 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 10 Self Piercing Rivets, to the quarter panel.
- 5 . Separate joints, cut through foam and remove the panel.

Installation

- 1 . Remove foam residue.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.

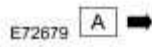
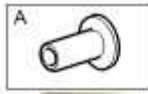


- 3 . Remove rivet remnants.
- 4 Offer up the new panel and check alignment. If correct proceed to next step, if not,
 . rectify and recheck before proceeding.
- 5 Using a 6.5mm Cryobit drill bit, drill 7 holes through the quarter panel lower
 . extension, into the new panel.
- 6 . Remove the new panel.
- 7 . Using a Roloc Bristle Disc, clean and prepare panel joint surfaces.
- 8 . Pyrosil the joints.
- 9 . Apply the coupling agent and allow to dry.
- 10 . Apply a 5mm adhesive bead to the body joints.
- 11 . Offer up the new panel, align and clamp into position.
- 12 Using the Genesis G4, install 7 Hemlocks, part no: C2S 11487, to the quarter panel
 . lower extension.



E74335 **B** ⇨

- Using the ESN50, install 3 Self Piercing Rivets, part no: C2C 20589, to the quarter panel.



- Remove any excess adhesive.
- Install is the reversal of removal.

Spare Wheel Well

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the spare wheel well is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly

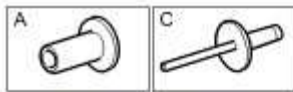
NOTE:

The rear subframe also has to be removed for access.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the battery.
- 4 . Remove the battery tray.
- 5 . Remove the navigation system module.
For additional information, refer to [Navigation System Module \(86.62.05\)](#)
- 6 . Remove the rear subframe.
For additional information, refer to [Rear Subframe \(64.25.01\)](#)
- 7 . Remove the fuel tank filler pipe.
For additional information, refer to [Fuel Tank Filler Pipe \(19.55.33\)](#)
- 8 . Remove the back panel assembly.
For additional information, refer to [Back Panel Assembly](#)
- 9 . Using an air saw, bulk cut the panel to allow access to joints for removal.



- 10 Using a 6.5mm Cryobit Drill Bit, remove 25 Self Piercing Rivets from the luggage floor. Remove 2 Monobolts, 1 from each side member.



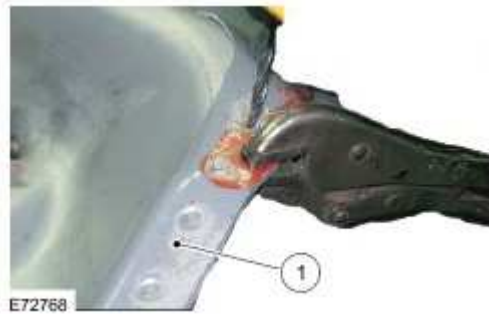
11 **NOTE:**

- Save the remnant as it will be used as a guide for drilling the fixing holes in the new panel, take care when separating the joint.

Separate joints and remove the panel.

Installation

- 1 . Remove rivet residue.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 Offer up the old panel remnant to the new panel and using this as a guide, drill 25 holes . in the new panel using a 6.5mm Cryobit Drill Bit.



4 . Deburr drilled holes.

5 Offer up the new panel. Check alignment, if correct proceed to next step, if not, rectify . and recheck before proceeding.

6 . Remove the new panel.

7 . Using a Roloc Bristle Disc, clean and prepare the new panel joint surfaces.

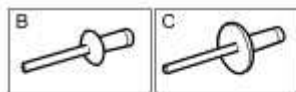
8 . Pyrosil the joints.

9 . Apply the coupling agent and allow to dry.

10 . Apply a 5mm adhesive bead to the new panel joints.

11 . Offer up the new panel, align and clamp into position.

12 Using the Genesis G4, install 25 Hemlocks, part no: C2C 7792, to the luggage floor . and 2 Monobolts, 1 each side, part number: C2P 4773, to the rear side member.



13 . Remove any excess adhesive.

14 . Install is the reversal of removal.

Rear Side Member Section

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear side member section is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly
- spare wheel well
- rear side member closing panel
- rear side member reinforcement panel

NOTE:

The rear subframe and the fuel tank have to be removed for access.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the rear side member reinforcement panel.
For additional information, refer to [Rear Side Member Reinforcement Panel](#)
- 4 . Remove the spare wheel well.
For additional information, refer to [Spare Wheel Well](#)
- 5 Using a Belt Sander, sand down the heads of 8 Self Piercing Rivets to the exhaust hanger bracket. Use a 6.5mm Cryobit Drill Bit to remove these 8 rivets.



6 . Remove the rivet remnants.

7 Using an air saw, Bulk cut the old panel at a point measured 185mm rearward from the top of the flange, as illustrated. Discard the cut section.



Installation

1 . Bulk cut the new panel, allowing for overlap.



2 . Offer up the new panel section, align and clamp against the old panel.

- 3 Using an air saw, cut through the new panel, using the edge of the original panel as a . guide, (at the 185mm marked point).
- 4 Measure and cut a 50mm section, to be used as a backing plate and 2 run on, run off . tabs, from the remnant of the new panel.
- 5 . Using a Roloc Bristle disc, clean and prepare the panel joint surfaces.
- 6 Clamp the backing plates and run on / run off tabs into position and check alignment. If . within tolerance continue to weld the backing plates, then the run on / run off tabs into position. If not, rectify and recheck before proceeding.



- 7 . Clamp the weld run on / run off tabs into position and then tack weld.
- 8 . Weld the section joint.



- 9 . Cut off run on / off tabs.
- 10 Carry out a non destructive crack inspection on the Butt Joint. If correct, proceed to . next step, if not, rectify and recheck before proceeding.
- 11 . Using a belt sander, sand down the weld joint.



12 . Prime the area, in and around, the backing plates.



13 Using the exhaust mounting bracket as a template, use a 6.5mm Cryobit Drill Bit to
· drill out the 8 holes in the Side Member.

14 . Deburr drilled holes.

NOTE:

Do not Roloc the exhaust hanger bracket.

15 . Apply a 5mm bead of adhesive to the exhaust hanger bracket.

16 Offer up the exhaust hanger bracket, then, using the Genesis G4, install 8 Hemloks.
· The 4 in the centre, (grouped in the illustration) are part no: C2C 22613. The
remaining 4, outer Hemloks are part no: C2C 10349.



E72810 **B** →

17 . Remove any excess adhesive.

18 . Install is the reversal of removal.

Quarter Panel Lower Extension

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the quarter panel lower extension is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly
- rear lamp mounting panel

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Release the inner wheelhouse wiring harness and position it aside.
- 4 . RH Side: Remove the antenna.
For additional information, refer to [Antenna \(86.51.17.60\)](#)
- 5 . Remove the rear lamp mounting panel.
For additional information, refer to [Rear Lamp Mounting Panel](#)
- 6 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 12 Self Piercing Rivets.



7 . Remove the foil patch at the joint with the rear quarter panel.



8 . Separate the joints, cut through foam and remove the panel.

Installation

- 1 . Remove foam residue.
- 2 . Using a Roloc Bristle Disc, remove adhesive residue.
- 3 . Remove rivet remnants.
- 4 Offer up the new panel and check alignment. If correct proceed to next step, if not, . rectify and recheck before proceeding.
- 5 Using a 6.5mm Cryobit drill bit, drill 4 holes through the rear quarter panel into the . new panel, ready for hemlok fixings.
- 6 . Remove the new panel.

- 7 . Using a Roloc Bristle Disc, clean and prepare panel joint surfaces.
- 8 . Pyrosil the joints.
- 9 . Apply the coupling agent and allow to dry.
- 10 . Apply a 5mm adhesive bead to the body joints.
- 11 . Offer up the new panel, align and clamp into position.
- 12 . Using the Genesis G4, install 4 Hemlocks, to the quarter panel, part no: C2S 11487.



- 13 Using the ESN50, install 8 Self Piercing Rivets, part no: C2C 20589, 6 to the rear side member closing panel and 2 to the rear wheelhouse.



- 14 . Remove any excess adhesive.
- 15 Note: Replace the foil patch at the joint with the quarter panel, after the primer application.

Quarter Panel Assembly - 2-Door

Removal

NOTE:

This is a category 'A' repair.

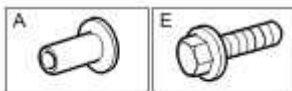
NOTE:

In this procedure the quarter panel assembly is replaced in conjunction with the:

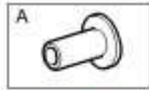
- rear bumper cover
- liftgate

- 1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 . Disconnect the battery.
For additional information, refer to
- 4 . Disconnect the generator electrical connections.
- 5 . Remove the rear bumper cover.
For additional information, refer to [Rear Bumper Cover \(76.22.74\)](#)
- 6 . Remove the rocker panel moulding.
For additional information, refer to [Rocker Panel Moulding \(76.11.36\)](#)
- 7 . Remove the liftgate.
- 8 . Remove the headliner.
For additional information, refer to [Headliner \(76.64.01\)](#)
- 9 . Remove the rear quarter window glass.
For additional information, refer to [Rear Quarter Window Glass - 2-Door \(76.31.31\)](#)
- 10 . Remove the bodyside weatherseal.

- 11 . Remove the roof moulding.
- 12 . Remove the rear drip gutter moulding.
- 13 . Remove the boot extractor vent.
- 14 . Remove the quarter panel speaker.
For additional information, refer to [Quarter Panel Speaker - 2-Door \(86.50.12\)](#)
- 15 . Remove the front safety belt retractor.
For additional information, refer to [Front Safety Belt Retractor \(76.73.10\)](#)
- 16 . Remove the door striker.
- 17 . Remove the liftgate guide.
- 18 . RH Side: Remove the antenna.
For additional information, refer to [Antenna \(86.51.17.60\)](#)
- 19 . Release the inner wheelhouse wiring harness and position it aside.
- 20 . RH side: Remove the fuel filler flap.
- 21 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 18 Self Piercing Rivets. 6 from the quarter panel inner reinforcement, 4 from the back panel assembly, 2 from the rear wheelhouse outer and 6 from the rear side member closing panel. Remove 3 10mm bolts from the rocker panel.



- 22 . Using the ESN50, remove 14 Self Piercing Rivets, from the door aperture.



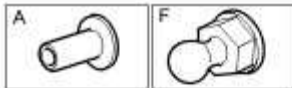
E71243 **A** →

23 . Remove the foil patch, located in the drain channel.



E75238

24 Using the ESN50, remove 16 Self Piercing Rivets. Remove the 2 which were covered by the foil patch and remove 14 from the drain channel. Remove the 1 13mm liftgate strut mounting bolt.



E71245 **A** → **F** →

25 . Saw cut the panel. Separate the joints and remove the panel bulk.

26 Mark the position of the roof panel to rear quarter panel assembly welded joint and saw cut 3mm below this point.

27 NOTE:

- There is a "hidden" Self Piercing Rivet under the roof panel.

Measure the position of the "hidden" Rivet, (see 1), and using a 6.5mm Cryobit drill bit, drill through from the drain channel side, to remove it.



- 28 . Separate the joint and remove the remaining quarter panel / drain channel remnant.

- 29 Using a belt sander, sand back the welded joint, inside and out, in preparation for the new quarter panel assembly.



Installation

- 1 . Remove the rivet remnants.
- 2 . Remove any foam/sealer remnants.
- 3 . Using a Roloc Bristle Disc, remove the adhesive residue.
- 4 . Deburr the drilled holes.
- 5 . With assistance, offer up the new panel, align and clamp into position.
- 6 Check alignment, if correct proceed to next step, if not, rectify and recheck before

. proceeding.

7 . Remove the new panel.

8 . Using a Roloc Bristle Disc, clean and prepare the panel joint surfaces.

9 . Pyrosil the joints, avoiding the area of the weld joint.

10 . Apply the coupling agent, avoiding the area of the weld joint and allow to dry.

11 . Apply Wurth semi-rigid sealer in the same locations as the old panel.

For additional information, refer to [Body Repairs](#)

12 . Apply a 5mm adhesive bead to the body joints, avoiding the area of the weld joint.

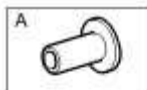
13 . With assistance, offer up the new panel, align and clamp into position.

14 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.

15 . Install 3 10mm bolts to the rocker panel.

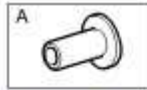
16 . Install 1 13mm liftgate strut mounting bolt.

17 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20591, to the inner B-Pillar.



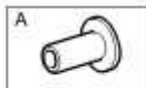
E71253 A →

18 . Using the ESN50, install 11 Self Piercing Rivets, part no: C2C 20593, to the B-Pillar.



E71254 **A** →

- 19 Using the ESN50, install 6 Self Piercing Rivets, part no: C2C 20589, to the quarter panel reinforcement.
- 20 Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20593, to the rocker panel.
- 21 Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20590, to the rear quarter window aperture, (lower side of the weld joint).
- 22 Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20589, to the rear quarter window aperture, (upper side of the weld joint).
- 23 Using the ESN50, install 14 Self Piercing Rivets, to the drain channel casting. Install 2, part no: C2C 20591 and 12, part no: C2C 20590.



E71255 **A** →

- 24 Using the ESN50, install 6 Self Piercing Rivets, part no: C2C 20589, to the rear side member closing.
- 25 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20589, to the rear

. wheelhouse outer.

26 . Cut 2 run on / run off tabs from the original panel, or from similar material.

27 . Tack weld the run on / run off tabs into position.

28 . Lap weld the joint between the quarter panel assembly and the roof panel.



29 . Remove the run on / run off tabs.

30 Carry out a non destructive crack inspection on the lap weld. If correct proceed to
. next step, if not, rectify and recheck before proceeding.

31 . Using a belt sander, dress the welded joint.



32 . Remove any excess adhesive.

33 . Note: Replace the foil patch on the drain channel after the primer application.

34 . Install is the reversal of removal.

Quarter Panel Assembly - Convertible

Removal

NOTE:

This is a category "A" repair.

NOTE:

In this procedure the quarter panel assembly is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- Luggage compartment lid
- Convertible top compartment lid
- Convertible top compartment lid hinges LH and RH
- Convertible top assembly
- Water drain panel

1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to [Body Repairs](#)

3 Remove the cover and disconnect the battery ground cable.

4 Remove the rear bumper cover.

For additional information, refer to [Rear Bumper Cover \(76.22.74\)](#)

5 Remove the rocker panel moulding.

For additional information, refer to [Rocker Panel Moulding \(76.11.36\)](#)

6 Remove the convertible top assembly.

For additional information, refer to [Convertible Top Assembly \(76.86.15\)](#)

7 Remove the convertible top compartment lid.

For additional information, refer to [Convertible Top Compartment Lid](#)

8 Remove the convertible top compartment lid hinges.

9 Remove the rear quarter window glass.

For additional information, refer to [Rear Quarter Window Glass - Convertible](#)

(76.31.31)

10 . Remove the boot extractor vent.

11 . Remove the door striker.

12 . RH side: Remove the antenna.

For additional information, refer to [Antenna \(86.51.17.60\)](#)

13 . RH side: Remove the fuel filler flap.

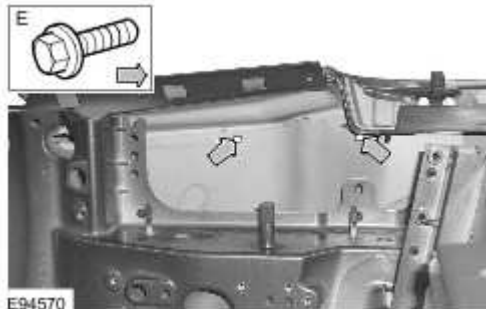
14 . Release the inner wheelhouse wiring harness and position it aside.

15 . Remove 4 10mm bolts at the rocker panel.



E94569

16 . Remove 2 10mm bolts from the inner quarter panel.



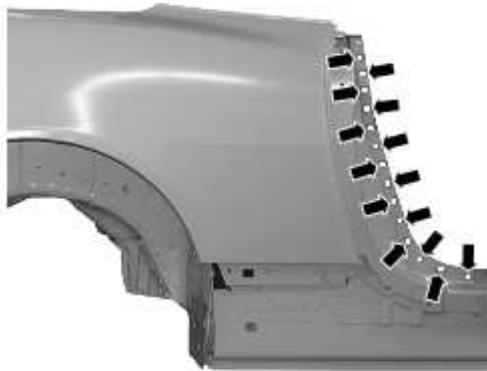
E94570

17 . Use the ESN50 to remove 1 Self Piercing Rivet at the rear inner wheelhouse half.



E94571

18 . Use the ESN50 to remove 14 Self Piercing Rivets at the door aperture.



E94572

19 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 12 Self Piercing Rivets at the quarter panel lower extension.



E94573

20 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 6 Self Piercing Rivets at the back panel.



E94574

21 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 4 Self Piercing Rivets at the water drain panel.



22 . Separate the joints and remove the panel.

Installation

- 1 . Remove the rivet remnants.
- 2 . Remove any foam/sealer remnants.
- 3 . Using a Roloc Bristle Disc, remove the adhesive residue.
- 4 . Deburr the drilled holes.
- 5 . Offer up the new panel, align and clamp into position.
- 6 . Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 7 . Remove the new panel.
- 8 . Using a Roloc Bristle Disc, clean and prepare the panel joints.
- 9 . Pyrosil the joints.
- 10 . Apply the coupling agent and allow to dry.
- 11 . Apply a flexible sealant / adhesive to the areas illustrated, in the same locations as the old panel.
For additional information, refer to [Body Repairs](#)



E94575

- 12 . Apply a flexible sealant / adhesive to the NVH element.
For additional information, refer to [Body Repairs](#)



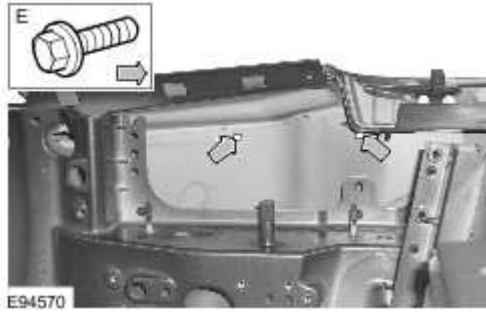
E94576

- 13 Apply a 5mm adhesive bead to the body joints. Adhesive must be applied between all riveted joints and any other locations where it was originally applied.
- 14 . Offer up the new panel, align and clamp into position.
- 15 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 16 . Install 4 10mm bolts to the Rocker Panel.

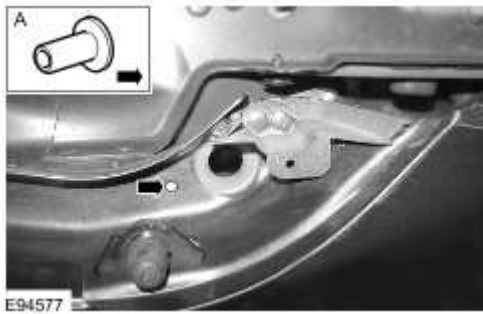


E94569

- 17 . Install 2 10mm bolts to the inner quarter panel.



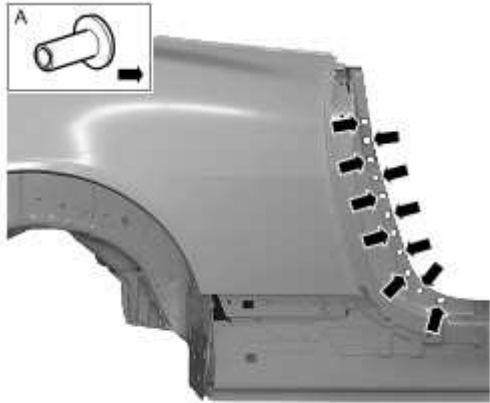
- 18 Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20589, (2 panel thickness), at the rear inner wheelhouse half.



- 19 Using the ESN50, install 2 Self Piercing Rivets, part no: C2C 20591, (2 panel thickness), at the door aperture.

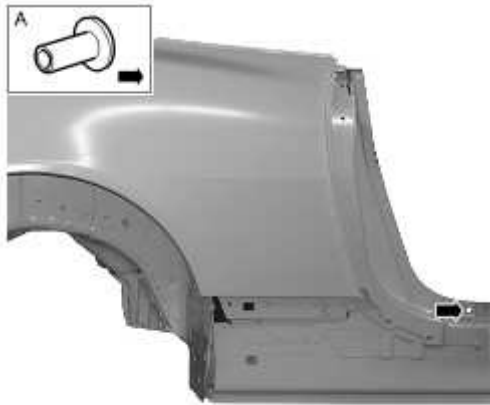


- 20 Using the ESN50, install 11 Self Piercing Rivets, part no: C2C 20593, (3 panel thickness), at the door aperture.



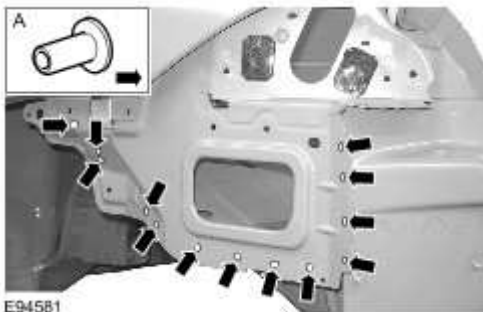
E94580

- 21 Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20590, (2 panel thickness), at the door aperture.



E94578

- 22 Using the ESN50, install 12 Self Piercing Rivets, part no: C2C 20589, (2 panel thickness), at the quarter panel lower extension.



E94581

- 23 Using the ESN50, install 6 Self Piercing Rivets, part no: C2C 20589, (2 panel thickness), at the back panel.



24 . Using the ESN50, install 3 Self Piercing rivets, part no: C2C 20589.



25 . Using the ESN50, install 1 Self Piercing rivets, part no: C2C 20592.



26 . Remove any excess adhesive.

27 The installation of associated panels and mechanical components is the reverse of removal.

Back Panel Assembly

Removal

NOTE:

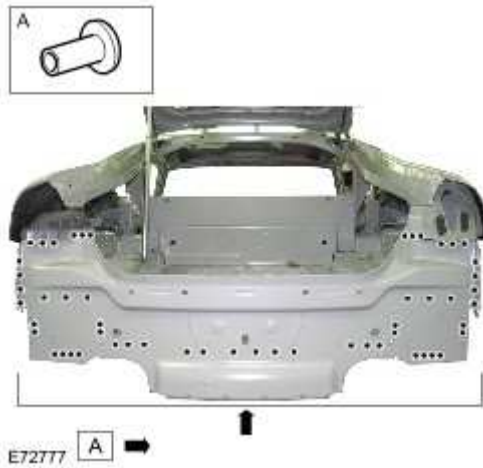
This is a category 'A' repair.

NOTE:

In this procedure the back panel assembly is replaced in conjunction with the:

- rear bumper cover
- rear bumper

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Disconnect the battery.
For additional information, refer to
- 4 . Remove the rear bumper.
For additional information, refer to [Rear Bumper \(76.22.27\)](#)
- 5 . Remove the LH and RH extractor vents.
- 6 . Remove the liftgate striker.
- 7 . Release the back panel wiring harness and position it aside.
- 8 Using a combination of the ESN50 and a 6.5mm Cryobit Drill Bit, remove 54 Self Piercing Rivets.



9 . Separate the joints and remove the panel.

Installation

1 . Remove rivet remnants.

2 . **NOTE:**

Do not clean the steel bracket on the spare wheel well.

Using a Roloc Bristle Disc, remove adhesive residue.

3 . Dress flanges where necessary.

4 Offer up the new panel and clamp into position. Check alignment, if correct proceed to . next step, if not, rectify and recheck before proceeding.

5 Using a 6.5mm Cryobit Drill Bit, drill 4 holes, 2 each side, through the rear side . member into the new panel.



6 Using a 6.5mm Cryobit Drill Bit, drill 12 holes through the trunk floor into the new

. panel.

7 Using a 6.5mm Cryobit Drill Bit, drill 6 holes, 3 each side, through the side member
. closing into the new panel.

8 . Countersink 4 holes, 2 each side, in the new panel.



9 . Remove the new panel.

10 . Deburr drilled holes.

11 . Using a Roloc Bristle Disc, clean and prepare the panel surfaces.

12 . Pyrosil the joints.

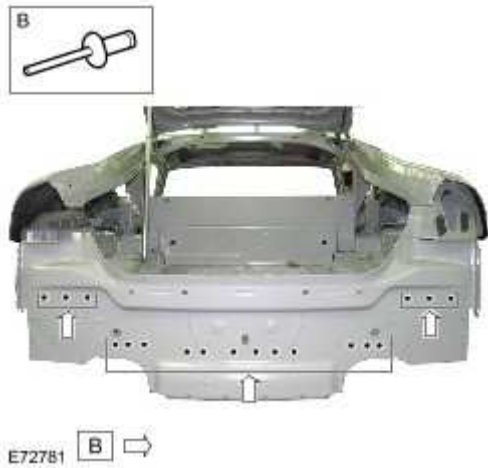
13 . Apply the coupling agent and allow to dry.

14 . Apply a 5mm adhesive bead to the body joints.



15 . Offer up the panel, align and clamp into position.

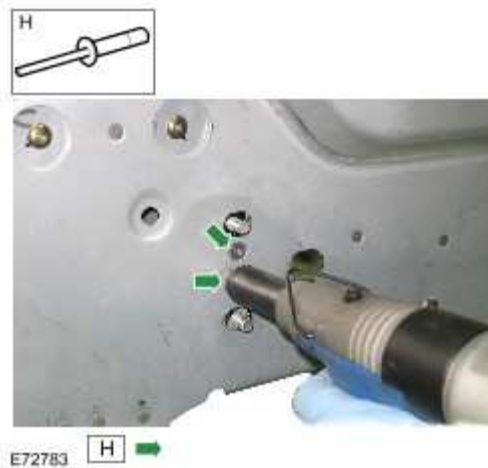
16 Using the Genesis G4, install 18 Hemlocks, 12 into the spare wheel well and 6 , 3 each
. side, into the rear side member closing panel, part no: C2C 7792.



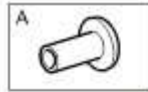
17 NOTE:

- These need to be Countersunk fixings as the rear bumper is fixed at these points and needs to sit flush with the back panel.

Using the Genesis G4, install 4 Countersunk Monobolts, 2 each side, into the rear side member, 2 each side.

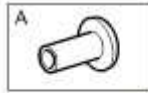


- 18 Using the ESN50, install 20 Self Piercing Rivets, 10 each side, into the quarter panel, part no: C2C 20589.
-



E72782 **A** →

- 19 . Using the ESN50, install 12 Self Piercing Rivets, 6 each side, into the rear side member, part no: C2C 20591.



E7311Q **A** →

- 20 . Remove any excess adhesive.

- 21 . Install is the reversal of removal.

Rear Side Member Closing Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear side member closing panel is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly

NOTE:

The fuel tank and rear subframe have to be removed for access.

NOTE:

The rear side member closing panel can only be installed with the rear side member reinforcement panel.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the battery.
- 4 . Remove the battery tray.
- 5 . Remove the fuel tank.
For additional information, refer to [Fuel Tank \(19.55.01\)](#)
- 6 . RH Side: Remove the fuel tank filler pipe.
For additional information, refer to [Fuel Tank Filler Pipe \(19.55.33\)](#)
- 7 . RH Side: Remove the antenna.
For additional information, refer to [Antenna \(86.51.17.60\)](#)
- 8 . Release the inner wheelhouse wiring harness and position it aside.

9 . Remove the navigation system module.

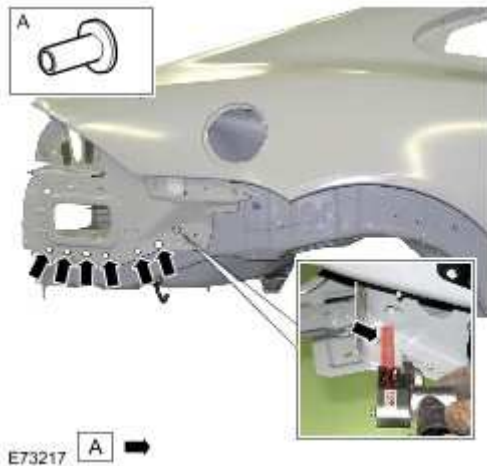
For additional information, refer to [Navigation System Module \(86.62.05\)](#)

10 . Remove the back panel assembly.

For additional information, refer to [Back Panel Assembly](#)

11 Using the ESN50, remove 6 Self Piercing Rivets, to the quarter panel lower extension.

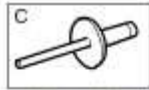
. Using a Belt Sander, sand down the head of 1 Self Piercing Rivet, (inset), accessed from underneath. (If the quarter panel assembly or the quarter panel lower extension is removed, the fixing can be removed using the ESN50).



12 . Using a 6.5mm Cryobit drill bit, remove 11 Self Piercing Rivets, to the wheelhouse.

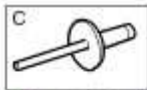


13 . Remove 3 Monobolts, to the rear side member reinforcement panel.



E73219 **C** ➔

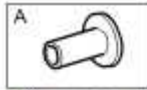
14 . Remove 2 Monobolts, to the luggage floor.



E73220 **C** ➔

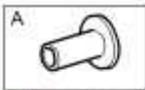
15 Using an air saw, Bulk Cut the old panel to enable access to further fixings. If the quarter panel or quarter panel lower extension is removed the Bulk Cut is not required.

16 Using a Belt Sander, sand down the underside heads of 20 Self Piercing Rivets, to the rear side member. Then, using the ESN50, remove the rivets.



E73221 A →

17 . Using the ESN50, remove 5 Self Piercing Rivets, to the rear side member.



E73222 A →

18 Using an air saw, bulk cut the old panel at its joint with the luggage floor, approx 42cm long.



E73223

19 . Separate joints and remove the bulk of the closing panel.

Installation

- 1 The side member closing panel is installed with the side member reinforcement panel.
 - . (The procedure for removing the remaining rear side member closing panel remnant and the installation of the rear side member closing panel, is described in the rear side member reinforcement panel procedure).

For additional information, refer to [Rear Side Member Reinforcement Panel](#)

Rear Side Member Reinforcement Panel

Removal

NOTE:

This is a category 'A' repair.

NOTE:

In this procedure the rear side member reinforcement panel is replaced in conjunction with the:

- rear bumper cover
- rear bumper
- back panel assembly
- rear side member closing panel

NOTE:

The fuel tank and rear subframe have to be removed for access.

NOTE:

The rear side member reinforcement panel can only be installed with the rear side member closing panel.

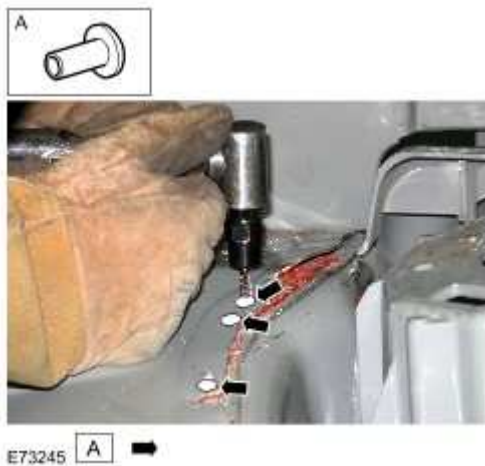
- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to
- 3 . Remove the rear side member closing panel.
For additional information, refer to [Rear Side Member Closing Panel](#)
- 4 Using an air saw, bulk cut the panel, then, using a 6.5mm Cryobit drill bit, remove 1 . Self Piercing Rivet, to the rear suspension top mount.



5 . Separate the joints and remove the bulk of the rear side member reinforcement panel.

6 Using a combination of the ESN50 and a 6.5mm Cryobit drill bit, remove 4 Self Piercing Rivets. Separate the joints and remove the rear side member reinforcement panel remnant.

7 Locate 3 hidden Self Piercing Rivets, (under the luggage floor), to the rear side member. Using a 6.5mm Cryobit drill bit, drill through the luggage floor above these rivets for access. Note: The holes may need to be enlarged slightly to expose the rivet heads. Use a 6.5mm Cryobit drill bit to remove.



8 Using a 6.5mm Cryobit drill bit, remove 1 Self Piercing Rivet, from underneath the vehicle, to the rear side member.



- 9 . Separate the joints and remove the remaining remnant of the rear side member closing panel.

Installation

NOTE:

The installation of the rear side member closing panel is carried out with the rear side member reinforcement panel.

- 1 . Using a Roloc Bristle Disc, remove adhesive residue.
- 2 . Remove rivet remnants.
- 3 . Offer up the rear side member reinforcement panel.
- 4 . Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.
- 5 . Clamp the rear side member reinforcement panel into position and using a 6.5mm Cryobit drill bit, drill 4 holes. Countersink the holes in the body panel ready to accept countersunk Monobolts.



- 6 Offer up the rear side member closing panel to the rear side member reinforcement panel. Use a nut and bolt through the two panels and one of the the rear suspension top mount fixing holes to align and clamp into position.



- 7 Check alignment, if correct proceed to next step, if not, rectify and recheck before proceeding.

- 8 Using a 6.5mm Cryobit drill bit, drill 11 holes through the wheelhouse into the new closing panel.



- 9 Using a 6.5mm Cryobit drill bit, drill 4 holes through the floor panel into the new closing panel. 3 of these holes are drilled from above, the fourth is drilled from underneath, (as shown in the inset).



10 . Remove the new panels.

11 . Deburr the drilled holes.

12 . Using a Roloc Bristle Disc, clean and prepare both panel joint surfaces.

13 . Pyrosil the joints of both panels.

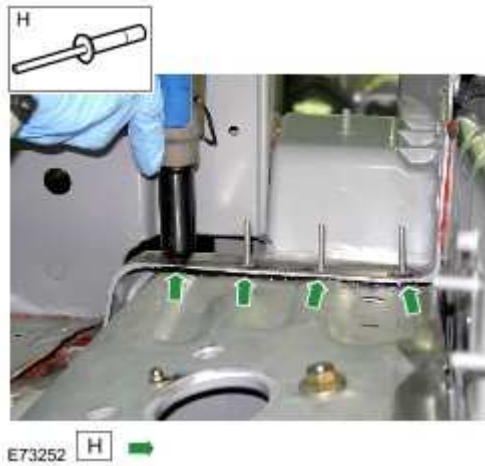
14 . Apply the coupling agent to both panels and allow to dry.

15 . Apply a 5mm adhesive bead to the reinforcement panel, offer up the panel and align.

16 . Using the Genesis G4, install 1 Hemlok, from underneath, part no: C2C 10349.

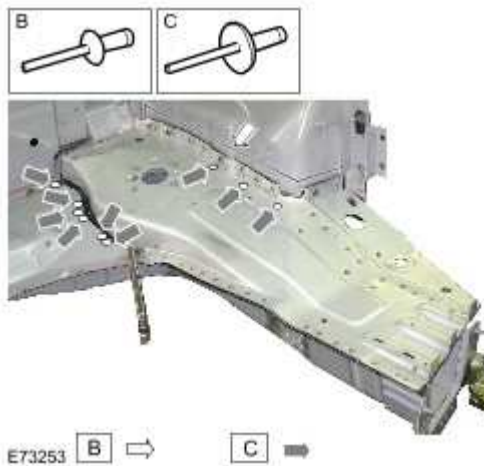


17 . Using the Genesis G4, install 4 Countersunk Monobolts.

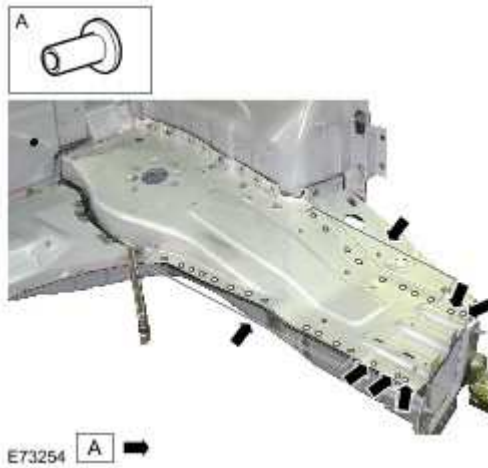


18 . Apply a 5mm adhesive bead to the closing panel, offer up the panel and align.

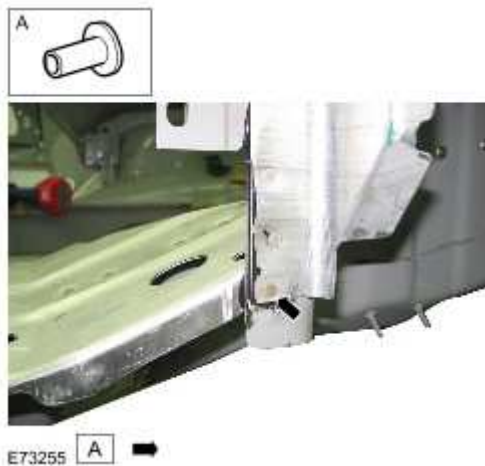
19 Using the Genesis G4, install 11 Hemloks, part no: C2C 7792, to the wheelhouse and
 . 9 Monobolts, part no: C2P 4773, 3 to the rear side member reinforcement panel and 6 to the luggage floor.



20 Using the ESN50, install 25 Self Piercing Rivets, part no: C2C 20595, to the rear side
 . member.



- 21 If the rear quarter panel lower extension, or quarter panel assembly is removed: Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20590, through the rear wheelhouse outer into the rear side member reinforcement panel, (as shown in the illustration).



- 22 If the rear quarter panel lower extension, or quarter panel assembly is in place: Using the ESN50, install 1 Self Piercing Rivet, part no: C2C 20595, through the rear quarter panel lower extension into the rear side member reinforcement panel.

23 . Remove any excess adhesive.

24 . Install is the reversal of removal.

Water Drain Panel - Convertible

Removal

NOTE:

This is a category "A" repair.

NOTE:

If the water drain panel is removed for access only, it will require renewal due to the holes made during its removal.

NOTE:

In this procedure the water drain panel is replaced in conjunction with the:

- Luggage compartment lid
- Convertible top compartment lid
- Convertible top compartment lid hinges LH and RH
- Convertible top assembly

1 . Before commencing this procedure ensure that you are aware of all Health and Safety requirements.

For additional information, refer to [Health and Safety Precautions](#)

2 . For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.

For additional information, refer to [Body Repairs](#)

3 . Remove the convertible top assembly.

For additional information, refer to [Convertible Top Assembly \(76.86.15\)](#)

4 . Remove the convertible top compartment lid.

For additional information, refer to [Convertible Top Compartment Lid](#)

5 . Remove the convertible top compartment lid hinges.

For additional information, refer to [Convertible Top Compartment Lid Hinge](#)

6 . Using the ESN50, remove 8 Self-Piercing Rivets.



7 NOTE:

- To aid separation, use a heat gun to soften the adhesive bond to the water drain panel reinforcement.

Separate the joints and remove the panel.

Installation

- 1 . Remove the rivet remnants.
- 2 . Using a Roloc Bristle Disc, clean and prepare the panel joints.
- 3 . Pyrosil the joints.
- 4 . Apply the coupling agent and allow to dry.
- 5 . Apply a 5mm adhesive bead to the water drain panel reinforcement.



6 NOTE:

- If the water drain panel is being fitted to the original quarter panel, the rivets must be installed avoiding the original removal holes.

Using the ESN50, install 6 Self-Piercing rivets, part no: C2C 20589.



E94586

7 NOTE:

- If the water drain panel is being fitted to the original water drain panel reinforcement, the rivets must be installed avoiding the original removal holes.

Using the ESN50, install 2 Self-Piercing rivets, part no: C2C 20592.



E94587

- 8 The installation of associated panels and mechanical components is the reverse of removal.

Water Drain Panel Reinforcement - Convertible

Removal

NOTE:

This is a category "A" repair.

NOTE:

In this procedure the water drain panel reinforcement is replaced in conjunction with the:

- Luggage compartment lid
- Convertible top compartment lid
- Convertible top compartment lid hinges LH and RH
- Convertible top assembly
- Water drain panel
- Quarter panel

NOTE:

At least one quarter panel has to be removed to enable this repair.

- 1 Before commencing this procedure ensure that you are aware of all Health and Safety requirements.
For additional information, refer to [Health and Safety Precautions](#)
- 2 For further information on the methods, tools and fixings used in this procedure refer to the body repairs - general information section.
For additional information, refer to [Body Repairs](#)
- 3 Remove the water drain panel.
For additional information, refer to [Water Drain Panel - Convertible](#)
- 4 Remove the quarter panel.
For additional information, refer to [Quarter Panel Assembly - Convertible](#)
- 5 Remove 4 10mm bolts, 2 each side.



6 . NOTE:

To aid separation, use a heat gun to soften the adhesive bond to the quarter panel.

Separate the joints and remove the panel.

Installation

NOTE:

The water drain panel reinforcement cannot be installed if the quarter panel is in place. The following 4 steps should be performed to the new panel prior to installing the quarter panel.

- 1 . Using a Roloc Bristle Disc, clean and prepare the panel joints.
- 2 . Pyrosil the joints.
- 3 . Apply the coupling agent and allow to dry.
- 4 Install the water drain panel reinforcement between its fixing brackets, but do not . secure it.
- 5 . Install the quarter panel.

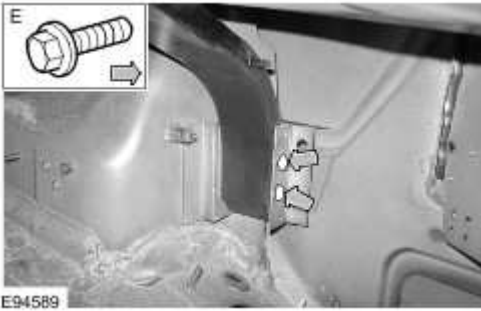
6 NOTE:

- The water drain panel rivets should be installed before the adhesive cures.

Apply a 5mm adhesive bead to the water drain panel reinforcement in the areas illustrated.



- 7 . Raise and align the reinforcement panel, once aligned, install 4 10mm bolts, 2 each side.



- 8 . Install the water drain panel.

- 9 . The installation of associated panels and mechanical components is the reverse of removal.

502 : Frame and Mounting

502-00 : Uni-Body, Subframe and Mounting System

Specifications

Specifications

Torque Specifications

Item	Nm	lb-ft	lb-in
Dash braces to engine bay - bolt	55	40	-
Front subframe to body - forward bolt	80 Nm + 360 degrees	59 lb-ft + 360 degrees	-
Front subframe to body - rear bolt	80 Nm + 270 degrees	59 lb-ft + 270 degrees	-
Front subframe NVH brace - bolt	55	40	-
Radiator brace lower to longitudinal brackets - bolt	23	17	-
Rear subframe to body - bolt	60 Nm + 240 degrees	44 lb-ft + 240 degrees	-
Rear K-frame brace - forward bolt	133	98	-
Rear K-frame brace - rear bolt	40	30	-
Reinforcer front floor pan to underfloor of BIW - screw	40	30	-

Front Subframe (76.10.05)

Special Service Tools



303-021

Engine support bracket

303-021



303-749

Engine lifting brackets

303-749



HTJ12002

Power train assembly jack HTJ

1200-2



502-010

E65082

Subframe alignment bolts

502-010

Removal

- 1 . Remove the cover and disconnect the battery ground cable.

For additional information, refer to

2



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3 . Remove the radiator air deflector.

For additional information, refer to Radiator Splash Shield (76.22.90)

4 . Remove the engine undershield.

For additional information, refer to Air Deflector (76.11.41)


5 . Remove the lower suspension arms.

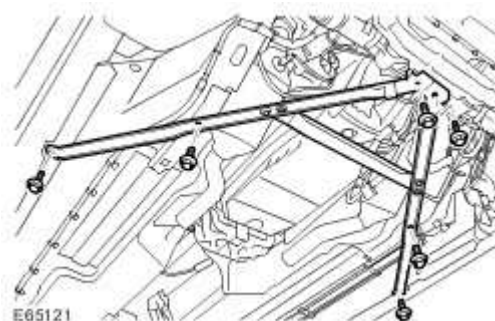
For additional information, refer to Rear Lower Arm (60.35.54)

6 . Remove the throttle body.

For additional information, refer to Throttle Body (19.70.04)

7 . With assistance, remove the A-frame.

 Remove the 6 bolts.



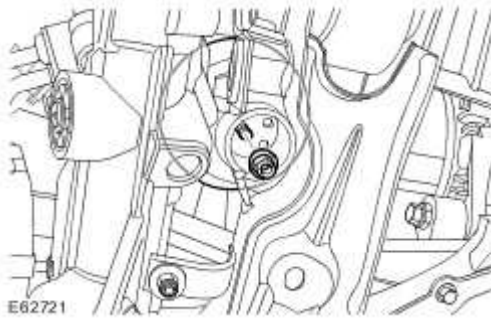
8 . **NOTE:**

RH illustration shown, LH is similar

Release the engine mounts.

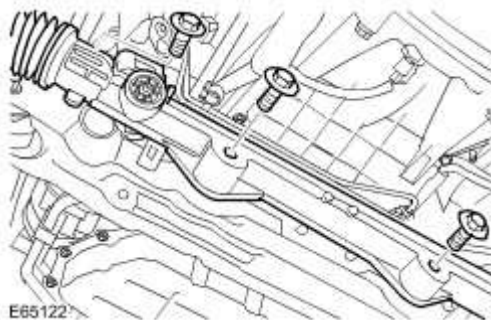
▶ Remove and discard the 2 nuts.

▶ Raise the engine.



9 . Support and release the power steering rack.

▶ Remove the 3 bolts.

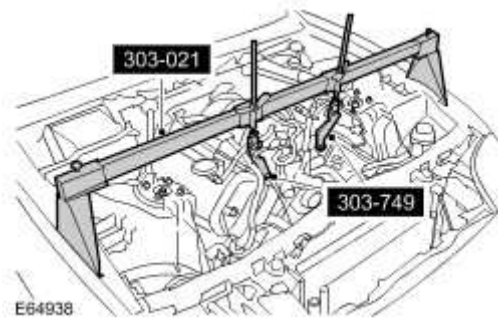


10 .



CAUTION: Protect the paintwork during this operation.

Using the special tools, support the engine.



11 . Secure the radiator assembly.

▶ Secure with cable ties.

12 . Using the special tool, support the subframe.

13 . **NOTE:**

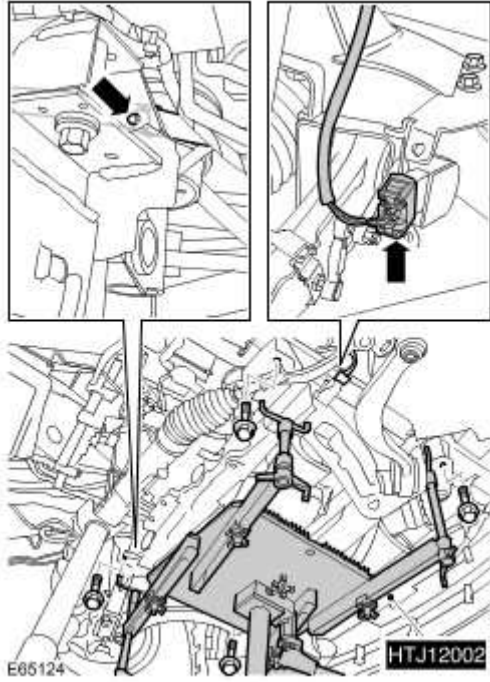
Note the fitted position.

With assistance, remove the front subframe assembly.

▶ Remove the 4 bolts.

▶ Release the PAS pipe to subframe clip.

▶ Disconnect the electrical connector.

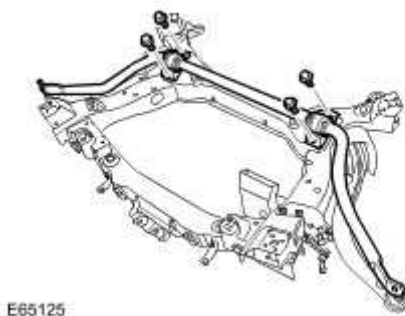


14 . NOTE:

Do not disassemble further if the component is removed for access only.

Remove the stabilizer bar.

- ▶ Remove the 4 bolts.
- ▶ Remove the stabilizer bar bushing.

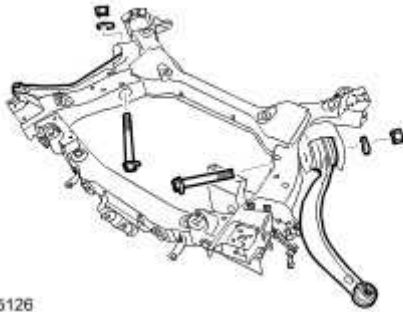


15 . NOTE:

Note the fitted position of the fasteners.

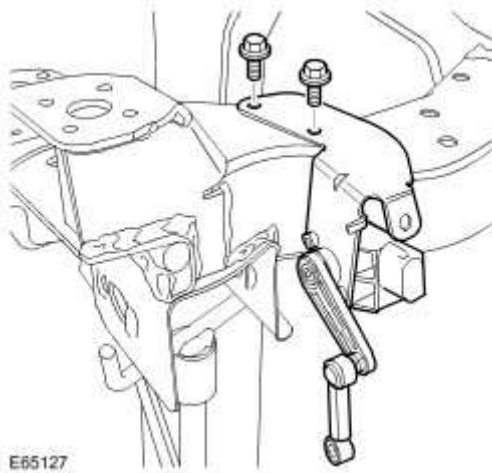
Remove the lower suspension arms.

▶ Remove the 2 bolts and discard the nuts.



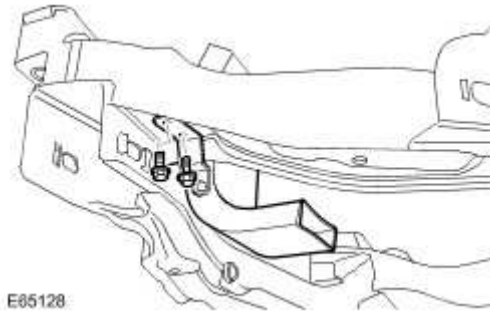
16 . Remove the suspension height sensor.

▶ Remove the 2 bolts.



17 . Remove the generator cooling duct

▶ Remove the 2 screws.



Installation

1 . Install the generator cooling duct

▶ Tighten the screws.

2 . Install the height sensor.

▶ Tighten the bolts to 25 Nm (18 lb.ft).

3



· **CAUTION: The final tightening of the suspension components must be carried out with the vehicle on its wheels.**

NOTE:

Align to the position noted on removal.


Install the lower suspension arms.

▶ Tighten the nut and bolt to 175 Nm (129 lb.ft).

4 . Install the stabilizer bar.

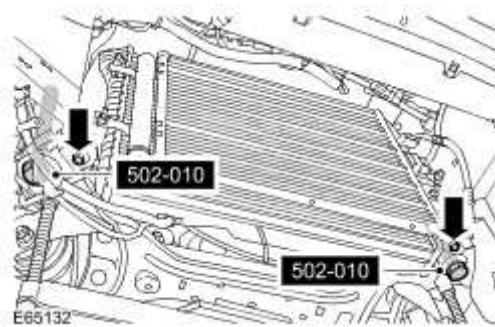
▶ Install the stabilizer bar bushings.

- ▶ Tighten the bolts to 45 Nm (33 lb.ft).

- 5 .  **CAUTION:** To align the sub-frame, install the special bolts in place of the front fixings. Tighten the rear fixings to set the position, remove the special bolts.

With assistance, install the front subframe.

- ▶ Position the radiator mountings.
- ▶ Using the special the special tools, align the subframe.
- ▶ Connect and secure the electrical connector.



- 6 . Tighten the subframe bolts.

- ▶ Tighten the front bolts (M15) to 80 Nm plus 360deg.
- ▶ Tighten the rear bolts (M12) to 80 Nm plus 270deg.

- 7 . With assistance, install the A-frame.

- ▶ Tighten the bolts to 55 Nm (40 lb.ft).


- 8 . Install the engine undershield.


For additional information, refer to Air Deflector (76.11.41)

9 . Install the radiator deflector.

For additional information, refer to Radiator Splash Shield (76.22.90)

10 . Lower the engine onto its mounts.

 Tighten the new nuts to 63 Nm (46 lb.ft).

 Remove the special tools.

11 . Remove and discard the 2 cable ties.

12 . Install the lower suspension arms.

For additional information, refer to Rear Lower Arm (60.35.54)

13 . Install the throttle body.

For additional information, refer to Throttle Body (19.70.04)

14 . Connect the battery ground cable and install the cover.

For additional information, refer to

15 Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment,
and adjust if required.

Rear Subframe (64.25.01)

Special Service Tools



Power train assembly jack HTJ
1200-2



Brake pedal hold down tool JDS 9013

Removal



CAUTION: Prior to removing the subframe it is important to mark the fitted position of the subframe in relation to the body. The subframe must then be accurately aligned to these marks upon installation.

1



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

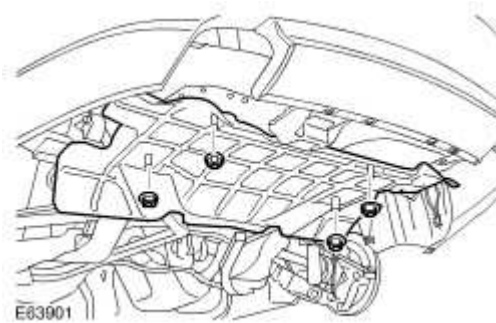
- 2 . Remove the rear wheels and tires.
For additional information, refer to Wheel and Tire (74.20.05)
- 3 . Remove the cover and disconnect the battery ground cable.
For additional information, refer to Specifications

4 Remove the driveshaft.

- For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

5 . Remove the exhaust rear heat shield .

- ▶ Remove the 4 nuts.



6



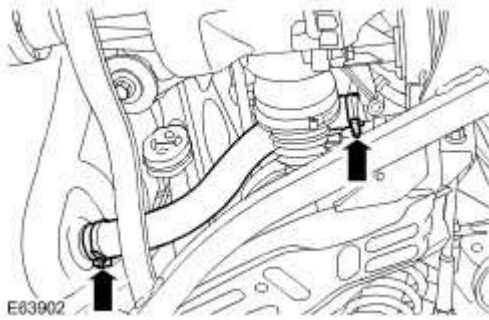
- **WARNING:** The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

NOTE:

The fuel tank has a non-return valve in the filler stub pipe, only the fuel present in the filler hose will be spilt.

Remove the fuel filler hose.

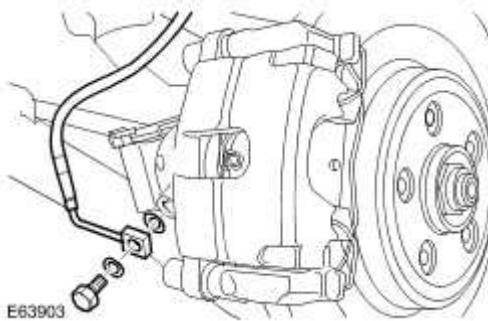
- ▶ Remove the 2 clips.



7 . Using the special tool, press and hold the brake pedal.

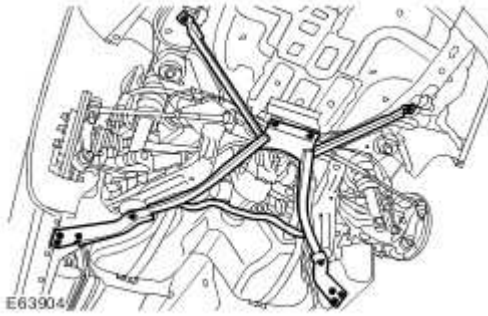
8 . Disconnect the brake hose from the LH caliper and tie aside.

- ▶ Remove and discard the 2 sealing washers.
- ▶ Release the brake hose from the upper arm.
- ▶ Repeat the above procedure for the other side.

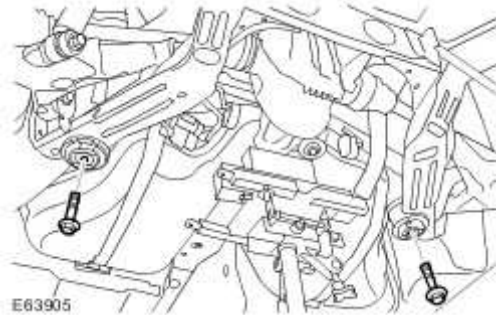


9 . With assistance: Remove the body K-frame.

- ▶ Using a jack, support the differential.
- ▶ Remove the 8 bolts.
- ▶ Remove the 4 Torx bolts.



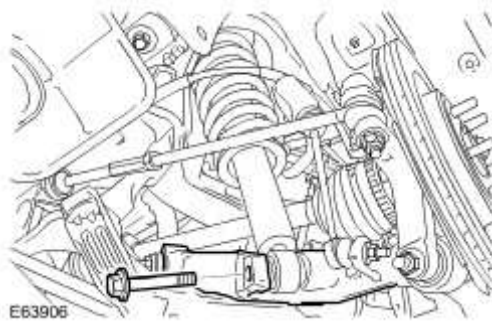
10 . Install the 2 subframe mounting bolts and remove the support jack.



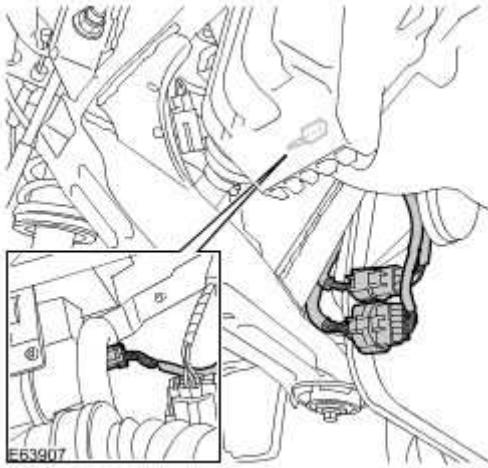
11 . Release the LH rear shock absorber from the lower suspension arm.

▶ Remove the bolt.

▶ Repeat the above procedure for the other side.



12 . Disconnect the 3 electrical connectors.




13 . Support the subframe using the special tool.

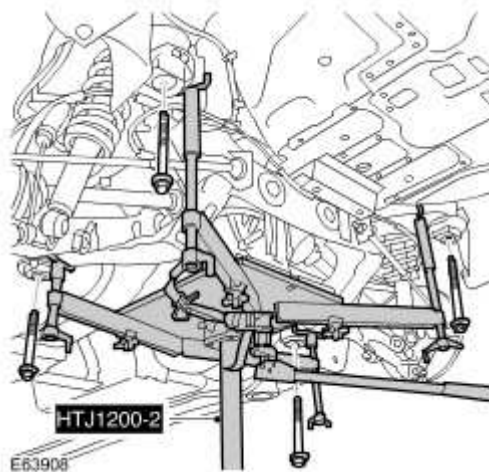
- 14  **CAUTION:** Mark the fitted position of the subframe in relation to the body at the 4 mounting points.

NOTE:

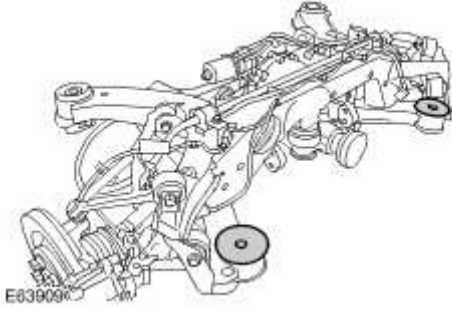
Note the fitted position.

With assistance, remove the rear subframe assembly.

-  Remove and discard the 4 bolts.



15 . Remove the 2 spacers.



Installation

1 . Install the spacers.

2 NOTE:

Align to the positions marked on removal. If installing a new subframe, or new body panels have been installed, the subframe bushes must be central to the holes in the body panels.

With assistance, position and secure the subframe.

▶ Install the bolts, but do not tighten fully at this stage.

3 . Position and secure the rear shock absorbers.

▶ Tighten the bolts to 133 Nm (98 lb.ft).

4 . Using a transmission jack, support the differential.

▶ Remove the 2 bolts.

5 . With assistance, install the K-frame.

- ▶ Tighten the M10 bolts to 40 Nm (30 lb.ft).
- ▶ Tighten the M12 bolts to 133 Nm (98 lb.ft).
- ▶ Tighten the sub frame bolts to 60 Nm (44 lb.ft), then a further 240 degrees.

6 . Remove the transmission jack.

7 . Connect and secure the electrical connectors.

8 . Connect the brake hose to the brake caliper.

- ▶ Install new sealing washers.
- ▶ Tighten the union to 35 Nm (26 lb.ft).
- ▶ Repeat the above procedure for the other side.
- ▶ Remove the special tool.

9 . Install the heat shield.

- ▶ Tighten the nuts to 10 Nm (7 lb.ft).

10 . Install the fuel filler hose.

- ▶ Remove the 2 clips.
- ▶ Position and secure the clips.

11 Install the driveshaft.

- For additional information, refer to Driveshaft - 4.2L NA V8 - AJV8/4.2L SC V8 - AJV8 (47.15.01)

12 . Bleed the brake system.

For additional information, refer to Brake System Bleeding (70.25.03)

13 . Install the wheels and tires.

For additional information, refer to Wheel and Tire (74.20.05)

14 . Connect the battery ground cable and install the cover.

For additional information, refer to Specifications

15 Using only four-wheel alignment equipment approved by Jaguar, check the wheel alignment,
and adjust if required.

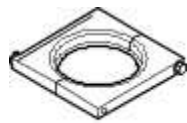
For additional information, refer to Four-Wheel Alignment

Rear Subframe Front Bushing (64.25.34)

Special Service Tools



Forcing bolt
204-469



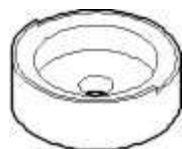
Remover support
204-479



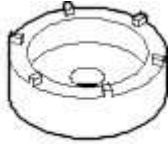
Reciever-bush
204-481



Remover-bush
204-482



Support-bush
204-480



204-483

Installer-bush
204-483

Removal

All vehicles

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

2



- **CAUTION: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

Vehicles with 4.2L engine

- 3 . Remove the rear subframe assembly.
For additional information, refer to Rear Subframe (64.25.01)

Vehicles with 5.0L engine

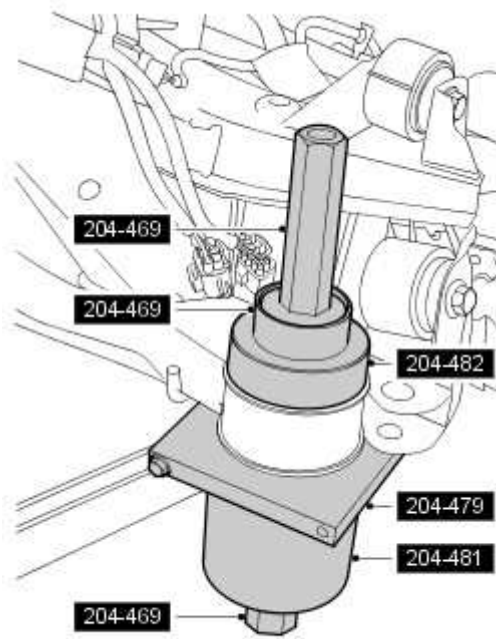
- 4 . Remove the rear subframe assembly.
For additional information, refer to

All vehicles

- 5 . **NOTE:**

Note the fitted position.

Using the special tools, remove and discard the rear subframe front bushing.



E63925

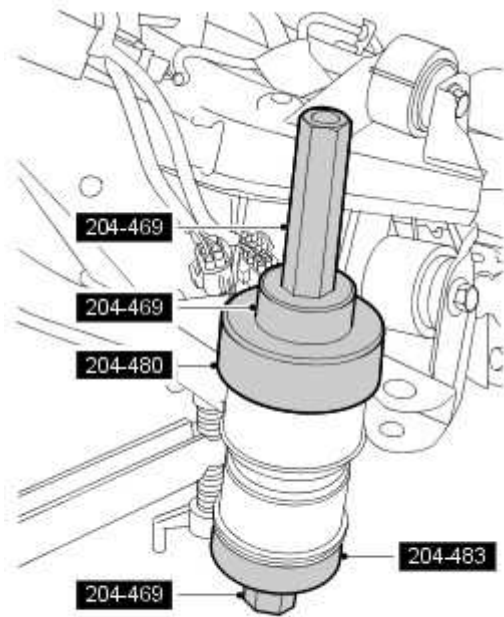
Installation

All vehicles

1 . NOTE:

Align to the position noted on removal.

Using the special tools, Install the new front bushings.



E63927

Vehicles with 4.2L engine

- 2 . Install the rear subframe.
For additional information, refer to Rear Subframe (64.25.01)

Vehicles with 5.0L engine

- 3 . Install the rear subframe.
For additional information, refer to

All vehicles

- 4 . Connect the battery ground cable.
For additional information, refer to Specifications

Rear Subframe Rear Bushing (64.25.36)

Special Service Tools



Forcing bolt
204-469



Receiver-bush
204-475



Replacer-bush
204-474



Remover bush
204-473




Remover support-bush
204-472

Removal

All vehicles

- 1 . Disconnect the battery ground cable.
For additional information, refer to Specifications

- 2  **WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.**

Raise and support the vehicle.

Vehicles with 4.2L engine

- 3 . Remove the rear subframe assembly.
For additional information, refer to Rear Subframe (64.25.01)

Vehicles with 5.0L engine

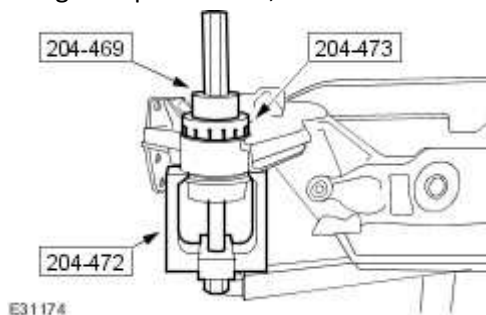
- 4 . Remove the rear subframe assembly.
For additional information, refer to

All vehicles

- 5 . **NOTE:**

Note the fitted position.

Using the special tools, remove and discard the rear subframe rear bushing.



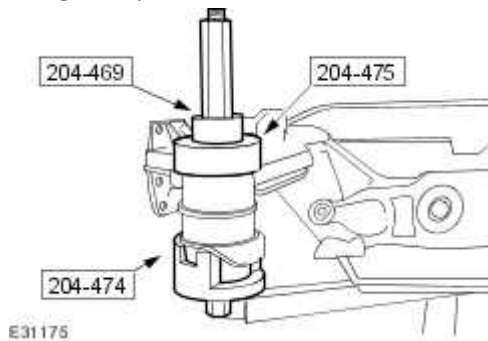
Installation

All vehicles

1 . NOTE:

Align to the position noted on removal.

Using the special tools, Install the new rear bushings.



Vehicles with 4.2L engine

2 . Install the rear subframe.

For additional information, refer to Rear Subframe (64.25.01)

Vehicles with 5.0L engine

3 . Install the rear subframe.

For additional information, refer to

All vehicles

4 . Connect the battery ground cable.

For additional information, refer to Specifications