JAGUAR

Workshop Manual



XJ Series

1998 MY On

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General Information - General Service Information

Description and Operation

Safety Notice

Appropriate service methods and proper 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 nor vehicle integrity is compromised from choices of methods, tools or parts.

Notes, Cautions and Warnings

Throughout this manual, important information is highlighted by the use of notes, cautions and warnings. NOTES give additional information on a topic or procedure, CAUTIONS are given to prevent damage to the vehicle, and WARNINGS are given to prevent personal injury.

Workshop Manual Organization

This manual incorporates descriptive, diagnostic, and repair information to help trained Jaguar technicians complete service and rectification procedures. The information can be accessed by choosing the appropriate five digit section number. For example, Section 412-03 covers air conditioning, which is part of the Climate Control System.

The manual is organized into groups covering generic aspects of the vehicle systems; the first digit of the section number represents a group selected from the following:

1. General Information.

2. Chassis.

3. Powertrain.

4. Electrical.

5. Body and Paint.

Each of the groups comprises sections relating to specific areas of the vehicle.

The second and third digits of the section number indicate the vehicle system.

The last two digits of the section number define the system covered, more specifically.

Each section comprises one or more of the following sub-sections:

Specification

- General specifications (including setting-up information, capacities, lubricants, fluids, sealants and adhesives).
- Torque specifications.

Description and Operation

- A general illustration and parts list to identify the components which comprise a particular system or assembly.
- A brief description of the system operating characteristics or description of the assembly.
- A description of each component and its function.

Diagnosis and Testing

- Descriptions of how to identify system problems.
- Inspection and verification information.
- Symptom charts comprising fault conditions, possible sources and actions.

General Procedures

- General maintenance procedures, including adjustment, alignment, bleeding and filling, with illustrated steps and supporting text.
- Tightening torque specifications, shown in the illustrations.

Removal and Installation

- Component removal and installation maintenance procedures, with illustrated steps and supporting text.
- Tightening torque specifications, shown in the illustrations.
- An illustrated tool chart for each procedure requiring the use of special tools.

Disassembly and Assembly

- Component disassembly and assembly maintenance procedures, with illustrated steps and supporting text.
- Tightening torque specifications, shown in the illustrations.
- An illustrated tool chart for each procedure requiring the use of special tools.

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 fitting of replacement parts and accessories:

- Safety features embodied in the vehicle may be impaired if other than genuine parts are fitted. In certain territories, legislation prohibits the fitting 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 fitted. If the efficiency of a locking device is impaired during removal it must be renewed.
- Owners purchasing accessories while travelling abroad should ensure that the accessory and its fitted location on the vehicle conform to mandatory requirements existing in their country of origin.
- The vehicle warranty may be invalidated by the fitting 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.

Thread Locking Devices

Patched Fasteners

Two types of patched fastener are essentially used on certain suspension, steering and other critical components, where operational movement of the component necessitates positive thread locking. Standard patched fasteners have part numbers bearing the suffix letter M. For identification of special patched fasteners, refer to the list of patched fasteners below, or the relevant component drawings.

Jaguar Specification JFS 02.01.02 patched fasteners incorporate a micro-encapsulated adhesive which is released into the mating threads during tightening. Following final tightening, the adhesive in this type of patched fastener must be allowed a period to cure before the component/vehicle is used. On removal, this type of fastener must be discarded and a new

patched fastener of the same specification fitted. All mating threads must be thoroughly cleaned prior to fitting of the new fastener.

Jaguar Specification JFS 02.01.04 patched fasteners incorporate a plastic/polyester on the thread. Acting as a wedge between the mating threads, this compound imposes a prevailing torque during tightening. Whilst this type of patched fastener can be re-used, the imposed torque diminishes. It is therefore recommended that following third removal, this type of patched fastener is discarded and a new fastener of the same specification is fitted.

Special fasteners bearing the following part numbers are of the micro-encapsulated adhesive type and following removal, must be discarded and replaced by new items of the same specification:

CAC 8223

JZB 10060; JZB 10061; JZB 10078.

JZH 100027.

JZS 100082; JZS100087; JZS 100088; JZS 100089; JZS 100090; JZS 100118; JZS 100157; JZS 100164; JZS 100166.

NCA 1451 AA.

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 ensure 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 for this range of vehicles.

References to Left- and Right-Hand

References to the left- or right-hand side of the vehicle are made as if viewing from the driver's seat.

References to Engine Banks

With the engine installed in the vehicle, the right-hand cylinder bank is designated Bank A, and the left-hand cylinder bank is designated Bank B.

Special Tools

Any special tools and equipment required to perform a maintenance procedure, are shown at the beginning of each maintenance procedure.

Torque Specifications

Torque specifications are shown in maintenance procedure illustrations and also in the torque specifications chart located at the front of the relevant section.

Disconnecting/Connecting the Battery

Owing to the electronic components used on the vehicle, it is important that the battery is disconnected when specified in a maintenance procedure.

When the battery is connected, the specified procedure must be followed, to ensure the correct operation of all vehicle systems; refer to Section 414-01.

Use of Control Modules

Control modules may only be used on the vehicle to which they were originally fitted. 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 that the relevant vehicle systems are working correctly.

Protecting the Vehicle

Always fit covers to protect the fenders before commencing work in the engine compartment. Cover the seats and carpets, 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 trunk to protect carpets. Always use the recommended service tool, or a satisfactory equivalent, where specified. Protect temporarily exposed screw threads by replacing nuts or fitting caps.

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 oilways, 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, oilways and fluid passages with compressed air. Do not permit compressed air to enter an open wound. Always use eye protection when using compressed air.

Ensure that any O-rings used for sealing are correctly refitted or renewed if disturbed. Mark mating parts to ensure 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 ensure that the correct part has been obtained.

Inspection

Before inspecting a component for wear or performing a dimensional check, ensure 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 part may be refitted 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.

Safety Precautions

• WARNINGS:

 WORKING ON THE FUEL SYSTEM RESULTS IN FUEL AND FUEL VAPOUR BEING PRESENT IN THE ATMOSPHERE. FUEL VAPOUR IS EXTREMELY FLAMMABLE, HENCE GREAT CARE MUST BE TAKEN WHILST WORKING ON THE FUEL SYSTEM. ADHERE STRICTLY TO THE FOLLOWING PRECAUTIONS:

- DO NOT SMOKE IN THE WORK AREA.
- DISPLAY 'NO SMOKING' SIGNS AROUND THE AREA.
- DISCONNECT THE BATTERY BEFORE WORKING ON THE FUEL SYSTEM.
- DO NOT CONNECT/DISCONNECT ELECTRICAL CIRCUITS, USE ELECTRICAL EQUIPMENT OR OTHER TOOLS OR ENGAGE IN WORKING PRACTICES WHICH IN ANY WAY MAY RESULT IN THE PRODUCTION OF SPARKS.
- ENSURE THAT A CO2 FIRE EXTINGUISHER IS CLOSE AT HAND.
- ENSURE THAT DRY SAND IS AVAILABLE TO SOAK UP ANY FUEL SPILLAGE.
- EMPTY FUEL USING SUITABLE FIRE PROOF EQUIPMENT INTO AN AUTHORIZED EXPLOSION PROOF CONTAINER.
- DO NOT EMPTY FUEL WHILE WORKING IN A WORKSHOP OR A PIT.
- ENSURE THAT WORKING AREA IS WELL VENTILATED.
- ENSURE THAT ANY WORK ON THE FUEL SYSTEM IS ONLY CARRIED OUT BY EXPERIENCED AND WELL QUALIFIED MAINTENANCE PERSONNEL.
- ENSURE THAT FUME EXTRACTION EQUIPMENT IS USED WHERE APPROPRIATE.

 FUME EXTRACTION EQUIPMENT MUST BE IN OPERATION WHEN SOLVENTS ARE USED E.G. TRICHLOROETHANE, WHITE SPIRIT, SBP3, METHYLENE CHLORIDE, PERCHLORETHYLENE. DO NOT SMOKE IN THE VICINITY OF VOLATILE DEGREASING AGENTS.

General workshop practices:

- Disconnect the grounded terminal of the vehicle battery.
- Do not apply heat in an attempt to free seized nuts or fittings; as well as causing damage to protective coatings, there is a risk of damage from stray heat to electronic equipment and brake lines.
- Keep oils and solvents away from naked flames and other sources of ignition.
- Adhere strictly to handling and safety instructions given on containers and labels.
- Ensure that a suitable form of fire extinguisher is conveniently located.
- When using electrical tools and equipment, inspect the power lead for damage and check that it is properly earthed.
- Do not leave tools, equipment, spilt oil etc. around the work area.

Working beneath a vehicle:

- Whenever possible, use a ramp or pit in preference to jacking.
- Position chocks at the wheels as well as applying the parking brake.
- Never rely on a jack alone to support a vehicle; use axle stands, or blocks carefully placed at the jacking points, to provide a rigid location.
- Check that any lifting equipment used has adequate capacity and is fully serviceable.

Working on air conditioning systems:

- Do not disconnect any pipes of the refrigeration system unless you are trained and instructed to do so; a refrigerant is used which can cause blindness if allowed to come into contact with the eyes.

Health Protection

Prolonged and repeated contact with mineral oil will result in the removal of natural oils from the skin, leading to dryness,

irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Washing facilities and adequate means of skin protection should be provided.

Observe these recommendations:

- Wear protective clothing and impervious gloves when necessary.
- Do not put oily rags in pockets. Avoid contaminating clothes, particularly underwear, with oil.
- Overalls must be cleaned regularly; discard oil impregnated clothing and footwear which cannot be washed or cleaned.
- First Aid treatment should be obtained immediately for open cuts or wounds.
- Use barrier creams, applying before each work period, to enable easier removal of dirty oil and grease from the skin.
- Wash with soap and water to ensure that all oil is removed (skin cleaner and a nail brush will help). The use of preparations containing lanolin will help to replace the natural skin oils which have been removed.
- Do not use petrol, kerosene, gas oil, thinners or solvents for washing skin.
- If skin disorders develop, obtain medical advice immediately.
- Where practicable, degrease components prior to handling.
- Where there is a risk of fluids coming into contact with the eyes, suitable eye protection should be worn - goggles or face shield. An eye wash facility should be provided.
- Ensure that adequate ventilation is provided when volatile degreasing agents are being used.

Environmental Protection

In some countries it is illegal to pour used oil onto the ground, down sewers or drains, or into water courses. The burning of used engine oil in small space heaters or boilers is not recommended unless emission control equipment is fitted. Dispose of used oil through authorized waste disposal contractors, to licensed waste disposal sites or to the waste oil reclamation trade. If in doubt, contact the Local Authority for advice on disposal facilities.

On-Board Diagnostics (OBD)

Vehicles use programmed electronic control systems to provide engine management and emission regulation, automatic transmission operation and anti-lock braking control. These control systems have an integral On-Board Diagnostics (OBD) facility for use in conjunction with either Jaguar diagnostic equipment or a scan tool which is capable of retrieving DTCs, PIDs and performing active commands.

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 vehicles without recourse to the portable diagnostic unit (PDU).

OBD related information can be found in the following sections:

- General Information
- Engine Management System
- Automatic Transmission
- Anti-lock Braking System

Where appropriate a section comprises the following sub-sections:

Description and Operation

- A general illustration and parts list to help the identification of the particular system or component.
- A brief description of the system operating characteristics and monitoring procedure accompanied by a component illustration.
- Additional information, where appropriate, is provided in the form of component calibrations, characteristics and cross sectional views.
- A localized circuit diagram is included to provide circuit identification and details of connectors, splices, fuses, wire gauge and colors. See Circuit Diagrams.

Diagnosis and Testing (dedicated to fault analysis and rectification)

- Recommended special tools.
- Symptom chart; a chart containing all relevant Diagnostic Trouble Codes (DTC), their possible causes and an indication of the appropriate test.
- Specific pinpoint test(s), designed so that fault diagnosis can be carried out in a logical and efficient manner.

• NOTE: For convenience, pinpoint test illustrations indicating voltage measurements do not always accurately reflect the conventional method of connecting a multimeter. More explicitly, if the multimeter probes are connected as shown in some illustrations (positive probe to ground), the voltage reading would be preceded by the negative sign '-', indicating that the probes have been connected in the reverse manner to the normal convention. The accuracy of the reading is not affected and the '-' sign can be ignored when comparing the reading with the results indicated in the text of the pinpoint test.

Removal and Installation

- Removal procedure(s), formatted in the recommended sequence
- Illustrated guide to the use of special tools
- Illustrations to support the relevant text
- Installation procedure as above and including special recommendations for processes, lubricants and tightening torques.

Circuit Diagrams

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

Fault Identification (DTC)

The diagnostic trouble codes (DTCs) are listed in Section 303-00 under Diagnostic Trouble Codes and include, where applicable, the corresponding manual section reference.

General Information - Terminology Glossary

Description and Operation

This glossary of terms is intended to cover 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
A		
Accelerator Pedal	AP	
After Bottom Dead Center	ABDC	Event occurring after BDC
After Top Dead Center	ATDC	Event occurring after TDC
Airbag / Supplementary Restraint System	Airbag, SRS	Airbag restraint system for driver and front seat passenger
Air Cleaner	ACL	
Air Conditioning	A/C	
Air Conditioning Control Module	A/CCM	Module controlling air conditioning, heating and ventilation
Air Conditioning Signal	ACS	Air conditioning compressor clutch operation is signalled to the ECM which induces idle speed corrections to compensate for engine load changes
Alternating current	ac	
Air Fuel Ratio	AFR	Nominally 14.7 parts air to one part fuel
Ampere	A	SI unit of current
Ampere hour	Ah	A current of one ampere flowing for one hour
Anti-Lock Braking 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)
ABS Control Module	ABS CM	
ABS / Traction Control Control Module	ABS / TC CM	
Atmosphere	atm	Unit of pressure (1.01325 bar)
Automatic Stability Control	ASC	A form of vehicle control in which the ECM reduces engine torque to control wheel-spin
B		
Barometric Absolute Pressure Sensor	BARO	Sensor measuring the 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 BDC
Before Top Dead Center	BTDC	Event (usually ignition) occurring before TDC
Blower	BLR	Device which supplies a current of air at moderate pressure, e.g. heater or A/C blower
Body Processor Module	BPM	Control module for body electrical systems, e.g. interior lamps, windshield wash / wipe control
Bottom Dead Center	BDC	Lowest point of piston travel in a reciprocating engine
Brake horsepower	bhp	Effective horsepower developed by an engine or motor, as measured by a brake applied to its output shaft
Brake Mean Effective Pressure	BMEP	That part of the effective pressure developed in a cylinder that would result in a cylinder output equal to the bhp of the engine
Brake On/Off	BOO	Indicates the position of the brake pedal
British Standard	BS	Standard specification issued by the British Standards Institution
British Standard Automotive	BSAu	
Bus		Topology of a communication network
Bypass Air	BPA	Mechanical control of throttle bypass air
C		
Camshaft Position Sensor	CMPS	Indicates camshaft position
Canadian Motor Vehicle	CMVSS	

Safety Standard		
Canister Purge	CANP	Controls purging of the EVAP canister
Carbon dioxide	CO2	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
Case Ground	CSE GND	Control module casing ground
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°
Central Processor Unit	CPU	The section of a computer that contains the arithmetic, logic and control circuits. It performs arithmetic operations, controls instruction processing, and provides timing signals and other housekeeping operations
Closed Loop	CL	
Closed Loop System	CLS	Control system with one or more feedback loops
Column/Mirror Control Module	C/MCM	
Control Module	CM	A self-contained group of electrical/electronic components, designed as a single replaceable unit, and controlling one or more processes
Controller Area Network	CAN	A communication system which allows control modules to be linked together in a network.
Crankshaft Position Sensor	CKPS	Generates crankshaft position information in conjunction with the CKPTR (also generates speed information in certain applications)
Crankshaft Position Timing Ring	CKPTR	Toothed ring which triggers the CKPS
Crankcase Ventilation System	CV	System which scavenges camshaft cover and crankcase emissions and feeds them into the inlet manifold
Cubic centimeter	cm3	
Curb weight		Weight of vehicle with fuel, lubricants and coolant, but excluding driver, passengers or payload
D		
Data Link Connector	DLC	Connector providing access and/or control of the vehicle information, operating conditions, and diagnostic information
Degree	deg, °	Angle or temperature
Department of Transportation (US)	DOT	
Department of Transport (UK)	DTp	
Deutsche Institut für Normung	DIN	German standards regulation body
Diagnostic Module	DM	Supplemental Restraint System (non-controlling) module for diagnostics overview
Diagnostic Test Mode	DTM	A level of capability in an OBD system. May include different functional states to observe signals, a base level to read DTCs, a monitor level which includes information on signal levels, bi-directional control with on/off board aids, and the ability to interface with remote diagnosis
Diagnostic Trouble Code	DTC	An alpha/numeric identifier for a fault condition identified by the On-Board Diagnostic (OBD) system
Dial test indicator	DTI	A mechanical measuring instrument, with a rotary indicating pointer connected to a linear operating probe
Differential pressure		Pressure difference between two regions e.g. between intake manifold and atmospheric pressures
Differential Pressure Feedback EGR	DPFE	An EGR system that monitors differential EGR pressure across a remote orifice to control EGR flow
Direct current	dc	Current which flows in one direction only, though it may have appreciable pulsations in its magnitude
Dual linear switch	DLS	J-gate switch connected to the TCM on SC vehicles
E		
EGR Temperature EGRT Sensor	EGRT	Sensing EGR function based on temperature change
EGR Vacuum Regulator	EVR	Controls EGR flow by changing vacuum to the EGR valve
EGR Valve Position	EVP	An EGR system that directly monitors EGR valve position to control EGR flow
Electrically Erasable Programmable Read-Only Memory	EEPROM	

Electrically Programmable Read-Only memory	EPROM	
Electronic Secondary Air Injection	EAIR	A pump-driven system for providing secondary air using an electric air pump
Engine Control Module	ECM	
End of dash	EOD	Referring to a vehicle fascia, eg EOD air vent
Engine Coolant Level	ECL	
Engine Coolant Temperature	ECT	
ECT Sensor	ECTS	Thermistor which provides engine coolant temperature signal to the ECM to trigger enrichment circuits which increase injector 'on' time for cold start and warm-up
Engine speed	RPM	
Environmental Protection Agency	EPA	
Evaporative Emission	EVAP	System designed to prevent fuel vapor from escaping into the atmosphere. Typically includes a charcoal filled canister to absorb fuel vapor
Evaporative Emission Control Valve	EVAPP	
Exhaust Gas Recirculation	EGR	System which reduces NOx emissions by adding exhaust gases to the incoming fuel/air charge
Exhaust Gas Recirculation Solenoid Vacuum Valve	EGRS	
Exhaust Gas Recirculation Temperature Sensor	EGRT Sensor	
Exhaust Gas Recirculation Valve	EGRV	
F		
Fan Control	FC	Engine cooling fan control
Federal Motor Vehicle Safety Standard (US)	FMVSS	
Figure	Fig.	Illustration reference
Flash Electrically Erasable Programmable Read-Only Memory	FEEPROM	
Flash Erasable Programmable Read-Only Memory	FEPROM	
Flywheel Sensor	CKFS	Sensor mounted so as to be triggered by each flywheel ring gear tooth to give an engine speed signal
Fuel Injectors	FI	Solenoid operated devices that spray a metered quantity of fuel into the inlet ports
Fuel Pressure Regulator Control	FPRC	Controls fuel pressure regulator; used primarily to give extra fuel at cold start-up
Fuel Pump	FP	
Fuel Pump Monitor	FPM	Monitors operation of fuel pump
Fuel Pump Relay	FPR	
Fuel rich/lean		Qualitative evaluation of air/fuel ratio based on a ratio known as stoichiometry, or 14.7:1 (Lambda)
Full Scale Deflection	FSD	The maximum indication point on an analogue meter or gauge
G		
Generator	GEN	Rotating machine which converts mechanical energy into electrical energy
Gramme centimeter	gcm	
Gramme (force)	gf	
Gramme (mass)	g	
Ground	GND	Electrical conductor used as a common return for an electrical circuit or circuits, and with a relative zero potential
H		
Hard fault		A fault currently present in the system
Headlamp	HL	
Heated Oxygen Sensor	HO2S	Electrically heated oxygen sensor which induces fueling corrections
Hertz (frequency)	Hz	Frequency, one cycle per second
High Mounted Stoplamp	HMSL	

High tension (electrical)	ht	
Hour	h	
Hydrocarbon	HC	
I		
Idle Air Control	IAC	Electrical control of throttle bypass air
Idle Air Control Valve	IACV	Stepper motor driven device which varies the volume of air by-passing the throttle to maintain the programmed idle speed
Ignition	ign	
Ignition amplifier	IA	Device which amplifies the ignition system output
Ignition ground	IGN GND	
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
Inertia Fuel Shut-off Switch	IFSS	Shuts down fuel and ignition systems in the event of a vehicle impact
Intake air		Air drawn through a cleaner and distributed to each cylinder for use in combustion
Input	I/P	An electrical input signal to a controlling device
Intake Air Temperature	IAT	Temperature of intake air
Intake Air Temperature Sensor	IATS	Device used to measure IAT
Intake Air Temperature Sensor Ignition	IATSI	Thermistor which signals the ECM to retard the ignition timing in response to high inlet air temperatures
Intake Air Temperature Sensor Injection	IATSF	Thermistor which inputs air density information to the ECM
Internal diameter	i.dia	
International Standards Organization	ISO	
K		
Kilogramme (mass)	kg	
Kilogramme (force)	kgf	
Kilogramme force per square centimeter	kgf/cm2	
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
L		
Left-hand	LH	
Left-hand drive vehicle	LHD	
Left-hand thread	LH Thd	
Light Emitting Diode	LED	Light-emitting semiconductor diode used in alphanumeric displays and as an indicator lamp
Liquid Crystal Display	LCD	Optical digital display system, applied voltage to which varies the way the crystals reflect light, thereby modifying the display
Liter	L	
Low tension	lt	Primary circuit of the ignition system, linking the battery to the primary winding in the ignition coil
M		
Malfunction Indicator Lamp	MIL	A required on-board indicator to alert the driver of an emission related malfunction
Manifold Absolute Pressure	MAP	Absolute pressure of the intake manifold air
Manifold Absolute Pressure Sensor	MAPS	Sensor located in the ECM and ported to the intake manifold
Manifold Surface Temperature	MST	
Mass Air Flow	MAF	System which provides information on the mass flow rate of the intake air to the engine
Mass Air Flow Sensor	MAFS	Hot-wire sensor which monitors air flow into the intake manifold for fueling and ignition control
Maximum	max.	

Meter (measurement)	m	
Metric (screw thread, e.g. M8)	M	
Microfarad	MFD	Unit of electrical capacitance, one millionth of a farad
Millimeter	mm	
Millimeter of mercury	mmHg	
Millisecond	ms	
Minimum	min.	
Minute	minute	
Model Year	MY	
Module	M	Self contained group of electrical/electronic components which is designed as a single replaceable unit
Modulating signal	MD	A shift process signal to the TCM on SC vehicles
Motorized In-Car Aspirator	MIA	Device which constantly samples cabin temperature by passing air over a sensor, and communicates with the A/CCM to modify A/C system performance to suit
Multi Protocol Adaptor	MPA	An interpreter for the various data languages present on a vehicle
N		
National Institute of Occupational Safety and Health (US)	NIOSH	
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)
Nitrous Oxide	NOx	Compounds of nitrogen and oxygen formed at high temperatures. Major source of exhaust-gas air pollution
Non-Volatile Random Access Memory	NVRAM	RAM which retains memory even if power supply is interrupted
Normally aspirated		Fueling system using intake air at atmospheric pressure; not supercharged or turbocharged
Normally Closed	NC	
Normally Open	NO	
North American Specification	NAS	Vehicles for sale in the USA and Canadian markets
Number	No.	
O		
Occupational Safety and Health Administration (US)	OSHA	
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
On-Board Refueling Vapor Recovery	ORVR	
Original Equipment Manufacturer	OEM	
Output	O/P	An electrical output signal from a controlling device
Outside diameter	o. dia	
Oxides of nitrogen	NOx	
Oxygen sensor	O2S	A sensor which detects oxygen content in the exhaust gases
P		
Parameter Identifier	PID	An index number referring to a parameter within a module without knowledge of its storage location
Park Neutral Position	PNP	
Park Neutral Position Switch	PNPS	Indicates the selected non-drive modes of the (automatic) transmission
Part number	part no.	
Portable Diagnostic Unit	PDU	Comprehensive electrical diagnosis system specific to Jaguar vehicles
Position	pos'n	
Power Assisted Steering	PAS	Hydraulic pump-assisted steering system
Power Steering Pressure	PSP	
Programmable Electronic Control Units System	PECUS	Process whereby a common ECM is programmed on the production line to suit the market requirements of a particular vehicle
Programmable Read-Only	PROM	ROM with some provision for setting the stored data after manufacture

Memory		
Pulse Width Modulation	PWM	A method of control in an electronic control system in which the duration of pulses in a pulse train is proportional to the amplitude of the modulating signal
R		
Random Access Memory	RAM	Fast access memory store which is accessible for entry or extraction of data
Read-Only Memory	ROM	Fast access memory in which data is fixed and may not be changed
Reservoir	RES	Container, usually for oils, coolants or hydraulic fluids
Return	RTN	A dedicated sensor ground circuit
Revolutions Per Minute	RPM	Shaft speed of a device, usually an engine or motor
Right-hand	RH	
Right-hand drive vehicle	RHD	
S		
Scan Tool	ST	Device that interfaces with and communicates information on a data link
Seat Control Module	SCM	Module controlling the seat motor systems (not electric raise/lower-only seats)
Secondary Air		Air provided to the exhaust system
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
Secondary Air Injection Bypass	AIRB	Vents secondary air to atmosphere
Secondary Air Injection Check Valve	AIRC	Valve which prevents back-flow of exhaust gas to the AIR system when the system is inoperative
Secondary Air Injection Diverter	AIRD	Diverts secondary air to either the catalyst or exhaust manifold
Secondary Air Injection Magnetic Clutch	AIRPC	Clutch mounted on the AIRP drive shaft
Secondary Air Injection Pump	AIRP	Mechanically driven rotary vane pump, driven through the AIRPC
Secondary Air Injection Relay	AIRR	Controls the injection of air into the exhaust system
Secondary Air Injection Switching Valve	AIRS	Vacuum operated valve backing-up the AIRC
Security and Locking Control Module	SLCM	Module controlling the vehicle's security and closure-locking functions
Sensor	S	Generic name for a device that senses either the absolute value or a change in a physical quantity such as temperature, pressure or flow rate, and converts that change into an electrical quantity signal
Service Repair Operation (number)	SRO	Number generated by Jaguar Methods and 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'
Shift signal	SD	A shift process signal to the TCM on SC vehicles
Shift Solenoid	SS	Controls shifting in an automatic transmission
Signal return	SIG RTN	
Sliding Roof Control Module	SRCM	
Society of Automotive Engineers	SAE	
Speed Control Control Module	SCCM	Module controlling Speed Control System
Square centimeter	cm2	
Standard	std	
Standard Corporate Protocol	SCP	A high-speed, serial communications system linking all body system control modules. Control messages and data are passed between modules at up to 786 messages per second
Supercharger	SC	An intake system which 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)
Supercharger Bypass	SCB	
Switch	SW	
T		

Tachometer	TACH	A circuit that provides input for an electronic tachometer display
Thermal Vacuum Valve	TVV	Controls vacuum levels or routing based on temperature
Throttle Body	TB	Device containing the throttle
Throttle Position	TP	
Throttle Position Sensor	TPS	Interprets throttle position and movement to identify idle, acceleration and full-power demands
Top Dead Center	TDC	
Torque Converter Clutch	TCC	
Total indicator reading	TIR	The total indicated movement on a DTI with the test piece rotated through 360°
Transmission Control Module	TCM	Controls the shifting pattern of the (automatic) transmission
Transmission Control Switch	TCS	Modifies the operation of electronically controlled transmissions
Transmission Oil Temperature	TOT	Indicates temperature of transmission fluid
Transmission Range	TR	The range in which the transmission is operating
Transmission Speed Sensor	TSS	Indicates rotational speed of transmission output shaft or turbine shaft
V		
Vacuum Solenoid Valve	VSV	Vacuum operated valve used in the speed control system
Vacuum Solenoid Valve (atm)	VSV VA	Vacuum atmospheric valve used in the speed control system
Vacuum Solenoid Valve (rel)	VSV VR	Vacuum release valve used in the speed control system
Vacuum Solenoid Valve (vac)	VSV VV	Vacuum valve used in the speed control system
Variable Valve Timing	VVT	A system by which the relationship of the crankshaft and camshaft may be altered during engine running
Vehicle Battery Adapter	VBA	Provides electrical power to the PDU and supplies a battery reference level
Vehicle Condition Monitor	VCM	Instrument panel display which warns of faults
Vehicle Emission Control Information Label	VECI Label	
Vehicle Identification Number	VIN	Number assigned to the vehicle by the manufacturer, primarily for licensing and identification purposes
Vehicle Interface Adapter	VIA	Extends the PDU capability and provides a parallel interface to vehicle harnesses and ECMs
Vehicle Speed Sensor	VSS	Sensor which provides vehicle speed information
Viscosity Index	VI	
Voltage Regulator	VR	Device which regulates the variable output voltage of a generator
W		
Watt	W	SI unit of power (1 hp = 745.7 watts)
Wide Open Throttle	WOT	Full throttle position

Identification Codes - Identification Codes

Description and Operation

Engine Number

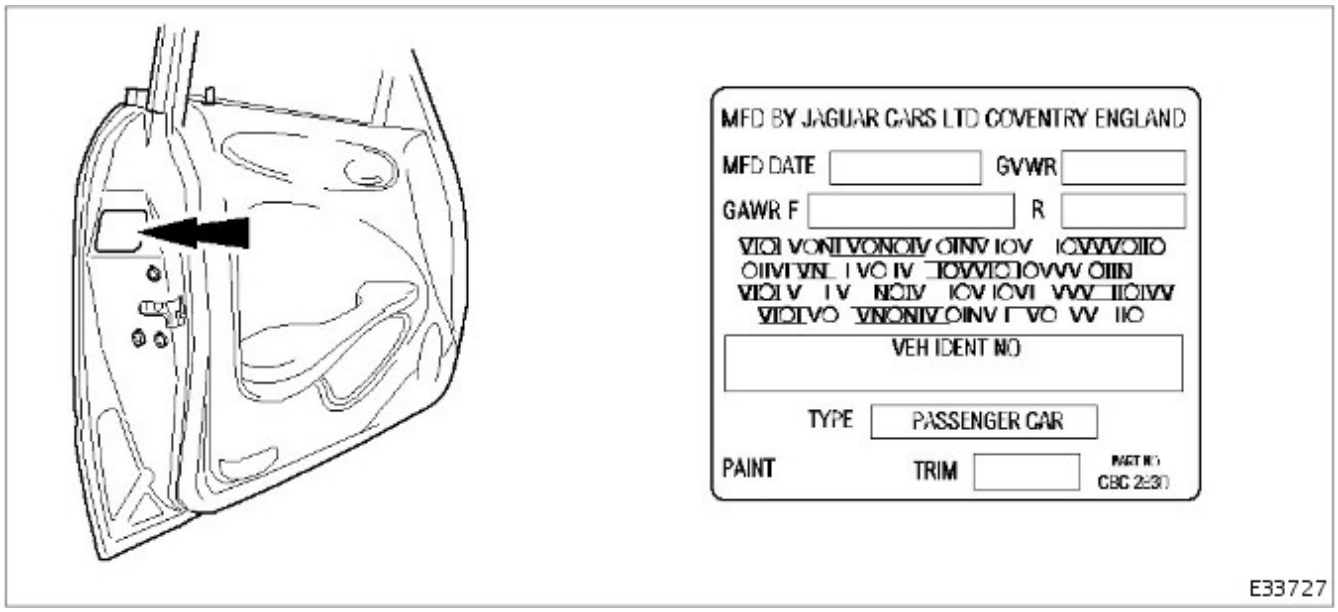
The engine number (10 digits) is stamped on a raised pad on the front of the engine block near the thermostat housing. The piston grade reference (8 digits) is also shown.

Automatic Transmission Number

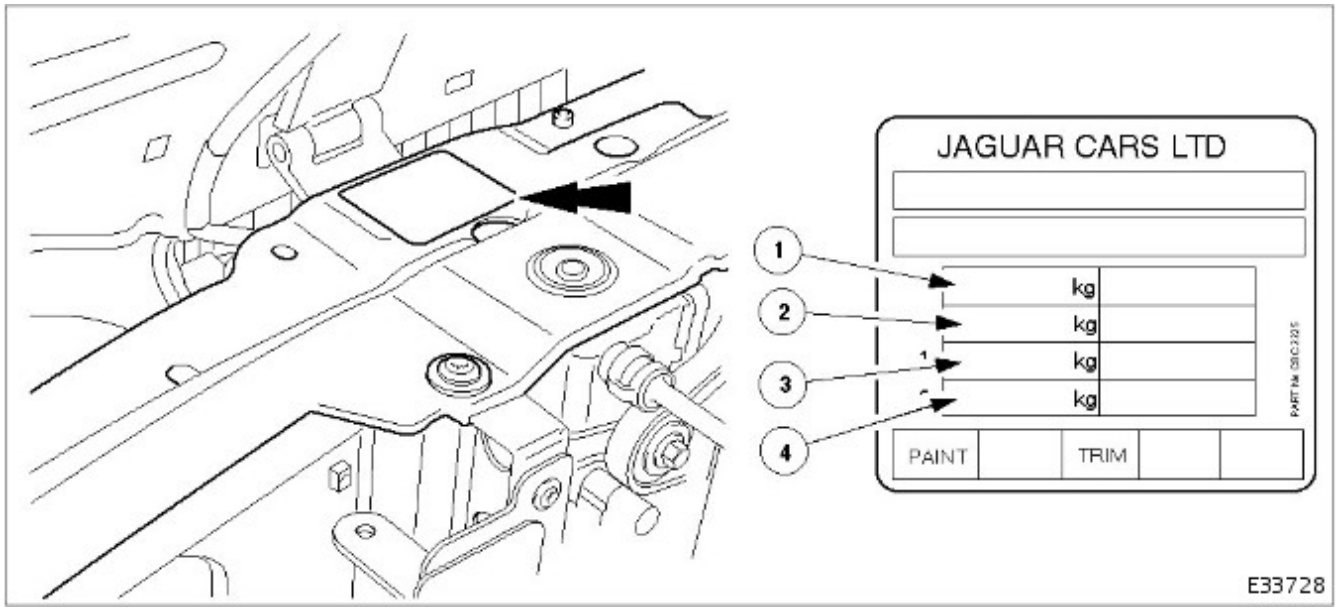
The serial number of the transmission unit is displayed on a metal or bar code label attached to the LH side of the transmission casing.

Vehicle Identification

Dependent upon market, the VIN and other information is displayed on a label located either on the rear edge of the LH front door or on the body front upper crossmember. For certain markets, the VIN appears on a bar code label referred to as the Certification Label and additionally carries the month and year of manufacture, vehicle weight data and paint and trim codes. The VIN is also displayed on a plate visible through the windshield. It is essential that the vehicle identification number (VIN) is quoted when ordering parts, and in all associated correspondence.



Item	Description
GVWR	Gross Vehicle Weight Rating
GAWR F	Gross Front Axle Weight Rating
GAWR R	Gross Rear Axle Weight Rating
Paint	Paint Code
Trim	Trim Code



Item	Description
1	Gross Vehicle Weight
2	Gross Train Weight
3	Maximum Permitted Front Axle Loading
4	Maximum Permitted Rear Axle Loading

Date of Manufacture

The date of manufacture (Build Date) of a vehicle is defined as the calendar month and year in which the bodyshell and powertrain are combined and the completed vehicle leaves the production line. For certain markets, VIN labels carry the month and year of manufacture. For other markets, the vehicle Build Date is also displayed on a metal plate located at the top of the battery tray in the trunk.

ANTI-THEFT LABELS

For some markets, anti-theft labels bearing the VIN printed on a special anti-forgery background are positioned on certain body components. An additional anti-theft label is positioned on the LH side of the engine/automatic transmission casing. Anti-theft labels must not be removed from a vehicle unless necessitated by component renewal.

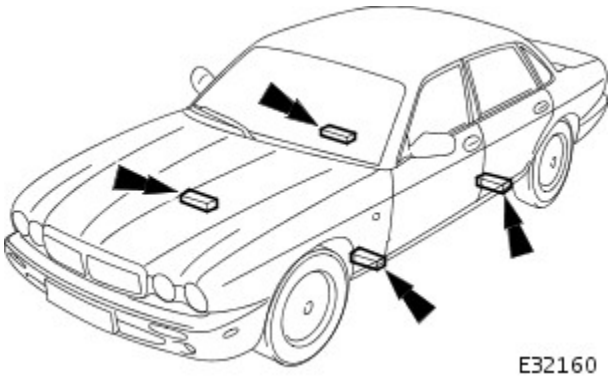
Jacking and Lifting - Jacking

Description and Operation

The vehicle jack and wheel chock are stored in the trunk as part of the vehicle toolkit.

Use of the vehicle jack and workshop jacks is described in the general procedures in this section.

Jacking Points



The four vehicle jacking points:

- Are situated below the body side members.
- Are located behind each front wheel and in front of each rear wheel.
- Consist of a square-section socket, protected by a rubber cover, to provide positive engagement with the vehicle jack.
- Provide the support points for the four lifting pads of a wheel-free lift.

Jacking and Lifting - Safety Precautions

Description and Operation

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

- Never rely on a jack alone to support a vehicle; use suitable vehicle stands to provide rigid support.
- When working beneath a vehicle, whenever possible use a ramp or inspection pit instead of a jack and vehicle stands.
- Ensure 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 transmission into Park if possible.
- Check that any lifting equipment used has adequate capacity for the load being lifted and is in proper working order.

Jacking and Lifting - Vehicle Recovery

Description and Operation

• NOTE: Prior to recovery, ensure that the vehicle keys are available and the security system disarmed.

Vehicle recovery methods are:

- By flat-bed transporter.
- By rear suspended tow.
- By emergency towing for very short distances.

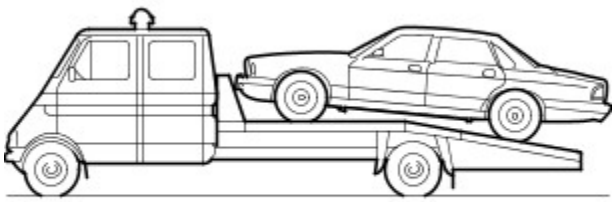
Gearshift Interlock

The gear selector lever can only be moved from the Park position by turning the ignition key to position II and depressing the brake pedal.

To remove the key from the ignition switch, the gear selector lever must be moved to the Park position. With the key removed, the gear selector is locked in the Park position.

The selector lever can be manually unlocked from the Park position in the event of electrical failure or when moving the vehicle without power. Refer to the general procedure in this section.

Transporter or Trailer Recovery

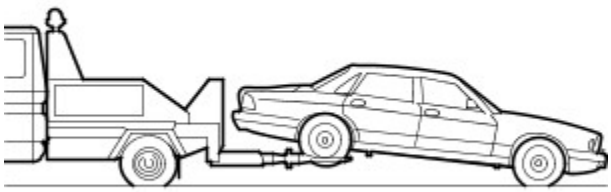


E32161

When the vehicle is being recovered by transporter or trailer:

- The parking brake must be be applied and the wheels chocked.
- The gear selector lever must be in Neutral. Do not select Park as the parking 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. There are four tie-down brackets on the vehicle underbody. Do not use the vehicle towing points or crossbeam tie bar.

Rear Suspended Tow



E32162

When the vehicle is being recovered by rear suspended tow:

- The ignition key must be removed from the ignition switch to lock the steering with the front wheels facing straight ahead.
- The rear wheels must be correctly positioned in the lifting cradle and securely tied down.

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.

• CAUTIONS:

A vehicle with a defective transmission must be towed by rear suspended tow.

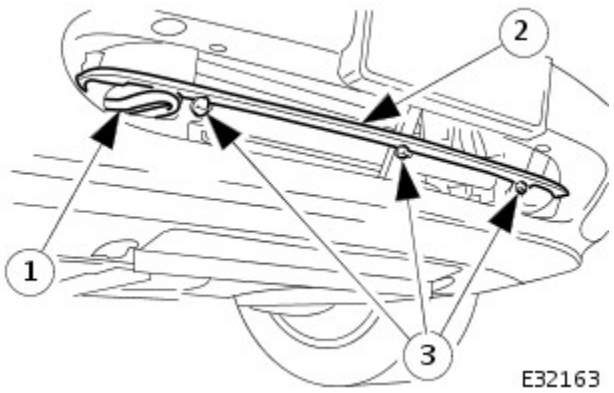
The vehicle towing point is not suitable for use with a solid tow-bar.

Do not use the crossbeam tie bar as a towing location.

When the vehicle is being towed on its own wheels:

- Local regulations for the towing of vehicles must be followed. 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 make the direction indicators, horn and stop lamps operate.
- 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 using the towing location provided; refer to Front Towing Point in this section.

Front Towing Point



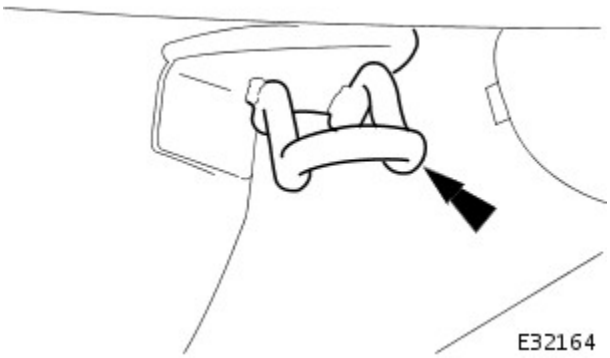
Parts List

Item	Part Number	Description
1	—	Front towing loop
2	—	Grille vane
3	—	Grille vane fastener

The front towing point:

- Is a welded loop on the right-hand bumper mounting bracket.
- Must only be used when the grille vane has been removed by turning the three fasteners anti-clockwise.

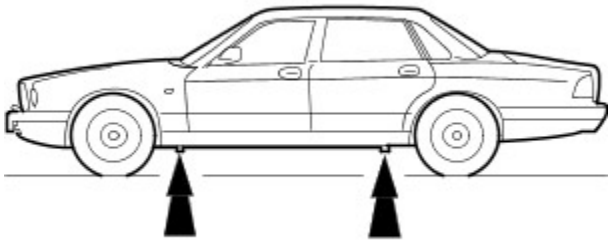
Rear Towing Point



The rear towing point is a welded loop on the right-hand side of the trunk floor panel; it must not be used for towing another vehicle.

Jacking and Lifting - Using the Vehicle Jack

General Procedures



E32165

1. WARNINGS:

ENSURE THAT THE VEHICLE IS STANDING ON FIRM, LEVEL GROUND.

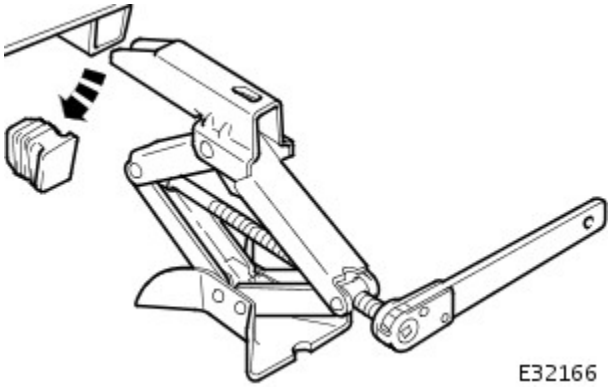
DO NOT START OR RUN THE ENGINE WHILE THE VEHICLE IS ONLY SUPPORTED BY THE VEHICLE JACK.

Position the jack at the appropriate front or rear jacking point.

- Put the parking brake ON and the transmission in Park.
- Chock the wheels to prevent movement of the vehicle.

2. Locate the arm of the jack securely in the jacking socket.

- Remove the rubber cover from the socket.



E32166

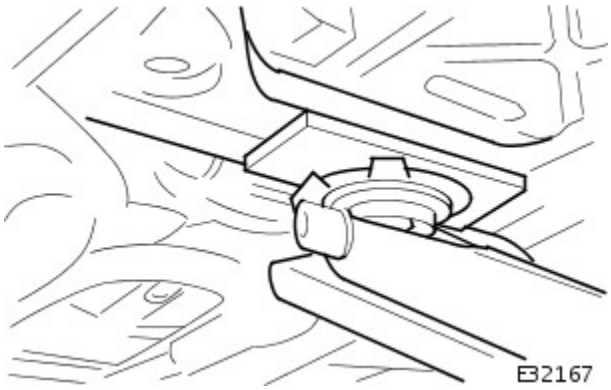
3. Raise/lower the vehicle using the jack ratchet handle.

4. Remove the jack from the jacking point.

- Fit the rubber cover to the jacking socket.

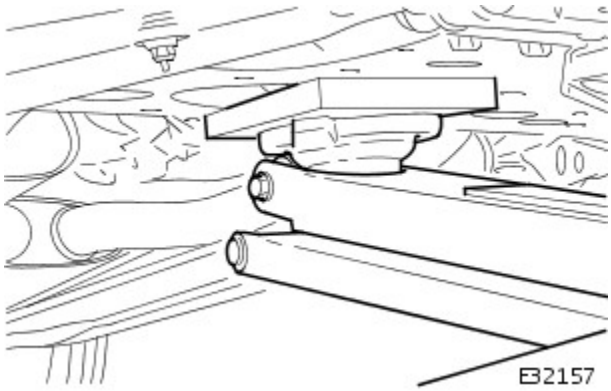
Jacking and Lifting - Using the Workshop Jack

General Procedures



1. To raise both front wheels:

- Position the jack centrally under the front suspension crossbeam.
- Place a block of wood between the jack head and the crossbeam.
- Raise the vehicle.
- Place suitable vehicle stands in position at the front vehicle jacking points.
- Lower the vehicle onto the vehicle stands.



2. To raise both rear wheels:

- Position the jack centrally under the rear suspension subframe.
- Place a block of wood between the jack head and the subframe.
- Raise the vehicle.
- Place suitable vehicle stands in position at the rear vehicle jacking points.
- Lower the vehicle onto the vehicle stands.

Suspension System - General Information -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Loctite	270
Grease	Shell Retinax 'A'
Grease	Castrol 'NTR'

Front Suspension Dimensions

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced.

Component	Dimension
Hub face - maximum run-out	0.038 mm

Rear suspension Dimensions

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced.

Component	Dimension
Hub face - maximum run-out	0.057 mm

Vehicle ride height

Model	Model Year	VIN RANGE		Market	Showroom mm(in)		Curb mm(in)	
		From	To		Front	Rear	Front	Rear
Comfort suspension	1998 to 2003.5	812317	F59525	All	390 (15.11)	384 (15.11)	389 (15.31)	373 (14.68)
Sport suspension	"	"	"	All	389 (15.31)	381 (15.00)	388 (15.27)	372 (14.64)
XJR	"	"	"	NAS	389 (15.31)	382 (15.03)	388 (15.27)	372 (14.64)
XJR	"	"	"	ROW	367 (14.44)	365 (14.37)	366 (14.40)	358 (14.09)
Supercharged super 8	"	"	"	All	389 (15.31)	382 (15.03)	388 (15.27)	372 (14.64)

- Ride height is measured from the center of the wheel to the apex of the wheel arch, through the wheel center line.
- Showroom is with all fluids at full and 9 liters (9.5 US quarts) of fuel.
- Curb is with all fluids at full and a full tank of fuel.
- All figures quoted assume a ± 15 mm (0.59in) anticipated build variance and condition.

Wheel Alignment - Front Camber - XJR Excluding NAS, and German Super-8

XJR Excluding NAS, and German Super-8								
1998 to 2003.5 VIN - 812317 to F59525	Units	Camber						Balance (RH - LH)
				Left - Hand		Right - Hand		
		Min	Max	Min	Max	Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	-1° 28'	-0° 28'	-1° 13'	-0° 13'	-0° 45'	+1° 15'	
	Decimal degrees	-1.47°	-0.47°	-1.22°	-0.22°	-0.75°	+1.25°	
Rest of World	Degrees/minutes	-1° 13'	-0° 13'	-1° 28'	-0° 28'	-1° 15'	+0° 45'	
	Decimal degrees	-1.22°	-0.22°	-1.47°	-0.47°	-1.25°	+0.75°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Wheel Alignment - Front Camber - XJR NAS, and Comfort/Sport/Daimler Super-8

XJR NAS, and Comfort/Sport/Daimler Super-8								
1998 to 2003.5 VIN - 812317 to F59525	Units	Camber						Balance (RH - LH)
				Left - Hand		Right - Hand		
		Min	Max	Min	Max	Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	-1° 02'	-0° 02'	-0° 47'	+0° 13'	-0° 45'	+1° 15'	
	Decimal degrees	-1.03°	-0.03°	-0.78°	+0.22°	-0.75°	+1.25°	
USA, Canada and Mexico, Dominican Republic (NAS)	Degrees/minutes	-0° 32'	+0° 28'	-1° 02'	-0° 02'	-1° 30'	+0° 30'	
	Decimal degrees	-0.53°	+0.47°	-1.03°	-0.03°	-1.50°	+0.50°	
Rest of World	Degrees/minutes	-0° 47'	+0° 13'	-1° 02'	-0° 02'	-1° 15'	+0° 45'	
	Decimal degrees	-0.78°	+0.22°	-1.03°	-0.03°	-1.25°	+0.75°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Wheel Alignment - Front Castor - XJR Excluding NAS, and German Super-8

XJR Excluding NAS, and German Super-8								
1998 to 2003.5 VIN - 812317 to F59525	Units	Castor						Balance (RH - LH)
				Left - Hand		Right - Hand		
		Min	Max	Min	Max	Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	+4° 00'	+8° 00'	+4° 00'	+8° 00'	-1° 12'	+1° 12'	
	Decimal degrees	+4.00°	+8.00°	+4.00°	+8.00°	-1.20°	+1.20°	
Rest of World	Degrees/minutes	+4° 00'	+8° 00'	+4° 00'	+8° 00'	-1° 12'	+1° 12'	
	Decimal degrees	+4.00°	+8.00°	+4.00°	+8.00°	-1.20°	+1.20°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Wheel Alignment - Front Castor - XJR NAS, and Comfort/Sport/Daimler Super-8

XJR NAS, and Comfort/Sport/Daimler Super-8								
1998 to 2003.5 VIN - 812317 to F59525	Units	Castor						Balance (RH - LH)
				Left - Hand		Right - Hand		
		Min	Max	Min	Max	Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	+4° 00'	+8° 00'	+4° 00'	+8° 00'	-1° 12'	+1° 12'	
	Decimal degrees	+4.00°	+8.00°	+4.00°	+8.00°	-1.20°	+1.20°	
USA, Canada and Mexico, Dominican Republic (NAS)	Degrees/minutes	+4° 00'	+8° 00'	+4° 00'	+8° 00'	-1° 12'	+1° 12'	
	Decimal degrees	+4.00°	+8.00°	+4.00°	+8.00°	-1.20°	+1.20°	
Rest of World	Degrees/minutes	+4° 00'	+8° 00'	+4° 00'	+8° 00'	-1° 12'	+1° 12'	
	Decimal degrees	+4.00°	+8.00°	+4.00°	+8.00°	-1.20°	+1.20°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Wheel Alignment - Front Toe - XJR Excluding NAS, and German Super-8

XJR Excluding NAS, and German Super-8				
1998 to 2003.5 VIN - 812317 to F59525	Units	Front Toe		Total Toe
		Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	0° 05'	+0° 25'	
	Decimal degrees	0.08°	+0.42°	
Rest of World	Degrees/minutes	0° 05'	+0° 25'	
	Decimal degrees	0.08°	+0.42°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Wheel Alignment - Front Toe - XJR NAS, and Comfort/Sport/Daimler Super-8

XJR NAS, and Comfort/Sport/Daimler Super-8				
1998 to 2003.5 VIN - 812317 to F59525	Units	Front Toe		Total Toe
		Min	Max	
All Right-Hand drive and Japan	Degrees/minutes	0° 05'	+0° 25'	
	Decimal degrees	0.08°	+0.42°	
USA, Canada and Mexico, Dominican Republic (NAS)	Degrees/minutes	0° 05'	+0° 25'	
	Decimal degrees	0.08°	+0.42°	
Rest of World	Degrees/minutes	0° 05'	+0° 25'	
	Decimal degrees	0.08°	+0.42°	

- All the above figures are at "showroom" height. (See ride height section above).
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

1998 to 2003.5
VIN - 812317 to F59525
All Markets

Units	Camber						Balance (RH - LH)
			Left Hand		Right Hand		
	Min	Max	Min	Max	Min	Max	
Degrees/Minutes	-1° 12'	-0° 06'	-1° 12'	-0° 06'	-1° 00	+1° 00	
Decimal Degrees	-1.20°	-0.10°	-1.20°	-0.10°	-1.00°	+1.00°	

Wheel Alignment - Rear Camber

- All the above figures are at "showroom" height. See vehicle ride height section above.
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

1998 to 2003.5
VIN - 812317 to F59525
All Markets

Units	Toe								Thrust Angle
			Left Hand		Right Hand		Total Toe		
	Min	Max	Min	Max	Min	Max	Min	Max	
Degrees/Minutes	+0°05'	+0° 15'	+0°05'	+0° 15'	0° 10'	+0° 30'	-0° 05'	+0° 05'	
Decimal Degrees	+0.08°	+0.25°	+0.08°	+0.25°	0.17°	+0.50°	-0.08°	+0.08°	

Wheel Alignment - Rear Toe

- All the above figures are at "showroom" height. See vehicle ride height section above.
- Tires must be inflated to normal pressure.
  For additional information, refer to Section 204-04 Wheels and Tires.

Suspension System - General Information - Front Camber and Caster Adjustment

General Procedures

• NOTE: Before any work is commenced, the vehicle must be checked to establish that it conforms to the Jaguar original specification, e.g. wheels, tires, tire pressures, etc.

• NOTE: The vehicle must be unladen and the fuel tank full when measuring suspension geometry.

1. Road test the vehicle to establish the exact nature of the complaint, e.g. pulling to one side, wander.
2. Measure the suspension geometry, fill in the 'Suspension Geometry Record Form', and contact Jaguar Technical Support for assistance.
3. Technical Support will give advice on the course of action to be taken to rectify the problem.
4. Each lower wishbone pivots on and is secured to the front crossbeam by two fulcrum bolts. A circular eccentric flange formed under the hexagonal head of each fulcrum bolt, has raised graduation marks to indicate radial position. A washer with a 'D' shaped hole locates on a flat on the threaded section of each bolt. This ensures that the washer rotates with the bolt, maintaining an eccentric position corresponding with the flanged head. The outer face of the washer is punch marked, ensuring correct installation with the chamfered face inwards. This permits the washer to rotate freely in the crossbeam cam reaction plate during a djustment. Each fulcrum bolt and washer are secured by a self locking nut.

   On rotation of the bolt, lateral movement of the eccentric flange and washer is restricted by the cam plate faces, forcing the bolt shank to move laterally in the crossbeam slots. Lateral movement of the bolt shank results in corresponding inward and outward movement of the wishbone arm, effecting adjustment of wheel alignment.

   Rotation of the front fulcrum bolt principally adjusts wheel caster angle, with a small amount of camber angle change. Adjustment of the rear fulcrum bolt mainly alters wheel camber angle with a small amount of caster angle change.

   On vehicles with VIN up to 833124, fulcrum bolt eccentric flanges have raised graduation marks representing 15 degree increments of bolt rotation from 0 to 90 degrees.

   On vehicles with VIN from 833125, the fulcrum bolt graduation marks represent bolt shank horizontal movement in 1mm increments from 0 to 3mm.

   The upper wishbone and fulcrum shaft are not adjustable and play no part in steering geometry adjustment.

Suspension System - General Information - Front Camber, Caster and Toe Adjustment

General Procedures

1. NOTE: Before checking or adjusting any alignment, examine the vehicle for curb impact damage on wheels and subsequent damage to steering and suspension components.

• NOTE: Wheel alignment must not be carried out with a space saver wheel installed on any of the hubs.

• NOTE: Before carrying out any checking or adjustment of wheel alignment, ensure that the vehicle wheels, tires and tire pressures are to Jaguar specification.

• NOTE: Position steering wheel in straight ahead position before adjusting front wheel toe evenly on both tie rods to maintain centralization of steering wheel.

Position alignment checking equipment on vehicle and following equipment manufacturer's instructions, check and if necessary adjust to Specifications in Section 204-01.

2. Check and as necessary adjust front wheel caster. Refer to 57.65.05.

3. Check and as necessary adjust front wheel camber. Refer to 57.65.06.

4. Check and as necessary adjust front wheel alignment. Refer to 57.65.01.

Suspension System - General Information - Front Toe Adjustment

General Procedures

1. NOTE: Before checking or adjusting front wheel alignment, examine the vehicle for curb impact damage on wheels and subsequent damage to steering and suspension components.

• NOTE: Wheel alignment must not be carried out with a space saver wheel installed on any of the hubs.

• NOTE: Before carrying out any checking or adjustment of wheel alignment, ensure that the vehicle wheels, tires and tire pressures are to Jaguar specification.

• NOTE: Position steering wheel in straight ahead position before adjusting front wheel toe evenly on both tie rods to maintain centralization of steering wheel.

Position alignment checking equipment on road wheels and following equipment manufacturer's instructions, check and if necessary adjust front wheel toe to Specifications in Section 204-01.

Suspension System - General Information - Rear Toe Adjustment

General Procedures

1. NOTE: Wheel alignment must not be carried out with a space saver wheel installed on any of the hubs.

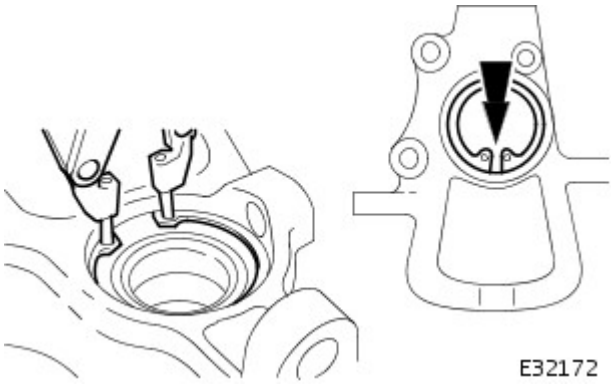
• NOTE: Before carrying out any checking or adjustment of wheel alignment, ensure that the vehicle wheels, tires and tire pressures are to Jaguar specification.

• NOTE: Before checking or adjusting rear wheel alignment, examine the vehicle for curb impact damage on wheels and subsequent damage to suspension components.

Position alignment checking equipment on road wheels and following equipment manufacturer's instructions, check and if necessary adjust rear wheel alignment to Specifications in Section 204-02.

Suspension System - General Information - Wheel Bearing Circlip Inspection

General Procedures

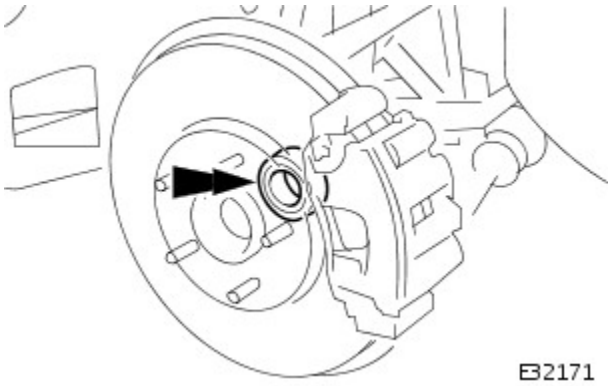


1. When installing the bearing circlips in the vertical link ensure that the ears are located at the lowest position to permit water drainage.

To achieve this, a perpendicular line drawn through the suspension upper ball-joint will indicate the position of the gap between the circlip ears. This procedure makes an allowance for the caster angle prior to installing the vertical link.

Suspension System - General Information - Wheel Bearing Inspection

General Procedures



1. During use, a small amount of surplus grease may appear around the bearing seal, this does not indicate a failed bearing or seal. The grease should not be removed as this will act as an additional barrier to the ingress of water or foreign matter.

Excessive end float or bearing rumble will indicate a failed bearing; for maximum permissible end float see specification section. Take care not to confuse suspension ball joint or upper or lower fulcrum bush movement for bearing end float.

If the hub is removed for any reason, a new bearing assembly must be installed. Never attempt to re-use a bearing.

Front Suspension -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Loctite	270
Grease	Shell Retinax 'A'
Grease	Castrol 'NTR'

Press-In Loads

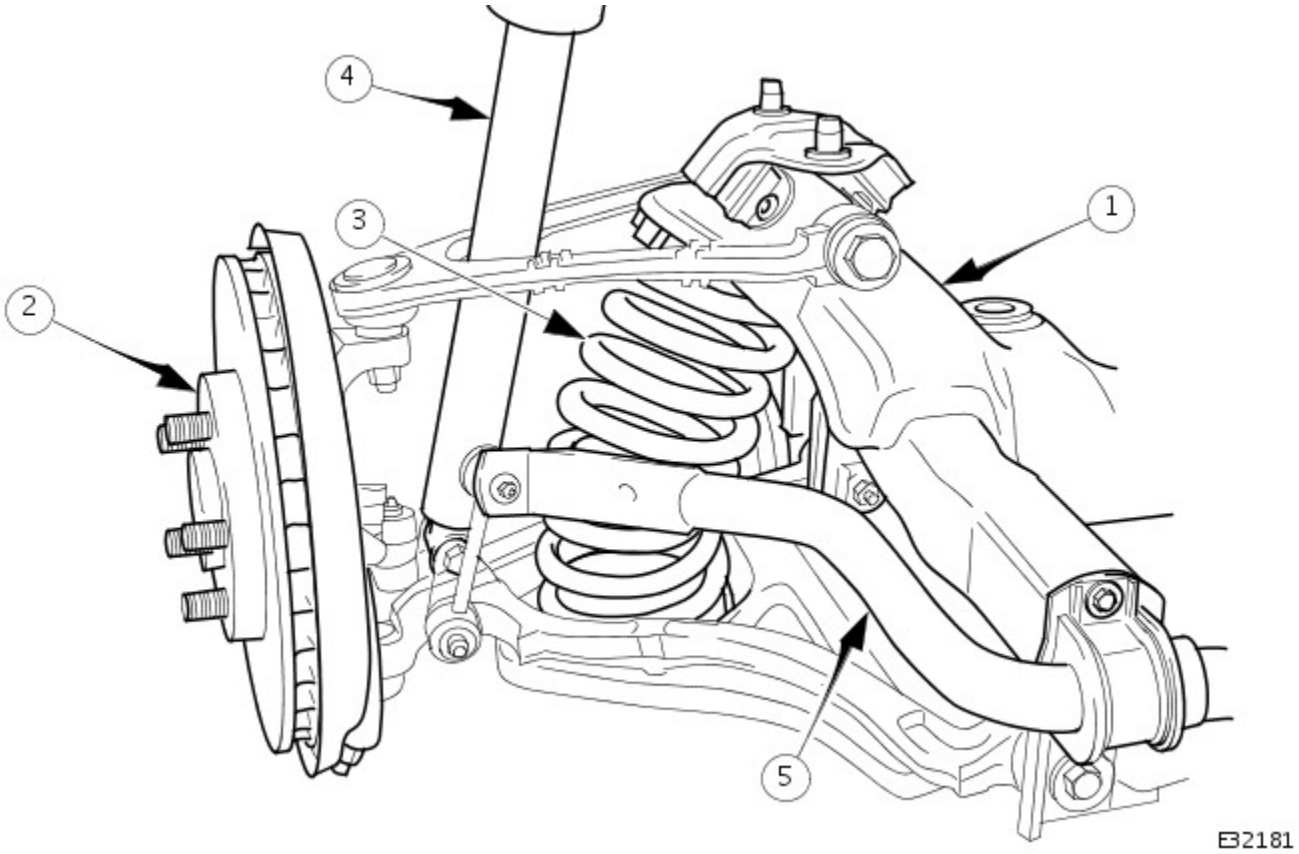
Component	Kn
Ball joint to upper wishbone	25 - 50
Ball joint to lower wishbone	25 - 50

Torques

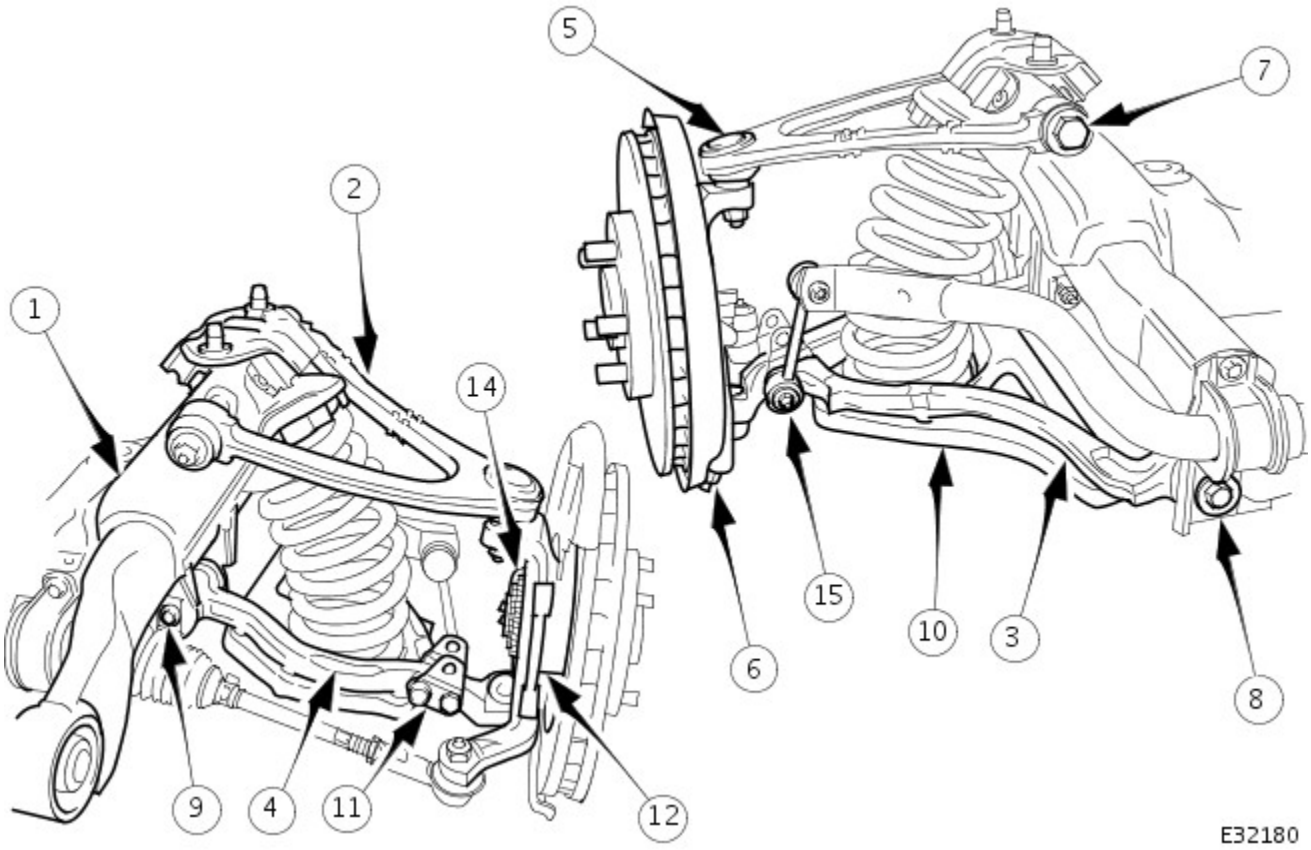
Component	Nm
Nut - ball joint, upper wishbone to vertical link.	60-80
Nut - ball joint, lower wishbone to vertical link.	60-80
Nut - fulcrum bolt, upper wishbone.	60-80
Nut - ball joint, tie rod to steering arm.	71-85
Bolt - wheel speed sensor to vertical link.	8-10
Bolt - front mounting to crossbeam.	22-28
Bolt - mounting , stabilizer bar.	30-40
Nut - link arm ball joint to stabilizer bar.	60-80
Bolt - mounting, steering rack to crossbeam.	41-54
Bolt - front mounting, crossbeam to body.	22-28
Bolt - spring pan to lower wishbone.	70-90
Nut - shock absorber to upper mounting (vehicles with adaptive damping).	16-18
Nut - shock absorber to upper mounting (vehicles without adaptive damping).	30-40
Nut - shock absorber lower to wishbone.	43-57
Bolt - engine Hydramount to crossbeam.	34-46
Bolt - crossbeam rear mounting to body.	131-185
Bolt - generator cooling duct deflector to crossbeam.	17-23
Nut - lower steering column to pinion shaft.	22-28
Nut - hub, speed sensor rotor.	270-330
Bolt - shield, brake disc.	9-12
Bolt - lower wishbone, front arm to rear arm.	77-103
Nut - stabilizer bar link arm to wishbone bracket.	41-54
Nut - wishbone front eccentric bolt.	113-153
Nut - wishbone rear eccentric bolt.	113-153
Nut - fulcrum shaft, upper wishbone.	60-80
Bolt - power steering pipes to pinion housing.	9-12

Front Suspension - Front Suspension

Description and Operation



Item	Part Number	Description
1	—	Suspension Crossbeam
2	—	Hub Assembly
3	—	Spring
4	—	Shock Absorber
5	—	Stabilizer Bar



Item	Part Number	Description
1	—	Crossbeam
2	—	Upper Wishbone
3	—	Lower Wishbone Arm, Front
4	—	Lower Wishbone Arm, Rear
5	—	Upper Wishbone Ball Joint
6	—	Lower Wishbone Ball Joint
7	—	Fulcrum Bolt
8	—	Adjuster Bolt, Front
9	—	Adjuster Bolt, Rear
10	—	Spring Pan
11	—	Shock Absorber Lower Mounting Plate
12	—	Vertical Link
13	—	Hub Assembly
14	—	Sensor Rotor
15	—	Bolt, Wishbone to Link Arm

Front Crossbeam

A fully stressed, pressed steel and tube fabrication with integral lower wishbone tie bars, the crossbeam is secured to the body on four resilient mountings.

The crossbeam incorporates mounting points for:

- The upper and lower wishbone fulcrum bolts.
- The stabilizer bar
- The power steering rack.
- The engine hydramounts.
- Road springs.

Slots and cam reaction plates on the crossbeam provide for adjustment of suspension geometry.

Upper Wishbones

Each upper wishbone assembly is a one-piece steel forging incorporating:

- A press-fit ball joint.
- Press-fit bushes for location of the upper fulcrum bolt.

Lower Wishbones

Each lower wishbone comprising forged steel front and rear arms bolted together, incorporates:

- A press-fit ball joint in the outer extremity of the rear arm.
- Press-fit bushes for location of the lower fulcrum bolts
- Location for the shock absorber lower mounting plates.

Vertical Links

The vertical links are of forged steel with integral steering arms. Each is supported between the upper and lower wishbones by two ball joints and carries:

- Front hub
- Brake caliper and disc shield assembly
- ABS sensor.

Front Hubs

Each forged steel front hub accommodates sealed for life cartridge type wheel bearings, and carries:

- The brake rotor assembly.
- A hub nut with toothed, integral ABS rotor.
- Suspension spring pin locking device.

Front Road Springs

- The road springs are of coil type with their rating dependent upon vehicle specification
- Each spring is installed between the suspension crossbeam location and the lower wishbone spring pan.
- Rubber seats are installed between the spring and the crossbeam and the spring pan.

Front Shock Absorbers

The shock absorbers are telescopic hydraulically operated units. Optional adaptive damping units incorporate a solenoid-operated control valve at their upper extremity.

- Each shock absorber is installed between the lower wishbone rear arm and a recess in the body.
- The lower end of the shock absorber is secured to plates on the wishbone by a bolt that also serves as a pivot.
- The upper end of each shock absorber is secured to the body location by a single nut.

Front Stabilizer Bar

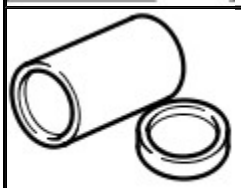
A front stabilizer bar installed on all vehicles is rated according to suspension specification.

Operation

As each road wheel rises, movement is transmitted through the vertical link assembly to the lower wishbone. The resulting rise of the wishbone compresses the road spring and partially telescopes the shock absorber. During this action, the spring absorbs associated shocks and the shock absorber minimizes spring oscillation.
During cornering, vehicle weight is transferred to the outer road wheel with a resulting tendency for the inner wheel to lift. The stabilizer bar assists in minimizing this tendency by transferring a proportion of potential lift of the inner wheel to the outer wheel. This results in enhanced body stability with improved cornering capabilities.

Front Suspension - Ball Joint

Removal and Installation

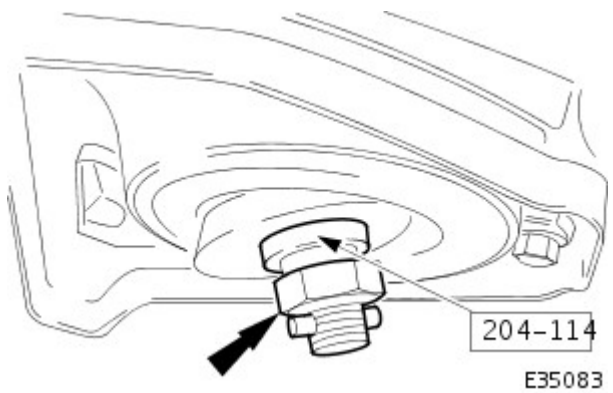
Special Tool(s)	
 E36462	Ball Joint Taper Separator 204-192 (JD 219)
 E36444	Front Camber Tie-down Link 204-114 (JD 133)
 E36427	Ball Joint Remover 204-200 (JD 240)
 E36426	Ball Joint Installer 204-199 (JD 239)

Removal

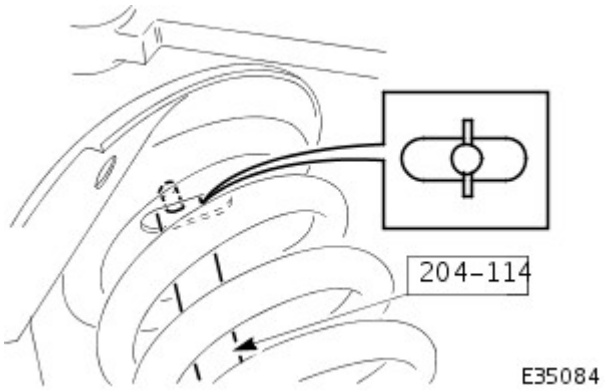
• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

The ball joint must be returned for warranty purposes, care must therefore be exercised to avoid damaging it during removal. Any damage incurred during removal must be noted and recorded.



1. Raise front of vehicle. Refer to Section 100-02.
2. Fully slacken adjuster nut of special tool 204-114 and position tool in center of road spring .

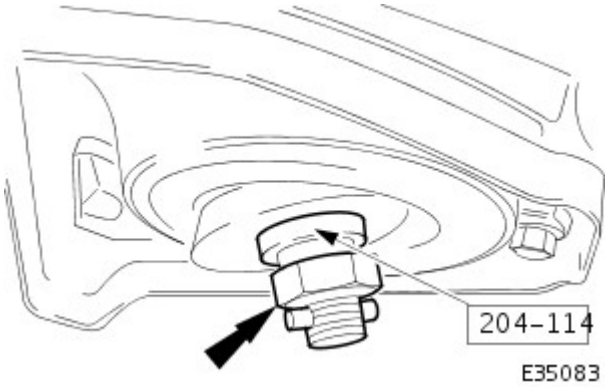


3. Lower front of vehicle.

4. WARNING: ENSURE THAT THE DOWEL OF TOOL 204-114 IS CORRECTLY POSITIONED ACROSS THE SUSPENSION TURRET SLOT.

Locate special tool in suspension turret slot.

- Pass special tool 204-114 through slot in suspension turret and rotate stem to locate dowel.



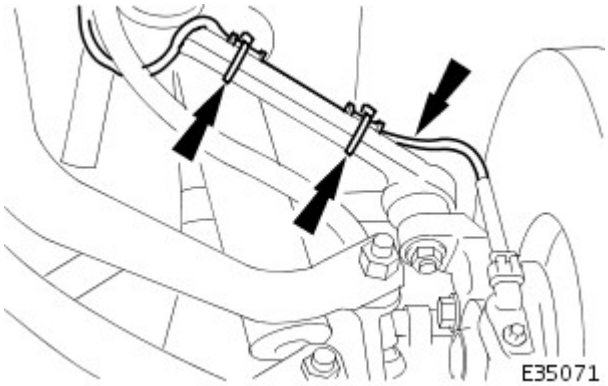
5. WARNING: WHEN TIGHTENING TOOL NUT, USE LOWER DOWEL AS A GUIDE TO ENSURE THAT THE TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Tighten nut of special tool 204-114 to full extent, to achieve suspension mid-laden position.

6. Raise front of vehicle and support on stands. refer to Section 100-02.

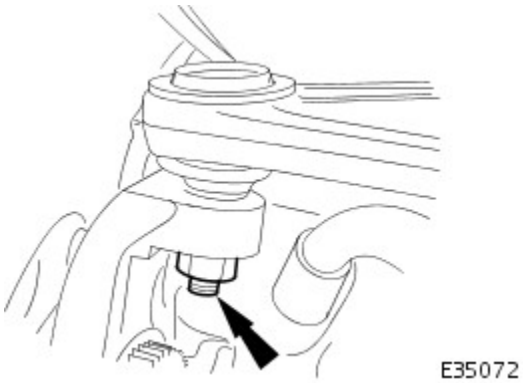
7. Remove appropriate road wheel. Refer to Section 100-02.

8. Remove and discard tiestraps securing wheel speed sensor harness to upper wishbone.

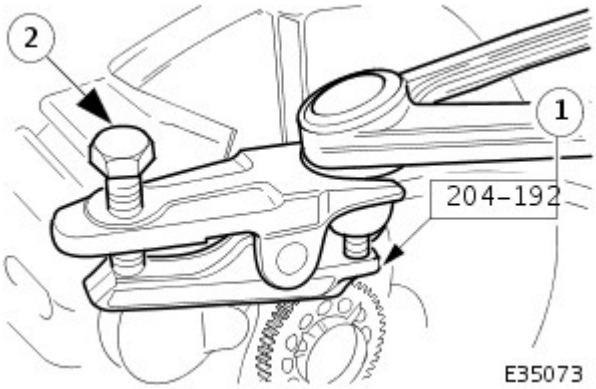


9. Move steering to appropriate full lock for access to suspension.

10. Remove nut securing upper wishbone ball joint to vertical link.



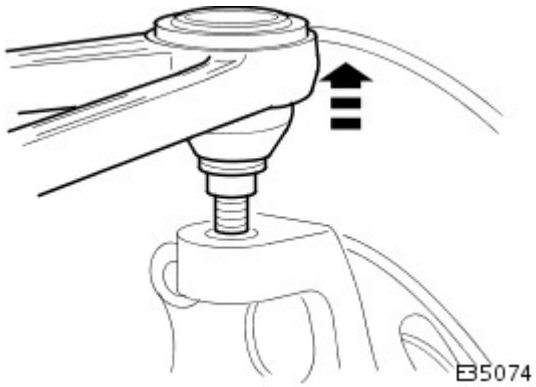
11. CAUTION: Do not use special tool 211-098 in the



following procedure as this will damage the ball joint gaiter.

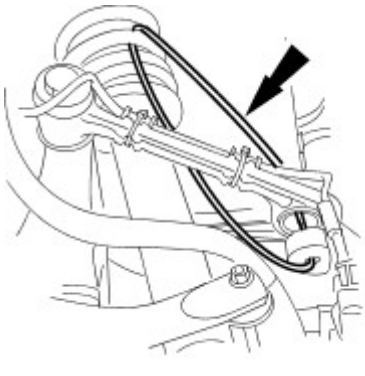
Release wishbone ball joint from vertical link.

1. Install special tool 204-192 on upper wishbone ball joint.
2. Tighten bolt of special tool to release ball joint taper from vertical link.

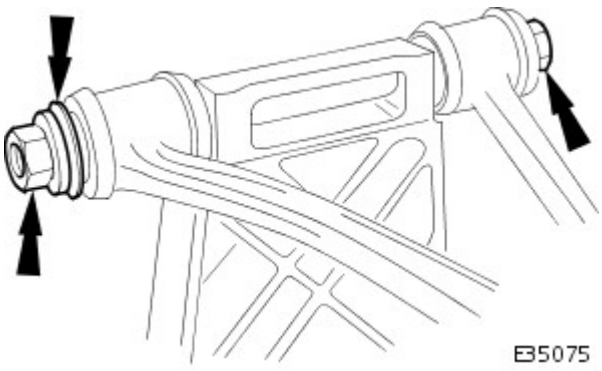


12. Remove special tool from ball joint.

13. Lift upper wishbone to withdraw ball joint from vertical link.



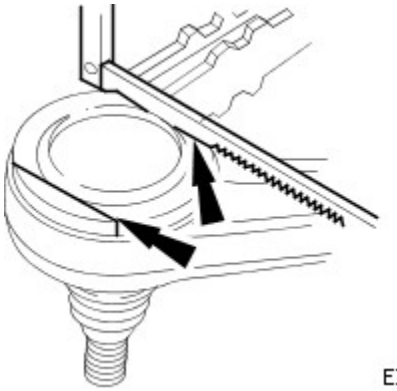
14. To prevent damage to lower ball joint, secure vertical link to road spring using strong wire.

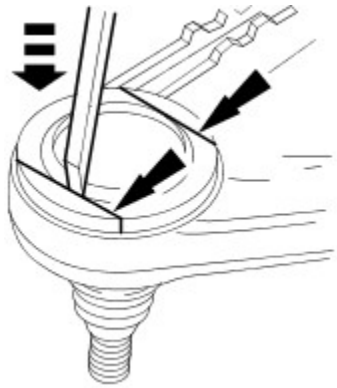


15. Remove upper wishbone fulcrum nut and bolt and withdraw wishbone from vehicle.

16. Secure upper wishbone in a vise.

17. Using a hacksaw, partially cut through two diametrically opposite segments of ball joint flange.

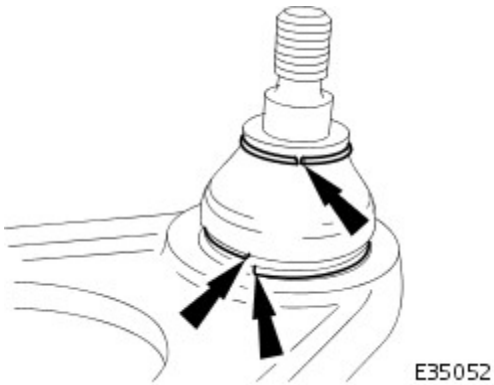


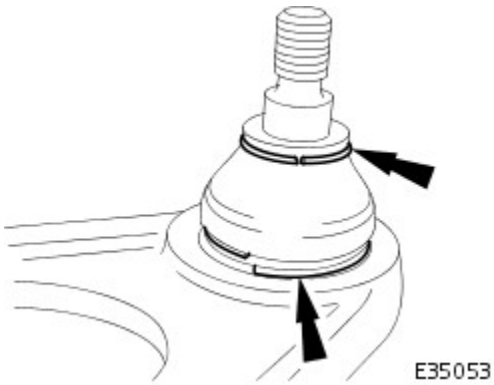


18. Carefully chisel through and remove the two ball joint flange segments to permit installation between press bed plates.

19. Remove wishbone from vise and thoroughly clean to remove swarf and road deposits.

20. For warranty purposes, paint positions of spring clip ends on ball joint housing and rubber gaiter.



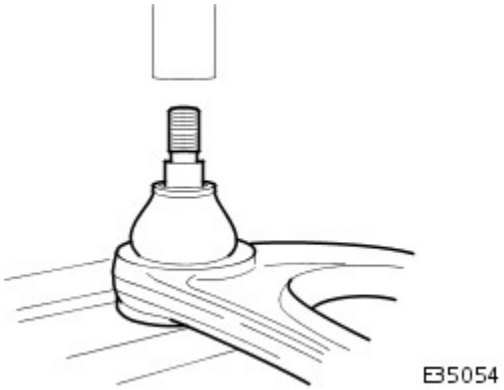


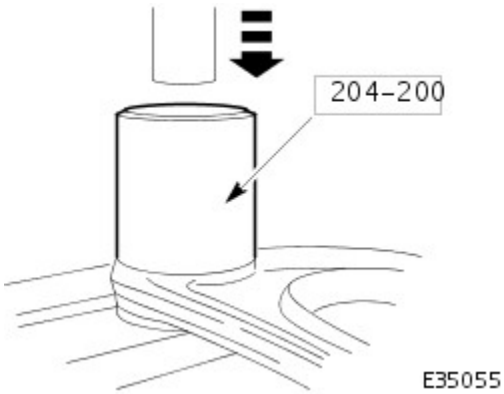
21. NOTE: Any gaiter damage incurred during removal must be recorded for warranty purposes.

Remove retaining clips and gaiter.

- Exercising care to avoid splitting or otherwise damaging gaiter, remove retaining clips.
- Remove gaiter and retain for warranty purposes.

22. Invert wishbone and position on press with ball joint flange between press bed plates.





23. Install special tool 204-200 on ball joint and operate press to release joint from wishbone.

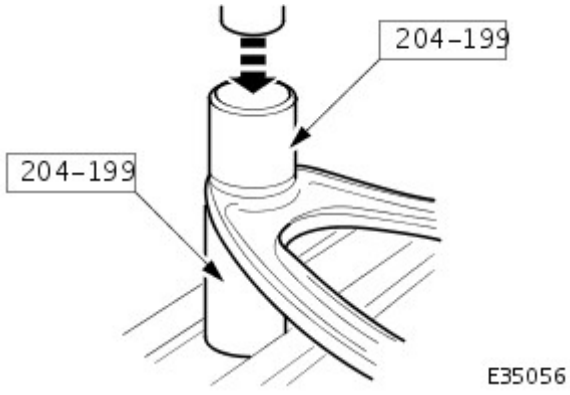
24. Remove special tool from ball joint.

25. Remove ball joint and wishbone from press.

26. Ensuring that their relative positions are clearly marked, place ball joint, rubber gaiter and retaining clip in a clean plastic bag and return for warranty purposes.

27. Thoroughly clean wishbone paying particular attention to ball joint and pivot bolt locations.

Installation



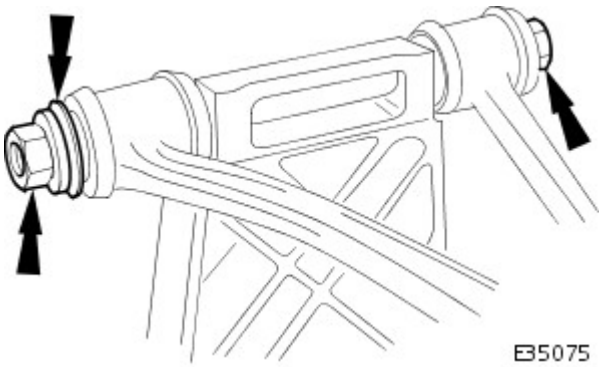
1. Install ball joint in wishbone.

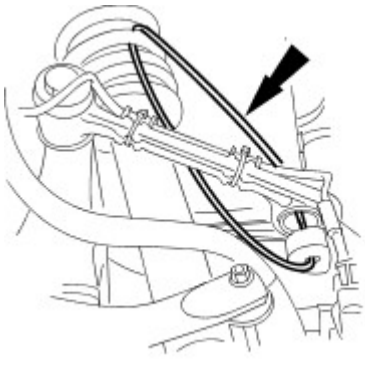
- Position support of special tool 204-199 on press bed and place wishbone on tool.
- Using ball joint plastic cover to align, position mandrel of special tool 204-199 on ball joint
- Align assembly with press ram and operate press to fully seat ball joint in wishbone.

2. Remove tool mandrel 204-199 from ball joint.

3. Remove wishbone and support tool 204-199 from press.

4. Position wishbone on suspension beam, install fulcrum shaft thread rearward, install nut and tighten to 60-80Nm.

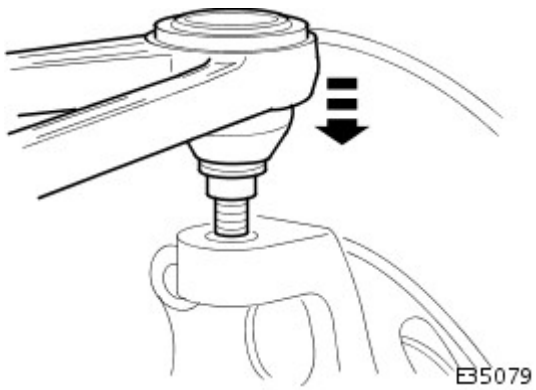




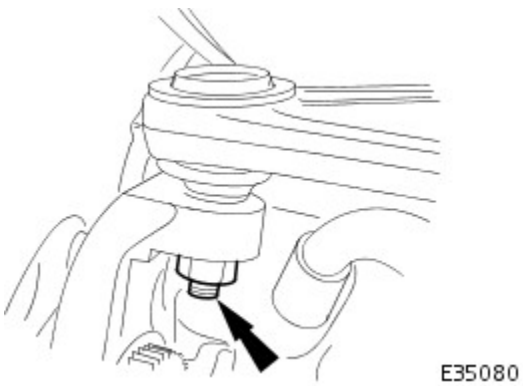
5. Remove wire temporarily securing vertical link to road spring.

6. Remove and discard plastic cover from ball joint.

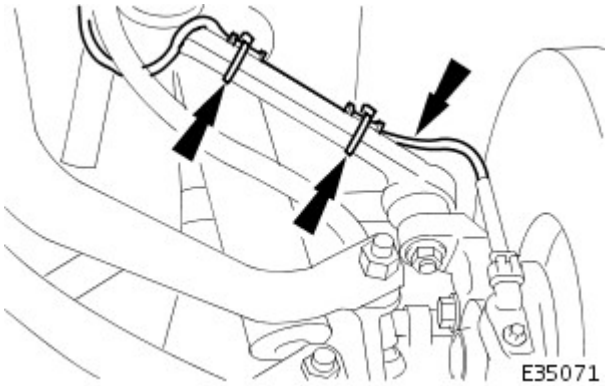
7. Position wishbone to engage ball joint taper in vertical link.



8. Install nut securing ball joint to vertical link and tighten nut to 60-80Nm.



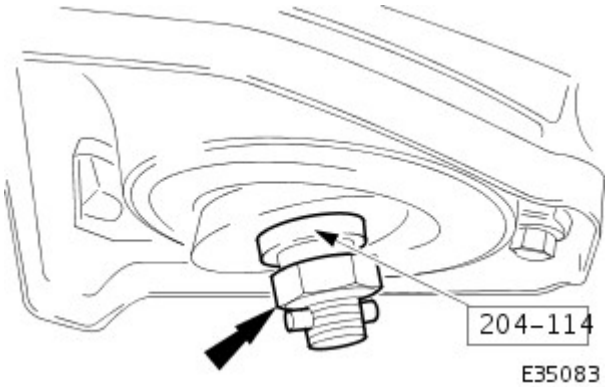
9. Reposition wheel speed sensor harness on wishbone and secure with two tiestraps.



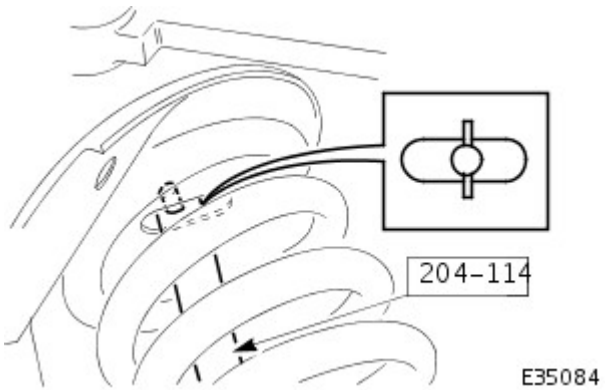
10. Install road wheel. Refer to Section 100-02

11. Raise vehicle, remove stands and fully lower vehicle.

12. Fully slacken nut on special tool 204-114.



13. Release dowel of special tool from suspension turret slot.



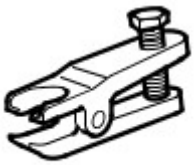
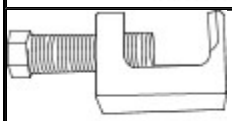
14. Raise vehicle for access and remove special tool from suspension.

15. Fully lower vehicle.

16. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

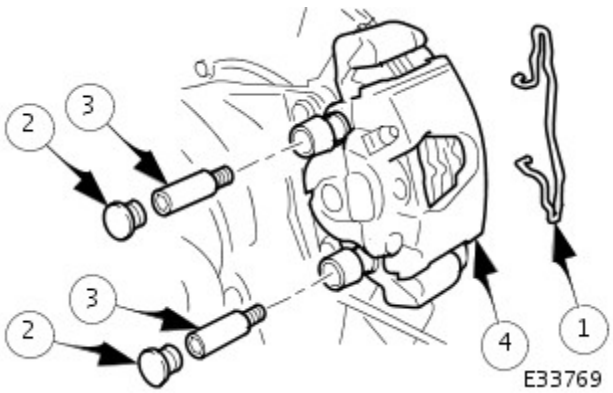
Front Suspension - Rear Lower Arm

Removal and Installation

Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Ball Joint Taper Separator 204-192 (JD 219)
 E31837	Ball joint splitter 204-293

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. Refer to Section 100-00 for further information.



1. Raise front of vehicle and support on stands. Refer to Section 100-02.

2. Remove appropriate road wheel. Refer to Section 100-02.

3. CAUTION: Do not suspend caliper from brake hose as this will damage the hose.

Remove brake calipers from carriers.

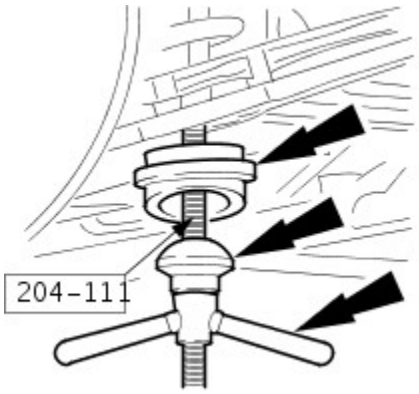
1. Remove caliper spring clip.
2. Remove guide pin dust caps.
3. Slacken and withdraw guide pins.
4. Remove caliper from carrier and tie to suspension mounting bracket.

4. Raise vehicle further to provide access for Special Tool 204-

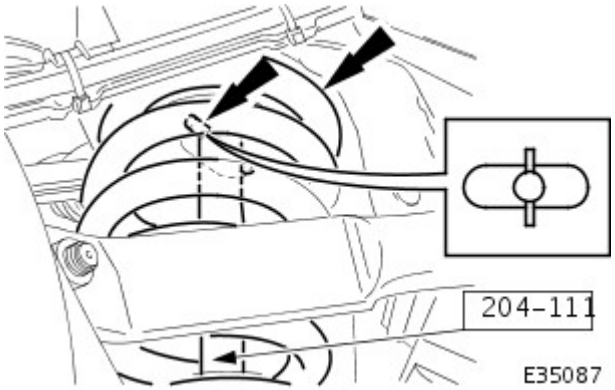
111 and support on stands. Refer to Section 100-02.

5. Install Special Tool 204-111 in road spring.

- Slacken tool adjuster to suit spring length.
- Install adaptor and thrust collar.
- Position stem of tool in center of spring passing dowel through slot in suspension turret.

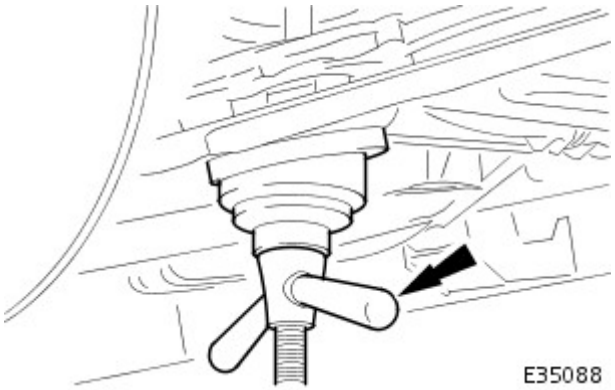


6. Rotate stem of Special Tool to position dowel across slot.

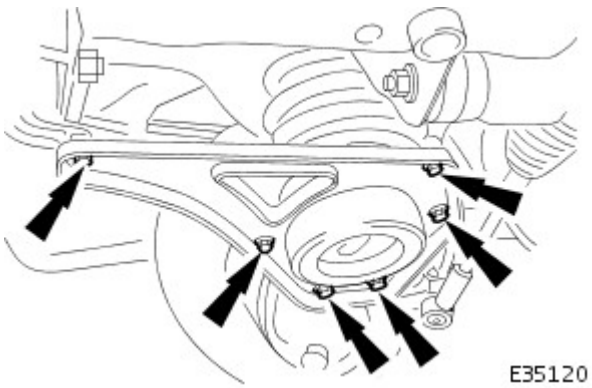


7. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

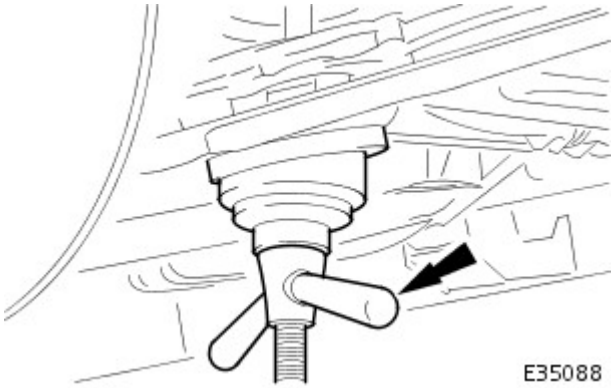
Rotate adjuster of Special Tool to tension spring.



8. Remove spring pan to lower wishbone securing bolts.



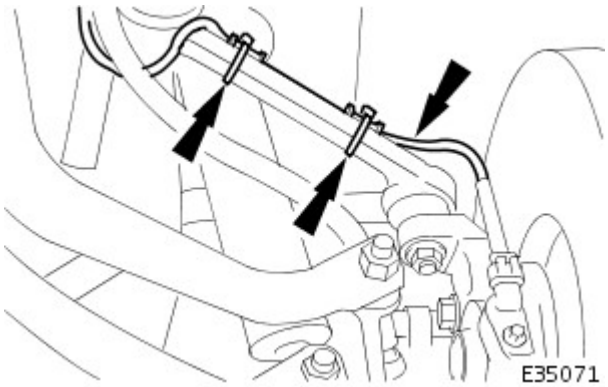
9. Rotate adjuster of Special Tool to release tension from spring.



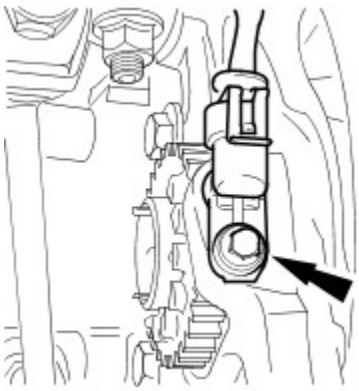
10. NOTE: It is not necessary to remove Special Tool from spring at this stage.

Remove spring assembly and Special Tool 204-111 from suspension turret.

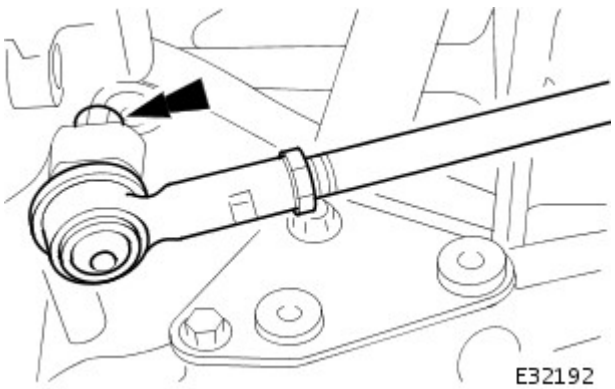
11. Lower vehicle to working height and support on stands.



12. Remove and discard tiestraps securing wheel speed sensor harness to upper wishbone.

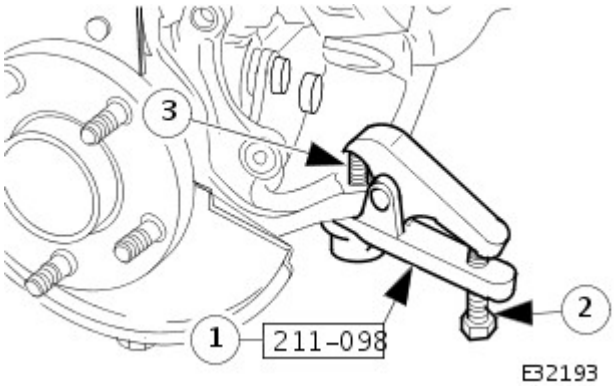


13. Remove wheel speed sensor securing screw and withdraw sensor from vertical link.

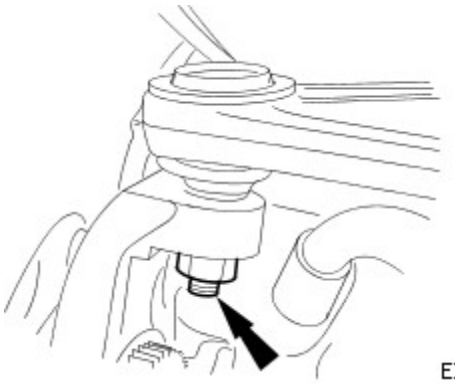


14. Remove nut securing tie rod outer ball joint to steering arm.

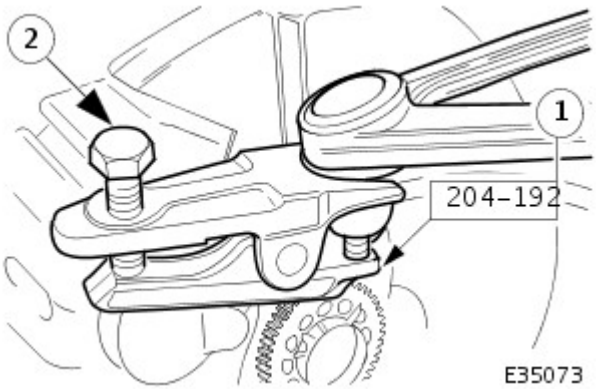
15. Release tie rod ball joint from vertical link.



1. Install special tool 211-098 on tie rod ball joint.
2. Tighten tool bolt to release taper pin from vertical link.



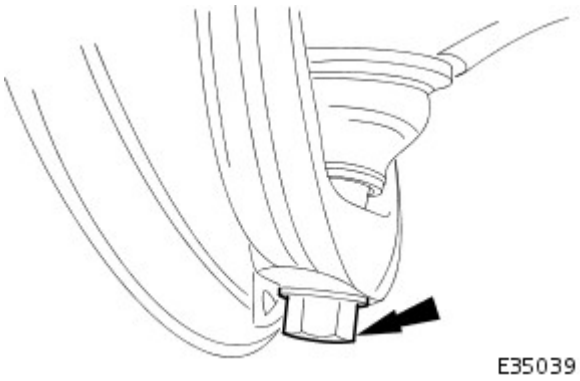
16. Remove nut securing upper wishbone ball joint to vertical link.



17. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

Release upper wishbone ball joint from vertical link/hub assembly.

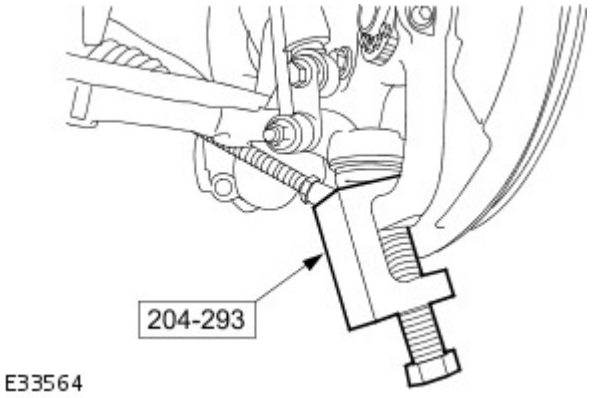
1. Install special tool 204-192 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.



18. Slacken but do not remove nut securing lower wishbone ball joint to vertical link.

19. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

Release lower wishbone ball joint from vertical link/hub assembly.

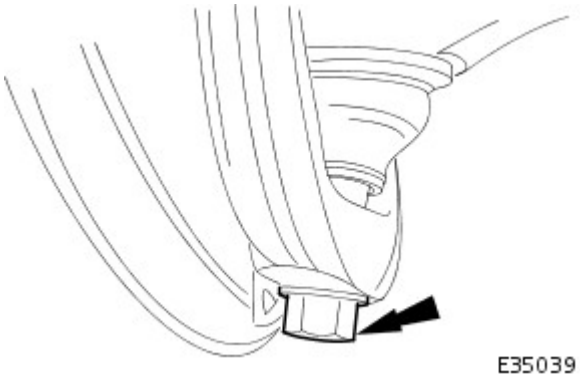


E33564

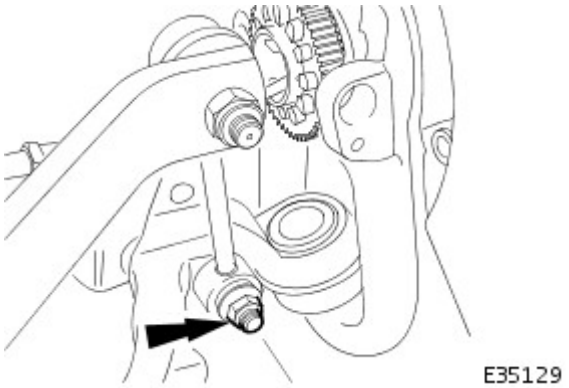
1. Install special tool 204-293 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.

20. Remove special tool 204-293 from ball joint.

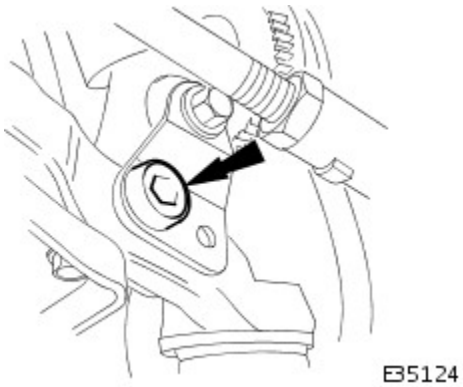
21. Remove vertical link/hub assembly.


E35039

- Supporting vertical link/ hub assembly, remove lower wishbone ball joint nut.
- Remove vertical link /hub assembly.

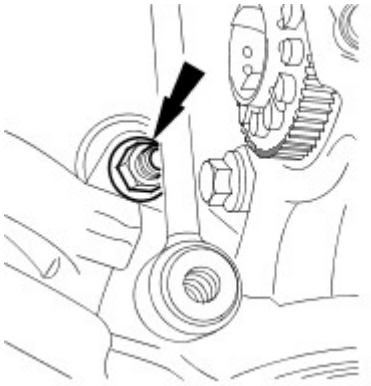

E35129

22. Remove stabilizer bar link to wishbone securing nut and bolt.


E35124

23. Remove wishbone front arm to rear arm securing bolt .

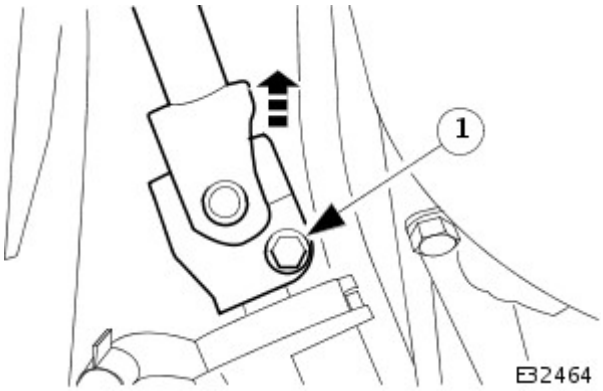
24. Slacken but do not remove shock absorber lower nut and bolt.



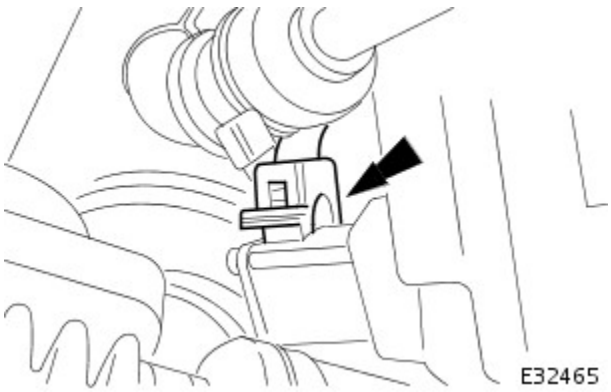
25. Release lower steering column from pinion shaft.

1. Remove lower steering column nut and bolt.

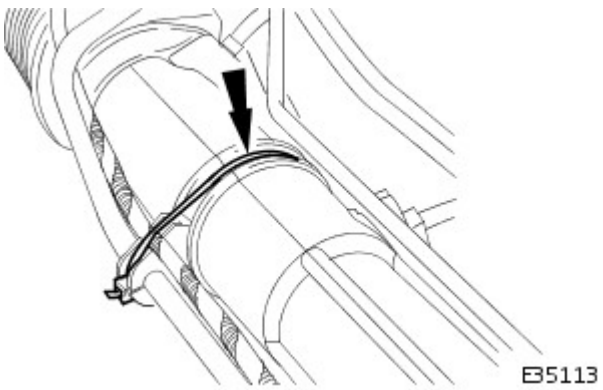
- Move column upwards to release it from pinion shaft.



26. Disconnect harness connector from steering transducer.



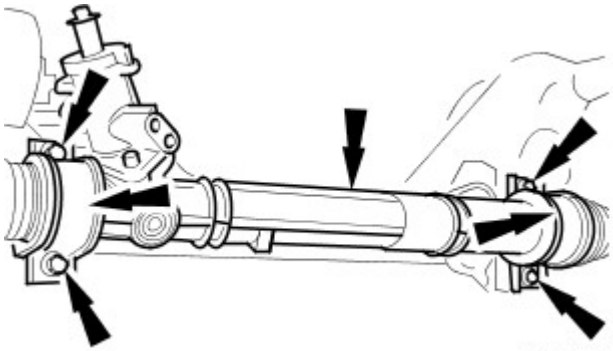
27. Remove tiestrap securing return pipe, harness (RHD only) and rubber support to steering rack.



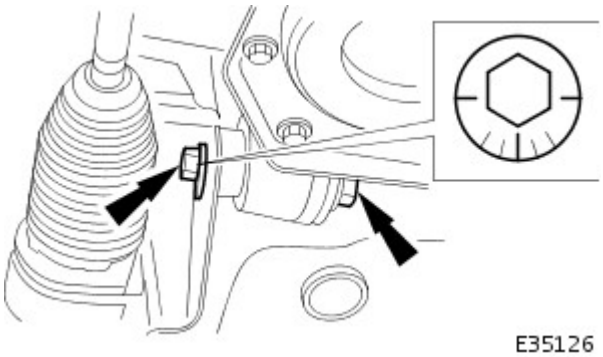
28. CAUTION: Do not allow steering pipes to support weight of steering rack.

Position steering rack for access.

- Pivot steering arm fully downwards



- Remove steering rack securing bolts.
- Carefully move steering rack downwards for access to wishbone eccentric bolt.

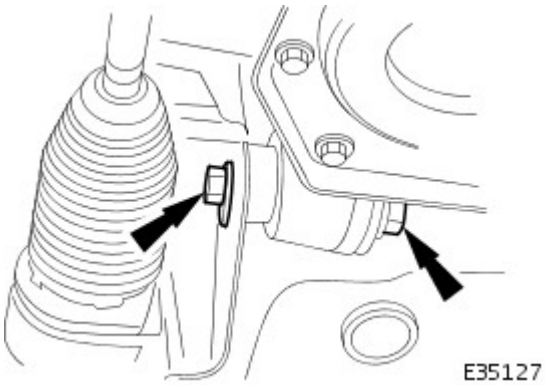


29. Remove lower wishbone rear arm eccentric bolt and nut.

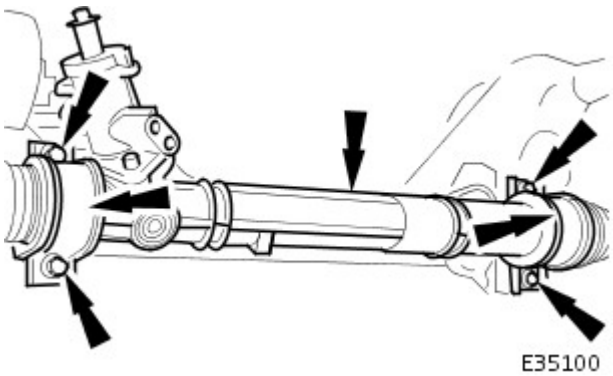
- Mark position of eccentric bolt large graduation mark on crossbeam.
- Remove wishbone rear eccentric bolt and nut.

30. Remove lower wishbone rear arm/ball joint assembly from crossbeam.

Installation



1. Position wishbone rear arm on crossbeam and install but do not tighten eccentric bolt.

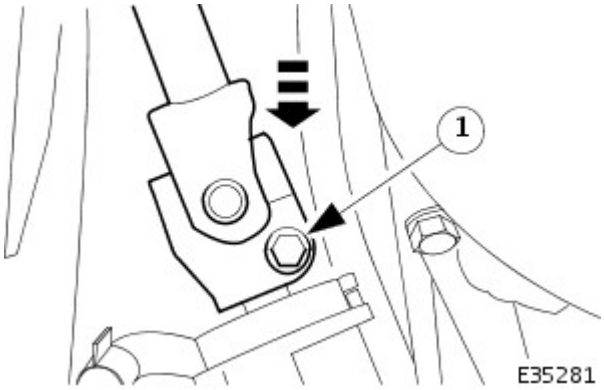


2. Install steering rack on crossbeam.

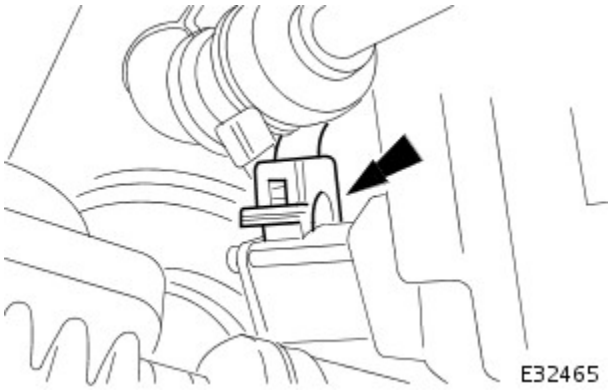
- Ensure that bushes are correctly positioned on steering rack.
- Position steering rack on crossbeam.
- Position support brackets over bushes.
- Install mounting bracket bolts and tighten to 41-54Nm.

3. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.

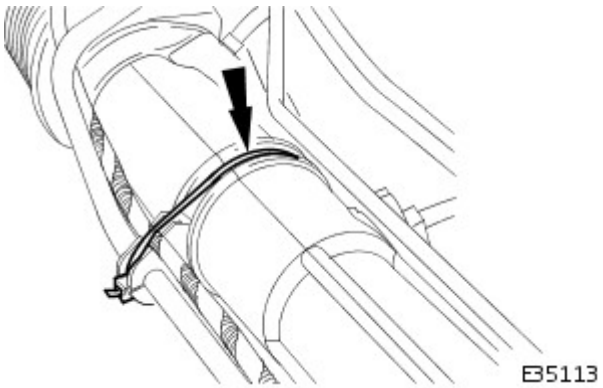


1. Install nut and bolt and tighten to 22-28Nm.



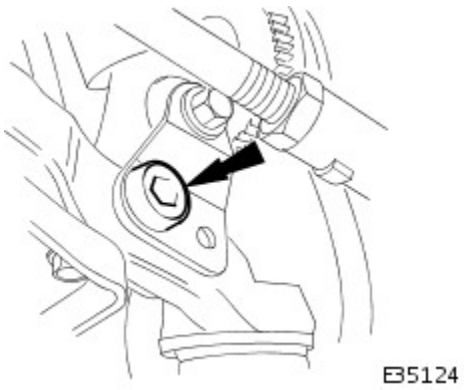
4. Position and connect harness to steering transducer.

- RHD vehicles. Position steering harness behind return pipe.
- Connect harness to transducer.



5. Secure return pipe on steering rack.

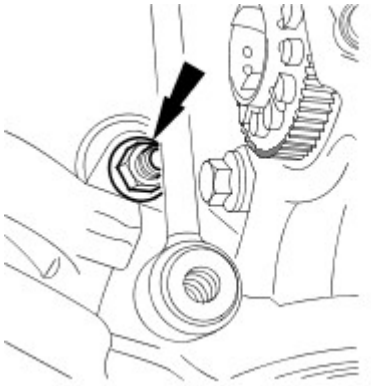
1. Position pipe rubber support on steering rack.
2. Position pipe on support .
3. RHD vehicles. Position harness on pipe support rubber.
4. Secure pipe and harness to support with new tiestrap.



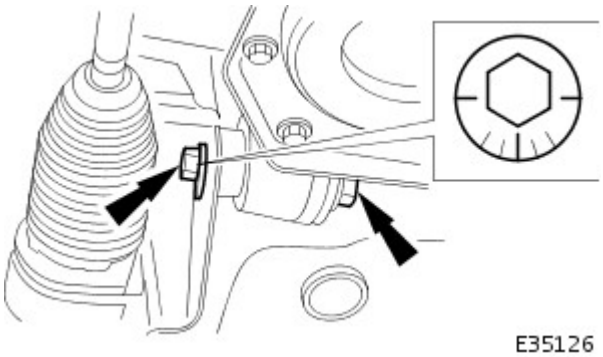
6. Install shock absorber and mounting bracket.

- Position shock absorber mounting bracket on wishbone rear arm.
- Install wishbone front arm to rear arm bolt and tighten to 77-103Nm.

7. Tighten shock absorber lower bolt and nut to 43-57Nm.



E35125



E35126

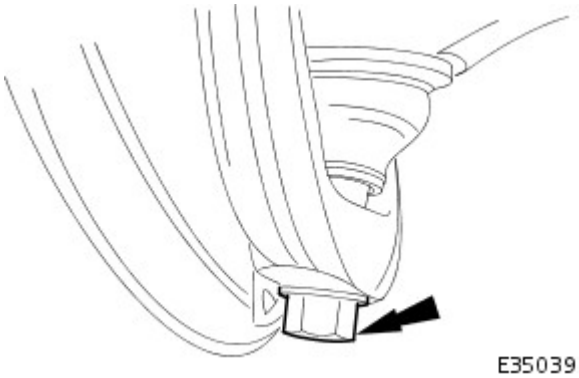
8. Position and partially tighten wishbone rear eccentric bolt.

- Rotate eccentric bolt to align large graduation with mark made during removal.
- Ensuring bolt remains in position, partially tighten nut.



E35129

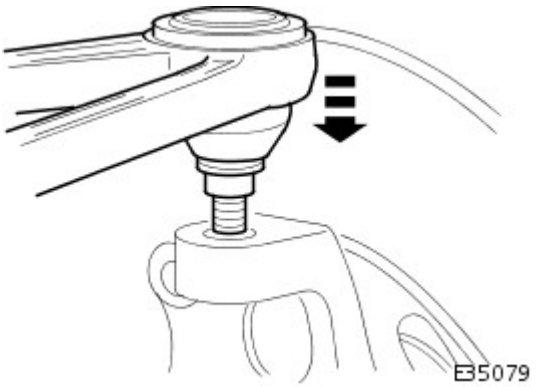
9. Install stabilizer bar link to wishbone securing nut and bolt and tighten to 41-54Nm.

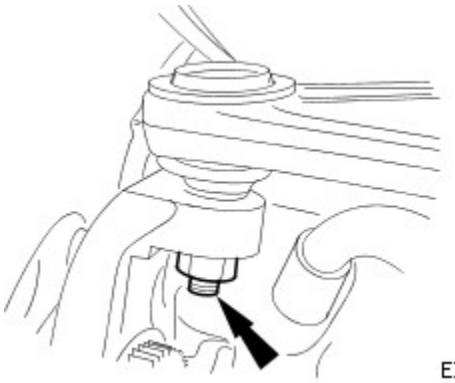


E35039

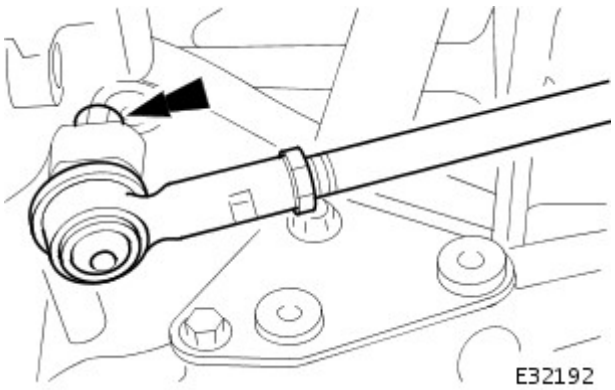
10. Position vertical link/ hub assembly on lower ball joint taper pin, install nut and tighten to 60-80Nm.

11. Position vertical link/ hub assembly on upper ball joint taper pin.





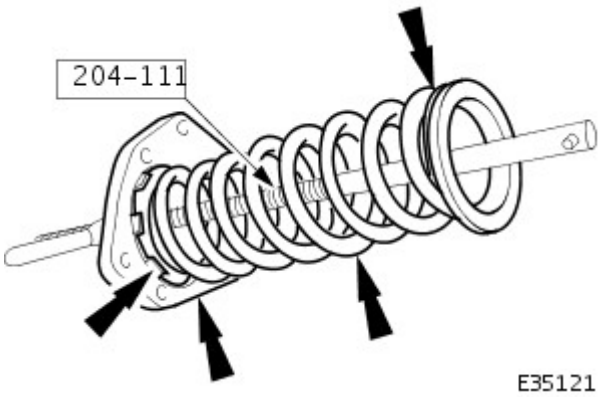
12. Install nut securing upper ball joint to vertical link and tighten to 60-80Nm.



13. Position tie rod ball joint taper pin on steering arm and install and tighten nut to 71-85Nm.

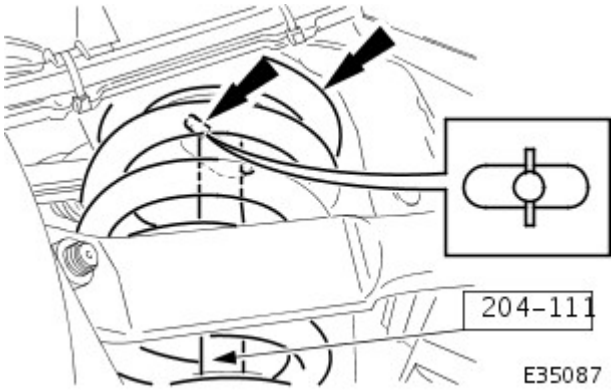
14. Raise vehicle and support on stands to provide access for Special Tool 204-111 and road spring.

15. Install spring pan, rubber lower seat, spring and rubber upper seat on Special Tool 204-111.

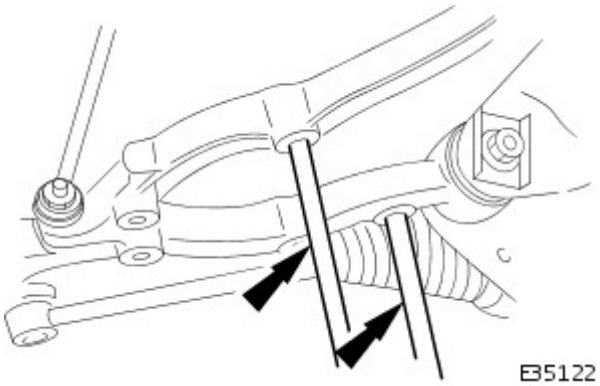


16. Install road spring in suspension turret.

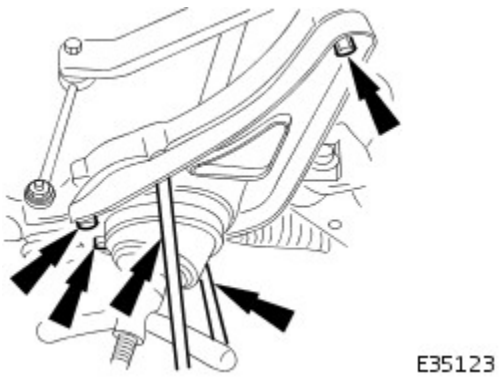
- Install spring pan/spring assembly and Special Tool 204-111 in suspension turret.



- Ensure spring upper seat is correctly positioned in turret.
- Engage tool dowel in turret slot.
- Rotate adjuster of Special Tool 204-111 to lightly tension spring.



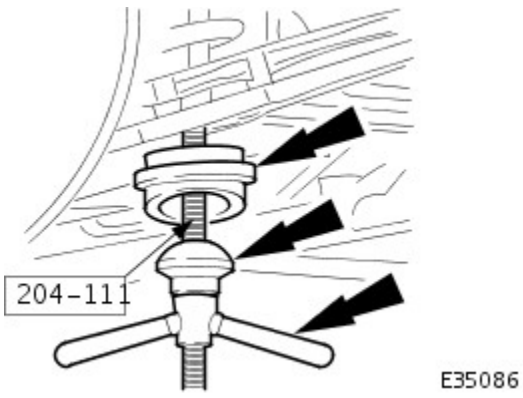
17. Install guide pins (supplied with Special Tool 204-111) in spring pan/wishbone bolt locations.



18. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Install spring pan to wishbone securing bolts.

- Rotate tool adjuster to gradually increase spring tension.
- Progressively install but do not tighten spring pan securing bolts.
- Tighten spring pan bolts to 70-90Nm.
- Ensure spring lower seat is correctly positioned in spring pan.



19. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

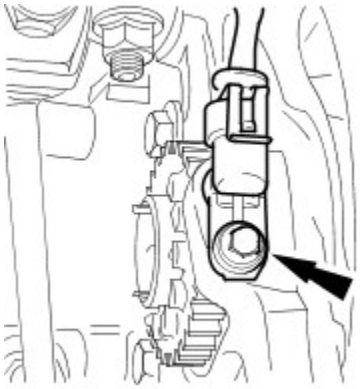
Remove Special Tool 204-111 from suspension.

- Rotate adjuster of Special Tool to release tension on spring.
- Rotate tool stem to release dowel from turret.
- Withdraw tool and adaptor .assembly.

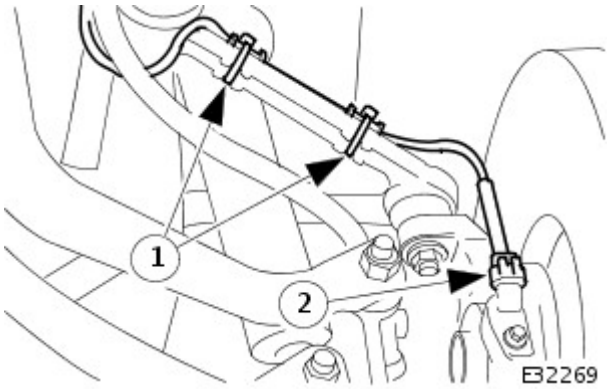
20. Lower vehicle to working height and support on stands.

21. Install wheel speed sensor.

- Position wheel speed sensor on vertical link.

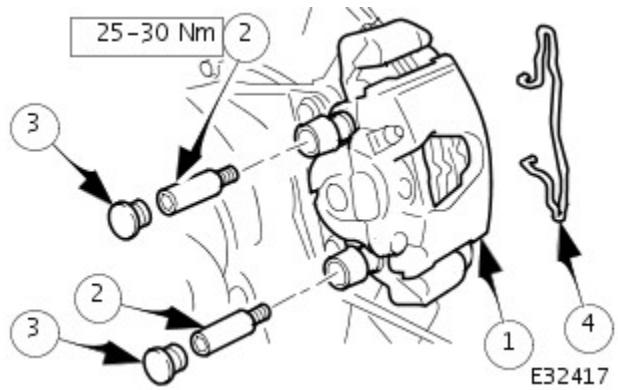


- Install sensor bolt and tighten to 8-10Nm.



22. Connect wheel speed sensor harness.

1. Connect wheel speed sensor harness to sensor.
2. Using new tiestraps secure wheel speed sensor harness to upper wishbone.



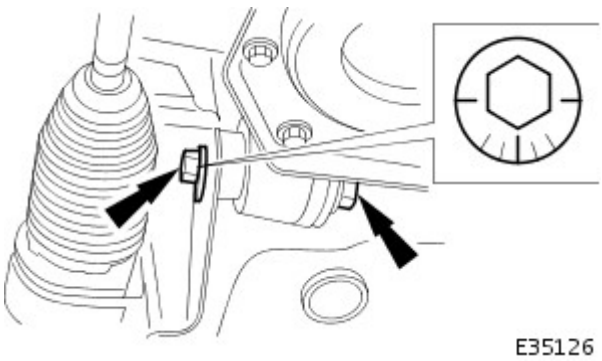
23. Install brake calipers.

- Remove tie supporting brake caliper.

1. Install caliper on carrier.
2. Install guide pins.
3. Install guide pin dust caps.
4. Install caliper spring clip.

24. Install road wheel. Refer to Section 100-02.

25. Raise vehicle, remove stands and lower vehicle onto road wheels.

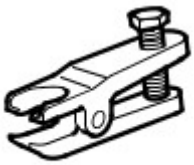
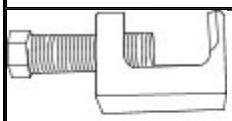


26. Ensuring graduation mark remains aligned, finally tighten wishbone rear eccentric bolt to 113-153Nm.

27. Check wheel alignment and if necessary adjust. Refer to 57.65.01.

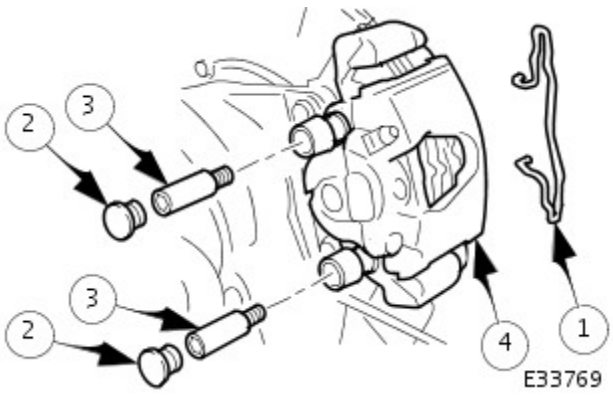
Front Suspension - Rear Lower Arm Bushing

Removal and Installation

Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Ball Joint Taper Separator 204-192 (JD 219)
 E31837	Ball joint splitter 204-293

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. Refer to Section 100-00 for further information.



1. Raise front of vehicle and support on stands. Refer to Section 100-02.

2. Remove appropriate road wheel. Refer to Section 100-02.

3. CAUTION: Do not suspend caliper from brake hose as this will damage the hose.

Remove brake calipers from carriers.

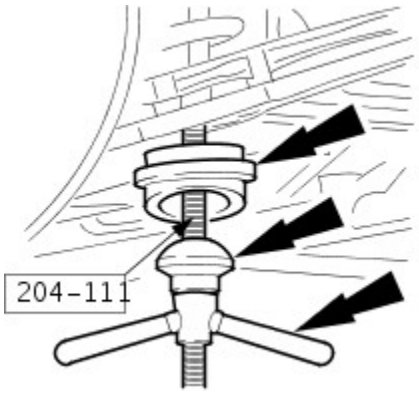
1. Remove caliper spring clip.
2. Remove guide pin dust caps.
3. Slacken and withdraw guide pins.
4. Remove caliper from carrier and tie to suspension mounting bracket.

4. Raise vehicle further to provide access for Special Tool 204-

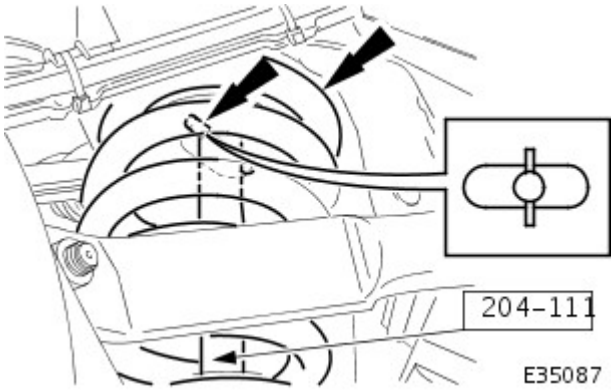
111 and support on stands. Refer to Section 100-02.

5. Install Special Tool 204-111 in road spring.

- Slacken tool adjuster to suit spring length.
- Fit adaptor and thrust collar.
- Position stem of tool in center of spring passing dowel through slot in suspension turret.

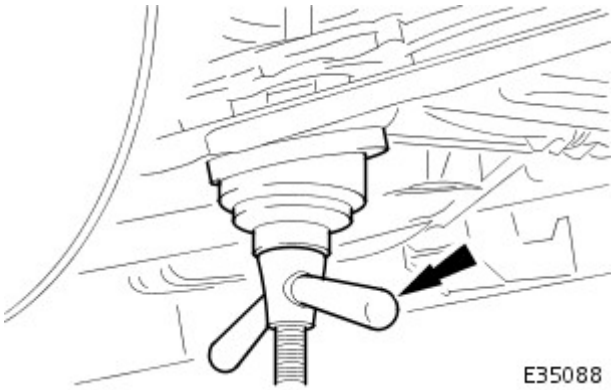


6. Rotate stem of Special Tool to position dowel across slot.

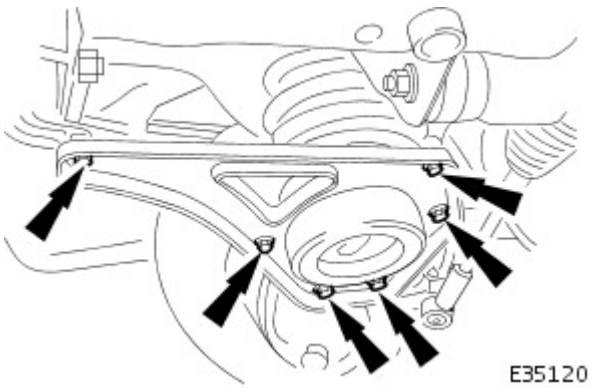


7. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

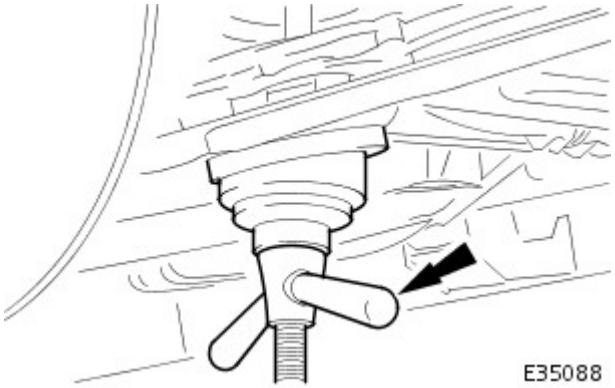
Rotate adjuster of Special Tool to tension spring.



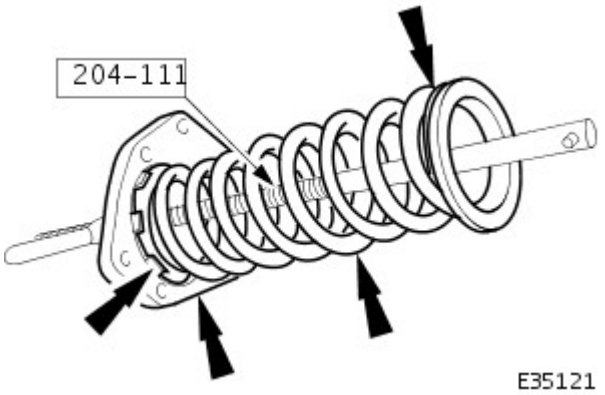
8. Remove spring pan securing bolts.



9. Rotate adjuster of Special Tool to release tension from spring.

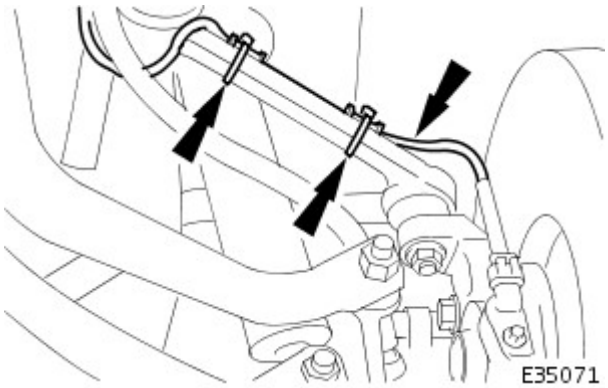


10. NOTE: It is not necessary to remove Special Tool from spring at this stage.

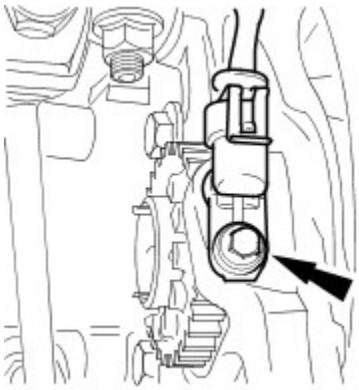


Remove spring assembly and Special Tool 204-111 from suspension turret.

11. Lower vehicle to working height and support on stands.

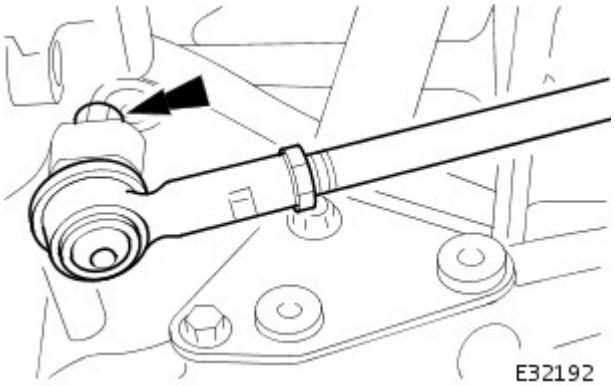


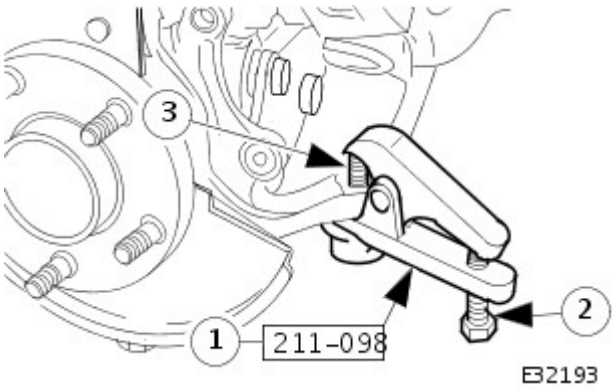
12. Remove tiestraps securing wheel speed sensor harness to upper wishbone.



13. Remove wheel speed sensor securing screw and withdraw sensor from vertical link.

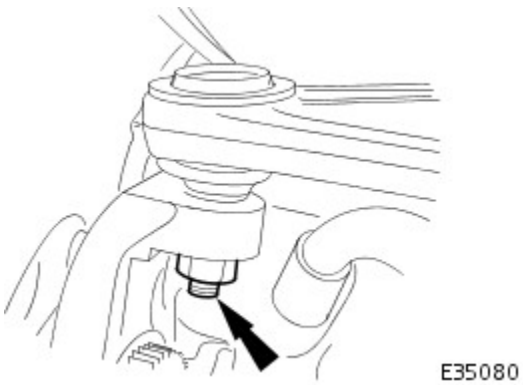
14. Remove nut securing tie rod outer ball joint to steering arm.



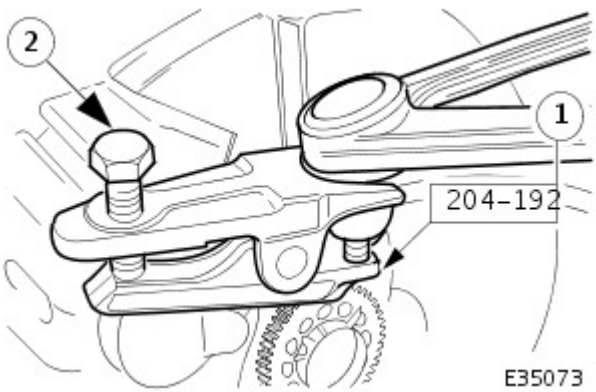


15. Release tie rod ball joint from vertical link.

1. Install special tool 211-098 on tie rod ball joint.
2. Tighten tool bolt to release taper pin from vertical link.



16. Remove nut securing upper wishbone ball joint to vertical link.

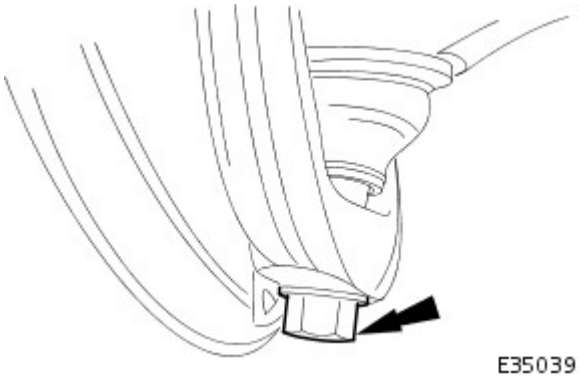


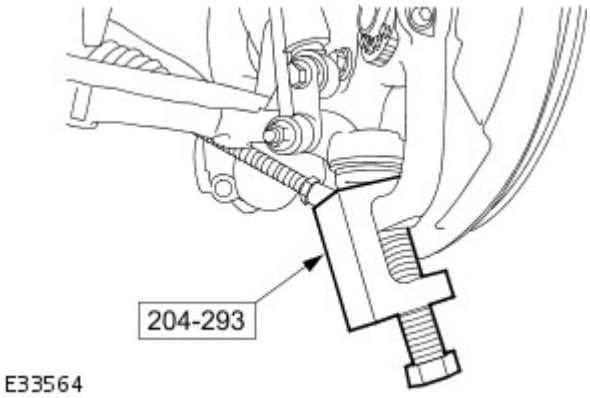
17. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

Release upper wishbone ball joint from vertical link/hub assembly.

1. Install special tool 204-192 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.

18. Slacken but do not remove nut securing lower wishbone ball joint to vertical link.





19. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

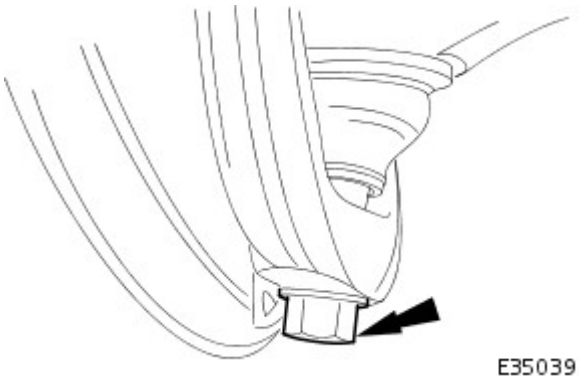
Release lower wishbone ball joint from vertical link/hub assembly.

1. Install special tool 204-293 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.

20. Remove special tool 204-293 from ball joint.

21. Remove vertical link/hub assembly.

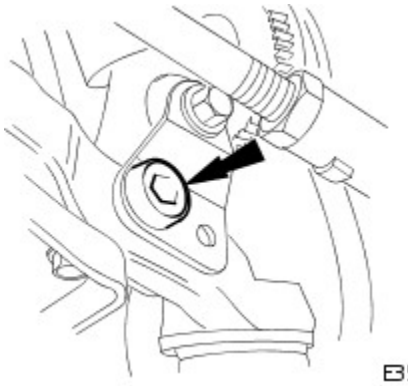
- Supporting vertical link/ hub assembly, remove lower wishbone ball joint nut.
- Remove vertical link /hub assembly.

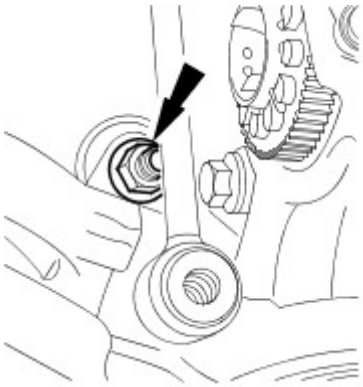




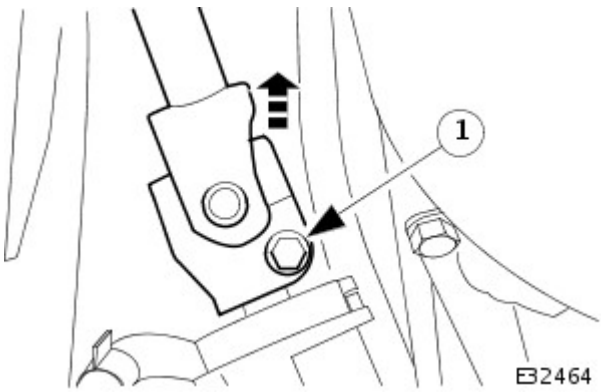
22. Remove stabilizer bar link to wishbone bracket securing nut and bolt.

23. Remove wishbone front arm to rear arm securing bolt .





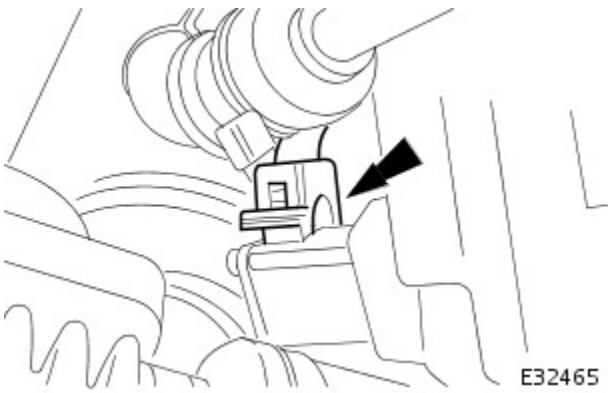
24. Slacken but do not remove shock absorber lower nut and bolt.



25. Release lower steering column from pinion shaft.

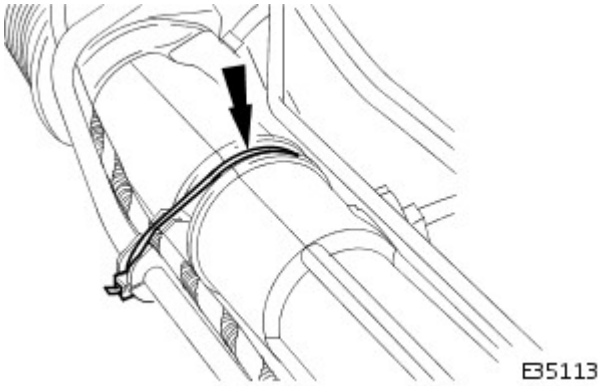
1. Remove lower steering column nut and bolt.

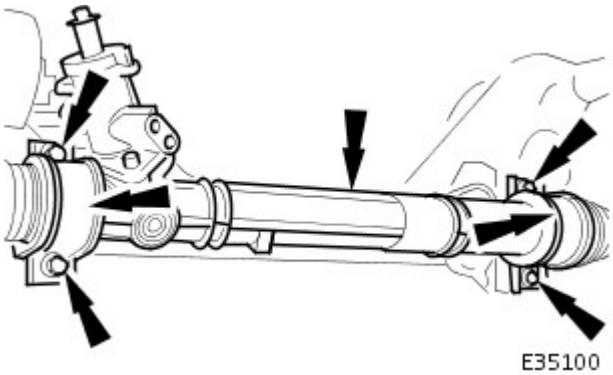
- Move column upwards to release it from pinion shaft.



26. Disconnect harness connector from steering transducer.

27. Remove tiestrap securing return pipe, harness (RHD only) and rubber support to steering rack.





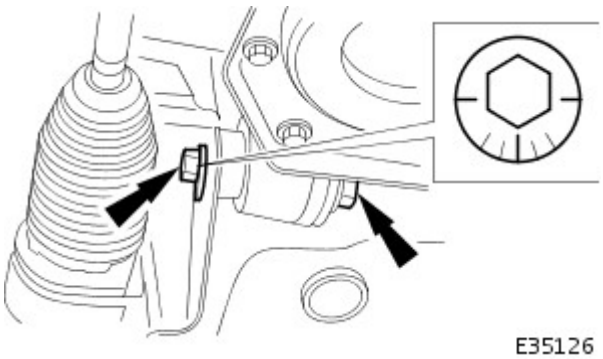
28. CAUTION: Do not allow steering pipes to support weight of steering rack.

Position steering rack for access.

- Pivot steering arm fully downwards
- Remove steering rack securing bolts.
- Carefully move steering rack downwards for access to wishbone eccentric bolt.

29. Remove lower wishbone rear arm eccentric bolt and nut.

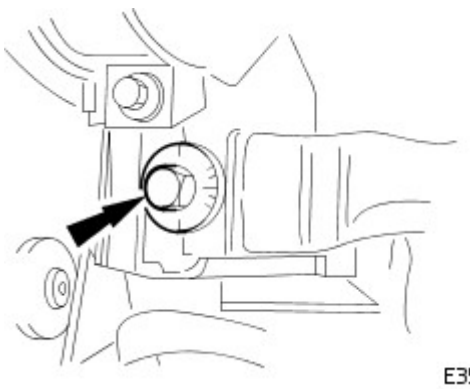
- Mark position of eccentric bolt large graduation mark on crossbeam.
- Remove wishbone eccentric bolt and nut.



30. Remove lower wishbone rear arm/ball joint assembly from crossbeam.

31. Remove lower wishbone front arm eccentric bolt and nut.

- Mark position of eccentric bolt large graduation mark on crossbeam.
- Remove wishbone front eccentric bolt and nut.

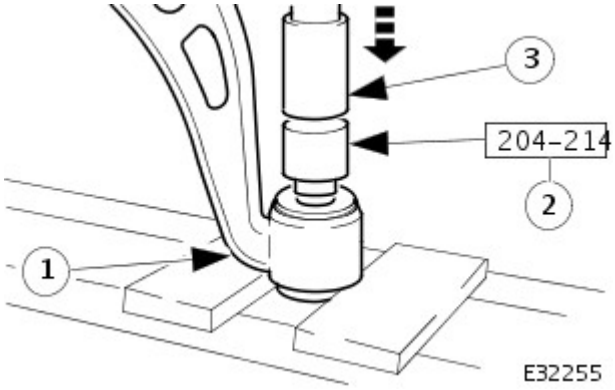


32. Remove lower wishbone front arm from crossbeam.

33. NOTE: For assembly purposes, note orientation of bush.

• NOTE: Initial press action will cause tool to shear bush flange.

Using a hydraulic press, remove bush from wishbone front arm.



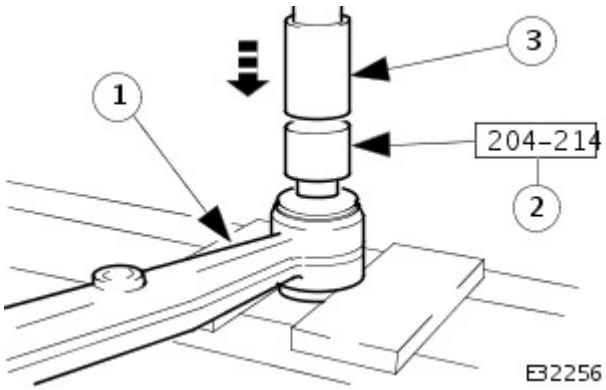
1. Position arm on suitable supports on press bed.
2. Position Special Tool 204-214 on top of bush.
3. Operate press to remove bush from arm.

34. Remove wishbone front arm from press

35. NOTE: For assembly purposes, note orientation of bush.

• NOTE: Initial press action will cause tool to shear bush flange.

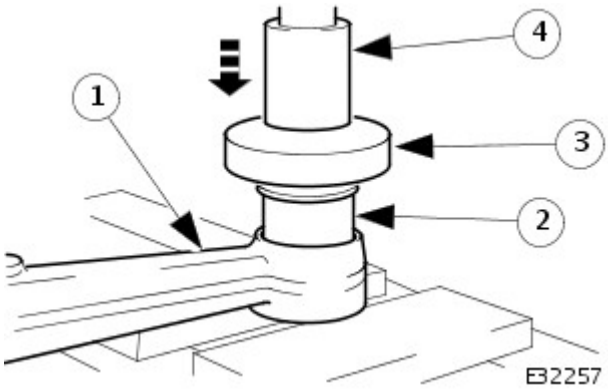
Using a hydraulic press, remove bush from rear wishbone arm.



1. Position arm on suitable supports on press bed.
2. Position special tool on top of bush.
3. Operate press to remove bush from arm.

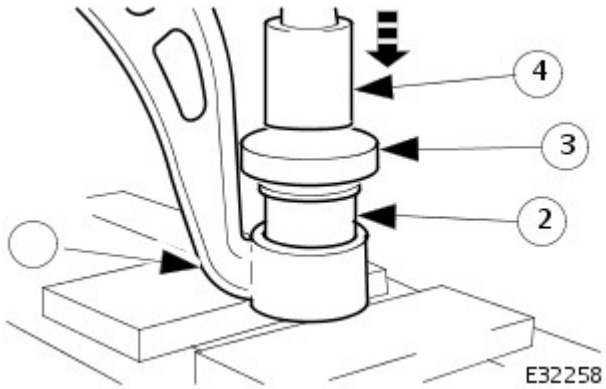
Installation

CAUTION: The wishbone front and rear arm bushes differ in length. Ensure the correct bush is installed in each arm.



1. Using a hydraulic press, install bush in wishbone rear arm/ball joint assembly.

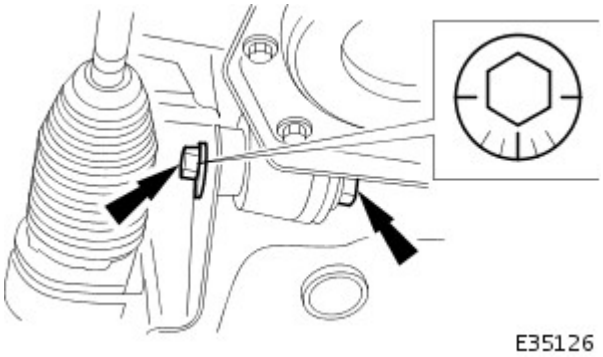
1. Position arm on suitable supports on press bed.
2. Position bush on arm ensuring orientation is as noted during removal of old bush.
3. Position suitable flat steel plate on top of bush.
4. Operate press to install bush in arm.



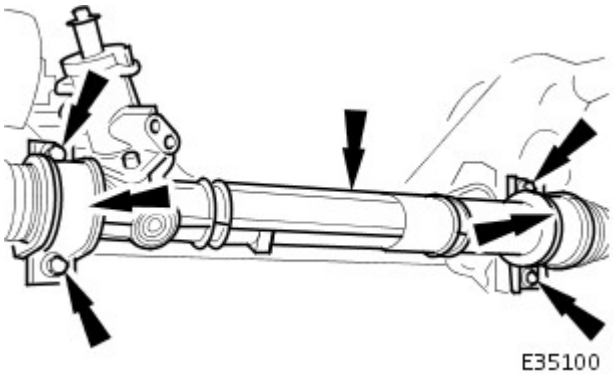
2. Using a hydraulic press, install bush in wishbone front arm.

1. Position arm on suitable supports on press bed.
2. Position bush on arm ensuring orientation is as noted during removal of old bush.
3. Position suitable flat steel plate on top of bush.
4. Operate press to install bush in arm.

3. Position wishbone rear arm on crossbeam and install but do

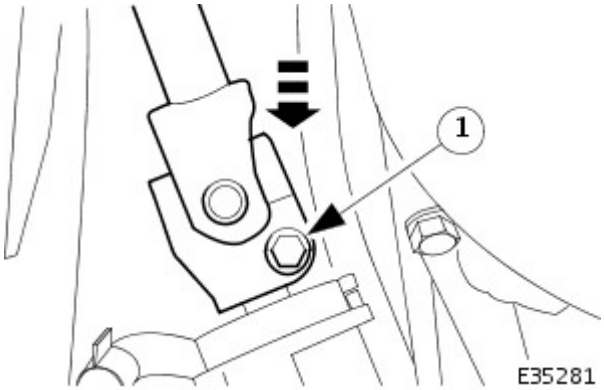


not tighten eccentric bolt and nut.



4. Install steering rack on crossbeam.

- Ensure that bushes are correctly positioned on steering rack.
- Position steering rack on crossbeam.
- Position support brackets over bushes.
- Install mounting bracket bolts and tighten to 41-54Nm.



5. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.
    1. Install nut and bolt and tighten to 22-28Nm.

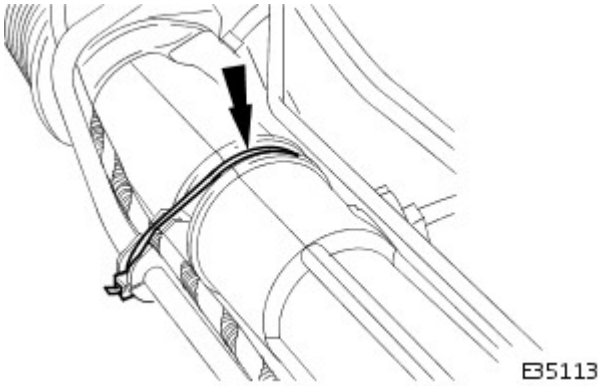


6. Position and connect harness to steering transducer.

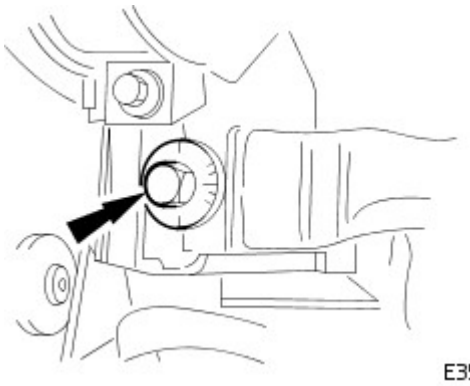
- RHD vehicles. Position steering harness behind return pipe.
- Connect harness to transducer.

7. Secure return pipe on steering rack.

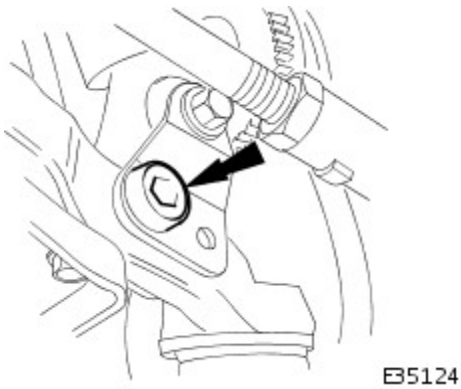
1. Position pipe rubber support on steering rack.
2. Position pipe on support .
3. RHD vehicles. Position harness on pipe support rubber.



4. Secure pipe and harness(RHD vehicles) to support with new tiestrap.

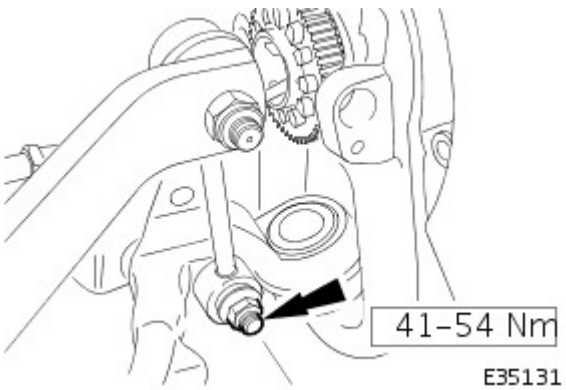


8. Position wishbone front arm on crossbeam and install but do not tighten eccentric bolt and nut.



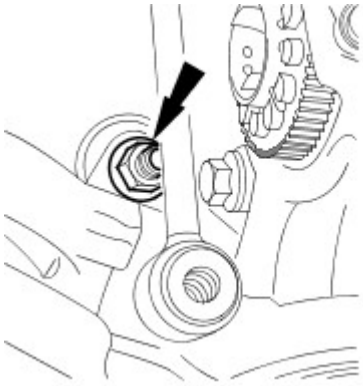
9. Install shock absorber mounting bracket.

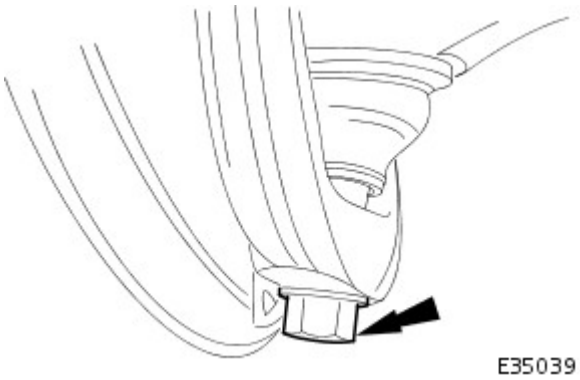
- Position shock absorber mounting bracket on wishbone rear arm.
- Install wishbone front arm to rear arm securing bolt and tighten to 77-103Nm.



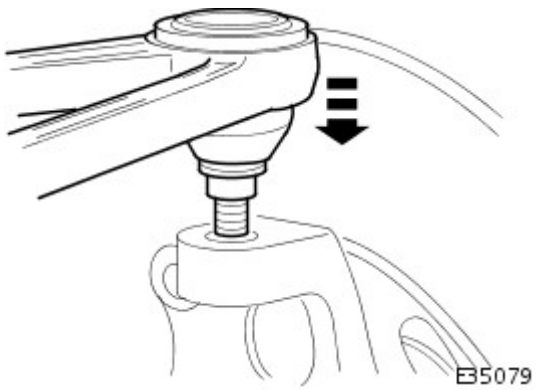
10. Install stabilizer bar link to wishbone bracket nut and bolt and tighten to 41-54Nm.

11. Tighten shock absorber lower bolt and nut to 43-57Nm.

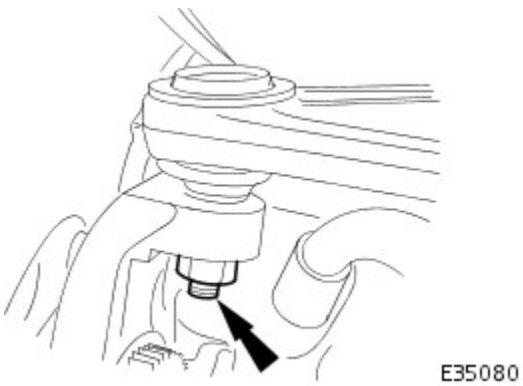




12. Position vertical link/ hub assembly on lower ball joint taper pin, install nut and tighten to 60-80Nm.

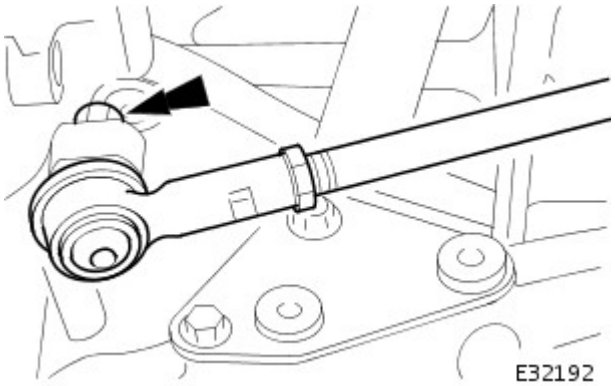


13. Position vertical link/ hub assembly on upper ball joint taper pin.

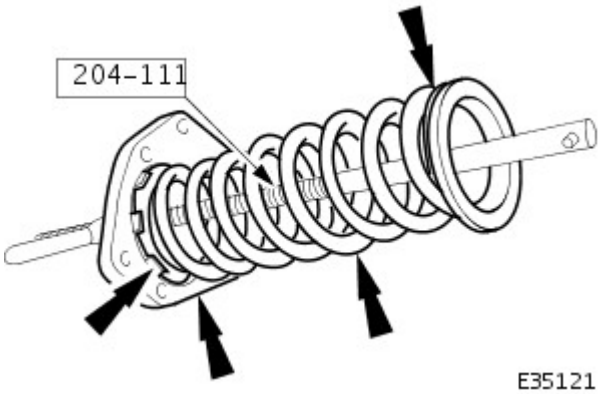


14. Install nut securing upper ball joint to vertical link and tighten to 60-80Nm.

15. Position tie rod ball joint taper pin on steering arm and install and tighten nut to 71-85Nm.

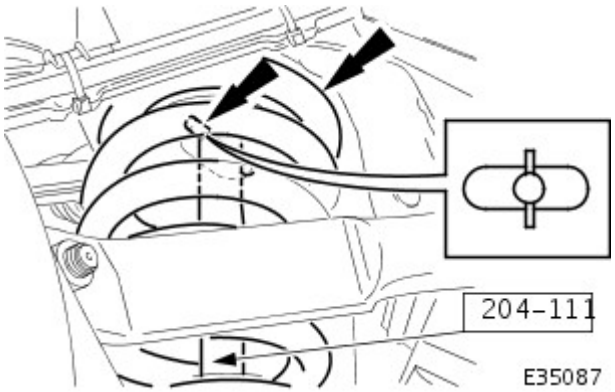


16. Install spring pan, rubber lower seat, spring and rubber upper seat on Special Tool 204-111.

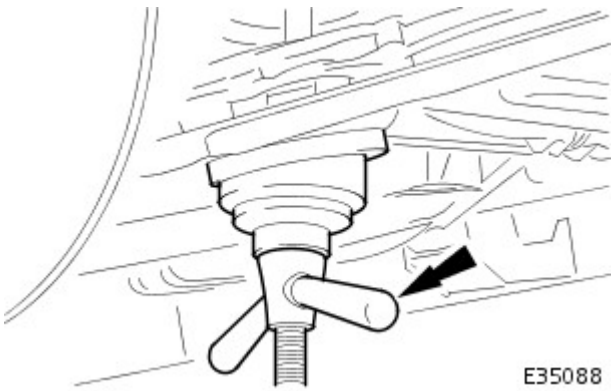


17. Install spring pan/spring assembly and special tool 204-111 in suspension turret.

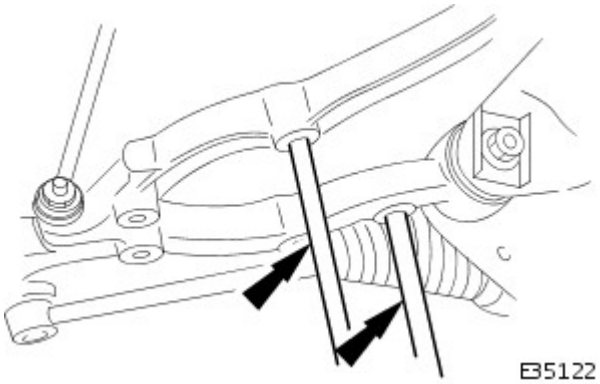
- Ensuring upper seat is correctly positioned, install spring in suspension turret.
- Engage tool dowel in turret slot.

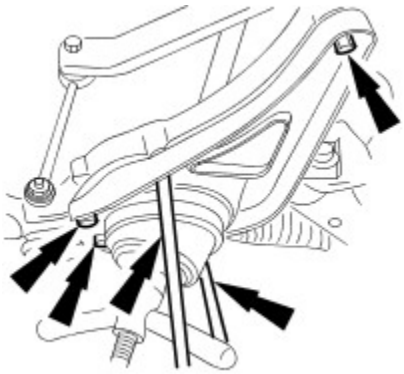


18. Rotate tool adjuster to lightly tension spring.



19. Install suitable guide pins in spring pan/wishbone bolt locations.

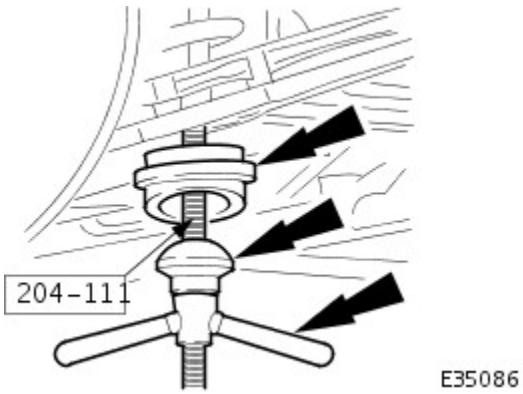




20. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Install spring pan to wishbone securing bolts.

- Rotate tool adjuster to gradually increase spring tension.
- Progressively substitute spring pan securing bolts for guide pins.
- Tighten spring pan bolts to 70-90Nm.
- Ensure spring lower seat is correctly positioned in spring pan.



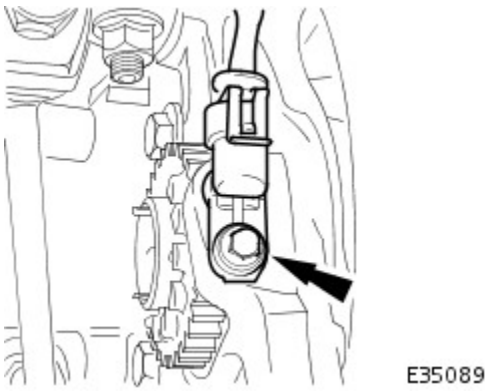
21. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Remove Special Tool 204-111 from suspension.

- Rotate adjuster of Special Tool to release tension on spring.
- Rotate tool stem to release dowel from turret and withdraw tool assembly.

22. Lower vehicle to working height and support on stands.

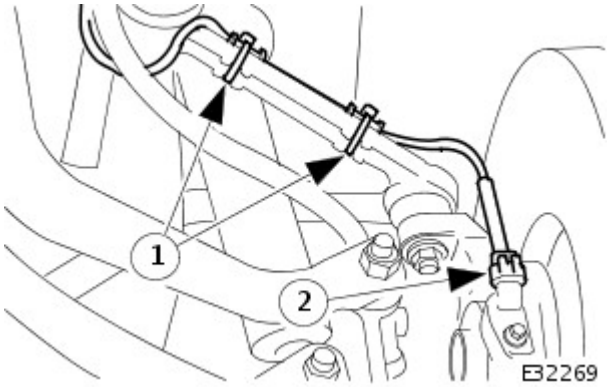
23. Install wheel speed sensor.



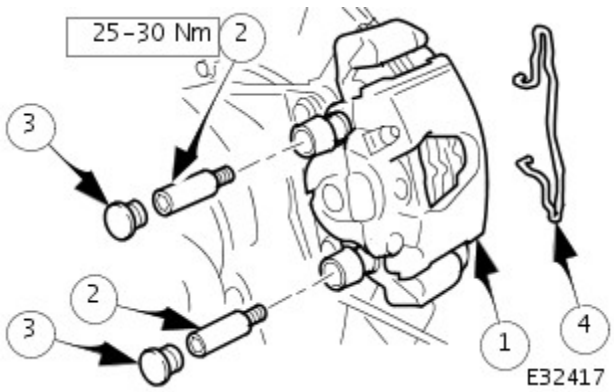
- Position wheel speed sensor on vertical link.
- Install sensor securing bolt and tighten to 8-10Nm.

24. Connect wheel speed sensor harness.

1. Connect wheel speed sensor harness to sensor.



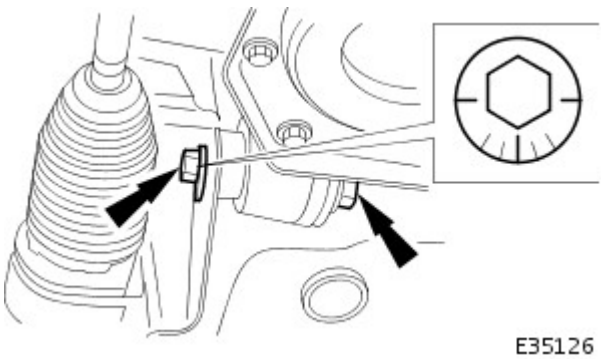
2. Using new tiestraps secure wheel speed sensor harness to upper wishbone.



25. Install brake calipers.

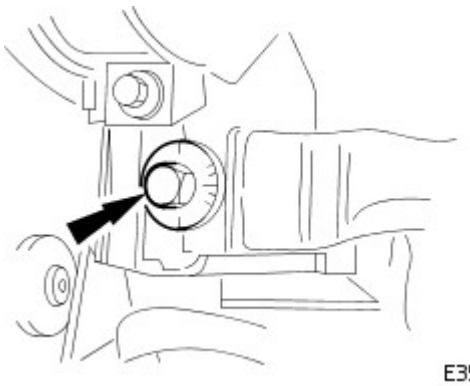
- Remove tie supporting brake caliper.

1. Install caliper on carrier.
2. Install guide pins and tighten to 25-30Nm.
3. Install guide pin dust caps.
4. Install caliper spring clip.



26. Position and partially tighten wishbone rear eccentric bolt.

- Rotate eccentric bolt to align large graduation with mark made during removal.



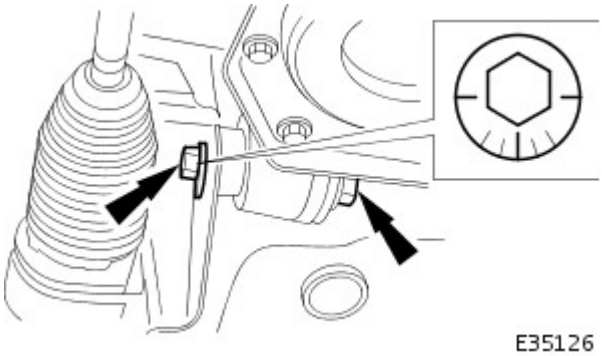
27. Position and partially tighten wishbone front eccentric bolt.

- Rotate eccentric bolt to align large graduation with mark made during removal.
- Partially tighten bolt.

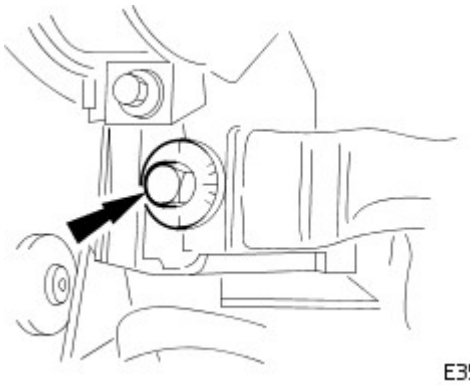
28. Fit road wheel. Refer to Section 100-02.

29. Raise vehicle, remove stands and lower vehicle onto road wheels.

30. Ensuring graduation mark remains aligned, finally tighten wishbone rear eccentric bolt to 113-153Nm.



E35126



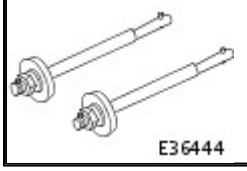
E35140

31. Ensuring graduation mark remains aligned, finally tighten wishbone front eccentric bolt to 113-153Nm.

32. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Front Shock Absorber

Removal and Installation

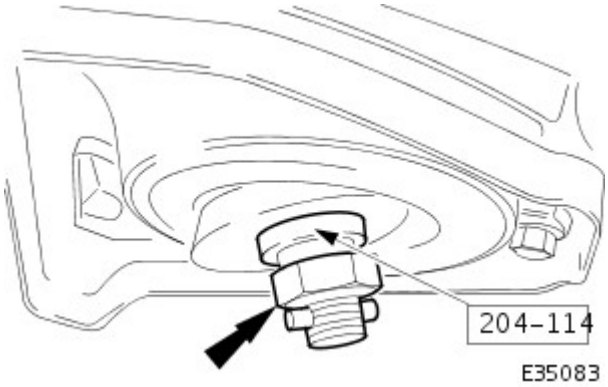
Special Tool(s)	
 E36444	Front Camber Tie-down Link 204-114 (JD 133)

Removal

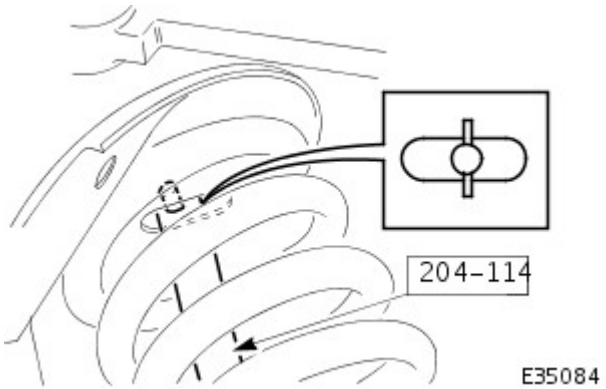
1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.
For additional information, refer to Section 100-00 General Information.

Raise the front of the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

2. Fully slacken the adjuster nut of the special tool 204-114 and position in the center of the road spring.



E35083



E35084

3. WARNING: ENSURE THAT THE DOWEL OF THE SPECIAL TOOL 204-114 IS CORRECTLY POSITIONED ACROSS THE SUSPENSION TURRET SLOT.

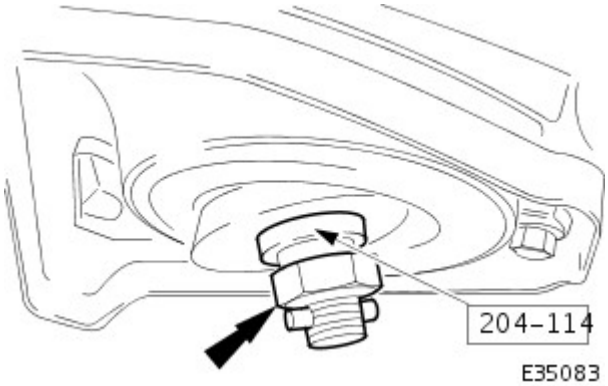
Locate the special tool in the suspension turret slot.

- Pass the upper dowel through the slot in the suspension turret and rotate to locate the dowel.

4. Lower the front of the vehicle.

5. WARNING: WHEN TIGHTENING THE TOOL NUT, USE THE LOWER DOWEL AS A GUIDE TO ENSURE THAT THE TOOL STEM DOES NOT ROTATE AND DISTURB THE POSITION OF THE DOWEL IN THE SUSPENSION TURRET.

Tighten the nut of the special tool 204-114 to its full extent, to achieve a suspension mid-laden position.

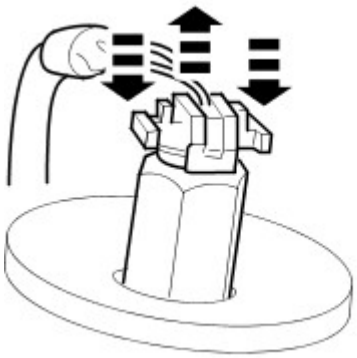


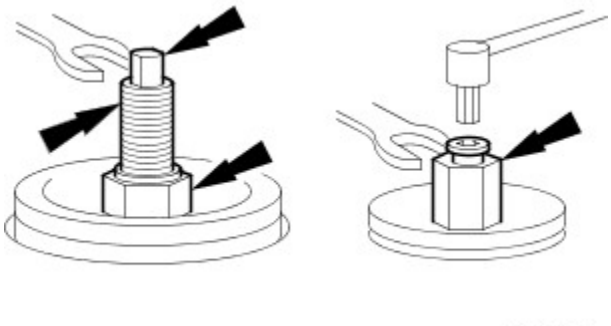
6. Raise the front of the vehicle and support on axle stands.
For additional information, refer to Section 100-02 Jacking and Lifting.

7. Remove the appropriate road wheel.
For additional information, refer to Section 204-04 Wheels and Tires.

8. On vehicles with adaptive damping:

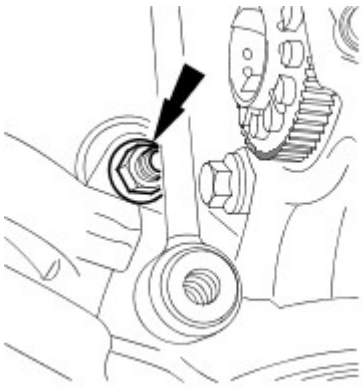
- Disconnect the shock absorber electrical connector by pressing the lugs down and pulling the connector up.





9. Remove the shock absorber from the upper mounting.

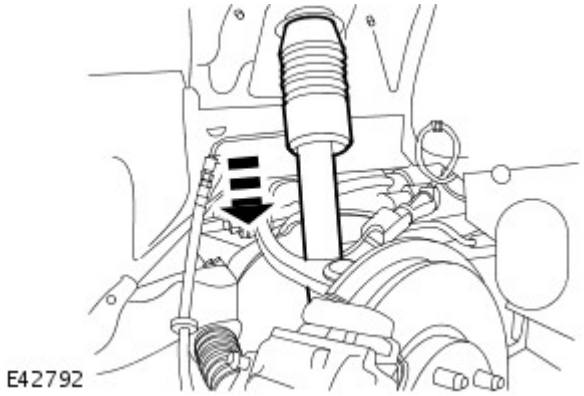
- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Remove the shock absorber upper retaining nut.
- Remove the upper washer and isolator.



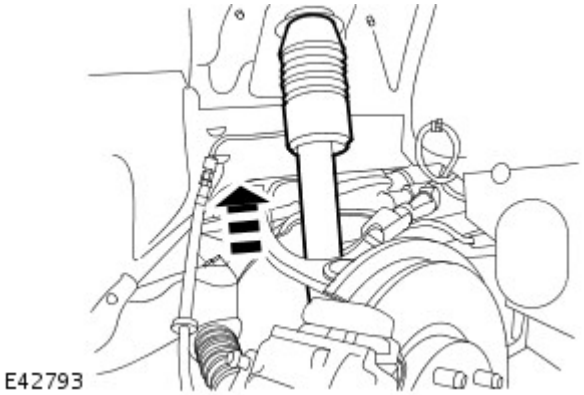
10. Detach the shock absorber.

- Remove the lower shock absorber retaining nut.
- Remove the lower shock absorber retaining bolt.

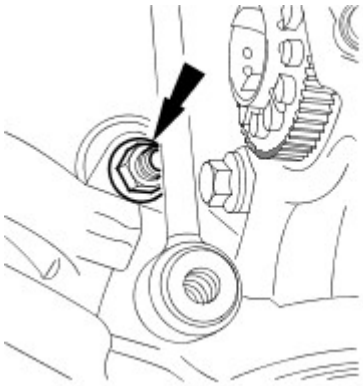
11. Remove the shock absorber through the lower wishbone.



Installation

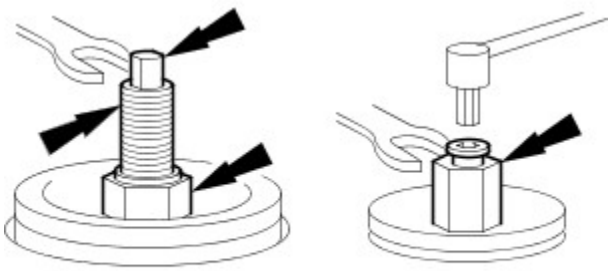


1. Install the shock absorber through the lower wishbone.



2. Attach the shock absorber.

- Install the lower shock absorber retaining nut.
- Install the lower shock absorber retaining bolt.
- Tighten to 43 to 57 Nm.

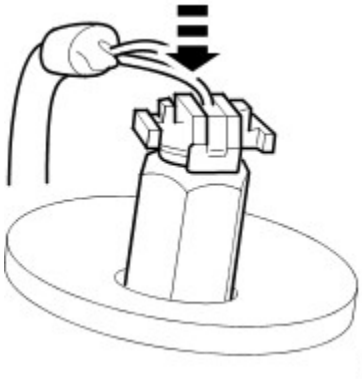


3. Attach the shock absorber to the upper mounting.

- Install the upper washer and isolator.
- Install the shock absorber upper retaining nut.
- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Tighten the shock absorber upper lock nut to 30-40 Nm (16-18 Nm on vehicles with adaptive damping).

4. CAUTION: Make sure the adaptive damping electrical connector is correctly aligned. Failure to follow these instructions may cause damage to the electrical connector.

On vehicles with adaptive damping:

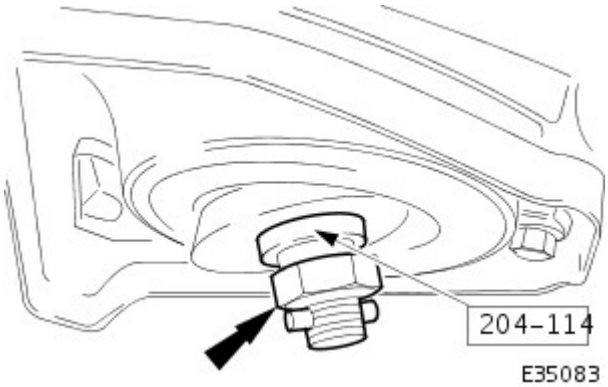


- Connect the shock absorber electrical connector, ensuring the electrical connector key locates in the socket keyway.

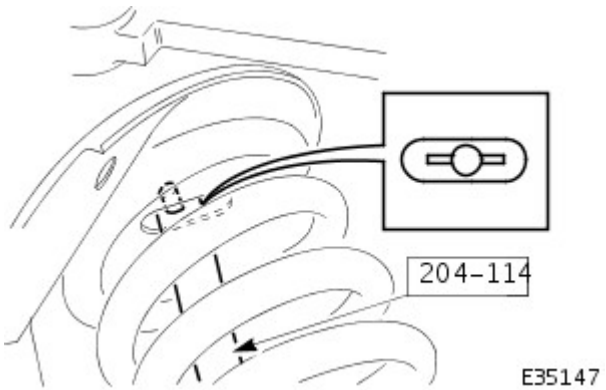
5. Fit the road wheel.
For additional information, refer to Section 204-04 Wheels and Tires.

6. Raise the vehicle, remove the axle stands and fully lower the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

7. Fully slacken the adjuster nut of the special tool 204-114.



8. Rotate the special tool 204-114 to release the dowel from the suspension turret slot.

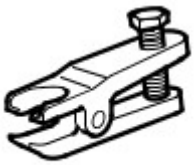


9. Raise the vehicle for access and remove the special tool 204-114 from the suspension.

10. Fully lower the vehicle.

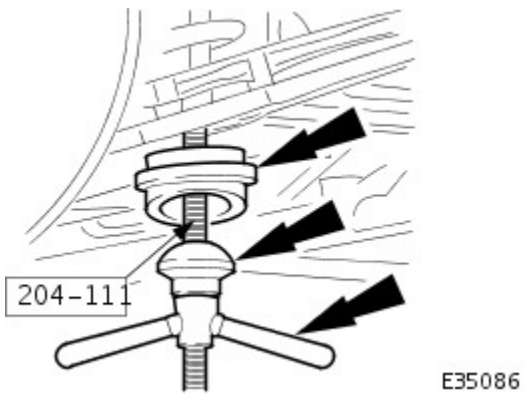
Front Suspension - Spring

Removal and Installation

Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Ball Joint Taper Separator 204-192 (JD 219)

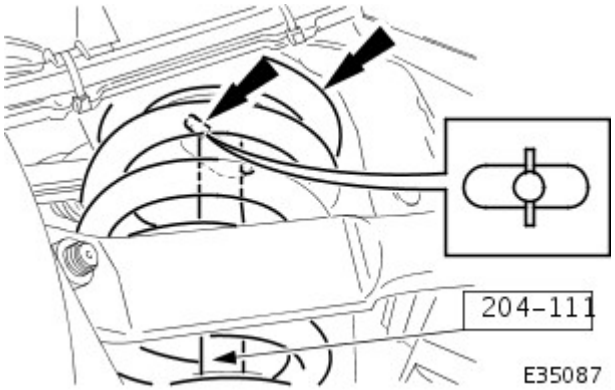
Removal

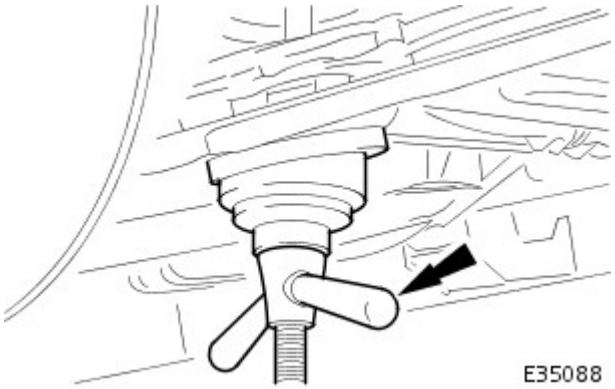
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



E35086

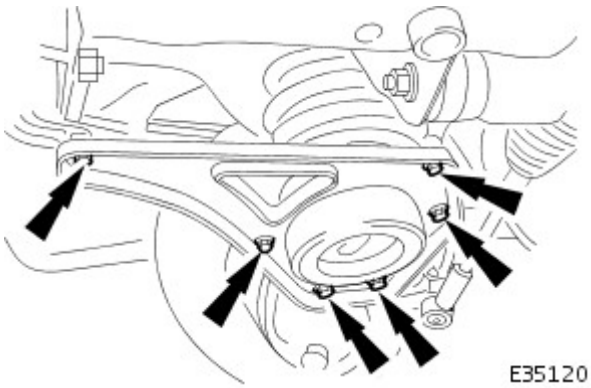
1. Raise front of vehicle to provide access for Special Tool 204-111. Refer to Section 100-02
2. Remove appropriate road wheel. Refer to Section 100-02.
3. Install Special Tool 204-111 in road spring.
   - Slacken tool adjuster to suit spring length.
   - Install adaptor and thrust collar.
   - Position stem of tool in center of spring passing dowel through slot in suspension turret.
4. Rotate stem of Special Tool 204-111 to position dowel across slot.



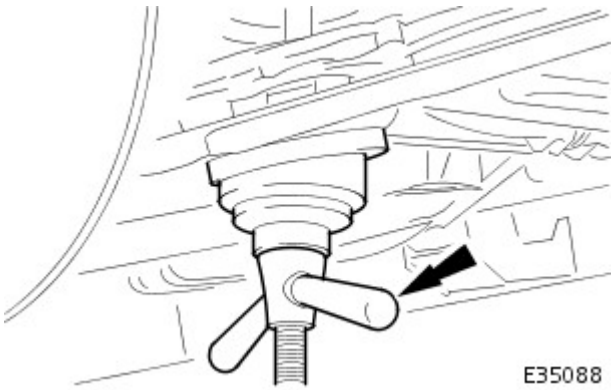


5. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Rotate adjuster of Special Tool to tension spring.



6. Remove spring pan to lower wishbone securing bolts.



7. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

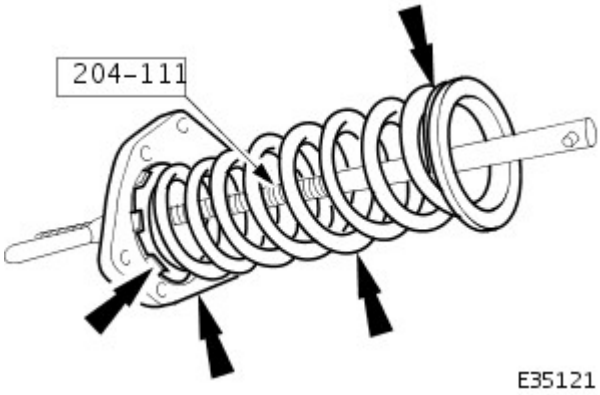
Rotate adjuster of Special Tool to release tension from spring.

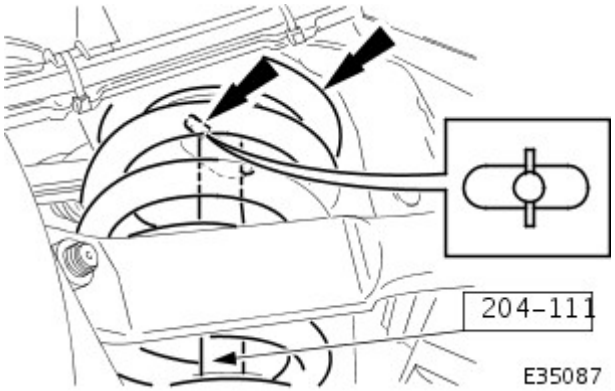
8. Remove spring assembly and Special Tool from suspension turret.

9. Remove Special Tool from spring assembly.

Installation

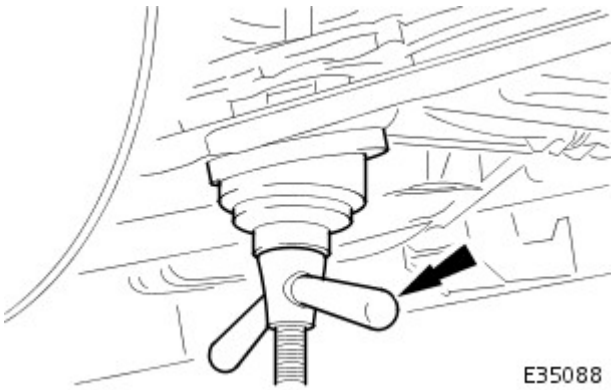
1. Install spring pan, new spring and new spring rubber upper and lower seats on Special Tool 204-111.





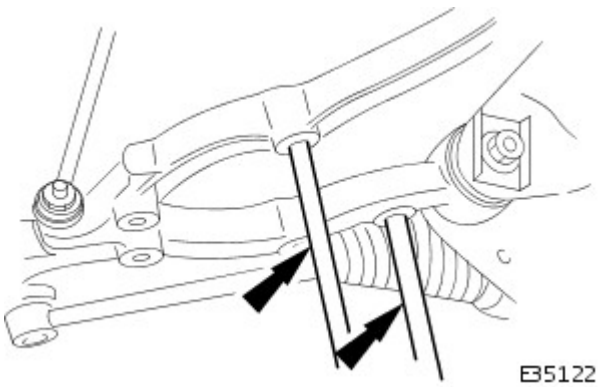
2. Install Special Tool 204-111 and spring assembly in suspension turret.

- Position spring assembly and Special Tool in suspension turret.
- Ensure spring upper rubber seat is correctly positioned and fully seated.
- Engage tool dowel in turret slot.



3. Position spring pan on lower wishbone.

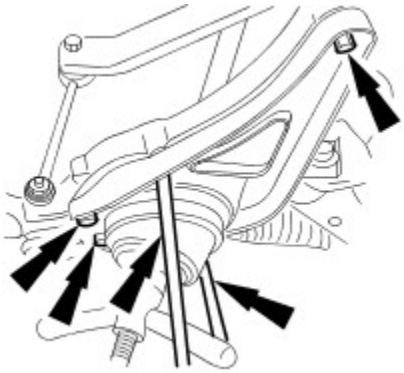
- Rotate adjuster of Special Tool to lightly tension spring.
- Align spring pan with lower wishbone bolt locations.



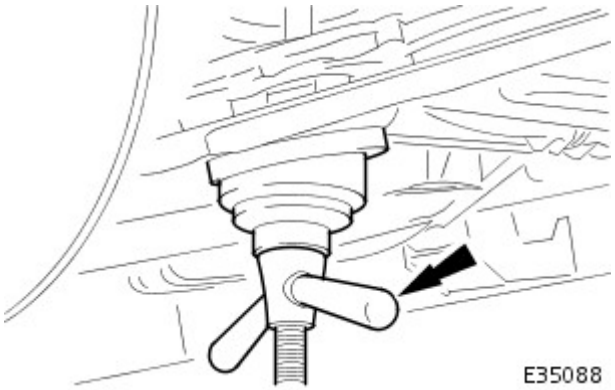
4. Install suitable guide pins in spring pan/wishbone bolt locations.

5. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Install spring pan to wishbone securing bolts.



- Rotate tool adjuster to gradually increase spring tension.
- Progressively substitute spring pan securing bolts for guide pins.
- Tighten spring pan securing bolts to 70-90Nm.

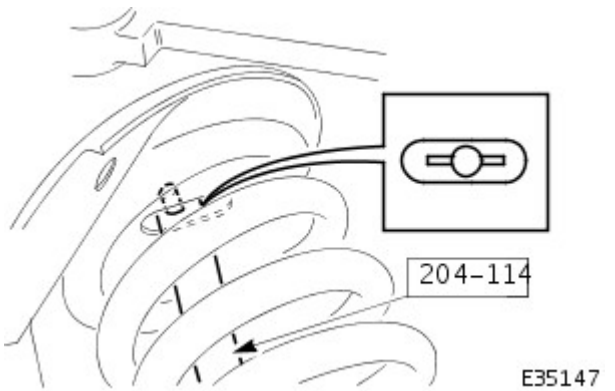


6. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Remove Special Tool 204-111 from suspension.

- Ensure spring lower rubber seat is correctly positioned and fully seated.
- Rotate adjuster of Special Tool to release tension on spring.

7. Rotate tool stem to release dowel from turret and withdraw tool assembly.



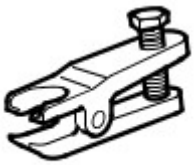
8. Lower vehicle to working height and support on stands.

9. Install road wheel. Refer to Section 100-02.

10. Raise vehicle, remove stands and lower vehicle onto road wheels.

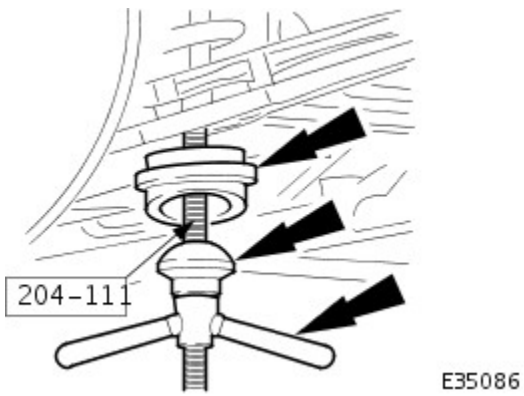
Front Suspension - Spring Seat

Removal and Installation

Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Ball Joint Taper Separator 204-192 (JD 219)

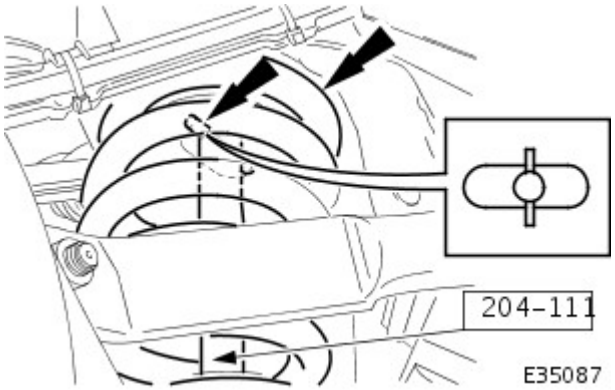
Removal

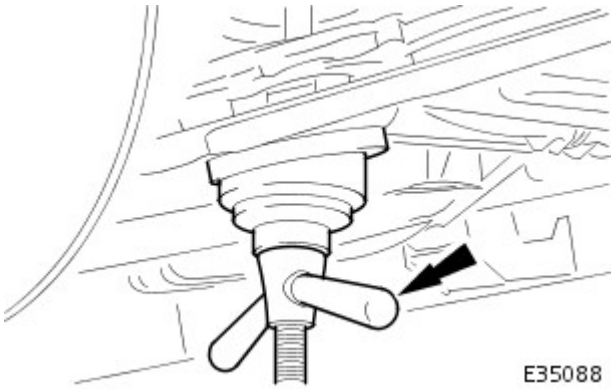
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



E35086

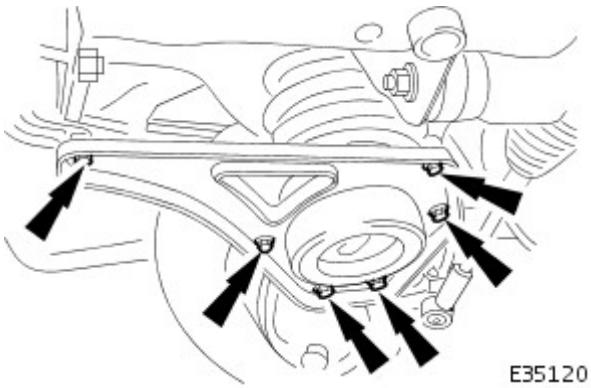
1. Raise front of vehicle to provide access for Special Tool 204-111. Refer to Section 100-02
2. Remove appropriate road wheel. Refer to Section 100-02.
3. Install Special Tool 204-111 in road spring.
   - Slacken tool adjuster to suit spring length.
   - Install adaptor and thrust collar.
   - Position stem of tool in center of spring passing dowel through slot in suspension turret.
4. Rotate stem of Special Tool 204-111 to position dowel across slot.



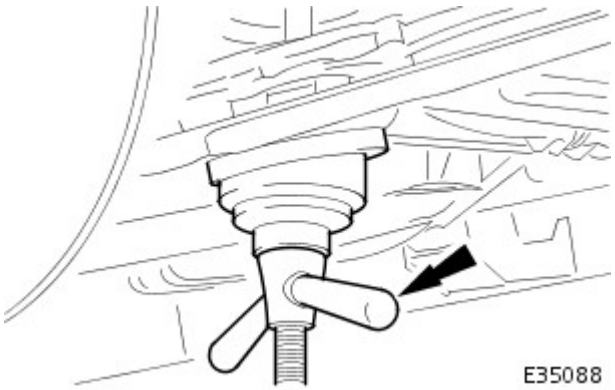


5. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Rotate adjuster of Special Tool to tension spring.



6. Remove spring pan to lower wishbone securing bolts.



7. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

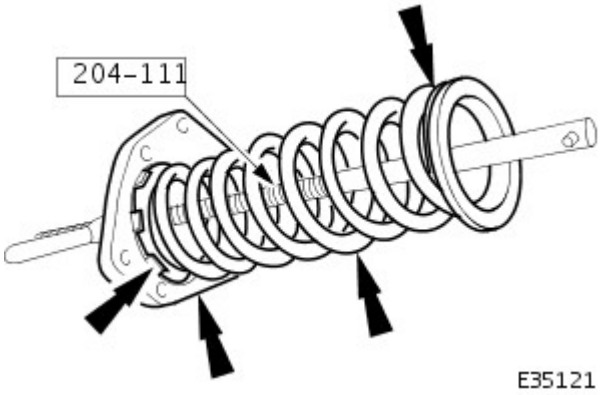
Rotate adjuster of Special Tool to release tension from spring.

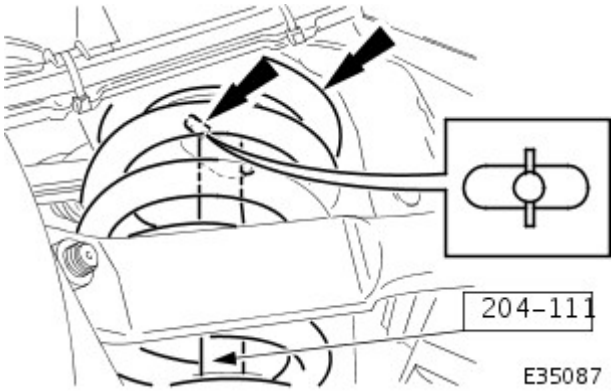
8. Remove spring assembly and Special Tool from suspension turret.

9. Remove Special Tool from spring assembly.

Installation

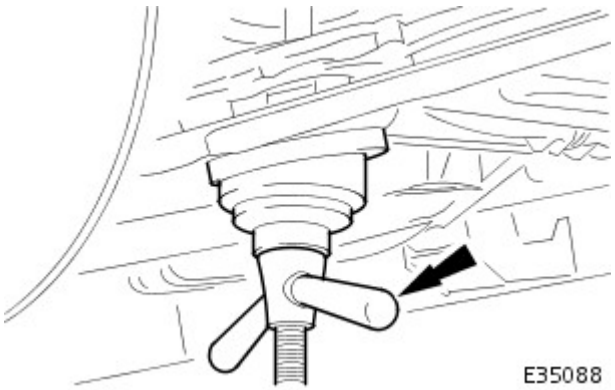
1. Install new spring pan, spring and spring rubber upper and lower seats on Special Tool 204-111.





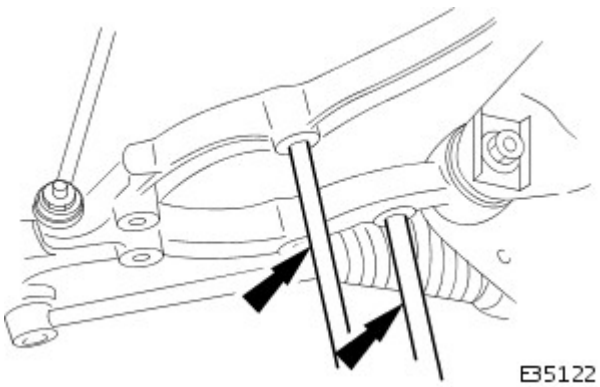
2. Install Special Tool 204-111 and spring assembly in suspension turret.

- Position spring assembly and Special Tool in suspension turret.
- Ensure spring upper rubber seat is correctly positioned and fully seated.
- Engage tool dowel in turret slot.



3. Position spring pan on lower wishbone.

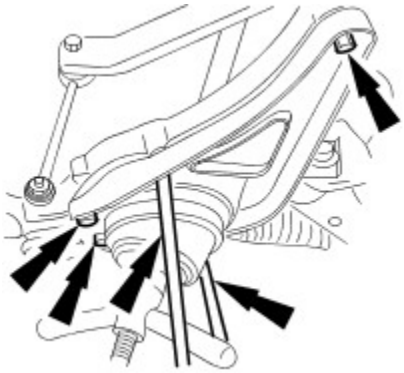
- Rotate adjuster of Special Tool 204-111 to lightly tension spring.

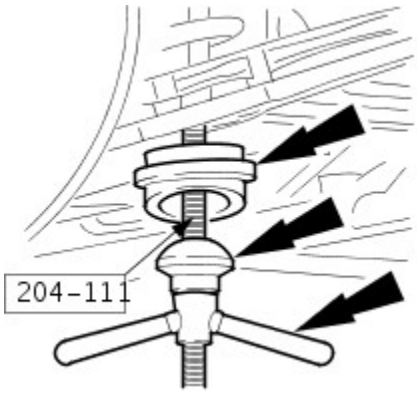


4. Install guide pins (supplied with Special Tool 204-111) in spring pan/wishbone bolt locations.

5. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Install spring pan to wishbone securing bolts.





- Align spring pan with lower wishbone bolt locations.
- Rotate tool adjuster to gradually increase spring tension.
- Progressively install but do not tighten spring pan securing bolts.
- Tighten spring pan securing bolts to 70-90Nm.
- Ensure spring lower rubber seat is correctly positioned in spring pan.

6. WARNING: WHEN ROTATING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT TURN AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Remove Special Tool 204-111 from suspension.

- Rotate adjuster of Special Tool to release tension on spring.
- Rotate tool stem to release dowel from turret.
- Withdraw tool and adaptor .assembly.

7. Lower vehicle to working height and support on stands.

8. Install road wheel. Refer to Section 100-02.

9. Raise vehicle, remove stands and lower vehicle onto road wheels.

10. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

11. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Front Stabilizer Bar

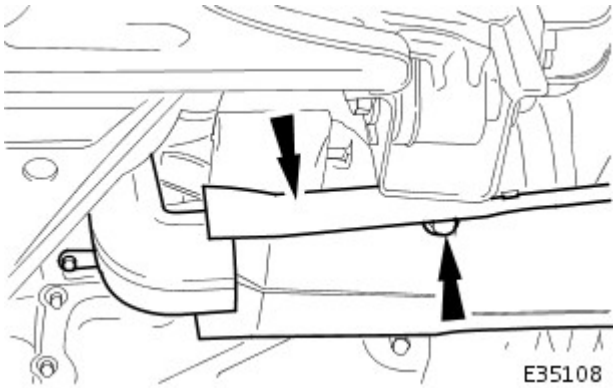
Removal and Installation

Materials

Name	Specification
Rubber Suspension Insulator Lube	Castrol NTR

Removal

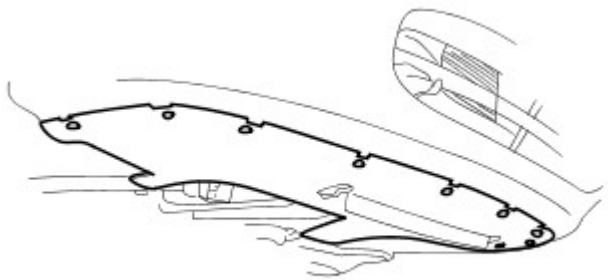
1. Raise front of vehicle and support on stands. Refer to Section 100-02.



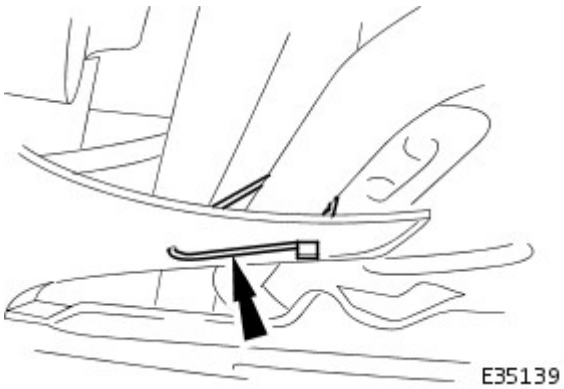
2. Remove generator front cooling duct.

- Remove bolt.
- Move duct rearwards to release tang from undertray.
- Release front duct from rear vertical duct.

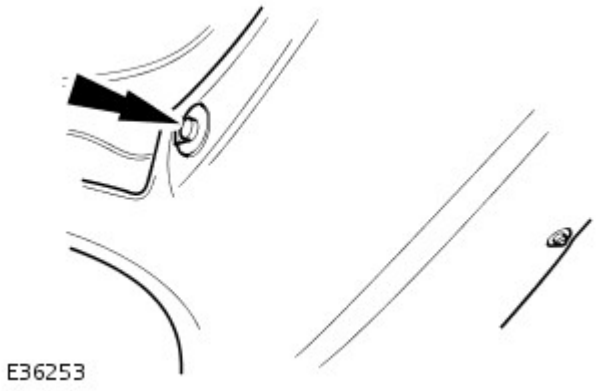
3. Remove scrivets or screws securing undertray to bumper cover. Discard scrivets.

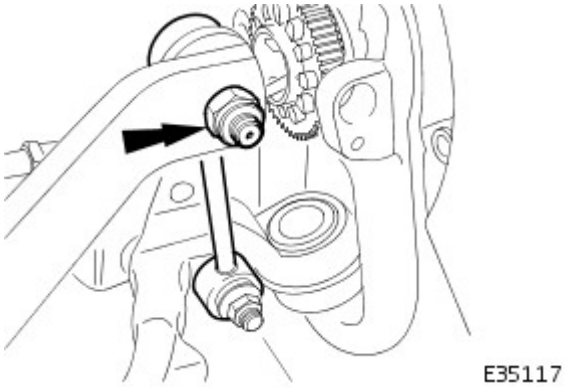


4. Remove and discard tiestrap securing undertray to crossbeam brace.



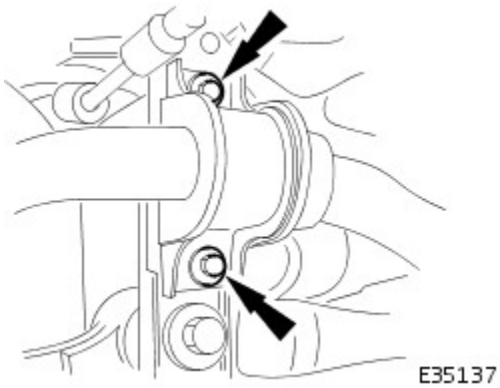
5. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.



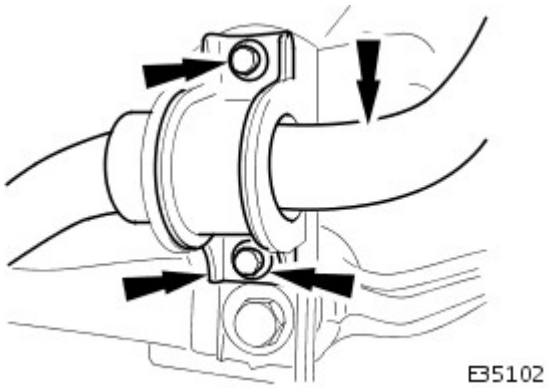


6. Release stabilizer bar from link arms.

- Remove stabilizer bar to link arm ball joint securing nut.
- Repeat operation at opposite end of stabilizer bar.



7. Slacken stabilizer bar securing bolts.

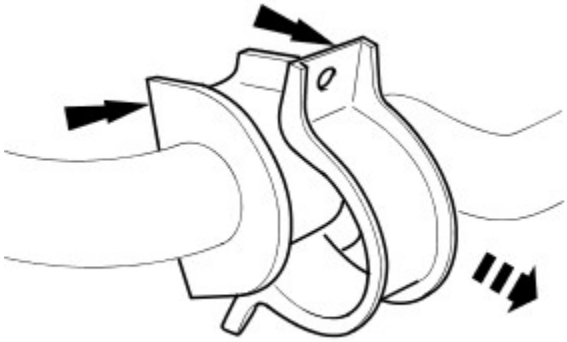


8. NOTE: On vehicles fitted with an engine oil cooler, it may be necessary to release the stabilizer bar from each ball joint in turn to achieve the required clearance from cooler pipes.

Remove stabilizer bar from crossbeam.

- Remove stabilizer bar securing bolts.
- Remove stabilizer bar and mounting brackets from crossbeam.

9. Remove mounting brackets and rubbers from stabilizer bar.



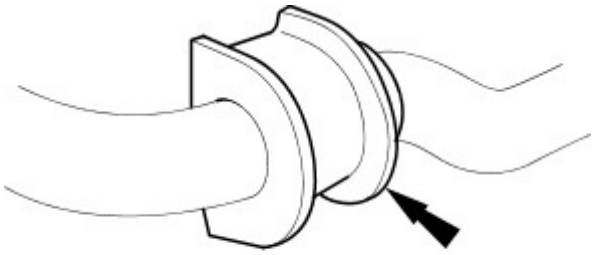
E35138

Installation

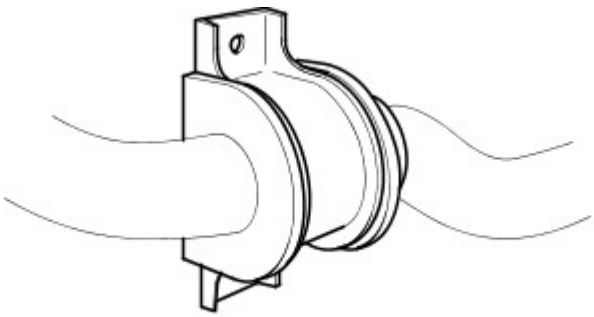
1. CAUTION: Make sure the Castrol NTR grease is only applied to the inner surface of the mounting bushes. Failure to follow this instruction may affect the retention of the bushes in the retaining brackets.

Apply a thin film of Castrol NTR grease to the inner surface of the bushes.

2. Install mounting rubbers on stabilizer bar.



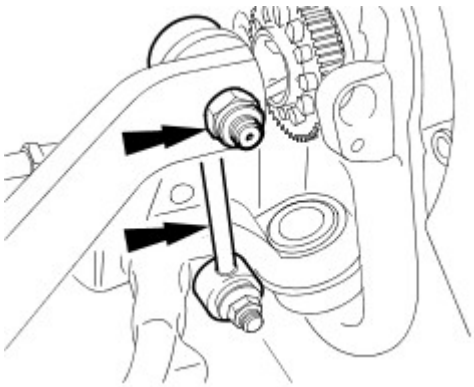
E35135



E35136

3. NOTE: Ensure mounting rubbers seat correctly between flanges.

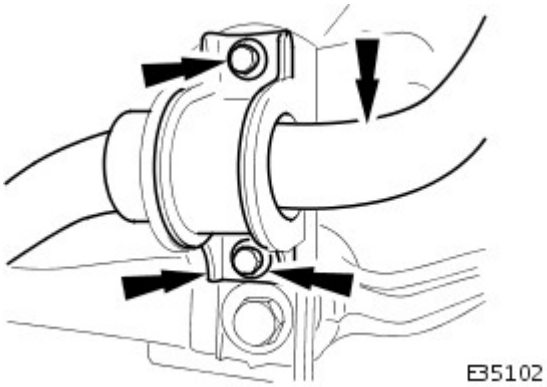
Install and fully seat mounting brackets on rubbers.



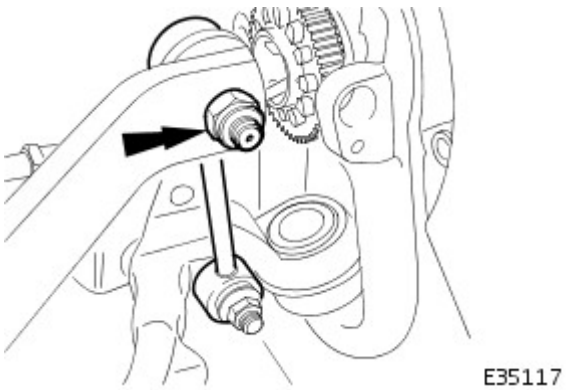
E35101

4. Position stabilizer bar assembly on link arms and install but do not tighten ball joint securing nuts.

5. Install stabilizer bar mounting bolts.

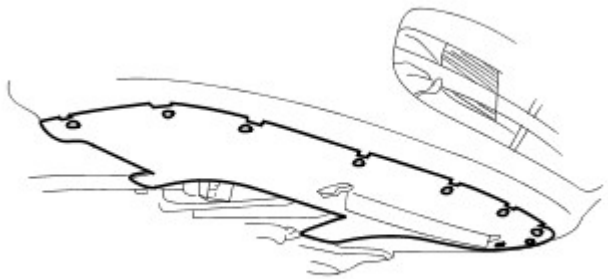


- Install but do not tighten stabilizer bar LH mounting bracket securing bolts.
- Install stabilizer bar RH mounting bracket securing bolts and tighten to 30-40Nm.
- Tighten LH mounting bracket bolts to 30-40Nm.

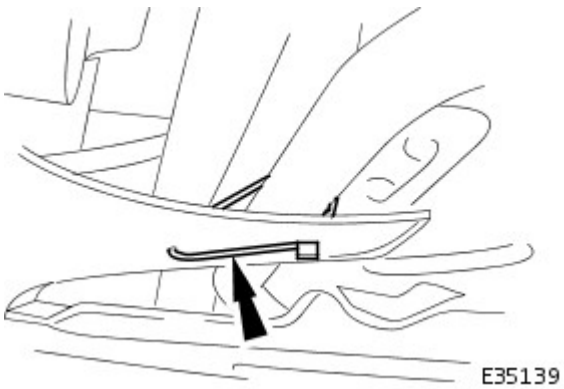


6. Secure link arms to stabilizer bar.

- Tighten LH link arm ball joint to stabilizer bar securing nut to 60-80Nm.
- Tighten RH link arm ball joint to stabilizer bar securing nut to 60-80Nm.

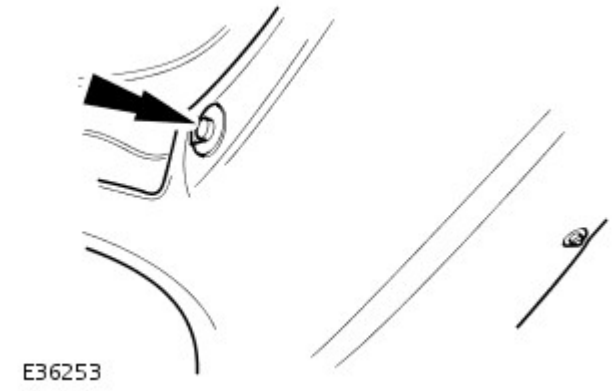


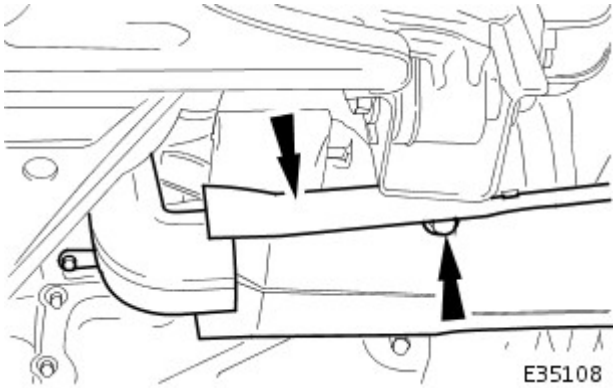
7. Using screws or new scrivets, secure undertray to front bumper cover.



8. Using a new tiestrap, secure undertray to crossbeam brace.

9. Using new scrivets, secure undertray to each wheelarch liner.





10. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Slide deflector forward to engage center tang over undertray.
- Install bolt and tighten to 17-23Nm.

11. Raise front of vehicle, remove stands and lower vehicle onto wheels. Refer to Section 100-02.

Front Suspension - Front Stabilizer Bar Bushing

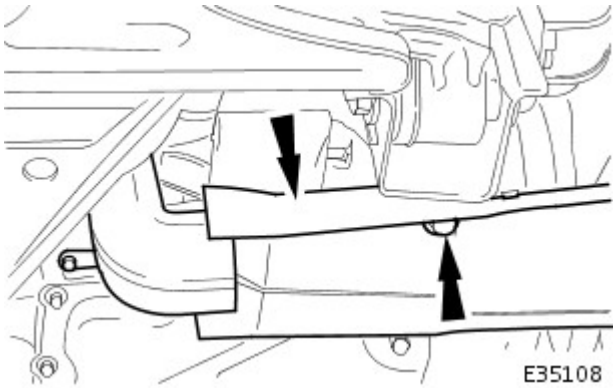
Removal and Installation

Materials

Name	Specification
Rubber Suspension Insulator Lube	Castrol NTR

Removal

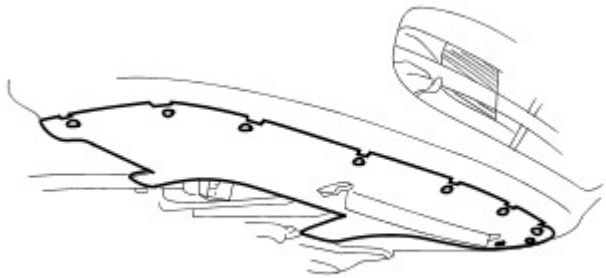
1. Raise front of vehicle and support on stands. Refer to Section 100-02.



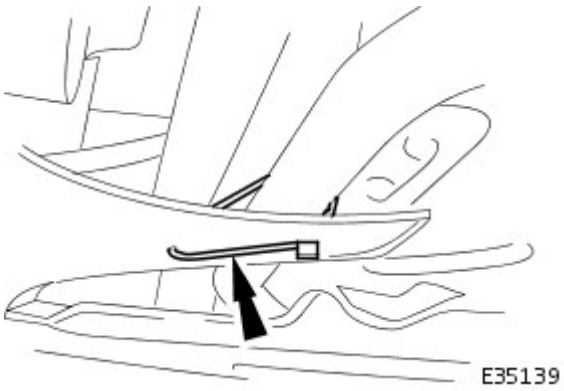
2. Remove generator front cooling duct.

- Remove bolt.
- Move duct rearwards to release tang from undertray.
- Release front duct from rear vertical duct.

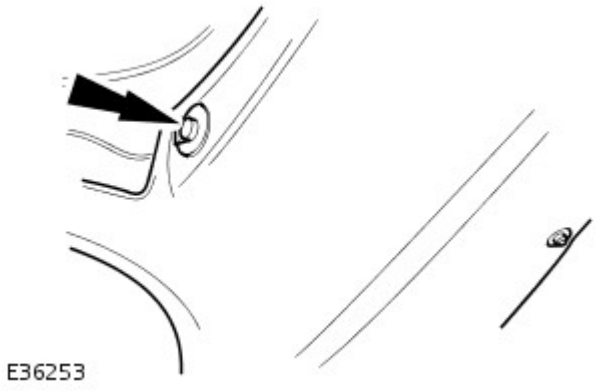
3. Remove scrivets or screws securing undertray to bumper cover. Discard scrivets.

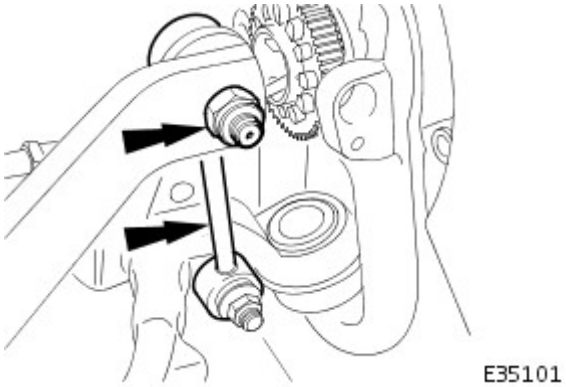


4. Remove and discard tiestrap securing undertray to crossbeam front brace.



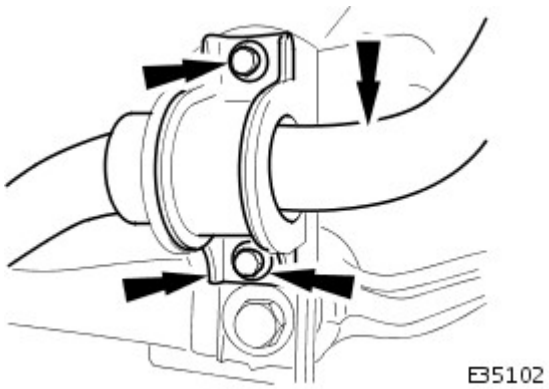
5. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.





6. Release stabilizer bar from link arms.

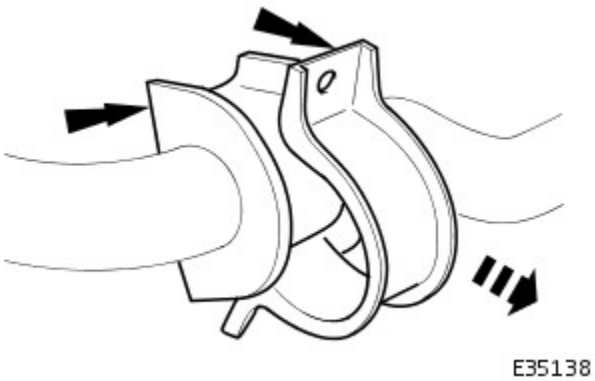
- Remove nut securing stabilizer bar to link.
- Release link arm from stabilizer bar.
- Repeat operation at opposite end of stabilizer bar.



7. NOTE: On vehicles fitted with an engine oil cooler, it may be necessary to release the stabilizer bar from each ball joint in turn to achieve the required clearance from cooler pipes.

Remove stabilizer bar from crossbeam.

- Remove stabilizer bar securing bolts.
- Remove stabilizer bar mounting brackets and remove bar from crossbeam.

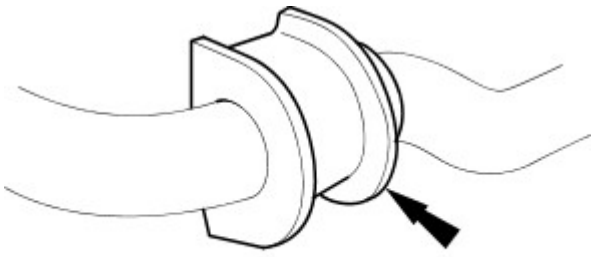


8. Remove mounting brackets and rubbers from stabilizer bar.

Installation

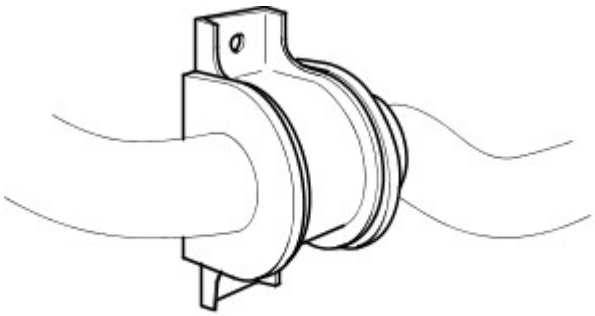
1. CAUTION: Make sure the Castrol NTR grease is only applied to the inner surface of the mounting bushes. Failure to follow this instruction may affect the retention of the bushes in the retaining brackets.

Apply a thin film of Castrol NTR grease to the inner surface of the bushes.



E35135

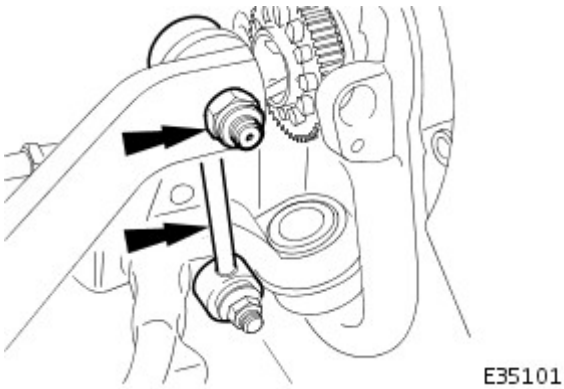
2. Position mounting rubbers on stabilizer bar.



E35136

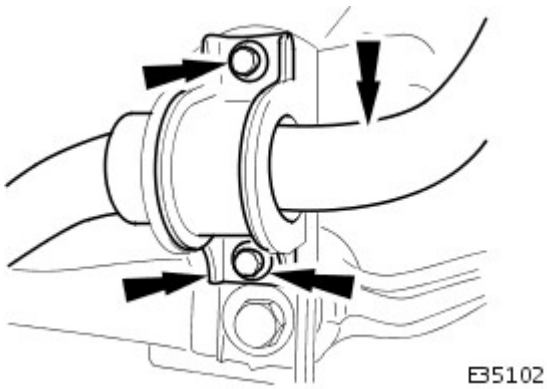
3. NOTE: Ensure mounting rubbers seat correctly between flanges.

Install and fully seat mounting brackets on rubbers.



E35101

4. Position stabilizer bar assembly on link arms and install but do not tighten nuts.



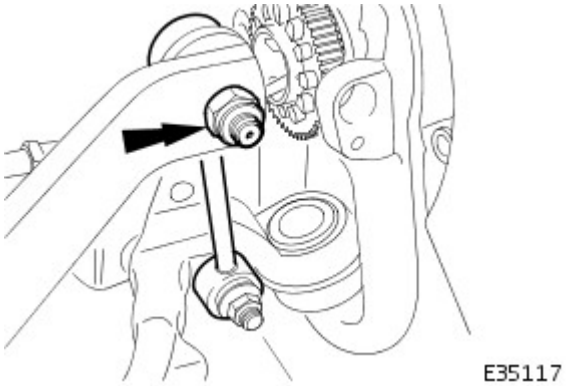
E35102

5. Install stabilizer bar mounting bolts.

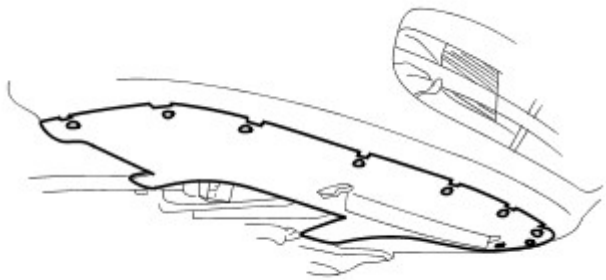
- Install but do not tighten stabilizer bar LH mounting bracket bolts.
- Install stabilizer bar RH mounting bracket bolts and tighten to 30-40Nm.
- Tighten LH mounting bracket bolts to 30-40Nm.

6. Secure link arms to stabilizer bar.

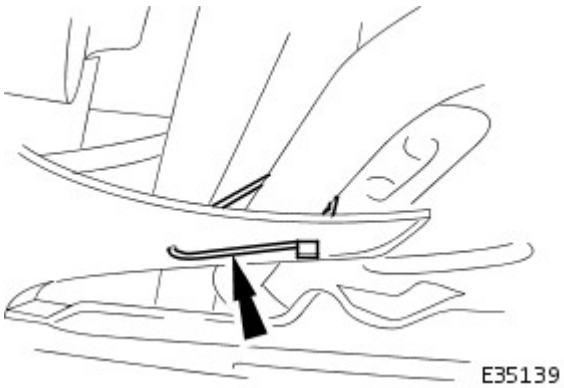
- Tighten LH link arm to stabilizer bar nut to 60-80Nm.
- Tighten RH link arm to stabilizer bar nut to 60-80Nm.



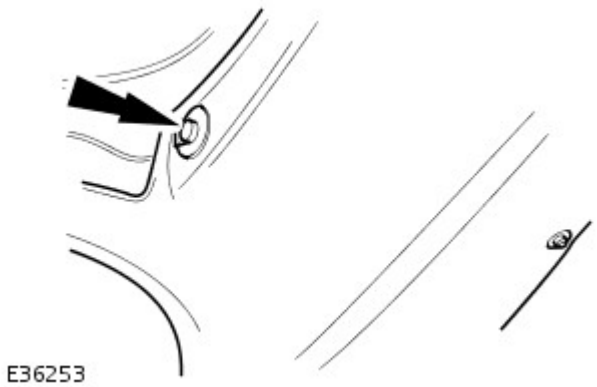
7. Using screws or new scrivets, secure undertray to front bumper cover.



8. Using a new tiestrap, secure undertray to crossbeam front brace.

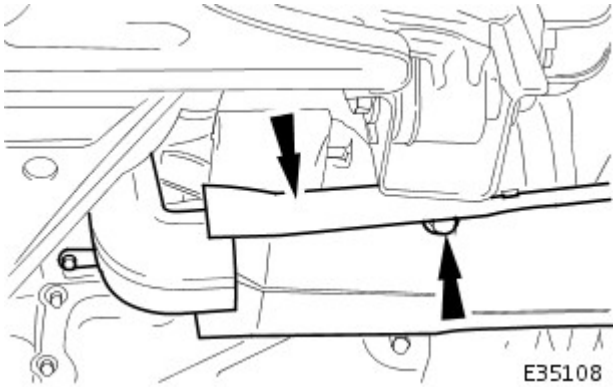


9. Using new scrivets, secure undertray to each wheelarch liner.



10. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Slide deflector forward to engage center tang over undertray.



- Install bolt and tighten to 17-23Nm.

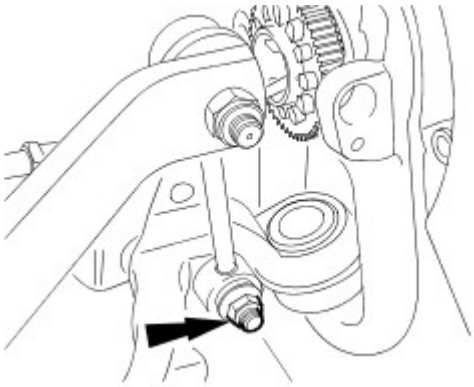
11. Raise front of vehicle, remove stands and lower vehicle onto wheels. Refer to Section 100-02.

Front Suspension - Front Stabilizer Bar Link

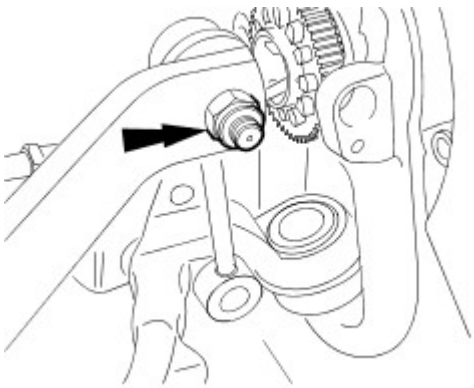
Removal and Installation

Removal

1. Raise front of vehicle and support on stands. Refer to Section 100-02.
2. Remove nut and bolt securing link arm to lower wishbone.



E35129



E35130

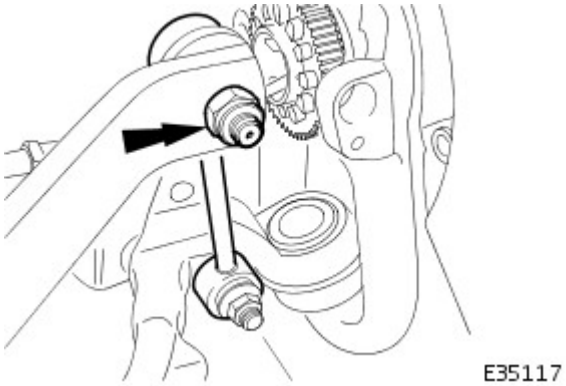
3. Remove nut securing link arm ball joint to stabilizer bar and remove link arm from vehicle.

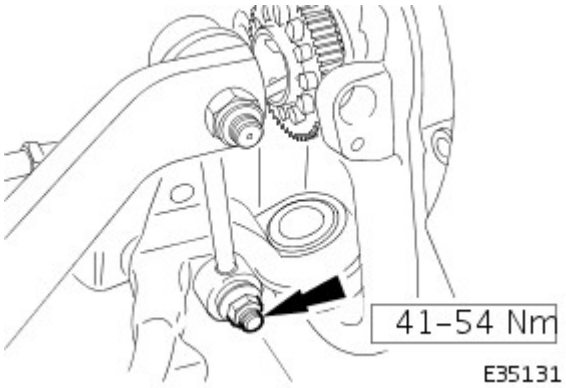
Installation



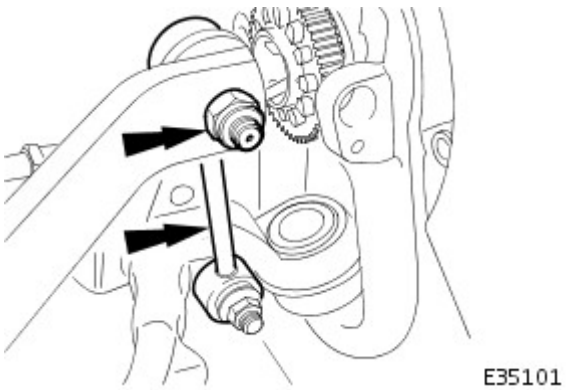
E35129

1. Position link assembly on lower wishbone and install but do not tighten bolt.
2. Position link arm ball joint stud in stabilizer bar and install but do not tighten nut.





3. Tighten link arm to wishbone nut and bolt to 41-54Nm.



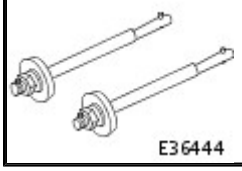
4. Secure link arm to stabilizer bar.

- Tighten link arm to stabilizer bar nut to 60-80Nm.
- Check that ball joint freedom of movement has been maintained.

5. Raise front of vehicle, remove stands and lower vehicle onto wheels. Refer to Section 100-02.

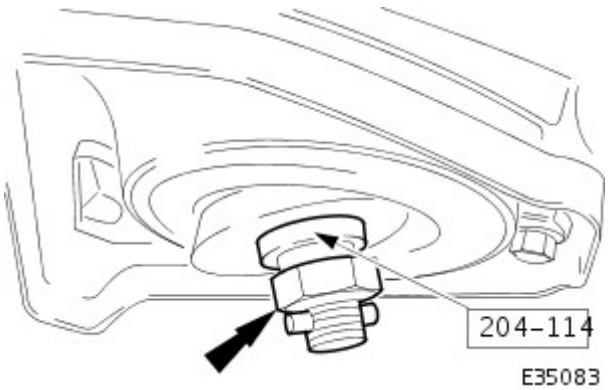
Front Suspension - Upper Arm Bushing

Removal and Installation

Special Tool(s)	
 E36462	Ball Joint Taper Separator 204-192 (JD 219)
 E36444	Front Camber Tie-down Link 204-114 (JD 133)

Removal

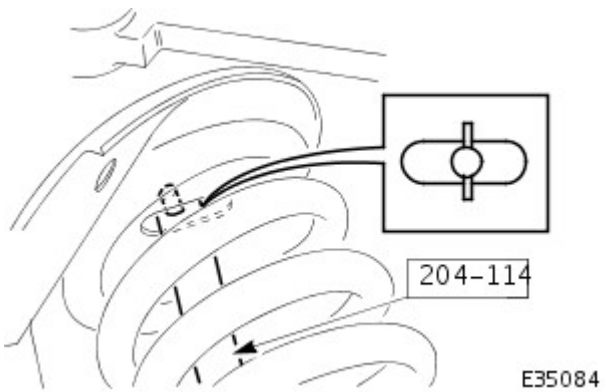
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



1. Raise front of vehicle. Refer to Section 100-02.

2. Position camber tie down special tool 204-114 on suspension.

- Fully slacken tool adjuster nut.
- Position tool in road spring and pass upper dowel through slot in suspension turret.



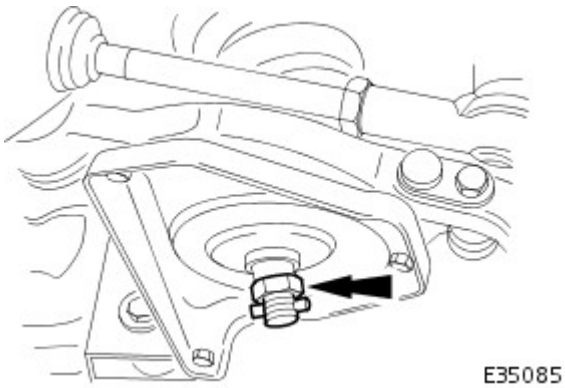
3. Lower front of vehicle.

4. Rotate stem of special tool 204-114 to locate dowel in suspension turret slot.

5. WARNING: WHEN TIGHTENING TOOL NUT, USE LOWER DOWEL AS A GUIDE TO ENSURE THAT THE TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Fully tighten nut of special tool to achieve suspension mid-laden

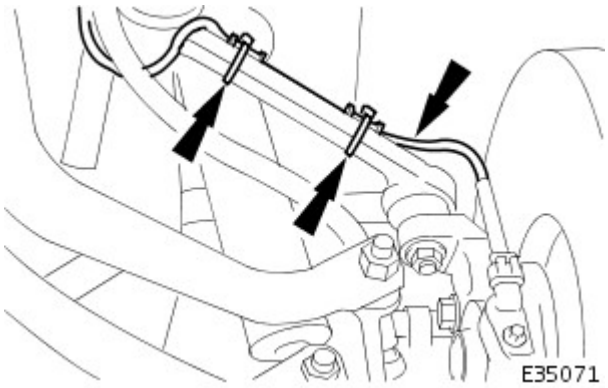
position.



6. Raise front of vehicle and support on stands. refer to Section 100-02.

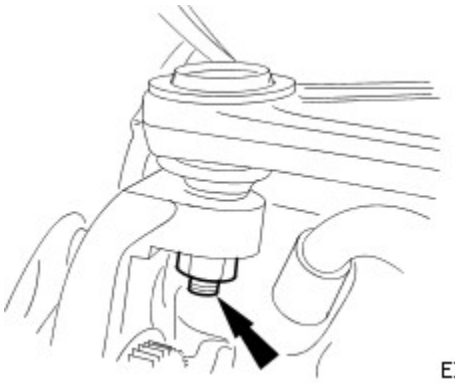
7. Remove appropriate road wheel. Refer to Section 100-02.

8. Remove tiestraps securing wheel speed sensor harness to upper wishbone.



9. Move steering to appropriate full lock for access to suspension.

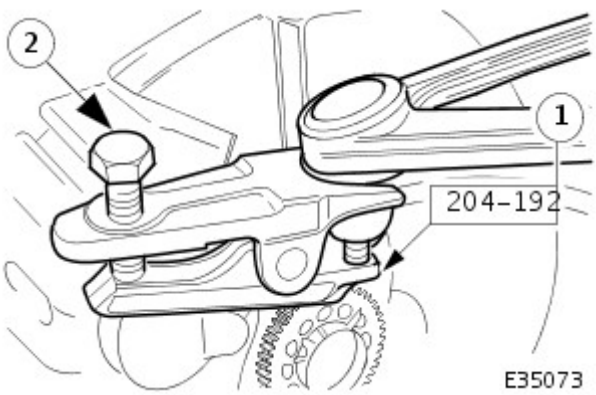
10. Remove nut securing upper wishbone ball joint to vertical link.



11. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

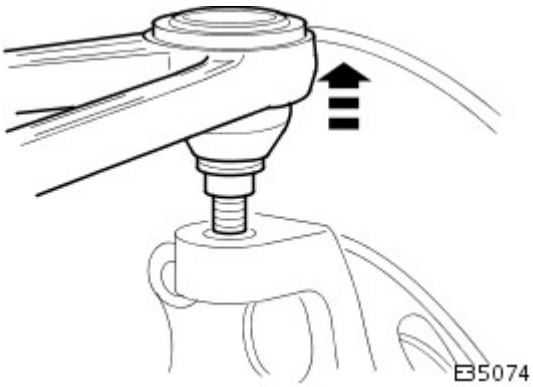
Release wishbone ball joint from vertical link.

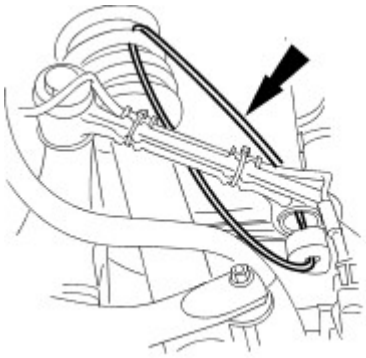
1. Install special tool 204-192 on upper wishbone ball joint.
2. Tighten bolt of special tool to release ball joint taper from vertical link.



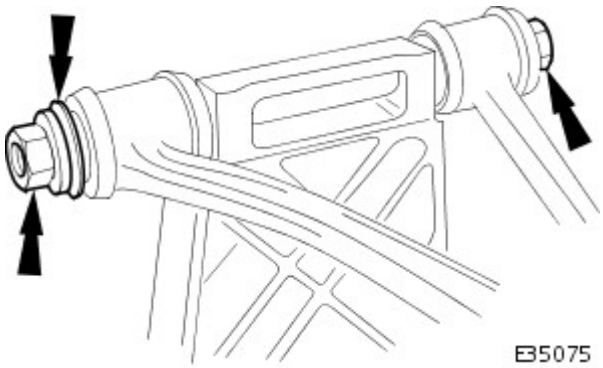
12. Remove special tool from ball joint.

13. Lift upper wishbone to withdraw ball joint from vertical link.





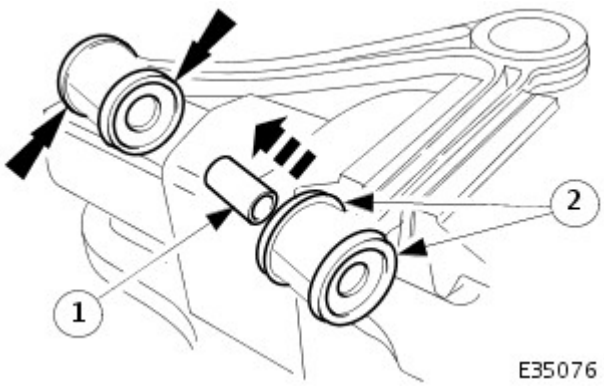
14. To prevent damage to lower ball joint, secure vertical link to road spring using strong wire.



15. Remove upper wishbone fulcrum nut and shaft and withdraw wishbone from crossbeam.

16. Secure upper wishbone in a vise.

17. Remove bush assemblies from wishbone.



1. Using a drift, remove thrust washer and spacer tube from each inner and outer half-bush.

2. Remove inner and outer half bushes from wishbone.

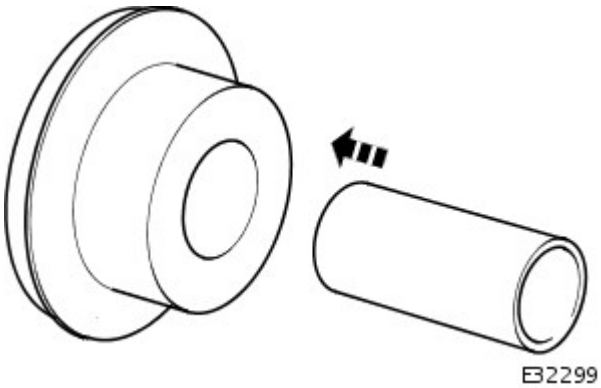
- Repeat procedure to remove remaining bush assembly.

18. Clean wishbone paying particular attention to bush locations.

19. Check that ball joint gaiter is not punctured or deeply abraded.

Installation

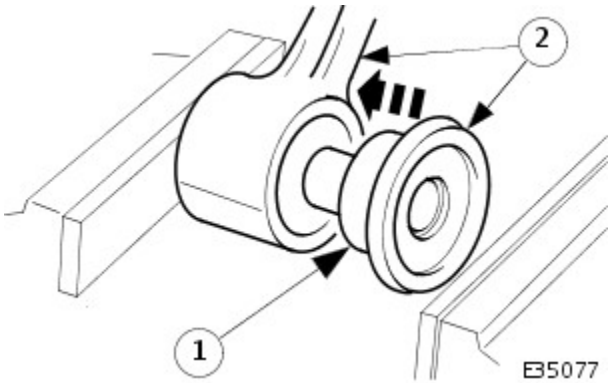
1. Install thrust washer and spacer tube in first wishbone half-bush.



2. Apply a suitable lubricant to exterior of each half-bush.

3. Install soft covers to vise jaws.

4. Install half-bush/spacer tube assembly in wishbone.

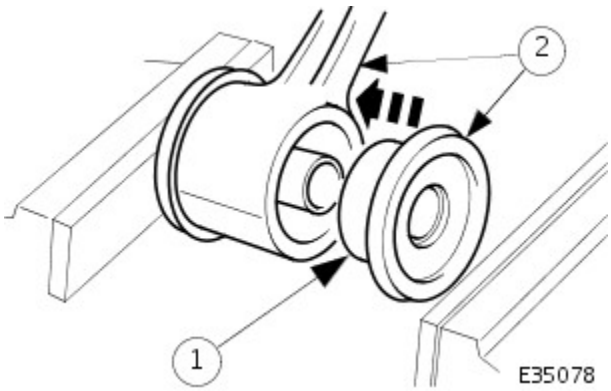


1. Align half-bush/spacer tube assembly with wishbone bore.
2. Position wishbone and half bush/spacer tube assembly between vise jaws.

- Close vise jaws until half-bush/tube assembly is fully seated in wishbone.

5. Remove wishbone from vise.

6. Install second half-bush in wishbone.



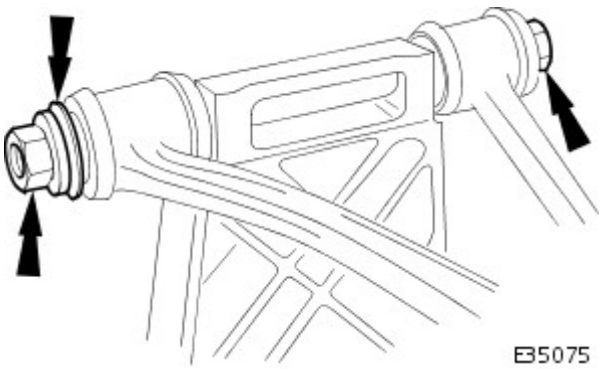
1. Align and engage second half-bush with installed spacer tube.
2. Position wishbone and half bush assembly between vise jaws.

- Close vise jaws until second half-bush assembly is fully seated.

7. Remove wishbone from vise.

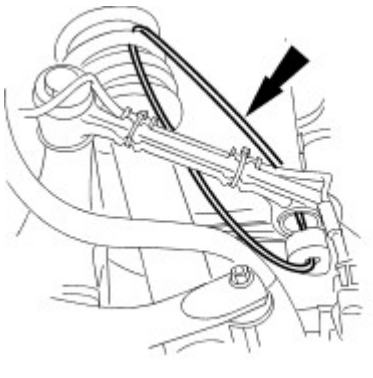
8. Following steps 1 to 7, install final bush assembly to wishbone.

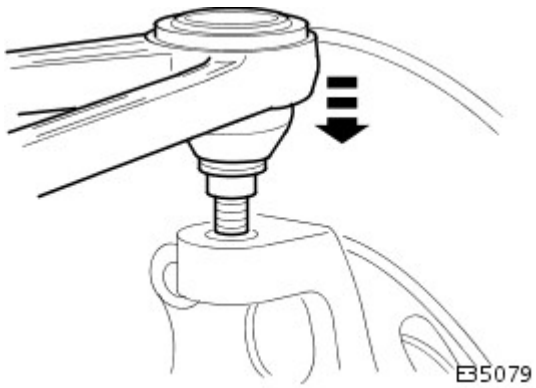
9. Install wishbone on crossbeam.



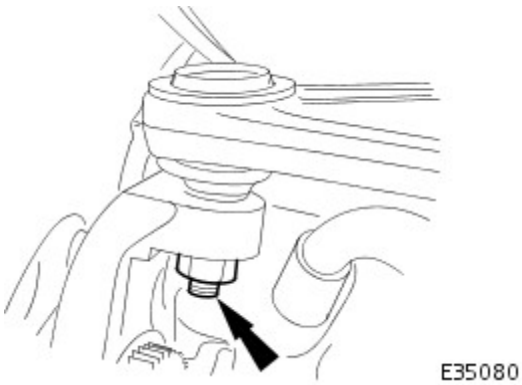
- Position wishbone on crossbeam.
- Install fulcrum shaft with threaded end rearward.
- Install nut and tighten to 60-80Nm.

10. Remove wire temporarily securing vertical link to road spring.

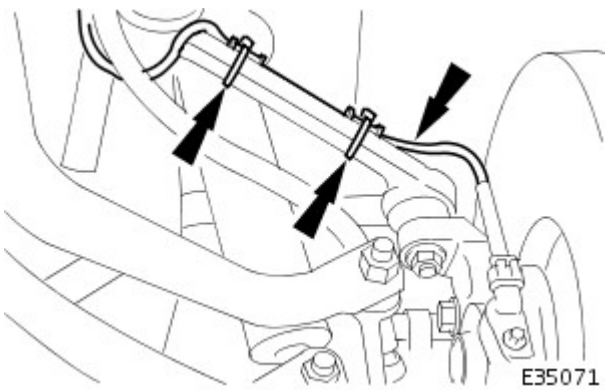




11. Position wishbone to engage ball joint taper in vertical link.



12. Install nut securing ball joint to vertical link and tighten nut to 60-80Nm.

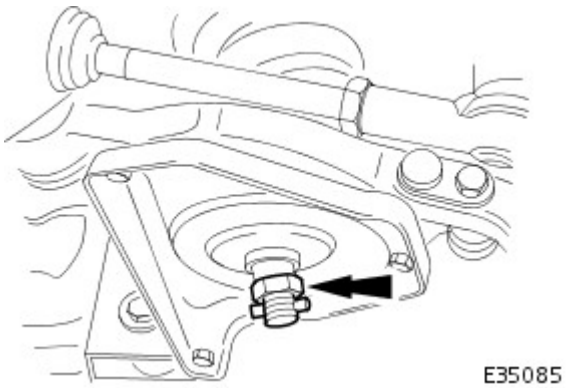


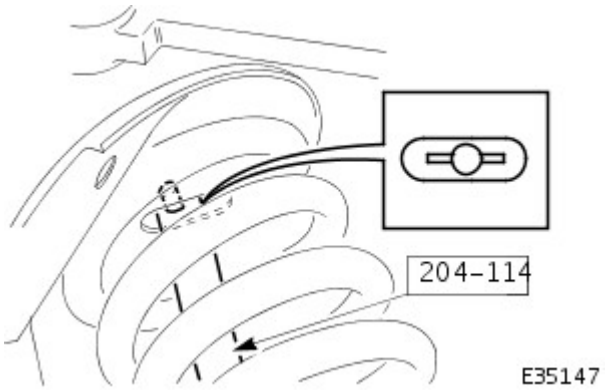
13. Reposition wheel speed sensor harness on wishbone and secure with two tiestraps.

14. Fit road wheel. Refer to Section 100-02

15. Raise vehicle, remove stands and fully lower vehicle.

16. Fully slacken nut on special tool.





17. Release dowel of special tool 204-114 from suspension turret slot.

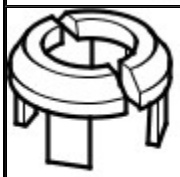
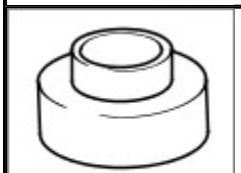
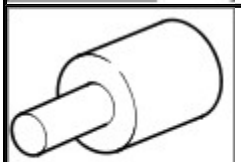
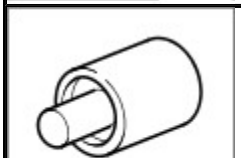
18. Raise vehicle for access and remove special tool from suspension.

19. Fully lower vehicle.

20. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Front Wheel Bearing

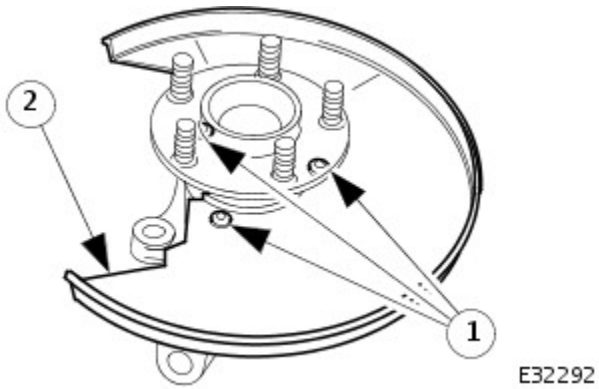
Removal and Installation

Special Tool(s)	
 E36390	Hub Remover 204-193 (JD 224)
 E36391	Hub Removal Collets 204-194 (JD 225)
 E36410	Hub Holding Tool 204-195 (JD 227)
 E36430	Hub Replacer 204-196 (JD 236)
 E36431	Wheel Bearing Remover 204-197 (JD 237)
 E36432	Wheel Bearing Replacer 204-198 (JD 238)
 E36443	ABS Rotor Nut Socket 206-066A
	Circlip Pliers

 E36412	18G 1004

Removal

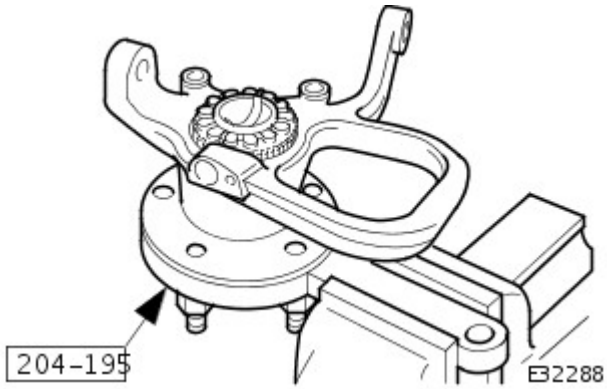
CAUTION: Replacement of nuts and bolts: Various thread-locking devises are used on nuts and bolts throughout the vehicle. These devises restrict the number of times a nut or bolt can be used. See section 100-00 for information.



1. Remove vertical link and hub assembly. Refer to 60.25.38.90.

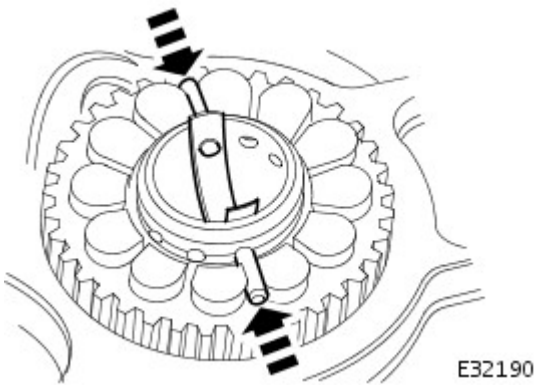
2. Remove brake disc shield from vertical link.

1. Remove screws.
2. Remove disc shield.



3. Using special tool, secure vertical link and hub assembly in a vise.

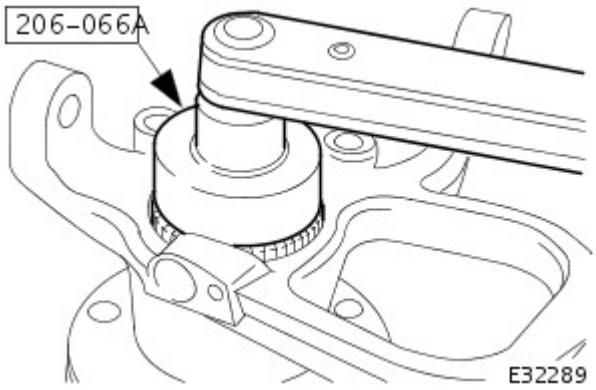
- Secure special tool in a vise.
- Position hub in tool.
- Install wheel nuts.



4. Remove rotor nut spring-clip.

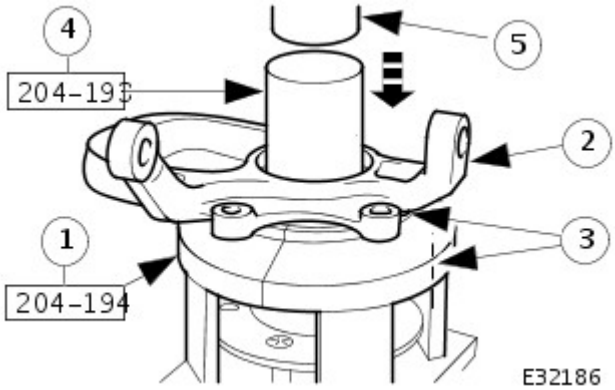
5. Remove rotor nut.

- Using special tool 206-066A remove rotor nut.



6. Remove vertical link and hub assembly from special tool.

7. Using a hydraulic press, remove hub from vertical link.

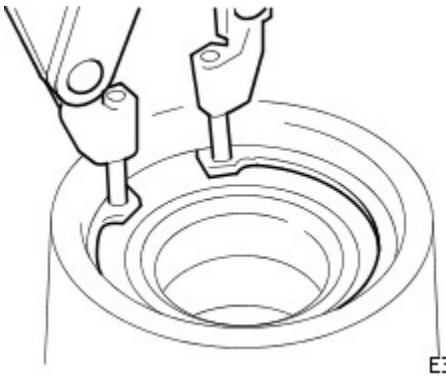


1. Place special tool 204-194 on press bed.
2. Position vertical link and hub assembly into tool collets.
3. Ensure one of the disc shield screw-bosses is in the center of one of the tool collets.
4. Position special tool 204-193 on top of hub.
5. Operate press to remove hub from vertical link.

8. Using special pliers, remove and discard inboard circlip from the vertical link.

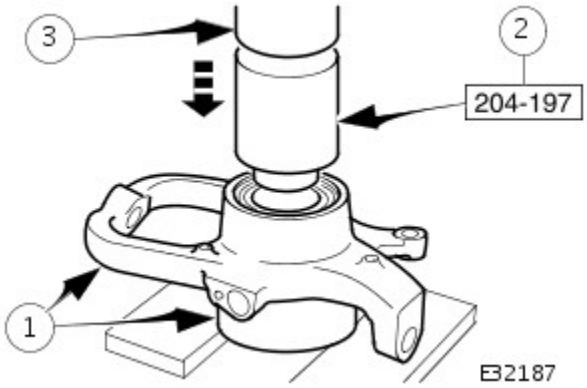


9. Using special pliers, remove and discard outboard circlip from the vertical link.



10. NOTE: Ensure the vertical link is level, and the supports are situated as near to the bearing bore as possible.

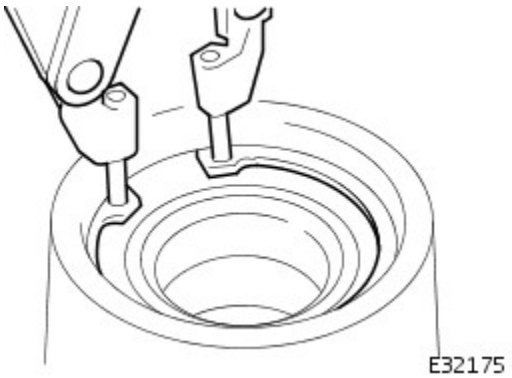
Using a hydraulic press, remove wheel bearing from vertical link.



1. Position the vertical link so that inboard side of the bearing bore is resting on suitable supports on the press-bed.
2. Position special tool 204-197 on top of bearing.
3. Operate press to remove bearing from vertical link, discard bearing.

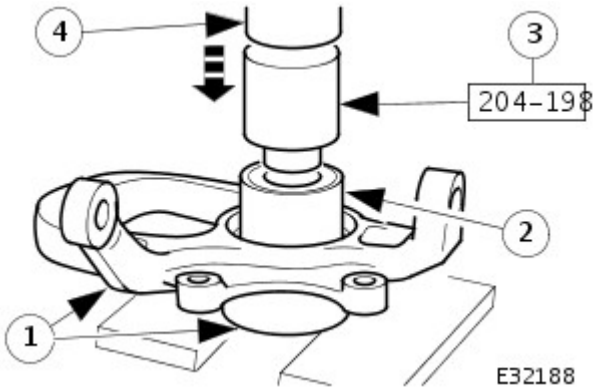
11. Clean relevant parts.

Installation



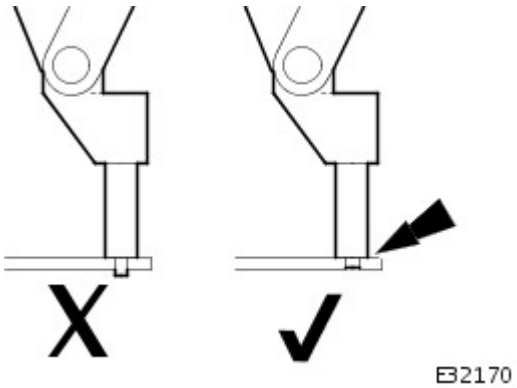
1. NOTE: The gap between the ears of the circlip must be positioned so that it is in the lowest position of the bore when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

Install outboard circlip in vertical link.



2. Using a hydraulic press, install bearing in the vertical link.

1. Position vertical link on the press bed with outboard side of the vertical link face down.
2. Position bearing on vertical link.
3. Position special tool on top of wheel bearing.
4. Operate press to install bearing, applying a three-ton load to ensure that the bearing is fully seated.

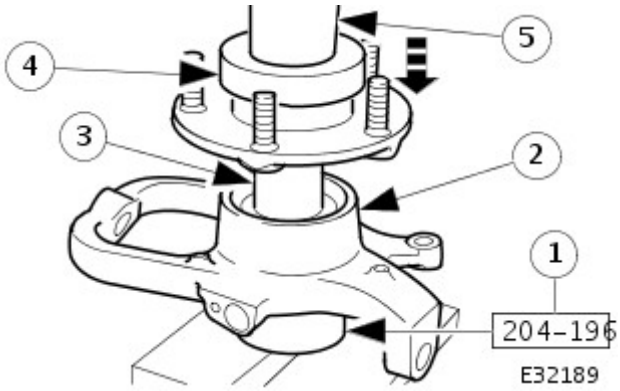


3. CAUTION: To prevent damage to the integral wheel-bearing seal, select circlip plier ends that do not protrude through the circlip ears.

4. NOTE: The gap between the ears of the circlip must be positioned so that it is in the lowest position of the bore, when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

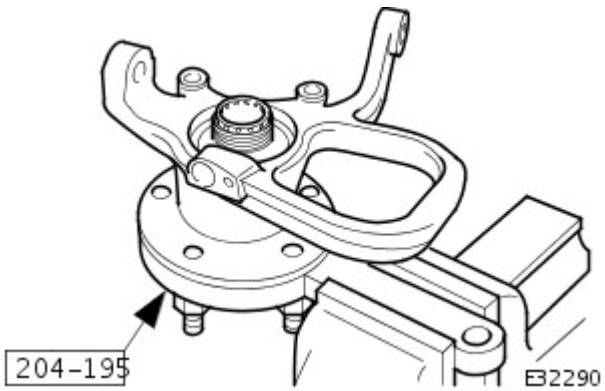


Install inboard circlip in vertical link.



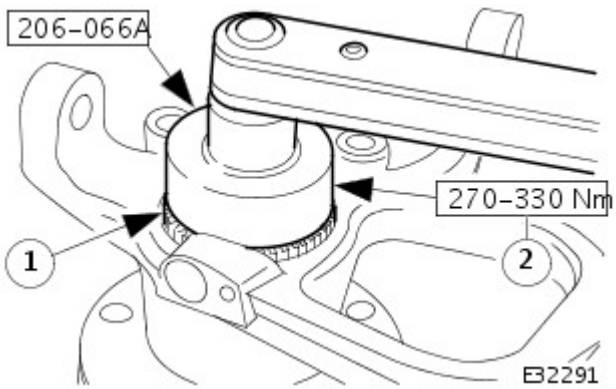
5. Using a hydraulic press, install hub in vertical link.

1. Position special tool on press bed.
2. Position the vertical link on the tool, with the inboard-side face down.
3. Position hub on bearing.
4. Position a flat steel plate across the face of the hub, DO NOT place plate across wheel studs.
5. Operate press to install the hub, applying a three-ton load to ensure hub is fully seated in bearing.



6. Using special tool, secure vertical link and hub assembly in a vise.

- Secure special tool in a vise.
- Position hub in tool.
- Install wheel nuts.

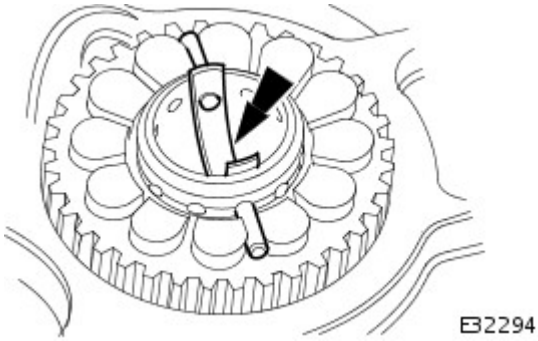


7. Install rotor nut .

1. Install rotor nut on hub.
2. Using special tool tighten rotor nut.

8. CAUTION: Do not slacken the rotor nut to engage the spring clip.

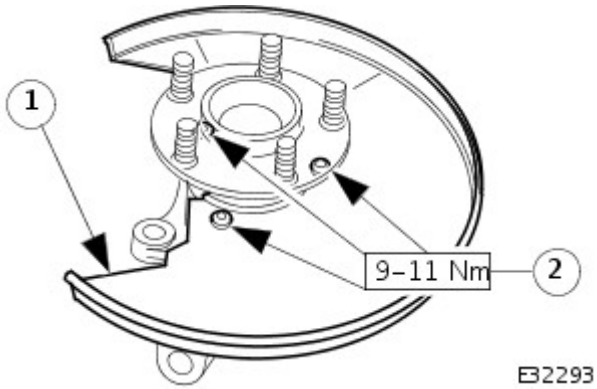
• NOTE: If the castellated slots of the rotor nut are not aligned, tighten the rotor nut further until the spring clip engages the



slots.

Install rotor nut spring-clip.

- Install spring clip in hub retaining holes and castellated slots of the rotor nut.



9. Install disc shield.

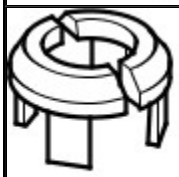
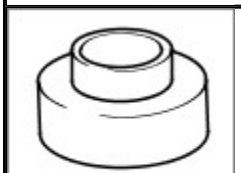
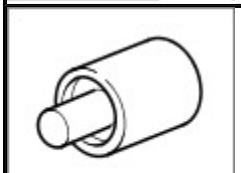
1. Position disc shield on vertical link.
2. Install bolts.

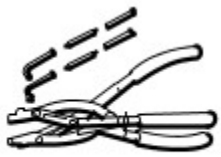
10. Install vertical link and hub assembly on vehicle. Refer to 60.25.38.90.

11. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Wheel Hub

Removal and Installation

Special Tool(s)	
 E36390	Hub Remover 204-193 (JD 224)
 E36391	Hub Removal Collets 204-194 (JD 225)
 E36410	Hub Holding Tool 204-195 (JD 227)
 E36430	Hub Replacer 204-196 (JD 236)
 E36431	Wheel Bearing Remover 204-197 (JD 237)
 E36432	Wheel Bearing Replacer 204-198 (JD 238)
 E36443	ABS Rotor Nut Socket 206-066A
	Circlip Pliers

 E36412	18G 1004

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devises are used on nuts and bolts throughout the vehicle. These devises restrict the number of times a nut or bolt can be used. Refer to Section 100-00 for further information.

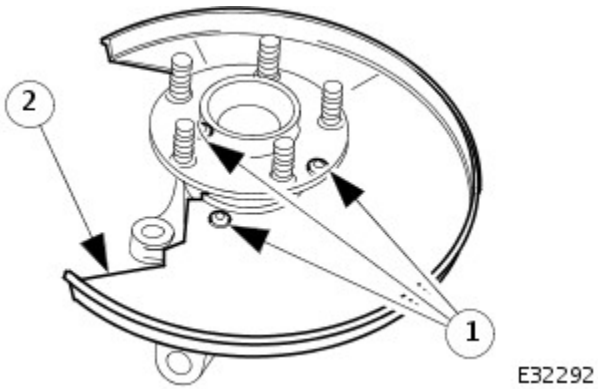
1. Raise front of vehicle and support on stands. Refer to Section 100-02.

2. Remove appropriate road wheel. Refer to Section 100-02.

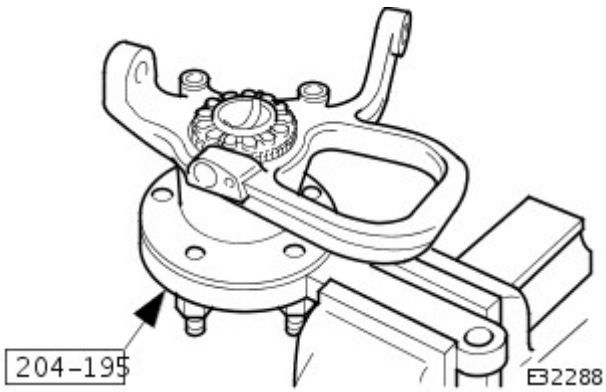
3. Remove front brake disc. Refer to 70.10.12.

4. Remove vertical link and hub assembly. Refer to operation 60.25.38.90.

5. Remove brake-disc shield from vertical link.



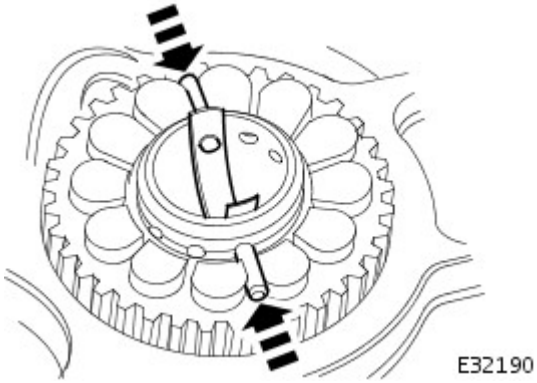
1. Remove screws.
2. Remove disc shield.

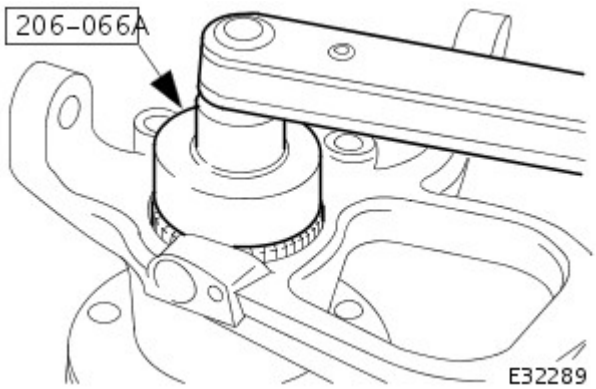


6. Using special tool, secure vertical link and hub assembly in a vise.

- Secure special tool 204-195 in a vise.
- Position hub in tool.
- Install wheel nuts.

7. Remove rotor nut spring-clip.

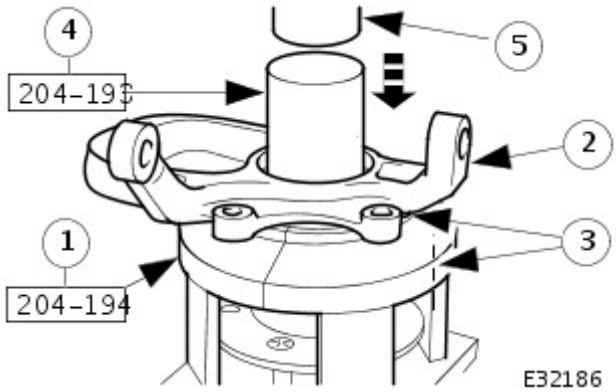




8. Remove rotor nut.

- Using special tool 206-066A remove rotor nut.

9. Remove vertical link and hub assembly from special tool.



10. CAUTION: Removing the hub from the vertical link damages the wheel bearing. A new wheel bearing MUST be fitted to the vertical link.

Using a hydraulic press, remove hub from vertical link.

1. Place special tool on press bed.
2. Position vertical link and hub assembly into tool collets.
3. Ensure one of the disc shield screw-bosses is in the center of one of the tool collets.
4. Position special tool on top of hub.
5. Operate press to remove hub from vertical link.

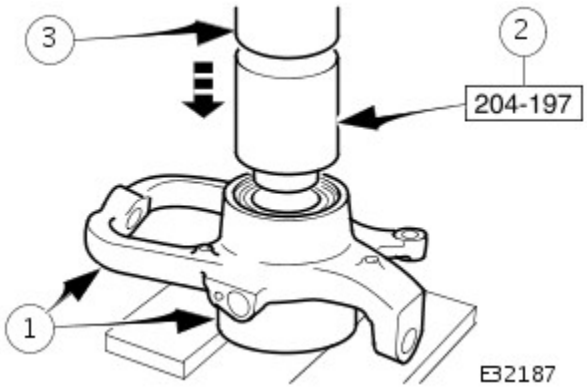


11. Using special pliers, remove and discard the inboard circlip from the vertical link.

12. Using special pliers, remove and discard outboard circlip from



the vertical link.



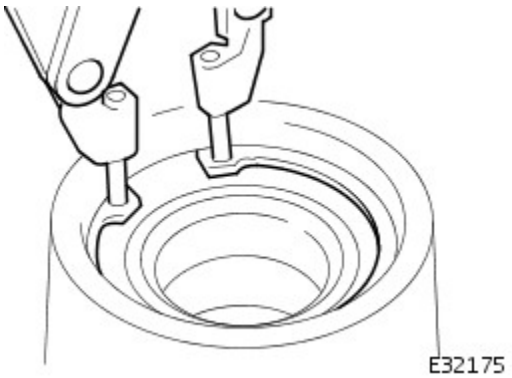
13. NOTE: Ensure the vertical link is level, and the supports are situated as near to the bearing bore as possible.

Using a hydraulic press, remove wheel bearing from the vertical link.

1. Position the vertical link so that the inboard side of the bearing bore is resting on suitable supports on the press-bed.
2. Position special tool 204-197 on top of bearing.
3. Operate press to remove bearing from vertical link, discard bearing.

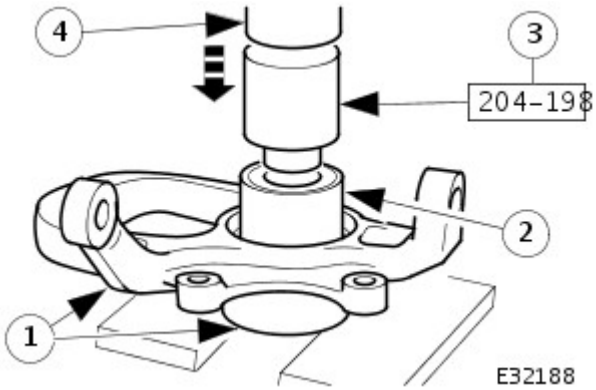
14. Clean relevant parts.

Installation



1. NOTE: The gap between the ears of the circlip must be positioned so that it is in the lowest position of the bore when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

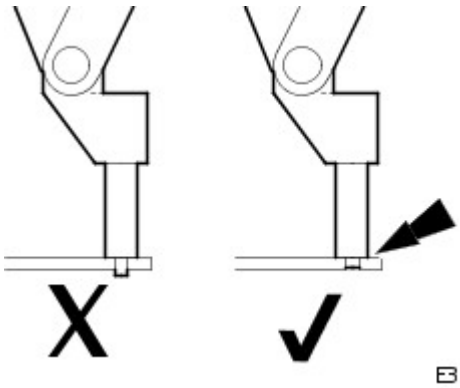
Install outboard circlip in vertical link.



2. Using a hydraulic press, install wheel bearing in vertical link.

1. Position vertical link on the press bed with outboard side of the vertical link face down.
2. Position wheel bearing on vertical link.
3. Position special tool on top of wheel bearing.
4. Operate press to install bearing, applying a three-ton seating load to ensure the bearing is fully seated.

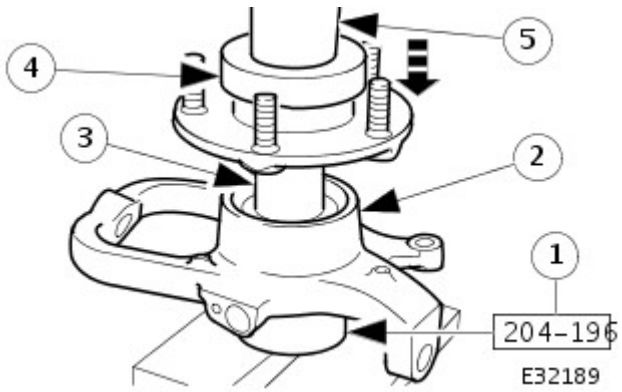
3. CAUTION: To prevent damage to the integral bearing seal, select circlip plier ends that do not protrude through the circlip ears.





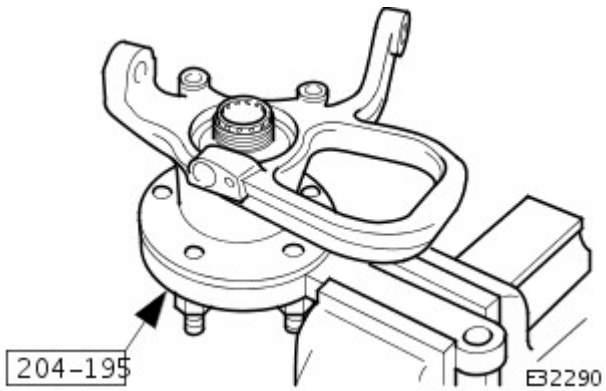
4. NOTE: The gap between the ears of the circlip must be positioned at the lowest point of the bore, when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

Install inboard circlip in vertical link.



5. Using a hydraulic press, install hub in vertical link.

1. Position special tool on press bed.
2. Position vertical link on tool, with the inboard-side downwards.
3. Position hub on bearing.
4. Position a flat steel plate across the face of the hub, DO NOT place plate across wheel studs.
5. Operate press to install hub in vertical link, applying a three-ton seating load to ensure hub fully seats in wheel bearing.

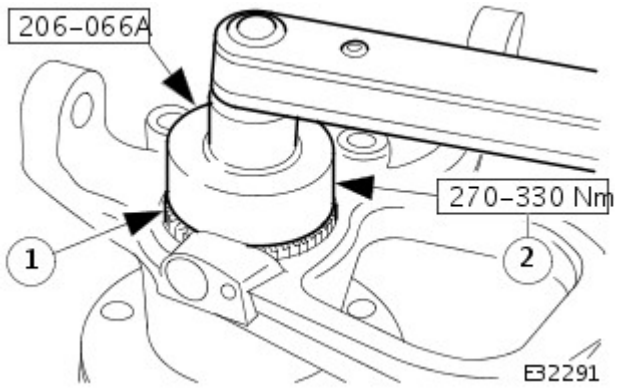


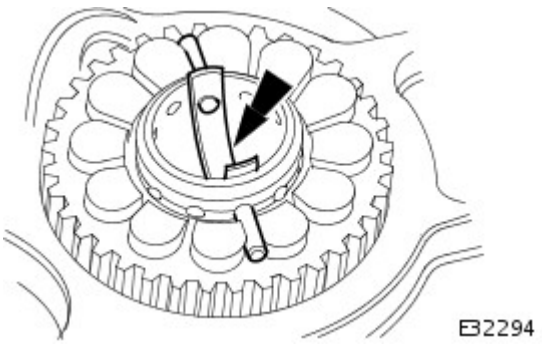
6. Using special tool, secure vertical link and hub assembly in a vise.

- Secure special tool in a vise.
- Position hub in tool.
- Install wheel nuts.

7. Install rotor nut.

1. Install rotor nut on hub.
2. Using special tool tighten rotor nut.





8. CAUTION: Do not slacken the rotor nut to engage the spring clip.

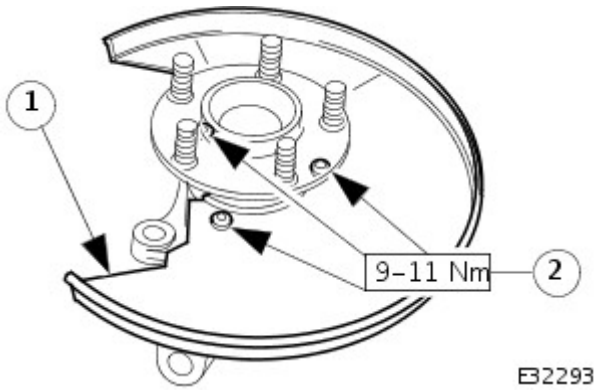
• NOTE: If the castellated slots of the rotor nut are not aligned, tighten the nut until the spring clip engages in the slots.

Install rotor nut spring-clip.

- Install spring clip in the hub retaining holes and, castellated slots of the rotor nut.

9. Install disc shield.

1. Position disc shield on vertical link.
2. Install bolts.

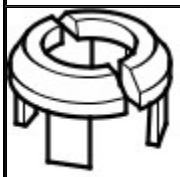
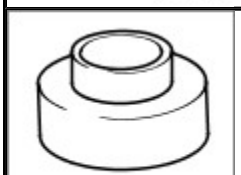
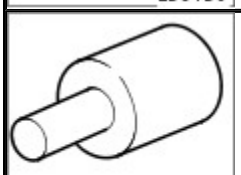
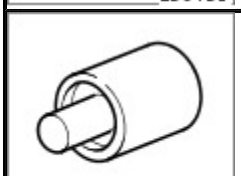


10. Install vertical link and hub assembly on vehicle. Refer to 60.25.38.90.

11. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Wheel Knuckle

Removal and Installation

Special Tool(s)	
 E36390	Hub Remover 204-193 (JD 224)
 E36391	Hub Removal Collets 204-194 (JD 225)
 E36410	Hub Holding Tool 204-195 (JD 227)
 E36430	Hub Replacer 204-196 (JD 236)
 E36431	Wheel Bearing Remover 204-197 (JD 237)
 E36432	Wheel Bearing Replacer 204-198 (JD 238)
 E36443	ABS Rotor Nut Socket 206-066A
	Circlip Pliers

 E36412	18G 1004

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devises are used on nuts and bolts throughout the vehicle. These devises restrict the number of times a nut or bolt can be used. See section 100-00 for information.

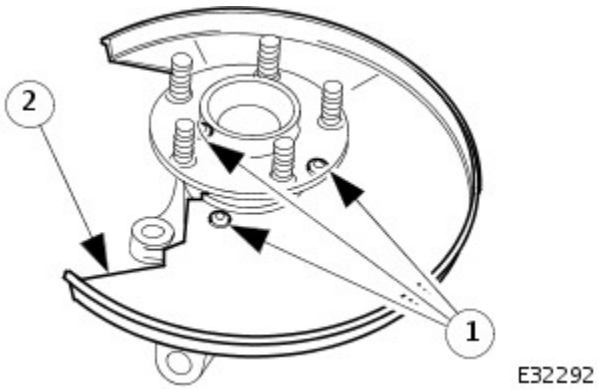
1. Raise front of vehicle and support on stands. Refer to Section 100-02.

2. Remove appropriate road wheel. Refer to Section 100-02.

3. Remove front brake disc. Refer to 70.10.12.

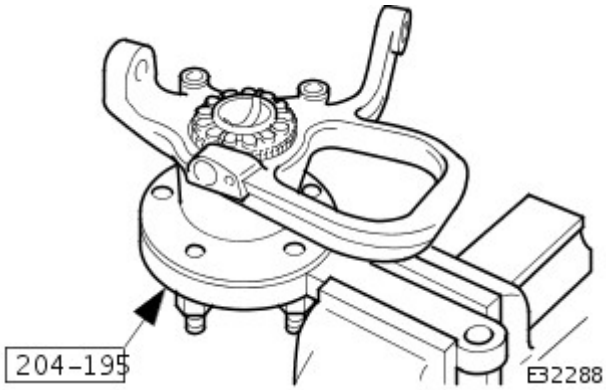
4. Remove vertical link and hub assembly. Refer to operation 60.25.38.90.

5. Remove brake-disc shield from vertical link.



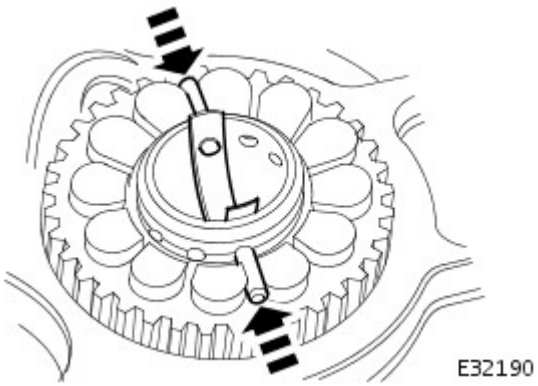
1. Remove screws.
2. Remove disc shield.

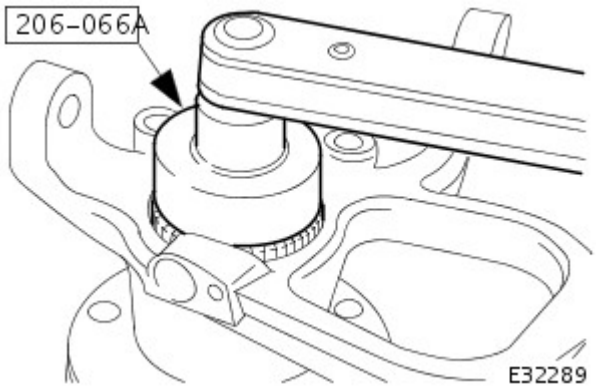
6. Using special tool, secure vertical link and hub assembly in a vise.



- Secure special tool in a vise.
- Position hub in tool.
- Install wheel nuts.

7. Remove rotor nut spring-clip.

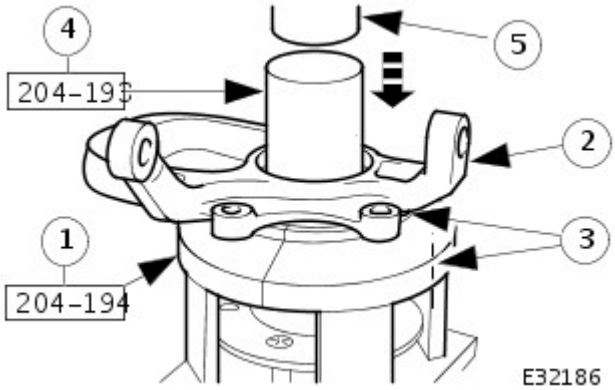




8. Remove rotor nut.

- Using special tool remove rotor nut.

9. Remove vertical link and hub assembly from special tool.



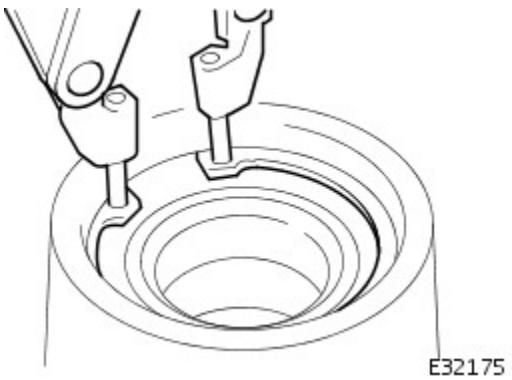
10. CAUTION: Removing the hub from the vertical link damages the wheel bearing. A new wheel bearing MUST be fitted to the vertical link.

Using a hydraulic press, remove vertical link from hub .

1. Place special tool on press bed.
2. Position vertical link and hub assembly in tool collets.
3. Ensure one of the disc shield screw-bosses is in the center of one of the tool collets.
4. Position special tool on top of hub.
5. Operate press to remove vertical link from hub.

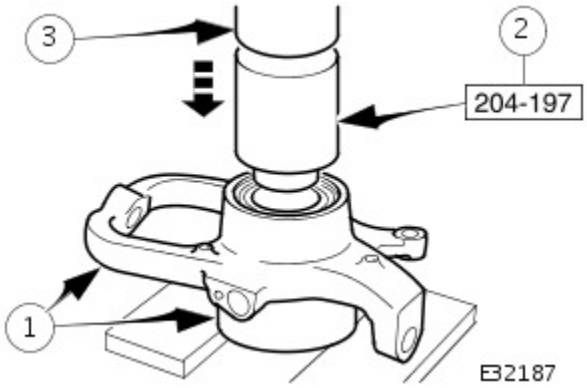


11. Using special pliers remove and discard the inboard circlip from the vertical link.



12. Using special pliers remove and discard outboard circlip from the vertical link.

13. NOTE: Ensure the vertical link is level, and the supports are situated as near to the bearing bore as possible.

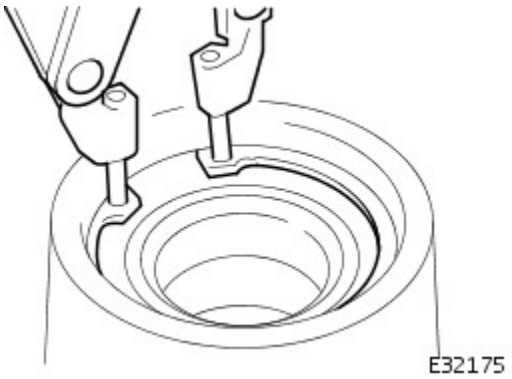


Using a hydraulic press, remove wheel bearing from the vertical link.

1. Position the vertical link so that the inboard side of the bearing bore is resting on suitable supports on the press-bed.
2. Position special tool on top of bearing.
3. Operate press to remove bearing from vertical link, discard bearing.

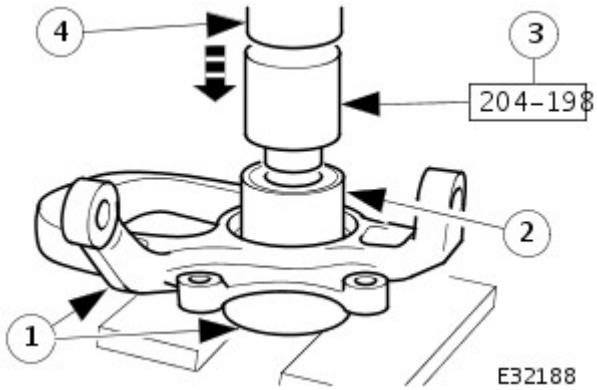
14. Clean relevant parts.

Installation



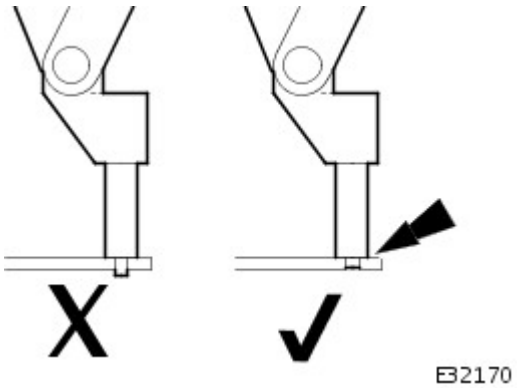
1. NOTE: The gap between the ears of the circlip must be positioned so that it is in the lowest position of the bore when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

Install outboard circlip in vertical link.



2. Using a hydraulic press, install bearing in vertical link.

1. Position vertical link on the press bed with outboard side of the vertical link face down.
2. Position wheel bearing on vertical link.
3. Position special tool on top of wheel bearing.
4. Operate press to install the bearing, applying a three-ton seating load to ensure bearing is fully seated.

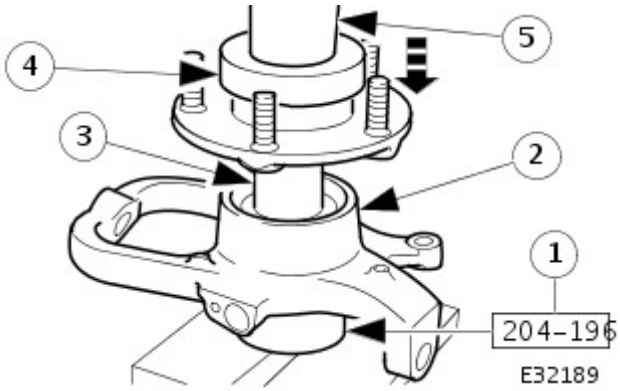


3. CAUTION: To prevent damage to the integral bearing seal, select circlip plier ends that do not protrude through the circlip ears.

4. NOTE: The gap between the ears of the circlip must be positioned at the lowest point of the bore, when the vertical link is installed on the vehicle. Refer to General Procedures for further information.

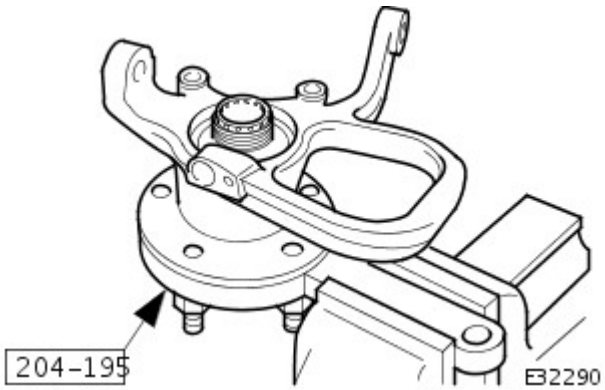


Install inboard circlip in vertical link.



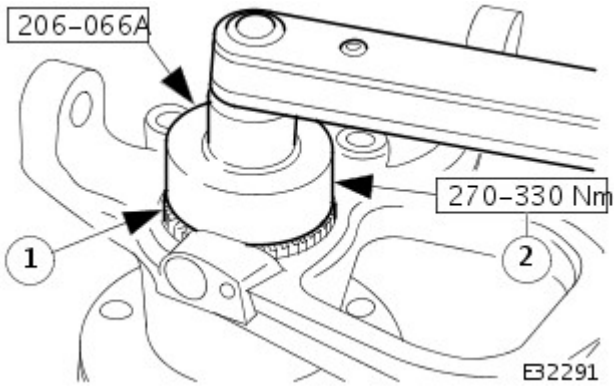
5. Using a hydraulic press, install hub in vertical link.

1. Position special tool on press bed.
2. Position vertical link on the tool, with the inboard-side downwards.
3. Position hub to bearing.
4. Position a flat steel plate across the face of the hub, DO NOT place plate across wheel studs.
5. Operate press to install hub in vertical link, applying a three-ton seating load to ensure hub fully seats in wheel bearing.



6. Using special tool, secure vertical link and hub assembly in a vise.

- Secure special tool in a vise.
- Position hub in tool.
- Install wheel nuts.

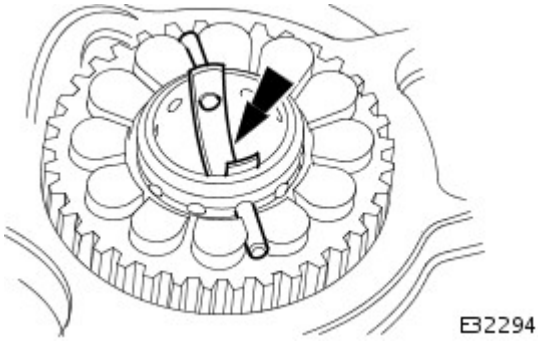


7. install rotor nut .

1. Install rotor nut on hub.
2. Using special tool tighten rotor nut to 270-330Nm.

8. CAUTION: Do not slacken the rotor nut to engage the spring clip.

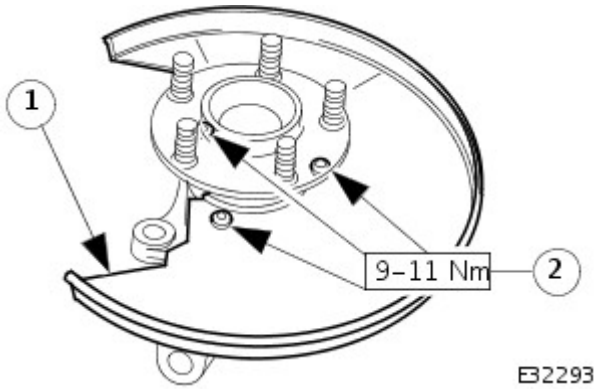
• NOTE: If the castellated slots of the rotor nut are not aligned,



tighten the nut until the spring clip engages in the slots.

Install rotor nut spring-clip.

- Install spring clip in hub retaining holes and castellated slots of the rotor nut.



9. Install disc shield on vertical link.

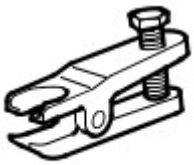
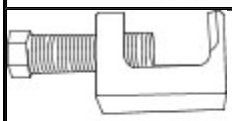
1. Position disc shield.
2. Install bolts.

10. Install vertical link and hub assembly on vehicle. Refer to 60.25.38.90.

11. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

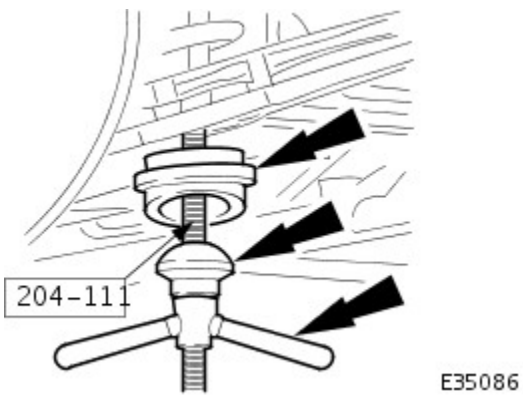
Front Suspension - Wheel Knuckle and Wheel Hub Assembly

Removal and Installation

Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Front suspension ball joint splitter 204-192 (JD 219)
 E31837	Ball joint splitter 204-293

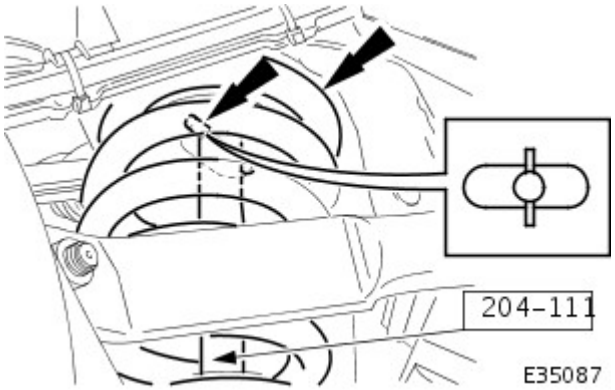
Removal

1. Raise front of vehicle and support on stands. Refer to Section 100-02.
2. Remove appropriate road wheel. Refer to 74.20.05.
3. Remove brake disc. Refer to 70.10.12.
4. Using wire or string, secure brake caliper to road spring to take weight off brake hose.
5. Raise vehicle sufficient to provide access for special tool 204-111.
6. Install special tool 204-111 in road spring.
   - Slacken tool adjuster to suit spring length.
   - Fit adaptor and thrust collar.
   - Position stem of tool in center of spring passing dowel through slot in suspension turret.



E35086

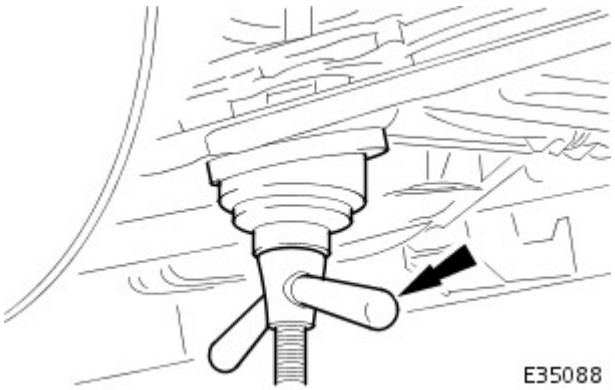
7. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE



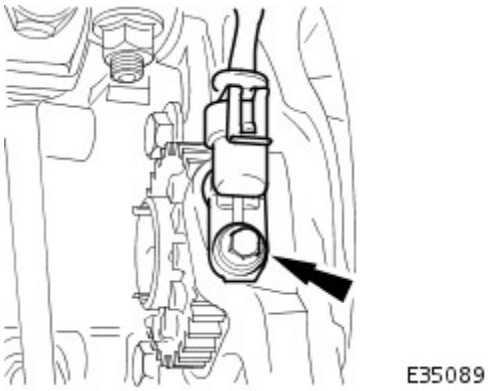
THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Engage dowel of special tool 204-111 in suspension turret and rotate to position across slot.

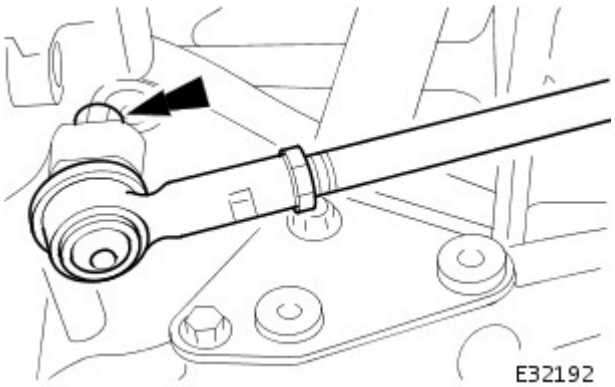
8. Lower vehicle onto stands.



9. Rotate tool adjuster to tension spring.



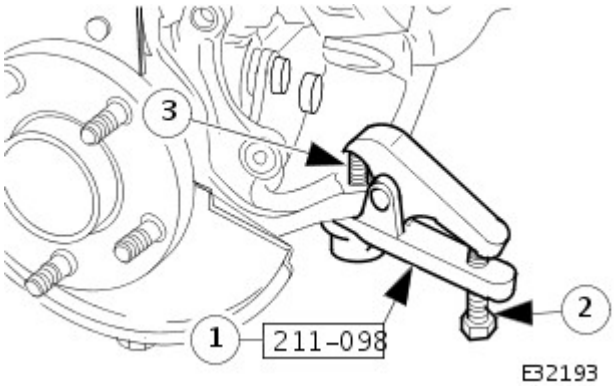
10. Remove wheel speed sensor securing screw and withdraw sensor from vertical link.



11. Remove nut securing tie rod outer ball joint to steering arm.

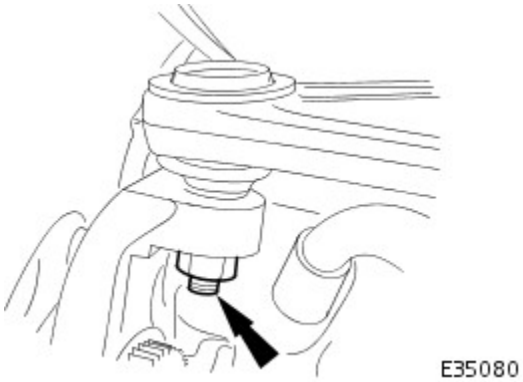
12. Release ball joint from vertical link.

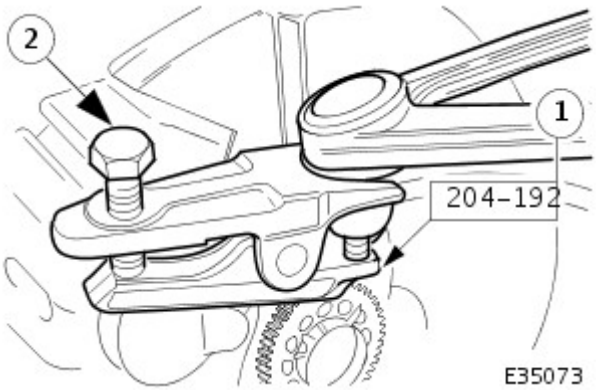
1. Install special tool 211-098 on tie rod outer ball joint.
2. Tighten tool bolt to release taper pin from vertical link.



13. Remove special tool from ball joint and position tie rod for access.

14. Remove nut securing upper wishbone ball joint to vertical link.

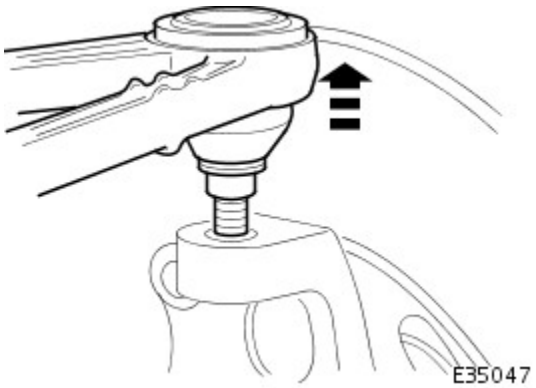




15. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

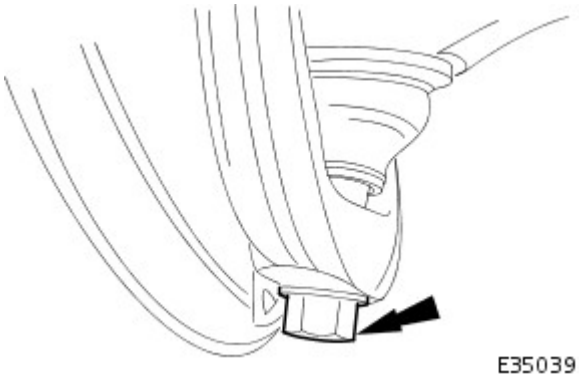
Release upper wishbone ball joint from vertical link/hub assembly.

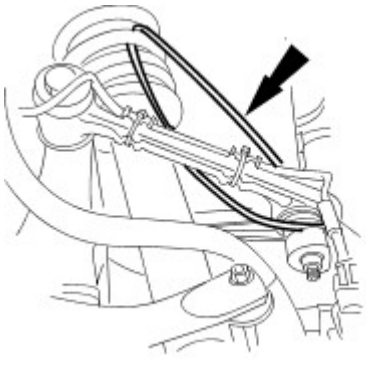
1. Install special tool 204-192 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.



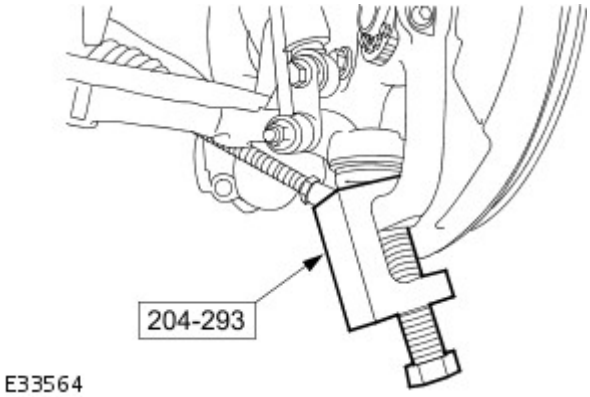
16. Raise upper wishbone to release ball joint pin from vertical link.

17. Remove nut securing lower wishbone ball joint to vertical link.





18. To prevent damage to lower ball joint, secure vertical link to road spring using strong wire.



19. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

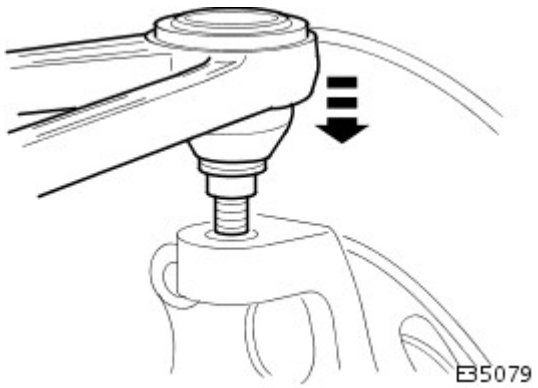
Release lower wishbone ball joint from vertical link/hub assembly.

1. Install special tool 204-293 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.

20. Remove special tool 204-293 from ball joint.

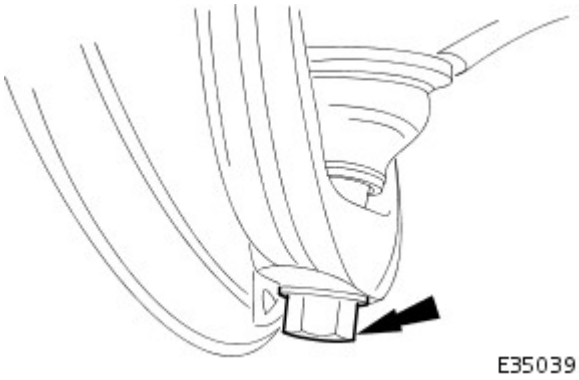
21. Clean all suspension to vertical link/hub assembly mating surfaces.

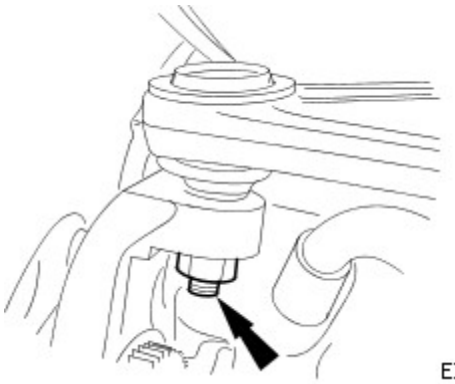
Installation



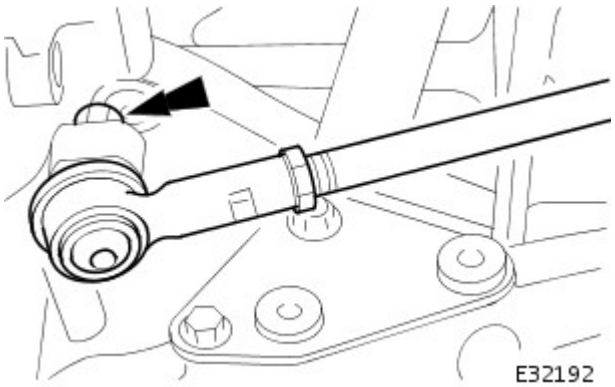
1. Position vertical link/ hub assembly on upper ball joint taper pin.

2. Position vertical link/ hub assembly on lower ball joint taper pin, install securing nut and tighten to 60-80Nm.

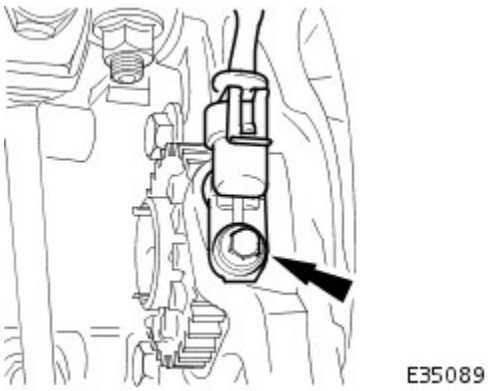




3. Install nut securing upper ball joint to vertical link and tighten to 60-80Nm.



4. Position tie rod ball joint taper pin on steering arm and install and tighten securing nut to 71-85Nm.



5. Install wheel speed sensor.

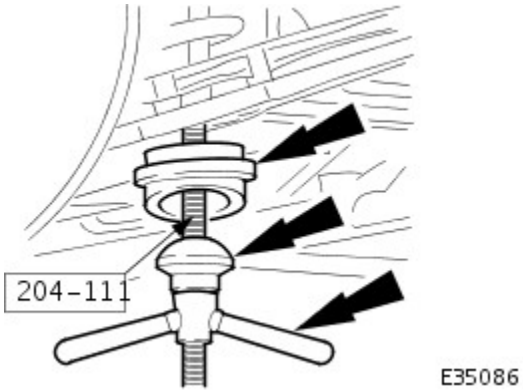
- Position wheel speed sensor on vertical link.
- Install sensor securing bolt and tighten to 8-10Nm.

6. Remove wire temporarily securing vertical link to road spring.

7. Install brake disc.

8. Release tension on road spring.

- Rotate adjuster of special tool 204-111 to release spring tension.



- Remove special tool and adaptor from spring.

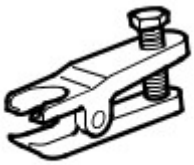
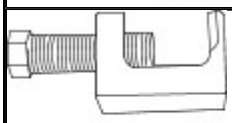
9. Install road wheel. Refer to 74.20.05.

10. Raise front of vehicle, remove stands and lower vehicle.

11. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Front Suspension - Wheel Knuckle and Wheel Hub Assembly Conversion

Removal and Installation

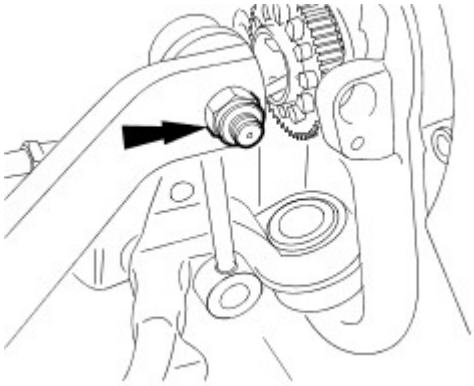
Special Tool(s)	
 E36463	Road spring compressor 204-111 (JD115)
 E36397	Taper separator 211-098 (JD 100)
 E36462	Front suspension ball joint splitter 204-192 (JD 219)
 E31837	Ball joint splitter 204-293

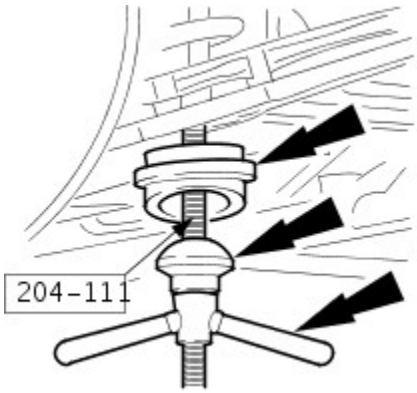
Removal

1. Raise front of vehicle and support on stands. Refer to Section 100-02.
2. Remove appropriate road wheel. Refer to 74.20.05.
3. Remove brake disc. Refer to 70.10.12.
4. Using wire or string, secure brake caliper to road spring to take weight off brake hose.
5. Raise vehicle sufficient to provide access for special tool 204-111.
6. Remove nut and bolt securing stabilizer bar link arm to lower wishbone.


E35129

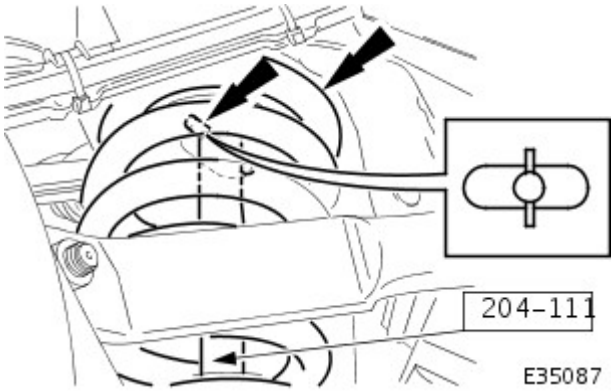
7. Remove nut securing link arm ball joint to stabilizer bar and remove link arm from vehicle.





8. Install special tool 204-111 in road spring.

- Slacken tool adjuster to suit spring length.
- Fit adaptor and thrust collar.
- Position stem of tool in center of spring passing dowel through slot in suspension turret.

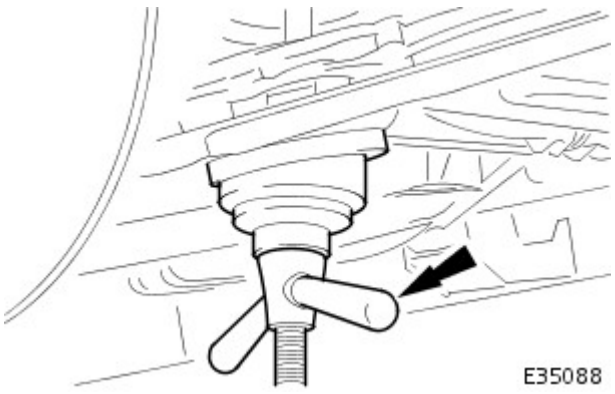


9. WARNING: WHEN TURNING TOOL ADJUSTER, ENSURE THAT TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

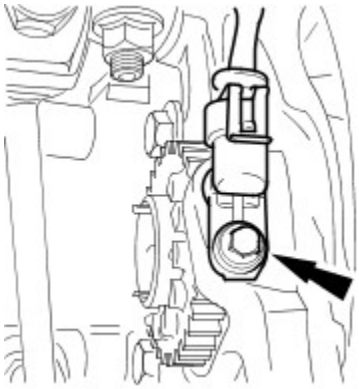
Engage dowel of special tool 204-111 in suspension turret and rotate to position across slot.

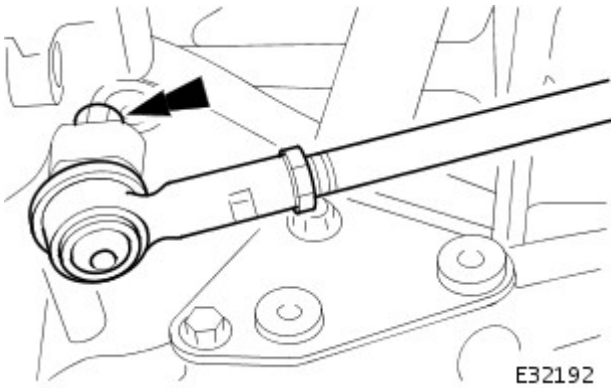
10. Lower vehicle onto stands.

11. Rotate tool adjuster to tension spring.

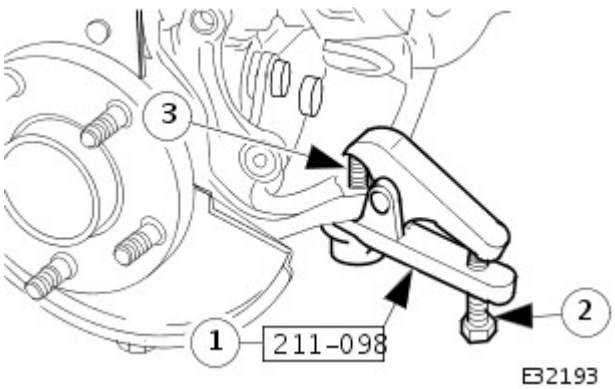


12. Remove wheel speed sensor securing screw and withdraw sensor from vertical link.





13. Remove nut securing tie rod outer ball joint to steering arm.

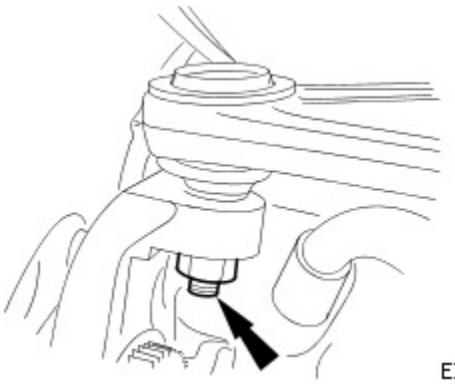


14. Release ball joint from vertical link.

1. Install special tool 211-098 on tie rod outer ball joint.
2. Tighten tool bolt to release taper pin from vertical link.

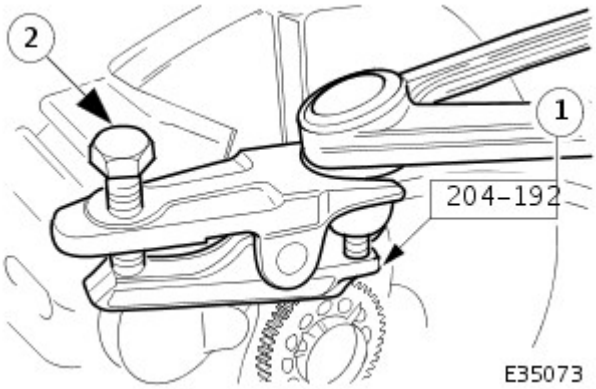
15. Remove special tool from ball joint and position tie rod for access.

16. Remove nut securing upper wishbone ball joint to vertical link.

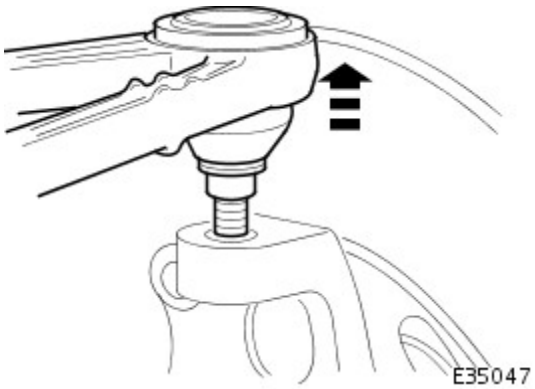


17. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

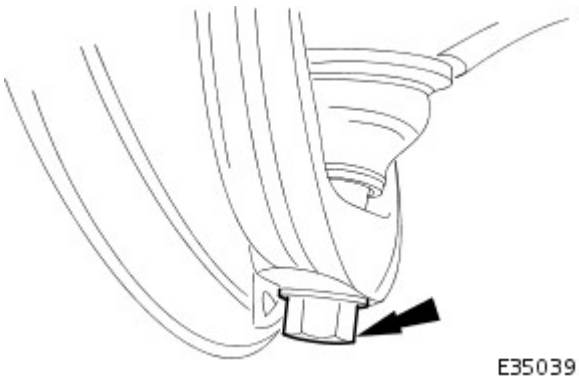
Release upper wishbone ball joint from vertical link/hub assembly.



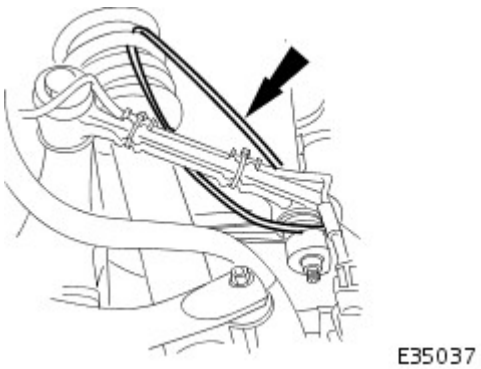
1. Install special tool 204-192 on ball joint.
2. Tighten tool bolt to release ball joint taper pin from vertical link.



18. Raise upper wishbone to release ball joint pin from vertical link.



19. Remove nut securing lower wishbone ball joint to vertical link.

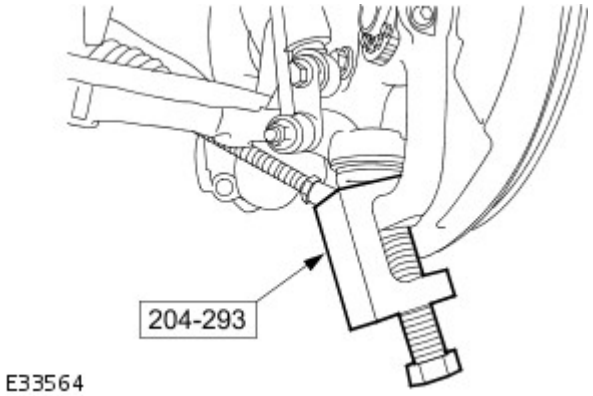


20. To prevent damage to lower ball joint, secure vertical link to road spring using strong wire.

21. CAUTION: Do not use special tool 211-098 in the following procedure as this will damage the ball joint gaiter.

Release lower wishbone ball joint from vertical link/hub assembly.

1. Install special tool 204-293 on ball joint.



E33564

2. Tighten tool bolt to release ball joint taper pin from vertical link.

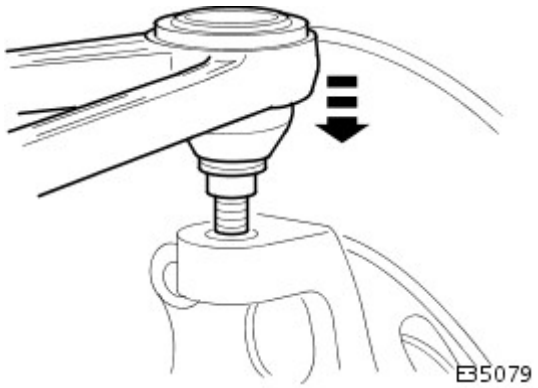
22. Remove vertical link/bearing assembly.

23. Remove special tool 204-293.

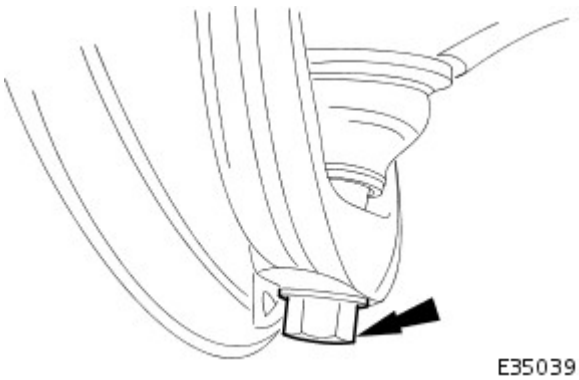
24. Clean all suspension to vertical link/hub assembly mating surfaces.

25. Repeat procedure steps 2 to 24 on opposite side of vehicle.

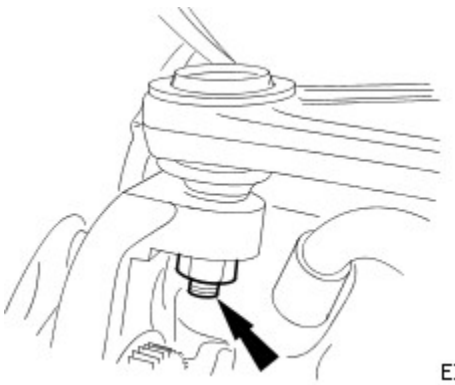
Installation


E35079

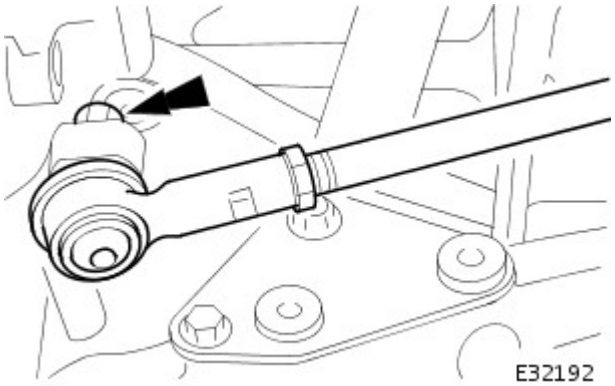
1. Position modified vertical link/ hub assembly on upper ball joint taper pin.


E35039

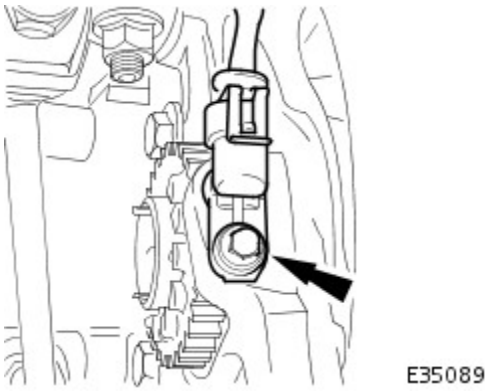
2. Position vertical link/ hub assembly on lower ball joint taper pin, install securing nut and tighten to 60-80Nm.


E35080

3. Install nut securing upper ball joint to vertical link and tighten to 60-80Nm.



4. Position tie rod ball joint taper pin on steering arm and install and tighten securing nut to 71-85Nm.

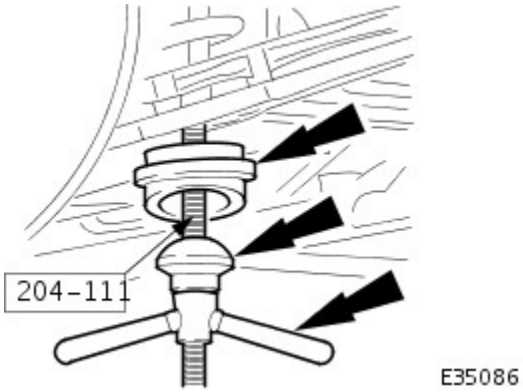


5. Install wheel speed sensor.

- Position wheel speed sensor on vertical link.
- Install sensor securing bolt and tighten to 8-10Nm.

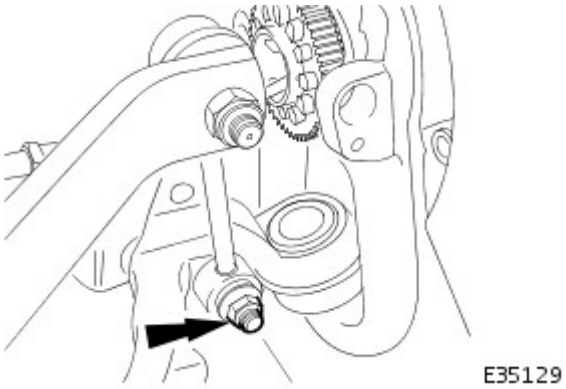
6. Remove wire temporarily securing vertical link to road spring.

7. Install brake disc.



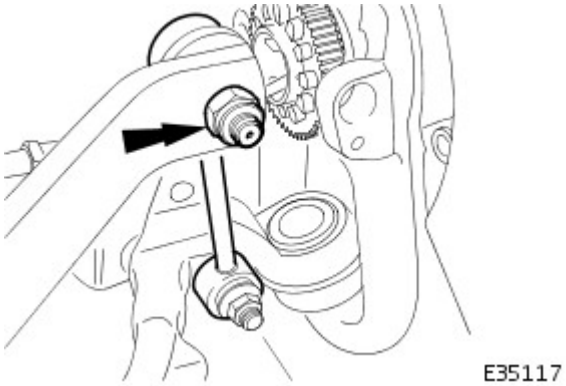
8. Release tension on road spring.

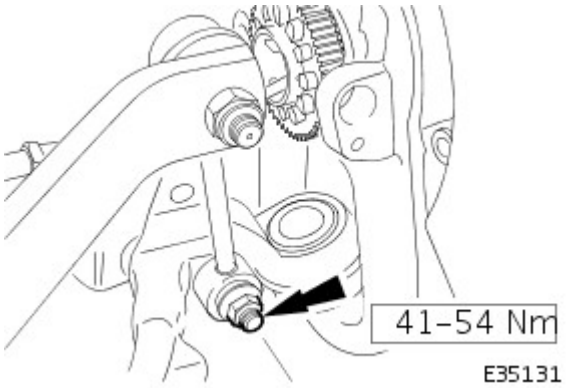
- Rotate adjuster of special tool 204-111 to release spring tension.
- Remove special tool and adaptor from spring.



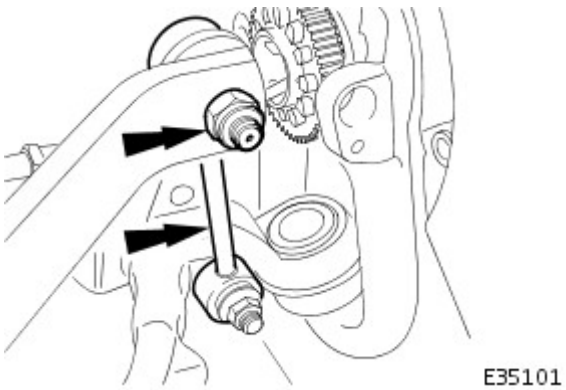
9. Position new link assembly on lower wishbone and install but do not tighten bolt.

10. Position new link arm ball joint stud in stabilizer bar and install but do not tighten nut.





11. Tighten new link arm to wishbone nut and bolt to 41-54Nm.



12. Secure new link arm to stabilizer bar.

- Tighten link arm to stabilizer bar nut to 60-80Nm.
- Check that ball joint freedom of movement has been maintained.

13. Install road wheel. Refer to 74.20.05.

14. Repeat procedure steps 1 to 13 on opposite side of vehicle.

15. Raise front of vehicle, remove stands and lower vehicle.

16. Carry out steering geometry and wheel alignment checks and if necessary adjust. Refer to 57.65.01.

Rear Suspension -

Lubricants, Fluids, Sealants and Adhesives

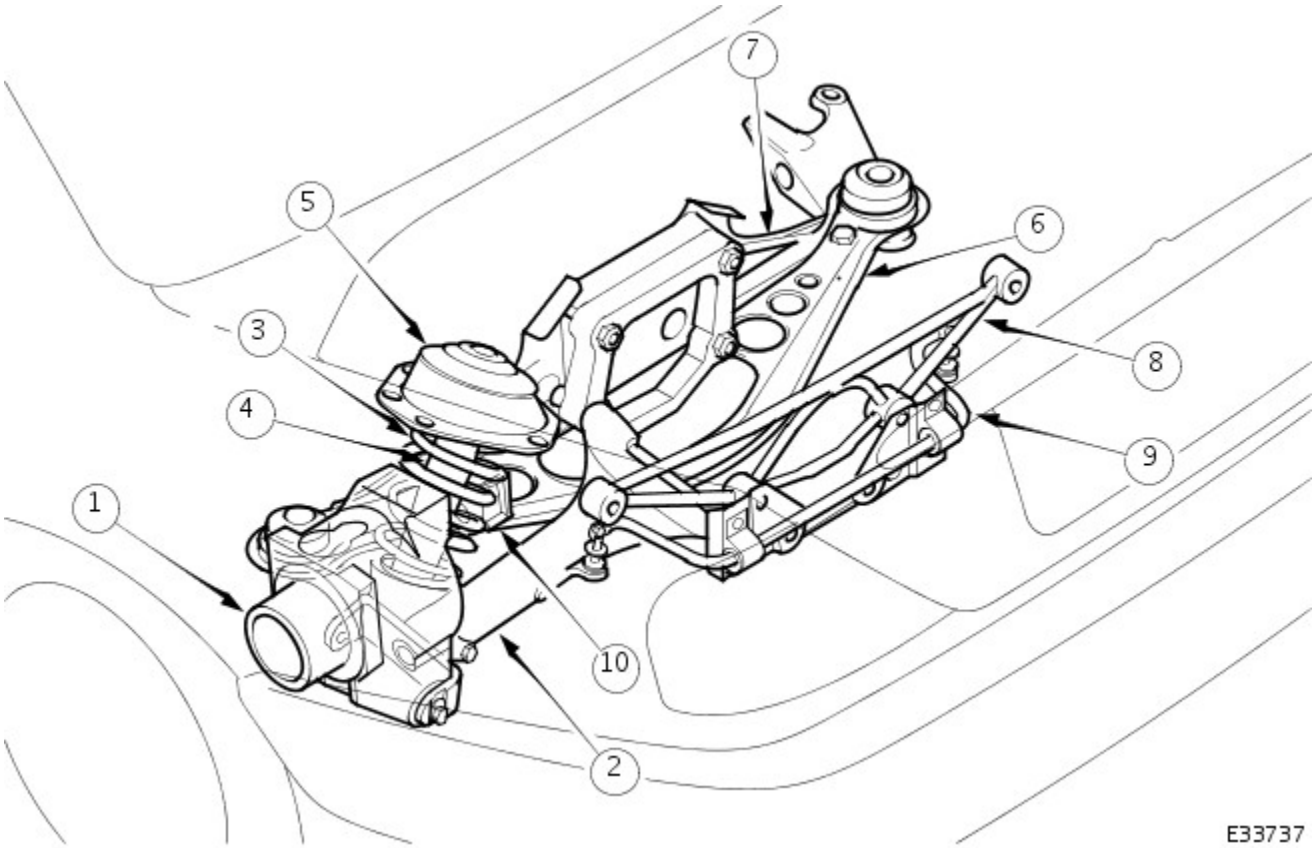
Unit	Specification
Loctite	270
Grease	Shell Retinax 'A'
Grease	Castrol 'NTR'

Torques

Component	Nm
Nut - hub to axle shaft	304 - 336
Nut - hub carrier pivot pin	88-118
Bolt - ABS sensor to hub carrier	8-10
Nut - stabilizer bar link to lower wishbone.	30-40
Nut - stabilizer bar to link assembly.	30-40
Bolts - monostrut to body mounting brackets	88-118
Bolts - monostrut to wishbone tie assembly	77-103
Bolts - bump stop to body	26-34
Bolt - damper lower mounting	80-100
Nut - damper top	31-39
Bolts - damper mounting plate to body	17-23

Rear Suspension - Rear Suspension

Description and Operation



Item	Part Number	Description
1	—	Hub Carrier
2	—	Wishbone
3	—	Spring
4	—	Shock Absorber
5	—	Suspension Turret
6	—	Suspension Subframe
7	—	Mounting Bracket
8	—	Differential Strut
9	—	Stabilizer Bar (Supercharged and Sport Suspension Models only)
10	—	Bump Stop

Description

The independent rear suspension incorporates co-axial spring and shock absorber units, a subframe, wishbone tie, pendulum assembly, mounting bracket, differential strut, cast wishbones and hub carriers. The suspension assembly is positively located by the subframe, mounting bracket and differential strut.

- Each wishbone pivots on a fulcrum bolt which locates in the wishbone tie and pendulum assembly.
- The wishbone tie and pendulum assemblies are respectively installed at the front and rear of the final drive housing.
- The differential strut is secured to the wishbone tie assembly.
- Two tie rods are installed between the front of the subframe and the top of the final drive housing.
- The outer extremity of each wishbone is secured to its respective hub carrier assembly by a fulcrum bolt.

Each fulcrum bolt head incorporates an eccentric circular flange which locates in a groove in the front face of the wishbone arm. Rotation of the fulcrum bolt results in horizontal movement of the bolt shank in an elongated hole in the rear of the wishbone arm. This action achieves corresponding movement of the hub carrier, facilitating adjustment of road wheel toe-in.

- Each road spring and is located between the wishbone integral spring seat and the body suspension turret.
- Each shock absorber unit is installed co-axially within the road spring.
- The lower end of each shock absorber is secured to the wishbone by a bolt which also functions as a pivot.
- Adaptive damping is available as an option.
- A rear stabilizer bar is installed on Supercharged and Sport Suspension models. Mounted at the rear of the wishbone tie assembly, the stabilizer bar is connected to the wishbone by short links.

Operation

As each road wheel rises, movement is transmitted through the hub carrier assembly to the wishbone and axle shaft. The corresponding rise of the wishbone compresses the road spring and partially telescopes the shock absorber. During this action, the spring absorbs resulting shocks and the shock absorber minimizes spring oscillation.

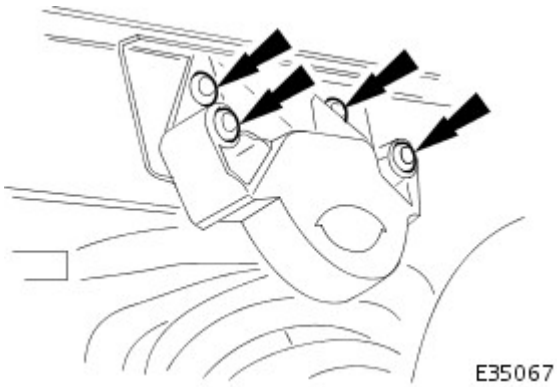
During cornering, vehicle weight is transferred to the outer road wheel with a resulting tendency for the inner wheel to lift. On Supercharged and Sport Suspension vehicles, a rear stabilizer bar assists in minimizing this tendency by transferring a proportion of potential lift of the inner wheel to the outer wheel. This results in enhanced body stability with improved cornering capabilities.

Rear Suspension - Axle Bump Stop

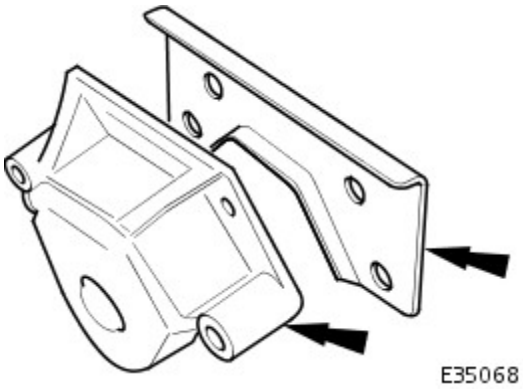
Removal and Installation

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

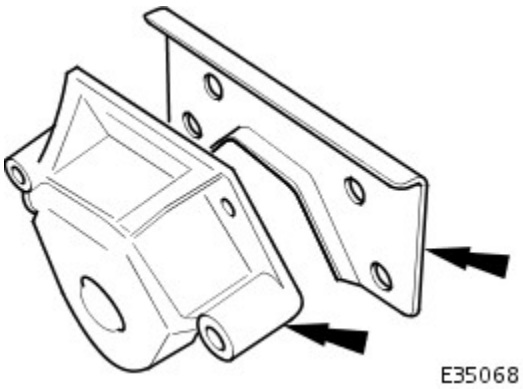


1. Raise rear of vehicle and support on stands. Refer to Section 100-02.
2. Remove appropriate road wheel. Refer to Section 100-02.
3. Remove bolts securing bump stop to body.

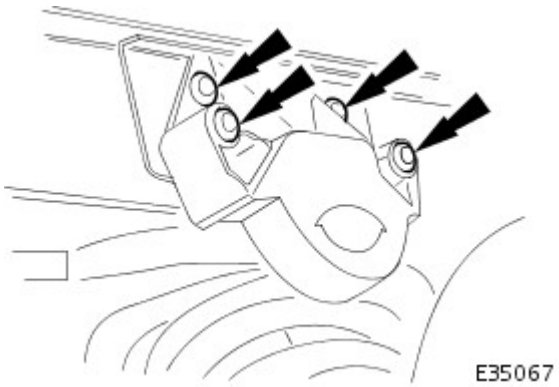


4. Remove bump stop and where applicable, reinforcement bracket from vehicle.

Installation



1. Position reinforcement bracket (where applicable) and bump stop on vehicle.
2. Install bump stop bolts and tighten to 26-34Nm.



3. Install road wheel. Refer to Section 100-02.
4. Raise vehicle remove stands and lower vehicle. Refer to Section 100-02.

Rear Suspension - Rear Suspension and Axle Assembly

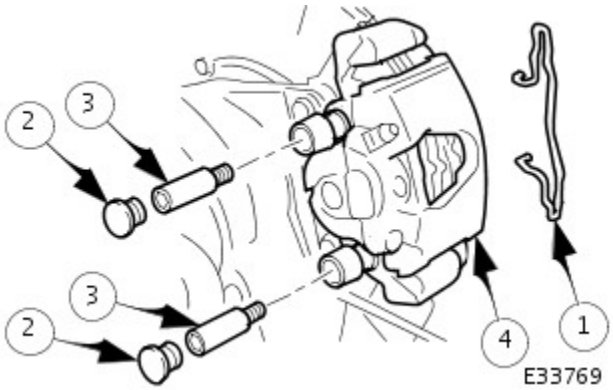
Removal and Installation

Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.
For additional information, refer to Section 100-00 General Information.

Raise the rear of the vehicle and support on axle stands.
For additional information, refer to Section 100-02 Jacking and Lifting.

2. Remove the rear wheels.
For additional information, refer to Section 204-04 Wheels and Tires.

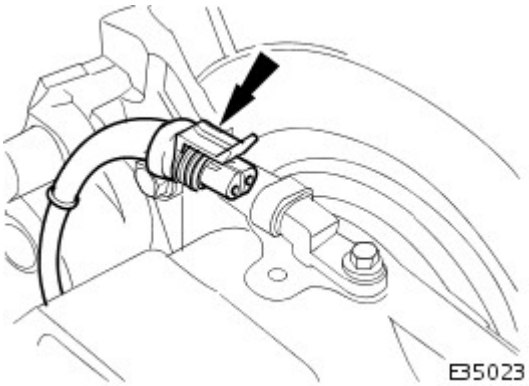


3. CAUTION: Do not suspend the caliper from the brake hose as this will damage the hose.

• NOTE: Right-hand shown, left-hand similar

Remove the brake calipers from the carriers.

1. Remove the caliper spring clip.
2. Remove the guide pin dust caps.
3. Slacken and withdraw the guide pins.
4. Remove the caliper from the carrier and secure to the suspension mounting bracket using a tie strap.

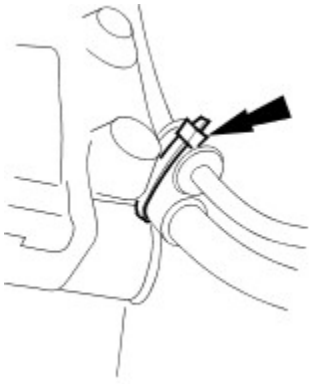


4. NOTE: Right-hand shown, left-hand similar

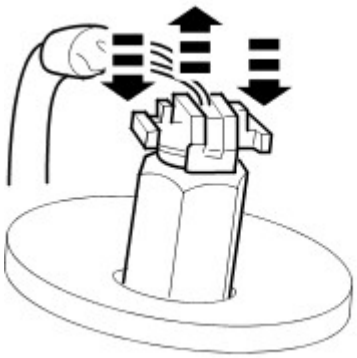
Disconnect the wheel speed sensor electrical connectors.

5. NOTE: Right-hand shown, left-hand similar

Remove and discard the tie straps securing the wheel speed sensor harnesses to the brake hose clips.



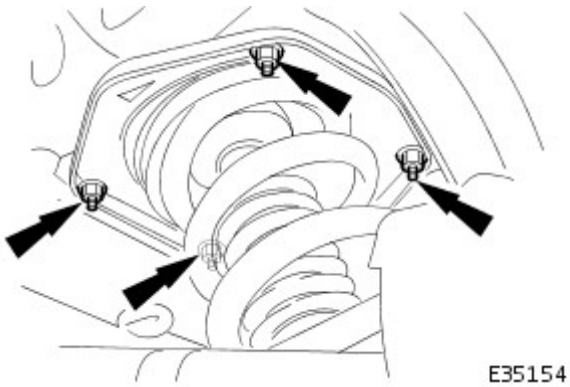
E35235



E35165

6. On vehicles with adaptive damping:

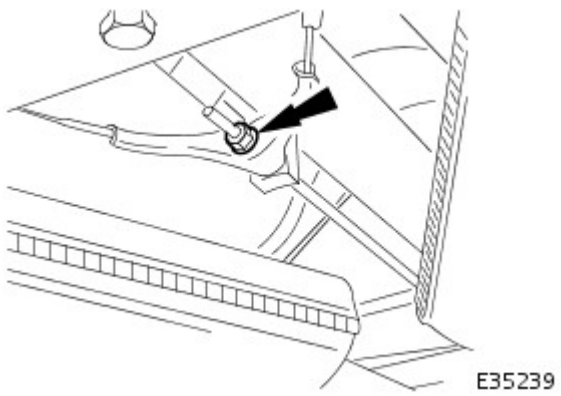
- Remove the top cover from the shock absorbers.
- Disconnect the shock absorber electrical connectors by pressing the lugs down and pulling the connectors up.



E35154

7. NOTE: Right-hand shown, left-hand similar

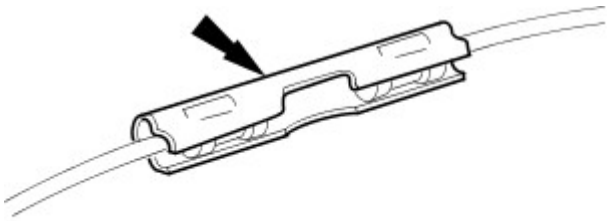
Remove shock absorber upper mounting plates to body nuts.



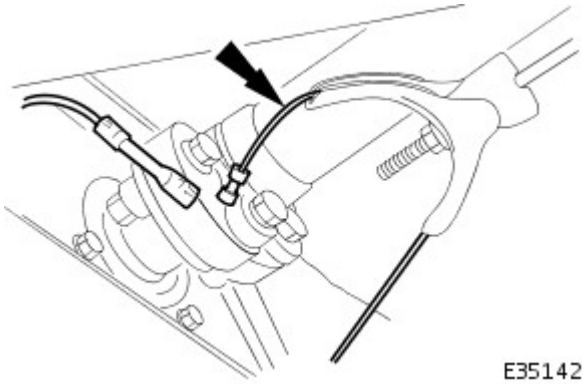
E35239

8. Fully slacken but do not remove the parking brake cable adjuster nut.

9. Release the parking brake cable from the connecting clip.

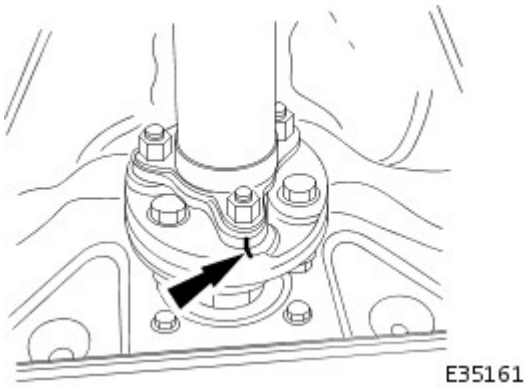


E34975



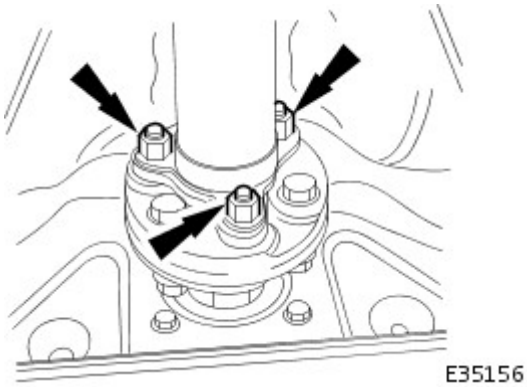
E35142

10. Withdraw the left-hand parking brake cable through the equalizer.



E35161

11. Mark the position of the drive shaft coupling to the flexible coupling.



E35156

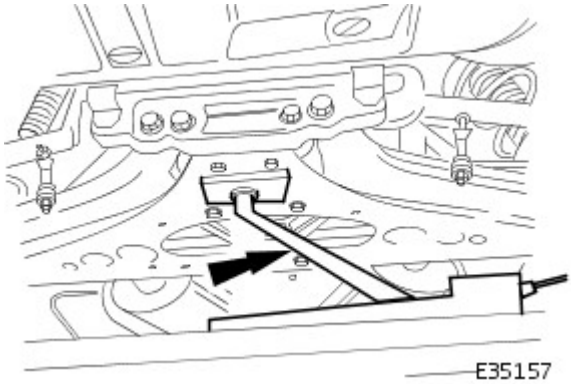
12. Remove the drive shaft from the differential drive coupling.

- Remove the drive shaft to differential drive coupling bolts.
- Carefully withdraw and lower the drive shaft from the differential coupling.

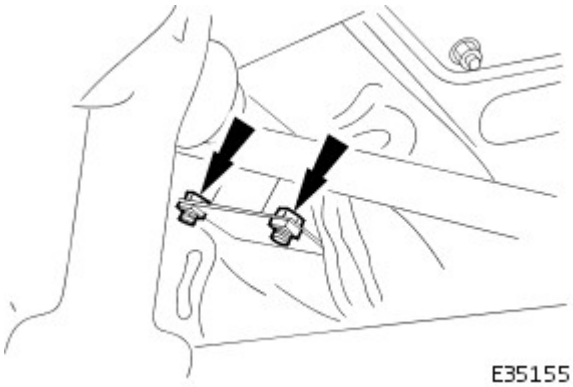
13. CAUTION: Position a suitable piece of wood between the jack and the rear suspension and axle assembly. Failure to follow this instruction may result in damage to the vehicle.

Support the rear suspension and axle assembly.

- Position a trolley jack under the rear suspension and axle assembly.

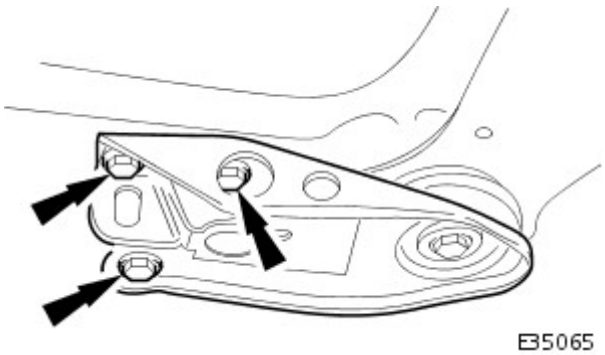


- Position a suitable piece of wood between the jack and the rear suspension and axle assembly.
- Raise the jack to take the weight of the rear suspension and axle assembly.



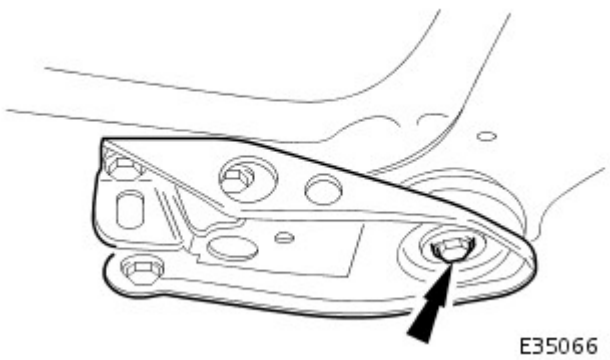
14. NOTE: Left-hand shown, right-hand similar

Remove the exhaust mounting to suspension bracket bolts.



15. NOTE: Right-hand shown, left-hand similar

Remove and discard the subframe front mounting brackets to body bolts.



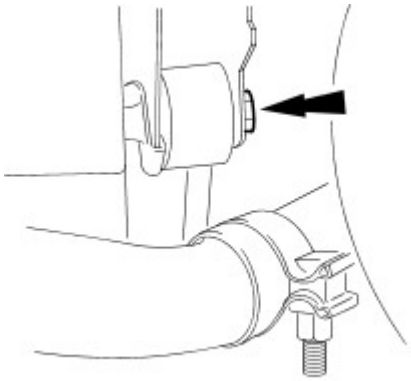
16. NOTE: Right-hand shown, left-hand similar

Remove the subframe front mounting brackets.

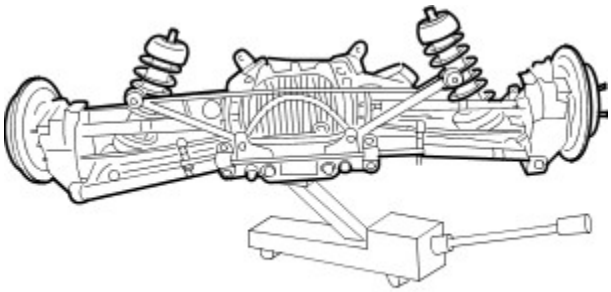
- Remove and discard the mounting bracket to subframe bolts.
- Remove the front mounting bracket.

17. NOTE: Left-hand shown, right-hand similar

Remove differential strut upper mounting to body bracket securing bolts.



E35059



E35158

18. WARNING: With assistance, support the rear suspension and axle assembly during removal. Failure to follow this instruction may result in personal injury.

Remove the rear suspension and axle assembly.

- Ensure that the hydraulic pipes, brake calipers, harnesses and the drive shaft will not obstruct the rear suspension and axle assembly during removal.
- Carefully lower the rear suspension and axle assembly and traverse clear of vehicle.

19. Retrieve the subframe mounting bush shims.



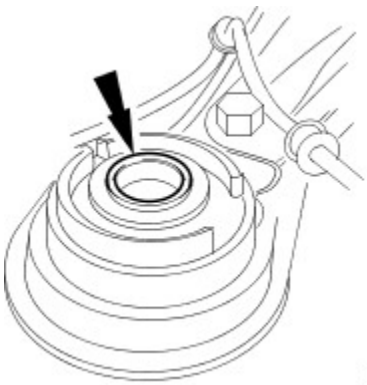
E35159

20. With assistance, position the rear suspension and axle assembly on to a bench.

21. Clean the subframe mounting bushes and corresponding body locations.

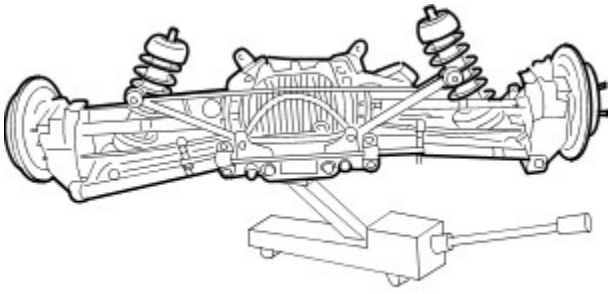
Installation

1. Apply a thin coat of grease to the subframe bushes and place the shims in position.



E35160

2. WARNING: With assistance, support the rear suspension



E35158

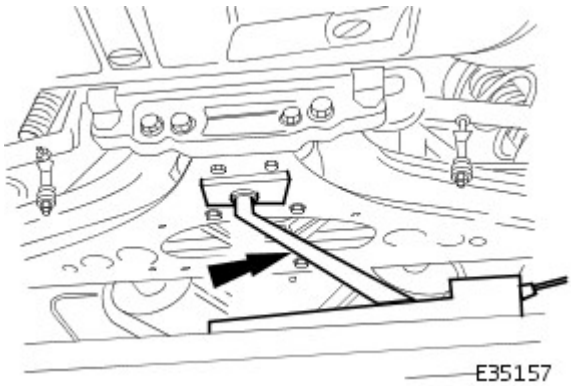
and axle assembly during installation. Failure to follow this instruction may result in personal injury.

CAUTION: Position a suitable piece of wood between the jack and the rear suspension and axle assembly. Failure to follow this instruction may result in damage to the vehicle.

Position the rear suspension and axle assembly on to a trolley jack.

3. WARNING: With assistance, support the rear suspension and axle assembly during installation. Failure to follow this instruction may result in personal injury.

Position the rear suspension and axle assembly under the vehicle.

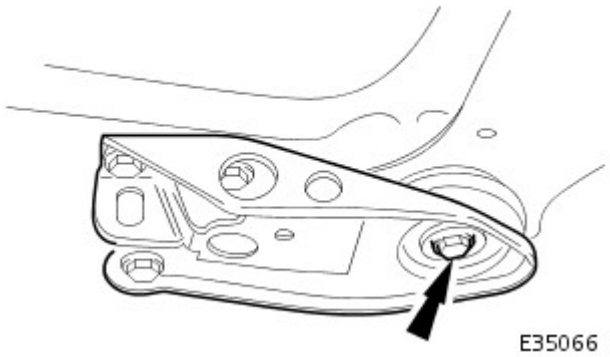


E35157

4. WARNING: With assistance, support the rear suspension and axle assembly during installation. Failure to follow this instruction may result in personal injury.

Raise the trolley jack to position the rear suspension and axle assembly to the vehicle.

5. NOTE: Right-hand shown, left-hand similar

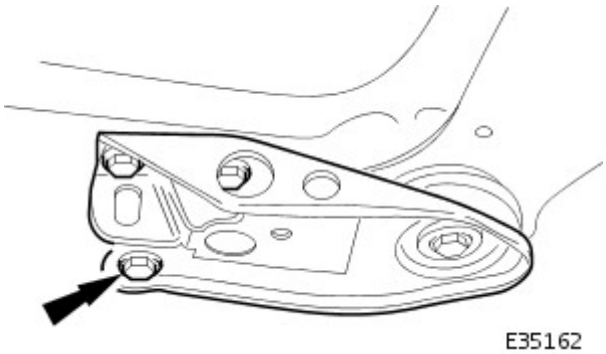


E35066

Install the mounting brackets.

- Position the mounting brackets to the subframe.
- Install but do not tighten new bolts to the mounting bracket .

6. NOTE: Right-hand shown, left-hand similar

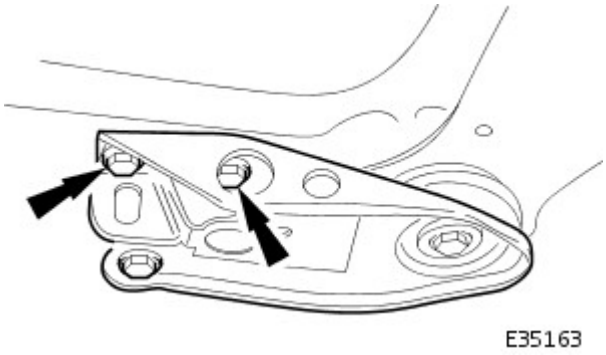


E35162

Install new outer bolts to the mounting bracket.

- Tighten to 41-54 Nm.

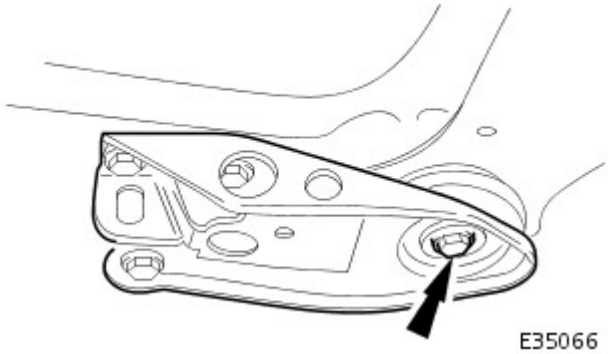
7. NOTE: Right-hand shown, left-hand similar


E35163

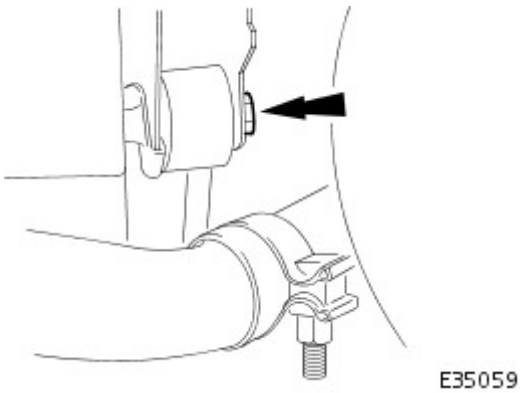
Install new inner mounting bracket bolts.

- Tighten to 88-118 Nm.

8. NOTE: Right-hand shown, left-hand similar


E35066

Tighten to 88-118 Nm.


E35059

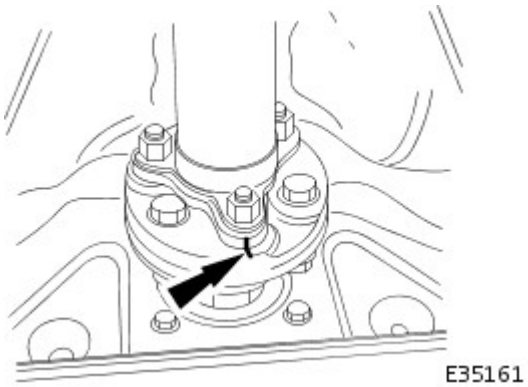
9. NOTE: Right-hand shown, left-hand similar

Install new differential strut to body bracket bolts.

- Tighten to 68-92 Nm.

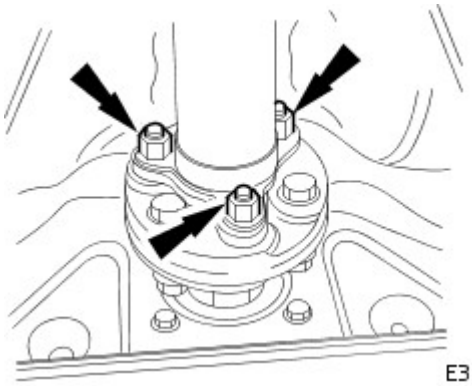
10. Lower and remove trolley jack.

11. Attach the drive shaft to the flexible coupling.

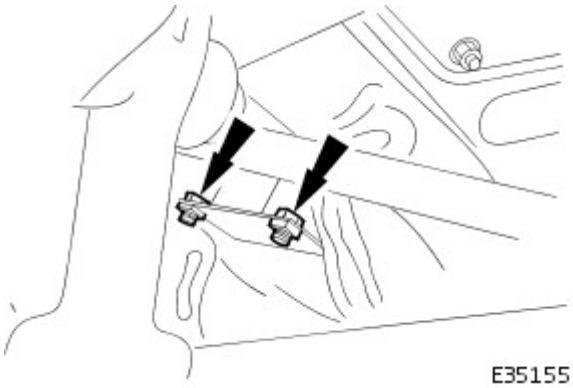

E35161

- Align the marks previously painted on drive shaft and flexible coupling.
- Install new drive shaft coupling bolts and nuts.

12. Tighten to 76-88 Nm.



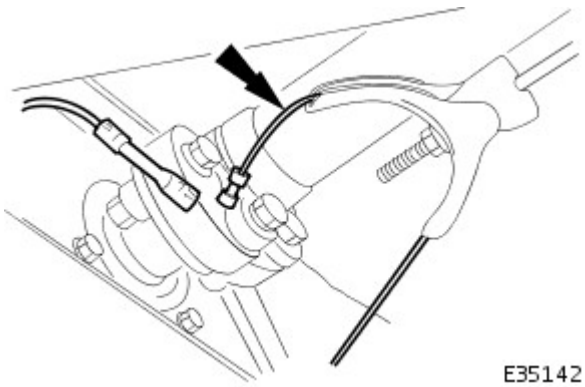
E35156



E35155

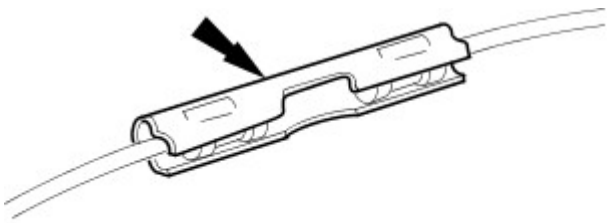
13. Install the exhaust brackets.

- Position exhaust mounting bracket on subframe.
- Install bolts and nuts.
- Tighten to 22-28 Nm.



E35142

14. Route the left hand parking brake cable through the equalizer.



E34975

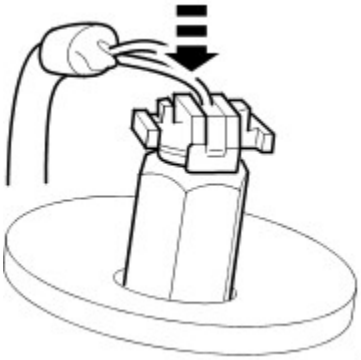
15. Install the parking brake cable in to the connecting clip.

16. Adjust the parking brake cable. Refer to 70.35.10.

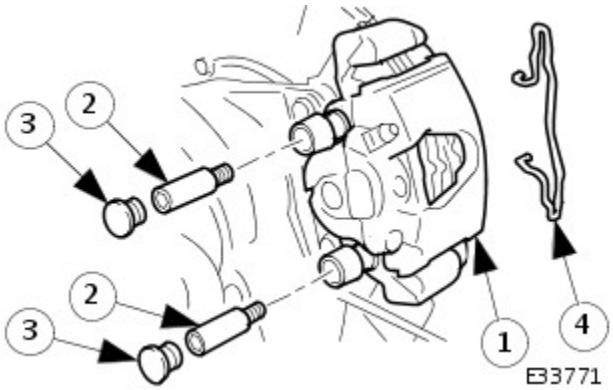
17. CAUTION: Make sure the adaptive damping electrical connector is correctly aligned. Failure to follow these instructions may cause damage to the electrical connector.

On vehicles with adaptive damping:

- Connect the shock absorber electrical connector, ensuring the electrical connector key locates in the socket keyway.



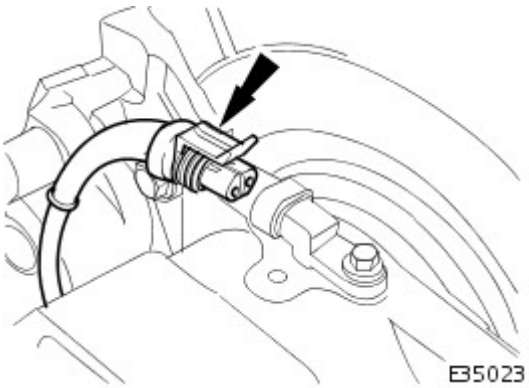
E35164



E33771

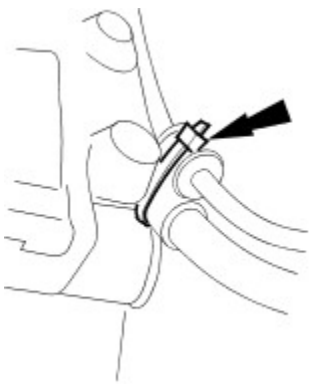
18. Install the brake caliper on to the carrier.

1. Position the caliper assembly on to the carrier.
2. Install the guide pins and tighten to 25-30 Nm.
3. Install the dust caps.
4. Install the brake caliper spring clip.



E35023

19. Connect the wheel speed sensor electrical connector.



E35235

20. Using a new tie strap, secure the wheel speed sensor harness to the brake hose clip.

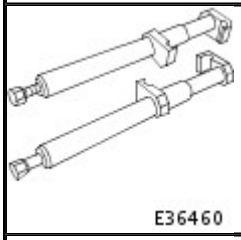
21. Install the rear wheels.
For additional information, refer to Section 204-04 Wheels and Tires.

22. Remove the axle stands and lower the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

23. Check and adjust the rear wheel alignment as necessary.
For additional information, refer to Section 204-00 Suspension System - General Information.

Rear Suspension - Rear Shock Absorber

Removal and Installation

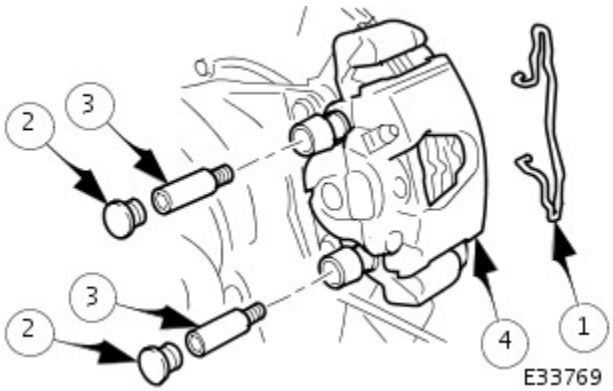
Special Tool(s)	
 E36460	Spring Compressors 204-179 (JD 199)
 E36461	Spring Retaining straps 204-179-1 (JD 199-1)

Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.
For additional information, refer to Section 100-00 General Information.

Raise the rear of the vehicle and support on axle stands.
For additional information, refer to Section 100-02 Jacking and Lifting.

2. Remove the relevant rear wheel.
For additional information, refer to Section 204-04 Wheels and Tires.



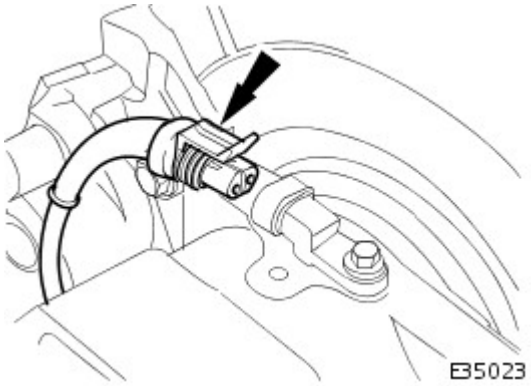
E33769

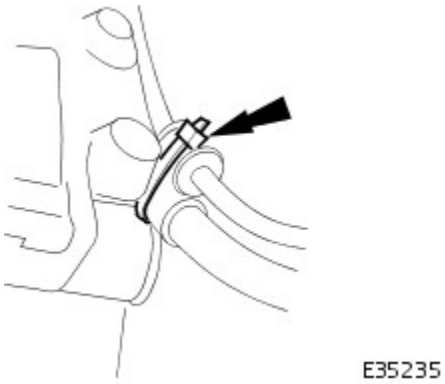
3. CAUTION: Do not suspend the caliper from the brake hose as this will damage the hose.

Remove the brake caliper from the carrier.

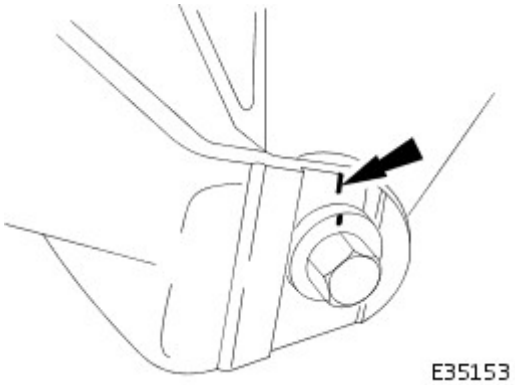
1. Remove the caliper spring clip.
2. Remove the guide pin dust caps.
3. Slacken and withdraw the guide pins.
4. Remove the caliper from the carrier and secure to the suspension mounting bracket using a tie strap.

4. Disconnect the wheel speed sensor electrical connector.

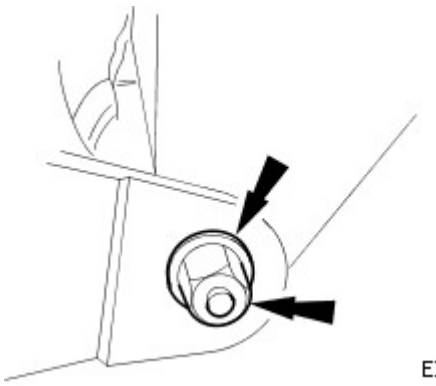




5. Remove and discard the tie strap securing the wheel speed sensor harness to the brake hose clip.



6. Mark the wishbone at the pivot pin eccentric flange marker to aid installation.

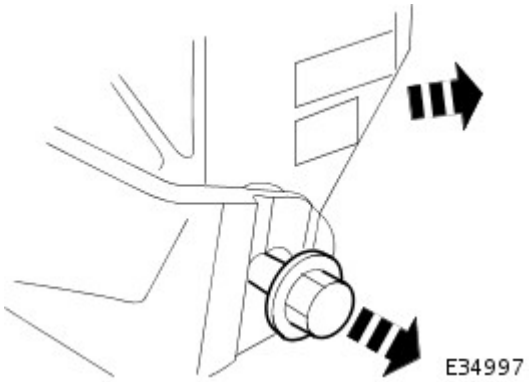


7. Remove the pivot pin nut and washer.

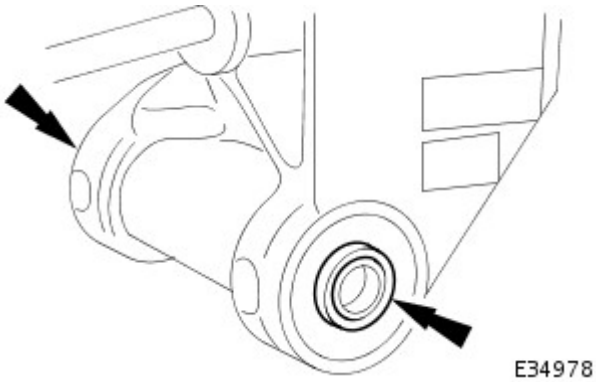
8. CAUTION: To prevent damage to the parking brake cable, the hub carrier must be supported on removal from the wishbone.

Remove the hub carrier from the wishbone.

- Remove the pivot pin from the hub carrier.

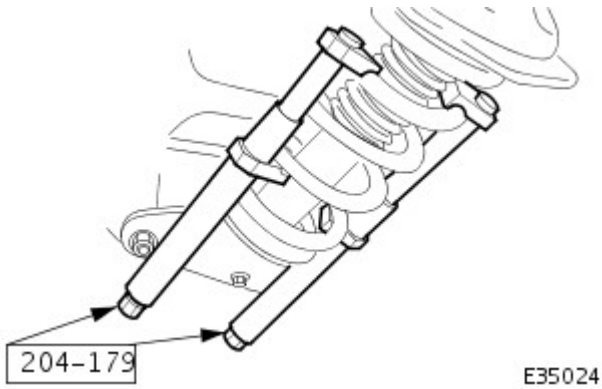


- Withdraw the hub carrier and support on a block of wood.



9. CAUTION: Note the position of the shims during removal. They must be returned to their original position during installation.

Noting their positions, remove the shim from each end of the pivot pin sleeve.



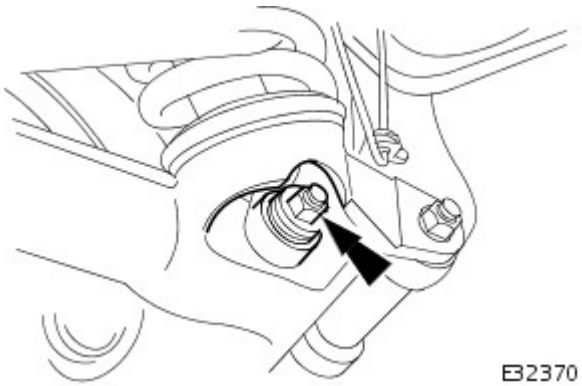
10. WARNINGS:

ENSURE THE SPECIAL TOOLS ARE POSITIONED DIAMETRICALLY OPPOSITE ON THE SPRING AND THE ARMS ARE CORRECTLY SEATED .

WHEN COMPRESSING THE SPRING, TIGHTEN THE SPECIAL-TOOL ADJUSTMENT BOLTS EVENLY.

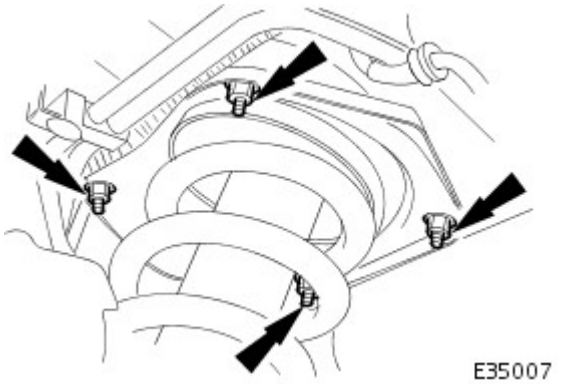
Compress the spring.

- Install and align the special tools 204-179 diametrically opposite on the spring.
- Evenly tighten the special tool tensioning bolts to compress the spring.

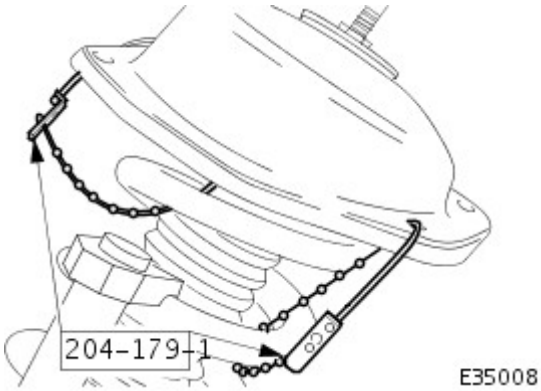


11. Remove the shock absorber to wishbone mounting nut and bolt.

12. Remove the nuts securing the shock absorber and spring upper mounting to the body.

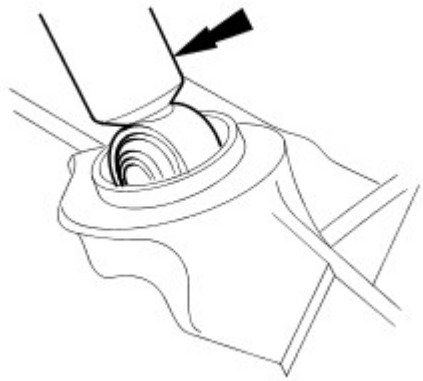


E35007



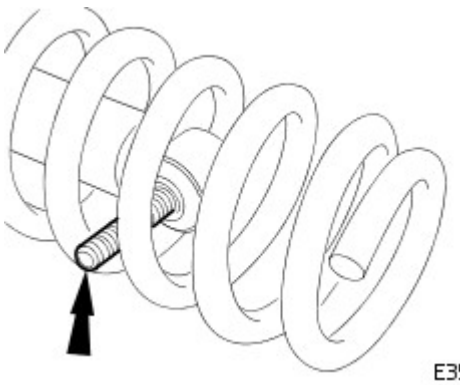
E35008

13. Using the special tools 204-179-1, secure the upper mounting to the spring.



E35017

14. Using a jack, retract the shock absorber through the wishbone aperture.



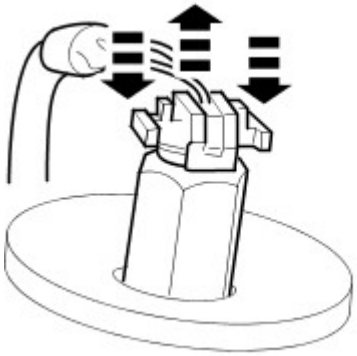
E35018

15. Position a bolt through the spring coils and shock absorber lower-bush, to temporarily locate the shock absorber.

16. Partially lower the jack for access to the top of the shock absorber.

17. On vehicles with adaptive damping:

- Disconnect the shock absorber electrical connector by pressing the lugs down and pulling the connector up.



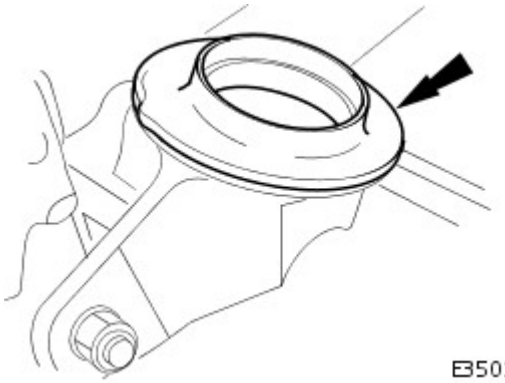
E35165

18. Lower and remove the jack.

19. Remove the shock absorber and spring assembly from the vehicle and place the assembly on a work bench.

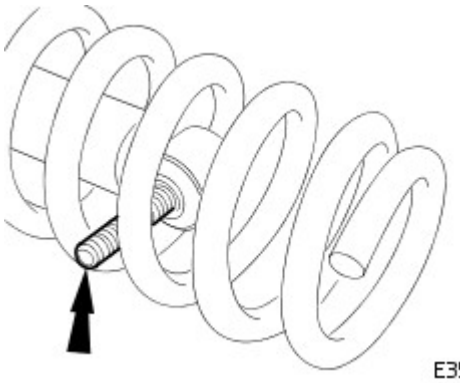
20. Clean the upper mounting spring location.

21. Remove the pigtail seat and clean the wishbone lower spring location.



E35011

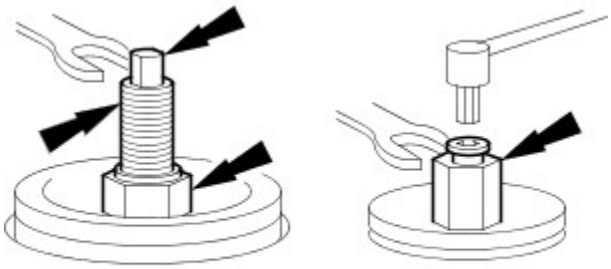
22. With assistance, manually compress the shock absorber and withdraw the bolt from the spring coils.



E35018

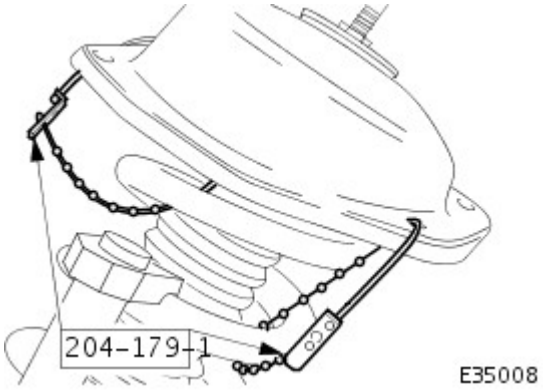
23. Remove the shock absorber from the upper mounting.

- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Remove the shock absorber upper retaining nut.
- Remove the upper washer and isolator.



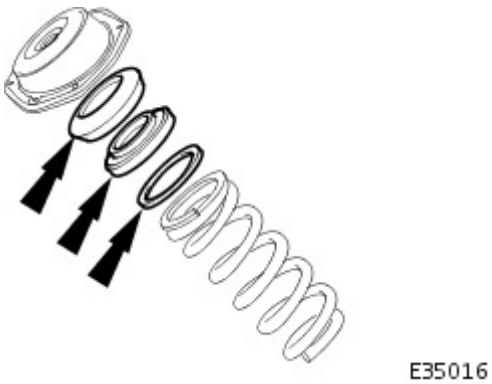
E35166

24. Remove the special tools 204-179-1 and remove the upper mounting from the spring.

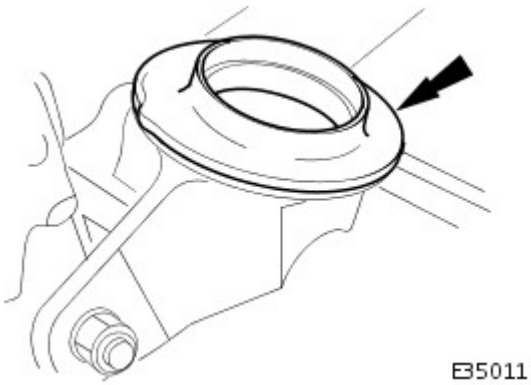


25. Remove the shock upper mounting assembly from the spring.

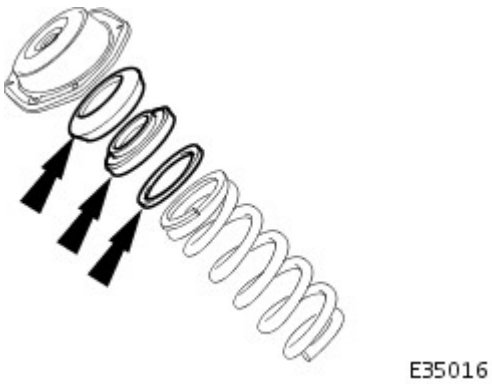
- Remove the spring upper isolator.
- Remove the upper spring pan.
- Remove the packing ring.



Installation



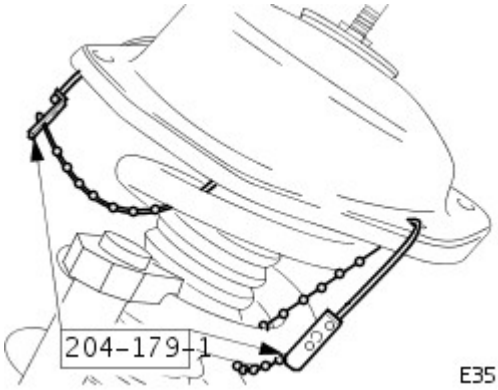
1. Install the spring pigtail lower seat on to the wishbone.



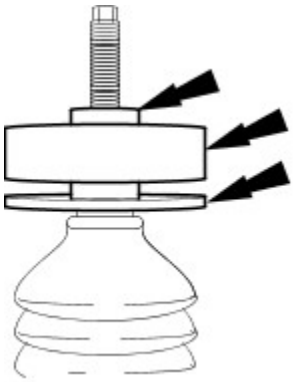
2. Install the spring in the upper mounting.

- Install the spring upper isolator.
- Install the upper spring pan.
- Install the packing ring.

3. Ensuring the correct orientation, secure the upper mounting to the spring using the special tools 204-179-1.

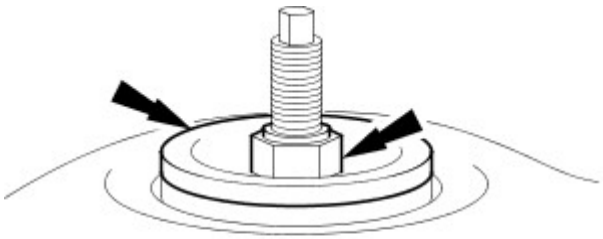


E35008


E35020

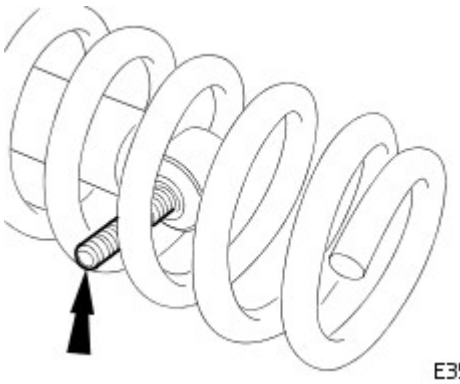
4. Position the spring upper mounting assembly on to the shock absorber.

- Apply a thin coat of grease to the upper mounting bush.
- Ensure that the washer, lower isolator and bush are correctly positioned on the shock absorber shaft.
- Position the shock absorber shaft in the upper mounting.


E35021

5. Secure the top of the shock absorber to the upper mounting.

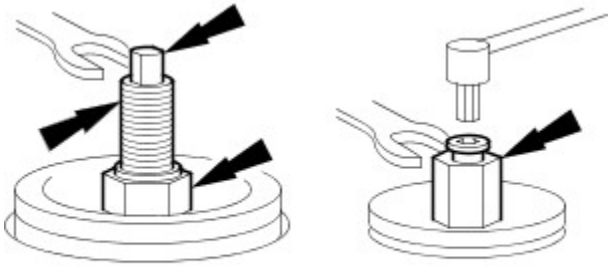
- Install the spring upper isolator.
- Install the upper washer.
- Install but do not tighten the locknut on to the shock absorber.


E35018

6. Manually retract the shock absorber and place a bolt through the spring coils and the shock absorber lower-bush.

7. Secure the shock absorber to the upper mounting.

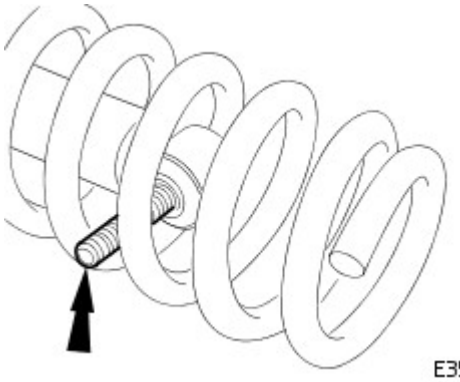
- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Tighten the shock absorber upper lock nut to 30-40 Nm (16-18 Nm on vehicles with adaptive damping).



E35166

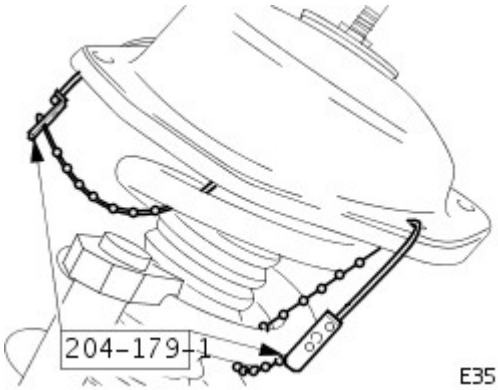
8. Position the shock absorber and spring assembly to the vehicle.

9. With assistance, manually retract the shock absorber and remove the temporary securing bolt.



E35018

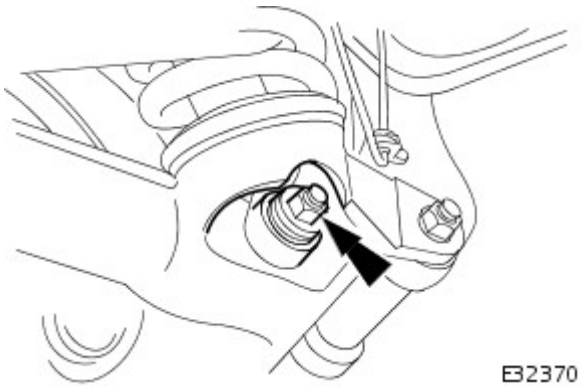
10. Remove the special tools 204-179-1.



E35008

11. Align the shock absorber lower bush to the wishbone and install the mounting bolt.

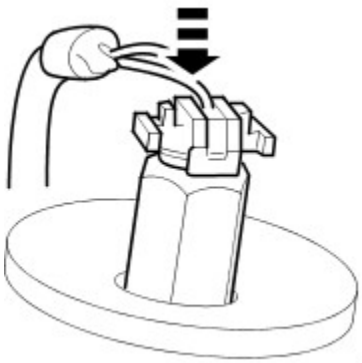
1. Install but do not tighten the nut.



E32370

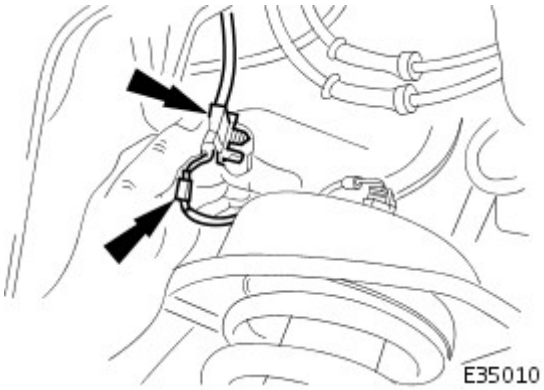
12. CAUTION: Make sure the adaptive damping electrical connector is correctly aligned. Failure to follow these instructions may cause damage to the electrical connector.

On vehicles with adaptive damping:



E35164

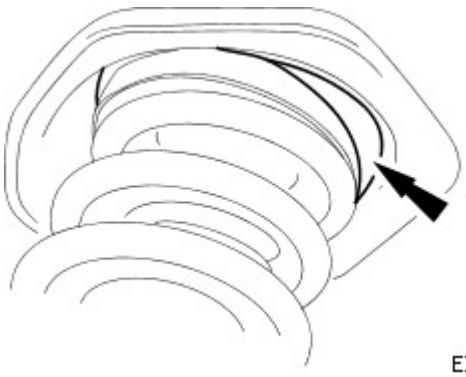
- Connect the shock absorber electrical connector, ensuring the electrical connector key locates in the socket keyway.



E35010

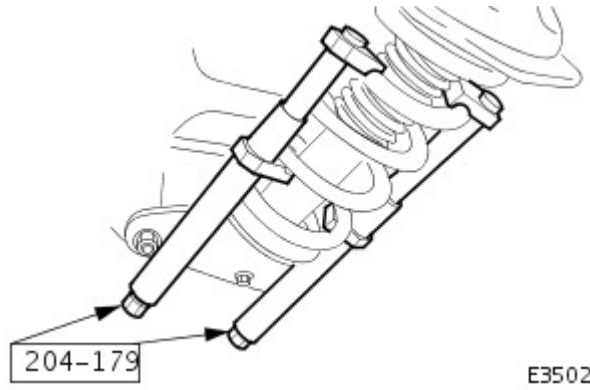
13. Seat the upper mounting in the body location.

1. If adaptive damping is installed, ensure the harness is correctly positioned.



E35022

14. Ensuring that the spring is seated on the isolator and spring pan, position the upper spring pan on to the body studs.



E35024

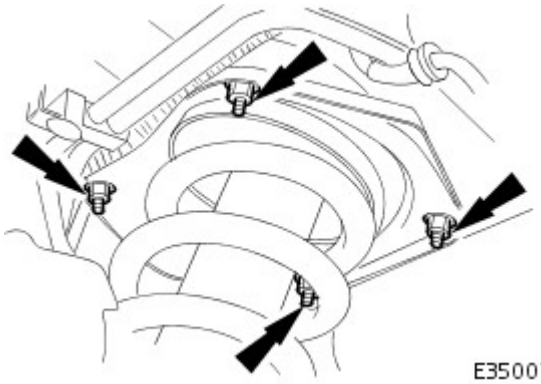
15. Release the spring tension.

- Ensuring that the spring is correctly located, evenly slacken the adjuster bolts on the special tools 204-179.

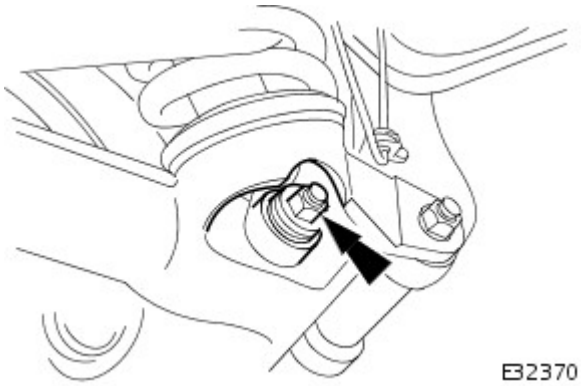
16. Remove the special tools 204-179.

17. Fully seat and secure the upper spring pan to the body.

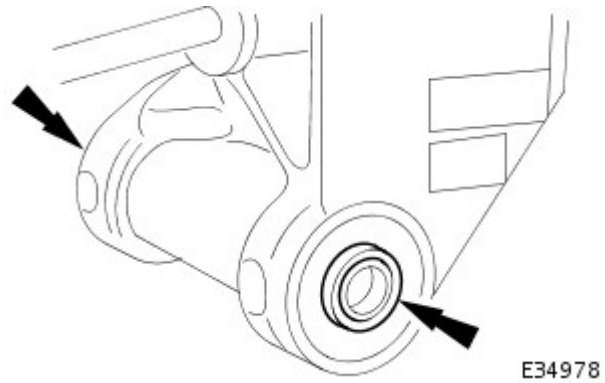
- Ensure the spring pan is correctly seated in the body location.
- Install the nuts securing the spring pan to the body studs.



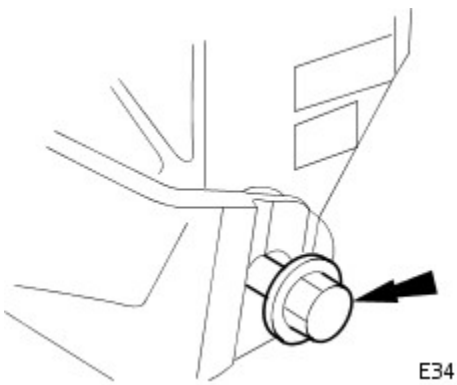
- Tighten to 17-23 Nm.



18. Tighten to 80-100 Nm.



19. Install the shims on the pivot pin sleeve in the positions noted during removal.

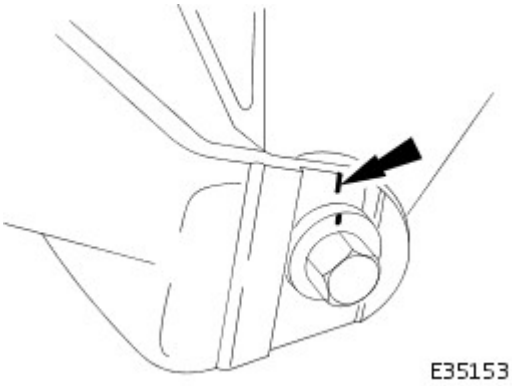


20. Install the hub assembly to the wishbone assembly.

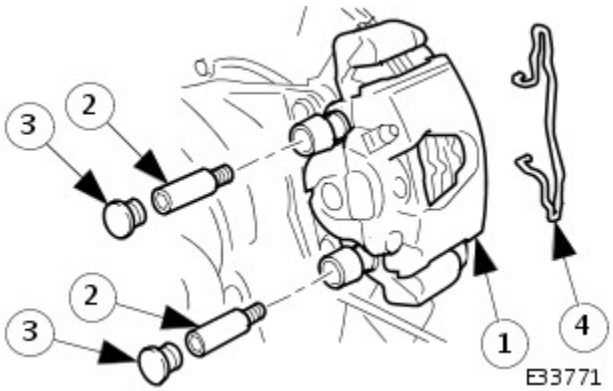
- Position the hub and carrier to the wishbone.
- Install the pivot pin ensuring that the eccentric flange correctly seats in the wishbone groove.

21. Install the pivot pin nut.

- Align the marker on the pivot pin flange with the mark made on wishbone.
- Install the nut on to the pivot pin and, ensuring the pin position is not disturbed, tighten the nut to 88-118 Nm.

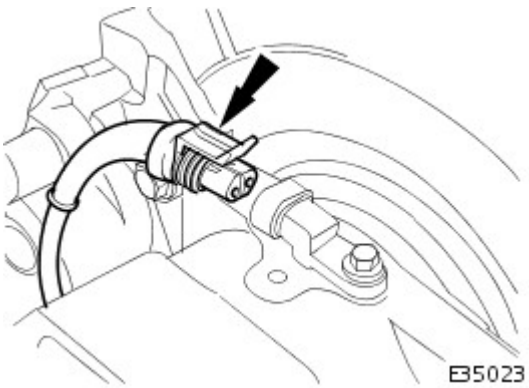


22. Release the tie strap securing the brake caliper to the suspension mounting bracket.

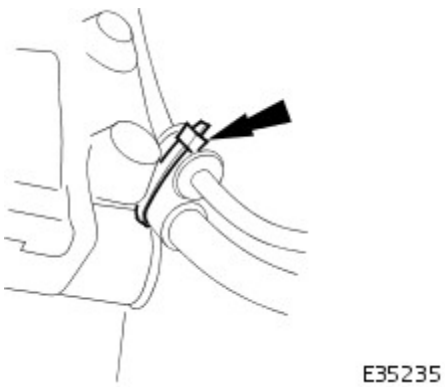


23. Install the brake caliper on to the carrier.

1. Position the caliper assembly on to the carrier.
2. Install the guide pins and tighten to 25-30 Nm.
3. Install the dust caps.
4. Install the brake caliper spring clip.



24. Connect the wheel speed sensor electrical connector.



25. Using a new tie strap, secure the wheel speed sensor harness to the brake hose clip.

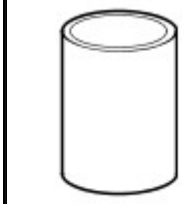
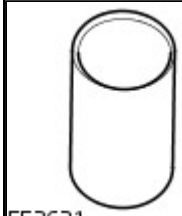
26. Install the rear wheel.
For additional information, refer to Section 204-04 Wheels and Tires.

27. Remove the axle stands and lower the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

28. Check and adjust the rear wheel alignment as necessary. For additional information, refer to Section 204-00 Suspension System - General Information.

Rear Suspension - Shock Absorber Lower Bushing

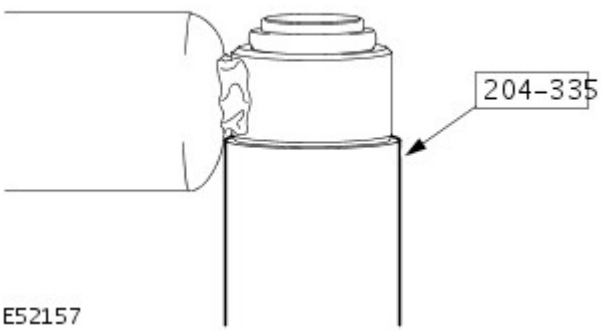
Removal and Installation

Special Tool(s)	
 E52622	Bushing Remover / installer 204-335
 E52621	Bushing remover 204-533
 E52620	Bushing installer 204-534

Removal

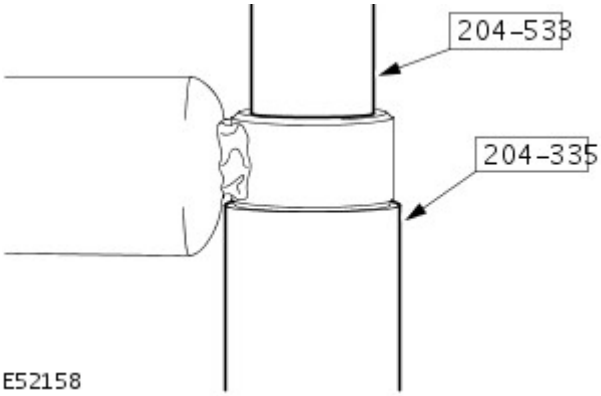
1. Mark the orientation of the shock absorber eye in relation to the lower suspension arm.
2. Remove the rear shock absorber.
   For additional information, refer to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).
3. NOTE: With assistance make sure the tool is aligned.

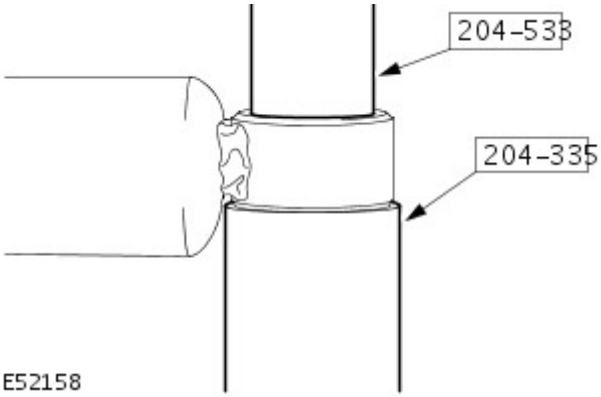
   Using the special tool, support the shock absorber.



4. NOTE: With assistance make sure the tool is aligned.

   Position and align the special tool to the shock absorber bush.

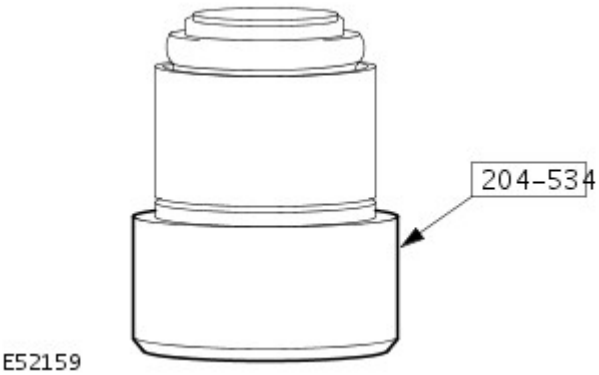




5. NOTE: With assistance make sure the tool is aligned.

Using special tools, slowly push the bush from the shock absorber.

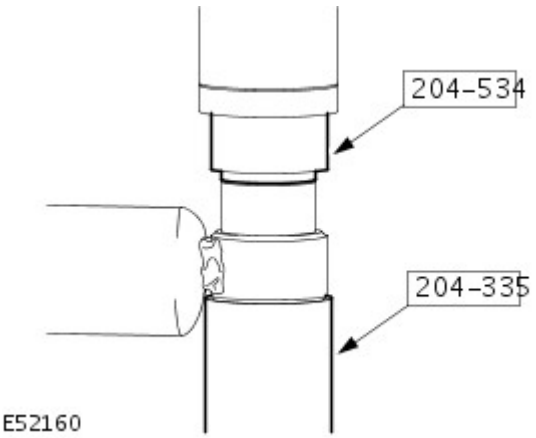
Installation



1. NOTE: Make sure the bush is clean and free from oil or grease.

• NOTE: Use a suitable lubricant to allow the bush to locate into the special tool.

Locate the new bush in the special tool.



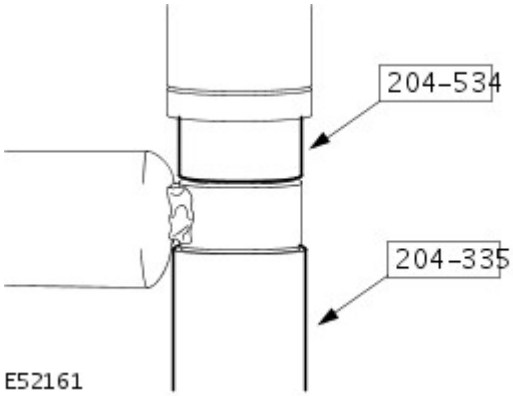
2. NOTE: Make sure the damper is clean and free from grease or oil and is not damaged prior to pushing in the new bush.

• NOTE: Make sure the shock absorber and bush are placed in the correct orientation.

Using the special tools, align the bush to the shock absorber.

3. NOTE: Make sure correct alignment is maintained.

Slowly push the bush into the shock absorber until the tool

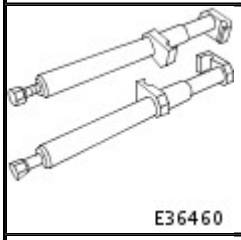


reaches the stop.

4. Install the rear shock absorber.
For additional information, refer to: Rear Shock Absorber (204-02 Rear Suspension, Removal and Installation).

Rear Suspension - Spring

Removal and Installation

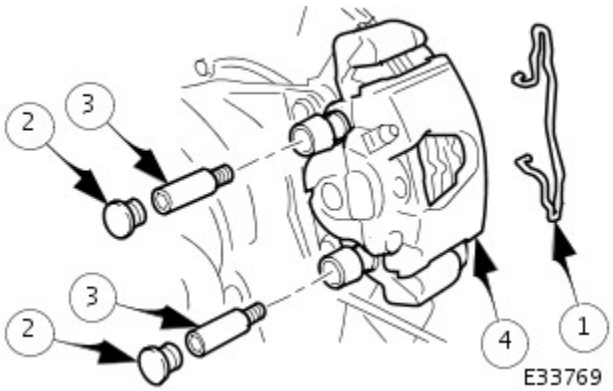
Special Tool(s)	
 E36460	Spring Compressors 204-179 (JD 199)
 E36461	Spring Retaining straps 204-179-1 (JD 199-1)

Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used.
For additional information, refer to Section 100-00 General Information.

Raise the rear of the vehicle and support on axle stands.
For additional information, refer to Section 100-02 Jacking and Lifting.

2. Remove the relevant rear wheel.
For additional information, refer to Section 204-04 Wheels and Tires.

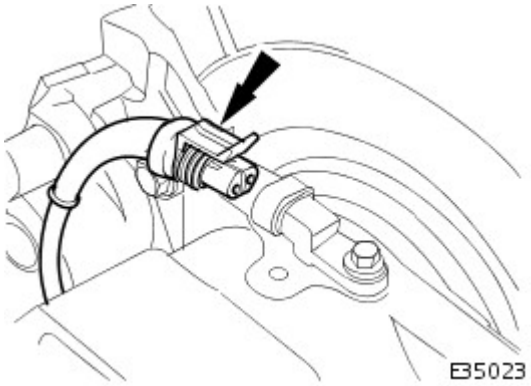


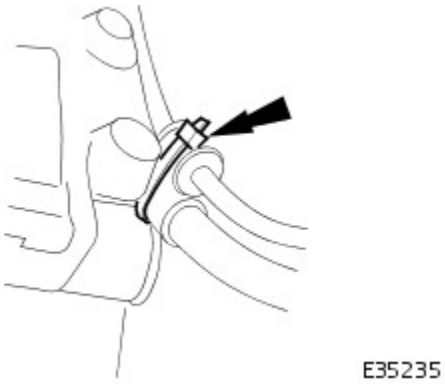
3. CAUTION: Do not suspend the caliper from the brake hose as this will damage the hose.

Remove the brake caliper from the carrier.

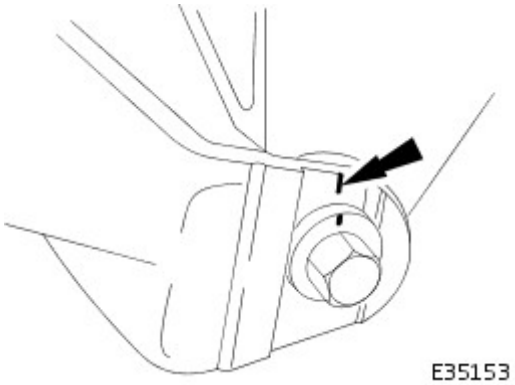
1. Remove the caliper spring clip.
2. Remove the guide pin dust caps.
3. Slacken and withdraw the guide pins.
4. Remove the caliper from the carrier and secure to the suspension mounting bracket using a tie strap.

4. Disconnect the wheel speed sensor electrical connector.

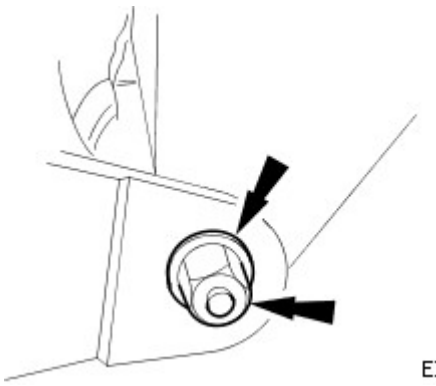




5. Remove and discard the tie strap securing the wheel speed sensor harness to the brake hose clip.



6. Mark the wishbone at the pivot pin eccentric flange marker to aid installation.

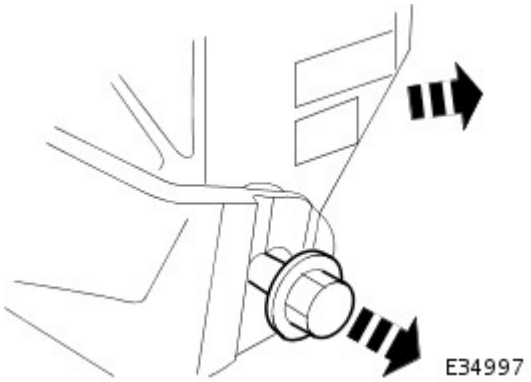


7. Remove the pivot pin nut and washer.

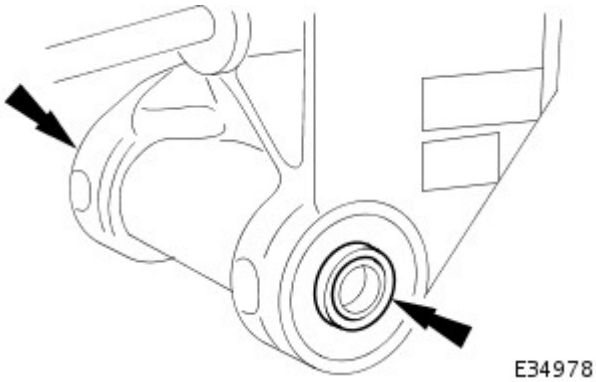
8. CAUTION: To prevent damage to the parking brake cable, the hub carrier must be supported on removal from the wishbone.

Remove the hub carrier from the wishbone.

- Remove the pivot pin from the hub carrier.

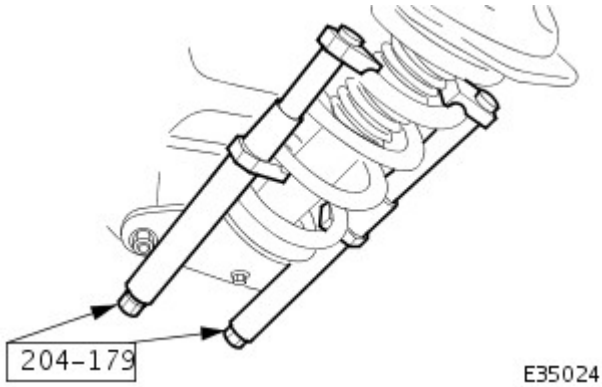


- Withdraw the hub carrier and support on a block of wood.



9. CAUTION: Note the position of the shims during removal. They must be returned to their original position during installation.

Noting their positions, remove the shim from each end of the pivot pin sleeve.



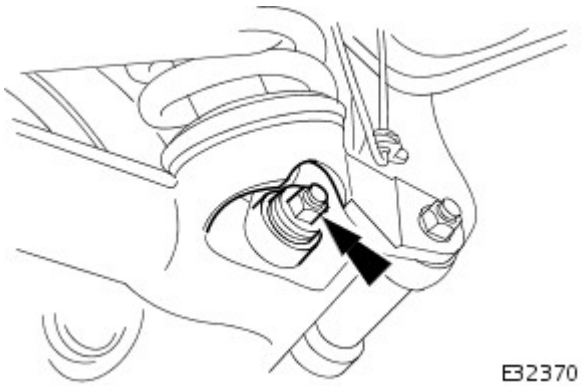
10. WARNINGS:

ENSURE THE SPECIAL TOOLS ARE POSITIONED DIAMETRICALLY OPPOSITE ON THE SPRING AND THE ARMS ARE CORRECTLY SEATED .

WHEN COMPRESSING THE SPRING, TIGHTEN THE SPECIAL-TOOL ADJUSTMENT BOLTS EVENLY.

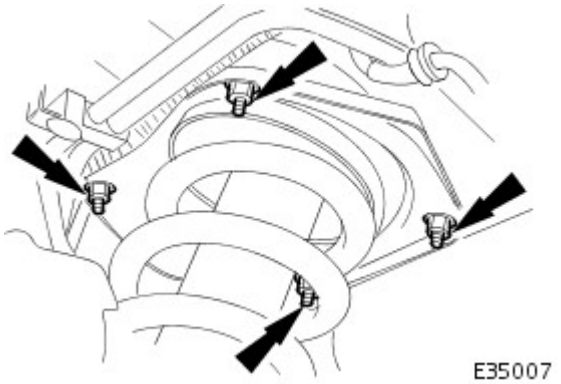
Compress the spring.

- Install and align the special tools 204-179 diametrically opposite on the spring.
- Evenly tighten the special tool tensioning bolts to compress the spring.

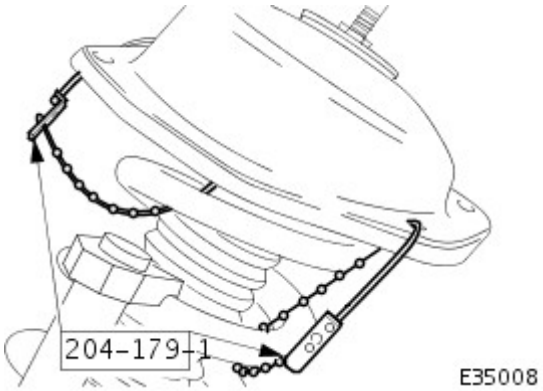


11. Remove the shock absorber to wishbone mounting nut and bolt.

12. Remove the nuts securing the shock absorber and spring upper mounting to the body.

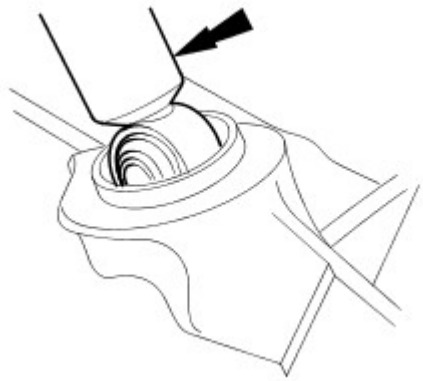


E35007



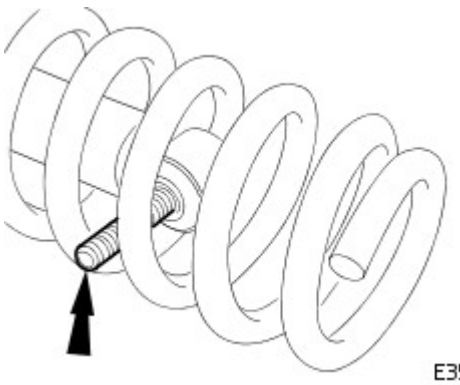
E35008

13. Using the special tools 204-179-1, secure the upper mounting to the spring.



E35017

14. Using a jack, retract the shock absorber through the wishbone aperture.



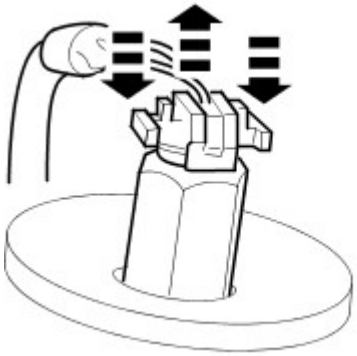
E35018

15. Position a bolt through the spring coils and shock absorber lower-bush, to temporarily locate the shock absorber.

16. Partially lower the jack for access to the top of the shock absorber.

17. On vehicles with adaptive damping:

- Disconnect the shock absorber electrical connector by pressing the lugs down and pulling the connector up.



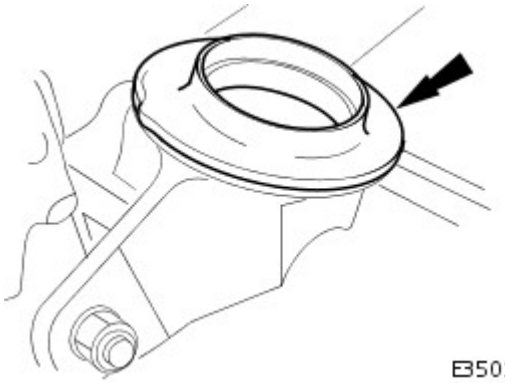
E35165

18. Lower and remove the jack.

19. Remove the shock absorber and spring assembly from the vehicle and place the assembly on a work bench.

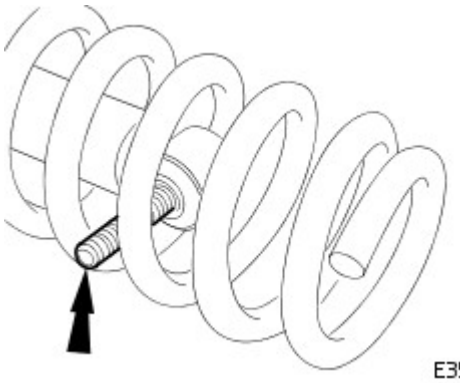
20. Clean the upper mounting spring location.

21. Remove the pigtail seat and clean the wishbone lower spring location.



E35011

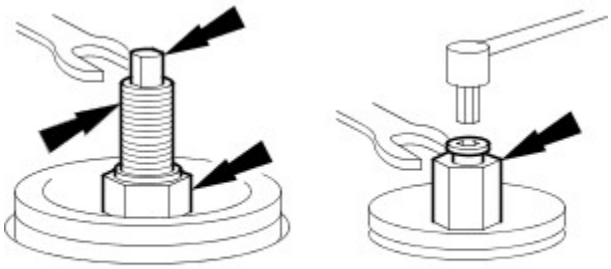
22. With assistance, manually compress the shock absorber and withdraw the bolt from the spring coils.



E35018

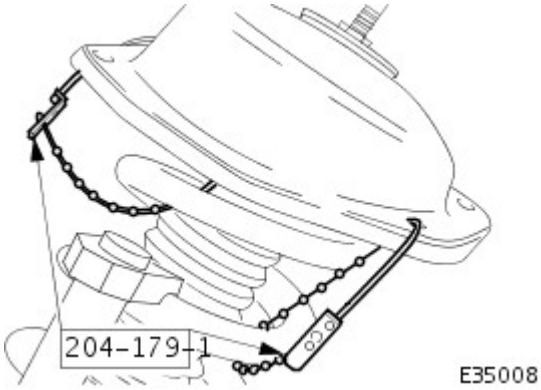
23. Remove the shock absorber from the upper mounting.

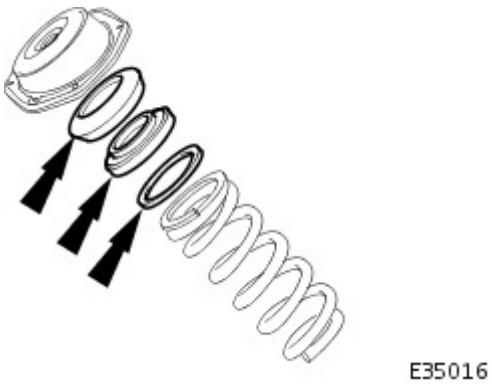
- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Remove the shock absorber upper retaining nut.
- Remove the upper washer and isolator.



E35166

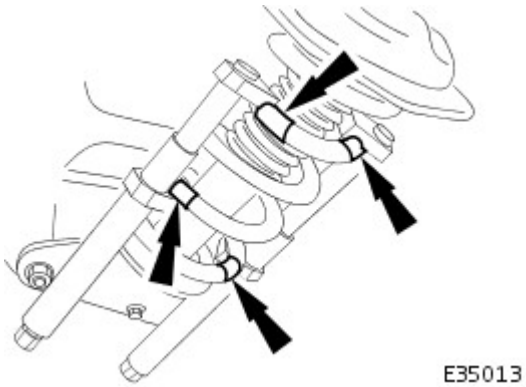
24. Remove the special tools 204-179-1 and remove the upper mounting from the spring.



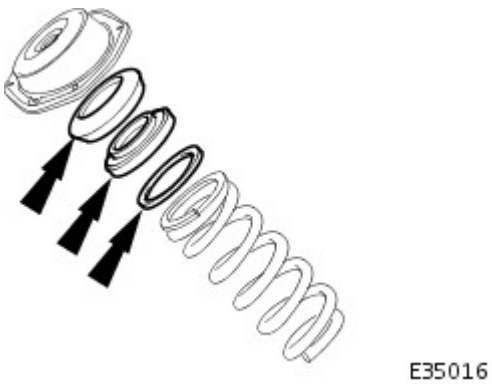


25. Remove the shock upper mounting assembly from the spring.

- Remove the spring upper isolator.
- Remove the upper spring pan.
- Remove the packing ring.



26. For installation purposes, mark position of tool arms on spring.



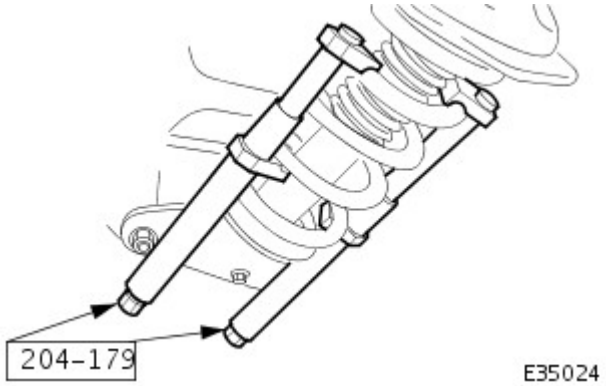
27. CAUTION: The type and number of packers fitted to rear springs is dependent upon spring rating. Some springs are fitted without any packers. The original packer(s) must therefore be retained on removal.

Remove the shock upper mounting assembly from the spring.

- Remove the spring upper isolator.
- Remove the upper spring pan.
- Remove the packing ring.

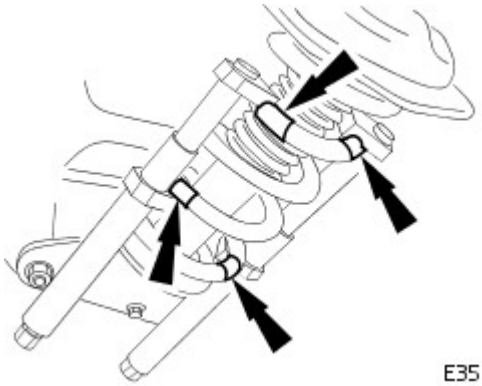
28. WARNING: WHEN RELEASING THE SPRING TENSION, SLACKEN THE SPECIAL-TOOL ADJUSTMENT BOLTS EVENLY.

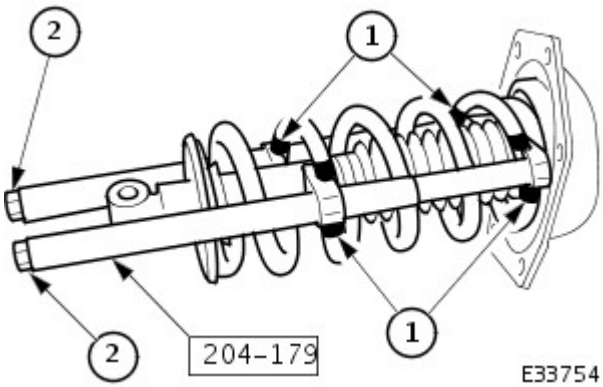
Evenly slacken the adjuster bolts on special tools 204-179 and remove the tools from the spring.



Installation

1. Transfer reference marks from old spring to replacement spring.





2. WARNINGS:

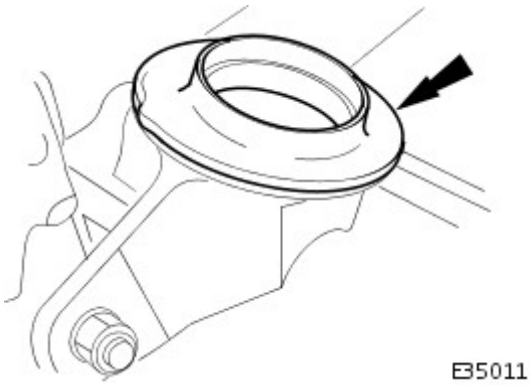
ENSURE THE SPECIAL TOOLS ARE POSITIONED DIAMETRICALLY OPPOSITE ON THE SPRING AND THE ARMS ARE CORRECTLY SEATED .

TIGHTEN THE SPECIAL TOOL ADJUSTMENT BOLTS EVENLY WHEN COMPRESSING THE SPRING.

Using the special tools 204-179 compress the spring.

1. Fit and align the arms of the special-tools to the spring reference marks.
2. Tighten the special-tool adjustment bolts evenly to compress the spring.

3. Install the spring pigtail lower seat on to the wishbone.

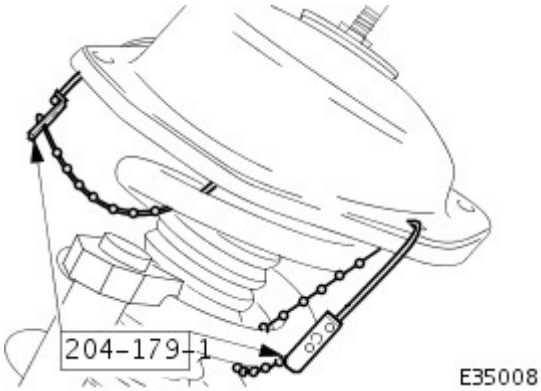




E35016

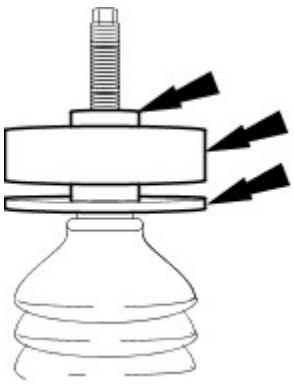
4. Install the spring in the upper mounting.

- Install the spring upper isolator.
- Install the upper spring pan.
- Install the packing ring.



E35008

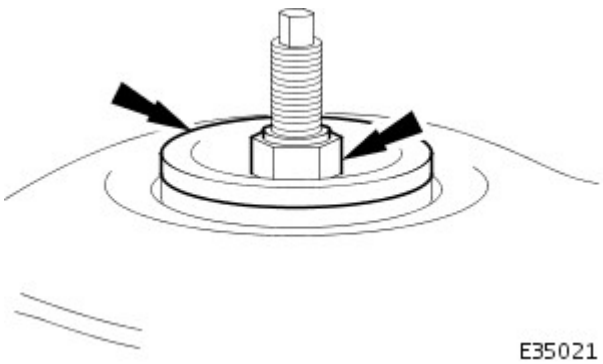
5. Ensuring the correct orientation, secure the upper mounting to the spring using the special tools 204-179-1.



E35020

6. Position the spring upper mounting assembly on to the shock absorber.

- Apply a thin coat of grease to the upper mounting bush.
- Ensure that the washer, lower isolator and bush are correctly positioned on the shock absorber shaft.
- Position the shock absorber shaft in the upper mounting.

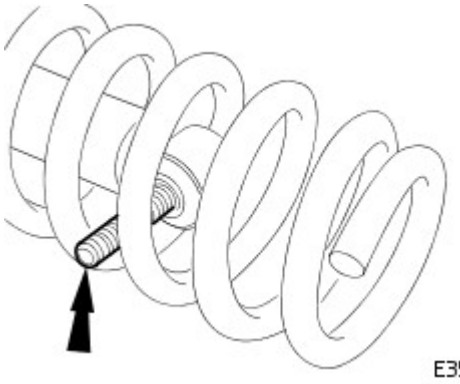


E35021

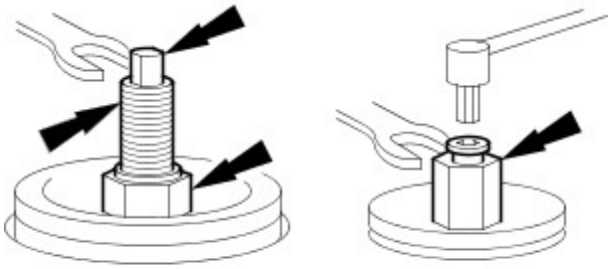
7. Secure the top of the shock absorber to the upper mounting.

- Install the spring upper isolator.
- Install the upper washer.
- Install but do not tighten the locknut on to the shock absorber.

8. Manually retract the shock absorber and place a bolt through the spring coils and the shock absorber lower-bush.



E35018



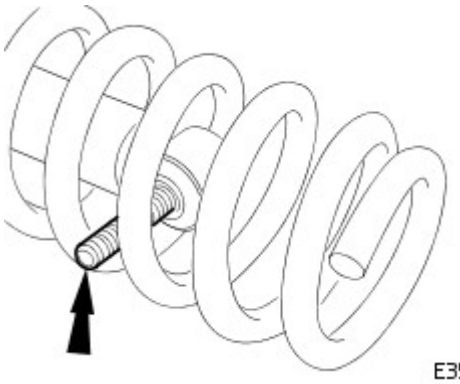
E35166

9. Secure the shock absorber to the upper mounting.

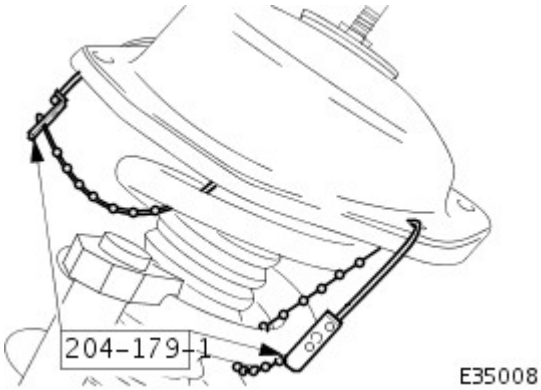
- Position a wrench on the shock absorber shaft flats to prevent rotation (wrench in socket on vehicles with adaptive damping).
- Tighten the shock absorber upper lock nut to 30-40 Nm (16-18 Nm on vehicles with adaptive damping).

10. Position the shock absorber and spring assembly to the vehicle.

11. With assistance, manually retract the shock absorber and remove the temporary securing bolt.



E35018

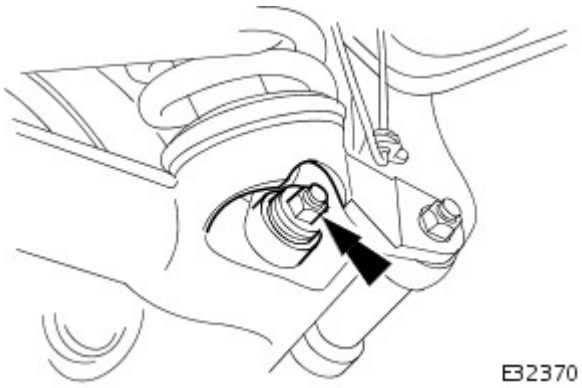


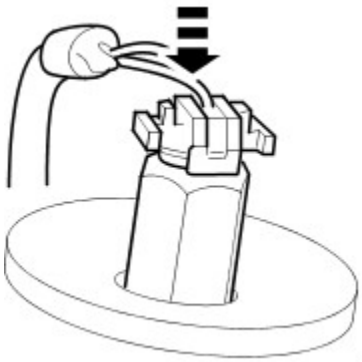
E35008

12. Remove the special tools 204-179-1.

13. Align the shock absorber lower bush to the wishbone and install the mounting bolt.

1. Install but do not tighten the nut.

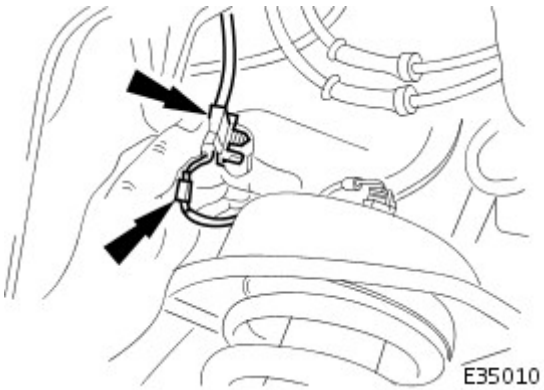

E32370


E35164

14. CAUTION: Make sure the adaptive damping electrical connector is correctly aligned. Failure to follow these instructions may cause damage to the electrical connector.

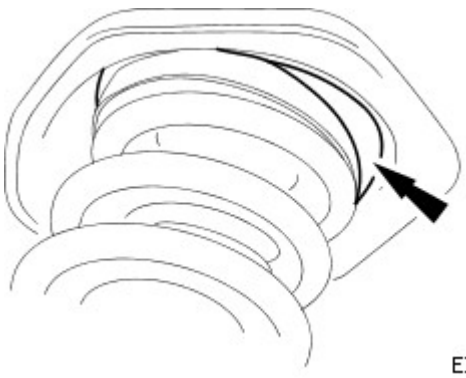
On vehicles with adaptive damping:

- Connect the shock absorber electrical connector, ensuring the electrical connector key locates in the socket keyway.


E35010

15. Seat the upper mounting in the body location.

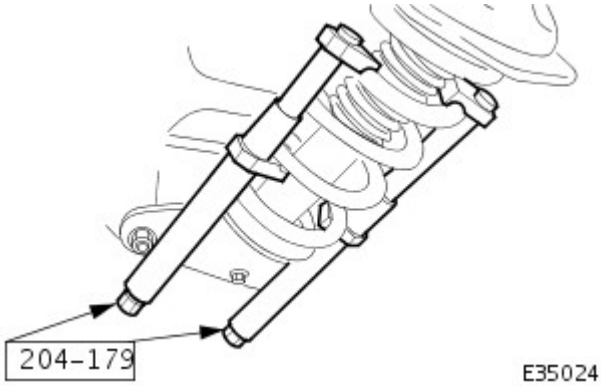
1. If adaptive damping is installed, ensure the harness is correctly positioned.


E35022

16. Ensuring that the spring is seated on the isolator and spring pan, position the upper spring pan on to the body studs.

17. Release the spring tension.

- Ensuring that the spring is correctly located, evenly slacken the adjuster bolts on the special tools 204-179.

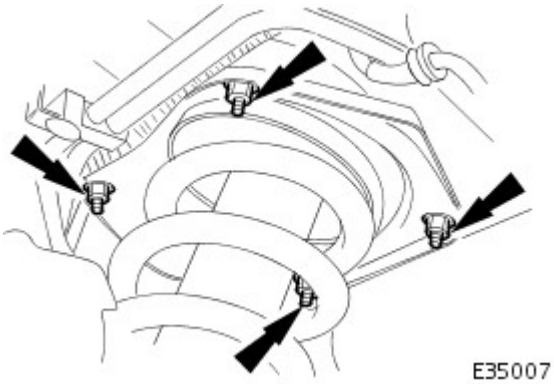


E35024

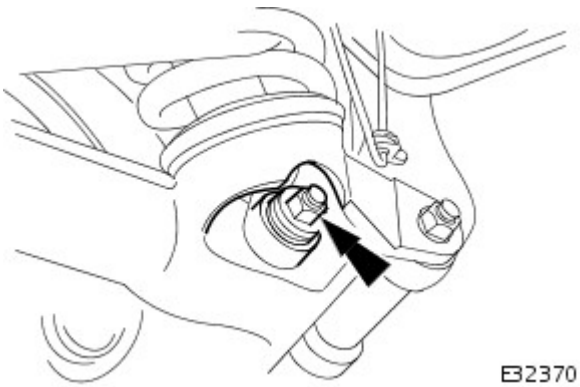
18. Remove the special tools 204-179.

19. Fully seat and secure the upper spring pan to the body.

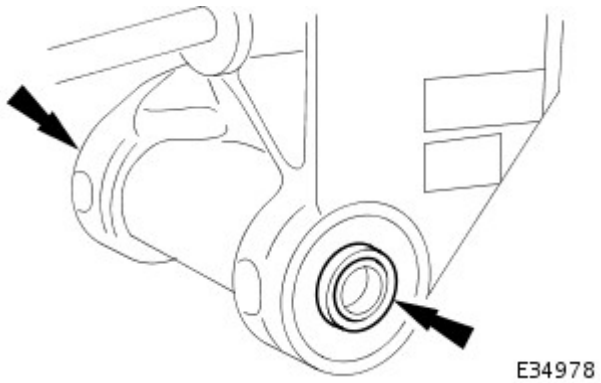
- Ensure the spring pan is correctly seated in the body location.
- Install the nuts securing the spring pan to the body studs.
- Tighten to 17-23 Nm.


E35007

20. Tighten to 80-100 Nm.

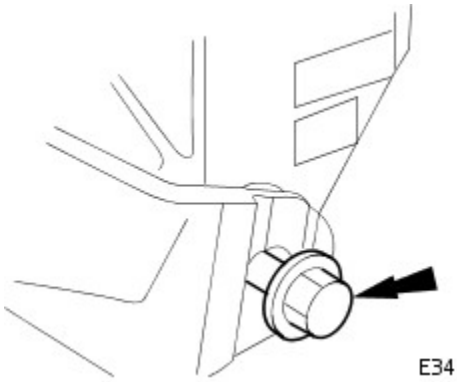

E32370

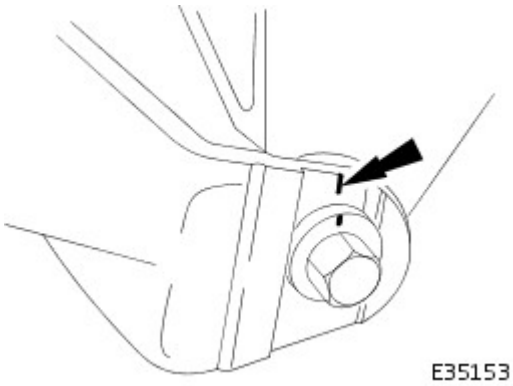
21. Install the shims on the pivot pin sleeve in the positions noted during removal.


E34978

22. Install the hub assembly to the wishbone assembly.

- Position the hub and carrier to the wishbone.
- Install the pivot pin ensuring that the eccentric flange correctly seats in the wishbone groove.

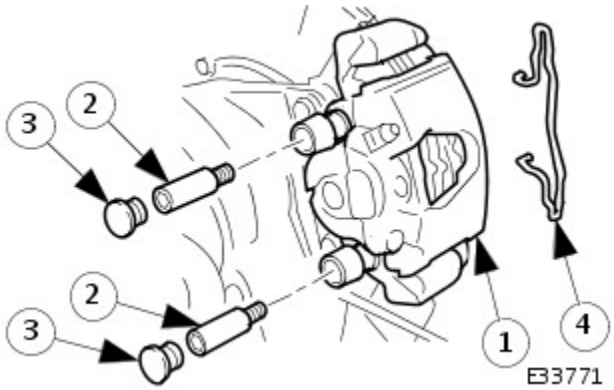




23. Install the pivot pin nut.

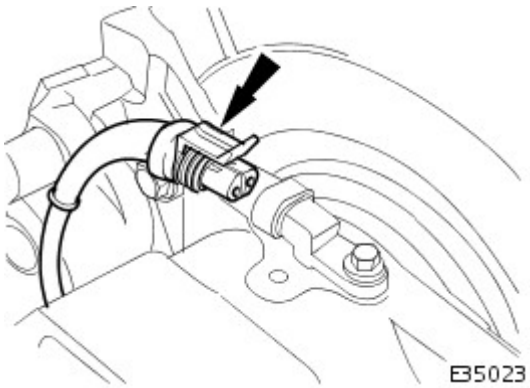
- Align the marker on the pivot pin flange with the mark made on wishbone.
- Install the nut on to the pivot pin and, ensuring the pin position is not disturbed, tighten the nut to 88-118 Nm.

24. Release the tie strap securing the brake caliper to the suspension mounting bracket.



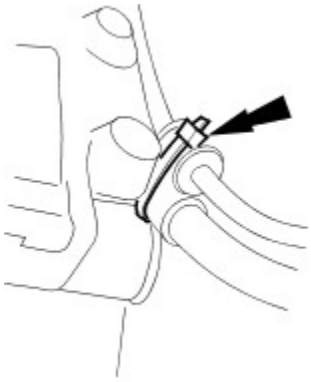
25. Install the brake caliper on to the carrier.

1. Position the caliper assembly on to the carrier.
2. Install the guide pins and tighten to 25-30 Nm.
3. Install the dust caps.
4. Install the brake caliper spring clip.



26. Connect the wheel speed sensor electrical connector.

27. Using a new tie strap, secure the wheel speed sensor harness to the brake hose clip.



E35235

28. Install the rear wheel.
For additional information, refer to Section 204-04 Wheels and Tires.

29. Remove the axle stands and lower the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

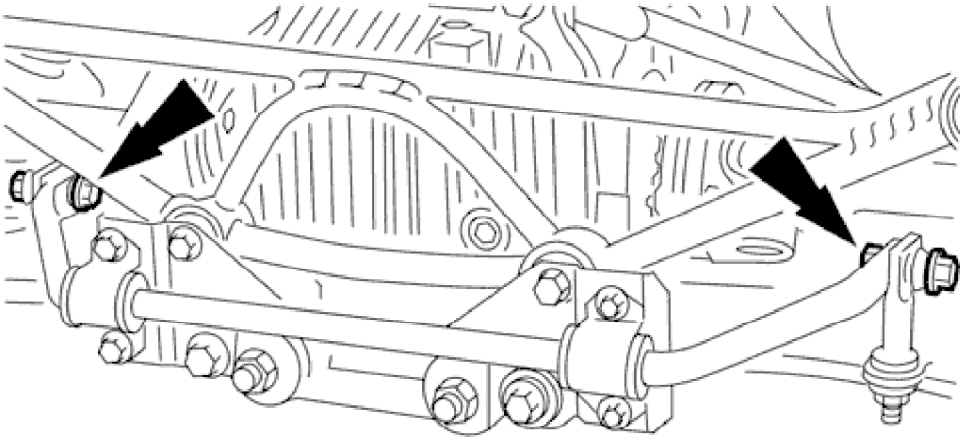
30. Check and adjust the rear wheel alignment as necessary.
For additional information, refer to Section 204-00 Suspension System - General Information.

Stabilizer Bar Vehicles With: Supercharger 64.35.08

Rubber Suspension Insulator Lube
Castrol NTR
Removal

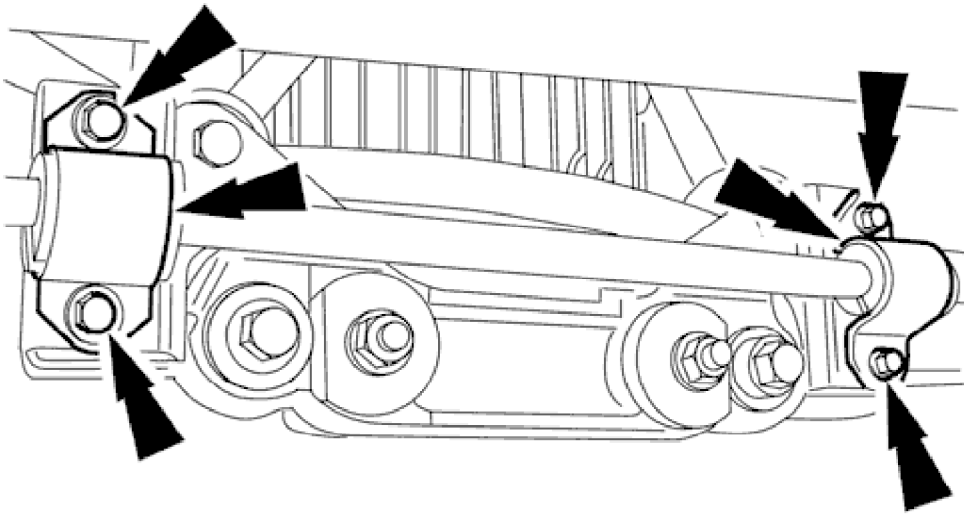
1. **CAUTION:**
   Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section <<100-00>> for information.

Raise vehicle on a four-post lift. Refer to section **<<100-02>>**.



E32322

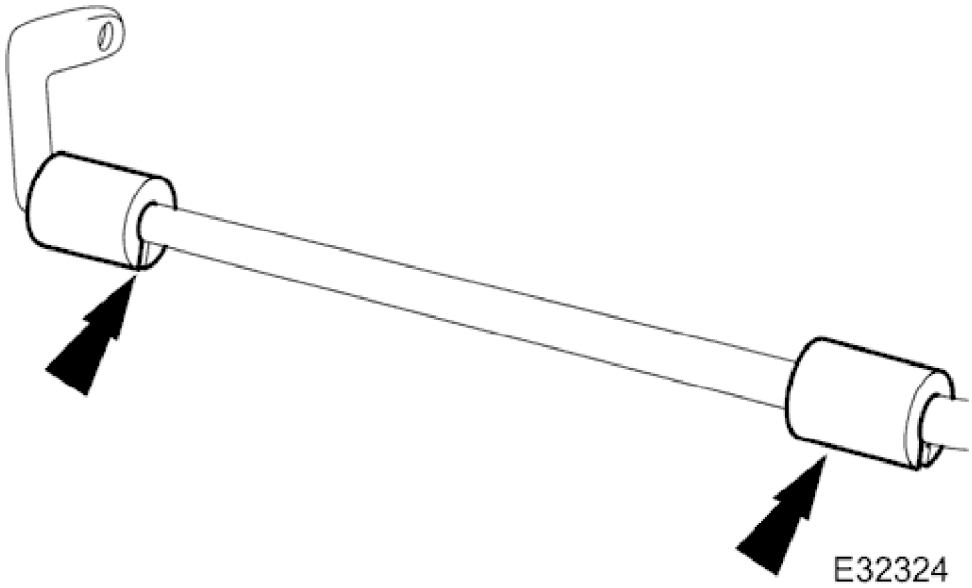
2. Remove nuts and bolts securing stabilizer bar to links.



E32323

3. Remove stabilizer bar mounting-brackets.
   - Remove bolts.

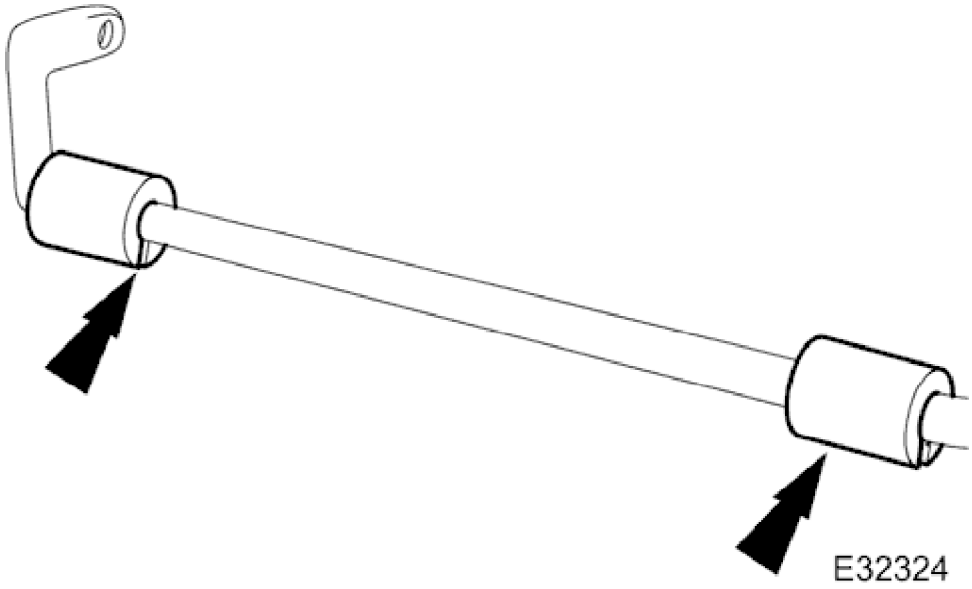
- Remove brackets.



4. Remove stabilizer bar from vehicle.
   - Remove bushes.

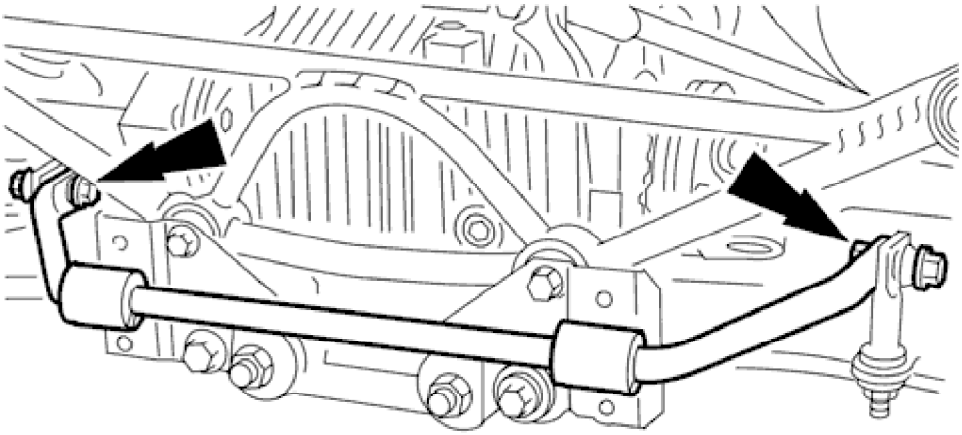
5. Clean relevant parts.

Installation



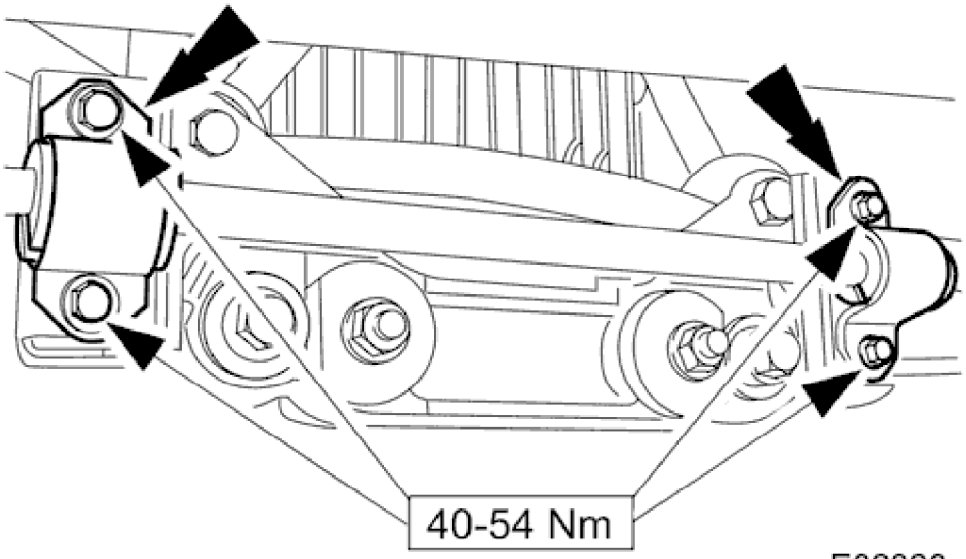
1. **CAUTION:**
   Make sure the Castrol NTRgrease is only applied to the inner surface of the mounting bushes. Failure to follow this instruction may affect the retention of the bushes in the retaining brackets.

Fit bushes to stabilizer bar.
- Apply a thin film of Castrol NTR grease to the inner surface of the bushes.



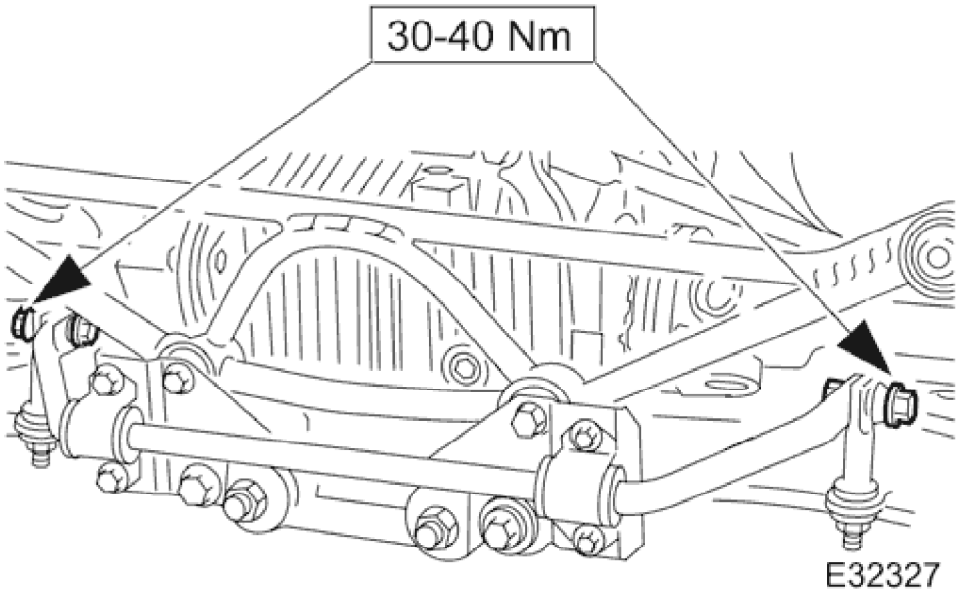
E32325

2. Position stabilizer bar to vehicle.
   - Position stabilizer bar to links.
   - Fit nuts and bolts, DO NOT tighten at this stage.



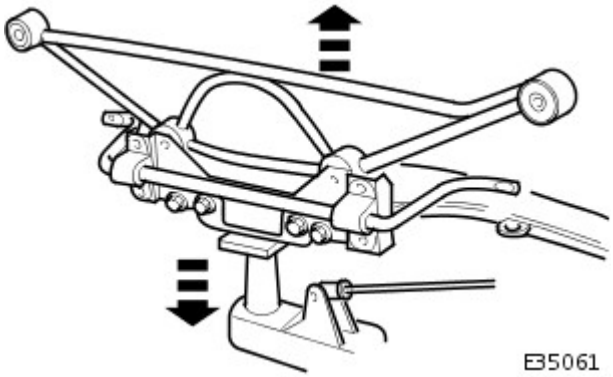
E32326

3. Fit mounting brackets to stabilizer bar.
   - Align bushes and fit mounting brackets.
   - Fit and tighten bolts.



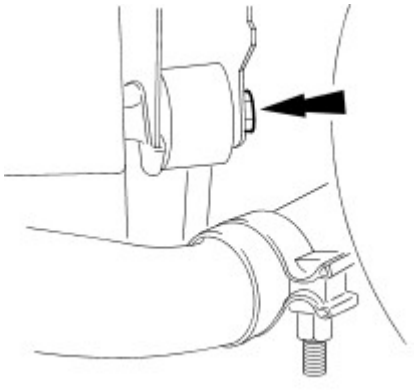
4. Tighten nuts securing stabilizer bar to links.

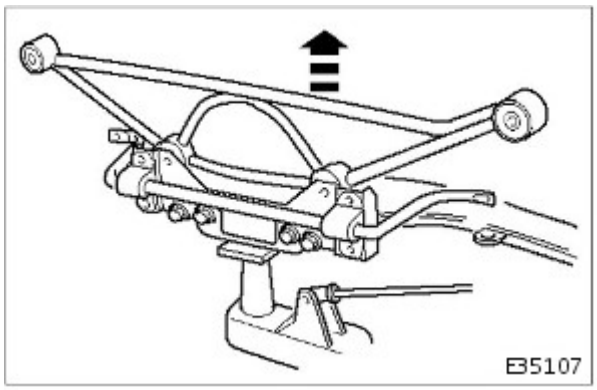
5. Lower four-post lift.


E35061

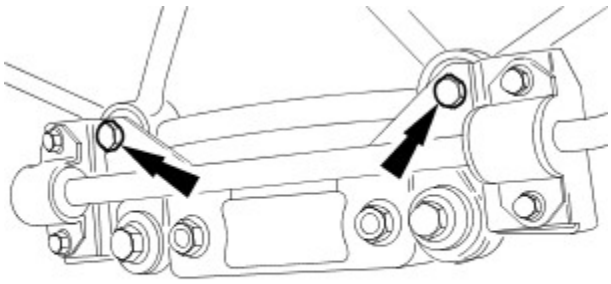
Installation

1. Position monostrut on rear suspension.
2. Align monostrut upper mountings and install but do not tighten bolts

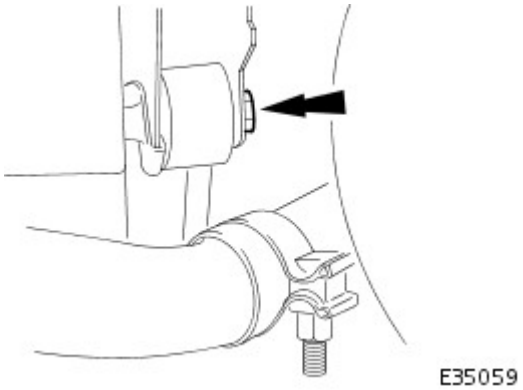

E35059


E35107

3. Raise rear of suspension to align with monostrut lower mounting holes.


E35058

4. Install monostrut lower bolts and nuts and tighten to 77-103 Nm.
5. Tighten monostrut upper bolts to 88-118 Nm.



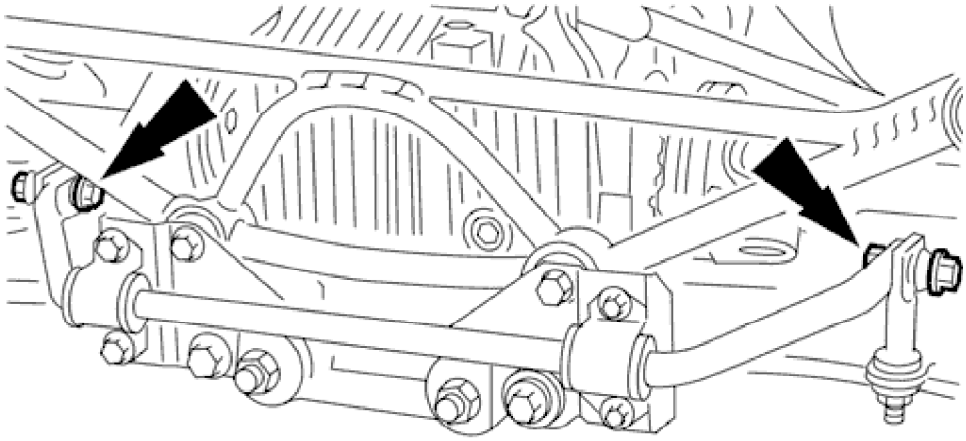
6. Raise vehicle, remove stands and lower vehicle. Refer to Section 100-02.

Stabilizer Bar Bushing Vehicles With: Supercharger 64.35.18

Rubber Suspension Insulator Lube
Castrol NTR
Removal

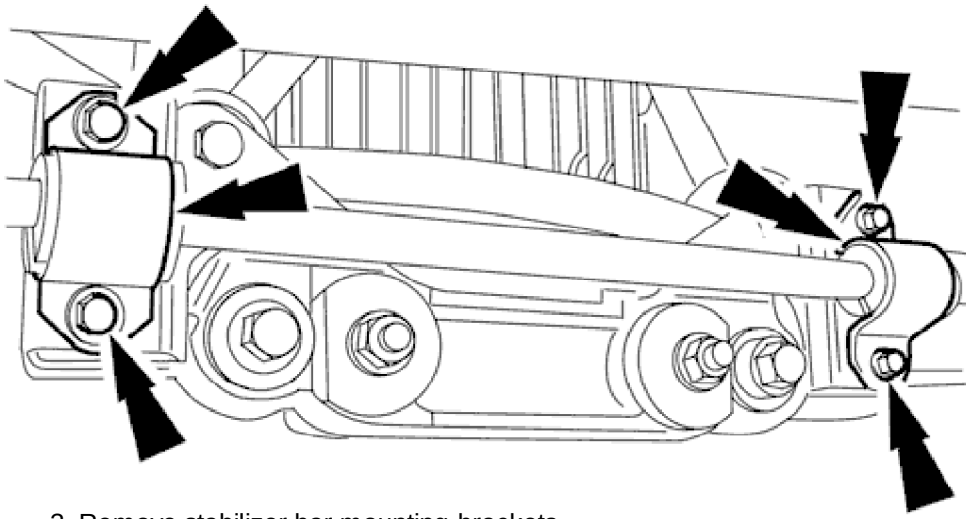
1. **CAUTION:**
   Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section <<100-00>> for information.

Raise vehicle on a four-post lift. Refer to section **<<100-02>>**.



E32322

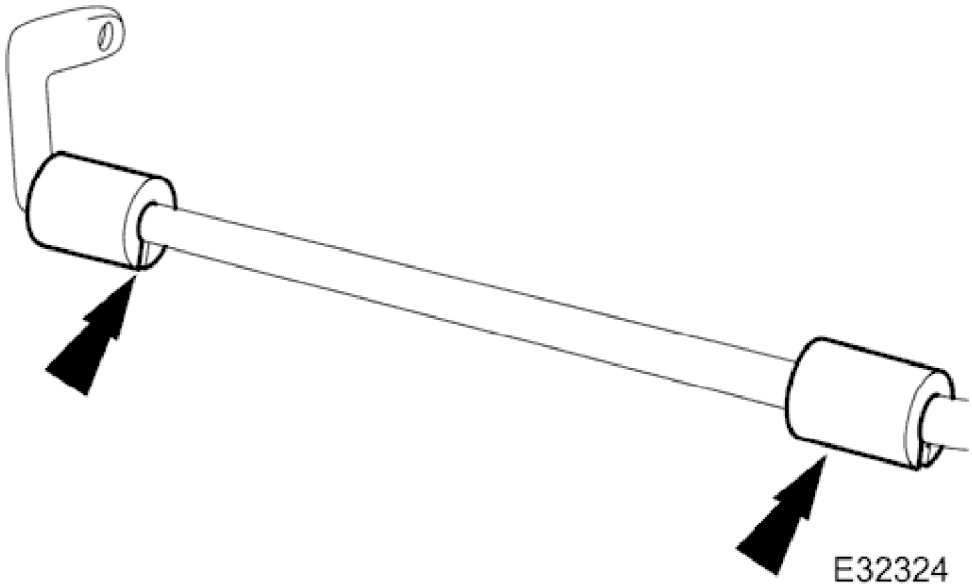
2. Remove nuts and bolts securing stabilizer bar to links.



E32323

3. Remove stabilizer bar mounting-brackets.
   - Remove bolts.

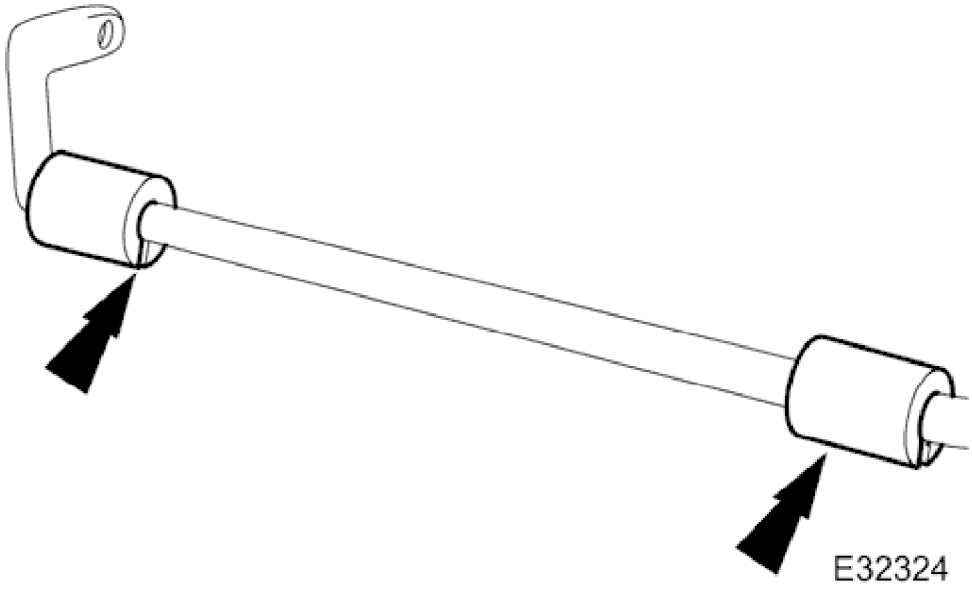
- Remove brackets.



4. Remove stabilizer bar from vehicle.
   - Remove bushes.

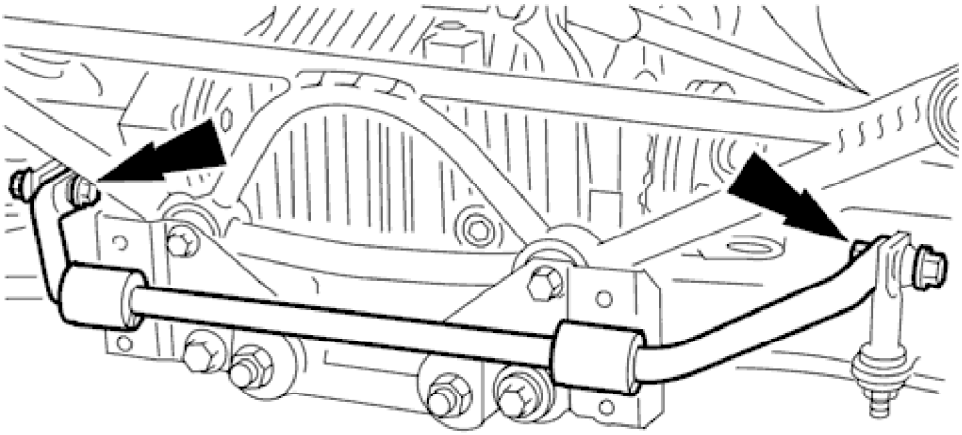
5. Clean relevant parts.

Installation



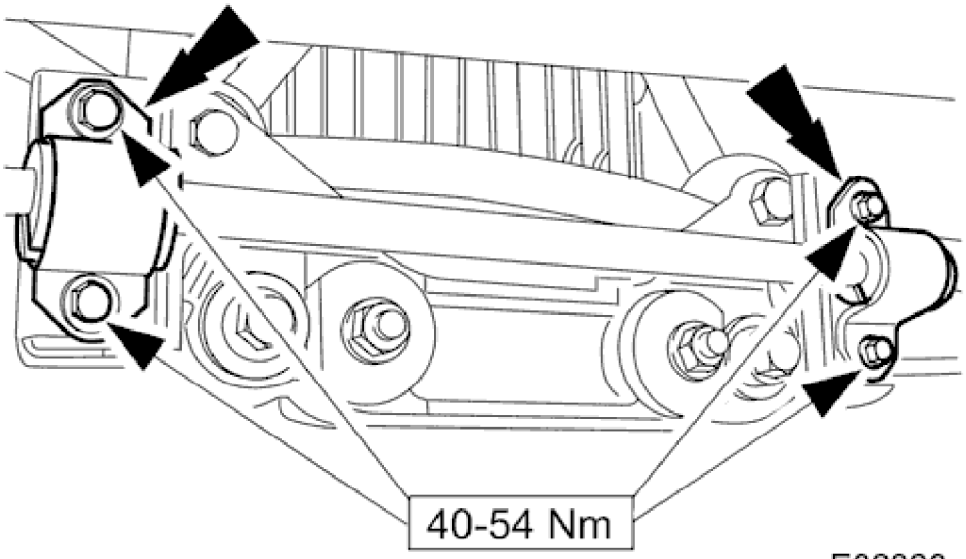
1. **CAUTION:**
   Make sure the Castrol NTR grease is only applied to the inner surface of the mounting bushes. Failure to follow this instruction may affect the retention of the bushes in the retaining brackets.

Fit bushes to stabilizer bar.
- Apply a thin film of Castro NTR grease to the inner surface of the bushes.



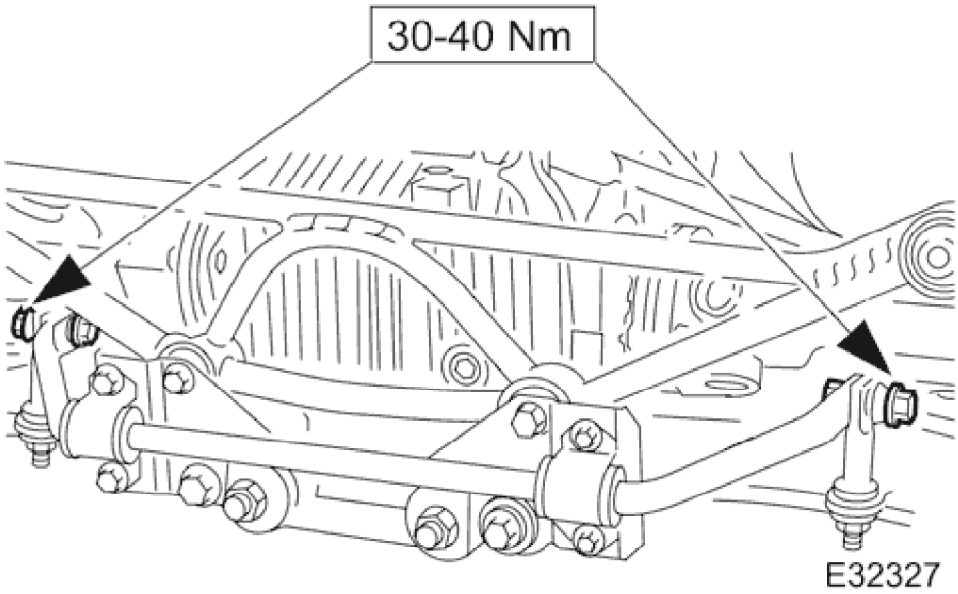
E32325

2. Position stabilizer bar to vehicle.
   - Position stabilizer bar to links.
   - Fit nuts and bolts, DO NOT tighten at this stage.



E32326

3. Fit mounting brackets to stabilizer bar.
   - Align bushes and fit mounting brackets.
   - Fit and tighten bolts.



4. Tighten nuts securing stabilizer bar to links.

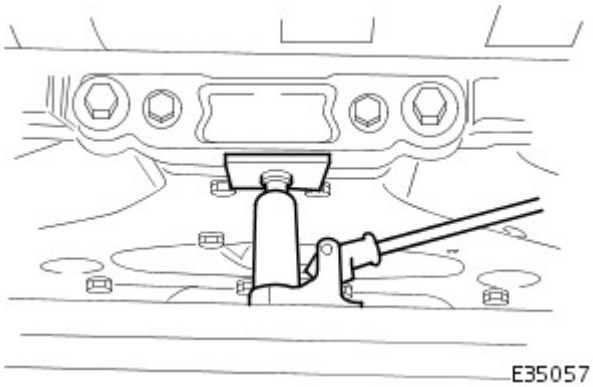
5. Lower four-post lift.

Rear Suspension - Stabilizer Bar Mounting Frame

Removal and Installation

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

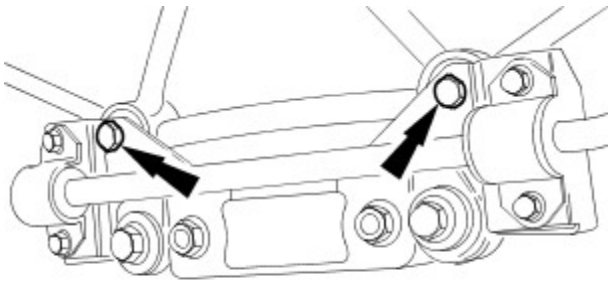


E35057

1. Raise rear of vehicle and support on stands. Refer to Section 100-02.

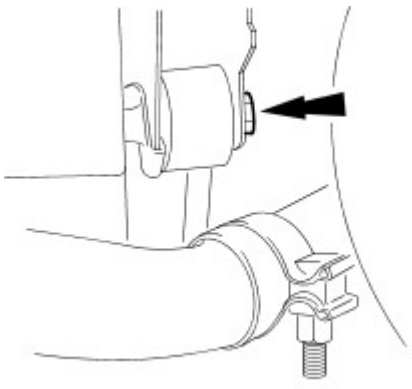
2. Support rear suspension.

- Position a piece of wood under rear edge of suspension unit.
- Position and raise a jack under wood to support suspension unit.



E35058

3. Remove monostrut lower nuts and bolts.



E35059

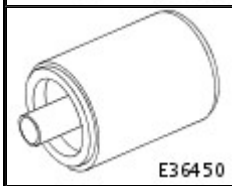
4. Remove monostrut upper mounting to body bracket securing bolts.

5. Remove monostrut.

- Lower rear edge of suspension unit just sufficient for access.
- Exercising care to avoid damaging fuel filler neck drain pipe, lift and withdraw monostrut from rear suspension.

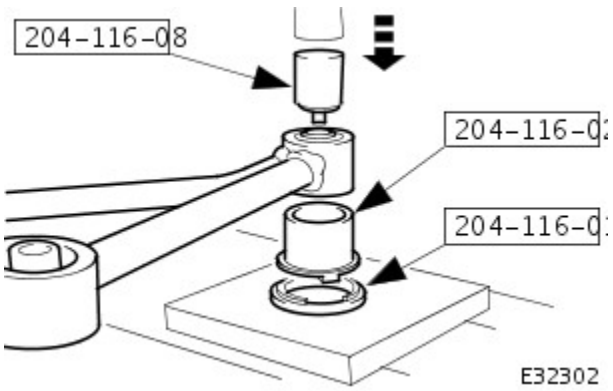
Rear Suspension - Stabilizer Bar Mounting Frame Bushing

Removal and Installation

Special Tool(s)	
 E36446	Adaptor Ring 204-116-01 (JD 143-1)
 E36447	Anvil Adaptor 204-116-02 (JD 143-2)
 E36450	Remover/Replacer Adaptor 204-116-08 (JD 143-8)
 E36425	Differential Strut - Bush Replacer 204-201 (JD 241)

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



1. Remove monostrut from vehicle. Refer to operation 64.25.12.

2. Using a hydraulic press remove bush from monostrut.

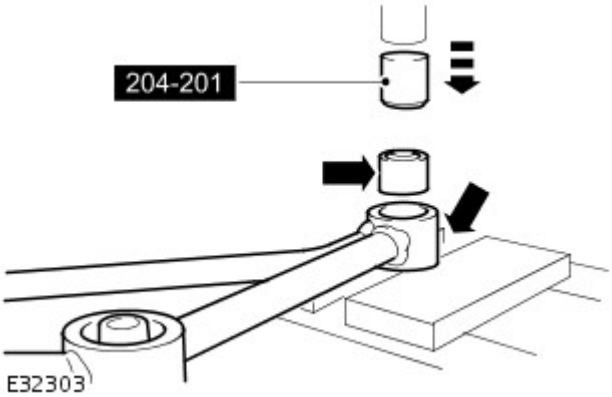
- Using special tools, support monostrut on the press bed.
- Position special tool on top of bush and align tool with press ram.
- Press bush from monostrut.

3. Clean relevant parts.

Installation

1. Using a hydraulic press, fit bush into monostrut.

- Support the bush-bore of the monostrut between plates on the press-bed.

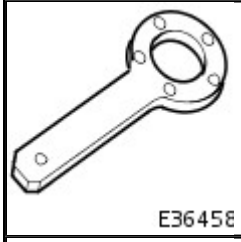
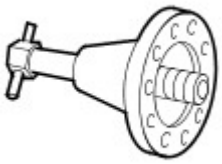
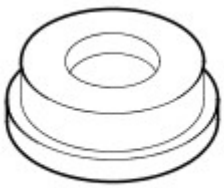
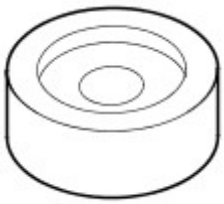


- Position bush to bore.
- Position special tool on top of bush and align tool with press ram.
- Press bush into monostrut.

2. Install monostrut on vehicle. Refer to operation 64.25.12 .

Rear Suspension - Rear Wheel Bearing

Removal and Installation

Special Tool(s)	
 E36458	Hub Holding Tool 204-195 (JD227)
 E36452	Hub Puller 204-011 (JD 1D)
 E36453	Rear-Hub Remover 204-113 (JD 132)
 E36455	Bearing Cup Replacer Adaptor 204-118 (JD 550-4/1)
 E36456	Bearing Cup Replacer Adaptor 204-118 (JD 550-4/2)
 E36457	Driver Handle 100-013 (18G-134)
 E36451	Rear-hub spacer replacer 204-003 (JD 15)
	Oil Seal Remover/Replacer

 E36454	205-234 (JD 550-1)

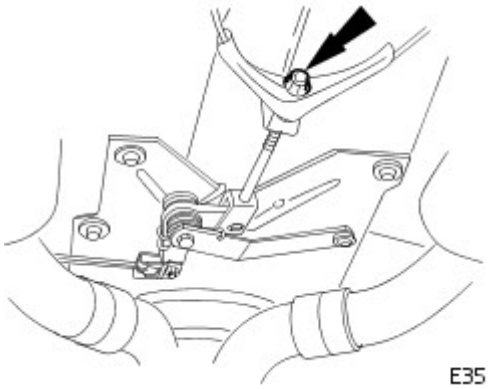
Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

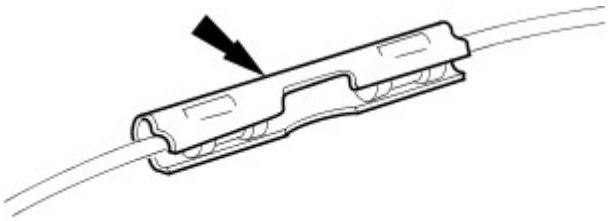
Release handbrake.

2. Raise the vehicle on a four-post lift.

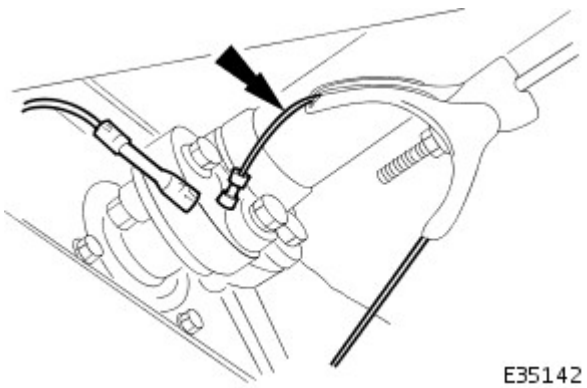
3. Fully slacken but do not remove parking brake cable adjuster nut.


E35206

4. Release appropriate side parking brake cable from connecting clip.


E34975

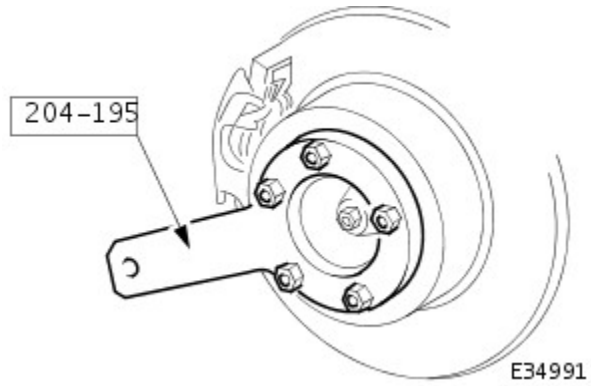
5. Withdraw parking brake cable through equalizer (LH side cable only).


E35142

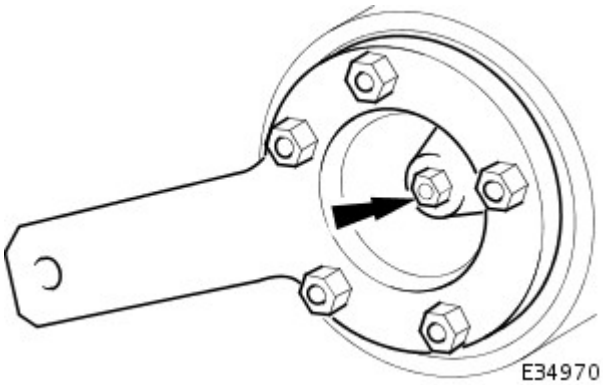
6. Lower four-post lift.

7. Raise rear of vehicle to working height and support on stands. Refer to section 100-02.

8. Remove rear wheel. Refer to section 204-04.



9. Position special tool 204-195 on hub studs and install securing nuts.



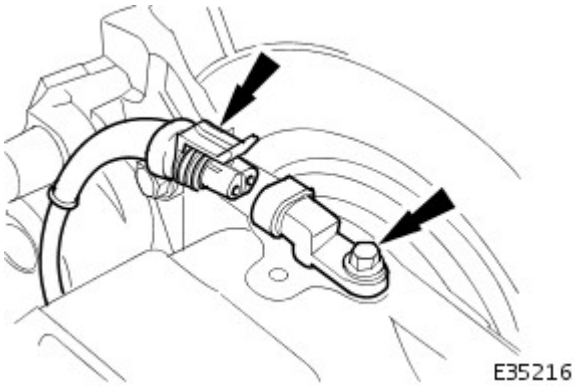
10. Slacken but do not remove hub to axle shaft securing nut.

11. Remove securing nuts and withdraw special tool (204-195) from hub.

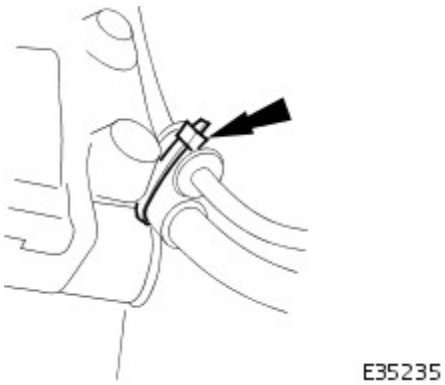
12. Remove rear brake disc. Refer to 70.10.13.

13. Remove parking brake shoes. Refer to 70.40.05.

14. Remove wheel speed sensor.



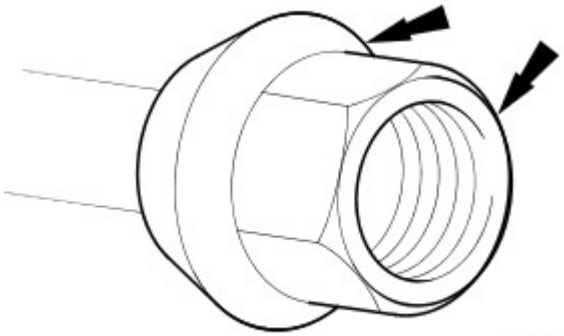
- Disconnect wheel speed sensor harness from sensor
- Remove wheel speed sensor securing bolt and withdraw sensor from hub carrier.



15. Sever and discard wheel speed sensor harness tie strap and position harness for access.

16. Remove hub nut and collar.

- Remove nut.



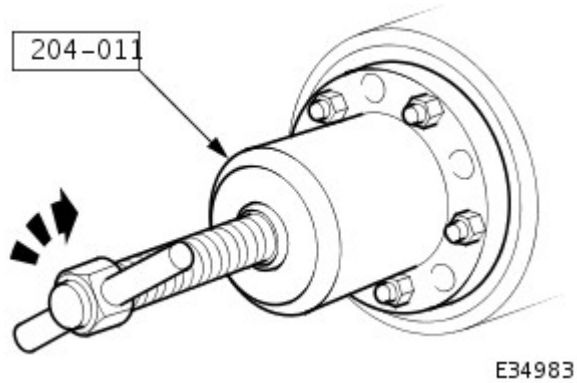
E34972

- Remove locating collar.



E34973

17. Install a thread protector on axle shaft.



E34983

18. Release hub from axle shaft.

- Position hub puller 204-011 on hub studs.
- Install securing nuts.
- Progressively tighten puller center bolt to release hub from axle shaft splines.

19. Remove hub puller and thread protector.

- Remove securing nuts and release puller from hub.
- Remove thread protector from axle shaft.

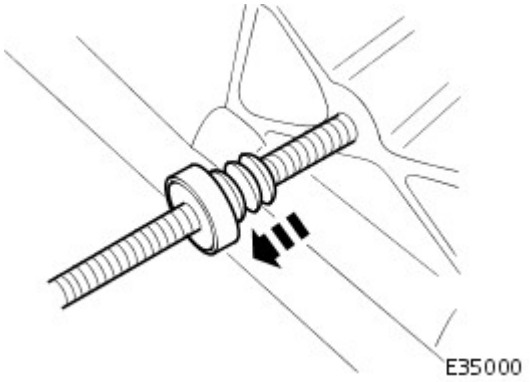


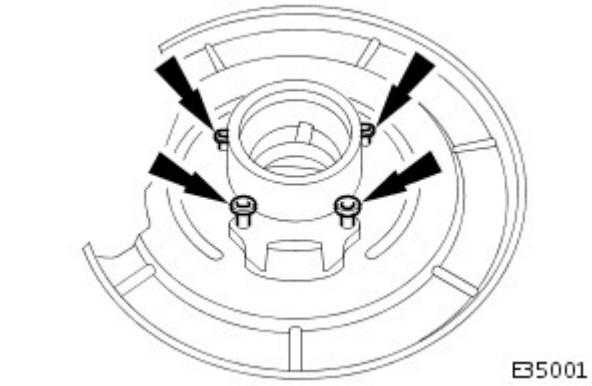
E34999

20. Release parking brake cable from suspension mounting bracket.

- Remove cable retaining clip.
- Draw cable through suspension mounting bracket aperture.

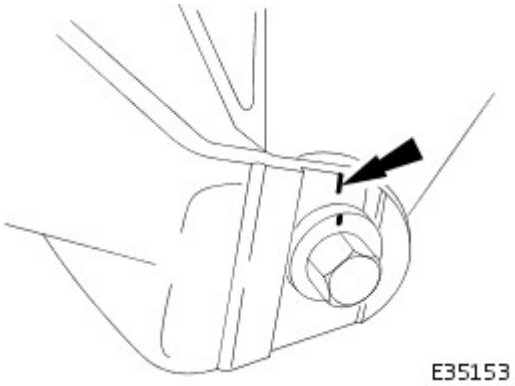
21. Remove parking brake cable to hub carrier grommet.



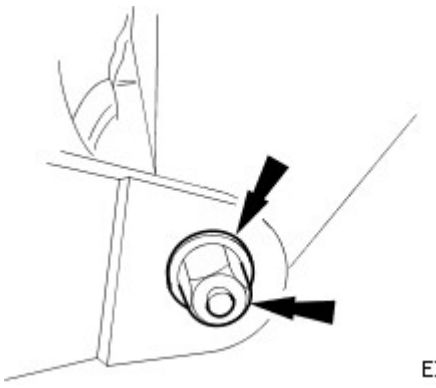


22. Remove back plate.

- Remove two bolts and two screws securing back plate to hub carrier.
- Withdraw back plate complete with parking brake cable.



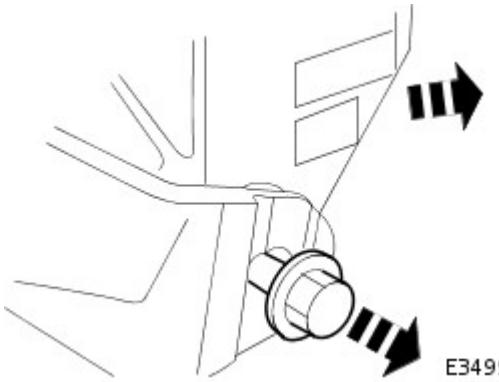
23. Mark wishbone at pivot pin eccentric flange marker to aid installation.

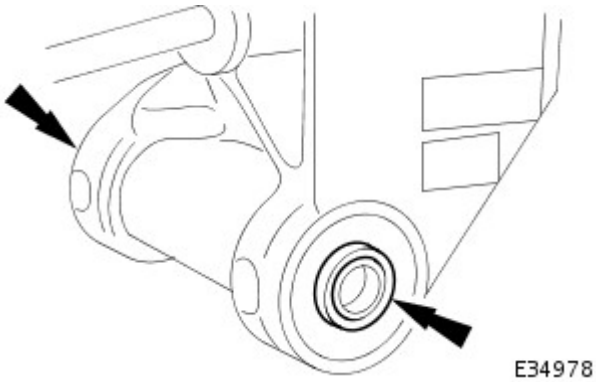


24. Remove nut and washer from pivot pin.

25. Remove hub and carrier from wishbone and axle shaft.

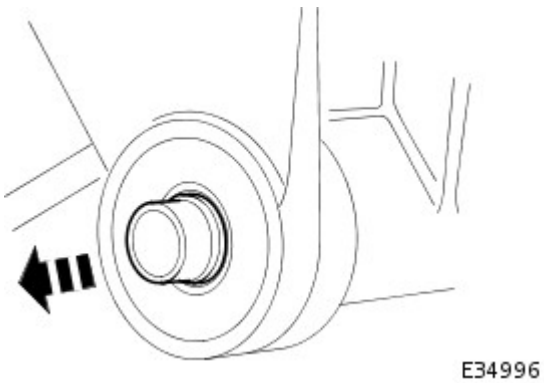
- Withdraw pivot pin and remove hub and carrier assembly.



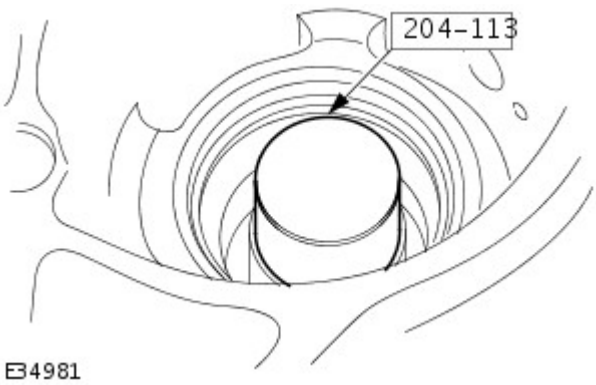


26. CAUTION: Note position of shims during removal. They must be returned to their original positions during installation.

Noting positions, remove shim from each end of pivot pin sleeve.



27. Withdraw pivot pin sleeve from hub carrier.

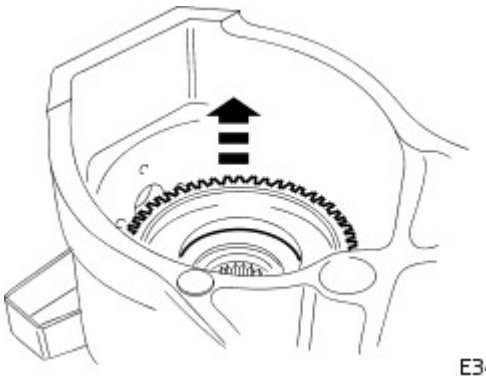


28. Using a hydraulic press, remove hub from carrier.

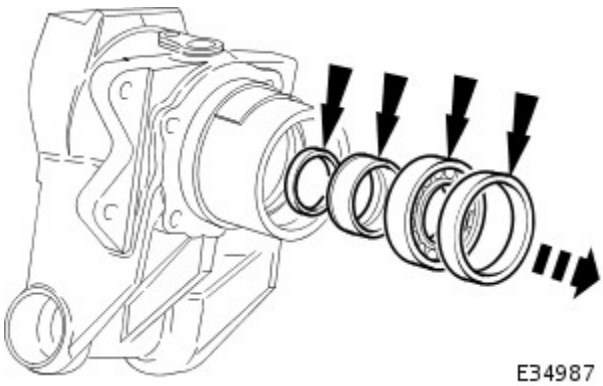
- Place large section of special tool 204-113 on press bed, with recess in tool uppermost.
- Position hub carrier on tool, ensuring handbrake cable housing locates in tool recess.
- Position small section of special tool on hub. 204-113.
- Align tool to press-ram, and operate press to remove hub from hub carrier.

29. Place hub carrier on a work bench.

30. Withdraw ABS rotor from hub carrier.



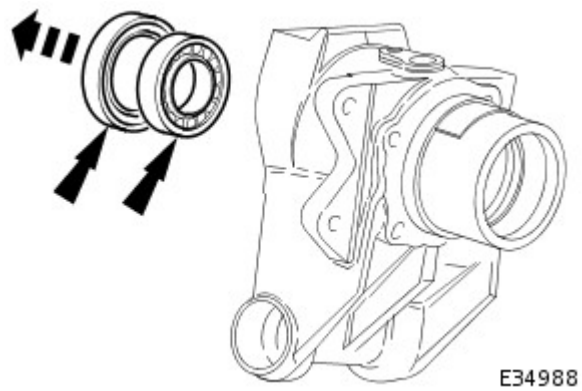
E34979



E34987

31. Remove outer seal and bearing assembly from hub carrier.

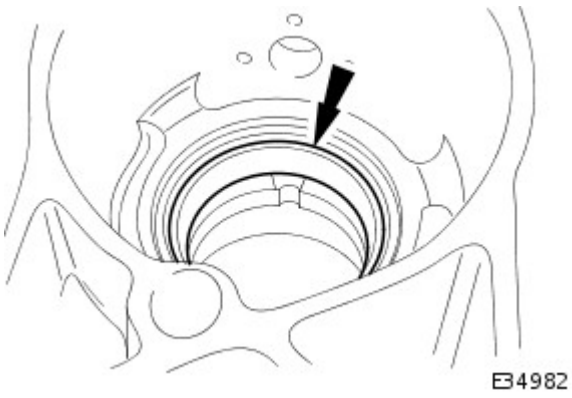
- Using a drift, remove and discard outer seal.
- Remove and discard outer bearing.
- Remove bearing spacer.
- Remove bearing shim.



E34988

32. Remove inner seal and bearing from hub carrier.

- Using a drift, remove and discard inner seal.
- Remove and discard inner bearing.



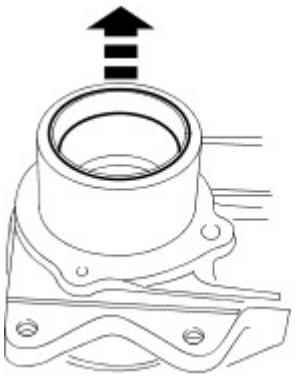
E34982

33. Remove inner bearing cup from hub carrier.

- Position hub carrier on a block of wood.
- Using a drift, remove and discard inner bearing cup.

34. Remove outer bearing cup from hub carrier.

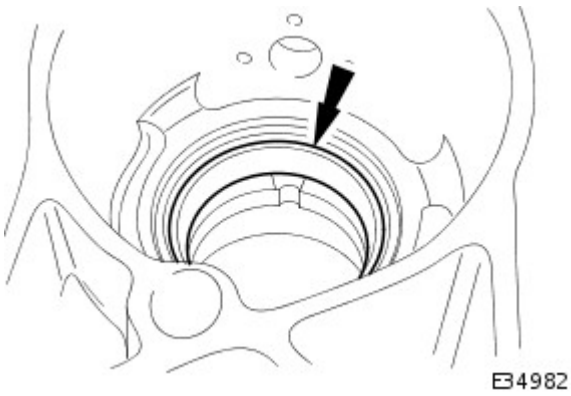
- Position hub carrier on a block of wood.
- Using a drift, remove and discard outer bearing cup.



E34995

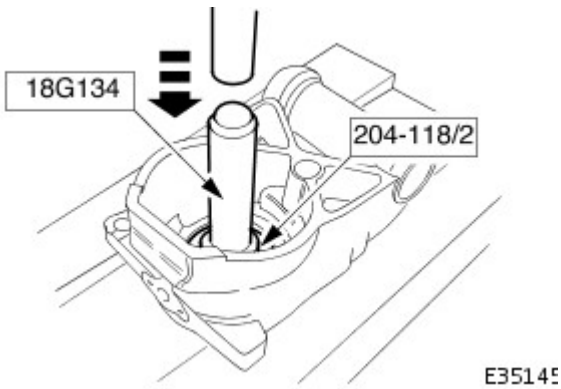
35. Clean hub and hub carrier.

Installation



E34982

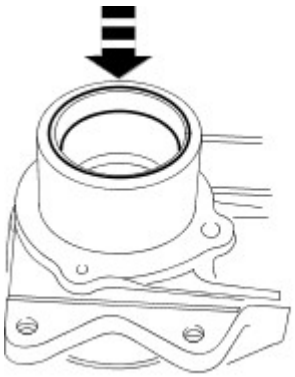
1. Place hub carrier on press bed and insert inner bearing cup.



E35145

2. Using a hydraulic press, install new inner bearing cup in hub carrier.

- Install special handle 18G134 to tool 204-118/2.
- Align special tool 204-118/2 to bearing cup.
- Align assembly to ram, and operate press to fully seat bearing cup.

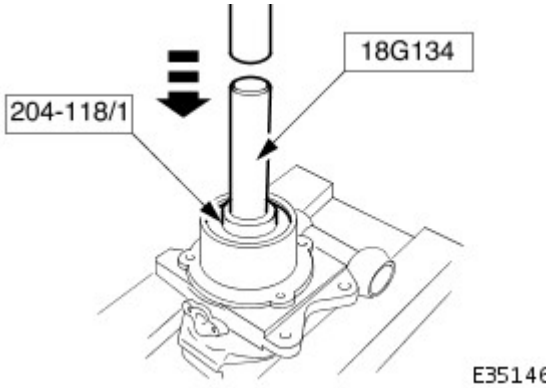


E35148

3. Place hub carrier on press-bed and insert outer bearing cup.

4. Using a hydraulic press, install outer bearing cup in hub carrier.

1. Install special handle 18G134 to tool 204-118/1

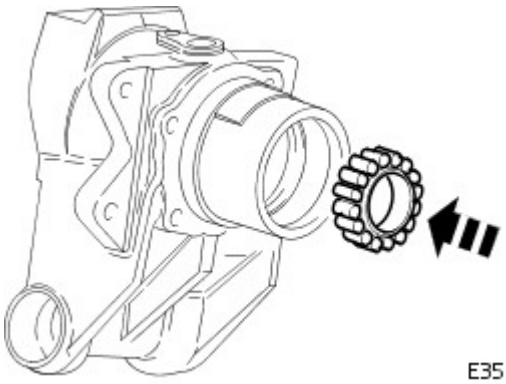


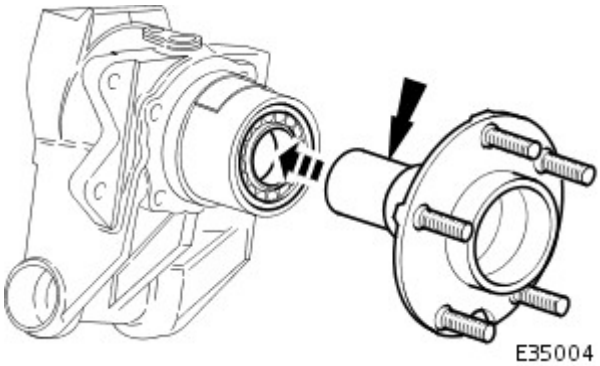
2. Align special tool 204-118/1 to bearing cup.

- Align assembly to ram, and operate press to fully seat bearing cup.

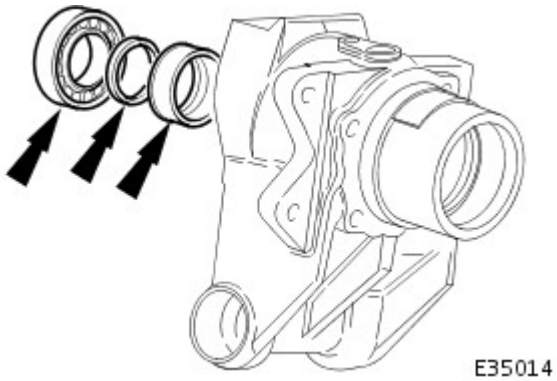
5. Place hub carrier on a work bench.

6. Install outer bearing in hub carrier.





7. Install hub in outer bearing and carrier.



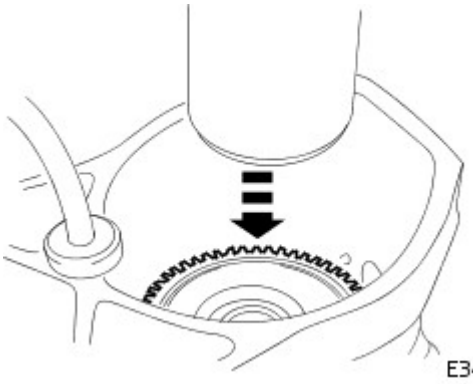
8. Install inner bearing in hub carrier.

1. Install bearing spacer to hub.
2. Install a 3.47 mm (maximum thickness) shim on hub.
3. Install inner bearing in hub carrier.

9. CAUTION: Do not allow press load to be directed on to hub studs.

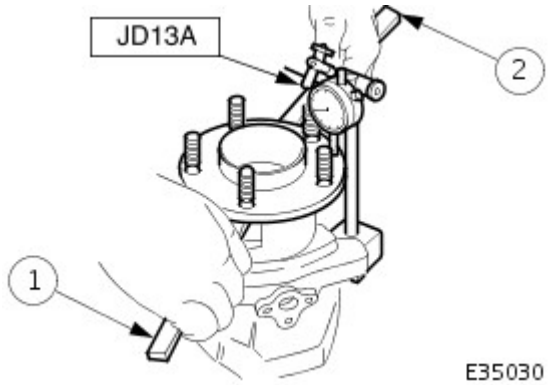
Using a hydraulic press, install ABS-sensor rotor to hub.

- Place block of wood on press-bed.



1. Position hub carrier on block of wood.
2. Position ABS-rotor sensor to hub.

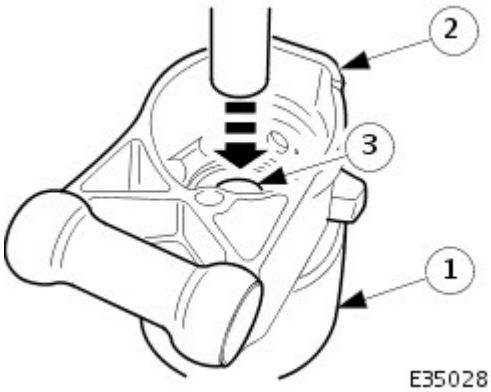
- Align assembly to press-ram, and operate press to install ABS-sensor rotor to hub.



10. CAUTION: Do not use excessive force when levering hub.

Measure hub end-float.

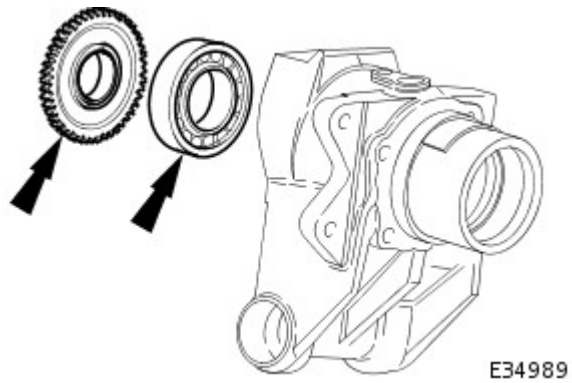
- Secure hub carrier in vice.
- Install special tool JD15 to hub.
  1. Install dial gauge JD 13A on hub carrier.
  2. Using two levers, measure and record hub end-float.
- Remove special tools from hub carrier.



11. Using hydraulic press, remove hub and outer bearing assembly from carrier.

1. Position large section of special tool JD132 on press bed, with recess in tool upper most.
2. Position hub carrier on tool, ensuring parking brake cable housing locates in tool recess.
3. Position small section of special tool JD132 on hub.

- Align assembly to press-ram, and operate press to remove hub from hub carrier.

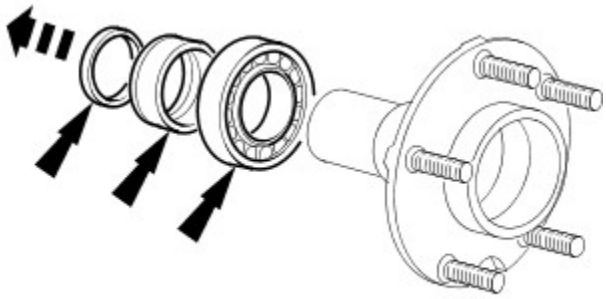


12. Remove ABS rotor and inner bearing from hub carrier.

- Remove ABS rotor.
- Remove inner bearing.

13. Remove outer bearing assembly from hub.

- Remove bearing shim.

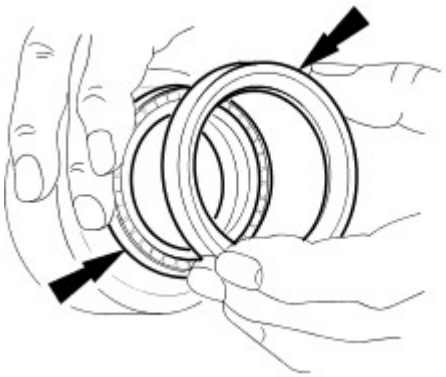


E34990

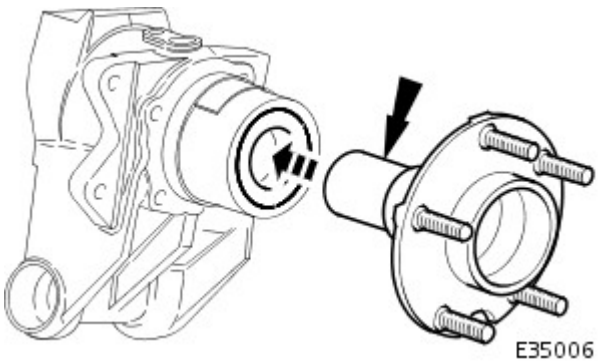
- Remove bearing spacer.
- Remove outer bearing.

14. Pack new inner and outer bearings with Shell Retinax 'A' grease.

15. Install outer bearing and using special tool 205-234, fully seat seal in hub carrier.

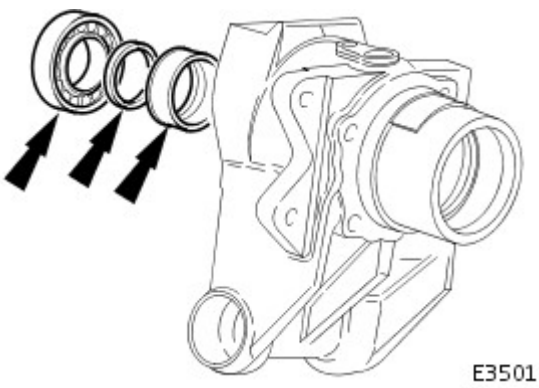


E34980



E35006

16. Using a press, install hub in carrier/bearing assembly.



E35014

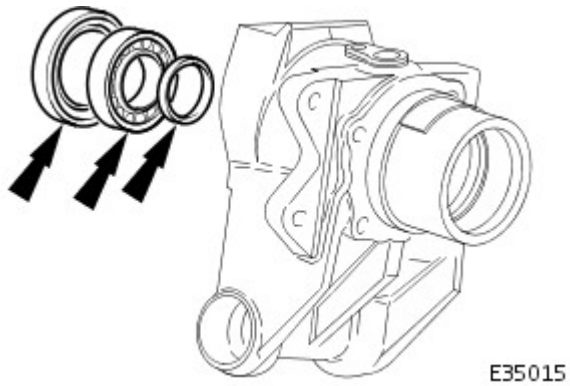
17. Install inner bearing assembly.

1. Install bearing spacer.
2. Install bearing shim.
3. Install inner bearing.

18. Determine hub end float.

- Measure and record end-float as a datum.
- Calculating from datum, select a shim that will achieve a 0.076 mm end-float.

19. Install new bearing shim.

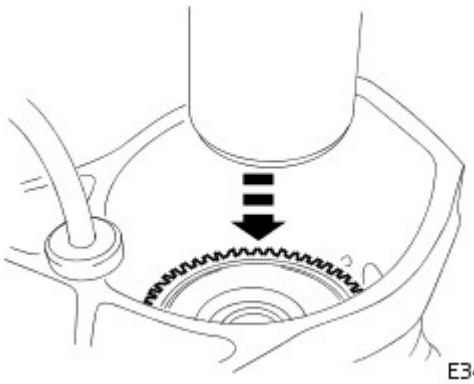

E35015

1. Install selected shim.

2. Install inner bearing.

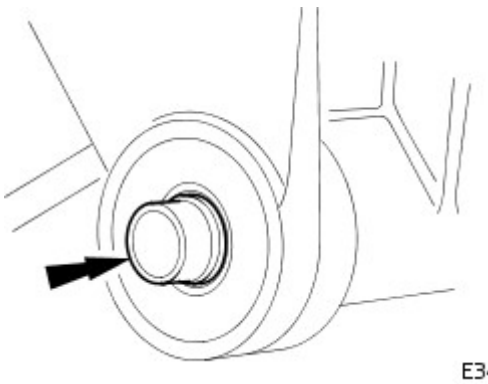
3. Using special tool 205-234, install inner bearing seal.

20. Place block of wood on hydraulic press-bed and position hub carrier on block.

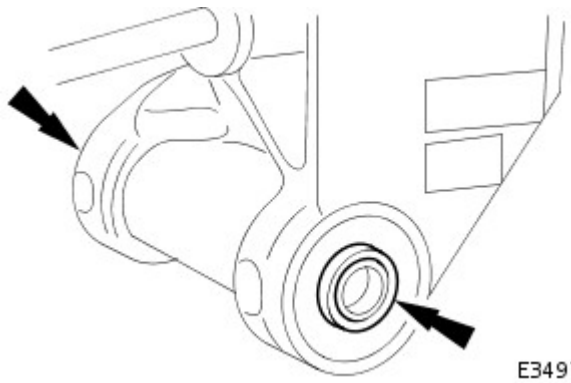

E34984

21. CAUTION: Do not allow press load to be directed on to hub studs.

Align ABS rotor to hub and operate press to fully seat rotor on hub.


E34985

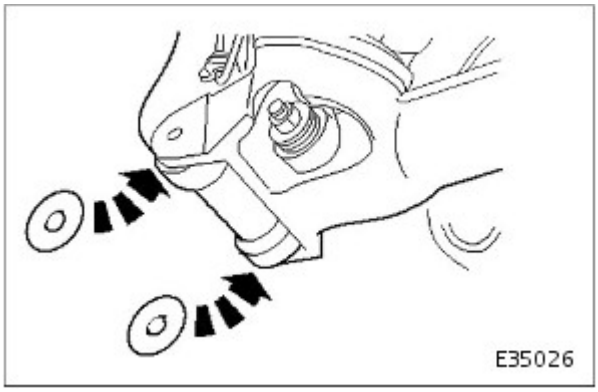
22. Install pivot pin sleeve in carrier bearings.

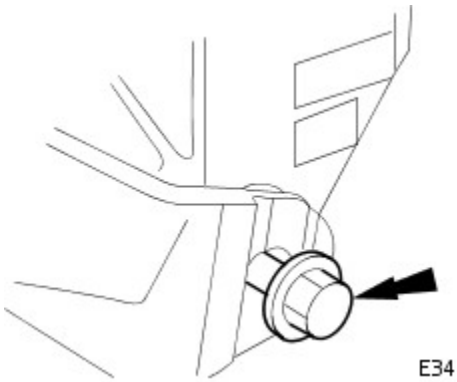

E34978

23. Install shims on pivot pin sleeve in positions noted during removal.

24. Position hub carrier assembly on wishbone.

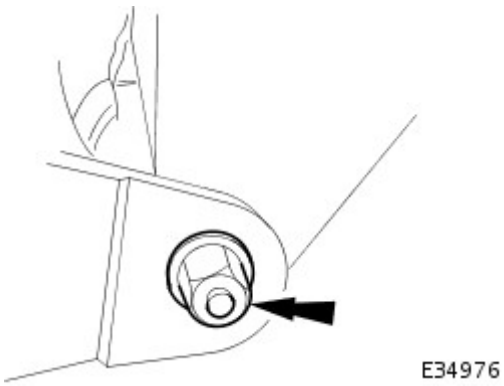
1. Ensuring shims remain positioned on sleeve, position hub carrier assembly on wishbone.



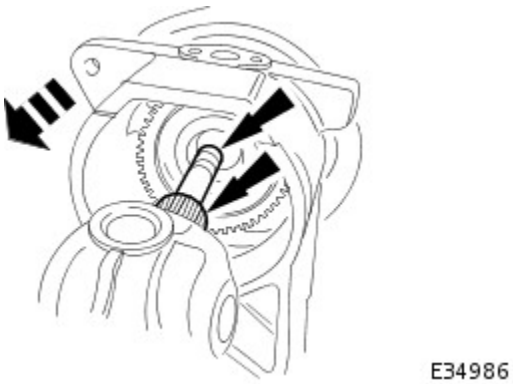


25. Install hub assembly to wishbone and axle assembly.

- Position hub and carrier to wishbone and axle shaft.
- Install pivot pin ensuring that eccentric flange correctly seats in wishbone groove.



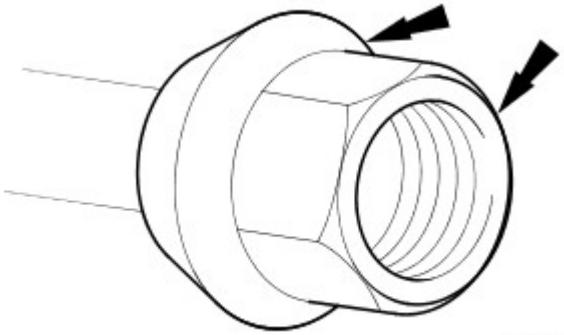
26. Install washer and nut on pivot pin, but DO NOT tighten nut.



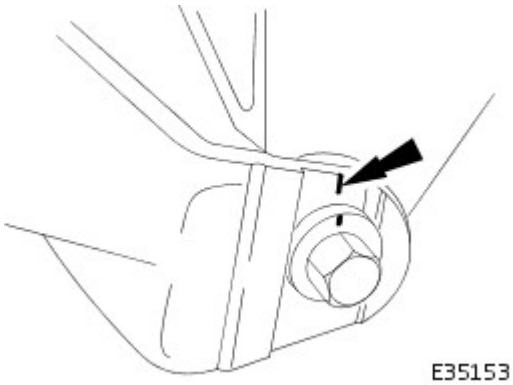
27. Install hub on axle shaft .

- Route parking brake cable through hub carrier aperture and install grommet.
- Apply Loctite 270 to axle shaft splines and thread, and fully seat hub on shaft.

28. Install locating collar and hub nut on axle shaft, but DO NOT tighten hub nut.



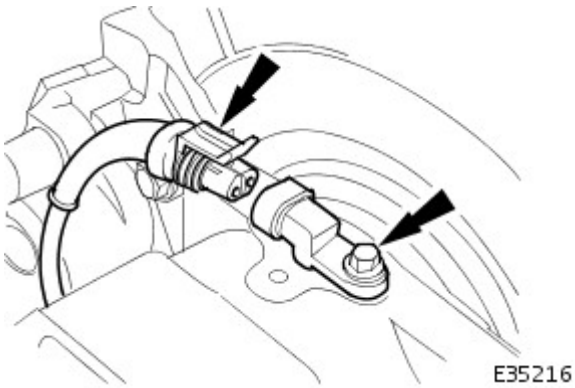
E34972



E35153

29. Tighten pivot pin nut.

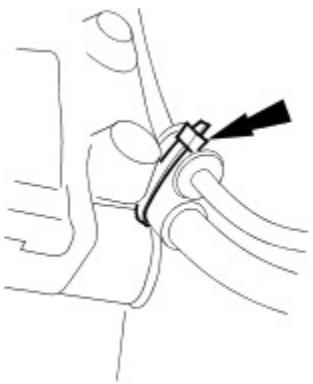
- Align marker on pivot pin flange with mark made on wishbone.
- Ensuring pin position is not disturbed, tighten nut to 88-118Nm.



E35216

30. Install wheel speed sensor on hub carrier.

- Position sensor on hub carrier and install and tighten bolt to 7-10Nm.
- Connect wheel speed sensor harness to sensor.



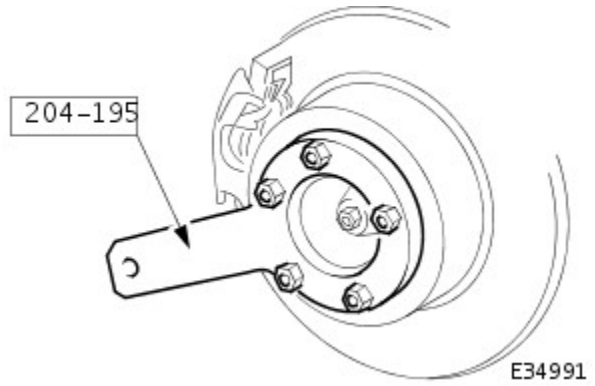
E35235

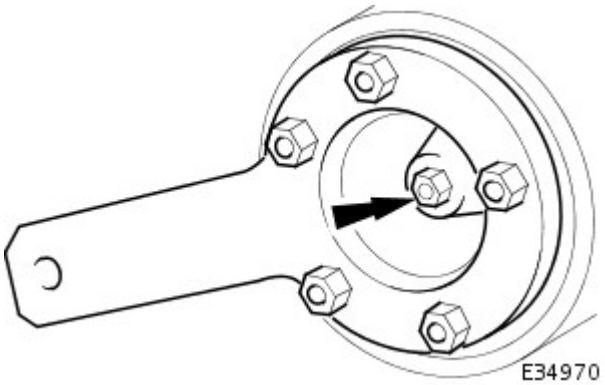
31. Using new tie strap, secure wheel speed sensor harness to hub carrier.

32. Install handbrake shoes. Refer to operation 70.40.05.

33. Install brake disc. Refer to operation 70.10.13.

34. Position special tool 204-195 on hub studs and install securing nuts.





35. Tighten hub nut to 304-336Nm.

36. Remove securing nuts and withdraw special tool 204-195 from hub.

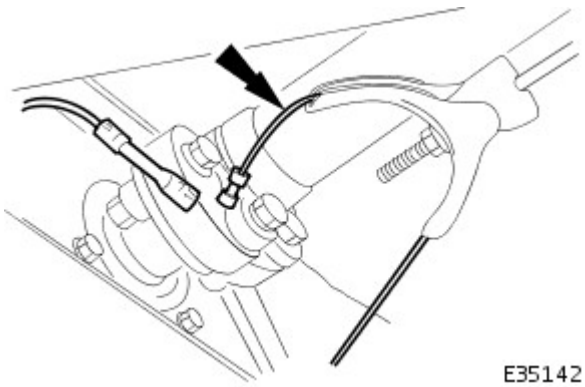
37. Install rear wheel. Refer to Section 204-04.

38. Remove stands and lower vehicle onto wheels. Refer to section 100-02.

39. Raise vehicle on four-post lift.

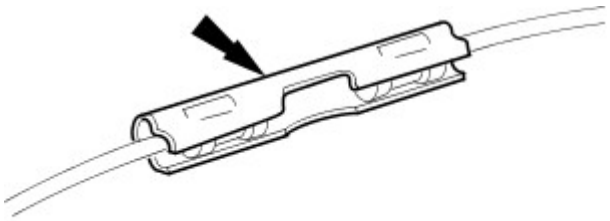
40. Route parking brake cable through suspension mounting bracket and secure with clip.





41. Route parking brake LH cable through equalizer.

42. Install LH cable in connecting clip.



E34975

43. Adjust parking brake cable. Refer to 70.35.10.

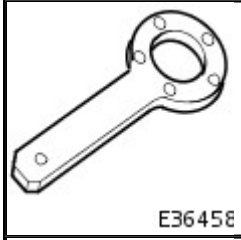
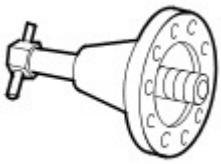
44. Lower four-post lift

45. Apply parking brake.

46. Carry out rear wheel alignment check and adjust as necessary. Refer to data in Specification section.

Rear Suspension - Wheel Hub Seal

Removal and Installation

Special Tool(s)	
 E36458	Hub Holding Tool 204-195 (JD227)
 E36452	Hub Puller 204-011 (JD 1D)
 E36453	Rear-Hub Remover 204-113 (JD 132)
 E36454	Oil Seal Remover/Replacer 205-234 (JD 550-1)

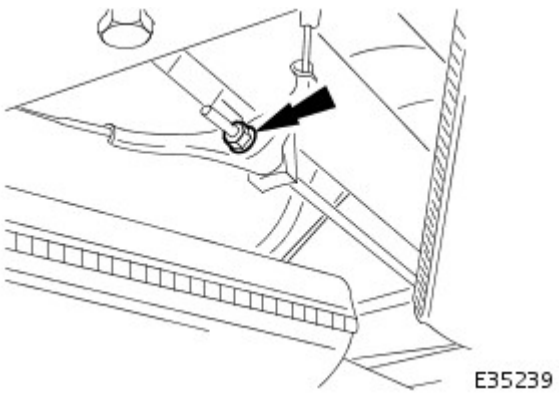
Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Release parking brake.

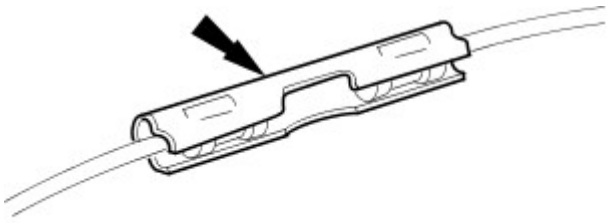
2. Raise the vehicle on a four-post lift.

3. Fully slacken but do not remove parking brake cable adjuster nut.

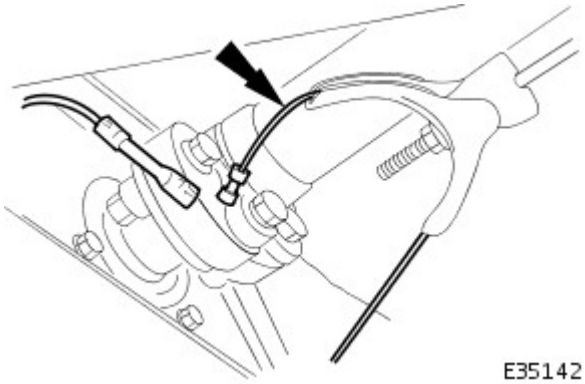

E35239

4. Release appropriate side parking brake cable from connecting

clip.



E34975



E35142

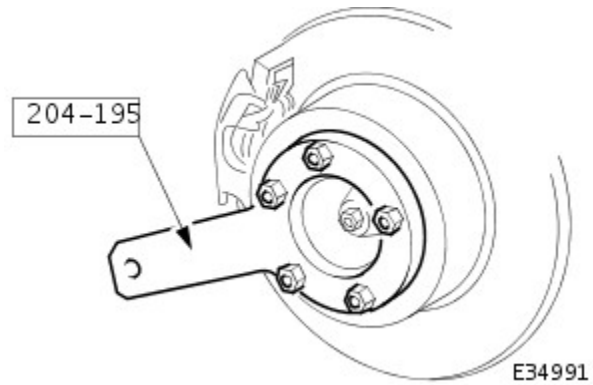
5. Withdraw parking brake cable through equalizer (LH side cable only).

6. Lower four-post lift.

7. Raise rear of vehicle to working height and support on stands. Refer to section 100-02.

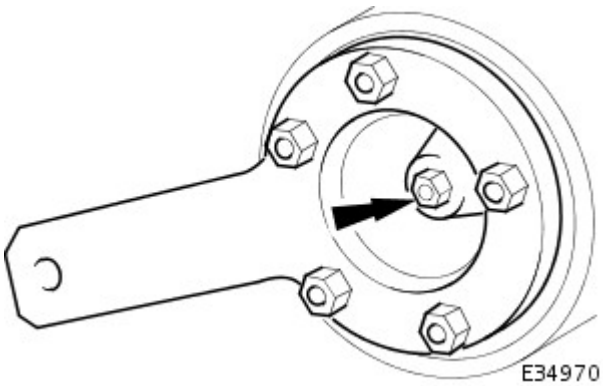
8. Remove rear wheel. Refer to section 204-04.

9. Position special tool (204-195) on hub studs and install securing nuts.



E34991

10. Slacken but do not remove hub to axle shaft securing nut.



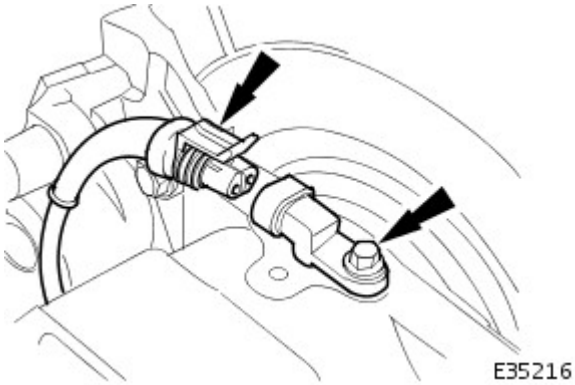
E34970

11. Remove nuts and withdraw special tool (204-195) from hub.

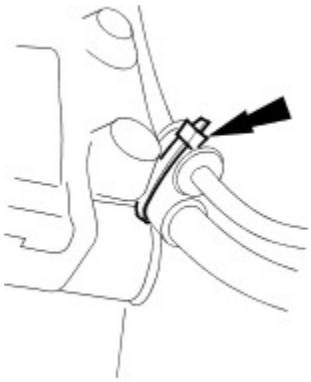
12. Remove rear brake disc. Refer to 70.10.13.

13. Remove parking brake shoes. Refer to 70.40.05.

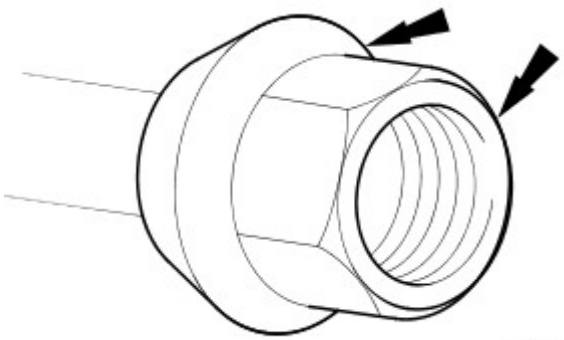
14. Remove wheel speed sensor.



- Disconnect wheel speed sensor harness connector.
- Remove sensor securing bolt and withdraw sensor from hub carrier.



15. Sever and discard wheel speed sensor harness tie strap and position harness for access.



16. Remove hub nut and collar.

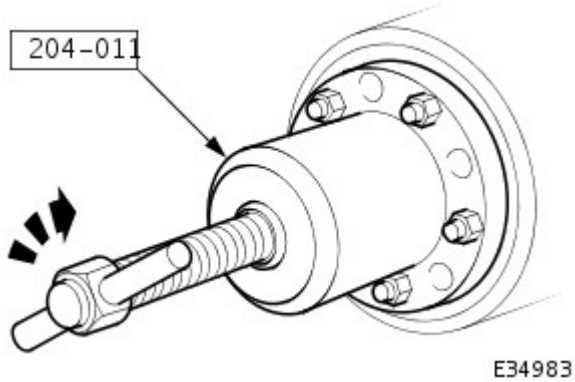
- Remove nut.
- Remove locating collar.



17. Install thread protector on axle shaft.

18. Release hub from axle shaft.

- Position hub puller on hub studs. (204-011)
- Install securing nuts.
- Progressively tighten puller center bolt to release hub from axle shaft splines.



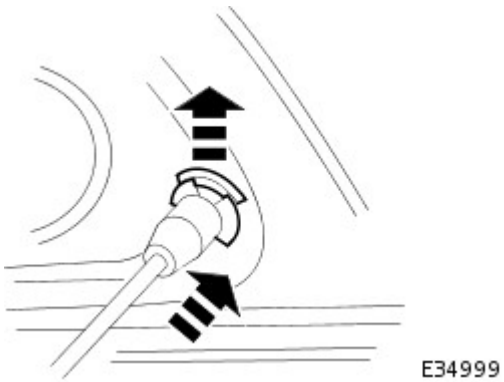
E34983

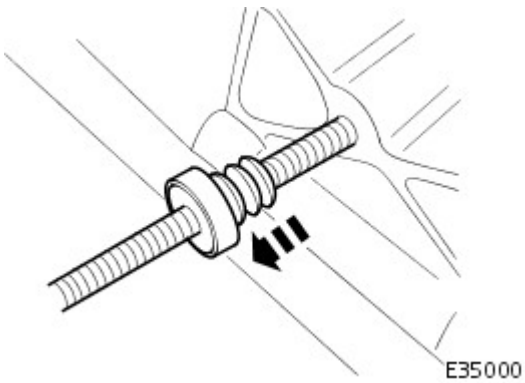
19. Remove hub puller and thread protector.

- Remove securing nuts and release puller from hub.
- Remove thread protector from axle shaft.

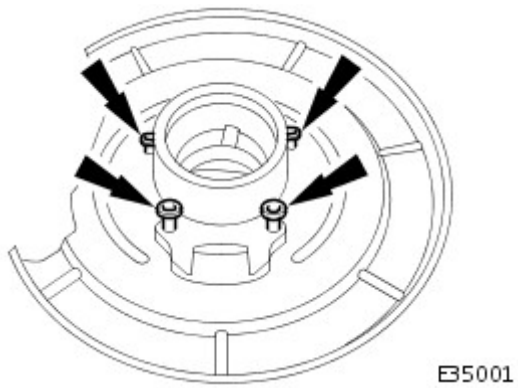
20. Release parking brake cable from suspension mounting bracket.

- Remove cable retaining clip.
- Draw cable through suspension mounting bracket aperture.


E34999


E35000

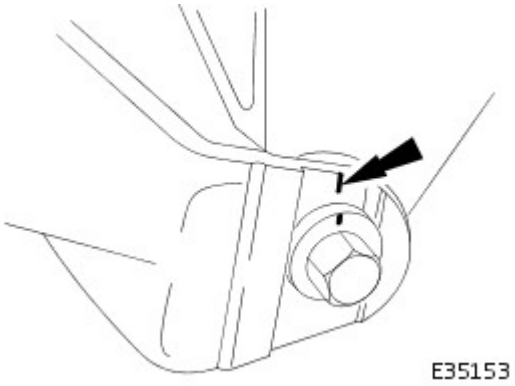
21. Remove parking brake cable to hub carrier grommet.


E35001

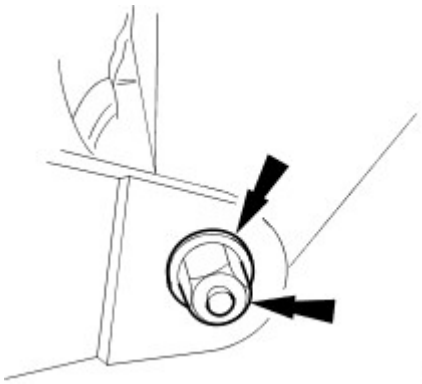
22. Remove back plate.

- Remove two bolts and two screws securing back plate to hub carrier.
- Withdraw back plate complete with parking brake cable.

23. Mark wishbone at pivot pin eccentric flange marker to aid installation.

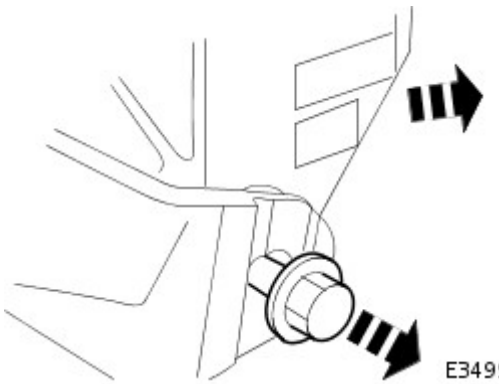


24. Remove nut and washer from pivot pin.



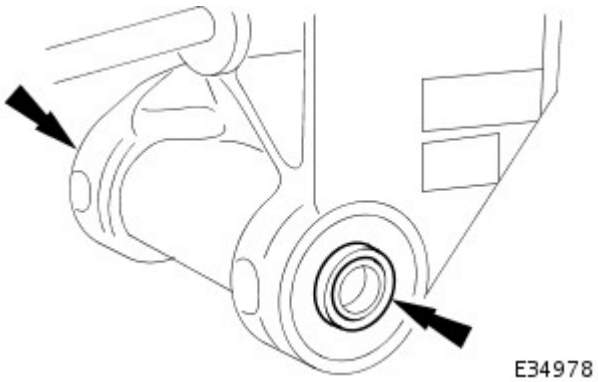
25. Remove hub and carrier from wishbone and axle shaft.

- Withdraw pivot pin and remove hub and carrier assembly.

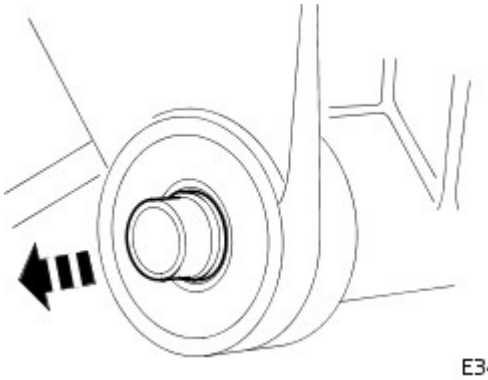


26. CAUTION: Note position of shims during removal. They must be returned to their original positions during installation.

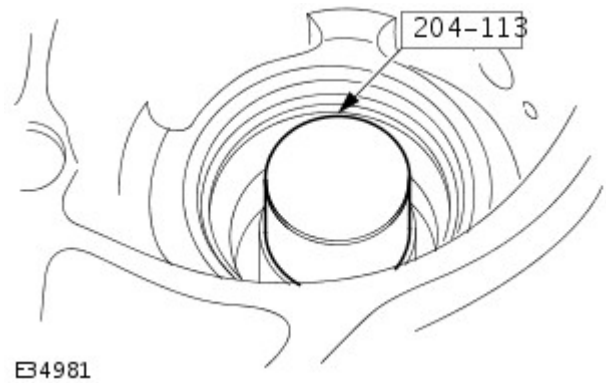
Noting positions, remove shim from each end of pivot pin sleeve.



27. Withdraw pivot pin sleeve from hub carrier.



E34996



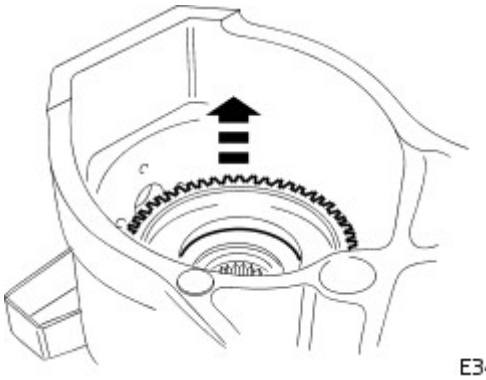
E34981

28. Using a hydraulic press, remove hub from carrier.

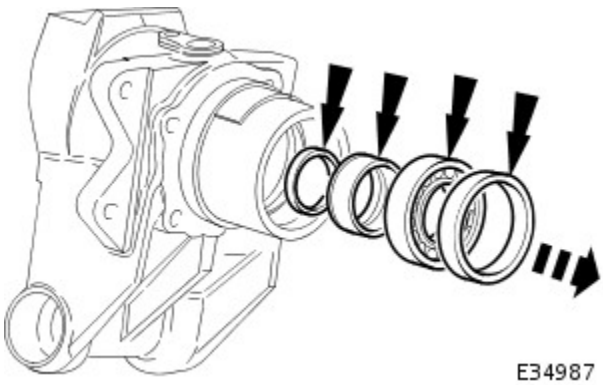
- Place large section of special tool (204-113) on press bed, with recess in tool uppermost.
- Position hub carrier on tool, ensuring handbrake cable housing locates in tool recess.
- Position small section of special tool (204-113) on hub.
- Align tool to press-ram, and operate press to remove hub from hub carrier.

29. Place hub carrier on a work bench.

30. Withdraw ABS rotor from hub carrier.



E34979



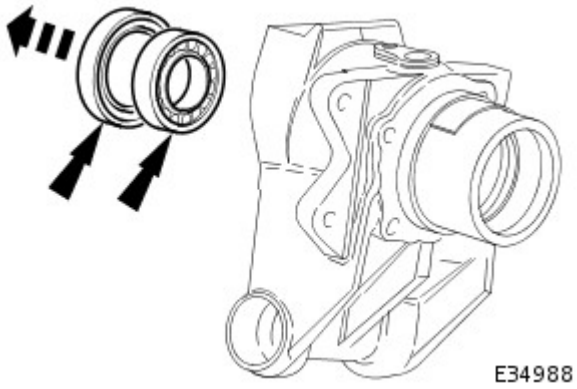
E34987

31. Remove outer seal and bearing assembly from hub carrier.

- Using a drift, remove and discard outer seal.
- Remove outer bearing.
- Remove bearing spacer.
- Remove bearing shim.

32. Remove inner seal and bearing from hub carrier.

- Using a drift, remove and discard inner seal.
- Remove inner bearing.



33. Using approved cleaning agents:

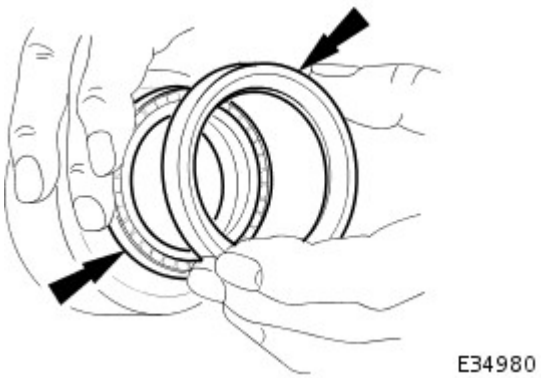
- Wash and thoroughly dry inner and outer bearings.
- Thoroughly clean hub carrier paying particular attention to bearing cups.
- Thoroughly clean hub.

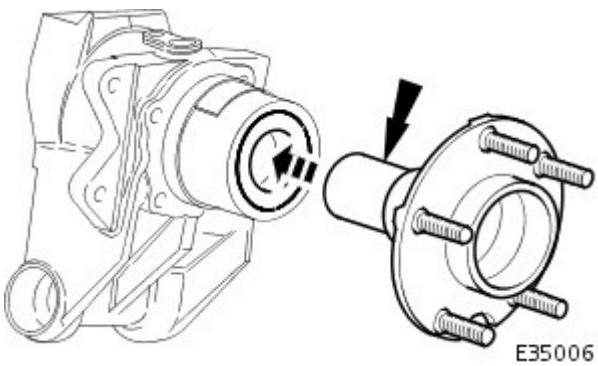
Installation

1. Grease bearings.

- Pack inner and outer bearing races with Shell Retinax 'A' grease:
- Apply a film of shell Retinax 'A' grease to bearing cups

2. Install outer bearing in hub carrier and fully seat new seal using special tool 205-234.

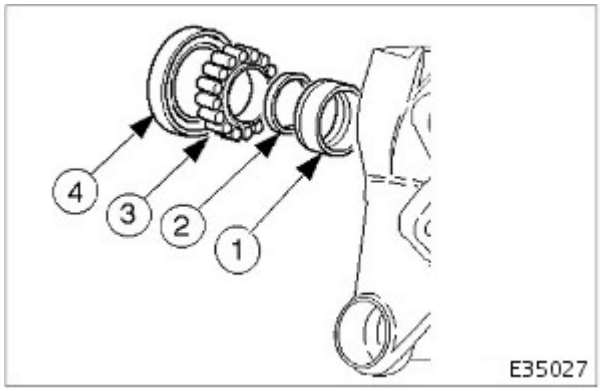




3. Apply a thin film of Shell Retinax 'A' grease to hub shaft and install hub in carrier/bearing assembly.

4. Install inner bearing assembly and seal.

1. Install bearing spacer.

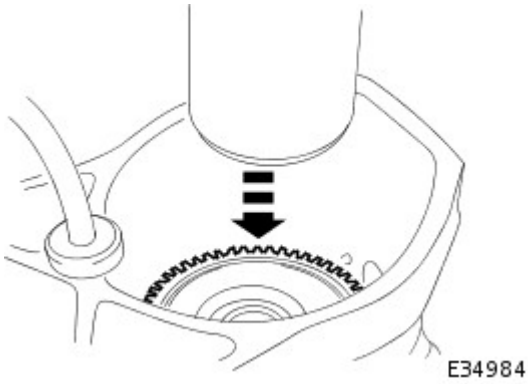


2. Install bearing shim.

3. Install inner bearing.

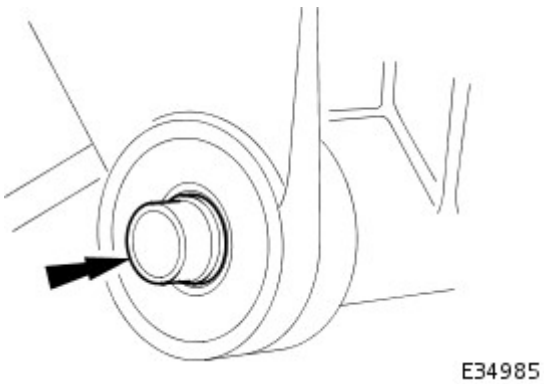
4. Install and fully seat new inner bearing seal using special tool 205-234.

5. Place block of wood on hydraulic press-bed and position hub carrier on block.

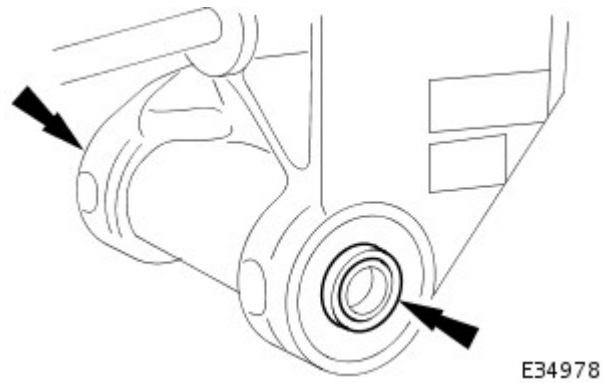


6. CAUTION: Do not allow press load to be directed onto hub studs.

Align ABS rotor to hub and operate press to fully seat rotor on hub.



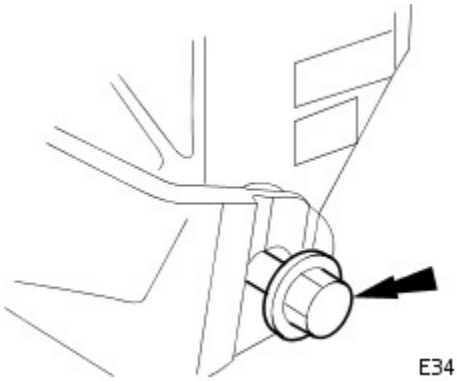
7. Install pivot pin sleeve in carrier bearings.



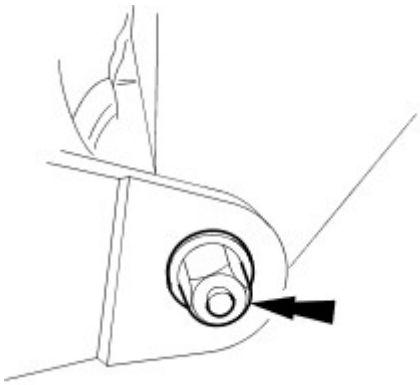
8. Install shims on pivot pin sleeve in positions noted during removal.

9. Install hub assembly to wishbone and axle assembly.

- Position hub and carrier to wishbone and axle shaft.
- Install pivot pin ensuring that eccentric flange correctly seats in wishbone groove.



E34977



E34976

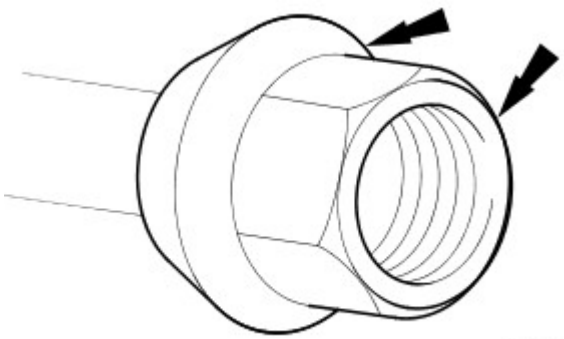
10. Install washer and nut on pivot pin, but DO NOT tighten nut.



E34986

11. Install hub on axle shaft .

- Route parking brake cable through hub carrier aperture and install grommet.
- Apply Loctite 270 to axle shaft splines and thread, and fully seat hub on shaft.

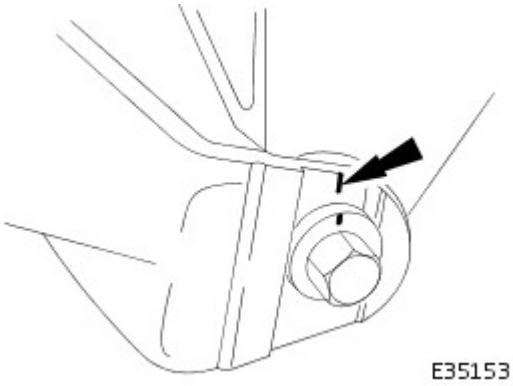


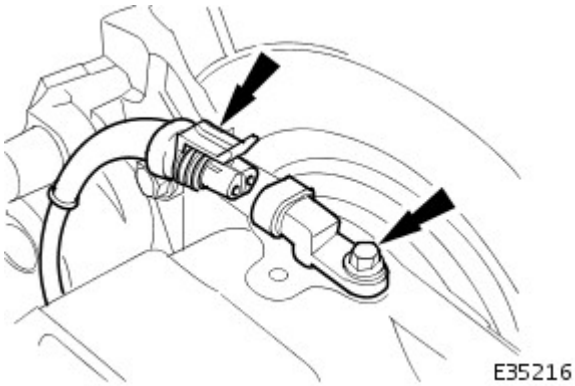
E34972

12. Install locating collar and hub nut on axle shaft, but DO NOT tighten hub nut.

13. Tighten pivot pin nut.

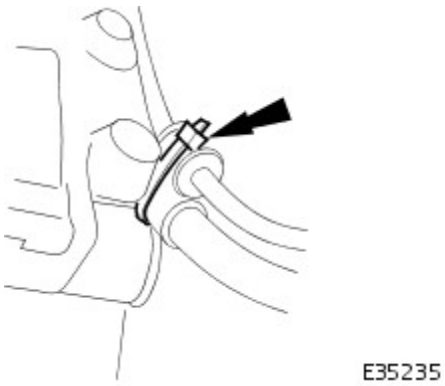
- Align marker on pivot pin flange with mark made on wishbone.
- Ensuring pin position is not disturbed, tighten nut to 88-118Nm.





14. Install wheel speed sensor on hub carrier.

- Position sensor on hub carrier and install and tighten bolt to 7-10Nm.
- Connect wheel speed sensor harness to sensor.

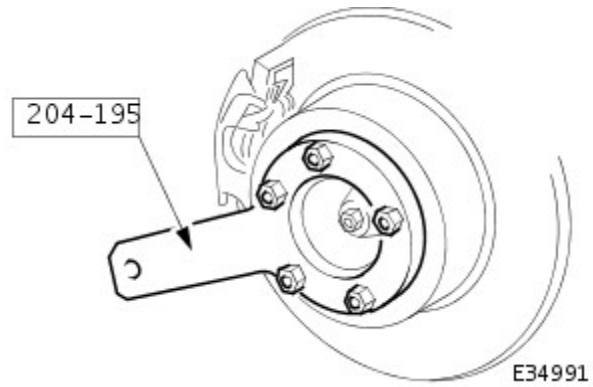


15. Using new tie strap, secure wheel speed sensor harness to hub carrier.

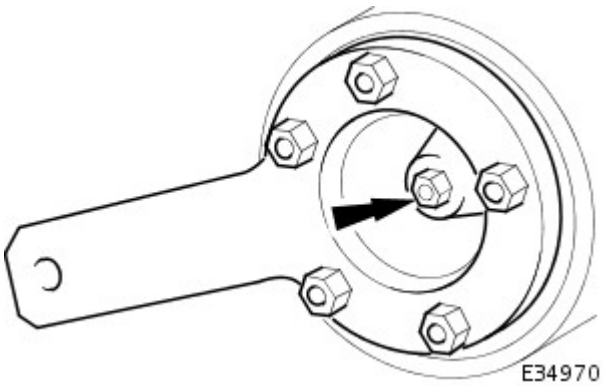
16. Install handbrake shoes. Refer to operation 70.40.05.

17. Install brake disc. Refer to operation 70.10.13.

18. Position special tool (204-195) on hub studs and install nuts.



19. Tighten hub nut to 304-336Nm.


E34970

20. Remove nuts and withdraw special tool (204-195) from hub.

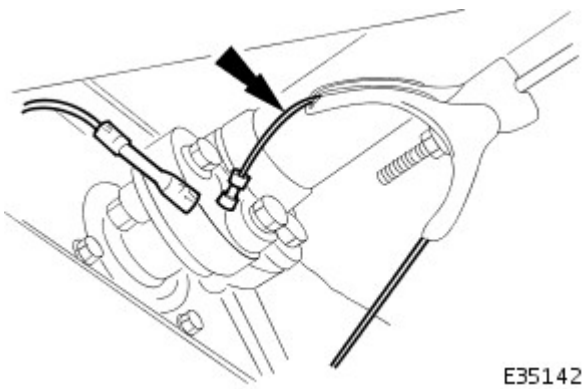
21. Install rear wheel. Refer to Section 204-04.

22. Remove stands and lower vehicle onto wheels. Refer to section 100-02.

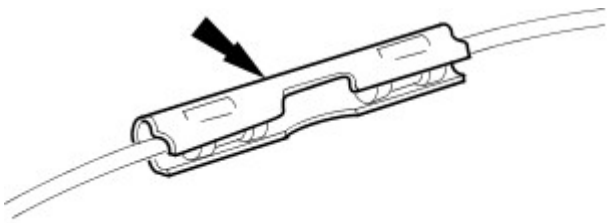
23. Raise vehicle on four-post lift.

24. Route parking brake cable through suspension mounting bracket and secure with clip.


E34974


E35142

25. Route parking brake cable through equalizer (LH side cable only).


E34975

26. Install parking brake cable in connecting clip.

27. Adjust parking brake cable. Refer to 70.35.10.

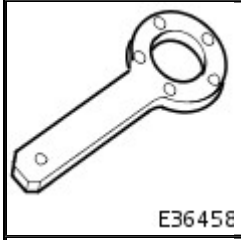
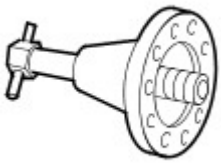
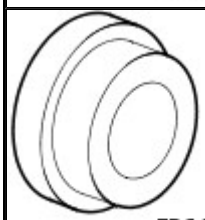
28. Lower four-post lift

29. Apply parking brake.

30. Carry out rear wheel alignment check and adjust as necessary. Refer to 204-02 Specification section.

Rear Suspension - Wheel Knuckle Bushing

Removal and Installation

Special Tool(s)	
 E36458	Hub Holding Tool 204-195 (JD227)
 E36452	Hub Puller 204-011 (JD 1D)
 E36457	Driver Handle 100-013 (18G-134)
 E36459	Bearing Cup Replacer Adaptor 204-120 (JD 550-6)

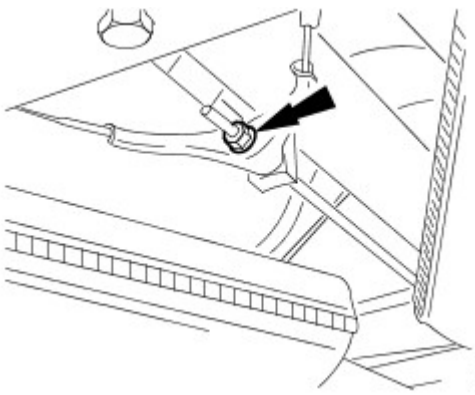
Removal

1. CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

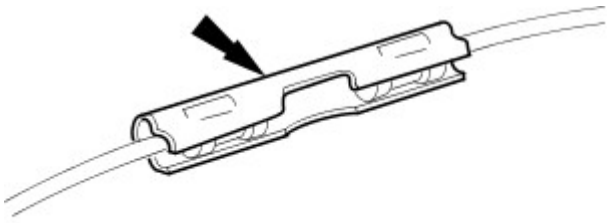
Release parking brake.

2. Raise the vehicle on a four-post lift.

3. Fully slacken but do not remove parking brake cable adjuster nut.

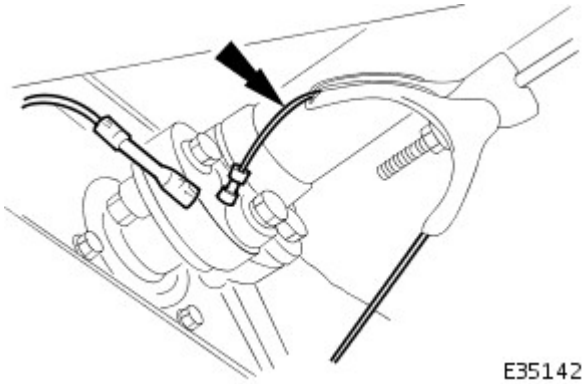

E35239

4. Release appropriate side parking brake cable from connecting



clip.

E34975



E35142

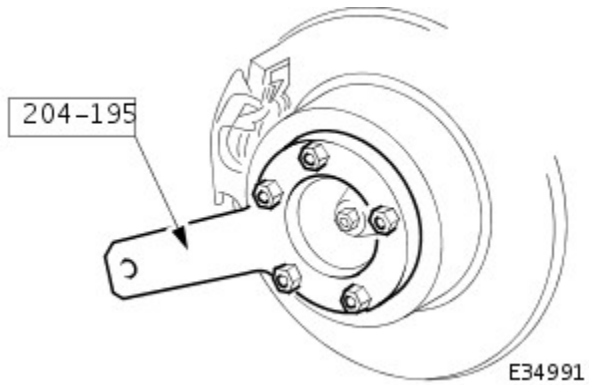
5. Withdraw parking brake cable through equalizer (LH side cable only).

6. Lower four-post lift.

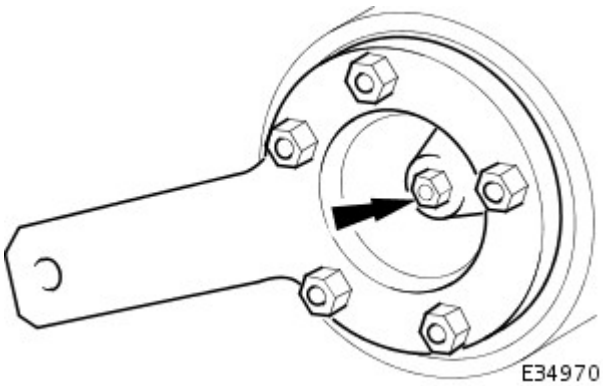
7. Raise rear of vehicle to working height and support on stands. Refer to section 100-02.

8. Remove rear wheel. Refer to section 204-04.

9. Position special tool (204-195) on hub studs and install securing nuts.



E34991



E34970

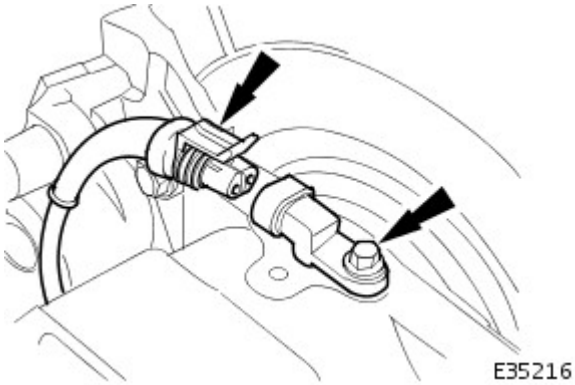
10. Slacken but do not remove hub to axle shaft securing nut.

11. Remove securing nuts from studs and withdraw special tool (204-195) from hub.

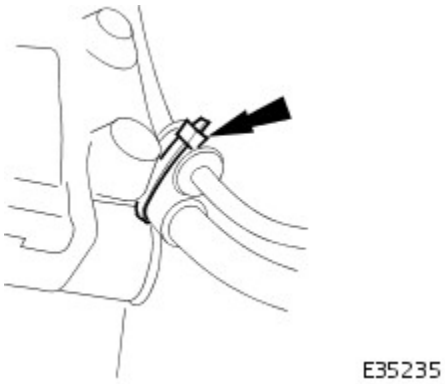
12. Remove rear brake disc. Refer to 70.10.13.

13. Remove parking brake shoes. Refer to 70.40.05.

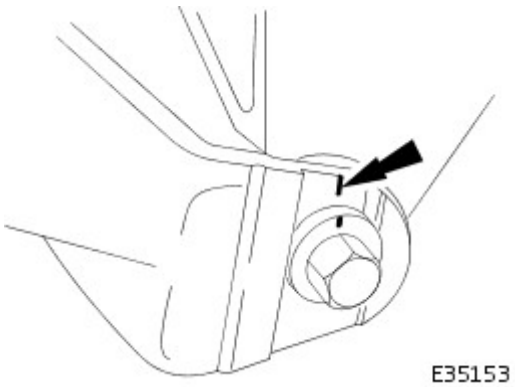
14. Remove wheel speed sensor.



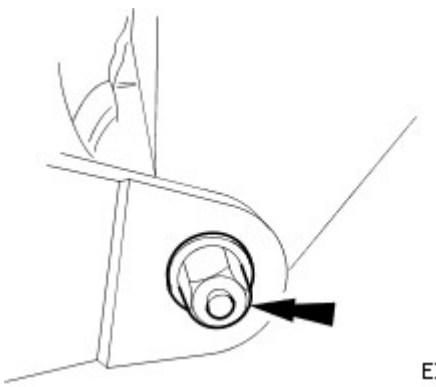
- Disconnect wheel speed sensor harness connector.
- Remove sensor securing bolt and withdraw sensor from hub carrier.



15. Remove wheel speed sensor harness tie strap and position harness for access.



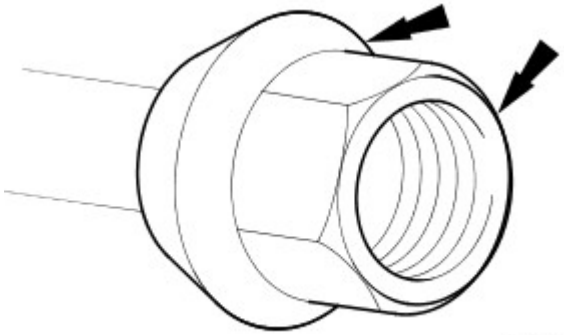
16. Mark wishbone at pivot pin eccentric flange marker to aid installation.



17. Remove nut and washer from pivot pin.

18. Remove hub securing nut and collar.

- Remove nut.
- Remove locating collar.

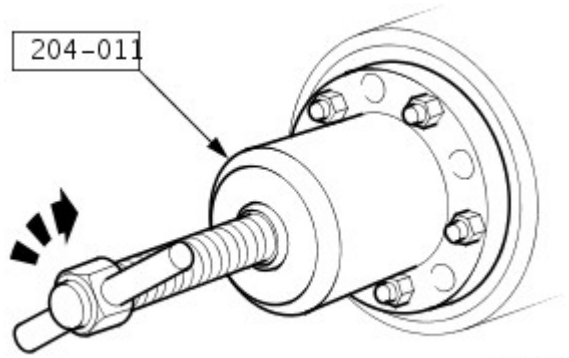


E34972



E34973

19. Install a thread protector on axle shaft.



E34983

20. Release hub from axle shaft.

- Position hub puller on hub studs. (204-011)
- Install securing nuts.
- Progressively tighten puller center bolt to release hub from axle shaft splines.

21. Remove nuts and release puller from hub.

22. Remove thread protector from axle shaft.

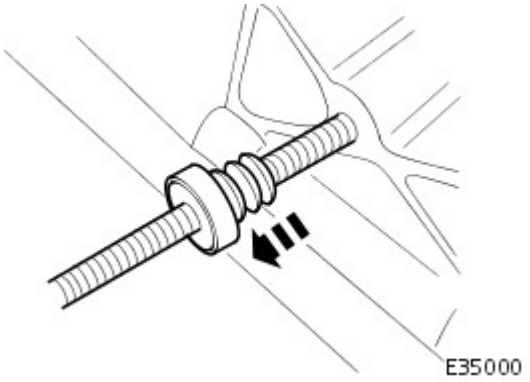
23. Release handbrake cable from suspension mounting bracket.



E34974

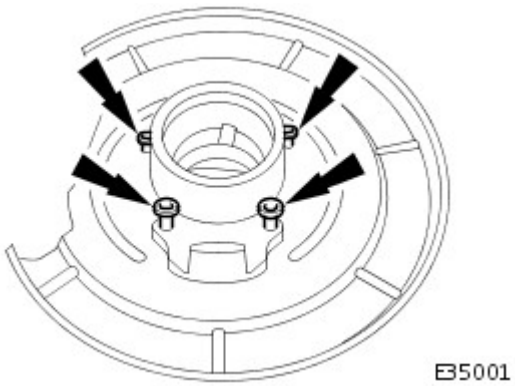
- Remove cable retaining clip.
- Draw cable through suspension mounting bracket aperture.

24. Remove parking brake cable to hub carrier grommet.



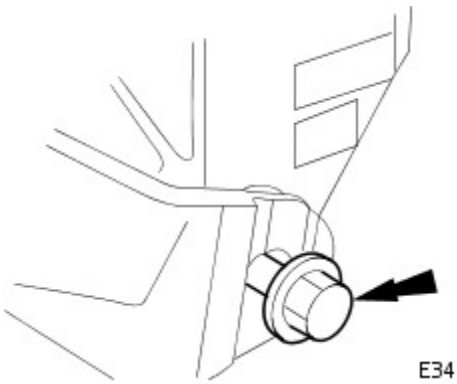
25. Remove back plate.

- Remove four screws securing back plate to hub carrier.
- Withdraw back plate complete with parking brake cable.

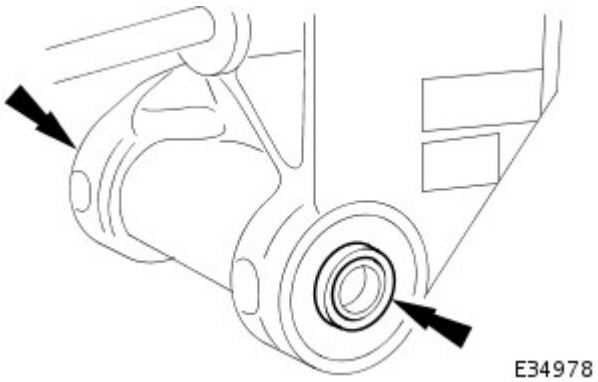


26. Remove hub and carrier.

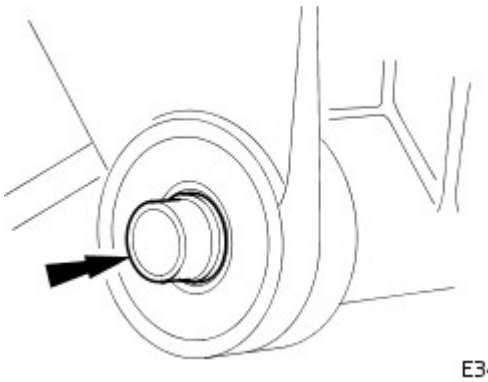
- Withdraw pivot pin.
- Remove hub and carrier assembly from wishbone and axle shaft.



27. Remove shim from each end of pivot pin sleeve.



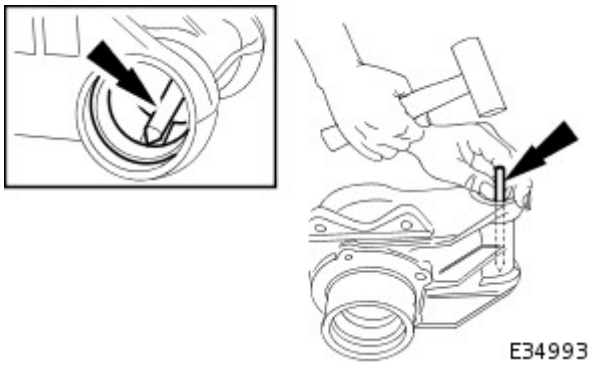
28. Withdraw pivot pin sleeve from hub carrier.



29. Secure hub carrier in a vise.

30. Remove and discard bearings from hub carrier.





31. Remove bearing cup from hub carrier.

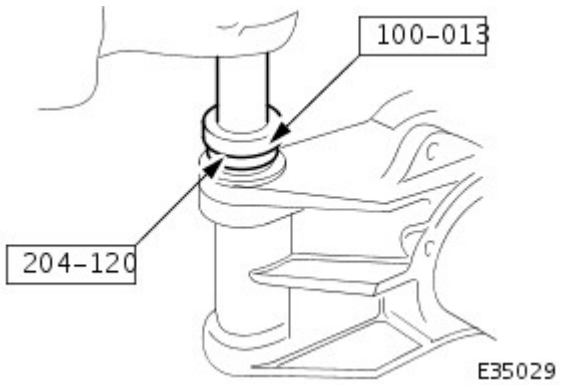
- Position hub carrier on a piece of wood.
- Position a long tapered drift in housing bore recess.
- Remove bearing cup.

32. Repeat procedure to remove opposite end bearing cup and discard both cups.

33. Remove hub carrier from vise.

34. Thoroughly clean all components.

Installation

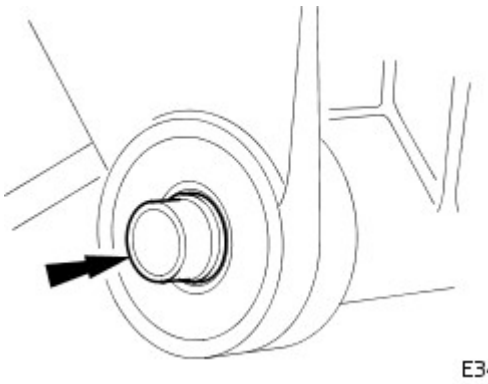


1. Using a hydraulic press, install new bearing cups in hub carrier.

1. Position hub carrier on press-bed.
2. Using special tool 100-013 and adapter 204-120, align bearing cup to hub carrier.

- Align assembly to ram, and operate press to fully seat bearing cup.
- Repeat procedure to fit other bearing cup.

2. Secure hub carrier in a vise.



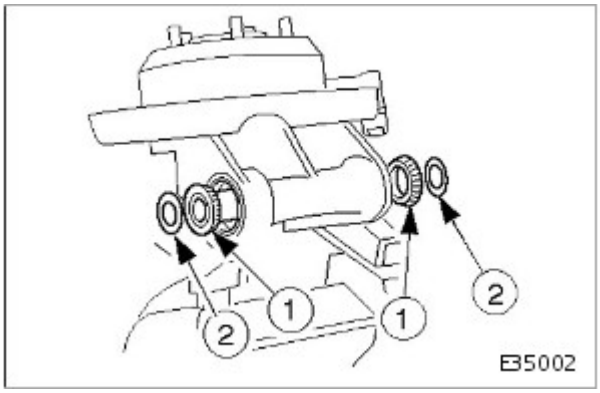
3. Install pivot pin sleeve in hub carrier.

4. Pack new pivot bearings with Shell Retinax 'A' grease.

5. Install pivot bearings in hub carrier.

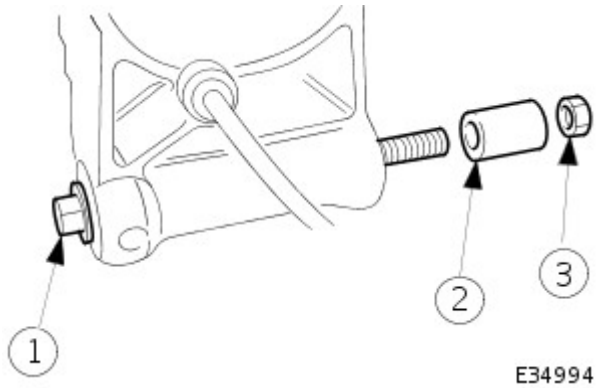
1. Slide bearing over pivot sleeve and seat in bearing cup.
2. Install a 3.905 mm (minimum size) shim to sleeve.

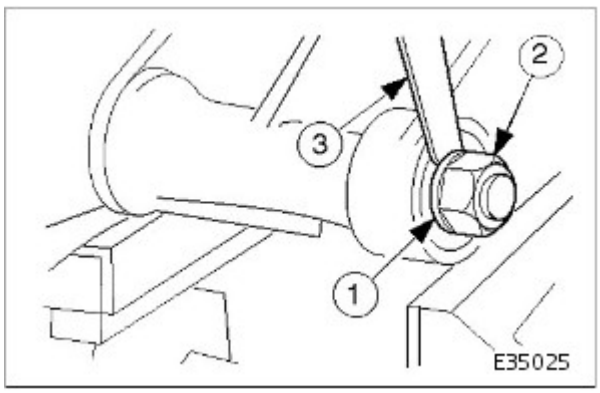
- Repeat procedure to install opposite end bearing and shim.



6. Press pivot pin sleeve into hub carrier.

- Install pivot pin in sleeve and position a piece of tube over part of thread.
- Install pivot pin nut and tighten until shims fully seat on pivot sleeve.
- Remove nut and tube.



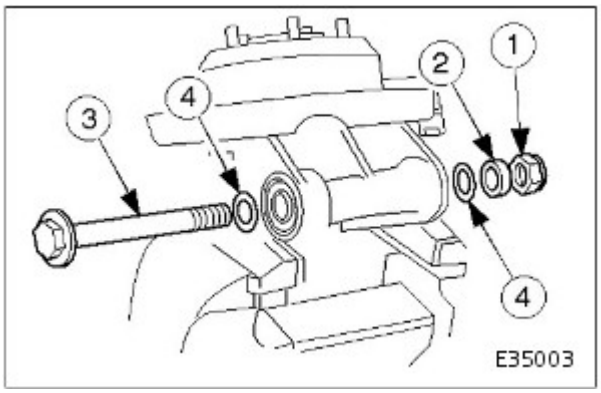


7. Measure bearing pre-load.

1. Position a flat washer to abut shim.
2. Install pivot pin nut.
3. Using a feeler gauge measure and record gap between shim and washer.

8. Remove shims from hub carrier.

1. Remove nut.
2. Remove washer.

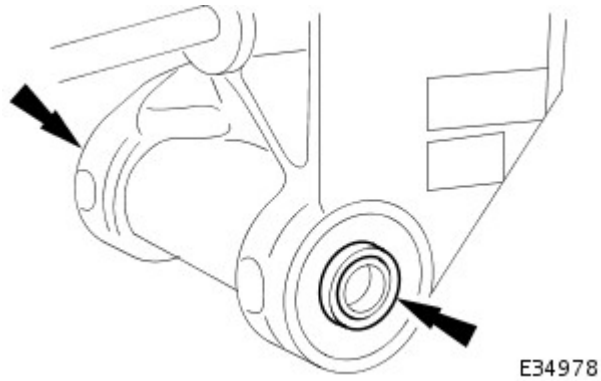


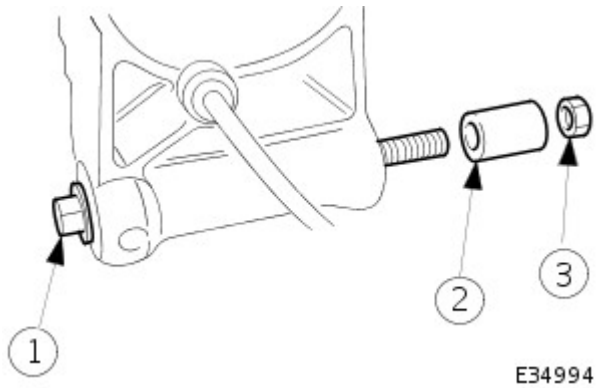
3. Remove pivot pin.

4. Remove both shims from pivot sleeve.

9. Using 3.905mm shim and pre-load measurements as a datum, select two new shims of equal thickness to provide a pre-load measurement of 0.076 mm.

10. Position shims on pivot sleeve.





11. Press selected shims into hub carrier.

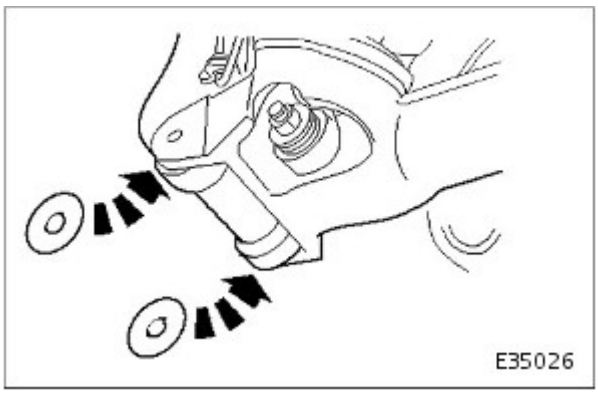
1. Install pivot pin in sleeve.

2. Position piece of tube over part of pivot pin thread.

3. Install nut to fully seat shims on sleeve.

12. Remove nut, tube and pivot pin from hub carrier.

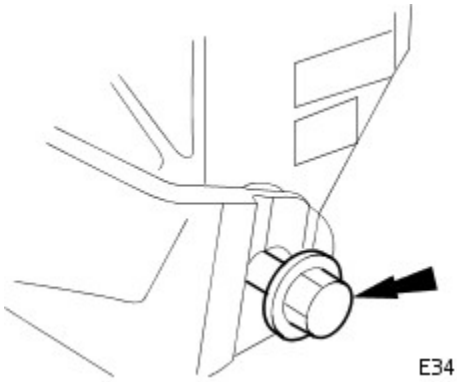
13. Position hub carrier assembly on wishbone.



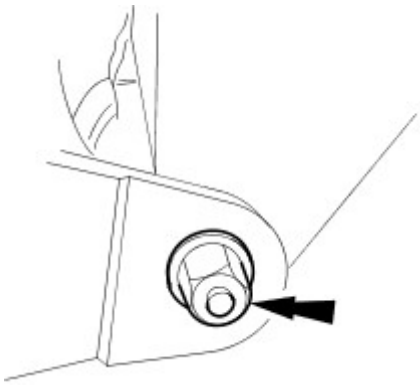
1. Ensuring shims remain positioned on sleeve, position hub carrier assembly on wishbone.

14. Install hub assembly to wishbone and axle assembly.

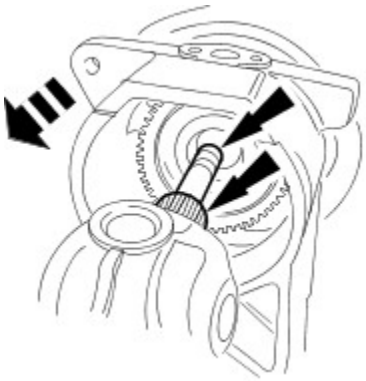
- Position hub and carrier to wishbone and axle shaft.



- Install pivot pin ensuring that eccentric flange correctly seats in wishbone groove.

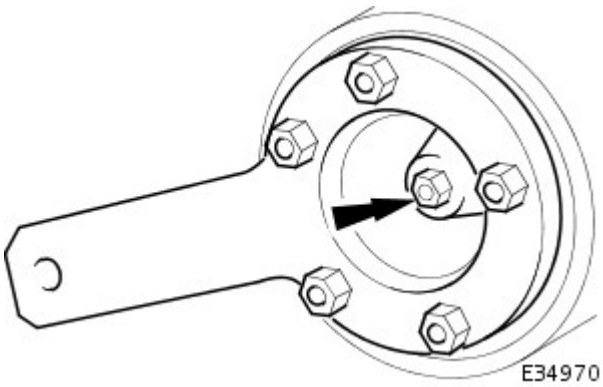


15. Install washer and nut on pivot pin, but DO NOT tighten nut.



16. Install hub on axle shaft .

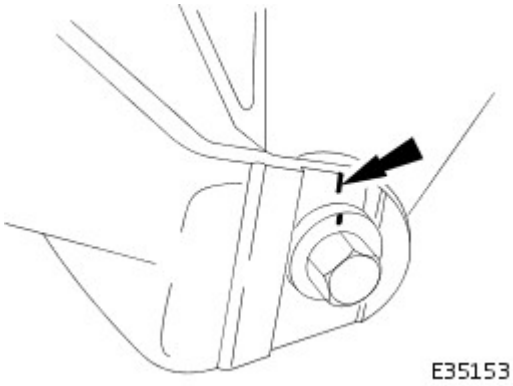
- Route handbrake cable through hub carrier.
- Apply Loctite 270 to axle shaft splines and thread, and fully seat hub on shaft.

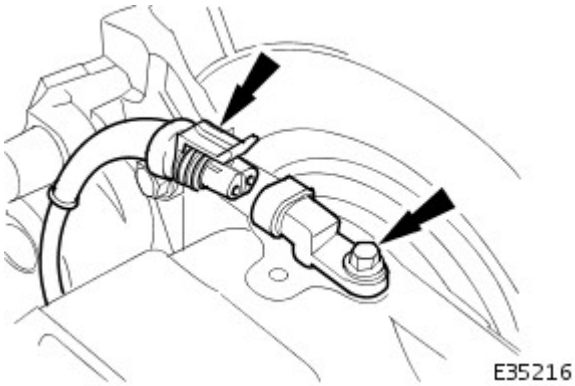


17. Install locating collar and hub nut on axle shaft, but DO NOT tighten hub nut.

18. Tighten pivot pin nut.

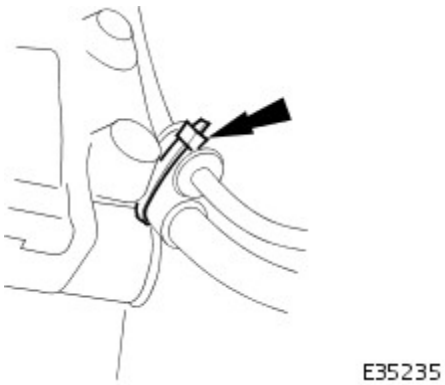
- Align marker on pivot pin flange with mark made on wishbone.
- Ensuring pin position is not disturbed, tighten nut to 88-118Nm.





19. Install wheel speed sensor on hub carrier.

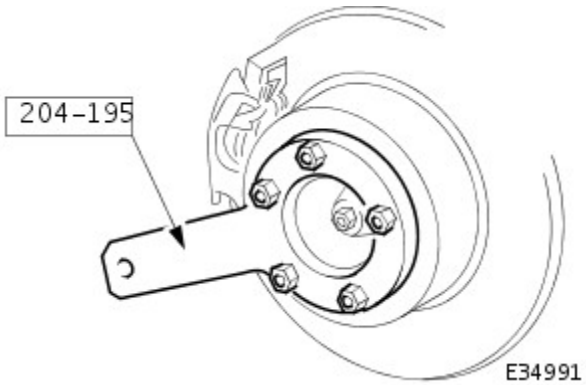
- Position sensor on hub carrier and install and tighten bolt to 7-10Nm.
- Connect wheel speed sensor harness to sensor.



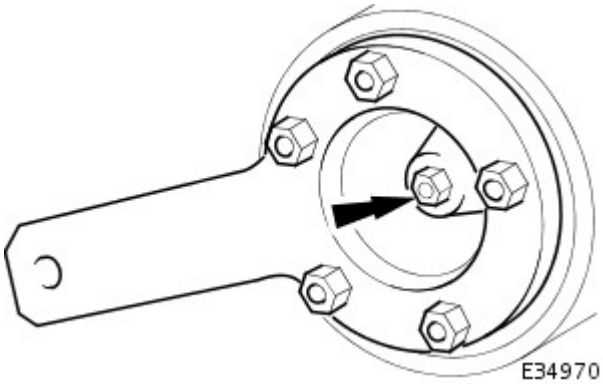
20. Using new tie strap, secure wheel speed sensor harness to brake hose clip.

21. Install parking brake shoes. Refer to 70.40.05.

22. Install special tool (204-195) on studs and install securing nuts.



23. Tighten hub nut to 304-336Nm.



24. Remove nuts and withdraw special tool (204-195) from hub studs.

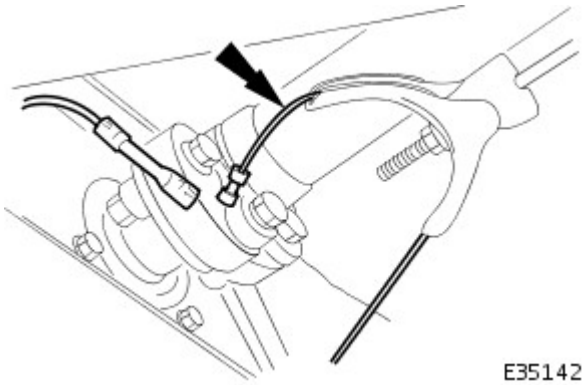
25. Install brake disc. Refer to operation 70.10.13.

26. Install rear wheel. Refer to section 204-04.

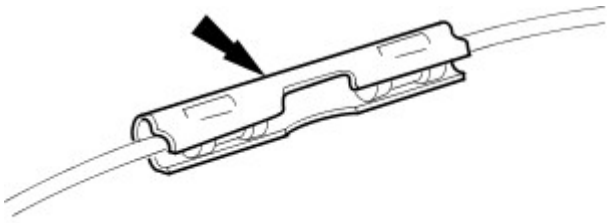
27. Remove stands and lower vehicle. Refer to section 100-02.

28. Raise vehicle on four-post lift.

29. Route brake LH cable through equalizer.



30. Install cable in connecting clip.



31. Adjust parking brake cable. Refer to 70.35.10.

32. Lower four-post lift.

33. Apply parking brake.

34. Carry out rear wheel alignment check and adjust as necessary. Refer to 204-02 Specification section.

Wheels and Tires -

Torques

Component	Nm
Wheel nut	88 - 102
Spare wheel retainer - temporary or full size spare	3

Inflation Pressures for Recommended Tires - Normal

Tire Size	Front	Rear
16, 17 and 18 inch	2.2 bar (32 lbf/in2)	2.3 bar (34 lbf/in2)

Inflation Pressures for Recommended Tires - Maximum Comfort Speeds up to 160 km/h (100 mph)

CAUTION: Only check tire pressures when the tires are cold, (when the tires have been operational wait until the tires have cooled to ambient temperature before checking the pressures).

Tire Size	Front	Rear
16, 17 and 18 inch	1.8 bar (26 lbf/in2)	1.9 bar (28 lbf/in2)

Inflation Pressures for Temporary Spare (space saver)

CAUTION: Do not exceed 80km/h (50mph) when the temporary spare wheel is installed.

Tire Size	Front	Rear
3.5" x 18" and 4" x 18"	4.1 bar (60 lbf/in2)	4.1 bar (60 lbf/in2)

Tires without Jaguar approval

Tires other than those recommended must be inflated to the following cold inflation pressure (front and Rear): 3.0 bar, 44lbf/in2
When using non-Jaguar approved winter tires, inflate to the recommended tire pressure and do not exceed the tire's speed capability.

Wheel Application

Refer to (204-04) Description and Operation Section for wheel designs and sizes.

Recommended Tires - UK, European and Overseas Markets

Manufacturer	Type	Size
Wheel Size: 7J x 16		
Pirelli	P 4000E	225 / 60 R 16
Wheel Size: 8J x 16		
Pirelli	P 6000	225 / 55 R 16
Wheel Size: 7.5J x 17		
Pirelli	P 6000	235 / 50 R 17
Wheel Size: 8J x 17		
Pirelli	P 6000	235 / 50 R 17
Wheel Size: 8J x 18		
Pirelli	P Zero	255 / 40 R 18
Wheel Size: 8.5J x 18		
Pirelli	P Zero	255 / 40 R 18
Wheel Size: Temporary Spare - 3.5J x 18 - Steel Wheel		
Pirelli		T115 / 85 R 18
Wheel Size: Temporary Spare - 4J x 18 - Alloy Wheel		
Pirelli		T115 / 85 R 18

Recommended Tires - North American Markets

Manufacturer	Type	Size
Wheel Size: 7J x 16		
Pirelli	P 4000E	225 / 60 R 16
Wheel Size: 8J x 18		
Pirelli	P Zero	255 / 40 R 18
Wheel Size: Temporary Spare - 3.5J x 18 - Steel Wheel		
Pirelli		T115 / 85 R 18
Wheel Size: Temporary Spare - 4J x 18 - Alloy Wheel		
Pirelli		T115 / 85 R 18

Recommended Winter Tires

CAUTION: Only use winter tires in complete sets of the same type and size.

Manufacturer	Type	Size
Wheel Size: 7J x 16		
Pirelli	Winter 210 M+S	225 / 60 R 16
Continental	Winter Contact	225 / 60 R 16
Wheel Size: 8J x 16		
Pirelli	Winter 210 M+S	225 / 55 R 16
Continental	Winter Contact	225 / 55 R 16
Wheel Size: 7.5J x 17		
Pirelli	Winter 210 M+S	255 / 45 R 17
Wheel Size: 8J x 17		
Pirelli	Winter 210 M+S	255 / 45 R 17
Wheel Size: 8J x 18		
Pirelli	Winter 210 M+S	255 / 40 R 18

Wheels and Tires - Wheels and Tires

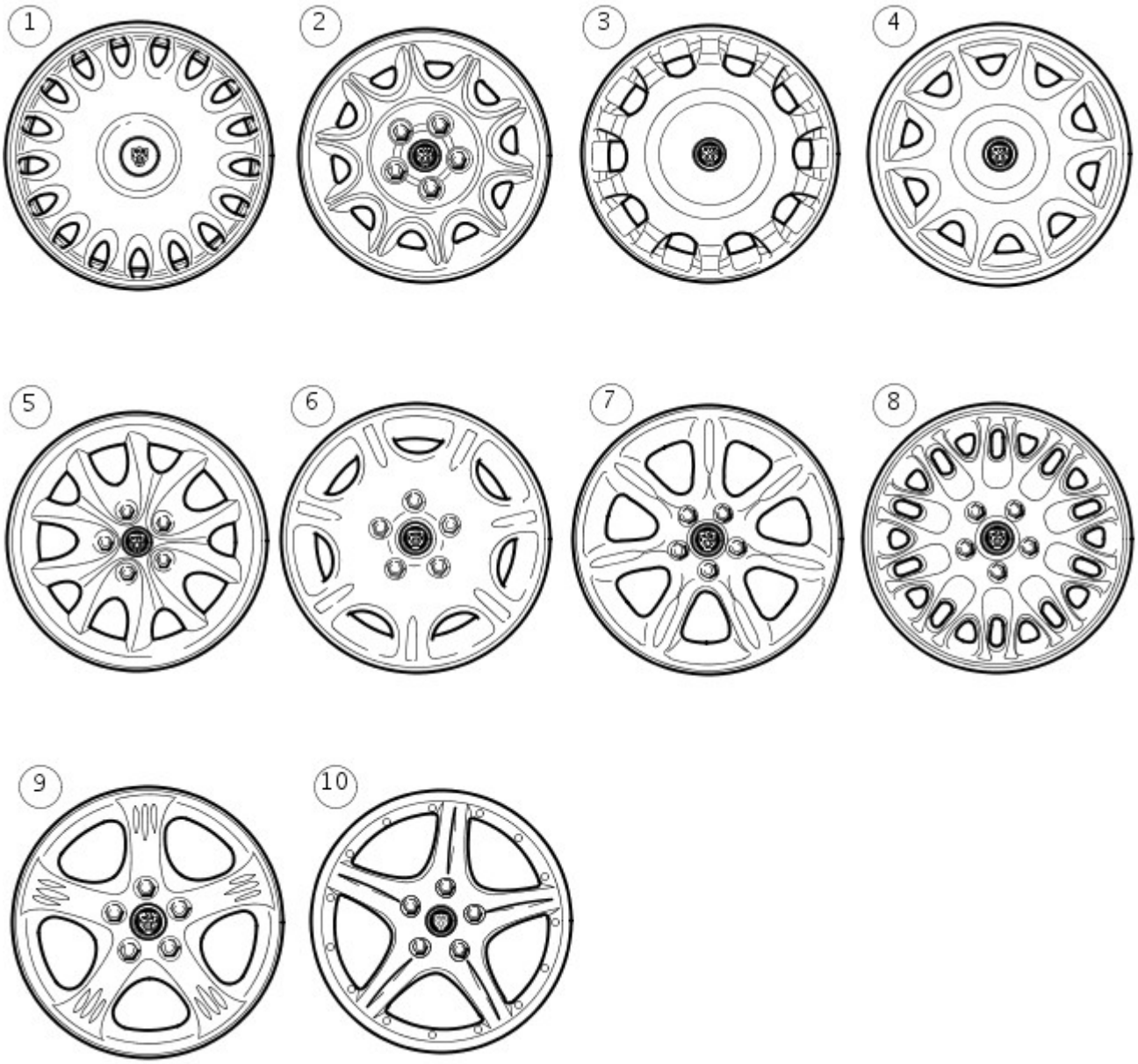
Description and Operation

Wheel Designs

• CAUTIONS:

The type of wheel design that can be installed to the vehicle is influenced by the vehicle's braking system. The optional Brembo brake has a larger disc diameter than the standard brake, therefore restricting what size of wheel can be installed to vehicles fitted with Brembo brakes.

The Milan and RK wheels can be installed to all vehicles; all other wheels must only be installed to vehicles fitted with standard brakes.



Item	Part Number	Description
1	—	Steel Wheel Trim 7J x 16
2	—	Starburst Alloy 7J x 16
3	—	Crown Alloy 7J x 16
4	—	Solar Alloy 7.5J x 17
5	—	Celtic Alloy 8J x 17
6	—	Lunar Alloy 7J x 16
7	—	Asteroid Alloy 8J x 18
8	—	Corona Alloy 7J x 16
9	—	Eclipse Alloy 8J x 16
10	—	Milan Alloy 8.5J x 18
11	—	RK Winter Wheel 8.5J x 18

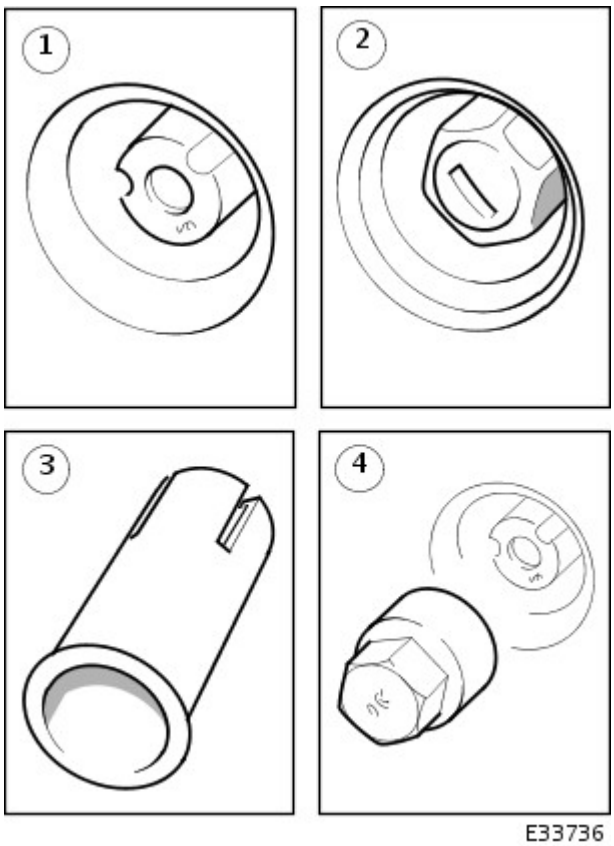
Wheel Changing

For wheel changing procedure refer to 74.20.05.

CAUTION: Do not allow grease to contaminate the wheel stud threads and wheel nut to wheel mating surface, as this may cause the nuts to loosen.

• NOTE: When installing the wheel, smear a thin layer of grease onto the hub mounting face and spigot; and wheel mounting face and spigot hole, to prevent the wheel corroding on to the hub.

Locking Wheel Nuts



Item	Part Number	Description
1	—	Locking wheel nut
2	—	Cover
3	—	Cover removal tool
4	—	Wrench socket

Locking wheel nuts are fitted as standard to UK vehicles.

One locking wheel nut is fitted to each road wheel and can only be removed by using the correctly coded socket. For road wheels with exposed wheel nuts, each locking wheel nut is provided with a cover, which is removed using the cover removal tool.

Locking wheel nuts have different coded keyway combinations with corresponding coded sockets. The correct socket, and cover removal tool are supplied with the vehicle toolkit. Sets of sockets are available to Jaguar dealers.

Temporary Spare Wheel

• NOTE: When using this type of spare wheel note that:

- Speed must not exceed 80 km/h (50 mph).
- The normal road wheel must be reinstalled as soon as possible.
- Only one temporary wheel may be installed to the vehicle.
- Traction control (where fitted) must be switched OFF.

In certain markets, the spare wheel supplied with the vehicle is of the temporary-use type, it is narrower than the normal road wheel and takes up less room in the luggage compartment.

Tires

The radial ply tires shown in the 204-04 Specification Section are recommended by Jaguar to meet the high speed performance of the vehicle. Only tires of identical specification may be fitted as replacements. Under no circumstances must cross-ply tires be fitted.

Tire Inflation Pressures

All recommended tires, including winter tires, must be inflated to the pressures shown in the 204-04 Specification Section. Inflation pressures must only be checked when the tires are cold.

Tire Replacement and Wheel-Interchanging

When renewal of tires is necessary, it is preferable to fit a complete set. If two replacement tires are fitted (to one axle), they must be of the same manufacturer and type as those on the other axle.

No attempt must be made to interchange wheels from the front to the rear or vice-versa, as wear produces a characteristic pattern on each tire depending upon its position on the vehicle. If this position is changed after wear has occurred, the performance of the tire will be adversely affected.

It should be remembered that new tires must be balanced before installing to the vehicle.

Winter Tires

• NOTE: Speed must not exceed 210 km/h (131 mph) when winter tires are installed.

Jaguar recommended winter tires as specified in 204-04 Specification Section must only be fitted in complete four-wheel sets of the same type and size.

Snow Chains and Spike Spider Traction System

Jaguar recommended snow chains, must only be installed when using 16 inch wheels with 255/60 R16 winter tires.

• NOTE: When using snow chains or the spike spider traction system, note that:

- Snow chains and the spike spider traction system must only be fitted to the rear wheels.
- Only Jaguar recommended snow chains and spike spider traction system must be used.
- The maximum permissible speed with winter tires and snow chains or the spike spider traction system fitted is 48 km/h (30 mph).
- Traction control (where fitted) must be switched OFF when using snow chains or the spike spider traction system.

- Snow chains and the spike spider traction system must not be used on roads which are clear of snow.

The Jaguar recommended spike spider traction system can be used on all wheel and tire sizes, except the temporary spare wheel.

Asymmetric Tires

Some tires recommended by Jaguar are asymmetric. Inner and outer markers embossed on the tire walls must be observed to ensure the correct installation of the tire to the wheel.

Tread Wear Indicator

• NOTE: Tire condition must comply with prevailing local legislation.

Tread wear indicators are molded into the bottom of the tread grooves across the width of the tire. The tire must be renewed when tread wear indicators become visible at the surface of the tread.

Wheels and Tires - Wheels and Tires

Diagnosis and Testing

General Notes

1. **1.** Factory installed tires and wheels are designed to provide optimum ride and handling characteristics when inflated to the recommended inflation pressures, with vehicle loads not exceeding the full-rated load capacity.

2. **2.** Correct tire pressures and driving technique have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase tire wear.

3. **3.** Replacement tires should follow the recommended:

    - Size.
    - Speed rating.
    - Load range.
    - Radial construction type.

4. **4.** The use of any other size or type of wheel / tire may seriously affect:

    - Safety.
    - Ride.
    - Handling.
    - Speedometer / odometer calibration.
    - Vehicle ground clearance.
    - Tire clearance between body and chassis.
    - Wheel bearing life.
    - Brake cooling.

5. **5.** Wheels must be renewed when:

    - Impact damaged.
    - Heavily corroded.
    - Porous
    - Wheel stud holes or seats become damaged.
    - They have excessive radial or lateral runout.

Safety Notes

• WARNINGS:

 DO NOT MIX DIFFERENT TYPES OF TIRES ON THE SAME VEHICLE, HANDLING MAY BE SERIOUSLY AFFECTED RESULTING IN LOSS OF CONTROL.

 DO NOT MIX DIFFERENT TYPES OF TIRES ON THE SAME VEHICLE, HANDLING MAY BE SERIOUSLY AFFECTED RESULTING IN LOSS OF CONTROL.

 A TIRE AND WHEEL MUST ALWAYS BE CORRECTLY MATCHED. WIDER OR NARROWER TIRES THAN RECOMMENDED COULD CAUSE DANGER THROUGH SUDDEN DEFLATION.

 WHEN USING THE TEMPORARY SPARE WHEEL, SPEED MUST NOT EXCEED 80 KM/H (50 MPH). DRIVE WITH CAUTION AND REPLACE WITH THE SPECIFIED WHEEL / TIRE ASSEMBLY AS SOON AS POSSIBLE.

 TRACTION CONTROL (IF AVAILABLE) MUST NOT BE ENGAGED WITH THE TEMPORARY SPARE WHEEL FITTED.

 WHEN CHANGING A WHEEL, ENSURE THAT THE VEHICLE CANNOT MOVE. ALWAYS APPLY THE PARK BRAKE AND SELECT TRANSMISSION 'P' POSITION.

 NEVER RUN THE ENGINE WITH ONE WHEEL OFF THE GROUND, FOR EXAMPLE, WHEN CHANGING THE WHEEL. THE VEHICLE COULD MOVE.

 TIGHTEN THE WHEEL NUTS TO SPECIFICATION. WHEELS MAY COME LOOSE IF OVER OR UNDER TIGHTENED.

 USE WHEELS AND WHEEL NUTS DESIGNED FOR XJ SERIES VEHICLES ONLY. AFTERMARKET WHEELS OR WHEEL NUTS MAY NOT FIT OR FUNCTION PROPERLY AND COULD CAUSE INJURY OR DAMAGE.

Inspection and Verification

To maximize tire performance, inspect the tires frequently for signs of:

- Uneven wear.
- Incorrect tire pressure.
- Wheel imbalance.
- Cuts.
- Abrasions.
- Bulges (blister).
- Ply separation.
- Embedded objects.
- Impact damage.

Inspection should be more frequent when:

- Continuous high speed operation is required.
- Rapid or extreme temperatures changes occur.
- Road surfaces are rough.
- Roads are littered with debris.

Tread Wear Indicator

• NOTE: Tire condition must comply with prevailing local legislation.

New tires must be installed if the wear indicators are exposed or if there is severe shoulder wear. Shoulder wear is usually caused by either excessive camber or toe on tires.

Tire Vibration Diagnosis

A tire vibration diagnostic procedure always begins with a road test. The road test and the customer interview (if available) will provide much of the information needed to find the source of vibration.

During the road test, drive the vehicle on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

- The speed at which the vibration occurs.
- What type of vibration occurs in each speed range - mechanical or audible.
- How the vibration is affected by changes in the following:
  - -engine torque
  - -vehicle speed
  - -engine speed.
- Type of vibration - sensitivity:
  - - torque sensitive,
  - - vehicle speed sensitive,
  - - or engine speed sensitive.

The following explanations will help isolate the source of vibration.

Torque Sensitive

This means that the condition can be improved or made worse by accelerating, decelerating, coasting, maintaining a steady vehicle speed, or applying engine torque.

Vehicle Speed Sensitive

This means that the vibration always occurs at the same vehicle speed and is not affected by engine torque, engine speed or gear selection.

Engine Speed Sensitive

This means that the vibration occurs at varying vehicle speeds when a different gear is selected. It can sometimes be isolated by increasing or decreasing engine speed with the transmission in neutral or by stall testing with the transmission in gear. If the condition is engine speed sensitive, the cause is probably not related to tires.

If the road test indicates that there is tire wine, but no shake or vibration, the noise originates with the contact between the tire and the road surface.

A thumping noise usually means that the tire is flat or has soft spots making a noise as they slap the roadway. Tire whine can be distinguished from axle noise, as tire whine remains the same over a range of speeds.

Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
Uneven tire wear.	* Incorrect tire inflation.	* Correct to specification.
	* Excessive radial and lateral runout.	* Renew tire or wheel.
	* Out of specification steering geometry.	* Realign steering geometry: Refer to Section 204-00.
	* Worn ball joint.	* Renew damaged component, realign steering geometry.
	* Worn tie-rod end.	* Renew component, realign steering geometry.
	* Incorrect tire / wheel usage.	* Install correct tire and wheel combination.
	* Loose or leaking shock absorbers.	* Tighten or Renew as necessary: Refer to Section 204-00.
	* Suspension geometry out of alignment.	* Check and adjust: Refer to Section 204-00.
	* Loose, worn or damaged suspension components.	* Inspect, Repair or Renew as necessary.
	* Wheel and tire assembly out of balance.	* Balance wheel and tire assembly.
	* Excessive lateral or radial runout of wheel or tire.	* Check, Repair or Renew as required.
Tires show excess wear on edge of treads.	* Tires under-inflated.	* Correct pressure to specification.
	* Vehicle overloaded.	* Correct to specification.
Tires show excess wear on edge of treads (with tire pressures correct).	* Incorrect toe setting.	* Set to specification: Refer to Section 204-00.
Tires show excess wear in center of tread.	* Tires over-inflated.	* Correct pressure to specification
Wheel mounting is difficult.	* Incorrect application or mismatched parts, including wheel studs and wheel nuts. Corroded, worn or damaged parts.	* Follow the manufacturer's specifications. Clean or Renew.
Wobble or shimmy affecting wheel runout.	* Damaged wheel (eventually damaging wheel bearings and causing uneven tire wear).	* Inspect wheel rims for damage and runout. Renew as required.
Vehicle vibrations from	* Tires / wheels mismatched.	* Install correct tire / wheel combination.

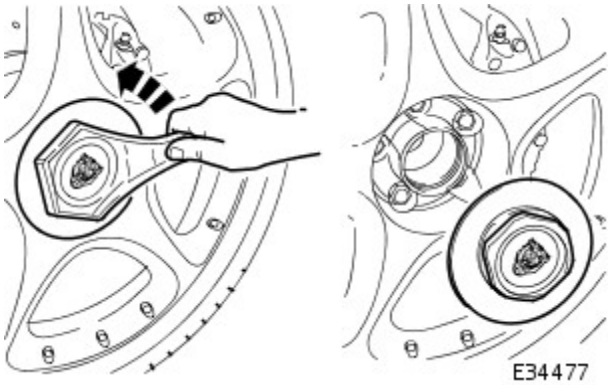
wheels and tires.	* Inflation pressure too high or low.	* Correct pressure to specification
	* Uneven tire wear.	* Refer to Diagnosis and Testing in this section.
	* Wheel and tire assembly imbalance.	* Balance wheel and tire assembly.
	* Brake disc imbalance.	* Check brake disc cooling fins for mud and foreign material. Check for damage or disc heavy spot. Refer to Section 206-00.
	* Damaged or distorted wheel.	* Renew wheel.
	* Excessive radial run-out of wheel or tire. * Excessive lateral run-out of wheel or tire.	* Renew wheel or tire.
	* Incorrectly seated tire.	* Remount the tire.
	* Loose wheel mountings: damaged wheel studs, wheel nuts, worn or broken wheel hub face or foreign material on mounting faces.	* Tighten or Renew worn or damaged parts. Clean mounting surfaces.
	* Defective wheel bearings.	* Renew worn or damaged bearing sets: Refer to Section 204-00.
	* Water in tires.	* Remove water.
Damaged wheel stud threads.	* Sliding wheel across the wheel studs during installation. Loose wheel nuts.	* Renew wheel studs.
Broken wheel studs.	* Loose or overtightened wheel nuts.	* Renew wheel studs.
Corrosion / contamination streaks from wheel stud holes.	* Loose wheel nuts.	* Check complete assembly. Renew damaged parts. Apply correct torque setting.
Damaged wheel nuts.	* Loose wheel assembly. * Over-tightened wheel nuts.	* Renew wheel nuts. Apply correct torque setting.
Seized wheel nuts.	* Corrosion	CAUTION: Do not permit lubricant to contaminate wheel hub stud holes or wheel nut seats. * If corrosion is light, wire brush away corrosion. If corrosion is excessive renew wheel studs and wheel nuts. Lubricate the first three threads of wheel studs with a graphite based lubricant.

Wheels and Tires - Wheel and Tire

Removal and Installation

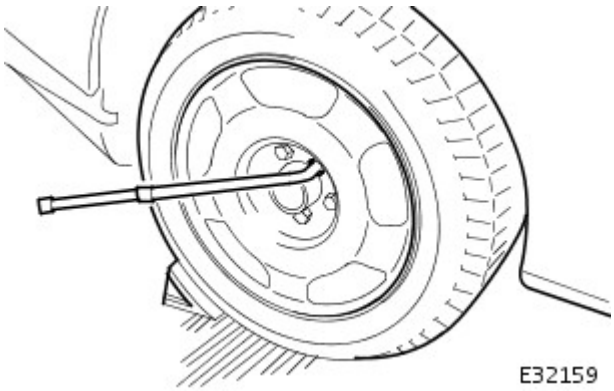
Removal

CAUTION: Do not use heat to loosen a seized wheel nut: heat will change the metal's properties and damage wheel bearing and brake caliper seals.



1. NOTE: Certain Jaguar wheels are fitted with a hexagon wheel nut cover

- Remove the cover with the plastic spanner supplied with the spare wheel jacking equipment.

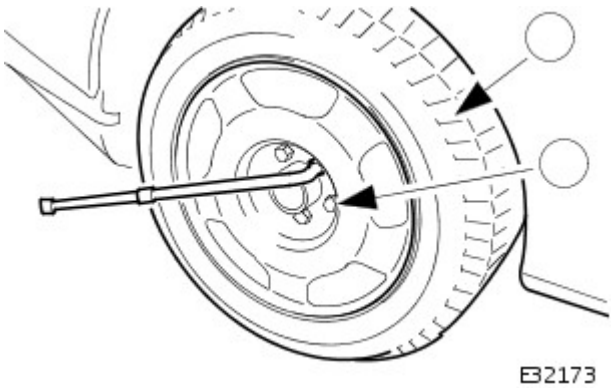


2. Loosen, but do not remove wheel nuts.

3. Raise vehicle and support on stands. Refer to Section 100-02.

4. Remove wheel and tire assembly.

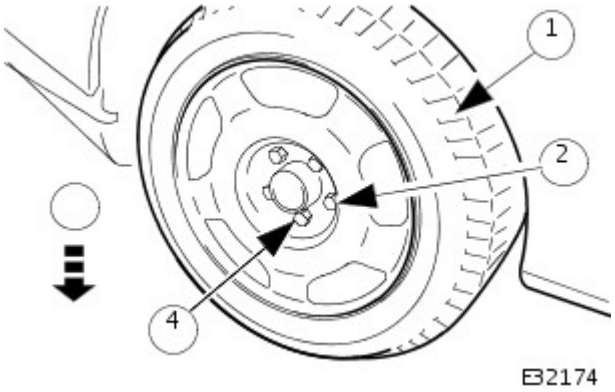
1. Remove wheel nuts.
2. Remove wheel.



Installation

1. CAUTION: Do not allow grease to contaminate the wheel stud threads and wheel nut to wheel mating surface, as this may cause the nuts to loosen.

• NOTE: To prevent the wheel corroding on to the hub, smear a thin layer of grease onto the hub mounting face and spigot; and wheel mounting face and spigot hole.



Install the wheel and tire assembly.

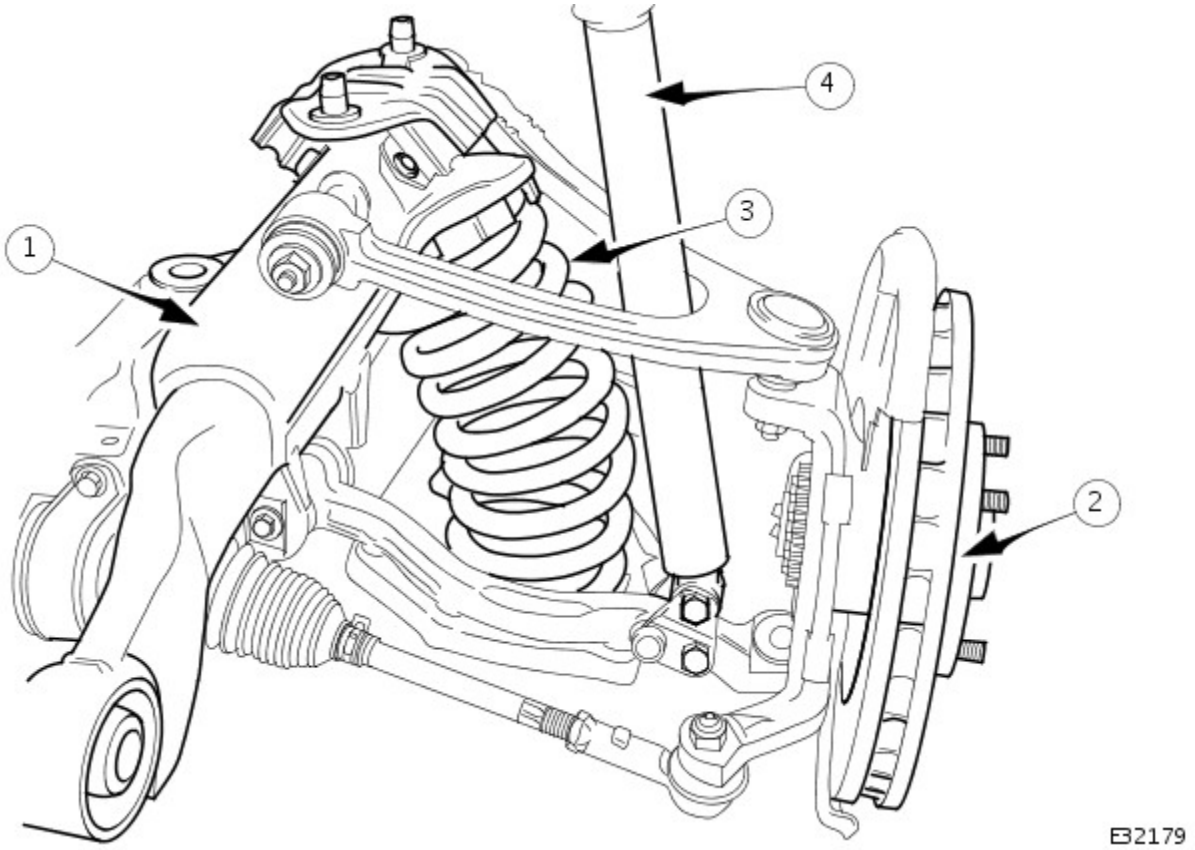
1. Install wheel.
2. Install wheel nuts to secure wheel in position.
3. Lower vehicle.
4. Tighten wheel nuts in a diagonal sequence to:

- Steel wheel 68-82 Nm.
- Alloy wheel 88-102 Nm.

Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Description and Operation

Front Shock Absorbers

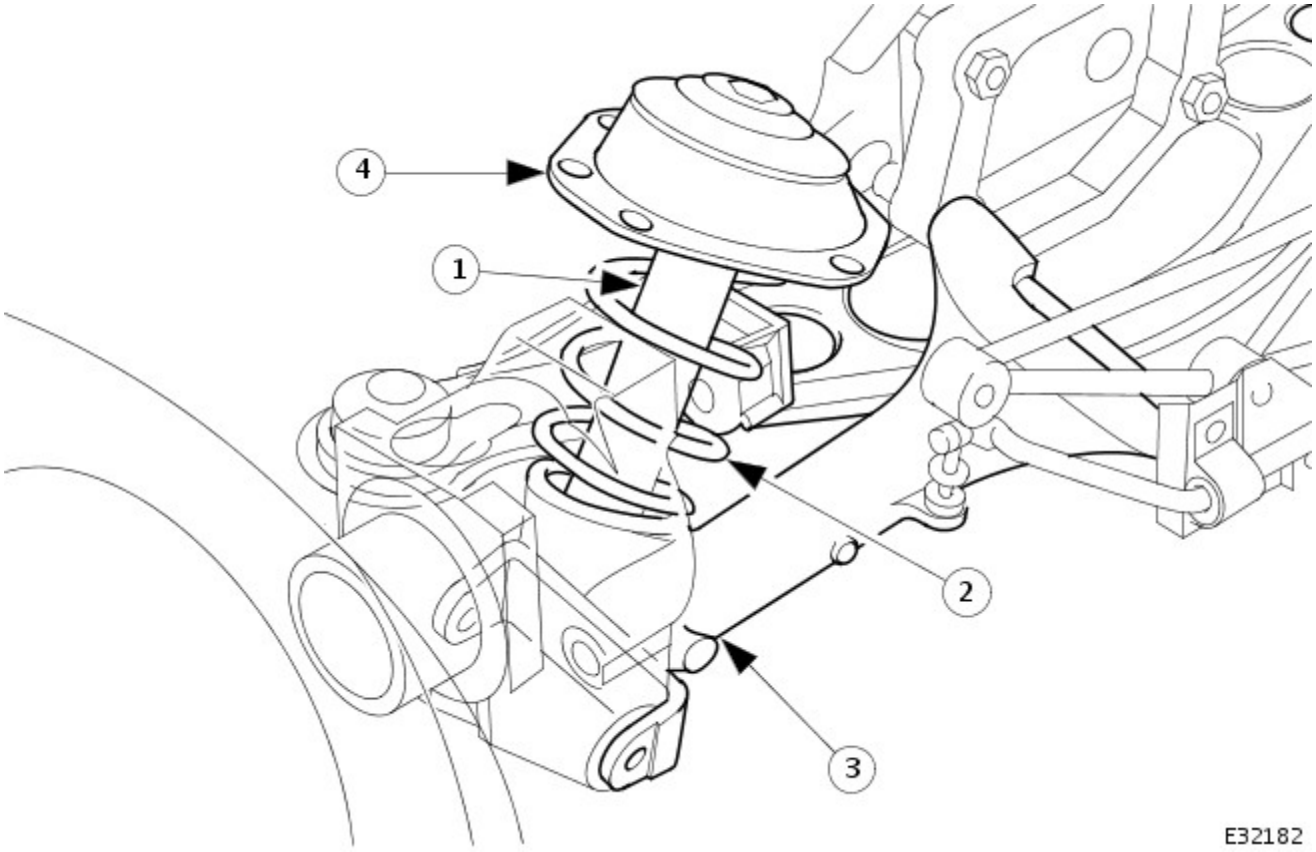


Item	Description
1	Front suspension crossbeam
2	Front hub assembly
3	Road spring
4	Damper

The front shock absorber comprises:

- A coil-type road spring, mounted between the lower wishbone spring pan and the front suspension crossbeam; different spring rates are used according to model.
- A telescopic, hydraulically controlled, damper mounted between the lower wishbone and the vehicle body.

Rear Shock Absorbers



Item	Description
1	Damper
2	Road spring
3	Lower wishbone
4	Upper spring seat

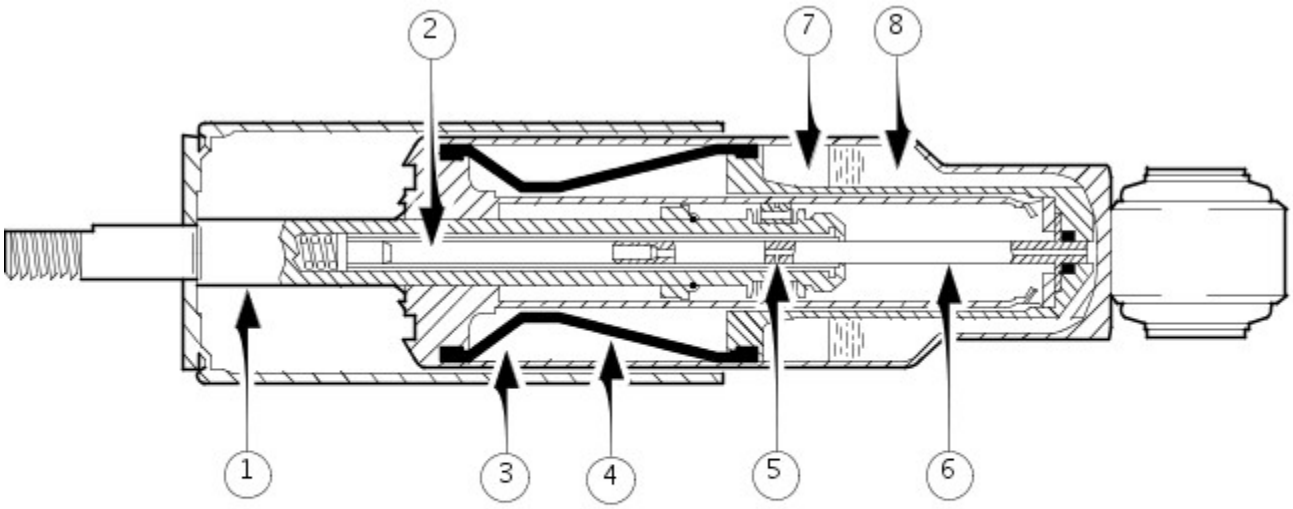
The rear shock absorber comprises:

- A coil-type road spring mounted between the lower wishbone and the upper spring seat on the vehicle body; different spring rates are used according to model.
- A telescopic, hydraulically controlled, damper, co-axial with the road spring, mounted between the lower wishbone and the upper spring seat on the vehicle body.

Damping Principle

Damping is achieved by controlling the flow of fluid from one end of the damping chamber to the other. The more the flow of fluid is restricted, the firmer the damping action.

Ride Levelling



E32183

Item	Description
1	Piston rod
2	Pump chamber
3	High pressure gas accumulator
4	Diaphragm
5	Control orifice
6	Pump rod
7	Low pressure gas chamber
8	Low pressure oil reservoir

The Nivomat ride levelling system improves ride quality by allowing the use of softer road springs, while controlling the effects on the suspension of a fully laden vehicle. The system uses special rear dampers in place of the normal units. There are no other components in the system. The ride levelling system is completely automatic, requiring no input from the driver.

Ride levelling may be specified as an option on certain models; it is not available in north American markets. Ride levelling and adaptive damping are mutually exclusive options.

The Nivomat damper:

- Supplements the load-carrying capacity of the road springs at high vehicle loads.
- Uses road inputs to the suspension to power the levelling function.
- Detects suspension height directly from road wheel travel.
- Provides load-dependent spring rates; the accumulator gas pressure increases with load.
- Provides load-dependent damping; the fluid pressure increases with load.

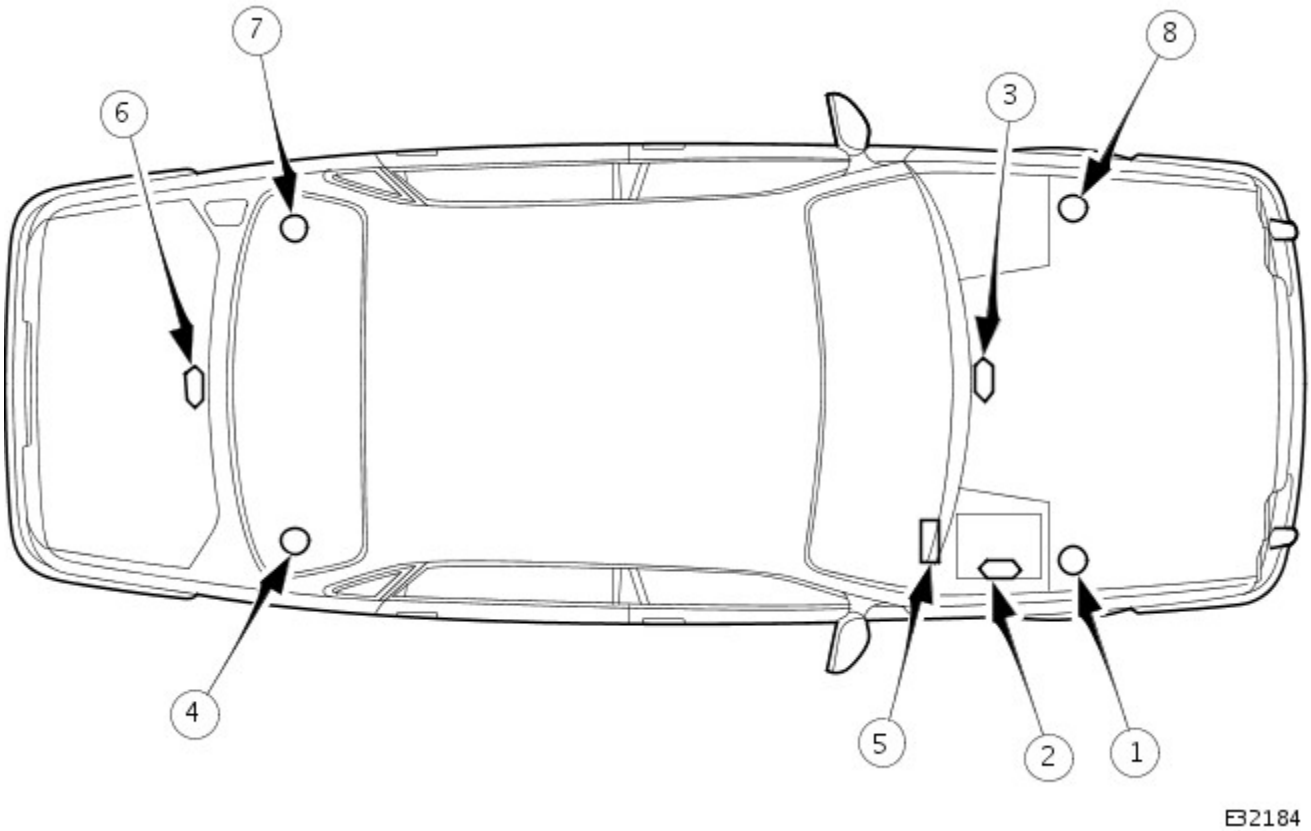
Operation

Following an increase in vehicle loading, the dampers adapt to maintain the height of the vehicle within its design range. The system uses road inputs to the suspension to power the levelling action, and requires up to approximately two kilometers of travel, following a change in load, to complete the process.

Normal movement of the suspension causes a pumping action to occur within the damper, as a result of extension and compression of the pump rod in the pump chamber. Hydraulic fluid is pumped from the pump chamber into a high pressure gas accumulator. The increase in gas pressure augments the force developed between the vehicle axle and the body, thereby providing lift.

A control orifice in the pump rod determines the levelling height. When the damper is compressed, this orifice is covered. When the damper extends, the control orifice is uncovered, pressure is released to the low pressure oil reservoir and the system ceases to rise. When the vehicle is high after unloading, the opened control orifice allows fluid to be returned to the low pressure oil reservoir, and the suspension returns to its normal unladen height.

Adaptive Damping



• NOTE: Items 2 and 5 are ALWAYS located on the passenger side of the vehicle

Item	Description
1	Damper, front right-hand
2	Accelerometer, lateral
3	Accelerometer, front vertical
4	Damper, rear right-hand
5	Adaptive damping control module (ADCM)
6	Accelerometer, rear vertical
7	Damper, rear left-hand
8	Damper, front left-hand

Adaptive damping enhances vehicle handling by the use of special dampers which are controlled by a dedicated control module.

Adaptive damping may be specified as an option on certain models. Adaptive damping and ride levelling are mutually exclusive options. The adaptive damping system is completely automatic, requiring no input from the driver.

Adaptive Dampers

The adaptive dampers:

- Are installed in place of the normal dampers.
- Can be identified by the cable and connector at the top of the unit.
- Have two settings; firm and soft.

- Require no adjustment and are non-serviceable items.

Accelerometers

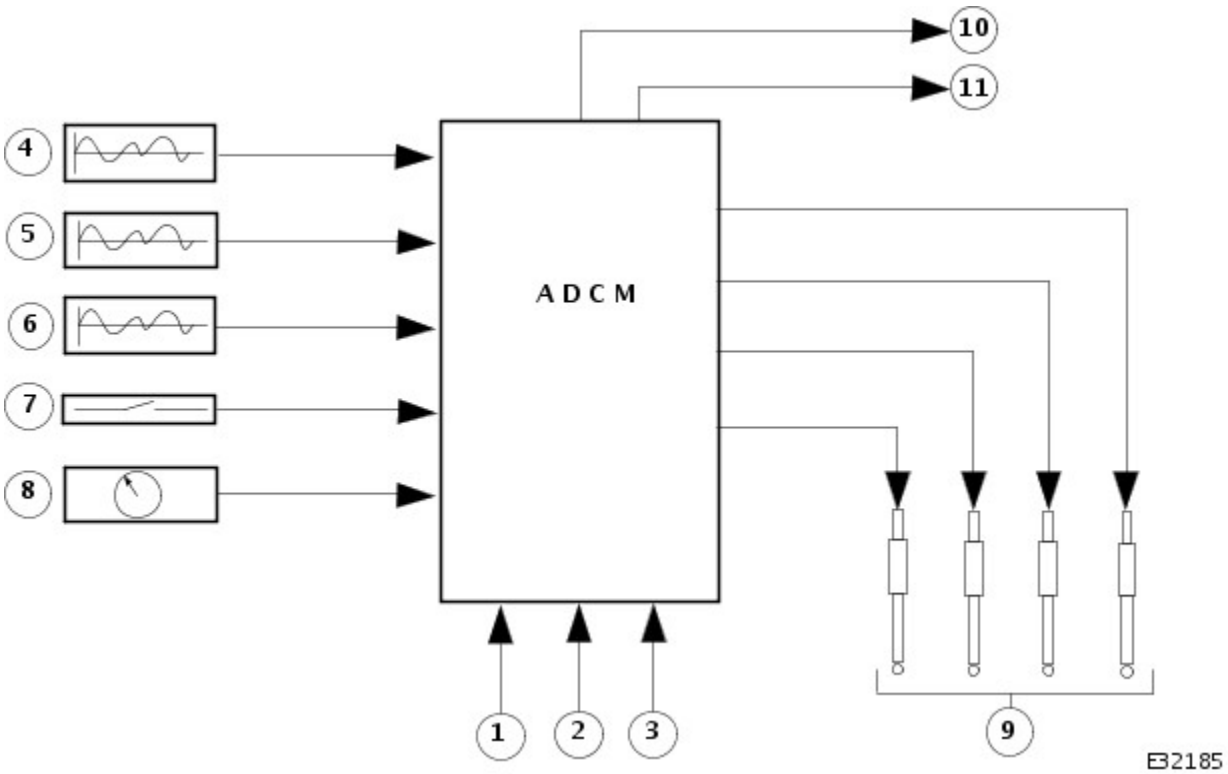
The three accelerometers:

- Sense vehicle body movement.
- Generate an analogue voltage (maximum +5 volts) proportional to body movement.
- Provide inputs to the adaptive damping control module.

The two vertical accelerometers are mounted on the bulkhead and in the trunk.

The lateral accelerometer is mounted in the ECM housing.

Adaptive Damping Control Module (ADCM)



Item	Description
1	Battery supply
2	Ignition supply
3	Ground
4	Input from vertical accelerometer, front
5	Input from vertical accelerometer, rear
6	Input from lateral accelerometer
7	Footbrake operation signal
8	Vehicle speed input
9	Damper control signals
10	Output to message center
11	Diagnostic connector serial link

The ADCM:

- Is mounted on the fascia support bracket.
- Controls the four adaptive dampers in response to analogue and digital inputs.

- Is hard-wired to the instrument cluster message center.
- Is hard-wired to the J1962 diagnostic connector.

Operation

The system selects the soft or firm damper setting according to the current road and driving conditions, to optimise vehicle ride and handling.

With the vehicle stationary, the dampers are in the firm setting, but will normally switch to the soft setting when the vehicle exceeds 8 km/h (5 mile/h); all dampers are switched simultaneously.

Sudden movement of the vehicle body, in response to road inputs, is detected by the vertical accelerometers, and the ADCM switches the dampers to the firm setting to give improved damping of the resultant oscillations.

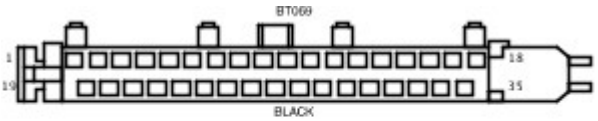
When cornering forces are detected by the lateral accelerometer, the ADCM switches the dampers to the firm setting to reduce the roll rate and improve wheel control.

After the event has passed, the dampers revert to the soft setting.

When the footbrake is applied, the ADCM receives a signal and calculates the rate of vehicle deceleration. If the deceleration rate is greater than a certain threshold, the dampers are switched to the firm setting to reduce the pitch rate and improve wheel control.

If a system failure occurs, the ADCM grounds the output line to the instrument cluster message center, which displays a text warning SUSPENSION FAULT and illuminates the amber warning lamp. Under fault conditions the system always fails to the firm setting, so that the vehicle will be safe to drive under all road and driving conditions.

Connector Pin Identity Chart for EM068



E3731

Pin Number	Circuit	Circuit Function
1		System error output to instrument cluster
2		Not used
3		O/P accelerometer ground
4 to 9		Not used
10		K-line to diagnostic socket
11		Ignition supply +12V
12		Not used
13		Control signal (+ve) output to left-hand rear damper
14		Control signal (+ve) output to right-hand front damper
15		Control signal (+ve) output to right-hand rear damper
16 and 17		Not used
18		Ground
19		Not used
20		Lateral accelerometer input
21		Front vertical accelerometer input
22		Rear vertical accelerometer input
23		Not used
24		Road speed input from instrument cluster
25		Power output +5V to supply accelerometers
26		Brake pedal input

27		Battery supply +12V
28		L-line to diagnostic socket
29		Not used
30		Control signal (+ve) output to left-hand front damper
31		Control signal (-ve) output to left-hand front damper
32		Control signal (-ve) output to left-hand rear damper
33		Control signal (-ve) output to right-hand front damper
34		Control signal (-ve) output to right-hand rear damper
35		Not used

Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Diagnosis and Testing

Refer to the PDU User Guide for details of diagnosing and testing the Adaptive Damping System. The PDU interrogates the ADCM directly via the K and L lines to the J1962 diagnostic socket.

The PDU will give an indication of the integrity of each electronic and electrical component. It will indicate, for example, that the accelerometers are not broken, but not that they functioning correctly when the vehicle is in motion. However, it is exceptional for an accelerometer to function incorrectly in its dynamic mode if it is proved to be functioning when static.

Basic Checks

The accelerometers have the following characteristics. At 0g (no movement of the body) each vertical accelerometer outputs approximately 2.5V steady voltage; the lateral accelerometer outputs approximately 1.5V. The voltage output due to body movement is proportional to acceleration in the acceleration axis, up to approximately 4.5V and down to approximately 0.5V.

Before changing any component, refer to the circuit diagrams and check the continuity of relevant harness circuits; in some instances, the PDU will not differentiate between a faulty component and a damaged connection or wiring.

Check the following fuses:

- Engine compartment fuse box, fuse F5 (10A).
- Engine management fuse box, fuse F1 (20A).

Check the following ADCM input/output lines:

- System error output from the ADCM to the instrument cluster.
- Vehicle speed output from the instrument cluster to the ADCM.
- Footbrake signal to the ADCM.

Check any relevant connections to confirm that the connection is electrically sound and that a terminal pin has not been pushed back into the connector shell, ie. not making a connection to its mating pin or socket.

Driveline System - General Information - Driveline System

Description and Operation

Details of the Driveline System can be found in sections 205-01 and 205-02.

Driveshaft -

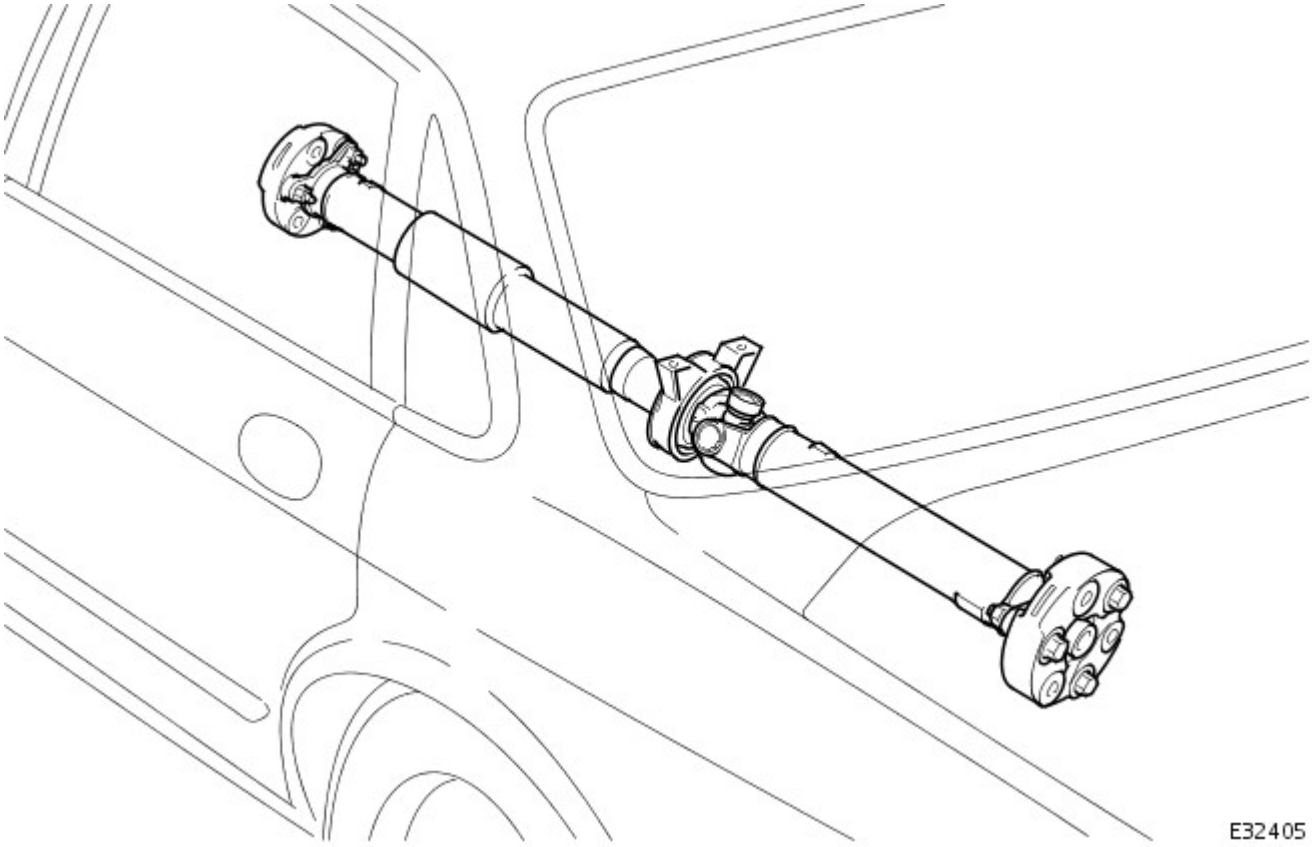
Torques

Component	Nm
Bolt M12 - Jurid flexible coupling to transmission and final drive flanges	75 - 88
Screw - Centre bearing to underbody	19,5 - 26,5
Screw - Parking brake relay mounting bracket to underbody	19,5 - 26,5

Driveshaft - Driveshaft

Description and Operation

Driveshaft Joint and Couplings



Parts List

Item	Part Number	Description
1	—	Flexible (Jurid) coupling at the transmission flange
2	—	Center bearing
3	—	Front tube, including deformable section
4	—	Flexible (Jurid) coupling at the final drive flange

Driveshaft - Driveshaft

Removal and Installation

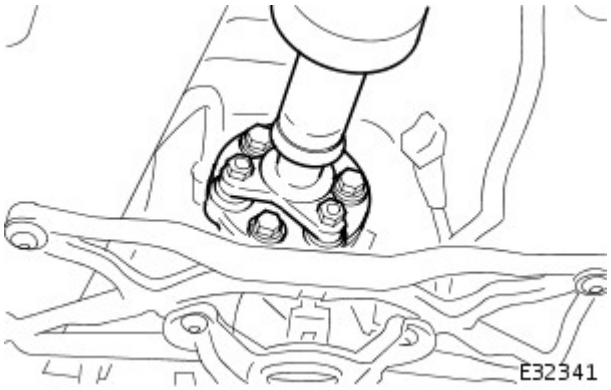
Removal

CAUTION: To preserve 'drive line' refinement, individual parts, other than fixings, MUST NOT be renewed. In the event of any balance or driveshaft component related problem, the complete assembly must be renewed. Under no circumstances may the flexible (Jurid) coupling be removed from the driveshaft (or its fixings be loosened). Do not drop or subject the driveshaft to damage.

1. Disconnect the battery ground lead and raise the vehicle for access

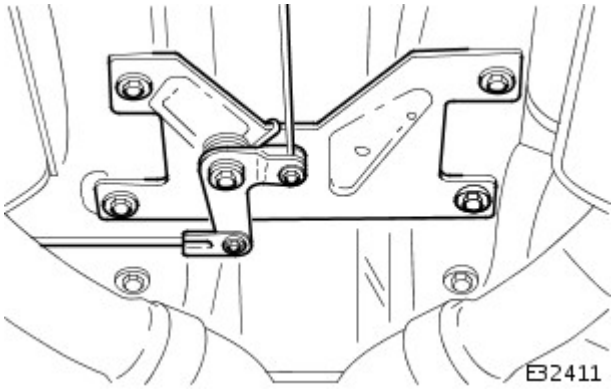
2. Remove the front exhaust muffler, 30.10.18

3. Remove the driveshaft from the transmission flange.

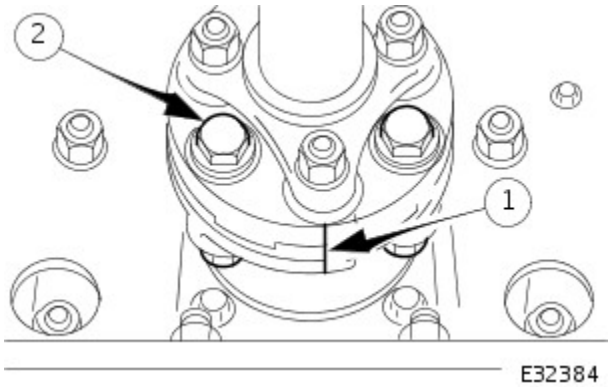


- If required, 'match mark' the transmission flang and coupling
- Unscrew the fixings (3)

4. Release the parking brake relay lever mounting bracket fixings (4) and allow the assembly to hang down



5. Disconnect the driveshaft from the differential flange

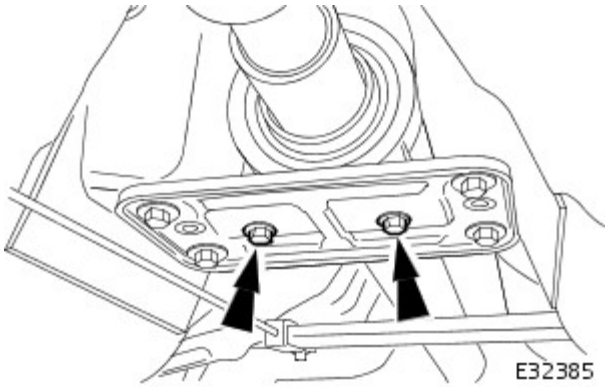


5. CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the drive shaft

1. 'Match mark' the FLEXIBLE COUPLING to the differential DRIVE FLANGE
2. Remove the fixings (3)

6. Remove the driveshaft

6. CAUTION: Ensure that the driveshaft front and rear sections do not become disengaged. Secure the front and rear sections to prevent sliding joint disengagement during transport

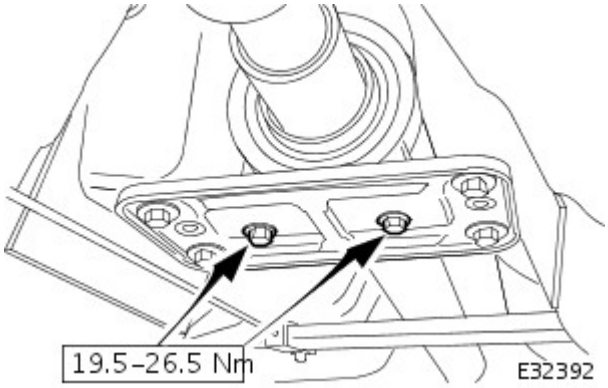


- Remove the fixings (2) center bearing to mounting bracket

Installation

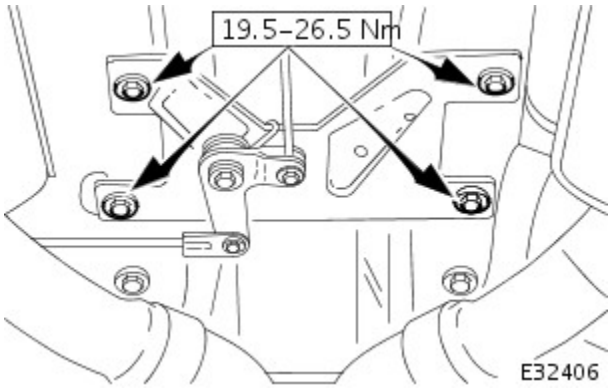
• NOTE: The large diameter driveshaft tube MUST be towards the transmission

1. Installation is the reverse of the removal procedure, noting that;

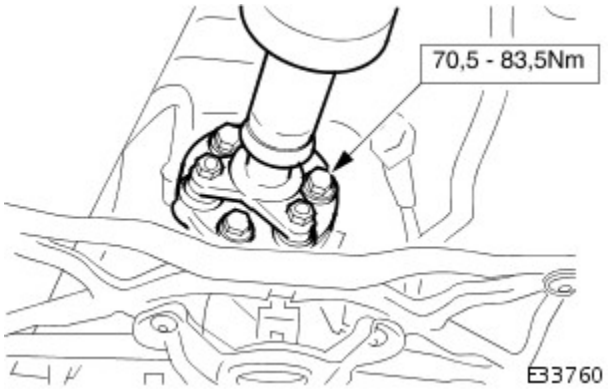


2. Refer to the illustration

- Ensure that the assembly is central and that the bearing housing does NOT contact the transmission tunnel



3. Refer to the illustration



4. Refer to the illustration - transmission AND final drive flanges

- Renew the driveshaft fixings

Rear Drive Axle / Differential -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Final Drive	Shell Spirax Super TS 90
Hub spline to Axle shaft	Loctite 270 Studlock or equivalent

Capacities

Unit	Liters
Final Drive	1,90

Torques

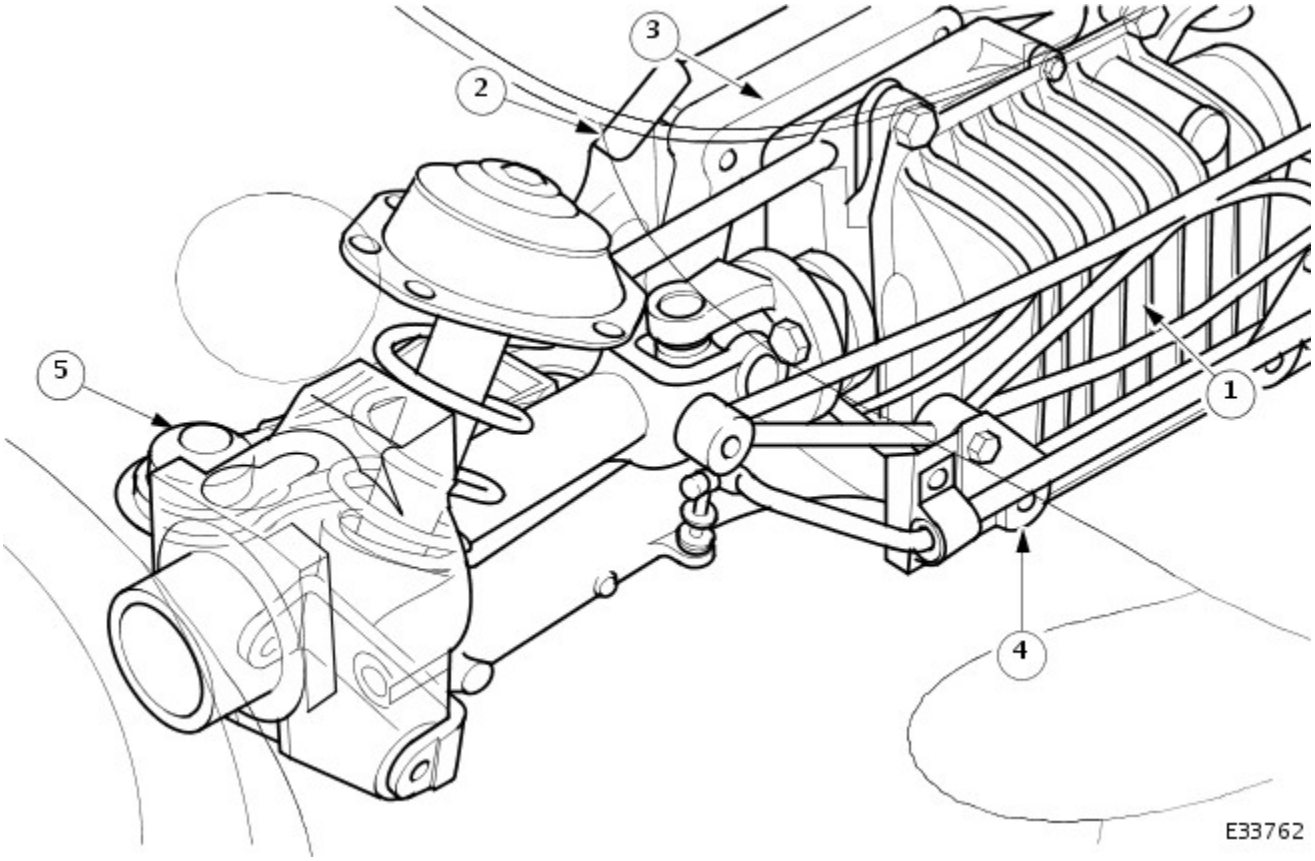
Component	Nm
Bolt - Final drive nose plate	39 - 51
Bolt - 'A' frame to final drive	90 - 110
Nut 'A' frame to rear mounting bracket	85 - 115
Nut - Axle shaft to final drive flange	81 - 99
Nut - Axle shaft to hub	304 - 336
Nut - Damper lower fixing	80 - 100
Bolt M12 - Jurid flexible coupling to transmission and final drive flanges	75 - 88
Nut - Lower fulcrum	90 - 110
Nut - Pendulum to final drive	160 - 200
Nut - Stabilizer to wishbone	30 - 40
Nut - Tie rod to final drive	85 - 105
Nut - Tie rod to wide mounting bracket	85 - 115
Nut - Wishbone pivot	80 - 100
Nut - Wishbone tie to final drive	85 - 105
Nut 'A' frame to wide mounting bracket	85 - 105

Rear Drive Axle / Differential - Rear Drive Axle and Differential

Description and Operation

Location

The differential unit is mounted between the wide mounting bracket, pendulum assembly and the wishbone tie assembly. Two tie rods are fitted between top rear of the final drive casing and the front of the wide mounting bracket.



Parts List

Item	Part Number	Description
1	—	Final Drive Unit
2	—	Wide Mounting Bracket
3	—	Pendulum Assembly
4	—	Wishbone Tie Assembly
5	—	'A' Frame

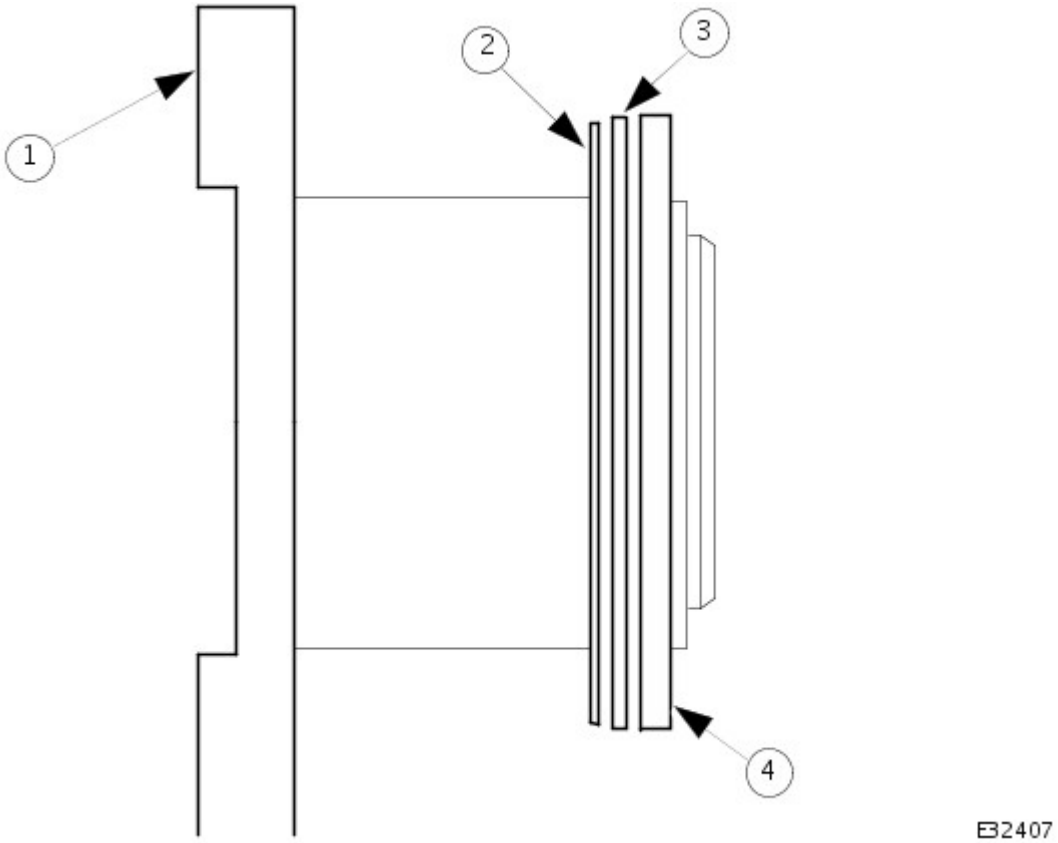
Description

The type 14 HU final drive assembly is a hypoid unit with the pinion arranged on the cross-car centerline. The driveshaft coupling utilizes a cassette type pinion oil seal, which is an integral part of the pinion flange. This type of seal cannot be separated from the pinion flange and therefore may only be renewed as a complete seal / flange assembly

The axle shafts are driven by the output flanges which rotate on sealed bearings, these assemblies being retained in the final drive unit by circlips.

Pinion Drive Flange / Seal Detail

• NOTE: The component parts are shown in an exploded view for clarity, this is NOT the fitted condition



Parts List

Item	Part Number	Description
1	—	Pinion flange
2	—	Backing ring
3	—	Ryton ring
4	—	Oil seal

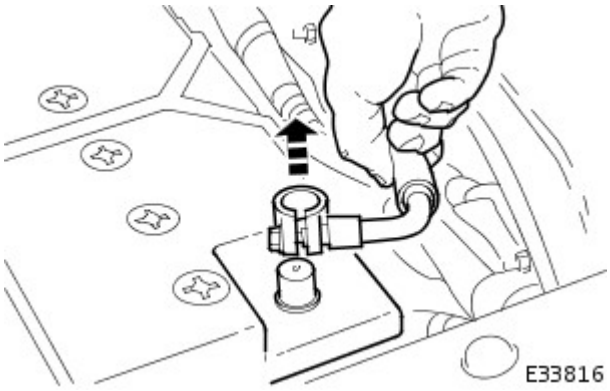
The assembly is filled for life (there being no drain plug) using a thermally stable lubricant.

Serviceable Parts

- Final drive unit complete
- Pinion flange / seal assembly
- Pinion flange nut
- Output shaft bearing 'O' ring
- Output shaft bearing circlip
- Output shaft bearing
- Output shaft

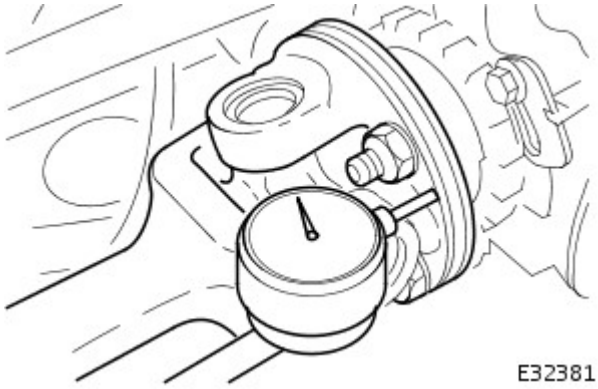
Rear Drive Axle / Differential - Differential Output Shaft End Float Check

General Procedures

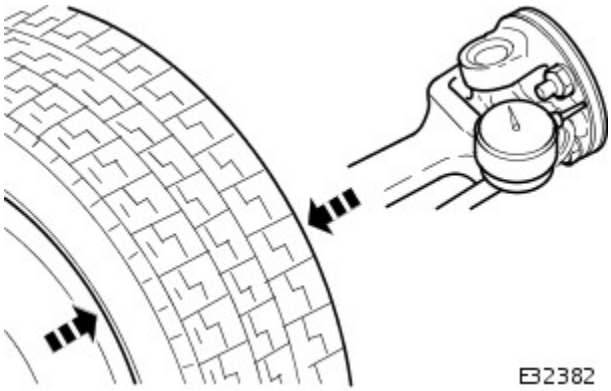


1. Disconnect the battery ground lead

2. Raise the vehicle for access



3. Mount a dial test indicator (DTI) to the differential housing with the probe resting on the axle shaft flange (the DTI probe must be parallel to the output shaft center line and NOT the axle shaft)



4. Check the end float

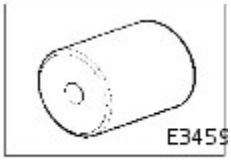
- Push the wheel / shaft assembly INWARDS
- Zero the DTI
- Pull the wheel / shaft assembly OUTWARDS
- Note the reading

5. Check the specification

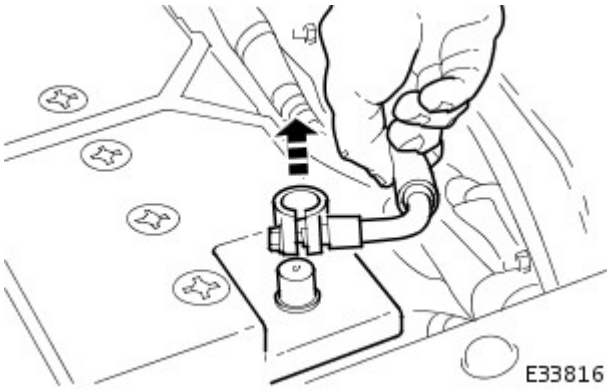
- 0 to 0,15 mm GOOD
- 0,15 mm + NOT GOOD; Renew the output shaft bearing

Rear Drive Axle / Differential - Axle Shaft

In-vehicle Repair

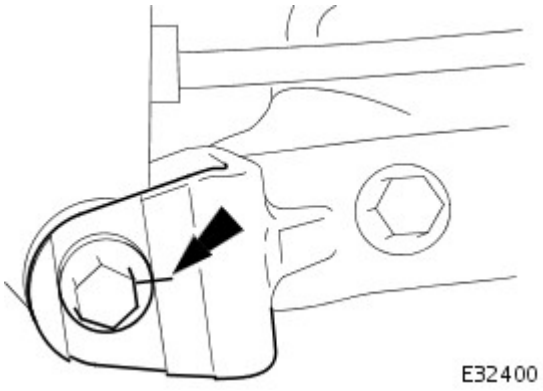
Special Tool(s)	
 E36396	Hub remover 204-011
 E3459	Thread protector JD 1D / 7

Removal


E33816

1. Disconnect the battery ground lead.

2. Support the vehicle at the rear and remove the appropriate rear road wheel.
3. Remove and discard the hub nut, apply the brakes to prevent rotation.
4. Remove the brake caliper in accordance with 70.55.03, but do not disconnect the hydraulics.
5. Prepare the hub carrier.


E32400

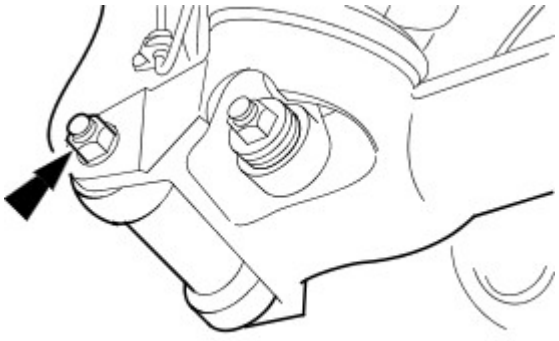
    1. 'Match mark' the hub carrier fulcrum bolt head and the carrier.

6. Prepare the hub carrier.

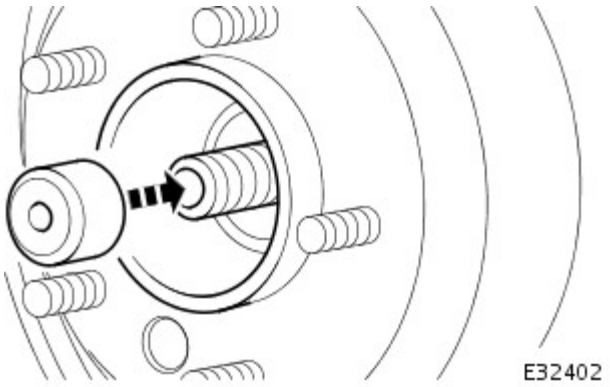
    1. Slacken the hub carrier fulcrum nut.

    2. Disconnect the ABS sensor multiplug at the hub

carrier

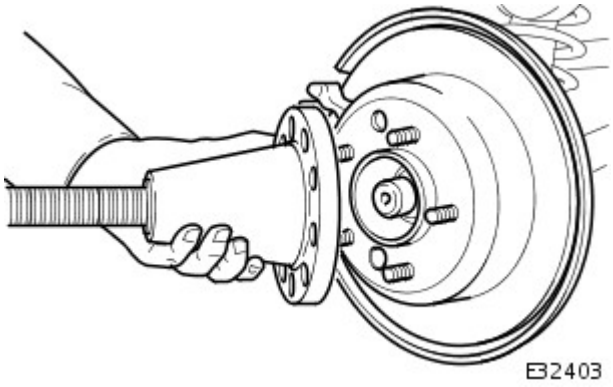


E32401



E32402

7. Protect the driveshaft thread with special tool JD 1D / 7.

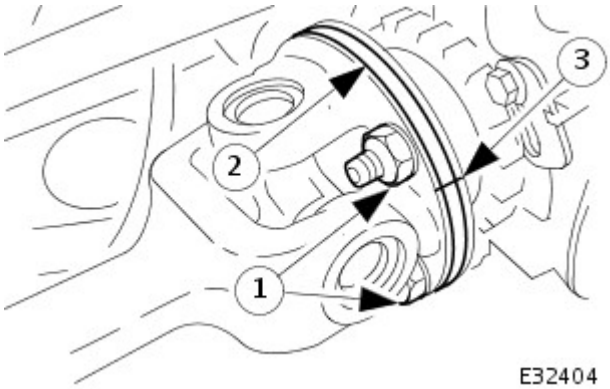


E32403

8. Withdraw the hub from the axle shaft

8. CAUTION: Take care not to introduce debris into the hub bearings, or damage the seal

- Using service tool 204 - 011, push the axle shaft through the hub



E32404

9. NOTE: In the wheel-free condition, the axle is in tension and the flanges will separate as the nuts are withdrawn

Release the axle shaft

1. Remove and discard the (4) nuts axle shaft to differential output shaft
2. Clear the axle shaft from the output flange studs
3. Remove and keep safe the camber shim

10. NOTE: The axle shaft nuts may damage the studs upon removal; check the thread condition by engaging a new nut 2 or 3 threads by hand.

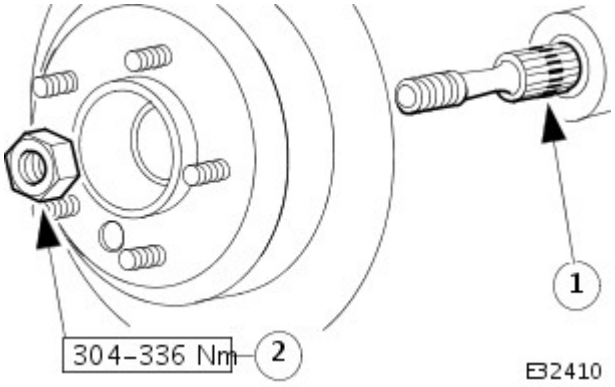
Inspect the output flange studs and renew if there is evidence of damage / distortion

11. Clean all traces of thread locking agent from the hub splines

(and axle shaft if it is to be re-used)

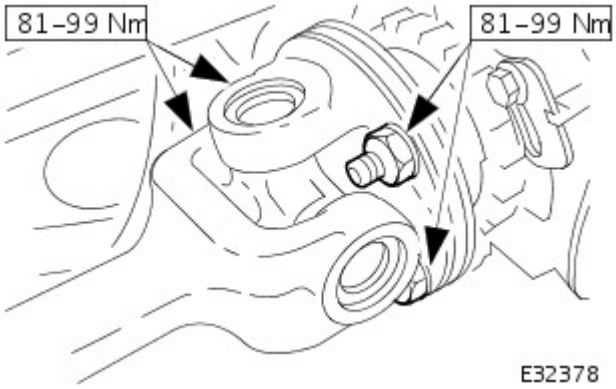
Installation

1. Installation is the reverse of the removal procedure, noting the following.

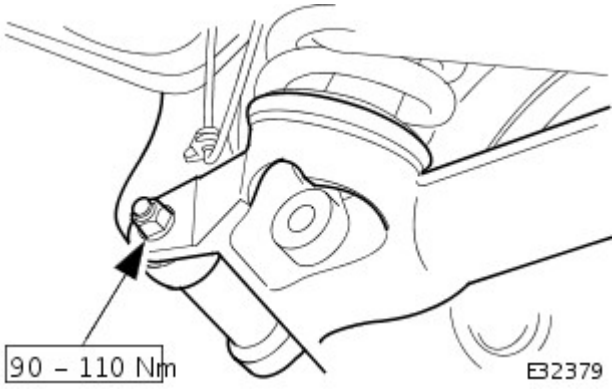


2. Secure the axle shaft.

1. Apply thread locking agent, to the SPLINE, as indicated.
2. Refer to the illustration - do NOT re-use the original nut.



3. Refer to the illustration.



4. Refer to the illustration.

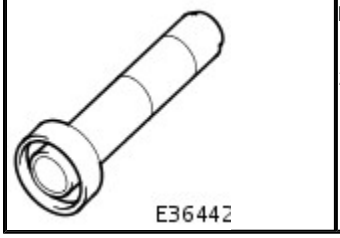
- Ensure that the match marks are aligned prior to securing the fixing.

5. Check and adjust as required, the final drive unit oil level.

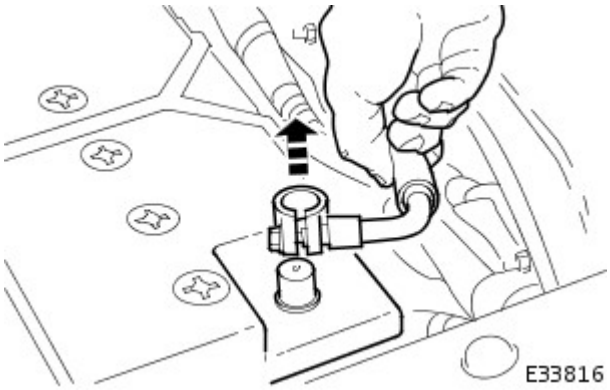
6. Check and adjust as required, the rear wheel alignment, 204-02.

Rear Drive Axle / Differential - Differential Output Shaft Bearing

In-vehicle Repair

Special Tool(s)	
 E36442	Replacer hub bearing 204-083

Removal

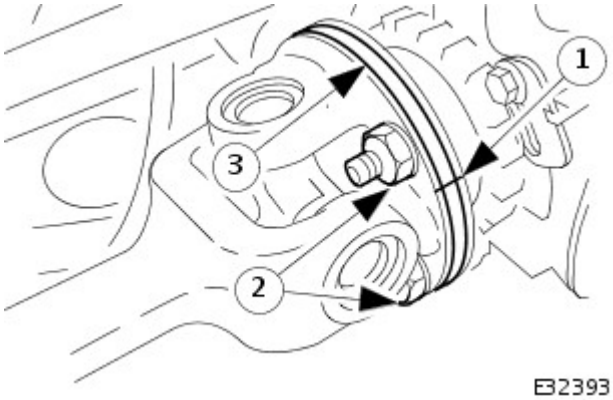

E33816

1. Disconnect the battery ground lead

2. Raise the vehicle for access

3. NOTE: In the wheel-free condition, the axle is in tension and the flanges will separate as the nuts are withdrawn

Release the axle shaft

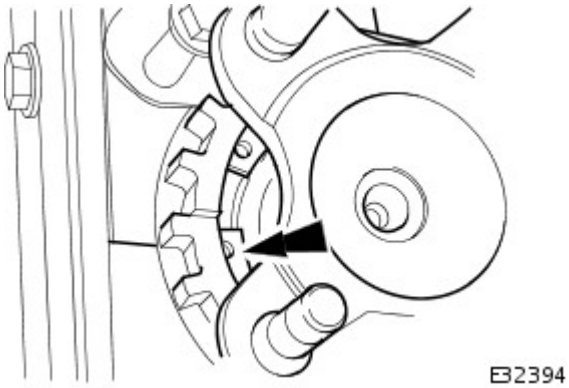


E32393

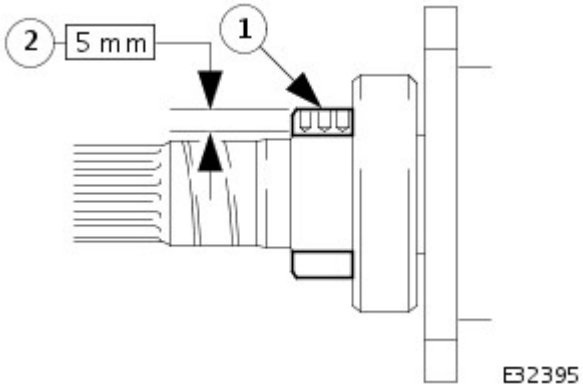
1. Match mark the output and axle shaft flanges (if the output shaft is to be re-used)
2. Remove and discard the (4) nuts axle shaft to differential output shaft
3. Remove and keep safe the camber shim

4. Thoroughly clean the area around the output shaft housing and differential case

5. Release the circlip and withdraw the output shaft assembly


E32394

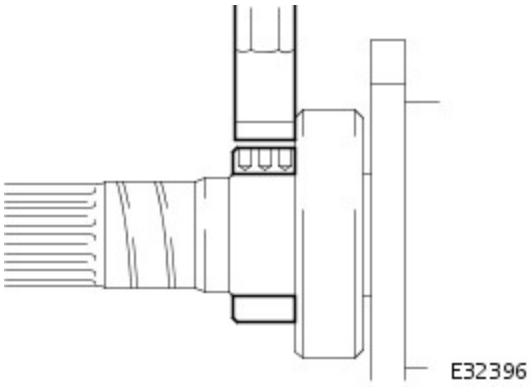
6. Prepare the retaining collar for removal



1. Mark the bearing retaining collar axially

6. CAUTION: Do not drill into the output shaft, it is not necessary to break the inside diameter of the collar

2. Drill 3 off holes 4,0 mm dia equally spaced, to a MAXIMUM depth of 5,0 mm



7. Remove the retaining collar

7. CAUTION: There is no need to split the collar when chiselling

- With a suitable chisel strike the collar across the three drilled holes (along the axis of the output shaft) to relieve tension within the steel

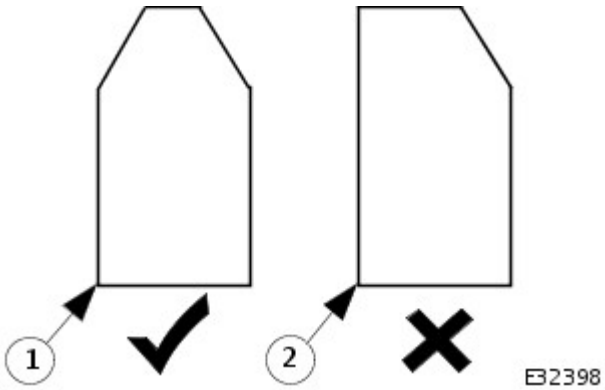
8. CAUTION: The original bearing must NOT be reused

Using a suitable press remove and discard the bearing, collar and circlip

Installation

1. Inspect the output shaft for damage and corrosion, replace as necessary

2. Identify the circlip cross section



1. This circlip is correct

2. This circlip MUST be discarded and the correct one used

3. Fit the bearing using special tool 204 - 083

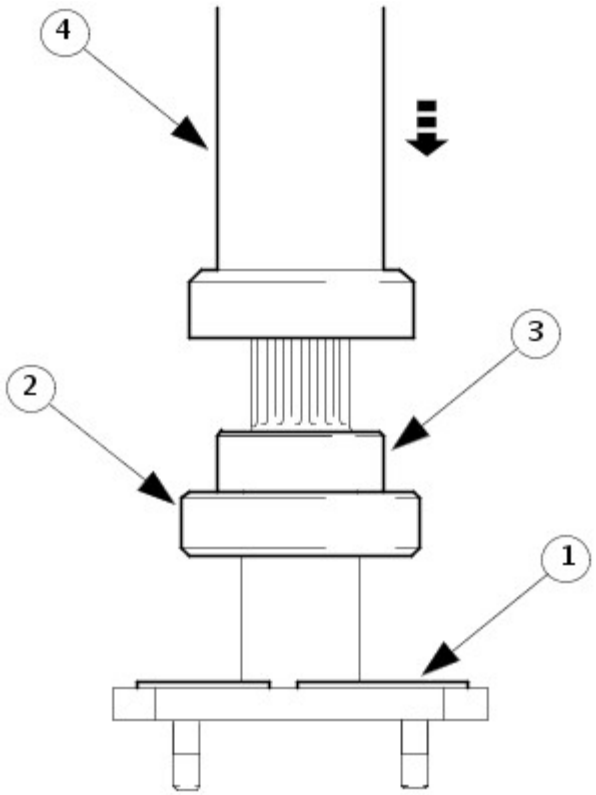
1. Position a new circlip

2. Locate the bearing

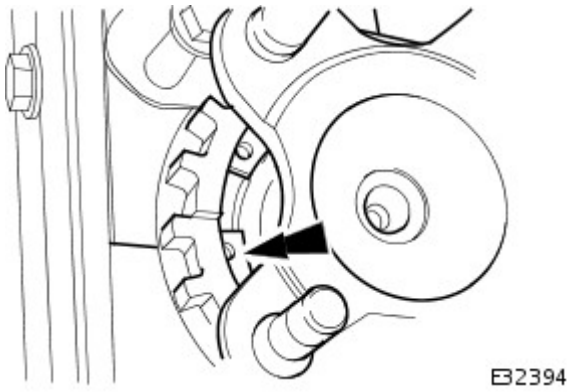
3. Locate the collar

• NOTE: It is strongly recommended that a press equipped with a pressure gauge is used, the assembly load MUST exceed 20Kn

4. Press the assembly



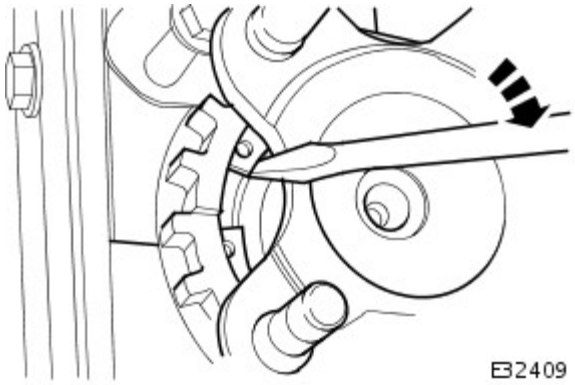
E32397



E32394

4. Fit the output shaft assembly to the final drive

- Lubricate the 'O' ring and seat the shaft assembly
- Secure the assembly with the circlip



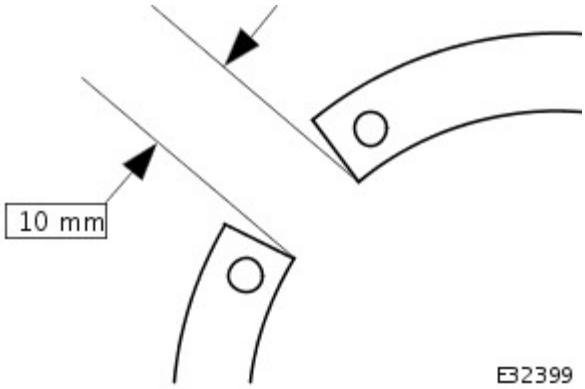
E32409

5. Ensure the correct circlip location

- Using a prybar, or similar, expand the circlip into its undercut by applying outward radial pressure. Start diametrically opposite to the circlip open ends and lever against the drive flange

6. Verify the circlip location

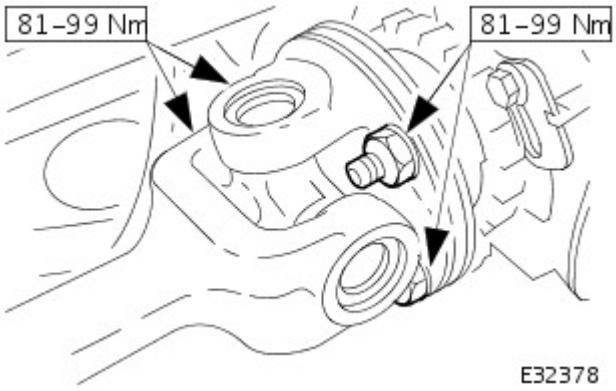
1. The gap MUST be greater than 10,0 mm



6. CAUTION: If the gap CANNOT be achieved, contact Jaguar Service

2. A gap smaller than specified will indicate an improperly fitted circlip. This may be rectified by refitting or by the application of radial pressure around the inner circumference of the circlip

7. Verify that the output shaft end-float is within specification



8. Refer to the illustration

- If appropriate realign the previously made match marks

9. Check the final drive oil level and adjust as required

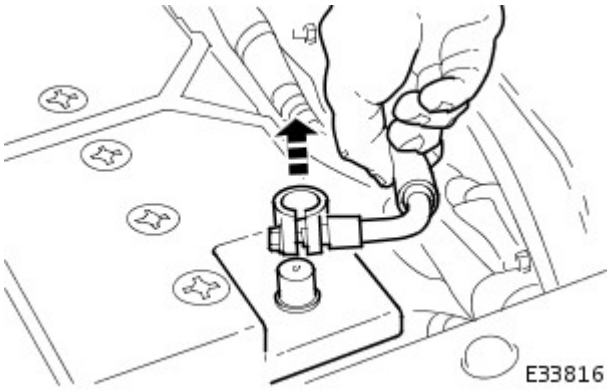
10. Check and adjust rear wheel camber setting

Rear Drive Axle / Differential - Drive Pinion Flange and Drive Pinion Seal

In-vehicle Repair

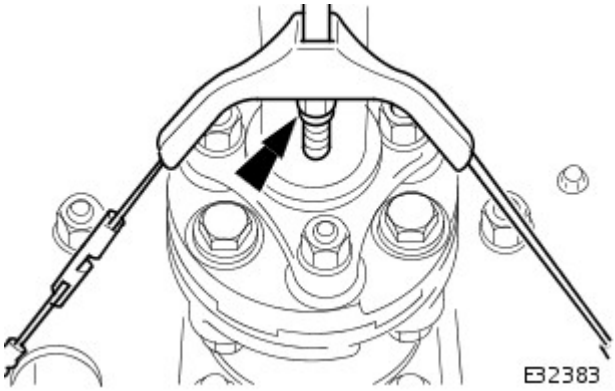
Special Tool(s)	
 E36392	Drive shaft flange wrench 205-053
 E93712	Drive shaft flange remover replacer. 205-272

Removal


E33816

1. Disconnect the battery ground lead.

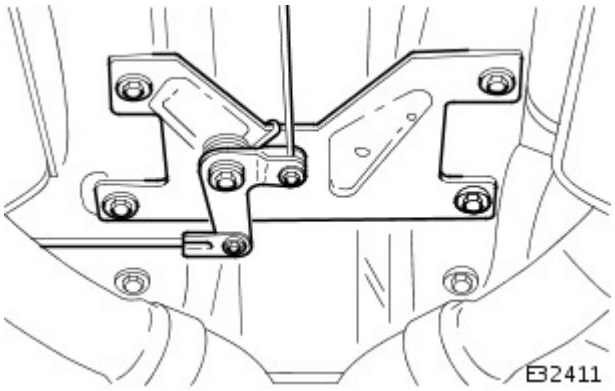
2. Raise the vehicle for access.

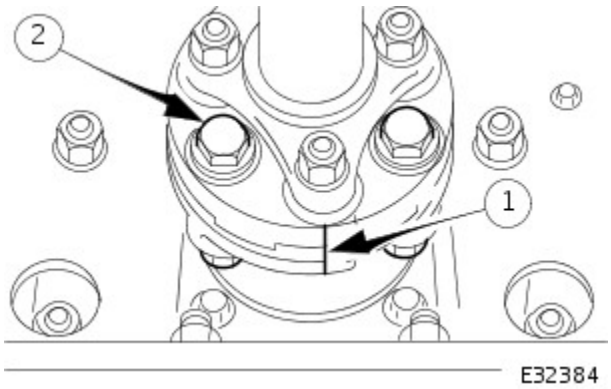

E32383

3. Disconnect the main parking brake cable at the compensator.

4. Release the parking brake relay lever mounting bracket and allow the assembly to hang down.

- Remove the fixings (4).





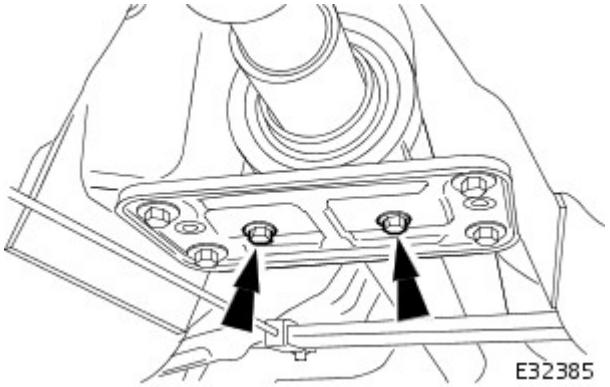
5. Disconnect the driveshaft from the differential flange.

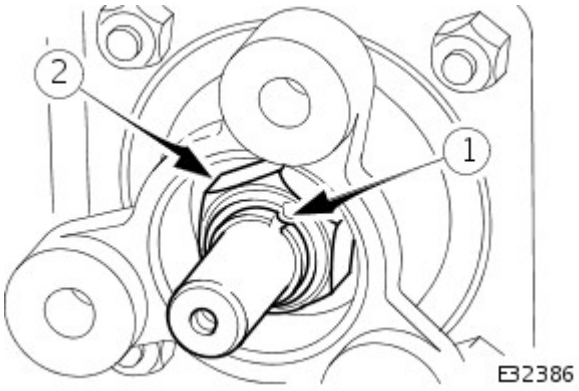
5. CAUTION: Under no circumstances must the flexible coupling (or its fixings) be loosened or removed from the drive shaft.

1. 'Match mark' the FLEXIBLE COUPLING to the differential DRIVE FLANGE.
2. Remove the fixings (3).

6. Support the driveshaft, do not allow it to hang.

7. Remove the fixings (2) center bearing to mounting bracket and push the drive shaft rear section forward to disengage from the pinion spigot.



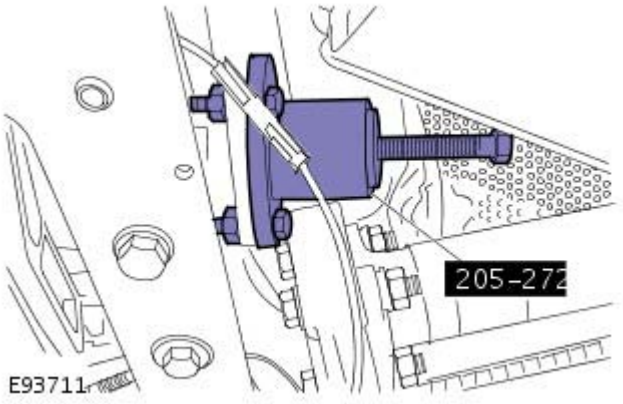


8. Remove the drive flange pinion nut.

1. Using a suitable tool, relieve the staked portion from the pinion keyway.
2. Remove the pinion nut using a suitable socket and tool 205 - 053 to resist rotation.

9. Remove the drive flange assembly.

1. Use tool 205-272 (puller) to remove the drive flange / seal assembly.



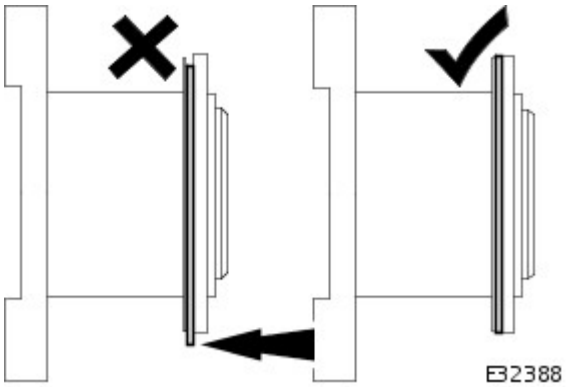
10. Clean the seal counterbore.

Installation

1. Installation is the reverse of the removal procedure, noting the following;

2. Lightly lubricate the seal O/D.

3. Check for the correct assembly condition.

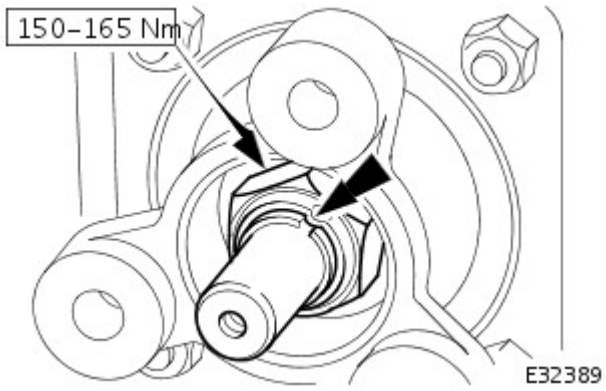


- Ensure that the seal, Ryton ring and backing are aligned and in contact with each other.

4. NOTE: Correct pinion seal location is automatic.

`Pull' the pinion flange / seal assembly down with the pinion nut - do not hammer the flange.

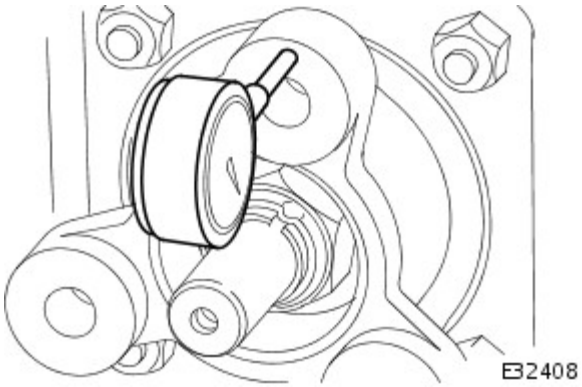
5. Refer to the illustration.



- Rotate the pinion prior to final tightening.
- Stake the nut to the pinion.

6. Check the pinion drive flange axial run-out.

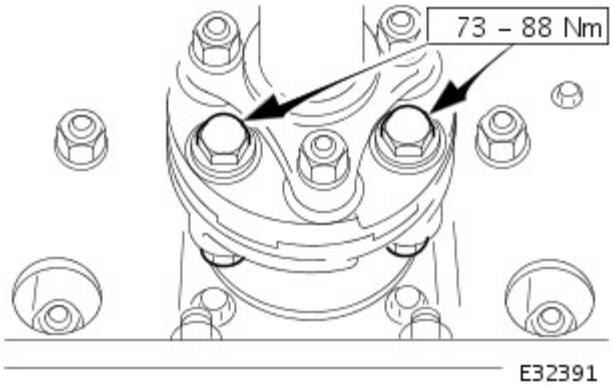
- 0,08 mm MAX TIR.
- If this specification is exceeded, renew the flange / seal assembly.





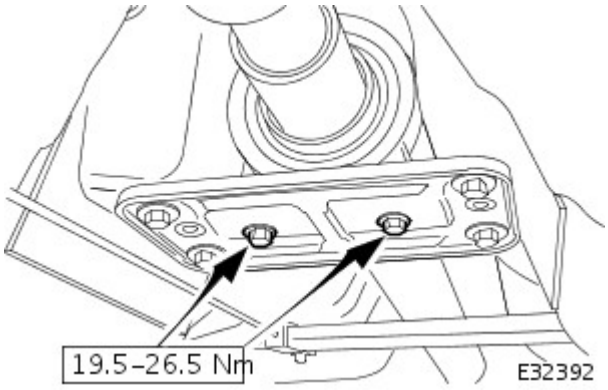
7. Check that the pinion spigot radial run-out.

- 0,08 mm MAX TIR.
- If this specification is exceeded, contact Jaguar Service.



8. Refer to the illustration.

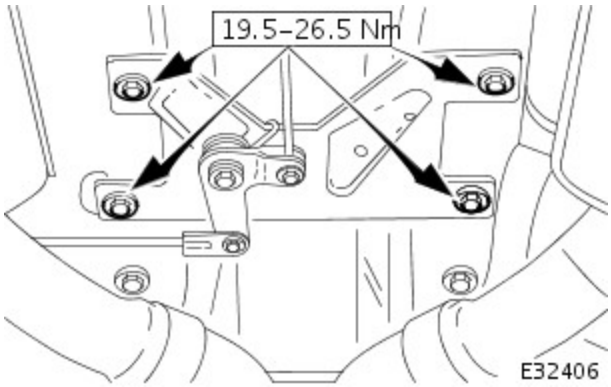
- Renew the driveshaft fixings.



9. Refer to the illustration.

- Ensure that the bearing is central.

10. Refer to the illustration.

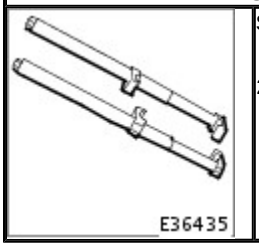


11. Correct the final drive oil level as required.

12. Adjust the parking brake cable as required.

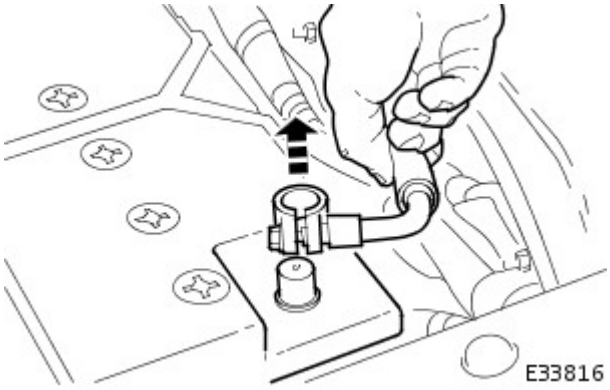
Rear Drive Axle / Differential - Axle Assembly

Removal and Installation

Special Tool(s)	
	Suspension Spring Compressor Tool 204-179

Removal

• NOTE: The pinion flange shown in this procedure is NOT intended to be a true representation



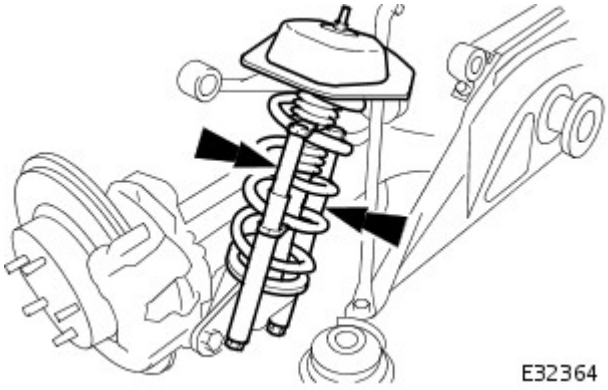
1. Disconnect the battery ground lead

2. Raise the vehicle for access and remove both rear roadwheels

3. Remove the rear suspension assembly, 51.25.13

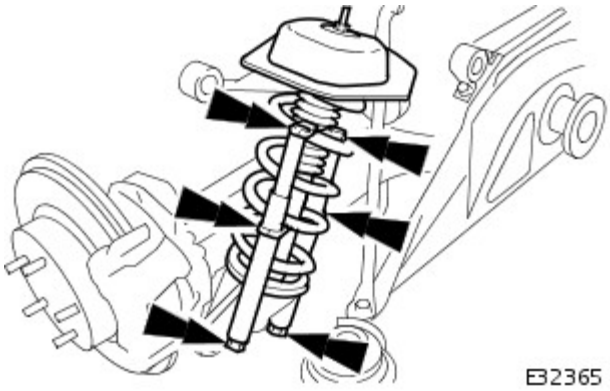
4. CAUTION: Do not lift the assembly by the axle shafts, this may cause damage

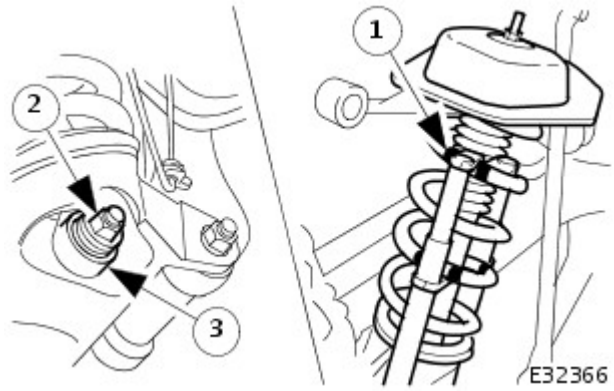
Using a suitable hoist, place the assembly onto a workbench



5. Locate the spring compressor 204 - 179 to the RH road spring

6. Tighten the spring compressor evenly to release the spring load on the damper



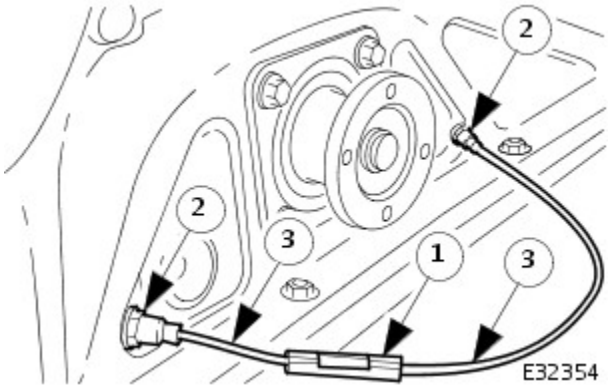


7. Remove the damper assembly

1. Mark the tool position on the spring with adhesive tape
2. Remove the damper lower fixing
3. Remove the damper assembly

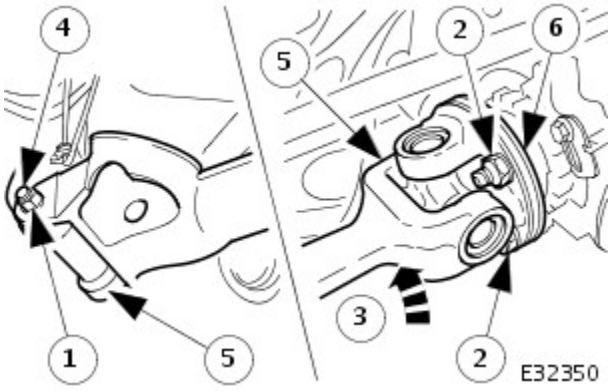
8. Repeat for the opposite hand spring / damper unit

9. Release the parking brake cable



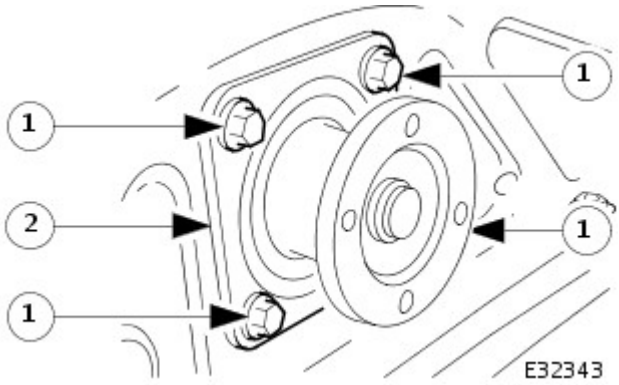
1. Disconnect the cable in-line connector
2. Remove the outer cable to frame clips (2)
3. Clear the cable through the frame

10. Remove the LH hub and axle shaft assembly



1. Remove the lower fulcrum shaft nut (1)
2. Remove and discard the axle shaft to drive flange nuts (4)
3. Turn the axle-shaft for access to access the fixings for step 2
4. Support the axle shaft assembly and remove the hub fulcrum
5. Remove the hub and axle shaft assembly
6. Note the position of and remove the camber adjustment spacer

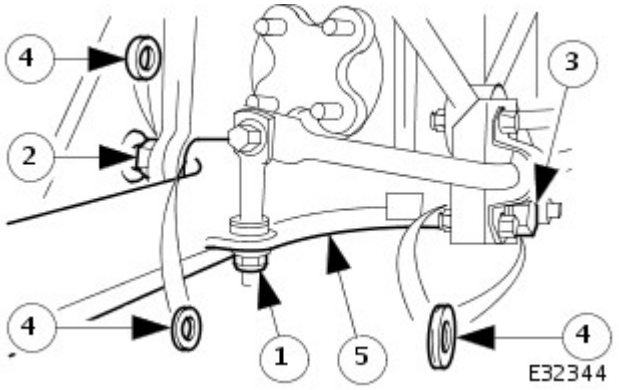
11. Repeat for the opposite hand



12. Remove the final drive nose plate.

1. Remove the final drive nose plate bolts (4)
2. Remove the final drive nose plate

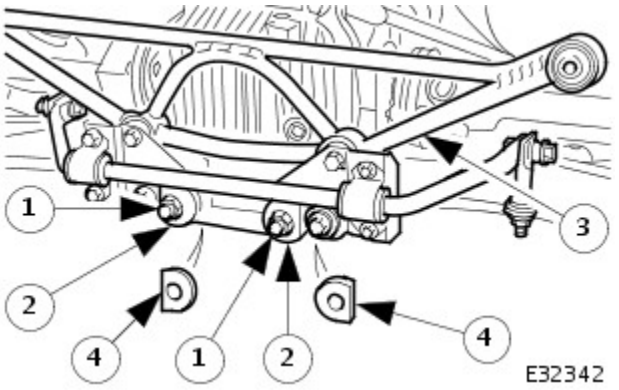
13. Position the axle assembly on its LH side and support it on wooden blocks



14. Remove the wishbone

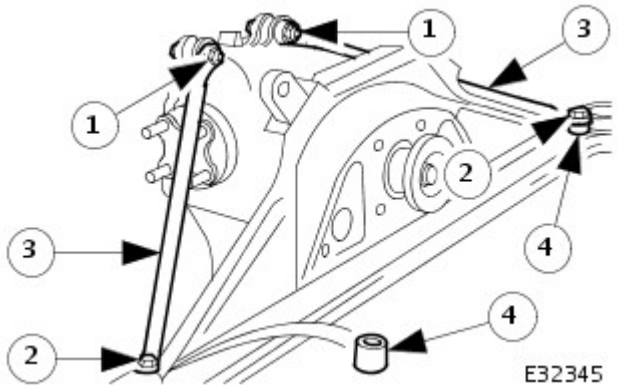
1. Remove the fixing, stabilizer bar link to wishbone
2. Remove the pivot nut
3. Remove pivot
4. Note the position of and remove the front spacer and rear washers
5. Remove the wishbone

15. Repeat for the opposite hand



16. Remove the wishbone tie assembly

1. Remove the wishbone tie to final drive fixings (2)
2. Remove the washers (2)
3. Remove the wishbone tie assembly
4. Remove the washers (2)

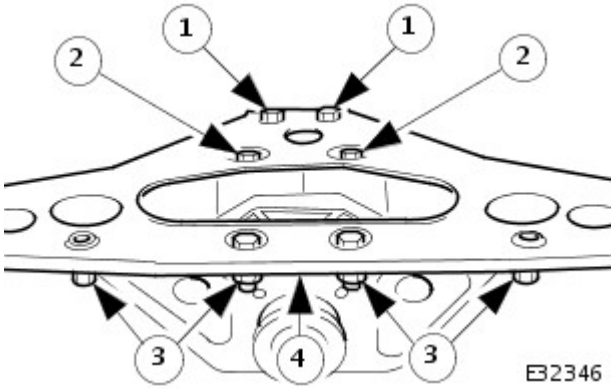


17. Remove the tie rods

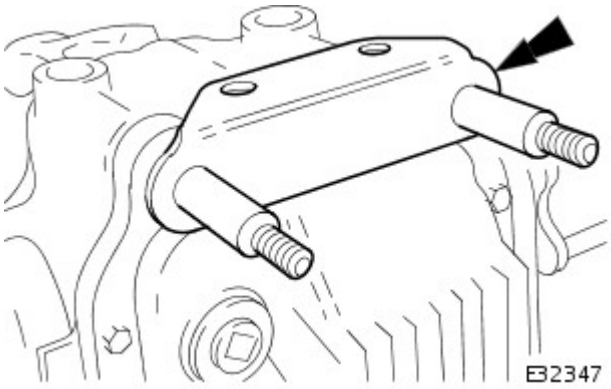
1. Remove the tie rod to final drive fixings (2)
2. Remove the tie rods to wide mounting bracket fixings (2)
3. Remove the tie rods
4. Note the position of and remove the spacers

18. Position the assembly for access to the 'A' frame to final drive fixings, noting that oil may issue from the breather

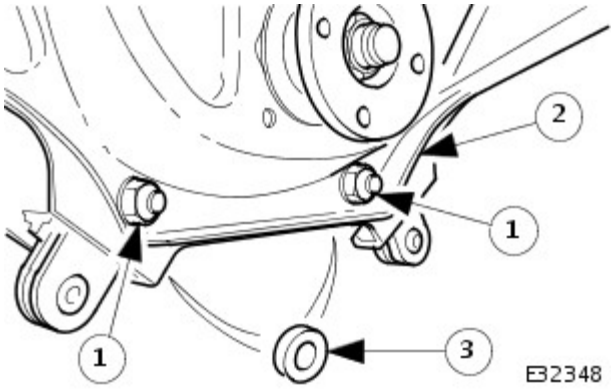
19. Remove the 'A' frame assembly



1. Remove the 'A' frame to rear mounting bracket fixings (2)
2. Remove the 'A' frame to final drive fixings (2)
3. Remove the 'A' frame to wide mounting bracket fixings (2)
4. Remove the 'A' frame assembly

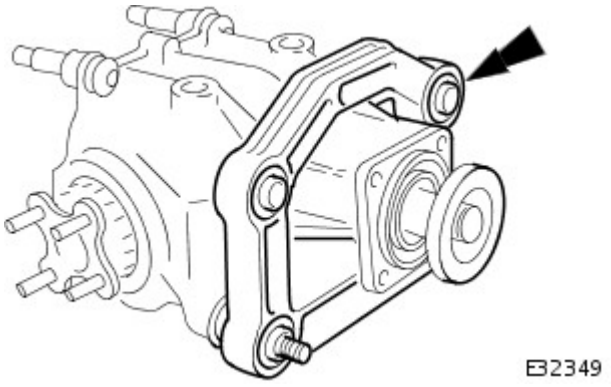


20. Remove the 'A' frame rear mounting bracket



21. Remove the wide mounting bracket assembly

1. Remove the wide mounting bracket / pendulum assembly to final drive fixings (2)
2. Remove the wide mounting bracket assembly
3. Remove the washers (2)



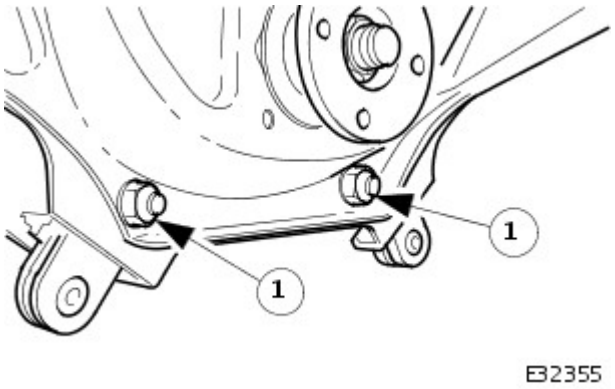
22. Remove the pendulum assembly

Installation

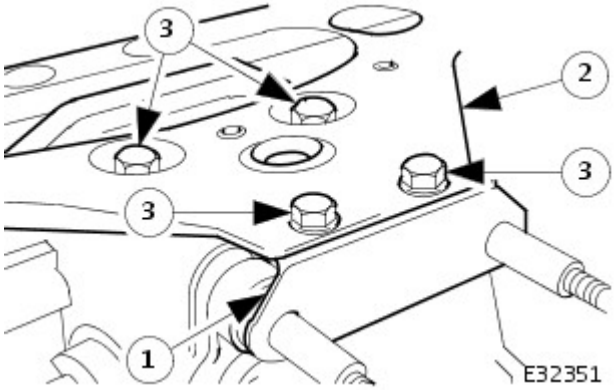
1. Installation is the reverse of the removal procedure noting the following

2. Locate the wide mounting bracket to the final drive.

1. Loose assemble the wide mounting bracket /

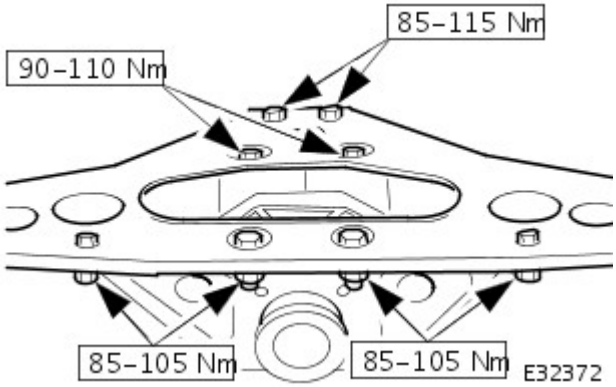


pendulum to final drive fixings

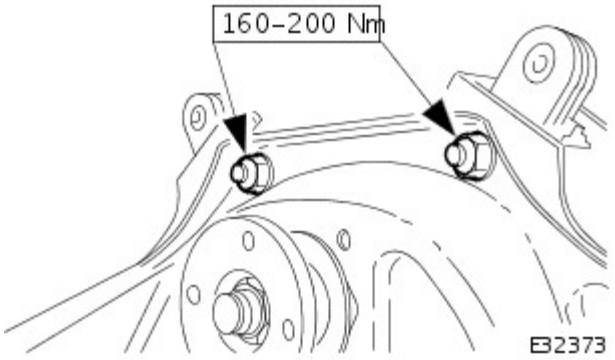


3. Locate the 'A' frame rear bracket and 'A' frame assembly

1. Fit the 'A' frame rear bracket
2. Fit the 'A' frame assembly
3. Loose assemble the 'A' frame to final drive fixings

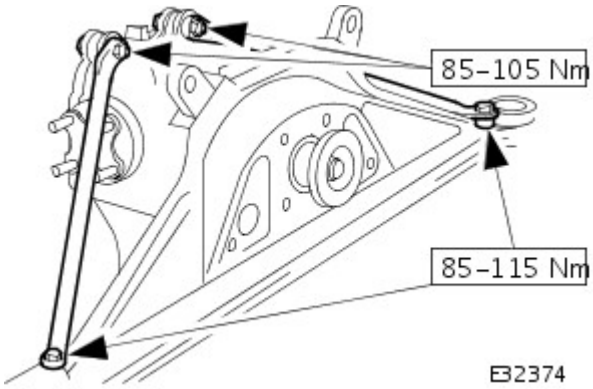


4. Refer to the illustration



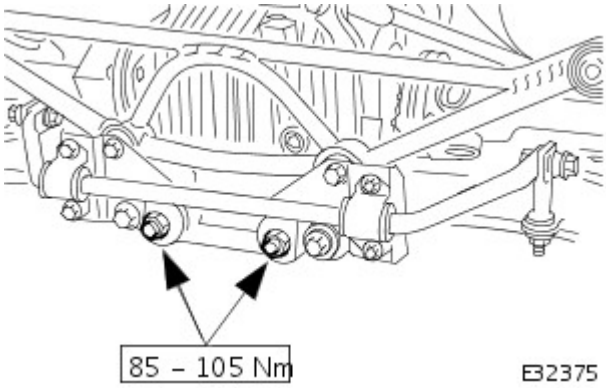
5. Refer to the illustration

6. Refer to the illustration

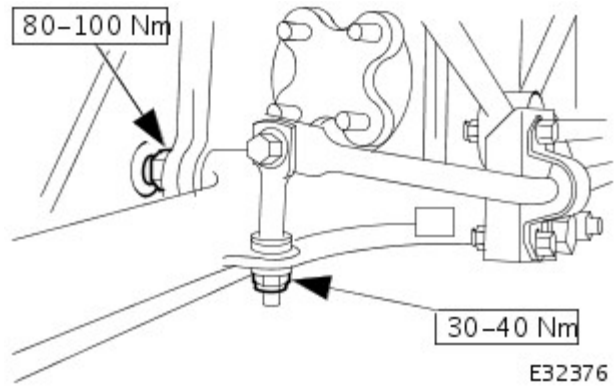


7. NOTE: Ensure the correct orientation of the flat sided washers

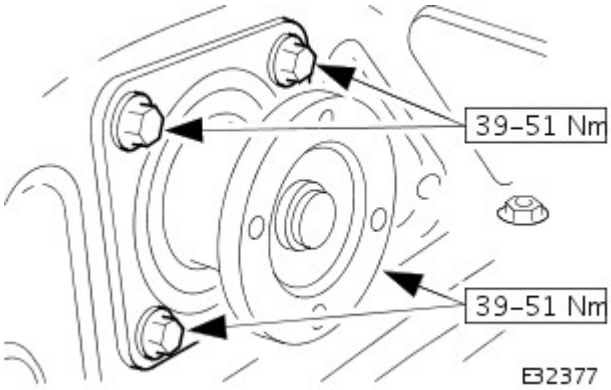
Refer to the illustration



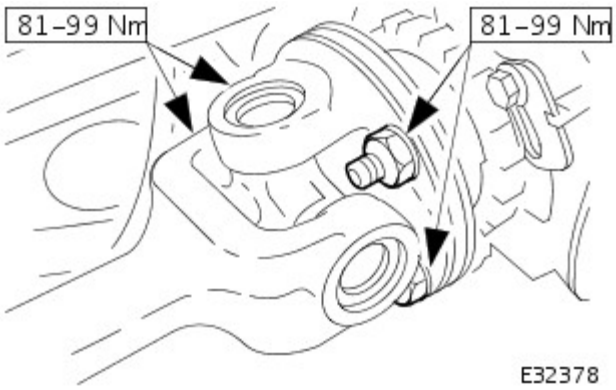
8. Refer to the illustration



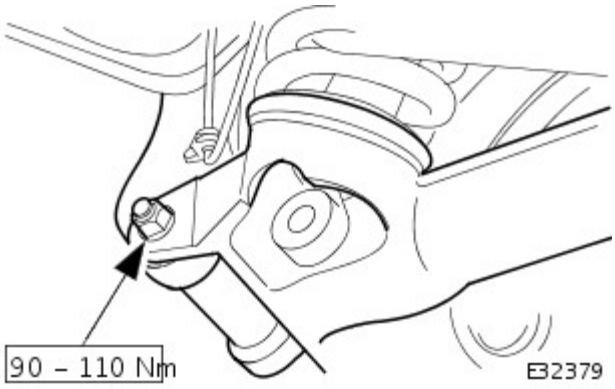
9. Refer to the illustration



10. Refer to the illustration

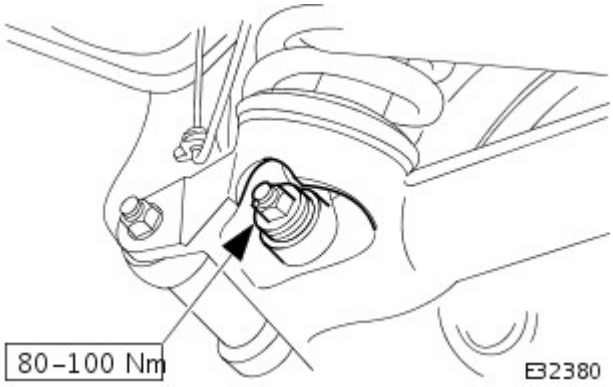


11. Refer to the illustration



12. Ensure that the spring pan and wishbone location reflects the original condition

13. Refer to the illustration



14. Check and adjust as required, the final drive unit oil level

15. Check and adjust as required, the rear wheel alignment, 204-02.

Brake System - General Information -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Brake fluid	ITT Super Dot 4
Brembo Brake Grease	Molikote Cu 7439

Front Brake Dimensions

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced. Care must be taken when refinishing brake discs that the dimension limits are not exceeded.

Component	Dimension - Normally Aspirated Vehicle	Dimension - Super Charged Vehicle
Brake disc - diameter	305 mm	325 mm
Brake disc - thickness (new)	28 - 28.5 mm	28 - 28.5 mm
Brake disc - minimum thickness	26 mm	26 mm
Brake disc - minimum wall thickness	6.2 mm	6.6 mm
Installed brake disc - maximum run-out	0.1 mm	0.1 mm
Brake pad - minimum thickness	2 mm	2 mm
Caliper piston diameter	60 mm	60 mm

Front Brake Dimensions - Brembo Brakes

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced. Care must be taken when refinishing brake discs and drums that the dimension limits are not exceeded.

Component	Dimension
Brake disc - diameter	355 mm
Brake disc - thickness (new)	32 mm
Brake disc - minimum thickness	30 mm
Brake disc - minimum wall thickness	6.7 mm
Installed brake disc - maximum run-out	0.1 mm
Caliper piston diameter	40/44 equivalent 60 mm
Brake pad - minimum thickness	2 mm

Rear Brake Dimensions

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced. Care must be taken when refinishing brake discs and drums that the dimension limits are not exceeded.

Component	Dimension
Brake disc - diameter	305 mm
Brake disc - thickness (new)	19.5 - 20 mm
Brake disc - minimum thickness	18.5 mm
Brake disc - minimum wall thickness	4.9 mm
Installed brake disc - maximum run-out	0.15 mm
Caliper piston diameter	42 mm
Parking brake drum - maximum diameter	181 mm
Brake pad - minimum thickness	2 mm
Parking brake shoes - minimum thickness	2 mm

Rear Brake Dimensions - Brembo Brakes

• NOTE: When a component reaches its maximum / minimum dimension limit the component must be replaced. Care must be taken when refinishing brake discs and drums that the dimension limits are not exceeded.

Component	Dimension
Brake disc - diameter	330 mm
Brake disc - thickness (new)	28 mm
Brake disc - minimum thickness	26 mm
Brake disc - minimum wall thickness	6.7 mm
Installed brake disc - maximum run-out	0.1 mm
Caliper piston diameter	28/30 equivalent 41 mm
Brake pad - minimum thickness	2 mm

Brake System - General Information - Brake System

Description and Operation

Details of the Brake System can be found in sections 206-03, 206-04, 206-05, 206-06, 206-07 and 206-09.

Brake System - General Information - Brake System

Diagnosis and Testing

Principles of Operations

The brake system operates by transferring effort applied to the brake pedal, by the driver to the brakes at each wheel.

The braking effort is distributed to each wheel, using a hydraulic system. The system is assisted using a vacuum brake booster that reduces pedal effort for a given hydraulic pressure. The parking brake operates on the rear wheels and is applied using a hand operated control.

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 tire and wheel 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 manufacture. Replace the damaged wheel or excessively worn tire. For additional information, refer toSection 204-04 Wheels and Tires.

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. For additional information, refer toSection 204-00 Suspension System - General Information.

Road Test

Visual Inspection Chart

Mechanical	Electrical
Brake master cylinder	Parking brake switch
Brake caliper piston(s)	Damaged or corroded wiring harness
Brake discs	Brake master cylinder fluid level switch
Wheel bearings	
Brake pads	
Power brake booster	
Brake pedal linkage	
Booster vacuum hose	
Tires	
Debris	

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

Symptom	Possible Sources	Action
Brakes noisy	* Brake pads. * Brake discs.	* GO to Pinpoint Test A.
Vibration when brakes are applied	* Wheels require balancing. * Wheel hub nuts. * 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 bush wear or failure. * Steering bush wear or failure.	* Go to Pinpoint Test B.
The brakes pull or drift	* Tire pressures/wear. * Calipers. * Brake pads. * Brake discs. * Wheel alignment adjustment. * Wheel bearing. * Suspension bushes and ball joints.	* GO to Pinpoint Test C.
The pedal feels spongy	* Air in brake system. * Leak in hydraulic system. * Brake booster/master cylinder. * Brake pads.	* GO to Pinpoint Test D.
The pedal goes down fast	* Air in brake system. * Leak in hydraulic system. * Brake booster/master cylinder. * Brake pads.	* GO to Pinpoint Test E.
The pedal goes down slowly	* Air in brake system. * Brake booster/master cylinder.	* Go to Pinpoint Test F.
Excessive brake pedal effort	* Brake pads. * Brake booster.	* GO to Pinpoint Test G.
Brake lockup during light brake pedal force	* Brake pads. * Calipers.	* GO to Pinpoint Test H.
Brakes drag	* Parking brake control applied/malfunction. * Seized parking brake cables. * Seized caliper slide pins. * Seized caliper. * Brake booster. * Pedal gear.	* GO to Pinpoint Test I.
Excessive/Erratic brake pedal travel	* Hydraulic system. * Brake pads. * Brake discs. * Hub and bearing assembly.	* GO to Pinpoint Test J.
The red brake warning indicator is always on	* Fluid level.	* FILL the system to specification. CHECK for leaks.
	* Brake fluid level sensor.	* INSTALL a new brake master cylinder fluid reservoir. For additional information, refer toSection 206-06 Hydraulic Brake Actuation.
	* Parking brake control.	* RELEASE and ADJUST the parking brake. For additional information, refer toSection 206-05 Parking Brake and Actuation.
	* Electrical circuit.	* For additional information, refer to PDU for analysis/rectification of the concern.
Slow or incomplete brake pedal return	* Brake pedal binding. * Brake booster/master cylinder.	* GO to Pinpoint Test K.

PINPOINT TEST A : BRAKES NOISY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: 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 A2. **No** CLEAN the front brake pads or INSTALL new front brake pads if necessary. For additional information, refer toSection 206-03 Front Disc Brake. CLEAN the rear brake pads or INSTALL new rear brake pads if necessary. For additional information, refer toSection 206-04 Rear Disc Brake. Test vehicle for presence of brake squeal.
A2: 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? REFER to Specification - in this section. **Yes** INSTALL new front brake discs and brake pads. For additional information, refer toSection 206-03 Front Disc Brake. INSTALL new rear brake discs and brake pads. For additional information, refer toSection 206-04 Rear Disc Brake. TEST the system for normal operation. **No** Vehicle is OK.

PINPOINT TEST B : VIBRATION WHEN BRAKES ARE APPLIED	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: 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. REPEAT road test if necessary. **No** GO to B2. .
B2: 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** If the vibration is from the front of the vehicle GO to B3. If the vibration is from the rear of the vehicle or can not be diagnosed between front or rear of the vehicle GO to B6. **No** Vehicle is OK.
B3: CHECK THE SUSPENSION AND STEERING COMPONENTS	
	1 Check the condition of the front suspension bushes and ball joints REFER to Section 204-01 Front Suspension. Check the condition of the steering linkage components REFER to Section 211-02 Power Steering / 211-03 Steering Linkage.
	Do any of the front suspension components or steering components require replacement? **Yes** INSTALL new components as necessary REFER to Section 204-01 Front Suspension / 211-02 Power Steering / 211-03 Steering Linkage. Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal. If vibration still exists GO to B4. **No** GO to B4.
B4: CHECK THE FRONT BRAKE PADS AND FRONT BRAKE DISCS	
	1 Check the condition of the front brake pads and front brake discs.
	Does excessive brake disc runout or brake disc thickness variation exist?

	REFER to Specification - / Front Brake Disc Runout Check - Vehicles With: Brembo Brakes / Front Brake Disc Runout Check - Vehicles Without: Brembo Brakes in this section. **Yes** GO to B5. **No** GO to B6.
B5: CHECK VEHICLE FOR A HISTORY OF BRAKE VIBRATION PROBLEMS	
	1 Check to see if the vehicle has recently been repaired for brake vibration problems by the installation of new front brake discs and pads.
	Has vehicle has recently been repaired for brake vibration problems by the installation of new front brake discs and pads. **Yes** INSTALL new front wheel hubs REFER to Section 204-01 Front Suspension. INSTALL new front brake discs and front brake pads REFER to Section 206-03 Front Disc Brake. TEST the system for normal operation. **No** INSTALL front brake discs and front brake pads REFER to Section 206-03 Front Disc Brake. CHECK for excessive brake disc runout REFER to Front Brake Disc Runout Check - Vehicles With: Brembo Brakes / Front Brake Disc Runout Check - Vehicles Without: Brembo Brakes in this section. If excessive brake disc runout exists INSTALL new front wheel hubs REFER to Section 204-01 Front Suspension. TEST the system for normal operation.
B6: CHECK THE REAR BRAKE PADS AND REAR BRAKE DISCS	
	1 Check the condition of the rear brake pads and rear brake discs.
	Does excessive brake disc runout or brake disc thickness variation exist? REFER to Specification - / Rear Brake Disc Runout Check - Vehicles Without: Brembo Brakes / Rear Brake Disc Runout Check - Vehicles With: Brembo Brakes in this section. **Yes** INSTALL rear brake discs and rear brake pads REFER to Section 206-04 Rear Disc Brake. CHECK for excessive brake disc runout. REFER to Rear Brake Disc Runout Check - Vehicles With: Brembo Brakes / Rear Brake Disc Runout Check - Vehicles Without: Brembo Brakes in this section. If excessive brake disc runout exists INSTALL new rear wheel hubs. TEST the system for normal operation. **No** REPEAT road test and re-check for a vibration concern. If vibration exists GO to B3.

PINPOINT TEST C : THE BRAKES PULL OR DRIFT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: ROAD TEST VEHICLE	
	1 Road test the vehicle and apply the brake pedal.
	Does the vehicle pull or drift? **Yes** GO to C2. **No** Vehicle is OK.
C2: INSPECT TIRE PRESSURE	
	1 Check for excessive tire wear or incorrect pressures.
	Are the tires at the correct pressure and in good condition? **Yes** GO to C3. **No** ADJUST the tire pressures or INSTALL new tires if excessively worn. TEST the system for normal operation.
C3: CHECK CALIPERS	
	1 Check the front caliper pistons for binding, leaking or sticking. For additional information, refer toSection 206-03 Front Disc Brake. Check the rear caliper pistons for binding, leaking or sticking. For additional information, refer toSection 206-04 Rear Disc Brake.

	Do the disc brake caliper pistons and pins bind, leak or stick? **Yes** INSTALL new calipers as necessary. TEST the system for normal operation. **No** GO to C4.
C4: INSPECT BRAKE DISCS	
	1 Check the brake discs for excessive damage, thickness variation or runout. For additional information, refer to General Procedures in this section.
	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 C5.
C5: INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY	
	1 Check the front hub and wheel bearing assembly. For additional information, refer toSection 204-00 Suspension System - General Information.
	Are the wheel bearings OK? **Yes** GO to C6. **No** INSTALL new wheel bearings. For additional information, refer toSection 204-01 Front Suspension. TEST the system for normal operation.
C6: CHECK SUSPENSION BUSHES AND BALL JOINTS.	
	1 Check all suspension bushes and ball joints.
	Are the suspension bushes and ball joints OK? **Yes** Vehicle is OK. **No** INSTALL new front suspension bushes and ball joints as required. For additional information, refer toSection 204-01 Front Suspension. INSTALL new rear suspension bushes and ball joints as required. For additional information, refer toSection 204-02 Rear Suspension.

PINPOINT TEST D : THE PEDAL FEELS SPONGY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: 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 D2.
D2: 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 D3. **No** BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation.
D3: 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 D4. **No** CHECK the vacuum to brake booster. For additional information, refer toSection 206-07 Power Brake Actuation.

D4: CHECK BRAKE FLUID LEVEL	
	1 Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? **Yes** BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. **No** CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder in this section. ADD fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.

PINPOINT TEST E : THE PEDAL GOES DOWN FAST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: ROAD TEST VEHICLE	
	1 Road test and apply the brake pedal.
	Is the brake pedal effort and brake pedal travel normal? **Yes** Vehicle is OK. **No** GO to E2.
E2: CHECK BRAKE FLUID LEVEL	
	1 Check the brake master cylinder reservoir fluid level.
	Is the fluid level within specification? **Yes** GO to E3. **No** CHECK the brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder Component Test in this section. ADD fluid and BLEED brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.
E3: 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. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test. **No** GO to E4.
E4: CHECK FOR BRAKE SYSTEM LEAKS	
	1 Check for external brake system leaks. For additional information, refer to Master Cylinder in this section.
	Are leaks found? **Yes** REPAIR as necessary, ADD fluid and BLEED brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test. **No** System is OK.

PINPOINT TEST F : THE PEDAL GOES DOWN SLOWLY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: 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 F2. **No** GO to F3.
F2: CHECK FOR BRAKE SYSTEM LEAKS	
	1 Check for external brake system leaks. For additional information, refer to Master Cylinder in this section.

	Are there any external brake system leaks? **Yes** REPAIR as necessary. ADD fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. **No** GO to F3.
F3: 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. For additional information, refer to General Procedures in this section. TEST the system for normal operation. **No** System is OK.

PINPOINT TEST G : EXCESSIVE BRAKE PEDAL EFFORT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: 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. For additional information, refer toSection 206-03 Front Disc Brake. INSTALL the rear brake pads correctly or INSTALL new rear brake pads if necessary. For additional information, refer toSection 206-04 Rear Disc Brake. REPEAT road test. **No** GO to G2.
G2: CHECK VACUUM	
	1 Disconnect the vacuum booster hose from the 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 40.5kPa (12 in-Hg) or greater? **Yes** GO to G3. **No** LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.
G3: 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 G4.
G4: CHECK POWER BRAKE BOOSTER VALVE	
	1 Check the brake booster valve. For additional information, refer to Brake Booster in this section.
	Is the power brake booster valve OK? **Yes** CHECK the brake booster. For additional information, refer to Brake Booster in this section. INSTALL a new brake booster if necessary. TEST the system for normal operation. **No** INSTALL a new brake booster valve. TEST the system for normal operation.

PINPOINT TEST H : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: TEST BRAKE LOCKUP	

	1 Road test the vehicle and apply the brake pedal lightly.
	Do the brakes lockup? **Yes** GO to H2. **No** Vehicle is OK.
H2: INSPECT BRAKE PADS	
	1 Inspect brake pads for contamination, correct installation, damage and type.
	Are any concerns found? **Yes** CHECK the front brake pads. For additional information, refer toSection 206-03 Front Disc Brake. CHECK the rear brake pads. For additional information, refer toSection 206-04 Rear Disc Brake. INSTALL new brake pads as necessary. REPEAT road test. **No** GO to H3.
H3: INSPECT BRAKE CALIPERS	
	1 Inspect brake calipers for binding, leaking or sticking.
	Are any concerns found? **Yes** CHECK the front brake calipers. For additional information, refer toSection 206-03 Front Disc Brake. CHECK the rear brake calipers. For additional information, refer toSection 206-04 Rear Disc Brake. INSTALL the brake calipers correctly or INSTALL new brake calipers as necessary. TEST the system for normal operation. REPEAT road test if necessary. **No** Vehicle is OK.

PINPOINT TEST I : BRAKES DRAG	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: ROAD TEST VEHICLE	
	1 Road test the vehicle and apply the brakes.
	Are the brakes functioning correctly? **Yes** Vehicle is OK. **No** GO to I2.
I2: CHECK CALIPERS	
	1 Check the front caliper pistons for binding, leaking or sticking. For additional information, refer toSection 206-03 Front Disc Brake. Check the rear caliper pistons for binding, leaking or sticking. For additional information, refer toSection 206-04 Rear Disc Brake.
	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. Road test vehicle. **No** GO to I3.
I3: CHECK BRAKE BOOSTER	
	1 Check the brake booster connecting rod alignment and travel. For additional information, refer toSection 206-07 Power Brake Actuation.
	Is the connecting rod OK? **Yes** Vehicle is OK. **No** INSTALL a new brake booster. For additional information, refer toSection 206-07 Power Brake Actuation. TEST the system for normal operation.

PINPOINT TEST J : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: 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 J2.
J2: CHECK BRAKE FLUID LEVEL	
	1 Check the brake master cylinder reservoir fluid level.
	Is the fluid level OK? **Yes** GO to J3. **No** CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder in this section. ADD brake fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.
J3: CHECK BRAKE PEDAL RESERVE	
	1 Engine is idle.
	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 J4. **No** CHECK the vacuum to the brake booster. For additional information, refer toSection 206-07 Power Brake Actuation.
J4: CHECK THE FRONT HUB AND BEARING ASSEMBLY	
	1 Check the front hub and bearing assembly. For additional information, refer toSection 204-01 Front Suspension.
	Are the front wheel bearings loose? **Yes** INSTALL a new front wheel bearing if damaged. For additional information, refer toSection 204-01 Front Suspension. TEST the system for normal operation. **No** CHECK the front brake discs for thickness variances. For additional information, refer to General Procedures in this section.

PINPOINT TEST K : SLOW OR INCOMPLETE BRAKE PEDAL RETURN	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK FOR BRAKE PEDAL RETURN	
	1 Run the engine at fast 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 K2.
K2: CHECK FOR BRAKE PEDAL BINDING	
	1 Check the brake pedal to make sure it is operating freely.
	Is the brake pedal operating freely? **Yes** INSTALL a new brake booster. For additional information, refer toSection 206-07 Power Brake Actuation. TEST the system for normal operation. **No** REPAIR or INSTALL new brake pedal. TEST the system for normal operation.

Component Tests

Brake Booster

1. **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. **2.** Check the hydraulic brake system for leaks or low fluid.

3. **3.** With the transmission in PARK, stop the engine and apply the parking brake. Pump the brake pedal several times to exhaust all vacuum in the system.

4. **4.** 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.

5. **5.** 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 transmission in PARK or NEUTRAL. 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.

6. **6.** 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. For additional information, refer to General Procedures in this section.

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.

- New 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

• NOTE: Prior to carrying out any diagnosis, make sure the brake system warning indicator is functional.

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:

- 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, an incorrectly adjusted parking brake, 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 condition may be caused by two types of none pressure external leaks.

Type 1: An external leak may be occur at the master cylinder reservoir cap because of incorrect positioning of gasket and cap. Reposition cap and gasket.

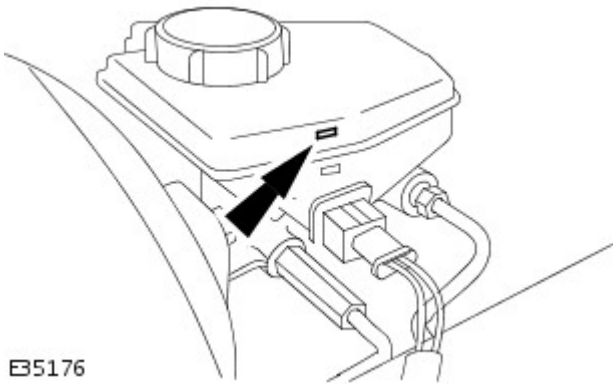
Type 2: An external leak may occur at the reservoir mounting seals. Repair such a leak by installing new seals and make sure that the reservoir retaining bolt is correctly installed.

Brake System - General Information - Brake System BleedingVehicles With: Standard Brakes

General Procedures

WARNING: WASH HANDS AFTER HANDLING BRAKE FLUID. IF BRAKE FLUID COMES INTO CONTACT WITH THE EYES, FLUSH EYES WITH COLD RUNNING WATER. IF IRRITATION PERSISTS SEEK MEDICAL ATTENTION. IF BRAKE FLUID IS TAKEN INTERNALLY, DRINK WATER AND INDUCE VOMITING. GET MEDICAL ATTENTION IMMEDIATELY.

CAUTION: Remove brake fluid spillage immediately from paint work with clean water.

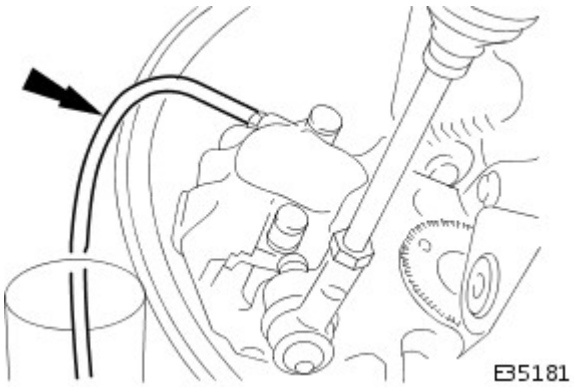


1. Position vehicle on a four-post lift.

2. Open engine compartment and fit paint work protection covers to fenders.

3. NOTE: Make sure the brake-fluid level does not fall below the fluid reservoir 'MIN' (minimum) mark when bleeding the brake system.

Fill fluid reservoir to the 'MAX' (maximum) mark.



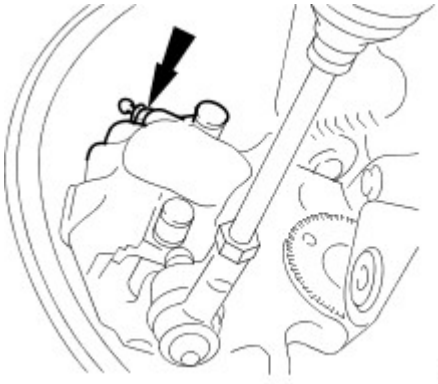
4. Prepare left-hand front, brake-caliper for bleeding.

- Remove dust cap.
- Connect bleed pipe and fluid container to bleed nipple.

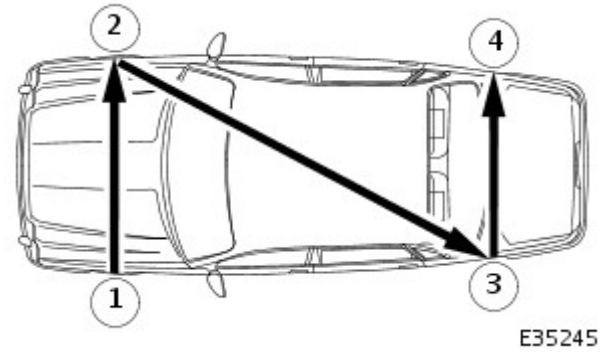
5. Bleed the brake.

1. Apply pressure to brake pedal
2. Open bleed nipple.
3. Fully depress brake pedal.
4. Close bleed nipple.
5. Release brake pedal.
6. Wait two seconds to allow system to prime.
7. Repeat procedure until air-free brake fluid is expelled from the caliper.

6. Tighten bleed nipple, see torque settings below.

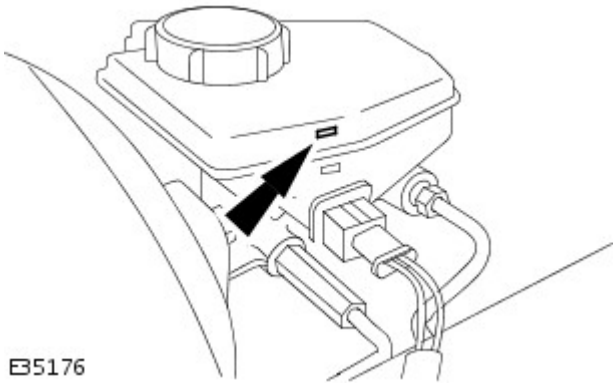


- Front caliper bleed nipple: 4-6 Nm.
- Rear caliper bleed nipple: 8-11 Nm.



7. Following the procedure below, bleed the brakes in the order shown:

1. Left-Hand Front,
2. Right-Hand Front,
3. Left- Hand Rear,
4. Right-Hand Rear.



8. CAUTION: Remove brake fluid spillage immediately from paint work with clean water.

Fill fluid reservoir.

- Fill reservoir to the 'MAX' mark.
- Fit filler cap.

9. Start engine.

10. Check for correct brake-pedal travel and pressure.

11. Apply brake pedal and check around vehicle for brake fluid leaks.

12. Make sure brake fluid level is at the 'MAX' mark.

Brake System - General Information - Brake System BleedingVehicles With: High Performance Brakes

General Procedures

1. WARNINGS:

IF BRAKE FLUID IS TAKEN INTERNALLY, DRINK WATER AND INDUCE VOMITING. GET MEDICAL ATTENTION IMMEDIATELY.

WASH HANDS AFTER HANDLING BRAKE FLUID. IF BRAKE FLUID COMES INTO CONTACT WITH THE EYES, FLUSH EYES WITH COLD RUNNING WATER. IF IRRITATION PERSISTS SEEK MEDICAL ATTENTION.

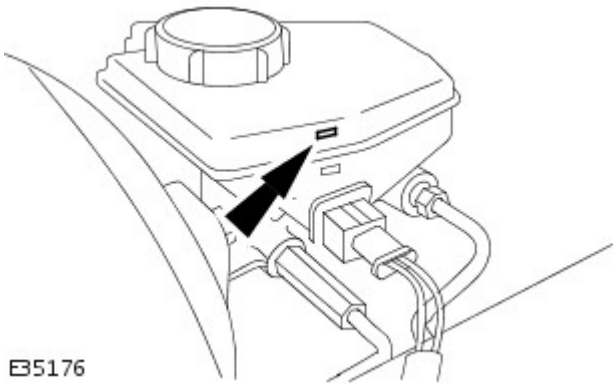
CAUTION: Remove brake fluid spillage immediately from paint work with clean water.

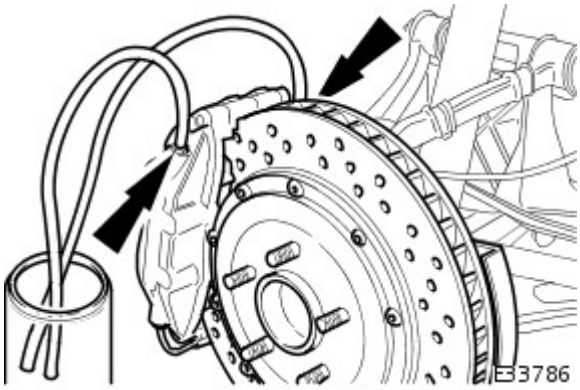
Position vehicle on a four-post lift.

2. Open engine compartment and fit paint work protection covers to fenders.

3. NOTE: Make sure the brake-fluid level does not fall below the fluid reservoir 'MIN' (minimum) mark when bleeding the brake system.

Fill fluid reservoir to the 'MAX' (maximum) mark.





4. Prepare the left-hand front, brake-caliper for bleeding.

- Connect bleed pipes and fluid containers to bleed nipples.

5. Bleed the brake.

1. Apply pressure to brake pedal.
2. Open caliper's outer bleed nipple.
3. Fully depress brake pedal.

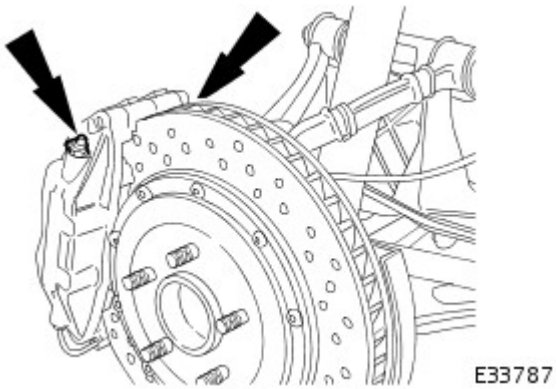
4. Close bleed nipple.

5. Release brake pedal.

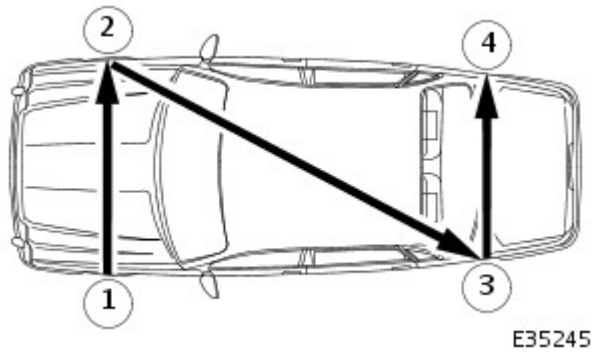
6. Wait two seconds to allow system to prime.

7. Repeat procedure until air-free brake fluid is expelled from the bleed nipple.

8. Repeat procedure to caliper's inner bleed nipple.



6. Tighten bleed nipples to 12-16 Nm.



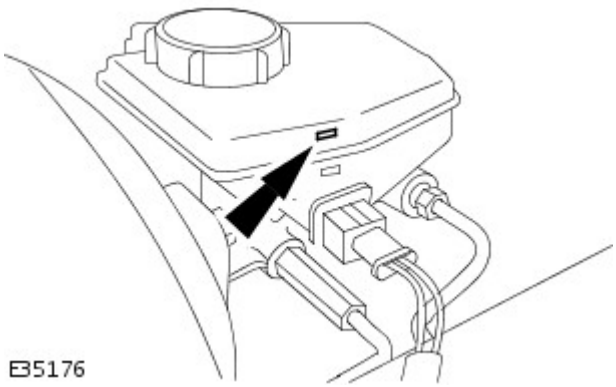
7. Following the procedure above, bleed the brakes in the order shown:

1. Left-Hand Front,

2. Right-Hand Front,

3. Left- Hand Rear,

4. Right-Hand Rear.



8. CAUTION: Remove brake fluid spillage immediately from paint work with clean water.

Fill fluid reservoir.

- Fill reservoir to the 'MAX' mark.
- Fit filler cap.

9. Start engine.

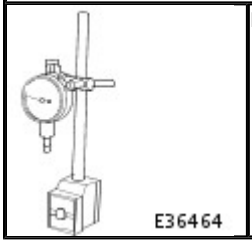
10. Check for correct brake-pedal travel and pressure.

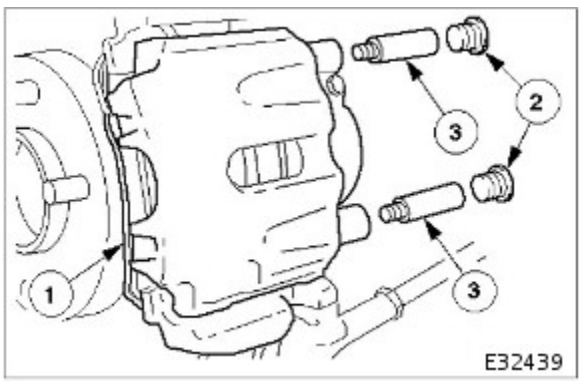
11. Apply brake pedal and check around vehicle for brake fluid leaks.

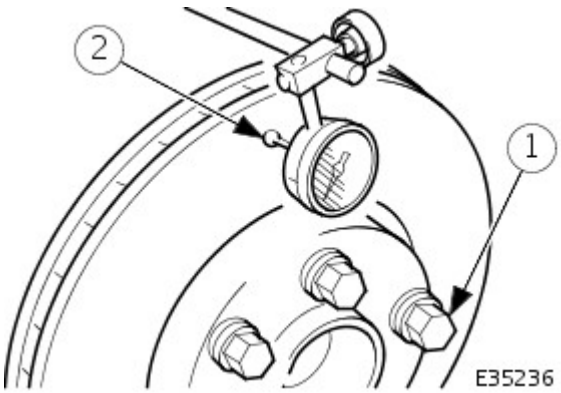
12. Make sure brake fluid level is at the 'MAX' mark.

Brake System - General Information - Front Brake Disc Runout CheckVehicles With: Standard Brakes

General Procedures

Special Tool(s)	
 E36464	Dial Test Indicator Gauge and Stand.





1. Raise front of vehicle and support on stands. Refer to section 100-02.
2. Remove wheel.
3. CAUTION: Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

   Remove caliper housing from caliper carrier.

   1. Remove anti-rattle spring.
   2. Remove dust covers.
   3. Remove guide pins.

   - Remove and tie caliper housing aside.

4. Make sure that wheel bearing end-float is correct. Refer to specification section 204-01.
5. Measure brake disc run-out.

   - Install brake disc to hub and secure with all wheel nuts, tighten wheel nuts to 20 Nm in a diagonal sequence.
   - Position the gauge so that the pointer contacts the disc, 10 mm from its outer edge.
   - Slowly rotate the disc one revolution, the disc run-out must not exceed the specification. Refer to Specification Section 206-03.

6. If the brake disc run-out exceeds specification, reposition the brake disc on the hub and repeat the above procedure. Continue repositioning the brake disc until the run-out is within specification.
7. If the brake disc run-out still exceeds specification, check the hub face run-out.
8. Remove brake disc. Refer to procedure 70.10.12.
9. Measure hub face run-out.

   - Position the gauge so that the pointer contacts the hub face.
   - Slowly rotate the hub one revolution, the hub run-out



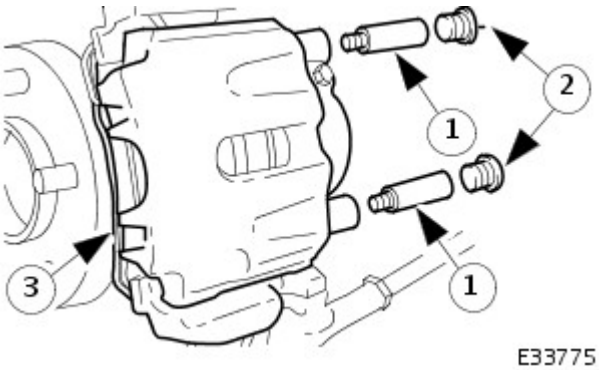
E35268

must not exceed the specification. Refer to Specification Section 204-01.

- If the hub exceeds the maximum run-out specification replace the hub. Refer to procedure 60.25.01.

10. NOTE: Make sure the brake disc and hub mating surfaces are clean.

If the hub run-out is within specification replace brake discs. Refer to procedure 70.10.12.



E33775

11. Install caliper housing to caliper carrier.

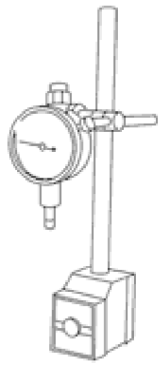
- Align housing to carrier.

1. Install and tighten guide pins to 25-30 Nm.
2. Install dust covers.
3. Install anti-rattle spring.

12. Install wheel. Refer to procedure 74.20.05.

Front Brake Disc Runout Check Vehicles With: Brembo Brakes

Special Service tools



Dial Test Indicator Gauge and Stand.

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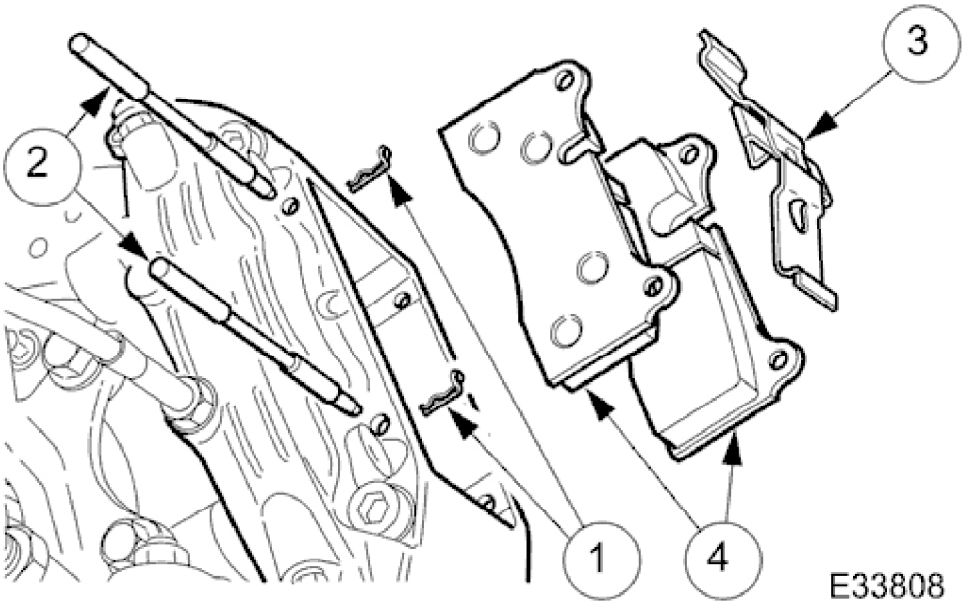
1. **WARNING:**
   BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

   CAUTION:
   Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section <<100-00>> for information.

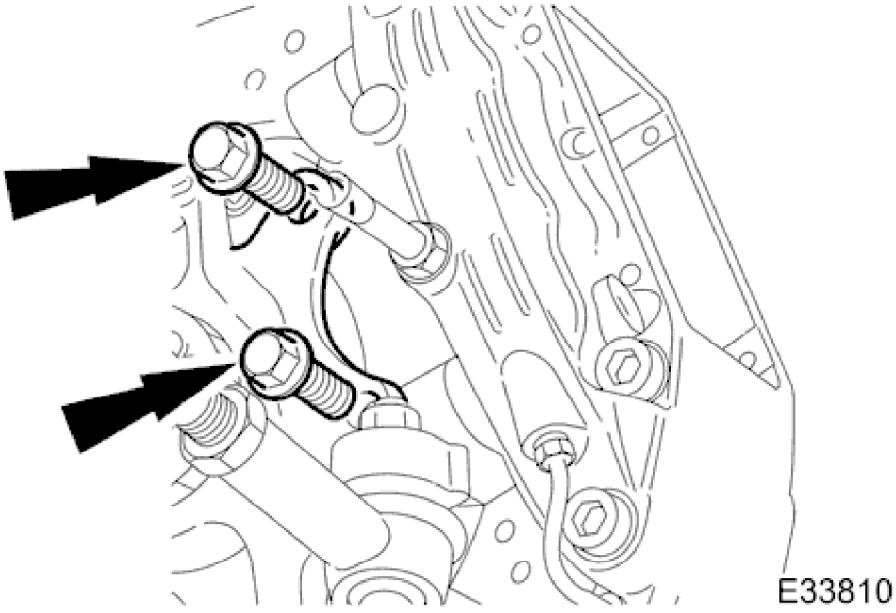
   CAUTION:
   The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

Raise front of vehicle and support on stands. Refer to section **<<100-02>>**.

2. Remove wheel. Refer to section **<<74.20.05>>**.



3. Remove brake pads from caliper.
    1. Remove 'R' clips.
    2. Withdraw pins from caliper.
    3. Remove anti-rattle spring.
    4. Remove brake pads.



4. **CAUTION:**
Only remove the bolts securing the caliper anchor bracket to the vertical link. Refer to caution above for more information.

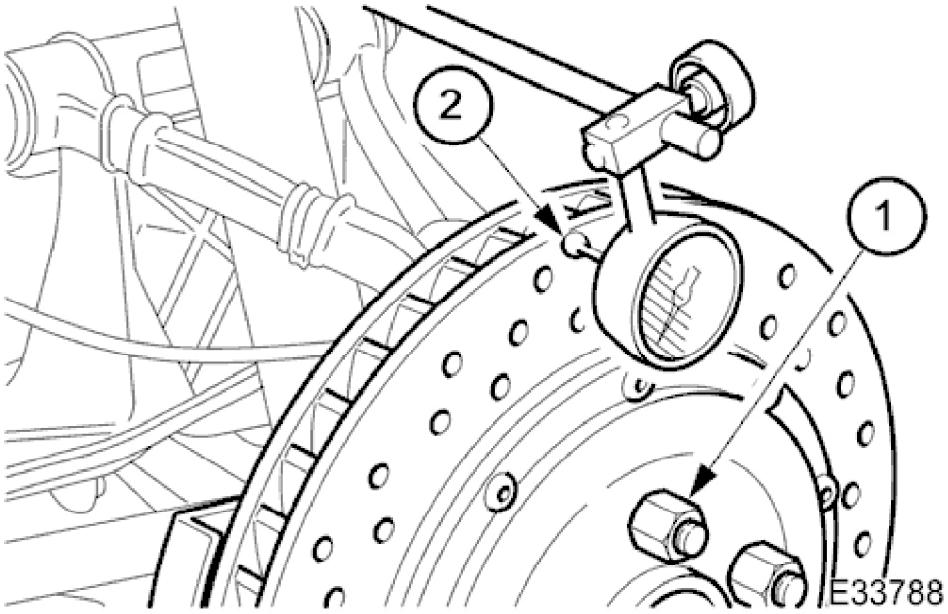
CAUTION:
Do not allow the caliper to hang on the hydraulic hose, as this will damage the hose.

Remove caliper from vertical link.

- Remove bolts.

- Remove and tie caliper aside.

5. Make sure that wheel bearing end-float is within specification. Refer to specification section **<<204-01>>**.

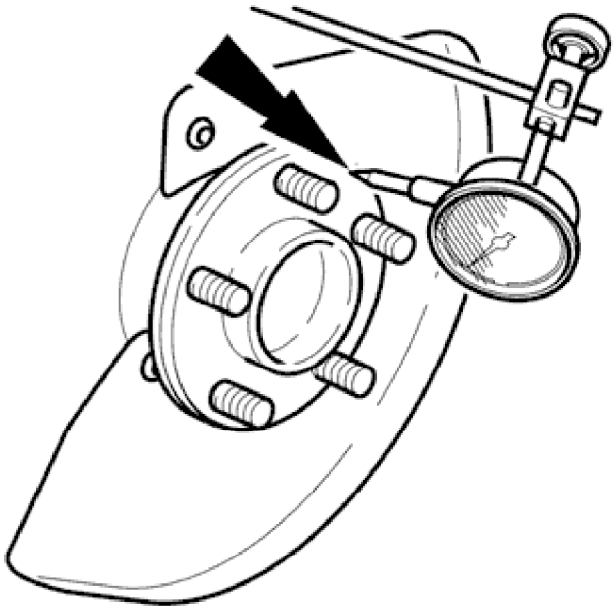


6. Measure brake disc run-out.
    1. Install brake disc to hub and secure with all wheel nuts, tighten wheel nuts to 20 Nm in a diagonal sequence.
    2. Position the gauge so that the pointer contacts the disc, between the disc's outer drill holes and the disc's outer edge.
    - Slowly rotate the disc one revolution, the disc run-out must not exceed the specification. Refer to Specification Section **<<206-03>>**.

7. If the brake disc run-out exceeds specification, reposition the brake disc on the hub and repeat the above procedure. Continue repositioning the brake disc until the run-out is within specification.

8. If the brake disc run-out still exceeds specification, check the hub face run-out.

9. Remove brake disc.



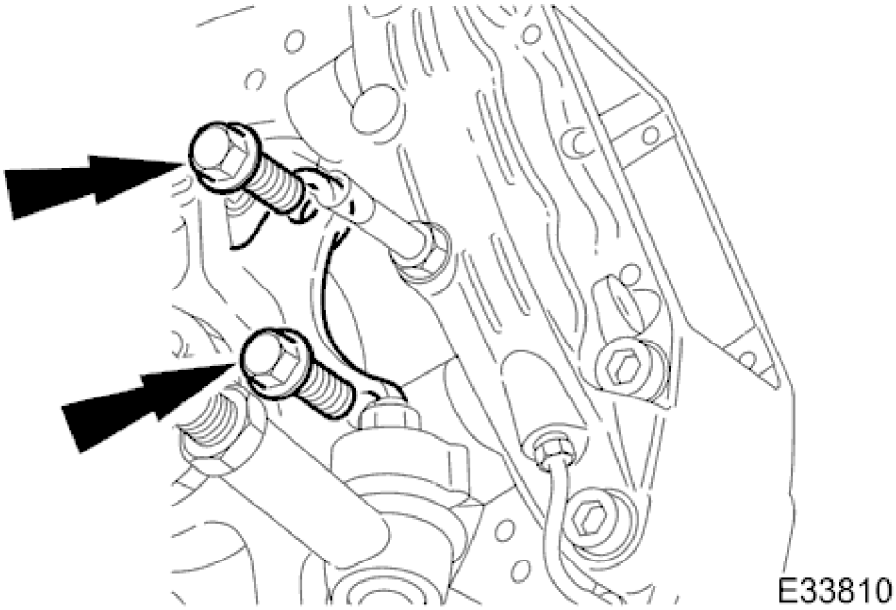
E33789

10. Measure hub face run-out.
    - Position the gauge so that the pointer contacts the hub face.
    - Slowly rotate the hub one revolution, the hub run-out must not exceed the specification. Refer to Specification Section **<<204-01>>**.
    - If the hub exceeds the maximum run-out specification replace the hub. Refer to procedure 60.25.01.

11. **NOTE:**
    Make sure the brake disc and hub mating surfaces are clean.

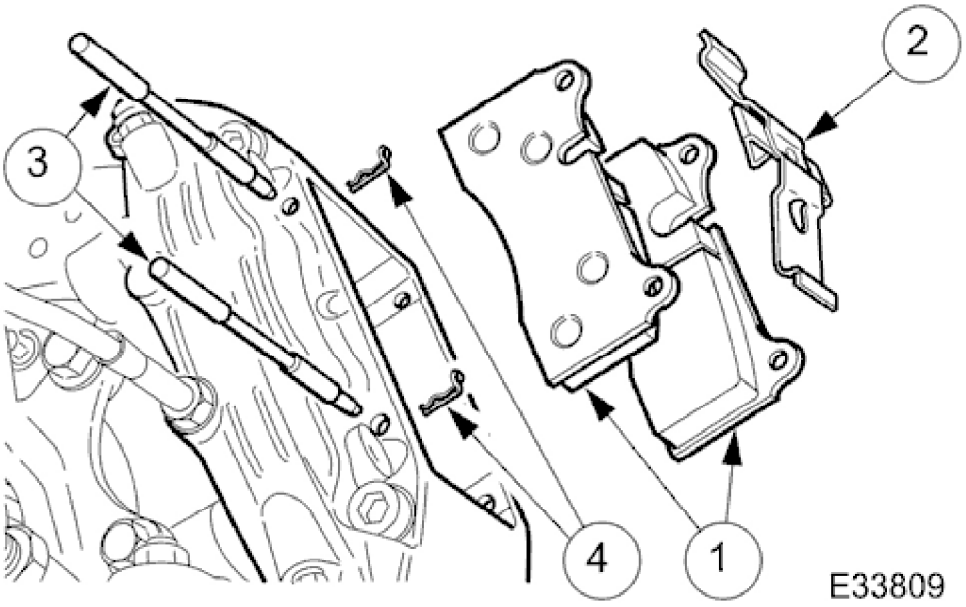
If the hub run-out is within specification replace the brake discs. Refer to procedure 70.10.12.

12. When the disc run-out is within specification, index mark the hub and disc for future installment.



E33810

13. Install caliper to vertical link.
    - Install and tighten bolts to 140 Nm.



14. **CAUTION:**
Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

CAUTION:
Note the condition of pins and 'R' clips and replace if necessary.

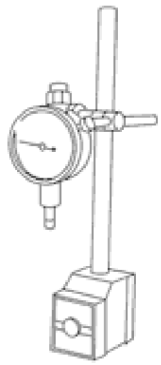
Install brake pads into caliper housing.

- Slowly retract caliper pistons.
  1. Install pads.
  2. Position anti-rattle spring.
  3. Install pins.
  4. Install 'R' clips.

15. Install wheels. Refer to operation **<<74.20.05>>**.

Rear Brake Disc Runout Check Vehicles Without: Brembo Brakes

Special Service tools

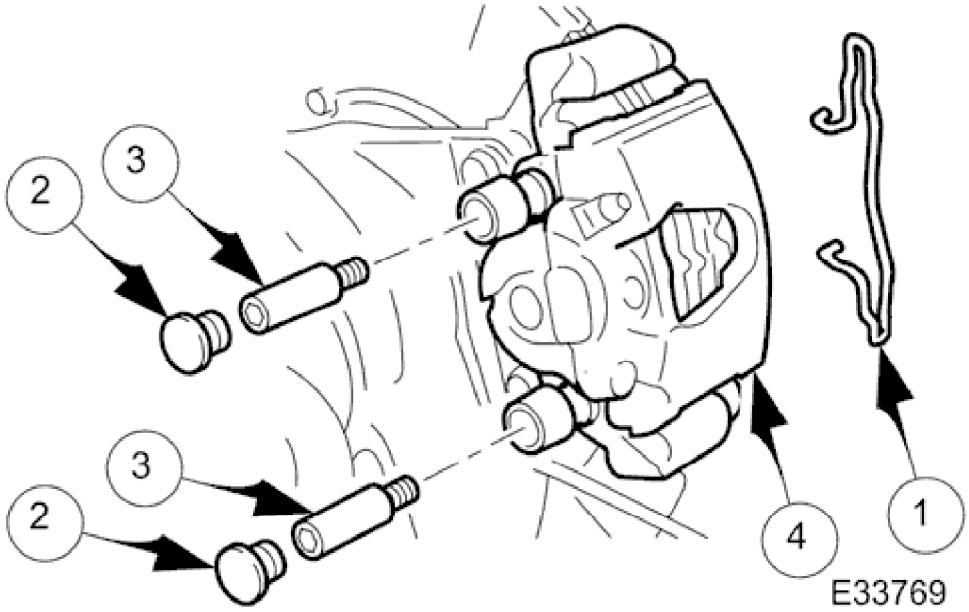


Dial Test Indicator Gauge and Stand.

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1. Raise rear of vehicle and support on stands. Refer to section **<<100-02>>**.

2. Remove wheel.



3. **CAUTION:**
Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

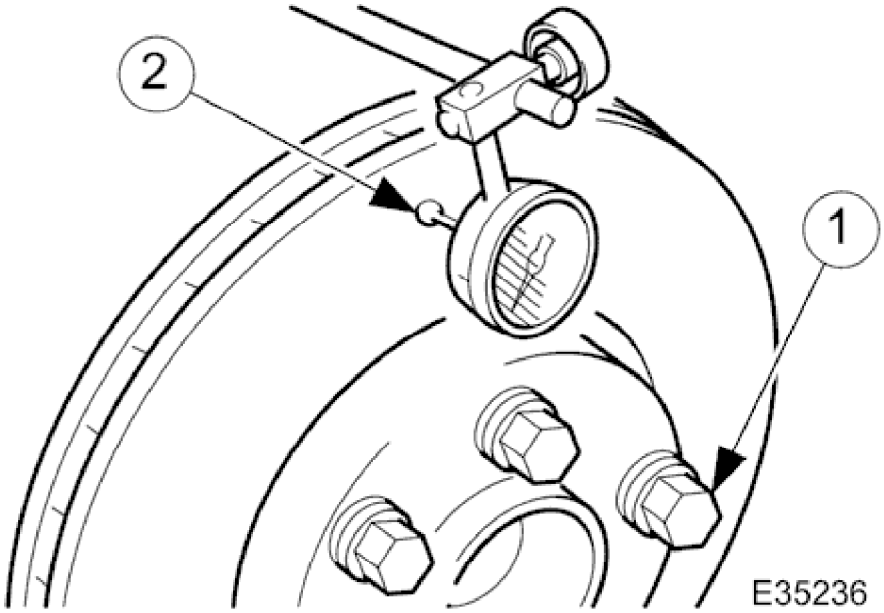
Remove caliper housing from caliper carrier.
1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.
4. Remove housing from carrier.

- Tie caliper housing aside.

4. **NOTE:**

Measurement of the brake disc run-out, must be carried-out with the disc and hub parking-brake adjuster-holes aligned.

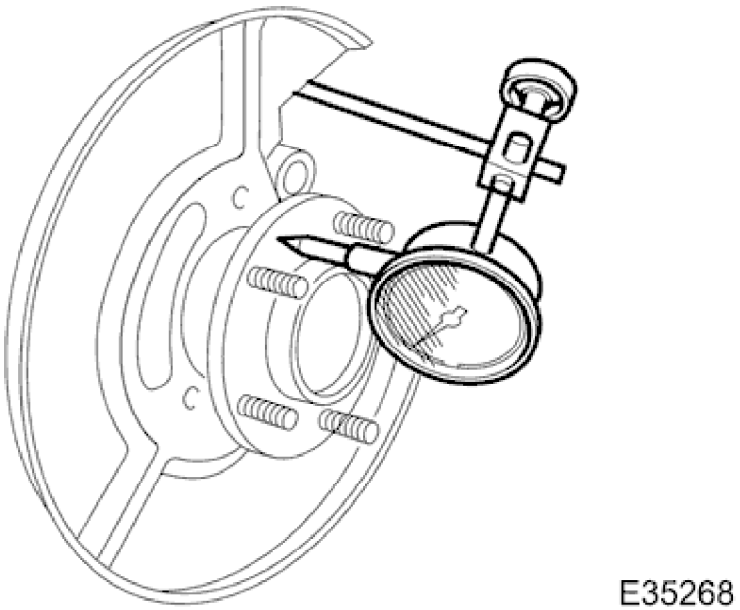
Make sure that wheel bearing end-float is correct. Refer to specification section **<<204-02>>**.



5. Measure brake disc run-out.
   - Install brake disc to hub and secure with all wheel nuts, tighten wheel nuts to 20 Nm in a diagonal sequence.
   - Position the gauge so that the pointer contacts the disc 10 mm from its outer edge.
   - Slowly rotate the disc one revolution, the disc run-out must not exceed the specification. Refer to specifications in section **<<206-04>>**.

6. If the brake disc run-out exceeds specification, check the hub face run-out.

7. Remove brake discs. Refer to procedure 70.10.13.

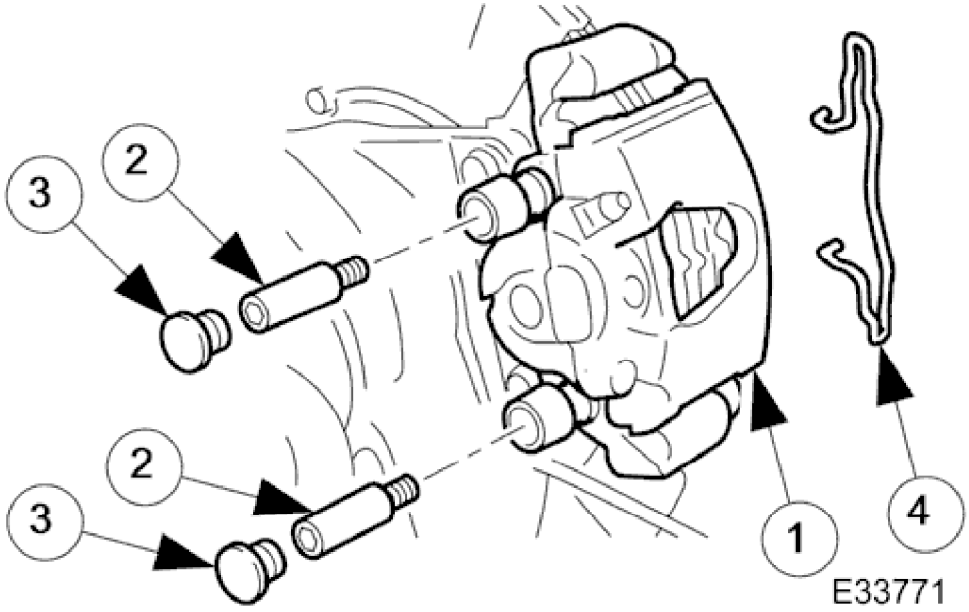


8. Measure hub face run-out.

- Position the gauge so that the pointer contacts the hub face.
- Slowly rotate the hub one revolution, the hub run-out must not exceed the specification. Refer to Specification Section **<<204-01>>**.
- If the hub exceeds the maximum run-out specification replace the hub. Refer to Section **<<204-01>>**.

9. **NOTE:**
   Make sure the brake disc and hub mating surfaces are clean.

If the hub run-out is within specification replace brake discs. Refer to procedure 70.10.13.

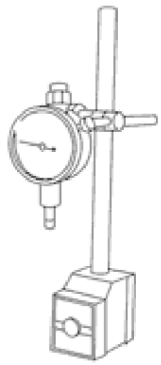


10. Install caliper housing to caliper carrier.
    1. Align housing to carrier.
    2. Install and tighten guide pins to 25-30 Nm.
    3. Install dust covers.
    4. Install anti-rattle spring.

11. Fit wheel. Refer to section **<<204-04>>**.

Rear Brake Disc Runout Check Vehicles With: Brembo Brakes

Special Service tools



Dial Test Indicator Gauge and Stand.

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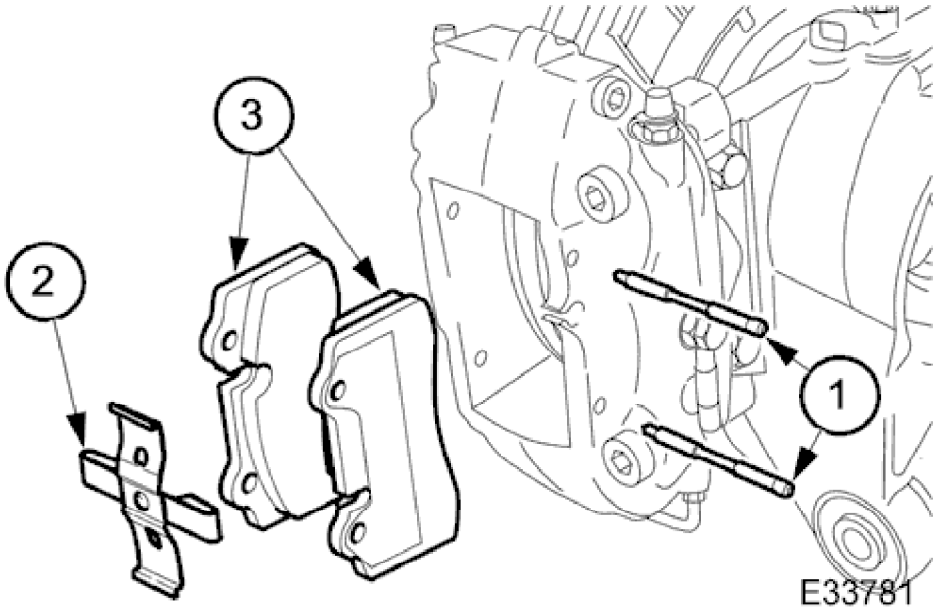
1. **WARNING:**
BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION:
Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section <<100-00>> for information.

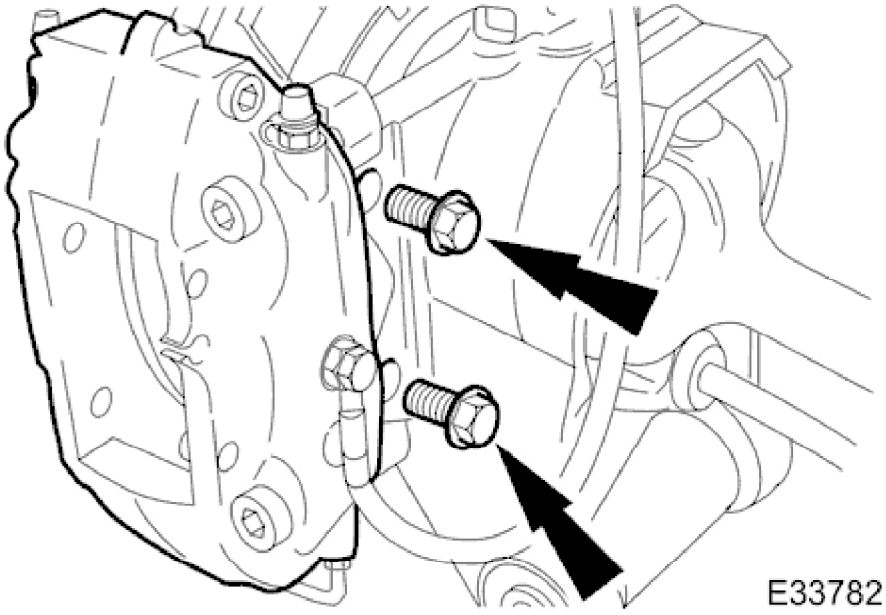
CAUTION:
The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the hub carrier only. DO NOT loosen any other caliper bolts.

Raise rear of vehicle and support on stands. Refer to section **<<100-02>>**.

2. Remove wheel. Refer to operation **<<74.20.05>>**.



3. Remove brake pads from caliper.
    1. Withdraw pins from caliper.
    2. Remove anti-rattle spring.
    3. Remove brake pads.

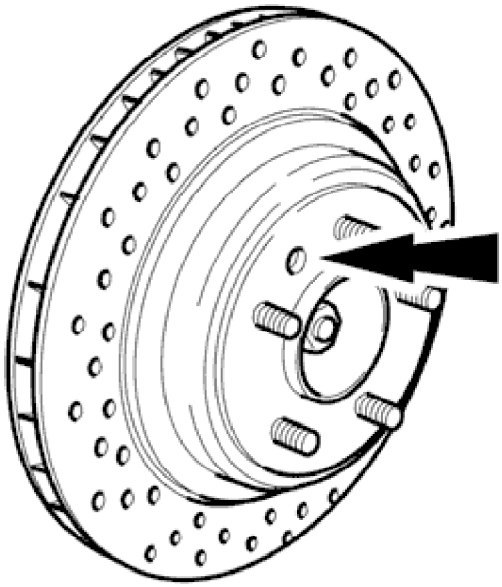


4. **CAUTION:**
Only remove the bolts securing the caliper anchor bracket to the hub carrier. Refer to caution above for more information.

CAUTION:
Do not allow the caliper to hang on the hydraulic hose, as this will damage the hose.

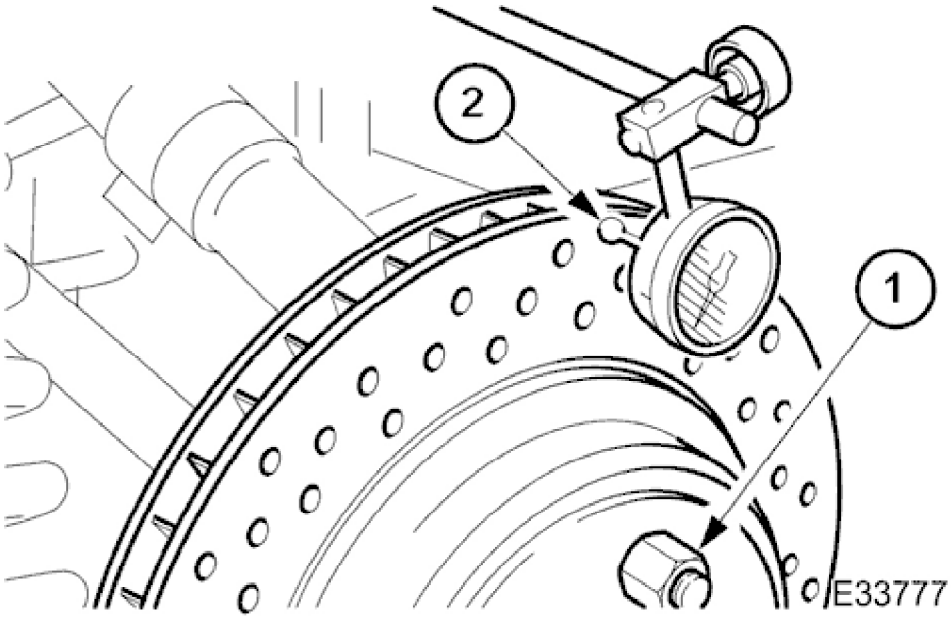
Remove caliper from hub carrier.
- Remove bolts.
- Remove and tie caliper aside.

5. Make sure that wheel bearing end-float is within specification. Refer to specification section **<<204-02>>**.



E33783

6. **NOTE:**
   Measurement of the brake disc run-out, must be carried-out with the disc and hub access holes aligned.



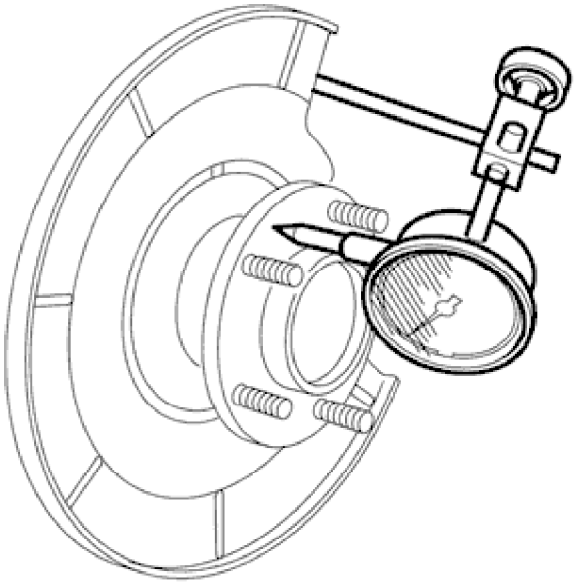
E33777

7. Measure brake disc run-out.
   1. Install brake disc to hub and secure with all wheel nuts, tighten wheel nuts to 20 Nm in a diagonal sequence.
   2. Position the gauge so that the pointer contacts the disc, between the disc's outer drill holes and the disc's outer edge.

   • Slowly rotate the disc one revolution, the disc run-out must not exceed the specification. Refer to specifications in section **<<206-04>>**.

8. If the brake disc run-out exceeds specification, check the hub face run-out.

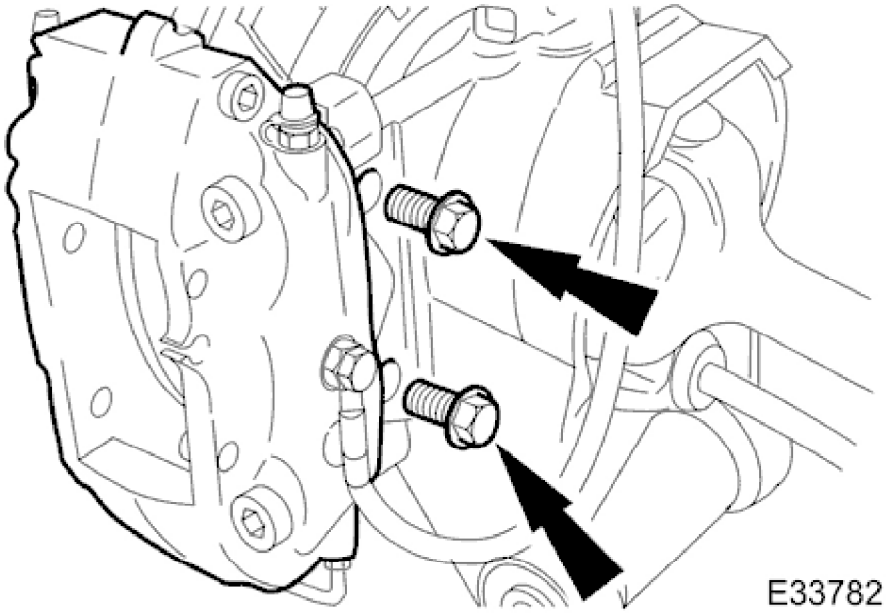
9. Remove brake discs. Refer to procedure 70.10.13.



E33814

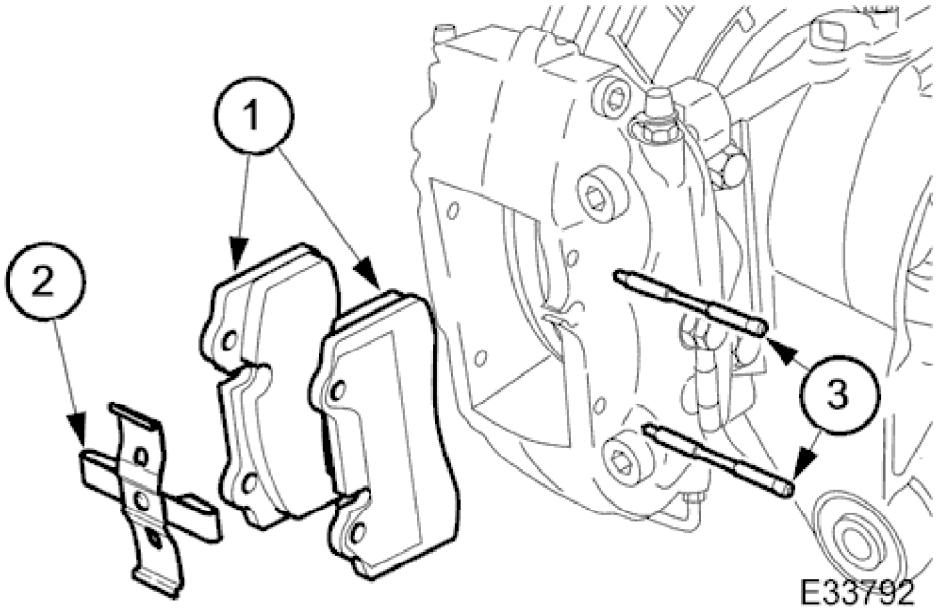
10. Measure hub face run-out.
    - Position the gauge so that the pointer contacts the hub face.
    - Slowly rotate the hub one revolution, the hub run-out must not exceed the specification. Refer to Specification Section **<<204-02>>**.
    - If the hub exceeds the maximum run-out specification replace the hub. Refer to operation **<<64.15.14>>**.

11. If the hub run-out is within specification replace brake discs. Refer to procedure 70.10.13.



E33782

12. Install caliper to hub carrier.
    - Install and tighten bolts to 60 Nm.



13. **CAUTION:**
Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work with clean water.

CAUTION:
Note condition of pins and replace if necessary.

Install brake pads to caliper.

- Slowly retract caliper pistons.
  1. Install pads.
  2. Position anti-rattle spring.
  3. Install pins - make sure pin collets are fully engaged into caliper.

14. Fit wheel. Refer to section **<<204-04>>**.

Front Disc Brake -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Brake fluid	ITT Super Dot 4

Torques - Brembo Brakes

Component	Nm
Bolt - anchor bracket to vertical link	180
Bolt - caliper to anchor bracket	DO NOT REMOVE
Bleed nipple	12-16
Hose union to caliper	22-26

Torques

Component	Nm
Bolt - caliper carrier to vertical link	140
Guide Pin - caliper housing to caliper carrier	25-30

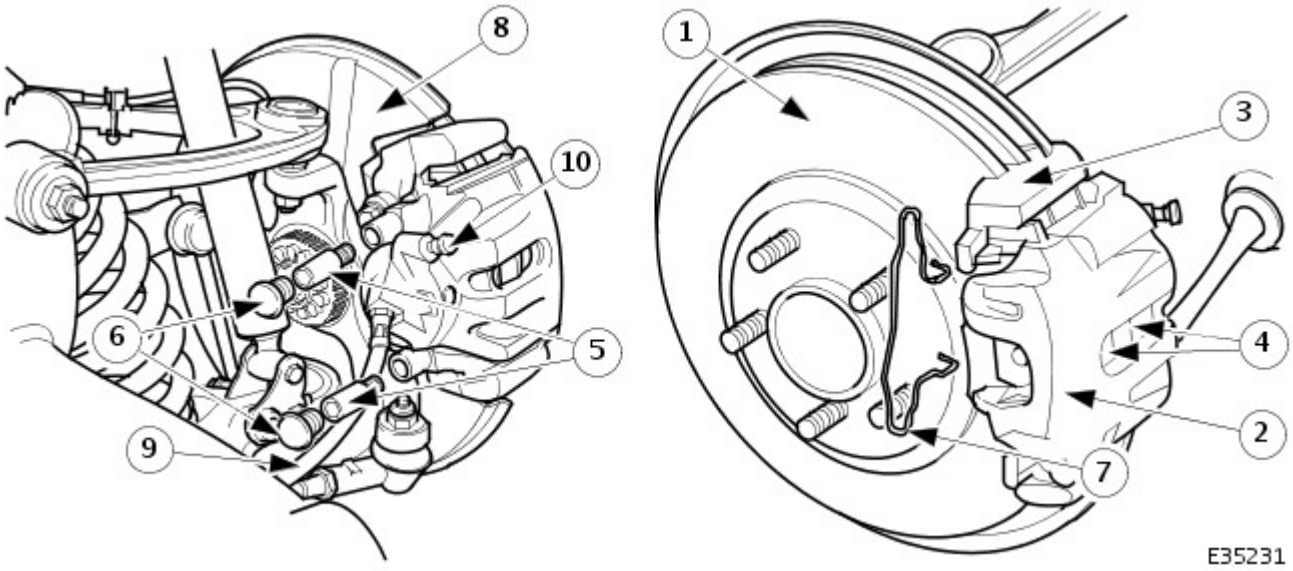
Brake Tube, Hoses and Bracket Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Bleed nipple - front	4-6
Bleed nipple - rear	8-11
Hose to front caliper	10-14
Hose union to rear caliper - union bolt	30-40
M10 hose locknut	15-20
M10 brake tube female-nut	13-17
M10 brake tube male-nut	13-17
M12 brake tube male-nut	15-20
M18 brake tube male-nut	22-28
Brake tube clip retention-bracket to body	4-6

Front Disc Brake - Front Disc Brake

Description and Operation



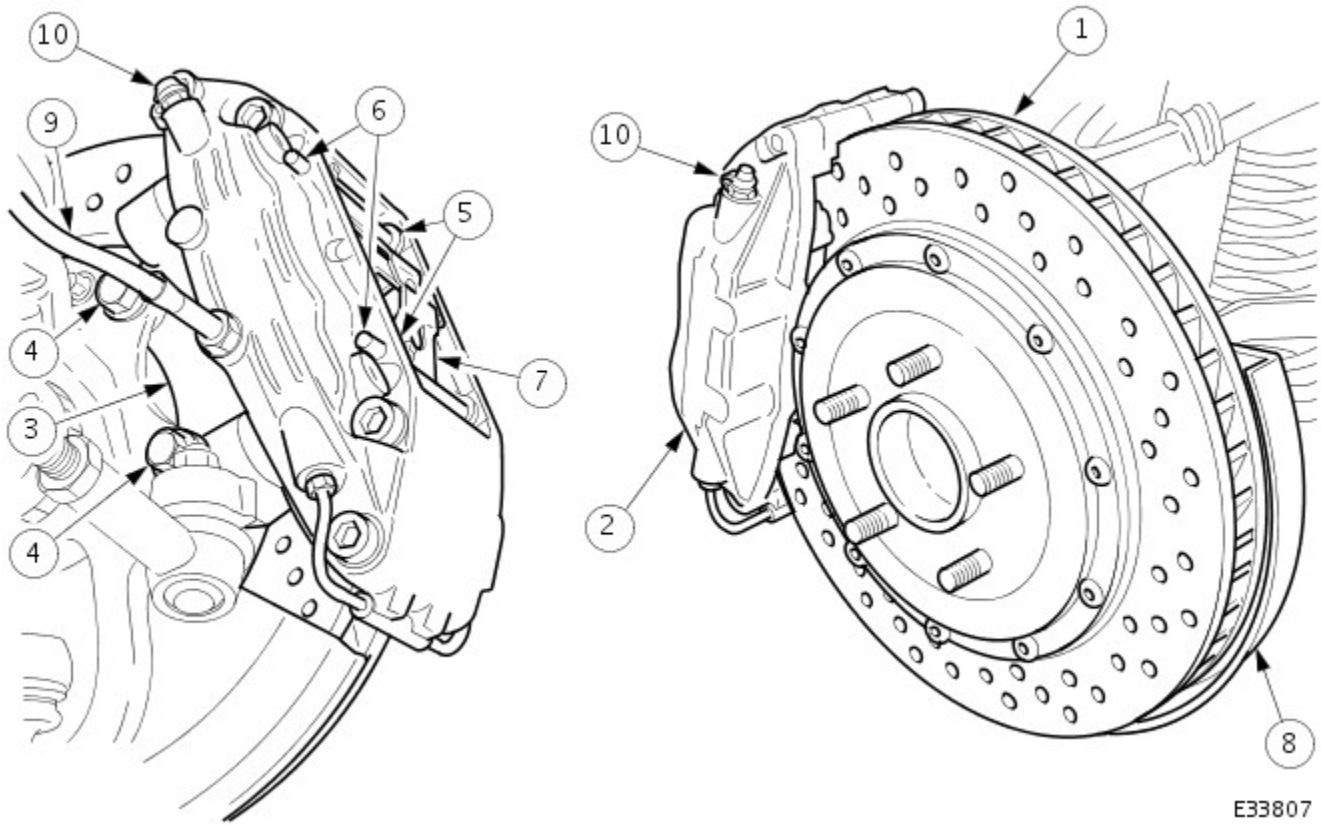
Item	Part Number	Description
1	—	Brake Disc
2	—	Caliper Housing
3	—	Caliper Carrier
4	—	Brake Pads
5	—	Guide Pins
6	—	Dust Covers
7	—	Anti-rattle Spring
8	—	Dust Shield
9	—	Brake Hose
10	—	Bleed Nipple

The brake disc is mounted on the wheel studs and is clamped between the wheel and hub. Cooling ducts run through the center of the brake disc to provide the required ventilation to keep the disc cool under operating conditions.

The caliper carrier, which is secured to the vertical link by two bolts, carries the single-piston caliper housing. The caliper housing is secured to the caliper carrier by two guide-pins and an anti-rattle spring. When the brakes are applied the caliper-housing piston pushes the brake pad in front of it, towards the brake disc. This movement forces the caliper housing to move along the guide-pins, in the opposite direction of the piston, to apply the second brake pad. The brake disc is therefore gripped between the two pads. As brake pressure is increased the grip on the brake disc is increased to slow-down the rotation of the road wheel.

The disc brakes require no adjustment.

Front Disc Brake—Brembo



Item	Part Number	Description
1	—	Brake Disc
2	—	Caliper
3	—	Anchor Bracket
4	—	Anchor Plate to Vertical Link - Bolts
5	—	Brake Pads
6	—	Guide Pins
7	—	Anti-rattle Spring
8	—	Disc Shield
9	—	Brake Hose
10	—	Bleed Nipples

• CAUTIONS:

The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

Do not loosen bolts securing brake disc to disc mounting.

Brembo calipers and discs provide higher-performance braking using the existing hydraulic braking system. The brakes are installed to the vehicle using unique vertical links, hubs, hydraulic hoses and disc shields.

The front brake disc consists of a ventilated, cross-drilled disc, bolted to a disc carrier. The disc assembly is mounted on the wheel studs and clamped between the wheel and hub.

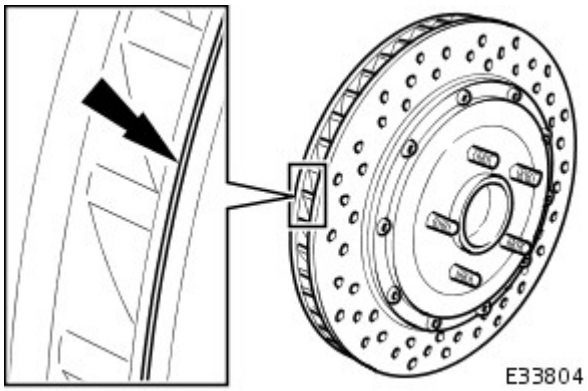
A unique feature of the front disc is the slanted (non radial) ventilation webs which lean the opposite-way to the disc's direction of rotation. This design enables heat generated by the disc to be dispersed by air entering at the disc's center and being forced outwards through the cooling ducts.

Due to the use of fixed calipers in place of the standard floating caliper, certain lateral dimensions on the vertical link and

hub are critical to achieve correct clearance and operation of the brakes. Therefore special vertical links and hubs set within a certain tolerance are installed with Brembo brakes.

The front discs are handed and must be fitted to the correct side of the vehicle. The left-hand disc can be identified by a groove running around the circumference of the outer disc wall as shown in the illustration below.

Left hand disc - identification mark



Modified disc shields are installed to accommodate the larger diameter discs.

The four cylinder brake caliper is rigidly attached to the vertical link via an anchor bracket. The caliper is a split assembly with each side of the caliper, housing two pistons. The two-pairs of opposed pistons act directly on the brake pads mounted one each side of the disc.

Stainless steel hydraulic hoses connect the calipers to the existing brake tubes. It is important that these hoses are aligned correctly when installed to prevent them fouling on the steering and suspension components. Refer to operation 70.55.24 for information.

The Brembo disc brakes require no adjustment.

Front Disc Brake - Brake CaliperVehicles With: Standard Brakes

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

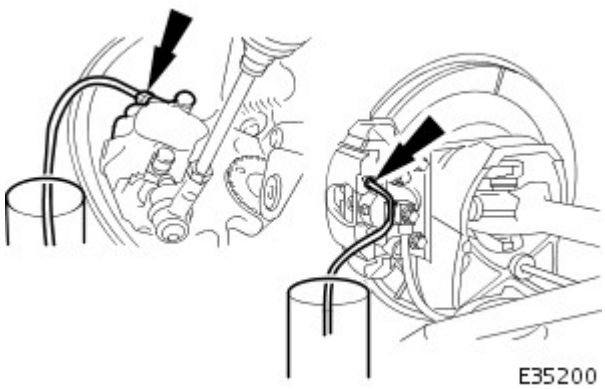
• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

A new brake hose must be installed when replacing a brake caliper.

The brake pad adhesive backing must not be reused, therefore always install new brake pads, irrespective of the condition of the original pads when replacing a brake caliper. Always replace brake pads as an axle set.


E35200

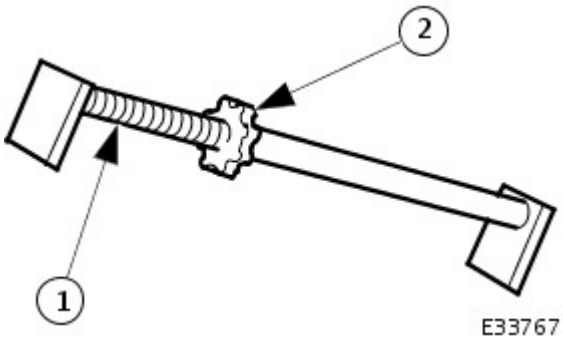
1. Open engine compartment and fit paint work protection covers to fenders.
2. Raise vehicle on a four-post lift.
3. Raise front of vehicle and support on stands. Refer to Section 100-02.
4. Remove front wheels. See Section 204-04.
5. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake hose.

   Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

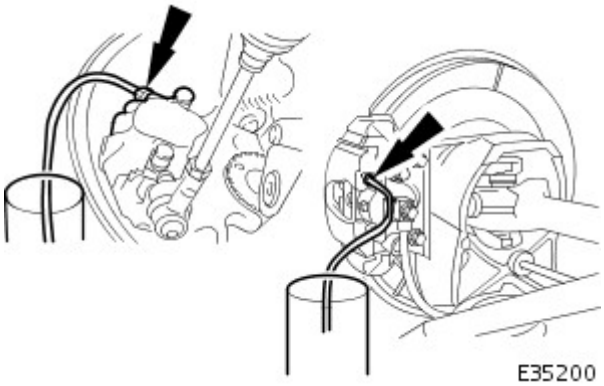
   - Connect a bleed tube and container to the calipers.
   - Open bleed nipples.

6. Depress and hold down brake pedal at the specified measurement using special tool.

   1. Position tool between brake pedal and seat frame.
   2. Turn the tool wheel until the brake pedal is held

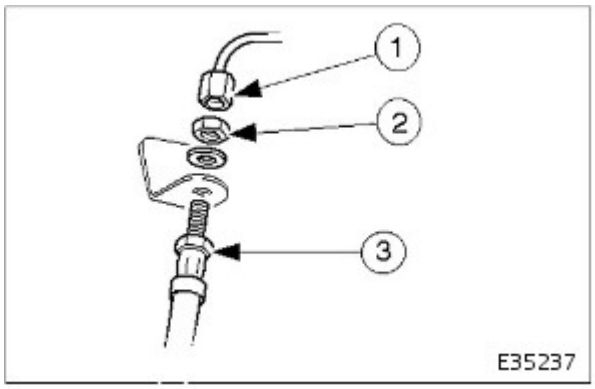


60mm down from its released position.



7. Close bleed nipples on both calipers.

- Remove bleed tubes and containers.
- Tighten front bleed nipple to 4-6 Nm.
- Tighten rear bleed nipple to 8-11 Nm.

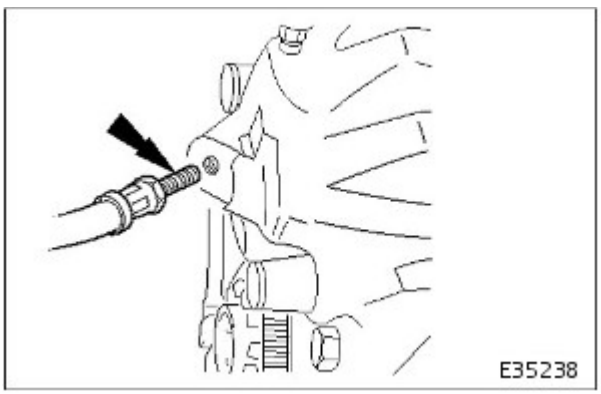


8. CAUTION: A new brake hose must be installed when replacing a brake caliper.

Disconnect brake hose from brake tube.

1. Unscrew brake tube union nut.
2. Remove nut from hose.
3. Remove hose from bracket.

- Fit plug to brake tube.

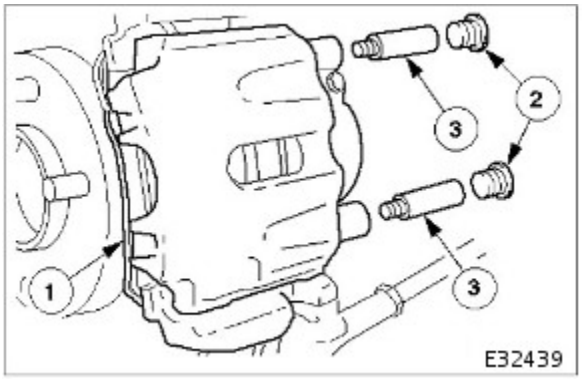


9. Remove brake hose from caliper.

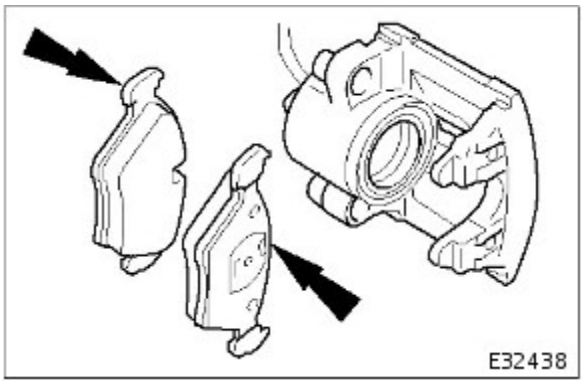
- Remove and discard brake hose.
- Fit plugs to caliper port.

10. Remove caliper housing from caliper carrier.

1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.

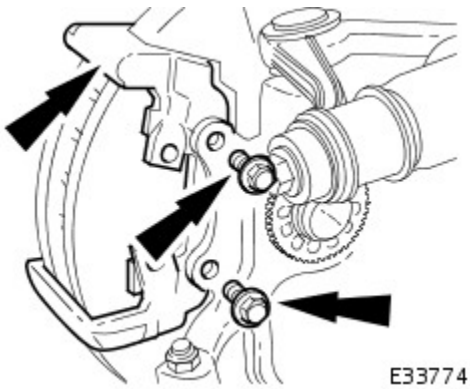


- Remove housing from carrier.



11. NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.

Remove and discard brake pads. (See Caution above).

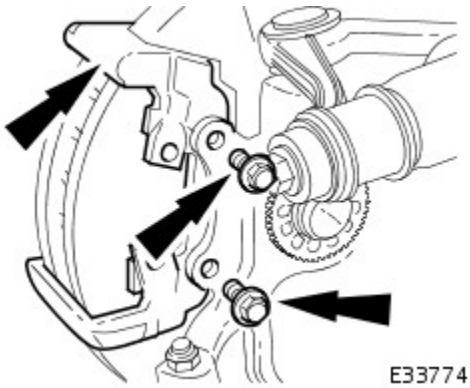


12. Remove brake carrier from vertical link.

- Remove bolts.
- Remove carrier.

13. Remove brake dust and clean caliper mating surfaces. See Warning above.

Installation

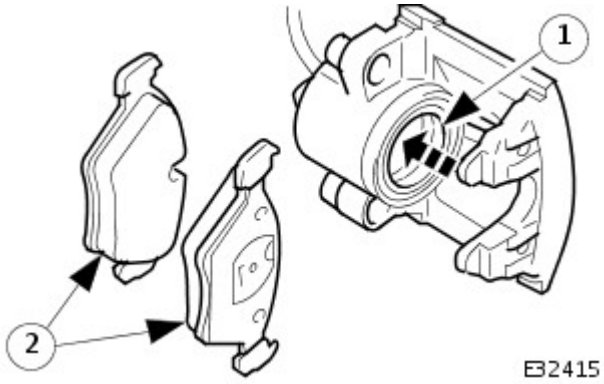


1. Install caliper carrier to vertical link.

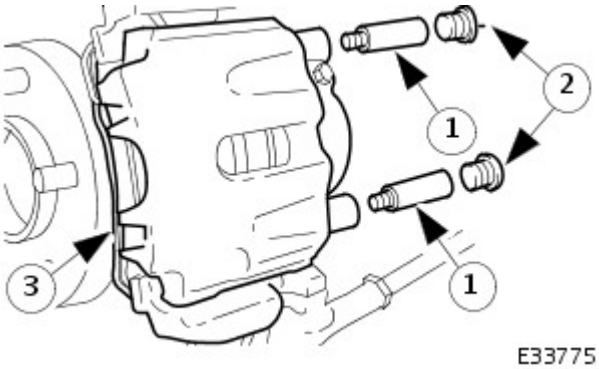
- Align carrier to vertical link .
- Install and tighten bolts to 140 Nm.

2. Install brake pads into caliper housing. (See Caution above).

1. Remove plug from port and slowly retract piston into caliper housing.



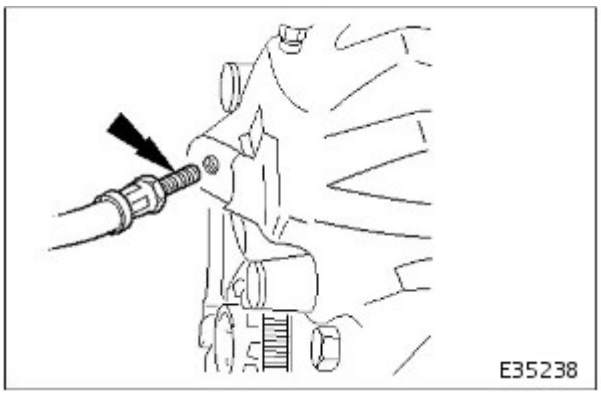
2. Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad into caliper piston.



3. Install caliper housing to caliper carrier.

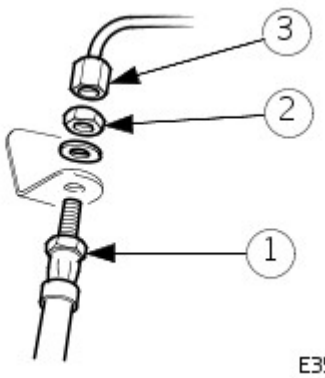
- Align housing to carrier.

1. Install and tighten guide pins to 25-30 Nm.
2. Install dust covers.
3. Install anti-rattle spring.



4. NOTE: The brake hose must only be installed with the vehicle's body supported and the suspension hanging.

Install and tighten brake hose to caliper housing to 10-14 Nm.



5. NOTE: Make sure the brake hose does not twist when tightening the hose lock-nut.

Connect brake hose to brake tube.

1. Position hose thread through bracket.
2. Install and tighten locking nut. Refer to Specifications, section 206-03.
3. Install and tighten brake-tube union nut. Refer to Specifications, section 206-03.

6. Remove special tool from brake pedal.

7. Fit wheels. Refer to section 204-04.

8. NOTE: Make sure the brake hose is routed correctly.

Remove stands and lower vehicle. Refer to section 100-02.

9. Bleed brake hydraulic system. See operation 70.25.03.

Front Disc Brake - Brake CaliperVehicles With: High Performance Brakes

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

1. WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

Open engine compartment and fit paint work protection covers to fenders.

2. Raise vehicle on a four-post lift.

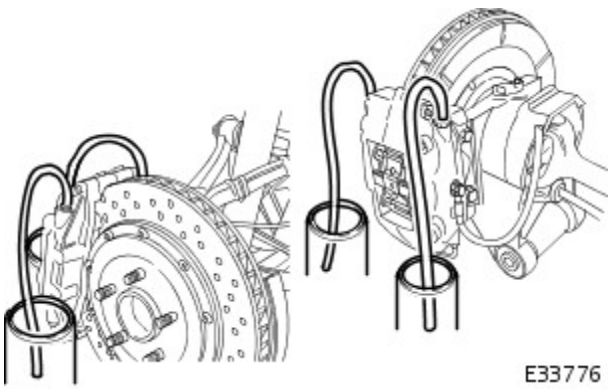
3. Raise front of vehicle and support on stands. Refer to Section 100-02.

4. Remove front wheels. Refer to operation 74.20.05.

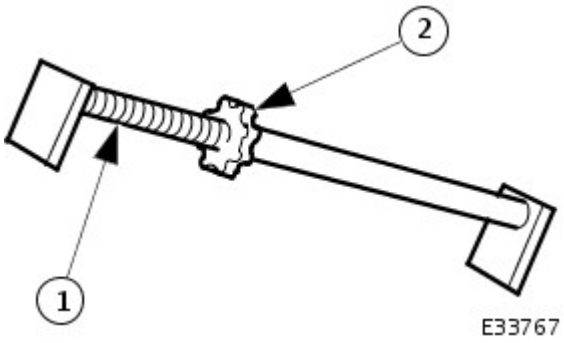
5. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake hose.

Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

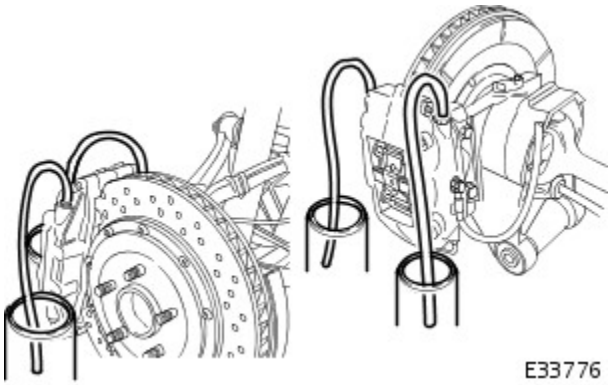
- Connect a bleed tube and container to the calipers.
- Open bleed nipples.


E33776

6. Depress and hold down brake pedal at the specified measurement using the special tool.

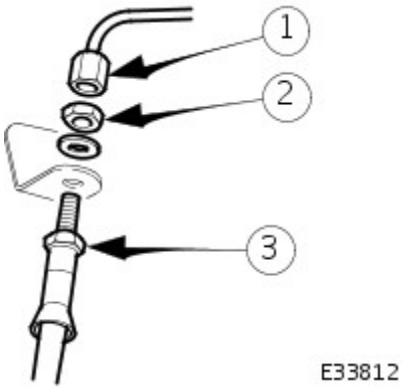


1. Position tool between brake pedal and seat frame.
2. Turn the tool wheel until the brake pedal is held 60mm down from its released position.



7. Close bleed nipples on both calipers.

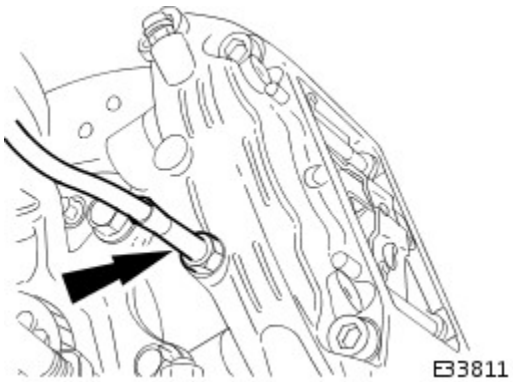
- Tighten bleed nipples to 12-16 Nm.
- Remove bleed tubes and containers.



8. Disconnect brake hose from brake tube.

1. Unscrew brake tube union nut.
2. Remove nut from hose.
3. Remove hose from bracket.

- Fit plugs to brake tube and hose.

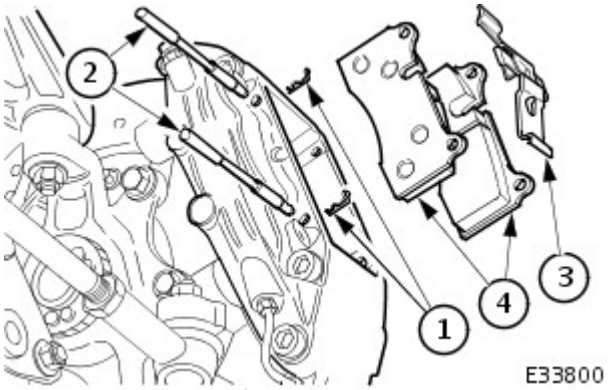


9. Release brake hose from caliper.

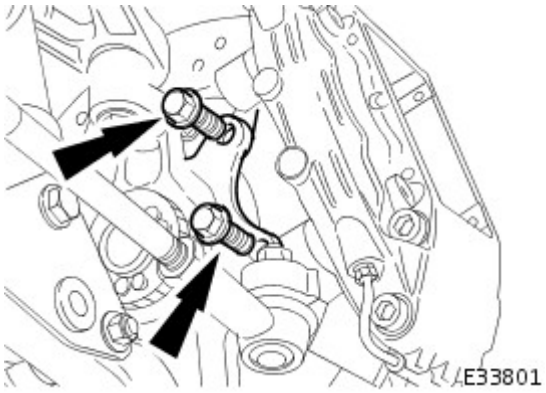
- Remove union bolt.
- Remove and discard sealing washers.
- Install plugs into caliper and hose.

10. Remove brake pads from caliper.

1. Remove 'R' clips.
2. Withdraw pins from caliper.
3. Remove anti-rattle spring.



4. Remove brake pads.



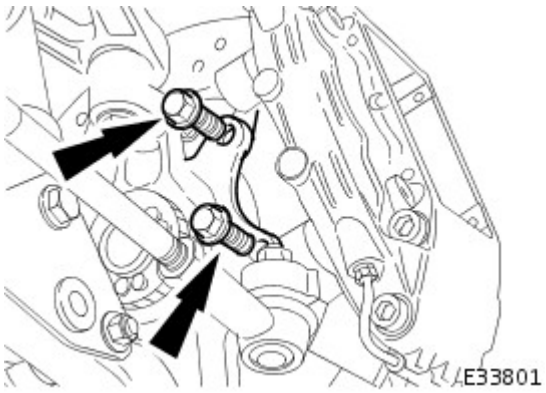
11. CAUTION: Only remove the bolts securing the caliper anchor bracket to the vertical link. Refer to caution above for more information.

Remove caliper from vertical link.

- Remove bolts.

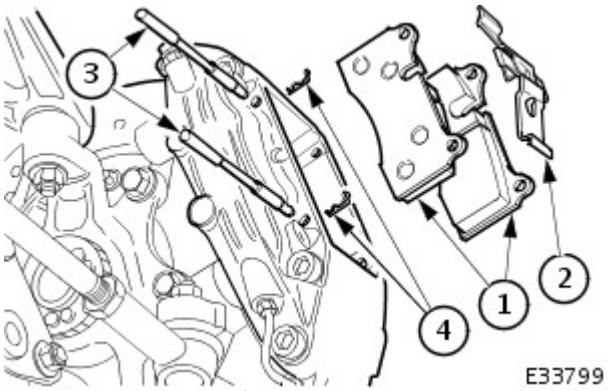
12. Remove brake dust and clean mating surfaces. See Warning above.

Installation



1. Install caliper to vertical link.

- Install and tighten bolts to 180 Nm.



2. CAUTIONS:

Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

Note the condition of pins and 'R' clips and replace if necessary.

Install brake pads into caliper.

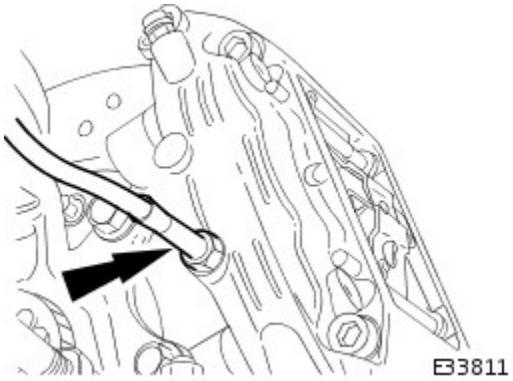
- Slowly retract caliper pistons.

1. Install pads.

2. Position anti-rattle spring.

3. Install pins.

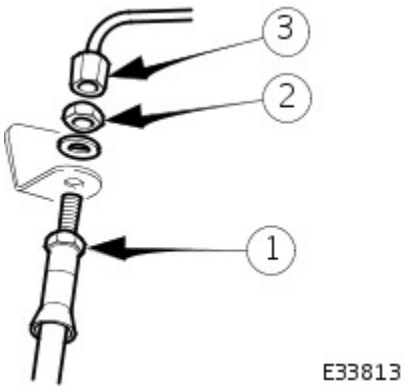
4. Install 'R' clips.



3. CAUTION: The brake hose must only be installed with the vehicle's body supported and the suspension hanging.

Install brake hose to caliper.

- Remove plugs from caliper and hose.
- Install new sealing washers.
- Install and tighten union bolt to 22-26 Nm.



4. NOTE: Make sure the brake hose does not twist when tightening the hose lock-nut.

Connect brake hose to brake tube.

1. Position hose thread through bracket.
2. Install and tighten locking nut. Refer to Specifications, section 206-03.
3. Install and tighten brake-tube union nut. Refer to Specifications, section 206-03.

5. Remove special tool from brake pedal.

6. Fit wheels. Refer to operation 74.20.05.

7. NOTE: Make sure the brake hose is routed correctly.

Remove stands and lower vehicle. Refer to section 100-02.

8. Bleed brake hydraulic system. See operation 70.25.06.

Front Disc Brake - Brake DiscVehicles With: Standard Brakes

Removal and Installation

Removal

• WARNINGS:

BRAKE DISCS MUST ALWAYS BE REPLACED IN PAIRS.

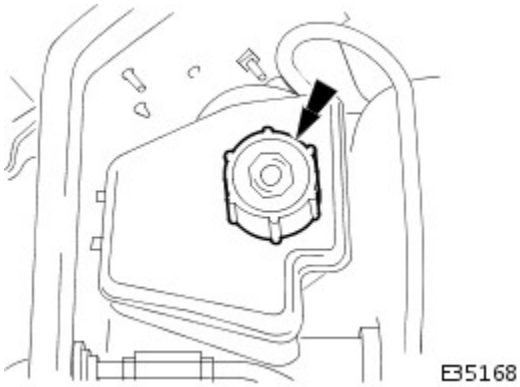
BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

1. Open engine compartment and install paint work protection covers to fenders.

2. Raise front of vehicle and support on stands. See Section 100-02.

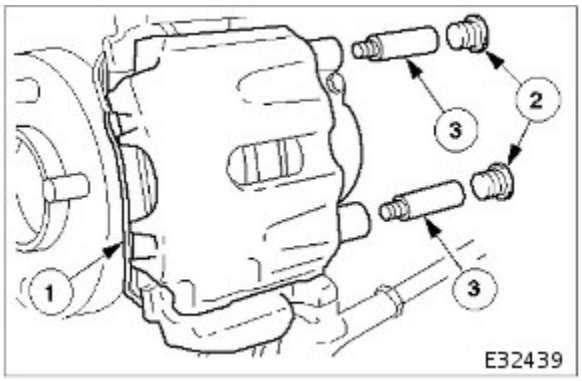
3. Remove front wheels. Refer to Section 204-04.



4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.



5. CAUTION: Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

Remove caliper housing from caliper carrier.

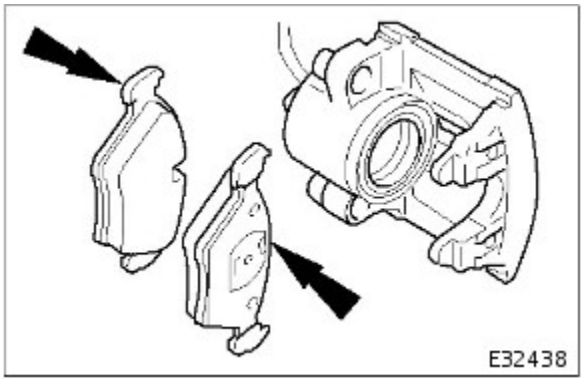
1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.

- Remove and tie caliper housing aside.

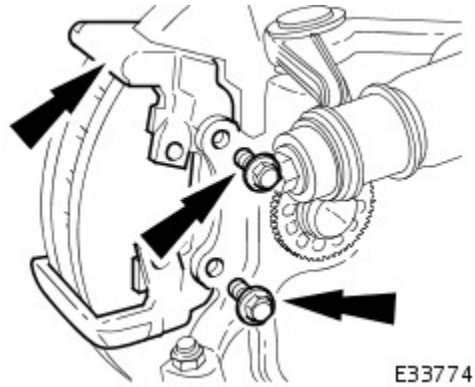
6. CAUTION: Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.

• NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.

Remove brake pads from caliper housing.

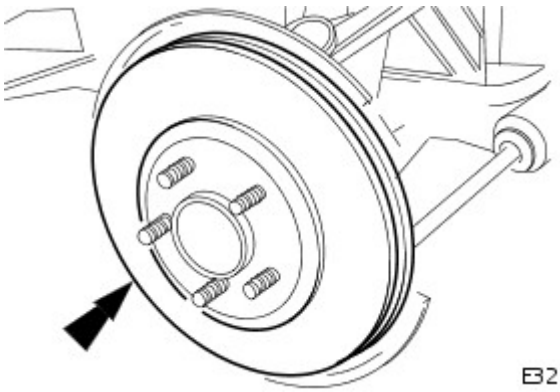


- Discard brake pads.



7. Remove brake carrier from vertical link.

- Remove bolts.
- Remove carrier.



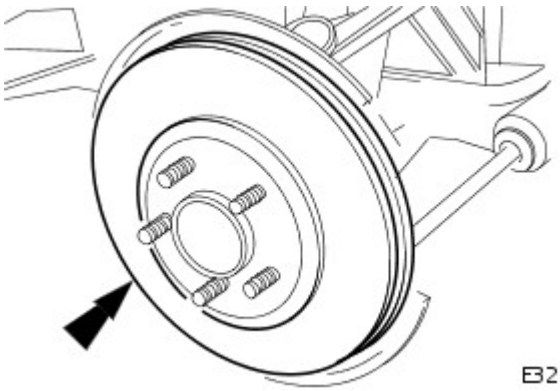
8. Withdraw brake disc from hub.

9. Repeat above procedure to remove opposite side brake disc.

10. Remove brake dust from calipers and clean mating surfaces, see WARNING above.

11. Thoroughly clean the area of the hubs where they mate against the brake discs.

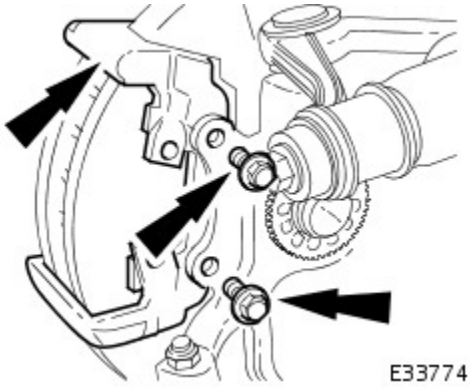
Installation



1. Install brake disc to hub.

2. Check brake disc run-out. Refer to General Procedures section 206-03.

3. Install caliper carrier to vertical link.



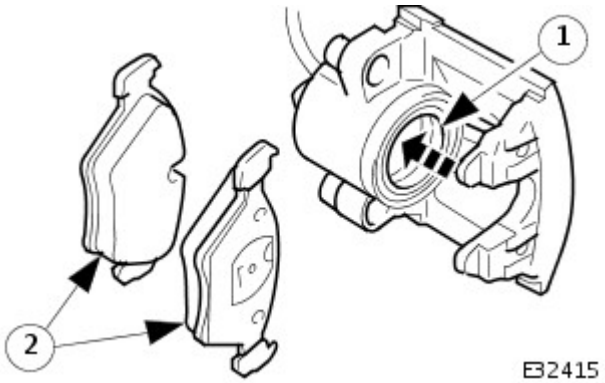
- Align carrier to vertical link .
- Install and tighten bolts to 140 Nm.

4. CAUTIONS:

⚠ Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.

⚠ Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

• NOTE: Clean caliper piston to pad mating surface.



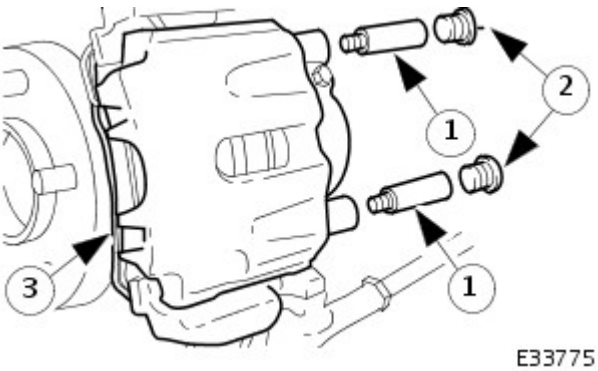
Install brake pads into caliper housing.

1. Slowly retract piston into caliper housing.
2. Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad into caliper piston.

5. Install caliper housing to caliper carrier.

- Align housing to carrier.

1. Install and tighten guide pins to 25-30 Nm.
2. Install dust covers.
3. Install anti-rattle spring.



6. Repeat above procedure to install opposite side brake disc.

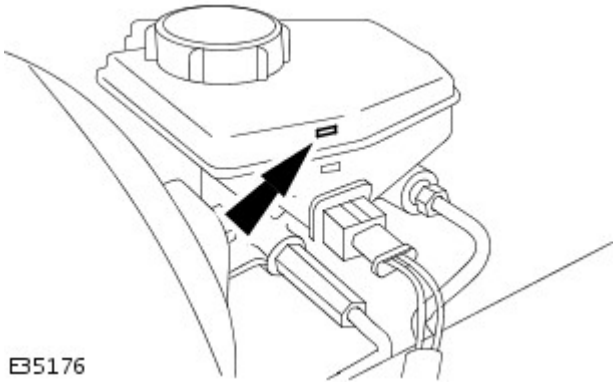
7. Fit wheels. Refer to operation 74.20.05.

8. Remove stands and lower vehicle. Refer to section 100-02.

9. ⚠ CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.



- Remove cloth.
- Fit cap.

10. Remove paint work protection covers, and close engine compartment.

11. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Front Disc Brake - Brake DiscVehicles With: High Performance Brakes

Removal and Installation

Removal

1. WARNINGS:

BRAKE DISCS MUST ALWAYS BE REPLACED IN PAIRS.

BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

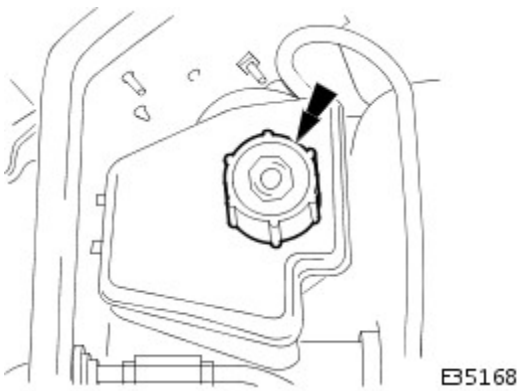
The front brake discs are directional and must be installed to the correct side of the vehicle. Refer to Description and Operation, section 206-03 for further information.

Do not loosen bolts securing brake disc to disc mounting.

Open engine compartment and install paint work protection covers to fenders.

2. Raise front of vehicle and support on stands. See Section 100-02.

3. Remove front wheels. Refer to operation 74.20.05.

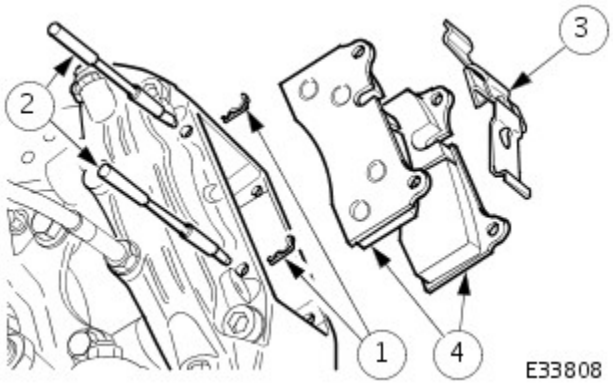


4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.

5. CAUTION: Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.



Remove brake pads from caliper.

1. Remove 'R' clips.
2. Withdraw pins from caliper.
3. Remove anti-rattle spring.
4. Discard brake pads.



6. CAUTIONS:

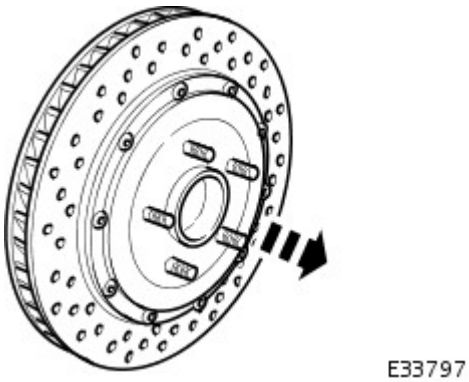
⚠ Only remove the bolts securing the caliper anchor bracket to the vertical link. Refer to caution above for more information.

⚠ Do not allow the caliper to hang on the hydraulic hose, as this will damage the hose.

Remove caliper from vertical link.

- Remove bolts.
- Remove caliper and tie aside.

7. Remove brake disc from hub.



8. Repeat above procedure to remove opposite side brake disc.

9. Remove brake dust from calipers and clean mating surfaces, see WARNING above.

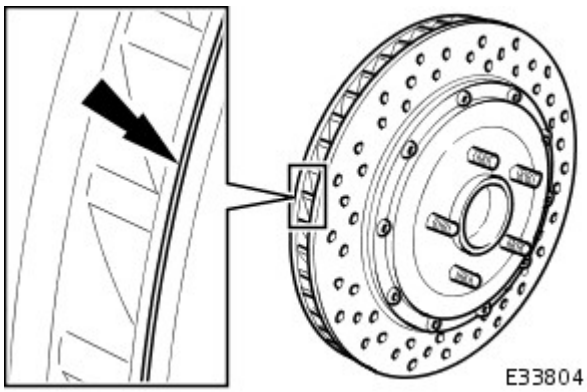
Installation

1. Thoroughly clean the mating surface areas of the hubs and brake discs.

2. ⚠ CAUTION: The front brake discs are directional and must be installed to the correct side of the vehicle.

Install brake disc to hub.

- The left-hand disc can be identified by a groove running around the circumference of the outer disc wall.

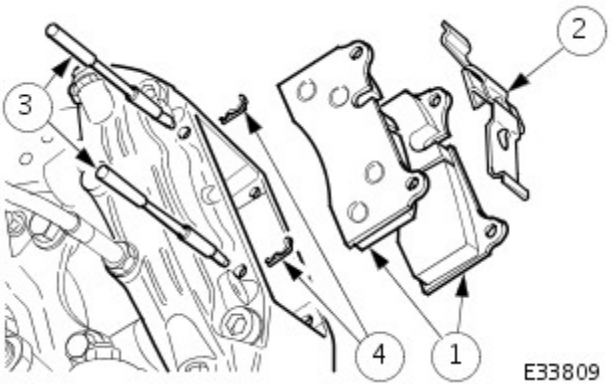


3. Check brake disc run-out. Refer to General Procedures section 206-03.

4. Install caliper to vertical link.

- Install and tighten bolts to 140 Nm.





5. CAUTIONS:

⚠ Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.

⚠ Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

⚠ Note the condition of pins and 'R' clips and replace if necessary.

Install brake pads into caliper housing.

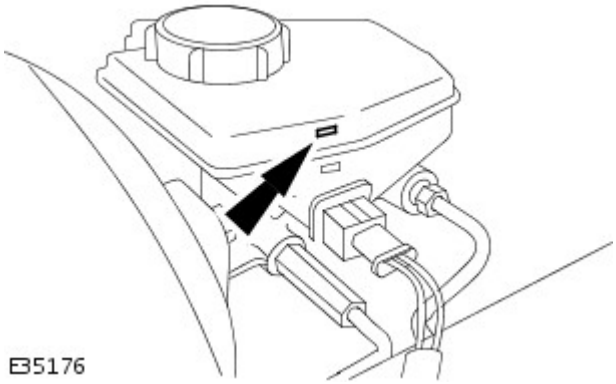
- Slowly retract caliper pistons.

1. Install pads.
2. Position anti-rattle spring.
3. Install pins.
4. Install 'R' clips.

6. Repeat above procedure to install opposite side brake disc.

7. Fit wheels. Refer to operation 74.20.05.

8. Remove stands and lower vehicle. Refer to section 100-02.



9. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

10. Remove paint work protection covers, and close engine compartment.

11. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Front Disc Brake - Brake PadsVehicles With: Standard Brakes

Removal and Installation

Removal

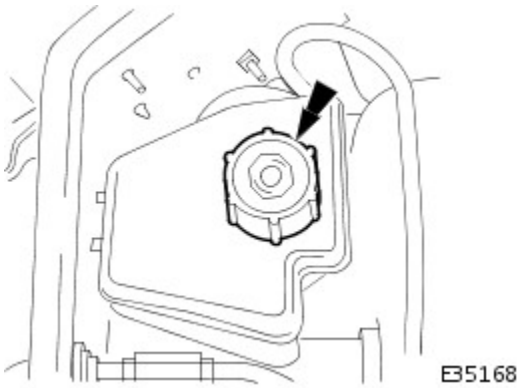
WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

1. Open engine compartment and fit paint work protection covers to fenders.

2. Raise front of vehicle and support on stands. See Section 100-02.

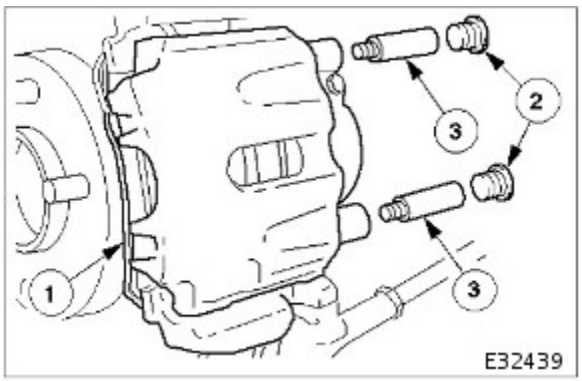
3. Remove front wheels. See Section 204-04.



4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.

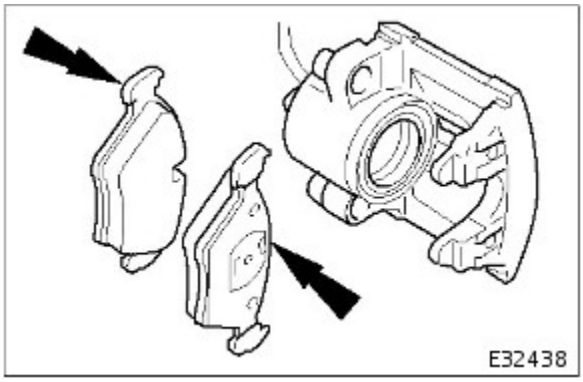


5. CAUTION: Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

Remove caliper housing from caliper carrier.

1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.

- Remove and tie caliper housing aside.



6. NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.

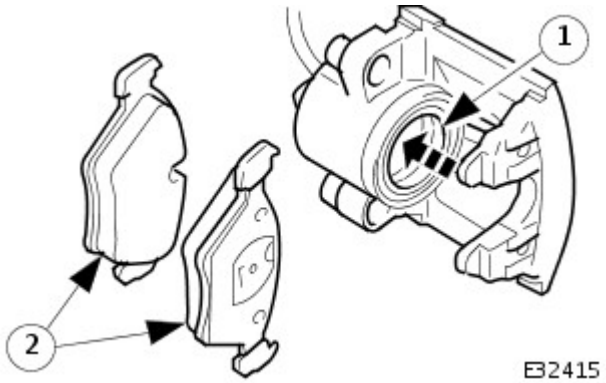
Remove brake pads from caliper housing.

- Discard brake pads.

7. Clean all mating surfaces and remove brake dust, see WARNING above.

8. Repeat above procedure to remove opposite side brake pads.

Installation

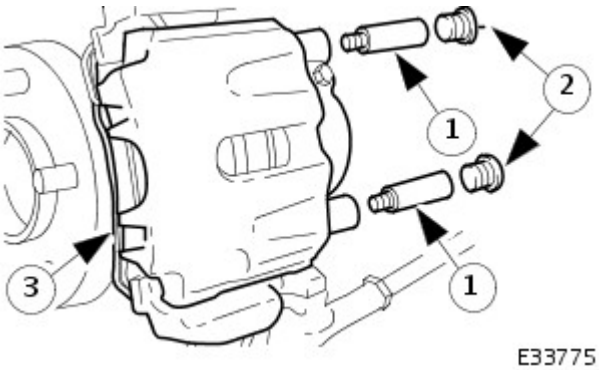


1. CAUTION: Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

• NOTE: Clean caliper piston to pad mating surface.

Install brake pads into caliper housing.

1. Slowly retract piston into caliper housing.
2. Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad into caliper piston.



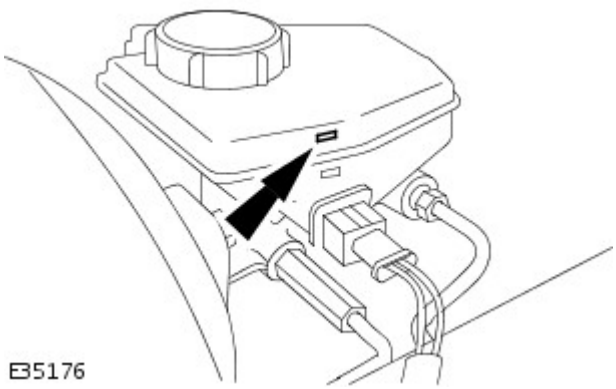
2. Install caliper housing to caliper carrier.

- Align housing to carrier.
  1. Install and tighten guide pins to 25-30 Nm.
  2. Install dust covers.
  3. Install anti-rattle spring.

3. Repeat above procedure to install opposite side brake pads.

4. Fit wheels. Refer to section 204-04.

5. Remove stands and lower vehicle. Refer to section 100-02.



6. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

7. Remove paint work protection covers, and close engine compartment.

8. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Front Disc Brake - Brake PadsVehicles With: High Performance Brakes

Removal and Installation

Removal

1. WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

Brake pads must always be replaced in axle sets.

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. For additional information, refer to: General Service Information (100-00 General Information, Description and Operation).

The High Performance brake caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

Open engine compartment and fit paint work protection covers to fenders.

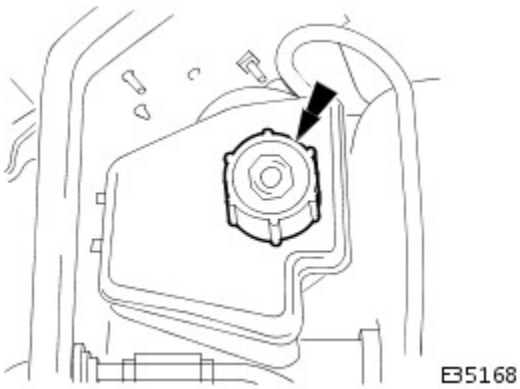
2. Raise front of vehicle and support on stands.
For additional information, refer to: Using the Workshop Jack (100-02 Jacking and Lifting, General Procedures).

3. Remove front wheels. Refer to operation.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

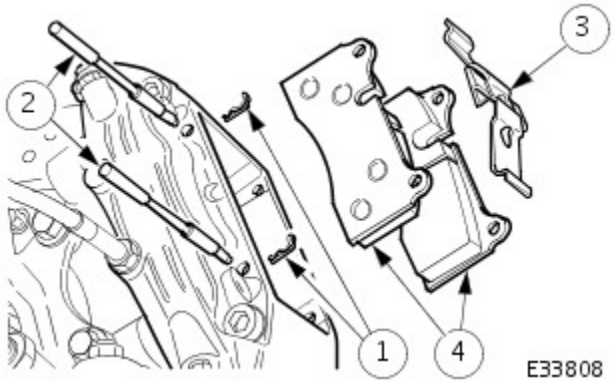
Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.



5. Remove brake pads from caliper.

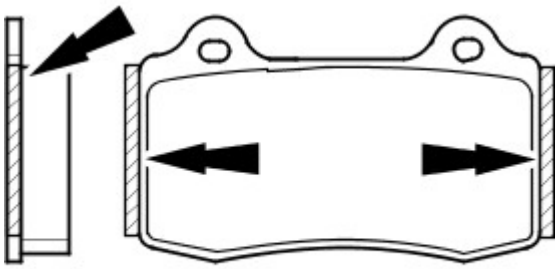
1. Remove 'R' clips.
2. Withdraw pins from caliper.
3. Remove anti-rattle spring.
4. Discard brake pads.



6. Clean all mating surfaces and remove brake dust, see WARNING above.

7. Repeat above procedure to remove opposite side brake pads.

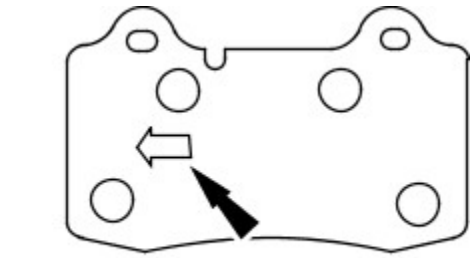
Installation



1. CAUTION: Make sure grease does not contact brake-pad friction surface or brake disc.

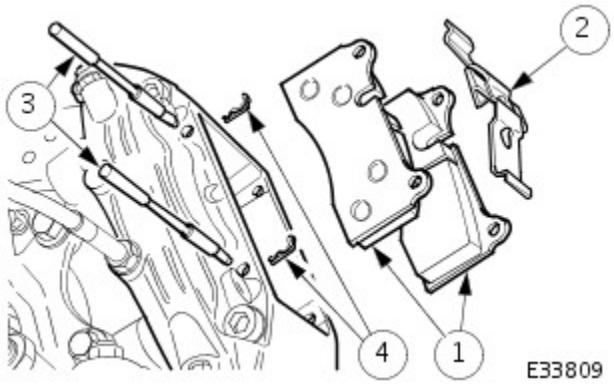
To prevent brake squeal apply grease to the shoulders of the brake-pad backplate.
For additional information, refer to: Specifications (206-04 Rear Disc Brake, Specifications).

- Apply a uniform layer of grease to backplate shoulders, making sure the whole shoulder is covered.



2. CAUTION: Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.

Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.



3. CAUTIONS:

Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

Make sure the brake pads are installed to the correct orientation.

Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.

Note condition of pins and 'R' clips and replace if necessary.

Install brake pads into caliper.

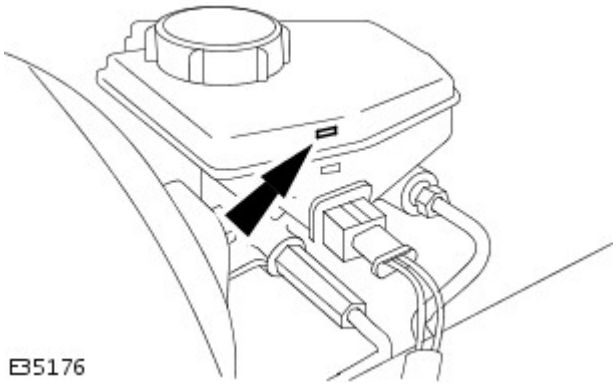
- Slowly retract caliper pistons into caliper.

1. Install pads.
2. Position anti-rattle spring.
3. Install pins.
4. Install 'R' clips.

4. Repeat above procedure to install opposite side brake pads.

5. Fit wheels.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

6. Remove stands and lower vehicle.
For additional information, refer to: Using the Workshop Jack (100-02 Jacking and Lifting, General Procedures).



7. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

8. Remove paint work protection covers, and close engine compartment.

9. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Rear Disc Brake -

Lubricants, Fluids, Sealants and Adhesives

CAUTION: Do not use brake fluid ITT Super Dot 4 on 2006my vehicles onwards. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Brake fluid ITT Super Dot 4 has now been superseded by Shell ESL Super Dot 4 which is the Jaguar recommended brake fluid. Shell ESL Super Dot 4 can be used on all model years.

Unit	Specification
Brake fluid	ITT Super Dot 4
Brake fluid	Shell ESL Super Dot 4
Brembo Brake Grease	Molikote Cu 7439

Torques - Brembo Brakes

Component	Nm
Bolt - anchor bracket to hub carrier	60
Bolt - caliper to anchor bracket	DO NOT REMOVE
Bleed nipple	12-16
Union bolt - brake hose to caliper	22-26

Torques

Component	Nm
Bolt - caliper carrier to hub carrier	60
Guide Pin - caliper housing to caliper carrier	25-30

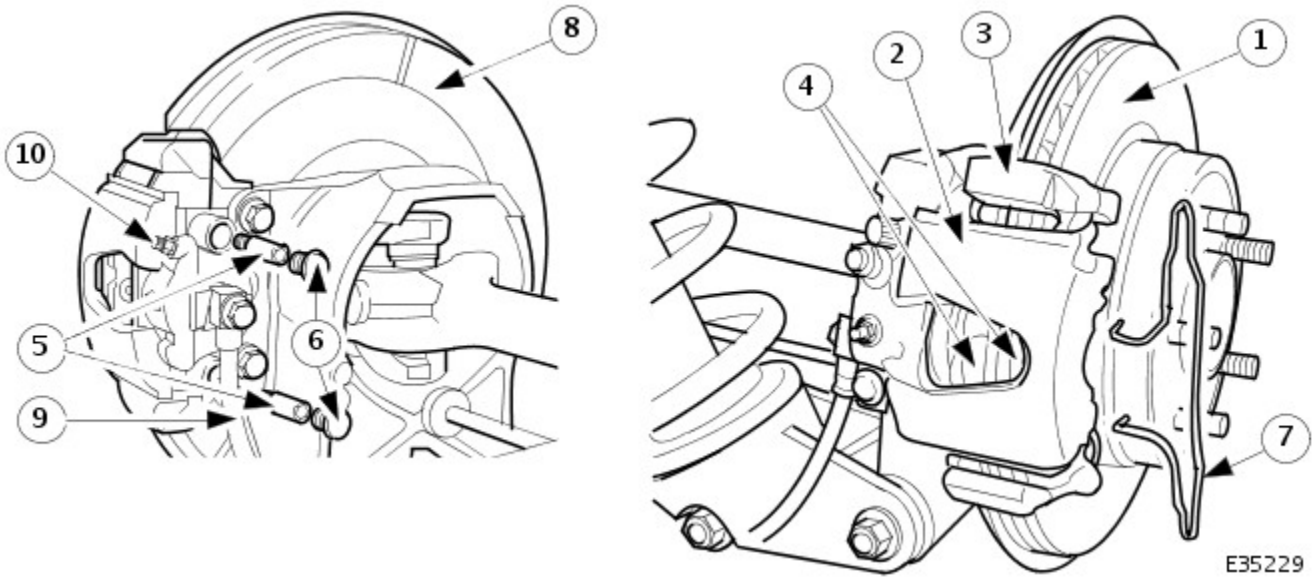
Brake Tube, Hoses and Bracket Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Bleed nipple - front	4-6
Bleed nipple - rear	8-11
Hose union to rear caliper - union bolt	30-40
Hose to front caliper	10-14
M10 hose locknut	15-20
M10 brake tube female-nut	13-17
M10 brake tube male-nut	13-17
M12 brake tube male-nut	15-20
M18 bulkhead brake tube connector	22-28
Brake tube clip retention-bracket to body	4-6

Rear Disc Brake - Rear Disc Brake

Description and Operation



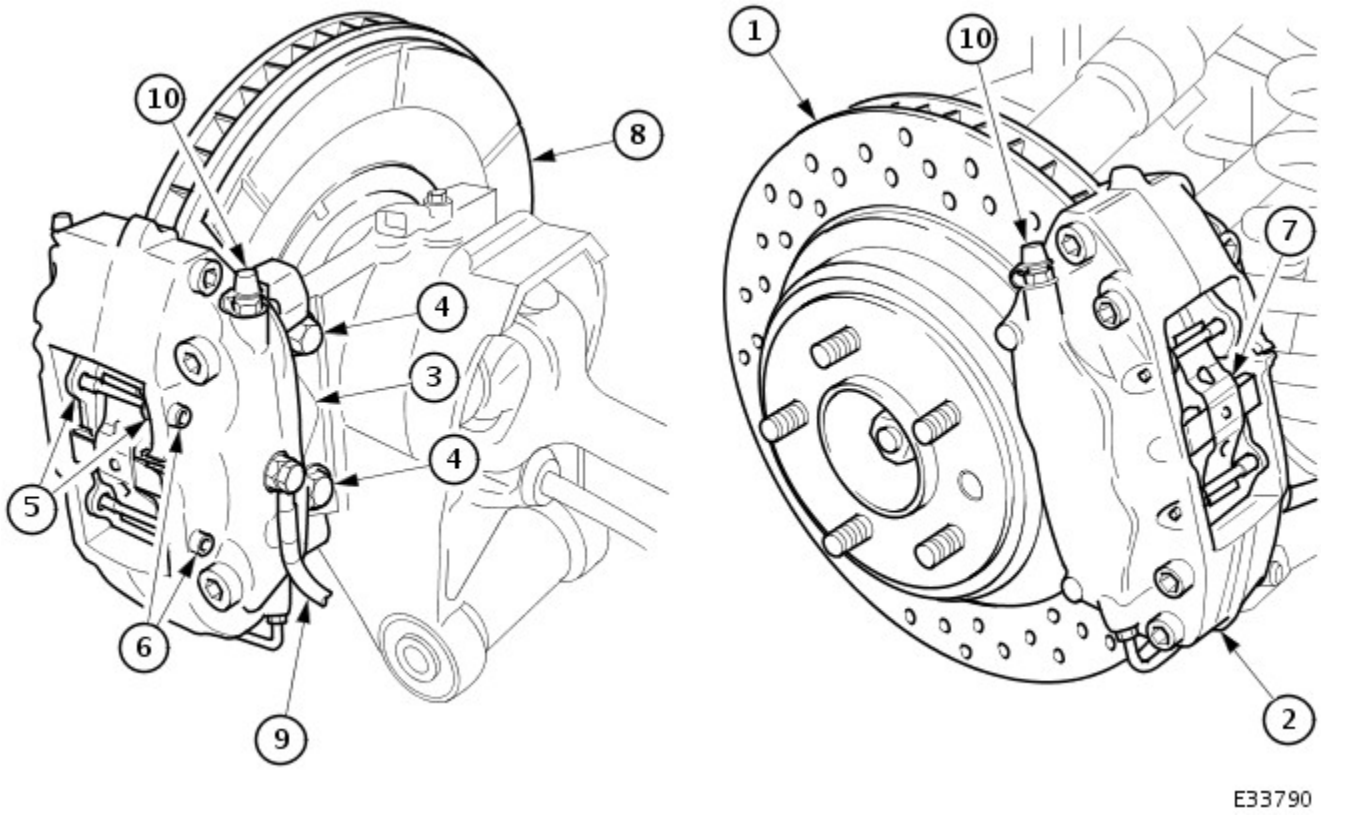
Item	Part Number	Description
1	—	Brake Disc
2	—	Caliper Housing
3	—	Caliper Carrier
4	—	Brake Pads
5	—	Guide Pins
6	—	Dust Covers
7	—	Anti-rattle Spring
8	—	Dust Shield
9	—	Brake Hose
10	—	Bleed Nipple

The brake disc is mounted on the wheel studs and is clamped between the wheel and hub. Cooling ducts run through the center of the brake disc to provide the required ventilation to keep the disc cool under operating conditions.

The caliper carrier, which is secured to the hub carrier by two bolts, carries the single-piston caliper housing. The caliper housing is secured to the caliper carrier by two guide-pins and an anti-rattle spring. When the brakes are applied the caliper-housing piston pushes the brake pad in front of it, towards the brake disc. This movement forces the caliper housing to move along the guide-pins, in the opposite direction of the piston, to apply the second brake pad. The brake disc is therefore gripped between the two pads. As brake pressure is increased the grip on the brake disc is increased to slow-down the rotation of the road wheel.

The disc brakes require no adjustment.

Rear Disc Brake - Brembo



Item	Part Number	Description
1	—	Brake Disc
2	—	Caliper Housing
3	—	Anchor Bracket
4	—	Anchor Bracket to Hub Carrier - Bolts
5	—	Brake Pads
6	—	Guide Pins
7	—	Anti-rattle Spring
8	—	Disc Shield
9	—	Brake Hose
10	—	Bleed Nipples

CAUTION: The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the hub carrier only. DO NOT loosen any other caliper bolts.

Brembo calipers and discs provide higher-performance braking using the existing hydraulic braking system. The brakes are installed to the vehicle using unique hub carriers, hubs, hydraulic hoses and disc shields.

The rear brake disc is a single piece construction which is ventilated and cross-drilled. The disc is mounted on the wheel studs and is clamped between the wheel and hub. Cooling ducts run through the center of the brake disc to provide the required ventilation to keep the disc cool under operating conditions.

Modified disc shields are installed to accommodate the larger diameter discs.

Due to the use of fixed calipers in place of the standard floating caliper, certain lateral dimensions on the hub carriers and hubs are critical to achieve correct clearance and operation of the brakes. Therefore special hub carriers and hubs set within a certain tolerance are installed with Brembo brakes.

The four cylinder brake caliper is rigidly attached to the vertical link via an anchor bracket. The caliper is a split assembly with each side of the caliper, housing two pistons. The two-pairs of opposed pistons act directly on the brake pads mounted one each side of the disc.

Stainless steel hydraulic hoses connect the calipers to the existing brake tubes. It is important that these hoses are aligned correctly when installed to prevent them fouling on the steering and suspension components. Refer to operation 70.55.25 for information.

The Brembo disc brakes require no adjustment.

Rear Disc Brake - Brake CaliperVehicles With: Standard Brakes

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

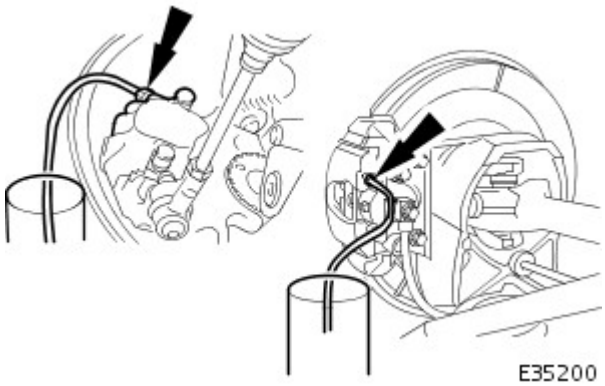
WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

The brake pad adhesive backing must not be reused, therefore always install new brake pads, irrespective of the condition of the original pads when replacing a brake caliper. Always replace brake pads as an axle set.


E35200

1. Open luggage compartment lid and fit suitable paintwork protection equipment.

2. Raise vehicle on a four-post lift.

3. Raise rear of vehicle and support on stands. See Section 100-02.

4. Remove rear wheel. See Section 204-04.

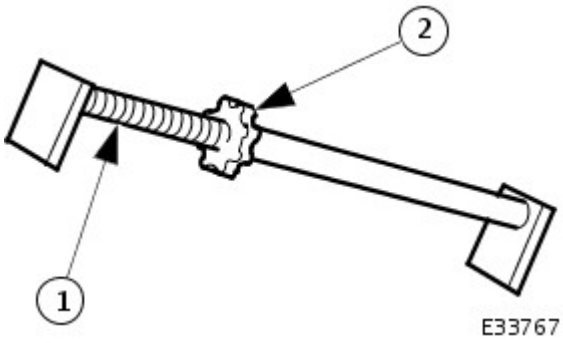
5. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake hose.

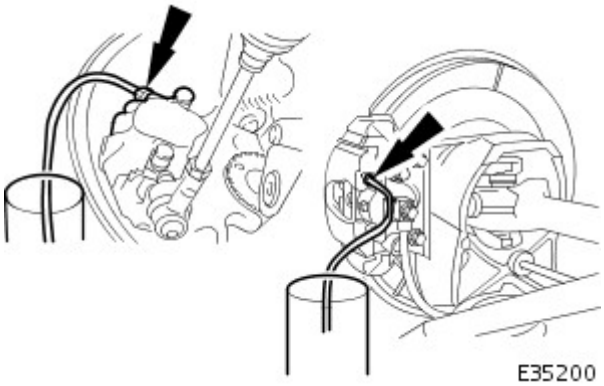
Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

- Connect a bleed tube and container to the calipers.
- Open bleed nipples.

6. Depress and hold down brake pedal at the specified measurement using the special tool.

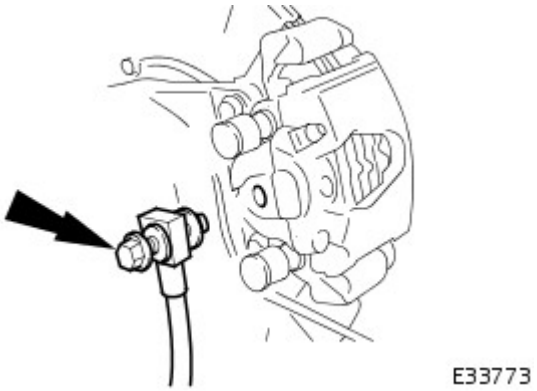
1. Position tool between brake pedal and seat frame.
2. Turn the tool wheel until the brake pedal is held 60mm down from its released position.





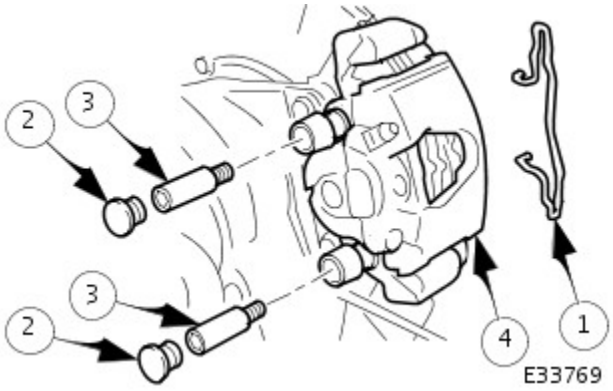
7. Close bleed nipples on both calipers.

- Remove bleed tubes and containers.
- Tighten front bleed nipple to 4-6 Nm.
- Tighten rear bleed nipple to 8-11 Nm.



8. Disconnect brake hose from rear caliper housing.

- Install plugs to caliper and brake hose.

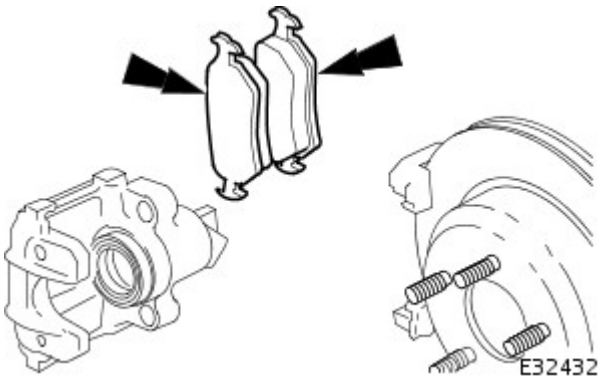


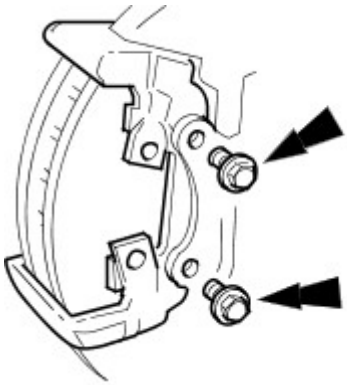
9. Remove caliper housing from caliper carrier.

1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.
4. Remove housing from carrier.

10. NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.

Remove and discard brake pads. (See Caution above).



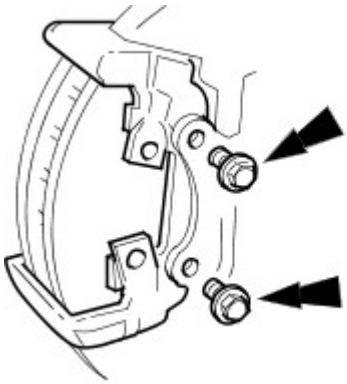


11. Remove caliper carrier from hub carrier.

- Remove bolts.
- Remove carrier.

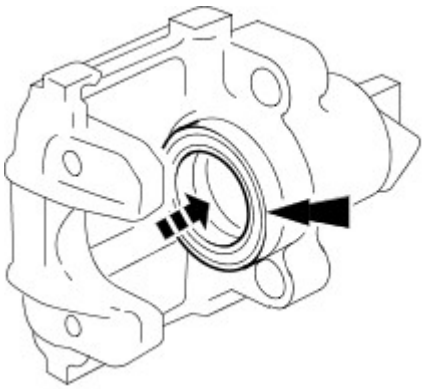
12. Clean all mating surfaces and remove brake dust. See Warning above.

Installation



1. Install caliper carrier to hub carrier.

- Align carrier to hub carrier.
- Install and tighten bolts to 60 Nm.



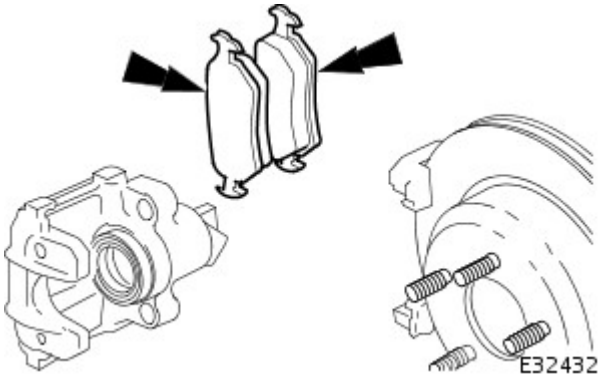
2. Make sure piston is fully retracted into caliper housing.

- Remove plug from caliper housing.
- Retract piston.

3. Install brake pads into caliper housing. (See Caution above).

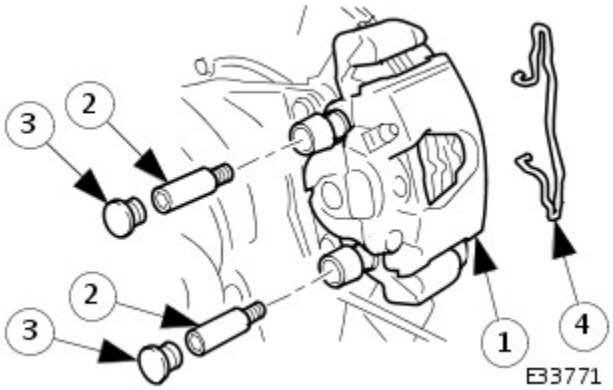
- Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad

into caliper piston.



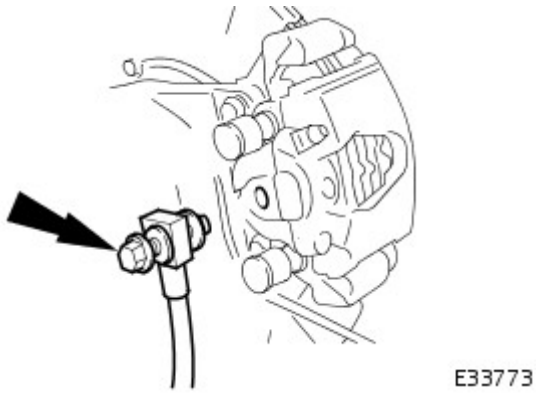
4. Install caliper housing to caliper carrier.

1. Align housing to carrier.
2. Install and tighten guide pins to 25-30 Nm.
3. Install dust covers.
4. Install anti-rattle spring.



5. Connect brake hose to caliper housing.

- Remove plugs.
- Install and tighten bolt to 30-40 Nm.



6. Remove special tool from brake pedal.
7. Fit wheels. See Section 204-04.
8. Remove stands and lower vehicle. See Section 100-02.
9. Bleed brake hydraulic system. Refer to operation 70.25.03.

Rear Disc Brake - Brake CaliperVehicles With: High Performance Brakes

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

1. WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the hub carrier only. DO NOT loosen any other caliper bolts.

Open engine compartment and fit paint work protection covers to fenders.

2. Raise vehicle on a four-post lift.

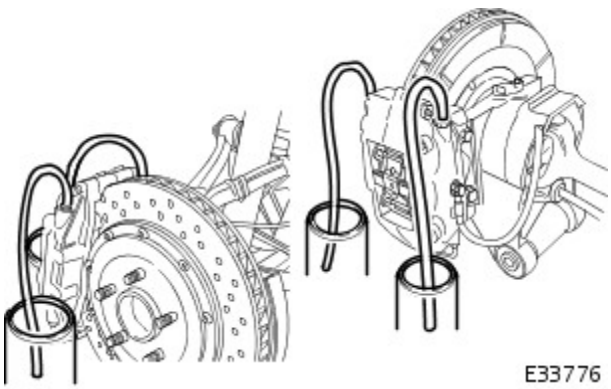
3. Raise front of vehicle and support on stands. Refer to Section 100-02.

4. Remove front wheels. Refer to operation 74.20.05.

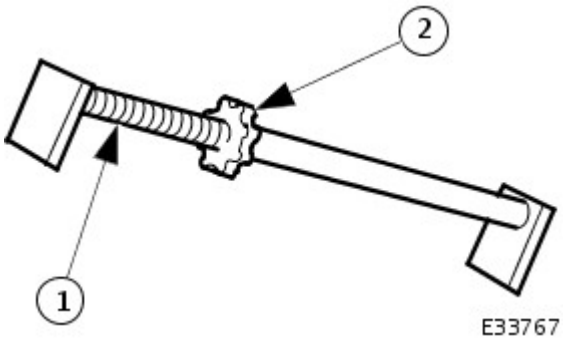
5. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake hose.

Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

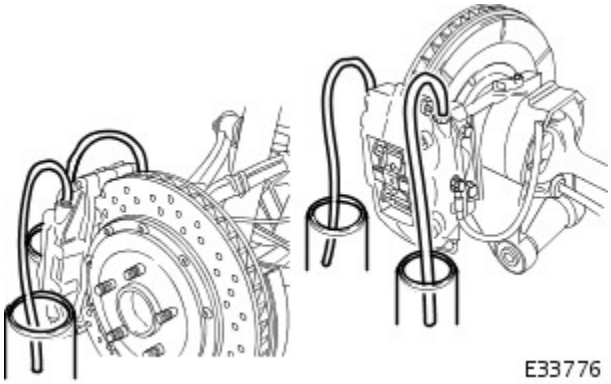
- Connect a bleed tube and container to the calipers.
- Open bleed nipples.


E33776

6. Depress and hold down brake pedal at the specified measurement using the special tool.

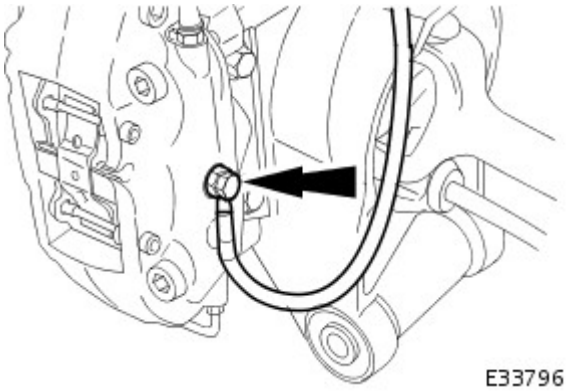


1. Position tool between brake pedal and seat frame.
2. Turn the tool wheel until the brake pedal is held 60mm down from its released position.



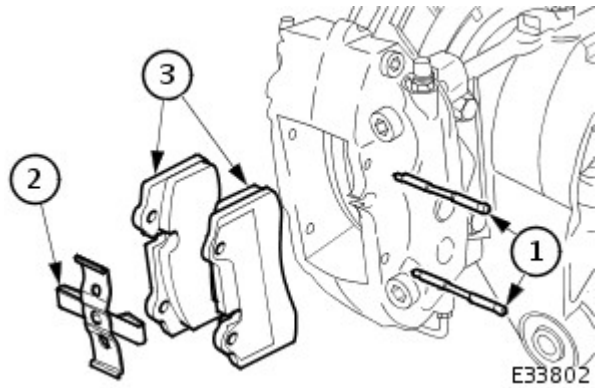
7. Close bleed nipples on both calipers.

- Tighten bleed nipples to 12-16 Nm.
- Remove bleed tubes and containers.



8. Release brake hose from caliper.

- Remove union bolt.
- Remove and discard sealing washers.
- Install plugs into caliper and hose.



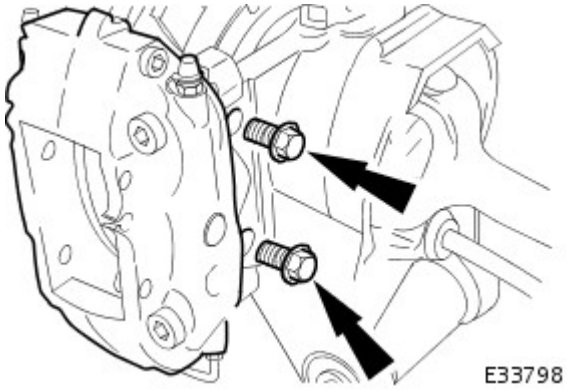
9. Remove brake pads from caliper.

1. Withdraw pins from caliper.
2. Remove anti-rattle spring.
3. Remove brake pads.

10. CAUTION: Only remove the bolts securing the caliper anchor bracket to the hub carrier. Refer to caution above for more information.

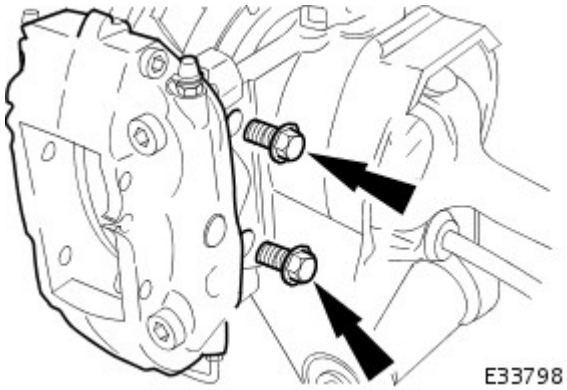
Remove caliper from hub carrier.

- Remove bolts.



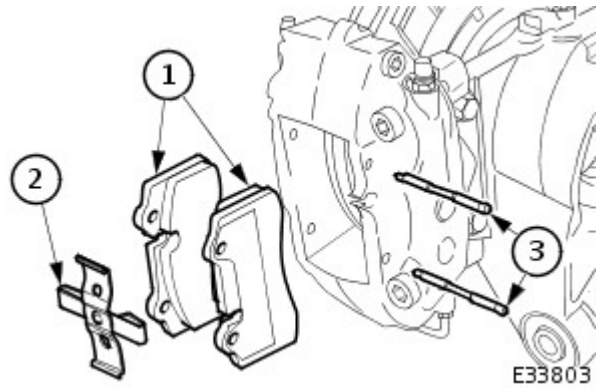
11. Remove brake dust and clean mating surfaces. See Warning above.

Installation



1. Install caliper to hub carrier.

- Install and tighten bolts to 60 Nm.



2. CAUTIONS:

⚠ Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work with clean water.

⚠ Note the condition of the pins and replace if necessary.

Install brake pads. Refer to 70.40.09 for anti-squeal grease application.

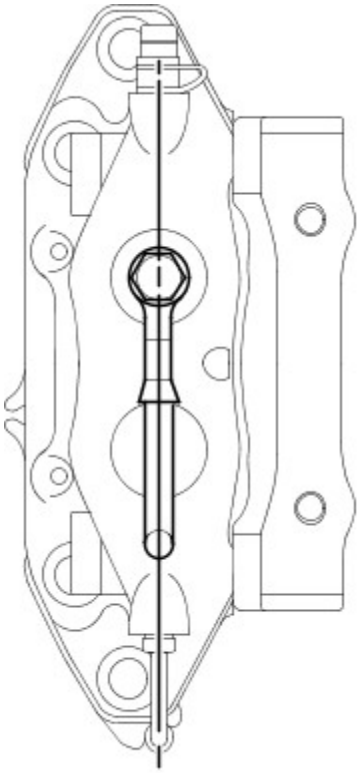
- Slowly retract caliper pistons.

1. Install pads.
2. Position anti-rattle spring.
3. Install pins - make sure pin collets are fully engaged into caliper.

3. CAUTIONS:

⚠ The brake hose must only be installed with the vehicle's body supported and the suspension hanging.

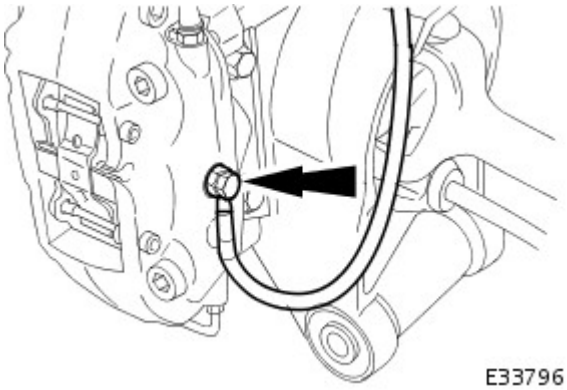
⚠ It is important that the brake hose is aligned correctly when



E33806

installed to prevent it fouling on the steering and suspension components.

After installation the brake hose must be aligned with the center line as shown.



E33796

4. Install brake hose to caliper.

- Remove plugs from caliper and hose.
- Install new sealing washers.
- Align hose as shown above.
- Install and tighten union bolt to 22-26 Nm.

5. Remove special tool from brake pedal.

6. Fit wheels. Refer to operation 74.20.05.

7. NOTE: Make sure the brake hose is routed correctly.

Remove stands and lower vehicle. Refer to section 100-02.

8. Bleed brake hydraulic system. Refer to operation 70.25.06.

Rear Disc Brake - Brake DiscVehicles With: Standard Brakes

Removal and Installation

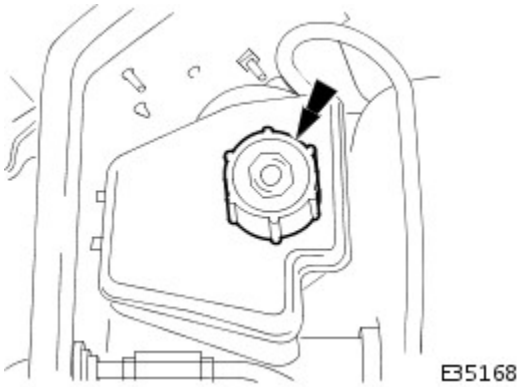
Removal

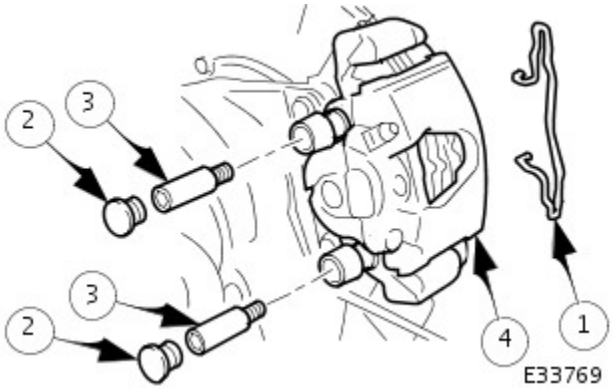
• WARNINGS:

BRAKE DISCS MUST ALWAYS BE REPLACED IN PAIRS.

BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.





1. Open engine compartment and fit paint work protection covers to fenders.
2. Raise rear of vehicle and support on stands. Refer to section 100-02.
3. Remove rear wheels. Refer to section 204-04.
4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

   Loosen brake fluid reservoir-cap.

   - Position a cloth around the reservoir to collect any fluid spillage.

5. CAUTION: Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

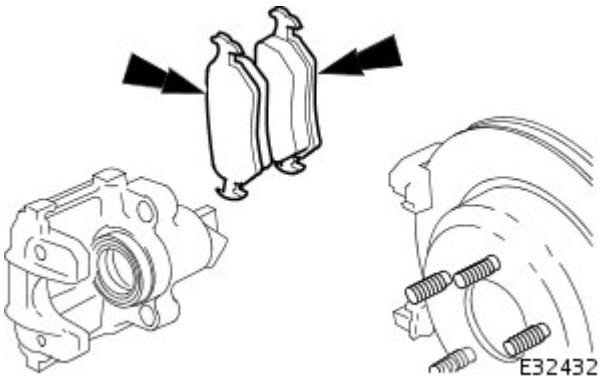
   Remove caliper housing from caliper carrier.

   1. Remove anti-rattle spring.
   2. Remove dust covers.
   3. Remove guide pins.
   4. Remove housing from carrier.

   - Tie caliper housing aside.

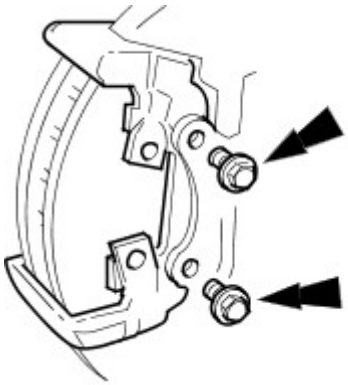
6. CAUTION: Always install new brake pads, irrespective of the condition of the original pads, when renewing a brake disc.

• NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.



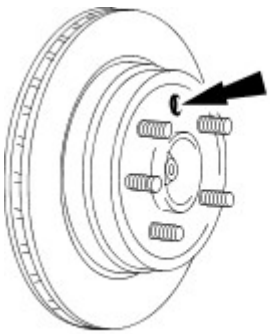
Remove brake pads from caliper housing.

- Discard brake pads.



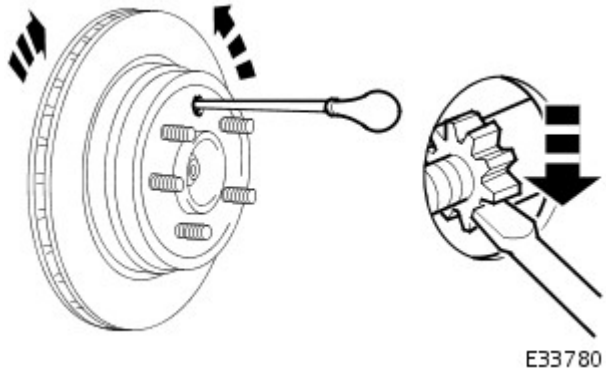
7. Remove caliper carrier from hub carrier.

- Remove bolts.
- Remove carrier.



8. Align brake disc access hole with parking brake adjuster.

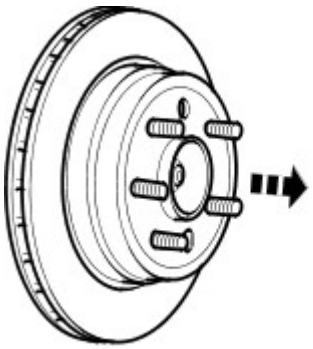
- Remove plug from access hole.
- Rotate brake disc until access hole is aligned with adjuster.



9. Slacken parking brake adjuster.

- Rotate adjuster clockwise.

10. Remove brake disc from wheel studs.



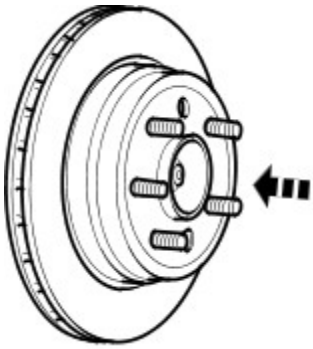
E32434

11. Remove brake dust from calipers, and from area of parking brake shoes, see WARNING above.

12. Repeat above procedure to remove opposite side brake disc.

13. Thoroughly clean the area of both hubs where they mate against the brake discs.

Installation



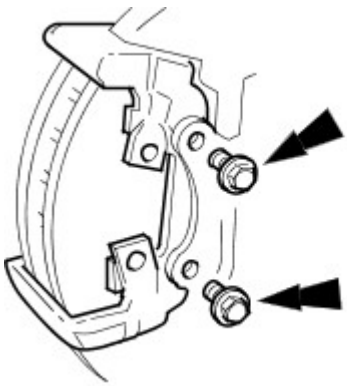
E32435

1. Install brake disc to wheel studs.

- Make sure hub and brake disc access holes are aligned.

2. Set the parking brake, refer to operation 70.35.37.

3. Check brake disc run-out. Refer to General Procedures section 206-04.



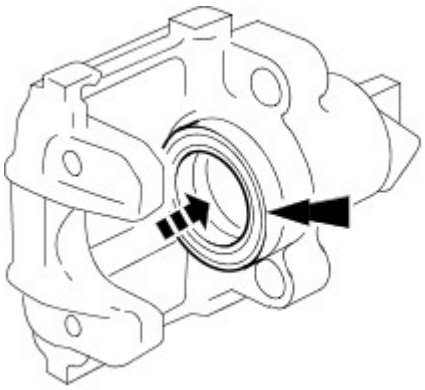
E32433

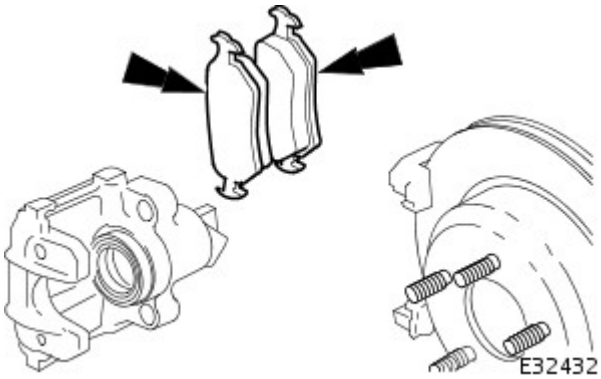
4. Install caliper carrier to hub carrier.

- Position carrier.
- Install and tighten bolts to 60 Nm.

5. CAUTION: Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

Slowly retract piston into caliper housing.


E32416


E32432

6. CAUTION: Always install new brake pads, irrespective of the condition of the original pads, when renewing a brake disc.

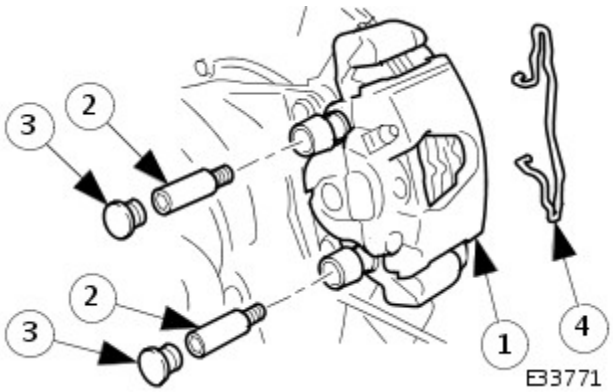
• NOTE: Clean caliper piston to pad mating surface.

Install brake pads to caliper housing.

- Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad into caliper piston.

7. Install caliper housing to caliper carrier.

1. Align housing to carrier.
2. Install and tighten guide pins to 25-30 Nm.
3. Install dust covers.
4. Install anti-rattle spring.

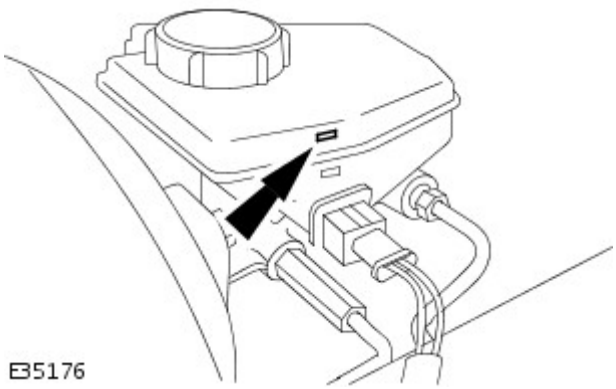


E33771

8. Repeat above procedure to install opposite side brake disc.

9. Fit wheels. Refer to section 204-04.

10. Remove stands and lower vehicle. Refer to section 100-02.


E35176

11. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

12. Remove paint work protection covers, and close engine compartment.

13. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Rear Disc Brake - Brake DiscVehicles With: High Performance Brakes

Removal and Installation

Removal

1. WARNINGS:

BRAKE DISCS MUST ALWAYS BE REPLACED IN PAIRS.

BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

The Brembo caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the hub carrier only. DO NOT loosen any other caliper bolts.

Open engine compartment and fit paint work protection covers to fenders.

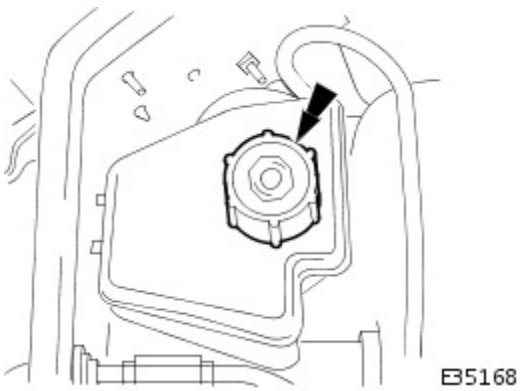
2. Raise rear of vehicle and support on stands. Refer to section 100-02.

3. Remove rear wheels. Refer to section 204-04.

4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

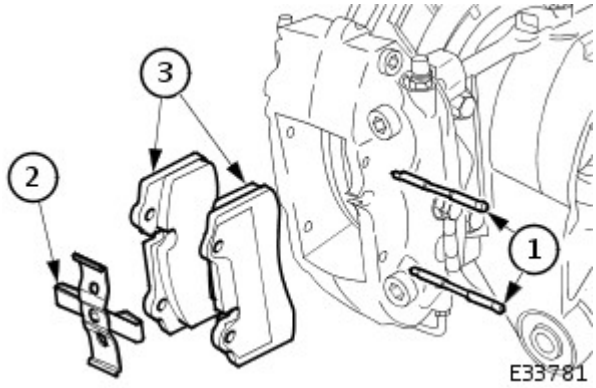
- Position a cloth around the reservoir to collect any fluid spillage.

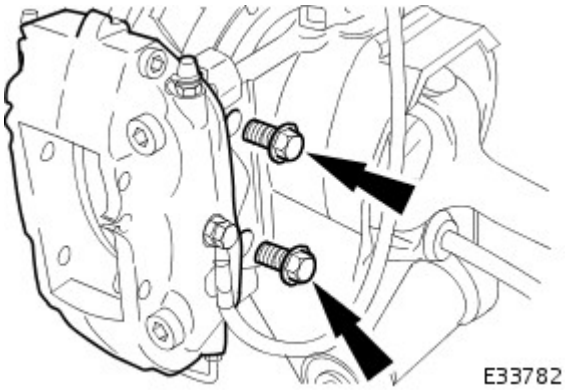


5. CAUTION: Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.

Remove brake pads from caliper.

1. Withdraw pins from caliper.
2. Remove anti-rattle spring.
3. Discard brake pads.





6. CAUTIONS:

⚠ Only remove the bolts securing the caliper anchor bracket to the hub carrier. Refer to caution above for more information.

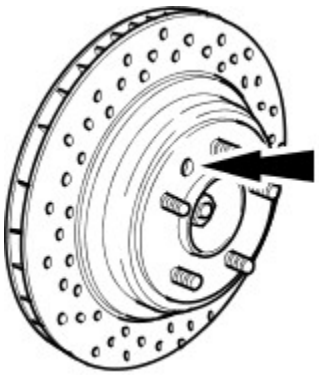
⚠ Do not allow the caliper to hang on the hydraulic hose, as this will damage the hose.

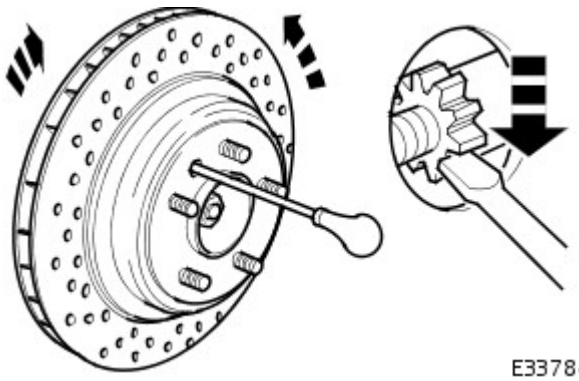
Remove caliper from hub carrier.

- Remove bolts.
- Remove and tie caliper aside.

7. Align brake disc access hole with parking brake adjuster.

- Remove plug from access hole.
- Rotate brake disc until access hole is aligned with adjuster.

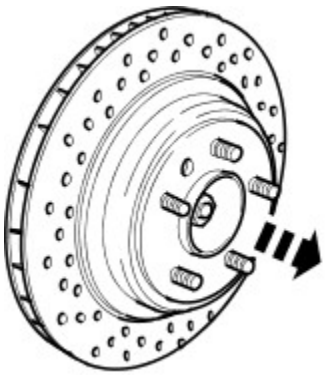




8. Slacken parking brake adjuster to allow for the removal of the brake disc.

- Rotate adjuster clockwise.

9. Remove brake disc from hub.



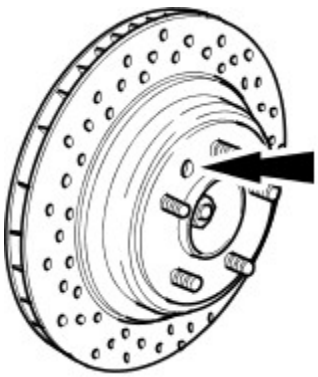
E33785

10. Remove brake dust from calipers, and from area of parking brake shoes, see WARNING above.

11. Repeat above procedure to remove opposite side brake disc.

12. Thoroughly clean the area of both hubs where they mate against the brake discs.

Installation



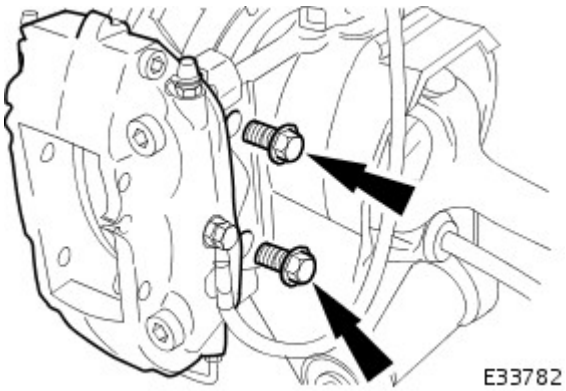
E33783

1. Install brake disc to wheel studs.

- Make sure hub and brake disc access holes are aligned.

2. Set the parking brake, refer to operation 70.35.37.

3. Check brake disc run-out. Refer to General Procedures section 206-04.



E33782

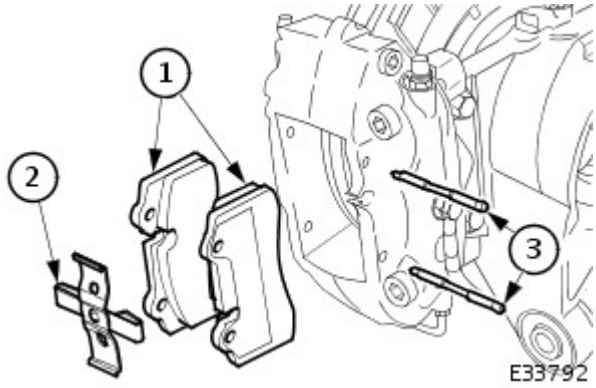
4. Install caliper to hub carrier.

- Install and tighten bolts to 60 Nm.

5. CAUTIONS:

Always install new brake pads, irrespective of the condition of the original pads, when renewing brake discs.

Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work with clean water.



Note the condition of pins and replace if necessary.

Install brake pads. Refer to 70.40.09 for anti-squeal grease application.

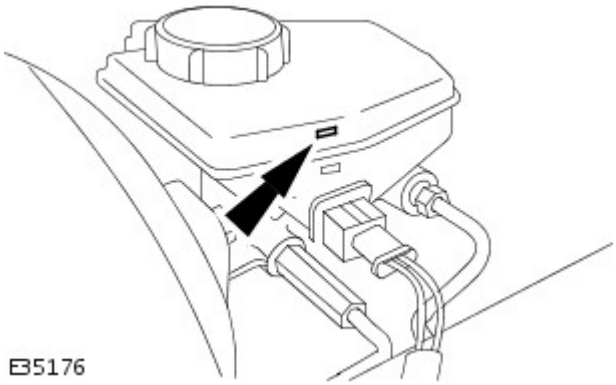
- Slowly retract caliper pistons.

1. Install pads.
2. Position anti-rattle spring.
3. Install pins - make sure pin collets are fully engaged into caliper.

6. Repeat above procedure to install opposite side brake disc.

7. Fit wheels. Refer to section 204-04.

8. Remove stands and lower vehicle. Refer to section 100-02.



9. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

10. Remove paint work protection covers, and close engine compartment.

11. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Rear Disc Brake - Brake PadsVehicles With: Standard Brakes

Removal and Installation

Removal

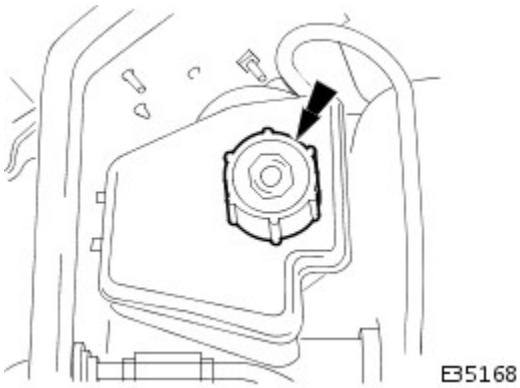
WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

1. Open engine compartment and fit paint work protection covers to fenders.

2. Raise rear of vehicle and support on stands. See Section 100-02.

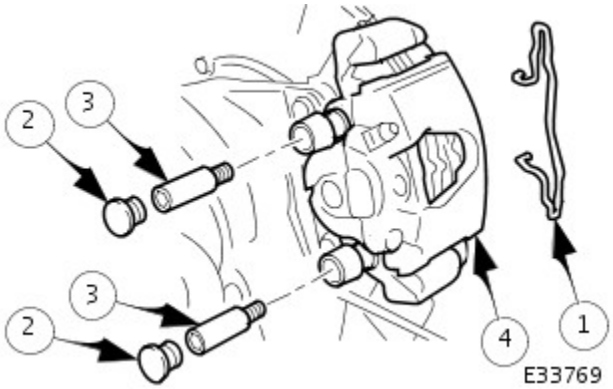
3. Remove both rear wheels. See Section 204-04.



4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.



5. CAUTION: Tie caliper housing aside. Do not allow the caliper housing to hang on the hydraulic hose, as this will damage the hose.

Remove caliper housing from caliper carrier.

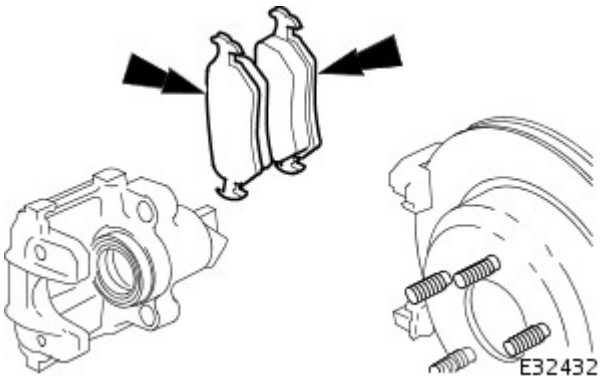
1. Remove anti-rattle spring.
2. Remove dust covers.
3. Remove guide pins.
4. Remove housing from carrier.

- Tie caliper housing aside.

6. NOTE: The inner brake pad is fitted with a clip which secures the pad into the caliper piston.

Remove brake pads from caliper housing.

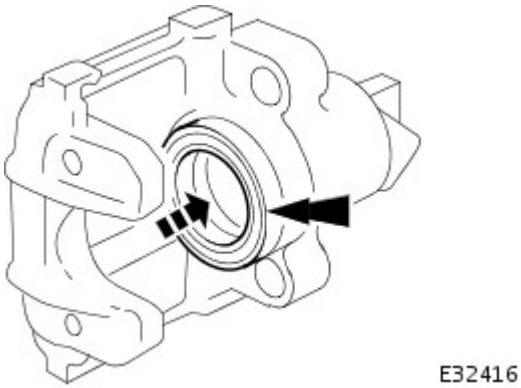
- Discard brake pads.



7. Clean all mating surfaces and remove brake dust. See Warning above.

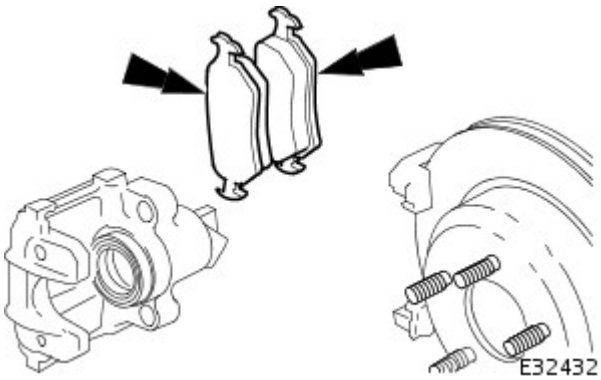
8. Repeat above procedure to remove opposite side brake pads.

Installation



1. CAUTION: Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work, with clean water.

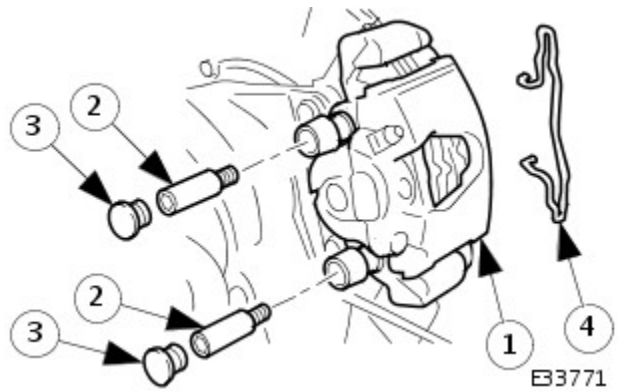
Slowly retract piston into caliper housing.



2. NOTE: Clean caliper piston to pad mating surface.

Install brake pads to caliper housing.

- Remove paper backing from pads to reveal adhesive shim. Install brake pads, insert clip located on back of inner pad into caliper piston.

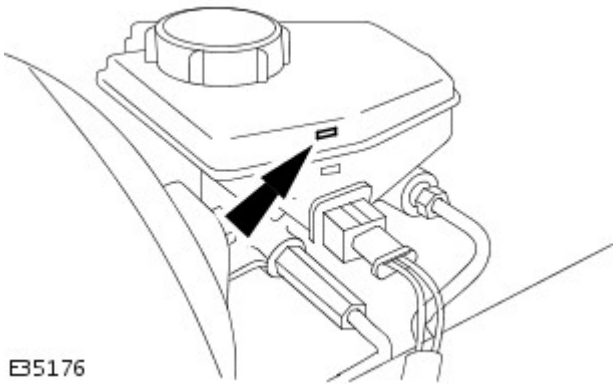


3. Install caliper housing to caliper carrier.

1. Align housing to carrier.
2. Install and tighten guide pins to 25-30 Nm.
3. Install dust covers.
4. Install anti-rattle spring.

4. Repeat above procedure to install opposite side brake pads.

5. Fit wheels. Refer to Section 204-04.



6. Remove stands and lower vehicle. Refer to Section 100-02.

7. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

8. Remove paint work protection covers, and close engine compartment.

9. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Rear Disc Brake - Brake PadsVehicles With: High Performance Brakes

Removal and Installation

Removal

1. WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

Brake pads must always be replaced in axle sets.

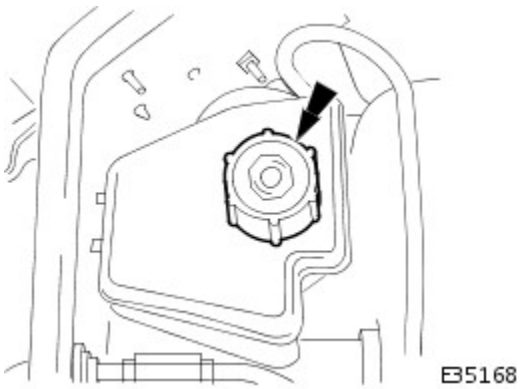
Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. For additional information, refer to: General Service Information (100-00 General Information, Description and Operation).

The High performance brake caliper is aligned to the brake disc when it is first installed to the vehicle, therefore, care must be taken not to disturb this alignment. When removing the caliper; remove the bolts that secure the anchor bracket to the vertical link only. DO NOT loosen any other caliper bolts.

Open engine compartment and fit paint work protection covers to fenders.

2. Raise rear of vehicle and support on stands.
For additional information, refer to: Using the Workshop Jack (100-02 Jacking and Lifting, General Procedures).

3. Remove rear wheels.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).



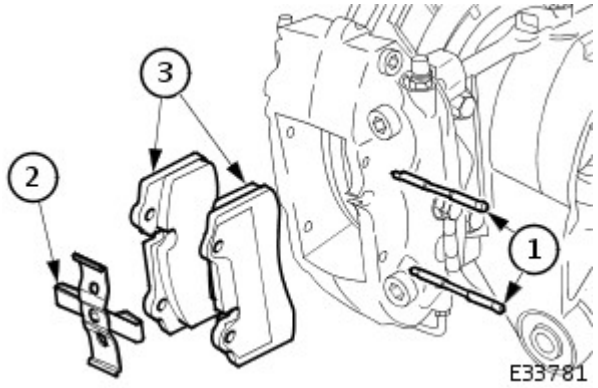
4. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Loosen brake fluid reservoir-cap.

- Position a cloth around the reservoir to collect any fluid spillage.

5. Remove brake pads from caliper.

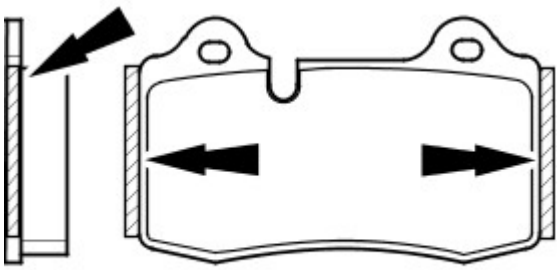
1. Withdraw pins from caliper.
2. Remove anti-rattle spring.
3. Discard brake pads.



6. Clean all mating surfaces and remove brake dust, see WARNING above.

7. Repeat above procedure to remove opposite side brake pads.

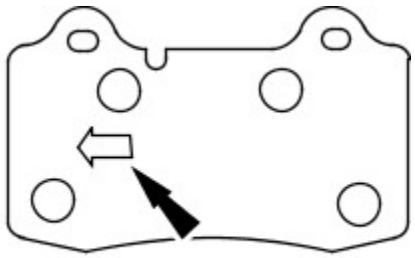
Installation



1. CAUTION: Make sure grease does not contact brake-pad friction surface or brake disc.

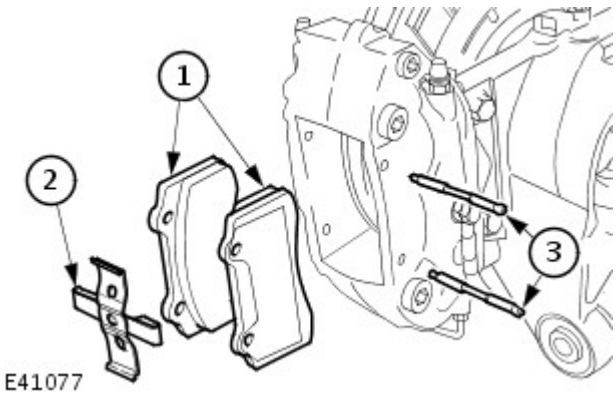
To prevent brake squeal apply grease to the shoulders of the brake-pad backplate.
For additional information, refer to: Specifications (206-04 Rear Disc Brake, Specifications).

- Apply a uniform layer of grease to backplate shoulders, making sure the whole shoulder is covered.



2. CAUTION: Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.

Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.



3. CAUTIONS:

Retracting the caliper piston may cause the fluid reservoir to over-flow. Remove brake fluid spillage immediately from paint work with clean water.

Make sure the brake pads are installed to the correct orientation.

Make sure the brake pads are fitted with the direction arrow following the direction of wheel rotation.

Note the condition of pins and replace if necessary.

• NOTE: Slowly retract caliper pistons.

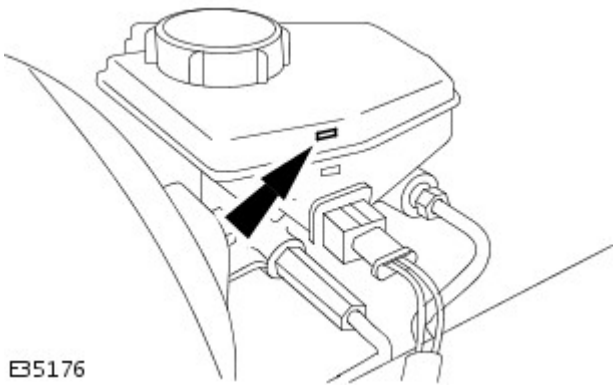
Install brake pads.

1. Install pads.
2. Position anti-rattle spring.
3. Install pins - make sure pin collets are fully engaged into caliper.

4. Repeat above procedure to install opposite side brake pads.

5. Fit wheels.
For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

6. Remove stands and lower vehicle.
For additional information, refer to: Using the Workshop Jack (100-02 Jacking and Lifting, General Procedures).



7. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Check brake fluid level.

- Check brake fluid level is at the maximum mark.
- Remove cloth.
- Fit cap.

8. Remove paint work protection covers, and close engine compartment.

9. Start the engine and repeatedly press the brake pedal until brake pressure is evident.

Parking Brake and Actuation -

Dimensions

• NOTE: When a component reaches its maximum / minimum limit the component must be replaced. Care must be taken when refinishing brake drums that the limits are not exceeded.

Component	Specification
Parking brake drum - maximum diameter	181 mm
Parking brake shoes - minimum thickness	2 mm

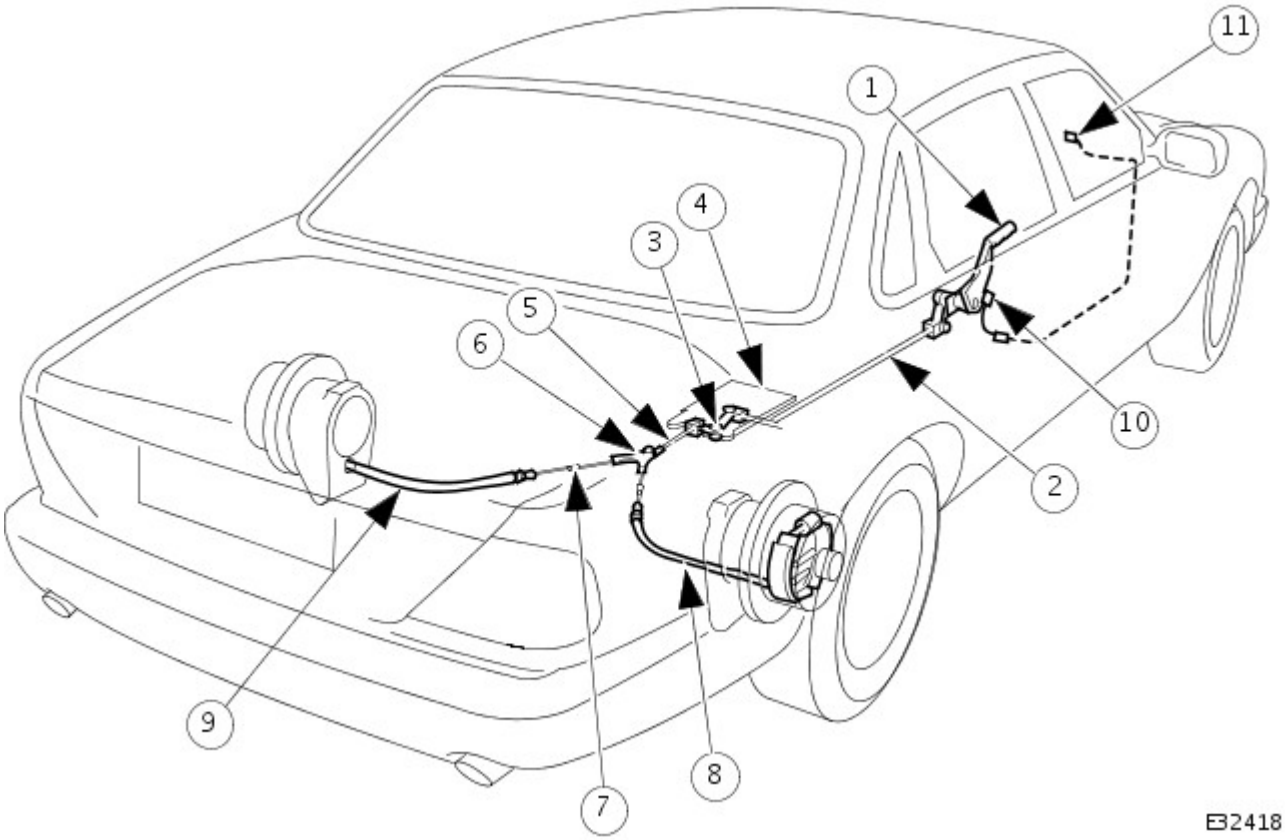
Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Bolt - blanking plate to body	22-28
Bolt - parking brake lever to body	22-28
Bolt - relay lever mounting plate to body	19-25
Bolt - relay lever to body	22-28
Screw - switch to parking brake lever	3

Parking Brake and Actuation - Parking Brake

Description and Operation



Parts List

Item	Part Number	Description
1	—	Hand Lever
2	—	Front Cable
3	—	Relay Lever and Mounting Plate
4	—	Driveshaft Center Mounting
5	—	Cable Adjuster Rod
6	—	Equalizer
7	—	Cable Connector
8	—	Rear Cable RH
9	—	Rear Cable LH
10	—	Warning Light Switch and Harness
11	—	Warning Lamp

The parking-brake hand lever is mounted on the transmission tunnel and incorporates the ratchet mechanism and release button.

The front cable is routed from the hand lever, under the carpet through to an abutment bracket adjacent to the transmission tunnel, and then connected to the relay lever. The relay lever is attached to a mounting plate by a center bolt on which it rotates The relay lever mounting plate straddles the transmission tunnel, the plate is secured by four bolts. The relay lever acts as a center pull system to transmit the force from the hand lever to the rear brakes shoes. The equalizer which is positioned in the center of the rear brake cables balances the force that is applied to the rear brakes.

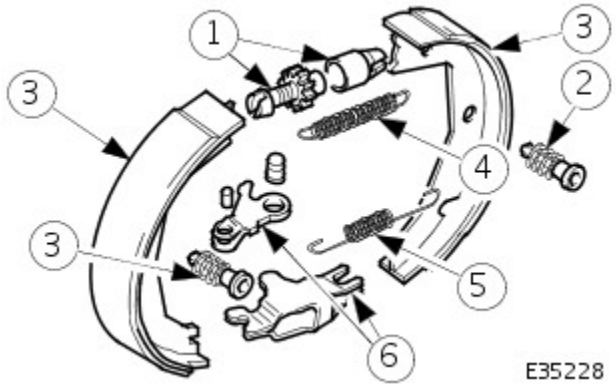
The rear brake cables are linked together: each cable passes through the rear hub carrier and connects to a brake shoe expander lever. Application of the parking brake causes the rear cables to pull on the expander levers, the expander lever mechanism rotates on a pivot pin to force the brake shoes outwards to contact the brake drums.

The parking brake cables are adjusted by the rotation of a nut on the adjuster rod. The parking brake shoes are adjusted by

means of a manual adjustment mechanism at each set of shoes. Refer to General Procedures in section 206-05.

If the vehicle is driven above 5 km/h with the parking brake applied, a warning lamp and text message will appear on the message center. The message clears when the brake is released or the speed drops below 3 km/h.

Parking Brake Shoe Arrangement

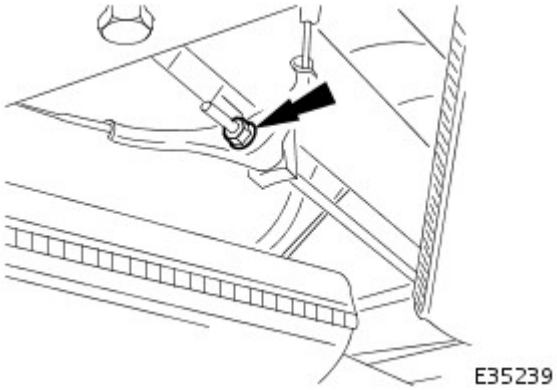


Item	Part Number	Description
1	—	Adjuster Mechanism
2	—	Retaining Pins
3	—	Brake Shoes
4	—	Upper Return Spring
5	—	Lower Return Spring
6	—	Expander Lever Mechanism

- The adjuster mechanism enables manual adjustment of the brake shoes.
- Retaining pins keep the shoes in contact with the dust shield.
- The brake shoes locate into the expander lever and the adjuster mechanism.
- Return springs retract the brake shoes when the parking brake is released.
- The expander lever mechanism moves the brake shoes outwards, in contact with the brake drum when the parking brake is applied.

Parking Brake and Actuation - Parking Brake Cable Adjustment

General Procedures

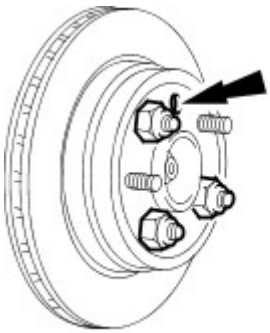


1. Raise rear of vehicle and support on stands. See section 100-02.
2. Make sure gear selector is in neutral position.
3. Adjust parking brake cable.
   - Rotate adjusting nut, until the parking brake can be applied by raising the parking brake lever 3 to 5 clicks.
4. CAUTION: Make sure that the rear wheels rotate freely when the parking brake lever is released.

Remove stands and lower vehicle.

Parking Brake and Actuation - Parking Brake Shoe and Lining Adjustment

General Procedures



E33772

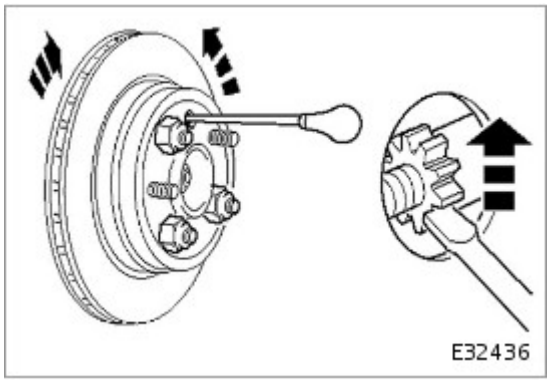
1. Raise rear of vehicle and support on stands. See section 100-02.

2. Remove both rear wheels.

3. Make sure that the parking brake lever is in the released position, and the gear selector lever is in neutral (N).

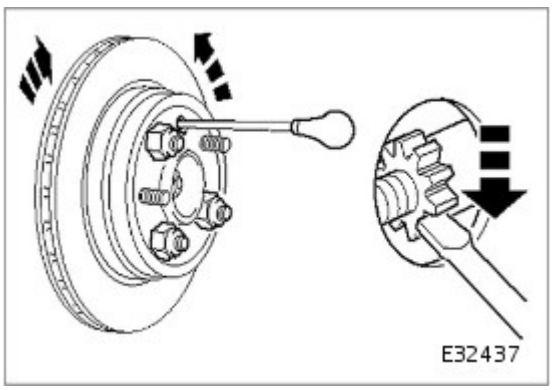
4. Align brake disc access hole with parking brake adjuster.

- Install three wheel nuts to secure brake disc to hub. Tighten nuts to 20 Nm.
- Remove plug from access hole.
- Rotate brake disc until access hole is aligned with adjuster.



E32436

5. Using a flat-bladed screwdriver rotate the adjuster anticlockwise until the brake disc cannot be rotated.



E32437

6. NOTE: The brake shoe return-spring next to the adjuster prevents the adjuster from rotating under normal operating conditions. Make sure that the spring is seated between the adjuster spokes, when brake adjustment is complete.

Rotate the adjuster gradually clockwise until the brake disc rotates freely.

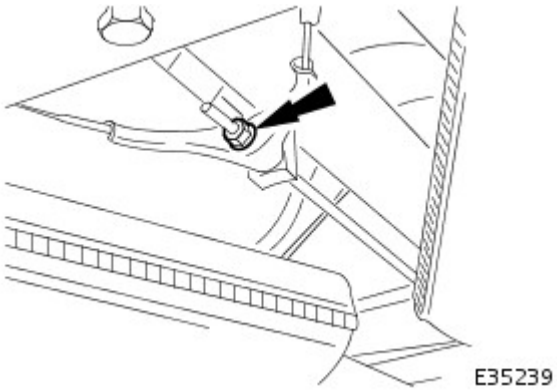
- Install plug to access hole.

7. Repeat parking brake setting procedure on opposite-side of vehicle.

8. CAUTION: Make sure that the rear wheels rotate freely when the parking brake lever is released.

Adjust parking brake cable.

- Rotate adjusting nut, until the parking brake can be applied by raising the parking brake lever 3 to 5 clicks.



9. Remove wheel nuts.

10. Fit rear wheels. See section 204-04.

11. Remove stands and lower vehicle.

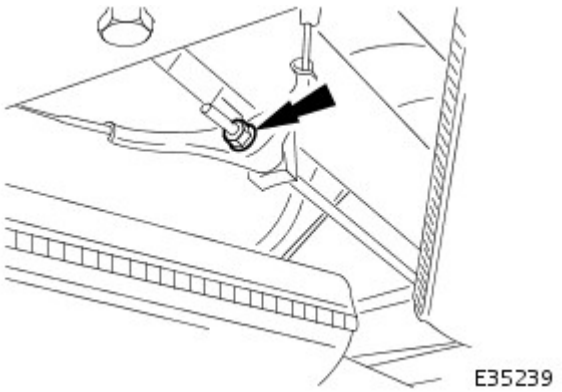
Parking Brake and Actuation - Parking Brake Control

Removal and Installation

Removal

WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.


E35239

1. Position vehicle on a four-post lift.

2. Release parking brake.

3. Release tension on parking brake cable.

- Slacken but do not remove adjustment nut.


E35240

4. Release parking brake cable.

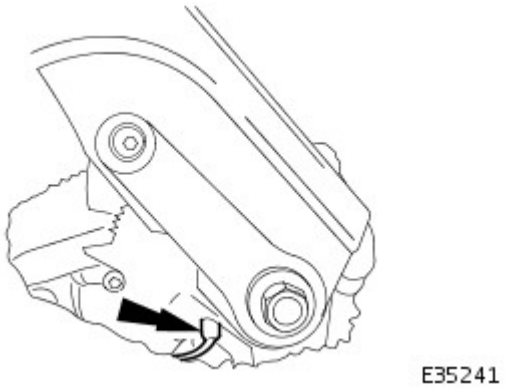
- Remove clip.
- Remove clevis pin.

5. Remove driver seat for access. Refer to operation 76.70.01.

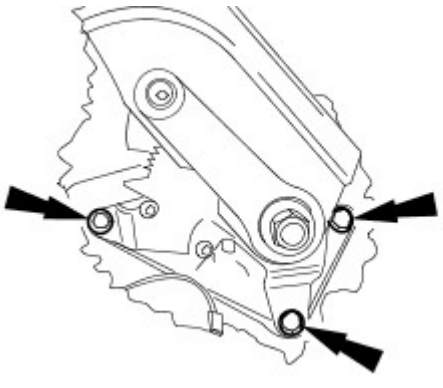
6. Remove trim from hand lever. Refer to operation 76.13.63.

7. Carefully reposition carpet from around hand lever for access.

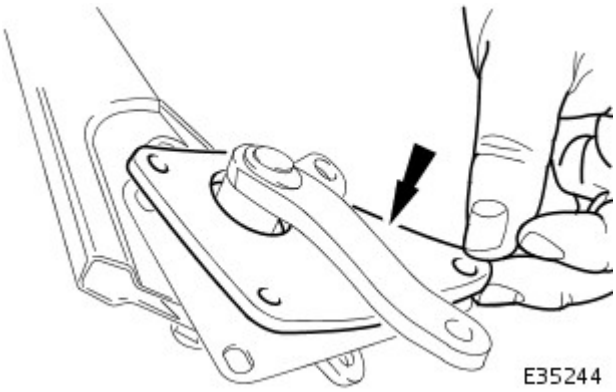
8. Disconnect parking-brake, warning-light switch connector.


E35241

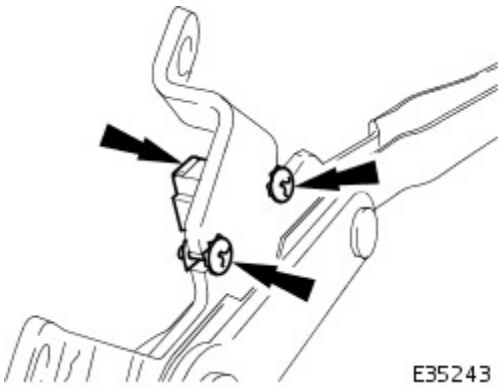
9. Remove hand lever from vehicle.



- Remove bolts.
- Remove lever.



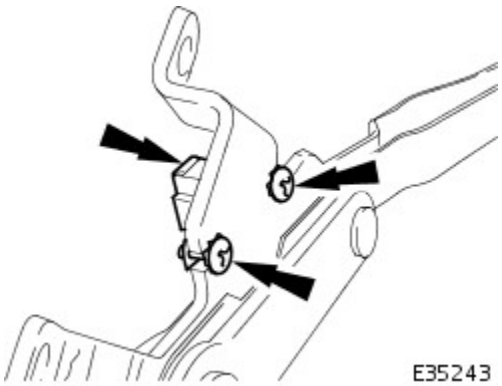
10. Remove gasket.



11. Remove warning-light switch from lever.

- Remove screws.
- Remove switch.

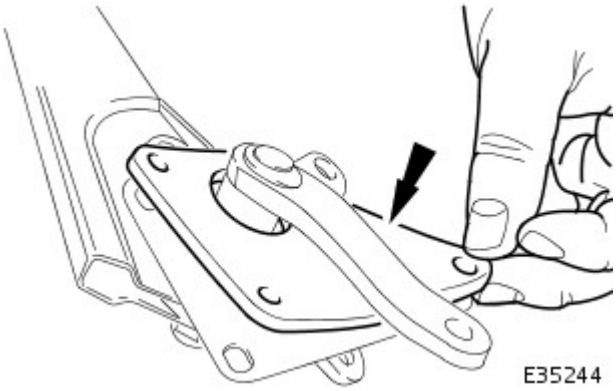
Installation



1. Install warning-light switch to hand lever.

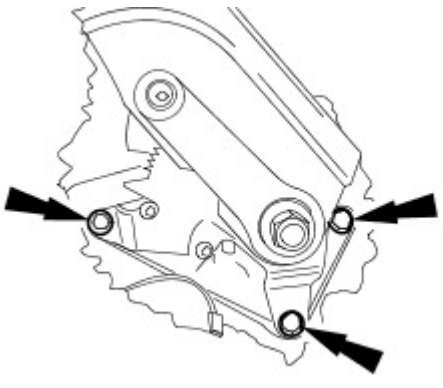
- Install and tighten screws to 3 Nm.

2. Install gasket to handbrake lever.

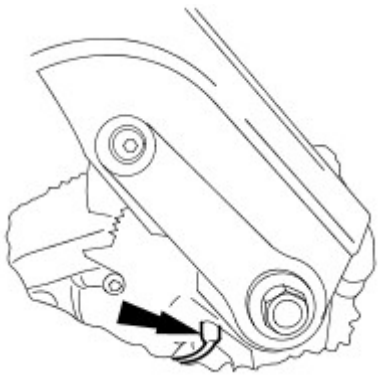


3. Install hand lever to vehicle.

- Install and tighten bolts to 22-28 Nm.



4. Connect parking-brake, warning-light switch connector.



5. Reposition carpet.

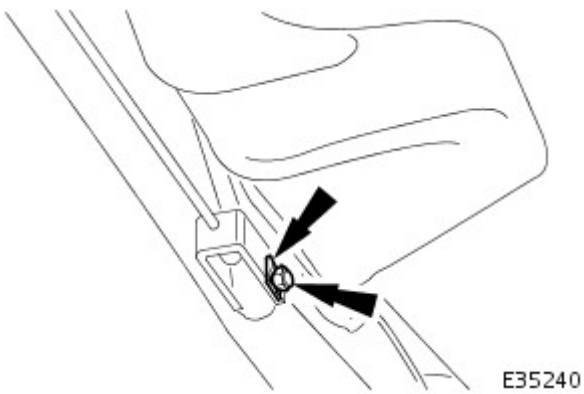
6. Install trim to hand lever. Refer to operation 76.13.63.

7. Install driver seat. Refer to operation 76.70.01.

8. Make sure parking brake is in the released position.

9. Connect parking brake cable.

- Align cable.
- Install clevis pin.
- Install clip.



10. Adjust parking brake. Refer to operation 70.35.10.

Parking Brake and Actuation - Parking Brake Control Shroud

Removal and Installation

Removal

1. Position handbrake lever fully up.
2. Remove trim from handbrake lever.

    1. Release press stud at top of handbrake lever trim.
    2. Ease lower moulding away from boss at base of lever and slide trim upwards.

Installation

1. Slide trim over handbrake lever and position lower moulding over boss.
2. Fasten press stud at top of trim.
3. Check that 'J' gate selector is in position P.
4. Lower handbrake lever, checking for freedom of movement.
5. Pull handbrake lever fully up.

Parking Brake and Actuation - Parking Brake Shoes

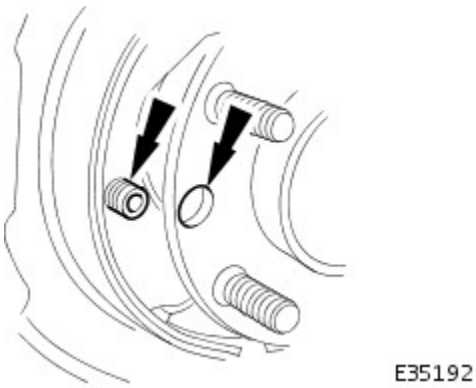
Removal and Installation

Removal

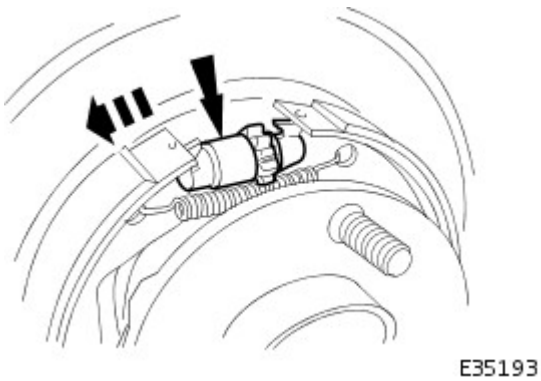
WARNING: BRAKE DUST, IF INHALED CAN DAMAGE YOUR HEALTH. ALWAYS REMOVE BRAKE DUST USING A VACUUM BRUSH. DO NOT USE A COMPRESSED-AIR LINE TO DISPERSE BRAKE DUST INTO THE ATMOSPHERE.

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

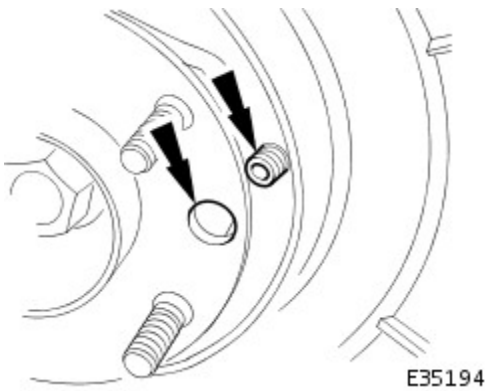
1. Raise rear of vehicle and support on stands. Refer to section 100-02.
2. Remove both rear wheels.
3. Remove both rear brake discs. Refer to operation 70.10.13.
4. Remove front shoe retaining pin.
   - Align hub access hole with retaining pin.
   - Turn pin until it releases from backing plate.


E35192

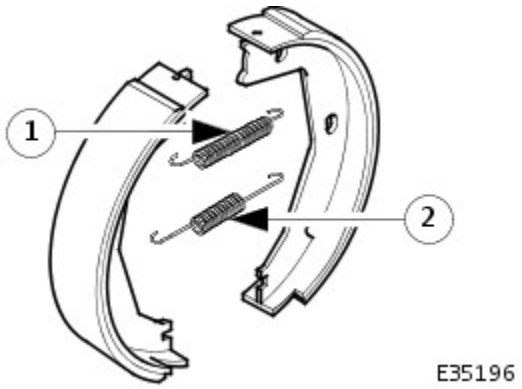
5. Remove adjuster assembly.
   - Move front shoe forwards.
   - Remove adjuster assembly.


E35193

6. Remove rear shoe retaining pin.
   - Align hub access hole with retaining pin.
   - Turn pin until it releases from backing plate.


E35194

7. Remove brake shoes from parking brake lever-mechanism and remove shoes from vehicle.
8. Remove return springs from shoes.



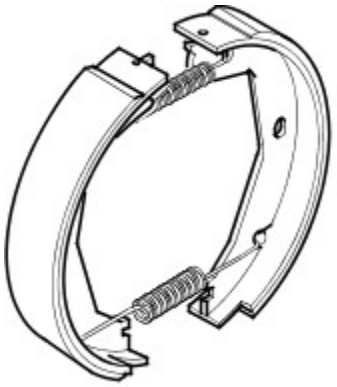
1. Remove upper return spring.

2. Remove lower return spring.

9. Remove brake dust and clean components, see WARNING above.

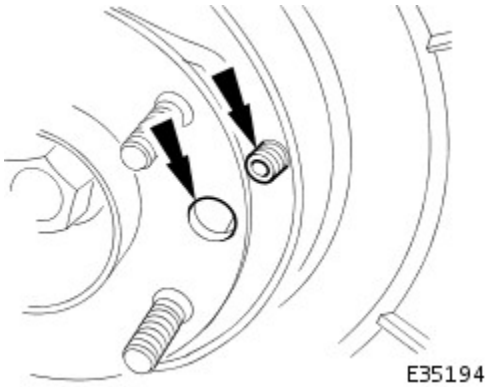
10. Repeat procedure to remove parking brake shoes on opposite side of vehicle.

Installation



1. Install brake shoes to vehicle.

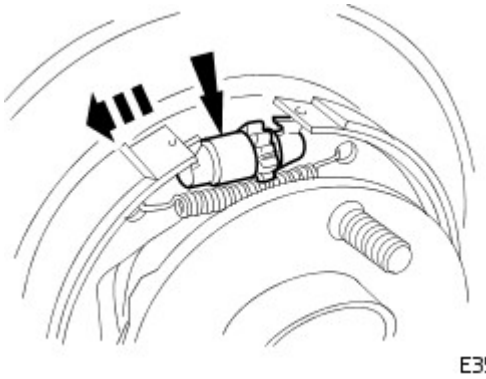
- Install brake shoes to parking brake lever-mechanism in the arrangement shown.



2. NOTE: Make sure retaining pin is seated correctly in backing plate.

Install rear shoe retaining pin.

- Align hub access hole.
- Install retaining pin.



3. Install adjuster assembly.

- Lubricate adjuster mechanism with appropriate grease.
- Move front shoe forwards.
- Install adjuster assembly.

4. NOTE: Make sure retaining pin is seated correctly in backing


E35192

plate.

Install front shoe retaining pin.

- Align hub access hole.
- Install retaining pin.

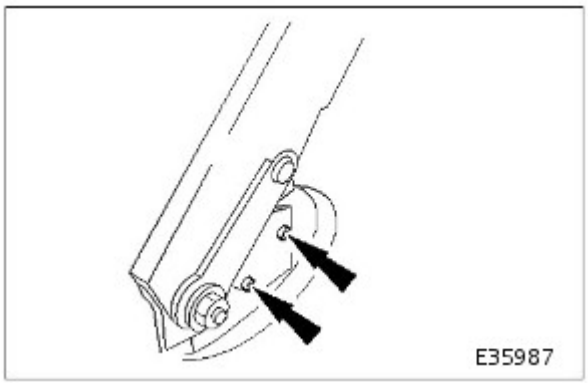
5. Make sure brake shoes are seated correctly in adjuster and lever mechanism.
6. Repeat procedure to install parking brake shoes on opposite side of vehicle.
7. Install both rear brake discs. Refer to operation 70.10.13.
8. Set parking brake. Refer to operation 70.35.37.
9. Fit rear wheels. See section 204-04.
10. Remove stands and lower vehicle.

Parking Brake and Actuation - Parking Brake Warning Indicator Switch

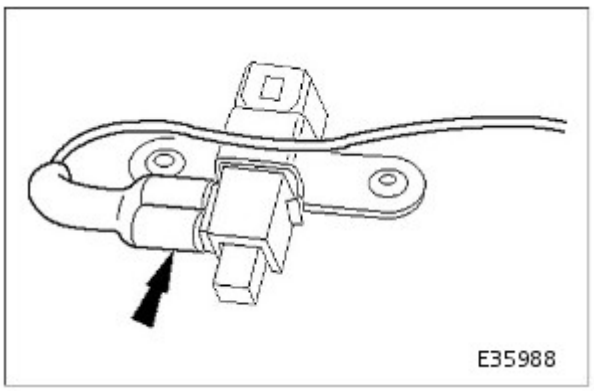
Removal and Installation

Removal

1. Remove driver seat for access. Refer to 76.70.01.
2. Raise hand lever fully.
3. Remove trim from hand lever. Refer to operation 76.13.63.
4. Remove screws securing switch to hand lever.

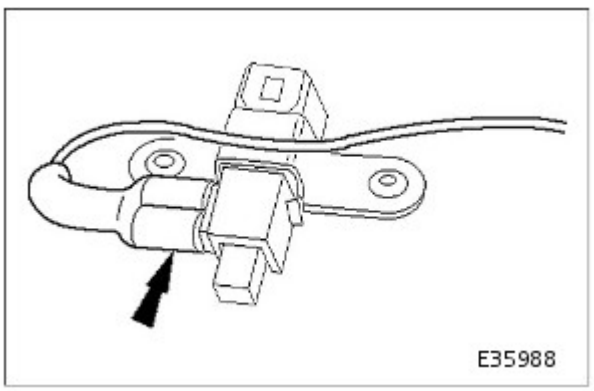


5. Disconnect electrical connector from switch.

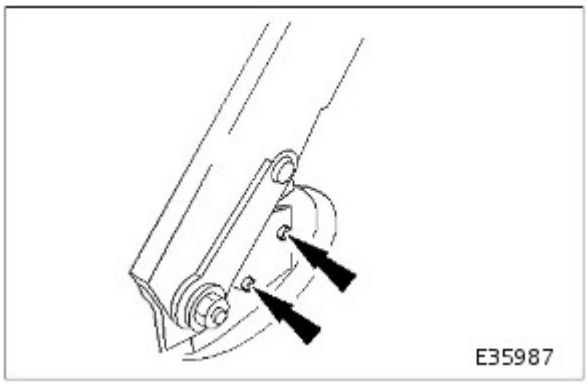


Installation

1. Disconnect electrical connector from switch.



2. Install switch to hand lever.
   - Install and tighten screws to 3 Nm.



3. Install trim to hand lever. Refer to operation 76.13.63.

4. Lower hand lever, checking for freedom of movement.

5. Fit driver seat. Refer to 76.70.01.

Hydraulic Brake Actuation -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Brake fluid	ITT Super Dot 4

Torques

Component	Nm
Nut - master cylinder to brake booster	21-29
Nut - brake pedal pivot-pin to pedal housing	17-23
Nut - brake switch to pedal housing	3
Nut - pedal housing to body	15-20
Nut - brake booster to pedal housing	22-28

Torques - Brembo Brakes

Component	Nm
Bleed nipple	12-16
Union bolt - brake hose to caliper	22-26

Brake Tube, Hoses and Bracket Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

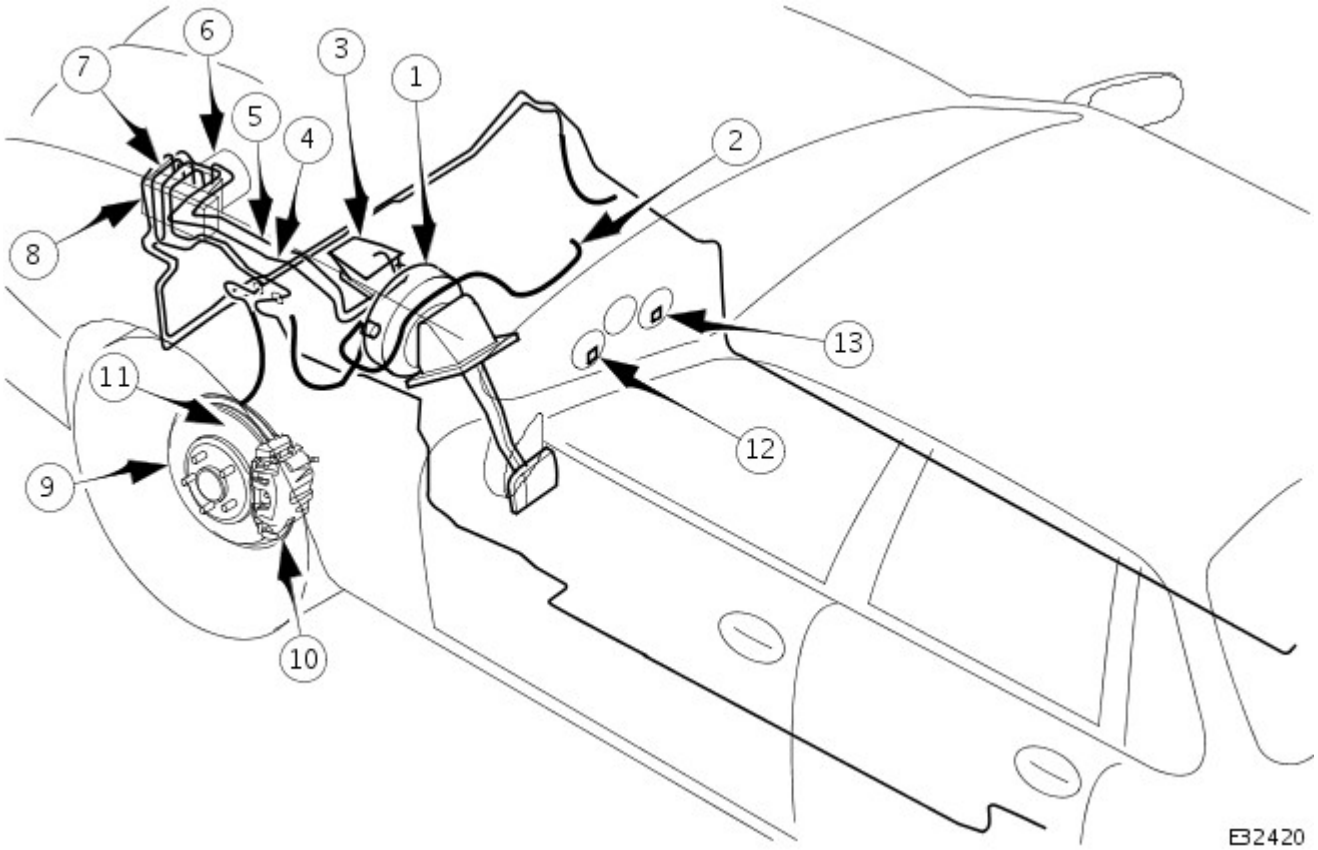
Component	Nm
Bleed nipple - front	4-6
Bleed nipple - rear	8-11
Hose to front caliper	10-14
Union to rear caliper - union bolt	30-40
M10 hose locknut	15-20
M10 brake tube female-nut	13-17
M10 brake tube male-nut	13-17
M12 brake tube male-nut	15-20
M18 brake tube male-nut	22-28
Brake tube clip retention-bracket to body	4-6

Hydraulic Brake Actuation - Hydraulic Brake Actuation

Description and Operation

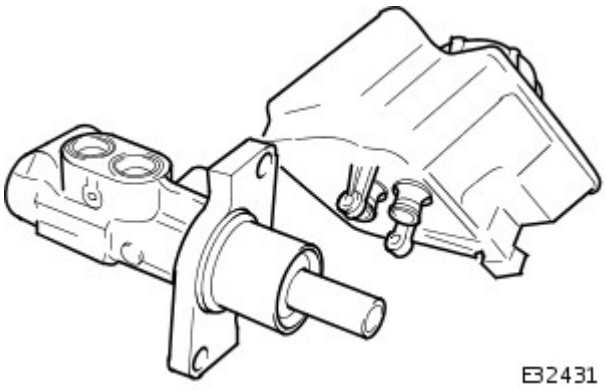
The hydraulic brake system is split in to two independent circuits: the primary circuit operates the front brakes and the secondary circuit operates the rear brakes. This type of system prevents complete brake failure in the event of a brake tube fracture.

The hydraulic brake system consists of the following components:



Item	Description
1	Pedal Housing / Booster - refer to 206-07
2	Vacuum Hose - refer to 206-07
3	Master Cylinder / Reservoir
4	Primary Brake Circuit
5	Secondary Brake Circuit
6	Hydraulic Pump / Motor Unit - refer to 206-09
7	ABS/Traction Control Control Module (ABS/TCCM) - refer to 206-09
8	Hydraulic Control Unit (HCU) - refer to 206-09
6/7/8	Brake Control Modulator
9	Brake Disc - refer to 206-03 or 206-04
10	Brake Caliper - refer to 206-03 or 206-04
11	Wheel Speed Sensor - refer to 206-09
12	ABS Warning Lamp - refer to 206-09
13	Brake Fluid Level Warning-Lamp

Master Cylinder and Reservoir



The tandem master cylinder contains two independent pistons, fluid pressure to each brake circuit is controlled by its own individual piston. Brake fluid is supplied to the master cylinder by the reservoir, which is divided into two sections to prevent total fluid loss should one of the circuits fail. A port situated at the bottom of each section of the reservoir supplies the fluid to each piston.

The fluid reservoir has a fluid-level indicator switch installed, which operates when the fluid level is low, causing the brake fluid level warning-lamp to illuminate.

Brake Caliper

The brake calipers are of the single piston type. The caliper carrier, which is secured to the vertical link by two bolts, carries the single-piston caliper housing. The caliper housing is secured to the caliper carrier by two guide-pins and an anti-rattle spring. When the brakes are applied, the caliper-housing piston pushes the brake pad in front of it, towards the brake disc. This movement forces the caliper housing to move along the guide-pins, in the opposite direction of the piston, to apply the second brake pad.

Brembo Brake Caliper

The four cylinder brake caliper is rigidly attached to the vertical link via an anchor bracket. The caliper is a split assembly with each side of the caliper, housing two pistons. The two-pairs of opposed pistons act directly on the brake pads mounted one each side of the disc.

Hydraulic Brake Actuation - Brake Fluid Reservoir

Removal and Installation

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.

2. Open engine compartment and fit paint work protection covers to fenders.

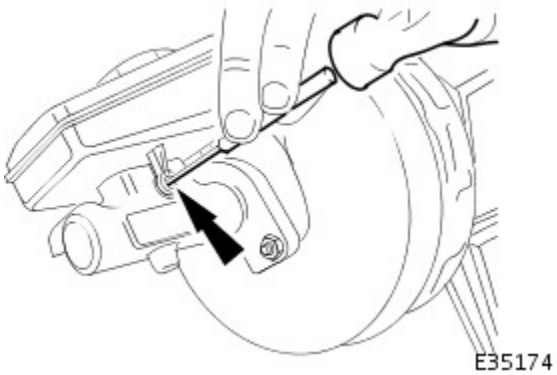
3. Disconnect battery ground cable (IMPORTANT, see operation 86.15.19 for further information).

4. Remove engine compartment rear cover. Refer to operation 76.11.35.

5. Remove pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

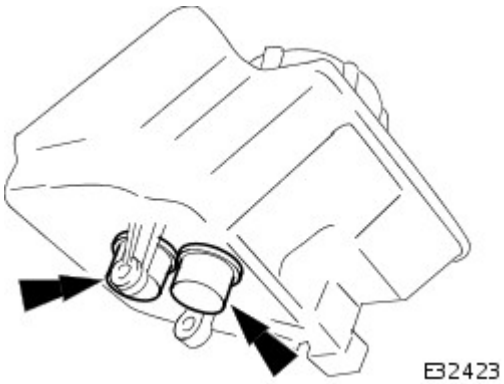
6. Remove reservoir filler cap and empty residual brake fluid into a container. Refit cap.

7. Remove fluid reservoir from master cylinder.

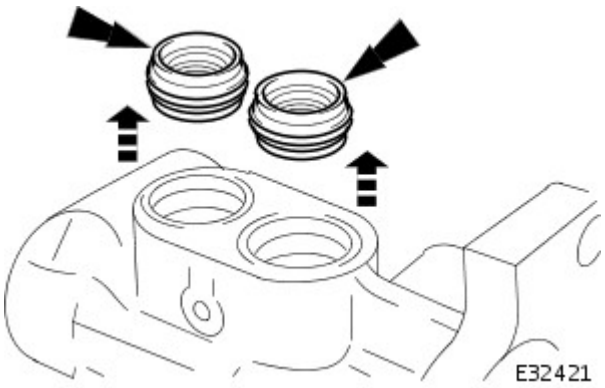


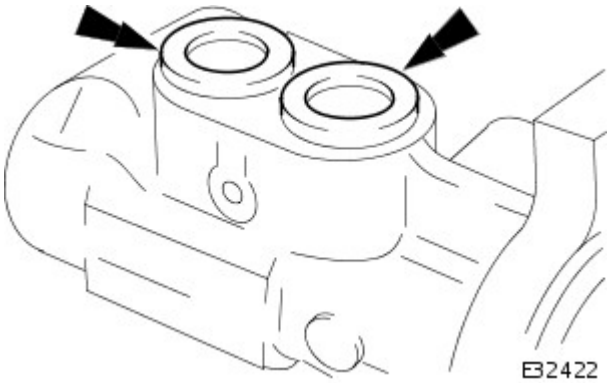
- Remove locating pin.
- Pull reservoir from master cylinder.

8. Install plugs into fluid reservoir ports.



9. Remove and discard seals from master cylinder.

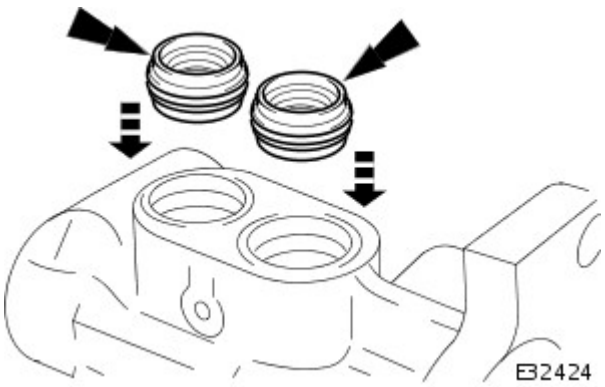




10. Install plugs into master cylinder ports.

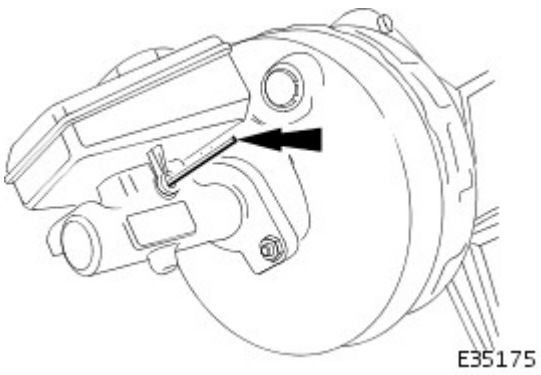
11. Clean components and mating surfaces.

Installation



1. Install seals into master cylinder.

- Remove plugs.
- Lubricate seals with clean brake fluid.
- Install seals.



2. Install reservoir to master cylinder.

- Remove plugs.
- Install reservoir, making sure reservoir is fully seated.
- Install locating pin.

3. Install pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

4. Install engine compartment rear cover. Refer to operation 76.11.35.

5. Reconnect battery ground cable (IMPORTANT, see operation

86.15.15 for further information).

6. Bleed brake system. Refer to operation 70.25.03.
7. Remove paint-work protection covers and close engine compartment.

Hydraulic Brake Actuation - Brake Master Cylinder

Removal and Installation

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.

2. Open engine compartment and fit paint work protection covers to fenders.

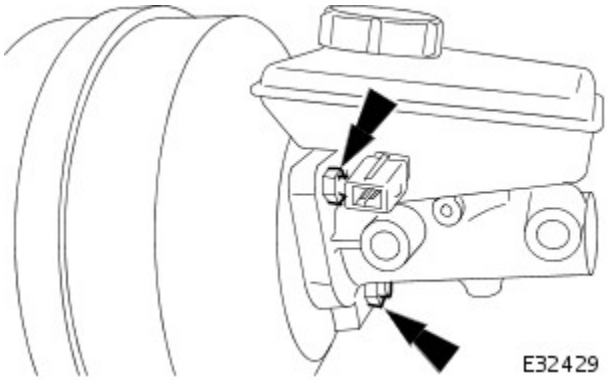
3. Disconnect battery ground cable (IMPORTANT, refer to operation 86.15.19 for further information).

4. Remove engine compartment rear cover. Refer to operation 76.11.35.

5. Remove pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

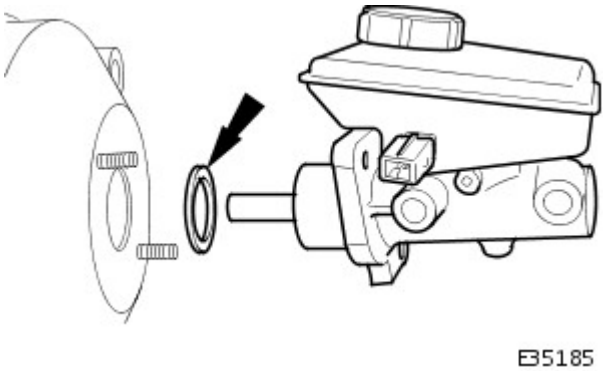
6. Place assembly on a work bench.

7. Remove nuts securing master cylinder to brake booster.



8. Remove master cylinder from brake booster.

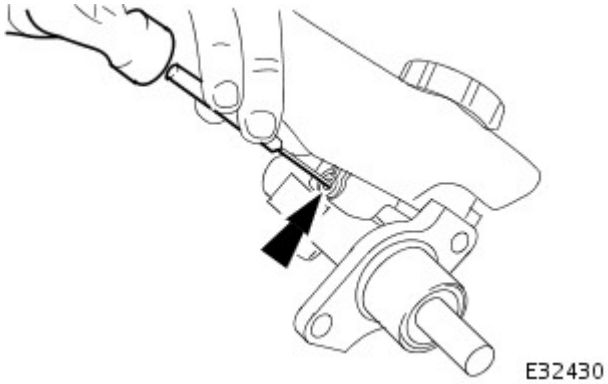
- Remove master cylinder.
- Remove and discard seal.



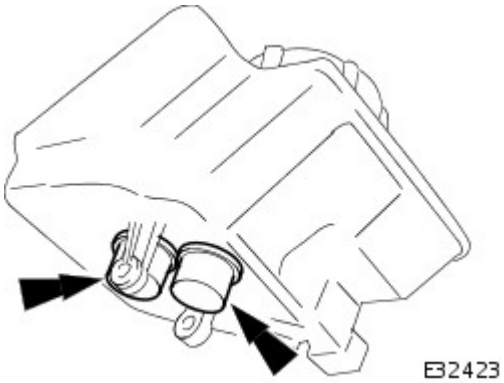
9. Remove filler cap and empty residual brake fluid into a container. Fit cap.

10. Remove fluid reservoir from master cylinder.

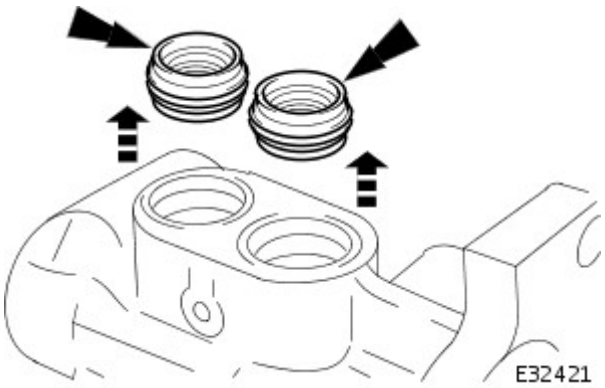
- Remove locating pin.
- Pull reservoir from master cylinder.



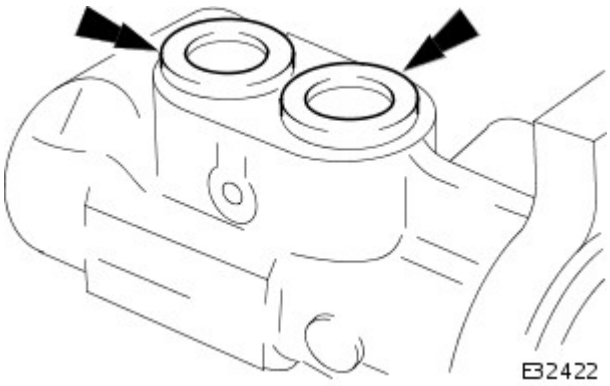
11. Install plugs into fluid reservoir ports.



12. Remove and discard seals from master cylinder.



13. Install plugs into master cylinder ports.

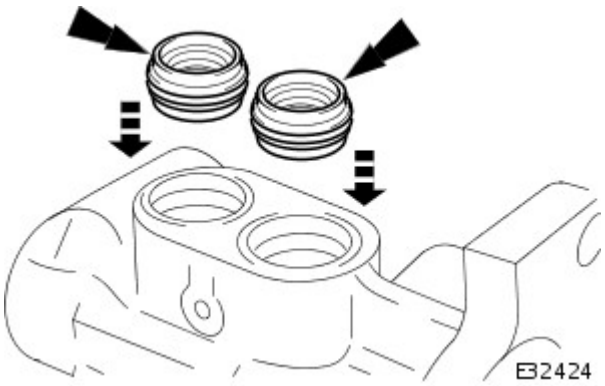


14. Clean components and mating surfaces.

Installation

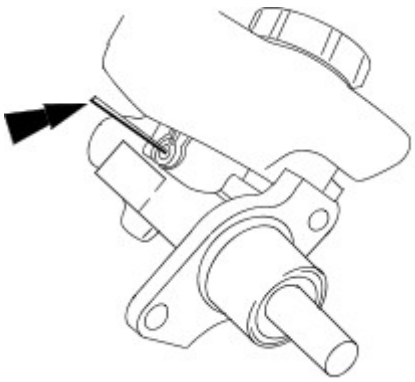
1. Install seals into master cylinder.

- Remove plugs.



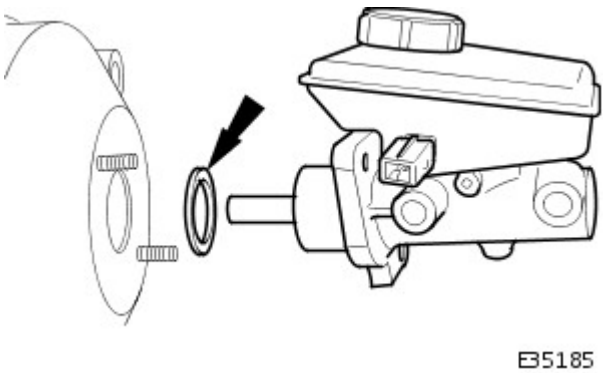
- Lubricate seals with clean brake fluid.
- Install seals.

2. Install fluid reservoir to master cylinder.



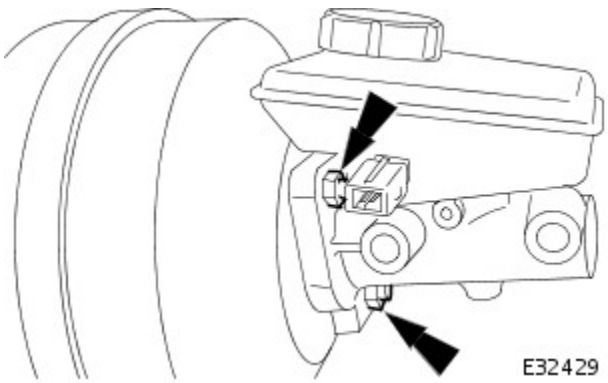
- Remove plugs from reservoir
- Install reservoir, making sure reservoir is fully seated.
- Install locating pin.

3. Install master cylinder to brake booster.



- Install seal.
- Install master cylinder, make sure master cylinder rod locates brake booster rod.

4. Install and tighten nuts to 21-29 Nm.



5. Install pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

6. Install engine compartment rear cover. Refer to operation 76.11.35.

7. Connect battery ground cable (IMPORTANT, see operation 86.15.15 for further information).

8. Bleed brake system. Refer to operation 70.25.03.

9. Remove paint-work protection covers and close engine compartment.

Hydraulic Brake Actuation - Brake Pedal and Bracket

Removal and Installation

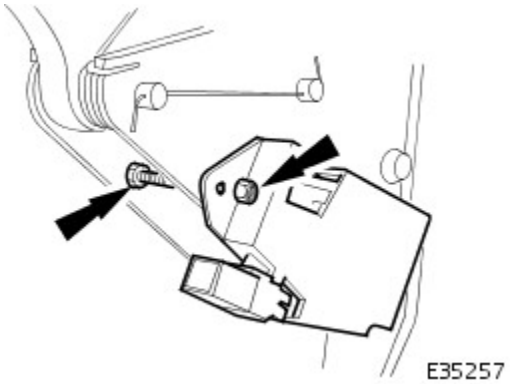
Removal

• CAUTIONS:

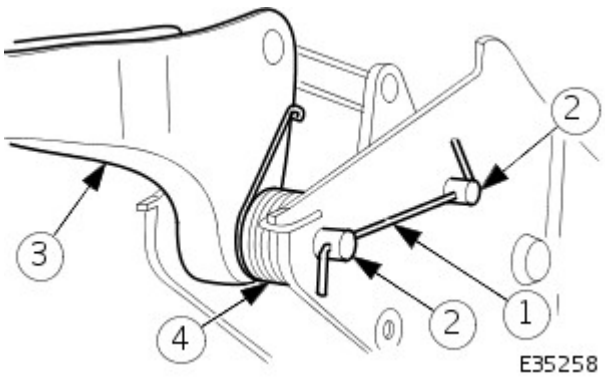
Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.
2. Open hood and fit suitable paintwork protection equipment.
3. Disconnect battery ground cable. (IMPORTANT, see 86.15.19 for further information).
4. Remove engine compartment rear cover. Refer to operation 76.11.35.
5. Remove pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.
6. Remove brake booster and master cylinder assembly. Refer to operation 70.50.18.
7. Remove brake warning-light switch.
   - Remove nut and bolt.
   - Slide switch forward to release from locating tag.



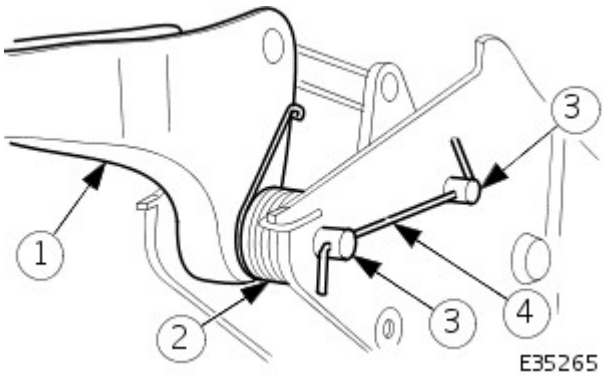
8. Remove throttle pedal assembly.
   1. Remove and discard retaining wire.
   2. Remove pivot pins.
   3. Remove throttle pedal assembly.
   4. Remove return spring.



9. Clean components and mating surfaces.

Installation

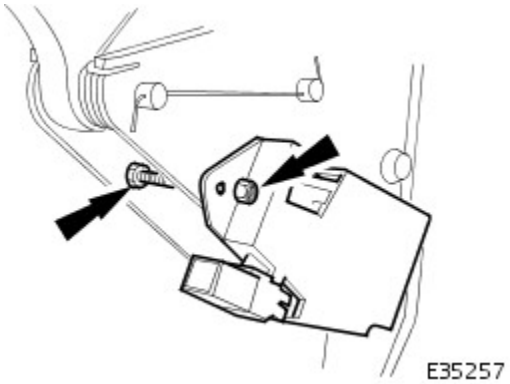
1. Apply grease to pivot pins.
2. Install throttle pedal assembly.
   1. Align throttle assembly.



2. Align return spring.

3. Install pivot pins.

4. Install retaining wire: bend ends of wire to secure pivot pins.



3. Install brake warning-light switch.

- Install switch onto locating tag.
- Install and tighten nut and bolt to 3Nm.

4. Install brake booster and master cylinder assembly. Refer to operation 70.50.18.

5. Install pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

6. Bleed brake system. Refer to operation 70.25.03.

7. Install engine compartment rear cover. Refer to operation 76.11.35.

8. Connect battery ground cable. (IMPORTANT, see 86.15.19 for further information).

Hydraulic Brake Actuation - Brake Pedal and Bracket, Brake Booster and Brake Master Cylinder

Removal and Installation

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.

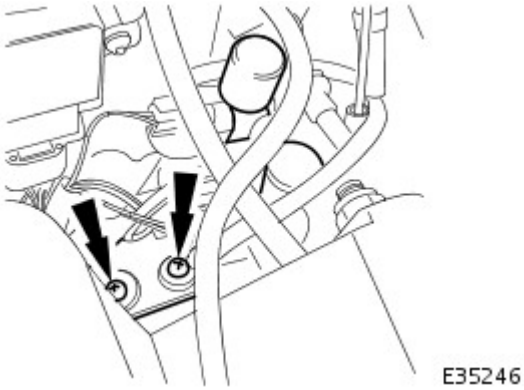
2. Open engine compartment and fit paint work protection covers to fenders.

3. Disconnect battery ground cable (IMPORTANT, refer to operation 86.15.19 for further information).

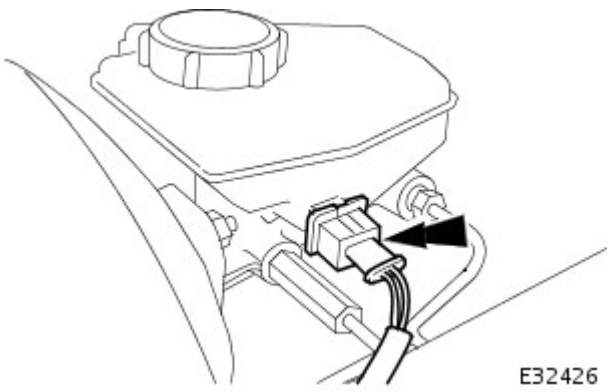
4. Remove engine compartment rear cover. Refer to operation 76.11.35.

5. Reposition the mounting bracket of the cruise control vacuum-valves for access (if installed).

- Remove screws.
- Reposition bracket.

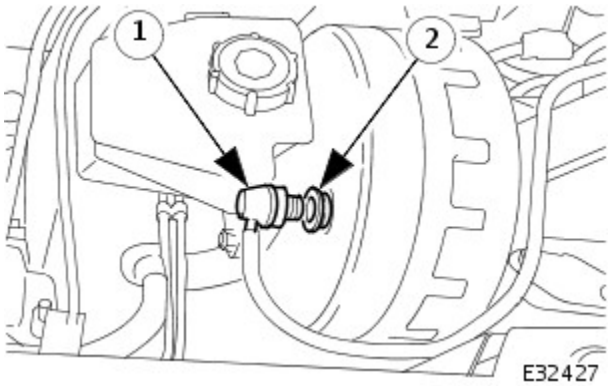


6. Disconnect low-level warning connector from master cylinder.



7. Disconnect vacuum pipe from brake booster.

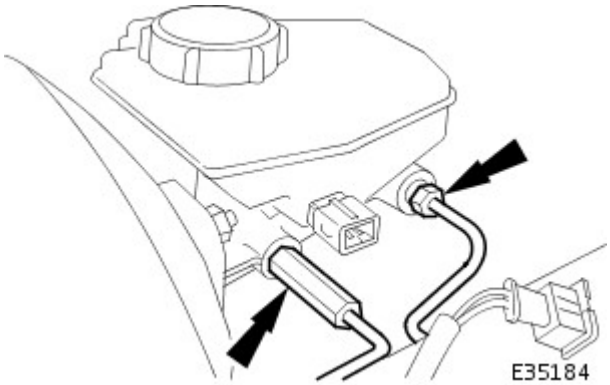
1. Disconnect pipe.
2. Remove and discard seal.



8. Position absorbent cloth underneath master cylinder to collect brake fluid spillage.

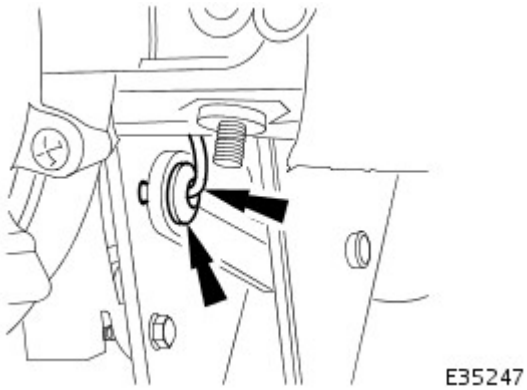
9. Disconnect brake tubes from master cylinder.

- Install plugs to brake tubes and master cylinder ports.



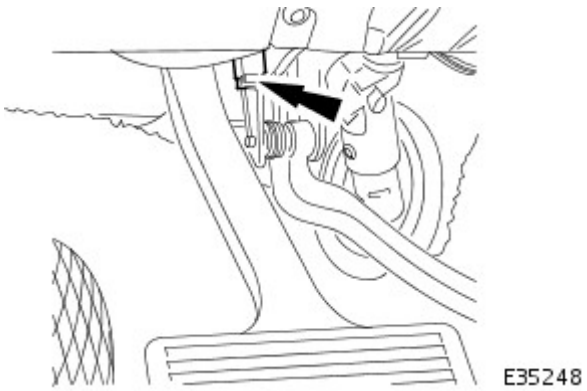
10. From driver footwell, disconnect throttle inner cable from pedal.

- Remove grommet.
- Release cable from pedal.



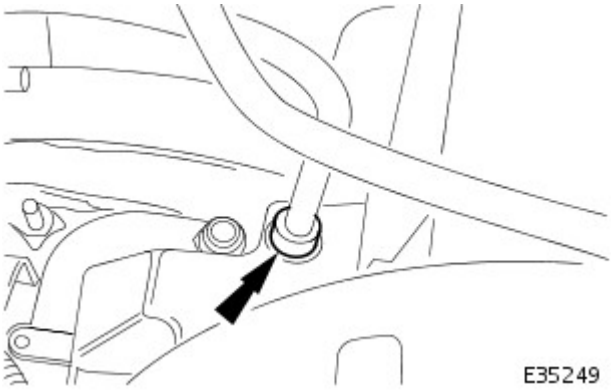
11. Disconnect stop-lamp-switch connector.

- Move carpet.
- Disconnect electrical connector.

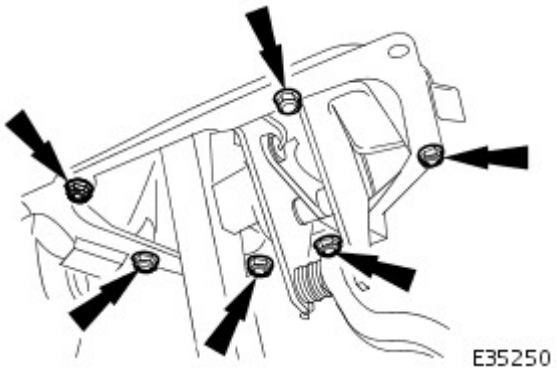


12. From engine compartment, remove throttle cable from pedal housing.

- Release grommet.

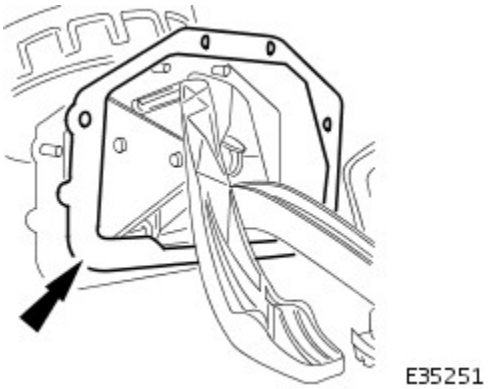


- Pull cable from pedal housing.



13. Remove pedal housing, brake booster and master cylinder assembly from vehicle.

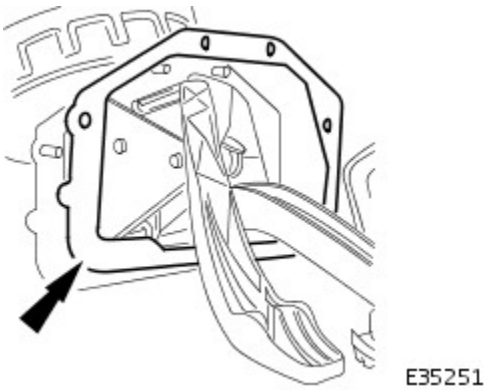
- From driver footwell, remove nuts.
- Carefully remove assembly.



14. Remove and discard gasket from pedal housing.

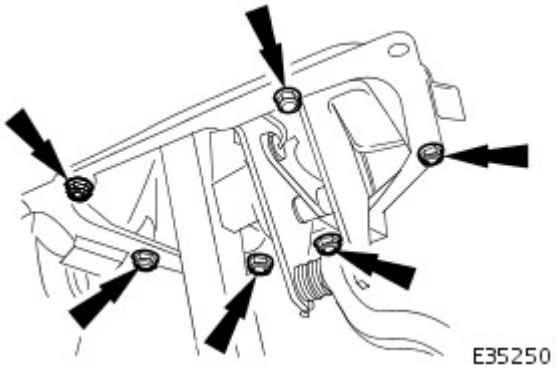
15. Clean components and mating surfaces.

Installation



1. Install gasket to pedal housing assembly.

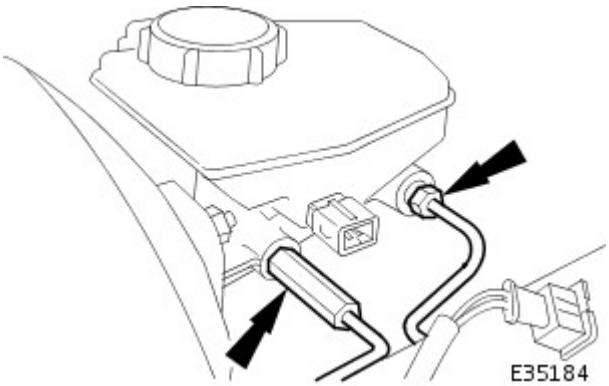
2. CAUTION: Make sure no pipes or cables become trapped when fitting the pedal housing assembly.



Install pedal housing to vehicle.

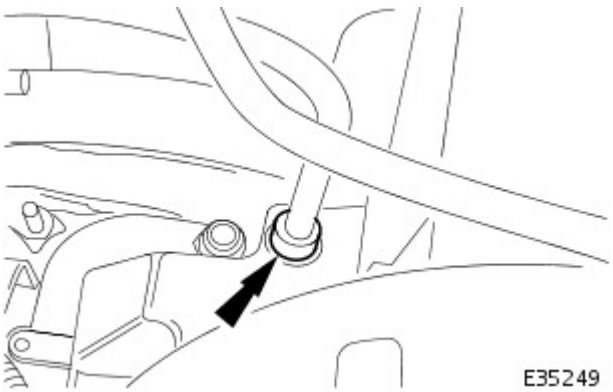
- Make sure pedal housing aperture is positioned correctly.
- Install and tighten nuts to 15-20 Nm.

3. Position cloth underneath master cylinder to collect brake fluid spillage.



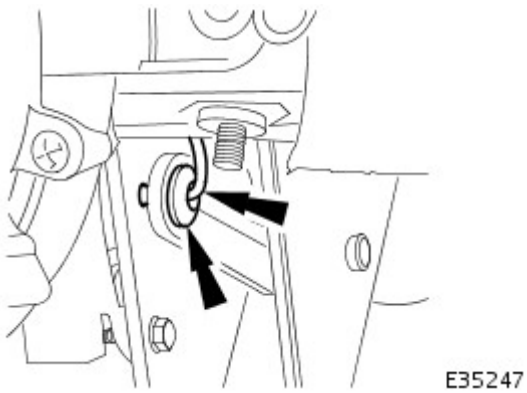
4. Install brake tubes to master cylinder.

- Remove plugs.
- Connect and tighten brake tubes. Refer to Specification section 206-06 for torque setting.
- Remove cloth from underneath master cylinder.



5. Connect throttle cable to pedal housing.

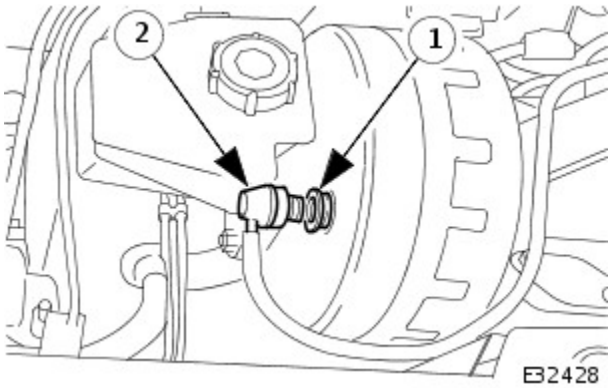
- Install cable to grommet.
- Install cable to pedal housing.

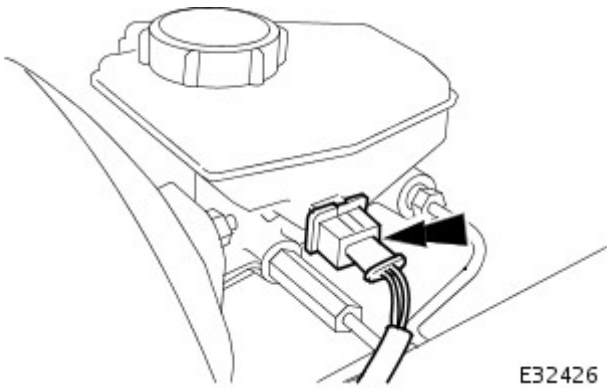


6. Connect throttle inner cable to pedal grommet.

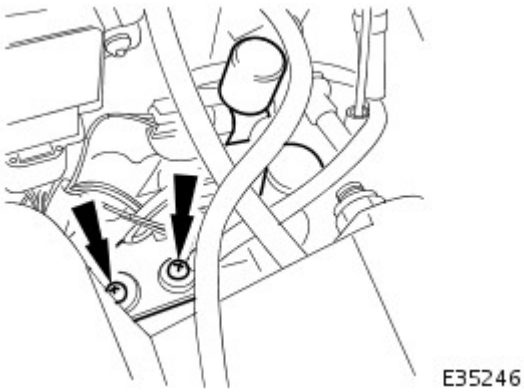
7. Connect vacuum pipe elbow to brake booster.

1. Install new seal.
2. Connect pipe.



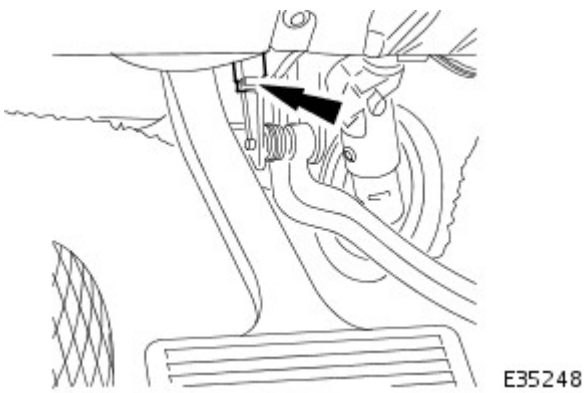


8. Connect low-level warning connector to master cylinder.



9. Install cruise control vacuum-valves, mounting bracket.

- Install and tighten bolts.



10. Connect stop lamp switch connector.

- Connect connector.
- Reposition carpet.

11. Connect battery ground cable (IMPORTANT, see operation 86.15.15 for further information).

12. Bleed brake system. See operation 70.25.03.

13. Install engine compartment rear cover. Refer to operation 76.11.35.

14. Remove paint-work protection covers and close engine compartment.

15. Connect battery ground cable (IMPORTANT, refer to operation 86.15.19 for further information).

Power Brake Actuation -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Brake fluid	ITT Super Dot 4

Brake Ratio

Front Brakes	65 per cent
Rear Brakes	35 per cent

Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Nut - master cylinder to brake booster	21-29
Nut - brake pedal pivot-pin to pedal housing	17-23
Nut - brake switch to pedal housing	3
Nut - pedal housing to body	15-20
Nut - brake booster to pedal housing	22-28

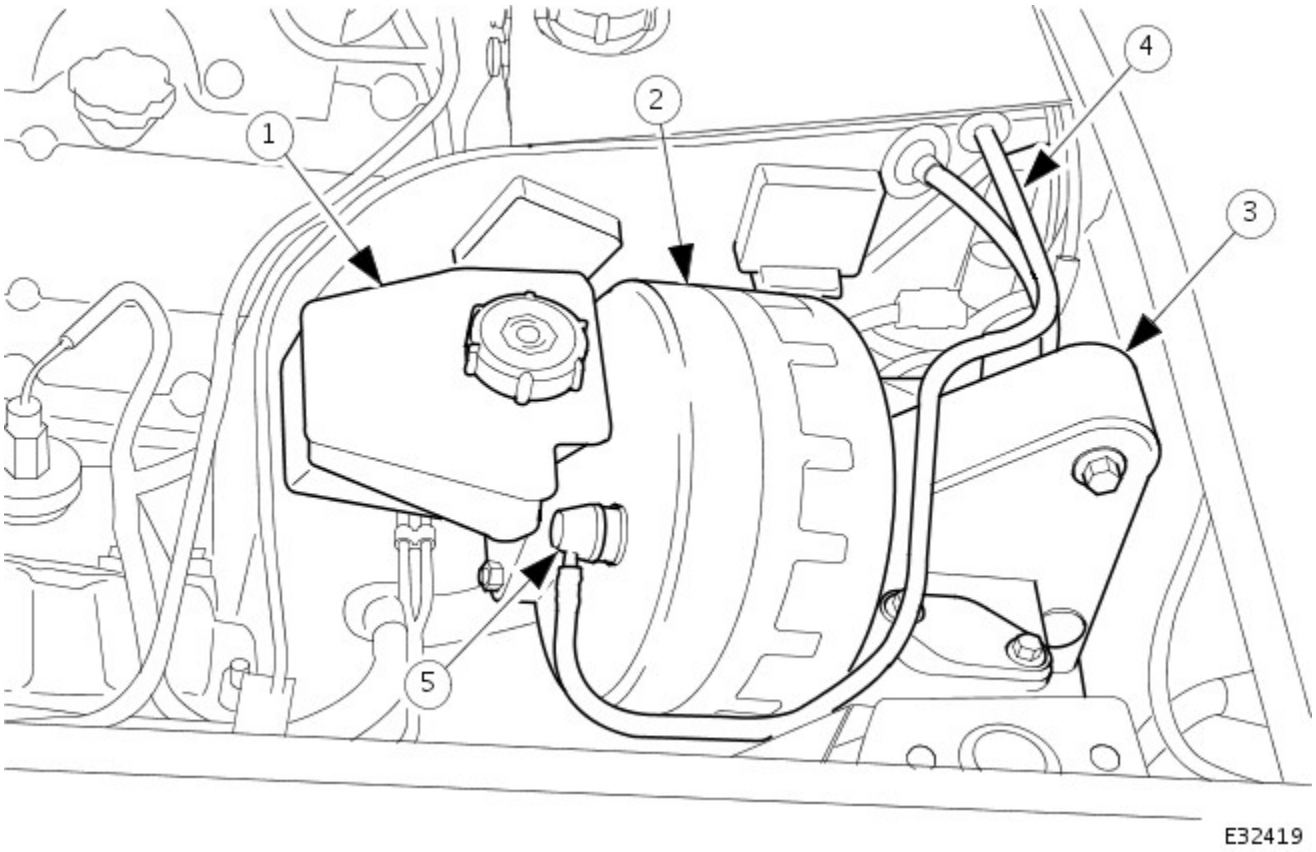
Brake Tube, Hoses and Bracket Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Bleed nipple - front	4-6
Bleed nipple - rear	8-11
Hose to front caliper	10-14
Hose banjo to rear caliper - bolt	30-40
M10 hose locknut	15-20
M10 brake tube female-nut	13-17
M10 brake tube male-nut	13-17
M12 brake tube male-nut	15-20
Bolt - 3-way tube connector to body	9-12

Power Brake Actuation - Brake Booster

Description and Operation



Item	Part Number	Description
1	—	Master Cylinder / Reservoir - refer to 206-06
2	—	Booster
3	—	Pedal Box - refer to 206-06
4	—	Vacuum Hose
5	—	Non-Return Valve

- The brake booster provides assistance by reinforcing the driver's effort when braking. The reinforced assistance provided by the booster is proportional to the driver's effort applied to the brake pedal.
- The brake force applied by the driver is increased by the booster in a ratio of 6.5:1.
- The vacuum used to operate the booster is formed in the engine's intake manifold. The booster is connected to the intake manifold by a hose.
- The booster is fail-safe therefore, if a fault develops in the vacuum unit, the braking system will still function. However, the driver will have to apply a greater force to the brake pedal to slow down the vehicle.

Power Brake Actuation - Brake Booster

Removal and Installation

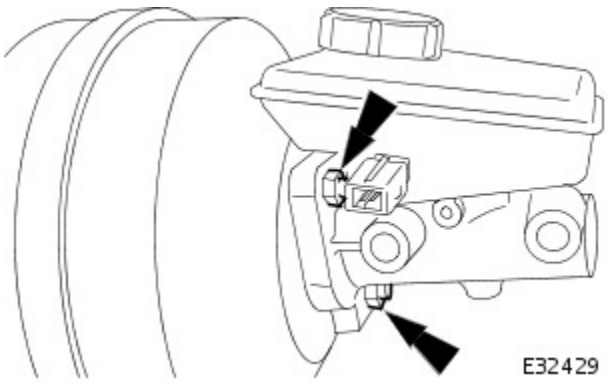
Removal

• CAUTIONS:

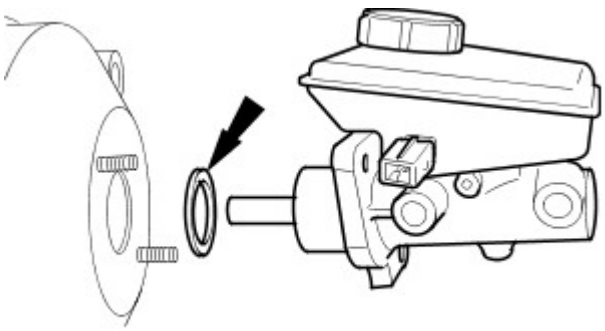
Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.
2. Open engine compartment and fit paint work protection covers to fenders.
3. Disconnect battery ground cable (IMPORTANT, see operation 86.15.19 for further information).
4. Remove engine compartment rear cover. Refer to operation 76.11.35.
5. Remove pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.
6. Remove brake booster and master cylinder assembly. Refer to operation 70.50.18.
7. Remove nuts securing master cylinder to brake booster.



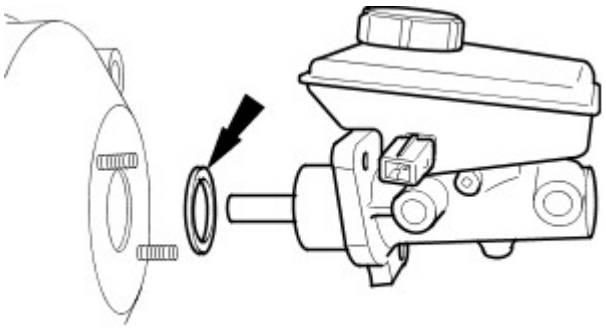
8. Remove master cylinder from brake booster.
   - Remove master cylinder.
   - Remove and discard seal.



9. Remove filler cap and empty residual brake fluid into a container.
10. Clean components and mating surfaces.

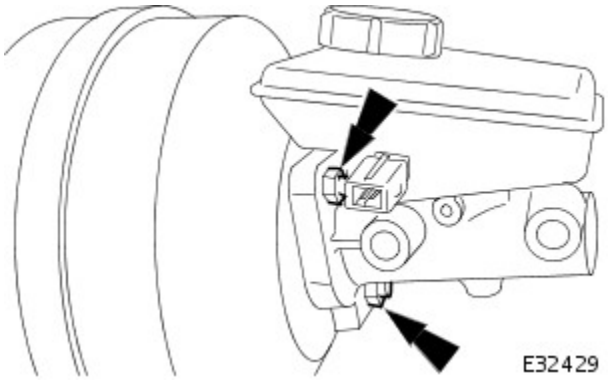
Installation

1. Install master cylinder to brake booster.
   - Install seal to master cylinder.



E35185

- Install master cylinder, make sure master cylinder rod locates brake booster rod.



E32429

2. Install and tighten nuts to 21-29 Nm.

3. Install brake booster and master cylinder assembly. Refer to operation 70.50.18.

4. Install pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

5. Install engine compartment rear cover. Refer to operation 76.11.35.

6. Reconnect battery ground cable (IMPORTANT, see operation 86.15.15 for further information).

7. Bleed brake system. Refer to operation 70.25.03.

8. Remove paint-work protection covers and close engine compartment.

Power Brake Actuation - Brake Booster and Brake Master Cylinder

Removal and Installation

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Remove brake fluid spillage immediately from paint work, with clean water.

1. Position vehicle on a four-post lift.

2. Move driver's seat fully rearward.

3. Open engine compartment and fit paint work protection covers to fenders.

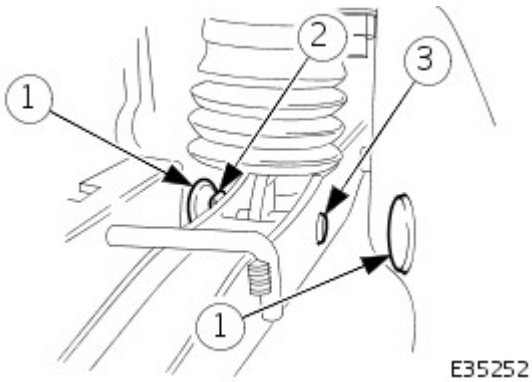
4. Disconnect battery ground cable (IMPORTANT, see operation 86.15.19 for further information).

5. Remove engine compartment rear cover. Refer to operation 76.11.35.

6. Remove pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

7. Remove reservoir filler cap and pour residual brake fluid into a container. Refit cap.

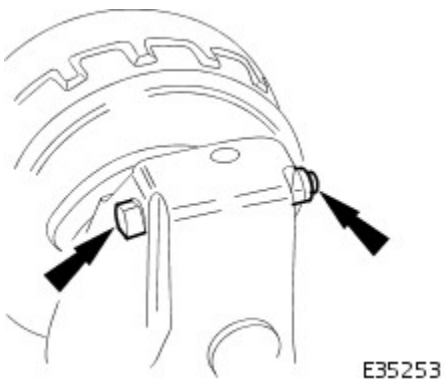
8. Remove the clevis pin connecting the brake pedal to the master cylinder push-rod fork.



E35252

1. Remove grommets from access holes.
2. Remove retaining clip.
3. Remove clevis pin.

9. Reposition the brake pedal to access the nuts securing the brake booster to the pedal housing.

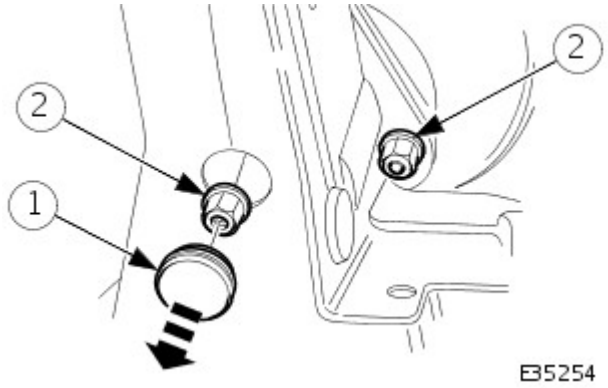

E35253

1. Remove pivot pin nut.
2. Remove pivot pin.

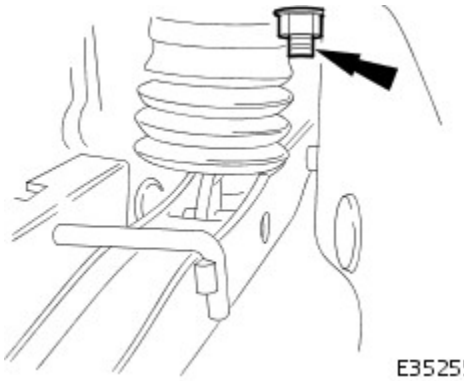
- Reposition brake pedal.

10. Remove brake booster from pedal housing.

1. Remove grommet from access hole.
2. Remove nuts.

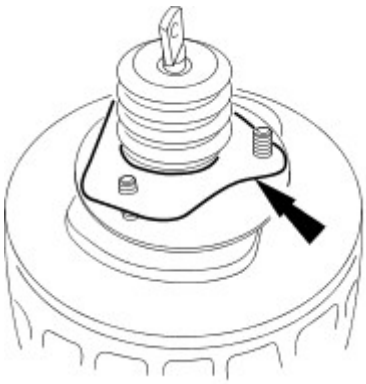


E35254


E35255

11. Remove brake booster from pedal housing.

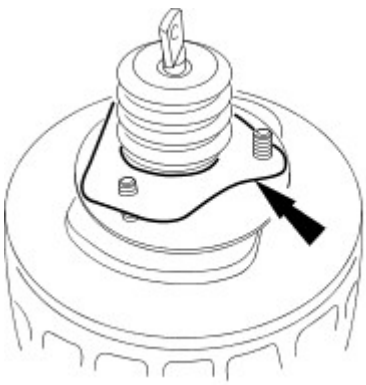
- Remove nut.
- Remove brake booster from pedal housing.
- Remove brake pedal from pedal housing.


E35256

12. Remove and discard gasket from brake booster.

13. Clean components and mating surfaces.

Installation


E35256

1. Install gasket to brake booster.

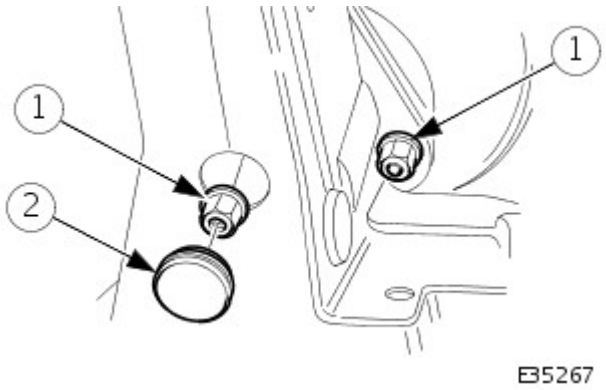
2. Position brake pedal into pedal housing.

- Apply grease to push-rod fork.

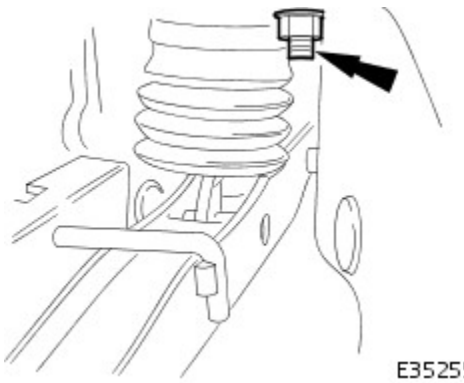
- Apply grease to brake pedal pivots.
- Position brake pedal.

3. Install brake pedal housing to brake booster.

- When installing brake booster, make sure push-rod locates inside brake pedal shaft.
  1. Install and tighten nuts to 22-28 Nm.
  2. Install grommet.

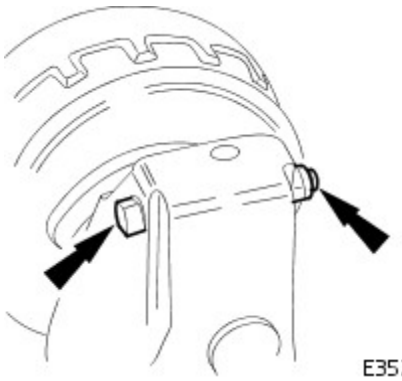


E35267


E35255

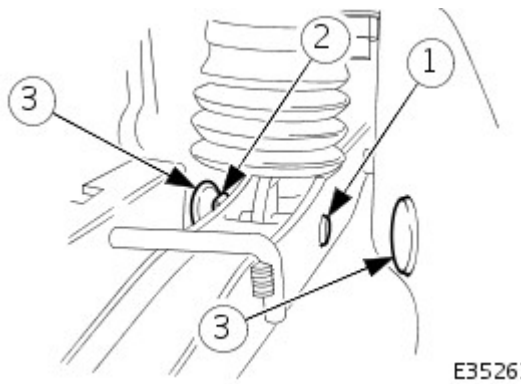
4. Install final securing nut.

- Tighten nut to 22-28 Nm.


E35253

5. Install brake pedal to pedal housing.

- Install pivot pin.
- Install nut and tighten to 17-23 Nm.



E35263

6. Install clevis pin connecting the brake pedal to the master cylinder push-rod fork.

- Apply grease to the clevis pin.
  1. Install clevis pin.
  2. Install retaining clip.
  3. Install grommets.

7. Install pedal housing, brake booster and master cylinder assembly. Refer to operation 70.35.39.

8. Install engine compartment rear cover. Refer to operation 76.11.35.

9. Reconnect battery ground cable (IMPORTANT, see operation 86.15.15 for further information).

10. Bleed brake system. Refer to operation 70.25.03.

11. Remove paint-work protection covers and close engine compartment.

Anti-Lock Control -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Brake fluid	ITT Super Dot 4

Torques

Component	Nm
Bolt - front wheel speed sensor	8-10
Bolt - rear wheel speed sensor	8-10
Bolt - hydraulic control unit to bracket	8-10
Bolt - hydraulic control unit bracket to body	10-14
Hub rotor nut	270-330

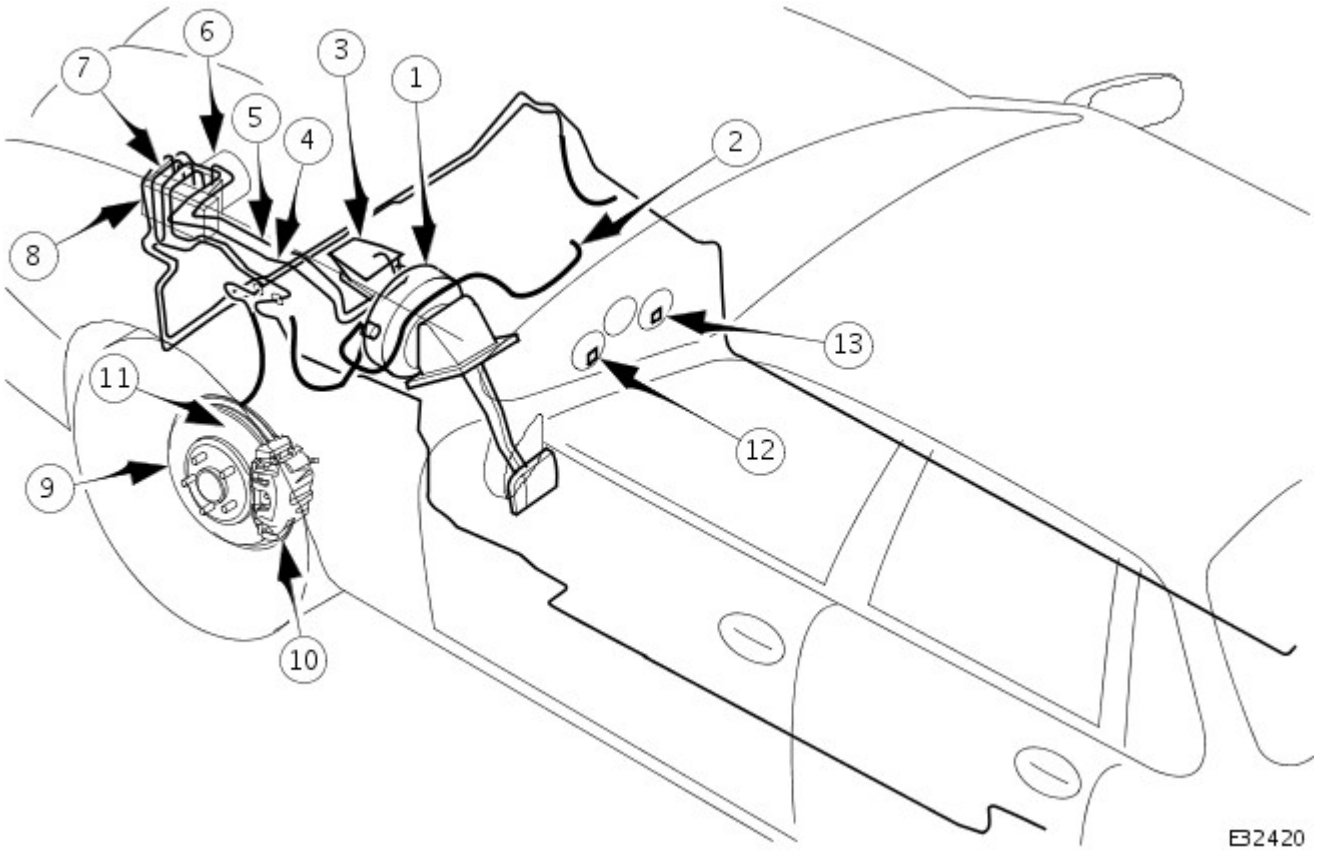
Brake Tube, Hoses and Bracket Torques

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

Component	Nm
Bleed nipple - front	4-6
Bleed nipple - rear	8-11
Hose to front caliper	10-14
Hose banjo to rear caliper - bolt	30-40
M10 hose locknut	15-20
M10 brake tube female-nut	13-17
M10 brake tube male-nut	13-17
M12 brake tube male-nut	15-20
M18 brake tube male-nut	22-28
Brake tube clip retention-bracket to body	4-6

Anti-Lock Control - Anti-Lock Control

Description and Operation



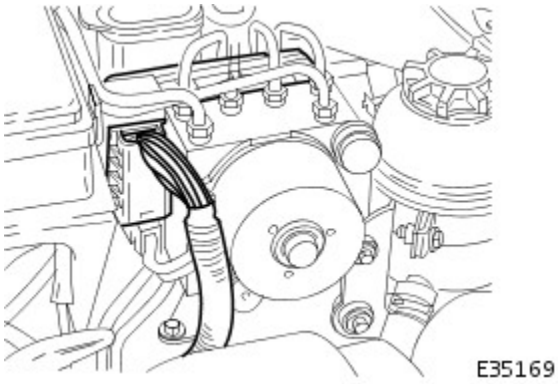
Item	Description
1	Pedal Housing / Booster - refer to 206-07
2	Vacuum Hose - refer to 206-07
3	Master Cylinder / Reservoir - refer to 206-06
4	Primary Brake Circuit - refer to 206-06
5	Secondary Brake Circuit - refer to 206-06
6	Hydraulic Pump / Motor Unit
7	ABS/Traction Control Control Module (ABS/TCCM)
8	Hydraulic Control Unit (HCU)
6/7/8	Brake Control Modulator
9	Brake Disc - refer to 206-03 or 206-04
10	Brake Caliper - refer to 206-03/206-04
11	Wheel Speed Sensor
12	ABS Warning Lamp
13	Brake Fluid Level Warning-Lamp - refer to 206-06

Wheel Speed Sensors

Each wheel is monitored by a wheel speed sensor, to detect the speed of movement of a toothed gear that is driven by the wheel. Signal's generated by the toothed gear passing the sensor are sent to the ABS/TCCM to communicate the speed of wheel rotation and any rapid change of wheel speed.

The frequency of the sinusoidal output voltage signal from the sensor, is proportional to road wheel rotational speed and the number of teeth on the toothed gear. The amplitude of the voltage is dependent upon the 'air gap' between the sensor and toothed wheel, therefore it is important that this preset gap remains clear and undisturbed.

Brake Control Modulator



The brake control modulator comprises:

- a ABS/TCCM
- a hydraulic control unit,
- an electrically driven hydraulic pump,
- two low pressure accumulators and damping chambers.

ABS / TCCM

The ABS/TCCM is integrated with the hydraulic control unit. It houses the solenoids that operate the hydraulic control unit's input and return valves; the valve stems locate into the ABS/TCCM's solenoids. There is no electrical connection between the ABS/TCCM and the hydraulic control unit.

The ABS/TCCM constantly monitors the brake electronic system by passing self-checking electrical pulses around the circuit. The self check procedures carried-out by the ABS/TCCM are listed below:

1. **1.** Monitoring of the operating voltage: the control module will shut-down should the voltages not be (approximately) in the range of 9 to 19V.

2. **2.** The pump is monitored for voltage supply and voltage feedback.

3. **3.** Monitoring for disturbance, where a failure may be caused by external radio frequency interference, internal leakage current, defective valve transistor or a faulty valve.

4. **4.** Internal controller failure, detected by a RAM and ROM test.

5. **5.** The controller area network (CAN) micro-controller checks for correct operation of the communication network and performs a RAM self-check.

   CAUTION: Disconnection of ABS/TCCM connectors may introduce other fault codes. Following rectification and reconnection, ensure that no induced codes exist.

   5.

Signals processed by the ABS/TCCM are also sent to the CAN for vehicle use, such as the instrument cluster speed display, cruise control and stability/traction control.

Hydraulic Control Unit

Control of the fluid pressure to the front and rear brakes is by means of the valves contained in the hydraulic control unit. The valves are operated by solenoids housed in the ABS/TCCM.

Hydraulic Pump

The hydraulic pump is integrated with the hydraulic control unit.

- It is a reciprocating two-circuit pump in which one brake circuit is assigned to each pump circuit.
- It supplies the fluid pressure and volume to supply the brake circuits under ABS and Traction control.
- The pump is driven by an electric motor, with the pump housing incorporating two low pressure accumulators and damping chambers for each brake circuit.
- The accumulator stores the pressure and smooths out the output pulses from the pump.

ABS Warning Lamp

The system will be set in a fail-safe mode if a problem is detected; a warning lamp on the instrument panel will notify the driver there is a problem.

Anti-Lock Braking System (ABS)

The ABS components are combined with an hydraulic booster and a tandem master cylinder to provide a two circuit braking system. The system comprises, four wheel speed sensors, a brake control modulator and an ABS warning lamp.

Should a wheel start to lock-up during braking a signal transmitted from the wheel speed sensor to the brake control modulator will start the hydraulic pump. The brake control modulator will close the input valve of the line connected to the locked-wheel to stop any increase in fluid pressure to the brake caliper. If this fails to prevent the wheel locking, the pressure in the caliper will be decreased by opening the return valve until the wheel starts accelerating again. The fluid pressure from the return valve is directed into the low pressure accumulator, housed in the pump.

From the low pressure accumulator, fluid is pumped through the damping chamber to the brake master cylinder. The pressure to the brake caliper will then be increased in small steps to maintain maximum adhesion between the tire and road surface. This is achieved by closing the return valve, and opening the input valve and using the hydraulic pump to increase the pressure.

Although the system senses all four wheels independently, the rear wheels are regulated as a pair. If a sensor on a rear wheel detects a wheel decelerating rapidly, then the fluid pressure to both wheels is reduced. The fluid pressure is then dictated by the wheel having the lowest adhesion with the road surface.

The ABS system will be set in a fail-safe mode if a problem is detected; a warning lamp on the instrument panel will notify the driver there is a problem. The brake system will still operate conventionally and with the same standard of performance as a vehicle not equipped with ABS.

Automatic Stability Control (ASC)

The ASC utilizes the ABS sensing arrangement to provide the maximum traction force to propel the vehicle.

The ASC is switched on when the engine is started. The system can be switched off by pressing the 'ASC OFF' (the switched is marked 'TRAC OFF' on vehicles fitted with traction control). The switch, which is situated in the center console switchpack, lights up to warn that the system is switched off. An 'ASC' amber warning light flashes on the instrument panel when the system detects a spinning wheel.

The ASC system uses engine intervention to reduce the torque delivered to the drive wheels to prevent them spinning.

Engine torque is reduced in three ways:

- The throttle is moved towards the closed position.
- The ignition is retarded.
- Fuel is cut-off at the cylinder injectors.

Wheel spin is detected by the wheel speed sensors and communicated to the ABS/TCCM. The ABS/TCCM uses information from the controller area network (CAN) to calculate the torque that the engine should produce to stop the wheel spinning.

Torque reductions are then requested from the engine control module (ECM) through the CAN. The throttle is then positioned to provide the target torque, which has been calculated to prevent wheel spin. During the transient phase of torque reduction the fuel is cut-off and the ignition retarded Both the fuel cut-off and ignition retard will be restored to normal when the throttle is set to its new position.

The ASC uses a brake control modulator with six solenoid valves: three normally open inlet valves and three normally

closed outlet valves.

Traction Control

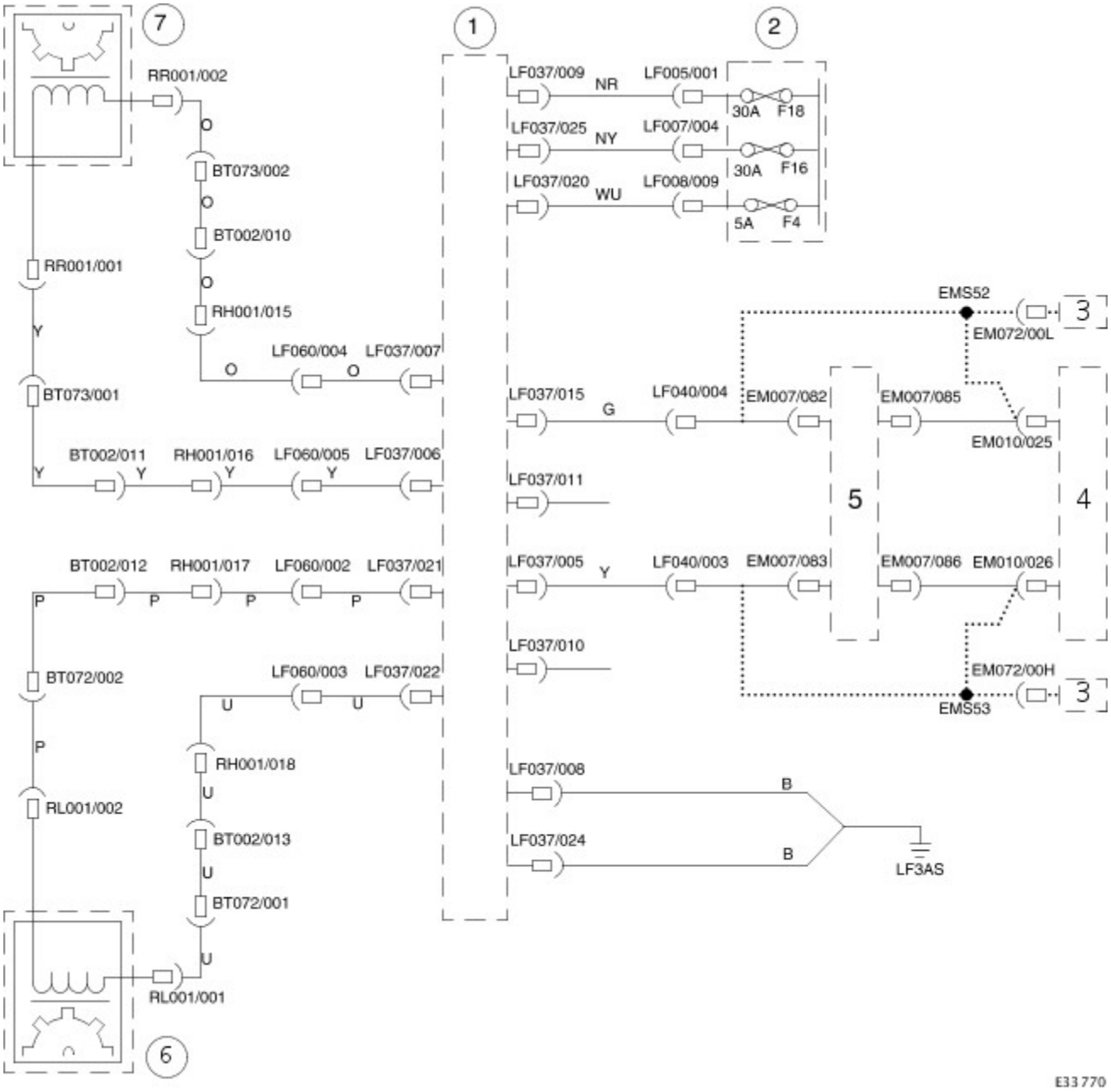
Traction control has the same capabilities as ASC but with the added ability to actuate the brakes of the spinning wheel. This enhances ASC by improving acceleration particularly on surfaces with uneven friction , e.g. one wheel on ice the other on tarmac.

When wheelspin occurs, brake line pressure to the slipping wheel is generated, to operate that wheel's brake. The BCM achieves this by closing the cut-off solenoid valve and operating the hydraulic pump. Brake fluid is then drawn from the reservoir through the non-actuated master cylinder to the brake caliper.

A 'TRAC' amber warning light flashes on the instrument panel when the system detects a spinning wheel.

The traction control system uses a brake control modulator with nine solenoid valves: four normally open inlet valves and four normally closed outlet valves and one special isolating valve. The outlet valves control the brakes of each each rear wheel individually on the traction control system.

Rear Wheel Speed Sensors and ABS/TCCM Circuit Diagram



Item	Part Number	Description
1	—	ABS / TCCM
2	—	Engine compartment fuse-box
3	—	TCM (supercharged)
4	—	ECM
5	—	TCM (normally aspirated)
6	—	Left rear wheel speed sensor
7	—	Right rear wheel speed sensor

Anti-Lock Control - Anti-Lock Control
Diagnosis and Testing

Overview

For information on the operation of the system:
REFER to: Anti-Lock Control (206-09 Anti-Lock Control, Description and Operation).

Inspection and verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious mechanical or electrical faults.

visual inspection

Mechanical	Electrical
● ABS sensors ● Wheel speed sensor ring for any damage/contamination ● Hydraulic control unit (with attached ABS module) condition and fitment	● Fuses ● Harnesses and connectors ● Warning light operation ● Wheel speed sensors ● Dynamic stability control (DSC) switch ● Stoplamp switch ● ABS module ● Controller area network (CAN) circuits

3. **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. **4.** Use the approved diagnostic system or a scan tool to retrieve any diagnostic trouble codes (DTCs) before moving onto the DTC index.

    - Make sure that all DTCs are cleared following rectification.

DTC Index

DTC	Description	Possible causes	Actions
C1095	Pump motor circuit failure	● Module power or ground supply fault ● Module failure	Check the module power and ground supplies. GO to Pinpoint Test A. Refer to the warranty policy and procedures manual if a module is suspect.
C1137	Control module internal circuit failure	● Module power or ground supply fault ● Module failure	Check the module power and ground supplies. GO to Pinpoint Test A. Refer to the warranty policy and procedures manual if a module is suspect.
C1145	Right-hand front wheel speed sensor (WSS) circuit failure	● WSS circuit: open circuit ● WSS circuit: short circuit to ground ● WSS circuit: short circuit to power ● WSS failure	For right-hand front WSS tests. GO to Pinpoint Test B.
C1155	Left-hand front wheel speed sensor (WSS) circuit failure	● WSS circuit: open circuit ● WSS circuit: short circuit to ground ● WSS circuit: short circuit to power ● WSS failure	For left-hand front WSS tests. GO to Pinpoint Test C.
C1165	Right-hand rear wheel speed sensor (WSS) circuit failure	● WSS circuit: open circuit ● WSS circuit: short circuit to ground	For right-hand rear WSS tests. GO to Pinpoint Test D.

		• WSS circuit: short circuit to power • WSS failure	
C1175	Left-hand rear wheel speed sensor (WSS) circuit failure	• WSS circuit: open circuit • WSS circuit: short circuit to ground • WSS circuit: short circuit to power • WSS failure	For left-hand rear WSS tests. GO to Pinpoint Test E.
C1267	Modulator valve failure	Supply voltages to valve solenoids or sensors out of range	For power and ground tests. GO to Pinpoint Test A.
B1342	CAN communication circuit failure	• CAN: open circuit fault • CAN: short circuit to ground • CAN: short circuit to power	For CAN tests. GO to Pinpoint Test F.
B1676	Supply voltage out of range	• Supply voltage: too low • Supply voltage: too high	Check for DTCs indicating a charging system fault. Rectify as necesssary.

Pinpoint tests

PINPOINT TEST A : MODULE POWER AND GROUND SUPPLIES	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE POWER SUPPLY FUSES	
	1 Make sure the ignition is turned off.
	2 Check fuses 04, 16 and 18 of the engine compartment junction box.
	Are the fuses in good condition? **Yes** GO to A2. **No** Install a new fuse as necessary. Check the system for normal operation. If the fuse fails again, check the circuit for a short circuit to ground. Refer to the electrical guides.
A2: CHECK THE PERMANENT POWER SUPPLY (1) TO THE MODULE	
	1 Disconnect the ABS module connector, LF27.
	2 Measure the voltage between LF27, pin 09 (NR) and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A3. **No** Repair the circuit between the engine compartment junction box, fuse 16, and LF27 pin 09. Refer to the electrical guides. Clear the DTC, check for normal operation.
A3: CHECK THE PERMANENT POWER SUPPLY (2) TO THE MODULE	
	1 Measure the voltage between LF27, pin 25 (NW) and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A4. **No** Repair the circuit between the engine compartment junction box, fuse 18, and LF27 pin 25. Refer to the electrical guides. Clear the DTC, check for normal operation.
A4: CHECK THE IGNITION POWER SUPPLY TO THE MODULE	
	1 Make sure the ignition is on.
	2 Measure the voltage between LF27, pin 20 (WU) and ground.
	Is the voltage greater than 10 volts? **Yes** GO to A5. **No** Repair the circuit between the engine compartment junction box, fuse 04, and LF27 pin 20. Refer to the electrical guides. Clear the DTC, check for normal operation.
A5: CHECK THE GROUND SUPPLY TO THE MODULE	
	1

	1 Make sure the ignition is turned off.
	2 Measure the resistances between LF27, pins 08 and 24 (B) and ground.
	Are the resistances less than 5 ohms? **Yes** The power and ground supplies to the module are ok. Recheck the DTCs for codes indicating a fault elsewhere. **No** Repair the high resistance circuit. Refer to the electrical guides. Clear the DTC, check for normal operation.

PINPOINT TEST B : CHECK THE RIGHT-HAND FRONT WSS AND CIRCUITS	
• NOTE: Check connectors and pins for damage/corrosion (see visual inspection).	
• NOTE: Check the WSS ring condition, wheel bearing etc. Before beginning pinpoint tests refer to the visual inspection.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE WSS OUTPUT	
	1 Disconnect the ABS sensor connector, FR01.
	2 Connect a multimeter set to read alternating current volts (AC volts) between pins 1 and 2 of the sensor.
	3 Spin the wheel by hand and check the meter display.
	Does the sensor generate a voltage? **Yes** GO to B2. **No** If the WSS ring is in good condition, install a new WSS. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Control, Removal and Installation).
B2: CHECK THE WSS SIGNAL CIRCUIT CONTINUITY	
	1 Make sure the ignition is off.
	2 Disconnect the ABS module connector, LF27.
	3 Measure the resistance between LF27, pin 03 (Y) and FR01, pin 02 (Y).
	Is the resistance less than 5 ohms? **Yes** GO to B3. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LF02. Refer to the electrical guides. Clear the DTC, check for normal operation.
B3: CHECK THE WSS RETURN CIRCUIT CONTINUITY	
	1 Measure the resistance between LF27, pin 04 (G) and FR01, pin 01 (G).
	Is the resistance less than 5 ohms? **Yes** The WSS and circuits are OK. Check for DTCs indicating a possible module failure. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LF02. Refer to the electrical guides. Clear the DTC, check for normal operation.

PINPOINT TEST C : CHECK THE LEFT-HAND FRONT WSS AND CIRCUITS	
• NOTE: Check connectors and pins for damage/corrosion (see visual inspection).	
• NOTE: Check the WSS ring condition, wheel bearing etc. Before beginning pinpoint tests refer to the visual inspection.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE WSS OUTPUT	
	1 Disconnect the ABS sensor connector, FL01.
	2 Connect a multimeter set to read alternating current volts (AC volts) between pins 1 and 2 of the sensor.
	3 Spin the wheel by hand and check the meter display.
	Does the sensor generate a voltage? **Yes** GO to C2. **No** If the WSS ring is in good condition, install a new WSS. REFER to: Front Wheel Speed Sensor (206-09 Anti-Lock Control, Removal and Installation).
C2: CHECK THE WSS SIGNAL CIRCUIT CONTINUITY	
	1

	1 Make sure the ignition is off.
	2 Disconnect the ABS module connector, LF27.
	3 Measure the resistance between LF27, pin 17 (W) and FL01, pin 02 (W).
	Is the resistance less than 5 ohms? **Yes** GO to C3. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LF02. Refer to the electrical guides. Clear the DTC, check for normal operation.
C3: CHECK THE WSS RETURN CIRCUIT CONTINUITY	
	1 Measure the resistance between LF27, pin 18 (R) and FL01, pin 01 (R).
	Is the resistance less than 5 ohms? **Yes** The WSS and circuits are OK. Check for DTCs indicating a possible module failure. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LF01. Refer to the electrical guides. Clear the DTC, check for normal operation.

PINPOINT TEST D : CHECK THE RIGHT-HAND REAR WSS AND CIRCUITS	
• NOTE: Check connectors and pins for damage/corrosion (see visual inspection).	
• NOTE: Check the WSS ring condition, wheel bearing etc. Before beginning pinpoint tests refer to the visual inspection.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE WSS OUTPUT	
	1 Disconnect the ABS sensor connector, RA02.
	2 Connect a multimeter set to read alternating current volts (AC volts) between pins 1 and 2 of the sensor.
	3 Spin the wheel by hand and check the meter display.
	Does the sensor generate a voltage? **Yes** GO to D2. **No** If the WSS ring is in good condition, install a new WSS. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Control, Removal and Installation).
D2: CHECK THE WSS SIGNAL CIRCUIT CONTINUITY	
	1 Make sure the ignition is off.
	2 Disconnect the ABS module connector, LF27.
	3 Measure the resistance between LF27, pin 07 (O) and RA02, pin 01 (O).
	Is the resistance less than 5 ohms? **Yes** GO to D3. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LA02. Refer to the electrical guides. Clear the DTC, check for normal operation.
D3: CHECK THE WSS RETURN CIRCUIT CONTINUITY	
	1 Measure the resistance between LF27, pin 06 (Y) and RA02, pin 02 (Y).
	Is the resistance less than 5 ohms? **Yes** The WSS and circuits are OK. Check for DTCs indicating a possible module failure. **No** Repair the high resistance circuit. This circuit includes intermediate connector, CA09. Refer to the electrical guides. Clear the DTC, check for normal operation.

PINPOINT TEST E : CHECK THE LEFT-HAND REAR WSS AND CIRCUITS	
• NOTE: Check connectors and pins for damage/corrosion (see visual inspection).	
• NOTE: Check the WSS ring condition, wheel bearing etc. Before beginning pinpoint tests refer to the visual inspection.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE WSS OUTPUT	
	1 Disconnect the ABS sensor connector, LA02.
	2 Connect a multimeter set to read alternating current volts (AC volts) between pins 1 and 2 of the sensor.

	3 Spin the wheel by hand and check the meter display.
	Does the sensor generate a voltage? **Yes** GO to E2. **No** If the WSS ring is in good condition, install a new WSS. REFER to: Rear Wheel Speed Sensor (206-09 Anti-Lock Control, Removal and Installation).
E2: CHECK THE WSS SIGNAL CIRCUIT CONTINUITY	
	1 Make sure the ignition is off.
	2 Disconnect the ABS module connector, LF27.
	3 Measure the resistance between LF27, pin 21 (U) and LA02, pin 01 (U).
	Is the resistance less than 5 ohms? **Yes** GO to E3. **No** Repair the high resistance circuit. This circuit includes intermediate connector, LA02. Refer to the electrical guides. Clear the DTC, check for normal operation.
E3: CHECK THE WSS RETURN CIRCUIT CONTINUITY	
	1 Measure the resistance between LF27, pin 22 (U) and LA02, pin 02 (U).
	Is the resistance less than 5 ohms? **Yes** The WSS and circuits are OK. Check for DTCs indicating a possible module failure. **No** Repair the high resistance circuit. This circuit includes intermediate connector, CA29. Refer to the electrical guides. Clear the DTC, check for normal operation.

PINPOINT TEST F : CONTROLLER AREA NETWORK (CAN) INTEGRITY TEST	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE NETWORK INTEGRITY FROM THE DIAGNOSTIC SOCKET	
	1 Measure the resistance between pins 06 (Y) and 14 (G) of the diagnostic socket.
	Is the resistance 60 ohms? **Yes** The CAN system is OK. Check for DTCs indicating a fault elsewhere. **No** Check the CAN system for open and short circuits. Refer to the electrical guides. Clear the DTC, check for normal operation.

Anti-Lock Control - Anti-Lock Brake System (ABS) Module

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

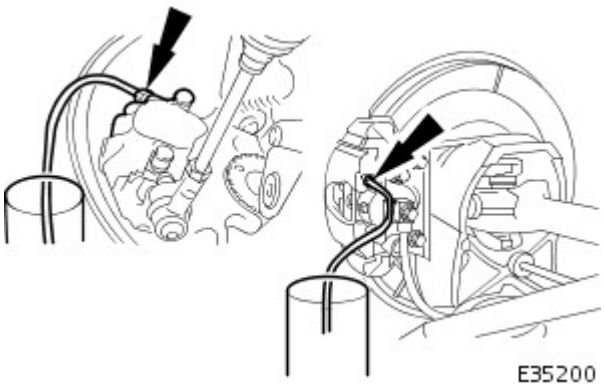
Remove brake fluid spillage immediately from paint work, with clean water.

1. Disconnect battery ground cable (IMPORTANT, see operation 86.15.19 for further information).

2. Position vehicle on a four-post lift.

3. Open engine compartment and fit paint work protection covers to fenders.

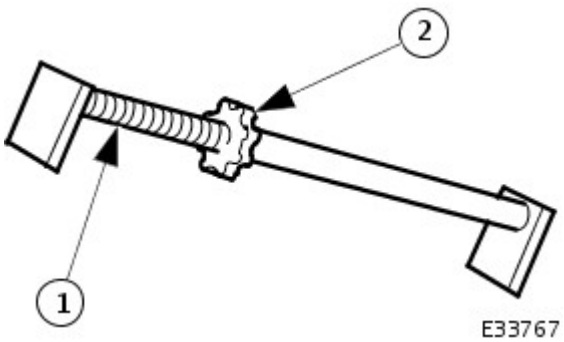
4. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake tubes.


E35200

Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

- Connect a bleed tube and container to the calipers.
- Open bleed nipples.

5. Depress and hold down brake pedal using special tool.

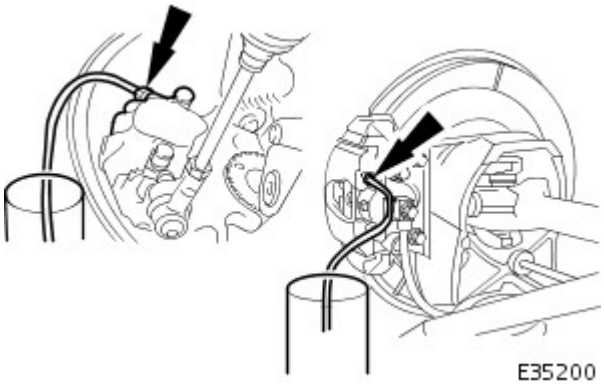


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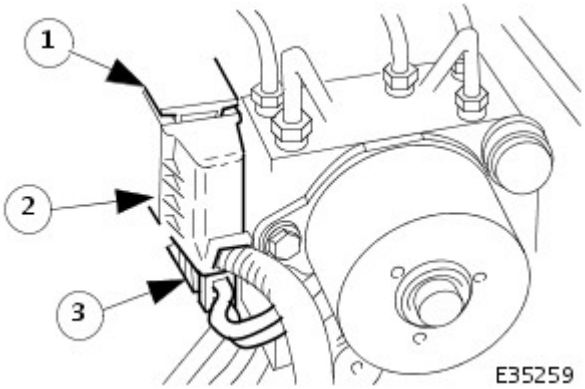
1. Position tool between brake pedal and seat frame.
2. Turn the tool wheel until the brake pedal is held 60mm down from its released position.

6. Tighten bleed nipples to:

- Front caliper bleed nipple 4-6 Nm.
- Rear caliper bleed nipple 8-11 Nm.



- Remove bleed tubes and containers.



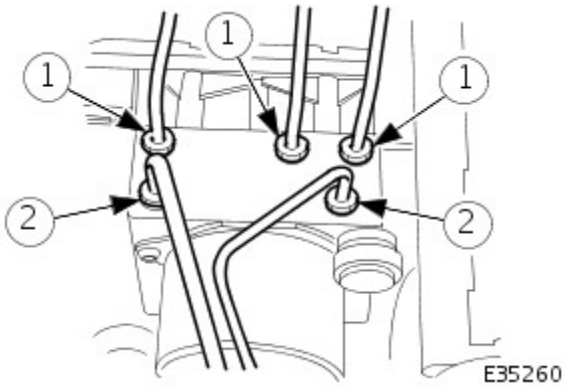
7. Disconnect electrical connectors from ABS/TCCM.

1. Pull plunger upwards.
2. Disconnect electrical connector.
3. Disconnect electrical connector

8. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Position an absorbent cloth underneath the HCU to collect brake fluid spillage.

9. NOTE: To minimize brake fluid loss, release the brake tubes from the HCU in the order shown.



Release brake tubes from HCU.

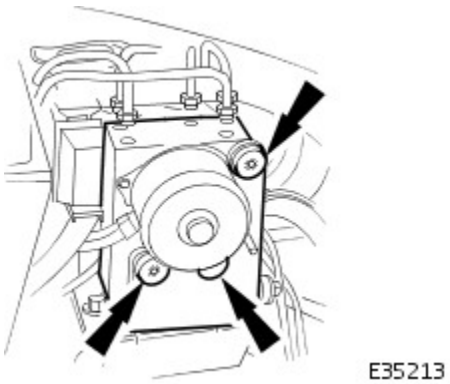
1. Undo union nuts and release inlet brake tubes.

- Install plugs to HCU inlet ports and brake tubes.

2. Undo union nuts and release outlet brake tubes.

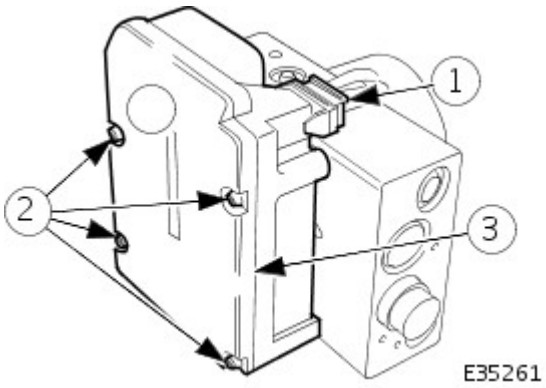
- Install plugs to HCU outlet ports and brake tubes.

10. Remove HCU from vehicle.



- Remove bolts.
- Taking care not to distort brake tubes remove HCU.

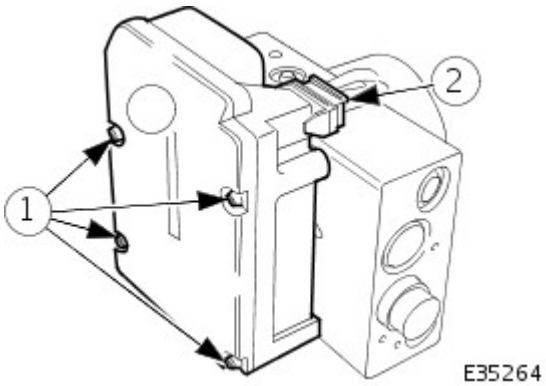
11. Remove ABS/TCCM from the HCU.



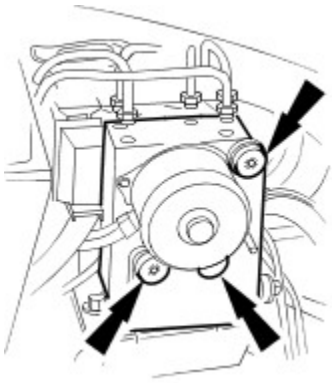
- Place the HCU on a work bench.
    1. Disconnect electrical connector.
    2. Remove bolts.
    3. Remove ABS/TCCM.

12. Clean components and mating surfaces.

Installation

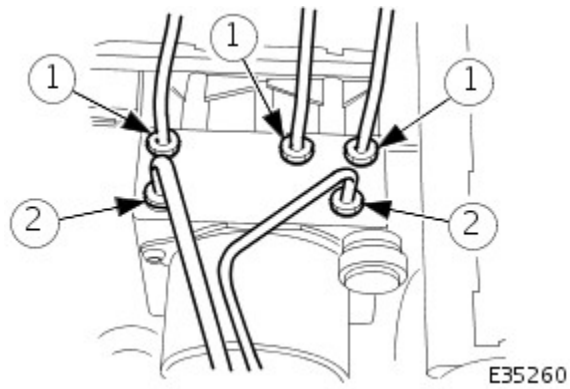


1. Install the ABS/TCCM to the HCU.
    1. Install and tighten bolts.
    2. Connect electrical connector.



2. Install HCU.

- Taking care not to distort brake tubes position HCU into bracket.
- Install bolts and tighten to 8-10 Nm.



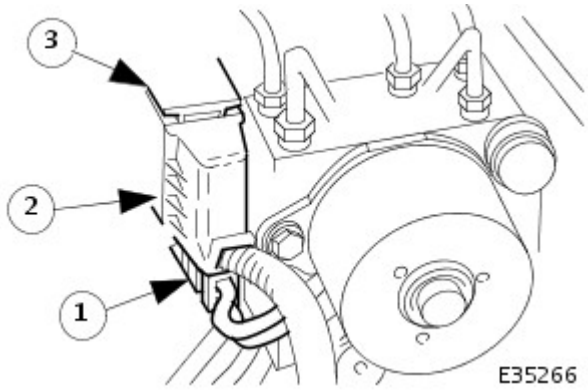
3. NOTE: To minimize brake fluid loss, install the brake tubes to the HCU in the order shown.

Install brake tubes to HCU.

- Remove plugs from outlet HCU ports and brake tubes.
    1. Install and tighten outlet brake-tube union nuts. Refer to Specification section 206-09 for torque setting.
- Remove plugs from inlet HCU ports and brake tubes.
    2. Install and tighten inlet brake-tube union nuts. Refer to Specification section 206-09 for torque setting.

4. Remove cloth from underneath HCU.

5. Connect electrical connectors to the ABS/TCCM.



1. Connect electrical connector.

2. Connect electrical connector.

3. Push plunger downwards.

6. Remove special tool from brake pedal.

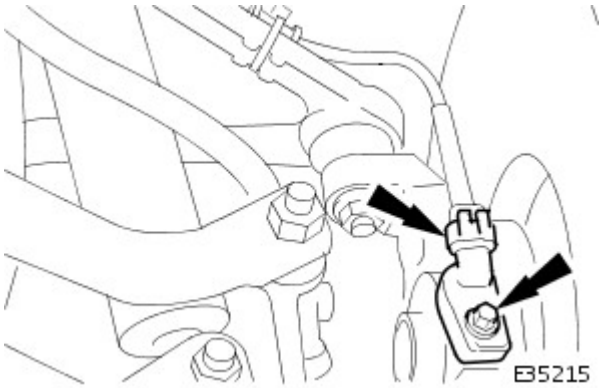
7. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

8. Bleed brake system. Refer to operation 70.25.03.

Anti-Lock Control - Front Wheel Speed Sensor

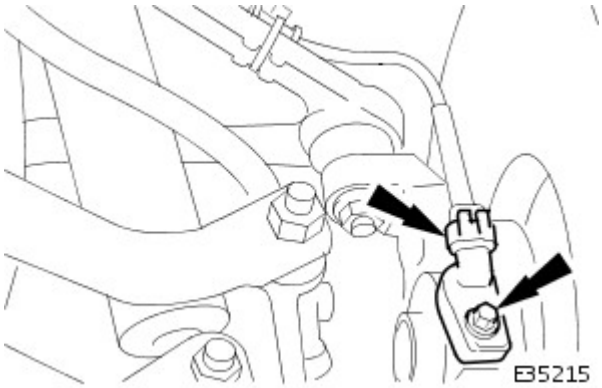
Removal and Installation

Removal



1. Raise front of vehicle and support on stands. Refer to section 100-02.
2. Remove wheel speed sensor.
   - Disconnect harness connector.
   - Remove bolt.
3. Clean components and mating surfaces.

Installation



1. Install wheel speed sensor.
   - Position sensor.
   - Install and tighten bolt to 8-10 Nm.
   - Connect harness connector.
2. Remove stands and lower vehicle.

Anti-Lock Control - Hydraulic Control Unit (HCU)

Removal and Installation

Special Tool(s)	
 E36399	Brake Pedal Hold Tool JDS 9013

Removal

• CAUTIONS:

Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

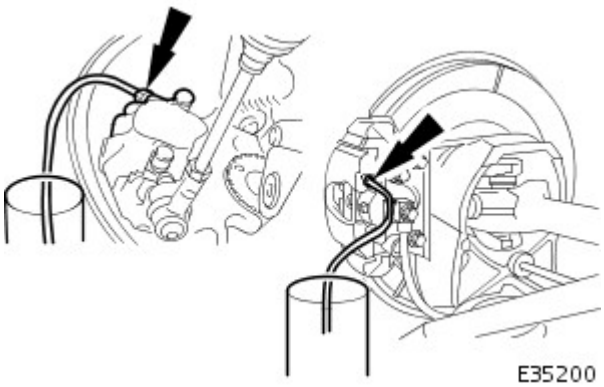
Remove brake fluid spillage immediately from paint work, with clean water.

1. Disconnect battery ground cable (IMPORTANT, see operation 86.15.19 for further information).

2. Position vehicle on a four-post lift.

3. Open engine compartment and fit paint work protection covers to fenders.

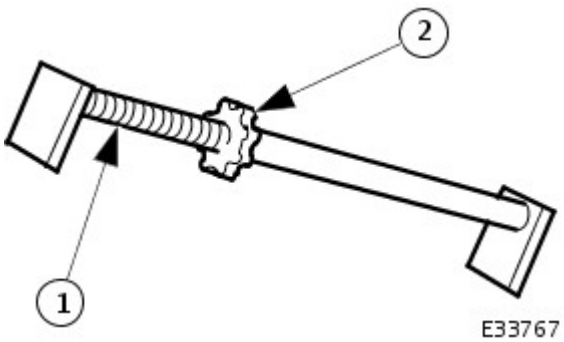
4. NOTE: The following three pictorial procedures must be carried-out to minimize brake fluid loss when disconnecting the brake tubes.


E35200

Open Left-Hand-Front and Left-Hand-Rear caliper bleed nipples.

- Connect a bleed tube and container to the calipers.
- Open bleed nipples.

5. Depress and hold down brake pedal using special tool.

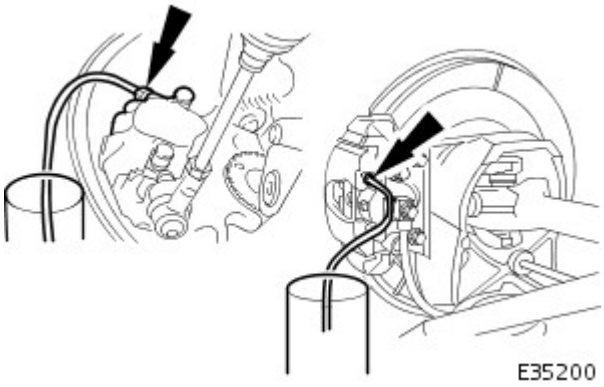


E33767

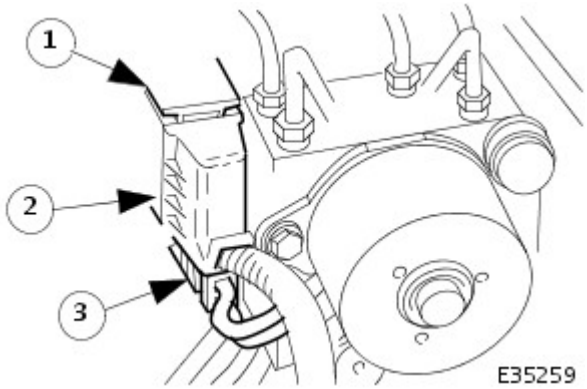
1. Position tool between brake pedal and seat frame.
2. Turn the tool wheel until the brake pedal is held 60mm down from its released position.

6. Tighten bleed nipples to:

- Front caliper bleed nipple 4-6 Nm.
- Rear caliper bleed nipple 8-11 Nm.



- Remove bleed tubes and containers.



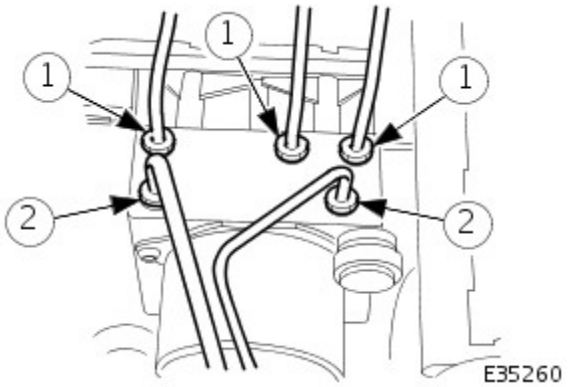
7. Disconnect electrical connectors from ABS/TCCM.

1. Pull plunger upwards.
2. Disconnect electrical connector.
3. Disconnect electrical connector

8. CAUTION: Remove brake fluid spillage immediately from paint work, with clean water.

Position an absorbent cloth underneath the HCU to collect brake fluid spillage.

9. NOTE: To minimize brake fluid loss, release the brake tubes from the HCU in the order shown.



Release brake tubes from HCU.

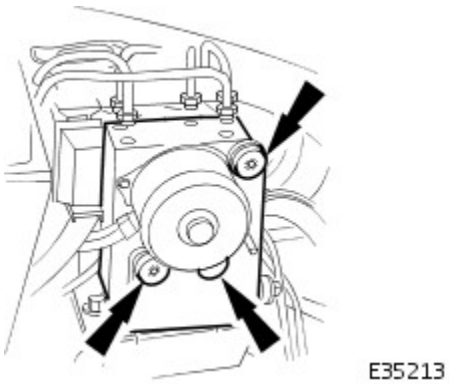
1. Undo union nuts and release inlet brake tubes.

- Install plugs to HCU inlet ports and brake tubes.

2. Undo union nuts and release outlet brake tubes.

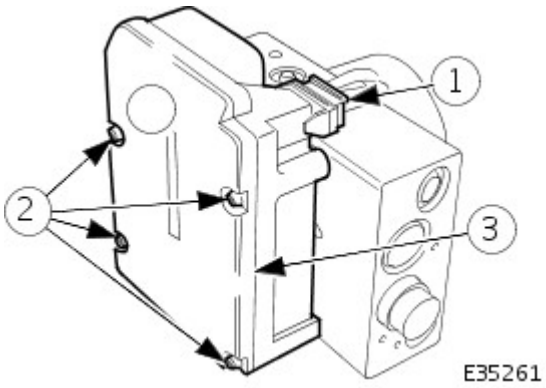
- Install plugs to HCU outlet ports and brake tubes.

10. Remove HCU from vehicle.



- Remove bolts.
- Taking care not to distort brake tubes remove HCU.

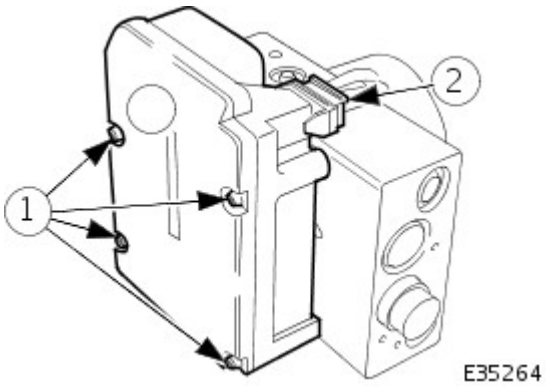
11. Remove ABS/TCCM from the HCU.



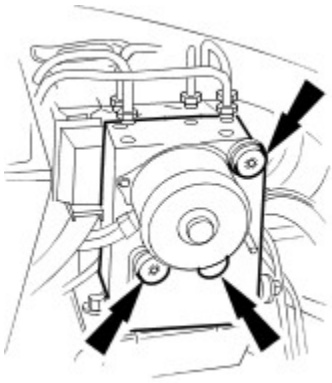
- Place the HCU on a work bench.
    1. Disconnect electrical connector.
    2. Remove bolts.
    3. Remove ABS/TCCM.

12. Clean components and mating surfaces.

Installation

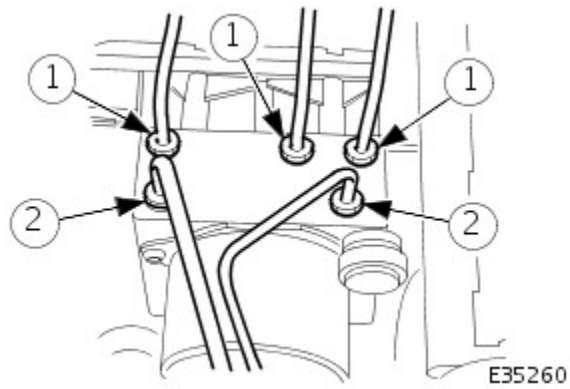


1. Install the ABS/TCCM to the HCU.
    1. Install and tighten bolts.
    2. Connect electrical connector.



2. Install HCU.

- Taking care not to distort brake tubes position HCU into bracket.
- Install bolts and tighten to 8-10 Nm.



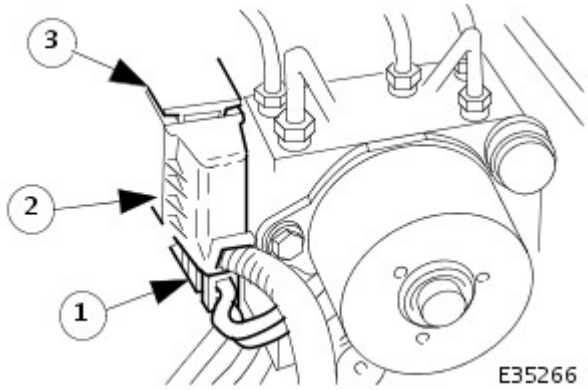
3. NOTE: To minimize brake fluid loss, install the brake tubes to the HCU in the order shown.

Install brake tubes to HCU.

- Remove plugs from outlet HCU ports and brake tubes.
    1. Install and tighten outlet brake-tube union nuts. Refer to Specification section 206-09 for torque setting.
- Remove plugs from inlet HCU ports and brake tubes.
    2. Install and tighten inlet brake-tube union nuts. Refer to Specification section 206-09 for torque setting.

4. Remove cloth from underneath HCU.

5. Connect electrical connectors to the ABS/TCCM.



1. Connect electrical connector.

2. Connect electrical connector.

3. Push plunger downwards.

6. Remove special tool from brake pedal.

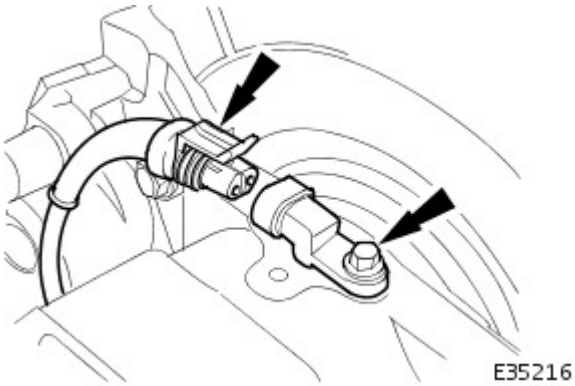
7. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

8. Bleed brake system. Refer to operation 70.25.03.

Anti-Lock Control - Rear Wheel Speed Sensor

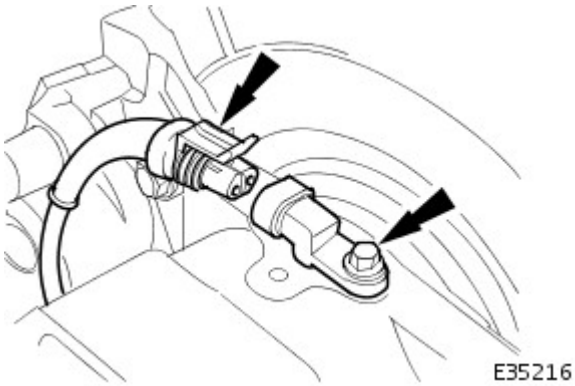
Removal and Installation

Removal



1. Raise rear of vehicle and support on stands. Refer to section 100-02.
2. Remove wheel speed sensor.
   - Disconnect harness connector.
   - Remove bolt.
3. Clean components and mating surfaces.

Installation



1. Install wheel speed sensor.
   - Position sensor.
   - Install and tighten bolt to 8-10 Nm.
   - Connect harness connector.
2. Remove stands and lower vehicle.

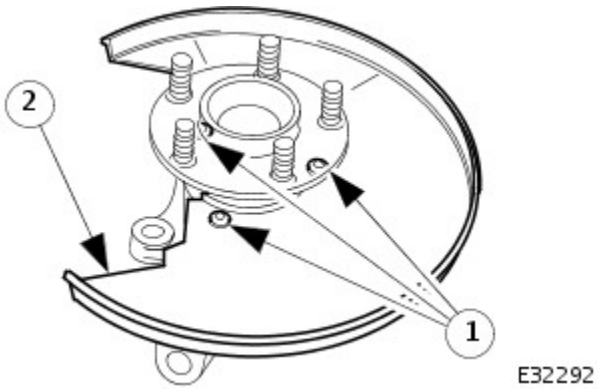
Anti-Lock Control - Wheel Speed Sensor Ring

Removal and Installation

Special Tool(s)	
 E36410	Hub Holding Tool 204-195 (JD 227)
 E36443	ABS Rotor Nut Socket 206-066A

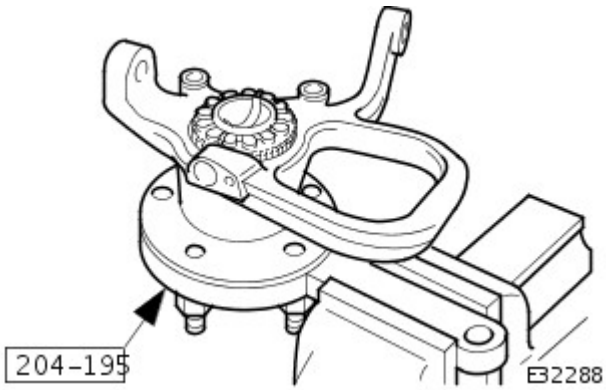
Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

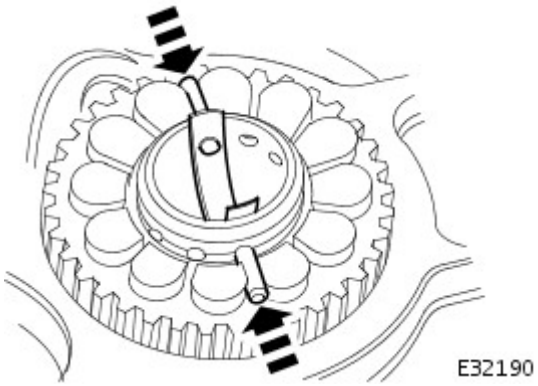


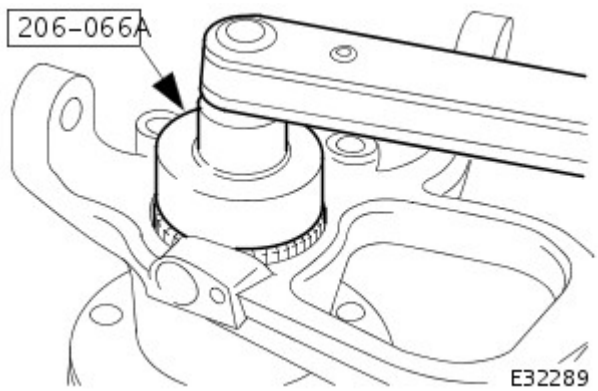
E32292

1. Open engine compartment and fit paintwork protectors to fenders.
2. Raise front of vehicle and support on stands. Refer to section 100-02.
3. Remove front wheel. Refer to section 204-04.
4. Remove front brake disc. Refer to operation 70.10.12.
5. Remove vertical link and hub assembly. Refer to operation 60.25.38.90.
6. Remove brake-disc shield from vertical link.
    1. Remove screws.
    2. Remove disc shield.
7. Using special tool, secure vertical link and hub assembly in a vice.
    - Secure special tool in a vice.
    - Position hub in tool.
    - Fit and tighten wheel nuts.



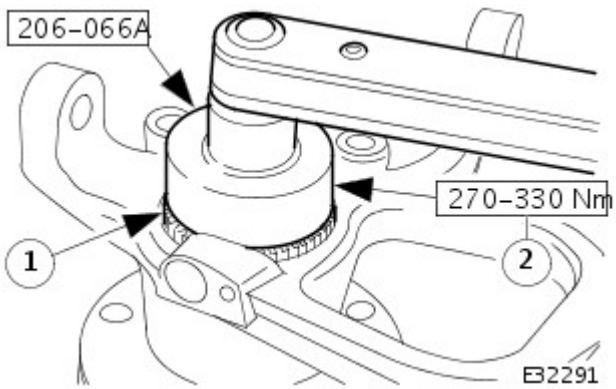
8. Remove rotor nut spring-clip.





9. Using special tool remove rotor nut.

Installation

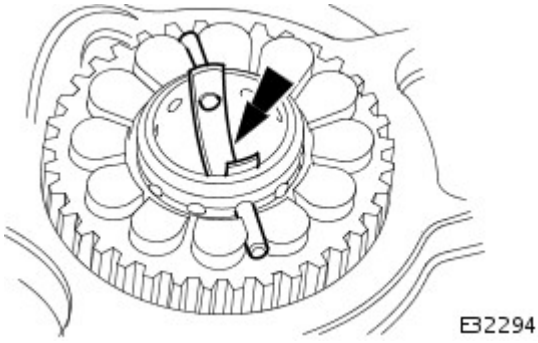


1. Fit rotor nut to hub.

1. Fit rotor nut.
2. Using special tool tighten rotor nut.

2. CAUTION: Do not slacken the rotor nut to engage the spring clip.

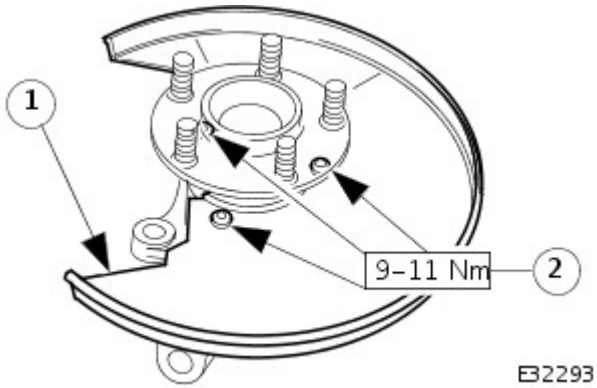
Fit rotor nut spring-clip.



- Fit spring clip into the hub retaining holes and, if aligned, into the castellated slots of the rotor nut.
- If the castellated slots of the rotor nut are not aligned it will be necessary to tighten the rotor nut further until the spring clip engages the slots.

3. Remove vertical link and hub assembly from special tool.

4. Fit disc shield to vertical link.



1. Position disc shield.
2. Fit and tighten bolts.

5. Fit vertical link and hub assembly to vehicle. Refer to operation 60.25.38.90.

6. Fit brake disc. Refer to operation 70.10.12.

7. Fit wheel. Refer to section 204-04.

8. Remove stands and lower vehicle.

Steering System - General Information -

Steering Linkage Specifications

Steering Linkage Free Play	Measurement (mm)	Measurement (in)
Free play (measured at the steering wheel rim)	0-6	0-0.24

Power Steering Pump Specifications

Item	Specification
Power steering pump relief pressure	106-114 bar

Lubricants, Fluids, Sealers and Adhesives

Item	Specification
Power steering fluid	Dextron 3

Steering System - General Information - Steering System

Description and Operation

Details of the Steering System can be found in sections 211-02, 211-03, 211-04 and 211-05.

Steering System - General Information - Steering System

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern by driving the vehicle.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Mechanical Inspection Chart

Mechanical Checks
• Incorrect tire pressure, loose wheel nuts, incorrect wheel alignment • Loose tie-rods • Loose damper and spring assemblies or ball joint • Loose steering column shaft universal joints • Loose pinch bolts on steering column shaft • Loose steering gear assembly • Check for external damage to the steering gear. - Damaged tie-rods - CAUTION: If a steering gear assembly is returned under warranty with leaking 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 seals being damaged due to foreign materials entering the steering gear boot and damaging the steering gear seals thereafter. Damaged steering gear boot • Damaged accessory drive belt • Binding or misaligned steering column, pump or steering gear • Incorrect fluid level • Hose leaks or line restrictions • Hose fouling bodywork

Electrical Inspection Chart

Electrical Checks / Tests
• Make sure all connectors are in place (steering gear Servotronic solenoid and steering control module (SCM) - if applicable) • Make sure all the fuses are in place and not blown • DISCONNECT the steering gear transducer and the steering should become heavy • TEST electrical values: - Power Supply to the SCM = 12 Volts - Steering gear transducer resistance 7.0 to 7.5 Ohms is normal (limits: less than 5 Ohms and greater than 9 Ohms would be declared unacceptable) - Steering gear transducer voltage = 6 Volts - Steering gear transducer current = 840 mA at 0 mph reducing to 0 mA at maximum speed

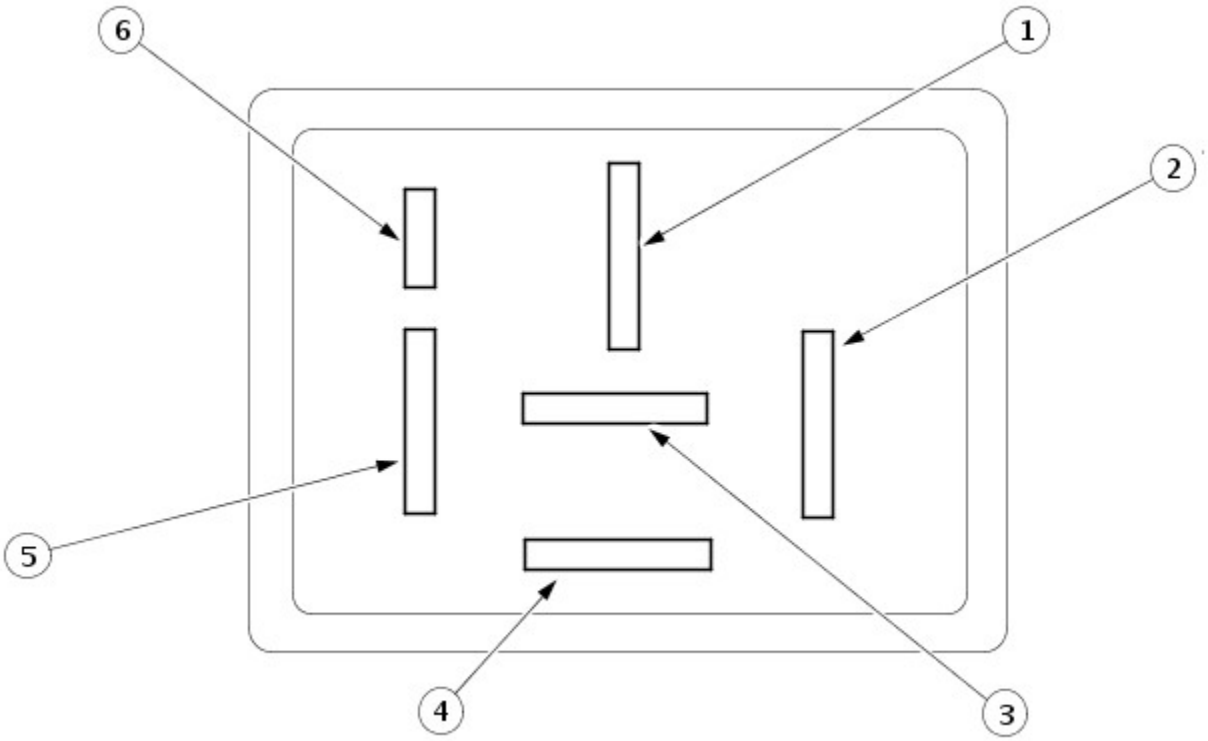
- RECONNECT all electrical items disturbed during testing

3. **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. **4.** Check the power steering fluid condition. For additional information, REFER to Power Steering Fluid Condition Check in this section.

5. **5.** If the concern is not visually evident, verify the symptom and REFER to Steering Fault Diagnosis by Symptom Charts in this section.

Steering Relay Harness Connector



E39815

Item	Description
1	Steering transducer ground
2	Ignition feed
3	Steering transducer feed
4	Ground
5	Speed sensor signal
6	Serial interface

Steering Linkage Inspection and Backlash (Freeplay) 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. **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. **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 result in the steering gear warranty to become invalid.

3. **3.** The backlash of the steering gear cannot be adjusted, install a new steering gear. For additional information, REFER to Section 211-02 Power Steering.

4. **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. For additional information, REFER to Section 211-04 Steering Column.

Power Steering Fluid Condition Check

1. **1.** Run the engine for 2 minutes.

2. **2.** Check the power steering fluid system level.

3. **3.** Observe the color and the odor. The color under normal circumstances should be dark reddish, not brown or black.

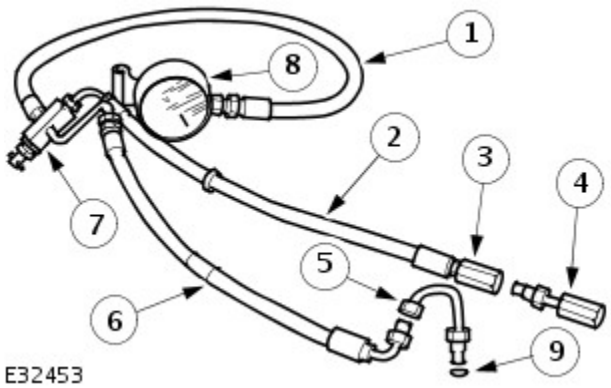
4. **4.** Allow the fluid to drip onto a facial tissue and examine the stain.

5. **5.** If evidence of solid material is found, the power steering fluid system should be drained for further inspection.

6. **6.** 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	Special Tool 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.

With the control valve (7) OPEN and the engine idling, the following system pressures may be checked:

- During turning.
- When the steering is held on full lock.
- With the steering at rest.

• CAUTIONS:

 To avoid excessive heating of the power steering pump, do not close the valve for longer than 5 seconds maximum.

 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. For additional information,
  REFER to Power Steering System Bleeding - in this section.

Steering Fault Diagnosis by Symptom Charts

Leakage

Condition	Possible Sources	Action
	Confirm the position of the fluid leak.	• CLEAN the area of the leak. • Inspect the area and confirm the exact position of leak. • Make sure the fluid is not from another system on the vehicle.

• Fluid leakage	• Overfilled system.	• CORRECT the fluid level as necessary.
	• Component leak.	• NOTE: Record the position of the leak and some indication of the rate of the leak on the Warranty Return Record Sheet. • LOCATE the suspect component or CHECK hose connections and repair as necessary.
	• Damaged fluid cap.	• INSTALL a new fluid cap.
	• Loose or damaged hose fittings.	• TIGHTEN or INSTALL a new hose as necessary.
	• Leakage at power steering pump.	• INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
• Fluid leakage	• Leakage at steering hose to steering gear connection.	• CHECK steering hose to steering gear connection for leakage. CHECK and TIGHTEN the steering hose to steering gear connection retaining bolts/bolts as necessary.
	• Power steering fluid leakage at O-ring seals.	• CHECK the power steering system for signs of steering fluid loss from O-ring seals. • INSTALL new O-ring seals as necessary. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Power steering fluid leakage from transfer pipes.	• CHECK the power steering system for signs of steering fluid loss from the transfer pipes. • CHECK and TIGHTEN the transfer pipes if required, INSTALL new transfer pipes as necessary. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Power steering fluid leakage from the steering gear.	• CHECK the power steering gear for signs of fluid loss. • INSTALL a new steering gear as necessary. For additional information, REFER to Section 211-02 Power Steering.
	• Power steering fluid leakage from steering gear boot.	• CHECK the power steering gear for signs of fluid loss. • INSTALL a new steering gear as necessary. For additional information, REFER to Section 211-02 Power Steering.

Functional

Condition	Possible Sources	Action
• Free play at steering wheel	• Excess play in the steering linkage.	• CHECK the steering linkage for excess play. For additional information, REFER to the Steering Linkage Inspection and Backlash (Freeplay) Check in this section.
	• Steering wheel loose.	• CHECK and TIGHTEN the steering wheel retaining bolt/bolts as necessary. For additional information, REFER to Section 211-04 Steering Column.
	• Lower steering column pinch bolt loose.	• CHECK and TIGHTEN the lower steering column pinch bolts as necessary. For additional information, REFER to Section 211-04 Steering Column.
	• Excessive wear in lower steering column.	• CHECK for lower steering column for wear in the universal joints. If wear is present, INSTALL a new lower steering column as necessary.
	• Wear in suspension joints.	CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will result in the steering gear warranty to become invalid. • CHECK for excess wear in the front suspension joints. For additional information, REFER to Section 204-00 Suspension System - General Information.

• Vehicle wanders from side to side on the road, when the vehicle is driven straight ahead and the steering wheel is held in a firm position	• Incorrect tire pressure or tire size.	• CHECK and ADJUST the tire pressure. For additional information, REFER to Section 204-04 Wheels and Tires. • INSTALL a new tire as necessary. For additional information, REFER to Section 204-04 Wheels and Tires.
	• Vehicle is unevenly or excessively loaded.	• ADJUST the load evenly.
	• Loose/worn tie-rods.	• INSTALL a new tie-rod end. For additional information, REFER to Section 211-03 Steering Linkage.
	• Steering gear bolts loose or damaged.	• TIGHTEN or INSTALL new bolts.
	• Loose or worn suspension ball joint(s).	• INSTALL a new suspension ball joint assembly. For additional information, REFER to Section 204-01 Front Suspension.
	• Steering column universal joint pinch bolt loose.	• TIGHTEN the steering column universal joint pinch bolt. For additional information, REFER to Section 211-04 Steering Column.
	• Incorrect toe adjustment.	• ADJUST as necessary. For additional information, REFER to Section 204-00 Suspension System - General Information.
	• Loose or worn rear suspension.	• TIGHTEN loose, or INSTALL new rear suspension components. For additional information, REFER to Section 204-02 Rear Suspension.
• Vehicle tends to pull to one side when driven on a level surface	• Incorrect tire pressure. • Incorrect tire size or different tire/tread type. • Uneven tire wear	• CHECK and ADJUST the tire pressure. For additional information, REFER to Section 204-04 Wheels and Tires. • INSTALL a new tire as necessary. For additional information, REFER to Section 204-04 Wheels and Tires.
	• Vehicle is unevenly loaded or overloaded.	• Adjust the load.
	• Incorrect toe adjustment.	• ADJUST as necessary. For additional information, REFER to Section 204-00 Suspension System - General Information.
	• Damaged front suspension components.	• INSTALL new front suspension components as necessary. For additional information, REFER to Section 204-01 Front Suspension.
	• Damaged rear suspension components.	• INSTALL new rear suspension components as necessary. For additional information, REFER to Section 204-02 Rear Suspension.
	• Steering gear valve effort out of balance.	• SHIFT the transmission into NEUTRAL while driving at no more than 30 miles/hour (50 km/h) and turn the ignition to position I (engine OFF-coasting). If the vehicle does not pull with the engine off, INSTALL a new steering gear. For additional information, REFER to Section 211-02 Power Steering. • If the vehicle does drift with the engine off, CROSS SWITCH front wheel assemblies. • If the vehicle pulls to the opposite side, SWITCH wheels that were on the rear to the same side on the front. • If the vehicle pull direction is not changed, CHECK the front suspension components and toe adjustments. For additional information, REFER to Section 204-01 Front Suspension.
	• Check the front and rear brakes for correct operation.	• ADJUST as necessary. For additional information, REFER to Section 206-00 Brake System - General Information.
	• Check for bent rear	• INSTALL new rear suspension components

	suspension components and for damaged coil springs in the front suspension.	as necessary. For additional information, REFER to Section 204-02 Rear Suspension. • INSTALL new front suspension components as necessary. For additional information, REFER to Section 204-01 Front Suspension.
	• Check the rear suspension for loose or worn suspension components.	• TIGHTEN or INSTALL new components as necessary. For additional information, REFER to Section 204-02 Rear Suspension.
	• Incorrect underbody alignment.	• CHECK underbody alignment. For additional information, REFER to Section 502-00 Uni-Body, Subframe and Mounting System.
• Poor returnability of the steering	• Lower steering column interference.	• CHECK the steering column is free from interference from the engine harness, sound proofing or the floor covering.
	• Incorrect tire pressure.	• CHECK and ADJUST the tire pressure. For additional information, REFER to Section 204-04 Wheels and Tires.
	• Incorrect tire size or type.	• INSTALL a new tire as necessary. For additional information, REFER to Section 204-04 Wheels and Tires.
	• Steering column upper shroud fouling on the steering wheel.	• CHECK steering column upper shroud for fouling. ADJUST as necessary.
	• Steering column universal joints binding.	• INSTALL a new steering column. For additional information, REFER to Section 211-04 Steering Column.
	• Steering column shaft floor seal binding.	• CHECK the steering column shaft floor seal for correct fitment and REFIT as necessary.
	• Steering column shaft floor seal may be torn.	• INSTALL a new steering column shaft floor seal as necessary.
	• Binding or damaged tie-rods.	• CHECK tie-rod end for excessive wear or tightness in ball joint. INSTALL a new tie-rod end. For additional information, REFER to Section 211-03 Steering Linkage.
	• Damaged or worn front suspension components.	• INSTALL new front suspension components as necessary. For additional information, REFER to Section 204-01 Front Suspension.
	• Incorrect toe adjustment.	• ADJUST as necessary. For additional information, REFER to Section 204-00 Suspension System - General Information.
• Excessive steering efforts required during low speed manoeuvring and/or during parking manoeuvres	• Low power steering fluid.	• CHECK steering system for signs of steering fluid loss. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Damaged accessory drive belt tensioner.	• INSTALL a new accessory drive belt tensioner.
	• Hose or cooler line restriction.	• CHECK hose or cooler lines for correct routing. • INSTALL a new hose as necessary.
	• Fluid aeration.	• BLEED the system. For additional information, REFER to Power Steering System Bleeding in this section.
	• Steering transducer not closed - no feed voltage.	• CHECK the steering transducer circuit. For additional information, REFER to the wiring diagrams. • Carry out the electrical checks and tests. For additional information, REFER to the Electrical Checks and Tests in this section.
	• Steering transducer not closed - cable fault.	• CHECK the steering transducer circuit. For additional information, REFER to the wiring diagrams. • Carry out the electrical checks and tests.

		For additional information, REFER to the Electrical Checks and Tests in this section.
	• Steering control module (SCM) defective.	• CHECK the SCM and INSTALL a new SCM as necessary.
	• Power steering fluid delivery pressure or flow too low.	• CHECK the power steering pressure. For additional information, REFER to the Power Steering Pressure Test in this section. • INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	• Internal steering gear leakage.	• CHECK the power steering pressure. For additional information, REFER to the Power Steering Pressure Test in this section. • INSTALL a new steering gear as necessary. For additional information, REFER to Section 211-02 Power Steering.
• Steering operation is very heavy when driving, but when stationary manoeuvring is good	• Steering transducer open early.	• CHECK steering transducer and INSTALL a new steering transducer as necessary. • Carry out the electrical checks and tests. For additional information, REFER to the Electrical Checks and Tests in this section.
	• Steering transducer open early, steering control module (SCM) fault.	• CHECK SCM and INSTALL a new SCM as necessary.
	• Steering transducer open early, speedo signal error.	• CHECK speedo circuit. For additional information, REFER to the wiring diagrams.
• Steering operation is very light when driving, but when stationary manoeuvring is good	• Steering transducer not open, (no power steering fluid flow).	• CHECK the power steering fluid condition. For additional information, REFER to the Power Steering Fluid condition check in this section.
	• Steering transducer not open, steering control module (SCM) fault.	• CHECK the SCM and INSTALL a new SCM as necessary. • Carry out the electrical checks and tests. For additional information, REFER to the Electrical Checks and Tests in this section.
	• Steering transducer not open, speedo signal error.	• CHECK the speedo circuit. For additional information, REFER to the wiring diagrams.
	• CHECK the power steering fluid low pressure pipe for restricted flow.	• INSTALL a new power steering fluid low pressure pipe.
• Steering heavy operation during rapid manoeuvring	• Air in power steering system.	• CHECK for an air leak into the power steering system and repair as necessary. • BLEED the power steering system. For additional information, REFER to Power Steering System Bleeding - in this section.
	• Fluid loss at the power steering pump shaft seal.	• CHECK the power steering pump for signs of steering fluid loss. • INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	• Power steering fluid delivery pressure or flow too low.	• CHECK the power steering pump for signs of steering fluid loss. • CHECK the power steering pressure. For additional information, REFER to the Power Steering Pressure Test in this section. • INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	• Lower steering column interference.	• CHECK the steering column is free from interference from the engine harness, sound proofing or the floor covering.
	• Incorrect steering geometry.	• CHECK the front wheel alignment. For additional information, REFER to Section 204-00 Suspension System - General Information.
		• CHECK the power steering pressure. For

	● Faulty rotary valve/seal.	additional information, REFER to the Power Steering Pressure Test in this section. ● INSTALL a new steering gear as necessary. For additional information, REFER to Section 211-02 Power Steering.
● Steering heavy operation in one direction	● Tire fouling on the wheel arch liner.	● CHECK for clearance between the tire and the wheel arch liner. ● Remove and refit the wheel arch liner or INSTALL a new wheel arch liner as necessary.
	● Low power steering fluid.	● CHECK steering system for signs of steering fluid loss. ● BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	● Air in power steering system.	● CHECK the power steering pump for signs of steering fluid loss. ● INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
● Steering heavy operation in both directions	● Fluid loss at the power steering pump shaft seal.	● CHECK the power steering pump for signs of steering fluid loss. ● INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	● Power steering fluid delivery pressure or flow too low.	● CHECK the power steering pump for signs of steering fluid loss. ● CHECK the power steering pressure. For additional information, REFER to the Power Steering Pressure Test in this section. ● INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	● Lower steering column interference.	● CHECK the steering column is free from interference from the engine harness, sound proofing or the floor covering.
● Steering operation varies from heavy to light when driving at constant speed	● Incorrect speedometer signal.	● CHECK the speedo circuit. For additional information, refer to the wiring diagrams.
	● Steering transducer cable/connection faulty or grounded.	● CHECK the steering transducer circuit. For additional information, refer to the wiring diagrams. ● Carry out the electrical checks and tests. For additional information, REFER to the Electrical Checks and Tests in this section.
	● Lower steering column interference.	● CHECK the steering column is free from interference from the engine harness, sound proofing or the floor covering.
● Steering wheel varies from light to heavy two times per revolution	● Steering column universal joints binding.	● INSTALL a new steering column. For additional information, REFER to Section 211-04 Steering Column.
	● Seized or damaged steering components.	● CHECK for wear or failure of suspension bushes and ball joints. For additional information, REFER to Section 204-00 Suspension System - General Information.

Noise

Condition	Possible Sources	Action
● Accessory drive belt squeal	● Incorrect accessory drive belt tension or accessory drive belt glazed.	● CHECK accessory drive belt condition and INSTALL a new accessory drive belt as necessary. For additional information, REFER to Section 303-05 Accessory Drive.
● Chirp noise in the steering pump	● Loose or worn accessory drive belt.	● CHECK accessory drive belt condition and INSTALL a new accessory drive belt as necessary. For additional information, REFER to Section 303-05 Accessory Drive.

• Power steering pump noisy	• Low power steering fluid.	• CHECK steering system for signs of steering fluid loss. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Power steering pump worn or otherwise defective.	• CHECK for leaks. REPAIR as necessary. • CHECK the power steering pressure. For additional information, REFER to the Power Steering Pressure Test in this section. • INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
• Whine type noise	• Aerated fluid.	• BLEED the power steering system. For additional information, REFER to Power Steering System Bleeding - in this section.
	• Power steering pump.	• CHECK for leaks. REPAIR as necessary. • INSTALL a new power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
• Noise during steering gear movement	• Low power steering fluid.	• CHECK steering system for signs of steering fluid loss. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Water contamination to the power steering fluid.	• DRAIN the power steering system. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Cavitation due to restricted power steering feed hose.	• CHECK and reposition power steering feed hoses and INSTALL new hoses as necessary.
• Continuous noise	• Low power steering fluid.	• CHECK steering system for signs of steering fluid loss. • BLEED the power steering system. For additional information, REFER to Section 211-00 Steering System - General Information.
	• Power steering pump drive loose.	• CHECK power steering coupling and power steering pump. • INSTALL a new power steering coupling or power steering pump as necessary. For additional information, REFER to Section 211-02 Power Steering.
	• Incorrect accessory drive belt tension or accessory drive belt glazed.	• CHECK accessory drive belt condition and INSTALL a new accessory drive belt as necessary. For additional information, REFER to Section 303-05 Accessory Drive.
	• Power steering pump drive pulley loose.	• CHECK and TIGHTEN the power steering pump drive pulley retaining bolts as necessary. For additional information, REFER to Section 303-03A Engine Cooling / 303-03B Supercharger Cooling.
	• Power steering pump retaining bolts loose.	• CHECK the power steering pump retaining bolts and TIGHTEN as necessary.
	• Power steering hose/pipe in contact with the vehicles body.	• CHECK and reposition power steering hoses/pipes, INSTALL new hoses/pipes as necessary.
	• Power steering hose restricted/twisted.	• CHECK and reposition power steering hose, replace hose as necessary.

Vibration

Condition	Possible Sources	Action
	• Loose/worn tie-rods.	• INSTALL a new tie-rod end. For additional information,

		REFER to Section 211-03 Steering Linkage.
● Feedback (knocking noises in the steering gear) - condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces	● Steering gear retaining bolts loose or damaged.	CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will result in the steering gear warranty to become invalid. ● CHECK and TIGHTEN the steering gear retaining bolts. ● INSTALL new retaining bolts as necessary. For additional information, REFER to Section 211-02 Power Steering.
	● Loose suspension bushing, bolts or ball joints.	● TIGHTEN or INSTALL new components as necessary. For additional information, REFER to Section 204-01 Front Suspension.
	● Steering column retaining bolts loose.	CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will result in the steering gear warranty to become invalid. ● CHECK and TIGHTEN the steering column retaining bolts/nuts and pinch bolts if required. For additional information, REFER to Section 211-04 Steering Column.
	● Excessive wear in steering column assembly.	● CHECK for steering column for wear in the universal joints and bearings. If wear is present, INSTALL a new steering column as necessary. For additional information, REFER to Section 211-04 Steering Column.
● Nibble (Shimmy) Oscillation of the steering wheel (not vertical which is SHAKE). This is driven by road wheel imbalance.	● Road wheel imbalance.	● CHECK for road wheel imbalance. ● CHECK for relevant SERVICE BULLETINS/SERVICE ACTIONS for the vehicle on Jaguar Communications Online (JCOL) or in hard copy form.
	● Steering wheel replacement.	● CHECK for relevant SERVICE BULLETINS/SERVICE ACTIONS for the vehicle on Jaguar Communications Online (JCOL) or in hard copy form.
	● Rack replacement.	● CHECK for relevant SERVICE BULLETINS/SERVICE ACTIONS for the vehicle on Jaguar Communications Online (JCOL) or in hard copy form.

Description of 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 rubbing 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.

Weep

Continuous mid-range sound (lower frequency than squeal, higher frequency than groan).

Whir / Whine

High-pitched buzzing sound, like an electric motor or drill.

Whistle

Sharp, shrill sound, like wind passing a small opening.

Description of 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 the end of 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 test 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. Is generally caused by interference between moving components such as the steering wheel to steering column shroud.

Grunt (Squawk)

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 load 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.

Rack Knock (Rack Slap)

CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will result in the steering gear warranty to become invalid.

Rack 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. Rack 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 with 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 parts, movable and flexible parts, 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 parts.

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 for slow steering inputs. 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 Ripple

Torque ripple is a concern with Electric Power Steering (EPS) systems. Torque ripple is most evident at static-park steering the wheel very slowly from lock to lock. Torque ripple is primarily caused by motor commutation.

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.

Steering Linkage

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. **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. **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.

3. CAUTION: DO NOT attempt to adjust the steering gear yoke. Failure to follow this instruction will result in the steering gear warranty to become invalid.

   3. The backlash of the steering gear cannot be adjusted, install a new steering gear. For additional information, REFER to Section 211-02 Power Steering.

4. **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. For additional information, REFER to Section 211-04 Steering Column.

Steering System - General Information - Power Steering System Filling and Bleeding

General Procedures



Fluid Level Indicator

1. Fill the reservoir to the bottom of the filler neck.
   - Wait for any air to escape and top up again.
   - Without the engine running, turn from lock to lock two or three times, topping up to the maximum level on the dip reservoir stick.
   - Start the engine and immediately top up as air is vented.
   - With the engine idling, turn lock to lock two or three times, topping up to the maximum level on the reservoir dip stick.
   - When no further change of fluid level occurs, run the engine for twenty minutes to vent any remaining air.
   - If possible, allow the vehicle to stand for thirty minutes before restarting the engine to vent any further air.
2. Note that air in the fluid can temporarily result in PAS pump noise, but this will not cause damage. The time allowances mentioned in the above procedures are to reduce the possibility of a customer collecting a vehicle while still subject to excessive pump noise.

Steering System - General Information - Power Steering System Flushing

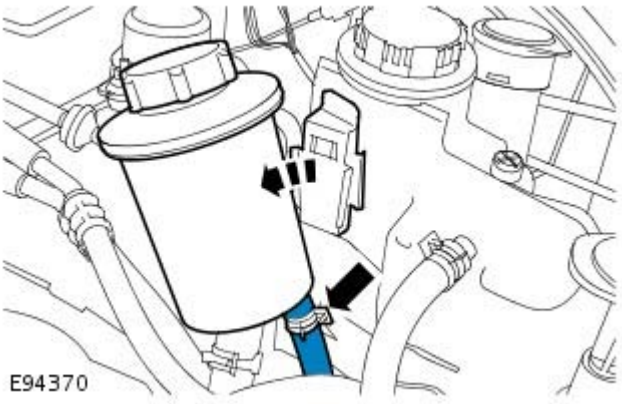
General Procedures

• 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.

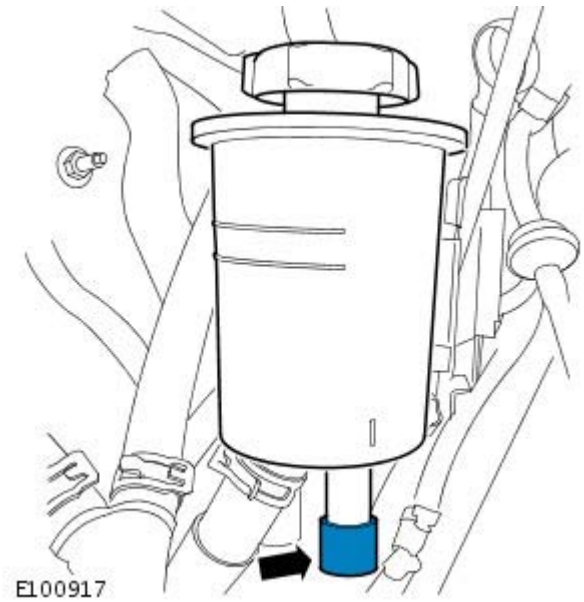


3. CAUTION: Be prepared to collect escaping fluids.

• 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.

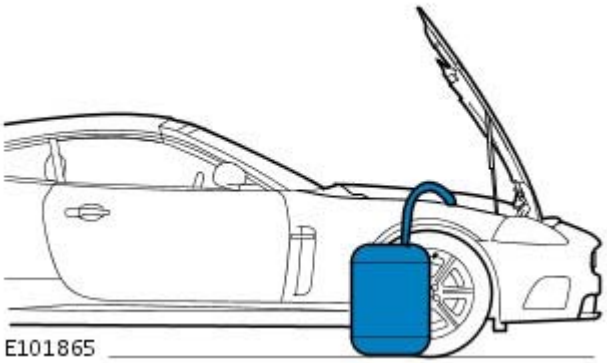
• NOTE: Make sure that all openings are sealed. Use new blanking caps.

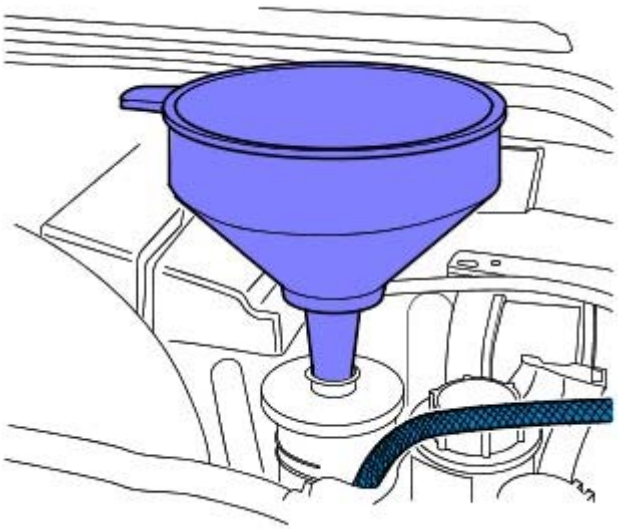
Using a suitable blanking cap, cap the power steering reservoir return pipe.

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.


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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. CAUTIONS:

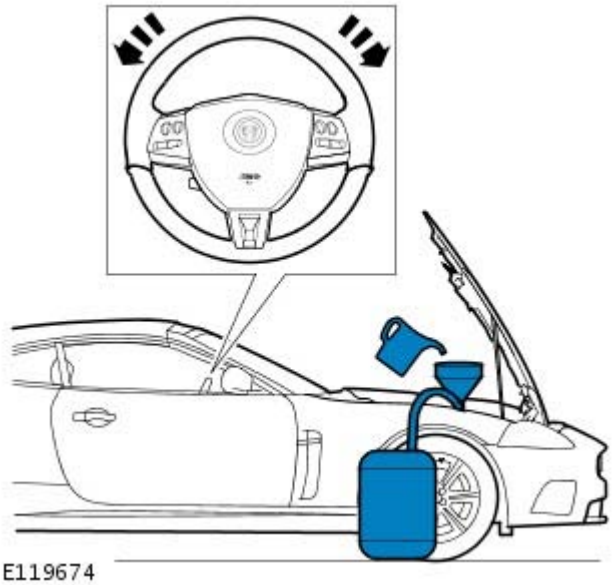
Steps 8 and 9 must be carried out within 2 - 3 seconds of each other. Failure to follow this instruction may result in damage to the power steering system.

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. CAUTIONS:

Be prepared to collect escaping fluids.


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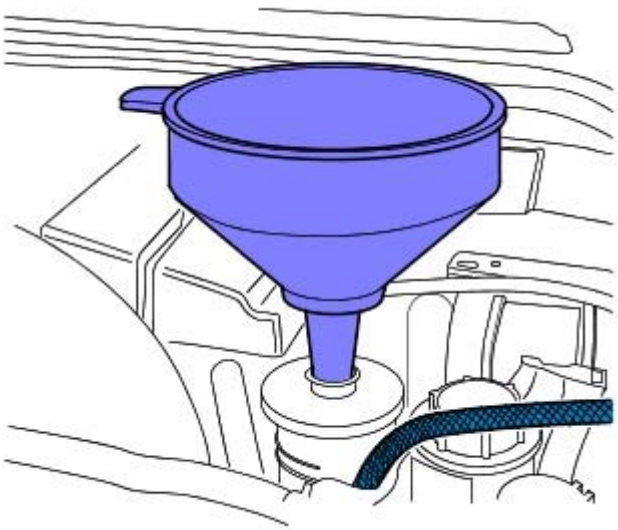
Do not allow the power steering fluid level in the power steering fluid reservoir to fall below the minimum power steering fluid level. Failure to follow this instruction may result in damage to the power steering system.

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.

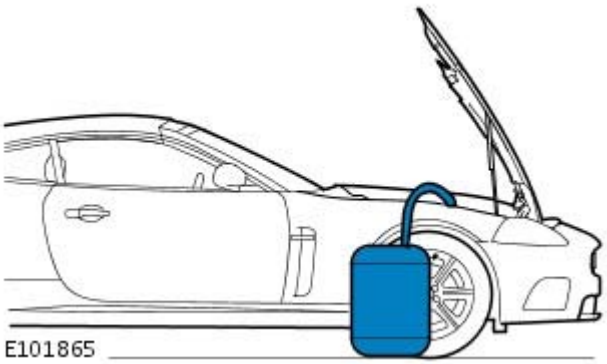
- Start the engine
- With assistance turn the steering slowly lock to lock 3 times at approximately 1 revolution every 5 seconds.
- Continue to flush the power steering system until 4 litres of power steering fluid has been added to the power steering reservoir. This should take approximately 30 seconds.

10. CAUTION: Be prepared to collect escaping fluids.


E94372

Remove the suitable funnel.

11. CAUTION: Be prepared to collect escaping fluids.


E101865

Remove the suitable pipe to the power steering return hose.

12. CAUTION: Be prepared to collect escaping fluids.

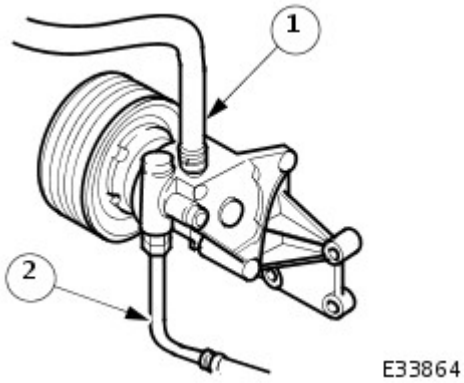
• NOTE: Note the orientation of the clip.

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. For additional information, refer to: (211-02)
Power Steering Fluid Reservoir - 4.2L/3.0L/2.7L Diesel (Removal and Installation),
Power Steering Fluid Reservoir - 3.0L Diesel (Removal and Installation).

Steering System - General Information - Power Steering System Vacuum Filling and Bleeding

General Procedures



Fluid Hoses

1.

Parts List

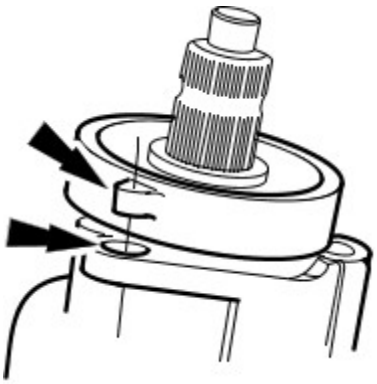
Item	Description
1	Return hose
2	High pressure hose

2. If vacuum filling equipment is available, proceed as follows:

- Disconnect both the high pressure hose and return hose from the PAS pump and the return hose from the steering rack.
- Drain as much fluid as possible from the system by turning the steering from lock to lock two or three times.
- Reconnect all hoses.
- Fill the system using the vacuum equipment according to the manufacturers instructions.
- Start the engine and top up the fluid as necessary.
- Turn the steering from lock to lock two or three times with the engine running, topping up with fluid as necessary.
- If possible, run the engine for twenty minutes to expel any remaining air.

Steering System - General Information - Steering Gear Centralizing

General Procedures



E33832

Rack Alignment Markers

1. The steering rack should always be centralized prior to steering column or suspension geometry adjustment.

    - Centralization of the steering rack is achieved by aligning the marker on the centralizing cap with a locator on the pinion housing.

Power Steering -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
PAS fluid	Dexron 3

Capacities

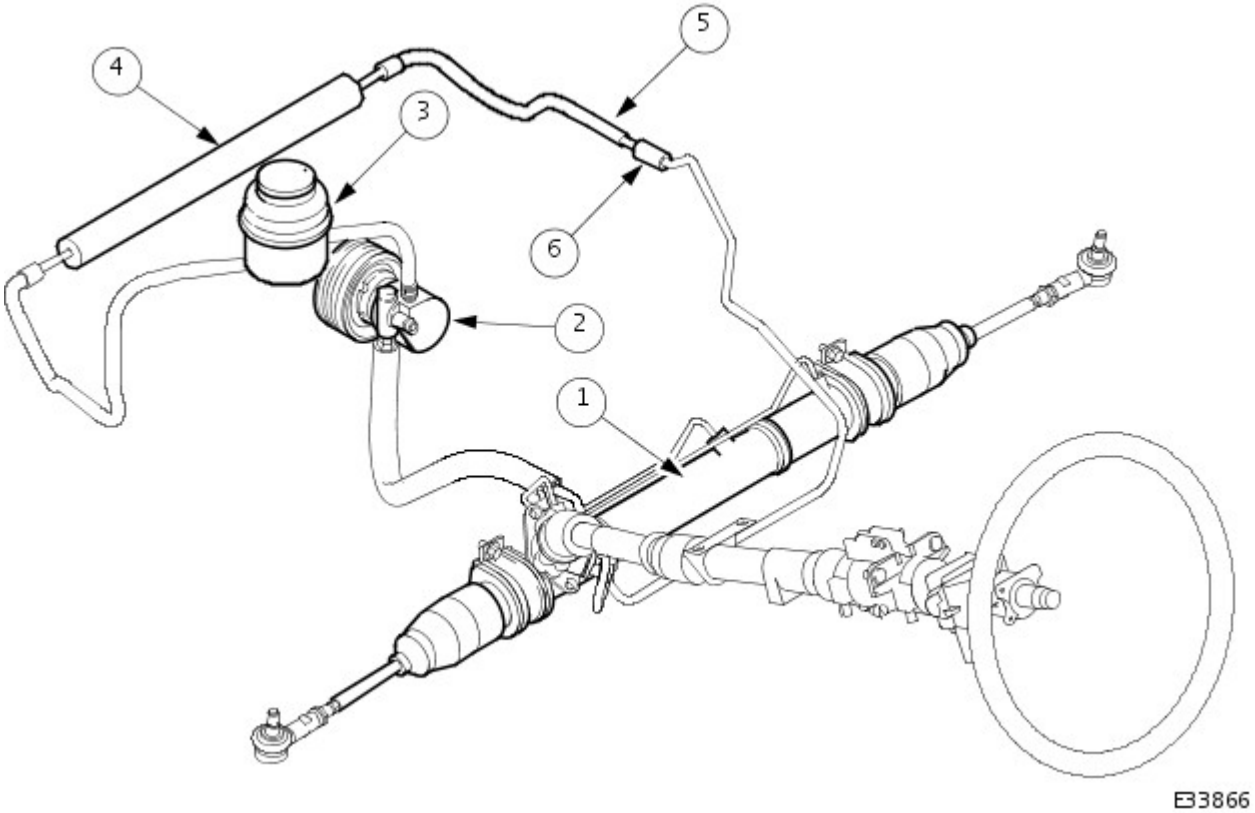
Unit	Liters
PAS system	1,0
PAS reservoir	0,4

Torques

Component	Nm
Rack mounting bracket to suspension crossbeam	40 - 50
PAS pump to front mounting bracket	22 - 26
PAS pump assembly to cylinder block	38 - 48
Pulley to PAS pump	18 - 24
High pressure hose to PAS pump	22 - 28
Rack pipe latch plate bolt	8.5 - 11.5
Reservoir mounting bracket to body nuts	4 - 5
Reservoir mounting bracket clamp	4 - 5
Fluid cooler to body	2.5 - 3.5
Transfer pipe to steering rack	7 - 8
Transfer pipe to hydraulic control valve	7 - 8

Power Steering - Power Steering

Description and Operation



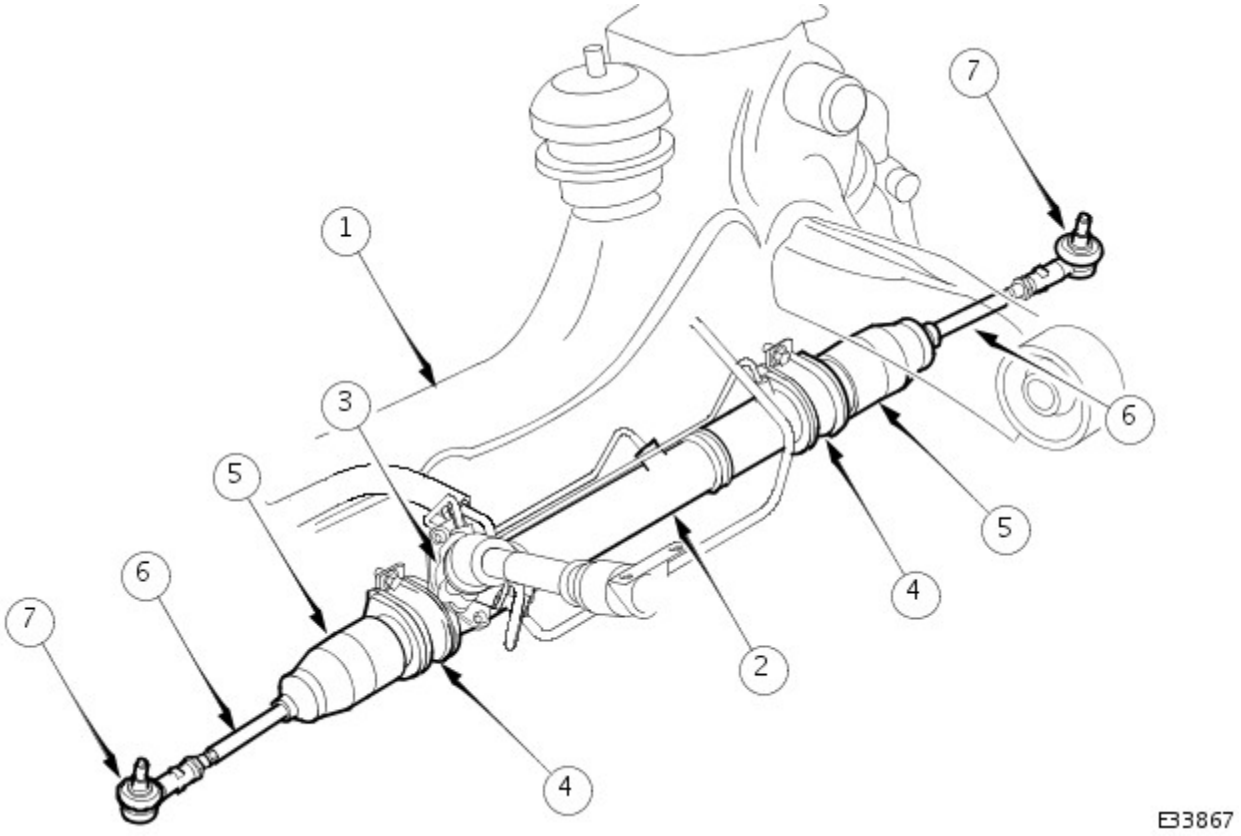
Parts List

Item	Part Number	Description
1	—	Steering rack assembly
2	—	Power assisted steering pump
3	—	Fluid reservoir
4	—	Fluid cooler
5	—	Hoses and pipework
6	—	In-line quick-fit connector

The power steering system is a rack and pinion design, with an engine-dri ven pump providing the steering assistance. The system features variable steering assistance with vehicle speed, a variable ratio steering rack, and a hydraulic control valve which has a torsion bar arrangement giving improved center feel to the steering.

Absolute cleanliness must be observed when replenishing the fluid or dismantling any part of the system. If any major component is renewed a new fluid reservoir must be fitted. New fluid from a sealed container must be used.

Steering Rack Assembly



Item	Part Number	Description
1	—	Front suspension crossbeam
2	—	Steering rack housing
3	—	Hydraulic control valve housing
4	—	Mounting bracket
5	—	Gaiter
6	—	Tie rod
7	—	Outer ball joint

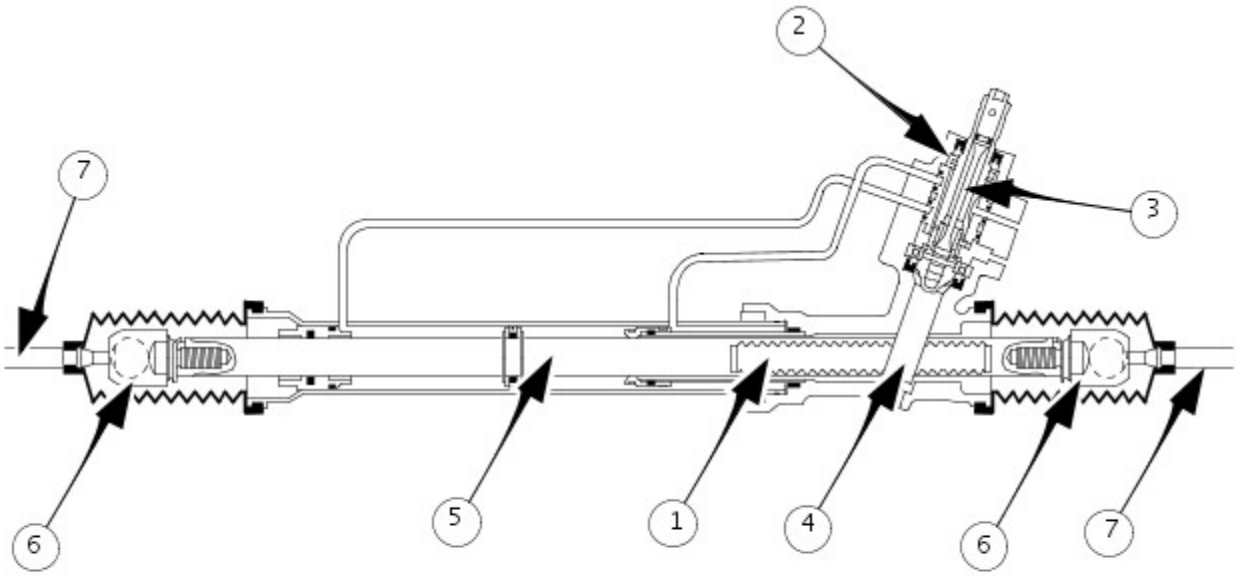
The steering rack assembly:

- Is mounted on the rear face of the front suspension crossbeam by two forged mounting brackets with resilient bushes. The bushes are handed (pinion side and non-pinion side) and are orientated according to the vehicle range application.
- Converts the rotary motion of the steering wheel, via the steering gear pinion, to the lateral motion of the rack.
- Features a variable ratio steering rack with integral hydraulic power steering cylinder and piston.
- Has a hydraulic control valve with Servotronic control and positive center feel torsion bar.

The basic steering rack assembly is not serviceable. The following components are serviceable items:

- Transfer pipework.
- Servotronic valve.
- Centralizing cap.
- Outer ball joint.
- Rack gaiter.
- Clips and fittings.

Steering Rack Components

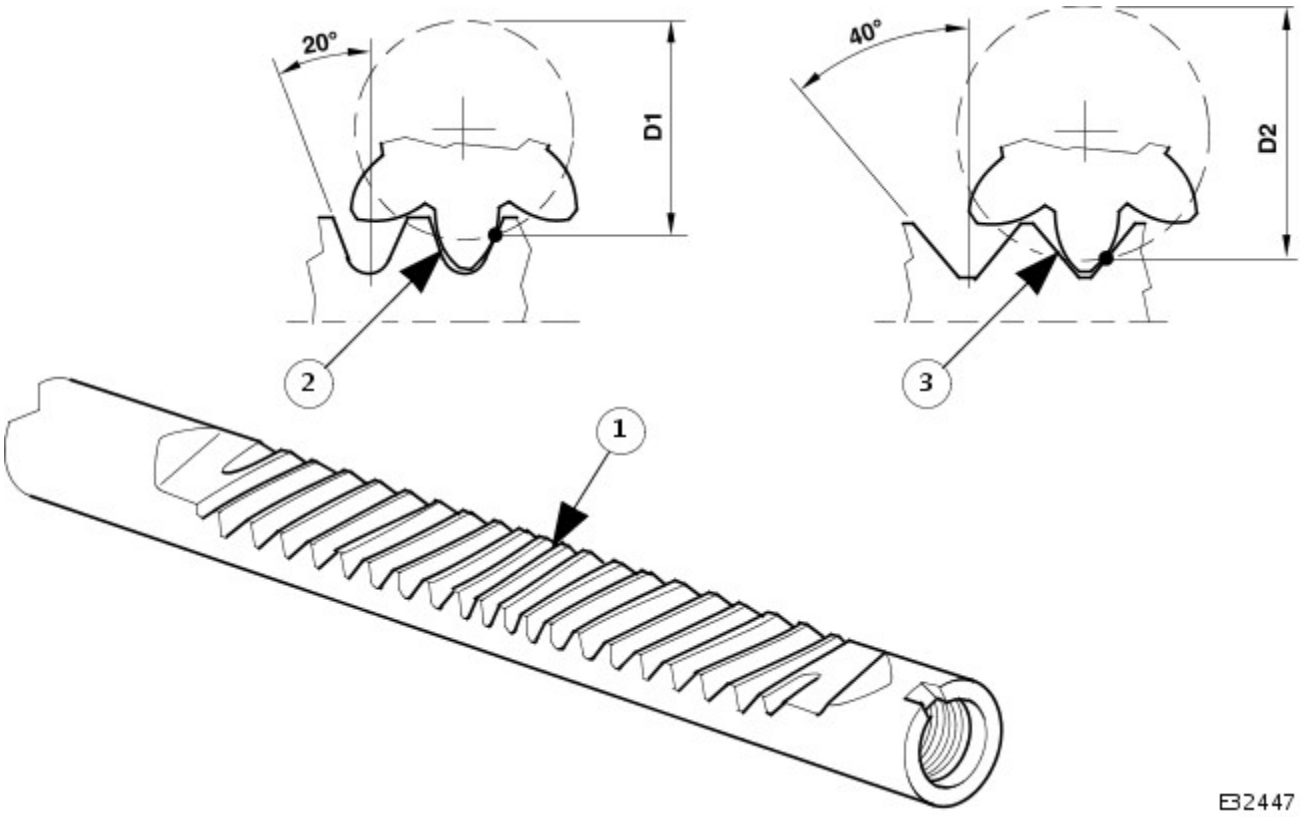


E3868

Parts List

Item	Part Number	Description
1	—	Steering rack
2	—	Hydraulic control valve
3	—	Torsion bar
4	—	Pinion
5	—	Operating cylinder and piston
6	—	Inner ball joint
7	—	Tie rod

Variable Ratio Steering Rack



Parts List

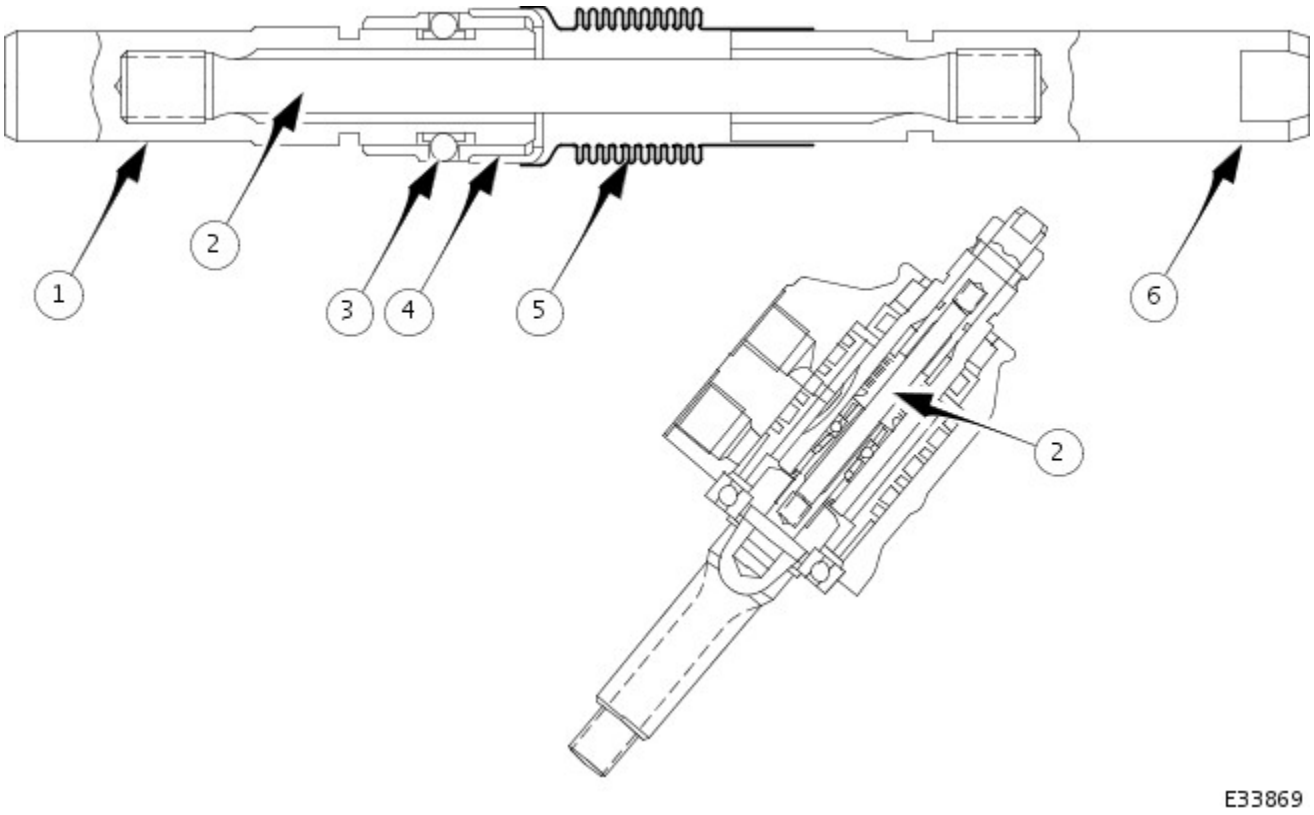
Item	Part Number	Description
1	—	Steering rack
2	—	Tooth contact angle at center of rack
3	—	Tooth contact angle at ends of rack

The variable ratio rack:

- Incorporates teeth of varying pitch and angle of contact, giving a variable pitch circle diameter which is a minimum at the center of the rack and a maximum at the ends.
- Reduces excessive response to on-center steering inputs during motorway driving.
- Causes the steering action to become progressively more direct as the steering wheel is turned from the center position.
- Allows a low number of turns of the steering wheel from lock to lock.

Positive Center-Feel Torsion Bar

Torsion Bar Components



Parts List

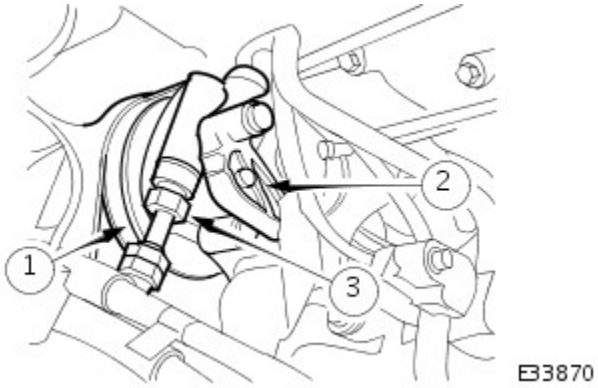
Item	Part Number	Description
1	—	End piece
2	—	Torsion bar
3	—	Caged ball bearings
4	—	Centering device
5	—	Bellows spring
6	—	Input shaft

The positive center-feel torsion bar improves the straight ahead feel of the steering in the region where very small amounts of hydraulic pressure, and hence reaction pressure, are generated.

The torsion bar assembly forms part of the hydraulic control valve assembly, and includes an axially pre-loaded metal bellows spring, which is arranged co-axially with the torsion bar. The torsion bar is positively connected between the end piece and the input shaft. One end of the bellows spring is attached to the input shaft, while the other end is attached to a centering device. The centering device has two prism-shaped recesses with caged, guided, ball bearings arranged between the recesses, and determines the zero-torsion position of the bellows spring.

On turning the steering wheel from the straight ahead position, the spring forces of the torsion bar assembly must be overcome. Initially, the bellows spring produces substantial additional torsional resistance. However, after an angular movement of approximately 0.2 degrees the torsional rigidity decreases and becomes similar to a conventional torsion bar.

Power Assisted Steering Pump



Parts List

Item	Part Number	Description
1	—	Power assisted steering pump
2	—	Engine mounting bracket
3	—	High pressure port

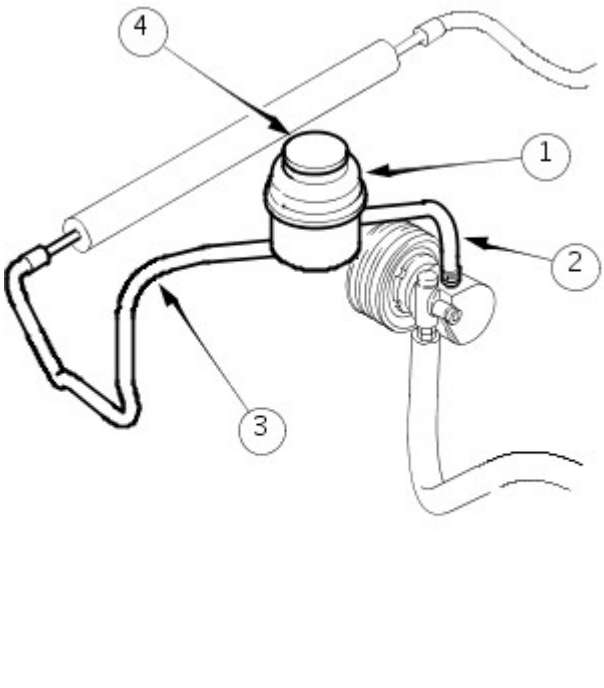
The power assisted steering pump:

- Is mounted on a bracket installed on the front of the engine.
- Provides hydraulic pressure for the power steering system.
- Is of the roller vane type.
- Is belt driven from the engine crankshaft.
- Will provide 105 bar fluid pressure.

The pump is not serviceable and should be renewed as a complete assembly.

Fluid Reservoir

Reservoir and Hoses



Parts List

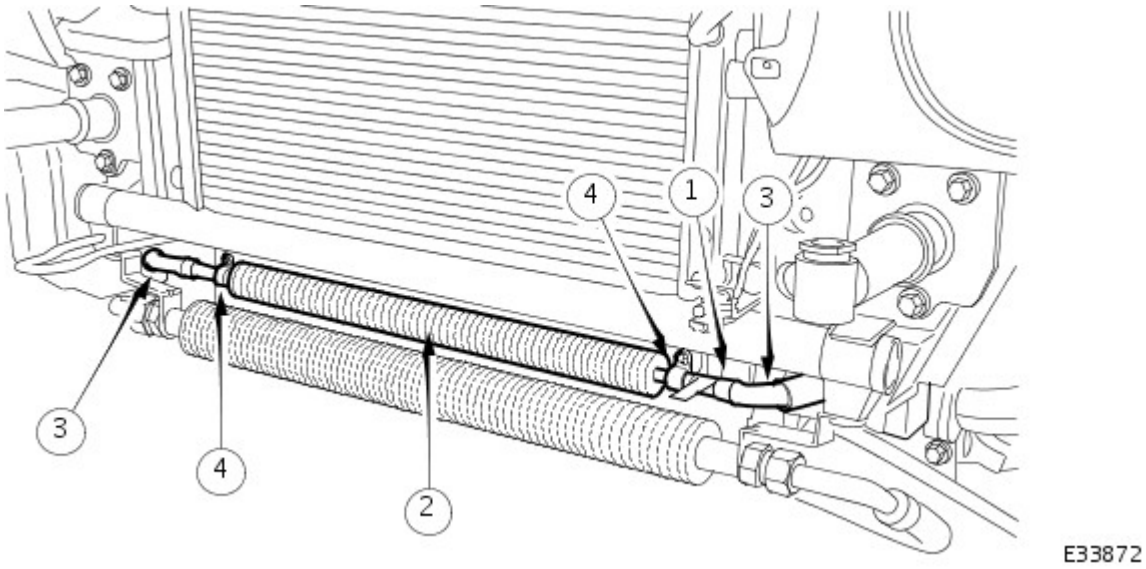
Item	Part Number	Description
1	—	Fluid reservoir
2	—	Supply line
3	—	Return line
4	—	Filler cap

The fluid reservoir:

- Is located in the engine compartment, mounted on the engine compartment fuse box bracket.
- Incorporates a 10 micron, lifetime, integral filter.
- Has a capacity of 0.4 liter.
- Has a dipstick incorporated into the filler cap for checking the fluid level.

A new reservoir must be fitted if the steering rack, pump or fluid cooler are renewed.

Fluid Cooler



Parts List

Item	Part Number	Description
1	—	Front body cross member
2	—	Fluid cooler
3	—	Integral hoses
4	—	Cooler mounting

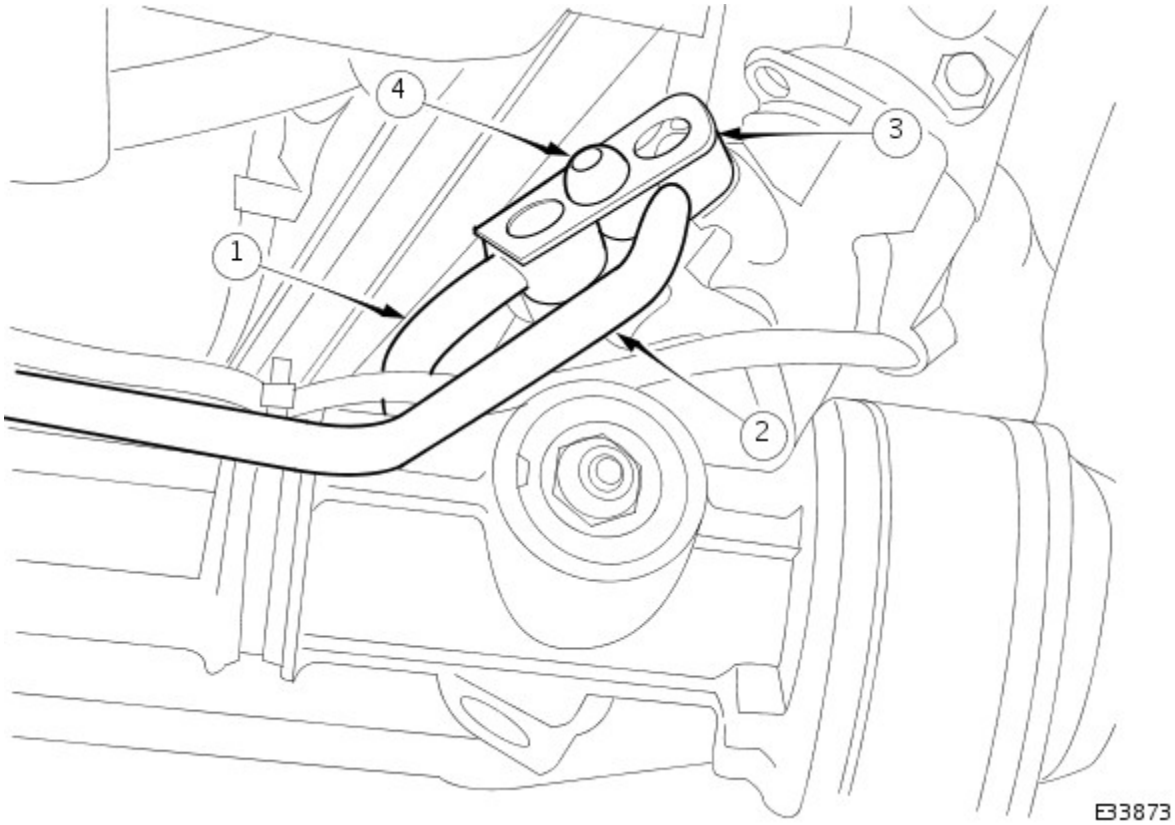
The fluid cooler:

- Is resiliently mounted on the front body cross member.
- Cools the fluid before it is returned to the reservoir.
- Is of the wire-bound tube type.
- Has integral hoses.

Supply and Return Hoses and Pipework

The supply and return hoses and pipework deliver fluid at high pressure from the pump to the steering rack assembly. The fluid is then returned to the reservoir through the cooler tube. The high pressure supply hose contains two cable-type attenuators, one at each end, to reduce noise. The return pipe is clipped to the steering rack housing by a resilient mounting.

Latch-Plate Location

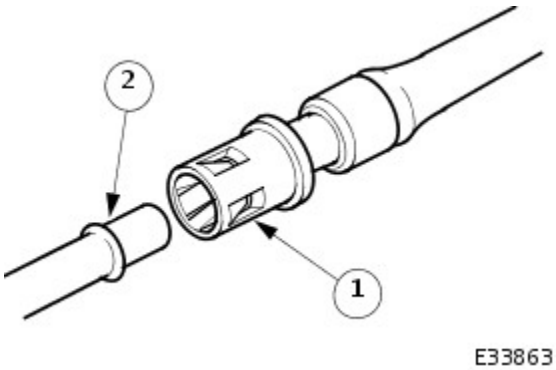


Parts List

Item	Part Number	Description
1	—	Return pipe (RH drive)
2	—	Supply pipe (RH drive)
3	—	Latch-plate
4	—	Latch-plate securing screw

The supply and return pipes are secured to the hydraulic control valve housing by a latch-plate having a single fixing screw. The latch-plate is captive to the supply pipe. Each pipe has an O-ring which is a serviceable item.

In-Line Quick-Fit Connector



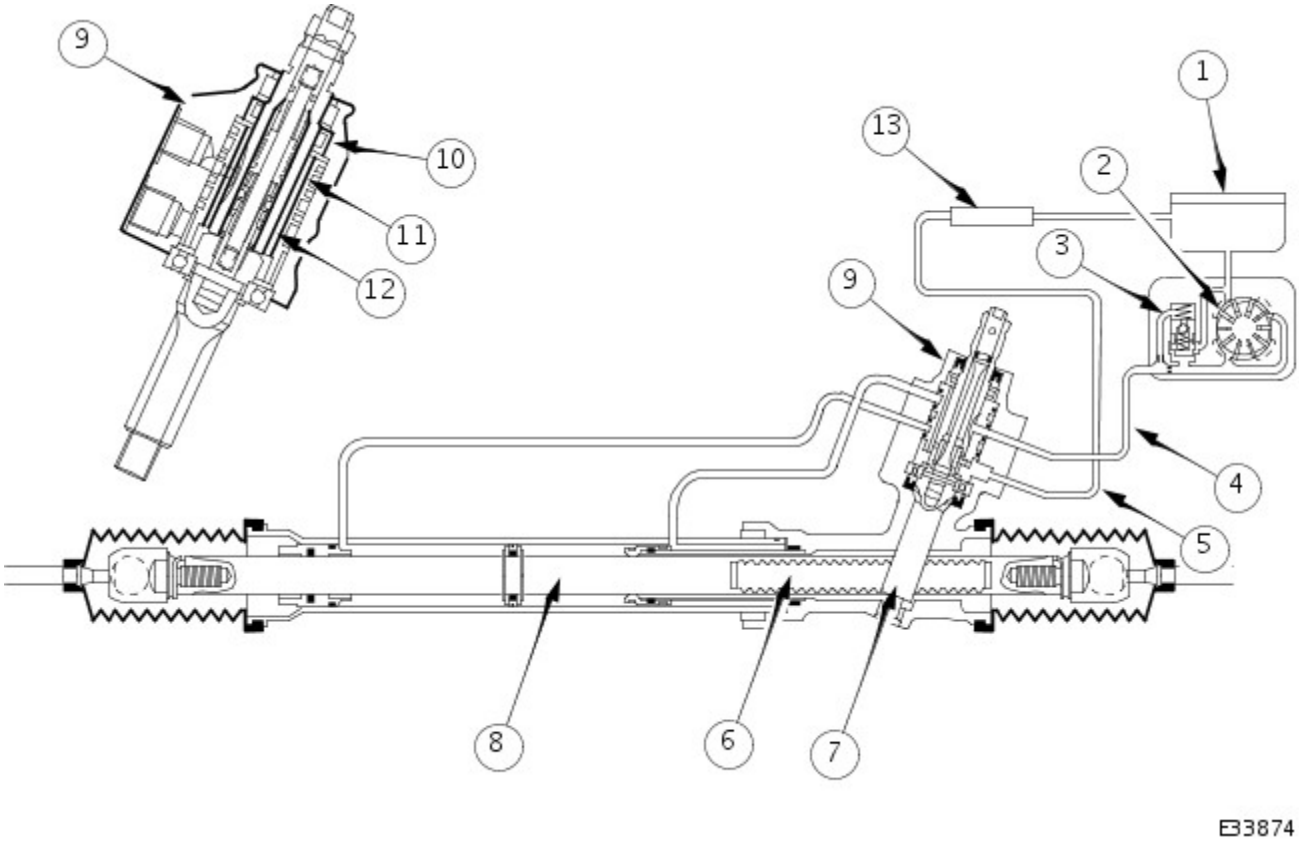
Parts List

Item	Part Number	Description
1	—	Quick-fit connector
2	—	Return pipe

A quick-fit connector with double O-ring seals is incorporated in the return line and is clipped to the right-hand chassis side member. The quick-fit connector O-rings are not serviceable.

Special tool JD 182 is required to disconnect the quick-fit connector.

Hydraulic System



Parts List

Item	Part Number	Description
1	—	Fluid reservoir
2	—	Pump
3	—	Pressure and flow limiting valve
4	—	Supply line
5	—	Return line
6	—	Steering rack
7	—	Pinion
8	—	Operating cylinder and piston
9	—	Hydraulic control valve
10	—	Hydraulic reaction piston
11	—	Control sleeve
12	—	Rotary distributor
13	—	Fluid cooler

Hydraulic System Operating Principle

The rotary motion of the steering wheel is converted, via the steering rack pinion, to the lateral motion of the rack. Steering assistance is provided by pressurized fluid being directed against a piston operating within the rack cylinder. Rack movement is achieved by differential pressures being applied on either side of the rack piston, caused by unequal restrictions within the hydraulic control valve.

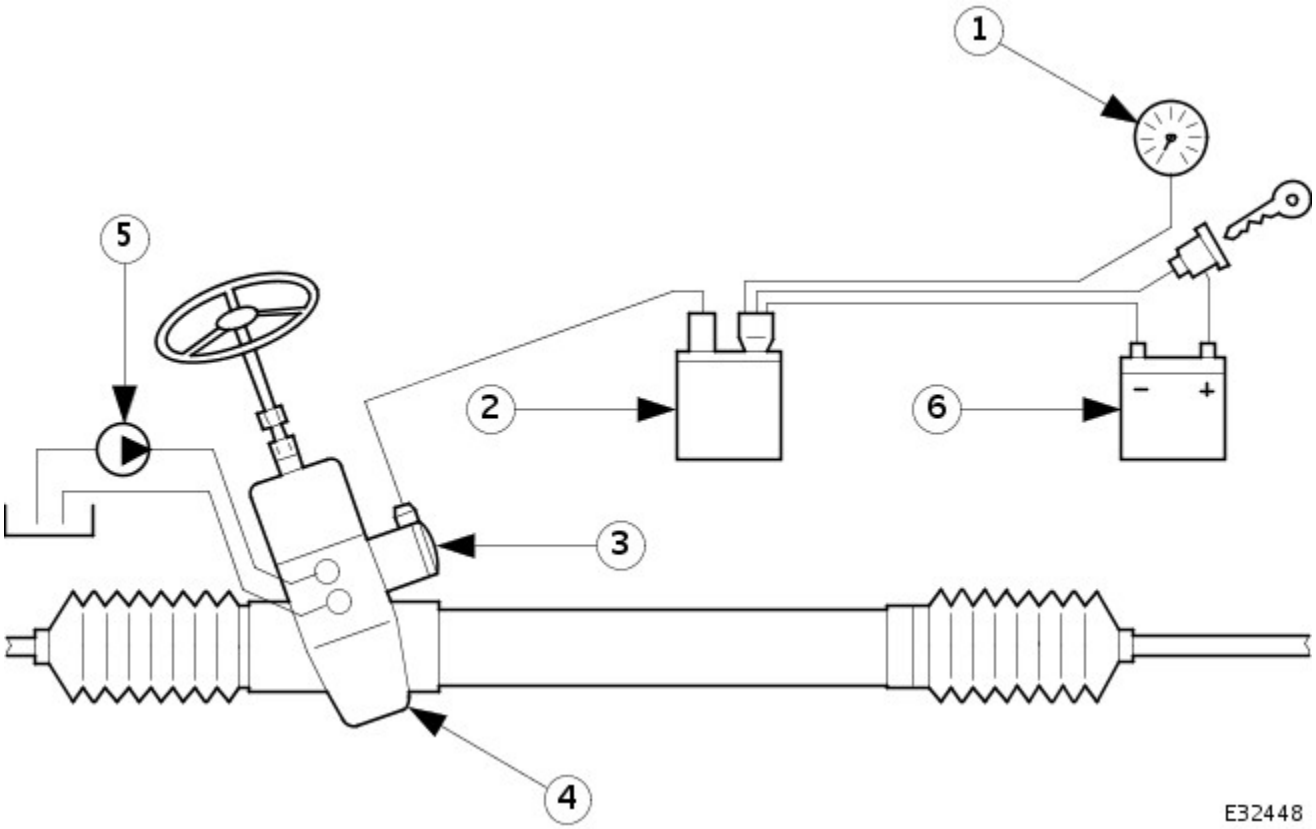
The main components of the hydraulic control valve are the rotary distributor, control sleeve and hydraulic reaction piston.

The rotary distributor and control sleeve turn relative to each other, forming the unequal restrictions which create the differential pressures to operate the rack piston; the displacement of the distributor and sleeve being controlled by the elastic deformation of a torsion bar which is concentric with the pinion and valve. Refer to Positive Center-Feel Torsion Bar in this sub-sectio n.

The hydraulic reaction piston moves axially, relative to the rotary distributor, and is connected to the control sleeve by a three-bearing helical screw. Pressure applied either side of the hydraulic reaction piston is translated into a rotational force which increases steering effort. For details of Servotronic speed-sensitive steering control, refer to Servotronic Control in this sub-section.

When the vehicle is travelling straight ahead, the valve restrictions are balanced, thus providing equal pressures on either side of the rack piston. When load is applied at the steering wheel, the two halves of the control valve (rotary distributor and control sleeve) are displaced making the restrictions unequal. The resulting differential pressures on either side of the rack piston, assist the steering rack to move to left or right. As the turning load is removed, the pressures equalize again and the steering returns to the straight ahead position, aided by suspension geometry.

Servotronic Control



Parts List

Item	Part Number	Description
1	—	Vehicle speed input
2	—	Steering control module
3	—	Servotronic valve
4	—	Hydraulic control valve housing
5	—	PAS steering pump
6	—	Battery

The Servotronic system provides steering assistance which is proportional to vehicle speed. It comprises the steering control module, and Servotronic valve forming part of the hydraulic control valve assembly.

The Servotronic valve is an electro-hydraulic device with a variable orifice, which varies in size according to the position of a needle valve. The needle valve is controlled by a solenoid in response to a variable current input from the steering control

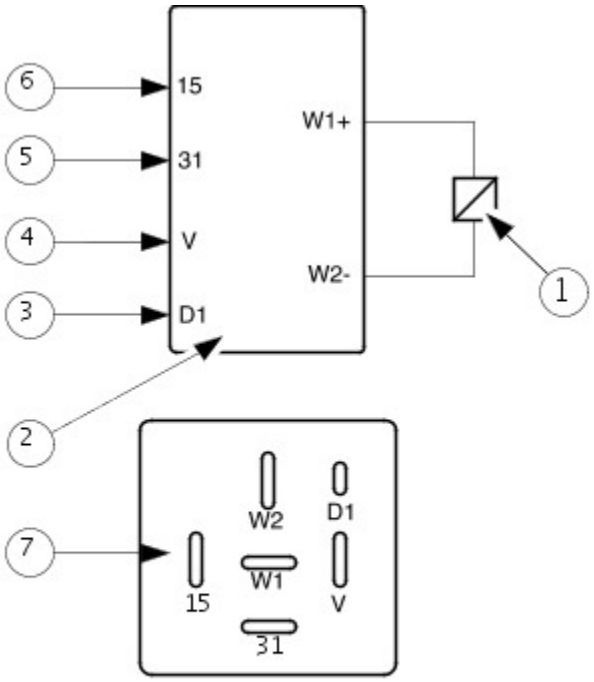
module. This regulates the fluid flow through the hydraulic control valve, which determines the amount of steering assistance.

Steering Control Module

The steering control module receives the vehicle speed from the instrument cluster and outputs the corresponding current values to the Servotronic valve. At parking speeds, when maximum assistance is required, the current is at its maximum value of 854 mA and the valve is closed. As the vehicle speed increases, the current progressively decreases to its minimum value of 15 mA and the valve opens in small increments. This results in an increasing amount of hydraulic pressure being applied to the reaction piston, making the steering feel more precise and responsive.

The rate of progression and shape of the characteristic between parking and high speed operation, is determined by the algorithm within the steering control module, and is matched to each suspension variant within the vehicle range.

Control Module Connections



E35275

Item	Description
1	Servotronic valve
2	Steering control module
3	Not used
4	Vehicle speed input
5	Ground
6	Ignition supply +12V
7	Base of steering control module

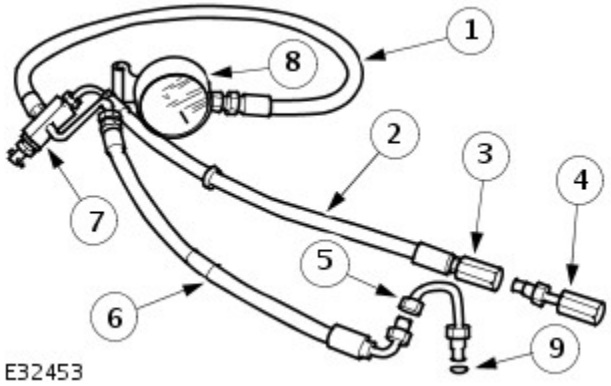
Power Steering - Power Steering

Diagnosis and Testing

Refer to the Description and Operation sub-section for details of the power operated steering system and Servotronic control system.

Power Steering Pressure Test

Test Equipment



Parts List

Item	Part Number	Description
1	—	Pressure gauge hose
2	—	Pump return hose
3	—	Pump return hose connector
4	—	Test equipment to HP hose adaptor
5	—	Pump HP outlet to hose adaptor
6	—	Pump adaptor to control valve hose
7	—	Control valve

Installing Test Equipment

To install the pressure test equipment:

- Place a suitable drain tray below the PAS 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 PAS pump high pressure outlet.
- Install the pump outlet to hose adaptor. Do not omit the O-ring.
- Connect the pump adaptor to control valve hose of the test equipment.
- Install the adaptor in the high pressure hose previously removed from the pump outlet.
- Connect the connector of the test equipment hose to the adaptor.
- Remove the hose clamp from the reservoir hose.
- Start the engine.

With the control valve OPEN and the engine idling, the following system pressures may be checked:

- During turning.
- When the steering is held on full lock.
- With the steering at rest.

• WARNINGS:

TO AVOID EXCESSIVE HEATING OF THE PAS PUMP, DO NOT CLOSE THE VALVE FOR LONGER THAN NECESSARY.

 DO NOT DRIVE THE VEHICLE WITH THE TEST EQUIPMENT INSTALLED.

With the control valve CLOSED the pump maximum output pressure can be checked.

Removing Test Equipment

To remove the test equipment:

- Install a hose clamp on the reservoir to pump hose.
- Removing the test equipment is a reversal of the installation instructions.
- Install a new O-ring to the PAS pump high pressure outlet to hose connection.
- Install the original hose to the PAS pump.
- Remove the clamp from the reservoir to pump hose.
- Top-up the reservoir fluid.
- Bleed the PAS system; refer to this section.

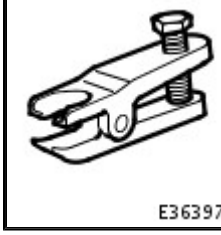
Refer to PDU User Guide

The PDU will diagnose all electrical components of the system.

Before changing a component, check fuse No. 12 (10A) in the left-hand heelboard fuse box. However, if this fuse is faulty a number of other components will also fail to function.

Power Steering - Steering Gear

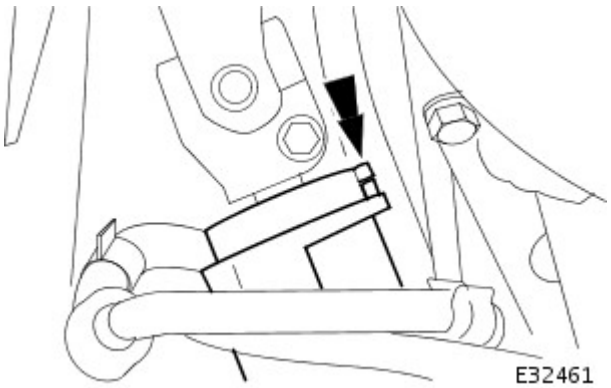
Removal and Installation

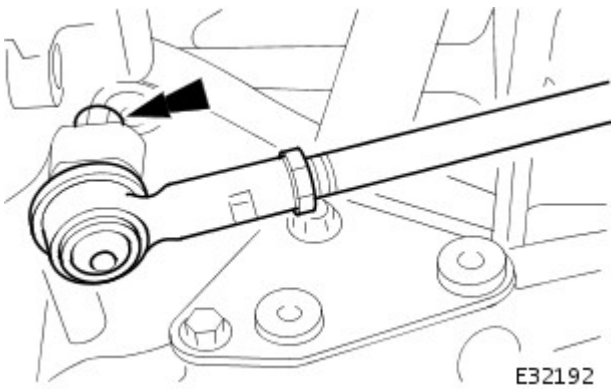
Special Tool(s)	
 E36397	Taper Separator 211-098 (JD 100)

Removal

All vehicles

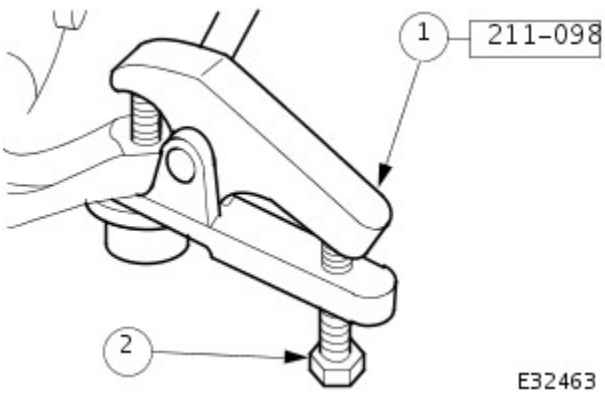
1. Centralize steering the wheel.
2. Raise and support the vehicle on a four-post ramp.
3. Place a suitable drain pan under the steering gear.
4. From below the vehicle, check that steering gear is centralized by aligning the centralizing notch on the dirt protection cover with the location hole in the pinion housing casting.





5. NOTE: Right-hand shown, left-hand similar.

   Remove and discard both tie rod end nuts.

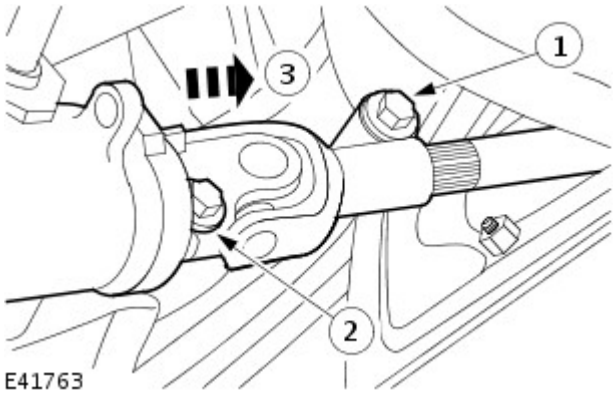


6. NOTE: Right-hand shown, left-hand similar.

   Detach both of the tie rod ends.

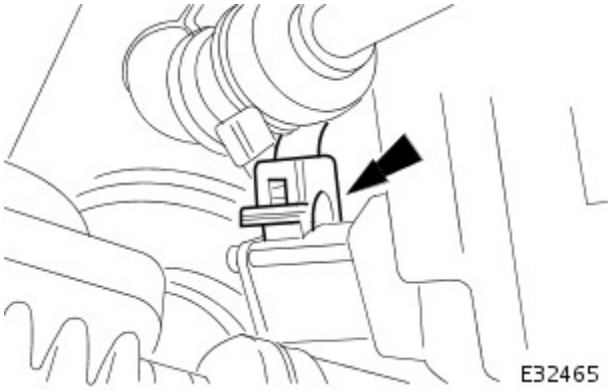
   1. Fit the special tool to tie rod end.
   2. Tighten the tool bolt to release the taper.

- Remove the tool.



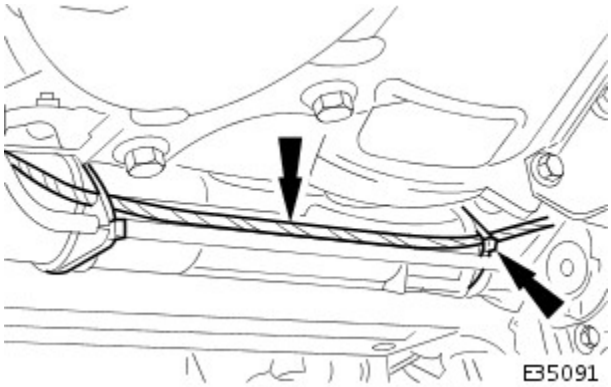
7. Detach the steering column lower shaft.

1. Loosen the steering column lower shaft retaining bolt.
2. Remove and discard the steering column lower shaft retaining bolt.
3. Detach the steering column lower shaft.



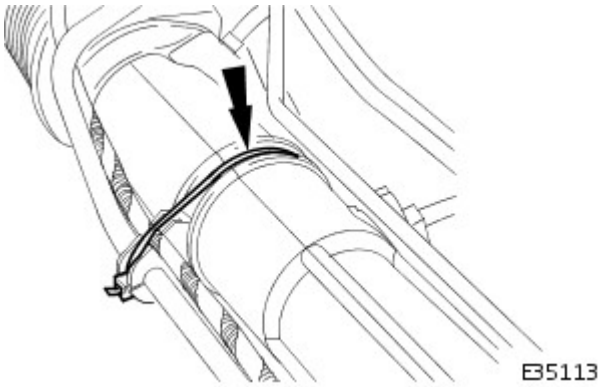
8. Disconnect the steering gear transducer electrical connector.

Right-hand drive vehicles



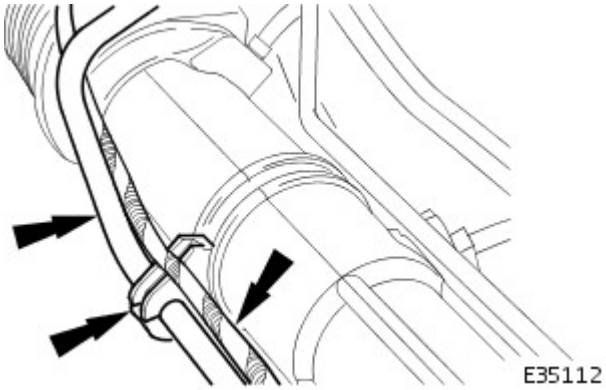
9. Cut and discard the steering gear transducer harness tie-strap.

All vehicles

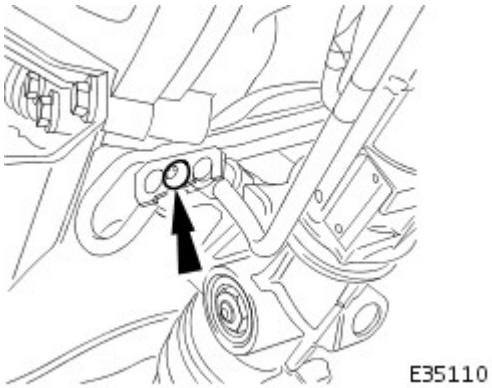


10. Cut and discard the power steering return pipe tie-strap.

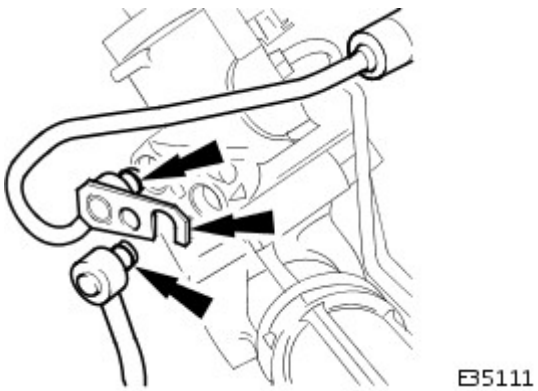
11. Detach the power steering return pipe from the mounting rubber.



- Route the steering gear transducer harness from behind the power steering return pipe (right-hand drive vehicles only).



12. Remove the power steering supply and return pipe retaining plate bolt and withdraw the plate.



13. Drain the power steering fluid.

- Disconnect the power steering supply and return pipes and allow the fluid to drain.
- Remove and discard the ´O´ ring seals from the pipe connectors.
- Fit suitable blanking caps to the pipe connectors and pinion housing ports.

14. Remove the drain pan and discard the fluid.

15. NOTE: The steering gear mounting bushings are handed; they are marked accordingly and must be replaced as a pair.

Remove the steering gear mounting bracket bushings.
For additional information, refer to: Steering Gear Bushing (211-02 Power Steering, Removal and Installation).

16. NOTE: When removing the steering gear, manoeuvre the power steering return pipe past the pinion housing to steering gear pipes.

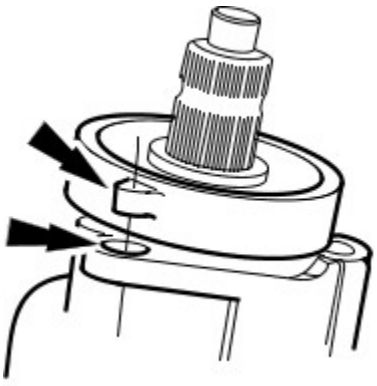
Remove the steering gear.

17. Using a tap (M10 x 1.5 mm), clean the steering gear to crossbeam bolt hole threads.

Installation

All vehicles

1. If a new steering gear assembly is to be fitted, make sure steering gear is centralized before installation.


E33832

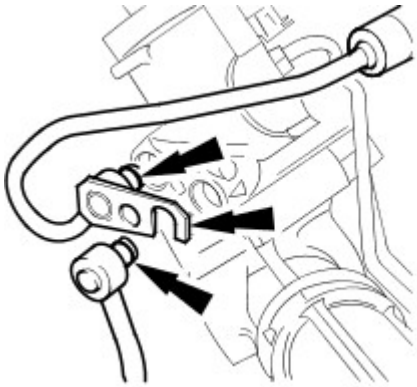
2. NOTE: When installing the steering gear, manoeuvre the power steering return pipe past the pinion housing to steering gear pipes.

• NOTE: A new steering gear assembly is supplied with a dirt protection cover/centralizing cap fitted.

Position the steering gear to vehicle.

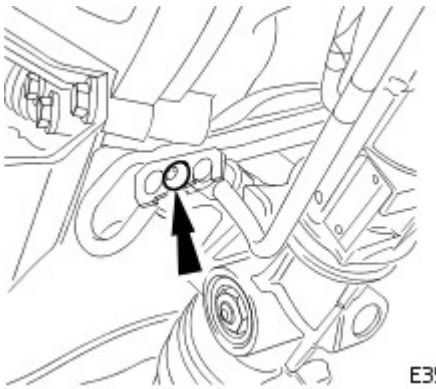
3. Install the steering gear mounting bracket bushings.
For additional information, refer to: Steering Gear Bushing (211-02 Power Steering, Removal and Installation).

4. Connect the power steering supply and return pipes to the pinion housing.


E35111

- Remove the blanking caps and install new ´O´ring seals in pipe connectors.
- lubricate the ´O´ring seals with clean power steering fluid.
- Remove the blanking caps from the pinion housing ports.
- Position the power steering supply and return pipes to the pinion ports and seat ´O´rings.

5. Attach the power steering supply and return pipes to the pinion housing.


E35110

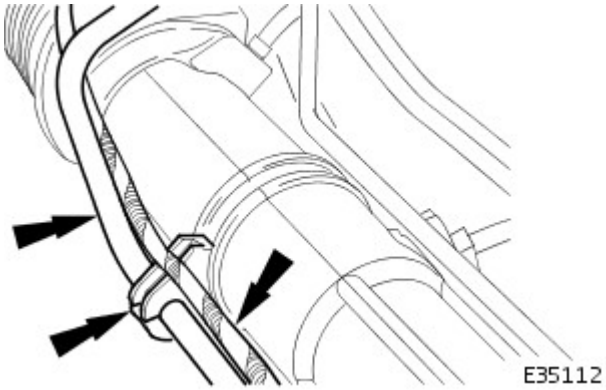
- Ensure the power steering supply and return pipes and the retaining plate are correctly seated.
- Install the bolt.
- Tighten to 9-12 Nm.

6. Clean any fluid spillage from the steering gear and surrounding area.

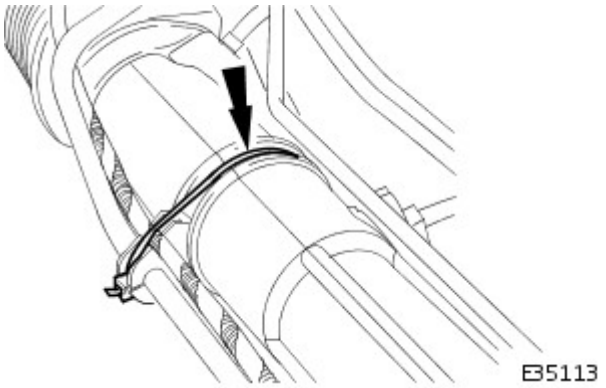
7. Attach the power steering return pipe to the steering gear.

- Attach the rubber support to the power steering return pipe.
- Route the steering gear transducer harness behind the power steering return pipe (right-hand drive vehicles

only).

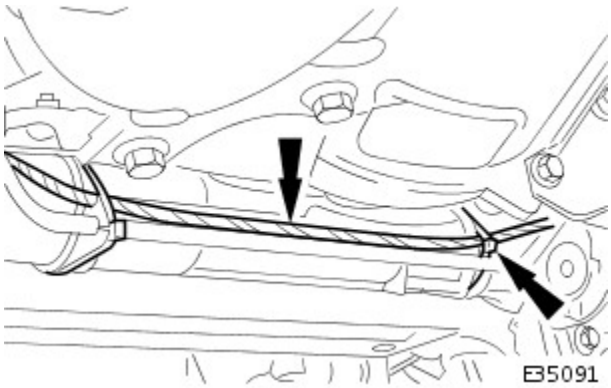


8. Install a new power steering return pipe tie-strap.



Right-hand drive vehicles

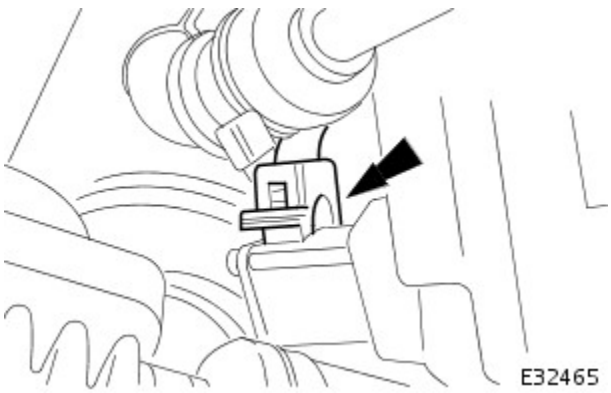
9. Install a new steering gear transducer harness tie-strap.



All vehicles

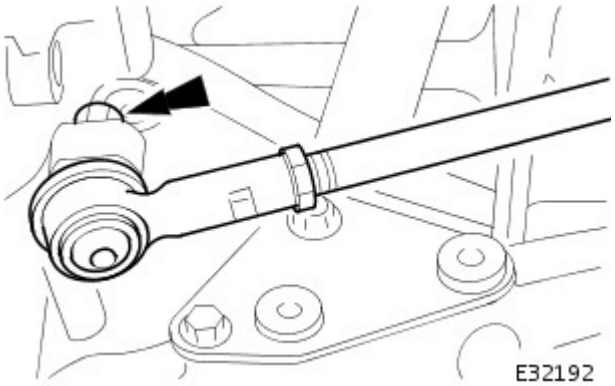
10. Connect the steering gear transducer electrical connector.

- On right-hand drive vehicles, position the steering gear transducer harness behind the power steering return pipe.

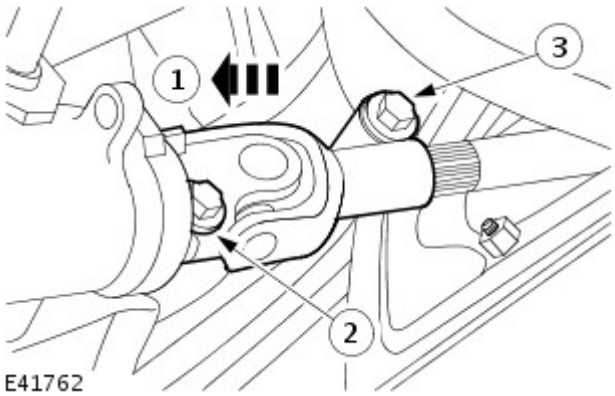


11. NOTE: Right-hand shown, left-hand similar.

Attach the tie rod end.



- Locate the tie rod end into the steering arm.
- Install a new nut.
- Tighten the nut to 22-28 Nm.



12. NOTE: Make sure the steering wheel and wheel and tire assemblies are in the straight ahead position before fitting the steering column lower shaft.

Attach the steering column lower shaft.

1. Attach the steering column lower shaft.
2. Install the steering column lower shaft retaining bolt.
   1. Tighten to 28 - 34 Nm.
3. Tighten to 28 - 34 Nm.

13. Fit a new power steering fluid reservoir, refill with new power steering fluid and bleed air from the system.
For additional information, refer to: Power Steering System Filling and Bleeding (211-00 Steering System - General Information, General Procedures).

14. Check and adjust the front toe.
For additional information, refer to: Front Toe Adjustment (204-00 Suspension System - General Information, General Procedures).

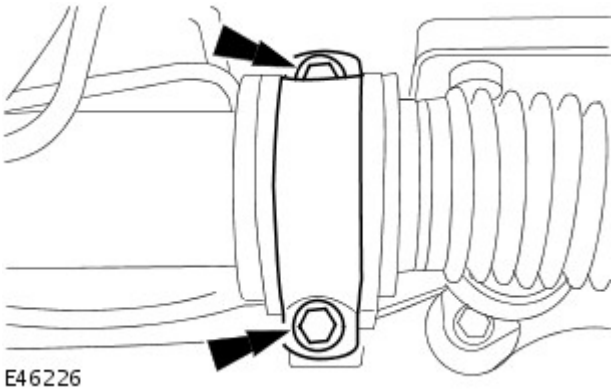
Power Steering - Steering Gear Bushing

Removal and Installation

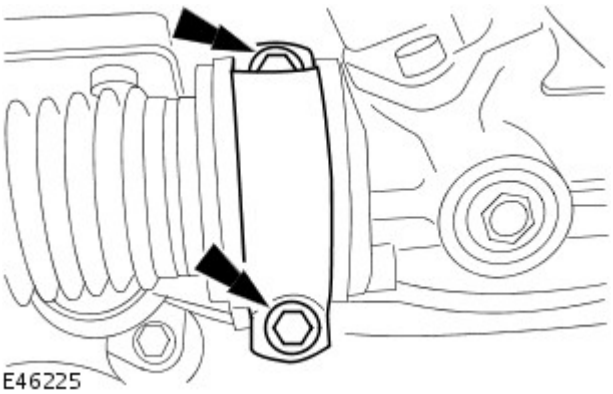
Removal

1. Raise the vehicle on a four-post ramp.

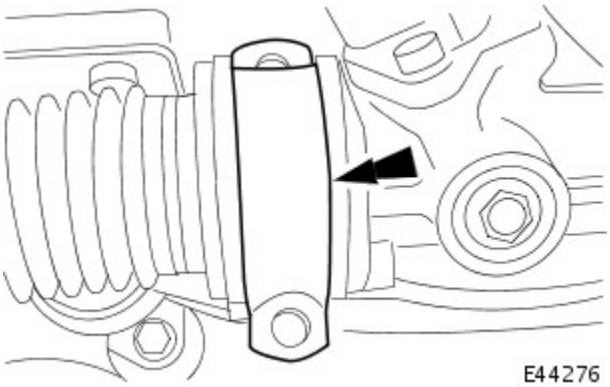
• NOTE: The steering gear bushings are handed; They are marked accordingly and must be replaced as a pair.



2. Loosen, but do not remove, the right-hand steering gear mounting bracket retaining bolts.



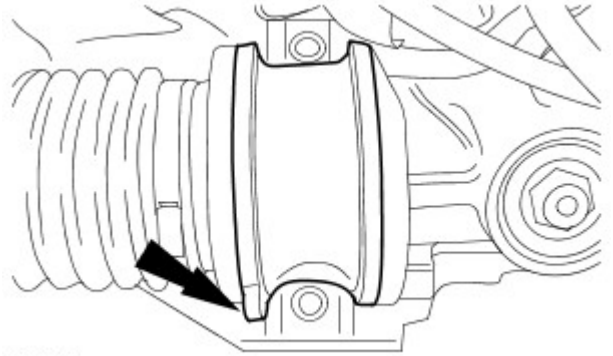
3. Remove the left-hand steering gear mounting bracket retaining bolts.



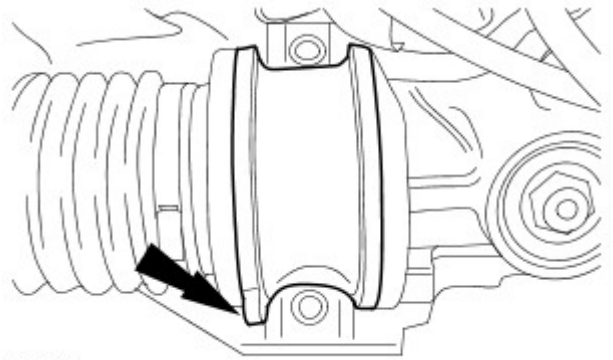
4. Remove the left-hand steering gear mounting bracket.

5. NOTE: Note the installation position of the bushing before removal.

Remove and discard the left-hand steering gear bushing.



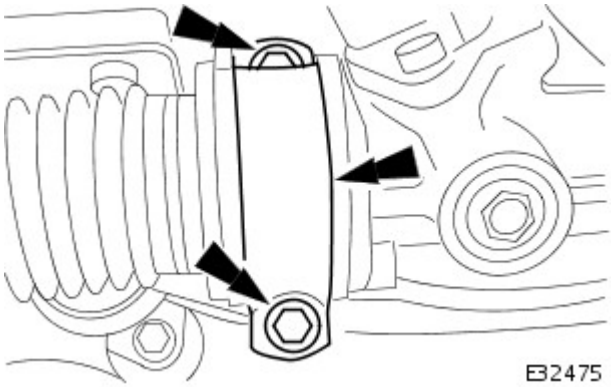
E44273



E44273

6. NOTE: Note the installation position of the bushing.

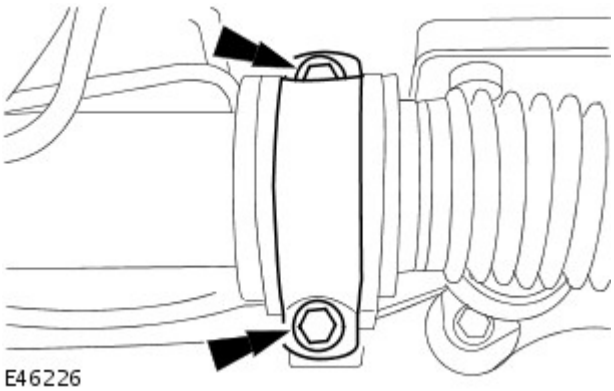
Install the left-hand steering gear bushing.



E32475

7. Install the left-hand steering gear mounting bracket.

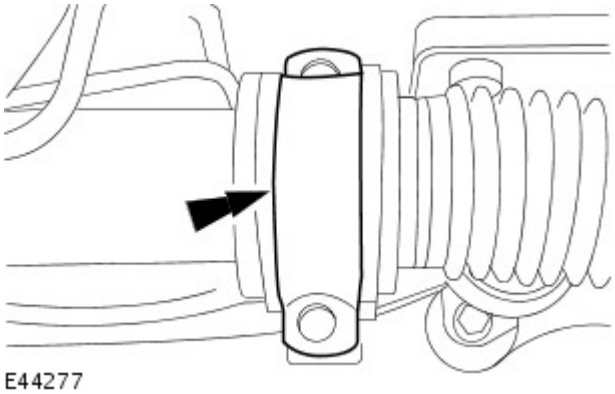
- Install the mounting bracket.
- Install, but do not tighten, the bolts.

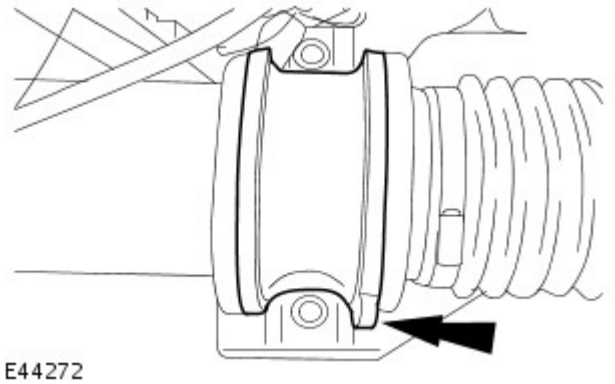


E46226

8. Remove the right-hand steering gear mounting bracket retaining bolts.

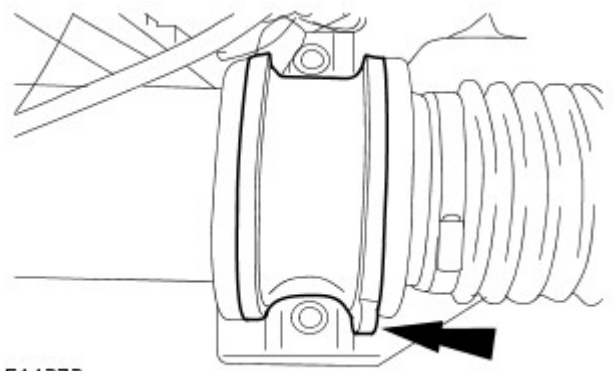
9. Remove the right-hand steering gear mounting bracket.


E44277


E44272

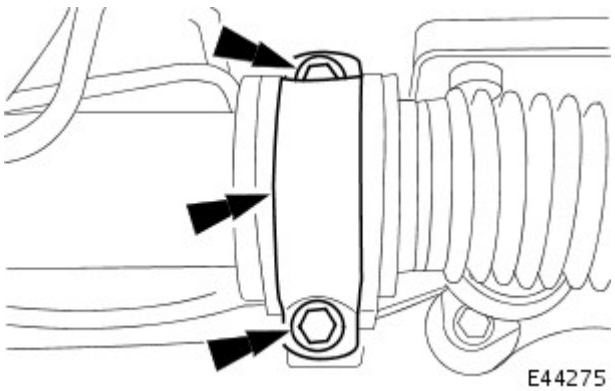
10. NOTE: Note the installation position of the bushing before removal.

Remove and discard the right-hand steering gear bushing.


E44272

11. NOTE: Note the installation position of the bushing.

Install the right-hand steering gear bushing.

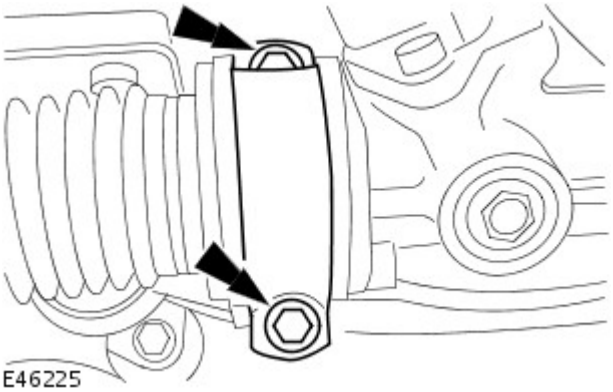

E44275

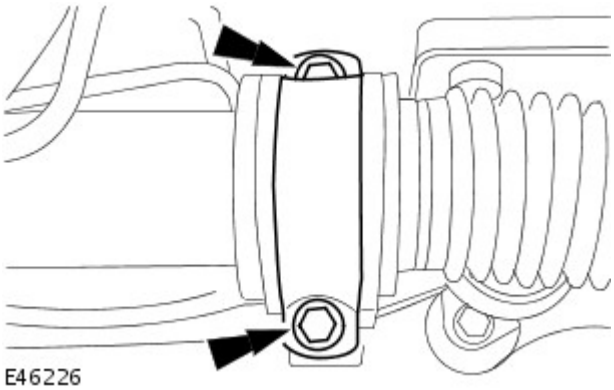
12. Install the right-hand mounting bracket to the steering gear.

- Install the mounting bracket.
- Install, but do not tighten, the bolts.

Installation

1. Tighten to 45 Nm.





2. Tighten to 45 Nm.

3. Lower the vehicle.

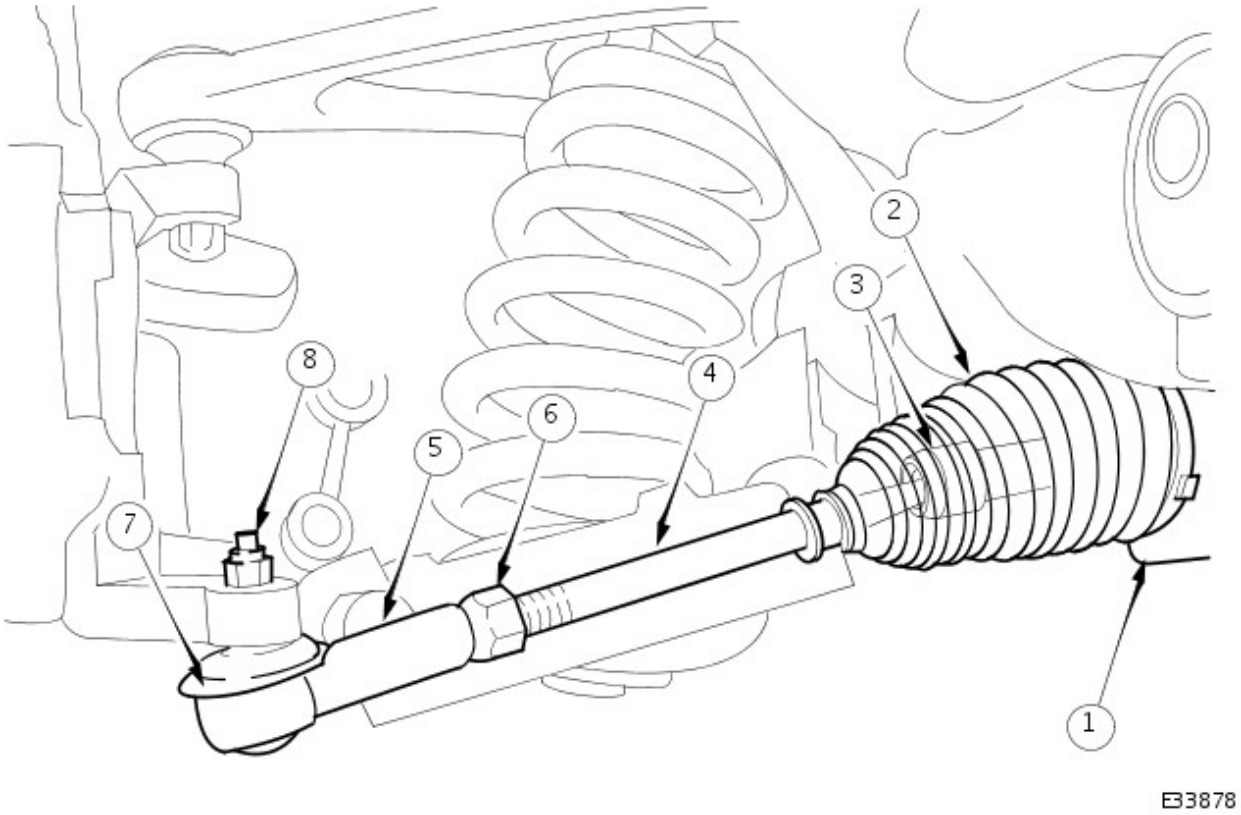
Steering Linkage -

Torques

Component	Nm
Outer tie rod end to steering arm nut	71 - 85
Outer tie rod end lock-nut	51 - 69

Steering Linkage - Steering Linkage

Description and Operation



Parts List

Item	Part Number	Description
1	—	Steering rack assembly
2	—	Steering rack gaiter
3	—	Inner ball joint
4	—	Tie rod
5	—	Outer tie rod end
6	—	Lock-nut
7	—	Outer ball joint
8	—	Outer ball joint nut

The left- and right-hand tie rod assemblies:

- Transmit steering forces from the steering rack to the steering arms which are integral with the vertical links.
- Comprise the tie rod, inner ball joint, outer tie rod end and outer ball joint.
- Provide front road wheel toe setting by adjustment of the threaded outer tie rod ends.

• NOTE: Steering geometry adjustments must only be carried out with the vehicle on turn plates to allow the wheels to move during adjustment.

The left- and right-hand steering rack gaiters:

- Are installed between the steering rack and the tie bars.
- Are of the concertina type.
- Retain lubricant and prevent the ingress of foreign matter.
- Permit movement of the steering rack and tie rods.

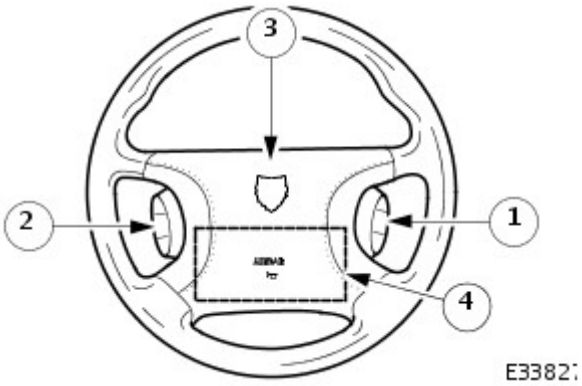
Steering Column -

Torques

Component	Nm
Upper steering column upper fixings	22 - 28
Steering wheel to column securing bolt	34 - 46
Upper bracket to body screws	22 - 28
Upper steering column lower fixings	17 - 23
Lower steering column pinch bolts (upper and lower)	28 - 34
Upper and lower cowl securing screws	1.5 (nominal)
Driver air bag fixings	4 - 5
Column switchgear to column	4 - 5

Steering Column - Steering Column
Description and Operation

Steering Wheel

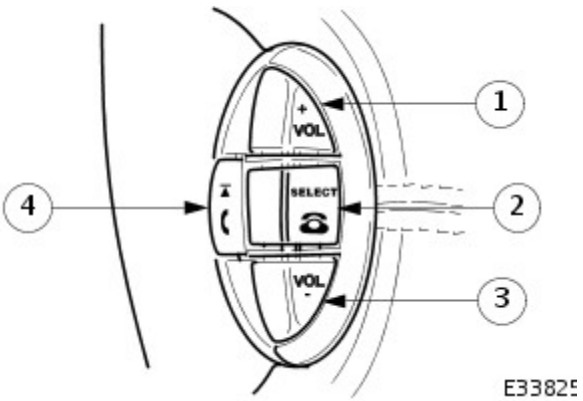


Item	Part Number	Description
1	-	Speed control switchpack
2	-	ICE switchpack
3	-	Horn pad
4	-	Air bag location

The steering wheel assembly incorporates:

- The speed control switchpack.
- The in-car entertainment (ICE) switchpack.
- The horn pad.
- The driver air bag module; refer to Section 501-20A Safety Belt SystemSection 501-20B Supplemental Restraint System.

ICE Switchpack



Item	Part Number	Description
1	-	Volume increase
2	-	ICE functions/telephone mode select
3	-	Volume decrease
4	-	ICE presets/telephone memory select

The in-car entertainment (ICE) switchpack is installed to the left of the steering wheel center, controlling the ICE functions and telephone (where fitted). The switchpack overrides the corresponding buttons on the ICE control panel and performs the following functions:

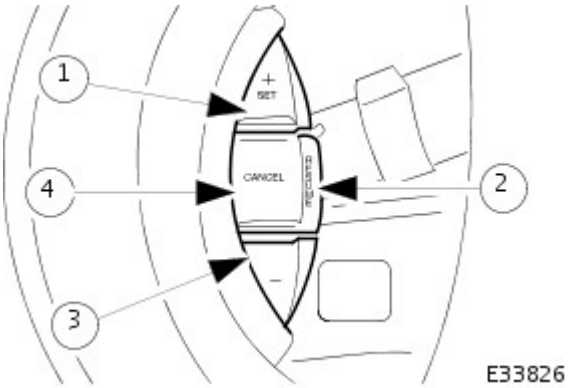
1. **1.** Increase the volume of the selected audio output or telephone.

2. **2.** Press and release to cycle through radio FM, radio AM, tape cassette, or CD player. Press and hold for two seconds to select telephone mode.

3. **3.** Decrease the volume of the selected audio output or telephone.

4. **4.** Press and release to select the next preset radio station, or the next track on tape or CD. Press and hold for two seconds to select the next radio station on the waveband upwards, or the next CD loaded in the player, or to change the side of tape. When in telephone mode, press and release to scroll up to the next memory location. Press and hold for two seconds to send and end a call.

Speed Control Switchpack



Item	Part Number	Description
1	-	Set speed or increase speed
2	-	Resume
3	-	Decrease speed
4	-	Cancel

The speed control switchpack is installed to the right of the steering wheel center and performs the following functions:

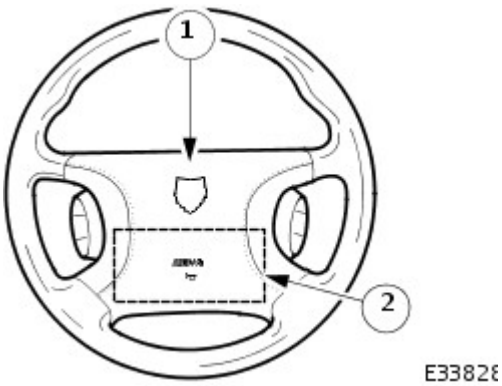
1. **1.** Set the desired speed or increase the set speed.

2. **2.** Resume the previously set speed.

3. **3.** Decrease the set speed.

4. **4.** Cancel speed control without erasing the set speed.

Horn and Driver Airbag Location



Item	Part Number	Description
1	-	Horn operating pad
2	-	Driver air bag location

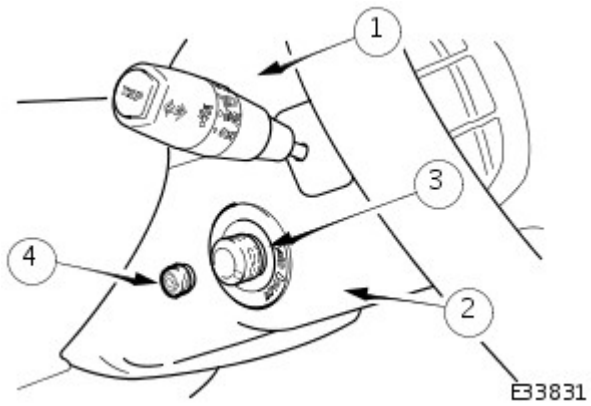
The horn operating pad is mounted in the central area of the steering wheel.

The driver air bag is mounted below the horn operating pad area, adjacent to the steering wheel hub.

For air bag safety and service information, refer to Section 501-20A Safety Belt SystemSection 501-20B Supplemental Restraint System.

Upper Steering Column

Motorized Upper Column Assembly



Item	Part Number	Description
1	-	Upper cowl
2	-	Lower cowl
3	-	Steering column adjustment switch
4	-	Dimmer switch

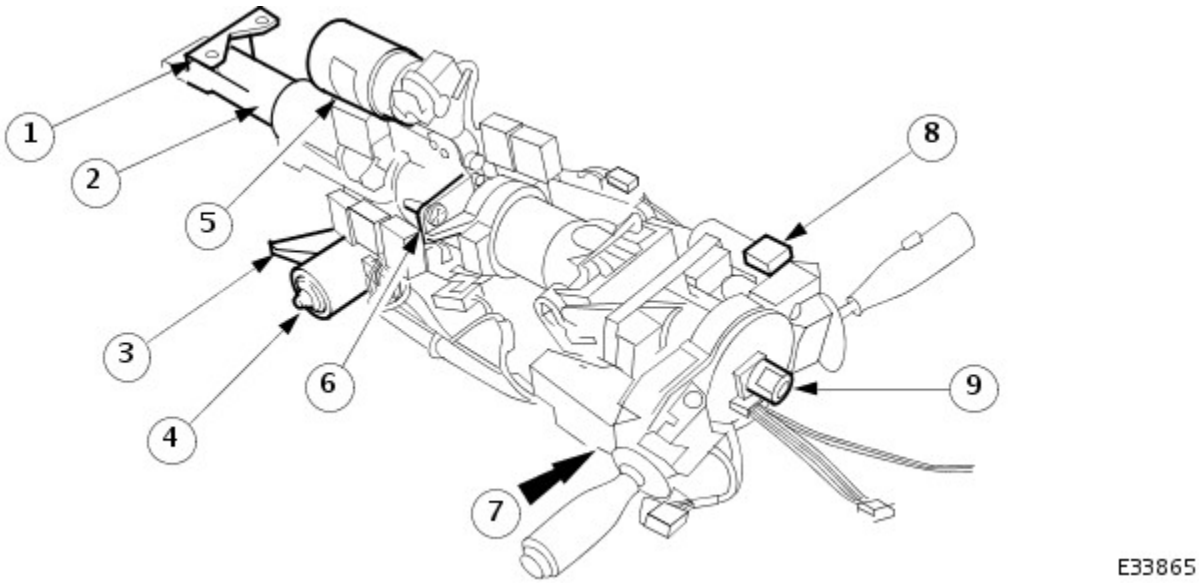
The motorized upper steering column:

- Is adjustable for both tilt and reach.
- Has a column adjustment switch installed on the left-hand side of the lower cowl.
- Will automatically move to the uppermost tilt and innermost reach position, when the automatic driver entry and exit function is selected.
- Has an instrument lighting dimmer switch installed on the left-hand side of the lower cowl.

The steering column adjustment switch:

- Controls steering column reach by movement of the switch towards and away from the steering wheel.
- Controls steering column tilt by movement of the switch up and down.
- Has two rotary positions, AUTO and OFF, for selecting the automatic entry and exit steering column tilt function.

Motorized Upper Column Components



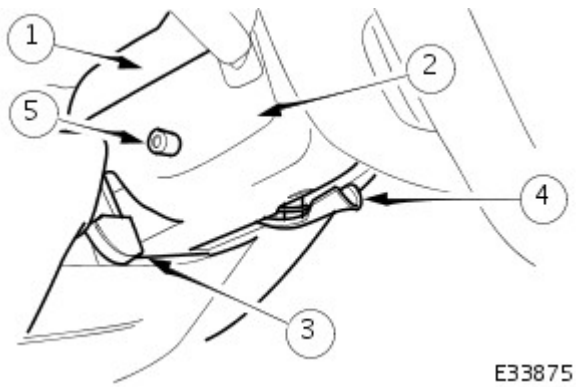
Item	Part Number	Description
1	-	Lower mounting bracket
2	-	Crash tube
3	-	Harness connector bracket
4	-	Tilt motor
5	-	Reach motor
6	-	Upper mounting bracket
7	-	Ignition switch (hidden)
8	-	Ignition key interlock solenoid
9	-	Steering wheel mounting shaft

The telescopic slider provides driver crash protection by retracting automatically in the event of an accident; it is clamped in position to a preset torque.

The motorized upper steering column has the following serviceable parts:

- Ignition switch assembly.
- Ignition key interlock solenoid.
- Tilt motor assembly.
- Reach motor assembly.

Manual Upper Column Assembly

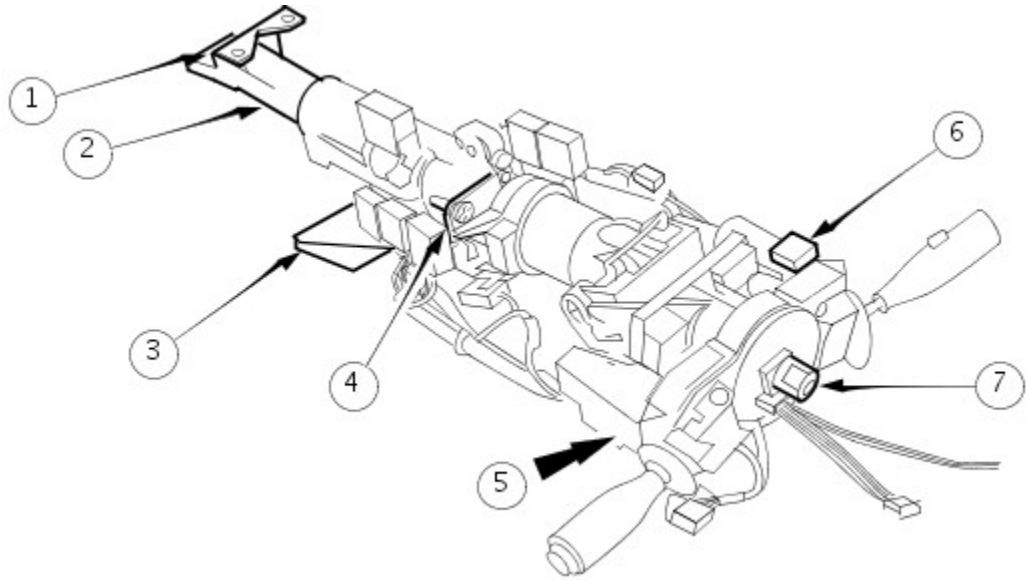


Item	Part Number	Description
1	-	Upper cowl
2	-	Lower cowl
3	-	Column tilt adjustment lever
4	-	Column reach adjustment lever
5	-	Dimmer switch

The manual upper steering column:

- Is adjustable for both tilt and reach.
- Has cable operated reach adjustment, using a rack and wedge, with approximately 16 latched positions.
- Has six latched tilt positions stepped at approximately 3° intervals.
- Has an unlatched top tilt position, allowing the column to be pulled down to engage the first detent without using the tilt lever.
- Has an instrument lighting dimmer switch installed on the left-hand side of the lower cowl.

Manual Upper Column Components



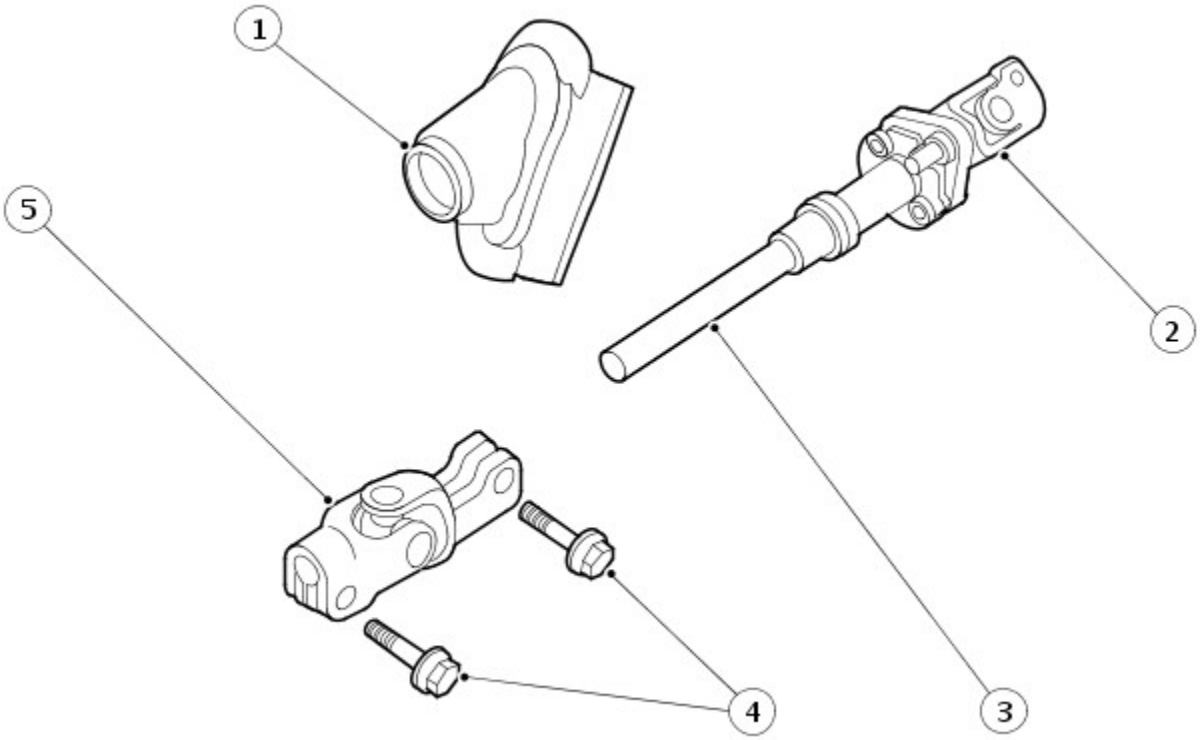
Item	Part Number	Description
1	-	Lower mounting bracket
2	-	Crash tube
3	-	Harness connector bracket
4	-	Upper mounting bracket
5	-	Ignition switch (hidden)
6	-	Ignition key interlock solenoid
7	-	Steering wheel mounting shaft

The telescopic slider provides driver crash protection by retracting automatically in the event of an accident; it is clamped in position to a preset torque.

The manual upper steering column has the following serviceable parts:

- Ignition switch assembly.
- Ignition key interlock solenoid.
- Bowden cable and lever assembly.

Lower Steering Column



E41851

Item	Part Number	Description
1	-	Boot
2	-	Universal joint to upper column
3	-	Lower steering column shaft
4	-	Retaining bolts
5	-	Universal joint to steering rack

The lower steering column:

- Is a handed assembly.
- Incorporates a column to toeboard seal which comprises a rolling element having two, low friction, PTFE rings. The rolling element locates in a rubber boot which seals to the toeboard.
- Has a lower universal joint connecting the lower column to the steering rack.
- Has an upper universal joint connecting the lower column to the upper column.
- Has a NVH damper incorporated into the upper universal joint assembly.
- May be installed in any orientation on the universal joint splines.
- Requires no setting or adjustment.
- Has no serviceable components.

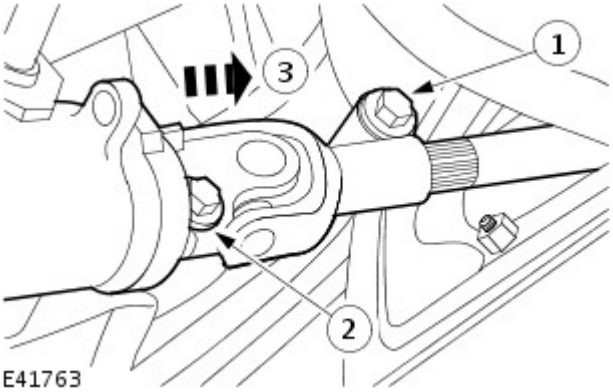
It is essential to disconnect the lower column from the steering rack before removing the engine or front suspension crossbeam.

Steering Column - Steering Column Lower Shaft

Removal and Installation

Removal

1. Raise and support the vehicle.
For additional information, refer to Section 100-02 Jacking and Lifting.

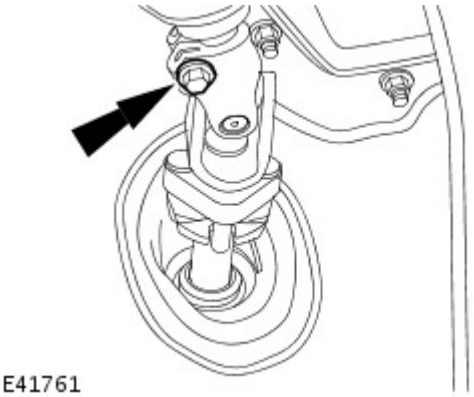


E41763

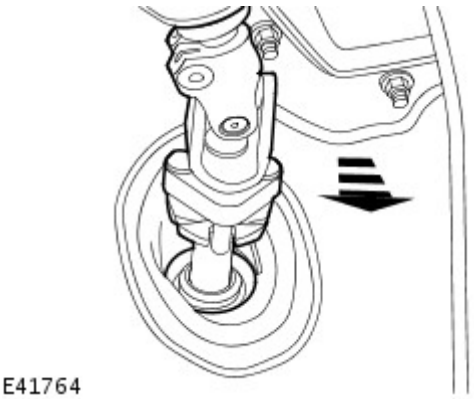
2. Detach the steering column lower shaft.

1. Loosen the steering column lower shaft sliding joint retaining bolt.
2. Remove and discard the steering column lower shaft retaining bolt.
3. Detach the steering column lower shaft.

3. Lower the vehicle.


E41761

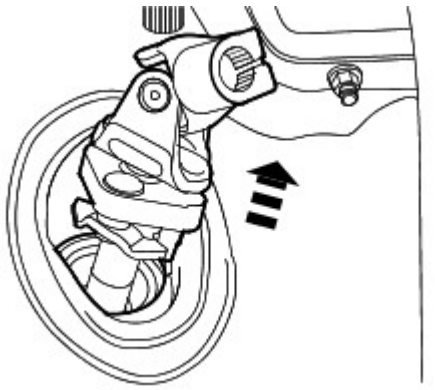
4. Remove and discard the steering column lower shaft retaining bolt.


E41764

5. Detach the steering column lower shaft.

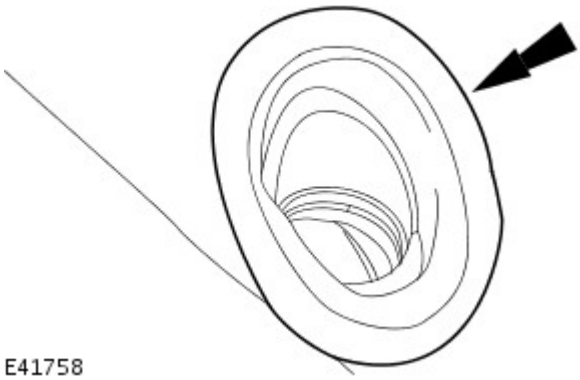
6. Remove the steering column lower shaft.

- Detach the boot.



E41765

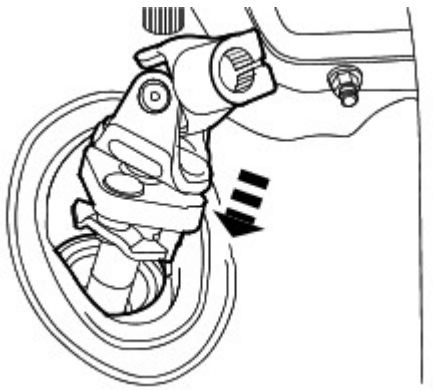
Installation



E41758

1. CAUTION: Make sure the boot is fully seated at the top and bottom.

Attach the boot.



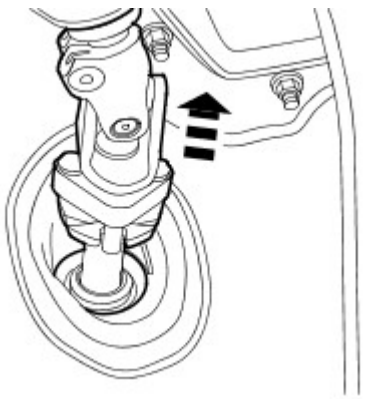
E41759

2. CAUTIONS:

Make sure the steering column lower shaft rolling element is fully seated into the boot.

Make sure the boot is fully seated at the top and bottom.

Install the steering column lower shaft.



E41760

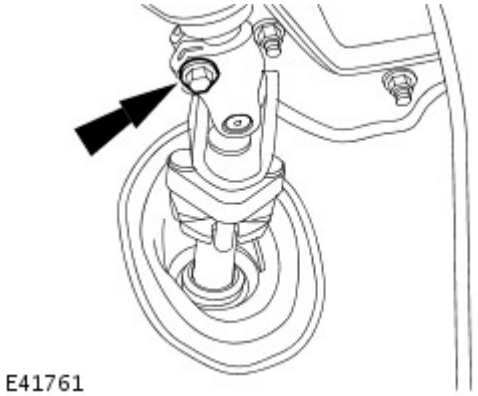
3. CAUTIONS:

Make sure the steering column lower shaft is fully installed to the steering column shaft splines.

Make sure the steering column lower shaft rolling element is fully seated into the boot.

Attach the steering column lower shaft.

4. WARNING: Install a new steering column lower shaft retaining bolt. Failure to follow this instruction, may result in personal injury.

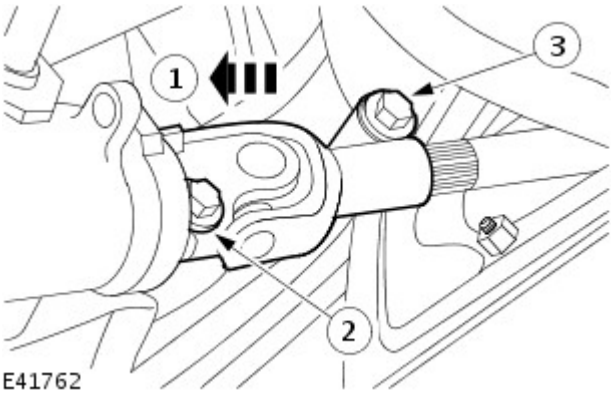

E41761

CAUTION: Make sure the steering column lower shaft is fully installed on the steering column shaft splines.

Install the steering column lower shaft retaining bolt.

- Tighten to 28 - 34 Nm.

5. Raise the vehicle.



E41762

6. WARNING: Install a new steering column lower shaft retaining bolt. Failure to follow this instruction, may result in personal injury.

Attach the steering column lower shaft.

1. Attach the steering column lower shaft.
2. Install the steering column lower shaft retaining bolt.
    1. Tighten to 28 - 34 Nm.
3. Tighten to 28 - 34 Nm.

Steering Column Switches -

Torques

Component	Nm
Switchgear securing screws	4 - 5
Steering column upper and lower cowl securing screws	1.5 (nominal)

Steering Column Switches - Steering Column Switches

Description and Operation

Ignition Switch

The key-operated ignition switch is located on the right-hand side of the steering column and has four positions.

Position 'O'



E33538

OFF. The only position in which the key can be inserted or removed. With the key removed, the steering lock engages. The key can only be removed when the transmission is in the Park position.

Position 'I'



E33539

AUXILIARY. Certain circuits, i.e. radio and windows, can be operated without switching on the ignition.

Position 'II'



E33541

IGNITION. All circuits, except the starter motor, are activated. The key remains in this position when driving.

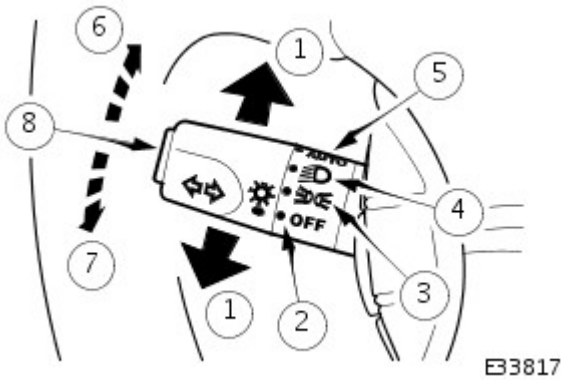
Position 'III'



E33542

START. The starter operates for as long as the key is held in this position, against spring pressure. If the engine fails to start, the key must be returned to position 'I' before another start is attempted.

Lighting Switch



Item	Description
1	Direction indicator LH or RH position
2	All lamps OFF
3	Sidelamps ON
4	Headlamps ON
5	Headlamps AUTO (where fitted)
6	Headlamp main beam position
7	Main beam flash position
8	Message center function button

The lighting switch is on the left-hand side of the steering column and controls the following functions.

Direction Indicators

The direction indicators:

- Operate when the ignition switch is in position II.
- Are operated by moving the switch stalk up or down until it latches in position, to indicate a right or left turn respectively.
- Can be operated while the switch stalk is held against spring pressure before reaching the latch position.
- Cancel automatically upon completion of a turn, the column switch returning to the center position.

An audible ticking and a flashing green warning lamp on the instrument cluster indicate that the direction indicators are

operating. If an indicator bulb fails, the warning lamp and ticking operate at twice the normal rate.

Sidelamps and Headlamps

These are controlled by rotating the end of the column switch as follows.

In the OFF position:

- All exterior lamps are switched OFF.

In the sidelamp position:

- The front sidelamps, tail, license plate and any other lamps required by local legislation are switched ON.
- The sidelamps tell-tale lamp illuminates.

In the headlamp position, with the ignition switch in position II:

- The headlamps are switched ON in addition to the lamps switched on in the sidelamp position.

If the ignition is switched to the OFF position with the column switch in the headlamp position, the sidelamps, tail and license plate lamps will stay ON, but the headlamps will switch OFF.

In the AUTO position (where fitted), with the ignition switch in position II:

- The sensor mounted on the back of the interior rear view mirror monitors exterior light levels and automatically switches the sidelamps and dipped headlamps ON and OFF.

The sensitivity level can be adjusted by turning the sensor control knob on the back of the interior mirror, left to decrease or right to increase. The sensor must not be covered and the windscreen must be kept clean.

Headlamp Main Beam Position

With the column switch in the headlamp position:

- Moving the switch stalk away from the steering wheel switches the headlamps to main beam.
- Moving the switch stalk towards the steering wheel switches the headlamps to dipped beam.

The main beam tell-tale lamp illuminates when the headlamps are switched to main beam.

Main Beam Flash

With the ignition switch and column switch in any position:

- Pulling the switch stalk against spring pressure towards the steering wheel illuminates the headlamps on main beam for as long as the switch is held.

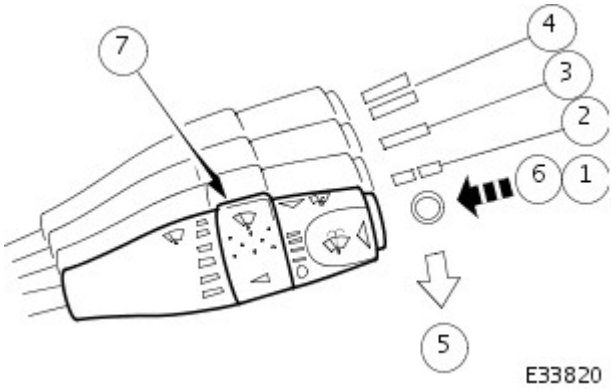
The main beam tell-tale lamp illuminates while the headlamps are illuminated.

Message Center Functions

The message center functions:

- Are selected by the button located at the end of the lighting switch stalk.
- Are selected in turn, by repeatedly pressing the button, from the odometer reading, through the trip computer data in sequence, and back to the odometer reading again.

Wiper and Washer Switch



Item	Description
1	Wiper off position
2	Intermittent wipe position
3	Normal speed wiper position
4	High speed wiper position
5	Flick wipe position
6	Wash/wipe button
7	Delay adjustment collar

The wiper and washer switch is on the right-hand side of the steering column and controls the following functions when the ignition switch in position II.

In the OFF position:

- The windscreen wiper is stationary and in the parked position.

In the intermittent wipe position:

- The wiper operates intermittently, with a variable time delay between wipes.
- The time delay can be varied by rotating the column switch collar, which has six positions and varies the delay between two and 20 seconds. The collar is turned counter-clockwise to increase the delay.

In the normal speed position:

- The wiper operates continuously at normal speed.

In the high speed position:

- The wiper operates continuously at high speed.

Flick wipe operation:

- Is obtained by pulling the switch stalk towards the steering wheel.
- Features a single wipe at normal speed if the switch stalk is released immediately.
- Features continuous wipe action at normal speed while the switch stalk position is held.

Wash / Wipe Operation

The wash/wipe function:

- Is operated by the button at the end of the switch stalk.
- Operates the washers and wiper, while the button is depressed, for up to 20 seconds.
- Provides an additional three sweeps of the wiper after the button is released.
- Provides a single drip-wipe sweep, four seconds after the wash/wipe sequence has been completed.
- Is disabled if the 'Washer Fluid Low' message is displayed, but manual operation is still available.

The wash/wipe button also operates the headlamp power wash function (where fitted).

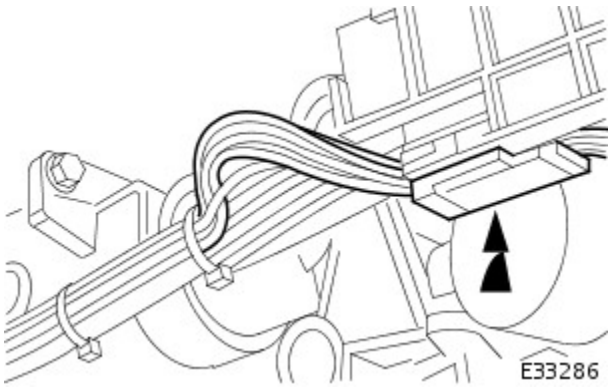
Steering Column Switches - Steering Column Multifunction Switch

Removal and Installation

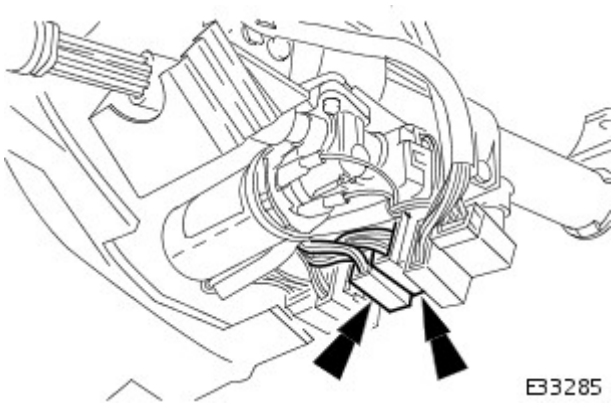
Removal

1. Disconnect battery ground cable; refer to 86.15.19.
2. NOTE: Steering wheel must be in the straight ahead position.

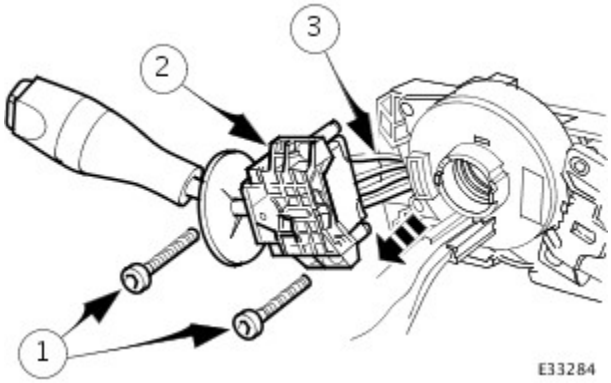
   Remove steering wheel.



3. Displace cancellation module connector from mounting bracket and disconnect.



4. Displace flasher/headlamp/trip switch connectors from mounting bracket and disconnect.
   - Cut and remove appropriate harness securing ties.



5. Remove switchgear.
   1. Remove two screws which secure switch assembly/cancellation module to mounting bracket.
   2. Displace switchgear from mounting bracket.
   3. Route switchgear harness through mounting bracket and remove switchgear.

Installation

1. Installation is reverse of removal.

Engine System - General Information -

Engine

Description	Model	Capacity
90°'Vee' 8 Cylinder 32 Valves	AJ26	3.2 Liters
90°'Vee' 8 Cylinder 32 Valves	AJ26	4 Liters

Engine Torque

Engine	Nm (DIN)/Rpm
Maximum Delivered - 3.2L	308 at 4500
Maximum Delivered - 4.0L	393 at 4250
Maximum Delivered - 4.0L SC	526 at 3500

Engine Power

Engine	BHP (DIN)/Rpm
Maximum Delivered - 3.2L	240 at 6250
Maximum Delivered - 4.0L	290 at 6100
Maximum Delivered - 4.0L SC	365 at 6000

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Engine Oil - USA/Canada	API SH or SJ / ILSAC GF-2
Engine Oil - Mexico	API SJ
Engine Oil - UK and ROW	API SH or SJ / ACEA A2
Engine Oil - Supercharged	API SH or SJ / ACEA A3
Anti-Freeze	ESD-M97B49-A
Sealant-Engine Block-to-Bedplate and Sump-to-Bedplate (RTV Silicone)	Loctite 5699 Ultra Grey
Sealant-Engine Core Plugs and Block Stub Pipe (Anaerobic Sealant)	Loctite 648

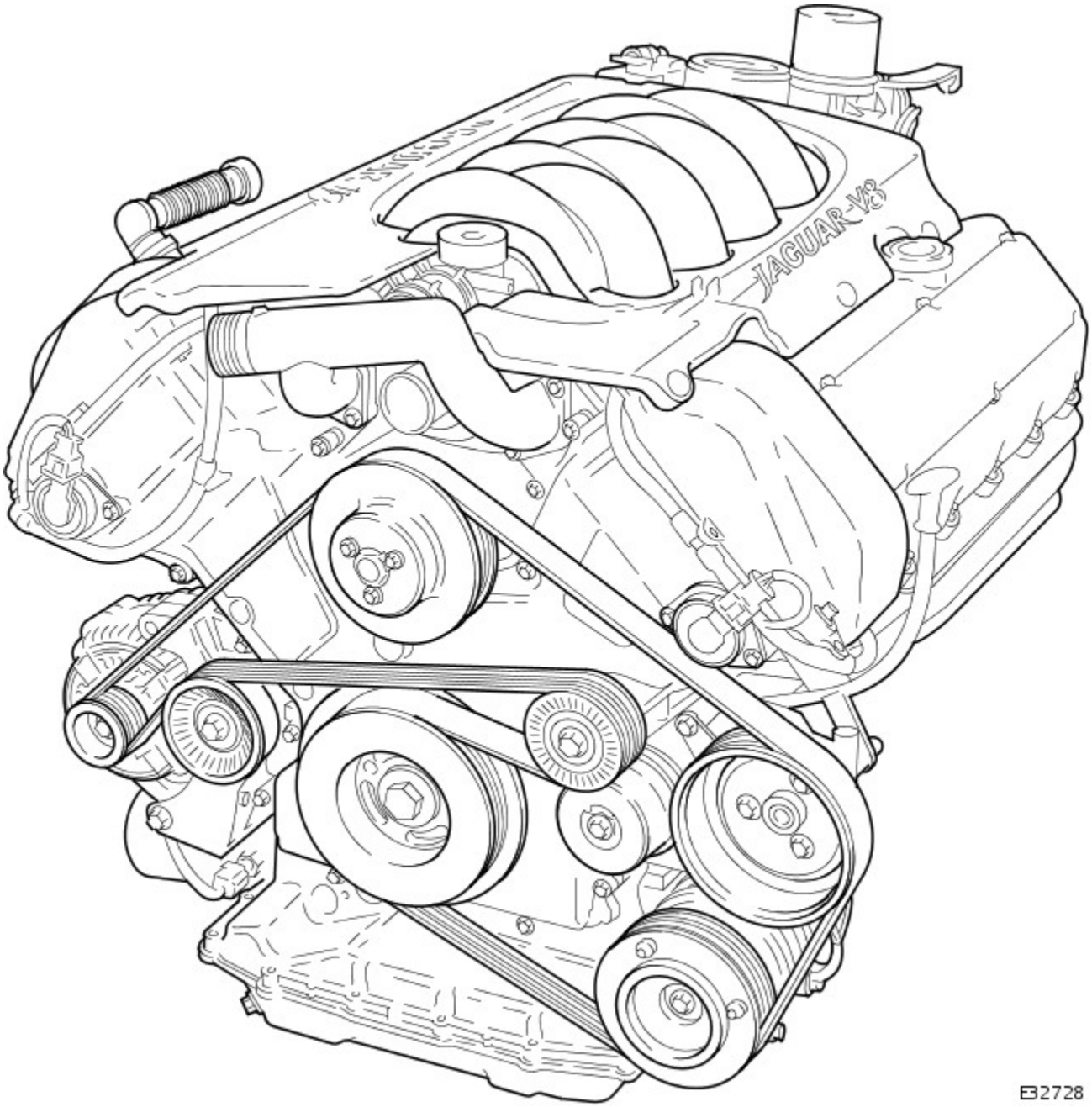
Capacities

Unit	Liters
Engine Oil-With Oil Cooler	7,3
Engine Oil-Without Oil Cooler	6,5
Coolant-Complete System	10
Coolant-Engine Only	3,7

Valve Clearances (Cold)	Specification
Inlet	0.20 mm
Exhaust	0.25-0.30 mm

Engine System - General Information - Engine

Description and Operation



The AJ26 power unit is available in 3.2 L and 4.0 L versions, and comprises:

- An eight cylinder 90 degree 'V' configuration liquid cooled aluminium cylinder block incorporating 'Nikasil' plated cylinder bores.
- Pistons of open-ended skirt design, with two compression and one oil control ring.
- Two aluminium cylinder heads, each incorporating two camshafts.
- Four valves per cylinder.
- Aluminium valve lifters and top mounted shims.
- Variable valve timing (VVT) of the inlet camshafts (4.0 L normally aspirated only).
- Camshaft covers manufactured from Vinylester.
- Aluminium timing cover which accommodates the crankshaft front oil seal.
- Single row primary and secondary chains drive the camshafts of each cylinder bank.
- An aluminium bed plate, incorporating iron main bearing supports, which accommodate the oil pump pick-up,

diverter valve (if fitted) and oil filter.
- Main bearings which are grooved in the upper positions and plain in the lower positions. They are manufactured from aluminium / tin material.
- A crankshaft with undercuts and rolled fillets for extra strength.
- Fracture-split connecting rods in sintered-forged steel.
- Brackets bolted to the front of the cylinder block are used to mount all accessories.
- A single, seven ribbed vee belt drives the accessories.
- An automatic belt tensioner for the front accessory drive, incorporating a wear indicator.
- An advanced engine management system incorporating electronic throttle control.
- The unit meets the requirements of the CARB OBDII USA legislation.

Ancillary Systems

The ancillary systems, driven by the engine, each have a detailed Description and Operation along with Diagnostic Procedures, and Removal and Installation instructions; refer to the following sections of this manual:

- Power Steering Pump - Section 211-02
- Air Conditioning Compressor - Section 412-03
- Engine Cooling Pump - Section 303-03
- Generator - Section 414-02

The drive belt, idler pulley and automatic tensioner are described in Section 303-05.

The engine starting system is described in Section 303-06.

Engine Management and Emission Control System

Engine Control Module (ECM)

Engine management and exhaust emissions are controlled by the ECM, which has the following main functions:

- Fuel injection
- Idle speed
- Ignition
- Evaporative loss system
- Engine cooling fans
- Climate control compressor clutch demand

The microprocessor within the ECM receives signals from various sensors and other modules and uses a pre-determined program to compute engine management functions.

Adaptive functions are incorporated in the ECM to cater for continuous adjustments to its computations to suit prevailing conditions. Because the system also controls emissions to suit all modes, neither CO levels nor idle speed require service attention or adjustment, except if an error should occur.

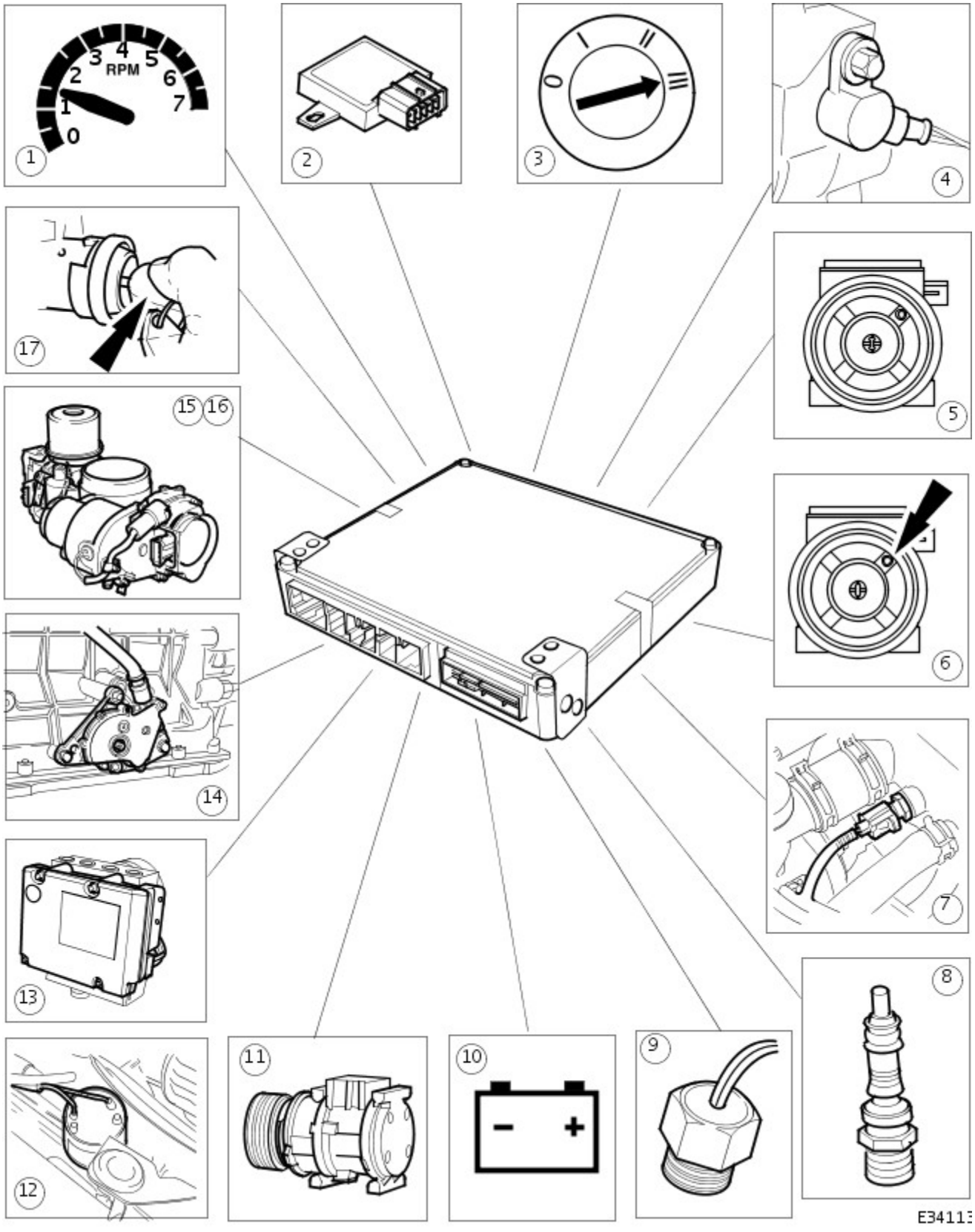
On Board Diagnostics are controlled by the ECM with the continuous monitoring of incoming signals and the subsequent verification against what the module expects to 'see'. Should a signal be incorrect or missing, the ECM will substitute a fixed value to provide the 'limp home mode' and alert the driver of the problem. Fixed values may be adopted for:

- Transmission oil temperature
- Mechanical guard position
- Throttle blade angle
- Camshaft position
- Intake air temperature

Diagnostic trouble codes (DTC), including OBD II codes, are stored in the ECM memory and can be read by an appropriate retrieval tool.

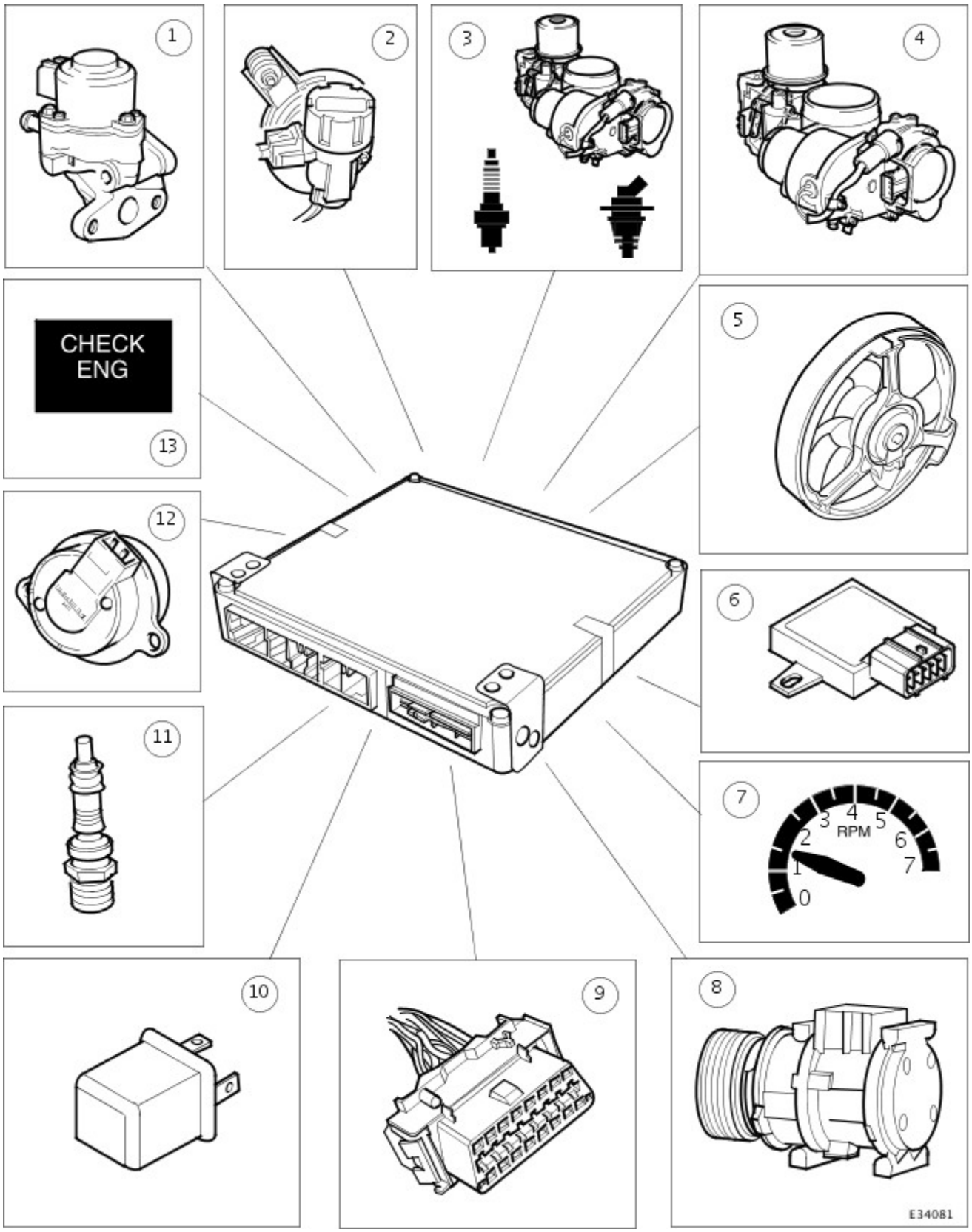
Should either the ECM or TCM fail, ensure that the control housing cooling fan is operating correctly. Failure of the cooling fan MUST be rectified before renewing a control module and details of a fan failure should accompany a returned control module.

The ignition supply is the main power source for the ECM; this supply will be disconnected by an inertia switch if the vehicle is subject to a violent deceleration, as in a collision. The ECM has separate ignition and battery supply inputs. The battery input maintains the ECM memory as long as the vehicle battery is connected.


RPM
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
E34113

ECM Inputs

Item	Part Number	Description
1	—	Engine speed
2	—	Ignition amplifier failure
3	—	Cranking
4	—	Camshaft position
5	—	Mass air flow
6	—	Intake air temperature
7	—	Coolant temperature
8	—	Exhaust gas oxygen content
9	—	Knock sensor
10	—	Power supply
11	—	Climate control compressor
12	—	Climate control system pressure
13	—	Traction control
14	—	Park / neutral switch
15	—	Throttle pedal demand
16	—	Throttle position
17	—	Security mode


1
2
3
4
CHECK
ENG
13
5
12
6
11
7
RPM
0
1
2
3
4
5
6
7
10
9
8
E34081

Item	Part Number	Description
1	—	Exhaust gas recirculation
2	—	Purge valve
3	—	Engine torque reduction
4	—	Electronic throttle assembly
5	—	Cooling fans
6	—	Ignition amplifier driver
7	—	Engine overspeed
8	—	Climate control compressor clutch
9	—	OBDII information (J1962, CAN, ISO)
10	—	Fuel pump relay
11	—	Heated oxygen sensor
12	—	Variable valve timing
13	—	MIL switching

Engine Management System Components

Electronic Throttle

The electronic throttle assembly, in response to signals from both the driver and the ECM, adjusts idle speed, sets the throttle valve to the position requested by the driver's accelerator / throttle pedal, cruise and traction control, power limitation and catalyst warm-up.

Mass Air Flow Meter

The sensor is located in the air flow meter assembly and outputs an analogue voltage to the ECM. This sensor measures air flow into the engine inlet system and is calibrated to measure kg / hour.

Intake Air Temperature

The intake air temperature sensor is located in the air flow meter assembly and outputs an analogue voltage to the ECM. The ECM will substitute a default value equal to 50°C should this sensor fail.

Fuel Injectors

The eight bottom fed fuel injectors are located in the fuel rails. The fuel injectors are electromagnetic solenoid valves controlled by the ECM. The pulse time for the injector combined with the fuel pressure determines the volume of fuel injected to the manifold.

Fuel Delivery

The fuel pump provides fuel to the fuel rail where the circulating pressure is controlled by a pressure regulator valve; excess fuel is returned to the fuel tank.

The pressure regulator valve is controlled by manifold depression so that fuel delivery pressure is maintained at approximately 3 bar above manifold pressure.

Fuel Pump Relay

The ECM controls this component for normal engine running. The security system may disable this relay via communication with the ECM.

Fuel Level Sensing

The tank fuel is measured by the fuel level sensor . This signal is used by the ECM as an input to certain diagnostics.

Evaporative Valve

Excess vapour formed in the fuel tank is absorbed into the evaporative emission purge control canister. While the engine is running, the fuel absorbed in the canister is gradually purged back into the engine. The rate of purging is governed by engine operating conditions and vapour concentration level. Operating conditions which affect the purge rate are:

- Speed and load
- Coolant temperature
- Time elapsed from start up
- Closed loop fuelling

Determination of the vapour concentration is made by stepped opening of the EVAP valve and subsequent monitoring of the fuelling correction. This function is performed prior to purging, so that at the onset of purging the EVAP valve can be set to the optimum position. Should the ECM be unable to determine the concentration before purging, a default value is employed, which is then modified whilst purging is in progress.

When the purging process is operational the ECM modifies the basic fuelling calculation to maintain the correct air / fuel ratio.

Purging is inhibited during fuel cut-off and stability / traction control intervention.

Coolant Temperature Sensor

The sensor outputs a voltage to the ECM which decreases as temperature increases.

Cooling Fans

In response to engine coolant temperature and climate control system demand, the ECM will energize the cooling fans.

Climate Control Compressor

The ECM will allow the compressor clutch to be engaged if the engine temperature and load demand are normal. Should the driver require maximum engine power or the coolant temperature be high, the request will be denied.

Cranking Signal

The ECM reacts to a signal from the Body Processor Module (BPM) when the starter motor relay is energized. This signal is used to trigger starting, fuel and ignition strategies.

Engine Speed and Crankshaft Position

Engine speed and crank position are monitored by a sensor which is mounted on the cylinder block (flywheel housing) behind the crankshaft drive plate. It indicates rotational speed to the ECM in the form of 12 pulses per crank revolution. Engine speed is used for synchronization of fuel and ignition systems, as well as other functions.

Camshaft Position

The camshaft position sensor is mounted at the rear of Bank 2 cylinder head on the inlet side and provides one signal every 720 degrees of crankshaft rotation. The signal, in conjunction with the signal from the crankshaft position sensor, indicates to the ECM that the piston of cylinder 1A is approaching TDC on the compression stroke.

Variable Valve Timing (Where Fitted)

By energising a solenoid to allow the passage of pressurized oil on each of the inlet camshaft drives, the ECM can vary by a single stepped amount, the relative timing of the inlet valves.

Ignition

Ignition spark is produced by individual on-plug coil units.

There are two ignition amplifiers; module #1 drives coils 1A, 2B, 3B and 4A, whilst module #2 drives coils 1B, 2A, 3A and 4B. The ECM controls the amplifiers.

Knock Sensor

This sensor uses a piezo-electric sensing element to detect knock which may occur under acceleration at critical conditions. Should detonation be present the ECM will retard ignition timing of individual cylinders.

Exhaust Gas Recirculation

The EGR valve (where fitted) reduces NOx emissions by recirculating a portion of the exhaust gases back into the inlet manifold.

Heated Oxygen Sensors

The heated oxygen sensors, one per bank, are situated upstream of the catalysts. Integral to the sensors are heaters (under ECM control) which allow the sensors to reach their operating temperature as soon as possible after engine start. A comparison between the level of oxygen in the exhaust gas to that in the atmosphere produces an output signal. This signal is used by the engine closed loop fuel strategy to make fuelling corrections and so control overall emission levels.

Oxygen Sensors

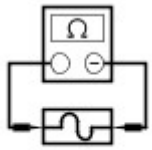
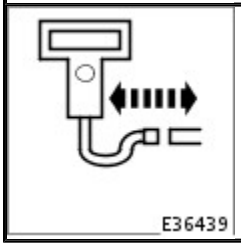
These sensors, one per bank, are situated downstream of the catalyst. The comparison of upstream and downstream signals allows determination of catalyst conversion efficiency.

Engine -

Torque Specifications

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner	43	-	-
Accessory drive belt idler pulley	61	-	-
Air intake tube to throttle body	5	-	-
A/C pipes to receiver / drier	9	-	-
A/C pipe manifold joints	9	-	-
Camshaft bearing caps	10	-	-
Camshaft cover	10	-	-
Charge Air Cooler Adaptor to cylinder head (SC)	21	-	-
Coolant outlet pipe (AJ26 NA)	10	-	-
Crankshaft damper bolt - no locking ring			
Stage 1	80	-	-
Stage 2	80°	-	-
Crankshaft damper bolt - with locking ring	375	-	-
Crankshaft position sensor	10	-	-
Cylinder head bolts M10	35	-	-
Cylinder head bolts M8 (two at front of head)	25	-	-
Driveshaft (propshaft) drive flange bolts	82	-	-
ERG pipe to exhaust manifold	21	-	-
Engine compartment cover (bonnet) hinges	25	-	-
Engine coolant radiator top securing panel	25	-	-
Engine front mounting	70	-	-
Engine oil cooler pipes (clamp)	21	-	-
Engine / Transmission assembly rear mounting centre bolt	35	-	-
Engine / Transmission assembly rear mounting outer bolts	25	-	-
Exhaust downpipe support bracket to flywheel housing	50	-	-
Exhaust downpipe to lower mounting bracket	48	-	-
Exhaust camshaft sprocket			
Stage 1	20	-	-
Stage 2	90°	-	-
Exhaust manifold to cylinder head	18	-	-
Exhaust manifold flange to downpipe	18	-	-
Exhaust Torca clamps	55	-	-
Fuel cross-over elbow	10	-	-
Fuel feed pipe to intake manifold	10	-	-
Fuel Injector (AJ26)	5	-	-
Fuel injector harness clips to camshaft cover (SC)	5	-	-
Fuel pressure regulator to intake manifold	10	-	-
Fuel rail to Charge Air Cooler Adaptor (SC)	21	-	-
Intake manifold to cylinder heads	21	-	-
Intake elbow support brackets	18	-	-
Oil filter	17	-	-
Oil Cooler	7	-	-
PAS pump hose unions	25	-	-
Primary timing chain fixed guide	12	-	-
Primary timing chain tensioner	12	-	-
Primary timing chain tensioner blade	14	-	-
Secondary timing chain tensioner to cylinder	12	-	-
Steering rack	45	-	-
Throttle body to intake elbow	21	-	-
Throttle cable abutment to throttle body	5	-	-
Throttle intake elbow to intake manifold	21	-	-
Timing cover	12	-	-
Variable camshaft timing oil control unit to intake camshaft			
Stage 1	20	-	-
Stage 2	90°	-	-
Variable camshaft timing oil control unit housing (bolt and nut)	21	-	-
Variable camshaft timing oil control solenoid	12	-	-
Water pump pulley	12	-	-

Engine - Engine
Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scan tool

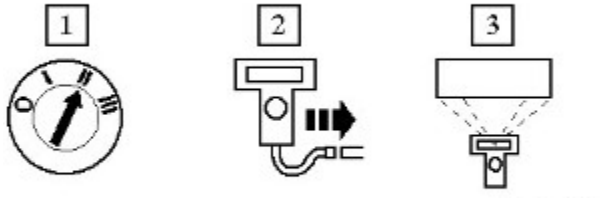
Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
DTC P1392 VVT solenoid A circuit low input	* Solenoid coil open circuit * Harness open circuit or blown fuse * Connector pins(s) bent, loose or corroded	* GO to **Pinpoint Test A**
DTC P1397 VVT solenoid B circuit low input	* Solenoid coil open circuit * Harness open circuit or blown fuse * Connector pins(s) bent, loose or corroded	* GO to **Pinpoint Test A**
DTC P1393 VVT solenoid A circuit high input	* Solenoid coil short circuit * Harness short circuit * Connector pins(s) bent, loose or corroded	* GO to **Pinpoint Test B**
DTC P1398 VVT solenoid B circuit high input	* Solenoid coil short circuit * Harness short circuit * Connector pins(s) bent, loose or corroded	* GO to **Pinpoint Test B**
DTC P1396 VVT solenoid B malfunction	* Oil pressure failure * VVT solenoid sticking * Connector pins(s) bent, loose or corroded * Crankshaft position sensor failure * ECM failure	* GO to **Pinpoint Test C**

Pinpoint test A: P1392 (P1397) VVT solenoid circuit low input

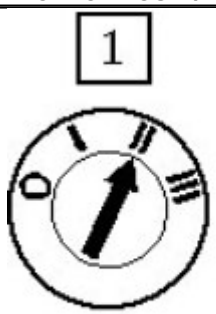
PINPOINT TEST A : P1392 (P1397) VVT SOLENOID CIRCUIT LOW INPUT	
• NOTE: References in brackets are for Bank B (2)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to **A2**

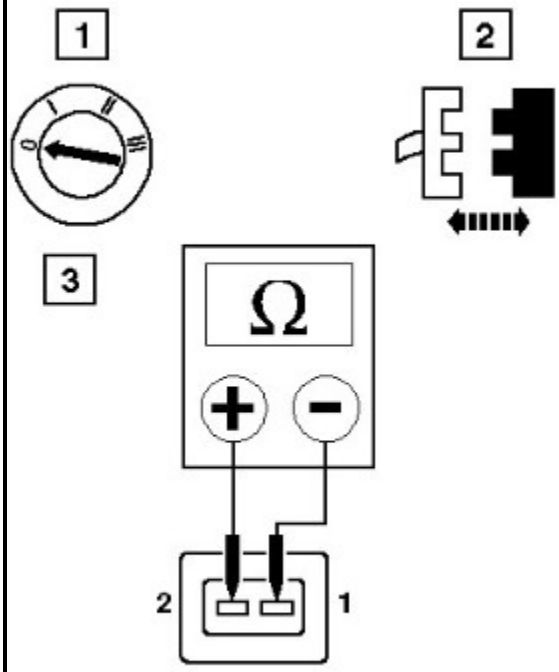
A2: CHECK FUSE / RELAY



E34925

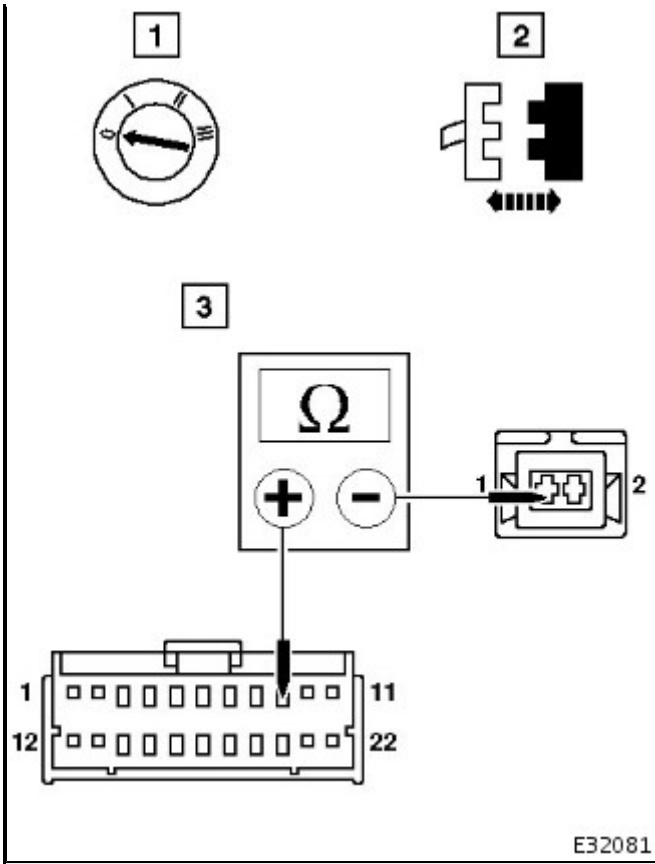
	1 Check that fuse F12 is good and that EMS control relay is energized
	OK? **Yes** GO to **A3** **No** Rectify as required

A3: CHECK VVT COIL RESISTANCE



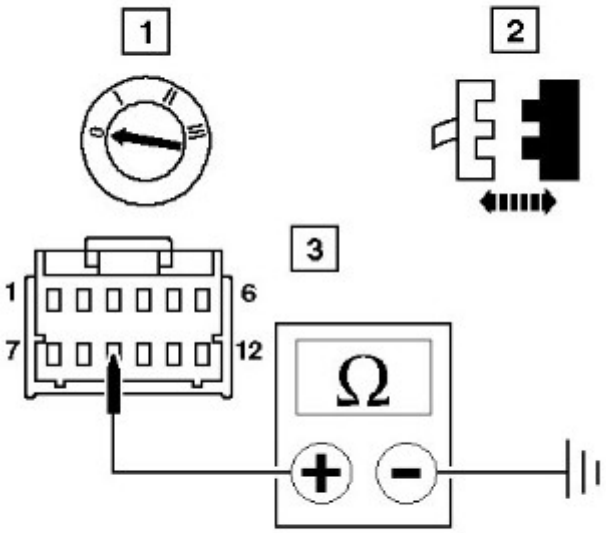
	1 With VVT connector PI031 - A bank or (PI032 - B bank) disconnected, measure the resistance between the pins 1 and 2 at the VVT actuator
	Is the resistance less than 5 OHM or greater than 20 OHM? **Yes** Renew the VVT solenoid and test the system for normal operation. **No** GO to **A4**

A4: CHECK HARNESS CONTINUITY



	1 With EM015 and PI031 (PI032) disconnected, measure the resistance between EM015/009 (EM015/008) and PI031/001 (PI032/001)
	Is the resistance < 0.5 OHM? **Yes** GO to **A5** **No** Inspect harness / connectors EM015, PI031 (PI032), PI001/016 (PI001/027) for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation.

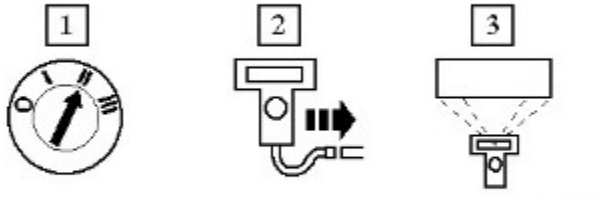
A5: CHECK HARNESS (GROUND) CONTINUITY



	1 With EM014 disconnected, measure the resistance between EM014/009 and ground EM016L
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM014, EM015, PI031 or (PI032) GO to **A6** **No** Inspect harness / connector EM014, ground stud and splice EMS37 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation.
A6: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

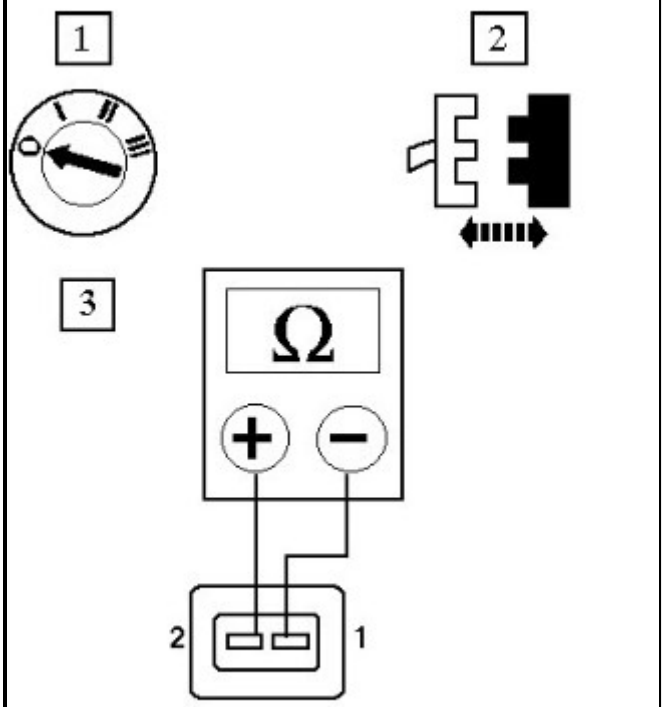
Pinpoint test B: P1393 (P1398) VVT solenoid circuit high input

PINPOINT TEST B : P1393 (P1398) VVT SOLENOID CIRCUIT HIGH INPUT	
• NOTE: References in brackets are for Bank B (2)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



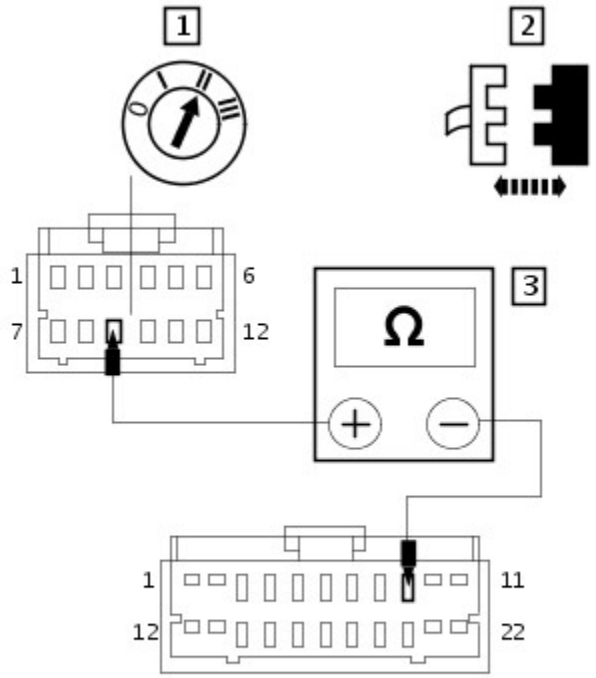
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to **B2**

B2: CHECK VVT COIL CONTINUITY



	1 With VVT connector PI031 - A bank or (PI032 - B bank) disconnected, measure the resistance between the pins 1 and 2 at the VVT actuator
	Is the resistance >20 OHM? **Yes** Renew the VVT solenoid and test the system for normal operation. **No** GO to **B3**

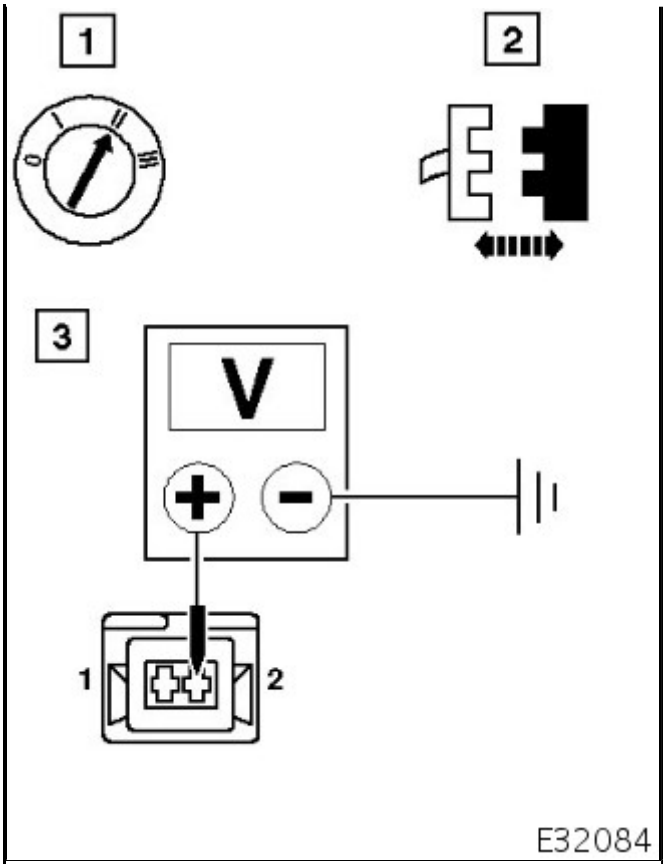
B3: CHECK SHORT TO B+



E32085

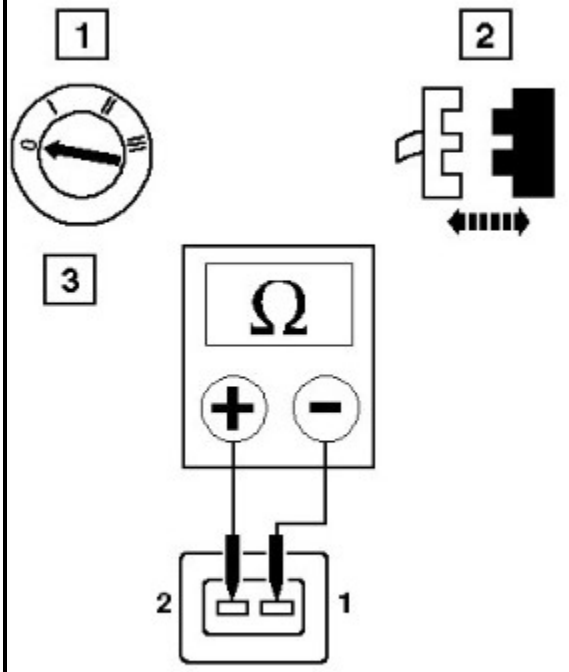
	1 Remove fuse F12
	2 With EM015, EM014, PI031 or (PI032) disconnected, measure the voltage between EM015/009 (EM015/008) and EM014/009
	0 V? **Yes** Reconnect EM015 and EM014 and replace fuse F12 GO to **B4** **No** Inspect EM015, PI031 or (PI032) for bent / pushed back pins or locate and repair the harness / connector PI001/016 or (PI001/027) Test the system for normal operation.

B4: CHECK B+ AT VVT SOLENOID



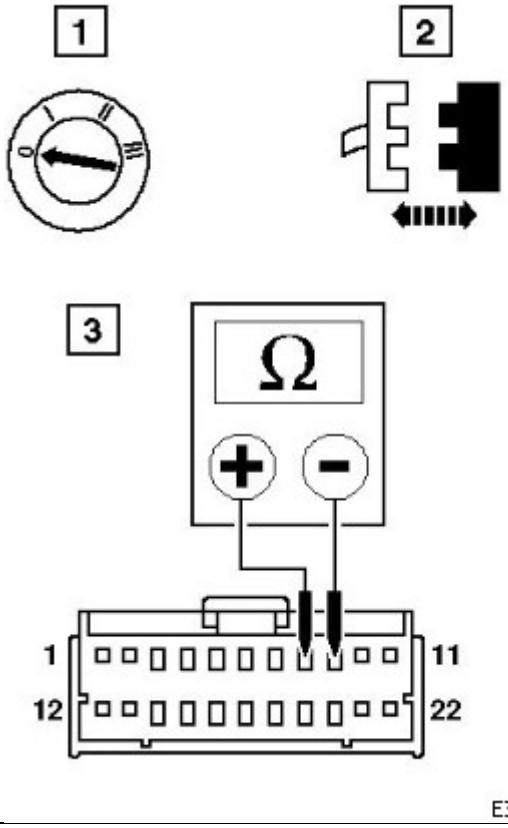
	1 Measure the voltage between PI031/002 (PI032/002) and ground EM016L
	B+ ? **Yes** GO to **B5** **No** Inspect EM020/010, PI001, PI031 (PI032) for bent / pushed back pins or locate and repair harness / splice PIS06.

B5: CHECK HARNESS SHORT TO GROUND



	1 With EM015 and EM014 disconnected, measure the insulation resistance between EM015/009 (EM015/008) and ground EM014/009
	Is the resistance > 10 MOHM? **Yes** Do not reconnect GO to **B6** **No** Inspect EM015, and EM014 for corrosion, bent / pushed back pins or locate and repair the harness / connector. Test the system for normal operation.

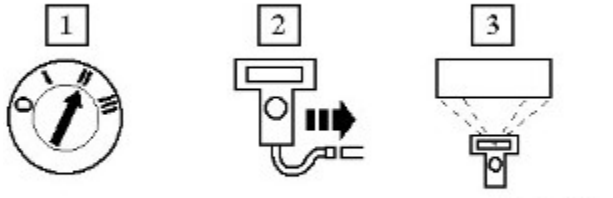
B6: CHECK HARNESS SHORT CORE TO CORE



	1 With EM015, EM014 PI031 and PI032 disconnected, measure the insulation resistance between EM015/009 and EM015/008
	Is the resistance > 10 MOHM? **Yes** Reconnect all connectors GO to **B7** **No** Inspect EM015 and PI031 (PI032) for corrosion, bent / pushed back pins or locate and repair the harness / connector PI001/016 (PI001/027). Test the system for normal operation.
B7: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test C: P1396 VVT solenoid malfunction

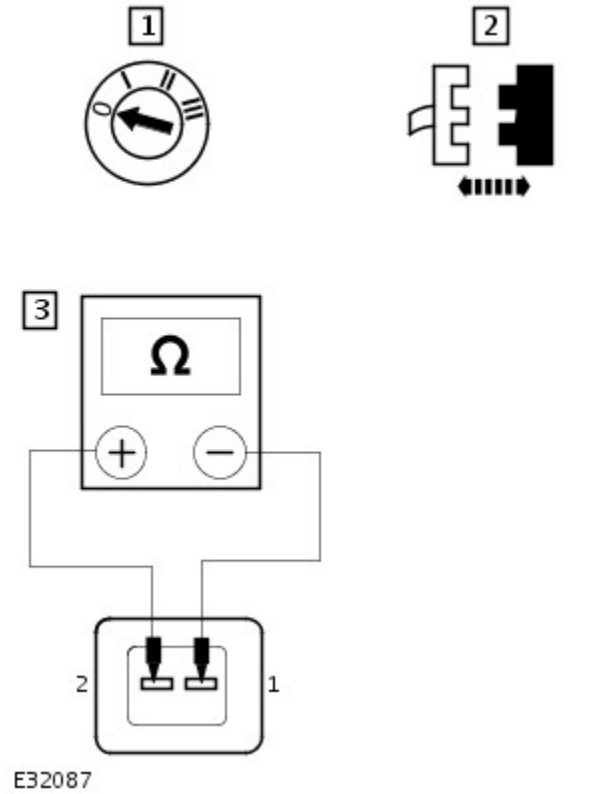
PINPOINT TEST C : P1396 VVT SOLENOID MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to **C2**

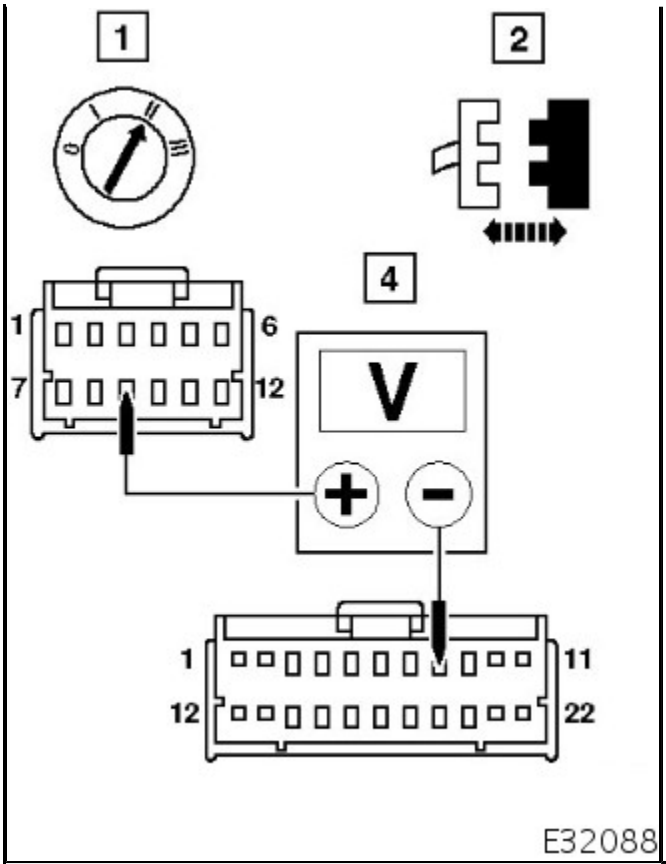
C2: CHECK VVT COIL CONTINUITY



E32087

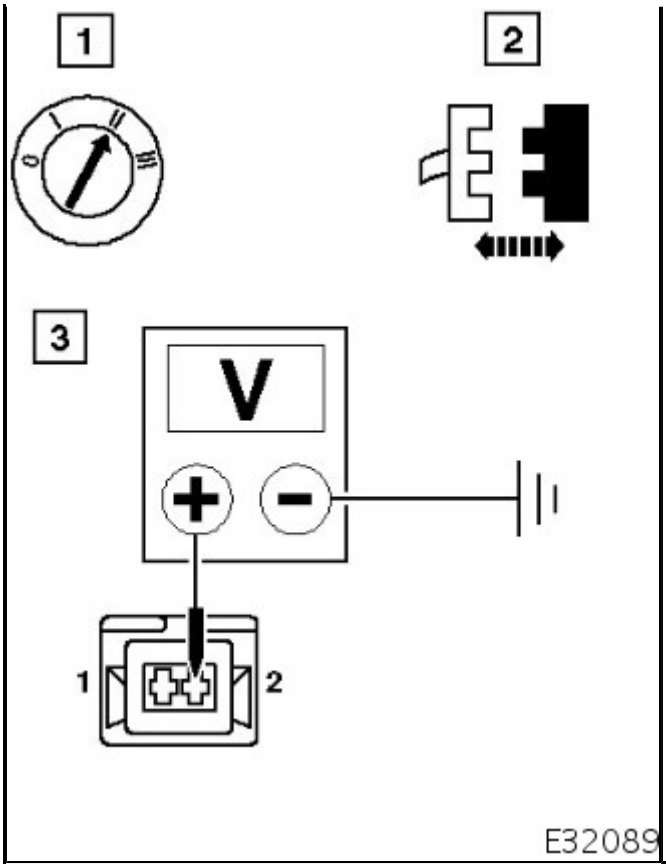
	1 With VVT connector PI032 disconnected, measure the resistance between the pins 1 and 2 at the VVT actuator
	Is the resistance >20 OHM? **Yes** Renew the VVT solenoid and test the system for normal operation. **No** GO to **C3**

C3: CHECK SHORT TO B+



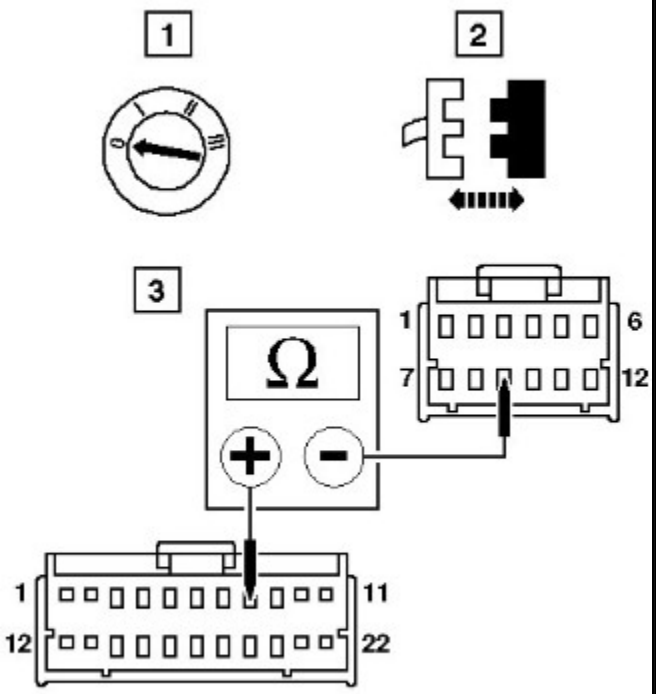
	1 Remove fuse F12
	2 With EM015, EM014, PI031 and PI032 disconnected, measure the voltage between EM015/008 and EM014/009
	0 V? **Yes** Reconnect EM015 and EM014 and replace fuse F12 GO to **C4** **No** Inspect EM015, PI001 or PI032 for bent / pushed back pins or locate and repair the harness / connector. Test the system for normal operation.

C4: CHECK B+ AT VVT SOLENOID



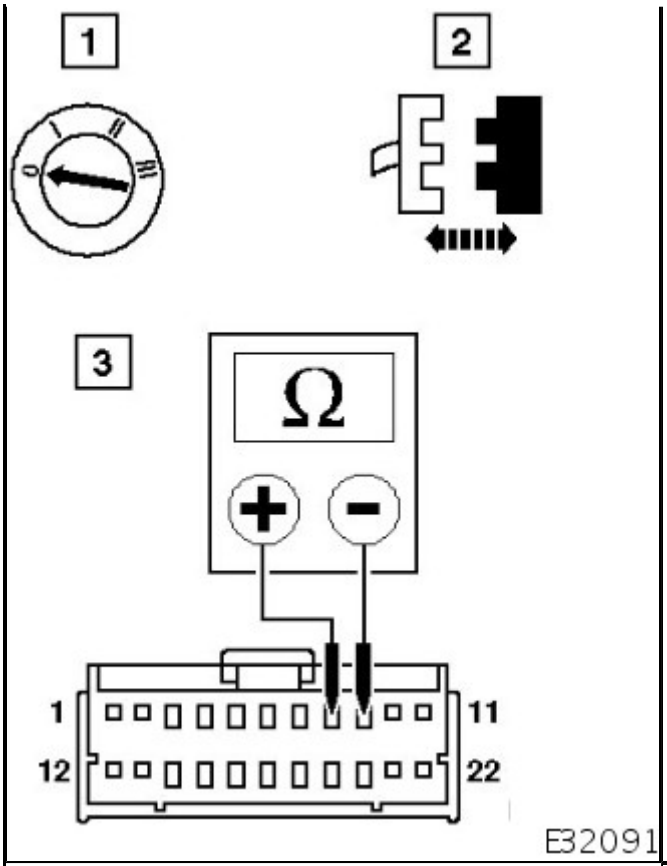
	1 Measure the voltage between PI032/002 and ground EM016L
	B+ ? **Yes** GO to **C5** **No** Inspect EM020/010 PI031 (PI032) for bent / pushed back pins or locate and repair harness / splice PIS06. Check fuse F12 is good and EMS control RELAY 1 energized. Test the system for normal operation.

C5: CHECK HARNESS SHORT TO GROUND



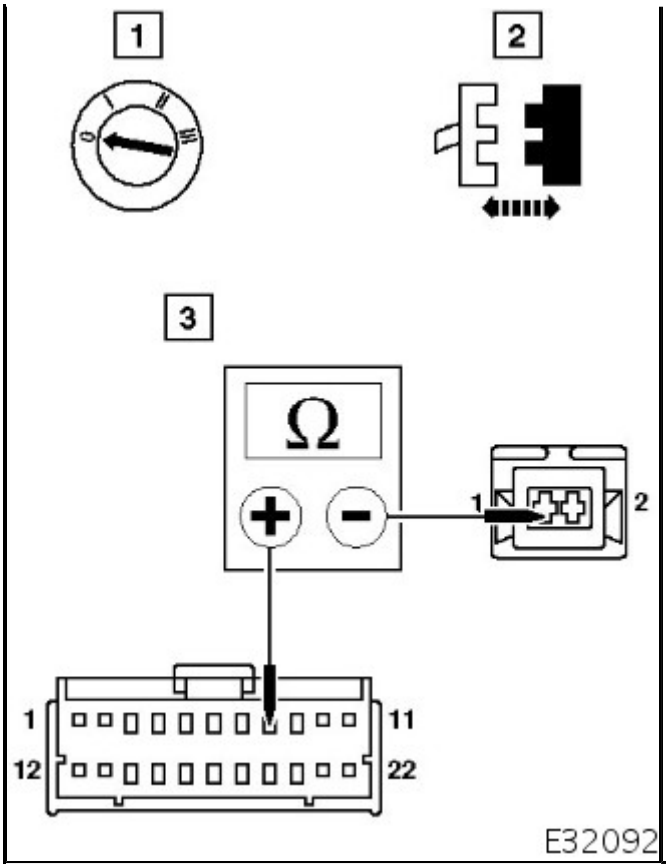
	1 With EM015 and EM014 disconnected, measure the insulation resistance between EM015/008 and ground EM014/009
	Is the resistance > 10 MOHM? **Yes** Do not reconnect GO to **C6** **No** Inspect EM015, and EM014 for corrosion, bent / pushed back pins or locate and repair the harness / connector. Test the system for normal operation.

C6: CHECK HARNESS SHORT CORE TO CORE



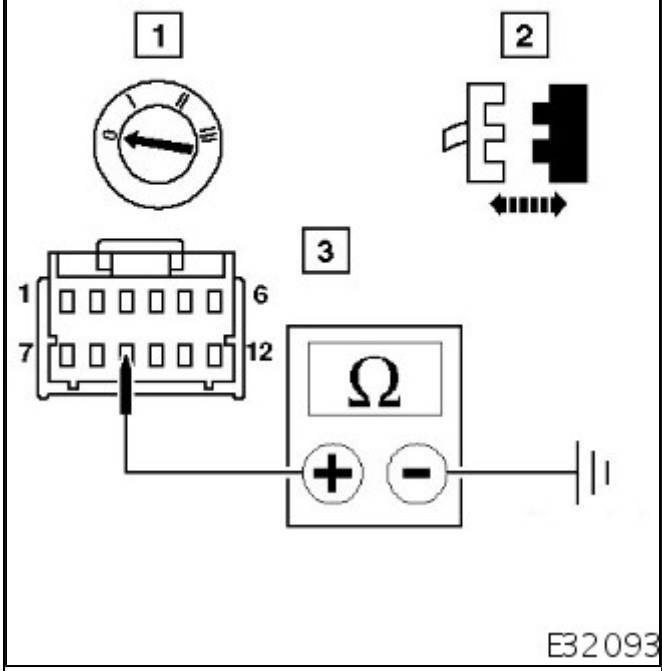
	1 With EM015, EM014, PI031 and PI032 disconnected, measure the insulation resistance between EM015/009 and EM015/008
	Is the resistance > 10 MOHM? **Yes** Reconnect all connectors GO to **C7** **No** Inspect EM015, PI031 and PI032 for corrosion, bent / pushed back pins or locate and repair the harness / connector PI001/016 or PI001/027. Test the system for normal operation.

C7: CHECK HARNESS CONTINUITY



	1 With EM015 and PI032 disconnected, measure the resistance between EM015/008 and PI032/001
	Is the resistance < 0.5 OHM? **Yes** GO to **C8** **No** Inspect harness / connectors EM015, PI032 and PI001/027 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation.

C8: CHECK HARNESS (GROUND) CONTINUITY



	1 With EM014 disconnected, measure the resistance between EM014/009 and ground EM016L
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM014, EM015, PI031 or (PI032) GO to **C10** **No** Inspect harness / connector EM014, ground stud and splice EMS037 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation.
C9: CHECK MECHANICAL CONDITION	
	1 Remove the VVT(s) and ensure that there is no foreign matter blocking the oil passageway
	OK? **Yes** GO to **C10** **No** Rectify as required
C10: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Engine - Valve Clearance Adjustment

General Procedures

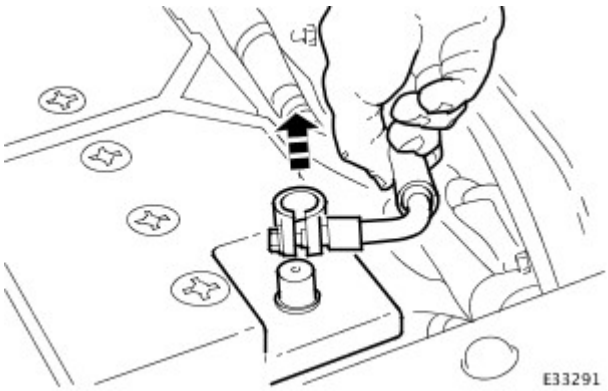
Special Tool(s)	
 E36404	Tappet adjustment 303-540
 E36428	Air gun, fan nozzle 303-590

1. Open the engine compartment and fit paintwork protection sheets. Open to the service position.

2. Carefully remove both engine covers, taking care not to damage the plastic fixings or the rubber inserts.

3. Disconnect the battery ground cable.

- Remove the battery cover.


E33291

4. Remove the cam cover from the 'A' bank and the 'B' bank; including the purge valve, the on-plug ignition coils and the air intake tube / air flow meter / air cleaner cover assembly. Refer to Operations 12.29.43 and 12.29.44.

5. Check, and note the valve clearances, as described earlier in this section.

6. Use a rag to wipe up as much oil as possible from the tappet wells.

7. Valve adjustment involves considerable repetition. A SUMMARY OF THE PROCEDURE follows:

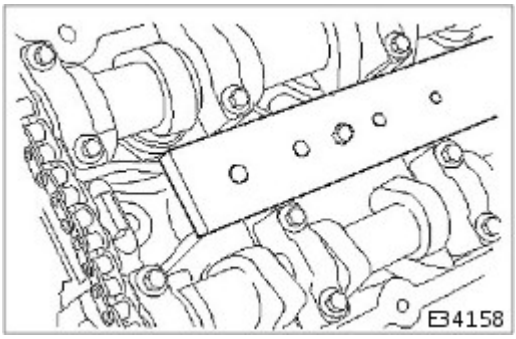
1. Fit the adjusting tool base plate to one cylinder head.
2. Rotate the crankshaft to position four valves ready for adjustment.
3. Use the attachment part of the special tool to adjust two valve clearances. Transfer the attachment and adjust the other two valve clearances.
4. Remove the attachment part from the adjusting tool base plate.

5. Repeat steps 2 to 4 three more times until all sixteen valves on the first cylinder head have been adjusted.

6. Repeat steps 1 to 5 for the other cylinder head.

7. Remove all equipment and reassemble the engine.

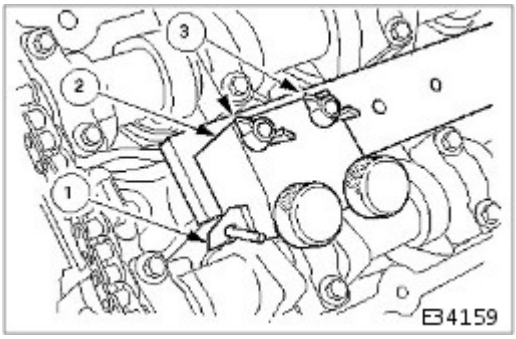
8. The following instructions describe the PROCEDURE FOR ADJUSTING THE VALVE CLEARANCES.



9. Fit the base plate of the tappet adjusting tool 303 - 540 to one of the heads; use the bolts which are supplied with the tool.

- It should be fitted along the head, between the two camshafts, and bolted to the tapped holes which normally secure the cam cover.

10. Rotate the crankshaft so that there are four valves which are 'off the cam'(cam lobes uppermost), so that their clearance may be measured.



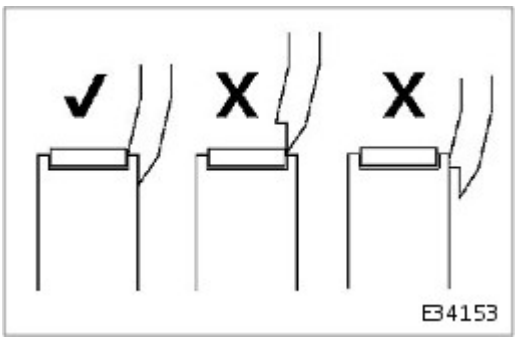
11. CAUTION: Do not rotate the crankshaft while the attachment is fitted to the base plate.

Fit the attachment of 303 - 540 to the base plate.

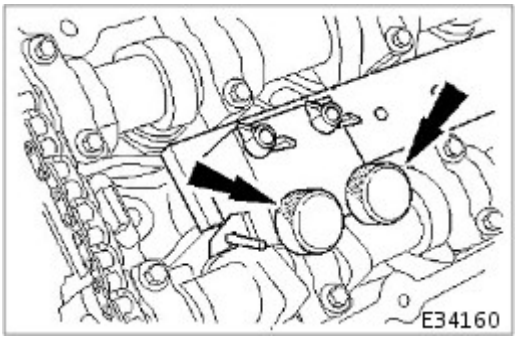
1. Set the fingers of the attachment to the highest position (unscrew the knurled bolts).

2. Fit the attachment to the base plate, adjacent to the first two valves to be adjusted.

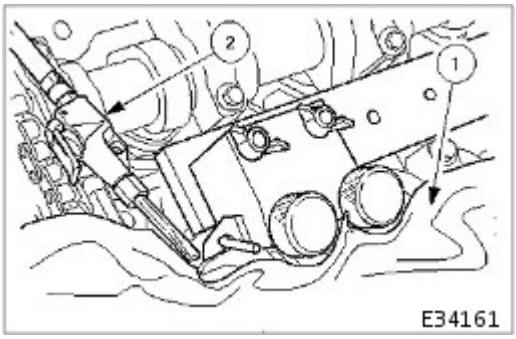
3. Tighten the screws to secure the attachment to the base plate.



12. Position the fingers on to the outer edges of the tappet. It is essential that the recessed step on each finger, locates on the edge of the tappet as indicated. The use of a mirror will help, as viewing access is restricted.



13. Tighten the knurled bolts to compress the valve springs, until a firm resistance is felt.



14. WARNING: THE FOLLOWING OPERATIONS REQUIRE THE USE OF COMPRESSED AIR - ALWAYS WEAR SUITABLE EYE PROTECTION.

Remove, clean and measure the shims.

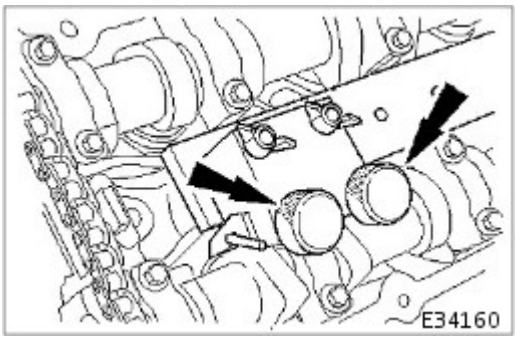
1. Surround the immediate working area with clean rag to contain any loose objects and shims displaced by the compressed air.

2. Use 303 - 590 Air Gun (with a fan nozzle) aimed at the edge of the shim to lift it from the tappet. Remove the shim from each tappet, noting the position of each.

15. Clean and measure the thickness of each shim.

16. Assess the increase or decrease required in shim thickness to produce the correct valve clearance.

17. Select two shims of the correct size, lubricate each and fit each to the respective tappet (as calculated in the previous step). Shims must be fitted with the size marking facing the tappet NOT the cam.



18. Loosen the knurled screws on 303 - 540 attachment to allow the valve springs to return to their normal position.

19. Check the valve clearance of the two valves. If the clearance is correct, remove the attachment from the base plate. transfer the attachment to the other two valves which are in position to be adjusted.

20. Repeat the adjustment procedure, as described in the Summary.

21. Refit the cam covers and associated components. Refer to Operations 12.29.43 and 12.29.44.

22. Refit the engine covers.

23. Check the engine oil level; rectify as necessary.

24. Move the engine compartment cover from the service position and connect the gas struts.

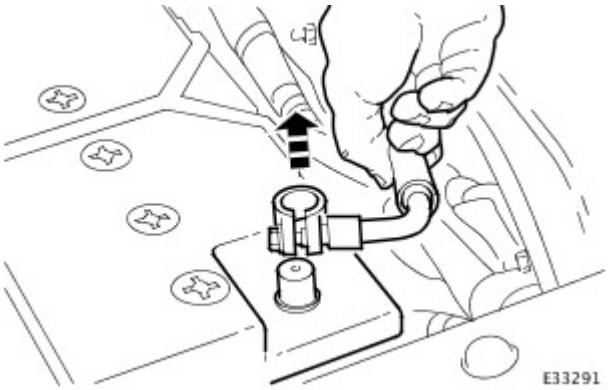
25. Remove the paint protection sheets and close the cover.

26. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Valve Clearance Check

General Procedures

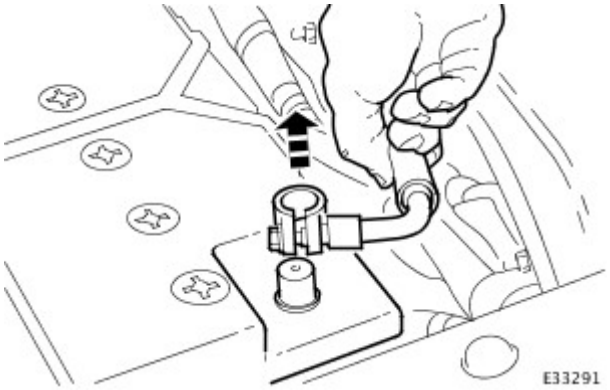


1. Open the engine compartment and fit paintwork protection sheets. Open to the service position.
2. Carefully remove both engine covers, taking care not to damage the plastic fixings or the rubber inserts.
3. Disconnect the battery ground cable.
    - Remove the battery cover.
4. Remove the cam cover from the 'A' bank and the 'B' bank; including the purge valve, the on-plug ignition coils and the air intake tube / air flow meter / air cleaner cover assembly. Refer to Operations 12.29.43 and 12.29.44.
5. Rotate the crankshaft so that there are four valves which are 'off the cam' (cam lobes uppermost), so that their clearance may be measured.
6. Measure the gap on each of the four valves. Note which valve has been measured, along with its relevant clearance.
7. Rotate the crankshaft a small amount so that the next four valves are 'off the cam'. Measure and note the clearances.
    - Repeat this step a further six times, until all valve clearances have been measured and noted.
8. Refit the cam covers and associated components. Refer to Operations 12.29.43 and 12.29.44.
9. Refit the engine covers.
10. Move the engine compartment cover from the service position and connect the gas struts.
11. Remove the paint protection sheets and close the cover.
12. Connect the battery and fit the battery cover.
    - Refer to the Battery Reconnection Procedure 86.15.15

Engine - Connecting Rod Bearings

In-vehicle Repair

Removal



1. Disconnect the battery ground cable.

- Remove the battery cover.

2. Open the engine compartment and fit paintwork protection sheets.

3. Remove the engine compartment cover. Refer to operation 76.16.01.

4. Remove the twin fan and motor assembly. Refer to Operation 26.25.12.

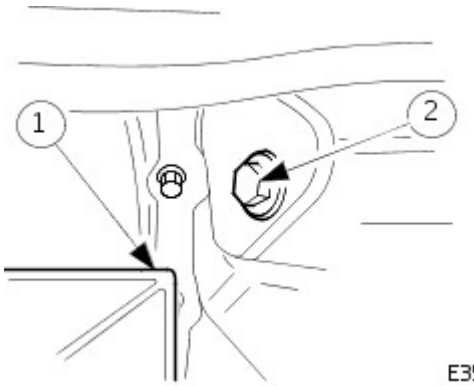
5. Remove the timing cover and all associated components, as detailed in Operation 12.65.01.

6. Remove both front wheel and tyre assemblies. Refer to Operation 74.20.05.

7. Remove the undertray. Refer to Operation 76.22.90.

8. Remove the front crossmember for access. Refer to Operation 76.10.05.

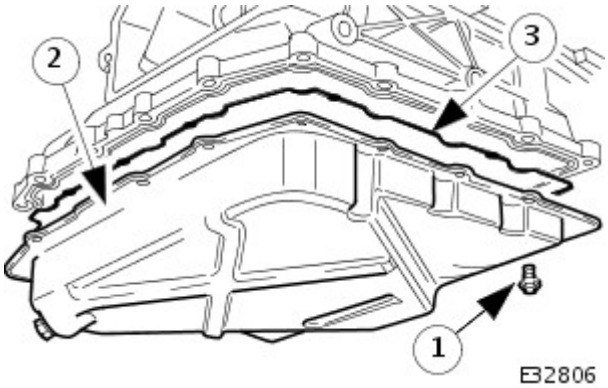
9. Drain the engine oil.



1. Position the waste oil bowser.
2. Remove the drain plug from the oil pan and drain the engine oil.

- Install a new sealing washer to the drain plug.
- Wipe the drain plug and install it to the oil pan to prevent oil dripping.
- Move the oil bowser away from the vehicle.

10. Remove the oil pan.



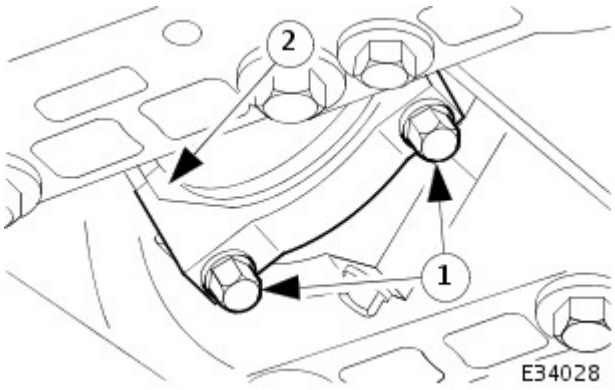
1. Remove the eighteen bolts which secure the oil pan to the oil pan body.
2. Remove the oil pan.
3. Remove the gasket from the oil pan body assembly.

11. Remove the oil pan body assembly. Refer to Operation

12.60.48.

12. Install the old bolt which secured the crankshaft damper, to allow the crankshaft to be rotated. Use a new bolt on final installation.

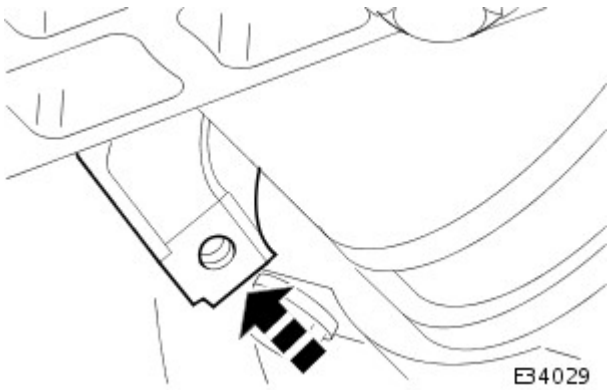
13. The following group of instructions (until stated otherwise) describe the procedure to renew the bearing shells in one connecting rod. Repeat the instructions as necessary.



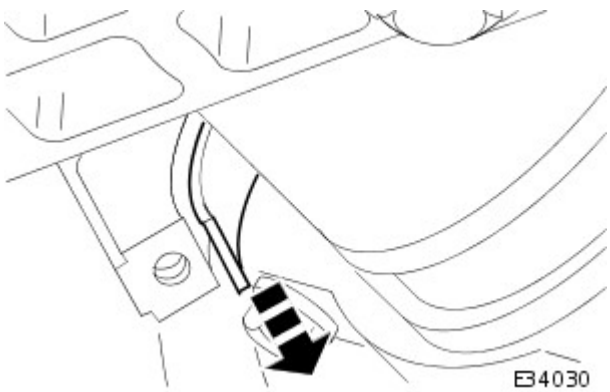
14. Rotate the crankshaft until the required connecting rod bolts are accessible.

1. Remove the bolts which secure the bearing cap.
2. Note the position of the identification marks and remove the cap.

- Remove the bearing shell from the cap and note the grade (colour coded).



15. Carefully move the connecting rod and piston assembly towards the cylinder head to disconnect it from the crankshaft. Rotate the crankshaft slightly if necessary.

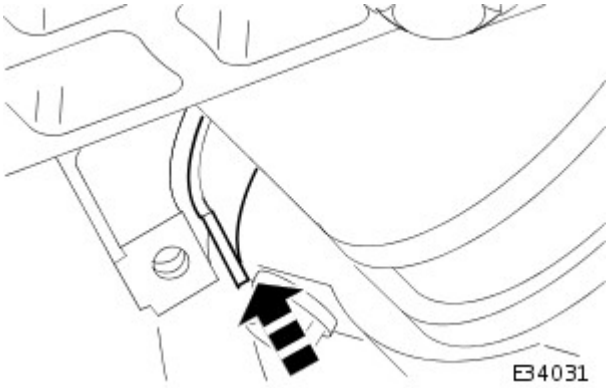


16. Remove the bearing shell from the connecting rod and note the grade (colour coded). The crankpin grades are also stamped on the cylinder block.

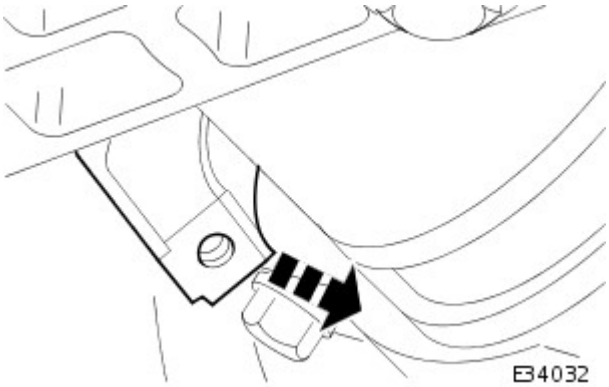
17. Refer to the Specification Section for details of the crankpin and bearing shell grades.

18. Clean all components and mating faces.

19. Install and align the new bearing shell to the connecting rod.



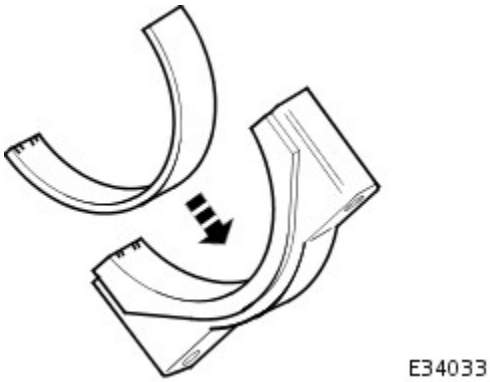
20. Apply new engine oil to the connecting rod bearing and to the crankpin.



21. Carefully move the connecting rod and piston assembly towards the the crankshaft and connect it to the crankpin. Rotate the crankshaft slightly if necessary.

22. If necessary, refer to the Specification Section for details of piston and connecting rod orientation.

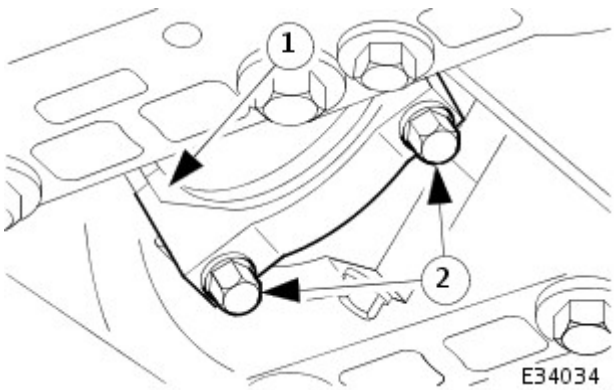
23. Install and align the new bearing shell to the connecting rod cap.



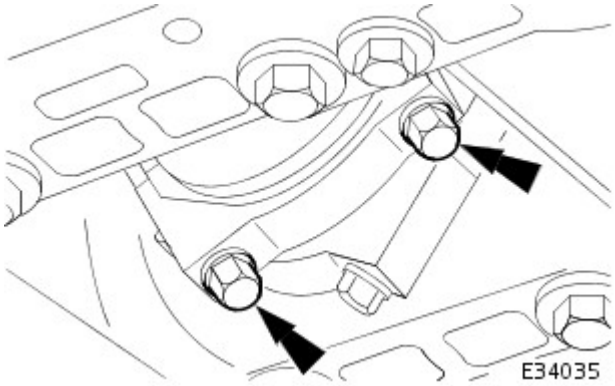
24. Apply new engine oil to the bearing shell.

25. Install the cap and NEW bolts to the connecting rod.

1. Note the position of the identification marks and install the cap so that the identification marks are adjacent to those on the connecting rod.
2. Install the new bolts which secure the bearing cap.



26. Tighten the bolts as follows:



- Tighten each bolt to 8 to 12 Nm initial torque value.
- Tighten to a final torque of 57 to 63 Nm.

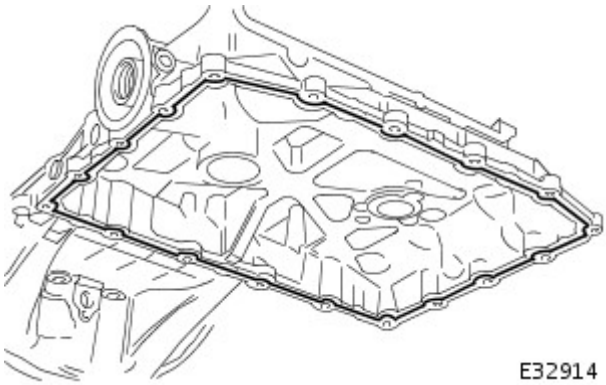
27. Check that the crankshaft turns freely.

28. Repeat the previous operations for each connecting rod bearing as necessary.

Installation

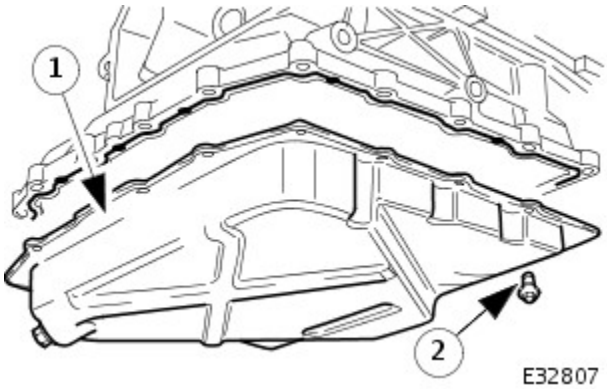
1. Install the oil pan body assembly. Refer to Operation 12.60.48.

2. Position and align the oil pan gasket to the oil pan body assembly.



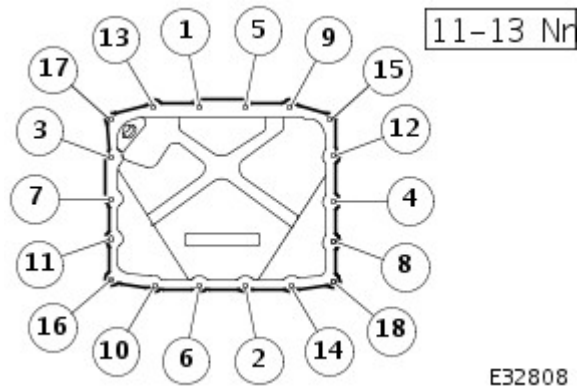
- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.

3. Install the oil pan to the oil pan body.



1. Position and align the oil pan.
2. Install, but do not tighten, all eighteen bolts which secure the oil pan.

4. Tighten the bolts to the correct torque figure 11-13 Nm, in the sequence indicated.



- Tighten the drain plug to 30-40 Nm.
- Install a new oil filter.

5. Install the front crossmember. Refer to Operation 76.10.05.
6. Install the undertray. Refer to Operation 76.22.90.
7. Install both front wheel and tyre assemblies. Refer to Operation 74.20.05.
8. Install the timing cover and all associated components, as detailed in Operation 12.65.01.
9. Install the twin fan and motor assembly. Refer to Operation 26.25.12.
10. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

Refill the engine with the correct specification engine oil.

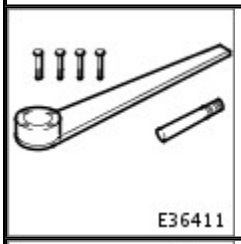
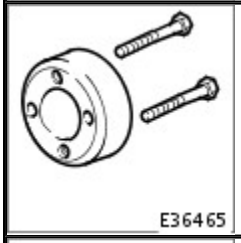
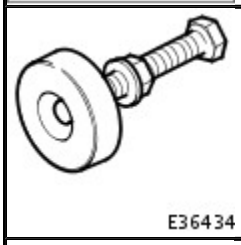
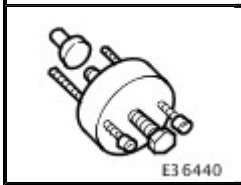
11. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

12. Check the oil level and start the engine. Check for leaks and that the engine runs correctly.
13. Install the engine compartment cover. Refer to operation 76.16.01.
14. Remove the paintwork protection sheets and close the engine compartment cover.

Engine - Crankshaft Front Seal4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

In-vehicle Repair

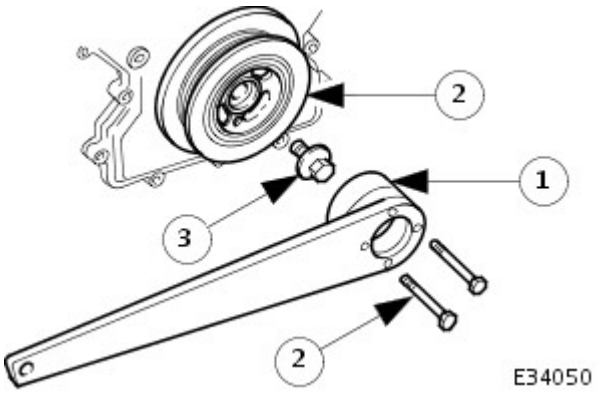
Special Tool(s)	
 E36411	Crankshaft locking, main tool 303-191
 E36465	Adaptor 303-191-02
 E36433	Crankshaft front seal remover 303-541
 E36434	Crankshaft front seal replacer 303-542
 E36440	Crankshaft pulley/damper remover 303-588

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Remove the drive belt from the front accessory drive. Refer to Operation 12.10.40.
4. Remove the twin fan and motor assembly for access. Refer to Operation 26.25.12

5. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

• NOTE: Should extra locking of the crankshaft be required, use a lever against one torque converter boss. Remove the plastic mesh cover from the torque converter housing for access.

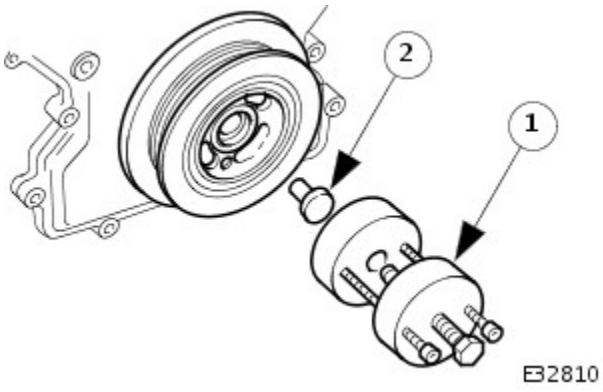


Install the crankshaft locking tool to the damper.

1. Install adaptor 303-191-02 to the main locking tool 303-191.
2. Reposition the crankshaft/damper to align the mounting holes and install the locking tool to the damper using the bolts provided with the tool.
3. Loosen, but do not remove the damper securing bolt from the crankshaft.

6. Remove the locking tool from the damper.

- Remove the damper securing bolt.



7. NOTE: The damper only needs to be withdrawn along the crankshaft nose by approximately 2mm before removing the puller. The damper will then either be loose or only require a sharp tap with a mallet to release it from the split locking ring.

Remove the damper from the crankshaft.

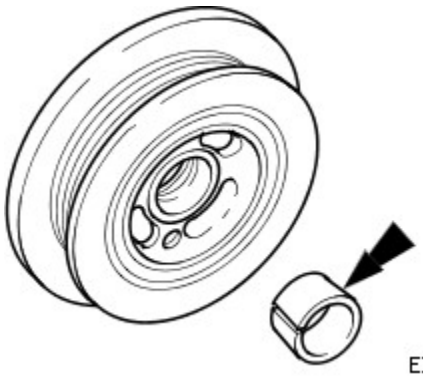
1. Transfer the adaptor 303-191-02 from the crankshaft locking tool to the damper extractor tool 303-588 (Use the socket head screws provided with the puller).
2. Locate the thrust button into the end of the crankshaft; the O-ring holds it in place.

- Assemble the puller to the damper.
- Extract the damper from the crankshaft.

8. Remove the puller components from the damper.

- Remove the thrust button from the end of the crankshaft.

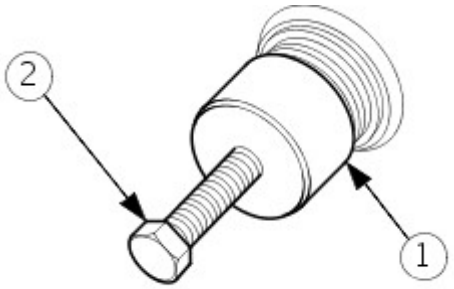
9. Remove the split locking ring from the damper.



10. Remove the internal O-ring seal.



E32839



E35326

11. Remove the crankshaft front seal.

1. Install and tighten the removal tool 303-541 to the crankshaft front seal.
2. Tighten the centre bolt of the tool to extract the seal.

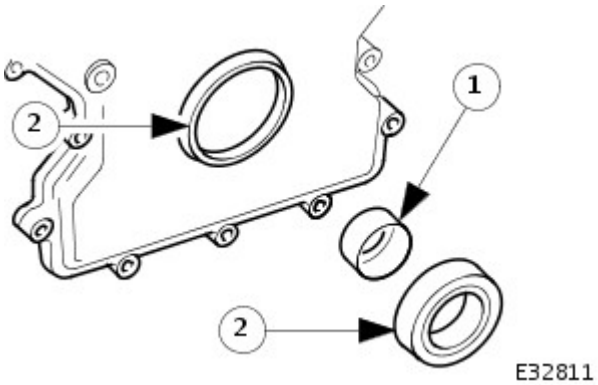
- Remove the tool and seal assembly.
- Separate the seal from the tool.

12. Very carefully clean the threads of the crankshaft, using a plug tap M16x2, to remove all old cured sealant.

- Keep the tap horizontal. Do not enlarge the crankshaft thread - remove sealant only.

13. Clean all relevant parts and faces.

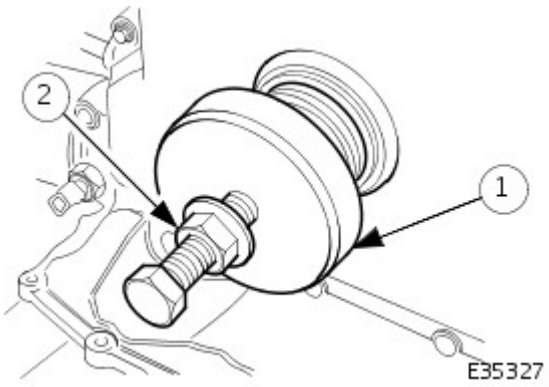
Installation



E32811

1. Locate the new oil seal into the timing cover.

1. Remove the transit ring from the oil seal.
2. Position the seal to the timing cover.



E35327

2. Install the new oil seal to the timing cover.

1. Install oil seal replacer tool 303-542 to the oil seal.
2. Use the nut and bolt provided with the tool, to fully seat the seal to the timing cover. Only tighten the nut sufficiently to locate the seal and no more, or the timing cover could become distorted.

- Allow the tool to stay in position against the seal for at least five seconds.
- Remove the special tool from the seal.

3. If the damper is not to be installed immediately, the transit ring should be installed temporarily to the seal.

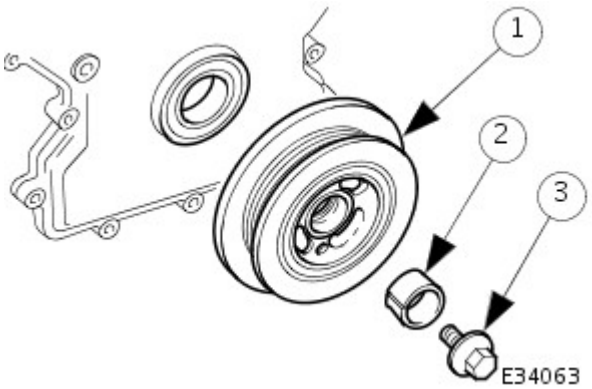
4. Install a new O-ring seal to the damper.


E32839

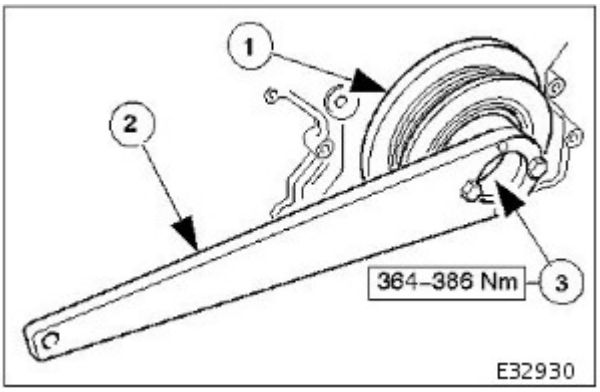
5. Install the crankshaft damper.

- Apply petroleum jelly to the damper bore and O-ring seal.

1. Install the damper onto the crankshaft.
2. Install the split locking ring onto the crankshaft, inside the centre bore of the damper.
3. Install, but do not tighten, a new damper securing bolt.



E34063



E32930

6. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

Tighten the damper securing bolt.

1. Reposition the damper to allow access to the bolt holes for installing the locking tool.
2. Install the locking tool (303-01 and 303-01-02) to the damper using the bolts provided.
3. Fully tighten the damper securing bolt to 364-386 Nm.

7. Remove the locking tool from the damper.

8. Install the drive belt to the front accessory drive. Refer to Section 303-05.

9. Install the twin fan and motor assembly. Refer to Section 303-03.

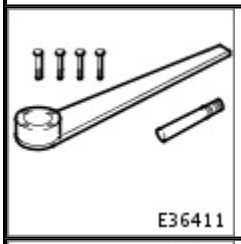
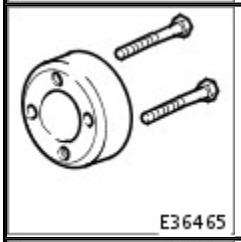
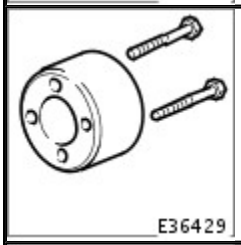
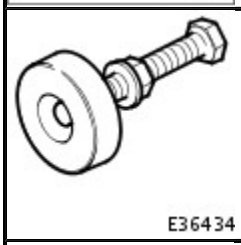
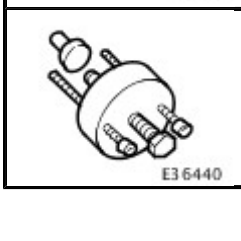
10. Install the plastic mesh cover to the torque converter housing; if removed for access to lock the crankshaft.

11. Reset the engine compartment cover to the normal position and connect the gas struts.

12. Remove the paintwork protection sheets and close the engine compartment.

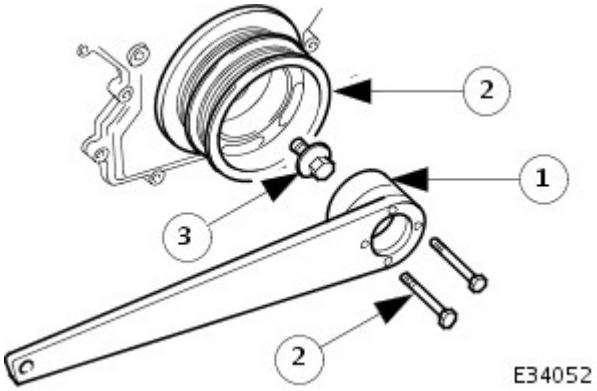
Engine - Crankshaft Front Seal4.0L SC V8 - AJ26

In-vehicle Repair

Special Tool(s)	
 E36411	Crankshaft locking, main tool 303-191
 E36465	Adaptor 303-191-02
 E36429	Adaptor 303-191-03
 E36433	Crankshaft front seal remover 303-541
 E36434	Crankshaft front seal replacer 303-542
 E36440	Crankshaft pulley/damper remover 303-588

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Remove the supercharger drive belt. Refer to Operation 18.50.08.
4. Remove the drive belt from the front accessory drive. Refer to Operation 12.10.40.



5. Remove the twin fan and motor assembly for access. Refer to Operation 26.25.12

6. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

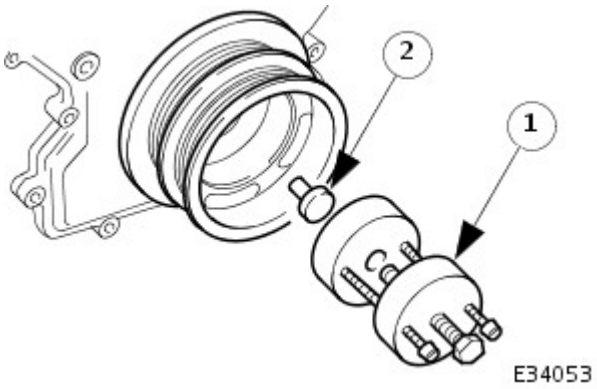
• NOTE: Should extra locking of the crankshaft be required, use a lever against one torque converter boss. Remove the plastic mesh cover from the torque converter housing for access.

Install the crankshaft locking tool to the damper.

1. Install adaptor 303-191-03 to the main locking tool 303-191.
2. Reposition the crankshaft/damper to align the mounting holes and install the locking tool to the damper using the bolts provided with the tool.
3. Loosen, but do not remove the damper securing bolt from the crankshaft.

7. Remove the locking tool from the damper.

- Remove the damper securing bolt.



8. NOTE: The damper only needs to be withdrawn along the crankshaft nose by approximately 2mm before removing the puller. The damper will then either be loose or only require a sharp tap with a mallet to release it from the split locking ring.

Remove the damper from the crankshaft.

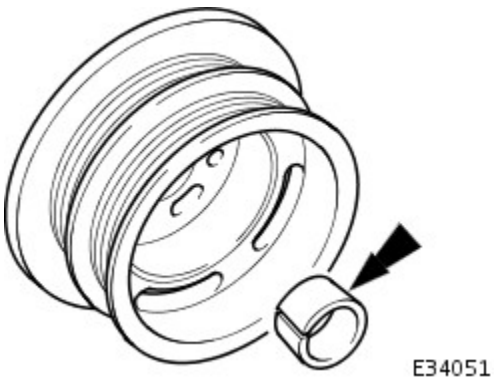
1. Install adaptor 303-191-02 to the damper extractor tool 303-588 (Use the socket head screws provided with the puller).
2. Locate the thrust button into the end of the crankshaft; the O-ring holds it in place.

- Assemble the puller to the damper.
- Extract the damper from the crankshaft.

9. Remove the puller components from the damper.

- Remove the thrust button from the end of the crankshaft.

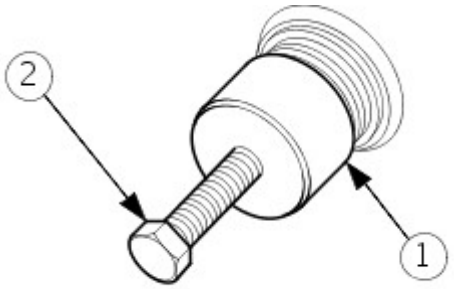
10. Remove the split locking ring from the damper.



11. Remove the internal O-ring seal.



E32839



E35326

12. Remove the crankshaft front seal.

1. Install and tighten the removal tool 303-541 to the crankshaft front seal.
2. Tighten the centre bolt of the tool to extract the seal.

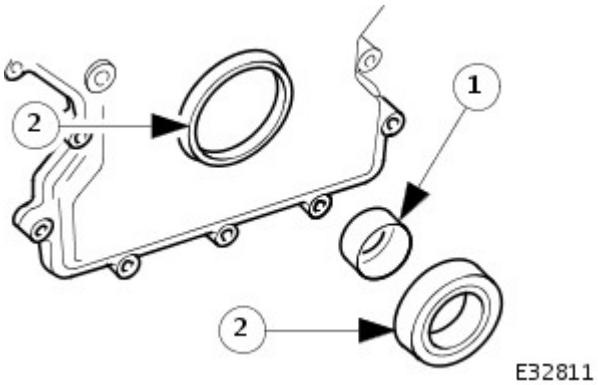
- Remove the tool and seal assembly.
- Separate the seal from the tool.

13. Very carefully clean the threads of the crankshaft, using a plug tap M16x2, to remove all old cured sealant.

- Keep the tap horizontal. Do not enlarge the crankshaft thread - remove sealant only.

14. Clean all relevant parts and faces.

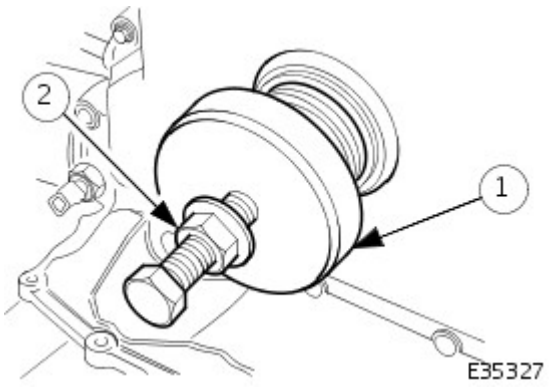
Installation



E32811

1. Locate the new oil seal into the timing cover.

1. Remove the transit ring from the oil seal.
2. Position the seal to the timing cover.



E35327

2. Install the new oil seal to the timing cover.

1. Install oil seal replacer tool 303-542 to the oil seal.
2. Use the nut and bolt provided with the tool, to fully seat the seal to the timing cover. Only tighten the nut sufficiently to locate the seal and no more, or the timing cover could become distorted.

- Allow the tool to stay in position against the seal for at least five seconds.
- Remove the special tool from the seal.

3. If the damper is not to be installed immediately, the transit ring should be installed temporarily to the seal.

4. Install a new O-ring seal to the damper.

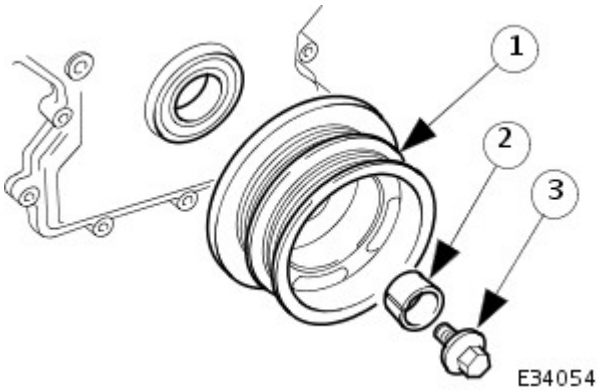


E32839

5. Install the crankshaft damper.

- Apply petroleum jelly to the damper bore and O-ring seal.

1. Install the damper onto the crankshaft.
2. Install the split locking ring onto the crankshaft, inside the centre bore of the damper.
3. Install, but do not tighten, a new damper securing bolt.

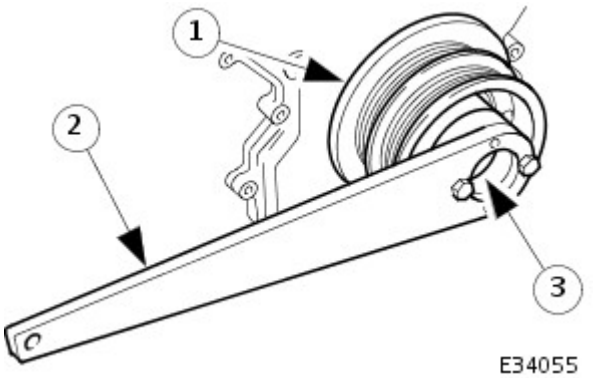


E34054

6. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

Tighten the damper securing bolt.

1. Reposition the damper to allow access to the bolt holes for installing the locking tool.
2. Install the locking tool (303-191 and 303-191-03) to the damper using the bolts provided.
3. Fully tighten the damper securing bolt to 364-386 Nm.



E34055

7. Remove the locking tool from the damper.

8. Install the drive belt to the front accessory drive. Refer to Operation 12.10.40.

9. Install the supercharger drive belt. Refer to Operation 18.50.08.

10. Install the twin fan and motor assembly. Refer to Section 303-03.

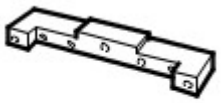
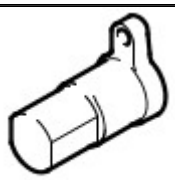
11. Install the plastic mesh cover to the torque converter housing; if removed for access to lock the crankshaft.

12. Reset the engine compartment cover to the normal position and connect the gas struts.

13. Remove the paintwork protection sheets and close the engine compartment.

Engine - Crankshaft Inner Sprocket4.0L NA V8 - AJ27

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303 - 530
 E36402	Timing chain tensioning 303 - 532
 E36407	Wedges, primary chain 303 - 533
 E36408	Crankshaft setting 303 - 531

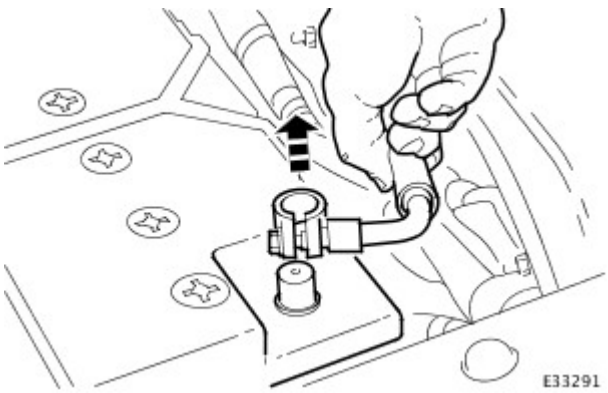
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

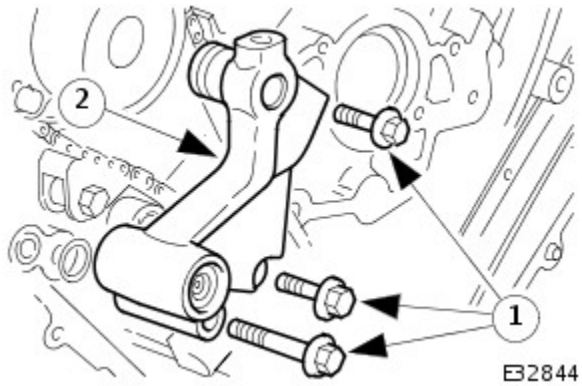
- Remove the battery cover.


E33291

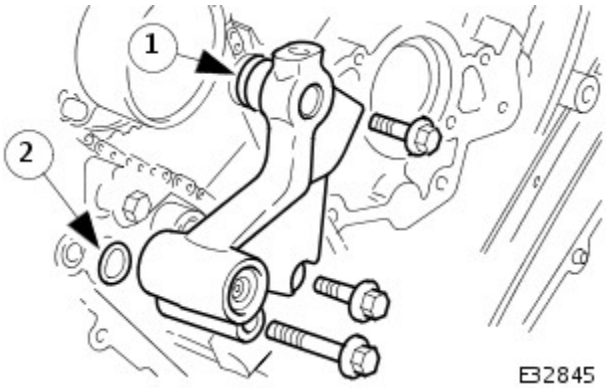
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Remove the VVT bush carrier from the A-Bank.

1. Remove the three bolts which secure the carrier to the cylinder block.

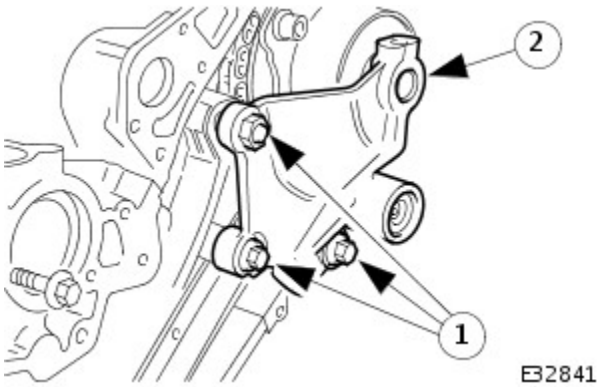


2. Release the carrier from the two ring dowels and remove it.



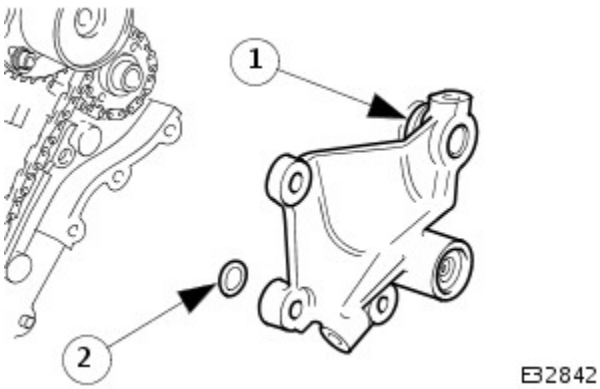
6. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.



7. Remove the VVT bush carrier from the B-Bank.

1. Remove the two bolts and one nut which secure the carrier to the cylinder block.
2. Release the carrier from the two ring dowels and remove it.



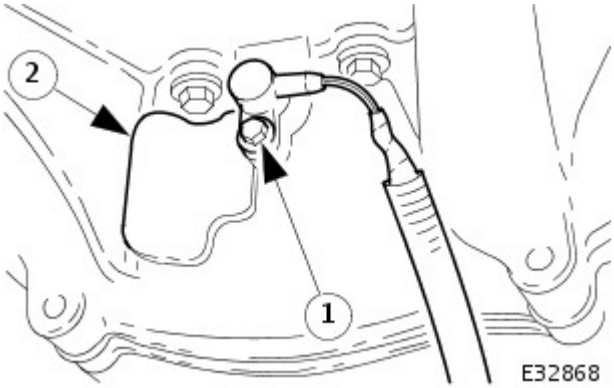
8. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.

9. Raise the vehicle on a ramp.

10. Remove the crankshaft position sensor.

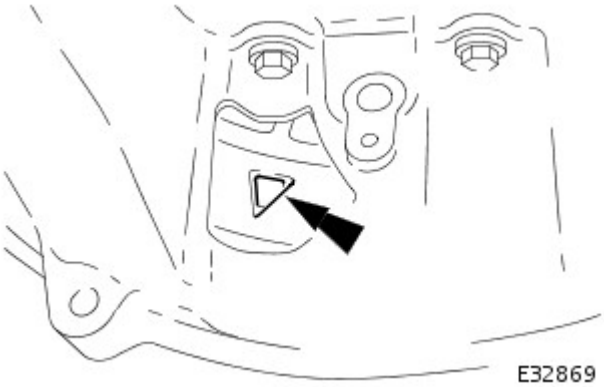
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
    1. Remove the sensor and allow it to hang free under the engine.



2. Remove the access grommet (for torque converter bolts) from the housing.

11. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

12. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





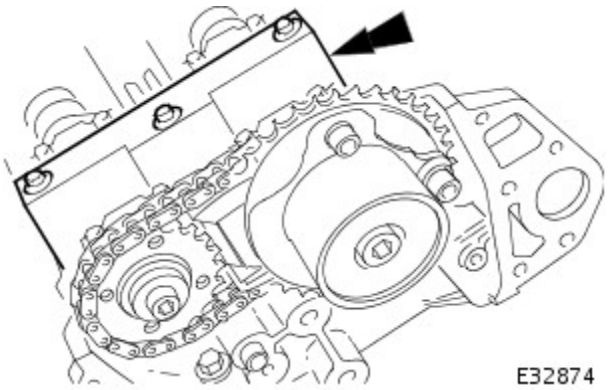
13. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.
    1. Position the crankshaft so that the setting peg engages fully into the timing slot.
2. Fit and tighten the bolt to secure the setting peg.

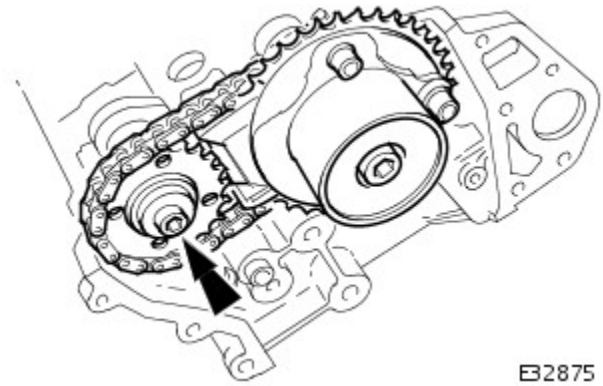
14. Remove the damper securing bolt from the crankshaft.

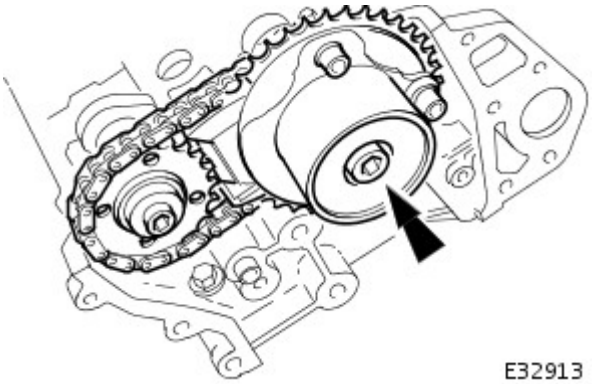
15. Lower the vehicle on the ramp.

16. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.

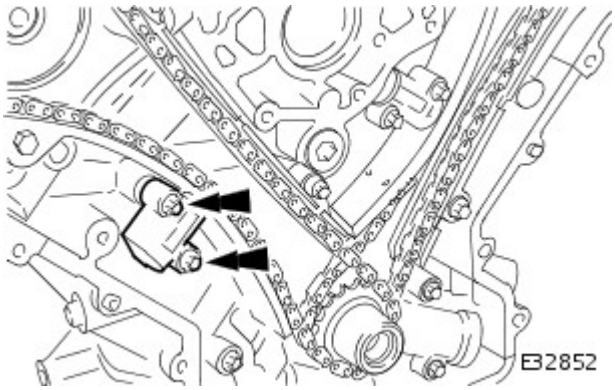


17. Loosen the bolt which secures the sprocket to the camshaft.

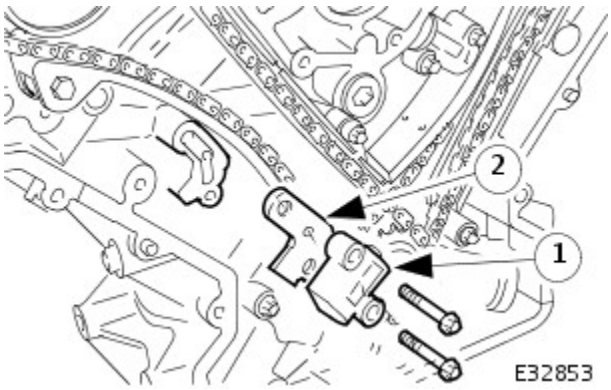




18. Loosen the bolt which secures the VVT unit to the camshaft.



19. Remove the primary chain tensioner bolts.

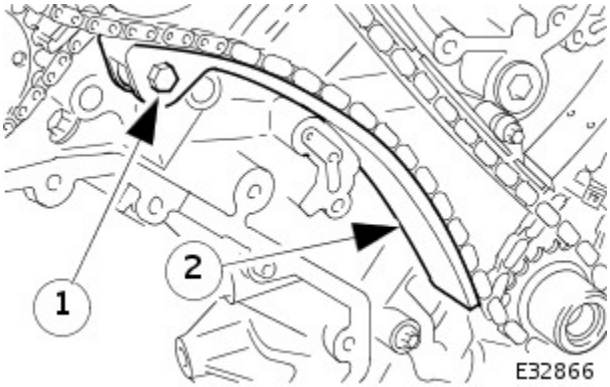


20. Remove the tensioner assembly.

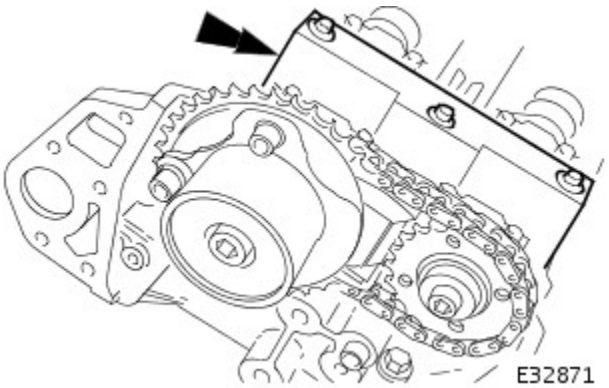
1. Remove the tensioner.
2. Remove the tensioner back-plate.

21. Remove the chain tensioner blade.

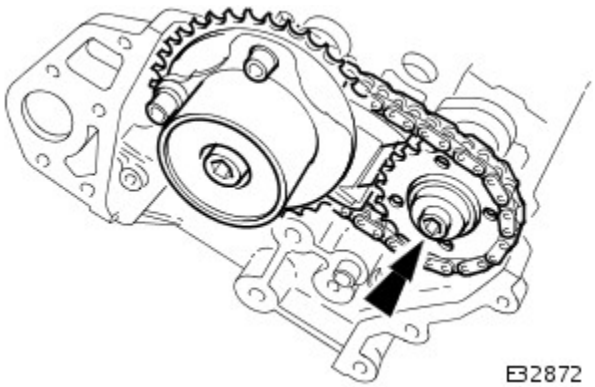
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.



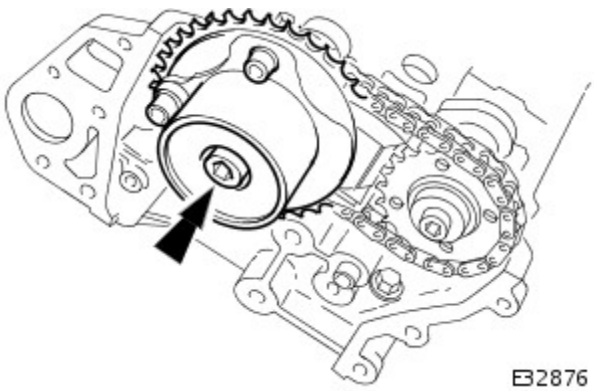
22. Remove the chain from the VVT unit and from the crankshaft pulley.



23. Remove the camshaft locking tool 303 - 530 and transfer it to the B-Bank camshafts, aligning the shafts slightly as necessary.

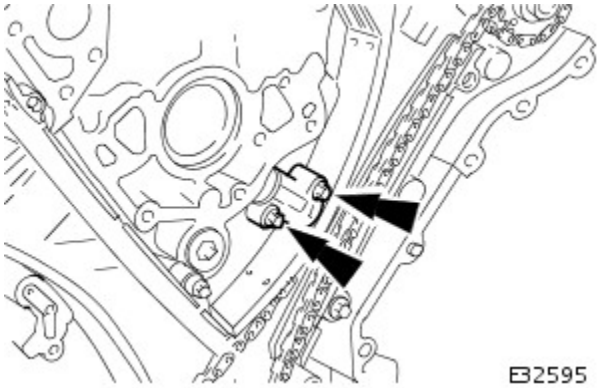


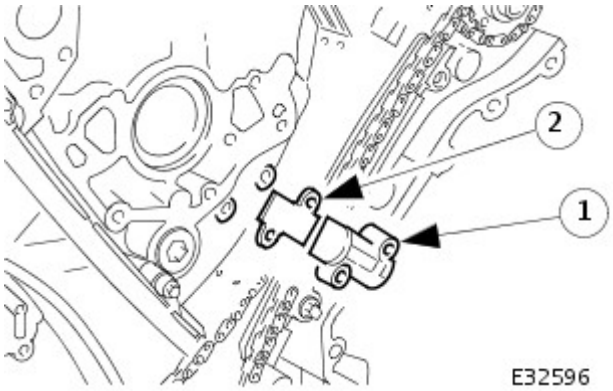
24. Loosen the bolt which secures the sprocket to the camshaft.



25. Loosen the bolt which secures the VVT unit to the camshaft.

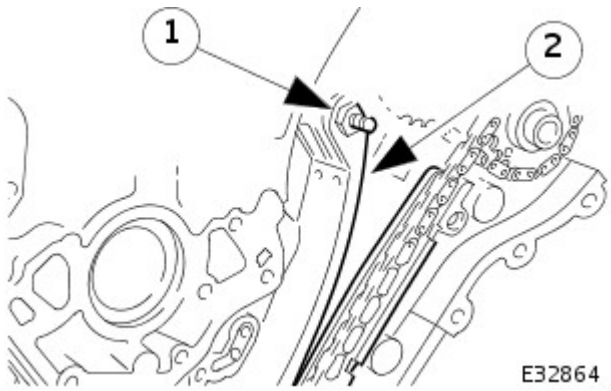
26. Remove the primary chain tensioner bolts.





27. Remove the tensioner assembly.

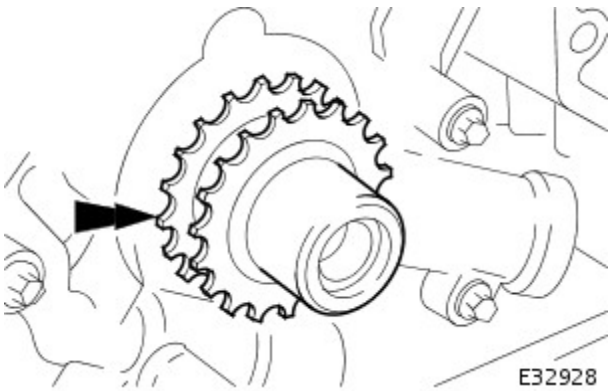
1. Remove the tensioner.
2. Remove the tensioner back-plate.



28. Remove the chain tensioner blade.

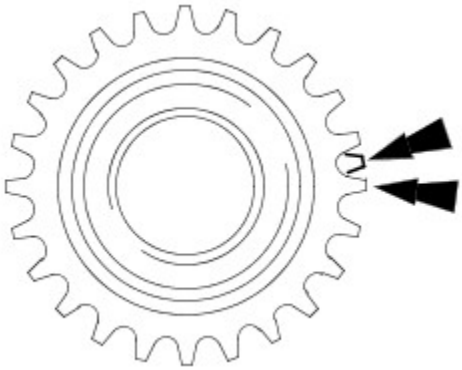
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

29. Reposition the VVT unit and exhaust camshaft sprocket forward along the camshaft bosses and remove the chain from the VVT unit and from the crankshaft sprocket.



30. Remove the sprocket from the crankshaft. To remove the B-Bank sprocket, the A-Bank sprocket must be removed first.

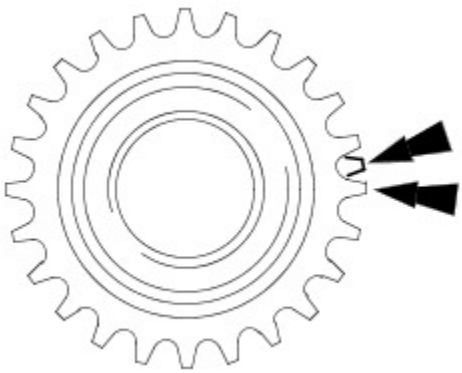
31. Note the orientation of the sprocket relative to the sprocket for the B-Bank drive (half a tooth out of line) and remove the sprocket.



E32912

32. Clean and inspect all relevant components.

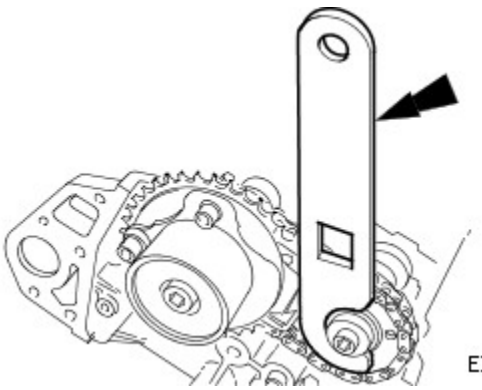
Installation



E32912

1. Fit the sprockets to the crankshaft.

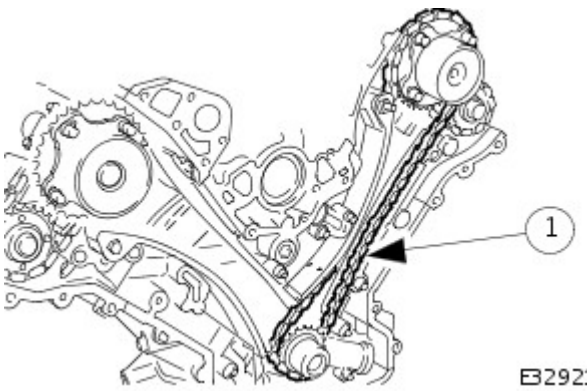
- The teeth of the A-Bank and the B-Bank sprockets on the crankshaft must be out of phase with each other. If they are in-phase after fitting, remove the A-Bank sprocket, turn it on its vertical axis and refit it.



E32879

2. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket, B-Bank.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



E32921

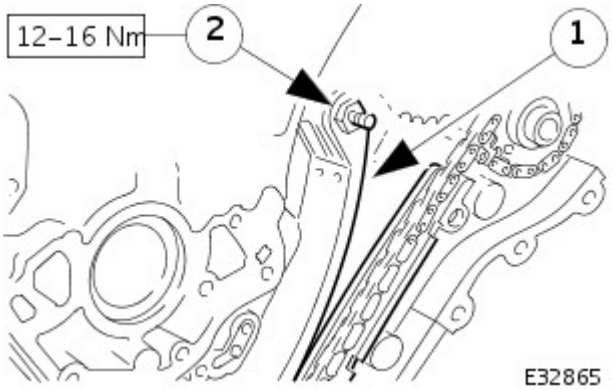
3. Refit the primary timing chain, B-Bank.

1. Fit the primary chain over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.

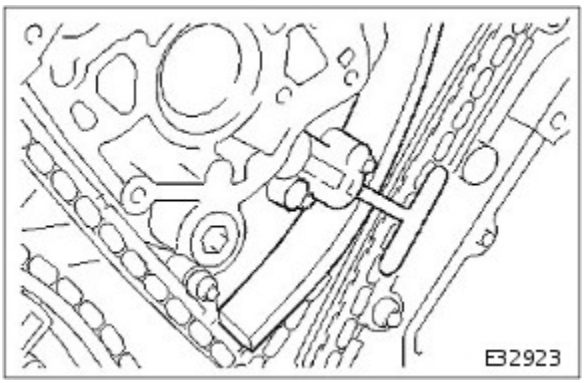
- Slide the VVT and exhaust sprocket fully rearwards onto the respective camshafts.

4. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

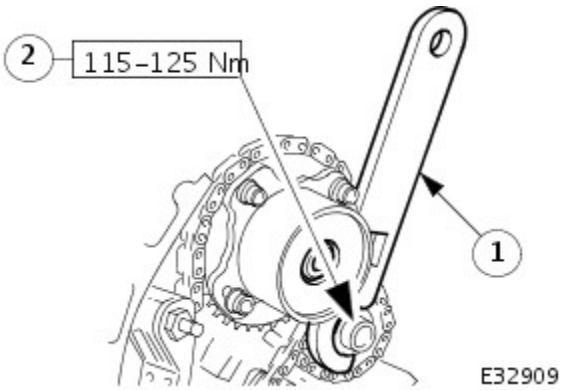


2. Fit the retaining / pivot bolt and tighten it to 12 - 16 Nm.



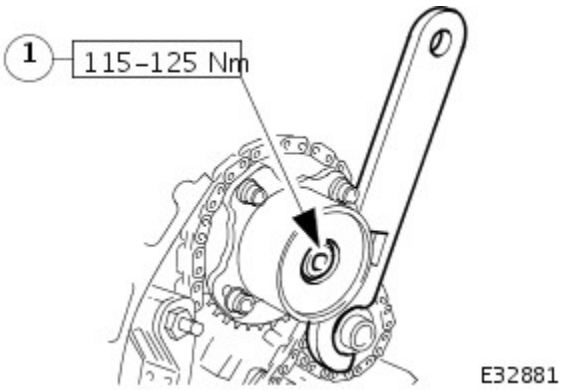
5. Refit the primary chain tensioner assembly. Refer to Operation 12.65.55 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



6. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.
    1. Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.
2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.

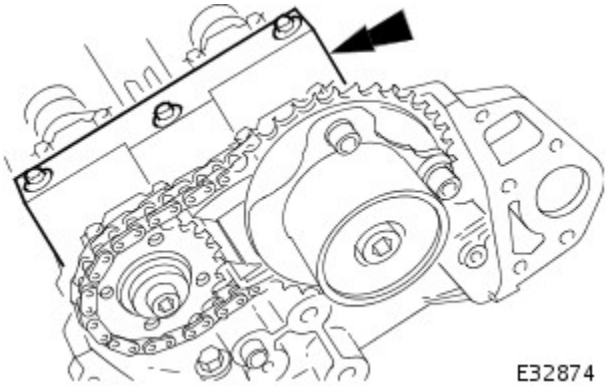


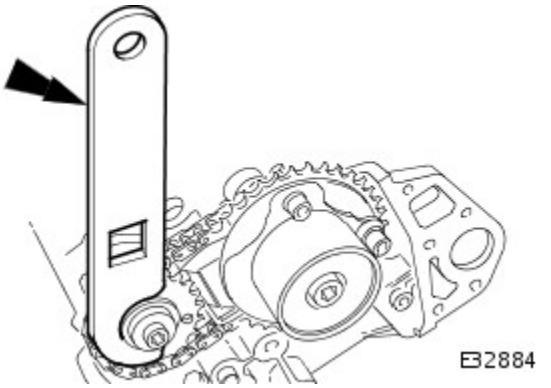
7. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

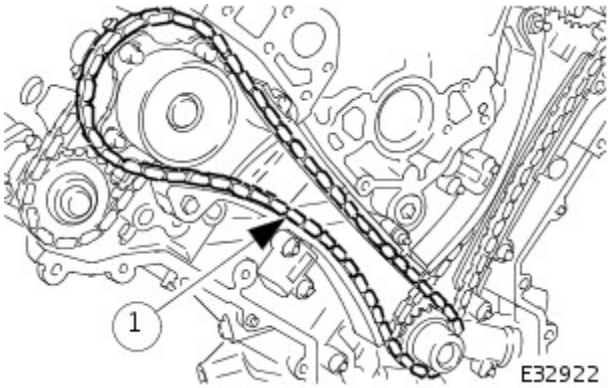
8. Remove the camshaft locking tool 303 - 530 and transfer it to the A-Bank camshafts, aligning the shafts slightly as necessary.





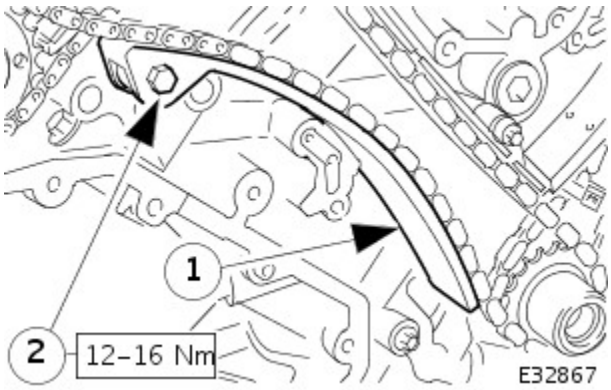
9. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket, A-Bank.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



10. Refit the primary timing chain, A-Bank.

1. Fit the primary chain over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.

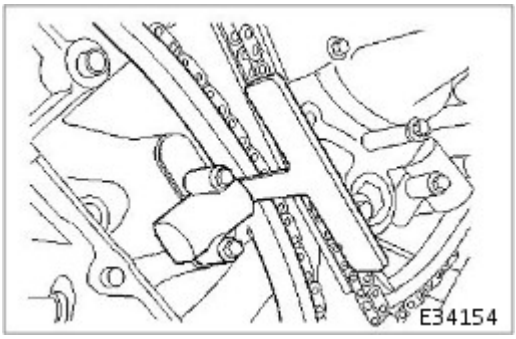


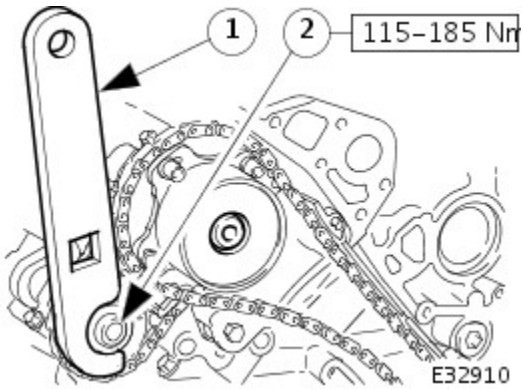
11. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12 - 16 Nm.

12. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

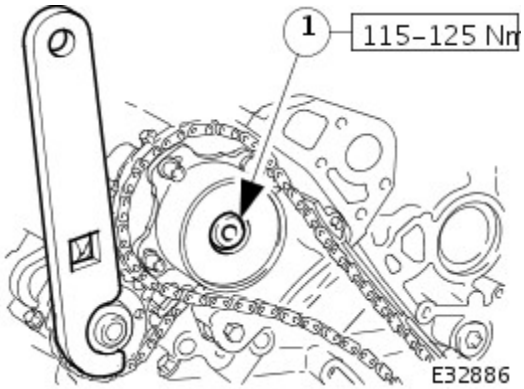
- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.





13. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.
    1. Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.
2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



14. Tighten the VVT unit securing bolt.

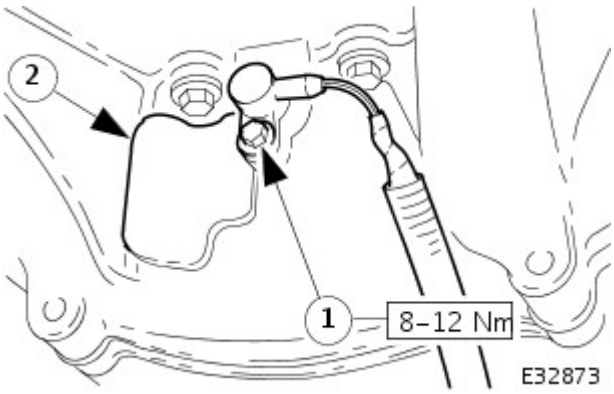
1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

15. Remove the camshaft locking tool 303 - 530.

16. Raise the vehicle on the ramp.

17. Remove the crankshaft setting tool 303 - 531.



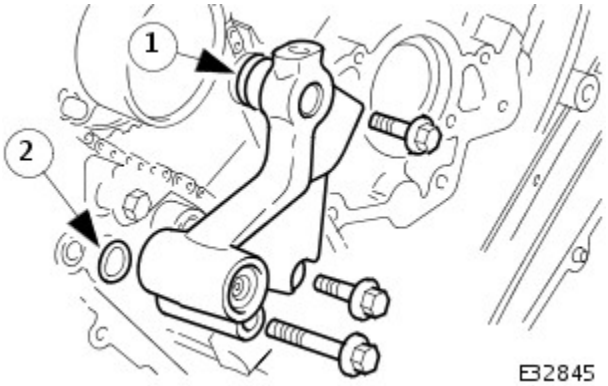
18. Refit the crankshaft position sensor.

1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8 - 12 Nm.
2. Refit the access grommet to the housing.

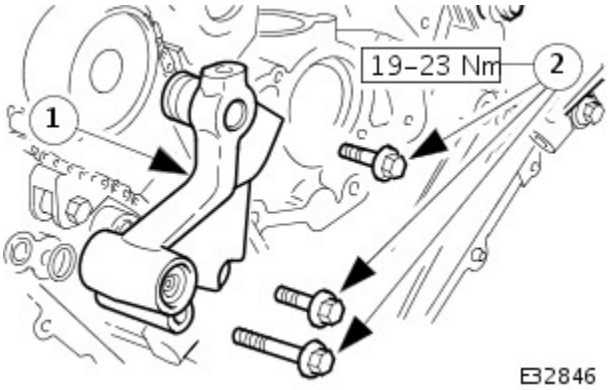
19. Lower the ramp.

20. Fit new seals to the VVT bush carrier, A-Bank.

1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.



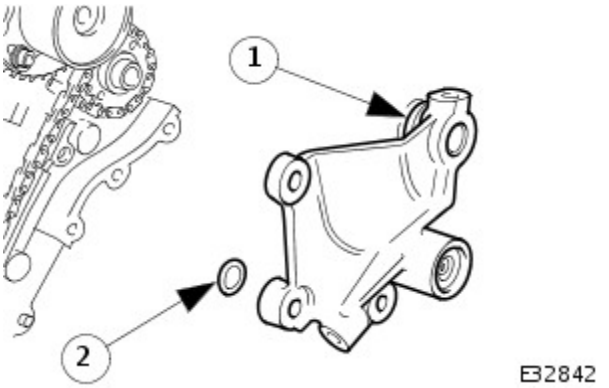
2. Fit a new O-ring to the carrier oil-way.



21. NOTE: Lubricate the seal (scarf jointed) and the bush.

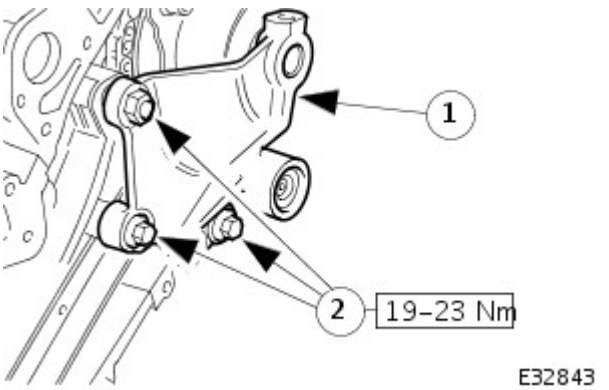
Fit the VVT bush carrier to the cylinder block.

1. Fit the bush carrier assembly.
    1. Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.
2. Fit the three securing bolts. Tighten to 19 - 23 Nm.



22. Fit new seals to the VVT bush carrier, B-Bank.

1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.
2. Fit a new O-ring to the carrier oil-way.



23. NOTE: Lubricate the seal (scarf jointed) and the bush.

Fit the VVT bush carrier to the cylinder block.

1. Fit the bush carrier assembly.
    1. Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.
2. Fit the two securing bolts and one nut. Tighten to 19 - 23 Nm.

24. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

25. Move the engine compartment cover from the service position and connect the gas struts.

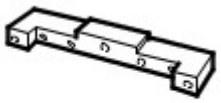
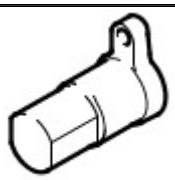
26. Remove the paint protection sheets and close the cover.

27. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Crankshaft Inner Sprocket3.2L NA V8 - AJ26

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

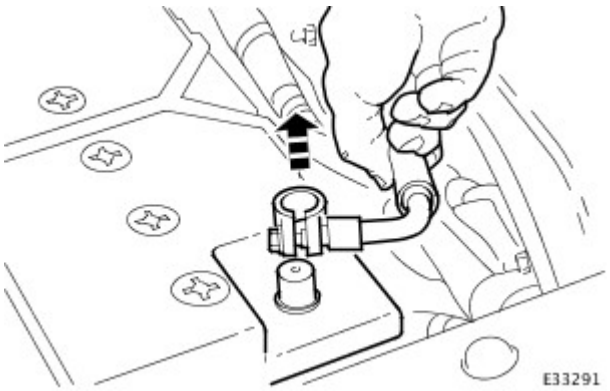
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

- Remove the battery cover.

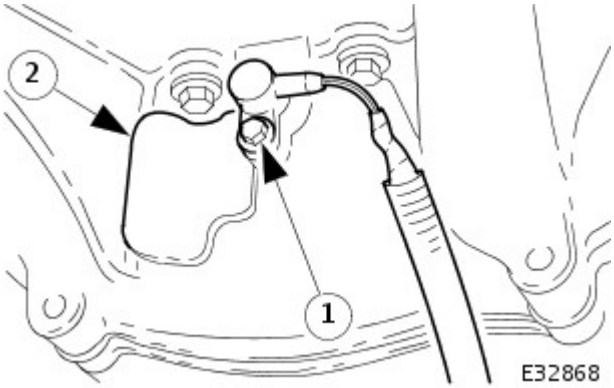

E33291

4. Remove the Timing Cover. Refer to Operation 12.65.01.

5. Raise the vehicle on a ramp.

6. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

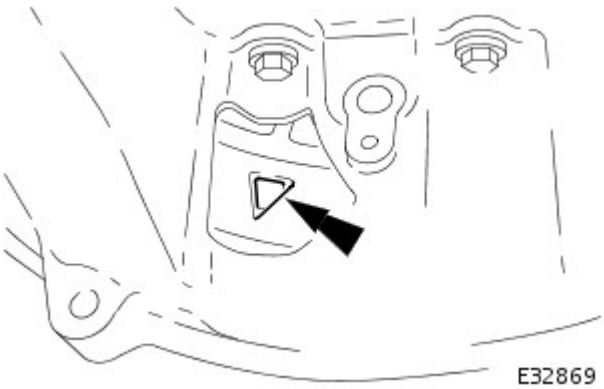


- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

7. Install the damper securing bolt (old one) to the crankshaft, hand-tight only.

8. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



9. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

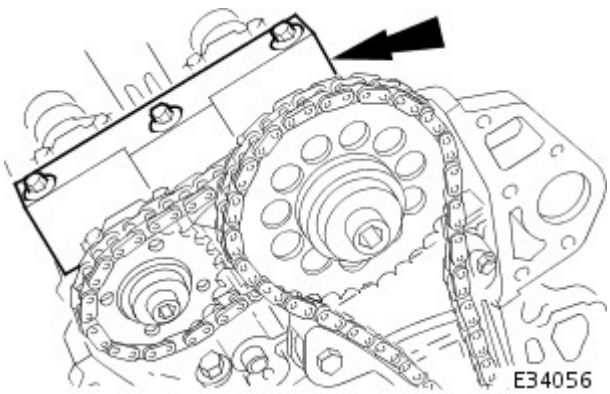
2. Install and tighten the bolt to secure the setting peg.



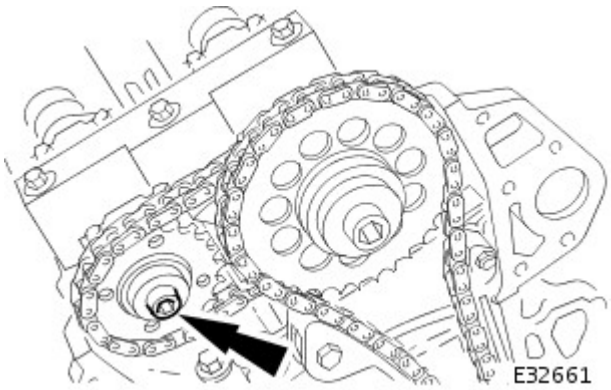
10. Remove the damper securing bolt from the crankshaft.

11. Lower the vehicle on the ramp.

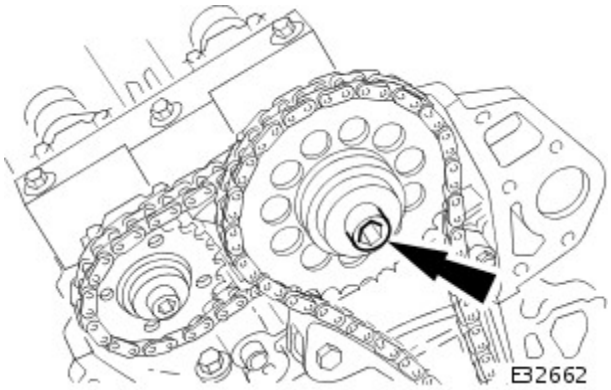
12. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.



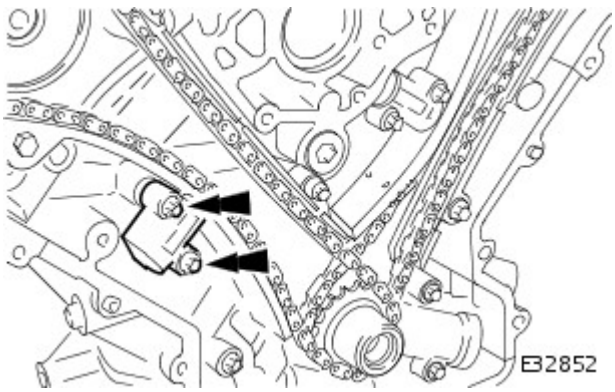
13. Loosen the bolt which secures the sprocket to the exhaust camshaft.



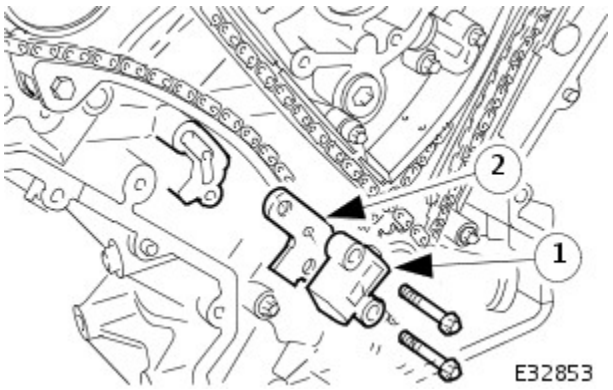
14. Loosen the bolt which secures the sprocket to the intake camshaft.



15. Remove the primary chain tensioner bolts.



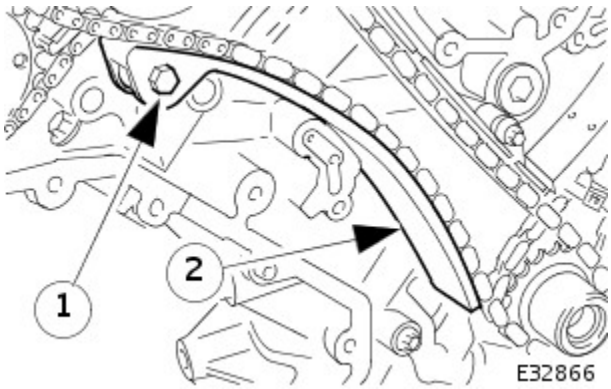
16. Remove the tensioner assembly.



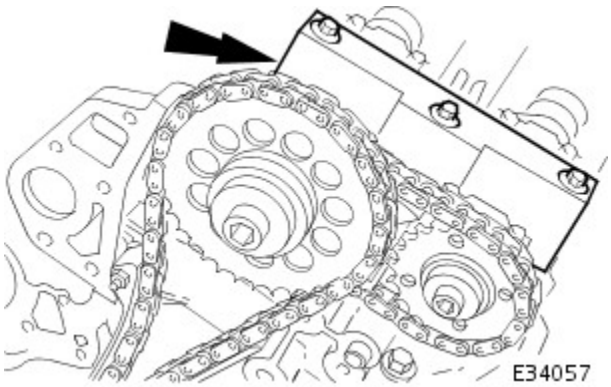
1. Remove the tensioner.
2. Remove the tensioner back-plate.

17. Remove the chain tensioner blade.

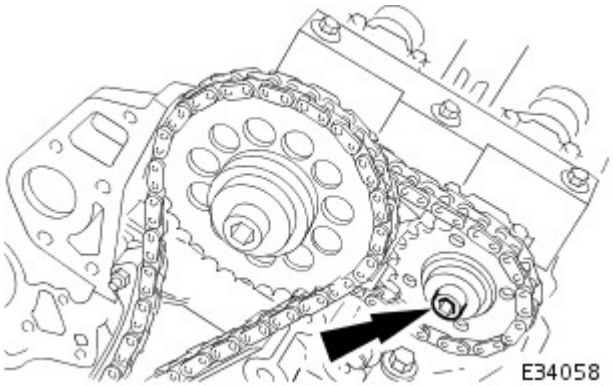
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.



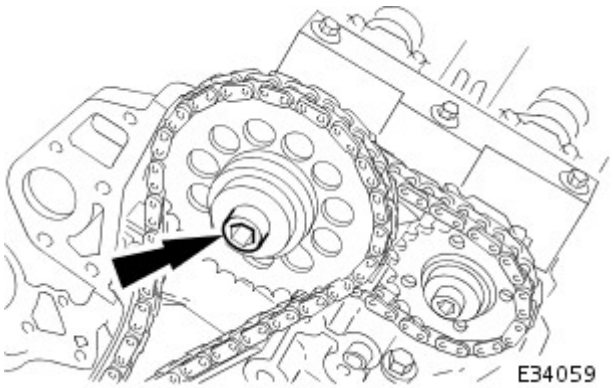
18. Remove the chain from the camshaft sprocket and from the crankshaft sprocket.



19. Remove the camshaft locking tool 303-530 and transfer it to Bank 2 camshafts, aligning the shafts slightly as necessary.

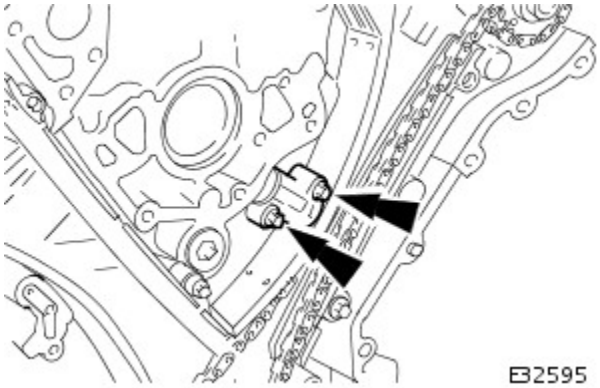


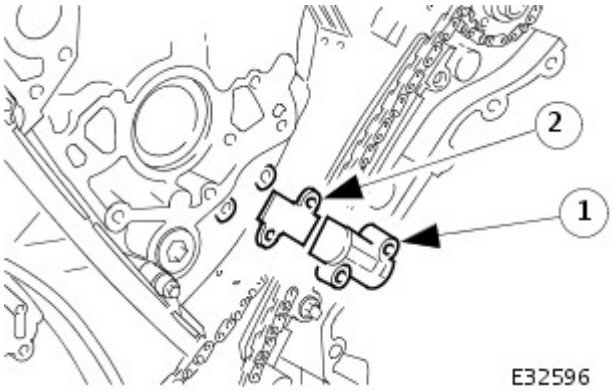
20. Loosen the bolt which secures the sprocket to the exhaust camshaft.



21. Loosen the bolt which secures the sprocket to the intake camshaft.

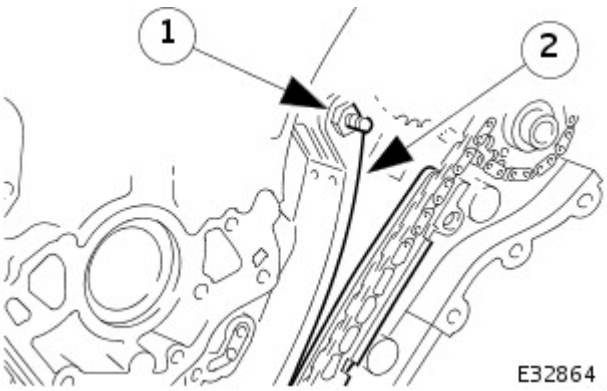
22. Remove the primary chain tensioner bolts.





23. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.

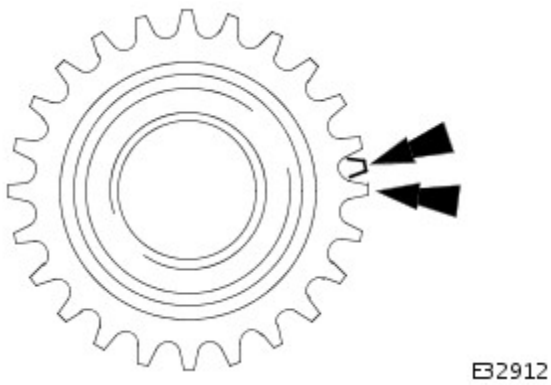


24. Remove the chain tensioner blade.

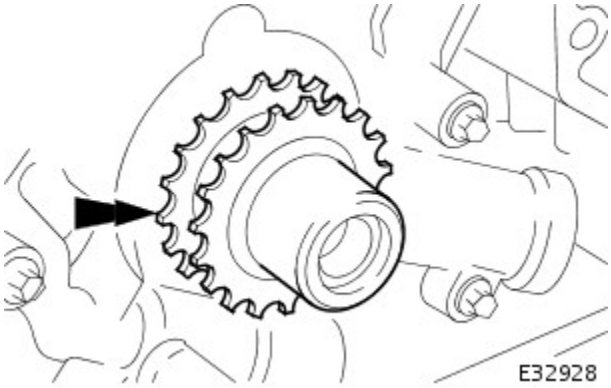
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

25. Reposition both camshaft sprockets forward along the camshaft bosses and remove the chain from the intake camshaft sprocket and from the crankshaft sprocket.

26. Note the orientation of the sprockets relative to each other (half a tooth out of line).

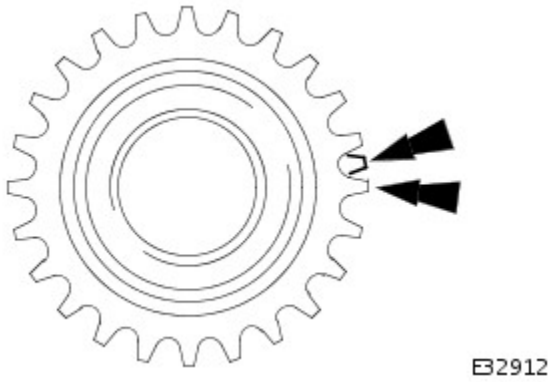


27. Remove the sprocket from the crankshaft. To remove the Bank 2 sprocket, the Bank 1 sprocket must be removed first.



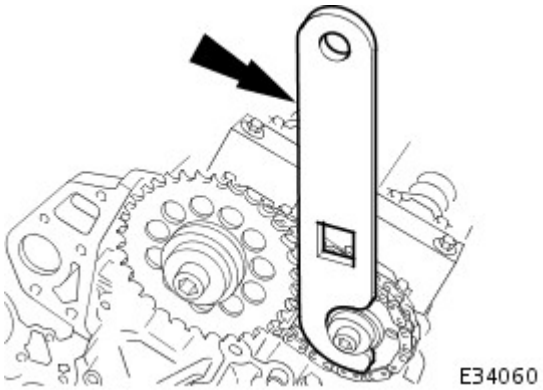
28. Clean and inspect all relevant components.

Installation



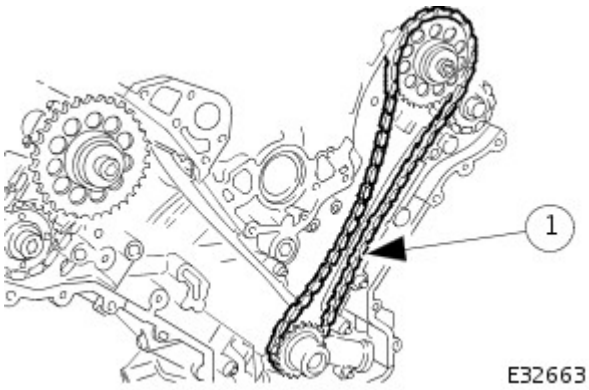
1. Fit the sprockets to the crankshaft.

- The teeth of Bank 1 and Bank 2 sprockets on the crankshaft must be out of phase with each other. If they are in-phase after fitting, remove the Bank 1 sprocket, turn it on its vertical axis and refit it.



2. Install the chain tensioning tool 303-532 to the exhaust camshaft sprocket, Bank 2.

- Reposition the sprocket to the most advantageous position for use of the tool.
- Remove the tool.



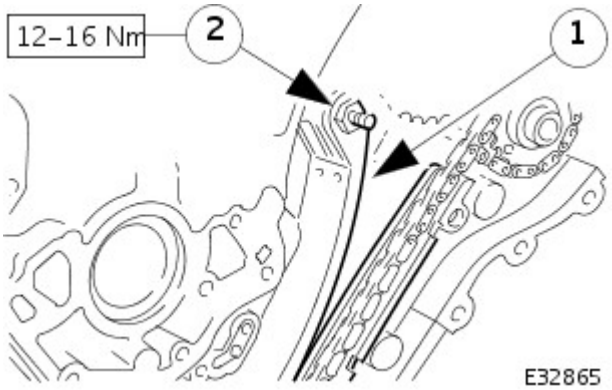
3. Install the primary timing chain, Bank 2.

1. Install the primary chain over the crankshaft sprocket and the intake camshaft sprocket. There must be no slack on the drive side of the primary chain and the sprockets should not be rotated on the camshafts (or the tensioning tool may not fit).

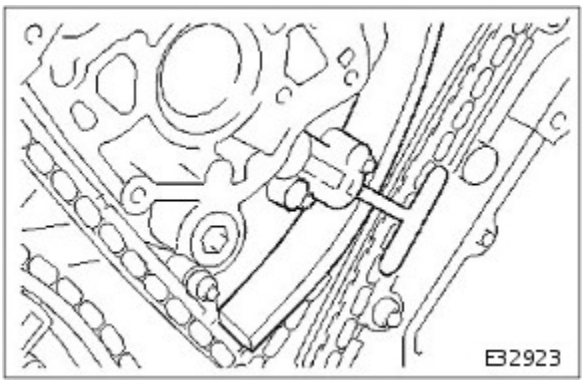
- Slide the camshaft sprockets fully rearwards onto the respective camshafts.

4. Install the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

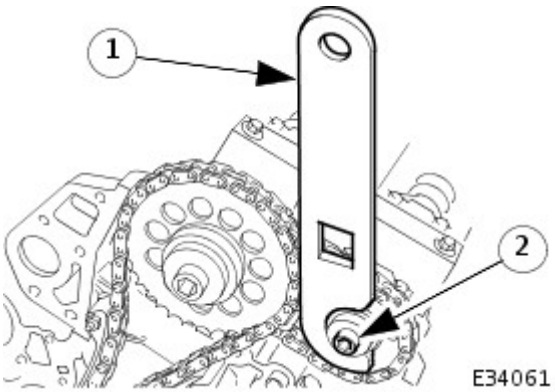


2. Install the retaining / pivot bolt and tighten it to 12-16 Nm.



5. Install the primary chain tensioner assembly. Refer to Operation 12.65.55.

- Use a wedge 303-533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

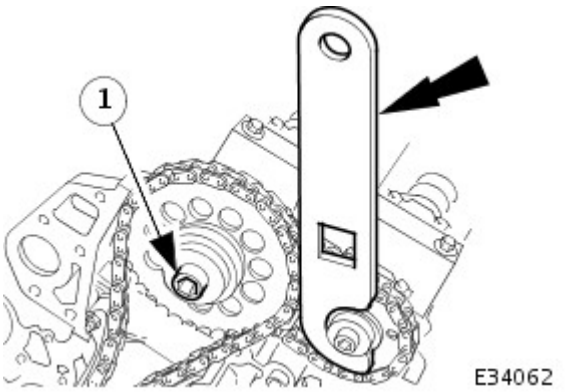


6. Tighten the exhaust camshaft sprocket securing bolt.

1. Install the chain tensioner tool 303-532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.

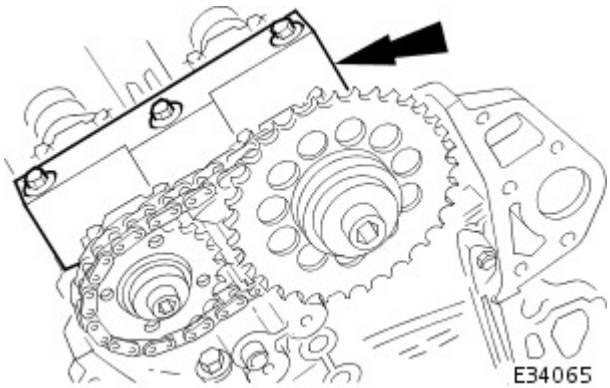


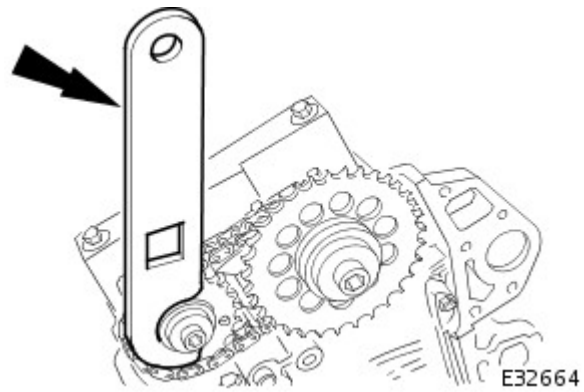
7. Tighten the intake camshaft sprocket securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303-532), check that the wedges are still in place, tighten the securing bolt to 115-125 Nm.

- Remove the chain tensioning tool and the wedge(s).

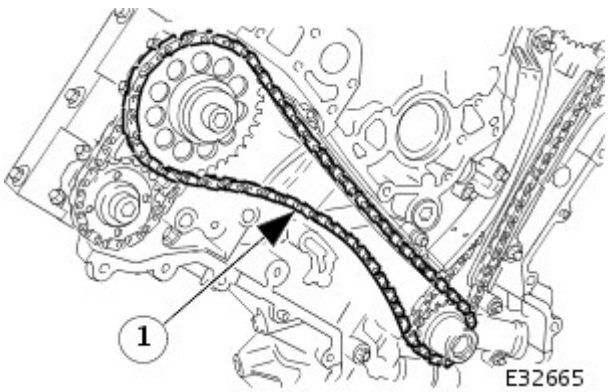
8. Remove the camshaft locking tool 303-530 and transfer it to Bank 1 camshafts, aligning the shafts slightly as necessary.





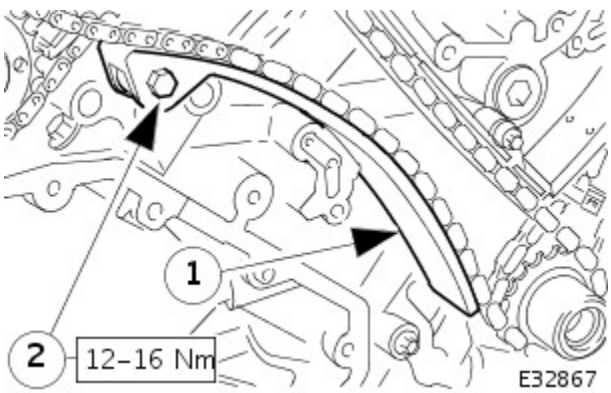
9. Install the chain tensioning tool 303-532 to the exhaust camshaft sprocket, Bank 1.

- Reposition the sprockets to the most advantageous position for use of the tool.
- Remove the tool.



10. Install the primary timing chain, Bank 1.

1. Install the primary chain over the crankshaft sprocket and the intake camshaft sprocket. There must be no slack on the drive side of the primary chain and the sprockets should not be rotated on the camshafts (or the tensioning tool may not fit).

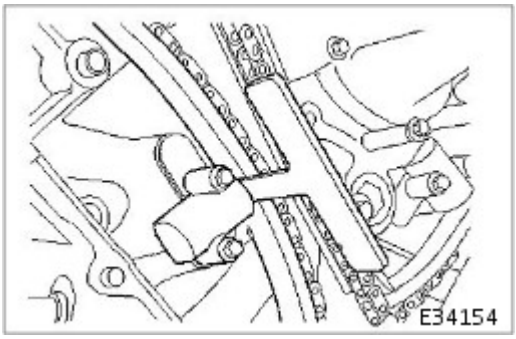


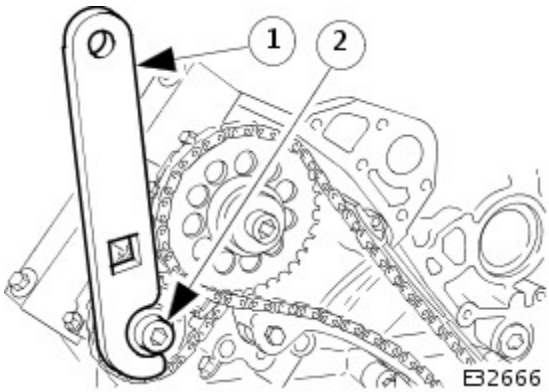
11. Install the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Install the retaining / pivot bolt and tighten it to 12-16 Nm.

12. Install the primary chain tensioner assembly. Refer to Operation 12.65.54.

- Use a wedge 303-533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



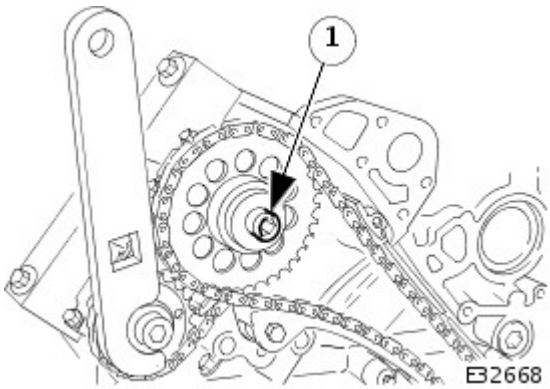


13. Tighten the exhaust camshaft sprocket securing bolt.

1. Install the chain tensioner tool 303-532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.



14. Tighten the intake camshaft sprocket securing bolt.

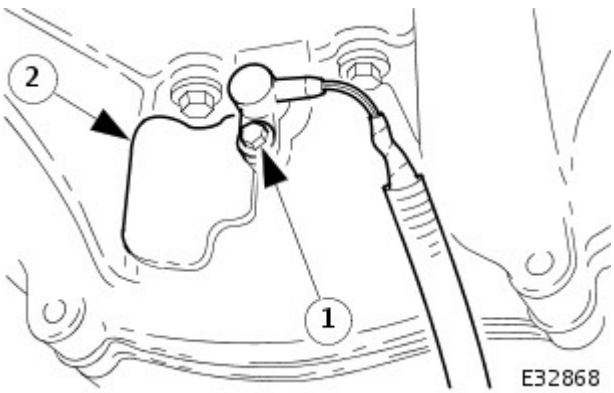
1. Whilst still applying the opposing force to the sprocket and chain (using 303-532), check that the wedges are still in place, tighten the securing bolt to 115-125 Nm.

- Remove the chain tensioning tool and the wedge(s).

15. Remove the camshaft locking tool 303-530.

16. Raise the vehicle on the ramp.

17. Remove the crankshaft setting tool 303-531.



18. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and install the securing bolt. Tighten to 6-8 Nm.

2. Install the access grommet to the housing.

19. Lower the ramp.

20. Install the Timing Cover. Refer to Operation 12.65.01.

21. Move the engine compartment cover from the service position and connect the gas struts.

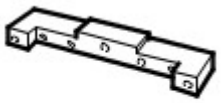
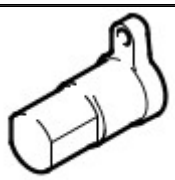
22. Remove the paint protection sheets and close the cover.

23. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Crankshaft Outer Sprocket

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

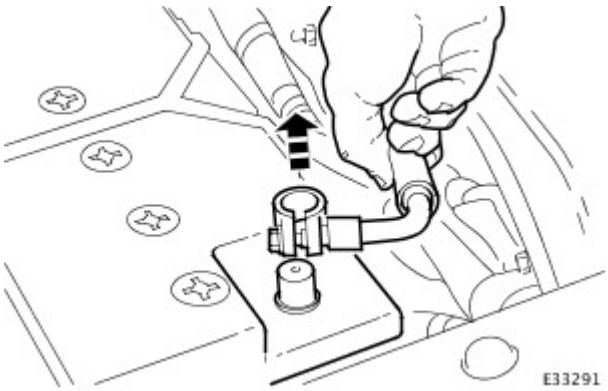
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

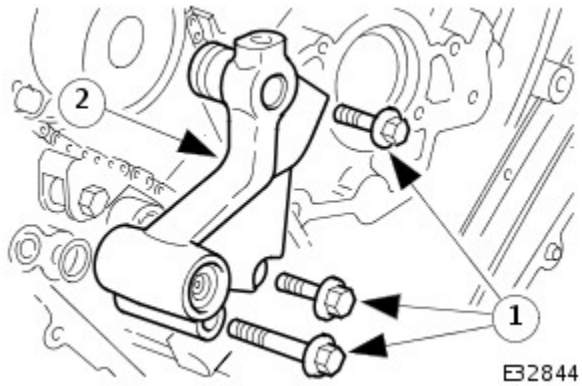
- Remove the battery cover.


E33291

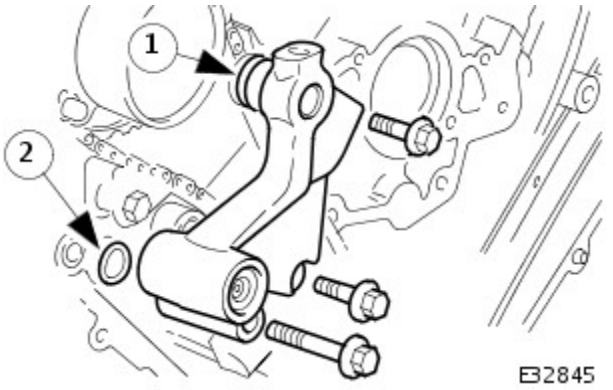
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Remove the VVT bush carrier.

1. Remove the three bolts which secure the carrier to the cylinder block.



2. Release the carrier from the two ring dowels and remove it.



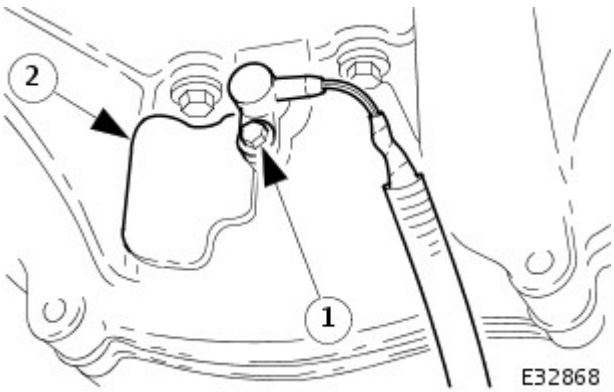
6. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.

2. Remove the O-ring from the carrier oil-way recess.

7. Raise the vehicle on a ramp.

8. Remove the crankshaft position sensor.



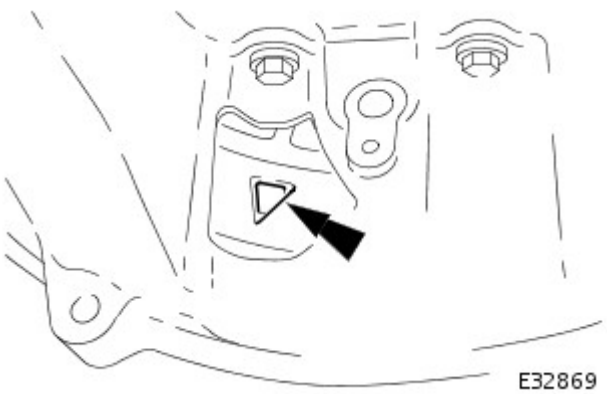
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

9. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

10. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



11. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.



1. Fit the crankshaft setting peg 303 - 531.

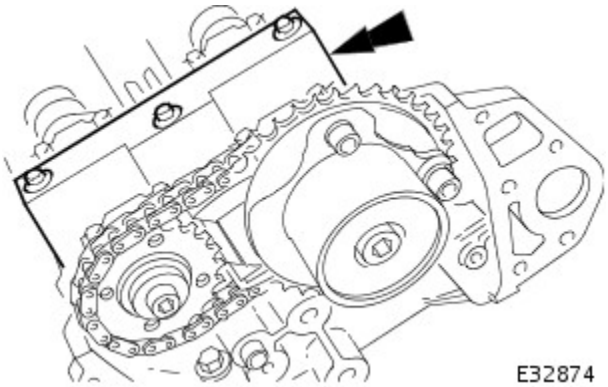
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Fit and tighten the bolt to secure the setting peg.

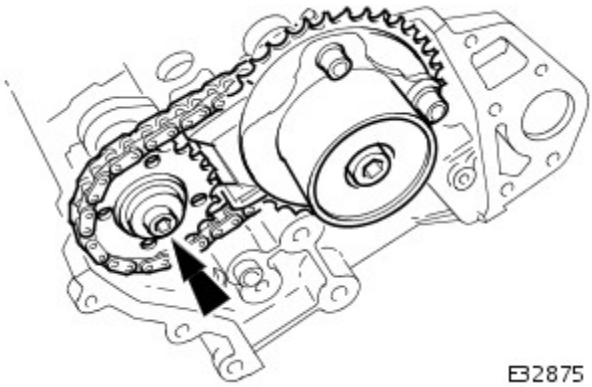
12. Remove the damper securing bolt from the crankshaft.

13. Lower the vehicle on the ramp.

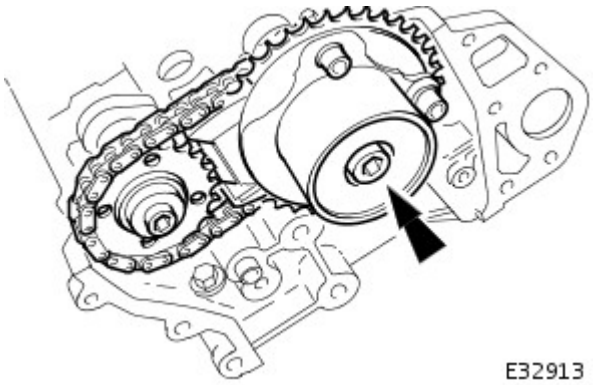
14. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.



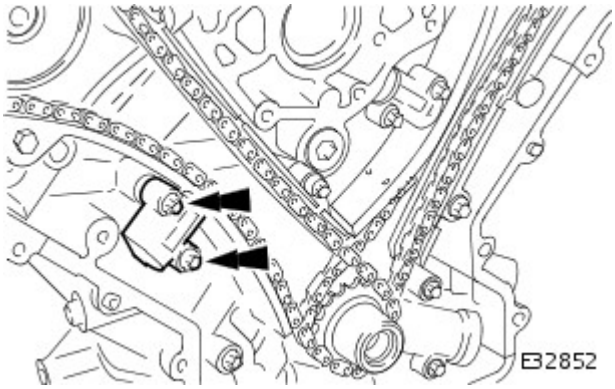
15. Loosen the bolt which secures the sprocket to the camshaft.

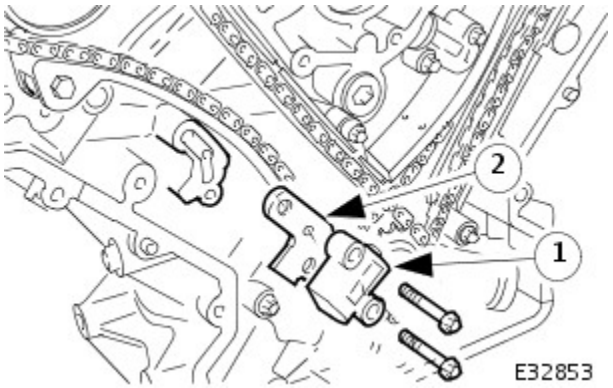


16. Loosen the bolt which secures VVT unit to the camshaft.



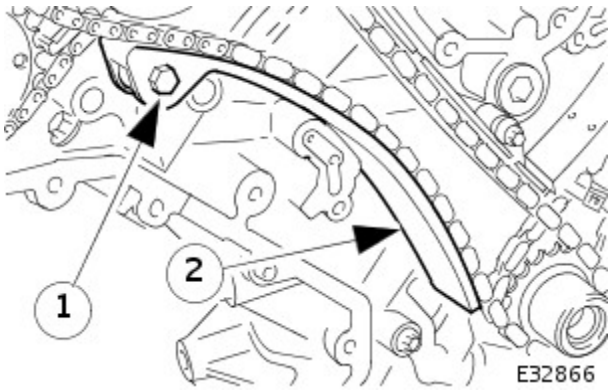
17. Remove the primary chain tensioner bolts.





18. Remove the tensioner assembly.

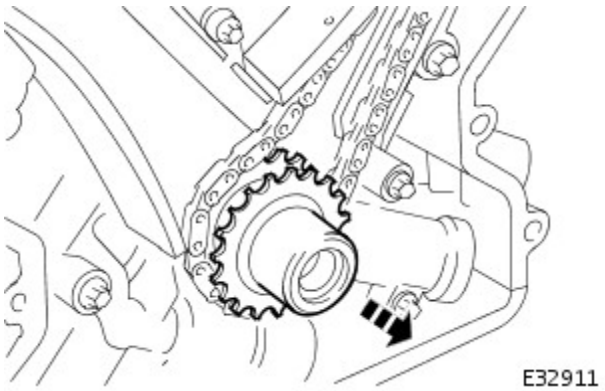
1. Remove the tensioner.
2. Remove the tensioner back-plate.



19. Remove the chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

20. Remove the chain from the VVT unit and from the crankshaft sprocket.



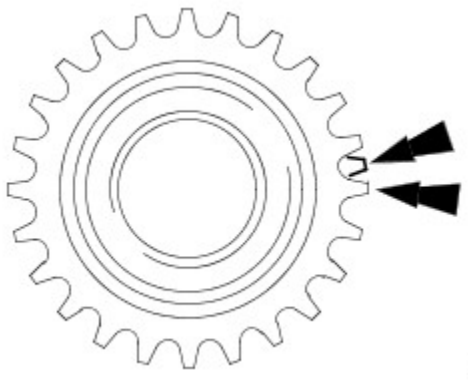
21. If necessary, remove the sprocket from the crankshaft.

- Note the orientation of the sprocket relative to the sprocket for the B-Bank drive (half a tooth out of line) and remove the sprocket.

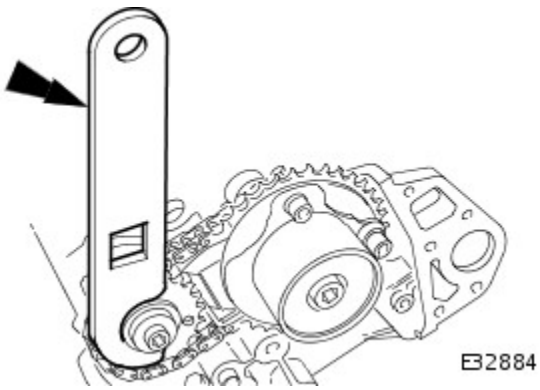
22. Clean and inspect all relevant components.

Installation

1. If removed previously, fit the sprocket to the crankshaft.

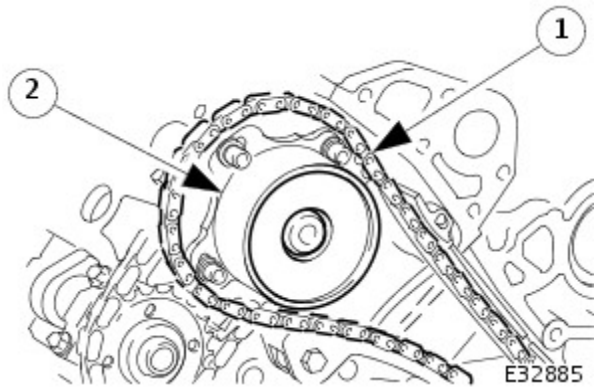


- The teeth of the A-Bank and the B-Bank sprockets on the crankshaft must be out of phase with each other. If they are in-phase after fitting, remove the sprocket, turn it on its vertical axis and refit it.



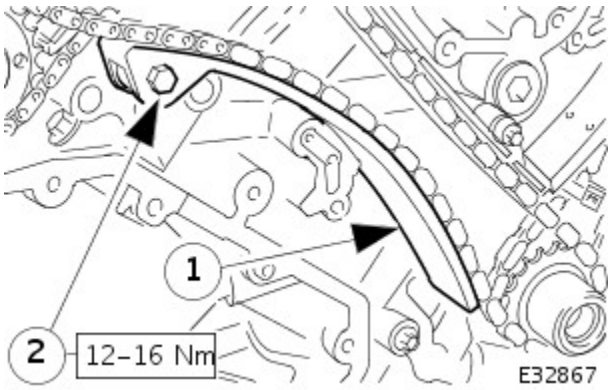
2. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



3. Refit the primary timing chain.

1. Fit the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.

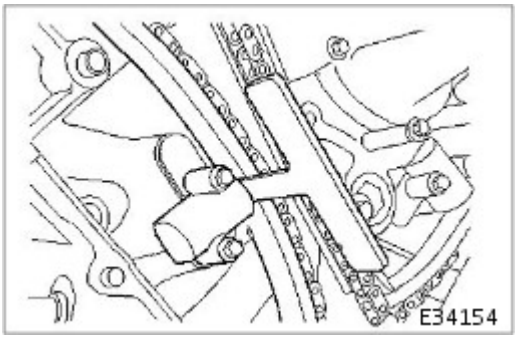


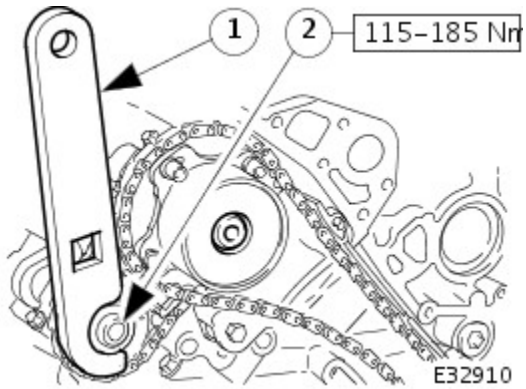
4. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.

5. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



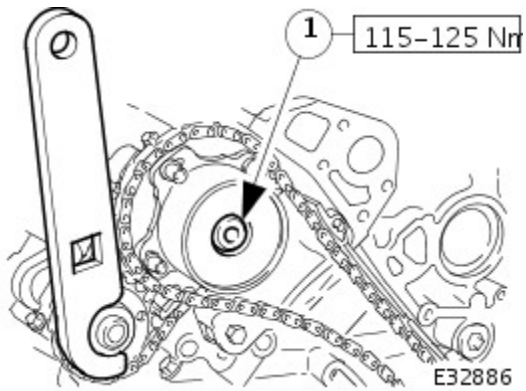


6. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



7. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

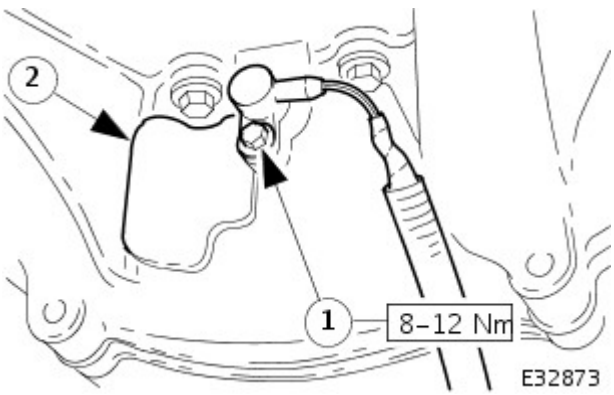
- Remove the chain tensioning tool and the wedge(s).

8. Remove the camshaft locking tool 303 - 530.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303 - 531.

11. Refit the crankshaft position sensor.



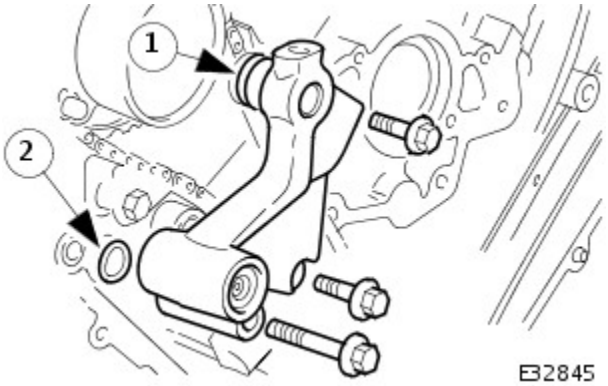
1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Refit the access grommet to the housing.

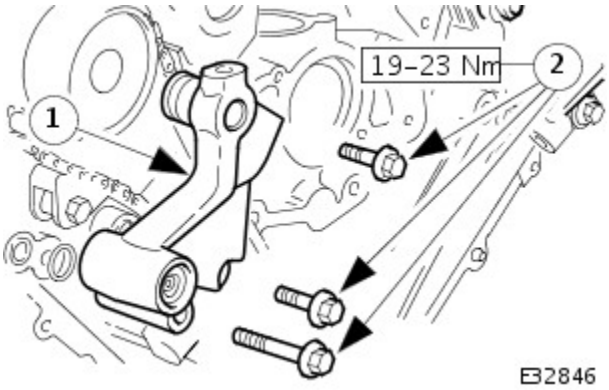
12. Lower the ramp.

13. Fit new seals to the VVT bush carrier.

1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.



2. Fit a new O-ring to the carrier oil-way.



14. Fit the VVT bush carrier to the cylinder block.

- Lubricate the seal (scarf jointed) and the bush.

1. Fit the bush carrier assembly.

- Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.

2. Fit the three securing bolts. Tighten to 19-23 Nm.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.

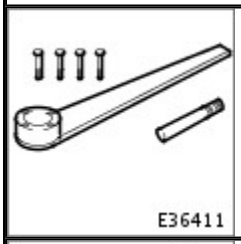
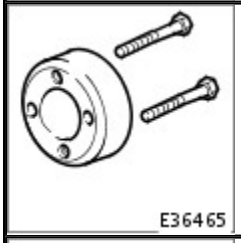
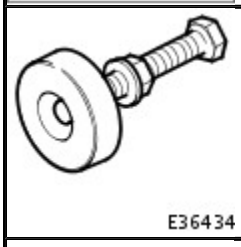
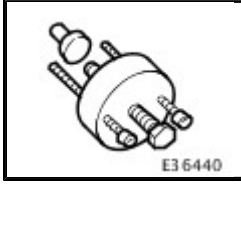
17. Remove the paint protection sheets and close the cover.

18. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure in Section 414-01.

Engine - Crankshaft Pulley4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

In-vehicle Repair

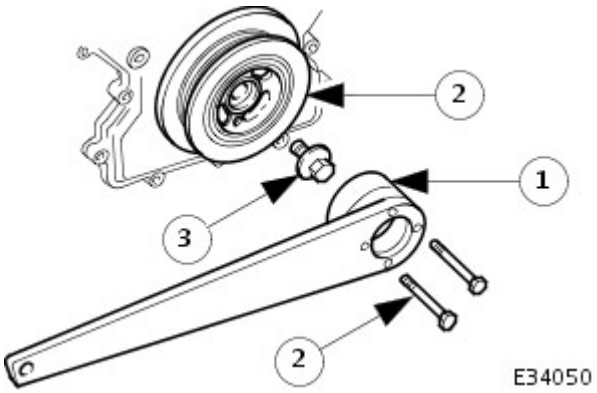
Special Tool(s)	
 E36411	Crankshaft locking, main tool 303-191
 E36465	Adaptor 303-191-02
 E36433	Crankshaft front seal remover 303-541
 E36434	Crankshaft front seal replacer 303-542
 E36440	Crankshaft pulley/damper remover 303-588

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Remove the drive belt from the front accessory drive. Refer to Operation 12.10.40.
4. Remove the twin fan and motor assembly for access. Refer to Operation 26.25.12

5. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

• NOTE: Should extra locking of the crankshaft be required, use a lever against one torque converter boss. Remove the plastic mesh cover from the torque converter housing for access.

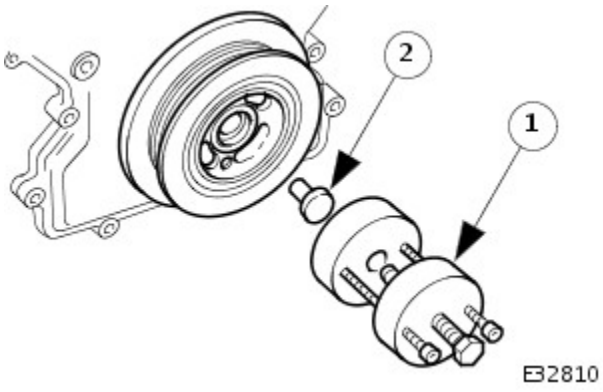


Install the crankshaft locking tool to the damper.

1. Install adaptor 303-191-02 to the main locking tool 303-191.
2. Reposition the crankshaft/damper to align the mounting holes and install the locking tool to the damper using the bolts provided with the tool.
3. Loosen, but do not remove the damper securing bolt from the crankshaft.

6. Remove the locking tool from the damper.

- Remove the damper securing bolt.



7. NOTE: The damper only needs to be withdrawn along the crankshaft nose by approximately 2mm before removing the puller. The damper will then either be loose or only require a sharp tap with a mallet to release it from the split locking ring.

Remove the damper from the crankshaft.

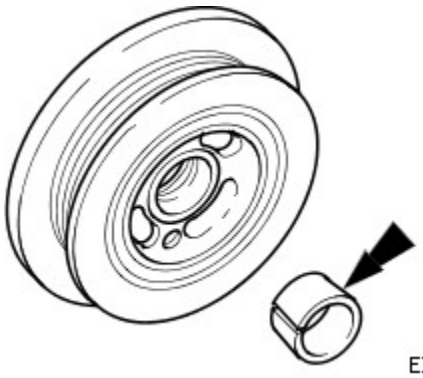
1. Transfer the adaptor 303-191-02 from the crankshaft locking tool to the damper extractor tool 303-588 (Use the socket head screws provided with the puller).
2. Locate the thrust button into the end of the crankshaft; the O-ring holds it in place.

- Assemble the puller to the damper.
- Extract the damper from the crankshaft.

8. Remove the puller components from the damper.

- Remove the thrust button from the end of the crankshaft.

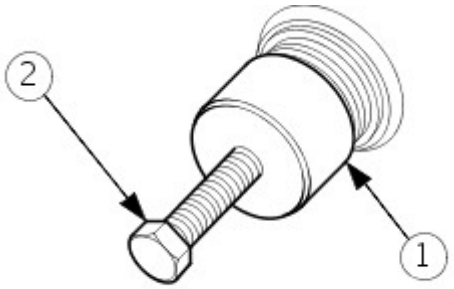
9. Remove the split locking ring from the damper.



10. Remove the internal O-ring seal.



E32839



E35326

11. Remove the crankshaft front seal.

1. Install and tighten the removal tool 303-541 to the crankshaft front seal.
2. Tighten the centre bolt of the tool to extract the seal.

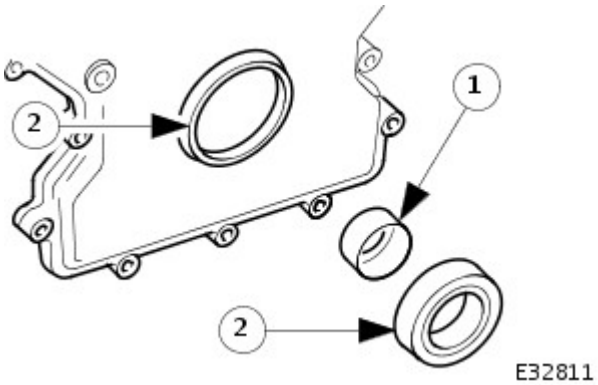
- Remove the tool and seal assembly.
- Separate the seal from the tool.

12. Very carefully clean the threads of the crankshaft, using a plug tap M16x2, to remove all old cured sealant.

- Keep the tap horizontal. Do not enlarge the crankshaft thread - remove sealant only.

13. Clean all relevant parts and faces.

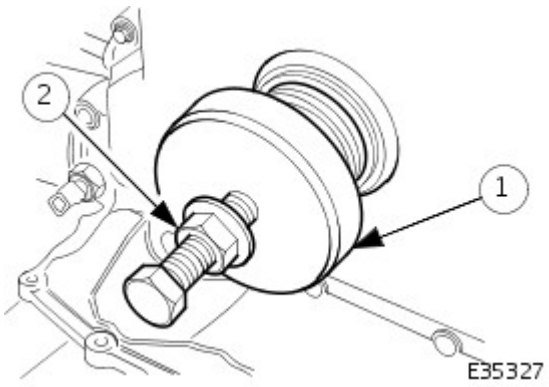
Installation



E32811

1. Locate the new oil seal into the timing cover.

1. Remove the transit ring from the oil seal.
2. Position the seal to the timing cover.



E35327

2. Install the new oil seal to the timing cover.

1. Install oil seal replacer tool 303-542 to the oil seal.
2. Use the nut and bolt provided with the tool, to fully seat the seal to the timing cover. Only tighten the nut sufficiently to locate the seal and no more, or the timing cover could become distorted.

- Allow the tool to stay in position against the seal for at least five seconds.
- Remove the special tool from the seal.

3. If the damper is not to be installed immediately, the transit ring should be installed temporarily to the seal.

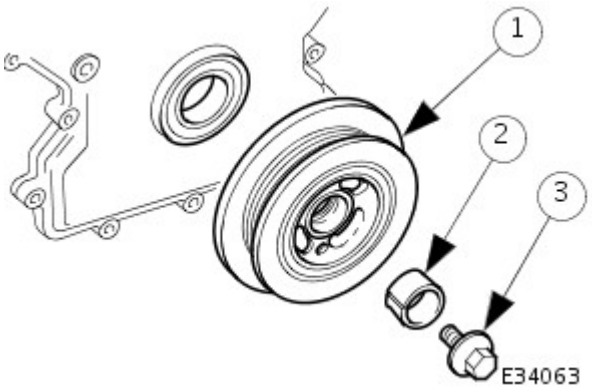
4. Install a new O-ring seal to the damper.


E32839

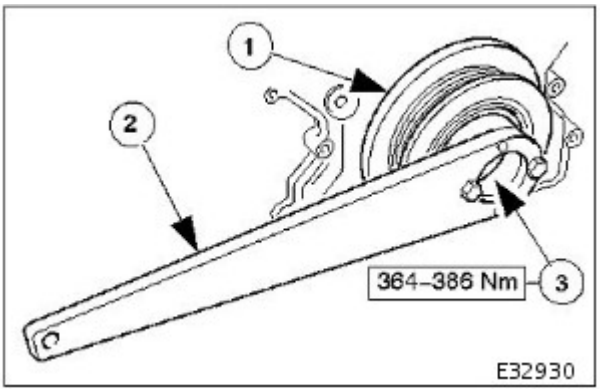
5. Install the crankshaft damper.

- Apply petroleum jelly to the damper bore and O-ring seal.

1. Install the damper onto the crankshaft.
2. Install the split locking ring onto the crankshaft, inside the centre bore of the damper.
3. Install, but do not tighten, a new damper securing bolt.



E34063



E32930

6. CAUTION: Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

Tighten the damper securing bolt.

1. Reposition the damper to allow access to the bolt holes for installing the locking tool.
2. Install the locking tool (303-01 and 303-01-02) to the damper using the bolts provided.
3. Fully tighten the damper securing bolt to 364-386 Nm.

7. Remove the locking tool from the damper.

8. Install the drive belt to the front accessory drive. Refer to Section 303-05.

9. Install the twin fan and motor assembly. Refer to Section 303-03.

10. Install the plastic mesh cover to the torque converter housing; if removed for access to lock the crankshaft.

11. Reset the engine compartment cover to the normal position and connect the gas struts.

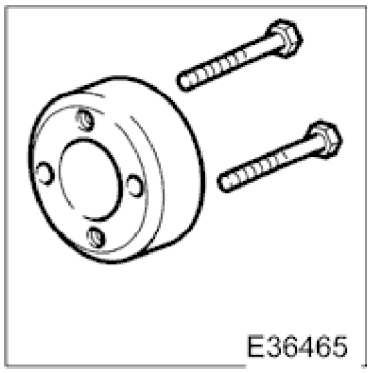
12. Remove the paintwork protection sheets and close the engine compartment.

Crankshaft Pulley Vehicles With: Supercharger 12.21.09

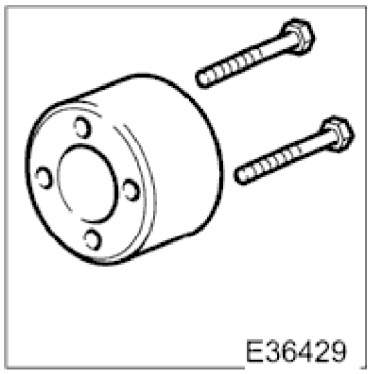
Special Service tools



Crankshaft locking, main tool
303-191



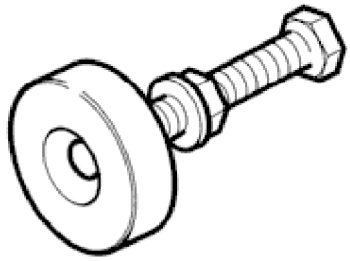
Adaptor
303-191-02



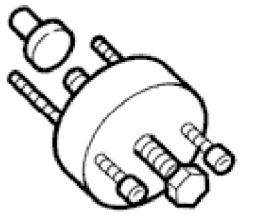
Adaptor
303-191-03



Crankshaft front seal remover
303-541



Crankshaft front seal replacer
303-542



Crankshaft pulley/damper remover
303-588

Removal

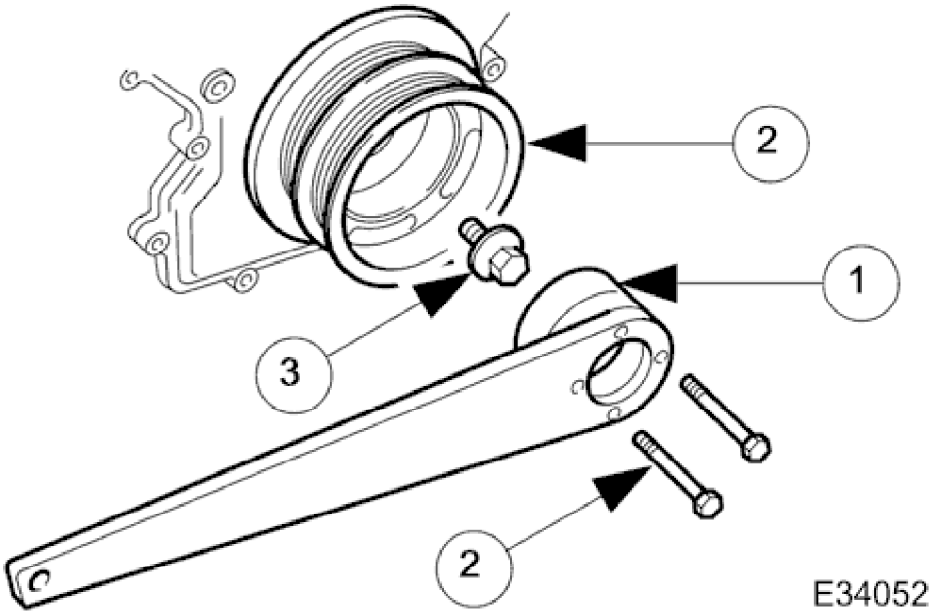
1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Remove the supercharger drive belt. Refer to Operation **<<18.50.08>>**.

4. Remove the drive belt from the front accessory drive. Refer to Operation **<<12.10.40>>**.

5. Remove the twin fan and motor assembly for access. Refer to Operation 26.25.12



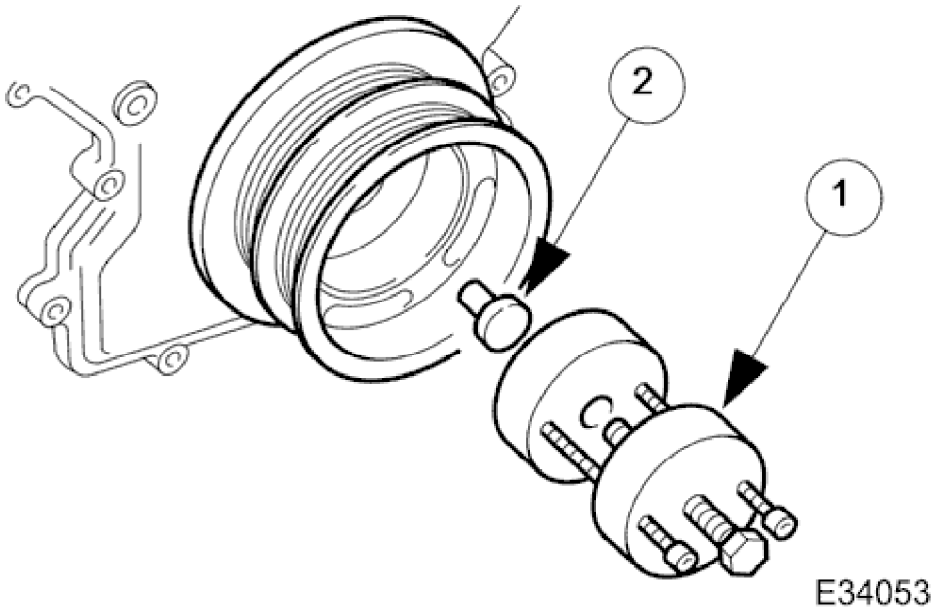
6. **CAUTION:**
Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

NOTE:
Should extra locking of the crankshaft be required, use a lever against one torque converter boss. Remove the plastic mesh cover from the torque converter housing for access.

Install the crankshaft locking tool to the damper.

1. Install adaptor 303-191-03 to the main locking tool 303-191.
2. Reposition the crankshaft/damper to align the mounting holes and install the locking tool to the damper using the bolts provided with the tool.
3. Loosen, but do not remove the damper securing bolt from the crankshaft.

7. Remove the locking tool from the damper.
   - Remove the damper securing bolt.



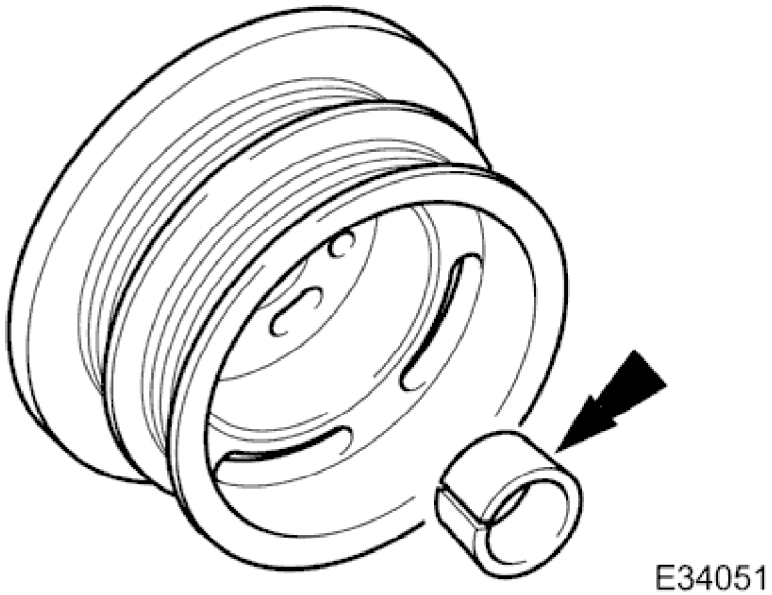
8. **NOTE:**
   The damper only needs to be withdrawn along the crankshaft nose by approximately 2mm before removing the puller. The damper will then either be loose or only require a sharp tap with a mallet to release it from the split locking ring.

Remove the damper from the crankshaft.

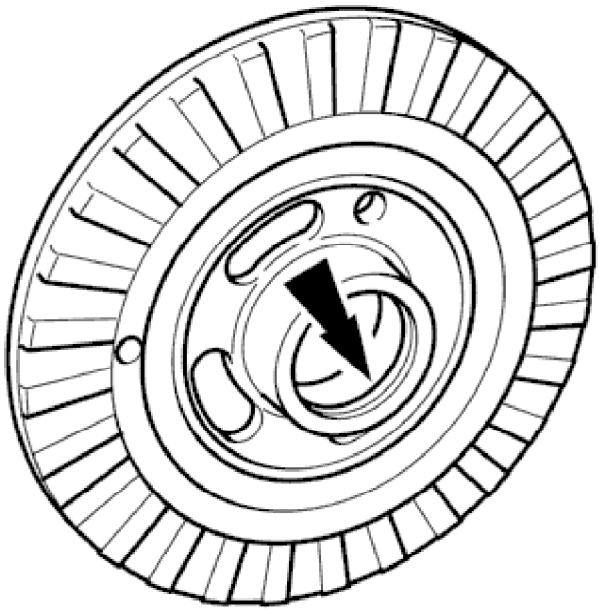
1. Install adaptor 303-191-02 to the damper extractor tool 303-588 (Use the socket head screws provided with the puller).
2. Locate the thrust button into the end of the crankshaft; the O-ring holds it in place.

- Assemble the puller to the damper.
- Extract the damper from the crankshaft.

9. Remove the puller components from the damper.
   - Remove the thrust button from the end of the crankshaft.

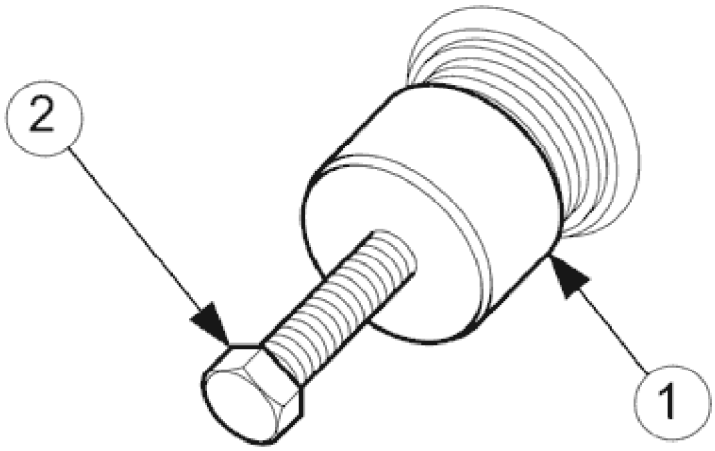


10. Remove the split locking ring from the damper.



E32839

11. Remove the internal O-ring seal.



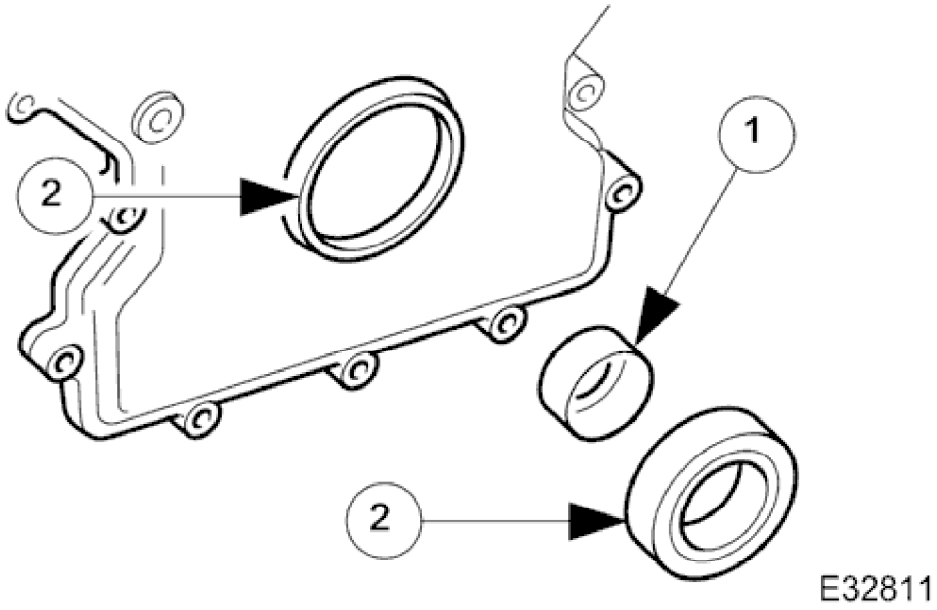
E35326

12. Remove the crankshaft front seal.
    1. Install and tighten the removal tool 303-541 to the crankshaft front seal.
    2. Tighten the centre bolt of the tool to extract the seal.
- Remove the tool and seal assembly.
- Separate the seal from the tool.

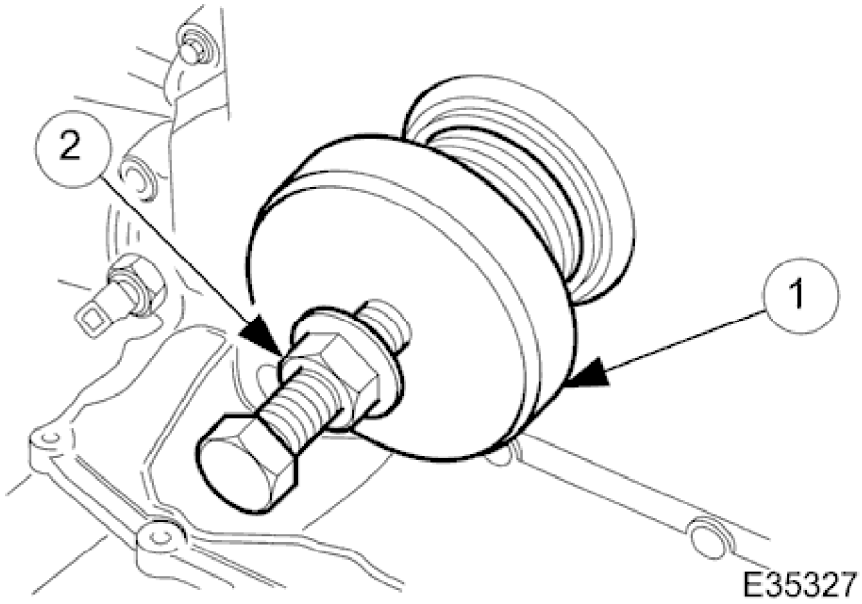
13. Very carefully clean the threads of the crankshaft, using a plug tap M16x2, to remove all old cured sealant.
- Keep the tap horizontal. Do not enlarge the crankshaft thread - remove sealant only.

14. Clean all relevant parts and faces.

Installation

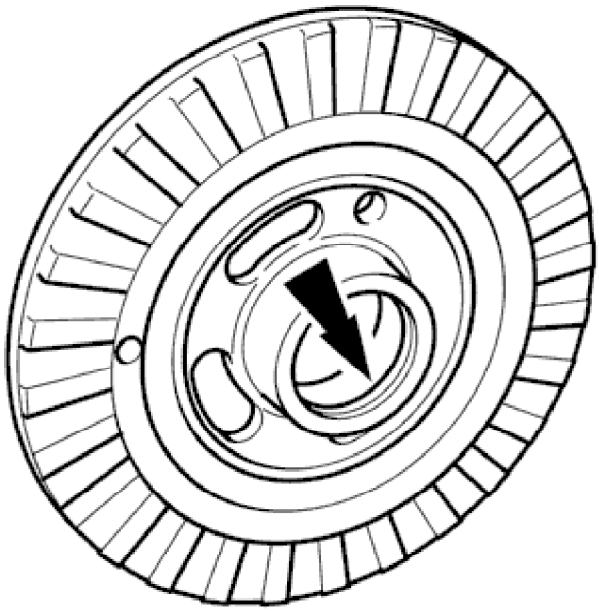


1. Locate the new oil seal into the timing cover.
    1. Remove the transit ring from the oil seal.
    2. Position the seal to the timing cover.



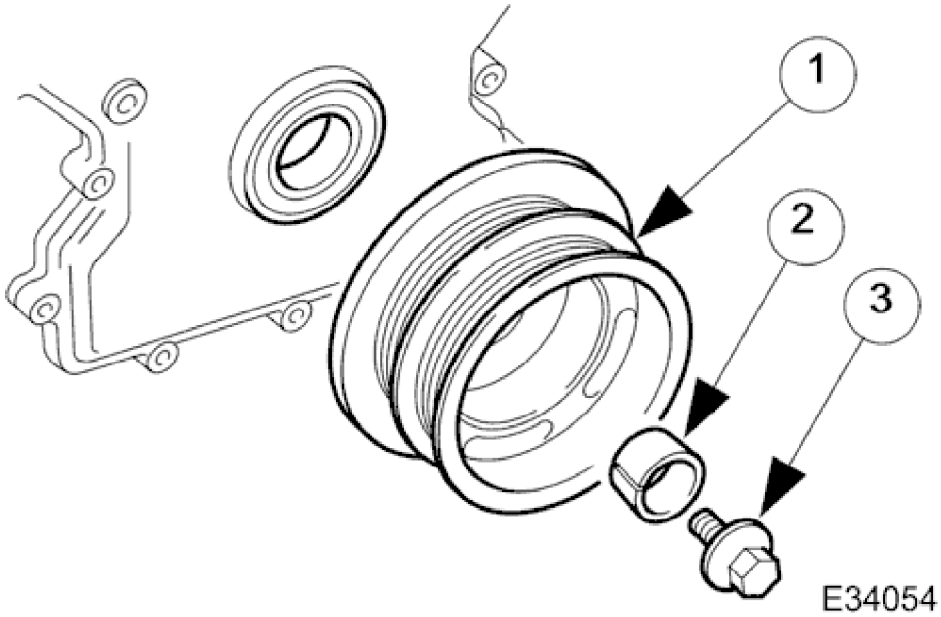
2. Install the new oil seal to the timing cover.
    1. Install oil seal replacer tool 303-542 to the oil seal.
    2. Use the nut and bolt provided with the tool, to fully seat the seal to the timing cover. Only tighten the nut sufficiently to locate the seal and no more, or the timing cover could become distorted.
    - Allow the tool to stay in position against the seal for at least five seconds.
    - Remove the special tool from the seal.

3. If the damper is not to be installed immediately, the transit ring should be installed temporarily to the seal.



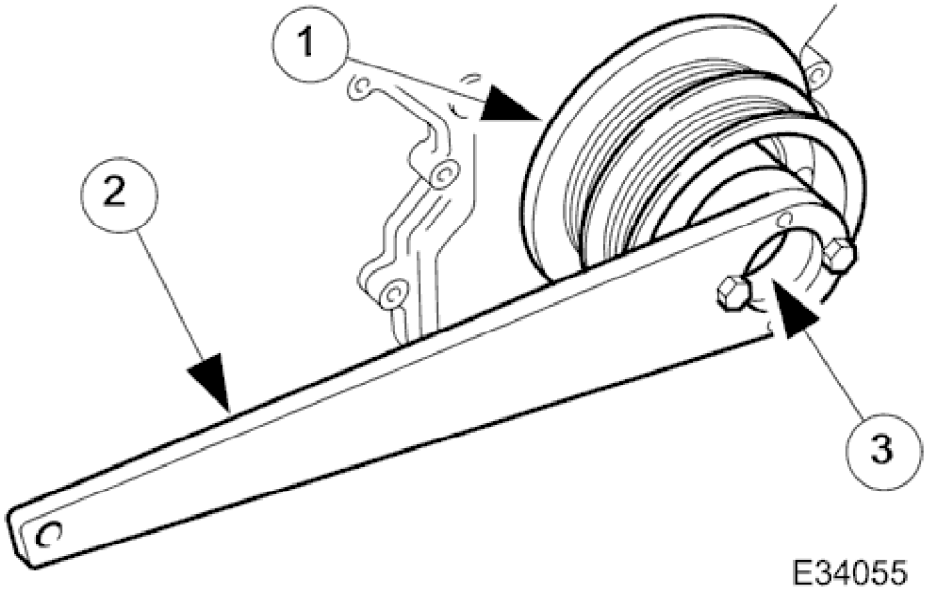
E32839

4. Install a new O-ring seal to the damper.



E34054

5. Install the crankshaft damper.
   - Apply petroleum jelly to the damper bore and O-ring seal.
     1. Install the damper onto the crankshaft.
     2. Install the split locking ring onto the crankshaft, inside the centre bore of the damper.
     3. Install, but do not tighten, a new damper securing bolt.



6. **CAUTION:**
Under no circumstances should the crankshaft setting peg 303-531 be used in the following operations, to lock the crankshaft.

Tighten the damper securing bolt.

1. Reposition the damper to allow access to the bolt holes for installing the locking tool.
2. Install the locking tool (303-191 and 303-191-03) to the damper using the bolts provided.
3. Fully tighten the damper securing bolt to 364-386 Nm.

7. Remove the locking tool from the damper.

8. Install the drive belt to the front accessory drive. Refer to Operation **<<12.10.40>>**.

9. Install the supercharger drive belt. Refer to Operation **<<18.50.08>>**.

10. Install the twin fan and motor assembly. Refer to Section 303-03.

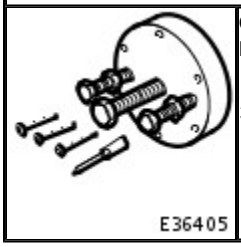
11. Install the plastic mesh cover to the torque converter housing; if removed for access to lock the crankshaft.

12. Reset the engine compartment cover to the normal position and connect the gas struts.

13. Remove the paintwork protection sheets and close the engine compartment.

Engine - Crankshaft Rear Seal4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

In-vehicle Repair

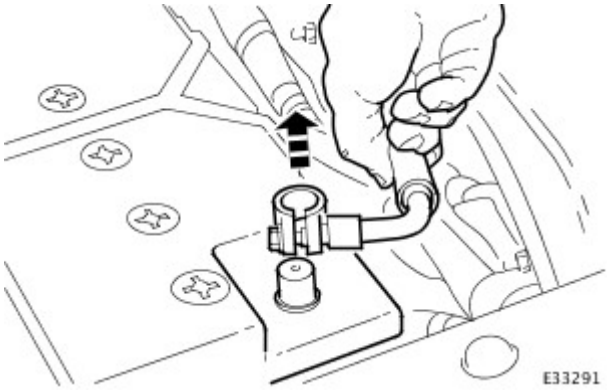
Special Tool(s)	
 E36405	Crankshaft Rear Oil Seal Remover / Replacer. 303 - 538

Removal

1. Open the engine compartment and fit paint protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.

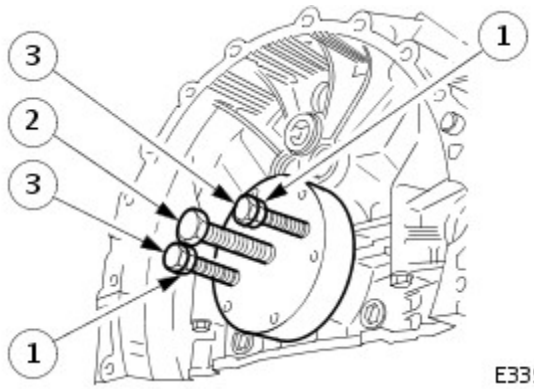

E33291

3. Remove the transmission. Refer to Operation 44.20. 01 in Section 307-01A.

4. Remove the drive plate. Refer to Operation 12.53.13.

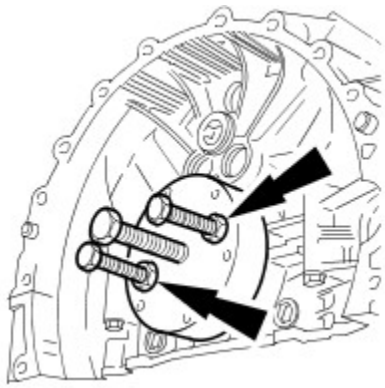
5. Fit and align the seal removal tool 303 - 538 to the crankshaft.

1. Unscrew the two nuts towards the head of each bolt to allow the bolts to fit fully into the crankshaft.
2. Unscrew the center bolt until it is below the face of the main tool and position the tool to the rear of the crankshaft.
3. Lightly tighten the two bolts so that they fully locate in the crankshaft.

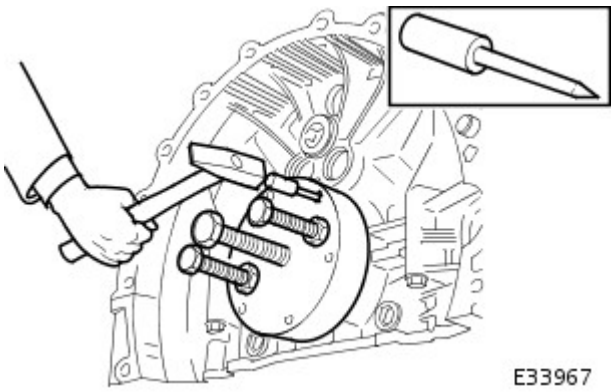


E33965

6. Hold the tool against the crankshaft and lightly and evenly tighten the two nuts to the face of the tool; to secure the tool and to hold it parallel to the face of the crankshaft.

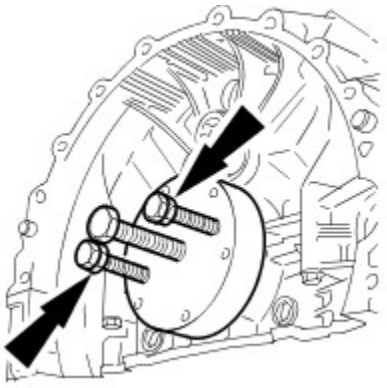

E33966

7. Secure the oil seal to the tool using the three self-tapping

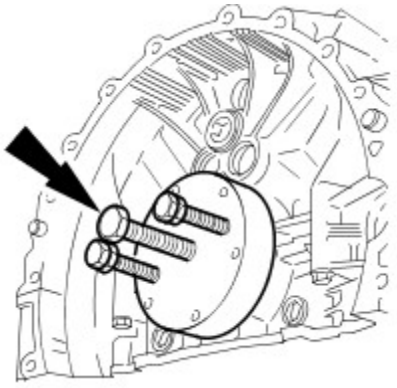

E33967

screws spaced evenly around the face of the tool.

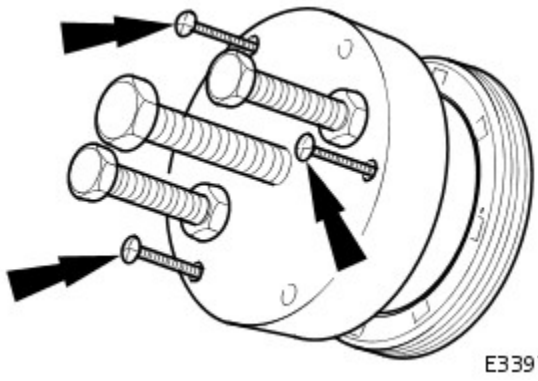
- Use the punch (provided) and a hammer to pierce the seal face and provide a pilot hole for one of the self-tapping screws provided.
- Fit a self-tapping screw and tighten by 11/2 turns only. DO NOT TIGHTEN BY MORE THAN TWO TURNS OR THE SCREW MAY BREAK.
- Repeat the above steps for the other two screws.


E33968

8. Hold the two bolts stationary and loosen fully the two nuts.


E33969

9. Tighten the centre bolt. This will draw out the seal and tool assembly which will be supported by the two bolts.


E33970

10. Remove the two bolts to release the tool and seal assembly from the crankshaft.

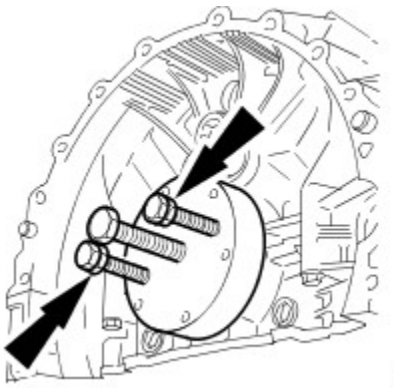
- Remove the three self-tapping screws.
- Remove and discard the seal.
- Unscrew the centre bolt until it is below the face of the tool.

11. Clean all relevant components.

Installation

1. Ensure that the transit sleeve is correctly in place and fit the new seal over the crankshaft. Do not use any lubricant on the seal, the transit sleeve or the crankshaft.

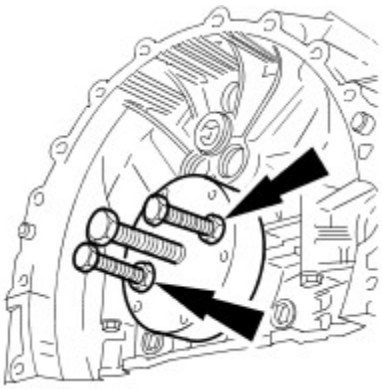
2. Carefully remove the transit sleeve, leaving the seal in place.



E33968

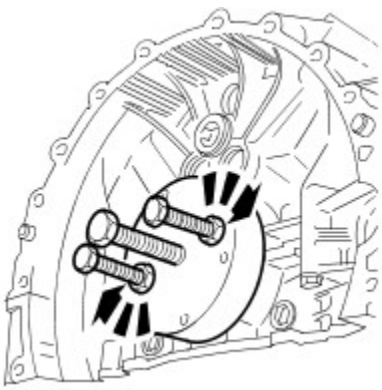
3. Fit the tool to the crankshaft.

- Ensure that the centre bolt is unscrewed to below the face which is to fit to the crankshaft and position the tool to the crankshaft.
- Check that the nuts are fully unscrewed and enter the two bolts to the crankshaft threads and lightly tighten.



E33966

4. Tighten the nuts, finger tight, to hold the tool assembly against the seal. Check that the seal and the tool are approximately parallel to the rear of the engine.



E33971

5. Press the seal into the housing.

- Hold each bolt stationary, in turn, and tighten its nut a small amount (approximately two to three flats) in turn, to press the seal fully into the housing. until the tool is in contact with the cylinder block.

6. Remove the tool from the crankshaft.

- Check that the seal is located correctly.

7. Fit the drive plate. Refer to Operation 12.53.13.

8. Install the transmission. Refer to Operation 44.20. 01 in Section 307-01A.

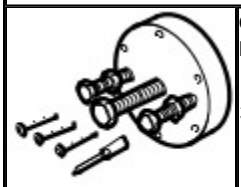
9. Remove the paint protection sheets and close the engine compartment cover.

10. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Crankshaft Rear Seal4.0L SC V8 - AJ26

In-vehicle Repair

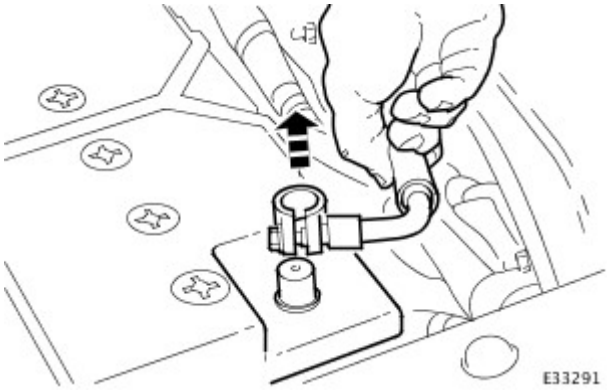
Special Tool(s)	
 E36405	Crankshaft Rear Oil Seal Remover / Replacer. 303 - 538

Removal

1. Open the engine compartment and fit paint protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.

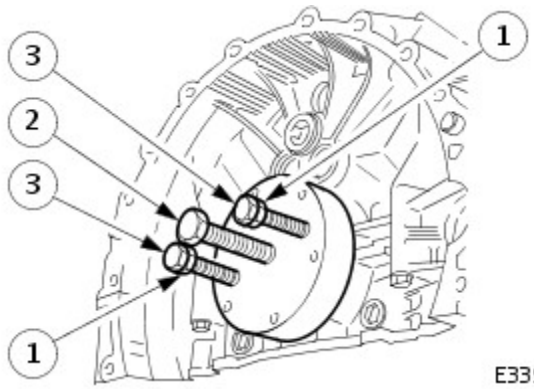

E33291

3. Remove the transmission. Refer to Operation 44.20. 01 in Section 307-01B.

4. Remove the drive plate. Refer to Operation (SC) 12.53.13.

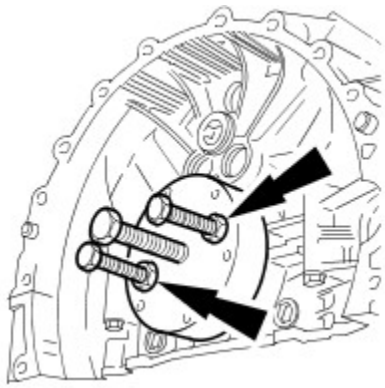
5. Fit and align the seal removal tool 303 - 538 to the crankshaft.

1. Unscrew the two nuts towards the head of each bolt to allow the bolts to fit fully into the crankshaft.
2. Unscrew the center bolt until it is below the face of the main tool and position the tool to the rear of the crankshaft.
3. Lightly tighten the two screws so that they fully locate in the crankshaft.

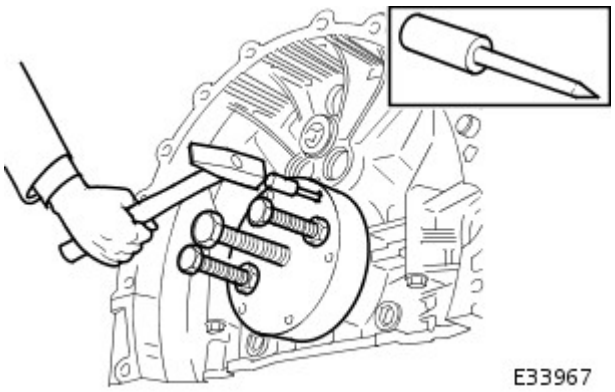


E33965

6. Hold the tool against the crankshaft and lightly and evenly tighten the two nuts to the face of the tool; to secure the tool and to hold it parallel to the face of the crankshaft.

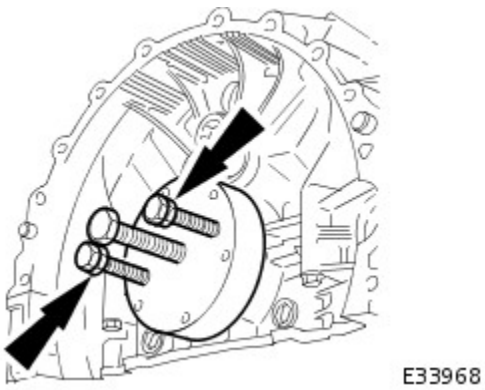

E33966

7. Secure the oil seal to the tool using the three self-tapping

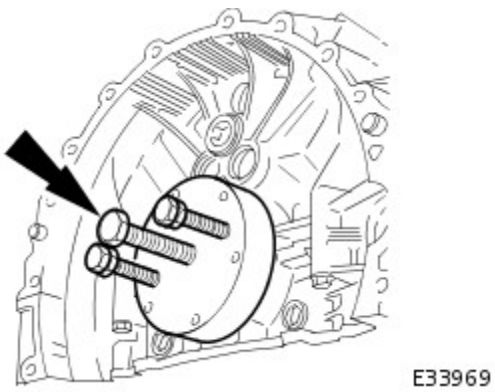

E33967

screws spaced evenly around the face of the tool.

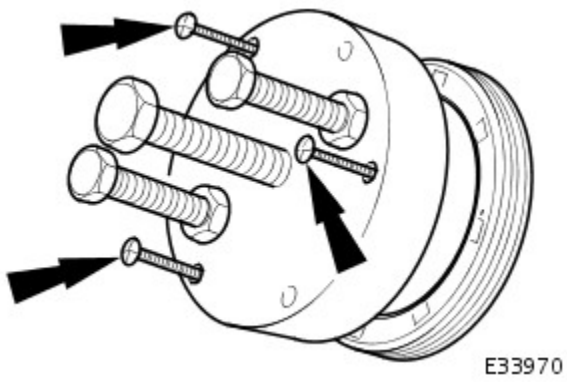
- Use the punch (provided) and a hammer to pierce the seal face and provide a pilot hole for one of the self-tapping screws provided.
- Fit a self-tapping screw and tighten by 11/2 turns only. DO NOT TIGHTEN BY MORE THAN TWO TURNS OR THE SCREW MAY BREAK.
- Repeat the above steps for the other two screws.


E33968

8. Hold the two bolts stationary and loosen fully the two nuts.


E33969

9. Tighten the centre bolt. This will draw out the seal and tool assembly which will be supported by the two bolts.


E33970

10. Remove the two bolts to release the tool and seal assembly from the crankshaft.

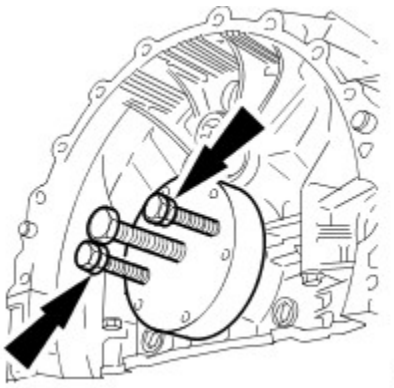
- Remove the three self-tapping screws.
- Remove and discard the seal.
- Unscrew the centre bolt until it is below the face of the tool.

11. Clean all relevant components.

Installation

1. Ensure that the transit sleeve is correctly in place and fit the new seal over the crankshaft. Do not use any lubricant on the seal, the transit sleeve or the crankshaft.

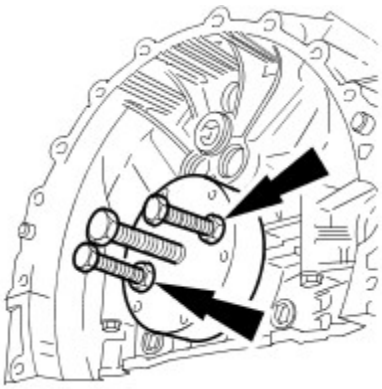
2. Carefully remove the transit sleeve, leaving the seal in place.



E33968

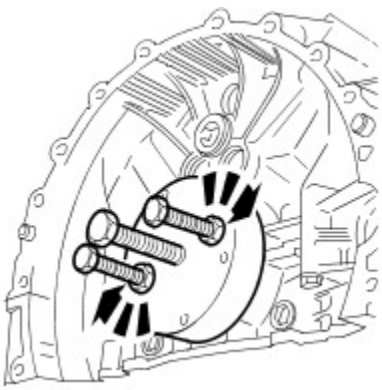
3. Fit the tool to the crankshaft.

- Ensure that the centre bolt is unscrewed to below the face which is to fit to the crankshaft and position the tool to the crankshaft.
- Check that the nuts are fully unscrewed and enter the two bolts to the crankshaft threads and lightly tighten.



E33966

4. Tighten the nuts, finger tight, to hold the tool assembly against the seal. Check that the seal and the tool are approximately parallel to the rear of the engine.



E33971

5. Press the seal into the housing.

- Hold each bolt stationary, in turn, and tighten its nut a small amount (approximately two to three flats) in turn, to press the seal fully into the housing. until the tool is in contact with the cylinder block.

6. Remove the tool from the crankshaft.

- Check that the seal is located correctly.

7. Fit the drive plate. Refer to Operation (SC) 12.53.13.

8. Install the transmission. Refer to Operation 44.20. 01 in Section 307-01B.

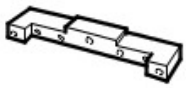
9. Remove the paint protection sheets and close the engine compartment cover.

10. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

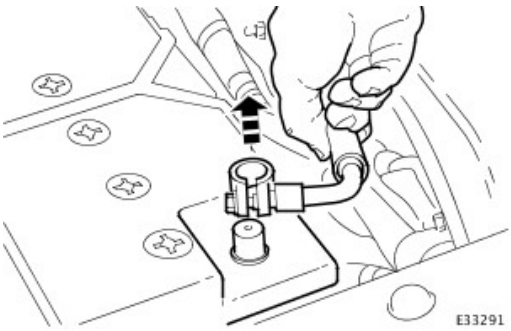
Engine - Cylinder Head LH

In-vehicle Repair

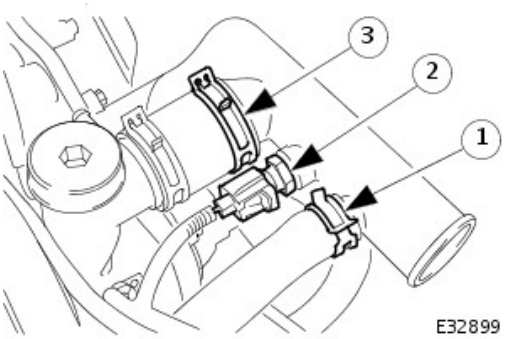
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

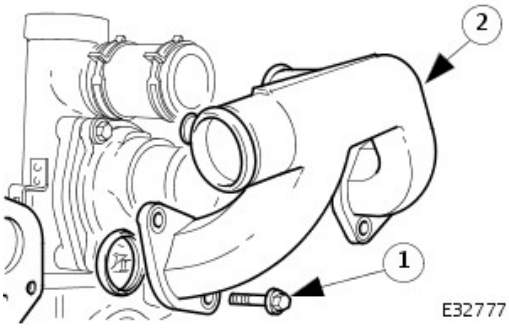
Removal

CAUTION: If a replacement cylinder head is to be installed to a vehicle with variable camshaft timing (VCT) the cylinder head must have the oil gallery blind rivet removed before installation.


E33291

1. Open the engine compartment and install paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.
4. Remove the engine fron cover.For additional information, refer to: Engine Front Cover (303-01 Engine, In-vehicle Repair).
5. Remove the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes depressurising the fuel system and removing the throttle housing.
6. Disconnect the hoses and multi-plug from the coolant outlet pipe.
   1. Release and reposition the hose clip, and disconnect the heater hose.
   2. Disconnect the multi-plug from the temperature sensor.
   3. Release and reposition the hose clip along the bypass hose.





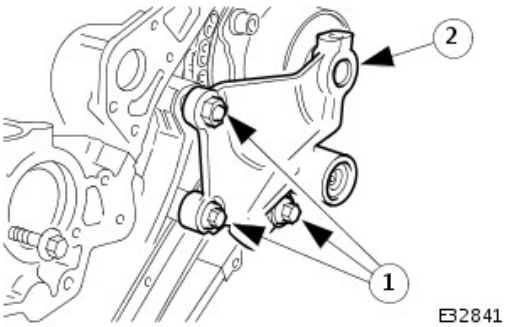
7. Remove the coolant outlet pipe.

1. Remove the four bolts which secure the outlet pipe.
2. Remove the outlet pipe from the bypass hose and from the cylinder heads.

8. Remove and discard the sealing rings from the outlet pipe grooves.

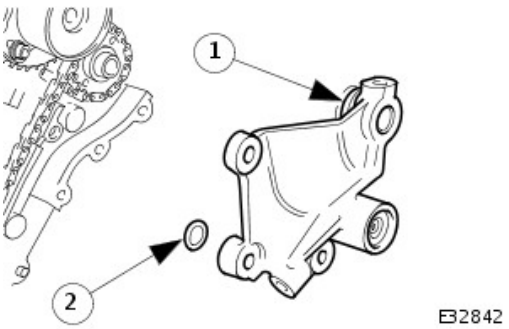
9. Remove the nuts which secure the catalytic converter to the B-Bank exhaust manifold flange.





10. Remove the VVT bush carrier.

1. Remove the two bolts and one nut which secure the carrier to the cylinder block.
2. Release the carrier from the two ring dowels and remove it.

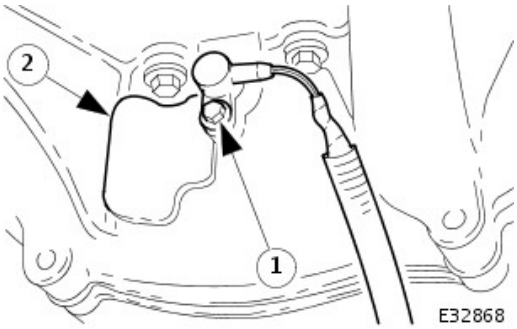


11. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.

12. Raise the vehicle on a ramp.

13. Remove the crankshaft position sensor.



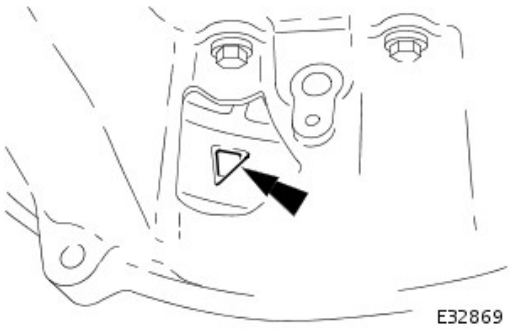
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

14. Install the damper securing bolt (old one) to the crankshaft, hand-tight only.

15. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





16. Install the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Install the crankshaft setting peg 303 - 531.

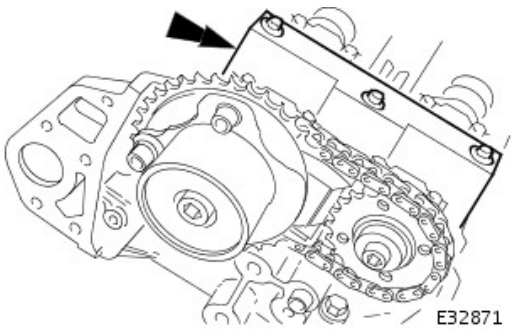
- Position the crankshaft so that the setting peg engages fully into the timing slot.

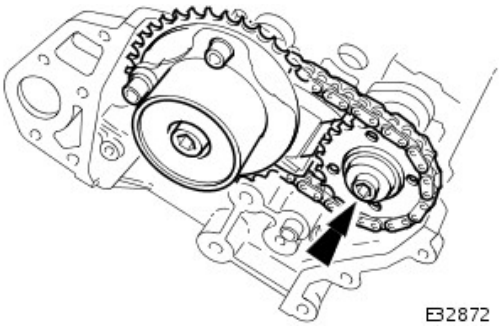
2. Install and tighten the bolt to secure the setting peg.

17. Remove the damper securing bolt from the crankshaft.

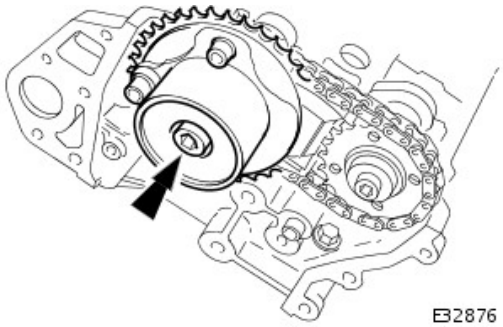
18. Lower the vehicle on the ramp.

19. Install the camshaft locking tool 303 - 530 to the B-Bank camshafts, aligning the shafts slightly as necessary.





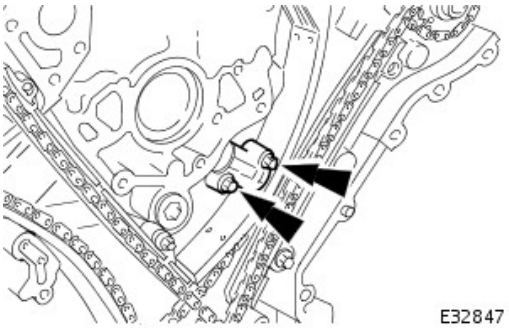
20. Loosen the bolt which secures the sprocket to the camshaft.

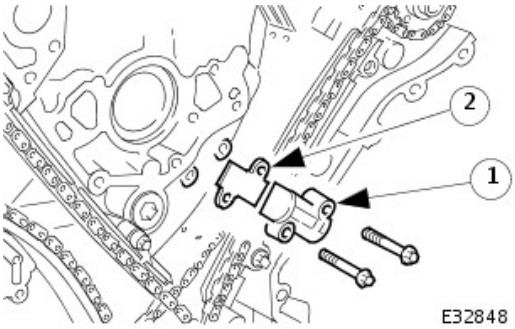


21. Loosen the bolt which secures the VVT unit to the camshaft.

22. Remove the camshaft locking tool 303 - 530 (installed for previous operation).

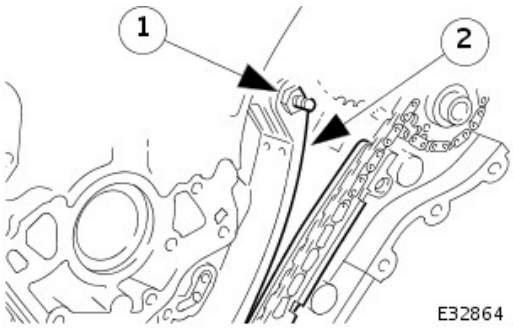
23. Remove the primary chain tensioner bolts.





24. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.



25. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

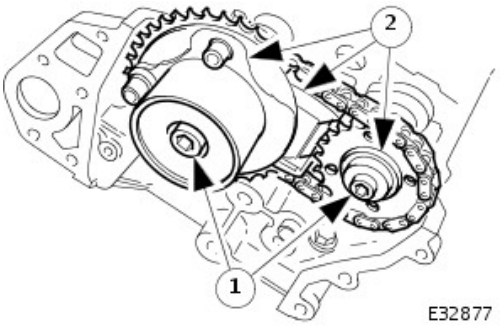
26. Reposition the VVT unit along the cam journal to allow the chain to clear the head casting.

- Disconnect the primary chain from the VVT unit and secure it to the bypass hose retaining clip, using a Ty-strap.

27. Remove the VVT unit and exhaust camshaft sprocket.

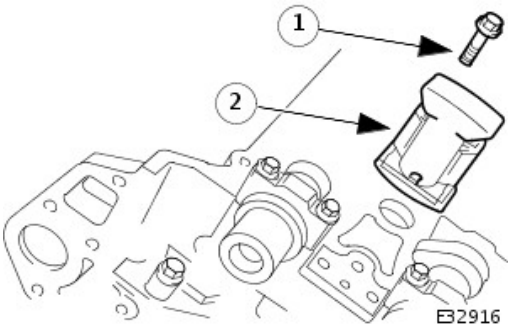
1. Remove the securing bolt from both the VVT unit and the exhaust cam sprocket.
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.



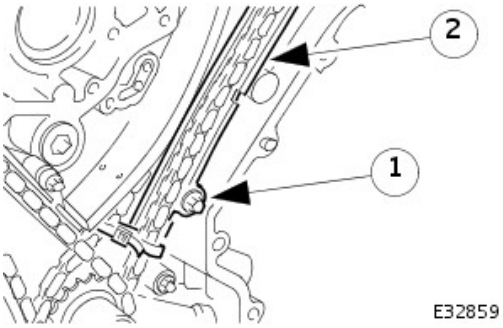
28. Remove the secondary chain tensioner.

1. Remove the two bolts which secure the chain tensioner to the cylinder head.
2. Remove the tensioner.



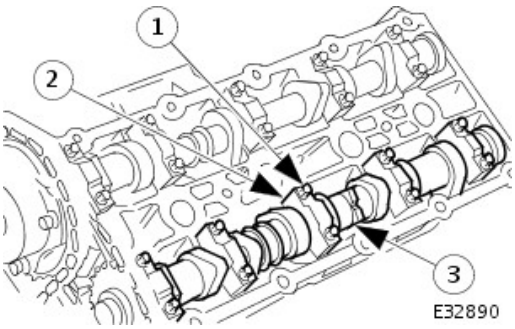
29. Remove the primary chain guide.

1. Remove the bolt which secures the chain guide.
2. Note the orientation of the chain guide and remove it from the upper retaining pin.



30. Remove the camshafts.

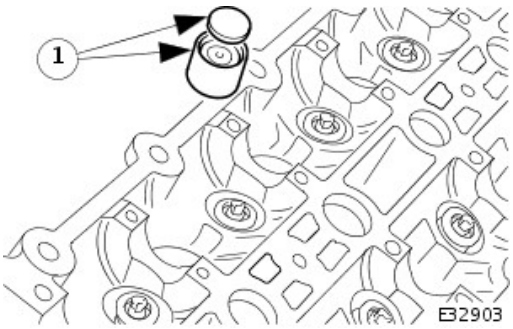
1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.
2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).
3. Remove the camshafts from the engine.



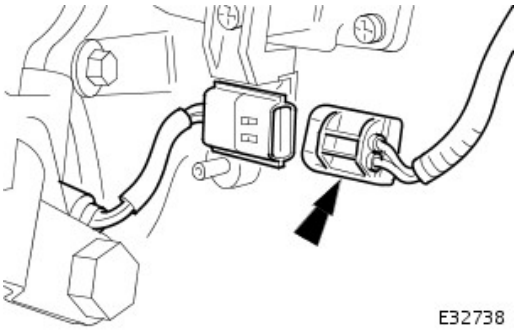
31. Remove the tappets and shims.

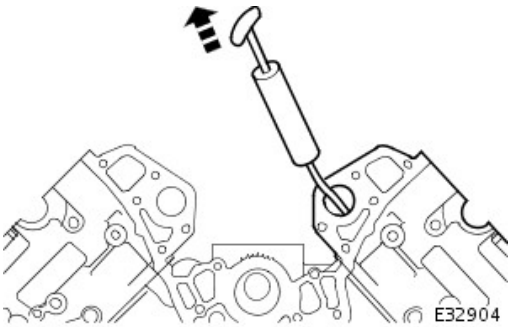
1. Note the position of each tappet, for reassembly, and remove each tappet and shim assembly - retain each shim with its original tappet.

- Mark the inside face of each tappet in pencil or felt tipped pen, with its original position within the cylinder head.



32. Disconnect the plug from the engine position sensor, at the rear of the cylinder head.

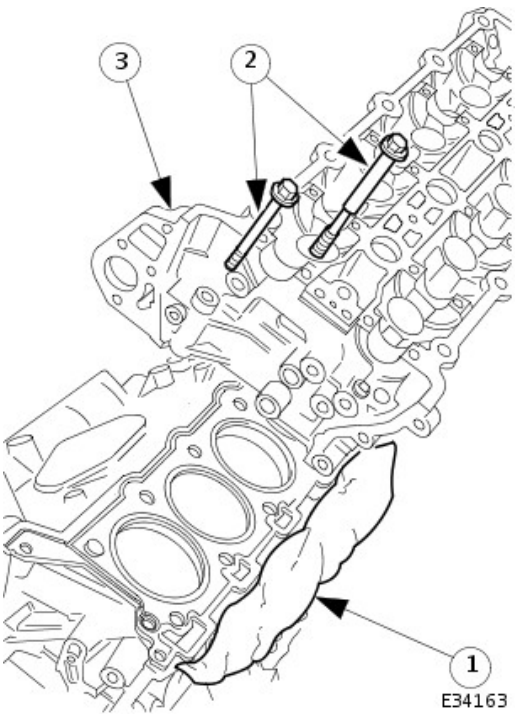




33. Remove residual coolant from the cylinder head.

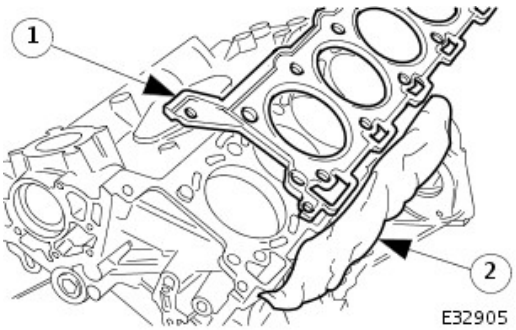
1. Place a drain tray under the engine.
2. Use a syringe with a length of thin rubber pipe connected, to drain the residual coolant from the outlet pipe water-way.

- A suitable syringe is Snap On YA 745.



34. Remove the cylinder head.

1. Place cloth around the area of the cylinder head to absorb coolant spillage, when removing the head.
2. Remove the bolts (10xM10 and 2xM8) which secure the cylinder head.
3. With assistance, remove the cylinder head.



35. Remove the cylinder head gasket.

1. Note how the gasket is installed and remove it.
2. Remove and discard the cloth, placed previously to absorb coolant spillage.

- Wipe up any leaked coolant.

36. Remove the coolant drain tray from under the engine.

37. Remove and discard the gasket from the downpipe catalyst.

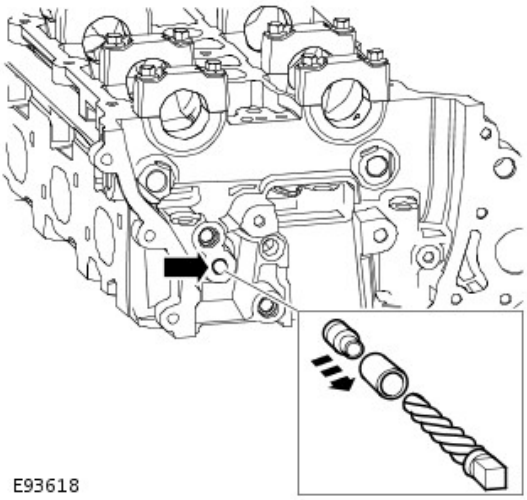
- Clean the gasket faces of the catalyst and the exhaust manifold.

38. Clean cylinder head and cylinder block gasket faces.

- Ensure that all threaded holes in the cylinder block face are clean and free from oil.
- Clean and inspect the cylinder head bolts. They may be re-used on two occasions. When re- used, each bolt head should be marked with one dot from an automatic centre punch.

39. Clean and inspect all relevant components and mating faces.

Installation


E93618

1. CAUTIONS:

⚠ If a replacement cylinder head is to be installed to a vehicle with VCT the cylinder head must have the oil gallery blind rivet removed before installation.

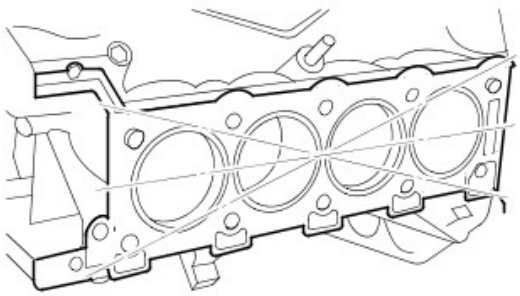
⚠ Make sure that all debris is removed from the cylinder head and cylinder head oil gallery.

Vehicles fitted with VCT: Remove the blind rivet from the VCT oil gallary.

- NOTE: The centre bore of the blind rivet is 6 mm diameter.
- Identify the VCT oil supply gallery and the 8 mm blind rivet.
- Using a suitable 3 mm punch release the centre of the blind rivet until it is released from the outer part of the blind rivet.
- Using a suitable extraction tool, remove the remaining part of the blind rivet.

2. Clean the component mating faces.

3. Check cylinder head face for distortion, across the center and from corner to corner.

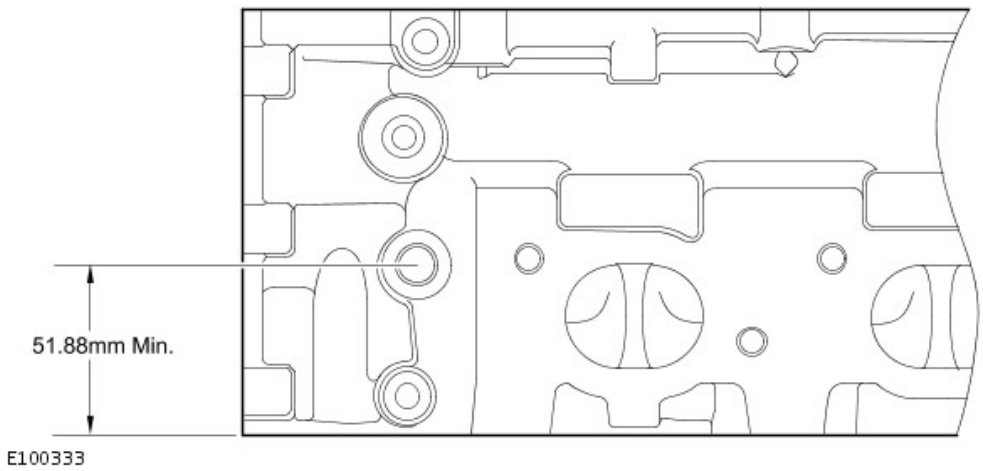

E46855

4. For cylinder head face distortion data, refer to specifications. For additional information, refer to: Specifications (303-01 Engine, Specifications).

5. NOTE: For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

Measure the cylinder head material.

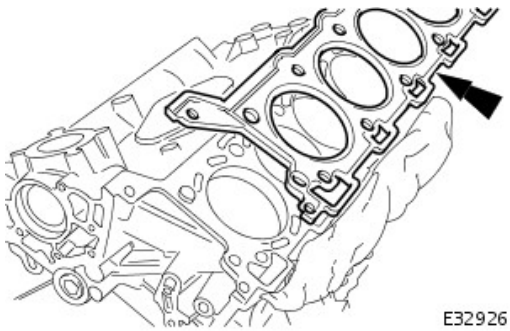
- Check measurement from the centre of the exhaust dowel to the cylinder head face as shown.
- If the measurement is less than 51.88 mm the cylinder head requires replacement.



E100333

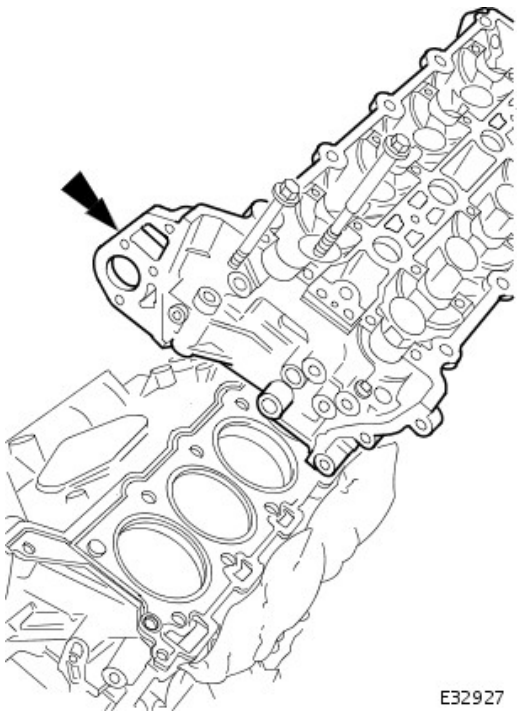
6. Install a new gasket to the downpipe catalyst flange.

7. Install and align a new cylinder head gasket to the cylinder block face.


E32926

8. With assistance, install the cylinder head.

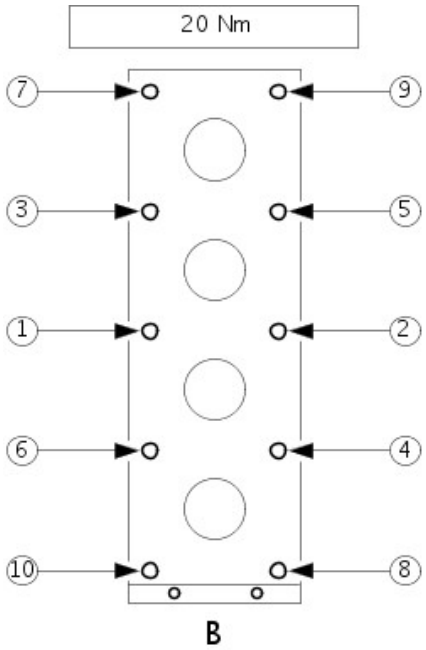
- Engage the cylinder head with the dowels on the block face, and the exhaust manifold flange with the studs on the downpipe catalyst.


E32927

9. Install the cylinder head bolts, hand tight only.

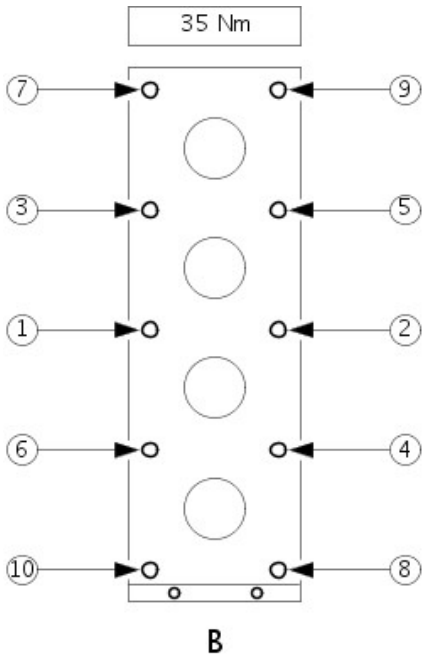
10. Tighten the cylinder head bolts in stages, in the sequence shown, using the following procedure:

- Stage 1 - tighten all M10 bolts in sequence, to 20 Nm.



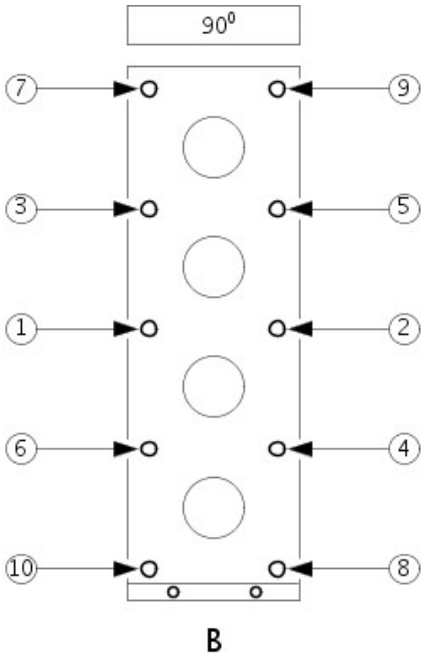
E35338

11. Stage 2 - tighten all M10 bolts in sequence, to 35 Nm.



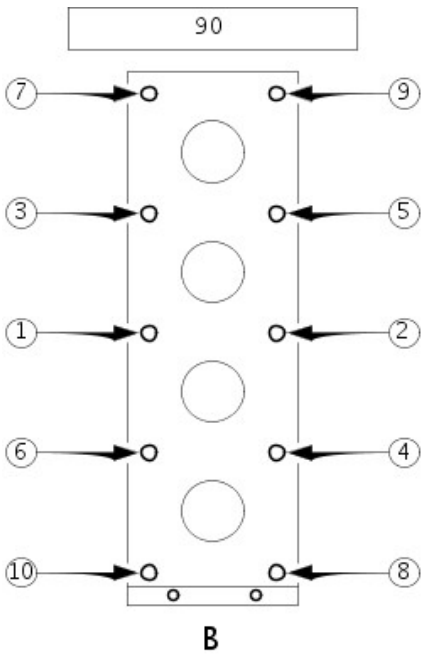
E35339

12. Stage 3 - tighten all M10 bolts in sequence by 90°.



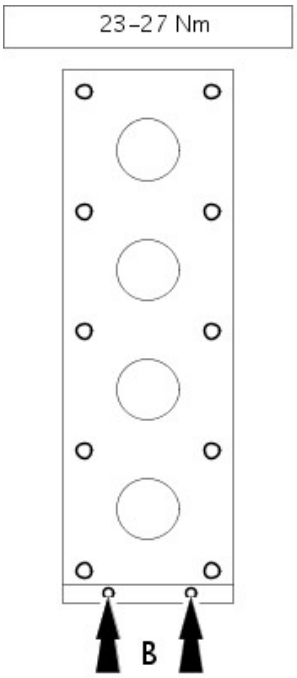
E35340

13. Stage 4 - tighten all M10 bolts in sequence by 90°.

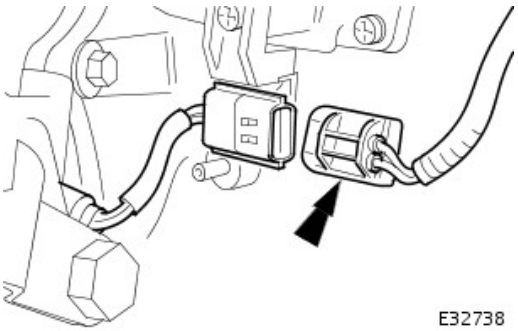


E33888

14. Stage 5 - tighten the two M8 bolts at the front of the cylinder head to 25Nm.

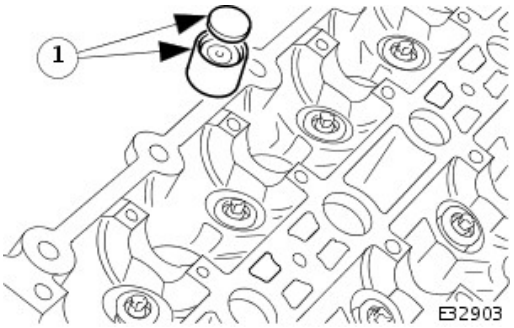


E35341



E32738

15. Connect the plug to the engine position sensor, at the rear of the cylinder head.

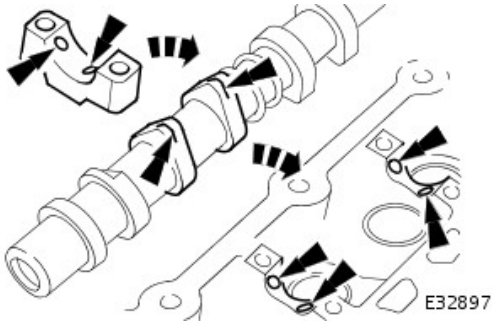


E32903

16. Install the tappet and shim assemblies.

- Lubricate each tappet assembly.

    1. Install each tappet and shim assembly to its previously identified position in the cylinder head.



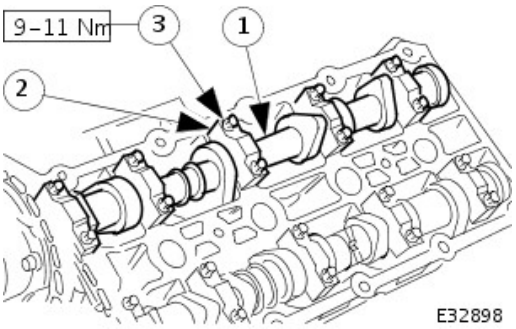
E32897

17. Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.

18. Install the camshafts.

1. Install the camshafts to position in the cylinder head, with the timing flats uppermost.

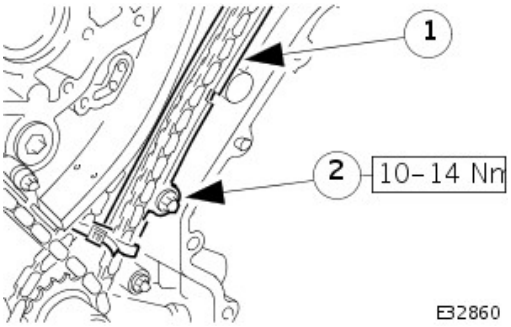


2. Install the camshaft caps to their respective locations (inlet 0 to 4 and exhaust 5 to 9 from the front) and in the correct orientation (arrow to front of engine).

3. Install and tighten the cap securing bolts. Tighten evenly, in stages, to 10 Nm.

19. Install the camshaft locking tool 303 - 530, align the camshafts as necessary.

20. Install the chain guide.

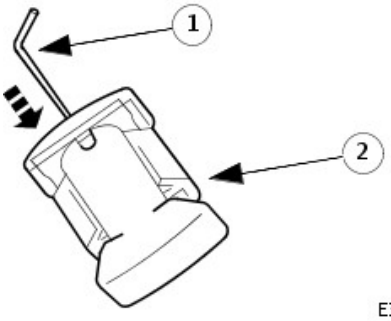


- The chain guide must be installed so that the slotted hole is towards the top, and the raised shoulder to the cylinder block.

1. Install the chain guide to the block and locate it onto the upper retaining pin.

2. Install the retaining bolt and tighten it to 12 Nm.

21. Push the secondary chain tensioner piston into the body to provide clearance for installing the chain.

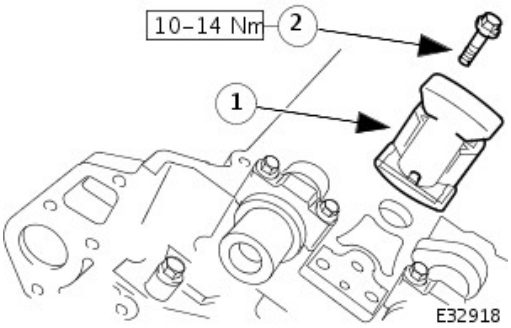


1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.

2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

22. Install the secondary chain tensioner to the engine.

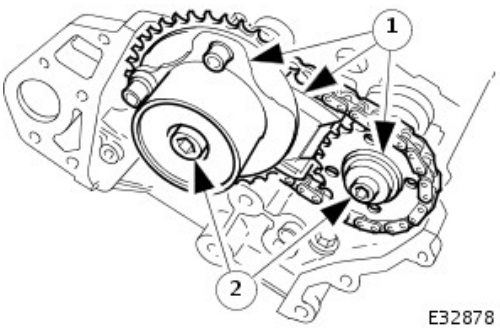


1. Fully seat the tensioner to the cylinder head.

2. Install the two bolts which secure the tensioner and tighten to 12 Nm.

23. NOTE: Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for installing to the engine.

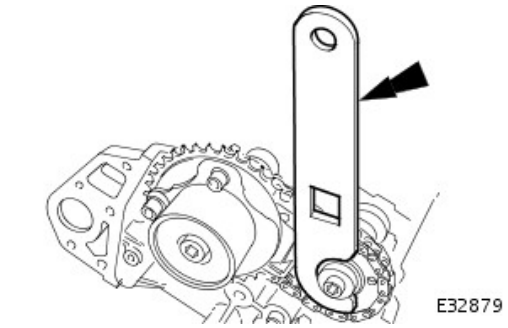
Install the VVT unit to the engine.



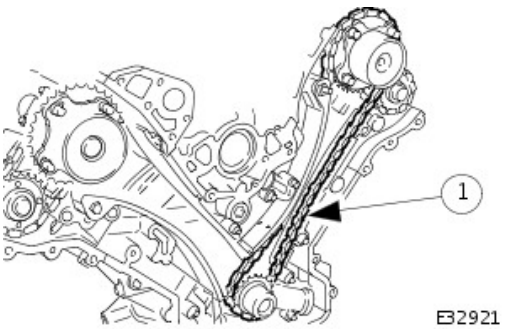
1. Install the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.

2. Install, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts.

24. Install the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.



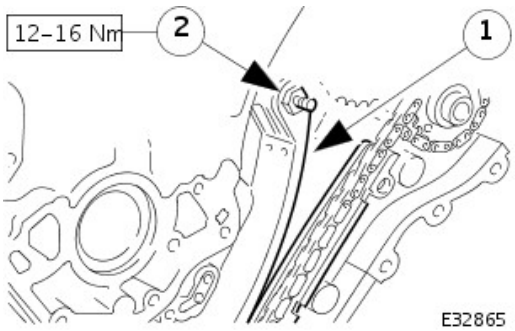
- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



25. Install the primary timing chain.

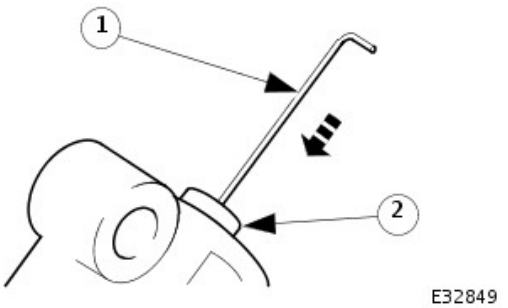
- Reposition the VVT unit forwards on the cam journal (do not rotate it) to allow the chain to clear the head casting. Disconnect the primary chain from the Ty-strap.

1. Install the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.



26. Install the primary chain tensioner blade.

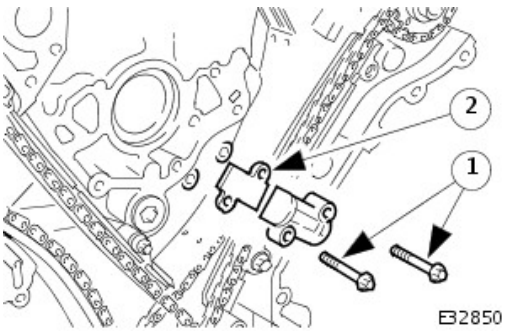
1. Position the tensioner blade to the cylinder block.
2. Install the retaining / pivot bolt and tighten it to 14 Nm.



27. Push the primary chain tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

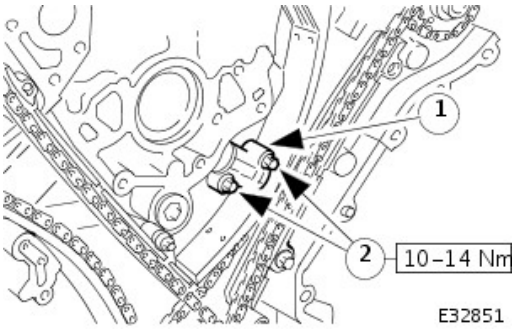


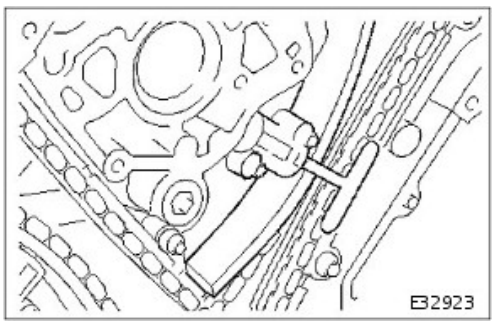
28. Assemble the tensioner.

1. Install the two mounting bolts to the tensioner.
2. Locate the tensioner back-plate to the two bolts.

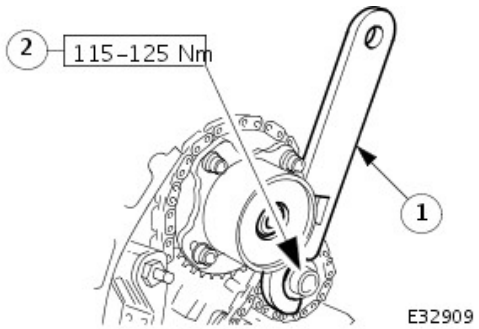
29. Install the tensioner to the cylinder block.

1. Position and align the tensioner to the cylinder block and to the mating slot on the rear face of the tensioner blade.
2. Install and tighten the two bolts to 12 Nm.





30. Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain, for tightening the VVT unit and exhaust camshaft sprocket.



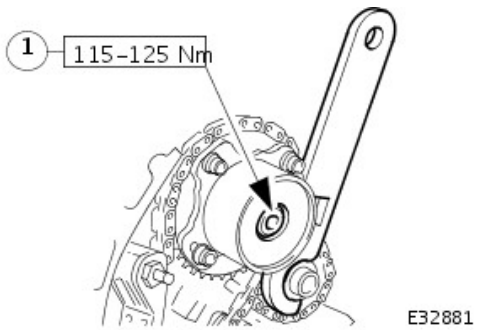
31. CAUTION: Make sure that a new bolt is installed.

Tighten the exhaust camshaft sprocket securing bolt.

1. Install the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 20 Nm +90°.



32. CAUTION: Make sure that a new bolt is installed.

Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 20Nm +90°.

- Remove the chain tensioning tool and the wedge(s).

33. Remove the camshaft locking tool 303 - 530.

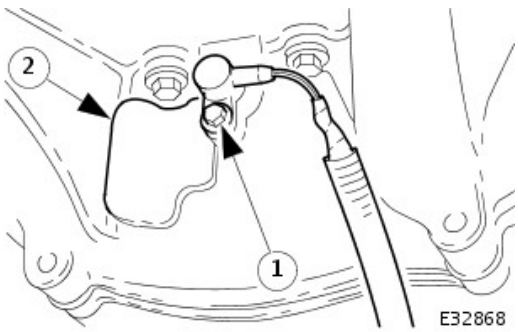
34. Raise the vehicle on the ramp.

35. Remove the crankshaft setting tool 303 - 531.

36. Install the crankshaft position sensor.

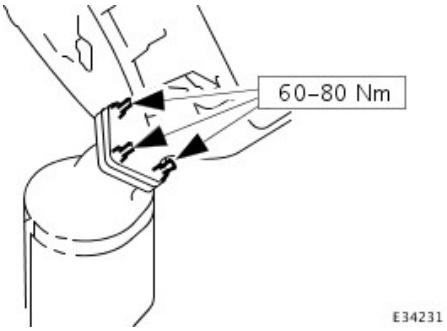
1. Install the sensor to the flywheel housing and install the securing bolt. Tighten to 10 Nm.

2. Install the access grommet to the housing.

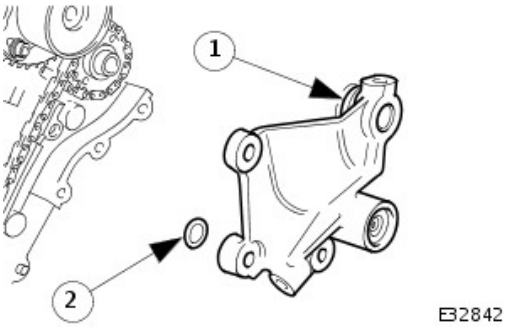


37. Lower the ramp.

38. Install and tighten the nuts which secure the exhaust manifold to the

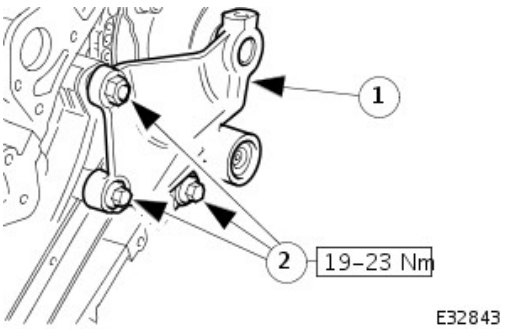


downpipe catalyst.



39. Install new seals to the B-Bank VVT bush carrier.

1. Install the new sealing ring (scarf jointed) to the carrier bush groove.
2. Install a new O-ring to the carrier oil-way.



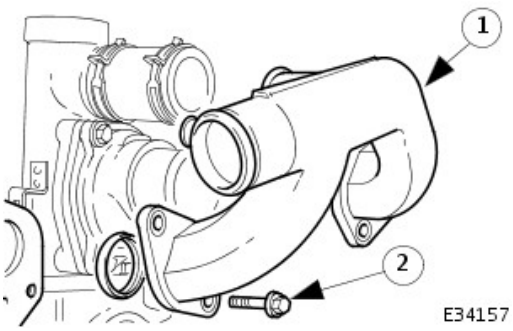
40. Install the bush carrier to the cylinder block.

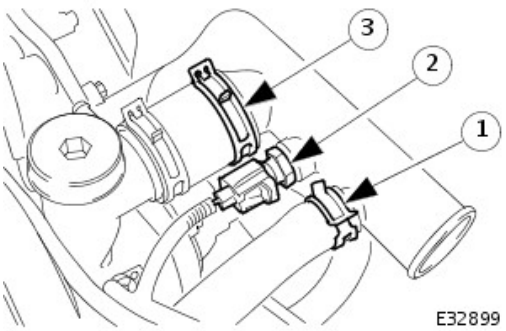
- Lubricate the seal (scarf jointed) and the bush.
  1. Install the bush carrier assembly.
- Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.
  2. Install the two securing bolts and one nut. Tighten to 21 Nm.

41. Install new sealing rings to the coolant outlet pipe grooves.

42. Install the coolant outlet pipe.

1. Install the outlet pipe to the bypass hose and to the cylinder heads.
2. Install the four bolts which secure the outlet pipe.





43. Connect the hoses and multi-plug to the coolant outlet pipe.

1. Connect the heater hose and reposition the hose clip.
2. Connect the multi-plug to the temperature sensor.
3. Expand and reposition the hose clip along the bypass hose.

44. Install the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes installing the throttle housing.

45. Install the engine front cover.For additional information, refer to: Engine Front Cover (303-01 Engine, In-vehicle Repair).

46. Move the engine compartment cover from the service position and connect the gas struts.

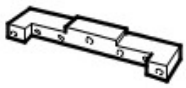
47. Remove the paint protection sheets and close the cover.

48. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

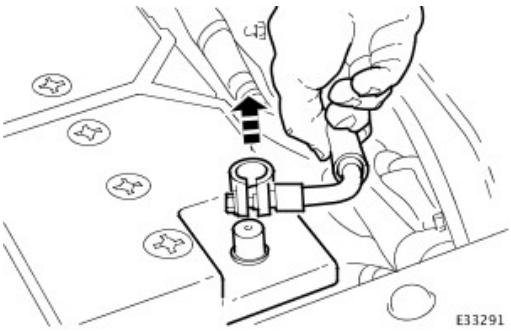
Engine - Cylinder Head RH

In-vehicle Repair

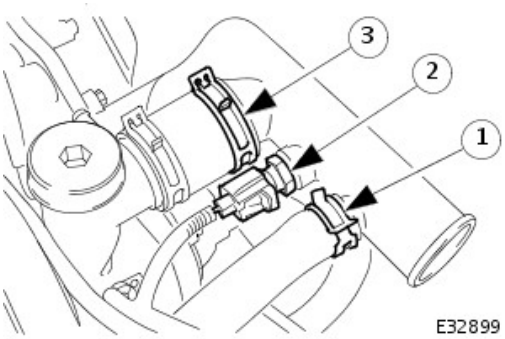
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

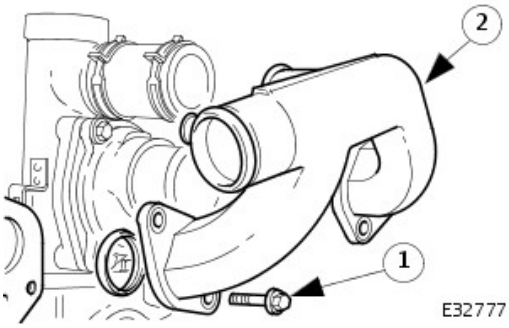
Removal

CAUTION: If a replacement cylinder head is to be installed to a vehicle with variable camshaft timing (VCT) the cylinder head must have the oil gallery blind rivet removed before installation.


E33291

1. Open the engine compartment and install paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.
4. Remove the engine front cover.For additional information, refer to: Engine Front Cover (303-01 Engine, In-vehicle Repair).
5. Remove the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes depressurising the fuel system and removing the throttle housing.
6. Disconnect the hoses and multi-plug from the coolant outlet pipe.
   1. Release and reposition the hose clip, and disconnect the heater hose.
   2. Disconnect the multi-plug from the temperature sensor.
   3. Release and reposition the hose clip along the bypass hose.





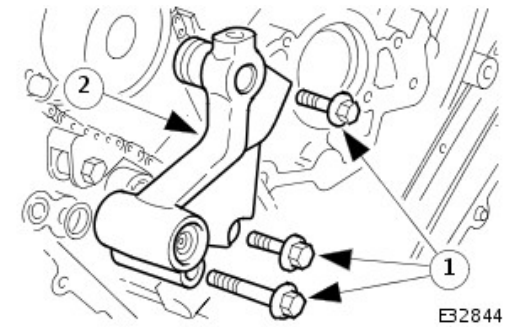
7. Remove the coolant outlet pipe.

1. Remove the four bolts which secure the outlet pipe.
2. Remove the outlet pipe from the bypass hose and from the cylinder heads.

8. Remove and discard the sealing rings from the outlet pipe grooves.

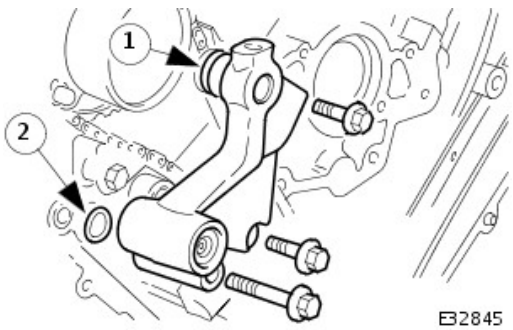
9. Remove the nuts which secure the catalytic converter to the A-Bank exhaust manifold flange.





10. Remove the VVT bush carrier.

1. Remove the three bolts which secure the carrier to the cylinder block.
2. Release the carrier from the two ring dowels and remove it.

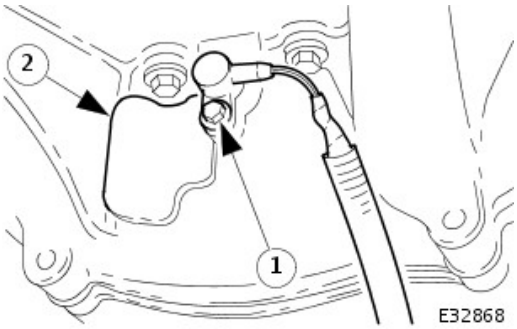


11. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.

12. Raise the vehicle on a ramp.

13. Remove the crankshaft position sensor.

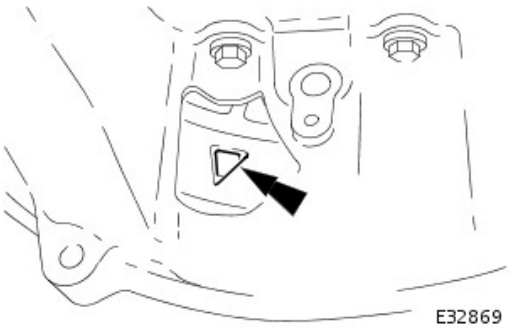


• NOTE: Remove the sensor and allow it to hang free under the engine.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
2. Remove the access grommet (for torque converter bolts) from the housing.

14. Install the damper securing bolt (old one) to the crankshaft, hand-tight only.

15. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





16. Install the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Install the crankshaft setting peg 303 - 531.

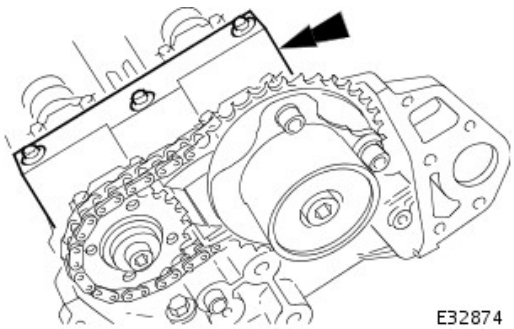
- Position the crankshaft so that the setting peg engages fully into the timing slot.

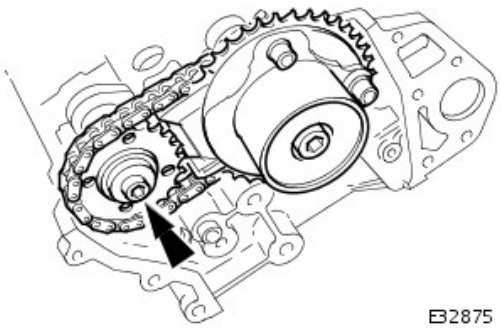
2. Install and tighten the bolt to secure the setting peg.

17. Remove the damper securing bolt from the crankshaft.

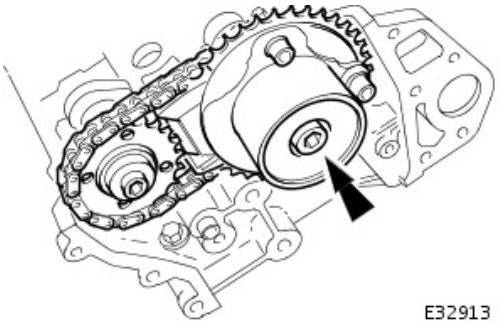
18. Lower the vehicle on the ramp.

19. Install the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.





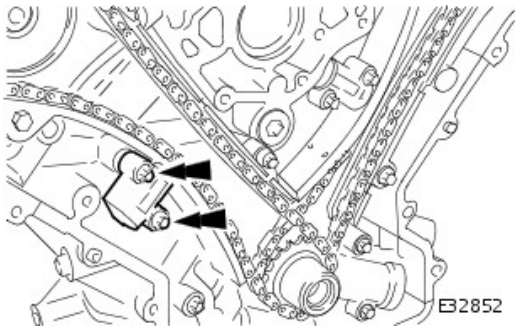
20. Loosen the bolt which secures the sprocket to the camshaft.



21. Loosen the bolt which secures the VVT unit to the camshaft.

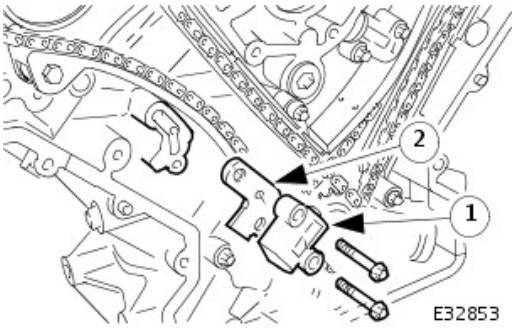
22. Remove the camshaft locking tool 303 - 530 (installed for previous operation).

23. Remove the primary chain tensioner bolts.



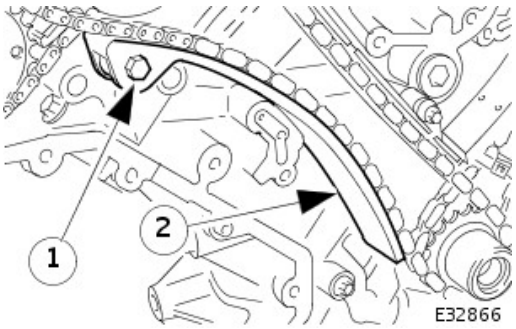
24. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.



25. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

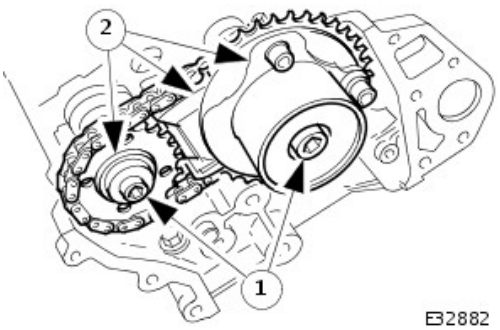


26. Remove the primary chain from the VVT unit and from the crankshaft pulley.

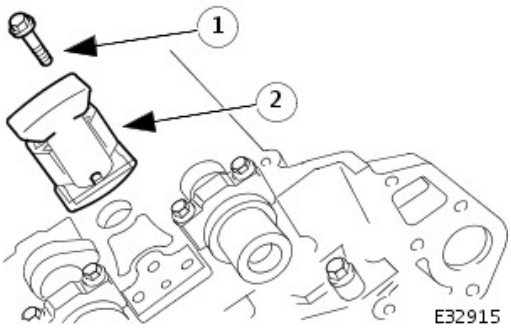
27. Remove the VVT unit and exhaust camshaft sprocket.

1. Remove the securing bolt from both the VVT unit and the exhaust cam sprocket.
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

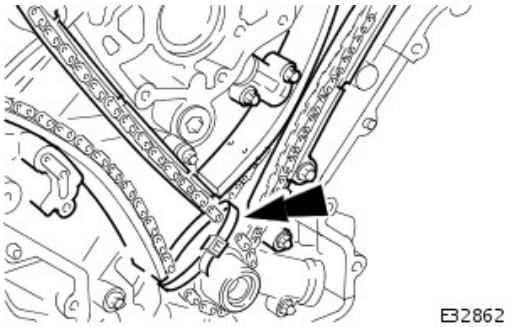


28. Remove the secondary chain tensioner.



1. Remove the two bolts which secure the chain tensioner to the cylinder head.

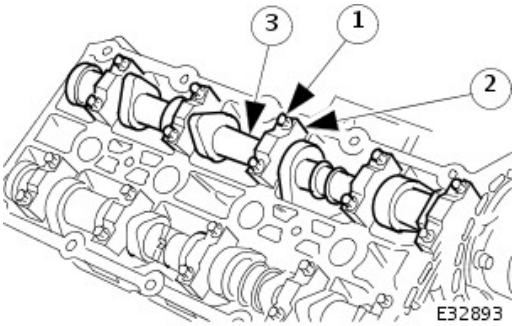
2. Remove the tensioner.



29. Remove the chain guide.

1. Remove the bolt which secures the chain guide.

2. Note the orientation of the chain guide and remove it from the upper retaining pin.

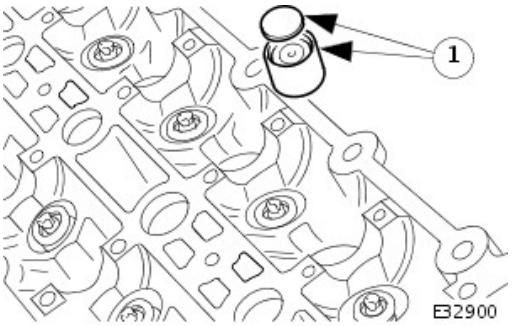


30. Remove the camshafts.

1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.

2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).

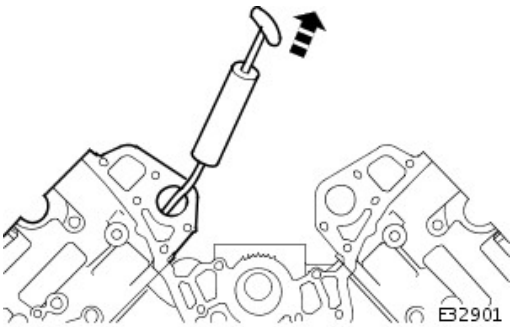
3. Remove the camshafts from the engine.



31. Remove the tappets and shims.

1. Note the position of each tappet, for reassembly, and remove each tappet and shim assembly - retain each shim with its original tappet.

- Mark the inside face of each tappet in pencil or felt tipped pen, with its original position within the cylinder head.



32. Remove residual coolant from the cylinder head.

1. Place a drain tray under the engine.

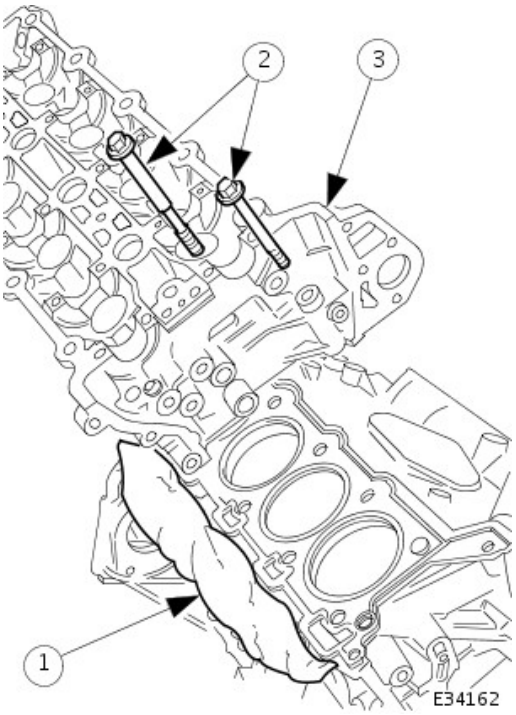
2. Use a syringe with a length of thin rubber pipe connected, to drain the residual coolant from the outlet pipe water-way.

- A suitable syringe is Snap On YA 745.

33. Remove the cylinder head.

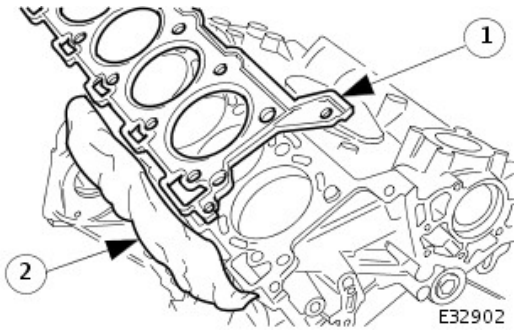
1. Place cloth around the area of the cylinder head to absorb coolant spillage, when removing the head.

2. Remove the bolts (10xM10 and 2xM8) which secure the cylinder



head.

3. With assistance, remove the cylinder head.



34. Remove the cylinder head gasket.

1. Note how the gasket is installed and remove it.
2. Remove and discard the cloth, placed previously to absorb coolant spillage.

- Wipe up any leaked coolant.

35. Remove the coolant drain tray from under the engine.

36. Remove and discard the gasket from the downpipe catalyst.

- Clean the gasket faces of the catalyst and the exhaust manifold.

37. Clean cylinder head and cylinder block gasket faces.

- Ensure that all threaded holes in the cylinder block face are clean and free from oil.
- Clean and inspect the cylinder head bolts. They may be re-used on two occasions. When re- used, each bolt head should be marked with one dot from an automatic centre punch.

38. Clean and inspect all relevant components and mating faces.

Installation

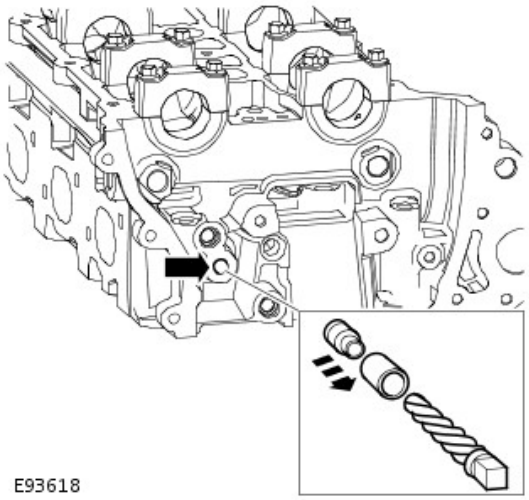
1. CAUTIONS:

⚠ If a replacement cylinder head is to be installed to a vehicle with VCT the cylinder head must have the oil gallery blind rivet removed before installation.

⚠ Make sure that all debris is removed from the cylinder head and cylinder head oil gallery.

Vehicles fitted with VCT: Remove the blind rivet from the VCT oil gallary.

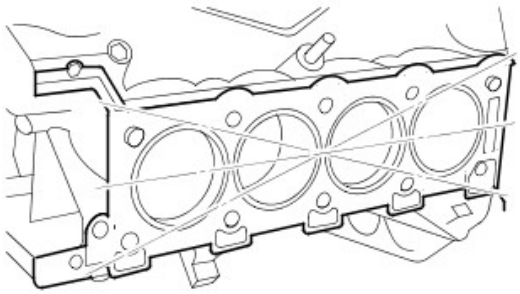
• NOTE: The centre bore of the blind rivet is 6 mm diameter.


E93618

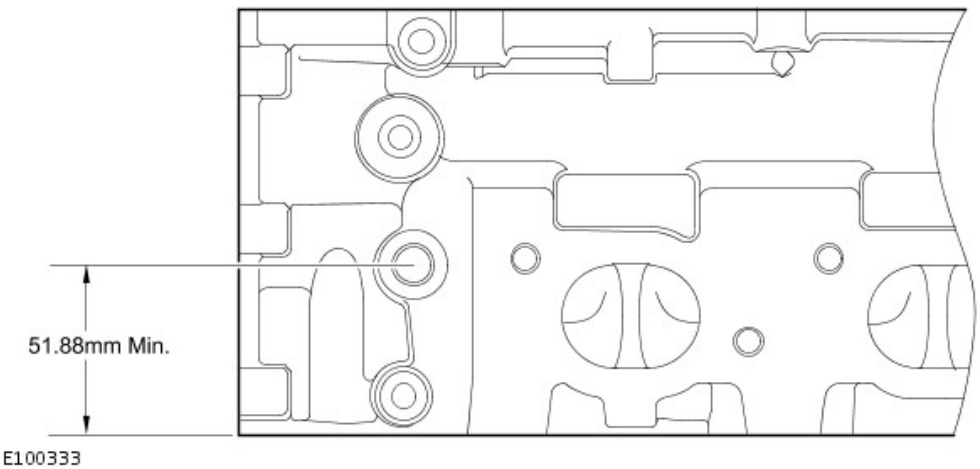
- Identify the VCT oil supply gallery and the 8 mm blind rivet.
- Using a suitable 3 mm punch release the centre of the blind rivet until it is released from the outer part of the blind rivet.
- Using a suitable extraction tool, remove the remaining part of the blind rivet.

2. Clean the component mating faces.

3. Check cylinder head face for distortion, across the center and from corner to corner.


E46855

4. For cylinder head face distortion data, refer to specifications.For additional information, refer to: Specifications (303-00 Engine System - General Information, Specifications).



E100333

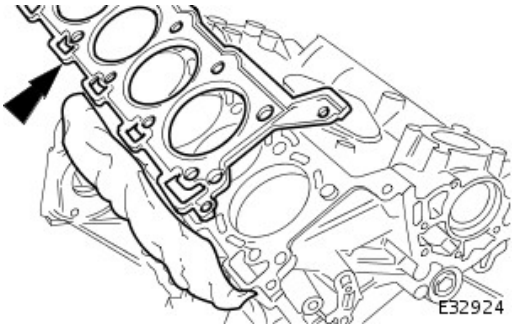
5. NOTE: For cylinder head with distortion above the maximum allowance, the cylinder head material must be measured.

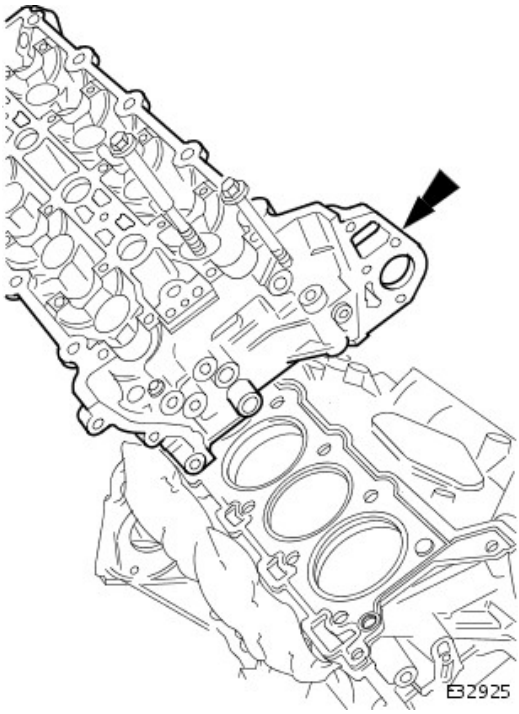
Measure the cylinder head material.

- 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.

6. Install a new gasket to the downpipe catalyst flange.

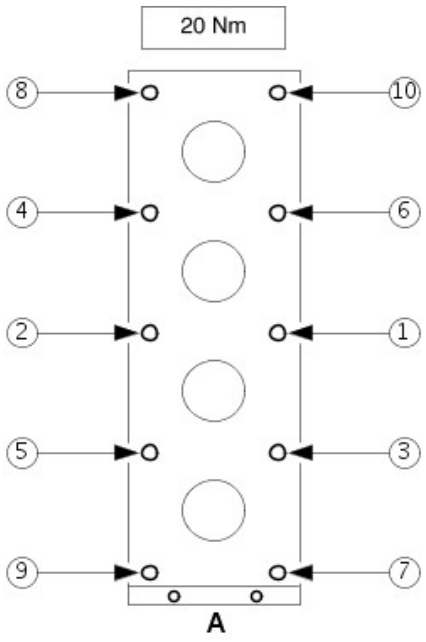
7. Install and align a new cylinder head gasket to the cylinder block face.





8. With assistance, install the cylinder head.

- Engage the cylinder head with the dowels on the block face, and the exhaust manifold flange with the studs on the downpipe catalyst.

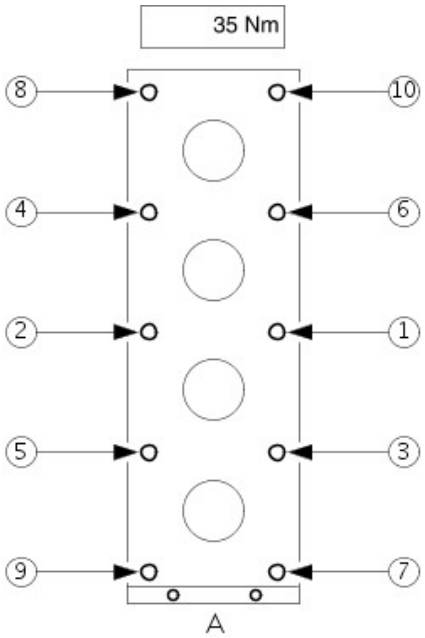


9. Install the cylinder head bolts, hand tight only.

10. Tighten the cylinder head bolts in stages, in the sequence shown, using the following procedure:

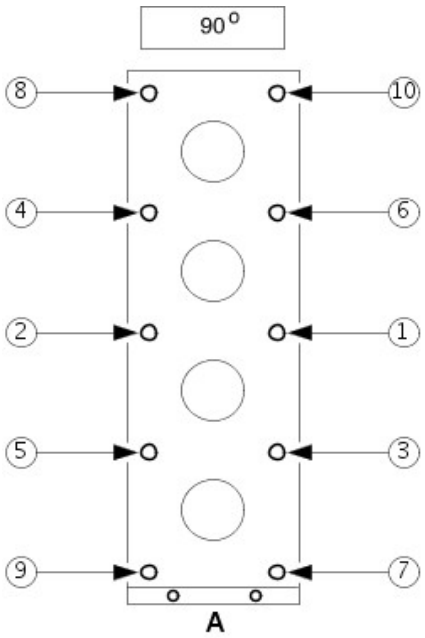
- Stage 1 - tighten all M10 bolts in sequence, to 20 Nm.

11. Stage 2 - tighten all M10 bolts in sequence, to 35 Nm.



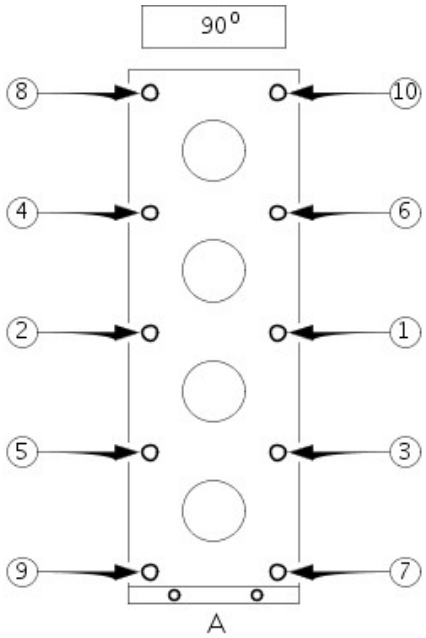
E35335

12. Stage 3 - tighten all M10 bolts in sequence by 90°.

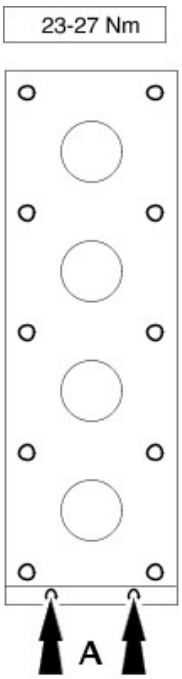


E35336

13. Stage 4 - tighten all M10 bolts in sequence by 90°.

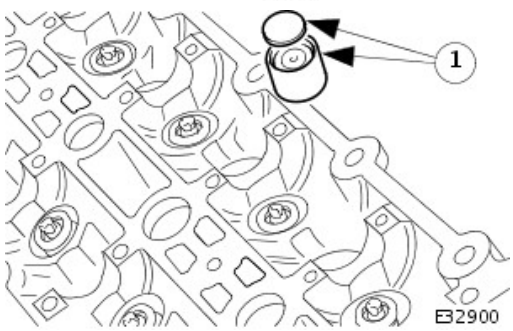


E33887



E35337

14. Stage 5 - tighten the two M8 bolts at the front of the cylinder head to 25 Nm.

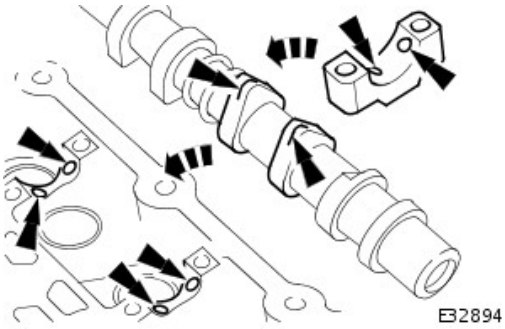


15. Install the tappet and shim assemblies.

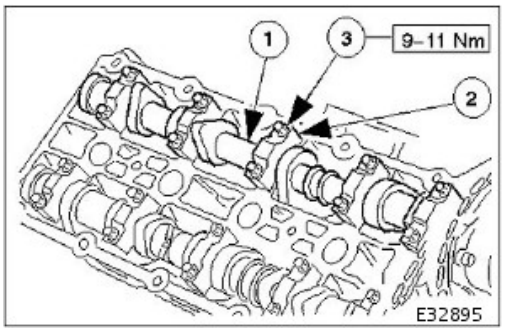
- Lubricate each tappet assembly.

1. Install each tappet and shim assembly to its previously identified position in the cylinder head.

16. Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:



- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.



17. Install the camshafts.

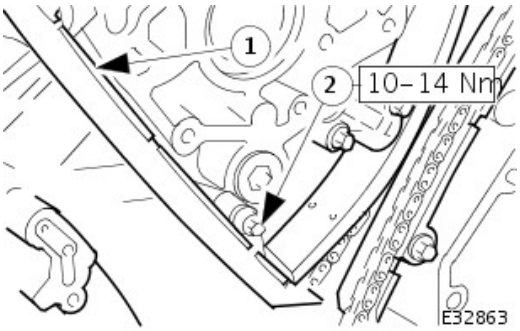
1. Install the camshafts to position in the cylinder head, with the timing flats uppermost.
2. Install the camshaft caps to their respective locations (inlet 0 to 4 and exhaust 5 to 9 from the front) and in the correct orientation (arrow to front of engine).
3. Install and tighten the cap securing bolts. Tighten evenly, in stages, to 10 Nm.

18. Install the camshaft locking tool 303 - 530, align the camshafts as necessary.

19. Install the chain guide.

• NOTE: The chain guide must be installed so that the slotted hole is towards the top, and the raised shoulder to the cylinder block.

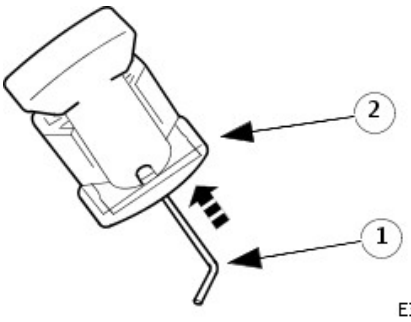
1. Install the chain guide to the block and locate it onto the upper retaining pin.
2. Install the retaining bolt and tighten it to 12 Nm.



20. Push the secondary chain tensioner piston into the body to provide clearance for installing the chain.

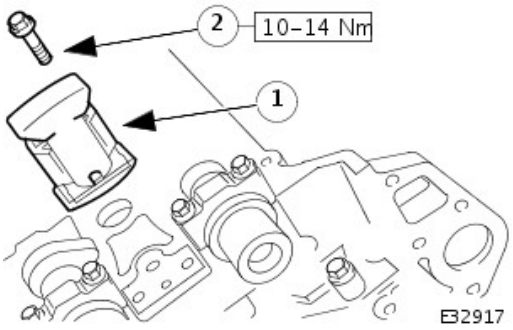
1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.



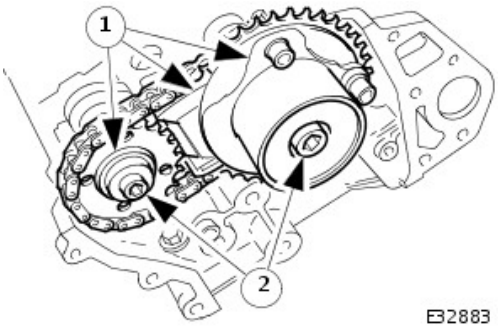
21. Install the secondary chain tensioner to the engine.

1. Fully seat the tensioner to the cylinder head.
2. Install the two bolts which secure the tensioner and tighten to 12 Nm.



22. Install the VVT unit to the engine.

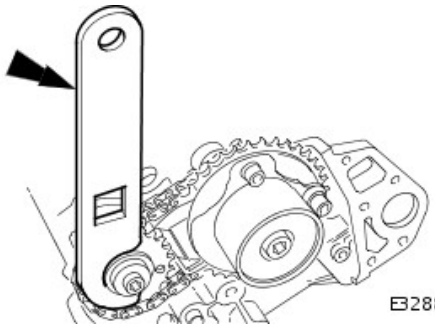
- Assemble the VVT unit, the exhaust camshaft sprocket and the



secondary chain, in preparation for installing to the engine.

1. Install the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.

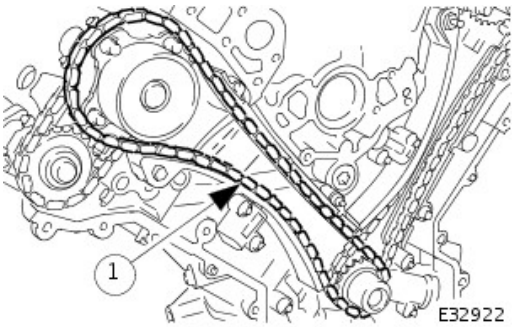
2. Install, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts.



23. Install the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

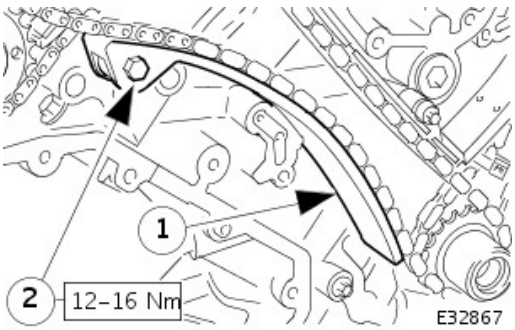
- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.

- Remove the tool.



24. Install the primary timing chain.

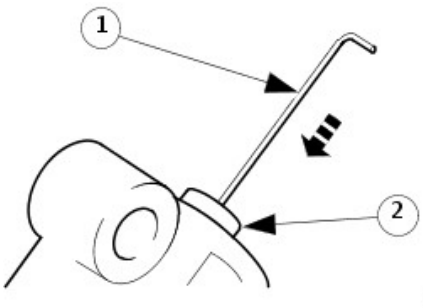
1. Install the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.



25. Install the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

2. Install the retaining / pivot bolt and tighten it to 14 Nm.



26. Push the primary chain tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.

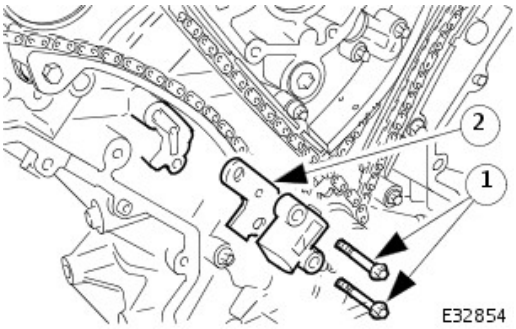
2. With the wire in position, press the piston fully into the tensioner body.

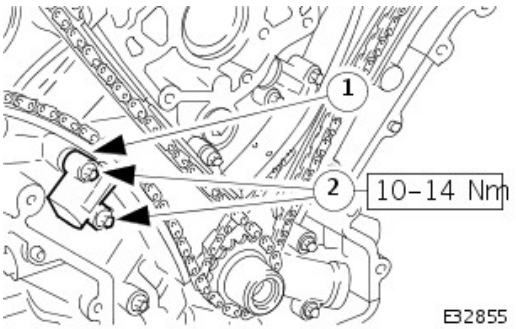
- Remove the wire.

27. Assemble the tensioner.

1. Install the two mounting bolts to the tensioner.

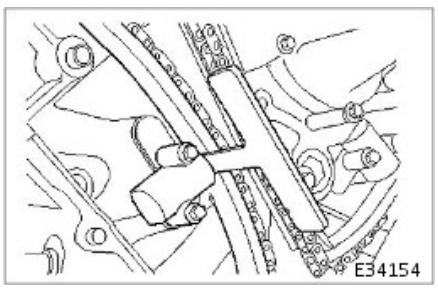
2. Locate the tensioner back-plate to the two bolts.



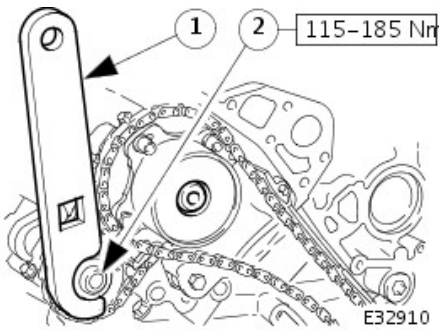


28. Install the tensioner to the cylinder block.

1. Position and align the tensioner to the cylinder block and to the mating slot on the rear face of the tensioner blade.
2. Install and tighten the two bolts to 12 Nm.



29. Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain, for tightening the VVT unit and exhaust camshaft sprocket.



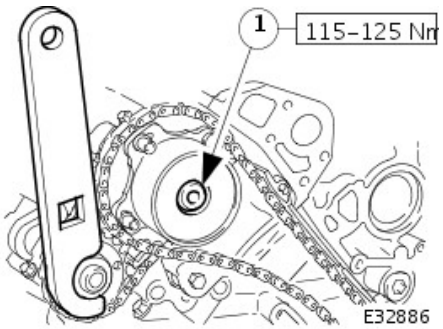
30. CAUTION: Make sure that a new bolt is installed.

Tighten the exhaust camshaft sprocket securing bolt.

1. Instal the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 20 Nm + 90°.



31. CAUTION: Make sure that a new bolt is installed.

Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 20 Nm + 90°.

- Remove the chain tensioning tool and the wedge(s).

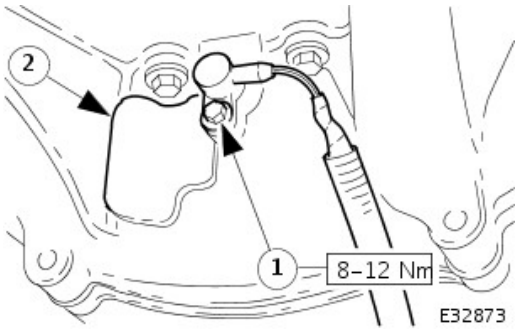
32. Remove the camshaft locking tool 303 - 530.

33. Raise the vehicle on the ramp.

34. Remove the crankshaft setting tool 303 - 531.

35. Install the crankshaft position sensor.

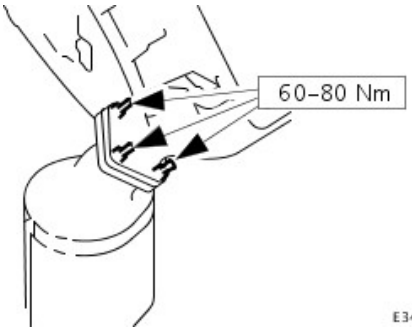
1. Install the sensor to the flywheel housing and Install the securing bolt. Tighten to 10 Nm.



2. Install the access grommet to the housing.

36. Lower the ramp.

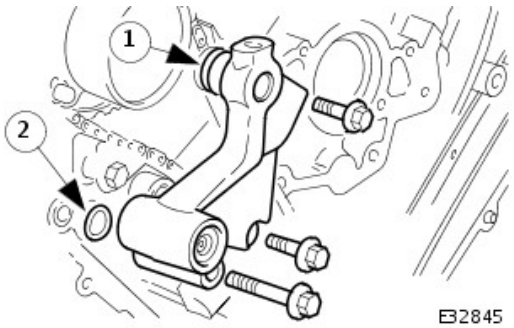
37. Install and tighten the nuts which secure the exhaust manifold to the downpipe catalyst.



38. Install new seals to the A-Bank VVT bush carrier.

1. Install the new sealing ring (scarf jointed) to the carrier bush groove.

2. Install a new O-ring to the carrier oil-way.



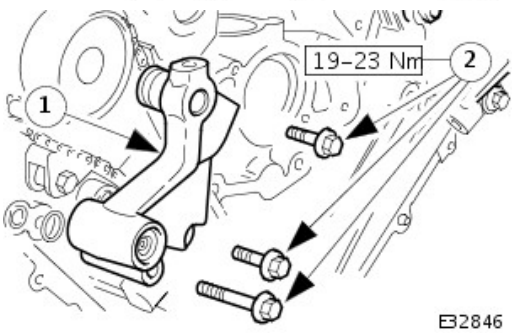
39. Install the bush carrier to the cylinder block.

- Lubricate the seal (scarf jointed) and the bush.

1. Install the bush carrier assembly.

- Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.

2. Install the three securing bolts. Tighten to 21 Nm.

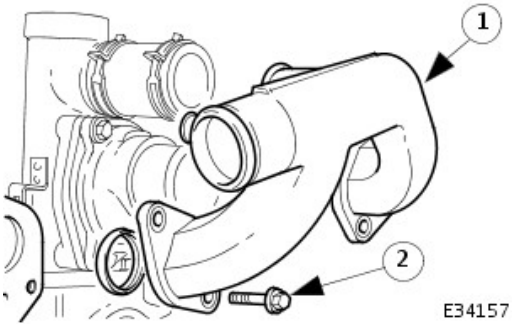


40. Install new sealing rings to the coolant outlet pipe grooves.

41. Install the coolant outlet pipe.

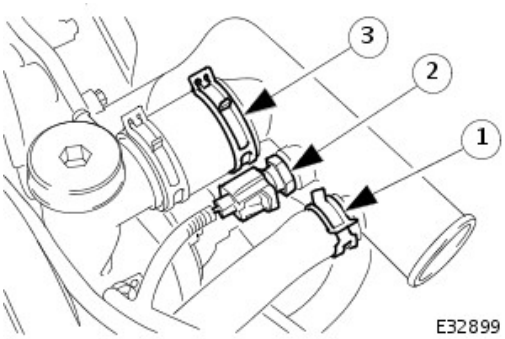
1. Install the outlet pipe to the bypass hose and to the cylinder heads.

2. Install the four bolts which secure the outlet pipe.



42. Connect the hoses and multi-plug to the coolant outlet pipe.

1. Connect the heater hose and reposition the hose clip.



2. Connect the multi-plug to the temperature sensor.

3. Expand and reposition the hose clip along the bypass hose.

43. Install the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes installing the throttle housing.

44. Install the engine front cover.For additional information, refer to: Engine Front Cover (303-01 Engine, In-vehicle Repair).

45. Move the engine compartment cover from the service position and connect the gas struts.

46. Remove the paint protection sheets and close the cover.

47. Connect the battery and install the battery cover.For additional information, refer to: Battery Connect (414-01 Battery, Mounting and Cables, General Procedures).

Engine - Engine Front Cover

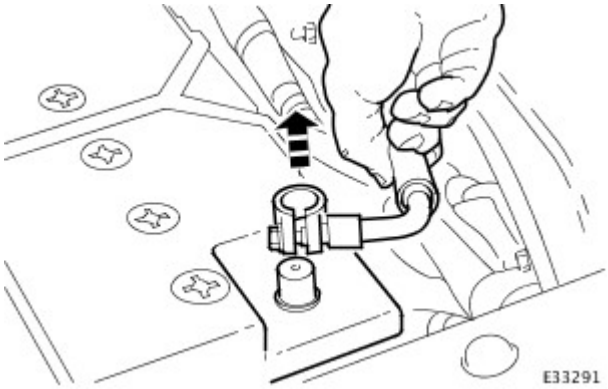
In-vehicle Repair

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the bonnet to the service access position.

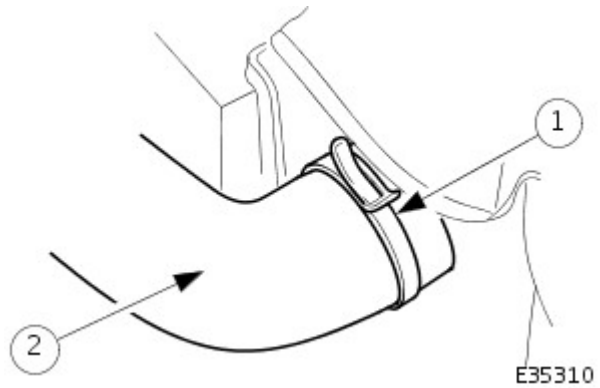
3. Disconnect the battery ground cable.



- Remove the battery cover.

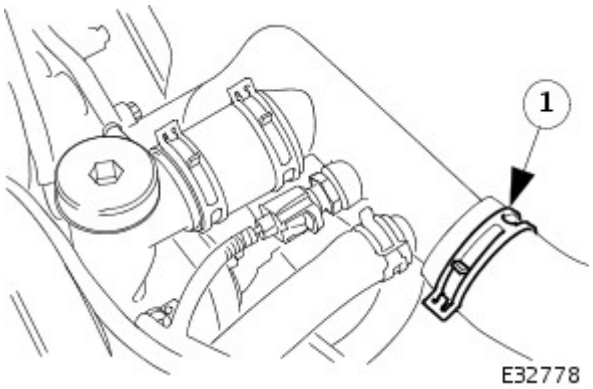
4. Drain the coolant from the radiator. Refer to Operation 26.10.01.

5. Disconnect the radiator top hose.



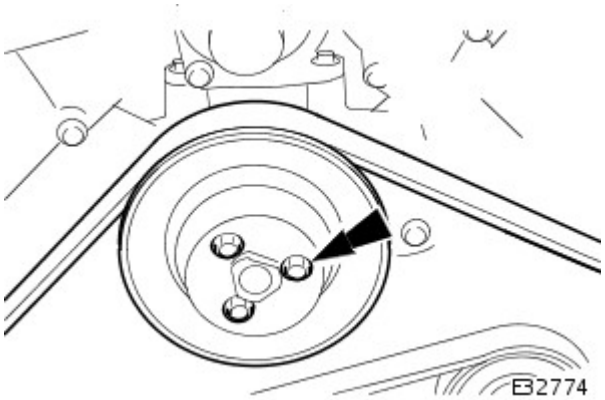
1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

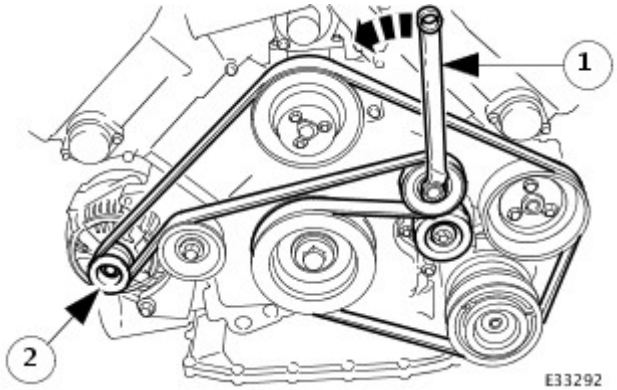
6. Disconnect the top hose from the coolant outlet pipe.



1. Release and reposition the hose clip, and disconnect the top hose.

7. Slacken the three screws which secure the water pump pulley.





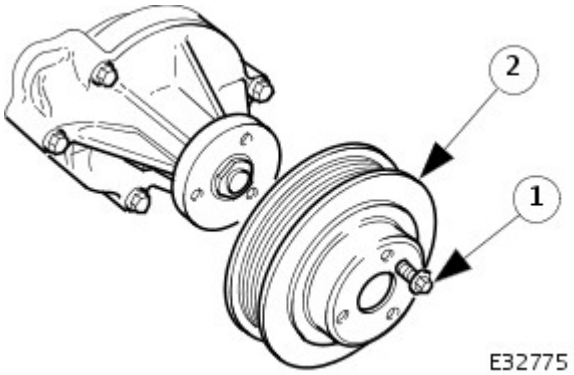
8. Remove the drive belt from the generator and accessory drive.

1. Use a spanner e.g. Churchill JD - 230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

- Disconnect the belt from the other pulleys and remove it.

9. Remove the pulley from the water pump.

1. Remove the pulley securing screws.
2. Remove the pulley from the water pump.



10. Remove the belt tensioner assembly, from the Front Accessory Drive. Refer to Operation 12.10.41.

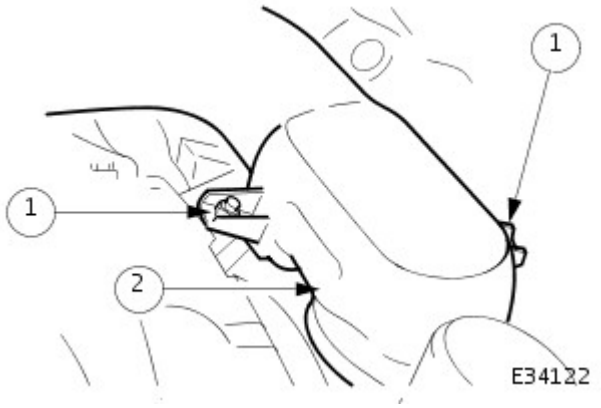
11. Remove the idler pulley, from the Front Accessory Drive. Refer to Operation 12.10.43.

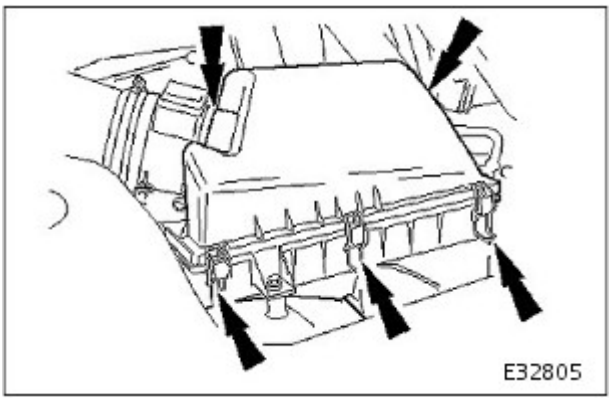
12. Remove the crankshaft damper. Refer to Operation 12.21.09.

13. Carefully remove the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

14. Disconnect the intake tube from the throttle body.

1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.





15. Disconnect the air cleaner cover.

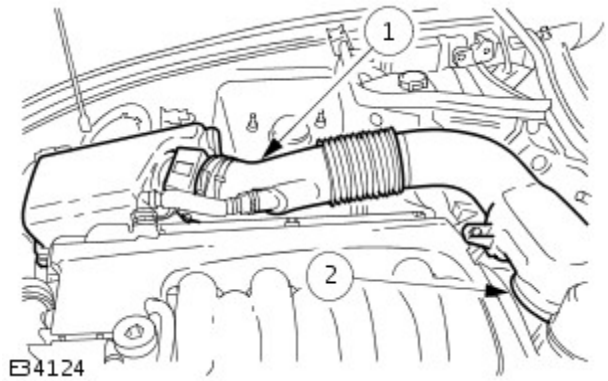
- Release the five clips which secure the air cleaner cover.

16. Disconnect the air flow meter multi-plug.

17. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.

2. Remove and discard the rubber seal; air intake tube to throttle body.



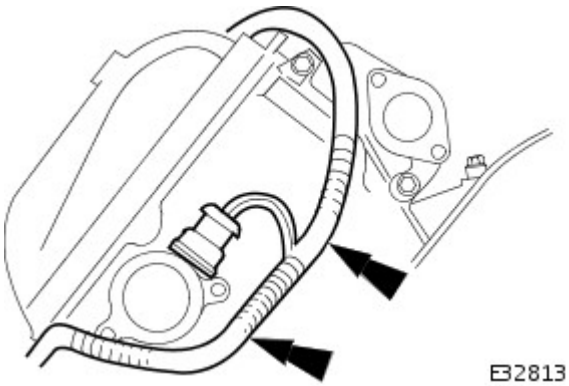
18. Remove the purge valve, from the evaporative control system. Refer to Operation 17.45.01.

19. Remove the on-plug ignition coils. Refer to Operation 18.20.41 and 18.20.42.

20. Remove the camshaft covers. Refer to Operations 12.29.43 and 12.29.44.

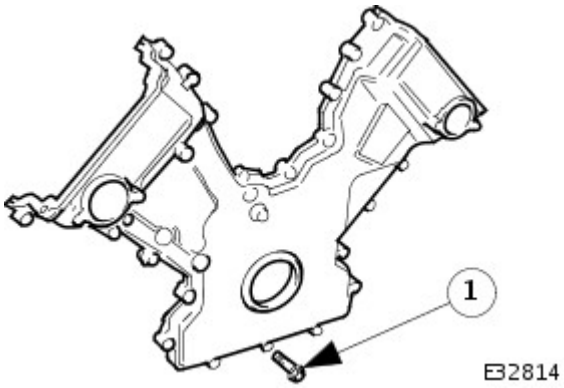
21. Remove the variable valve timing solenoids. Refer to Operation18.30.63.

22. Disconnect the engine harness retaining clips from the timing cover.



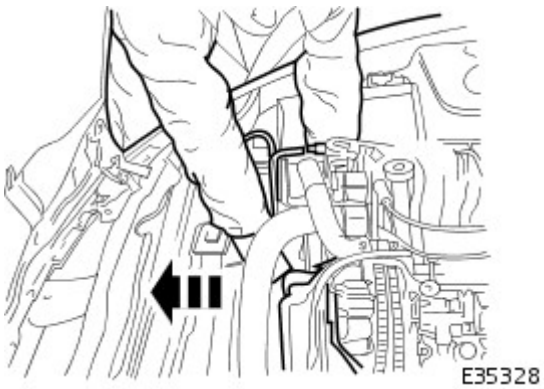
23. Remove the timing cover securing bolts.

1. Remove the twenty-four bolts which secure the timing cover.



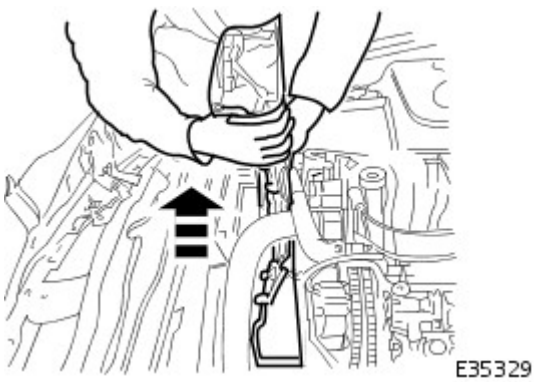
24. Remove the timing cover, step 1.

- Ease the cover towards the front of the vehicle to separate it from the engine.



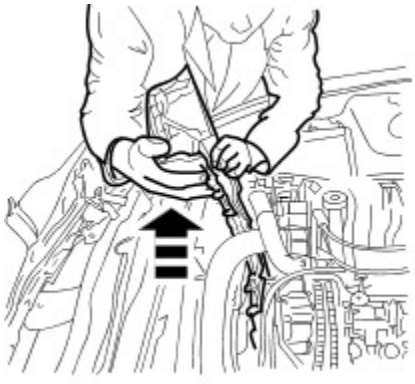
25. Remove the timing cover, step 2.

- Standing at the right hand side of the vehicle, rotate and manoeuvre the cover upwards to clear the water pump and hoses.



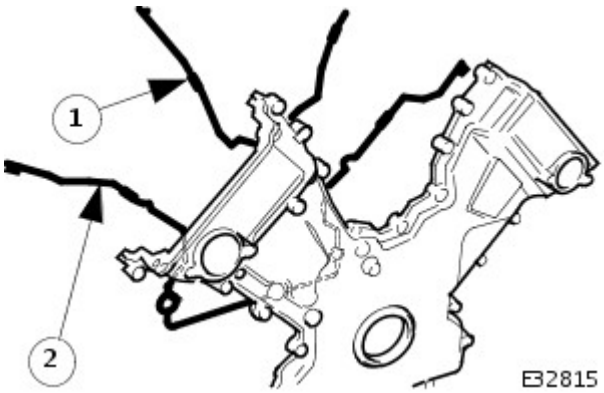
26. Remove the timing cover, step 3.

- Lift the cover clear of the engine compartment.



27. Clean all parts and mating faces.

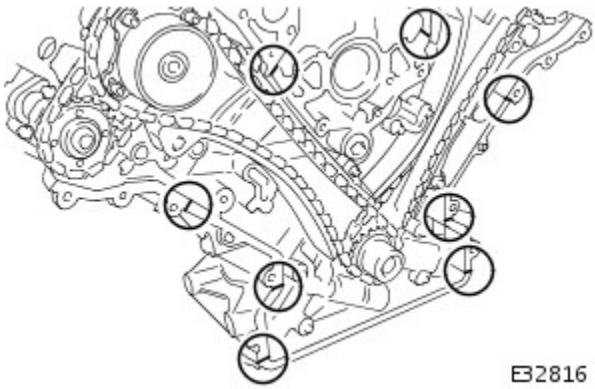
Installation



1. Fit new seals to the timing cover.

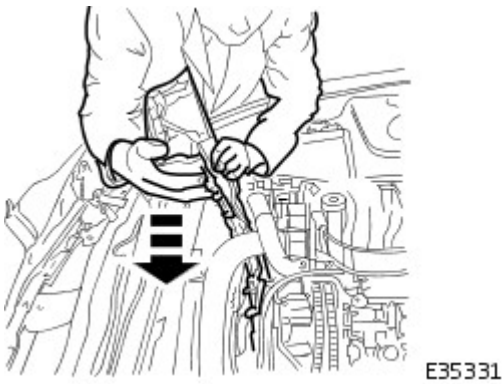
1. Fit and fully locate, a new seal to the inner groove on the face of the timing cover.
2. Fit and fully locate, a new seal to the outer groove on the face of the timing cover.

- Remove the transit ring and check that the oil seal is not damaged.



2. 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 3mm bead. (Fit and tighten the securing bolts within twenty minutes of sealant application)



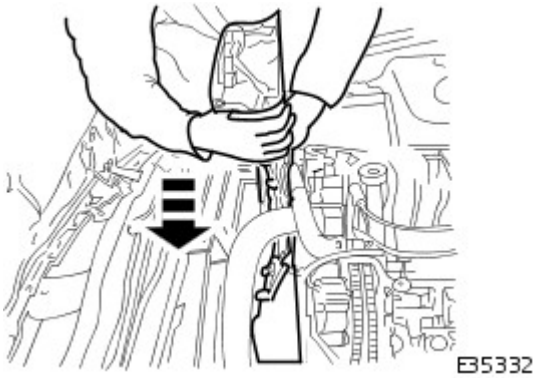
3. Refit the timing cover, step 1.

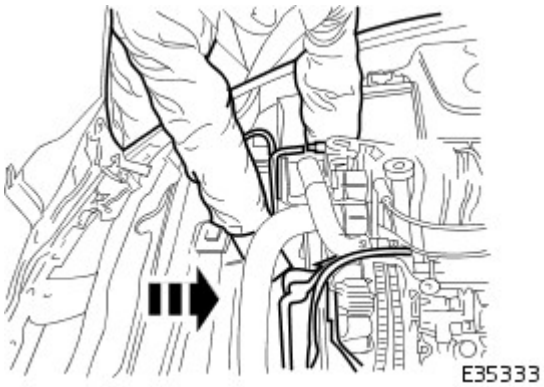
- Lower the cover into the engine compartment, to its approximate position.

4. Refit the timing cover, step 2.

- Standing at the right hand side of the vehicle, rotate and manoeuvre the cover downwards to clear the water pump

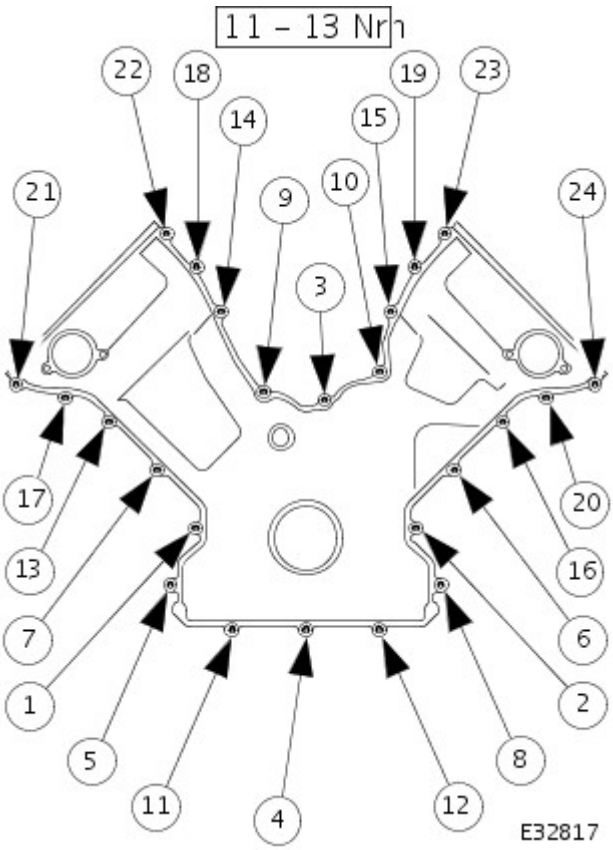
and hoses.





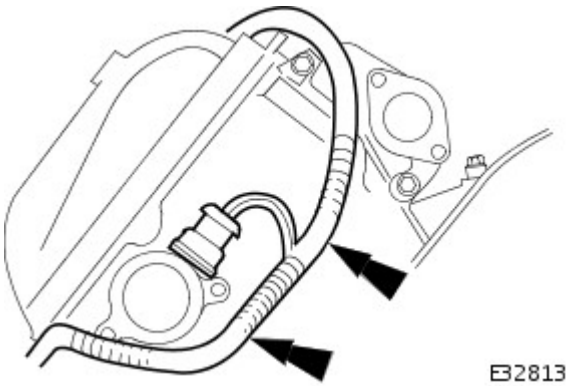
5. Refit the timing cover, step 3.

- Ease the cover towards the engine and locate it directly onto the dowels so that the gaskets or sealant are not smeared.



6. Fit and tighten the securing bolts in the correct order. Tighten to 11-13 Nm.

7. Reposition and secure the engine harness clips to the timing cover.



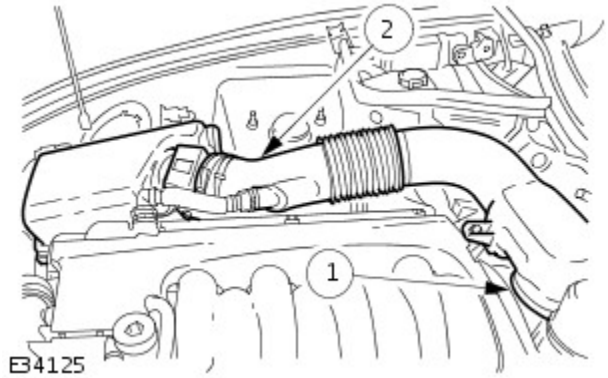
8. Refit the variable valve timing solenoids. Refer to Operation 18.30.63.

9. Refit the camshaft covers. Refer to Operations 12.29.43.and 12.29.44.

10. Refit the on-plug ignition coils and coil covers. Refer to Operation 18.20.41 and 18.20.42.

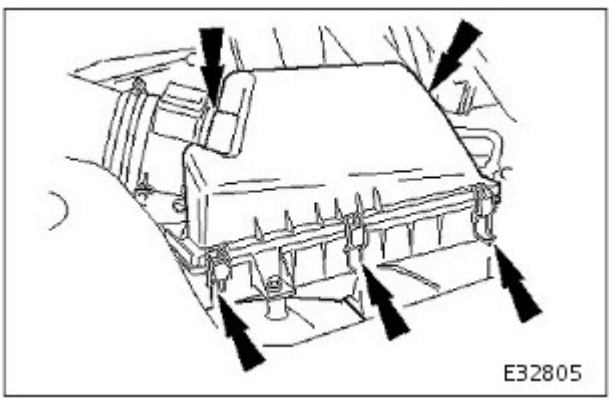
11. Refit the purge valve. Refer to Operation 17.45.01.

12. Fit the intake tube / air flow meter / air cleaner cover assembly.



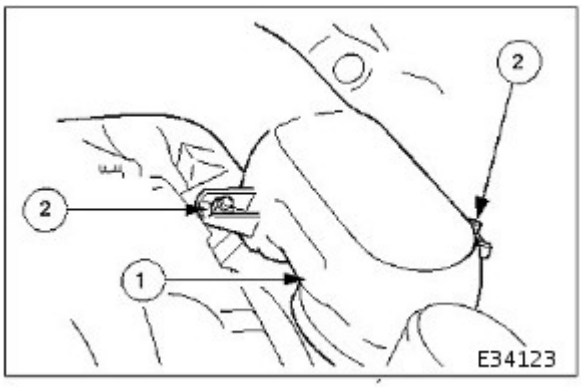
1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.

13. Reconnect the air cleaner cover.



- Fit the five clips which secure the air cleaner cover.

14. Connect the intake tube to the throttle body.



1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

15. Reconnect the air flow meter multi-plug.

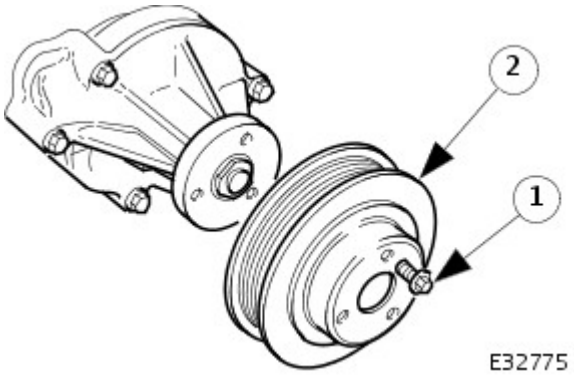
16. Refit the engine covers.

17. Refit the crankshaft damper. Refer to Operation 12.21.09.

18. Refit the idler pulley, to the Front Accessory Drive. Refer to Operation 12.10.43.

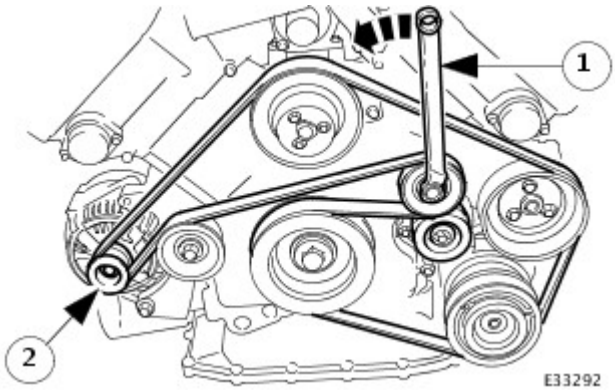
19. Refit the belt tensioner assembly, to the Front Accessory Drive. Refer to Operation 12.10.41.

20. Refit the pulley to the water pump.



1. Refit the pulley to the water pump.

2. Fit the pulley securing screws. Tighten as far as possible; then to the correct torque after the belt has been fitted.



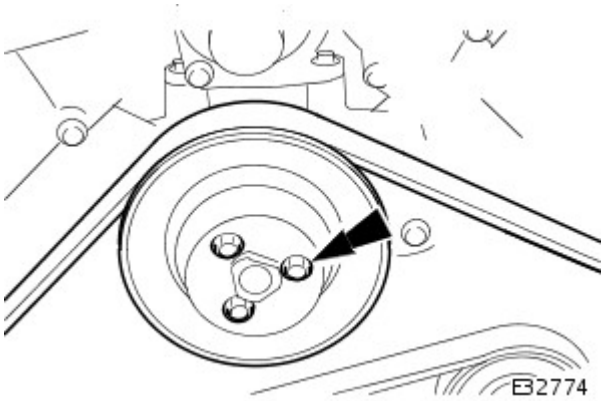
21. Refit the drive belt to the generator and accessory drive.

- Locate the belt around the pulleys, except the generator pulley.

1. Use a spanner e.g. Churchill JD - 230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.

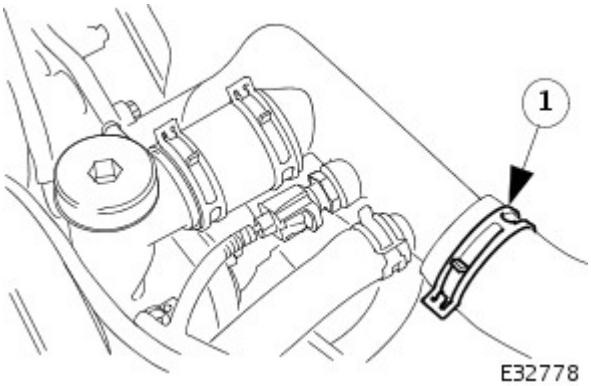
2. Whilst holding the tensioner against spring tension, connect the drive belt to the generator pulley. Release the tensioner slowly and remove the spanner.

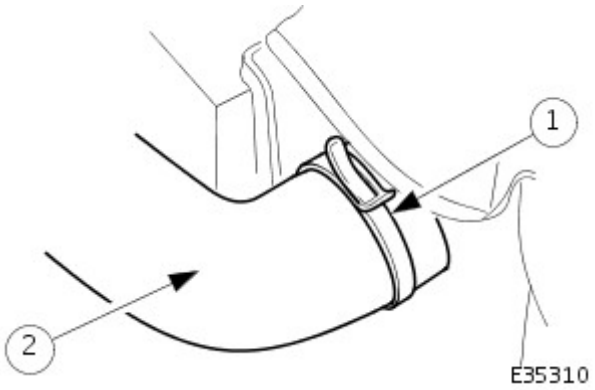
22. Tighten the three screws which secure the water pump pulley, to 10-14 Nm.



23. Connect the top hose to the coolant outlet pipe.

1. Connect the top hose. Reposition the hose clip and tighten.





24. Connect the radiator top hose.

1. Connect the hose to the radiator.
2. Reposition the clip along the hose and tighten the clip.

25. Reset the bonnet to the normal position and connect the gas struts.

26. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

27. Refill the cooling system. Refer to Operation 26.10.01.

28. Remove the paintwork protection sheets and close the engine compartment.

Engine - Engine Front Cover Gasket

In-vehicle Repair

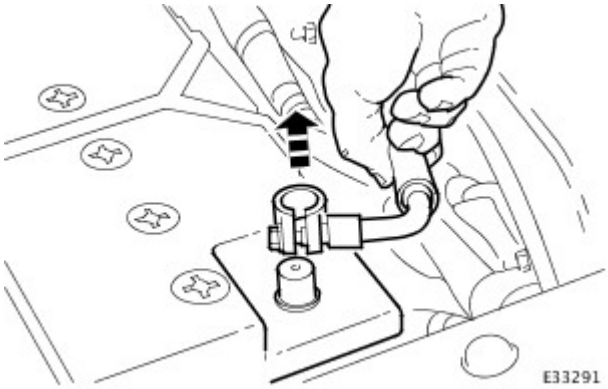
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the bonnet to the service access position.

3. Disconnect the battery ground cable.

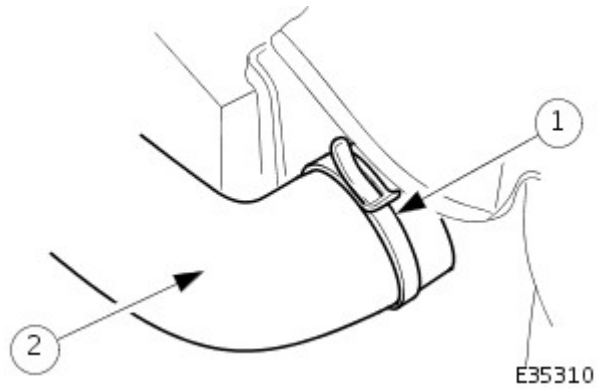
- Remove the battery cover.



4. Drain the coolant from the radiator. Refer to Operation 26.10.01.

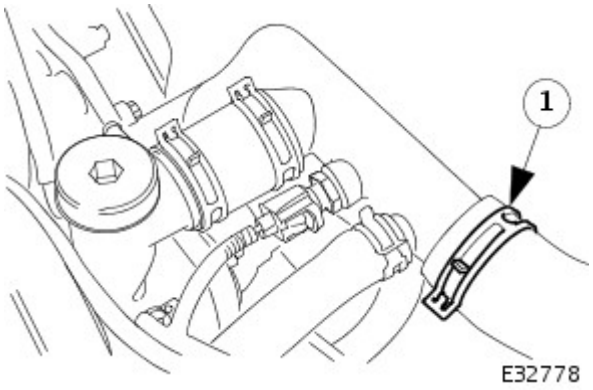
5. Disconnect the radiator top hose.

1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

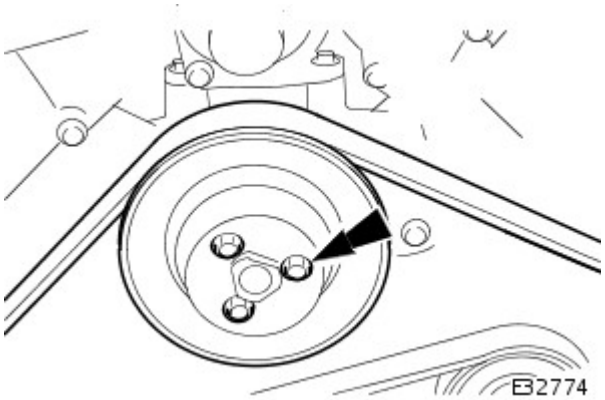


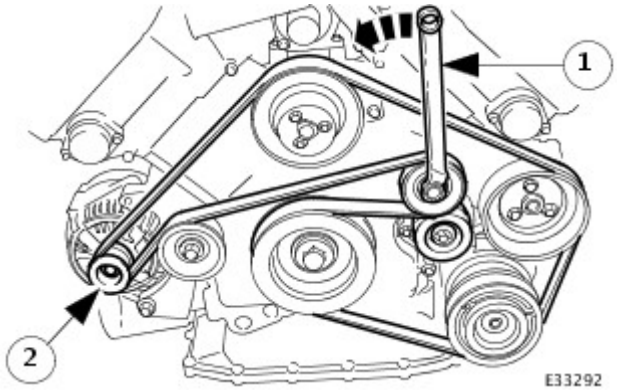
6. Disconnect the top hose from the coolant outlet pipe.

1. Release and reposition the hose clip, and disconnect the top hose.



7. Slacken the three screws which secure the water pump pulley.





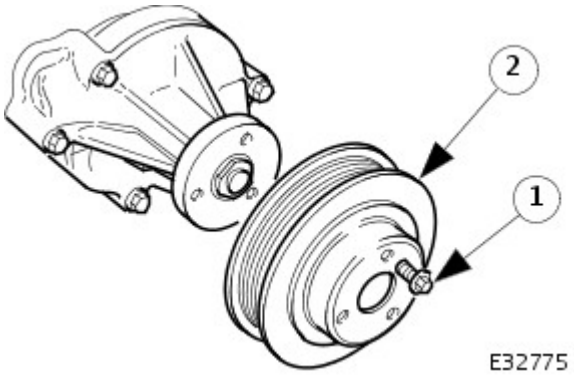
8. Remove the drive belt from the generator and accessory drive.

1. Use a spanner e.g. Churchill JD - 230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

- Disconnect the belt from the other pulleys and remove it.

9. Remove the pulley from the water pump.

1. Remove the pulley securing screws.
2. Remove the pulley from the water pump.



10. Remove the belt tensioner assembly, from the Front Accessory Drive. Refer to Operation 12.10.41.

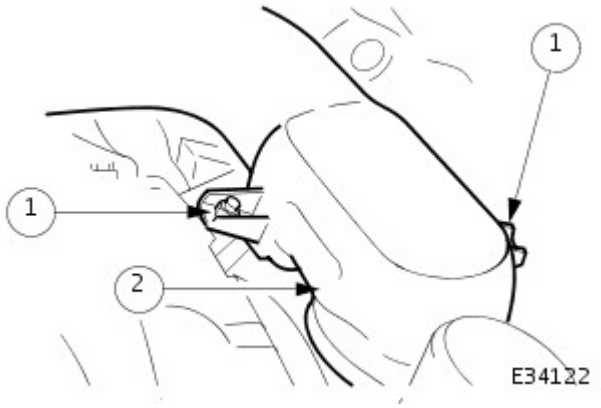
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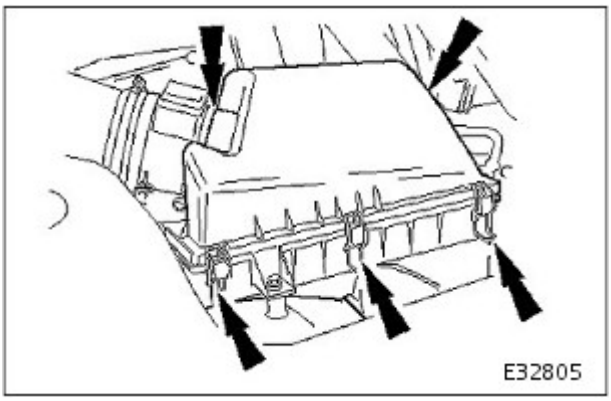
12. Remove the crankshaft damper. Refer to Operation 12.21.09.

13. Carefully remove the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

14. Disconnect the intake tube from the throttle body.

1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.





15. Disconnect the air cleaner cover.

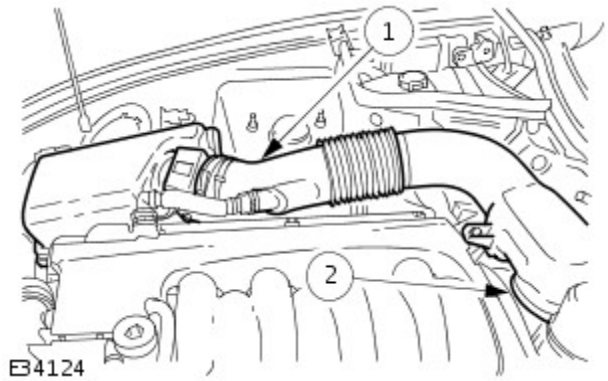
- Release the five clips which secure the air cleaner cover.

16. Disconnect the air flow meter multi-plug.

17. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.

2. Remove and discard the rubber seal; air intake tube to throttle body.



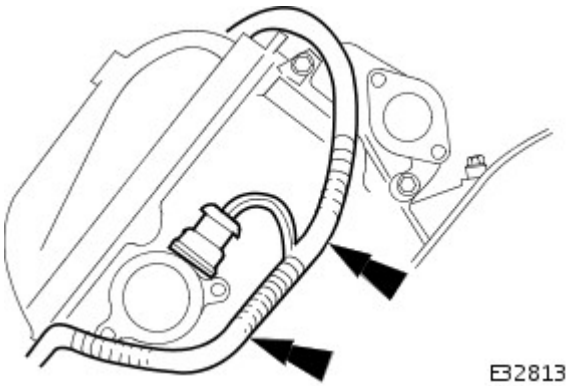
18. Remove the purge valve, from the evaporative control system. Refer to Operation 17.45.01.

19. Remove the on-plug ignition coils. Refer to Operation 18.20.41 and 18.20.42.

20. Remove the camshaft covers. Refer to Operations 12.29.43 and 12.29.44.

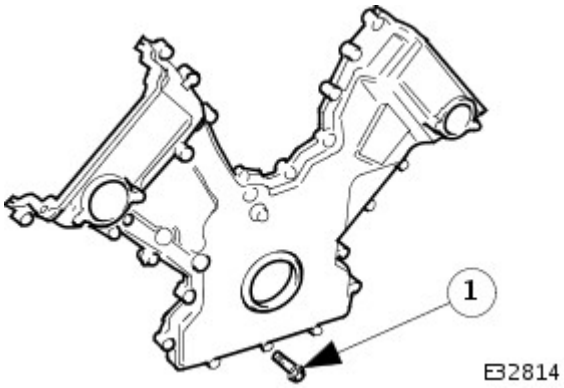
21. Remove the variable valve timing solenoids. Refer to Operation18.30.63.

22. Disconnect the engine harness retaining clips from the timing cover.



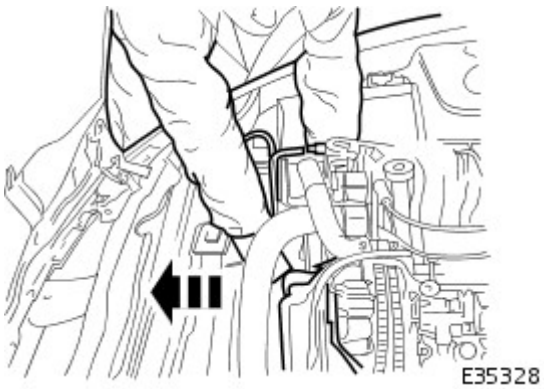
23. Remove the timing cover securing bolts.

1. Remove the twenty-four bolts which secure the timing cover.



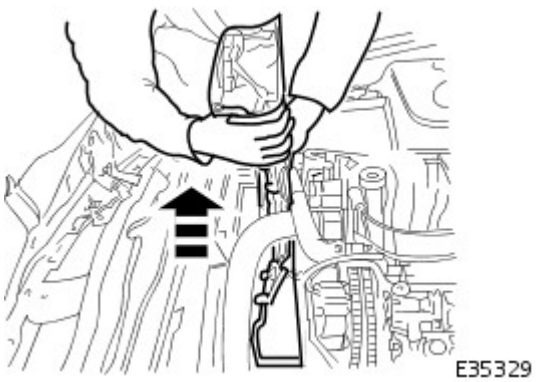
24. Remove the timing cover, step 1.

- Ease the cover towards the front of the vehicle to separate it from the engine.



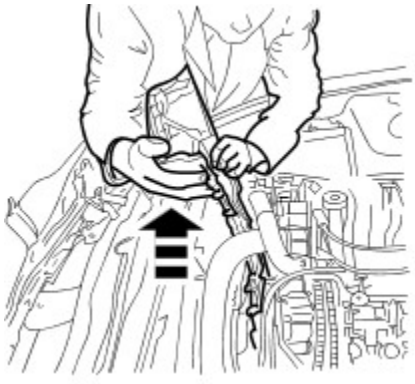
25. Remove the timing cover, step 2.

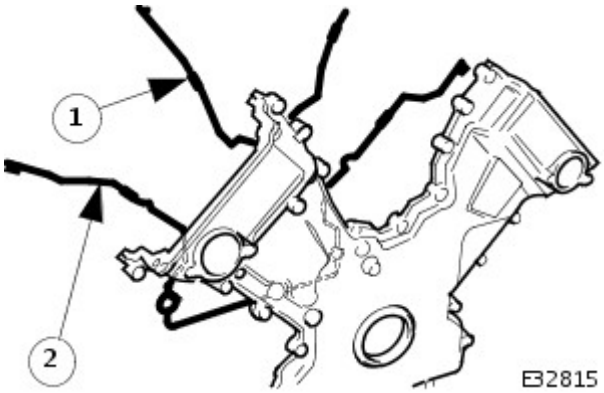
- Standing at the right hand side of the vehicle, rotate and manoeuvre the cover upwards to clear the water pump and hoses.



26. Remove the timing cover, step 3.

- Lift the cover clear of the engine compartment.





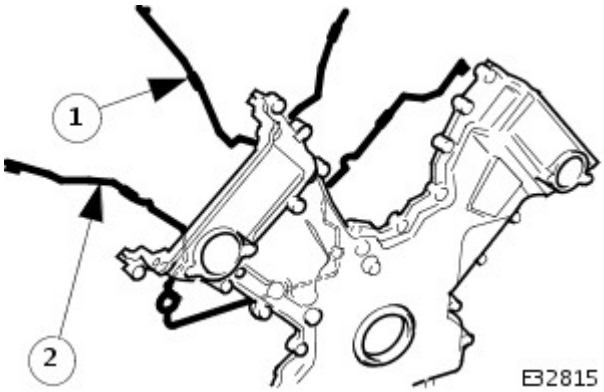
27. Remove and discard the inner and outer seals from the timing cover.

1. Remove the seal from the inner groove on the face of the timing cover.
2. Remove the seal from the outer groove on the face of the timing cover.

- Check the condition of the oil seal and renew as necessary.

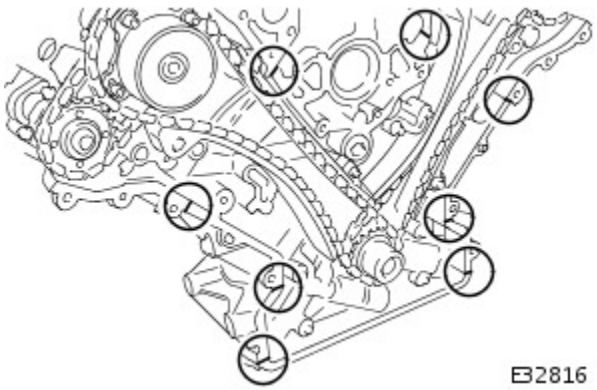
28. Clean all parts and mating faces.

Installation



1. Fit new seals to the timing cover.

1. Fit and fully locate, a new seal to the inner groove on the face of the timing cover.
2. Fit and fully locate, a new seal to the outer groove on the face of the timing cover.

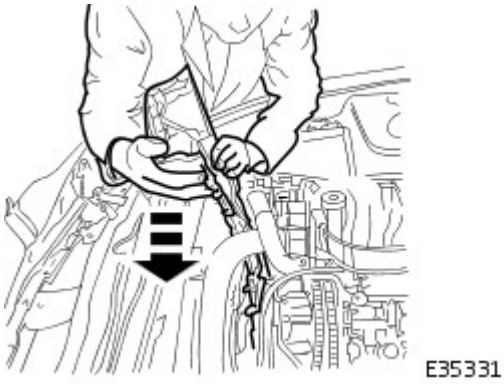


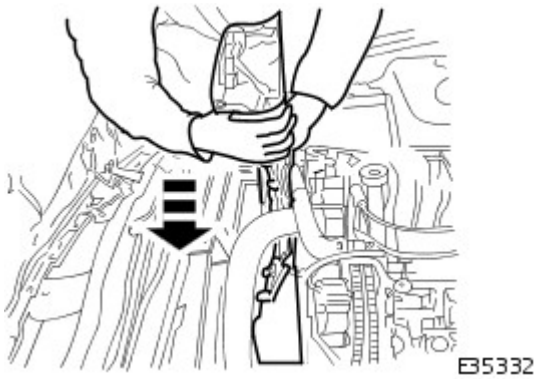
2. Apply sealant to the eight joints on the engine face.

- Sealant beads to be 3mm diameter and 12mm long. Cut the nozzle of the sealant tube to produce a 3mm bead. (Fit and tighten the securing bolts within twenty minutes of sealant application)

3. Refit the timing cover, step 1.

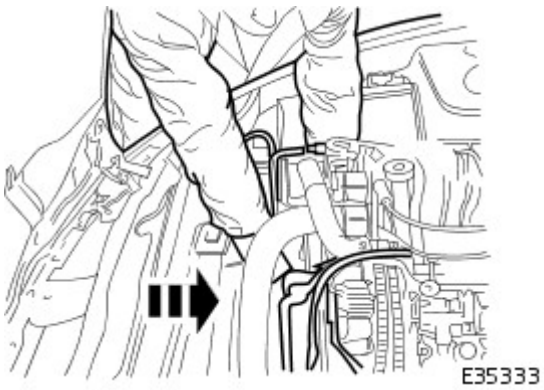
- Lower the cover into the engine compartment, to its approximate position.





4. Refit the timing cover, step 2.

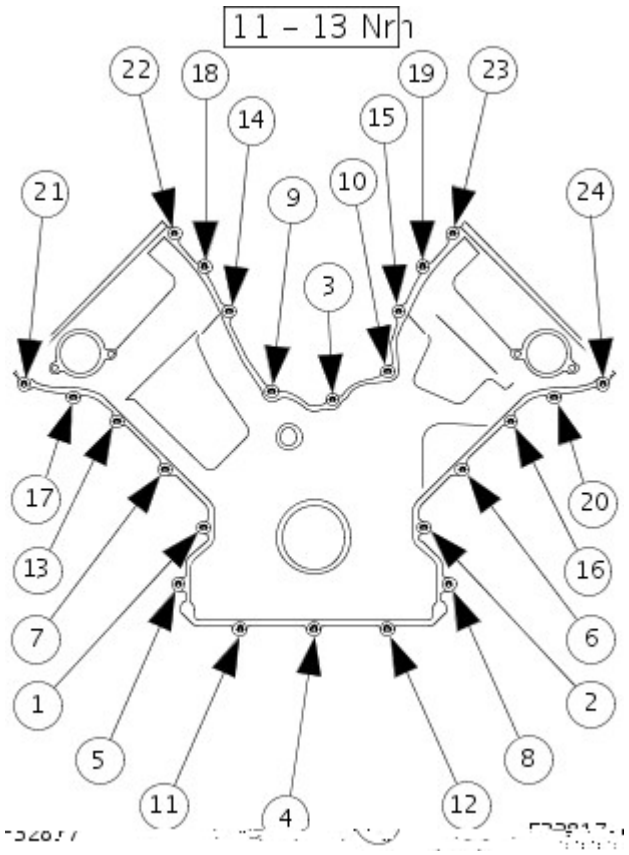
- Standing at the right hand side of the vehicle, rotate and manoeuvre the cover downwards to clear the water pump and hoses.

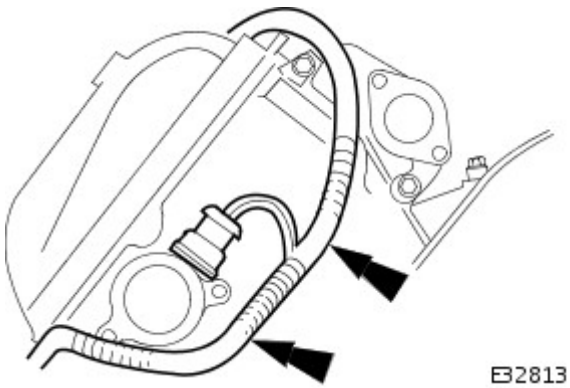


5. Refit the timing cover, step 3.

- Ease the cover towards the engine and locate it directly onto the dowels so that the gaskets or sealant are not smeared.

6. Fit and tighten the securing bolts in the correct order. Tighten to 11-13 Nm.





7. Reposition and secure the engine harness clips to the timing cover.

8. Refit the variable valve timing solenoids. Refer to Operation 18.30.63.

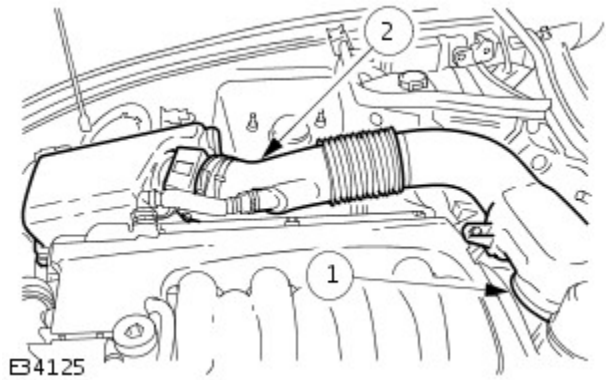
9. Refit the camshaft covers. Refer to Operations 12.29.43.and 12.29.44.

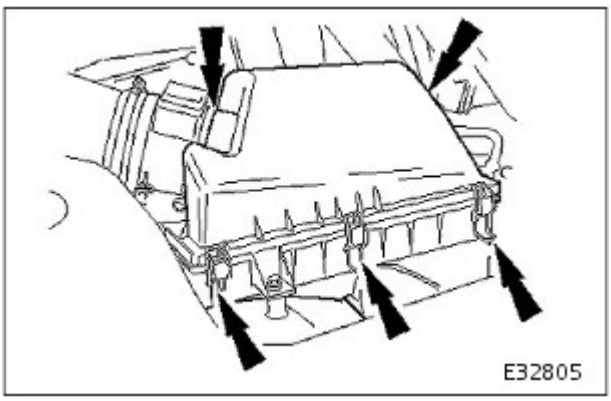
10. Refit the on-plug ignition coils and coil covers. Refer to Operation 18.20.41 and 18.20.42.

11. Refit the purge valve. Refer to Operation 17.45.01.

12. Fit the intake tube / air flow meter / air cleaner cover assembly.

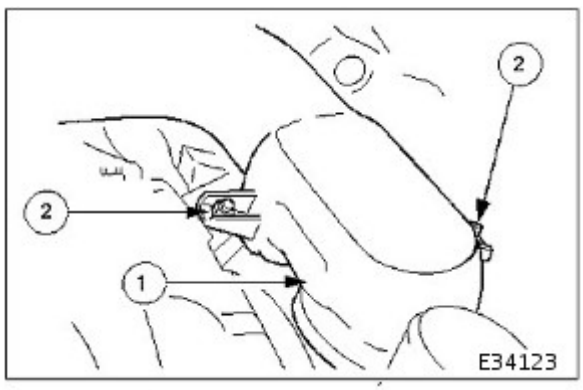
1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.





13. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.



14. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

15. Reconnect the air flow meter multi-plug.

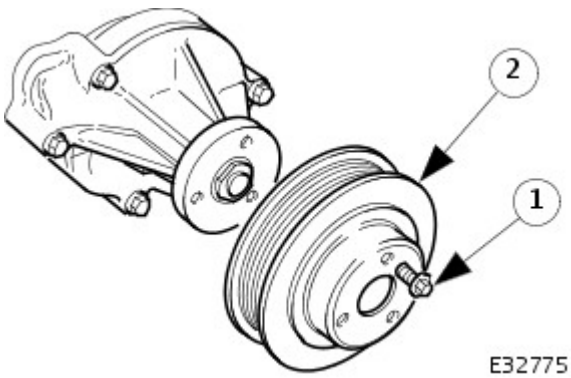
16. Refit the engine covers.

17. Refit the crankshaft damper. Refer to Operation 12.21.09.

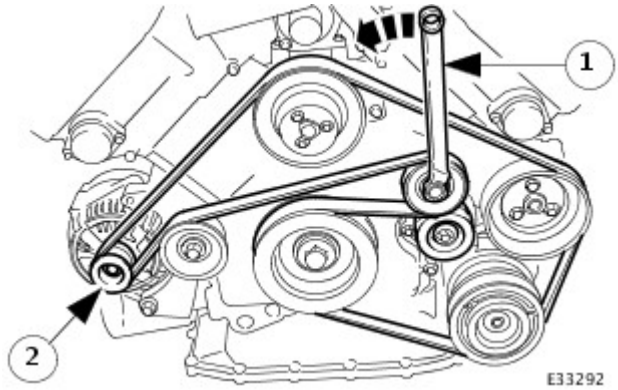
18. Refit the idler pulley, to the Front Accessory Drive. Refer to Operation 12.10.43.

19. Refit the belt tensioner assembly, to the Front Accessory Drive. Refer to Operation 12.10.41.

20. Refit the pulley to the water pump.



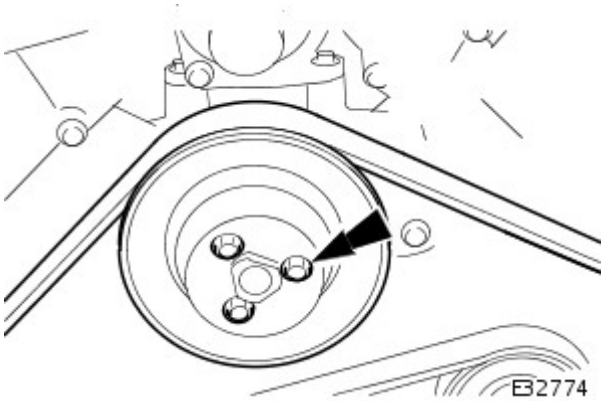
1. Refit the pulley to the water pump.
2. Fit the pulley securing screws. Tighten as far as possible; then to the correct torque after the belt has been fitted.



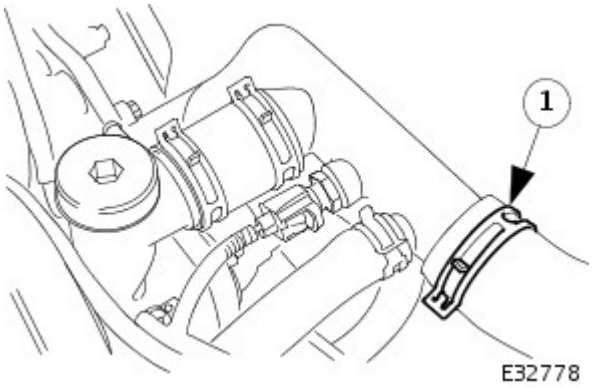
21. Refit the drive belt to the generator and accessory drive.

- Locate the belt around the pulleys, except the generator pulley.

1. Use a spanner e.g. Churchill JD - 230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
2. Whilst holding the tensioner against spring tension, connect the drive belt to the generator pulley. Release the tensioner slowly and remove the spanner.

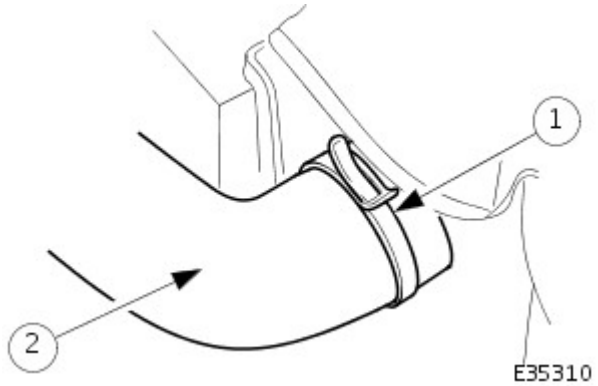


22. Tighten the three screws which secure the water pump pulley, to 10-14 Nm.



23. Connect the top hose to the coolant outlet pipe.

1. Connect the top hose. Reposition the hose clip and tighten.



24. Connect the radiator top hose.

1. Connect the hose to the radiator.
2. Reposition the clip along the hose and tighten the clip.

25. Reset the bonnet to the normal position and connect the gas struts.

26. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

27. Refill the cooling system. Refer to Operation 26.10.01.

28. Remove the paintwork protection sheets and close the engine compartment.

Engine - Exhaust Camshaft LH

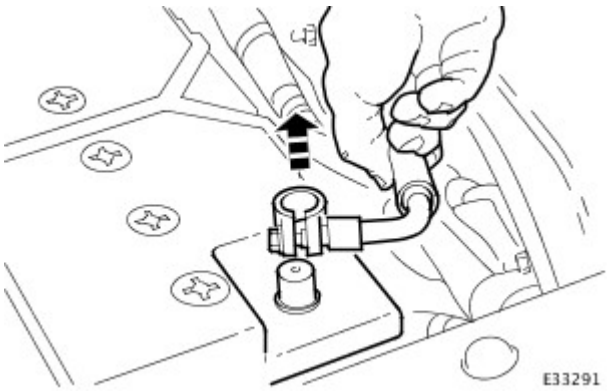
In-vehicle Repair

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

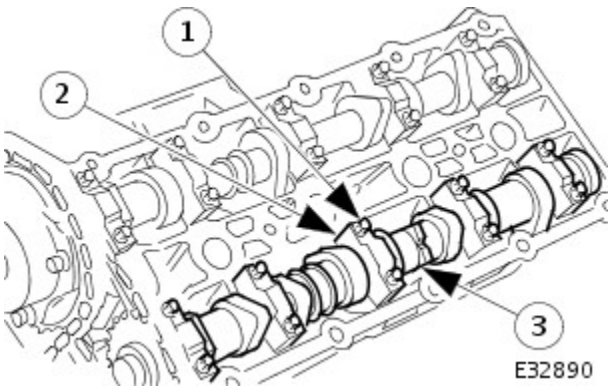


- Remove the battery cover.

4. Remove Exhaust Camshaft Sprocket. Refer to Operation 12.65.74.

5. Remove the camshaft locking tool 303 - 530 (fitted for previous operation).

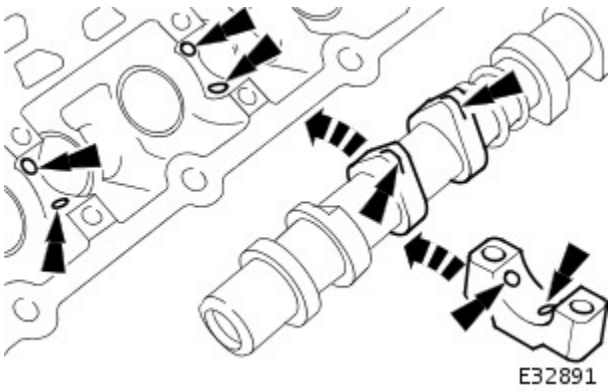
6. Remove the camshaft.



1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.
2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).
3. Remove the camshaft from the engine.

7. Clean and inspect all relevant components.

Installation

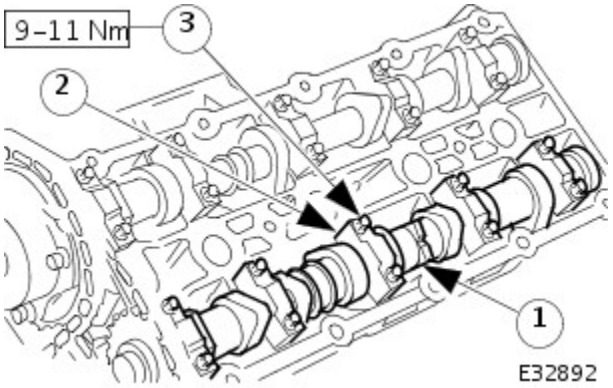


1. Apply oil (EP - 90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.

2. Refit the camshaft.

1. Fit the camshaft to position in the cylinder head, with the timing flats uppermost.



2. Fit the camshaft caps to their respective locations (5 to 9 from the front) and in the correct orientation (arrow to front of engine).

3. Fit and tighten the cap securing bolts. Tighten evenly, in stages, to 9 - 11 Nm.

3. Fit the camshaft locking tool 303 - 530 (fitted for following operation) align the camshaft as necessary.

4. Refit Exhaust Camshaft Sprocket. Refer to Operation 12.65.74.

5. With the camshaft (303 - 530) and crankshaft (303 - 531) setting tools removed, after the previous operation, adjust the valve clearances on the exhaust camshaft. refer to Operation 12.29.48.

6. Move the engine compartment cover from the service position and connect the gas struts.

7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Camshaft RH

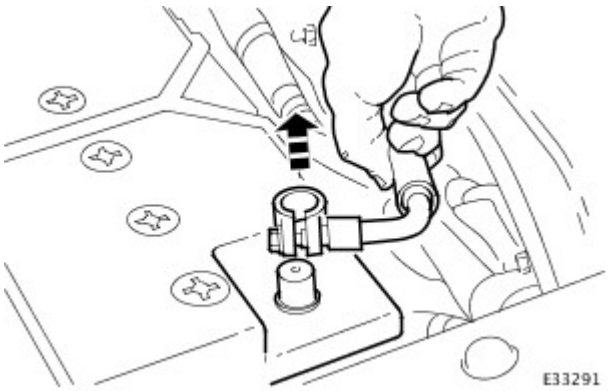
In-vehicle Repair

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

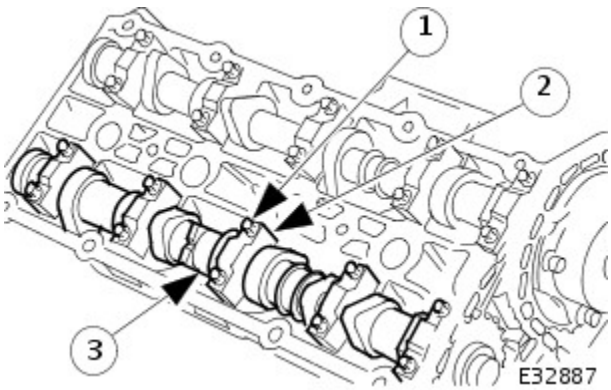


- Remove the battery cover.

4. Remove Exhaust Camshaft Sprocket. Refer to Operation 12.65.73.

5. Remove the camshaft locking tool 303 - 530 (fitted for previous operation).

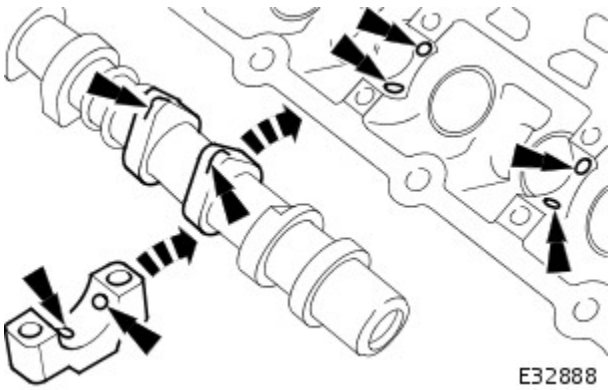
6. Remove the camshaft.



1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.
2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).
3. Remove the camshaft from the engine.

7. Clean and inspect all relevant components.

Installation

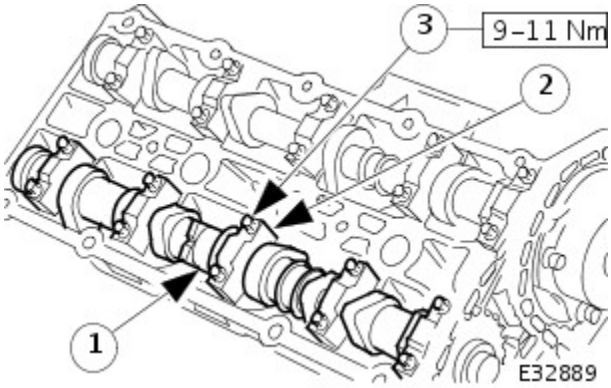


1. Apply oil (EP - 90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.

2. Refit the camshaft.

1. Fit the camshaft to position in the cylinder head, with the timing flats uppermost.



2. Fit the camshaft caps to their respective locations (5 to 9 from the front) and in the correct orientation (arrow to front of engine).

3. Fit and tighten the cap securing bolts. Tighten evenly, in stages, to 9 - 11 Nm.

3. Fit the camshaft locking tool 303 - 530 (fitted for following operation) align the camshaft as necessary.

4. Refit Exhaust Camshaft Sprocket. Refer to Operation 12.65.73.

5. With the camshaft (303 - 530) and crankshaft (303 - 531) setting tools removed, after the previous operation, adjust the valve clearances on the exhaust camshaft. refer to Operation 12.29.48.

6. Move the engine compartment cover from the service position and connect the gas struts.

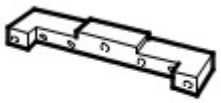
7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Camshaft Sprocket LH4.0L NA V8 - AJ27

In-vehicle Repair

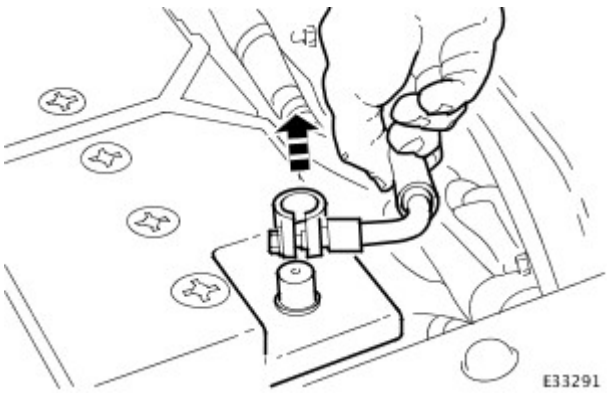
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.



3. Remove the Cam Cover from Bank 2. Refer to Operation 12.29.43.

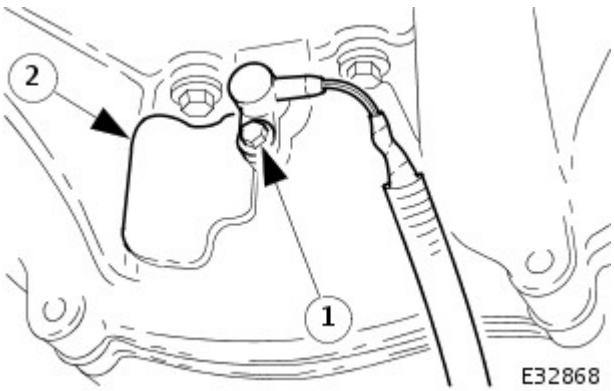
4. Raise the vehicle on a ramp.

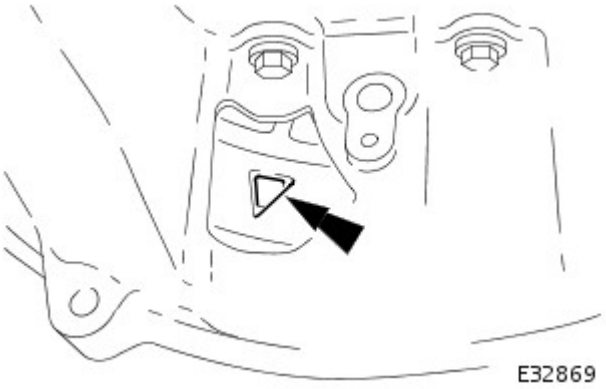
5. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

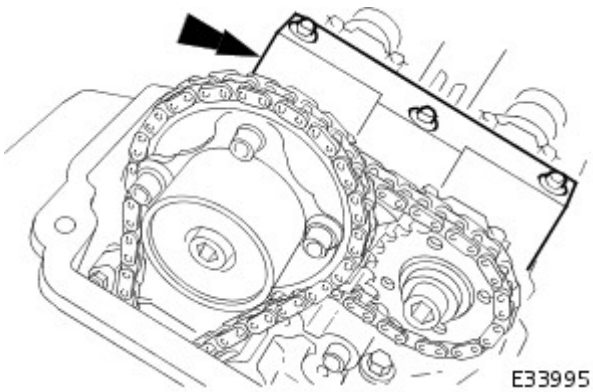
1. Install the crankshaft setting peg 303-531.

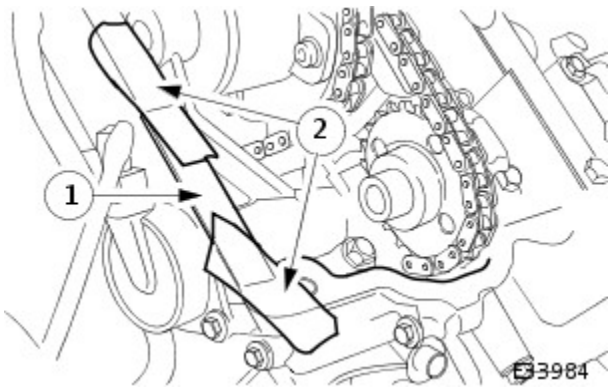
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 2 camshafts, aligning the shafts slightly as necessary.





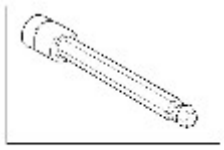
10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

Protect the upper face of the timing cover from scratches, when removing the bolt which secures the sprocket.

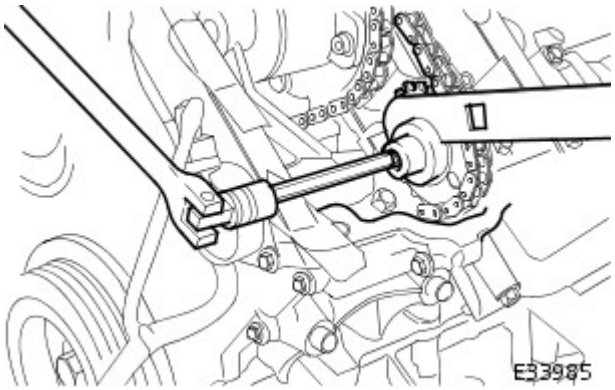
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.



E34593

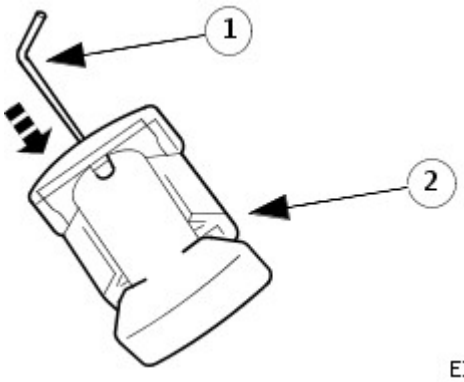


12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.
- Remove the sprocket and leave the chain resting on the cylinder head.

13. Clean and inspect all relevant components.

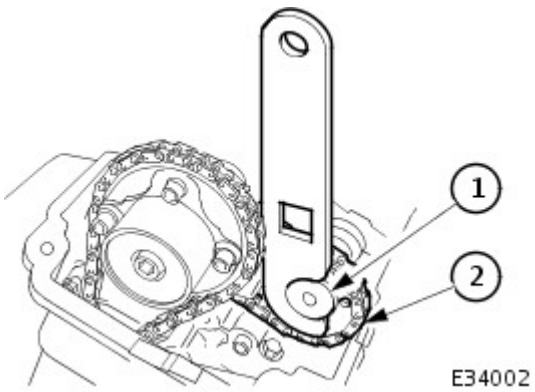
Installation



1. Push the tensioner piston into the body to provide clearance for installing. Tensioner fitted to cylinder head.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

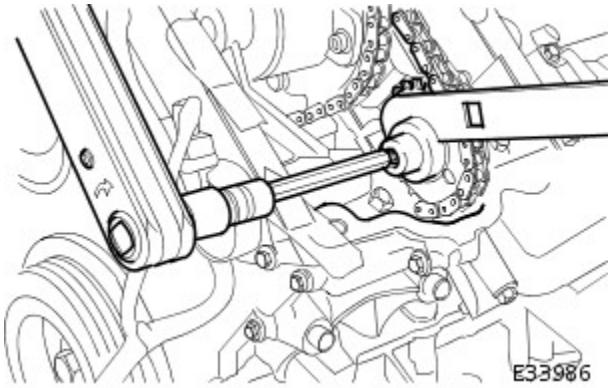


2. Install the sprocket to the secondary chain.

1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.
2. Adjust the position of the sprocket within the chain to allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

3. Install the camshaft sprocket.

- Apply force to the tool (303-532) in an anti-clockwise direction to tension the chain on its drive side.
- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.



4. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

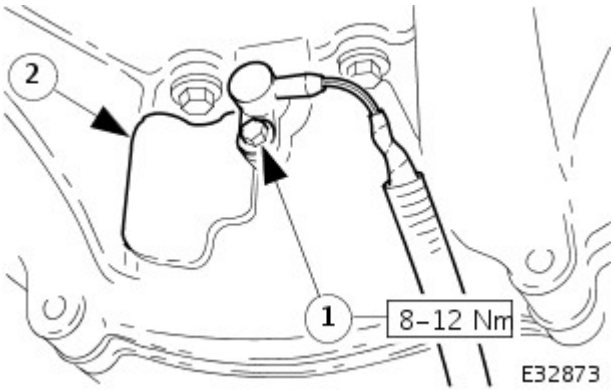
5. Remove the camshaft locking tool.

6. Install the Cam Cover to Bank 2. Refer to Operation 12.29.43.

7. Raise the vehicle on the ramp.

8. Remove the crankshaft setting tool 303-531.

9. Install the crankshaft position sensor.



1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Install the access grommet to the housing.

10. Lower the ramp.

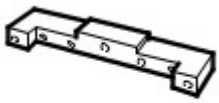
11. Remove the paint protection sheets and close the engine compartment cover.

12. Connect the battery and install the battery cover.

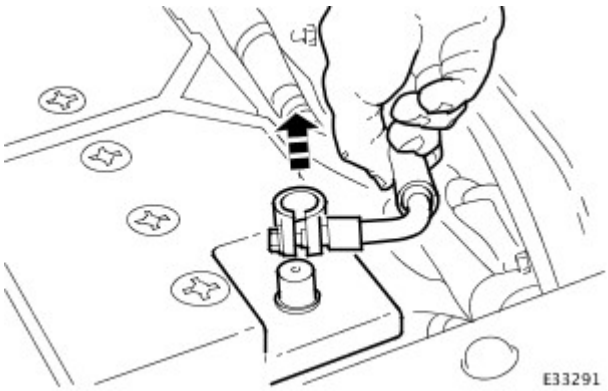
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Camshaft Sprocket LH4.0L SC V8 - AJ26 / 3.2L NA V8 - AJ26

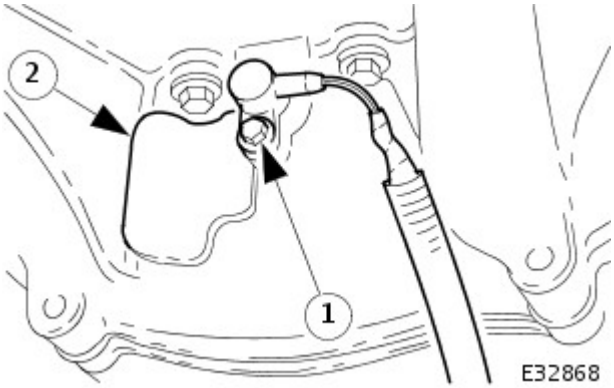
In-vehicle Repair

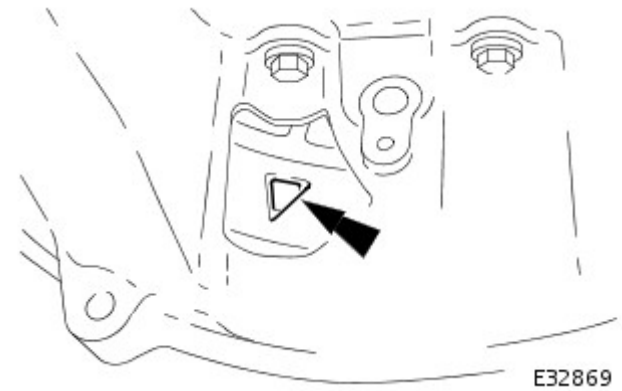
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal


E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Cam Cover from Bank 2. Refer to Operation 12.29.43.
4. Raise the vehicle on a ramp.
5. Remove the crankshaft position sensor.
   1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
   - Remove the sensor and allow it to hang free under the engine.
   2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

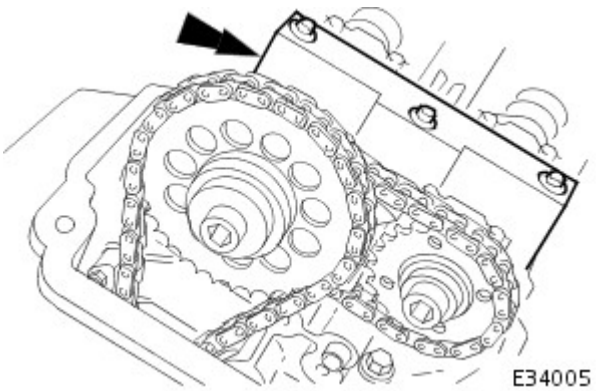
1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

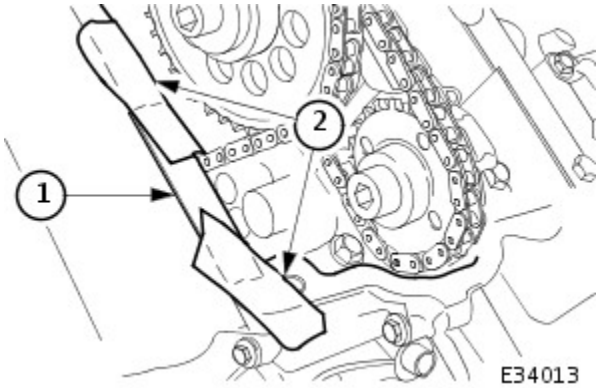
8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 2 camshafts, aligning the shafts slightly as necessary.



10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

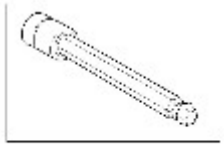
Protect the upper face of the timing cover from scratches, when



removing the bolt which secures the sprocket.

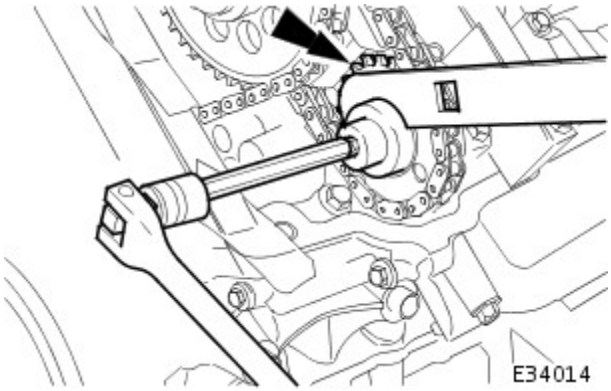
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.



E34593

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.

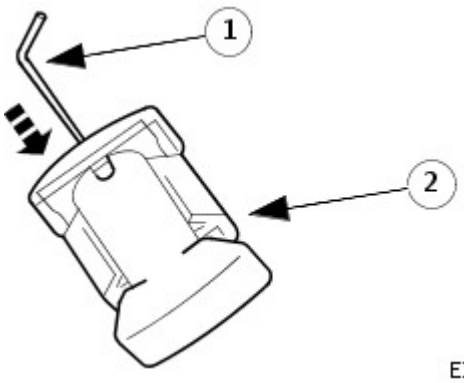


12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.
- Remove the sprocket and leave the chain resting on the cylinder head.

13. Clean and inspect all relevant components.

Installation



1. Push the tensioner piston into the body to provide clearance for installing. Tensioner fitted to cylinder head.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.

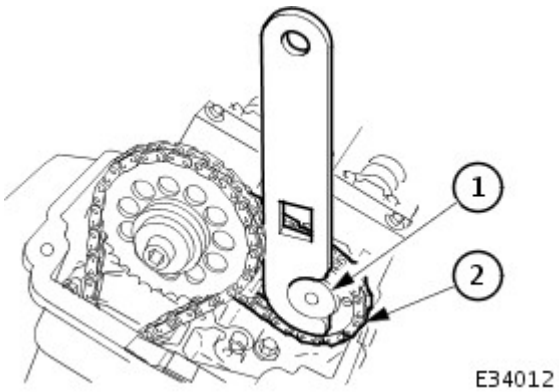
2. With the wire in position, press the piston fully into the tensioner body.

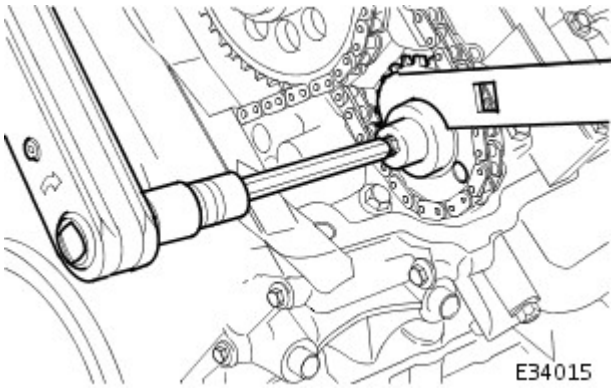
- Remove the wire.

2. Install the sprocket to the secondary chain.

1. With the sprocket installed to the chain, temporarily position the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to allow the chain tensioning tool 303-532 to be approximately vertical, as shown.





3. Install the camshaft sprocket.

- Install the bolt to secure the sprocket.
- Apply force to the tool (303-532) in an anti-clockwise direction to tension the chain on its drive side.
- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.

4. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

5. Remove the camshaft locking tool.

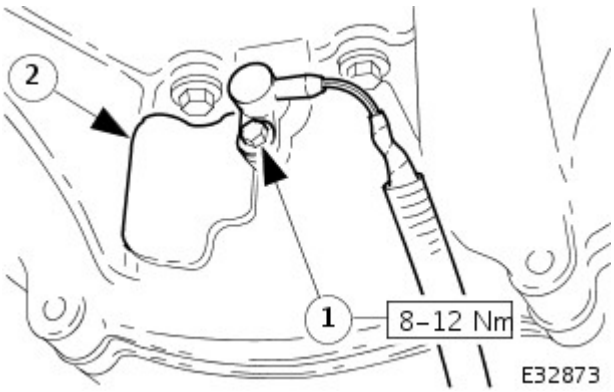
6. Install the Cam Cover to Bank 2. Refer to Operation 12.29.43.

7. Raise the vehicle on the ramp.

8. Remove the crankshaft setting tool 303-531.

9. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.



10. Lower the ramp.

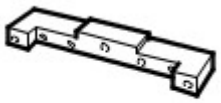
11. Remove the paint protection sheets and close the engine compartment cover.

12. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Camshaft Sprocket RH4.0L NA V8 - AJ27

In-vehicle Repair

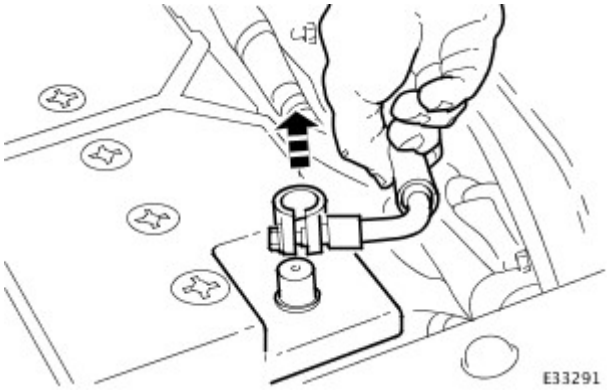
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.



3. Remove the Cam Cover from Bank 1. Refer to Operation 12.29.44.

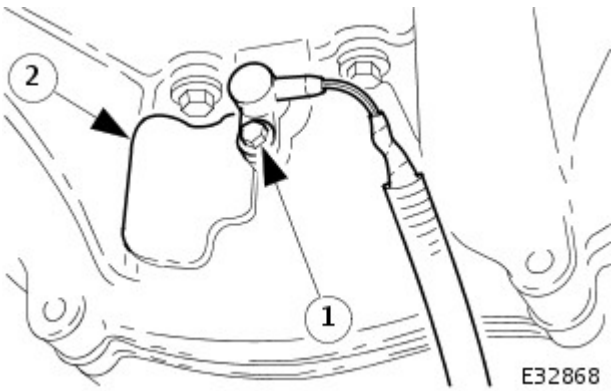
4. Raise the vehicle on a ramp.

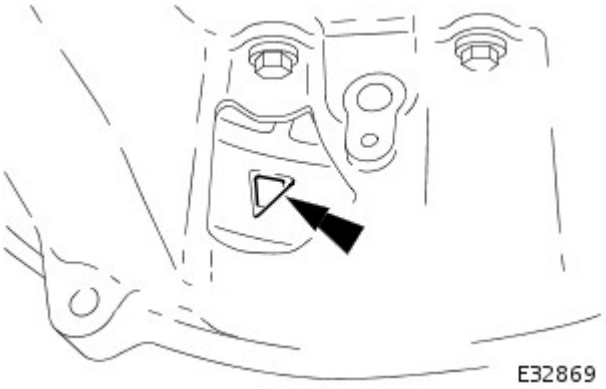
5. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

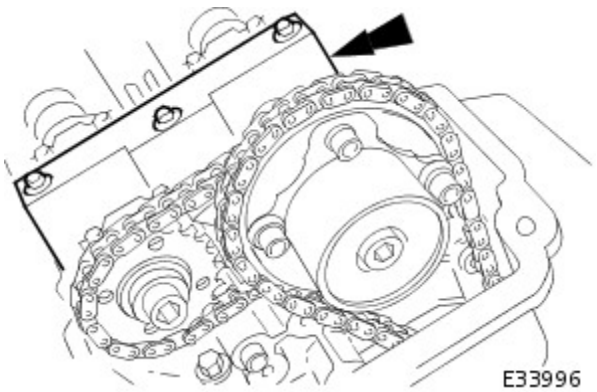
1. Install the crankshaft setting peg 303-531.

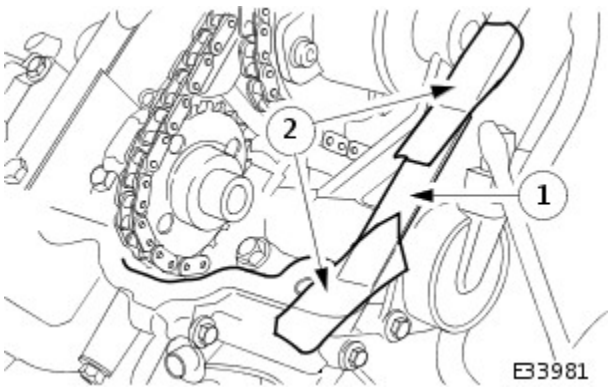
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.





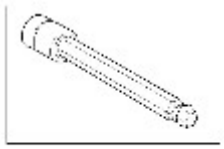
10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

Protect the upper face of the timing cover from scratches, when removing the bolt which secures the sprocket.

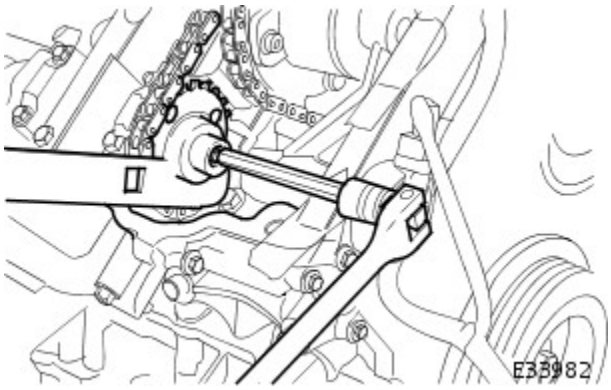
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.

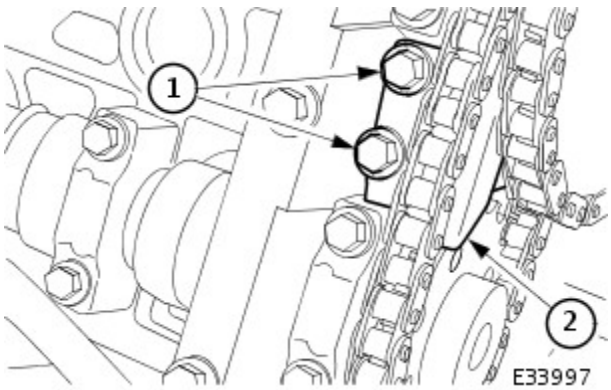


E34593



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner. The tensioner piston cannot be pushed into the body with the assembly in position.

1. Remove the two bolts which secure the tensioner.

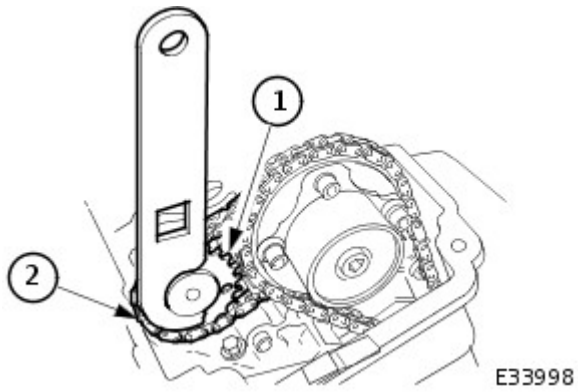
- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket and leave the chain resting on the cylinder head.

15. Clean and inspect all relevant components.

Installation



1. Install the sprocket to the secondary chain.

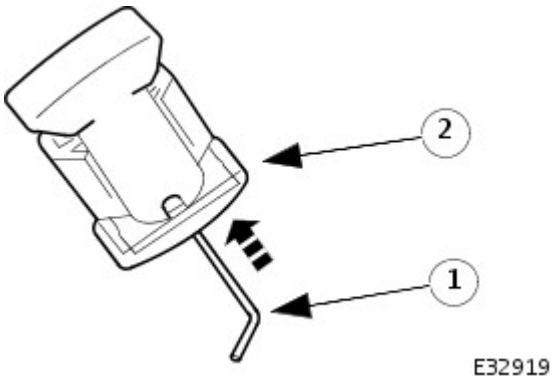
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.

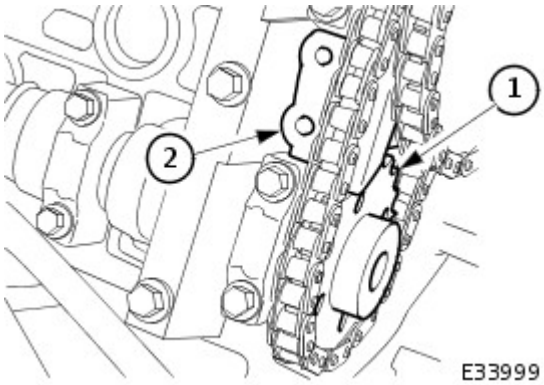
2. Push the tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.



2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

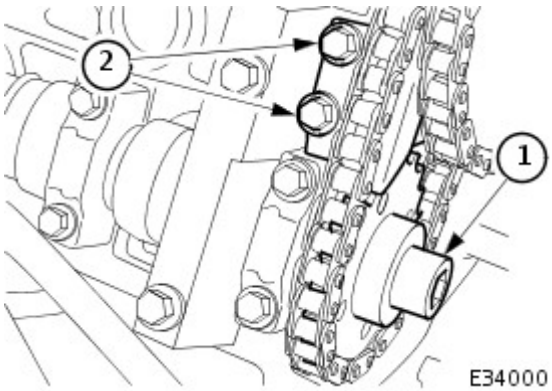


3. Install the chain tensioner between the chain path.

1. Reposition the sprocket, still captive in the chain, upwards for access.

2. Install the chain tensioner between the sprockets.

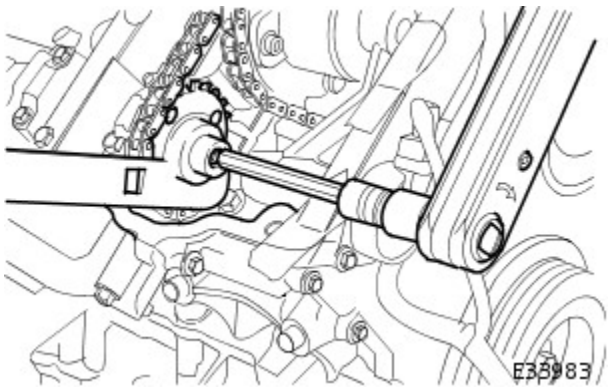
- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.



4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.

2. Install the two bolts which secure the tensioner and tighten to 10-14 Nm.



5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.

- Remove the chain tensioning tool.

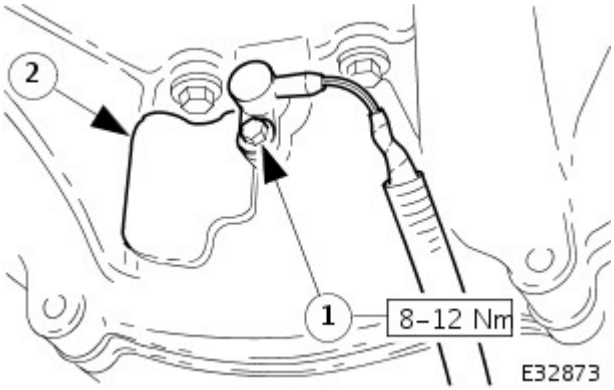
6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 1. Refer to Operation 12.29.44.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.



11. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

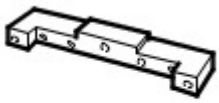
13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

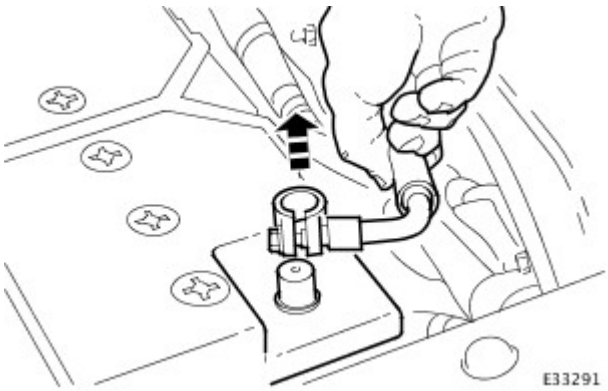
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Camshaft Sprocket RH4.0L SC V8 - AJ26 / 3.2L NA V8 - AJ26

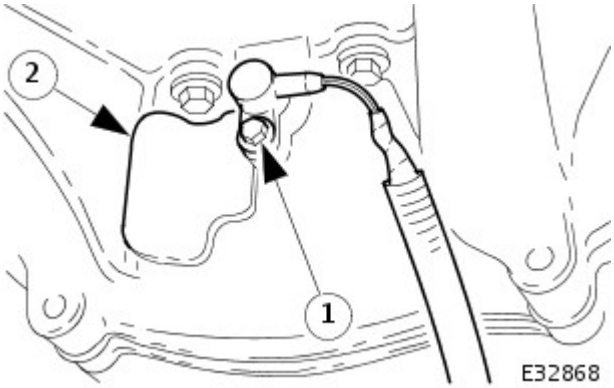
In-vehicle Repair

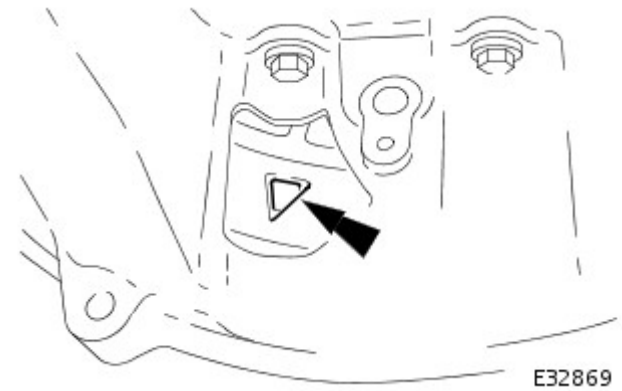
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

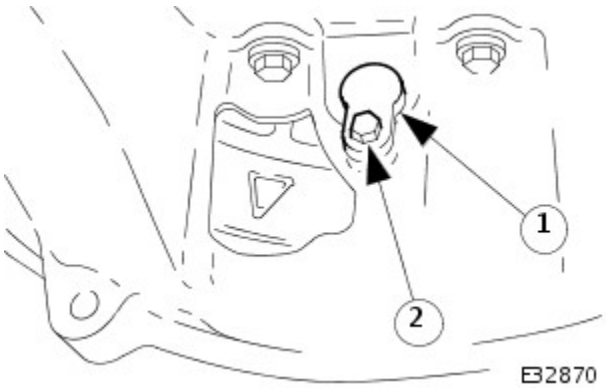

E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Cam Cover from Bank 1. Refer to Operation 12.29.44.
4. Raise the vehicle on a ramp.
5. Remove the crankshaft position sensor.
   1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
   - Remove the sensor and allow it to hang free under the engine.
   2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

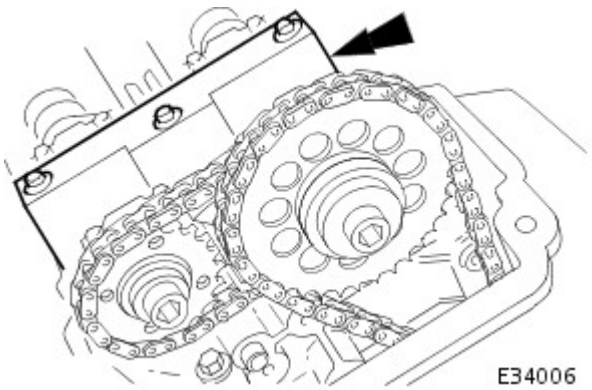
1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

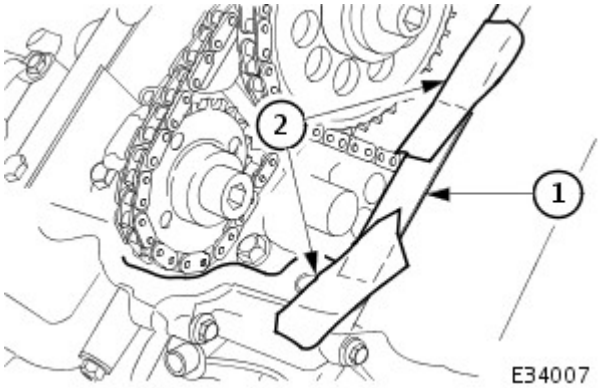
8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.



10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

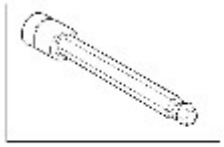
Protect the upper face of the timing cover from scratches, when



removing the bolt which secures the sprocket.

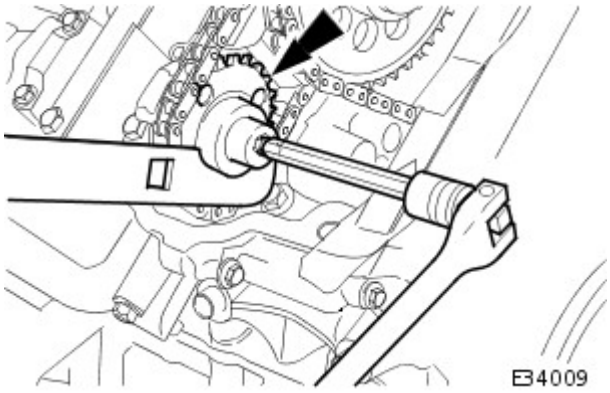
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.



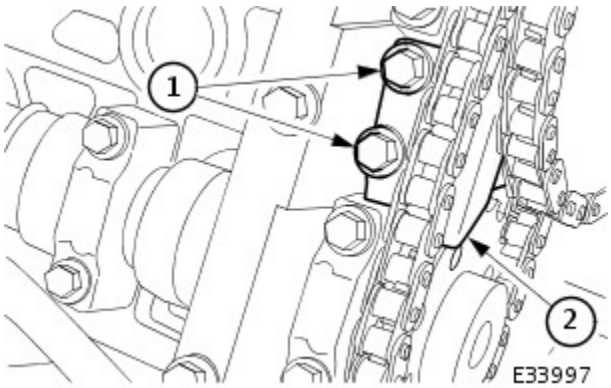
E34593

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner. The tensioner piston cannot be pushed into the body with the assembly in position.

1. Remove the two bolts which secure the tensioner.

- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket and leave the chain resting on the cylinder head.

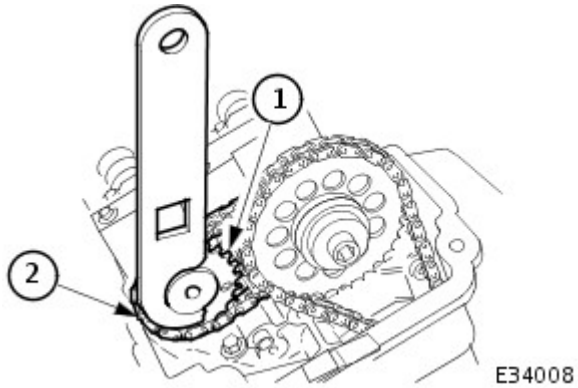
15. Clean and inspect all relevant components.

Installation

1. Install the sprocket to the secondary chain.

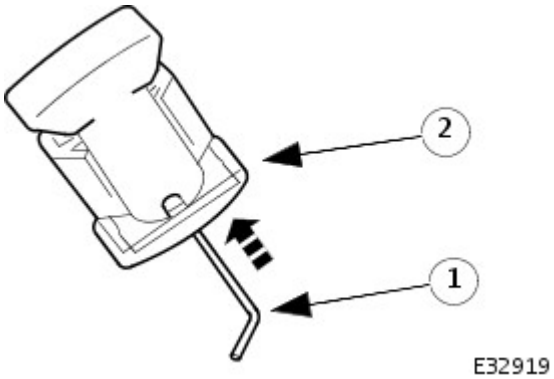
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to



allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

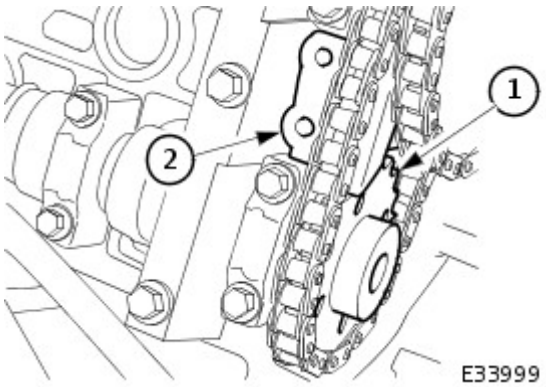
- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.



2. Push the tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

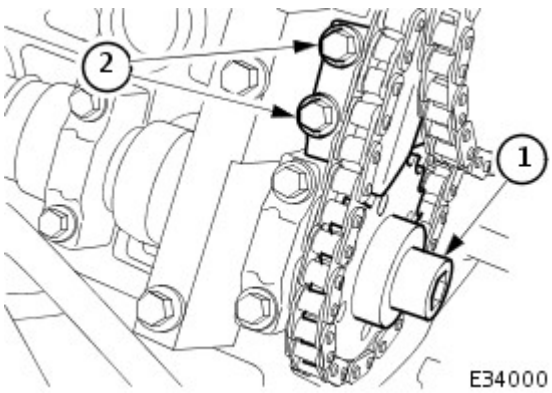
- Remove the wire.



3. Install the chain tensioner between the chain path.

1. Reposition the sprocket, still captive in the chain, upwards for access.
2. Install the chain tensioner between the sprockets.

- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.

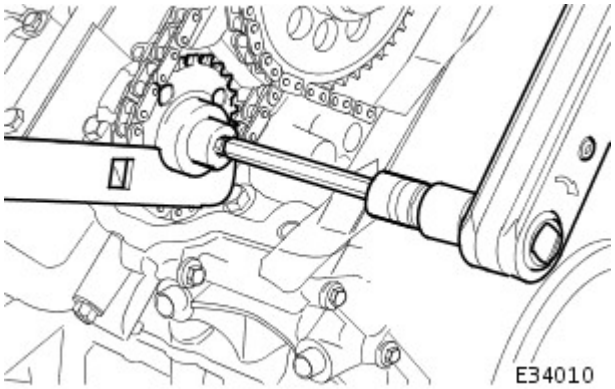


4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.
2. Install the two bolts which secure the tensioner and tighten to 10-14 Nm.

5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.
- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.



- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.

6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

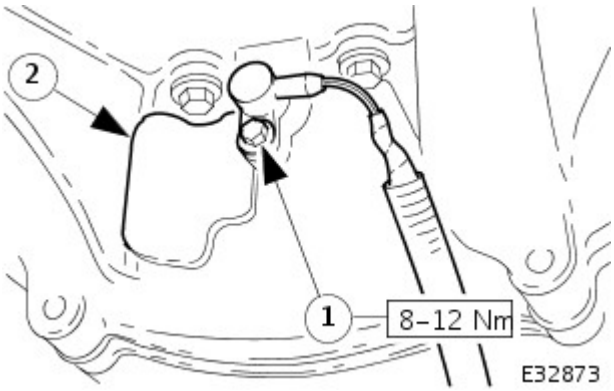
7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 1. Refer to Operation 12.29.44.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.

11. Install the crankshaft position sensor.



1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

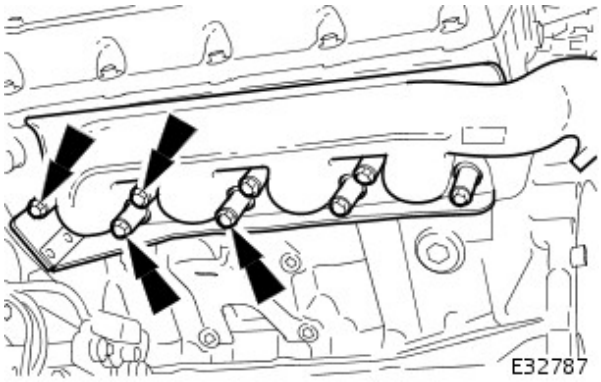
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Exhaust Manifold LH

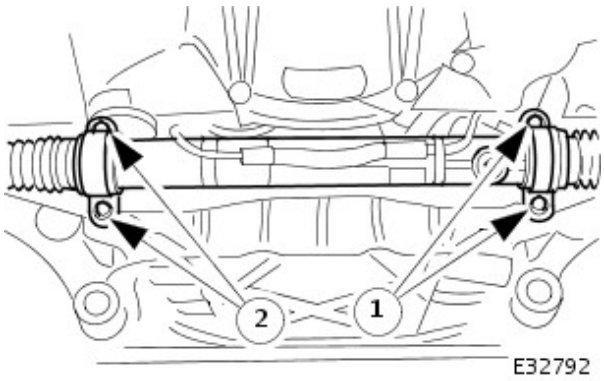
In-vehicle Repair

Removal

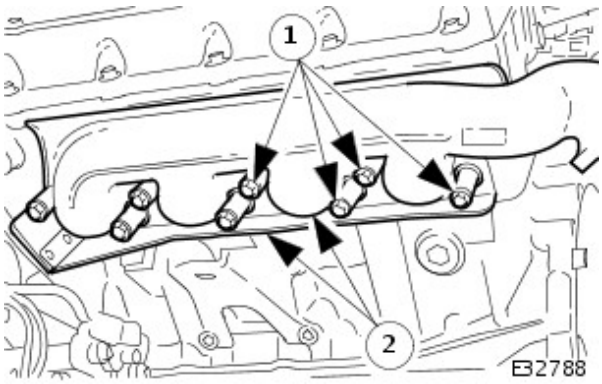
1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the front silencer. Refer to Section 309-00.
3. Remove the downpipe catalytic converter, left hand side. Refer to Section 309-00.
4. Working from above the vehicle, remove the bolts which secure the front section of the exhaust manifold to the cylinder head.



5. If working on a left hand drive vehicle; working from below the vehicle, reposition the steering rack for access.
    1. Remove the two bolts which secure the steering rack at the driver's side.
    2. Loosen, but do not remove, the two bolts which secure the steering rack at the passenger side.
    - Reposition the steering rack for access.



6. Working from below the vehicle, remove the manifold.
    1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.
    2. Remove the manifold and the manifold gasket.



7. Clean the manifold faces (if refitting) and the mating faces on the cylinder head.
8. Use a thread tap (plug) to clean out the threads of the manifold securing bolt holes, in the cylinder head.

Installation

1. Installation is the reverse of removal. Use new gaskets and new securing bolts for the manifold.

Engine - Exhaust Manifold RH

In-vehicle Repair

Removal

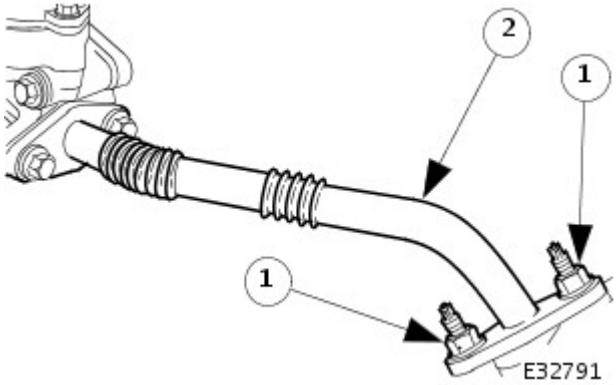
1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the air cleaner assembly. Refer to Section 303-12.

3. Remove the front silencer. Refer to Section 309-00.

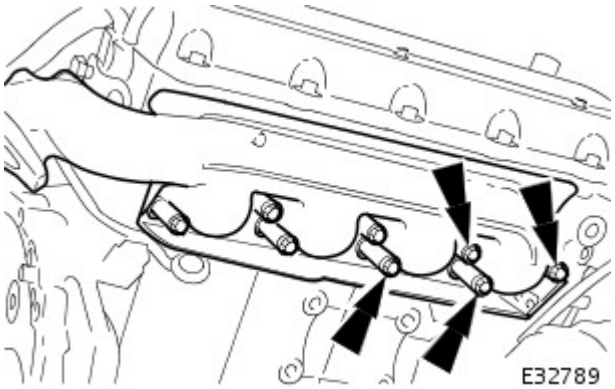
4. Remove the downpipe catalytic converter, right hand side. Refer to Section 309-00.

5. From above the vehicle, disconnect the EGR pipe from the exhaust manifold.

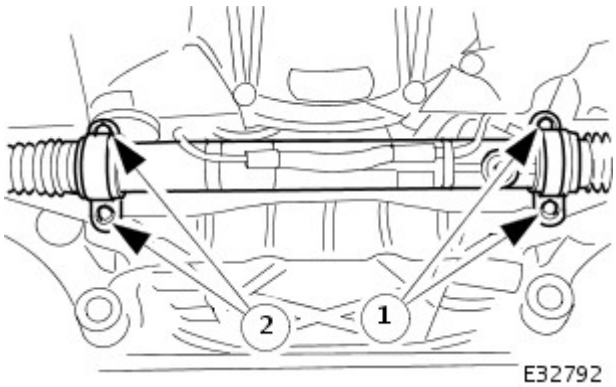


1. Remove the two nuts which secure the EGR flange to the right hand exhaust manifold.
2. Reposition the EGR pipe from the manifold.

6. Remove the bolts which secure the front section of the exhaust manifold to the cylinder head.



7. If working on a right hand drive vehicle; reposition the steering rack for access.

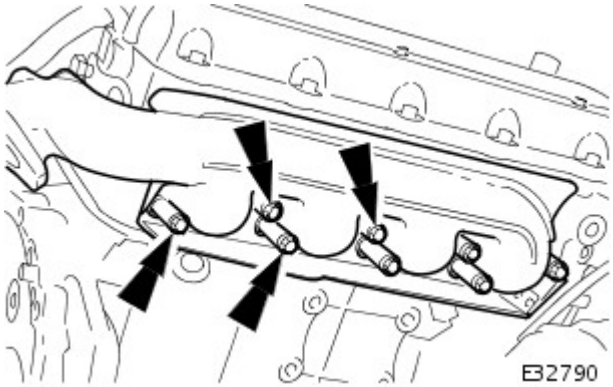


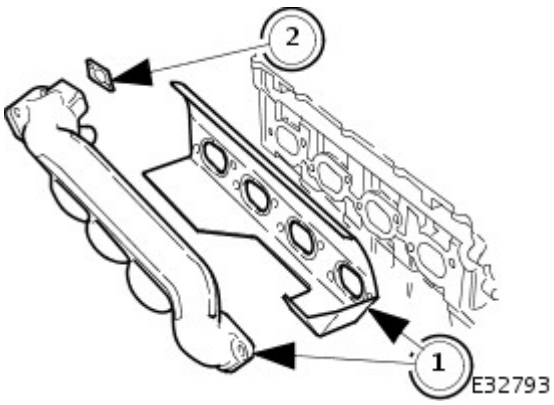
1. Remove the two bolts which secure the steering rack at the passenger side.
2. Loosen, but do not remove, the two bolts which secure the steering rack at the driver's side.

- Reposition the steering rack for access.

8. Working from below the vehicle, remove the manifold bolts.

1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.





9. Remove the manifold.

1. Remove the manifold and the manifold gasket from the cylinder head.
2. Remove the gasket from the EGR flange.

10. If fitting a new manifold, remove the two studs from the EGR flange of the manifold. and transfer them to the new manifold.

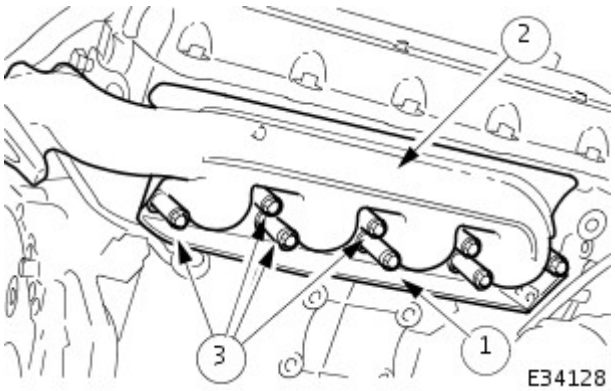
11. Clean the manifold faces (if refitting) and the mating faces on the cylinder head.

12. Use a thread tap (plug) to clean out the threads of the manifold securing bolt holes, in the cylinder head.

Installation

1. Fit a spacer to each new manifold securing bolt (8 bolts).

2. Fit the manifold and manifold gasket.



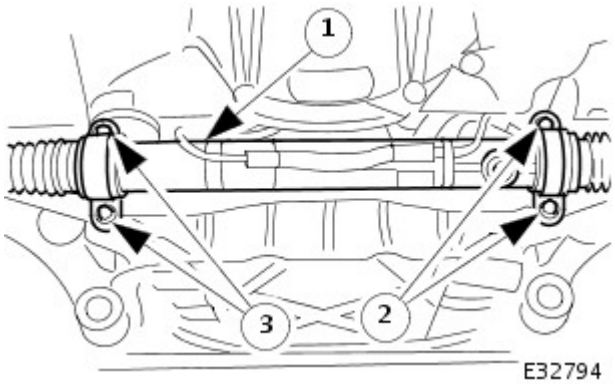
1. Fit and align the new gasket to the cylinder head.
2. Fit and align the manifold to the cylinder head.
3. Fit the rear four bolts which secure the manifold, but do not tighten.

3. Working from above the vehicle, fit and tighten the remaining manifold securing bolts.

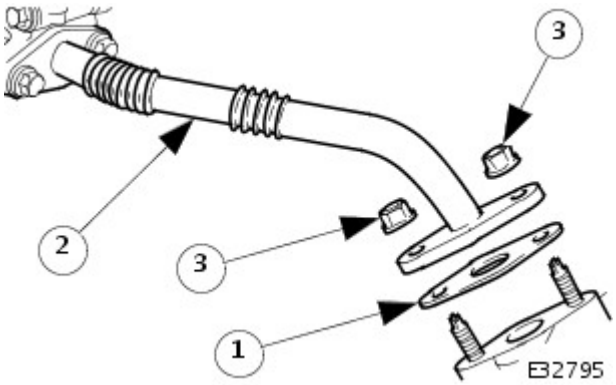
4. Working from below the vehicle, fully tighten the rear bolts on each manifold.

5. Refit the steering rack (if removed for access).

1. Reposition the steering rack.
2. Fit and tighten the rack mounting bolts on the passenger side.



3. Tighten the rack mounting bolts on the driver's side.



6. From above the vehicle, connect the EGR pipe to the exhaust manifold.

1. Fit a new EGR gasket to the manifold.
2. Reposition the EGR pipe to the manifold.
3. Fit the two nuts which secure the EGR flange to the exhaust manifold.

7. Fit the downpipe catalytic converter, right hand side. Refer to Section 309-00.

8. Fit the front silencer. Refer to Section 309-00.

9. Fit the air cleaner assembly. Refer to Section 303-12.

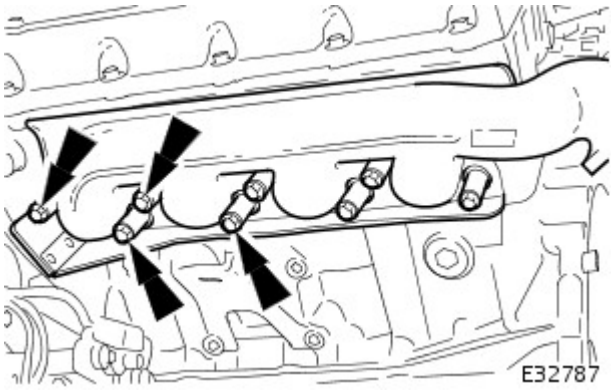
10. Remove paintwork protection sheets and close the engine compartment.

Engine - Exhaust Manifold LH and RH

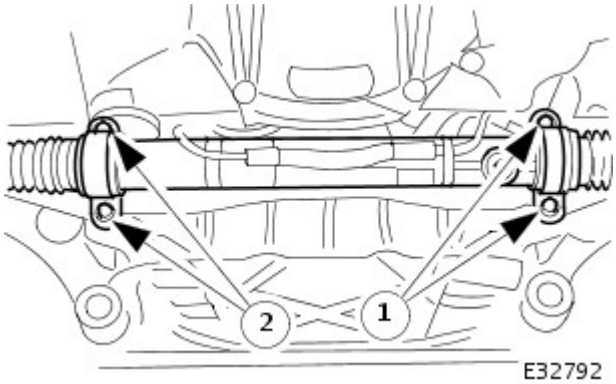
In-vehicle Repair

Removal

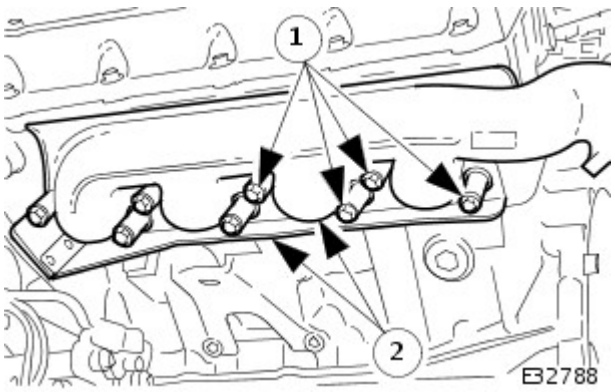
1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the downpipe catalytic converter, right hand side. Refer to Section 309-00.
3. Remove the downpipe catalytic converter, left hand side. Refer to Section 309-00.
4. Remove the front silencer. Refer to Section 309-00.
5. Remove the air cleaner assembly. Refer to Section 303-12.
6. Working from above the vehicle, remove the bolts which secure the front section of the left hand exhaust manifold to the cylinder head.



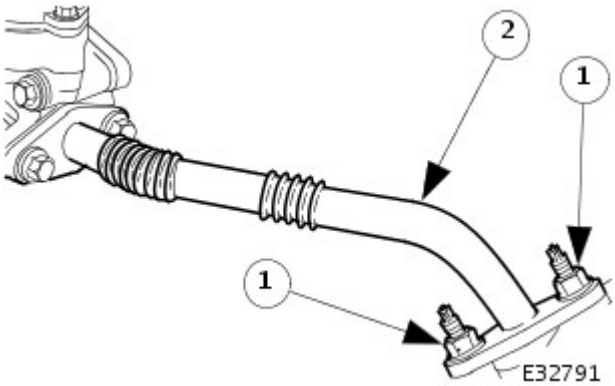
7. Working from below the vehicle, reposition the steering rack for access.
    1. Remove the two bolts which secure the steering rack at the driver's side.
    2. Loosen, but do not remove, the two bolts which secure the steering rack at the passenger side.
    - Reposition the steering rack for access.

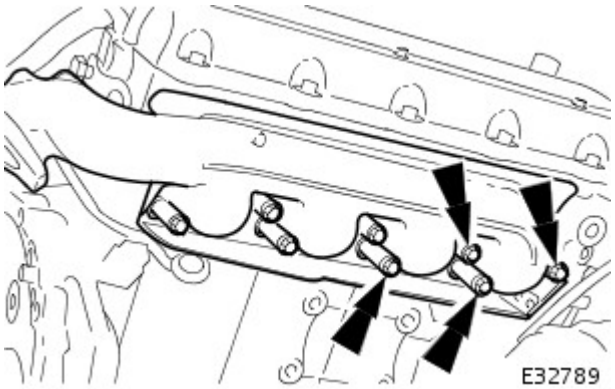


8. Working from below the vehicle, remove the manifold.
    1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.
    2. Remove the manifold and the manifold gasket.

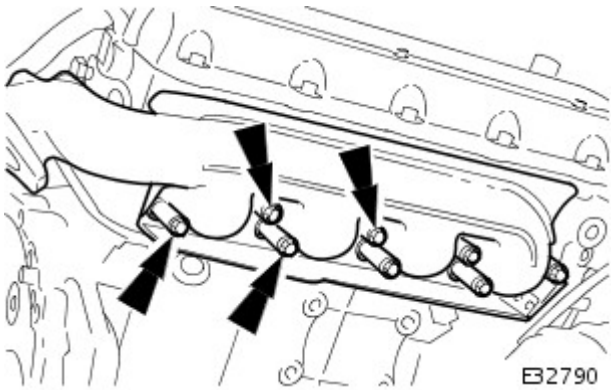


9. From above the vehicle, disconnect the EGR pipe from the right hand exhaust manifold.
    1. Remove the two nuts which secure the EGR flange to the right hand exhaust manifold.
    2. Reposition the EGR pipe from the manifold.



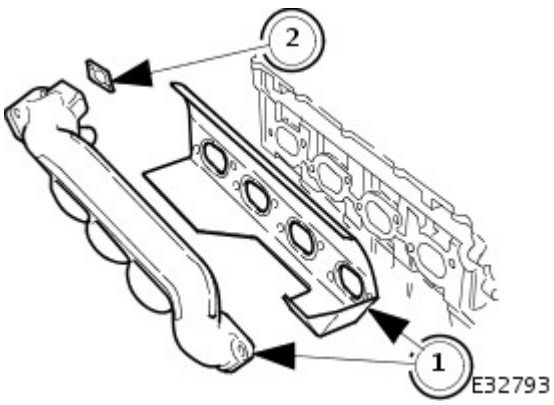


10. Remove the bolts which secure the front section of the right hand exhaust manifold to the cylinder head.



11. Working from below the vehicle, remove the manifold bolts.

1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.



12. Remove the manifold.

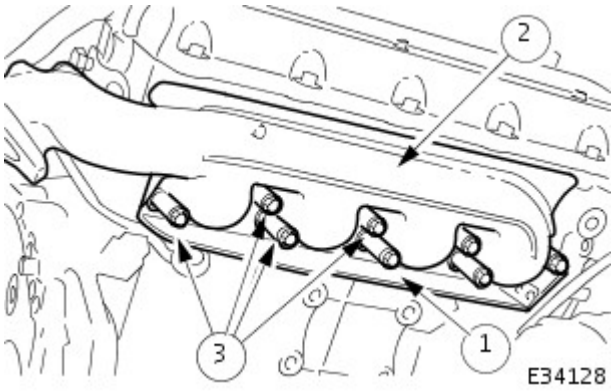
1. Remove the manifold and the manifold gasket from the cylinder head.
2. Remove the gasket from the EGR flange.

13. If fitting a new manifold, remove the two studs from the EGR flange of the manifold. and transfer them to the new manifold.

14. Clean the manifold faces (if refitting), the EGR pipe flange and the mating faces on the cylinder head.

15. Use a thread tap (M8 x 1,25 plug) to clean out the threads of each manifold securing bolt hole, in the cylinder heads.

Installation



1. Use new manifold securing bolts and.fit a spacer to each.

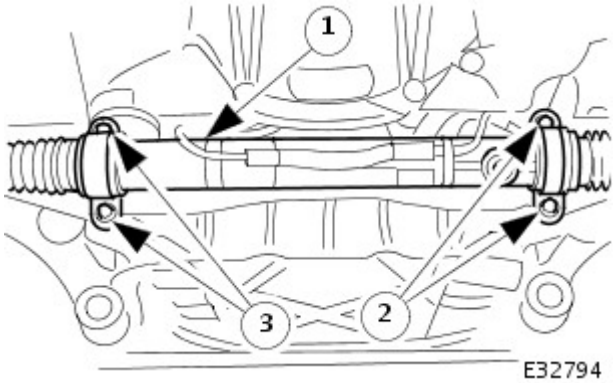
2. Fit each manifold and manifold gasket.

1. Fit and align the new gasket to the cylinder head.
2. Fit and align the manifold to the cylinder head.
3. Fit the rear four bolts which secure the manifold, but do not tighten.

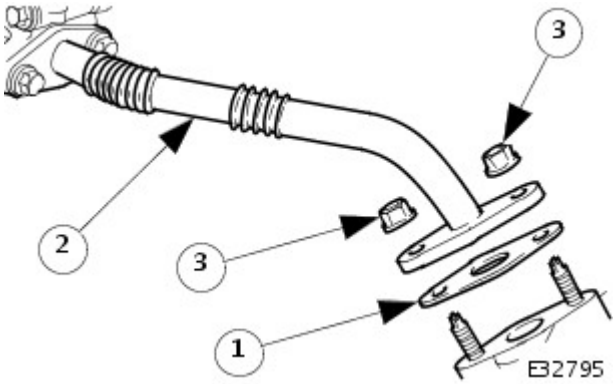
3. Working from above the vehicle, fit and tighten the remaining manifold securing bolts.

4. Working from below the vehicle, fully tighten the rear bolts on each manifold.

5. Refit the steering rack.



1. reposition the steering rack.
2. Fit and tighten the rack mounting bolts on the driver's side.
3. Tighten the rack mounting bolts on the passenger side.



6. From above the vehicle, connect the EGR pipe to the right hand exhaust manifold.

1. Fit a new EGR gasket to the manifold.
2. Reposition the EGR pipe to the manifold.
3. Fit the two nuts which secure the EGR flange to the exhaust manifold.

7. Fit the downpipe catalytic converter, left hand side. Refer to Section 309-00.

8. Fit the downpipe catalytic converter, right hand side. Refer to Section 309-00.

9. Fit the front silencer. Refer to Section 309-00.

10. Fit the air cleaner assembly. Refer to Section 303-12.

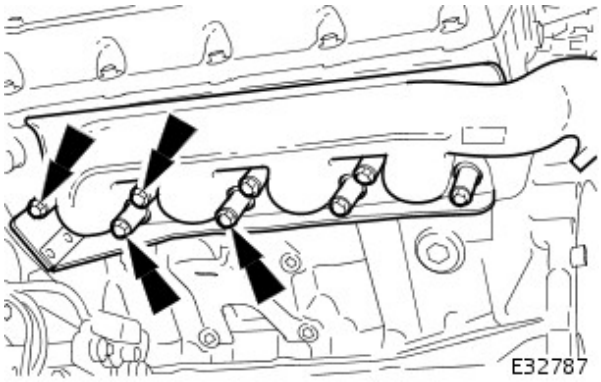
11. Remove paintwork protection sheets and close the engine compartment.

Engine - Exhaust Manifold Gasket LH

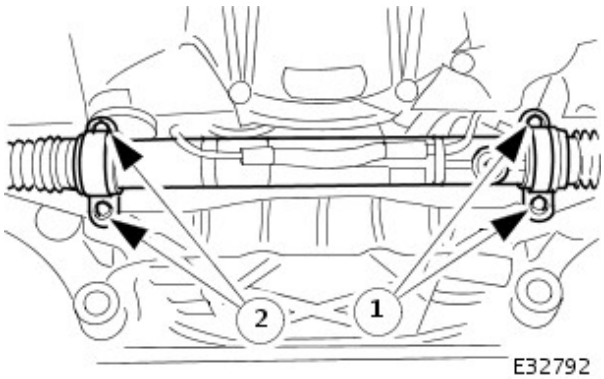
In-vehicle Repair

Removal

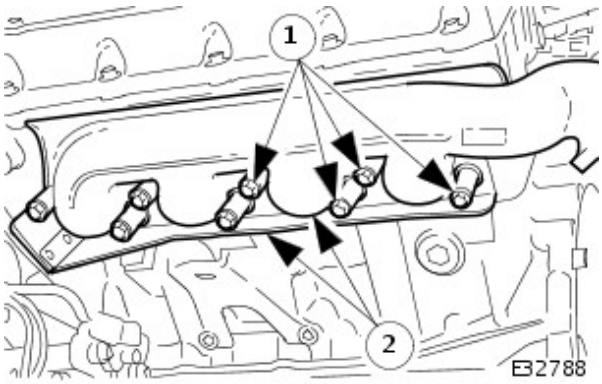
1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the front silencer. Refer to Section 309-00.
3. Remove the downpipe catalytic converter, left hand side. Refer to Section 309-00.
4. Working from above the vehicle, remove the bolts which secure the front section of the exhaust manifold to the cylinder head.



5. If working on a left hand drive vehicle; working from below the vehicle, reposition the steering rack for access.
    1. Remove the two bolts which secure the steering rack at the driver's side.
    2. Loosen, but do not remove, the two bolts which secure the steering rack at the passenger side.
    - Reposition the steering rack for access.



6. Working from below the vehicle, remove the manifold.
    1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.
    2. Remove the manifold and the manifold gasket.



7. Clean the manifold faces (if refitting) and the mating faces on the cylinder head.
8. Use a thread tap (plug) to clean out the threads of the manifold securing bolt holes, in the cylinder head.

Installation

1. Installation is the reverse of removal. Use new gaskets and new securing bolts for the manifold.

Engine - Exhaust Manifold Gasket RH

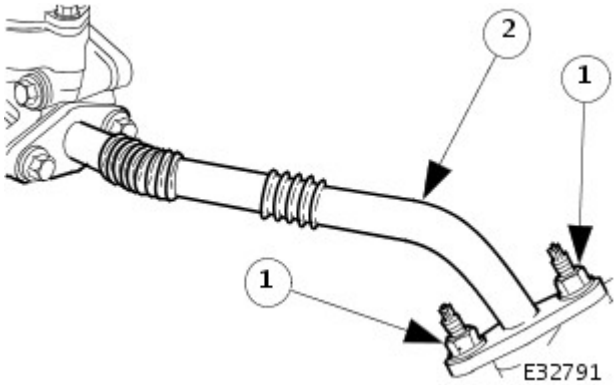
In-vehicle Repair

1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the air cleaner assembly. Refer to Section 303-12.

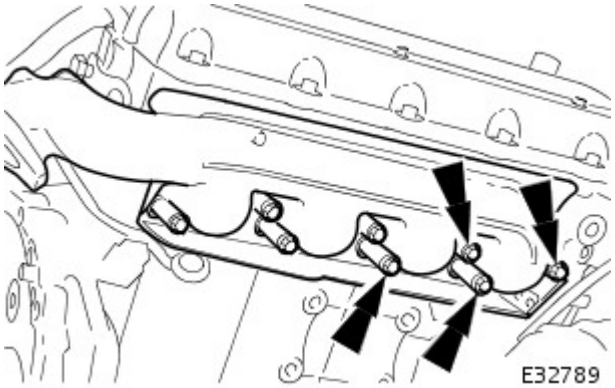
3. Remove the front silencer. Refer to Section 309-00.

4. Remove the downpipe catalytic converter, right hand side. Refer to Section 309-00.

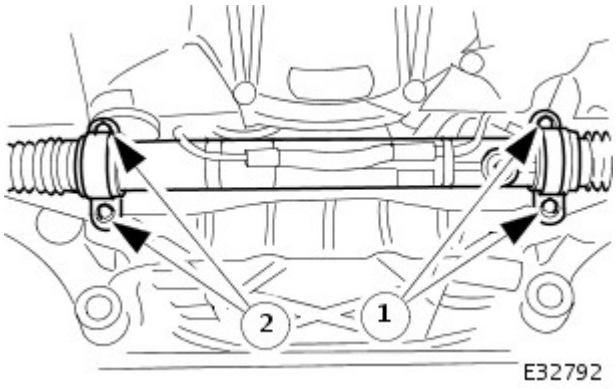


5. From above the vehicle, disconnect the EGR pipe from the exhaust manifold.

1. Remove the two nuts which secure the EGR flange to the right hand exhaust manifold.
2. Reposition the EGR pipe from the manifold.



6. Remove the bolts which secure the front section of the exhaust manifold to the cylinder head.



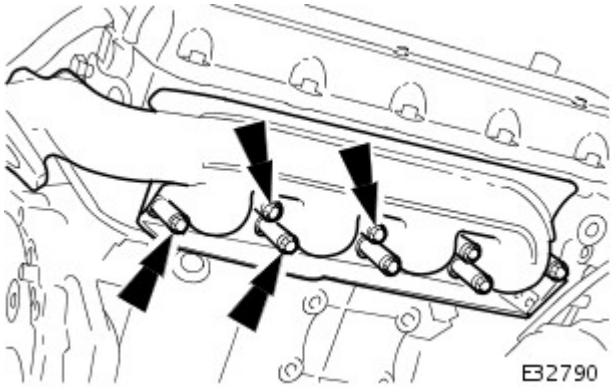
7. If working on a right hand drive vehicle; reposition the steering rack for access.

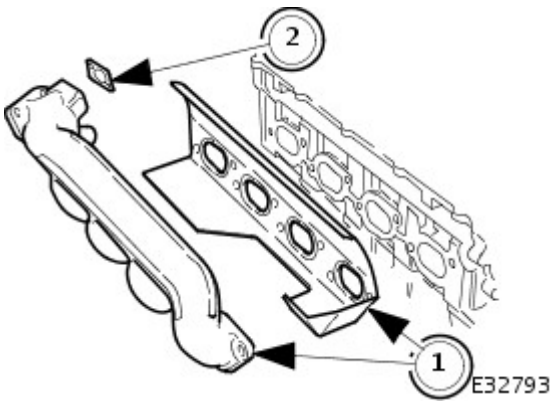
1. Remove the two bolts which secure the steering rack at the passenger side.
2. Loosen, but do not remove, the two bolts which secure the steering rack at the driver's side.

- Reposition the steering rack for access.

8. Working from below the vehicle, remove the manifold bolts.

1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.





9. Remove the manifold.

1. Remove the manifold and the manifold gasket from the cylinder head.
2. Remove the gasket from the EGR flange.

10. If fitting a new manifold, remove the two studs from the EGR flange of the manifold. and transfer them to the new manifold.

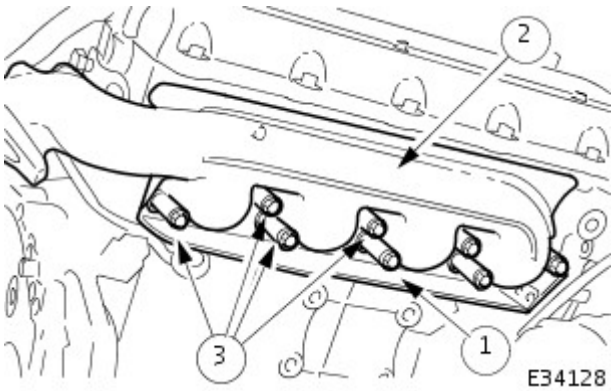
11. Clean the manifold faces (if refitting) and the mating faces on the cylinder head.

12. Use a thread tap (plug) to clean out the threads of the manifold securing bolt holes, in the cylinder head.

Installation

1. Fit a spacer to each new manifold securing bolt (8 bolts).

2. Fit the manifold and manifold gasket.



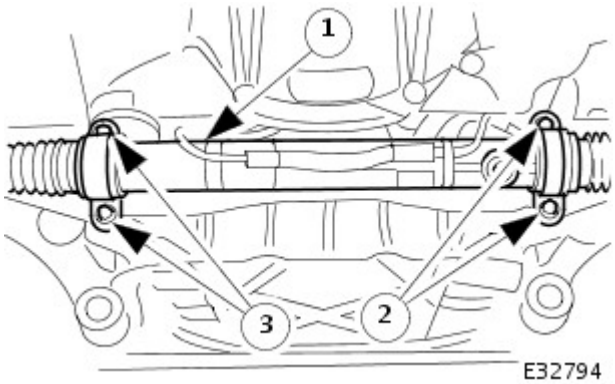
1. Fit and align the new gasket to the cylinder head.
2. Fit and align the manifold to the cylinder head.
3. Fit the rear four bolts which secure the manifold, but do not tighten.

3. Working from above the vehicle, fit and tighten the remaining manifold securing bolts.

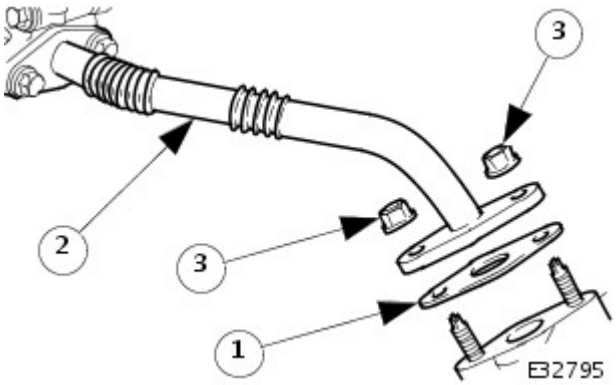
4. Working from below the vehicle, fully tighten the rear bolts on each manifold.

5. Refit the steering rack (if removed for access).

1. Reposition the steering rack.
2. Fit and tighten the rack mounting bolts on the passenger side.



3. Tighten the rack mounting bolts on the driver's side.



6. From above the vehicle, connect the EGR pipe to the exhaust manifold.

1. Fit a new EGR gasket to the manifold.
2. Reposition the EGR pipe to the manifold.
3. Fit the two nuts which secure the EGR flange to the exhaust manifold.

7. Fit the downpipe catalytic converter, right hand side. Refer to Section 309-00.

8. Fit the front silencer. Refer to Section 309-00.

9. Fit the air cleaner assembly. Refer to Section 303-12.

10. Remove paintwork protection sheets and close the engine compartment.

Engine - Exhaust Manifold Gasket LH and RH

In-vehicle Repair

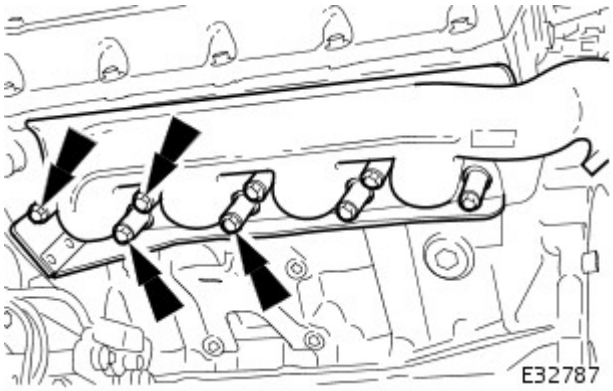
1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the downpipe catalytic converter, right hand side. Refer to Section 309-00.

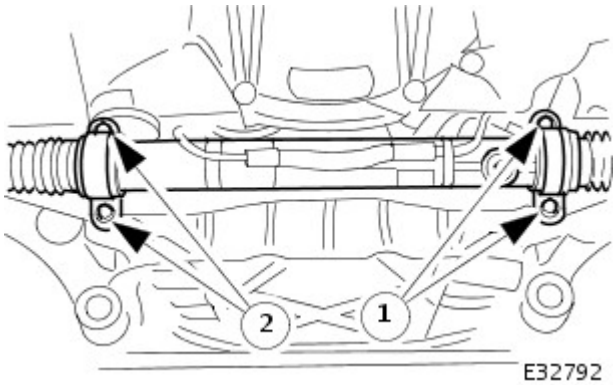
3. Remove the downpipe catalytic converter, left hand side. Refer to Section 309-00.

4. Remove the front silencer. Refer to Section 309-00.

5. Remove the air cleaner assembly. Refer to Section 303-12.



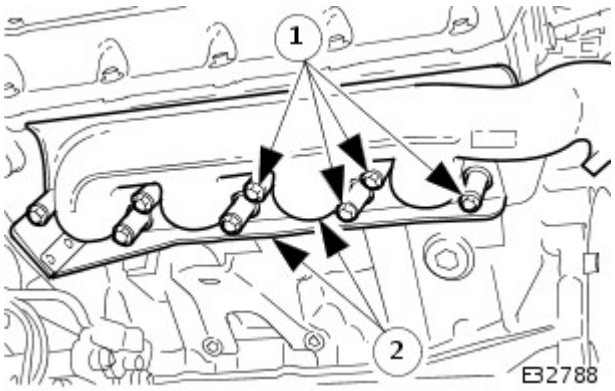
6. Working from above the vehicle, remove the bolts which secure the front section of the left hand exhaust manifold to the cylinder head.



7. Working from below the vehicle, reposition the steering rack for access.

1. Remove the two bolts which secure the steering rack at the driver's side.
2. Loosen, but do not remove, the two bolts which secure the steering rack at the passenger side.

- Reposition the steering rack for access.

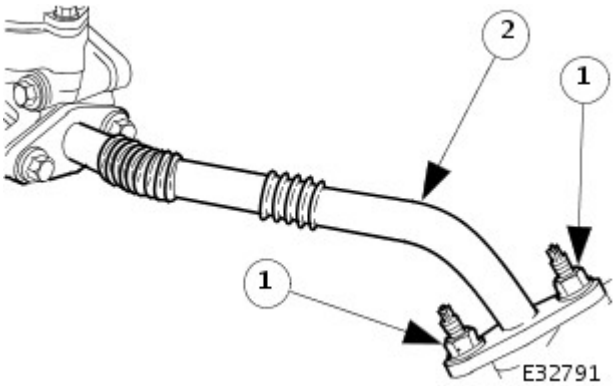


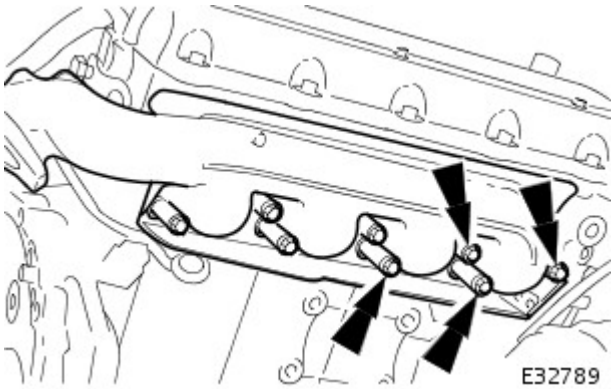
8. Working from below the vehicle, remove the manifold.

1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.
2. Remove the manifold and the manifold gasket.

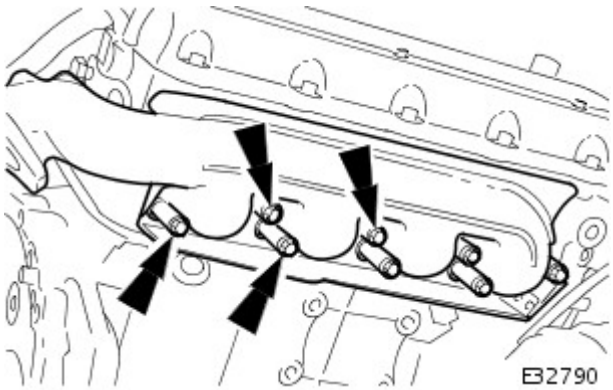
9. From above the vehicle, disconnect the EGR pipe from the right hand exhaust manifold.

1. Remove the two nuts which secure the EGR flange to the right hand exhaust manifold.
2. Reposition the EGR pipe from the manifold.



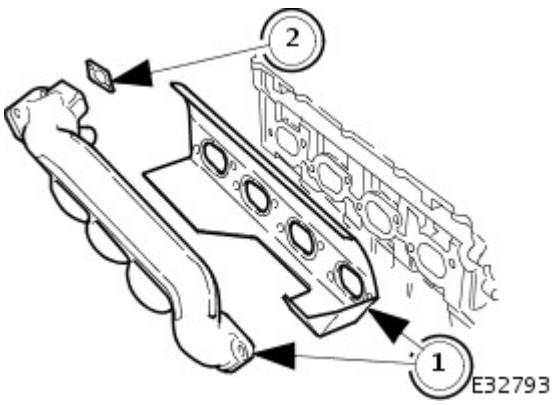


10. Remove the bolts which secure the front section of the right hand exhaust manifold to the cylinder head.



11. Working from below the vehicle, remove the manifold bolts.

1. Remove the bolts which secure the rear section of the exhaust manifold to the cylinder head.



12. Remove the manifold.

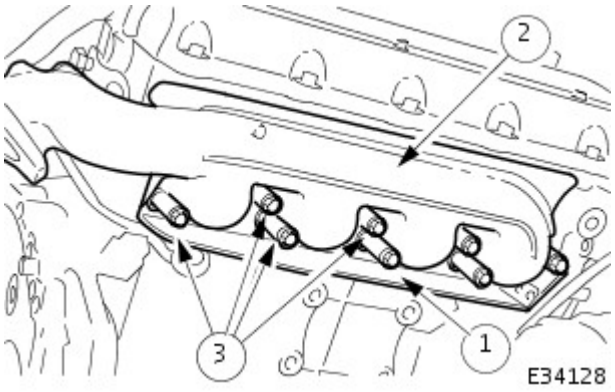
1. Remove the manifold and the manifold gasket from the cylinder head.
2. Remove the gasket from the EGR flange.

13. If fitting a new manifold, remove the two studs from the EGR flange of the manifold. and transfer them to the new manifold.

14. Clean the manifold faces (if refitting), the EGR pipe flange and the mating faces on the cylinder head.

15. Use a thread tap (M8 x 1,25 plug) to clean out the threads of each manifold securing bolt hole, in the cylinder heads.

Installation



1. Use new manifold securing bolts and.fit a spacer to each.

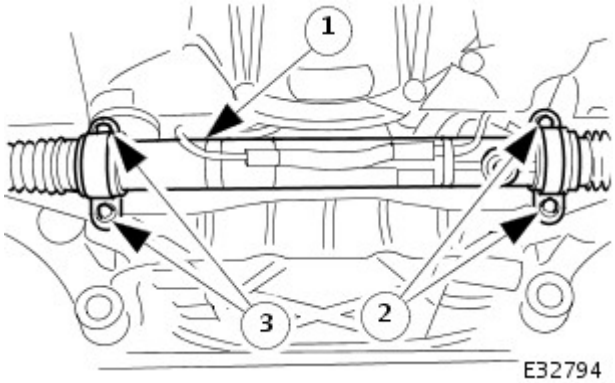
2. Fit each manifold and manifold gasket.

1. Fit and align the new gasket to the cylinder head.
2. Fit and align the manifold to the cylinder head.
3. Fit the rear four bolts which secure the manifold, but do not tighten.

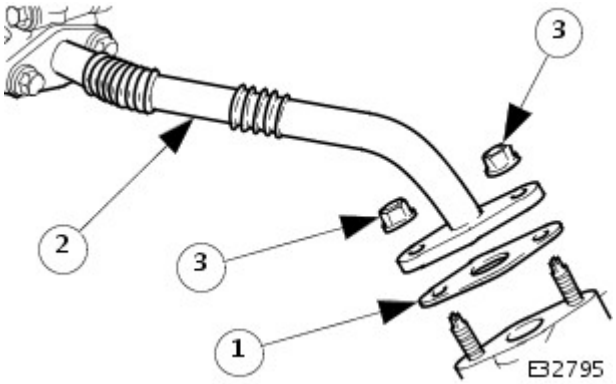
3. Working from above the vehicle, fit and tighten the remaining manifold securing bolts.

4. Working from below the vehicle, fully tighten the rear bolts on each manifold.

5. Refit the steering rack.



1. reposition the steering rack.
2. Fit and tighten the rack mounting bolts on the driver's side.
3. Tighten the rack mounting bolts on the passenger side.



6. From above the vehicle, connect the EGR pipe to the right hand exhaust manifold.

1. Fit a new EGR gasket to the manifold.
2. Reposition the EGR pipe to the manifold.
3. Fit the two nuts which secure the EGR flange to the exhaust manifold.

7. Fit the downpipe catalytic converter, left hand side. Refer to Section 309-00.

8. Fit the downpipe catalytic converter, right hand side. Refer to Section 309-00.

9. Fit the front silencer. Refer to Section 309-00.

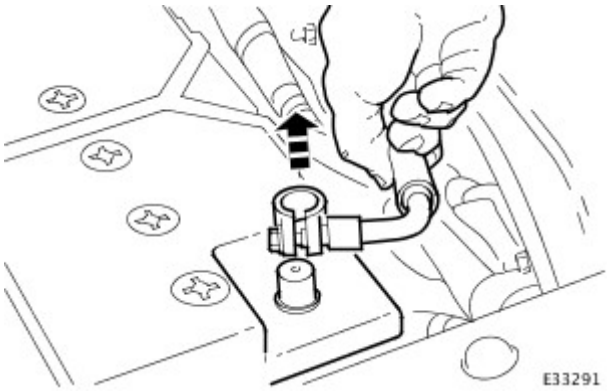
10. Fit the air cleaner assembly. Refer to Section 303-12.

11. Remove paintwork protection sheets and close the engine compartment.

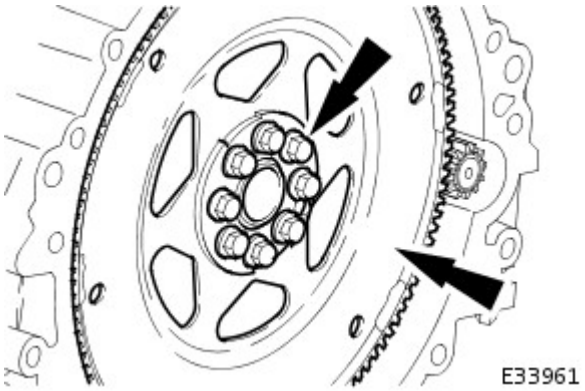
Engine - Flexplate4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

In-vehicle Repair

Removal

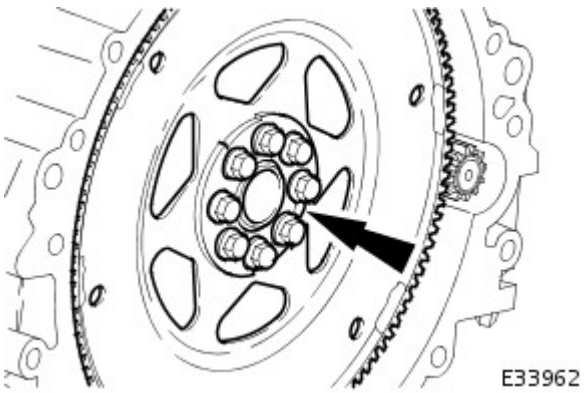


1. Open the engine compartment and fit paint protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Engine Covers, Air Intake Tube, Catalytic Converters and the Front Muffler. Drain the transmission fluid and remove the transmission for access.
   - Refer to Operation 44.20. 01 Transmission Remove, in Section 307-01A, which includes each of the above operations.

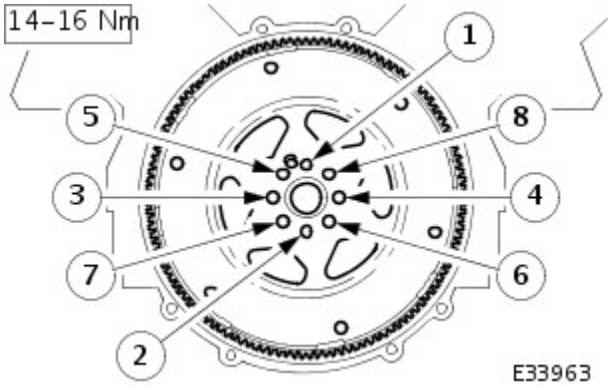


4. Remove the drive plate.
   - Prevent the drive plate from rotating by use of a small wedge in the ring gear.
   - Remove the bolts which secure the drive plate to the crankshaft.
   - Remove the drive plate.
5. Clean the crankshaft mating face and any other components which are to be refitted.

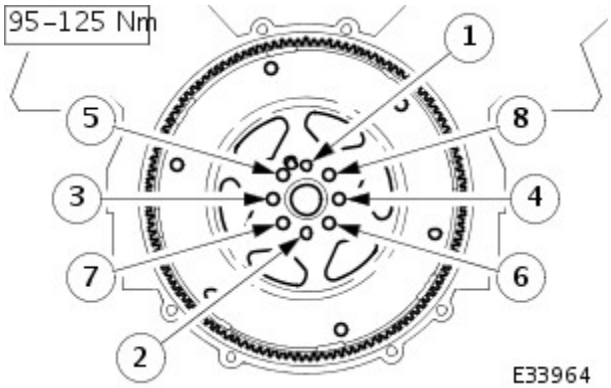
Installation



1. Fit the drive plate.
   - Fit and align the drive plate to the crankshaft.
   - Fit, but not tighten, the bolts which secure the drive plate to the crankshaft.
   - Prevent the drive plate from rotating by use of a small wedge in the ring gear.
2. Tighten the securing bolts in two stages and in the order shown.



- STAGE ONE tighten to 14 - 16 Nm.



3. Tighten the securing bolts in two stages and in the order shown.

- STAGE TWO tighten to 95 - 125 Nm.

4. Refit the Transmission, Catalytic Converters and the Front Muffler, Air Intake Tube and Engine Covers. Refill the transmission with new fluid.

- Refer to Operation 44.20. 01 Transmission Install, in Section 307-01A, which includes each of the above operations.

5. Remove the paint protection sheets and close the engine compartment cover.

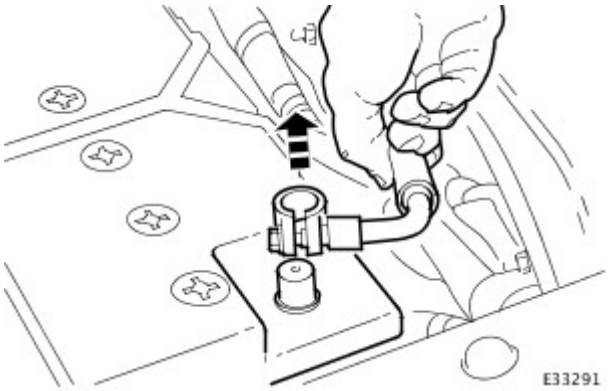
6. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

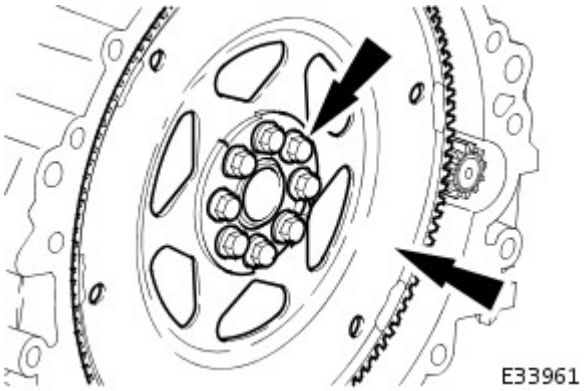
Engine - Flexplate4.0L SC V8 - AJ26

In-vehicle Repair

Removal

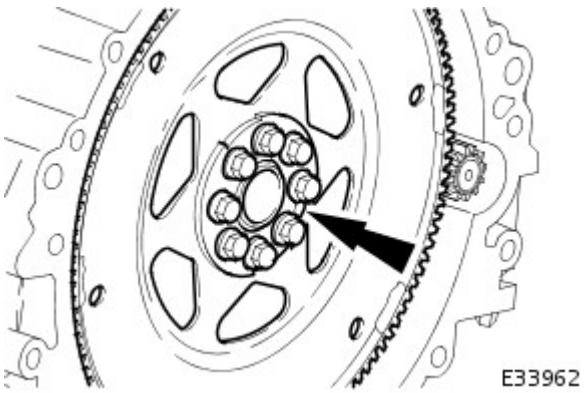


1. Open the engine compartment and fit paint protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Engine Covers, Air Intake Tube, Catalytic Converters and the Front Muffler. Drain the transmission fluid and remove the transmission for access.
   - Refer to Operation 44.20. 01 Transmission Remove, in Section 307-01B, which includes each of the above operations.

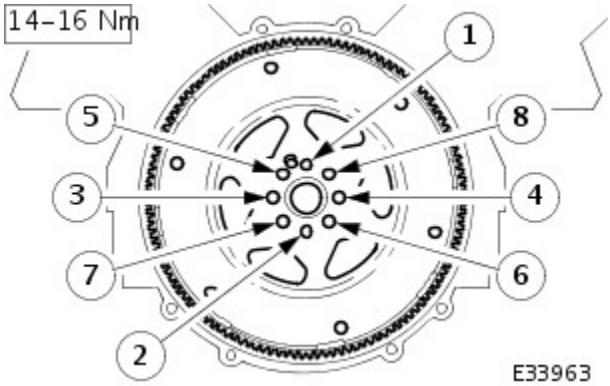


4. Remove the drive plate.
   - Prevent the drive plate from rotating by use of a small wedge in the ring gear.
   - Remove the bolts which secure the drive plate to the crankshaft.
   - Remove the drive plate.
5. Clean the crankshaft mating face and any other components which are to be refitted.

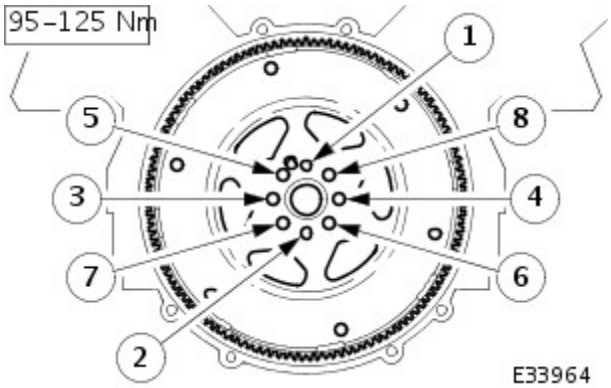
Installation



1. Fit the drive plate.
   - Fit and align the drive plate to the crankshaft.
   - Fit, but not tighten, the bolts which secure the drive plate to the crankshaft.
   - Prevent the drive plate from rotating by use of a small wedge in the ring gear.
2. Tighten the securing bolts in two stages and in the order shown.



- STAGE ONE tighten to 14 - 16 Nm.



3. Tighten the securing bolts in two stages and in the order shown.

- STAGE TWO tighten to 95 - 125 Nm.

4. Refit the Transmission, Catalytic Converters and the Front Muffler, Air Intake Tube and Engine Covers. Refill the transmission with new fluid.

- Refer to Operation 44.20. 01 Transmission Install, in Section 307-01B, which includes each of the above operations.

5. Remove the paint protection sheets and close the engine compartment cover.

6. Connect the battery and fit the battery cover.

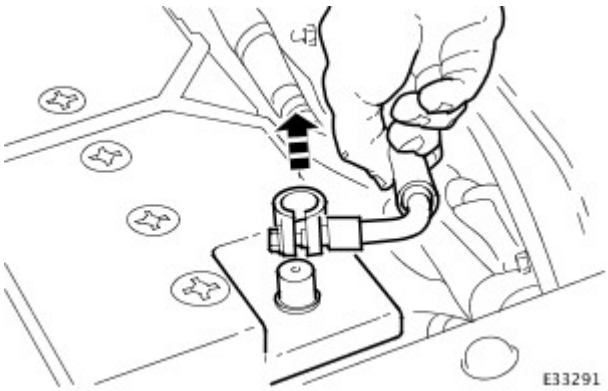
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Intake Camshaft LH

In-vehicle Repair

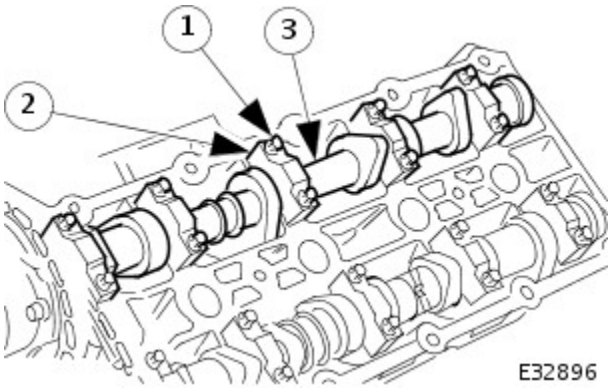
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.



- Remove the battery cover.

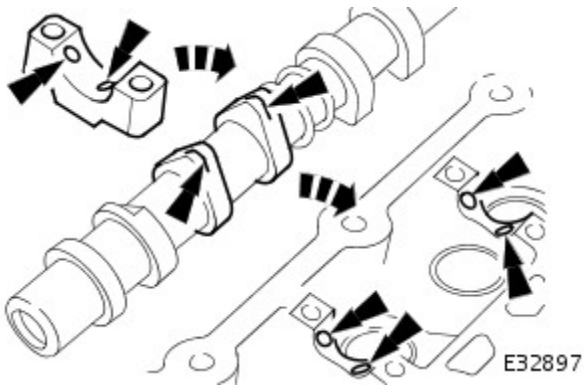
4. Remove the Timing Cover. Refer to Operation 12.65.01.
5. Remove the VVT Unit from the B-Bank. Refer to Operation 12.65.71. This also includes the VVT Bush Carrier Assembly, Primary Chain and Tensioner.
6. Remove the camshaft locking tool 303 - 530 (fitted for previous operation).
7. Remove the camshaft.



1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.
2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).
3. Remove the camshaft from the engine.

8. Clean and inspect all relevant components.

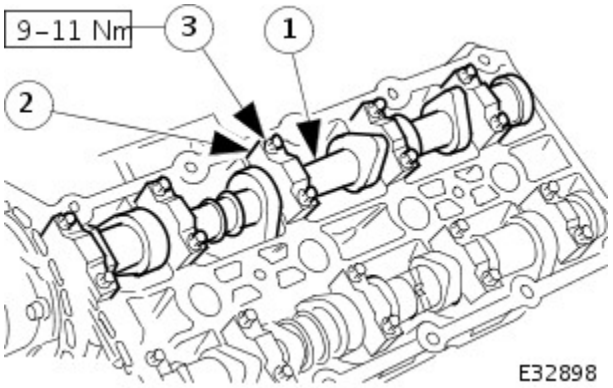
Installation



1. Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.

2. Refit the camshaft.



1. Fit the camshaft to position in the cylinder head, with the timing flats uppermost.
2. Fit the camshaft caps to their respective locations (0 to 4 from the front) and in the correct orientation (arrow to front of engine).
3. Fit and tighten the cap securing bolts. Tighten evenly, in stages, to 9 - 11 Nm.

3. Fit the camshaft locking tool 303 - 530 (fitted for following operation) align the camshaft as necessary.

4. Refit the VVT Unit to the A-Bank. Refer to Operation 12.65.71. This also includes the VVT Bush Carrier Assembly, Primary Chain and Tensioner.

5. With the camshaft (303 - 530) and crankshaft (303 - 531) setting tools removed, after the previous operation, adjust the valve clearances on the inlet camshaft. refer to Operation 12.29.48.

6. Refit the Timing Cover. Refer to Operation 12.65.01.

7. Move the engine compartment cover from the service position and connect the gas struts.

8. Remove the paint protection sheets and close the cover.

9. Connect the battery and fit the battery cover.

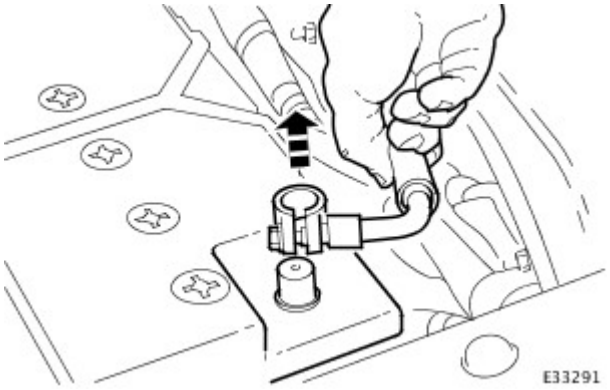
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Intake Camshaft RH

In-vehicle Repair

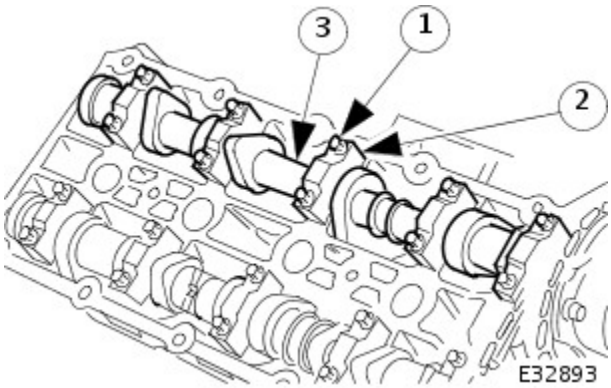
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.



- Remove the battery cover.

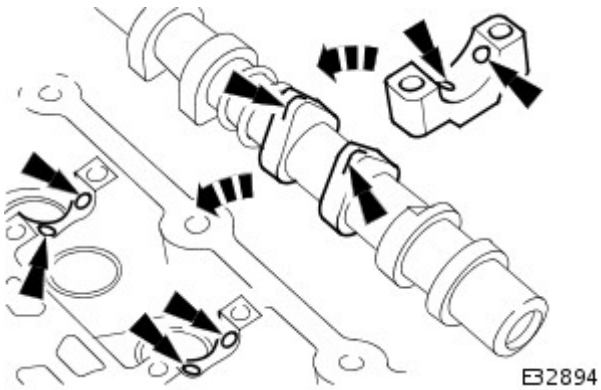
4. Remove the Timing Cover. Refer to Operation 12.65.01.
5. Remove the VVT Unit from the A-Bank. Refer to Operation 12.65.70. This also includes the VVT Bush Carrier Assembly, Primary Chain and Tensioner.
6. Remove the camshaft locking tool 303 - 530 (fitted for previous operation).
7. Remove the camshaft.



1. Remove the bolts which secure the camshaft caps; loosen them evenly, in stages.
2. Remove the camshaft caps. Note their orientation and markings - each is marked with its position (a number) and orientation (an arrow).
3. Remove the camshaft from the engine.

8. Clean and inspect all relevant components.

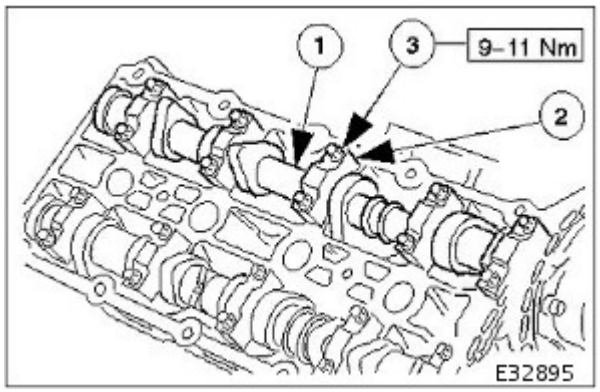
Installation



1. Apply oil (EP-90) to the camshaft and bearing surfaces, as follows:

- To the upper face of each bearing surface (two places) in the cylinder head.
- To the upper face of each bearing surface (two places) in each bearing cap.
- On the cam lobes ONLY, not on the base circle area.

2. Refit the camshaft.



1. Fit the camshaft to position in the cylinder head, with the timing flats uppermost.
2. Fit the camshaft caps to their respective locations (0 to 4 from the front) and in the correct orientation (arrow to front of engine).
3. Fit and tighten the cap securing bolts. Tighten evenly, in stages, to 9 - 11 Nm.

3. Fit the camshaft locking tool 303 - 530 (fitted for following operation) align the camshaft as necessary.

4. Refit the VVT Unit to the A-Bank. Refer to Operation 12.65.70. This also includes the VVT Bush Carrier Assembly, Primary Chain and Tensioner.

5. With the camshaft (303 - 530) and crankshaft (303 - 531) setting tools removed, after the previous operation, adjust the valve clearances on the inlet camshaft. refer to Operation 12.29.48.

6. Refit the Timing Cover. Refer to Operation 12.65.01.

7. Move the engine compartment cover from the service position and connect the gas struts.

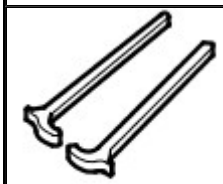
8. Remove the paint protection sheets and close the cover.

9. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Intake Manifold

In-vehicle Repair

Special Tool(s)	
 E36393	Quick Fit Connector Release Tool 310-044
 E36394	Quick Fit Connector Release Tool 310-054
 E36424	Injector Removal Tools 303-539
 E36466	Fuel Injection Pressure Test Equipment 310-058

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Carefully remove the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

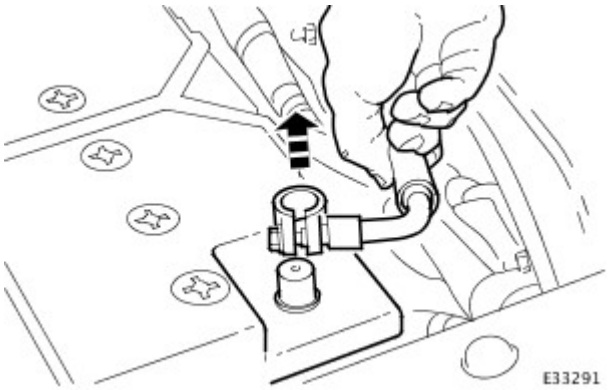

E35302

3. Depressurise the fuel system.
   - Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
   - Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.
4. Connect the fuel injection pressure test equipment 310 - 058



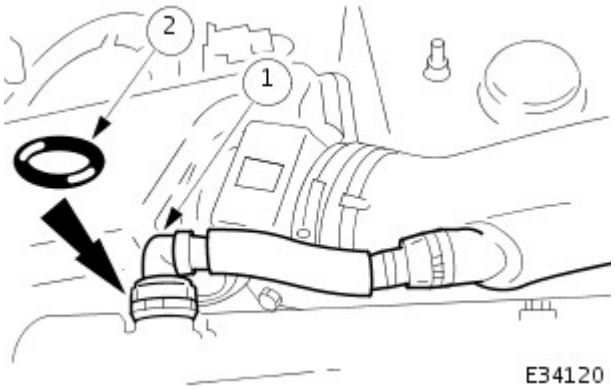
(or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.



6. Disconnect the battery ground cable.

- Remove the battery cover.



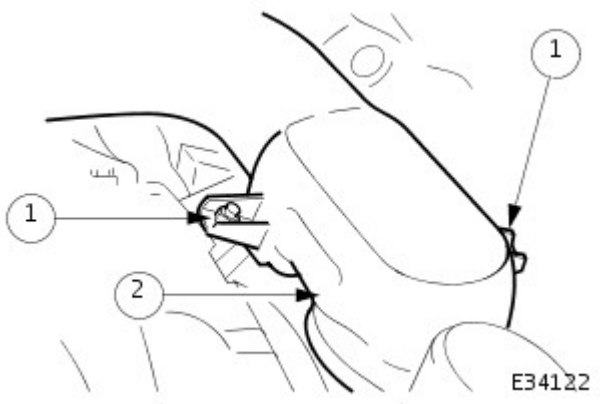
7. Disconnect the breather pipe from the A-Bank camshaft cover.

1. Disconnect the breather pipe from the stub pipe.
2. Remove and discard the O-ring seal from the breather pipe.

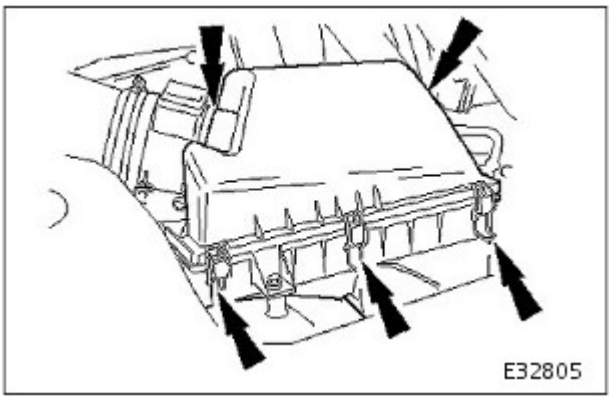
8. Disconnect the air flow meter multi-plug.

9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

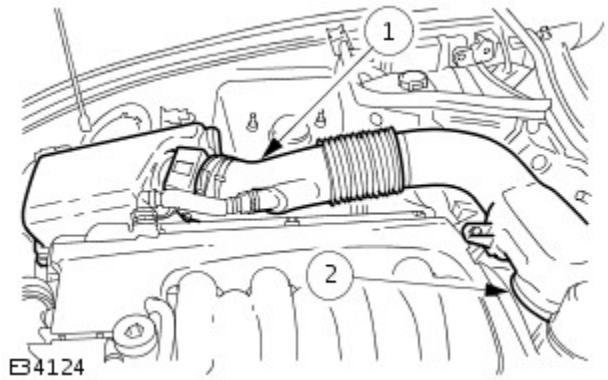


1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.



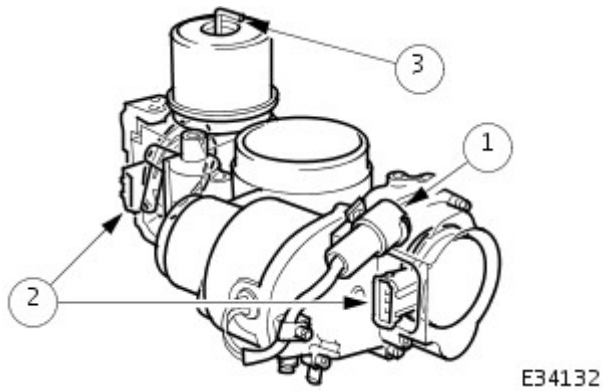
11. Disconnect the air cleaner cover.

1. Remove the five clips which secure the air cleaner cover.



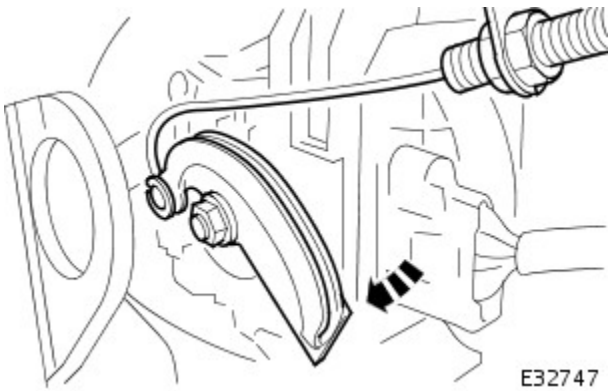
12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.



13. Disconnect the multi-plugs from the throttle body.

1. Disconnect the throttle body motor multi-plug.
2. Disconnect the two potentiometer multi-plugs, one each side of the throttle.
3. Disconnect the vacuum pipe elbow from the throttle actuator.

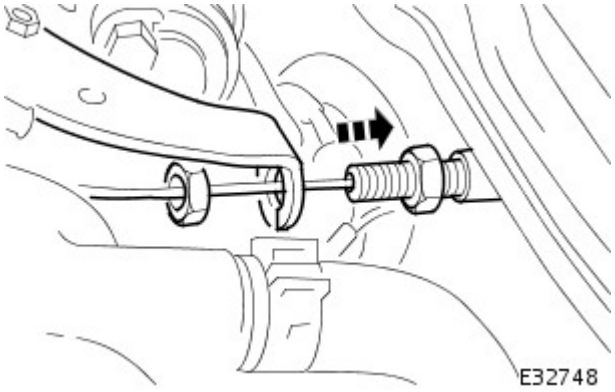


14. Disconnect the throttle inner cable.

- Turn the throttle pulley to the fully open position.
- Disconnect the throttle inner cable from the pulley.

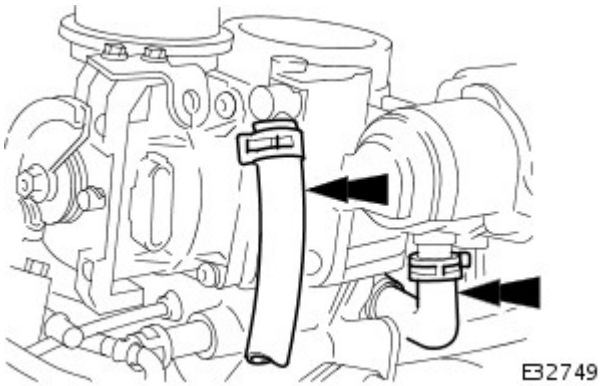
15. Disconnect the throttle outer cable.

- Remove the throttle cable adjusting nut from the outer cable.
- Remove the cable from the adjustment bracket.

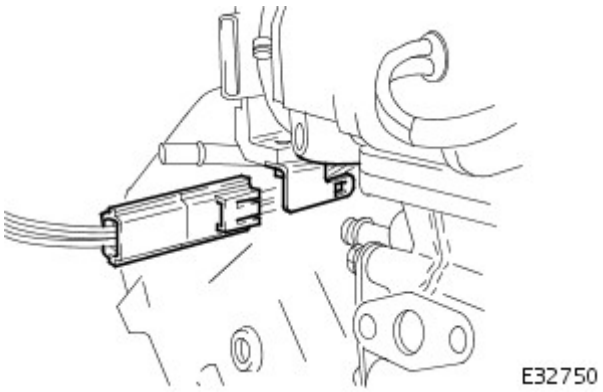


16. Disconnect the coolant hoses from the throttle body.

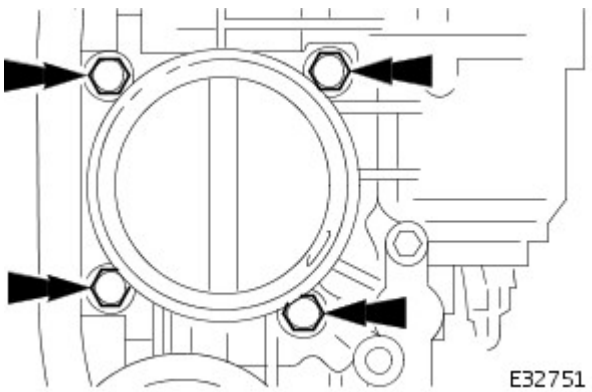
- Release the clip which secures the coolant return hose and disconnect the hose. Fit a blanking plug to the hose to prevent water leakage.
- Release the clip which secures the coolant feed hose and disconnect the hose. Fit a blanking plug to the hose to prevent water leakage.



17. Disconnect the multi-plug, located on the bracket under the left side of the throttle body.

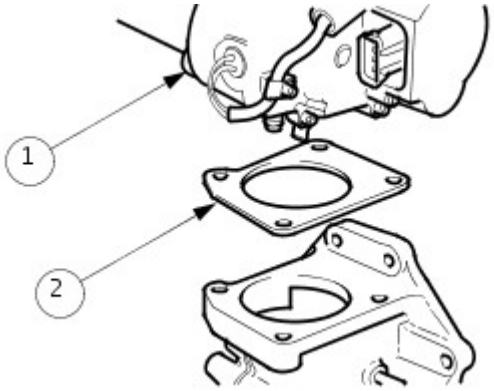


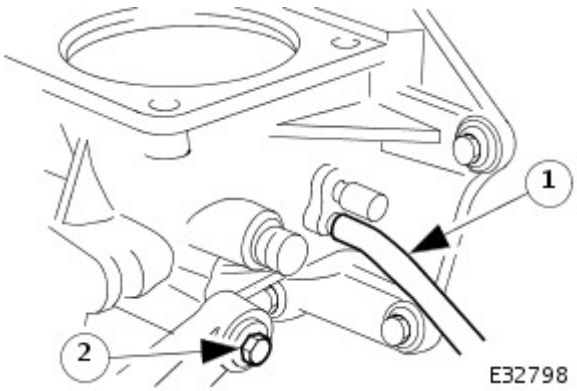
18. Remove the throttle body securing bolts.



19. Remove the throttle body.

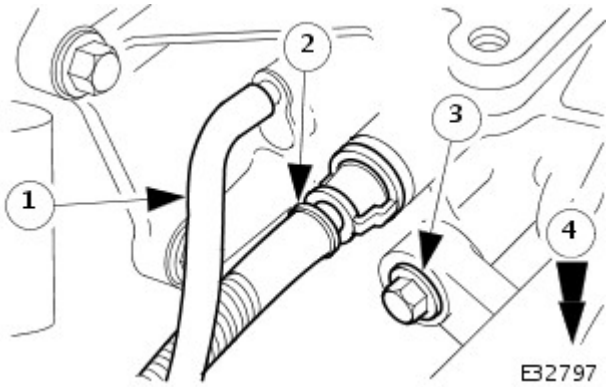
1. Remove the throttle body from the induction elbow.
2. Remove and discard the throttle body gasket.





20. Release the induction elbow support; working from the right hand side.

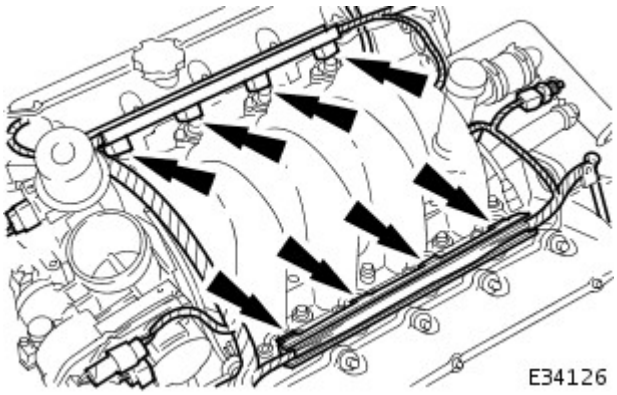
1. Disconnect the vacuum pipe from the centre of the induction elbow.
2. Remove the upper bolt from the induction elbow support bracket.



21. Release the induction elbow support; working from the left hand side.

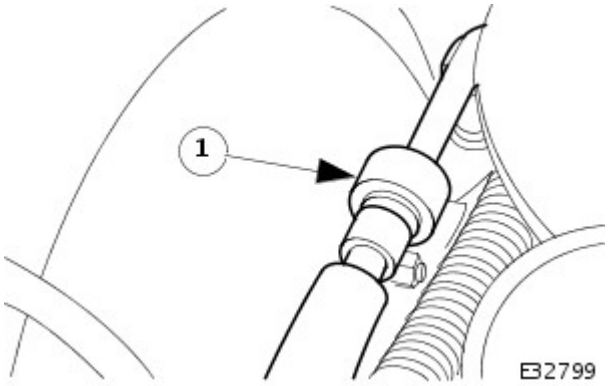
1. Disconnect the vacuum pipe from the front of the induction elbow.
2. Disconnect the engine breather T-piece from the induction elbow.
3. Remove the upper bolt from the induction elbow support bracket.
4. Loosen, but do not remove, the lower two bolts at the induction elbow support bracket.

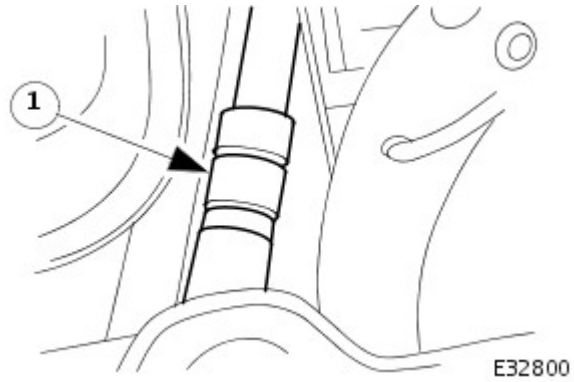
22. Disconnect the electrical connector from each fuel injector.



23. Disconnect the fuel feed hose.

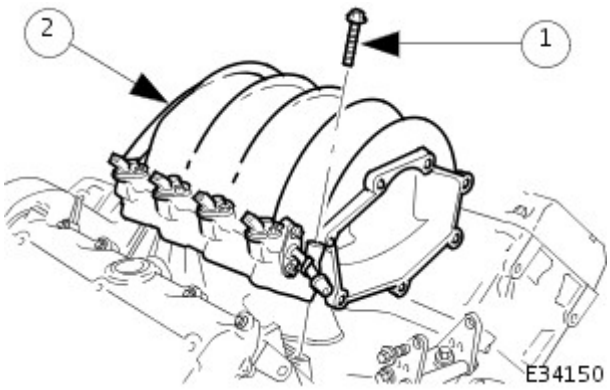
1. Disconnect the fuel feed hose at the Quick Fit connector, using special tool 310 - 044.





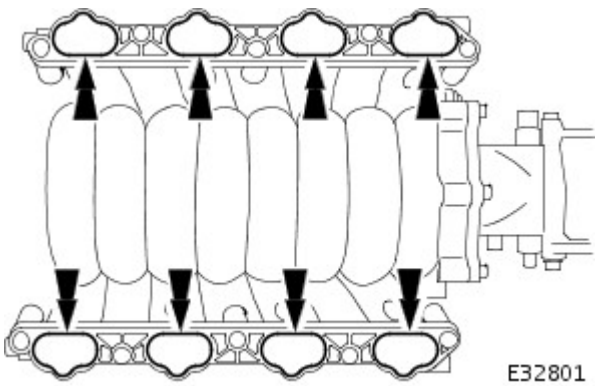
24. Disconnect the fuel return hose.

1. Disconnect the fuel return hose at the Quick Fit connector, using special tool 310 - 054.



25. Remove the inlet manifold.

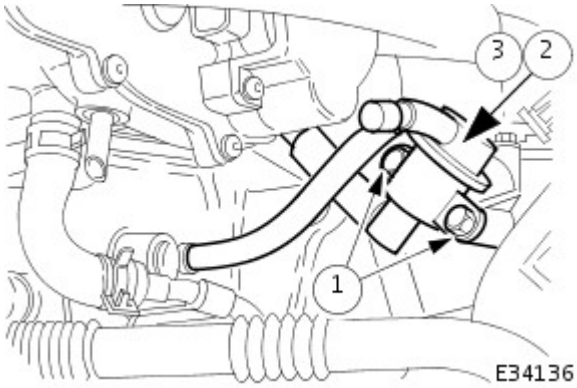
1. Remove the ten bolts which secure the inlet manifold.
2. Remove the inlet manifold



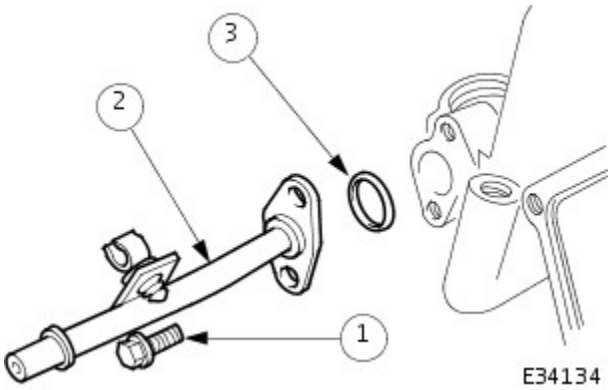
26. Remove and discard the eight seals from the inlet manifold ports.

27. Remove the fuel pressure regulator from the manifold.

1. Remove the two bolts which secure the pressure regulator.
2. Remove the pressure regulator.

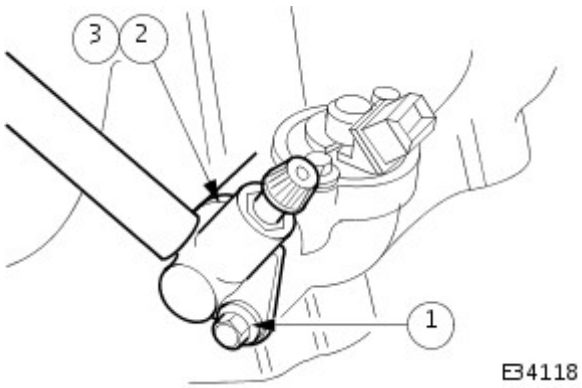


3. Remove and discard the regulator O-ring seal.



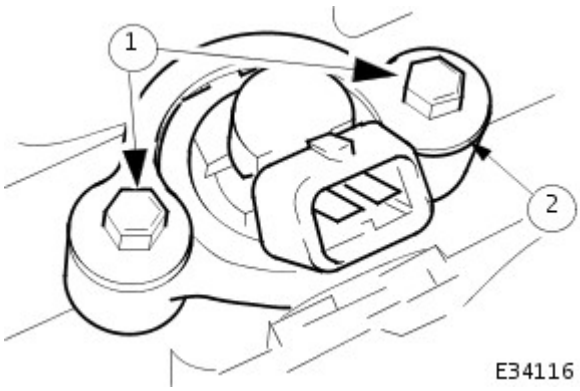
28. Remove the fuel feed pipe from the manifold.

1. Remove the two bolts which secure the fuel feed pipe to the inlet manifold.
2. Remove the fuel feed pipe.
3. Remove and discard the pipe O-ring seal.



29. Remove the fuel cross over elbow from the inlet manifold.

1. Remove the one bolt each side which secures the cross over elbow.
2. Remove the elbow from the manifold.
3. Remove and discard the O-ring seal.



30. Remove the fuel injectors.

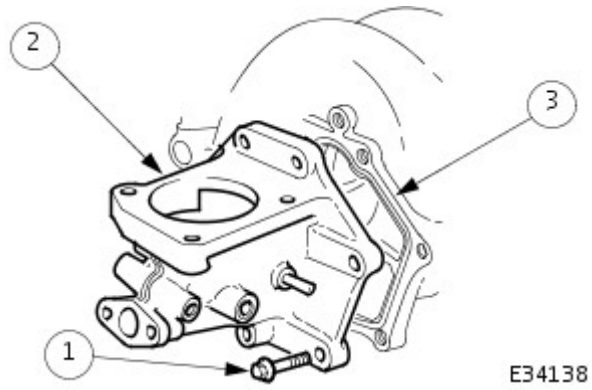
1. Remove the securing screws from each fuel injector.
2. Remove the injector clamping plates.

31. Remove the injectors from the manifold; use special tool 303 - 539 if necessary.





32. Remove and discard the sixteen sealing rings from the injectors.



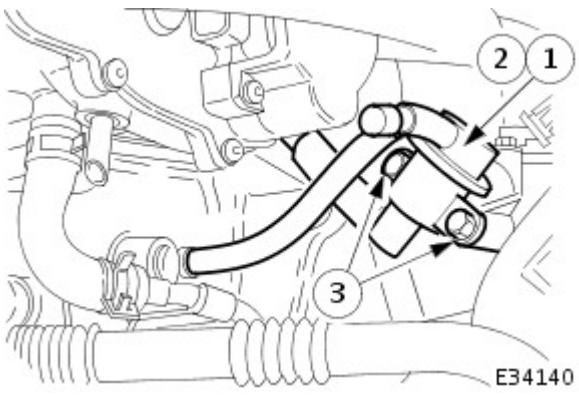
33. Remove the throttle induction elbow from the inlet manifold.

1. Remove the seven bolts which secure the throttle induction elbow.
2. Remove the elbow.
3. Remove the induction elbow seal from the manifold.

Installation

1. Clean all parts and relevant mating faces.

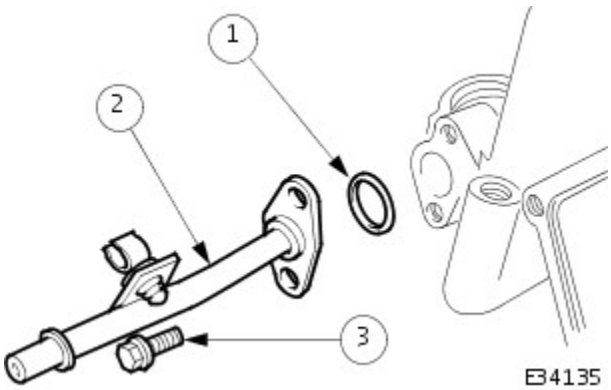
2. Fit the fuel pressure regulator to the manifold.



1. Lubricate and fit a new O-ring seal to the regulator.
2. Fit the pressure regulator to the manifold.
3. Fit the two bolts which secure the pressure regulator.

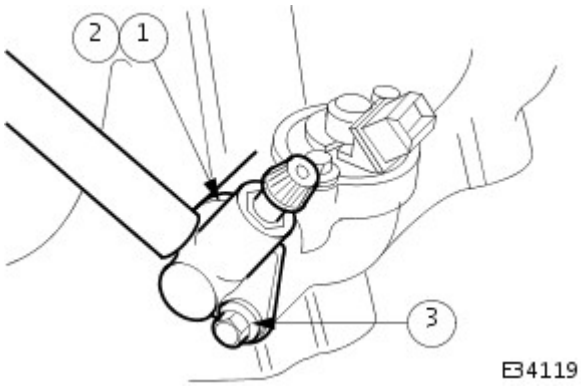
3. Fit the fuel feed pipe to the manifold.

1. Lubricate and fit a new O-ring seal to the feed pipe.



2. Fit the feed pipe to the manifold.

3. Fit the two bolts which secure the feed pipe.



4. Fit the fuel cross over elbow to the inlet manifold.

1. Lubricate and fit new O-ring seals to the cross over elbow.

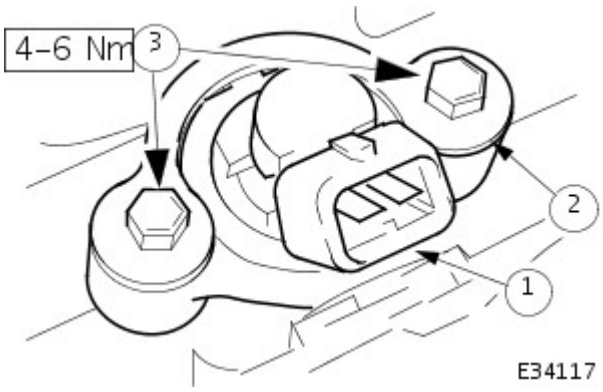
2. Fit the cross over elbow to the manifold.

3. Fit the one bolt each side which secures the cross over elbow.



5. Fit the sealing rings to the fuel injectors.

1. Lubricate and fit the sixteen (two to each injector) new sealing rings.



6. Fit the fuel injectors to the intake manifold.

1. Locate the injectors into the manifold.

2. Position the injector clamping plates.

3. Fit the securing screws for each fuel injector.

7. Fit the throttle induction elbow to the inlet manifold.

1. Fit a new induction elbow seal to the manifold.

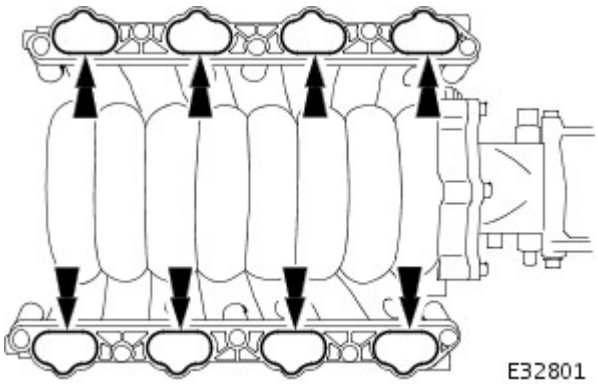
2. Fit the elbow.

3. Fit the seven bolts which secure the throttle induction

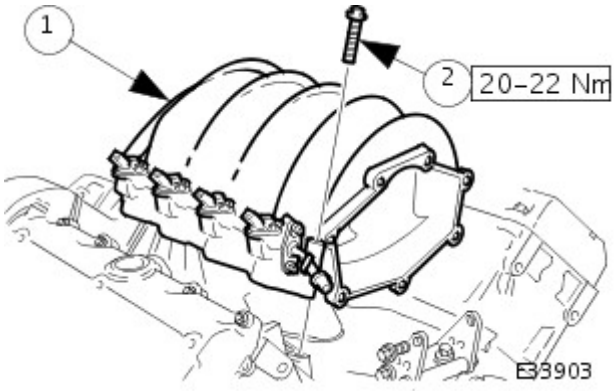


elbow.

8. Refit the Manifold Assembly to the Engine, as follows.

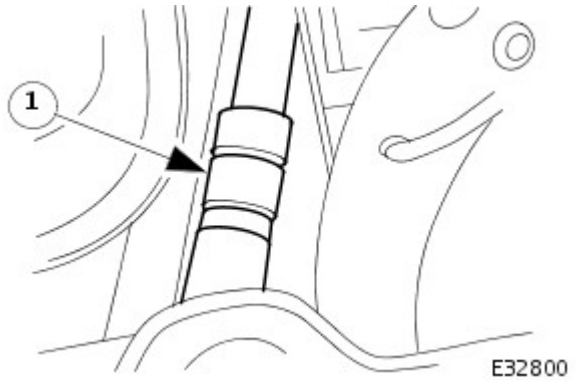


9. Fit eight new seals to the inlet manifold ports.



10. Fit the inlet manifold to the engine.

1. Fit the inlet manifold.
2. Fit the ten bolts which secure the inlet manifold.

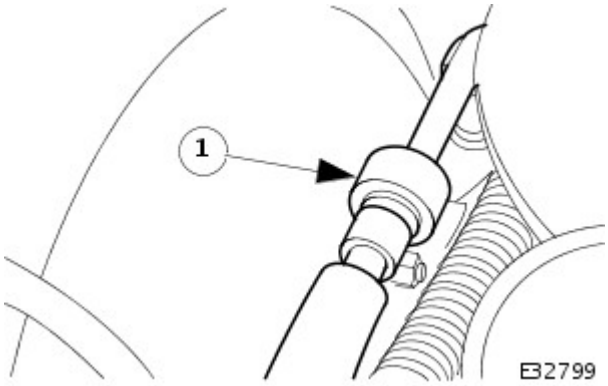


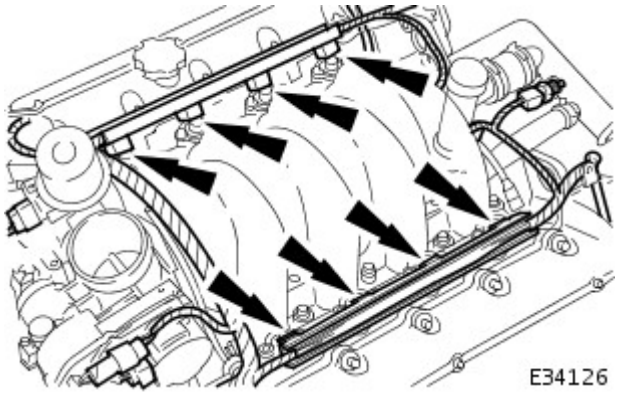
11. Connect the fuel feed hose.

1. Connect the fuel feed hose at the Quick Fit connector. Ensure that the hose is fully seated to the feed pipe.

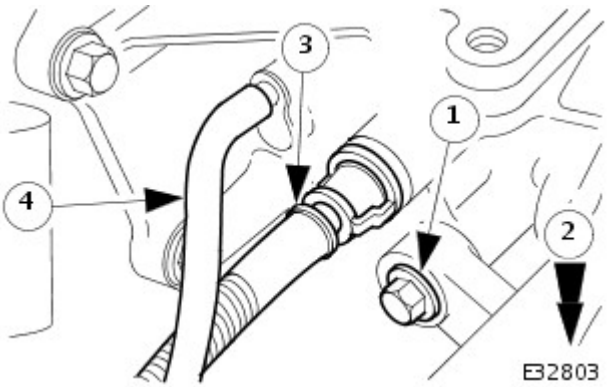
12. Connect the fuel return hose.

1. Connect the fuel return hose at the Quick Fit connector. Ensure that the hose is fully seated to the feed pipe.



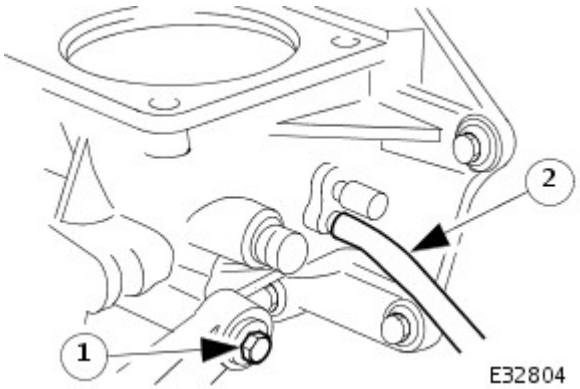


13. Reconnect the electrical connector to each fuel injector.



14. Refit the induction elbow support; working from the left hand side.

1. Fit the upper bolt to the induction elbow support bracket.
2. Tighten the lower two bolts at the induction elbow support bracket.
3. Connect the engine breather T-piece to the induction elbow.
4. Connect the vacuum pipe to the front of the induction elbow.

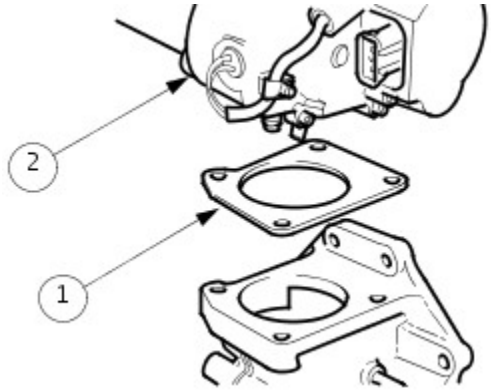


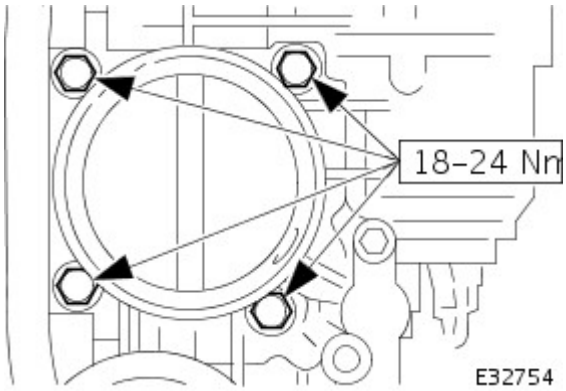
15. Fit the induction elbow support; working from the right hand side.

1. Fit the upper bolt to the induction elbow support bracket.
2. Reconnect the vacuum pipe to the centre of the induction elbow.

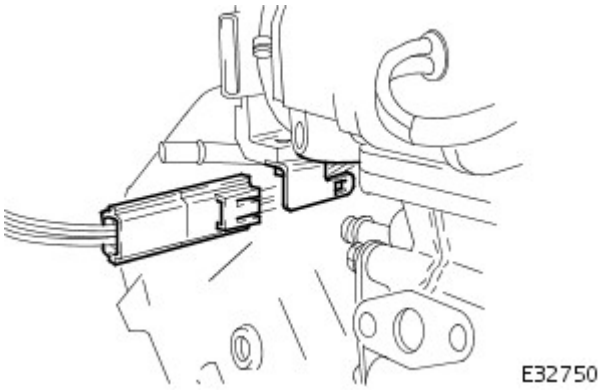
16. Fit the throttle body.

1. Fit a new gasket to the throttle body.
2. Position the throttle body to the induction elbow.

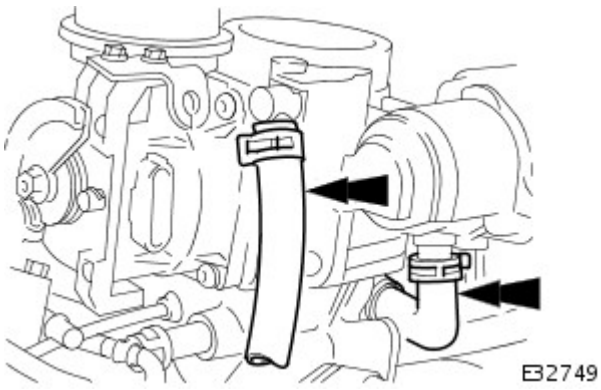




17. Fit the throttle body securing bolts.



18. Reconnect the multi-plug, located on the bracket under the left side of the throttle body.

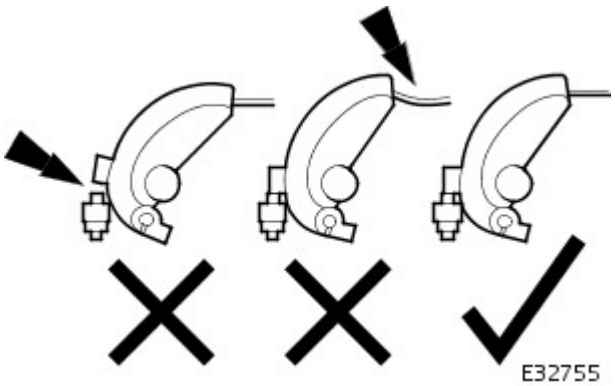


19. Connect the coolant hoses to the throttle body.

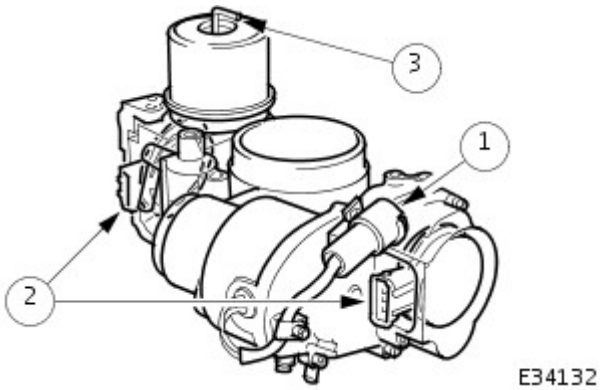
- Remove the blanking plugs from the hoses.
- Connect the coolant feed hose and secure with the clip.
- Connect the coolant return hose and secure with the clip.

20. CAUTION: Under no circumstances may the quadrant be held clear of the throttle stop by cable tension

Refit the throttle cable and ensure that there is neither tension nor slack in the cable

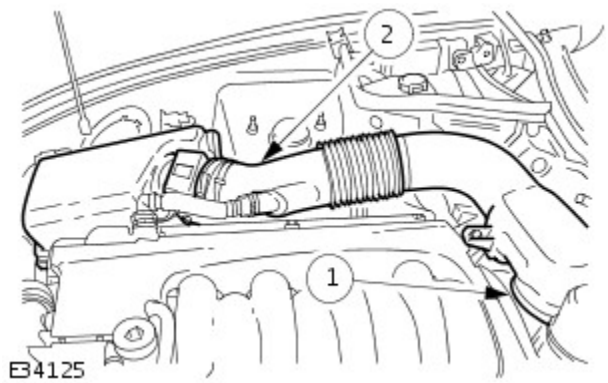


- Tighten the locknut without altering the setting or introducing twist into the cable outer
- Check the kickdown setting using the PDU. For scan tool procedure, refer to 303-14, Throttle cable, Renew



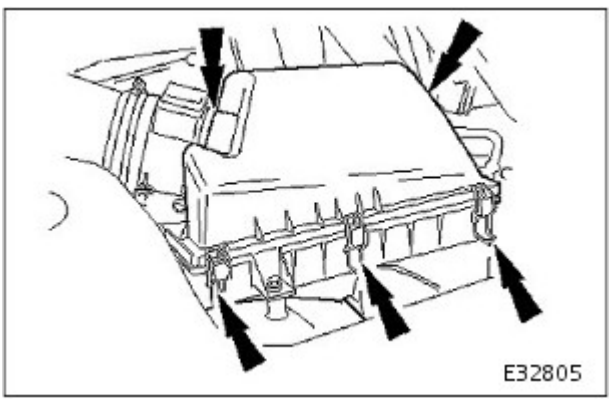
21. Reconnect the multi-plugs to the throttle body.

1. Connect the throttle body motor multi-plug.
2. Connect the two potentiometer multi-plugs, one each side of the throttle.
3. Connect the vacuum pipe elbow to the throttle actuator.



22. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.

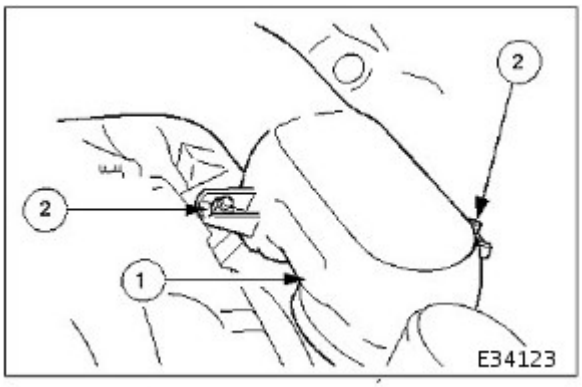


23. Reconnect the air cleaner cover.

1. Fit the five clips which secure the air cleaner cover.

24. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.



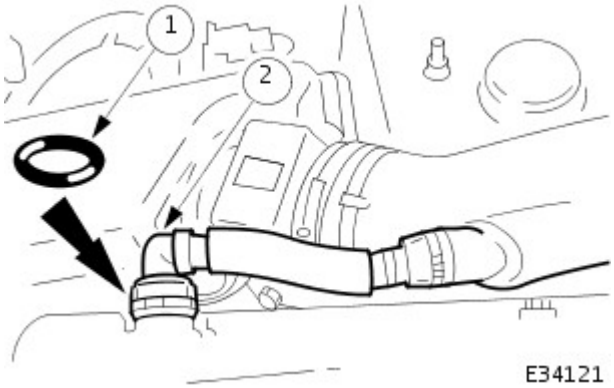
25. Reconnect the air flow meter multi-plug.

26. fit a new strap to secures the vacuum pipe to the induction elbow.

27. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.

2. Reconnect the breather pipe to the stub pipe.



28. Carefully refit the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

29. Connect the battery ground cable. Refit the battery cover. Reset the clock and the radio information.

30. Check for leaks and that all pipes are securely connected. Remove the protection sheets, close the engine compartment, luggage compartment and doors.

Engine - Intake Manifold Gaskets

In-vehicle Repair

Special Tool(s)	
 E36393	Quick Fit Connector Release Tool 310-044
 E36394	Quick Fit Connector Release Tool 310-054
 E36466	Fuel Injection Pressure Test Equipment 310-058

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Carefully remove the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.


E35302

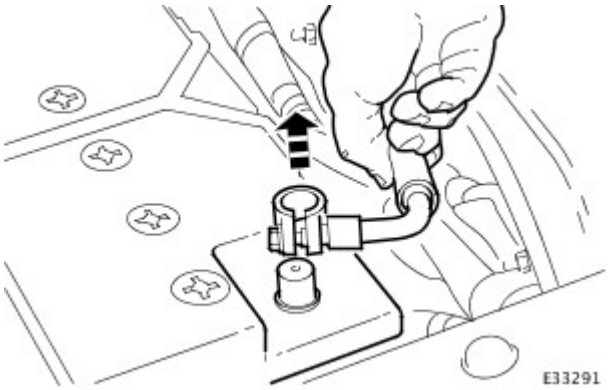
3. Depressurise the fuel system.
   - Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
   - Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.
4. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

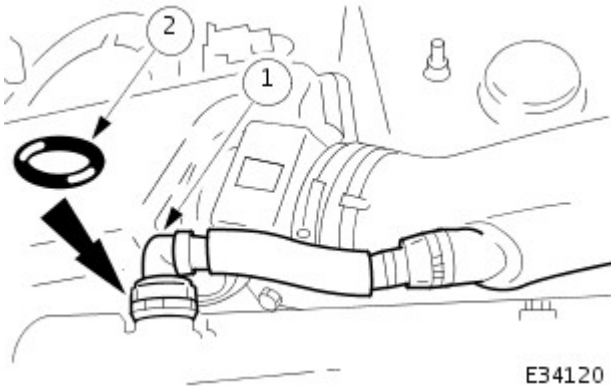


5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.

6. Disconnect the battery ground cable.

- Remove the battery cover.





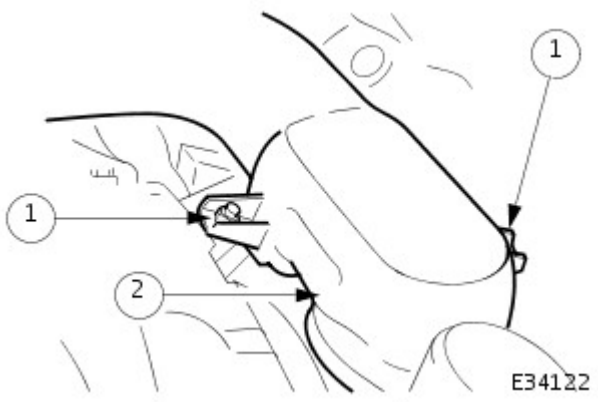
7. Disconnect the breather pipe from the A-Bank camshaft cover.

1. Disconnect the breather pipe from the stub pipe.
2. Remove and discard the O-ring seal from the breather pipe.

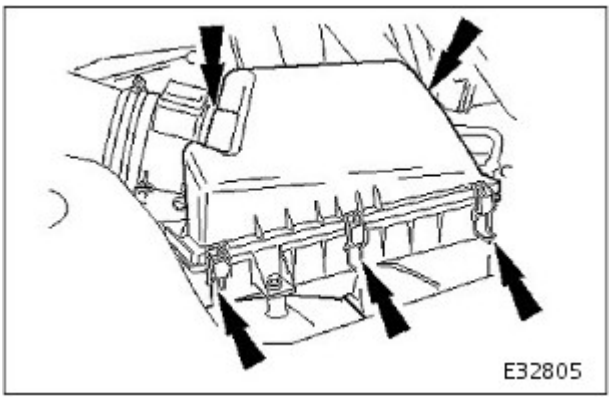
8. Disconnect the air flow meter multi-plug.

9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

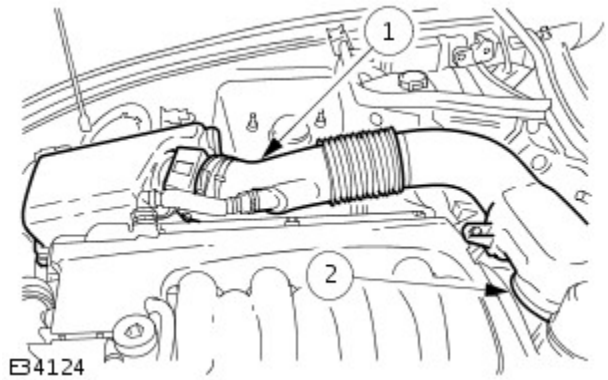


1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.



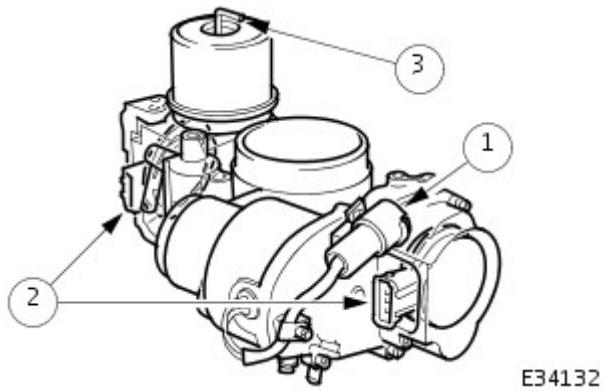
11. Disconnect the air cleaner cover.

1. Remove the five clips which secure the air cleaner cover.



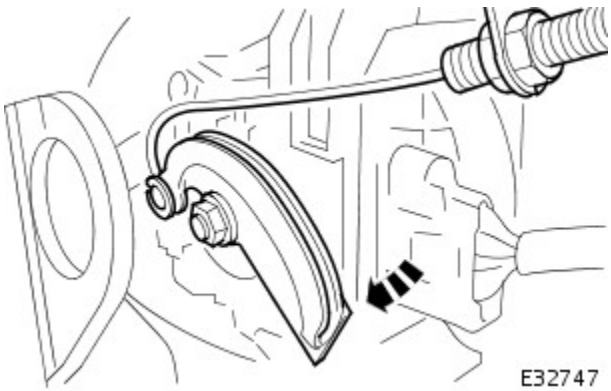
12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.



13. Disconnect the multi-plugs from the throttle body.

1. Disconnect the throttle body motor multi-plug.
2. Disconnect the two potentiometer multi-plugs, one each side of the throttle.
3. Disconnect the vacuum pipe elbow from the throttle actuator.

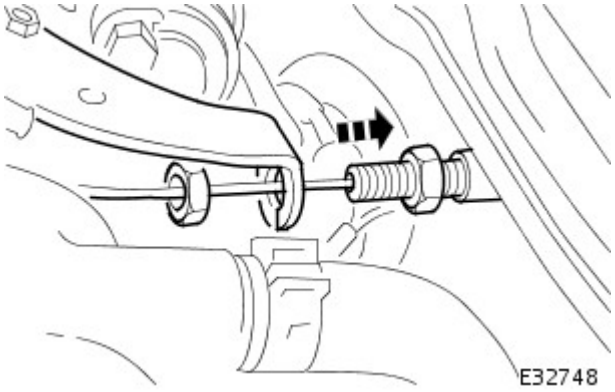


14. Disconnect the throttle inner cable.

- Turn the throttle pulley to the fully open position.
- Disconnect the throttle inner cable from the pulley.

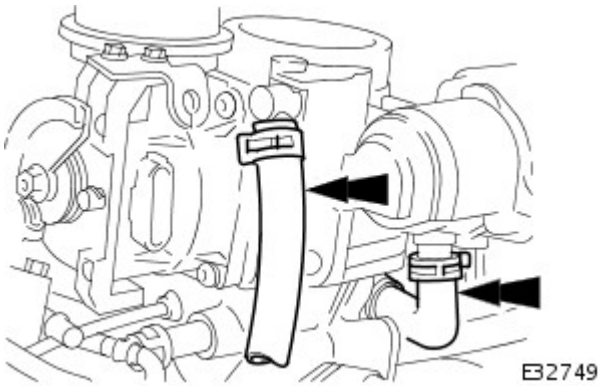
15. Disconnect the throttle outer cable.

- Remove the throttle cable adjusting nut from the outer cable.
- Remove the cable from the adjustment bracket.

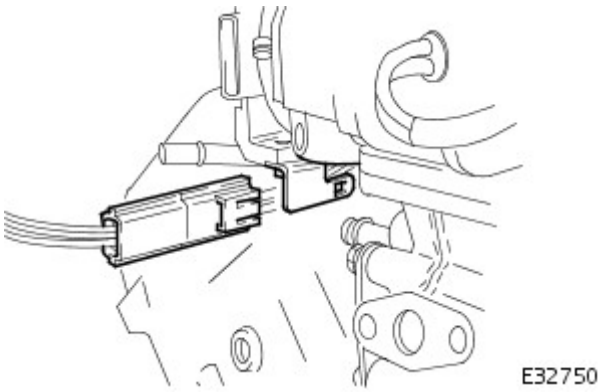


16. Disconnect the coolant hoses from the throttle body.

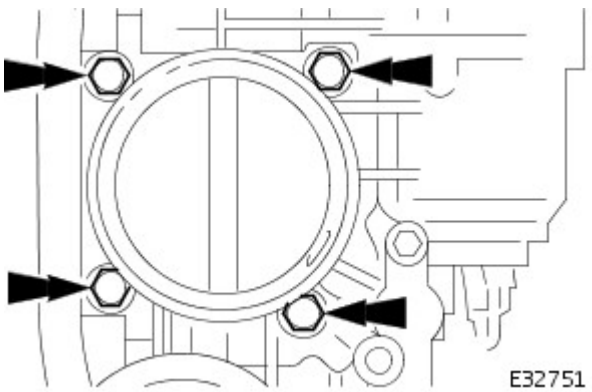
- Release the clip which secures the coolant return hose and disconnect the hose. Fit a blanking plug to the hose to prevent water leakage.
- Release the clip which secures the coolant feed hose and disconnect the hose. Fit a blanking plug to the hose to prevent water leakage.



17. Disconnect the multi-plug, located on the bracket under the left side of the throttle body.

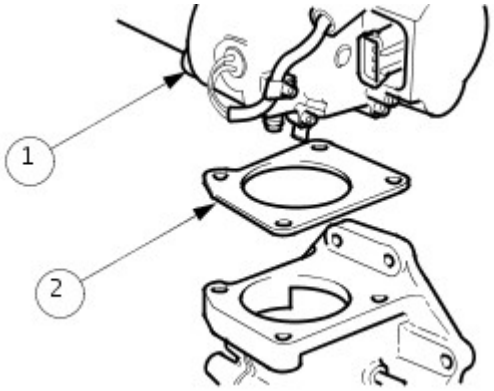


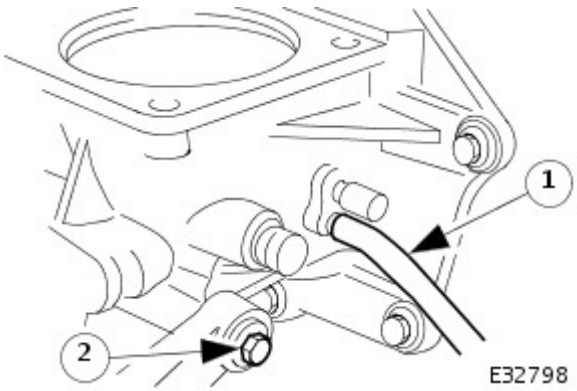
18. Remove the throttle body securing bolts.



19. Remove the throttle body.

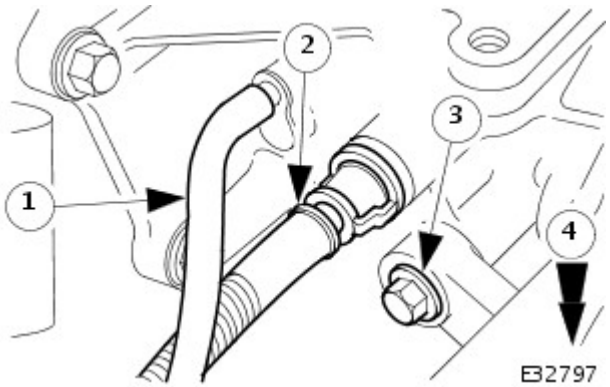
1. Remove the throttle body from the induction elbow.
2. Remove and discard the throttle body gasket.





20. Release the induction elbow support; working from the right hand side.

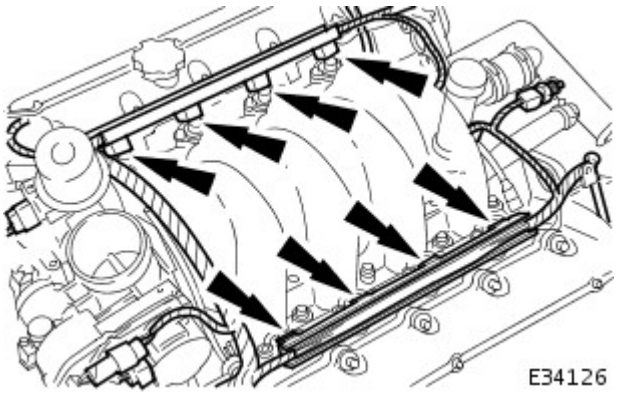
1. Disconnect the vacuum pipe from the centre of the induction elbow.
2. Remove the upper bolt from the induction elbow support bracket.



21. Release the induction elbow support; working from the left hand side.

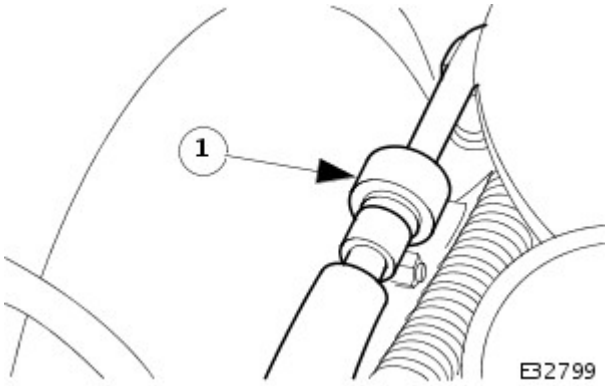
1. Disconnect the vacuum pipe from the front of the induction elbow.
2. Disconnect the engine breather T-piece from the induction elbow.
3. Remove the upper bolt from the induction elbow support bracket.
4. Loosen, but do not remove, the lower two bolts at the induction elbow support bracket.

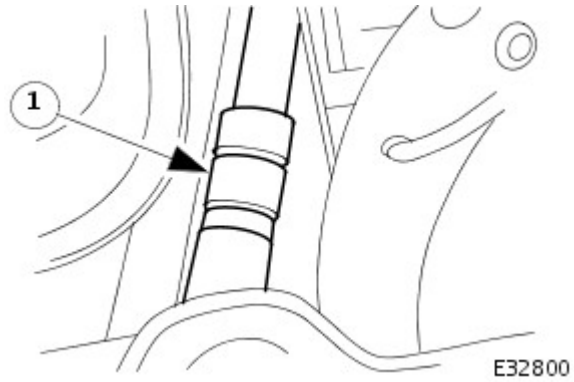
22. Disconnect the electrical connector from each fuel injector.



23. Disconnect the fuel feed hose.

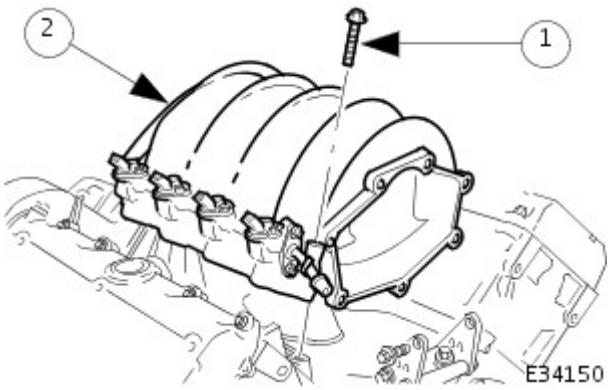
1. Disconnect the fuel feed hose at the Quick Fit connector, using special tool 310 - 044.





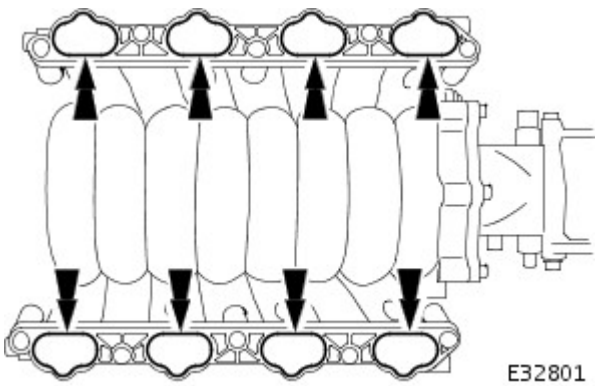
24. Disconnect the fuel return hose.

1. Disconnect the fuel return hose at the Quick Fit connector, using special tool 310 - 054.



25. Remove the inlet manifold.

1. Remove the ten bolts which secure the inlet manifold.
2. Remove the inlet manifold

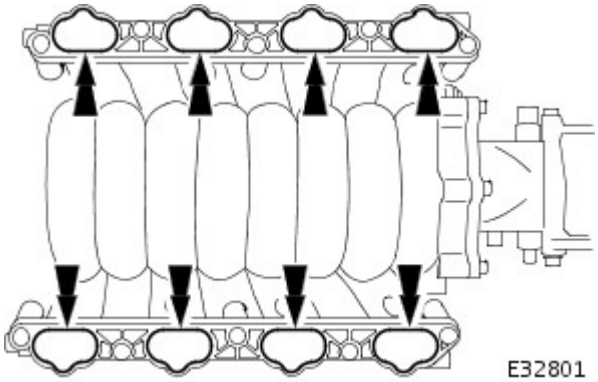


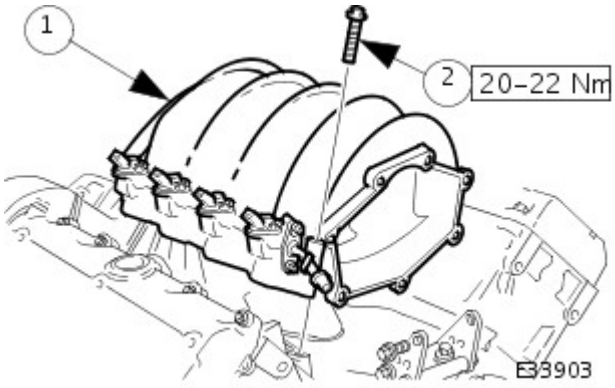
26. Remove and discard the eight seals from the inlet manifold ports.

Installation

1. Clean all parts and relevant mating faces.

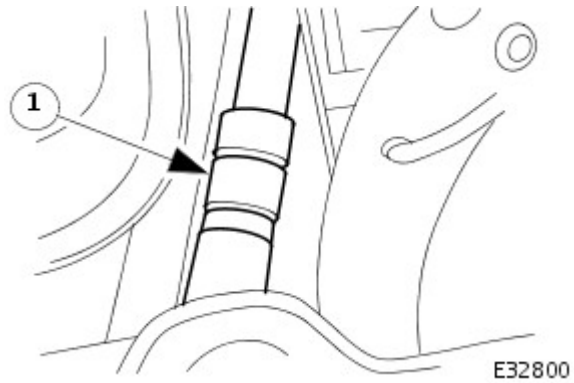
2. Fit eight new seals to the inlet manifold ports.





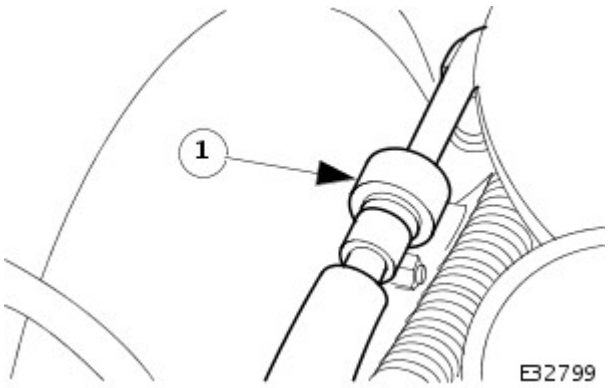
3. Fit the inlet manifold to the engine.

1. Fit the inlet manifold.
2. Fit the ten bolts which secure the inlet manifold.



4. Connect the fuel feed hose.

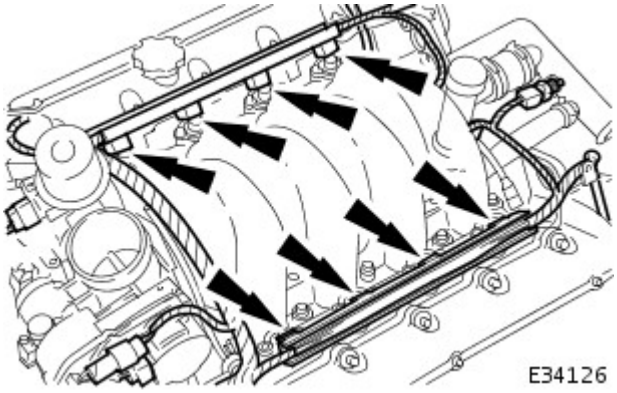
1. Connect the fuel feed hose at the Quick Fit connector. Ensure that the hose is fully seated to the feed pipe.

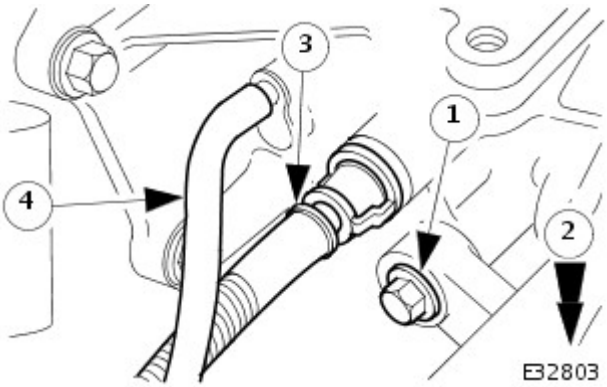


5. Connect the fuel return hose.

1. Connect the fuel return hose at the Quick Fit connector. Ensure that the hose is fully seated to the feed pipe.

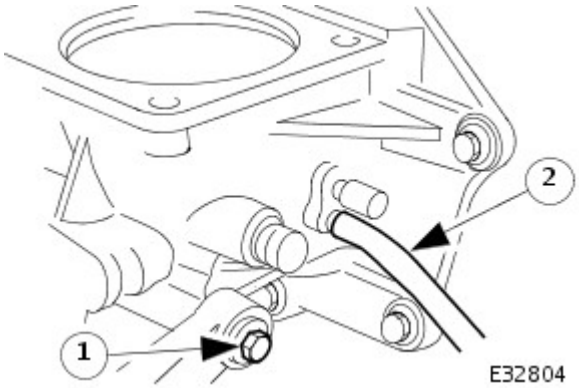
6. Reconnect the electrical connector to each fuel injector.





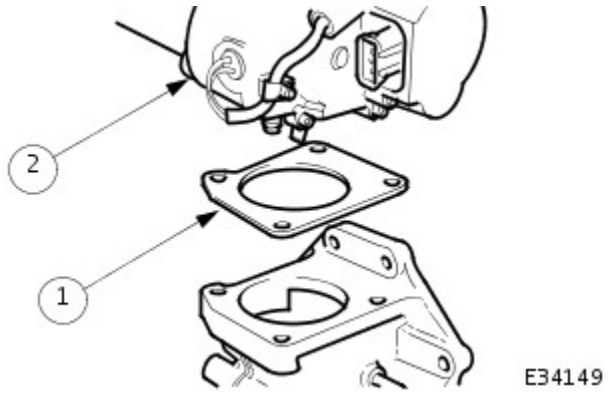
7. Refit the induction elbow support; working from the left hand side.

1. Fit the upper bolt to the induction elbow support bracket.
2. Tighten the lower two bolts at the induction elbow support bracket.
3. Connect the engine breather T-piece to the induction elbow.
4. Connect the vacuum pipe to the front of the induction elbow.



8. Fit the induction elbow support; working from the right hand side.

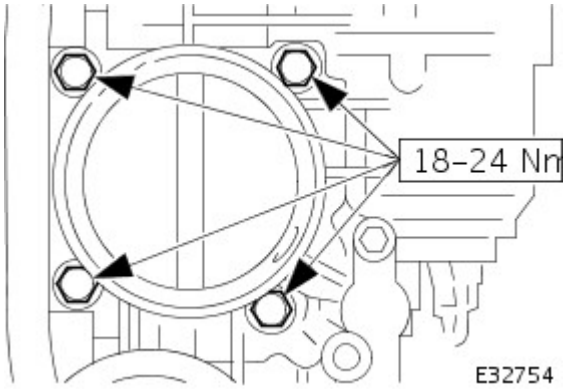
1. Fit the upper bolt to the induction elbow support bracket.
2. Reconnect the vacuum pipe to the centre of the induction elbow.

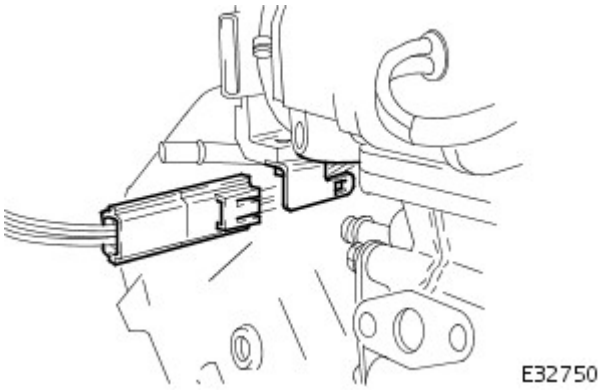


9. Fit the throttle body.

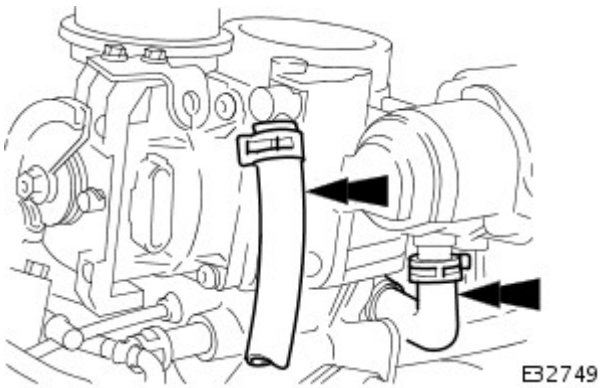
1. Fit a new gasket to the throttle body.
2. Position the throttle body to the induction elbow.

10. Fit the throttle body securing bolts.



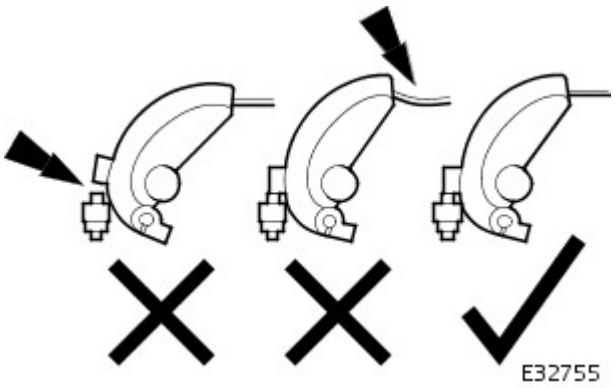


11. Reconnect the multi-plug, located on the bracket under the left side of the throttle body.



12. Connect the coolant hoses to the throttle body.

- Remove the blanking plugs from the hoses.
- Connect the coolant feed hose and secure with the clip.
- Connect the coolant return hose and secure with the clip.



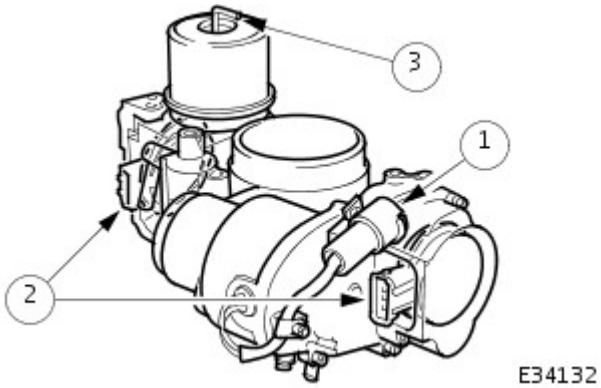
13. CAUTION: Under no circumstances may the quadrant be held clear of the throttle stop by cable tension

Refit the throttle cable and ensure that there is neither tension nor slack in the cable

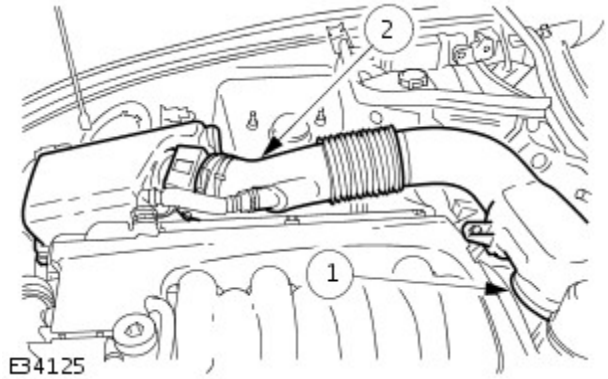
- Tighten the locknut without altering the setting or introducing twist into the cable outer
- Check the kickdown setting using the PDU. For scan tool procedure, refer to 303-14, Throttle cable, Renew

14. Reconnect the multi-plugs to the throttle body.

1. Connect the throttle body motor multi-plug.
2. Connect the two potentiometer multi-plugs, one each side of the throttle.

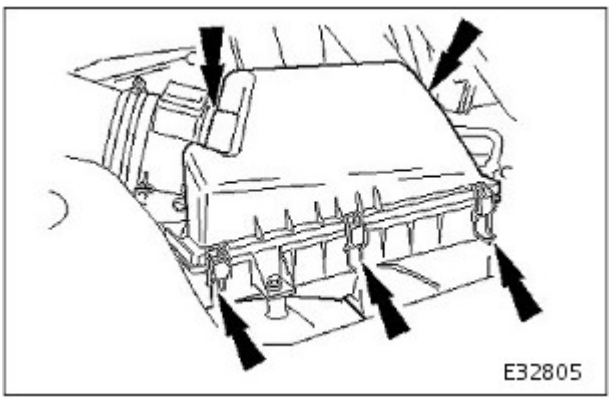


3. Connect the vacuum pipe elbow to the throttle actuator.



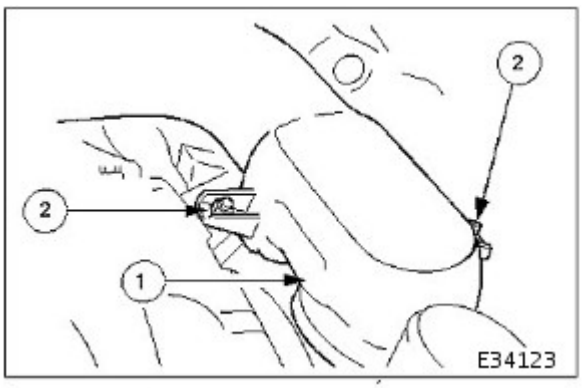
15. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.



16. Reconnect the air cleaner cover.

1. Fit the five clips which secure the air cleaner cover.



17. Connect the intake tube to the throttle body.

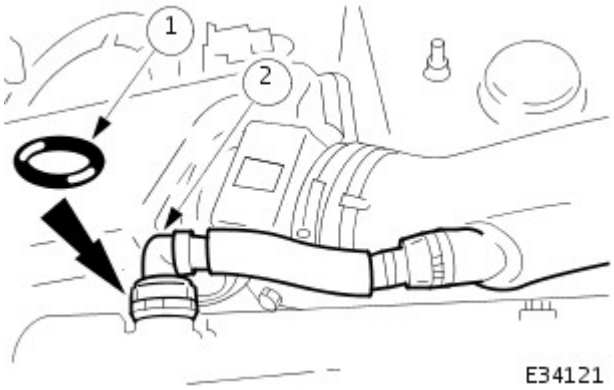
1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

18. Reconnect the air flow meter multi-plug.

19. Fit a new strap to secures the vacuum pipe to the induction elbow.

20. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.



2. Reconnect the breather pipe to the stub pipe.

21. Carefully refit the engine covers, taking care not to damage the plastic fixings or the rubber inserts.

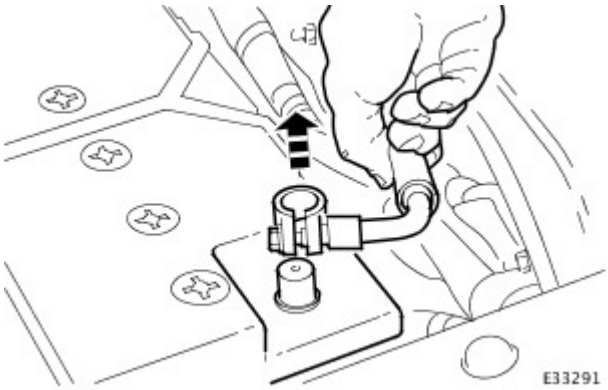
22. Connect the battery ground cable. Refit the battery cover. Reset the clock and the radio information.

23. Check for leaks and that all pipes are securely connected. Remove the protection sheets, close the engine compartment, luggage compartment and doors.

Engine - Intake Manifold LH

In-vehicle Repair

Removal



1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.

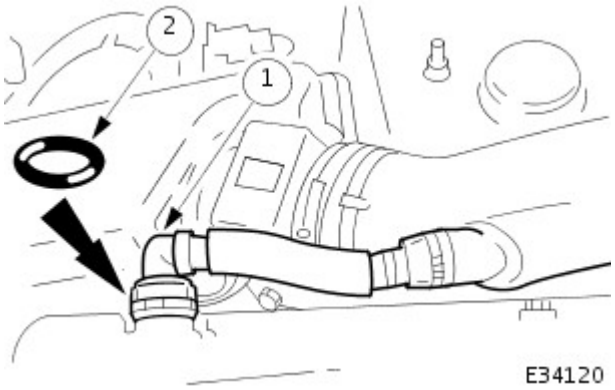
WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.



3. Depressurise the fuel system.
   - Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
   - Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.



4. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.
5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.
6. Drain the radiator coolant. Refer to Operation 26.10.01.
7. Disconnect the breather pipe from the A-Bank camshaft cover.
   1. Disconnect the breather pipe from the stub pipe.
   2. Remove and discard the O-ring seal from the breather

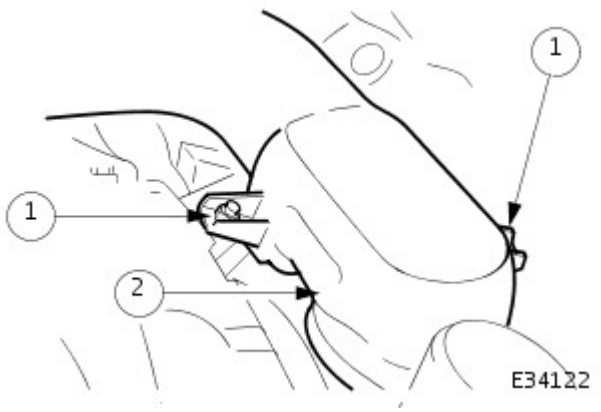


pipe.

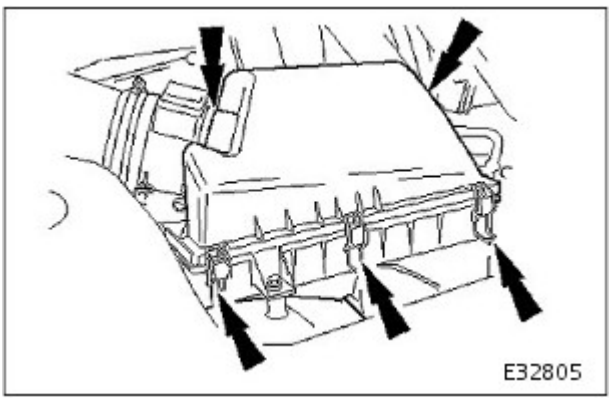
8. Disconnect the air flow meter multi-plug.

9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

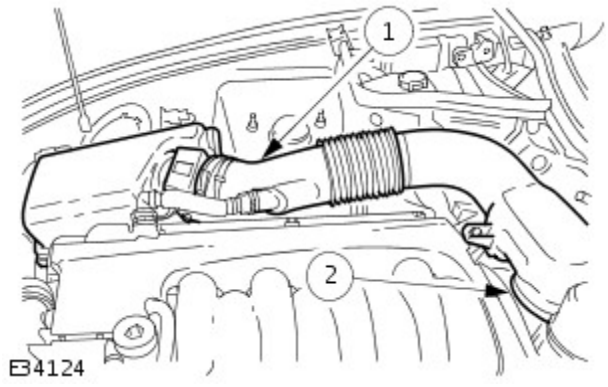


1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.



11. Disconnect the air cleaner cover.

- Remove the five clips which secure the air cleaner cover.



12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

13. Remove the throttle housing. Refer to Operation 19.70.04.

14. Remove the throttle induction elbow. Refer to Operation

19.70.28.

15. Remove the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

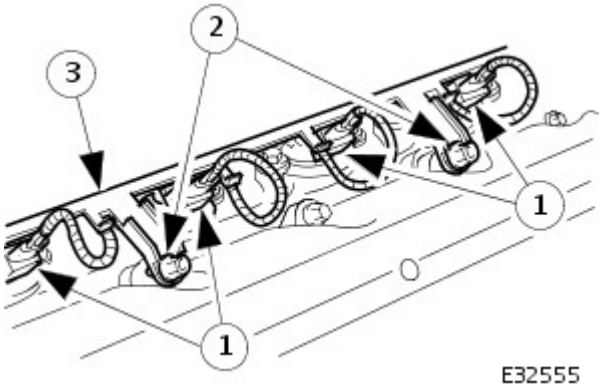
16. Remove the coolant output pipe. Refer to Operation (SC) 26.31.08.

17. Remove the supercharger drive belt. Refer to Operation 18.50.08.

18. Remove the supercharger assembly. Refer to operation 18.50.15.

19. Remove the B-Bank intercooler. Refer to Operation 18.50.19.

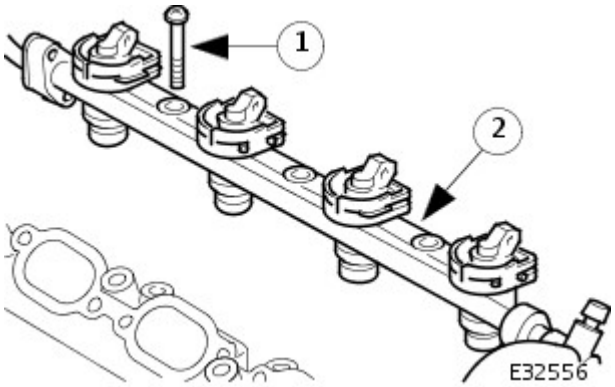
20. Disconnect the fuel injector harness.



E32555

1. Disconnect the multi-plugs from the B-Bank injectors.
2. Loosen, do not remove, the nuts which secure the harness to the camshaft cover.
3. Reposition the harness for access.

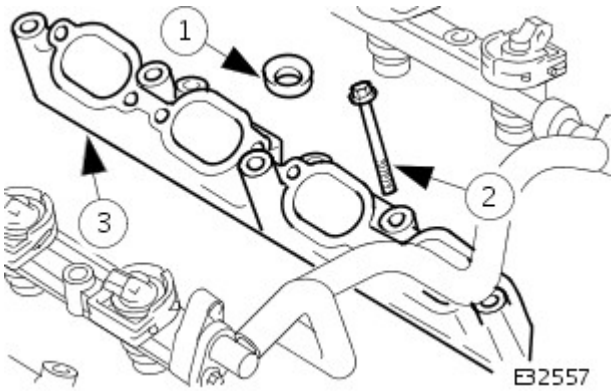
21. Remove the fuel rail.



E32556

1. Remove the three bolts which secure the fuel rail to the intercooler adaptor.
2. Remove the fuel rail from the adaptor; still connected to the fuel crossover pipe and fuel feed pipe.

22. Remove the intercooler adaptor assembly.



E32557

1. Remove and discard the seals from the fuel rail.
2. Remove the five bolts which secure the adaptor assembly to the cylinder head.
3. Remove the adaptor assembly from the cylinder head.

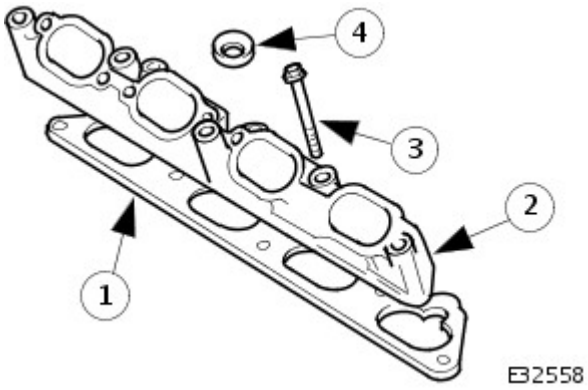
- Remove the gasket; adaptor assembly to cylinder head.

23. Clean and inspect all relevant mating faces.

Installation

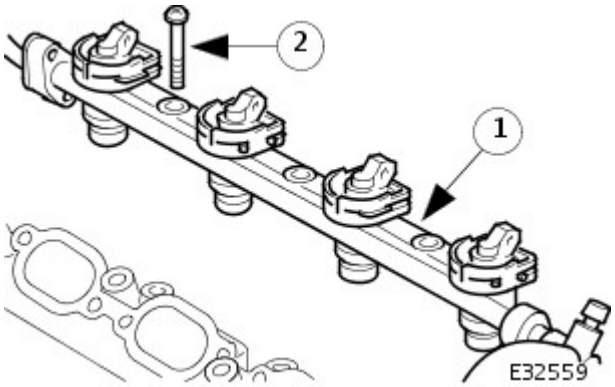
1. Fit the intercooler adaptor assembly.

1. Fit a new gasket; adaptor assembly to cylinder head.
2. Align and fit the adaptor assembly to the cylinder head.



3. Fit the five bolts which secure the adaptor assembly to the cylinder head.

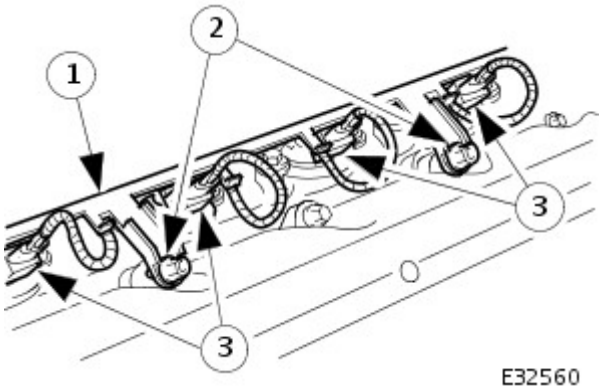
4. Fit new seals to the fuel rail.



2. Fit the fuel rail to the intercooler adaptor.

1. Align the fuel rail to the adaptor; still connected to the fuel crossover pipe and fuel feed pipe. Locate the fuel rail into the adaptor.

2. Fit the three bolts which secure the fuel rail to the adaptor.



3. Connect the fuel injector harness.

1. Reposition the harness.

2. Tighten the nuts which secure the harness to the camshaft cover.

3. Connect the multi-plugs to the B-Bank injectors.

4. Fit the B-Bank intercooler. Refer to Operation 18.50.19.

5. Fit the supercharger assembly. Refer to operation 18.50.15.

6. Fit the supercharger drive belt. Refer to Operation 18.50.08.

7. Fit the coolant output pipe. Refer to Operation (SC) 26.31.08.

8. Fit the throttle induction elbow. Refer to Operation 19.70.28.

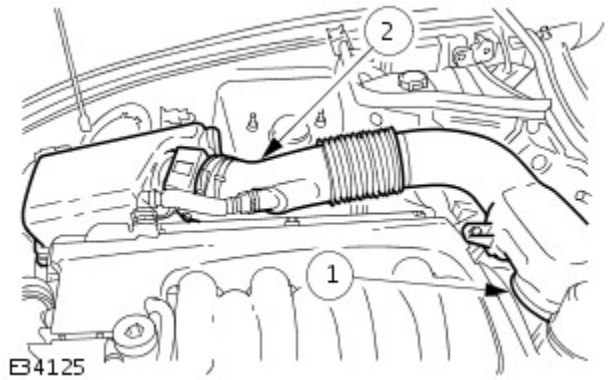
9. Fit the throttle housing. Refer to Operation 19.70.04.

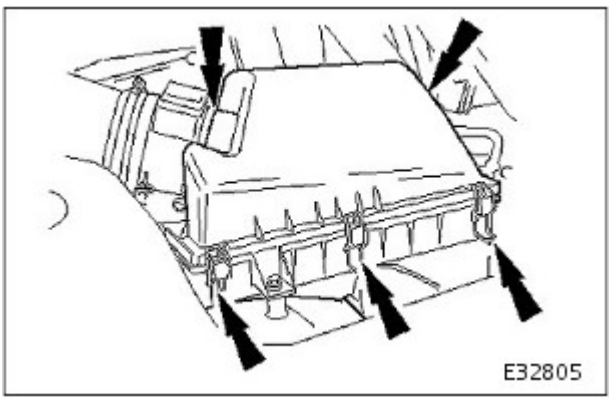
10. Fit the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

11. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.

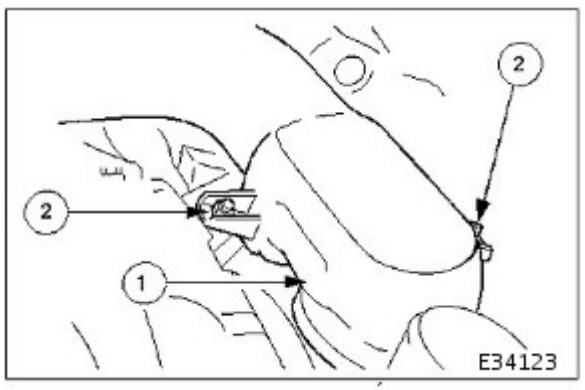
2. Fit the intake tube / air flow meter / air cleaner cover assembly.





12. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

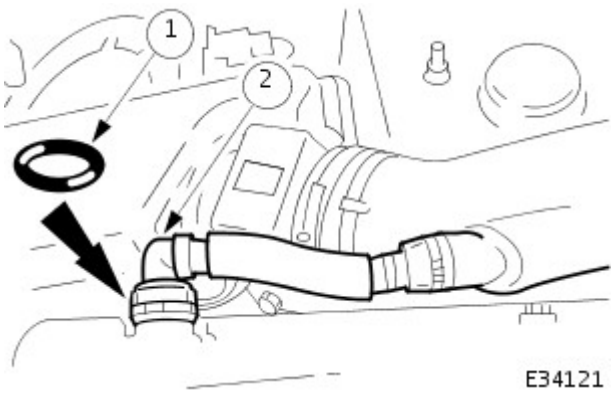


13. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

14. Reconnect the air flow meter multi-plug.

15. Fit a new strap to secure the vacuum pipe to the induction elbow.



16. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.
2. Reconnect the breather pipe to the stub pipe.

17. Refill the cooling system. Refer to Operation (SC) (26.10.01).

18. Connect the battery and fit the battery cover.

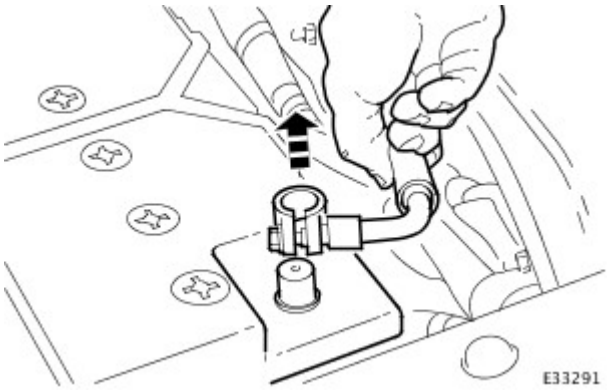
- Refer to the Battery Reconnection Procedure (86.15.15).

19. Remove the paintwork protection sheets and close the engine cover.

Engine - Intake Manifold RH

In-vehicle Repair

Removal



1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.

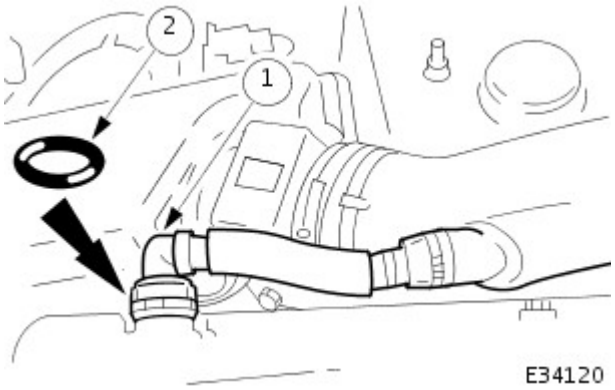
WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.



3. Depressurise the fuel system.
   - Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
   - Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.



4. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.
5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.
6. Drain the radiator coolant. Refer to Operation 26.10.01.
7. Disconnect the breather pipe from the A-Bank camshaft cover.
   1. Disconnect the breather pipe from the stub pipe.
   2. Remove and discard the O-ring seal from the breather

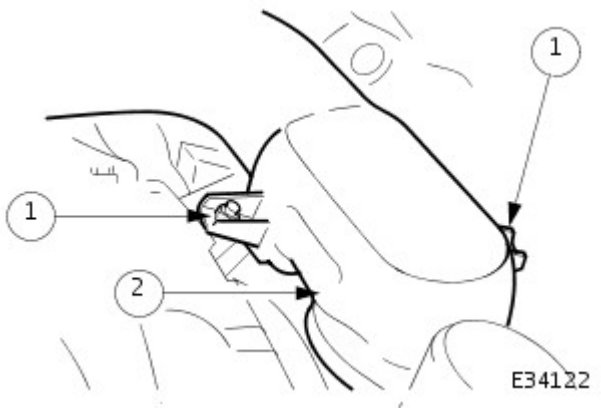


pipe.

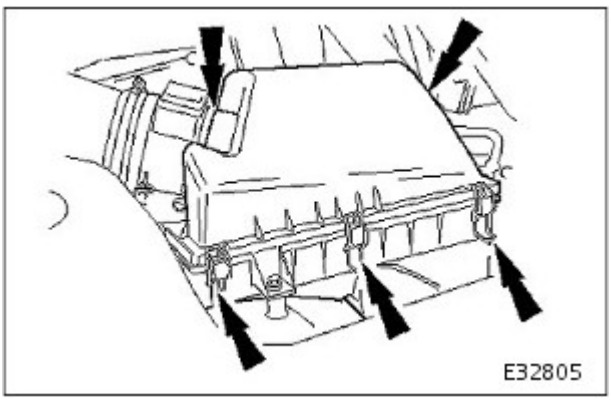
8. Disconnect the air flow meter multi-plug.

9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

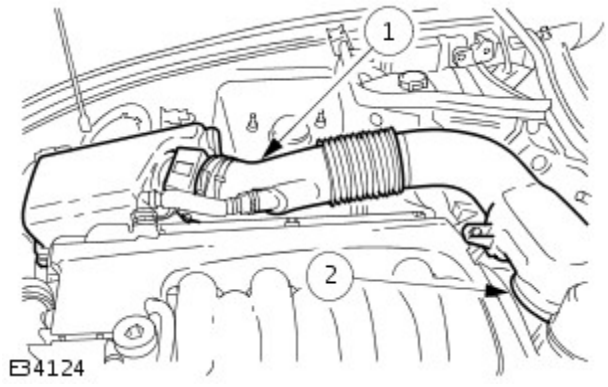


1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.



11. Disconnect the air cleaner cover.

- Remove the five clips which secure the air cleaner cover.



12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

13. Remove the throttle housing. Refer to Operation 19.70.04.

14. Remove the throttle induction elbow. Refer to Operation

19.70.28.

15. Remove the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

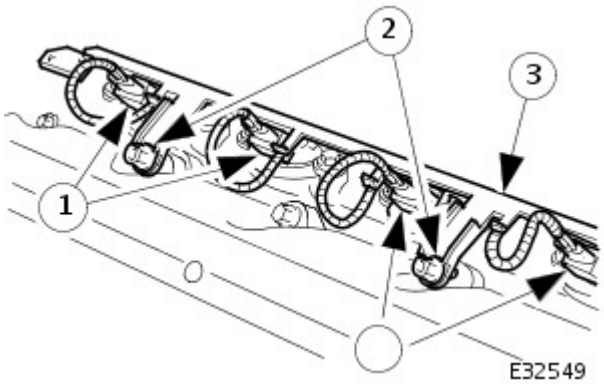
16. Remove the coolant output pipe. Refer to Operation (SC) 26.31.08.

17. Remove the supercharger drive belt. Refer to Operation 18.50.08.

18. Remove the supercharger assembly. Refer to operation 18.50.15.

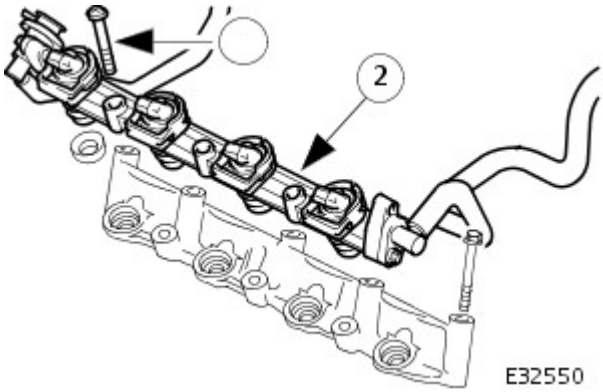
19. Remove the A-Bank intercooler. Refer to Operation 18.50.18.

20. Disconnect the fuel injector harness.



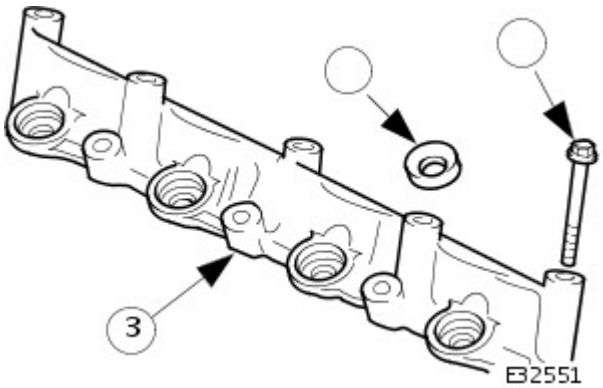
1. Disconnect the multi-plugs from the A-Bank injectors.
2. Loosen, do not remove, the nuts which secure the harness to the camshaft cover.
3. Reposition the harness for access.

21. Remove the fuel rail.



1. Remove the three bolts which secure the fuel rail to the intercooler adaptor.
2. Remove the fuel rail from the adaptor; still connected to the fuel crossover pipe and fuel return pipe.

22. Remove the intercooler adaptor assembl y.



1. Remove and discard the seals from the fuel rail.
2. Remove the five bolts which secure the adaptor assembly to the cylinder head.
3. Remove the adaptor assembly from the cylinder head.

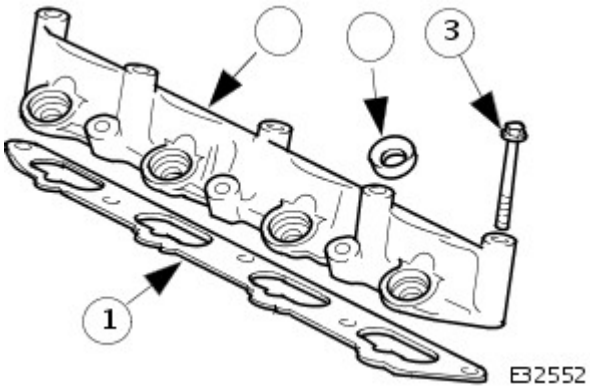
- Remove the gasket; adaptor assembly to cylinder head.

23. Clean and inspect all relevant mating faces.

Installation

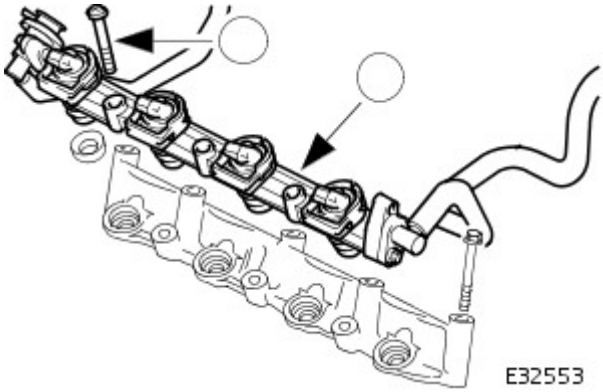
1. Fit the intercooler adaptor assembly.

1. Fit a new gasket; adaptor assembly to cylinder head.
2. Align and fit the adaptor assembly to the cylinder head.



3. Fit the five bolts which secure the adaptor assembly to the cylinder head.

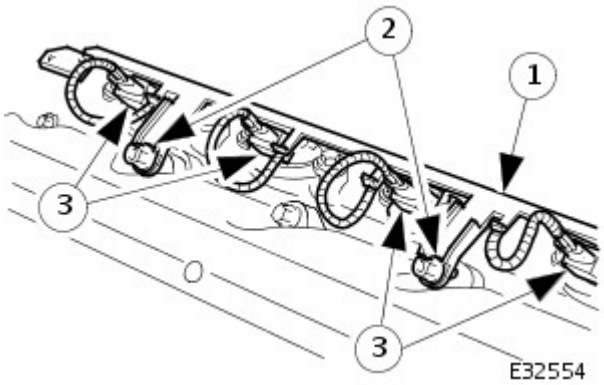
4. Fit new seals to the fuel rail.



2. Fit the fuel rail to the intercooler adaptor.

1. Align the fuel rail to the adaptor; still connected to the fuel crossover pipe and fuel return pipe. Locate the fuel rail into the adaptor.

2. Fit the three bolts which secure the fuel rail to the adaptor.



3. Connect the fuel injector harness.

1. Reposition the harness.

2. Tighten the nuts which secure the harness to the camshaft cover.

3. Connect the multi-plugs to the A-Bank injectors.

4. Fit the A-Bank intercooler. Refer to Operation 18.50.18.

5. Fit the supercharger assembly. Refer to operation 18.50.15.

6. Fit the supercharger drive belt. Refer to Operation 18.50.08.

7. Fit the coolant output pipe. Refer to Operation 26.31.08.

8. Fit the throttle induction elbow. Refer to Operation 19.70.28.

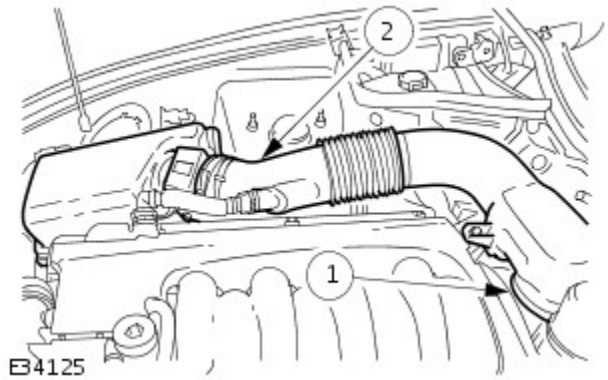
9. Fit the throttle housing. Refer to Operation 19.70.04.

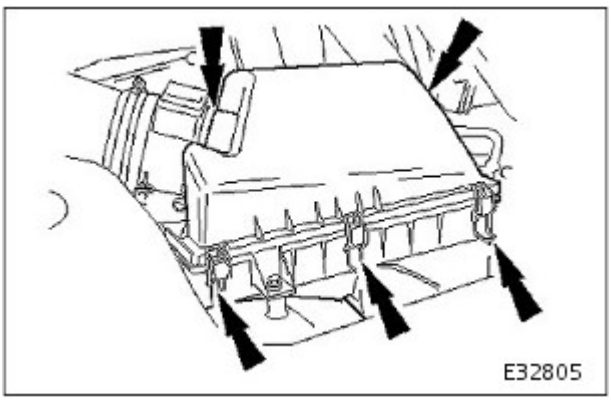
10. Fit the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

11. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.

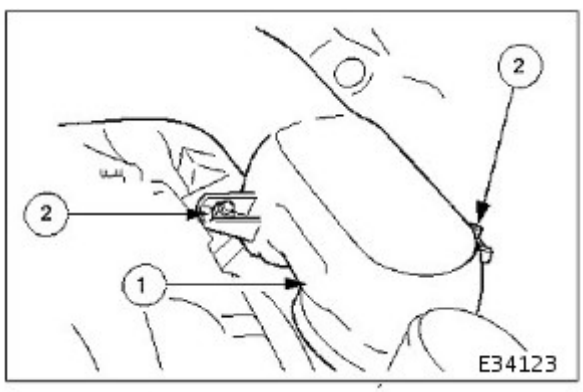
2. Fit the intake tube / air flow meter / air cleaner cover assembly.





12. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

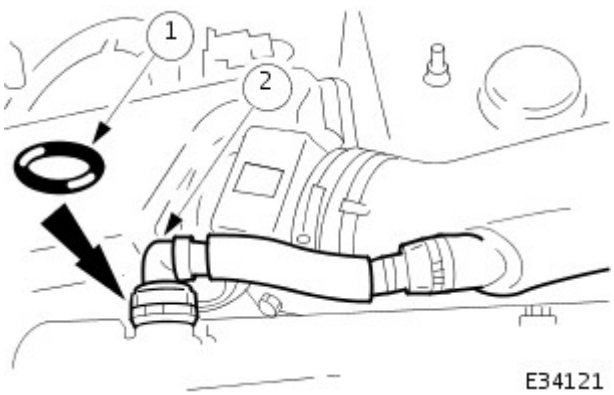


13. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

14. Reconnect the air flow meter multi-plug.

15. Fit a new strap to secure the vacuum pipe to the induction elbow.



16. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.
2. Reconnect the breather pipe to the stub pipe.

17. Refill the cooling system. Refer to Operation (SC) (26.10.01).

18. Connect the battery and fit the battery cover.

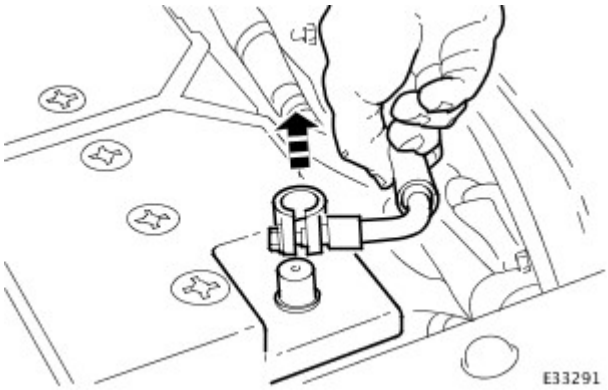
- Refer to the Battery Reconnection Procedure (86.15.15).

19. Remove the paintwork protection sheets and close the engine cover.

Engine - Intake Manifold Gasket LH

In-vehicle Repair

Removal



1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.

WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.



3. Depressurise the fuel system.

- Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
- Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.



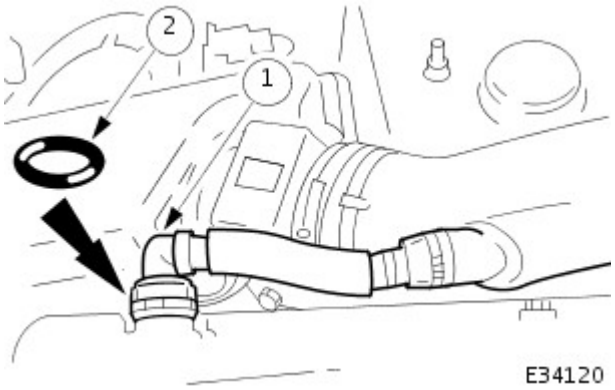
4. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.

6. Drain the radiator coolant. Refer to Operation 26.10.01.

7. Disconnect the breather pipe from the A-Bank camshaft cover.

1. Disconnect the breather pipe from the stub pipe.
2. Remove and discard the O-ring seal from the breather

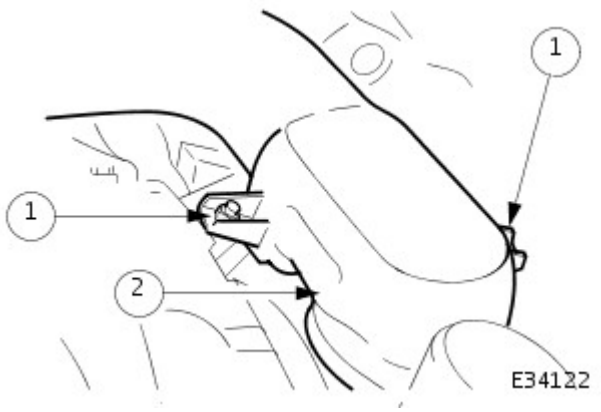


pipe.

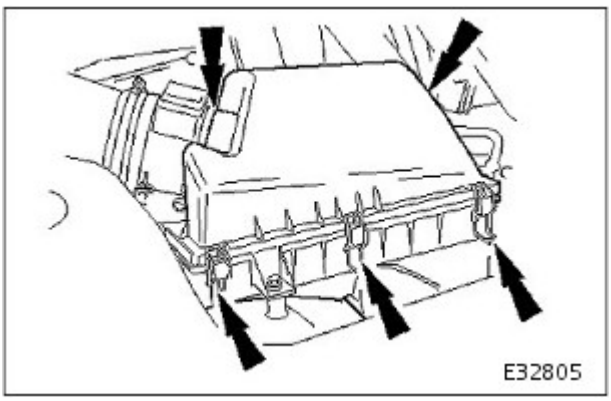
8. Disconnect the air flow meter multi-plug.

9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

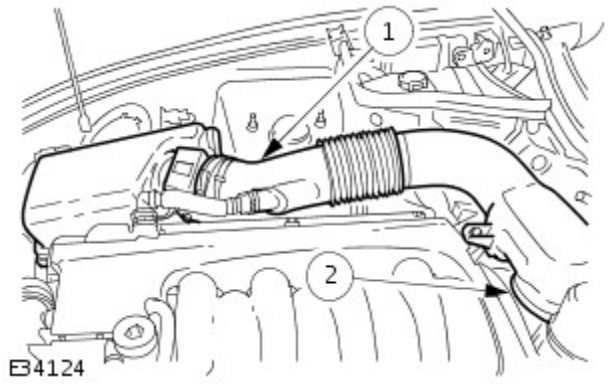


1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.



11. Disconnect the air cleaner cover.

- Remove the five clips which secure the air cleaner cover.



12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

13. Remove the throttle housing. Refer to Operation 19.70.04.

14. Remove the throttle induction elbow. Refer to Operation

19.70.28.

15. Remove the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

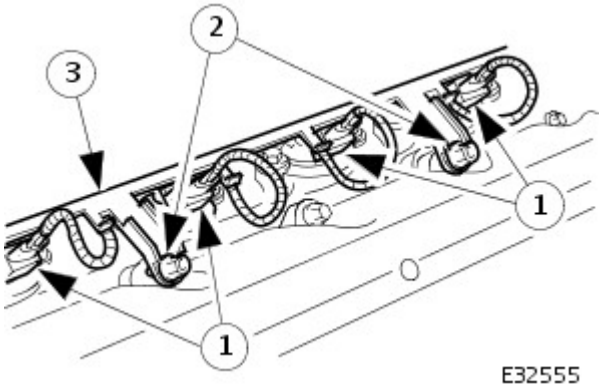
16. Remove the coolant output pipe. Refer to Operation (SC) 26.31.08.

17. Remove the supercharger drive belt. Refer to Operation 18.50.08.

18. Remove the supercharger assembly. Refer to operation 18.50.15.

19. Remove the B-Bank intercooler. Refer to Operation 18.50.19.

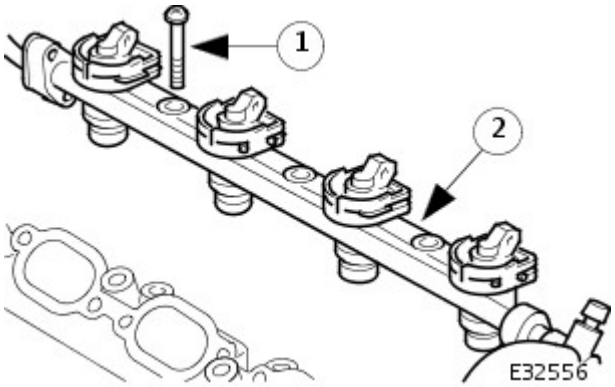
20. Disconnect the fuel injector harness.



E32555

1. Disconnect the multi-plugs from the B-Bank injectors.
2. Loosen, do not remove, the nuts which secure the harness to the camshaft cover.
3. Reposition the harness for access.

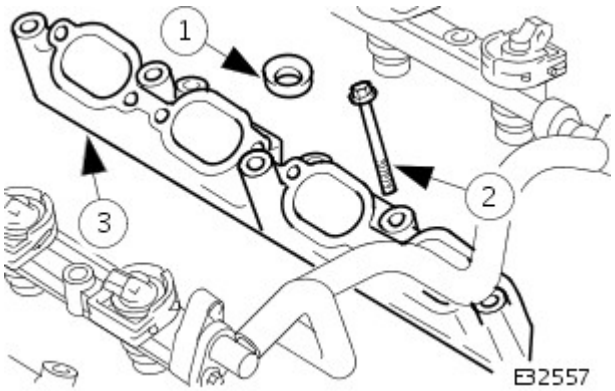
21. Remove the fuel rail.



E32556

1. Remove the three bolts which secure the fuel rail to the intercooler adaptor.
2. Remove the fuel rail from the adaptor; still connected to the fuel crossover pipe and fuel feed pipe.

22. Remove the intercooler adaptor assembly.



E32557

1. Remove and discard the seals from the fuel rail.
2. Remove the five bolts which secure the adaptor assembly to the cylinder head.
3. Remove the adaptor assembly from the cylinder head.

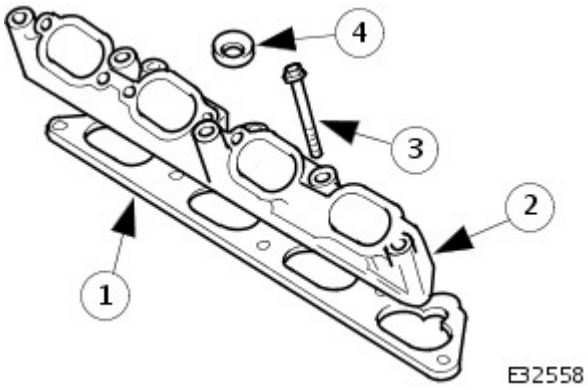
- Remove the gasket; adaptor assembly to cylinder head.

23. Clean and inspect all relevant mating faces.

Installation

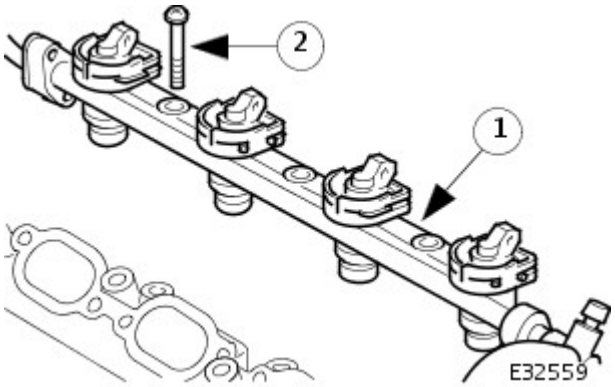
1. Fit the intercooler adaptor assembly.

1. Fit a new gasket; adaptor assembly to cylinder head.
2. Align and fit the adaptor assembly to the cylinder head.



3. Fit the five bolts which secure the adaptor assembly to the cylinder head.

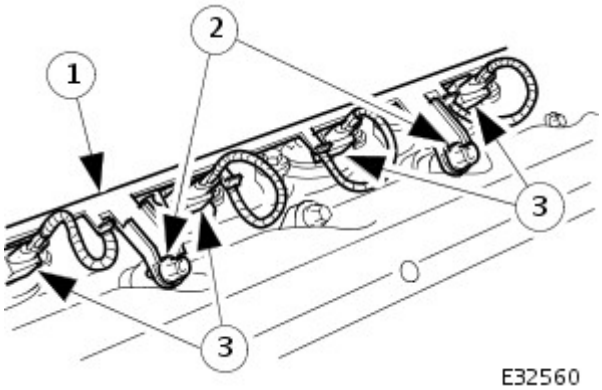
4. Fit new seals to the fuel rail.



2. Fit the fuel rail to the intercooler adaptor.

1. Align the fuel rail to the adaptor; still connected to the fuel crossover pipe and fuel feed pipe. Locate the fuel rail into the adaptor.

2. Fit the three bolts which secure the fuel rail to the adaptor.



3. Connect the fuel injector harness.

1. Reposition the harness.

2. Tighten the nuts which secure the harness to the camshaft cover.

3. Connect the multi-plugs to the B-Bank injectors.

4. Fit the B-Bank intercooler. Refer to Operation 18.50.19.

5. Fit the supercharger assembly. Refer to operation 18.50.15.

6. Fit the supercharger drive belt. Refer to Operation 18.50.08.

7. Fit the coolant output pipe. Refer to Operation (SC) 26.31.08.

8. Fit the throttle induction elbow. Refer to Operation 19.70.28.

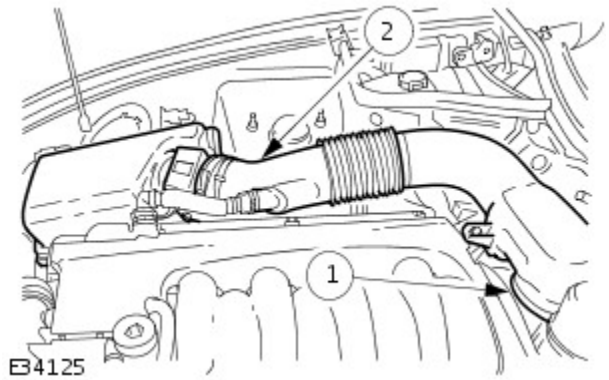
9. Fit the throttle housing. Refer to Operation 19.70.04.

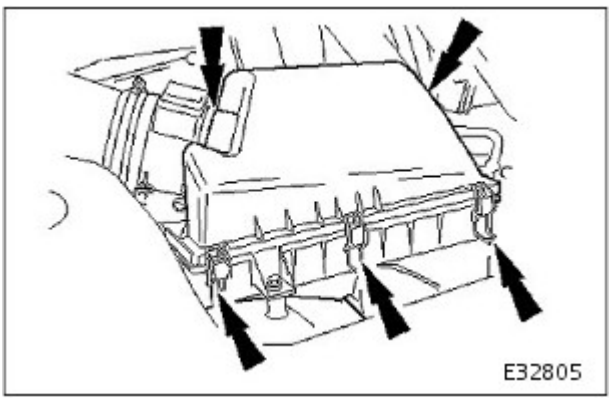
10. Fit the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

11. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.

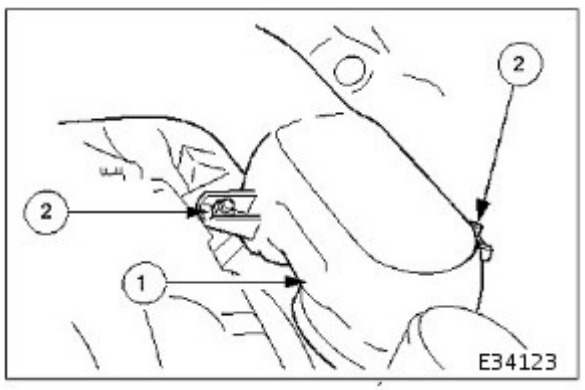
2. Fit the intake tube / air flow meter / air cleaner cover assembly.





12. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

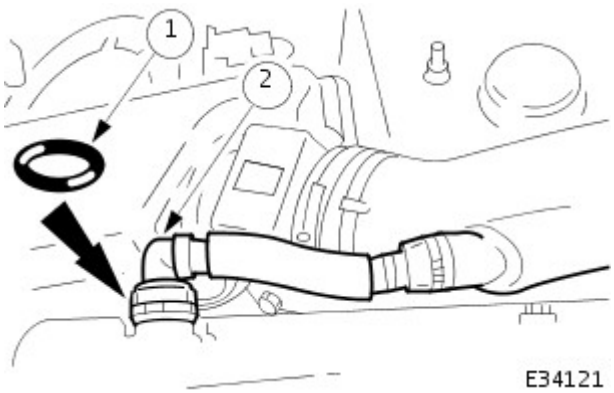


13. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

14. Reconnect the air flow meter multi-plug.

15. Fit a new strap to secure the vacuum pipe to the induction elbow.



16. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.
2. Reconnect the breather pipe to the stub pipe.

17. Refill the cooling system. Refer to Operation (SC) (26.10.01).

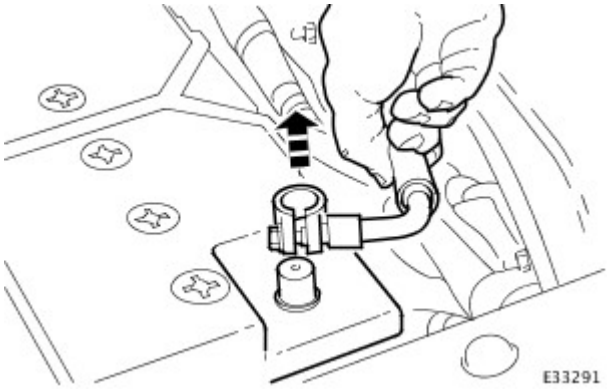
18. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure (86.15.15).

19. Remove the paintwork protection sheets and close the engine cover.

Engine - Intake Manifold Gasket RH

In-vehicle Repair



1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.



3. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNINGS GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

Depressurise the fuel system.

- Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
- Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.



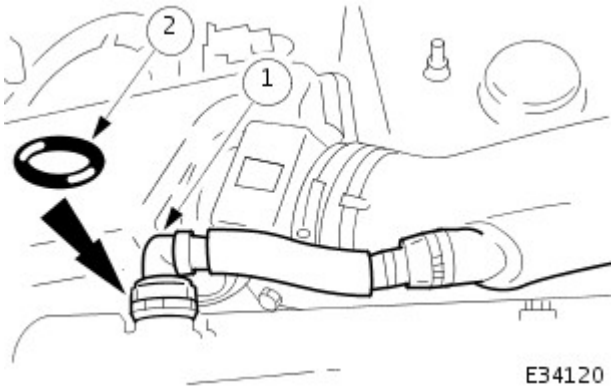
4. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

5. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. refit the valve cap.

6. Drain the radiator coolant. Refer to Operation 26.10.01.

7. Disconnect the breather pipe from the A-Bank camshaft cover.

1. Disconnect the breather pipe from the stub pipe.
2. Remove and discard the O-ring seal from the breather pipe.



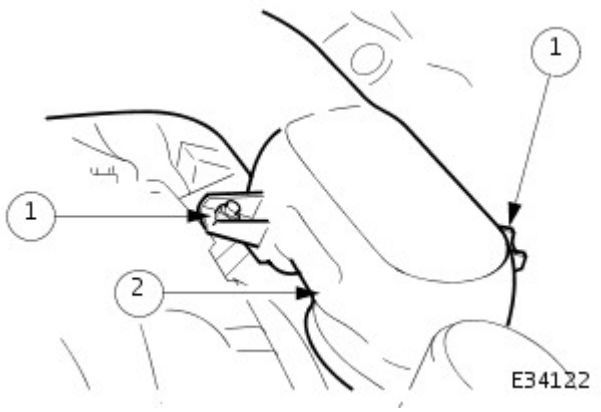
8. Disconnect the air flow meter multi-plug.

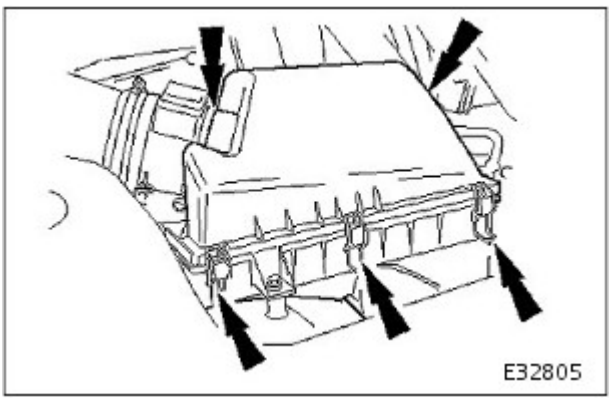
9. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

10. Disconnect the intake tube from the throttle body.

1. Remove the two bolts which secure the intake tube to the throttle body.

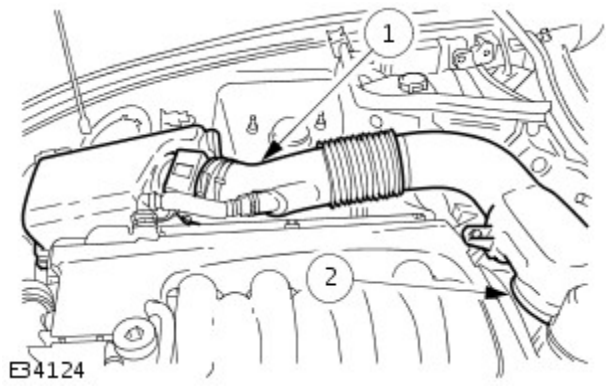
2. Disconnect the intake tube from the throttle body.





11. Disconnect the air cleaner cover.

- Remove the five clips which secure the air cleaner cover.



12. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.

2. Remove and discard the rubber seal; air intake tube to throttle body.

13. Remove the throttle housing. Refer to Operation 19.70.04.

14. Remove the throttle induction elbow. Refer to Operation

19.70.28.

15. Remove the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

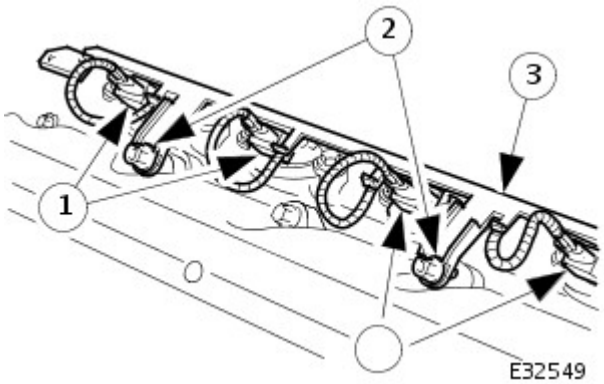
16. Remove the coolant output pipe. Refer to Operation (SC) 26.31.08.

17. Remove the supercharger drive belt. Refer to Operation 18.50.08.

18. Remove the supercharger assembly. Refer to operation 18.50.15.

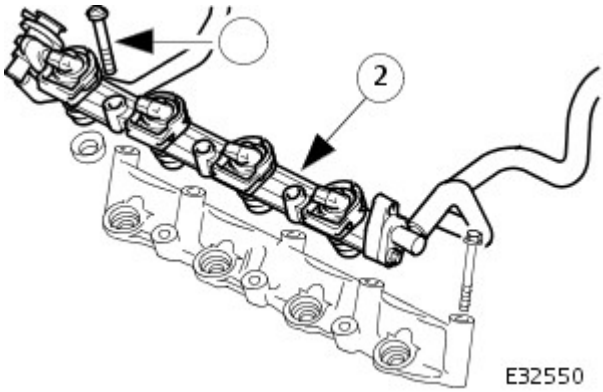
19. Remove the A-Bank intercooler. Refer to Operation 18.50.18.

20. Disconnect the fuel injector harness.



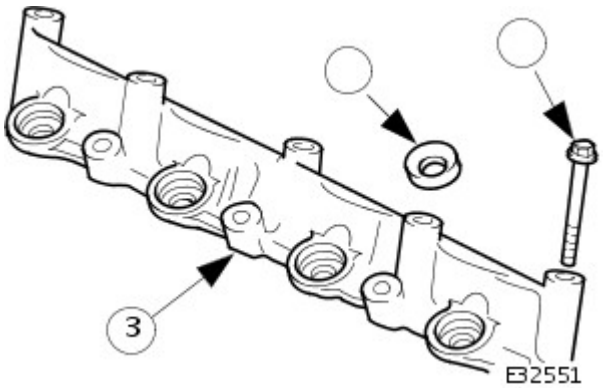
1. Disconnect the multi-plugs from the A-Bank injectors.
2. Loosen, do not remove, the nuts which secure the harness to the camshaft cover.
3. Reposition the harness for access.

21. Remove the fuel rail.



1. Remove the three bolts which secure the fuel rail to the intercooler adaptor.
2. Remove the fuel rail from the adaptor; still connected to the fuel crossover pipe and fuel return pipe.

22. Remove the intercooler adaptor assembly.



1. Remove and discard the seals from the fuel rail.
2. Remove the five bolts which secure the adaptor assembly to the cylinder head.
3. Remove the adaptor assembly from the cylinder head.

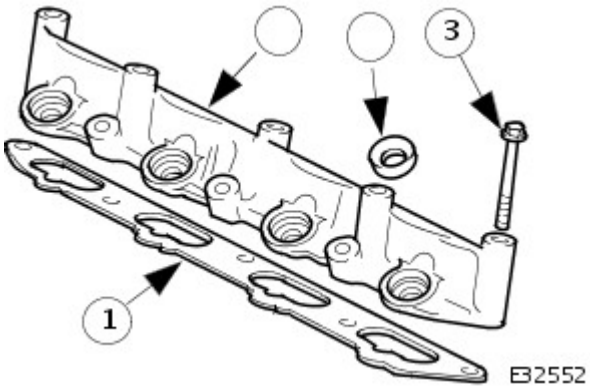
- Remove the gasket; adaptor assembly to cylinder head.

23. Clean and inspect all relevant mating faces.

Installation

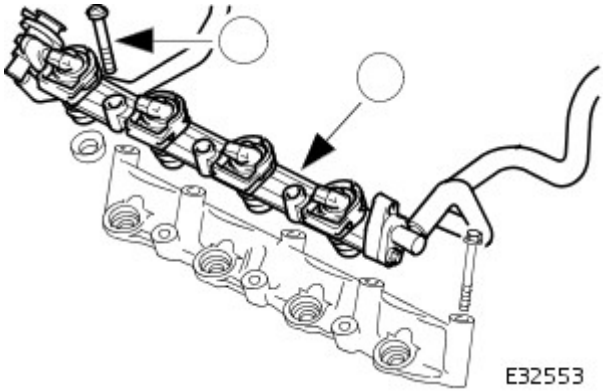
1. Fit the intercooler adaptor assembly.

1. Fit a new gasket; adaptor assembly to cylinder head.
2. Align and fit the adaptor assembly to the cylinder head.



3. Fit the five bolts which secure the adaptor assembly to the cylinder head.

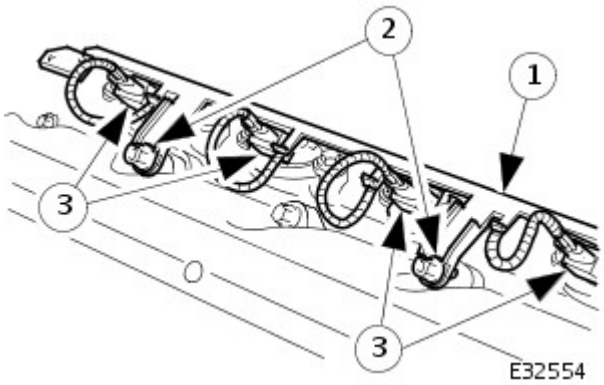
4. Fit new seals to the fuel rail.



2. Fit the fuel rail to the intercooler adaptor.

1. Align the fuel rail to the adaptor; still connected to the fuel crossover pipe and fuel return pipe. Locate the fuel rail into the adaptor.

2. Fit the three bolts which secure the fuel rail to the adaptor.



3. Connect the fuel injector harness.

1. Reposition the harness.

2. Tighten the nuts which secure the harness to the camshaft cover.

3. Connect the multi-plugs to the A-Bank injectors.

4. Fit the A-Bank intercooler. Refer to Operation 18.50.18.

5. Fit the supercharger assembly. Refer to operation 18.50.15.

6. Fit the supercharger drive belt. Refer to Operation 18.50.08.

7. Fit the coolant output pipe. Refer to Operation 26.31.08.

8. Fit the throttle induction elbow. Refer to Operation 19.70.28.

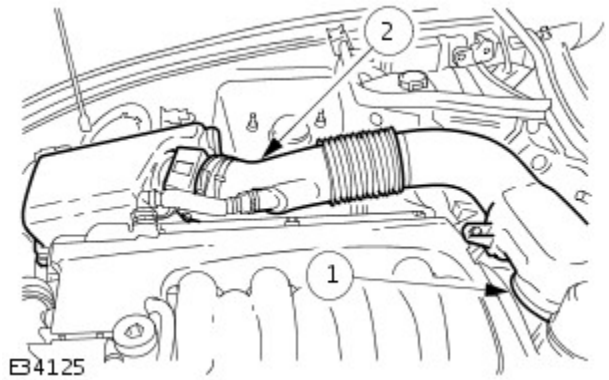
9. Fit the throttle housing. Refer to Operation 19.70.04.

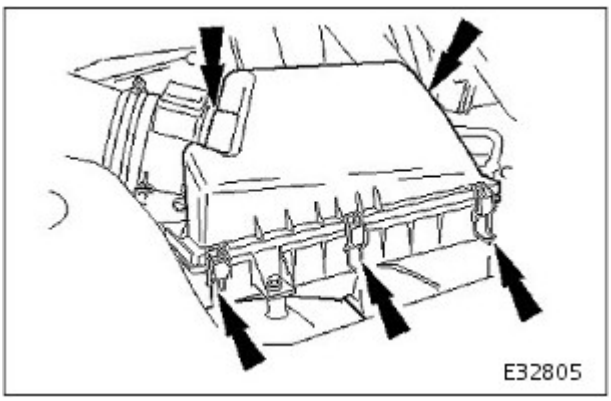
10. Fit the supercharger outlet duct and gasket. Refer to Operation 18.50.17.

11. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.

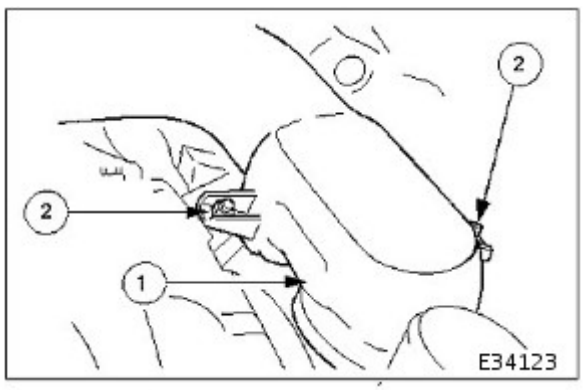
2. Fit the intake tube / air flow meter / air cleaner cover assembly.





12. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

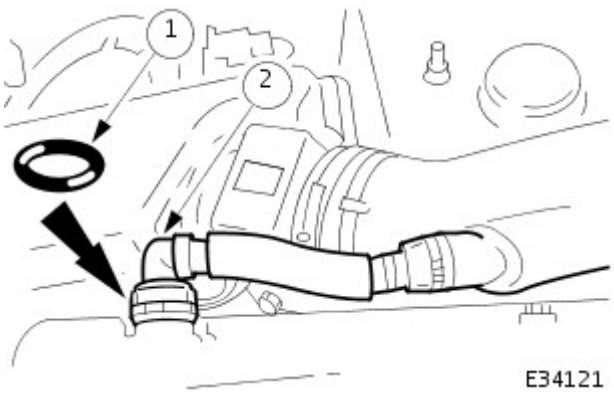


13. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.

14. Reconnect the air flow meter multi-plug.

15. Fit a new strap to secure the vacuum pipe to the induction elbow.



16. Connect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.
2. Reconnect the breather pipe to the stub pipe.

17. Refill the cooling system. Refer to Operation (SC) (26.10.01).

18. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure (86.15.15).

19. Remove the paintwork protection sheets and close the engine cover.

Engine - Oil Pan

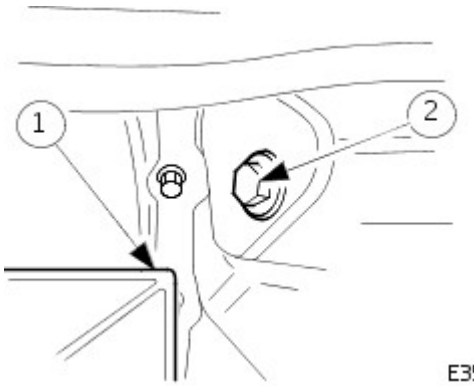
In-vehicle Repair

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Raise the vehicle on a ramp.

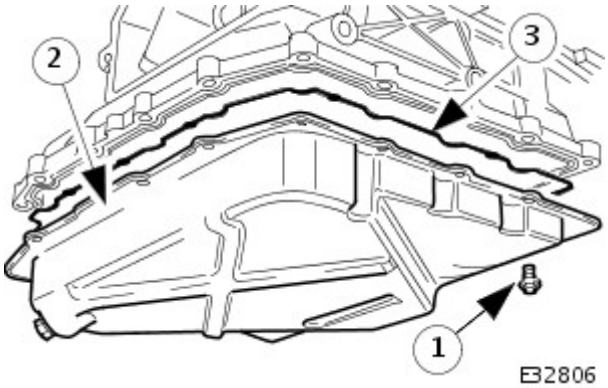
3. Drain the engine oil.



1. Position the waste oil bowser.
2. Remove the oil pan drain plug and drain the engine oil.

- Wipe the drain plug and refit it, to prevent oil dripping.
- Move the oil bowser away from the vehicle.

4. Remove the oil pan.

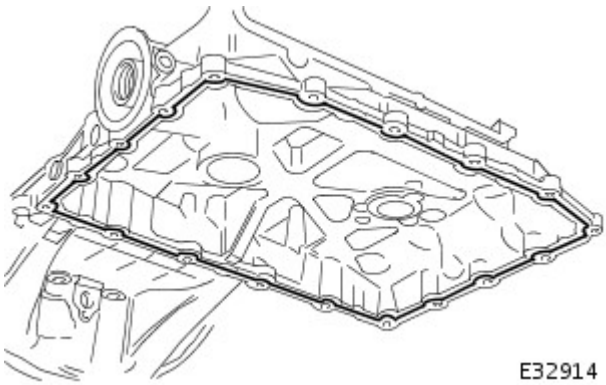


1. Remove the eighteen bolts which secure the oil pan to the oil pan body.
2. Remove the oil pan from the oil pan body.
3. Remove the gasket from the oil pan body assembly.

5. Clean and inspect the sealing faces on the oil pan body assembly.

- Clean and inspect the new oil pan mating face.

Installation

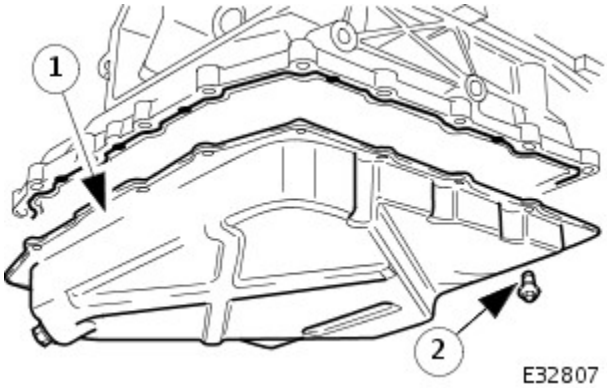


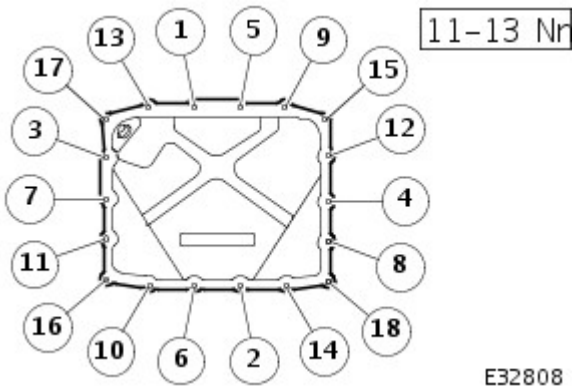
1. Fit the oil pan gasket to the oil pan body assembly.

- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.

2. Fit the oil pan to the oil pan body.

1. Position and align the oil pan.
2. Fit, but do not tighten, all eighteen bolts which secure the oil pan.





3. Tighten the oil pan bolts to the correct torque figure 11 - 13 Nm, in the sequence indicated.

- A new oil pan is supplied with the drain plug fitted. Check that the plug is tightened to the correct torque figure of 30 - 40 Nm.

4. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

Lower the ramp. Refill the engine with the correct specification engine oil.

5. Remove the paint protection sheets and close the engine compartment.

Engine - Oil Pan Gasket

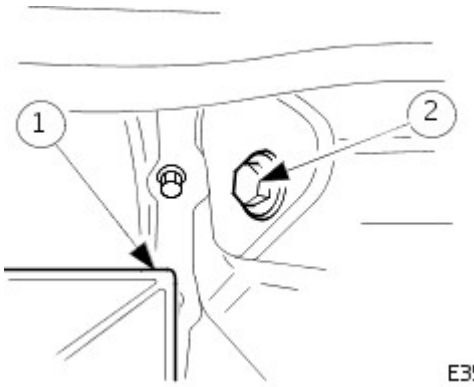
In-vehicle Repair

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Raise the vehicle on a ramp.

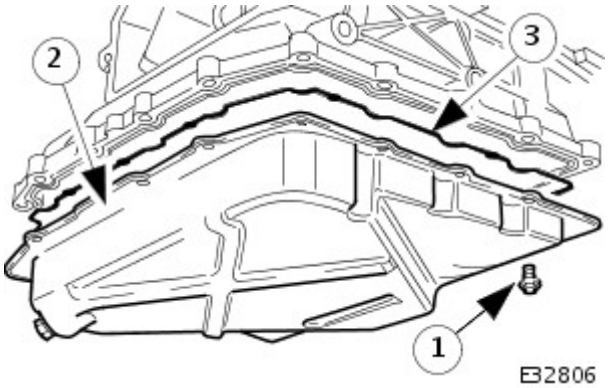
3. Drain the engine oil.



1. Position the waste oil bowser.
2. Remove the drain plug and drain the engine oil.

- Fit a new sealing washer to the drain plug.
- Wipe the drain plug and refit it to the oil pan to prevent oil dripping.
- Move the oil bowser away from the vehicle.

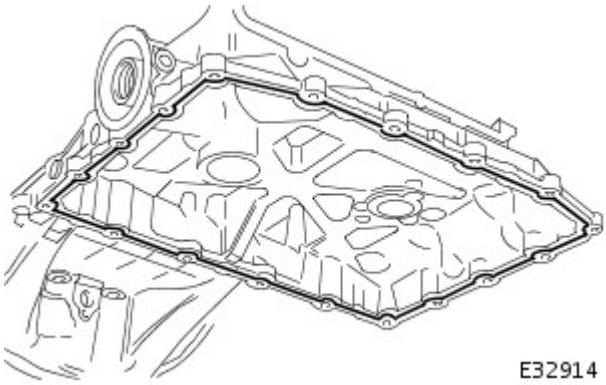
4. Remove the oil pan.



1. Remove the eighteen bolts which secure the oil pan.
2. Remove the oil pan.
3. Remove the gasket.

5. Clean and inspect the sealing faces on the oil pan. and mating faces.

Installation

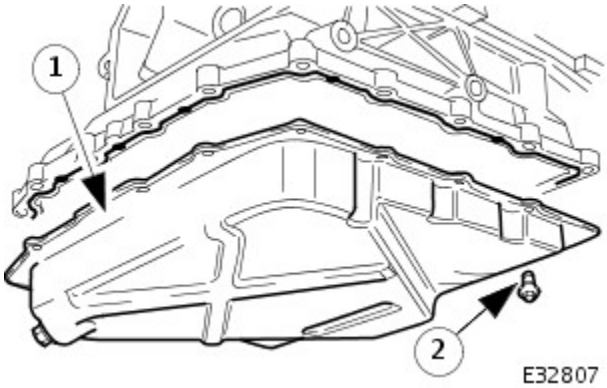


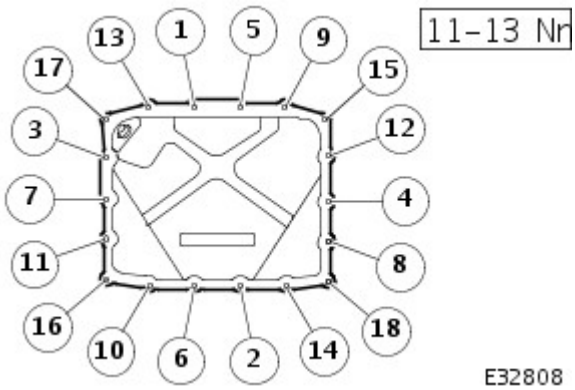
1. Fit the oil pan gasket to the cylinder block adaptor body.

- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.

2. Fit the oil pan.

1. Position and align the oil pan.
2. Fit, but do not tighten, all eighteen bolts which secure the oil pan.





3. Tighten the bolts to the correct torque figure 11 - 13 Nm, in the sequence indicated.

- Tighten the drain plug to 30 - 40 Nm.
- Fit a new oil filter.

4. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

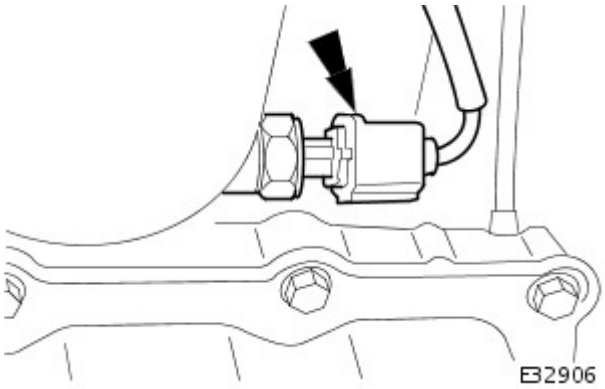
Lower the ramp. Refill the engine with the correct specification engine oil.

5. Remove the paint protection sheets and close the engine compartment.

Engine - Oil Pressure Switch

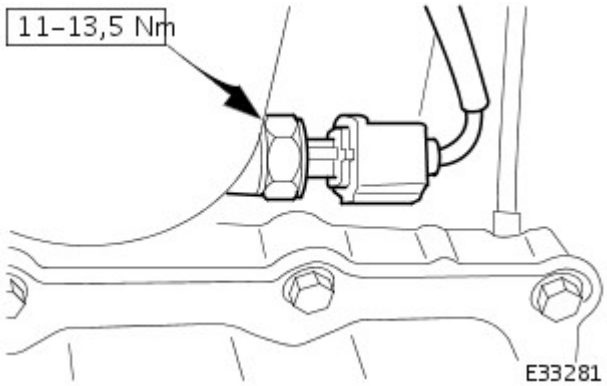
In-vehicle Repair

Removal



1. Raise vehicle on four post ramp.
2. Remove oil pressure switch.
   - Disconnect connector.
   - Remove oil pressure switch from oil filter head.

Installation



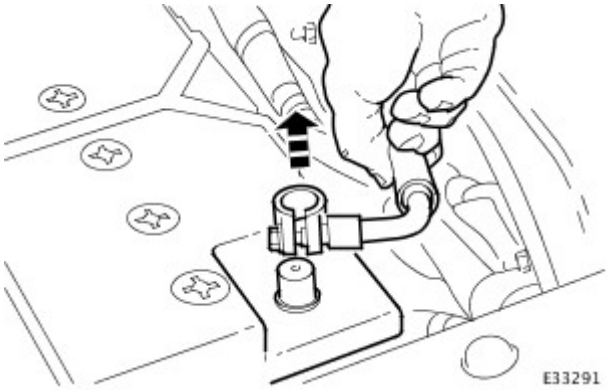
1. NOTE: Fit new sealing washer to oil pressure switch.

Installation is reverse of removal.

Engine - Oil Pump4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

In-vehicle Repair

Removal



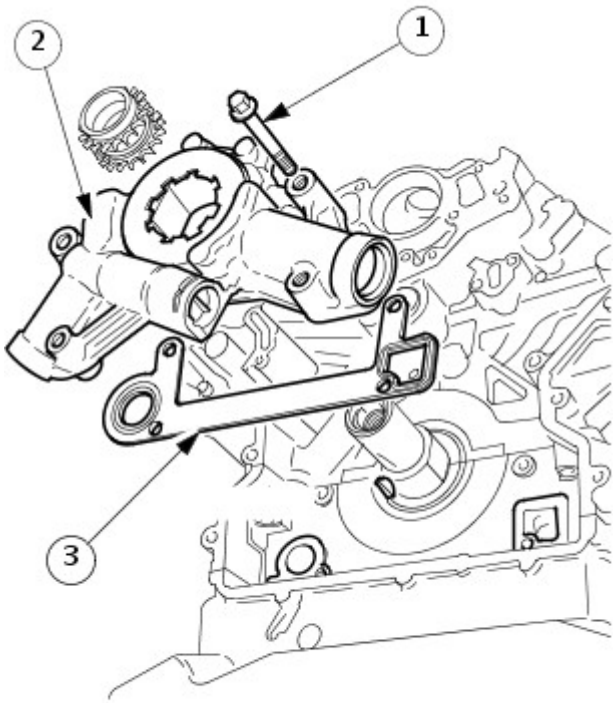
1. Disconnect battery ground cable.

- Remove the battery cover.

2. Remove the engine compartment cover (bonnet) for improved access to the front of the engine. Refer to Operation 76.16.01.

3. Remove the Crankshaft Sprocket B-Bank. Refer to Operation 12.65.76.

4. Remove the oil pump.



E33890

1. Remove the four bolts which secure the oil pump to the cylinder block.
2. Remove the oil pump.
3. Remove the gasket.

5. Clean and inspect all components and mating faces.

Installation

1. Fit the oil pump to the cylinder block.

1. Fit a new gasket to the block face.
2. Fit the oil pump onto the front of the crankshaft, to the block face; ensure that the drive flats on the



E33891

inside of the pump gear engage correctly with the mating flats on the crankshaft.

3. Fit the securing bolts and tighten to 11 - 13 Nm.

2. Refit both sprockets to the crankshaft, both primary timing chains, the timing cover and all associated components. Refer to Operation 12.65.76.

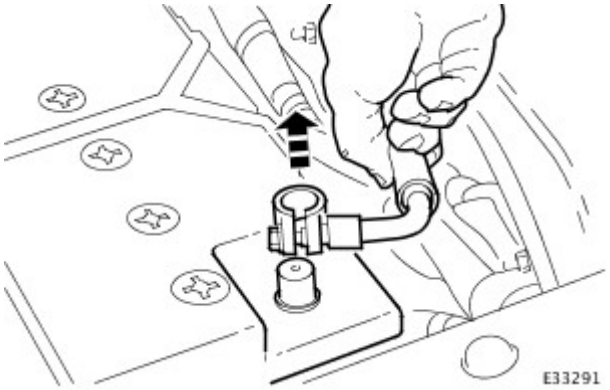
3. Refit the engine compartment cover (bonnet). Refer to Operation 76.16.01.

4. Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Oil Pump4.0L SC V8 - AJ26

In-vehicle Repair

Removal



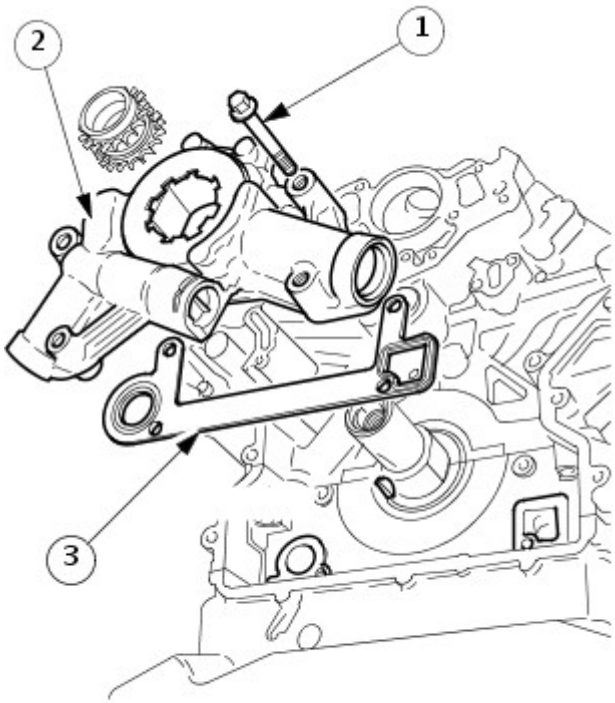
1. Disconnect battery ground cable.

- Remove the battery cover.

2. Remove the engine compartment cover (bonnet) for improved access to the front of the engine. Refer to Operation 76.16.01 (SC).

3. Remove the Crankshaft Sprocket B-Bank. Refer to Operation 12.65.76 (SC).

4. Remove the oil pump.



E33890

1. Remove the four bolts which secure the oil pump to the cylinder block.
2. Remove the oil pump.
3. Remove the gasket.

5. Clean and inspect all components and mating faces.

Installation

1. Fit the oil pump to the cylinder block.

1. Fit a new gasket to the block face.
2. Fit the oil pump onto the front of the crankshaft, to



E33891

the block face; ensure that the drive flats on the inside of the pump gear engage correctly with the mating flats on the crankshaft.

3. Fit the securing bolts and tighten to 11 - 13 Nm.

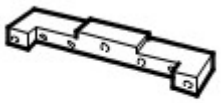
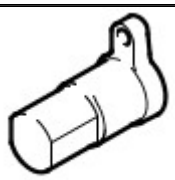
2. Refit both sprockets to the crankshaft, both primary timing chains, the timing cover and all associated components. Refer to Operation 12.65.76 (SC).

3. Refit the engine compartment cover (bonnet). Refer to Operation 76.16.01 (SC).

4. Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain LH4.0L NA V8 - AJ27

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303 - 530
 E36402	Timing chain tensioning 303 - 532
 E36407	Wedges, primary chain 303 - 533
 E36408	Crankshaft setting 303 - 531

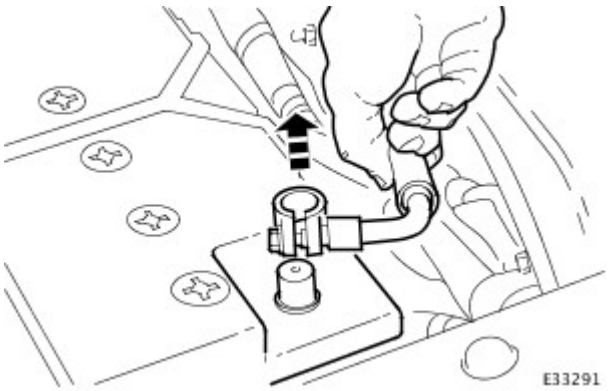
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

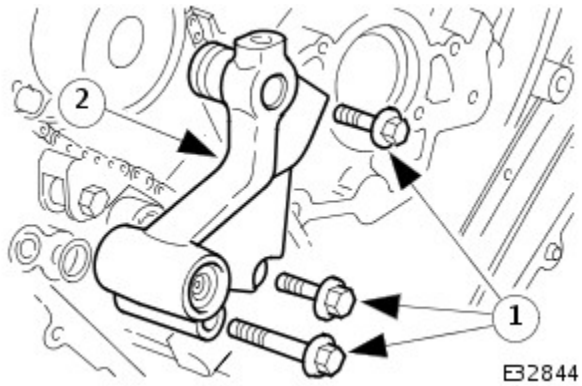
- Remove the battery cover.


E33291

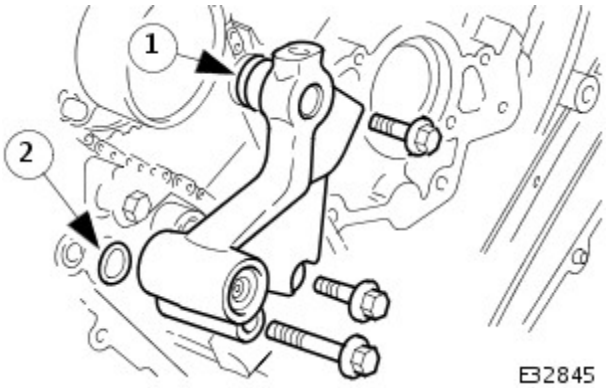
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Remove the VVT bush carrier from the A-Bank.

1. Remove the three bolts which secure the carrier to the cylinder block.

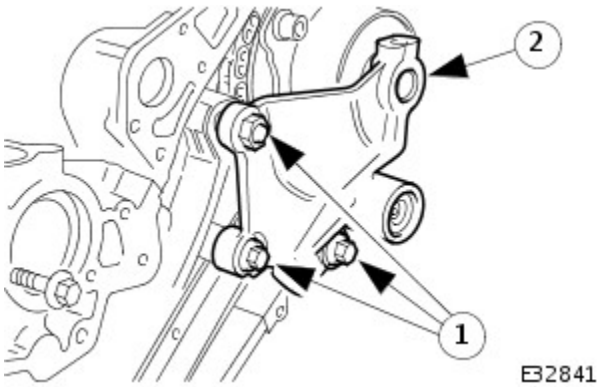


2. Release the carrier from the two ring dowels and remove it.



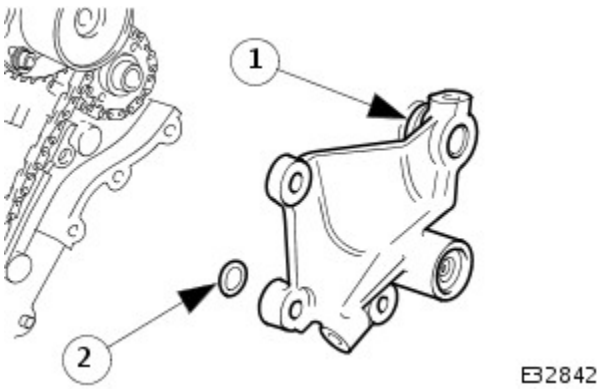
6. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.



7. Remove the VVT bush carrier from the B-Bank.

1. Remove the two bolts and one nut which secure the carrier to the cylinder block.
2. Release the carrier from the two ring dowels and remove it.



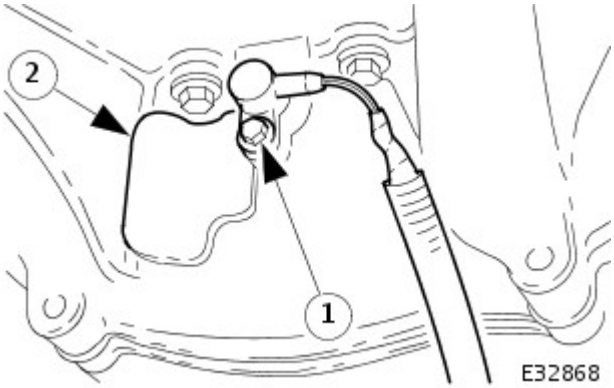
8. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
2. Remove the O-ring from the carrier oil-way recess.

9. Raise the vehicle on a ramp.

10. Remove the crankshaft position sensor.

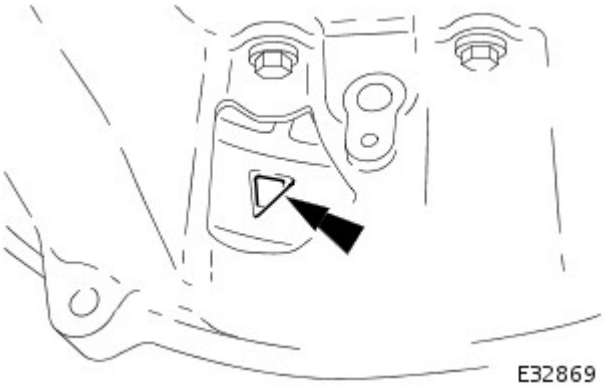
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
    1. Remove the sensor and allow it to hang free under the engine.



2. Remove the access grommet (for torque converter bolts) from the housing.

11. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

12. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





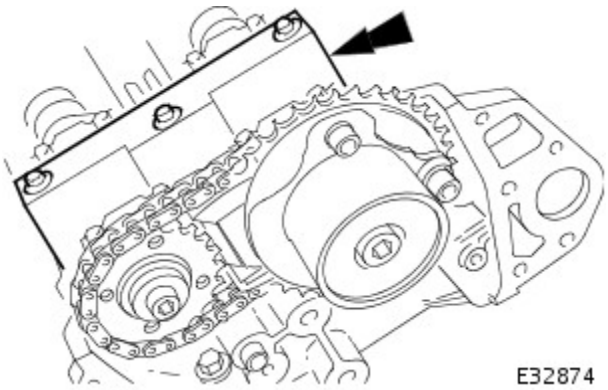
13. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.
    1. Position the crankshaft so that the setting peg engages fully into the timing slot.
2. Fit and tighten the bolt to secure the setting peg.

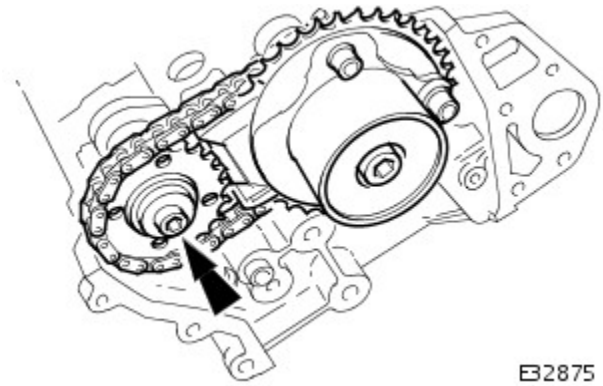
14. Remove the damper securing bolt from the crankshaft.

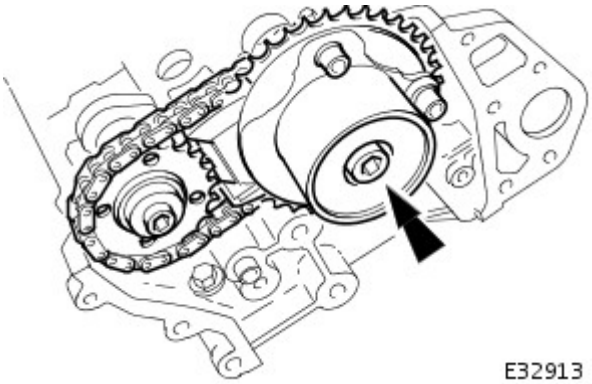
15. Lower the vehicle on the ramp.

16. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.

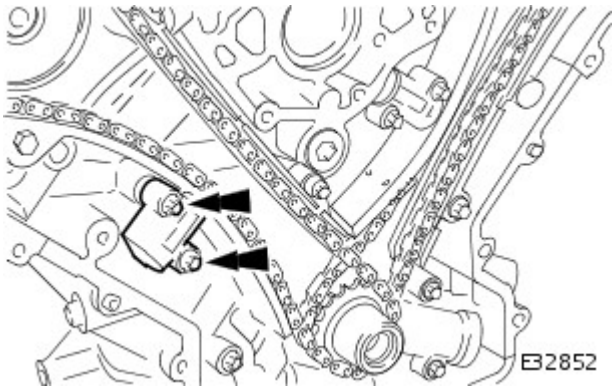


17. Loosen the bolt which secures the sprocket to the camshaft.

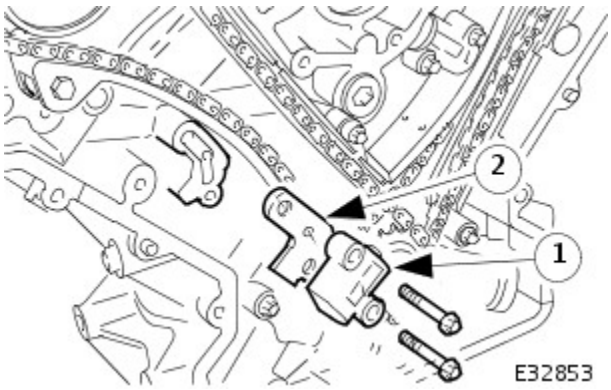




18. Loosen the bolt which secures the VVT unit to the camshaft.



19. Remove the primary chain tensioner bolts.

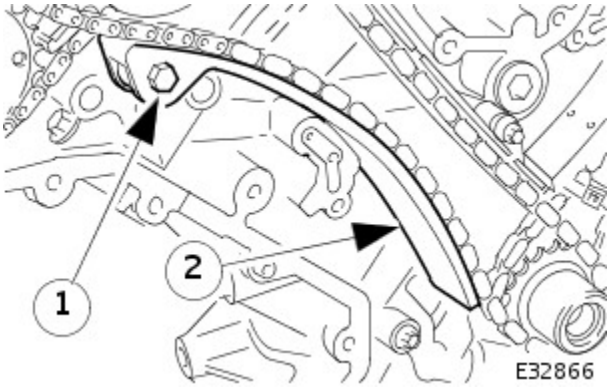


20. Remove the tensioner assembly.

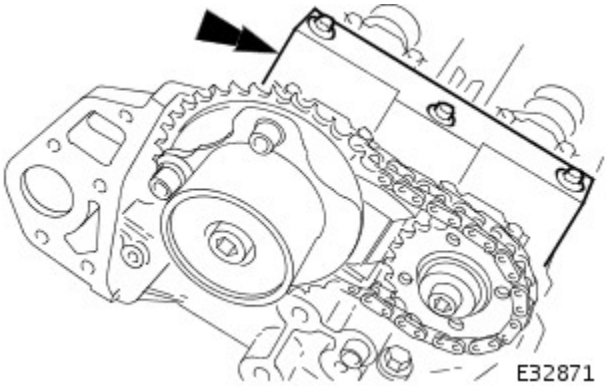
1. Remove the tensioner.
2. Remove the tensioner back-plate.

21. Remove the chain tensioner blade.

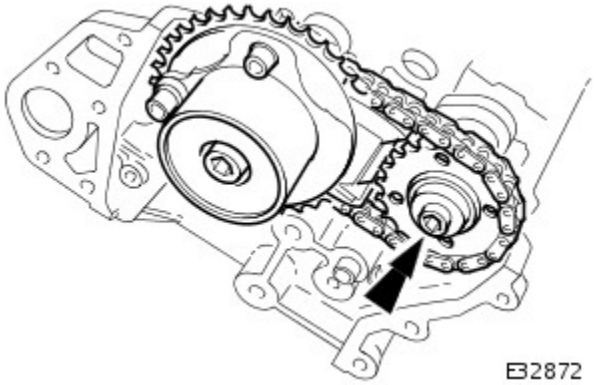
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.



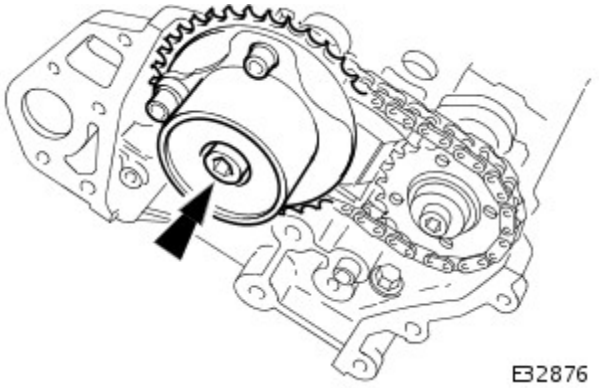
22. Remove the chain from the VVT unit and from the crankshaft pulley.



23. Remove the camshaft locking tool 303 - 530 and transfer it to the B-Bank camshafts, aligning the shafts slightly as necessary.

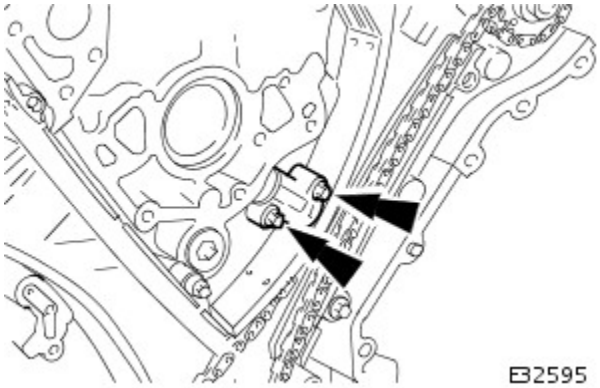


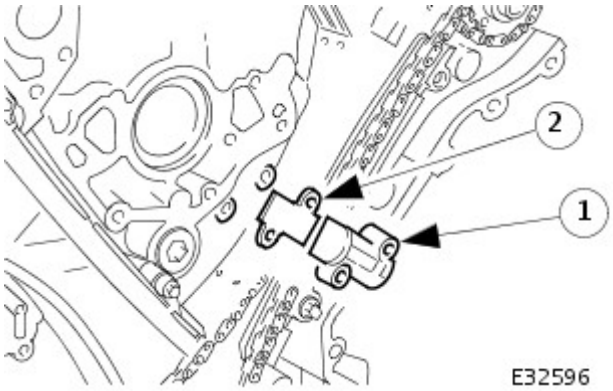
24. Loosen the bolt which secures the sprocket to the camshaft.



25. Loosen the bolt which secures the VVT unit to the camshaft.

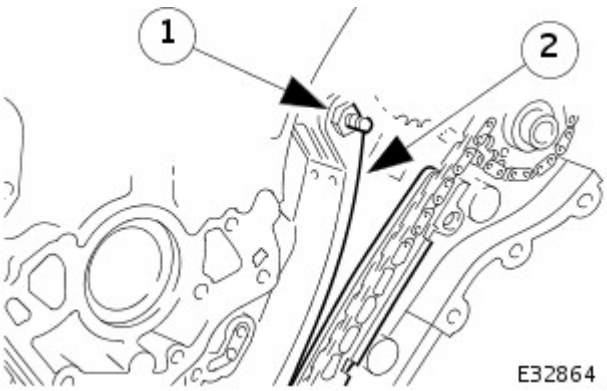
26. Remove the primary chain tensioner bolts.





27. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.

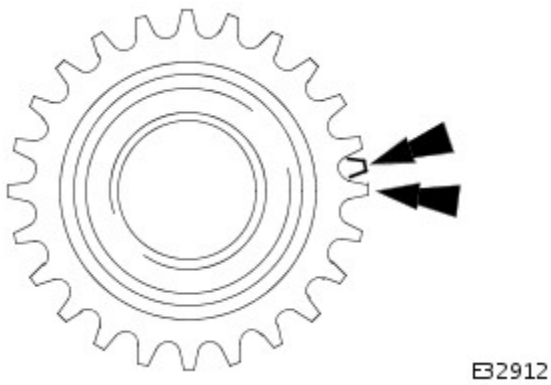


28. Remove the chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

29. Reposition the VVT unit and exhaust camshaft sprocket forward along the camshaft bosses and remove the chain from the VVT unit and from the crankshaft sprocket.

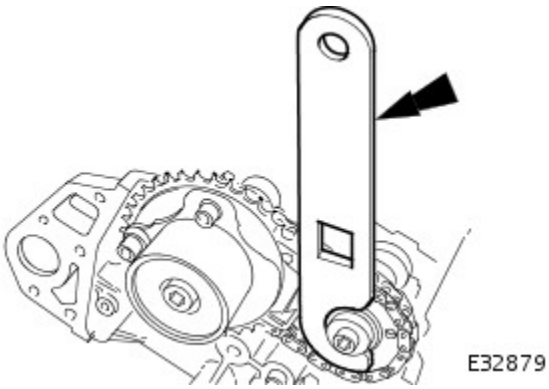
30. Note the orientation of the sprockets relative to each other (half a tooth out of line).



31. Clean and inspect all relevant components.

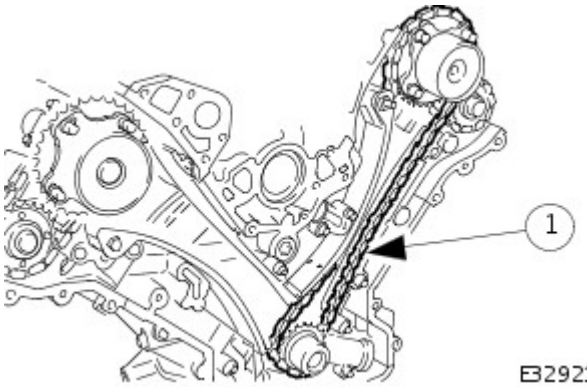
Installation

1. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft



sprocket, B-Bank.

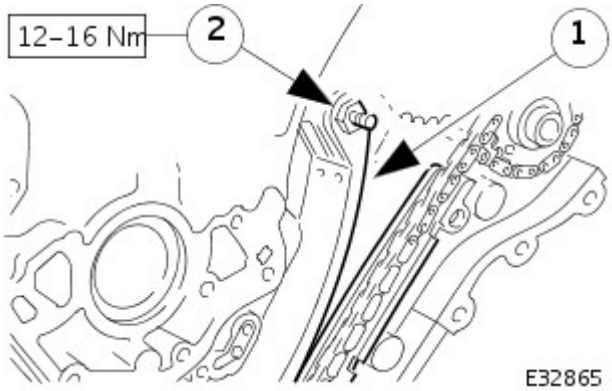
- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



2. Refit the primary timing chain, B-Bank.

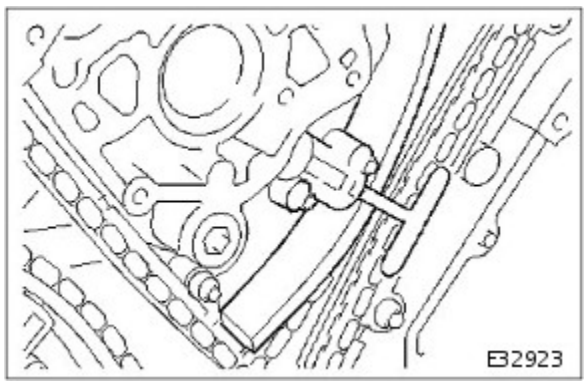
1. Fit the primary chain over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.

- Slide the VVT and exhaust sprocket fully rearwards onto the respective camshafts.



3. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12 - 16 Nm.

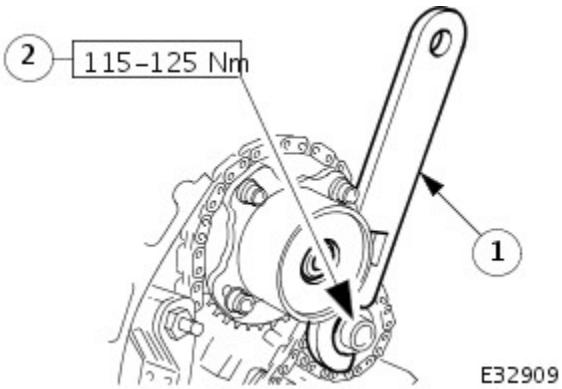


4. Refit the primary chain tensioner assembly. Refer to Operation 12.65.55 in this Section.

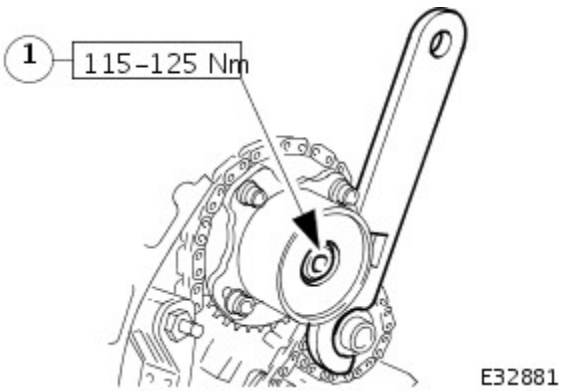
- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

5. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.
    1. Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.
2. Whilst applying the opposing force to the sprocket



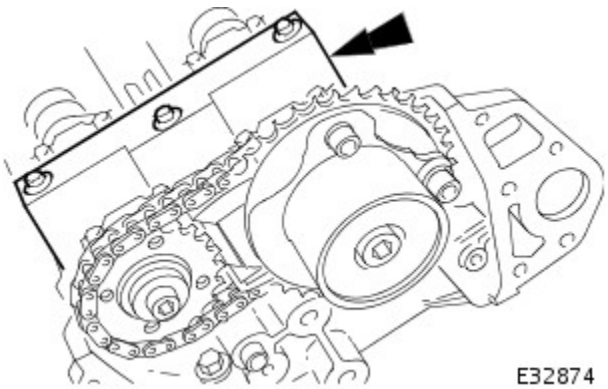
and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



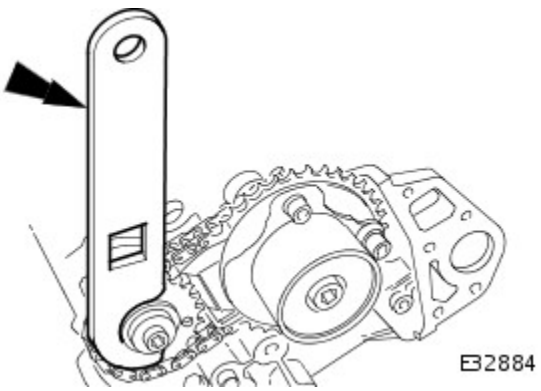
6. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).



7. Remove the camshaft locking tool 303 - 530 and transfer it to the A-Bank camshafts, aligning the shafts slightly as necessary.



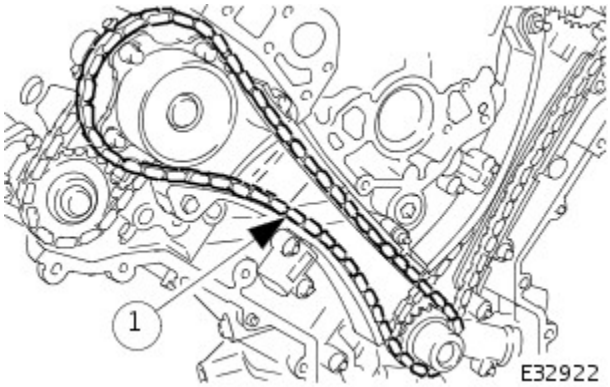
8. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket, A-Bank.

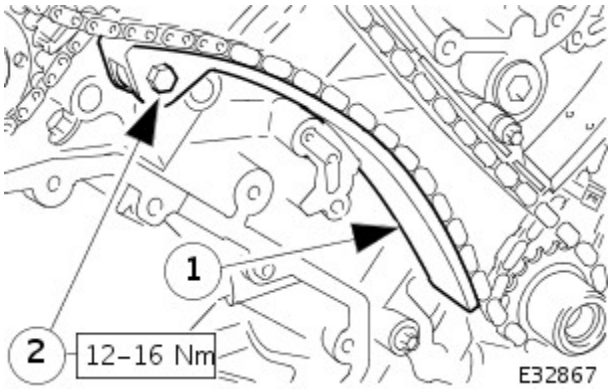
- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.

- Remove the tool.

9. Refit the primary timing chain, A-Bank.

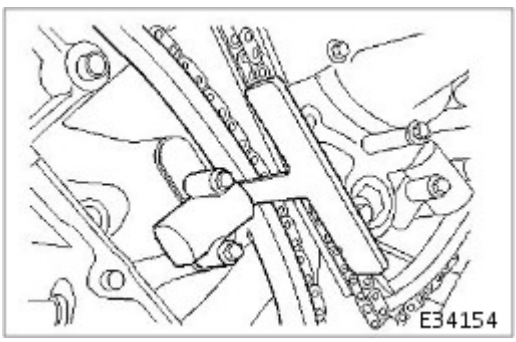
1. Fit the primary chain over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.





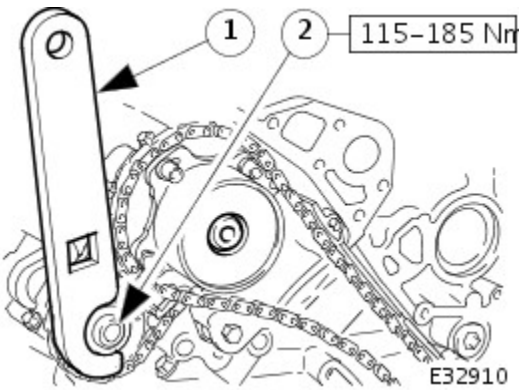
10. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12 - 16 Nm.



11. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



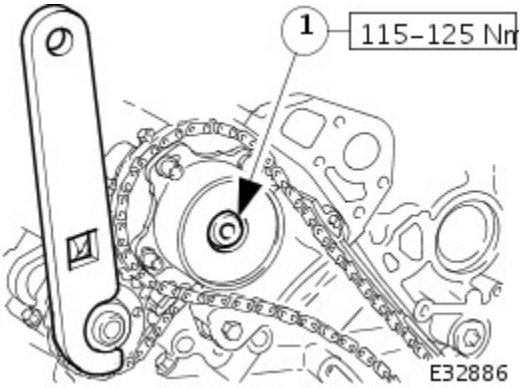
12. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.
    1. Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.
2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.

13. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

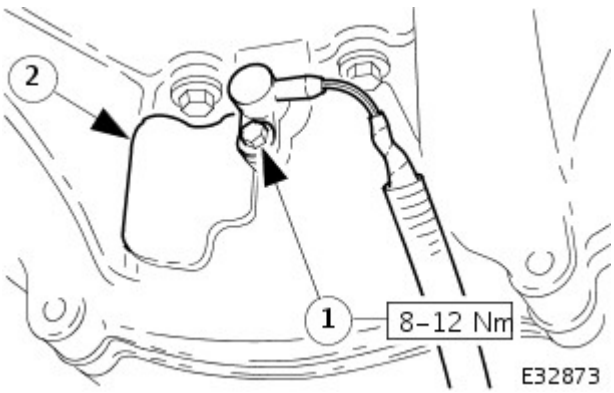


14. Remove the camshaft locking tool 303 - 530.

15. Raise the vehicle on the ramp.

16. Remove the crankshaft setting tool 303 - 531.

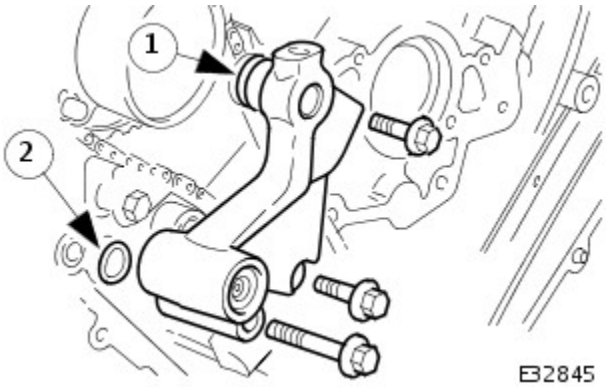
17. Refit the crankshaft position sensor.



1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8 - 12 Nm.
2. Refit the access grommet to the housing.

18. Lower the ramp.

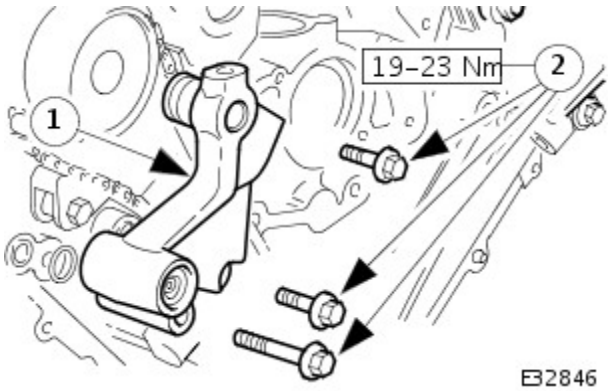
19. Fit new seals to the VVT bush carrier, A-Bank.



1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.
2. Fit a new O-ring to the carrier oil-way.

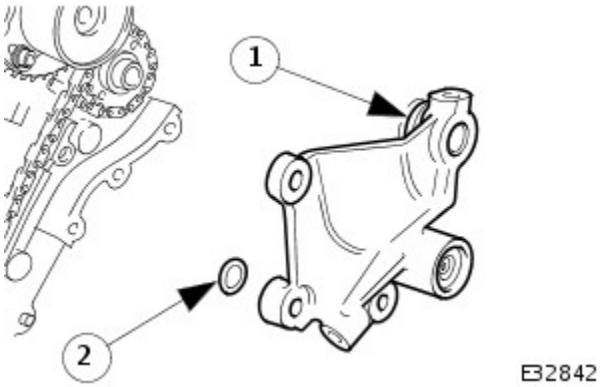
20. NOTE: Lubricate the seal (scarf jointed) and the bush.

Fit the VVT bush carrier to the cylinder block.



1. Fit the bush carrier assembly.
    1. Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.
2. Fit the three securing bolts. Tighten to 19 - 23 Nm.

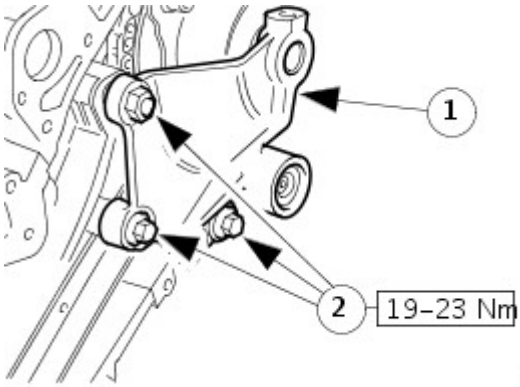
21. Fit new seals to the VVT bush carrier, B-Bank.



E32842

1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.

2. Fit a new O-ring to the carrier oil-way.



E32843

22. NOTE: Lubricate the seal (scarf jointed) and the bush.

Fit the VVT bush carrier to the cylinder block.

1. Fit the bush carrier assembly.
    1. Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.

2. Fit the two securing bolts and one nut. Tighten to 19 - 23 Nm.

23. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

24. Move the engine compartment cover from the service position and connect the gas struts.

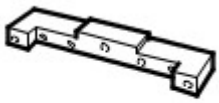
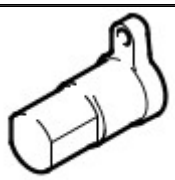
25. Remove the paint protection sheets and close the cover.

26. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

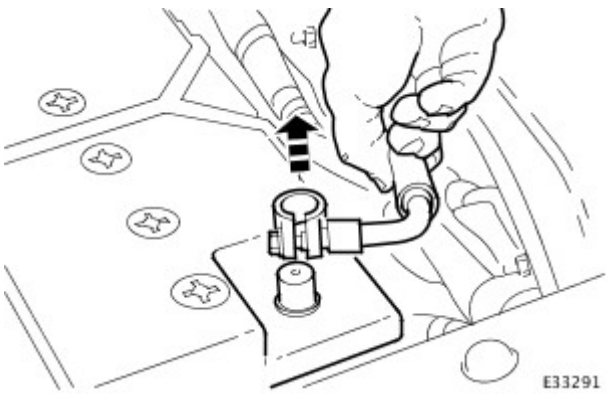
Engine - Primary Timing Chain LH4.0L SC V8 - AJ26 / 3.2L NA V8 - AJ26, 3.2L / 4.0L

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

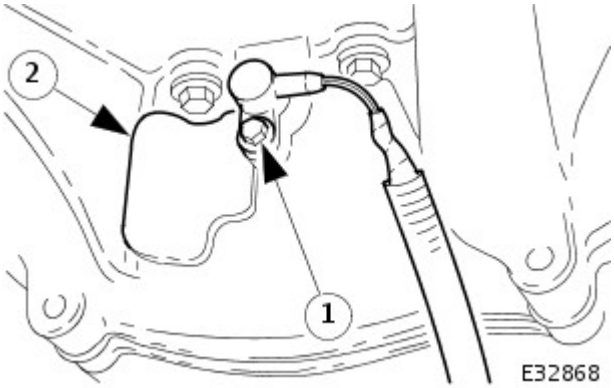
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.


E33291

4. Remove the Timing Cover. Refer to Operation 12.65.01.
5. Raise the vehicle on a ramp.
6. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft



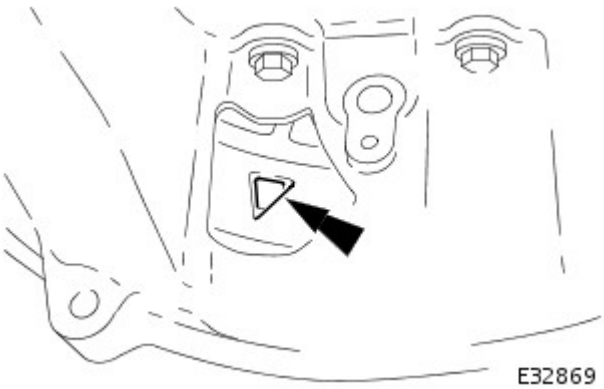
position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

7. Install the damper securing bolt (old one) to the crankshaft, hand-tight only.

8. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



9. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

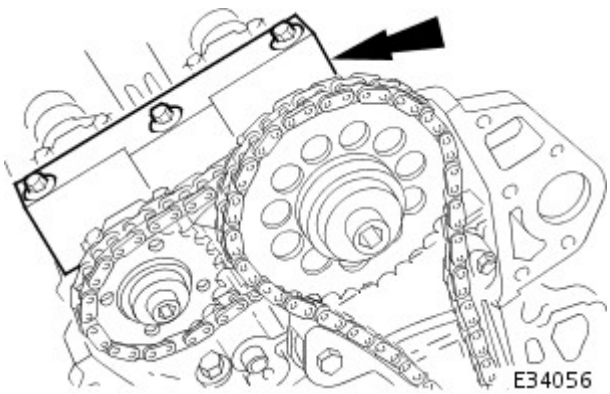
2. Install and tighten the bolt to secure the setting peg.



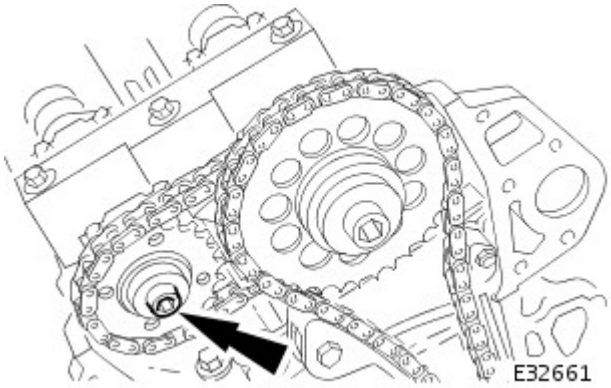
10. Remove the damper securing bolt from the crankshaft.

11. Lower the vehicle on the ramp.

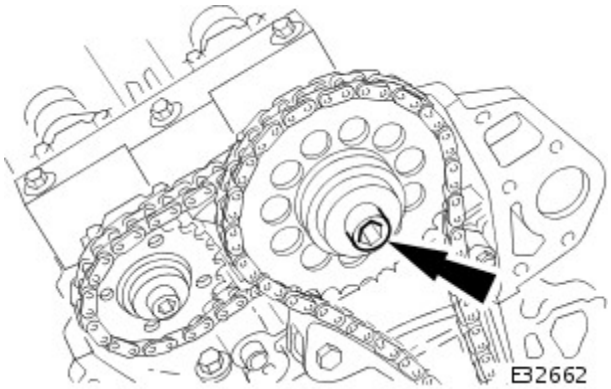
12. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.



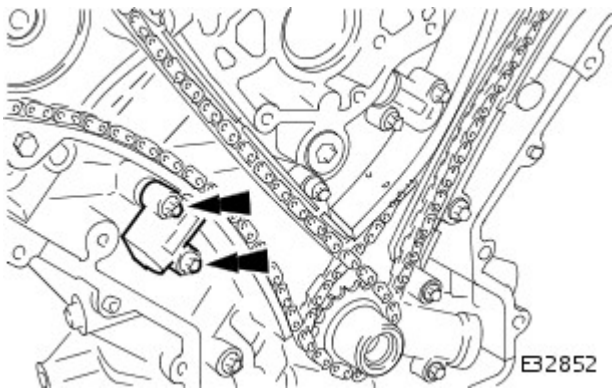
13. Loosen the bolt which secures the sprocket to the exhaust camshaft.



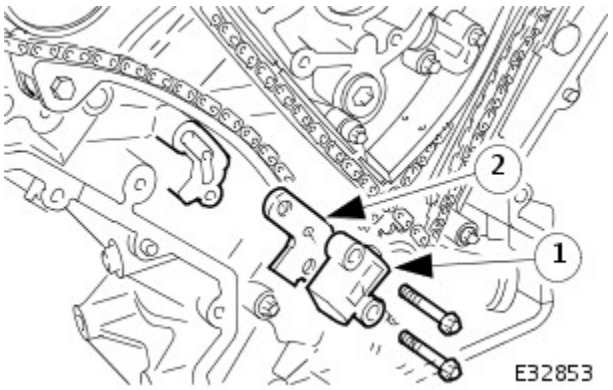
14. Loosen the bolt which secures the sprocket to the intake camshaft.



15. Remove the primary chain tensioner bolts.



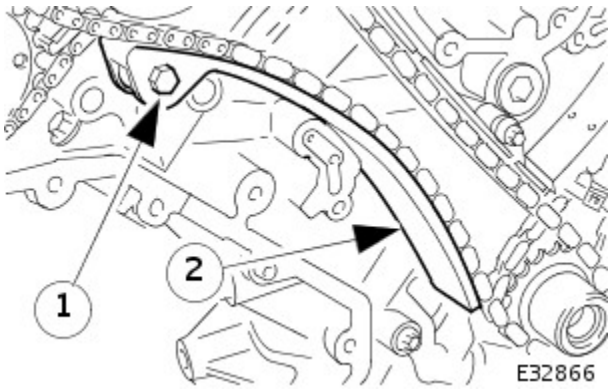
16. Remove the tensioner assembly.



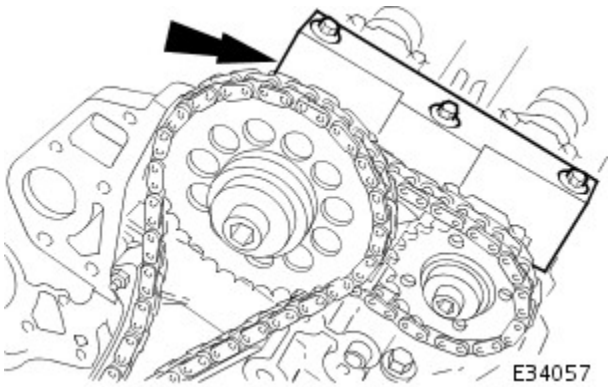
1. Remove the tensioner.
2. Remove the tensioner back-plate.

17. Remove the chain tensioner blade.

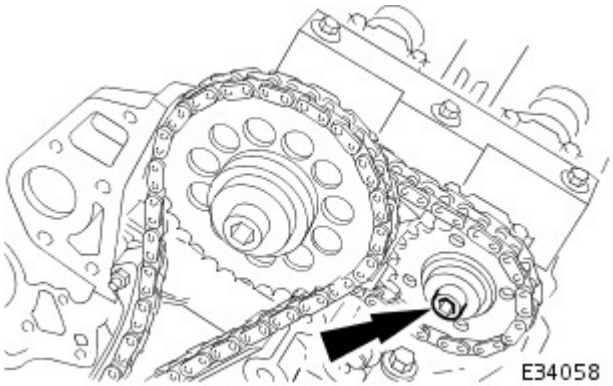
1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.



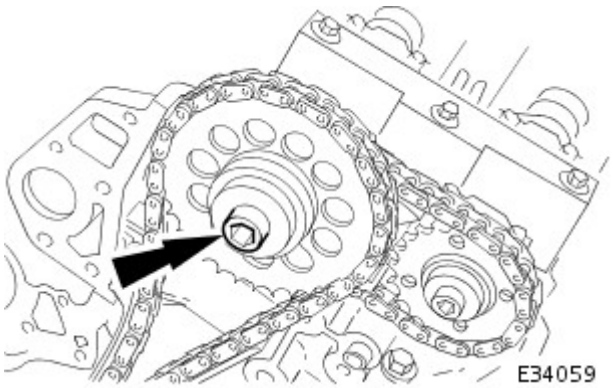
18. Remove the chain from the camshaft sprocket and from the crankshaft sprocket.



19. Remove the camshaft locking tool 303-530 and transfer it to Bank 2 camshafts, aligning the shafts slightly as necessary.

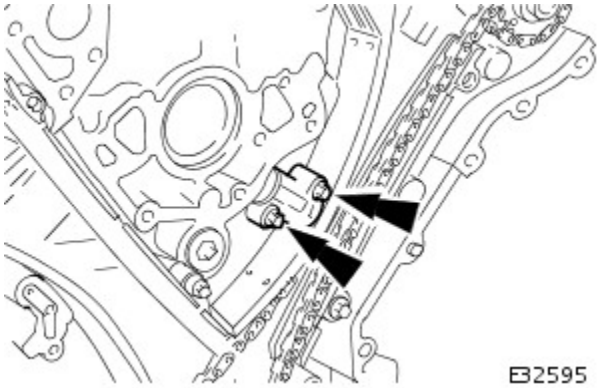


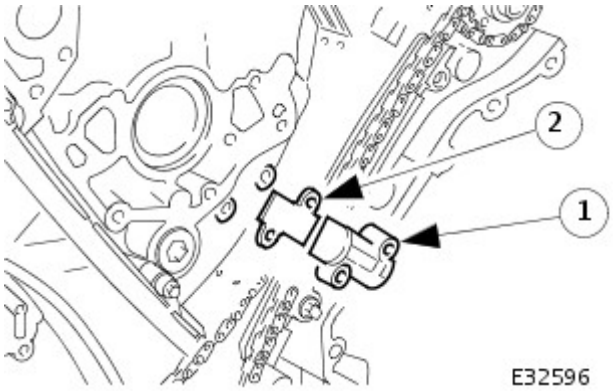
20. Loosen the bolt which secures the sprocket to the exhaust camshaft.



21. Loosen the bolt which secures the sprocket to the intake camshaft.

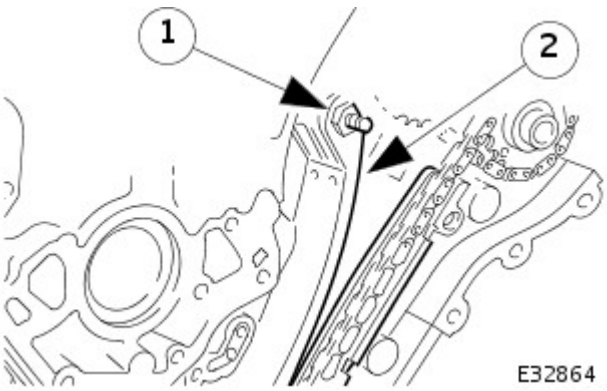
22. Remove the primary chain tensioner bolts.





23. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.

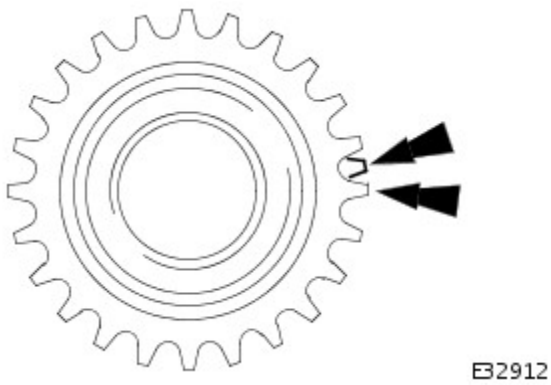


24. Remove the chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

25. Reposition both camshaft sprockets forward along the camshaft bosses and remove the chain from the intake camshaft sprocket and from the crankshaft sprocket.

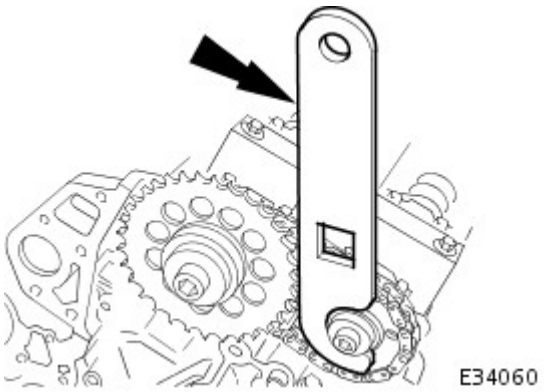
26. Note the orientation of the sprockets relative to each other (half a tooth out of line).



27. Clean and inspect all relevant components.

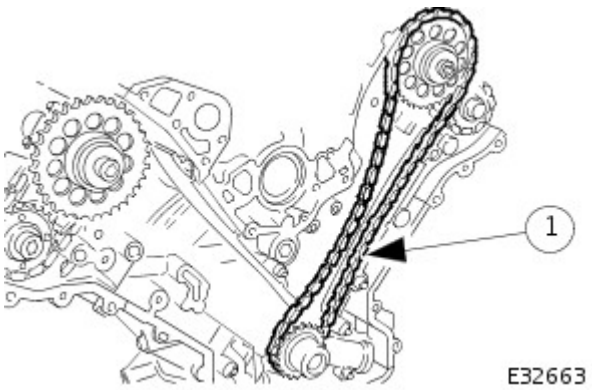
Installation

1. Install the chain tensioning tool 303-532 to the exhaust



camshaft sprocket, Bank 2.

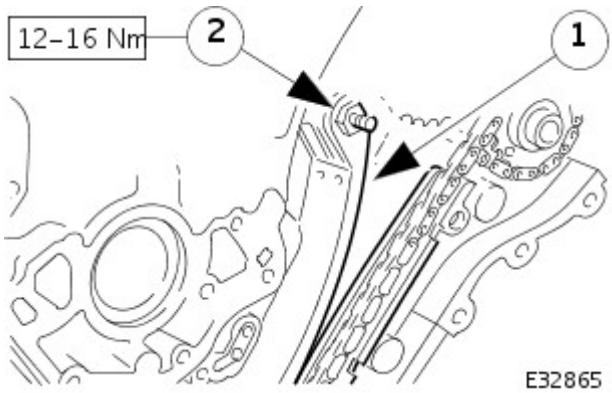
- Reposition the sprocket to the most advantageous position for use of the tool.
- Remove the tool.



2. Install the primary timing chain, Bank 2.

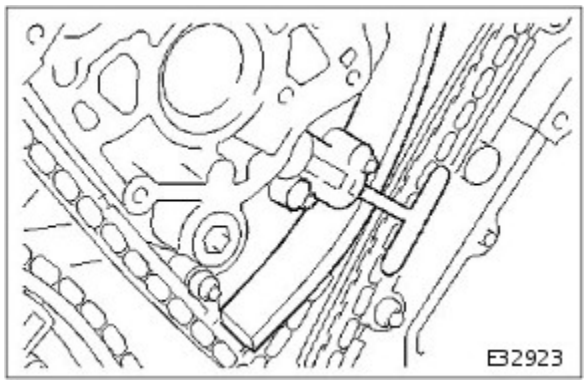
1. Install the primary chain over the crankshaft sprocket and the intake camshaft sprocket. There must be no slack on the drive side of the primary chain and the sprockets should not be rotated on the camshafts (or the tensioning tool may not fit).

- Slide the camshaft sprockets fully rearwards onto the respective camshafts.



3. Install the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Install the retaining / pivot bolt and tighten it to 12-16 Nm.



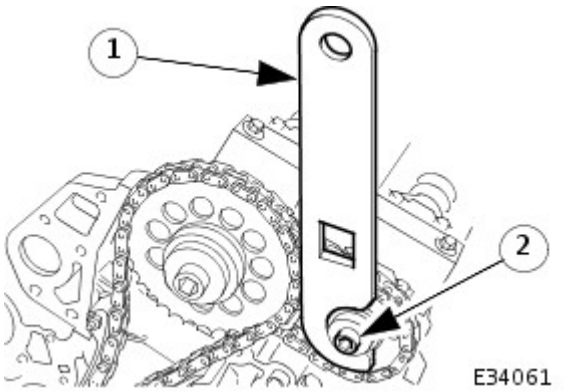
4. Install the primary chain tensioner assembly. Refer to Operation 12.65.55.

- Use a wedge 303-533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

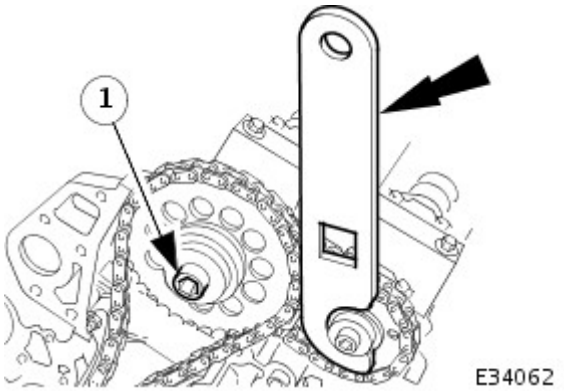
5. Tighten the exhaust camshaft sprocket securing bolt.

1. Install the chain tensioner tool 303-532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.



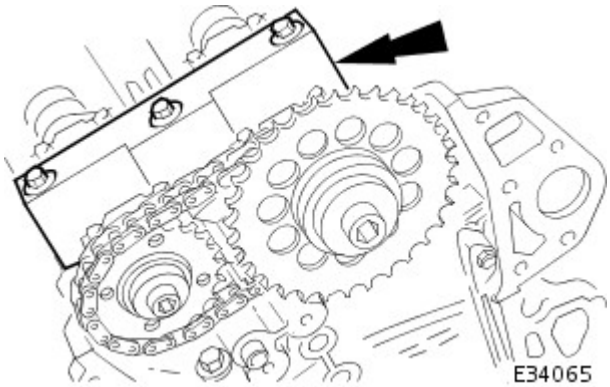
2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.



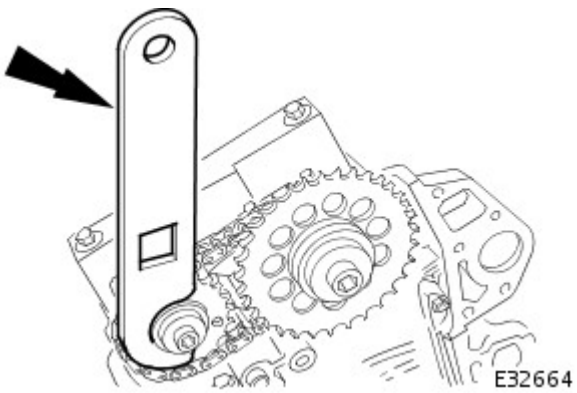
6. Tighten the intake camshaft sprocket securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303-532), check that the wedges are still in place, tighten the securing bolt to 115-125 Nm.

- Remove the chain tensioning tool and the wedge(s).



7. Remove the camshaft locking tool 303-530 and transfer it to Bank 1 camshafts, aligning the shafts slightly as necessary.



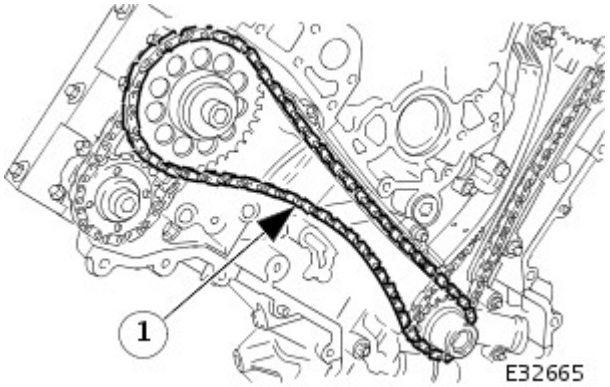
8. Install the chain tensioning tool 303-532 to the exhaust camshaft sprocket, Bank 1.

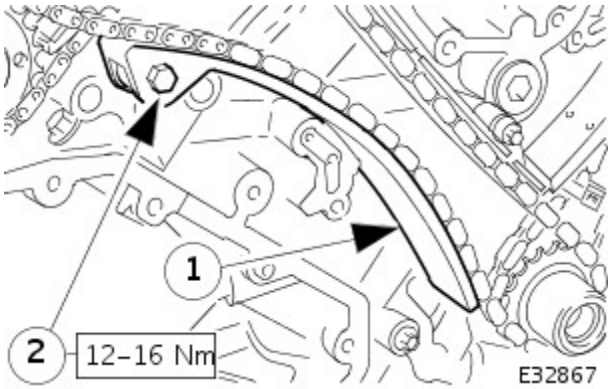
- Reposition the sprockets to the most advantageous position for use of the tool.

- Remove the tool.

9. Install the primary timing chain, Bank 1.

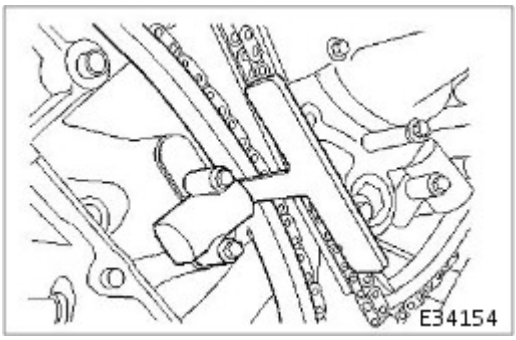
1. Install the primary chain over the crankshaft sprocket and the intake camshaft sprocket. There must be no slack on the drive side of the primary chain and the sprockets should not be rotated on the camshafts (or the tensioning tool may not fit).





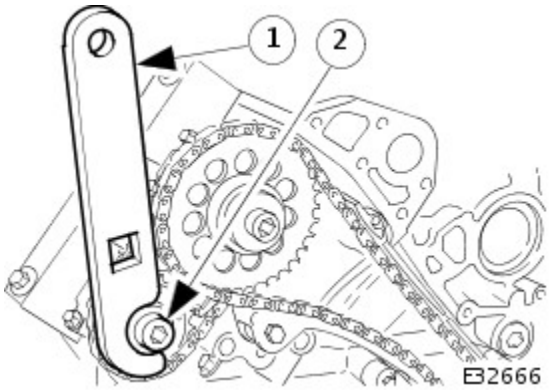
10. Install the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Install the retaining / pivot bolt and tighten it to 12-16 Nm.



11. Install the primary chain tensioner assembly. Refer to Operation 12.65.54.

- Use a wedge 303-533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



12. Tighten the exhaust camshaft sprocket securing bolt.

1. Install the chain tensioner tool 303-532 to the sprocket holes.

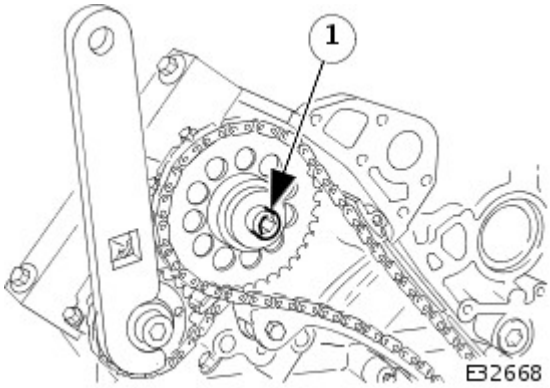
- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.

13. Tighten the intake camshaft sprocket securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303-532), check that the wedges are still in place, tighten the securing bolt to 115-125 Nm.

- Remove the chain tensioning tool and the wedge(s).



14. Remove the camshaft locking tool 303-530.

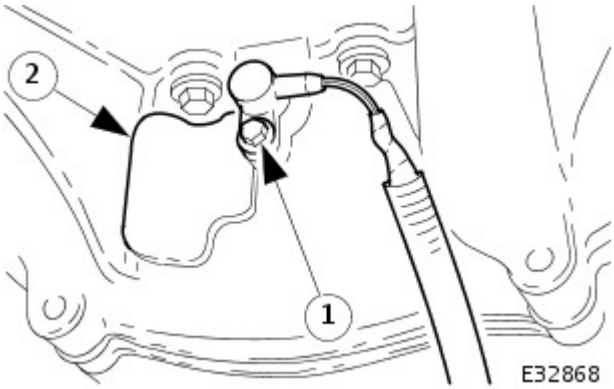
15. Raise the vehicle on the ramp.

16. Remove the crankshaft setting tool 303-531.

17. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and install the securing bolt. Tighten to 6-8 Nm.

2. Install the access grommet to the housing.



18. Lower the ramp.

19. Install the Timing Cover. Refer to Operation 12.65.01.

20. Move the engine compartment cover from the service position and connect the gas struts.

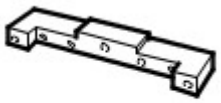
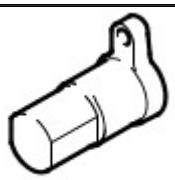
21. Remove the paint protection sheets and close the cover.

22. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain RH

In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

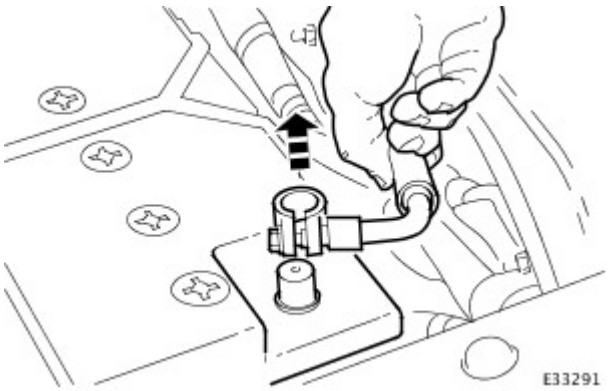
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

3. Disconnect the battery ground cable.

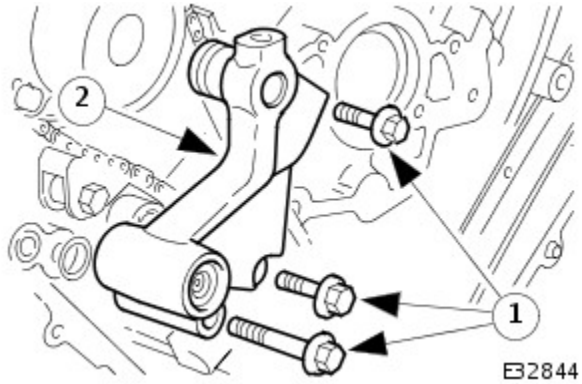
- Remove the battery cover.


E33291

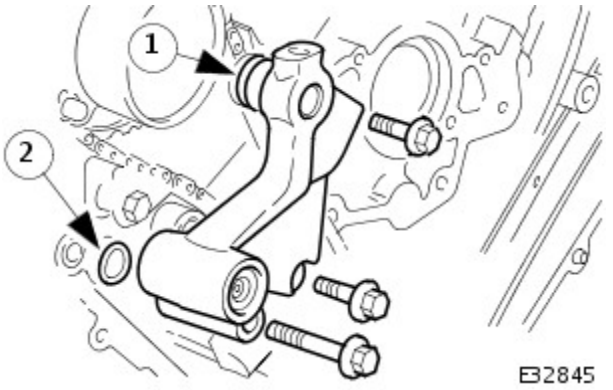
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Remove the VVT bush carrier.

1. Remove the three bolts which secure the carrier to the cylinder block.



2. Release the carrier from the two ring dowels and remove it.



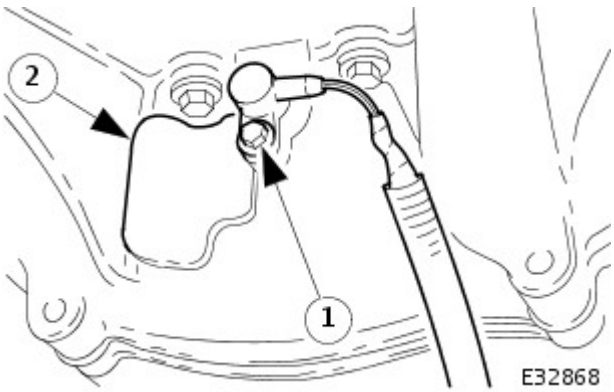
6. Remove the seals from the bush carrier.

1. Remove the sealing ring (scarf jointed) from the carrier bush groove.

2. Remove the O-ring from the carrier oil-way recess.

7. Raise the vehicle on a ramp.

8. Remove the crankshaft position sensor.



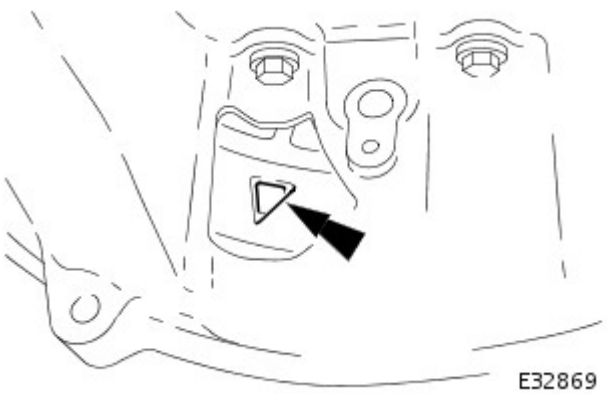
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

9. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

10. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



11. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.



1. Fit the crankshaft setting peg 303 - 531.

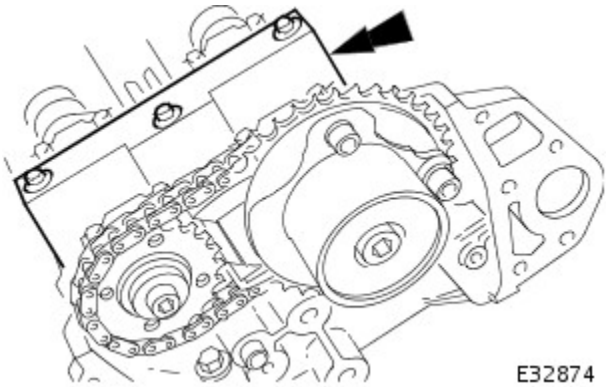
- Position the crankshaft so that the setting peg engages fully into the timing slot.

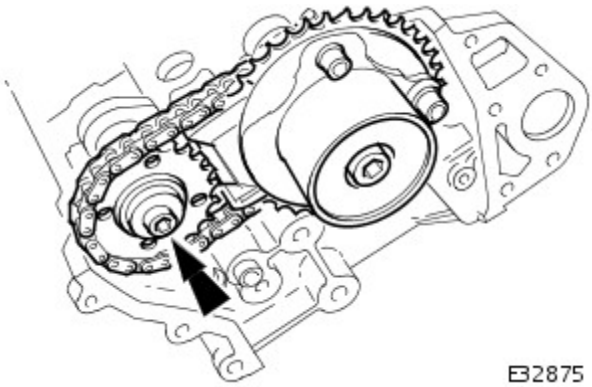
2. Fit and tighten the bolt to secure the setting peg.

12. Remove the damper securing bolt from the crankshaft.

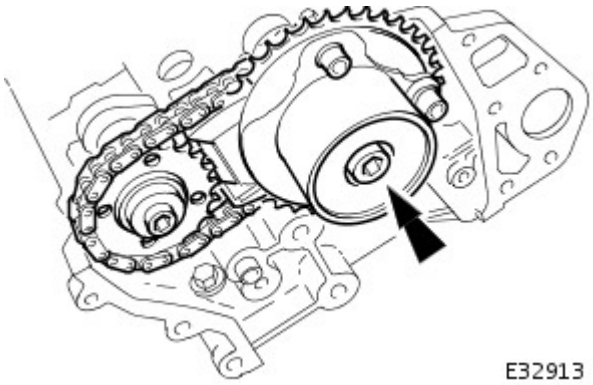
13. Lower the vehicle on the ramp.

14. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.



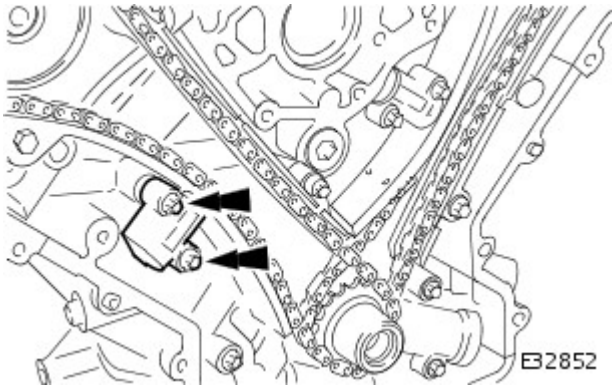


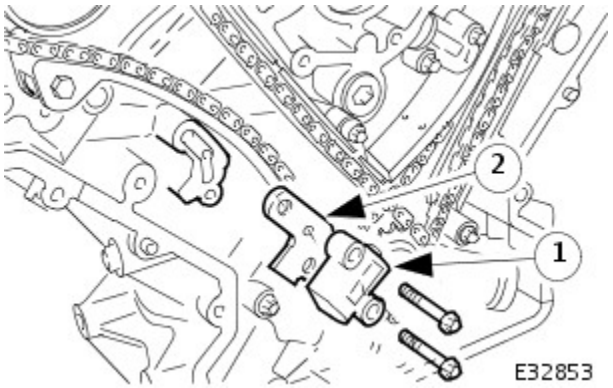
15. Loosen the bolt which secures the sprocket to the camshaft.



16. Loosen the bolt which secures VVT unit to the camshaft.

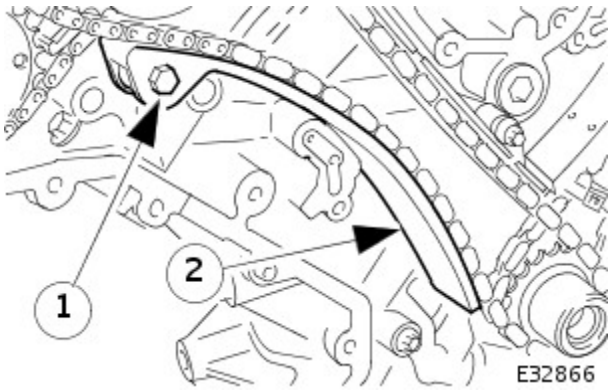
17. Remove the primary chain tensioner bolts.





18. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.



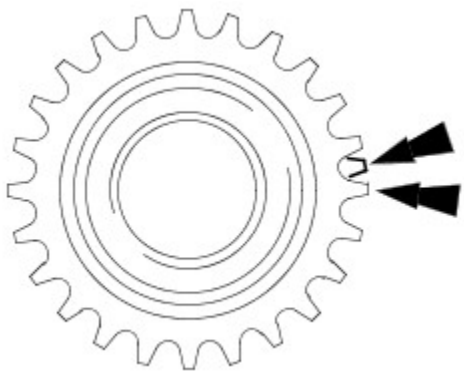
19. Remove the chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

20. Remove the chain from the VVT unit and from the crankshaft sprocket.

21. Clean and inspect all relevant components.

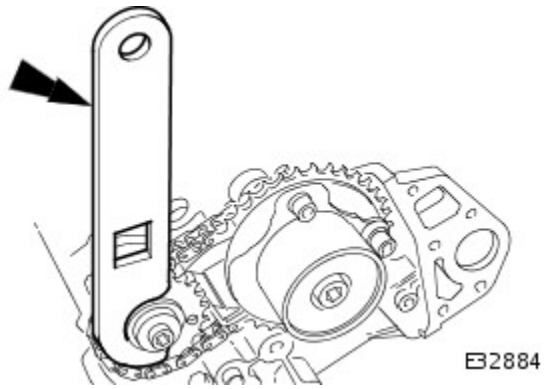
Installation



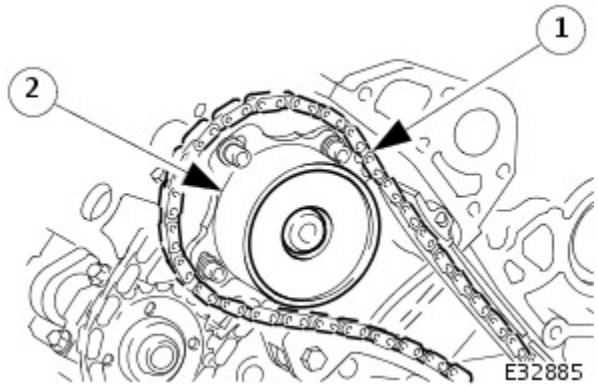
1. If removed previously, fit the sprocket to the crankshaft.

- The teeth of the A-Bank and the B-Bank sprockets on the crankshaft must be out of phase with each other. If they are in-phase after fitting, remove the sprocket, turn it on its vertical axis and refit it.

2. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

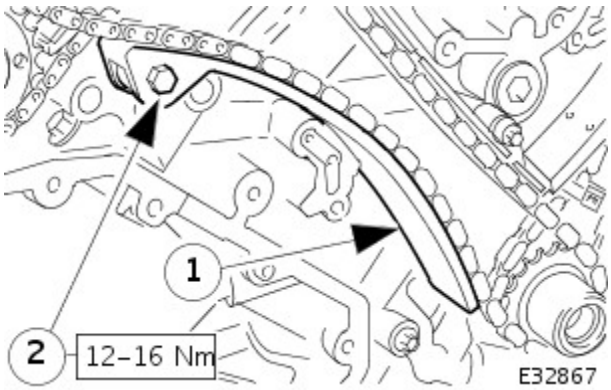


- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



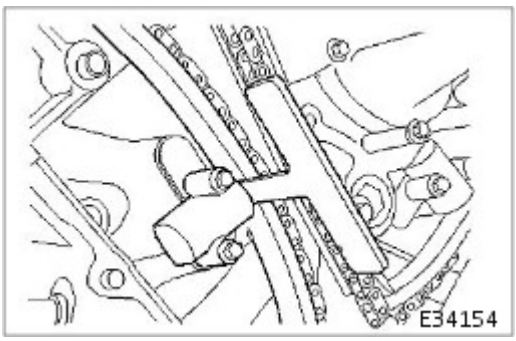
3. Refit the primary timing chain.

1. Fit the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.



4. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.



5. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

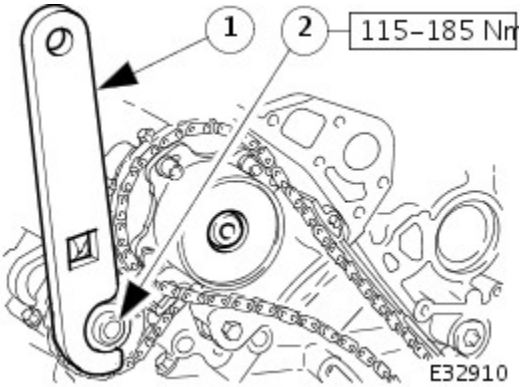
- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

6. Tighten the exhaust camshaft sprocket securing bolt.

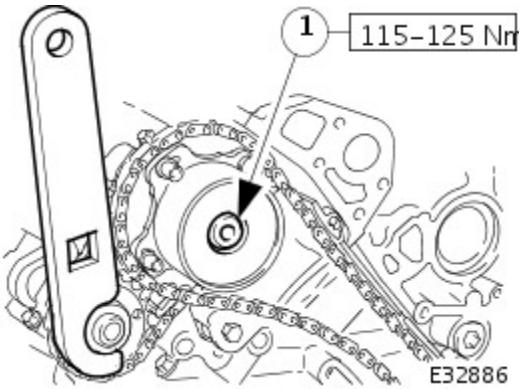
1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket



and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



7. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

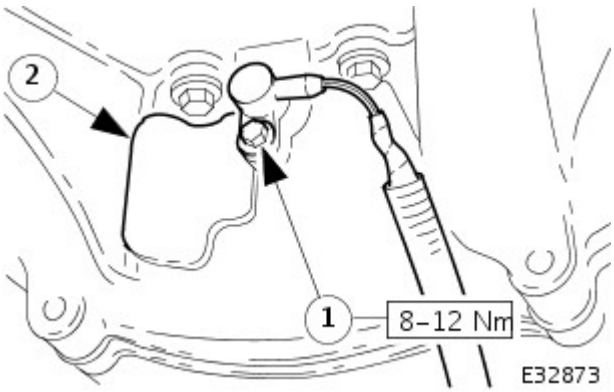
- Remove the chain tensioning tool and the wedge(s).

8. Remove the camshaft locking tool 303 - 530.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303 - 531.

11. Refit the crankshaft position sensor.

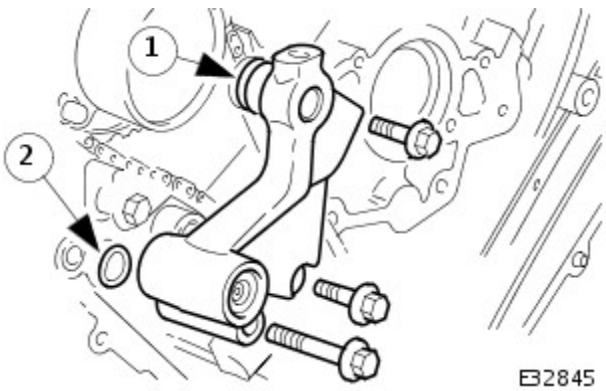


1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Refit the access grommet to the housing.

12. Lower the ramp.

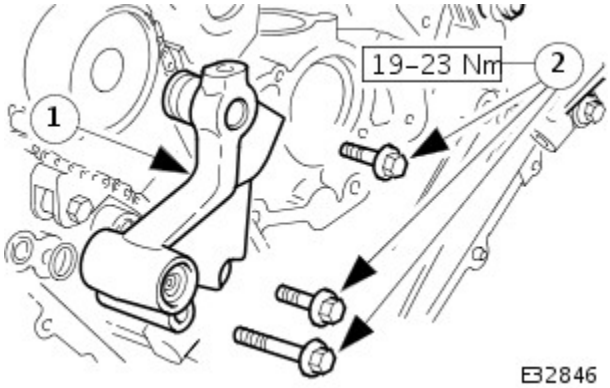
13. Fit new seals to the VVT bush carrier.



1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.

2. Fit a new O-ring to the carrier oil-way.

14. Fit the VVT bush carrier to the cylinder block.



- Lubricate the seal (scarf jointed) and the bush.

1. Fit the bush carrier assembly.

- Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.

2. Fit the three securing bolts. Tighten to 19-23 Nm.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.

17. Remove the paint protection sheets and close the cover.

18. Connect the battery and fit the battery cover.

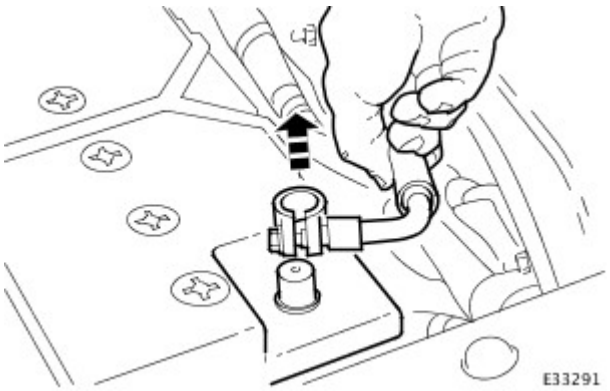
- Refer to the Battery Reconnection Procedure in Section 414-01.

Engine - Primary Timing Chain Inner Guide LH

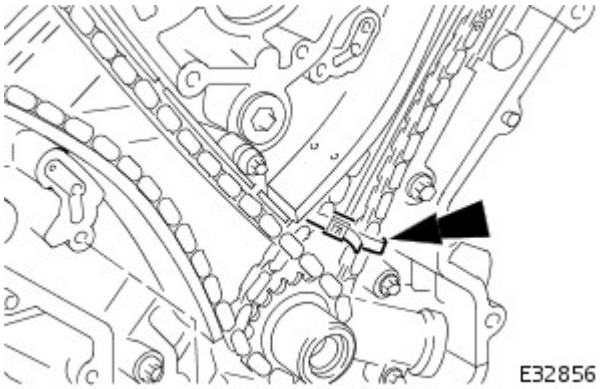
In-vehicle Repair

Removal

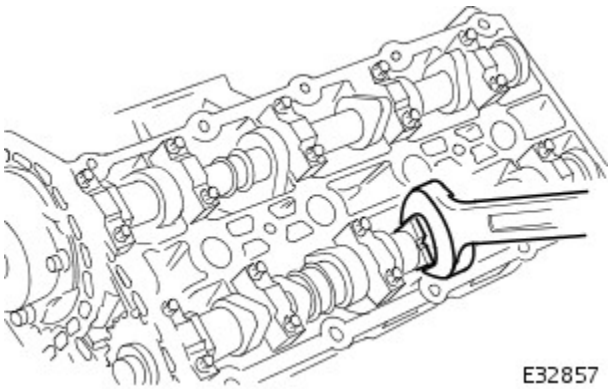
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



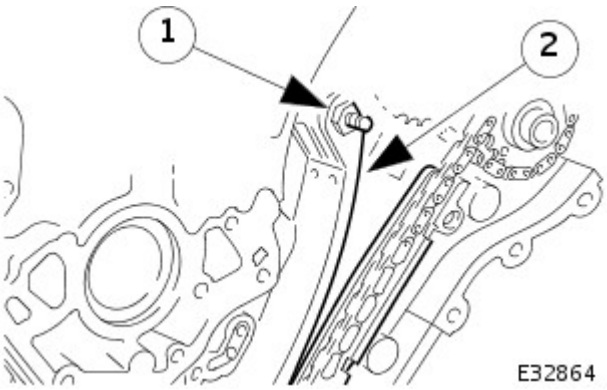
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the VVT Bush Carrier Assembly from the B-Bank. Refer to Operation 12.65.52 in this Section.
6. Remove the Timing Chain Tensioner - Primary, from the B-Bank. Refer to Operation 12.65.55 in this Section.
7. Fit a Tie-Strap through the links of the primary chain, just above the crankshaft sprocket, to retain the chain to the sprocket.



8. Rotate the inlet camshaft (and the exhaust camshaft), using a spanner on the flats, to provide sufficient slack in the chain to remove the chain tensioner blade.



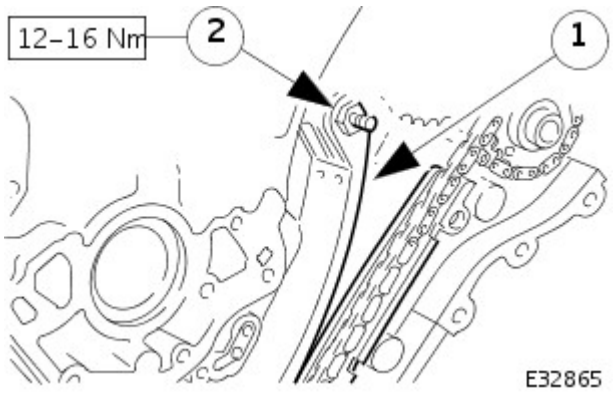
9. Remove the chain tensioner blade.
   1. Remove the pivot bolt which secures the tensioner blade.



2. Remove the tensioner blade.

10. Clean and inspect all relevant components.

Installation



1. Fit the chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.

2. Remove the Tie-Strap from the chain.

3. Refit the Timing Chain Tensioner - Primary. The camshafts may need to be turned slightly to provide slack in the chain, on the tensioner side. Refer to Operation 12.65.55 in this Section.

4. Refit the VVT Bush Carrier Assembly. Refer to Operation 12.65.52 in this Section.

5. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

6. Move the engine compartment cover from the service position and connect the gas struts.

7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

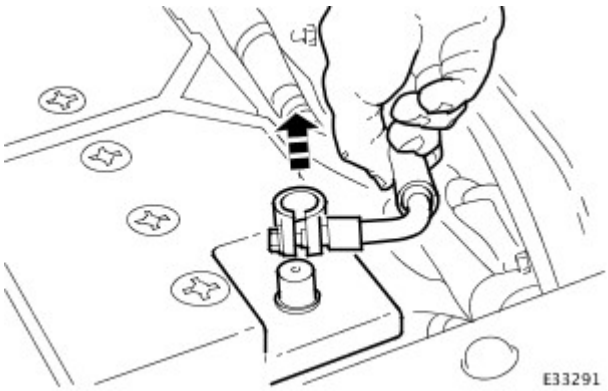
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain Inner Guide RH

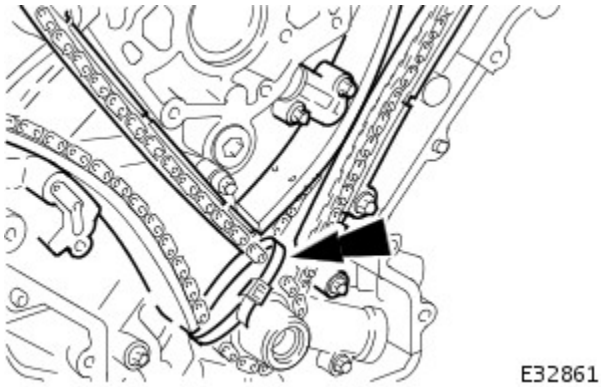
In-vehicle Repair

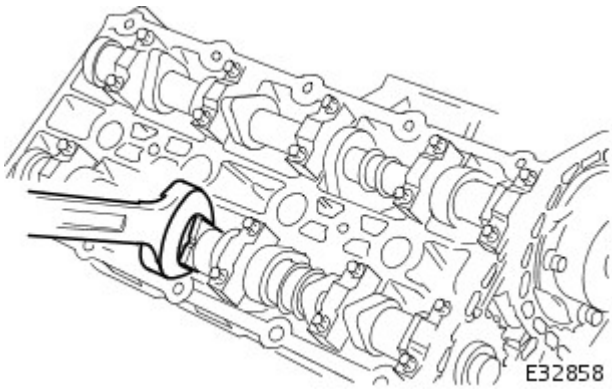
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.

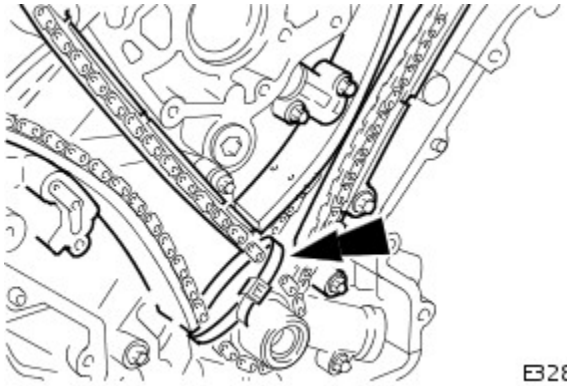


4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the VVT Bush Carrier Assembly from the A-Bank. Refer to Operation 12.65.51 in this Section.
6. Remove the Timing Chain Tensioner - Primary, from the A-Bank. Refer to Operation 12.65.54 in this Section.
7. Fit a Tie-Strap through the links of the primary chain, just above the crankshaft sprocket, to retain the chain to the sprocket.





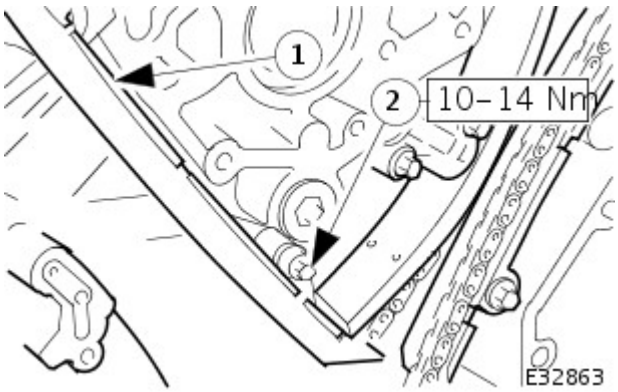
8. Rotate the inlet camshaft (and the exhaust camshaft), using a spanner on the flats, to provide sufficient slack in the chain to remove the chain guide.
9. Remove the chain guide.
   1. Remove the bolt which secures the chain guide.
   2. Note the orientation of the chain guide and remove it



from the upper retaining pin.

10. Clean and inspect all relevant components.

Installation



1. Fit the chain guide.

- The chain guide must be fitted so that the slotted hole is towards the top, and the raised shoulder to the cylinder block.

1. Fit the chain guide to the block and locate it onto the upper retaining pin.

2. Fit the retaining bolt and tighten it to 10-14 Nm.

2. Remove the Tie-Strap from the chain.

3. Refit the Timing Chain Tensioner - Primary. The camshafts may need to be turned slightly to provide slack in the chain, on the tensioner side. Refer to Operation 12.65.54 in this Section.

4. Refit the VVT Bush Carrier Assembly. Refer to Operation 12.65.51 in this Section.

5. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

6. Move the engine compartment cover from the service position and connect the gas struts.

7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

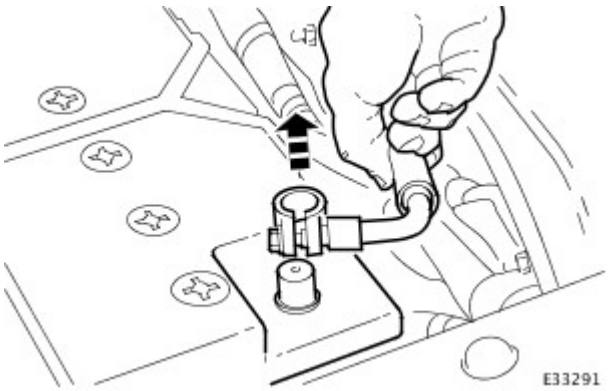
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain Outer Guide LH

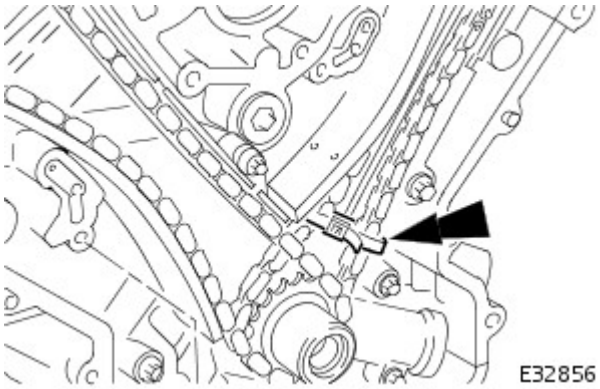
In-vehicle Repair

Removal

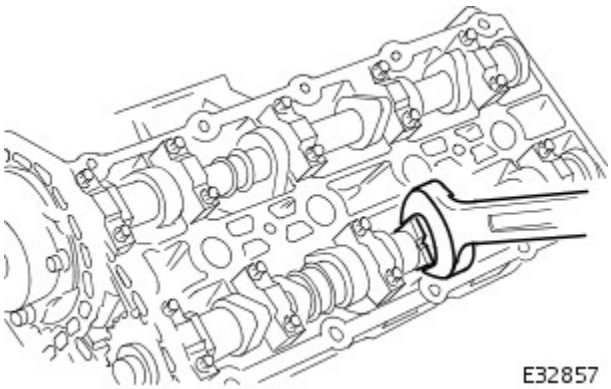
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



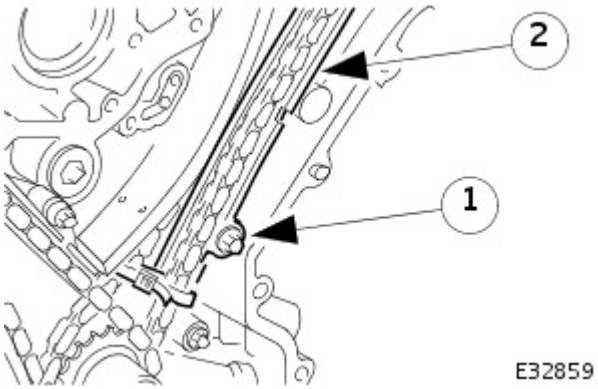
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the VVT Bush Carrier Assembly from the B-Bank. Refer to Operation 12.65.52 in this Section.
6. Remove the Timing Chain Tensioner - Primary, from the B-Bank. Refer to Operation 12.65.55 in this Section.
7. Fit a Tie-Strap through the links of the primary chain, just above the crankshaft sprocket, to retain the chain to the sprocket.



8. Rotate the inlet camshaft (and the exhaust camshaft), using a spanner on the flats, to provide sufficient slack in the chain to remove the chain guide.



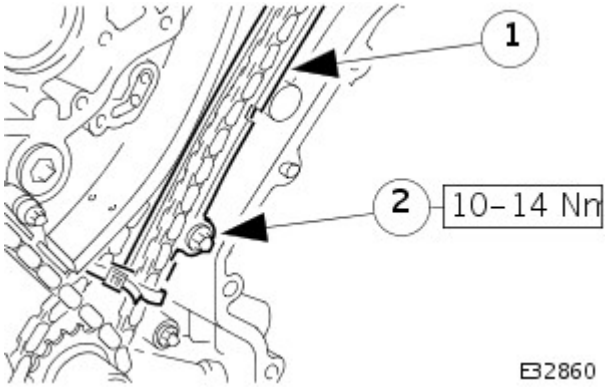
9. Remove the chain guide.
   1. Remove the bolt which secures the chain guide.
   2. Note the orientation of the chain guide and remove it



from the upper retaining pin.

10. Clean and inspect all relevant components.

Installation



1. Fit the chain guide.

- The chain guide must be fitted so that the slotted hole is towards the top, and the raised shoulder to the cylinder block.

1. Fit the chain guide to the block and locate it onto the upper retaining pin.

2. Fit the retaining bolt and tighten it to 10-14 Nm.

2. Remove the Tie-Strap from the chain.

3. Refit the Timing Chain Tensioner - Primary. The camshafts may need to be turned slightly to provide slack in the chain, on the tensioner side. Refer to Operation 12.65.55 in this Section.

4. Refit the VVT Bush Carrier Assembly. Refer to Operation 12.65.52 in this Section.

5. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

6. Move the engine compartment cover from the service position and connect the gas struts.

7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

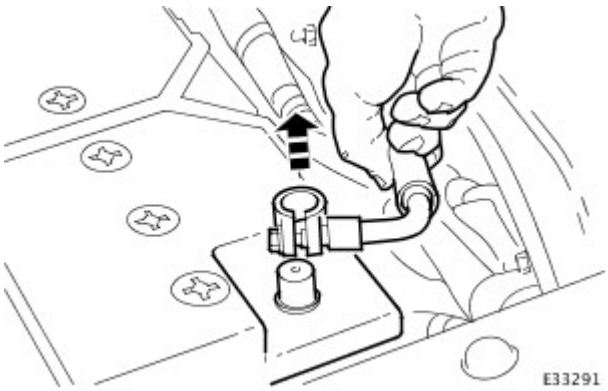
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain Outer Guide RH

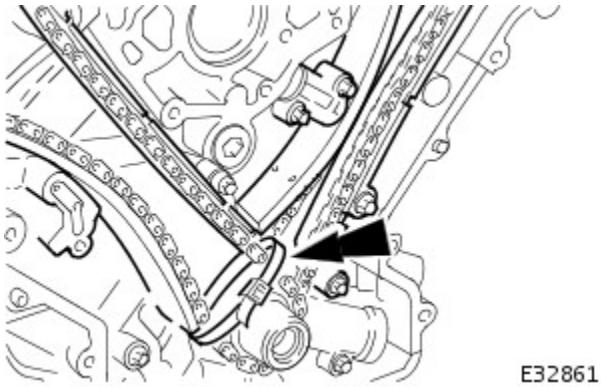
In-vehicle Repair

Removal

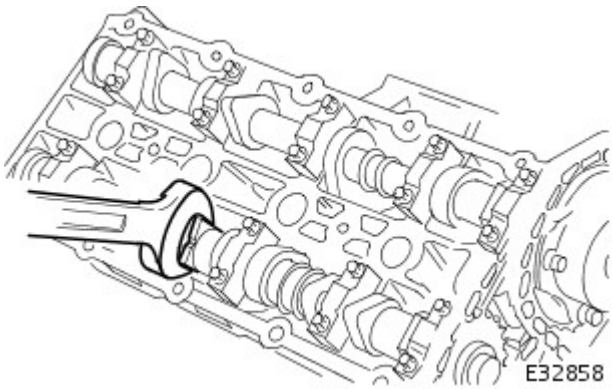
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



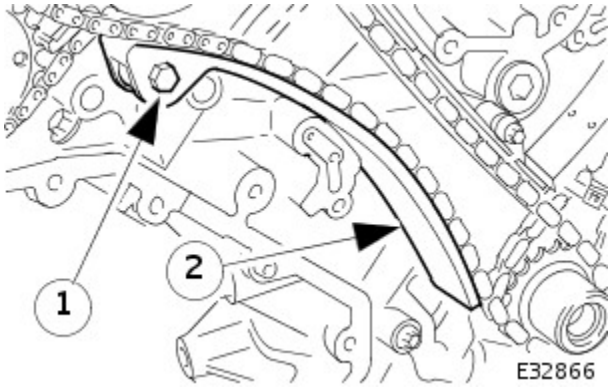
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the VVT Bush Carrier Assembly from the A-Bank. Refer to Operation 12.65.51 in this Section.
6. Remove the Timing Chain Tensioner - Primary, from the A-Bank. Refer to Operation 12.65.54 in this Section.
7. Fit a Tie-Strap through the links of the primary chain, just above the crankshaft sprocket, to retain the chain to the sprocket.



8. Rotate the inlet camshaft (and the exhaust camshaft), using a spanner on the flats, to provide sufficient slack in the chain to remove the chain guide.



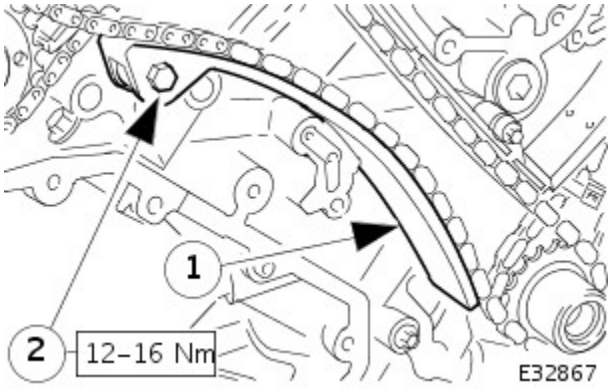
9. Remove the chain tensioner blade.
   1. Remove the pivot bolt which secures the tensioner blade.



2. Remove the tensioner blade.

10. Clean and inspect all relevant components.

Installation



1. Fit the chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.

2. Remove the Tie-Strap from the chain.

3. Refit the Timing Chain Tensioner - Primary. The camshafts may need to be turned slightly to provide slack in the chain, on the tensioner side. Refer to Operation 12.65.54 in this Section.

4. Refit the VVT Bush Carrier Assembly. Refer to Operation 12.65.51 in this Section.

5. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

6. Move the engine compartment cover from the service position and connect the gas struts.

7. Remove the paint protection sheets and close the cover.

8. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain Tensioner LH

In-vehicle Repair

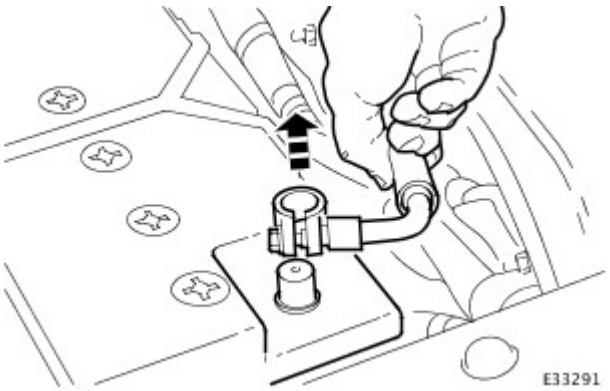
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.

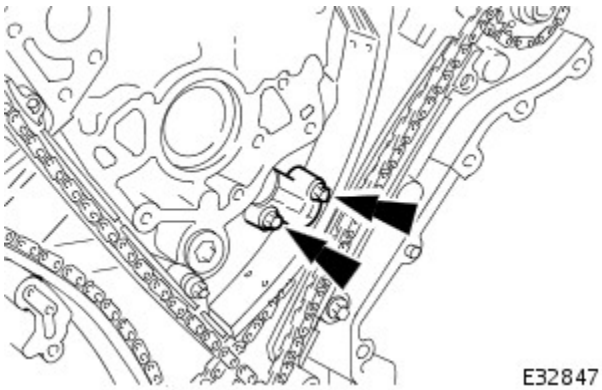
3. Disconnect the battery ground cable.

- Remove the battery cover.



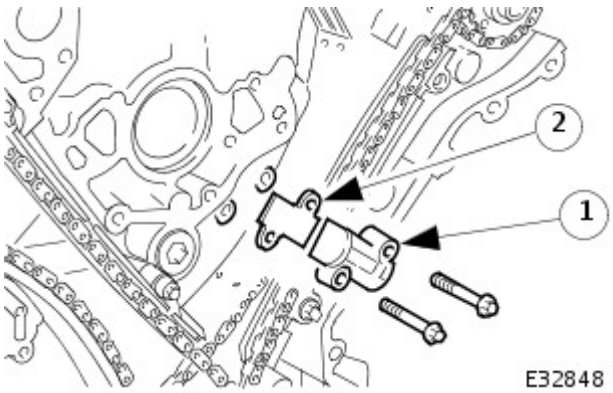
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Remove the primary chain tensioner bolts.



6. Remove the tensioner assembly.

1. Remove the tensioner.
2. Remove the tensioner back-plate.

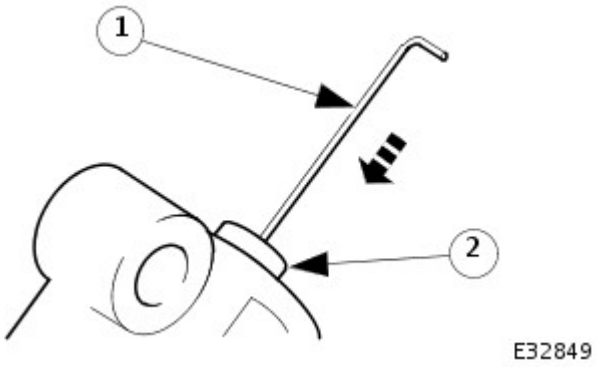


7. Clean and inspect all relevant components.

Installation

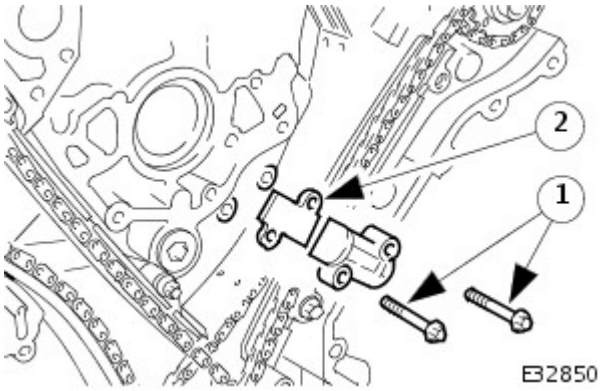
1. Push the tensioner piston into the body to provide clearance for fitting.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.



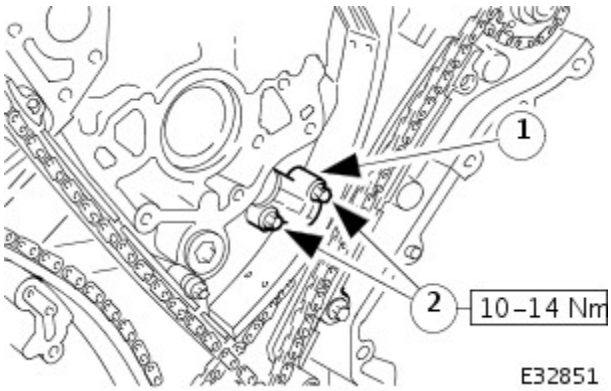
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.



2. Assemble the tensioner.

1. Fit the two mounting bolts to the tensioner.
2. Locate the tensioner back-plate to the two bolts.



3. Fit the tensioner to the cylinder block.

1. Position and align the tensioner to the cylinder block and to the mating slot on the rear face of the tensioner blade.
2. Fit and tighten the two bolts to 10-14 Nm.

4. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Move the engine compartment cover from the service position and connect the gas struts.

6. Remove the paint protection sheets and close the cover.

7. Connect the battery and fit the battery cover.

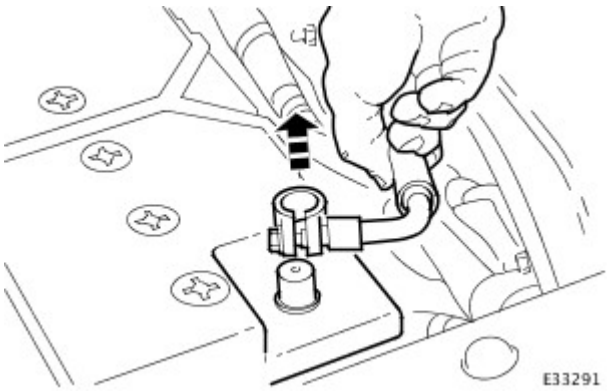
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Primary Timing Chain Tensioner RH

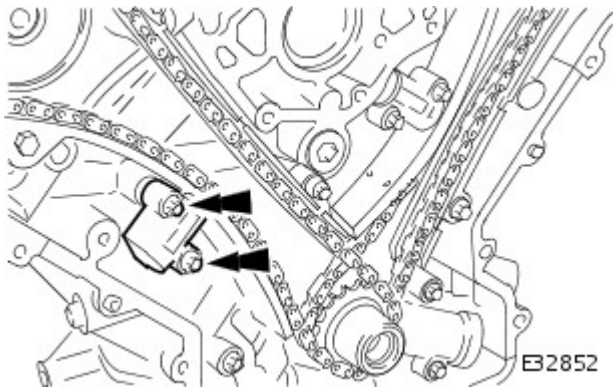
In-vehicle Repair

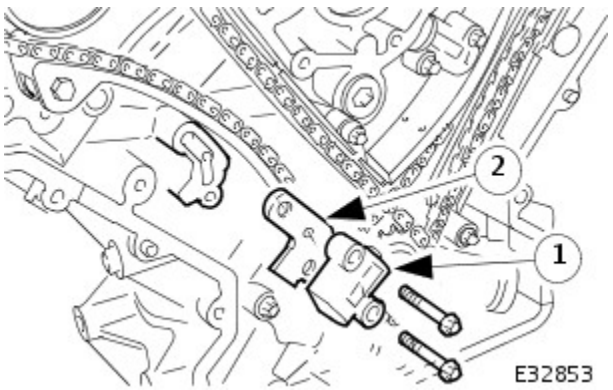
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the primary chain tensioner bolts.

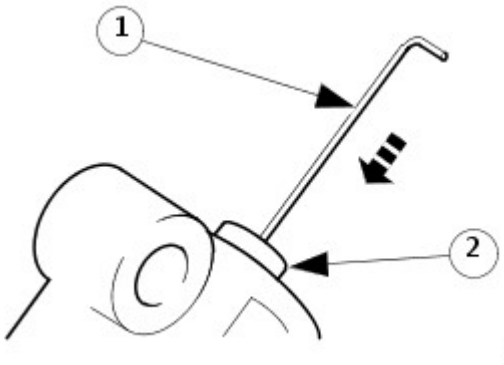




6. Remove the tensioner assembly.
   1. Remove the tensioner.
   2. Remove the tensioner back-plate.
7. Clean and inspect all relevant components.

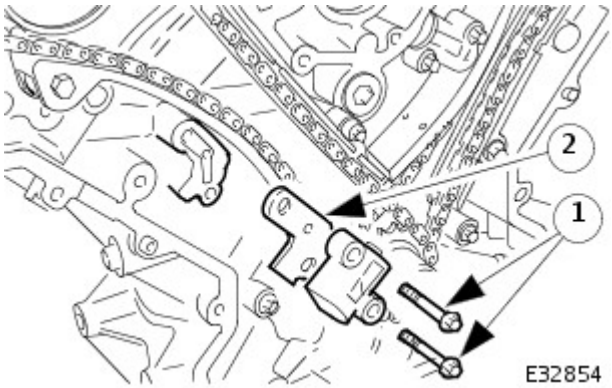
Installation

1. Push the tensioner piston into the body to provide clearance for fitting.
   1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.



2. With the wire in position, press the piston fully into the tensioner body.

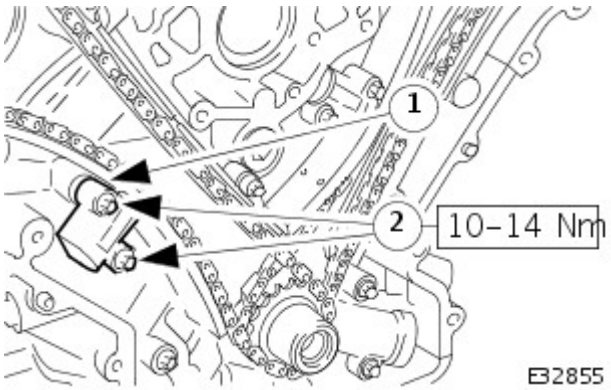
- Remove the wire.



2. Assemble the tensioner.

1. Fit the two mounting bolts to the tensioner.

2. Locate the tensioner back-plate to the two bolts.



3. Fit the tensioner to the cylinder block.

1. Position and align the tensioner to the cylinder block and to the mating slot on the rear face of the tensioner blade.

2. Fit and tighten the two bolts to 10-14 Nm.

4. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

5. Move the engine compartment cover from the service position and connect the gas struts.

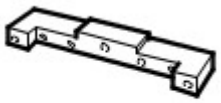
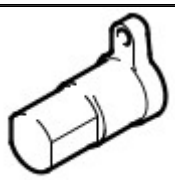
6. Remove the paint protection sheets and close the cover.

7. Connect the battery and fit the battery cover.

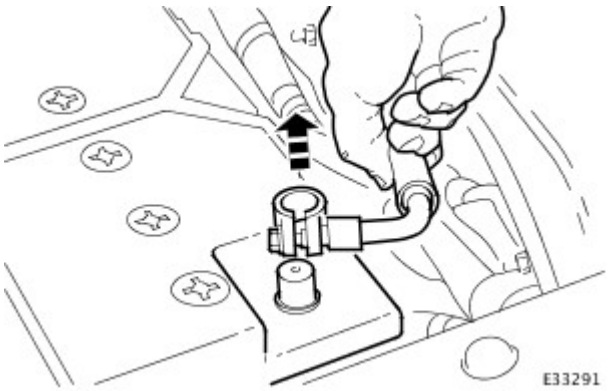
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain LH

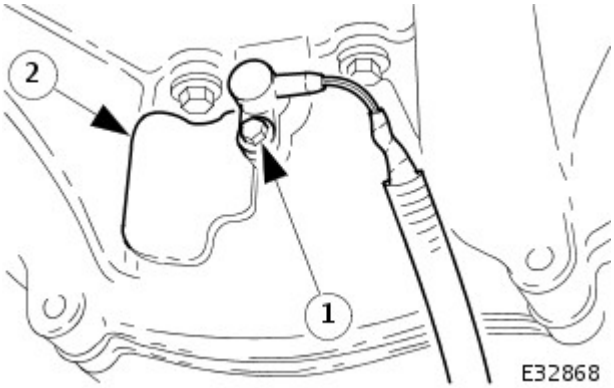
In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal


E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.52 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



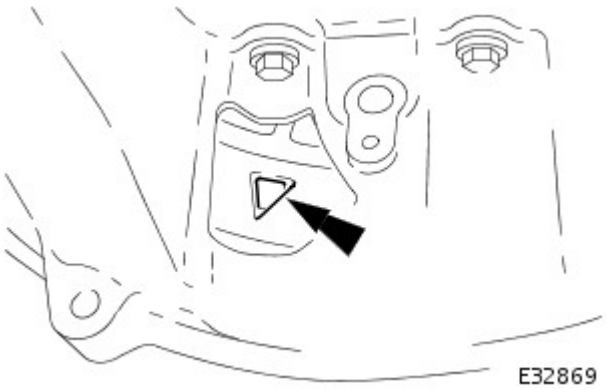
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

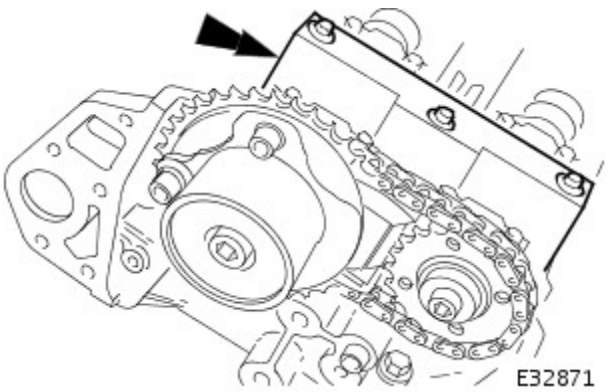
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Fit and tighten the bolt to secure the setting peg.

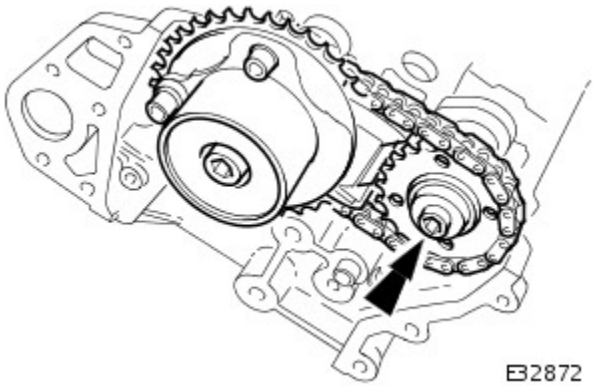
11. Remove the damper securing bolt from the crankshaft.

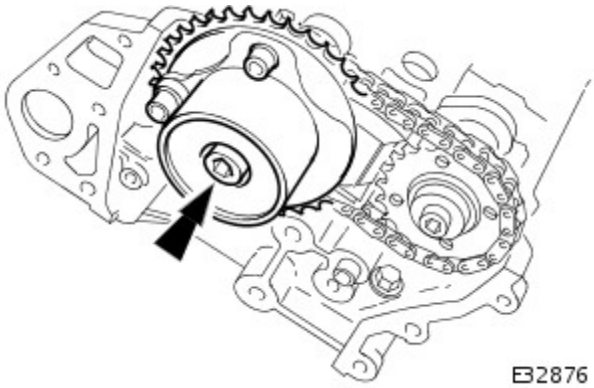
12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the B-Bank camshafts, aligning the shafts slightly as necessary.



14. Loosen the bolt which secures the sprocket to the exhaust camshaft.



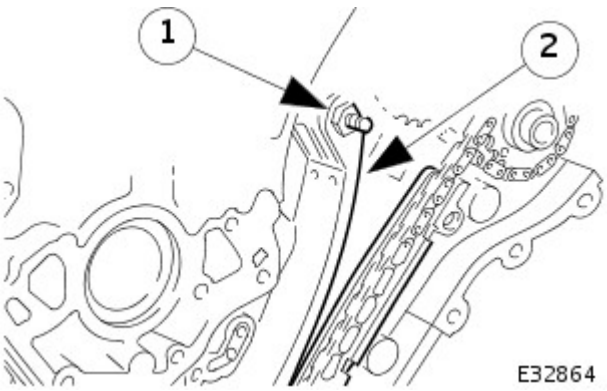


15. Loosen the bolt which secures the VVT unit.

- Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.

16. Remove the primary chain tensioner. Refer to operation 12.65.55, in this Section.

17. Remove the primary chain tensioner blade.



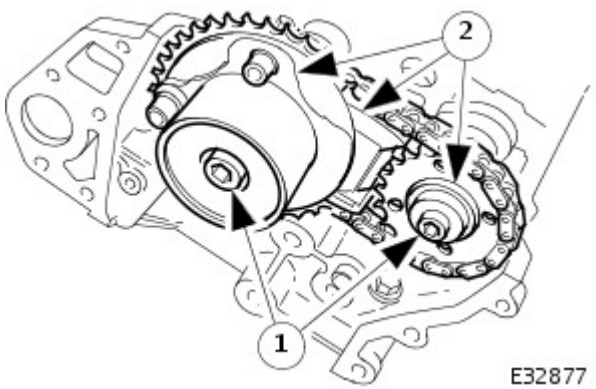
1. Remove the pivot bolt which secures the tensioner blade.

2. Remove the tensioner blade.

18. Reposition the VVT unit along the cam journal to allow the chain to clear the head casting.

- Disconnect the primary chain from the VVT unit and reposition it against the crankshaft sprocket.

19. Remove the VVT unit.



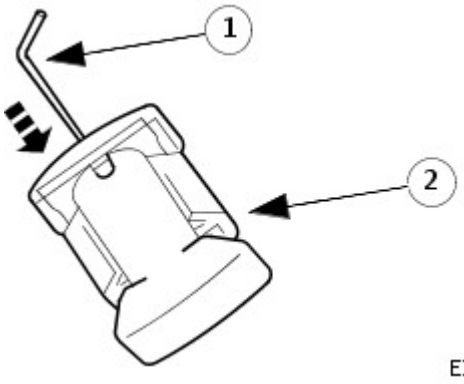
1. Remove the securing bolt from the VVT unit and the exhaust cam sprocket.

2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

20. Clean and inspect all relevant components.

Installation

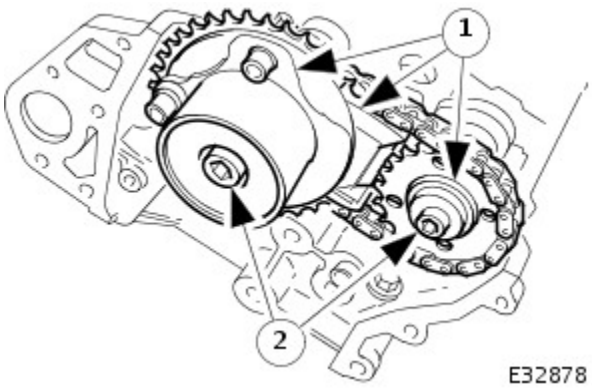


E32920

1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

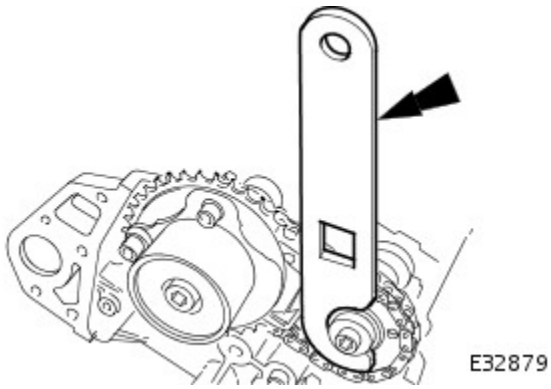


E32878

2. Fit the VVT unit to the engine.

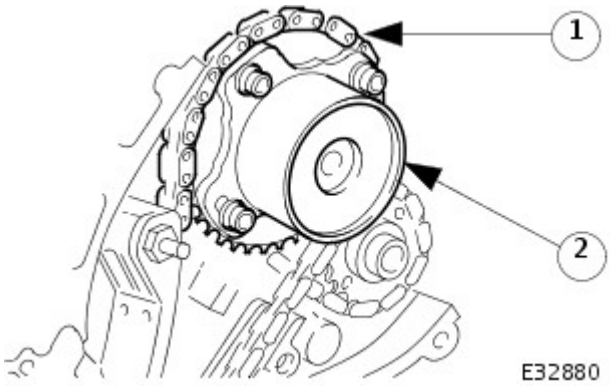
- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.
2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts. Allow the VVT unit sufficient space to fit the primary chain, in a later operation.


E32879

3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



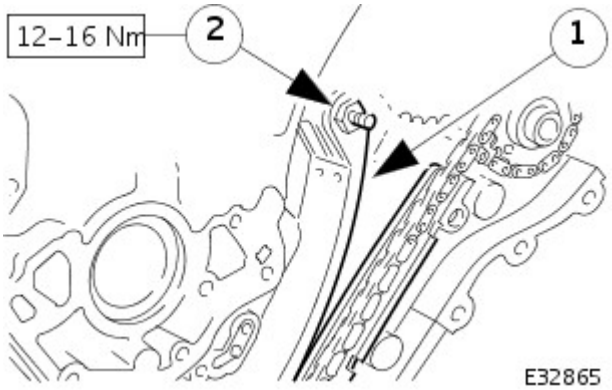
E32880

4. Refit the primary timing chain.

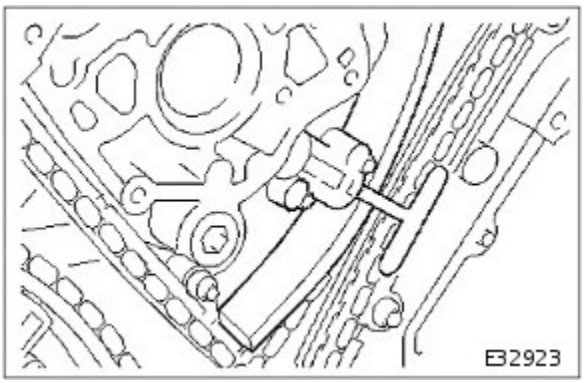
1. Lift the primary chain and position it over the VVT unit sprocket (the VVT unit must be pulled forward to clear the cylinder head casting). There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.
2. Slide the VVT unit fully on to the camshaft.

5. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

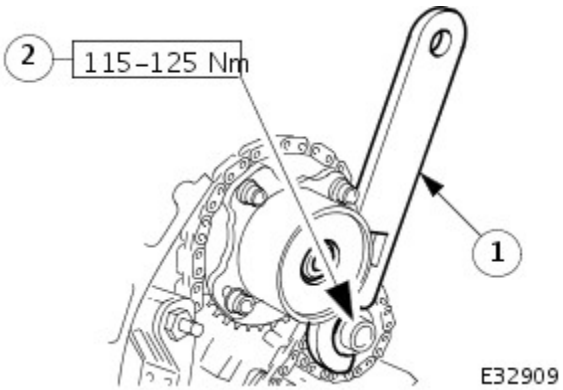


2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.



6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.55 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

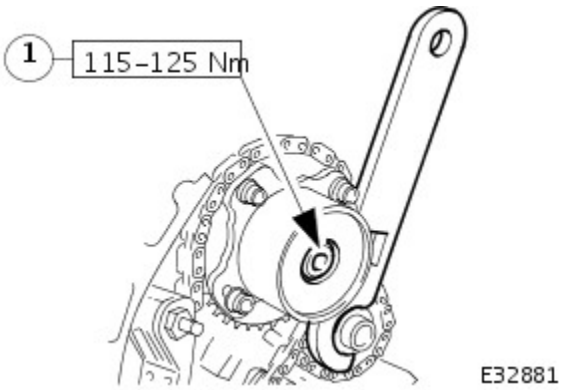


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

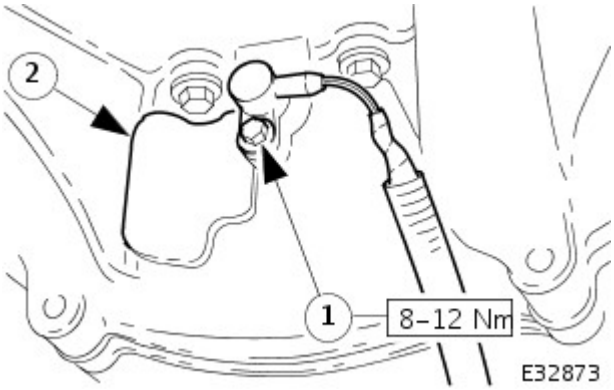
9. Remove the camshaft locking tool 303 - 530.

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.

1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.



2. Refit the access grommet to the housing.

13. Lower the ramp.

14. Refit the B-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.52 in this Section.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.

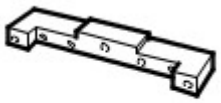
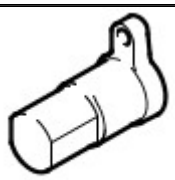
17. Remove the paint protection sheets and close the cover.

18. Connect the battery and fit the battery cover.

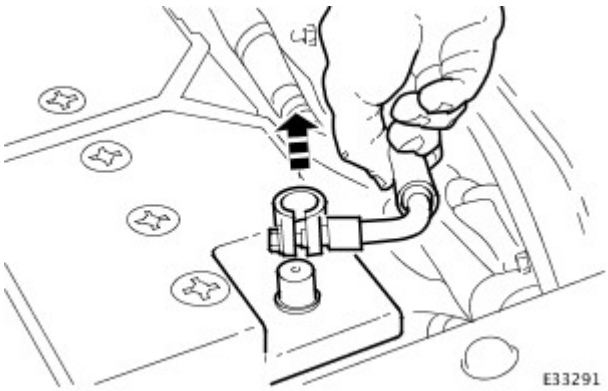
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain RH

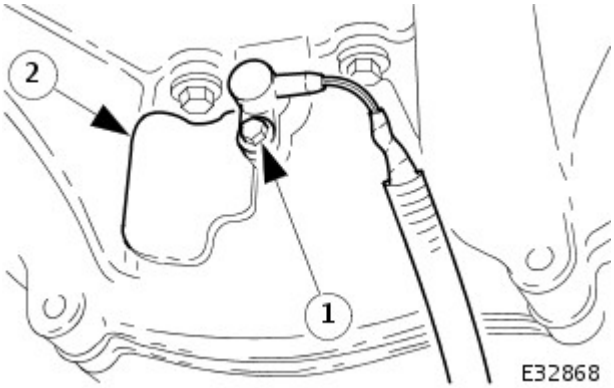
In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal


E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.51 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



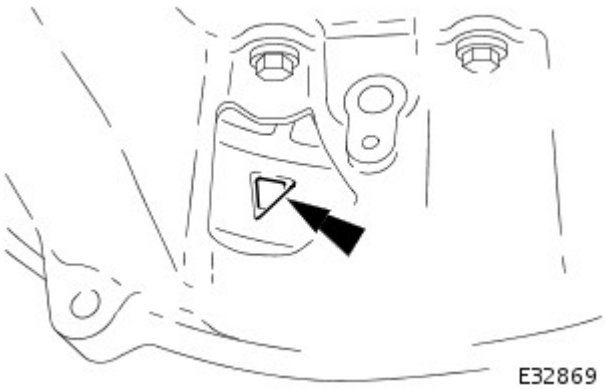
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

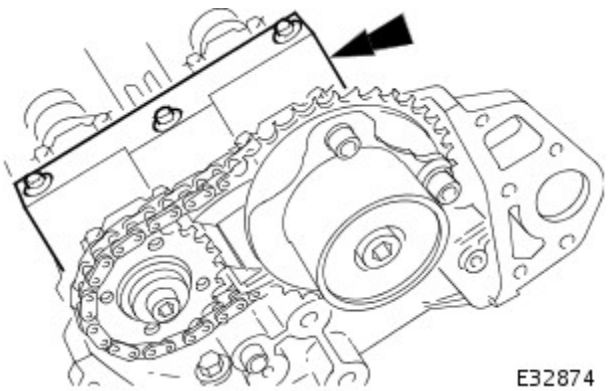
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Fit and tighten the bolt to secure the setting peg.

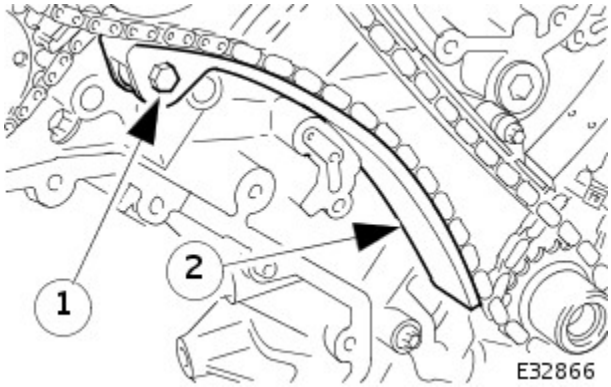
11. Remove the damper securing bolt from the crankshaft.

12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.



14. Remove the primary chain tensioner. Refer to operation 12.65.54, in this Section

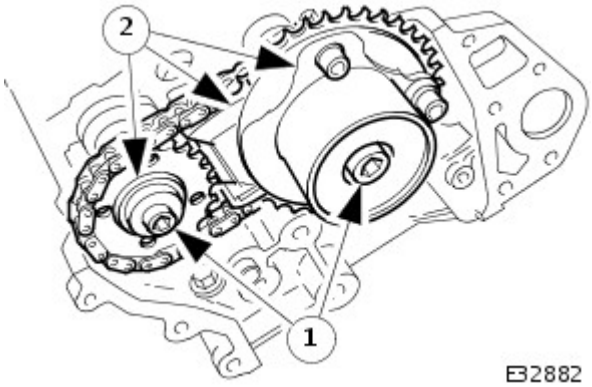


15. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

16. Disconnect the primary chain from the VVT unit and the crankshaft sprocket, and remove it completely.

17. Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.



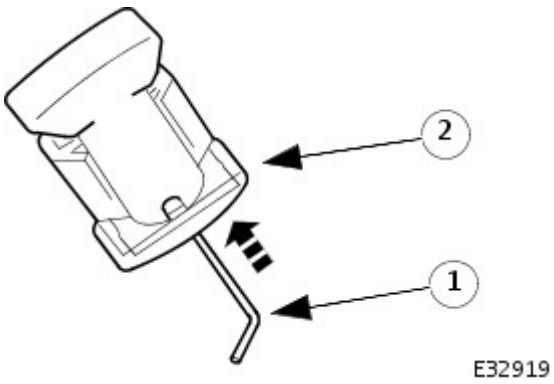
18. Remove the VVT unit.

1. Remove the securing bolt from both the VVT unit and the exhaust cam sprocket.
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

19. Clean and inspect all relevant components.

Installation



1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.

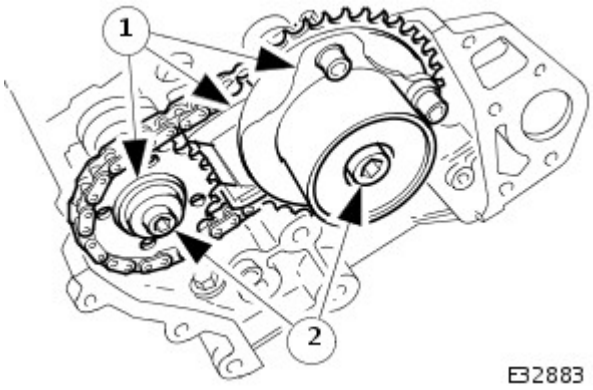
1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

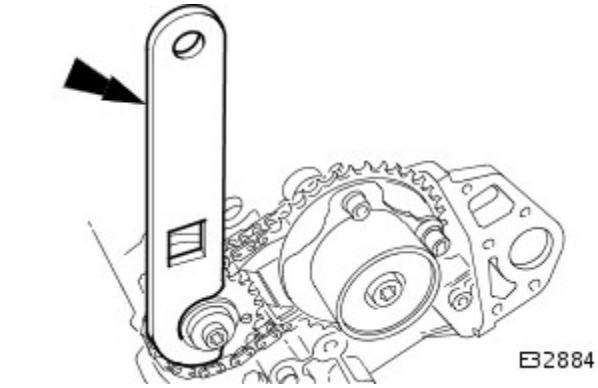
- Remove the wire.

2. Fit the VVT unit to the engine.

- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

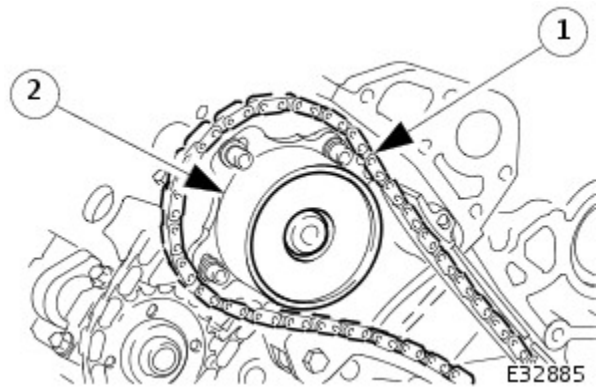
1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.
2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts.





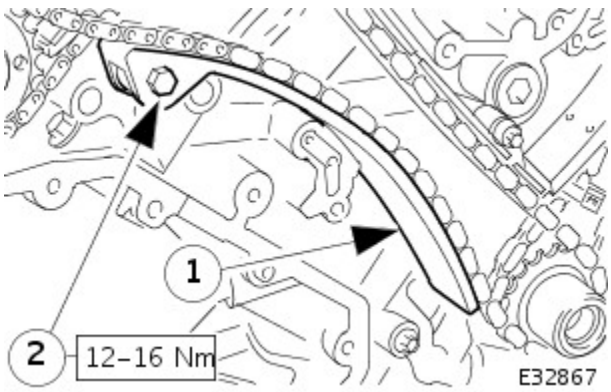
3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



4. Refit the primary timing chain.

1. Fit the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain.
2. The VVT unit must not be rotated on the camshaft

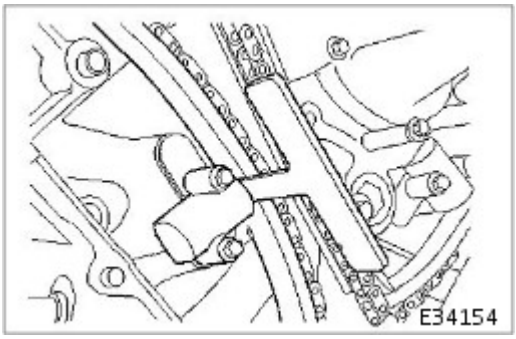


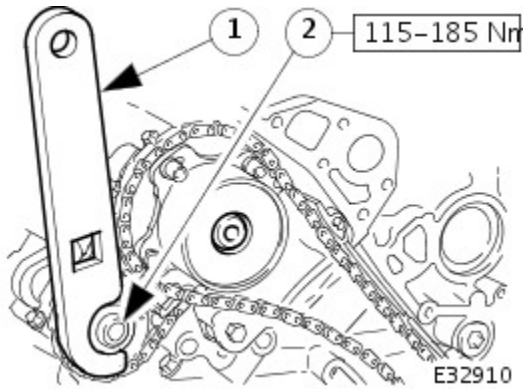
5. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.

6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



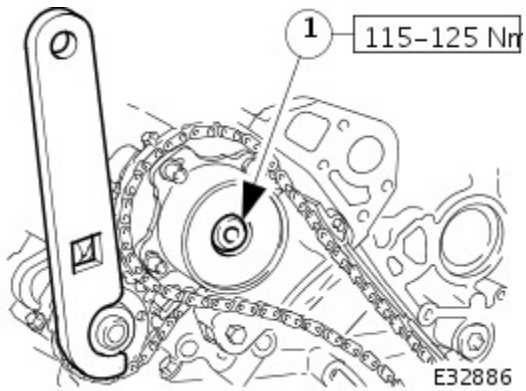


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

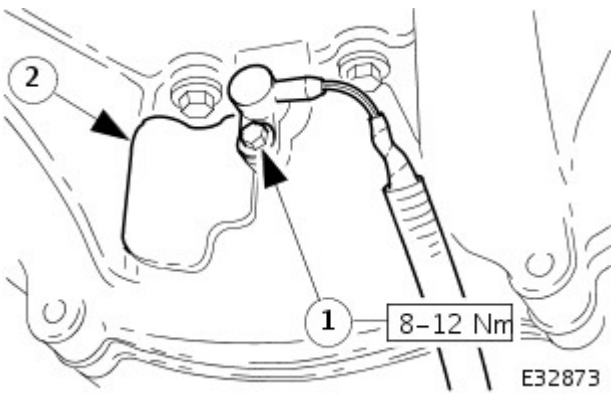
- Remove the chain tensioning tool and the wedge(s).

9. Remove the camshaft locking tool 303 - 530.

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.



1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Refit the access grommet to the housing.

13. Lower the ramp.

14. Refit the A-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.51 in this Section.

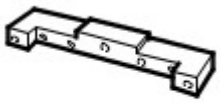
15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.
17. Remove the paint protection sheets and close the cover.
18. Connect the battery and fit the battery cover.

    - Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain Tensioner LH4.0L NA V8 - AJ27

In-vehicle Repair

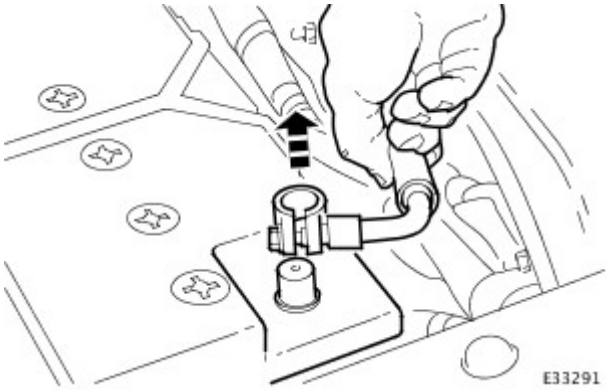
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.



3. Remove the Cam Cover from Bank 2. Refer to Operation 12.29.43.

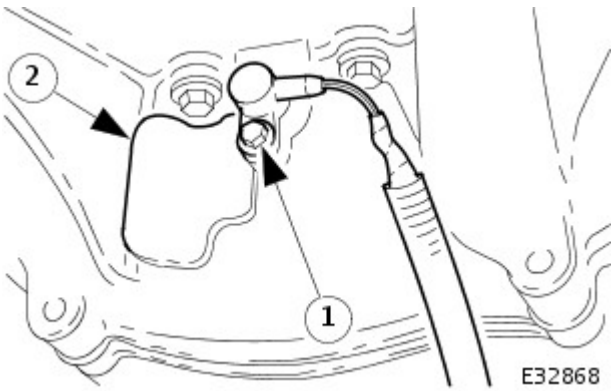
4. Raise the vehicle on a ramp.

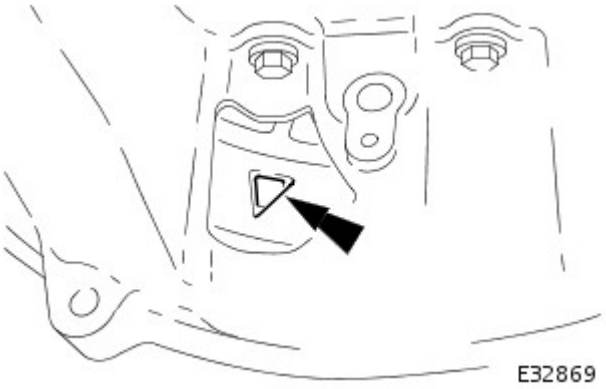
5. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

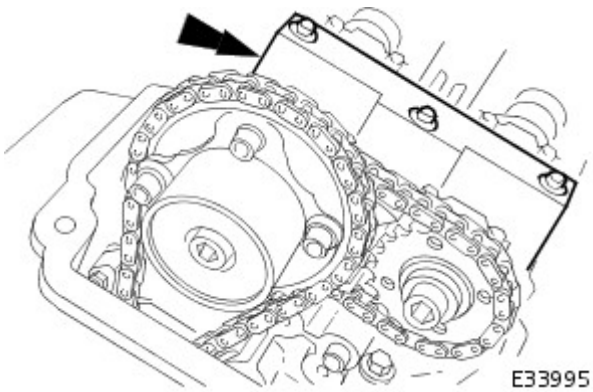
1. Install the crankshaft setting peg 303-531.

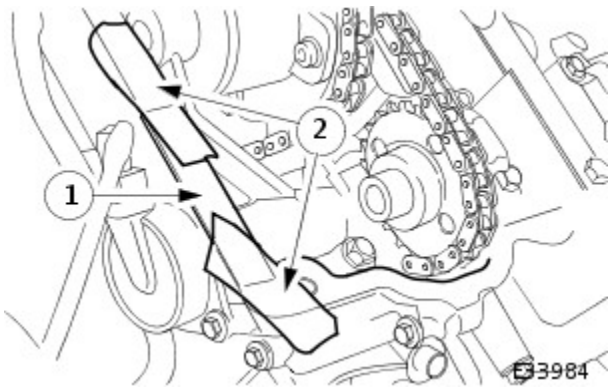
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 2 camshafts, aligning the shafts slightly as necessary.





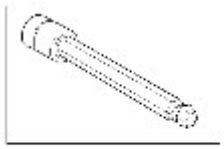
10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

Protect the upper face of the timing cover from scratches, when removing the bolt which secures the sprocket.

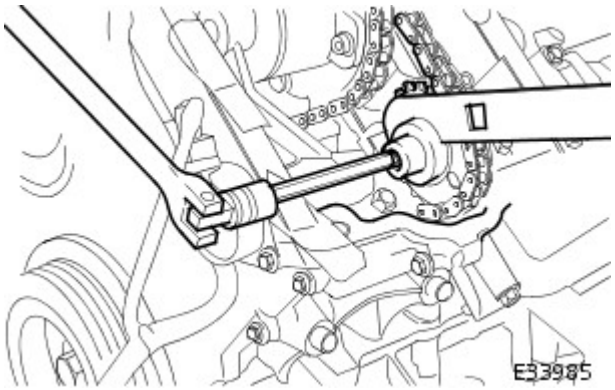
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.

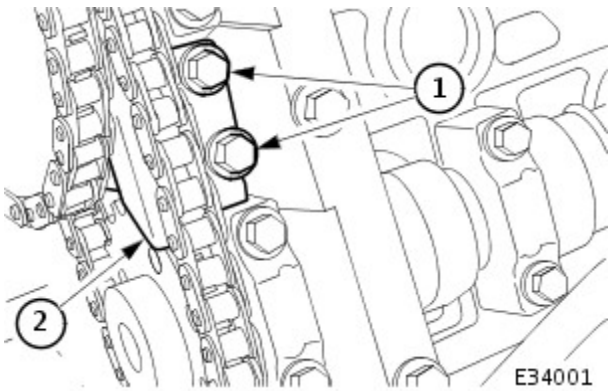


E34593



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner.

1. Remove the two bolts which secure the tensioner.

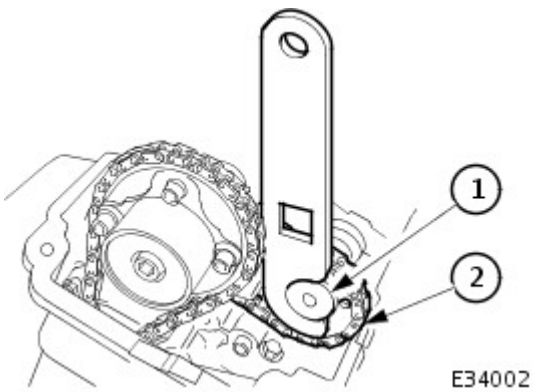
- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket if required, or leave it in the chain resting on the cylinder head.

15. Clean and inspect all relevant components.

Installation



1. Install the sprocket to the secondary chain.

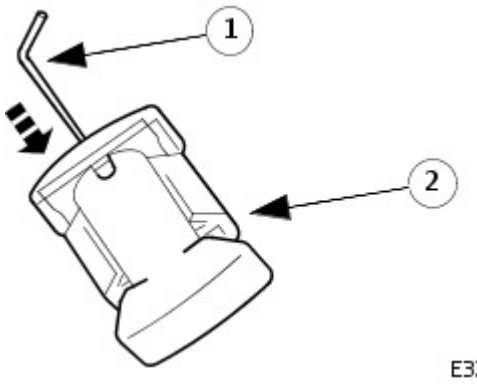
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.

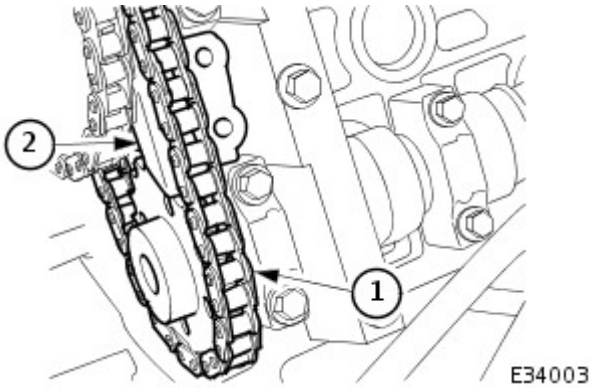
2. Push the tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.



2. With the wire in position, press the piston fully into the tensioner body.

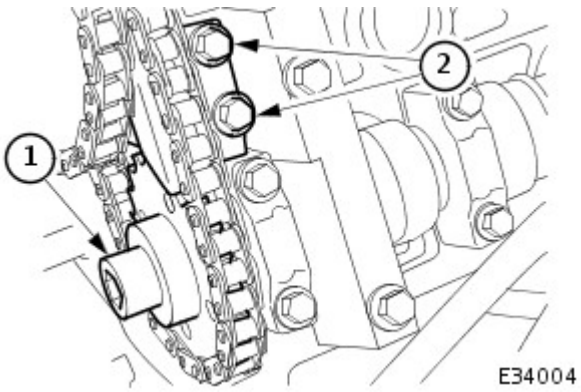
- Remove the wire.



3. Install the chain tensioner between the chain path.

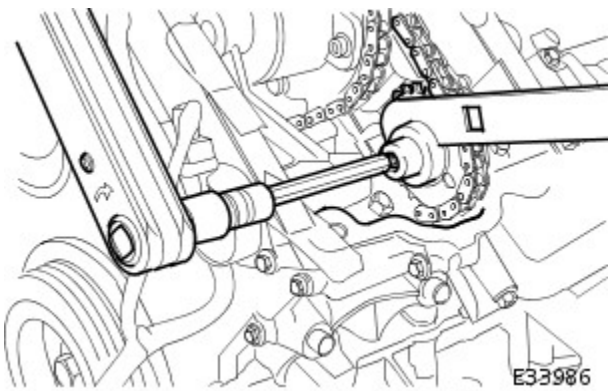
1. Reposition the sprocket, still captive in the chain, upwards for access.
2. Install the chain tensioner between the sprockets.

- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.



4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.
2. Install the two bolts which secure the tensioner and tighten to 10-14 Nm.



5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.
- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.
- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.

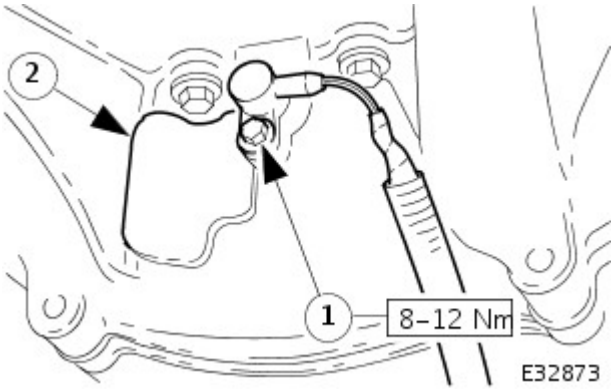
6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 2. Refer to Operation 12.29.43.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.



11. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

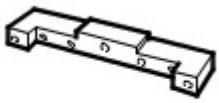
13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

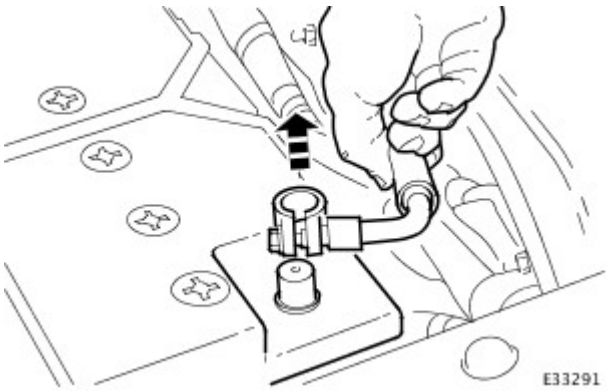
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain Tensioner LH4.0L SC V8 - AJ26 / 3.2L NA V8 - AJ26

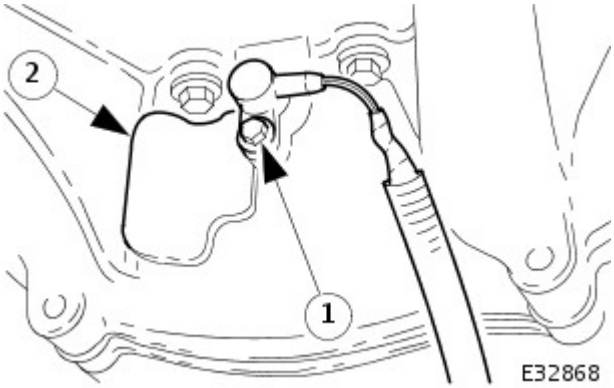
In-vehicle Repair

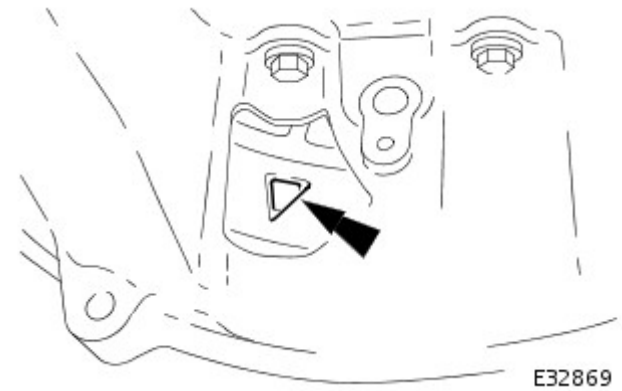
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal


E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Cam Cover from Bank 2. Refer to Operation 12.29.43.
4. Raise the vehicle on a ramp.
5. Remove the crankshaft position sensor.
   1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
   - Remove the sensor and allow it to hang free under the engine.
   2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

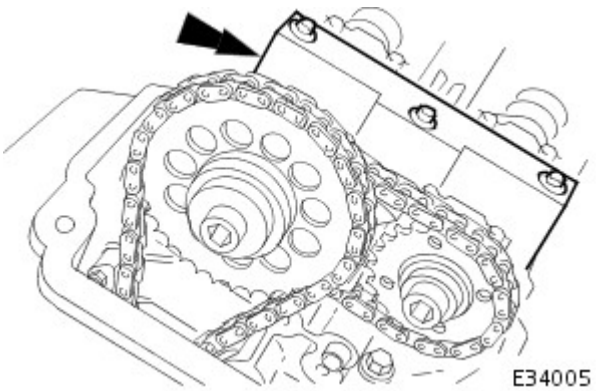
1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

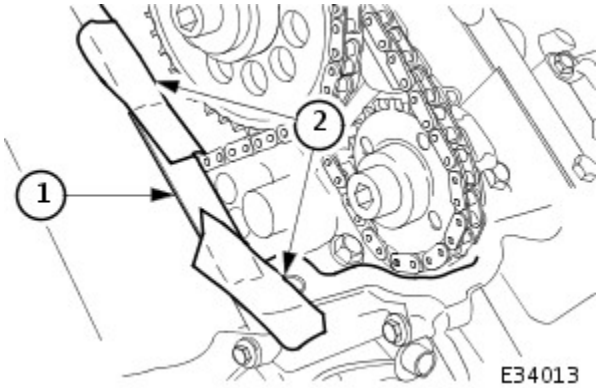
8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 2 camshafts, aligning the shafts slightly as necessary.



10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

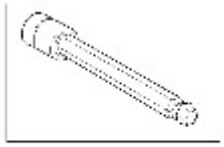
Protect the upper face of the timing cover from scratches, when



removing the bolt which secures the sprocket.

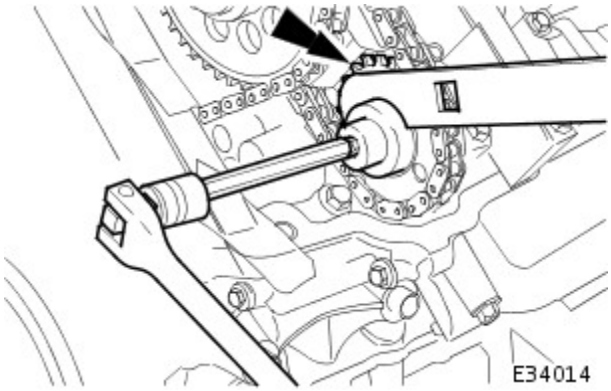
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.



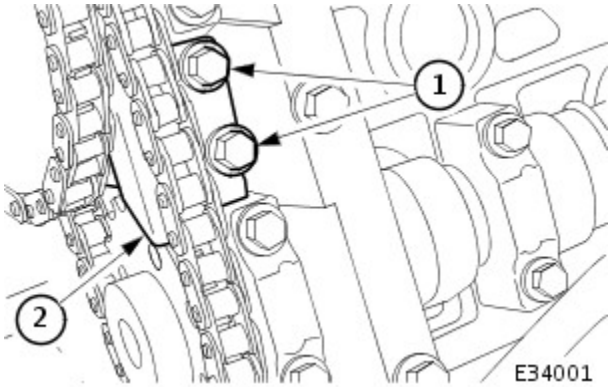
E34593

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner.

1. Remove the two bolts which secure the tensioner.

- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket if required, or leave it in the chain resting on the cylinder head.

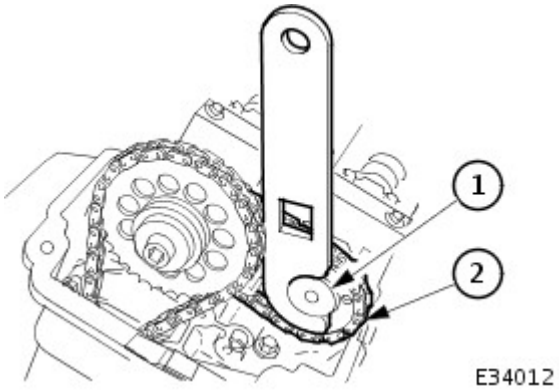
15. Clean and inspect all relevant components.

Installation

1. Install the sprocket to the secondary chain.

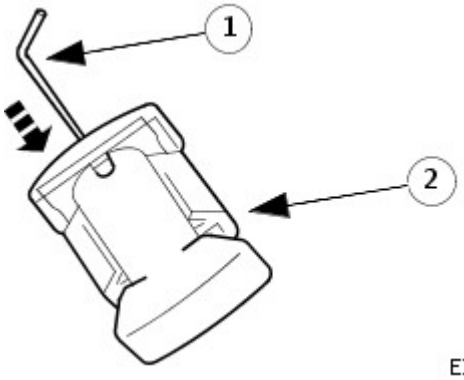
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to



allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

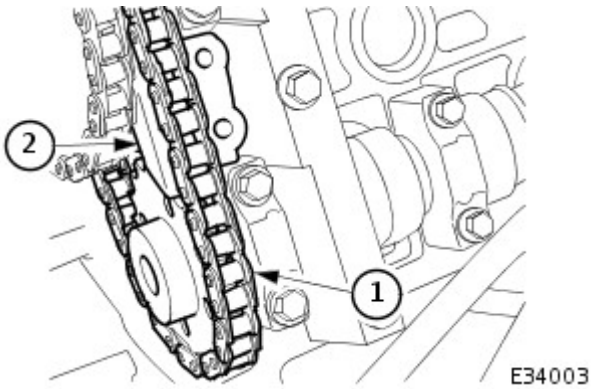
- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.



2. Push the tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

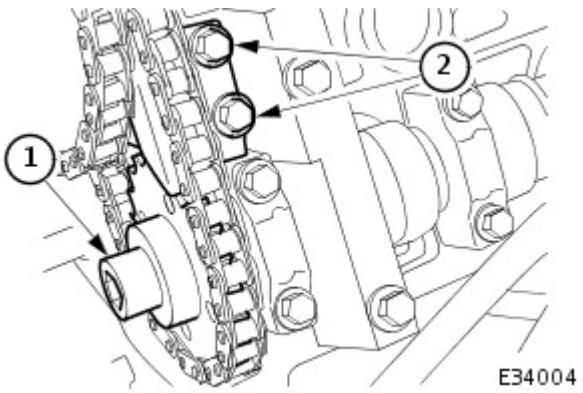
- Remove the wire.



3. Install the chain tensioner between the chain path.

1. Reposition the sprocket, still captive in the chain, upwards for access.
2. Install the chain tensioner between the sprockets.

- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.

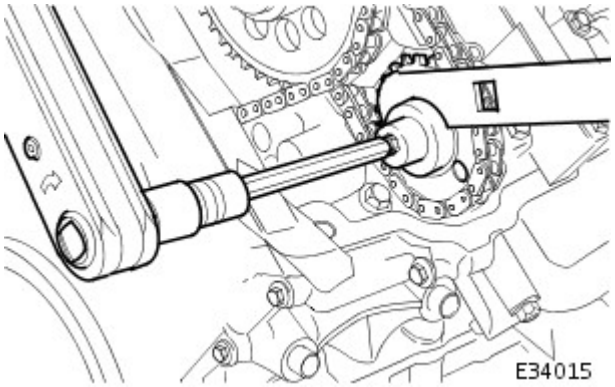


4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.
2. Install the two bolts which secure the tensioner and tighten to 10-14 Nm.

5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.
- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.



- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.

6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

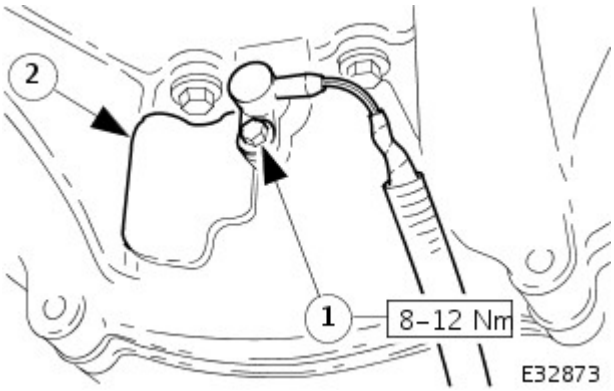
7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 2. Refer to Operation 12.29.43.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.

11. Install the crankshaft position sensor.



1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

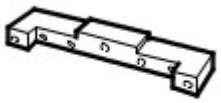
13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain Tensioner RH4.0L NA V8 - AJ27

In-vehicle Repair

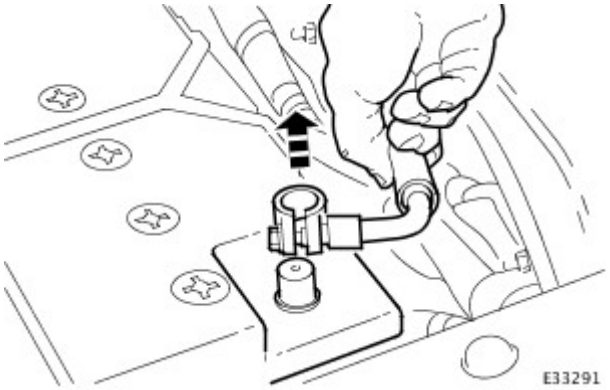
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.



3. Remove the Cam Cover from Bank 1. Refer to Operation 12.29.44.

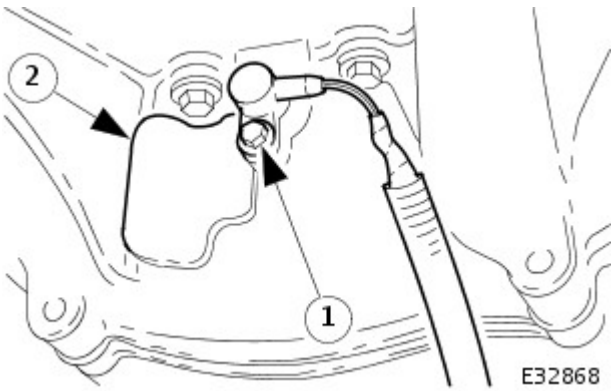
4. Raise the vehicle on a ramp.

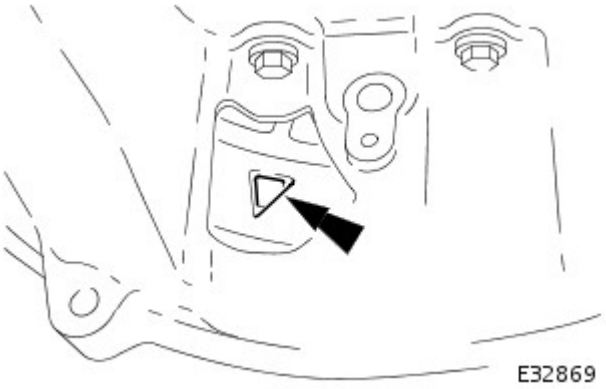
5. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

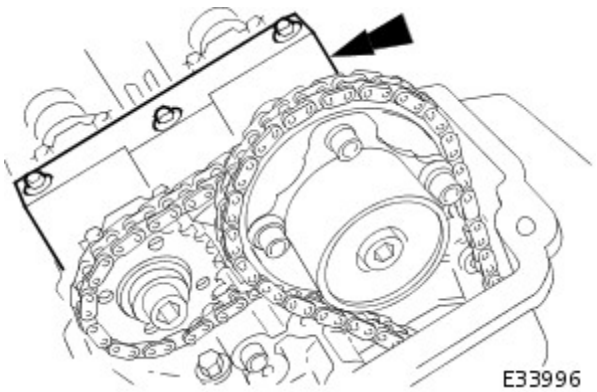
1. Install the crankshaft setting peg 303-531.

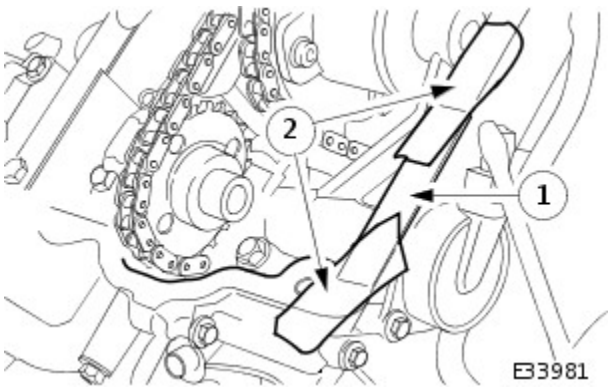
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.





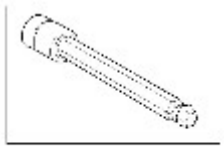
10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

Protect the upper face of the timing cover from scratches, when removing the bolt which secures the sprocket.

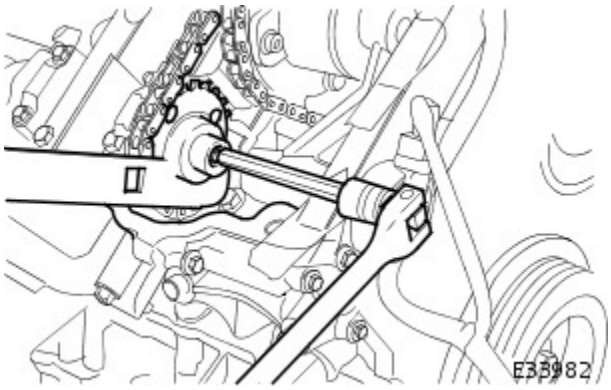
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.

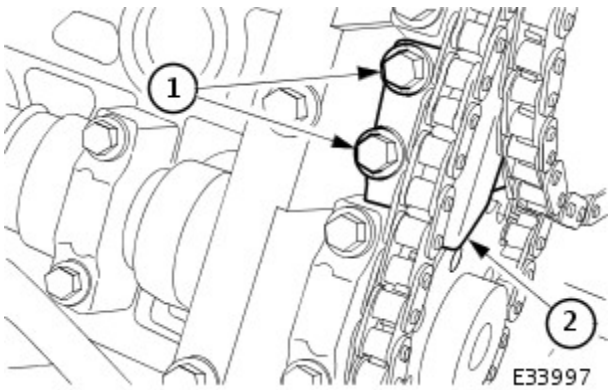


E34593



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner.

1. Remove the two bolts which secure the tensioner.

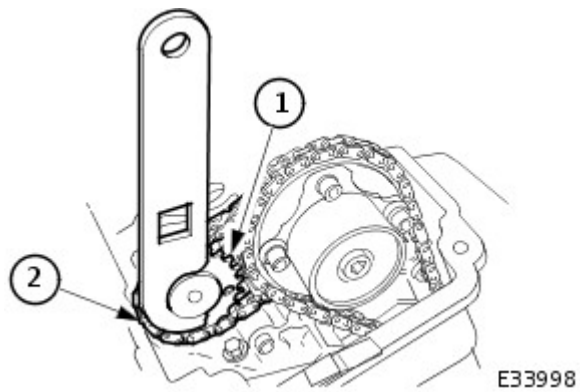
- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket if required, or leave it in the chain resting on the cylinder head.

15. Clean and inspect all relevant components.

Installation



1. Install the sprocket to the secondary chain.

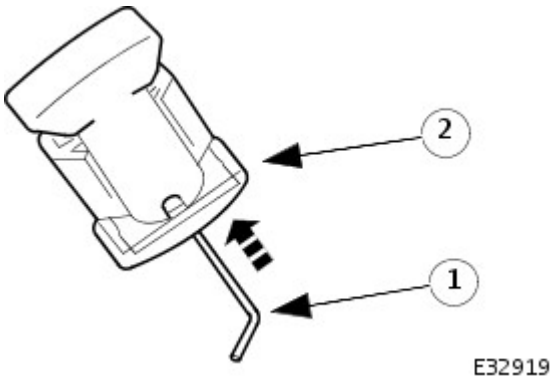
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.

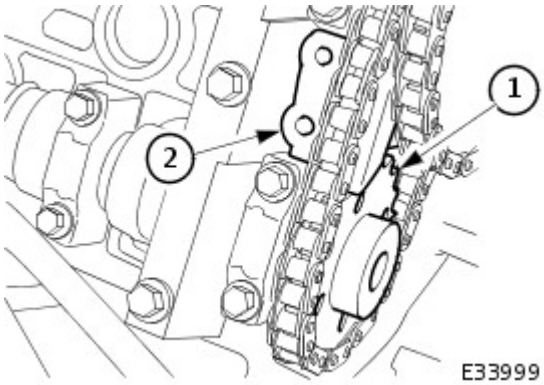
2. Push the tensioner piston into the body to provide clearance for fitting.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.



2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

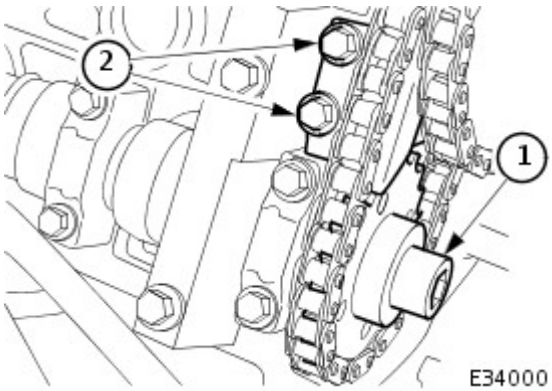


3. Install the chain tensioner between the chain path.

1. Reposition the sprocket, still captive in the chain, upwards for access.

2. Install the chain tensioner between the sprockets.

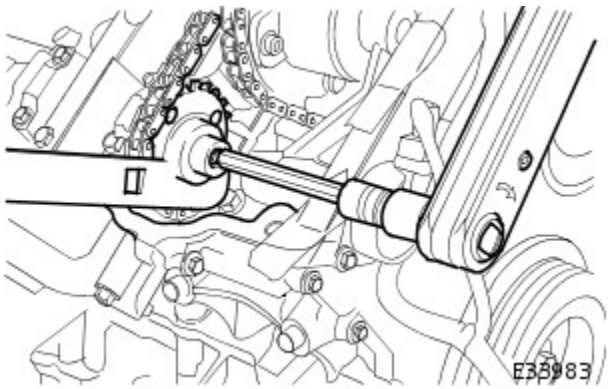
- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.



4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.

2. Install the two bolts which secure the tensioner and tighten to 10-14 Nm.



5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.

- Remove the chain tensioning tool.

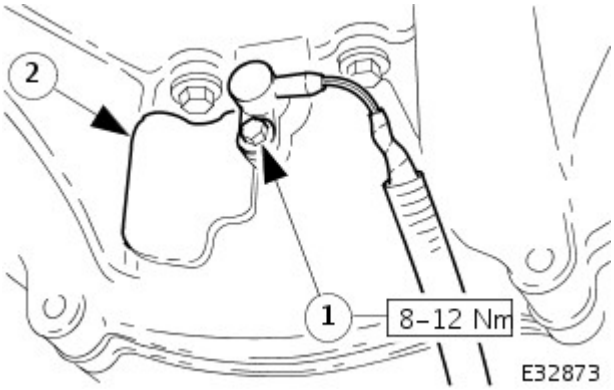
6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 1. Refer to Operation 12.29.44.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.



11. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

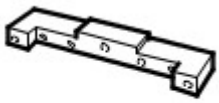
13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

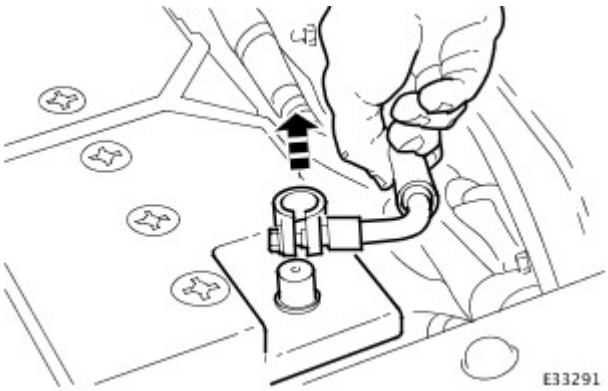
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Secondary Timing Chain Tensioner RH4.0L SC V8 - AJ26 / 3.2L NA V8 - AJ26, 3.2L / 4.0L

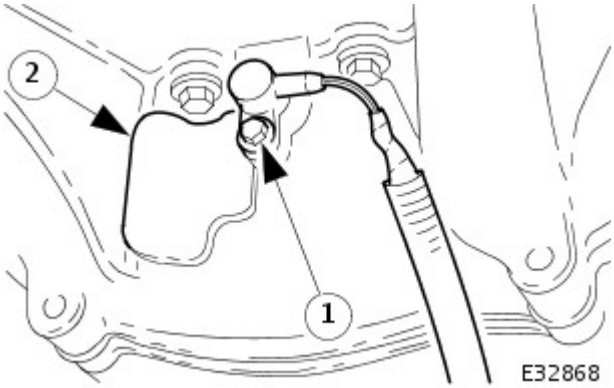
In-vehicle Repair

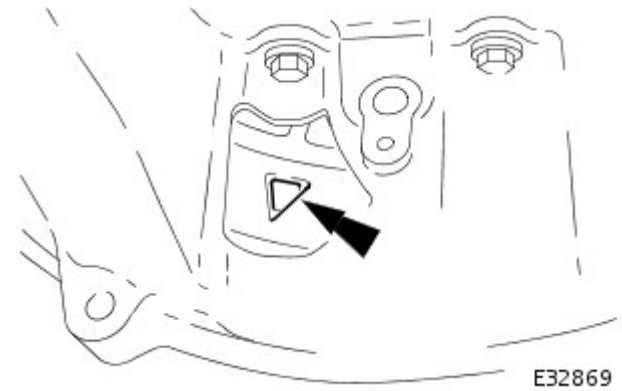
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36408	Crankshaft setting 303-531
 E36402	Timing chain tensioning 303-532

Removal

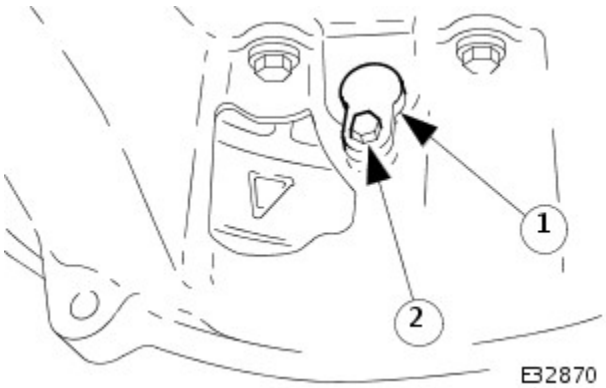

E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Remove the Cam Cover from Bank 1. Refer to Operation 12.29.44.
4. Raise the vehicle on a ramp.
5. Remove the crankshaft position sensor.
   1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
   - Remove the sensor and allow it to hang free under the engine.
   2. Remove the access grommet (for torque converter bolts) from the housing.





6. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.



7. Install the crankshaft setting peg 303-531 to the crankshaft position sensor location.

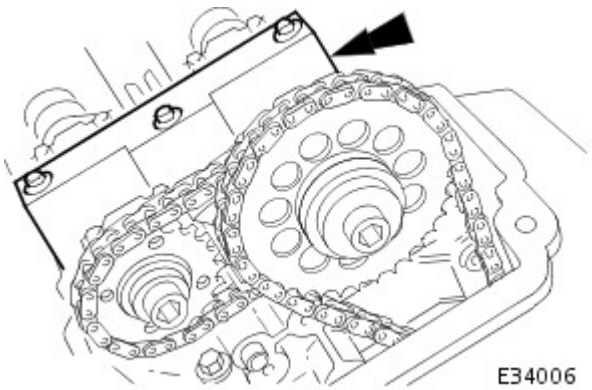
1. Install the crankshaft setting peg 303-531.

- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Install and tighten the bolt to secure the setting peg.

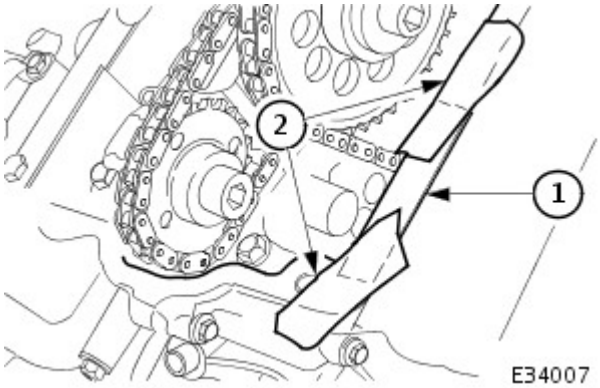
8. Lower the vehicle on the ramp.

9. Install the camshaft locking tool 303-530 to Bank 1 camshafts, aligning the shafts slightly as necessary.



10. CAUTION: Use a length of steel strip that will not fall into the timing cover.

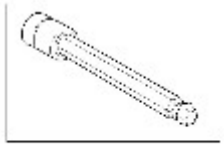
Protect the upper face of the timing cover from scratches, when



removing the bolt which secures the sprocket.

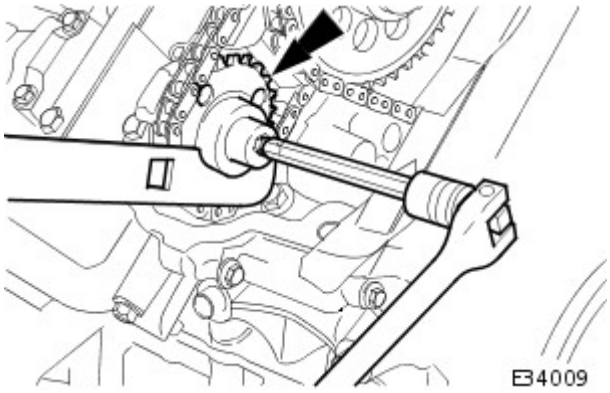
1. Place a flat piece of steel strip along the timing cover horizontal jointing face, adjacent to the exhaust camshaft sprocket.

2. Secure the steel strip in place with adhesive tape.



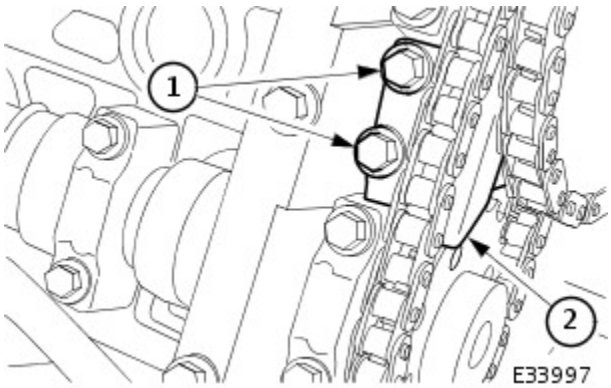
E34593

11. A ball-ended hexagon drive bit is required to remove the sprocket securing bolt. A suitable tool is available from Snap On as (FABLM10E) Long Series 10mm AF.



12. Remove the bolt which secures the sprocket to the exhaust camshaft.

- Move the sprocket forward from the camshaft boss.



13. Remove the secondary chain tensioner.

1. Remove the two bolts which secure the tensioner.

- Lift the tensioner, sprocket (release it fully from the camshaft) and chain assembly.

2. Remove the tensioner rearward from between the chain.

14. Remove the sprocket if required, or leave it in the chain resting on the cylinder head.

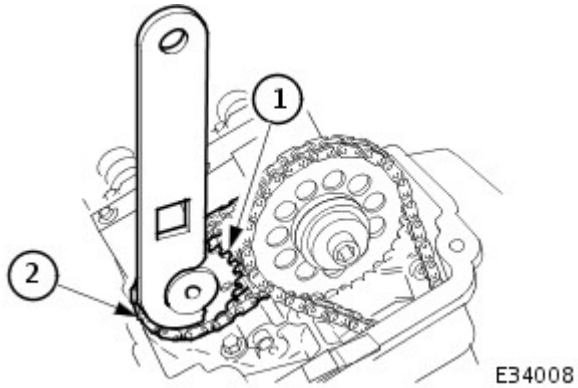
15. Clean and inspect all relevant components.

Installation

1. Install the sprocket to the secondary chain.

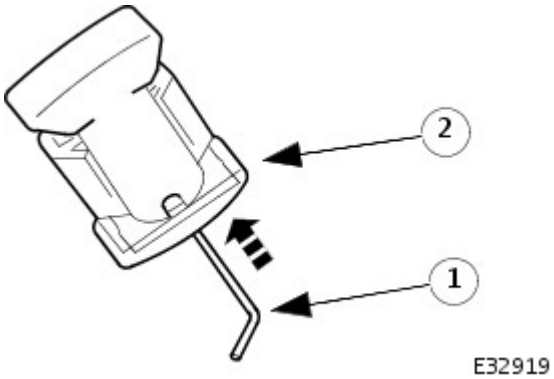
1. With the sprocket installed to the chain, temporarily position (do not install the securing bolt) the sprocket onto the camshaft.

2. Adjust the position of the sprocket within the chain to



allow the chain tensioning tool 303-532 to be approximately vertical, as shown.

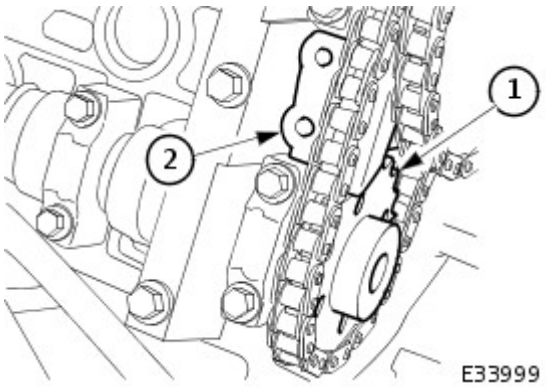
- Remove the chain tensioning tool; during future operations, do not move the sprocket within the chain.



2. Push the tensioner piston into the body to provide clearance for installing.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

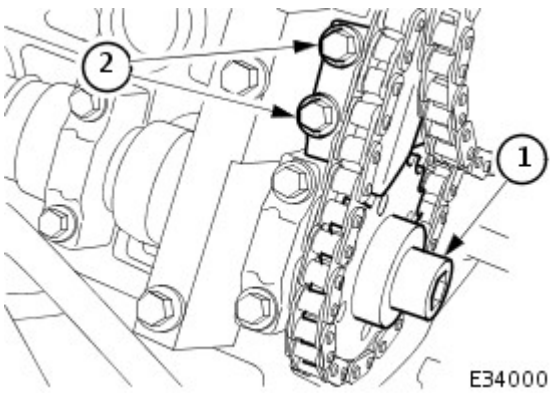
- Remove the wire.



3. Install the chain tensioner between the chain path.

1. Reposition the sprocket, still captive in the chain, upwards for access.
2. Install the chain tensioner between the sprockets.

- Position the cam sprocket, chain and tensioner assembly into position and locate the sprocket onto the camshaft spigot.

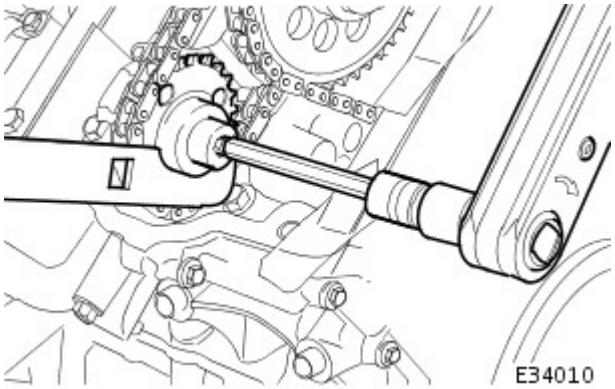


4. Install the chain tensioner to the engine.

1. Fully seat the sprocket onto the camshaft and install the securing bolt, hand tight.
2. install the two bolts which secure the tensioner and tighten to 10-14 Nm.

5. Install the camshaft sprocket.

- Install the chain tensioner tool 303-532 to the sprocket holes.
- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.



- Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115-125 Nm.
- Remove the chain tensioning tool.

6. Remove the tape and steel strip from the timing cover upper face. Wipe any residue of tape from the joint face.

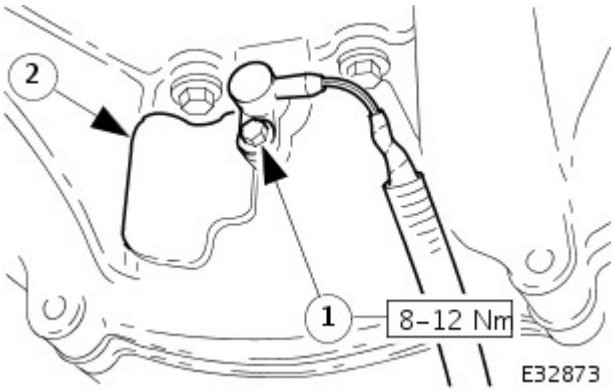
7. Remove the camshaft locking tool.

8. Install the Cam Cover to Bank 1. Refer to Operation 12.29.44.

9. Raise the vehicle on the ramp.

10. Remove the crankshaft setting tool 303-531.

11. Install the crankshaft position sensor.



1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

12. Lower the ramp.

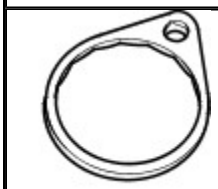
13. Remove the paint protection sheets and close the engine compartment cover.

14. Connect the battery and install the battery cover.

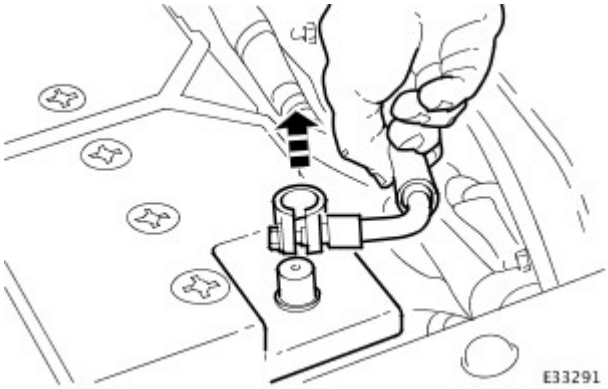
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Upper Oil Pan3.2L NA V8 - AJ26

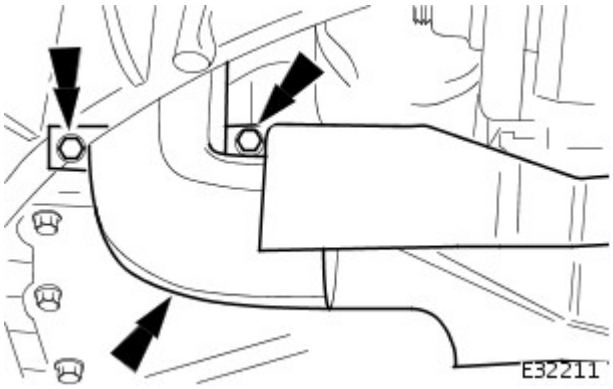
In-vehicle Repair

Special Tool(s)	
 303-752	Installer/remover, Oil Filter 303-752

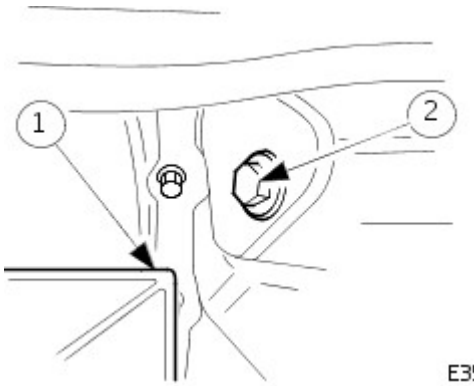
Removal



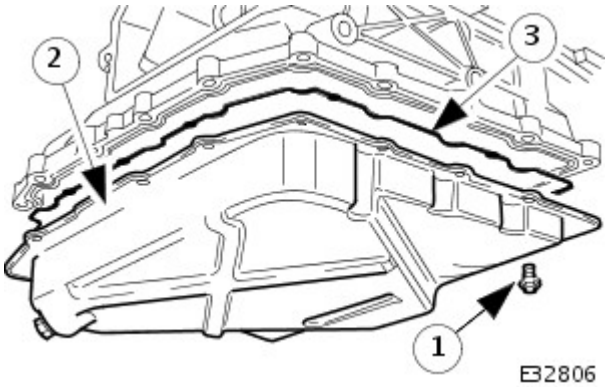
1. Disconnect the battery ground cable.
   - Remove the battery cover.
2. Open the engine compartment and fit paintwork protection sheets.
3. Set the engine compartment cover to the service access position.
4. Remove the timing cover and all associated components, as detailed in Operation 12.65.01.
5. Remove both front wheel and tyre assemblies. Refer to Operation 74.20.05.
6. Remove the undertray. Refer to Operation 76.22.90.



7. Remove the two bolts which secure the generator cooling duct to the oil pan body and remove the duct.
8. Remove the front cross member for access. Refer to Operation 76.10.05.
9. Drain the engine oil.
   1. Position the waste oil bowser.
   2. Remove the drain plug from the oil pan and drain the engine oil.
   - Fit a new sealing washer to the drain plug.

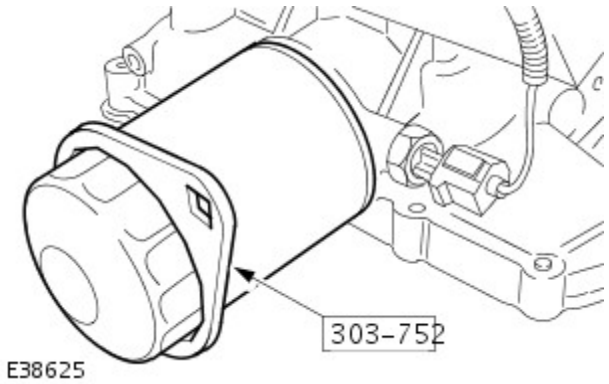


- Wipe the drain plug and install it to the oil pan to prevent oil dripping.
- Move the oil bowser away from the vehicle.



10. Remove the oil pan.

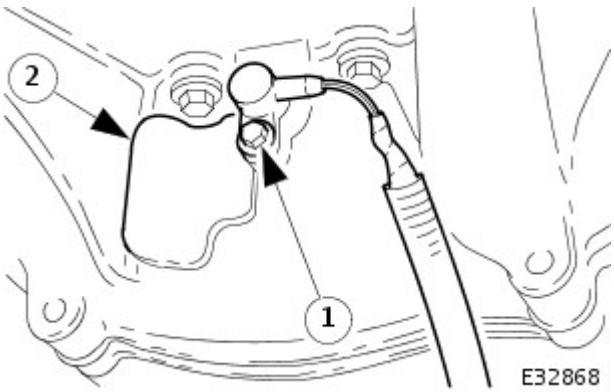
1. Remove the eighteen bolts which secure the oil pan to the oil pan body.
2. Remove the oil pan.
3. Remove the gasket from the oil pan body assembly.



11. NOTE: Place a suitable container underneath filter to prevent oil spillage.

Using the special tool, remove the oil filter.

12. Remove the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.

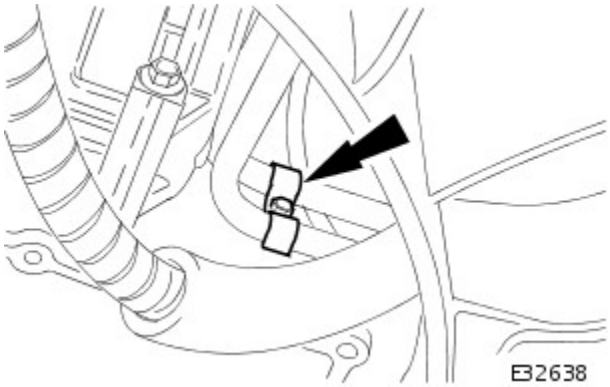


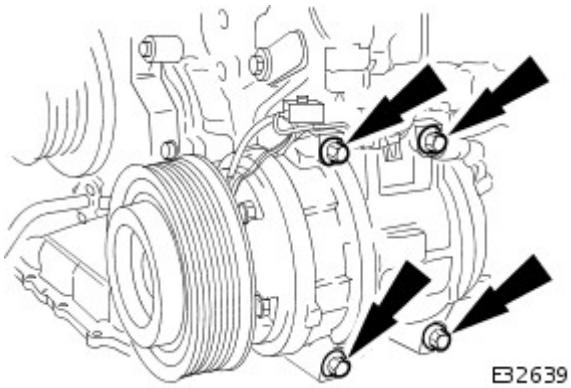
13. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
2. Remove the access grommet from the housing.

- Remove the sensor and allow it to hang free under the engine.
- Release the harness clips from the oil pan body.

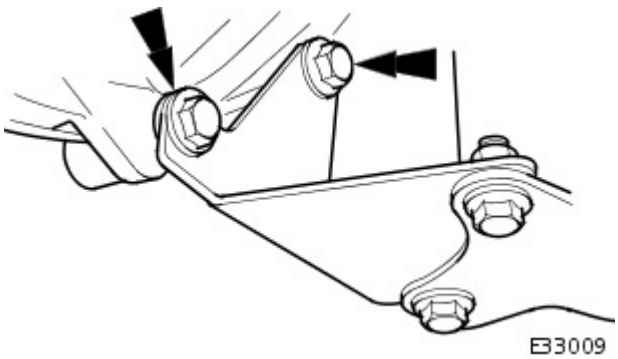
14. Remove the bolt which secures the transmission cooler pipes and remove the clamping bracket.



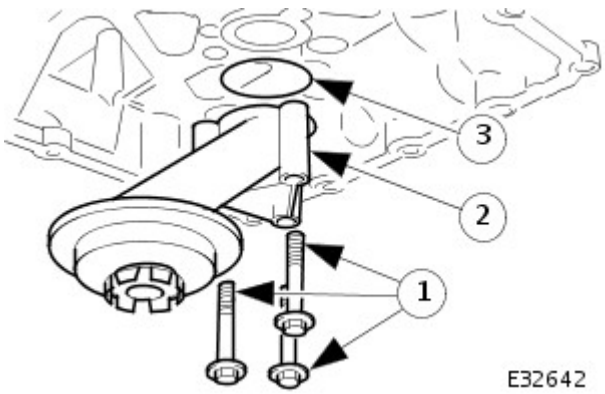


15. Release the air conditioning compressor.

- Remove the lower securing bolts.
- Loosen, but do not remove, the upper securing bolts.
- Release the compressor from the lower dowel.



16. Remove the four bolts (two each side) which secure the exhaust downpipes to the oil pan body.

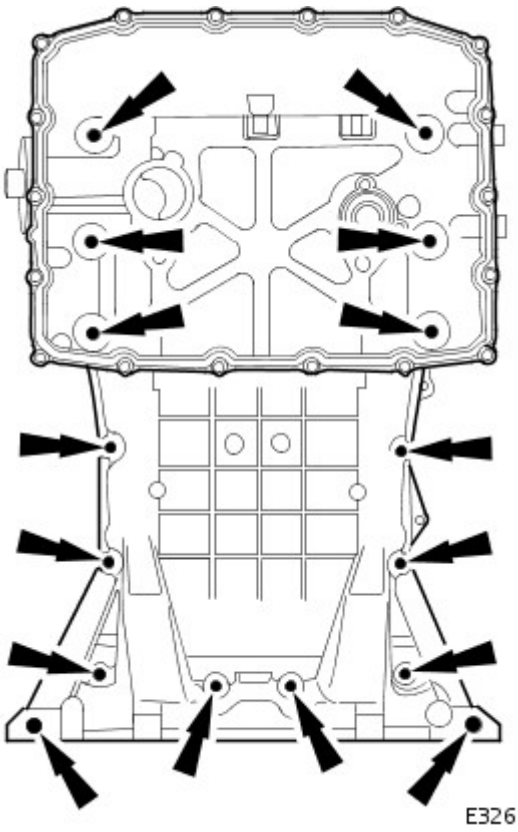


17. Remove the oil pick-up pipe.

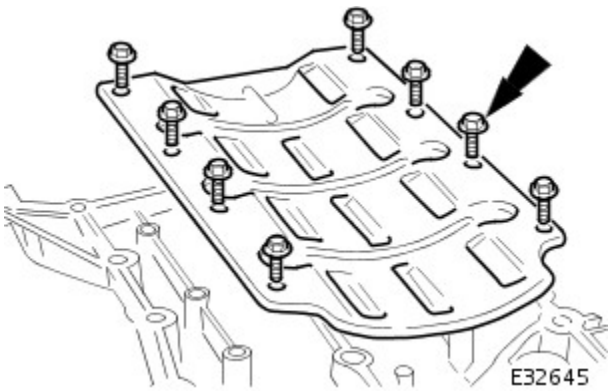
1. Remove the bolts which secure the pipe.
2. Remove the pipe.
3. Remove and discard the seal.

18. Remove the bolts, ten outer and six inner, which secure the oil pan body.

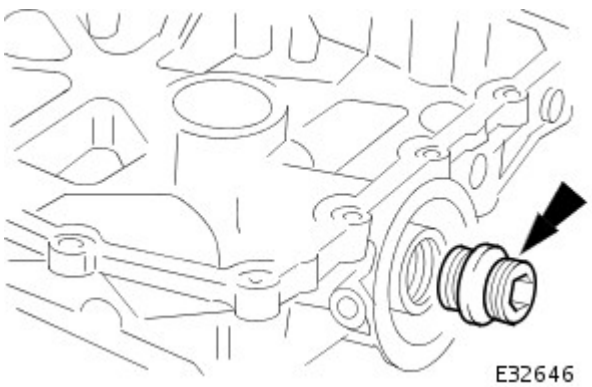
- Remove the oil pan body.



19. Remove the eight screws and release the windage tray.



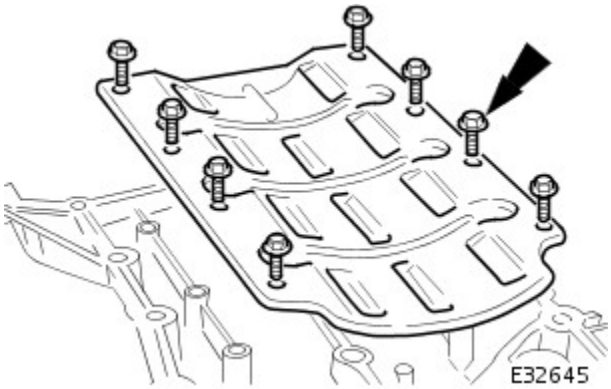
20. Remove the oil filter adaptor.



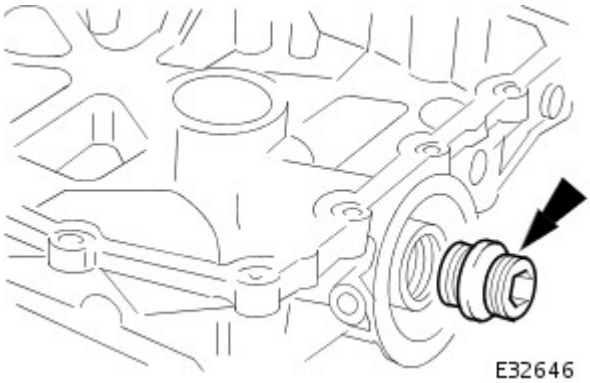
21. Clean all components and relevant mating faces; cylinder block, oil pan, oil pan body, windage tray, oil pick-up pipe and timing cover.

Installation

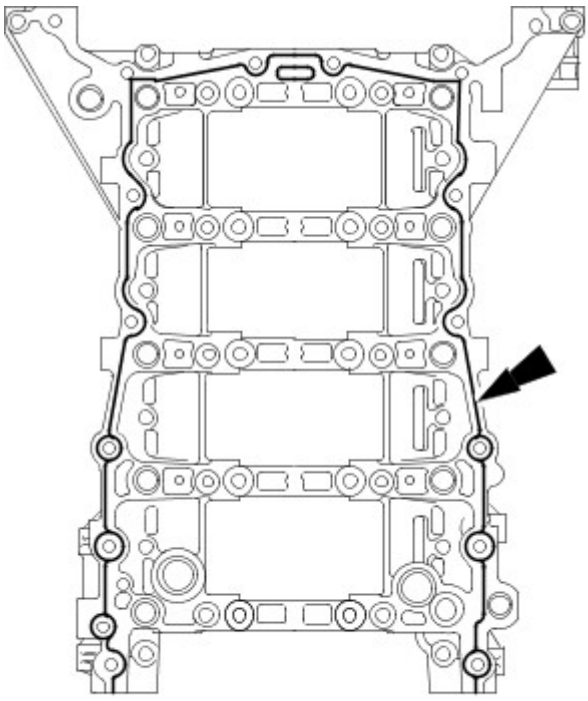
1. Reposition the windage tray and install the eight screws,



tighten to 5-7 Nm.



2. Install the oil filter adaptor and tighten to 26-34 Nm.

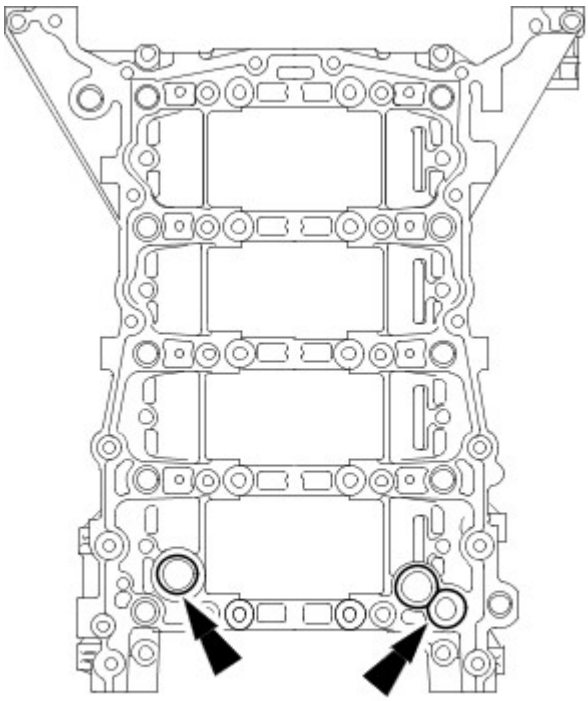


3. Apply a continuous bead of RTV sealant (Loctite 5699) 3 mm diameter, around the bed plate flange OR around the oil pan body flange; as indicated.

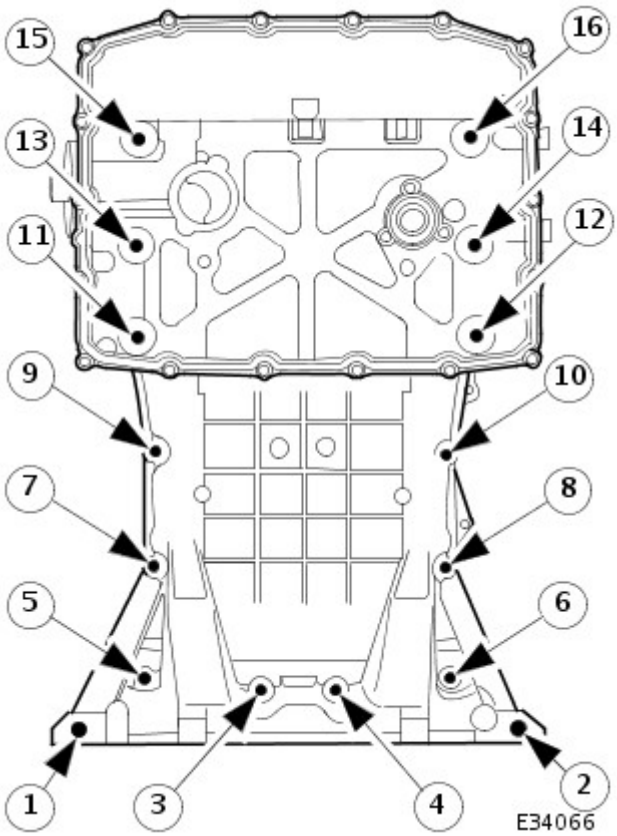
- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.

4. Apply a continuous bead of RTV sealant (Loctite 5699) 2 mm diameter, around the oil pick-up pipe flange; as indicated.

- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.



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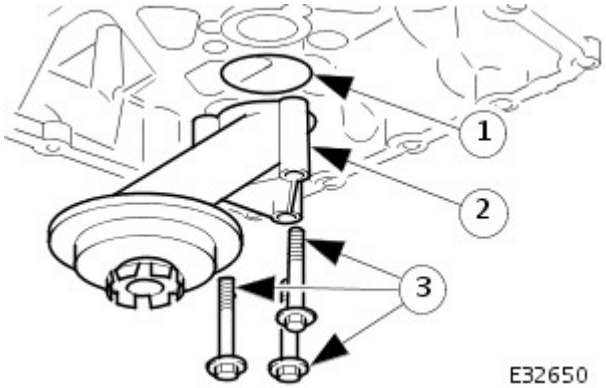


5. Position and align the oil pan body to the bedplate.

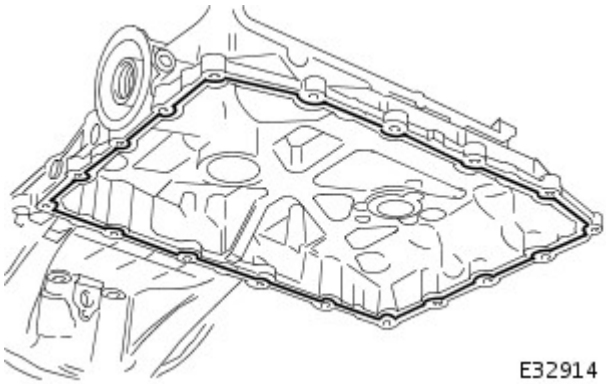
- Install the sixteen bolts and tighten to 20-22 Nm in the sequence indicated.

6. Install the oil pick-up pipe.

1. Install a new O-ring seal to the pick-up pipe.
2. Lubricate the O-ring seal with clean engine oil and install the pipe to the oil pan body.

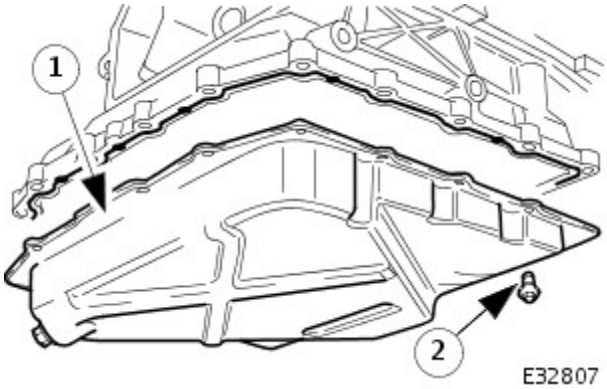


3. Install and tighten the bolts to 11-13 Nm.



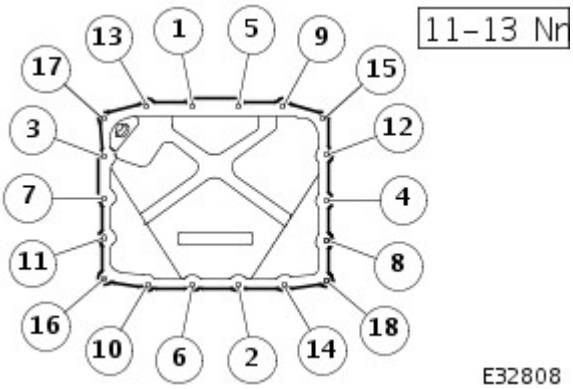
7. Install the oil pan gasket to the oil pan body assembly.

- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.



8. Install the oil pan to the oil pan body.

1. Position and align the oil pan.
2. Install, but do not tighten, all eighteen bolts which secure the oil pan.



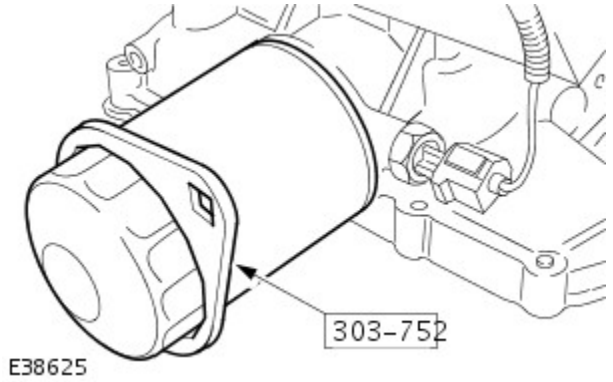
9. Tighten the bolts to the correct torque figure 11-13 Nm, in the sequence indicated.

- Tighten the drain plug to 30-40 Nm.

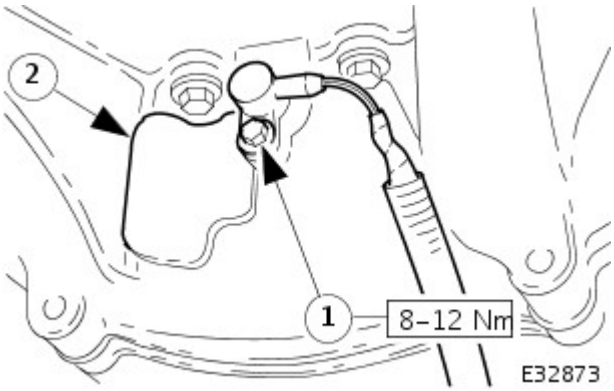
10. Install the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.

11. NOTE: Apply a suitable amount of clean engine oil to lubricate the oil filter O-ring seal.

Using the special tool, install the oil filter.

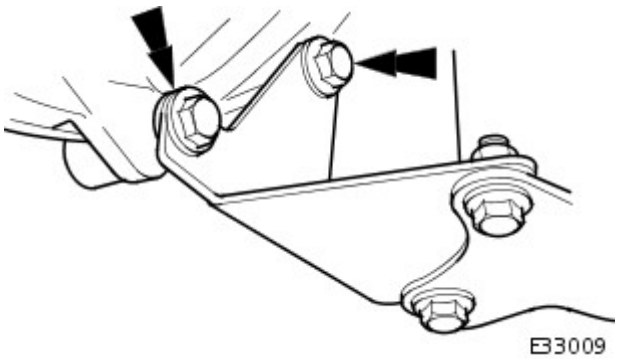


- Tighten the oil filter to 15-18 Nm.

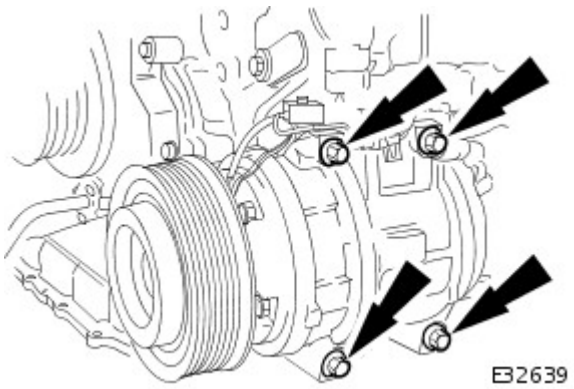


12. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.



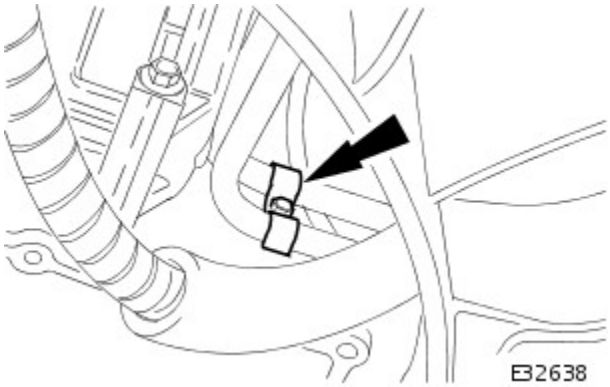
13. Install the four bolts (two each side) which secure the exhaust downpipes to the oil pan body.

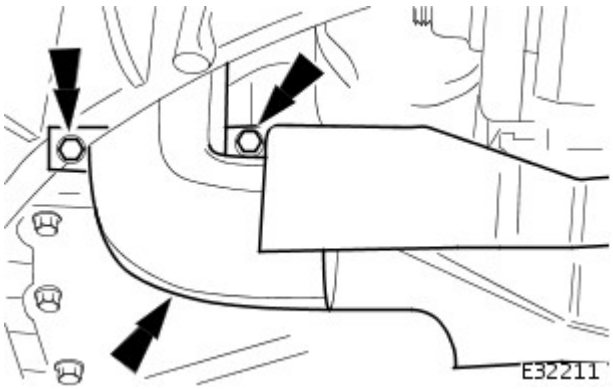


14. Install the air conditioning compressor.

- Locate the compressor onto the lower dowel.
- Tighten the upper securing bolts.
- Install and tighten the lower securing bolts to 18-24 Nm.
- Tighten the upper securing bolts to 18-24 Nm.

15. Position the transmission cooler pipes and the clamping bracket. Install the bolt to secure the clamp and tighten to 7-9 Nm.





16. Install the front crossmember. Refer to Operation 76.10.05.

17. Position the generator cooling duct to the oil pan body and install the two bolts.

18. Install the undertray. Refer to Operation 76.22.90.

19. Install both front wheel and tyre assemblies. Refer to Operation 74.20.05.

20. Install the timing cover and all associated components, as detailed in Operation 12.65.01.

21. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

Refill the engine with the correct specification engine oil.

22. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

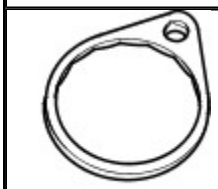
23. Check the oil level and start the engine. Check for leaks and that the engine runs correctly.

24. Reposition the engine compartment cover and connect the gas struts.

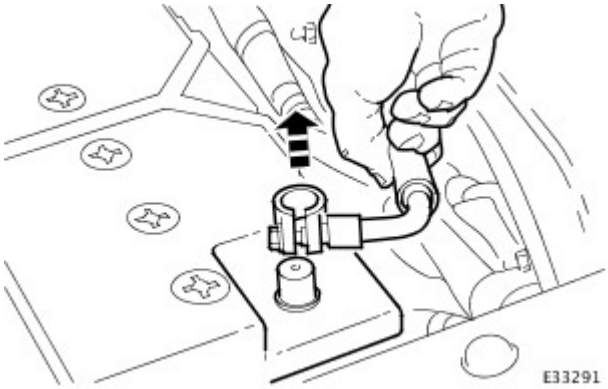
25. Remove the paintwork protection sheets and close the engine compartment cover.

Engine - Upper Oil Pan4.0L NA V8 - AJ27, 4.0L

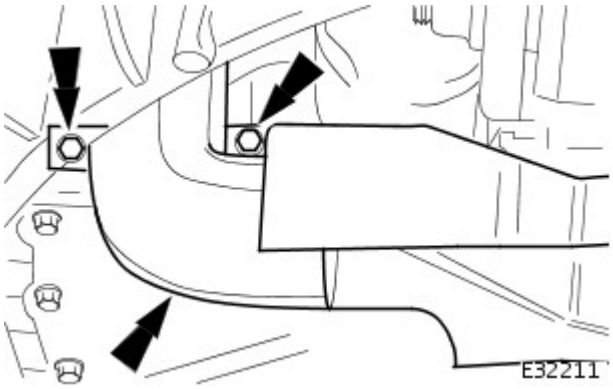
In-vehicle Repair

Special Tool(s)	
 303-752	Installer/remover, Oil Filter 303-752

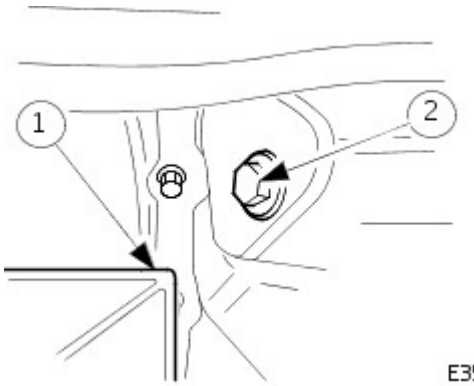
Removal



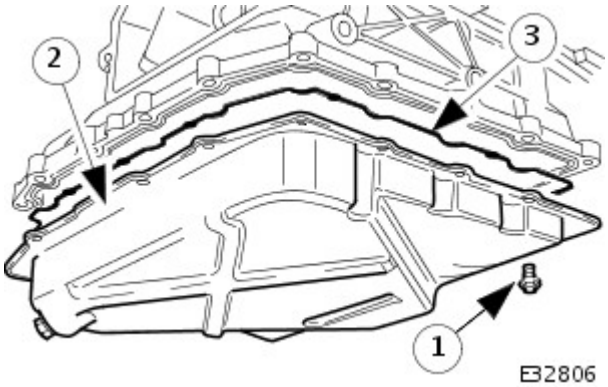
1. Disconnect the battery ground cable.
   - Remove the battery cover.
2. Open the engine compartment and fit paintwork protection sheets.
3. Set the engine compartment cover to the service access position.
4. Remove the timing cover and all associated components, as detailed in Operation 12.65.01.
5. Remove both front wheel and tyre assemblies. Refer to Operation 74.20.05.
6. Remove the undertray. Refer to Operation 76.22.90.



7. Remove the two bolts which secure the generator cooling duct to the oil pan body and remove the duct.
8. Remove the front cross member for access. Refer to Operation 76.10.05.
9. Drain the engine oil.
   1. Position the waste oil bowser.
   2. Remove the drain plug from the oil pan and drain the engine oil.
   - Fit a new sealing washer to the drain plug.

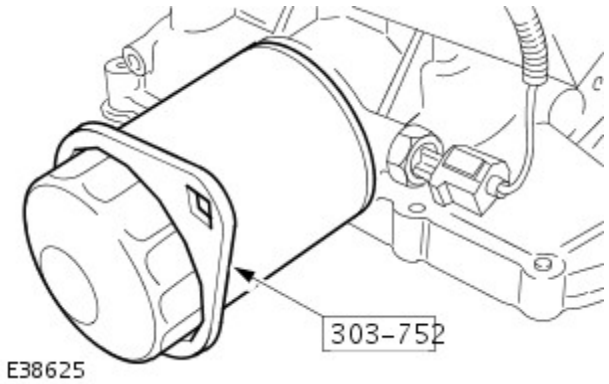


- Wipe the drain plug and install it to the oil pan to prevent oil dripping.
- Move the oil bowser away from the vehicle.



10. Remove the oil pan.

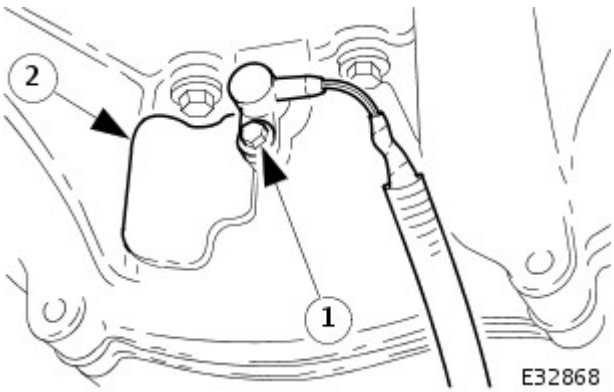
1. Remove the eighteen bolts which secure the oil pan to the oil pan body.
2. Remove the oil pan.
3. Remove the gasket from the oil pan body assembly.



11. NOTE: Place a suitable container underneath filter to prevent oil spillage.

Using the special tool, remove the oil filter.

12. Remove the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.

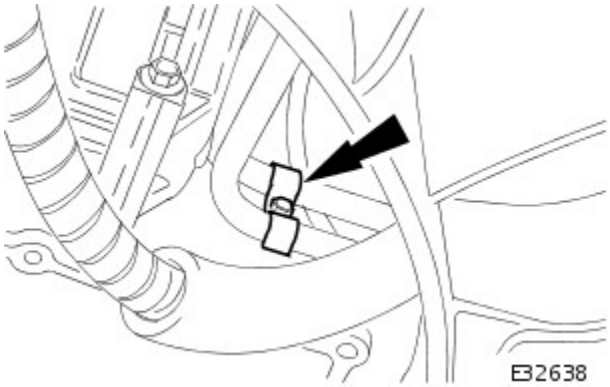


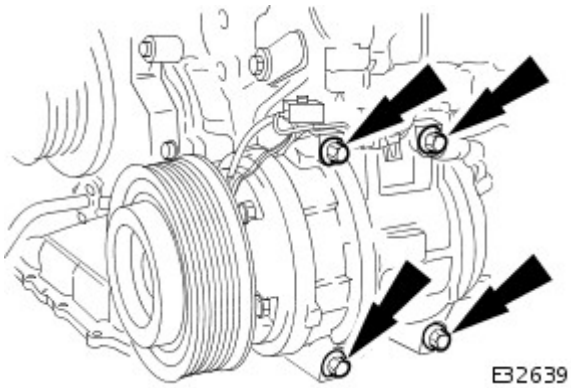
13. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
2. Remove the access grommet from the housing.

- Remove the sensor and allow it to hang free under the engine.
- Release the harness clips from the oil pan body.

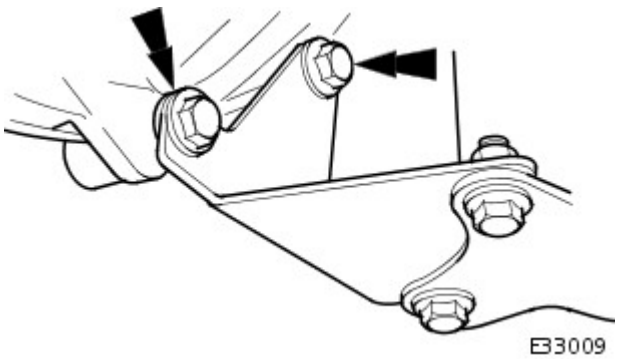
14. Remove the bolt which secures the transmission cooler pipes and remove the clamping bracket.



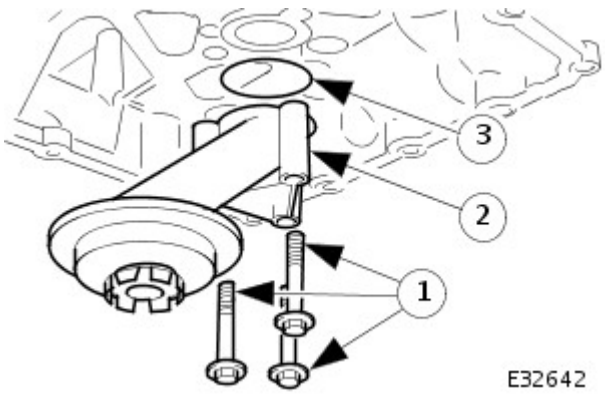


15. Release the air conditioning compressor.

- Remove the lower securing bolts.
- Loosen, but do not remove, the upper securing bolts.
- Release the compressor from the lower dowel.



16. Remove the four bolts (two each side) which secure the exhaust downpipes to the oil pan body.

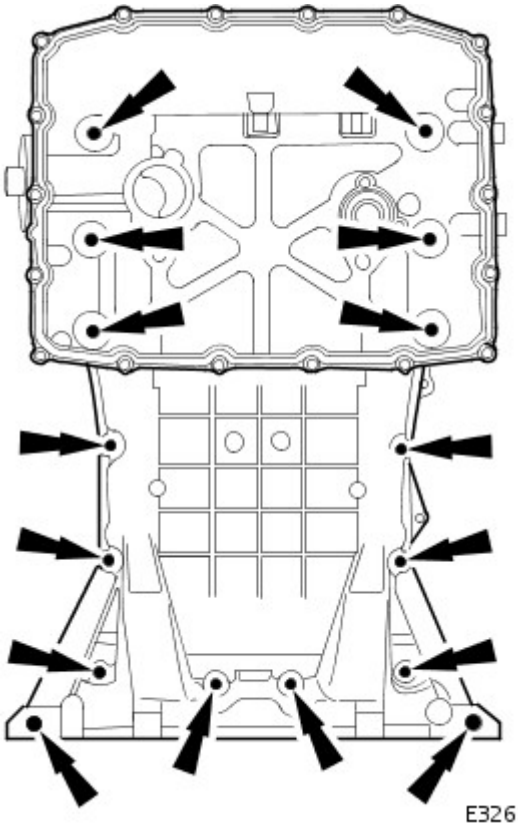


17. Remove the oil pick-up pipe.

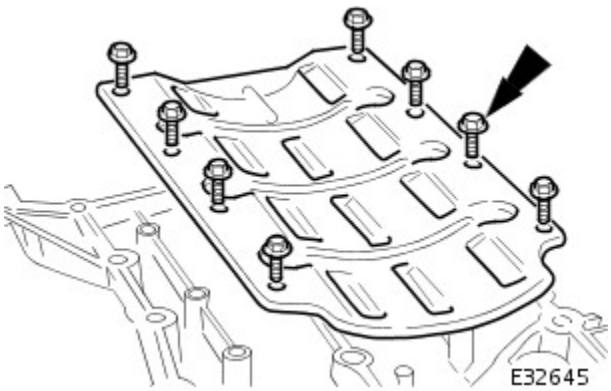
1. Remove the bolts which secure the pipe.
2. Remove the pipe.
3. Remove and discard the seal.

18. Remove the bolts, ten outer and six inner, which secure the oil pan body.

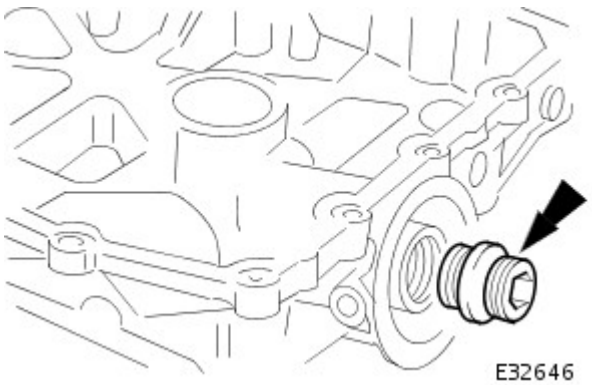
- Remove the oil pan body.



19. Remove the eight screws and release the windage tray.



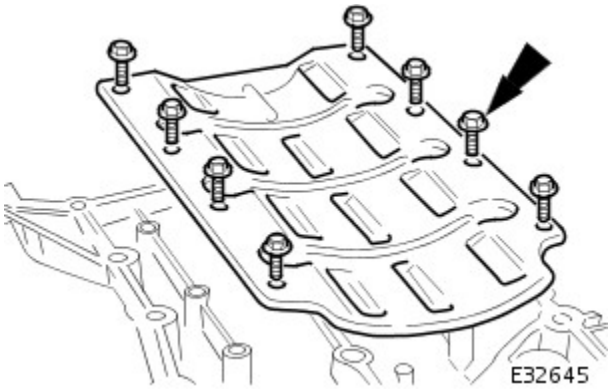
20. Remove the oil filter adaptor.



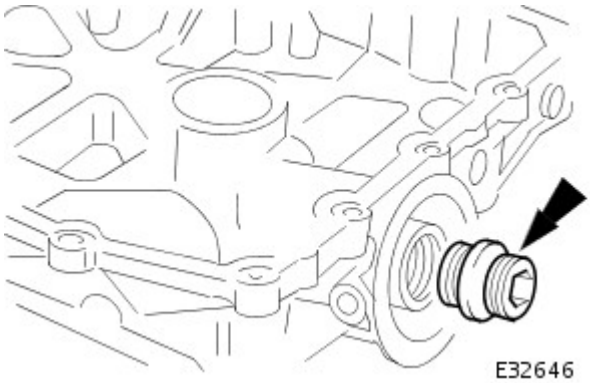
21. Clean all components and relevant mating faces; cylinder block, oil pan, oil pan body, windage tray, oil pick-up pipe, diverter valve and timing cover.

Installation

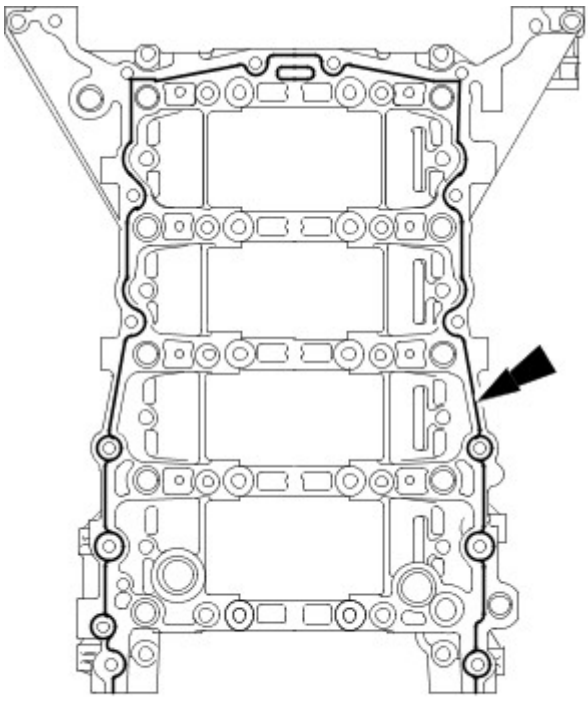
1. Reposition the windage tray and install the eight screws,



tighten to 5-7 Nm.



2. Install the oil filter adaptor and tighten to 26-34 Nm.

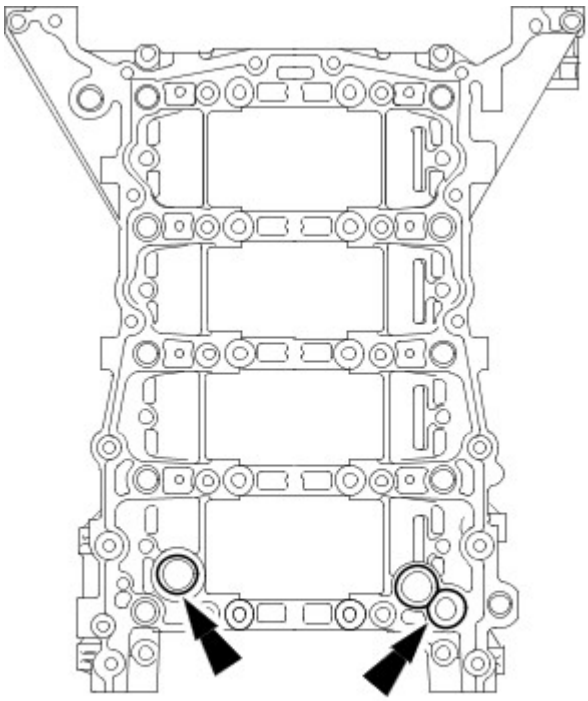


3. Apply a continuous bead of RTV sealant (Loctite 5699) 3 mm diameter, around the bed plate flange OR around the oil pan body flange; as indicated.

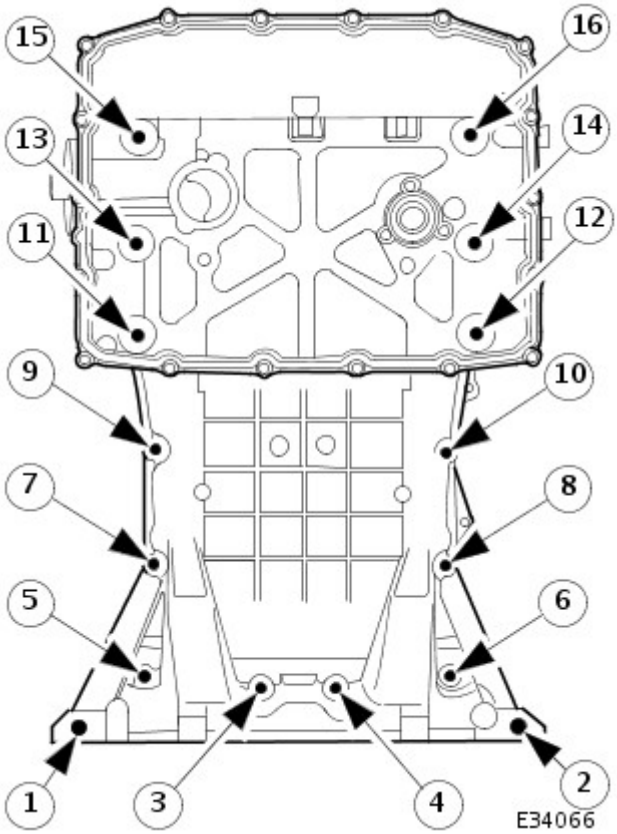
- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.

4. Apply a continuous bead of RTV sealant (Loctite 5699) 2 mm diameter, around the oil pick-up pipe and the diverter valve flanges; as indicated.

- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.



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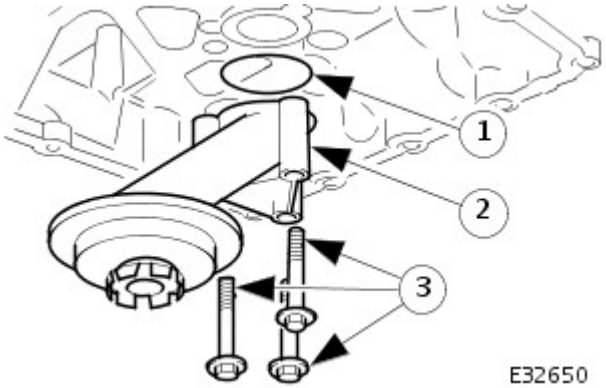


5. Position and align the oil pan body to the bedplate.

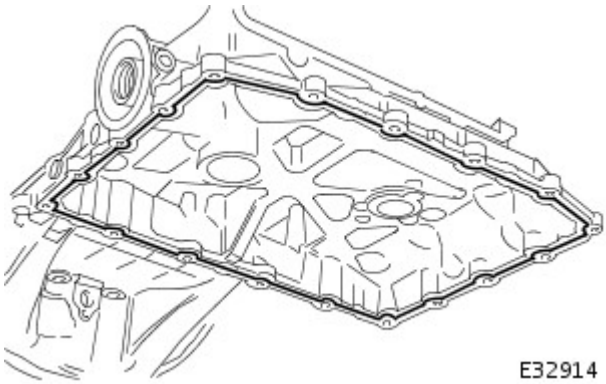
- Install the sixteen bolts and tighten to 20-22 Nm in the sequence indicated.
- Confirm that the transmission face of the sump body is level with the transmission face of the cylinder block; within the limits 0.1 mm proud to 0.2 mm below the level of the block face.

6. Install the oil pick-up pipe.

1. Install a new O-ring seal to the pick-up pipe.
2. Lubricate the O-ring seal with clean engine oil and install the pipe to the oil pan body.

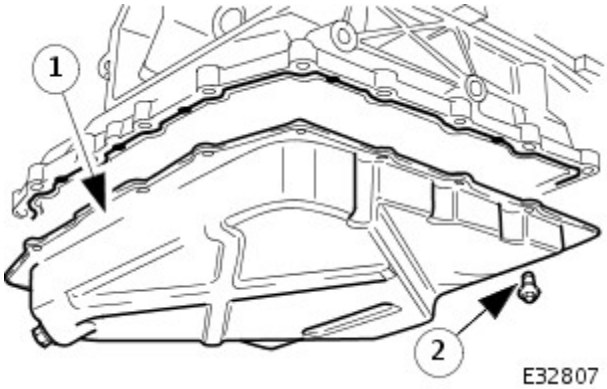


3. Install and tighten the bolts to 11-13 Nm.



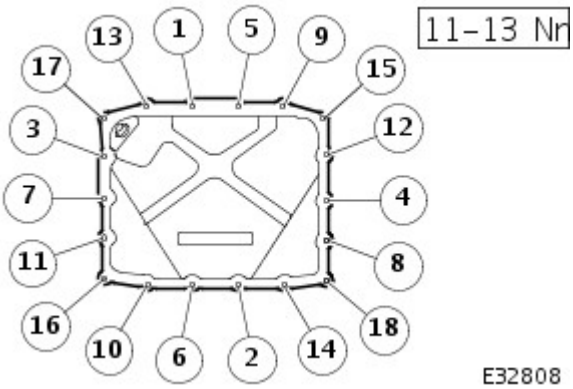
7. Install the oil pan gasket to the oil pan body assembly.

- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.



8. Install the oil pan to the oil pan body.

1. Position and align the oil pan.
2. Install, but do not tighten, all eighteen bolts which secure the oil pan.



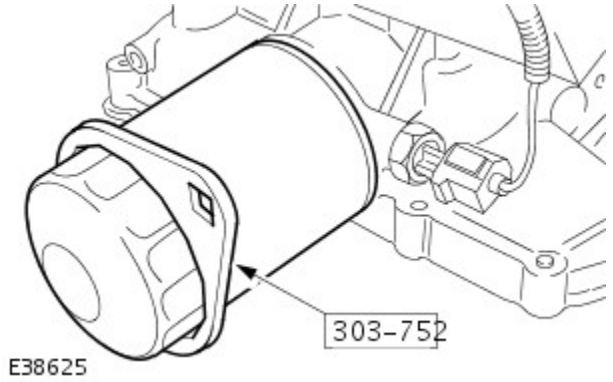
9. Tighten the bolts to the correct torque figure 11-13 Nm, in the sequence indicated.

- Tighten the drain plug to 30-40 Nm.

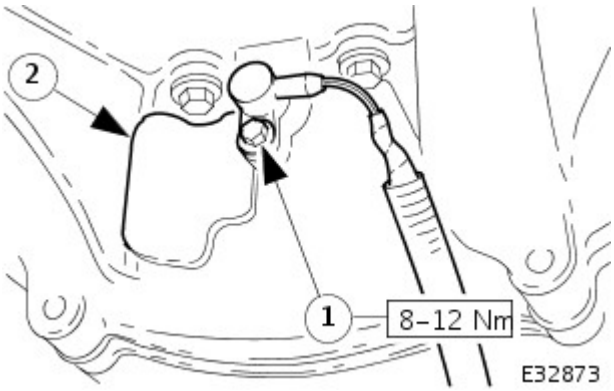
10. Install the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.

11. NOTE: Apply a suitable amount of clean engine oil to lubricate the oil filter O-ring seal.

Using the special tool, install the oil filter.



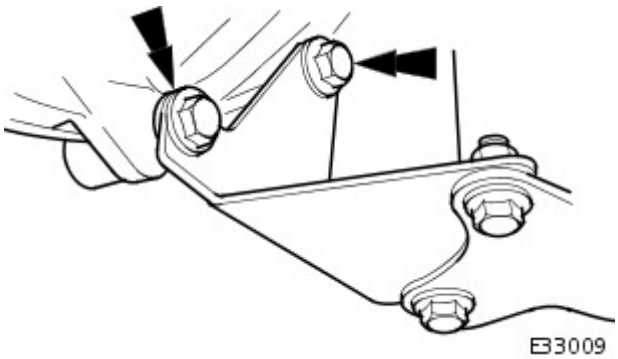
- Tighten the oil filter to 15-18 Nm.



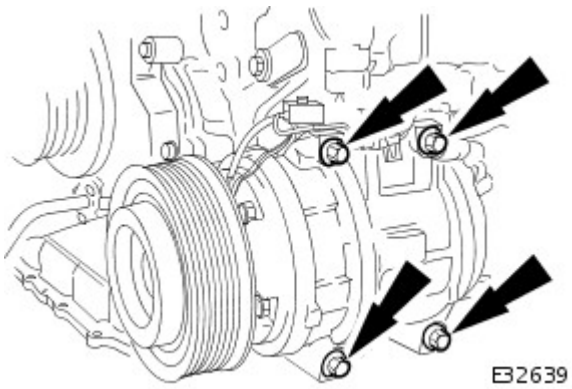
12. Install the crankshaft position sensor.

1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.

- Connect the harness clips to the oil pan body.



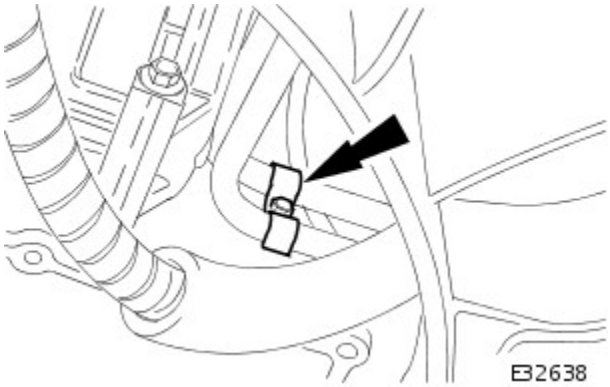
13. Install the four bolts (two each side) which secure the exhaust downpipes to the oil pan body and transmission casing.

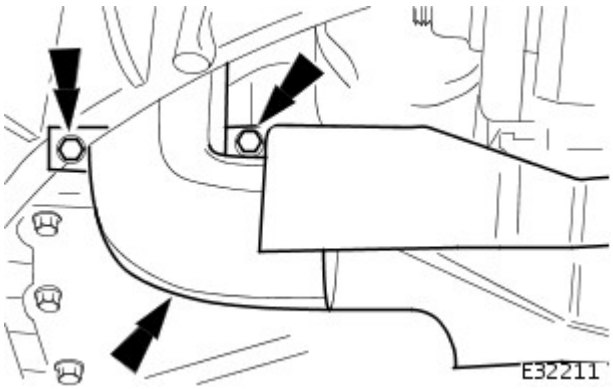


14. Install the air conditioning compressor.

- Locate the compressor onto the lower dowel.
- Tighten the upper securing bolts.
- Install and tighten the lower securing bolts to 18-24 Nm.
- Tighten the upper securing bolts to 18-24 Nm.

15. Position the transmission cooler pipes and the clamping bracket. Install the bolt to secure the clamp and tighten to 7-9 Nm.





16. Install the front crossmember. Refer to Operation 76.10.05.

17. Position the generator cooling duct to the oil pan body and install the two bolts.

18. Install the undertray. Refer to Operation 76.22.90.

19. Install both front wheel and tyre assemblies. Refer to Operation 74.20.05.

20. Install the timing cover and all associated components, as detailed in Operation 12.65.01.

21. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

Refill the engine with the correct specification engine oil.

22. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

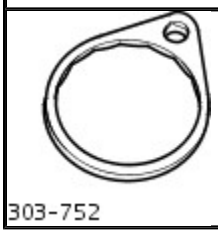
23. Check the oil level and start the engine. Check for leaks and that the engine runs correctly.

24. Reposition the engine compartment cover and connect the gas struts.

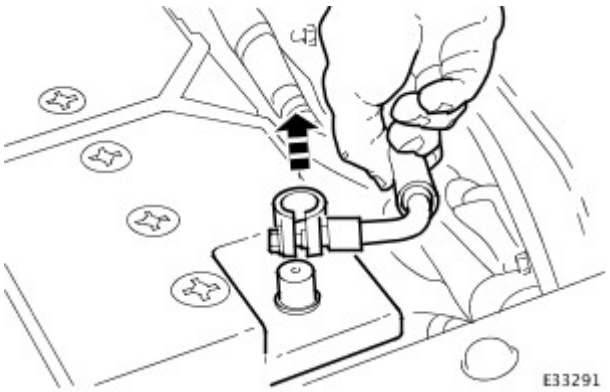
25. Remove the paintwork protection sheets and close the engine compartment cover.

Engine - Upper Oil Pan4.0L SC V8 - AJ26, 4.0L, Vehicles With: Supercharger

In-vehicle Repair

Special Tool(s)	
 303-752	Installer/remover, Oil Filter 303-752

Removal



1. Disconnect the battery ground cable.

- Remove the battery cover.

2. Open the engine compartment and fit paintwork protection sheets.

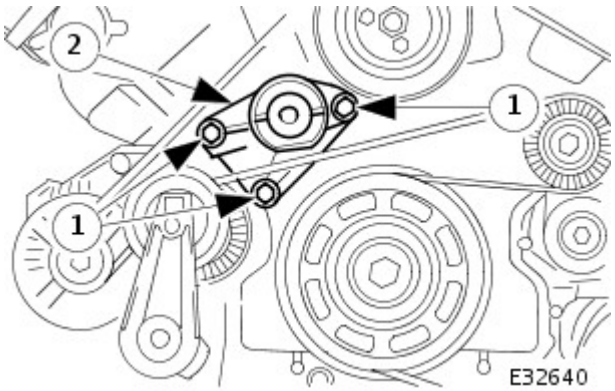
3. Remove the engine compartment cover. Refer to Operation 76.16.01.

4. Remove the twin fan and motor assembly. Refer to Operation 26.25.12.

5. Remove the coolant outlet pipe. Refer to Operation 26.31.08.

6. Remove the supercharger drive belt. Refer to Operation 18.50.08.

7. Remove the supercharger drive belt idler pulley. Refer to Operation 18.50.09.



8. Remove the supercharger idler pulley mounting bracket.

1. Remove the three bolts which secure the mounting bracket.
2. Remove the mounting bracket.

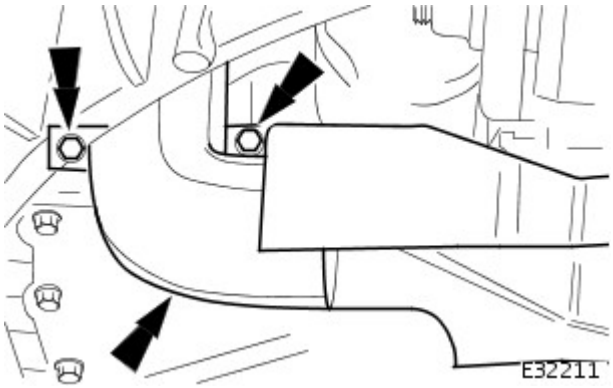
9. Remove the supercharger drive belt tensioner. Refer to Operation 18.50.24.

10. Remove the timing cover and all associated components, as detailed in Operation 12.65.01.

11. Remove both front wheel and tyre assemblies. Refer to Operation 74.20.05.

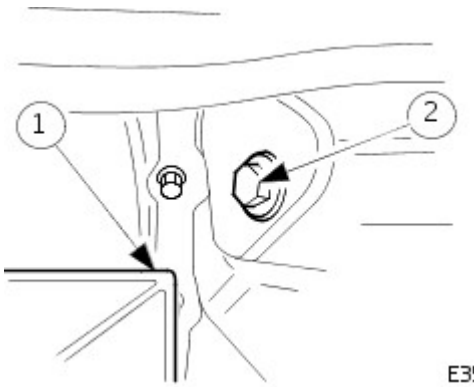
12. Remove the undertray. Refer to Operation 76.22.90.

13. Remove the two bolts which secure the generator cooling duct to the oil pan body and remove the duct.



14. Remove the front cross member for access. Refer to Operation 76.10.05.

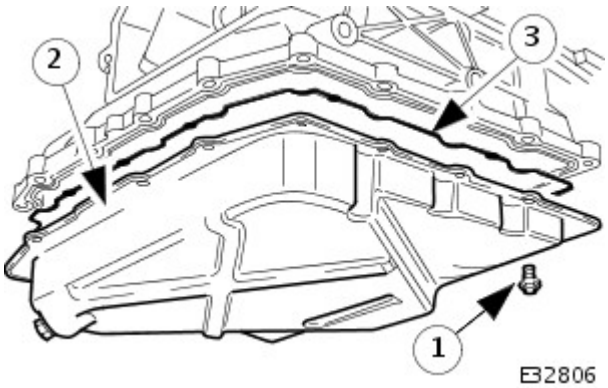
15. Drain the engine oil.



1. Position the waste oil bowser.
2. Remove the drain plug from the oil pan and drain the engine oil.

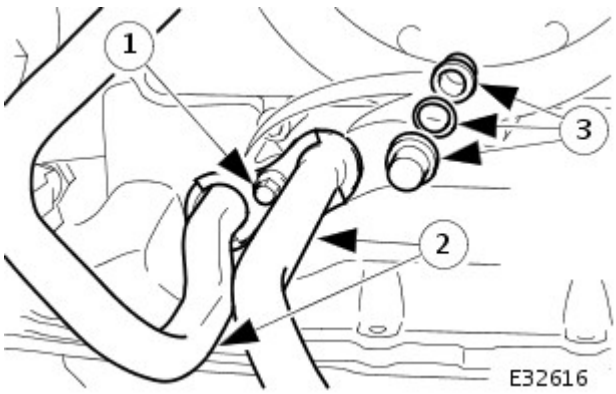
- Fit a new sealing washer to the drain plug.
- Wipe the drain plug and install it to the oil pan to prevent oil dripping.
- Move the oil bowser away from the vehicle.

16. Remove the oil pan.



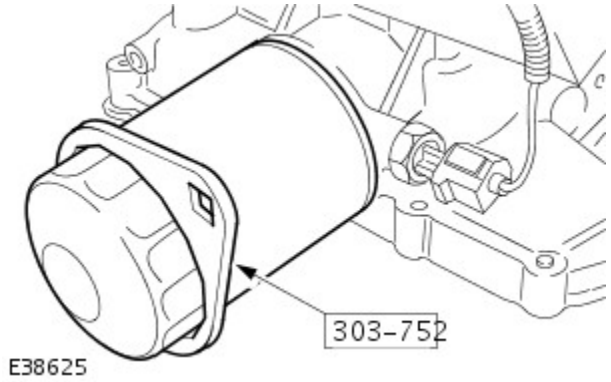
1. Remove the eighteen bolts which secure the oil pan to the oil pan body.
2. Remove the oil pan.
3. Remove the gasket from the oil pan body assembly.

17. Disconnect the oil cooler pipes.



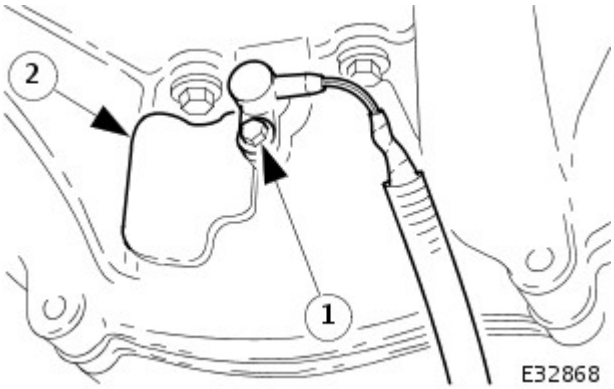
1. Remove the bolt which secures the oil cooler pipes.
2. Disconnect the oil cooler pipes from the oil pan body assembly.
3. Remove and discard the O-ring seals from the pipes and install blanking plugs to the pipes and unions.

18. NOTE: Place a suitable container underneath filter to prevent oil spillage.



Using the special tool, remove the oil filter.

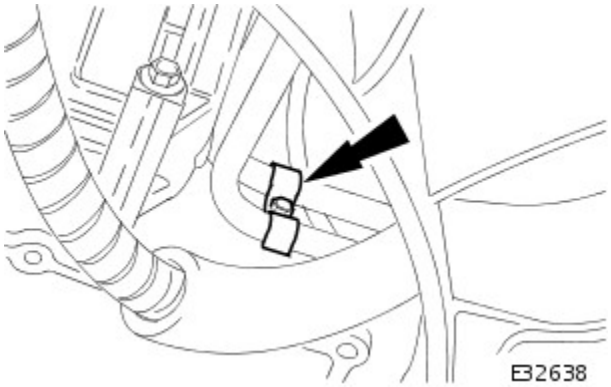
19. Remove the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.



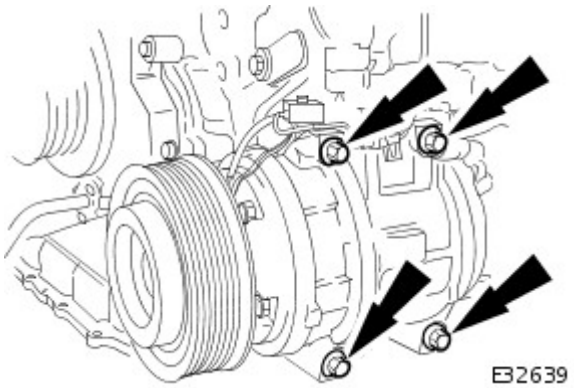
20. Remove the crankshaft position sensor.

1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.
2. Remove the access grommet from the housing.

- Remove the sensor and allow it to hang free under the engine.
- Release the harness clips from the oil pan body.



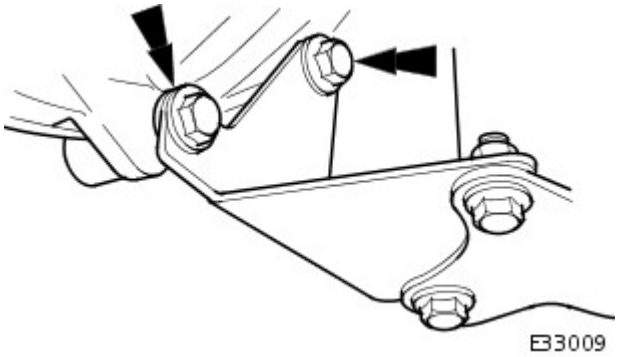
21. Remove the bolt which secures the transmission cooler pipes and remove the clamping bracket.

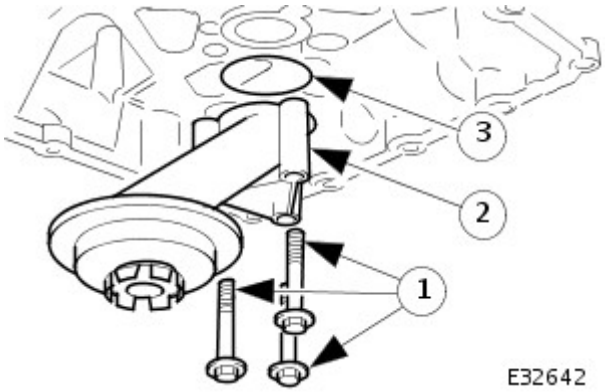


22. Release the air conditioning compressor.

- Remove the lower securing bolts.
- Loosen, but do not remove, the upper securing bolts.
- Release the compressor from the lower dowel.

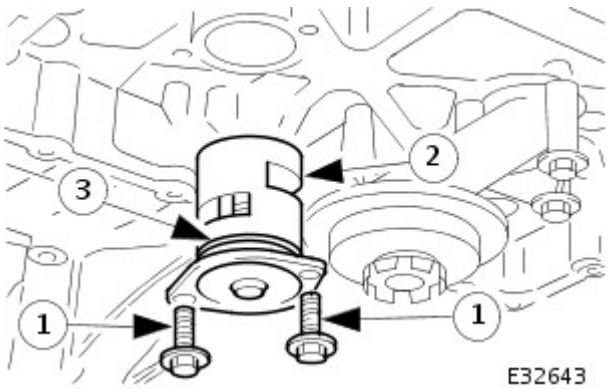
23. Remove the four bolts (two each side) which secure the exhaust downpipes to the oil pan body.





24. Remove the oil pick-up pipe.

1. Remove the bolts which secure the pipe.
2. Remove the pipe.
3. Remove and discard the seal.

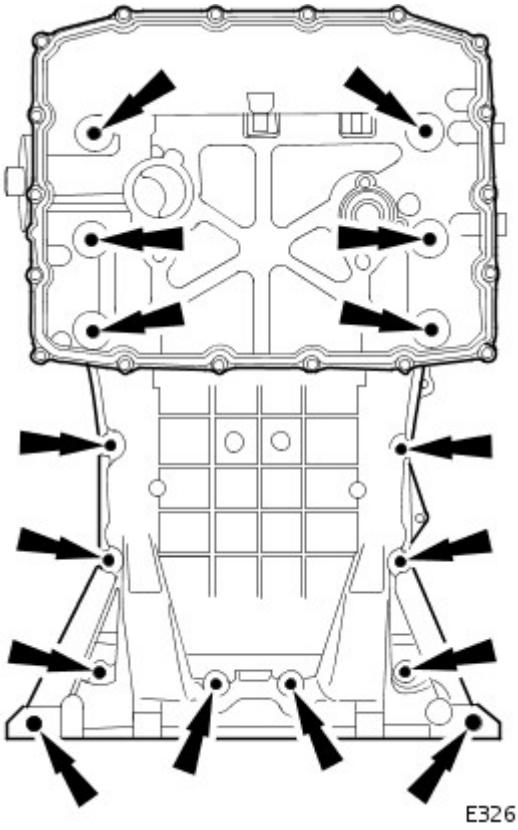


25. Remove the diverter valve.

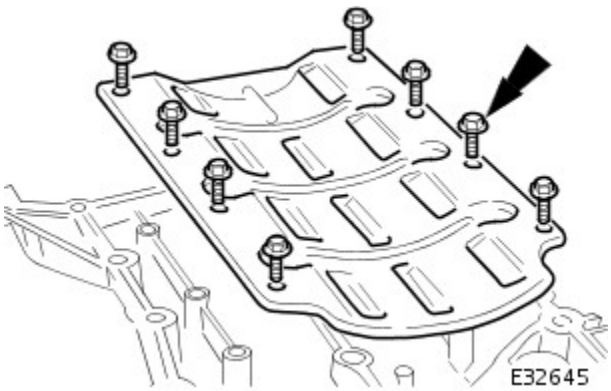
1. Remove the bolts which secure the valve.
2. Remove the valve.
3. Remove and discard the O-ring seal.

26. Remove the bolts, ten outer and six inner, which secure the oil pan body.

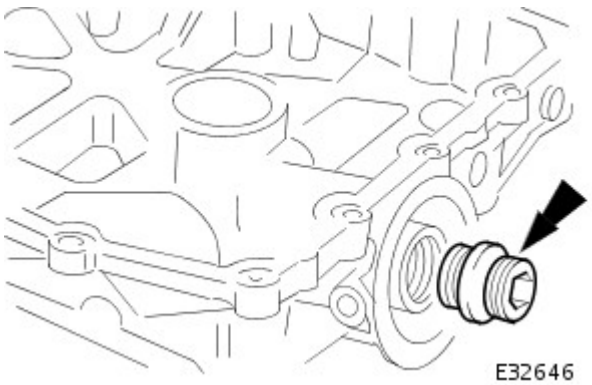
- Remove the oil pan body.



27. Remove the eight screws and release the windage tray.



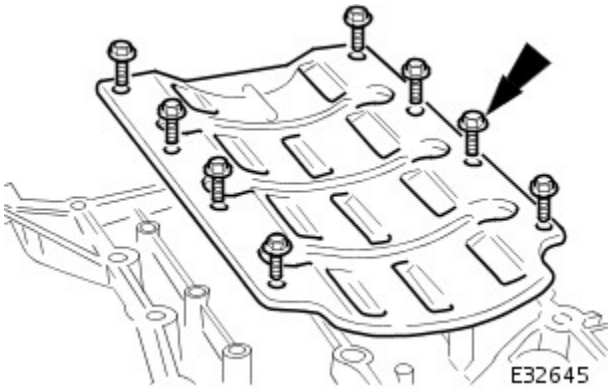
28. Remove the oil filter adaptor.



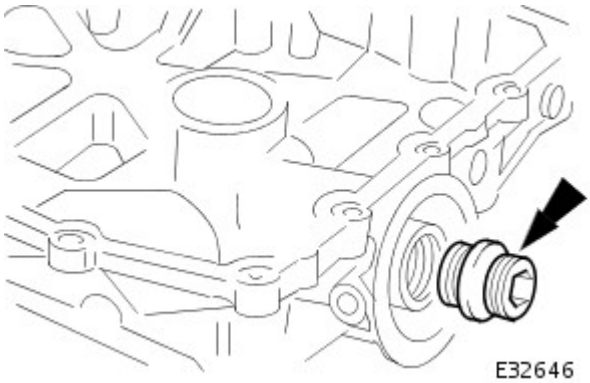
29. Clean all components and relevant mating faces; cylinder block, oil pan, oil pan body, windage tray, oil pick-up pipe, diverter valve and timing cover.

Installation

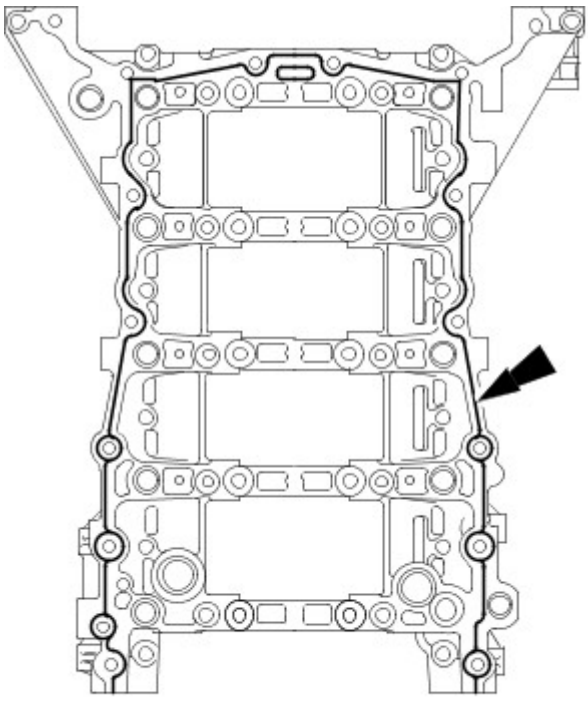
1. Reposition the windage tray and install the eight screws,



tighten to 5-7 Nm.



2. Install the oil filter adaptor and tighten to 26-34 Nm.

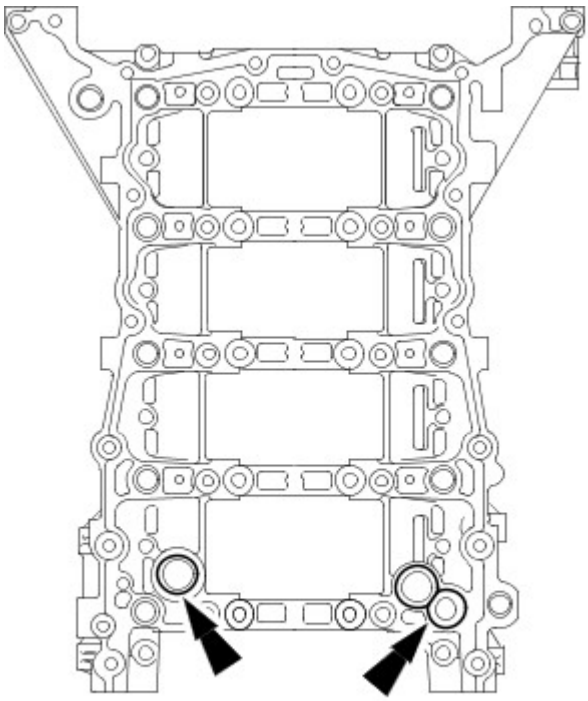


3. Apply a continuous bead of RTV sealant (Loctite 5699) 3 mm diameter, around the bed plate flange OR around the oil pan body flange; as indicated.

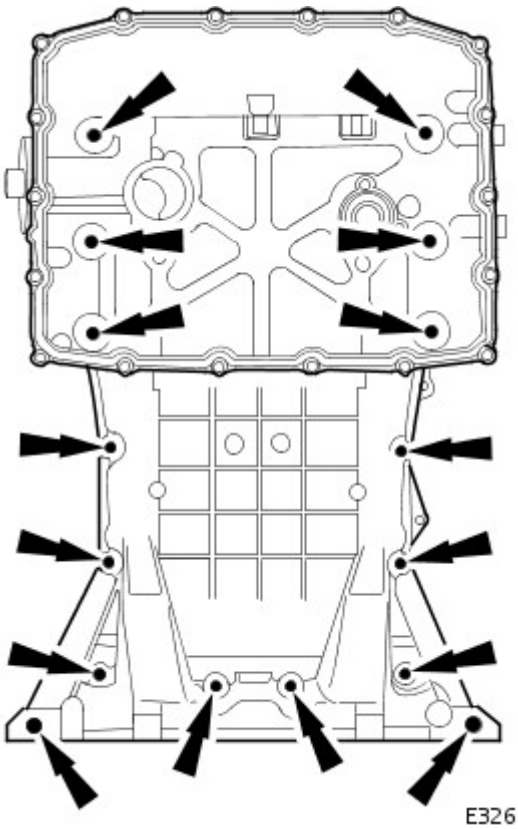
- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.

4. Apply a continuous bead of RTV sealant (Loctite 5699) 2 mm diameter, around the oil pick-up pipe and the diverter valve flanges; as indicated.

- It is important that the oil pan body is bolted to the bedplate within twenty minutes of applying the RTV sealant.



E32648



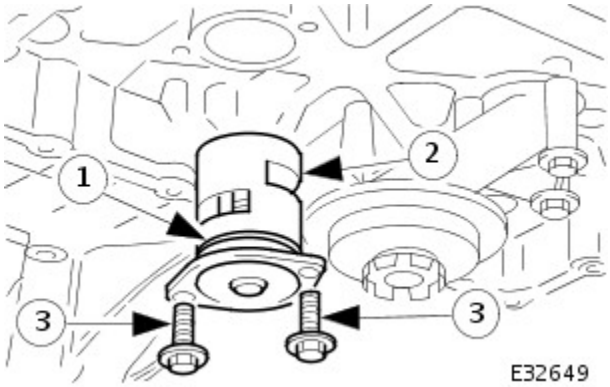
E32644

5. Position and align the oil pan body to the bedplate.

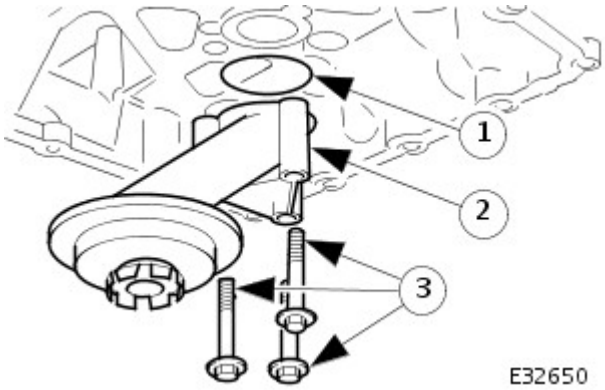
- Install the sixteen bolts and tighten to 20-22 Nm in the sequence indicated.

6. Install the oil diverter valve.

1. Install a new O-ring seal to the diverter valve.
2. Lubricate the O-ring seal with clean engine oil and install the valve into the oil pan body.

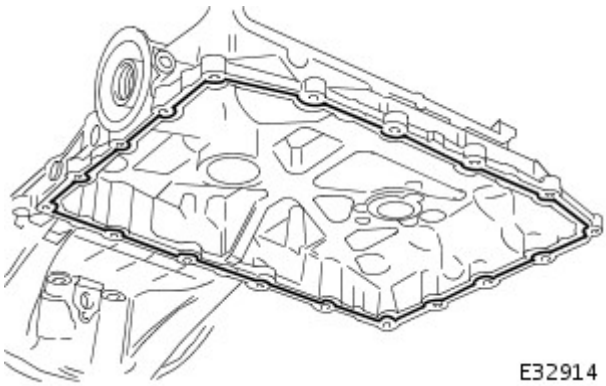


3. Install and tighten the bolts to 11-13 Nm.



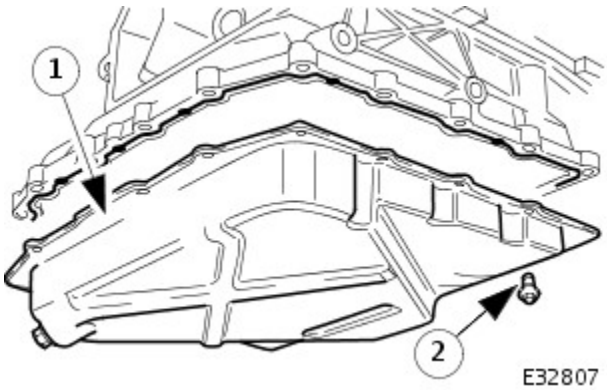
7. Install the oil pick-up pipe.

1. Install a new O-ring seal to the pick-up pipe.
2. Lubricate the O-ring seal with clean engine oil and install the pipe to the oil pan body.
3. Install and tighten the bolts to 11-13 Nm.



8. Install the oil pan gasket to the oil pan body assembly.

- Insert the seal into the locating positions in the groove, working around from a corner.
- Press in the remainder of the seal, following the same procedure.

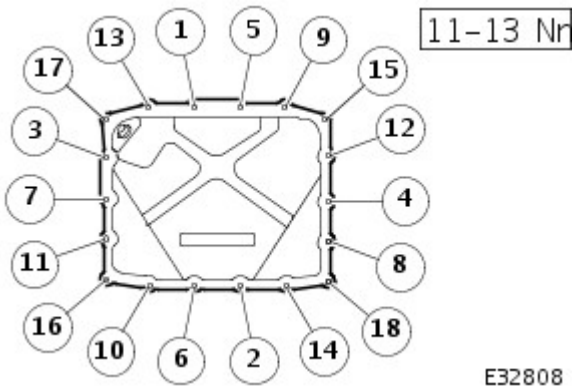


9. Install the oil pan to the oil pan body.

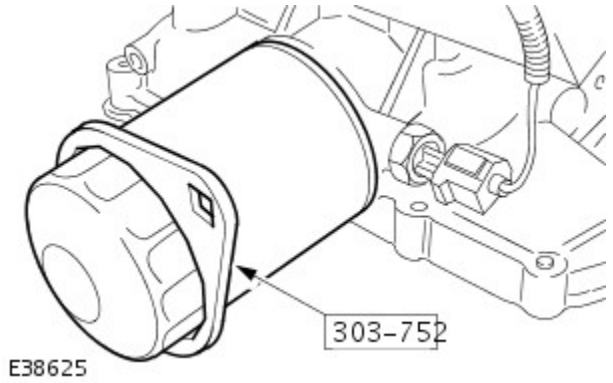
1. Position and align the oil pan.
2. Install, but do not tighten, all eighteen bolts which secure the oil pan.

10. Tighten the bolts to the correct torque figure 11-13 Nm, in the sequence indicated.

- Tighten the drain plug to 30-40 Nm.



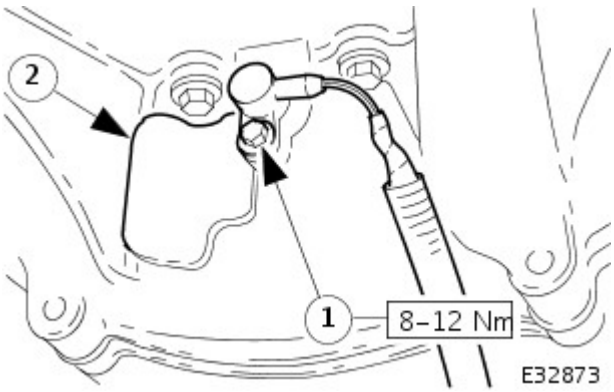
11. Install the oil pressure switch.
For additional information, refer to Oil Pressure Switch - in this section.



12. NOTE: Apply a suitable amount of clean engine oil to lubricate the oil filter O-ring seal.

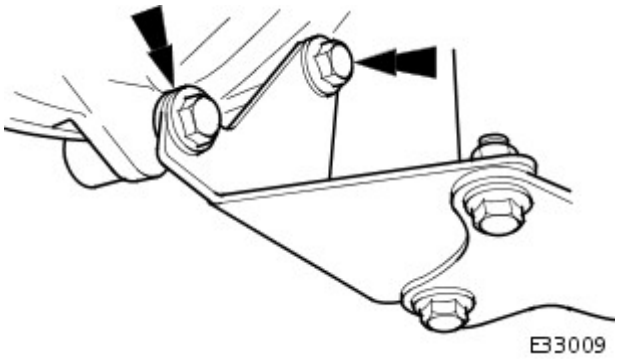
Using the special tool, install the oil filter.

- Tighten the oil filter to 15-18 Nm.



13. Install the crankshaft position sensor.

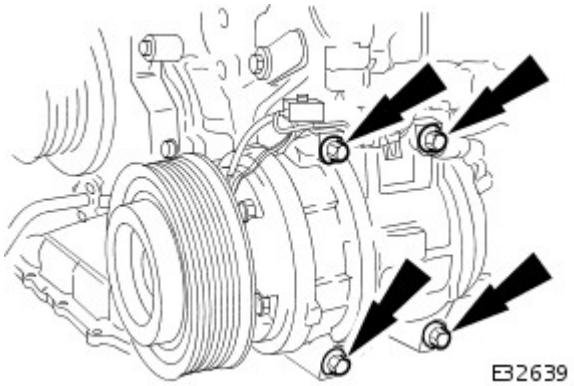
1. Install the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.
2. Install the access grommet to the housing.



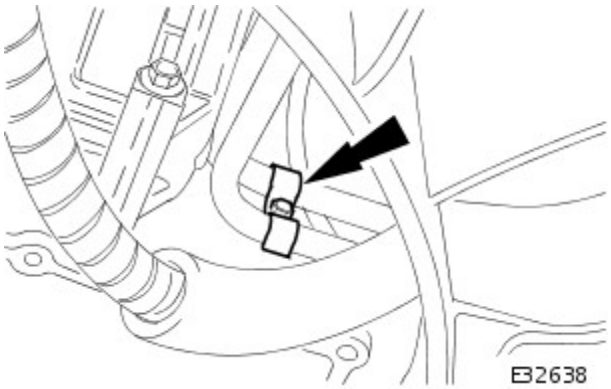
14. Install the four bolts (two each side) which secure the exhaust downpipes to the oil pan body.

15. Install the air conditioning compressor.

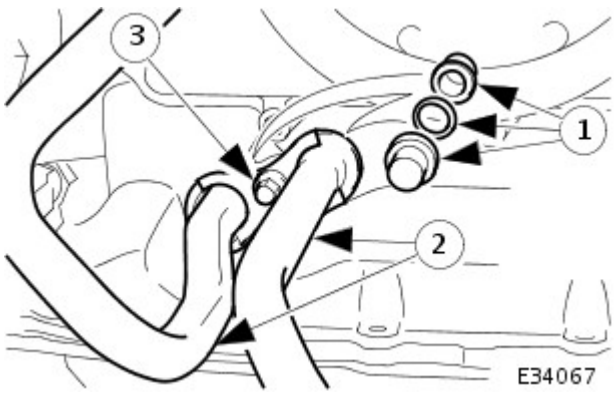
- Locate the compressor onto the lower dowel.
- Tighten the upper securing bolts.



- Install and tighten the lower securing bolts to 18-24 Nm.
- Tighten the upper securing bolts to 18-24 Nm.



16. Position the transmission cooler pipes and the clamping bracket. Install the bolt to secure the clamp and tighten to 7-9 Nm.

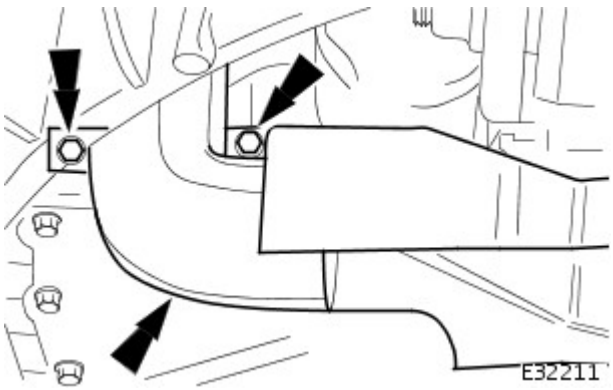


17. Connect the oil cooler pipes to the oil pan body assembly (vehicles with engine oil cooler).

1. Remove the blanking plugs and install new O-ring seals.
2. Connect the oil cooler pipes.
3. Install the clamp and bolt which secures the oil cooler pipes. Tighten to 18-24 Nm.

18. Install the front crossmember. Refer to Operation 76.10.05.

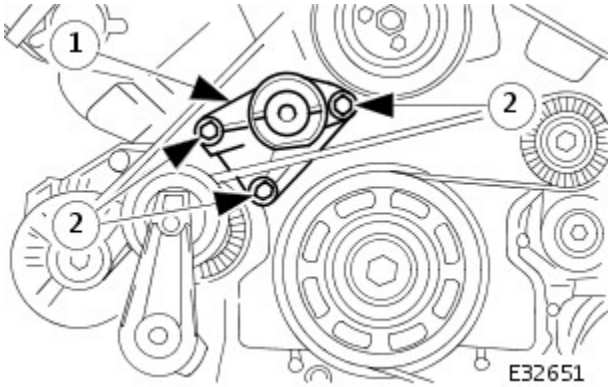
19. Position the generator cooling duct to the oil pan body and install the two bolts.



20. Install the undertray. Refer to Operation 76.22.90.

21. Install both front wheel and tyre assemblies. Refer to Operation 74.20.05.

22. Install the timing cover and all associated components, as detailed in Operation 12.65.01. Do not refill the cooling system at this stage.



23. Install the supercharger drive belt tensioner. Refer to Operation 18.50.24.

24. Install the supercharger idler pulley mounting bracket.

1. Position the mounting bracket to the timing cover.
2. Install the three bolts which secure the mounting bracket. Tighten to 8-10 Nm.

25. Install the supercharger drive belt idler pulley. Refer to Operation 18.50.09. (34-46 Nm).

26. Install the supercharger drive belt. Refer to Operation 18.50.08.

27. Install the coolant outlet pipe. Refer to Operation 26.31.08.

28. Install the twin fan and motor assembly. Refer to Operation 26.25.12.

29. Refill the cooling system. Refer to Operation 26.10.01 in General Procedures section of the cooling system.

30. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875 L is hung up.

Refill the engine with the correct specification engine oil.

31. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

32. Check the oil level and start the engine. Check for leaks and that the engine runs correctly.

33. Install the engine compartment cover. Refer to Operation 76.16.01.

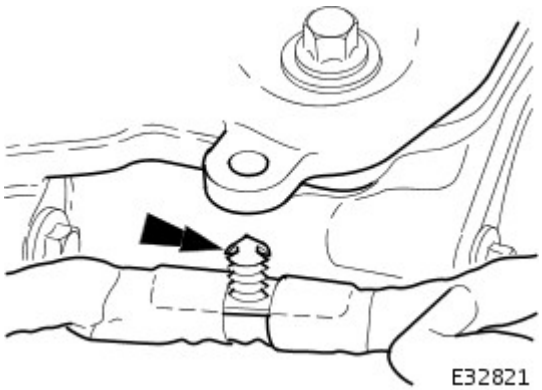
34. Remove the paintwork protection sheets and close the engine compartment cover.

Engine - Valve Cover LH

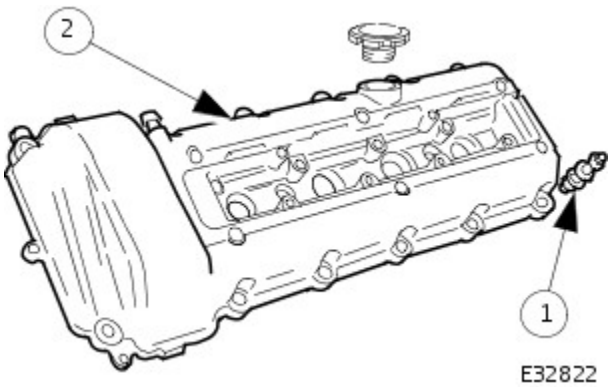
In-vehicle Repair

Removal

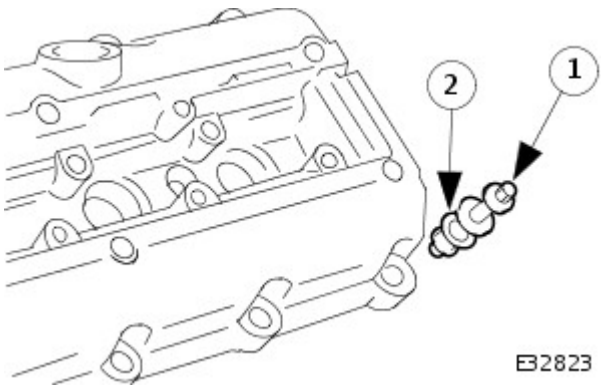
1. Open the engine compartment and fit paintwork protection sheets.
2. Carefully remove the left hand engine cover, taking care not to damage the plastic fixings or the rubber inserts.
3. Remove the on-plug ignition coils from the 'B' bank. Refer to Operation 18.20.42.
4. Remove the purge valve, from the evaporative control system. Refer to Operation 17.45.01.
5. Release the clips which secure the engine harness to the cam cover.



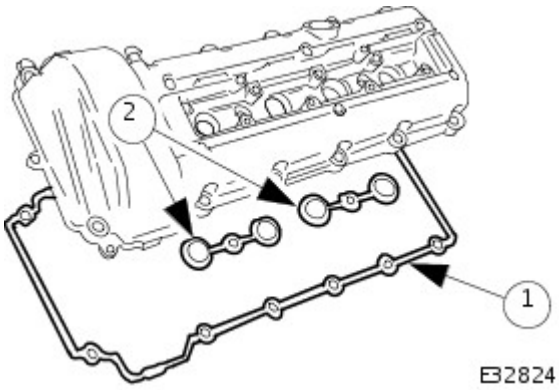
6. Remove the cam cover assembly.
    1. Release the fourteen screws which secure the cam cover. The screws stay in place, held by the seals.
    2. Remove the cam cover, screws and seals, as an assembly.
    - Remove the oil filler cap.



7. Separate the screws and seals from the cam cover.
    1. One at a time, remove each securing screw from the cam cover.
    2. Remove the rubber sealing ring from each securing screw.

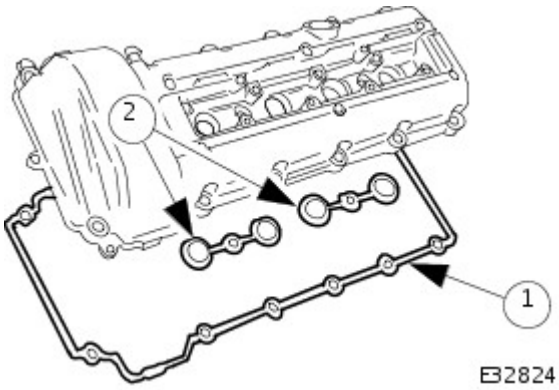


8. Remove the main seals from the cam cover.
    1. Remove and discard the outer seal.
    2. Remove and discard the two seals from around the spark plug apertures.



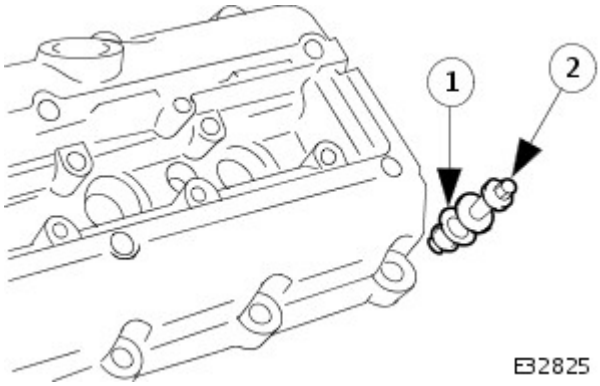
9. Clean all relevant parts and mating faces.

Installation



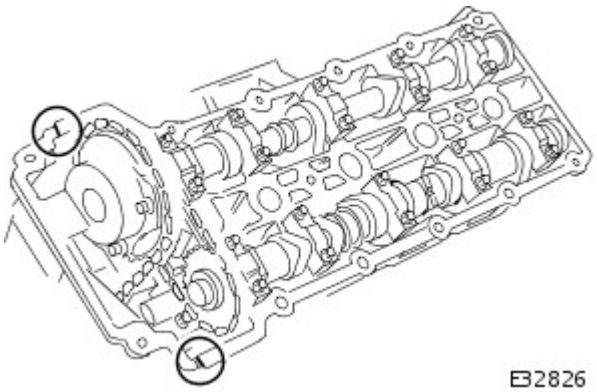
1. Fit new seals to the cam cover.

1. Fit the new outer seal.
2. Fit the two new spark plug aperture seals.



2. Fit the securing screws to the cam covers.

1. Fit a new sealing ring to each screw assembly.
2. Fit the screws to the cam covers. Each screw is retained by the cam cover gasket.



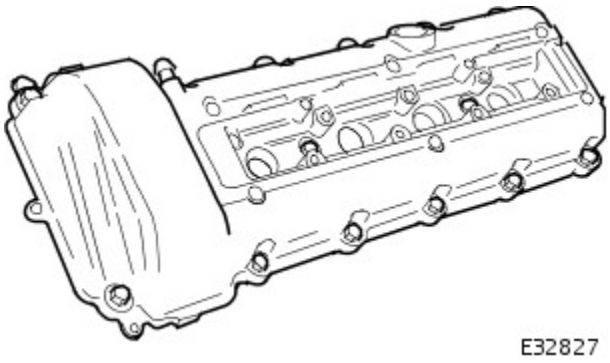
3. Apply RTV sealant WSS-M4G320-A3 to two places on the joint between the front of the cam cover and the cylinder head.

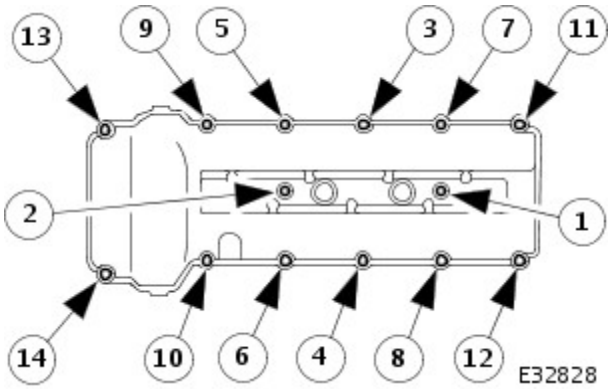
- The application of sealant must be 3mm diameter by 12mm long. Fit the cam cover immediately after applying the sealant.
- The cover should be fitted directly to the head without smearing the sealant or the seals.

4. Refit the cam cover.

- Position the cam cover onto the cylinder head without smearing the sealant and start the threads of each

securing screw.

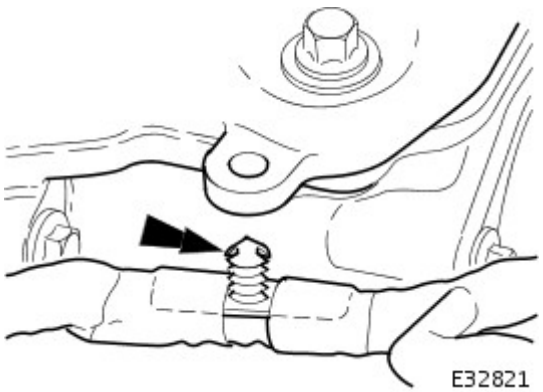




5. Tighten the securing screws to 9 - 11 Nm. Tighten in the sequence indicated.

6. Fit the oil filler cap.

7. Reposition the clips which secure the engine harness to the cam cover.



8. Refit the on-plug ignition coils and the coil cover. Refer to Operation 18.20.42.

9. Refit the purge valve. Refer to Operation 17.45.01.

10. Reconnect the air flow meter multi-plug.

11. Refit the left hand engine cover.

12. Remove the paintwork protection sheets and close the engine compartment.

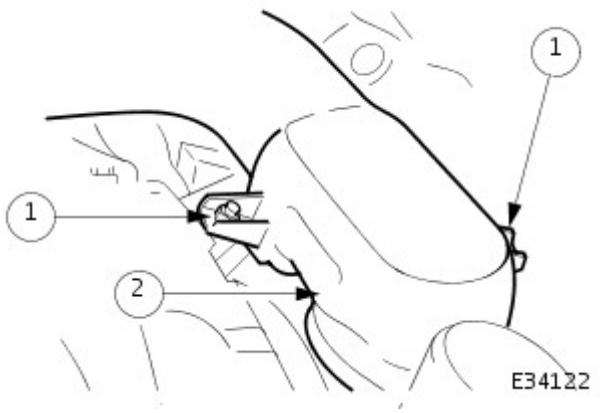
Engine - Valve Cover RH

In-vehicle Repair

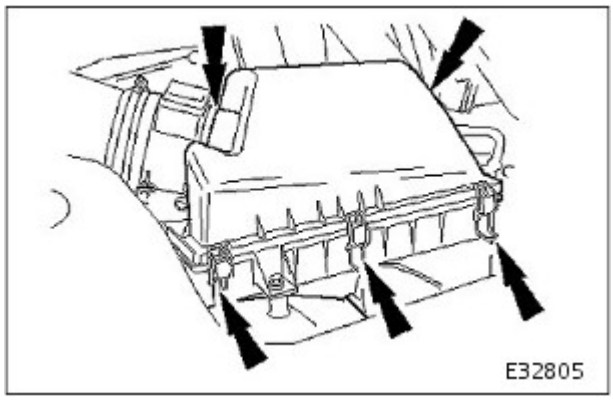
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the intake tube from the throttle body.



1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.

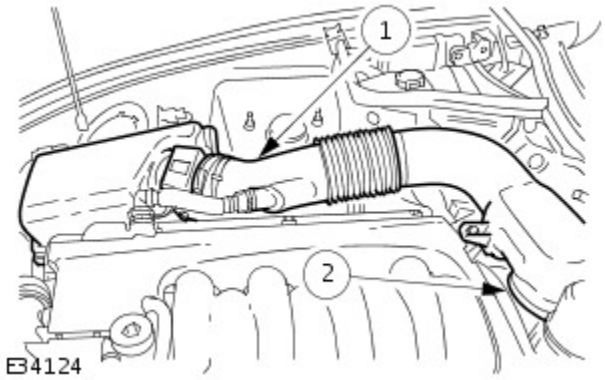


3. Disconnect the air cleaner cover.

- Release the five clips which secure the air cleaner cover.

4. Disconnect the air flow meter multi-plug.

5. Remove the intake tube / air flow meter / air cleaner cover assembly.

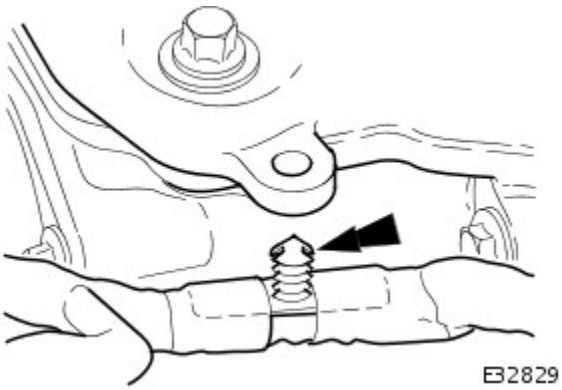


1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

6. Carefully remove the right hand engine cover, taking care not to damage the plastic fixings or the rubber inserts.

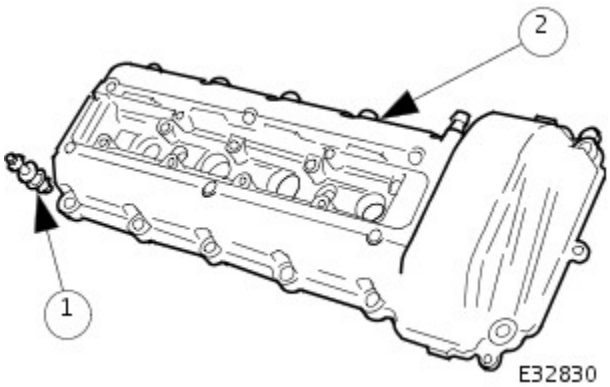
7. Remove the on-plug ignition coils from the 'A' bank. Refer to Operation 18.20.41.

8. Release the clips which secure the engine harness to the cam cover.



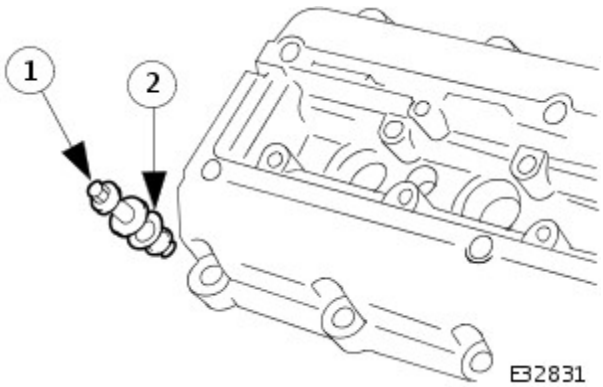
9. Remove the cam cover assembly.

1. Release the fourteen screws which secure the cam cover. The screws stay in place, held by the seals.
2. Remove the cam cover, screws and seals, as an assembly.



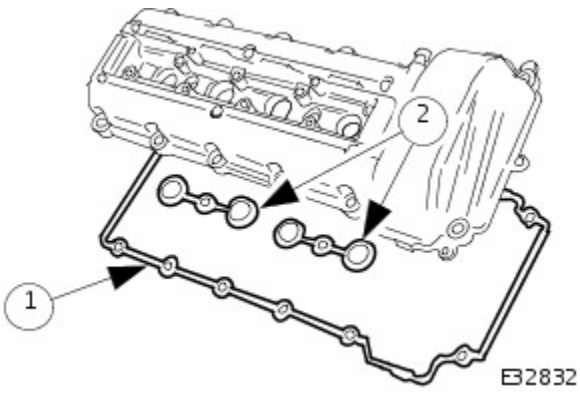
10. Separate the screws and seals from the cam cover.

1. One at a time, remove each securing screw from the cam cover.
2. Remove the rubber sealing ring from each securing screw.



11. Remove the main seals from the cam cover.

1. Remove and discard the outer seal.
2. Remove and discard the two seals from around the spark plug apertures.

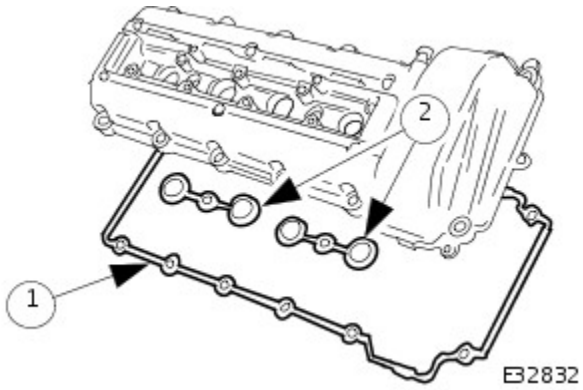


12. Clean all relevant parts and mating faces.

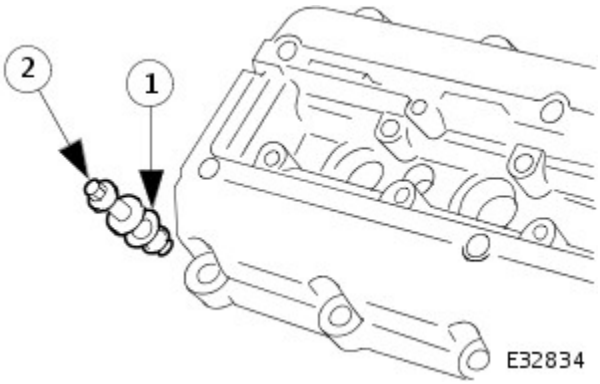
Installation

1. Fit the new main seals to the cam cover.

1. Fit the new outer seal.

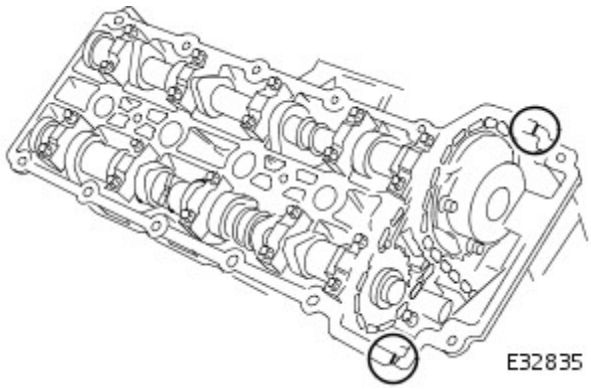


2. Fit the two new spark plug aperture seals.



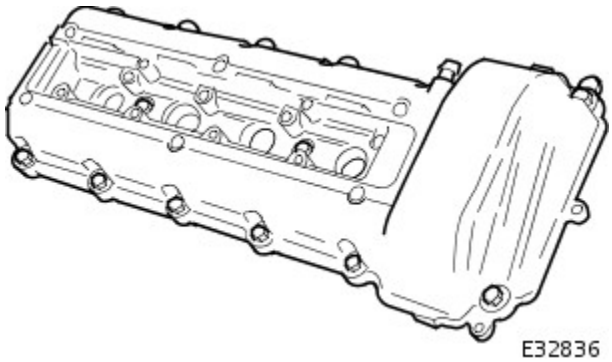
2. Fit the securing screws to the cam covers.

1. Fit a new sealing ring to each screw assembly.
2. Fit the screws to the cam covers. Each screw is retained by the cam cover gasket.



3. Apply RTV sealant WSS-M4G320-A3 to two places on the joint between the front of the cam cover and the cylinder head.

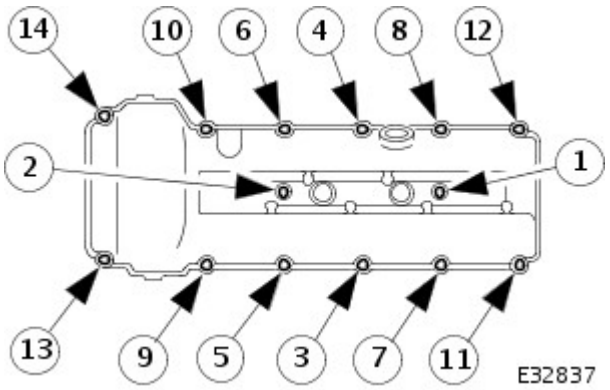
- The application of sealant must be 3mm diameter by 12mm long. Fit the cam cover immediately after applying the sealant.
- The cover should be fitted directly to the head without smearing the sealant or the seals.

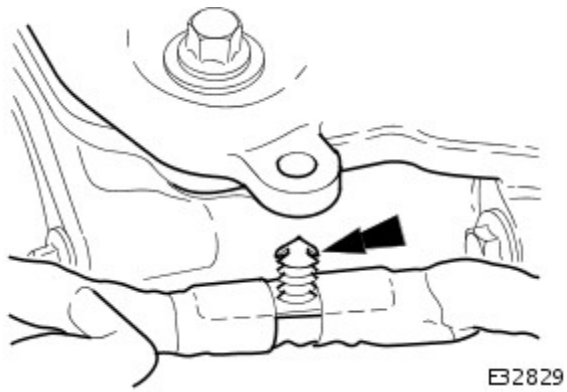


4. Refit the cam cover.

- Position the cam cover onto the cylinder head without smearing the sealant and start the threads of each securing screw.

5. Tighten the securing screws to 9 - 11 Nm. Tighten in the sequence indicated.

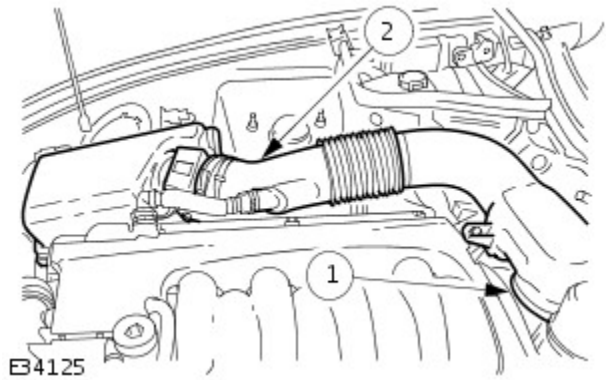




6. Reposition the clips which secure the engine harness to the cam cover.

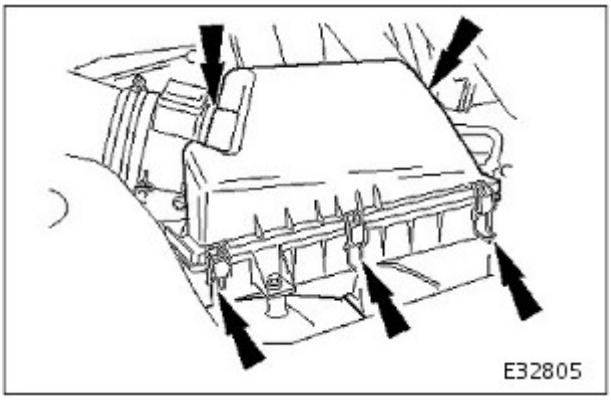
7. Refit the on-plug ignition coils and the coil cover. Refer to Operation 18.20.41.

8. Refit the right hand engine cover.



9. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.

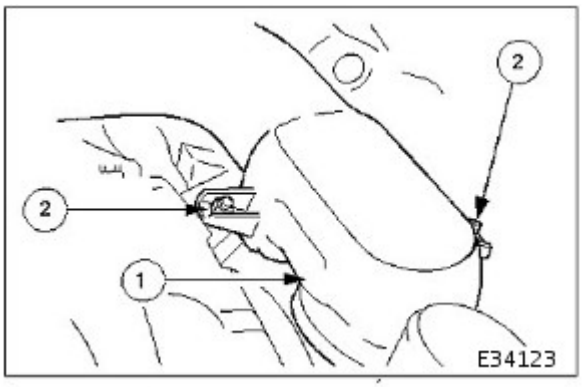


10. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

11. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.



2. Fit the two bolts which secure the intake tube to the throttle body.

12. Remove the paintwork protection sheets and close the engine compartment.

Engine - Valve Cover Gasket LH

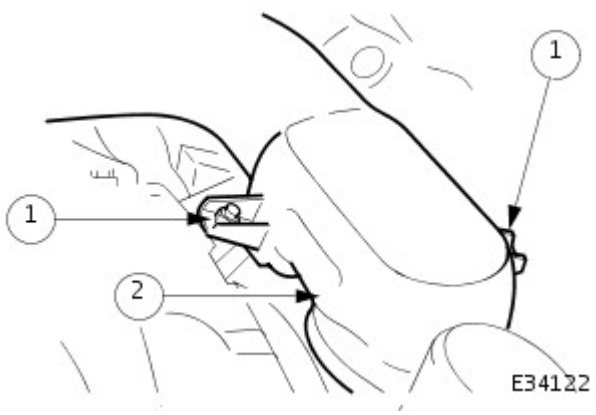
In-vehicle Repair

Removal

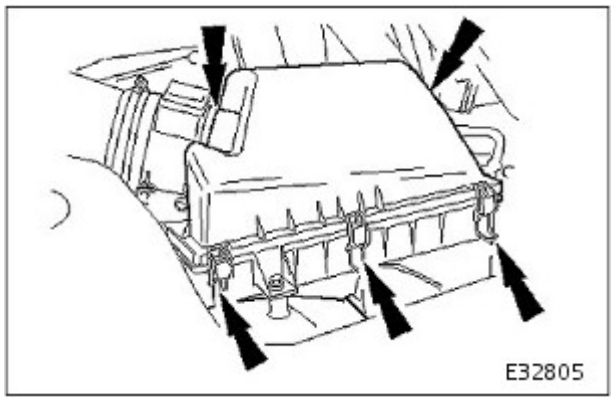
1. Open the engine compartment and fit paintwork protection sheets.

2. Carefully remove the left hand engine cover, taking care not to damage the plastic fixings or the rubber inserts.

3. Disconnect the intake tube from the throttle body.



1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.

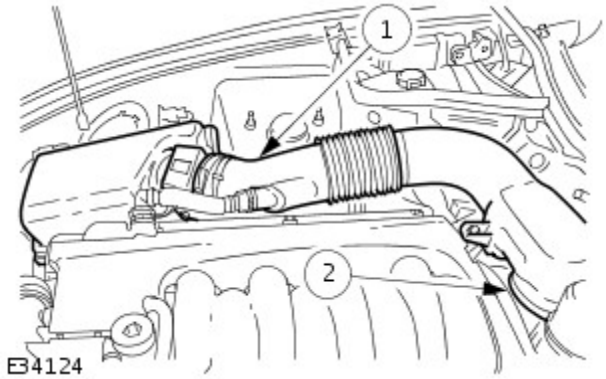


4. Disconnect the air cleaner cover.

- Release the five clips which secure the air cleaner cover.

5. Disconnect the air flow meter multi-plug.

6. Remove the intake tube / air flow meter / air cleaner cover assembly.

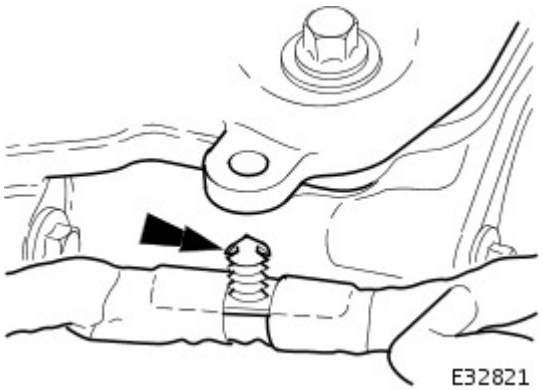


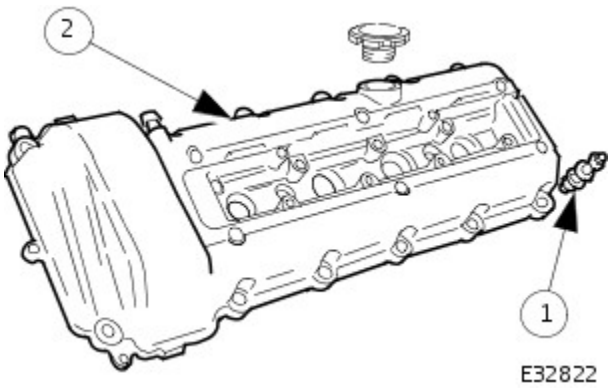
1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

7. Remove the on-plug ignition coils from the 'B' bank. Refer to Operation 18.20.42.

8. Remove the purge valve, from the evaporative control system. Refer to Operation 17.45.01.

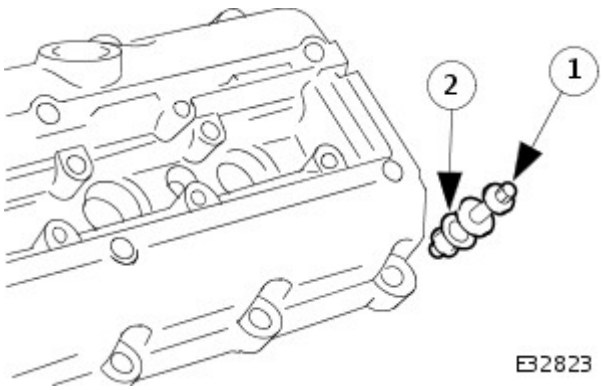
9. Release the four clips which secure the engine harness to the cam cover.





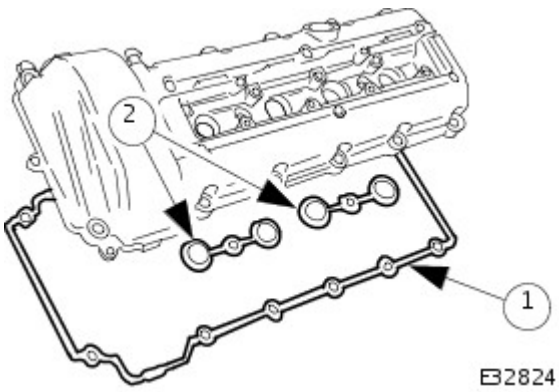
10. Remove the cam cover assembly.

1. Release the fourteen screws which secure the cam cover. The screws stay in place, held by the seals.
2. Remove the cam cover, screws and seals, as an assembly.



11. Separate the screws and seals from the cam cover.

1. One at a time, remove each securing screw from the cam cover.
2. Remove the rubber sealing ring from each securing screw.



12. Remove the main seals from the cam cover.

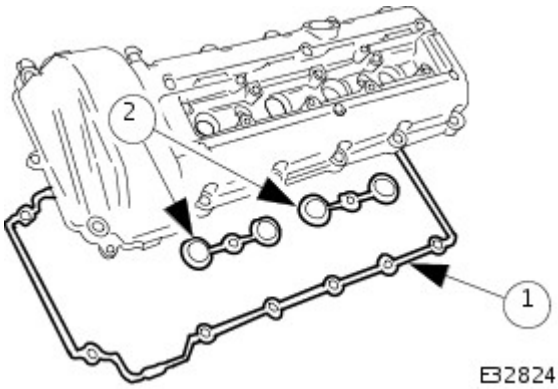
1. Remove and discard the outer seal.
2. Remove and discard the two seals from around the spark plug apertures.

13. Clean all relevant parts and mating faces.

Installation

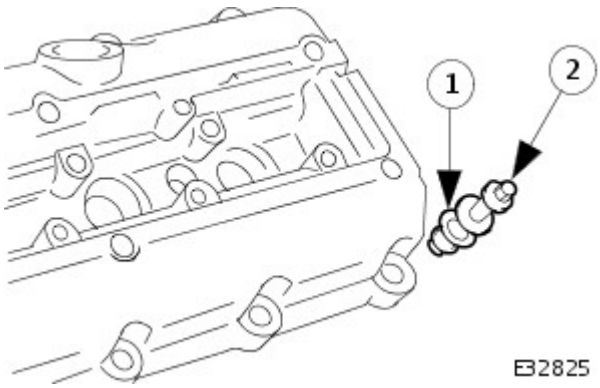
1. Fit the new main seals to the cam cover.

1. Fit the new outer seal.



E32824

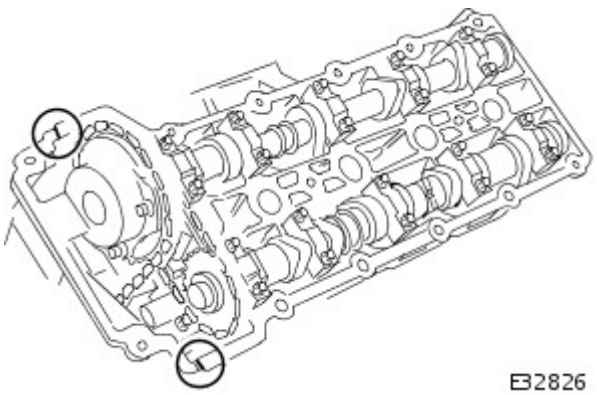
2. Fit the two new spark plug aperture seals.



E32825

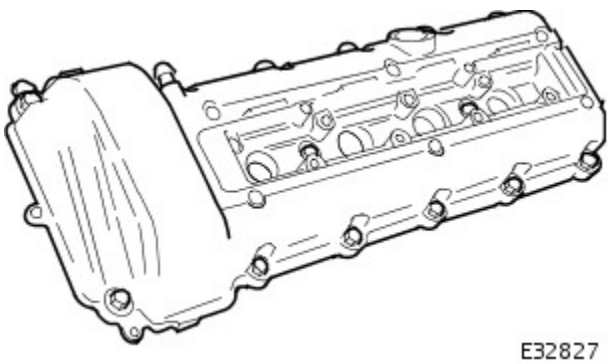
2. Fit the securing screws to the cam covers.

1. Fit a new sealing ring to each screw assembly.
2. Fit the screws to the cam covers. Each screw is retained by the cam cover gasket.


E32826

3. Apply sealant to two places on the joint between the front of the cam cover and the cylinder head.

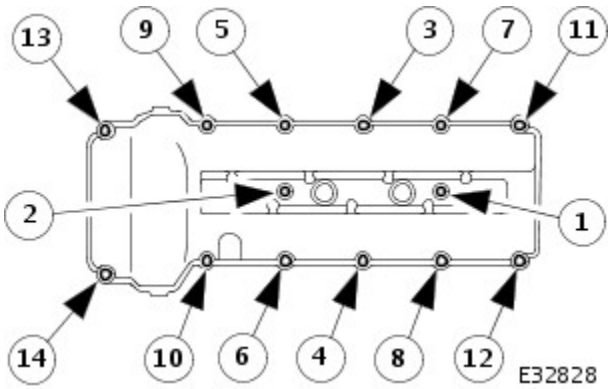
- The application of sealant must be 3mm diameter by 12mm long. Fit the cam cover immediately after applying the sealant.
- The cover should be fitted directly to the head without smearing the sealant or the seals.

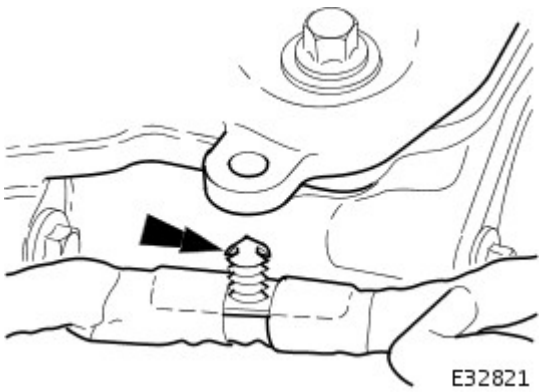

E32827

4. Refit the cam cover.

1. Position the cam cover onto the cylinder head without smearing the sealant and start the threads of each securing screw.

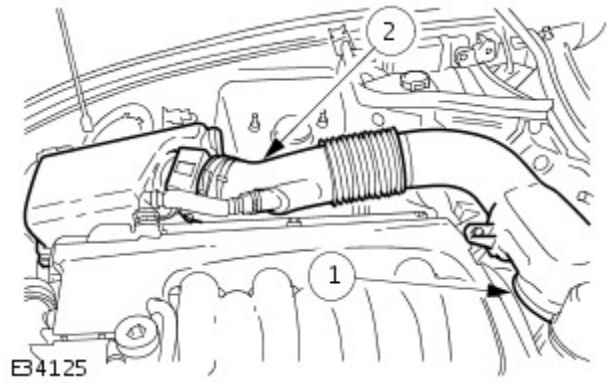
5. Tighten the securing screws to 9-11 Nm. Tighten in the sequence indicated.





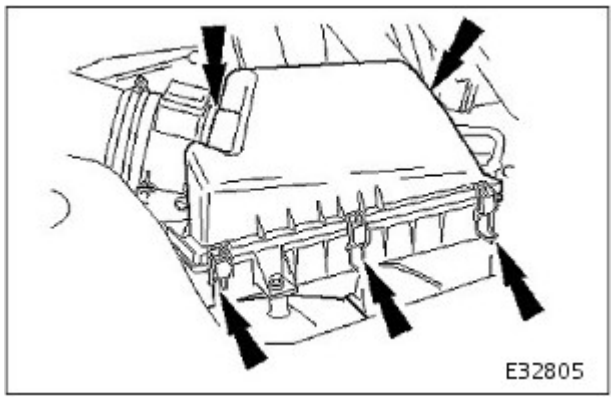
6. Reposition the clips which secure the engine harness to the cam cover.

7. Refit the on-plug ignition coils and the coil cover. Refer to Operation 18.20.42.



8. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.

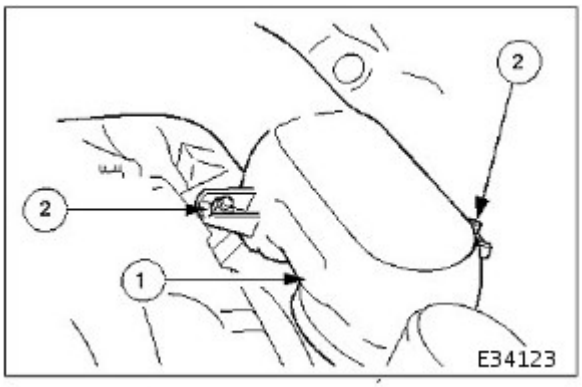


9. Reconnect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.

10. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the



throttle body.

11. Refit the purge valve. Refer to Operation 17.45.01.

12. Reconnect the air flow meter multi-plug.

13. Refit the left hand engine cover.

14. Remove the paintwork protection sheets and close the engine compartment.

Engine - Valve Cover Gasket RH

In-vehicle Repair

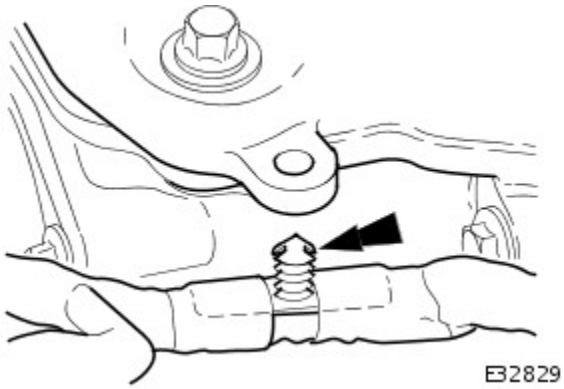
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Carefully remove the right hand engine cover, taking care not to damage the plastic fixings or the rubber inserts.

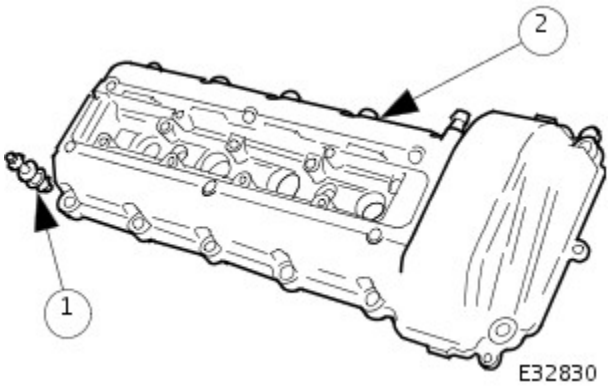
3. Remove the on-plug ignition coils from the 'A' bank. Refer to Operation 18.20.41.

4. Release the four clips which secure the engine harness to the cam cover.



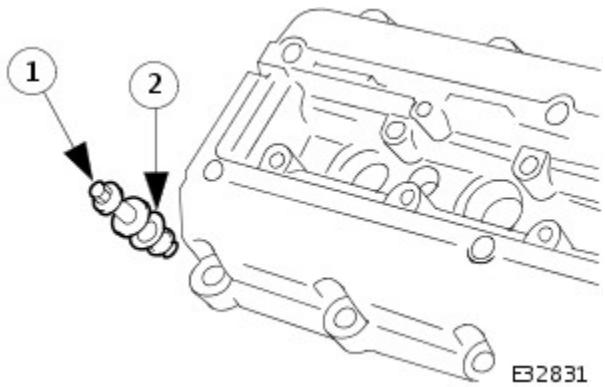
5. Remove the cam cover assembly.

1. Release the fourteen screws which secure the cam cover. The screws stay in place, held by the seals.
2. Remove the cam cover, screws and seals, as an assembly.



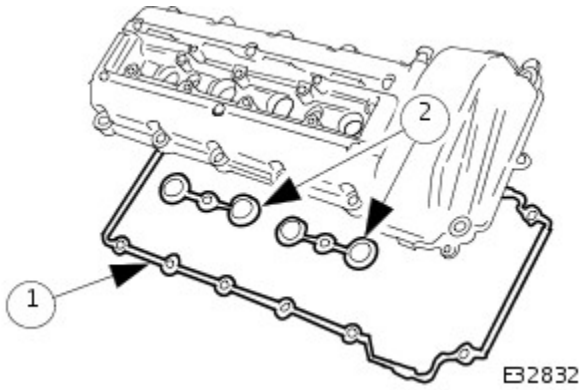
6. Separate the screws and seals from the cam cover.

1. One at a time, remove each securing screw from the cam cover.
2. Remove the rubber sealing ring from each securing screw.



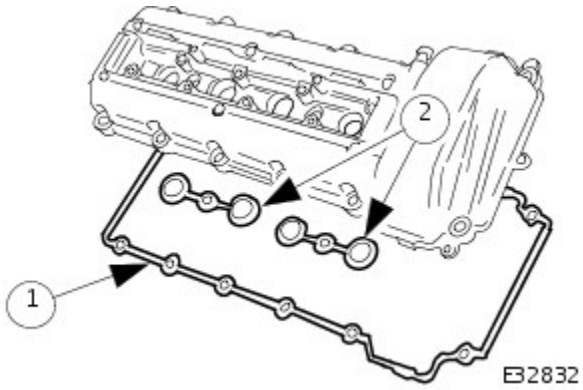
7. Remove the main seals from the cam cover.

1. Remove and discard the outer seal.
2. Remove and discard the two seals from around the spark plug apertures.



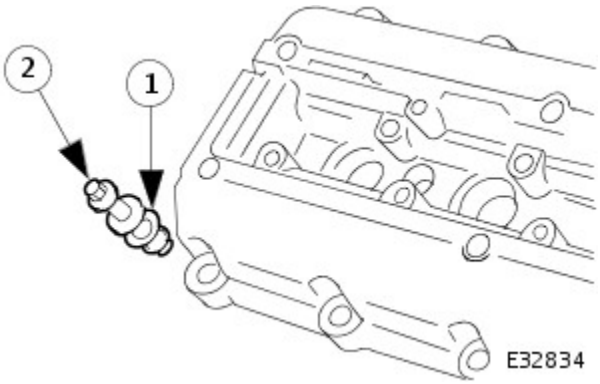
8. Clean all relevant parts and mating faces.

Installation



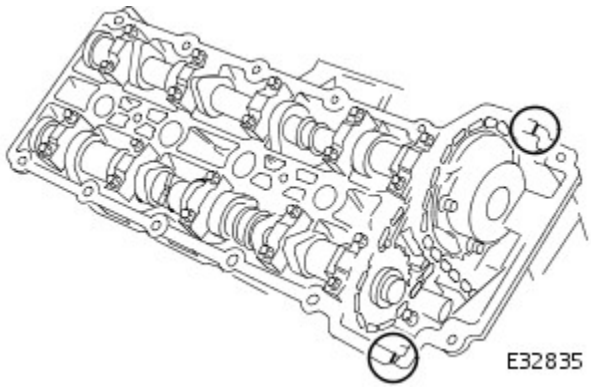
1. Fit the new main seals to the cam cover.

1. Fit the new outer seal.
2. Fit the two new spark plug aperture seals.



2. Fit the securing screws to the cam covers.

1. Fit a new sealing ring to each screw assembly.
2. Fit the screws to the cam covers. Each screw is retained by the cam cover gasket.



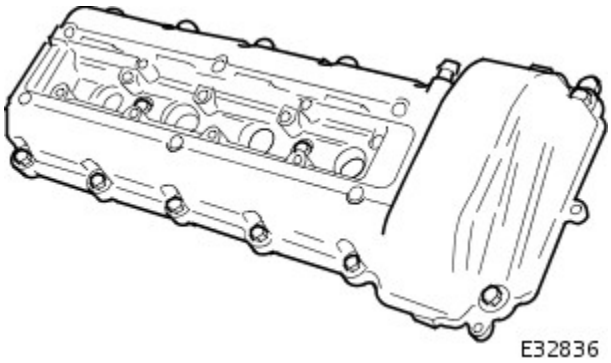
3. Apply sealant to two places on the joint between the front of the cam cover and the cylinder head.

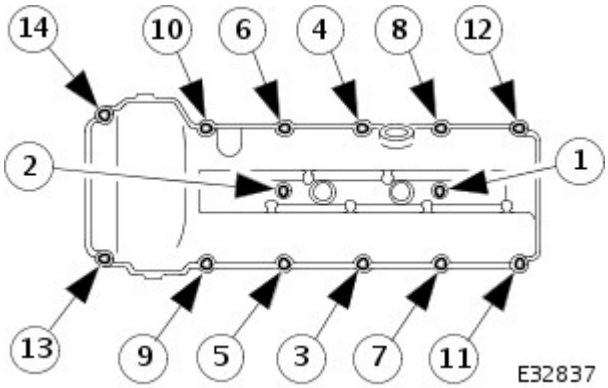
- The application of sealant must be 3mm diameter by 12mm long. Fit the cam cover immediately after applying the sealant.
- The cover should be fitted directly to the head without smearing the sealant or the seals.

4. Refit the cam cover.

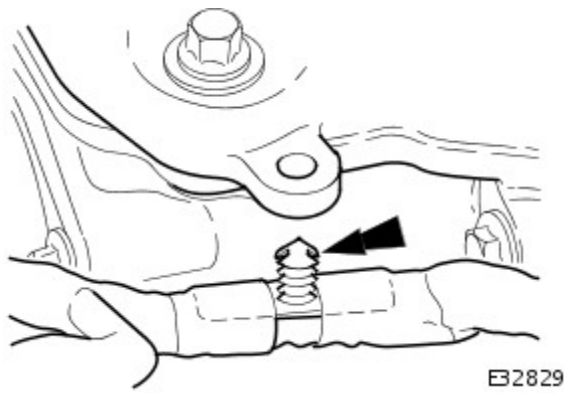
1. Position the cam cover onto the cylinder head without smearing the sealant and start the threads of each

securing screw.





5. Tighten the securing screws to 9-11 Nm. Tighten in the sequence indicated.



6. Reposition the clips which secure the engine harness to the cam cover.

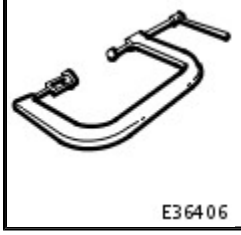
7. Refit the on-plug ignition coils and the coil cover. Refer to Operation 18.20.41.

8. Refit the right hand engine cover.

9. Remove the paintwork protection sheets and close the engine compartment.

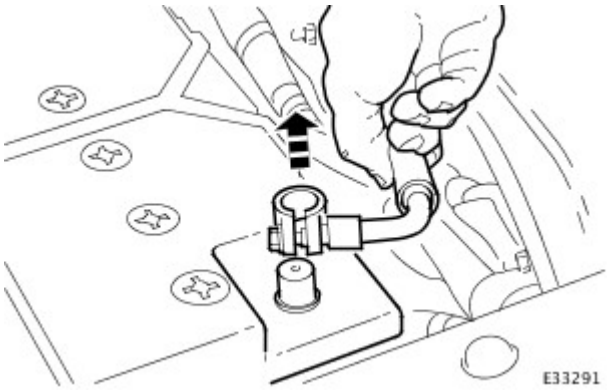
Engine - Valve Springs LH

In-vehicle Repair

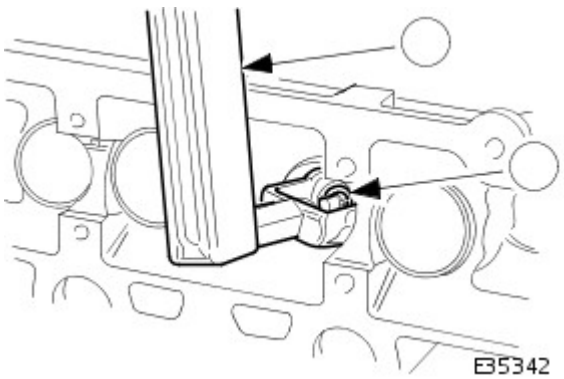
Special Tool(s)	
 E36406	Valve spring compressor 303-252

Removal

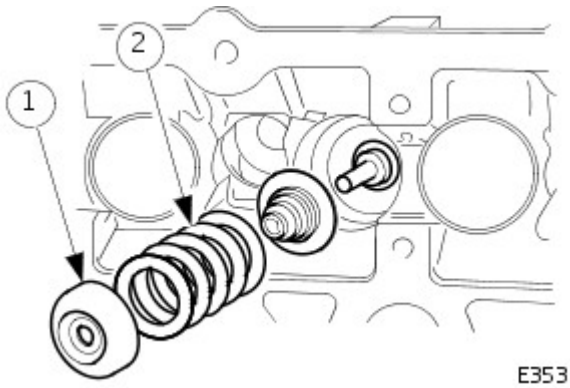
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.


E33291

4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section. This operation includes draining the coolant from the radiator and removing the cam covers.
5. Remove the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes depressurising the fuel system and removing the throttle housing.
6. Remove the Cylinder Head and Gasket. Refer to Operation 12.29.02 in this Section.
7. Remove the valve collets from the first valve.
   1. Fit the valve spring compressor 303 - 252 to the relevant spring.
   2. Compress the spring and remove the collets.


E35342

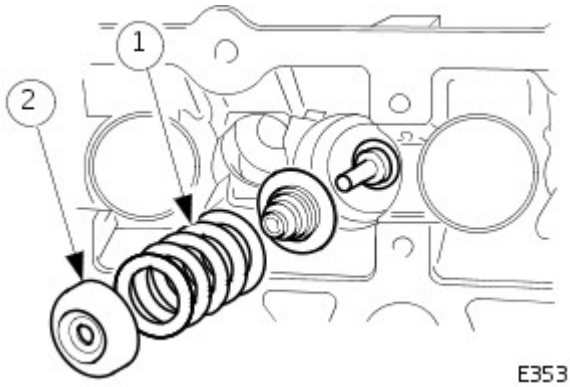
8. Remove the valve spring.
   - Remove the valve spring compressor 303 - 252.
     1. Remove the valve collar.
     2. Remove the valve spring.



9. Repeat the instructions for each valve spring to be removed.

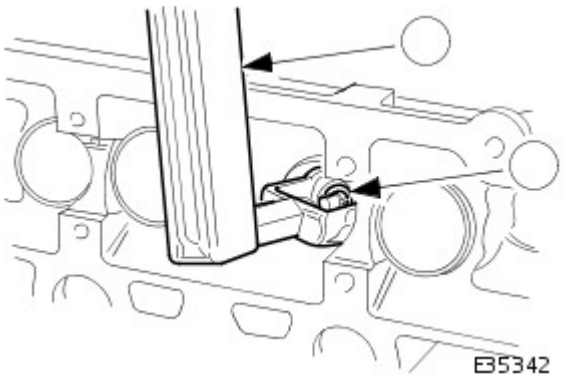
10. Clean all relevant components.

Installation



1. Fit the valve spring.

1. Fit the valve spring.
2. Locate the valve collar onto the spring.



2. Refit the valve collets to the first valve.

1. Fit the valve spring compressor 303 - 252 to the relevant spring.
2. Compress the spring and fit the collets.

- Remove the valve spring compressor and check that the collets are correctly seated.

3. Repeat the instructions for each valve spring to be fitted.

4. Refit the Cylinder Head and Gasket. Refer to Operation 12.29.03 in this Section.

5. Refit the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes refitting the throttle housing.

6. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section. This operation includes refitting the cam covers and refilling the coolant system.

7. Move the engine compartment cover from the service position and connect the gas struts.

8. Remove the paint protection sheets and close the cover.

9. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

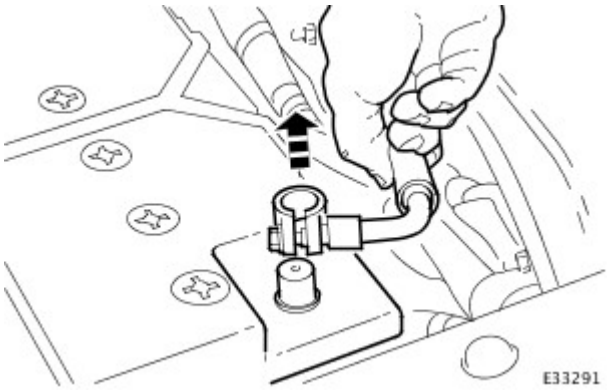
Engine - Valve Springs RH

In-vehicle Repair

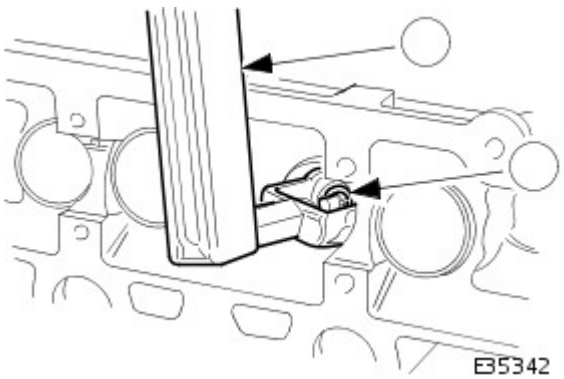
Special Tool(s)	
 E36406	Valve spring compressor 303-252

Removal

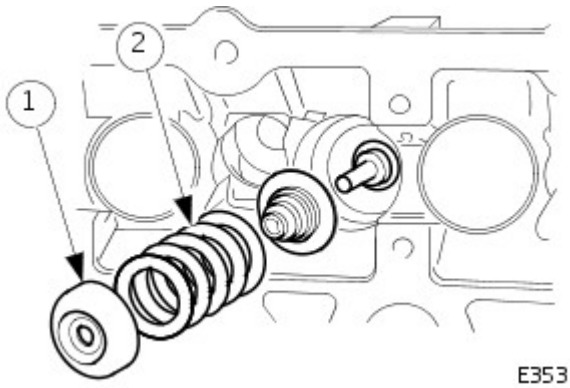
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section. This operation includes draining the coolant from the radiator and removing the cam covers.
5. Remove the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes depressurising the fuel system and removing the throttle housing.
6. Remove the Cylinder Head and Gasket. Refer to Operation 12.29.03 in this Section.
7. Remove the valve collets from the first valve.
   1. Fit the valve spring compressor 303 - 252 to the relevant spring.
   2. Compress the spring and remove the collets.



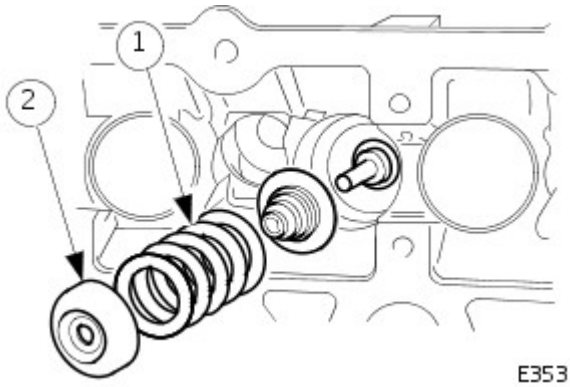
8. Remove the valve spring.
   - Remove the valve spring compressor 303 - 252.
     1. Remove the valve collar.
     2. Remove the valve spring.



9. Repeat the instructions for each valve spring to be removed.

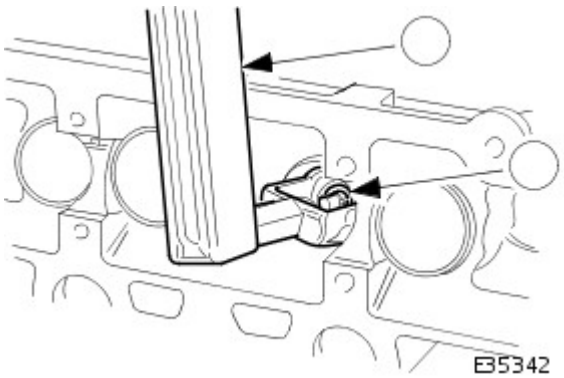
10. Clean all relevant components.

Installation



1. Fit the valve spring.

1. Fit the valve spring.
2. Locate the valve collar onto the spring.



2. Refit the valve collets to the first valve.

1. Fit the valve spring compressor 303 - 252 to the relevant spring.
2. Compress the spring and fit the collets.

- Remove the valve spring compressor and check that the collets are correctly seated.

3. Repeat the instructions for each valve spring to be fitted.

4. Refit the Cylinder Head and Gasket. Refer to Operation 12.29.03 in this Section.

5. Refit the Inlet Manifold. Refer to Operation 30.15.01 in this Section. This operation includes refitting the throttle housing.

6. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section. This operation includes refitting the cam covers and refilling the coolant system.

7. Move the engine compartment cover from the service position and connect the gas struts.

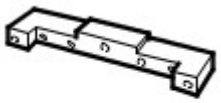
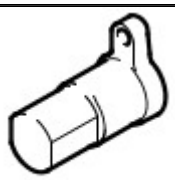
8. Remove the paint protection sheets and close the cover.

9. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

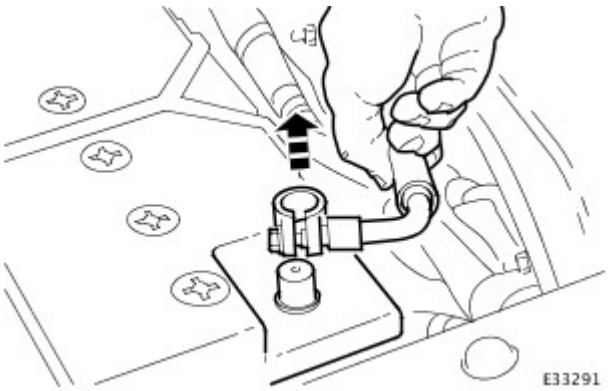
Engine - Variable Camshaft Timing Oil Control Unit LH

In-vehicle Repair

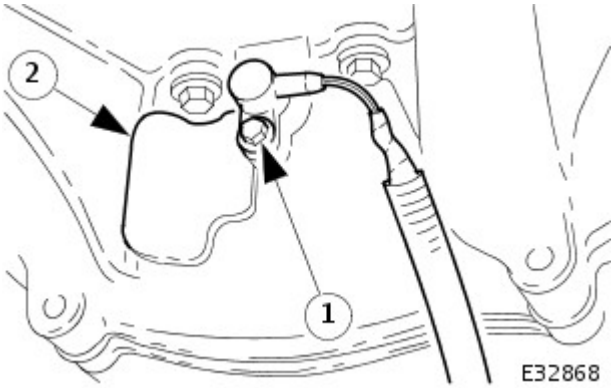
Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.


E33291

4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.52 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



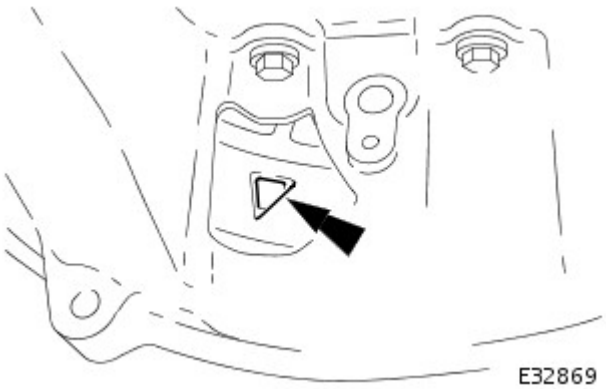
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

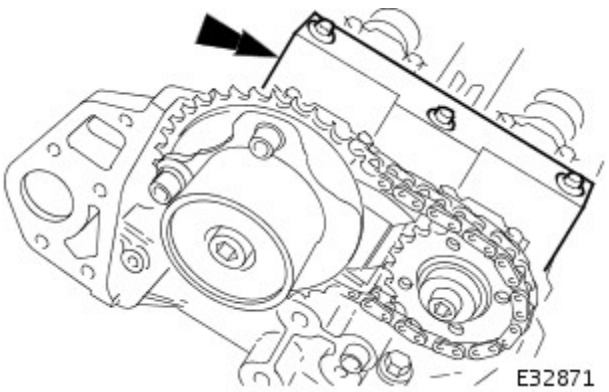
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Fit and tighten the bolt to secure the setting peg.

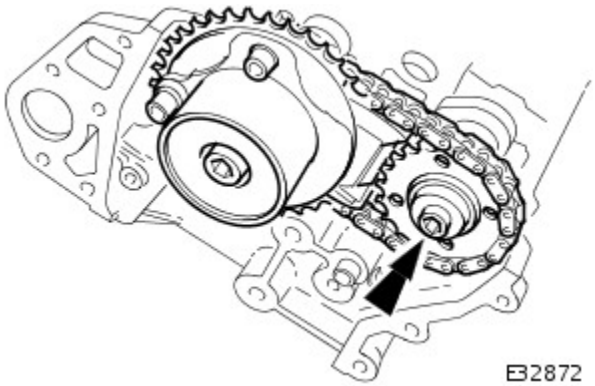
11. Remove the damper securing bolt from the crankshaft.

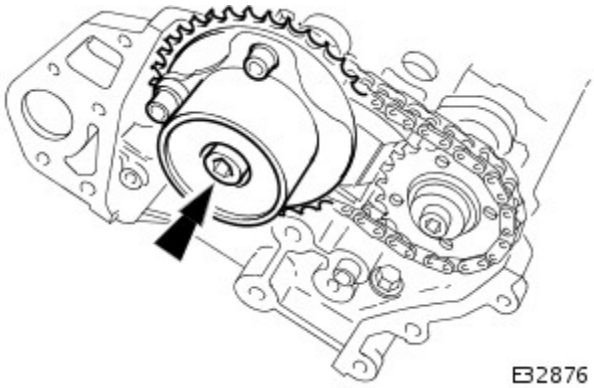
12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the B-Bank camshafts, aligning the shafts slightly as necessary.



14. Loosen the bolt which secures the sprocket to the exhaust camshaft.



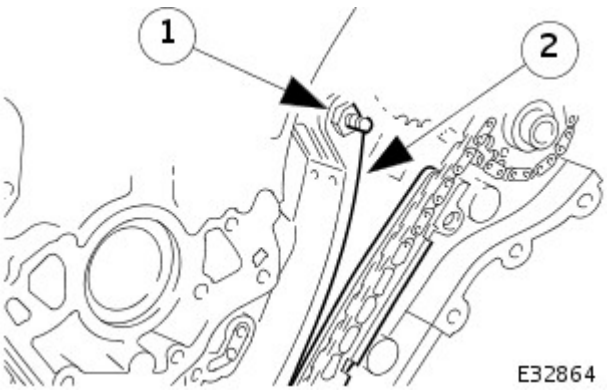


15. Loosen the bolt which secures the VVT unit.

- Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.

16. Remove the primary chain tensioner. Refer to operation 12.65.55, in this Section.

17. Remove the primary chain tensioner blade.



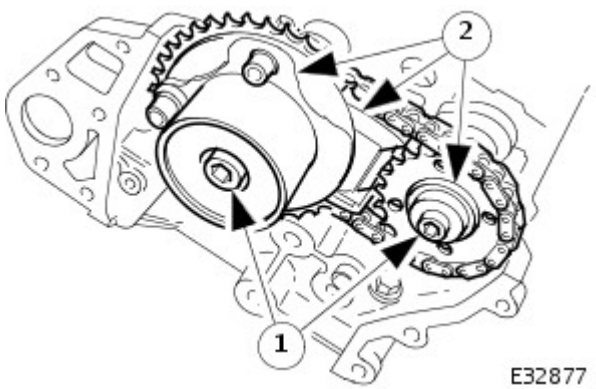
1. Remove the pivot bolt which secures the tensioner blade.

2. Remove the tensioner blade.

18. Reposition the VVT unit along the cam journal to allow the chain to clear the head casting.

- Disconnect the primary chain from the VVT unit and reposition it against the crankshaft sprocket.

19. Remove the VVT unit.



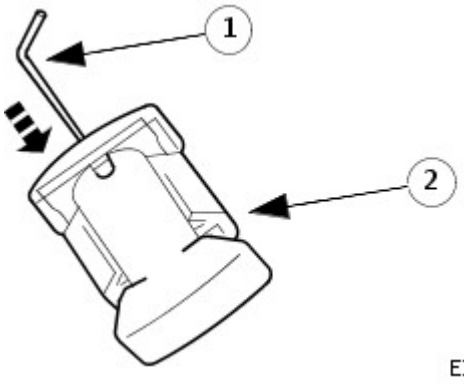
1. Remove the securing bolt from the VVT unit and the exhaust cam sprocket.

2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

20. Clean and inspect all relevant components.

Installation

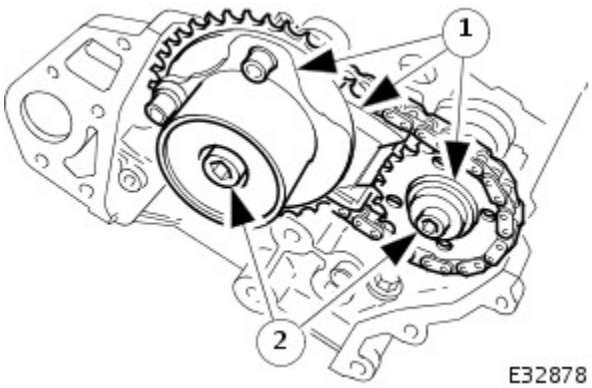


E32920

1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.

1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

- Remove the wire.

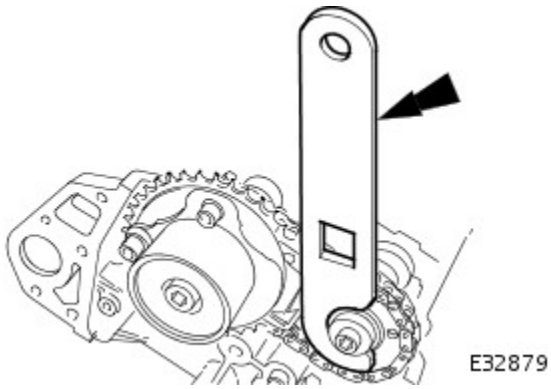


E32878

2. Fit the VVT unit to the engine.

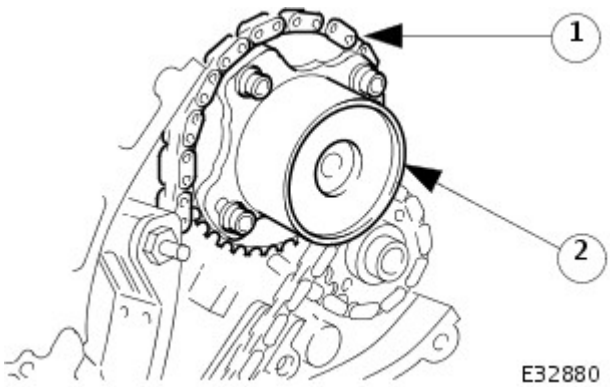
- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.
2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts. Allow the VVT unit sufficient space to fit the primary chain, in a later operation.


E32879

3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



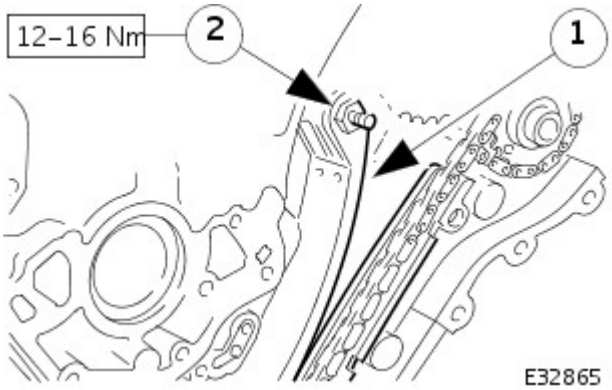
E32880

4. Refit the primary timing chain.

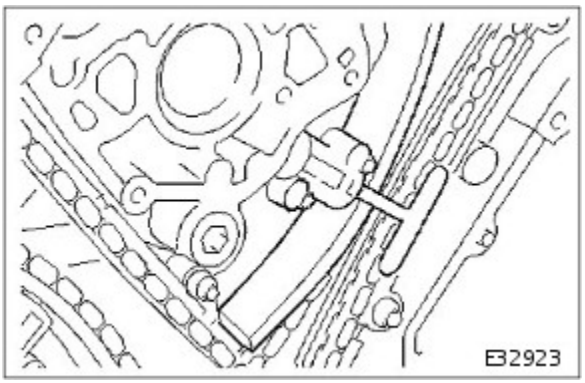
1. Lift the primary chain and position it over the VVT unit sprocket (the VVT unit must be pulled forward to clear the cylinder head casting). There must be no slack on the drive side of the primary chain and the VVT unit must not be rotated on the camshaft.
2. Slide the VVT unit fully on to the camshaft.

5. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.

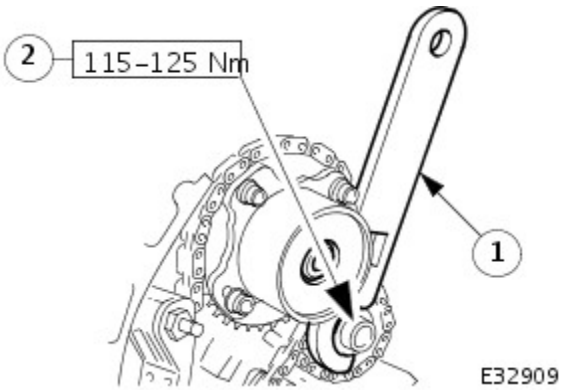


2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.



6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.55 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.

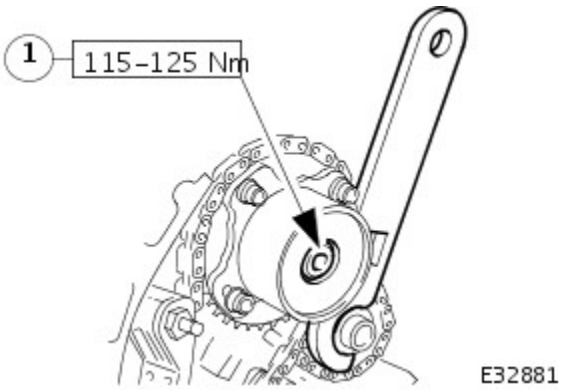


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

- Remove the chain tensioning tool and the wedge(s).

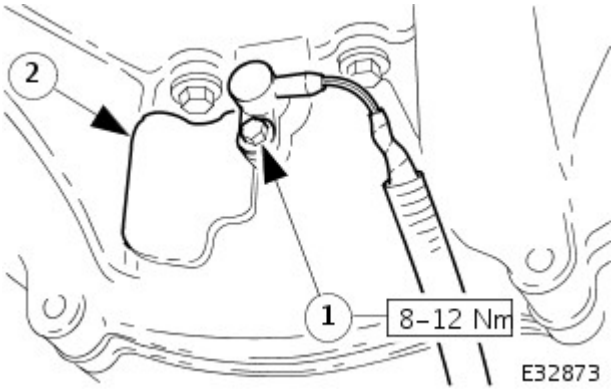
9. Remove the camshaft locking tool 303 - 530 .

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.

1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.



2. Refit the access grommet to the housing.

13. Lower the ramp.

14. Refit the B-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.52 in this Section.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.

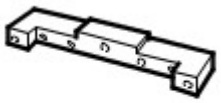
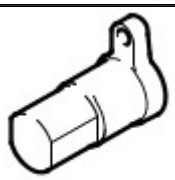
17. Remove the paint protection sheets and close the cover.

18. Connect the battery and fit the battery cover.

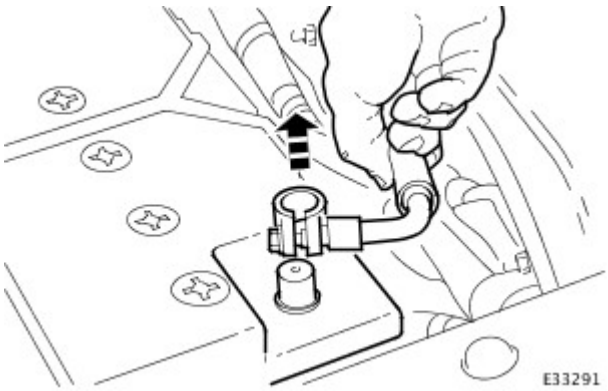
- Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Variable Camshaft Timing Oil Control Unit RH

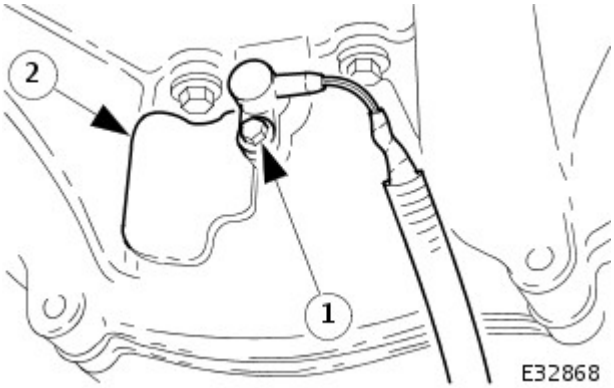
In-vehicle Repair

Special Tool(s)	
 E36401	Camshaft setting 303-530
 E36402	Timing chain tensioning 303-532
 E36407	Wedges, primary chain 303-533
 E36408	Crankshaft setting 303-531

Removal


E33291

1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.
4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the Variable Valve Timing Bush Carrier Assembly. Refer to Operation 12.65.51 in this Section
6. Raise the vehicle on a ramp.
7. Remove the crankshaft position sensor.



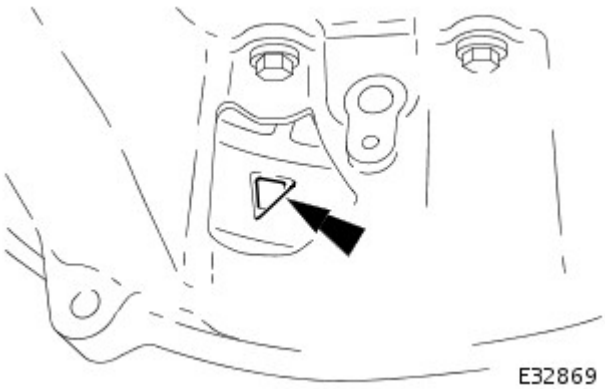
1. Remove the bolt which secures the crankshaft position sensor to the flywheel housing.

- Remove the sensor and allow it to hang free under the engine.

2. Remove the access grommet (for torque converter bolts) from the housing.

8. Fit the damper securing bolt (old one) to the crankshaft, hand-tight only.

9. Rotate the crankshaft until the triangular arrow indent on the drive plate is visible through the access hole; confirm that the timing flat on each camshaft is uppermost.





10. Fit the crankshaft setting peg 303 - 531 to the crankshaft position sensor location.

1. Fit the crankshaft setting peg 303 - 531.

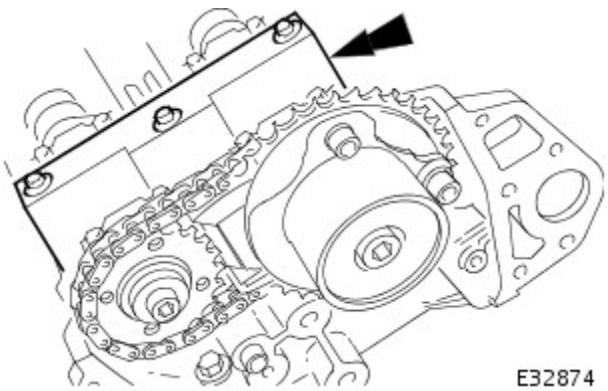
- Position the crankshaft so that the setting peg engages fully into the timing slot.

2. Fit and tighten the bolt to secure the setting peg.

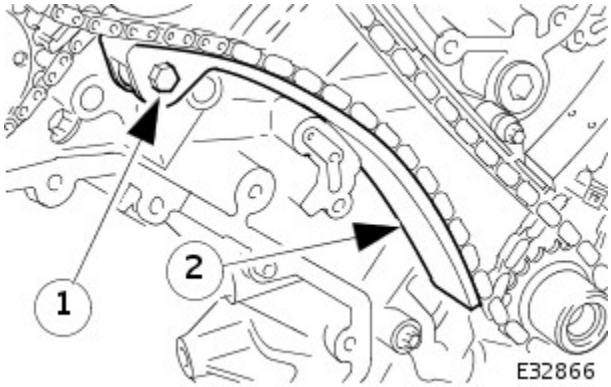
11. Remove the damper securing bolt from the crankshaft.

12. Lower the vehicle on the ramp.

13. Fit the camshaft locking tool 303 - 530 to the A-Bank camshafts, aligning the shafts slightly as necessary.



14. Remove the primary chain tensioner. Refer to operation 12.65.54, in this Section

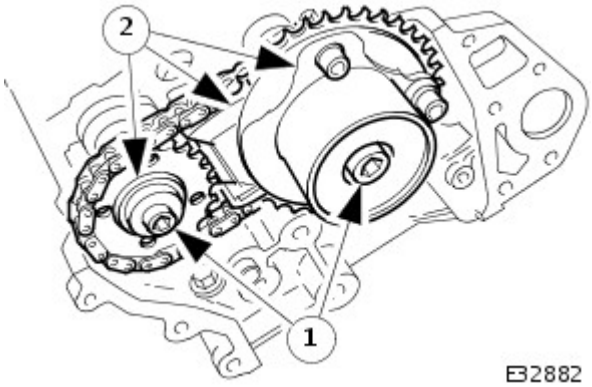


15. Remove the primary chain tensioner blade.

1. Remove the pivot bolt which secures the tensioner blade.
2. Remove the tensioner blade.

16. Disconnect the primary chain from the VVT unit and the crankshaft sprocket, and remove it completely.

17. Do not tamper with the three bolts which secure the VVT mechanism to the sprockets. It is sealed at the factory to the correct valve timing specification for the engine and is supplied only as a complete unit.



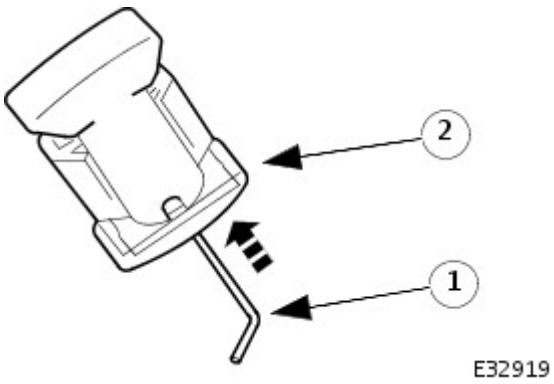
18. Remove the VVT unit.

1. Remove the securing bolt from both the VVT unit and the exhaust cam sprocket.
2. Remove the VVT unit, exhaust sprocket and secondary chain as an assembly (release the chain from the tensioner which is still secured to the cylinder head).

- Remove the secondary chain from the VVT unit and the sprocket.

19. Clean and inspect all relevant components.

Installation



1. Push the tensioner piston (secondary chain) into the body to provide clearance for fitting.

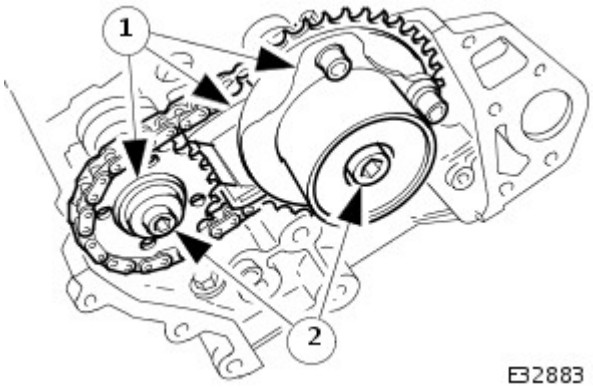
1. Insert a thin rigid wire through the hole in the end of the tensioner piston to displace the ball from the non-return valve seat.
2. With the wire in position, press the piston fully into the tensioner body.

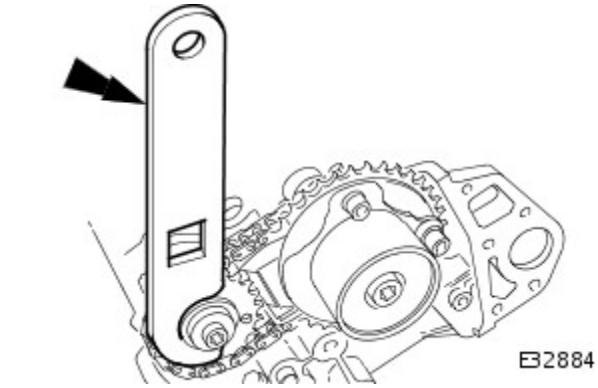
- Remove the wire.

2. Fit the VVT unit to the engine.

- Assemble the VVT unit, the exhaust camshaft sprocket and the secondary chain, in preparation for fitting to the engine.

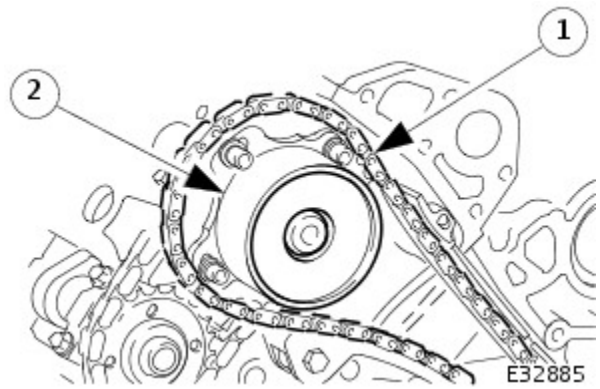
1. Fit the above assembly to the camshafts with the chain correctly positioned over the tensioner; VVT unit to the inlet and the sprocket to the exhaust.
2. Fit, but do not tighten, each bolt which secures the VVT unit and the exhaust sprocket to the camshafts.





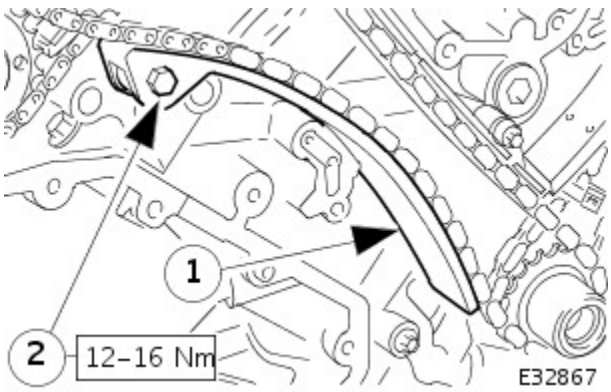
3. Fit the chain tensioning tool 303 - 532 to the exhaust camshaft sprocket.

- Reposition the sprocket (and the VVT unit) for the most advantageous position for use of the tool.
- Remove the tool.



4. Refit the primary timing chain.

1. Fit the primary chain to position over the crankshaft sprocket and the VVT unit sprocket. There must be no slack on the drive side of the primary chain.
2. The VVT unit must not be rotated on the camshaft

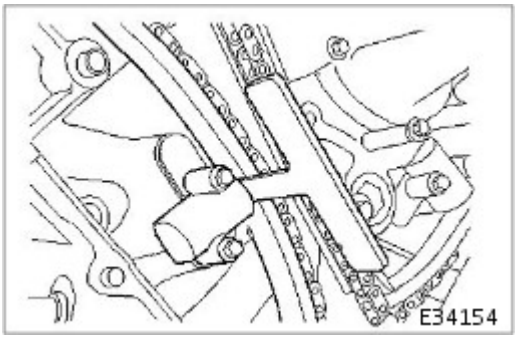


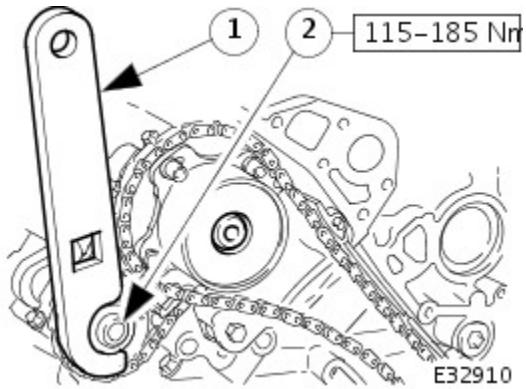
5. Fit the primary chain tensioner blade.

1. Position the tensioner blade to the cylinder block.
2. Fit the retaining / pivot bolt and tighten it to 12-16 Nm.

6. Refit the primary chain tensioner assembly. Refer to Operation 12.65.54 in this Section.

- Use a wedge 303 - 533 (or two if required) between the primary chain tensioner and tensioner blade, to take up the slack in the chain.



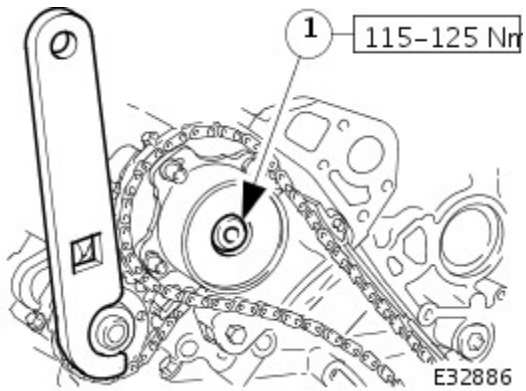


7. Tighten the exhaust camshaft sprocket securing bolt.

1. Fit the chain tensioner tool 303 - 532 to the sprocket holes.

- Apply force to the tool in an anti-clockwise direction to tension the chain on its drive side.

2. Whilst applying the opposing force to the sprocket and chain, tighten the sprocket securing bolt to 115 - 125 Nm.



8. Tighten the VVT unit securing bolt.

1. Whilst still applying the opposing force to the sprocket and chain (using 303 - 532), check that the wedges are still in place, tighten the VVT unit securing bolt to 115 - 125 Nm.

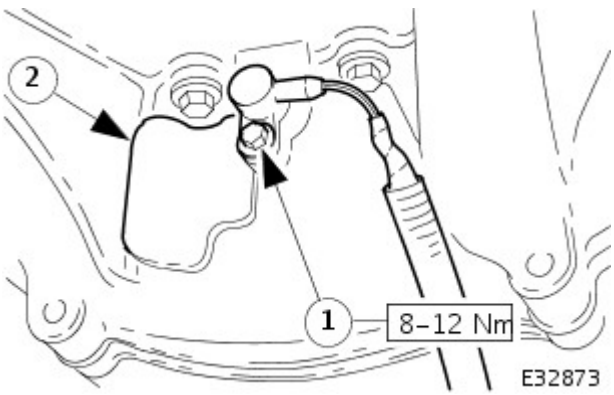
- Remove the chain tensioning tool and the wedge(s).

9. Remove the camshaft locking tool 303 - 530.

10. Raise the vehicle on the ramp.

11. Remove the crankshaft setting tool 303 - 531.

12. Refit the crankshaft position sensor.



1. Fit the sensor to the flywheel housing and fit the securing bolt. Tighten to 8-12 Nm.

2. Refit the access grommet to the housing.

13. Lower the ramp.

14. Refit the A-Bank VVT Bush Carrier Assembly. Refer to operation 12.65.51 in this Section.

15. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

16. Move the engine compartment cover from the service position and connect the gas struts.
17. Remove the paint protection sheets and close the cover.
18. Connect the battery and fit the battery cover.

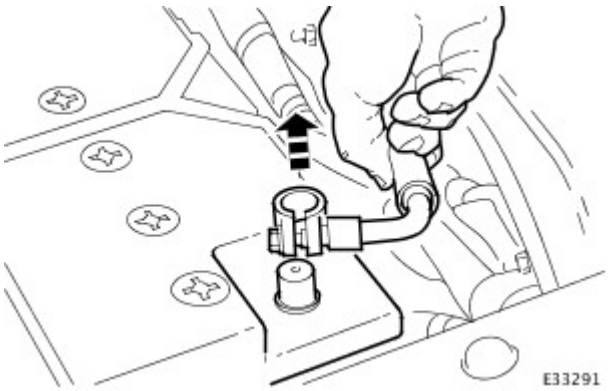
    - Refer to the Battery Reconnection Procedure 86.15.15.

Engine - Variable Camshaft Timing Oil Control Unit Housing LH

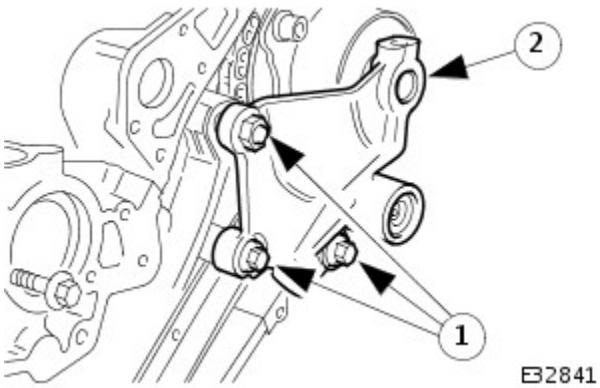
In-vehicle Repair

Removal

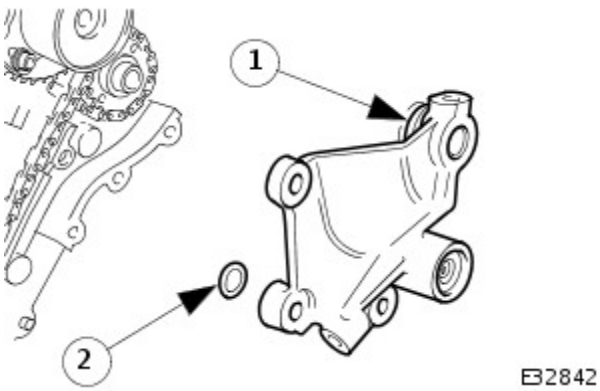
1. Open the engine compartment and fit paintwork protection sheets.
2. Set the engine compartment cover to the service access position.
3. Disconnect the battery ground cable.
   - Remove the battery cover.



4. Remove the Timing Cover. Refer to Operation 12.65.01 in this Section.
5. Remove the VVT bush carrier.
   1. Remove the two bolts and one nut which secure the carrier to the cylinder block.
   2. Release the carrier from the two ring dowels and remove it.



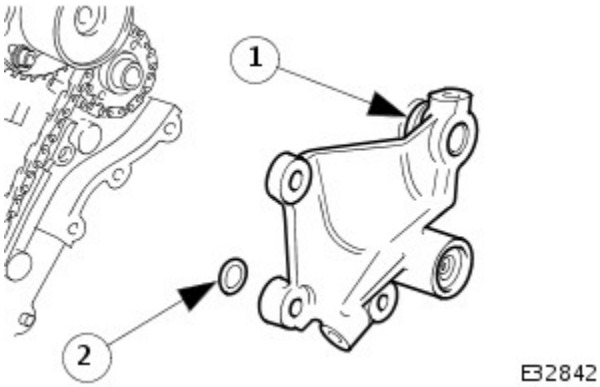
6. Remove the seals from the bush carrier.
   1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
   2. Remove the O-ring from the carrier oil-way recess.

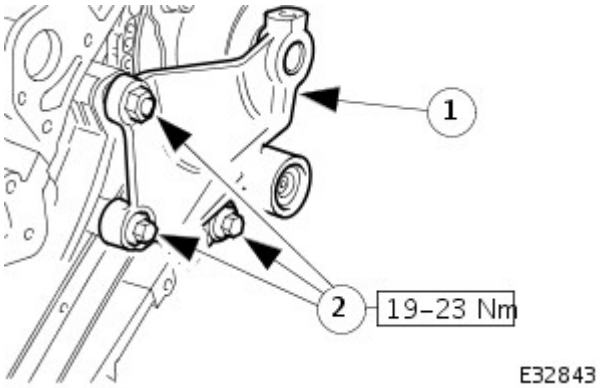


7. Clean and inspect all relevant components.

Installation

1. Fit new seals to the bush carrier.
   1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.
   2. Fit a new O-ring to the carrier oil-way.





2. Fit the bush carrier to the cylinder block.

- Lubricate the seal (scarf jointed) and the bush.

  1. Fit the bush carrier assembly.

- Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.

  2. Fit the two securing bolts and one nut. Tighten to 19-23 Nm.

3. Refit the Timing Cover. Refer to Operation 12.65.01 in this Section.

4. Move the engine compartment cover from the service position and connect the gas struts.

5. Remove the paint protection sheets and close the cover.

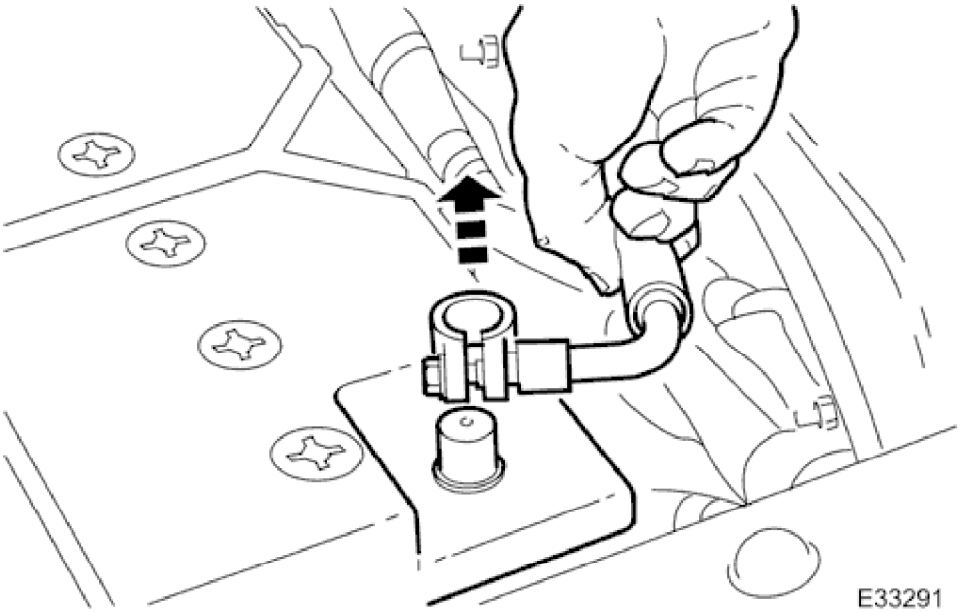
6. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Variable Camshaft Timing Oil Control Unit Housing RH 12.65.51
Removal

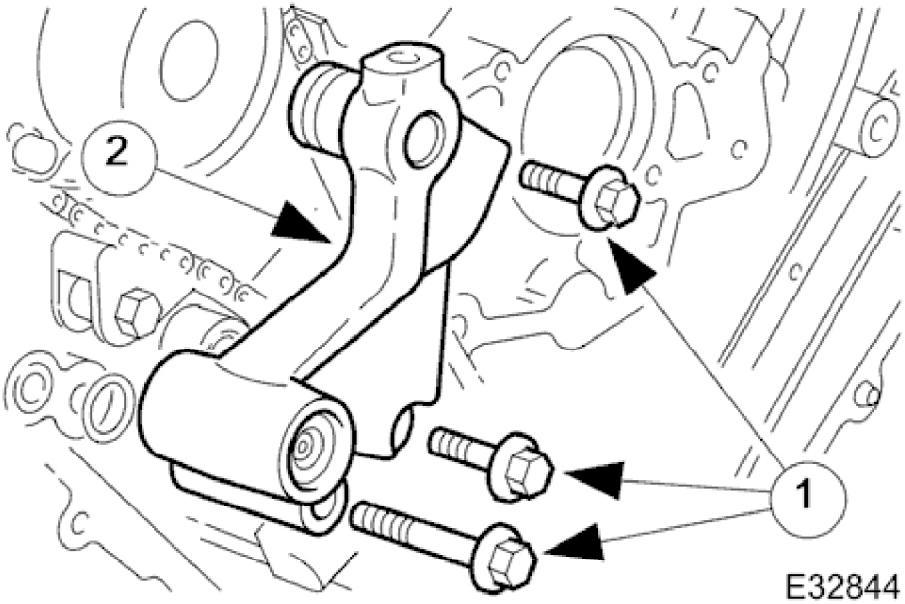
1. Open the engine compartment and fit paintwork protection sheets.

2. Set the engine compartment cover to the service access position.



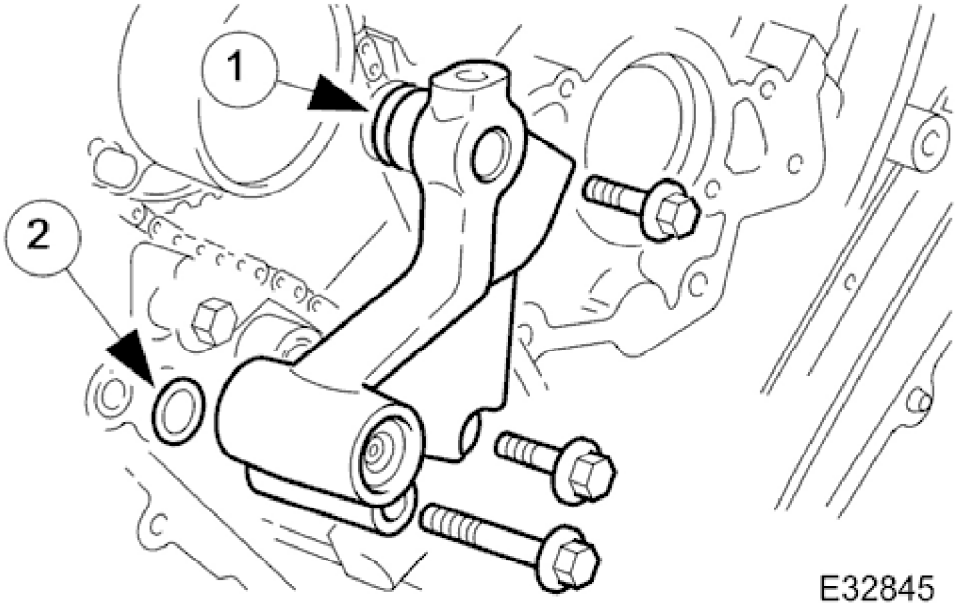
3. Disconnect the battery ground cable.
   - Remove the battery cover.

4. Remove the Timing Cover. Refer to Operation **<<12.65.01>>** in this Section.



5. Remove the VVT bush carrier.
   1. Remove the three bolts which secure the carrier to the cylinder block.

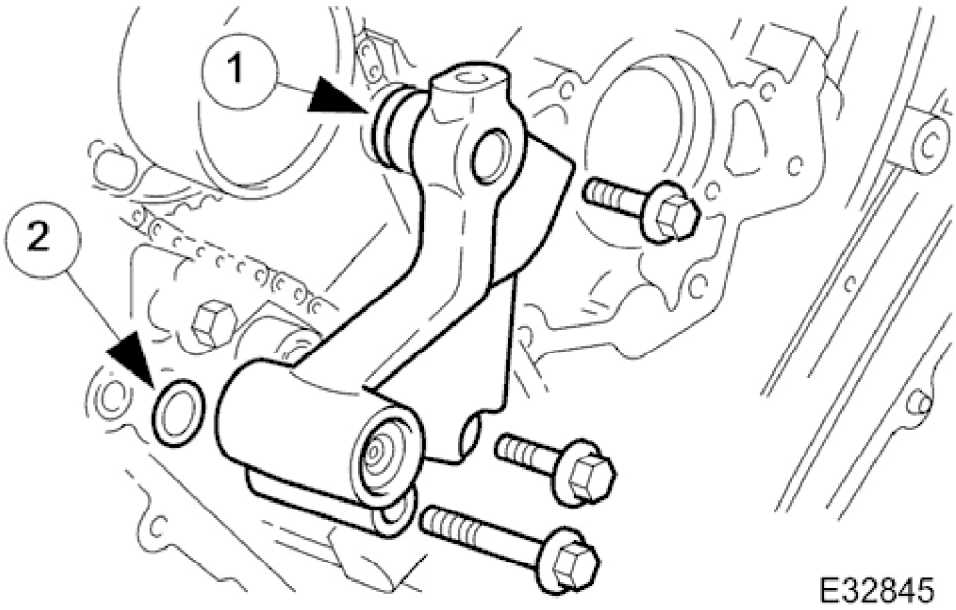
2. Release the carrier from the two ring dowels and remove it.



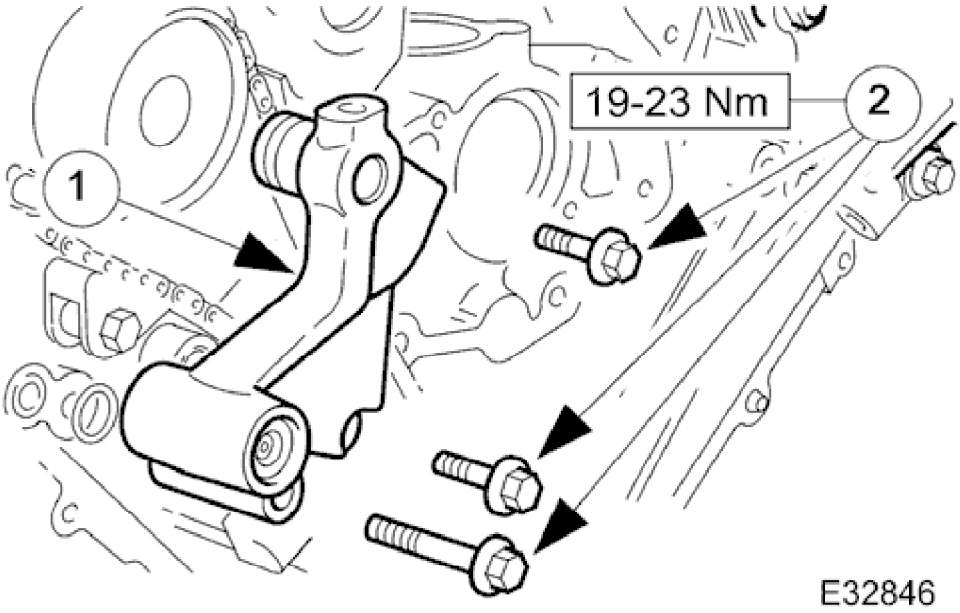
6. Remove the seals from the bush carrier.
    1. Remove the sealing ring (scarf jointed) from the carrier bush groove.
    2. Remove the O-ring from the carrier oil-way recess.

7. Clean and inspect all relevant components.

Installation



1. Fit new seals to the bush carrier.
    1. Fit the new sealing ring (scarf jointed) to the carrier bush groove.
    2. Fit a new O-ring to the carrier oil-way.



2. Fit the bush carrier to the cylinder block.
   - Lubricate the seal (scarf jointed) and the bush.
     1. Fit the bush carrier assembly.
   - Check that the seals are in place and that the ring dowels are engaged squarely. Fully locate the assembly as much as possible by hand pressure.
     2. Fit the three securing bolts. Tighten to 19-23 Nm.

3. Refit the Timing Cover. Refer to Operation **<<12.65.01>>** in this Section.

4. Move the engine compartment cover from the service position and connect the gas struts.

5. Remove the paint protection sheets and close the cover.

6. Connect the battery and fit the battery cover.
   - Refer to the Battery Reconnection Procedure **<<86.15.15>>**.

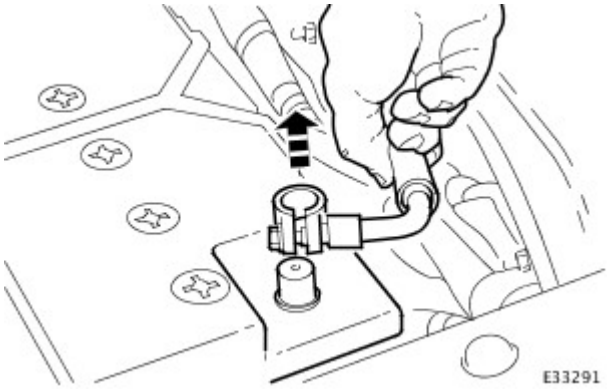
Engine - Engine

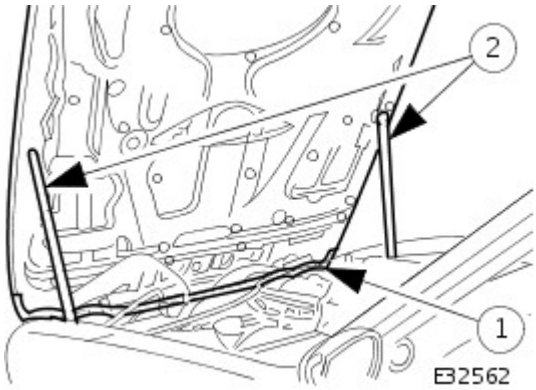
Removal

Special Tool(s)	
 E36403	Engine Lifting Brackets 303-536
 E36393	Quick Fit Connector Release Tool 310-044
 E36394	Quick Fit Connector Release Tool 310-054
 E34592	Quick Fit Connector Release Tool 303-623
 E36466	Fuel Injection Pressure Test Equipment 310-058

Removal

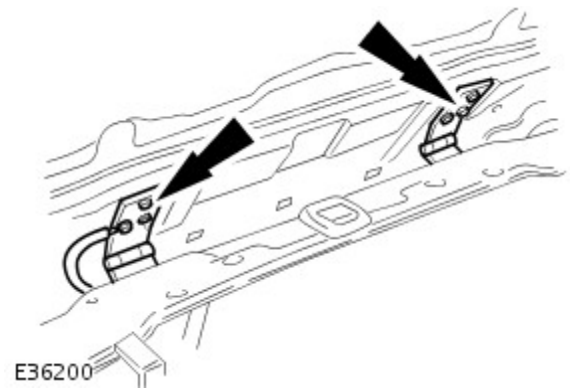
1. Park the vehicle on a four post ramp, over which, an overhead lifting crane is available, and set the gear selector to 'N'.
   - The crane should be rated at a minimum of 500 kg Safe Working Load and have sufficient fore and aft movement to traverse the engine assembly clear of the vehicle.
   - Do not apply the handbrake, but use wedges to chock one wheel to prevent movement of the vehicle.
2. Open the engine compartment and fit paintwork protection sheets.
3. Disconnect the battery ground cable.
   - Remove the battery cover.





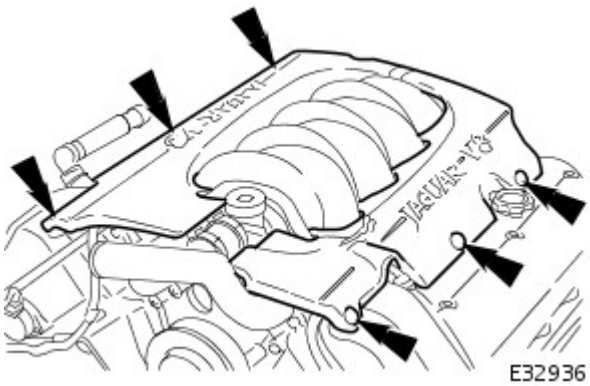
4. Remove the engine compartment cover (bonnet).

1. Apply masking tape to the front edge of the engine compartment cover to protect the paintwork during removal and storage.
2. With assistance, support the cover and release the gas struts.



5. With assistance, release the six bolts which retain the cover (bonnet) and lift the cover clear.

- Disconnect the ground cable from the left hand hinge.



6. Remove the engine covers

7. Drain the cooling system. Refer to Operation 26.10.01. Conserve as much of the coolant as possible to refill the system.

8. Depressurise the air conditioning system. Refer to Operation 82.30.30 and note all Warnings and Cautions.

• WARNINGS:

ENSURE THAT ALL FIRE PREVENTION PROCEDURES ARE ACTIVE.

BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.



9. Depressurise the fuel system.

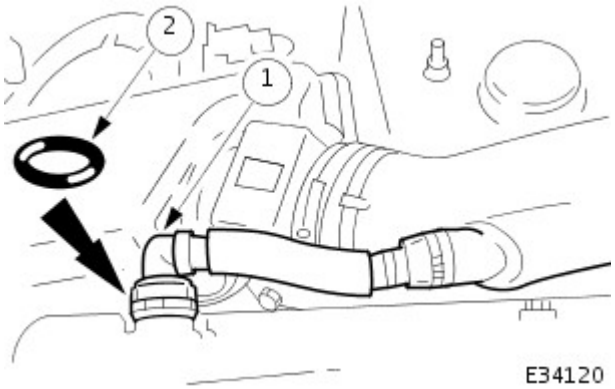
- Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
- Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.



10. Connect the fuel injection pressure test equipment 310 - 058 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

11. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. Refit the valve cap.

12. Disconnect the breather pipe from the A-Bank camshaft cover.



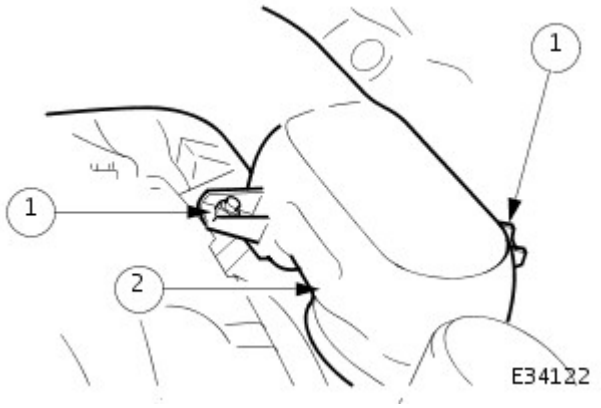
1. Disconnect the breather pipe from the stub pipe.
2. Remove and discard the O-ring seal from the breather pipe.

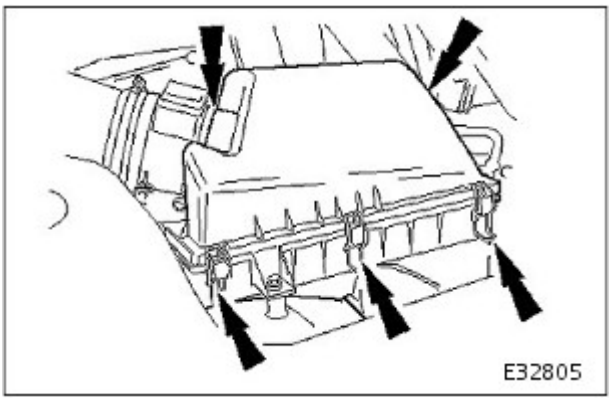
13. Disconnect the air flow meter multi-plug.

14. Cut and remove the strap which secures the vacuum pipe to the induction elbow.

15. Disconnect the intake tube from the throttle body.

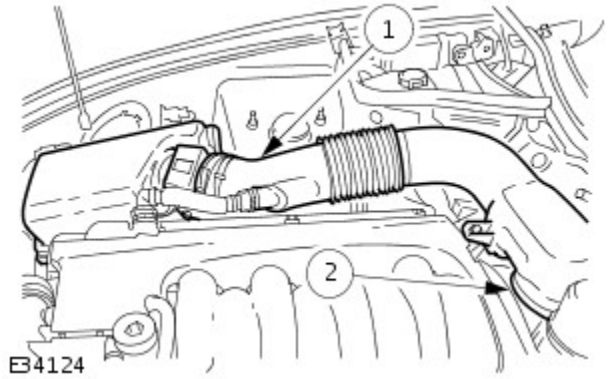
1. Remove the two bolts which secure the intake tube to the throttle body.
2. Disconnect the intake tube from the throttle body.





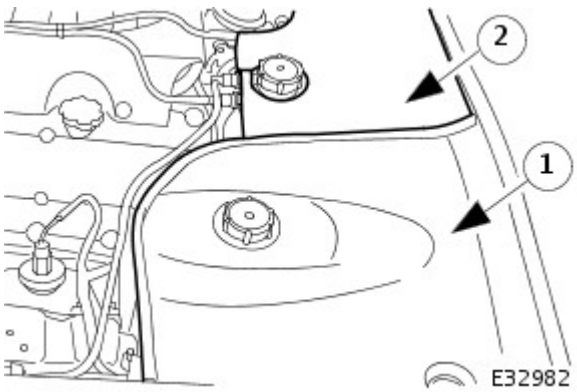
16. Disconnect the air cleaner cover.

- Remove the five clips which secure the air cleaner cover.



17. Remove the intake tube / air flow meter / air cleaner cover assembly.

1. Remove the intake tube / air flow meter / air cleaner cover assembly.
2. Remove and discard the rubber seal; air intake tube to throttle body.

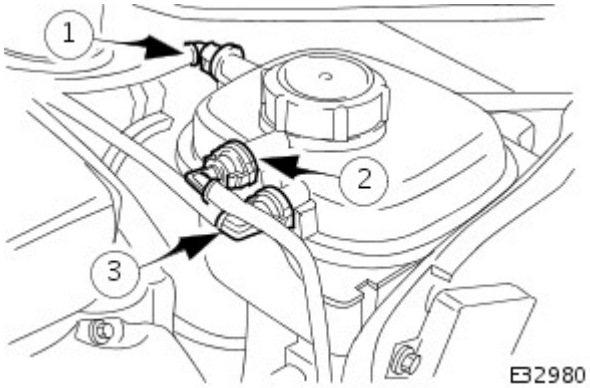


18. Remove the centre trim panel from the engine compartment.

1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.

19. Release the hoses (Quick Fit connections) from the expansion tank, using 303 - 623.

1. Release the hose, expansion tank to thermostat housing (coolant outlet pipe on supercharged engines).

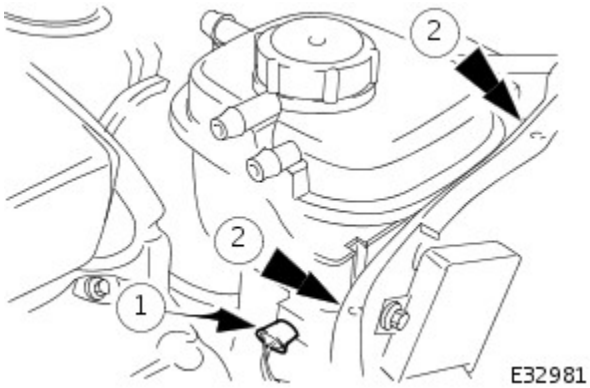


2. Release the hose, expansion tank to recovery tank.

3. Release the hose, expansion tank to radiator.

20. Fit blanking plugs to the pipes and the tank.

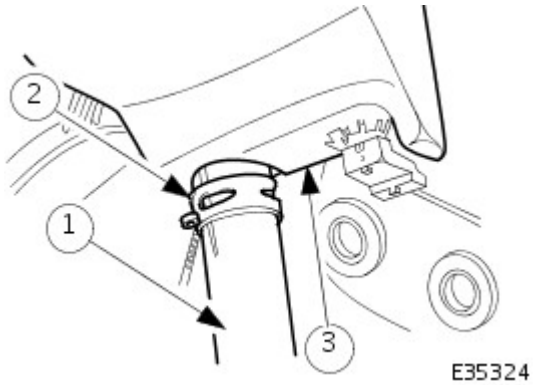
21. Remove the expansion tank from the mounting.



1. Disconnect the coolant level sensor connector.

2. Remove the nuts which secure the tank.

22. Remove the expansion tank from the vehicle.



1. It may be necessary to use a pipe clamp to clamp the bottom hose branch.

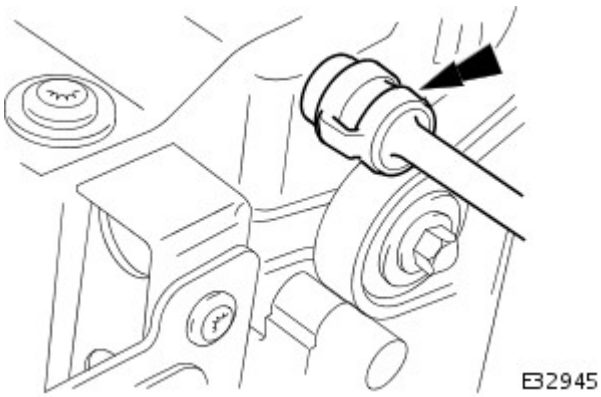
2. Release the pipe clip and move it along the pipe.

3. Disconnect the tank from the bottom hose and remove it from the vehicle.

23. Empty any remaining coolant from the expansion tank into a drain tray.

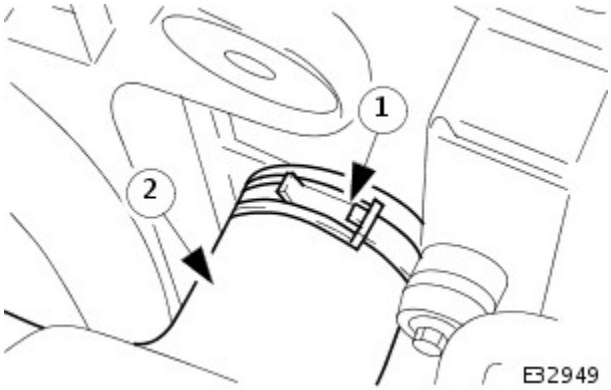
24. Remove the cloth from the engine and clean any spillage from the engine bay.

25. Disconnect the radiator breather hose.



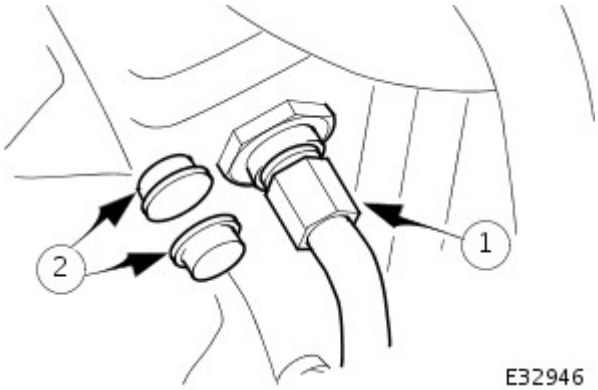
- Release the Quick-Fit hose (radiator to expansion tank) using 303 - 623, and disconnect the hose from the radiator.

26. Remove the twin fan and motor assembly. Refer to Operation 26.25.12.



27. Disconnect the radiator top hose.

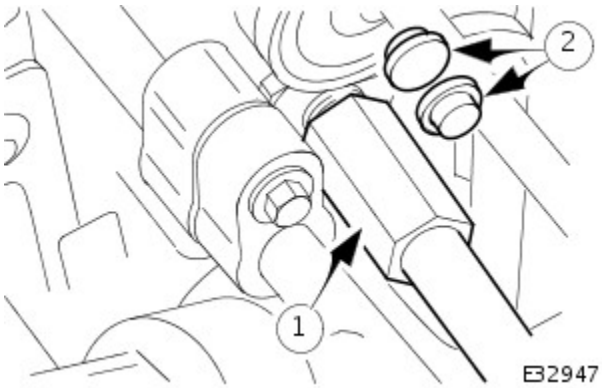
1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.



28. Disconnect the transmission oil cooler lower pipe.

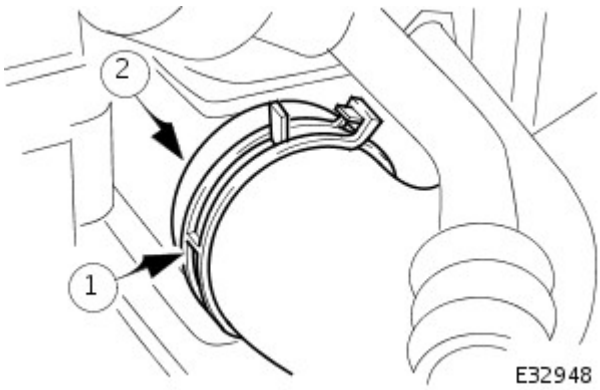
- Position a drain tray for the transmission fluid.

1. Disconnect and reposition the union nut, lower cooler pipe to radiator. Disconnect the pipe.
2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.



29. Disconnect the transmission oil cooler upper pipe.

1. Disconnect and reposition the union nut, upper cooler pipe to radiator. Disconnect the pipe.
2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.

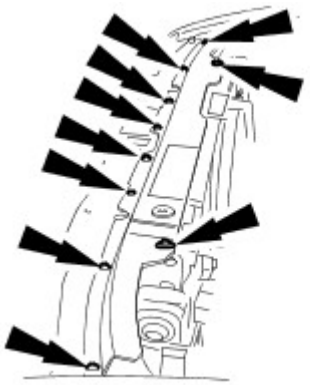


30. Disconnect the radiator bottom hose.

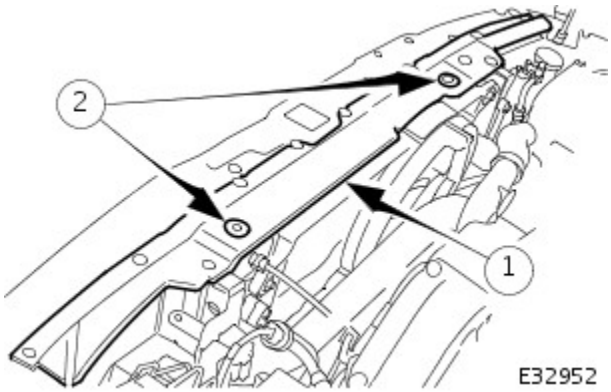
1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

31. Release the radiator top retaining panel.

- Remove the ten bolts which secure the panel.



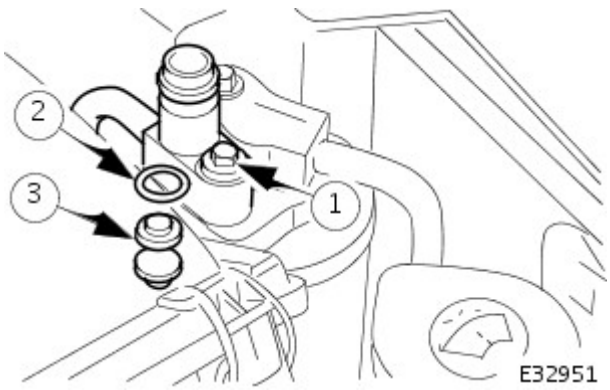
E35477



E32952

32. Remove the radiator top retaining panel.

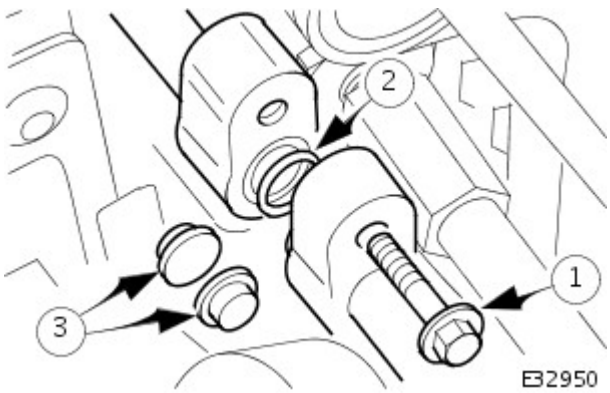
1. Remove the panel.
2. Remove the radiator top mounting bushes.



E32951

33. Disconnect the condenser jump hose from the receiver / drier.

1. Remove the bolt which secures the condenser jump hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.
3. Fit blanking plugs to the hose and to the receiver / drier.



E32950

34. Disconnect the discharge hose from the condenser.

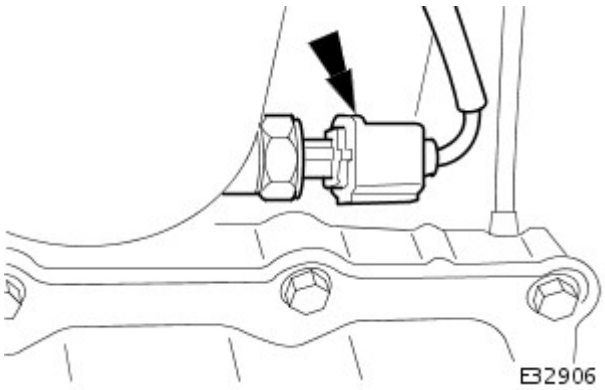
1. Remove the bolt which secures the condenser discharge hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.
3. Fit blanking plugs to the hose and to the condenser.

35. Remove the radiator.

- Remove the radiator assembly.
- Clean coolant spillage from the radiator.

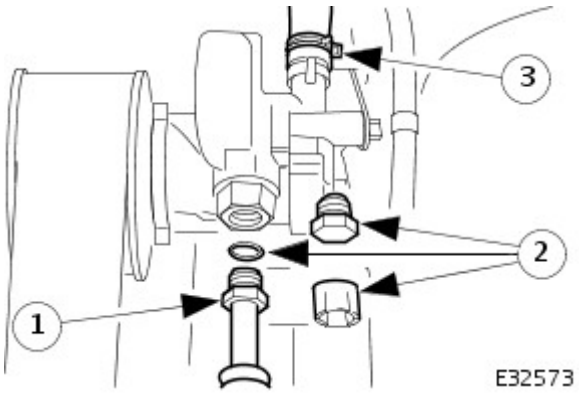


36. Disconnect the engine oil pressure transmitter.



37. Remove the filler cap from the power steering reservoir.

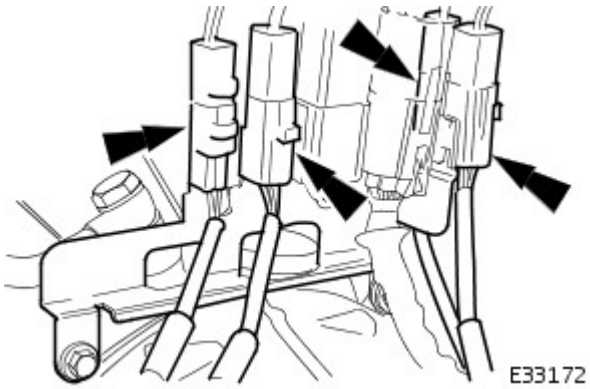
38. Disconnect the hoses from the power steering pump.



- Position a drain tray under the pump.

1. Release the high pressure hose union nut and drain the fluid.
2. Discard the O-ring seal and fit blanking plugs to the pipe and union.
3. Release the feed hose from the pump and fit blanking plugs to the pipe and union.

- Discard the fluid.



39. Release the Oxygen sensor multi-plugs from the mounting bracket and disconnect the plugs.

40. Remove the four nuts, each side, which secure the downpipe catalytic converters to the exhaust manifold.

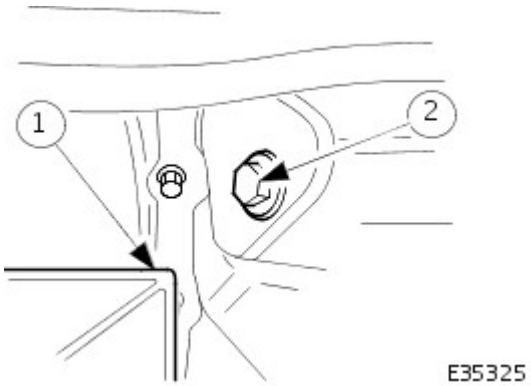


41. Raise the vehicle on the ramp.

42. Drain the engine oil.

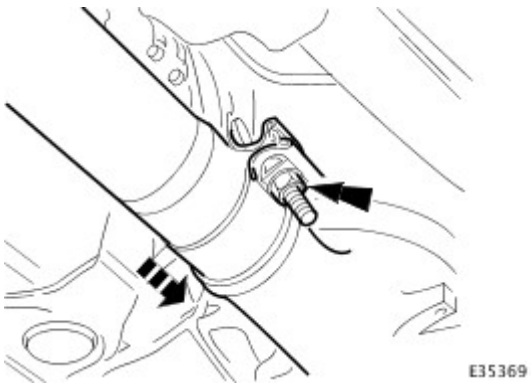
1. Position the waste oil bowser.
2. Remove the sump drain plug and drain the engine oil.

- Wipe the drain plug and refit it to the sump to prevent oil dripping.
- Move the oil bowser away from the vehicle.

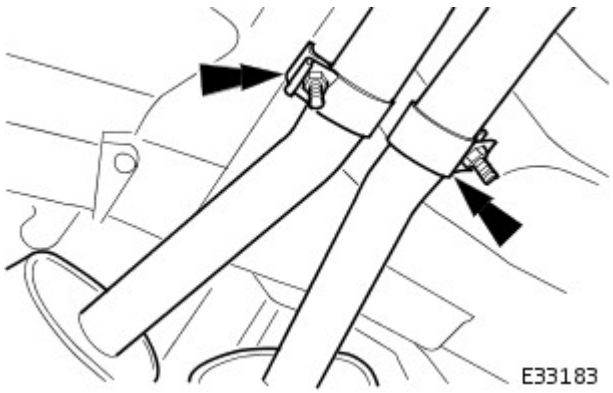


43. Move the front muffler forward to allow the intermediate mufflers to be displaced.

- Slacken the clamps (left-hand and right-hand sides), catalytic converter to front muffler.



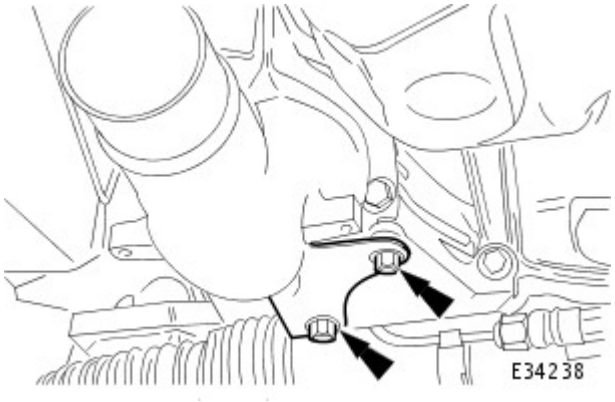
44. Slacken the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.



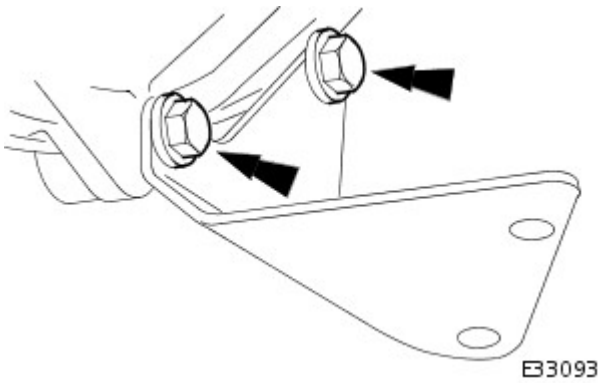
45. Remove the front muffler.

- Disconnect the front muffler from the intermediate mufflers and then from the downpipe catalytic converters.

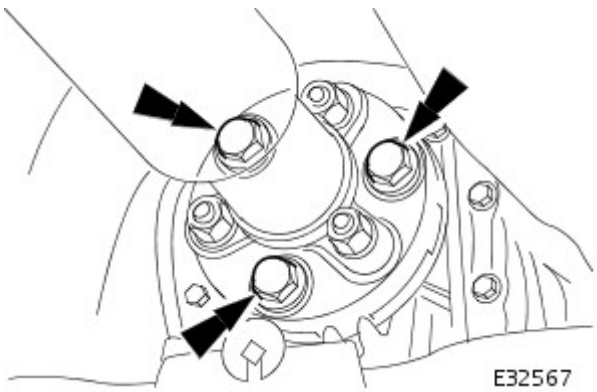
46. Remove the downpipe catalytic converters.



- Remove the bolts which secure the downpipe to the lower mounting bracket.
- Remove the downpipe assembly.
- Repeat the above operations for the other downpipe catalytic converter.



47. Remove the two bolts which secure each mounting bracket to the bell housing and remove the brackets.



48. Disconnect the driveshaft (propshaft) flange from the transmission output flange.

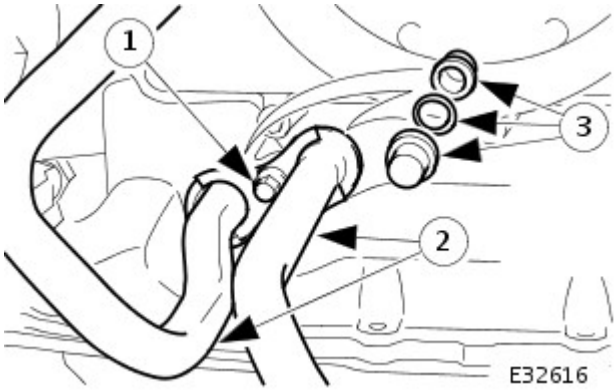
- Remove the three bolts which secure the flange. Rotate the shaft for access to each bolt.
- Disconnect the shaft and reposition it to the side.



49. Remove the securing bolt and disconnect the ground lead from the transmission casing.

50. Disconnect the oil cooler pipes (where fitted) from the engine.

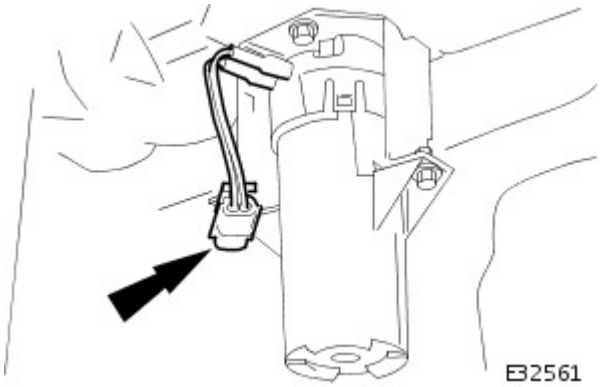
1. Remove the bolt which secures the pipe clamping plate. Remove the clamping plate.
2. Place a drain tray beneath the pipes and disconnect



the pipes. Allow the oil to drain.

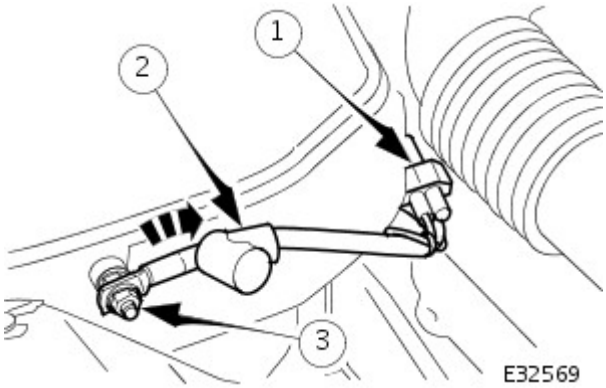
3. Remove the O-ring seals and fit blanking plugs to the pipes and to the mating unions on the engine.

51. Lower the ramp.



52. Disconnect the generator suppression module (where fitted) harness.

- Disconnect the harness multi-plug and reposition the harness from under the suppression module.



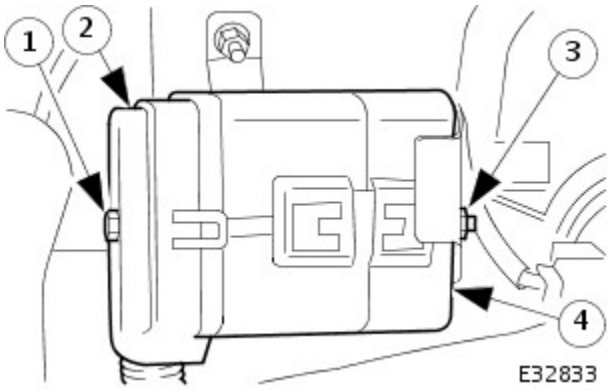
53. Disconnect the starter motor power cable, at the right hand side engine compartment enclosure.

1. Disconnect the multi-plug, engine management harness to starter motor.

2. Reposition the protective boot from the starter motor power stud.

3. Remove the nut and disconnect the power cable.

- Cut the tie strap which secures the power cable to the enclosure and route the cable into the engine bay.



54. Disconnect the P.I. harness from the engine management harness.

1. Release the bolt which secures the P.I. harness multi-plug to the engine management harness.

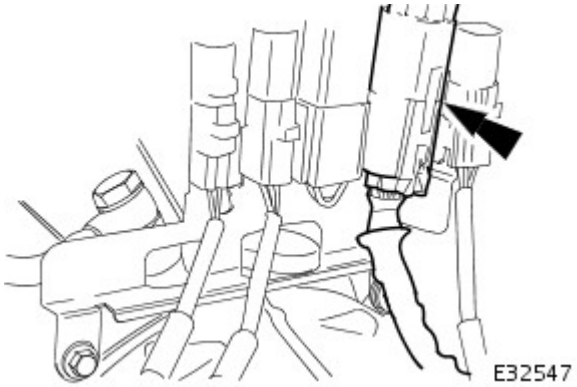
2. Disconnect the multi-plug.

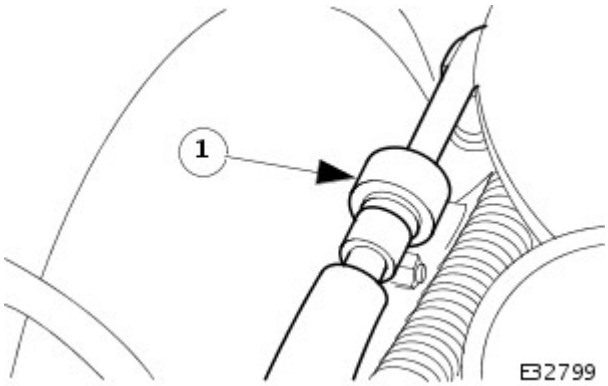
3. Remove the nut which secures the engine management harness multi-plug to the mounting bracket.

4. Reposition the multi-plug from the bracket.

55. Disconnect the transmission rotary switch harness connector.

- Reposition and disconnect the harness multi-plug.

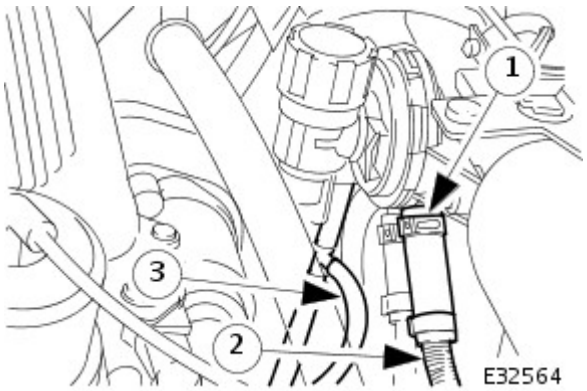




56. Disconnect the fuel feed and return hoses.

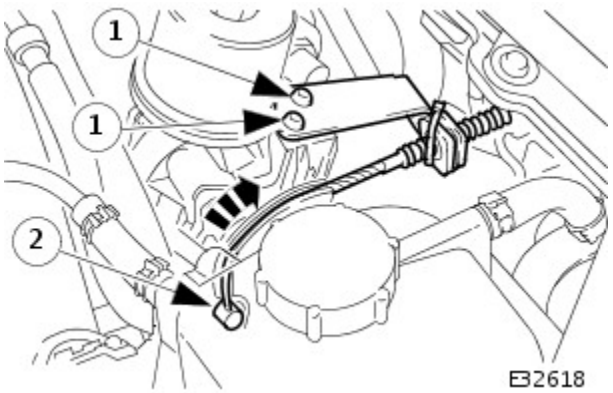
1. Disconnect the fuel hoses at the Quick Fit connectors, using special tool 310 - 044 for the feed hose and 310 - 54 for the return hose.

- Disconnect the return hose from the feed hose clip.
- Fit blanking plugs to the pipes.



57. Disconnect the pipes from the purge valve.

1. Remove the clip which secures the part load breather hose to the purge valve.
2. Disconnect the part load breather hose.
3. Disconnect the vacuum hose from the purge valve and reposition the hose.

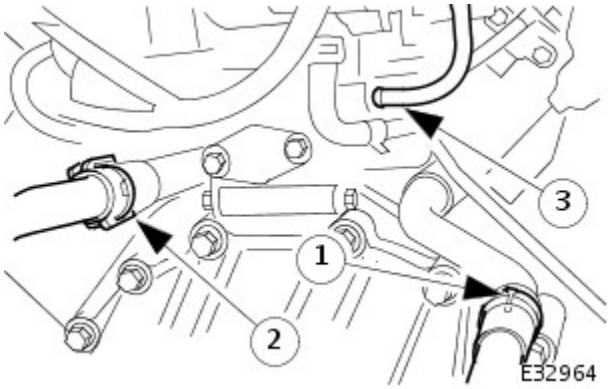


58. Disconnect the throttle cable.

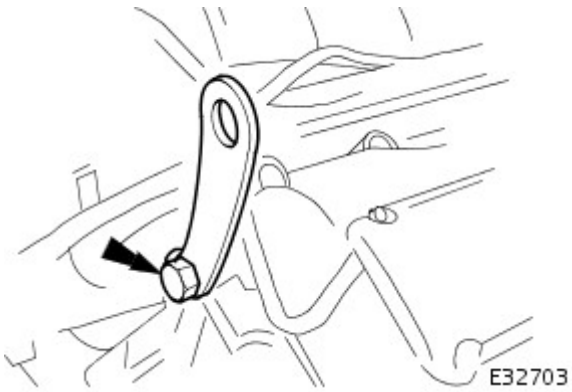
1. Secure the cable abutment to the bracket with tape or a ratchet strap, if necessary (to save subsequent adjustment procedure). Remove the bolts which secure the abutment bracket to the throttle body.
2. Rotate the butterfly actuator cam and disconnect the cable. Reposition the cable.

59. Disconnect the heater and brake servo hoses.

1. Disconnect the heater return hose.
2. Release the heater feed hose locking lever and disconnect the hose.



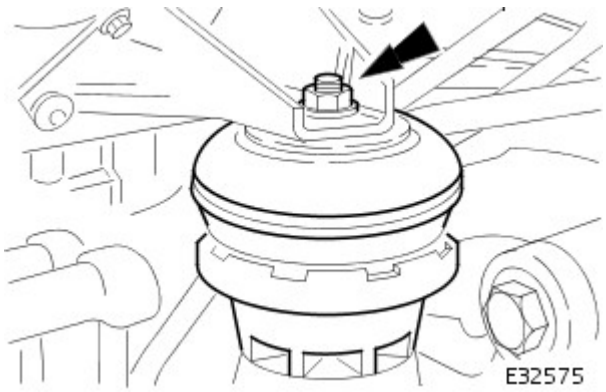
3. Disconnect the brake servo hose.



60. Fit engine rear lifting eyes (303 - 536).

61. Traverse the hoist to the engine compartment and lower it to working height.

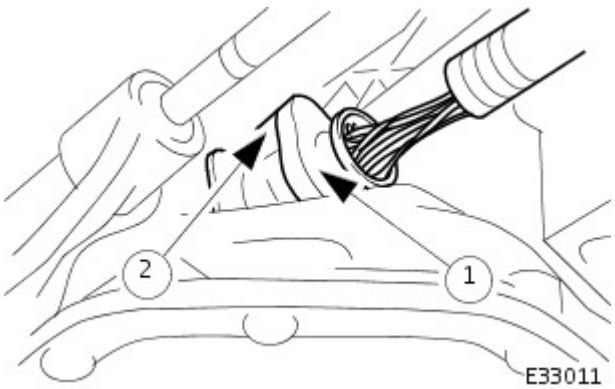
62. Fit lifting chains to the hoist and connect to each engine lifting eye. Use longer chains to the rear lifting eyes to allow the engine to tilt rearwards when removing from the vehicle.



63. Remove the engine front mounting nuts.

64. Raise the ramp.

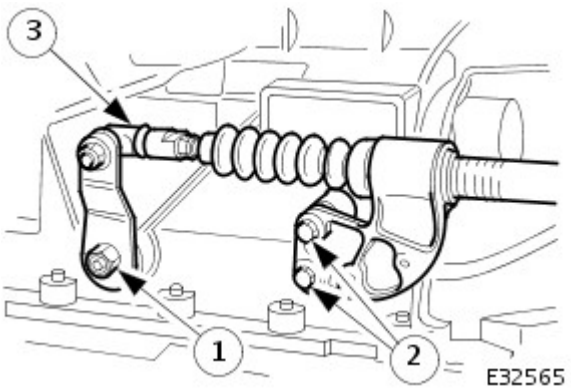
65. Disconnect the transmission connector.



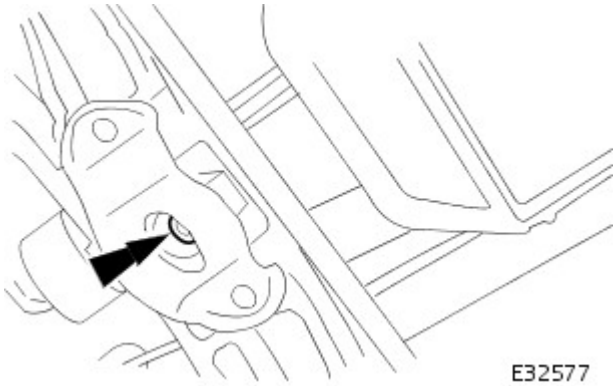
1. Release the lever lock on the transmission harness multi-plug.

2. Disconnect the connector.

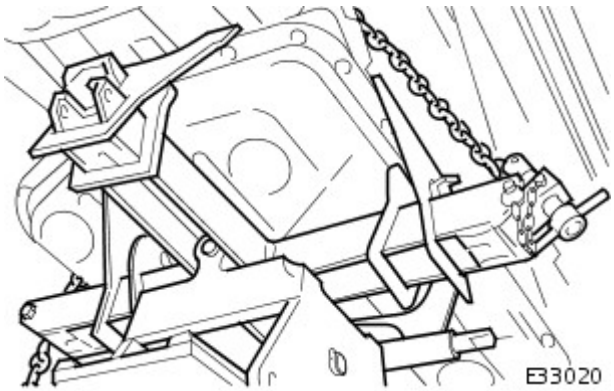
66. Disconnect the transmission selector cable.



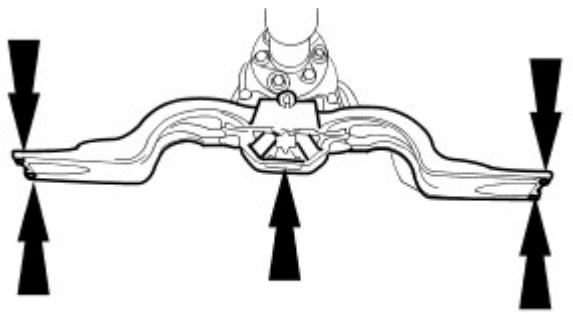
1. Remove the nut which secures the selector lever to the transmission cross shaft.
2. Remove the selector cable abutment bolts.
3. Disconnect the selector arm from the cross shaft.



67. Loosen the bolt which secures the engine rear mounting rubber to the transmission.



68. Position a transmission jack e.g. Epco V100 and raise the support bed of the jack to take the weight of the transmission. Fit and adjust the chains to secure the transmission to the jack.

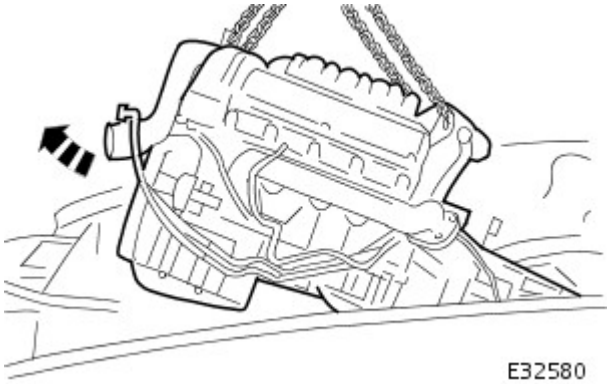


69. Remove the engine rear mounting assembly.

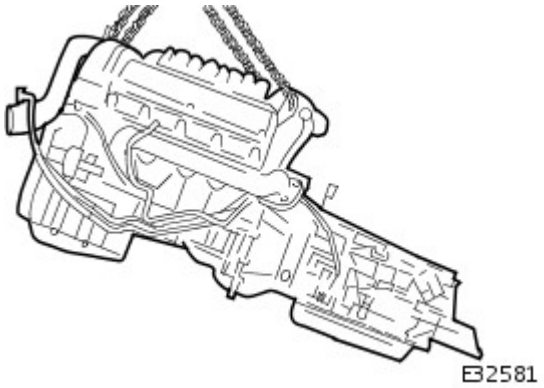
- Remove the mounting centre bolt.
- Remove the four bolts which secure the crossmember to the body.
- Remove the crossmember and mounting assembly.

70. Release the engine and transmission assembly from the engine compartment.

- Take the weight of the engine / transmission with the hoist and move it towards the front of the vehicle.
- Lower the transmission jack slightly to release the securing chains. Remove the jack from below the vehicle.



- Remove the engine and transmission assembly, upwards and forwards, from the vehicle.



71. Remove the engine and transmission assembly from the vehicle.

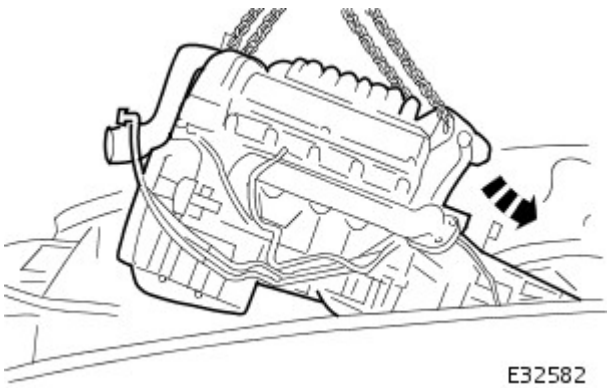
- Operate the crane controls and the ramp simultaneously (with assistance) to lower the vehicle to a convenient working height.
- Traverse the crane clear until the assembly can be lowered.

Engine - Engine

Installation

Special Tool(s)	
 E36403	Engine Lifting Brackets 303-536
 E36393	Quick Fit Connector Release Tool 310-044
 E36394	Quick Fit Connector Release Tool 310-054
 E34592	Quick Fit Connector Release Tool 303-623
 E36466	Fuel Injection Pressure Test Equipment 310-058

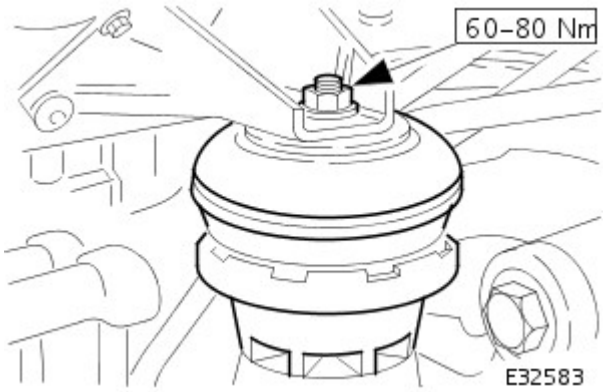
Installation


E32582

1. Position the engine into the engine compartment.

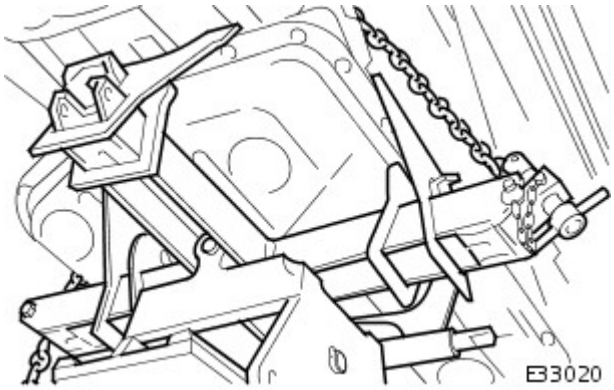
- Traverse the engine / transmission assembly to the vehicle and lower the assembly into the engine compartment and onto front mounting locations.

2. Align the engine front mountings.

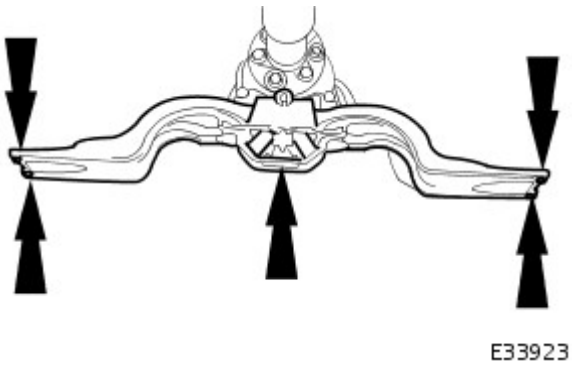


- Align the engine front mountings and fit the securing nuts.
- Tighten to the stated torque value.

3. Operate the crane controls and the ramp simultaneously (with assistance) to raise the vehicle to a convenient working height.

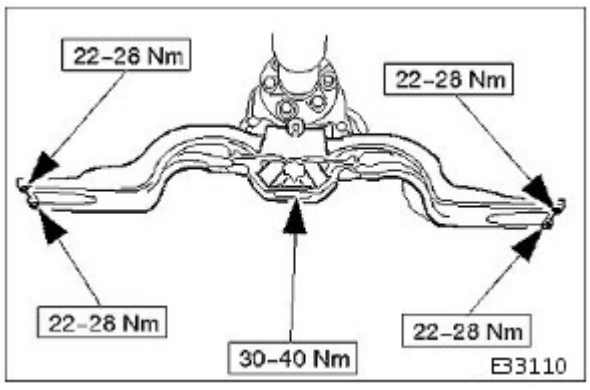


4. Position the transmission jack and raise it to take the weight of the transmission. Fit and adjust the chains to secure the transmission to the jack.



5. Fit the engine rear mounting bracket.

- Fit the four bolts which secure the crossmember to the body.
- Fit the bolt which secures the engine rear mounting rubber to the transmission.

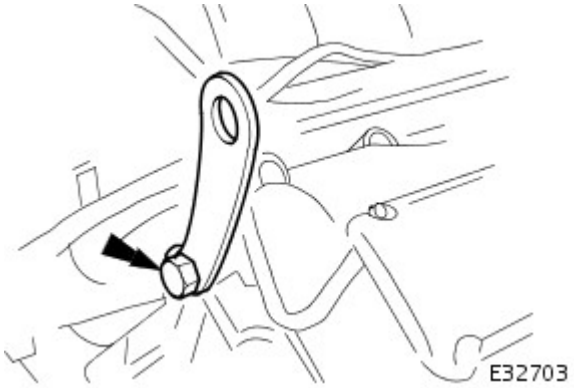


6. Tighten the rear mounting bolts to the stated torque figure.

7. Release and remove the transmission jack.

8. Operate the crane controls and the ramp simultaneously (with assistance) to lower the vehicle to a convenient working height.

9. Lower the crane and remove the chain assembly and lifting eyes.

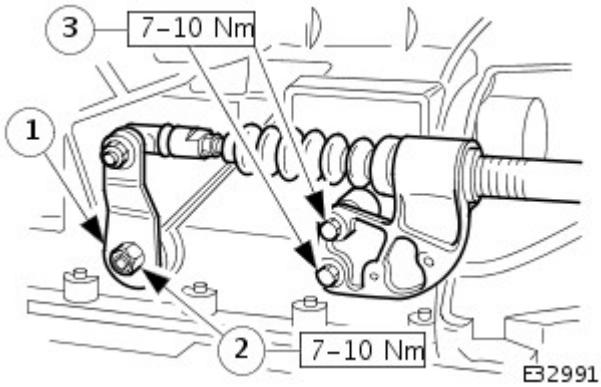


- Remove the engine rear lifting eyes.

10. Move the crane away from the vehicle.

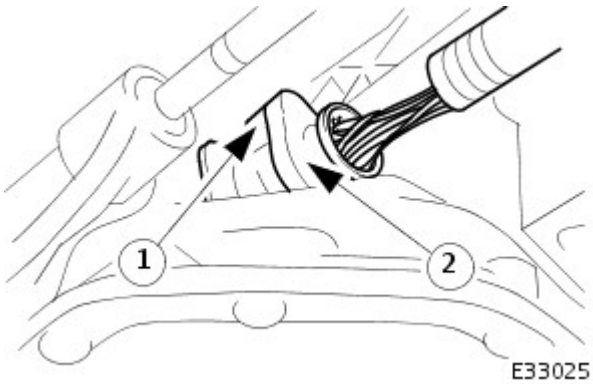
11. Raise the vehicle on the ramp.

12. Connect the transmission selector cable.



1. Fit the selector lever to the cross shaft.
2. Fit the nut which secures the selector lever to the transmission cross shaft.
3. Reposition the selector cable abutment bracket to the transmission and fit the securing bolts.

13. Connect the transmission harness connector.



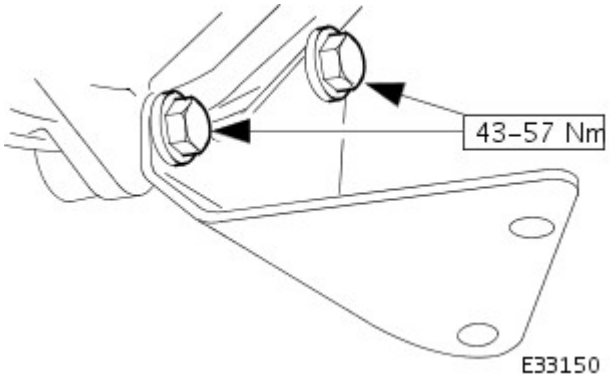
1. Connect the transmission harness connector.
2. Secure the lever lock mechanism.

14. Reposition the ground lead to the transmission casing and fit the securing bolt.

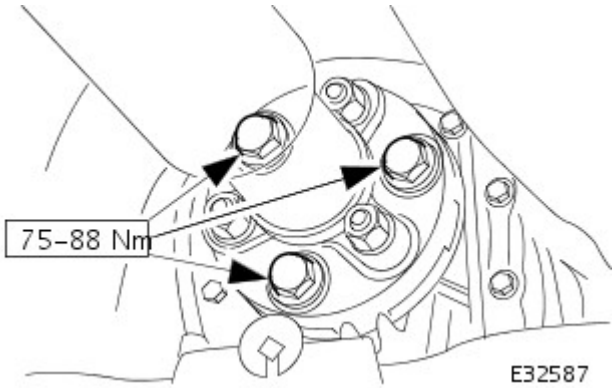


15. Fit the brackets which support the downpipe catalytic converters to the bell housing.

- Position the mounting bracket and fit the two bolts which secure it to the bell housing.

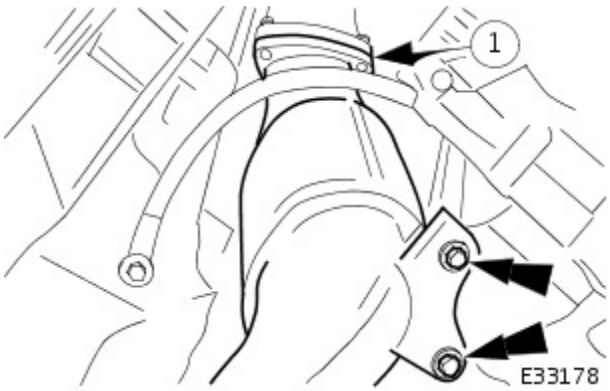


- Repeat the above procedure for the other side.



16. Connect the driveshaft (propshaft) flange to the transmission output flange.

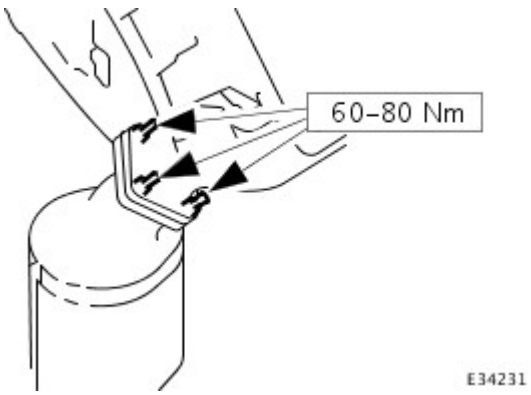
- Fit the three bolts which secure the flange.



17. Fit the downpipe catalytic converters.

1. Fit a new gasket to the downpipe flange and fit the downpipe assembly. to the manifold.

- Fit the bolts which secure the downpipe to the lower mounting bracket.
- Repeat the above operations for the other downpipe catalytic converter.

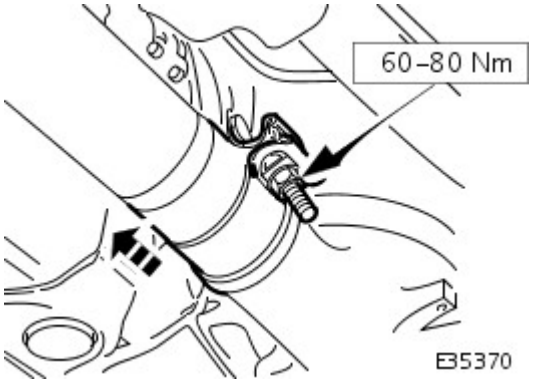


18. From above the vehicle, tighten the manifold flange nuts, A-Bank and B-Bank flanges, to the correct torque.

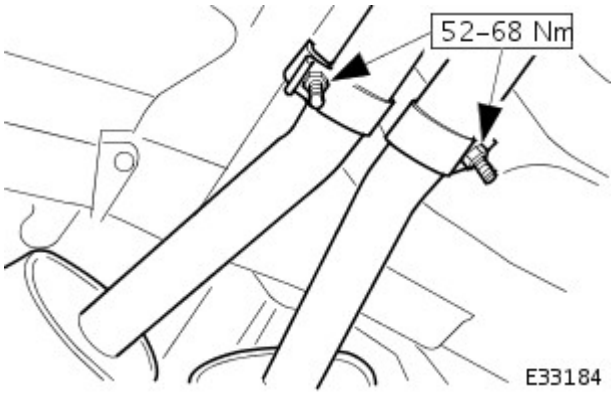
19. Fit the front muffler assembly.

- Locate the front muffler into the downpipe catalytic converters.

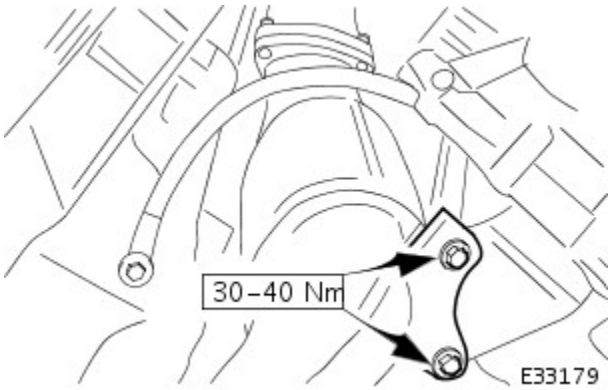
20. Move the front muffler forward to allow the intermediate mufflers to be connected.



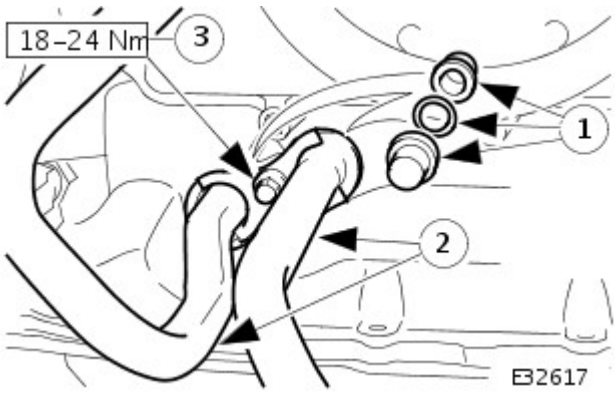
- Connect the front muffler to the intermediate muffler, noting the alignment of the indicator rings.
- With the front muffler positioned correctly, tighten the clamps (left-hand and right-hand sides) to the catalytic converter.



21. Tighten the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.



22. Tighten the downpipe bracket securing bolts to the correct torque



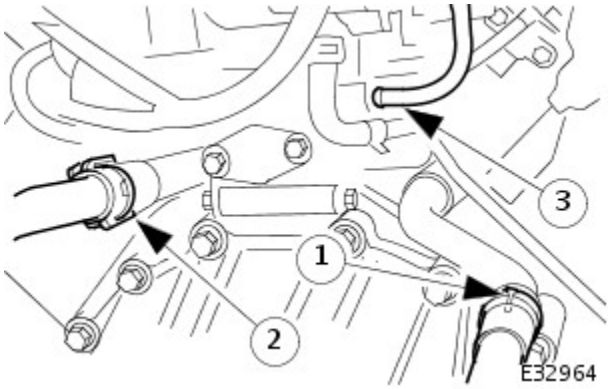
23. Connect the oil cooler pipes (where fitted) to the engine.

1. Remove the blanking plugs from the pipes and from the mating unions on the engine.
2. Fit new O-ring seals to the pipes and lubricate with new engine oil.
3. Connect the pipes to the engine and fit the clamping plate and bolt.

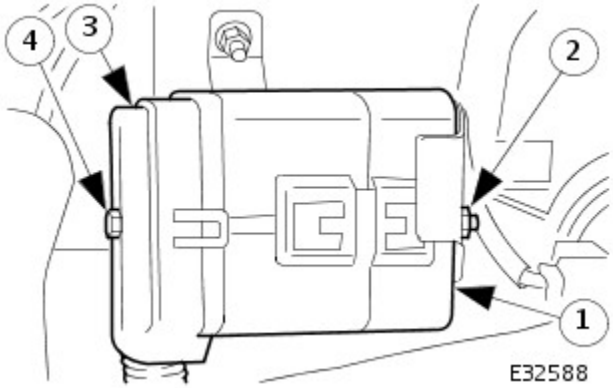
24. Lower the vehicle on the ramp.

25. Connect the heater and brake servo hoses.

1. Connect the heater return hose.
2. Connect the heater feed hose and secure the locking lever.

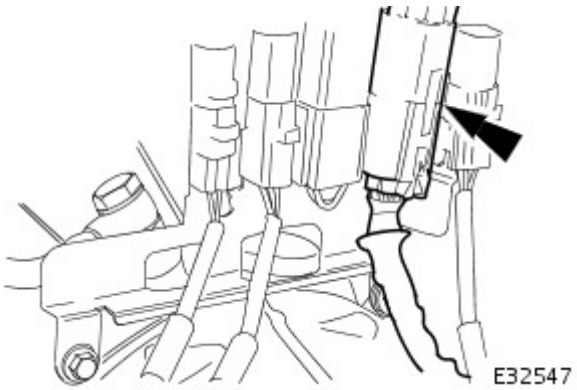


3. Connect the brake servo hose.



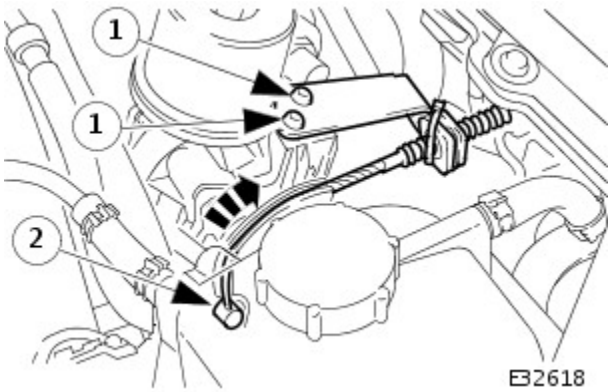
26. Connect the P.I. harness to the engine management harness.

1. Reposition the engine management harness connector to the bracket.
2. Fit the nut which secures the engine management harness connector to the mounting bracket.
3. Connect the connectors.
4. Fit the bolt which secures the P.I. harness connector to the engine management harness.



27. Connect the transmission rotary switch harness connector.

- Reposition and connect the harness.



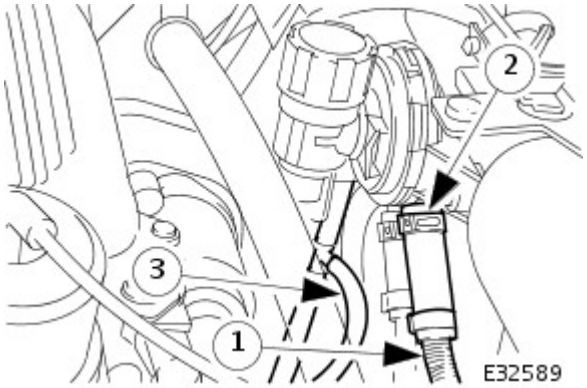
28. Connect the throttle cable.

1. Fit the bolts which secure the abutment bracket to the throttle body. Tighten to 4-6 Nm.
2. Rotate the butterfly actuator cam and connect the cable. Reposition the cable into the cam.

- Remove any tape or plastic strap which was fitted when disconnecting the cable abutment.

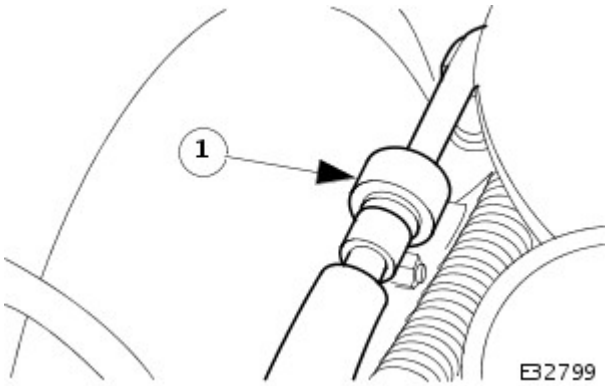
29. Connect the pipes to the purge valve.

1. Connect the part load breather hose.
2. Fit the clip which secures the part load breather hose to the purge valve.



3. Connect the vacuum hose to the purge valve.

WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

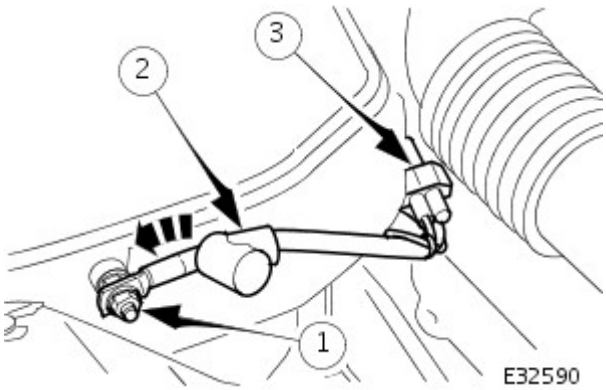


30. Connect the fuel feed and return hoses.

- Remove the blanking plugs from the mating pipes.

1. Connect the hoses at the Quick Fit connectors.

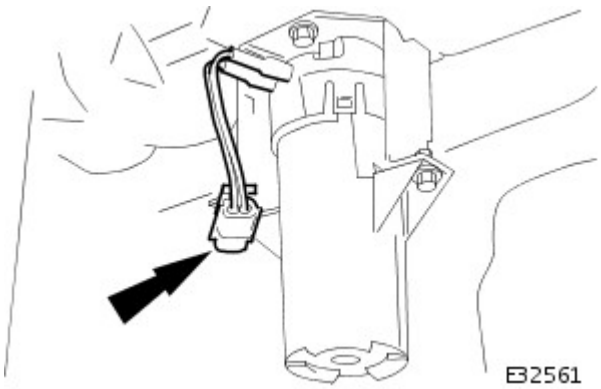
- Fit the return hose into the feed hose clip.



31. Connect the starter motor power cable.

1. Reposition and connect the power cable to the power stud. Fit the securing nut to the stud.
2. Reposition the protective boot over the starter motor power stud.
3. Connect the harness connector, engine management harness to starter motor. Fit the connector to the mounting bracket.

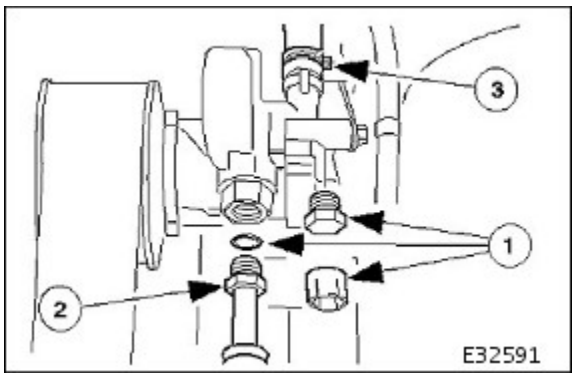
- Renew the tie strap which secures the power cable to the right hand enclosure.



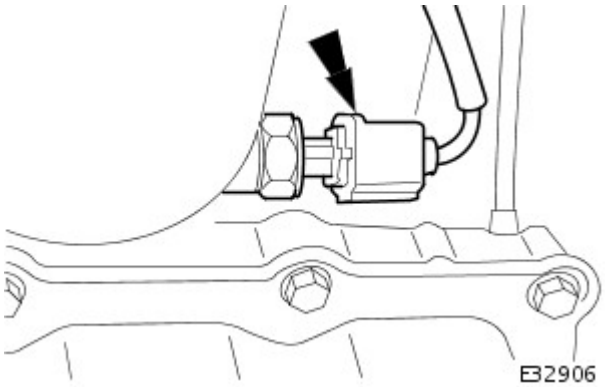
32. Connect the generator suppression module (where fitted) harness.

- Reposition the harness under the suppression module and connect the harness connector.

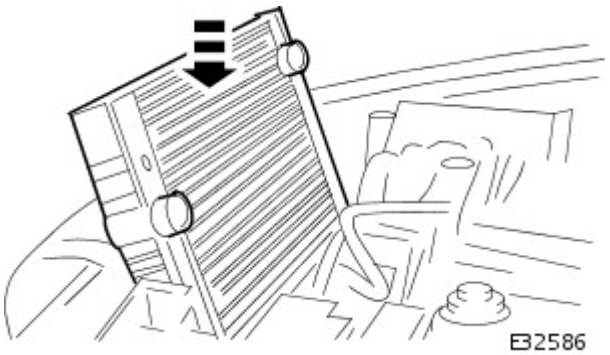
33. Connect the hoses to the power steering pump.



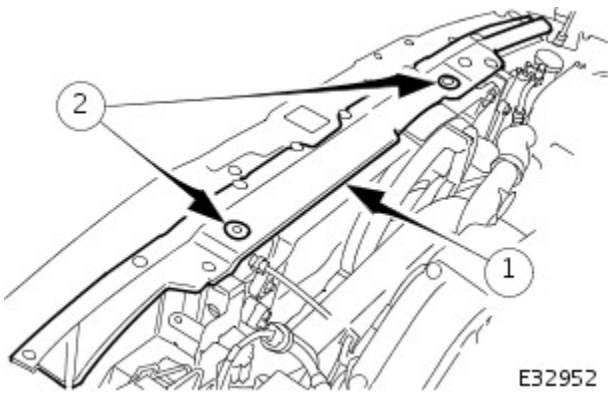
1. Remove the blanking plugs from the pipes and unions. Fit a new sealing washer to the high pressure hose joint.
2. Connect the high pressure hose union.
3. Connect the feed hose to the pump.



34. Connect the engine oil pressure transmitter.



35. Fit the radiator and condenser assembly. Check that the lower mounting rubbers are located correctly.

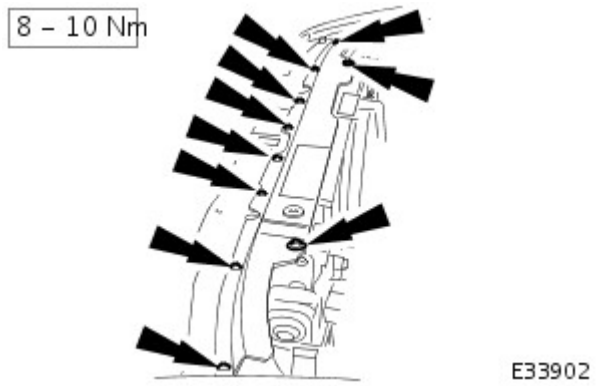


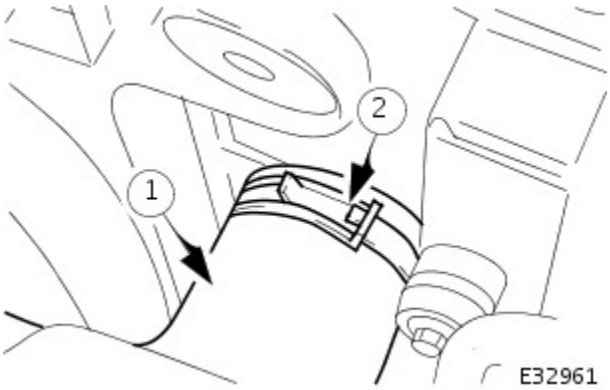
36. Fit the radiator top retaining panel.

1. Fit the panel.
2. Check that the radiator top mounting bushes are located correctly.

37. Fit the radiator top retaining panel.

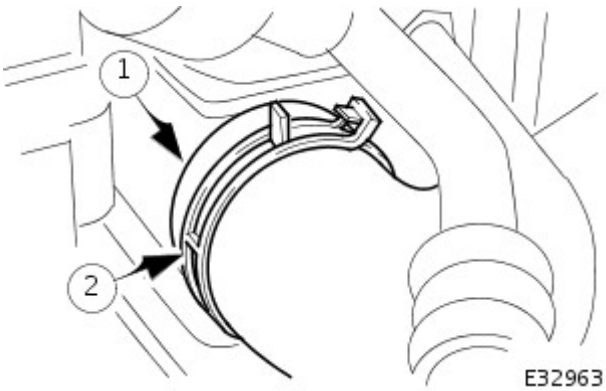
- Fit the ten bolts which secure the panel.





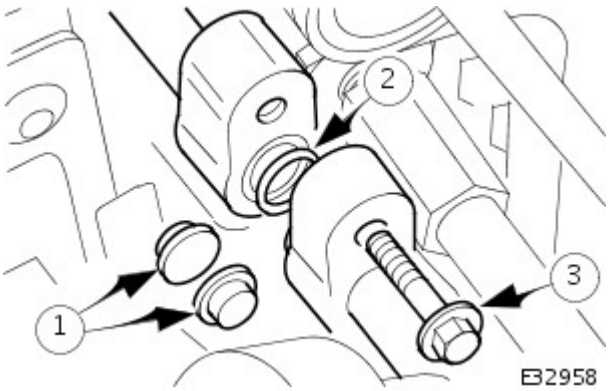
38. Connect the radiator top hose.

1. Connect the hose to the radiator.
2. Reposition and secure the hose retaining clip.



39. Connect the radiator bottom hose.

1. Connect the hose to the radiator.
2. Reposition and secure the hose retaining clip.

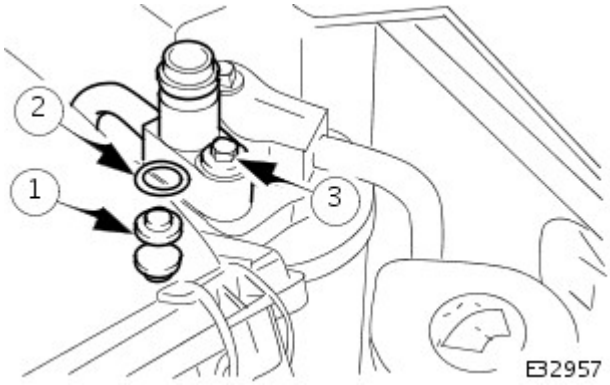


40. Connect the discharge hose to the condenser.

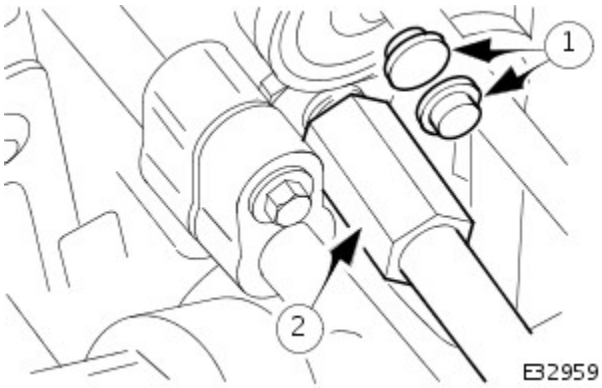
1. Remove the blanking plugs from the hose and condenser.
2. Fit and fully seat a new O-ring seal to the hose. Lubricate the seal with clean compressor oil
3. Fit the hose to the condenser and tighten the securing bolt.

41. Connect the jump hose to the receiver/drier.

1. Remove the blanking plugs from the hose and receiver/drier.
2. Fit and fully seat a new O-ring seal to the hose. Lubricate the seal with clean compressor oil



3. Fit the hose and tighten the securing bolt.

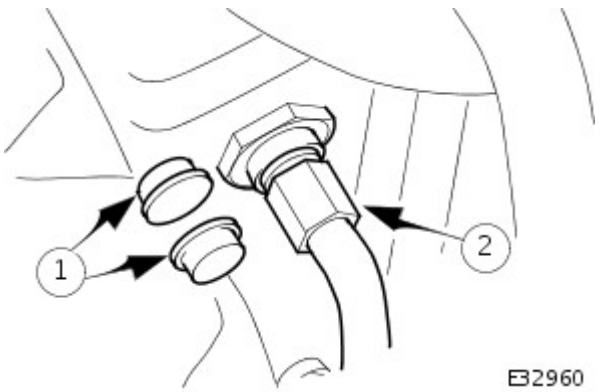


42. Connect the transmission oil cooler upper pipe.

1. Remove the blanking plugs from the pipe and the radiator.

- Fit and fully seat a new O-ring seal to the pipe. Lubricate the seal with clean transmission oil

2. Reposition and connect the union nut, upper cooler pipe to radiator.



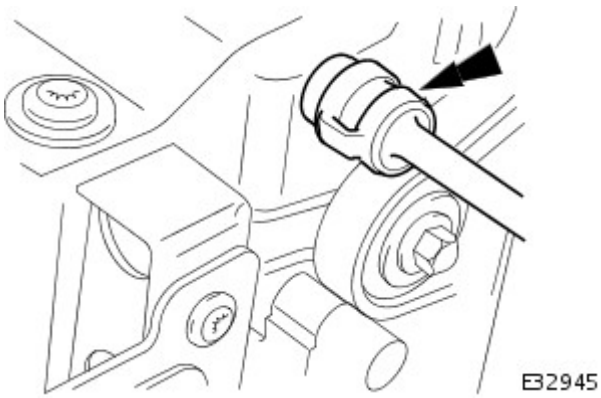
43. Connect the transmission oil cooler lower pipe.

1. Remove the blanking plugs from the pipe and the radiator.

- Fit and fully seat a new O-ring seal to the pipe. Lubricate the seal with clean transmission oil

2. Reposition and connect the union nut, lower cooler pipe to radiator.

44. Fit the twin fan and motor assembly. Refer to Operation 26.25.12.

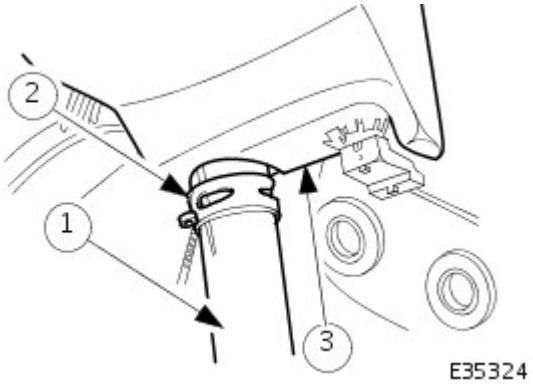


45. Connect the radiator breather hose.

- Reposition the Quick-Fit hose (radiator to expansion tank) and connect the hose to the radiator.

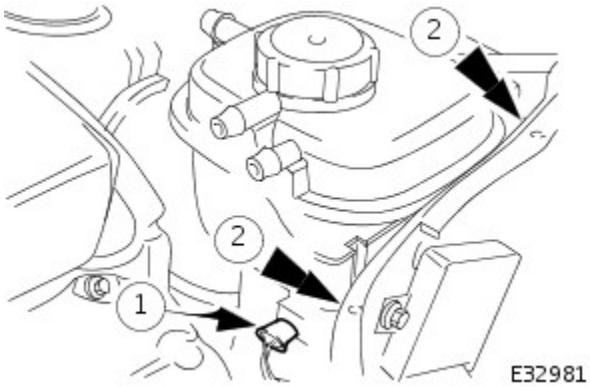
46. Fit the expansion tank to the vehicle.

1. Remove the pipe clamp if still in place and connect the hose to the expansion tank.



2. Reposition and secure the pipe clip.

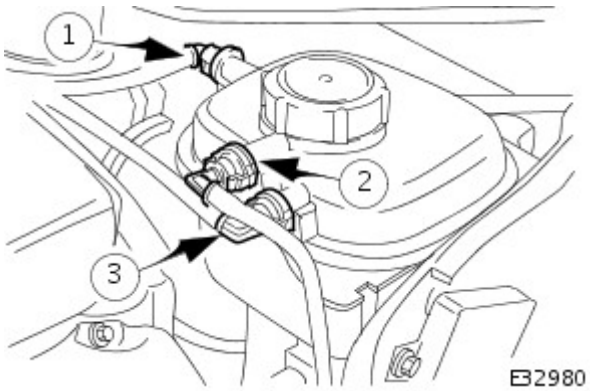
3. Position the expansion tank to the left side enclosure panel.



47. Fit the expansion tank securing nuts.

1. Connect the coolant level sensor connector.

2. Fit the nuts which secure the tank.



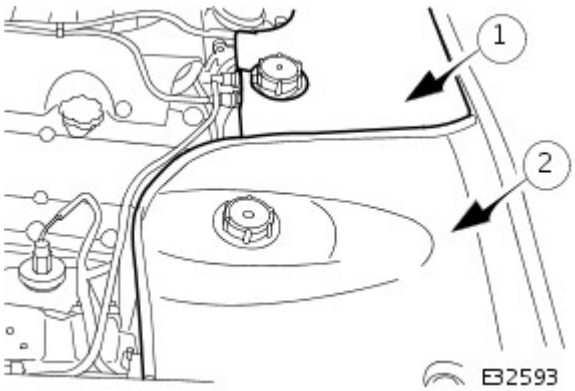
48. Connect the hoses (Quick Fit connections) to the expansion tank.

- Remove all blanking plugs from the pipes and the expansion tank.

1. Connect the hose, expansion tank to thermostat housing (coolant outlet pipe on supercharged engines).

2. Connect the hose, expansion tank to recovery tank.

3. Connect the hose, expansion tank to radiator.



49. Fit the trim panels to the engine compartment.

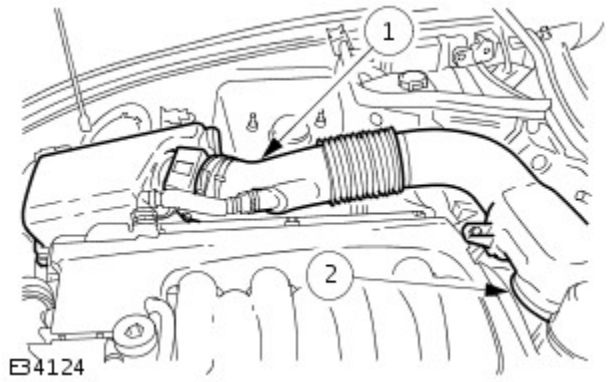
1. Locate the centre trim panel.

2. Fit the left hand side enclosure panel.

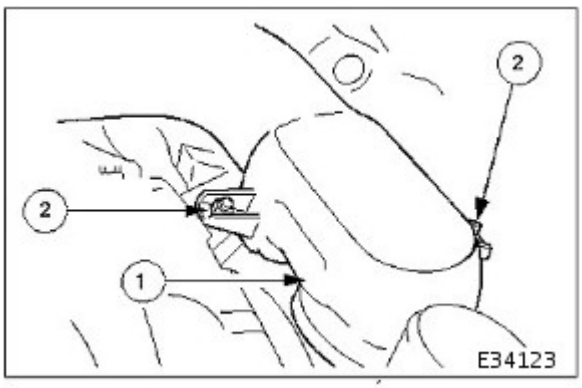
50. Fit the intake tube / air flow meter / air cleaner cover assembly.

1. Position the intake tube / air flow meter / air cleaner cover assembly.

2. Fit a new rubber seal and position the air intake tube

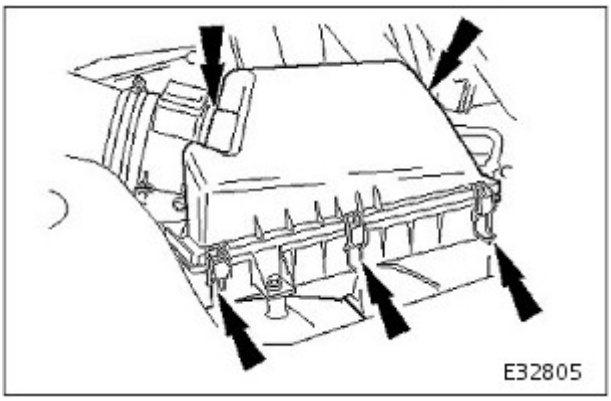


to the throttle body.



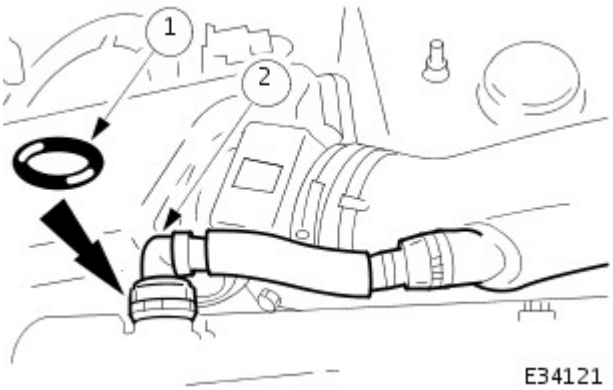
51. Connect the intake tube to the throttle body.

1. Fit a new seal and connect the intake tube to the throttle body.
2. Fit the two bolts which secure the intake tube to the throttle body.



52. Connect the air cleaner cover.

- Fit the five clips which secure the air cleaner cover.



53. Reconnect the breather pipe to the A-Bank camshaft cover.

1. Fit a new O-ring seal to the breather pipe.
2. Connect the breather pipe to the stub pipe.

54. Connect the air flow meter connector.

55. Fit a new Ty-strap to secures the vacuum pipe to the induction elbow.

56. Refill the cooling system. Refer to Operation 26.10.01.

57. NOTE: When the engine is started from cold and run for a short period only, before being switched off, a quantity of oil will

be 'hung up' within the engine because it is not up to operating temperature.

Should the oil level subsequently be topped-up, the level could become too high, causing oil burning.

Typically, 0.875L is hung up.

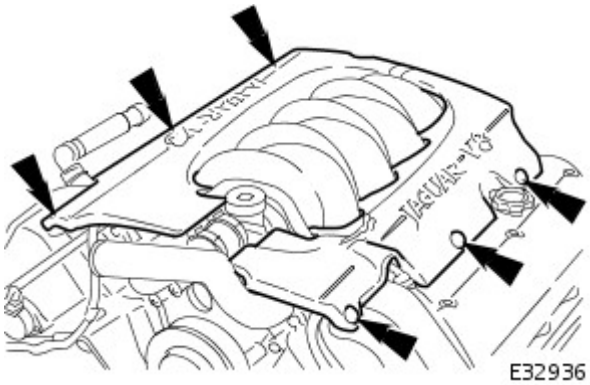
Refill the engine with the correct specification engine oil.

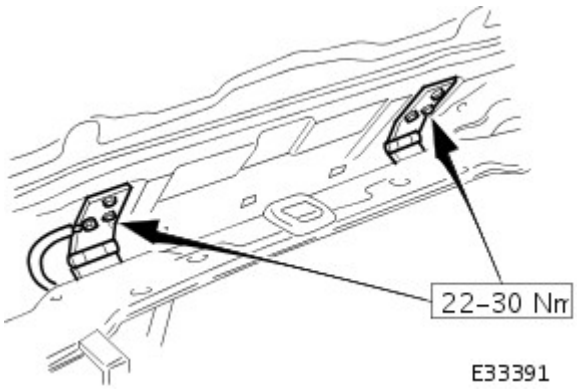
58. Refill the automatic transmission. Refer to Section 307-01A, Operation 44.24. 02.

59. Refill and bleed the power steering system. Refer to Section 211-02 General Procedures.

60. Repressurise the air conditioning system. Refer to Operation 82.30.30 and note all Warnings and Cautions.

61. Fit the engine covers.





62. With assistance, reposition the engine compartment cover (bonnet) and fit the six bolts; reconnect the ground lead to the original location on the left hand hinge.

- Reconnect the gas struts.
- Remove the masking tape from the front edge.

63. Remove the paintwork protection sheets and close the engine compartment cover.

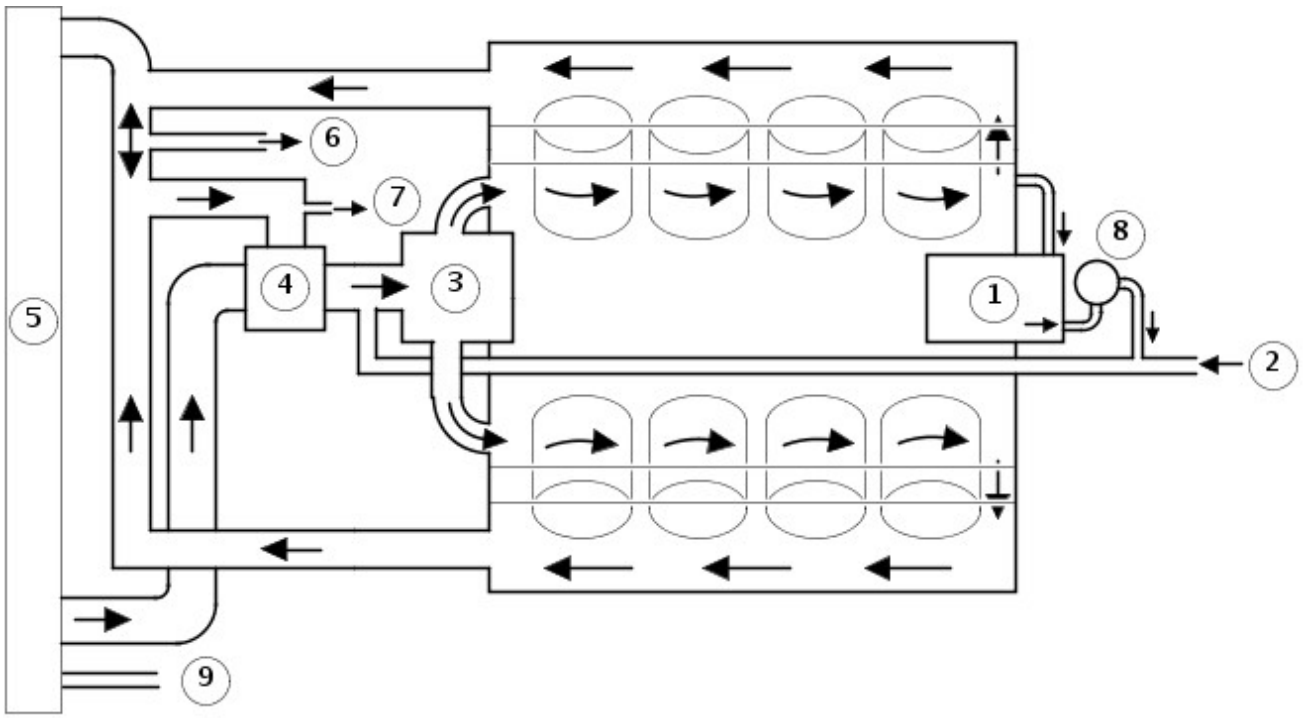
64. Reconnect the battery ground cable and fit the battery cover.

- Reset the clock and the radio information.

Engine Cooling - Engine Cooling

Description and Operation

Engine Cooling Components - Normally Aspirated Vehicles



E32979

Item	Description
1	Throttle Body
2	Heater Return
3	Coolant Pump
4	Thermostat Housing
5	Vehicle Radiator
6	Heater Supply
7	Bleed Outlet (to expansion tank)
8	EGR Valve (when fitted)
9	Bleed Outlet (to expansion tank)

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 temperature of the bores is increased.

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.

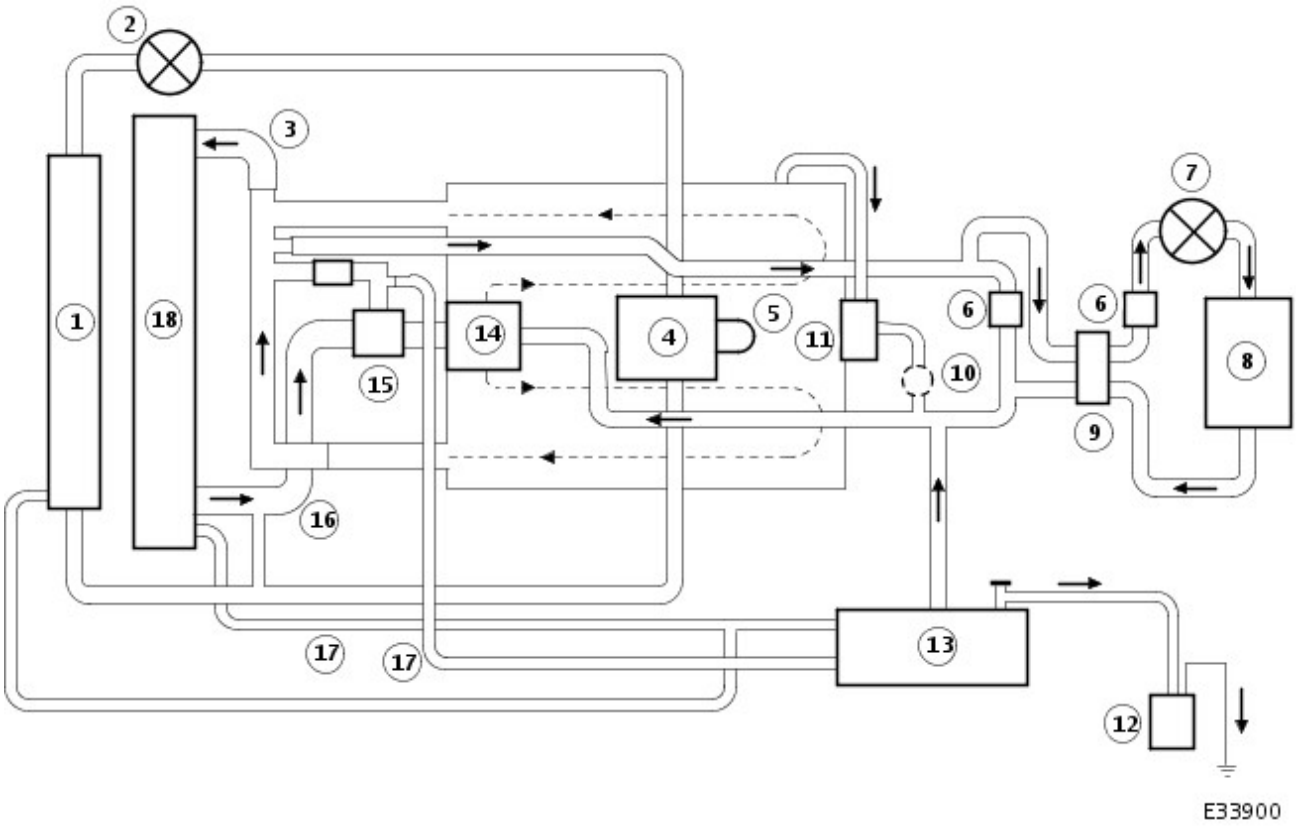
With the thermostat closed, coolant returns directly to the pump through the bypass on the thermostat housing.

With the thermostat open, coolant returns to the pump via the radiator.

The cooling system uses a mixture of water and Jaguar Anti-Freeze/Inhibitor (Dow 542).

The cooling system on a supercharged engine is similar, but has additional components for cooling the intake air.

Engine Cooling Components - Supercharged Vehicles

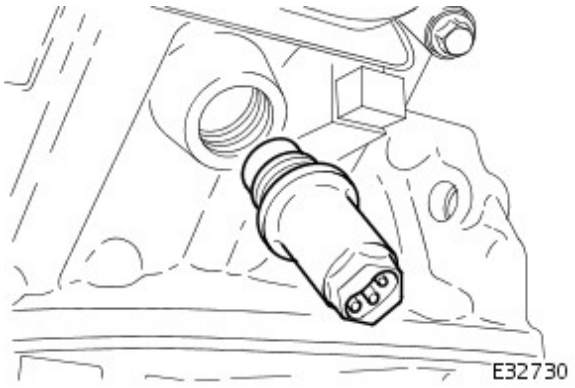


Item	Description
1	Radiator - Intake Air Coolant
2	Electrically Operated Coolant Pump
3	Top Hose
4	Charge Air Coolers - Intake Air Cooling
5	Filling Point for Intake Air Cooling
6	Non-Return Valves - Heater
7	Electrically Operated Coolant Pump
8	Heater Matrix
9	Water Valve - Heater Control
10	EGR Valve (when fitted)
11	Throttle Body
12	Coolant Recovery Bottle
13	Header/Expansion Tank
14	Engine Coolant Pump
15	Thermostat Housing
16	Bottom Hose
17	Air Bleed Pipes
18	Radiator - Main Cooling System

The cooling system for the supercharged engine is very similar to the normally aspirated engine, but with the addition of a water cooled, intake air charge cooling system. This comprises a radiator, an electrically operated water pump and two charge air cooler assemblies (heat exchangers) - one for each bank. The system works independently, but is connected to the main cooling system at the bottom hose to allow for thermal expansion and to help to prevent unwanted circulation.

The condenser for the air conditioning system fits between the coolant main radiator and the charge air cooling system radiator.

Cylinder Block Heater, Drain Location

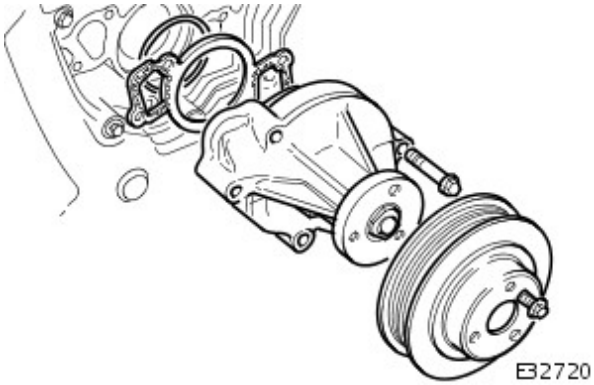


A coolant drain plug is located at the rear of the cylinder block.

Coolant may be drained from the A-bank, by removing the coolant pipe from behind the starter motor.

For vehicles fitted with the cold climate package, a cylinder block heater (shown) replaces the drain plug located on the B-bank.

Coolant Pump and Flow Control



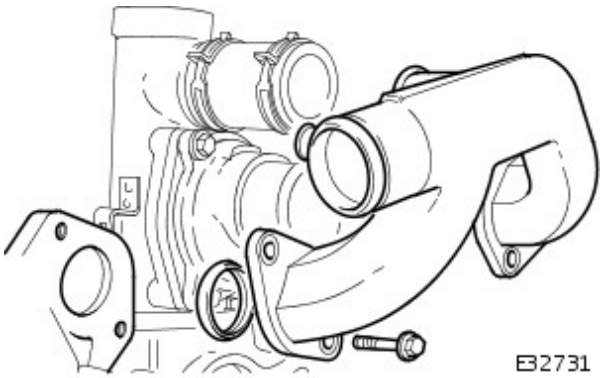
The coolant pump is fitted between the two cylinder banks, on the front face of the cylinder block.

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 support 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.

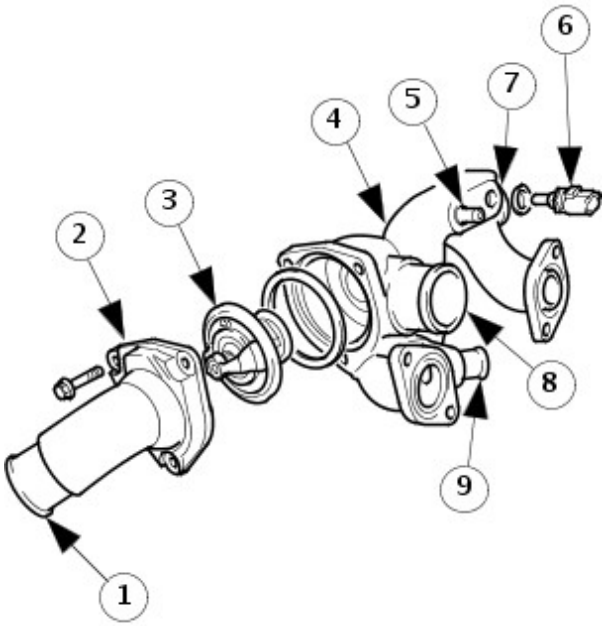
An O-ring and an aluminum-alloy gasket, seal the ports between the pump and the cylinder banks.

Coolant Outlet Duct



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 Engine Coolant Temperature (ECT) sensor which provides a signal representing coolant temperature at the cylinder heads. The outlet pipe has connections to supply the heater matrix 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 duct joint.

Coolant Outlet Duct - Supercharged



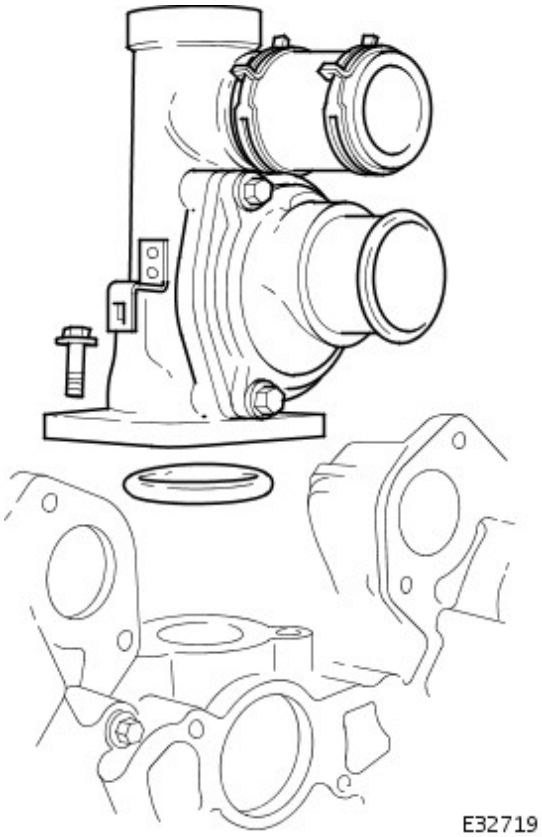
E32942

Item	Description
1	Bottom Hose Connection
2	Thermostat Cover
3	Thermostat
4	Coolant Outlet Duct
5	Breather Connection
6	ECT Sensor
7	Top Hose Connection
8	Bypass to Water Pump
9	Heater Hose Connection

The coolant outlet duct on the supercharged engine performs exactly the same function as on the normally aspirated engine and connects to the same ports on the engine. The main physical difference is that the thermostat housing has been

combined with the outlet duct and consequently, there is no separate housing assembly fitted above the water pump, as used on the normally aspirated engine. The illustration shows the outlet duct viewed from the engine.

Thermostat Housing



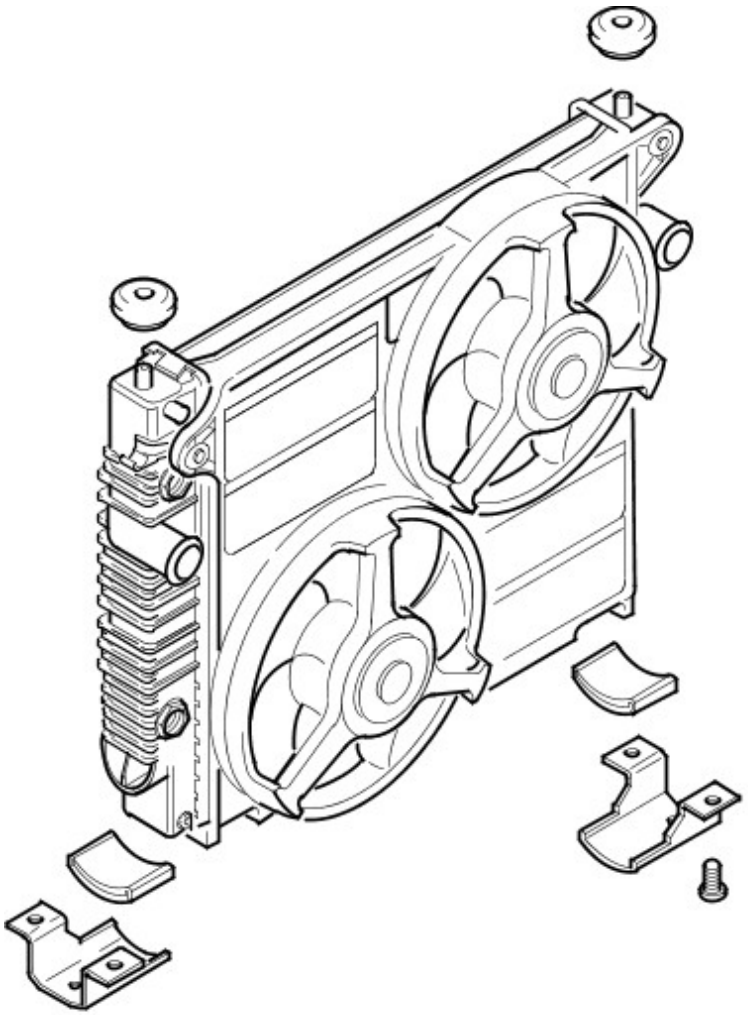
The plastic housing for the thermostat is fitted between the two cylinder banks immediately above the coolant pump. Controlling the coolant flow through the radiator, the thermostat starts to open at 80 ° to 84 °C and is fully open at 96 °C.

A duct in the cylinder block connects the thermostat housing outlet to the coolant pump inlet. The joint between the thermostat housing and the cylinder block is via an in-groove seal.

An air bleed outlet vents any air in the system into the expansion reservoir, during normal operation. A removable cap (using a hex key) allows air to vent from the system when filling from empty.

On supercharged engines, the thermostat housing is combined with the coolant outlet duct.

Radiator



E32943

The cooling pack incorporates the radiator assembly with integral transmission oil cooler (located in the radiator outlet tank), an air conditioning condenser, and the cooling fans and cowl assembly.

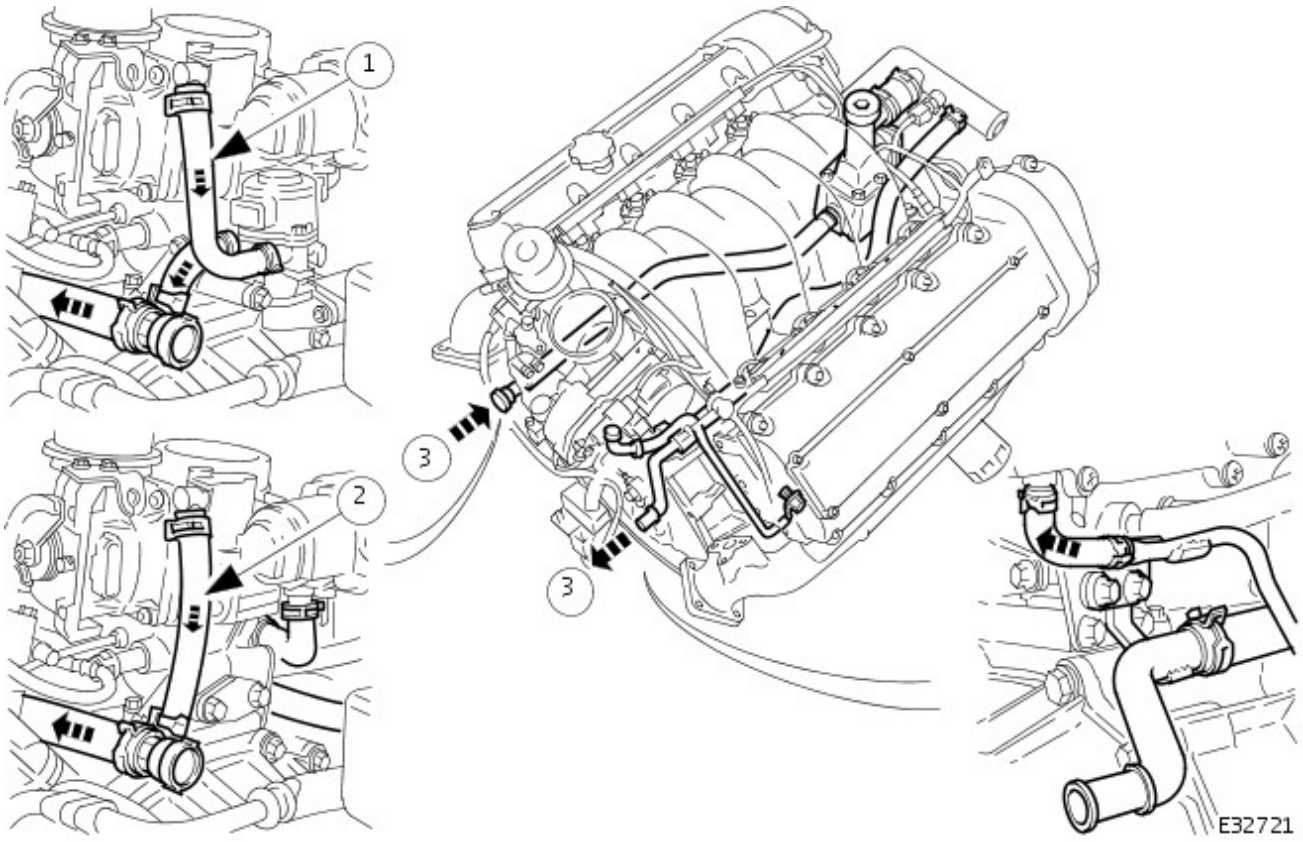
The cooling pack on supercharged vehicles is the same as described above, but with the addition of a charge air cooler coolant radiator located in front of the condenser.

Radiator Mounting / Retention

The radiator is mounted on four rubber mounts, one on each end of the upper and lower horizontal face. The two lower mountings are supported on two isolated brackets mounted on the body; the lower cradle assembly has subsequently been deleted.

A closing panel made from polypropylene, which retains the radiator assembly, fits over the top of the radiator and is bolted to the vehicle top panel.

Coolant Hoses - Engine



Item	Description
1	EGR Engines
2	Non-EGR Engines
3	Heater Connections

Where considered necessary, some hose connections have an indication mark to ensure correct orientation of the hose when being fitted.

All joints use spring-band clips, except small pipes on the bleed system joints - which use cobra clips. The heater feed and return hoses use quick-connection unions.

Supply and return hoses for the heater are located between the cylinder banks.

A connection on the rear of the A-bank provides coolant supply for the electronic throttle and the EGR valve (where fitted). The outlet from the electronic throttle connects to the return hose from the heater.

Coolant Header and Recovery Tanks

A recovery system comprising the header tank and a recovery tank is fitted. The recovery tank is located in front of the left hand front wheel arch liner.

The header tank provides the cooling system filling point and carries the coolant level sensor. The pressure cap allows controlled release of coolant to the recovery tank during normal operation.

The recovery tank accommodates the expansion of the system coolant during normal operation. On engine cool-down, the coolant contracts and is returned to the main system.

Cooling Fans

The two radiator cooling fans are mounted in a cowl assembly within the cooling module.

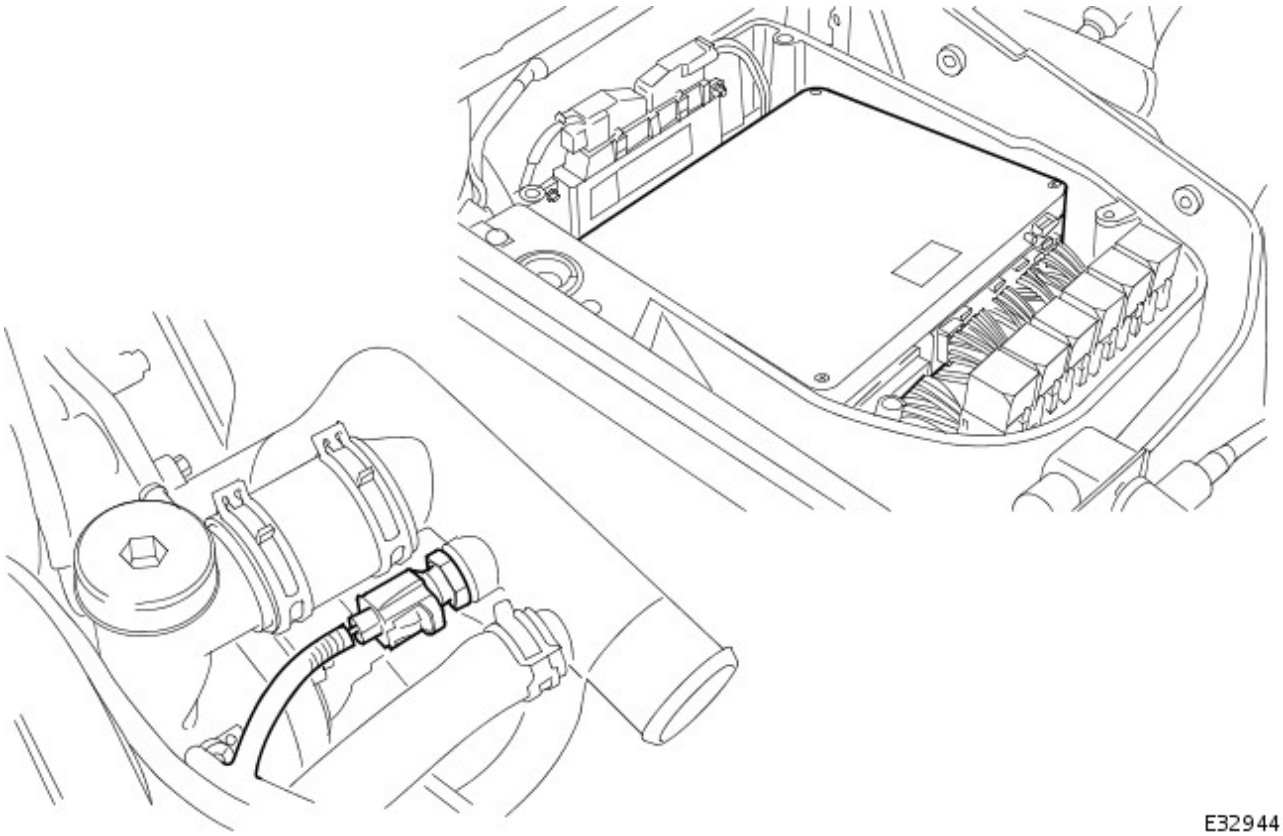
The fans are controlled by the ECM dependent on the demand from the cooling system (temperature) or the air conditioning

system (pressure).

Outputs from the ECM control the radiator fans control module, located behind the left hand side of the bumper, to operate the fans in the series mode (slow), parallel mode (Fast) or Off modes. Hysteresis in the temperature and pressure switching values prevents 'hunting' between modes.

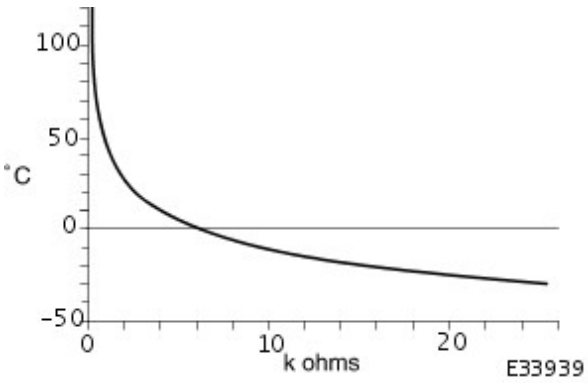
Under hot operating conditions, the fans may continue to operate for some time after the engine has been switched off, but will stop automatically when the coolant temperature has been sufficiently reduced.

Engine Coolant Temperature Sensor (ECT) and ECM



The engine coolant temperature (ECT) sensor is located in the coolant outlet pipe and reacts to engine coolant temperature changes, providing an input to the Engine Control Module (ECM). The sensor has a negative temperature coefficient so that the sensor resistance decreases as temperature rises.

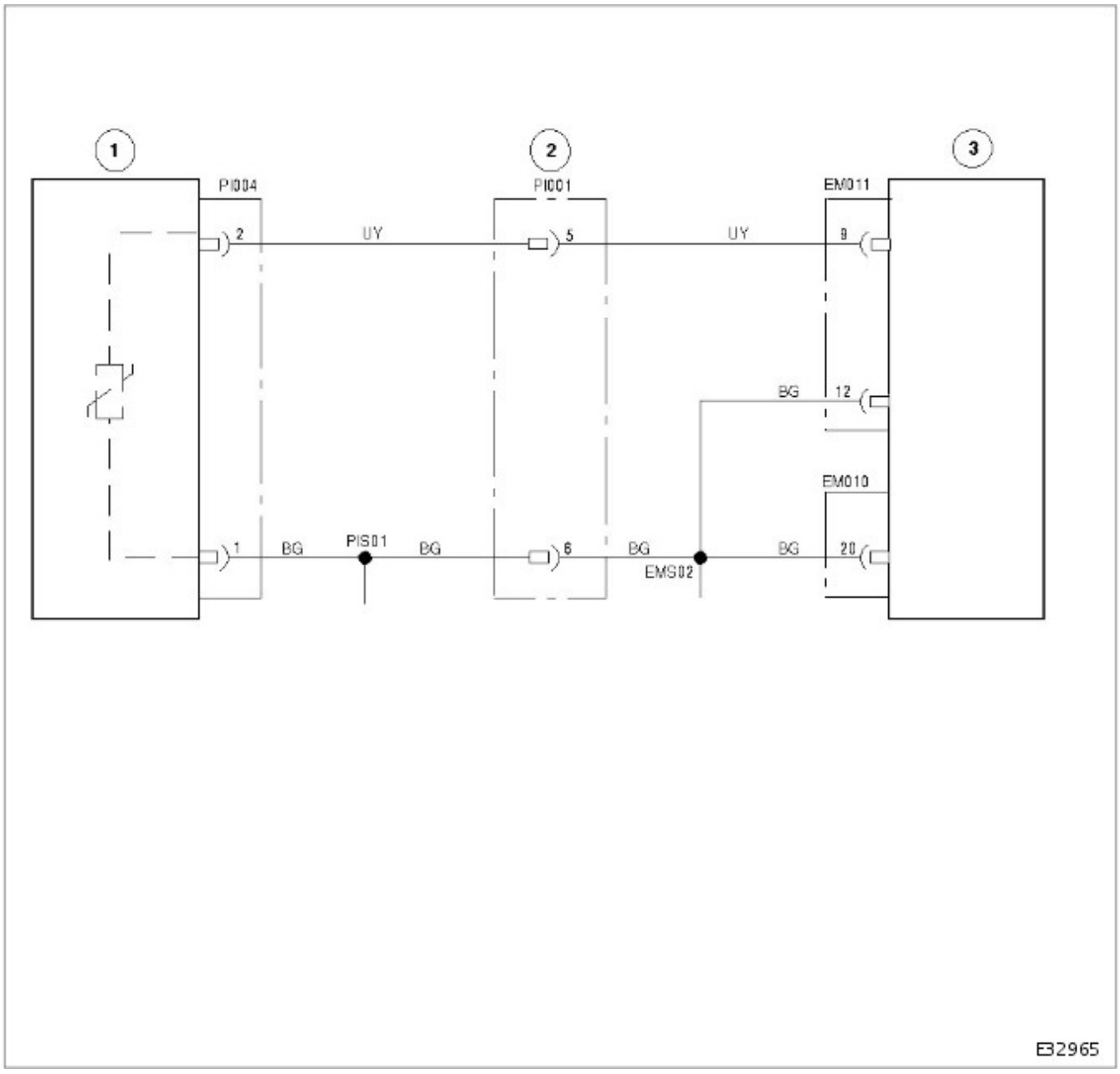
Temperature / Resistance Relationship Graph



Temperature / Resistance Relationship Table

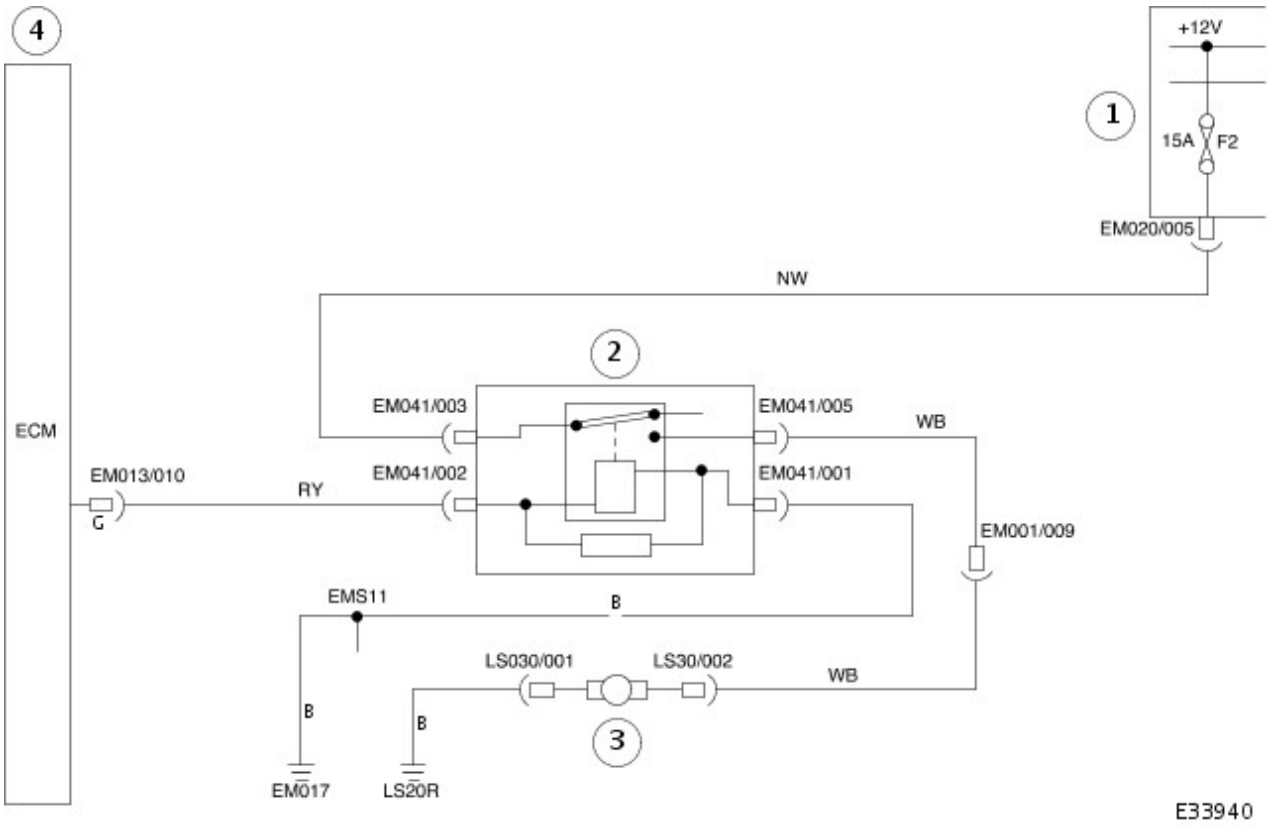
Temperature (°C)	Nominal Resistance (kOHM)
-20	15.04
0	5.74
20	2.45
40	1.15
60	0.584
80	0.32
100	0.184

Engine Coolant Temperature Sensor (ECT) - Circuit Diagram



Item	Part Number	Description
1	—	Engine Coolant Temperature (ECT) Sensor
2	—	Engine to EMS Harness Connector
3	—	EMS Control Module

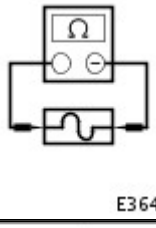
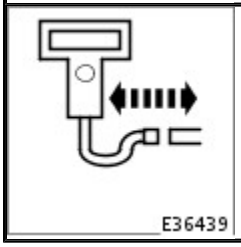
Intercooler Pump Relay - Circuit Diagram



Item	Part Number	Description
1	—	Luggage compartment fuse box
2	—	Intercooler pump relay
3	—	Intercooler pump
4	—	Electronic control module

Engine Cooling - Engine Cooling

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scan tool

Related Faults / Codes

Adaptive Fueling

Condition	Possible Source	Action
• DTC P0171 System too lean bank 1 (A) • DTC P0174 System too lean bank 2 (B)	• Fuel delivery blockage • Fuel delivery pressure (low) • Faulty injector (blocked) • Air intake system leak • Fuel injector electrical fault • ECT sensor fault • MAFM sensor fault • IAT sensor fault • Throttle position sensor fault	• Mechanical check • Mechanical check • Mechanical check • Mechanical check • Go to DTC P0201 to 0208 • Go to DTC P0116 to 0118, P0125 • Go to DTC P0101 to 0103, P1104 • Go to DTC P0111 to 0113 • Go to DTC P0121 to 0123, P0222, P0223
• DTC P0172 System too rich bank 1 (A) • DTC P0175 System too rich bank 2 (B)	• Fuel delivery pressure (high) • Faulty injector (leaking) • Fuel injector continuously open • Air intake system restricted • Fuel injector electrical fault • ECT sensor fault • MAFM sensor fault • IAT sensor fault • Throttle position sensor fault	• Mechanical check • Mechanical check • Mechanical check • Mechanical check • Go to DTC P0201 to P0208 • Go to DTC P0116 to P0118, P0125 • Go to DTC P0101 to P0103, P1104 • Go to DTC P0111 to P0113 • Go to DTC P0121 to P0123, P0222, P0223

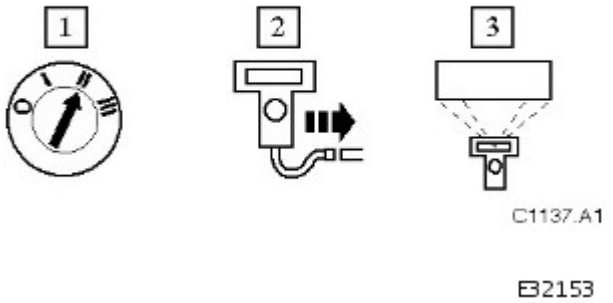
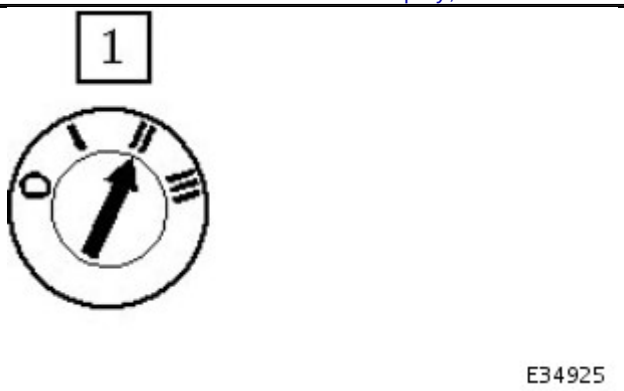
Symptom Chart

Symptom Chart

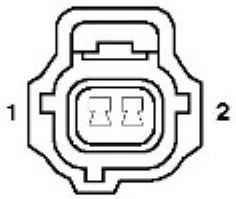
Symptom	Possible Sources	Action
DTC P0116 ECT circuit range / performance problem	* Thermostat * Coolant level / contamination * Sensor out of range * Harness open circuit * Connector loose or corroded	* GO to Pinpoint Test A
DTC P0125 Insufficient coolant temperature for closed loop fuel control	* Thermostat * Coolant level / contamination * Sensor out of range * Harness open circuit * Connector loose or corroded	* GO to Pinpoint Test A
DTC P0117 ECT circuit low input	* Sensor open circuit * Harness open circuit * Harness short	* GO to Pinpoint Test B

	* Connector loose or corroded	
DTC P0118 ECT circuit high input	* Sensor short * Harness open circuit * Harness short * Connector loose or corroded	* GO to Pinpoint Test C
DTC P1474 Intercooler coolant pump relay malfunction	* Intercooler pump relay failure * Intercooler pump relay to ECM drive circuit fault * Intercooler pump relay coil ground circuit fault * Harness fault * Connector loose or corroded * Connector pins(s) bent or tracking between connections * ECM power supply fault	* GO to Pinpoint Test D

Pinpoint test A: P0116, P0125

PINPOINT TEST A : P0116, P0125	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2
A2: ENGINE COOLANT SYSTEM CHECK	
• NOTE: Do not use the instrument display, if the ECT has failed this will not operate correctly.	
	
	1 Check engine temperature rise using a thermocouple or similar device.
	Engine temperature increasing? **Yes** GO to A3 **No** Check coolant level Check coolant for contamination Check/test thermostat

A3: CHECK ECT SENSOR RANGE



E32121

1 Allow the engine to achieve any noted temperature within the specified range, refer to temperature / resistance relationship table or graph

2 Ignition switch to position 0

3 Disconnect PI004

- Rear of top hose

4 Measure the resistance between sensor pins 1 and 2.

Temperature / resistance relationship OK?

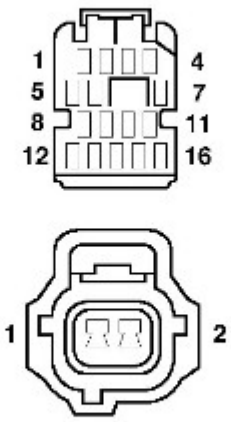
Yes

GO to A4

No

Remove sensor and check temperature / resistance relationship for 3 different temperatures. Renew as required and test the system for normal operation.

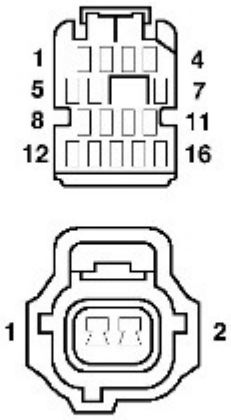
A4: CHECK HARNESS CONTINUITY



	1 Ignition switch to position 0 2 Disconnect EM011 • Inside ECM housing 3 Measure the resistance between EM011/009 and PI004/002. Is the resistance < 0.5 OHM? **Yes** GO to A5 **No** Inspect harness / connector EM011/009, PI004/002 and PI001/005 for corrosion, damage, bent or pushed back pins. Repair as necessary and test the system for normal operation.

A5: CHECK HARNESS CONTINUITY

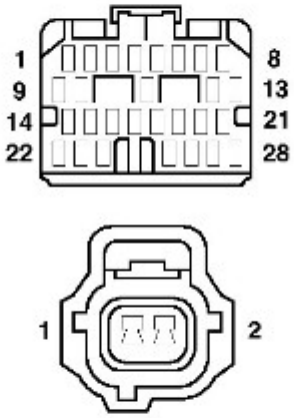
• NOTE: To avoid a spurious result, disconnect connectors PI042 and PI006 (electronic throttle body) and PI035 (MAF meter).



	1 Ignition switch to position 0 2 Disconnect EM010 • Inside ECM housing 3 Measure the resistance between EM011/012 and PI004/001. Is the resistance < 0.5 OHM? **Yes** GO to A6 **No** Inspect harness/connector EM011/012, PI004/001, PI001/006 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation.

A6: CHECK HARNESS CONTINUITY

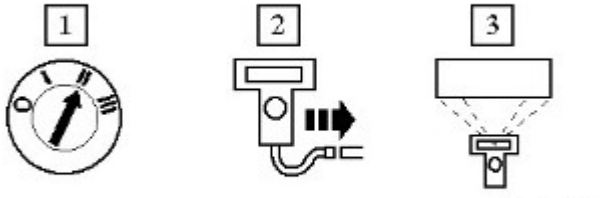
• NOTE: Do not reconnect electronic throttle body connectors PI042 and PI006.



	1 Ignition switch to position 0 2 Disconnect EM010 • Inside ECM housing 3 Measure the resistance between the ECM connector EM010/020 and the ECT connector PI004/001. Is the resistance < 0.5 OHM? **Yes** GO to A7 **No** Inspect harness / connector EM010/020, PI004/001, PI001/006 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins. Repair as necessary and reconnect all connectors. Test the system for normal operation.
A7: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test B: P0117

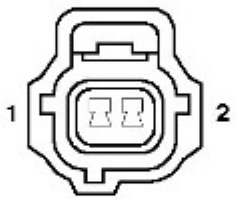
PINPOINT TEST B : P0117	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to B2

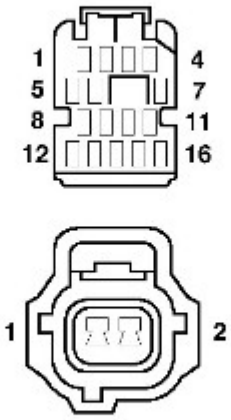
B2: CHECK ECT SENSOR OPEN CIRCUIT



E32121

	1 Ignition switch to position 0
	2 Disconnect PI004 • Rear of top hose
	3 Measure the resistance between the ECT sensor pins 1 and 2.
	Resistance > 30 kOHM? **Yes** Renew sensor and proceed to B6 **No** GO to B3

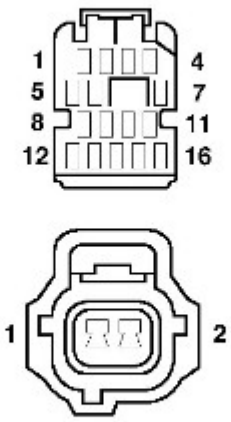
B3: CHECK HARNESS CONTINUITY



	1 Ignition switch to position 0
	2 Disconnect EM011 • Inside ECM housing
	3 Disconnect PI004 • Rear of top hose
	4 Measure the resistance between the ECM connector EM011/009 and the ECT connector PI004/002.
	Is the resistance < 0.5 OHM? **Yes** GO to B4 **No** Inspect harness / connector EM011/009, PI004/002 and PI001/005 for corrosion, damage, bent or pushed back pins. Repair as necessary and test the system for normal operation.

B4: CHECK HARNESS CONTINUITY

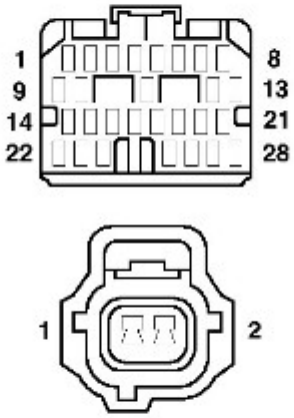
• NOTE: To avoid a spurious result, disconnect connectors PI042 and PI006 (electronic throttle body) and PI035 (MAF meter).



	1 Ignition switch to position 0 2 Disconnect EM010 • Inside ECM housing 3 Measure the resistance between the ECM connector EM011/012 and the ECT connector PI004/001. Is the resistance < 0.5 OHM? **Yes** GO to B5 **No** Inspect harness / connector EM011/012, PI004/001, PI001/006 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins. Repair as necessary, reconnect all connectors. Test the system for normal operation.

B5: CHECK HARNESS CONTINUITY

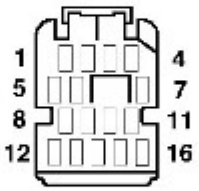
• NOTE: Do not reconnect electronic throttle body connectors PI042 and PI006.



E32135

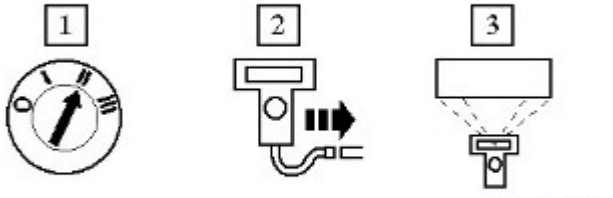
	1 Ignition switch to position 0 2 Disconnect EM010 • Inside ECM housing 3 Measure the resistance between the ECM connector EM010/020 and the ECT connector PI004/001.
	Is the resistance < 0.5 OHM? **Yes** GO to B6 **No** Inspect harness / connector EM010/020, PI004/001, PI001/006 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins. Repair as required and reconnect all connectors. Test the system for normal operation.

B6: CHECK FOR SHORT TO B+

 E32118	
	1 Ignition switch to position 0 2 Disconnect EM011 • Inside ECM housing 3 Ignition switch to position II 4 Measure the voltage between pins 9 and 12 of the connector. Is the voltage > 1 V? **Yes** Inspect harness / connector EM011/009, PI004/002, PI001/005 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins. Repair as required and reconnect all connectors. Test the system for normal operation. **No** GO to B7
B7: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test C: P0118

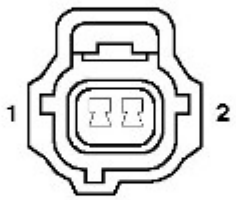
PINPOINT TEST C : P0118	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to C2

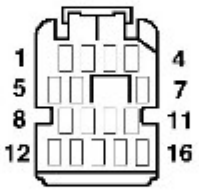
C2: CHECK ECT SENSOR SHORT



E32121

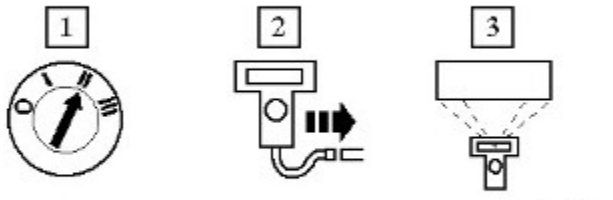
	1 Ignition switch to position 0
	2 Disconnect PI004 • Rear of top hose
	3 Measure the resistance between sensor pins 1 and 2.
	Resistance < 100 OHM? **Yes** Renew sensor and proceed to C5 **No** GO to C3

C3: CHECK FOR SHORT TO GROUND

 E32118	
	1 Ignition switch to position 0 2 Disconnect EM011 • Inside ECM housing 3 Measure the resistance between pins 9 and 12 of the connector. Resistance < 0.5 OHM? **Yes** Inspect harness / connector EM011/0012, PI004/001, PI001/006 and splices EMS02 / PIS01 for corrosion, damage, bent or pushed back pins. Repair as required and reconnect all connectors. Test the system for normal operation. **No** GO to C4
C4: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test D: P1474

PINPOINT TEST D : P1474	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	

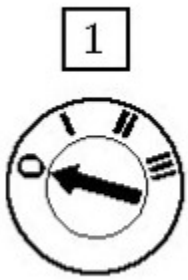


E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to D2

D2: CHECK FUSE

• NOTE: See further steps for possible cause of fuse failure.

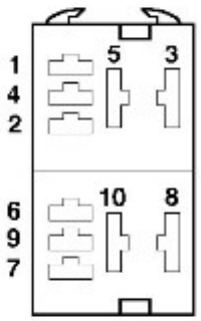


E32154

	1 Check fuse F2 integrity (located in the engine management fuse box).
	OK? **Yes** GO to D3 **No** Renew fuse and test the system for normal operation.

D3: CHECK RELAY SOCKET SUPPLY VOLTAGE

• NOTE: Do not replace relay.

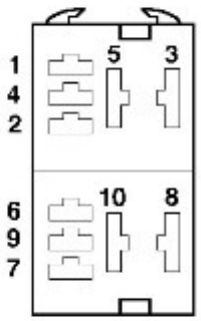


E32123

	1 Ignition switch to position 0 2 Remove intercooler coolant pump relay • Inside ECM housing 3 Ignition switch to position II 4 Check for battery voltage at relay socket between pins 3 and 2. B+ ? **Yes** GO to D6 **No** GO to D4

D4: CHECK RELAY SOCKET SUPPLY CONTINUITY

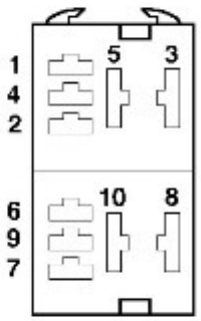
• NOTE: Install fuse F2. Do not replace relay.



E32123

	1 Ignition switch to position 0
	2 Remove engine management fuse F2
	3 Measure the resistance between relay socket pin 3 and the load side of fuse F2.
	Is the resistance < 0.5 OHM? **Yes** GO to D5 **No** Inspect harness / connectors EM020 and EM041 (relay socket) for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

D5: CHECK RELAY SOCKET GROUND CONTINUITY

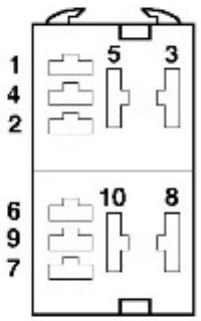


E32123

	1 Ignition switch to position 0 2 Measure resistance between relay socket pin 1 and ground EM017. Is the resistance < 0.5 OHM? **Yes** GO to D6 **No** Inspect harness / connectors EM020, EM041 (relay socket) and splice EMS11 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

D6: CHECK RELAY COIL SUPPLY VOLTAGE

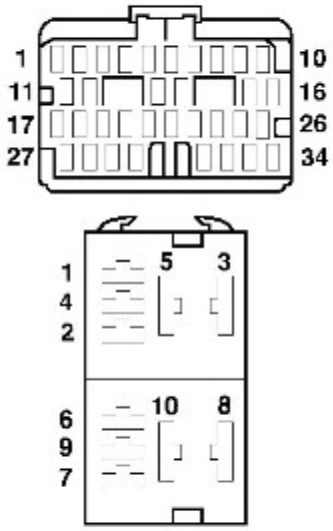
• NOTE: Renew relay.



E32123

	1 Ignition switch to position II 2 Measure voltage between relay socket between pin 2 and ground EM017. B+ ? **Yes** GO to D8 **No** GO to D7

D7: CHECK ECM SUPPLY TO RELAY CONTINUITY



E32136

	1 Ignition switch to position 0
	2 Disconnect EM013 • Inside ECM housing
	3 Measure the resistance between EM013/010 and relay socket pin 2.
	Is the resistance < 0.5 OHM? **Yes** STOP, renew the relay and test the system for normal operation. **No** Inspect harness / connector EM013 and relay socket for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.
D8: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Engine Cooling - Cooling System Draining, Filling and Bleeding4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

General Procedures

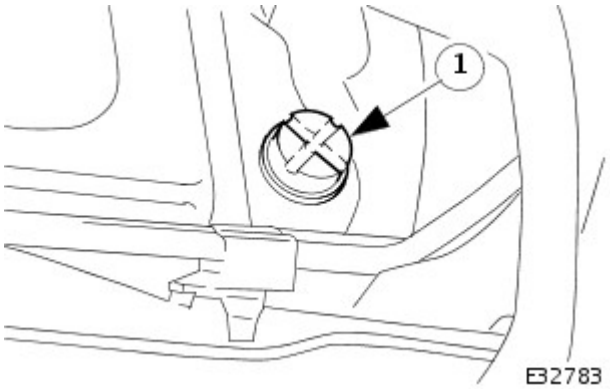
Drain

1. Open the engine compartment and fit paintwork protection sheets.

2. Ensure that the cooling system is cool and very carefully, remove the pressure cap from the header tank.

3. Raise the vehicle.

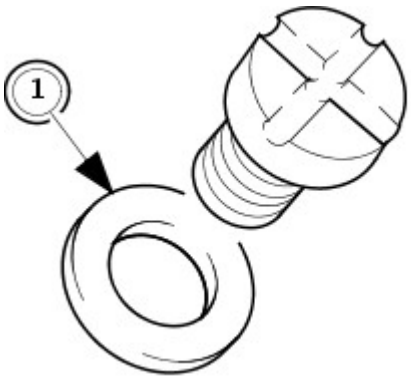
4. Drain the coolant.



- Place a coolant drain tray on the floor, below the radiator drain plug.

1. Remove the radiator drain plug. and allow the coolant to drain.

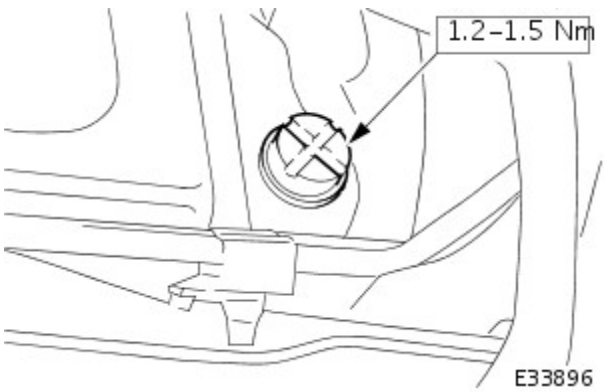
5. Fit a new seal to the drain plug.



1. Remove the seal from the drain plug. and clean the plug face.

- Fit a new seal.

6. Refit the radiator drain plug.



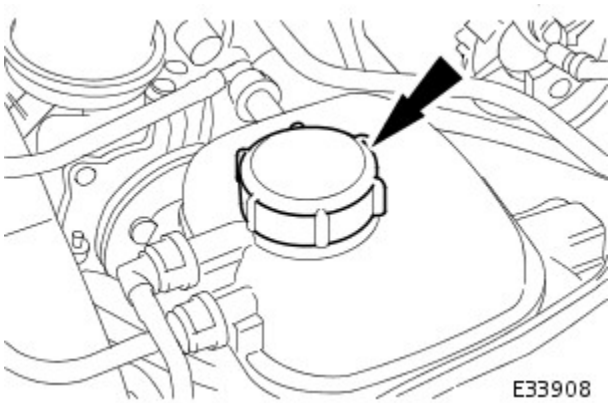
- Clean any coolant from the underside of the vehicle. Remove the drain tray.

7. Lower the vehicle.

Refill

1. Refill the cooling system with a 50% solution of water and Jaguar Antifreeze / Corrosion Inhibitor ESD-M97B49-A.

1. Fill the cooling system at the header tank until the level stabilises at the top of the breather neck.



- Allow at least 2 minutes for air to purge from the system.
- Top up the header tank as required and fit the pressure cap.

2. Switch on the ignition, switch off the climate control system and start the engine.

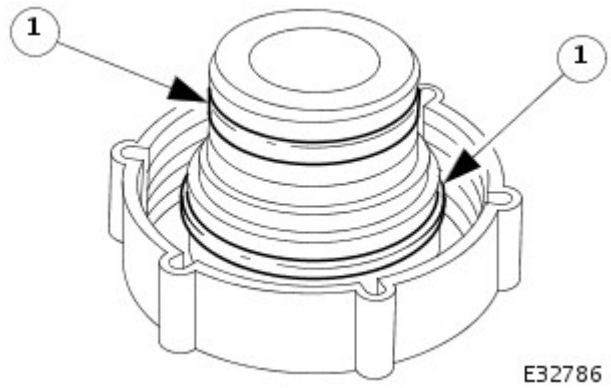
3. Run the engine at between 1500 and 2000 rpm until the cooling fans operate.

4. Switch on the A/C system, set to maximum heat, and check that heat is coming from the heater at the fascia vents or the footwell outlets.

5. Switch off the engine and allow it to cool down.

6. When cool, remove the pressure cap and top up the system as necessary at the header tank.

7. If necessary, fit new seals to the pressure cap.



1. Remove both O-rings from the pressure cap.

- Fit and fully seat new O-rings to the pressure cap.

8. Fit the pressure cap.

9. Remove the paintwork protection sheets and close the engine cover.

Engine Cooling - Cooling System Draining, Filling and Bleeding4.0L SC V8 - AJ26

General Procedures

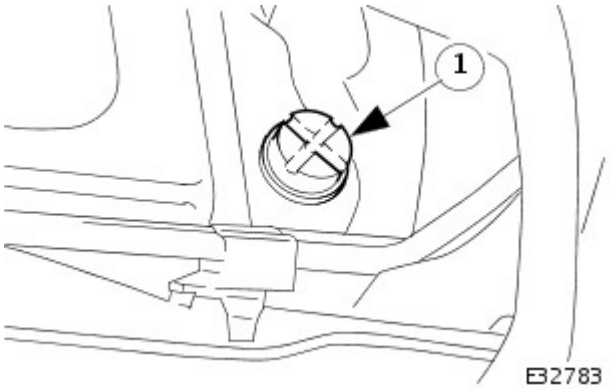
Drain

1. Open the engine compartment and fit paintwork protection sheets.

2. Ensure that the cooling system is cool and very carefully, remove the pressure cap from the header tank.

3. Raise the vehicle.

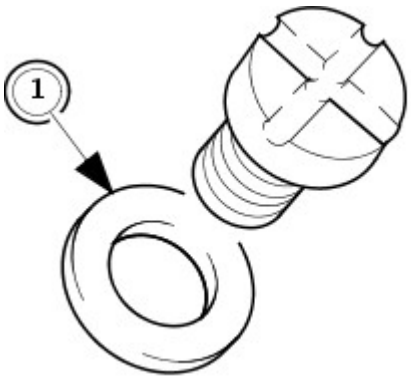
4. Drain the coolant.



- Place a coolant drain tray on the floor, below the radiator drain plug.

1. Remove the radiator drain plug. and allow the coolant to drain.

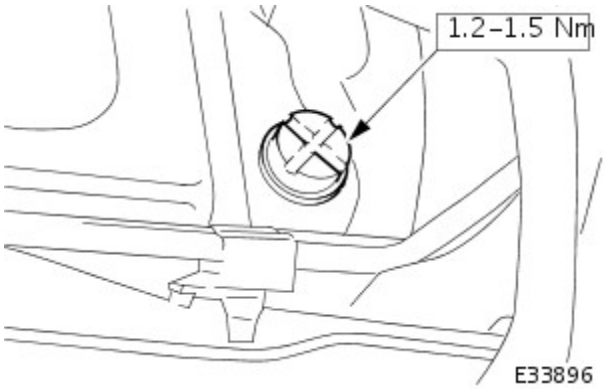
5. Fit a new seal to the drain plug.



1. Remove the seal from the drain plug. and clean the plug face.

- Fit a new seal.

6. Refit the radiator drain plug.



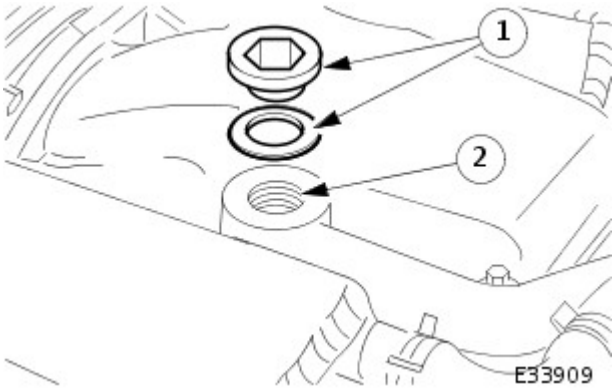
- Clean any coolant from the underside of the vehicle. Remove the drain tray.

7. Lower the vehicle.

Refill

1. Refill the cooling system with a 50% solution of water and Jaguar Antifreeze / Corrosion Inhibitor ESD-M97B49-A.

1. Remove the threaded plug and Dowty washer from the charge air cooler fill point.

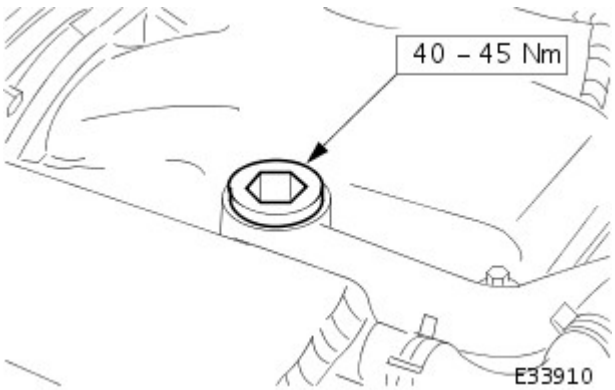


2. Fill the cooling system at the header tank until the level stabilises near the top of the charge air cooler fill point. This will take some time, as air is being purged from the system.

- Ensure that the header tank is full.

• NOTE: To ensure that air is not drawn into the system during the following operations:

- Do not remove the cap from the header tank whilst the charge air cooling system is open to atmosphere.
- Do not switch on the ignition when the charge air cooling system is open to atmosphere because the electrical cooling pump may draw air into the system.



2. Fit the pressure cap to the header tank.

3. Pour coolant carefully into the charge air cooler fill point until the system is full.

- Fit the plug and washer to the fill point.

4. Remove the pressure cap from the header tank.

5. Switch on the ignition and switch off the climate control system.

- Leave the ignition switched on (do not start the engine) for at least 2 minutes to allow the air charge cooler electric water pump to operate and to purge any air from the air charge cooler radiator to the header tank. (This operation will be repeated later)

6. Switch off the ignition for at least 1 minute.

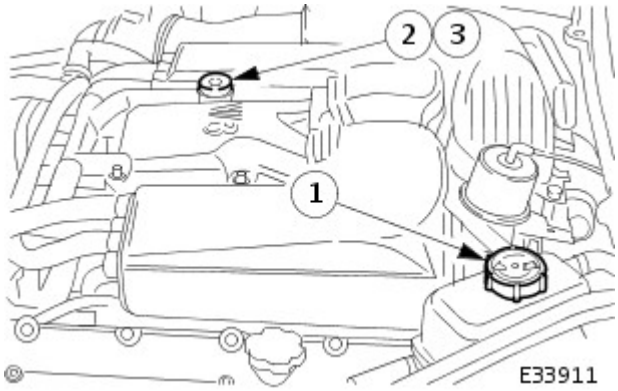
7. Leave the ignition switched on (do not start the engine) for at least 2 minutes to allow the air charge cooler electric water pump to operate and to purge any air from the air charge cooler radiator to the header tank.

8. Top up the cooling system.

1. Top up the header tank and fit the pressure cap.

2. Remove the plug from the air charge cooler fill point. Pour coolant carefully into the air charge cooler fill point until the system is full.

3. Fit the plug and washer to the fill point.



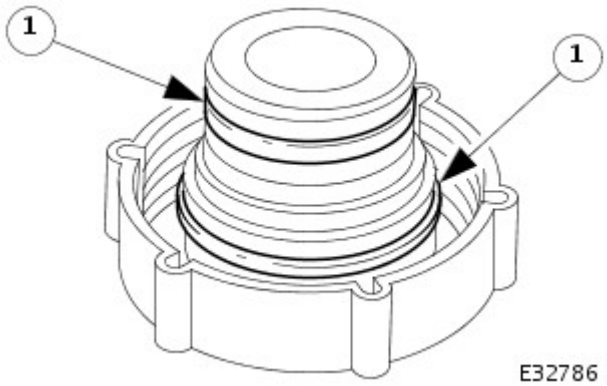
9. Run the engine at between 1500 and 2000 rpm until the cooling fans operate.

10. Switch on the climate control system, set to maximum heat, and check that heat is coming from the heater at the fascia vents or the footwell outlets.

11. Switch off the engine and allow it to cool down.

12. When cool, remove the pressure cap and top up the system as necessary at the header tank.

13. If necessary, fit new seals to the pressure cap.



1. Remove both O-rings from the pressure cap.

- Fit and fully seat new O-rings to the pressure cap. Fit the pressure cap.

14. Check that the pressure cap is fitted. Remove the plug from the air charge cooler fill point. Pour coolant carefully into the air charge cooler fill point until the system is full.

- Fit the plug to the fill point, using a new Dowty sealing washer.

15. Remove the paintwork protection sheets and close the engine cover.

Engine Cooling - Cooling System Draining and Vacuum Filling

General Procedures

WARNING: To avoid having scalding hot coolant or steam blowing 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 (still with a cloth) turn and remove the coolant pressure cap from the coolant expansion tank. Failure to follow these instructions may result in personal injury.

• CAUTIONS:

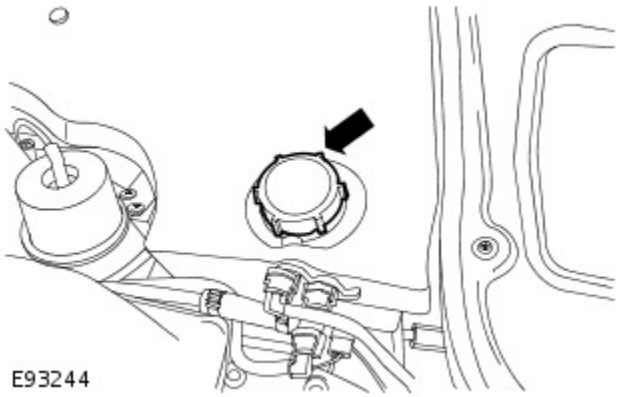
The engine cooling system must be maintained with the correct concentration and type of anti-freeze solution to prevent corrosion and frost damage. Failure to follow this instruction may result in damage to the vehicle.

Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

• NOTE: Vehicles fitted with supercharged engines shown, V8 NA engines similar.

All vehicles

1. Set the heater controls to maximum HOT.

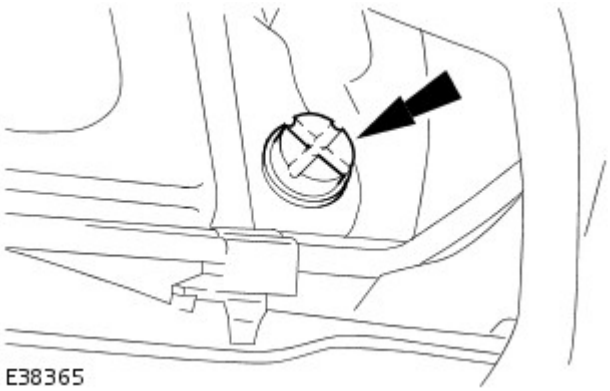


2. WARNING: Relieve the cooling system pressure by unscrewing the coolant pressure cap. Failure to follow this instruction may result in personal injury.

Remove the coolant expansion tank pressure cap.

3. Raise and support the vehicle.

4. NOTE: Remove and discard the radiator drain plug seal.



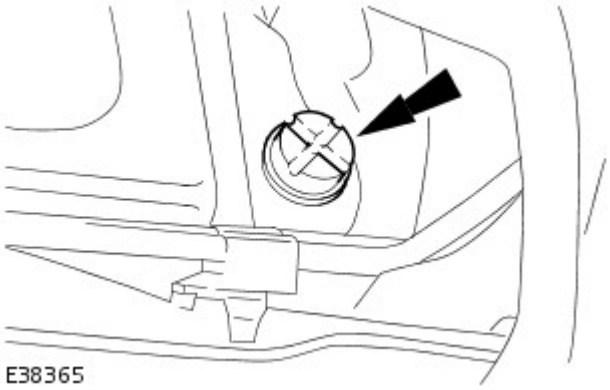
Drain the coolant into a suitable container.

- Remove the radiator drain plug.

5. CAUTION: Do not over tighten the drain plug. Failure to follow this instruction may result in damage to the vehicle.

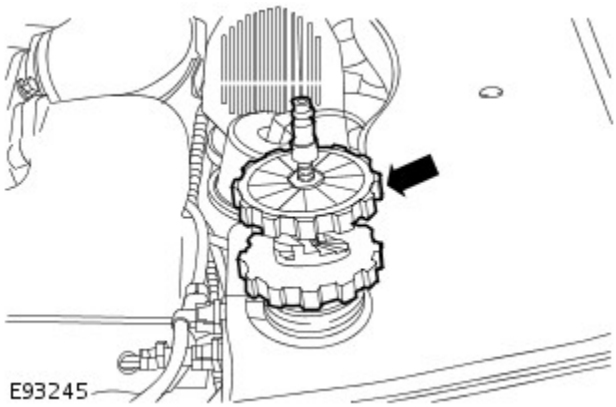
• NOTE: Install a new radiator drain plug seal.

Install the coolant drain plug.

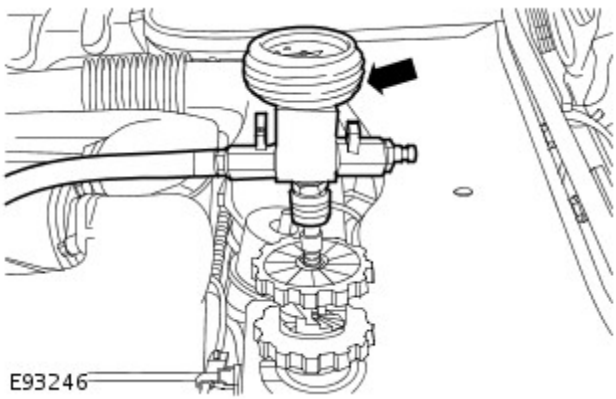


- Remove the drain tray.

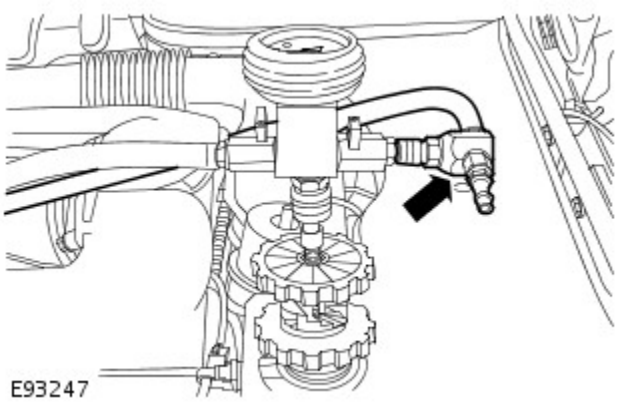
6. Lower the vehicle.



7. Install the cooling system vacuum refill adaptor to the expansion tank.

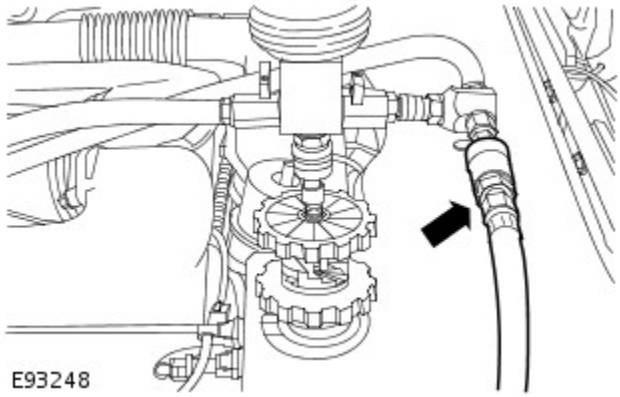


8. Install the vacuum filler gauge to the cooling system vacuum refill adaptor.

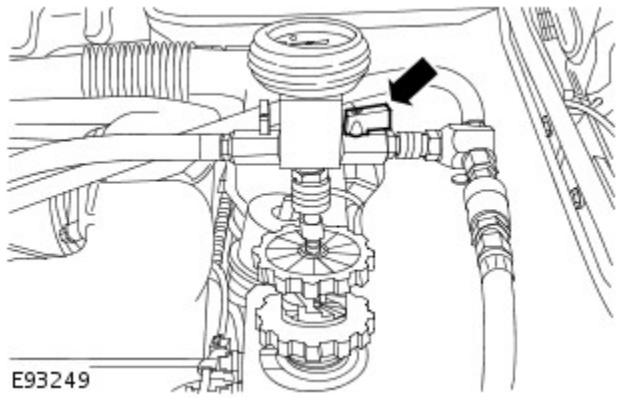


9. Install the venturi tube assembly to the vacuum filler gauge.

10. Connect a regulated compressed air supply to the venturi tube assembly.



11. Position the evacuated air hose into a container.

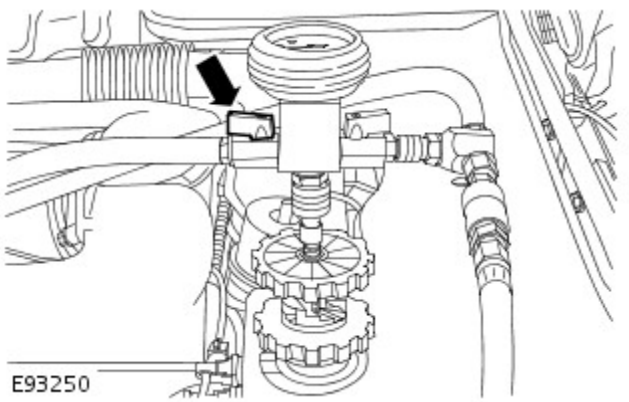


12. NOTE: Make sure the coolant supply valve is in the closed position on the vacuum filler gauge assembly.

• NOTE: The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.

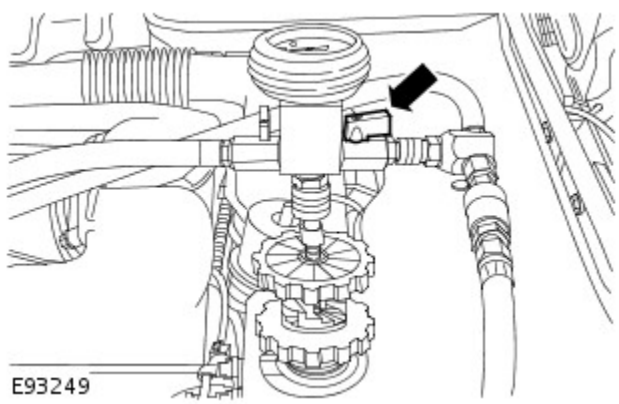
• NOTE: Small diameter or long airlines may restrict airflow to the coolant vacuum fill tool.

Open the air supply valve.



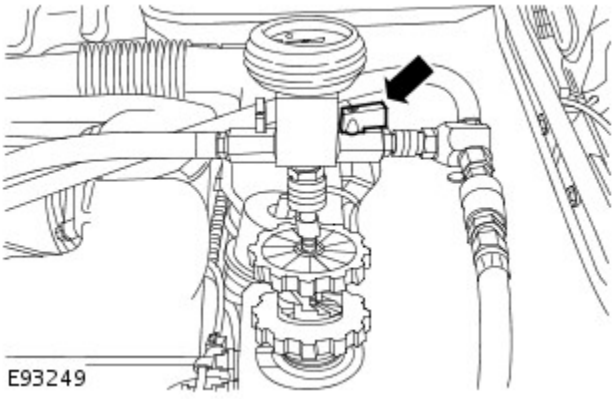
13. NOTE: Make sure the coolant supply hose is positioned into a container of fifty percent mixture of Jaguar Premium Cooling System Fluid or equivalent, meeting Jaguar specification WSS M97B44-D and fifty percent water. Make sure no air can enter the coolant supply hose.

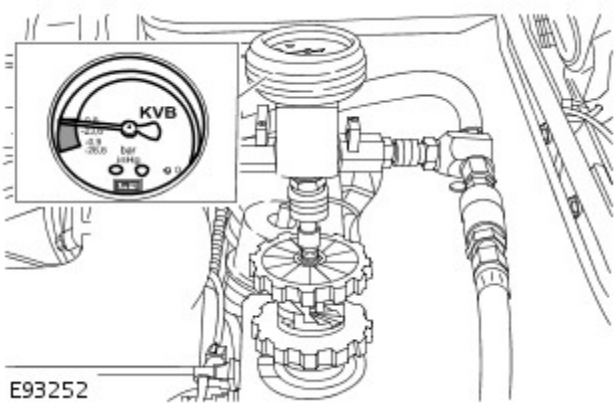
Open the coolant supply valve for 2 seconds to prime the coolant supply hose.



14. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.

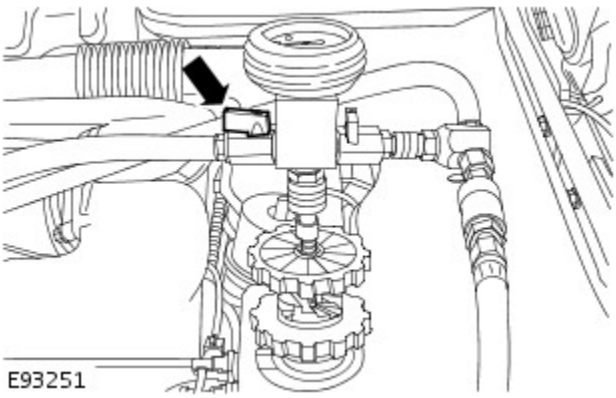
15. Close the air supply valve.





16. Allow one minute to check the vacuum is held.

- Disconnect the air supply.



17. 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.

18. Remove the vacuum filler gauge and cooling system vacuum refill adaptor assembly.

19. Install the coolant expansion tank pressure cap.

Vehicles with supercharger

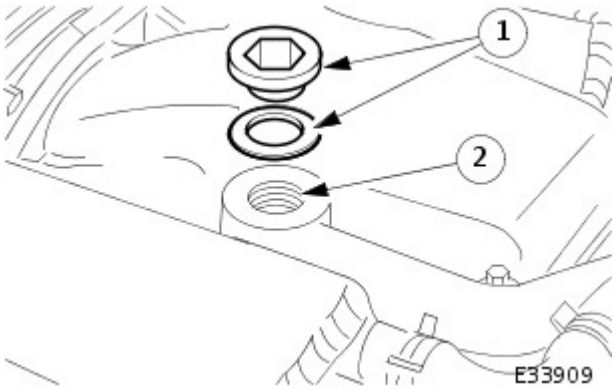
20. NOTE: To ensure that air is not drawn into the system during the following operations, do not remove the coolant expansion tank pressure cap whilst the supercharger filler plug is open.

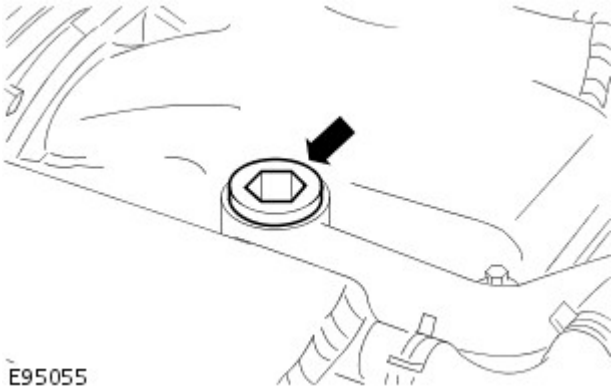
• NOTE: Place a suitable cloth around supercharger fill port.

Top up the supercharger coolant.

1. Remove the filler plug and discard the sealing washer.

2. Top up the coolant through the supercharger fill port.





21. NOTE: Install a new sealing washer.

• NOTE: Clean off any spillages.

Install the supercharger coolant fill plug.

- Tighten to 45 Nm.

22. Remove the coolant expansion tank pressure cap.

23. Switch ignition on.

24. CAUTION: Do not allow the supercharger water pump to run dry. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Leave the ignition switched on (do not start the engine) for at least 2 minutes to allow the air charge cooler electric water pump to operate and to purge any air from the air charge cooler radiator to the header tank.

Allow the supercharger pump to run and top up the system through the coolant expansion tank.

25. Switch the ignition off.

26. Install the coolant expansion tank pressure cap.

All vehicles

27. START and RUN the engine.

28. 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.

Run the engine at between 1500 and 2000 rpm until the cooling fan operates.

29. Switch off the engine.

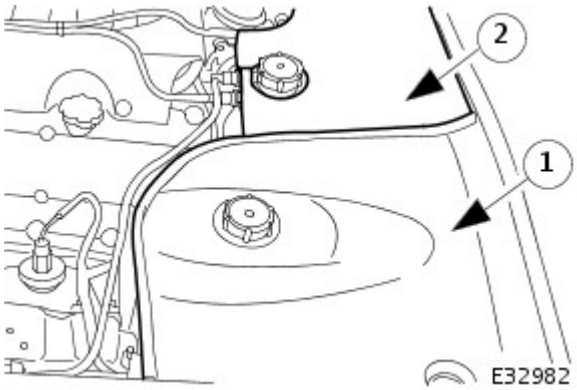
30. Allow the engine to cool.

31. Check and top-up the coolant if required.

Engine Cooling - Coolant Expansion Tank

Removal and Installation

Removal



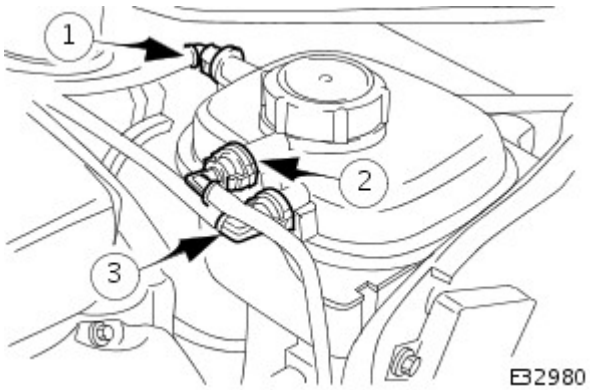
1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the centre trim panel from the engine compartment.

1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.

3. Ensure that the cooling system is cool and very carefully, remove the pressure cap.

4. Place a cloth under the expansion tank to absorb any spillage caused by disconnecting the hoses.

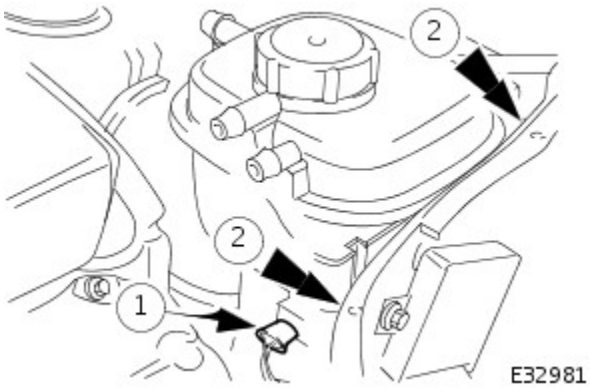


5. Release the hoses (Quick Fit connections) from the expansion tank.

1. Release the hose, expansion tank to thermostat housing (coolant outlet pipe on supercharged engines).
2. Release the hose, expansion tank to recovery tank.
3. Release the hose, expansion tank to radiator..

6. Fit blanking plugs to the pipes and the tank.

7. Remove the expansion tank from the mounting.

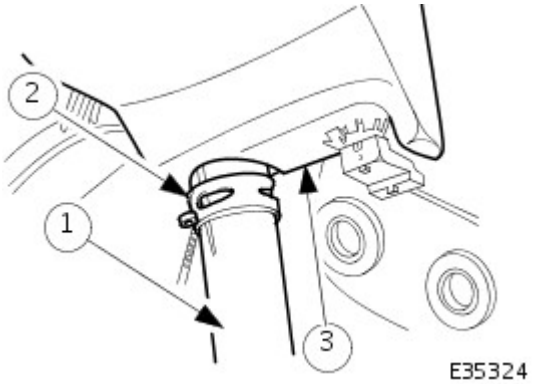


1. Disconnect the coolant level sensor connector.
2. Remove the nuts which secures the tank.

8. Remove the expansion tank from the vehicle.

1. Use a pipe clamp to clamp the bottom hose branch.
2. Release the pipe clip and move it along the pipe.
3. Disconnect the tank from the bottom hose and

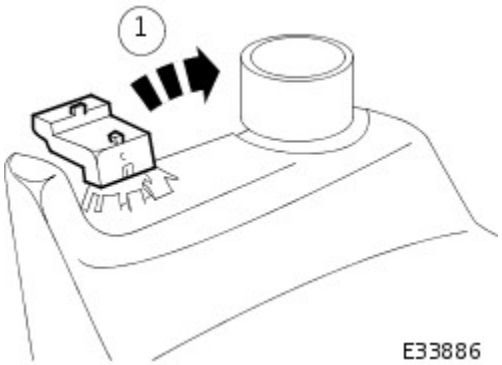
remove it from the vehicle.



9. Empty any surplus coolant from the expansion tank into a drain tray.

10. Remove the cloth from the engine and clean any spillage from the engine bay.

11. Remove the coolant level sensor by carefully levering it downwards at one side.



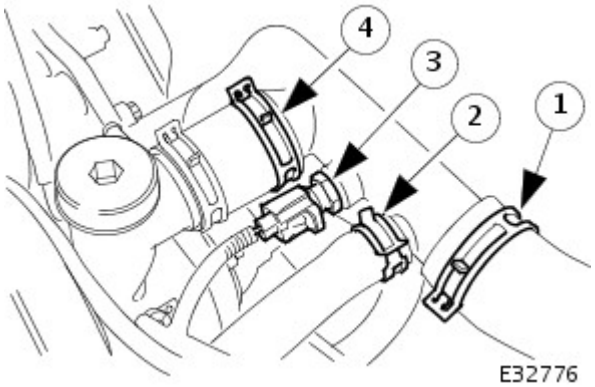
Installation

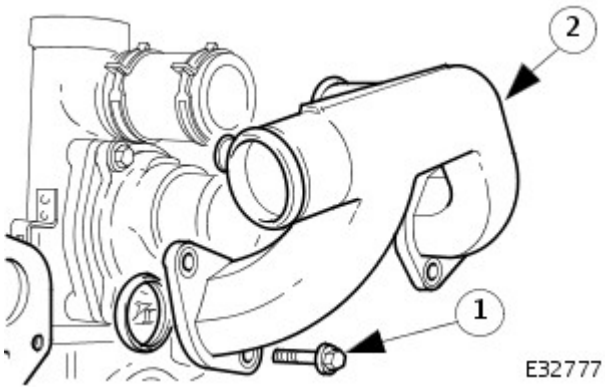
1. Installation is the reverse of the removal procedure.

Engine Cooling - Coolant Outlet Pipe

Removal and Installation

Removal





1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the outlet pipe.
3. Disconnect the hoses and multi-plug from the coolant outlet pipe.
    1. Release and reposition the hose clip, and disconnect the top hose.
    2. Release and reposition the hose clip, and disconnect the heater hose.
    3. Disconnect the multi-plug from the temperature sensor and unscrew the sensor from the outlet pipe.
    4. Release and reposition the hose clip along the bypass hose.
4. Remove the coolant outlet pipe.
    1. Remove the four bolts which secure the outlet pipe.
    2. Remove the outlet pipe from the bypass hose and from the cylinder heads.
5. Remove and discard the sealing rings from the outlet pipe grooves.

Installation

1. Installation is the reverse of the removal procedure. Use new sealing rings on the coolant outlet pipe.
2. Tighten the coolant outlet pipe bolts to 10-14 Nm If replacing the coolant temperature sensor, tighten to 15-19 Nm.
3. Refill the cooling system as described in General Procedures.

Engine Cooling - Coolant Outlet Pipe

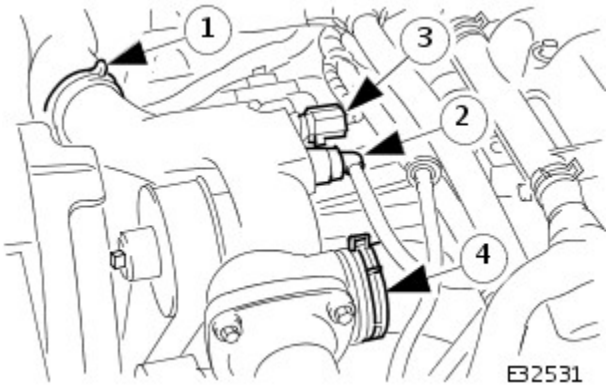
Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.

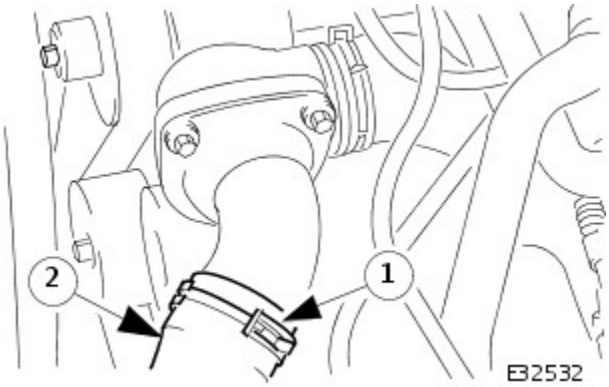
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the outlet pipe.

3. Disconnect the top hose and breather pipe from the coolant outlet pipe.



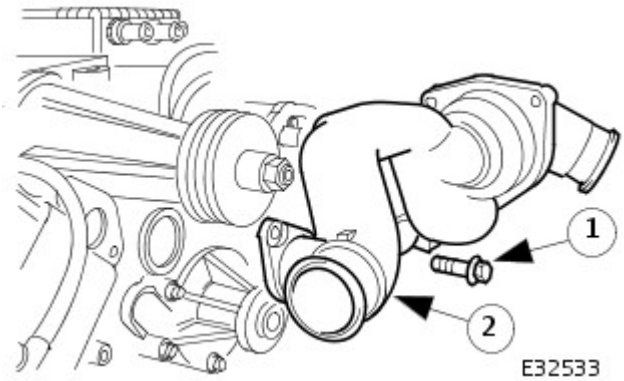
1. Release and reposition the hose clip, and disconnect the top hose.
2. Release and disconnect the breather pipe quick fit connector.
3. Disconnect the multi-plug from the temperature sensor and unscrew the sensor from the outlet pipe.
4. Release and reposition the hose clip along the bypass hose.

4. Disconnect the bottom hose from the thermostat housing.



1. Release and reposition the hose clip along the hose.
2. Disconnect the bottom hose.

5. Disconnect the coolant outlet pipe from the cylinder heads.

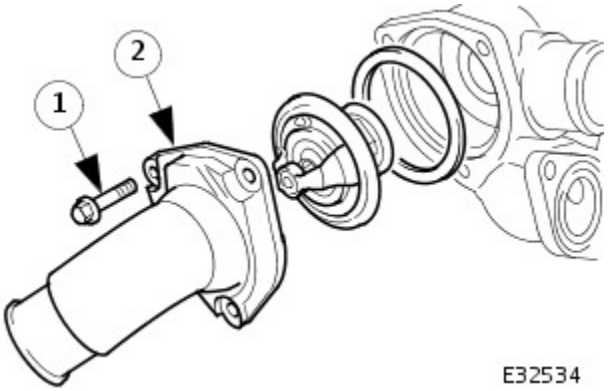


1. Remove the four bolts which secure the outlet pipe.
2. Remove the outlet pipe from the bypass hose and from the cylinder heads (still connected to the heater hose).

6. Release and reposition the clip which secures the heater hose to the outlet pipe and disconnect the hose. Remove the outlet pipe.

7. Remove the thermostat from the outlet pipe.

1. Remove the three bolts which secure the thermostat cover to the outlet pipe.
2. Remove the thermostat cover, the thermostat and the seal from the outlet pipe. Discard the seal.



8. Remove and discard the sealing rings from the outlet pipe grooves.

Installation

1. Installation is the reverse of the removal procedure.
   - Use new sealing rings on the coolant outlet pipe and thermostat housing.
   - The thermostat ball valve must locate in the recess in the cover.
2. Tighten the coolant outlet pipe bolts to 8-12 Nm. If replacing the coolant temperature sensor, tighten to 15-19 Nm.
3. Refill the cooling system as described in General Procedures.

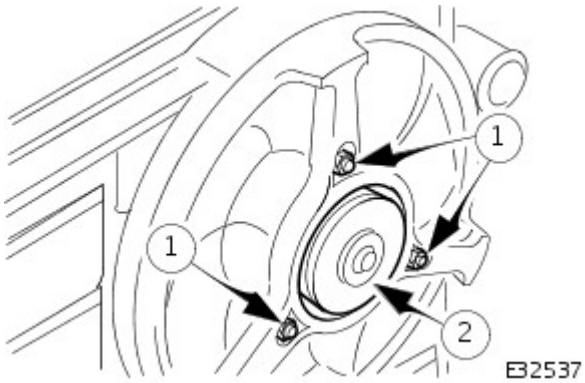
Engine Cooling - Cooling Fan Motor

Removal and Installation

Removal

1. Remove the Twin Fan and Motor Assembly (26.25.12) described in this section.

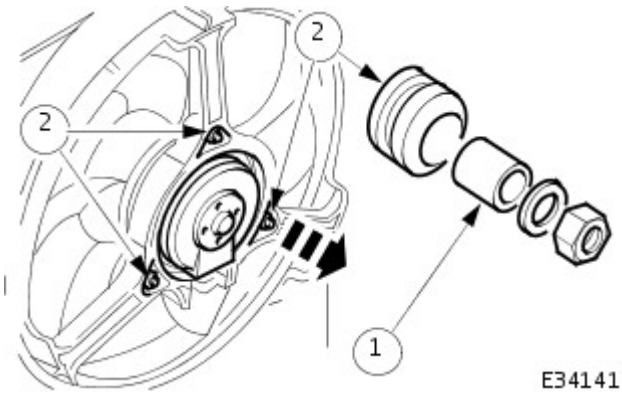
2. Remove the fan and motor unit from the twin fan and motor assembly.



1. Remove the three nuts which secure the fan and motor unit.

2. Remove the fan and motor unit.

3. Remove the fan rubber mountings.



1. Remove the spacer from each rubber mounting.

2. Remove the three rubber mountings.

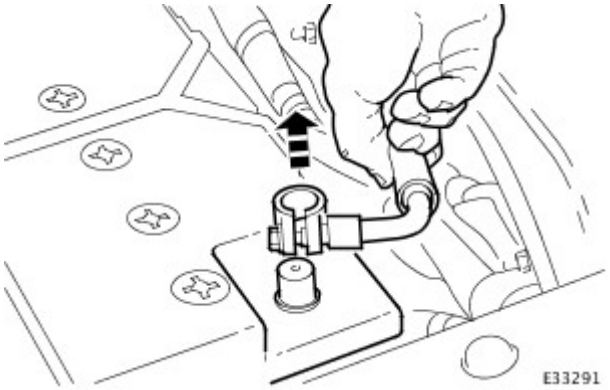
Installation

1. Installation is the reverse of the removal procedure.

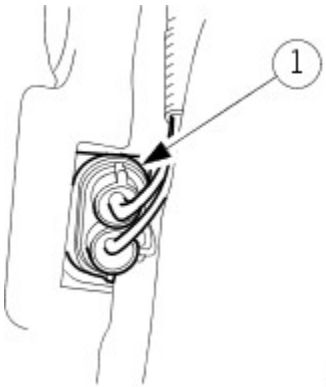
Engine Cooling - Cooling Fan Motor and Shroud

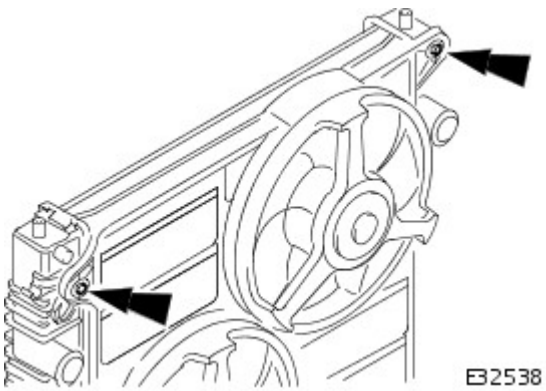
Removal and Installation

Removal



1. Disconnect the battery ground cable.
   - Remove the battery cover.
2. Open the engine compartment and fit paintwork protection sheets.
3. Disconnect the harness multiplug from each cooling fan.
   - Cut and remove the ratchet strap which secures each fan harness to the fan motor lower support leg.
     1. Disconnect the multiplug from each fan.
   - Disconnect each harness from the clip on the fan mounting frame and reposition the harness.





4. Remove the two bolts which secure the fan and motor assembly to the radiator.
5. Carefully remove the fan and motor assembly from the vehicle.
6. Remove the mounting grommets and spacer tubes from the assembly.

Installation

1. Installation is the reverse of the removal procedure. Ensure that the fan and motor assembly locate into the lower mountings.
2. Connect the battery and fit the battery cover. Reset the clock and the radio.

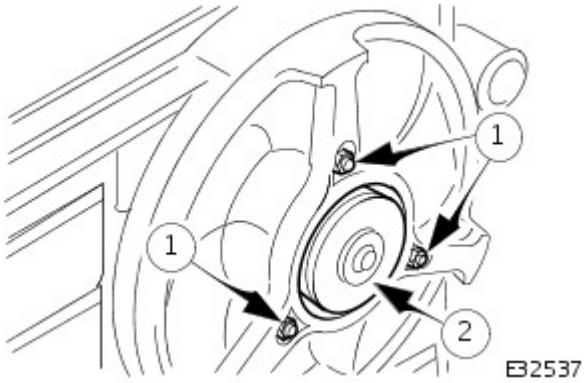
Engine Cooling - Cooling Fan Motors

Removal and Installation

Removal

1. Remove the Twin Fan and Motor Assembly (26.25.12) described in this section. Do not remove the harness and pipe securing clips from the assembly.

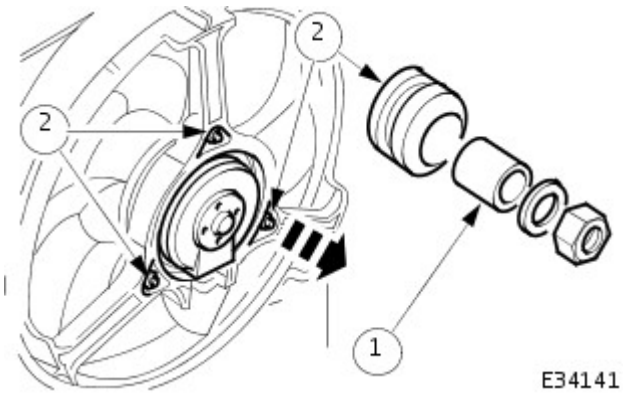
2. Remove the fan and motor units from the twin fan and motor assembly.



1. Remove the three nuts which secure the fan and motor unit.
2. Remove the fan and motor unit.

- Repeat the above two operations for the second fan.

3. Remove the fan rubber mountings.



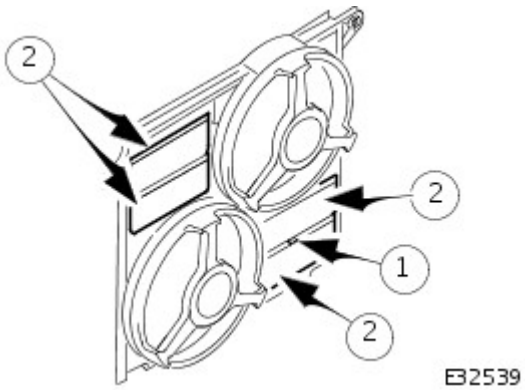
1. Remove the spacer from each rubber mounting.
2. Remove the rubber mountings; three for each fan unit.

Installation

1. Installation is the reverse of the removal procedure.

Engine Cooling - Cooling Fan Shroud

Removal and Installation



Removal

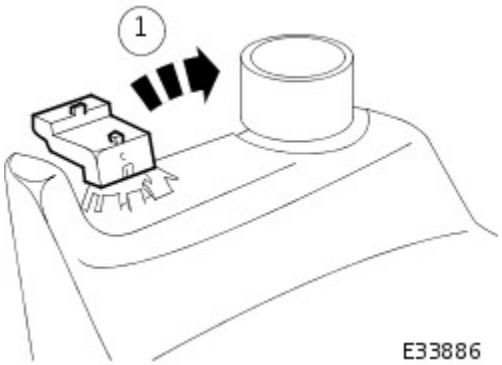
1. Remove the Twin Fan and Motor Assembly (26.25.12) from the radiator.
2. With twin fan and motor assembly on the bench, remove both fan and motor units (26.25.25).
3. Remove the components from the mounting frame.
    1. Remove the harness and pipe securing clips.
    2. Remove the rubber vent flaps.

Installation

1. Installation is the reverse of the removal procedure.

Engine Cooling - Engine Coolant Level Switch

Removal and Installation



Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the expansion tank; refer to Operation (26.15.01.) in this section.
3. Remove the coolant level probe.

    1. Use a lever to release the probe from the expansion tank and remove it.

4. Clean the expansion tank probe aperture.

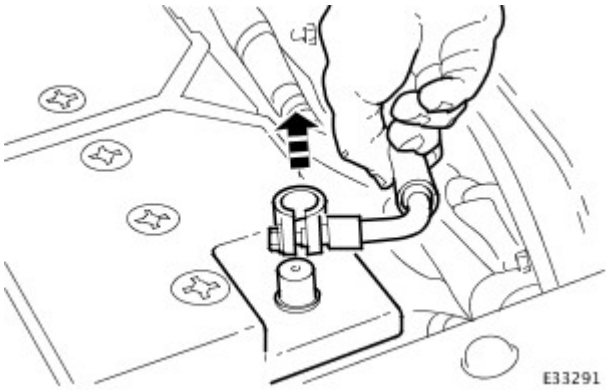
Installation

1. Installation is the reverse of the removal procedure.

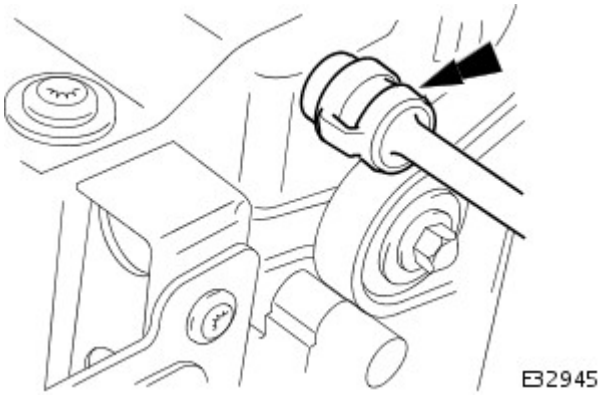
Engine Cooling - Radiator4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

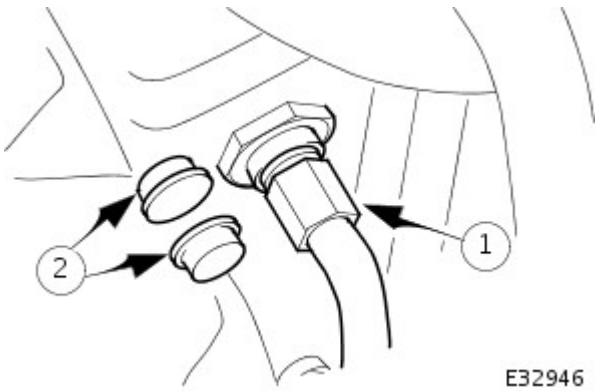
Removal



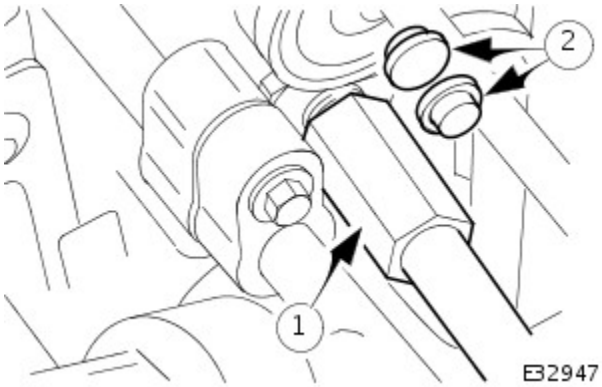
1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Drain the coolant from the radiator.
4. Depressurise the climate control system. Refer to Section 412-03 Observe all safety warnings and precautions stated in that section.
5. Release both gas struts, set the engine compartment cover fully forward to the service access position and support with a wooden (or similar) strut - take care not to damage the engine compartment cover or the radiator grille.
6. Remove the twin fan and motor assembly. Refer to Operation 26.25.12 in this section.



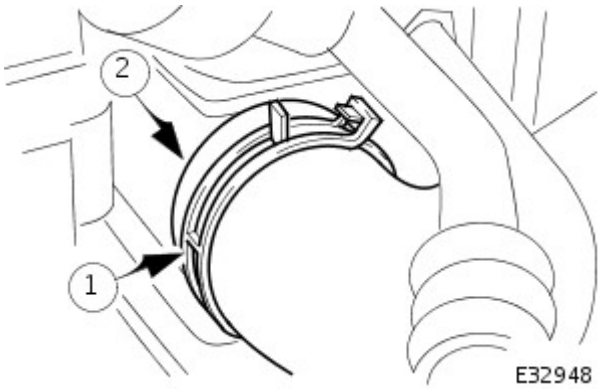
7. Disconnect the radiator breather hose.
   - Release the Quick-Fit hose (radiator to expansion tank) and disconnect the hose from the radiator.



8. Disconnect the transmission oil cooler lower pipe.
   1. Disconnect and reposition the union nut, lower cooler pipe to radiator. Disconnect the pipe.
   2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.
9. From above the vehicle, disconnect the transmission oil cooler upper pipe.

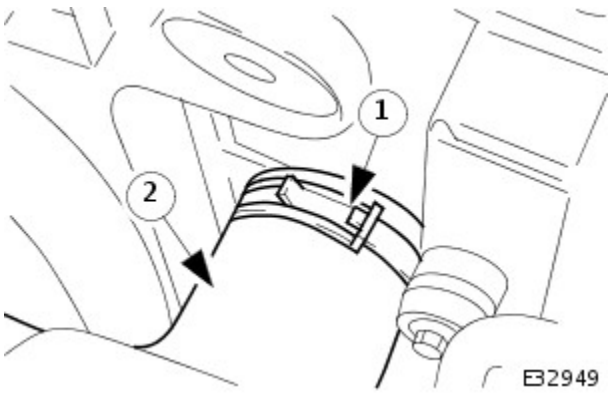


1. Disconnect and reposition the union nut, upper cooler pipe to radiator. Disconnect the pipe.
2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.



10. Disconnect the radiator bottom hose.

1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.



11. Disconnect the radiator top hose.

1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

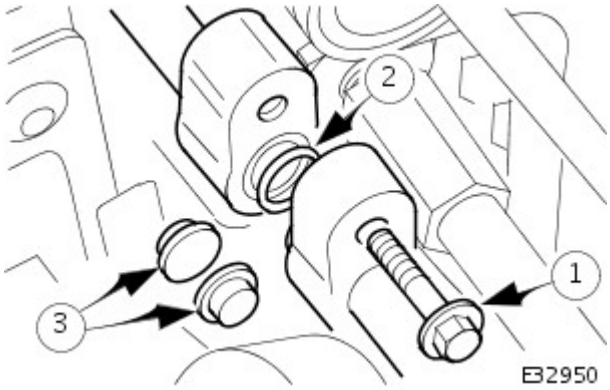


12. Release the radiator top retaining panel.

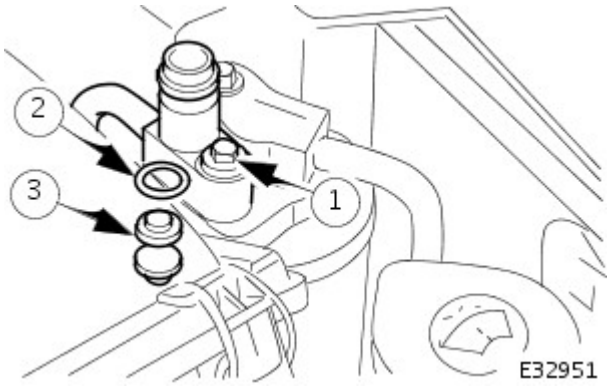
- Remove the ten bolts which secure the panel.

13. Disconnect the discharge hose from the condenser.

1. Remove the bolt which secures the condenser discharge hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.

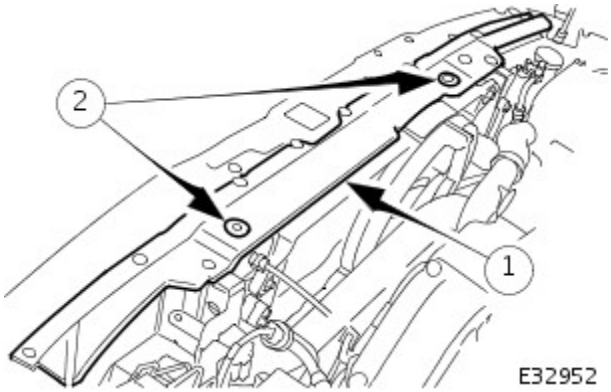


3. Fit blanking plugs to the hose and to the condenser.



14. Disconnect the condenser jump hose from the receiver / drier.

1. Remove the bolt which secures the condenser jump hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.
3. Fit blanking plugs to the hose and to the receiver / drier.



15. Remove the radiator top retaining panel.

1. Remove the panel.
2. Remove the radiator top mounting bushes.

16. Disconnect the bonnet switch harness.

17. Remove the radiator.

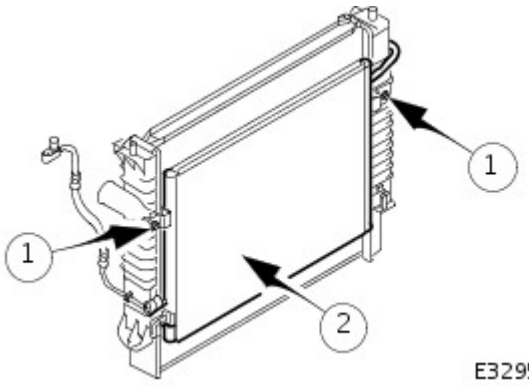


- Remove the radiator assembly.
- Clean coolant spillage from the radiator lower carrier panel.

18. Remove the condenser from the radiator.

1. Remove the two bolts which secure the condenser to the radiator.
2. Remove the condenser.

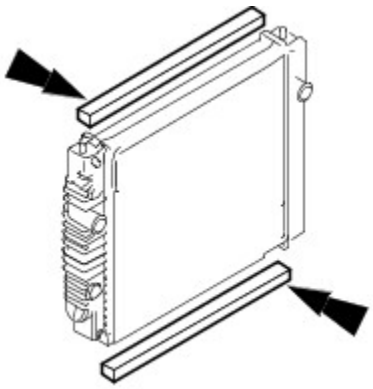
- If necessary, remove the jump hose from the condenser.



E32954

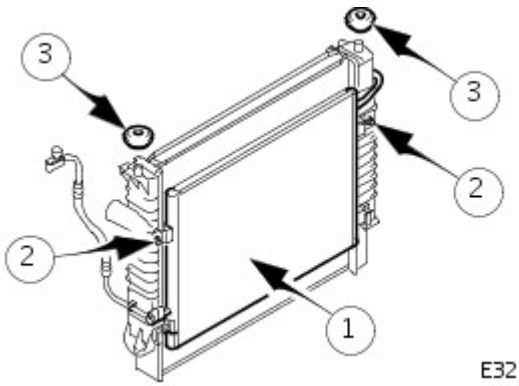
19. Remove the fan switch.

Installation


E32955

1. Fit new foam sealing strips to the radiator top, and bottom faces.

- If removed previously, refit the jump hose to the condenser.



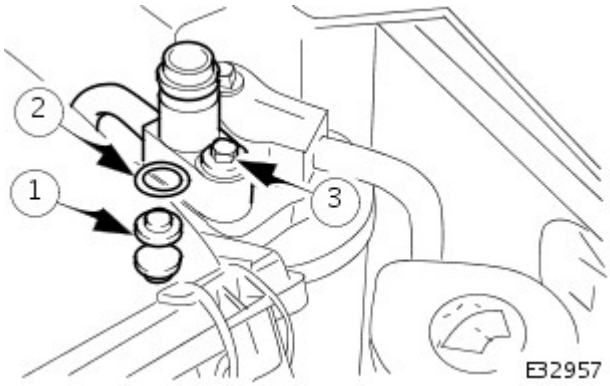
E32956

2. Fit the condenser to the radiator.

1. Position the condenser.
2. Fit the two bolts which secure the condenser to the radiator.
3. Fit the upper mounting bushes to the radiator.

3. Reposition the radiator to the vehicle.

4. Connect the jump hose to the receiver / drier.

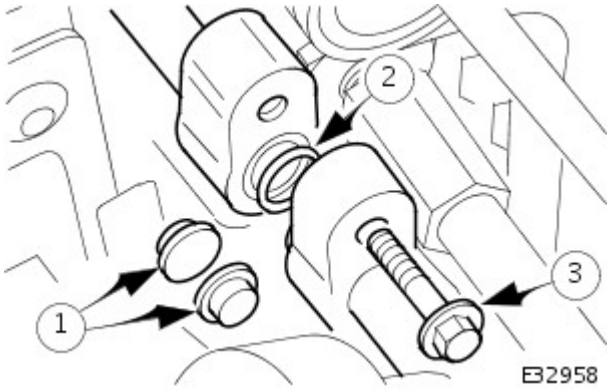


E32957

1. Remove the blanking plugs from the pipe and from the receiver / drier.
2. Fit a new O-ring seal to the pipe. Lubricate the seal with A/C compressor oil.
3. Connect the pipe to the receiver / drier and fit the securing bolt.

5. Connect the discharge hose to the condenser.

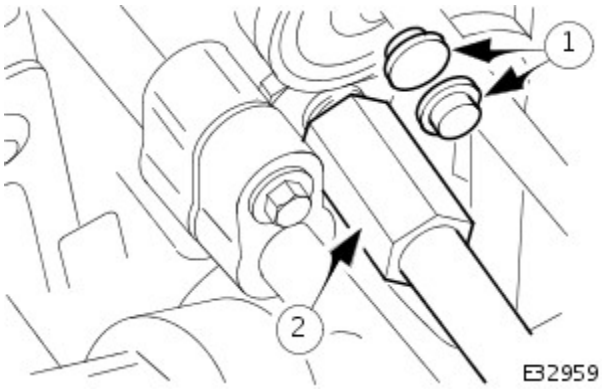
1. Remove the blanking plugs from the pipe and



condenser.

2. Fit a new O-ring seal to the pipe. Lubricate the seal with A/C compressor oil.

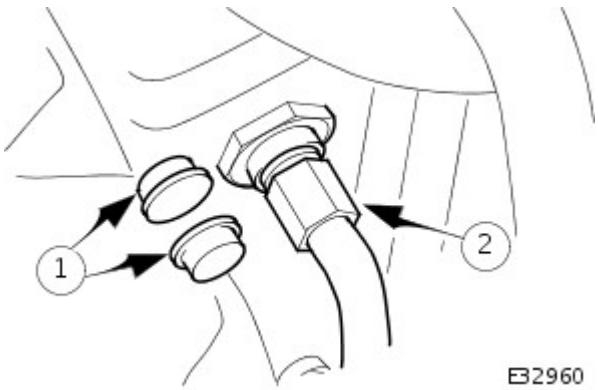
3. Reconnect the pipe to the condenser and fit the securing bolt.



6. Connect the transmission oil cooler upper pipe.

1. Remove the blanking plugs and fit a new O-ring seal to the pipe. Lubricate the seal with automatic transmission fluid, and reposition the pipe and the union nut to the radiator.

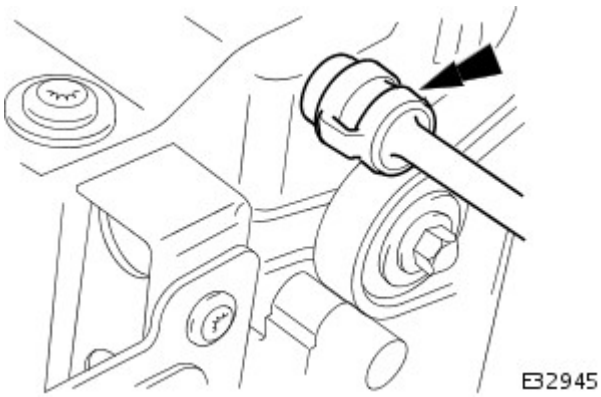
2. Connect and tighten the union nut.



7. Connect the transmission lower cooler pipe to the radiator.

1. Remove the blanking plugs and fit a new O-ring seal to the cooler pipe. Lubricate the seal with automatic transmission fluid

2. Reposition the pipe and the union nut to the radiator. Connect and tighten the union nut.



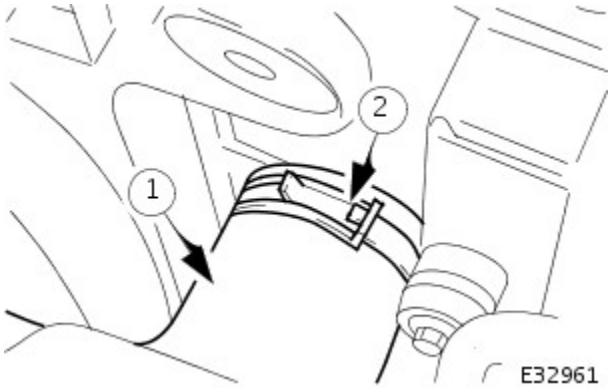
8. Connect the radiator breather hose (radiator to expansion tank).

- Connect the hose to the radiator.

9. Connect the radiator coolant top hose.

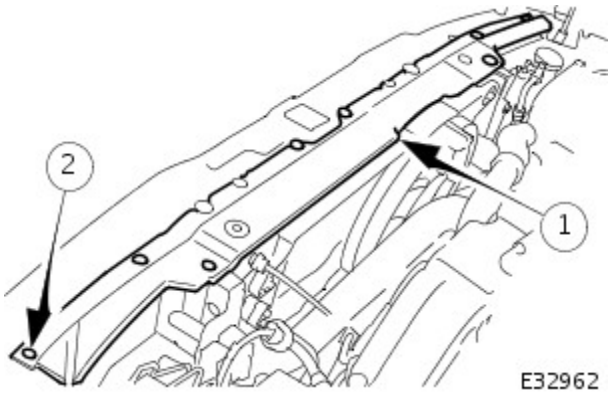
1. Reposition and connect the top hose to the radiator.

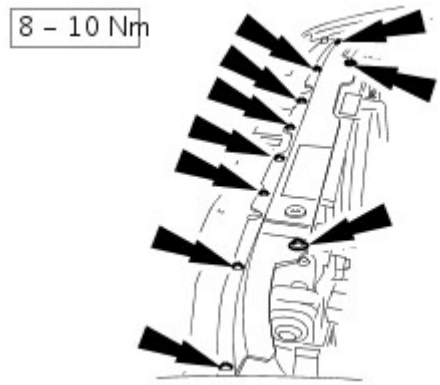
2. Reposition the hose clip.



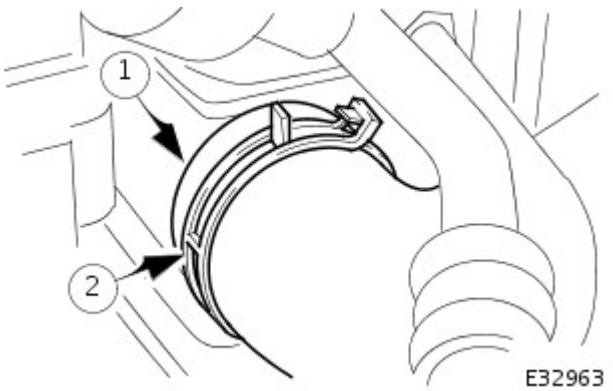
10. Fit the radiator top securing panel.

1. Position and align the top securing panel.
2. Fit the eight securing bolts to the panel.





11. Tighten the ten bolts which secure the radiator top panel.



12. Connect the radiator coolant bottom hose.

1. Reposition and connect the bottom hose to the radiator.
2. Reposition the hose clip.

13. Fit the twin fan and motor assembly. Refer to Operation 26.25.12 in this section.

14. Remove the temporary wooden support strut and reconnect the gas struts to the engine compartment cover.

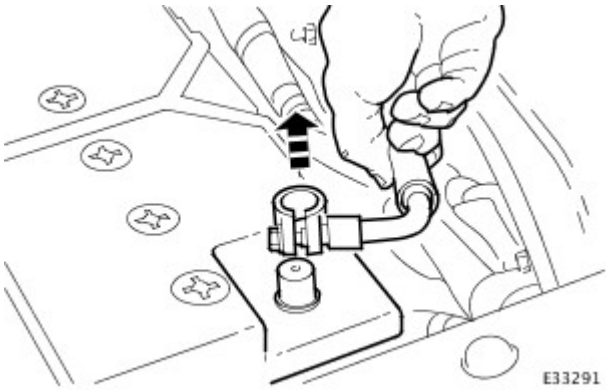
15. Check the level and replenish the transmission fluid as necessary. Refer to Section 307 for the recommended procedure.

16. Refill the cooling system. Refer to the Refill procedure in General Procedures.
17. Repressurise the climate control system. Refer to Section 412-03 Observe all safety warnings and precautions stated in that section.
18. Close the engine compartment cover.
19. Connect the battery and fit the battery cover. Reset the clock and the radio.

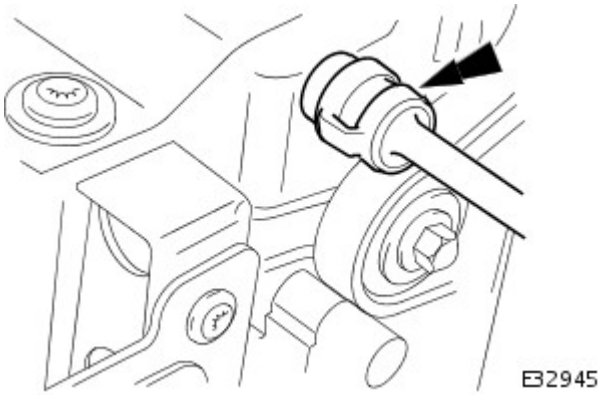
Engine Cooling - Radiator4.0L SC V8 - AJ26

Removal and Installation

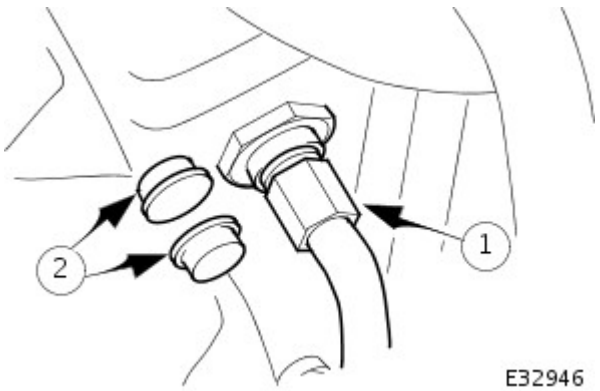
Removal



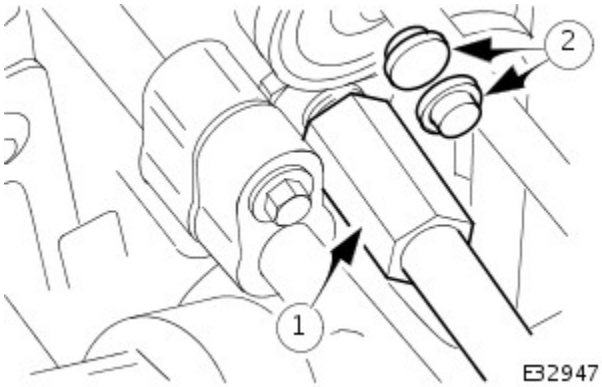
1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.
3. Drain the coolant from the radiator.
4. Depressurise the climate control system. Refer to Section 412-03 Observe all safety warnings and precautions stated in that section.
5. Release both gas struts, set the engine compartment cover fully forward to the service access position and support with a wooden (or similar) strut - take care not to damage the engine compartment cover or the radiator grille.
6. Remove the twin fan and motor assembly. Refer to Operation 26.25.12 in this section.



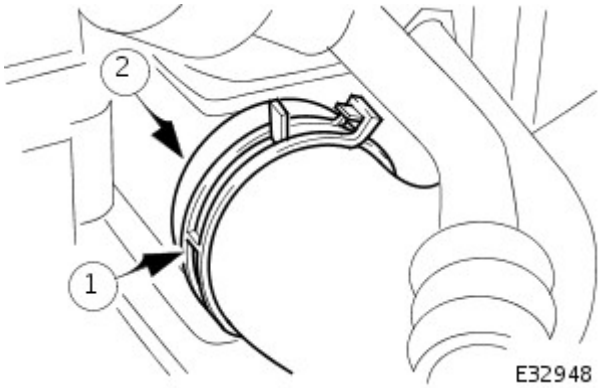
7. Disconnect the radiator breather hose.
   - Release the Quick-Fit hose (radiator to expansion tank) and disconnect the hose from the radiator.



8. Disconnect the transmission oil cooler lower pipe.
   1. Disconnect and reposition the union nut, lower cooler pipe to radiator. Disconnect the pipe.
   2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.
9. From above the vehicle, disconnect the transmission oil cooler upper pipe.

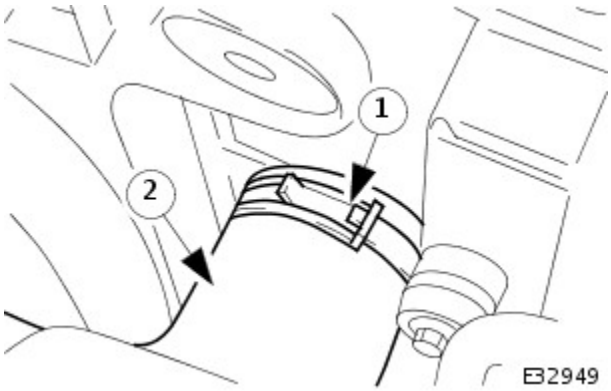


1. Disconnect and reposition the union nut, upper cooler pipe to radiator. Disconnect the pipe.
2. Remove and discard the O-ring seal from the pipe and fit blanking plugs to the pipe and to the union on the radiator.



10. Disconnect the radiator bottom hose.

1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.



11. Disconnect the radiator top hose.

1. Slacken the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

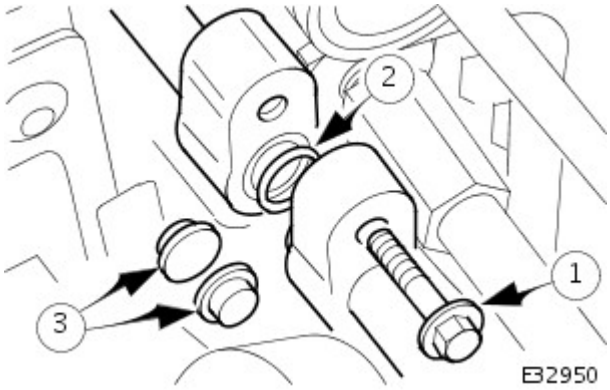


12. Release the radiator top retaining panel.

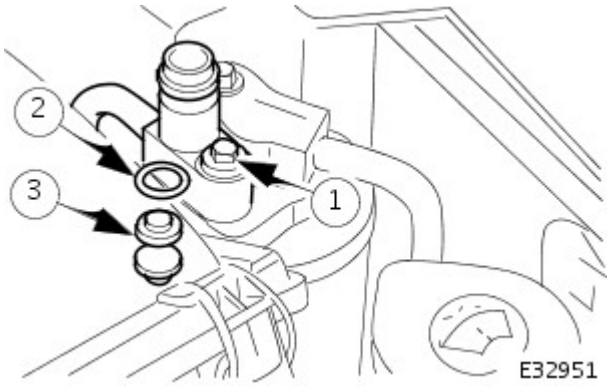
- Remove the ten bolts which secure the panel.

13. Disconnect the discharge hose from the condenser.

1. Remove the bolt which secures the condenser discharge hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.

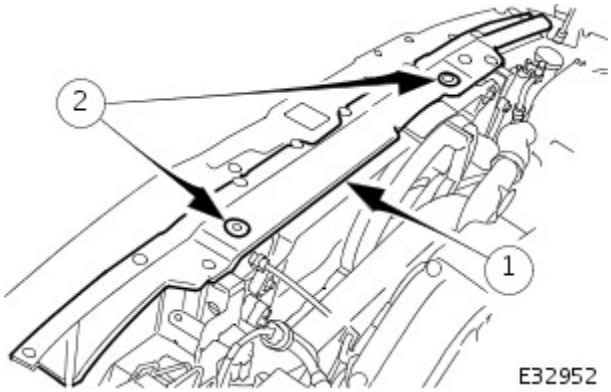


3. Fit blanking plugs to the hose and to the condenser.



14. Disconnect the condenser jump hose from the receiver / drier.

1. Remove the bolt which secures the condenser jump hose and disconnect the hose.
2. Remove and discard the O-ring seal from the hose.
3. Fit blanking plugs to the hose and to the receiver / drier.



15. Remove the radiator top retaining panel.

1. Remove the panel.
2. Remove the radiator top mounting bushes.

16. Disconnect the bonnet switch harness.

17. Remove the radiator.

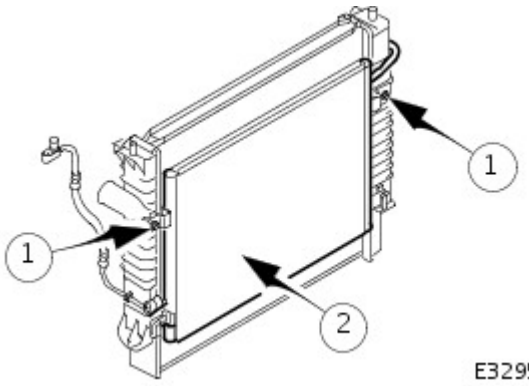


- Remove the radiator assembly.
- Clean coolant spillage from the radiator lower carrier panel.

18. Remove the condenser from the radiator.

1. Remove the two bolts which secure the condenser to the radiator.
2. Remove the condenser.

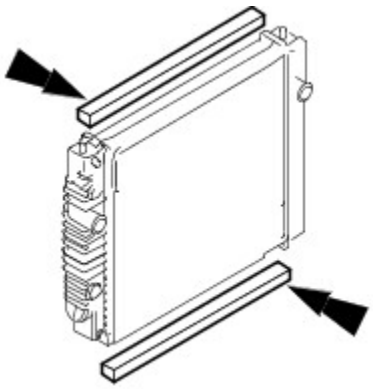
- If necessary, remove the jump hose from the condenser.



E32954

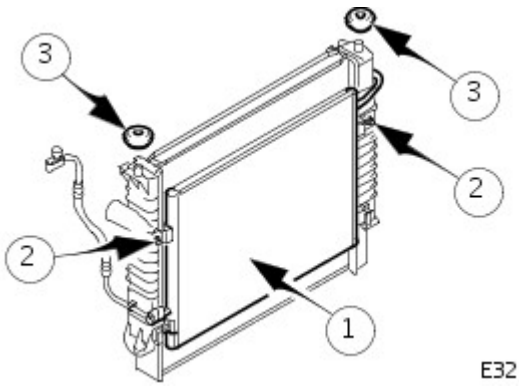
19. Remove the fan switch.

Installation


E32955

1. Fit new foam sealing strips to the radiator top, and bottom faces.

- If removed previously, refit the jump hose to the condenser.



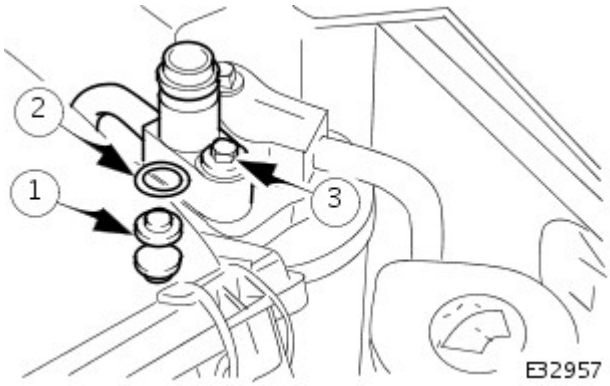
E32956

2. Fit the condenser to the radiator.

1. Position the condenser.
2. Fit the two bolts which secure the condenser to the radiator.
3. Fit the upper mounting bushes to the radiator.

3. Reposition the radiator to the vehicle.

4. Connect the jump hose to the receiver / drier.

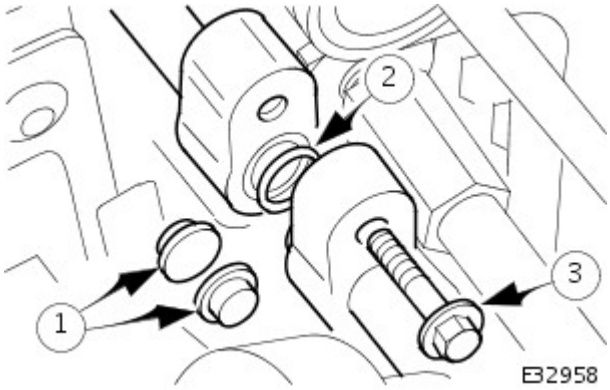


E32957

1. Remove the blanking plugs from the pipe and from the receiver / drier.
2. Fit a new O-ring seal to the pipe. Lubricate the seal with A/C compressor oil.
3. Connect the pipe to the receiver / drier and fit the securing bolt.

5. Connect the discharge hose to the condenser.

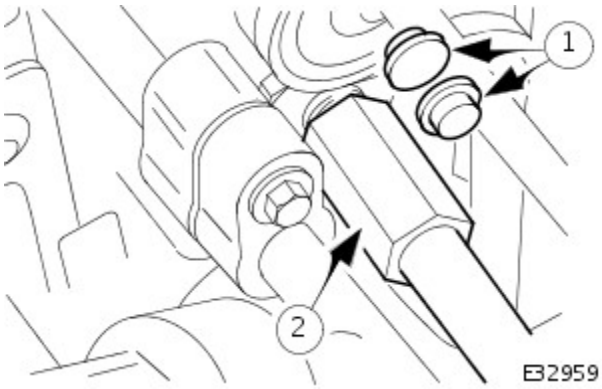
1. Remove the blanking plugs from the pipe and



condenser.

2. Fit a new O-ring seal to the pipe. Lubricate the seal with A/C compressor oil.

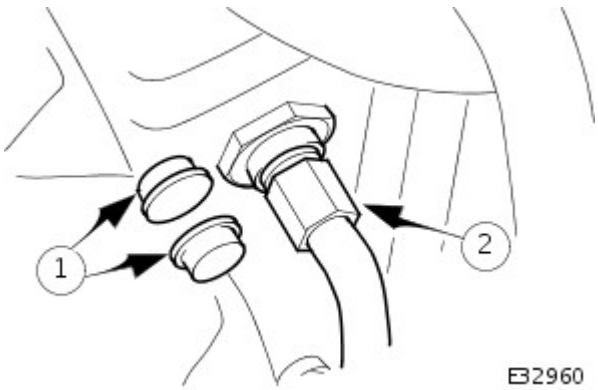
3. Reconnect the pipe to the condenser and fit the securing bolt.



6. Connect the transmission oil cooler upper pipe.

1. Remove the blanking plugs and fit a new O-ring seal to the pipe. Lubricate the seal with automatic transmission fluid, and reposition the pipe and the union nut to the radiator.

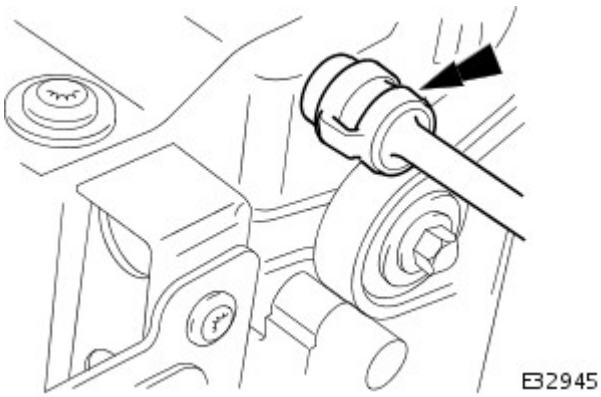
2. Connect and tighten the union nut.



7. Connect the transmission lower cooler pipe to the radiator.

1. Remove the blanking plugs and fit a new O-ring seal to the cooler pipe. Lubricate the seal with automatic transmission fluid

2. Reposition the pipe and the union nut to the radiator. Connect and tighten the union nut.



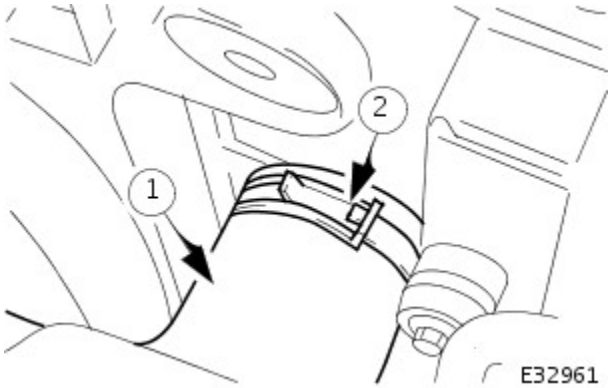
8. Connect the radiator breather hose (radiator to expansion tank).

- Connect the hose to the radiator.

9. Connect the radiator coolant top hose.

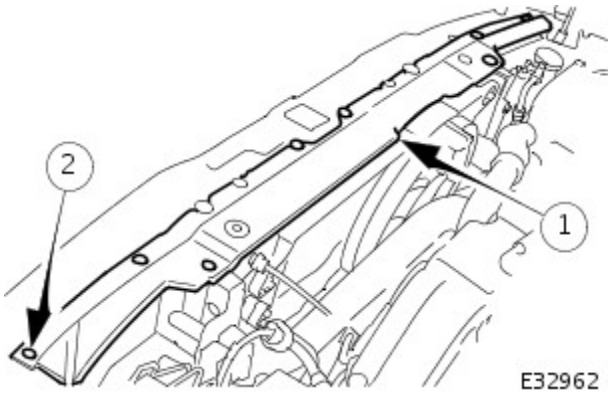
1. Reposition and connect the top hose to the radiator.

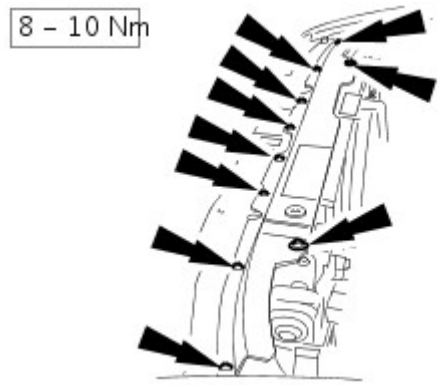
2. Reposition the hose clip.



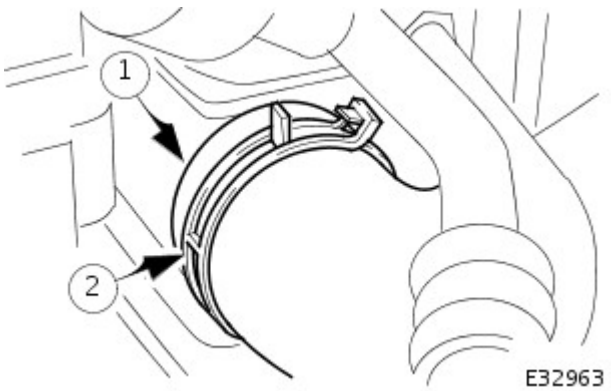
10. Fit the radiator top securing panel.

1. Position and align the top securing panel.
2. Fit the eight securing bolts to the panel.





11. Tighten the ten bolts which secure the radiator top panel.



12. Connect the radiator coolant bottom hose.

1. Reposition and connect the bottom hose to the radiator.
2. Reposition the hose clip.

13. Fit the twin fan and motor assembly. Refer to Operation 26.25.12 in this section.

14. Remove the temporary wooden support strut and reconnect the gas struts to the engine compartment cover.

15. Check the level and replenish the transmission fluid as necessary. Refer to Section 307 for the recommended procedure.

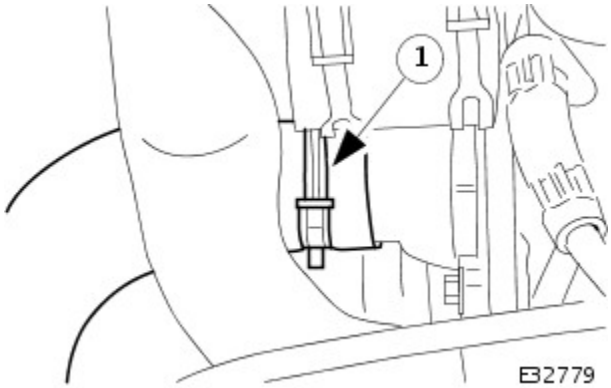
16. Refill the cooling system. Refer to the Refill procedure in General Procedures.
17. Repressurise the climate control system. Refer to Section 412-03 Observe all safety warnings and precautions stated in that section.
18. Close the engine compartment cover.
19. Connect the battery and fit the battery cover. Reset the clock and the radio.

Engine Cooling - Radiator Lower Hose4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

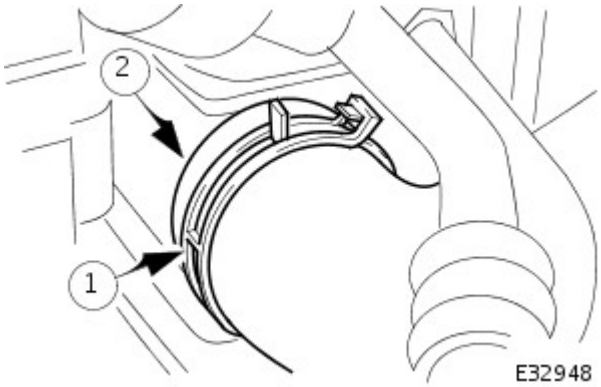
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the thermostat cover.
3. Disconnect the radiator bottom hose from the thermostat cover.



    1. Release and reposition the hose clip, and disconnect the bottom hose.

4. Disconnect the bottom hose from the radiator.



    1. Slacken the hose retaining clip and reposition the clip along the hose.
    2. Disconnect the hose from the radiator.

5. Remove the spring band clips from the hose.

Installation

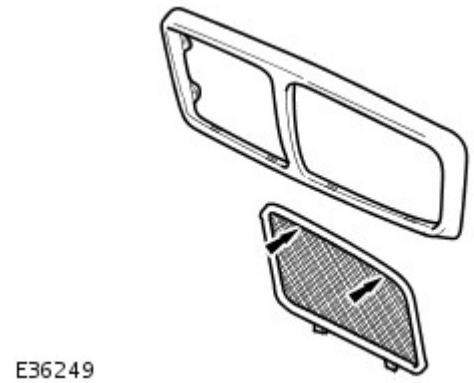
1. Installation is the reverse of the removal procedure.
2. Refill the cooling system as described in General Procedures.

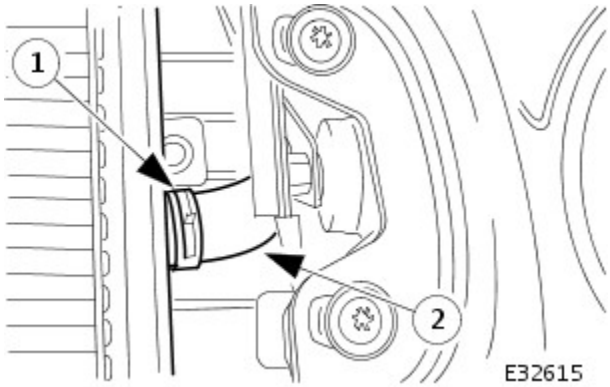
Engine Cooling - Radiator Lower Hose4.0L SC V8 - AJ26

Removal and Installation

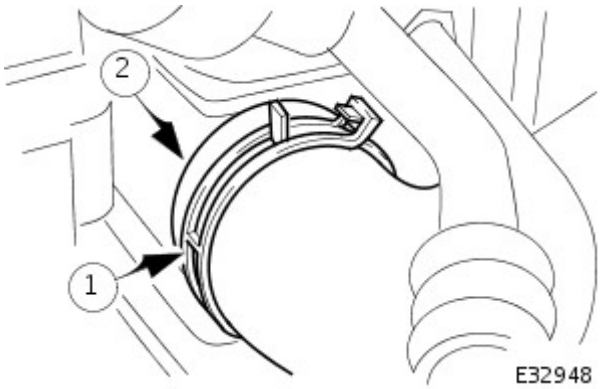
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the thermostat cover.
3. Remove the two screws which secure the radiator grille and remove the grille for access.

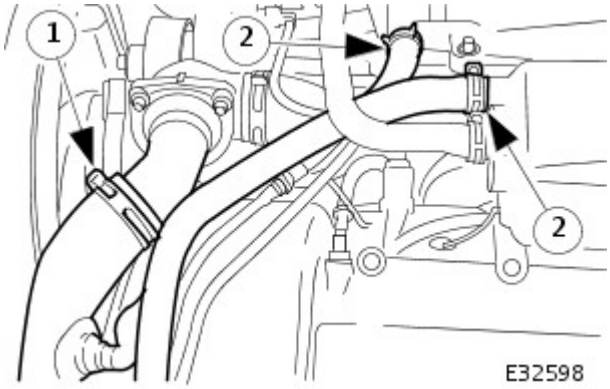




4. Release and reposition the spring clip, and disconnect the hose from the charge air cooler radiator.



5. Disconnect the bottom hose from the radiator.
    1. Slacken the hose retaining clip and reposition the clip along the hose.
    2. Disconnect the hose from the radiator.
6. Disconnect the radiator bottom hose from the thermostat cover and air charge cooler.
    1. Release and reposition the hose clip, and disconnect the bottom hose from the thermostat cover.
    2. Release and reposition the hose clips, and disconnect the two sections of moulded hose from the air charge cooler.



- Remove the hose assembly.

7. Remove the spring band clips from the hose.

Installation

1. Installation is the reverse of the removal procedure.

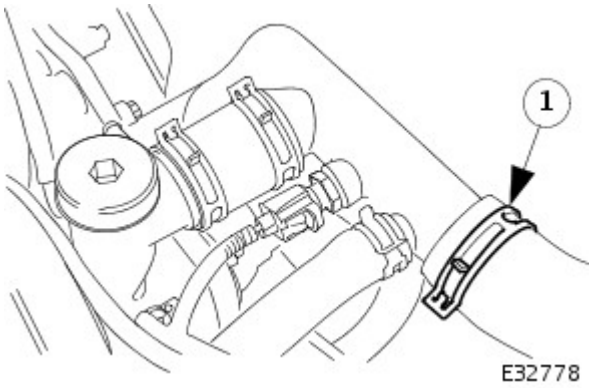
2. Refill the cooling system as described in General Procedures.

Engine Cooling - Radiator Upper Hose4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

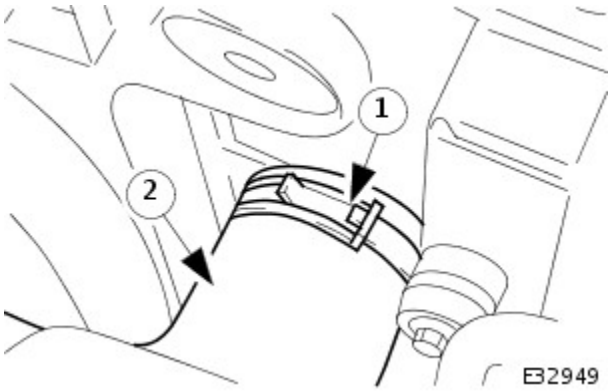
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the hose.
3. Disconnect the top hose from the coolant outlet pipe.



1. Release and reposition the hose clip, and disconnect the top hose.

4. Release the top hose from the radiator.



1. Release the hose retaining clip and reposition the clip along the hose.
2. Disconnect the hose from the radiator.

- Remove the hose clips from the top hose.

Installation

1. Installation is the reverse of the removal procedure.
2. Refill the cooling system as described in General Procedures.

Engine Cooling - Radiator Upper Hose4.0L SC V8 - AJ26

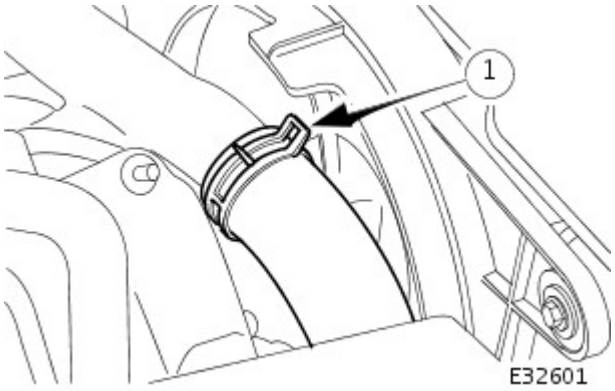
Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.

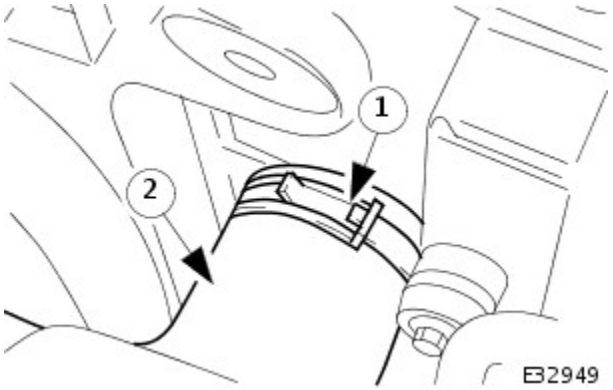
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the hose.

3. Disconnect the top hose from the coolant outlet pipe.



1. Release and reposition the hose clip, and disconnect the top hose.

4. Release the top hose from the radiator.



1. Release the hose retaining clip and reposition the clip along the hose.

2. Disconnect the hose from the radiator.

- Remove the hose clips from the top hose.

Installation

1. Installation is the reverse of the removal procedure.

2. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

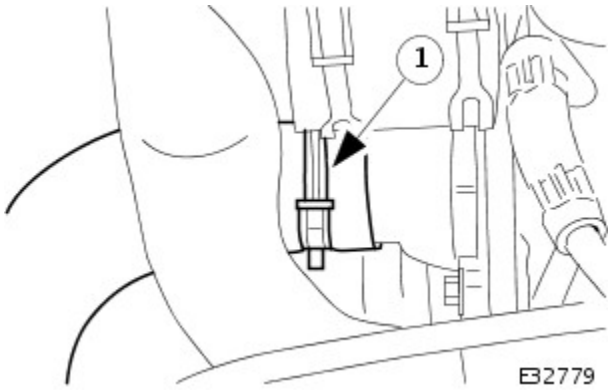
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the thermostat cover.

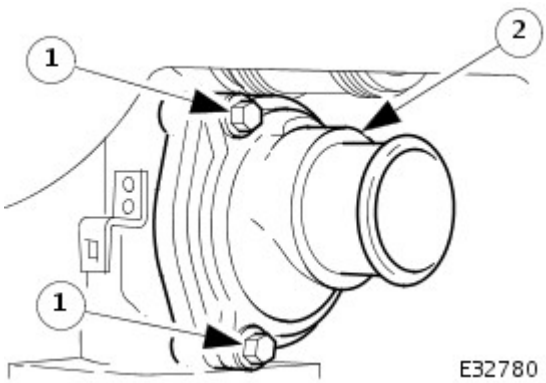
3. Remove the engine cover panels for access.

4. Disconnect the radiator bottom hose from the thermostat cover.



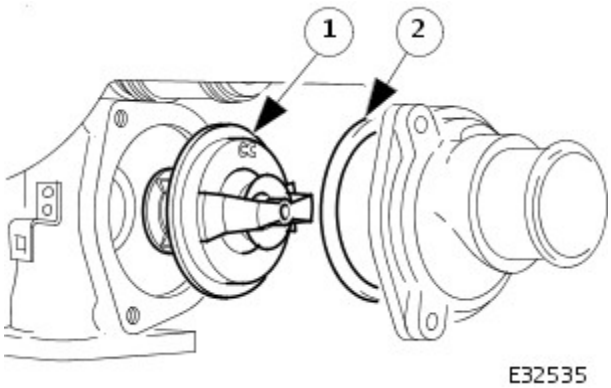
1. Release and reposition the hose clip, and disconnect the bottom hose from the thermostat cover.

5. Remove the thermostat cover.



1. Remove the three bolts which secure the thermostat cover to the housing.
2. Remove the thermostat cover from the housing.

6. Remove the thermostat from the housing.



1. Remove the thermostat from the housing.
2. Remove (and discard) the seal from the thermostat.

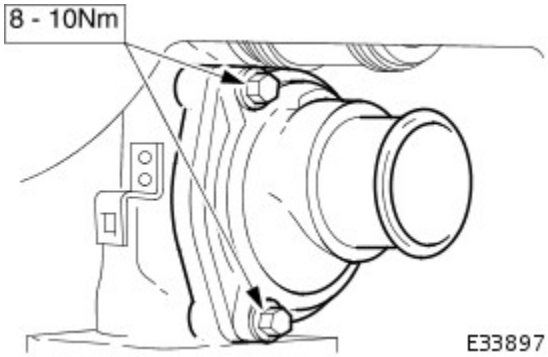
- Fit a new seal to the thermostat. The seal may be fitted either way round.

Installation

1. Installation is the reverse of the removal procedure.

2. Fit the thermostat so that the vent ball valve locates in the recess in the cover.

3. Tighten the thermostat cover bolts to 8-10 Nm.



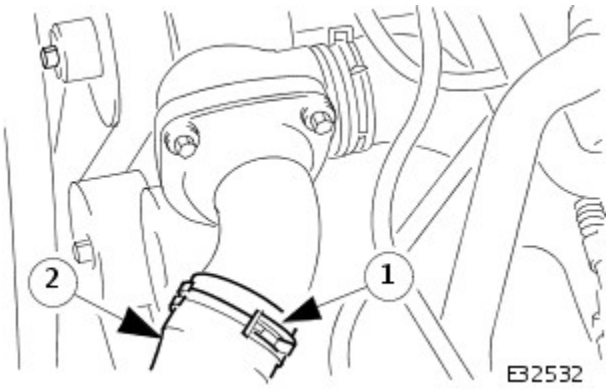
4. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat4.0L SC V8 - AJ26

Removal and Installation

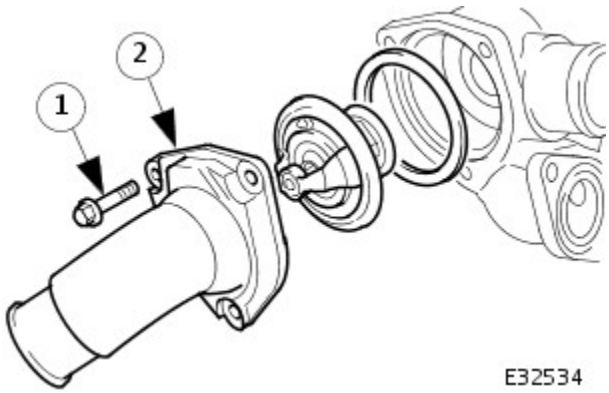
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the outlet pipe.
3. Disconnect the bottom hose from the coolant outlet pipe.



   1. Release and reposition the hose clip.
   2. Disconnect the bottom hose.

4. Remove the thermostat from the outlet pipe.



   1. Remove the three bolts which secure the thermostat cover to the outlet pipe.
   2. Remove the thermostat cover, the thermostat and the seal from the outlet pipe. Discard the seal.

Installation

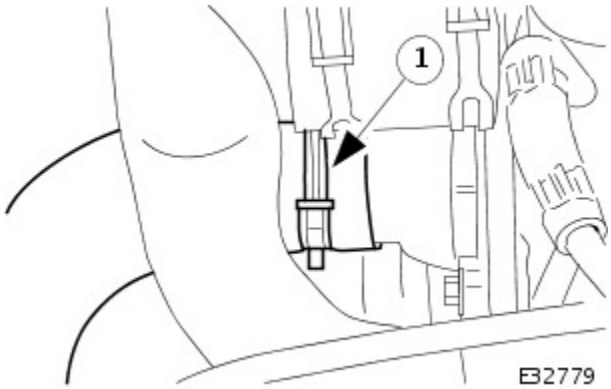
1. Installation is the reverse of the removal procedure.
   - Use new sealing rings on the coolant outlet pipe and thermostat housing.
   - The thermostat ball valve must locate in the recess in the cover.
2. Tighten the thermostat cover bolts to 8-10 Nm.
3. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat Housing Cover4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

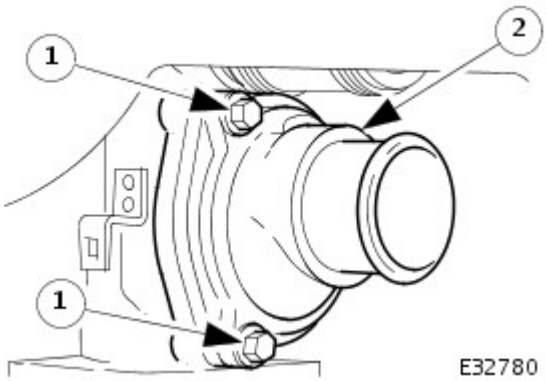
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the thermostat cover.
3. Remove the engine cover panels for access.
4. Disconnect the radiator bottom hose from the thermostat cover.



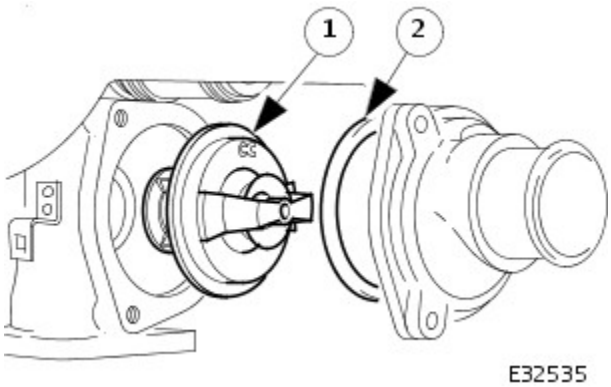
1. Release and reposition the hose clip, and disconnect the bottom hose from the thermostat cover.

5. Remove the thermostat cover.



1. Remove the three bolts which secure the thermostat cover to the housing.
2. Remove the thermostat cover from the housing.

6. Remove the thermostat from the housing.

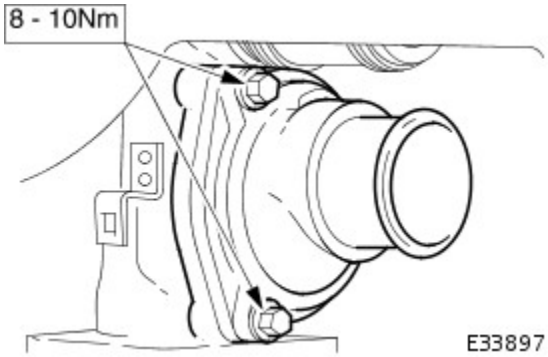


1. Remove the thermostat from the housing.
2. Remove (and discard) the seal from the thermostat.

- Fit a new seal to the thermostat. The seal may be fitted either way round.

Installation

1. Installation is the reverse of the removal procedure.
2. Fit the thermostat so that the vent ball valve locates in the recess in the cover.
3. Tighten the thermostat cover bolts to 8-10 Nm.



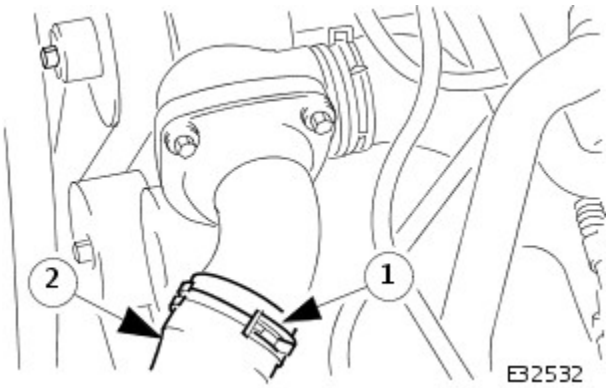
4. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat Housing Cover4.0L SC V8 - AJ26

Removal and Installation

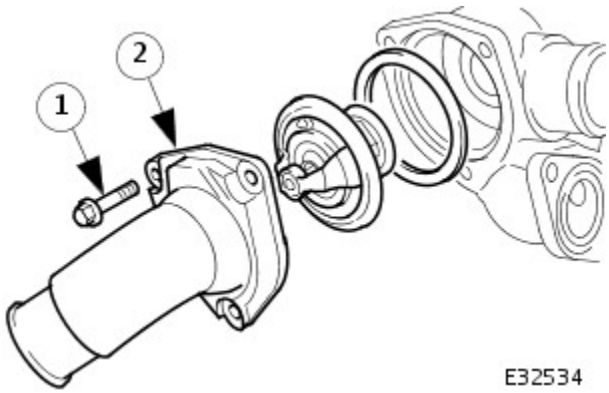
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the outlet pipe.
3. Disconnect the bottom hose from the coolant outlet pipe.



    1. Release and reposition the hose clip.
    2. Disconnect the bottom hose.

4. Remove the thermostat from the outlet pipe.



    1. Remove the three bolts which secure the thermostat cover to the outlet pipe.
    2. Remove the thermostat cover, the thermostat and the seal from the outlet pipe. Discard the seal.

Installation

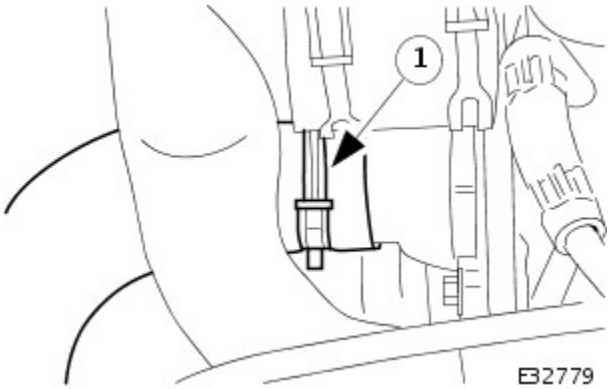
1. Installation is the reverse of the removal procedure.
    - Use new sealing rings on the coolant outlet pipe and thermostat housing.
    - The thermostat ball valve must locate in the recess in the cover.
2. Tighten the thermostat cover bolts to 8-10 Nm.
3. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat Housing Cover Seal4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

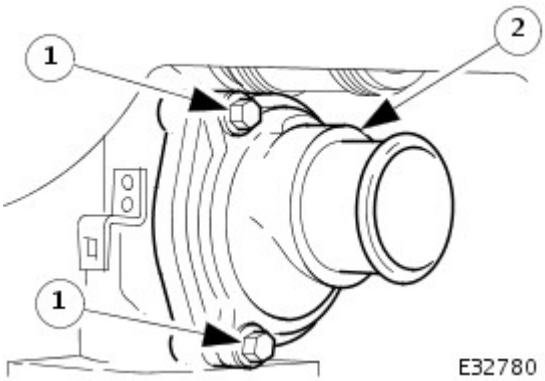
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the thermostat cover.
3. Remove the engine cover panels for access.
4. Disconnect the radiator bottom hose from the thermostat cover.



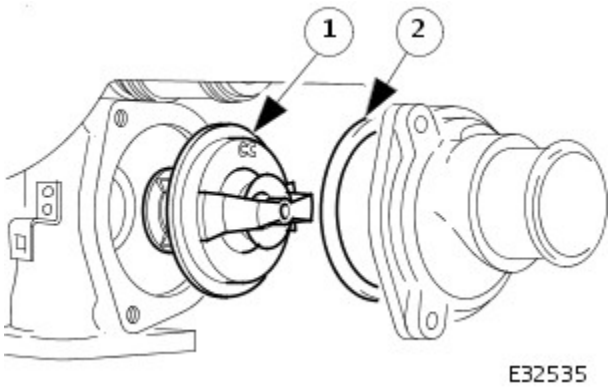
1. Release and reposition the hose clip, and disconnect the bottom hose from the thermostat cover.

5. Remove the thermostat cover.



1. Remove the three bolts which secure the thermostat cover to the housing.
2. Remove the thermostat cover from the housing.

6. Remove the thermostat from the housing.

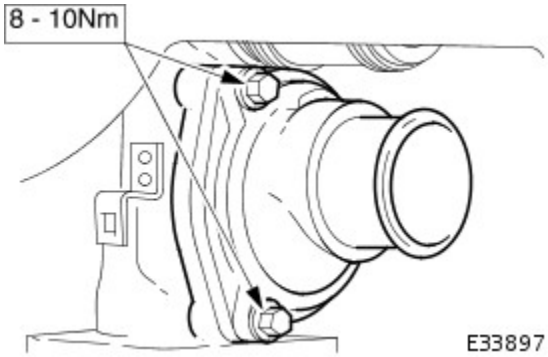


1. Remove the thermostat from the housing.
2. Remove (and discard) the seal from the thermostat.

- Fit a new seal to the thermostat. The seal may be fitted either way round.

Installation

1. Installation is the reverse of the removal procedure.
2. Fit the thermostat so that the vent ball valve locates in the recess in the cover.
3. Tighten the thermostat cover bolts to 8-10 Nm.



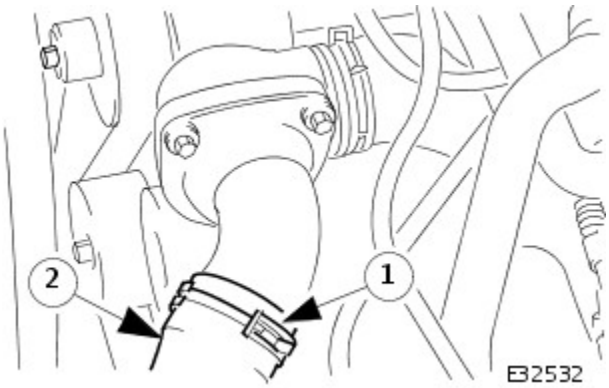
4. Refill the cooling system as described in General Procedures.

Engine Cooling - Thermostat Housing Cover Seal4.0L SC V8 - AJ26

Removal and Installation

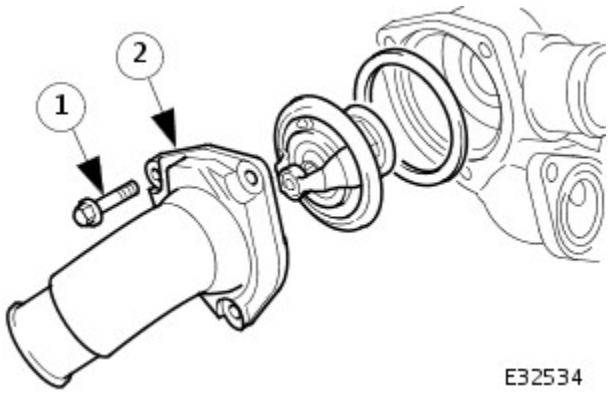
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the radiator. Refer to General Procedures. Retain the coolant drain tray in position to catch any spillage when removing the outlet pipe.
3. Disconnect the bottom hose from the coolant outlet pipe.



   1. Release and reposition the hose clip.
   2. Disconnect the bottom hose.

4. Remove the thermostat from the outlet pipe.



   1. Remove the three bolts which secure the thermostat cover to the outlet pipe.
   2. Remove the thermostat cover, the thermostat and the seal from the outlet pipe. Discard the seal.

Installation

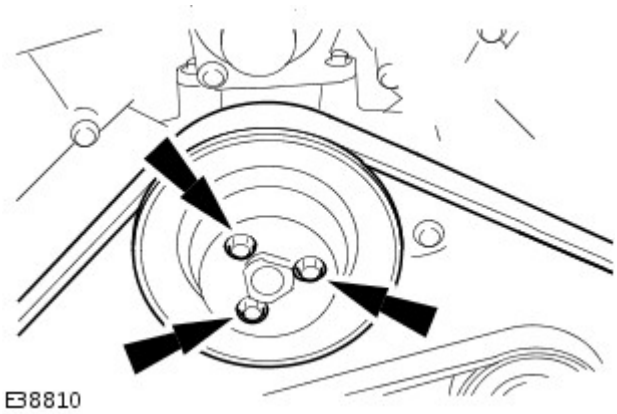
1. Installation is the reverse of the removal procedure.
   - Use new sealing rings on the coolant outlet pipe and thermostat housing.
   - The thermostat ball valve must locate in the recess in the cover.
2. Tighten the thermostat cover bolts to 8-10 Nm.
3. Refill the cooling system as described in General Procedures.

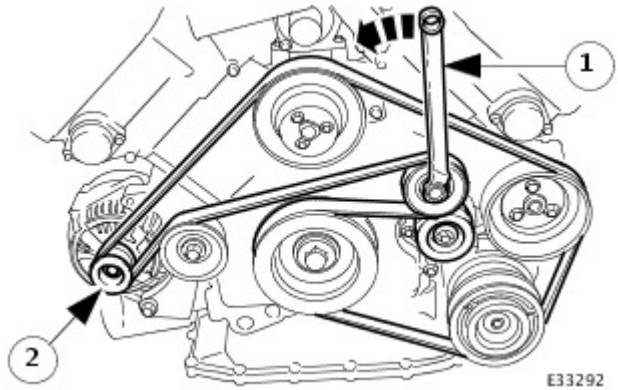
Engine Cooling - Water Pump4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the cooling system.
   For additional information, refer to Cooling System Draining, Filling and Bleeding - Vehicles Without: Supercharger in this section.
3. Slacken the three screws which secure the water pump pulley.





4. CAUTION: When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

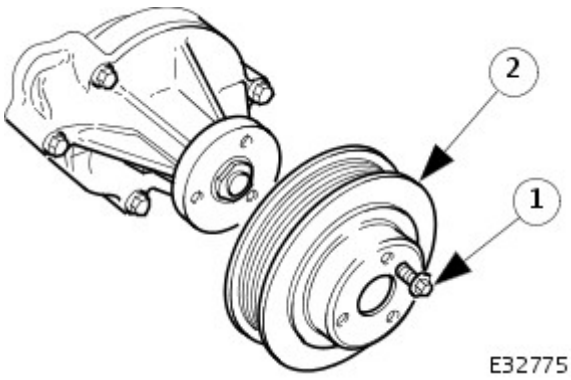
   Remove the drive belt from the generator and accessory drive.

   1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
   2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

   - Disconnect the belt from the other pulleys, as necessary, to move it clear of the pump pulley.

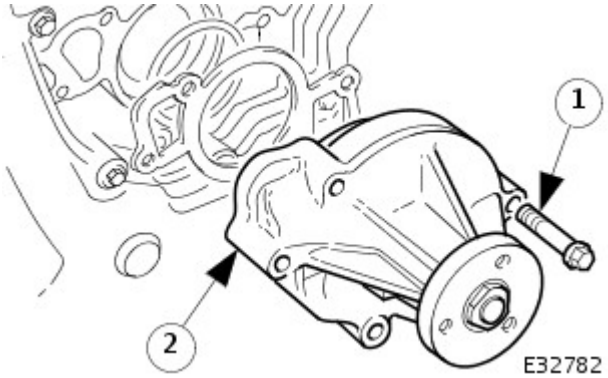
5. Remove the pulley from the water pump.

   1. Remove the pulley securing screws.
   2. Remove the pulley from the water pump.

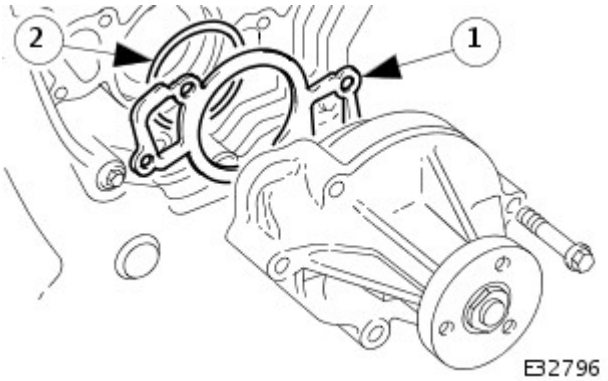


6. Remove the water pump.

   1. Remove the five bolts which secure the water pump.



2. Remove the water pump from the engine.



7. Remove the gasket.

1. Remove and discard the water pump gasket.
2. Remove and discard the water pump O-ring seal.

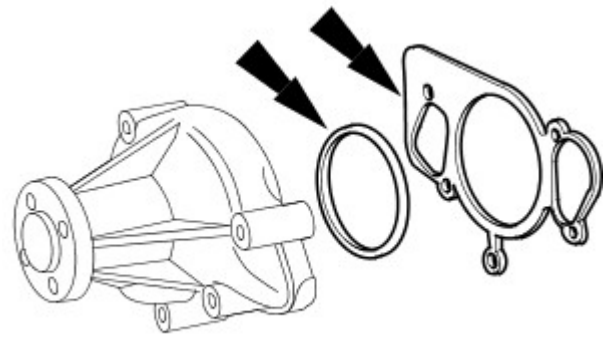
8. Clean any coolant spillage from the engine compartment.

9. Clean all relevant parts and sealing faces.

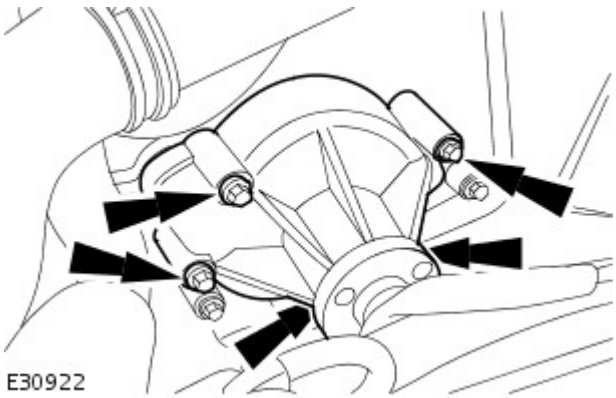
Installation

1. To install, reverse the removal procedure.

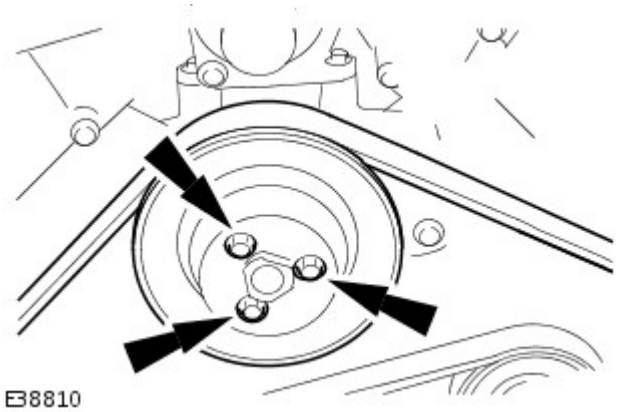
- Install a new water pump gasket and O-ring seal.


VUJ0001458

2. Tighten the water pump bolts to 8 Nm + 90°.


E30922

3. Tighten the water pump pulley bolts to 10-14 Nm.



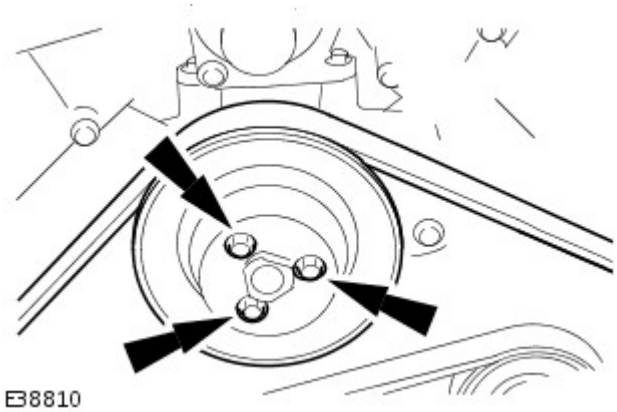
4. Fill the cooling system.
   For additional information, refer to Cooling System Draining, Filling and Bleeding - Vehicles Without: Supercharger in this section.

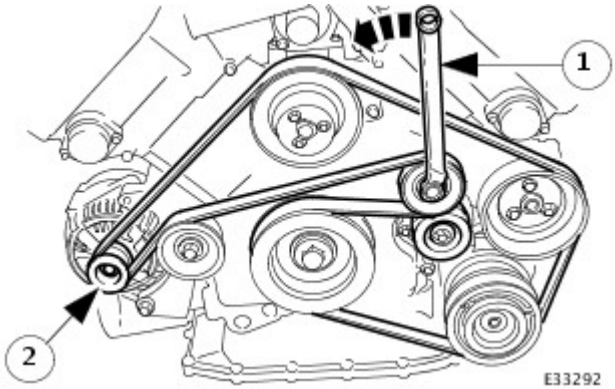
Engine Cooling - Water Pump4.0L SC V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Drain the cooling system.
   For additional information, refer to Cooling System Draining, Filling and Bleeding - Vehicles With: Supercharger in this section.
3. Remove the supercharger drive belt. Refer to Operation 18.50.08.
4. Slacken the three screws which secure the water pump pulley.





5. CAUTION: When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

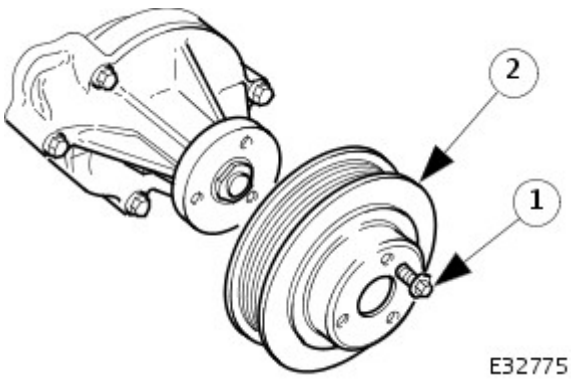
   Remove the drive belt from the generator and accessory drive.

   1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
   2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

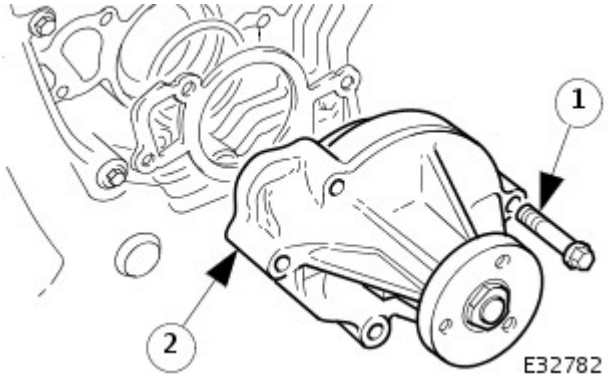
   - Disconnect the belt from the other pulleys, as necessary, to move it clear of the pump pulley.

6. Remove the pulley from the water pump.

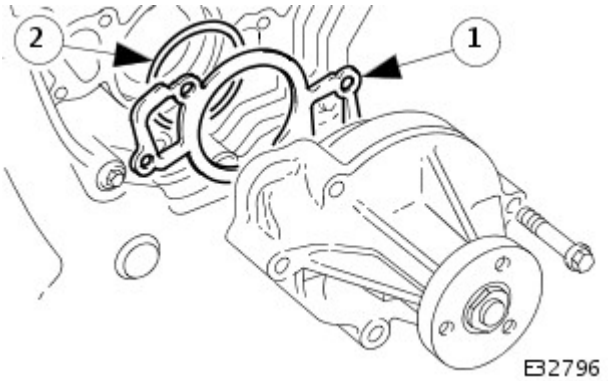
   1. Remove the pulley securing screws.
   2. Remove the pulley from the water pump.



7. Remove the water pump.



1. Remove the five bolts which secure the water pump.
2. Remove the water pump from the engine.



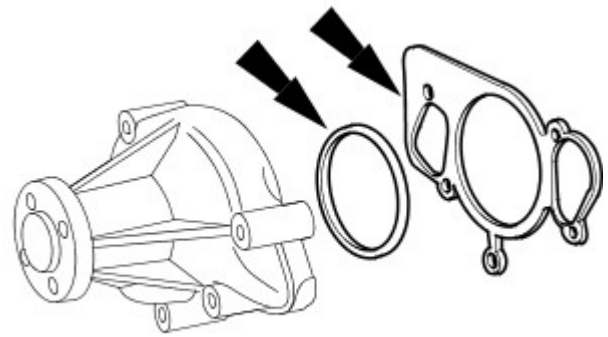
8. Remove the gasket.

1. Remove and discard the water pump gasket.
2. Remove and discard the water pump O-ring seal.

9. Clean any coolant spillage from the engine compartment.

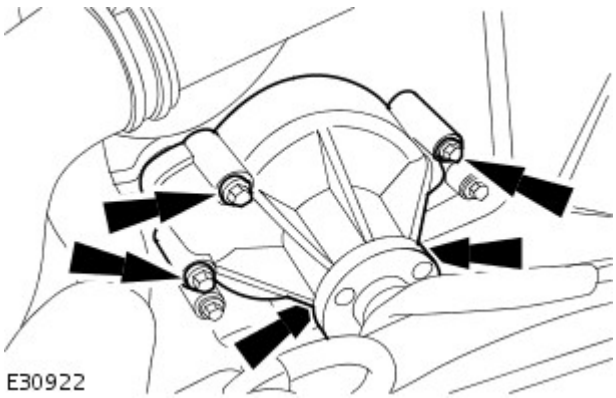
10. Clean all relevant parts and sealing faces.

Installation


VUJ0001458

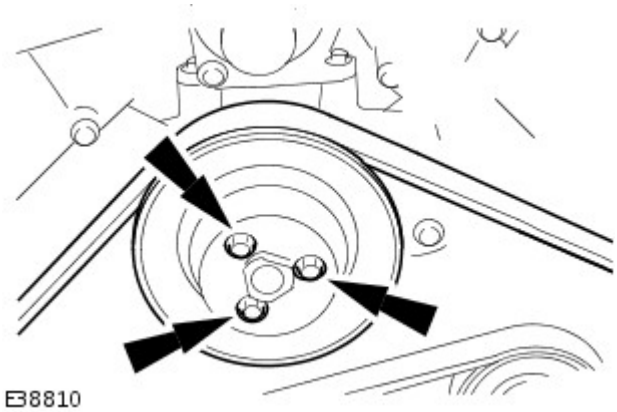
1. To install, reverse the removal procedure.

- Install a new water pump gasket and O-ring seal.



2. Tighten the water pump securing bolts to 8 Nm + 90°.

3. Tighten the water pump pulley bolts to 10-14 Nm.

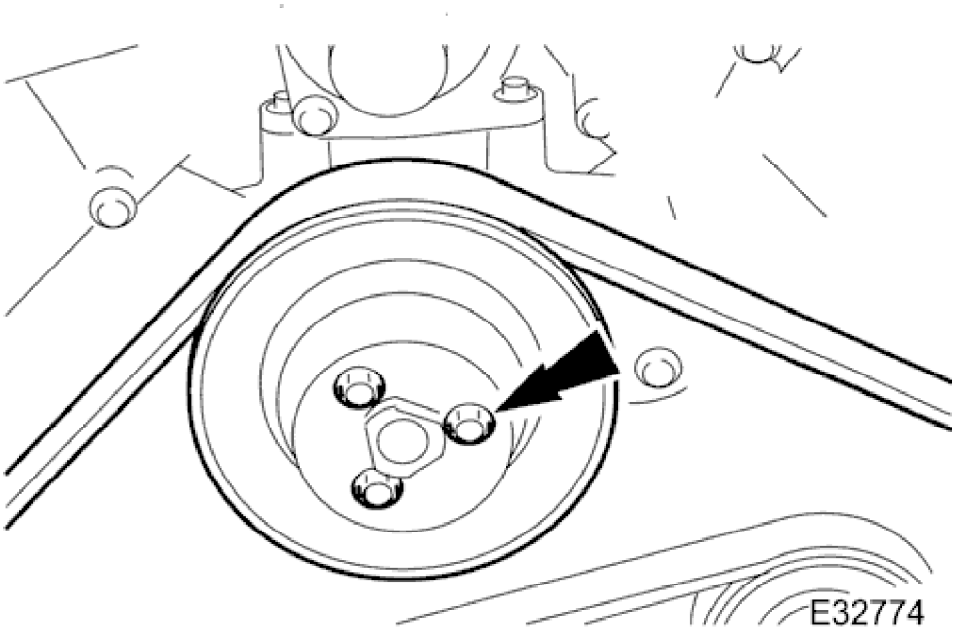

E38810

4. Fill the cooling system.
   For additional information, refer to Cooling System Draining, Filling and Bleeding - Vehicles With: Supercharger in this section.

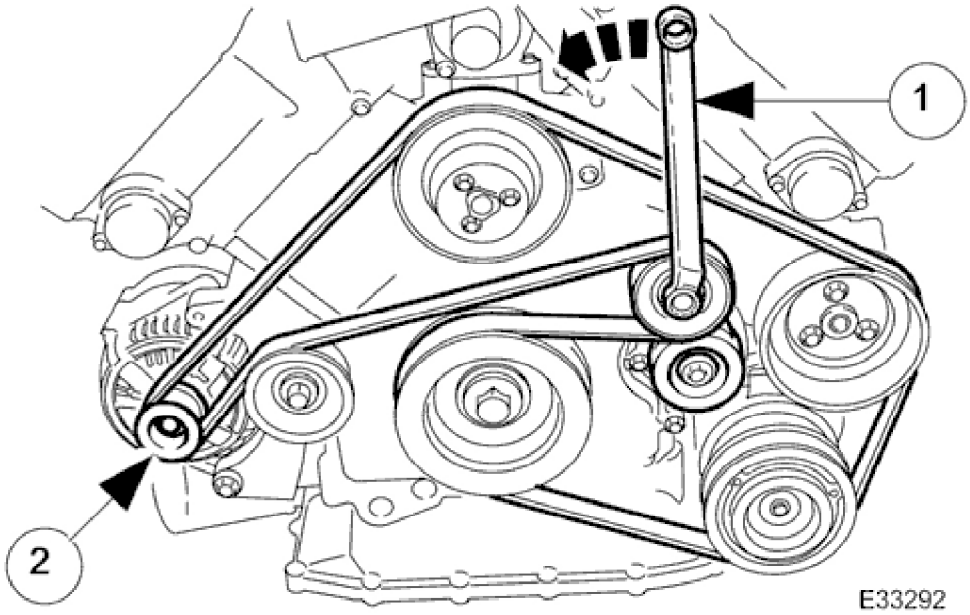
Water Pump Pulley Vehicles Without: Supercharger 26.50.05

Removal

1. Open the engine compartment and fit paintwork protection sheets.



2. Slacken the three screws which secure the water pump pulley.



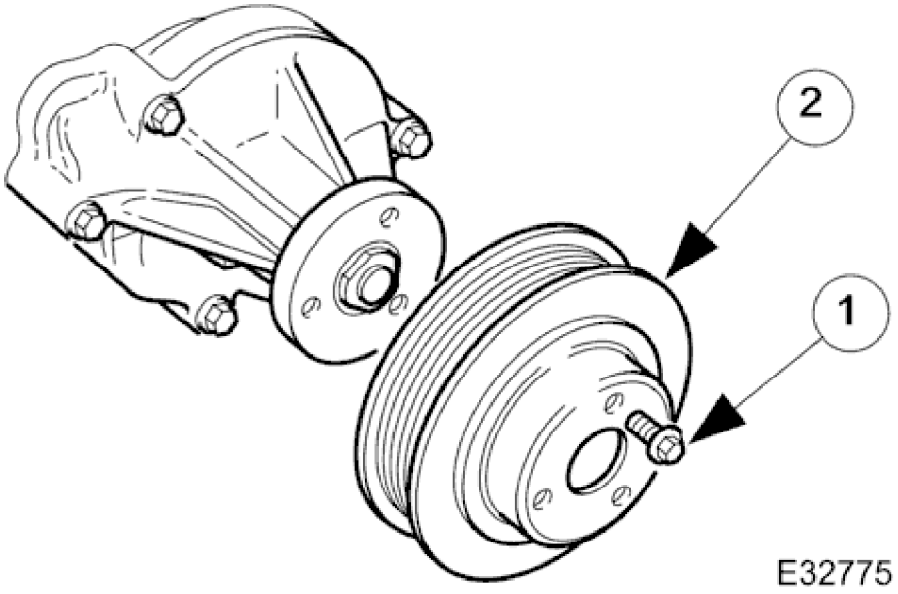
3. **CAUTION:**
When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

Remove the drive belt from the generator and accessory drive.

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.

2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

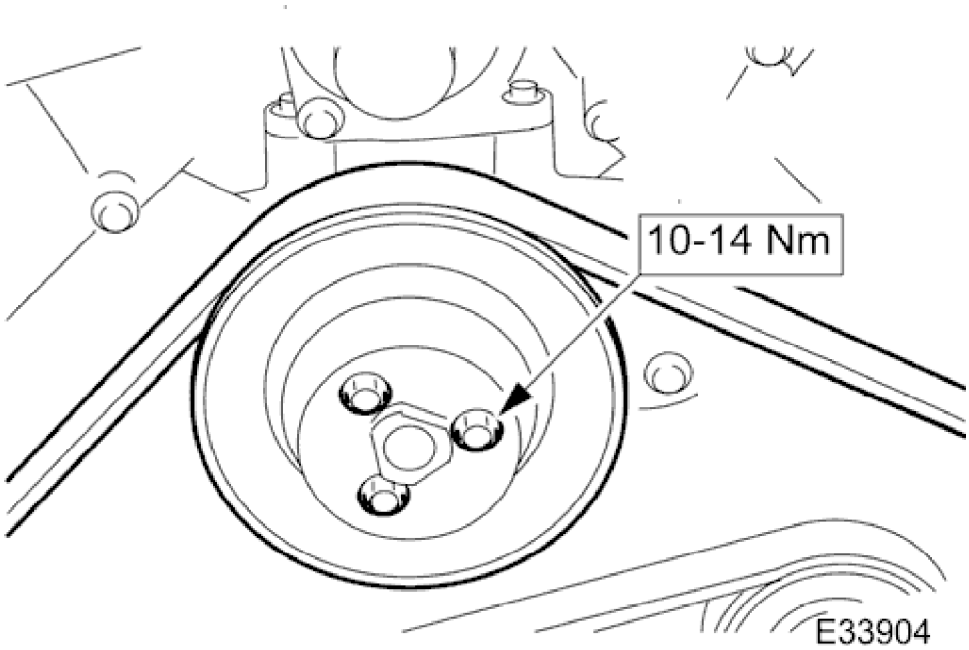
- Disconnect the belt from the other pulleys, as necessary, to move it clear of the pump pulley.



4. Remove the pulley from the water pump.
   1. remove the pulley securing screws.
   2. Remove the pulley from the water pump.

- Clean relevant parts and faces.

Installation



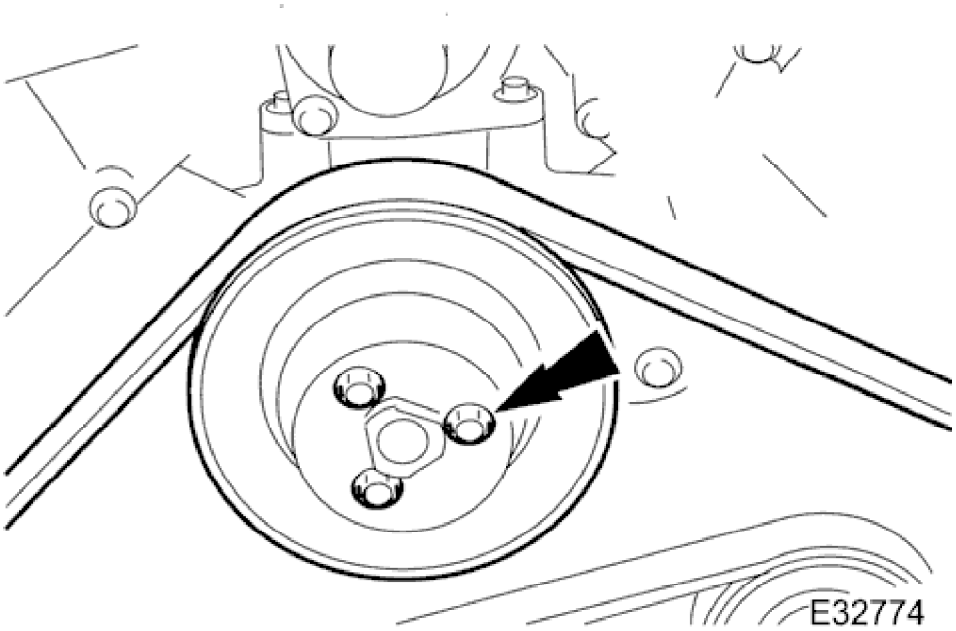
1. Installation is the reverse of the removal procedure. Tighten the pulley securing bolts to 10-14 Nm.

Water Pump Pulley Vehicles With: Supercharger 26.50.05

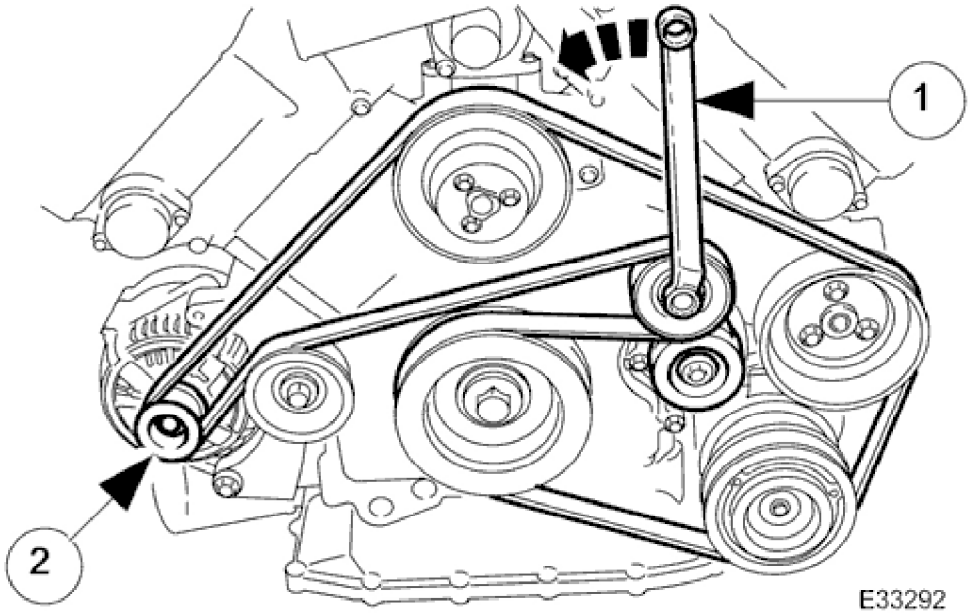
Removal

1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the supercharger drive belt. Refer to Operation **<<18.50.08>>**.



3. Slacken the three screws which secure the water pump pulley.

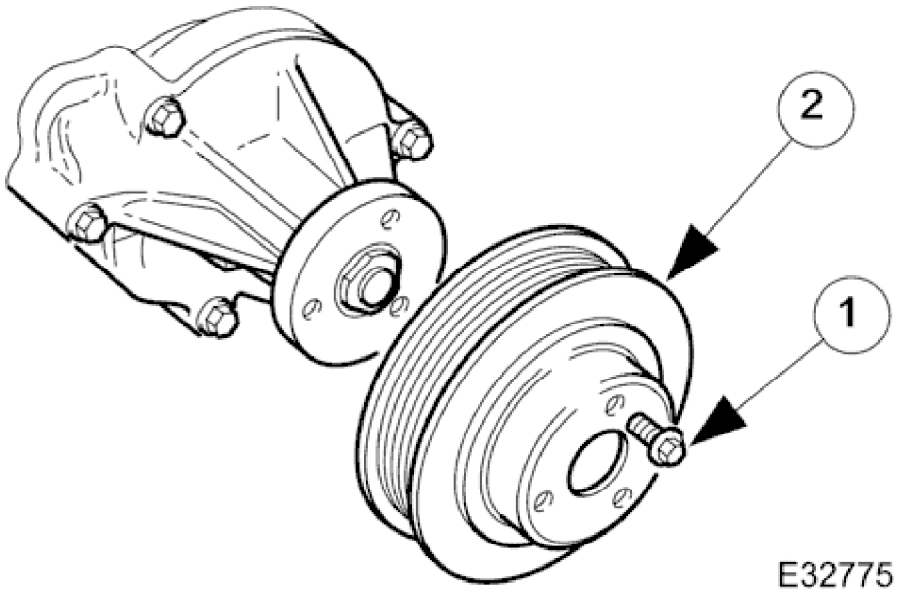


4. **CAUTION:**
When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

Remove the drive belt from the generator and accessory drive.

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

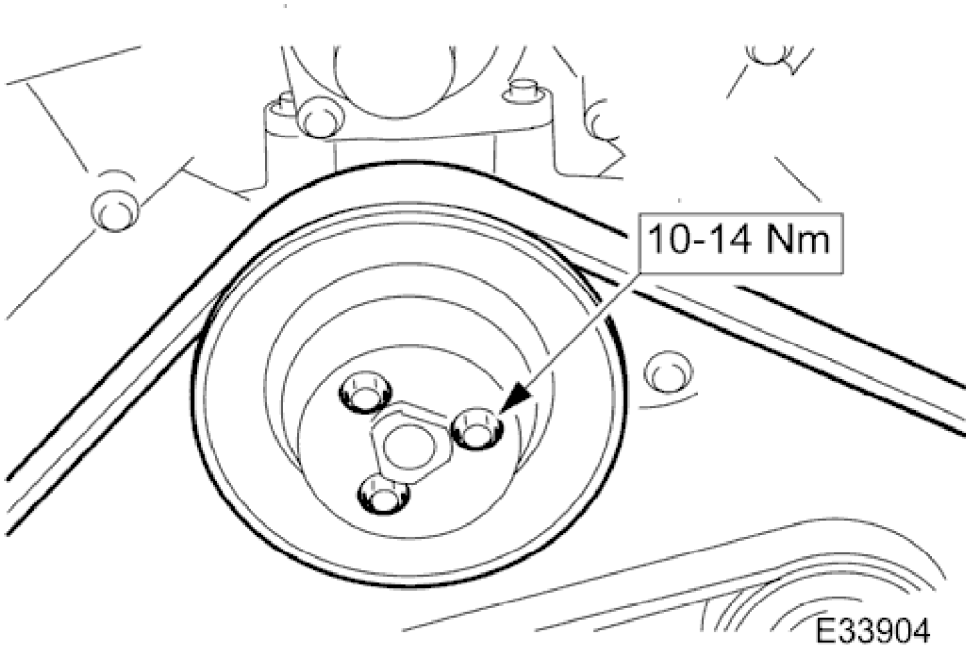
- Disconnect the belt from the other pulleys, as necessary, to move it clear of the pump pulley.



5. Remove the pulley from the water pump.
    1. remove the pulley securing screws.
    2. Remove the pulley from the water pump.

- Clean relevant parts and faces.

Installation



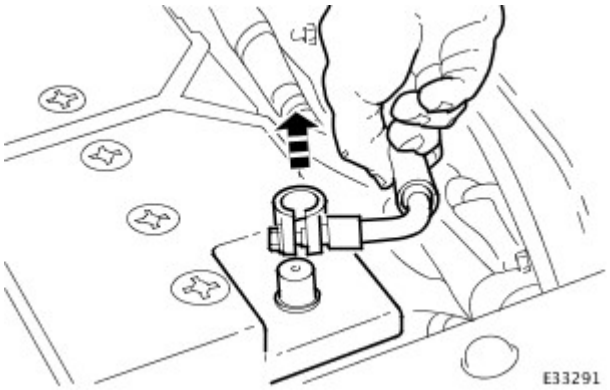
1. Installation is the reverse of the removal procedure. Tighten the pulley securing bolts to 10-14 Nm.

Supercharger Cooling - Water Pump

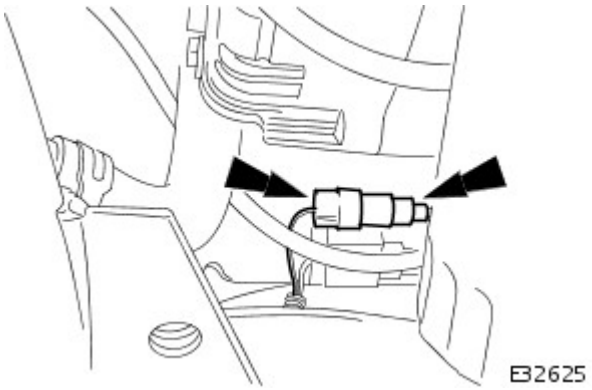
Removal and Installation

Removal

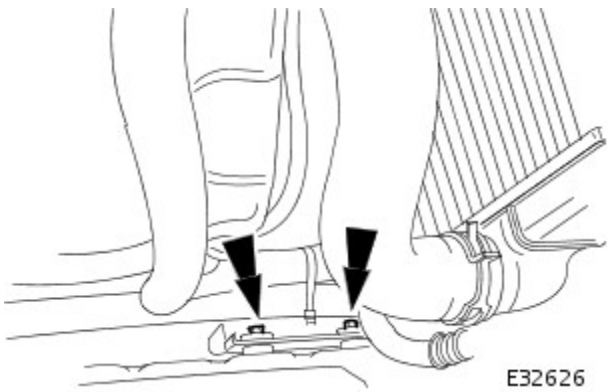
1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.



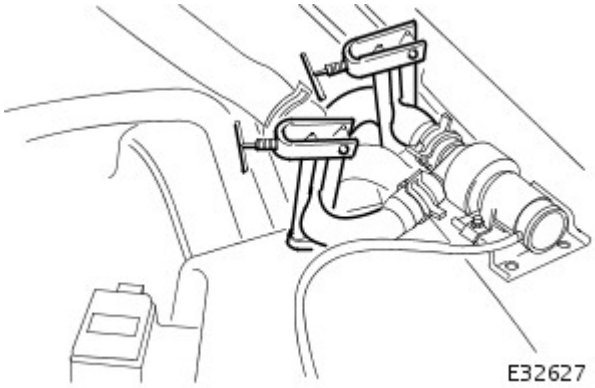
3. Remove the twin fan and motor assembly. Refer to Operation 26.25.12.
4. Disconnect the harness electrical connector.
   - Release the harness connector from the mounting bracket.
   - Disconnect the harness connector.

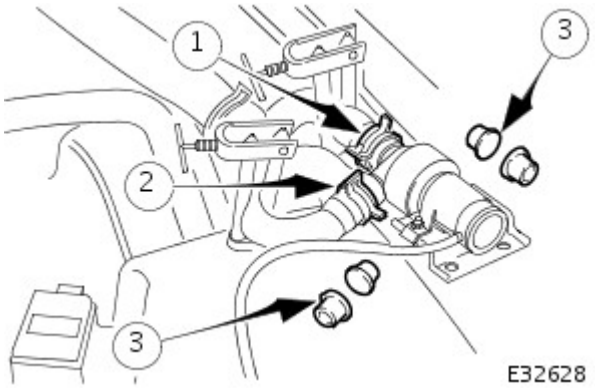


5. Remove the two nuts which secure the pump to the flexible mountings.



6. Reposition the pump to fit hose clamps.
   - Fit a hose clamp to the inlet pipe and one to the outlet pipe.

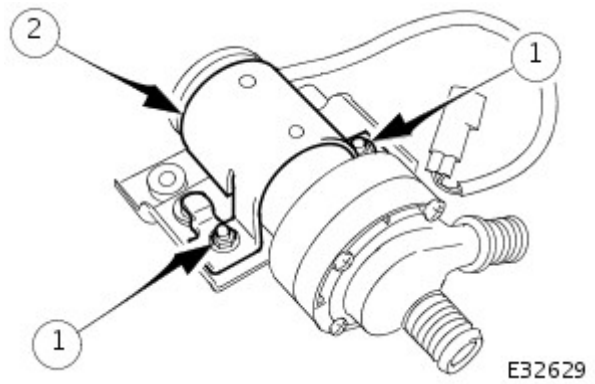




7. Disconnect the pipes from the pump and remove the pump.

1. Release and reposition the hose clip along the inlet hose and disconnect the hose.
2. Release and reposition the hose clip along the outlet hose and disconnect the pump from the hose.
3. Fit blanking plugs to the pipes and to the pump.

- Remove the pump and mounting bracket assembly from the vehicle.



8. Remove the mounting bracket and clamp from the pump.

1. Remove the nuts which secure the clamp.
2. Remove the clamp.

9. Clean the adjacent area of any water spillage.

Installation

1. Fitting is the reverse of the removal procedure.

2. Fit the twin fan and motor assembly. Refer to Operation 26.25.12.

3. Connect the battery and fit the battery cover. Refer to the Battery Reconnection Procedure 86.15.15.

4. Switch on the ignition and allow the pump to operate for one minute to circulate coolant.

- Switch off the ignition.
- Top up the coolant. If necessary, refer to Operation 26.10.01 Coolant Refill Procedure.

Fuel Charging and Controls -

Torque Specifications

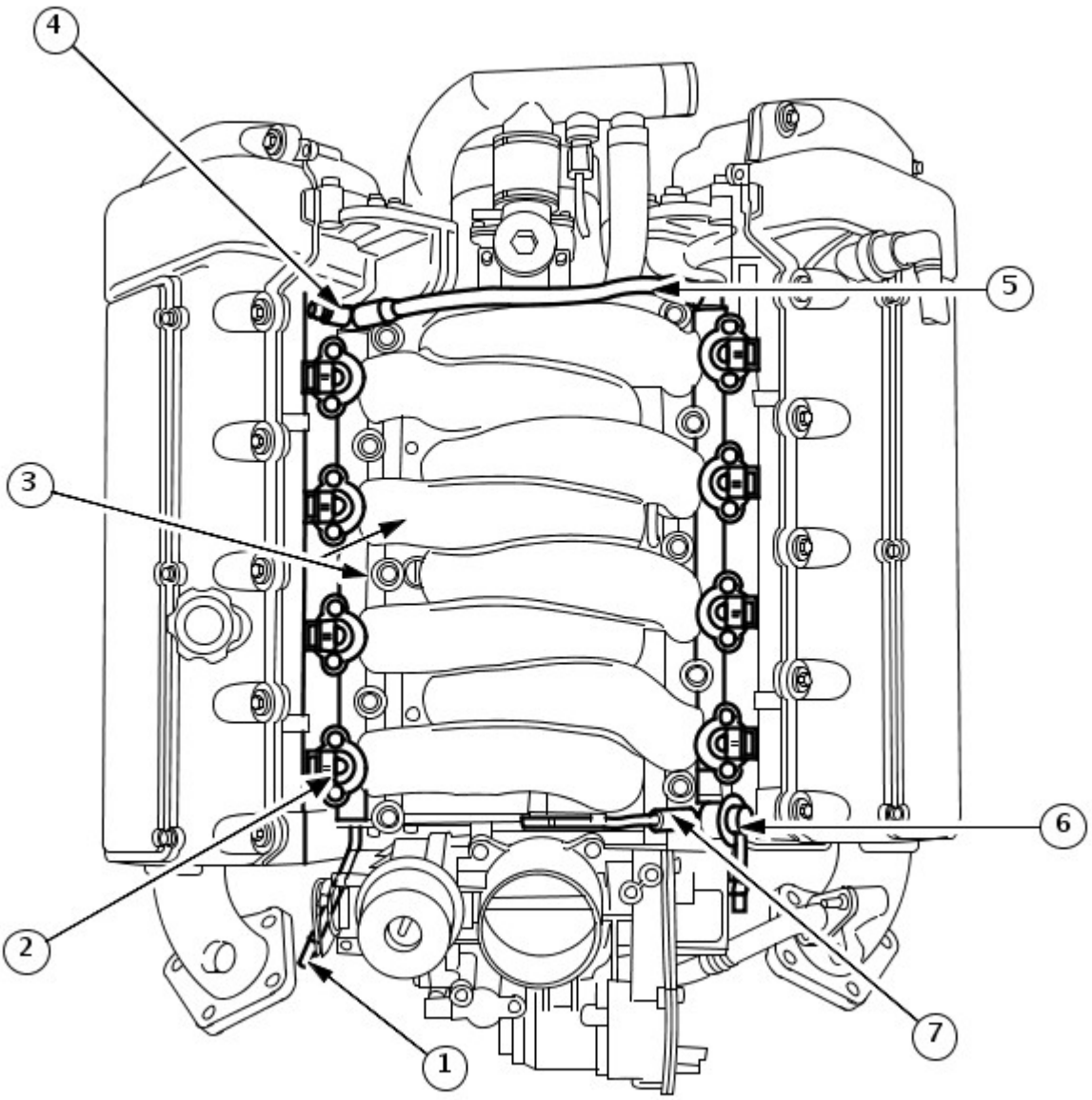
Component	Nm
Fuel injector clamp plate bolts	4-6
Intake manifold fuel feed pipe to fuel rail bolts	8-12
Intake manifold fuel cross-over pipe to fuel rail bolts	8-12
Fuel pressure regulator / return pipe to fuel rail / intake manifold bolts	8-12
Harness to camshaft cover nuts	4-5
Fuel pressure regulator / return pipe to fuel rail bolts (SC)	8-12
Fuel rail to charge air cooler adaptor bolts (SC)	18-24
Fuel rail to fuel cross-over pipe bolt (SC)	8-12
Fuel feed pipe to fuel rail bolts (SC)	8-12

Fuel Charging and Controls - Fuel Charging and Controls

Description and Operation

This section provides service information for the fuel distribution components located on the engine and includes the supercharger, where fitted. Refer to Section 310-01 for information on the fuel tank, fuel lines and related fuel supply items.

Fuel Charging and Controls - Normally Aspirated Vehicles



E34075

Parts List

Item	Part Number	Description
1	—	Fuel feed from tank to bank 2
2	—	Fuel injector
3	—	Intake manifold/fuel rail
4	—	Test/de-pressurization valve
5	—	Fuel cross-over pipe
6	—	Fuel pressure regulator
7	—	Fuel return to tank

Fuel Distribution

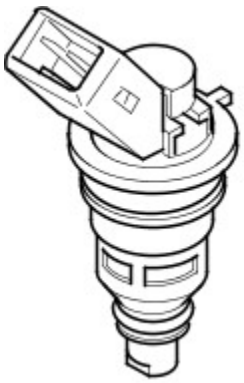
Fuel is supplied to the engine via eight fuel injectors (one per cylinder). The injectors are located in two fuel rails which run the length of each cylinder bank and are integral with the air intake manifold.

Fuel pumped from the tank enters a feed pipe at the rear of bank 2. Fuel flow is along bank 2 fuel rail, across the top front of the engine (cross-over pipe) and through bank 1 fuel rail, the unused fuel returning to the tank via a pressure regulator.

The fuel injectors are each controlled electrically from the engine control module (ECM).

A test valve is fitted to the cross-over pipe connecting the fuel rails at the front of the intake manifold. This valve allows the fuel system to be depressurized during servicing and troubleshooting.

Fuel Injector



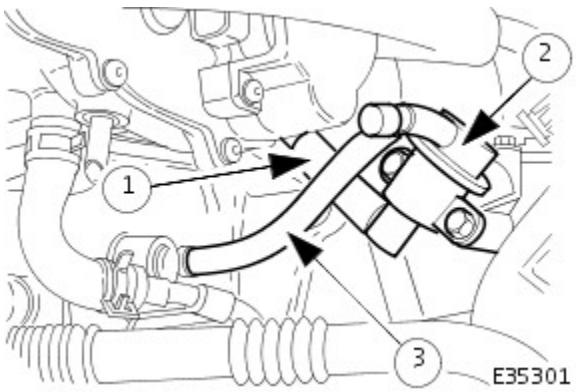
Eight, side-fed, dual straight-jet fuel injectors are fitted in the fuel rails.

The injector consists of a solenoid, core, needle valve and housing. When a control signal from the ECM is applied to the solenoid coil, the needle valve lifts up and fuel is injected under pressure into the intake port. The fuel sprays from the injectors are directed onto the back of the intake valves.

The injection quantity is determined by the length of time that the ECM signal is applied to the solenoid coil.

The injectors installed in the fuel rails of supercharged engines are of a higher flow rating than those installed in normally aspirated engines and are secured in position by spring clips. Seals are installed between the injector mounts of the fuel rails and the related recesses in the charge air cooler adaptors.

Pressure Regulator



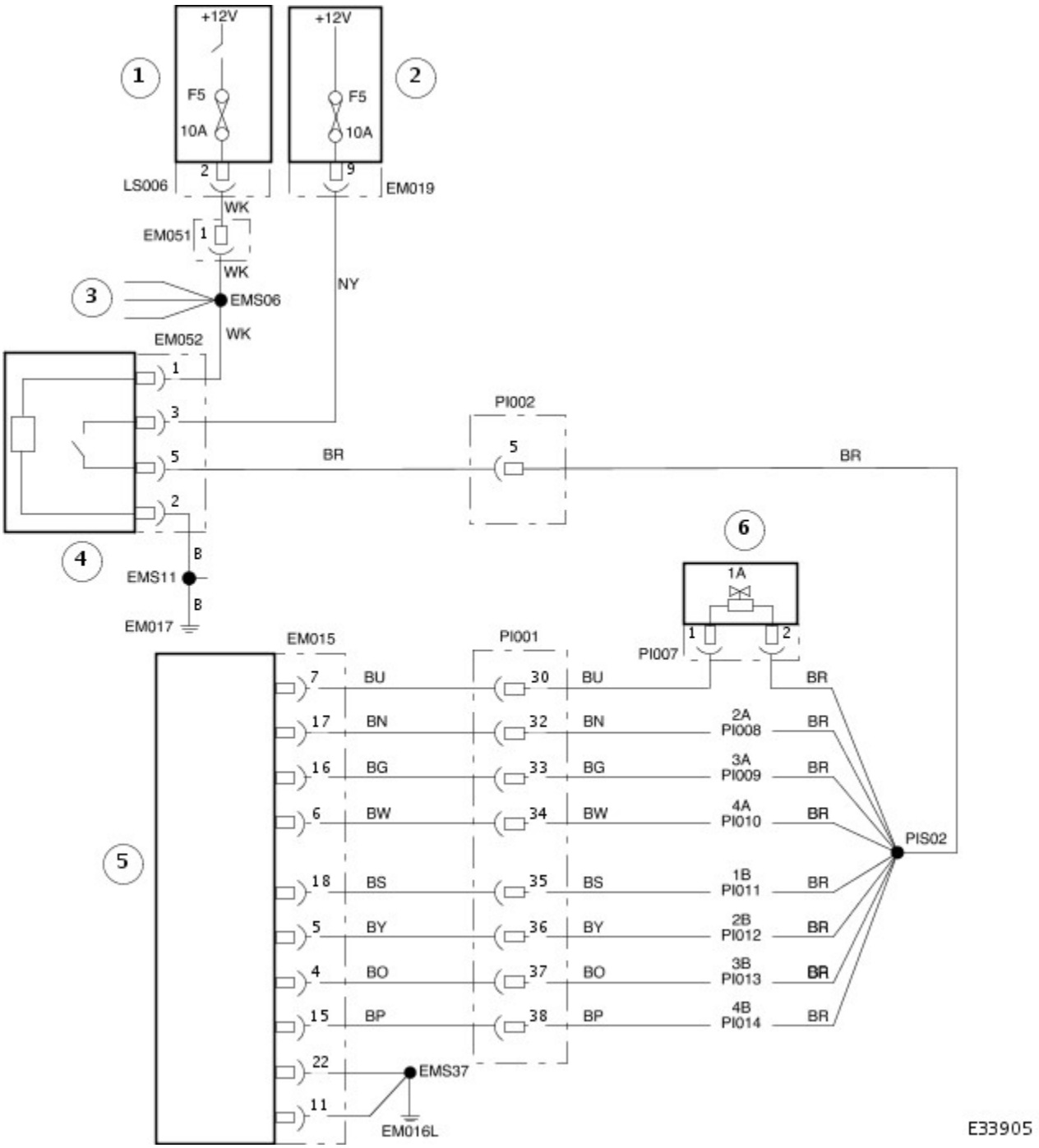
Parts List

Item	Part Number	Description
1	—	Fuel Return
2	—	Fuel Pressure Regulator
3	—	Intake Manifold Pressure

The pressure regulator is a diaphragm-operated valve that regulates fuel-rail pressure at 3,0 bar above the intake manifold pressure. A pipe connects the throttle induction elbow to the pressure regulator to provide the vacuum control signal. On supercharged engines, the pressure regulator vacuum feed is taken from the top of the supercharger outlet duct.

The regulator is fitted between the rear end of the right-hand fuel rail (bank 1) and the fuel return line to the tank.

Circuit Diagram, Fuel Injection System - Normally Aspirated Vehicles



Item	Part Number	Description
1	—	Engine compartment fuse-box
2	—	Engine management fuse-box
3	—	Splice - 12V to other circuits
4	—	PI main relay
5	—	Engine control module (ECM)
6	—	Fuel injector 1A - other injectors similar

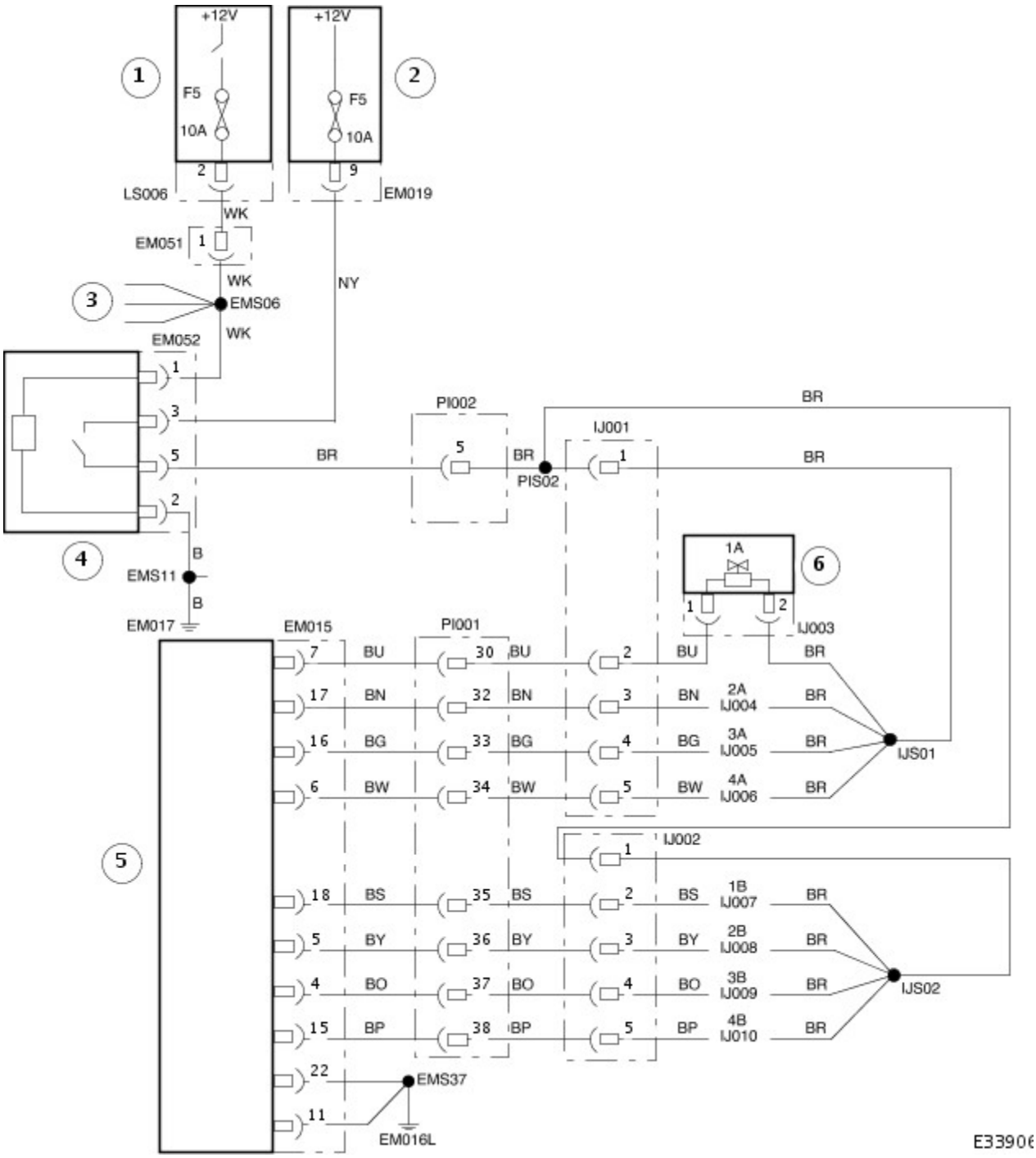
Circuit references to injectors:

'A' refers to bank 1;

'B' refers to bank 2.

Fuel Charging and Controls - Supercharged Vehicles

Circuit Diagram, Fuel Injection System - Supercharged Vehicles



Item	Part Number	Description
1	—	Engine compartment fuse-box
2	—	Engine management fuse-box
3	—	Splice - 12V to other circuits
4	—	PI main relay
5	—	Engine control module (ECM)
6	—	Fuel injector 1A - other injectors similar

Circuit references to injectors:

'A' refers to bank 1;

'B' refers to bank 2.

Charge Air Cooler Adaptors

The charge air cooler adaptors:

- provide the interface between the charge air coolers and the cylinder heads
- locate the fuel rails and injectors

For removal and installation refer to section 303-01.

Fuel Rails

The plastic fuel rails locate in the charge air cooler adaptors:

- Bank 2 fuel rail has the fuel feed pipe attached at the rear of the engine and the fuel cross-over pipe at the front
- Bank 1 fuel rail connects to the other side of the cross-over pipe at the front of the engine and the fuel return pipe / pressure regulator at the rear

Fuel Cross-over Pipe

The fuel cross-over pipe connects the fuel rails together but is not interchangeable between the normally aspirated engine and the supercharged version.

Fuel Charging and Controls - Fuel Charging and Controls

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Confirm which, if any, warning lights and/or messages were displayed on the instrument cluster.

• NOTE: If any warning lights and/or messages were displayed when the fault occurred, refer to the Driver Information table for DTCs associated with the display, then to the DTC index table for possible sources and actions. Some warnings will appear to clear when the ignition is cycled. This is often because the warning has flagged as a result of one of the vehicle's on-board diagnostic routines having run to detect the fault. If the same routine is not run when the ignition is switched **ON**, the warning will not reflag until the routine does run. See the DTC summaries for drive cycle routines.

3. **3.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel contamination • Throttle body • Poly-vee belt	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM) • Transmission control module • Check spark plug type. Only resisted plugs should be fitted. Refer to specifications section for gap • Relay date codes. If the date on the relay is between R6 k1 and R6 k8, replace the relay

4. **4.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system

5. **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. **6.** Where the Jaguar approved diagnostic system is available, complete the S93 report before clearing any or all fault codes from the vehicle.

• NOTE: If a DTC cannot be cleared, then there is a permanent fault present that flags again as soon as it is cleared (the exception to this is P1260, which will only clear following an ignition **OFF/ON** cycle after rectification).

7. **7.** If the cause is not visually evident and the Jaguar approved diagnostic system is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTC) Index Chart, or the Symptom Chart if no DTCs are set.

• NOTE: If the DTC flagged was not present for two or more consecutive cycles, it is classed as temporary, and will be deleted following three cycles during which no fault was present. This could result in a reported warning light/message with no stored DTCs. If a fault is present for three consecutive cycles, the DTC becomes permanent, and will remain in the module's memory for 40 drive cycles (a cycle is an ignition **OFF/ON**, which will occur during the owner's normal use of the vehicle. No action on the part of the technician is necessary to perform this cycle. A drive cycle is a series of conditions needed to make the on-board diagnostic routine run, and may need a specific action on the part of the technician. See the DTC summaries for drive cycle routines).

8. **8.** Using the Jaguar approved diagnostic system where available, and a scan tool where not, check the freeze frame data for information on the conditions applicable when the fault was flagged. The format of this will vary, depending on the tool used, but can provide information useful to the technician in diagnosing the fault.

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

• NOTE: When performing electrical 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.

Symptom Chart

Symptom	Possible source	Action
Engine cranks, but does not fire	• Security system /Immobiliser engaged • Throttle contaminated • Harness damage • Fuel pump relay • Fuel system • Refer to service action S491	Contact dealer technical support for information on security system. Check bulletins for throttle cleaning procedure. For fuel pump relay circuit tests, GO to Pinpoint Test E. . Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. Check for associated DTCs. Check service actions.
Engine cranks and fires, but will not start	• Fuel pump relay • Throttle contaminated • Purge valve • Fuel pump • Engine coolant temperature (ECT) sensor • Spark plugs fouled • Ignition coil failure(s) • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • Cylinder compression loss (short-term. Refer to bulletin; 303-52) • Refer to service action S491	For fuel pump relay tests, GO to Pinpoint Test E. . Check bulletins for throttle cleaning procedure. For evaporative emissions tests, REFER to Section 303-13 Evaporative Emissions. Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For ECT sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For ignition system, REFER to Section 303-07 Engine Ignition. Check bulletins and service actions.
Difficult to start cold	• Rochester valve • Battery • Throttle contaminated • Fuel pump • Engine coolant temperature (ECT) sensor • Purge valve • Cylinder compression loss (short-term. Refer to bulletin; 303-52) • Blocked part-load breather (service action S474) • Refer to service action S491	For rochester valve tests, REFER to Section 303-14 Electronic Engine Controls. For battery information, REFER to Section 414-01 Battery, Mounting and Cables. Check bulletins for throttle cleaning procedure. Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For ECT sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For evaporative emissions tests, REFER to Section 303-13 Evaporative Emissions. Check bulletins and service actions.
Difficult to start hot	• Rochester valve • Purge valve • Throttle contaminated • Fuel pump • Engine coolant temperature (ECT) sensor • Blocked part-load breather (service action S474) • Injector leak	For Rochester valve test, REFER to Section 303-14 Electronic Engine Controls. For injector leak test, REFER to technical service bulletin, 303-39. Check fuel pressure, For evaporative emissions components, REFER to Section 303-13 Evaporative Emissions. For ECT sensor tests, REFER to Section 303-14 Electronic Engine Controls.
Difficult to start after hot soak (vehicle standing after engine has reached operating temperature)	• Rochester valve • Throttle contaminated • Purge valve • Fuel pump • Engine coolant temperature	

	(ECT) sensor ● Blocked part-load breather (service action S474) ● Injector leak	
Engine stalls soon after start	● Fuel pump relay ● ECM relay ● Throttle contaminated ● CMP/CKP sensor synchronization malfunction ● Harness ● Fuel pump ● MAF sensor malfunction ● Engine coolant temperature (ECT) sensor ● Fuel lines ● Air leakage ● Fuel pressure regulator	For fuel pump relay tests, GO to Pinpoint Test E. . For ECM relay tests, REFER to Section 303-14 Electronic Engine Controls. Check bulletins for throttle cleaning procedure. For CMP/CKP sensor tests, REFER to Section 303-14 Electronic Engine Controls. Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For MAF sensor and ECT sensor tests, REFER to Section 303-14 Electronic Engine Controls. For fuel line information, REFER to Section 310-01 Fuel Tank and Lines. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For fuel pressure regulator check, GO to Pinpoint Test D. .
Engine hesitates/poor acceleration	● Fuel pump ● Exhaust gas recirculation (EGR) ● Air leakage ● Stop lamp switch ● Throttle sensors ● Throttle motor ● Spark plugs fouled ● Check for water ingress into spark plug wells ● Ignition coil failure(s) ● HT short to ground (tracking) check rubber boots for cracks/damage ● ECM failure	Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For EGR information, REFER to Section 303-08 Engine Emission Control. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For stop lamp switch information, refer to the wiring diagrams. For throttle position sensor and throttle motor relay tests, REFER to Section 303-14 Electronic Engine Controls. For ignition system, REFER to Section 303-07 Engine Ignition. Contact dealer technical support for advice on possible ECM failure.
Engine backfires	● Fuel pump ● Air leakage ● MAF sensor ● HO2 sensors ● Spark plugs ● Check for water ingress into spark plug wells ● HT short to ground (tracking) check rubber boots for cracks/damage ● Ignition coil failure(s)	Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For MAF and HO2 sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For ignition system, REFER to Section 303-07 Engine Ignition.
Engine surges	● Air leakage ● Fuel pump ● Stop lamp switch ● MAF sensor ● Harness ● Throttle sensors ● Throttle motor ● Spark plugs ● Check for water ingress into spark plug wells ● HT short to ground (tracking) check rubber boots for cracks/damage ● ECM failure	For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. For stop lamp switch information, refer to the wiring diagrams. For MAF sensor, throttle position sensor and throttle motor relay tests, REFER to Section 303-14 Electronic Engine Controls. For ignition system, REFER to Section 303-07 Engine Ignition. Contact dealer technical support for advice on possible ECM failure.

Engine detonates/knocks	• Fuel pump • HO2 sensors • Air leakage • Blocked part-load breather (service action S474) • Mass air flow (MAF) sensor	Check fuel pressure. REFER to Section 310-00 Fuel System - General Information. For HO2 sensor circuit tests, check for DTC indicating which sensor and follow indicated pinpoint test. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. Check service action S474. For MAF sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls.
No throttle response	• Throttle sensors • Throttle motor	For throttle position sensor and throttle motor relay tests, REFER to Section 303-14 Electronic Engine Controls.
Poor throttle response	• Throttle sensors • Throttle motor • Air leakage • Mass air flow (MAF) sensor	For throttle position sensor and throttle motor relay tests, REFER to Section 303-14 Electronic Engine Controls. For intake system, REFER to Section 303-12 Intake Air Distribution and Filtering. For MAF sensor tests, REFER to Section 303-14 Electronic Engine Controls.

Driver Information Chart

• NOTE: Use this table to identify DTCs associated with the message center display, then refer to the DTC index for possible sources and actions.

• NOTE: For definitions of Default Modes, see the foot of this table.

Warning light	Message	Default Mode	DTC
Red	Engine Failsafe Mode	Limp-Home	P1224
Red	Engine Failsafe Mode	Limp-Home	P1229
Red	Engine Failsafe Mode	Limp-Home	P0122, P0123,
Red	Engine Failsafe Mode	Limp-Home	P0222, P0223
Red	Engine Failsafe Mode	Limp-Home	P0121
Red	Engine Failsafe Mode	Limp-Home	P1122, P1123
Red	Engine Failsafe Mode	Limp-Home	P1222, P1223
Red	Engine Failsafe Mode	Limp-Home	P1121, P1632
Red	Engine Failsafe Mode	Limp-Home	P1251, P0560, P1658
Red	Engine Failsafe Mode	Limp-Home	P1631
Red	Engine Failsafe Mode	Limp-Home	P1611
Red	Engine Failsafe Mode	Limp-Home	P1633
Red	Engine Failsafe Mode	Limp-Home	P1609
Red	Engine Failsafe Mode	Limp-Home	P0506, P0507
Red	Engine Failsafe	Limp-Home	P1656

	Mode		
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1254
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1250
Amber	Engine Failsafe Mode	Cruise inhibited	P1516
Amber	Engine Failsafe Mode	Cruise inhibited	P1517
Amber	Engine Failsafe Mode	Cruise inhibited	P1571
Amber	Engine Failsafe Mode	Cruise inhibited	P1696
Amber	Engine Failsafe Mode	Cruise inhibited	P0568
Amber	Engine Failsafe Mode	Cruise inhibited	P0570
Amber	Engine Failsafe Mode	Cruise inhibited	P0569
Amber	Engine Failsafe Mode	Cruise inhibited	P0567
Amber	Engine Failsafe Mode	Cruise inhibited	P0566
Amber	Engine Failsafe Mode	Cruise inhibited	P1697
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P0560, P1254
Amber	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled. High idle speed	P1250, P1254
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P1250
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0116, P0117, P0118, P0125
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0101, P0102, P0103, P0104
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P1313, P1314
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0327, P0328, P0332, P0333, P1648
Amber	Restricted Performance	Reverse throttle progression enabled	P1474
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1230
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1671
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1112, P1113
Amber	Restricted Performance	Gearbox default to 4th gear	P1601 (SC only)
Amber	Restricted Performance	Gearbox default to 4th gear	P1605 (NA only)
Amber	Restricted Performance	Gearbox default to 4th gear	P0702
Amber	Restricted Performance	Gearbox default to 4th gear	P1795
Amber	Restricted Performance	Gearbox default to 4th gear	P1796
Amber	Restricted Performance	Gearbox default to 4th gear	P1797
Amber	Restricted Performance	Gearbox default to 4th gear	P1605
Amber	None	Gearbox default to 4th gear	P0705 (SC only)
Amber	None	Gearbox default to 4th gear	P0706
Amber	None	Gearbox default to 4th gear	P1720

Default mode Definitions

MECHANICAL LIMP-HOME MODE:

- No electronic throttle operation (mechanical operation for last quarter of pedal travel)
- Maximum 25° throttle opening, depending on adjustment of throttle mechanical linkage
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off
- High idle speed (1200 rpm approx.)
- Misfire at idle, due to cylinder cut as a means of controlling idle speed (the misfire will switch cylinders, as the strategy varies the cylinder cut)
- Cruise (speed) control inhibited

REVERSE THROTTLE PROGRESSION ENABLED:

- Electronic throttle operation, limited to maximum 25°
- Cruise (speed) control inhibited

• NOTE: The throttle operation uses the same map as for reverse gear.

ENGINE SPEED LIMIT:

- Engine runs normally, up to 3000 rpm
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off
- Cruise (speed) control inhibited

LIMP-HOME UNAVAILABLE:

- Cruise (speed) control inhibited
- Reverse throttle progression engaged at second occurrence of DTC flagging

Diagnostic Trouble Code (DTC) index

DTC	Condition	Possible Causes	Action
P0171	Right-hand cylinders combustion too lean	• Air intake leak between MAF sensor and throttle • Fuel filter system blockage • Fuel injector blockage • Fuel pressure regulator failure (low fuel pressure) • Low fuel pump output • H02S harness wiring fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP.	For intake system, REFER to Section 303-12 Intake Air Distribution and Filtering. For fuel filter, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors. Check the fuel pressure regulator. Check fuel pressure. For HO2S circuit tests, REFER to Section 303-14 Electronic Engine Controls. For exhaust information, REFER to Section 309-00 Exhaust System. For sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls.
P0172	Right-hand cylinders combustion too rich	• Engine misfire • Blocked air filter • Fuel system return blockage • Leaking fuel injector(s) • Fuel pressure regulator failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	Check for 'engine misfire detected' DTCs. Check the air filter element, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel lines, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors, REFER to Fuel Injectors - in this section. For fuel pressure regulator check,GO to Pinpoint Test D. . Check the fuel pressure,

			REFER to Section 310-00 Fuel System - General Information. Check for DTCs indicating a sensor fault, REFER to Section 303-14 Electronic Engine Controls.
P0174	Left-hand cylinders combustion too lean	• Air intake leak between MAF sensor and throttle • Fuel filter system blockage • Fuel injector blockage • Fuel pressure regulator failure (low fuel pressure) • Low fuel pump output • H02S harness wiring fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	For air intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel filter, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors, REFER to Fuel Injectors - in this section. For fuel pressure regulator check,GO to Pinpoint Test D. . Check the fuel pressure, REFER to Section 310-00 Fuel System - General Information. Check for DTCs indicating which HO2 sensor is faulty, REFER to Section 303-14 Electronic Engine Controls. Check for DTCs indicating a sensor fault, REFER to Section 303-14 Electronic Engine Controls.
P0175	Left-hand cylinders combustion too rich	• Engine misfire • Blocked air filter • Fuel system return blockage • Leaking fuel injector(s) • Fuel pressure regulator failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	Check for 'engine misfire detected' DTCs. Check the air filter element, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel lines, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors, REFER to Fuel Injector - Vehicles Without: Supercharger / Fuel Injector - Vehicles With: Supercharger in this section. For fuel pressure regulator check,GO to Pinpoint Test D. . Check for DTCs indicating a sensor fault, REFER to Section 303-14 Electronic Engine Controls.
P0201	Fuel injector circuit malfunction, Cyl 1	• Injector disconnected • Injector wiring open or short circuit • Injector failure	For fuel injector circuit tests,GO to Pinpoint Test A. .
P0202	Fuel injector circuit malfunction, Cyl 3		
P0203	Fuel injector circuit malfunction, Cyl 5		
P0204	Fuel injector circuit malfunction, Cyl 7		
P0205	Fuel injector circuit malfunction, Cyl 2		
P0206	Fuel injector circuit malfunction, Cyl 4		
P0207	Fuel injector circuit malfunction, Cyl 6		
P0208	Fuel injector circuit malfunction, Cyl 8		
P0300	Random misfire detected	• ECM to ignition coil primary circuit faults (cylinder misfire detected DTCs also logged) • Ignition coil ground circuit; open circuit, high resistance • Fuel injector circuit fault(s) (injector DTCs also logged)	For ignition circuit tests, REFER to Section 303-07 Engine Ignition. For engine information, REFER to Section 303-00 Engine System - General Information. For fuel injector circuit tests,GO to

		• Ignition coil failure(s) • HT short to ground (tracking) check rubber boots for cracks/damage • Spark plug failure/fouled/incorrect gap • Cylinder compression low • Fuel delivery pressure (low/high) • Fuel injectors restricted/leaking • Fuel contamination • PAS pulley bolts loose (see Service Action S462) • Worn camshaft/broken valve springs	Pinpoint Test A. . Check fuel pressure, REFER to Section 310-00 Fuel System - General Information. Check fuel injectors, REFER to Fuel Injectors - in this section. Check service actions.
P0301	Misfire detected, Cyl 1	REFER to possible sources for P0300	REFER to actions for P0300.
P0302	Misfire detected, Cyl 3		
P0303	Misfire detected, Cyl 5		
P0304	Misfire detected, Cyl 7		
P0305	Misfire detected, Cyl 2		
P0306	Misfire detected, Cyl 4		
P0307	Misfire detected, Cyl 6		
P0308	Misfire detected, Cyl 8		
P0460	Fuel level sense signal performance	• Fuel level sensor to instrument cluster circuits intermittent short or open circuit • Fuel level sensor failure • Instrument cluster fault (incorrect fuel level data)	For fuel level sensor tests,GO to Pinpoint Test B. .
P1224	Throttle control position error	• Throttle adaptations not performed after battery disconnect • TP sensor disconnected • TP sensor to ECM sense circuits; open circuit, high resistance • Throttle motor relay failure • Throttle motor relay to ECM circuit fault • Throttle motor relay power supply open circuit • ECM ground circuit fault (relay coil drive) • Throttle motor to ECM drive circuits; open circuit, short circuit, high resistance • Throttle motor failure • Throttle body failure	Carry out the throttle adaptation procedure, REFER to Section 303-14 Electronic Engine Controls. ECM adaptations. For throttle motor relay tests, throttle position sensor tests, ECM ground tests, REFER to Section 303-14 Electronic Engine Controls.
P1229	Throttle motor control circuit malfunction	• Throttle motor disconnected • Throttle motor to ECM drive circuits; short circuit or open circuit • Throttle motor failure	For throttle motor relay tests, REFER to Section 303-14 Electronic Engine Controls.
P1250	Engine load malfunction	• Air intake leak • Engine breather leak • TP sensor circuit fault (DTC P0121) • Throttle valve spring failure	For air intake system, REFER to Section 303-12 Intake Air Distribution and Filtering. Check engine breather system for leaks. For TP sensor tests, REFER to Section 303-14 Electronic Engine Controls.
P1313	Right-hand cylinders misfire rate catalyst damage (this DTC will flag only when accompanied by an individual cylinder misfire DTC: P0300-P0308)	Refer to possible causes for P0300-P0308	Refer to actions for P0300-P0308.
P1314	Left-hand cylinders misfire rate catalyst damage (this DTC will flag only when accompanied by an individual cylinder misfire DTC: P0300-P0308)	Refer to possible causes for P0300-P0308	Refer to actions for P0300-P0308.

P1316	Misfire excess emission (this DTC will flag only when accompanied by an individual cylinder misfire DTC: P0300-P0308)	Refer to possible causes for P0300-P0308	Refer to actions for P0300-P0308.
P1611	Throttle angle malfunction	• TP sensor circuit fault • APP sensor circuit fault • Throttle assembly failure • ECM failure	For TP and APP sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For throttle assembly information, refer to throttle body in this section. Contact dealer technical support for advice on possible ECM failure.
P1612	Throttle offset malfunction	• TP sensor circuit fault • APP sensor circuit fault • Throttle assembly failure • ECM failure	For TP and APP sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For throttle assembly information, refer to throttle body in this section. Contact dealer technical support for advice on possible ECM failure.
P1646	Fuel pump 2 relay malfunction (this DTC applies only to the supercharger secondary fuel pump)	• Fuel pump 2 relay failure • Fuel pump 2 relay to ECM circuit fault • Fuel pump 2 relay coil power supply open circuit • ECM ground circuit fault (relay coil drive)	For fuel pump 2 relay circuit tests, GO to Pinpoint Test C. .

Pinpoint Tests

PINPOINT TEST A : DTC P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208; FUEL INJECTOR CIRCUIT MALFUNCTION	
• NOTE: The DTC set will indicate which cylinder injector or circuit is faulty. Only in the event of multiple cylinder misfires will it be necessary to check more than one injector or circuit, in which case, multiple DTCs will be set.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE INJECTOR COIL RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the relevant injector electrical connector, (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine).
	3 Measure the resistance between the injector pins.
	Is the resistance between 12 and 16 ohms? **Yes** GO to A2. **No** INSTALL a new injector. REFER to Fuel Injector - Vehicles Without: Supercharger in this section. CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE INJECTOR COIL INSULATION	
	1 Measure the resistance between the injector pin 01 and the injector body.
	2 Measure the resistance between the injector pin 02 and the injector body.
	Are both resistances greater than 10 Mohms? **Yes** GO to A3. **No** INSTALL a new injector. CLEAR the DTC. TEST the system for normal operation.
A3: CHECK THE INJECTOR SUPPLY VOLTAGE	
	1 Turn the ignition switch to the **ON** position.
	2 Disconnect the relevant injector electrical connector, (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine).
	3 Measure the voltage between the relevant injector harness electrical connector (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine), pin 02 (BR) and GROUND.
	Is the voltage greater than 12 volts? **Yes** GO to A4. **No** REPAIR the circuit between the relevant injector harness electrical connector, pin 02 and battery. This

	circuit includes the EMS fuse box, fuse 05, and the fuel injection relay. For additional information, refer to the wiring diagrams. CLEAR DTC. TEST the system for normal operation.
A4: CHECK THE INJECTOR GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.
	3 Disconnect the ECM electrical connector, (EM15, vehicles with AJ26 engine, EM84, vehicles with AJ27 engine).
	4 Measure the resistance between the relevant injector harness electrical connector (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine), pin 01 and the ECM electrical connector, pins as follows - Vehicles with AJ26 engine: • Cyl 1 IJ03, pin 01 (BU) and EM15, pin 07 • Cyl 2 IJ07, pin 01 (BU) and EM15, pin 18 • Cyl 3 IJ04, pin 01 (BN) and EM15, pin 17 • Cyl 4 IJ08, pin 01 (BN) and EM15, pin 05 • Cyl 5 IJ05, pin 01 (BG) and EM15, pin 16 • Cyl 6 IJ09, pin 01 (BG) and EM15, pin 04 • Cyl 7 IJ06, pin 01 (BW) and EM15, pin 06 • Cyl 8 IJ10, pin 01 (BW) and EM15, pin 15 Vehicles with AJ27 engine: • Cyl 1 PI07, pin 01 (BG) and EM84, pin 02 • Cyl 2 PI11, pin 01 (BW) and EM84, pin 06 • Cyl 3 PI08, pin 01 (BO) and EM84, pin 21 • Cyl 4 PI12, pin 01 (BW) and EM84, pin 04 • Cyl 5 PI09, pin 01 (BG) and EM84, pin 14 • Cyl 6 PI13, pin 01 (BO) and EM84, pin 03 • Cyl 7 PI10, pin 01 (BW) and EM84, pin 05 • Cyl 8 PI14, pin 01 (BR) and EM84, pin 13
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit between the relevant injector harness electrical connector pin 01 and the engine control module electrical connector. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to A5.
A5: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO BATTERY	
	1 Reconnect the battery negative terminal.
	2 Measure the voltage between the relevant injector harness electrical connector (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine), pin 01 and GROUND.
	Is the voltage greater than 3 volts? **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 A6.
A6: CHECK THE INJECTOR GROUND CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Measure the resistance between the relevant injector harness electrical connector (IJ03 to IJ10, vehicles with AJ26 engine, PI07 to PI14, vehicles with AJ27 engine), pin 01 and GROUND.
	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** Contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST B : DTC P0460; FUEL LEVEL SENSE SIGNAL PERFORMANCE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE FUEL LEVEL SENSOR REFERENCE GROUND	
	1 Disconnect the fuel level sensor electrical connector, BT15.

	2 Measure the resistance between BT15 and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to B2. **No** GO to B3.
B2: CHECK THE FUEL LEVEL SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the instrument cluster electrical connector, FC25.
	2 Measure the resistance between FC25, pin 14 (RW) and BT15 (RW).
	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 B3.
B3: CHECK THE FUEL LEVEL SENSOR (EMPTY)	
	1 Disconnect the fuel level sensor electrical connectors, BT14 and BT15.
	2 Empty the fuel tank.
	3 Measure the resistance between the fuel level sensor connections.
	Is the resistance 900 ohms? **Yes** GO to B4. **No** INSTALL a new fuel level sensor. REFER to Section 310-01 Fuel Tank and Lines. CLEAR the DTC. TEST the system for normal operation.
B4: CHECK THE FUEL LEVEL SENSOR (FULL)	
	1 Fill the fuel tank.
	2 Measure the resistance between the fuel level sensor connections.
	Is the resistance 80 ohms? **Yes** GO to B5. **No** INSTALL a new fuel level sensor. REFER to Section 310-01 Fuel Tank and Lines. CLEAR the DTC. TEST the system for normal operation.
B5: CHECK THE FUEL LEVEL SENSOR SIGNAL WIRE FOR HIGH RESISTANCE	
	1 Disconnect the instrument cluster electrical connector, FC25.
	2 Measure the resistance between FC25, pin 13 (BW) and BT14 (BW).
	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 instrument cluster. REFER to Section 413-01 Instrument Cluster. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : DTC P1646; FUEL PUMP 2 (SC) RELAY MALFUNCTION	
• NOTE: This DTC applies only to the supercharged system fuel pump 2.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE FUEL PUMP 2 RELAY POWER SUPPLY	
	1 Remove the fuel pump 2 relay.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between the relay base, pin 01 and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the relay base, pin 01 and battery. This circuit includes the trunk fuse box, the ignition positive relay, and the high power protection module. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C2.

C2: CHECK THE FUEL PUMP 2 RELAY TO ECM CIRCUIT	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Measure the resistance between the relay base, pin 02 and EM13, pin 09 (KB).
	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 fuel pump 2 relay. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST D : CHECK THE FUEL PRESSURE REGULATOR FUNCTION	
CAUTION: Do not run the engine for more than 30 seconds with the vacuum hose disconnected.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK FOR FUEL PRESSURE CHANGE WHEN THE REGULATOR IS DISCONNECTED	
	1 Connect a fuel pressure gauge set, REFER to Section 310-00 Fuel System - General Information.
	2 Start the engine.
	3 Note the fuel pressure reading with the fuel pressure regulator vacuum hose connected.
	4 Disconnect the fuel pressure regulator vacuum hose.
	5 Note the new reading.
	Does the fuel pressure increase when the hose is disconnected? **Yes** Check for DTCs. Carry out the pinpoint tests indicated. **No** INSTALL a new fuel presssure regulator. TEST the system for normal operation.

PINPOINT TEST E : DTC P1230; FUEL PUMP RELAY MALFUNCTION	
• NOTE: This DTC applies only to the N/A system single fuel pump, and the S/C system fuel pump 1	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE FUEL PUMP RELAY BATTERY SUPPLY	
	1 Remove the fuel pump relay.
	2 Measure the voltage between the relay base, pin 03 and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the relay base, pin 03 and the battery power bus. This circuit includes the trunk fuse box and the high power protection module. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to E2.
E2: CHECK THE FUEL PUMP RELAY IGNITION SWITCHED SUPPLY	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between the relay base, pin 01 and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the relay base, pin 01 and battery. This circuit includes the trunk fuse box, fuse 16 of the left-hand fuse box, the ignition positive relay and the high power protection module. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to E3.
E3: CHECK THE FUEL PUMP RELAY TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM83.
	3 Measure the resistance between EM83, pin 04 (WR) and the relay base, 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** INSTALL a new fuel pump relay. CLEAR the DTC. TEST the system for normal operation. If the DTC is repeated, contact dealer technical support for advice on possible ECM failure.

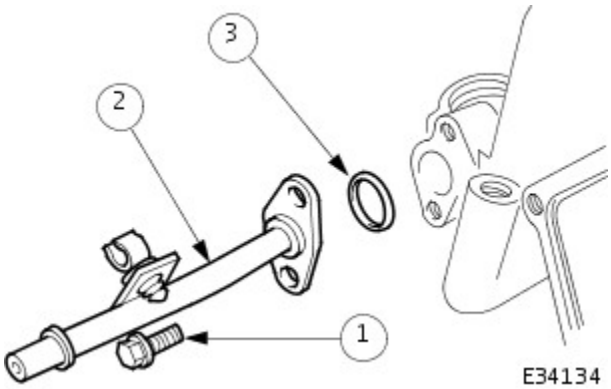
Fuel Charging and Controls - Fuel Injection Supply Manifold LH

Removal and Installation

Removal

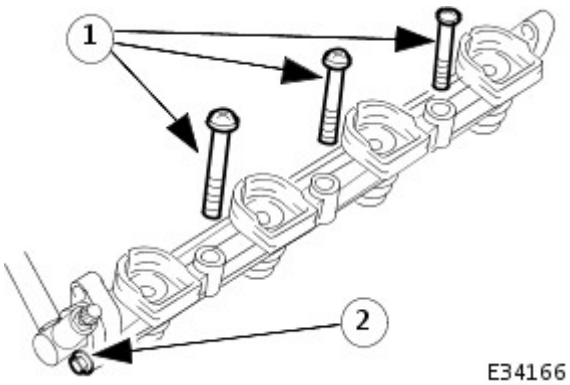
1. Remove fuel injectors; refer to (SC) 18.10.01.

2. Disconnect fuel feed pipe from fuel rail.



1. Remove two bolts.
2. Reposition fuel feed pipe.
3. Discard O-ring.

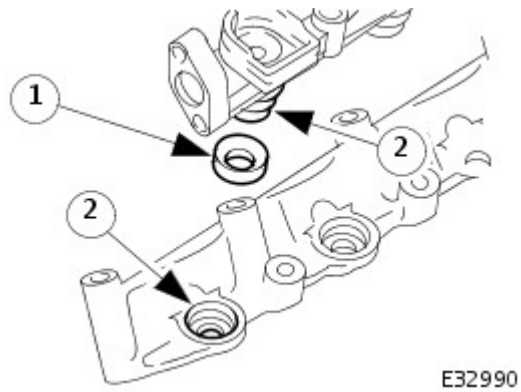
3. Remove fuel rail from charge air cooler adaptor.



1. Remove three bolts.
2. Reposition fuel rail and remove cross-over pipe securing bolt.

- Discard O-ring from fuel cross-over pipe.
- Remove fuel rail.

4. Remove seals between fuel rail and charge air cooler adaptor.



1. Discard seals.
2. Clean and inspect mating faces.

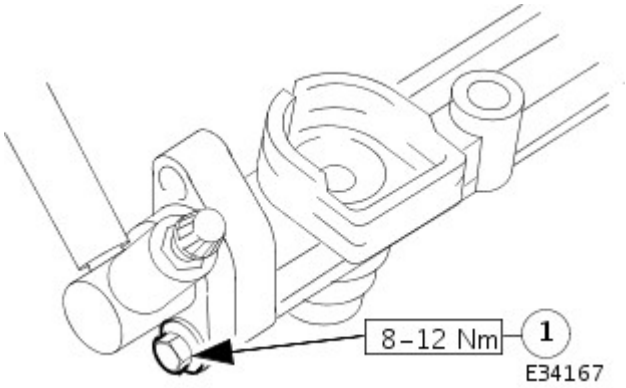
Installation

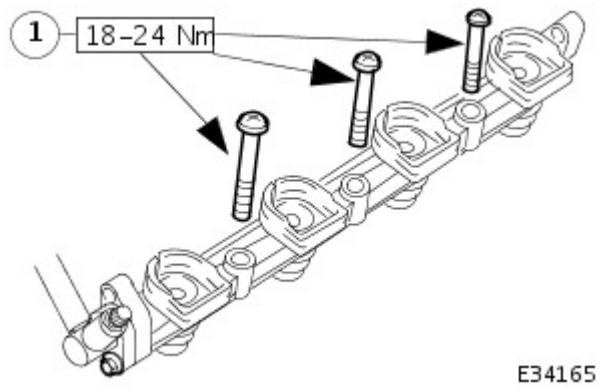
1. Install new seals between fuel rail and charge air cooler adapter ensuring that they are fully seated.

2. Install fuel rail to fuel cross-over pipe.

- Install new O-ring and lubricate with petroleum jelly.

1. Install bolt.

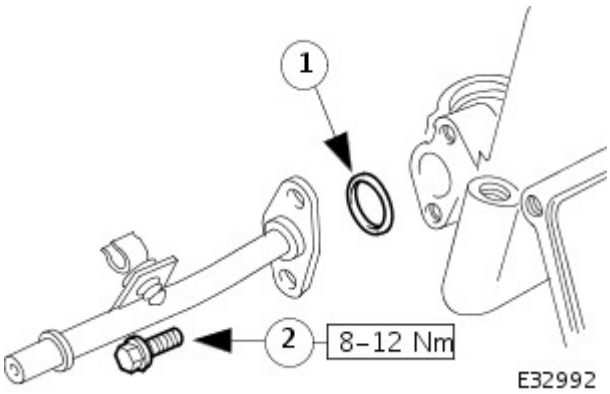




3. Install fuel rail to charge air cooler adaptor.

- Locate fuel rail into adaptor.

    1. Install bolts.



4. Connect fuel feed pipe to fuel rail.

1. Install new O-ring and lubricate with petroleum jelly.
2. Install two bolts.

5. Install fuel injectors; refer to (SC) 18.10.01.

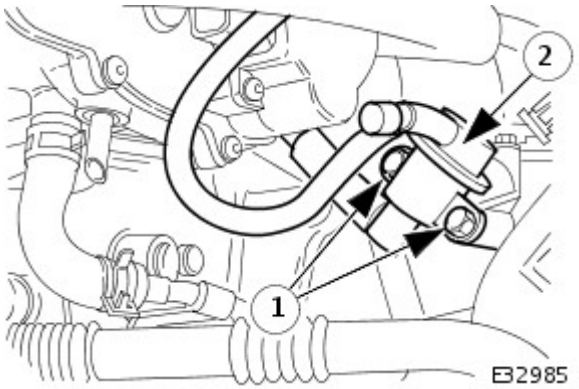
Fuel Charging and Controls - Fuel Injection Supply Manifold RH

Removal and Installation

Removal

1. Remove fuel injectors; refer to (SC) 18.10.01.

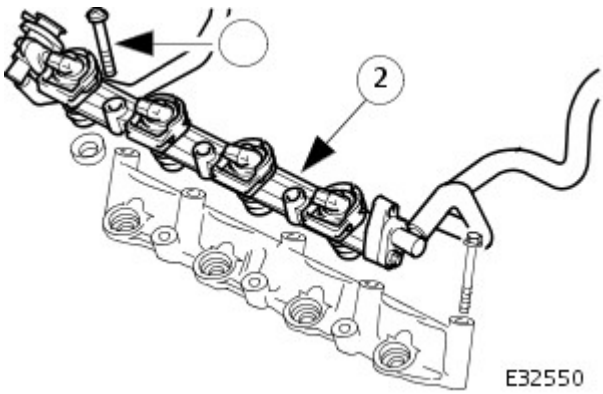
2. Disconnect fuel pressure regulator.



1. Remove bolts.
2. Reposition pressure regulator.

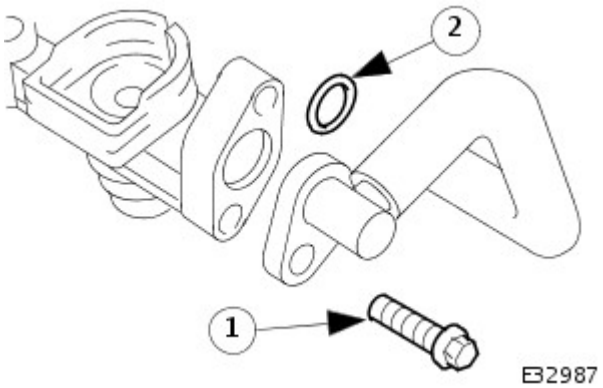
- Discard O-ring.

3. Remove fuel rail from charge air cooler adaptor.



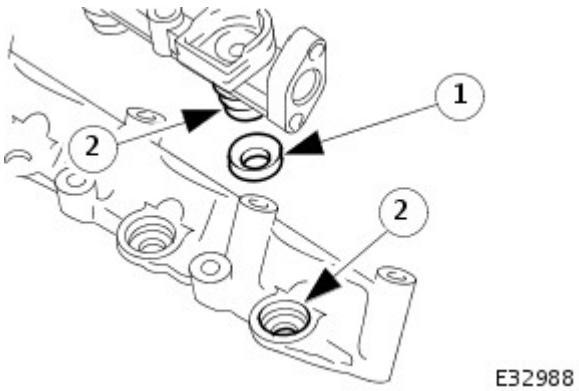
1. Remove three bolts.
2. Remove fuel rail; still connected to fuel crossover pipe and fuel return pipe.

4. Remove fuel rail from fuel cross-over pipe.



1. Remove bolt.
2. Discard O-ring.

5. Remove fuel rail to charge air cooler adaptor seals.

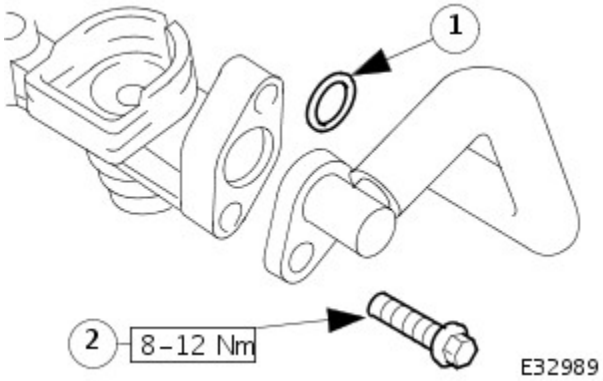


1. Discard seals.
2. Clean and inspect mating faces.

Installation

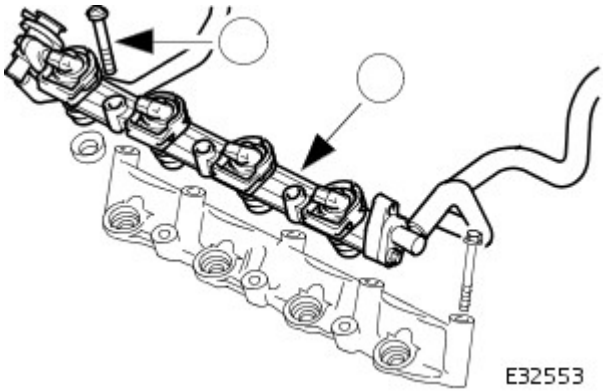
1. Install new seals between fuel rail and charge air cooler adapter, ensuring they are fully seated.

2. Install fuel rail to fuel cross-over pipe.



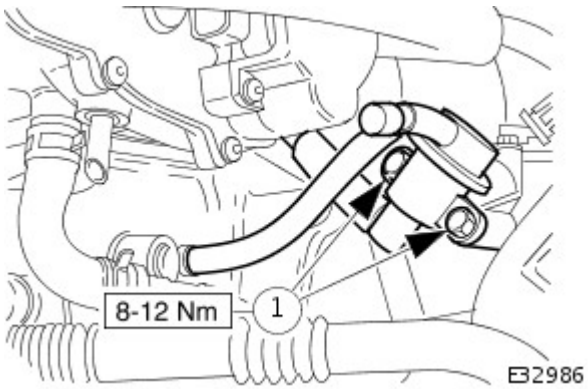
1. Install new O-ring and lubricate with petroleum jelly.
2. Install bolt.

3. Install fuel rail to charge air cooler adaptor.



1. Align fuel rail to adaptor; still connected to fuel crossover pipe and fuel return pipe. Locate fuel rail into adaptor.
2. Install three bolts which secure fuel rail to adaptor. Tighten to 18-24 Nm.

4. Install fuel pressure regulator.



- Install a new O-ring to fuel pressure regulator and lubricate with petroleum jelly

1. Install bolts.

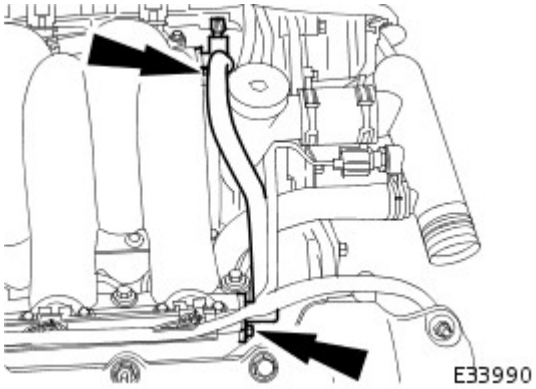
5. Install fuel injectors; refer to (SC) 18.10.01.

Fuel Charging and Controls - Fuel Injection Supply Manifold Pipe

Removal and Installation

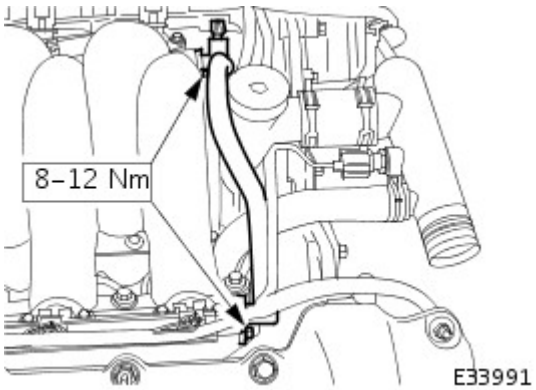
Removal

WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.



1. Depressurize fuel system; refer to 19.50.02.
2. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
3. Remove inlet manifold fuel cross-over pipe.
   - Place cloth under pipe elbows to collect any spillage.
   - Remove elbow securing screws.
   - Disconnect first elbow.
   - Disconnect remaining elbow and remove assembly.
   - Discard O-ring seals from pipe elbows.
   - Clean relevant parts and mating faces.

Installation

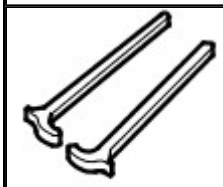


1. NOTE: Install and lubricate new O-ring seals.

Installation is the reverse of the removal procedure.

Fuel Charging and Controls - Fuel Injector4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

Removal and Installation

Special Tool(s)	
 E36424	Remover - Fuel Injector 303-539 (JD 231)

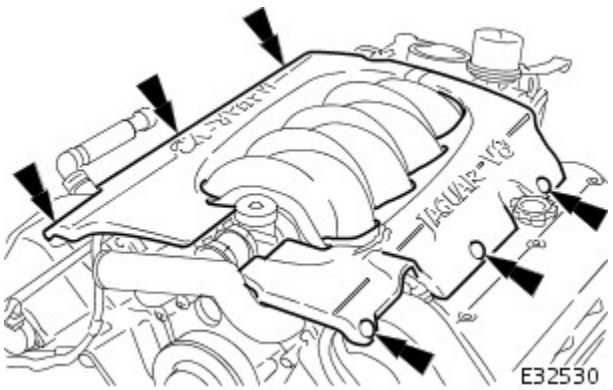
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

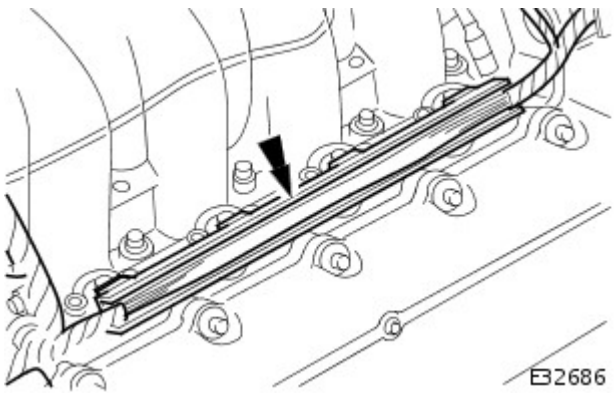
2. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

   Depressurize the fuel system; refer to 19.50.02.

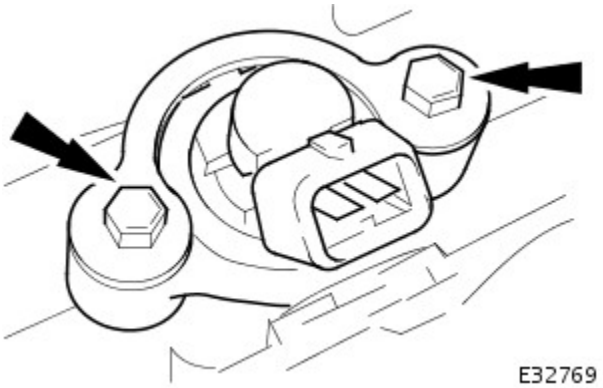
3. Remove engine covers.



4. Disconnect bank 1 or 2 injector connectors and reposition harness to allow access to injectors.



5. Remove bolts which secure fuel injector clamp plate to inlet manifold.

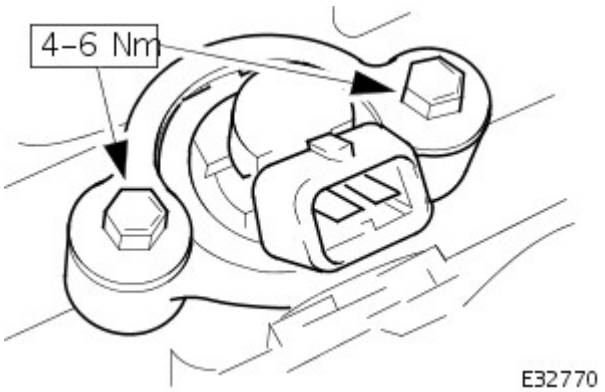




6. Using special tool JD-231, remove injector(s).

- Discard seals and clean all mating faces.

Installation



1. Installation is a reversal of the removal procedure.

- Install new seals and lubricate with petroleum jelly.

Fuel Charging and Controls - Fuel Injector4.0L SC V8 - AJ26

Removal and Installation

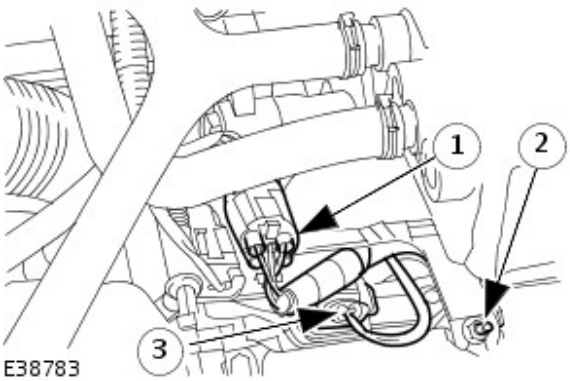
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

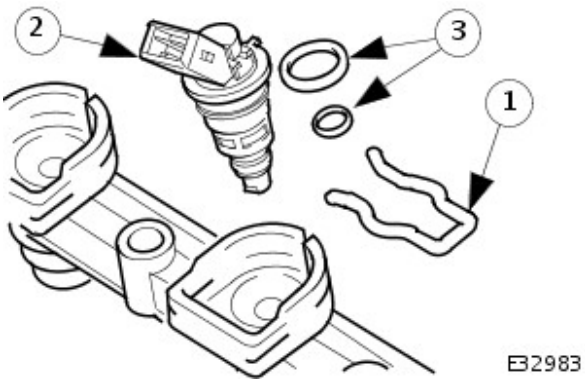
Depressurize fuel system; refer to 19.50.02.

3. Disconnect injector connector.



1. Disconnect and reposition bank 1 or 2 fuel injector harness connector to allow access to injector.
2. Loosen but do not remove nut securing injector harness support bracket to camshaft cover. Reposition injector harness to allow access to injector.
3. Detach injector connector.

4. Remove fuel injector.



1. Prise out injector retaining clip, ensuring that it is not ejected and lost. Note orientation of clip.
2. Using a suitable implement, carefully lever injector from fuel rail.
3. Discard injector O-rings.

5. Clean all mating faces.

Installation

1. Install fuel injector.

1. Install new O-rings, lubricated with petroleum jelly, to fuel injector.
2. Install fuel injector into fuel rail. Press firmly until it is felt to click into place.
3. Hold injector firmly down and install injector securing clip in correct orientation.

2. Re-connect injector and harness connectors.

3. Tighten harness nut to 4-5Nm.

4. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Fuel Charging and Controls - Fuel Injectors4.0L SC V8 - AJ26

Removal and Installation

Removal

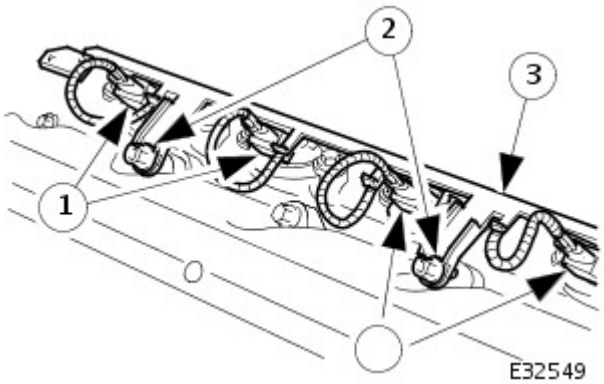
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

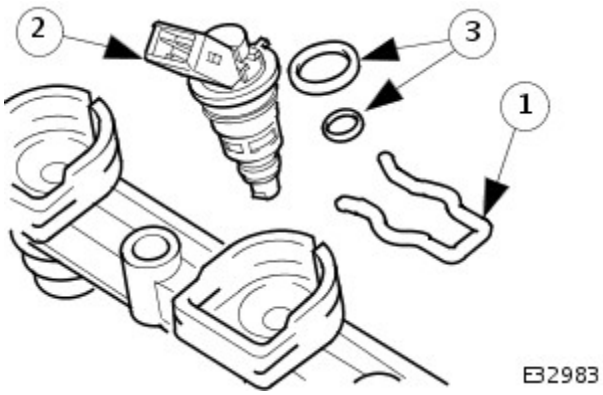
2. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

   Depressurize fuel system; refer to 19.50.02.

3. Drain radiator coolant; refer to 26.10.01.
4. Remove air cleaner cover / intake assembly; refer 19.10.30.
5. Remove throttle body; refer to 19.70.04.
6. Remove throttle induction elbow; refer to (SC) 19.70.28.
7. Remove exhaust gas re-circulation valve (EGR) if fitted; refer to 17.45.01.
8. Remove supercharger outlet duct and gasket; refer to 18.50.16.
9. Remove coolant outlet pipe; refer to (SC) 26.31.08 .
10. Remove supercharger drive belt; refer to 18.50.08.
11. Remove supercharger assembly; refer to 18.50.15.
12. Remove bank 1 or 2 charge air cooler as required; refer to 18.50.18 and / or 18.50.19.
13. Disconnect fuel injector harness.

    1. Disconnect injector connectors.
    2. Loosen two nuts which secure harness to camshaft cover.
    3. Reposition harness to allow access to injectors.





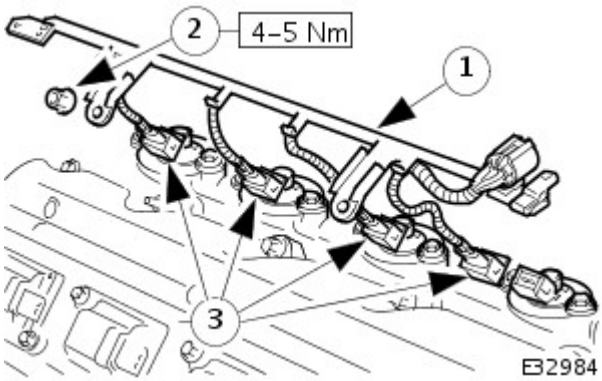
14. CAUTION: Take care to avoid dropping any objects or foreign matter into induction manifold with the fuel injectors removed.

    Remove fuel injector(s).

    1. Prise out injector retaining clip, ensuring that it is not ejected and lost. Note orientation of the clip.
    2. Using a suitable implement, carefully lever injector from fuel rail.
    3. Discard injector O-rings.

15. Clean all mating faces.

Installation



1. Install fuel injector(s).

1. Install new O-rings, lubricated with petroleum jelly, to fuel injector.
2. Install fuel injector into fuel rail. Press firmly until it is felt to click into place.
3. Hold injector firmly down and fit injector securing clip in the correct orientation.

2. Connect fuel injector harness.

1. Reposition harness.
2. Tighten nuts which secure harness to camshaft cover.
3. Re-connect injectors.

3. Install charge air cooler; refer to 18.50.18 and / or 18.50.19.

4. Install supercharger assembly; refer to 18.50.15.

5. Install supercharger drive belt; refer to 18.50.08.

6. Install coolant outlet pipe; refer to 26.31.08.

7. Install throttle induction elbow; refer to 19.70.28.

8. Install exhaust gas re-circulation valve (EGR) if applicable; refer to 17.45.01.

9. Install throttle body; refer to 19.70.04.

10. Install supercharger outlet duct; refer to 18.50.16.

11. Install air cleaner cover / intake assembly; refer to 19.10.30.

12. Refill cooling system; refer to (SC) 26.10.01 .

13. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Fuel Charging and Controls - Throttle Body

Removal and Installation

Removal

• CAUTIONS:

⚠ When the throttle body is being replaced by a unit with the part number suffix '**BA**', and carrying a sticker such as the illustration below, then the usual cleaning procedure is **NOT** to be carried out. These throttle bodies have a molykote coating which will be damaged by normal cleaning procedures. Refer to the latest service actions for further information.

⚠ This process assumes the use of the original throttle cable. The cable setting procedure in this instance is NOT appropriate for a new cable; see 19.20.06.

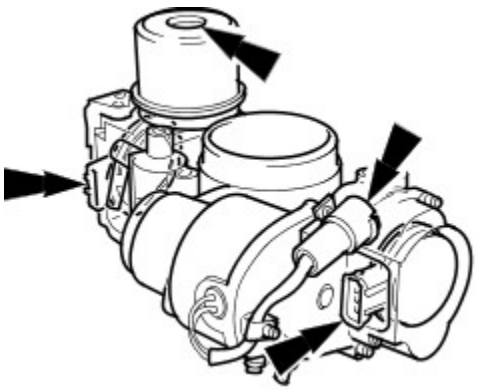


E50048

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

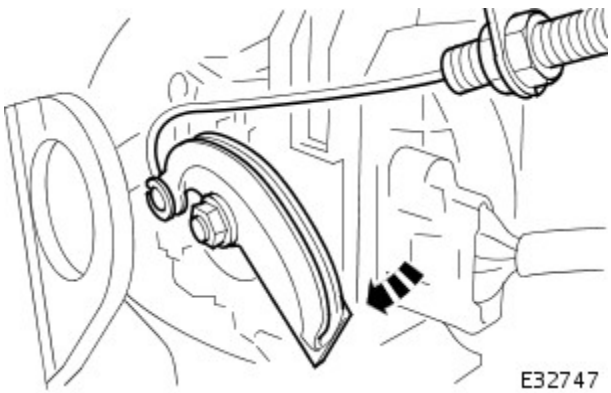
2. Remove air cleaner cover / intake assembly; refer 19.10.30

3. Disconnect connectors and vacuum pipe.



E32746

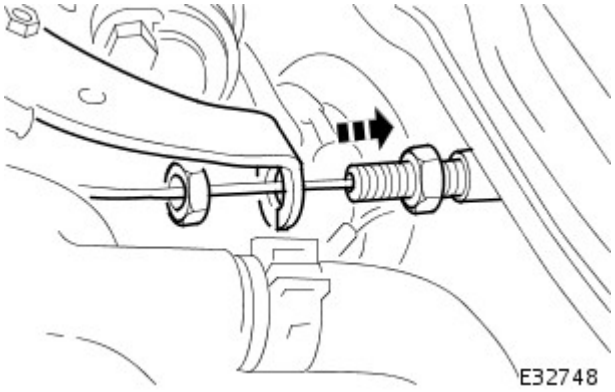
4. Rotate throttle quadrant to allow disconnection of inner cable.



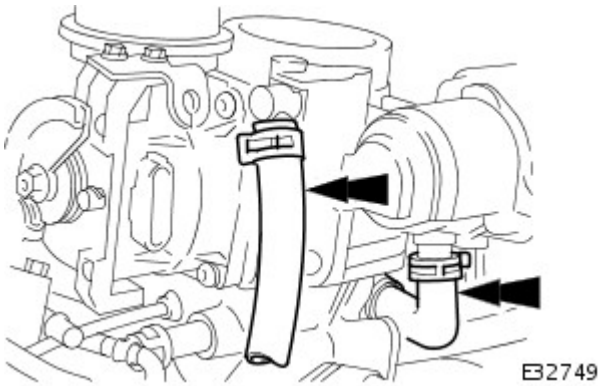
E32747

5. NOTE: Do not disturb adjusting nut

Release throttle cable locking nut and displace outer cable from

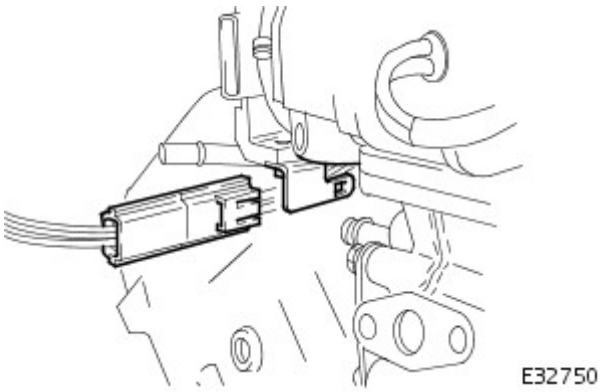


the abutment bracket.

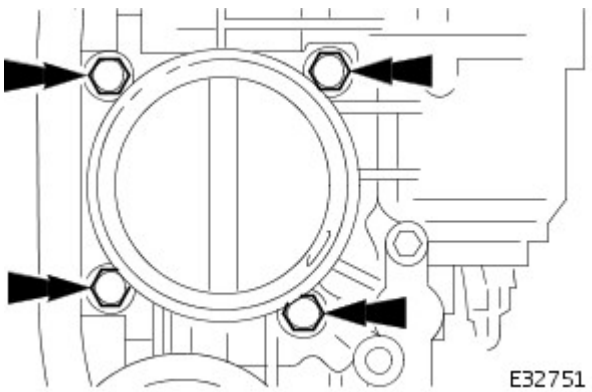


6. Remove coolant hoses.

- Install suitable blanking plugs.



7. Release connector from bracket under LH side of assembly.

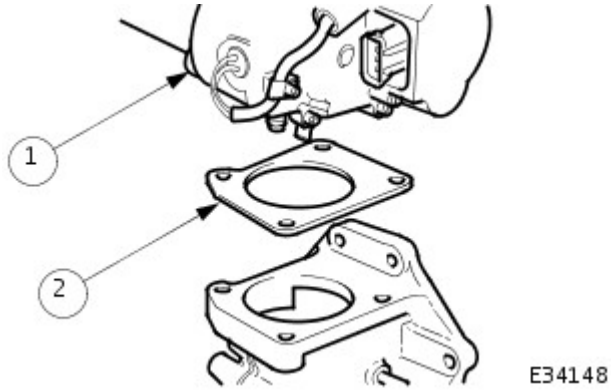


8. Remove throttle body to induction elbow securing bolts.

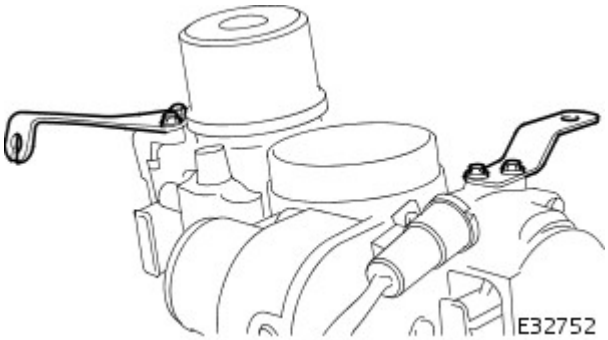
9. Remove throttle body from induction elbow.

1. Remove throttle body.
2. Discard gasket.

- Clean mating faces.

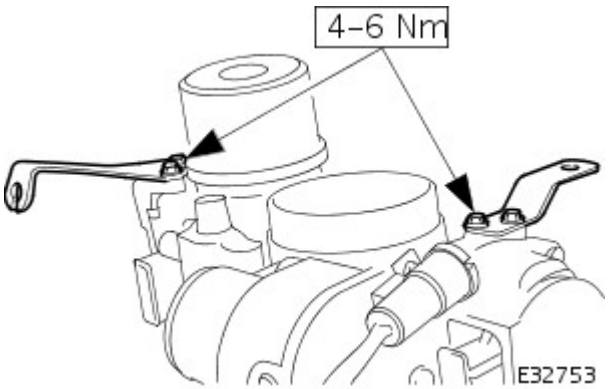


- Blank off inlet tract to prevent ingress of foreign matter.

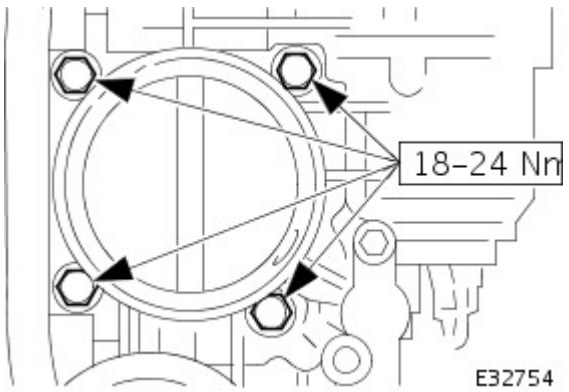


10. Remove throttle cable and intake duct brackets.

Installation



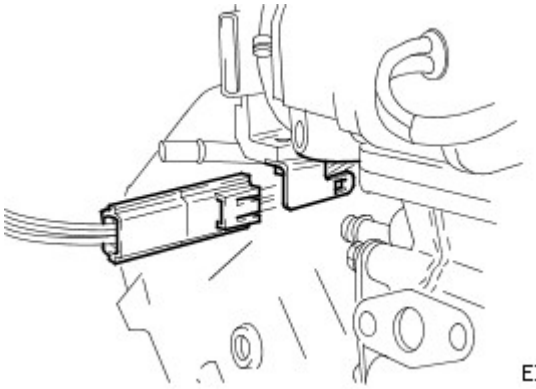
1. Install throttle cable and intake duct brackets.

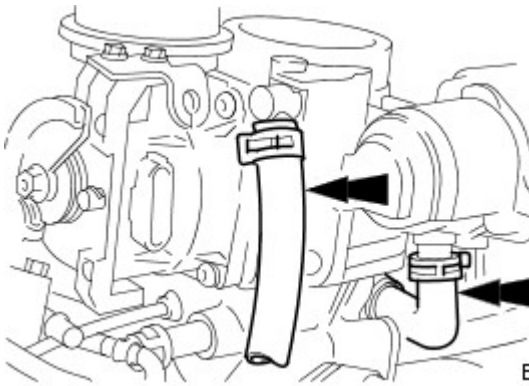


2. Install throttle.

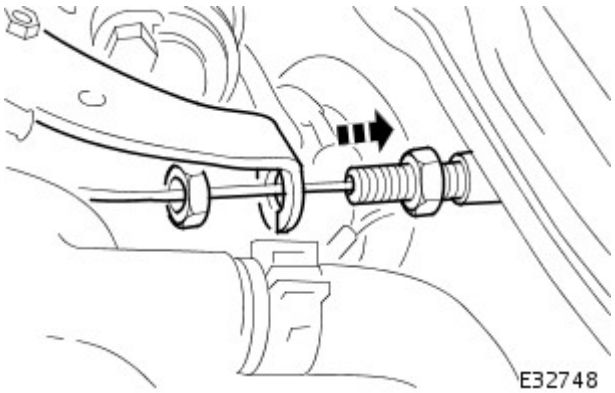
- Install new gasket.

3. Install connector.



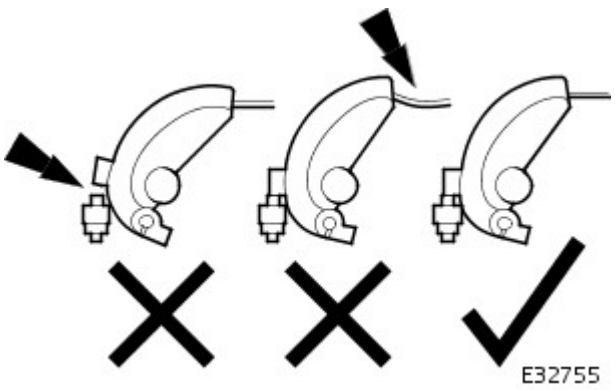


4. Install coolant hoses.



5. Reposition outer cable to abutment bracket.

- Install but do not tighten adjusting nut.



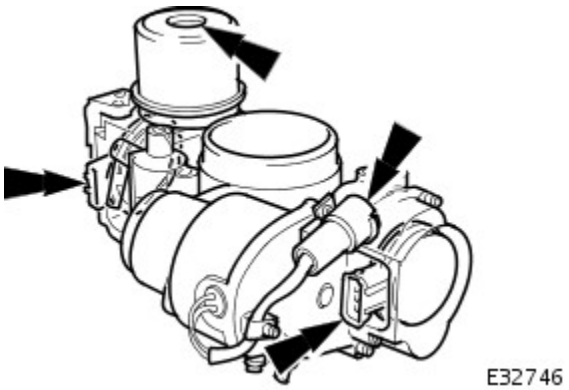
6. CAUTION: Under no circumstances should quadrant be held clear of throttle stop by cable tension.

• NOTE: Make sure there is neither tension nor slack in the cable.

Install throttle cable.

- Tighten locknut without altering setting or introducing twist into the cable outer.

7. Connect connectors and vacuum pipe.



8. Where appropriate check kickdown setting is within specification and reset if required as detailed from step 6 (Installation).

- PDU users see 44.15.38

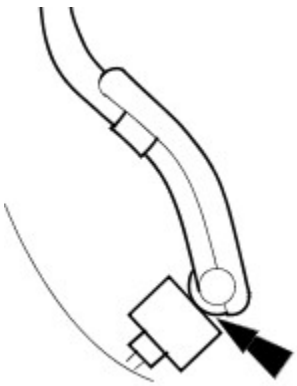
9. Connect scantool.

- Read 'Current Powertrain Data'.
- Display PID 120F (pedal demand).



10. NOTE: Ensure that contact with switch does not result in switch movement.

Push throttle pedal until light contact is made with kickdown switch.



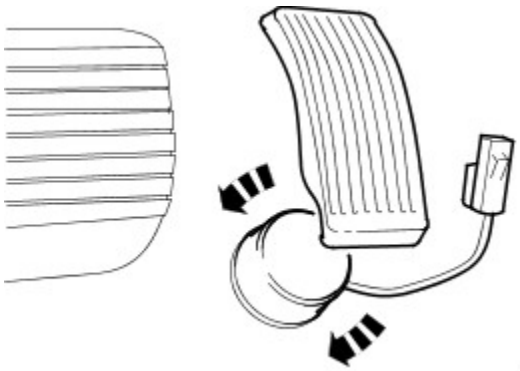
11. Specified PID value = 3.66 to 3.76 volts (2F9 + or - A hex).

- If the value is outside these limits, proceed to step 9 (Installation).
- If the value is within these limits, proceed to step 13 (Installation).



12. Pull carpet from around kickdown switch.

13. Disconnect kickdown switch flying lead connector (to avoid cable twist as the switch is rotated).



E32765

14. Adjust kickdown switch to the value as defined in step 8 (Installation).

15. Reconnect kickdown flying lead connector and verify setting.

16. Install air cleaner cover / intake assembly; refer 19.10.30.

17. Check coolant level and top up if required.

18. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Fuel Charging and Controls - Throttle Body Gasket

Removal and Installation

Removal

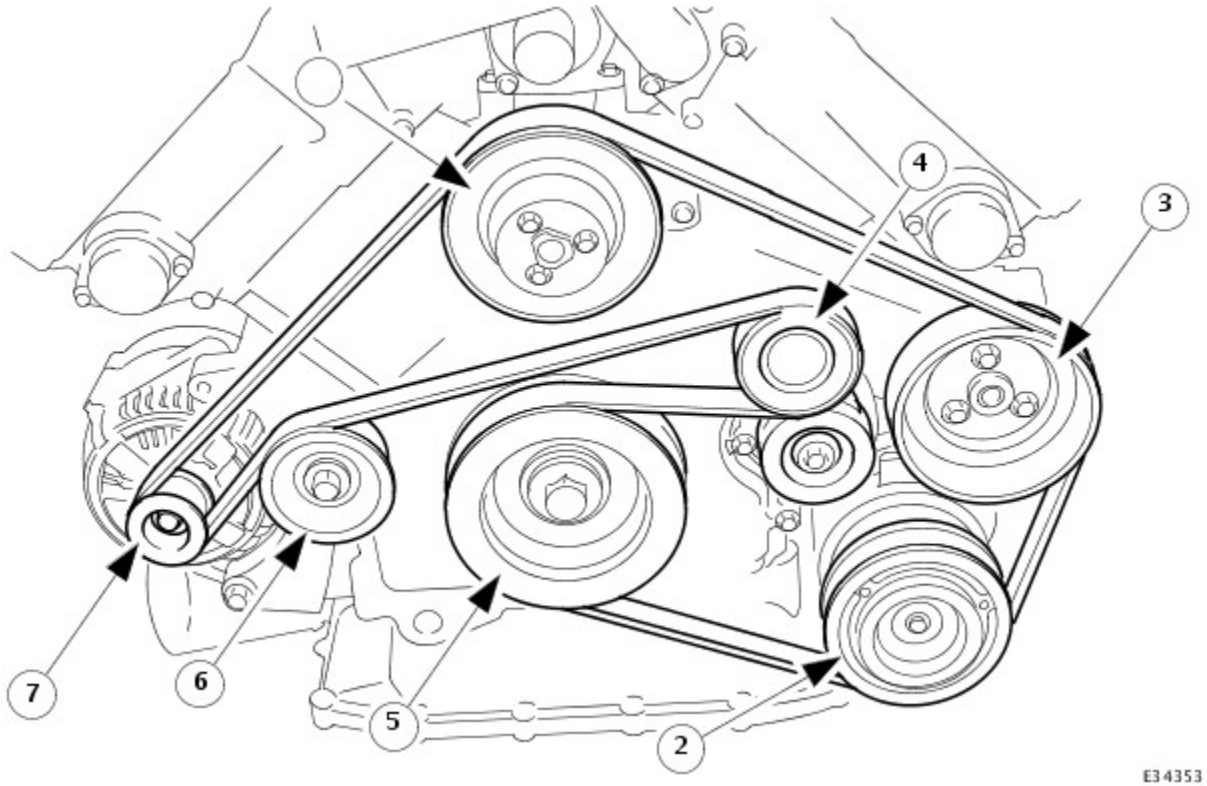
1. Remove throttle body; refer to 19.70.04.

Installation

1. Installation is a reversal of the removal procedure.

Accessory Drive - Accessory Drive

Description and Operation



Parts List

Item	Part Number	Description
1	—	Coolant Pump Drive
2	—	Air-Conditioning Compressor Drive
3	—	Power Steering Pump Drive
4	—	Automatic Belt Tensioner
5	—	Crankshaft Pulley
6	—	Idler Pulley
7	—	Generator Drive

Crankshaft Pulley

The combined crankshaft pulley and torsional vibration damper drives a single, seven ribbed vee belt. The belt drives all of the engine-mounted accessories; the generator, the power assisted steering pump, the air-conditioning compressor and the coolant water pump.

Idler Pulley

An idler pulley, on the right-hand accessory mounting, increases the wrap-angle around the generator pulley.

Coolant Pump Drive

The coolant pump pulley is the uppermost of the accessory drive pulleys. The coolant pump is fitted between the two cylinder banks on the front face of the engine.

Air Conditioning Compressor Drive

This is positioned at the lowest point of the front-end accessory-d rive on the left hand side accessory mounting.

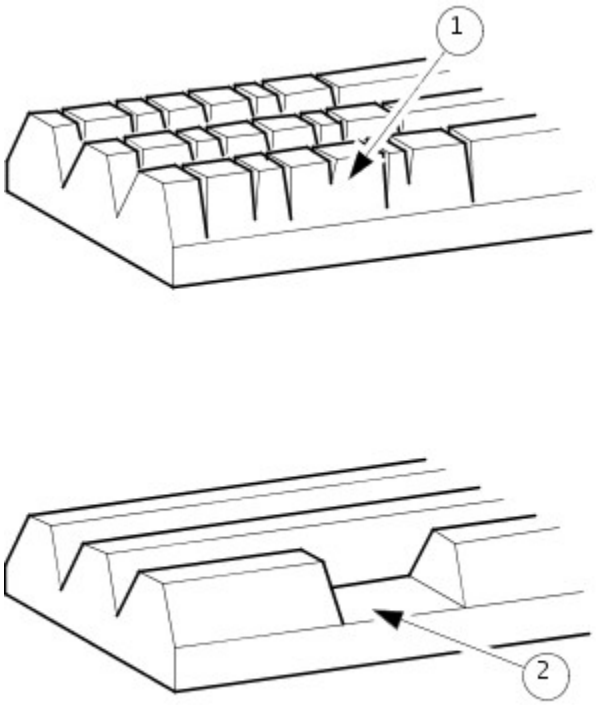
Power Assisted Steering Pump Drive

The power assisted steering pump pulley is located on the left side, above the air-conditioning compressor.

Generator Drive

The generator is fitted on the right hand accessory mounting.

Drive Belt



E35291

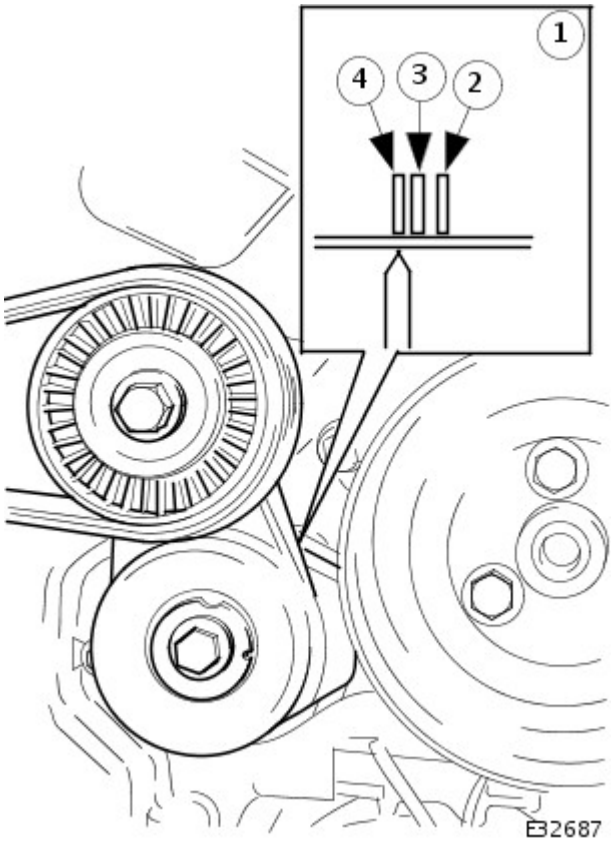
Item	Description
1	Acceptable Drive Belt Cracking
2	Unacceptable Drive Belt Damage

The drive belt should be inspected at every routine service for excessive wear and damage. A drive belt which displays symptoms of cracking may be perfectly fit for further service.

Should cracking be detected, serviceability may be assessed using the following guidelines:

- Fifteen cracks per rib over a 100 mm length of drive belt is acceptable.
- Section(s) of belt missing from any rib is not acceptable and the drive belt must be renewed.

Automatic Belt Tensioner



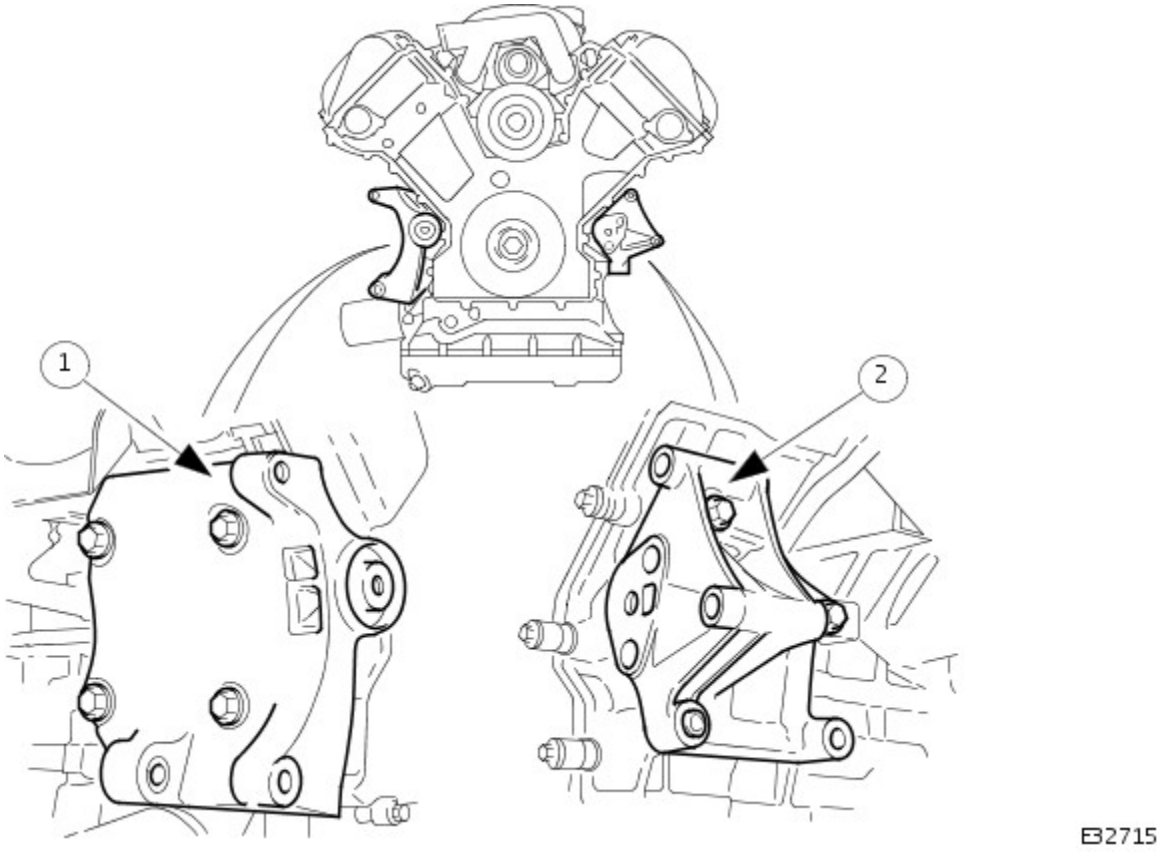
Item	Description
1	Belt Wear Indicator
2	Renew Belt Indicator
3	New Belt Maximum Length
4	New Belt Minimum Length

The automatic belt tensioner consists of an idler pulley which is free to rotate on a bearing, located at the end of a spring-loaded pivot arm.

The pivot arm can be turned counter-clockwise (viewed from the front of the engine) for belt removal and installation.

A belt-wear indicator is incorporated on the rear horizontal face of the pivot arm.

Accessory Mounting Brackets



Parts List

Item	Part Number	Description
1	—	Right Hand Mounting Bracket
2	—	Left Hand Mounting Bracket

All engine accessories are rigidly-mounted onto the cylinder block by means of accessory mounting brackets on the left and right-hand sides of the engine.

The left-hand bracket supports the air-conditioning compressor and steering pump.

The right-hand bracket supports the generator.

Dowels between the accessory mounting brackets and the engine ensure that the accessory pulleys are accurately aligned with the accessory drive belt.

Accessory Drive on Supercharged Engines

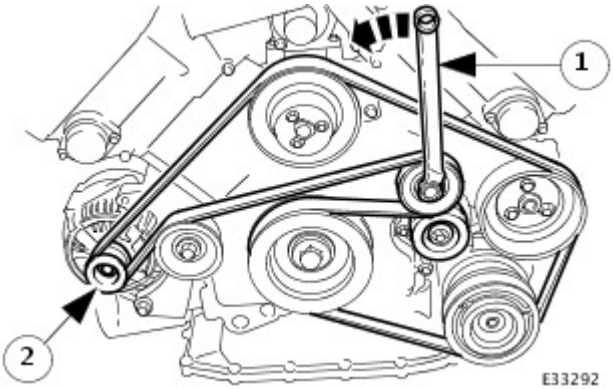
The front end accessory drive description and information for the supercharged engine is identical to that given above. The only difference is that the drive belt for the supercharger passes immediately in front of the accessory drive belt. Therefore, before any work can be done on the accessory drive belt and associated components, the supercharger drive belt must first be removed.

Accessory Drive - Accessory Drive Belt4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Check the belt wear indicator marks to confirm that the drive belt is / is not within limits.



3. CAUTION: When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

Remove the drive belt from the accessory drive.

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left, viewed from the front, against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

- Disconnect the belt from the other pulleys, as necessary.

Installation

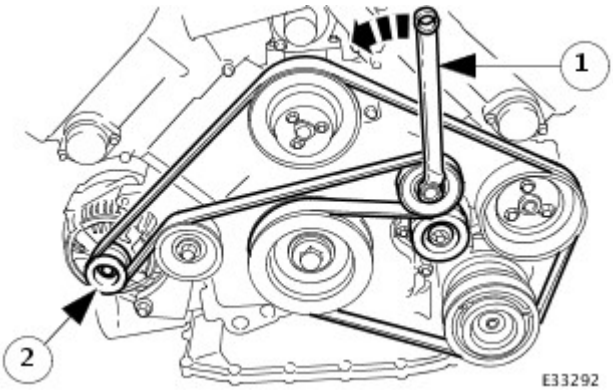
1. Installation is the reverse of the removal procedure. Ensure that the belt is correctly and squarely located on each pulley.

Accessory Drive - Accessory Drive Belt4.0L SC V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the supercharger drive belt, for access. Refer to operation 18.50.08.
3. Check the belt wear indicator marks to confirm that the drive belt is / is not within limits.



4. CAUTION: When releasing the belt tension, never apply any torque in a clockwise direction to the pulley centre bolt (left hand thread) as it could subsequently loosen.

Remove the drive belt from the accessory drive.

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left, viewed from the front, against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

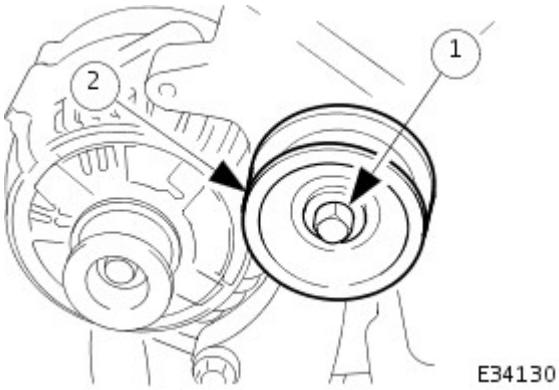
- Disconnect the belt from the other pulleys, as necessary.

Installation

1. Installation is the reverse of the removal procedure. Ensure that the belt is correctly and squarely located on each pulley.
2. Refit the supercharger drive belt. Refer to operation 18.50.08.

Accessory Drive - Accessory Drive Belt Idler Pulley4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation



1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the drive belt for access. Refer to Operation (12.10.40)

3. Remove the idler pulley.

1. Remove the securing bolt from the idler pulley.

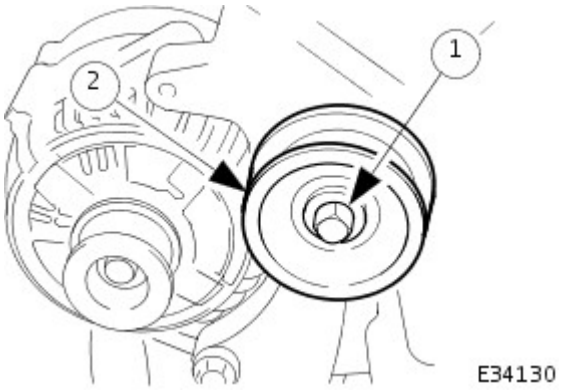
2. Remove the idler pulley.

Installation

1. Installation is the reverse of the removal procedure. Tighten the pulley securing bolt to 53-69 Nm. Ensure that the belt is correctly and squarely located on each pulley.

Accessory Drive - Accessory Drive Belt Idler Pulley4.0L SC V8 - AJ26

Removal and Installation



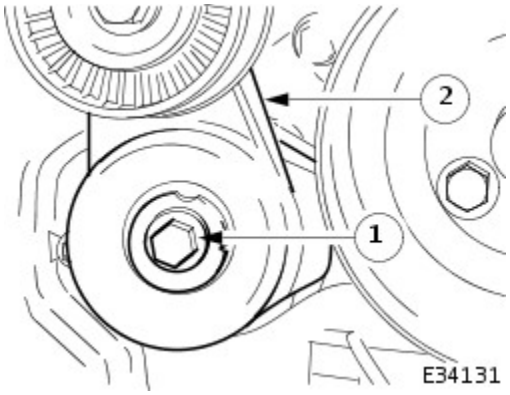
1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the supercharger drive belt, for access. Refer to operation 18.50.08.
3. Remove the accessory drive belt for access. Refer to Operation (12.10.40)
4. Remove the idler pulley.
    1. Remove the securing bolt from the idler pulley.
    2. Remove the idler pulley.

Installation

1. Installation is the reverse of the removal procedure. Tighten the pulley securing bolt to 53-69 Nm. Ensure that the belt is correctly and squarely located on each pulley.
2. Refit the supercharger drive belt. Refer to operation 18.50.08.

Accessory Drive - Accessory Drive Belt Tensioner4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation



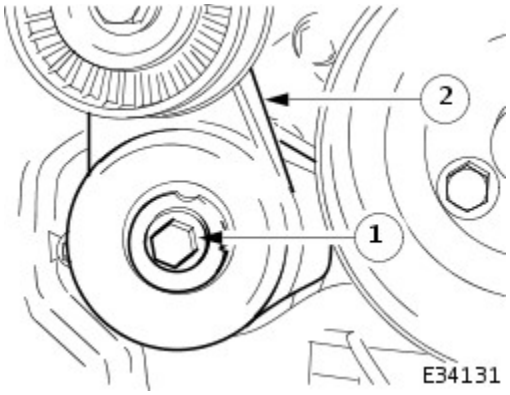
1. Remove the drive belt for access. Refer to Operation (12.10.40)
2. Remove the tensioner assembly, which includes the tensioner pulley..
    1. Remove the bolt which secures the tensioner assembly to the engine.
    2. Remove the tensioner assembly.

Installation

1. Installation is the reverse of the removal procedure. Tighten the tensioner assembly securing bolt to 38-48 Nm. Ensure that the belt is correctly and squarely located on each pulley.

Accessory Drive - Accessory Drive Belt Tensioner4.0L SC V8 - AJ26

Removal and Installation



1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the supercharger drive belt, for access. Refer to operation 18.50.08.
3. Remove the accessory drive belt for access. Refer to Operation (12.10.40)
4. Remove the tensioner assembly, which includes the tensioner pulley..
    1. Remove the bolt which secures the tensioner assembly to the engine.
    2. Remove the tensioner assembly.

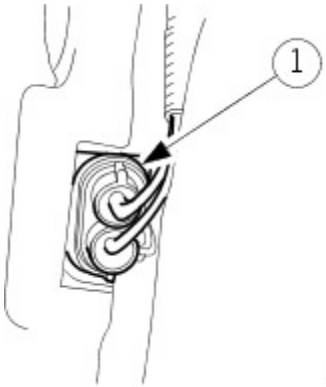
Installation

1. Installation is the reverse of the removal procedure. Tighten the tensioner assembly securing bolt to 38-48 Nm. Ensure that the belt is correctly and squarely located on each pulley.
2. Refit the supercharger drive belt. Refer to operation 18.50.08.

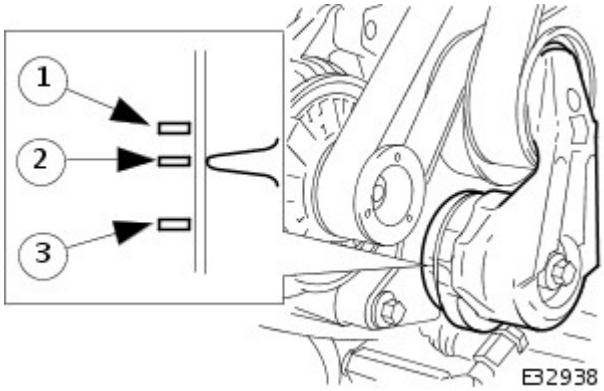
Accessory Drive - Supercharger Belt

Removal and Installation

Removal

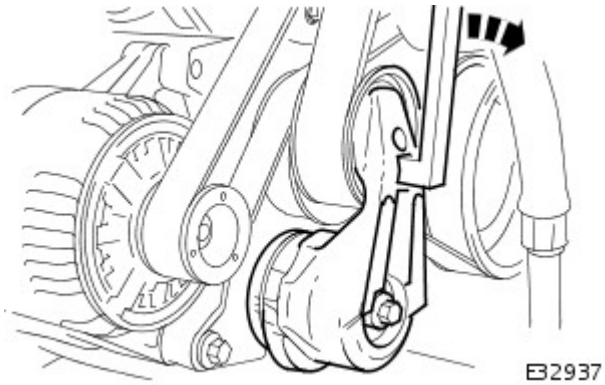


1. Disconnect RH fan motor connector.



2. Check supercharger drive belt length by observing belt wear indicator marks on side of tensioner.

1. Pointer at this mark, indicates minimum new belt length.
2. Pointer at this mark, indicates maximum new belt length.
3. Pointer at this mark, indicates belt must be renewed.



3. Remove drive belt from supercharger.

- Fit 1/2 inch square drive ratchet or bar into square aperture on front face of tensioner. Using bar, turn tensioner assembly to the right (viewed from front) against spring tension.
- Whilst holding the tensioner against spring tension, remove drive belt from tensioner pulley. Release tensioner slowly and remove bar.
- Disconnect belt from other pulleys and remove it from rear of tensioner.

Installation

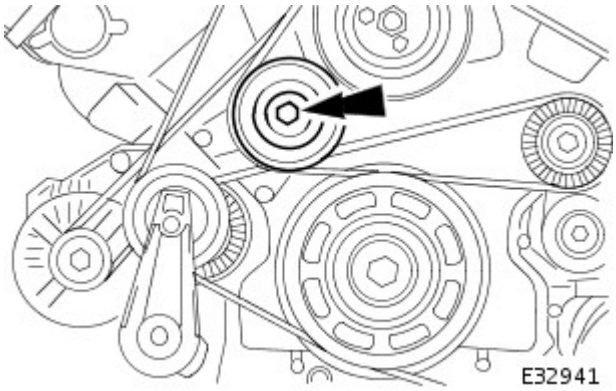
1. NOTE: Ensure that belt is correctly and squarely located on each pulley. Check belt wear indicator marks to confirm that drive belt is within limits.

Installation is a reversal of the removal procedure.

Accessory Drive - Supercharger Belt Idler Pulley

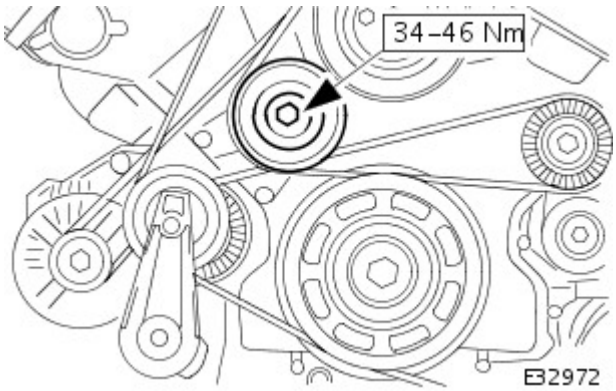
Removal and Installation

Removal



1. Remove supercharger drive belt; refer to 18.50.08.
2. Remove supercharger drive belt idler pulley.
   - Remove bolt .
   - Remove idler pulley.

Installation

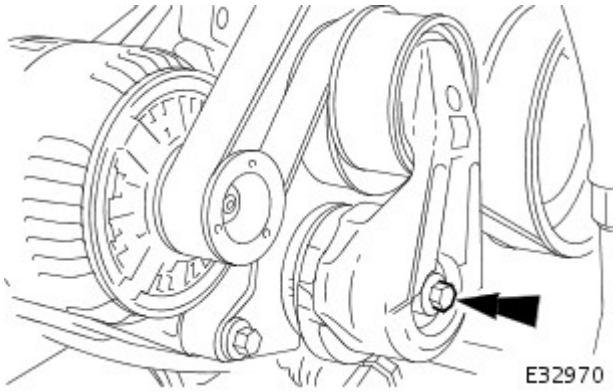


1. Installation is a reversal of the removal procedure.

Accessory Drive - Supercharger Belt Tensioner

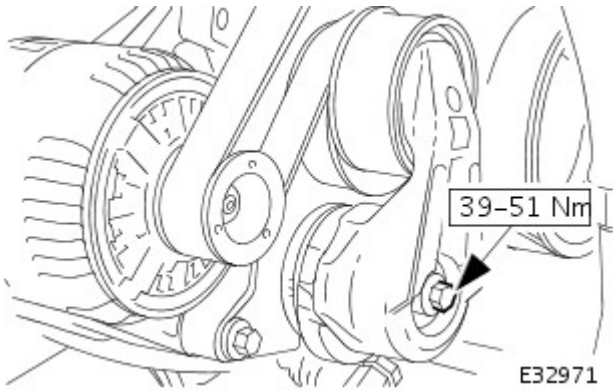
Removal and Installation

Removal



1. Remove twin fan and motor assembly; refer to (SC) 26.25.12.
2. Remove supercharger drive belt; refer to 18.50.08.
3. Remove tensioner from alternator mounting bracket.
   - Remove bolt.
   - Remove tensioner.

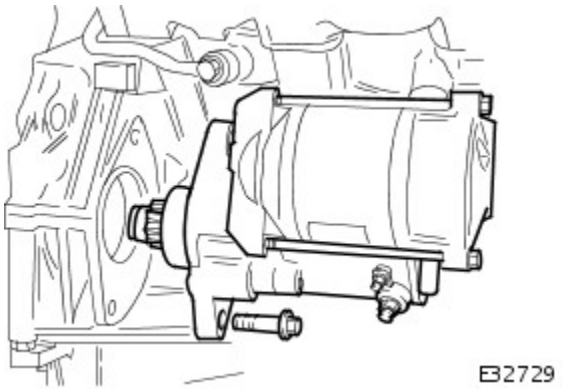
Installation



1. Install drive belt tensioner to alternator mounting bracket.
   - Locate tensioner using its locating pegs.
2. Install supercharger drive belt; refer to 18.50.08.
3. Install twin fan and motor assembly; refer to (SC) 26.25.12.

Starting System - Starting System

Description and Operation



Manufacturer - NipponDenso

Type - RA1.4.

Weight - 3.75 kg (8.27 lb)

Output - 1.4 kW

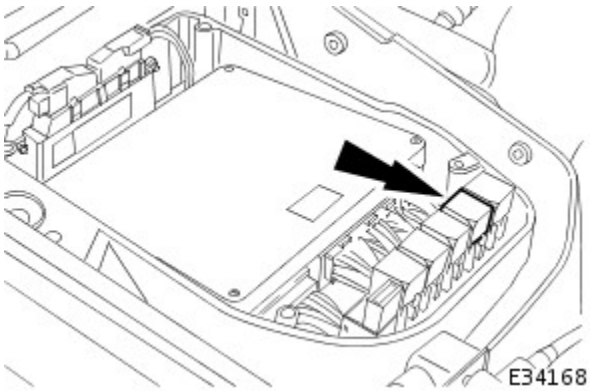
Rated Time - 30 seconds

Rotation - Clockwise, viewed from pinion end

The starter is of the pre-engaged type; located at the rear left-side of the engine.

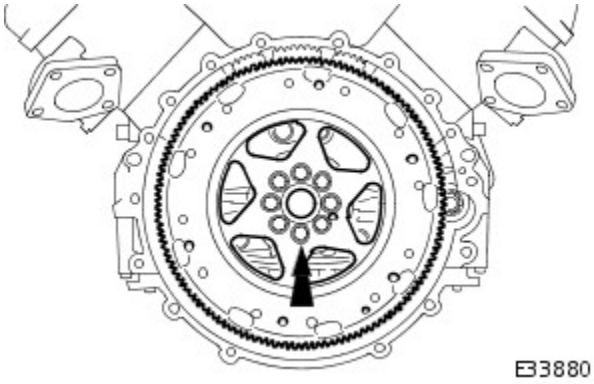
When the starter is operated from the key-switch, the engagement lever moves the pinion into mesh with the engine ring gear teeth, the electrical contacts within the solenoid complete the high power circuit and the starter motor operates to turn the engine.

Starter Relay



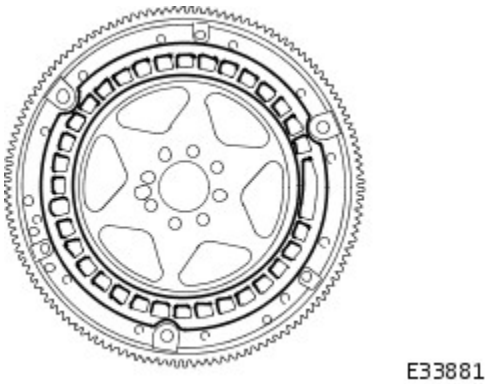
The starter motor control relay is, relay number 5, located inside the engine compartment enclosure (left side of vehicle RHD and right side of vehicle on LHD).

Starter Drive Plate



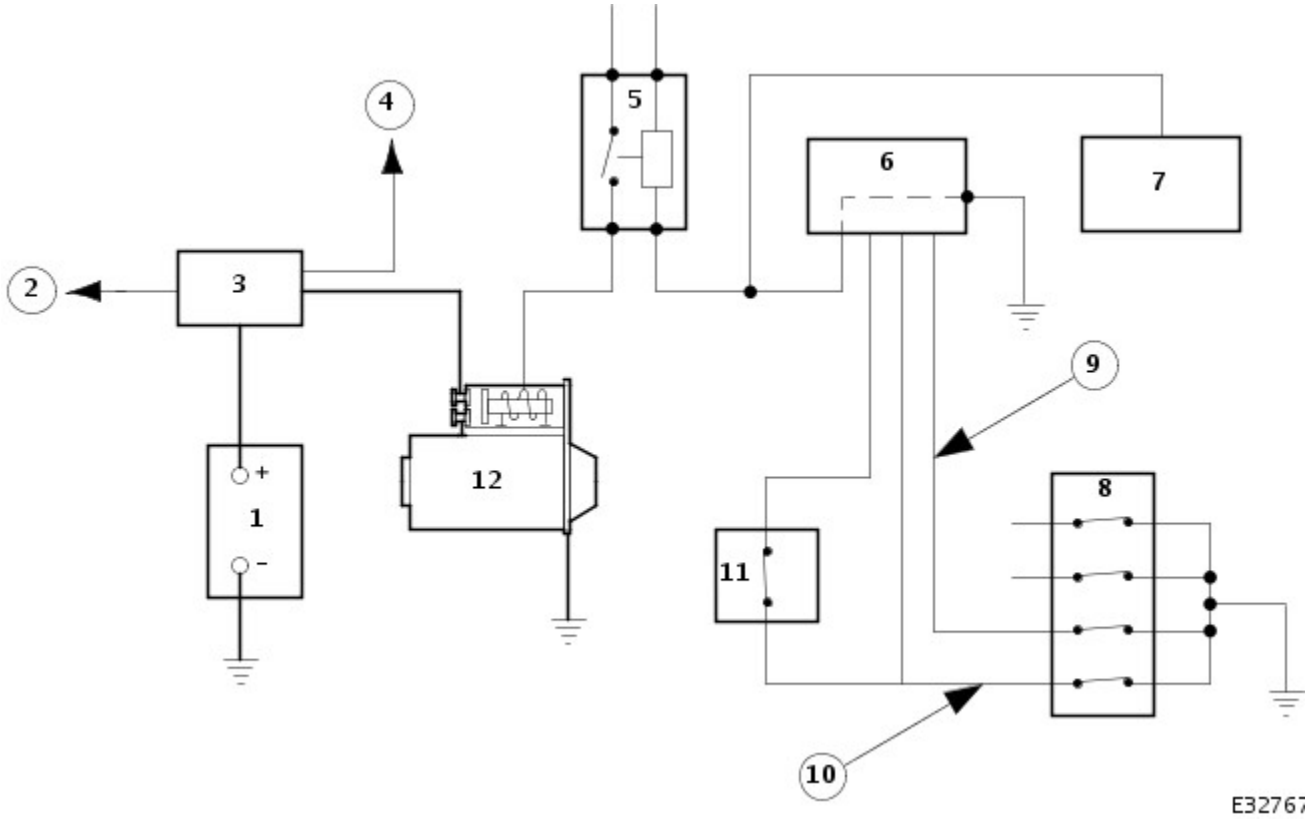
The starter drive plate is attached to the rear of the crankshaft by eight bolts.

Timing Disc



A timing disc, for the engine speed sensor, is spot-welded to the front face of the starter drive plate.

Starting System Operation



Item	Description
1	Battery
2	To Rear Fusebox
3	High Power Protection Module
4	To Front Fuseboxes
5	Starter Relay
6	Body Processor Module (BPM)
7	Engine Control Module (ECM)
8	Ignition Switch
9	CRANK Signal
10	Ignition ON Signal
11	Inertia Switch
12	Starter Motor and Solenoid

The illustration above is a simplified explanation of how the starting system operates in conjunction with the Body Processor Module (BPM) and the Engine Control Module (ECM).

Refer to the Starting Circuit Diagram in the Electrical Guide.

Ignition Switch to ON Position

When the ignition key is set to the normal run position, the following sequence occurs:

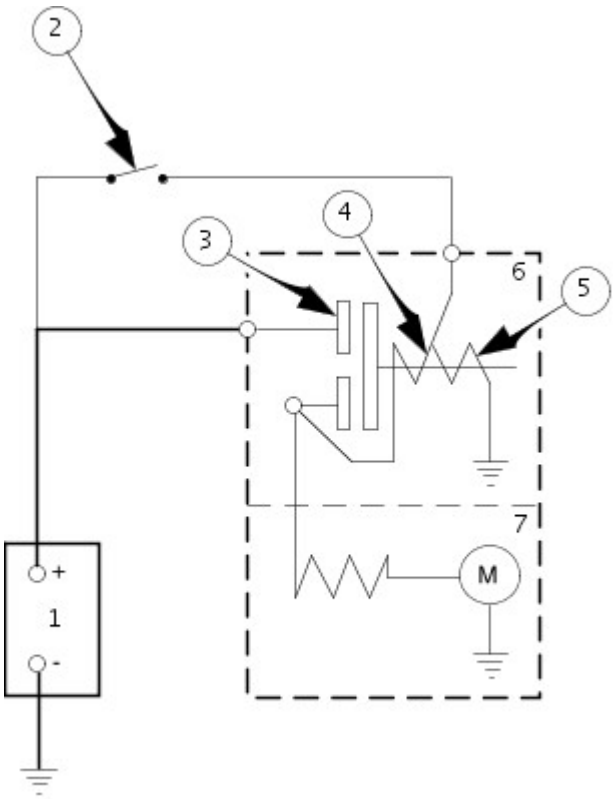
- The isolation relay in each fusebox is energised to supply battery power to the fuses and associated circuits.
- The BPM 'IGN ON' terminal is taken to 0V by the ignition switch.
- The BPM checks that various parameters are correct e.g. - inertia switch is in the active condition - transmission is in PARK - security system has been correctly disabled.

Ignition Switch at CRANK Position

When the ignition key is set to the crank position, the following sequence occurs:

- The BPM 'CRANK SELECTED' terminal is taken to 0V by the ignition switch.
- The BPM 'O/P ENGINE CRANK' terminal provides a path to ground for the starter relay coil, via Fuse 5 (10A) located in the engine compartment front fusebox. This path to ground also indicates to the ECM 'I/P ENGINE CRANK' terminal, by taking it to 0V, that the engine has been requested to crank.
- With the starter relay contacts closed, power via Fuse 3 (25A) in the engine compartment rear fusebox, is supplied to the pull-in winding of the starter solenoid.
- The solenoid main contacts close and are held closed by the solenoid hold-in winding.
- Battery power is supplied to the starter motor through the solenoid main contacts, direct from the battery and the High Power Protection Module.

Starter Motor Internal Connections



E32768

Item	Description
1	Battery
2	Ignition Switch
3	Solenoid Contacts
4	Solenoid Pull-In Winding
5	Solenoid Hold-In Winding
6	Solenoid
7	Starter Motor Main Body

Refer to the Starting Circuit Diagram in the Electrical Guide for the actual layout and connection details.

The starter motor and solenoid in the previous figure are shown diagrammaticall y to indicate simply, the electrical circuit and various connections.

Starting System - Starting System
Diagnosis and Testing

Inspection and Verification

WARNING: Make sure the vehicle is in **NEUTRAL** or **PARK** for vehicles with automatic transmission, **NEUTRAL** for vehicles with manual transmission, and apply the parking brake. Failure to follow this instruction may result in personal injury.

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage, correct fitment, etc.

Visual Inspection Chart

Mechanical	Electrical
• Starter motor • Flywheel ring gear • Engine seized	• Battery condition, state of charge • Starter motor • Fuse 3 of the EMS fuse box • High power protection module • Starter relay • Ignition switch • Wiring harness(es) • Damaged, loose or corroded connectors • Body processor module (BPM) • Engine Control Module (ECM)

3. **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. **4.** If the concern is not visually evident, refer to the Diagnostic trouble code (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: When performing electrical 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.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Non-Start	Engine does not crank	• Engine siezed • Battery and/or cables • Inhibitor circuit • Starter motor • Starter relay • Ignition switch • ECM relay • Body processor module	Check that the engine turns. Check the battery condition and state of charge. For starter motor and cable tests,GO to Pinpoint Test A. . For ECM relay tests, REFER to Section 303-14 Electronic Engine Controls.
	Engine cranks too fast/slow	• Battery and/or cables • Starter motor • Cylinder compression	Check the battery condition and state of charge. For starter motor and cable tests,GO to Pinpoint Test A. . Check compressions.

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P1245	Engine crank signal low voltage	• Starter relay coil to ECM/BPM circuit open circuit	For starter relay circuit tests,GO to Pinpoint Test B. .
P1246	Engine crank signal high voltage	• Starter relay coil to ECM/BPM circuit short circuit to B+ voltage • BPM failure	For starter relay circuit tests,GO to Pinpoint Test B. .

Pinpoint Tests

PINPOINT TEST A : CHECK THE POWER SUPPLY, GROUND AND TRIGGER TO THE STARTER CIRCUIT	
• NOTE: During cranking with the engine disabled, observe the engine cranking speed. A cranking speed as low as 90 rpm is acceptable, but will be difficult to measure. A degree of discretion must be used as to when an engine is cranking too slowly.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE VOLT DROP ACROSS THE STARTER CIRCUIT	
	1 Measure the volt drop across the circuit between the battery positive terminal and the starter motor terminal, ST01.
	Is the volt drop greater than 1 volt? **Yes** CHECK the battery connections, cable connections at false bulkhead stud connector, and starter motor. Make sure all connections are in good condition and secure. If all connections are sound, INSTALL a new battery lead. REFER to Section 414-01 Battery, Mounting and Cables. TEST the system for normal operation. **No** GO to A2.
A2: CHECK THE VOLT DROP ACROSS THE STARTER CIRCUIT (CRANKING)	
	1 Disable the fuel or ignition system to prevent the engine starting.
	2 Turn the ignition switch to the **CRANK** position.
	3 Measure the volt drop across the circuit between the battery positive terminal and the starter motor terminal, ST01.
	Is the volt drop greater than 1 volt? **Yes** CHECK the battery connections, cable connections at false bulkhead stud connector, and starter motor. Make sure all connections are in good condition and secure. If all connections are sound, INSTALL a new battery lead. REFER to Section 414-01 Battery, Mounting and Cables. TEST the system for normal operation. **No** GO to A3.
A3: CHECK THE GROUND TO THE STARTER MOTOR	
	1 Measure the resistance between the engine GROUND lead and the starter motor body.
	Is the resistance greater than 5 ohms? **Yes** CLEAN the connection between the starter motor body and it's fittings, recheck the resistance. TEST the system for normal operation. **No** GO to A4.
A4: CHECK THE STARTER SIGNAL FROM THE STARTER RELAY	
	1 Remove the fuel pump relay.
	2 Disconnect the starter motor signal electrical connector, ST03 (WR).
	3 Turn the ignition switch to the **CRANK** position.
	4 Measure the voltage between ST03 (WR) and GROUND.
	Is the voltage less than 10 volts? **Yes** GO to A5. **No** INSTALL a new starter motor. REFER to Starter Motor - in this section. TEST the system for normal operation.
A5: CHECK THE STARTER SIGNAL CIRCUIT FOR HIGH RESISTANCE	
	1 Remove the starter relay.
	2 Measure the resistance between the starter relay base, pin 05 and ST03 (WR).

	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 B1.

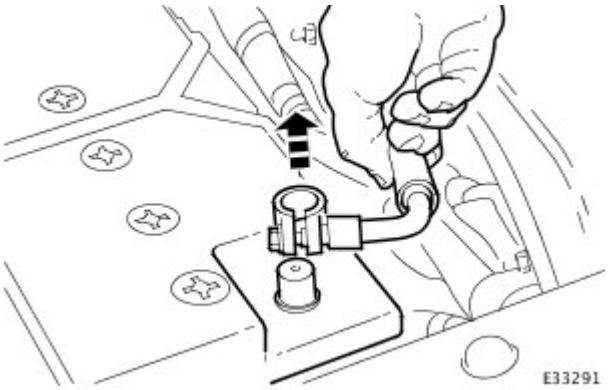
PINPOINT TEST B : DTC P1245, P1246; ENGINE CRANK SIGNAL HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE STARTER RELAY 'ACTIVATE' SIGNAL AT THE RELAY BASE	
	1 Remove the starter relay.
	2 Turn the ignition switch to the **CRANK** position.
	3 Measure the resistance between the relay base, pin 02 and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to B2. **No** Check the starter relay supply circuits and relay operation. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
B2: CHECK THE STARTER RELAY 'ACTIVATE' SIGNAL AT THE ECM	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector (EM11 for vehicles with AJ26 engine, EM82 for vehicles with AJ27 engine).
	3 Reconnect the battery negative terminal. Vehicles with AJ26 engine: • Measure the resistance between EM11, pin 06 (GO) and GROUND Vehicles with AJ27 engine: • Measure the resistance between EM82, pin 02 (GO) and GROUND
	Is the resistance greater than 5 ohms? **Yes** GO to B3. **No** INSTALL a new starter relay. TEST the system for normal operation.
B3: CHECK THE STARTER RELAY/ECM/BPM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the BPM electrical connector, FC15. Vehicles with AJ26 engine: • Measure the resistance between the relay base, pin 02 and EM11, pin 06 (GO) • Measure the resistance between the relay base, pin 02 and FC15, pin 73 (GO) Vehicles with AJ27 engine: • Measure the resistance between the relay base, pin 02 and EM82, pin 02 (GO) • Measure the resistance between the relay base, pin 02 and FC15, pin 73 (GO)
	Is either 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 B4.
B4: CHECK THE STARTER RELAY/ECM/BPM CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Measure the voltage between the relay base, pin 02 and GROUND.
	Is the voltage greater than 6 volts?

	Yes REPAIR the short circuit to high voltage. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to B5.
B5: CHECK THE IGNITION SWITCHED GROUND TO THE BPM	
	1 Turn the ignition switch to the **CRANK** position.
	2 Measure the resistance between FC15, pin 41 (RW) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to B6. **No** Contact dealer technical support for advice on possible BPM failure.
B6: CHECK THE IGNITION SWITCHED GROUND CIRCUIT TO THE BPM FOR HIGH RESISTANCE	
	1 Disconnect the ignition switch electrical connector, FC04.
	2 Measure the resistance between FC15, pin 41 (RW) and FC04, pin 01 (RW).
	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 ignition switch. CLEAR the DTC. TEST the system for normal operation.

Starting System - Starter Motor

Removal and Installation

Removal



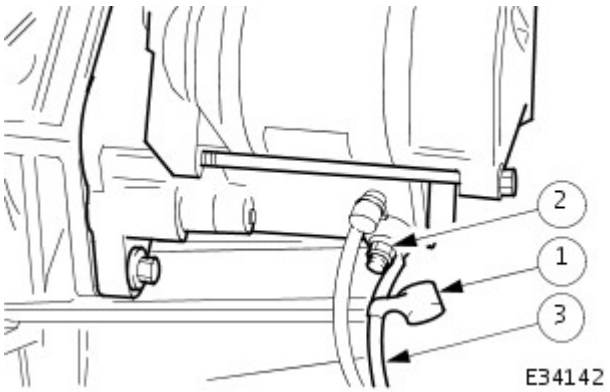
1. Open the engine compartment and fit paintwork protection sheets.

2. Disconnect the battery ground cable.

- Remove the battery cover.

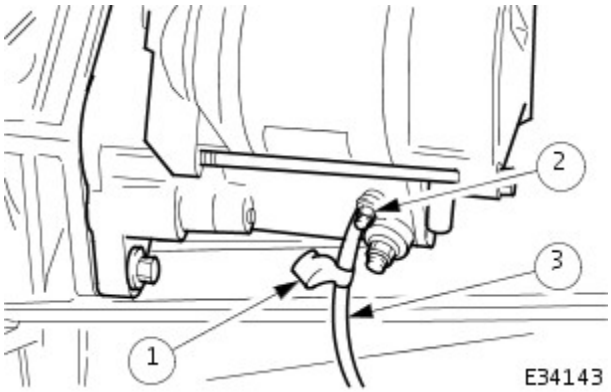
3. Place the vehicle on a ramp.

4. Working from below the vehicle, remove the power steering rack for access. Refer to Operation 57.10.01.



5. Disconnect the starter motor main terminal.

1. Reposition the rubber boot from the main terminal.
2. Remove the nut from the starter motor main terminal.
3. Disconnect the main cable from the terminal.

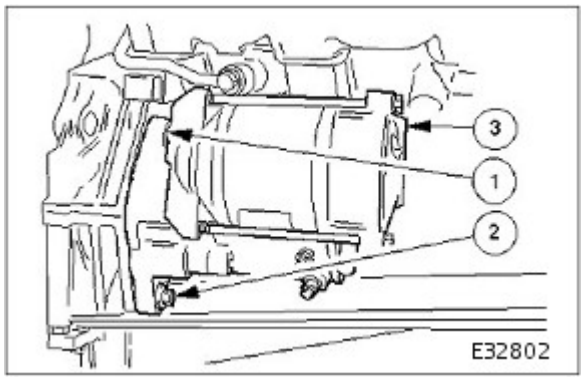


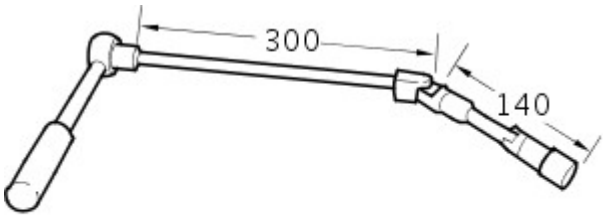
6. Disconnect the starter motor solenoid terminal.

1. Reposition the rubber boot from the terminal.
2. Remove the nut from the solenoid terminal.
3. Disconnect the cable from the terminal.

7. Remove the starter motor securing bolts.

1. Remove the upper securing bolt. Preferably, use a short 13 mm spanner or a Snap On Half Moon spanner CMX1113 to initially loosen the bolt. (Refer to the next step).
2. Remove the lower securing bolt.
3. Carefully remove the starter motor.





E35288

8. The upper bolt may be removed (after loosening) using a 3/8" square drive 13 mm socket, extensions and U.J as shown.

Installation

1. Installation is the reverse of the removal procedure. Tighten the starter motor securing bolts to 38-48 Nm.
2. Refit the steering rack as detailed in Operation 57.10.01. Refill the reservoir with the recommended fluid and bleed the steering system.
3. Lower the ramp. Remove the protection sheets and close the engine compartment cover.
4. Connect the battery and fit the battery cover.

- Reset the radio information and the clock.

Engine Ignition -

General Specifications

Item / Model	Specification
Firing Order (cylinder - bank)	1-1, 1-2, 4-1, 2-1, 2-2, 3-1, 3-2, 4-2
Spark Plug Type	
(Leaded markets - service fit only)	NGK BKR5E-11
Normally Aspirated	NGK PFR5G-11E
Supercharged	NGK PFR6G-13E
Spark Plug Gap	mm (in)
(Leaded markets - service fit only)	1.0 - 1.1 (0.039 - 0.043)
Normally Aspirated	1.0 - 1.1 (0.039 - 0.043)
Supercharged	1.2 - 1.3 (0.047 - 0.051)
High Temperature Nickel Anti-Seize Lubricant (Spark Plug Thread)	'Neverseez' (ESE-M12A4-A)

Torque Specifications

Component	Nm
Spark Plugs	25 - 29
Coil on Plug Bolts	4 - 6
Coil Cover Bolts	4 - 6

Engine Ignition - Engine Ignition

Description and Operation

Ignition coil and spark plug reference

Any positional references are based upon the following convention:

viewing from the driving position, the right-hand cylinder bank is designated bank 1 (A on circuit diagrams) and the left-hand cylinder bank as bank 2 (B on circuit diagrams).

The cylinder bores of each bank are numbered 1 to 4, from the front of the vehicle.

Ignition System

The ignition system provides timing control in accordance with the engine management strategy and powertrain sensor inputs; the system consists of:

- engine control module
- ignition coils supply relay
- ignition control modules
- ignition coils
- spark plugs

Engine Control Module (ECM)

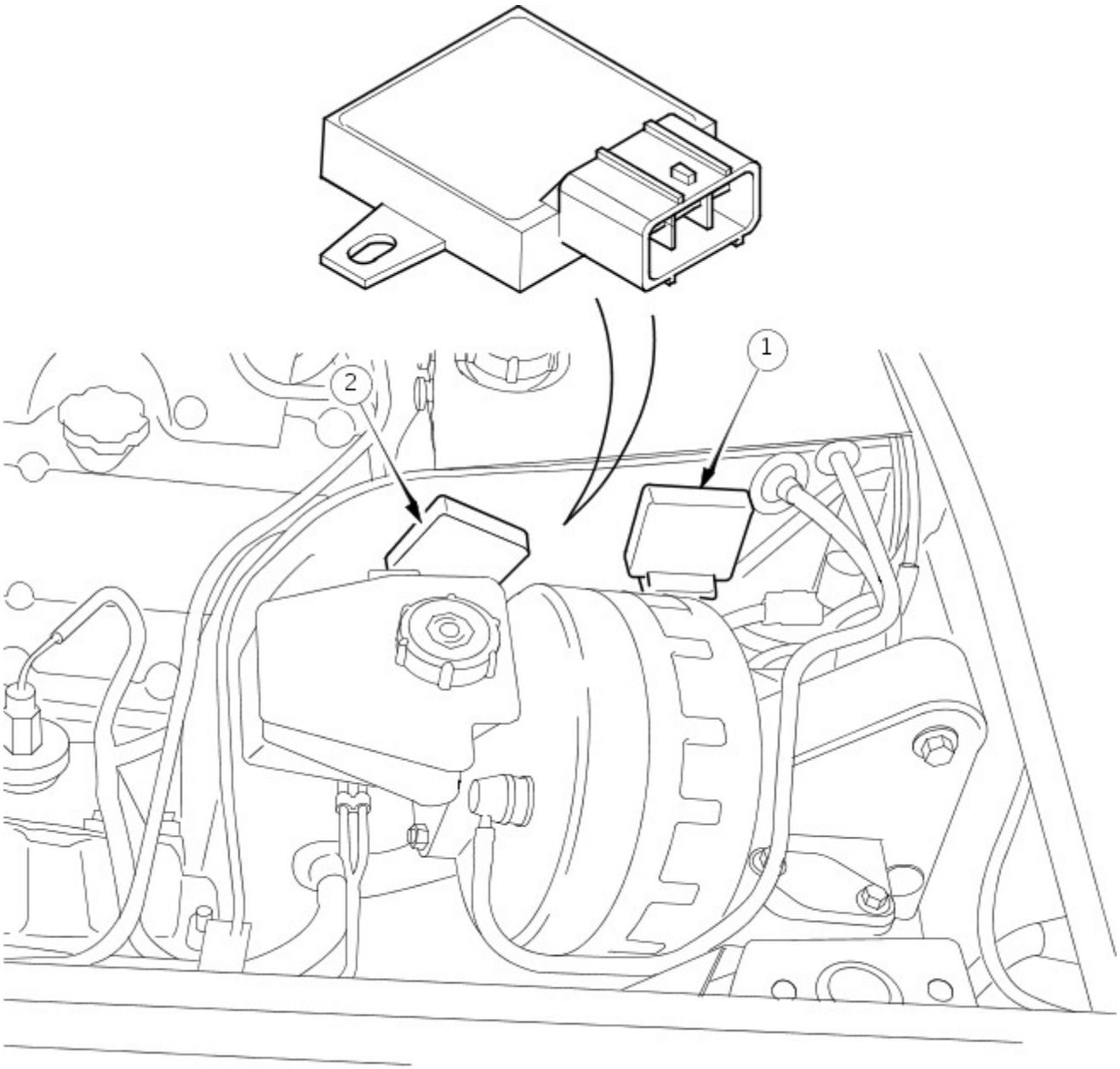
- provides triggering for the ignition control modules to control individual firing of the spark plugs
- supplies ground for the ignition coils supply relay

Ignition Coils Supply Relay

The ignition coils supply relay is located in the engine and transmission control module compartment; refer to Relay Details in Electrical Wiring and Circuit Protection, Section 418-01.

The ECM switches a ground to the coil of the ignition coils supply relay; the relay energizes and switches a 12v supply to the ignition control modules and the ignition coils.

Ignition Control Modules

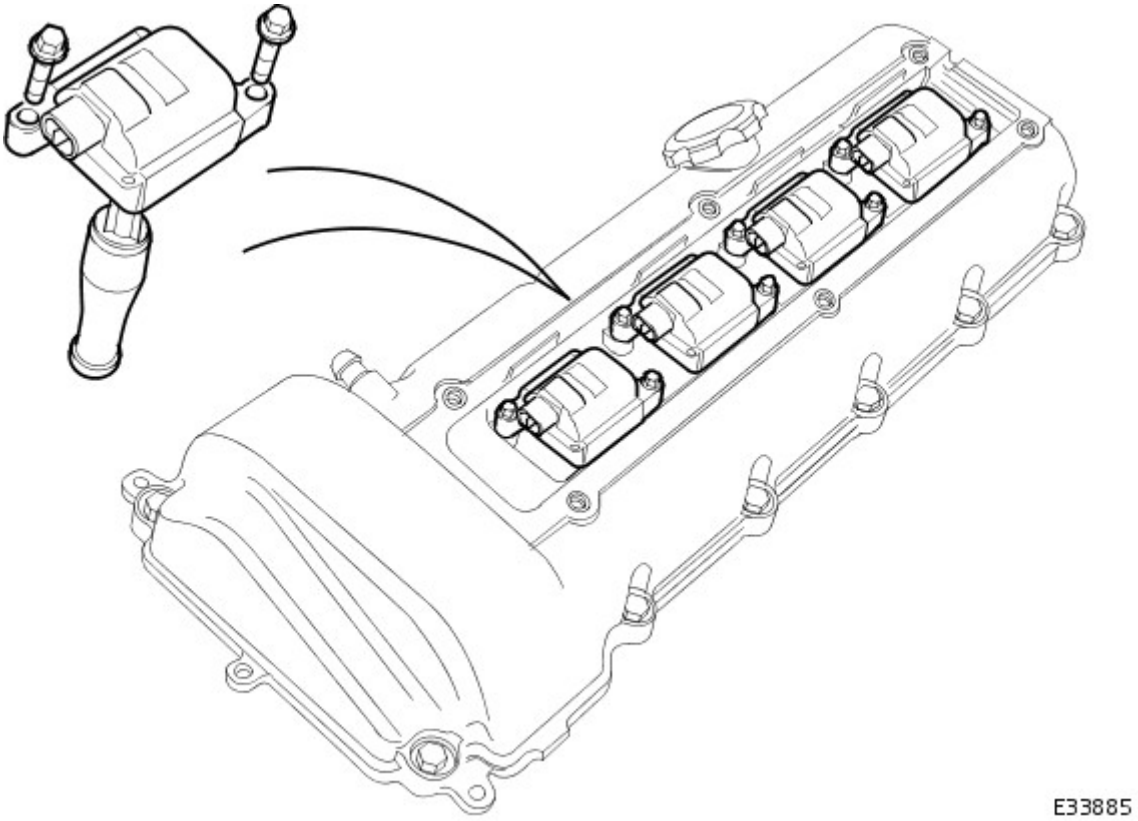


Item	Part Number	Description
1	—	Ignition control module 1
2	—	Ignition control module 2

Two ignition control modules control firing of the spark plugs when triggered by the engine control module (ECM); the modules provide an interface between the ECM and the coil on plugs such that:

- Ignition control module 1 drives bank 1 - coils 1 and 4, bank 2 - coils 2 and 3.
- Ignition control module 2 drives bank 1 - coils 2 and 3, bank 2 - coils 1 and 4.

Ignition Coil - coil on plug

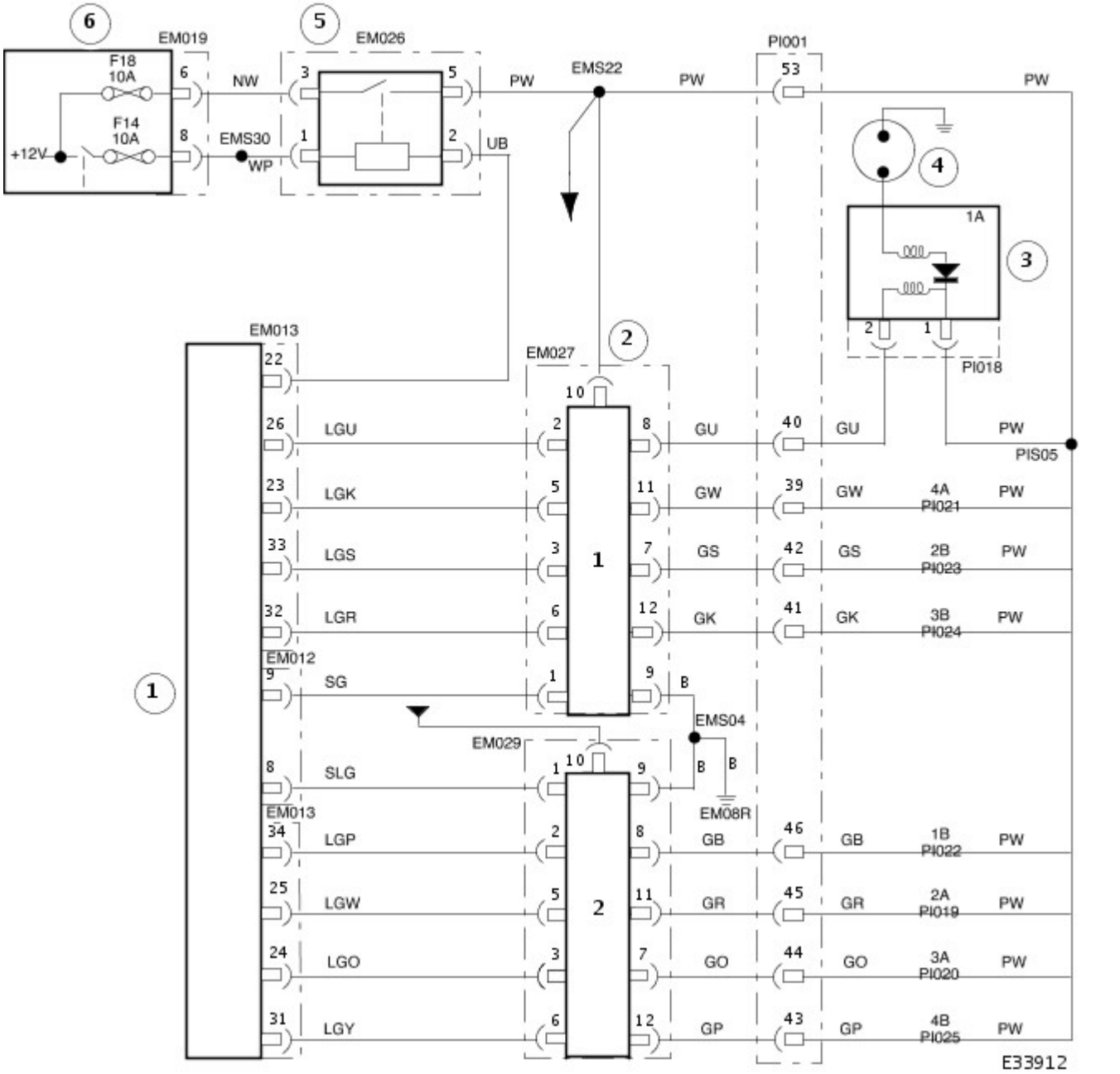


- Four separate ignition coils are mounted to each camshaft cover, directly above the spark plugs and are controlled by the ECM via the ignition control modules.
- Each coil comprises an encapsulated step-up transformer and a direct push on connection to the spark plug.

Spark Plug

The spark plug changes the high voltage pulse into a spark which ignites the fuel and air mixture. Refer to specification in this section for spark plug details covering different markets and models.

Circuit Diagram, Ignition System



Item	Part Number	Description
1	—	Engine control module (ECM)
2	—	Ignition control modules (1 and 2)
3	—	Ignition coils - 1A (bank 1, coil 1 only drawn)
4	—	Spark plug - 1A (bank 1, plug 1 only drawn)
5	—	Ignition coils supply relay
6	—	Engine management system fuse-box

Engine Ignition - Engine Ignition

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Confirm which, if any, warning lights and/or messages were displayed on the instrument cluster.

• NOTE: If any warning lights and/or messages were displayed when the fault occurred, refer to the Driver Information table for DTCs associated with the display, then to the DTC index table for possible sources and actions. Some warnings will appear to clear when the ignition is cycled. This is often because the warning has flagged as a result of one of the vehicle's on-board diagnostic routines having run to detect the fault. If the same routine is not run when the ignition is switched ON, the warning will not reflag until the routine does run. See the DTC summaries for drive cycle routines.

3. **3.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel contamination • Throttle body • Poly-vee belt	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM) • Relay date codes. If the date on the relay is between R6 k1 and R6 k8, replace the relay

4. **4.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system
- Fuel charging system

5. **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. **6.** Where the Jaguar approved diagnostic system is available, complete the S93 report before clearing any or all fault codes from the vehicle.

• NOTE: If a DTC cannot be cleared, then there is a permanent fault present that flags again as soon as it is cleared (the exception to this is P1260, which will only clear following an ignition OFF/ON cycle after rectification).

7. **7.** If the cause is not visually evident and the Jaguar approved diagnostic system is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTC) Index Chart, or the Symptom Chart if no DTCs are set.

• NOTE: If the DTC flagged was not present for two or more consecutive cycles, it is classed as temporary, and will be deleted following three cycles during which no fault was present. This could result in a reported warning light/message with no stored DTCs. If a fault is present for three consecutive cycles, the DTC becomes permanent, and will remain in the module's memory for 40 drive cycles (a cycle is an ignition ON/OFF, which will occur during the owner's normal use of the vehicle. No action on the part of the technician is necessary to perform this cycle. A drive cycle is a series of conditions needed to make the on-board diagnostic routine run, and may need a specific action on the part of the technician. See the DTC summaries for drive cycle routines).

8. **8.** Using the Jaguar approved diagnostic system where available, and a scan tool where not, check the freeze frame data for information on the conditions applicable when the fault was flagged. The format of this will vary, depending on the tool used, but can provide information useful to the technician in diagnosing the fault.

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

• NOTE: When performing electrical 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.

Symptom Chart

Symptom	Possible source	Action
Engine cranks, but does not fire	● Security system /Immobiliser engaged ● Harness ● Fuel system ● ECM fault	Contact dealer technical support for information on security system. Check fuel system pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For ECM tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing).
Engine cranks and fires, but will not start	● Fuel pump relay ● Fuel pump ● Cylinder compression loss (short-term. Refer to bulletin; 303-52) ● Engine coolant temperature (ECT) sensor ● Spark plugs fouled, gapped incorrectly ● Ignition coil failure(s) ● Check for water ingress into spark plug wells ● HT short to ground (tracking) check rubber boots for cracks/damage	For fuel pump relay tests, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For compression loss, REFER to the technical service bulletins. For ECT sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For spark plug tests, GO to Pinpoint Test B. . For ignition system tests, GO to Pinpoint Test A. .
Difficult to start cold	● Battery ● Fuel pump ● Cylinder compression loss (short-term. Refer to bulletin; 303-52) ● Spark plugs fouled, gapped incorrectly	For battery information, REFER to: Battery and Cables (414-01 Battery, Mounting and Cables, Description and Operation). Check fuel pressure. REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For compression loss, REFER to the technical service bulletins. For spark plug tests, GO to Pinpoint Test B. . For ignition system tests, GO to Pinpoint Test A. .
Difficult to start hot	● Rochester valve ● Injector leak ● Purge valve ● Fuel pump ● Engine coolant temperature (ECT) sensor	For Rochester valve test, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For injector leak test, REFER to technical service bulletins. Check fuel pressure. For evaporative emissions components, REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). For ECT sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing).
Difficult to start after hot soak (vehicle standing after engine has reached operating temperature)	● Rochester valve ● Injector leak ● Purge valve ● Fuel pump ● Engine coolant temperature (ECT) sensor	For Rochester valve test, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For injector leak test, REFER to technical service bulletins. Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures).

		For evaporative emissions components, REFER to: Evaporative Emissions (303-13 Evaporative Emissions, Diagnosis and Testing). For ECT sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing).
Engine stalls soon after start	• Fuel pump relay • ECM relay • Harness damage • Fuel pump • Engine coolant temperature (ECT) sensor • Fuel lines • Fuel pressure regulator • Air leakage	Check for DTCS. For fuel pump and ECM relay tests, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). Check fuel pressure. REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For ECT sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For fuel line information, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). For fuel pressure regulator, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). For intake system information, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation).
Engine hesitates/poor acceleration	• Fuel pump • Air leakage • Fuel pressure regulator • Fuel lines • Harness damage • Throttle sensors • Throttle motor • Spark plugs fouled, gapped incorrectly • Ignition coil failure(s) • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • Exhaust gas recirculation (EGR) (SC only)	Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For intake system information, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation). For fuel pressure regulator, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). For fuel lines information, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). For throttle position sensor and throttle motor relay tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For spark plug tests, GO to Pinpoint Test B. . For ignition system tests, GO to Pinpoint Test A. . For EGR information, REFER to: Engine Emission Control (303-08 Engine Emission Control, Description and Operation).
Engine backfires	• Fuel pump • Fuel lines • Air leakage • Mass air flow (MAF) sensor • Spark plugs • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage	Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For fuel pump and lines, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). For intake system, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation). For MAF sensor tests,

		REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For spark plug tests, GO to Pinpoint Test B. . For ignition system tests, GO to Pinpoint Test A. .
Engine surges	• Air leakage • Fuel pump • Fuel lines • Mass air flow (MAF) sensor • Harness damage • Throttle sensors • Throttle motor • Spark plugs • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage	For intake system, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation). Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For fuel pump and lines, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). For MAF sensor, throttle position sensor and throttle motor relay tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For spark plug tests, GO to Pinpoint Test B. . For ignition system tests, GO to Pinpoint Test A. .
Engine detonates/knocks	• Fuel lines • Fuel pressure regulator • Air leakage • Mass air flow (MAF) sensor • Oxygen sensors • Fuel pump	For fuel lines, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). For fuel pressure regulator, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). For intake system, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation). For MAF sensor and oxygen sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures).
No throttle response	• Throttle sensors • Throttle motor	For throttle position sensor tests, throttle motor relay tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing).
Poor throttle response	• Throttle sensors • Throttle motor • Air leakage • Mass air flow (MAF) sensor	For throttle position sensor and throttle motor relay tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing). For intake system, REFER to: Intake Air Distribution and Filtering (303-12 Intake Air Distribution and Filtering, Description and Operation). For MAF sensor tests, REFER to: Electronic Engine Controls (303-14 Electronic Engine Controls, Diagnosis and Testing).

Driver Information Chart

• NOTE: Use this table to identify DTCs associated with the message center display, then refer to the DTC index for possible sources and actions.

• NOTE: For definitions of Default Modes, see the foot of this table.

Warning light	Message	Default Mode	DTC
Red	Engine Failsafe Mode	Limp-Home	P1224
Red	Engine Failsafe Mode	Limp-Home	P1229
Red	Engine Failsafe Mode	Limp-Home	P0122, P0123,
Red	Engine Failsafe Mode	Limp-Home	P0222, P0223
Red	Engine Failsafe Mode	Limp-Home	P0121
Red	Engine Failsafe Mode	Limp-Home	P1122, P1123
Red	Engine Failsafe Mode	Limp-Home	P1222, P1223
Red	Engine Failsafe Mode	Limp-Home	P1121, P1632
Red	Engine Failsafe Mode	Limp-Home	P1251, P0560, P1658
Red	Engine Failsafe Mode	Limp-Home	P1631
Red	Engine Failsafe Mode	Limp-Home	P1611
Red	Engine Failsafe Mode	Limp-Home	P1633
Red	Engine Failsafe Mode	Limp-Home	P1609
Red	Engine Failsafe Mode	Limp-Home	P0506, P0507
Red	Engine Failsafe Mode	Limp-Home	P1656
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1254
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1250
Amber	Engine Failsafe Mode	Cruise inhibited	P1516
Amber	Engine Failsafe Mode	Cruise inhibited	P1517
Amber	Engine Failsafe Mode	Cruise inhibited	P1571
Amber	Engine Failsafe Mode	Cruise inhibited	P1696
Amber	Engine Failsafe Mode	Cruise inhibited	P0568
Amber	Engine Failsafe Mode	Cruise inhibited	P0570
Amber	Engine Failsafe Mode	Cruise inhibited	P0569
Amber	Engine Failsafe Mode	Cruise inhibited	P0567
Amber	Engine Failsafe Mode	Cruise inhibited	P0566
Amber	Engine Failsafe Mode	Cruise inhibited	P1697
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P0560, P1254
Amber	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled. High idle speed	P1250, P1254
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P1250

Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0116, P0117, P0118, P0125
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0101, P0102, P0103, P0104
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P1313, P1314
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0327, P0328, P0332, P0333, P1648
Amber	Restricted Performance	Reverse throttle progression enabled	P1474
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1230
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1671
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1112, P1113
Amber	Restricted Performance	Gearbox default to 4th gear	P1601 (SC only)
Amber	Restricted Performance	Gearbox default to 4th gear	P1605 (NA only)
Amber	Restricted Performance	Gearbox default to 4th gear	P0702
Amber	Restricted Performance	Gearbox default to 4th gear	P1795
Amber	Restricted Performance	Gearbox default to 4th gear	P1796
Amber	Restricted Performance	Gearbox default to 4th gear	P1797
Amber	Restricted Performance	Gearbox default to 4th gear	P1605
Amber	None	Gearbox default to 4th gear	P0705 (SC only)
Amber	None	Gearbox default to 4th gear	P0706
Amber	None	Gearbox default to 4th gear	P1720

Default mode Definitions

MECHANICAL LIMP-HOME MODE:

- No electronic throttle operation (mechanical operation for last quarter of pedal travel)
- Maximum 25° throttle opening, depending on adjustment of throttle mechanical linkage
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off
- High idle speed (1200 rpm approx.)
- Misfire at idle, due to cylinder cut as a means of controlling idle speed (the misfire will switch cylinders, as the strategy varies the cylinder cut)
- Cruise (speed) control inhibited

REVERSE THROTTLE PROGRESSION ENABLED:

- Electronic throttle operation, limited to maximum 25°
- Cruise (speed) control inhibited

• NOTE: The throttle operation uses the same map as for reverse gear.

ENGINE SPEED LIMIT:

- Engine runs normally, up to 3000 rpm.
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off.
- Cruise (speed) control inhibited

LIMP-HOME UNAVAILABLE:

- Cruise (speed) control inhibited
- Reverse throttle progression engaged at second occurrence of DTC flagging

Diagnostic Trouble Code (DTC) index

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0300	Random misfire detected	• ECM to ignition coil primary circuit faults (cylinder misfire detected DTCs also logged) • Ignition coil ground circuit; open circuit, high resistance • Fuel injector circuit fault(s) (injector DTCs also logged) • Ignition coil failure(s) • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • Spark plug failure/fouled/incorrect gap • Cylinder compression low • Fuel delivery pressure (low/high) • Fuel injectors restricted/leaking • Fuel contamination • PAS pulley bolts loose (see Service Actions) • Worn camshaft/broken valve springs	For ignition system tests,GO to Pinpoint Test A. . For injector circuit tests, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Description and Operation). Check compressions. For spark plug tests,GO to Pinpoint Test B. . Check fuel pressure, REFER to: Fuel System Pressure Check (310-00 Fuel System - General Information, General Procedures). For fuel injectors, REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls, Diagnosis and Testing). For fuel tank and lines information, REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines, Description and Operation). Check PAS pulley bolt torque (REFER to technical service bulletins). For engine information, REFER to: Specifications (303-01 Engine, Specifications).
P0301	Misfire detected, Cyl 1	REFER to possible sources for P0300	REFER to actions for P0300.
P0302	Misfire detected, Cyl 3		
P0303	Misfire detected, Cyl 5		
P0304	Misfire detected, Cyl 7		
P0305	Misfire detected, Cyl 2		
P0306	Misfire detected, Cyl 4		
P0307	Misfire detected, Cyl 6		
P0308	Misfire detected, Cyl 8		
P0351	Ignition coil primary/secondary circuit malfunction, cyl 1	• ECM to ignition module primary circuit open circuit, short circuit to ground, high resistance • Ignition module to ignition coil primary circuit open circuit, short circuit to ground, high resistance • Ignition module ground circuit open circuit, high resistance • Ignition coil failure • Ignition module failure	For ignition circuit tests,GO to Pinpoint Test A. .
P0352	Ignition coil primary/secondary circuit malfunction, cyl 3		
P0353	Ignition coil primary/secondary circuit malfunction, cyl 5		
P0354	Ignition coil primary/secondary circuit malfunction, cyl 7		
P0355	Ignition coil primary/secondary circuit malfunction, cyl 2		
P0356	Ignition coil primary/secondary circuit malfunction, cyl 4		
P0357	Ignition coil primary/secondary circuit malfunction, cyl 6		
P0358	Ignition coil primary/secondary circuit malfunction, cyl 8		
P1313	Misfire rate catalyst damage, Right-hand cylinders. NOTE. This DTC will flag only when accompanied by a random or individual cylinder misfire DTC; P0300,	Refer to possible causes for P0300-P0308	Refer to actions for P0300-P0308.

	P0301 to P0304		
P1314	Misfire rate catalyst damage, Left-hand cylinders. NOTE. This DTC will flag only when accompanied by a random or individual cylinder misfire DTC; P0300 to P0308		
P1316	Misfire excess emission. NOTE. This DTC will flag only when accompanied by an individual cylinder misfire DTC; P0300 to P0308		
P1367	Ignition monitor (ignition module 1)	• Ignition module 1 disconnected • Ignition module 1 to ECM circuits open circuit, short circuit to ground or short circuit to B+ voltage • Ignition module 1 ground circuit fault • Ignition coil relay failure • Ignition coil open/short circuit • Ignition module 1 failure	For ignition circuit tests,GO to Pinpoint Test A. .
P1368	Ignition monitor (ignition module 2)	• Ignition module 2 disconnected • Ignition module 2 to ECM circuits open circuit, short circuit to ground or short circuit to B+ voltage • Ignition module 2 ground circuit fault • Ignition coil relay failure • Ignition coil open/short circuit • Ignition module 2 failure	For ignition circuit tests,GO to Pinpoint Test A. .

Pinpoint Tests

PINPOINT TEST A : DTC P0300, P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358; RANDOM MISFIRE DETECTED, COIL PRIMARY/SECONDARY CIRCUIT MALFUNCTION	
• NOTE: Unless multiple cylinder misfires are apparent, only one circuit will normally need to be tested. The DTC set will indicate which cylinder is misfiring.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK COIL FUNCTION BY SUBSTITUTION	
	1 Swap the suspect coil for a known good unit.
	2 CLEAR the DTC. TEST the system for normal operation.
	Does the same DTC reoccur? The DTC will indicate if the same cylinder is misfiring. **Yes** GO to A2. **No** INSTALL a new coil. REFER to: Ignition Coil-On-Plug LH (303-07 Engine Ignition, Removal and Installation) / Ignition Coil-On-Plug RH (303-07 Engine Ignition, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.
A2: CHECK THE IGNITION COIL SUPPLY VOLTAGE	
	1 Disconnect the relevant ignition coil electrical connector(s).
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between: • Cyl 1 PI18, pin 1 (PW) and GROUND • Cyl 2 PI22, pin 1 (PW) and GROUND • Cyl 3 PI19, pin 1 (PW) and GROUND • Cyl 4 PI23, pin 1 (PW) and GROUND • Cyl 5 PI20, pin 1 (PW) and GROUND • Cyl 6 PI24, pin 1 (PW) and GROUND • Cyl 7 PI21, pin 1 (PW) and GROUND • Cyl 8 PI25, pin 1 (PW) and GROUND
	Is the voltage less than 10.5 volts? **Yes** REPAIR the relevant ignition coil supply voltage circuit. This circuit includes the ignition coil relay and ignition modules. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the

	system for normal operation. **No** GO to A3.
A3: CHECK THE IGNITION COIL GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the relevant ignition module electrical connector(s), EM27 and EM29.
	3 Measure the resistance between: • Cyl 1 PI18, pin 2 (GU) and EM27, pin 08 (GU) • Cyl 2 PI22, pin 2 (GB) and EM29 pin 08 (GB) • Cyl 3 PI19, pin 2 (GR) and EM29, pin 11 (GR) • Cyl 4 PI23, pin 2 (GS) and EM27, pin 07 (GS) • Cyl 5 PI20, pin 2 (GO) and EM29, pin 07 (GO) • Cyl 6 PI24, pin 2 (GK) and EM27, pin 12 (GK) • Cyl 7 PI21, pin 2 (GW) and EM27, pin 11 (GW) • Cyl 8 PI25, pin 2 (GP) and EM29, pin 12 (GP)
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. This circuit includes in-line connector, PI01. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A4.
A4: CHECK THE POWER SUPPLIES TO THE IGNITION MODULES	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between EM27, pin 10 (PW) and GROUND.
	3 Measure the voltage between EM29, pin 10 (PW) and GROUND.
	Are both voltages greater than 10 volts? **Yes** GO to A5. **No** REPAIR the circuit between EM27, pin 10 (PW) and/or EM29, pin 10 (PW). This circuit includes the ignition coil relay, and the harness splice, EMS22. For additional information, refer to the wiring diagrams.
A5: CHECK THE GROUNDS TO THE IGNITION MODULES	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM27, pin 09 (B) and GROUND.
	3 Measure the resistance between EM27, pin 09 (B) and GROUND.
	Is either resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. This circuit includes the harness splice, EMS04. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** GO to A6.
A6: CHECK THE CIRCUIT BETWEEN THE IGNITION MODULES AND THE ECM FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Measure the resistance between the following: • Cyl 1 EM27, pin 02 (LGU) and EM13, pin 26 (LGU) • Cyl 2 EM29, pin 02 (LGP) and EM13, pin 34 (LGP) • Cyl 3 EM29, pin 05 (LGW) and EM13, pin 25 (LGW) • Cyl 4 EM27, pin 03 (LGS) and EM13, pin 33 (LGS) • Cyl 5 EM29, pin 03 (LGO) and EM13, pin 24 (LGO) • Cyl 6 EM27, pin 06 (LGR) and EM13, pin 32 (LGR) • Cyl 7 EM27, pin 05 (LGK) and EM13, pin 23 (LGK) • Cyl 8 EM29, pin 06 (LGY) and EM13, pin 31 (LGY)
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTCs. TEST the system for normal operation. **No** INSTALL a new ignition module for the affected cylinder(s). CLEAR the DTCs. TEST the system for normal operation. If the DTC is repeated, contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST B : CHECK SPARK PLUG	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK SPARK PLUG	
• NOTE: Some spark plug types cannot be regapped and must be replaced.	
	1 Remove the suspect spark plug(s). REFER to: Spark Plugs (303-07 Engine Ignition, Removal and Installation).
	2 Visually inspect the spark plug for cracks, damage, carbon buildup or wet fouling, check the condition of the ground electrode, the center electrode tip and the spark plug HT contact and confirm that the spark plug gap is correctly set using a wire gauge taking care not to cause damage to the center or ground electrode tips. REFER to: Specifications (303-07 Engine Ignition, Specifications).
	Is the spark plug condition good, and the spark plug gap correct ? **Yes** Check ignition coil and circuits. See possible sources list for misfire. **No** Install a new spark plug(s) as required. REFER to: Spark Plugs (303-07 Engine Ignition, Removal and Installation). CLEAR the DTC. TEST the system for normal operation.

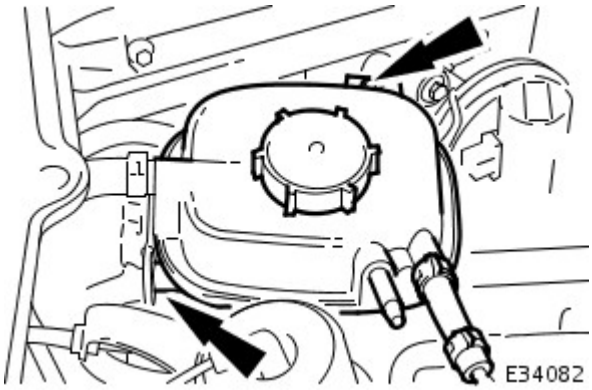
Engine Ignition - Ignition Coil-On-Plug LH

Removal and Installation

Removal

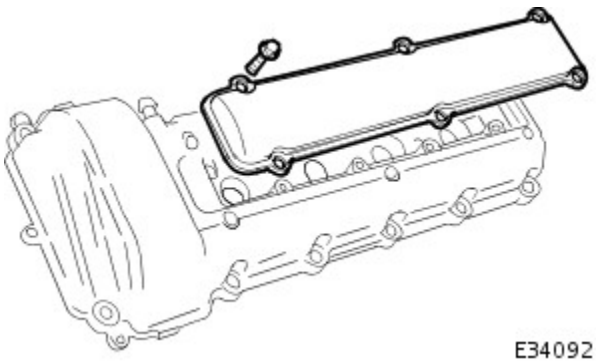
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. Remove the coolant expansion tank for access.



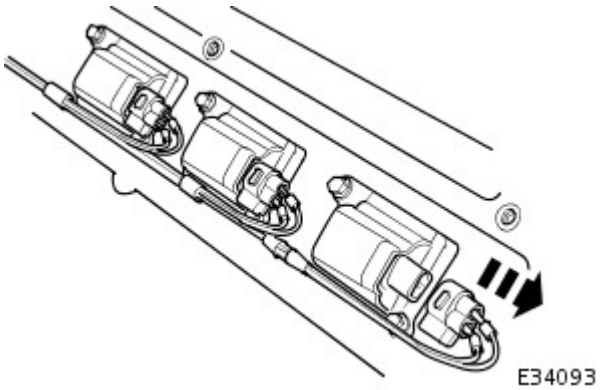
- Remove screw.
- Position tank aside and secure with suitable tie.

3. Remove coil on-plug cover.

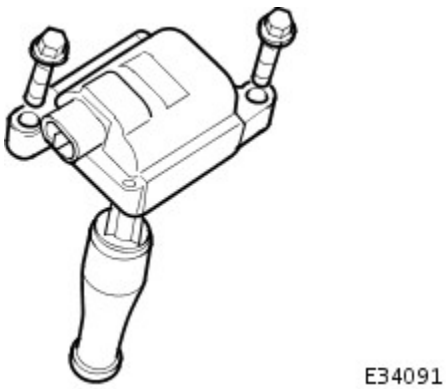


- Remove six bolts.
- Remove cover.
- Clean mating faces.

4. Detach harness from retaining clips as necessary and disconnect relevant coil connector.

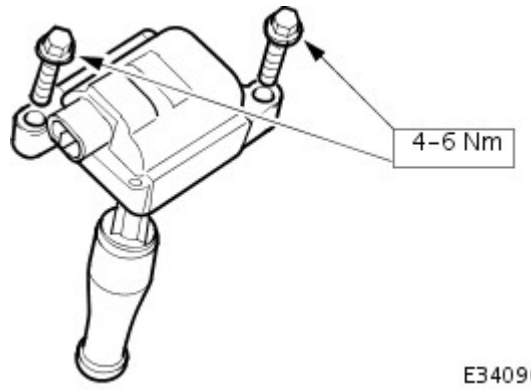


5. Remove relevant ignition coil.

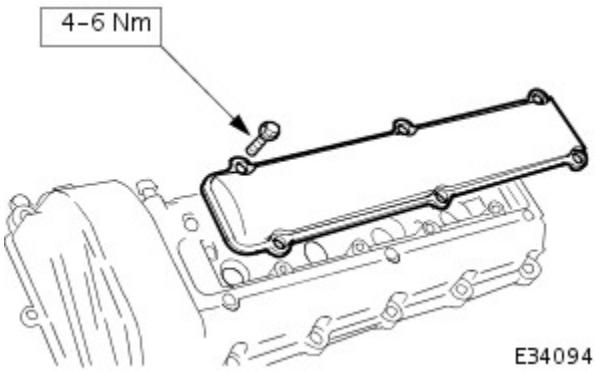


- Remove bolts.
- Remove coil.

Installation



E34090



E34094

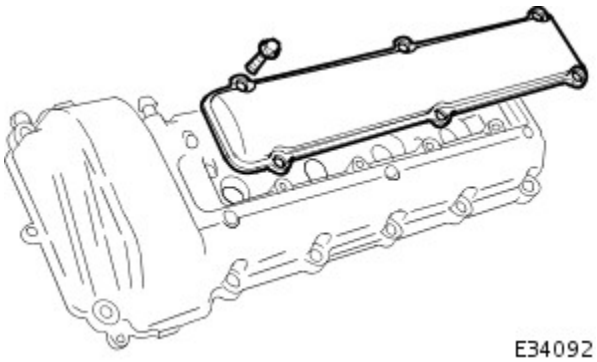
1. Installation is a reversal of the removal procedure.

Engine Ignition - Ignition Coil-On-Plug RH

Removal and Installation

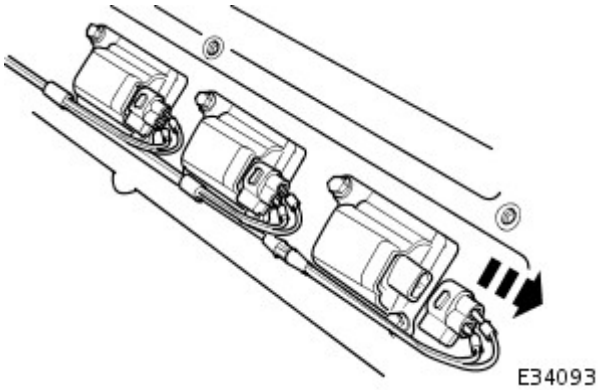
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove the air intake tube / meter / air cleaner cover for access; refer to 19.10.30.
3. Remove coil on-plug cover.
   - Remove six bolts.
   - Remove cover.
   - Clean mating faces.



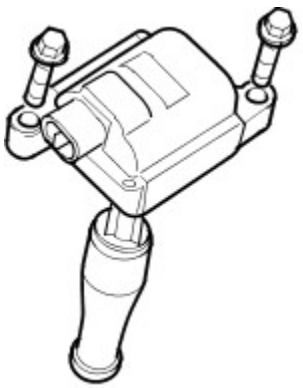
E34092

4. Detach harness from retaining clips as necessary and disconnect relevant coil connector.



E34093

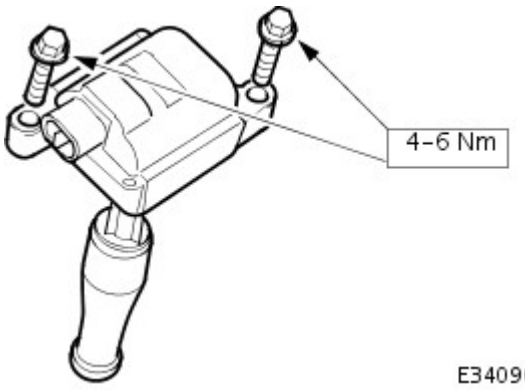
5. Remove relevant ignition coil.
   - Remove bolts.
   - Remove coil.



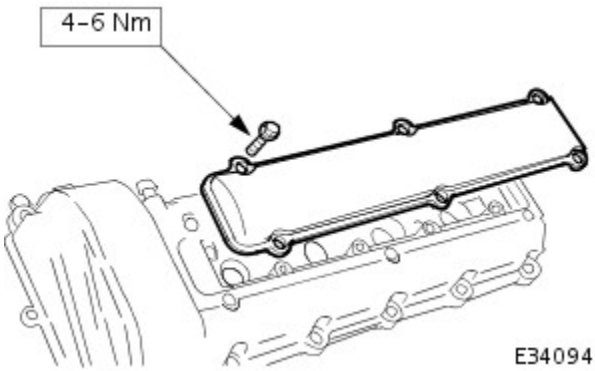
E34091

Installation

1. Installation is a reversal of the removal procedure.



2.

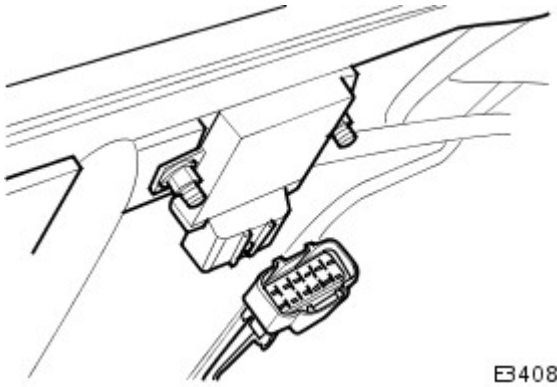


Engine Ignition - Ignition Module

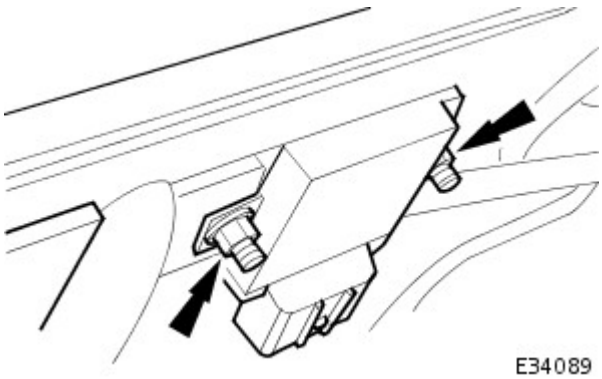
Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Disconnect connector from ignition control module.



3. Remove fixings securing module.
   - Remove module



Installation

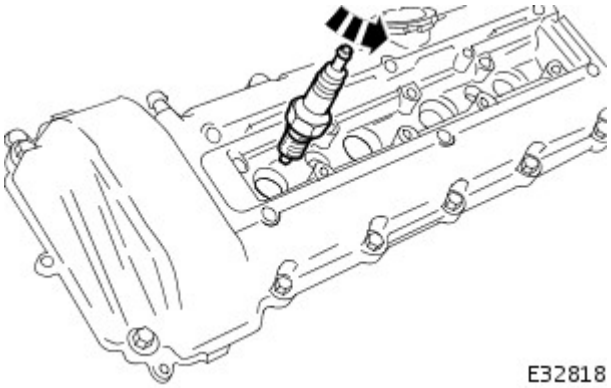
1. Installation is a reversal of the removal procedure.

Engine Ignition - Spark Plugs

Removal and Installation

Removal

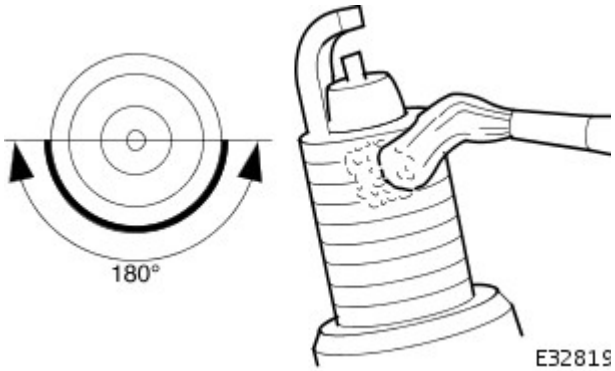
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove air intake tube / meter / air cleaner cover for access; refer to 19.10.30.
3. Remove ignition coils; refer to 18.20.41 (bank 1) and 18.20.42 (bank 2).
4. Remove spark plugs.



5. Clean all components as necessary.

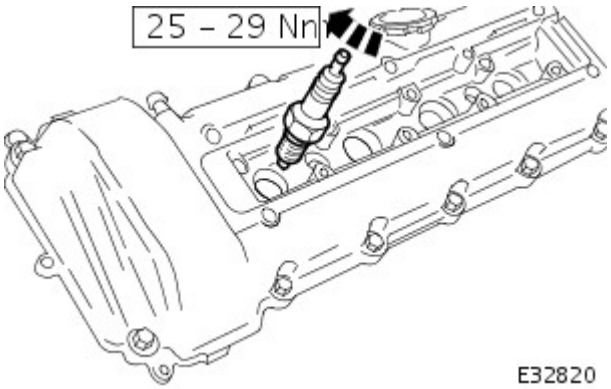
Installation

1. Installation is a reversal of the removal procedure.



- Check electrode gap is to the correct specification. Refer to the Specification Section and current Service Bulletins.
- Apply suitable lubricant e.g. Neverseez Compound, to lower four threads of spark plug(s) adjacent to the electrodes.
- The lubricant must be applied to full thread depth for at least 180° of the thread circumference.
- The electrodes must not be contaminated during this process.

2.



Engine Emission Control -

Torque Specifications

Description	Nm	lb-ft	lb-in
EGR valve tube to EGR valve retaining bolts	21	15	-
Exhaust manifold to EGR valve tube retaining bolts	21	15	-
Exhaust manifold to EGR valve tube retaining nuts	21	15	-
Evaporative emission canister purge valve retaining bolts	6	-	53
EGR valve to throttle body elbow retaining bolts	12	9	-

Engine Emission Control - Engine Emission Control

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage, correct fitment, etc.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Throttle body • Poly-vee belt • Engine breather system pipework/connections • EGR pipework condition (cracking, etc)	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

3. **3.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system
- Fuel charging system
- Ignition system

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

5. **5.** Where the Jaguar approved diagnostic system is available, complete the S93 report before clearing any or all fault codes from the vehicle.

• NOTE: If a DTC cannot be cleared, then there is a permanent fault present that flags again as soon as it is cleared (the exception to this is P1260, which will only clear following an ignition OFF/ON cycle after rectification).

6. **6.** If the cause is not visually evident and the Jaguar approved diagnostic system is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTC) Index Chart, or the Symptom Chart if no DTCs are set.

7. **7.** Using the Jaguar approved diagnostic system where available, and a scan tool where not, check the freeze frame data for information on the conditions applicable when the fault was flagged. The format of this will vary, depending on the tool used, but can provide information useful to the technician in diagnosing the fault.

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

• NOTE: When performing electrical 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.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Poor driveability	Engine hesitates/poor acceleration	• Fuel pump • Air leakage • Fuel pressure regulator	Check fuel pressure, REFER to Section 310-00 Fuel System - General Information.

		• Fuel lines • Harness damage • Throttle sensors • Throttle motor • Spark plugs fouled • Ignition coil failure(s) • HT short to ground (tracking) check rubber boots for cracks/damage • Exhaust gas recirculation (EGR)	For air intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For fuel pressure regulator tests, REFER to Section 303-04 Fuel Charging and Controls. For fuel line information, REFER to Section 310-01 Fuel Tank and Lines. For throttle sensor circuit tests, REFER to Section 303-14 Electronic Engine Controls. For throttle motor circuit tests, REFER to Section 303-04 Fuel Charging and Controls. For ignition system tests, REFER to Section 303-07 Engine Ignition. Inspect EGR components, for circuit tests, GO to Pinpoint Test A. .

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0400	Exhaust gas recirculation (EGR) flow malfunction	• EGR valve connector pins high resistance • EGR pipe/exhaust manifold leak • EGR pipe blocked • EGR valve stuck open/closed, blocked • EGR valve failure	Check the EGR pipe, valve and manifold for leaks/blockages. Check the EGR valve function. For EGR valve circuit tests,GO to Pinpoint Test A. .
P0405	Exhaust gas recirculation (EGR) drive circuits open circuit	• EGR valve power supply circuit open circuit • EGR valve to ECM drive circuit pair - EGR pins 1/3, 4/6 open circuit, high resistance • EGR valve failure (stepper motor open circuit)	For EGR valve circuit tests,GO to Pinpoint Test A. .
P0406	Exhaust gas recirculation (EGR) drive circuits short circuit	• EGR valve to ECM drive circuit pair - EGR pins 1/3, 4/6 short circuit to ground or high voltage • EGR valve failure (stepper motor short circuit)	For EGR valve circuit tests,GO to Pinpoint Test A. .

Pinpoint Tests

PINPOINT TEST A : DTC P0400, P0405; EGR VALVE FLOW MALFUNCTION/DRIVE CIRCUITS OPEN CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE EMS POWER SUPPLIES TO THE EGR VALVE	
	1 Disconnect the EGR valve electrical connector, PI34.
	2 Turn the ignition switch to the **ON** position.
	3 Make sure the EMS relay is energized. Vehicles with AJ26 engine: • Measure the voltage between PI34, pins 02 and 05 (WP) and GROUND Vehicles with AJ27 engine: • Measure the voltage between PI34, pins 02 and 05 (WU) and GROUND
	Is the voltage at either pin less than 10 volts? **Yes**

REPAIR the circuit between the EGR valve and battery. This circuit includes the EMS relay and the EMS fuse box. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

No

GO to A2.

A2: CHECK THE EGR VALVE COIL WINDINGS FOR CONTINUITY

1 Measure the resistance between pins 04 and 06 of the EGR valve.

2 Measure the resistance between pins 01 and 03 of the EGR valve.

Is either resistance greater than 80 ohms?

Yes

INSTALL a new EGR valve.
REFER to Exhaust Gas Recirculation (EGR) Valve - in this section.
CLEAR the DTC. TEST the system for normal operation.

No

GO to A3.

A3: CHECK THE EGR VALVE COIL WINDINGS TO POWER SUPPLY CIRCUIT FOR CONTINUITY

1 Measure the resistance between pins 02 and 03 of the EGR valve.

2 Measure the resistance between pins 05 and 06 of the EGR valve.

Is either resistance greater than 80 ohms?

Yes

INSTALL a new EGR valve.
REFER to Exhaust Gas Recirculation (EGR) Valve - in this section.
CLEAR the DTC. TEST the system for normal operation.

No

GO to A4.

A4: CHECK THE EGR VALVE TO ECM CIRCUITS FOR HIGH RESISTANCE

1 Disconnect the battery negative terminal.

Vehicles with AJ26 engine:

- Disconnect the ECM electrical connector, EM12
- Measure the resistance between the following:
- PI34, pin 04 (YU) and EM12, pin 01 (YU)
- PI34, pin 01 (YG) and EM12, pin 02 (YG)
- PI34, pin 06 (YN) and EM12, pin 03 (YN)
- PI34, pin 03 (YR) and EM12, pin 04 (YR)

Vehicles with AJ27 engine:

- Disconnect the ECM electrical connector, EM85
- Measure the resistance between the following:
- PI34, pin 04 (YU) and EM85, pin 03 (YU)
- PI34, pin 01 (YG) and EM85, pin 04 (YG)
- PI34, pin 06 (YR) and EM85, pin 09 (YR)
- PI34, pin 03 (YR) and EM85, pin 10 (YR)

Are any of the resistances 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 A5.

A5: CHECK THE EGR VALVE TO ECM CIRCUITS FOR SHORT TO HIGH VOLTAGE

1 Reconnect the battery negative terminal.

2 Measure the voltage between the following:

- PI34, pin 04 (YU) and GROUND
- PI34, pin 01 (YG) and GROUND
- PI34, pin 06 (YN) and GROUND
- PI34, pin 03 (YR) and GROUND

Are any of the voltages greater than 3 volts?

Yes

REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

No

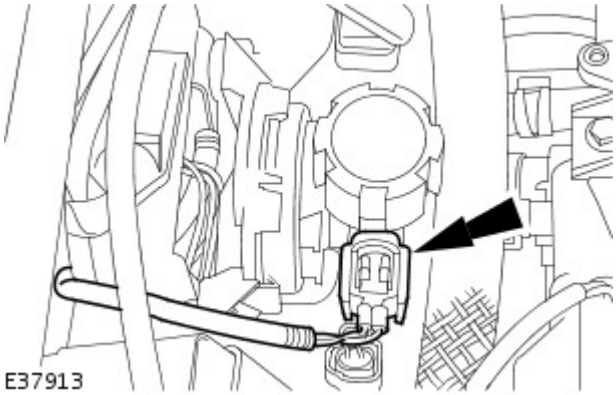
	GO to A6.
A6: CHECK THE EGR VALVE TO ECM CIRCUITS FOR SHORT TO GROUND	
	1 Measure the resistance between the following: • PI34, pin 04 (YU) and GROUND • PI34, pin 01 (YG) and GROUND • PI34, pin 06 (YN) and GROUND • PI34, pin 03 (YR) and GROUND
	Are any of the resistances less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible ECM failure.

Engine Emission Control - Exhaust Gas Recirculation (EGR) Valve

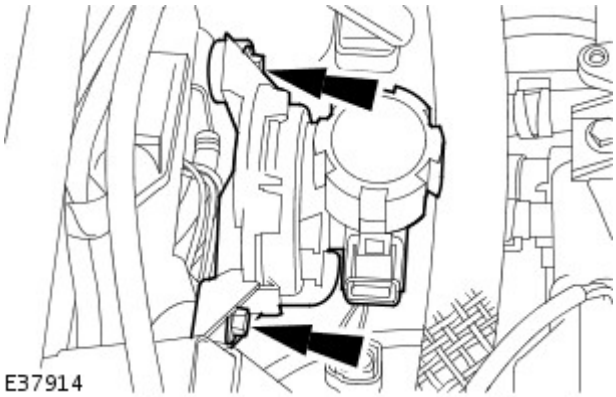
Removal and Installation

Removal

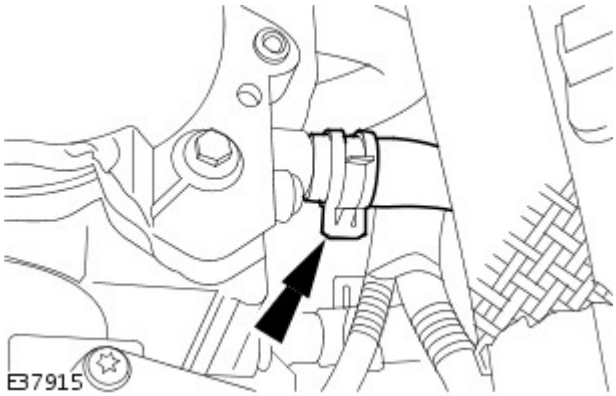
1. Remove the engine cover.
   For additional information, refer to Section 501-05 Interior Trim and Ornamentation.



2. Disconnect the evaporative emission canister purge valve electrical connector.



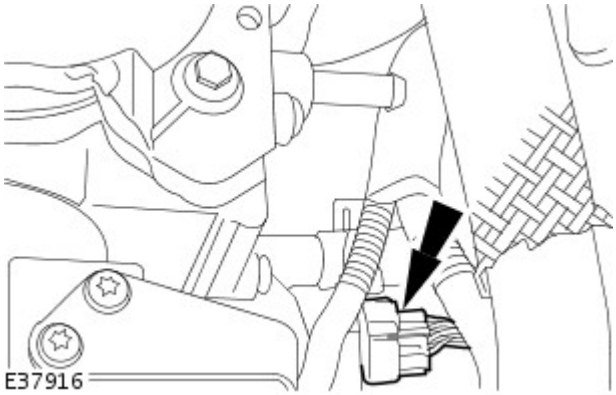
3. Detach and reposition the evaporative emission canister purge valve.

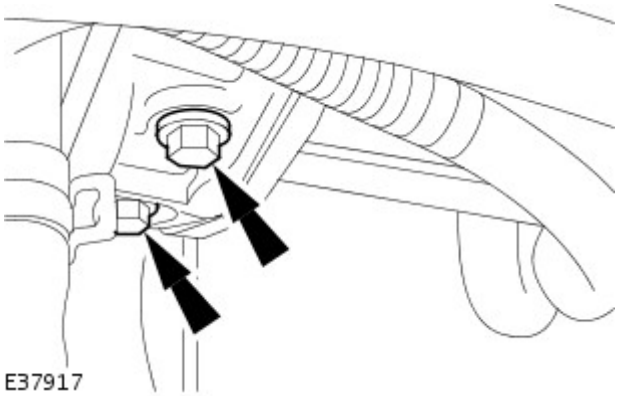


4. NOTE: Cap the coolant hose to minimize coolant loss.

   Disconnect the coolant hose.

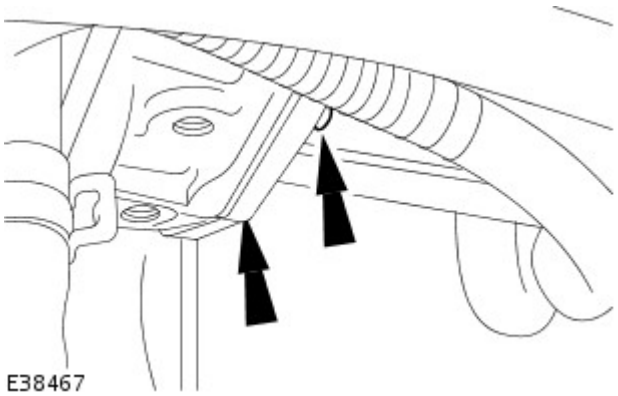
5. Disconnect the exhaust gas recirculation (EGR) valve electrical connector.





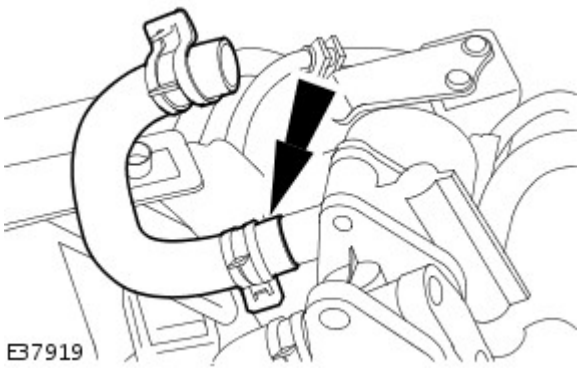
6. Remove the EGR valve to throttle body elbow retaining bolts.

- Remove and discard the EGR valve to throttle body elbow gasket.



7. Remove the exhaust manifold to EGR valve tube retaining bolts.

- Remove and discard the exhaust manifold to EGR valve tube gasket.



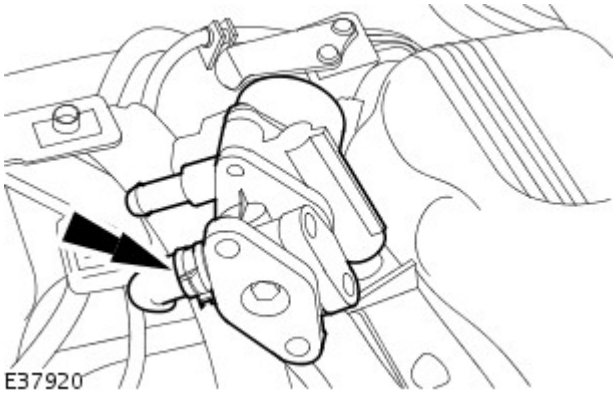
8. NOTE: Note the orientation of the coolant hose to EGR valve before removal.

Remove the coolant hose.

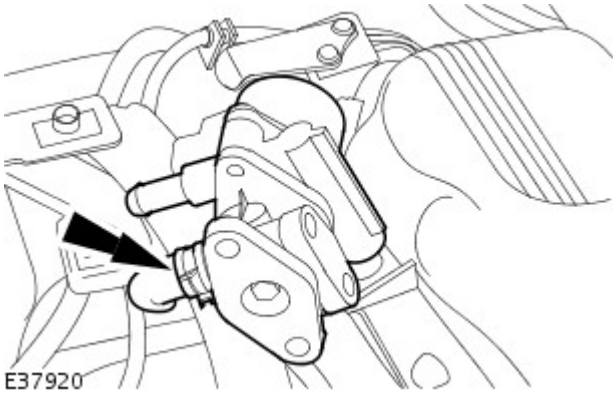
9. NOTE: Note the orientation of the coolant hose to EGR valve before removal.

• NOTE: Cap the coolant hose to minimize coolant loss.

Remove the EGR valve.



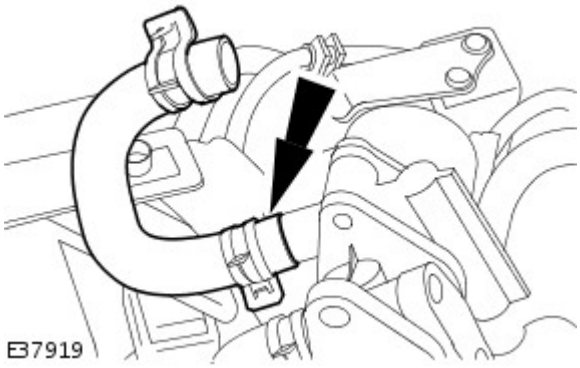
Installation



1. NOTE: Make sure the EGR valve to the coolant hose is installed to the orientation noted during removal.

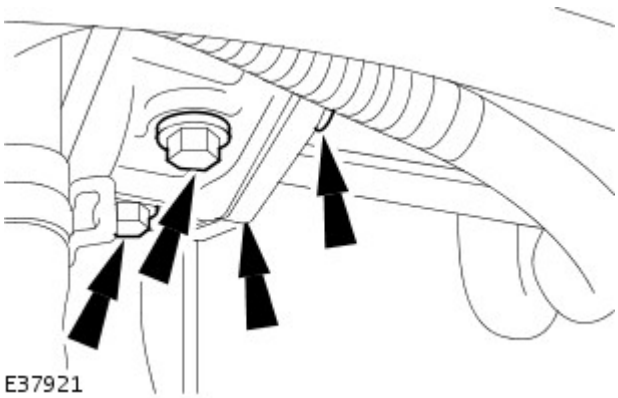
• NOTE: Un-cap the coolant hose.

Install the EGR valve.



2. NOTE: Make sure the EGR valve to the coolant hose is installed to the orientation noted during removal.

Install the coolant hose.



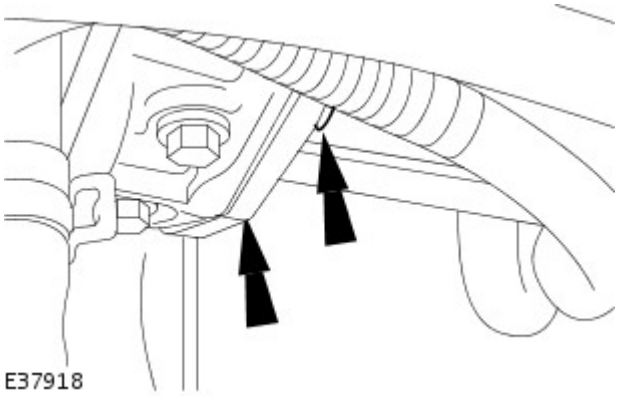
3. NOTE: Install a new exhaust manifold to EGR valve tube gasket.

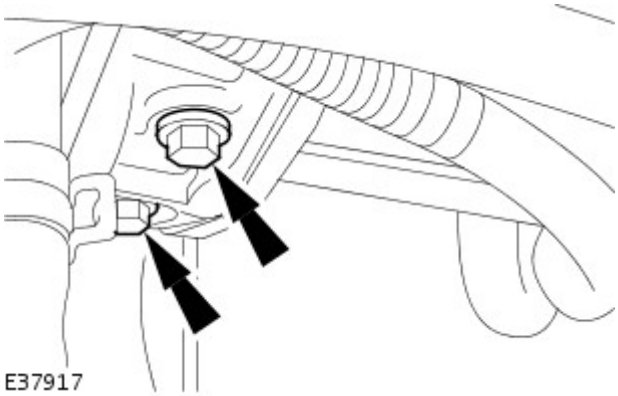
• NOTE: Install a new EGR valve to throttle body elbow gasket.

Loosely install the exhaust manifold to EGR valve tube and the EGR valve to throttle body elbow.

4. Tighten the exhaust manifold to EGR valve tube retaining bolts.

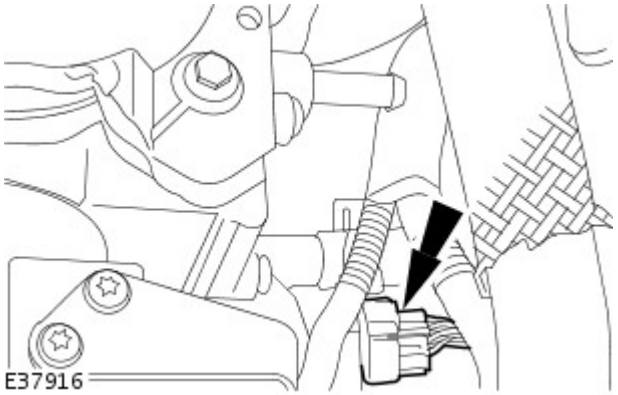
- Tighten to 21 Nm.



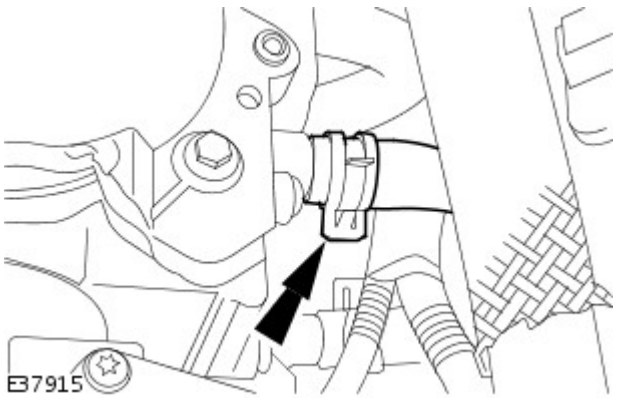


5. Tighten the EGR valve to throttle body retaining bolts.

- Tighten to 12 Nm.



6. Connect the EGR valve electrical connector.

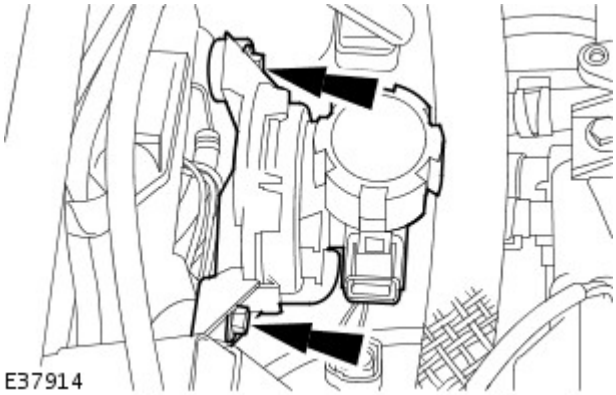


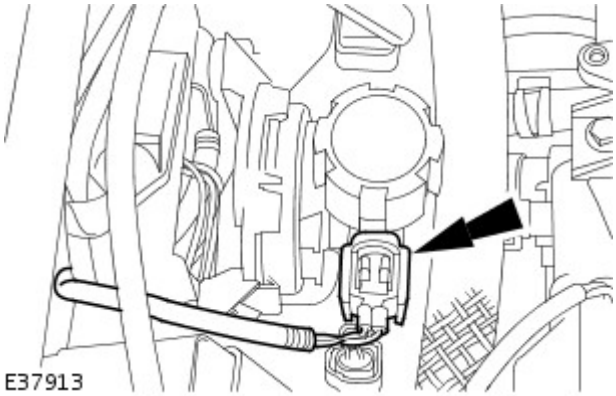
7. NOTE: Un-cap the coolant hose.

Connect the coolant hose.

8. Attach the evaporative emission canister purge valve.

- Tighten to 6 Nm.





9. Connect the evaporative emission canister purge valve electrical connector.

10. Check and if necessary top up the cooling system.

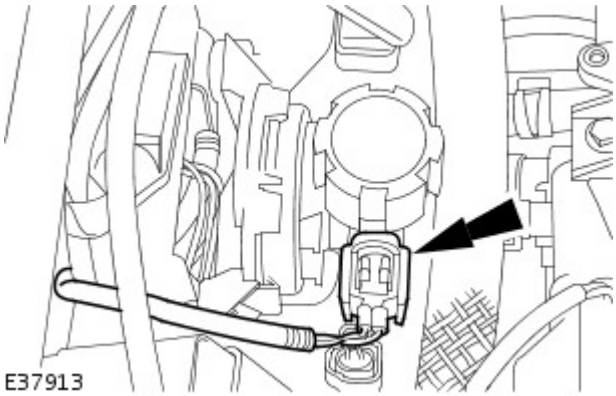
11. Install the engine cover.
For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

Engine Emission Control - Exhaust Manifold to Exhaust Gas Recirculation (EGR) Valve Tube

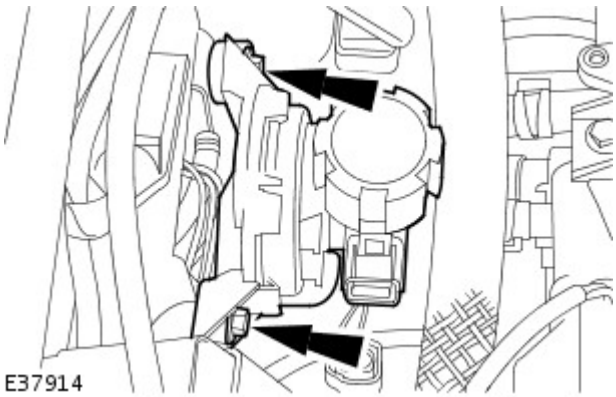
Removal and Installation

Removal

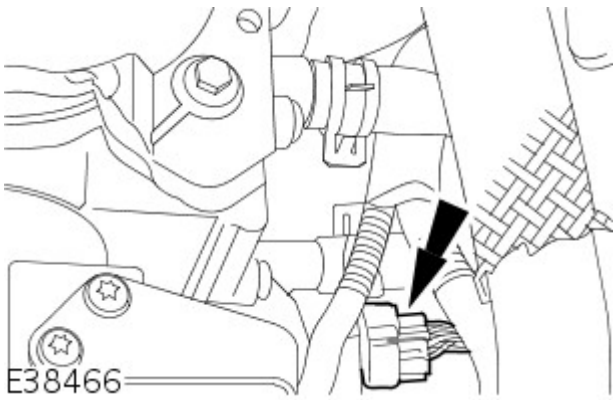
1. Remove the engine cover.
   For additional information, refer to Section 501-05 Interior Trim and Ornamentation.



2. Disconnect the evaporative emission canister purge valve electrical connector.



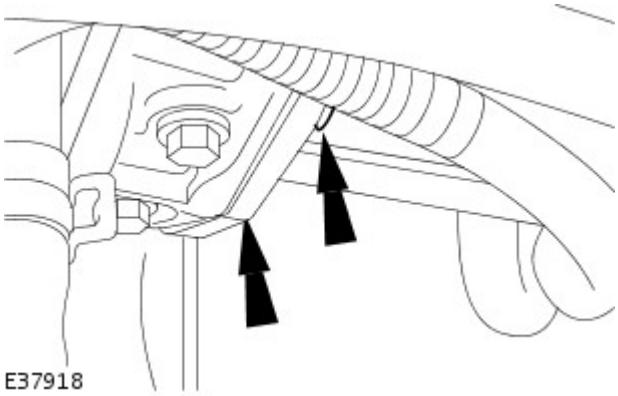
3. Detach and reposition the evaporative emission canister purge valve.

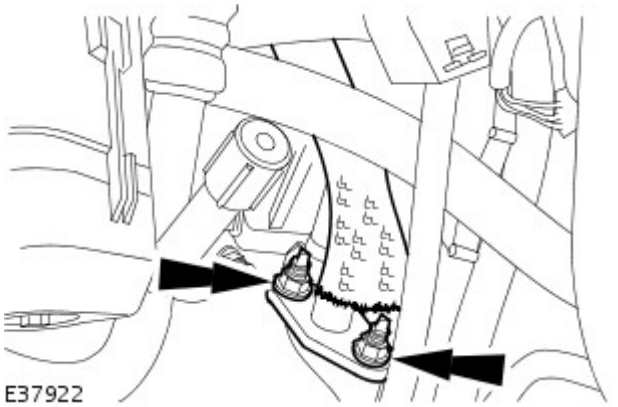


4. Disconnect the exhaust gas recirculation (EGR) valve electrical connector.

5. Remove the exhaust manifold to EGR valve tube retaining bolts.

   - Remove and discard the exhaust manifold to EGR valve tube gasket.

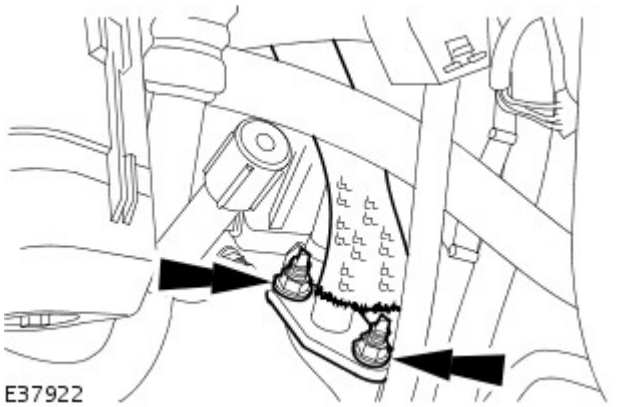




6. Remove the exhaust manifold to EGR valve tube.

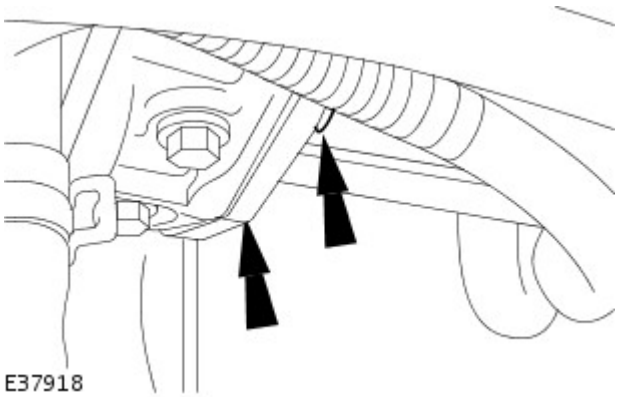
- Remove and discard the exhaust manifold to EGR valve tube gasket.

Installation



1. NOTE: Install a new exhaust manifold to EGR valve tube gasket.

Loosely install the exhaust manifold to EGR valve tube.



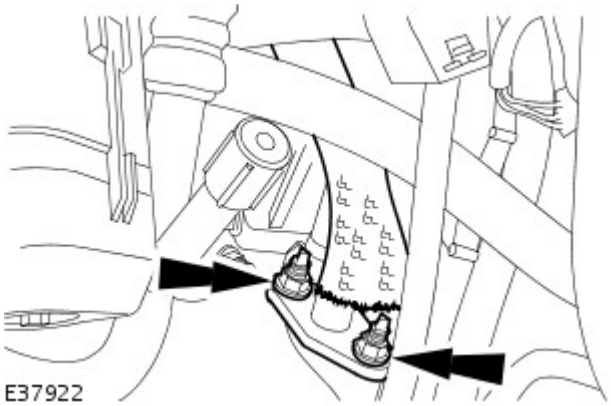
2. NOTE: Install a new exhaust manifold to EGR valve tube gasket.

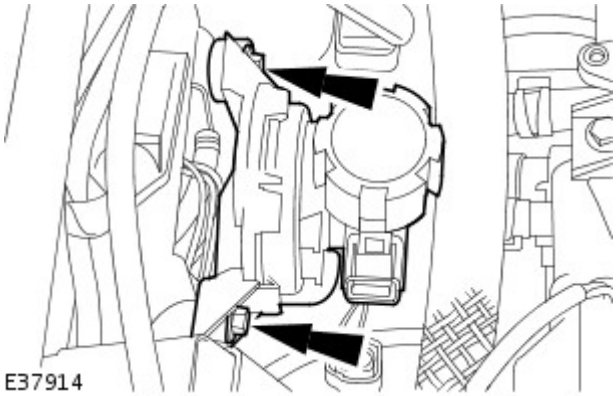
Install the exhaust manifold to EGR valve tube retaining bolts.

- Tighten to 21 Nm.

3. Tighten the exhaust manifold to EGR valve tube retaining bolts.

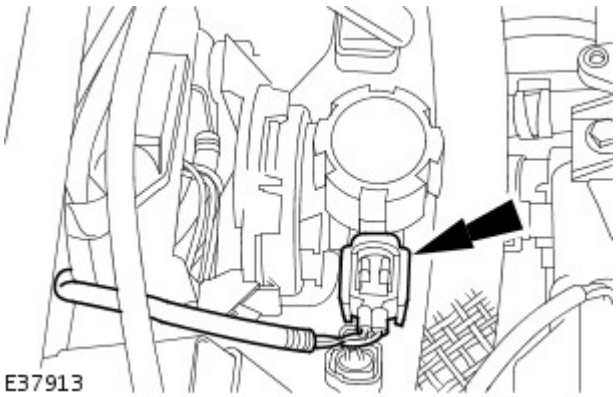
- Tighten to 21 Nm.





4. Attach the evaporative emission canister purge valve.

1. Tighten to 6 Nm.



5. Connect the evaporative emission canister purge valve electrical connector.

6. Install the engine cover.
For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

Intake Air Distribution and Filtering -

Torque Specifications

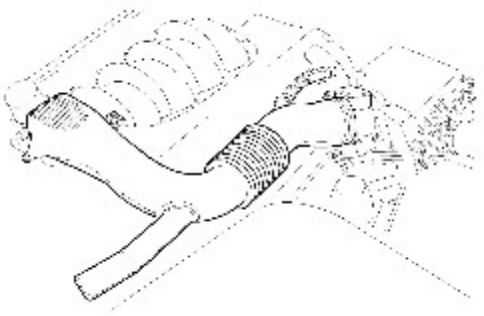
Component	Nm
Throttle intake elbow to intake manifold	18-24
Throttle body to throttle intake elbow	18-24
Left-hand support bracket to throttle intake elbow	16-20
Right-hand support bracket to throttle intake elbow	16-20
Blanking plate to throttle intake elbow	18-24
Intake manifold to engine	20-22
Supercharger drive belt idler pulley bolt	34-46
Supercharger drive belt tensioner to alternator mounting bracket bolt	39-51
Supercharger to engine bolts	18-24
Charge air cooler inlet assembly to charge air cooler bolts	18-24
Supercharger outlet duct to supercharger bolts	9-11
Charge air cooler inlet assembly to supercharger outlet duct bolts	18-24
Charge air cooler to charge air cooler adaptor	11-13
By-pass valve to throttle intake elbow	8-12

Intake Air Distribution and Filtering - Intake Air Distribution and Filtering

Description and Operation

Intake Air Distribution and Filtering - Normally Aspirated Vehicles

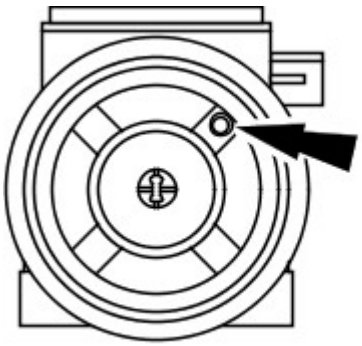
Air Intake Assembly



E32931

The air cleaner assembly consists of a two piece box containing the air filter, an airflow/temperature unit and the air intake duct which connects to the top of the throttle assembly. The engine full load breather feeds into the intake duct from the bank 1 camshaft cover. A tuned stub on the air intake duct reduces the intake noise level.

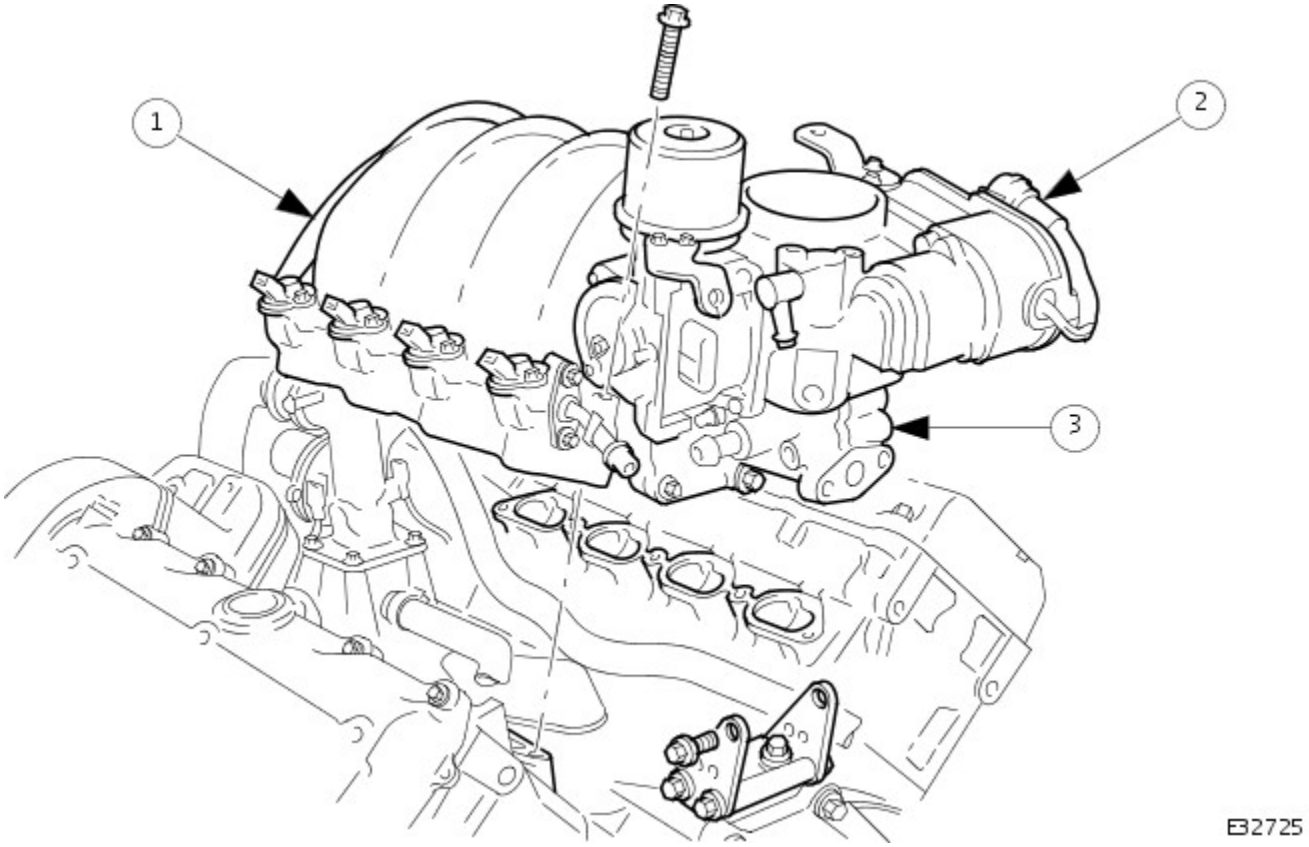
Mass Air Flow and Temperature Sensors



E34025

The intake air is monitored by the Mass Air Flow (MAF) sensor assembly which is fitted at the outlet of the air filter assembly. Two sensors are incorporated in the MAF sensor assembly, measuring air flow and temperature (temperature sensor arrowed); both sensors provide analogue signal inputs to the engine control module (ECM) and are further described in Section 303-14.

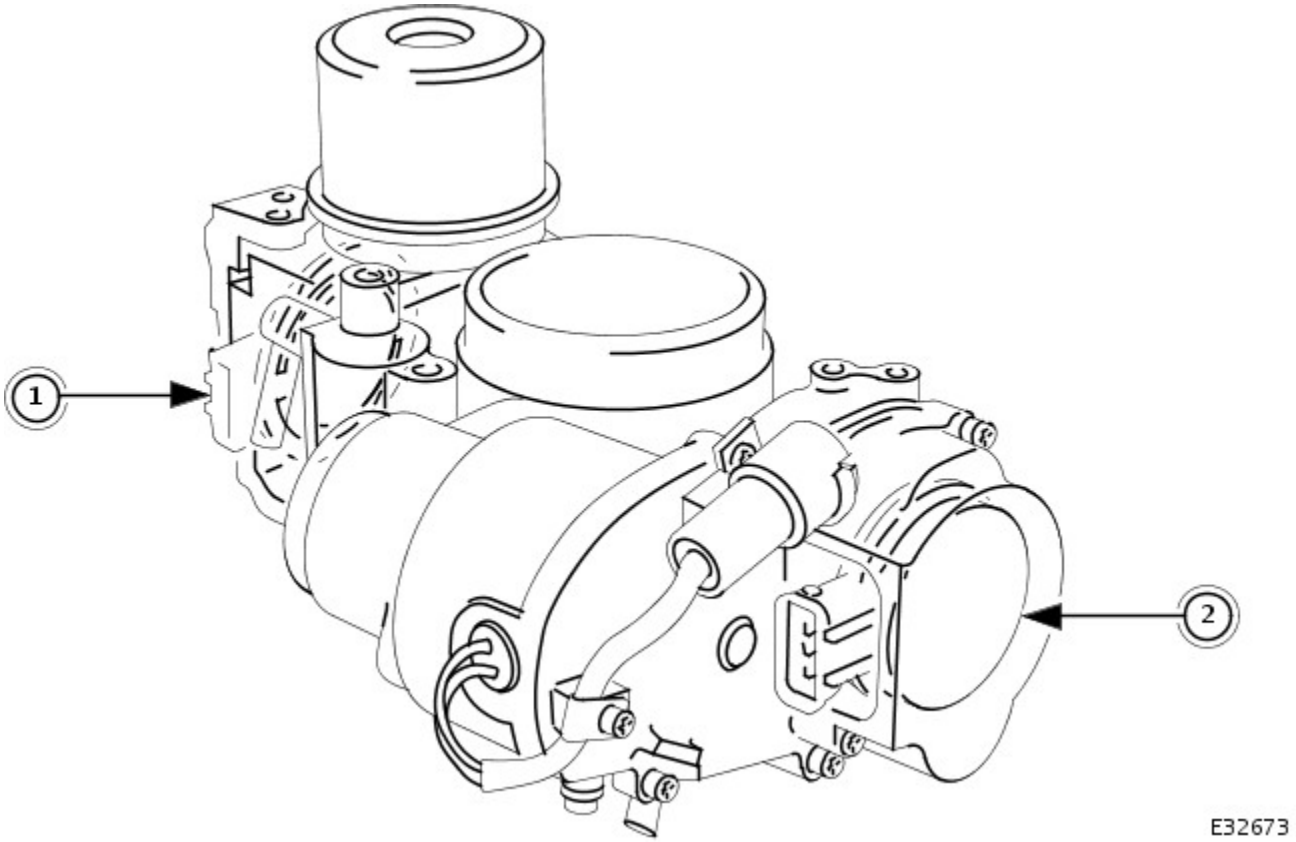
Throttle and Manifold Assemblies



Parts List

Item	Part Number	Description
1	—	Intake Manifold
2	—	Electronic Throttle
3	—	Intake Elbow

Throttle Body



Parts List

Item	Part Number	Description
1	—	Accelerator pedal and mechanical guard position sensors
2	—	Throttle (blade) position sensor

CAUTION: Do not attempt to renew or adjust the throttle cable without consulting the relevant procedure. Two procedures apply: reconnection of an original cable (19.70.04) or the fitting of a new cable (19.20.06).

The filtered air from the intake duct is drawn downwards through the throttle body to the intake elbow on which the throttle body is mounted. The airflow through the throttle body is varied by the electrically operated throttle valve according to driver demand and engine management system requirements.

The throttle body assembly has the following features:

- Convential cable operated input shaft connected to the accelerator pedal.
- Mechanical guard to limit throttle angle should driver demand exceed ECM controlled parameters and a mechanical back-up in the event of a throttle motor failure.
- Vacuum actuator for operation of the mechanical guard in cruise control mode.
- Throttle valve (blade) to regulate air flow into the engine.
- Thermostatic air valve to allow and control air by-pass around the throttle.
- DC electric motor to operate the throttle in response to ECM control.
- Three sensors (accelerator pedal, mechanical guard and the throttle valve) to relay positional information about the input shaft to the ECM.
- Return and control springs fitted to the input shaft, mechanical guard, throttle valve and dc motor drive gear.

Throttle Control Modes

There are seven throttle control modes:

1. **1.** Normal

2. **2.** Cruise
3. **3.** Mechanical guard
4. **4.** Fixed idle
5. **5.** Redundancy
6. **6.** Full authority
7. **7.** Engine shut-down

Normal mode occurs when the ECM uses the mechanical and monitoring arrangement of the throttle valve to control throttle opening. The ECM does not permit driver demand to be exceeded but it can be restricted to allow for such features as stability / traction control, or engine power limitation.

The ECM determines engine idle speed by controlling the throttle valve motor to vary the blade angle between the non-adjustable preset limits of the mechanical guard and the throttle valve motor.

Cruise mode is engaged as a result of the ECM calculating and controlling the required throttle valve opening via the vacuum system. When the driver releases the throttle pedal, the input shaft disengages from the mechanical guard or the vacuum actuator pulls the guard away from the throttle valve. The throttle pedal will feel light should it be pushed again to accelerate (pressing the pedal further will re-engage the input shaft with the mechanical guard and restore normal feel).

The ECM utilizes sensors to monitor the relative positions of the mechanical guard and throttle valve and adjusts them to maintain the set cruise speed.

Mechanical guard mode permits full mechanical operation of the throttle if the ECM detects that a problem has been encountered with the throttle valve position sensor, dc motor, associated harnesses / connectors or the ECM.

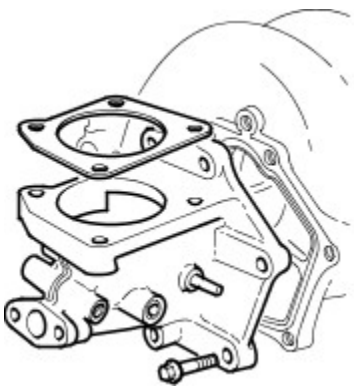
Fixed idle mode occurs when any two of the three sensors (two input shaft sensors and the mechanical guard sensor) fail. The ECM will assume values which represent a blade angle of approximately 2,5° and 1200 rpm (unloaded) maximum engine speed.

Redundancy mode occurs when any one of the three sensors (two input shaft sensors and the mechanical guard sensor) fails. The operational pair will be deemed to be safe to continue without intervention, but cruise will be inhibited.

Full authority mode is invoked when a mechanical guard failure occurs which indicates that the guard is stuck fully open. The red warning lamp will be lit and road speed will be limited to 120 kph.

Engine shut-down mode will occur following multiple failures, such as mechanical guard mode following full authority mode (or vice versa) or the throttle blade sticks.

Intake Elbow



The intake elbow directs the metered airflow from the electronic throttle to the intake manifold. Stub pipes on both sides of

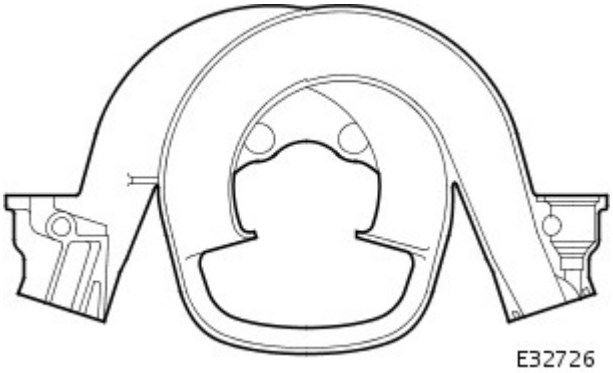
the intake elbow provide connections for vacuum actuators and are also used to redirect emissions into the engine.

On the right-hand side of the elbow a large diameter pipe connects to the brake servo. The smaller pipe provides a vacuum feed to the fuel rail pressure regulator and throttle cruise control system. On the left-hand side of the elbow the front pipe supplies vacuum control for the evaporative emissions system valves.

Emissions from the engine part load breather (bank 2) and purged fuel vapor from the EVAP valve are drawn via a common T piece into the left-hand side of the intake elbow. Re-circulated exhaust gas enters the intake elbow via the EGR valve which is mounted directly on the rear of the elbow : where the EGR system is not used, a blanking plate is fitted.

The fuel system, throttle and emission control systems are described more fully in the relevant sections.

Intake Manifold



Filtered air from the vehicle's intake ducting is metered by the electronic throttle and distributed to the two cylinder banks via an integral intake manifold.

The intake manifold is manufactured in plastic with integral plastic fuel rails and metal-thread inserts; the very smooth internal surfaces give excellent air flow.

Individual ducts lead off a central chamber to the inlet valves of each cylinder.

Silicon-rubber gaskets, located in channels in the intake manifold, seal the joints between the ducts and the cylinder heads.

Engine Ventilation

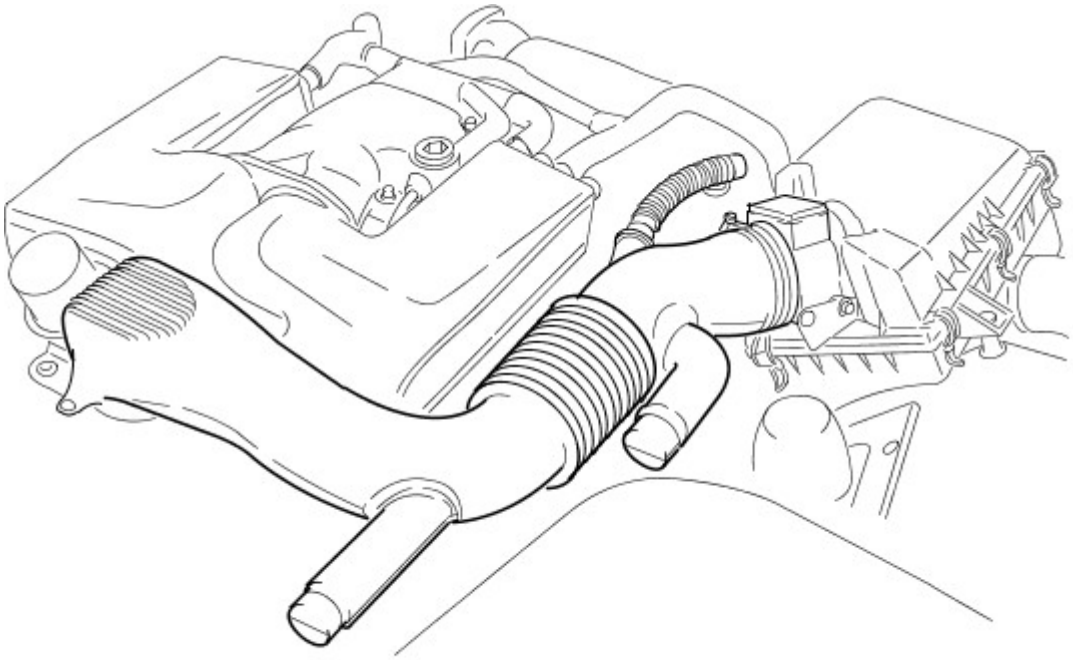
The engine is ventilated through two breathers; a part-load breather and a full-load breather, one on each camshaft cover. The outlet hose for the part-load breather is connected between the bank 2 camshaft cover and the intake elbow. The full-load outlet hose is connected from the bank 1 camshaft cover to the intake duct between the MAF sensor assembly and the throttle body.

Constructed in plastic, the hoses incorporate O-ring seals and quick-release connectors; refer to Section 303-01.

Intake Air Distribution and Filtering - Supercharged Vehicles

Air is supplied to the supercharger via an intake cleaner/duct, throttle assembly and intake elbow which are similar to those used for normally aspirated engines. The supercharger delivers pressurized air to two separate charge air cooler units, each unit being mounted on the cylinder bank which it supplies. Pressurized cooled air is fed from the charge air coolers directly into each inlet port.

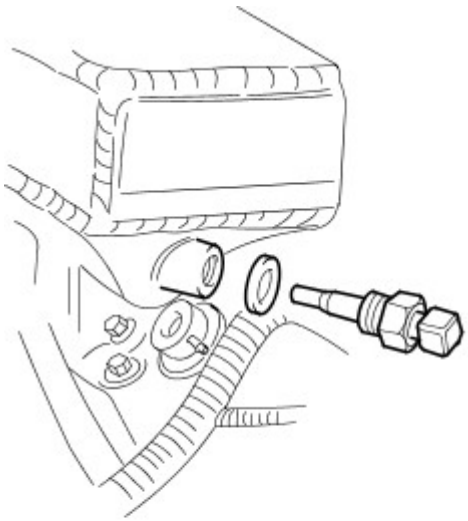
Air Intake Assembly



E32932

The air cleaner assembly consists of a two piece box containing the air filter, an airflow/temperature unit (MAF sensor) and the air intake duct which connects to the top of the throttle assembly. The engine full load breather feeds into the intake duct from the bank 1 camshaft cover. Two tuned stubs on the air intake duct reduce the intake noise level.

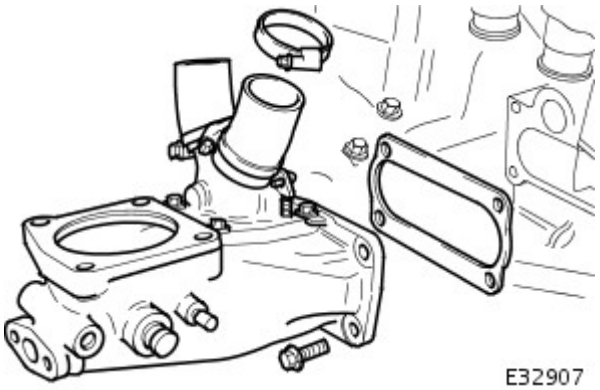
Temperature Sensor



E32908

A second intake air temperature sensor (IAT sensor 2) is fitted at the outlet of the bank 1 charge air cooler. The sensor provides an input to the ECM.

Intake Elbow and Bypass



The intake elbow directs the metered airflow from the electronic throttle outlet (underside of the throttle body) into the intake of the supercharger.

The supercharger by-pass valve assembly is bolted to the intake elbow. The 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 to non supercharged levels. Progressive opening of the throttle causes the by-pass valve to gradually close.

On the right-hand side of the elbow a large diameter pipe connects to the brake servo. On the left-hand side the smaller pipe supplies vacuum control for the evaporative emissions system valves.

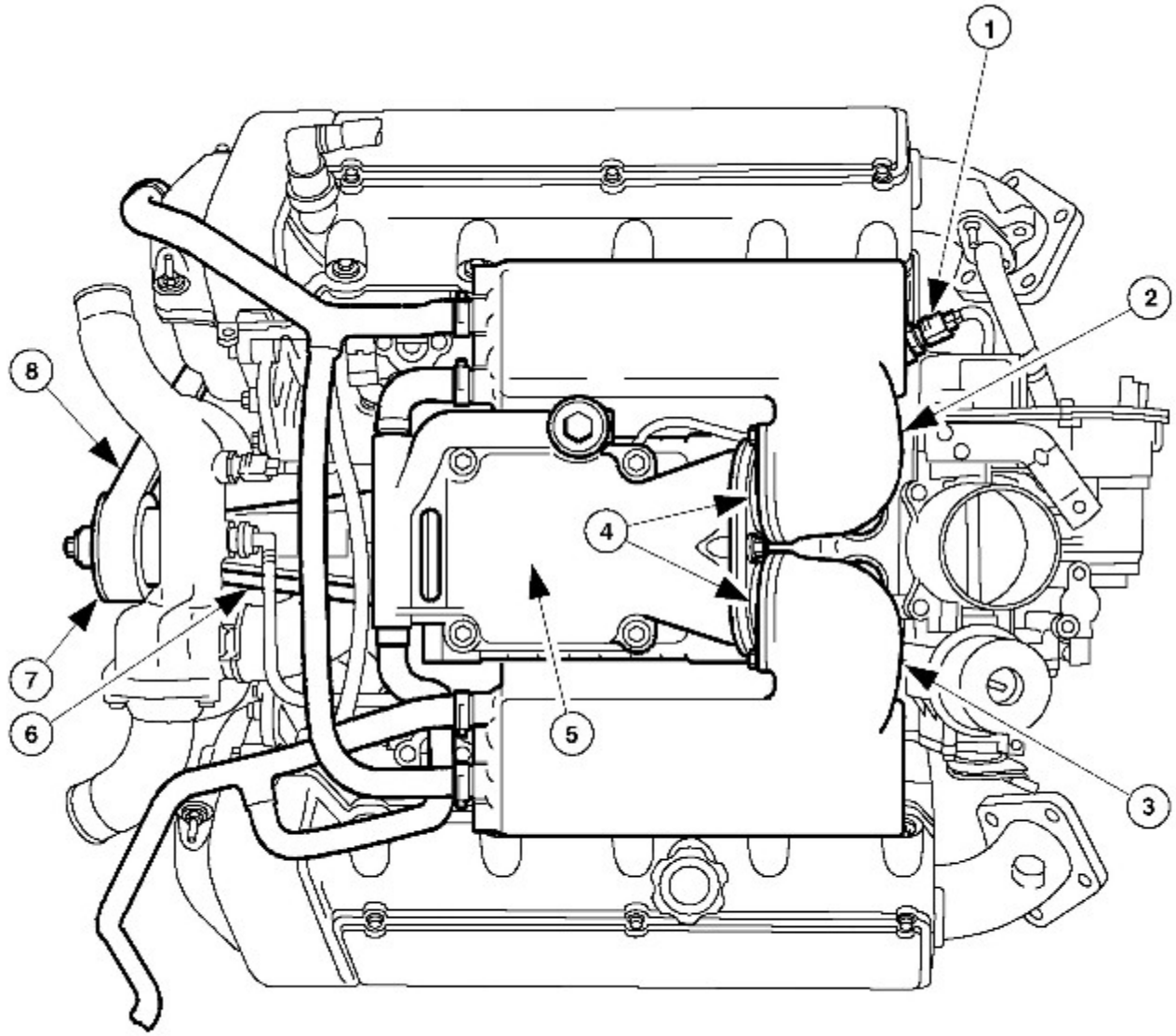
Emissions from the engine part load breather (bank 1) and purged fuel vapor from the EVAP valve are drawn via a common T piece into the left-hand side of the intake elbow. Re-circulated exhaust gas enters the intake elbow via the EGR valve which is mounted directly on the rear of the elbow. Where the EGR system is not used, a blanking plate is fitted.

The fuel system and emission control systems are described more fully in the relevant sections.

Fuel Pressure Regulation and Cruise Control Vacuum Feed

The inlet vacuum feed for the fuel rail pressure regulator and the cruise control system is taken from the supercharger outlet duct. The feed pipe is located below the large charge air cooler coolant filler plug.

Supercharger and associated components



E34076

Parts List

Item	Part Number	Description
1	—	Intake Air Temperature Sensor 2
2	—	Charge Air Cooler - Bank 1
3	—	Charge Air Cooler - Bank 2
4	—	Charge Air Cooler - Inlet Duct
5	—	Supercharger Outlet Duct
6	—	Supercharger
7	—	Supercharger Pulley
8	—	Supercharger Drive Belt

Supercharger

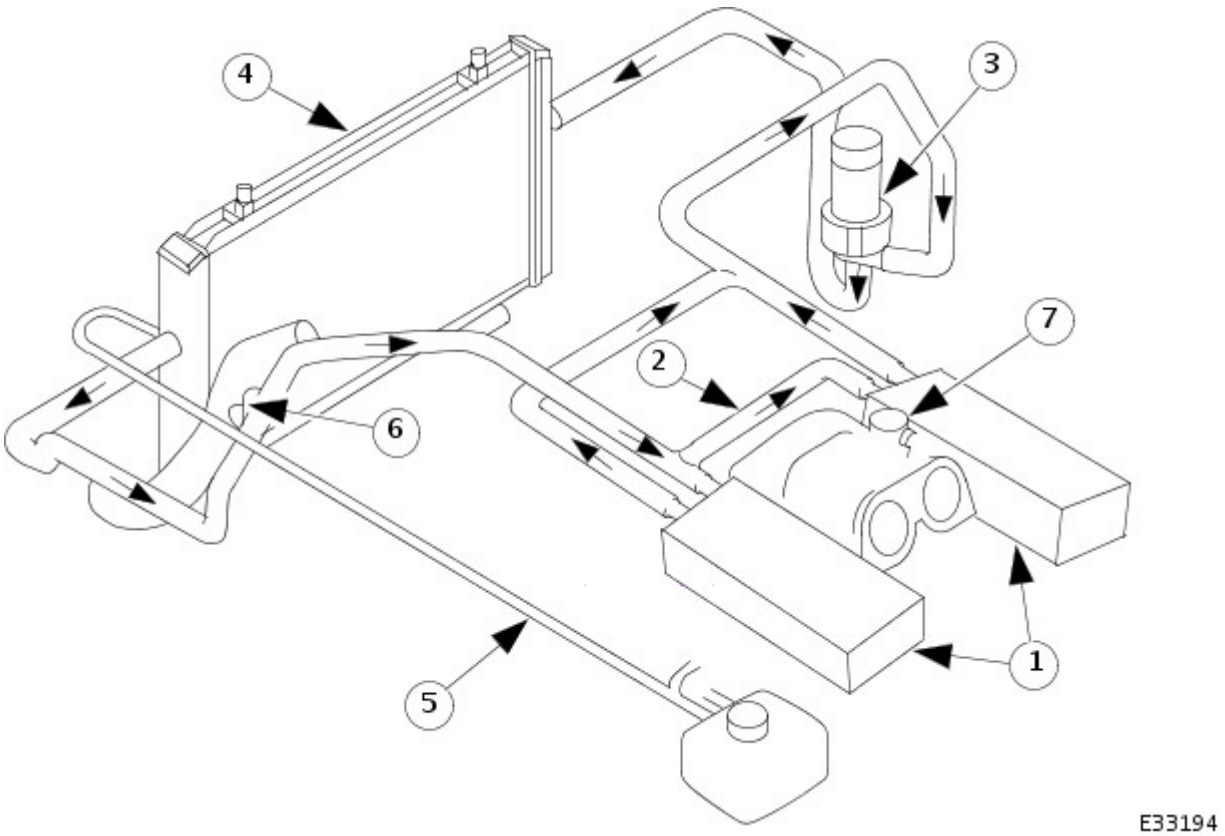
The supercharger:

- is attached to the three mounting bosses between the V of the cylinder block
- has a filled for life internal lubrication system
- is positively aligned with the drive belt by a doweled mounting bracket

Charge Air Cooler System

Each cylinder bank is fitted with a charge air cooler unit which supplies pressurized air to the four cylinders via an adaptor block. The inlet ports to the two charge air coolers are connected to the supercharger outlet by an inlet assembly consisting of rubber ducts and clamp plates. An outlet stub at the rear of each charge air cooler unit provides the connection for the by-pass valve airflow. The charge air coolers are water cooled via a radiator and coolant pump.

Charge Air Cooler Coolant System



Parts List

Item	Part Number	Description
1	—	Charge air coolers
2	—	Coolant hoses
3	—	Coolant pump
4	—	Radiator
5	—	Bleed pipe to main coolant circuit expansion tank
6	—	Charge air cooler to engine coolant circuit connection
7	—	Coolant top up plug

Each charge air cooler unit is a fin and tube air to liquid heat exchanger. The coolant circuit for the charge air coolers consists of a pump, radiator, connecting hoses and a bleed pipe.

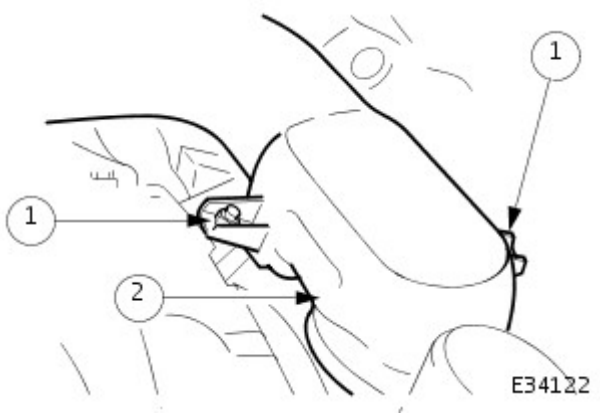
Intake Air Distribution and Filtering - Air Cleaner

Removal and Installation

Removal

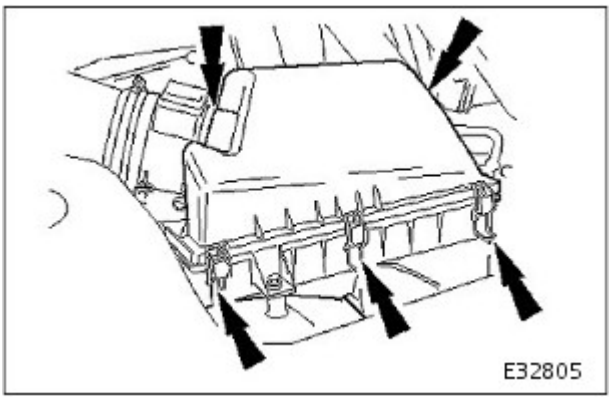
1. Open the engine compartment and fit paintwork protection sheets.

2. Release the air intake trunking to gain access to the air cleaner cover inner rear clip



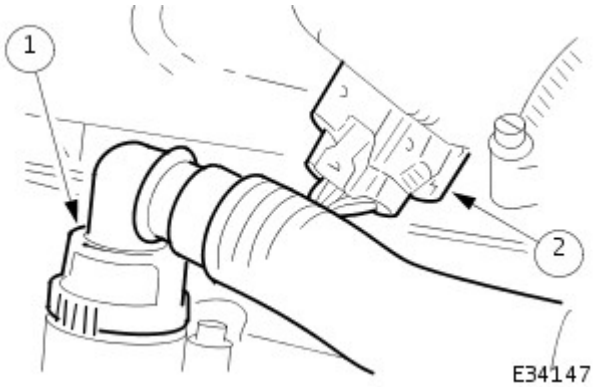
1. Remove the bolts which secure the trunking to the intake elbow.
2. Release the trunking from the elbow and carefully lift the assembly to gain access to the inner rear clip.

3. Disconnect the air cleaner cover.



- Release the five clips which secure the air cleaner cover. Lift the cover.

4. Remove the air cleaner cover and trunking as an assembly.



1. Release the breather pipe from the camshaft cover.
2. Disconnect the electrical connector from the air flow meter.

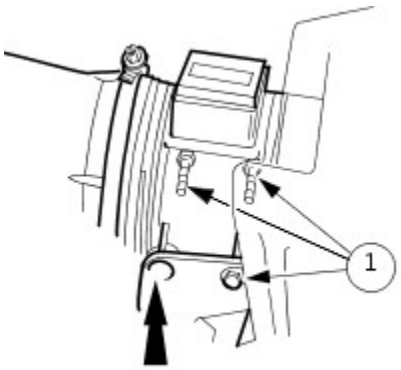
- Remove the air cleaner cover and trunking as an assembly.

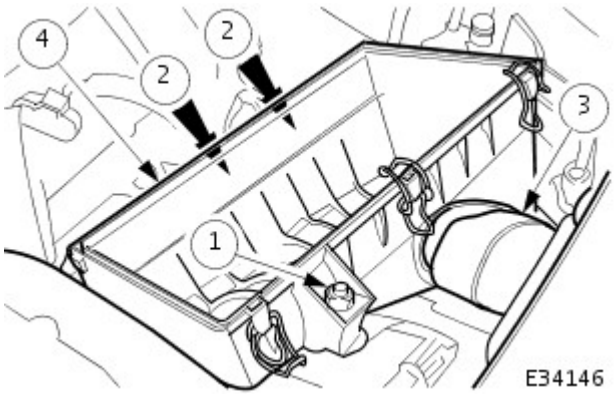
5. Lift out the air cleaner element.

6. Disconnect and remove the air cleaner cover from the air flow meter.

1. Remove the three bolts which secure the air flow meter to the air cleaner cover. Remove the blanking plug.

- Carefully separate the air cleaner cover from the air flow meter.



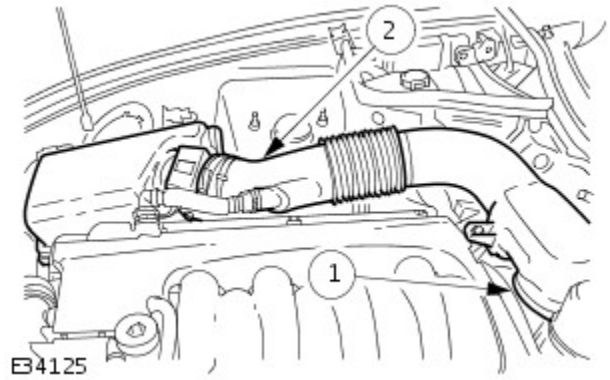


7. Remove the air cleaner assembly.

1. Remove the nut which secures the base of the air cleaner assembly to the rubber mounting.
2. Release the assembly from the lower rubber mountings.
3. Release the intake section from the assembly and move it clear, into the grommet in the inner wing.
4. Remove the air cleaner assembly.

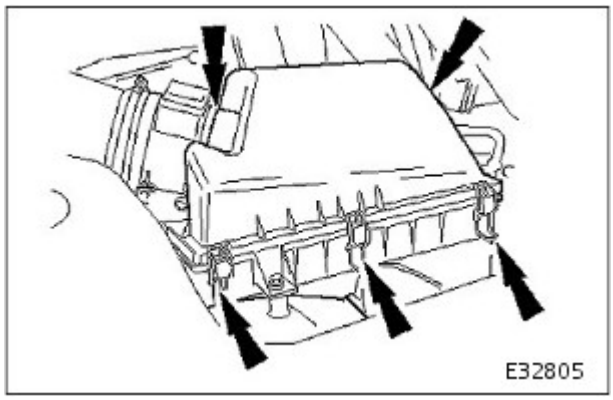
8. Clean all mating faces of components which are to be refitted.

Installation



1. Fit the intake tube/air flow meter/air cleaner cover assembly.

1. Fit a new rubber seal; air intake tube to throttle body.
2. Fit the intake tube / air flow meter / air cleaner cover assembly.

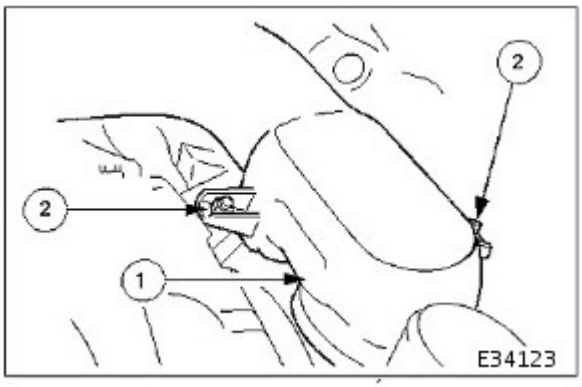


2. Reconnect the air cleaner cover.

1. Fit the five clips which secure the air cleaner cover.

3. Connect the intake tube to the throttle body.

1. Connect the intake tube to the throttle body.

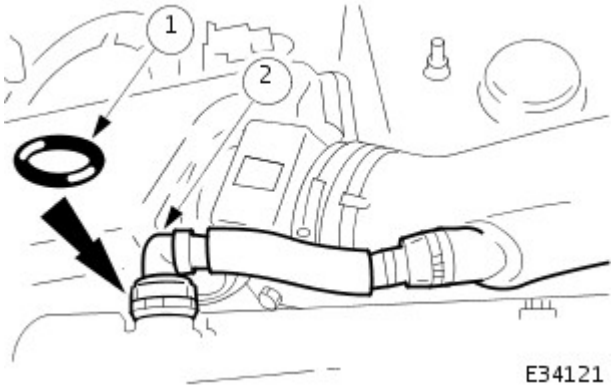


2. Fit the two bolts which secure the intake tube to the throttle body.

4. Reconnect the air flow meter multi-plug.

5. Fit a new strap to secures the vacuum pipe to the induction elbow.

6. Connect the breather pipe to the A-bank camshaft cover.



1. Fit a new O-ring seal to the breather pipe.

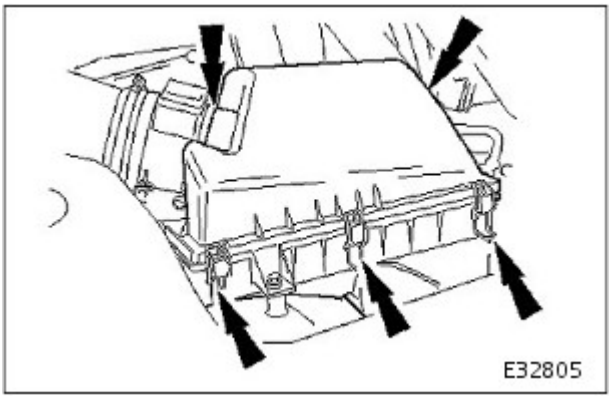
2. Reconnect the breather pipe to the stub pipe.

Intake Air Distribution and Filtering - Air Cleaner Element

Removal and Installation

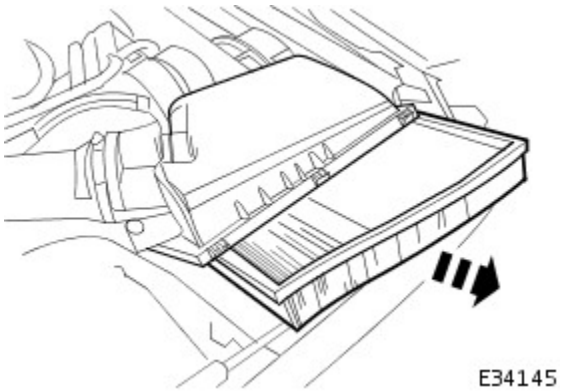
Removal

1. Open the engine compartment and fit paintwork protection sheets.



2. Disconnect the air cleaner cover.

1. Release the five clips which secure the air cleaner cover. Lift the cover.



3. Release and remove the air cleaner element.

4. Clean the air cleaner cover and body.

Installation

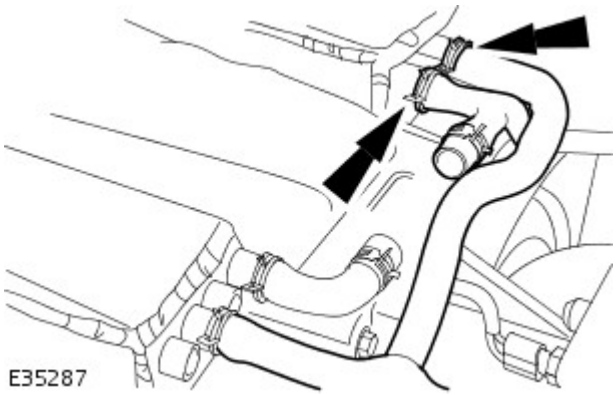
1. Installation is the reverse of the removal procedure.

Intake Air Distribution and Filtering - Charge Air Cooler LH

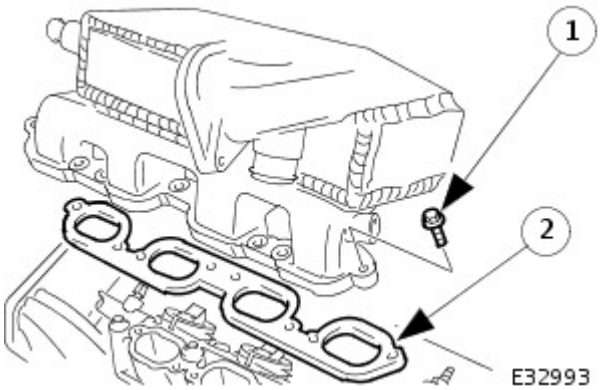
Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Drain radiator coolant; refer to 26.10.01.
3. Remove air cleaner cover / intake assembly; refer to 19.10.30.
4. Remove throttle body; refer to 19.70.04.
5. Remove exhaust gas re-circulation valve (EGR) if installed; refer to 17.45.01.
6. Remove throttle intake elbow; refer to (SC) 19.70.28.
7. Remove supercharger outlet duct; refer to 18.50.16.
8. Remove coolant outlet pipe; refer to operation (SC) 26.31.08.
9. Remove supercharger drive belt; refer to 18.50.08.
10. Remove supercharger; refer to operation 18.50.15.
11. Detach engine harness retaining clip from rear of charge air cooler.
12. Disconnect hoses from charge air cooler.



- Place absorbent cloth in appropriate position.
- Disconnect hoses.



13. CAUTION: Take care to avoid dropping any objects or foreign matter into engine inlet duct with charge air cooler removed.

Remove charge air cooler from the engine.

1. Remove eight bolts.

- Remove charge air cooler.

2. Discard gasket.

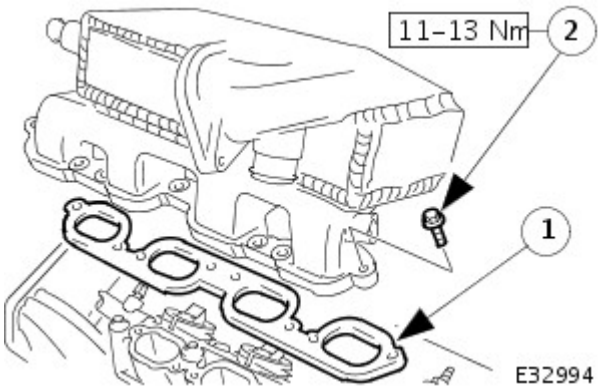
- Clean all mating faces.

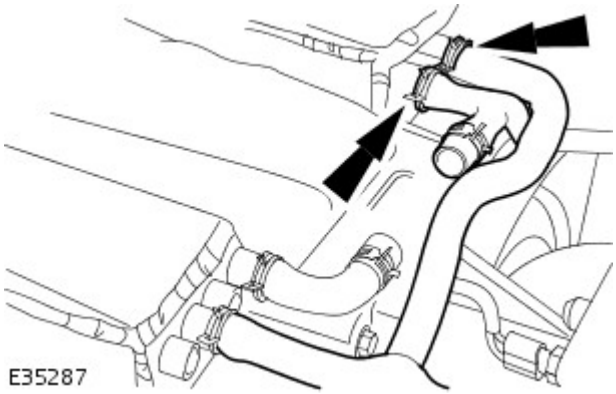
Installation

1. Install charge air cooler to adaptor.

1. Install new gasket.

2. Install charge air cooler.





2. Connect hoses to charge air cooler.

- Connect hoses.

3. Install supercharger; refer to 18.50.15.

4. Install supercharger drive belt; refer to 18.50.08.

5. Install engine coolant outlet pipe; refer to 26.31.08.

6. Install supercharger outlet duct and new gasket; refer to 18.50.16.

7. Install throttle intake elbow; refer to 19.70.28.

8. Install exhaust gas re-circulation valve (EGR) if applicable; refer to 17.45.01.

9. Install throttle body; refer to 19.70.04.

10. Install air cleaner cover / intake assembly; refer to 19.10.30.

11. Refill cooling system; refer to (SC) (26.10.01).

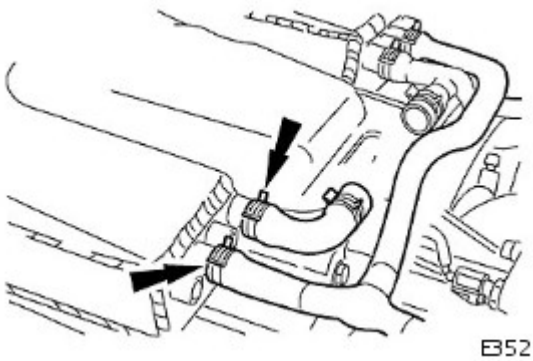
12. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Intake Air Distribution and Filtering - Charge Air Cooler RH

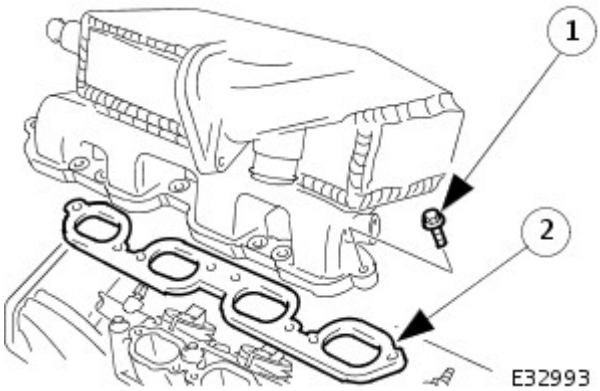
Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Drain radiator coolant; refer to 26.10.01.
3. Remove air cleaner cover / intake assembly; refer to 19.10.30.
4. Remove throttle body; refer to 19.70.04.
5. Remove exhaust gas re-circulation valve (EGR) if installed; refer to 17.45.01.
6. Remove throttle intake elbow; refer to (SC) 19.70.28.
7. Remove supercharger outlet duct; refer to 18.50.16.
8. Remove coolant outlet pipe; refer to operation (SC) 26.31.08.
9. Remove supercharger drive belt; refer to 18.50.08.
10. Remove supercharger; refer to operation 18.50.15.
11. Remove intake air temperature sensor 2 from charge air cooler; refer to 18.30.52.
12. Detach engine harness retaining clip from rear of charge air cooler.
13. Disconnect hoses from charge air cooler.



- Place absorbent cloth in appropriate position.
- Disconnect hoses.



14. CAUTION: Take care to avoid dropping any objects or foreign matter into engine inlet duct with charge air cooler removed.

Remove charge air cooler from the engine.

1. Remove eight bolts.

- Remove charge air cooler.

2. Discard gasket.

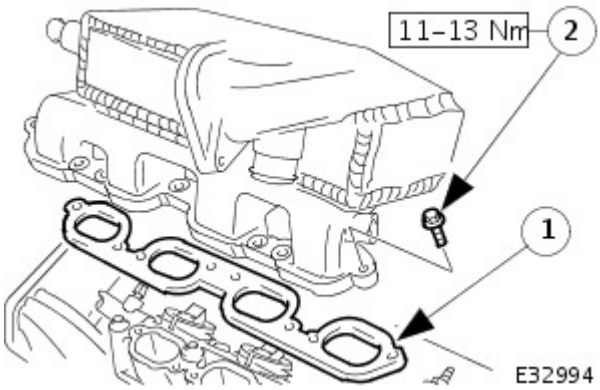
- Clean all mating faces.

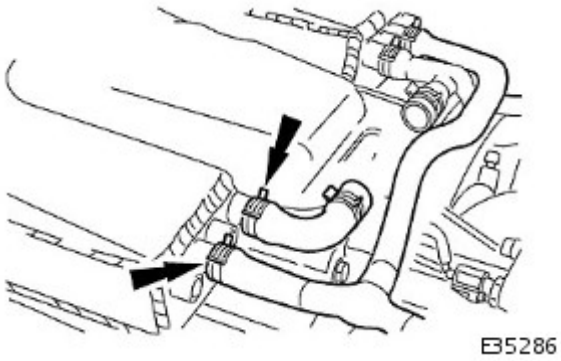
Installation

1. Install charge air cooler to adaptor.

1. Install new gasket.

2. Install charge air cooler.





2. Connect hoses to charge air cooler.

- Connect hoses.

3. Install intake air temperature sensor 2 to charge air cooler; refer to 18.30.52.

4. Install supercharger; refer to 18.50.15.

5. Install supercharger drive belt; refer to 18.50.08.

6. Install engine coolant outlet pipe; refer to 26.31.08.

7. Install supercharger outlet duct and new gasket; refer to 18.50.16.

8. Install throttle intake elbow; refer to 19.70.28.

9. Install exhaust gas re-circulation valve (EGR) if applicable; refer to 17.45.01.

10. Install throttle body; refer to 19.70.04.

11. Install air cleaner cover / intake assembly; refer to 19.10.30.

12. Refill cooling system; refer to (SC) (26.10.01).

13. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Intake Air Distribution and Filtering - Charge Air Cooler Gasket LH

Removal and Installation

Removal

1. Remove charge air cooler, bank 2; refer to 18.50.19.

Installation

1. Installation is a reversal of the removal procedure.

Intake Air Distribution and Filtering - Charge Air Cooler Gasket RH

Removal and Installation

Removal

1. Remove charge air cooler, bank 1; refer to 18.50.18.

Installation

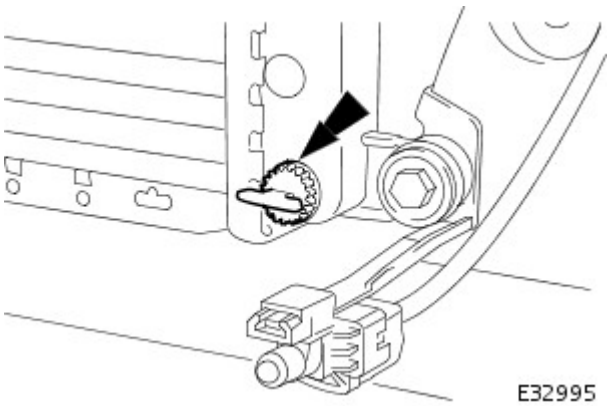
1. Installation is a reversal of the removal procedure.

Intake Air Distribution and Filtering - Charge Air Cooler Radiator

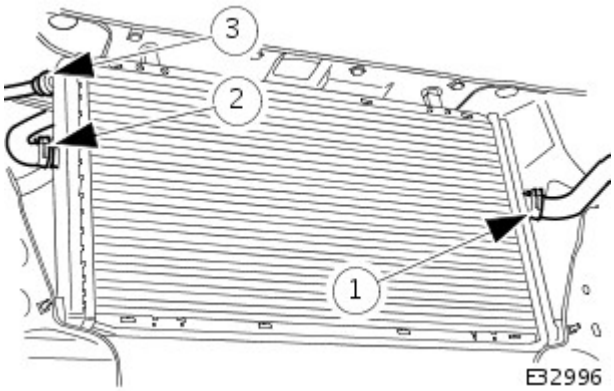
Removal and Installation

Removal

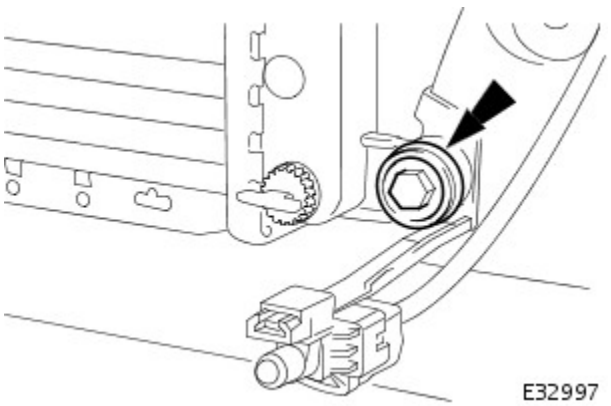
1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery.
    1. Remove the battery cover.
    2. Disconnect the battery ground cable.
3. Remove the engine radiator and air conditioning condensor assembly. Refer to operation 26.40.01.
4. Remove the grill assembly for access. Refer to operation 76.55.15.
5. Drain the charge air cooler radiator.
    - Reach through the front bumper splitter vane to remove the radiator drain plug.



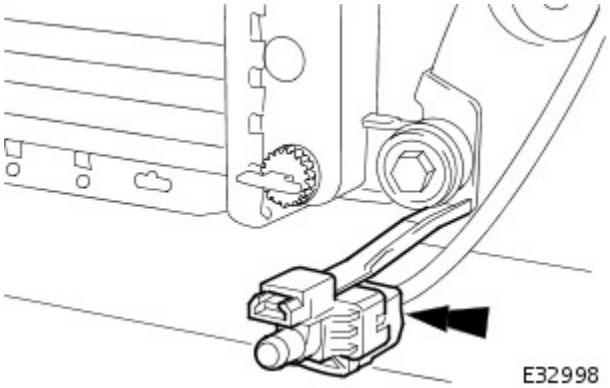
6. Disconnect the radiator hoses from the radiator.
    1. Disconnect the coolant pump to radiator hose.
    2. Disconnect the return hose.
    3. Disconnect the bleed pipe.

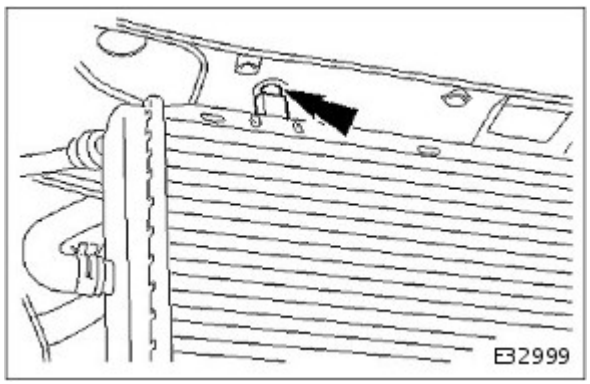


7. Remove the two radiator fixing bolts.



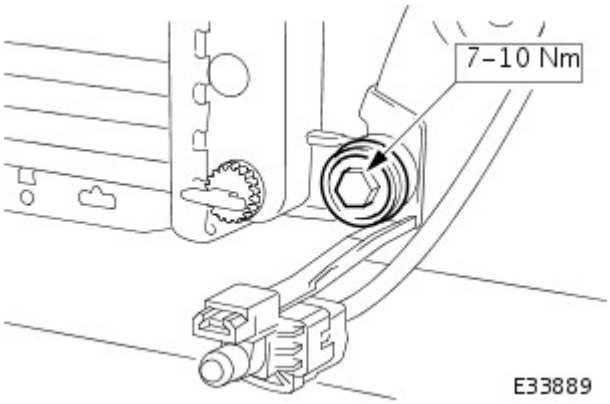
8. Displace and re-position the ambient air temperature sensor and bracket.





9. Displace the radiator from the top mounting rubbers.

Installation



1. Fit and seat the radiator to the top mounting rubbers.

2. Fit the two securing bolts. Ensure that the ambient air temperature sensor mounting bracket is secured by the lefthand radiator bolt.

3. Re-connect the radiator feed hose, return hose and bleed pipe. Fit all hose spring clips.

4. Refill the radiator coolant. Refer to operation 26.10.01.

5. Fit the grill assembly. Refer to operation 76.55.15.

6. Fit the engine radiator and air conditioning condensor assembly. Refer to operation 26.40.01.

7. Reconnect the battery. Refer to the battery reconnection procedure in 86.15.15.

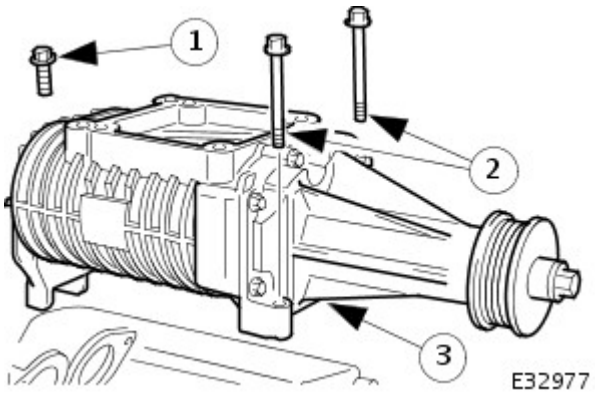
8. Remove the paintwork protection sheets and close the engine cover.

Intake Air Distribution and Filtering - Supercharger

Removal and Installation

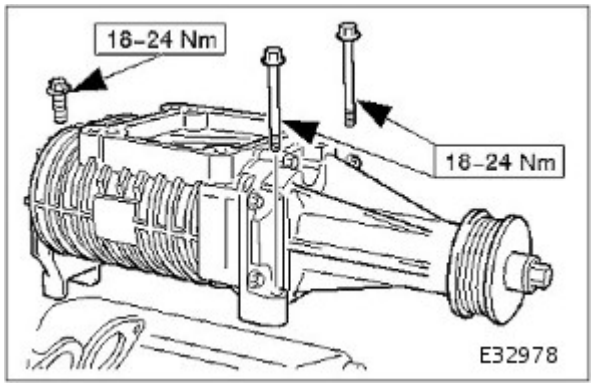
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Drain radiator coolant; refer to 26.10.01.
3. Remove air cleaner cover / intake assembly; refer to 19.10.30.
4. Remove throttle body; refer to 19.70.04.
5. Remove exhaust gas re-circulation valve (EGR) if installed; refer to 17.45.01.
6. Remove throttle intake elbow; refer to (SC) 19.70.28.
7. Remove supercharger outlet duct; refer to 18.50.16.
8. Remove coolant outlet pipe; refer to operation (SC) 26.31.08.
9. Remove supercharger drive belt; refer to 18.50.08.
10. Disconnect remaining coolant hoses from charge air coolers.
    - Position pipes to facilitate removal of supercharger.
    - Install suitable blanking plugs.
11. Remove supercharger from engine.



1. Remove bolt.
2. Remove bolts .
3. Remove supercharger.

Installation



1. Install supercharger.
2. Connect all hoses to charge air coolers.
3. Install supercharger drive belt; refer to 18.50.08.
4. Install engine coolant outlet pipe; refer to 26.31.08.
5. Install supercharger outlet duct and new gasket; refer to 18.50.16.
6. Install throttle intake elbow; refer to 19.70.28.
7. Install exhaust gas re-circulation valve (EGR) if applicable;

refer to 17.45.01.

8. Install throttle body; refer to 19.70.04.

9. Install air cleaner cover / intake assembly; refer to19.10.30.

10. Refill cooling system; refer to (SC) (26.10.01).

Intake Air Distribution and Filtering - Supercharger Outlet Pipe

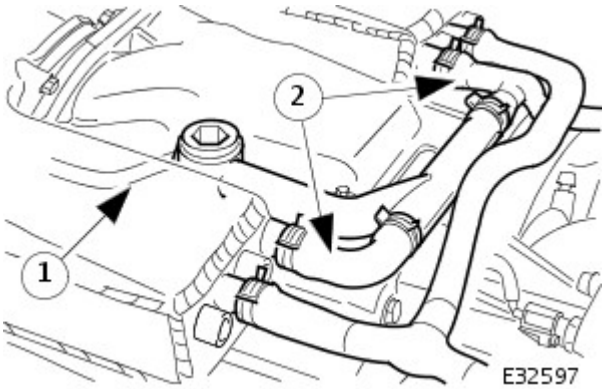
Removal and Installation

Removal

1. Remove air cleaner cover / intake assembly; refer to 19.10.30.

2. Drain radiator coolant; refer to operation (SC) 26.10.01.

3. Disconnect coolant hoses and vacuum pipe from supercharger outlet duct.

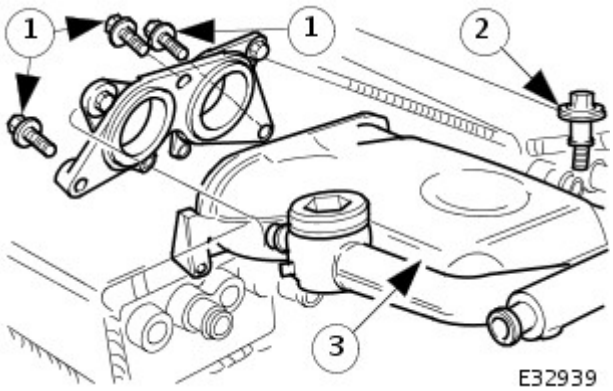


- Place absorbent rags under the two coolant hoses which are connected to the outlet duct.

1. Remove vacuum pipe.

2. Disconnect hoses.

- Plug hoses and outlet duct stub pipes to prevent spillage.



4. CAUTION: Take care to avoid any coolant from dripping into supercharger.

Remove supercharger outlet duct.

1. Remove three bolts.

2. Remove four bolts.

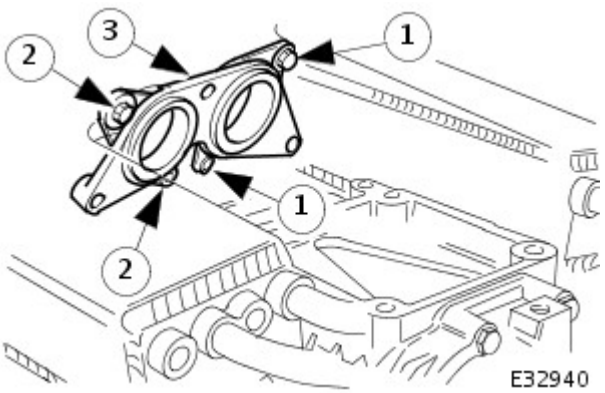
- Discard rubber seals from bolts.

3. Remove outlet duct.

- Discard outlet duct gasket.

5. Blank supercharger outlet with body tape, or similar, to prevent ingress of foreign matter.

6. Remove charge air cooler inlet assembly.



1. Remove two bolts.

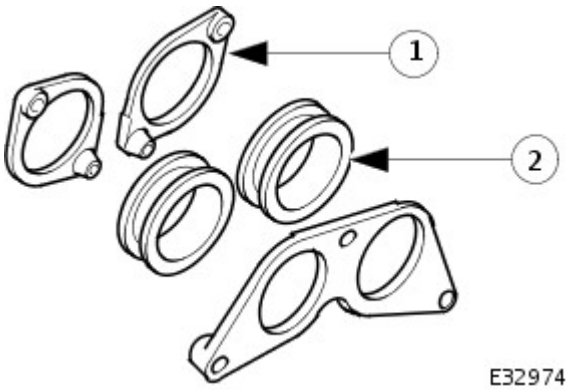
2. Remove two bolts.

3. Remove charge air cooler inlet assembly.

7. Remove ducts from charge air cooler inlet assembly.

1. Remove two clamp plates.

2. Discard two ducts.



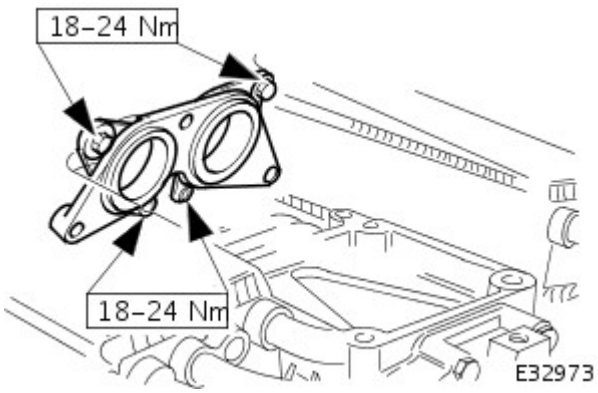
8. Clean all relevant parts and mating faces.

Installation

1. Re-assemble charge air cooler clamp inlet assembly.

- Use new ducts.

2. Install charge air cooler inlet assembly to charge air coolers.



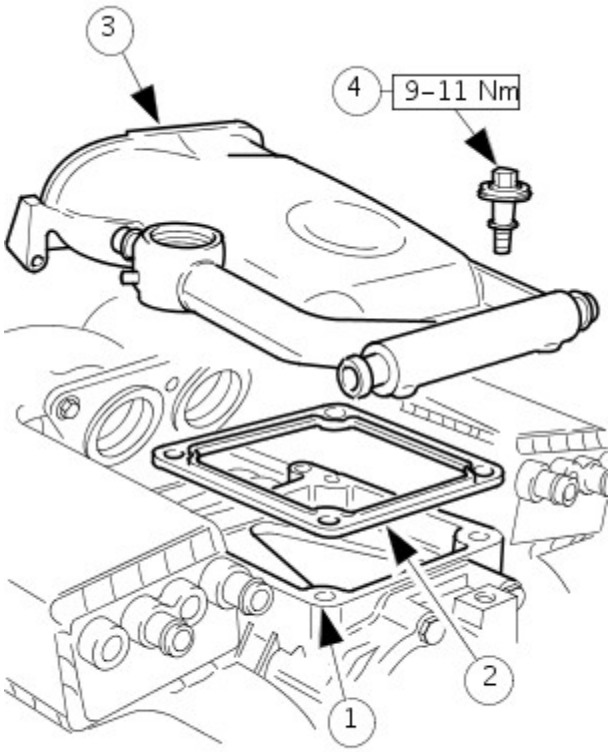
3. CAUTION: Take care to avoid ingress of dirt or foreign matter into the supercharger.

Install supercharger outlet duct.

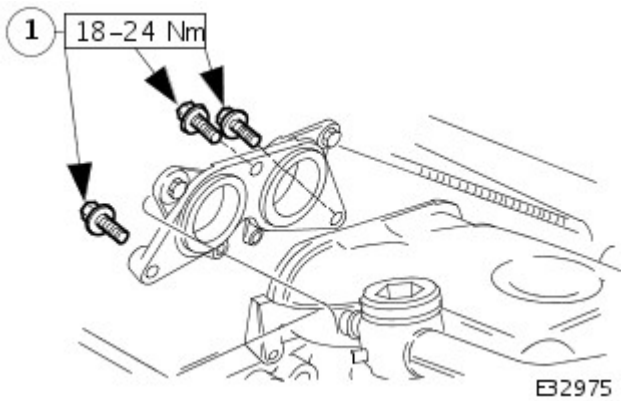
1. Remove blanking tape from outlet port of supercharger.

- Clean supercharger outlet mating face.

2. Install new gasket.
3. Install duct.
4. Install new rubber seals to the four bolts.



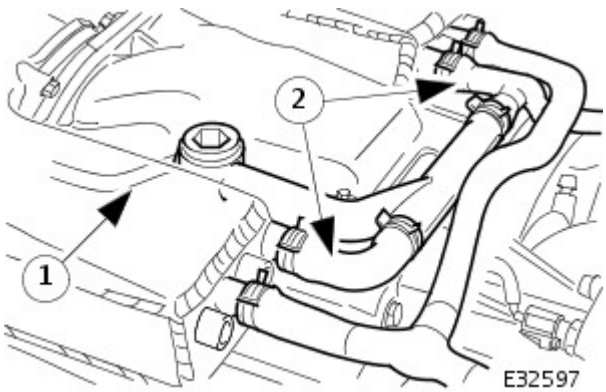
E32976



E32975

4. Secure charge air cooler inlet assembly to supercharger outlet duct.

1. Install bolts.



E32597

5. Install coolant hoses and vacuum pipe to outlet duct.

1. Install vacuum pipe.
2. Install coolant hoses.

6. Refill cooling system; refer to (SC) (26.10.01).

7. Install intake tube / air flow meter / air cleaner cover assembly; refer to 19.10.30.

Intake Air Distribution and Filtering - Supercharger Outlet Pipe Gasket

Removal and Installation

Removal

1. Remove supercharger outlet duct; refer to 18.50.16.

Installation

1. Installation is a reversal of the removal procedure.

Intake Air Distribution and Filtering - Throttle Body Elbow

Removal and Installation

Removal

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT WARNING NOTES GIVEN IN SECTION 100-00 (UNDER HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

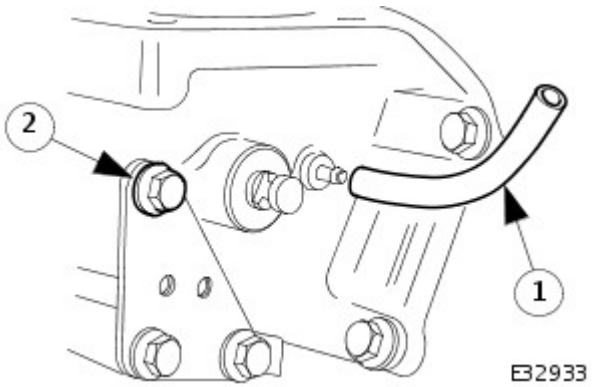
Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. Remove air cleaner cover / intake assembly; refer 19.10.30.

3. Remove throttle assembly; refer to 19.70.04.

4. Remove exhaust gas recirculation (EGR) valve where installed; refer 17.45.01.

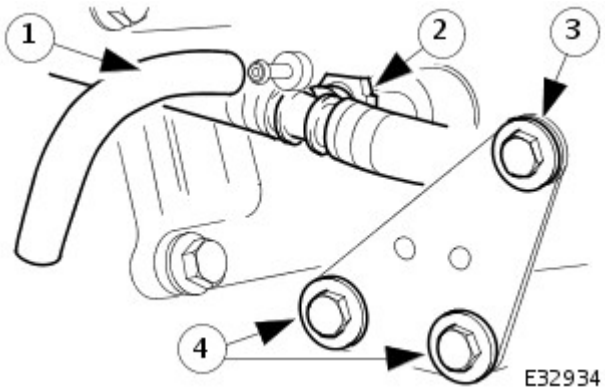
5. Release intake elbow from right-hand support bracket.



- Release brake servo vacuum pipe and disconnect pipe.

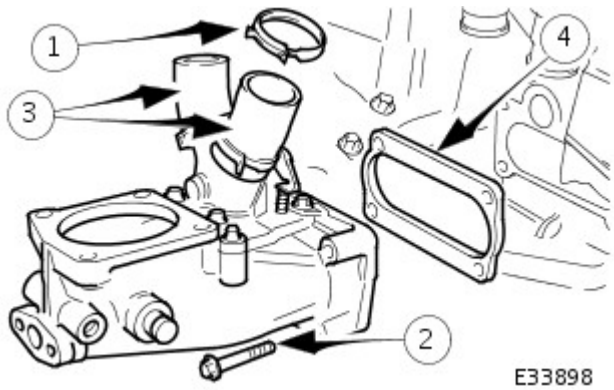
1. Disconnect vacuum pipe.
2. Remove upper bolt.

6. Release intake elbow from left-hand support bracket.



1. Disconnect vacuum pipe.
2. Disconnect engine breather T-piece.
3. Remove upper bolt.
4. Loosen, but do not remove, lower two bolts.

7. Remove intake elbow from supercharger.



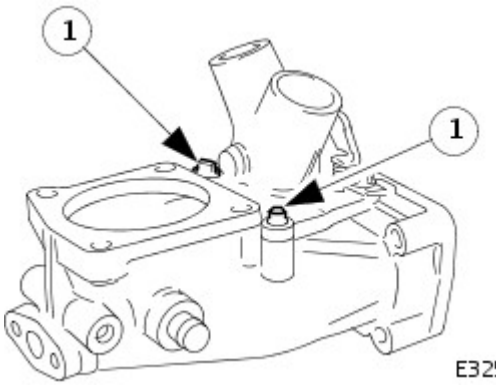
1. Release and pull back clips securing bypass hoses at charge air coolers.
2. Remove four bolts.
3. Remove hoses from charge air cooler stub pipes.

- Remove assembly from vehicle.

4. Discard gasket.

- Clean all mating faces.

8. Remove by-pass valve assembly from intake elbow.



1. Remove two bolts.

- Remove by-pass assembly from elbow and discard O-ring.

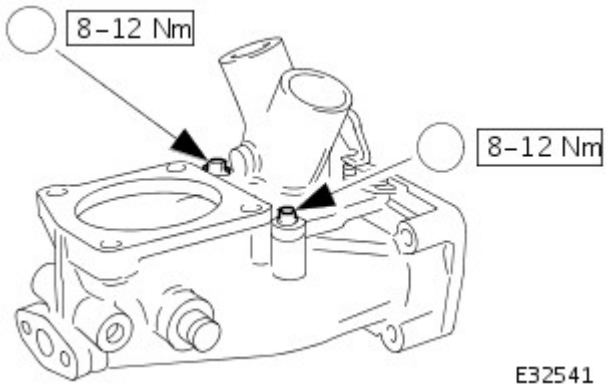
9. Where necessary, remove blanking plate from intake elbow.

- Remove bolts.
- Discard gasket.
- Clean all mating faces.

Installation

1. Where necessary, install blanking plate to intake elbow.

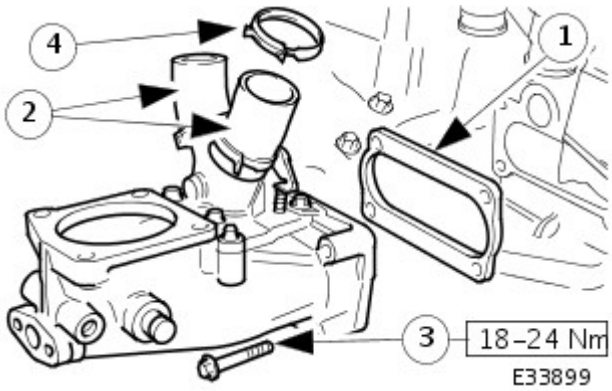
- Install new gasket.
- Install bolts (18-24Nm).



2. Install by-pass valve assembly to intake elbow.

- Install new O-ring and lubricate with petroleum jelly.

1. Install bolts.

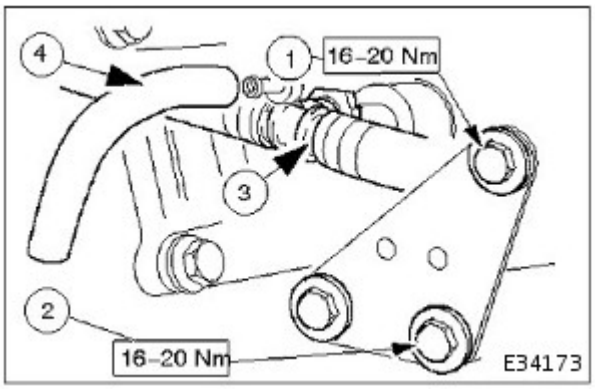


3. Install intake elbow to supercharger.

1. Install two bolts to intake elbow and install new gasket.
2. Position intake elbow assembly with by-pass hoses located on charge air cooler stub pipes.
3. Install and tighten four bolts .
4. Position hose securing clips.

4. Install left-hand support bracket to intake elbow and re-connect pipework.

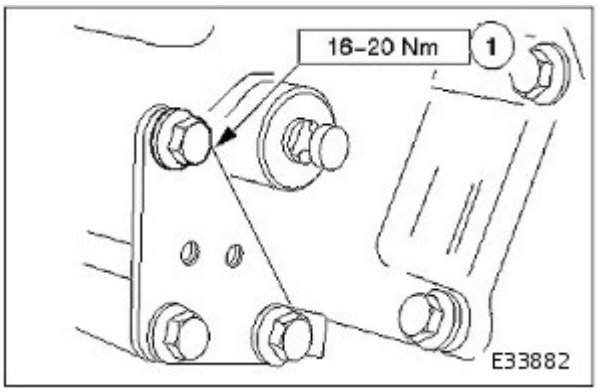
1. Install bolt.



2. Fully tighten two bolts.

3. Connect breather/purge pipe T-piece to intake elbow.

4. Connect vacuum pipe to intake elbow.



5. Install right-hand support bracket to intake elbow.

1. Install bolt.

6. Install exhaust gas re-circulation valve (EGR) if applicable; refer to 17.45.01.

7. Install throttle assembly; refer to 19.70.04.

8. Install air cleaner cover / intake assembly; refer to 19.10.30.

9. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Intake Air Distribution and Filtering - Throttle Body Elbow4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Special Tool(s)	
 E36393	Release tool - quick fit 310-044 (JD 182)
 E36394	Release tool 5 /16 - quick fit 310-054 (JD 203)

Removal

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

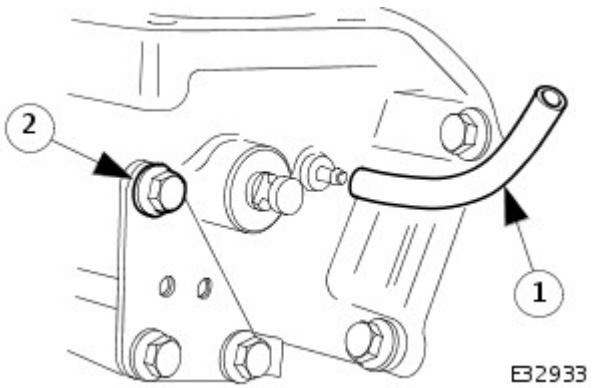
Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. Depressurize fuel system; refer to 19.50.02

3. Remove air cleaner cover / intake assembly; refer to 19.10.30.

4. Remove throttle body; refer to 19.70.04.

5. Release intake elbow from right-hand support bracket.

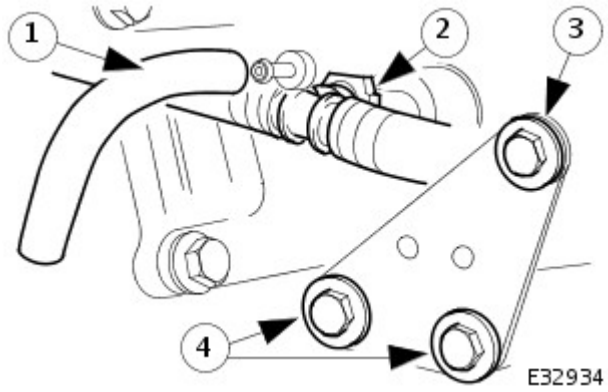


- Release brake servo vacuum pipe and disconnect pipe.

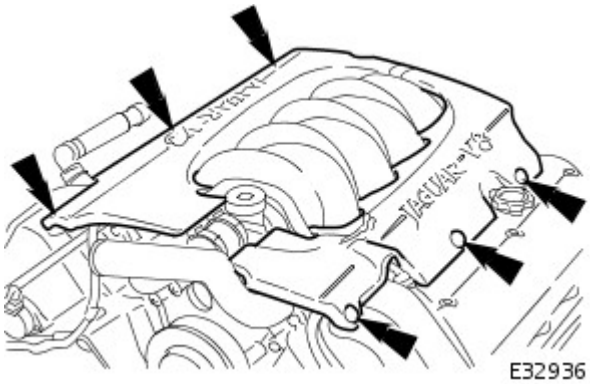
1. Disconnect vacuum pipe.
2. Remove bolt.

6. Release intake elbow from left-hand support bracket.

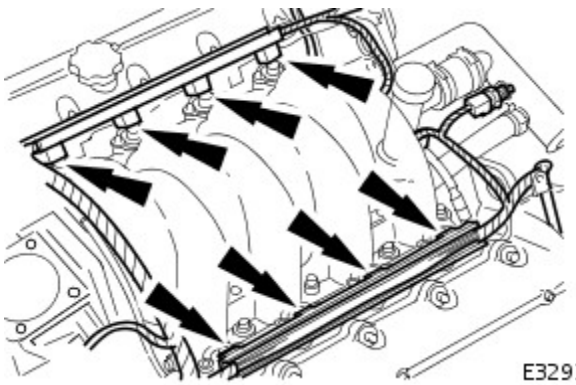
1. Disconnect vacuum pipe.
2. Disconnect engine breather T-piece.
3. Remove bolt.
4. Loosen, but do not remove two bolts.



7. Remove engine covers

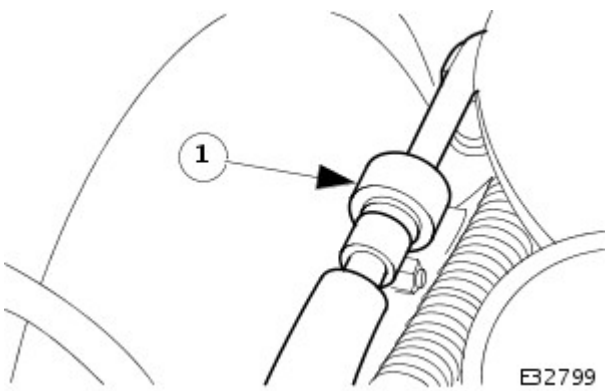


8. Disconnect electrical connector from each fuel injector.



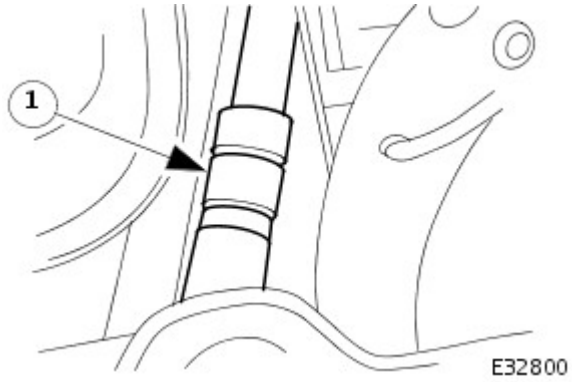
9. Disconnect fuel feed hose.

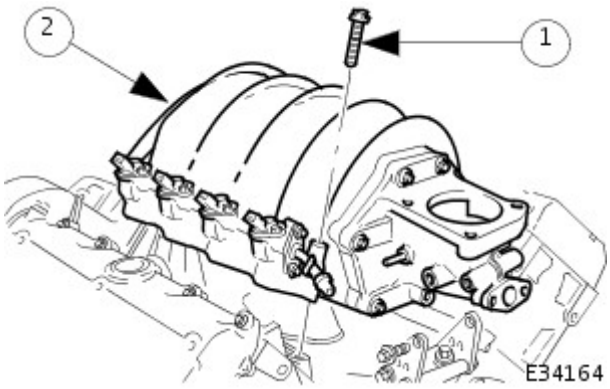
1. Use special tool 310-044 (JD 182).



10. Disconnect fuel return hose.

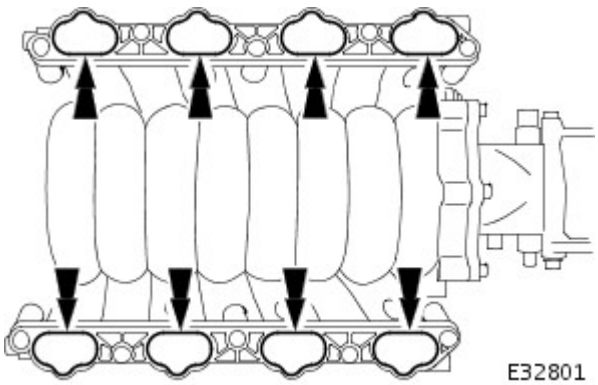
1. Use special tool 310-054 (JD 203).



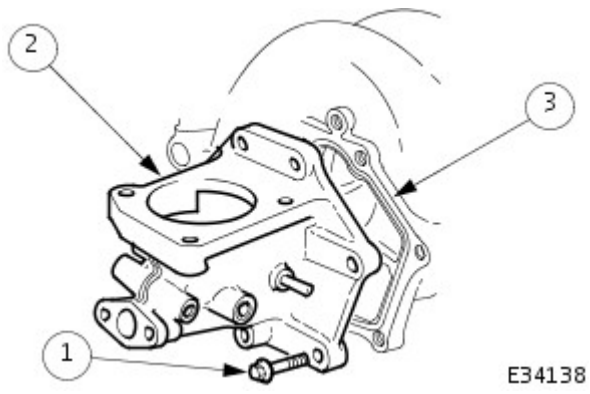


11. Remove intake manifold.

1. Remove ten bolts.
2. Remove intake manifold



12. Discard eight seals from intake manifold ports.



13. Remove throttle intake elbow from intake manifold.

1. Remove seven bolts.
2. Remove elbow.
3. Remove seal.

14. Where necessary, remove blanking plate from intake elbow.

- Remove bolts.
- Discard gasket.
- Clean all mating faces.

15. Clean manifold and mating faces on cylinder heads.

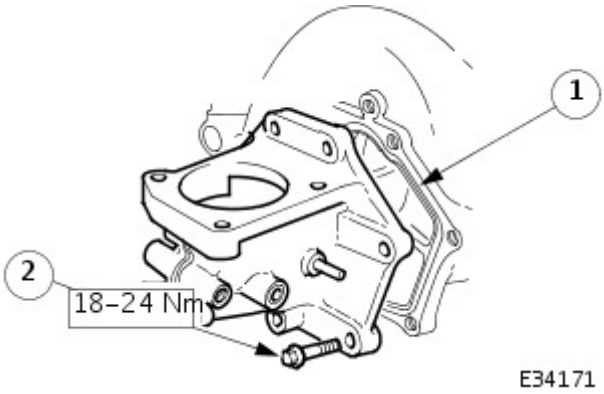
Installation

1. Where necessary, install blanking plate to intake elbow.

- Install new gasket.
- Install bolts (18-24Nm).

2. Install intake elbow to intake manifold.

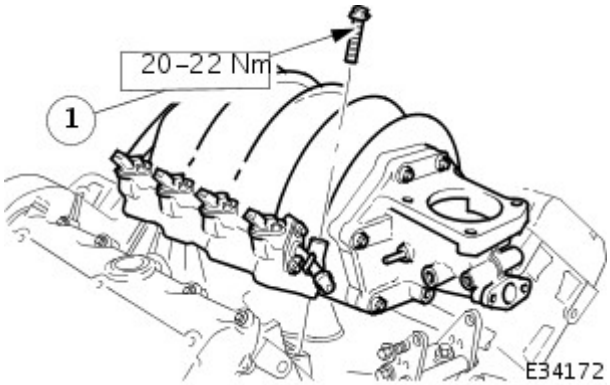
1. Install new seal.
2. Install seven bolts.



3. Install new seals to the eight intake manifold ports. Ensure the seals are fully seated.

4. Install intake manifold.

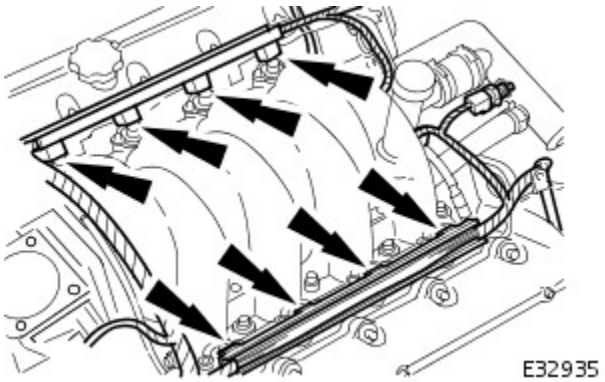
1. Install ten bolts.



5. Connect fuel feed hose to fuel rail feed pipe. Ensure hose is fully installed.

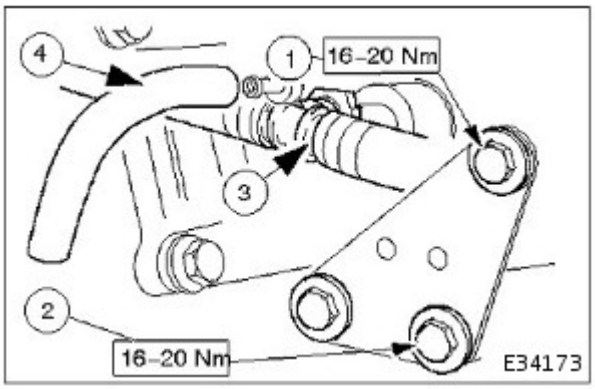
6. Connect fuel return hose to fuel rail return pipe. Ensure hose is fully installed.

7. Connect electrical connectors to fuel injectors.



8. Install left-hand support bracket to intake elbow and re-connect pipework.

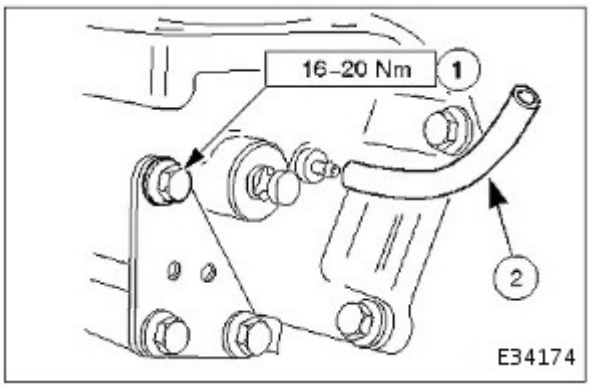
1. Install bolt.



2. Tighten two bolts.

3. Connect breather/purge pipe T-piece.

4. Connect vacuum pipe.



9. Install right-hand support bracket to intake elbow.

1. Install bolt.

2. Connect vacuum pipe.

10. Install throttle assembly; refer to 19.70.04.

11. Install air cleaner cover / intake assembly; refer to 19.10.30.

12. Install engine covers.

13. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Intake Air Distribution and Filtering - Throttle Body Elbow4.0L SC V8 - AJ26

Removal and Installation

Removal

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT WARNING NOTES GIVEN IN SECTION 100-00 (UNDER HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

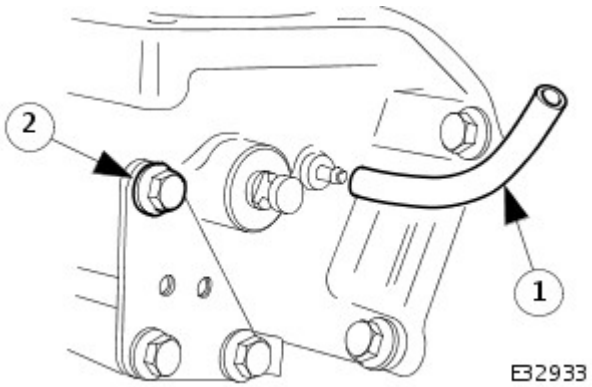
Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. Remove air cleaner cover / intake assembly; refer 19.10.30.

3. Remove throttle assembly; refer to 19.70.04.

4. Remove exhaust gas recirculation (EGR) valve where installed; refer 17.45.01.

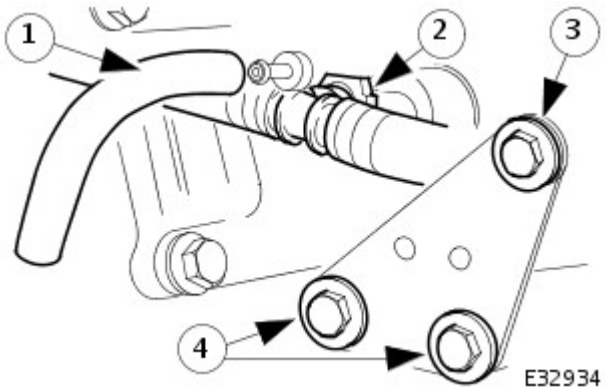
5. Release intake elbow from right-hand support bracket.



- Release brake servo vacuum pipe and disconnect pipe.

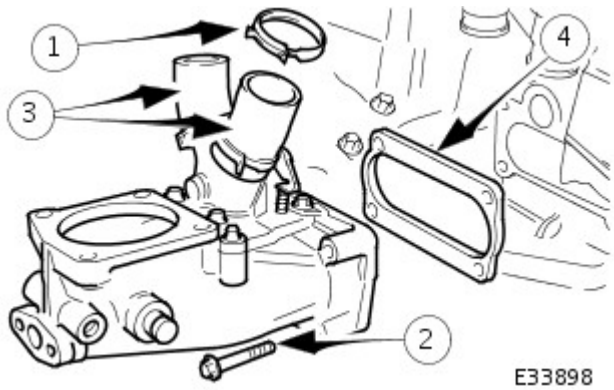
1. Disconnect vacuum pipe.
2. Remove upper bolt.

6. Release intake elbow from left-hand support bracket.



1. Disconnect vacuum pipe.
2. Disconnect engine breather T-piece.
3. Remove upper bolt.
4. Loosen, but do not remove, lower two bolts.

7. Remove intake elbow from supercharger.



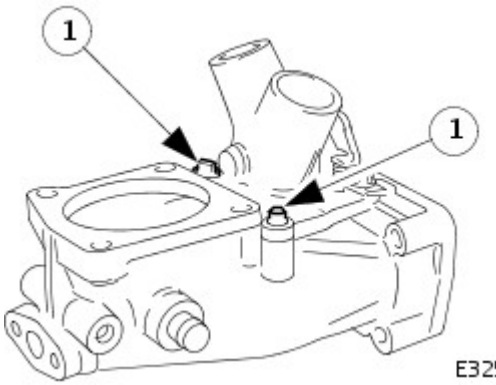
1. Release and pull back clips securing bypass hoses at charge air coolers.
2. Remove four bolts.
3. Remove hoses from charge air cooler stub pipes.

- Remove assembly from vehicle.

4. Discard gasket.

- Clean all mating faces.

8. Remove by-pass valve assembly from intake elbow.



1. Remove two bolts.

- Remove by-pass assembly from elbow and discard O-ring.

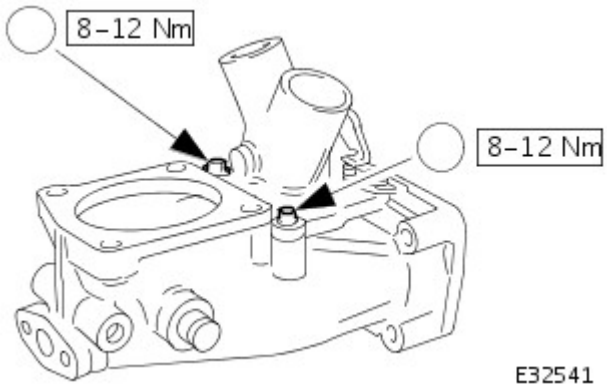
9. Where necessary, remove blanking plate from intake elbow.

- Remove bolts.
- Discard gasket.
- Clean all mating faces.

Installation

1. Where necessary, install blanking plate to intake elbow.

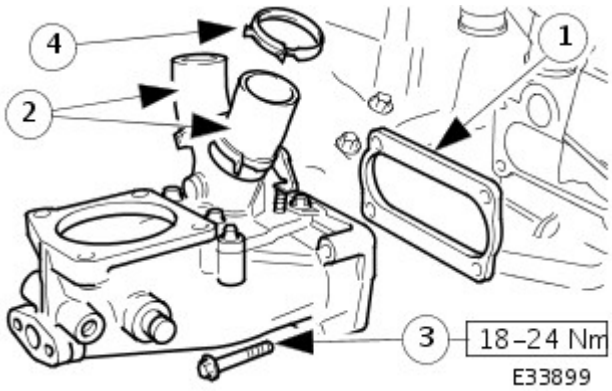
- Install new gasket.
- Install bolts (18-24Nm).



2. Install by-pass valve assembly to intake elbow.

- Install new O-ring and lubricate with petroleum jelly.

1. Install bolts.

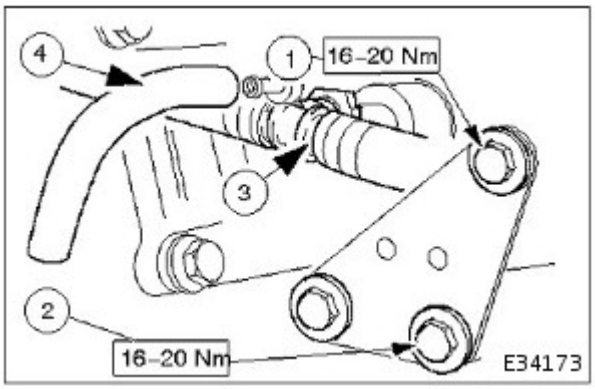


3. Install intake elbow to supercharger.

1. Install two bolts to intake elbow and install new gasket.
2. Position intake elbow assembly with by-pass hoses located on charge air cooler stub pipes.
3. Install and tighten four bolts .
4. Position hose securing clips.

4. Install left-hand support bracket to intake elbow and re-connect pipework.

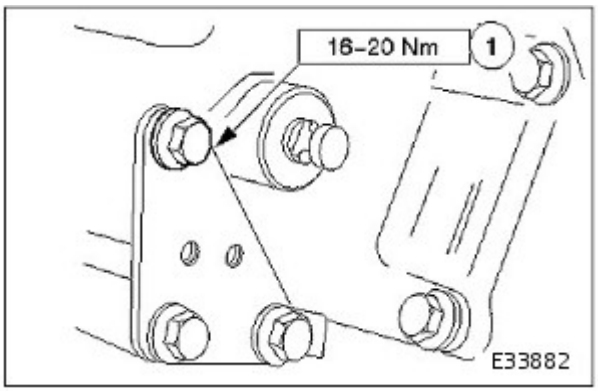
1. Install bolt.



2. Fully tighten two bolts.

3. Connect breather/purge pipe T-piece to intake elbow.

4. Connect vacuum pipe to intake elbow.



5. Install right-hand support bracket to intake elbow.

1. Install bolt.

6. Install exhaust gas re-circulation valve (EGR) if applicable; refer to 17.45.01.

7. Install throttle assembly; refer to 19.70.04.

8. Install air cleaner cover / intake assembly; refer to 19.10.30.

9. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Intake Air Distribution and Filtering - Throttle Body Elbow Gasket

Removal and Installation

Removal

1. Remove throttle intake elbow; refer to (SC)19.70.28.

Installation

1. Installation is a reversal of the removal procedure.

Intake Air Distribution and Filtering - Throttle Body Elbow Gasket4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal

1. Remove throttle intake elbow; refer to 19.70.28.

Installation

1. Installation is a reversal of the removal procedure.

Intake Air Distribution and Filtering - Throttle Body Elbow Gasket4.0L SC V8 - AJ26

Removal and Installation

Removal

1. Remove throttle intake elbow; refer to (SC)19.70.28.

Installation

1. Installation is a reversal of the removal procedure.

Evaporative Emissions - Evaporative Emissions

Description and Operation

To reduce the emission of fuel vapour, the fuel tank is vented to atmosphere through activated charcoal adsorption canister (s) which collects the fuel droplets. The charcoal is periodically purged of fuel when the EVAP Canister Purge Valve opens the vapour line between the canister(s) and the air intake induction elbow. This action allows manifold depression to draw air through the canister atmospheric vent, taking up the deposited fuel from the charcoal adsorber and burning the resulting fuel vapour in the engine.

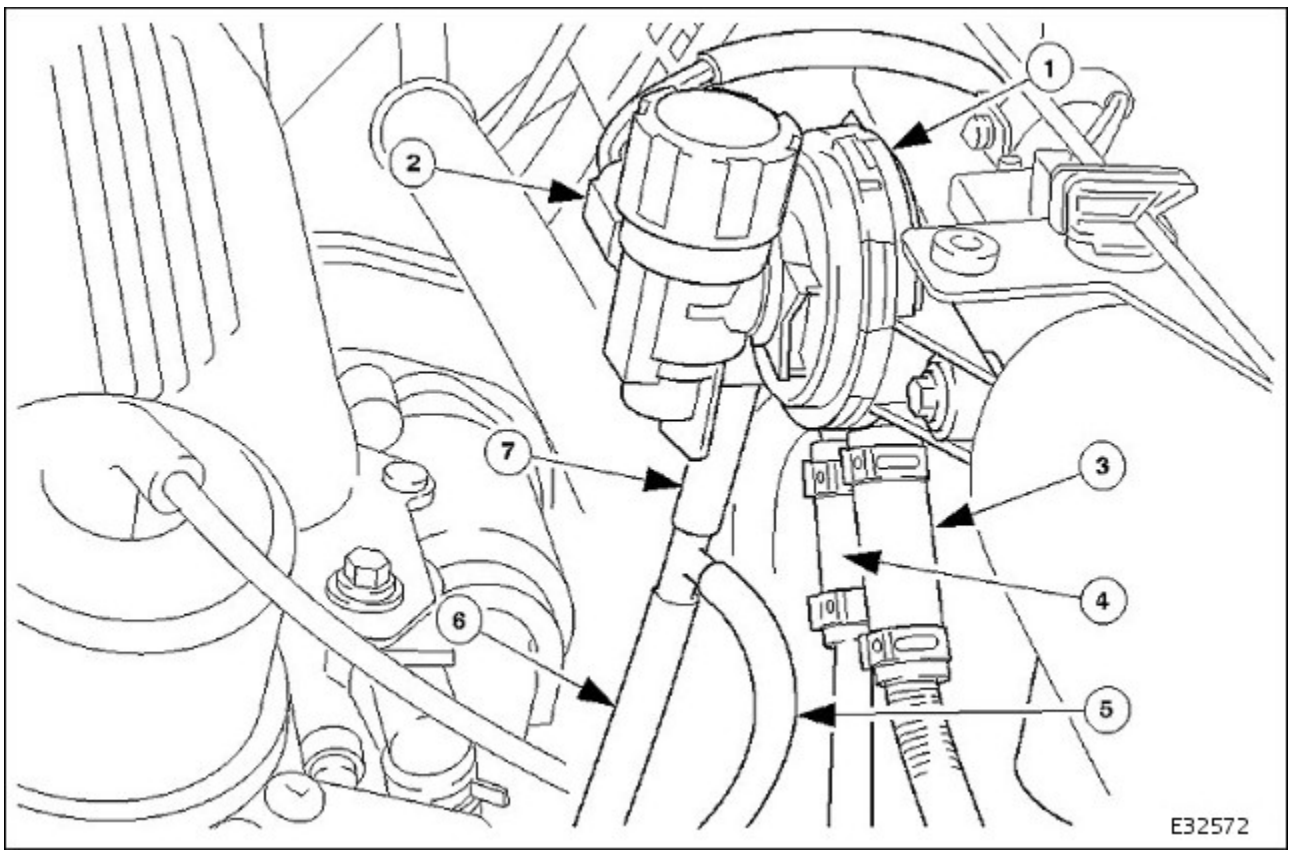
The EVAP Canister Purge Valve is controlled by the engine management system ECM. Purging is carried out in accordance with the engine management fueling strategy (see below).

The fuel tank vapour outlet is via a removeable flange assembly on the top surface of the tank. The vapour storage canister or canisters are fitted on the underside of the vehicle below the rear seats.

There are three variants of the evaporative system. All systems use the charcoal adsorber storage canisters and purge valve and operate as described above. The specific features of each system are described below. The evaporative systems are designated as :

- single canister system
- running loss system
- running loss with On-board Re-fueling Vapour Recovery (ORVR) system

EVAP Canister Purge Valve



Item	Part Number	Description
1	—	EVAP canister purge valve
2	—	Valve solenoid connector
3	—	Vapour outlet to induction elbow
4	—	Vapour inlet from canister(s)
5	—	Vacuum control pipe from induction elbow
6	—	Vacuum control pipe to vapour pressure control valve - applicable to single canister systems only
7	—	Vacuum control connection to EVAP valve

The EVAP canister purge valve controls the flow rate of fuel vapour drawn into the engine during the canister purge operation. The valve is opened by a vacuum feed from the induction elbow : the vacuum feed is controlled by the integral valve solenoid and is applied when the solenoid is energised. The solenoid is pulsed on (energised) and off by a fixed frequency (100Hz) variable pulse width control signal (pulse width modulation). By varying the pulse on to off time, the ECM controls the duty cycle of the valve (time that the valve is open to time closed) and thus the vapour flow rate to the engine.

With no ECM signal applied to the valve solenoid, the valve remains closed.

Canister Purge Operation

The following pre-conditions are necessary for purging to commence :

- after battery disconnection/reconnection, engine management adaptations must be re-instated.
- engine has run for at least 8 seconds.
- engine coolant temperature is not less than 70 °C.
- engine not running in the fuel cut off condition (eg overrun).
- the adaptive fuel correction function has not registered a rich or lean failure
- the evaporative emission leak test has not failed
- no faults have been diagnosted in the relevant sensor and valve circuits - Air Flow Meter (AFM), Engine Coolant Temperature sensor, Evaporative Canister Purge valve and Canister Close Valve (CCV).

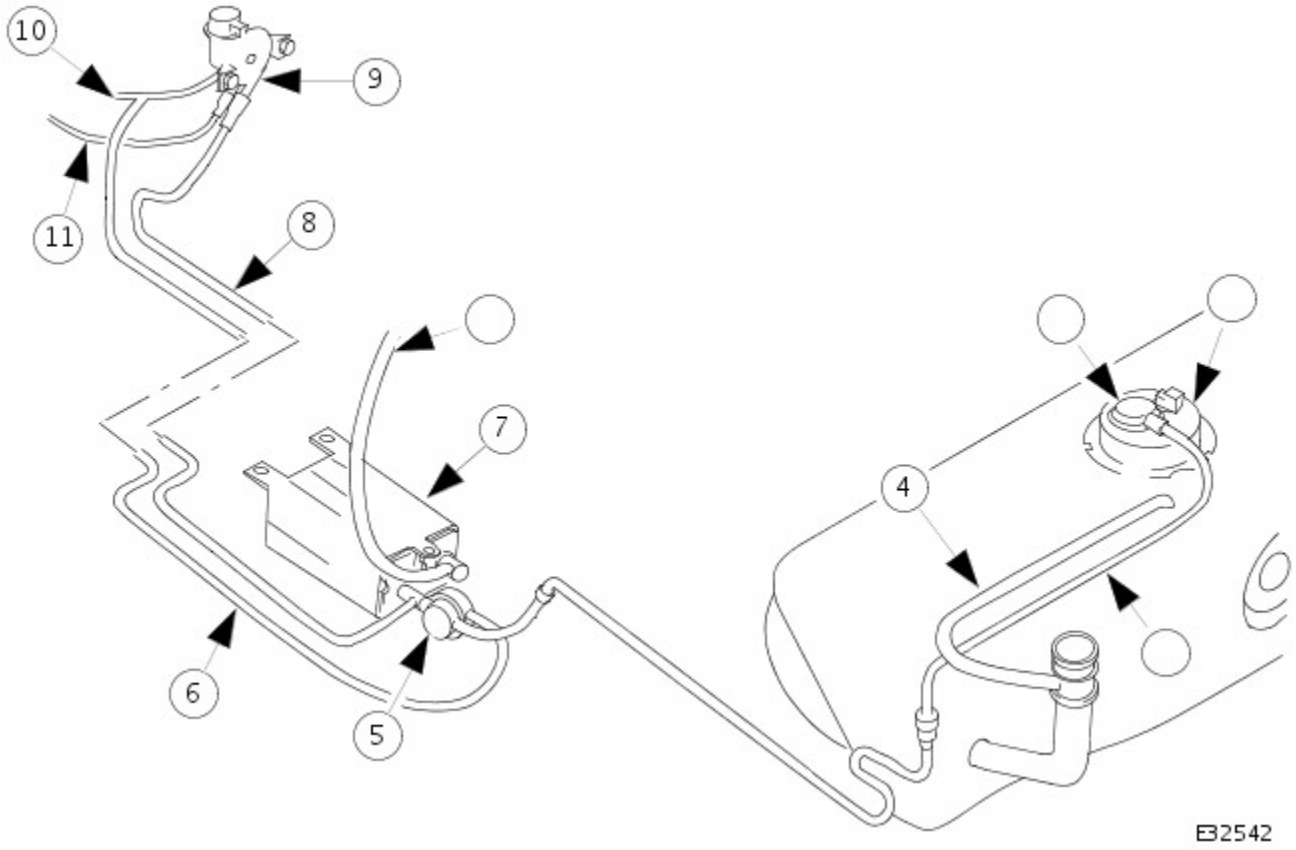
If these conditions have been satisfied, purging is started. If any failures are registered, purging is inhibited.

The canister(s) is purged during each drive cycle at various rates in accordance with the prevailing engine conditions. The engine management software stores a map of engine speed (RPM) against engine load (grams of air inducted / rev). For any given engine speed and load, a vapour purge rate is assigned (purge rate increases with engine speed and load).

The preset purge rates are based on the assumption of a vapour concentration of 100%. The actual amount of vapour is measured by the closed loop fueling system : the input of evaporative fuel into the engine causes the outputs from the upstream oxygen sensors to change, the amount of change providing a measure of the vapour concentration. This feedback causes the original purge rate to be adjusted and also reduces the amount of fuel input via the injectors to maintain the correct air to fuel ratio.

Engine speed/load mapping and the corresponding purge rates are different for single canister, running loss and ORVR evaporative systems.

Single Canister System



Item	Part Number	Description
1	—	Evaporative flange assembly
2	—	Vapour outlet rollover valve
3	—	Tank vapour outlet pipe
4	—	Breather pipe
5	—	Pressure control valve
6	—	Induction vacuum control pipe
7	—	Charcoal canister
8	—	Canister vapour outlet pipe
9	—	EVAP canister purge valve
10	—	Vacuum control signal from induction
11	—	EVAP canister purge valve outlet
12	—	Canister vent to atmosphere

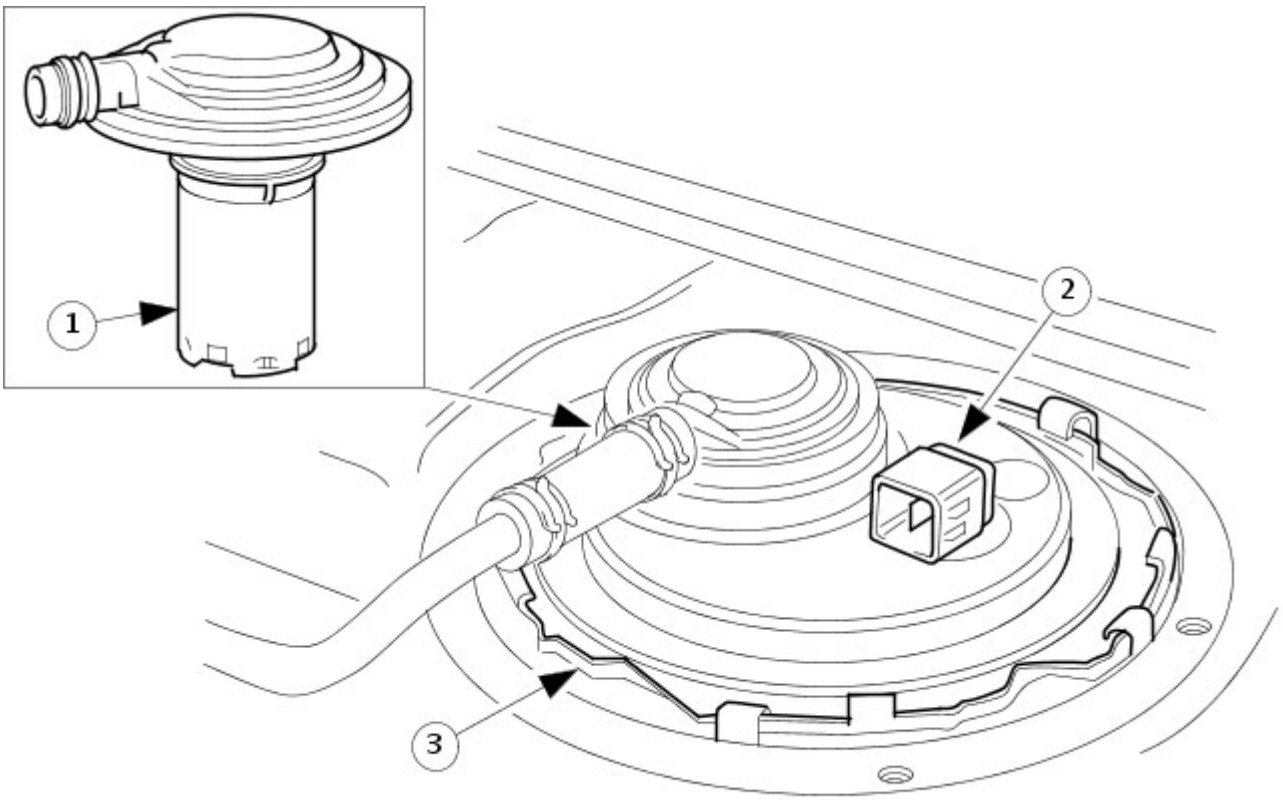
This system uses a single charcoal canister with a pressure control valve between the canister and the fuel tank vapour outlet. A vacuum control pipe is connected from the engine intake induction elbow to the pressure control valve. The vapour outlet from the fuel tank is taken via a safety rollover valve fitted to the removeable flange at the top of the tank.

With the engine stopped, the pressure control valve is closed, maintaining a slight positive pressure in the tank : any further increase in pressure causes the valve to open and release vapour to the canister.

When the engine is running, manifold depression (via the vacuum control pipe) holds the pressure control valve open. Air is drawn into the tank to maintain atmospheric pressure as fuel is used and vapourised fuel is deposited in the charcoal canister.

Canister purge operation is as described in Evaporative Emissions Control.

Evaporative Flange Assembly



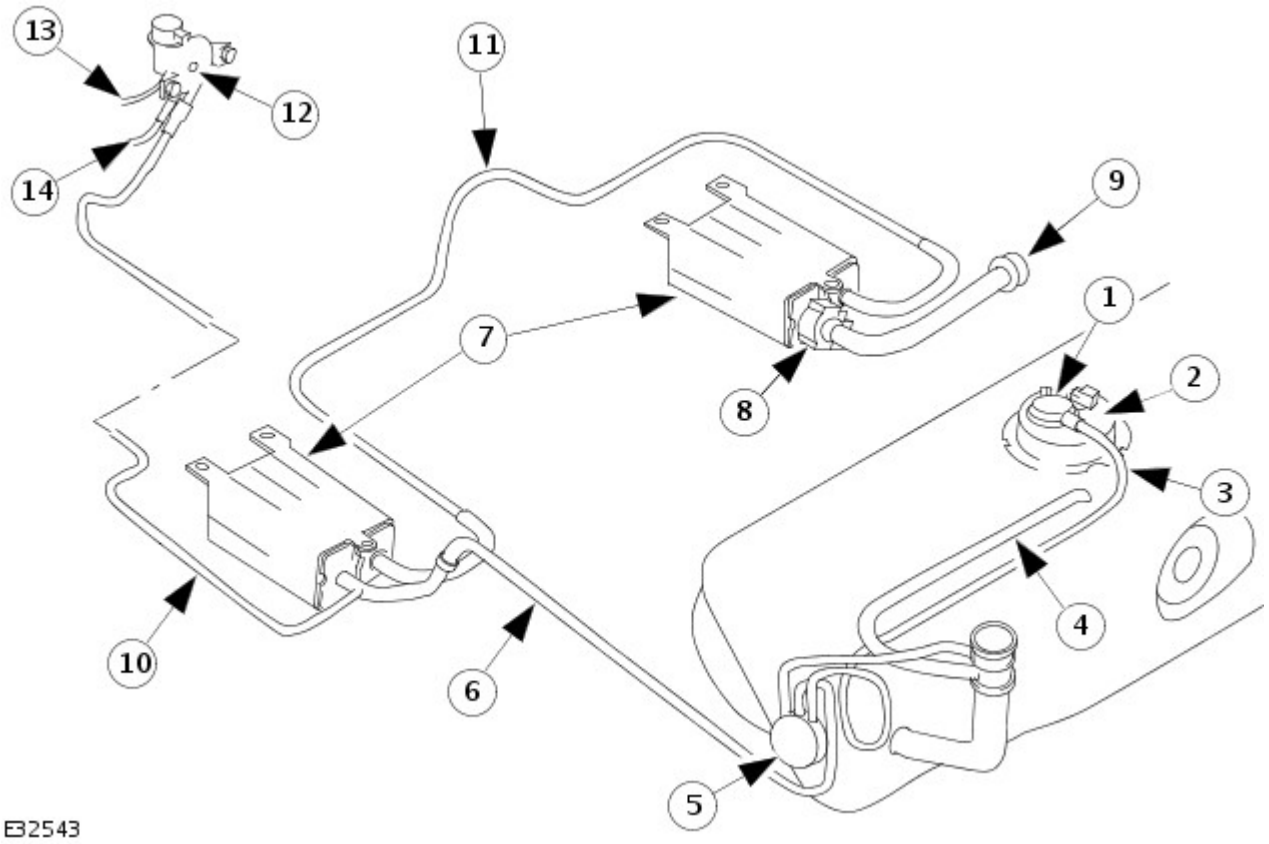
E32545

Item	Part Number	Description
1	—	Vapour vent / rollover protection valve
2	—	Fuel pump connector
3	—	Evaporative loss flange locking ring

The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring. The assembly is removeable complete with the fitted components.

The vapour vent / rollover valve is a push fit via a sealing grommet. The fuel pump connector is push fitted and crimped into a location tube on the underside of the flange.

Running Loss System



Item	Part Number	Description
1	—	Vapour outlet rollover valve
2	—	Evaporative flange assembly
3	—	Tank vapour outlet pipe
4	—	Breather pipe
5	—	Pressure control valve
6	—	Vapour pipe to canister
7	—	Charcoal canisters
8	—	Canister close valve
9	—	Vent pipe air filter
10	—	Canister purge outlet pipe
11	—	Vapour pipe connecting canisters
12	—	EVAP canister purge valve
13	—	Vacuum control signal from induction elbow
14	—	EVAP purge valve outlet to induction elbow

The running loss system has the following features :

- a normally open pressure control valve is fitted at the lefthand side of the tank.
- two charcoal canisters are connected in series to reduce the concentration of fuel in vapour vented to atmosphere.
- a tank pressure sensor and canister close valve are fitted to allow the on-board diagnostic facility to test for leaks in the fuel and evaporative system.

The pressure control valve allows continuous venting of vapour to the charcoal canisters during normal running but prevents fuel entering the vent line during refueling. Fuel vapour from the tank passes through the valve to the lefthand canister and a third pipe connects the valve to the filler neck. When refueling, the difference in pressure between the tank interior and the open filler neck causes the valve to close, shutting off the vapour vent line. When the fuel cap is replaced, the pressures are equalised and the pressure control valve opens the vent line to the canisters.

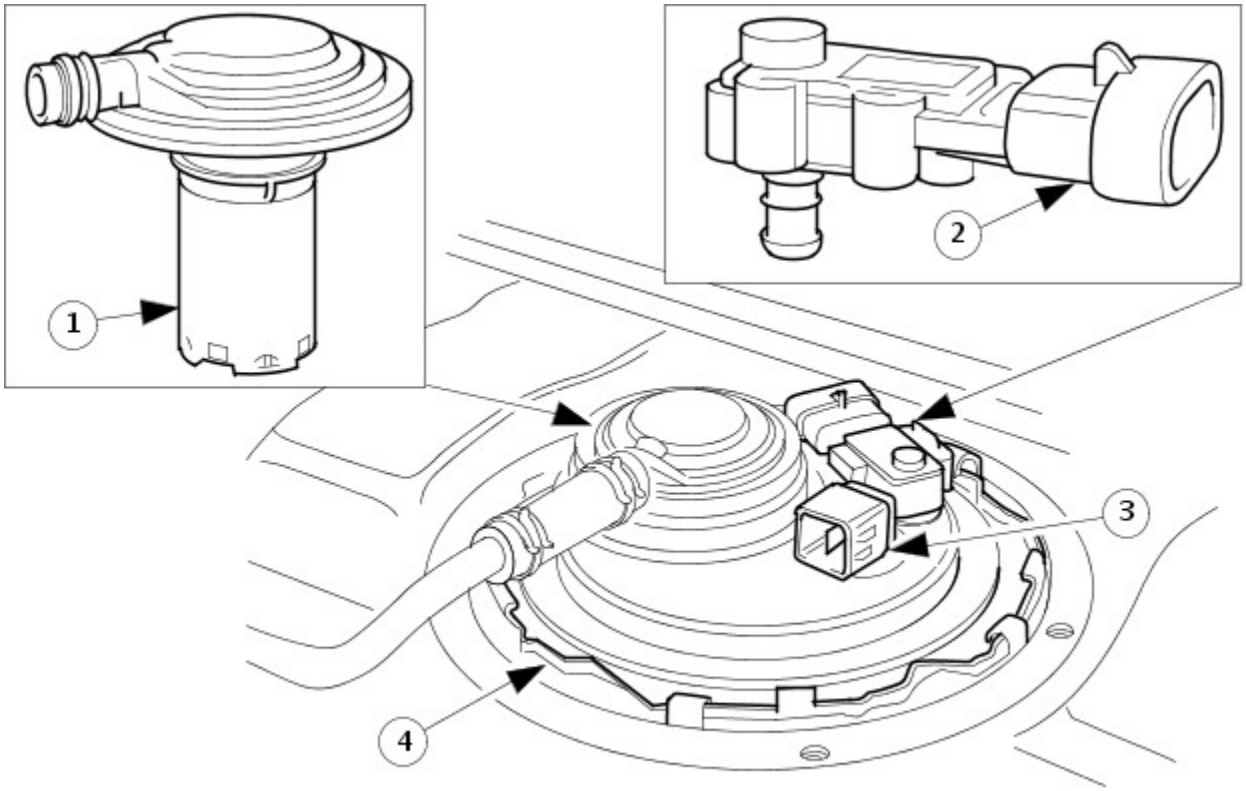
The canister close valve is a solenoid operated device controlled by the ECM. The valve is normally open and is closed only during the leak test sequence.

The fuel pressure sensor is fitted to the evaporative loss flange and provides a voltage to the ECM which is proportional to

tank vapour pressure.

Canister purge operation is as described in Evaporative Emissions Control.

Evaporative Flange Assembly



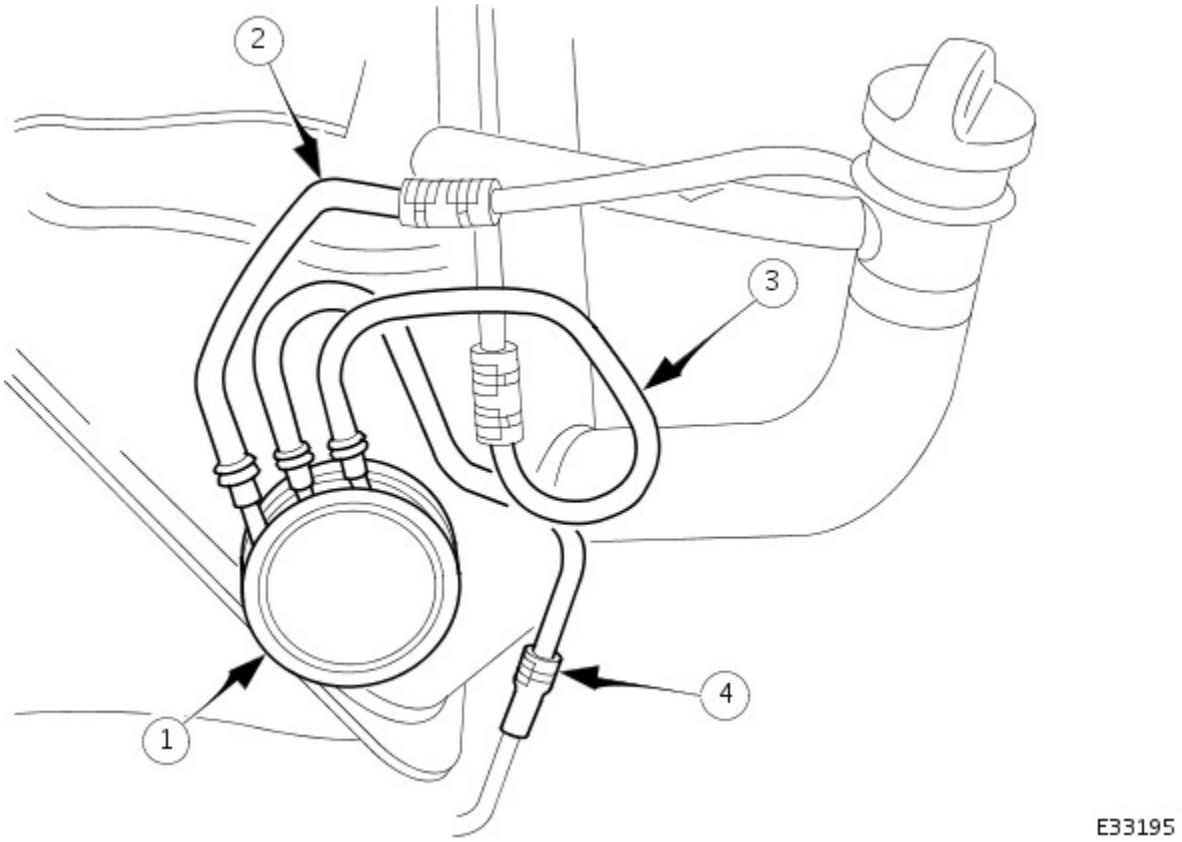
E32546

Item	Part Number	Description
1	—	Vapour vent / rollover protection valve
2	—	Pressure sensor
3	—	Fuel pump connector
4	—	Evaporative loss flange locking ring

The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring. The assembly is removeable complete with the fitted components.

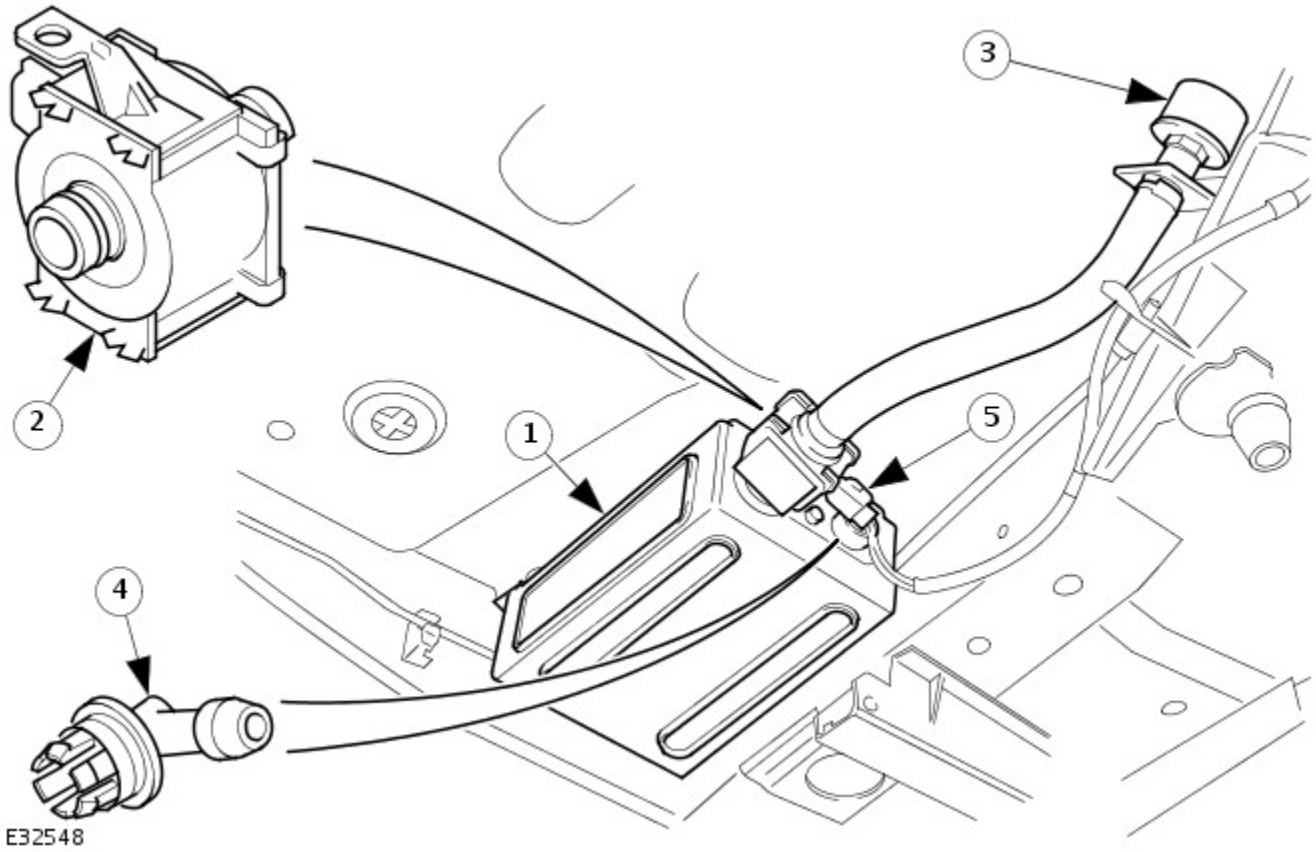
The vapour vent / rollover valve and pressure sensor are a push fit via sealing grommets. The fuel pump connector is push fitted and crimped into a location tube on the underside of the flange.

Pressure Control Valve



Item	Part Number	Description
1	—	Pressure control valve
2	—	Filler neck pressure sensing pipe
3	—	Vapour pipe from tank
4	—	Vapour outlet pipe to underfloor canister

The pressure control valve is fastened by adhesive to the lefthand side of the tank. It is a non-serviceable component.



Item	Part Number	Description
1	—	Charcoal canister (righthand) in mounting bracket
2	—	Canister close valve (showing canister stub pipe)
3	—	Air filter
4	—	Quick-fit vapour inlet connector
5	—	Canister close valve electrical connector

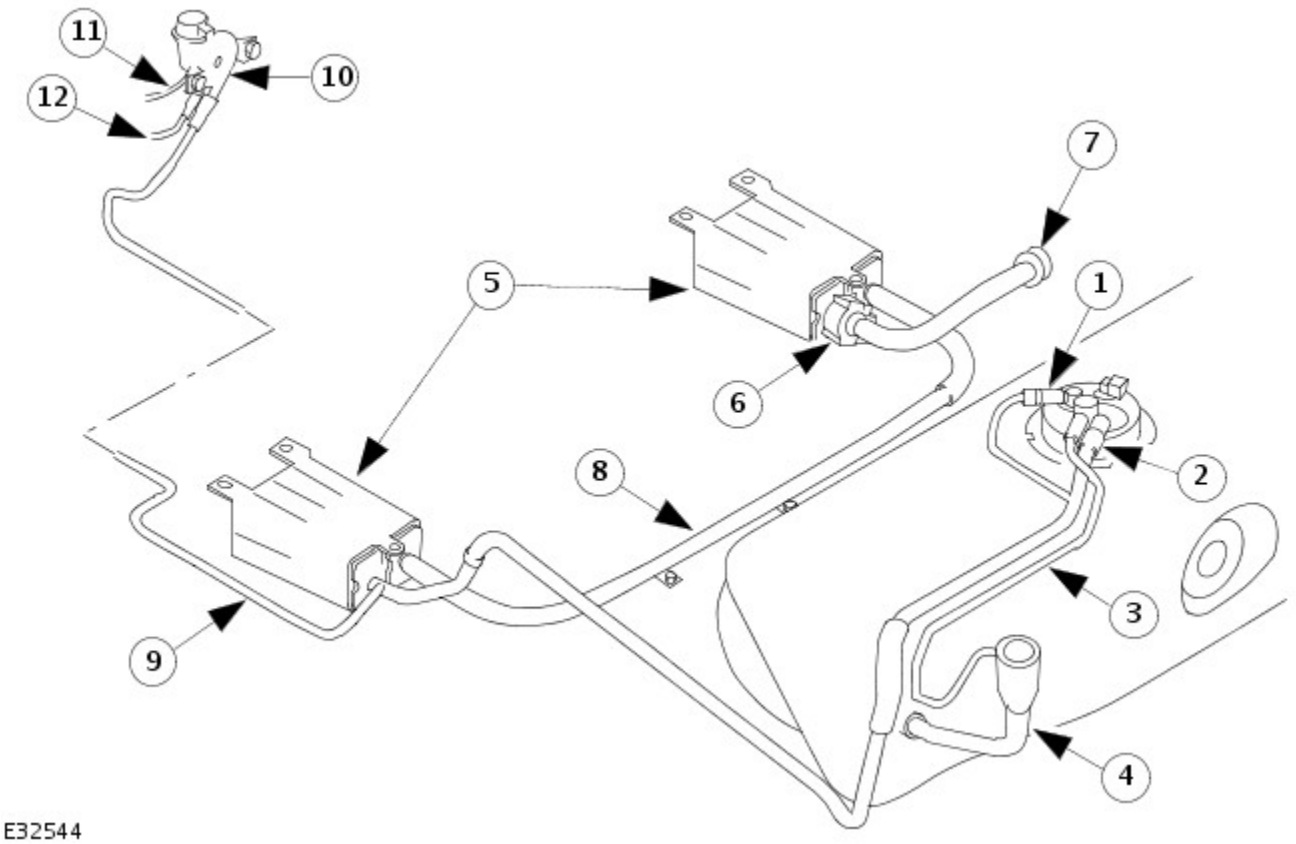
The canisters are fixed to the underside of the vehicle either directly or via semi-enclosed mounting brackets. Two fixing bolts are used at the front of the canister(or bracket) and a single rear bolt supports the canister and the canister close valve (CCV).

The vapour pipes to the canisters, other than the CCV, use multi-tang connectors which are push fitted and pulled out without the use of tools.

The canister close valve has a stub pipe with 'O' ring seal which is a simple push fit into the canister. A mounting bracket on the canister close valve enables it to be secured to the underbody via the canister rear mounting bolt.

A hose connects the CCV to the bracket mounted adaptor into which the vent system air filter is screwed.

Running Loss with On-board Refueling Vapour Recovery (ORVR) System



E32544

Item	Part Number	Description
1	—	Grade vent valve outlet
2	—	Vapour outlet from fill level vent valve (FLVV)
3	—	FLVV pressure relief valve outlet pipe
4	—	Narrow diameter fuel filler tube
5	—	Charcoal canisters
6	—	Canister close valve
7	—	Vent pipe air filter
8	—	Vapour pipe connecting canisters
9	—	Canister purge outlet pipe
10	—	EVAP canister purge valve (engine bay)
11	—	Vacuum control signal from induction elbow
12	—	EVAP purge valve outlet to induction elbow

The system has the following features :

- on-board refueling vapour recovery (ORVR) to reduce the fuel vapour vented directly to atmosphere from the filler nozzle when refueling.
- two charcoal canisters are connected in series to reduce the concentration of fuel in vapour vented to atmosphere.
- a tank pressure sensor and canister close valve are fitted to allow the on-board diagnostic facility to test for leaks in the fuel and evaporative system.

The canister close valve is a solenoid operated device controlled by the ECM. The valve is normally open and is closed only during the leak test sequence.

The fuel pressure sensor is fitted to the evaporative loss flange and provides a voltage to the ECM which is proportional to tank vapour pressure.

Operation of ORVR System

The ORVR system enables fuel vapour generated during re-fueling to be collected by the charcoal canisters. During normal running of the vehicle, the vapour is collected and purged in the same way as for non-ORVR systems.

The ORVR system features are :

- Narrow fuel filler pipe and tank check valve.
- Fuel level vent valve (FLVV) fitted to the evaporative flange and consisting of a two stage shut-off valve with rollover protection and a pressure relief valve.
- Grade vent valve with rollover protection, fitted to the evaporative flange and with an outlet pipe connected to the FLVV vapour outlet pipe.
- Large bore vapour vent pipes.

The fuel filler pipe has a reduced diameter between the nozzle guide and the tank, providing a liquid seal when re-fueling and preventing the fuel vapour venting directly to atmosphere. There is no breather tube fitted between the tank and the filler nozzle. To prevent spit back when re-fueling, a check valve is fitted at the lower end of the filler pipe inside the tank (see Figure).

During re-fueling, the tank is vented to atmosphere via the fuel level vent valve (FLVV), large bore vapour pipes and the charcoal canisters. The FLVV incorporates a float valve which is closed by the rising fuel level, creating a back pressure and causing the fuel delivery to stop. In the closed position, the FLVV also sets the fuel level.

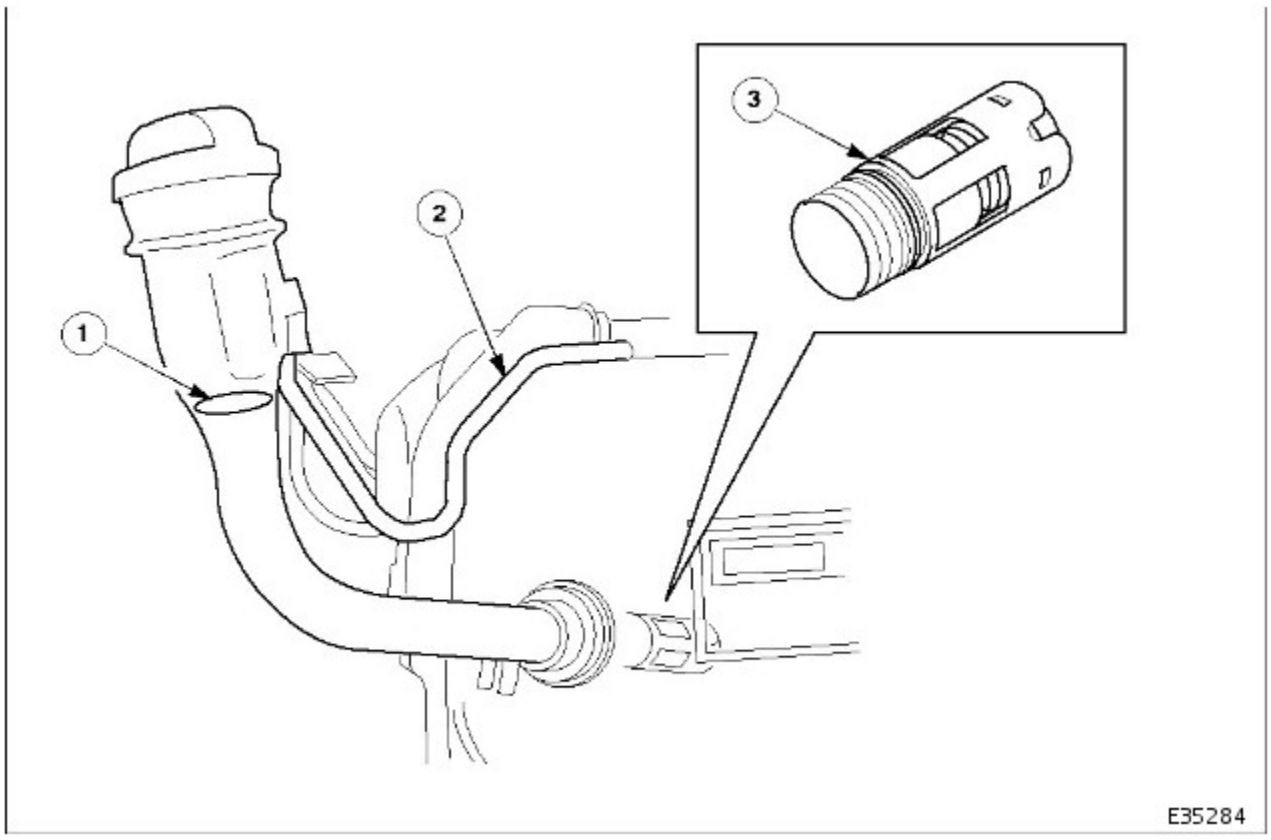
With the FLVV closed (tank full), any increase in pressure or overfilling is relieved by a separate rollover protected grade vent valve. The outlet from this valve feeds into the main FLVV vapour outlet pipe, bypassing the closed FLVV.

When the fuel level is below full, the FLVV opens to allow unrestricted venting via the canisters.

A pressure relief valve is incorporated into the FLVV assembly and has an outlet pipe to the filler nozzle,. If a blockage or other restriction (eg, canister close valve failing in the closed position) occurs in the vapour vent system, the pressure relief valve opens to allow venting to atmosphere via the filler nozzle guide and fuel filler cap.

Canister purge operation is as described in Evaporative Emissions Control.

Filler Tube and Check Valve

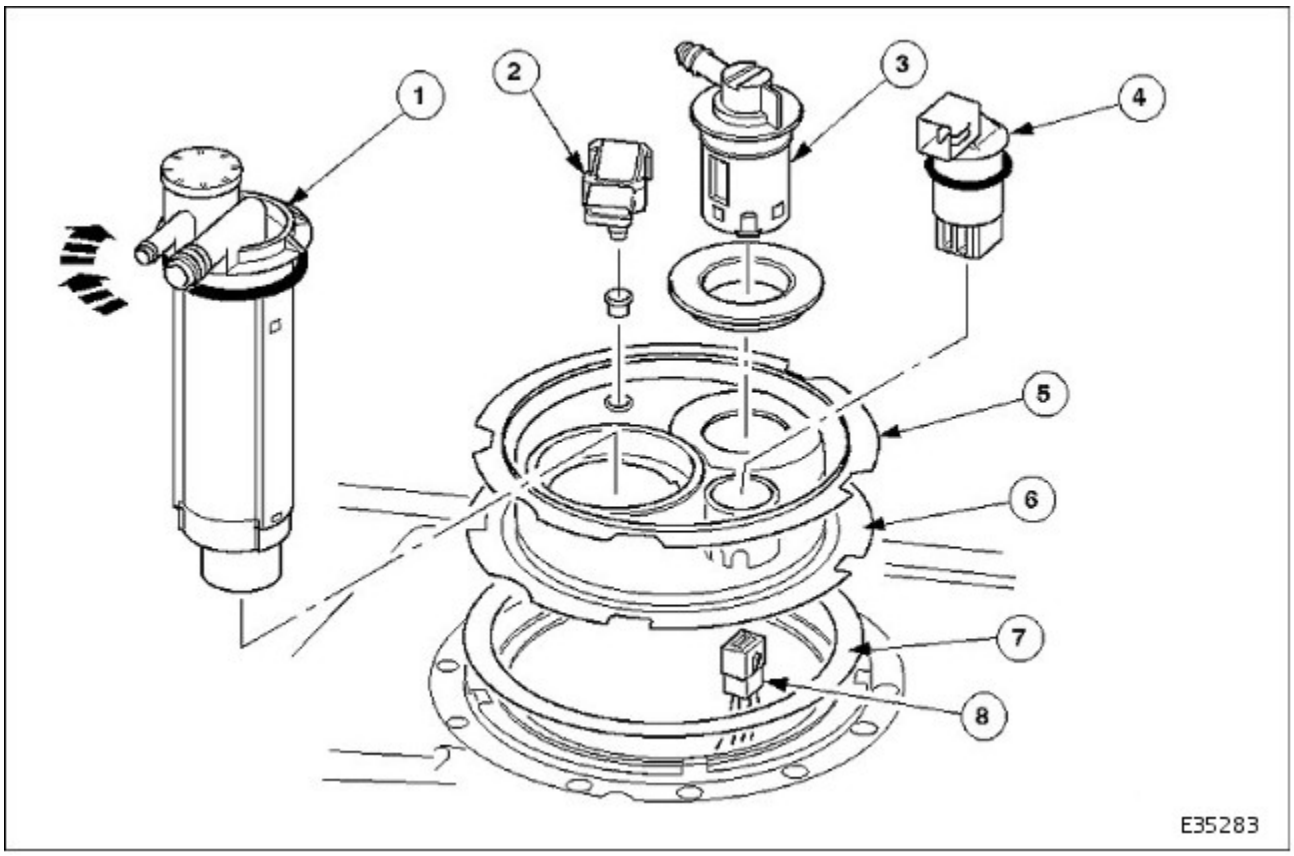


Item	Part Number	Description
1	—	Anti-surge valve
2	—	Pressure relief pipe
3	—	Check valve

The fuel filler cap is the same as that used on non-ORVR systems.

The check valve assembly is a push fit into the end of the fuel filler tube and is accessible with the evaporative flange removed. The valve has a light spring loading and opens under the inflow of fuel.

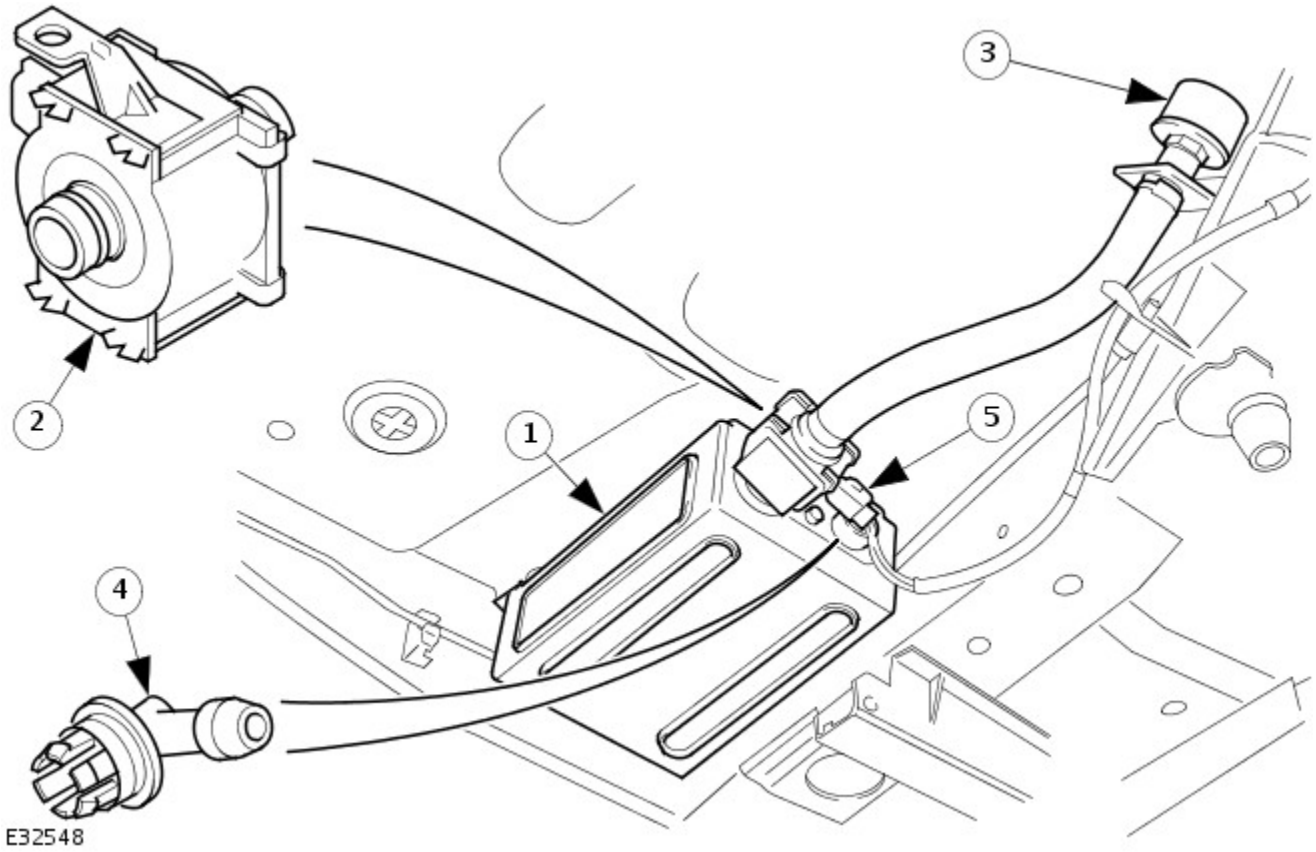
ORVR Evaporative Loss Flange Assembly



Item	Part Number	Description
1	—	Fill level vent valve (FLVV) / pressure relief valve assembly
2	—	Pressure sensor
3	—	Grade vent valve
4	—	Fuel pump connector
5	—	Locking ring
6	—	Evaporative loss flange (ELF)
7	—	Seal
8	—	Fuel pump link lead

The evaporative loss flange assembly is fitted to the top of the tank via a seal and locking ring arrangement identical to that used for non-ORVR systems. The assembly is removeable complete with the fitted components.

The fuel level vent valve (FLVV) is mounted in the ELF assembly via a bayonet fitting : it is turned approximately 90 ° clockwise to release. The grade vent valve and pressure sensor are push in fits via sealing grommets : note that, due to the tight fit, removal of these components may require cutting the grommets. The fuel pump connector is push fitted and crimped into a location tube on the underside of the flange.



Item	Part Number	Description
1	—	Charcoal canister (righthand) in mounting bracket
2	—	Canister close valve (showing canister stub pipe)
3	—	Air filter
4	—	Quick-fit vapour inlet connector
5	—	Canister close valve electrical connector

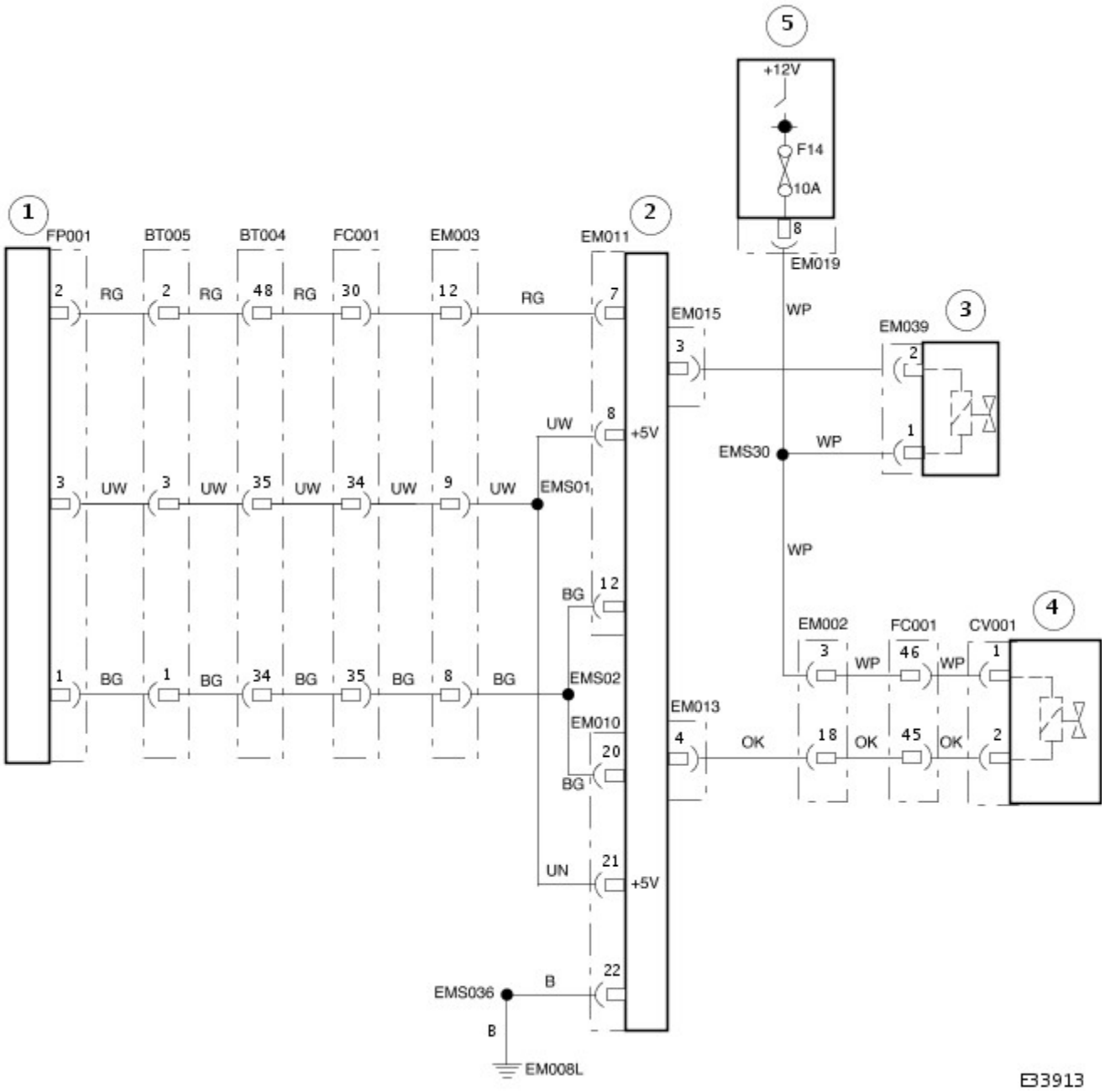
The canisters are fixed to the underside of the vehicle either directly or via semi-enclosed mounting brackets. Two fixing bolts are used at the front of the canister(or bracket) and a single rear bolt supports the canister and the canister close valve (CCV).

The vapour pipes to the canisters, other than the CCV, use multi-tang connectors which are push fitted and pulled out without the use of tools.

The canister close valve has a stub pipe with 'O' ring seal which is a simple push fit into the canister. A mounting bracket on the canister close valve enables it to be secured to the underbody via the canister rear mounting bolt.

A hose connects the CCV to the bracket mounted adaptor into which the vent system air filter is screwed.

Circuit diagram, evaporative emissions systems



Item	Part Number	Description
1	—	Fuel tank pressure sensor (if applicable)
2	—	Engine management ECU
3	—	EVAP canister purge valve
4	—	EVAP canister close valve (if applicable)
5	—	Engine management fusebox - IGN supply

Evaporative Emissions - Evaporative Emissions

Diagnosis and Testing

Preliminary Inspection

1. **1.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Throttle body • Poly-vee belt	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

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

3. **3.** If the concern is not visually evident, verify the symptom and proceed with diagnosis, using the Jaguar approved diagnostic system, where available.

4. **4.** Where K-Line or Vacutec equipment is available, it should be used as an aid to diagnosis. The equipment must be capable of testing to the 0.020 thou standard (2001 MY on).

Diagnostic Drive Cycles

Following the setting of a DTC, the appropriate repairs must be carried out, and the normal operation of the system checked. This will be done by performing a series of drive cycles which will enable the vehicle to operate the evaporative emissions system as a function check. For details of the drive cycles,
REFER to Section 303-14 Electronic Engine Controls.
ECM adaptations.

Diagnostic Trouble Code (DTC) index/Symptom Chart

1. **1.** Where the Jaguar approved diagnostic system is available, complete the S93 report before clearing any or all fault codes from the vehicle.

• NOTE: If a DTC cannot be cleared, then there is a permanent fault present that flags again as soon as it is cleared. (The exception to this is P1260, which will only clear following an ignition **OFF/ON** cycle after rectification).

2. **2.** If the cause is not visually evident and the Jaguar approved diagnostic system is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTC) Index Chart, or the Symptom Chart if no DTCs are set.

3. **3.** Using the Jaguar approved diagnostic system where available, and a scan tool where not, check the freeze frame data for information on the conditions applicable when the fault was flagged. The format of this will vary, depending on the tool used, but can provide information useful to the technician in diagnosing the fault.

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

• NOTE: When performing electrical 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.

Symptom Chart

Symptom	Possible Source	Action
Difficulty in filling	• Restriction in the vapor line between the fuel tank and the carbon canister outlet/atmospheric port	Check for free flow of air.
Fuel smell	• Adaptations incomplete • Canister purge valve inoperative	Carry out the adaptations procedure, REFER to Section 303-14 Electronic Engine Controls. Check canister purge valve operation.
Message center display (see below)	• Fuel filler cap missing/not tightened after refuelling	Check fuel filler cap condition and fitment.

Driver Information

• NOTE: Use this table to identify DTCs associated with the message center display, then refer to the DTC index for possible sources and actions.

• NOTE: A trip is an ignition **OFF**, 30 seconds delay, ignition **ON** cycle, plus a minimum coolant temperature increase of 22° C (40°F) after which the coolant temperature should reach a minimum 71°C (160°F)

Warning Light	Message	Default Mode	DTC
Red	Check Engine (after two trips)	ECM default (canister purge inhibited, adaptive fuel metering inhibited)	P0442, P0444, P0445, P0447, P0448.
Red	Check Engine (after two trips)	None	P0452, P0453.

Diagnostic Trouble Code (DTC) index

Diagnostic Trouble Code	Description	Possible Source	Action
P0442	System leak detected	• Fuel tank filler cap seal defective • System leak (canister damage, pipework damage) • Canister close valve leaking • Fuel tank leak	Check filler cap, system pipework, fuel tank,GO to Pinpoint Test A. . For fuel tank information, REFER to Section 310-01 Fuel Tank and Lines.
P0444	Canister purge valve circuit open circuit	• Canister purge valve to ECM drive circuit; open circuit, high resistance • Canister purge valve failure	For purge valve circuit tests,GO to Pinpoint Test B. .
P0445	Canister purge valve circuit short circuit	• Canister purge valve to ECM drive circuit; short circuit to ground • Canister purge valve failure (stuck closed)	For purge valve circuit tests,GO to Pinpoint Test B. .
P0447	Canister close valve (CCV) circuit open circuit.	• CCV power supply circuit; open circuit, short circuit • CCV to ECM drive circuit; open circuit, high resistance, short circuit to B+ voltage • CCV failure	For CCV circuit tests,GO to Pinpoint Test C. .
P0448	Canister Close Valve (CCV) circuit short circuit	• Canister close valve to ECM drive circuit; short circuit to ground • Canister close valve failure	For CCV circuit tests,GO to Pinpoint Test C. .
P0452	Fuel tank Pressure (FTP) sensor circuit; low voltage (low pressure)	• FTP sensor disconnected • FTP sensor to ECM sense circuit; open circuit, short circuit to ground • FTP sensor to ECM power supply circuit open circuit, short circuit to ground • FTP sensor failure	For FTP sensor circuit tests,GO to Pinpoint Test D. .
P0453	Fuel tank Pressure (FTP) sensor circuit; high voltage (high pressure)	• FTP sensor to ECM signal ground circuit open circuit • FTP sensor to ECM wiring (supply, sense, signal ground), short circuit to each other • FTP sensor to ECM sense circuit short circuit to B+ voltage • FTP sensor failure	For FTP sensor circuit tests,GO to Pinpoint Test D. .

Pinpoint Tests

PINPOINT TEST A : P0442; SYSTEM LEAK DETECTED	
• NOTE: For K-Line or Vacutec equipment connection, see bulletin 05.1-29, or Vacutec operating instructions	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: CHECK PIPEWORK, ETC FOR LEAKS	
	1 Carry out a visual inspection of all accessible pipes, connectors and components. Rectify any faults noted.
	2 Using K-line or Vacutec equipment, check the joints/connections in the following order: • Filler cap • Canister purge valve • Underfloor purge line connectors • Carbon canister connections and vapor hoses • Canister close valve and it's atmospheric port (disconnect the air vent tube if necessary)
	Was a fault found? **Yes** Rectify the fault as necessary. Repeat the K-line or Vacutec test. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. Recheck DTCs. For additional information, see "diagnostic drive cycles" above. **No** GO to A2.
A2: CHECK THE CANISTER PURGE VALVE FOR FLOW	
	1 Run the engine.
	2 Make sure the canister purge valve is operating.
	3 Using a flowmeter (or a small piece of paper) at the CCV inlet tube, confirm flow through the canister purge valve.
	Is there flow through the canister purge valve? **Yes** Possible intermittent fault with vapor hoses, O-ring seals. Carefully check condition of hoses and seals. Replace any suspect seals. Repeat the K-line or Vacutec test. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. Recheck DTCs. For additional information, see "diagnostic drive cycles" above. **No** INSTALL a new canister purge valve. REFER to Evaporative Emission Canister Purge Valve - in this section. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle.

PINPOINT TEST B : P0444, P0445; PURGE VALVE CIRCUIT OPEN / SHORT CIRCUIT	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
B1: CHECK THE PURGE VALVE DRIVE CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal. Vehicles with AJ26 engine: • Disconnect the ECM electrical connector, EM15 • Disconnect the purge valve electrical connector, EM39 • Measure the resistance between EM15, pin 03 (PN) and EM39, pin 02 (PN) Vehicles with AJ27 engine: • Disconnect the ECM electrical connector, EM80 • Disconnect the purge valve electrical connector, EM39 • Measure the resistance between EM80, pin 01 (UY) and EM39, pin 02 (UY)
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see

	"diagnostic drive cycles" above. **No** GO to B2.
B2: CHECK THE PURGE VALVE DRIVE CIRCUIT FOR SHORT TO GROUND	
	1 Reconnect the battery negative terminal.
	2 Measure the resistance between EM39, pin 02 (PN for vehicles with AJ26 engine, UY for vehicles with AJ27 engine), and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** INSTALL a new purge valve, REFER to Evaporative Emission Canister Purge Valve - in this section. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. Recheck DTCs. For additional information, see "diagnostic drive cycles" above. If the DTC is repeated, contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST C : P0447, P0448; CANISTER CLOSE VALVE CIRCUIT OPEN/SHORT CIRCUIT	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE CCV DRIVE CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal. Vehicles with AJ26 engine: ● Disconnect the ECM electrical connector, EM13 ● Disconnect the CCV electrical connector, CV01 ● Measure the resistance between EM13, pin 04, (OK) and CV1, pin 02 (OK) Vehicles with AJ27 engine: ● Disconnect the ECM electrical connector, EM80 ● Disconnect the CCV electrical connector, CV01 ● Measure the resistance between EM80, pin 02 (GU) and CV1, pin 02 (GU)
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above. **No** GO to C2.
C2: CHECK THE CCV DRIVE CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Reconnect the battery negative terminal.
	2 Measure the resistance between CV01, pin 02 (OK for vehicles with AJ26 engine, GU for vehicles with AJ27 engine), and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** INSTALL a new CCV. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. Recheck DTCs. For additional information, see "diagnostic drive cycles" above. If the DTC is repeated, contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST D : P0452, P0453; FUEL TANK PRESSURE (FTP) SENSOR LOW/HIGH VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE FTP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.

	Vehicles with AJ26 engine: • Disconnect the ECM electrical connector, EM11 • Disconnect the FTP sensor electrical connector, FP01 • Measure the resistance between EM11, pin 07 (RG) and FP01, pin 02 (RG) Vehicles with AJ27 engine: • Disconnect the ECM electrical connector, EM81 • Disconnect the FTP sensor electrical connector, FP01 • Measure the resistance between EM81, pin 16 (RG) and FP01, pin 02 (RG)
	Is the resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above. **No** GO to D2.
D2: CHECK THE FTP SENSOR SENSE CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Reconnect the battery negative terminal.
	2 Measure the resistance between FP01, pin 07 (RG) and GROUND.
	Is the resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** GO to D4.
D3: CHECK THE FTP SENSOR SENSE CIRCUIT FOR SHORT CIRCUIT TO HIGH VOLTAGE	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between FP01, pin 02 (RG) and GROUND.
	Is the voltage greater than 3 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** GO to D4.
D4: CHECK THE FTP SENSOR SIGNAL GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal. Vehicles with AJ26 engine: • Disconnect the ECM electrical connector, EM10 • Measure the resistance between EM11, pin 12 (BG) and FP01, pin 01 (BG) • Measure the resistance between EM10, pin 20 (BG) and FP01, pin 01 (BG) Vehicles with AJ27 engine: • Reconnect the ECM electrical connector, EM81 • Disconnect the ECM electrical connector, EM82 • Disconnect the ECM electrical connector, EM83 • Measure the resistance between EM82, pin 07 (BG) and FP01, pin 01 (BG) • Measure the resistance between EM83, pin 13 (BG) and FP01, pin 01 (BG)
	Is either resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. This circuit includes harness splice, EMS02. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above. **No** GO to D5.
D5: CHECK THE FTP SENSOR SIGNAL GROUND CIRCUIT FOR SHORT CIRCUIT TO GROUND	
	1 Reconnect the battery negative terminal.
	2 Measure the resistance between FP01, pin 01 (BG) and GROUND.
	Is the resistance less than 10,000 ohms?

	Yes REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** GO to D6.
D6: CHECK THE FTP SENSOR POWER SUPPLY CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal. Vehicles with AJ26 engine: • Measure the resistance between EM11, pin 08 (UW) and FP01, pin 03 (UW) • Measure the resistance between EM10, pin 21 (UW) and FP01, pin 03 (UW) Vehicles with AJ27 engine: • Measure the resistance between EM82, pin 01 (OY) and FP01, pin 03 (OY) • Measure the resistance between EM83, pin 05 (OY) and FP01, pin 03 (OY)
	Is either resistance greater than 5 ohms? **Yes** REPAIR the high resistance circuit. This circuit includes harness splice, EMS01. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above. **No** GO to D7.
D7: CHECK THE FTP SENSOR WIRING FOR SHORT CIRCUIT TO EACH OTHER	
	1 Measure the resistance between FP01, pins 01 (BG) and 02 (RG).
	2 Measure the resistance between FP01, pins 02 (RG) and 03 (UW).
	Is either resistance less than 10,000 ohms? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. **No** INSTALL a new FTP sensor. CLEAR the DTC. Carry out a full Evaporative system monitor drive cycle. For additional information, see "diagnostic drive cycles" above.

Evaporative Emissions - Evaporative Emission Canister

Removal and Installation

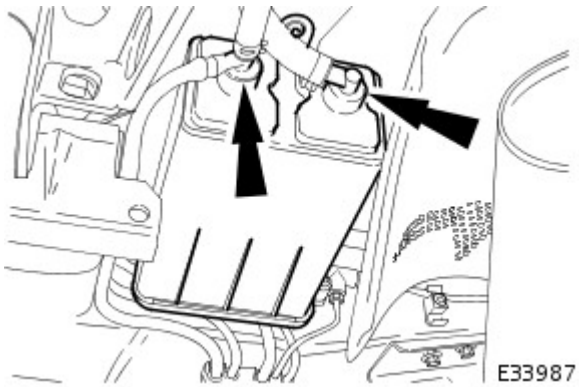
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

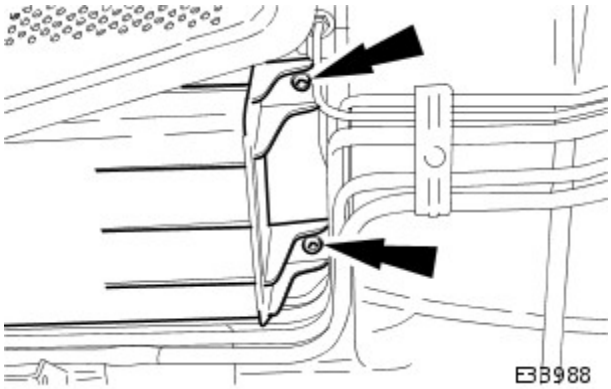
WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

2. Raise vehicle on four post ramp.
3. NOTE: Discard O-ring seals from adapter elbows.

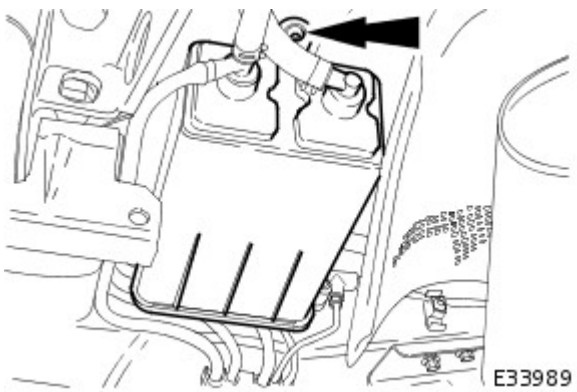
Disconnect inlet and outlet pipe adapter elbow.



4. Remove EVAP canister assembly from body.
   - Remove front mounting bolts.



5. Remove rear mounting bolt.
   - Remove EVAP canister.

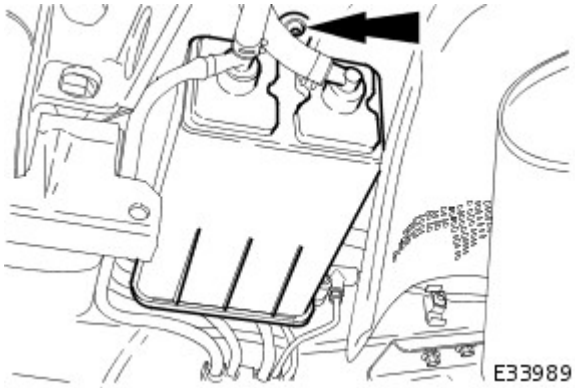


Installation

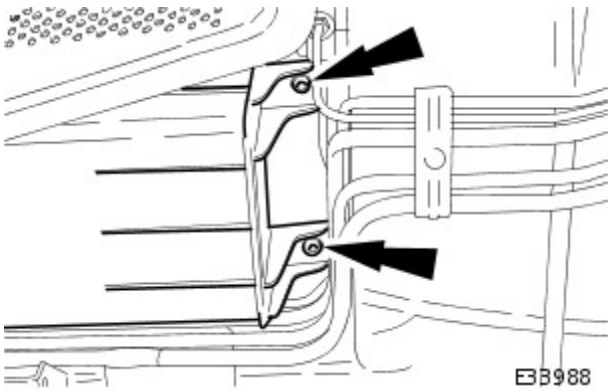
1. NOTE: Install new O-ring seals to adapter elbows and apply suitable lubrication.

Installation is the reverse of the removal procedure.

2. Tighten to specification.



- 9-12 Nm.



3. Tighten to specification.

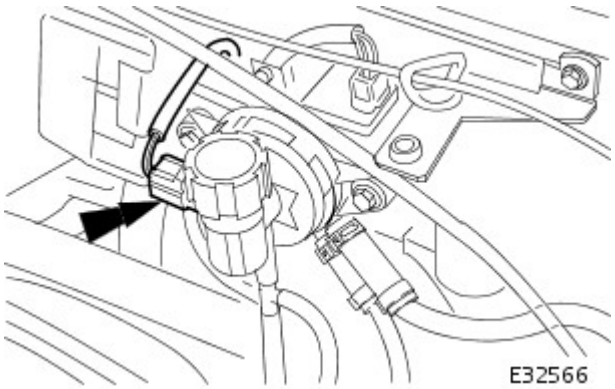
- 9-12 Nm.

Evaporative Emissions - Evaporative Emission Canister Purge Valve

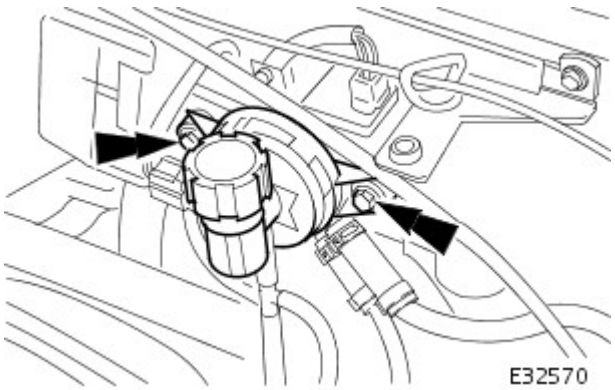
Removal and Installation

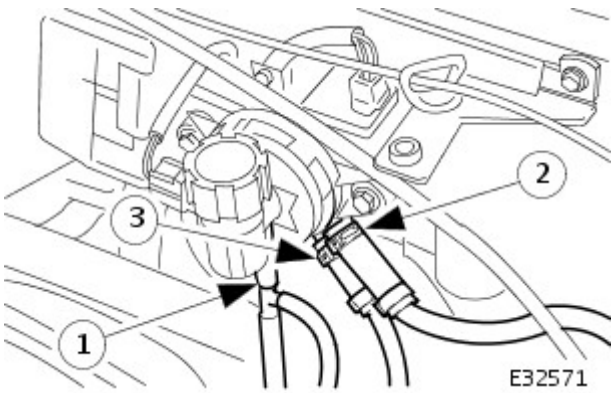
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery.
   - Remove the battery cover.
   - Disconnect the battery ground (negative) cable.
3. Disconnect the purge valve harness connector.



4. Remove the two securing nuts.





5. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

   Disconnect the three valve hoses.

   1. Pull off the vacuum pipe.
   2. Release the clip and disconnect the upper vapour hose.
   3. Release the clip and disconnect the lower vapour hose. Plug the hose (note the warning above).

Installation

1. Remove the two mounting rubbers from the old valve and fit to the new valve.
2. Fitting a new purge valve assembly is the reverse of the removal procedure.

3. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure (86.15.15).

4. Carry out a leak test of the evaporative emissions system.

Evaporative Emissions - Fuel Tank Pressure Sensor

Removal and Installation

Removal

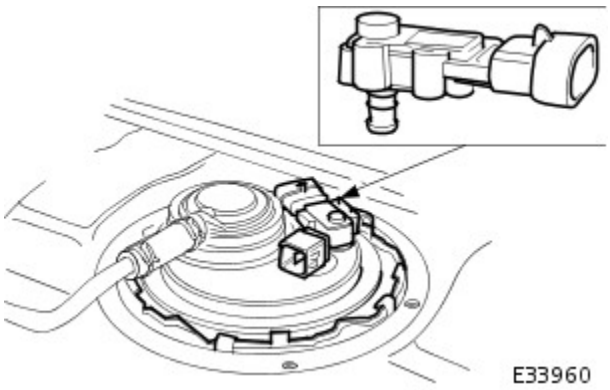
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

   Drain the fuel tank using a suitable suction pump/tanker. If the On-board Refueling Vapor Recovery (ORVR) system is fitted, refer to General Procedures Section 310-01.

3. Remove the fuel tank; refer to operation 19.55.01.

4. Remove pressure sensor from evaporative loss flange.



Installation

1. Installation is the reverse of the removal procedure.

Evaporative Emissions - Fuel Vapor Vent Valve Housing

Removal and Installation

Removal

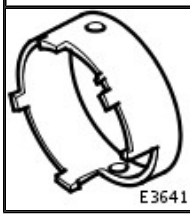
1. Refer to 19.55.25.

Installation

1. Installation is a reversal of the removal procedure.

Evaporative Emissions - Fuel Vapor Vent Valve Housing Seal

Removal and Installation

Special Tool(s)	
 E36415	Lock Ring Wrench - Fuel Tank Flange 412-070 (JD 174)

Removal

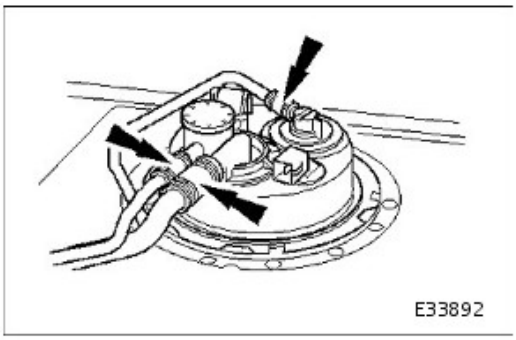
• NOTE: The Removal and Installation procedures below show one type of flange but are applicable to the other evaporative loss systems described.

1. Remove battery. Refer to 86.15.01.

2. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

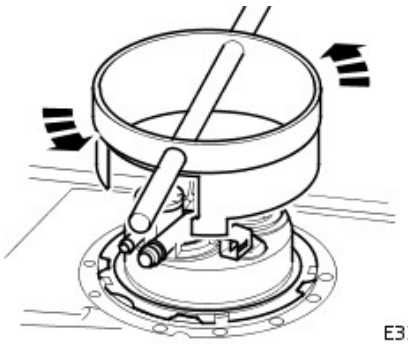
Remove fuel tank assembly for access. Refer to operation 19.55.01.

3. Disconnect vapor hose(s) from flange assembly.

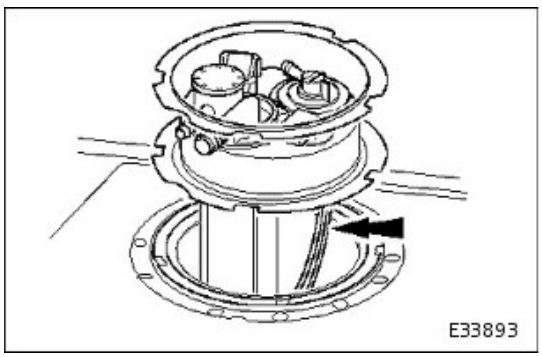

E33892

4. Remove locking ring using special tool 412-070 (JD 174).

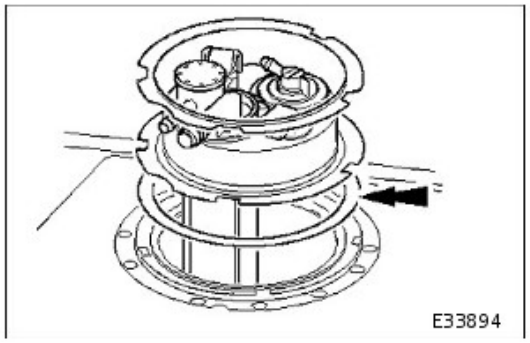
- Install special tool to locking ring.
- Using a suitable bar, turn special tool anti-clockwise to release locking ring from the five tank tabs.


E33895

5. Lift flange assembly slightly and disconnect fuel pump link lead from the underside of flange connector. Secure connector to tank aperture.

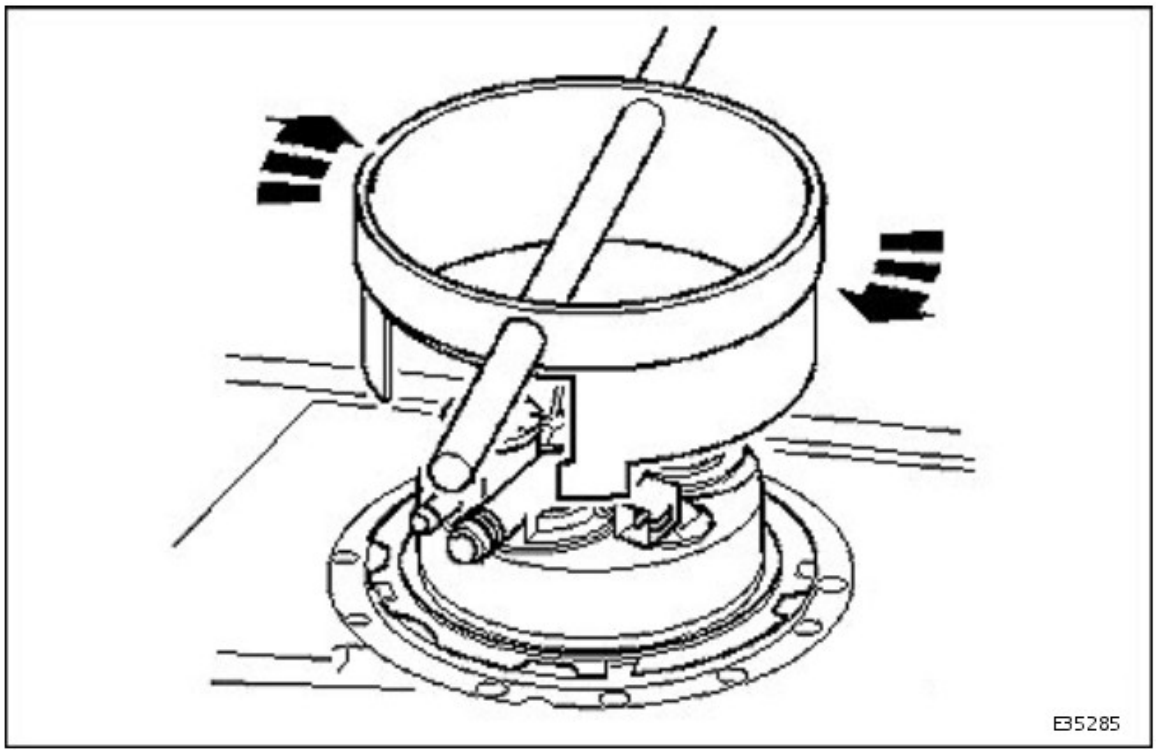

E33893

6. Discard sealing ring.



Installation

1. Install new sealing ring. Make sure it is seated correctly.
2. Connect fuel pump link lead to flange connector.
3. Align and install evaporative loss flange. Make sure sealing ring remains correctly seated.



4. Install and fully seat locking ring using the special tool.
   - Install special tool with bar to locking ring.
   - Turn clockwise until raised tabs on locking ring locate against the fixed tabs on the tank.
5. Connect vapor hose(s).
6. Install fuel tank. Refer to operation 19.55.01.
7. Install battery. Refer to 86.15.01 and 86.15.15.
8. Carry out a leak test of the evaporative emissions system.

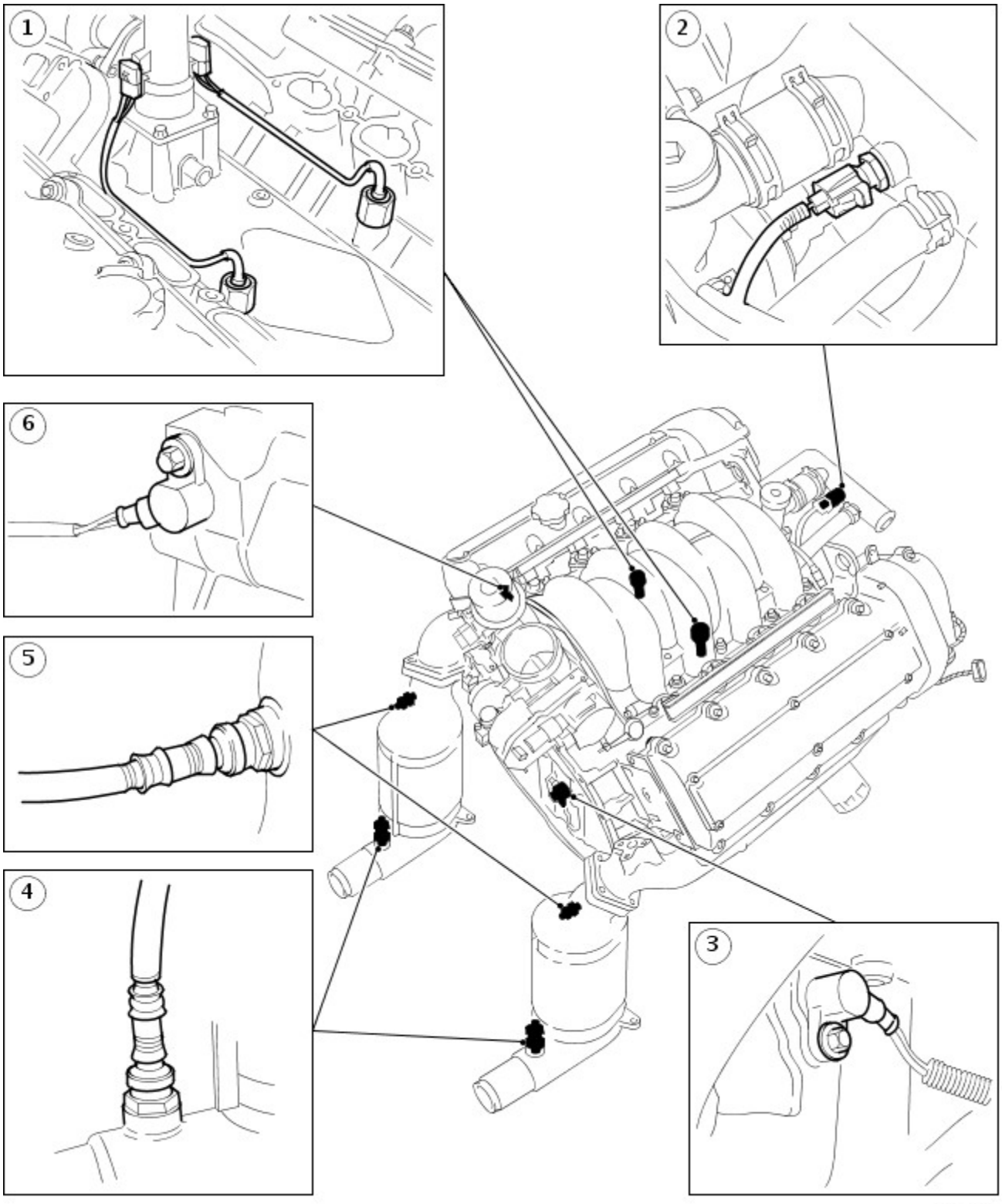
Electronic Engine Controls -

Torque specification

Component	Nm
Engine coolant temperature sensor	15 - 19
Camshaft position sensor	9 - 11
Crankshaft position sensor	8 - 12
Knock sensor	31 - 41
Oxygen sensor to downpipe	40 - 50
Intake air temperature sensor (SC only)	30 - 40

Electronic Engine Controls - Electronic Engine Controls

Description and Operation



Parts List

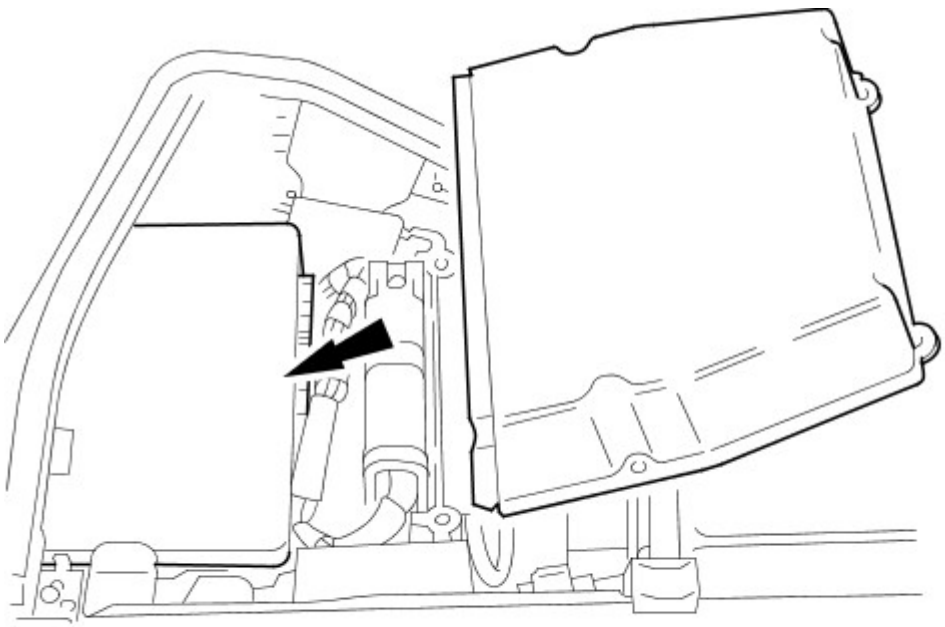
Item	Part Number	Description
1	—	Knock sensor
2	—	Engine coolant temperature sensor
3	—	Crankshaft position sensor
4	—	Downstream oxygen sensor
5	—	Upstream oxygen sensor
6	—	Camshaft position sensor

The engine management system provides optimum control of the engine under all operating conditions using several strategically placed sensors and any necessary actuators. Electronic engine control consists of:

- engine control module
- throttle position sensor
- engine coolant temperature sensor
- camshaft position sensor
- crankshaft position sensor
- mass air flow sensor
- intake air temperature sensor
- knock sensor
- heated oxygen sensor

Electronic Engine Control

Engine Control Module (ECM)



E34101

The ECM incorporates a comprehensive monitoring and diagnostic capability including software variations to ensure system compliance with the latest diagnostic and emissions legislation in different markets. The engine control module controls the coil on plug ignition system, electronic fuel system, cruise control and the electronic throttle control system.

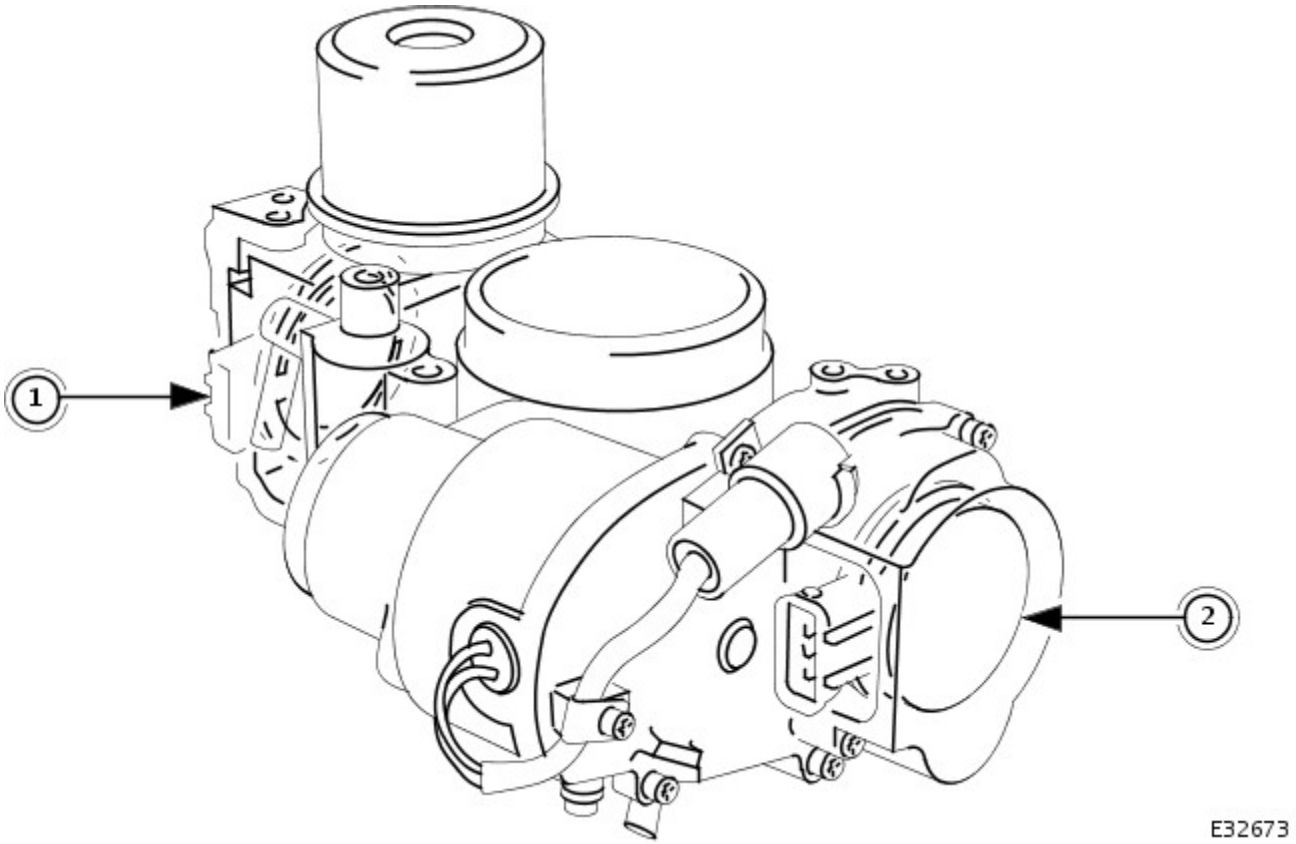
The ECM responds to input signals received from sensors relating to engine operating conditions and provides output signals to the appropriate actuators. These output signals are based on the evaluated input signals which are compared with calibrated data tables or maps held within the ECM before the output signal is generated.

The ECM needs the following inputs to calibrate the engine properly:

- camshaft position
- engine rpm
- engine coolant temperature
- amount of engine detonation

Throttle Position (TP) Sensor

Location



Parts List

Item	Part Number	Description
1	—	Accelerator pedal and mechanical guard position sensors
2	—	Throttle (blade) position sensor

- sends the ECM a signal indicating throttle plate angle
- is the main input to the ECM from the driver
- is a dual Hall effect device mounted on the motor end of the throttle body

Two additional sensors are attached to the throttle body to provide additional feedback to the ECM: a mechanical guard position sensor and an accelerator pedal position sensor.

Camshaft Position (CMP) Sensor

- sends the ECM a signal indicating camshaft position for fuel synchronization purposes
- is a variable reluctance device mounted on bank 2 cylinder side face
- generates a signal when the ring fitted to the bank 2 inlet camshaft passes the sensor

Crankshaft Position (CKP) Sensor

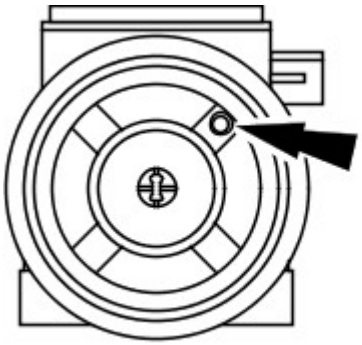
- is a variable reluctance device mounted on the engine oil pan

- generates a signal when the drive plate passes the sensor
- sends the ECM signals indicating crankshaft position and engine speed
- is essential for calculating spark timing

Engine Coolant Temperature (ECT) Sensor

- sends the ECM a signal indicating the temperature of the engine coolant
- is a temperature dependent resistor with a negative temperature coefficient (resistance changes inversely with respect to temperature) and is constantly monitored by the ECM

Intake Air Temperature (IAT) Sensor



E34025

- is mounted in the same housing as the MAF sensor but is not a serviceable item
- sends the ECM a signal indicating the temperature of the air entering the engine
- is a temperature dependent resistor which has a negative temperature coefficient (its resistance changes inversely with respect to ambient temperature).

Knock Sensor (KS)

- is a piezo-electric device which sends a signal to the ECM indicating engine detonation

Between 700 and 6800 rpm, the ECM will retard individual cylinder ignition timing when detonation occurs while allowing the other cylinders to continue operating normally.

During acceleration, at critical load and speed conditions, the ECM retards ignition timing to prevent the onset of detonation.

Heated Oxygen Sensor (HO2S)

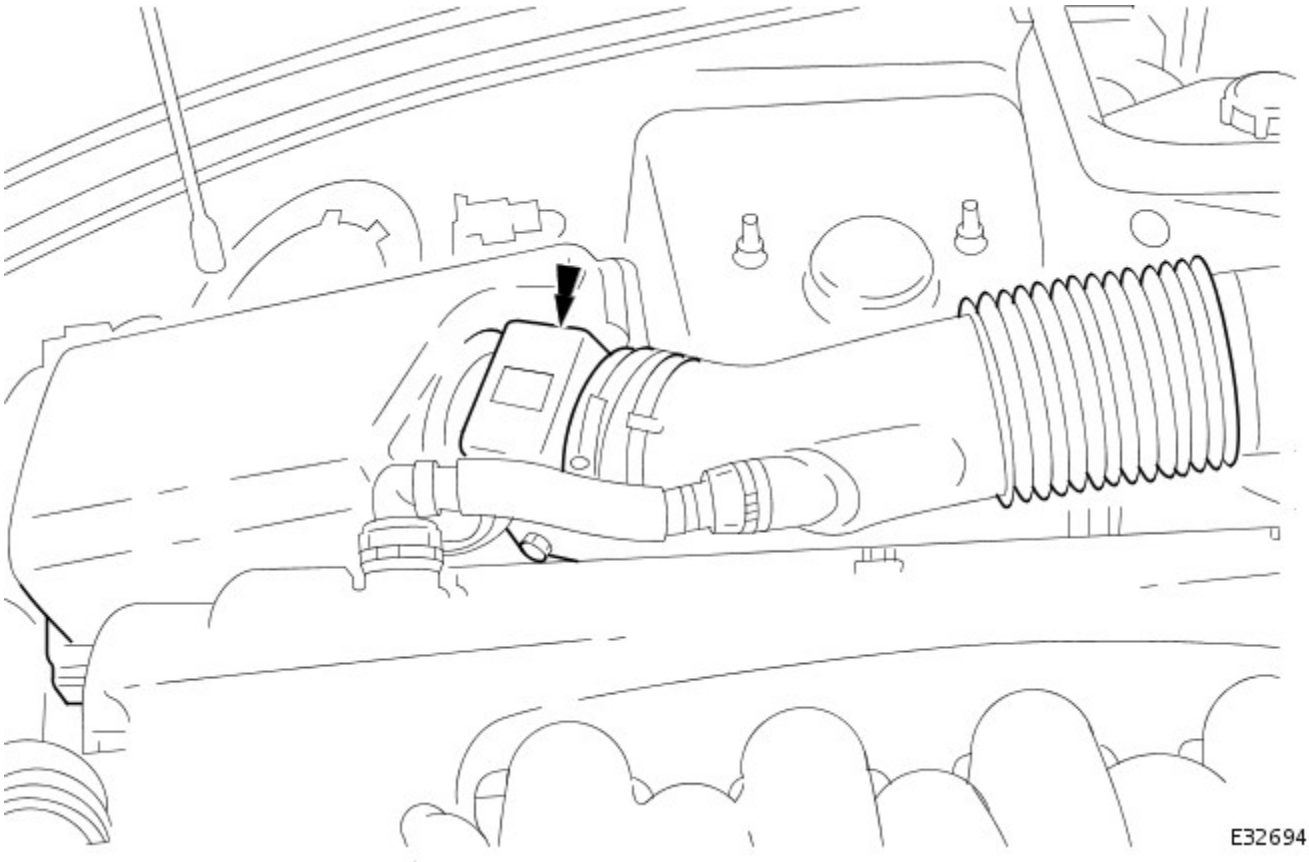
- are positioned upstream of the catalytic convertor
- is equipped with a heating element which improves the response time of the sensors during engine warm-up
- has the ability to generate a voltage signal proportional to the oxygen content of the exhaust gases leaving the engine
- provides feedback information to the ECM used to calculate fuel delivery and provide optimum gas emissions

Variable Valve Timing (VVT) Solenoid

Refer to section 303-01.

Mass Air Flow (MAF) Sensor

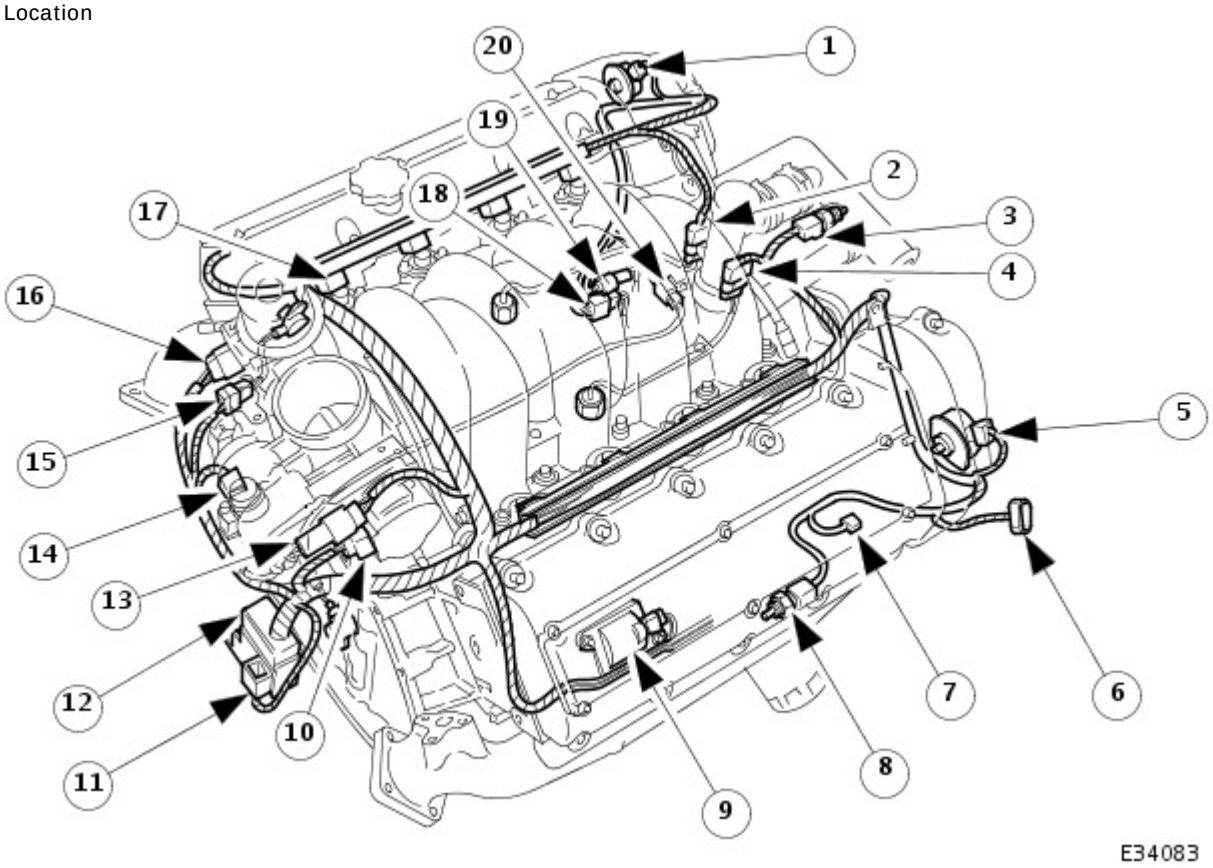
Location



- is of the 'hot-wire' type (the resistance of the wire varies as incoming air passing over it has a cooling effect)
- provides feedback to the ECM to permit monitoring of mass air flow
- is NOT serviceable, necessitating its renewal should a fault occur

Engine Harness Connectors

Location

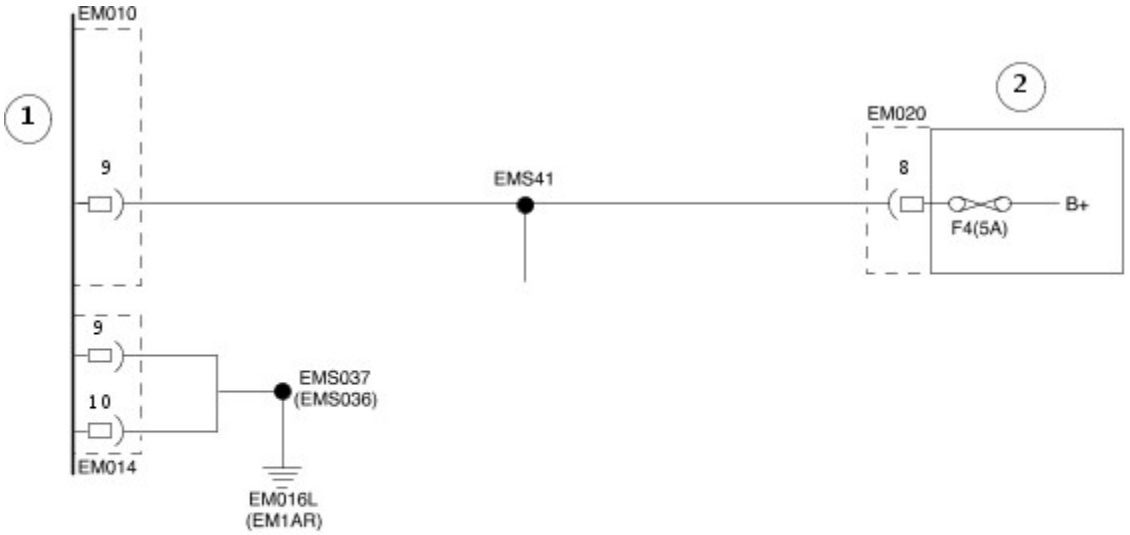


Parts List

Item	Part Number	Description
1	—	PI032 VVT solenoid 2
2	—	PI027 KS 2
3	—	PI004 ECT sensor
4	—	PI026 KS 1
5	—	PI031 VVT solenoid 1
6	—	PI035 MAFS (on vehicle)
7	—	PI050 Generator
8	—	PI040 Oil pressure switch
9	—	PI018 to PI021 Bank 1 Ignition coils 1 to 4 PI022 to PI025 Bank 2 Ignition coils 1 to 4
10	—	PI006 Throttle valve position sensor
11	—	PI002 Engine management harness (on vehicle)
12	—	PI001 Engine management harness (on vehicle)
13	—	PI033 Throttle valve motor
14	—	PI034 EGR valve (where fitted)
15	—	PI015 CMP sensor
16	—	PI042 Accelerator pedal and mechanical guard sensors
17	—	PI007 to PI010 Bank 1 Injectors 1 to 4 PI011 to PI014 Bank 2 Injectors 1 to 4
18	—	PI037 Compressor lock sensor (where fitted)
19	—	PI036 Compressor clutch
20	—	PI017 CKP sensor

Circuit Diagrams (extracts only)

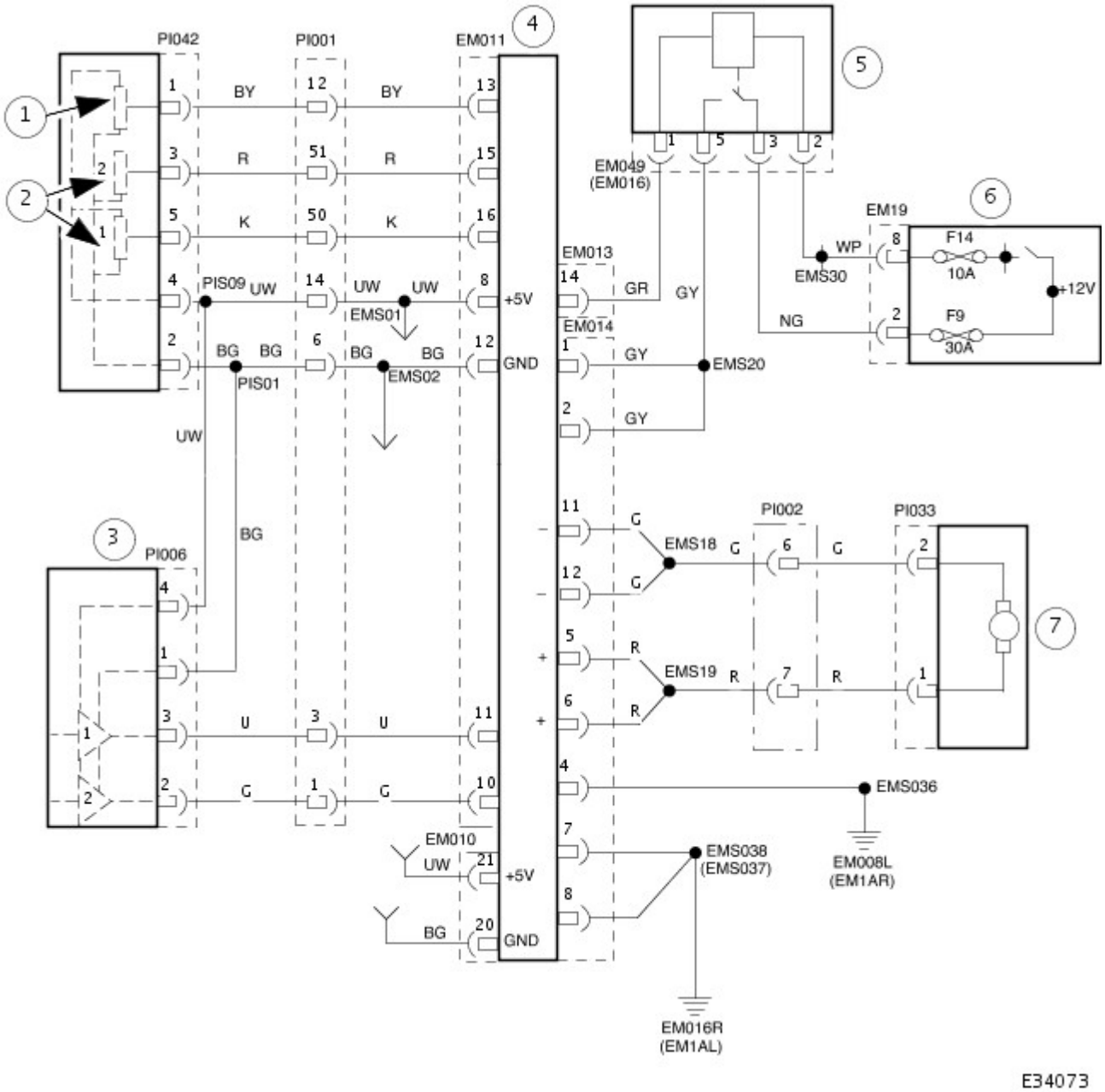
ECM Supply Voltage



E34072

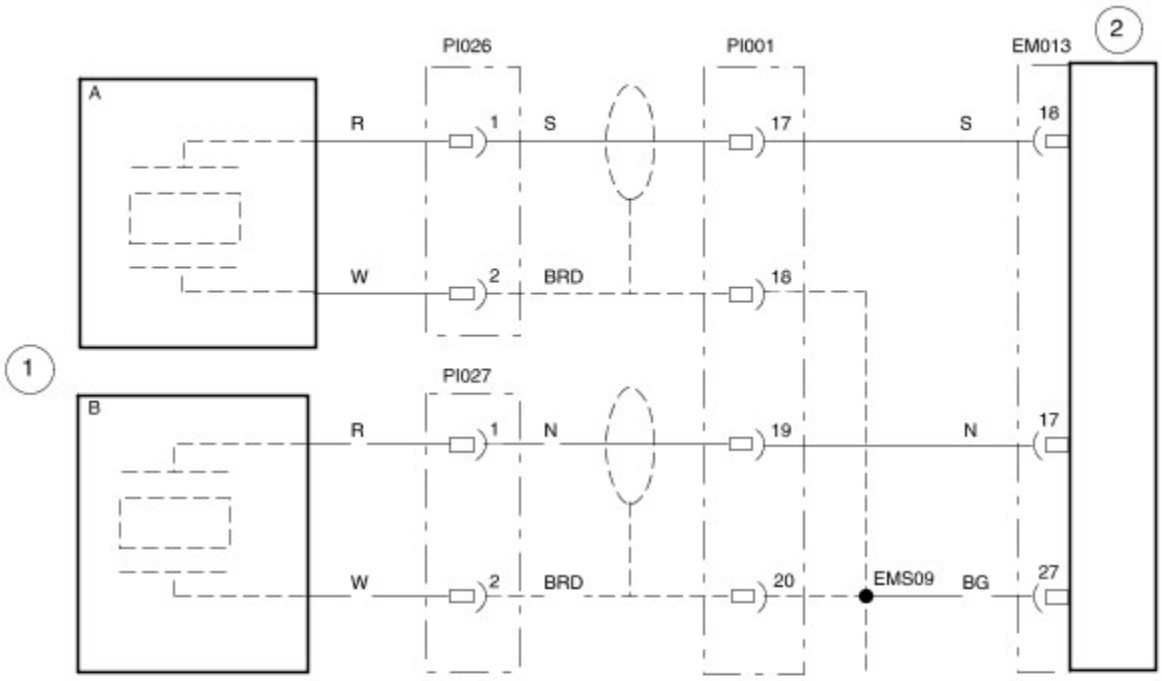
Item	Part Number	Description
1	—	Engine management fuse box
2	—	Engine control module (ECM)

Throttle Sensors and Control



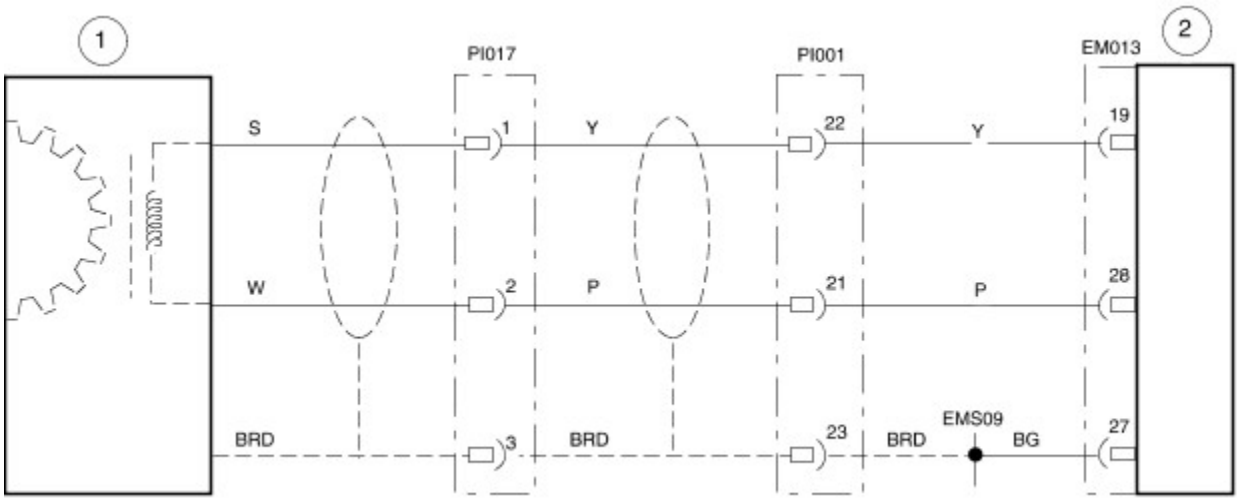
E34073

Item	Description
1	Mechanical guard position sensor (potentiometer)
2	Pedal demand sensors (potentiometers)
3	Throttle position sensor
4	Engine control module (ECM)
5	Throttle motor power relay
6	EMS fuse box
7	Throttle motor



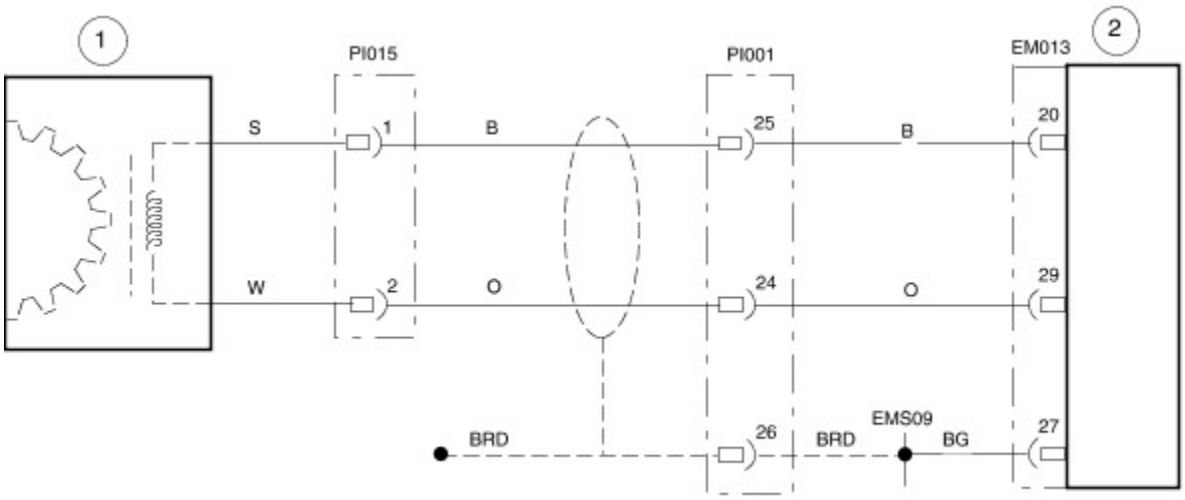
E32966

Item	Part Number	Description
1	—	Knock sensors, banks 1 and 2
2	—	Engine control module (ECM)



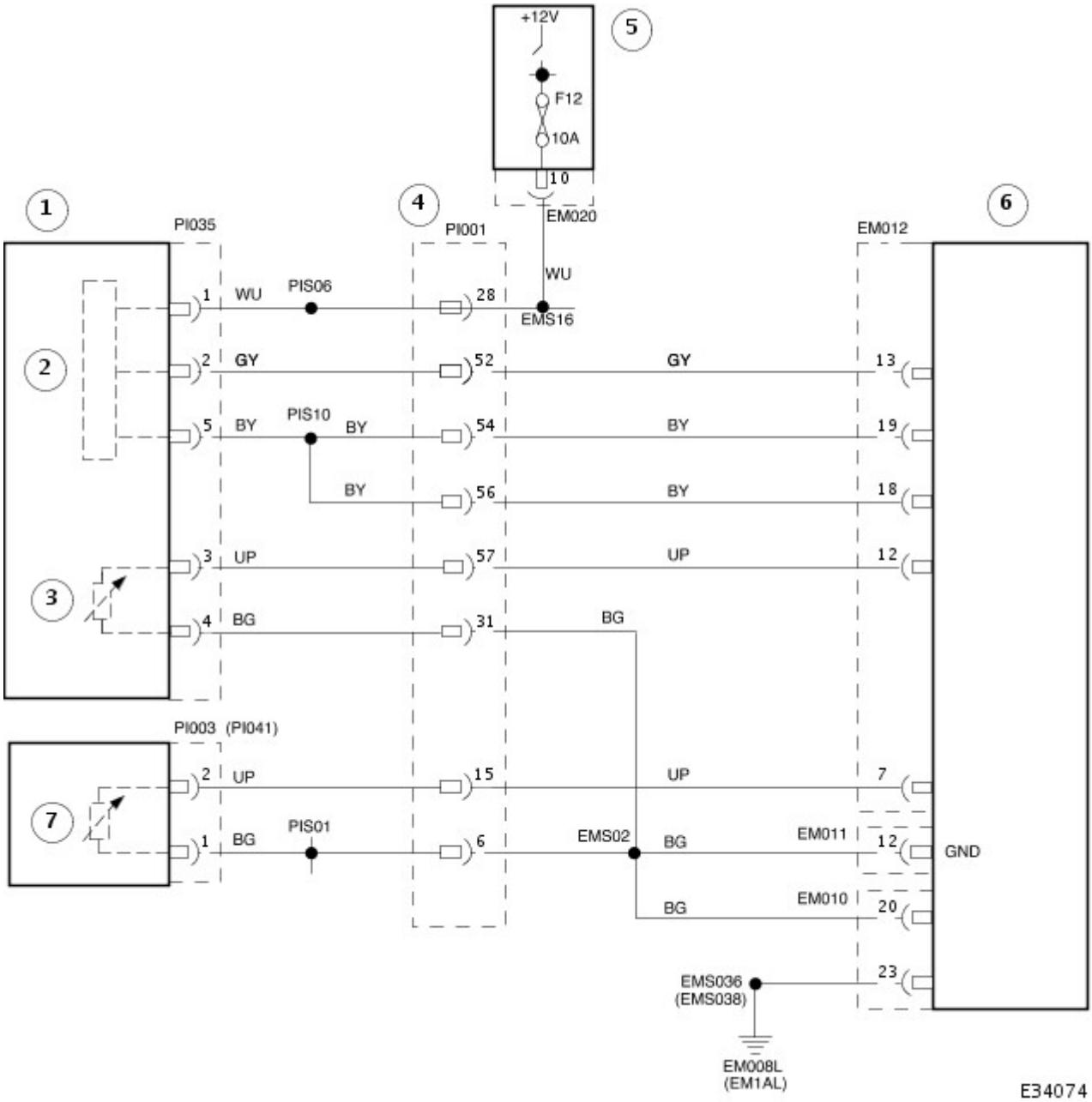
E32968

Item	Part Number	Description
1	—	Crankshaft position sensor
2	—	Engine control module (ECM)



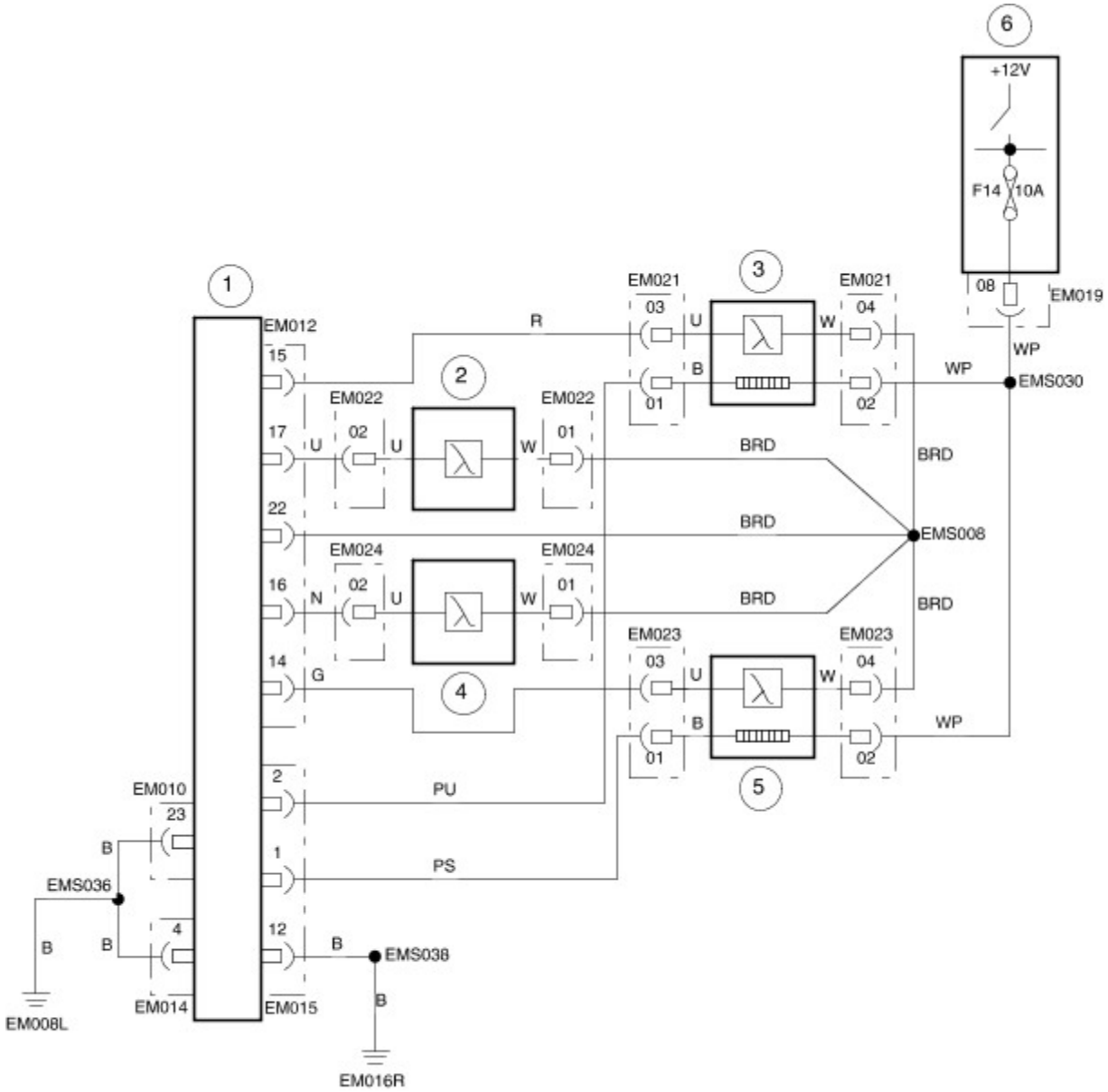
E32967

Item	Part Number	Description
1	—	Camshaft position sensor
2	—	Engine control module (ECM)



Item	Part Number	Description
1	—	MAF assembly
2	—	MAF sensor
3	—	IAT sensor
4	—	Engine to vehicle harness connector
5	—	EMS fuse box
6	—	Engine control module (ECM)
7	—	Charge air cooler - IAT sensor (supercharged engines only)

Oxygen Sensors



E33917

Item	Description
1	Engine control module (ECM)
2	Downstream oxygen sensor (A)
3	Upstream heated oxygen sensor (A)
4	Downstream oxygen sensor (B)
5	Upstream heated oxygen sensor (B)
6	Engine management fuse box

Electronic Engine Controls - Electronic Engine Controls

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Confirm which, if any, warning lights and/or messages were displayed on the instrument cluster.

• NOTE: If any warning lights and/or messages were displayed when the fault occurred, refer to the Driver Information table for DTCs associated with the display, then to the DTC index table for possible sources and actions. Some warnings will appear to clear when the ignition is cycled. This is often because the warning has flagged as a result of one of the vehicle's on-board diagnostic routines having run to detect the fault. If the same routine is not run when the ignition is switched ON, the warning will not reflag until the routine does run. See the DTC summaries for drive cycle routines.

3. **3.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical	Electrical
• Engine oil level • Cooling system coolant level • Fuel contamination • Throttle body • Poly-vee belt	• Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM) • Transmission control module • Check spark plug type. Only resisted plugs should be fitted. Refer to specifications section for gap • Relay date codes. If the date on the relay is between R6 k1 and R6 k8, replace the relay

4. **4.** Verify the following systems are working correctly:

- Air intake system
- Cooling system
- Charging system
- Fuel charging system

5. **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. **6.** Where the Jaguar approved diagnostic system is available, complete the S93 report before clearing any or all fault codes from the vehicle.

• NOTE: If a DTC cannot be cleared, then there is a permanent fault present that flags again as soon as it is cleared (the exception to this is P1260, which will only clear following an ignition OFF/ON cycle after rectification).

7. **7.** If the cause is not visually evident and the Jaguar approved diagnostic system is not available, use a fault code reader to retrieve the fault codes before proceeding to the Diagnostic Trouble Code (DTC) Index Chart, or the Symptom Chart if no DTCs are set.

• NOTE: If the DTC flagged was not present for two or more consecutive cycles, it is classed as temporary, and will be deleted following three cycles during which no fault was present. This could result in a reported warning light/message with no stored DTCs. If a fault is present for three consecutive cycles, the DTC becomes permanent, and will remain in the module's memory for 40 drive cycles (a cycle is an ignition ON/OFF, which will occur during the owner's normal use of the vehicle. No action on the part of the technician is necessary to perform this cycle. A drive cycle is a series of conditions needed to make the on-board diagnostic routine run, and may need a specific action on the part of the technician. See the DTC summaries for drive cycle routines).

8. **8.** Using the Jaguar approved diagnostic system where available, and a scan tool where not, check the freeze frame data for information on the conditions applicable when the fault was flagged. The format of this will vary, depending on the tool used, but can provide information useful to the technician in diagnosing the fault.

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

• NOTE: When performing electrical 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.

Symptom Chart

Symptom (general)	Symptom (specific)	Possible source	Action
Non-Start	Engine does not crank	● Starter relay ● ECM relay ● Battery ● **Park/Neutral** switch ● Starting system ● Harness damage ● Engine siezed	Check relay dates. Check for DTCS. For starting system, REFER to Section 303-06 Starting System. For ECM relay tests, GO to Pinpoint Test AD. . For battery information, REFER to Section 414-01 Battery, Mounting and Cables. For **Park/Neutral** tests, GO to Pinpoint Test AC. . For engine information, REFER to Section 303-01 Engine.
	Engine cranks, but does not fire	● Security system /Immobiliser engaged ● Throttle contaminated ● Harness damage ● Fuel pump relay ● Fuel system ● Refer to service action S491	Contact dealer technical support for information on security system. For fuel system, REFER to Section 303-04 Fuel Charging and Controls. Check bulletins for throttle cleaning procedure. Check service actions.
	Engine cranks and fires, but will not start	● Fuel pump relay ● Throttle contaminated ● Purge valve ● Fuel pump ● Engine coolant temperature (ECT) sensor ● Spark plugs fouled ● Ignition coil failure(s) ● Check for water ingress into spark plug wells ● HT short to ground (tracking) check rubber boots for cracks/damage ● Cylinder compression loss (short-term. Refer to bulletin; 303-52) ● Refer to service action S491	For fuel pump relay tests, REFER to Section 303-04 Fuel Charging and Controls. . Check bulletins for throttle cleaning procedure. Check fuel pressure. Refer to Technical service bulletins. For ECT sensor tests, GO to Pinpoint Test C. . For ignition system, REFER to Section 303-07 Engine Ignition. Check bulletins and service actions.
Difficult to start	Difficult to start cold	● Rochester valve ● Battery ● Throttle contaminated ● Fuel pump ● Engine coolant temperature (ECT) sensor ● Purge valve ● Cylinder compression loss (short-term. Refer to bulletin; 303-52) ● Blocked part-load breather (service action S474) ● Refer to service action S491	For Rochester valve test, GO to Pinpoint Test AE. . For battery information, REFER to Section 414-01 Battery, Mounting and Cables. Check bulletins for throttle cleaning procedure. Check fuel pressure. For ECT sensor circuit tests, GO to Pinpoint Test C. . For evaporative emissions tests, REFER to Section 303-13 Evaporative Emissions. Refer to bulletins for compression information, and service actions for part-load breather procedure and compressions.
	Difficult to start hot	● Rochester valve ● Purge valve ● Throttle contaminated	For Rochester valve test, GO to Pinpoint Test AE. . For evaporative emissions tests, REFER to Section 303-13 Evaporative

		• Fuel pump • Engine coolant temperature (ECT) sensor • Blocked part-load breather (service action S474) • Injector leak	Emissions. Check bulletins for throttle cleaning procedure. Check fuel pressure. For ECT sensor circuit tests, GO to Pinpoint Test C. . Refer to Service action S474 for part-load breather procedure. For injector leak test, Refer to technical service bulletin 303-39.
	Difficult to start after hot soak (vehicle standing after engine has reached operating temperature)	• Rochester valve • Throttle contaminated • Purge valve • Fuel pump • Engine coolant temperature (ECT) sensor • Blocked part-load breather (service action S474) • Injector leak	
	Engine cranks too fast/slow	• Battery • Starter relay • Harness • Cylinder compression loss (NA short term only. Refer to technical service bulletin; 303-39) • Refer to service action S491	For battery information, REFER to Section 414-01 Battery, Mounting and Cables. For starting system. REFER to Section 303-06 Starting System. Refer to technical service bulletins and service actions.
Engine stalls	Engine stalls soon after start	• Fuel pump relay • ECM relay • Throttle contaminated • CMP/CKP sensor synchronization malfunction • Harness • Fuel pump • MAF sensor malfunction • Engine coolant temperature (ECT) sensor • Fuel lines • Air leakage • Fuel pressure regulator	Check relay dates. Check for DTCs. For fuel pump relay tests, REFER to Section 303-04 Fuel Charging and Controls. For ECM relay tests, GO to Pinpoint Test AD. . Check bulletins for throttle cleaning procedure. For CMP sensor circuit tests, GO to Pinpoint Test C. , for CKP sensor circuit tests, GO to Pinpoint Test N. . Check fuel pressure. For MAF sensor circuit tests, GO to Pinpoint Test A. . For ECT sensor tests, GO to Pinpoint Test C. . For fuel system, REFER to Section 303-04 Fuel Charging and Controls. and REFER to Section 310-01 Fuel Tank and Lines. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering.
	Engine stalls on overrun	• Throttle contaminated • ECM relay • Fuel pump relay • CMP/CKP sensor synchronization malfunction	Check bulletins for throttle cleaning procedure. Check relay dates. For ECM relay tests, GO to Pinpoint Test AD. . For fuel pump relay tests, REFER to Section 303-04 Fuel Charging and Controls. For CMP sensor circuit tests, GO to Pinpoint Test O. , for CKP sensor circuit tests, GO to Pinpoint Test N. .
	Engine stalls at steady speed, with or without cruise enabled	• Throttle contaminated • ECM relay • Fuel pump relay • CMP/CKP sensor synchronization malfunction • Harness • Blocked part-load breather (service action S474)	Check bulletins for throttle cleaning procedure. Check relay dates. For ECM relay circuit tests,GO to Pinpoint Test AD. . For fuel pump relay circuit tests, REFER to Section 303-04 Fuel Charging and Controls. For CMP sensor circuit tests,GO to Pinpoint Test O. , for CKP sensor circuit tests,GO to Pinpoint Test N. . Check service actions.
	Engine stalls when maneuvering	• ECM relay • Fuel pump relay • CMP/CKP sensor synchronization malfunction	Check relay dates. For ECM relay circuit tests,GO to Pinpoint Test AD. . For fuel pump relay circuit tests, REFER to Section 303-04 Fuel Charging and Controls. For CMP sensor circuit tests,GO to Pinpoint Test O. , for CKP sensor circuit tests,GO to Pinpoint Test N. .

Poor driveability	Engine hesitates/poor acceleration	• Fuel pump • Exhaust gas recirculation (EGR) • Air leakage • Stop lamp switch • Throttle sensors • Throttle motor • Spark plugs fouled • Check for water ingress into spark plug wells • Ignition coil failure(s) • HT short to ground (tracking) check rubber boots for cracks/damage • ECM failure	Check fuel pressure. For EGR information, REFER to Section 303-08 Engine Emission Control. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For stop lamp switch information, refer to the wiring diagrams. For throttle position sensor tests,GO to Pinpoint Test D.. For throttle motor control circuit tests,GO to Pinpoint Test T.. For ignition system, REFER to Section 303-07 Engine Ignition. For ECM circuit tests,GO to Pinpoint Test AD..
	Engine backfires	• Fuel pump • Air leakage • MAF sensor • HO2 sensors • Spark plugs • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition coil failure(s)	Check fuel pressure. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. For MAF sensor circuit tests,GO to Pinpoint Test A.. For HO2 sensor circuit tests, check for DTC indicating which sensor and follow indicated pinpoint test. For ignition system, REFER to Section 303-07 Engine Ignition.
	Engine surges	• Air leakage • Fuel pump • Stop lamp switch • MAF sensor • Harness • Throttle sensors • Throttle motor • Spark plugs • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • ECM failure	For intake system, REFER to Section 303-12 Intake Air Distribution and Filtering. Check fuel pressure. For stop lamp information, refer to the wiring diagrams. For MAF sensor tests,GO to Pinpoint Test A.. For throttle position sensor tests,GO to Pinpoint Test D., andGO to Pinpoint Test K.. For throttle motor circuit tests,GO to Pinpoint Test T.. For ignition system, REFER to Section 303-07 Engine Ignition. For ECM circuit tests,GO to Pinpoint Test AD..
	Engine detonates/knocks	• Fuel pump • HO2 sensors • Air leakage • Blocked part-load breather (service action S474) • Mass air flow (MAF) sensor	Check fuel pressure. For HO2 sensor circuit tests, check for DTC indicating which sensor and follow indicated pinpoint test. For intake system information, REFER to Section 303-12 Intake Air Distribution and Filtering. Check service action S474. For MAF sensor tests,GO to Pinpoint Test A..
	No throttle response	• Traction control invoked • Throttle sensors • Throttle motor	For throttle position sensor tests,GO to Pinpoint Test D., andGO to Pinpoint Test K.. For throttle motor circuit tests,GO to Pinpoint Test T..
	Cruise control inhibited or disabled	• Cruise control switch • Throttle sensors • Stop lamp switch	For cruise control switches, REFER to Section 310-03 Speed Control. For throttle position sensor tests,GO to Pinpoint Test D., andGO to Pinpoint Test K.. For stop light switch information, refer to the wiring diagrams.

Driver Information Chart

• NOTE: Use this table to identify DTCs associated with the message center display, then refer to the DTC index for possible sources and actions.

• NOTE: For definitions of Default Modes, see the foot of this table.

Warning light	Message	Default Mode	DTC
Red	Engine Failsafe Mode	Limp-Home	P1224
Red	Engine Failsafe Mode	Limp-Home	P1229
Red	Engine Failsafe Mode	Limp-Home	P0122, P0123,
Red	Engine Failsafe Mode	Limp-Home	P0222, P0223
Red	Engine Failsafe Mode	Limp-Home	P0121
Red	Engine Failsafe Mode	Limp-Home	P1122, P1123
Red	Engine Failsafe Mode	Limp-Home	P1222, P1223
Red	Engine Failsafe Mode	Limp-Home	P1121, P1632
Red	Engine Failsafe Mode	Limp-Home	P1251, P0560, P1658
Red	Engine Failsafe Mode	Limp-Home	P1631
Red	Engine Failsafe Mode	Limp-Home	P1611
Red	Engine Failsafe Mode	Limp-Home	P1633
Red	Engine Failsafe Mode	Limp-Home	P1609
Red	Engine Failsafe Mode	Limp-Home	P0506, P0507
Red	Engine Failsafe Mode	Limp-Home	P1656
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1254
Red	Engine Failsafe Mode	Engine shut-down when combined with other throttle failures	P1250
Amber	Engine Failsafe Mode	Cruise inhibited	P1516
Amber	Engine Failsafe Mode	Cruise inhibited	P1517
Amber	Engine Failsafe Mode	Cruise inhibited	P1571
Amber	Engine Failsafe Mode	Cruise inhibited	P1696
Amber	Engine Failsafe Mode	Cruise inhibited	P0568
Amber	Engine Failsafe Mode	Cruise inhibited	P0570
Amber	Engine Failsafe Mode	Cruise inhibited	P0569
Amber	Engine Failsafe Mode	Cruise inhibited	P0567
Amber	Engine Failsafe Mode	Cruise inhibited	P0566
Amber	Engine Failsafe Mode	Cruise inhibited	P1697
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P0560, P1254
Amber	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled. High idle speed	P1250, P1254
Red	Restricted Performance	Limp-Home unavailable. Reverse throttle progression enabled	P1250
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0116, P0117, P0118, P0125
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0101, P0102, P0103, P0104
Amber	Restricted	Engine Speed Limit (runs normally, limited to	P0300, P0301, P0302, P0303, P0304, P0305,

	Performance	3000 rpm)	P0306, P0307, P0308, P1313, P1314
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P0327, P0328, P0332, P0333, P1648
Amber	Restricted Performance	Reverse throttle progression enabled	P1474
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1230
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1671
Amber	Restricted Performance	Engine Speed Limit (runs normally, limited to 3000 rpm)	P1112, P1113
Amber	Restricted Performance	Gearbox default to 4th gear	P1601 (SC only)
Amber	Restricted Performance	Gearbox default to 4th gear	P1605 (NA only)
Amber	Restricted Performance	Gearbox default to 4th gear	P0702
Amber	Restricted Performance	Gearbox default to 4th gear	P1795
Amber	Restricted Performance	Gearbox default to 4th gear	P1796
Amber	Restricted Performance	Gearbox default to 4th gear	P1797
Amber	Restricted Performance	Gearbox default to 4th gear	P1605
Amber	None	Gearbox default to 4th gear	P0705 (SC only)
Amber	None	Gearbox default to 4th gear	P0706
Amber	None	Gearbox default to 4th gear	P1720

Default mode Definitions

MECHANICAL LIMP-HOME MODE:

- No electronic throttle operation (mechanical operation for last quarter of pedal travel)
- Maximum 25° throttle opening, depending on adjustment of throttle mechanical linkage
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off
- High idle speed (1200 rpm approx.)
- Misfire at idle, due to cylinder cut as a means of controlling idle speed (the misfire will switch cylinders, as the strategy varies the cylinder cut)
- Cruise (speed) control inhibited

REVERSE THROTTLE PROGRESSION ENABLED:

- Electronic throttle operation, limited to maximum 25°
- Cruise (speed) control inhibited

• NOTE: The throttle operation uses the same map as for reverse gear.

ENGINE SPEED LIMIT:

- Engine runs normally, up to 3000 rpm
- Engine speed restricted to 3000 rpm maximum, by fuel cut-off
- Cruise (speed) control Inhibited

LIMP-HOME UNAVAILABLE:

- Cruise (speed) control inhibited
- Reverse throttle progression engaged at second occurrence of DTC flagging

Diagnostic Trouble Code (DTC) Index

Diagnostic Trouble Code (DTC) Index

DTC	Description	Possible Source	Action
P0101	Mass air flow (MAF) sensor range/performance	• Blocked air filter • Air intake leak • Engine breather leak • Throttle control malfunction • MAF sensor to ECM sensing circuit high resistance • MAF sensor to ECM sensing circuit intermittent short circuit to ground • MAF sensor supply circuit high resistance • MAF sensor failure	Check the air filter element, check the air intake system for leaks, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the engine breather system for leaks, REFER to Section 303-08 Engine Emission Control. For throttle control circuit tests,GO to Pinpoint Test T. . For MAF sensor circuit tests,GO to Pinpoint Test A. .
P0102	Mass air flow (MAF) sensor sense circuit low voltage	• Blocked air filter • MAF sensor to ECM sensing circuit high resistance or open circuit • MAF sensor to ECM sensing circuit intermittent short circuit to ground • MAF sensor supply circuit open circuit or short circuit to ground • MAF sensor failure	Check the air filter element, REFER to Section 303-12 Intake Air Distribution and Filtering. For MAF sensor circuit tests, GO to Pinpoint Test A. .
P0103	Mass air flow (MAF) sensor sense circuit high voltage	• MAF sensor to ECM reference ground circuit open circuit • MAF sensor to ECM sensing circuit short circuit to high voltage • MAF sensor failure	For MAF sensor circuit tests,GO to Pinpoint Test A. .
P0106	BARO circuit, low voltage	• BARO failure (internal ECM fault)	Contact dealer technical support for advice on possible ECM failure.
P0107	BARO circuit, high voltage	• BARO failure (internal ECM fault)	Contact dealer technical support for advice on possible ECM failure.
P0111	Intake air temperature (IAT) sensor range/performance	• Blocked air filter • Air intake leak • Engine breather leak • IAT sensor to ECM wiring open circuit or high resistance • IAT sensor to ECM sensing circuit short circuit to high voltage • IAT sensor failure	Check the air filter element, check the air intake system for leaks, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the engine breather system for leaks, REFER to Section 303-08 Engine Emission Control. For IAT sensor circuit tests,GO to Pinpoint Test B. .
P0112	Intake air temperature (IAT) sensor sense circuit high voltage (low air temperature)	• IAT sensor to ECM wiring open circuit or high resistance • IAT sensor to ECM sensing circuit short circuit to high voltage • IAT sensor failure	For IAT sensor circuit tests,GO to Pinpoint Test B. .
P0113	Intake air temperature (IAT) sensor sense circuit low voltage (high air temperature)	• IAT sensor to ECM wiring short circuit to ground • IAT sensor failure	For IAT sensor circuit tests,GO to Pinpoint Test B. .
P0116	Engine coolant temperature (ECT) sensor range / performance	• Low/contaminated coolant • Thermostat failure • ECT sensor to ECM sensing circuit high resistance when hot • ECT sensor to ECM sensing circuit intermittent high resistance • ECT sensor failure	Check coolant level and condition. Check thermostat function. For ECT sensor circuit tests,GO to Pinpoint Test C. .
P0117	Engine coolant temperature (ECT) sensor sense circuit high voltage (low coolant temperature)	• ECT sensor disconnected • ECT sensor to ECM sensing circuit high resistance, open circuit or short circuit to high voltage • ECT sensor failure	For ECT sensor circuit tests,GO to Pinpoint Test C. .
P0118	Engine coolant temperature (ECT) sensor sense circuit low voltage (high coolant temperature)	• Engine overheat condition • ECT sensor to ECM wiring short circuit to ground • ECT sensor failure	Check engine for overheating. For ECT sensor circuit tests,GO to Pinpoint Test C. .
P0121	Throttle position (TP) sensor circuit range/performance	• TP sensor to ECM wiring open circuit or high resistance • TP sensor to ECM sensing circuits 1 or 2 short circuit to high voltage • TP sensor failure	For TP sensor circuit tests,GO to Pinpoint Test D. , and GO to Pinpoint Test K. .

P0122	Throttle position (TP) sensor 1 low voltage	• TP sensor to ECM sensing circuit 1 (TP sensor pin 3) open circuit or high resistance • TP sensor failure	For TP sensor circuit tests,GO to Pinpoint Test D. , and GO to Pinpoint Test K. .
P0123	Throttle position (TP) sensor 1 high voltage	• TP sensor to ECM sensing circuit 1 (TP sensor pin 3) short circuit to high voltage • TP sensor failure	For TP sensor circuit tests,GO to Pinpoint Test D. , and GO to Pinpoint Test K. .
P0125	Engine coolant temperature (ECT) sensor response (for closed loop fuel control)	• Low/contaminated coolant • Thermostat failure • ECT sensor to ECM sensing circuit high resistance, open circuit or short circuit to high voltage	Check coolant level and condition. Check thermostat function. For ECT sensor circuit tests,GO to Pinpoint Test C. .
P0131	Right-hand H02S sense circuit low voltage	• H02S disconnected • H02S to ECM wiring open circuit • H02S short circuit to ground • H02S failure	For Right-hand HO2S circuit tests,GO to Pinpoint Test E. .
P0132	Right-hand H02S sense circuit high voltage	• H02S sensing circuit short circuit to high voltage • H02S ground braided shield open circuit • H02S failure	For Right-hand HO2S circuit tests,GO to Pinpoint Test E. .
P0133	Right-hand H02S sense circuit slow response	• Engine misfire • H02S disconnected • H02S mechanical damage • H02S to ECM wiring intermittent open circuit • H02S sensing circuit short circuit to high voltage • H02S short circuit to ground • H02S ground braided shield open circuit • H02S heater circuit fault • Exhaust leak • Low exhaust temperature • Injector flow partially blocked • Catalyst efficiency decrease • H02S failure	Check for 'engine misfire detected' DTCs. For HO2S circuit tests,GO to Pinpoint Test E. .GO to Pinpoint Test F. . Check for exhaust leaks, REFER to Section 309-00 Exhaust System. Check injectors, REFER to Section 303-04 Fuel Charging and Controls.
P0135	Right-hand H02S heater circuit malfunction	• H02S disconnected • H02S heater power supply open circuit • H02S heater to ECM wiring short circuit or open circuit • H02S heater failure	For right-hand HO2S heater circuit tests,GO to Pinpoint Test F. .
P0137	Right-hand catalyst monitor sensor sense circuit low voltage	• Catalyst monitor sensor disconnected • Catalyst monitor sensor to ECM wiring open circuit • Catalyst monitor sensor short circuit to ground • Catalyst monitor sensor failure	For right-hand catalyst monitor sensor circuit tests,GO to Pinpoint Test G. .
P0138	Right-hand catalyst monitor sensor sense circuit high voltage	• Catalyst monitor sensor sensing circuit short circuit to high voltage • Catalyst monitor sensor ground braided shield open circuit • Catalyst monitor sensor failure	For right-hand catalyst monitor sensor circuit tests,GO to Pinpoint Test G. .
P0140	Right-hand catalyst monitor sensor sense circuit no activity	• Catalyst monitor sensor disconnected • Catalyst monitor sensor mechanical damage • Catalyst monitor sensor to ECM wiring open circuit • Catalyst monitor sensor sensing circuit short circuit to high voltage • Catalyst monitor sensor short circuit to ground • Catalyst monitor sensor ground braided shield open circuit	For right-hand catalyst monitor sensor circuit tests, GO to Pinpoint Test G. . Check for exhaust leaks, REFER to Section 309-00 Exhaust System. Check injectors, REFER to Section 303-04 Fuel Charging and Controls.

		• Exhaust leak • Low exhaust temperature • Catalyst monitor sensor failure	
P0151	Left-hand H02S sense circuit low voltage	• H02S disconnected • H02S to ECM wiring open circuit • H02S short circuit to ground • H02S failure	For left-hand HO2S circuit tests, GO to Pinpoint Test H. .
P0152	Left-hand H02S sense circuit high voltage	• H02S sensing circuit short circuit to high voltage • H02S ground braided shield open circuit • H02S failure	For left-hand HO2S circuit tests,GO to Pinpoint Test H. .
P0153	Left-hand H02S sense circuit slow response	• Engine misfire • H02S disconnected • H02S mechanical damage • H02S to ECM wiring intermittent open circuit • H02S sensing circuit short circuit to high voltage • H02S short circuit to ground • H02S ground braided shield open circuit • H02S heater circuit fault • Exhaust leak • Low exhaust temperature • Injector flow partially blocked • Catalyst efficiency decrease • H02S failure	Check for 'engine misfire detected' DTCs. For HO2S circuit tests, GO to Pinpoint Test H. . Check for exhaust leaks, REFER to Section 309-00 Exhaust System. Check injectors, REFER to Section 303-04 Fuel Charging and Controls.
P0155	Left-hand H02S heater circuit malfunction	• H02S disconnected • H02S heater power supply open circuit • H02S heater to ECM wiring short circuit or open circuit • H02S heater failure	For left-hand HO2S heater circuit tests,GO to Pinpoint Test I. .
P0157	Left-hand catalyst monitor sensor sense circuit low voltage	• Catalyst monitor sensor disconnected • Catalyst monitor sensor to ECM wiring open circuit • Catalyst monitor sensor short circuit to ground • Catalyst monitor sensor failure	For left-hand catalyst monitor sensor circuit tests,GO to Pinpoint Test J. .
P0158	Left-hand catalyst monitor sensor sense circuit high voltage	• Catalyst monitor sensor sensing circuit short circuit to high voltage • Catalyst monitor sensor ground braided shield open circuit • Catalyst monitor sensor failure	For left-hand catalyst monitor sensor circuit tests,GO to Pinpoint Test J. .
P0160	Left-hand catalyst monitor sensor sense circuit no activity	• Catalyst monitor sensor disconnected • Catalyst monitor sensor mechanical damage • Catalyst monitor sensor to ECM wiring open circuit • Catalyst monitor sensor sensing circuit short circuit to high voltage • Catalyst monitor sensor short circuit to ground • Catalyst monitor sensor ground braided shield open circuit • Exhaust leak • Low exhaust temperature • Catalyst monitor sensor failure	For left-hand catalyst monitor sensor circuit tests,GO to Pinpoint Test J. . Check for exhaust leaks, REFER to Section 309-00 Exhaust System.
P0171	Right-hand cylinders combustion too lean	• Air intake leak between MAF sensor and throttle • Fuel filter system blockage • Fuel injector blockage • Fuel pressure regulator failure (low fuel pressure) • Low fuel pump output	Check air intake system for leaks, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel filter, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors and fuel

		• H02S harness wiring fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	pressure regulator, REFER to Section 303-04 Fuel Charging and Controls. Check the fuel pressure. Check the exhaust system for leaks, REFER to Section 309-00 Exhaust System. Refer to pinpoint tests for sensors listed.
P0172	Right-hand cylinders combustion too rich	• Engine misfire • Blocked air filter • Fuel system return blockage • Leaking fuel injector(s) • Fuel pressure regulator failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	Check for 'engine misfire detected' DTCs. Check the air filter element, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel lines, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors and fuel pressure regulator, REFER to Section 303-04 Fuel Charging and Controls. Refer to pinpoint tests for sensors listed.
P0174	Left-hand cylinders combustion too lean	• Air intake leak between MAF sensor and throttle • Fuel filter system blockage • Fuel injector blockage • Fuel pressure regulator failure (low fuel pressure) • Low fuel pump output • H02S harness wiring fault • Exhaust leak (before catalyst) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	Check the air intake system for leaks, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel filter, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors and fuel pressure regulator, REFER to Section 303-04 Fuel Charging and Controls. Check the fuel pressure. For HO2S circuit tests,GO to Pinpoint Test H. , andGO to Pinpoint Test I. . Check the exhaust system for leaks, REFER to Section 309-00 Exhaust System. Refer to pinpoint tests for sensors listed.
P0175	Left-hand cylinders combustion too rich	• Engine misfire • Blocked air filter • Fuel system return blockage • Leaking fuel injector(s) • Fuel pressure regulator failure (high fuel pressure) • ECM receiving incorrect signal from one or more of the following sensors - ECT, MAF, IAT, TP	Check for 'engine misfire detected' DTCs. Check air filter element, REFER to Section 303-12 Intake Air Distribution and Filtering. Check the fuel lines, REFER to Section 310-01 Fuel Tank and Lines. Check the fuel injectors and fuel pressure regulator, REFER to Section 303-04 Fuel Charging and Controls. Refer to pinpoint tests for sensors listed.
P0201	Fuel injector circuit malfunction, cyl 1	• Injector disconnected • Injector wiring open or short circuit • Injector failure	For fuel injector circuit tests, REFER to Section 303-04 Fuel Charging and Controls.
P0202	Fuel injector circuit malfunction, cyl 3		
P0203	Fuel injector circuit malfunction, cyl 5		
P0204	Fuel injector circuit malfunction, cyl 7		
P0205	Fuel injector circuit malfunction, cyl 2		
P0206	Fuel injector circuit malfunction, cyl 4		
P0207	Fuel injector circuit malfunction, cyl 6		
P0208	Fuel injector circuit malfunction,		

	cyl 8		
P0222	Throttle position (TP) sensor circuit 2 low voltage	• TP sensor to ECM sensing circuit 2 (TP sensor pin 2) open circuit or high resistance • TP sensor failure	For TP sensor circuit tests,GO to Pinpoint Test D. , andGO to Pinpoint Test K. .
P0223	Throttle position (TP) sensor circuit 2 high voltage	• TP sensor to ECM sensing circuit 2 (TP sensor pin 2) short circuit to battery voltage • TP sensor failure	For TP sensor circuit tests,GO to Pinpoint Test D. , andGO to Pinpoint Test K. .
P0300	Random misfire detected	• ECM to ignition module primary circuit faults (cylinder misfire detected DTCs also logged) • Ignition module to ignition coil primary circuit fault(s) (cylinder misfire DTC also logged) • Ignition module ground circuit; open circuit, high resistance • Ignition coil failure(s) • Ignition module failure(s) • Check for water ingress into spark plug wells • HT short to ground (tracking) check rubber boots for cracks/damage • Spark plug failure/fouled/incorrect gap • Cylinder compression low • Fuel injector circuit fault(s) (injector DTCs also logged) • Fuel delivery pressure (low/high) • Fuel injectors restricted/leaking • Fuel contamination • PAS pulley bolts loose (see Service Action S462) • Worn camshaft/broken valve springs	For ignition circuit tests, REFER to Section 303-07 Engine Ignition. For engine information, REFER to Section 303-00 Engine System - General Information. For fuel system information, REFER to Section 303-04 Fuel Charging and Controls. Check service actions.
P0301	Misfire detected, cyl 1	Refer to possible sources for P0300	Refer to actions for P0300.
P0302	Misfire detected, cyl 3		
P0303	Misfire detected, cyl 5		
P0304	Misfire detected, cyl 7		
P0305	Misfire detected, cyl 2		
P0306	Misfire detected, cyl 4		
P0307	Misfire detected, cyl 6		
P0308	Misfire detected, cyl 8		
P0327	Right-hand knock sensor (KS) sense circuit out of range (low voltage)	• Poor sensor contact with cylinder block • KS to ECM sense circuit short circuit to ground • KS failure	For right-hand knock sensor circuit tests,GO to Pinpoint Test L. .
P0328	Right-hand knock sensor (KS) sense circuit out of range (high voltage)	• Poor sensor contact with cylinder block • KS to ECM sense circuit high resistance or open circuit • KS to ECM sense circuit short circuit to high voltage • KS failure	For right-hand knock sensor circuit tests,GO to Pinpoint Test L. .
P0332	Left-hand knock sensor (KS) sense circuit out of range (low voltage)	• Poor sensor contact with cylinder block • KS to ECM sense circuit short circuit to ground • KS failure	For left-hand knock sensor circuit tests,GO to Pinpoint Test M. .
P0333	Left-hand knock sensor (KS) sense circuit out of range (high voltage)	• Poor sensor contact with cylinder block • KS to ECM sense circuit high resistance or open circuit • KS to ECM sense circuit short circuit to high voltage	For left-hand knock sensor circuit tests,GO to Pinpoint Test M. .

		• KS failure	
P0335	Crankshaft position (CKP) sensor circuit malfunction	• CKP sensor disconnected • CKP sensor air gap incorrect/foreign matter on face • CKP sensor sensing circuit open circuit, short circuit to ground, short circuit to high voltage • CKP sensor failure	For CKP sensor circuit tests,GO to Pinpoint Test N. .
P0340	Camshaft position (CMP) sensor circuit malfunction	• CMP sensor disconnected • CMP sensor air gap incorrect/foreign matter on face • CMP sensor sensing circuit open circuit, short circuit to ground, short circuit to high voltage • CMP sensor failure	For CMP sensor circuit tests,GO to Pinpoint Test O. .
P0351	Ignition coil primary/secondary circuit malfunction, cyl 1	• ECM to ignition module primary circuit open circuit, short circuit to ground, high resistance • Ignition module to ignition coil primary circuit open circuit, short circuit to ground, high resistance • Ignition module ground circuit open circuit, high resistance • Ignition coil failure • Ignition module failure	For ignition circuit tests, REFER to Section 303-07 Engine Ignition.
P0352	Ignition coil primary/secondary circuit malfunction, cyl 3		
P0353	Ignition coil primary/secondary circuit malfunction, cyl 5		
P0354	Ignition coil primary/secondary circuit malfunction, cyl 7		
P0355	Ignition coil primary/secondary circuit malfunction, cyl 2		
P0356	Ignition coil primary/secondary circuit malfunction, cyl 4		
P0357	Ignition coil primary/secondary circuit malfunction, cyl 6		
P0358	Ignition coil primary/secondary circuit malfunction, cyl 8		
P0400	Exhaust gas recirculation (EGR) flow malfunction	• EGR valve connector pins high resistance • EGR pipe/exhaust manifold leak • EGR pipe blocked • EGR valve stuck open/closed, blocked • EGR valve failure	For EGR pinpoint tests, REFER to Section 303-08 Engine Emission Control.
P0405	Exhaust gas recirculation (EGR) drive circuits open circuit	• EGR valve power supply circuit open circuit • EGR valve to ECM drive circuit pair - EGR pins 1/3, 4/6 open circuit, high resistance • EGR valve failure (stepper motor open circuit)	For EGR pinpoint tests, REFER to Section 303-08 Engine Emission Control.
P0406	Exhaust gas recirculation (EGR) drive circuits short circuit	• EGR valve to ECM drive circuit pair - EGR pins 1/3, 4/6 short circuit to ground or high voltage • EGR valve failure (stepper motor short circuit)	For EGR pinpoint tests, REFER to Section 303-08 Engine Emission Control.
P0420	Right-hand catalytic converter efficiency below threshold	• HO2S disconnected. • HO2S to ECM wiring fault. • HO2S heater to ECM wiring fault. • HO2S heater failure. • HO2S failure. • Catalyst monitor sensor failure. • Catalytic converter failure.	Refer to pinpoint tests for components listed. Visually inspect catalytic converters.
P0442	Evaporative emissions system (EVAP) leak detected	• Fuel filler cap missing • Fuel filler cap seal faulty • EVAP system leak (canister damage, pipework damage) • EVAP valve to ECM drive circuit open circuit, short circuit, high resistance • EVAP valve to engine purge pipe damaged/blocked/leaking • EVAP operating vacuum hose	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.

		leak/blockage • EVAP valve failure	
P0444	Evaporative emissions system (EVAP) valve circuit open circuit	• EVAP to ECM drive circuit open circuit or high resistance • EVAP failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0445	Evaporative emissions system (EVAP) valve circuit short circuit	• EVAP to ECM drive circuit short circuit to ground • EVAP failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0447	Canister close valve (CCV) circuit open circuit	• CCV to ECM drive circuit open circuit, high resistance or short circuit to ground • EVAP failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0448	Canister close valve (CCV) circuit short circuit	• CCV to ECM drive circuit short circuit to high voltage • CCV failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0452	Fuel tank pressure (FTP) sensor circuit low voltage	• FTP sensor disconnected • FTP sensor to ECM sense circuit open circuit or short circuit to ground • FTP sensor to ECM power supply circuit open circuit or short circuit to ground • FTP sensor failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0453	Fuel tank pressure (FTP) sensor circuit high voltage	• FTP sensor to ECM signal ground circuit open circuit • FTP sensor to ECM wiring (supply, sense, signal, ground) short circuit to each other • FTP sensor to ECM sense circuit short circuit to high voltage • FTP sensor failure	For evaporative emissions pinpoint tests, REFER to Section 303-13 Evaporative Emissions.
P0460	Fuel level sense signal performance	• Fuel level sensor to instrument cluster circuits intermittent short or open circuit • Fuel level sensor failure • Instrument cluster fault (incorrect fuel level data)	For fuel level sensor circuit tests, REFER to Section 303-04 Fuel Charging and Controls.
P0506	Idle rpm lower than expected	• Air intake blockage • Accessory drive overload (defective/siezed component) • Throttle valve stuck closed • Throttle assembly failure	Check the air intake system. REFER to Section 303-12 Intake Air Distribution and Filtering. Check the accessory drive components, REFER to Section 303-05 Accessory Drive. For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P0507	Idle rpm higher than expected	• Intake air leak between MAF sensor and throttle • Intake air leak between throttle and engine • Engine breather leak • Cruise (speed) control vacuum failure • Throttle valve stuck open • Throttle assembly failure	Check the air intake system. REFER to Section 303-12 Intake Air Distribution and Filtering. Check the engine breather system, REFER to Section 303-08 Engine Emission Control. For cruise (speed) control information, REFER to Section 310-03 Speed Control. For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P0560	Vehicle voltage malfunction	• ECM battery power supply open circuit, high resistance	For ECM power supply circuit tests, GO to Pinpoint Test AD. .
P0566	Cruise (speed) control **CANCEL** switch ON fault	• Cruise (speed) control switches internal steering wheel short circuit to ground	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed

		• Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **CANCEL** switch failure (stuck ON)	Control.
P0567	Cruise (speed) control **RESUME** switch ON fault	• Cruise (speed) control switches internal steering wheel short circuit to ground • Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **RESUME** switch failure (stuck ON)	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed Control.
P0568	Cruise (speed) control switch ground malfunction	• Cruise (speed) control switches internal steering wheel open circuit • Steering wheel cassette reel open circuit or high resistance • Cassette reel to ECM circuit **ACCEL / DECEL** open circuit or high resistance • **ACCEL / DECEL** switch failure	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed Control.
P0569	Cruise (speed) control **DECEL / SET (SET-)** switch ON fault	• Cruise (speed) control switches internal steering wheel short circuit to ground • Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **DECEL / SET** switch failure (stuck ON)	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed Control.
P0570	Cruise (speed) control **ACCEL / SET (SET+)** switch ON fault	• Cruise (speed) control switches internal steering wheel short circuit to ground • Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **ACCEL / SET** switch failure (stuck ON)	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed Control.
P0603	ECM data corrupted	• ECM failure	Contact dealer technical support for advice on possible ECM failure.
P1000	System checks not complete since last memory clear	OBD diagnostic monitors have not completed	Carry out comprehensive component monitor drive cycle. Refer to the DTC section of JTIS.
P1104	Mass air flow (MAF) sensor ground malfunction	• MAF sensor to ECM reference ground circuit open circuit, short circuit to high voltage, high resistance • MAF sensor to ECM sensing circuit open circuit • MAF sensor failure	For MAF sensor circuit tests,GO to Pinpoint Test A. .
P1111	System checks complete since last memory clear	OBD diagnostic monitors have completed	No action necessary.
P1112	Intake air temperature (IAT) sensor 2 sense circuit high voltage (low charge air temperature)	• IAT sensor 2 disconnected • IAT sensor 2 to ECM sensing circuit high resistance, open circuit or short circuit to high voltage • IAT sensor 2 failure	For IAT sensor 2 circuit tests,GO to Pinpoint Test Q. .
P1113	Intake air temperature (IAT) sensor 2 sense circuit low voltage (high charge air temperature)	• Supercharger intercooler failure • IAT sensor 2 to ECM sensing circuit short circuit to ground • IAT sensor 2 failure	For IAT sensor 2 circuit tests,GO to Pinpoint Test Q. .
P1121	Accelerator pedal position (APP) sensor circuit 'A' range/performance	• APP sensor to ECM sense circuit 'A' (sensor pin 5) open circuit, short circuit or high resistance • Sensor power supply fault • Sensor reference ground fault • APP sensor failure	For APP sensor circuit tests,GO to Pinpoint Test R. , andGO to Pinpoint Test S. .

P1122	Accelerator pedal position (APP) sensor circuit 'A' low voltage	• APP sensor to ECM sense circuit 'A' (sensor pin 5) open circuit or high resistance • Sensor power supply fault • APP sensor failure	For APP sensor circuit tests,GO to Pinpoint Test R. , andGO to Pinpoint Test S. .
P1123	Accelerator pedal position (APP) sensor circuit 'A' high voltage	• APP sensor to ECM sense circuit 'A' (sensor pin 5) short circuit to high voltage • APP sensor failure	For APP sensor circuit tests, GO to Pinpoint Test R. , and GO to Pinpoint Test S. .
P1221	Accelerator pedal position (APP) sensor circuit 'B' range/performance	• APP sensor to ECM sense circuit 'B' (sensor pin 3) open circuit, short circuit or high resistance • Sensor power supply fault • Sensor reference ground fault • APP sensor failure	For APP sensor circuit tests,GO to Pinpoint Test R. , andGO to Pinpoint Test S. .
P1222	Accelerator pedal position (APP) sensor circuit 'B' low voltage	• APP sensor to ECM sense circuit 'B' (sensor pin 3) open circuit or high resistance • Sensor power supply fault • APP sensor failure	For APP sensor circuit tests,GO to Pinpoint Test R. , andGO to Pinpoint Test S. .
P1223	Accelerator pedal position (APP) sensor circuit 'B' high voltage	• APP sensor to ECM sense circuit 'B' (sensor pin 3) short circuit to high voltage • APP sensor failure	For APP sensor circuit tests,GO to Pinpoint Test R. , andGO to Pinpoint Test S. .
P1224	Throttle control position error	• Throttle position adaptations not performed after battery disconnect • TP sensor disconnected • TP sensor to ECM sense circuits open circuit, high resistance • Throttle motor power relay failure • Throttle motor power relay to ECM circuit fault • Throttle motor power relay power supply open circuit • ECM ground circuit fault (relay coil drive) • Throttle motor to ECM drive circuits open circuit, short circuit, high resistance • Throttle motor failure • Throttle assembly failure	Carry out throttle adaptation procedure. For TP sensor circuit tests,GO to Pinpoint Test D. , andGO to Pinpoint Test K. . For throttle motor circuit tests,GO to Pinpoint Test T. . For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1226	Mechanical guard sensor range/performance	• Mechanical guard sensor to ECM sense circuit open circuit, short circuit or high resistance • Sensor power supply fault • Sensor reference ground fault • Mechanical guard sensor failure • Mechanical guard actuator seized/spring broken	For mechanical guard circuit tests,GO to Pinpoint Test U. . For sensor power supply circuit tests,GO to Pinpoint Test V. . For sensor ground circuit tests,GO to Pinpoint Test W. . For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1227	Mechanical guard sensor circuit low voltage	• Mechanical guard sensor to ECM sense circuit open circuit or high resistance • Sensor power supply fault • Mechanical guard sensor failure	For mechanical guard circuit tests,GO to Pinpoint Test U. . For sensor power supply circuit tests,GO to Pinpoint Test V. . For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1228	Mechanical guard sensor circuit high voltage	• Mechanical guard sensor to ECM sense circuit short circuit to high voltage • Mechanical guard sensor failure	For mechanical guard circuit tests,GO to Pinpoint Test U. . For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1229	Throttle motor control circuit mallfunction	• Throttle motor disconnected • Throttle motor to ECM drive circuits short circuit or open circuit • Throttle motor failure	For throttle motor circuit tests,GO to Pinpoint Test T. .
P1230	Fuel pump relay malfunction. NOTE. This DTC covers the S/C system fuel pump 1	• Fuel pump relay failure • Fuel pump to ECM circuit fault • Fuel pump relay coil power supply	For fuel pump relay circuit tests, REFER to Section 303-04 Fuel Charging and Controls.

		• open circuit • ECM ground circuit fault (relay coil drive)	
P1235	Vacuum switching valve (VSV) 1 circuit range/performance (mechanical guard position)	• Vacuum leak/blockage between the throttle elbow and the throttle vacuum actuator • Vacuum actuator failure • Mechanical guard actuator seized/spring broken	Carry out mechanical checks for vacuum leak/blockage, failed vacuum actuator, and broken/siezed actuator spring.
P1236	Vacuum switching valve (VSV) 1 (vacuum) circuit failure	• VSV 1 disconnected • VSV 1 to ECM drive circuit high resistance, open circuit or short circuit • VSV 1 power supply open circuit • VSV 1 failure	For VSV tests, REFER to Section 310-03 Speed Control.
P1237	Vacuum switching valve (VSV) 2 (atmosphere) circuit failure	• VSV 2 disconnected • VSV 2 to ECM drive circuit high resistance, open circuit or short circuit • VSV 2 power supply open circuit • VSV 2 failure	For VSV tests, REFER to Section 310-03 Speed Control.
P1238	Vacuum switching valve (VSV) 3 (release) circuit failure	• VSV 3 disconnected • VSV 3 to ECM drive circuit high resistance, open circuit or short circuit • VSV 3 power supply open circuit • VSV 3 failure	For VSV tests, REFER to Section 310-03 Speed Control.
P1240	Sensor reference voltage malfunction (throttle sensors, fuel tank pressure sensor) (ECM pins EM10-21; EM11-8)	• ECM to sensors reference voltage short circuit to ground, short circuit to high voltage, open circuit, high resistance • TP sensor, pedal position and mechanical guard sensor(s), fuel tank pressure sensor failure(s)	For sensor reference voltage circuit tests,GO to Pinpoint Test V. .
P1241	Sensor reference voltage low (throttle sensors, fuel tank pressure sensor) (ECM pins EM10-21; EM11-8)	• ECM to sensors reference voltage short circuit to ground • TP sensor, APP and mechanical guard sensor(s), fuel tank pressure sensor failure(s)	For sensor reference voltage circuit tests,GO to Pinpoint Test V. .
P1242	Sensor reference voltage high (throttle sensors, fuel tank pressure sensor) (ECM pins EM10-21; EM11-8)	• ECM to sensors reference voltage circuit open circuit, high resistance, short circuit to high voltage • TP sensor, APP and mechanical guard sensor(s), fuel tank pressure sensor failure(s)	For sensor reference voltage circuit tests,GO to Pinpoint Test V. .
P1243	Sensor reference ground malfunction (throttle sensors, fuel tank pressure sensor, ECT sensor, IAT sensor, IAT sensor 2) (ECM pins EM10-20; EM11-12)	• ECM to sensors reference ground circuit open circuit, high resistance • Throttle sensors, fuel tank pressure sensor, ECT sensor, IAT sensor, IAT sensor 2 failures	For sensor reference ground circuit tests,GO to Pinpoint Test W. .
P1245	Engine crank signal low voltage	• Starter relay coil to ECM/BPM circuit open circuit	For engine crank circuit tests,GO to Pinpoint Test X. .
P1246	Engine crank signal high voltage	• Starter relay coil to ECM/BPM circuit short circuit to B+ voltage • BPM failure	For engine crank circuit tests,GO to Pinpoint Test X. .
P1250	Engine load malfunction	• Air intake leak • Engine breather leak • TP sensor circuit fault (DTC P0121) • Throttle valve spring failure	Check air intake system for leaks, REFER to Section 303-12 Intake Air Distribution and Filtering. Check engine breather system for leaks, REFER to Section 303-08 Engine Emission Control. See pinpoint test for P0121. For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1251	Throttle position malfunction (engine off)	• TP sensor to ECM wiring open circuit or high resistance	For TP sensor circuit tests,GO to Pinpoint Test D. , andGO to Pinpoint

		• TP sensor to ECM sensing circuits ('1' or '2') short circuit to high voltage • TP sensor failure • Throttle motor disconnected • Throttle motor to ECM drive circuits short circuit or open circuit • Throttle motor failure • Throttle assembly failure	Test K. . For throttle motor circuit tests,GO to Pinpoint Test T. . For throttle body information, REFER to Section 303-04 Fuel Charging and Controls.
P1252	Mechanical guard position malfunction (cruise (speed) control)	• VSV 1, 2, 3 vacuum and/or electrical circuit fault(s) open circuit, short circuit or high resistance • Mechanical guard sensor to ECM sense circuit • Mechanical guard sensor failure • Mechanical guard actuator siezed/spring broken • Throttle vacuum actuator fault	See pinpoint tests for components listed.
P1253	Mechanical guard position malfunction (engine off)	• VSV 1, 2, 3 vacuum and/or electrical circuit fault(s) • Mechanical guard sensor to ECM sense circuit • Mechanical guard sensor failure • Mechanical guard actuator siezed/spring broken • Throttle vacuum actuator fault	See pinpoint tests for components listed.
P1260	Security input malfunction	• KTM to ECM circuit short circuit, high resistance or open circuit • KTM failure	For KTM circuit tests,GO to Pinpoint Test Y. .
P1313	Misfire rate catalyst damage, right-hand. NOTE: This DTC will flag only when accompanied by a random or individual cylinder misfire DTC; P0300, P0301 to P0304	Refer to possible causes for P0300-P0308	Refer to actions for P0300-P0308.
P1314	Misfire rate catalyst damage, left-Hand: NOTE. This DTC will flag only when accompanied by a random or individual cylinder misfire DTC; P0300 to P0308		
P1316	Misfire excess emission. NOTE: This DTC will flag only when accompanied by an individual cylinder misfire DTC; P0300 to P0308		
P1336	Crankshaft position (CKP) sensor / camshaft position (CMP) sensor synchronization malfunction	• CKP sensor/CMP sensor disconnected • CKP sensor/CMP sensor gap incorrect/foreign matter on sensor face • CKP sensor/CMP sensor sensing circuit open circuit, short circuit to ground, short circuit to high voltage • CKP sensor/CMP sensor failure	For CKP sensor circuit tests,GO to Pinpoint Test N. . For CMP sensor circuit tests,GO to Pinpoint Test O. .
P1367	Ignition monitor (ignition module 1)	• Ignition module 1 disconnected • Ignition module 1 to ECM circuits open circuit, short circuit to ground or short circuit to B+ voltage • Ignition module 1 ground circuit fault • Ignition coil relay failure • Ignition coil open/short circuit • Ignition module 1 failure	For ignition circuit tests, REFER to Section 303-07 Engine Ignition.
P1368	Ignition monitor (ignition module 2)	• Ignition module 2 disconnected • Ignition module 2 to ECM circuits open circuit, short circuit to ground	For ignition circuit tests, REFER to Section 303-07 Engine Ignition.

		or short circuit to B+ voltage • Ignition module 2 ground circuit fault • Ignition coil relay failure • Ignition coil open/short circuit • Ignition module 2 failure	
P1474	Intercooler coolant pump relay malfunction	• Intercooler pump relay failure • Intercooler pump relay to ECM drive circuit fault • Intercooler pump relay coil ground circuit fault • ECM power supply fault	For intercooler pump relay circuit tests,GO to Pinpoint Test Z. .
P1475	Radiator fans slow (series) circuit malfunction	• Radiator fan control relay module to ECM 'series' drive circuit (relay pin 9) fault • Relay coil ignition power supply open circuit • ECM ground circuit fault (relay coil drive) • ECT sensor circuit malfunction (refer to P0116)	For radiator fan series circuit tests,GO to Pinpoint Test AA.
P1476	Radiator fans fast (parallel) circuit malfunction	• Radiator fan control relay module to ECM 'parallel' drive circuit (relay pin 7) fault • Relay coil ignition power supply open circuit • ECM ground circuit fault (relay coil drive) • ECT sensor circuit malfunction (refer to P0116)	For radiator fan parallel circuit tests,GO to Pinpoint Test AB. .
P1516	Gear change **PARK / NEUTRAL** driving malfunction	• Transmission range (TR) sensor to ECM circuit open circuit or high resistance • TR sensor failure • D-4 switch to TCM circuit open circuit or high resistance • D-4 switch fault	For **PARK / NEUTRAL** tests,GO to Pinpoint Test AC. .
P1517	Engine **PARK / NEUTRAL** cranking malfunction	• Transmission range (TR) sensor to ECM circuit open circuit or high resistance • TR sensor failure	For **PARK / NEUTRAL** tests,GO to Pinpoint Test AC. .
P1571	Brake switch malfunction	• Brake switch to ECM circuit open circuit, short circuit to ground, high resistance • Brake switch ignition switched ground circuit open circuit • Brake switch failure • Brake cancel switch to ECM circuit open circuit, short circuit to ground, high resistance • Brake cancel switch to cruise (speed) control switch circuit open circuit, short circuit to ground, high resistance • Brake cancel switch ignition switched power supply open circuit • Brake cancel switch failure • Cruise (speed) control switch failure	For cruise (speed) control circuit tests, REFER to Section 310-03 Speed Control.
P1606	Engine management system (EMS) control relay malfunction	• ECM control relay failure • ECM control relay to ECM circuit fault • ECM control relay coil power supply open circuit • ECM ground circuit fault (relay coil drive)	For ECM relay circuit tests,GO to Pinpoint Test AD. .
P1609	ECM microprocessor-to-microprocessor communication	• ECM failure	Contact dealer technical support for advice on possible ECM failure.

	failure		
P1611	Throttle angle malfunction	• TP sensor circuit fault (refer to P0121) • APP sensor circuit fault (refer to P0121) • Throttle assembly failure • ECM failure	See pinpoint tests for components listed. For throttle body information, REFER to Section 303-04 Fuel Charging and Controls. Contact dealer technical support for advice on possible ECM failure.
P1612	Throttle offset malfunction	• TP sensor circuit fault (refer to P0121) • APP sensor circuit fault (refer to P0121) • Throttle assembly failure • ECM failure	See pinpoint tests for components listed. For throttle body information, REFER to Section 303-04 Fuel Charging and Controls. Contact dealer technical support for advice on possible ECM failure.
P1637	CAN ABS/TCCM token missing	• CAN open circuit fault - ABS/TCCM to ECM • CAN short circuit fault • ABS/TCCM failure • ECM failure	For network circuit tests, REFER to Section 418-00 Module Communications Network.
P1638	CAN INST token missing	• CAN open circuit fault - INST to ECM • CAN short circuit fault • INST failure • ECM failure	For network circuit tests, REFER to Section 418-00 Module Communications Network.
P1642	CAN circuit malfunction	• CAN short circuit fault • Control module failure - check for additional logged DTCs to locate control module source	For network circuit tests, REFER to Section 418-00 Module Communications Network.
P1643	CAN TCM token missing	• CAN open circuit fault - TCM to ECM • CAN short circuit fault • TCM failure • ECM failure	For network circuit tests, REFER to Section 418-00 Module Communications Network.
P1646	Fuel pump 2 relay malfunction. NOTE: This DTC applies only to the S/C fuel pump 2	• Fuel pump 2 relay failure • Fuel pump 2 relay to ECM circuit fault • Fuel pump 2 relay coil power supply open circuit • ECM ground circuit fault (relay coil drive)	For fuel pump 2 relay circuit tests, REFER to Section 303-04 Fuel Charging and Controls.

Pinpoint Tests

PINPOINT TEST A : DTC P0101, P0102, P0103; MASS AIR FLOW (MAF) SENSOR RANGE/PERFORMANCE, HIGH/LOW VOLTAGE	
• NOTE: Before commencing this test, check the air filter for blockage, the engine air intake and breather systems for leaks, and the TPS for additional DTCs.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: CHECK THE MAF SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM12.
	3 Disconnect the MAF sensor electrical connector, PI35.
	4 Measure the resistance between EM12, pin 13 (GY) and PI35, pin 02 (GY).
	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 A2.
A2: CHECK THE MAF SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between the MAF sensor electrical connector, PI35, pin 02 (GY) and GROUND.
	Is the voltage greater than 3 volts?

	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 A3.
A3: CHECK THE MAF SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
• NOTE: The short to GROUND may be intermittent. Move the wiring to attempt to reproduce the conditions under which the DTC was logged, and visually inspect the harness for any signs of chafing, see "visual inspection chart".	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI35, pin 02 (GY) and GROUND.
	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 A4.
A4: CHECK THE MAF SENSOR SUPPLY CIRCUIT VOLTAGE	
	1 Reconnect the ECM electrical connector, EM12.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between the MAF sensor electrical connector, PI35, pin 01 (WU) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to A5. **No** REPAIR the circuit between the MAF sensor electrical connector, PI35, pin 01 (WU) and BATTERY. This circuit includes the EMS control relay, fuse 12 of the EMS fuse board, and splices in the harness. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
A5: CHECK THE MAF SENSOR SUPPLY CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the EMS fuse board electrical connector, EM20.
	3 Measure the resistance between EM20, pin 10 (WU) and PI35, pin 01 (WU).
	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 MAF sensor. REFER to Mass Air Flow (MAF) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : DTC P0111, P0112, P0113; INTAKE AIR TEMPERATURE (IAT) SENSOR RANGE/PERFORMANCE, HIGH/LOW VOLTAGE	
• NOTE: Before commencing this test, check the air filter for blockage and the engine air intake and breather systems for leaks.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE IAT SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM12.
	3 Disconnect the MAF sensor electrical connector, PI35.
	4 Measure the resistance between EM12, pin 12 (UP) and PI35, pin 03 (UP).
	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 B2.
B2: CHECK THE IAT SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI35, pin 03 (UP) and GROUND.

	Is the voltage greater than 3 volts? **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 B3.
B3: CHECK THE IAT SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI35, pin 03 (UP) and GROUND.
	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** INSTALL a new MAF sensor. REFER to Mass Air Flow (MAF) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : DTC P0116, P0117, P0118; ENGINE COOLANT TEMPERATURE (ECT) SENSOR RANGE/PERFORMANCE, HIGH/LOW VOLTAGE	
• NOTE: Before commencing this test, check the coolant level and condition, check the operation of the thermostat, rectify as necessary.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK THE ECT SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM11.
	3 Disconnect the ECT sensor electrical connector, PI04.
	4 Measure the resistance between EM11, pin 09 (UY) and PI04, pin 02 (UY).
	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 C2.
C2: CHECK THE ECT SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI04, pin 02 (UY) and GROUND.
	Is the voltage greater than 3 volts? **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 C3.
C3: CHECK THE ECT SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI04, pin 02 (UY) and GROUND.
	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** INSTALL a new ECT sensor. REFER to Section 303-03A Engine Cooling / 303-03B Supercharger Cooling. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST D : DTC P0121, P0122, P0123; THROTTLE POSITION (TP) SENSOR RANGE/PERFORMANCE, HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE TP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.

	2 Disconnect the ECM electrical connector, EM11.
	3 Disconnect the TP sensor electrical connector, PI06.
	4 Measure the resistance between EM11, pin 11 (U) and PI06, pin 03 (U).
	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 D2.
D2: CHECK THE TP SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI06, pin 03 (U) and GROUND.
	Is the voltage greater than 5 volts? **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 D3.
D3: CHECK THE TP SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI06, pin 03 (U) and GROUND.
	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** INSTALL a new TP sensor. REFER to Throttle Position (TP) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : DTC P0131, P0132, P0133; RIGHT-HAND H02S LOW / HIGH VOLTAGE, SLOW RESPONSE	
• NOTE: Before commencing this test, check the sensor connections and harness, check for exhaust leaks, engine misfire, etc. See 'visual inspection chart' and 'possible causes'.	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
E1: CHECK THE H02S SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the H02S electrical connector, EM21.
	3 Disconnect the ECM electrical connector, EM12
	4 Measure the resistance between EM21, pin 03 (R) and EM12, pin 15 (R).
	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 E2.
E2: CHECK THE H02S SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM12, pin 15 (R) and GROUND.
	Is the voltage greater than 3 volts? **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 E3.
E3: CHECK THE H02S SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM12, pin 15 (R) and GROUND.

	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 E4.
E4: CHECK THE H02S GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Reconnect the ECM electrical connector, EM12.
	2 Measure the resistance between EM21, pin 04 (BRD) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit (this is a braided lead which would require different repair techniques to standard wiring). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new H02S. REFER to Heated Oxygen Sensor (HO2S) RH in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : DTC P0133, P0135; RIGHT-HAND H02S HEATER CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE H02S HEATER POWER SUPPLY CIRCUIT	
	1 Disconnect the H02S electrical connector, EM21.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM21, pin 02 (WP) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to F2. **No** REPAIR the circuit. This circuit includes the EMS control relay and fuse 14 of the EMS fuse board. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
F2: CHECK THE H02S HEATER CONTROL CIRCUIT FROM ECM FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM15.
	3 Measure the resistance between EM15, pin 02 (PU) and EM21, pin 01 (PU).
	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 F3.
F3: CHECK THE H02S HEATER CONTROL CIRCUIT FROM ECM FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM21, pin 01 (PU) and GROUND.
	Is the voltage greater than 3 volts? **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 F4.
F4: CHECK THE H02S HEATER CONTROL CIRCUIT FROM ECM FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM21, pin 01 (PU) and GROUND.
	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** INSTALL a new H02S. REFER to Heated Oxygen Sensor (HO2S) RH in this section.

	CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST G : DTC P0137, P0138; RIGHT-HAND CATALYST MONITOR SENSOR LOW / HIGH VOLTAGE, NO ACTIVITY	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
G1: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the catalyst monitor sensor electrical connector, EM22.
	3 Disconnect the ECM electrical connector, EM12.
	4 Measure the resistance between EM22, pin 02 (U) and EM12, pin 17 (U).
	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 G2.
G2: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM12, pin 17 (U) and GROUND.
	Is the voltage greater than 3 volts? **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 G3.
G3: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM12, pin 17 (U) and GROUND.
	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 G4.
G4: CHECK THE CATALYST MONITOR SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Reconnect the ECM electrical connector, EM12.
	2 Measure the resistance between EM22, pin 01 (BRD) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit (this is a braided lead which would require different repair techniques to standard wiring). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new catalyst monitor sensor. REFER to Catalyst Monitor Sensor RH in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST H : DTC P0151, P0152, P0153; LEFT-HAND H02S LOW / HIGH VOLTAGE, SLOW RESPONSE	
• NOTE: Before commencing this test, check the sensor connections and harness, check for exhaust leaks, engine misfire, etc. See 'visual inspection chart' and 'possible causes'.	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
H1: CHECK THE H02S SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the H02S electrical connector, EM23.
	3 Disconnect the ECM electrical connector, EM12.
	4 Measure the resistance between EM23, pin 03 (G) and EM12, pin 14 (G).
	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 H2.
H2: CHECK THE H02S SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM12, pin 14 (G) and GROUND.
	Is the voltage greater than 3 volts? **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 H3.
H3: CHECK THE H02S SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM12, pin 14 (G) and GROUND.
	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 H4.
H4: CHECK THE H02S GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Reconnect the ECM electrical connector, EM12.
	2 Measure the resistance between EM23, pin 04 (BRD) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit (this is a braided lead which would require different repair techniques to standard wiring). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new H02S. REFER to Heated Oxygen Sensor (HO2S) RH in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST I : DTC P0153, P0155; LEFT-HAND H02S HEATER CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: CHECK H02S HEATER POWER SUPPLY CIRCUIT	
	1 Disconnect the H02S electrical connector, EM23.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM23, pin 02 (WP) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to I2. **No** REPAIR the power supply circuit to the H02S heater. This circuit includes the EMS control relay and fuse 14 of the EMS fuse board. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
I2: CHECK H02S HEATER CONTROL CIRCUIT FROM ECM FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM15.
	3 Measure the resistance between EM15, pin 01 (PS) and EM23, pin 01 (PS).
	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 I3.
I3: CHECK H02S HEATER CONTROL CIRCUIT FROM ECM FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.

	1
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM23, pin 01 (PS) and GROUND.
	Is the voltage greater than 3 volts? **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 I4.
I4: CHECK H02S HEATER CONTROL CIRCUIT FROM ECM FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM23, pin 01 (PS) and GROUND.
	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** INSTALL a new H02S. REFER to Heated Oxygen Sensor (HO2S) LH in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST J : DTC P0157, P0158; LEFT-HAND CATALYST MONITOR SENSOR LOW/HIGH VOLTAGE, NO ACTIVITY	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the catalyst monitor sensor electrical connector, EM24.
	3 Disconnect the ECM electrical connector, EM12.
	4 Measure the resistance between EM24, pin 02 (N) and EM12, pin 16 (N).
	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 J2.
J2: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM12, pin 16 (N) and GROUND.
	Is the voltage greater than 3 volts? **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 J3.
J3: CHECK THE CATALYST MONITOR SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM12, pin 16 (N) and GROUND.
	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 J4.
J4: CHECK THE CATALYST MONITOR SENSOR GROUND CIRCUIT FOR OPEN CIRCUIT	
	1 Reconnect the ECM electrical connector, EM12.
	2 Measure the resistance between EM24, pin 01 (BRD) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit (this is a braided lead which would require different repair techniques to standard wiring). For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for

	normal operation. **No** INSTALL a new catalyst monitor sensor. REFER to Catalyst Monitor Sensor LH in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST K : DTC P0222, P0223; THROTTLE POSITION (TP) SENSOR CIRCUIT 2 LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: CHECK TP SENSOR 2 SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the TP sensor electrical connector, PI06.
	3 Disconnect the ECM electrical connector, EM11.
	4 Measure the resistance between PI06, pin 02 (G) and EM11, pin 10 (G).
	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 K2.
K2: CHECK TP SENSOR 2 SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI06, pin 02 (G) and GROUND.
	Is the voltage greater than 5 volts? **Yes** REPAIR the short circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new TP sensor. REFER to Throttle Position (TP) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST L : DTC P0327, P0328; RIGHT-HAND KNOCK SENSOR (KS) CIRCUIT OUT OF RANGE (LOW VOLTAGE)	
• NOTE: Before commencing this test, make sure that the sensor is making a good electrical contact with the cylinder block. See 'possible causes'.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: CHECK THE KS SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the KS electrical connector, PI26.
	3 Disconnect the ECM electrical connector, EM13.
	4 Measure the resistance between PI26, pin 01 (S) and EM13, pin 18 (S).
	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 L2.
L2: CHECK THE KS SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Turn the ignition switch to the **ON** position.
	2 Reconnect the battery negative terminal.
	3 Measure the voltage between PI26, pin 01 (S) and GROUND.
	Is the voltage greater than 3 volts? **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 L3.

L3: CHECK THE KS SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI26, pin 01 (S) and GROUND.
	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** INSTALL a new KS. REFER to Knock Sensor (KS) in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST M : DTC P0332, P0333; LEFT-HAND KNOCK SENSOR (KS) CIRCUIT OUT OF RANGE (LOW VOLTAGE)	
• NOTE: Before commencing this test, make sure that the sensor is making a good electrical contact with the cylinder block. See 'possible causes'.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
M1: CHECK THE KS SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the KS electrical connector, PI27.
	3 Disconnect the ECM electrical connector, EM13.
	4 Measure the resistance between PI27, pin 01 (N) and EM13, pin 17 (N).
	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 M2.
M2: CHECK THE KS SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Turn the ignition switch to the **ON** position.
	2 Reconnect the battery negative terminal.
	3 Measure the voltage between PI27, pin 01 (N) and GROUND.
	Is the voltage greater than 3 volts? **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 M3.
M3: CHECK THE KS SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI27, pin 01 (N) and GROUND.
	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** INSTALL a new KS. REFER to Knock Sensor (KS) in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST N : DTC P0335; CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
N1: CHECK THE CKP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the **OFF** position.
	2 Check the CKP sensor for correct installation.
	Is the CKP sensor correctly installed? **Yes** GO to N2. **No** INSTALL the CKP sensor correctly.

	REFER to Crankshaft Position (CKP) Sensor in this section. Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
N2: CHECK THE CKP SENSOR FOR DEBRIS	
	1 Remove the CKP sensor and inspect for debris.
	Is the CKP sensor free of debris? **Yes** GO to N3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to Crankshaft Position (CKP) Sensor in this section. Reconnect the sensor. CLEAR the DTCs. TEST the system for normal operation.
N3: CHECK THE CKP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Measure the resistance between EM13, pin 19 (Y) and PI17, pin 01 (Y).
	4 Measure the resistance between EM13, pin 28 (P) and PI17, pin 02 (P).
	Is either 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 N4.
N4: CHECK THE CKP SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI17, pin 19 (Y) and GROUND.
	4 Measure the voltage between PI17, pin 28 (P) and GROUND.
	Is either voltage greater than 3 volts? **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 N5.
N5: CHECK THE CKP SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM13, pin 19 (Y) and GROUND.
	3 Measure the resistance between EM13, pin 28 (P) and GROUND.
	Is either 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** INSTALL a new CKP sensor. REFER to Crankshaft Position (CKP) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST O : DTC P0340; CAMSHAFT POSITION (CMP) SENSOR CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
O1: CHECK THE CMP SENSOR FOR CORRECT INSTALLATION	
	1 Turn the ignition switch to the **OFF** position.
	2 Check the CMP sensor for correct installation.
	Is the CMP sensor correctly installed? **Yes** GO to O2. **No** INSTALL the CMP sensor correctly. REFER to Camshaft Position (CMP) Sensor in this section. CLEAR the DTCs. TEST the system for normal operation.
O2: CHECK THE CMP SENSOR FOR FOREIGN DEBRIS	
	1 Remove the CMP sensor and inspect for foreign debris.
	Is the CMP sensor free of foreign debris?

	Yes GO to N3. **No** CLEAN the sensor and wheel. INSTALL the sensor. REFER to Camshaft Position (CMP) Sensor in this section. CLEAR the DTCs. TEST the system for normal operation.
O3: CHECK THE CMP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Measure the resistance between EM13, pin 20 (B) and PI15, pin 01 (B).
	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 O3.
O4: CHECK THE CMP SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM13, pin 20 (B) and GROUND.
	Is the voltage greater than 3 volts? **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 O5.
O5: CHECK THE CMP SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI15, pin 01 (B) and GROUND.
	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** INSTALL a new CMP sensor. REFER to Camshaft Position (CMP) Sensor in this section. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST P : DTC P0560; VEHICLE VOLTAGE MALFUNCTION	
• NOTE: When checking the EMS switched supplies to the ECM in test P3, the EMS relay must be energized when testing EM10, pin 01 and EM14, pin 03.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
P1: CHECK THE BATTERY POWER SUPPLY TO THE ECM	
	1 Disconnect the ECM electrical connector, EM10.
	2 Measure the voltage between EM10, pin 09 (NO) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to P2. **No** REPAIR the battery power supply circuit. This circuit includes fuse 4 of the EMS fuse board. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
P2: CHECK THE IGNITION SWITCHED POWER SUPPLY TO THE ECM	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between EM10, pin 05 (WK) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to P3. **No** REPAIR the ignition switched power supply circuit. This circuit includes fuse 9 of the right-hand heelboard fuse box. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

P3: CHECK THE EMS SWITCHED POWER SUPPLIES TO THE ECM	
	1 Disconnect the ECM electrical connector, EM14.
	2 Make sure the EMS relay is energized.
	3 Measure the voltage between EM10, pin 01 (WR) and GROUND.
	4 Measure the voltage between EM14, pin 03 (WR) and GROUND.
	Are both voltages greater than 10 volts? **Yes** Contact Dealer technical support for advice on possible ECM failure. **No** REPAIR the EMS switched power supply circuits. The supply circuit to EM10, pin 01 includes fuse 18 of the right-hand heelboard fuse box, the supply circuit to EM14, pin 03 includes fuse 01 of the trunk fuse box. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Q : DTC P1112, P1113; INTAKE AIR TEMPERATURE (IAT) SENSOR #2 SENSE CIRCUIT HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Q1: CHECK IAT SENSOR 2 SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the IAT sensor 2 electrical connector, PI03.
	3 Disconnect the ECM electrical connector, EM12.
	4 Measure the resistance between PI03, pin 02 (UP) and EM12, pin 07 (UP).
	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 Q2.
Q2: CHECK IAT SENSOR 2 SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI03, pin 02 (UP) and GROUND.
	Is the voltage greater than 3 volts? **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 Q3.
Q3: CHECK IAT SENSOR 2 SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI03, pin 02 (UP) and GROUND.
	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** INSTALL a new IAT sensor 2. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST R : DTC P1121, P1122, P1123; ACCELERATOR PEDAL POSITION (APP) SENSOR CIRCUIT "A" RANGE/PERFORMANCE, HIGH/LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
R1: CHECK THE APP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM11.
	3 Disconnect the APP sensor electrical connector, PI42.
	4 Measure the resistance between EM11, pin 16 (K) and PI42, pin 05 (K).
	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 R2.
R2: CHECK THE APP SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 05 (K) and GROUND.
	Is the voltage greater than 3 volts? **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 R3.
R3: CHECK THE APP SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI42, pin 05 (K) and GROUND.
	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 R4.
R4: CHECK THE APP SENSOR COMMON REFERENCE VOLTAGE AT THE SENSOR	
	1 Reconnect the ECM electrical connector, EM11.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 04 (UW) and GROUND.
	Is the voltage less than 4 volts? **Yes** GO to R5. **No** GO to R6.
R5: CHECK THE APP SENSOR COMMON REFERENCE VOLTAGE CIRCUIT	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the ECM electrical connector, EM11.
	3 Measure the resistance between EM11, pin 08 (UW) and PI42, pin 04 (UW).
	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 the ECM power supplies. REFER to Electronic Engine Controls in this section.
R6: CHECK THE APP SENSOR COMMON REFERENCE GROUND	
	1 Measure the resistance between PI42, pin 02 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to R7. **No** INSTALL a new APP sensor. CLEAR the DTC. TEST the system for normal operation.
R7: CHECK THE APP SENSOR COMMON REFERENCE GROUND CIRCUIT	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between EM10, pin 20 (BG) and PI42, pin 02 (BG).
	3 Measure the resistance between EM11, pin 12 (BG) and PI42, pin 02 (BG).
	Is either 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 the ECM GROUND circuits. If the GROUND circuits are sound, contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST S : DTC P1221, P1222, P1223; ACCELERATOR PEDAL POSITION (APP) SENSOR

CIRCUIT 'B' RANGE/PERFORMANCE, HIGH/LOW VOLTAGE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: CHECK THE APP SENSOR SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM11.
	3 Disconnect the APP sensor electrical connector, PI42.
	4 Measure the resistance between EM11, pin 15 (R) and PI42, pin 03 (R).
	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 S2.
S2: CHECK THE APP SENSOR SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 03 (R) and GROUND.
	Is the voltage greater than 3 volts? **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 S3.
S3: CHECK THE APP SENSOR SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI42, pin 03 (R) and GROUND.
	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 S4.
S4: CHECK THE APP SENSOR COMMON REFERENCE VOLTAGE AT THE SENSOR	
	1 Reconnect the ECM electrical connector, EM11.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 04 (UW) and GROUND.
	Is the voltage less than 4 volts? **Yes** GO to S5. **No** GO to S6.
S5: CHECK THE APP SENSOR COMMON REFERENCE VOLTAGE CIRCUIT	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.
	3 Disconnect the ECM electrical connector, EM11.
	4 Measure the resistance between EM11, pin 08 (UW) and PI42, pin 04 (UW).
	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 the ECM power supplies. REFER to Electronic Engine Controls in this section.
S6: CHECK THE APP SENSOR COMMON REFERENCE GROUND	
	1 Measure the resistance between PI42, pin 02 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to S7. **No** INSTALL a new APP sensor. CLEAR the DTC. TEST the system for normal operation.
S7: CHECK THE APP SENSOR COMMON REFERENCE GROUND CIRCUIT	

	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between EM10, pin 20 (BG) and PI42, pin 02 (BG).
	4 Measure the resistance between EM11, pin 12 (BG) and PI42, pin 02 (BG).
	Is either 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 the ECM GROUND circuits. If the GROUND circuits are sound, contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST T : DTC P1224, P1229; THROTTLE CONTROL POSITION SENSOR ERROR/THROTTLE MOTOR CONTROL CIRCUIT MALFUNCTION	
• NOTE: Before commencing this test, check the TP sensor connections, perform the throttle adaptions procedure.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
T1: CHECK THE TP SENSOR TO ECM SENSE CIRCUIT 1 FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the TP sensor electrical connector, PI06.
	3 Disconnect the ECM electrical connector, EM11.
	4 Measure the resistance between PI06, pin 02 (G) and EM11, pin 10 (G).
	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 T2.
T2: CHECK THE THROTTLE MOTOR RELAY CONSTANT SUPPLY	
	1 Reconnect the battery negative terminal.
	2 Remove the throttle motor relay.
	3 Measure the voltage between the throttle motor relay base, pin 3 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to T3. **No** REPAIR the circuit. This circuit includes the EMS fuse box, fuse 09. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T3: CHECK THE THROTTLE MOTOR RELAY EMS SWITCHED SUPPLY	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between the throttle motor relay base, pin 1 and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to T4. **No** REPAIR the circuit between the throttle motor relay base, pin 1 and the battery. This circuit includes the EMS fuse box, fuse 20, and the EMS control relay. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
T4: CHECK THE THROTTLE MOTOR RELAY TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the battery negative terminal.
	3 Disconnect the ECM electrical connector, EM13.
	4 Measure the resistance between EM13, pin 14 (GR) and throttle motor relay base, pin 2.
	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 T5.
T5: CHECK THE THROTTLE MOTOR RELAY OUTPUT TO ECM	
	1 Reconnect the ECM electrical connector, EM13.

	2 Disconnect the ECM electrical connector, EM14.
	3 INSTALL the throttle motor relay.
	4 Reconnect the battery negative terminal.
	5 Turn the ignition switch to the **ON** position.
	6 Measure the voltage between EM14, pins 01 and 02, (GY) and GROUND.
	Is the voltage greater than 10 volts? **Yes** GO to T6. **No** INSTALL a new throttle motor relay. For additional information, refer to the electrical guide. CLEAR the DTC. TEST the system for normal operation.
T6: CHECK THE THROTTLE MOTOR TO ECM DRIVE SUPPLY CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the throttle motor electrical connector, PI33.
	2 Measure the resistance between PI33, pin 01 (R) and EM14, pins 05 and 06 (R).
	Is either 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 T7.
T7: CHECK THE THROTTLE MOTOR TO ECM DRIVE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Measure the resistance between PI33, pin 02 (G) and EM14, pins 11 and 12 (G).
	Is either 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 T8.
T8: CHECK THE THROTTLE MOTOR TO ECM DRIVE SUPPLY CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the ECM electrical connector, EM14.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI33, pin 01 (R) and GROUND.
	Is the voltage greater than 10 volts? **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 T9.
T9: CHECK THE THROTTLE MOTOR TO ECM DRIVE SUPPLY CIRCUIT FOR SHORT TO GROUND	
	1 Disconnect the ECM electrical connector, EM14.
	2 Turn the ignition switch to the **OFF** position.
	3 Measure the resistance between PI33, pin 01 (R) and GROUND.
	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** INSTALL a new throttle motor. REFER to Section 303-04 Fuel Charging and Controls. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST U : DTC P1226; MECHANICAL GUARD SENSOR RANGE/PERFORMANCE, HIGH /LOW VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
U1: CHECK THE MECHANICAL GUARD SENSE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the mechanical guard sensor electrical connector, PI42.
	3 Disconnect the ECM electrical connector, EM11.
	4 Measure the resistance between PI42, pin 01 (BY) and EM11, pin 13 (BY).
	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 U2.
U2: CHECK THE MECHANICAL GUARD SENSE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 01 (BY) and GROUND.
	Is the voltage greater than 10 volts? **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 U3.
U3: CHECK THE MECHANICAL GUARD SENSE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI42, pin 01 (BY) and GROUND.
	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 U4.
U4: CHECK THE MECHANICAL GUARD SENSOR POWER SUPPLY CIRCUIT	
	1 Reconnect the ECM electrical connector, EM11.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 04 (UW) and GROUND.
	Is the voltage less than 5 volts? **Yes** REPAIR the power supply circuit. This circuit includes the ECM. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new mechanical guard sensor. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST V : DTC P1240, P1241, P1242; SENSOR REFERENCE VOLTAGE MALFUNCTION, HIGH/LOW VOLTAGE (THROTTLE SENSORS, FUEL TANK PRESSURE SENSOR)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
V1: CHECK THE REFERENCE VOLTAGE AT THE APP SENSOR/MECHANICAL GUARD SENSOR	
	1 Disconnect the APP sensor electrical connector, PI42.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 04 (UW) and GROUND.
	Is the voltage less than 5 volts? **Yes** GO to V2. **No** GO to V3.
V2: CHECK THE APP SENSOR/MECHANICAL GUARD SENSOR REFERENCE VOLTAGE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between PI42, pin 04 (UW) and EM10, pin 21 (UW).
	4 Measure the resistance between PI42, pin 04 (UW) and EM11, pin 08 (UW).
	Is either 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 V3.
V3: CHECK THE APP SENSOR/MECHANICAL GUARD SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1

	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between PI42, pin 04 (UW) and GROUND.
	Is the voltage greater than 6 volts? **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 V4.
V4: CHECK THE APP SENSOR / MECHANICAL GUARD SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI42, pin 04 (UW) and GROUND.
	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 V5.
V5: CHECK THE REFERENCE VOLTAGE AT THE THROTTLE POSITION SENSOR	
	1 Reconnect the ECM electrical connectors, EM10 and EM11.
	2 Disconnect the TP sensor electrical connector, PI06.
	3 Turn the ignition switch to the **ON** position.
	4 Measure the voltage between PI06, pin 04 (UW) and GROUND.
	Is the voltage less than 5 volts? **Yes** GO to V6. **No** GO to V7.
V6: CHECK THE THROTTLE POSITION SENSOR REFERENCE VOLTAGE CIRCUIT FOR HIGH RESISTANCE	
	1 Turn the ignition switch to the **OFF** position.
	2 Disconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between PI06, pin 04 (UW) and EM10, pin 21 (UW).
	4 Measure the resistance between PI06, pin 04 (UW) and EM11, pin 08 (UW).
	Is either 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 V7.
V7: CHECK THE THROTTLE POSITION SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between PI06, pin 04 (UW) and GROUND.
	Is the voltage greater than 6 volts? **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 V8.
V8: CHECK THE THROTTLE POSITION SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between PI06, pin 04 (UW) and GROUND.
	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 V9.
V9: CHECK THE REFERENCE VOLTAGE AT THE FUEL TANK PRESSURE SENSOR	
	1 Disconnect the FTP sensor electrical connector, FP01.
	2 Reconnect the ECM electrical connectors, EM10 and EM11.
	3 Turn the ignition switch to the **ON** position.

	4 Measure the voltage between FP01, pin 03 (UW) and GROUND.
	Is the voltage less than 5 volts? **Yes** GO to V10. **No** CHECK for DTCs associated with TP sensor, APP/mechanical guard sensor, or FTP sensor. INSTALL a new sensor as indicated by the DTC. CLEAR the DTC. TEST the system for normal operation.
V10: CHECK THE FUEL TANK PRESSURE SENSOR REFERENCE VOLTAGE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between FP01, pin 03 (UW) and EM10, pin 21 (UW).
	4 Measure the resistance between FP01, pin 03 (UW) and EM11, pin 08 (UW).
	Is either 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 V11.
V11: CHECK THE FUEL TANK PRESSURE SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between FP01, pin 03 (UW) and GROUND.
	Is the voltage greater than 6 volts? **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 V12.
V12: CHECK THE FUEL TANK PRESSURE SENSOR REFERENCE VOLTAGE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between FP01, pin 03 (UW) and GROUND.
	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** CHECK for DTCs associated with TP sensor, APP/mechanical guard sensor, or FTP sensor. INSTALL a new sensor as indicated by the DTC. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST W : DTC P1243; SENSOR REFERENCE GROUND MALFUNCTION (THROTTLE SENSORS, FUEL TANK PRESSURE SENSOR, ECT, IAT, IAT 2 SENSORS)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
W1: CHECK THE SENSOR REFERENCE GROUND AT THE THROTTLE SENSORS	
	1 Disconnect the TP sensor electrical connector, PI06.
	2 Measure the resistance between PI06, pin 01 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to W2. **No** GO to W3.
W2: CHECK THE THROTTLE SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between PI06, pin 01 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between PI06, pin 01 (BG) and EM11, pin 12 (BG).
	Is either 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 W3.
W3: CHECK THE SENSOR REFERENCE GROUND AT THE APP SENSOR/MECHANICAL GUARD SENSOR	

	1 Disconnect the APP sensor/mechanical guard sensor electrical connector, PI42.
	2 Reconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between PI42, pin 02 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to W4. **No** GO to W5.
W4: CHECK THE APP SENSOR/MECHANICAL GUARD SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between PI42, pin 02 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between PI42, pin 02 (BG) and EM11, pin 12 (BG).
	Is either 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 W5.
W5: CHECK THE SENSOR REFERENCE GROUND AT THE FUEL TANK PRESSURE SENSOR	
	1 Disconnect the FTP sensor electrical connector, FP01.
	2 Reconnect the ECM electrical connectors, EM10 and EM11.
	3 Measure the resistance between FP01, pin 01 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to W6. **No** GO to W7.
W6: CHECK THE FUEL TANK PRESSURE SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between FP01, pin 01 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between FP01, pin 01 (BG) and EM11, pin 12 (BG).
	Is either 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 W7.
W7: CHECK THE SENSOR REFERENCE GROUND AT THE ECT SENSOR	
	1 Reconnect the ECM electrical connectors, EM10 and EM11.
	2 Disconnect the ECT sensor electrical connector, PI04.
	3 Measure the resistance between PI04, pin 01 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to W8. **No** GO to W9.
W8: CHECK THE ECT SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between PI04, pin 01 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between PI04, pin 01 (BG) and EM11, pin 12 (BG).
	Is either 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 W9.
W9: CHECK THE SENSOR REFERENCE GROUND AT THE IAT SENSOR (MAF)	
	1 Reconnect the ECM electrical connectors, EM10 and EM11.
	2 Disconnect the IAT sensor (MAF) electrical connector, PI35.
	3 Measure the resistance between PI35, pin 04 (BG) and GROUND.

	Is the resistance greater than 5 ohms? **Yes** GO to W10. **No** GO to W11.
W10: CHECK THE IAT SENSOR REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between PI35, pin 04 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between PI35, pin 04 (BG) and EM11, pin 12 (BG).
	Is either 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 W11.
W11: CHECK THE SENSOR REFERENCE GROUND AT THE IAT SENSOR #2	
	1 Reconnect the ECM electrical connectors, EM10 and EM11.
	2 Disconnect the IAT sensor 2 electrical connector, PI03.
	3 Measure the resistance between PI03, pin 01 (BG) and GROUND.
	Is the resistance greater than 5 ohms? **Yes** GO to W12. **No** CHECK for DTCs associated with TP sensor, APP/mechanical guard sensor, FTP sensor, ECT sensor, IAT sensor, or IAT sensor 2. INSTALL a new sensor as indicated by the DTC. CLEAR the DTC. TEST the system for normal operation.
W12: CHECK THE IAT SENSOR #2 REFERENCE GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connectors, EM10 and EM11.
	2 Measure the resistance between PI03, pin 01 (BG) and EM10, pin 20 (BG).
	3 Measure the resistance between PI03, pin 01 (BG) and EM11, pin 12 (BG).
	Is either 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 associated with TPS, APP/mechanical guard sensor, FTP sensor, ECT sensor, IAT sensor, or IAT sensor #2. INSTALL a new sensor as indicated by the DTC. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST X : DTC P1245, P1246; ENGINE CRANK SIGNAL LOW/HIGH VOLTAGE	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
X1: CHECK THE STARTER RELAY SIGNAL CIRCUIT FROM ECM AND BPM FOR SHORT TO B+	
	1 Remove the starter relay.
	2 Measure the voltage between the relay base, pin 02 and GROUND.
	Is the voltage greater than 3 volts? **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 X2.
X2: CHECK THE STARTER RELAY SIGNAL CIRCUIT FROM ECM AND BPM FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connector, EM11.
	2 Disconnect the BPM electrical connector, FC15.
	3 Measure the resistance between EM11, pin 06 (GO) and the starter relay base, pin 02.
	4 Measure the resistance between FC15, pin 73 (GO) and the starter relay base, pin 02.
	Is either 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 BPM. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Y : DTC P1260; SECURITY INPUT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Y1: CHECK THE KTM TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the ECM electrical connector, EM10.
	2 Disconnect the KTM electrical connector, FC22.
	3 Measure the resistance between EM10, pin 06 (O) and FC22, pin 16 (O).
	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 KTM. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST Z : DTC P1474; INTERCOOLER COOLANT PUMP RELAY MALFUNCTION	
• NOTE: Early production vehicles have connector pin numbers that differ from the volume production pin numbers shown. Use the wire color code for pin identification on early production vehicles.	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
Z1: CHECK THE INTERCOOLER PUMP RELAY TO ECM DRIVE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Remove the intercooler pump relay.
	3 Disconnect the ECM electrical connector, EM13.
	4 Measure the resistance between the relay base, pin 01 and EM13, pin 10 (RY).
	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 Z2.
Z2: CHECK THE INTERCOOLER PUMP RELAY TO ECM DRIVE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between the relay base, pin 01 and GROUND.
	Is the voltage greater than 3 volts? **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 Z3.
Z3: CHECK THE INTERCOOLER PUMP RELAY TO ECM DRIVE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between the relay base, pin 01 and GROUND.
	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 Z4.
Z4: CHECK THE INTERCOOLER PUMP RELAY GROUND CIRCUIT	
	1 Measure the resistance between the relay base, pin 02 and GROUND.
	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 intercooler pump relay. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AA : DTC P1475; RADIATOR FANS SLOW (SERIES) CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**

AA1: CHECK THE RADIATOR FAN MODULE TO ECM 'SERIES' DRIVE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Disconnect the fan module electrical connector, LS31.
	4 Measure the resistance between EM13, pin 15 (W) and LS31, pin 09 (W).
	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 AA2.
AA2: CHECK THE RADIATOR FAN MODULE TO ECM 'SERIES' DRIVE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM13, pin 15 (W) and GROUND.
	Is the voltage greater than 3 volts? **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 AA3.
AA3: CHECK THE RADIATOR FAN MODULE TO ECM 'SERIES' DRIVE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM13, pin 15 (W) and GROUND.
	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 AA4.
AA4: CHECK THE RADIATOR FAN MODULE IGNITION SUPPLY	
	1 Reconnect the ECM electrical connector, EM13.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between LS31, pin 08 (WP) and GROUND.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new radiator fan module. REFER to Section 303-03A Engine Cooling / 303-03B Supercharger Cooling. CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit. This circuit includes the EMS fuse box, (fuse 14), the EMS relay, etc. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AB : DTC P1476; RADIATOR FANS FAST (PARALLEL) CIRCUIT MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AB1: CHECK THE RADIATOR FAN MODULE TO ECM 'PARALLEL' DRIVE CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM13.
	3 Disconnect the fan module electrical connector, LS31.
	4 Measure the resistance between EM13, pin 16 (WU) and LS31, pin 07 (WU).
	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 AA2.
AB2: CHECK THE RADIATOR FAN MODULE TO ECM 'PARALLEL' DRIVE CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between EM13, pin 16 (WU) and GROUND.

	Is the voltage greater than 3 volts? **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 AB3.
AB3: CHECK THE RADIATOR FAN MODULE TO ECM 'PARALLEL' DRIVE CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between EM13, pin 16 (WU) and GROUND.
	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 AA4.
AB4: CHECK THE RADIATOR FAN MODULE IGNITION SUPPLY	
	1 Reconnect the ECM electrical connector, EM13.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between LS31, pin 08 (WP) and GROUND.
	Is the voltage greater than 10 volts? **Yes** INSTALL a new radiator fan module. REFER to Section 303-03A Engine Cooling / 303-03B Supercharger Cooling. CLEAR the DTC. TEST the system for normal operation. **No** REPAIR the circuit between LS31, pin 08 (WP) and battery. This circuit includes the EMS fuse box-(fuse 14), the EMS relay, etc. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AC : DTC P1516, P1517; GEAR CHANGE PARK/NEUTRAL DRIVING MALFUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AC1: CHECK THE TRANSMISSION RANGE (TR) SENSOR TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the TR sensor electrical connector, EM47.
	3 Disconnect the ECM electrical connector, EM10.
	4 Measure the resistance between EM47, pin K (RU) and EM10, pin 15 (RU).
	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 AC2.
AC2: CHECK THE TRANSMISSION RANGE (TR) SENSOR PARK/NEUTRAL SWITCHING ACTION	
	1 Measure the resistance between pins J and K of the TR sensor.
	2 Move the selector lever from **PARK** to **NEUTRAL** and back.
	Does the resistance switch between open circuit and continuity as the lever moves? **Yes** GO to AC3. **No** INSTALL a new transmission range sensor. CLEAR the DTC. TEST the system for normal operation.
AC3: CHECK THE D-4 SWITCH TO TCM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the D-4 switch electrical connector, CC07.
	2 Disconnect the TCM electrical connector, EM07.
	3 Measure the resistance between CC07, pin 01 (US) and EM07, pin 13 (US).
	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 transmission range sensor. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AD : DTC P1606; EMS CONTROL RELAY MALFUNCTION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
AD1: CHECK THE EMS RELAY PERMANENT B+ SUPPLY	
	1 Remove the EMS relay.
	2 Measure the voltage between the relay base, pins 02 and 03 and GROUND.
	Are both voltages greater than 10 volts? **Yes** GO to AD2. **No** REPAIR the circuit between the relay base and battery. This circuit includes the high power protection module. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation.
AD2: CHECK THE EMS RELAY TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM10.
	3 Measure the resistance between the relay base, pin 01 and EM10, pin 16 (PK).
	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 EMS relay. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST AE : CHECK ROCHESTER VALVE FUNCTION	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
AE1: CHECK VACUUM INTEGRITY OF ROCHESTER VALVE	
	1 Disconnect hoses from the Rochester valve.
	2 Blank off outlet side of valve.
	3 Connect a hand-held vacuum pump to the vacuum inlet of the valve.
	4 Apply a vacuum to the valve and monitor the reading for 2 minutes.
	Does the valve hold vacuum? **Yes** Inspect the pipes at either side of the valve for leaks/damage. Rectify as necessary. **No** INSTALL a new Rochester valve. TEST the system for normal operation.

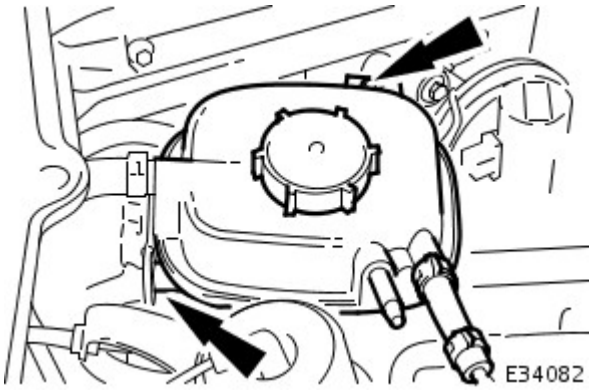
Electronic Engine Controls - Camshaft Position (CMP) Sensor

Removal and Installation

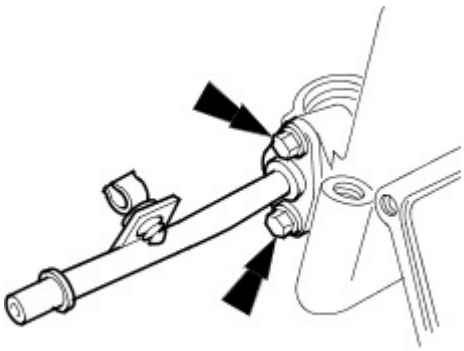
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove engine covers; refer to 12.30.06.
3. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

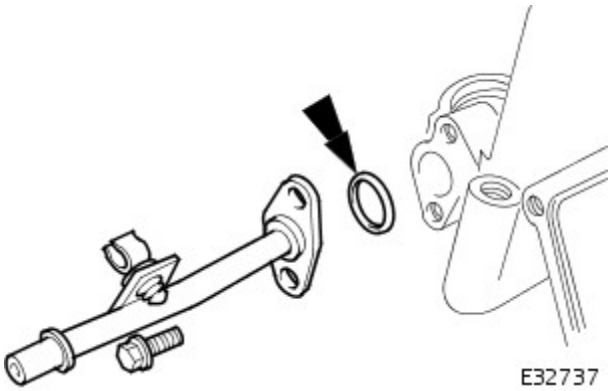
   De-pressurize fuel system; refer to 19.50.02.



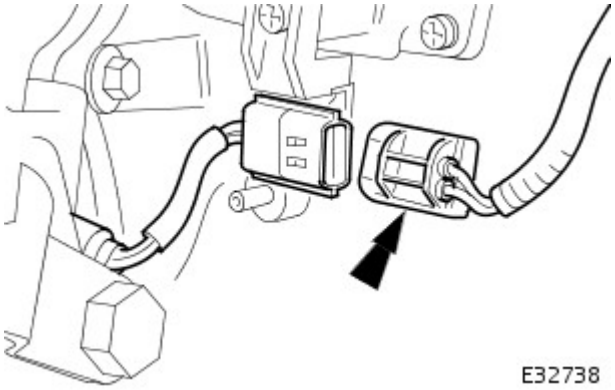
4. Remove coolant expansion tank fixings and reposition tank for access.

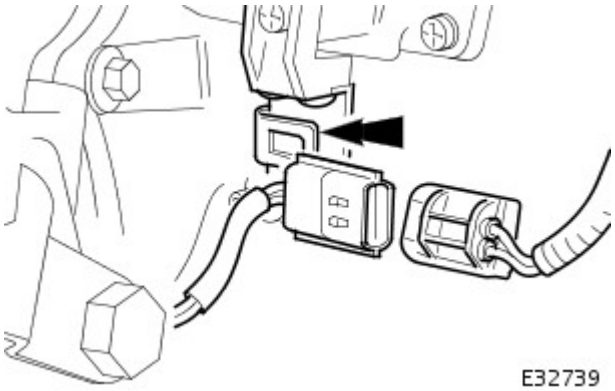


5. Remove bolts securing fuel feed pipe to inlet manifold.



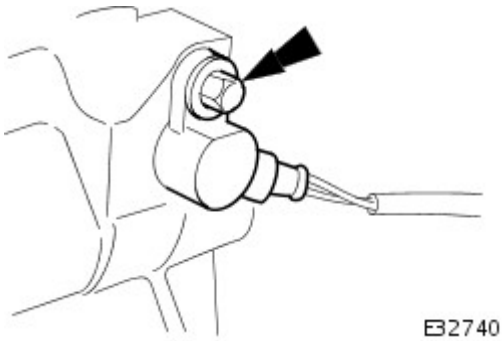
6. Disconnect fuel feed pipe from inlet manifold and pull pipe assembly clear.
   - Discard O-ring.
   - Install suitable blanking plugs.
7. Disconnect CMP sensor connector.
   - Depress tang on connector to release, tools are not necessary.





8. Release CMP sensor socket from mounting bracket.

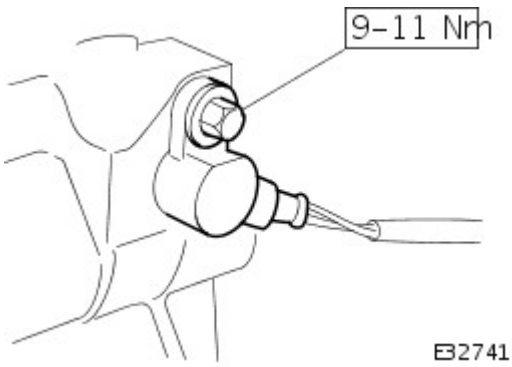
- Depress tang on socket to release, tools are not necessary.



9. Remove CMP sensor.

- Remove fixing.
- Remove sensor.
- Discard O-ring.
- Install suitable blanking plug.

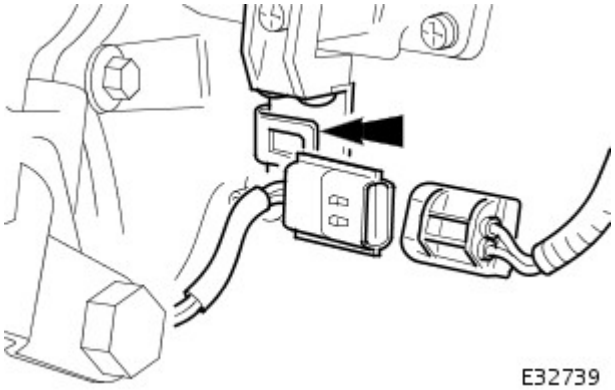
Installation

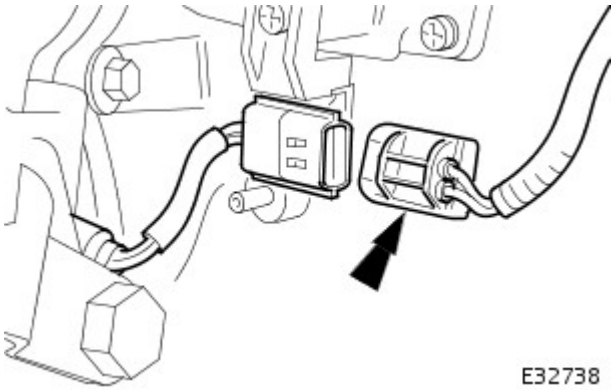


1. Install CMP sensor.

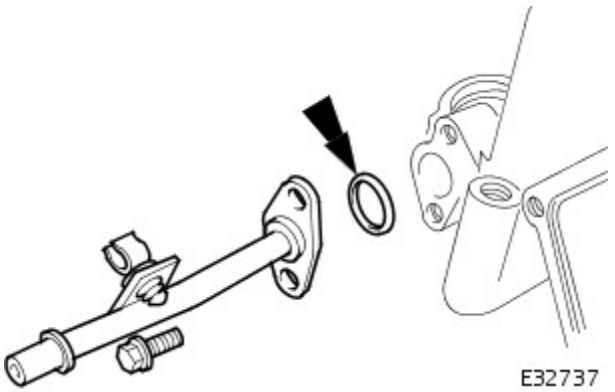
- Clean relevant parts and mating faces.
- Remove blanking plug.
- Install and lubricate new O-ring.

2. Install CMP sensor socket to mounting bracket.



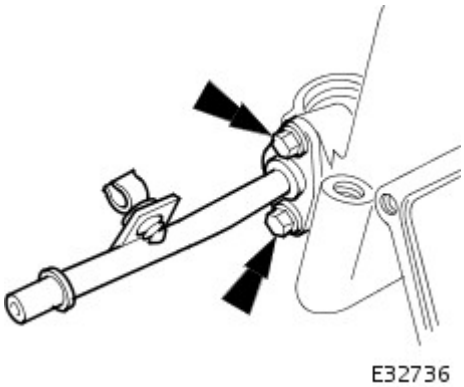


3. Connect CMP sensor connector.



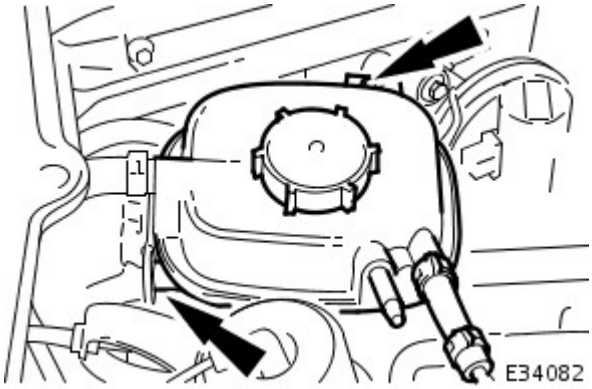
4. Connect fuel feed pipe to inlet manifold.

- Remove blanking plugs.
- Install and lubricate new O-ring.



5. Install bolts securing fuel feed pipe to the inlet manifold.

6. Install coolant expansion tank.



7. Install engine covers; refer to 12.30.06.

8. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

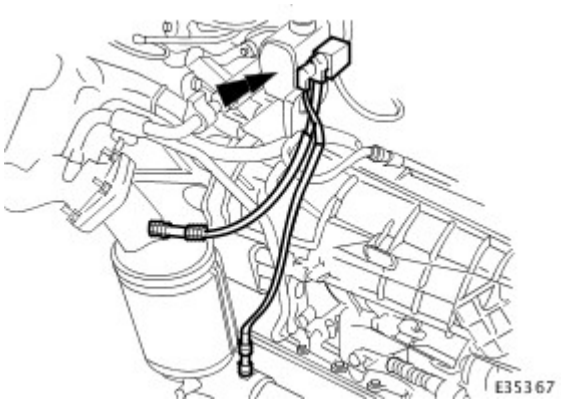
Electronic Engine Controls - Catalyst Monitor Sensor LH

Removal and Installation

General Equipment

Snap-on tool S6176

Removal

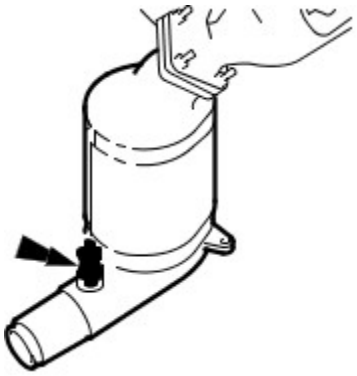


1. WARNING: ENSURE THAT THE EXHAUST AND CATALYST ARE COLD BEFORE COMMENCING WORK.

Disconnect the battery ground lead.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

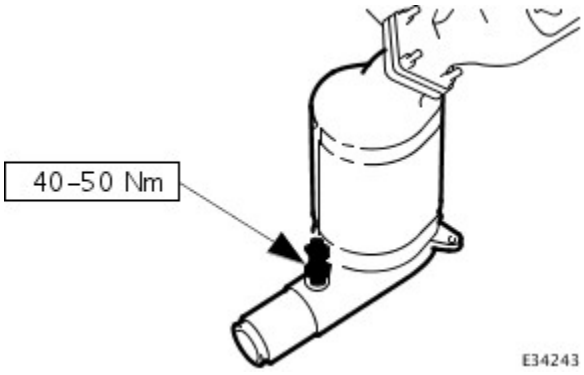
From inside the engine compartment, release the relevant sensor(s) multiplug from its mounting bracket and disconnect the plug.



3. NOTE: Right-hand shown, left-hand similar.

Using the Snap-on tool S6176, remove the sensor from underneath the vehicle.

Installation



1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Tighten the sensor to specification.

3. Make good the exhaust seals.

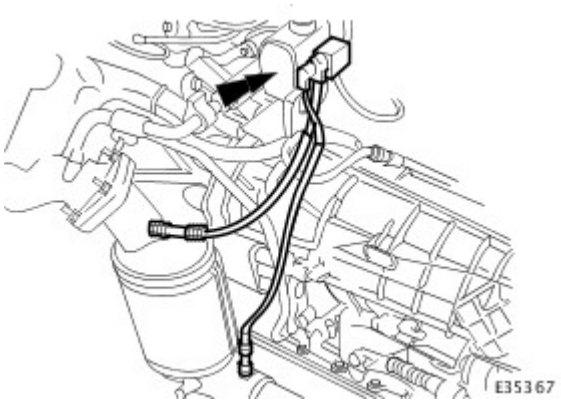
Electronic Engine Controls - Catalyst Monitor Sensor RH

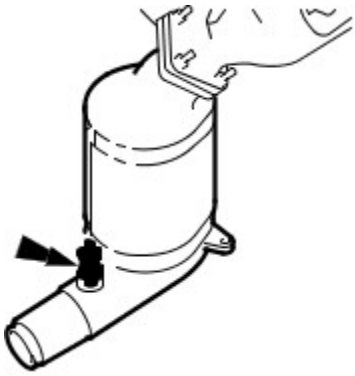
Removal and Installation

General Equipment

Snap-on tool S6176

Removal





1. WARNING: ENSURE THAT THE EXHAUST AND CATALYST ARE COLD BEFORE COMMENCING WORK.

Disconnect the battery ground lead.

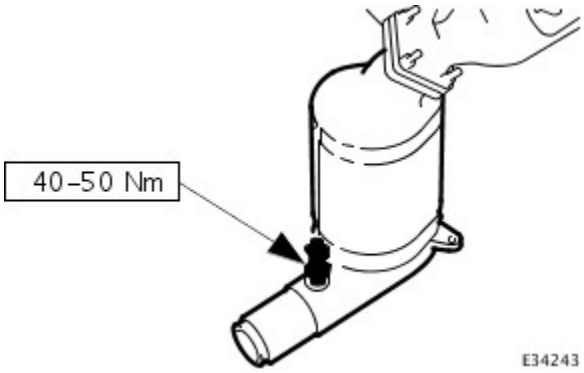
2. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Left-hand shown, right-hand similar.

From inside the engine compartment, release the relevant sensor(s) multiplug from its mounting bracket and disconnect the plug.

3. Using the Snap-on tool S6176, remove the sensor from underneath the vehicle.

Installation



1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

Tighten the sensor to specification.

3. Make good the exhaust seals.

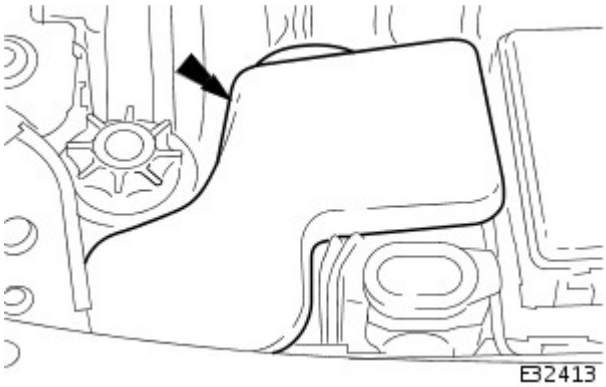
Electronic Engine Controls - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

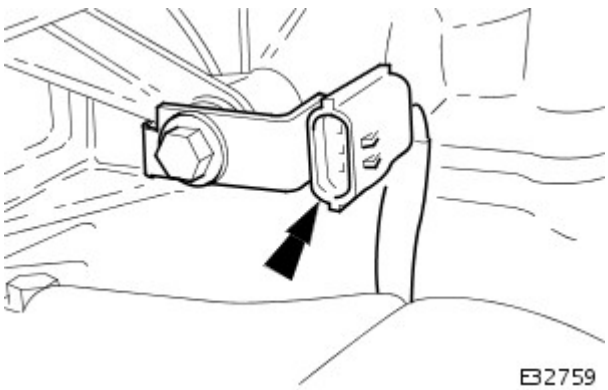
2. Remove ABS controller cover for access.





3. Disconnect engine harness connector from CKP sensor connector.

- Depress tang on connector to release, tools are not necessary.

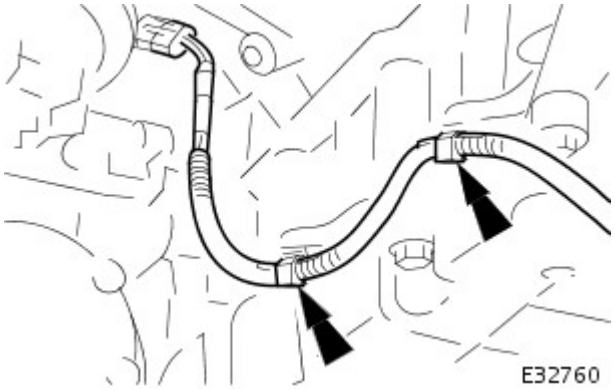


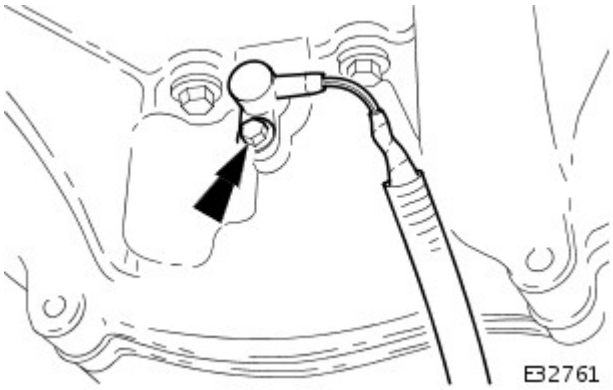
4. Release CKP sensor plug from mounting bracket.

- Depress tang on sensor plug to release, tools are not necessary.

5. Raise vehicle.

6. From below: release harness clips from engine.

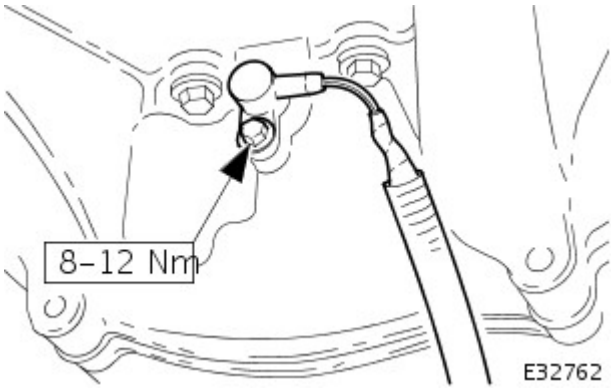




7. Remove crankshaft position sensor.

- Remove fixing.
- Remove sensor.
- Retain harness clips

Installation



1. Installation is a reversal of the removal procedure.

Electronic Engine Controls - Engine Control Module (ECM) Adaptation

General Procedures

When to carry out adaptations

1. Whenever the battery is disconnected, the Engine Control Module (ECM) adaptations are reset to a "green" ECM condition. In this condition, certain functions of the ECM are inhibited, and the ECM must "relearn" these functions. To enable the ECM to do this, the vehicle will have to perform some maneuvres which it may, or may not, do during a normal road test. The routine in this procedure should be carried out at Pre-Delivery Inspection, and after any emissions related rectification work involving the disconnection of the battery.

DTCs P1000/P1111

2. When the DTCs relating to a rectified concern are cleared, P1000 (system checks not complete since last memory clear) will be flagged. This DTC does not indicate a failure, just that diagnostic drive cycles need to be performed. The vehicle's on-board diagnostic system will confirm that all the diagnostic drive cycles are complete by flagging P1111, (system checks complete since last memory clear)

Conditions for adaptation

1. Make sure these conditions are checked and corrected, if necessary, before carrying out the adaptation procedure.

Mechanical	Electrical
• Engine oil level correct • Coolant level correct • Fuel level greater than 30%, less than 80% • Fuel filler cap correctly fitted/secure, seal in good condition • All rectification work relating to DTCs completed • Fuel, ignition and cooling systems in good order	• All Diagnostic Trouble Codes (DTCs) cleared • All rectification work relating to DTCs completed • Fuses • Harnesses • Electrical connectors

Fuelling Adaptations Drive Cycle

• NOTE: Make sure the engine is at normal operating temperature. (75°C, 167°F)

1. Either the Jaguar approved diagnostic system (where available), or a scan tool should be connected to measure the Mass Air Flow rate. Most generic scan tools should be capable of reading this parameter.

Site	Mass Air Flow (grams/second)	Driving Conditions
1	Up to 7 g/s	Idle in **P** for 2 minutes
2	10 to 14 g/s	Open throttle in **P** for 2 minutes
3	18 to 22 g/s	Open throttle in **P** or **D** with guidance * for 2 minutes
4	25 to 30 g/s	Drive with guidance * for 2 minutes

Depending on road conditions and dealer location, it may be difficult to achieve the road speeds necessary to reach the air flow indicated. It is possible to reach these air flow figures by inducing a load on the vehicle, (making use of hills, using a lower gear ratio, etc) or, if no alternative is possible, by restraining the vehicle and reaching the air flow figure

stationery in **D**.

WARNING: This should not be attempted without the vehicle being in a safe area and suitably chocked. Failure to follow this instruction may result in personal injury.

Without using the Jaguar approved diagnostic system or a scan tool with system readiness capability, it will not be possible to confirm when the adaptations are complete, unless P1111, (system checks complete since last memory clear) is flagged. If such equipment is not available, **ALL** the diagnostic monitors will have to run to enable DTC P1111 to be flagged. In some US states, this code is a requirement for annual emissions tests.

Diagnostic Monitor Completion

1. The drive cycles detailed here will enable the monitors to run, but only **after** fuelling adaptations are complete.

Entry Conditions

Diagnostic	Engine Speed	Vehicle Speed	Mass Air Flow (grams/second)	Time to Completion
Catalyst Monitor	1100 to 1600 rpm	50 to 72 kph (31 to 45 mph)	5 to 30 g/s	23 seconds
HO2S	600 to 2500 rpm	29 to 113 kph (18 to 70 mph)	4 to 16 g/s	Fuel cut for more than 10 seconds, but less than 30 seconds *
Catalyst Monitor Sensor	N/A	N/A	10 to 90 g/s	140 seconds
Fuel System	N/A	N/A	More than 6 g/s	33 seconds
AACV	N/A	61 to 121 kph (38 to 75 mph)	4 to 16 g/s	Fuel cut for 2 seconds *
P/N switch	1800 to 2200 rpm	80 to 101 kph (50 to 63 mph)	N/A	31 seconds
Evaporative emissions	N/A	48 to 89 kph (30 to 55 mph) and idle	Refer to drive cycles for leak tests in this section	Refer to drive cycles for leak tests in this section

2. During the drive cycle, drive gently, avoiding hard acceleration, braking or cornering and rough roads.

1. Drive at 84 to 97 kph (52 to 60 mph) for 40 seconds.
2. Accelerate to 113 kph (70 mph).
3. Close the throttle, (ideally at the start of a descent) continue with closed throttle for 10 seconds. (* Fuel cut)
4. Drive at 56 to 64 kph (35 to 40 mph), holding the throttle as steady as possible, on a flat level road for 30 seconds minimum.

Drive Cycle for 40 thou leak test

1. Make sure the "conditions for adaptation" detailed at the start of this section are met.

1. Avoiding high engine loads, drive the vehicle steadily between 48 and 89 kph (30 and 55 mph) for 15 to 20 minutes after starting the engine. (Depending on the amount of fuel vapor generated, the test may take longer than this).

2. Where possible, avoid body roll to minimise fuel movement.

3. If the scan tool being used is able to read TIDs, check TID 08 in mode 6. If the test has not completed, this TID will display "0". Any other value indicates that the test has successfully completed.

4. If the test has not completed, the drive cycle must be repeated.

5. If the scan tool being used is not able to read TIDs, the only way to confirm that the test has run is to check for P1111 after running the 20 thou test, where applicable.

Drive Cycle for 20 thou leak test (2001 my on only)

1. This test needs to be completed within 50 minutes of starting the engine from cold. It should be run following the 40 thou test.

1. Continue driving the vehicle steadily between 48 and 89 kph, (30 and 55 mph) avoiding high engine loads for a further 15 minutes.

2. Avoiding excessive fuel movement, bring the vehicle to rest.

3. Allow to idle for two minutes.

4. Provided the vapor conditions are suitable, the test will complete.

5. If the scan tool being used is able to read TIDs, check TID 06 in mode 6. If the test has not completed, this TID will display "0". Any other value indicates that the test has successfully completed.

6. If the test has not completed, the drive cycle must be repeated.

7. Check for DTCs. P1111 will be flagged if all monitors have run.

8. Leak check drive cycles will only normally be necessary if an Evaporative Emissions related DTC is flagged.

9. Unless P1111 is required for the State inspection, fuelling adaptations will normally be all that is required for the vehicle to adapt itself and complete

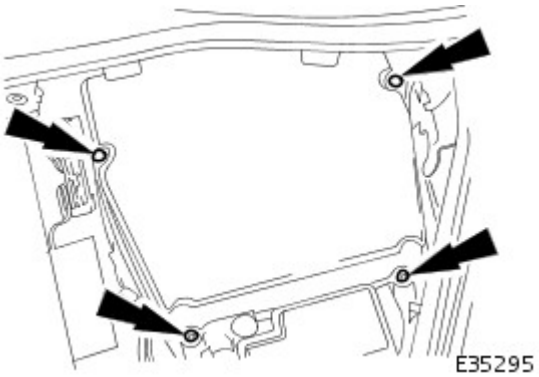
diagnostic drive cycles in the course of it's normal use.

Electronic Engine Controls - Engine Control Module (ECM)

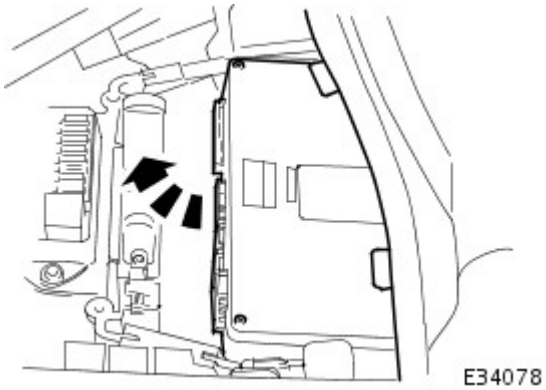
Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove ECM housing cover.



3. RHD only: Remove security bracket securing screws.
   - Remove bracket.
4. Disconnect electrical connectors.
5. Lift ECM from housing.



6. RHD only: Remove security bracket securing screws.
   - Remove brackets.

Installation

1. NOTE: A replacement ECM may only be obtained from an authorised Jaguar dealer and MUST be ordered against the VIN.

• NOTE: Check condition of housing seals and replace as necessary.

Installation is a reversal of the removal procedure.

2. Synchronize ECM, KTM and BPM using PDU.
3. Complete engine set-up using JDS/PDU.

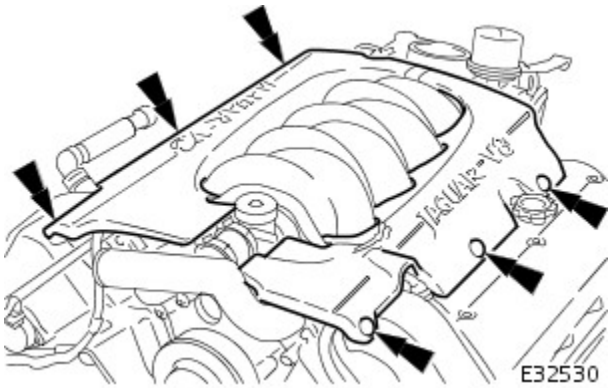
Electronic Engine Controls - Engine Coolant Temperature (ECT) Sensor4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

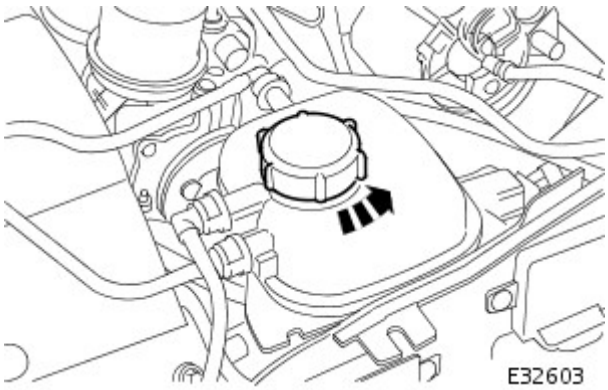
Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.

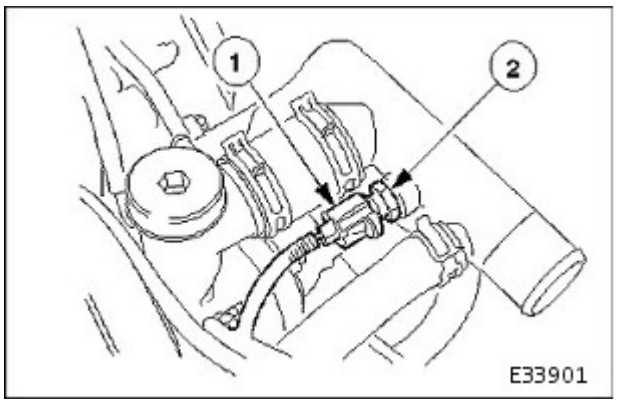
2. Remove the engine covers.





3. WARNING: ENSURE THAT THE ENGINE IS COLD BEFORE COMMENCING WORK.

Slacken the coolant reservoir cap to relieve coolant pressure and re-tighten.



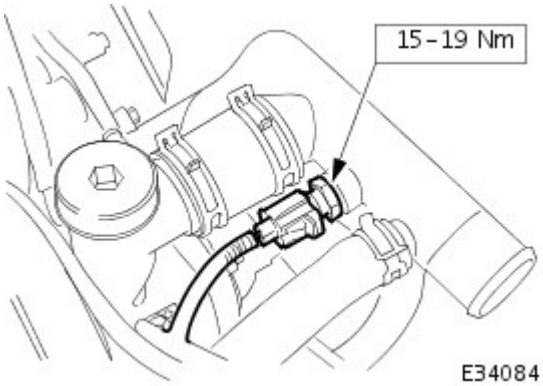
4. Remove the engine coolant temperature sensor.

1. Disconnect the harness plug from the sensor.

2. Remove the sensor and sealing washer.

Installation

1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used and tighten the sensor as specified



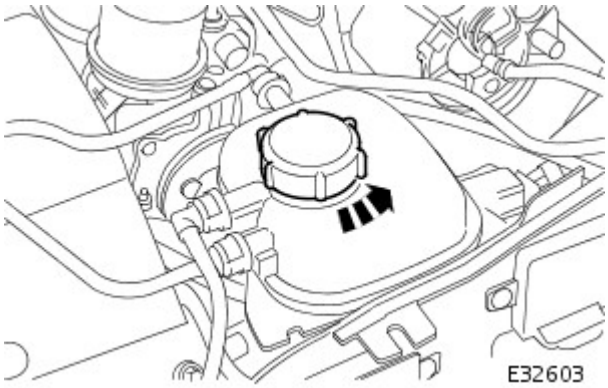
2. Check and adjust the coolant level as required.

Electronic Engine Controls - Engine Coolant Temperature (ECT) Sensor4.0L SC V8 - AJ26

Removal and Installation

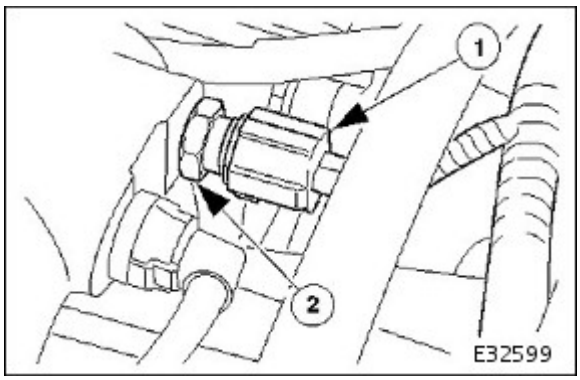
Removal

1. Open the engine compartment and fit paintwork protection sheets.



2. WARNING: ENSURE THAT THE ENGINE IS COLD BEFORE COMMENCING WORK.

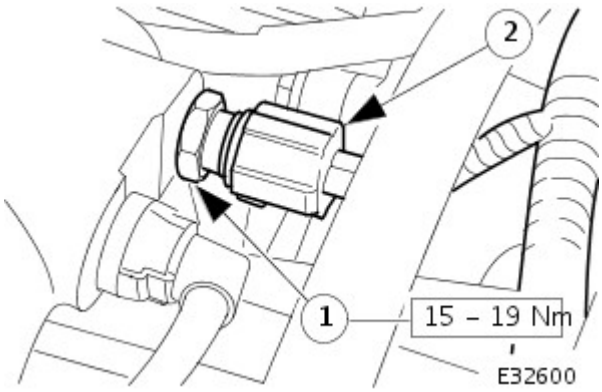
Slacken the coolant reservoir cap to relieve coolant pressure and re-tighten.



3. Remove the engine coolant temperature sensor.

1. Disconnect the harness plug from the sensor.
2. Remove the sensor and sealing washer.

Installation



1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used and tighten the sensor as specified

2. Check and adjust the coolant level as required.

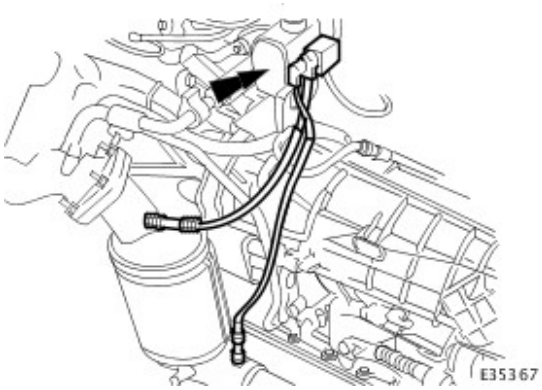
Electronic Engine Controls - Heated Oxygen Sensor (HO2S) LH

Removal and Installation

General Equipment

Snap-on tool S6176

Removal



1. WARNING: ENSURE THAT THE EXHAUST AND CATALYST ARE COLD BEFORE COMMENCING WORK

Disconnect the battery ground lead.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

From inside the engine compartment, release the relevant sensor (s) multiplug from its mounting bracket and disconnect the plug.

3. To gain access to the sensor(s) the front muffler assembly must be displaced for clearance; refer to 30.10.18.

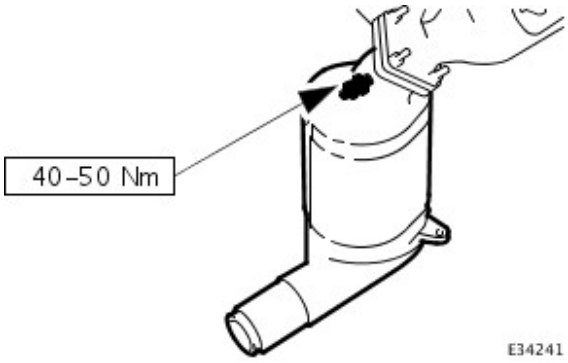


4. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Using the Snap-on tool S6176, remove the sensor.

Installation



1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Right-hand shown, left-hand similar.

Tighten the sensor to specification.

3. Make good the exhaust seals.

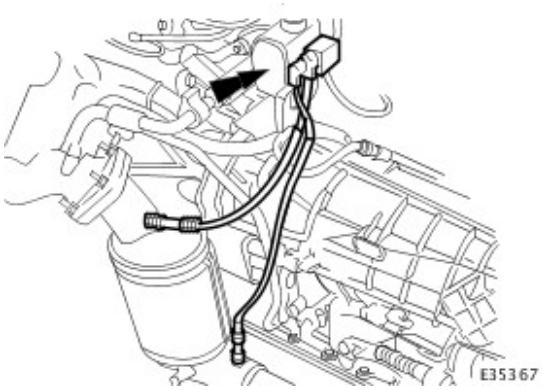
Electronic Engine Controls - Heated Oxygen Sensor (HO2S) RH

Removal and Installation

General Equipment

Snap-on tool S6176

Removal



1. WARNING: ENSURE THAT THE EXHAUST AND CATALYST ARE COLD BEFORE COMMENCING WORK

Disconnect the battery ground lead.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

• NOTE: Left-hand shown, right-hand similar.

From inside the engine compartment, release the relevant sensor (s) multiplug from its mounting bracket and disconnect the plug.

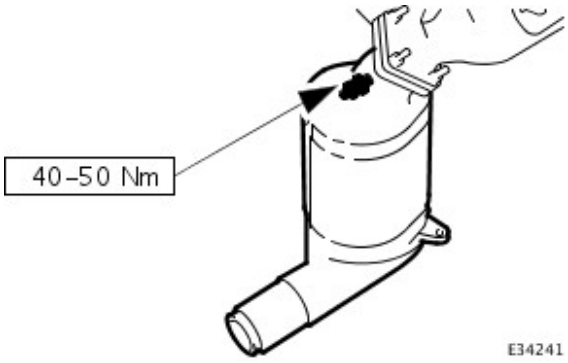


3. To gain access to the sensor(s) the front muffler assembly must be displaced for clearance; refer to 30.10.18.

4. CAUTION: Make sure the wiring harness is not twisted or damaged on removal. Failure to follow this instruction may result in damage to the vehicle.

Using the Snap-on tool S6176, remove the sensor.

Installation



1. Fitting is the reverse of the removal procedure, noting that a new sealing washer should be used.

2. CAUTION: Make sure the wiring harness is not twisted or damaged on installation. Failure to follow this instruction may result in damage to the vehicle.

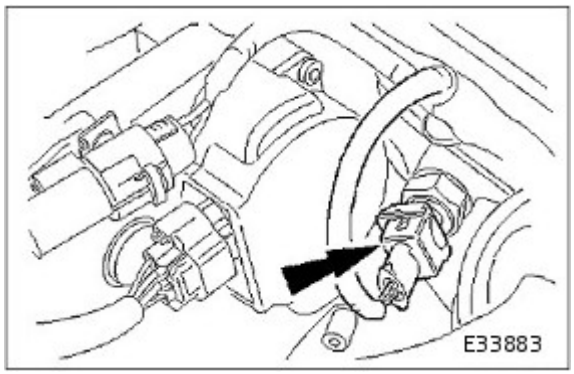
Tighten the sensor to specification.

3. Make good the exhaust seals.

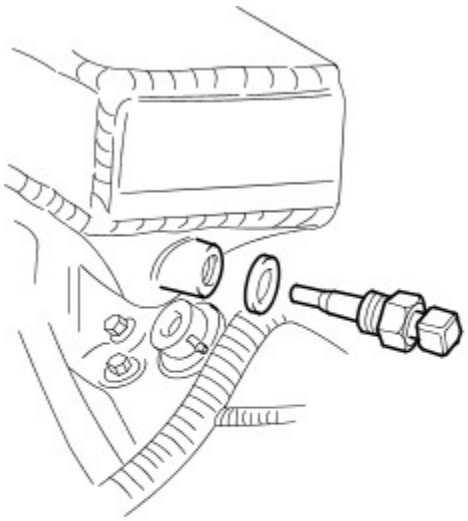
Electronic Engine Controls - Intake Air Temperature (IAT) Sensor

Removal and Installation

Removal



1. Disconnect sensor connector at rear of bank 1 charge air cooler.



2. Remove sensor.
   - Remove sensor using a deep socket.
   - Discard sealing washer.

E32908

Installation

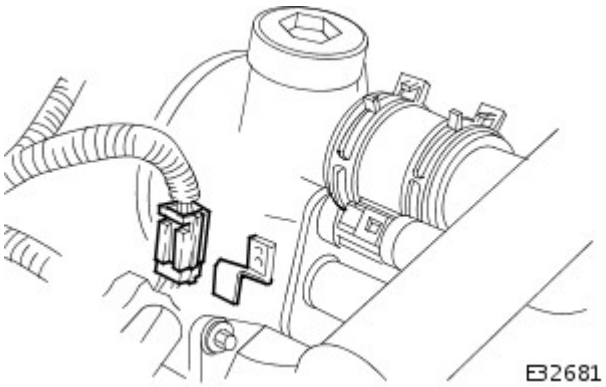
1. Installation is a reversal of the removal procedure.

Electronic Engine Controls - Knock Sensor (KS) LH4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

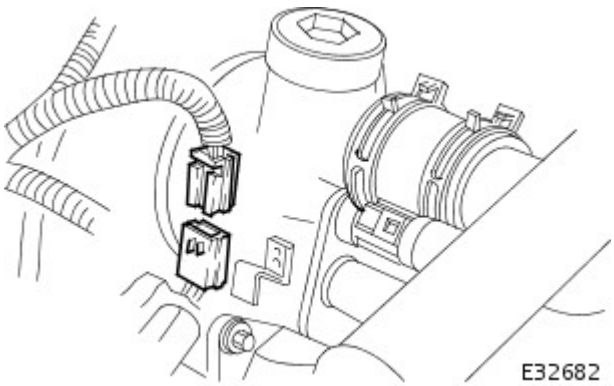
Removal and Installation

Removal

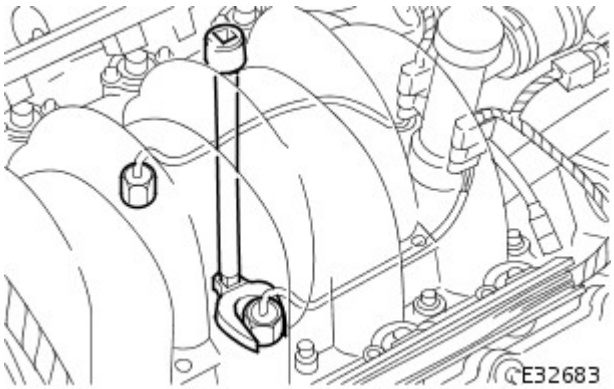
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove for access, appropriate engine cover; refer to 12.30.06.
3. NOTE: Bank 1 shown.



Disconnect knock sensor connector from mounting bracket.



4. Disconnect connector.



5. NOTE: Bank 1 shown.

Using special tools, crowfoot and extension, remove knock sensor.

Installation

1. Installation is a reversal of the removal procedure.
2. Tighten sensor to 31 - 41 Nm.

Electronic Engine Controls - Knock Sensor (KS) LH4.0L SC V8 - AJ26

Removal and Installation

Removal

1. Remove supercharger; refer to 18.50.15.
2. Remove knock sensor from engine.
   - Detach connector and disconnect.
   - Remove knock sensor.

Installation

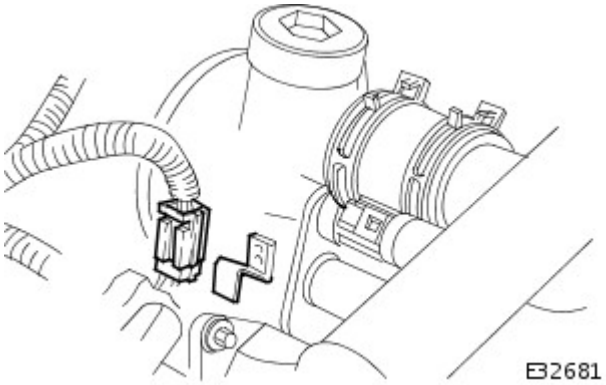
1. Installation is a reversal of the removal procedure.
2. Tighten sensor to 31 - 41 Nm.

Electronic Engine Controls - Knock Sensor (KS) RH4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

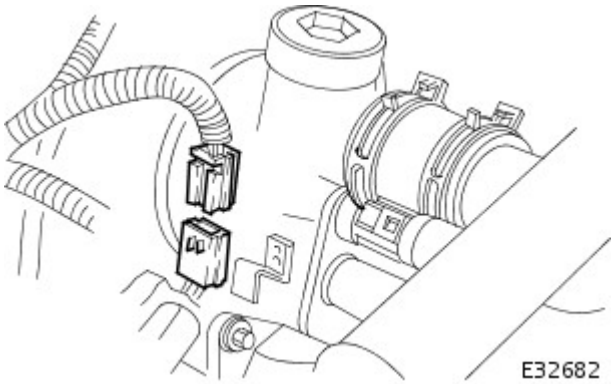
Removal and Installation

Removal

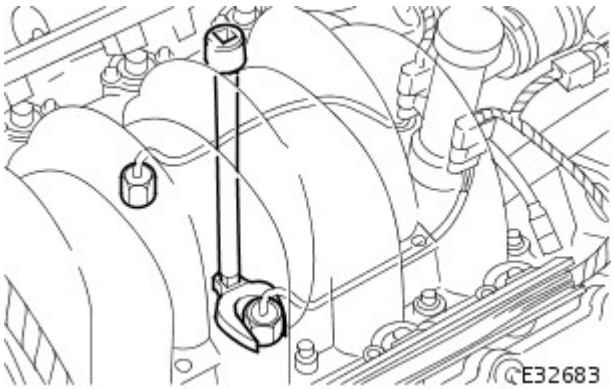
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove for access, appropriate engine cover; refer to 12.30.06.
3. Disconnect knock sensor connector from mounting bracket.



4. Disconnect connector.



5. Using special tools, crowfoot and extension, remove knock sensor.



Installation

1. Installation is a reversal of the removal procedure.
2. Tighten sensor to 31 - 41 Nm.

Electronic Engine Controls - Knock Sensor (KS) RH4.0L SC V8 - AJ26

Removal and Installation

Removal

1. Remove supercharger; refer to 18.50.15.
2. Remove knock sensor from engine.
   - Detach connector and disconnect.
   - Remove knock sensor.

Installation

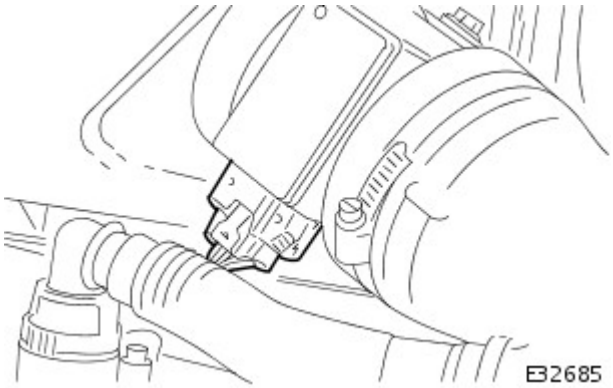
1. Installation is a reversal of the removal procedure.
2. Tighten sensor to 31 - 41 Nm.

Electronic Engine Controls - Mass Air Flow (MAF) Sensor

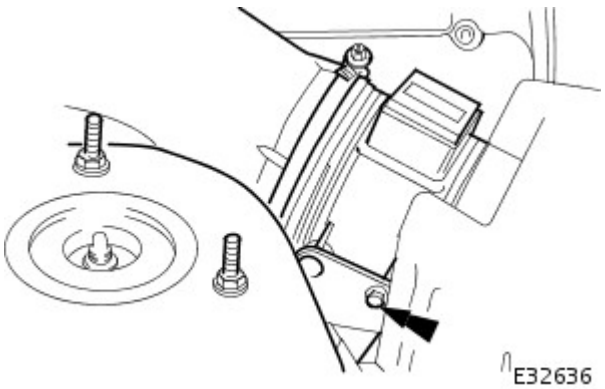
Removal and Installation

Removal

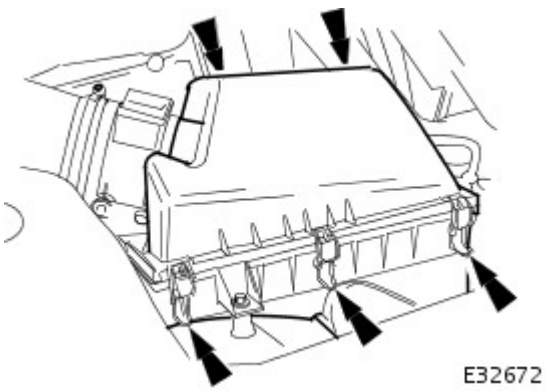
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Disconnect connector from MAF sensor.



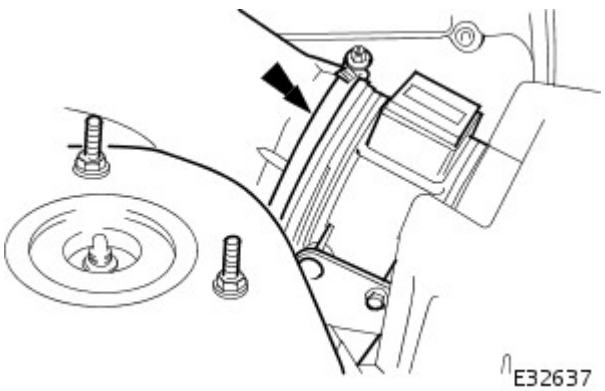
3. Remove bolts securing MAF sensor to air cleaner.



4. Remove air cleaner cover.
   - Release clips.



5. Release band clip - trunking to MAF sensor and remove assembly.
   - Discard sensor seals



Installation

1. NOTE: Install new seals.

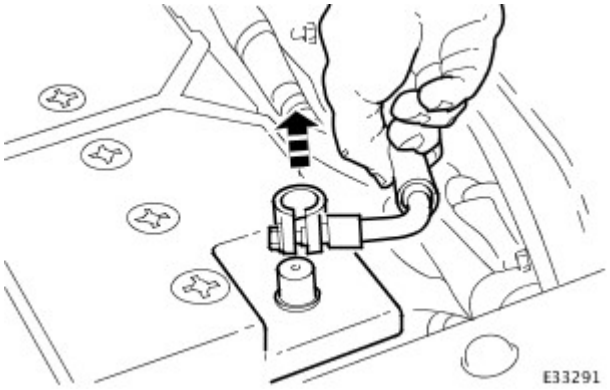
Installation is a reversal of the removal procedure.

Electronic Engine Controls - Variable Camshaft Timing (VCT) Oil Control Solenoid

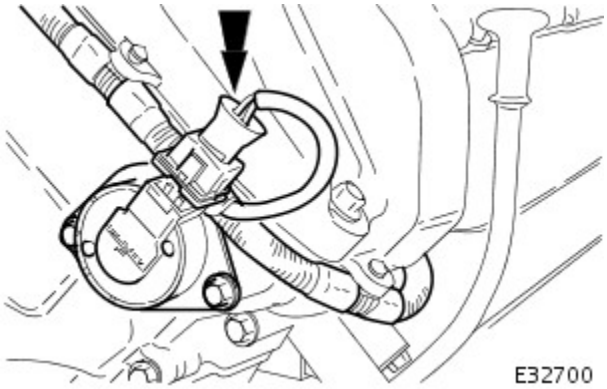
Removal and Installation

Removal

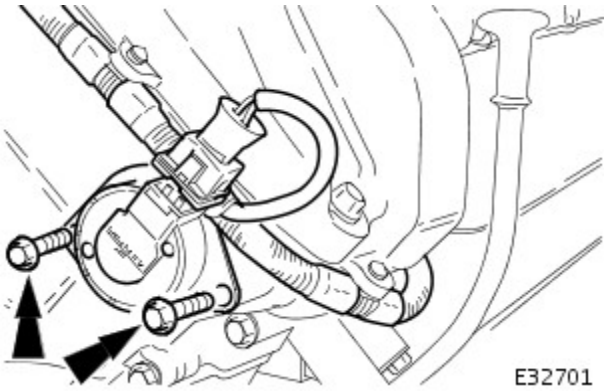
1. Open the engine compartment and fit paintwork protection sheets.
2. Disconnect the battery ground cable.
   - Remove the battery cover.



3. Disconnect the VVT solenoid connector.



4. Remove the two bolts which secure the VVT solenoid to the timing cover.

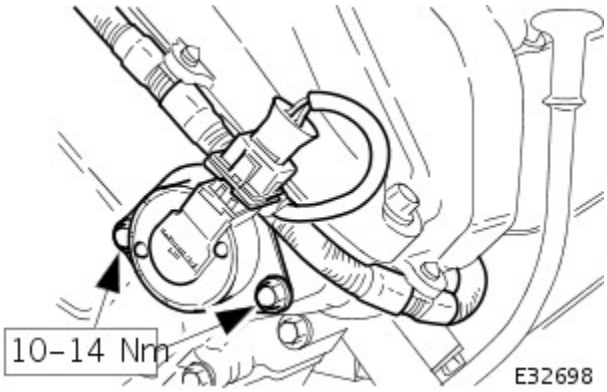


5. Pull the VVT solenoid clear and discard the O-ring.



Installation

1. Fitting a new VVT solenoid assembly is the reverse of the removal procedure. Fit a new O-ring, lubricated with petroleum jelly,.



2. Fit and tighten the two bolts to 10 - 14 Nm.

3. Remove the paintwork protection sheets and close the cover.

4. Connect the battery and fit the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 -

Lubricants, Fluids, Sealants and Adhesives - ZF Automatic Transmission (Normally Aspirated Vehicles)

Unit	Specification
Transmission fluid	Esso ATF LT 71141
Torque converter spigot	Molycote or equivalent

Capacities - ZF Automatic Transmission (Normally Aspirated Vehicles)

Unit	Liters
Transmission fluid (with torque converter)	10,0

Torques - ZF Automatic Transmission (Normally Aspirated Vehicles)

Component	Nm
Locking ferrule - Shift knob	7 - 10
Plug - Drain fluid pan	27 - 33
Plug - Level / fill (transmission case M18 x 1.5)	32 - 38
Tube nut - Cooler pipe to transmission unit	17 - 23
Bolt - Drive plate to torque converter	43 - 57
Bolt - Driveshaft coupling to transmission	75 - 88
Bolt - Fluid filter to valve block	4,5 - 5,5
Bolt - Fluid pan to transmission case	9 - 11
Bolt - Rear extension housing to transmission case	21 - 25
Bolt - Rear engine (isolation) mounting to mounting bracket	22 - 28
Bolt - Rear engine mounting bracket to body	22 - 28
Bolt - Rear engine mounting bracket to transmission rear extension	30 - 40
Bolt - Selector cable bracket to transmission case	7 - 10
Bolt - Transmission unit to engine	43 - 57
Nut - Transmission drive flange	108 - 132
Nut - Selector cable inner to shift lever	1,5 - 2,5
Nut - Selector cable inner to selector lever	7 - 10
Nut - Selector cable outer to bracket	22 - 28
Nut - Selector lever pivot shaft	7 - 10
Nut - Shift interlock solenoid to housing	5 - 7
Nut - Shift interlock solenoid actuating lever	11 - 13
Screw - Input sensor bracket to transmission case (M5)	4,5 - 5,5
Screw - Output sensor bracket to transmission case (M6)	7,5 - 8,5
Screw - Solenoid / regulator plate to valve body	4,5 - 5,5
Screw - Valve block to transmission case	7,5 - 8,5

Internal Gear Ratios

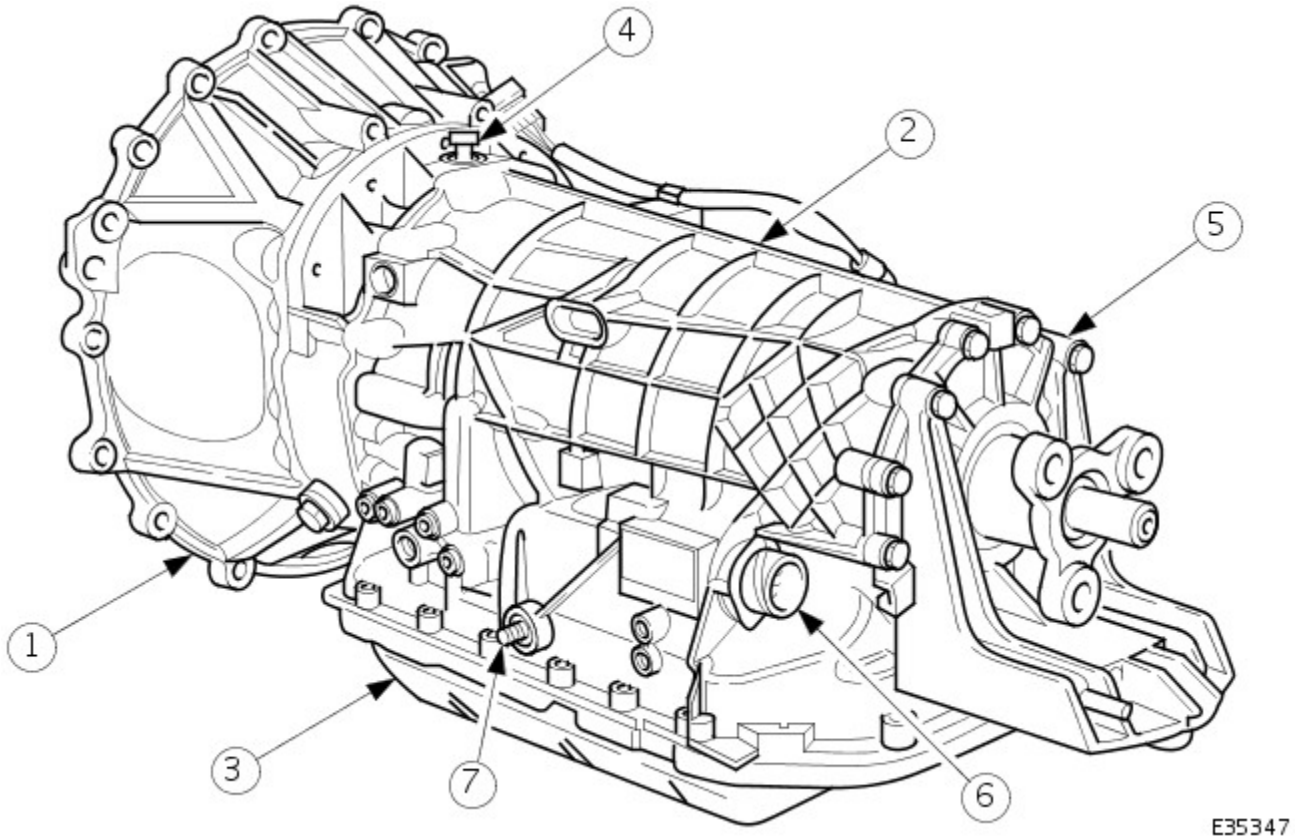
Gear	Ratio
1st	3,571:1
2nd	2,2:1
3rd	1,508:1
4th	1,00:1
5th	0,803:1
Reverse	4,063:1

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Description

Description and Operation

Transmission Assembly

Introduction



Item	Part Number	Description
1	—	Torque converter housing
2	—	Transmission casing
3	—	Fluid pan
4	—	Transmission breather
5	—	Rear extension housing
6	—	16-way connector
7	—	Gear selector shaft

Component Descriptions

The torque converter:

- Acts as a fluid coupling between the engine and transmission geartrain.
- Provides multiplication of engine torque.
- Consists of an impeller, turbine and stator, housed within a converter cover.
- Has a lock-up clutch with variable slip control.

The transmission casing:

- Houses the geartrain and electro-hydraulic control unit.
- Contains the input speed sensor which measures turbine speed.
- Contains the output speed sensor which measures the transmission output speed.

- Contains the hydraulic system pump.
- Contains the fluid temperature sensor.

The epicyclic geartrain:

- Provides five forward gears and Reverse.
- Has hydraulically actuated, multi-disk clutches, to select the required gear ratios.
- Features clutch-to-clutch operation to permit gear shifts for uninterrupted power flow.

The electro-hydraulic control unit:

- Is located in the lower part of the unit, within the fluid pan.
- Is controlled by the TCM (transmission control module), and the manual selector valve which is cable operated.
- Regulates the flow of fluid to the geartrain clutches via three solenoid-operated valves and the manual selector valve.
- Has five pressure regulators for controlling fluid pressures within the system.
- Is connected to the TCM via a 16-way connector mounted on the left-hand side of the transmission casing. Refer to Connector Pins Identification, Section 307-01A.

The hydraulic system pump:

- Is located at the front of the transmission casing.
- Is driven from the impeller hub, pressurising the fluid whenever the engine is running.
- Supplies fluid under pressure to the torque converter, geartrain, electro-hydraulic control unit and the lubrication circuit.
- Draws fluid from the fluid pan below the transmission casing, through a filter.

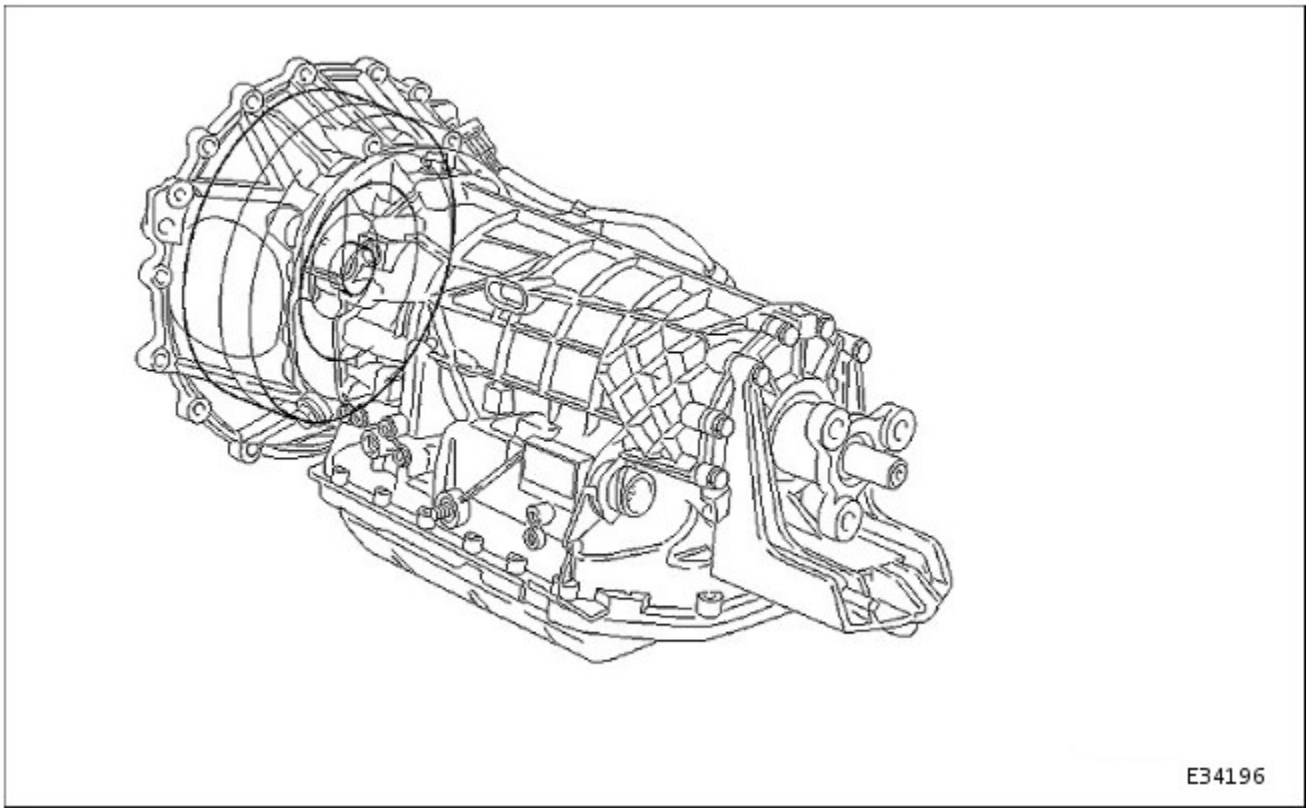
The rear extension housing:

- Is bolted to the rear of the transmission casing.
- Provides the rear engine / transmission mounting point; refer to section 303-01.
- Carries the transmission output shaft oil seal.

Filled-for-life Fluid System

The transmission is 'filled for life' and does not require fluid changes, except where extreme driving conditions prevail. Routine level checking is not required and a dipstick is not provided. A level / filler plug is fitted for level checking and replenishment, following service actions; see 303-01 General Procedures.

Transmission Torque Converter



Operation

The Transmission Control Module (TCM) is able to monitor the state of the torque converter clutch at all times.

There are three operating modes for the converter

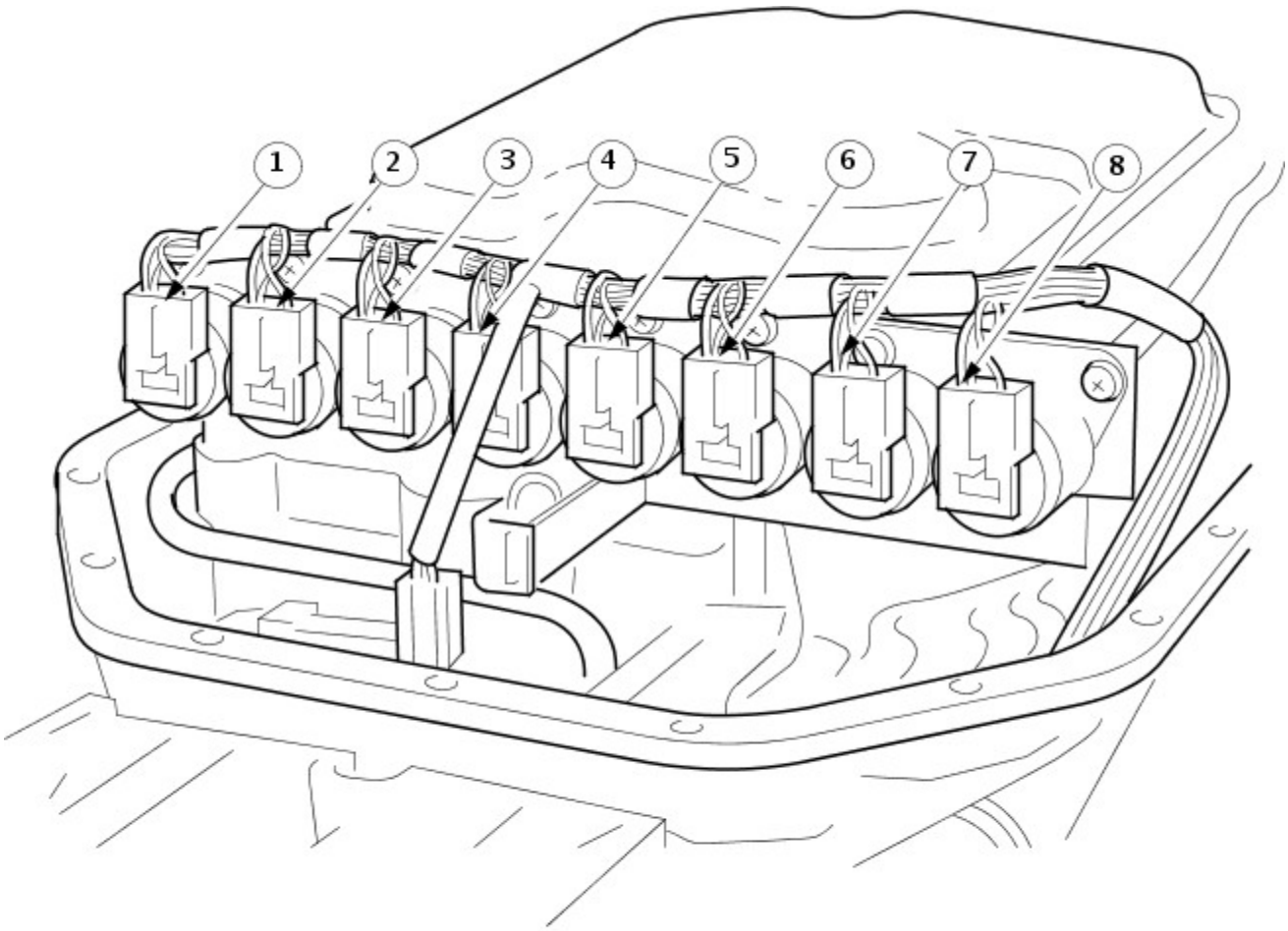
1. **1.** Fully open - Torque converter 'unlocked'
2. **2.** Fully closed - Torque converter 'locked'
3. **3.** Slip control - The TCM monitors slip and may apply sufficient pressure to allow a small degree of slip. This mode maximises economy by reducing slip to a minimum whilst providing isolation from drive-line shunt and vibration.

The TCM constantly measures the slip within the torque converter by comparing engine speed (via CAN) and input (turbine speed). Differences in these speeds indicate the amount of slip.

Clutch Hydraulic Pressure Regulation

The TCM supplies an internally switched +12V supply to the #4 pressure regulator. The regulator is operated by switching the other side of the operating winding to ground. Hydraulic pressure is controlled by 'pulse width modulation' (PWM) of the ground switching signal i.e. the duty cycle; the time that the pressure regulator is switched on.

Hydraulic Control - Transmission Pressure Regulators and Shift Solenoids



E33151

Item	Part Number	Description
1	—	Shift Solenoid #3
2	—	Shift Solenoid #2
3	—	Shift Solenoid #1
4	—	Pressure Regulator #5
5	—	Pressure Regulator #4
6	—	Pressure Regulator #3
7	—	Pressure Regulator #2
8	—	Pressure Regulator #1

Operation

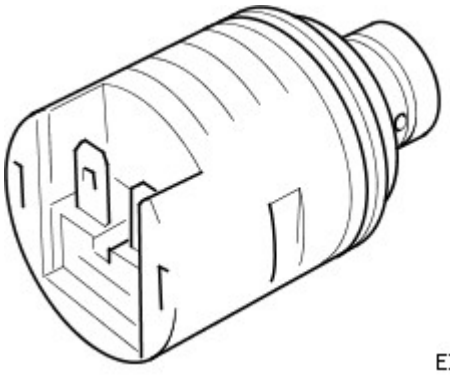
Fluid flow within the transmission assembly is controlled by three solenoid valves and five pressure regulators.

The TCM supplies an internally switched +12V supply to each shift solenoid and pressure regulator. Hydraulic pressure from the pressure regulators is controlled by 'pulse width modulation' (PWM) of the ground switching signal i.e. the duty cycle; the time that the pressure regulator is switched on. Control of the solenoids is effected by switching one side to ground through the TCM.

During normal operation the TCM monitors 'Switch On' of the solenoids, regulators and the TCM output stages, but does not check output stage 'Switch Off'.

Voltage is monitored at the regulators and solenoids for continuity and shorts. For example, when a solenoid is ON the voltage on the TCM side should be ground, when OFF the voltage should be +12.

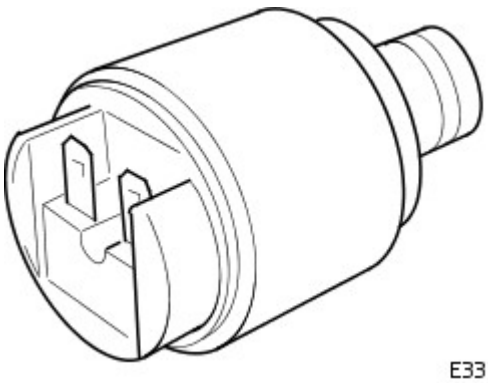
Shift Solenoid



E33053

The function of the three solenoid valves is to control the flow of transmission oil to the various transmission components. Three solenoid valves are located within the transmission assembly, and are closed when not energized.

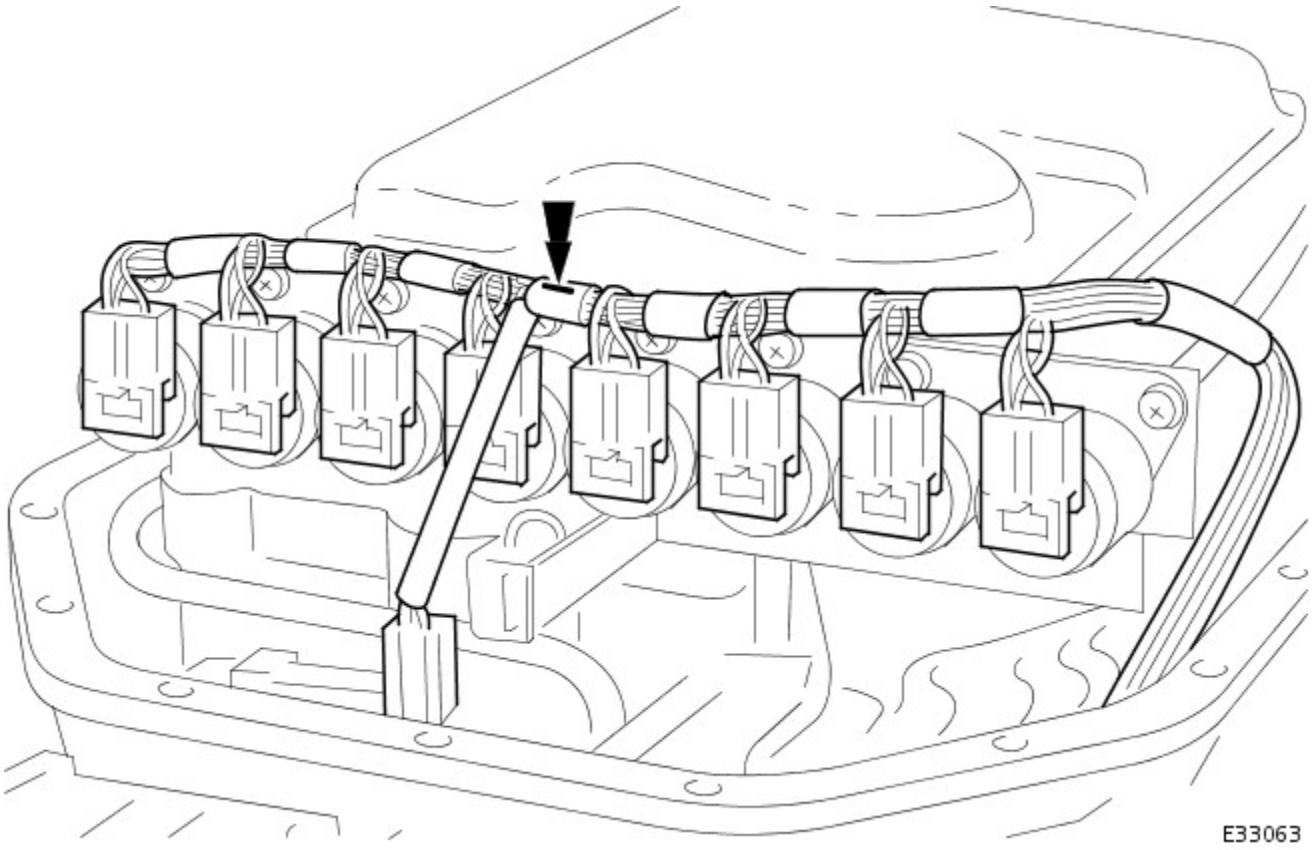
Pressure Regulator



E33052

The function of the five pressure regulators is to modulate the oil pressure to the various transmission components. The regulators are pulse width modulated by the TCM, switching to ground potential. The other side of the regulators being connected, via an internal TCM relay, to battery voltage. The regulator is closed when not energized by the TCM.

Transmission Fluid Temperature Sensor



Operation

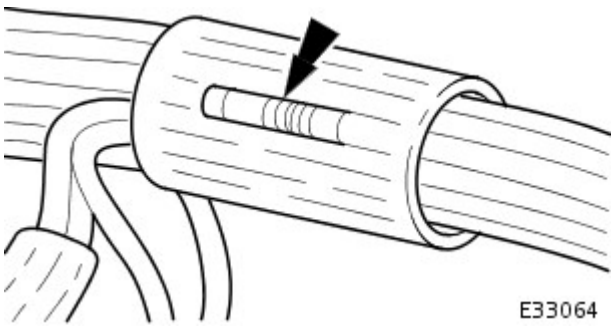
The transmission fluid temperature sensor is integrated into the internal harness within the fluid pan.

It should be noted that this component is not serviceable, necessitating the renewal of the internal harness should a fault occur.

Following engine start-up, if the fluid temperature is < 20 °C and does not increase by 10 °C after 180 seconds, a failure judgement is made. A similar judgement is made should the temperature change by more than 5 °C in <100 milliseconds. The MIL is illuminated if the failure judgement is made on two successive trips.

Sensor output is continuously monitored for out of range values. If a sustained high, or low input is sensed, indicating a harness or connector fault, a failure judgement is made.

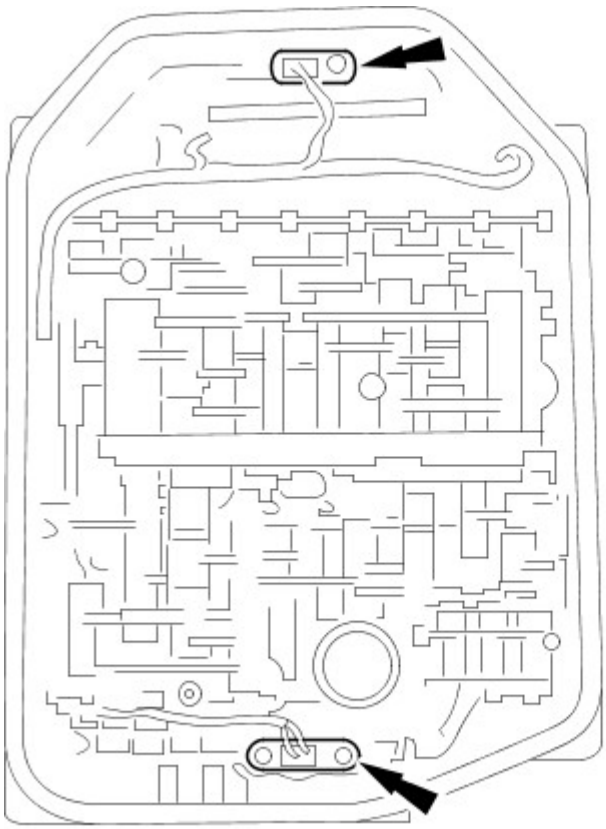
Location of Sensor Within The Harness



Temperature / Resistance Relationship Chart

Temperature (°C)	Nominal Resistance (kOHM)
-20	685
0	812
20	953
40	1107
60	1276
80	1458
100	1653

Transmission Speed Sensors (Gear Shift Control)

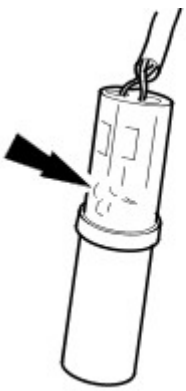


E35351

Operation

There are two speed sensors within the transmission assembly; one on the input shaft or convertor turbine and the other on the output shaft.

Both sensors are of the inductive type and sense toothed wheels; the input wheel having 30 teeth and the output 36 teeth.



E35356

Input speed is monitored by the TCM with a rationality check being made against output speed. A fault will be flagged if the indicated input speed exceeds 7400 rpm. Additionally, a failure judgement will be made if the indicated input speed is <160 rpm with engine speed >608 rpm and output speed >224 rpm

The procedure is similar for the output speed diagnostic. A fault (non OBDII) will be flagged if the indicated input speed exceeds 6712 rpm. Additionally a failure judgement will be made if the indicated output speed is <160 rpm and the average road wheel speed exceeds 100 rpm.

Under normal circumstances after the output speed diagnostic fault code has been set, the TCM uses rear wheel speed information to compute its calculations, this has no effect on transmission operation. However, should a second fault occur, in the ABS system, thus making rear wheel speed information unavailable, an additional fault code will be logged.

Control Systems

Introduction

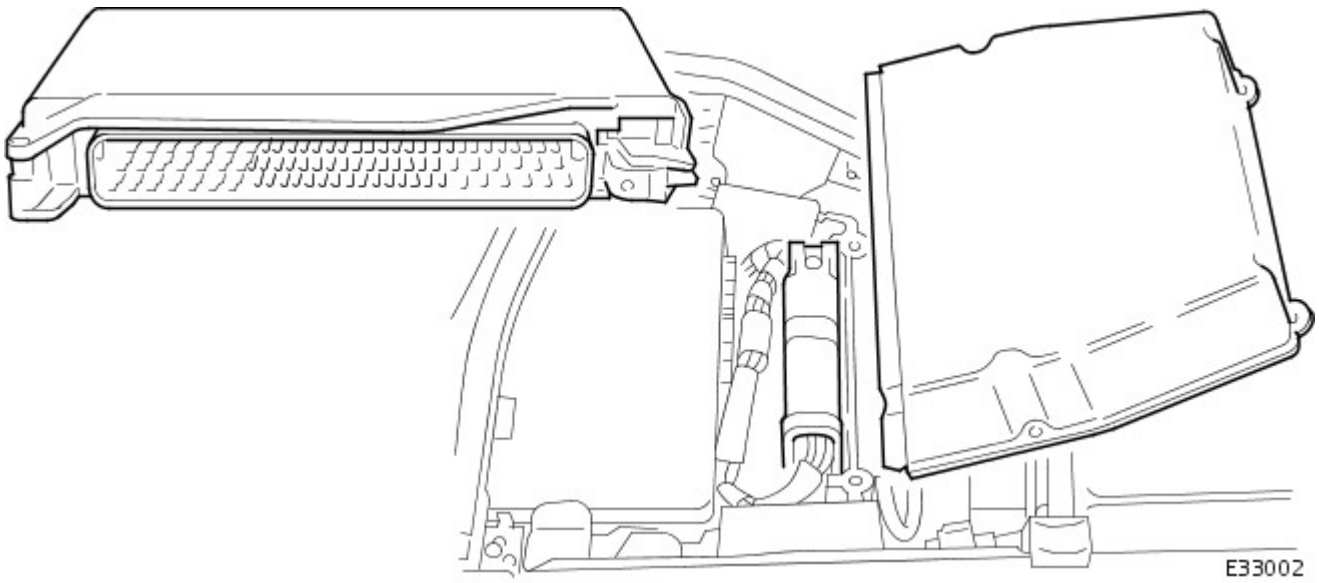
Gear selection is achieved by controlling the flow of transmission fluid to internal multi-disc clutches.

The three solenoid valves direct the transmission fluid flow to the selected clutches and the pressure regulators control the fluid pressure to each component. One pressure regulator serves as a master pressure control for the entire system and a second is used exclusively for torque converter clutch lock-up operation.

The TCM controls the internal components thus determining gear selection and shift pattern.

In the event of an electronic system fault the basic functions Park, Reverse Neutral and Drive Fourth are retained by the hydraulic system.

Transmission Control Module (TCM)



The TCM is located in the same housing as the ECM and is accessed in the same manner.

The TCM performs several 'self check' procedures to ensure correct operation. It is possible due to the nature of these faults that the module will fail to communicate with other nodes. However, condemnation of the TCM should not take place until any CAN or power supply related problems have been resolved.

There are three self check procedures for the TCM.

1. **1.** Check on ROM by calculating a checksum and comparing this with a known stored value.

2. **2.** Check on non-volatile diagnostic memory by writing a test pattern and then reading it back.

3. **3.** Internal 'watchdog' hardware to check whether the TCM has crashed.

Transmission Control Module Supply Voltage

The TCM monitors battery and ignition switched supply voltages.

A permanent supply is used to maintain a battery backed 'memory'. Should this supply be cut, due to battery disconnection perhaps, the 'adaptive shift' values will be lost. This will result in a small reduction in shift quality for a period until the adaptions are 're-learned'

The TCM will adopt 'limp home' mode as a result of the supply voltage being >16V or <7V with an engine speed >1600 rpm.

Should the ignition supply be >7V but <9V the TCM will hold the gear that it has currently selected. If after 2.5 seconds, with the engine speed >1600 rpm, the voltage remains at this level, 'limp home' mode will be adopted. The 2.5 second delay is built in to prevent reaction to a momentary voltage fluctuation.

Operation

CAUTION: Disconnection of the TCM and / or the vehicle battery will cause system adaptions to be lost; this may be apparent by shift quality degradation. Following reconnection, a period of 'varied' driving will reinstate adaptions and thus normal operation. Please ensure that the customer is made aware that the adaption period is variable and may occur after handover, as the transmission re-learns the prevailing driving style.

• NOTE: Should the TCM fail, please ensure that the control housing cooling fan is operating correctly. Failure of the cooling fan MUST be rectified before renewing the TCM and details of a fan failure should accompany the returned TCM.

The TCM processes information received in both analogue and digital form, such as:

- Transmission input speed
- Transmission output speed
- Throttle position
- Pedal demand
- Gear selector position
- Engine torque
- Engine speed
- Transmission oil temperature
- Mode switch

This information is then used by the TCM to control shift energy management and decide which shift program to implement and which gear to select.

The TCM uses the various sensors and inputs to monitor the correct operation of the system and is programmed to take default action and inform the operator when a fault occurs.

Safety Functions

The safety functions are designed to safeguard against inappropriate actions by the operator as well as against system malfunctions. The system prevents reverse gear from being engaged at high forward speeds and prevents manual downshifting at excessive engine speeds; these functions are not operational in mechanical limp-home mode.

The TCM constantly monitors the transmission for faults. In the event of a problem the TCM will adopt a 'limp home' mode in which only P R N D - (selector in D but only fourth gear is enabled) are available. The operator will be made aware of certain faults by an instrument panel warning.

The electrical and diagnostic system has been designed such that system integrity is protected at all times, the safety concept being based on the following three points:

1. **1.** The hydraulic system has 'fail-safe' characteristics regarding its electrical operation, such that should the power supply be lost to the electro-hydraulic actuators the transmission will initiate a limp-home mode.

2. **2.** Recognition of critical shift operation by monitoring the last element in the signal path, ie the solenoid valve, and checking by means of redundant measured variables, ie engine speed, input speed and output speed.

3. **3.** Each time the vehicle is started there is a check on the entire safety hardware and the associated program parts and signal paths. A malfunction in this part of the system, or triggering of the safety circuit, is communicated to the operator through the illumination of the transmission warning lamp.

TCM Inputs

Input Speed Sensor (Torque Converter Turbine)

The input speed sensor provides the TCM with transmission input shaft speed information. This signal is produced from an inductive pick-up, generating 30 pulses per revolution.

Transmission Output Speed Sensor

The output speed sensor provides the TCM with transmission output shaft speed information. This signal is produced from an inductive pick-up, generating 36 pulses per revolution.

Transmission Oil Temperature Sensor

A thermistor which provides an electrical indication of the oil temperature to the TCM. The signal is measured as a voltage with reference to analogue ground in the TCM.

Kickdown Switch (where fitted)

Kickdown is intended to provide maximum vehicle acceleration, via the appropriate downshift(s), when the operator uses full throttle. A kickdown switch provides an electrical signal to the TCM when the accelerator pedal is fully pressed. The switch is normally open, connected to vehicle ground. Should the switch fail the TCM will detect kickdown using the accelerator pedal position.

Throttle Pedal Stop (where fitted)

This component, used where the kickdown switch is not fitted, limits throttle pedal travel .in the same way. The kickdown feature is retained, but is controlled by throttle position only. The pedal stop must be set, using the PDU, in the same way as the kickdown switch to optimize performance.

Mode Selection Switch

The mode selection switch is a two position switch indicating to the TCM the current performance mode selected by the driver. The switch generates a two-bit digital input to the TCM.

Rotary Position Switch

The rotary position switch detects the position of the transmission selector shaft. The switch is supplied as part of a new transmission assembly, mounted on the transmission body. The switch is used to indicate to the TCM the six positions of the shaft: Park, Reverse, Neutral, Drive, Third and Second. The switch provides a four-bit input to the TCM.

Drive to Fourth Switch

Detects the movement of the selector lever from Drive to Fourth position. The selector cable, and therefore the transmission selector shaft, does not move as the lever is operated between these two positions. The switch is located within the 'J-gate' assembly, producing a digital output to indicate to the TCM that the lever has moved from D to 4 .

Serial Communications Interfaces

Controller Area Network (CAN)

The TCM is an integral part of the CAN system which facilitates the interchange of real-time data between control modules and sensors. Please see section 303-14 for a full description of CAN.

OBDII Interface

Data concerning OBDII related transmission failures is stored in the ECM for access via the J1962 socket.

System Functions

Range Selection

The selector lever is connected to the transmission via a bowden cable, which operates the transmission selector shaft between all positions except Drive to 4 .

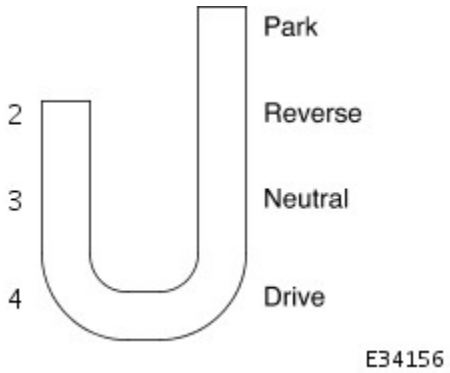
The TCM detects the gear selected by means of a rotary position switch fitted to the transmission selector shaft. A separate Drive to 4 switch is located within the 'J' gate' assembly.

Movement of the selector lever between Park, Reverse, Neutral and Drive manually directs the flow of transmission oil; the TCM having control of the forward gears selected while the lever is in the Drive position.

Shift Point Selection

The gearshift points are selected, by the TCM, as a function of the output speed, engine load, selector position and shift program selected. The operator has control over the shift points via the selector lever, throttle pedal movement, kickdown function and mode switch.

'J' Gate Layout



Mode Switch

This switch allows the driver to select one of two base shift maps; Normal and Sport modes, the switch being illuminated when Sport is selected.

Special Shift Programs

These specific condition shift maps are available to enhance the operation of the vehicle under specific driving conditions. and are listed below in order of priority / title and operating condition.

1. **1.** Traction: When traction intervention is active
2. **2.** Hot mode: Extreme engine / transmission temperatures

3. **3.** Gradient: Under specific speeds and loads
4. **4.** Cruise: During cruise control
5. **5.** Manual: Shift map when the LH side of the 'J gate' is used

Three specific condition shift maps have a higher priority than the two base shift maps and will intervene when appropriate conditions prevail for traction, gradient or cruise.

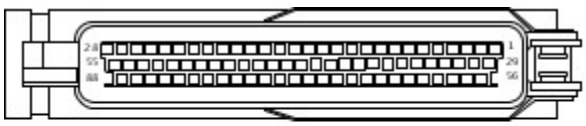
When traction control (engine or brake system derived) is operational the TCM will implement the traction map to maximise control of wheel slip.

The gradient maps are intended to enhance vehicle drivability when towing or climbing a gradient. The TCM will implement the maps when increased driving resistance is detected and enhanced drivability, cooling and increased performance is appropriate.

The cruise map is intended to minimize unwanted gearshifts and 'hunting' and is activated when cruising near to the set speed, or resuming.

Connector Pins Identification

Connector Pin Identity Chart for EM007

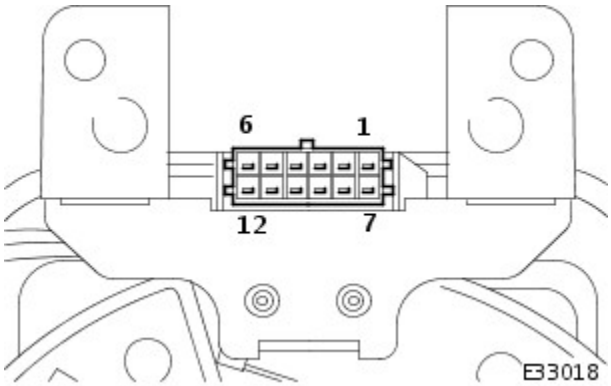


E34194

Pin Number	Circuit Function
001	Pressure regulator 2
002	Mode switch status
003	Not used
004	Pressure regulator #4
005	Pressure regulator #1
006	Power ground
007	Not used
008	Rotary switch L2
009	Rotary switch L4
010 to 011	Not used
012	Mode switch Pin B (Sport)
013	D to 4 switch
014	Input speed sensor (-)
015	Output speed sensor (screen)
016	Output speed sensor (+)
017	Not used
018	Kickdown switch (where used)
019 to 020	Not used
021	Analogue ground
022	Fluid temperature sensor
023	Input speed sensor (screen)
024 to 025	Not used
026	B+
027	Not used
028	Digital ground
029	Pressure regulator #3

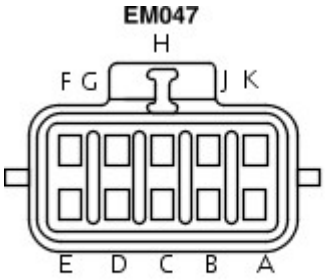
030	Shift solenoid valve #1
031	Not used
032	Shift solenoid valve #3
033	Shift solenoid valve #2
034	Power ground
035	Not used
036	Rotary switch L1
037	Rotary switch L3
038 to 041	Not used
042	Input speed sensor (+)
043	Not used
044	Output speed sensor (-)
045	Mode switch Pin A (Normal)
046 to 050	Not used
051	Pressure regulator #5
053	Solenoid valve (+)
052	Pressure regulator (+)
054	Fused ignition (+)
055	Fused ignition (+)
056 to 081	Not used
082	CAN link In (-)
083	CAN link In (+)
084	Not used
085	CAN link Out (-)
086	CAN link Out (+)
087	JDS L-line (not used)
088	JDS K-line (not used)

Connector Pin Identity Chart for CC014



Pin Number	Circuit Function
1	12V ignition
2	Security LED (power)
3	CAN link In (-)
4	CAN link In (+)
5	Gate illumination (power)
6	Security LED (ground)
7	Not used
8	CAN link Out (-)
9	CAN link Out (+)
10	Gate illumination (ground)
11	Not used
12	Not used

Connector Pin Identity Chart for EM047



E34176

Pin Number	Circuit Function
00A	Position L1
00B	Position L2
00C	Position L3
00D	Position L4
00E	Digital ground
00F	Not used
00G	Not used
00H	Not used
00J	B+
00K	Park and neutral switch

Connector Pin Identity Chart for EM046

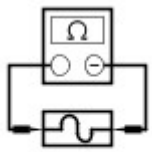
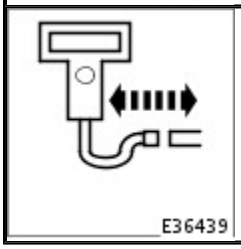


E34175

Pin Number	Circuit Function
001	Output speed sensor (+)
002	Pressure regulator #1
003	Pressure regulator #2
004	Shift solenoid valve #3
005	Input speed sensor (+)
006	Input speed sensor (-)
007	Pressure regulator #3
008	Shift solenoid valve #1
009	Shift solenoid valve #2
010	Output speed sensor (-)
011	Pressure regulator #4
012	Shift solenoid valves (+)
013	Analogue ground
014	Fluid temperature sensor
015	Pressure regulator #5
016	Pressure regulators (+)

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Diagnostic Strategy

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scantool

Quick Reference Fault Chart

Quick Reference Fault Chart

Symptom	Possible Sources	Action
Normal transmission operation but fault codes stored	• NOTE: If P0706 is logged ignore P0742 * Output speed sensor circuit fault * TCM faulty * ABS system fault (this code may log erroneously following an ABS problem) * Position switch and D to 4 switch circuit fault * P R 4 circuit fault	* GO to P0721 * GO to P1603 * GO to P0742
Sport mode will not select	* Mode switch circuit fault	* GO to P0790
Mode switch state lamp not working	* Mode switch supply * Mode switch circuit fault	* GO to P0790
Poor, or reduced shift quality	* Presence of EMS faults (may affect the accuracy of the torque signal)	* GO to EMS
	* Transmission temperature sensor circuit	* GO to P0710
Out of sequence shift	* Output / input speed sensor circuit fault * Mechanical fault (check all other operations)	* GO to P1731
No torque converter lock-up	* P R 4 circuit fault	* GO to P0743
	* Mechanical fault, should P R 4 be OK	* GO to P0741
Harsh shifts, engine stalling (torque converter stuck on)	* P R 4 circuit fault * Mechanical fault, should P R 4 be OK	* GO to P0742
Default to 4th gear	* Solenoid / pressure regulator supply from TCM	* GO to P0702
	• NOTE: If the code logs when 3rd is selected, then the D to 4 switch is the most probable cause If the code logs when D is selected from the LH side of the gate, then check selector cable adjustment * 'J gate' or selector cable out of adjustment * D to 4th switch * Rotary position switch circuit	* GO to P0706
	* Input speed sensor circuit fault * Input speed sensor faulty	* GO to P0715
	* Solenoid #1 circuit fault	* GO to P0753
	* Solenoid #2 circuit fault	* GO to

		P0758
	* Solenoid #3 circuit fault	* GO to P0763
	* TCM faulty	* GO to P1605 and P1608
	* ABS fault * CAN circuit fault between ABS/TCCM and TCM * Output speed sensor circuit fault	* GO to P1720
	* Mechanical fault (check all other operations)	* GO to P1726
	* Pressure regulator, solenoid or speed sensor circuit fault * Mechanical fault - transmission defaulted to 5th?	* GO to P1734
	* Pressure regulator #1 circuit fault	* GO to P1745
	* Pressure regulator #2 circuit fault	* GO to P1746
	* Pressure regulator #3 circuit fault	* GO to P1747
	* Pressure regulator #4 circuit fault	* GO to P0743
	* Pressure regulator #5 circuit fault	* GO to P1748
	* Mechanical fault - transmission defaulted during 2nd to 3rd or 3rd to 4th shift?	* GO to P1779
	* Power (ignition) supply fault to TCM * Vehicle battery charging system fault	* GO to P1789 and P1793
	* Incompatible ECM, ABS/TCCM, TCM or INST - check part number	* GO to P1795
	* CAN circuit fault * Check fault code(s) in ECM, ABS/TCCM or INST and rectify as required	* GO to P1796
	* Faulty ECM * CAN circuit fault between ECM and TCM	* GO to P1797
Default to 5th gear	* Output speed sensor circuit fault * Mechanical fault (check pulling away from standstill performance)	* GO to P1722
	* Output / input speed sensor circuit fault * Mechanical fault (check operation of transmission in 2nd, 3rd and 4th gears)	* GO to P1730

Symptom Chart

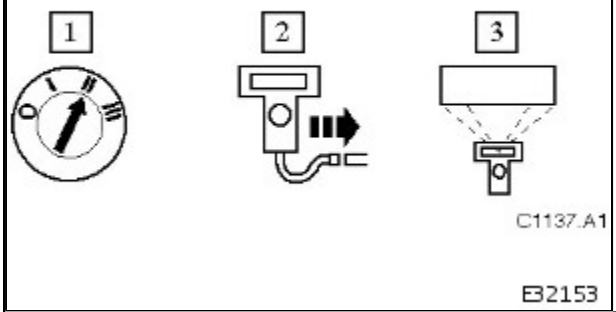
Symptom Chart

Symptom	Possible Sources	Action
DTC P0741 Torque converter clutch system performance or stuck off	* Torque converter clutch slipping or stuck off	* GO to Pinpoint Test A
DTC P0742 Torque converter clutch system stuck on	* Torque converter clutch stuck on	* GO to Pinpoint Test A
DTC P0743 Torque converter clutch system electrical	* #4 pressure regulator faulty * Harness fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test B
DTC P0702 Transmission control system electrical	* Harness fault * High side switch (FET) fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C or D
DTC P0753 Shift solenoid A electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0758 Shift solenoid B electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0763 Shift solenoid C electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C

DTC P1745 Pressure regulator 1 malfunction	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P1746 Pressure regulator 2 malfunction	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P1747 Pressure regulator 3 malfunction	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P0743 Torque converter clutch system electrical	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P1748 Pressure regulator 5 malfunction	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P0721 Output / turbine speed sensor circuit malfunction	• NOTE: This DTC is non OBDII but is included for reference to P1720 * Output speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * Damaged harness screen	* GO to Pinpoint Test E
DTC P1720 Loss of output speed and wheel speed information	* As P0721 * ABS fault	* GO to Pinpoint Test E
DTC P0715 Input / turbine speed sensor circuit malfunction	* Input speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * Damaged harness screen	* GO to Pinpoint Test F
DTC P1722 Stall speed	* Output speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * TCM failure * Transmission mechanical fault	* GO to Pinpoint Test G
DTC P1726 Engine overspeed malfunction	* Transmission mechanical fault	* GO to Pinpoint Test H
DTC P1730 Gear control malfunction 2,3,5,	* Input speed sensor signal faulty * Output speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * TCM failure * Transmission mechanical fault	* GO to Pinpoint Test I
DTC P1734 Gear control malfunction 4	* Input speed sensor signal faulty * Output speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * TCM failure * Transmission mechanical fault	* GO to Pinpoint Test I
DTC P1779 Load control malfunction	* Input speed sensor signal faulty * Output speed sensor signal faulty * Harness fault * Connector pins(s) bent, loose or corroded * TCM failure * Transmission mechanical fault	* GO to Pinpoint Test I
DTC P1603 EEPROM malfunction	* See Monitoring Procedure	* GO to Pinpoint Test J
DTC P1605 TCM checksum failure	* See Monitoring Procedure	* GO to Pinpoint Test J
DTC P1608 Watchdog malfunction	* See Monitoring Procedure	* GO to Pinpoint Test J
DTC P1793 Ignition supply malfunction >16 < 7 volts	* Battery charging system fault * Harness fault * Connector loose or corroded	* GO to Pinpoint Test K

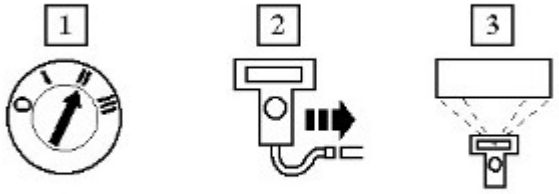
	* Connector pin(s) bent or tracking between connections	
DTC P1789 Ignition supply malfunction >7 < 9 volts	* Battery charging system fault * Blown fuse * Harness fault * Connector loose or corroded * Connector pin(s) bent or tracking between connections * Ground fault	* GO to Pinpoint Test K
DTC P0710 Transmission fluid temperature sensor malfunction	* Damaged sensor * Sensor out of range / short * Harness open circuit * Harness short * Connector loose or corroded	* GO to Pinpoint Test L

Pinpoint test A: P0741, P0742, P0743

PINPOINT TEST A : P0741, P0742, P0743	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2
A2: RENEW TORQUE CONVERTER	
	1 Renew the torque converter
	Has the torque converter been renewed? **Yes** GO to A3
A3: END	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test B: P0743

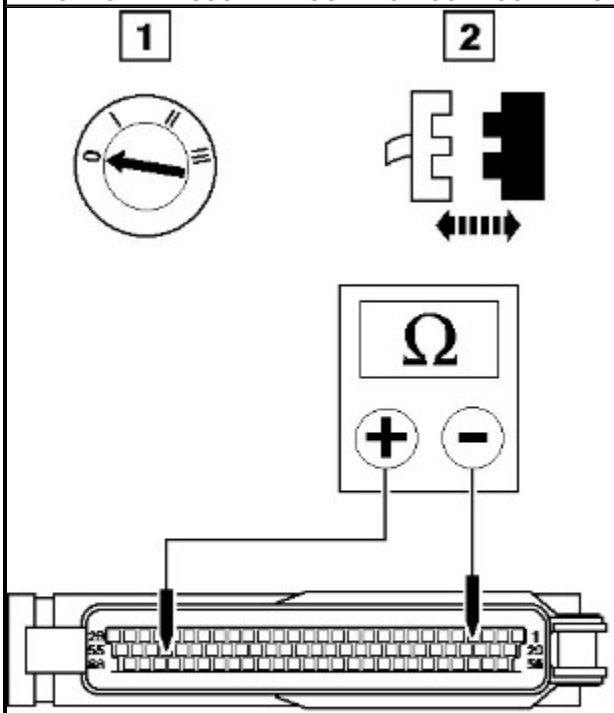
PINPOINT TEST B : P0743	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to B2

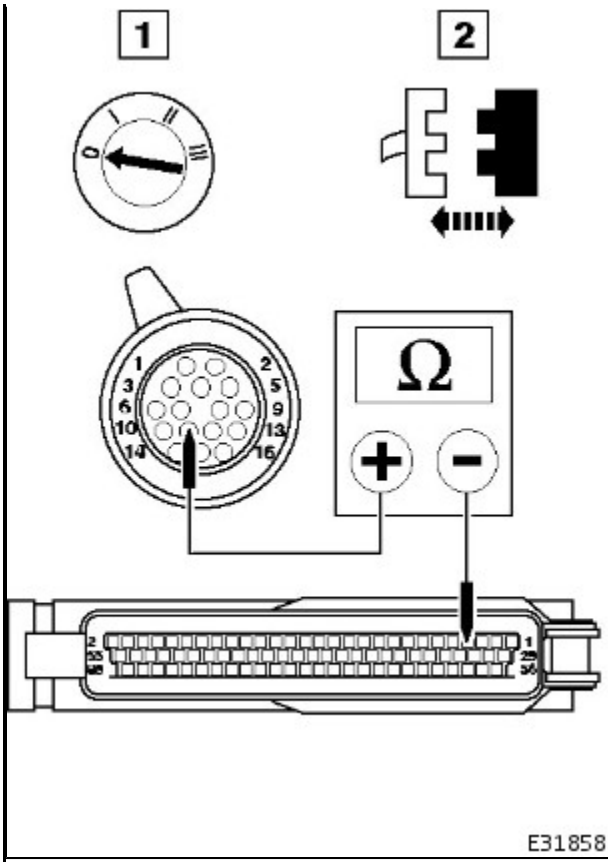
B2: CHECK PRESSURE REGULATOR COIL CONTINUITY



E31857

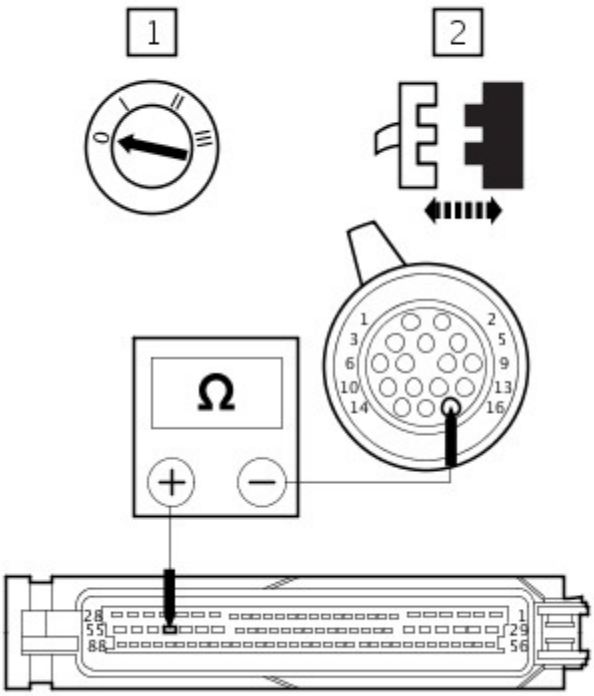
	1 With, EM007 disconnected, measure the resistance between EM007/052 and EM007/004
	Is the resistance >5.0 and <7.0 OHM? **Yes** GO to B6 **No** GO to B3

B3: CHECK HARNESS SIGNAL CONTINUITY



	1 With EM007 and EM046 disconnected, measure the resistance between EM046/011 and EM007/004
	Is the resistance < 0.5 OHM? **Yes** GO to B4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

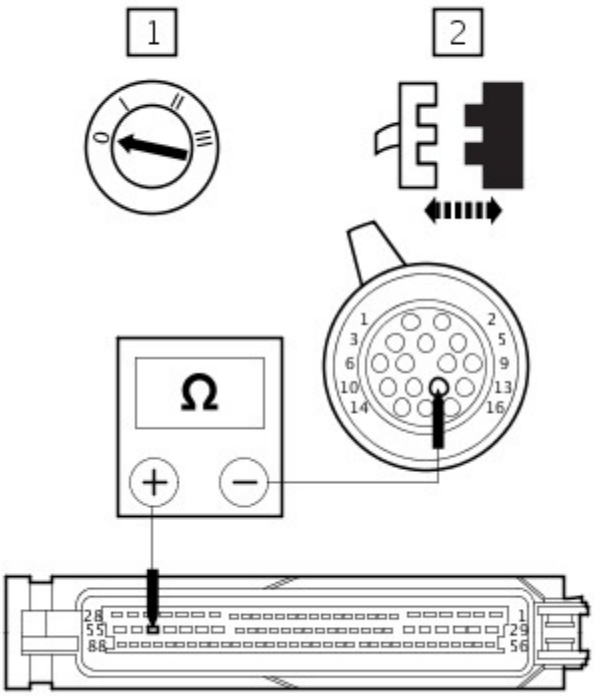
B4: CHECK HARNESS +VE CONTINUITY



E31859

	1 With EM007 and EM046 disconnected, measure the resistance between EM046/016 and EM007/052
	Is the resistance < 0.5 OHM? **Yes** GO to B5 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

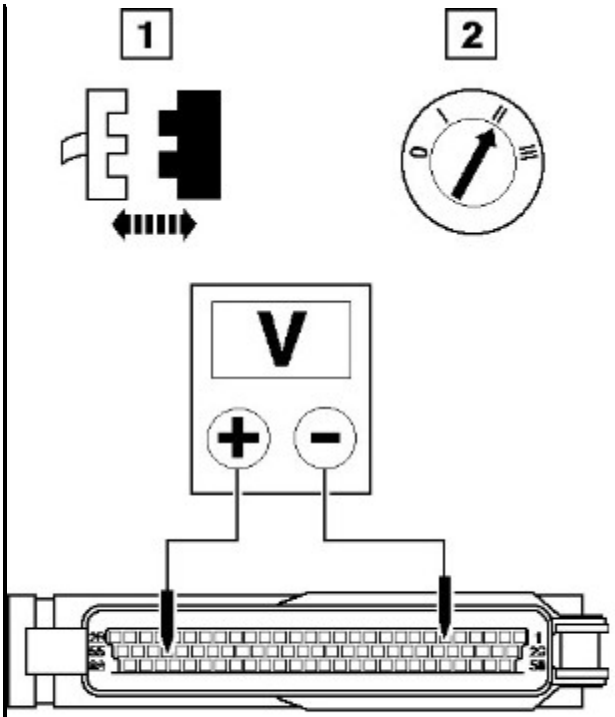
B5: CHECK HARNESS +VE CONTINUITY



E31860

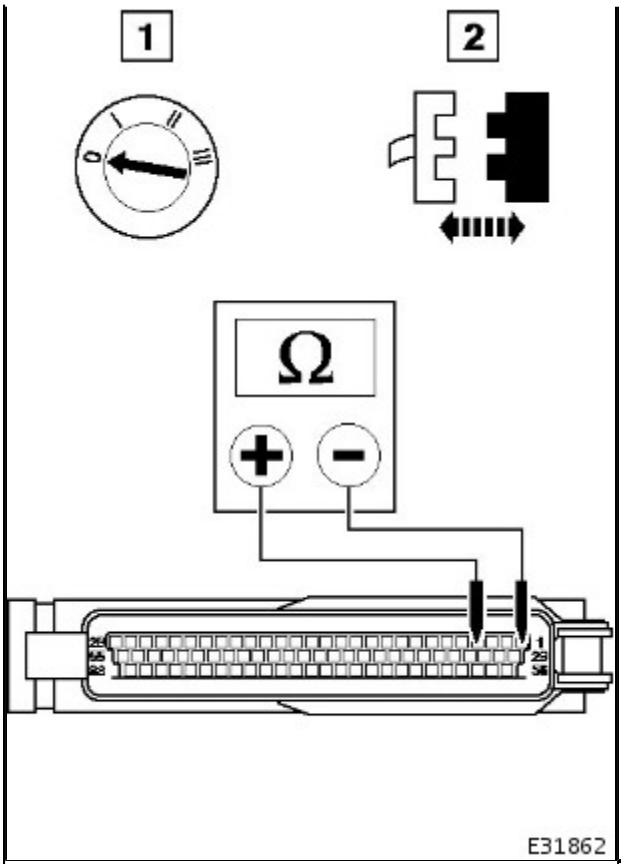
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/012 and EM007/053
	Is the resistance < 0.5 OHM? **Yes** GO to B6 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

B6: CHECK FOR SHORT TO B+



	1 With EM007 disconnected, measure the voltage between EM007/052 and EM007/006
	2 Repeat for EM007/053 and EM007/006
	12 V? **Yes** GO to B7 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

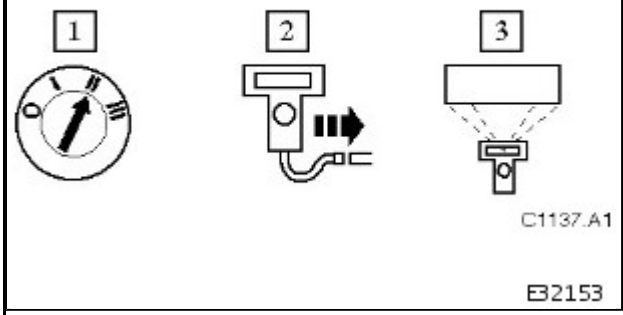
B7: CHECK HARNESS CORE TO CORE INSULATION



	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/004 and EM007/001
	2 Repeat for EM007/004 and EM007/005
	3 Repeat for EM007/004 and EM007/029
	4 Repeat for EM007/004 and EM007/051
	5 Repeat for EM007/004 and EM007/052
	6 Repeat for EM007/004 and EM007/053
	Is the resistance > 10 MOHM? **Yes** GO to B8 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
B8: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

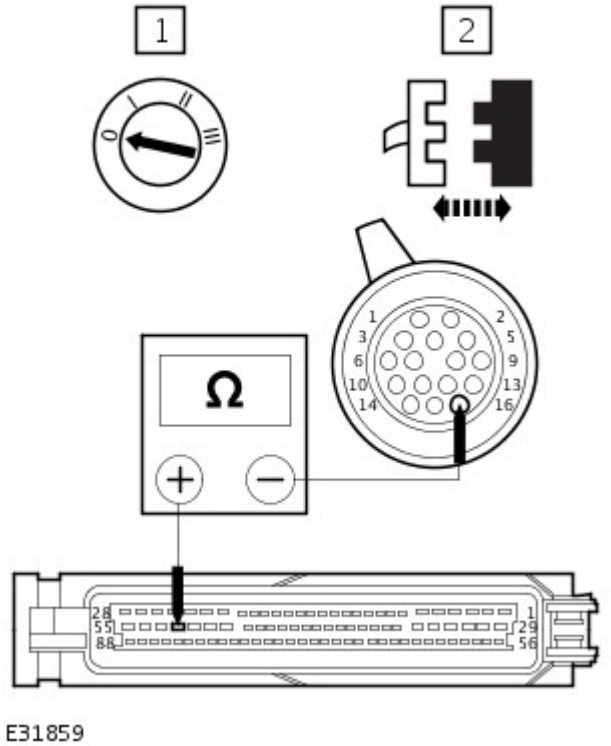
Pinpoint test C: P0702, P0753, P0758, P0763

PINPOINT TEST C : P0702, P0753, P0758, P0763	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



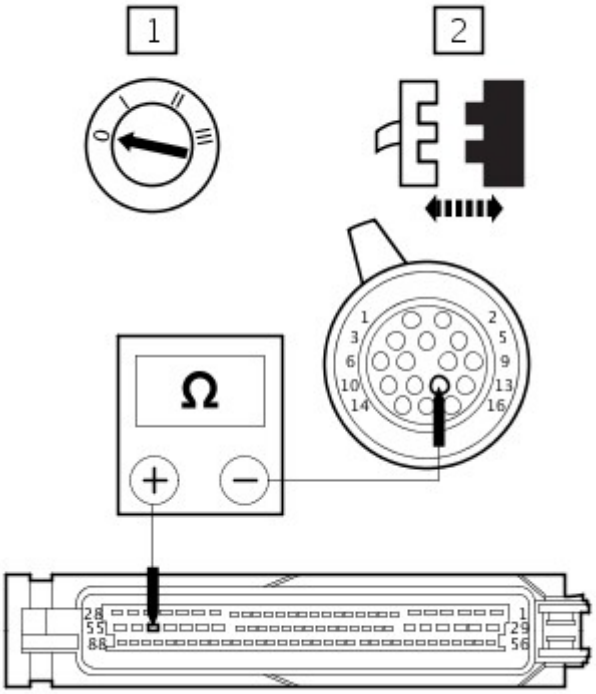
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to C2

C2: CHECK HARNESS +VE CONTINUITY



	1 With EM007 and EM046 disconnected, measure the resistance between EM046/016 and EM007/053
	Is the resistance < 0.5 OHM? **Yes** GO to C3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

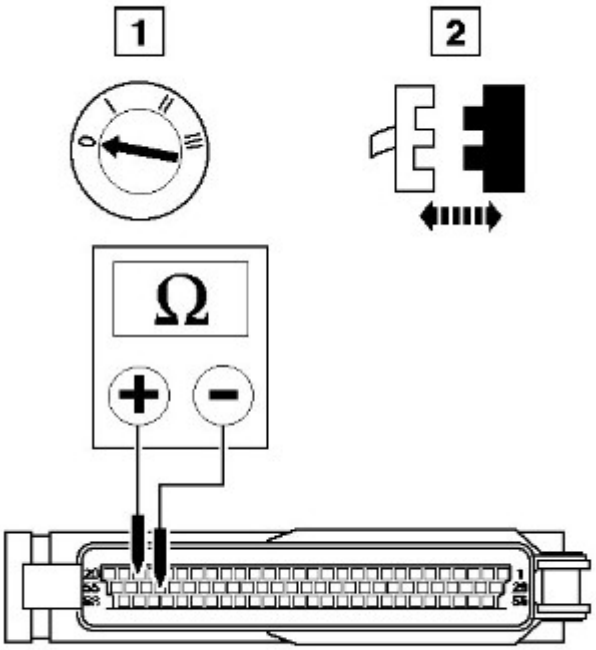
C3: CHECK HARNESS +VE CONTINUITY



E31860

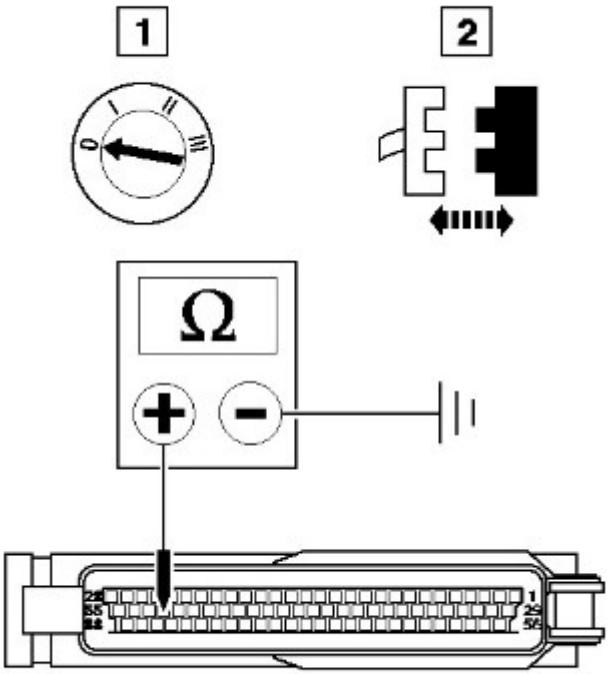
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/012 and EM007/052
	Is the resistance < 0.5 OHM? **Yes** GO to C4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C4: CHECK FOR SHORT TO B+



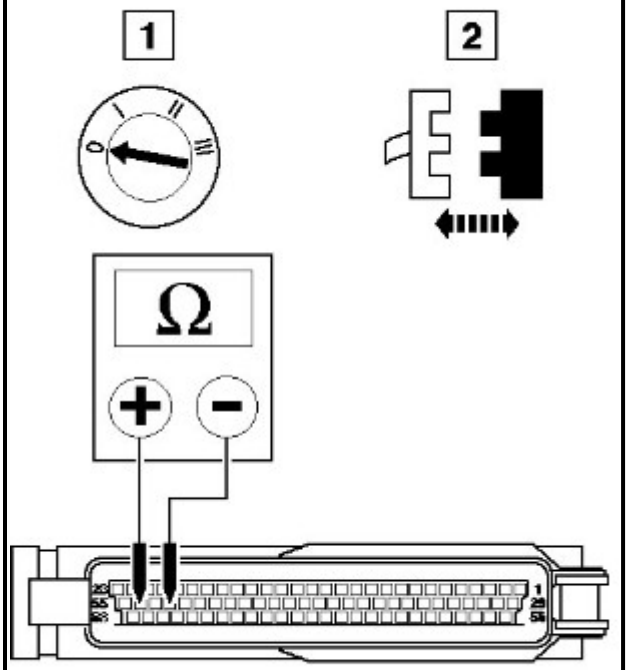
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM007/026
	2 Repeat for EM007/053 and EM007/026
	> 10 MOHM? **Yes** GO to C5 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C5: CHECK HARNESS SHORT TO GROUND



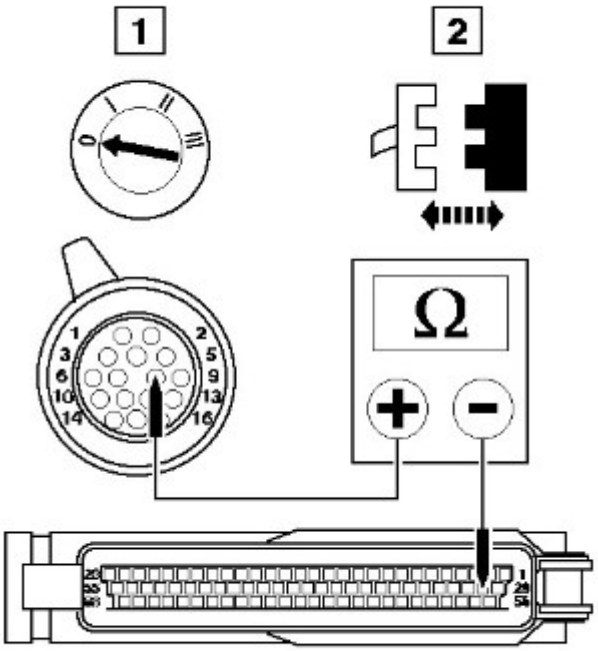
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM008R
	2 Repeat for EM007/053 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to C6 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C6: CHECK FOR SHORT TO IGNITION



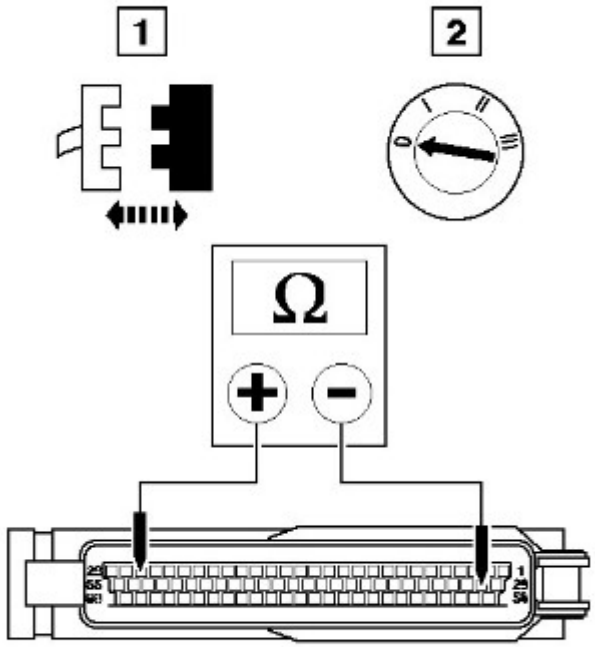
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM007/054
	2 Repeat for EM007/053 and EM007/054
	> 10 MOHM? **Yes** GO to C7 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C7: CHECK HARNESS CONTINUITY - SOLENOID



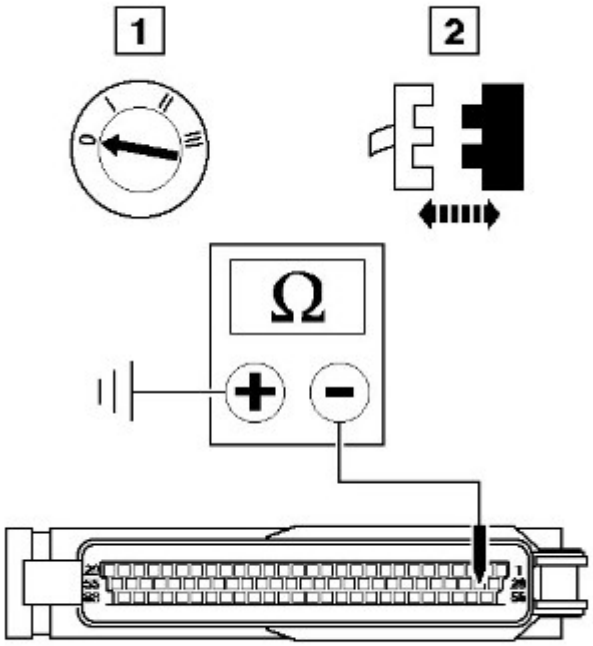
	1 With EM007 and EM046 disconnected, measure the resistance in turn;
	2 EM007/030 and EM046/008
	3 EM007/033 and EM046/009
	4 EM007/032 and EM046/004
	Is the resistance < 0.5 OHM? **Yes** GO to C8 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C8: CHECK FOR SOLENOID SHORT TO B+



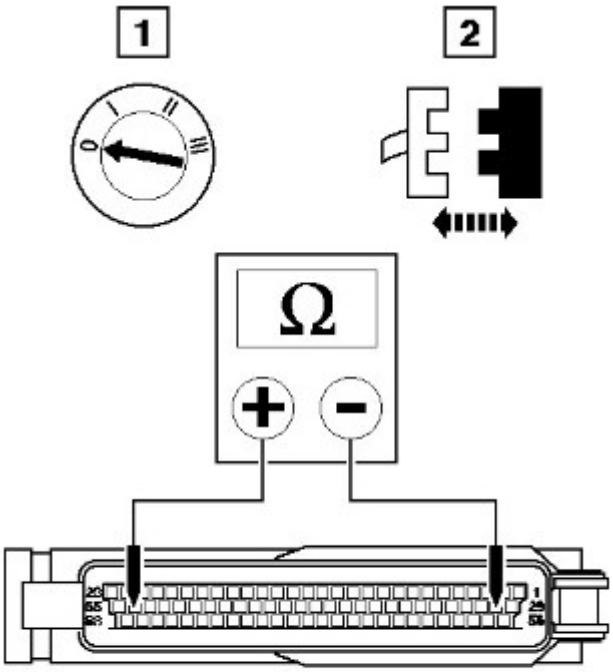
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/030 and EM007/026 • Repeat for 2 EM007/033 and EM007/026 3 EM007/032 and EM007/026 Is the resistance > 10 MOHM? **Yes** GO to C9 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

C9: CHECK HARNESS SHORT TO GROUND



	1 With EM007 and EM046 disconnected, measure the resistance between EM007/030 and EM008R • Repeat for 2 EM007/033 and EM008R 3 EM007/032 and EM008R Is the resistance > 10 MOHM? **Yes** GO to C10 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

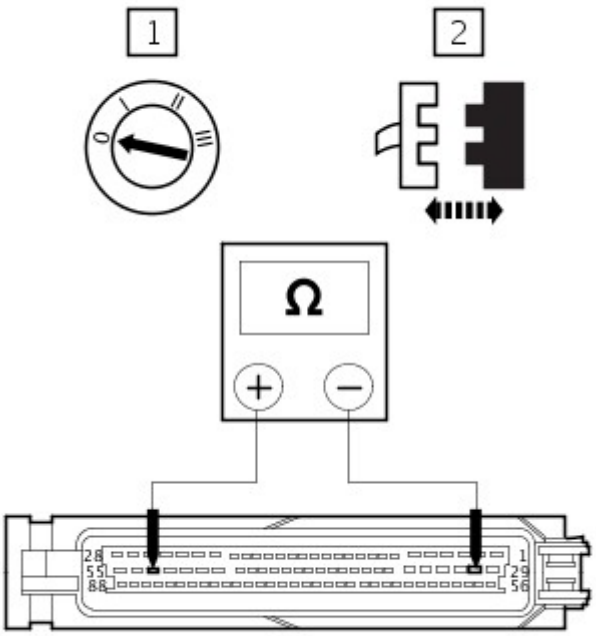
C10: CHECK FOR SOLENOID SHORT TO IGNITION



E31845

	1 With EM007 and EM046 disconnected, measure the resistance between EM007/030 and EM007/054 • Repeat for 2 EM007/033 and EM007/054 3 EM007/032 and EM007/054 Is the resistance > 10 MOHM? **Yes** Reconnect EM046 GO to C11 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

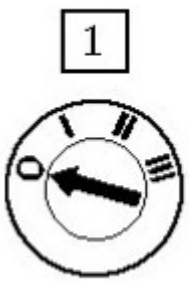
C11: CHECK INTERNAL HARNESS AND COMPONENT CONTINUITY - SOLENOIDS



E31846

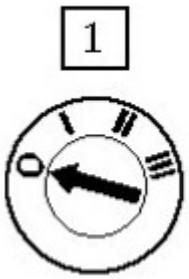
	1 With EM007 disconnected, measure the resistance between the following, noting the relevant DTC
	2 For P0702 or P0753 EM007/53 and EM007/030
	3 For P0702 or P0758 EM007/53 and EM007/033
	4 For P0702 or P0763 EM007/53 and EM007/032
	Is the resistance 30 to 35 OHM? **Yes** Reconnect EM007 GO to C14 **No** Disconnect EM046 and reconnect EM007 GO to C12

C12: INTERNAL TRANSMISSION CHECK

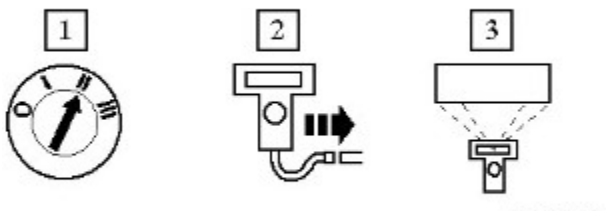


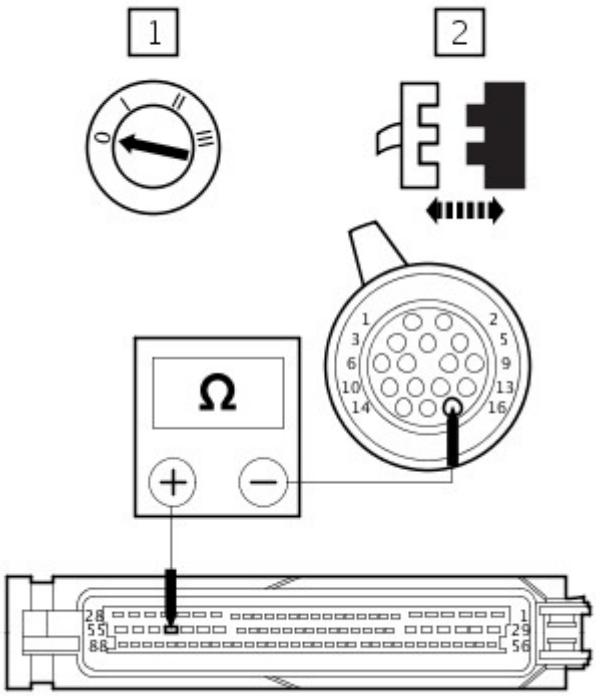
E32154

	1 Remove the fluid pan; refer to 44.24.04. Disconnect the harness from the relevant solenoid and measure the component resistance.
	30 to 35 OHM? **Yes** GO to C13 **No**

	Renew the solenoid; refer to 44.15.50.
C13: INTERNAL TRANSMISSION HARNESS CHECK	
 E32154	
	1 Measure the resistance from transmission internal harness multiplug to the relevant solenoid connector
	Is the resistance < 0.5 OHM? **Yes** GO to C14 **No** Renew the internal harness; refer to 44.15.35.
C14: END	
	1 Cycle the ignition ON - (OFF for 2 minutes) - ON, start the engine and run >1600 rpm
	Has the fault code cleared? **Yes** STOP **No** P0702 present? **Yes** GO to D1 **No** P0753, P0758, P0763 present? **Yes** Contact Jaguar Service

Pinpoint test D: P0702, P1745, P1746, P1747, P0743, P1748

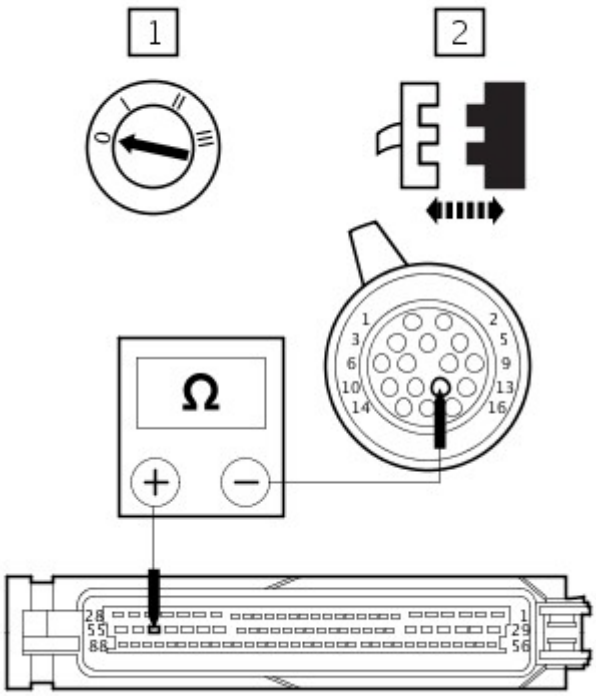
PINPOINT TEST D : P0702, P1745, P1746, P1747, P0743, P1748	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present	
 E32153	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to D2
D2: CHECK HARNESS +VE CONTINUITY	



E31859

	1 With EM007 and EM046 disconnected, measure the resistance between EM046/016 and EM007/052
	Is the resistance < 0.5 OHM? **Yes** GO to D3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

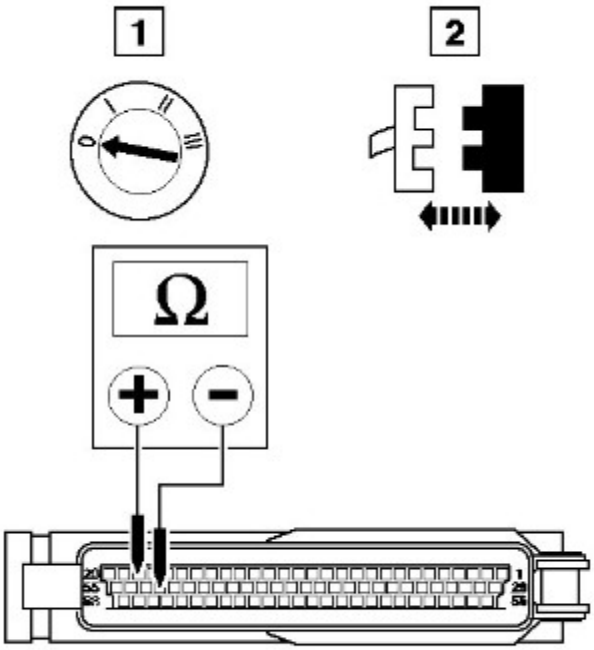
D3: CHECK HARNESS +VE CONTINUITY



E31860

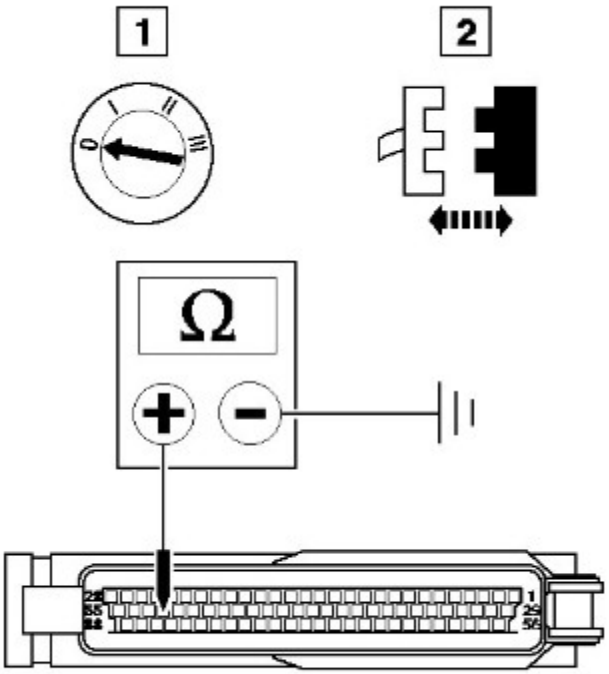
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/012 and EM007/053
	Is the resistance < 0.5 OHM? **Yes** GO to D4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D4: CHECK FOR SHORT TO B+



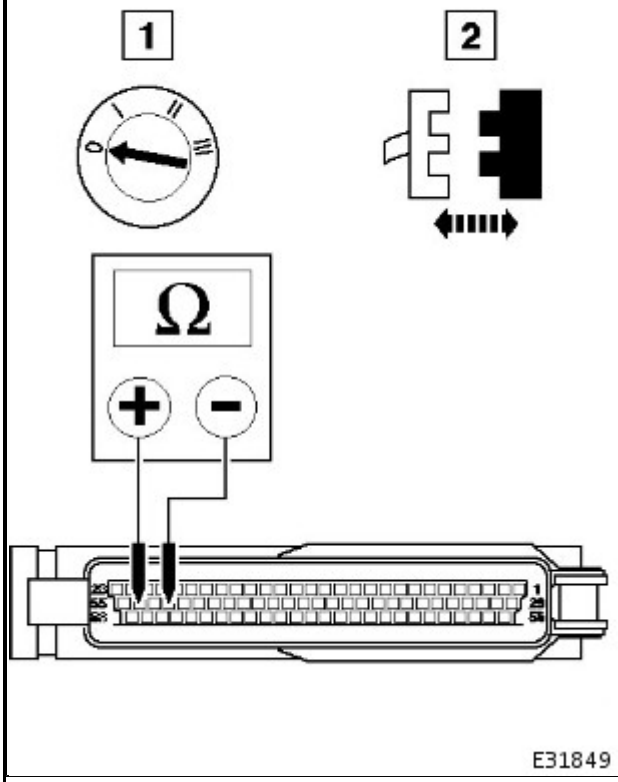
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM007/026
	2 Repeat for EM007/053 and EM007/026
	> 10 MOHM? **Yes** GO to D5 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D5: CHECK HARNESS SHORT TO GROUND



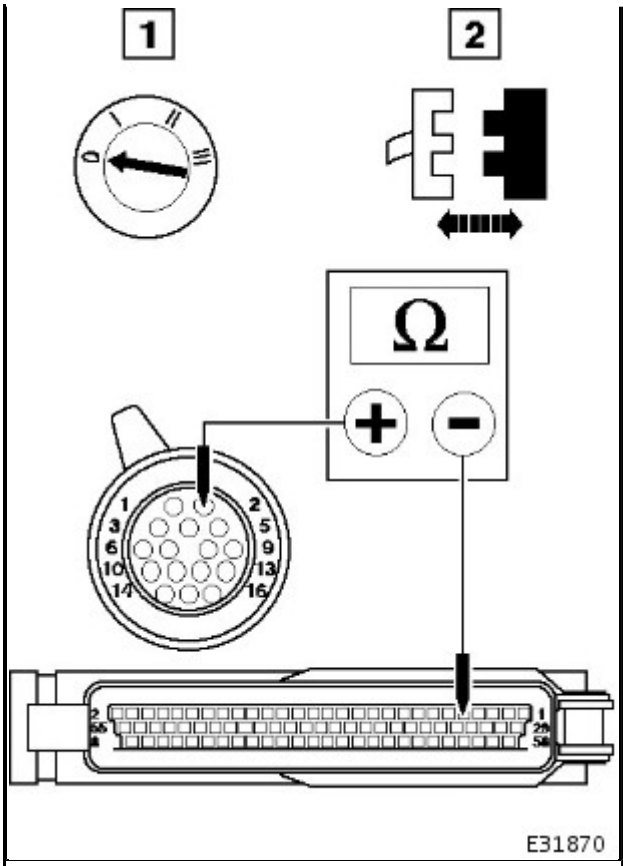
	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM008R
	2 Repeat for EM007/053 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to D6 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D6: CHECK FOR SHORT TO IGNITION



	1 With EM007 and EM046 disconnected, measure the resistance between EM007/052 and EM007/054
	2 Repeat for EM007/053 and EM007/054
	Is the resistance > 10 MOHM? **Yes** GO to D7 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D7: CHECK HARNESS CONTINUITY - PRESSURE REGULATOR



1	With EM007 and EM046 disconnected, measure the resistance in turn;
2	EM007/005 and EM046/002
3	EM007/001 and EM046/003
4	EM007/029 and EM046/007
5	EM007/004 and EM046/011
6	EM007/051 and EM046/015

Is the resistance < 0.5 OHM?

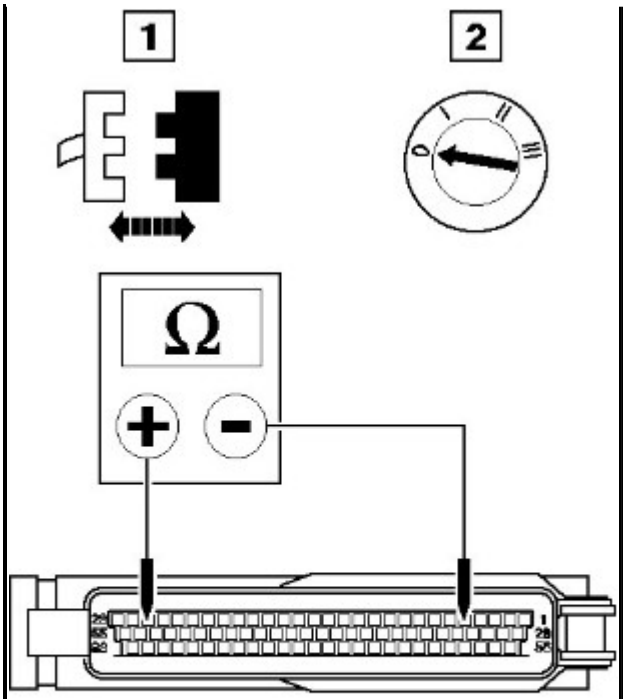
Yes

GO to D8

No

Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D8: CHECK FOR PRESSURE REGULATOR SHORT TO B+



1	With EM007 and EM046 disconnected, measure the resistance between EM007/005 and EM007/026
2	Repeat for EM007/001 and EM007/026
3	EM007/029 and EM007/026
4	EM007/004 and EM007/026
5	EM007/051 and EM007/026

Is the resistance > 10 MOHM?

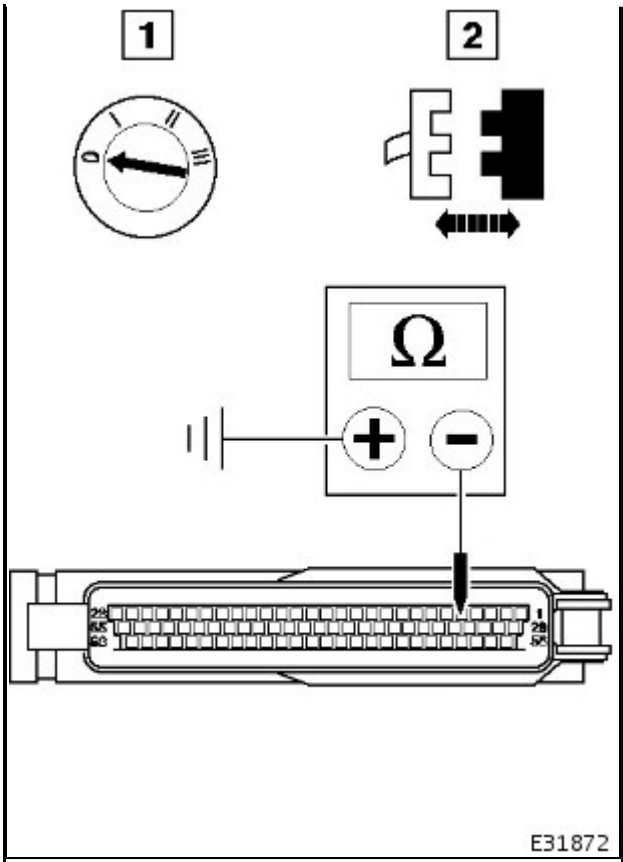
Yes

GO to D9

No

Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D9: CHECK HARNESS SHORT TO GROUND



1	With EM007 and EM046 disconnected, measure the resistance between EM007/005 and EM008R
2	Repeat for EM007/001 and EM008R
3	EM007/029 and EM008R
4	EM007/004 and EM008R
5	EM007/051 and EM008R

Is the resistance > 10 MOHM?

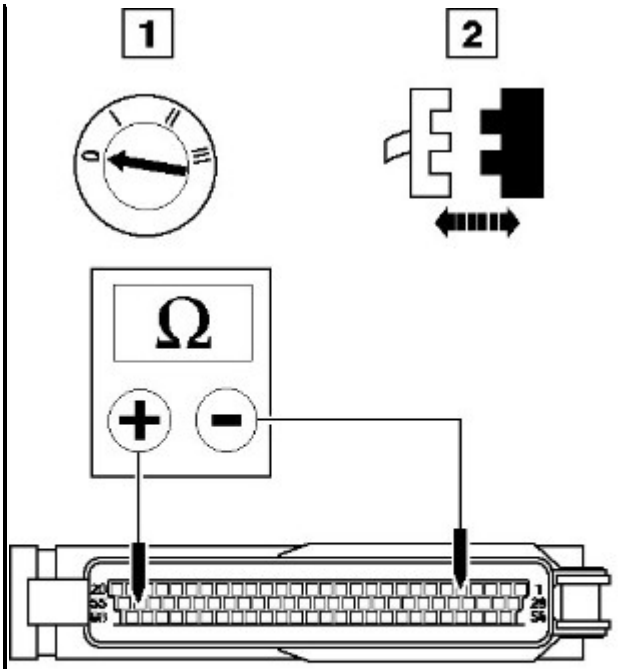
Yes

GO to D10

No

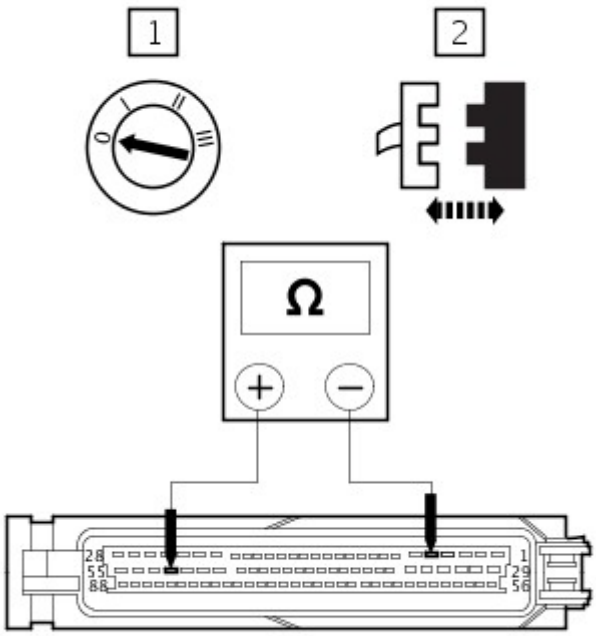
Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

D10: CHECK FOR SHORT TO IGNITION



	1 With EM007 and EM046 disconnected, measure the resistance between EM007/005 and EM007/054 • Repeat for
	2 EM007/001 and EM007/054
	3 EM007/029 and EM007/054
	4 EM007/004 and EM007/054
	5 EM007/051 and EM007/054
	Is the resistance > 10 MOHM? **Yes** Reconnect EM046 GO to D11 **No** Inspect harness / connectors EM007 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

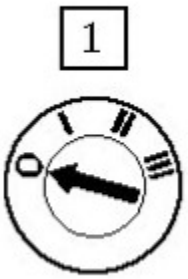
D11: CHECK INTERNAL HARNESS AND COMPONENT CONTINUITY - PRESSURE REGULATORS



E31869

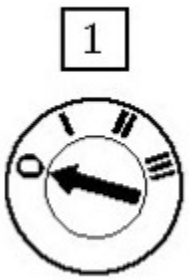
	1 With EM007 disconnected, measure the resistance between the following, noting the relevant DTC
	2 For P0702 or P1745 EM007/52 and EM007/005
	3 For P0702 or P1746 EM007/52 and EM007/001
	4 For P0702 or P1747 EM007/52 and EM007/029
	5 For P0702 or P0743 EM007/52 and EM007/004
	6 For P0702 or P1748 EM007/52 and EM007/051
	Is the resistance 5 to 7 OHM? **Yes** Reconnect EM007 GO to D14 **No** Disconnect EM046 and reconnect EM007 GO to D12

D12: INTERNAL TRANSMISSION CHECK

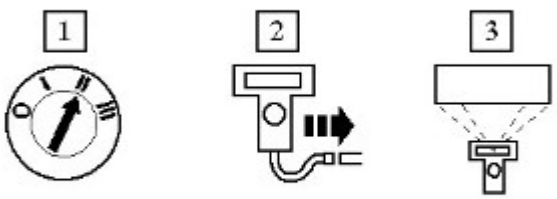


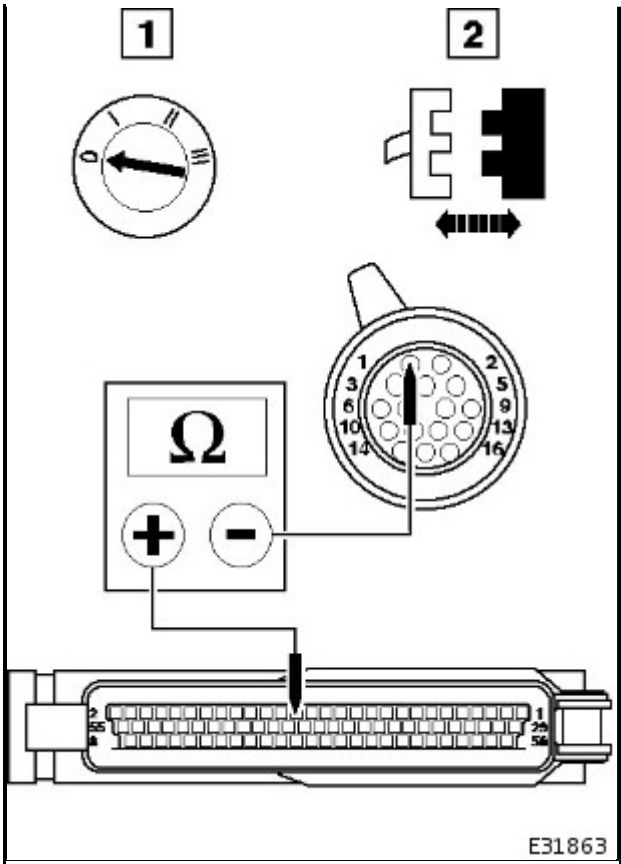
E32154

	1 Remove the fluid pan; refer to 44.24.04. Disconnect the harness from the relevant pressure regulator and measure the component resistance.
	5 to 7 OHM? **Yes**

	GO to D13 **No** Renew the pressure regulator; refer to 44.15.51.
D13: INTERNAL TRANSMISSION HARNESS CHECK	
 E32154	
	1 Measure the resistance from transmission internal harness multiplug to the relevant pressure regulator connector
	Is the resistance < 0.5 OHM? **Yes** GO to D14 **No** Renew the internal harness; refer to 44.15.35.
D14: END	
	1 Cycle the ignition ON - (OFF for 2 minutes) - ON, start the engine and run >1600 rpm
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

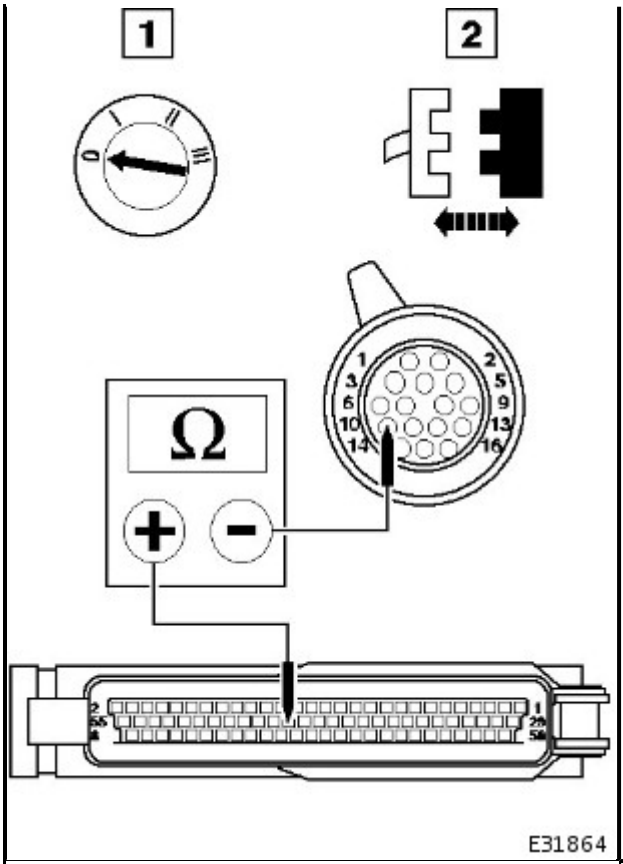
Pinpoint test E: P1720 (P0721)

PINPOINT TEST E : P1720 (P0721)	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
 C1137.A1 E32153	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to E2
E2: CHECK HARNESS +VE CONTINUITY (OUTPUT SPEED SENSOR)	



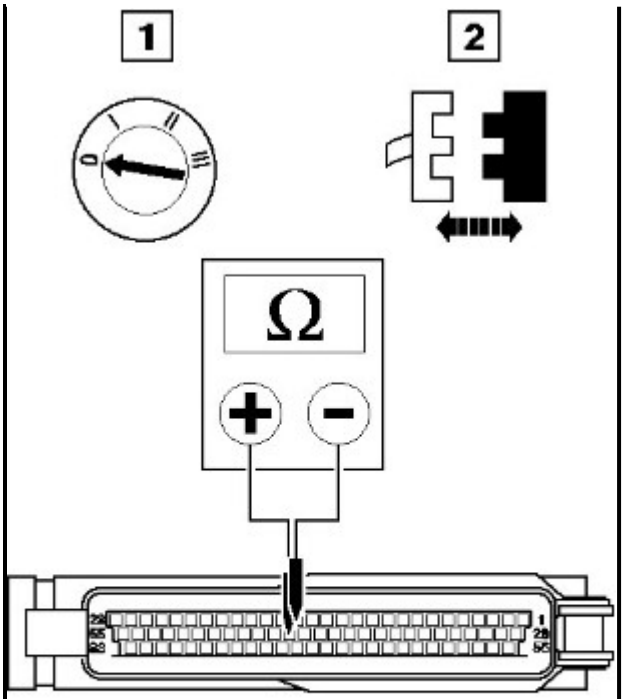
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/001 and EM007/016
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM046 GO to E3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

E3: CHECK HARNESS -VE CONTINUITY (OUTPUT SPEED SENSOR)



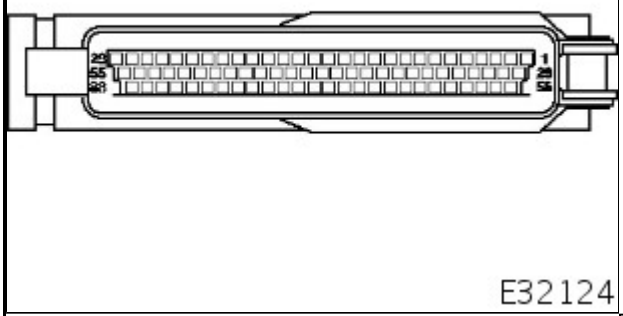
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/010 and EM007/044
	Is the resistance < 0.5 OHM? **Yes** GO to E4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

E4: CHECK OUTPUT SPEED SENSOR COIL CONTINUITY



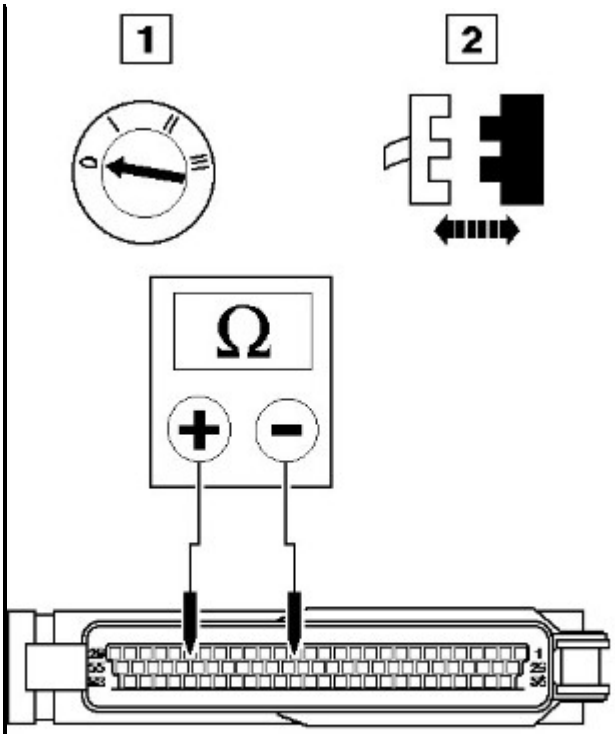
	1 With, EM007 disconnected, measure the sensor value between EM007/016 and EM007/044
	Is the resistance between 280 and 1200 OHM? **Yes** GO to E5 **No** Renew the output speed sensor.

E5: CHECK FOR SHORT TO B+



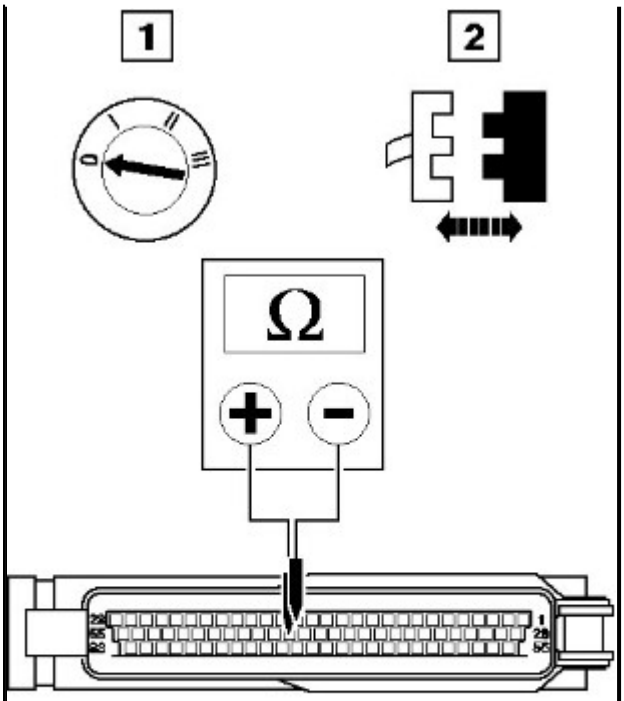
	1 With EM007 disconnected, measure the voltage between EM007/015 and EM007/044
	2 Repeat for EM007/016 and EM007/044
	0V? **Yes** GO to E6 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

E6: CHECK HARNESS SHORT TO SCREEN



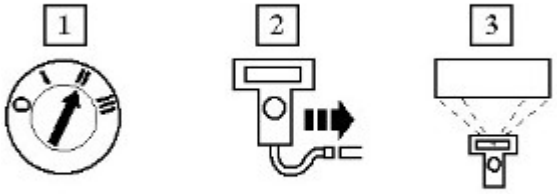
	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/023
	Is the resistance > 10 MOHM? **Yes** GO to E7 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

E7: CHECK HARNESS CORE TO CORE INSULATION

	
	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/044
	Is the resistance > 10 MOHM? **Yes** GO to E8 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
E8: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test F: P0715

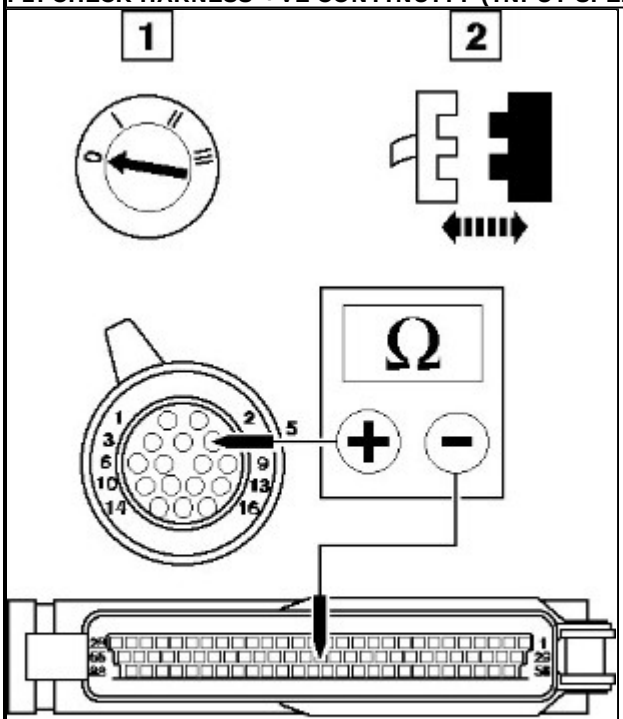
PINPOINT TEST F : P0715	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to F2

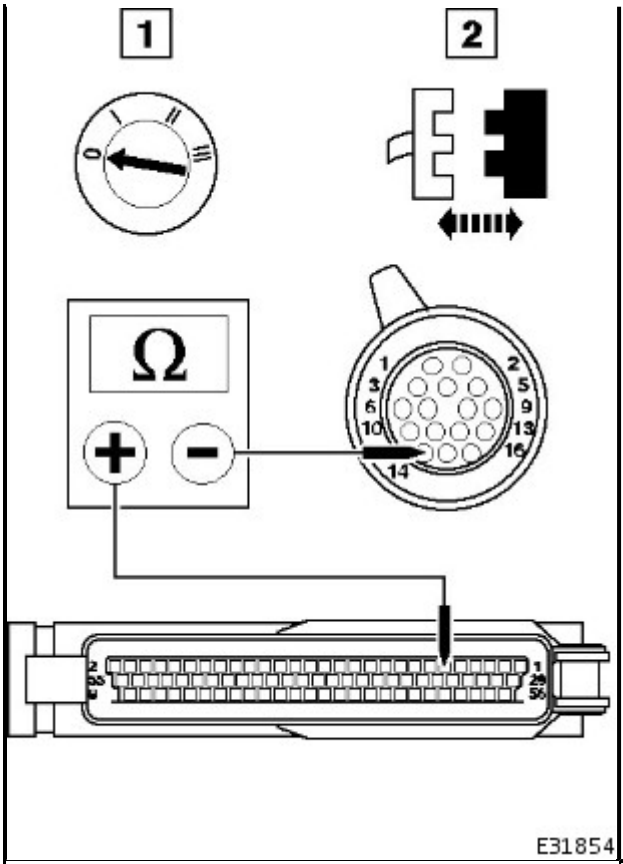
F2: CHECK HARNESS +VE CONTINUITY (INPUT SPEED SENSOR)



E31853

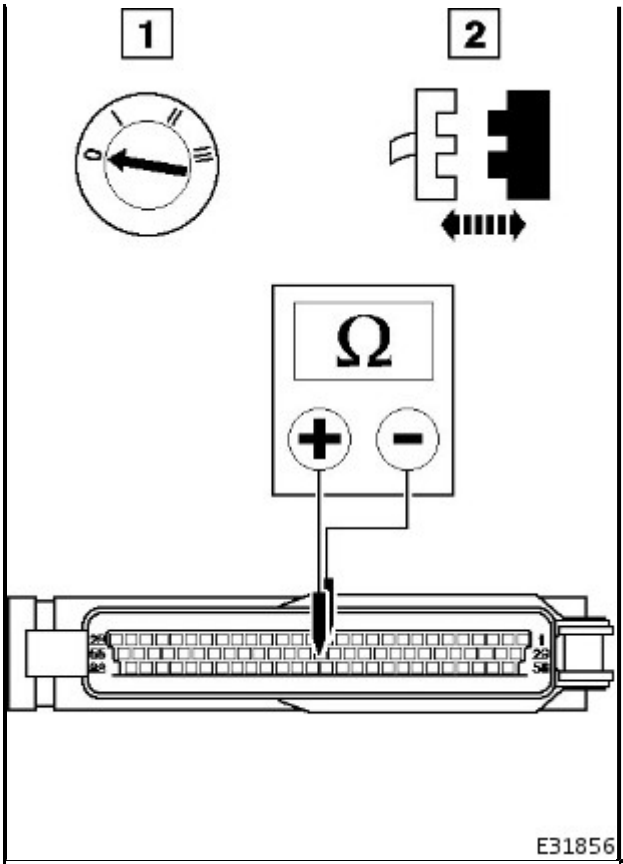
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/005 and EM007/042
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM046 GO to F3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

F3: CHECK HARNESS -VE CONTINUITY (INPUT SPEED SENSOR)



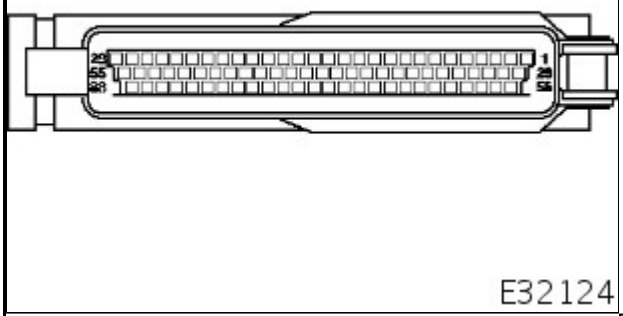
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/014 and EM007/006
	Is the resistance < 0.5 OHM? **Yes** GO to F4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

F4: CHECK INPUT SPEED SENSOR COIL CONTINUITY



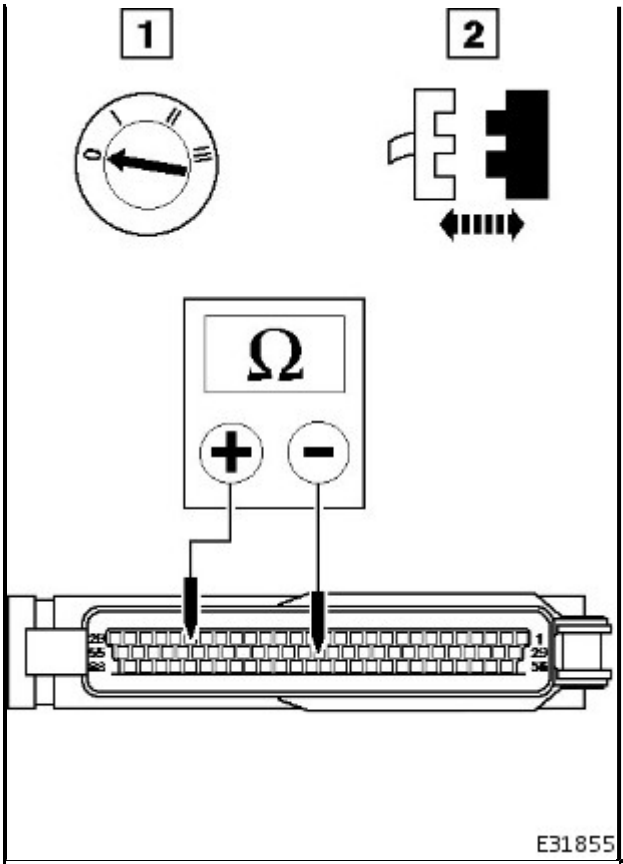
	1 With, EM007 disconnected, measure the sensor value between EM007/042 and EM007/014
	Is the resistance between 280 and 1200 OHM? **Yes** GO to F5 **No** Renew the input speed sensor

F5: CHECK FOR SHORT TO B+



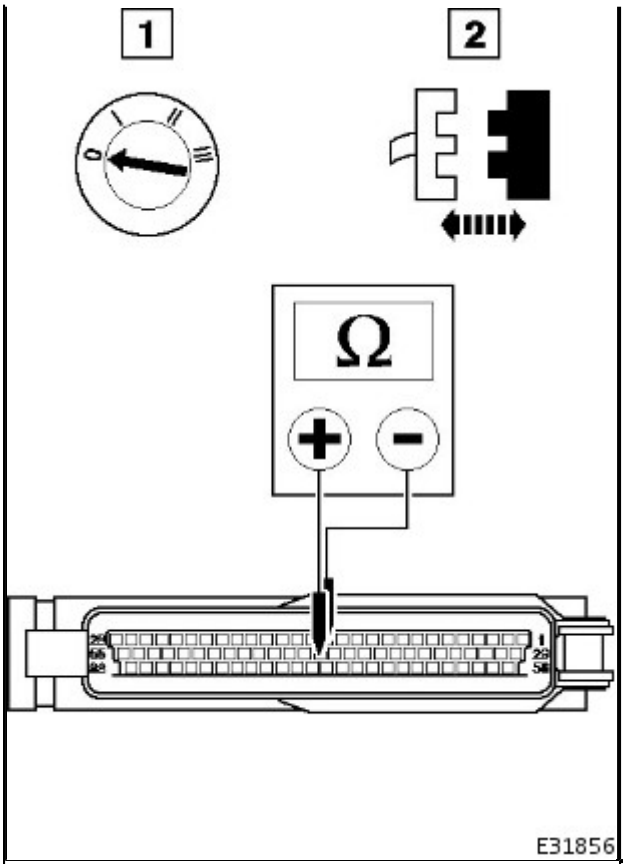
	1 With EM007 disconnected, measure the voltage between EM007/014 and EM007/026
	2 Repeat for EM007/042 and EM007/026
	0V? **Yes** GO to F6 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

F6: CHECK HARNESS SHORT TO SCREEN



	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/042 and EM007/023
	Is the resistance > 10 MOHM? **No** 4 Repeat for EM007/014 and EM007/023 **Yes** GO to F7 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

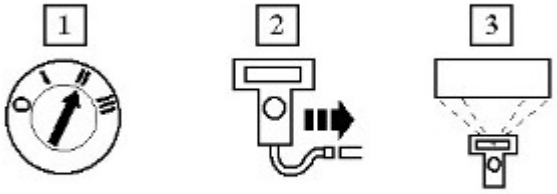
F7: CHECK HARNESS CORE TO CORE INSULATION



	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/014 and EM007/042
	Is the resistance > 10 MOHM? **Yes** GO to F8 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
F8: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test G: P1722

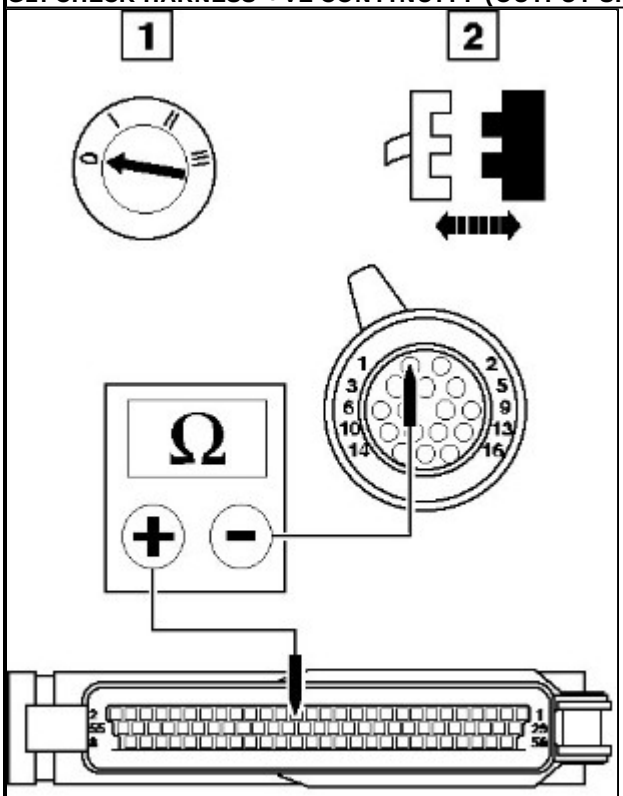
PINPOINT TEST G : P1722	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to G2

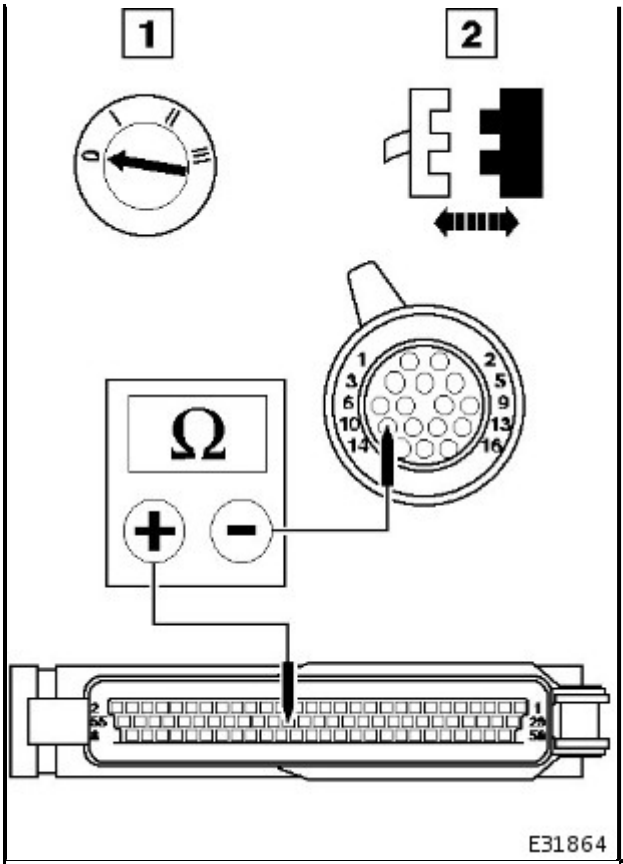
G2: CHECK HARNESS +VE CONTINUITY (OUTPUT SPEED SENSOR)



E31863

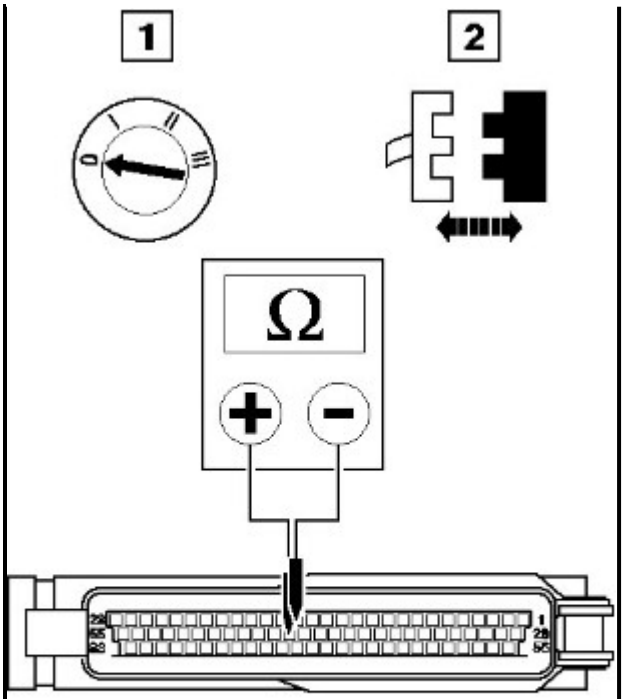
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/001 and EM007/016
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM046 GO to G3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

G3: CHECK HARNESS -VE CONTINUITY (OUTPUT SPEED SENSOR)



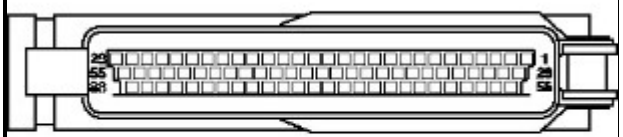
	1 With EM007 and EM046 disconnected, measure the resistance between EM046/010 and EM007/044
	Is the resistance < 0.5 OHM? **Yes** GO to G4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

G4: CHECK OUTPUT SPEED SENSOR COIL CONTINUITY



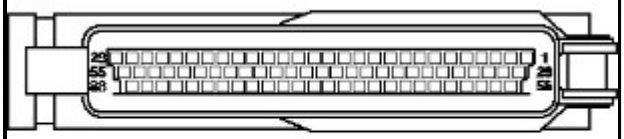
	1 With, EM007 disconnected, measure the sensor value between EM007/016 and EM007/044
	Is the resistance between 280 and 1200 OHM? **Yes** GO to G5 **No** Renew the output speed sensor

G5: CHECK FOR SHORT TO B+



	1 With EM007 disconnected, measure the voltage between EM007/015 and EM007/044
	2 Repeat for EM007/016 and EM007/044
	0V? **Yes** GO to G6 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

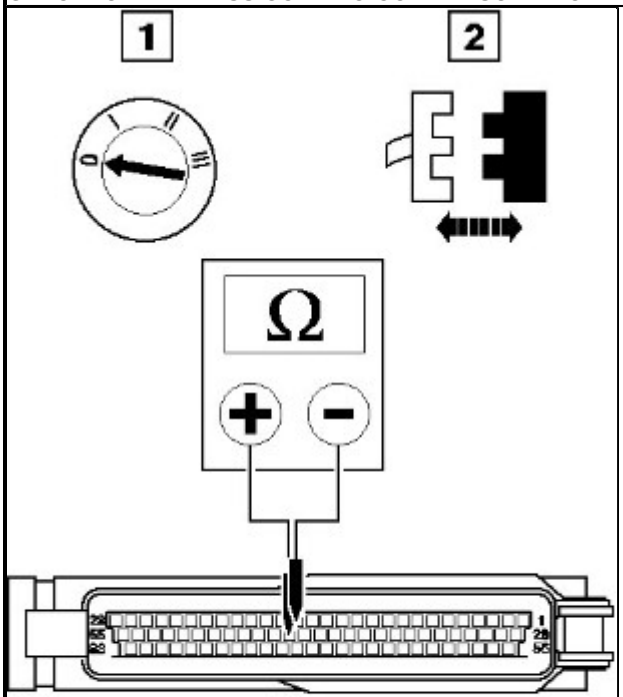
G6: CHECK HARNESS SHORT TO SCREEN



E32124

	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/015
	Is the resistance > 10 MOHM? **No** 4 Repeat for EM007/015 and EM007/044 **Yes** GO to G7 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

G7: CHECK HARNESS CORE TO CORE INSULATION

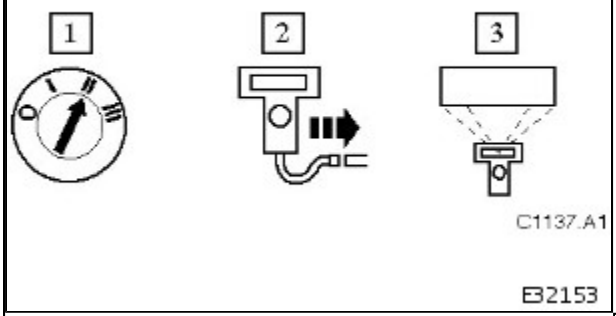


E31865

	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/044
	Is the resistance > 10 MOHM? **Yes** GO to G8 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

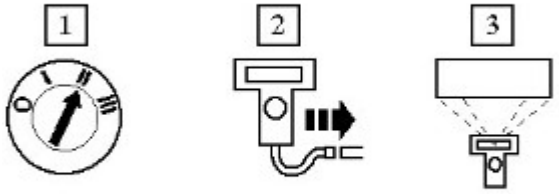
G8: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test H: P1726

PINPOINT TEST H : P1726	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to H2
H2: RENEW TRANSMISSION	
	1 Renew the transmission
	Has the transmission been renewed? **Yes** GO to H3
H3: END	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test I: P1730, P1734, P1779

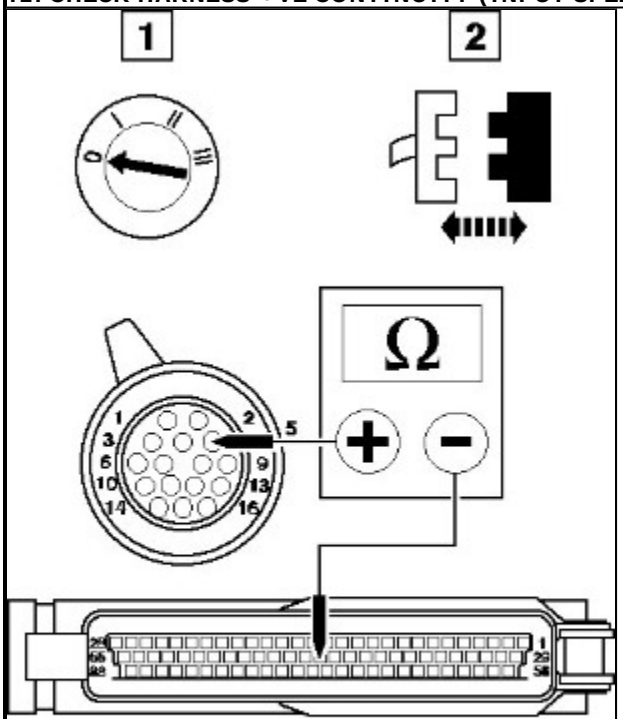
PINPOINT TEST I : P1730, P1734, P1779	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
I1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to I2

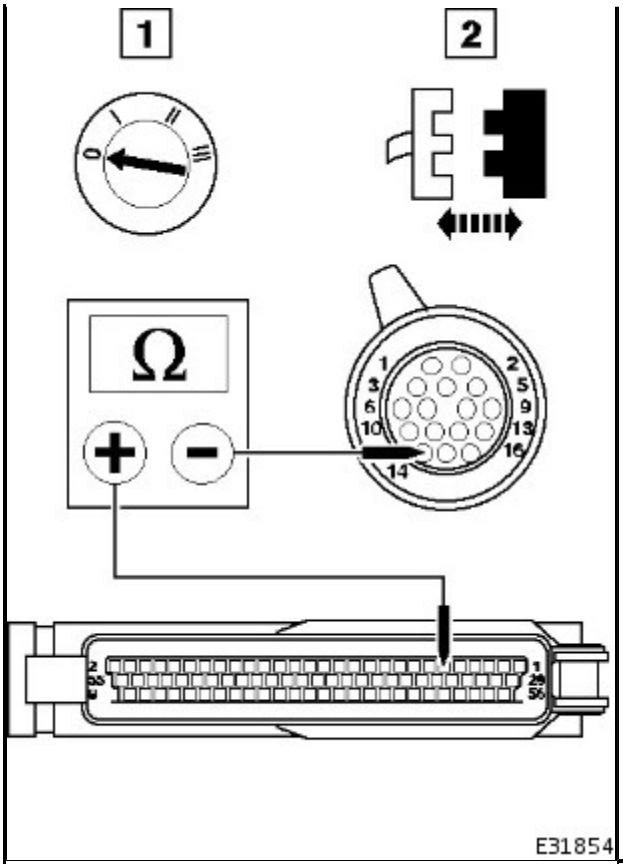
I2: CHECK HARNESS +VE CONTINUITY (INPUT SPEED SENSOR)



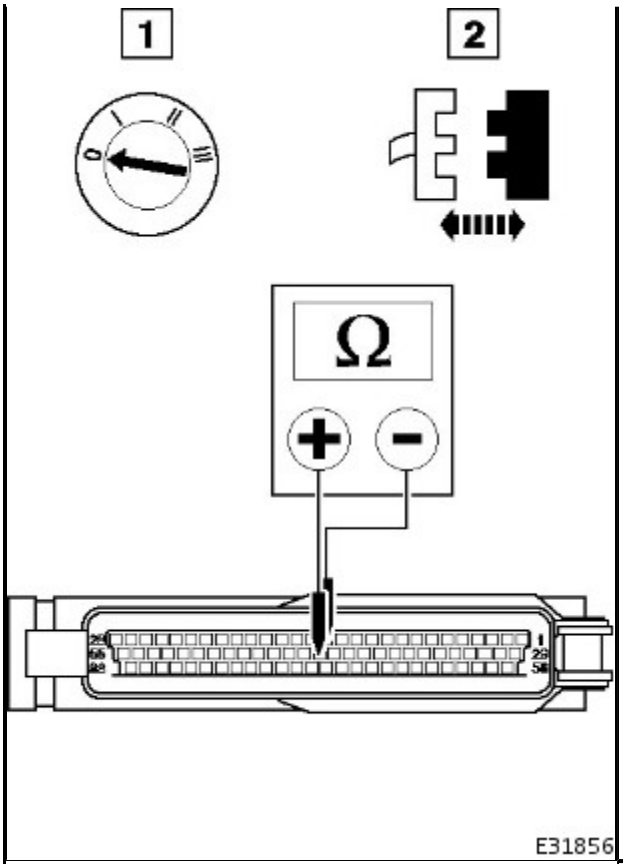
E31853

	1 With EM007 and EM046 disconnected, measure the resistance between EM046/005 and EM007/042
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM046 GO to I3 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

I3: CHECK HARNESS -VE CONTINUITY (INPUT SPEED SENSOR)

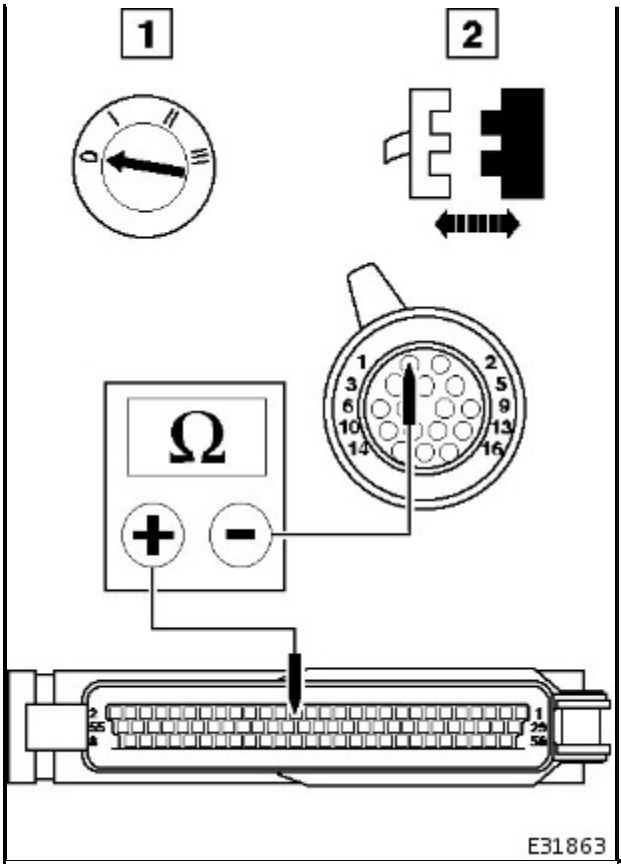


	1 With EM007 and EM046 disconnected, measure the resistance between EM046/014 and EM007/006
	Is the resistance < 0.5 OHM? **Yes** GO to I4 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
I4: CHECK INPUT SPEED SENSOR COIL CONTINUITY	



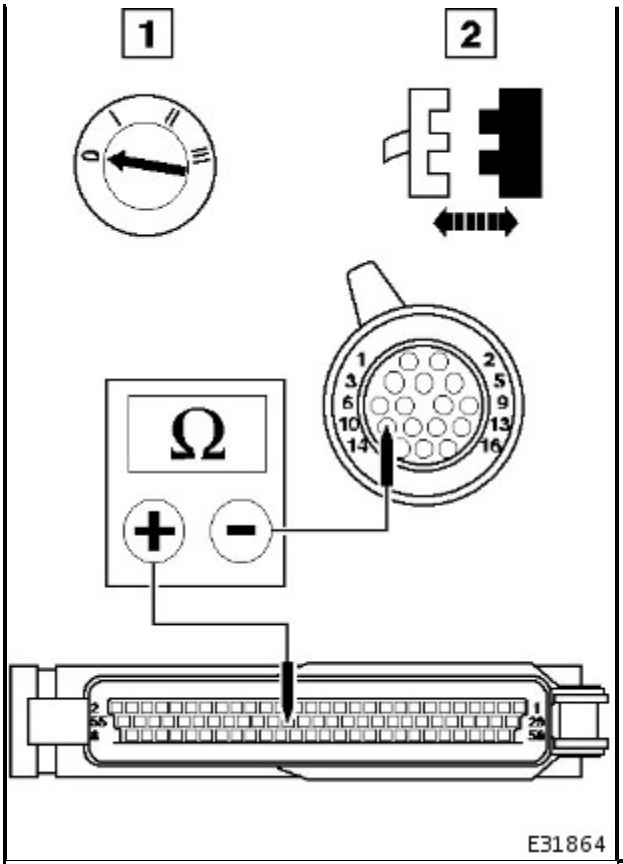
	1 With, EM007 disconnected, measure the sensor value between EM007/042 and EM007/014
	Is the resistance between 280 and 1200 OHM? **Yes** GO to I5 **No** Renew the input speed sensor

I5: CHECK HARNESS +VE CONTINUITY (OUTPUT SPEED SENSOR)

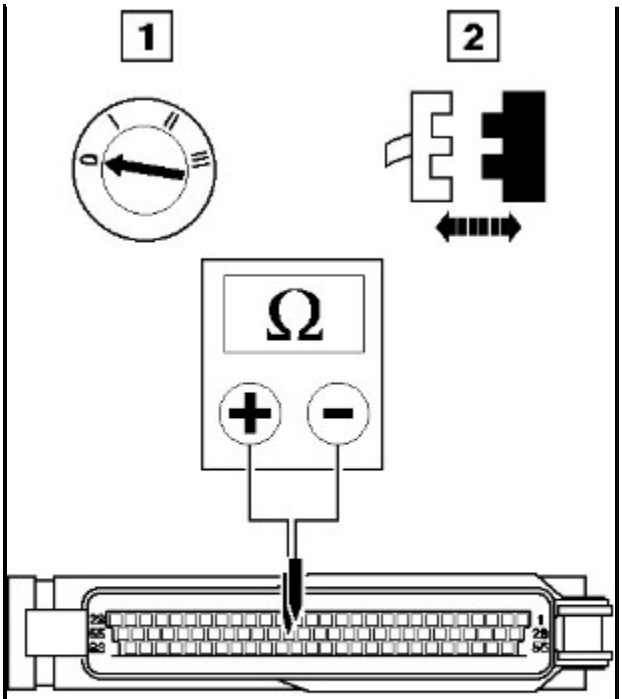


	1 With EM007 and EM046 disconnected, measure the resistance between EM046/001 and EM007/016
	Is the resistance < 0.5 OHM? **Yes** Reconnect EM046 GO to I6 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

I6: CHECK HARNESS -VE CONTINUITY (OUTPUT SPEED SENSOR)

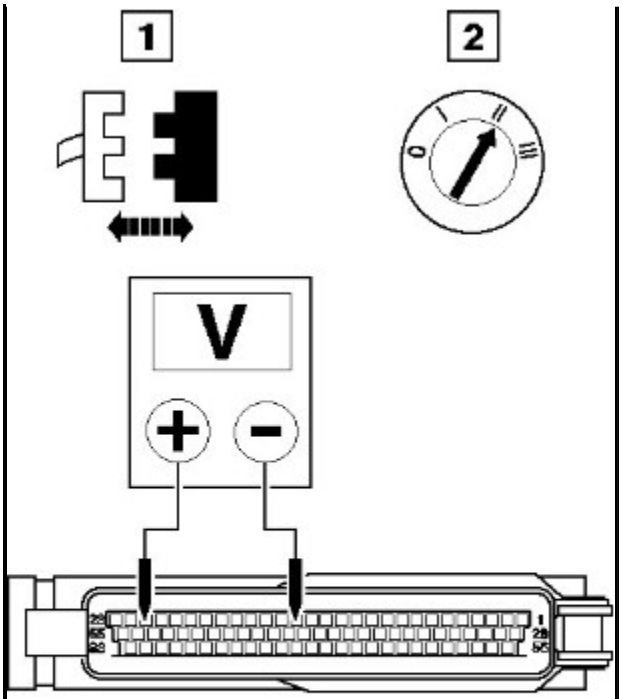


	1 With EM007 and EM046 disconnected, measure the resistance between EM046/010 and EM007/044
	Is the resistance < 0.5 OHM? **Yes** GO to I7 **No** Inspect EM007 and EM046 for corrosion, bent / pushed back pins or locate and repair the harness Test the system for normal operation
I7: CHECK OUTPUT SPEED SENSOR COIL CONTINUITY	



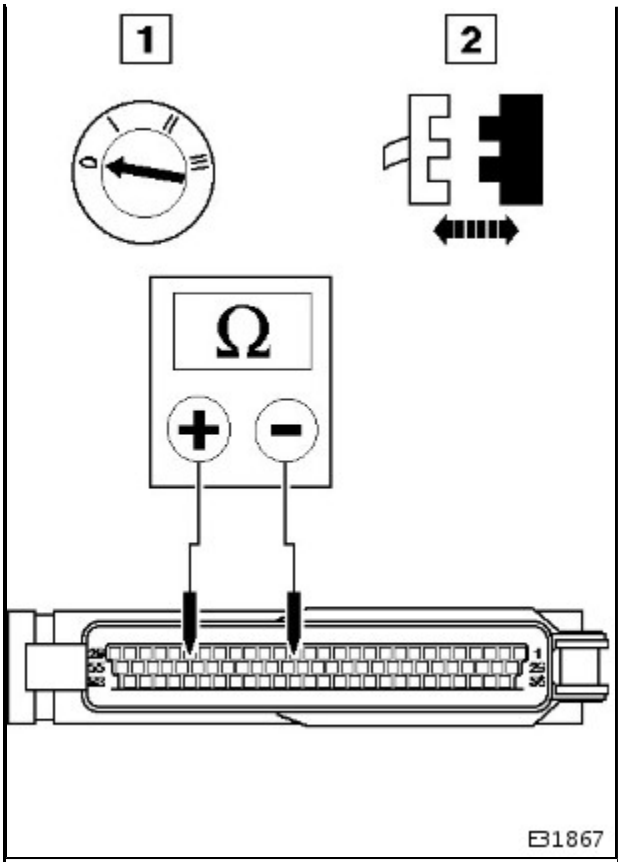
	1 With, EM007 disconnected, measure the sensor value between EM007/016 and EM007/044
	Is the resistance between 280 and 1200 OHM? **Yes** GO to I8 **No** Renew the output speed sensor

I8: CHECK FOR SHORT TO B+



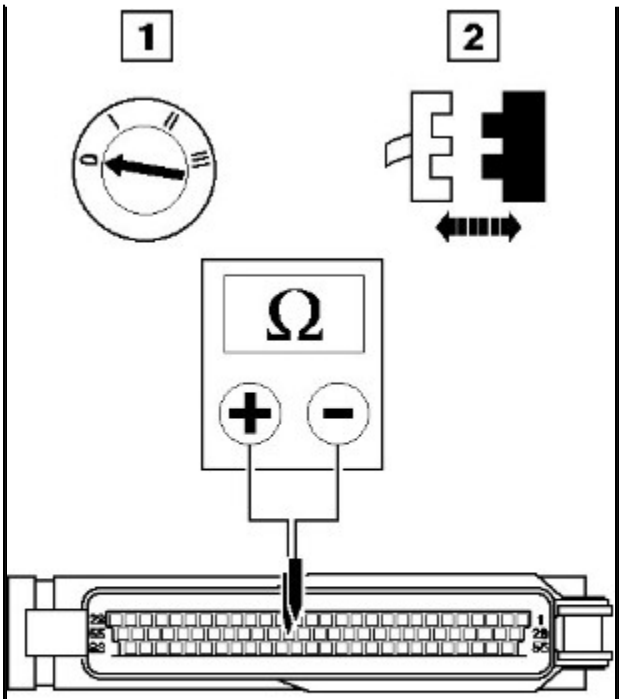
	1 With EM007 disconnected, measure the voltage between EM007/016 and EM007/026
	2 Repeat for EM007/026 and EM007/044
	0V? **Yes** GO to I9 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

I9: CHECK HARNESS SHORT TO SCREEN



	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/023
	2 Repeat for EM007/044 and EM007/023
	Is the resistance > 10 MOHM? **Yes** GO to I10 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.

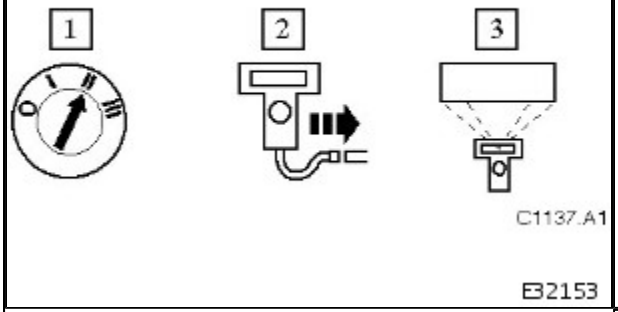
I10: CHECK HARNESS CORE TO CORE INSULATION



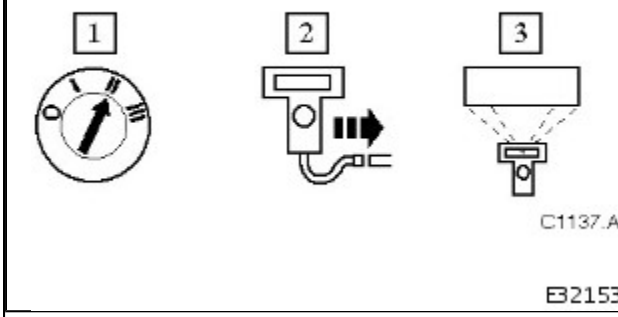
	1 With EM007 and EM046 disconnected, measure the insulation resistance between EM007/016 and EM007/044
	2 Repeat for EM007/014 and EM007/042
	Is the resistance > 10 MOHM? **Yes** GO to I11 **No** Inspect harness / connectors EM007 and EM046 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
I11: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

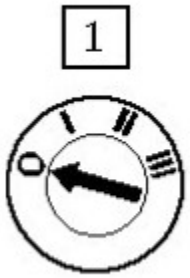
Pinpoint test J: P1603, P1605, P1608

PINPOINT TEST J : P1603, P1605, P1608	
• NOTE: It is important that J3 item 1 is carried out in order that system adaptions take place	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
J1: RETRIEVE DTCS	
• NOTE: Following ECM power-down, the DTC will be lost and may only be displayed when the ignition is energized	

	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to J2
J2: RENEW TCM	
	1 Renew the TCM Has the TCM been renewed? **Yes** GO to J3
J3: END	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test K: P1789, P1793

PINPOINT TEST K : P1789, P1793	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
K1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to K2
K2: CHECK FUSE	



Is underhood fuse F1 OK?

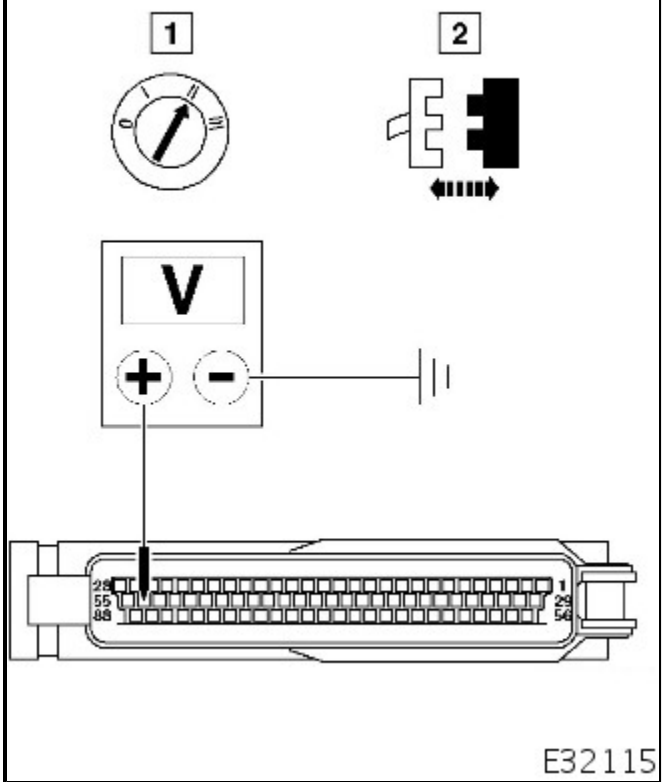
Yes

GO to K3

No

Renew the fuse (10A) and test the system for normal operation

K3: CHECK SWITCHED POWER SUPPLY



1 With EM007 disconnected measure the voltage between EM007/054 and ground EM008R

2 Repeat for EM007/055 and ground EM008R

B+?

Yes

Cycle the ignition ON - (OFF for 2 minutes) - ON, start the engine and run >1600 rpm, if the fault re-logs contact Jaguar Service

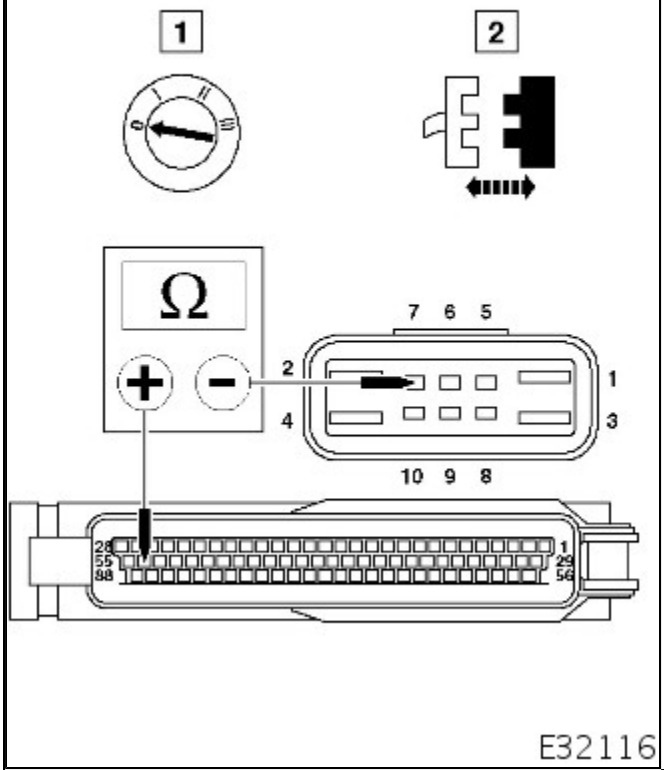
No

No re-log?
GO to K5

No

GO to K4

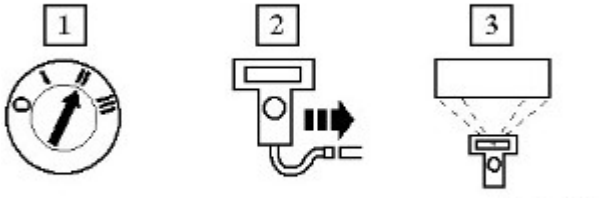
K4: CHECK HARNESS CONTINUITY - SWITCHED POWER SUPPLY



	1 With EM007 and LS008 disconnected, measure the resistance between EM007/054 and LS008/007
	2 Repeat for EM007/055 and LS008/007
	Is the resistance < 0.5 OHM? **Yes** GO to K5 **No** Inspect harness / connector EM007, LS008, EM051, splice EMS42 for damage, corrosion, bent / pushed back pins. Repair as necessary and test the system for normal operation.
K5: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test L: P0710

PINPOINT TEST L : P0710	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
L1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to L2
L2: CHECK CONTINUITY HARNESS	

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Fluid Drain and Refill

General Procedures

Special Tool(s)	
 E36416	Syringe

Removal

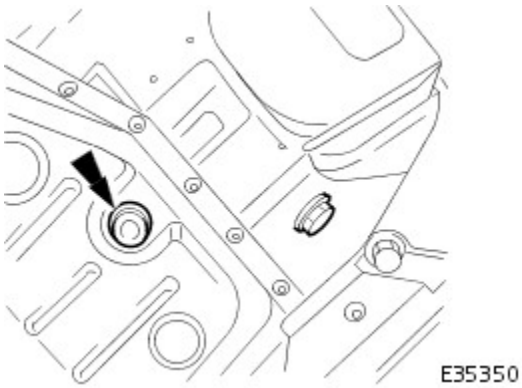
1. Raise the vehicle for access.

2. NOTE: This procedure will not remove residual fluid from the torque converter.

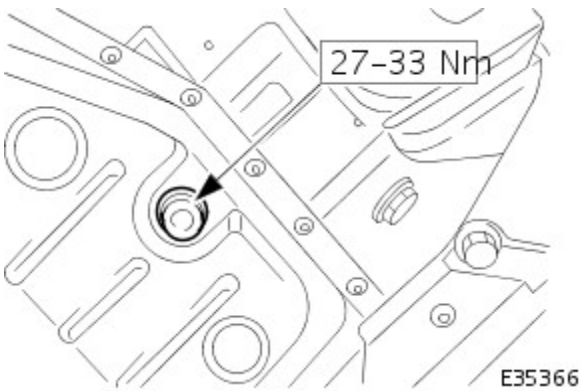
Drain the transmission fluid.

2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED AND THAT THE RECEPTACLE FOR WASTE HAS SUFFICIENT CAPACITY.

- Carefully remove the drain plug and drain the transmission fluid.


E35350

3. Refit the drain plug and tighten to the specified torque figure.

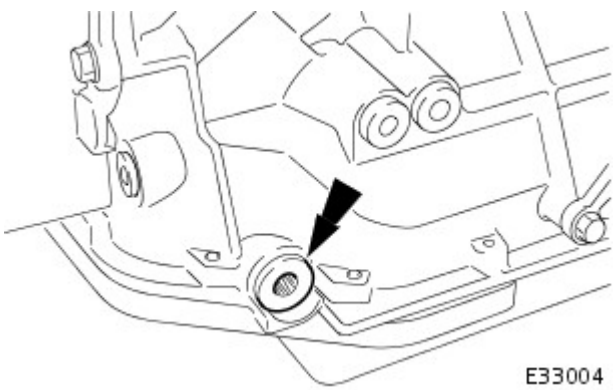


E35366

- Use a new O-ring.

Installation

1. Remove the fluid level / filler plug.

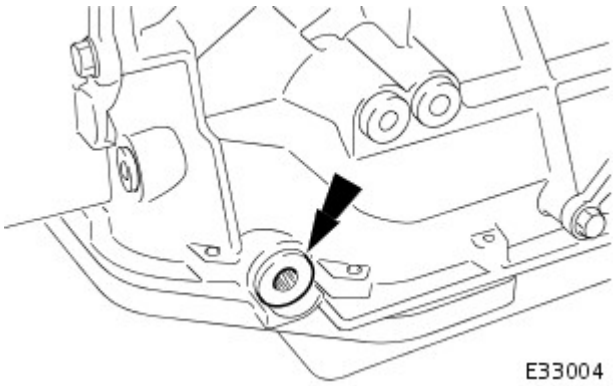

E33004

2. Using a syringe dedicated to transmission fluid only (not used for any other type of oil or fluids), inject transmission fluid until

it overflows from the plug orifice.

2. CAUTION: It is essential that only the specified fluid is used.

- Wait until the flow of fluid has reduced to a trickle.



3. Fit, but do not tighten the plug.

4. Prepare PDU (at the base station).

1. Install the appropriate disk and switch ON.
2. Select the vehicle specification - ENTER.
3. From Engineering Tools select Toolbox - ENTER.
4. From Toolbox select Powertrain - ENTER.
5. Connect MPA and download cable to PDU and base station.
6. Select Datalogger - ENTER.
7. Select Transmission - ENTER.
8. Disconnect download cable.
9. Connect MPA to PDU.

5. Connect PDU (at the vehicle).

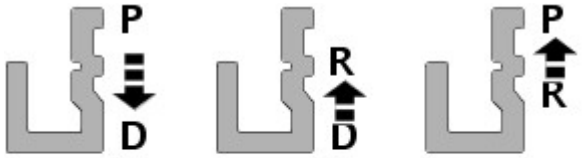
1. Connect MPA cable to the vehicle diagnostic socket - ENTER.
2. Energize the vehicle ignition - ENTER.
3. From the menu select Transmission oil temperature (TOT) - ENTER.
4. Check that the fluid temperature is <30°C.

6. From above.

7. NOTE: Ensure that the TCM is connected and functioning correctly.

Select Park and start the engine.



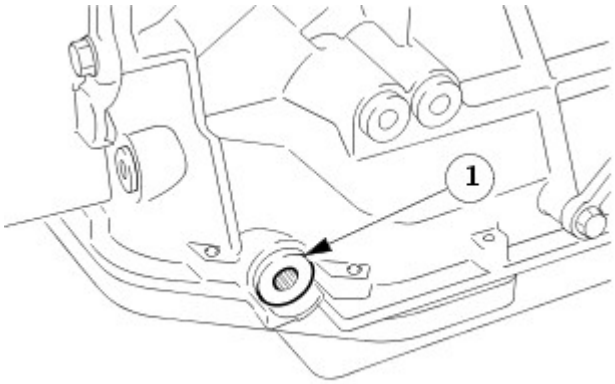


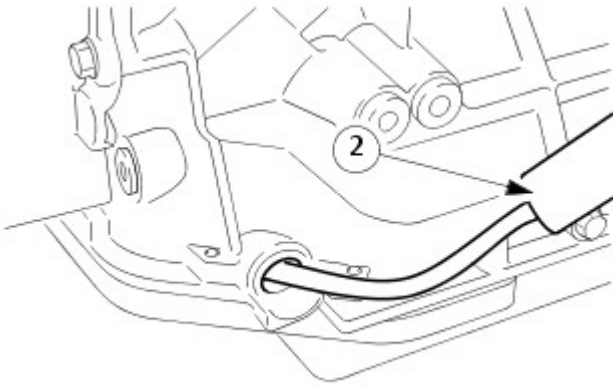
E33017

8. Cycle the gear selector.

- From P to D.
- From D to R.
- From R to P.

9. From below.





E34201

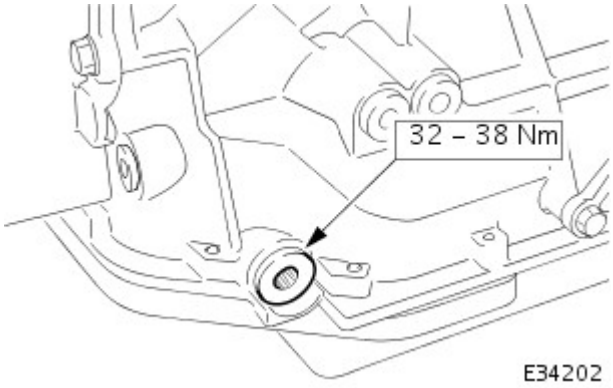
10. Adjust the transmission fluid level.

1. Remove the filler / level plug.
2. Inject fluid until it overflows from the plug orifice.

10. CAUTION: The fluid temperature MUST NOT exceed 50°C.

- Wait for the flow of fluid to reduce to a trickle (for at least 1 minute).

11. Refit the filler / level plug and tighten to the specified torque figure.



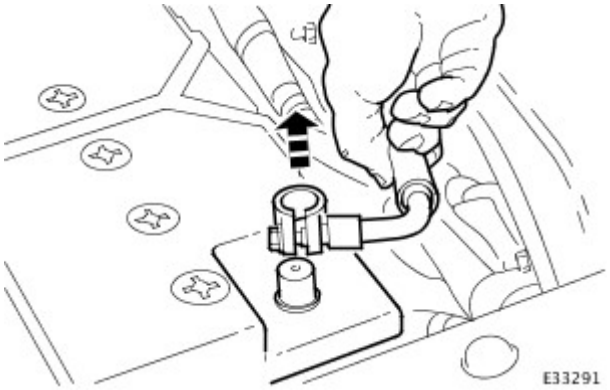
12. Check for leaks and remove spilt fluid.

13. Shut down and disconnect PDU.REMOVAL AND INSTALLATION

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Electronic Pressure Control (EPC) Solenoid

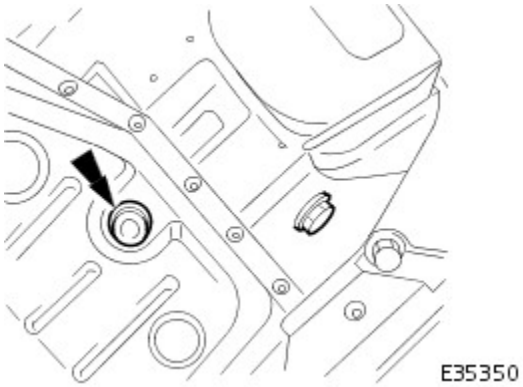
In-vehicle Repair

Removal



1. Disconnect battery ground cable.

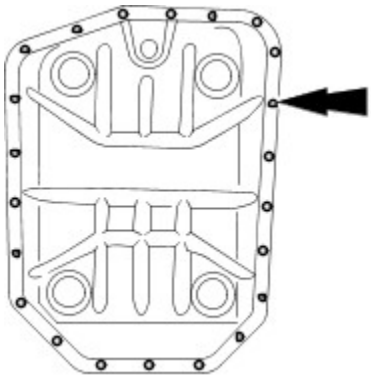
- Remove the battery cover.



2. Raise the vehicle on a suitable lift.

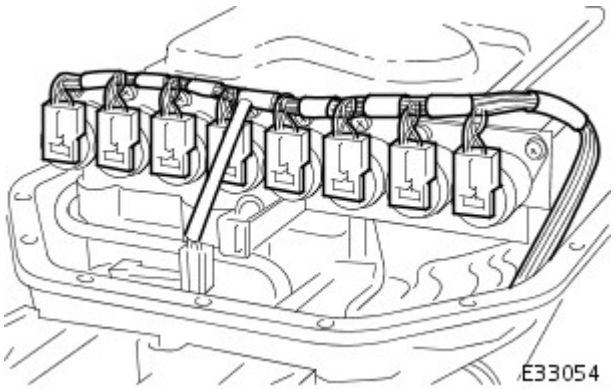
2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



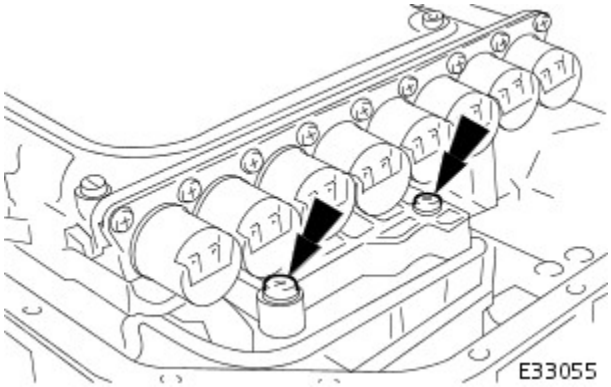
3. Remove the twenty-two fixings which secure the fluid pan .

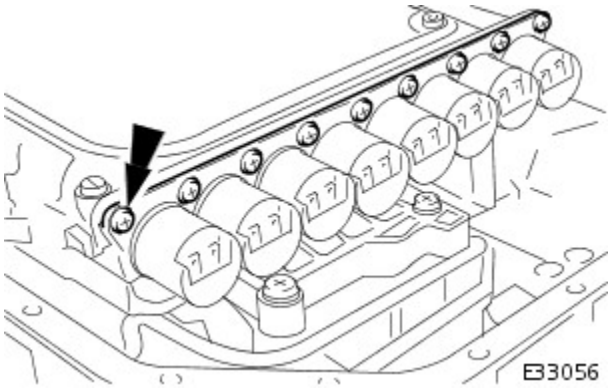
- Remove the fluid pan and all traces of gasket material.



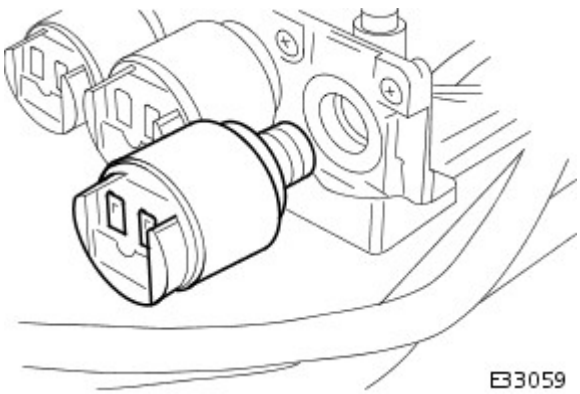
4. Disconnect regulator / solenoid connectors.

5. Remove RH rear valve body securing screws.



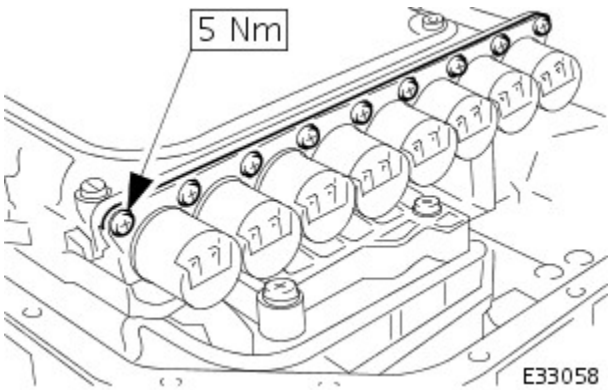


6. Remove the nine screws from the pressure regulator / solenoid retaining plate.



7. Remove the relevant pressure regulator.

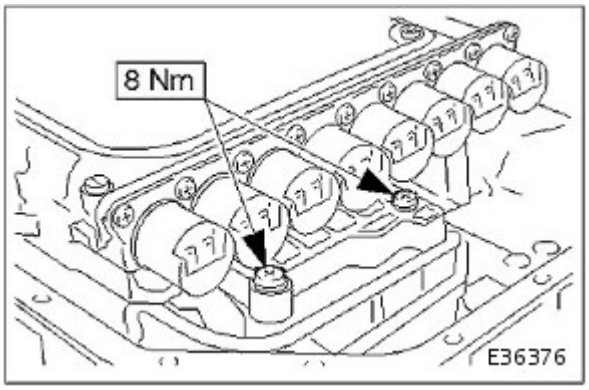
Installation

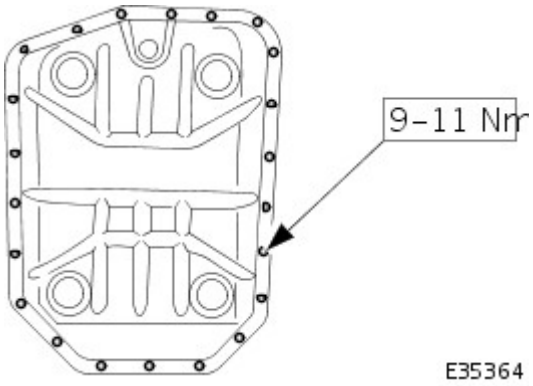


1. Installation is the reverse of the removal procedure, noting that a new pressure regulator 'O' ring MUST be used.

- Fit the nine screws securing the pressure regulator / solenoid retaining plate and tighten to the specified torque figure.

2. Refit the RH rear valve body securing screws and tighten to the specified torque figure.





3. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.

Using a new gasket, install the fluid pan and tighten the fixings to the specified torque figure.

4. Connect the battery and fit the battery cover..

- Reset the radio and the clock.

5. Refer to (44.24.02) for fluid fill procedure.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Extension Housing Seal

In-vehicle Repair

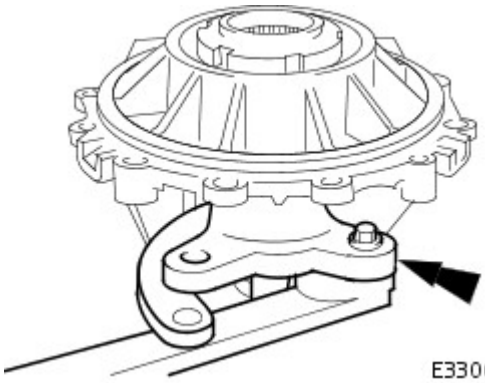
Special Tool(s)	
 E36392	Drive shaft flange wrench 205-053
 E36436	Coupling nut socket 307-356
 E36437	Oil seal replacer 307-358

Removal

1. Remove the rear extension housing, 44.20.19.

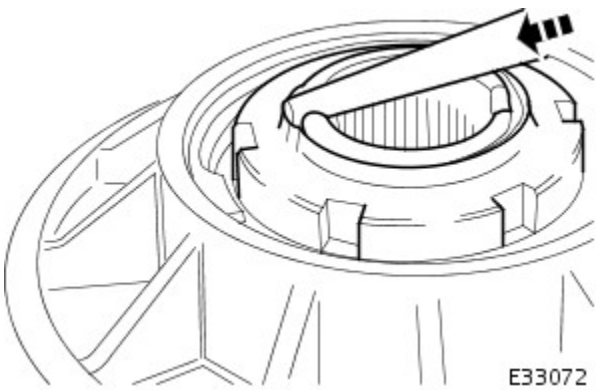
2. Fit tool 205 - 053 to the transmission drive coupling.

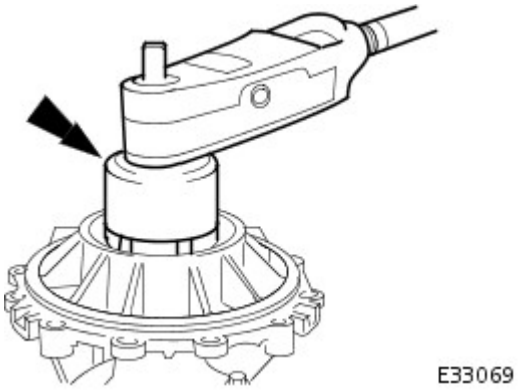
- Install two bolts to attach the coupling to the tool.


E33068

3. Locate the tool 205 - 053 / housing assembly in a vice.

4. Using a punch, knock back the two staked areas of the coupling nut.


E33072

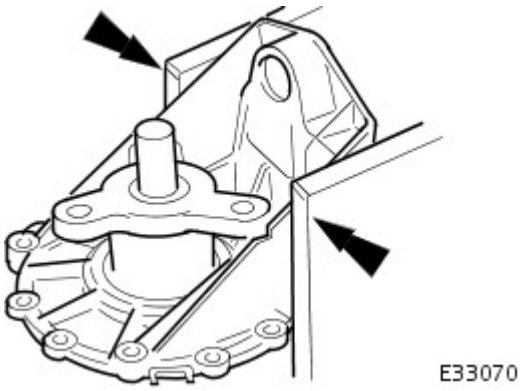

E33069

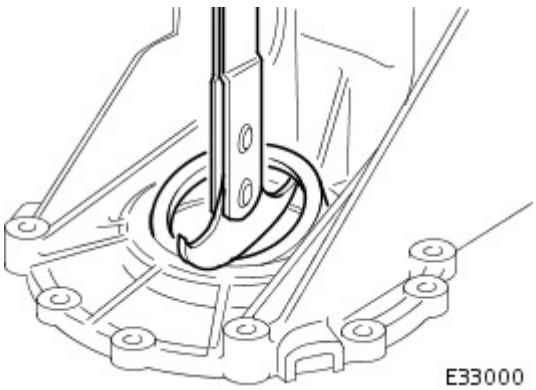
5. Use tool 307 - 356 to remove the coupling nut.

6. Remove tool 205 - 053 from the coupling.

7. Remove the drive coupling from the housing.

- Hold the housing assembly in a vice with soft jaws fitted and pull the coupling free.


E33070

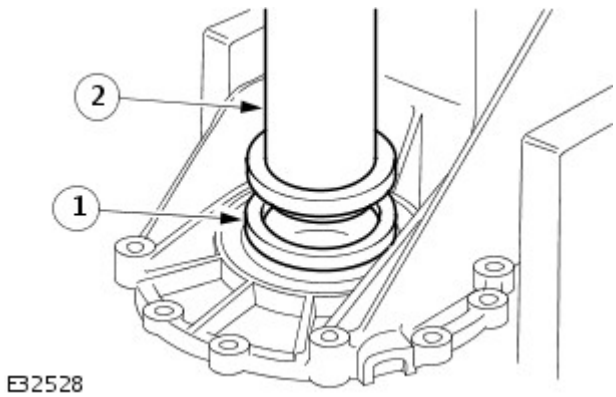

E33000

8. Remove the housing oil seal.

- Use a suitable seal puller.

9. Clean the oil seal mating faces.

Installation

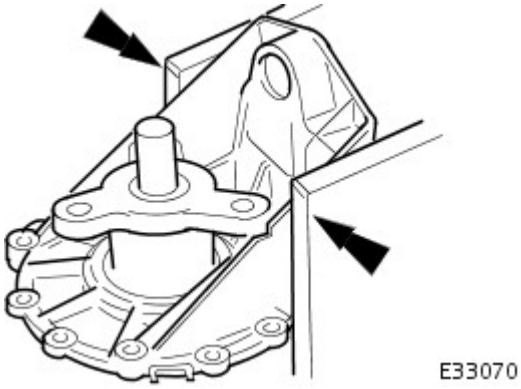


E32528

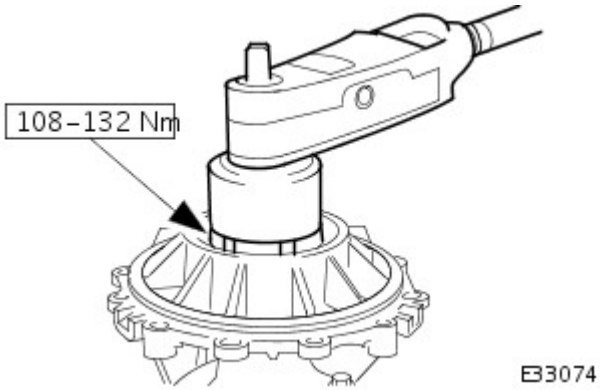
1. Install a new housing oil seal.

1. Lubricate the oil seal prior to fitting.
2. Using tool 307 - 358, fit the oil seal.

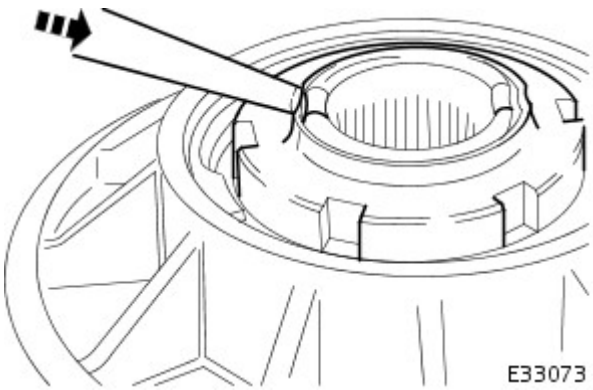
2. Fit the drive coupling to the housing.



- Hold the housing assembly in a vice with soft jaws fitted and carefully insert the coupling.
- Fit tool 205 - 053 to the coupling.



3. Use tool 307 - 356 to tighten the coupling nut to the specified torque figure.



4. Stake the coupling nut at two positions.

5. Refit the rear extension housing. Refer to Operation 44.20.19.

6. Check the transmission fluid level. Refer to Operation 44.24.02.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Extension Housing O-Ring Seal

In-vehicle Repair

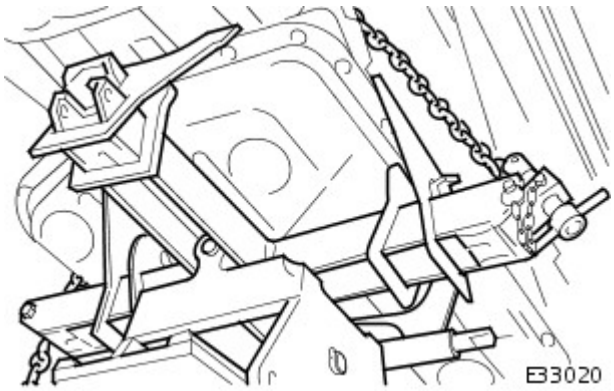
Removal

1. Select N position.

2. Raise the vehicle for access.

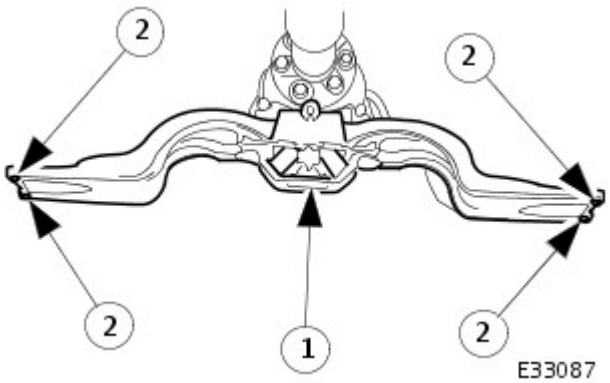
3. Remove the front muffler, 30.10.18.

4. Locate a transmission jack, Epco V-100 or similar, under the transmission unit.



- Adjust the angle of the jack to suit the transmission.
- Secure the side clamps.
- Pass the safety chain over the transmission unit and secure.
- Take the weight of the transmission and engine.

5. Remove the engine rear mounting bracket.

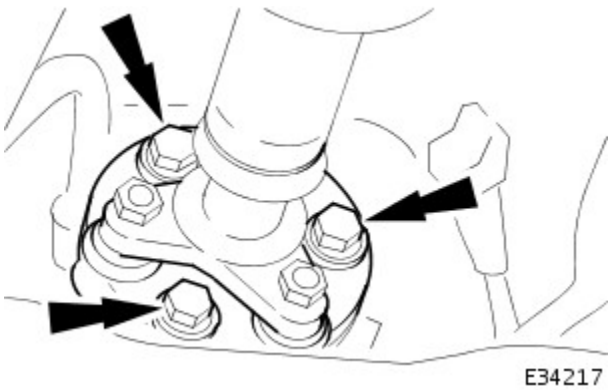


1. Remove the engine rear mounting to bracket bolt.
2. Remove the mounting bracket to body bolts.

6. Gently lower the transmission jack.

7. CAUTION: Under no circumstances remove the driveshaft to flexible coupling fixings.

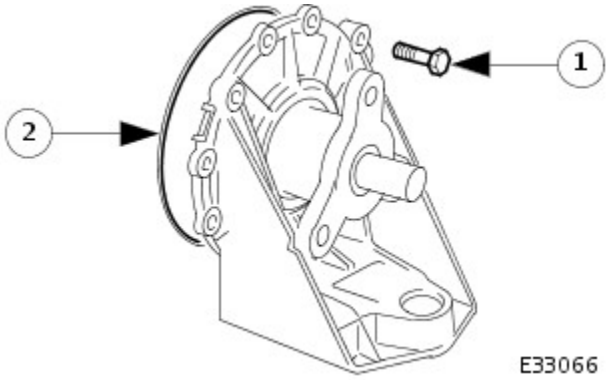
Detach the driveshaft from the transmission unit.



- Mark the position of the coupling to drive flange.
- Remove the three bolts which secure the transmission drive flange to the flexible coupling .

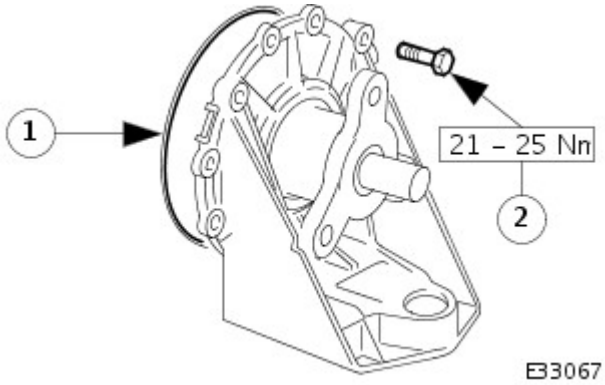
8. Remove the rear extension housing assembly.

1. Remove the ten bolts, noting their location for installation.
2. Remove and discard the O-ring.



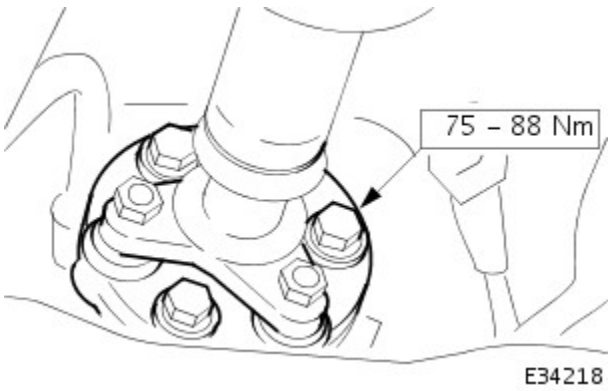
9. Clean the mating faces.

Installation



1. Installation is the reverse of the removal procedure noting that;

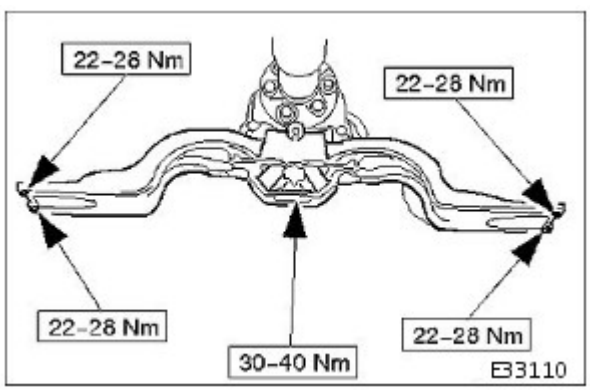
1. Install a new O-ring seal.
2. Tighten the ten bolts to the specified torque figure.



2. Align the driveshaft with the transmission drive flange using the marks made on removal.

- Tighten the three bolts to the specified torque figure.

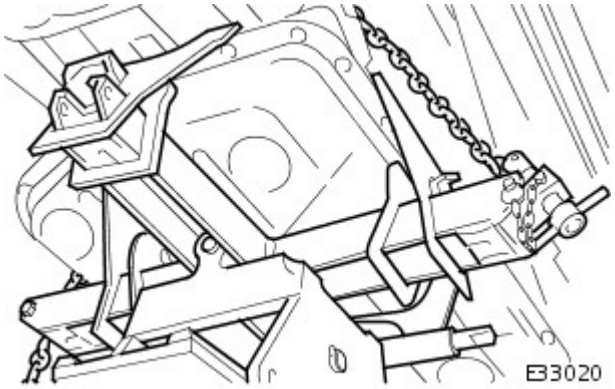
3. Raise the transmission carefully to position, using the transmission jack



4. Fit the engine rear mounting and tighten the centre bolt and outer bolts to the specified torque figures.

- Check that the safety chain on the transmission jack will not be trapped when the mounting is fitted.

5. Remove the transmission jack.

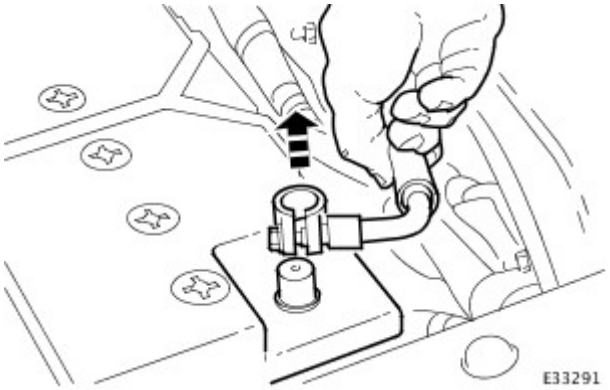


6. Check the transmission fluid level. Refer to Operation 44.24.02.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Main Control Valve Body

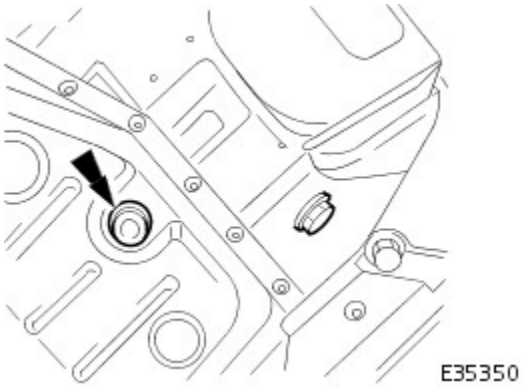
In-vehicle Repair

Removal



1. Disconnect battery ground cable.

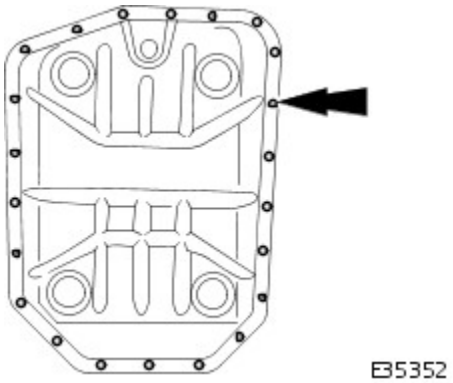
- Remove the battery cover.



2. Raise the vehicle for access.

2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



3. Remove the twenty-two bolts which secure the fluid pan.

- Remove the fluid pan and all traces of gasket material.

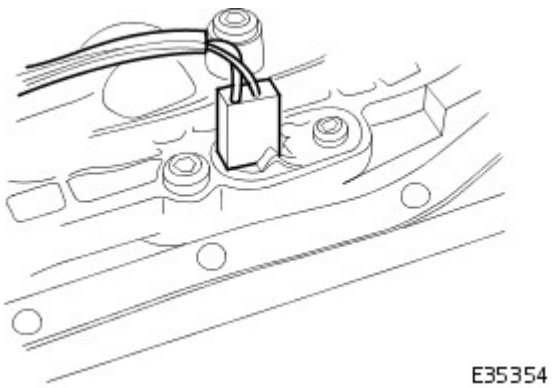
4. Remove the fluid filter, (44.24.07).

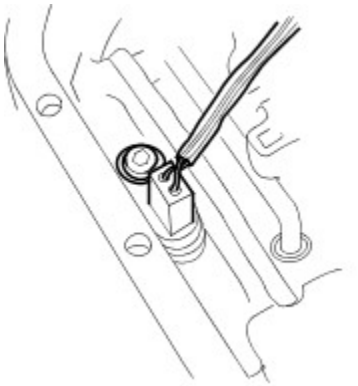
5. Remove the input speed sensor.

• NOTE: M5 fixing.

1. Remove the screw from the input speed sensor securing bracket and pull the sensor clear.

- Disconnect the harness multiplug.



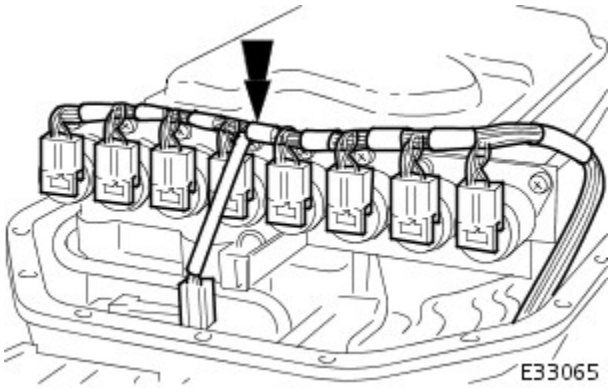

E35357

6. Remove the output speed sensor.

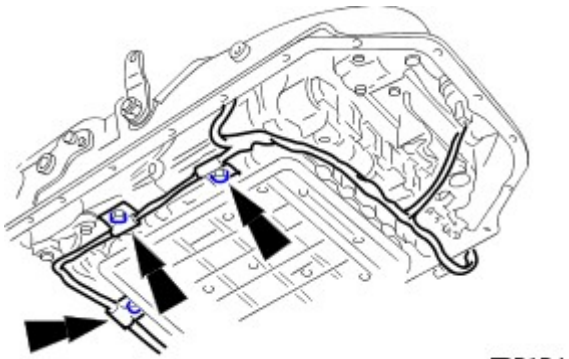
- NOTE: M6 fixing.

1. Remove the screw from the output speed sensor securing bracket and pull the sensor clear.

- Disconnect the harness multiplug.

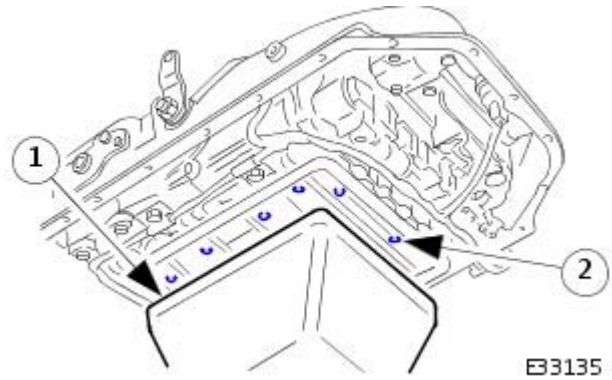

E33065

7. Disconnect the five pressure regulator connectors and three solenoid connectors.


E3134

8. Reposition the internal harness for access.

- Release the internal harness from the retaining clips.



E3135

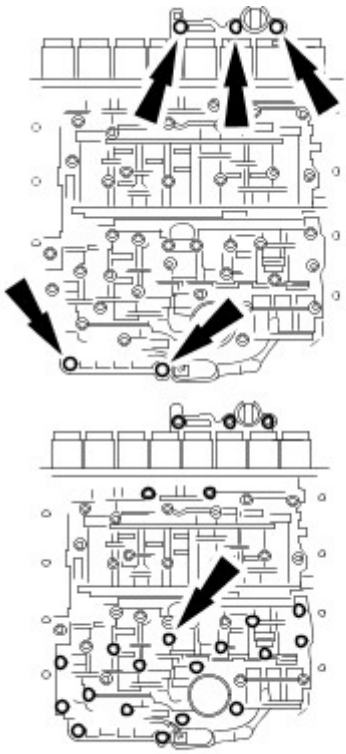
9. Drain the valve body.

1. Position a suitable drain tin below the valve body.
2. Slacken (do not remove) the twenty-two screws, valve body to transmission case.

- Allow the fluid to drain.

10. Remove the valve body.

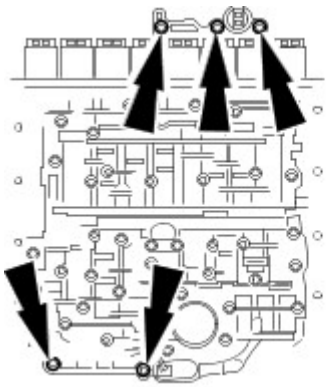
- Remove five M6 X 30 screws, valve body to transmission case.
- Remove seventeen M6 X 60 screws, valve body to transmission case.



E34208

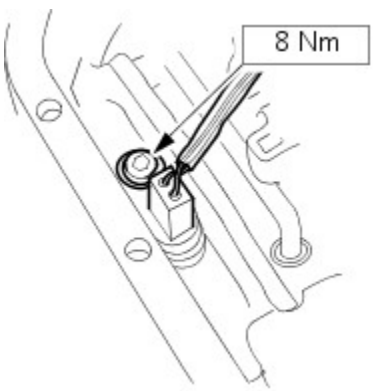
Installation

1. Installation is the reverse of the removal procedure, noting the following steps.
2. Fit the valve body retaining screws.



E34205

- Note the location of the five screws M6 X 30. Fit and tighten to the specified torque figure.
- Note the location of the seventeen screws M6 X 60. Fit and tighten to the specified torque figure.

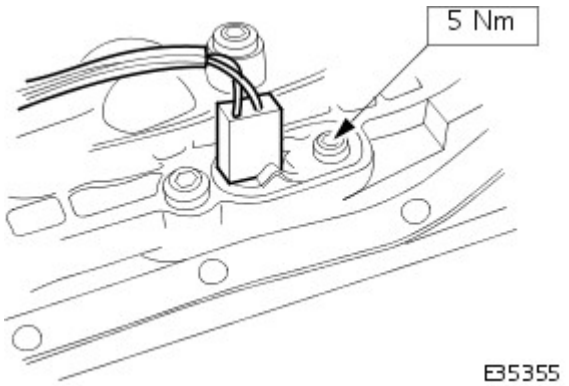


E35358

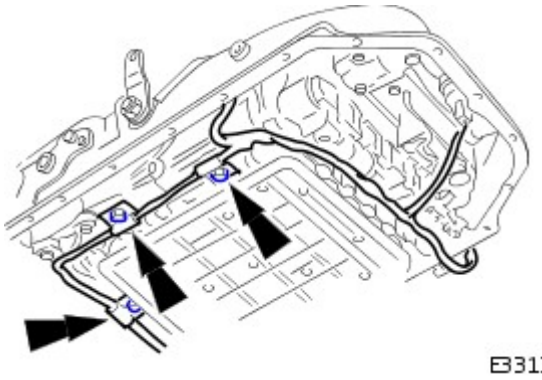
3. NOTE: M6 fixing.

   Fit the output speed sensor and tighten the retaining screw to the specified torque figure..

4. NOTE: M5 fixing.

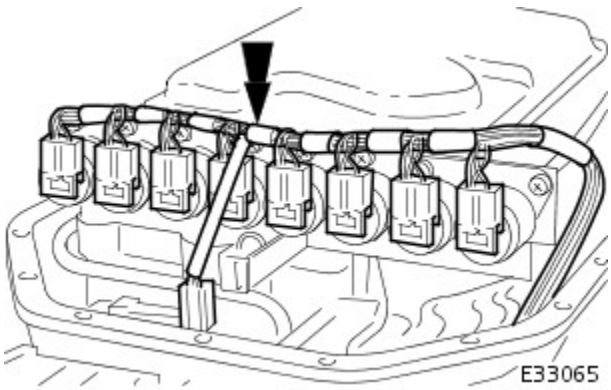


Fit the input speed sensor and tighten the retaining screw to the specified torque figure..

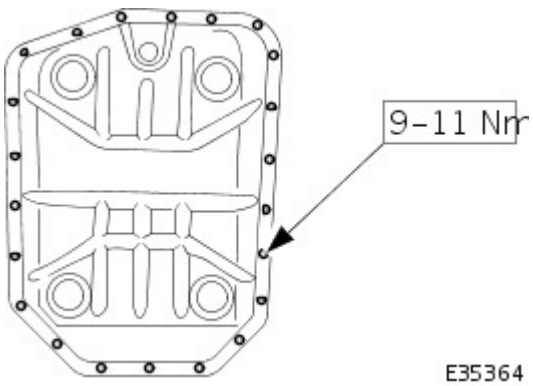


5. Reposition the internal harness for.

- Release the internal harness from the retaining clips.



6. Connect the five pressure regulator connectors and three solenoid connectors.



7. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.

Using a new gasket, install the fluid pan and tighten the twenty-two fixings to the specified. torque figure

8. Connect the battery and fit the battery cover..

- Reset the radio and the clock.

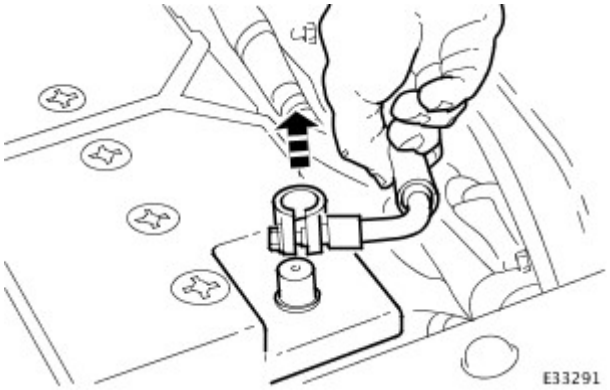
9. Refer to (44.24.02) for fluid fill procedure.

10. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Output Shaft Speed (OSS) Sensor

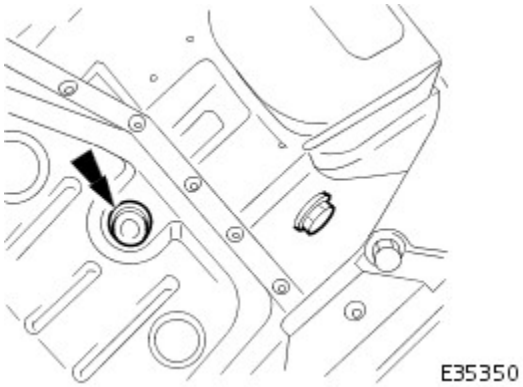
In-vehicle Repair

Removal



1. Disconnect battery ground cable.

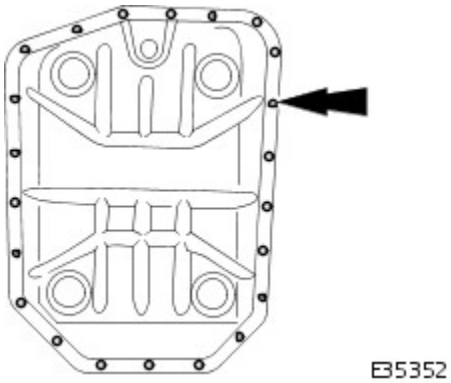
- Remove the battery cover.



2. Raise the vehicle on a lift.

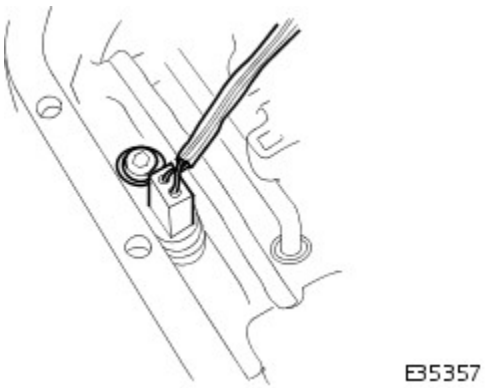
2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



3. Remove the twenty-two bolts which secure the fluid pan.

- Remove the fluid pan and all traces of gasket material.

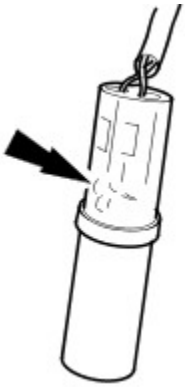


4. Remove the output speed sensor.

• NOTE: M6 fixing.

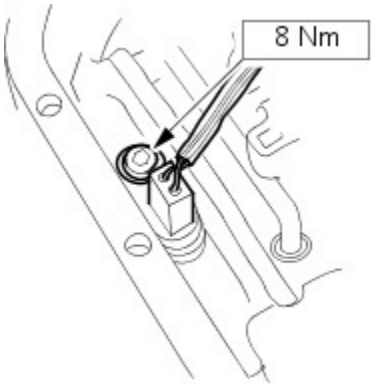
1. Release the screw which secures the output speed sensor bracket and pull the sensor clear.

5. Disconnect the multiplug from the speed sensor.



E35356

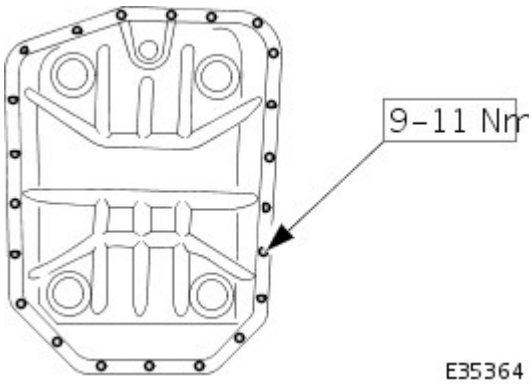
Installation



E35358

1. NOTE: M6 fixing.

Connect the multiplug, install the output speed sensor and securing bracket. Tighten the screw to the specified torque figure.



E35364

2. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.

Using a new gasket, install the fluid pan and tighten the twenty-two fixings to the specified. torque figure.

3. Connect the battery and fit the battery cover..

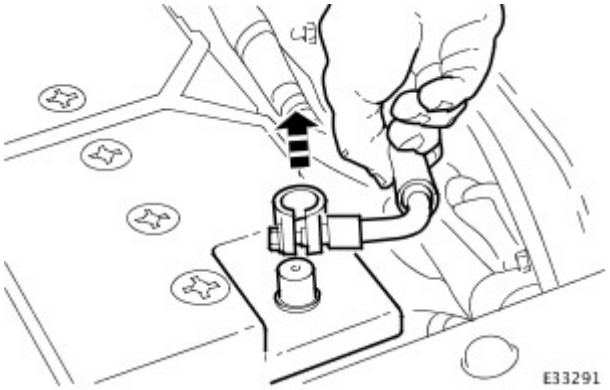
- Reset the radio and the clock.

4. Refer to (44.24.02) for fluid fill procedure.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Shift Solenoids (SS)

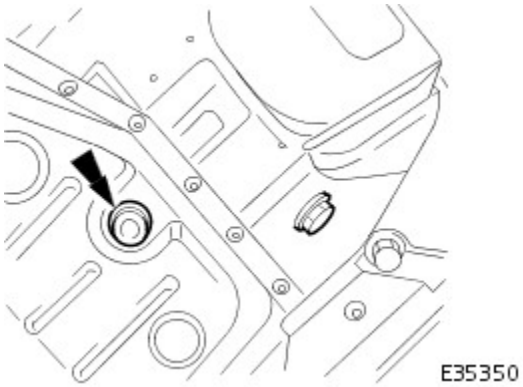
In-vehicle Repair

Removal



1. Disconnect battery ground cable.

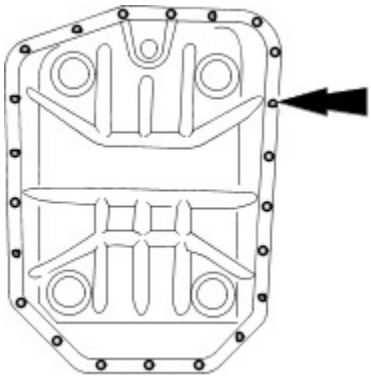
- Remove the battery cover.



2. Raise the vehicle on a lift.

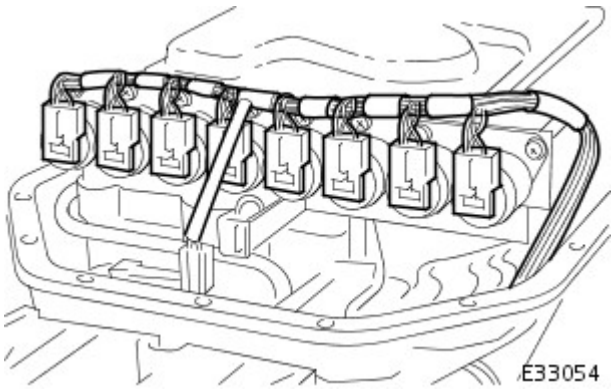
2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



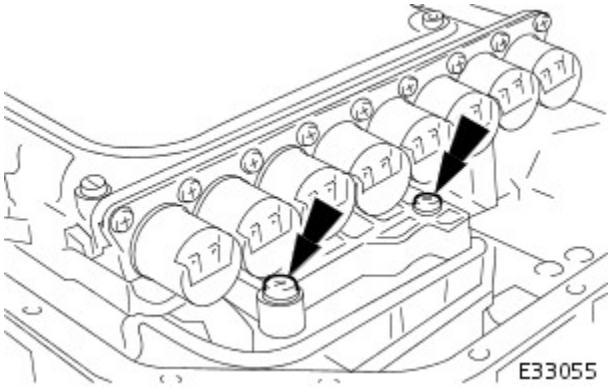
3. Remove the twenty-two bolts which secure the fluid pan.

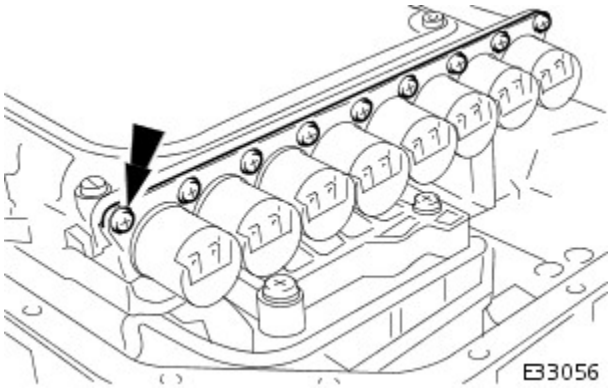
- Remove the fluid pan and all traces of gasket material.



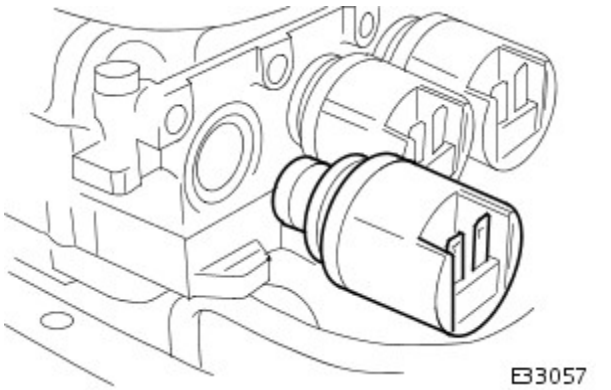
4. Disconnect the eight solenoid / regulator connectors.

5. Remove the RH rear valve body securing screws.



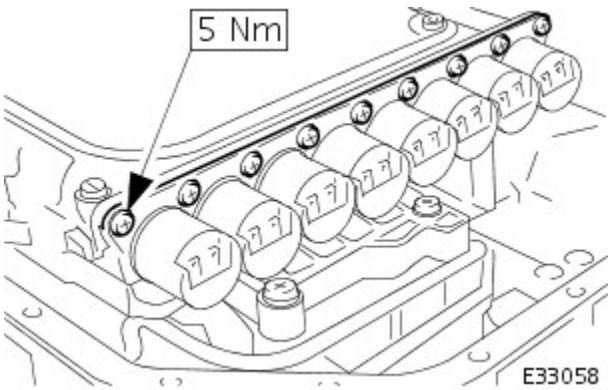


6. Remove the nine screws which secure the solenoid / pressure regulator retaining plate.



7. Remove the relevant solenoid.

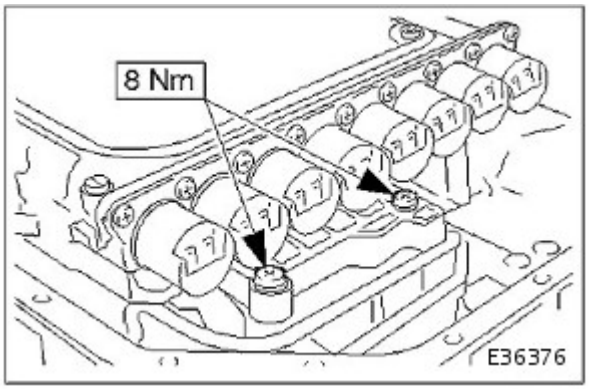
Installation

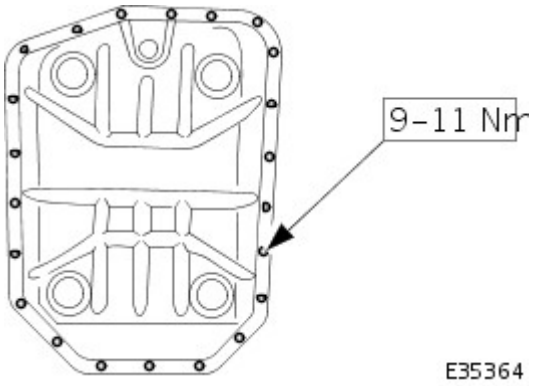


1. Installation is the reverse of the removal procedure, noting the specific tightening of fixings and related procedures.

- Fit the nine screws securing the pressure regulator / solenoid retaining plate and tighten to the specified torque figure.

2. Refit the RH rear valve body securing screws and tighten to the specified torque figure.





3. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.

Using a new gasket, install the fluid pan and tighten the twenty-two fixings to the specified torque figure.

4. Connect the battery and fit the battery cover..

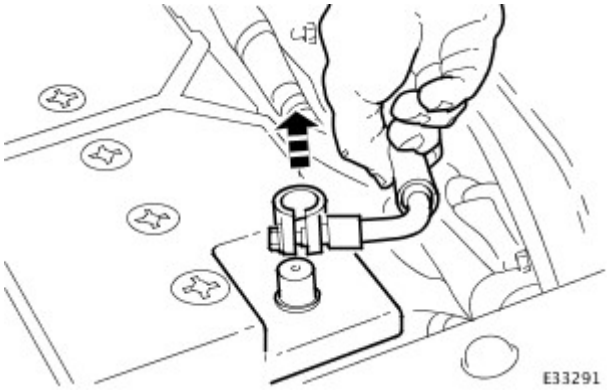
- Reset the radio and the clock.

5. Refer to (44.24.02) for fluid fill procedure.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Control Module (TCM)

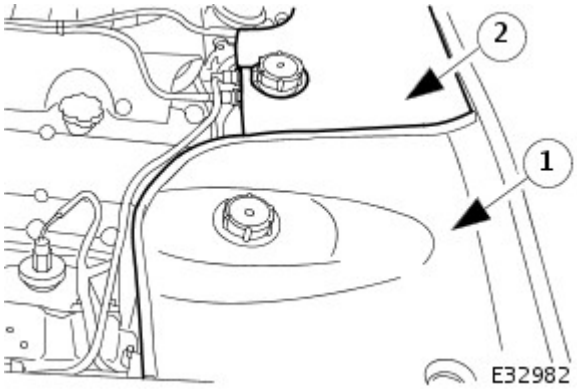
In-vehicle Repair

Removal



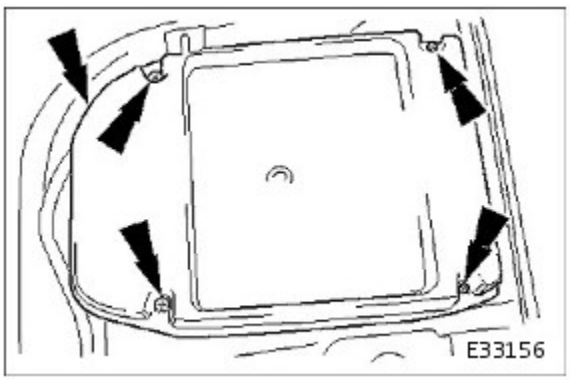
1. Disconnect battery ground cable.

- Remove the battery cover.

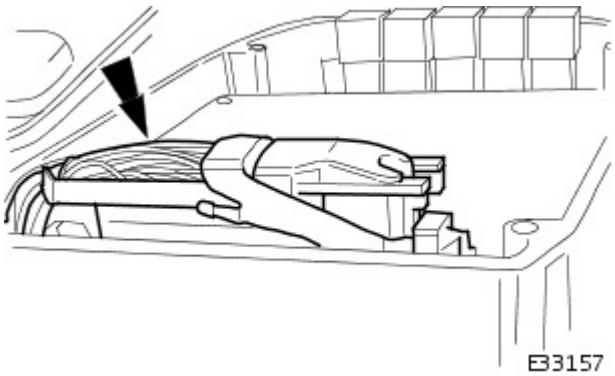


2. Remove the trim panel from the engine compartment, passenger side.

1. Remove the left hand side enclosure panel.
2. If necessary, remove the centre trim panel.



3. Release the fixings and remove the cover from the ECM / TCM housing.



4. Disconnect the TCM harness multiplug EM007.

5. Lift the TCM from its housing.

Installation

1. NOTE: A replacement TCM may only be obtained from an authorized Jaguar dealer and MUST be ordered against the VIN.

Fitting a new TCM is the reverse of the removal procedure.

- At this point ensure that the ECM is correctly located and pushed fully rearward against the housing.

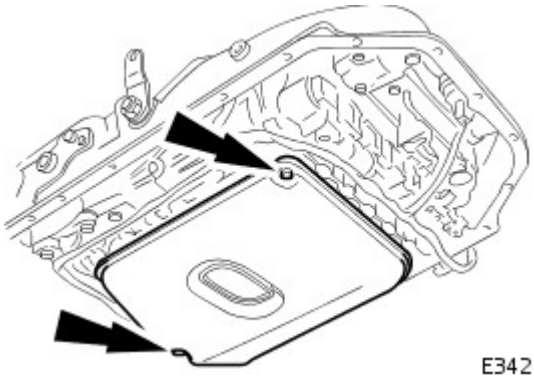
2. Connect the battery and fit the battery cover..

- Reset the radio and the clock.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Fluid Filter

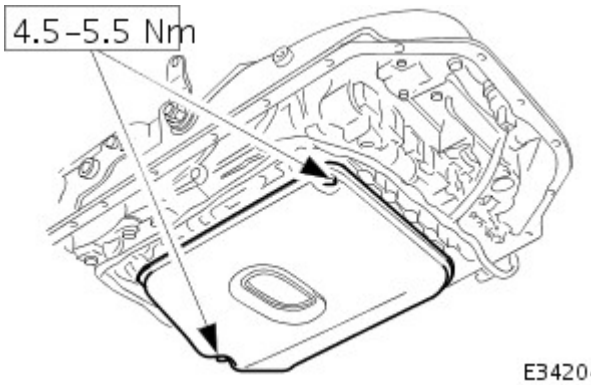
In-vehicle Repair

Removal


E34203

1. Raise the vehicle for access.
2. Remove the fluid pan, 44.24.04.
3. Remove and discard the fluid filter.
   - Remove the two bolts which secure the filter.
   - Discard the 'O' ring.
   - Clean the fluid filter mating face.

Installation



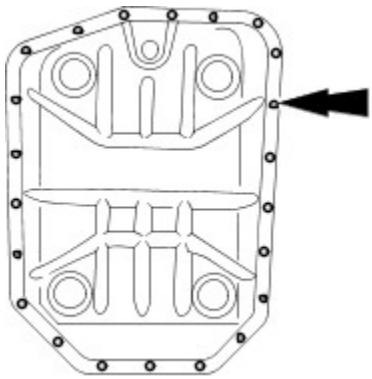
E34204

1. Installation is the reverse of the removal procedure.
2. Renew the 'O' ring.
3. Tighten the two bolts to the specified torque figure, to secure the filter .
4. Refill the transmission with fluid. Refer to Operation 44.24.02.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Fluid Pan

In-vehicle Repair

Removal

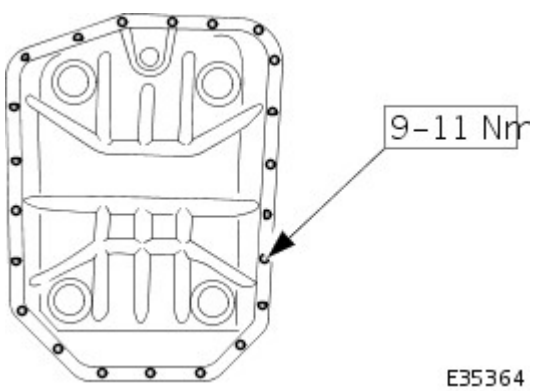


1. Raise the vehicle for access and drain the transmission fluid.
2. Remove the fluid pan.
   - Remove the twenty-two bolts.



3. Discard the fluid pan gasket and clean the mating faces.
4. Remove the magnets from the fluid pan.
   - Clean the magnets and refit them to the fluid pan.

Installation

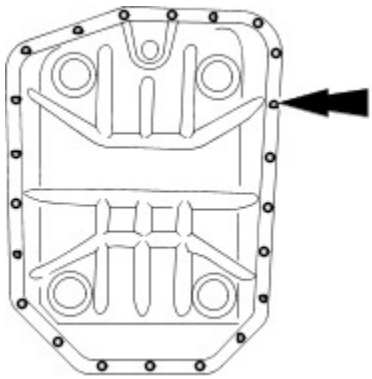


1. Installation is the reverse of the removal procedure:
2. Tighten the fluid pan bolts to the specified torque figure.
3. Refill the transmission fluid. Refer to Operation 44.24.02.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Fluid Pan Gasket

In-vehicle Repair

Removal

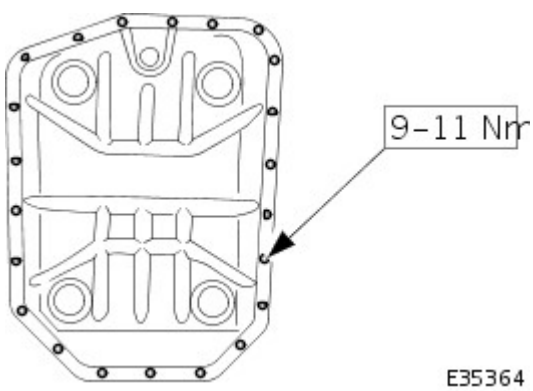


1. Raise the vehicle for access and drain the transmission fluid.
2. Remove the fluid pan.
   - Remove the twenty-two bolts.



3. Discard the fluid pan gasket and clean the mating faces.
4. Remove the magnets from the fluid pan.
   - Clean the magnets and refit them to the fluid pan.

Installation



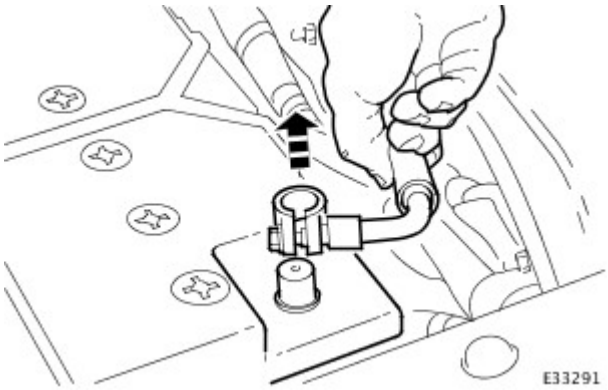
1. Installation is the reverse of the removal procedure:
2. Tighten the fluid pan bolts to the specified torque figure.
3. Refill the transmission fluid. Refer to Operation 44.24.02.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Internal Wiring Harness

In-vehicle Repair

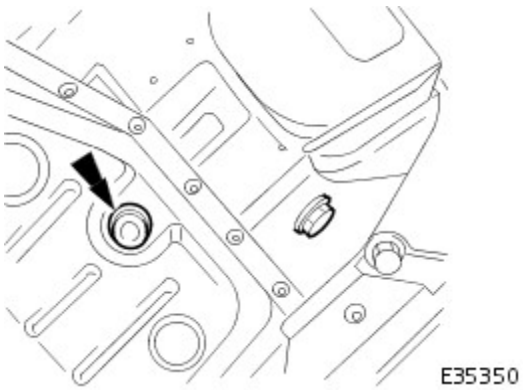
Removal

• NOTE: The temperature sensor is integral with the internal harness.



1. Disconnect battery ground cable.

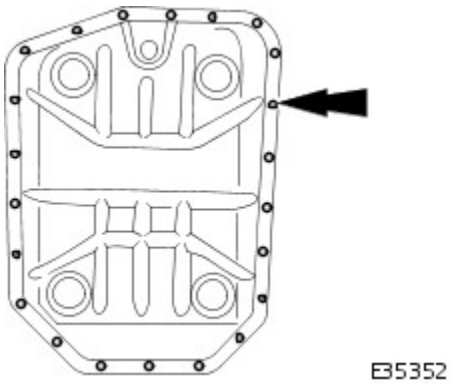
- Remove the battery cover.



2. Raise the vehicle on a lift.

2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



3. Remove the twenty-two bolts which secure the fluid pan.

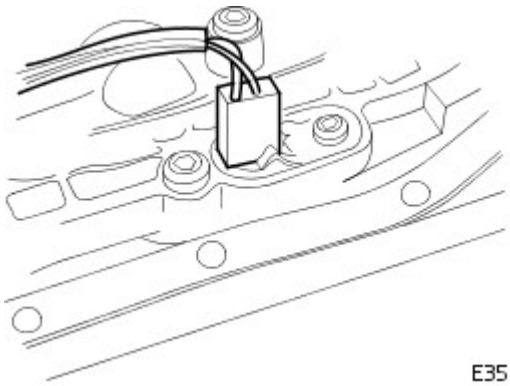
- Remove the fluid pan and all traces of gasket material.

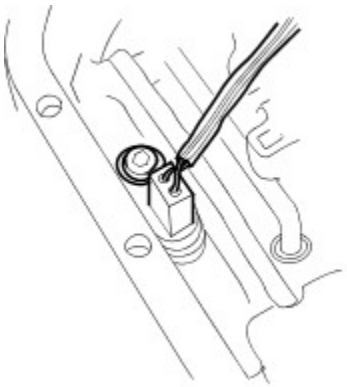
4. Remove the input speed sensor.

• NOTE: M5 fixing.

1. Release the screw which secures the input speed sensor bracket and pull the sensor clear.

- Disconnect harness multiplug.



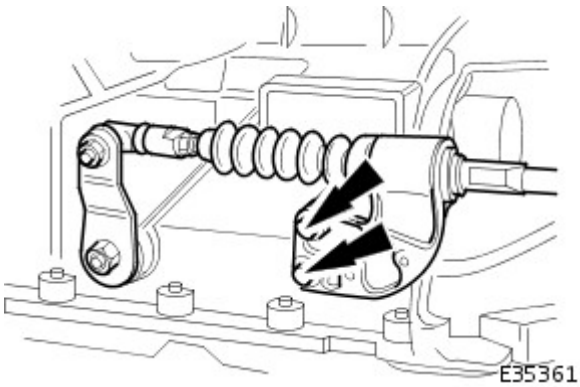


5. Remove the output speed sensor.

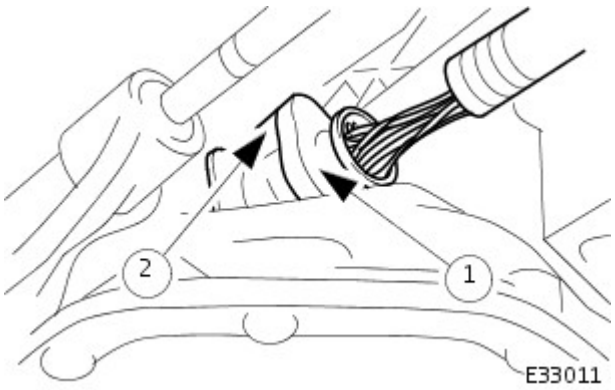
- NOTE: M6 fixing.

1. Release the screw which secures the output speed sensor bracket and pull the sensor clear.

- Disconnect harness multiplug.



6. Remove the selector cable abutment bracket fixings and reposition the bracket for access to the multiplug.

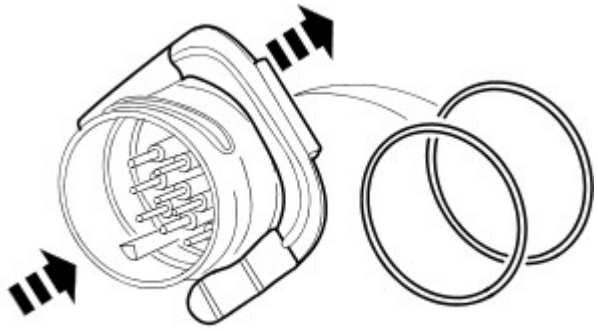


7. Disconnect the transmission harness multiplug.

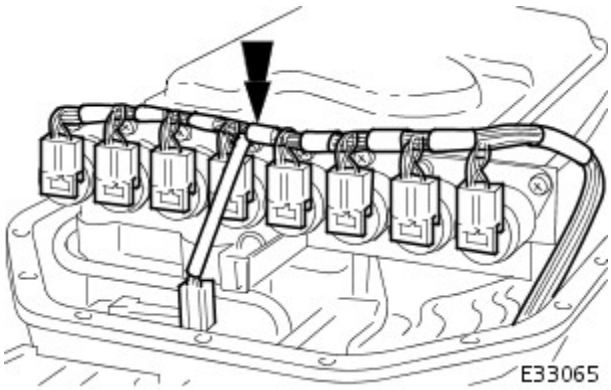
1. Release the harness locking lever.
2. Disconnect the harness multiplug.

8. Remove harness multiplug retaining clip.

- Push the multiplug into the transmission casing to release.
- Discard the two 'O' rings.

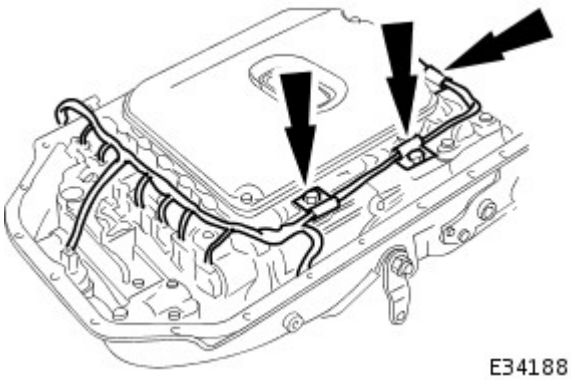


E35362



E33065

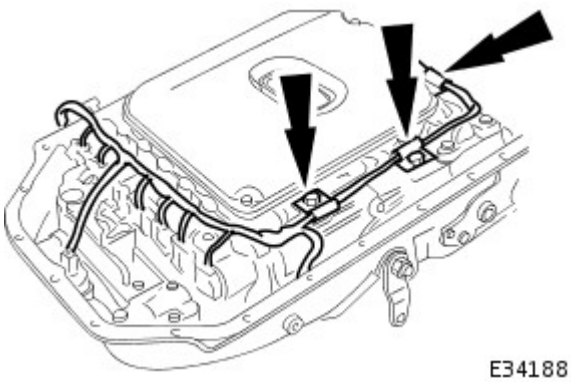
9. Disconnect the eight solenoid / regulator connectors.



E34188

10. Release the internal harness from the retaining clips and remove the harness.

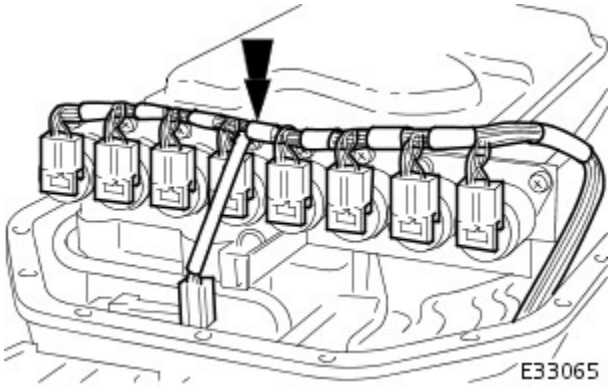
Installation



E34188

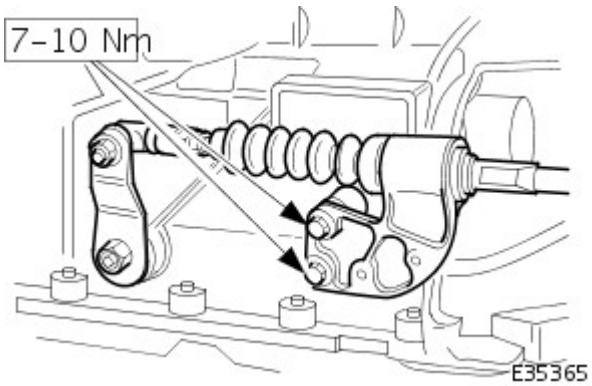
1. Position the internal harness and fit it to the retaining clips.

2. Connect the eight solenoid / regulator harness connectors.

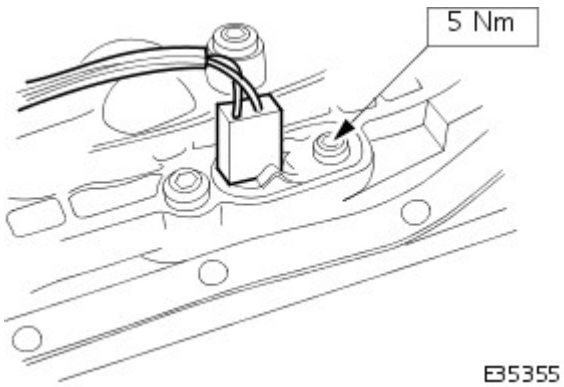


3. Lubricate the harness connector 'O' rings with transmission fluid prior to fitting.

- Fit the new 'O' rings, the harness connector and the retaining clip

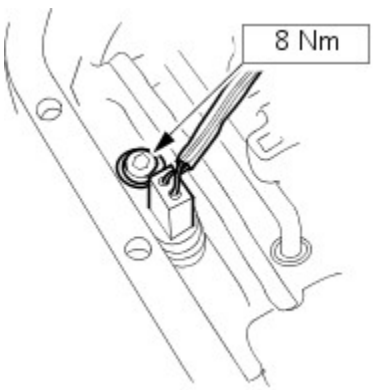


4. Tighten selector cable abutment fixings.



5. NOTE: M5 fixing.

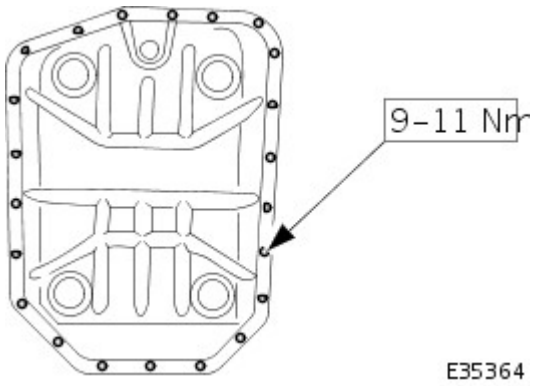
Refit the input speed sensor and tighten the retaining screw to the specified torque figure.



6. NOTE: M6 fixing.

Refit the output speed sensor and tighten the retaining screw to the specified torque figure.

7. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.



Using a new gasket, install the fluid pan and tighten the twenty-two bolts to the specified torque figure.

8. Connect the battery and fit the battery cover..

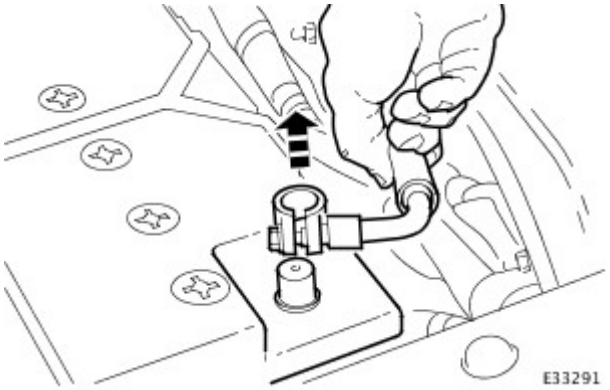
- Reset the radio and the clock.

9. Refer to (44.24.02) for fluid fill procedure.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Internal Wiring Harness Electrical Connector O-Ring Seals

In-vehicle Repair

Removal



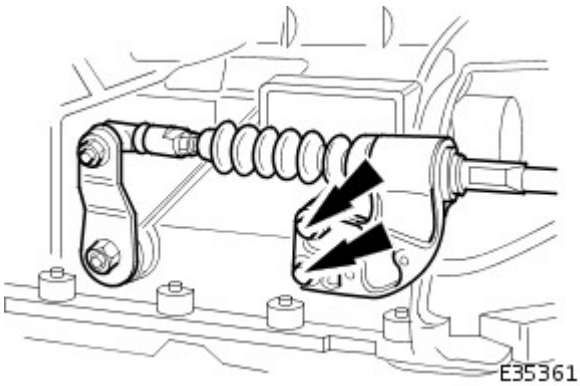
1. Disconnect battery ground cable.

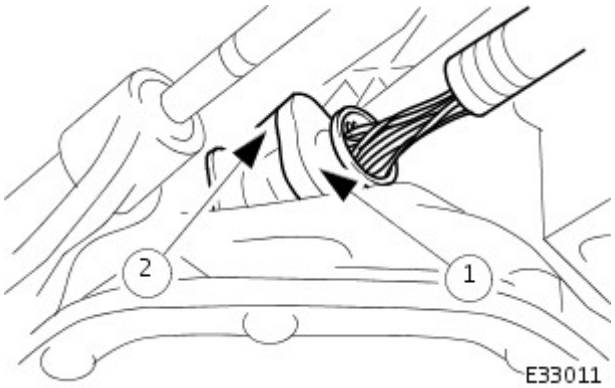
- Remove the battery cover.

2. Raise the vehicle for access.

3. Remove the fluid pan; refer to 44.24.04.

4. Remove selector cable abutment bracket fixings (2) and reposition the bracket for access to the multiplug.



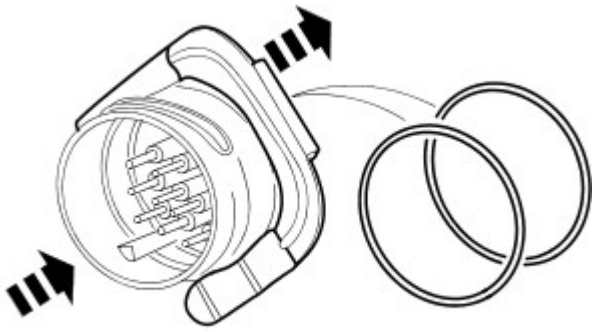


5. Disconnect the transmission harness multiplug.

1. Release the harness locking lever.
2. Disconnect the harness multiplug.

6. Remove harness multiplug retaining clip.

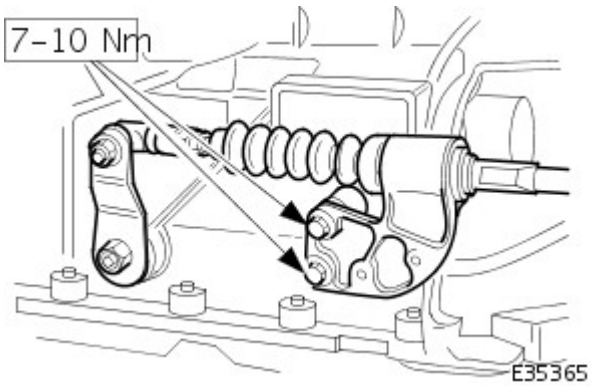
- Push the multiplug into the transmission casing to release.
- Discard the two 'O' rings.



E35362

Installation

1. Installation is the reverse of the removal procedure noting that:
2. Lubricate the new 'O' rings prior to fitting.
3. Tighten the securing bolts, selector cable bracket to transmission casing, to the specified torque figure.



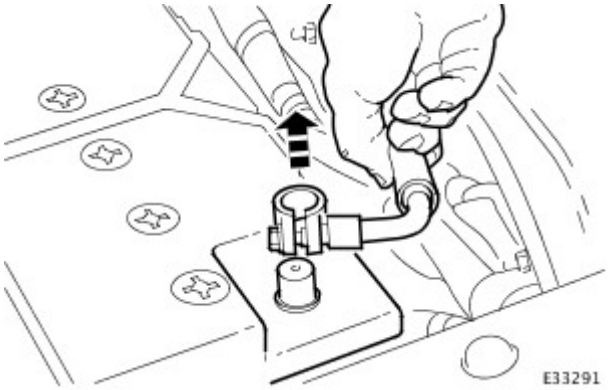
E35365

4. Connect the battery and fit the battery cover..
   - Reset the radio and the clock.
5. Refer to (44.24.02) for fluid fill procedure.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Range (TR) Sensor

In-vehicle Repair

Removal

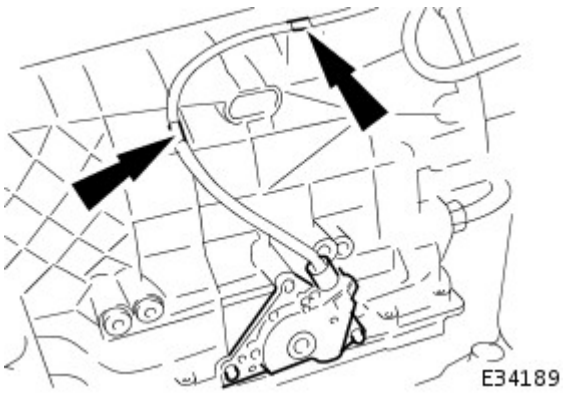


1. Disconnect battery ground cable.

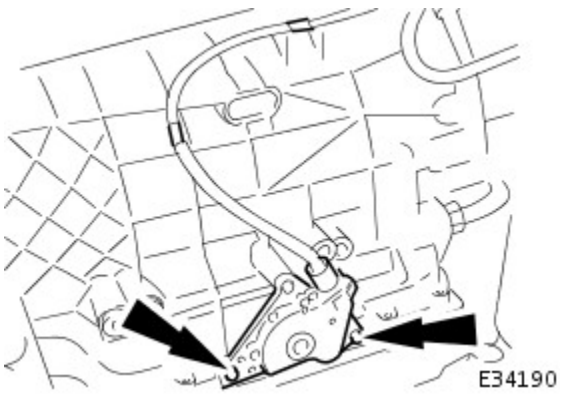
- Remove the battery cover.



2. From above, disconnect the rotary switch harness multiplug.

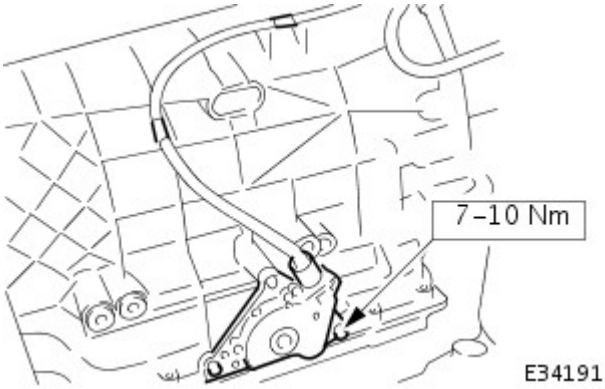


3. From below, release the harness from the retaining clips.



4. Remove the rotary switch retaining fixings.

Installation



1. Fitting a new rotary switch is the reverse of the removal procedure noting that the fixings must be tightened to the specified torque figure.

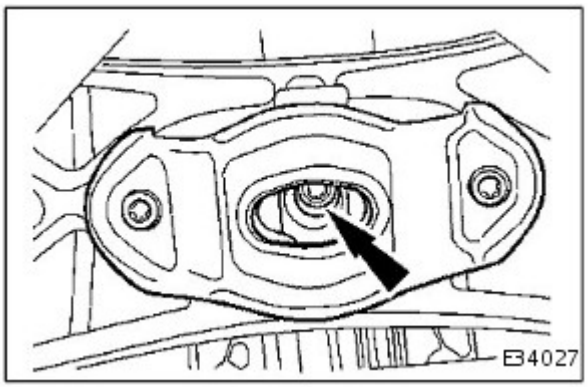
2. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

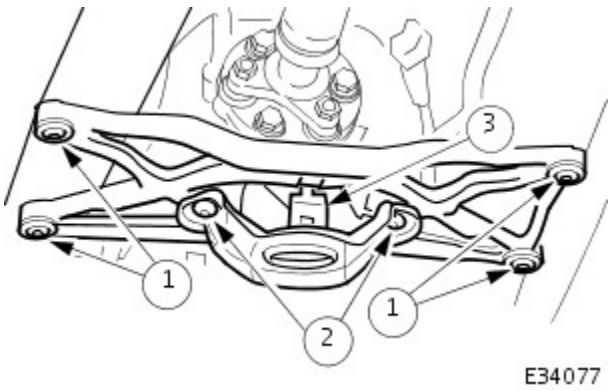
Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Support Insulator

In-vehicle Repair

Removal

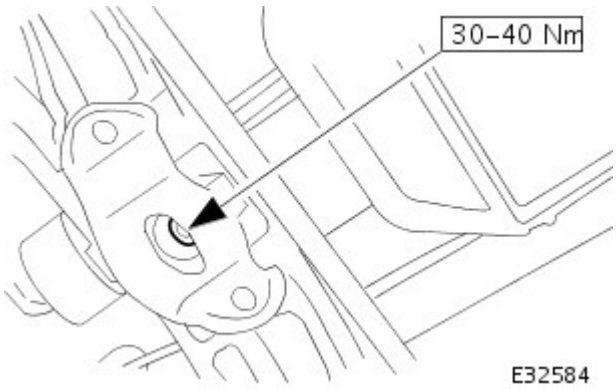


1. Raise the vehicle on a ramp to a suitable height for working on the rear mounting.
2. Remove the bolt which secures the engine rear mounting rubber to the transmission.
3. Position a transmission jack under the transmission casing. Take the weight of the transmission on the jack.
4. Remove the rear mounting rubber.

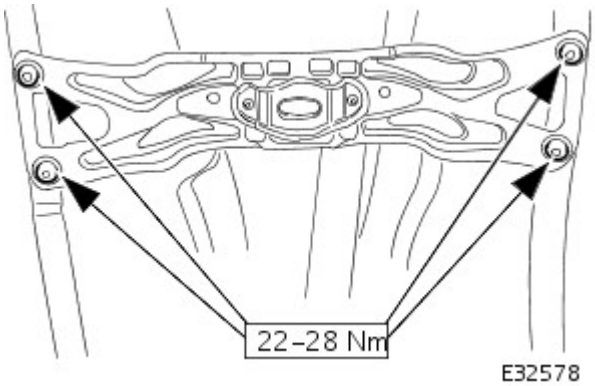


1. Slacken the four bolts which secure the rear crossmember to the vehicle floor.
2. Remove the two bolts which secure the mounting rubber to the crossmember.
3. Remove the mounting rubber.

Installation



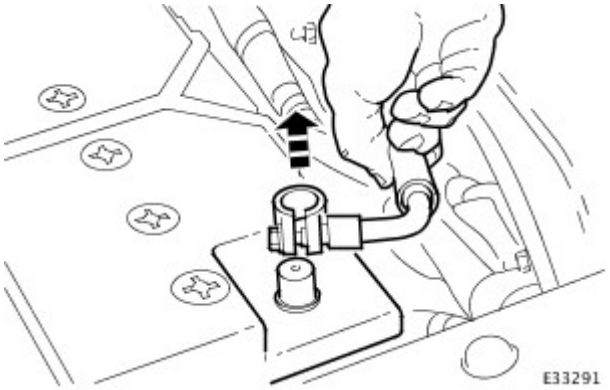
1. Fit the mounting rubber assembly to position and tighten the centre bolt to 30-40 Nm .
2. Tighten the crossmember to body bolts and the mounting rubber to crossmember bolts to 22-28 Nm.


22–28 Nm
E32578

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Turbine Shaft Speed (TSS) Sensor

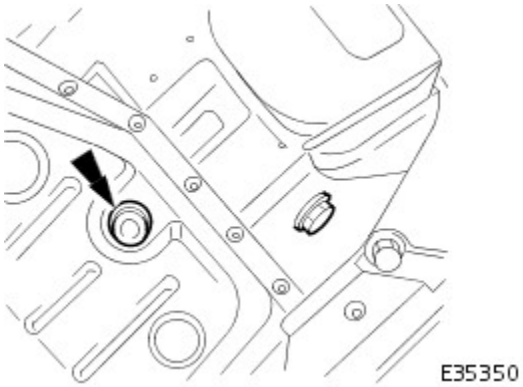
In-vehicle Repair

Removal



1. Disconnect battery ground cable.

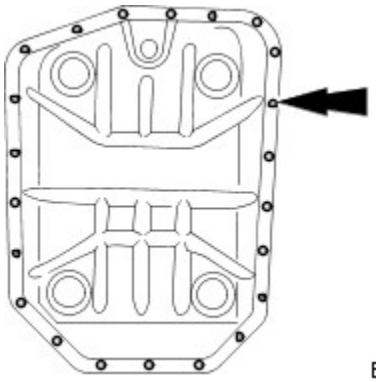
- Remove the battery cover.



2. Raise the vehicle on a lift.

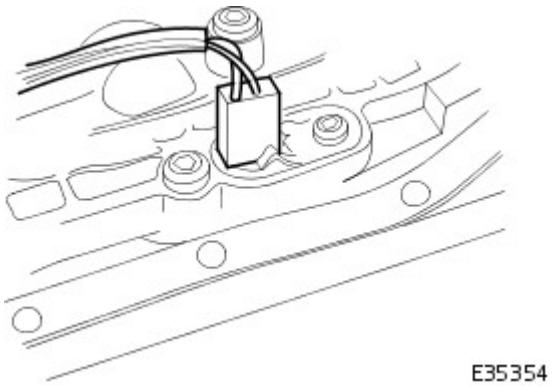
2. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED.

- Carefully remove the drain plug and drain the transmission fluid.



3. Remove the twenty-two bolts which secure the fluid pan.

- Remove the fluid pan and all traces of gasket material.

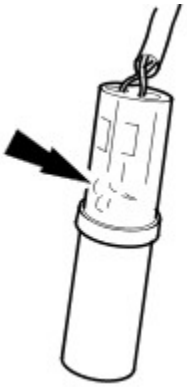


4. Remove the input speed sensor.

• NOTE: M5 fixing.

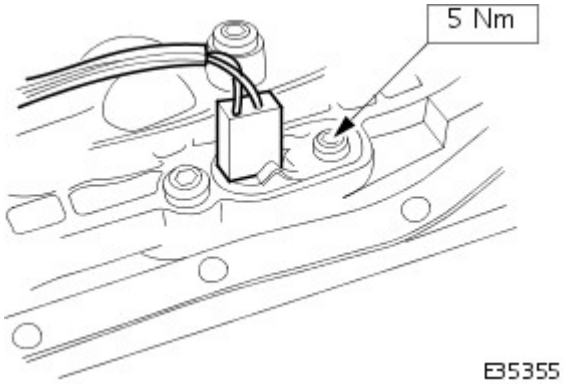
1. Release the screw which secures the input speed sensor bracket and pull the sensor clear.

5. Disconnect the multiplug from the speed sensor.



E35356

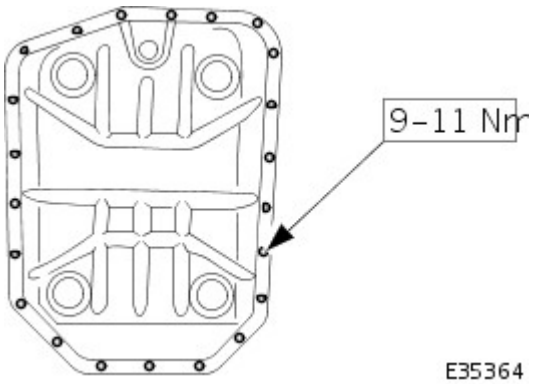
Installation



E35355

1. NOTE: M5 fixing.

Connect the multiplug, install the input speed sensor and securing bracket. Tighten the screw to the specified torque figure.



E35364

2. NOTE: Ensure extreme cleanliness and never reuse transmission fluid.

Using a new gasket, install the fluid pan and tighten the twenty-two fixings to the specified. torque figure.

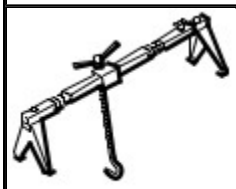
3. Connect the battery and fit the battery cover..

- Reset the radio and the clock.

4. Refer to (44.24.02) for fluid fill procedure.

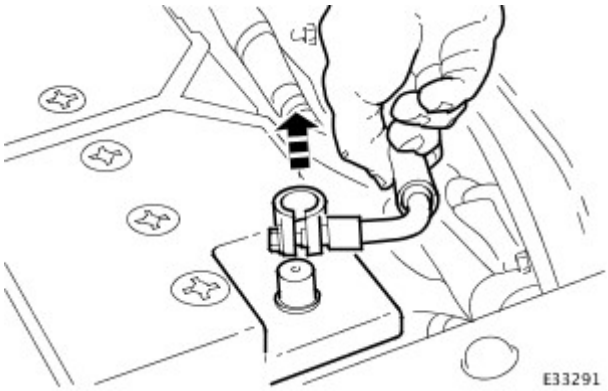
Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission

Removal

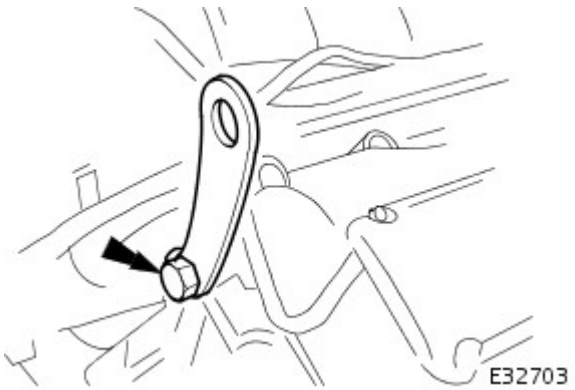
Special Tool(s)	
 E36400	Engine support 303-021
 E36403	Engine lifting brackets 303-536

Removal

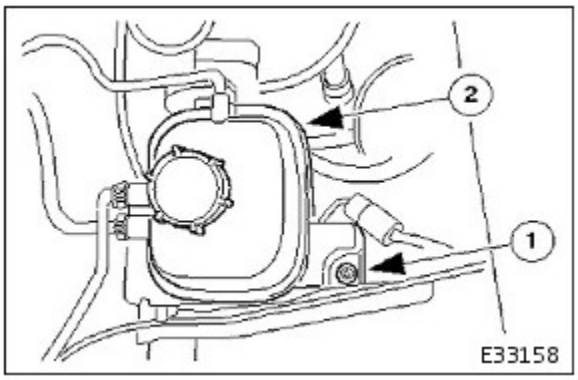
1. Select N gear position.
2. Open the engine compartment and fit paintwork protection sheets.
3. Disconnect battery ground cable.
   - Remove the battery cover.


E33291

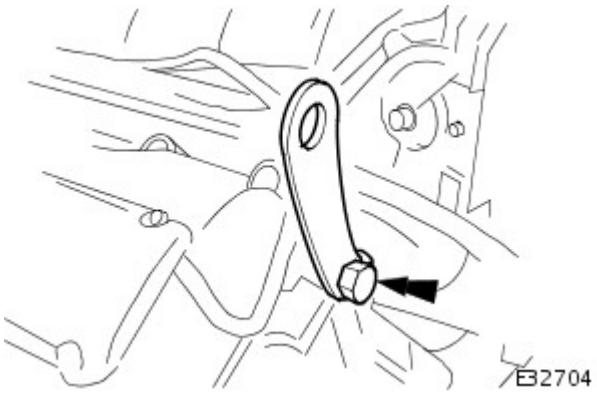
4. Remove the engine covers (12.30.06).
5. Remove the air intake tube, MAFM and air cleaner cover assy, (19.10.30).
6. Install engine lifting bracket 303 - 536 at the rear RH.


E32703

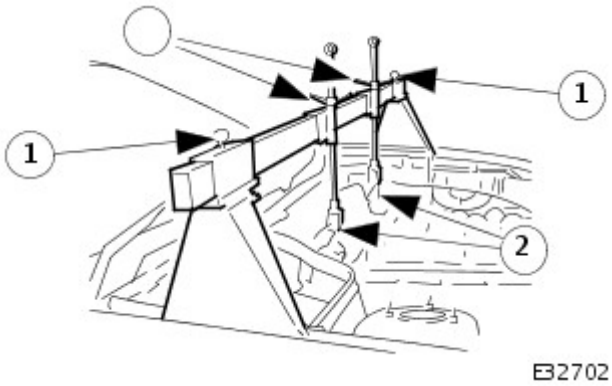
7. Reposition the coolant header tank for access.
   1. Remove the securing bolt.



2. Reposition the tank.



8. Install engine lifting bracket 303 - 536 at the rear LH.



9. Support the engine using 303 - 021.

1. Adjust and locate the stands in the LH and RH fender channels and tighten the beam fixings.
2. Engage the support hooks in the lifting brackets.
3. Tighten the support hook adjusters and take the weight of the engine.

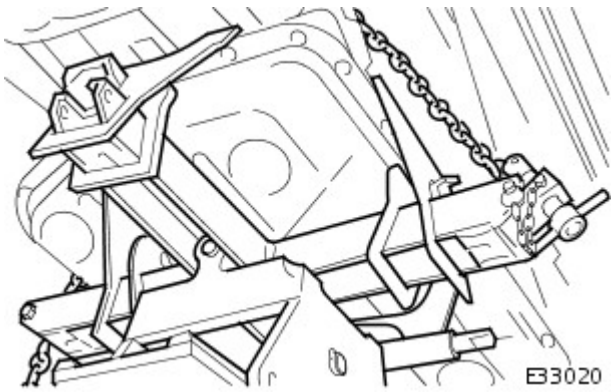
10. Raise the vehicle for access.

11. Remove the LH downpipe catalytic converter (17.50.09).

12. Remove the front muffler (30.10.18).

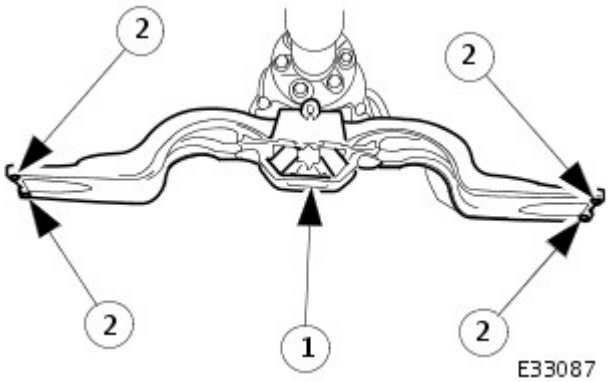
13. Remove the RH downpipe catalytic converter (17.50.09 and 17.50.10).

14. Drain the transmission fluid, (44.24.02).



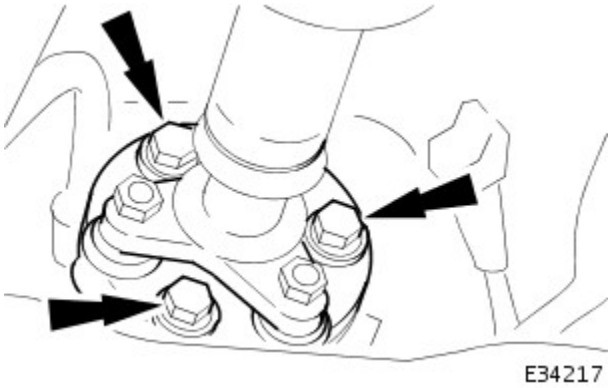
15. Locate a transmission jack, Epco V-100 or similar, under the transmission unit.

- Adjust the angle of the jack to suit the transmission.
- Secure the side clamps.
- Pass the safety chain over the transmission unit and secure.



16. Remove the engine rear mounting bracket.

1. Remove the engine rear mounting to bracket bolt.
2. Remove the mounting bracket to body bolts.

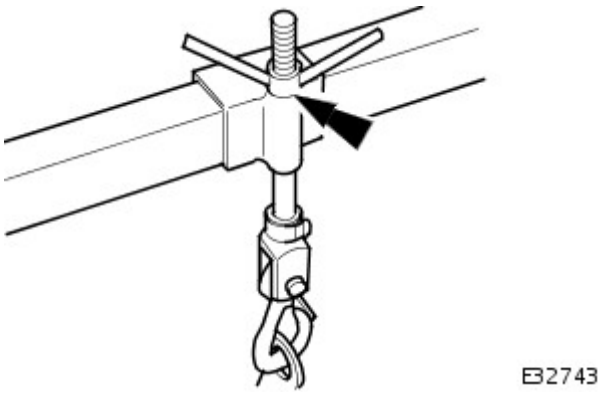


17. Detach the driveshaft from the transmission drive flange.

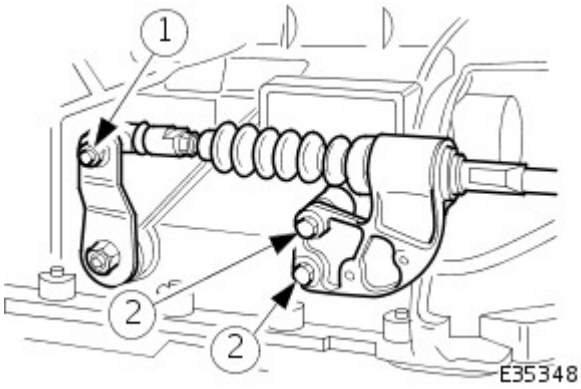
- If the transmission is to be refitted, mark the position of the coupling to drive flange.

17. CAUTION: Under no circumstances remove the driveshaft to flexible coupling fixings.

- Remove the transmission drive flange to flexible coupling three fixings.



18. Lower the transmission unit by carefully releasing the engine support beam and by lowering the transmission jack.

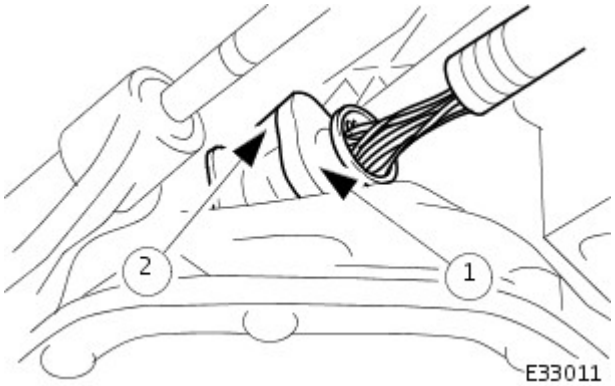


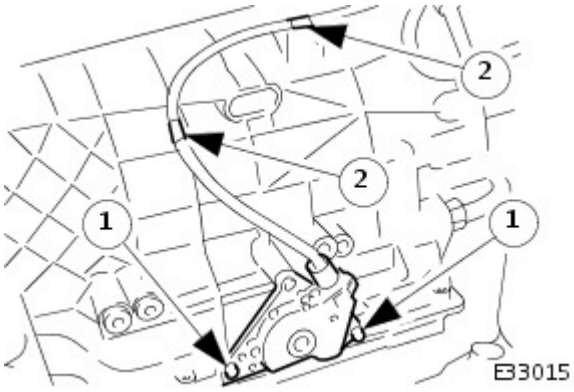
19. Detach the gear selector cable from the transmission unit.

1. Remove the selector cable ball pin to selector lever nut.
2. Remove the selector cable to transmission casing bolts.

20. Disconnect the transmission harness multiplug.

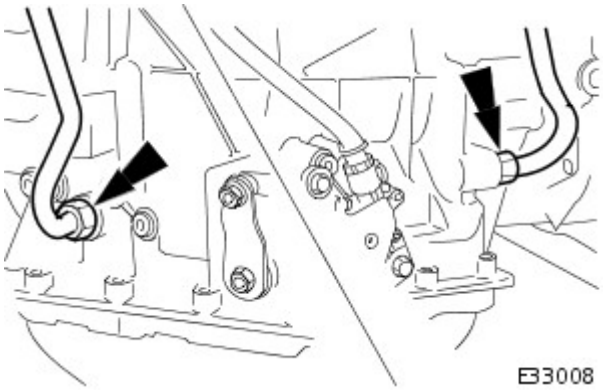
1. Rotate the locking lever to release.
2. Disconnect the multiplug.





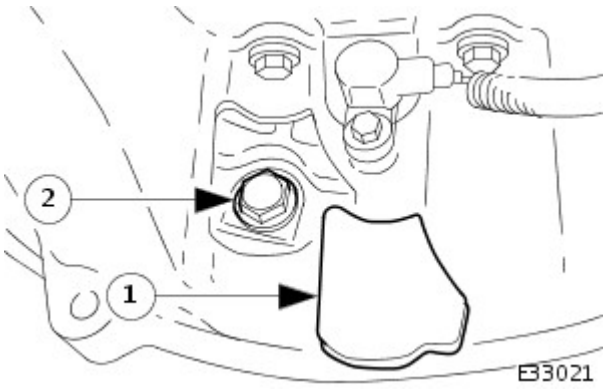
21. Detach the rotary switch.

1. Remove the switch fixings.
2. Displace the switch harness from the clips.



22. Disconnect the fluid cooler pipes.

- Unscrew the cooler pipe tube nuts, one at each side of the transmission casing.
- Discard the 'O' rings.
- Plug the pipes and transmission.

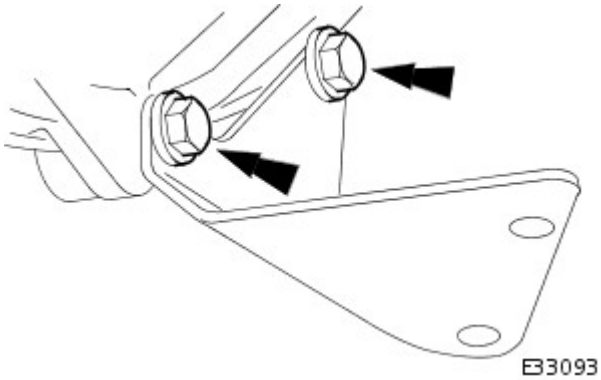


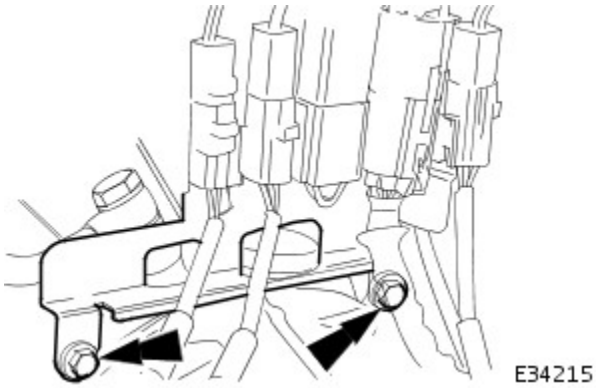
23. Remove the three bolts which secure the torque converter to the drive plate.

1. Remove the access cover.
2. Rotate the crankshaft and hold to prevent movement, and remove the bolts.

24. Remove the LH and RH catalyst mounting brackets from the transmission case.

- Remove the bolts.



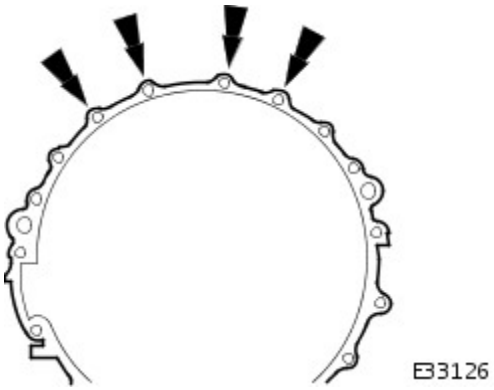


25. Remove the bolts which secure the engine harness connector mounting bracket and move the bracket aside for access.

26. On the RH side, clear the cooler pipe for access.

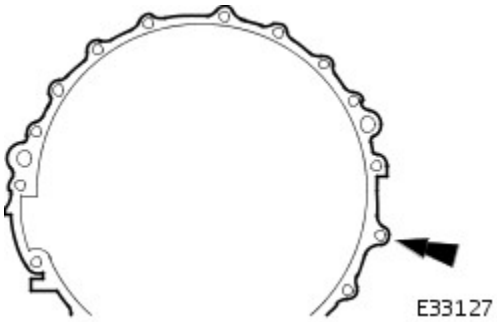
27. NOTE: Viewed from the rear of the vehicle.

Remove the four upper transmission to engine bolts.



28. NOTE: Viewed from the rear of the vehicle.

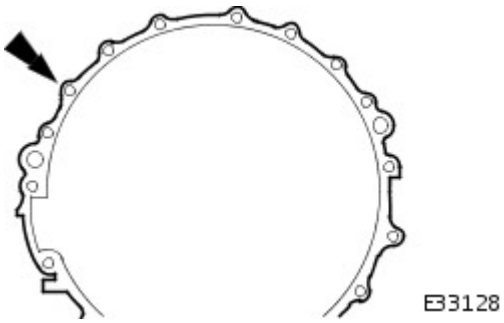
Remove the ground lead bolt.

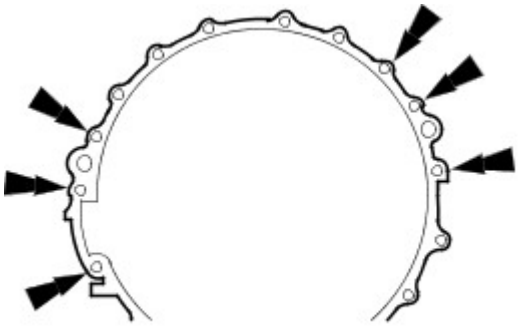


29. On the LH side.

30. NOTE: Viewed from the rear of the vehicle.

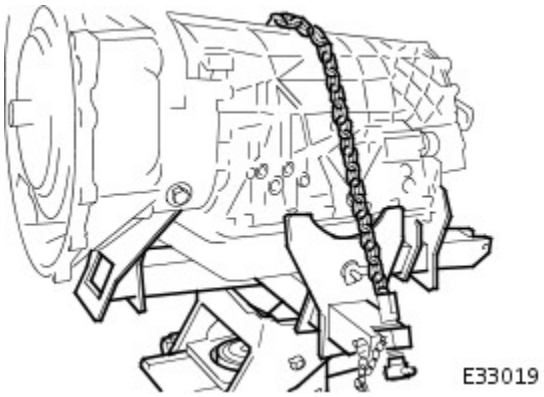
Remove the upper cooler pipe clip to transmission case bolt.





31. NOTE: Viewed from the rear of the vehicle.

Remove the six remaining transmission case to cylinder block bolts.



32. NOTE: Do not allow the converter to detach from the transmission.

Remove the transmission / converter assembly from the vehicle.

- Lower the transmission jack and remove the transmission, ensuring that the torque converter spigot disengages cleanly from the engine.

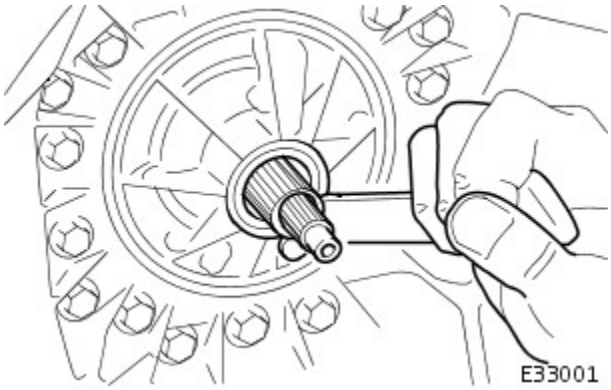
33. If appropriate, fit retaining straps to the converter / transmission assembly.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Input Shaft Seal

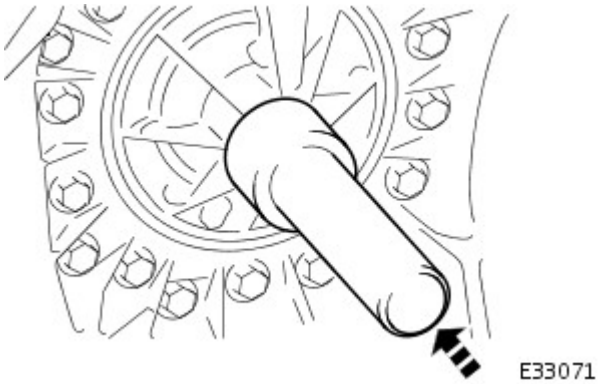
Disassembly and Assembly of Subassemblies

Special Tool(s)	
 E36438	Oil seal replacer 307-357

1. Remove the transmission unit, 44.20.01.
2. Remove the torque converter from the transmission unit, 44.17.07.
3. Remove the front pump seal.
   - Remove and discard the seal retaining snap-ring.
   - Using a 'Snap-on' oil seal puller, remove and discard the seal.

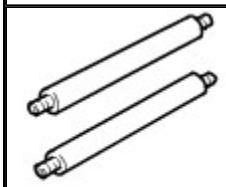

E33001

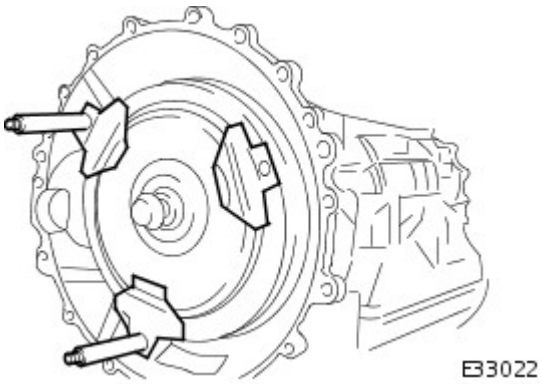
4. Clean the seal housing.
5. Installation is the reverse of the removal procedure.
6. Use tool 307 - 357 to install the seal.
   - Lubricate the seal prior to fitting.


E33071

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Torque Converter

Disassembly and Assembly of Subassemblies

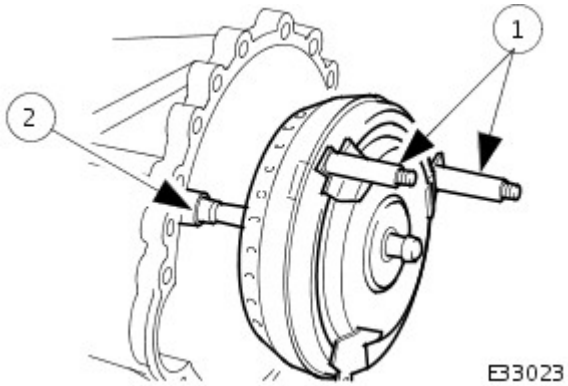
Special Tool(s)	
 E36441	Lifting handle 307-139


E33022

1. Remove the transmission unit from the vehicle; 44.20.01.
2. Remove the torque converter from the transmission unit.
   - Install lifting handles 307 - 139.
3. Remove lifting handles 307 - 139 from the torque converter.
4. Clean the torque converter and mating faces.
5. CAUTIONS:

 Use extreme care NOT to damage the oil seal with the converter spigot.

 Ensure that the converter is fully located.



E33023

Install the torque converter.

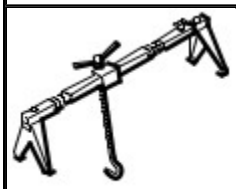
1. Install lifting handles 307 - 139.
2. Lubricate the front pump seal.

   - To facilitate location, rotate the converter as it is being fitted and note the engagement of splines and oil pump drive.

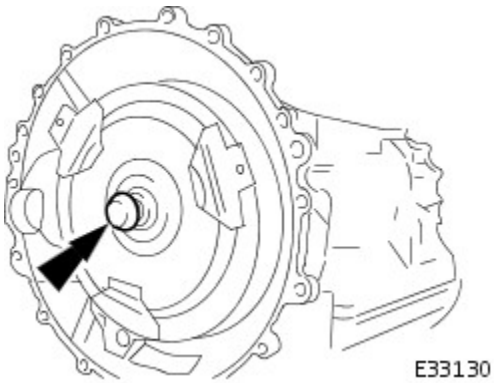
6. Check that the three converter fixing boss faces are approximately 8,0 mm proud of the transmission mounting face.
7. Remove lifting handles 307 - 139 from the torque converter.
8. Install the transmission unit; refer to Operation 44.20.01, noting especially the alignment instructions.

Automatic Transmission / Transaxle - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission

Installation

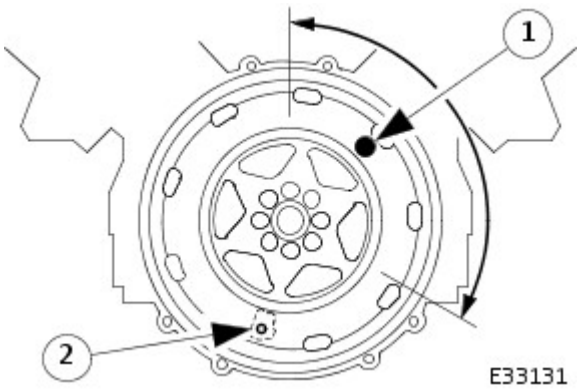
Special Tool(s)	
 E36400	Engine support 303-021
 E36403	Engine lifting brackets 303-536

Installation


E33130

1. Clean all mating faces and relevant parts.

2. Apply lubricant, Molycote or equivalent, to the spigot of the torque converter.



E33131

3. Align the engine drive plate.

1. Rotate the crankshaft to position the ORANGE dot within the indicated sector.

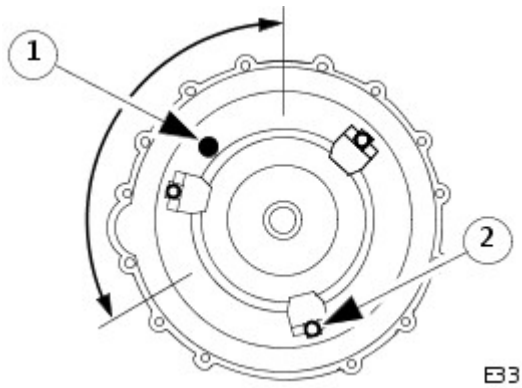
• NOTE: Viewed from the rear of the vehicle.

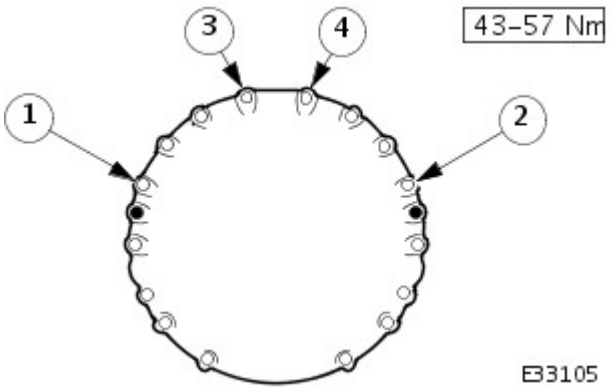
2. Keeping the dot within the sector, align the nearest converter fixing hole to the access aperture.

4. Align the torque converter

1. Rotate the converter to position the BLUE dot within the indicated sector.

2. Keeping the dot within the sector, align the nearest fixing boss as indicated, so that when the two units are mated, the converter need only be moved the minimum amount.

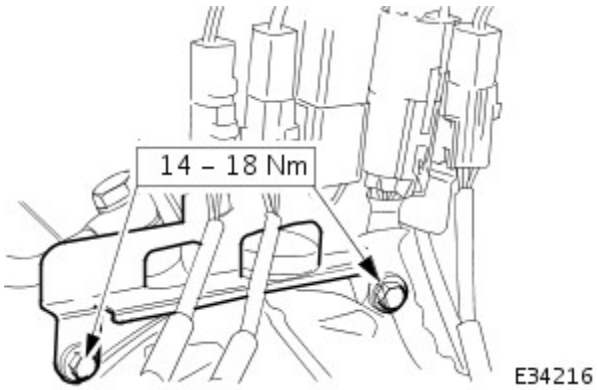




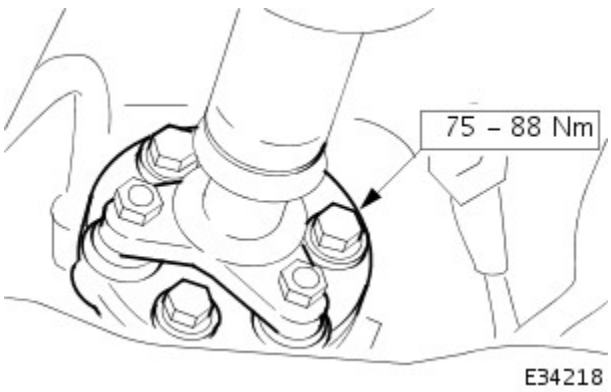
5. Fit the transmission to the engine.

- Loosely assemble - Cooler pipe clip.
- Loosely assemble - Ground lead.
- Loosely assemble - Catalyst brackets.

1. Tighten in sequence 1, 2, 3, 4 as shown on the illustration, then the others in any order.



6. Reposition the mounting bracket for the engine harness connector and fit the securing bolts.

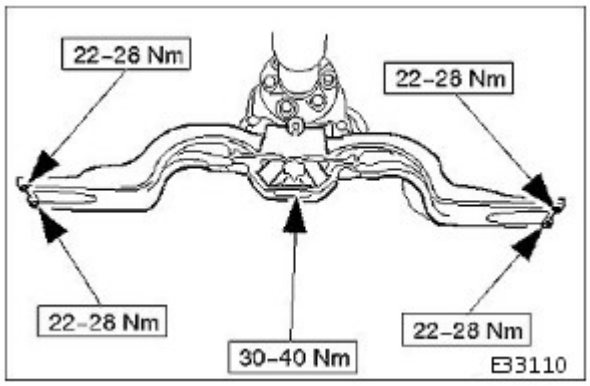


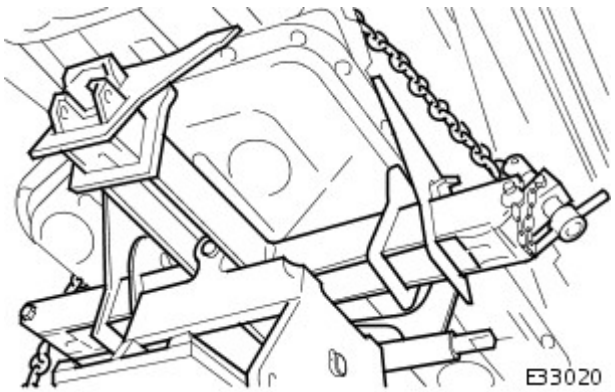
7. Connect the drive shaft, aligning any marks made when removing - if applicable. Tighten the bolts to the specified torque figure.

8. Fit the engine rear mounting and tighten the centre bolt and outer bolts to the specified torque figures.

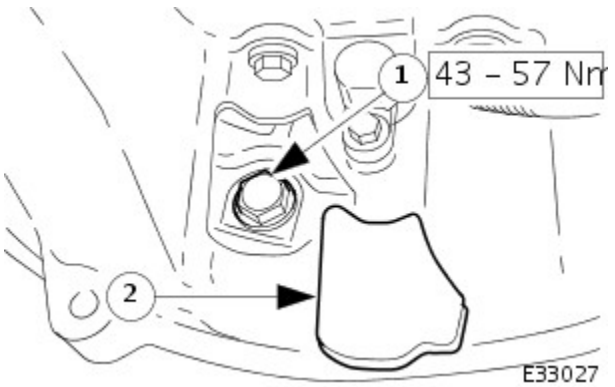
- Check that the hooks of the engine support beam are not trapped, before tightening the rear mounting.
- Check that the safety chain on the transmission jack will

not be trapped when the mounting is fitted.



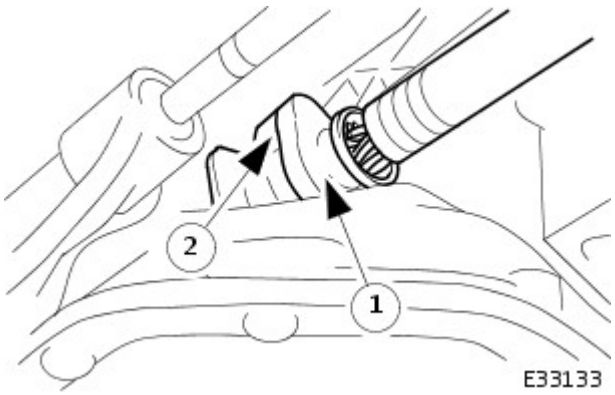


9. Remove the transmission jack.



10. Fit the three bolts which secure the torque converter to the drive plate.

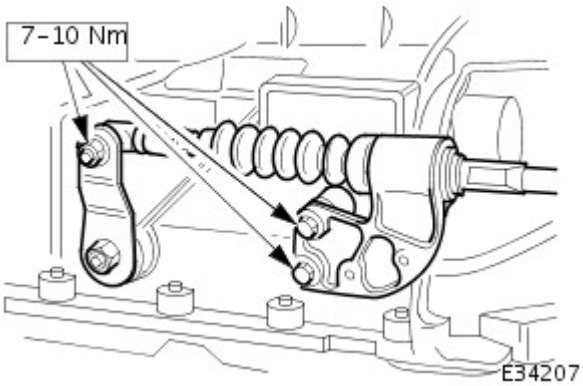
1. Loosely assemble all three drive plate to torque converter bolts. Whilst preventing crankshaft rotation, tighten the three converter bolts to the specified torque figure.
2. Fit the blanking plug.

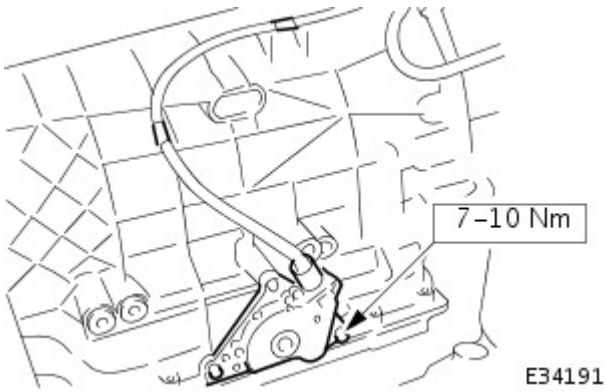


11. Connect the transmission harness multiplug.

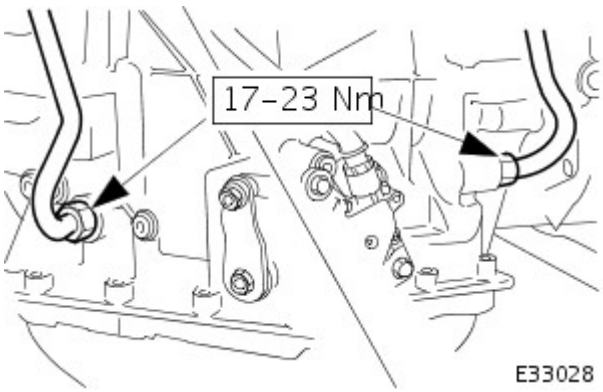
1. Engage the multiplug.
2. Rotate the locking lever to secure.

12. Connect the selector cable to the selector lever and fit the abutment bracket to the transmission casing. Tighten the nut and two bolts to the specified torque figure.



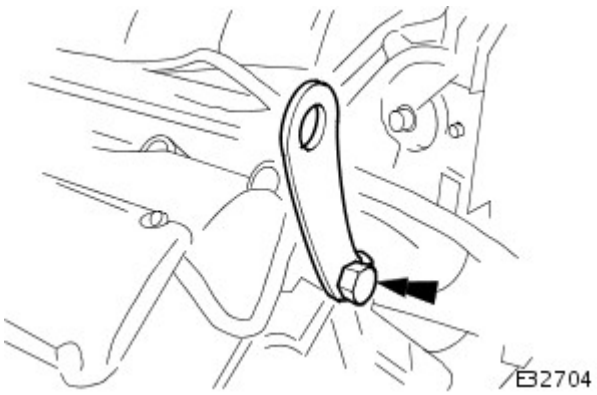


13. Refit the rotary switch and tighten the two screws to the specified torque figure. Locate the switch harness into the clips.



14. Connect the fluid cooler pipes to the transmission.

- Remove the blanking plugs.
- Fit new O-ring seals.
- Tighten the union nuts to the specified torque figure.



15. Remove the engine support beam.

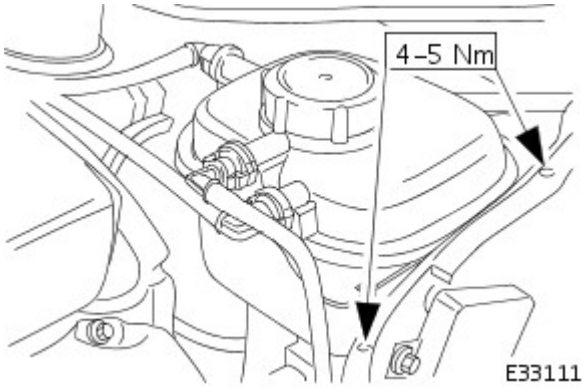
- Remove both engine lifting brackets 303 - 536.

16. Refit the RH downpipe catalytic converter. Refer to Operation 17.50.09 and 17.50.10

17. Refit the front muffler. Refer to Operation 30.10.18.

18. Refit the LH downpipe catalytic converter. Refer to Operation 17.50.09

19. Lower the vehicle on the ramp.



20. Reposition the coolant header tank and tighten the securing bolt to the specified torque figure.

21. Refit the air intake tube, MAFM and air cleaner cover assembly. Refer to Operation 19.10.30.

22. Refit the engine covers. refer to operation 12.30.06.

23. Connect the battery and fit the battery cover..

- Reset the radio and the clock.

24. Refill the transmission with new fluid. Refer to Operation 44.24.02.

25. Remove the protection sheets and close the engine compartment.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 -

Lubricants, Fluids, Sealants and Adhesives - Automatic Transmission (Supercharged Vehicles)

Unit	Specification
Transmission fluid	Shell ATF 3403 - M115

Capacities - Automatic Transmission (Supercharged Vehicles)

Unit	Liters
Transmission assembly (with torque converter)	9,5

Torques - Automatic Transmission (Supercharged Vehicles)

Component	Nm
Bolt - EMS bracket to cylinder head	43 - 53
Bolt - Driveshaft coupling to transmission	75 - 88
Bolt - Fluid pan (clamp) to transmission case	8 - 10
Bolt - Harness heatshield to case and fluid pan clamp	9 - 11
Bolt - Muffler bracket to transmission case	43 - 57
Bolt - Rear engine (isolation) mounting to mounting bracket	22 - 28
Bolt - Rear engine mounting bracket to adapter (transmission case)	39 - 51
Bolt - Rear engine mounting bracket to body	22 - 28
Bolt - Torque converter to drive plate	43 - 57
Bolt - Transmission unit to engine	43 - 57
Bolt - Valve body to transmission case	7 - 9
Bolt - 'W' clip (fluid cooler pipe) to cylinder block	7 - 9
Banjo bolt - Cooler pipe to transmission unit	30 - 40
Nut - Coolant header tank to bracket	4 - 5
Nut - Selector cable abutment to transmission case	7 - 10
Nut - Selector cable ball end to selector lever	7 - 10
Nut - Transmission output shaft flange	200
Plug - Fluid pan drain	20 - 24
Screw - Coolant header tank to bracket	4 - 5
Screw - Filler tube to transmission case	14 - 18

Internal Rear Ratios - Automatic Transmission (Supercharged Vehicles)

Gear	Ratio
1st	3,59:1
2nd	2,19:1
3rd	1,41:1
4th	1,00:1
5th	0,83:1
Reverse	-1,93 (Normal mode)
Reverse	-3,165 (Sport mode)

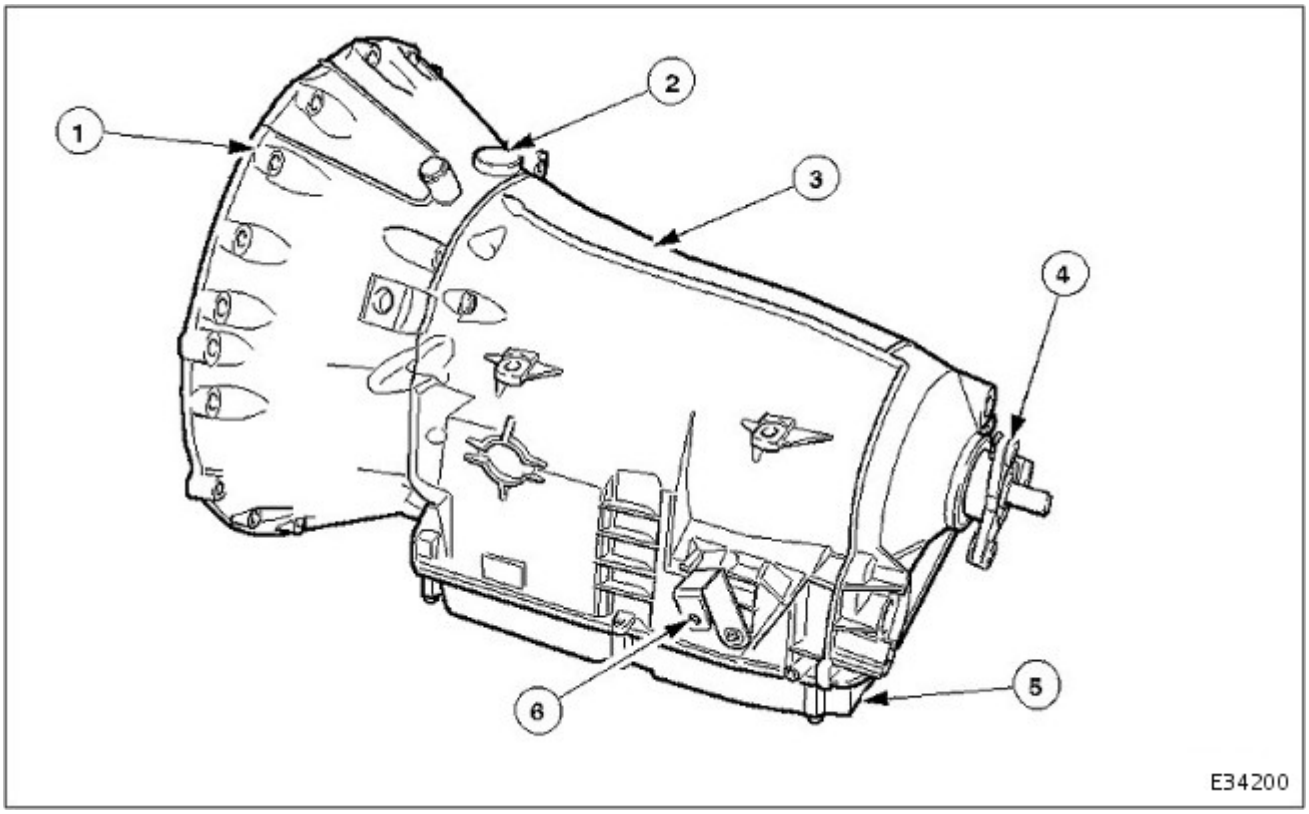
Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Description

Description and Operation

Transmission Assembly

This electronically controlled five speed unit is unique to supercharged vehicles.

Introduction



Parts List

Item	Part Number	Description
1	—	Torque converter housing
2	—	Breather
3	—	Transmission casing
4	—	Drive flange (output shaft)
5	—	Fluid pan
6	—	Selector lever

Transmission Fluid

It is not necessary to change the transmission fluid in normal service; routine level checking is not required. The sealed dipstick tube is fitted for service requirements only, with a dipstick being available as a special tool and NOT fitted as standard.

Components and Functions

Transmission Casing

The following components are housed within the casing;

- Stator, intermediate and output shafts.
- Three epicyclic geartrains.
- Six multi-disc clutch/brake packs.
- Two freewheels (One-way clutches).
- Hydraulic pump.
- Parking lock assembly.
- Electro-hydraulic control unit.
- Internal harness and 13 pin connector with bayonet lock.

Hydraulic pump

- This engine driven pump is located at the front of the transmission casing and provides pressure for the hydraulic functions.
- Supplies fluid under pressure to the torque converter, geartrain, electro-hydraulic control unit and the lubrication circuit.
- Draws fluid from the fluid pan below the transmission casing, through a filter.

Parking lock

This component prevents movement of the vehicle by engaging a fixed pawl with the parking lock gear located on the output shaft. The pawl is engaged by moving the gear selector lever to the park (**P**) position.

Electro-hydraulic control unit

This unit, mounted in the transmission lower case, converts signals, mechanical from the J-gate and electrical from the TCM, into hydraulic functions.

The following components are assembled to the unit:

- Selector valve.
- Shift plate.
- Control valve - modulating pressure.
- Control valve - shift pressure.
- Solenoid valve 1 <-> 2 and 4 <-> 5 shift.
- Solenoid valve 3 <-> 4 shift.
- Solenoid valve 2 <-> 3 shift.
- Solenoid valve - converter lock-up.
- Speed sensors (2).
- Temperature sensor.

Speed sensors

There are two speed sensors within the transmission assembly which provide input to the TCM. These inputs, when used in conjunction with CAN data relative to engine speed (from ECM) and road speed (from ABS), are used to electronically control the transmission.

Temperature sensor

The output from this sensor allows the TCM to compensate for the affect of fluid temperature on shift time and quality

Control Systems

Hydraulic Control

The selector valve is operated directly by the J-gate and directs fluid flow for **P R N D**.

Of the four solenoid valves, 3 control shifts and 1 controls converter lock-up. One control valve controls modulating pressure and the other shift pressure.

Regulating valves are used to maintain/control pressure for lubrication, normal operating functions, and the supply to the control valves and shift valves.

In the event of a system fault, the TCM will adopt 'limp home' mode.

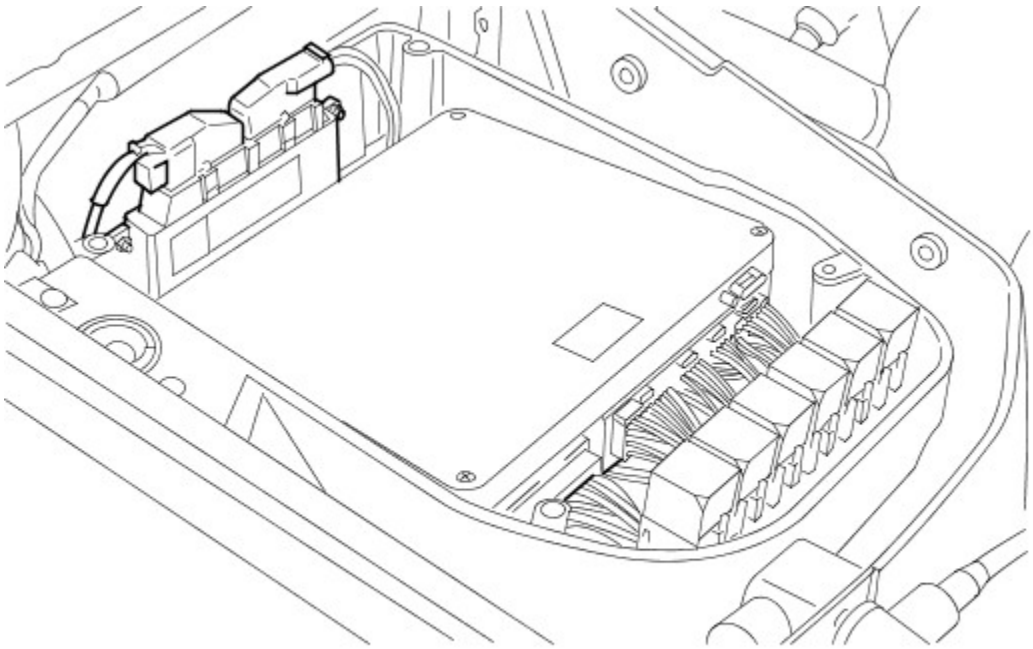
Electrical control

Refer to Section 307-01B.

Transmission Control Components

Transmission Control Module (TCM)

The TCM controls the transmission internal components thus determining gear selection and shift pattern.



E34197

The TCM is located in the same housing as the engine control module (ECM) and is accessed in the same manner. With the two connectors unplugged the TCM may be withdrawn, complete with mounting bracket. The mounting bracket is secured to the TCM by 2 locknuts.

Operation

CAUTION: Disconnection of OTHER control module connectors and / or the vehicle battery, may introduce fault codes (DTCs). Following rectification and reconnection, ensure that no induced codes exist in the TCM memory.

The TCM processes input and output in both analogue and digital form which may be summarized in four categories:

Input Signals

- Gear selector position (Dual Linear Switch x 4 inputs see 307.05)
- Transmission oil temperature
- Kickdown
- Speed sensor #1
- Speed sensor #2
- Mode switch

CAN Input Signals

- Traction status
- ABS malfunction
- ABS status
- Engine torque status
- Throttle position
- Accelerator pedal position
- Engine torque reduction confirmation
- Engine speed
- Engine coolant temperature
- Cruise status
- OBDII fault code clear request
- Throttle malfunction warning RED or AMBER
- All road wheel speeds
- Token for network status ECM
- Token for network status INST
- Token for network status ABS
- Diagnostic data in from external device (PDU)

Output Signals

- Solenoid valve 1 <-> 2 and 4 <-> 5 shift
- Solenoid valve 2 <-> 3 shift
- Solenoid valve 3 <-> 4 shift
- Solenoid valve converter lock-up clutch
- Control valve - modulating pressure
- Control valve - shift pressure

CAN Output Signals

- Engine torque reduction request
- MIL status (whether present DTC should operate MIL)
- Transmission input speed
- Transmission output speed
- Converter slip
- Kickdown status
- Gear position (actual)
- Gear position (selected)
- Gear selection fault
- Converter lock-up status
- Current selected shift map
- Transmission oil temperature
- Transmission malfunction
- Pecus flag (state of current TCM program)
- Target for next gear position
- Gear shift torque transfer progress at shift
- MIL status (response to activate the MIL relevant to a DTC)
- OBDII fault code clear acknowledgement
- Transmission DTCs (P codes)
- Token for network status TCM
- Diagnostic data out to external device (PDU)

Emergency Running (electronic limp-home mode)

The TCM constantly monitors the transmission for faults. In the event of a problem the TCM will adopt the limp-home mode, in which the gear currently held remains engaged, until P is selected. The modulating and shift pressures will increase to maximum and converter lock-up will be inhibited.

Following the selection of P , the only ratios available will be 2 (irrespective of forward ratio manual selection) and R .

With the vehicle at rest, the procedure to manually select is as follows:

1. **1.** Select P .

2. **2.** Switch OFF the ignition.
3. **3.** Wait 10 seconds.
4. **4.** Start the engine.
5. **5.** Select R (reverse will be selected).
6. **6.** Select D (2 will be selected).

The limp-home mode will be retained until the fault is remedied or the fault code has been erased. Intermittent faults may be cleared by cycling the ignition OFF/ON. In certain cases the component may need to be operated before the fault code is cleared eg. a shift solenoid.

Emergency Running (mechanical/hydraulic limp-home mode)

Should slip be detected, due to a mechanical failure or loss of pressure, the transmission will either shift to, and hold 3 or shift to, and hold, the last gear which was known to be alright. This condition may be cleared by cycling the ignition OFF/ON following mechanical repair.

The operator will be made aware of certain faults by a warning message on the instrument cluster.

Data concerning OBDII related transmission failures is stored in the ECM for access via the J1962 socket.

Safety Functions

These functions are designed to safeguard against inappropriate actions by the operator as well as system malfunctions.

The electrical and diagnostic system has been designed such that system integrity is protected at all times, the safety concept being based on the following three points.

1. **1.** The hydraulic system has 'fail-safe' characteristics regarding its electrical operation, such that should the power supply be lost to the electro-hydraulic actuators the transmission will initiate a limp-home mode.
2. **2.** Recognition of critical shift operation by monitoring the last element in the signal path, ie the solenoid valve, and checking by means of redundant measured variables relative to engine, transmission and road speeds.
3. **3.** Each time the vehicle is started there is a check on the entire safety hardware and the associated program parts and signal paths. A malfunction in this part of the system, or triggering of the safety circuit, is communicated to the operator by a warning message on the instrument cluster.

CAUTION: Do not engage R or P with the vehicle in motion.

Should R be engaged with the vehicle in forward motion, the transmission will default to neutral until either the vehicle speed decreases to 4 mph or D is selected.

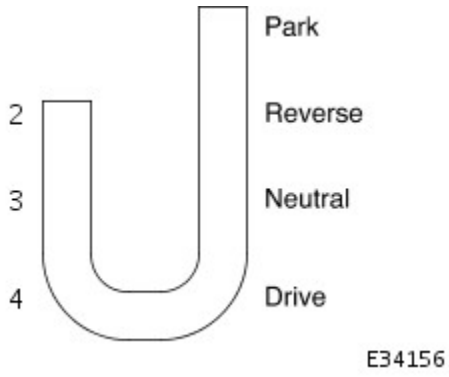
Towing

The vehicle may be towed provided that:

- Selector in position N
- Speed < 50 kph
- Distance < 50 km

System Functions

'J' Gate Layout



Range Selection

The 'J' gate selector lever is connected to the transmission via a cable which operates the transmission selector shaft between positions P R N D only. The shift lever disconnects from the cable when the lever is moved across the gate from D to 4 .

Movement of the lever between P R N D manually controls the flow of transmission fluid, the TCM having control of the forward gear selected in D .

Movement of the lever to 4 , 3 and 2 positions does not manually modify the fluid flow, the TCM detects these positions using the DLS and controls the ratios electronically by energizing solenoids.

Shift Point Control

The gearshift points are controlled by the TCM, as a function of the output speed, engine load, engine speed, selector position and shift program selected. The operator has control over the shift points via the shift lever, throttle pedal movement, kickdown function and mode switch.

Mode Switch

This switch allows operator selection of two base shift modes; Normal and Sport; the switch being illuminated when Sport is selected. This function alters the values in the TCM shift point calculations.

Shift Programs

Upon encountering the following conditions, the TCM will automatically modify the Normal or Sports shift map to enhance the operation of the vehicle:

1. **1.** Traction: When traction intervention is active.
2. **2.** Hot mode: Extreme engine/transmission temperatures.
3. **3.** Gradient: Under specific speeds and loads.
4. **4.** Manual: Driver initiated override of the normal shift map when the LH side of the 'J gate' is used.

Traction

When traction or stability control (engine or brake system derived) is operational the TCM will implement the traction map to maximize control of wheel slip.

Gradient

The gradient function is intended to enhance vehicle driveability when climbing a gradient or towing. The TCM will implement the function when increased driving resistance is detected, and provides enhanced driveability, additional cooling

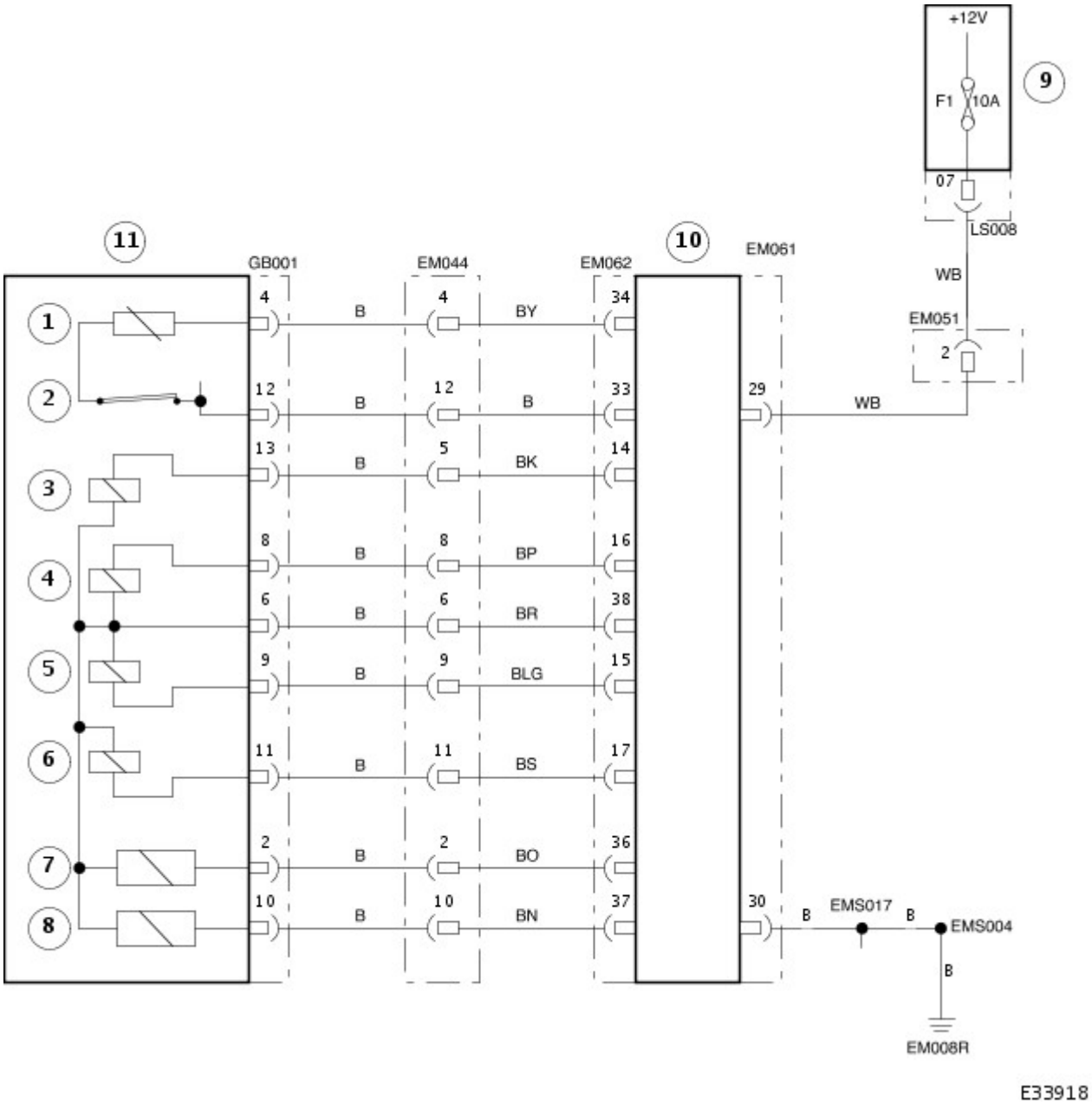
and/or increased performance as appropriate.

Serial Communications Interfaces

Controller Area Network (CAN)

The TCM is an integral part of the CAN system which facilitates the interchange of real-time data between control modules and sensors; refer to 303-14 for a full description of CAN.

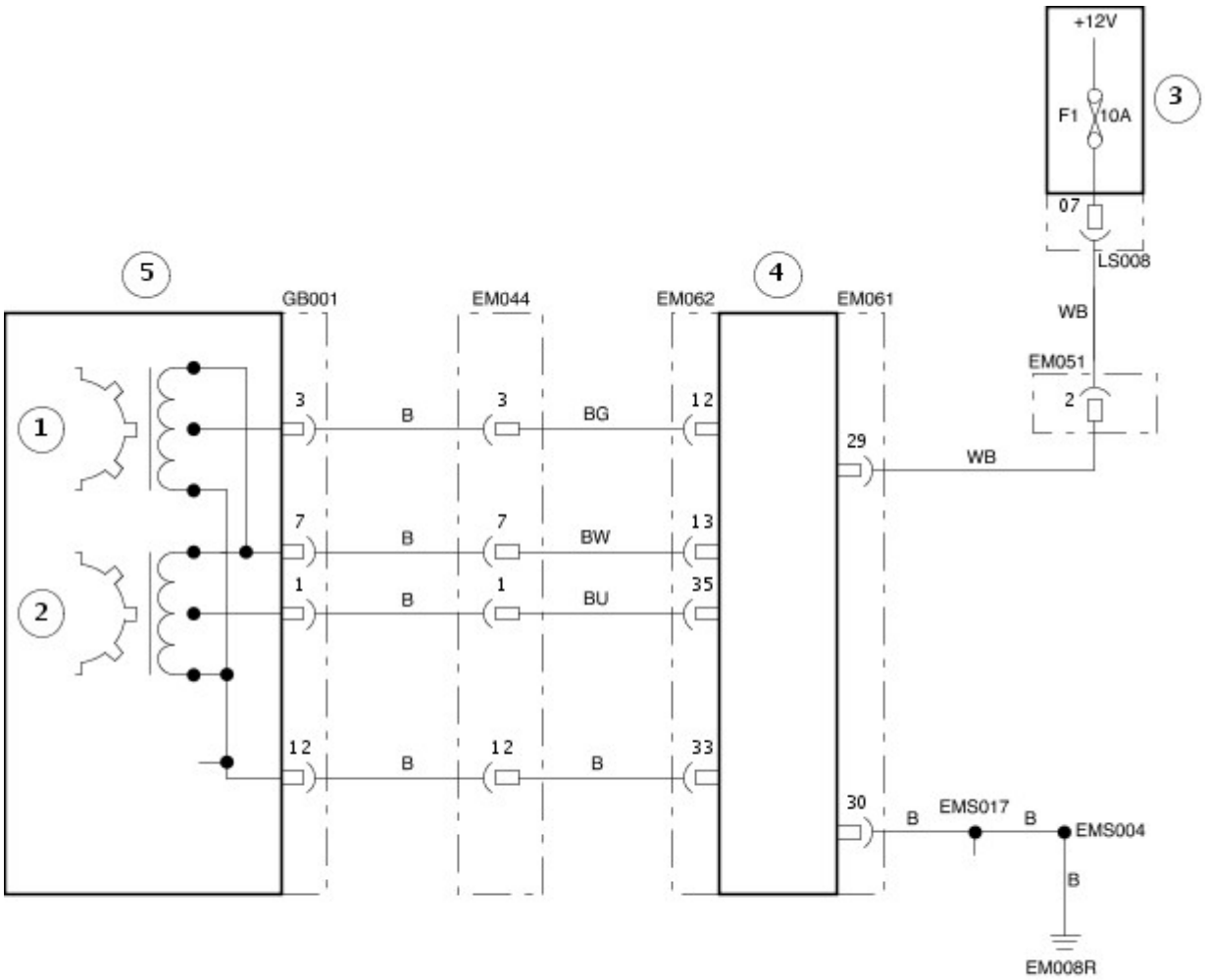
Transmission Pressure Regulators and Shift Solenoids Circuit Diagram



Item	Part Number	Description
1	—	Transmission oil temperature sensor
2	—	Switch
3	—	Shift solenoid 1 <-> 2, 4 <-> 5
4	—	Shift solenoid 2 <-> 3

5	—	Shift solenoid 3 <-> 4
6	—	TCC pressure regulator
7	—	Modulation pressure regulator
8	—	Shift pressure regulator
9	—	Engine compartment fuse box
10	—	Transmission control module
11	—	Transmission

Speed Sensor / TCM Circuit Diagram

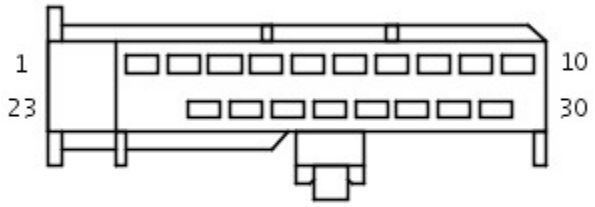


E33919

Item	Part Number	Description
1	—	n2 speed sensor
2	—	n3 speed sensor
3	—	Engine compartment fuse box
4	—	Transmission control module
5	—	Transmission

Connector Pins Identification

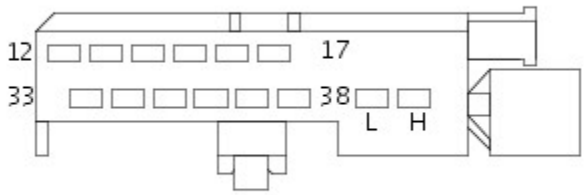
Connector Pin Identity Chart for EM061



E34209

Pin Number	Circuit	Circuit Function
001		Not used
002		Kickdown SW
003		Mode SW
025		DLS position WO
026		DLS position W1
027		DLS position W2
028		DLS position W3
029		Ignition B+
030		Power ground (common to DLS)

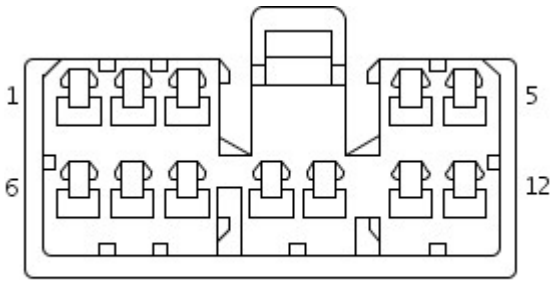
Connector Pin Identity Chart for EM062



E34210

Pin Number	Circuit	Circuit Function
012		n2 speed signal
013		Speed sensor +ve
014		Solenoid 1 <-> 2 and 4 <-> 5
015		Solenoid 3 <-> 4
016		Solenoid 2 <-> 3
017		Torque converter solenoid
033		Speed and temperature sensor ground
034		Temperature sensor
035		n3 speed signal
036		Pressure regulator Modulating signal
037		Pressure regulator Shift signal
038		Solenoid and pressure regulator +ve
040		CAN link -ve
041		CAN link +ve

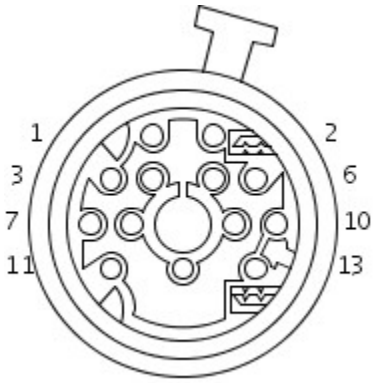
Connector Pin Identity Chart for CC008



E34213

Pin Number	Circuit	Circuit Function
001		DLS position W3
002		Power ground (common to TCM)
003		Ignition B+
004		Neutral (BPU)
005		Park / neutral (ECM)
006		DLS position W1
007		DLS position WO
008		DLS position W2

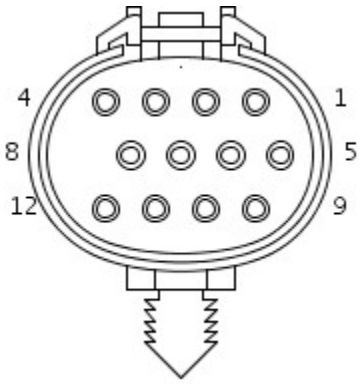
Connector Pin Identity Chart for GB001



E34212

Pin Number	Circuit	Circuit Function
001		n3 speed signal
002		Pressure regulator MD signal
003		n2 speed signal
004		Temperature sensor
005		Not used
006		Solenoid and pressure regulator +ve
007		Speed sensor +ve
008		Solenoid 2 <-> 3
009		Solenoid 3 <-> 4
010		Pressure regulator SD signal
011		Torque converter solenoid
012		Speed and temperature sensor ground
013		Solenoid 1 <-> 2, 4 <-> 5

Connector Pin Identity Chart for EM044

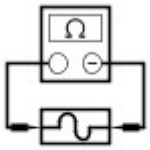
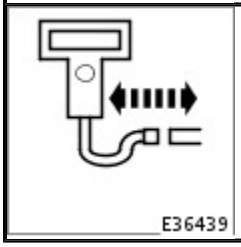


E34211

Pin Number	Circuit	Circuit Function
001		n3 speed signal
002		Pressure regulator MD signal
003		n2 speed signal
004		Temperature sensor
005		Solenoid 1 <-> 2, 4 <-> 5
006		Solenoid and pressure regulator +ve
007		Speed sensor +ve
008		Solenoid 2 <-> 3
009		Solenoid 3 <-> 4
010		Pressure regulator SD signal
011		Torque converter solenoid
012		Speed and temperature sensor ground

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Diagnostic Strategy

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scantool

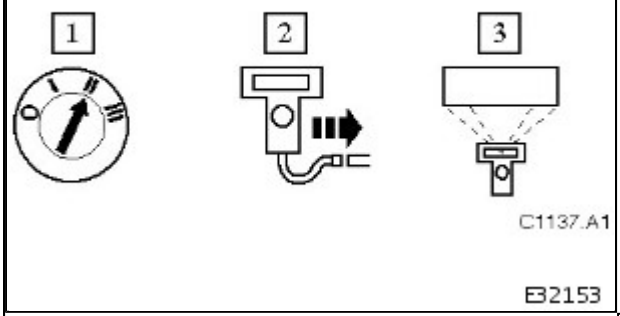
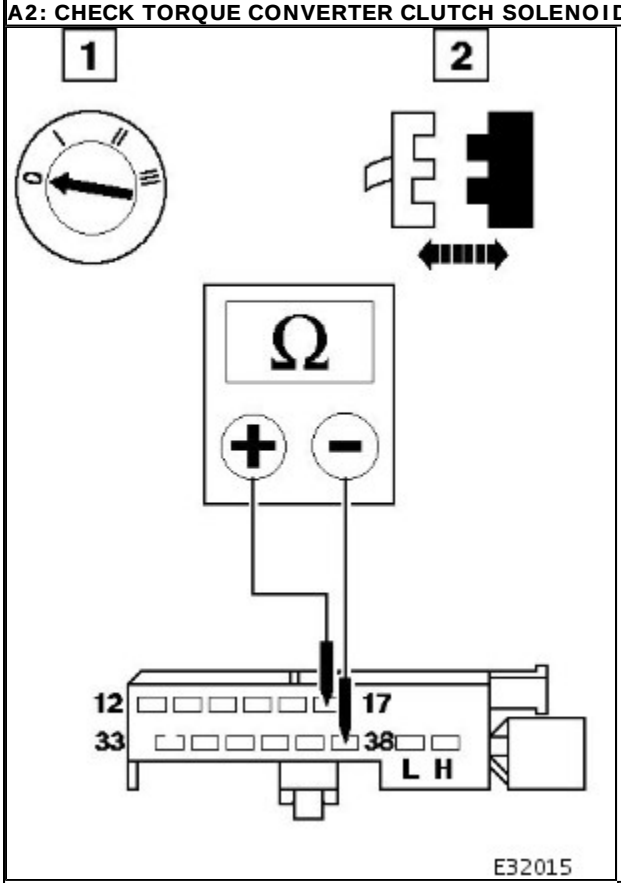
Symptom Chart

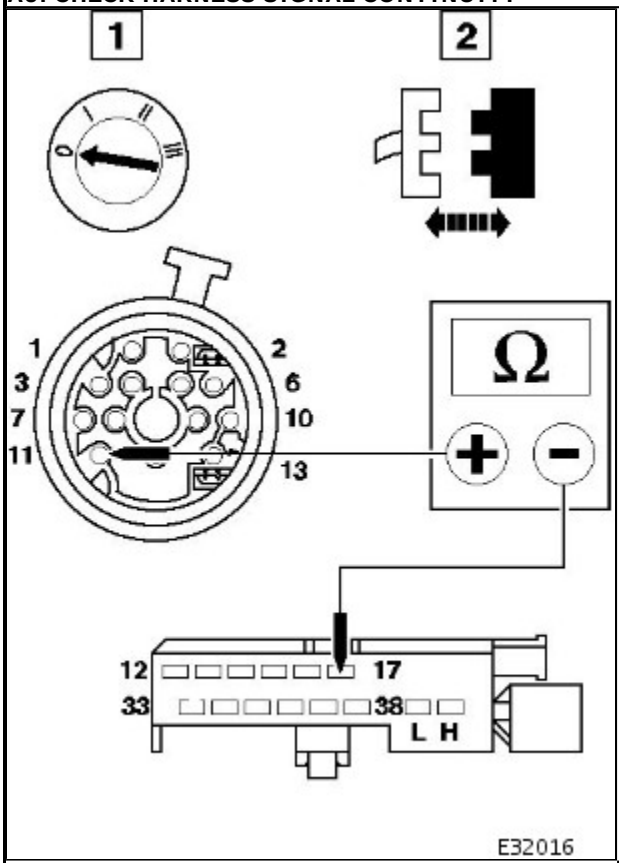
Symptom Chart

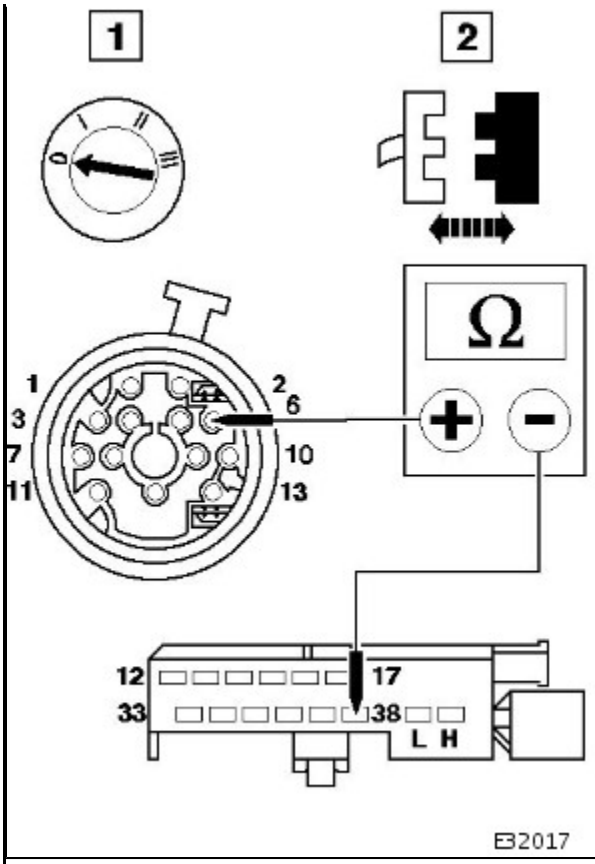
Symptom	Possible Sources	Action
DTC P0740 Torque converter clutch system electrical	* Harness fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test A
DTC P0740 Torque converter clutch system stuck on	* Torque converter clutch stuck on	* GO to Pinpoint Test B
DTC P1744 Torque converter clutch system stuck off	* Torque converter clutch stuck off	* GO to Pinpoint Test B
DTC P0702 Transmission control system electrical	* Harness fault * High side switch (FET) fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C or D
DTC P0753 Shift solenoid A electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0758 Shift solenoid B electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0763 Shift solenoid C electrical	* Harness fault * Solenoid open circuit * Solenoid short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0748 Pressure control solenoid electrical	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P1748 Pressure control solenoid B electrical	* Harness fault * Pressure regulator open circuit * Pressure regulator short * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test D
DTC P0702 Transmission control system electrical	* Harness fault * Speed sensor voltage supply out of tolerance * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test E
DTC P0715 Input / turbine speed sensor circuit malfunction	* Speed sensor n2 or supply open circuit * Speed sensor n3 * Harness fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test F
DTC P1601 Internal control module computer error	* Faulty TCM	* GO to Pinpoint Test G

DTC P0730 Incorrect gear ratio	* Engaged gear implausible / transmission slipping * Oil level low * Valve body assembly faulty * Transmission faulty	* GO to Pinpoint Test H
DTC P0780 Shift malfunction	* Valve body assembly faulty * Transmission faulty	* GO to Pinpoint Test H

Pinpoint test A: P0740

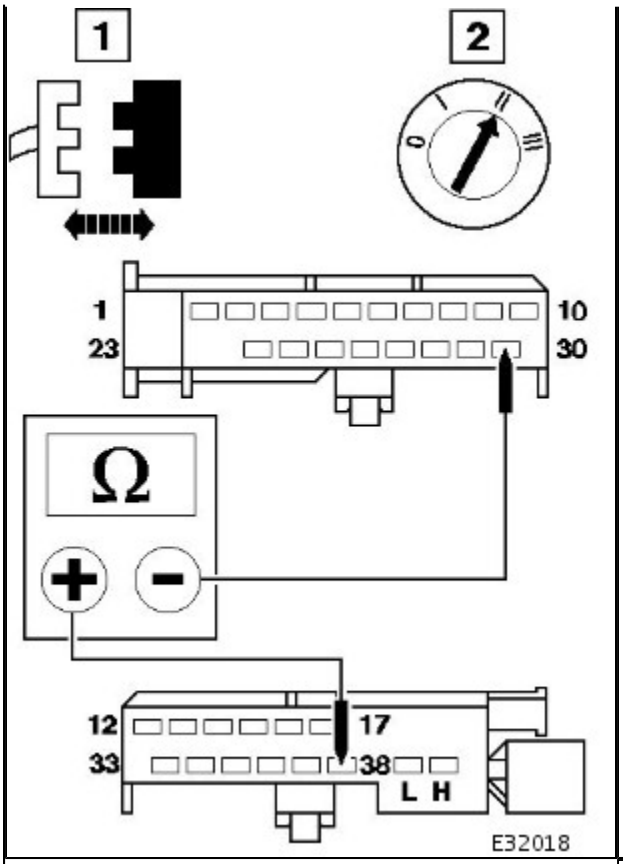
PINPOINT TEST A : P0740	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2
A2: CHECK TORQUE CONVERTER CLUTCH SOLENOID RESISTANCE	
	
	1 With, EM062 disconnected, measure the resistance between

	EM062/017 and EM062/038.
	Is the resistance >4.0 and <8.0 OHM? **Yes** GO to A6 **No** GO to A3
A3: CHECK HARNESS SIGNAL CONTINUITY	
	
	1 With EM062 and GB001 disconnected, measure the resistance between GB001/011 and EM062/017.
	Is the resistance < 0.5 OHM? **Yes** GO to A4 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
A4: CHECK HARNESS +VE CONTINUITY	



	1 With EM062 and GB001 disconnected, measure the resistance between GB001/006 and EM062/038
	Is the resistance < 0.5 OHM? **Yes** GO to A5 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

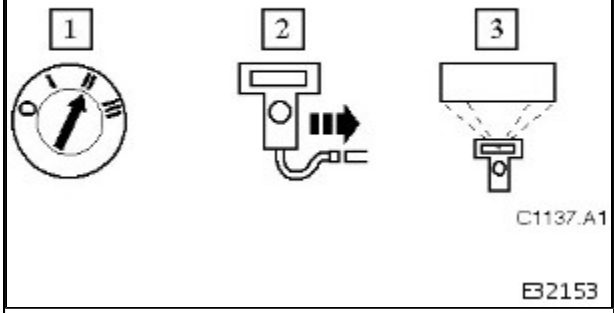
A5: CHECK FOR SHORT TO B+



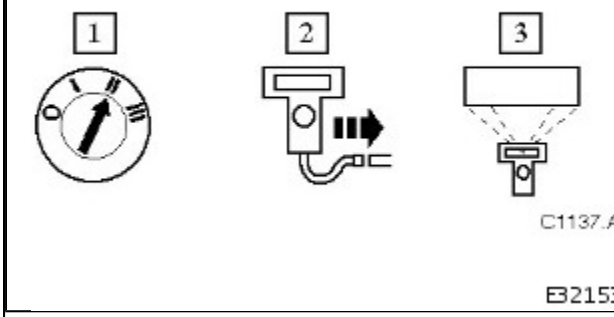
	1 With EM062 and EM061 disconnected, measure the voltage between EM062/038 and EM061/030.
	0V? **Yes** GO to A6 **No** Inspect EM062, EM063, EM044 and EM061 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
A6: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

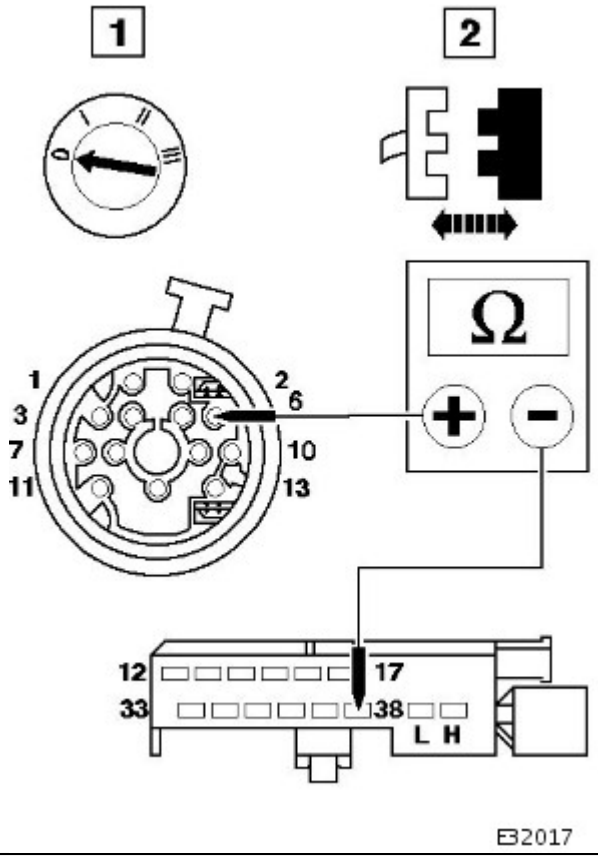
Pinpoint test B: P0740, P1744

PINPOINT TEST B : P0740, P1744	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	

	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to B2
B2: RENEW TORQUE CONVERTER	
	1 Renew the torque converter Has the torque converter been renewed? **Yes** GO to B3
B3: END	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

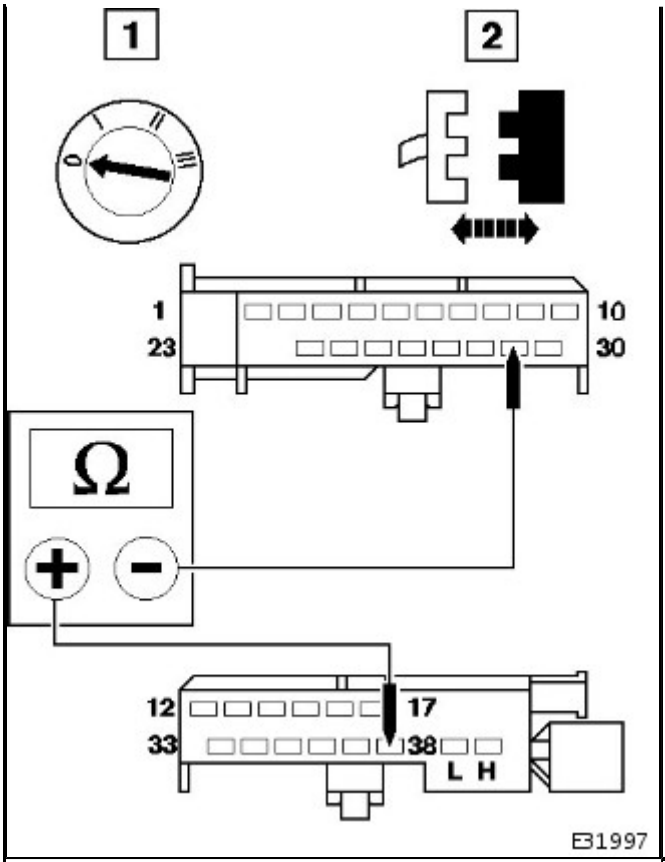
Pinpoint test C: P0702, P0753, P0758, P0763

PINPOINT TEST C : P0702, P0753, P0758, P0763	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to C2
C2: CHECK HARNESS +VE CONTINUITY	



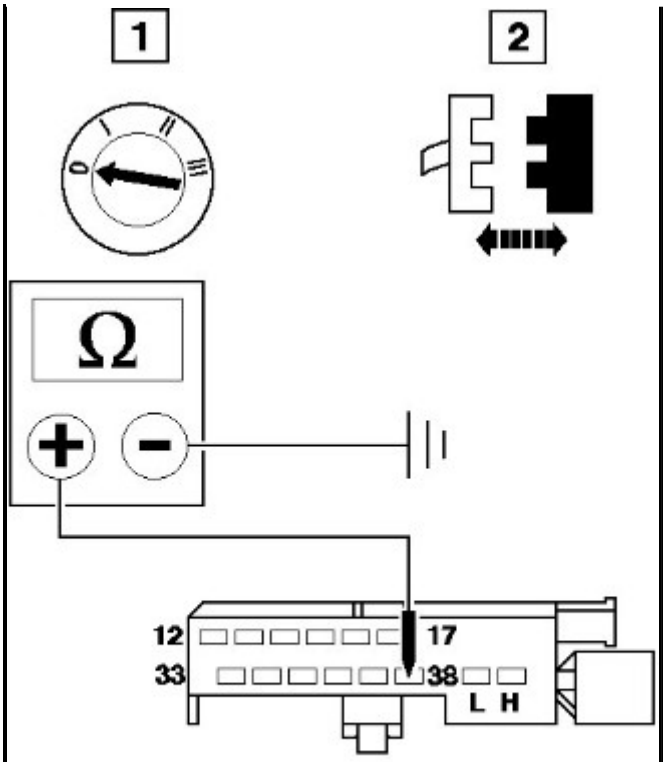
	1 With EM062 and GB001 disconnected, measure the resistance between GB001/006 and EM062/038
	Is the resistance < 0.5 OHM? **Yes** GO to C3 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

C3: CHECK FOR SHORT TO B+



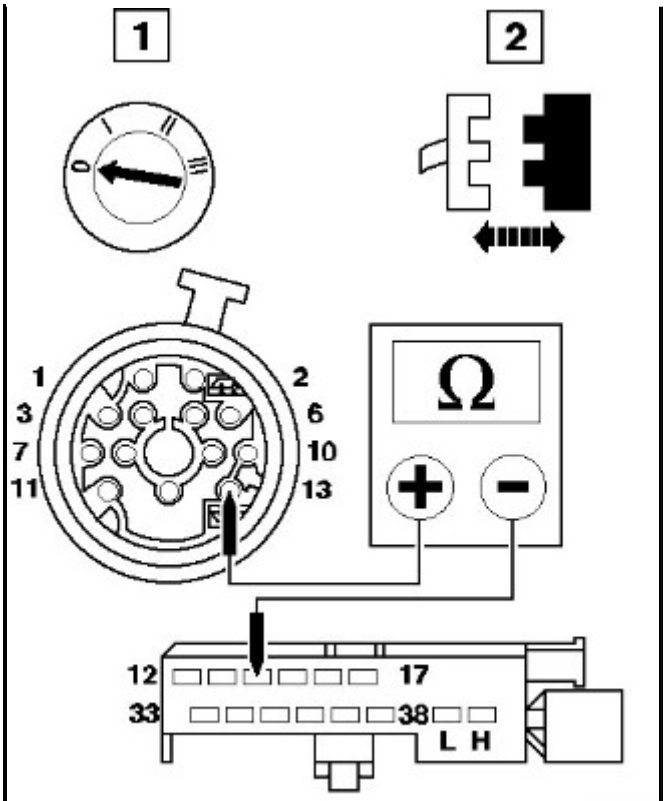
	1 With EM062 and GB001 disconnected, measure the resistance between EM062/038 and EM061/029
	> 10 MOHM? **Yes** GO to C4 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

C4: CHECK HARNESS SHORT TO GROUND



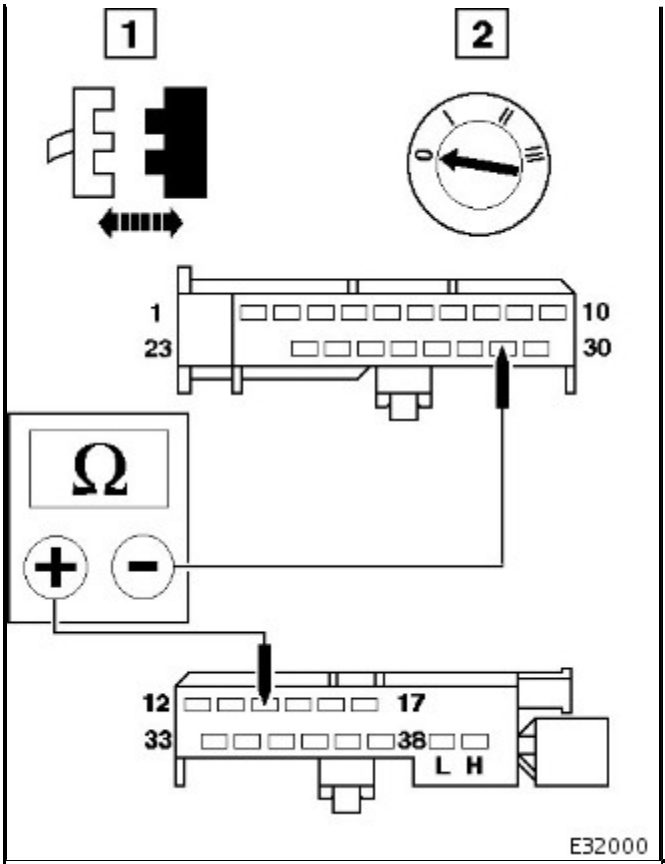
	1 With EM062 and GB001 disconnected, measure the resistance between EM062/038 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to C5 **No** Inspect EM062 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

C5: CHECK HARNESS CONTINUITY - SOLENOID



	1 With EM062 and GB001 disconnected, measure the resistance in turn: 2 EM062/014 and GB001/013 3 EM062/016 and GB001/008 4 EM062/015 and GB001/009 Is the resistance < 0.5 OHM? **Yes** GO to C6 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

C6: CHECK FOR SHORT TO B+



1	With EM062 and GB001 disconnected, measure the resistance between EM062/014 and EM061/029
2	Repeat for EM062/015 and EM061/029
3	EM062/016 and EM061/029

Is the resistance > 10 MOHM?

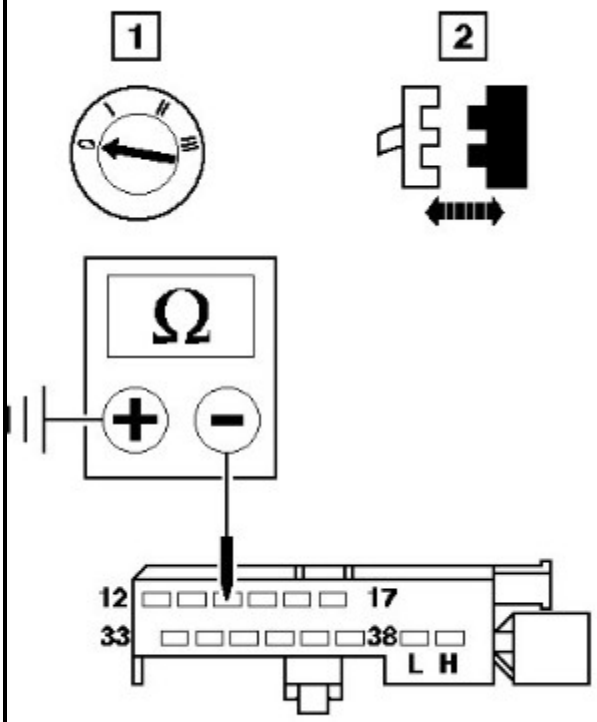
Yes

GO to C7

No

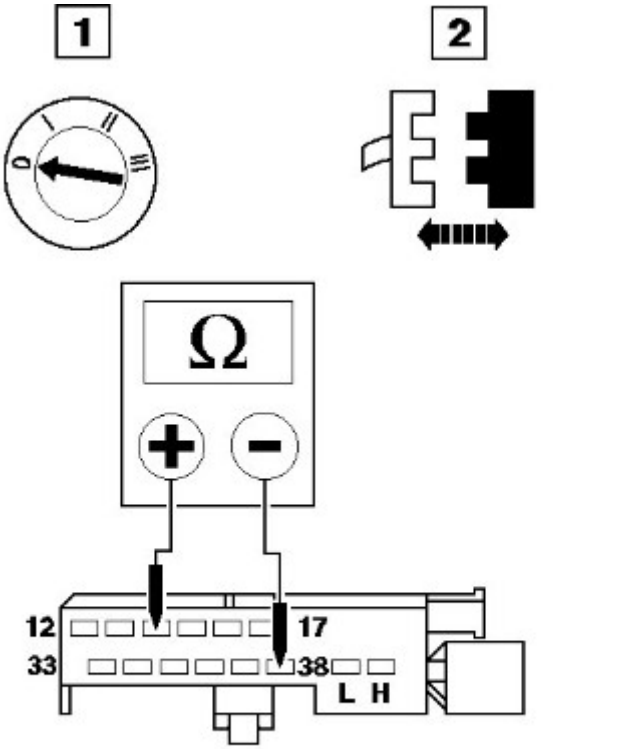
Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

C7: CHECK HARNESS SHORT TO GROUND



	1 With EM062 and GB001 disconnected, measure the resistance between EM062/014 and EM008R
	2 Repeat for EM062/015 and EM008R
	3 EM062/016 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to C8 **No** Inspect EM062 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

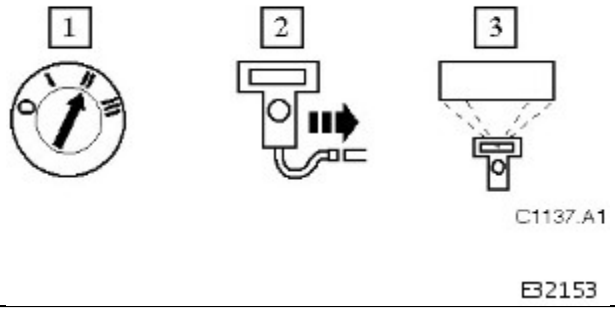
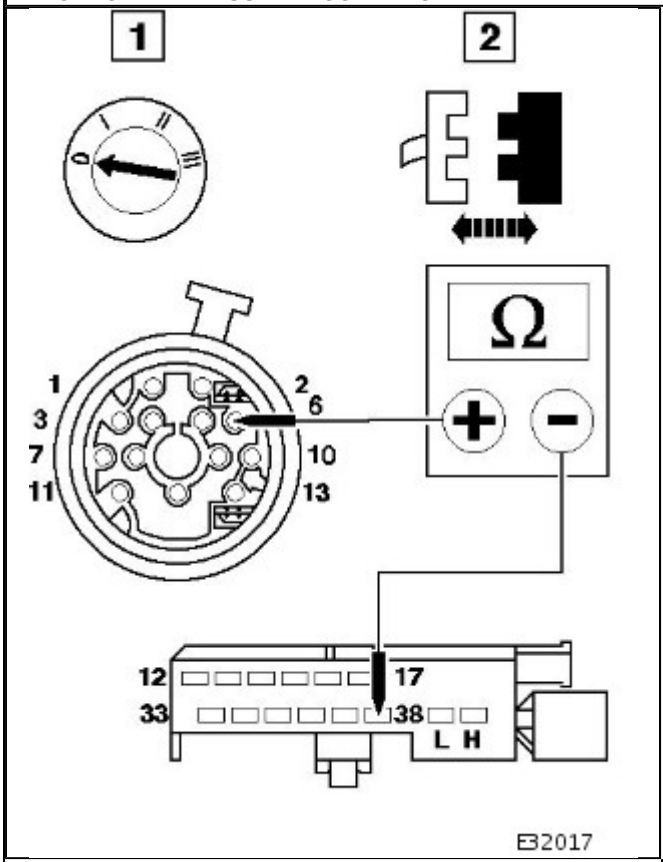
C8: CHECK INTERNAL HARNESS AND COMPONENT CONTINUITY - SOLENOIDS



	1 With EM062 disconnected, measure the resistance between the following, noting the relevant DTC
	2 For P0702 or P0753 EM062/38 and EM062/014
	3 For P0702 or P0758 EM062/38 and EM062/016
	4 For P0702 or P0763 EM062/38 and EM062/015
	Is the resistance 105 to 110 kOHM? **Yes** Reconnect EM062 GO to C10 **No** Disconnect GB001 and reconnect EM062 GO to C9
C9: RENEW VALVE BODY ASSEMBLY	
	1 Renew the Valve Body Assembly; refer to 44.40.01.
	2 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** GO to C10
C10: END	
	1 Cycle the ignition ON - (OFF for 2 minutes) - ON, start the engine and run >1600 rpm
	Has the fault code cleared? **Yes** STOP **No** P0702 present? **Yes** GO to D1 **No**

	P0753, P0758, P0763 present? **Yes** Contact Jaguar Service

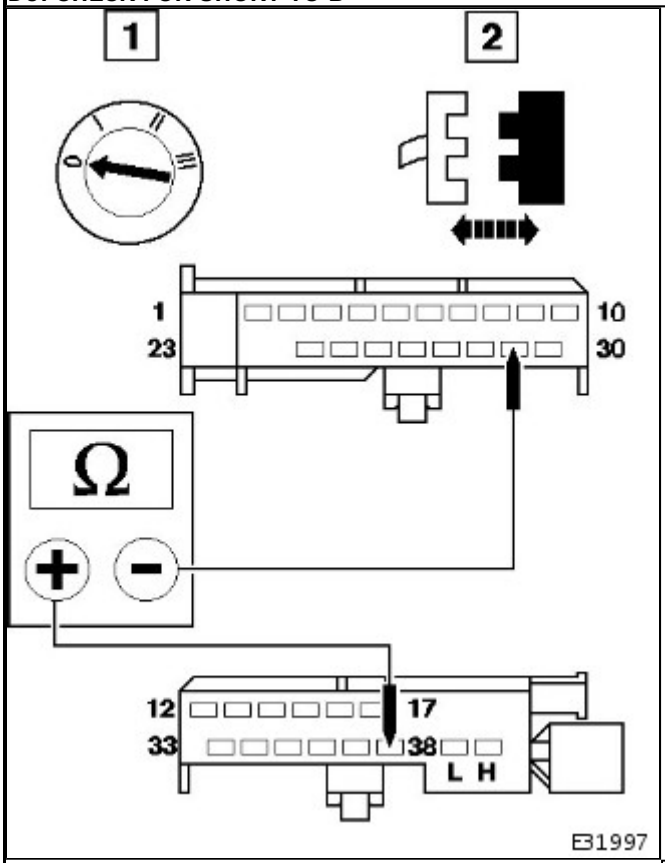
Pinpoint test D: P0702, P0748, P1748

PINPOINT TEST D : P0702, P0748, P1748	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to D2
D2: CHECK HARNESS +VE CONTINUITY	
	
	1 With EM062 and GB001 disconnected, measure the resistance between GB001/006 and EM062/038
	Is the resistance < 0.5 OHM? **Yes** GO to D3

No

Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

D3: CHECK FOR SHORT TO B+



1 With EM062 and GB001 disconnected, measure the resistance between EM062/038 and EM061/029

> 10 MOHM?

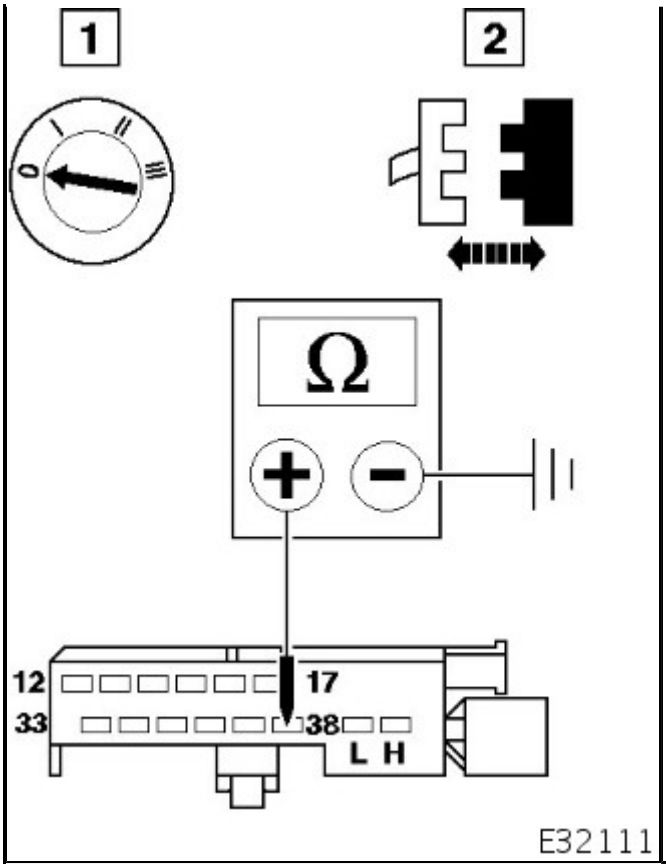
Yes

GO to D4

No

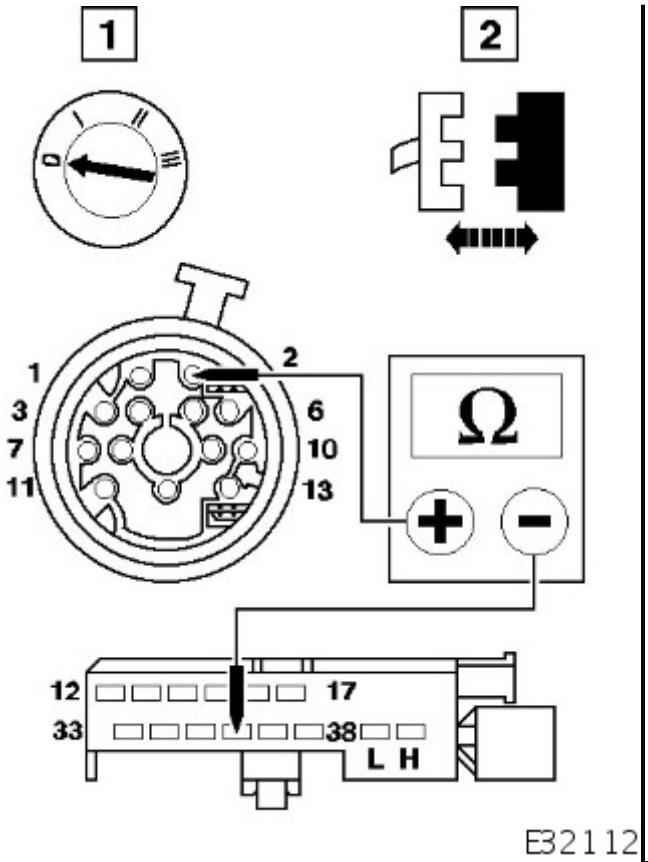
Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

D4: CHECK HARNESS SHORT TO GROUND



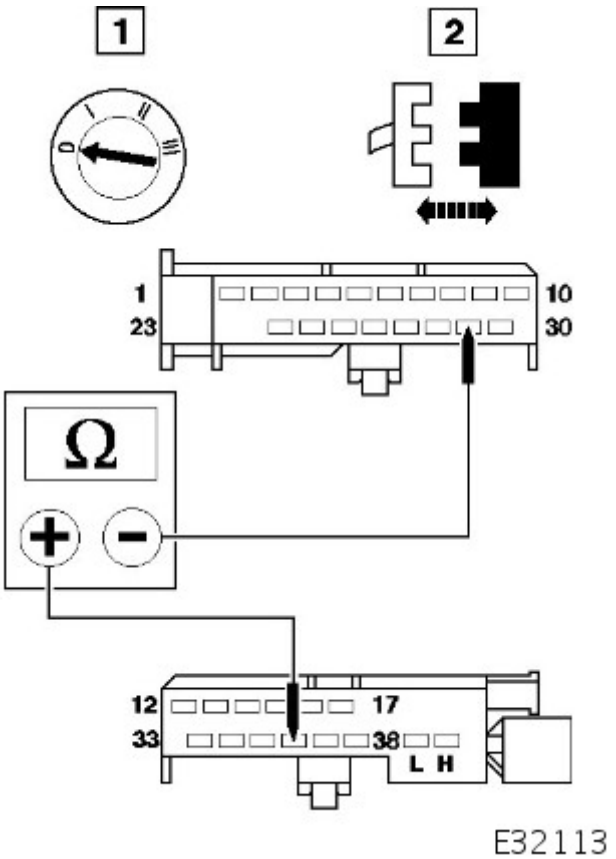
	1 With EM062 and GB001 disconnected, measure the resistance between EM062/038 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to D5 **No** Inspect EM062 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

D5: CHECK HARNESS CONTINUITY - PRESSURE REGULATOR



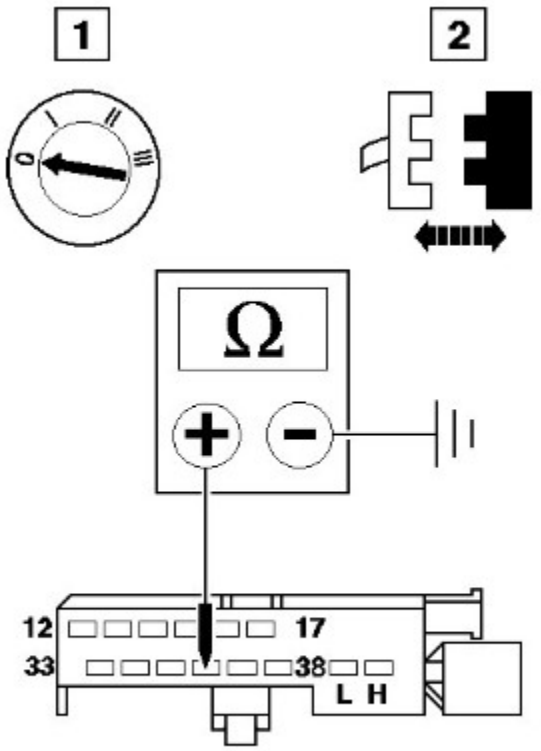
	1 With EM062 and GB001 disconnected, measure the resistance in turn: 2 EM062/036 and GB001/002 3 EM062/037 and GB001/010 Is the resistance < 0.5 OHM? **Yes** GO to D6 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

D6: CHECK FOR SHORT TO B+



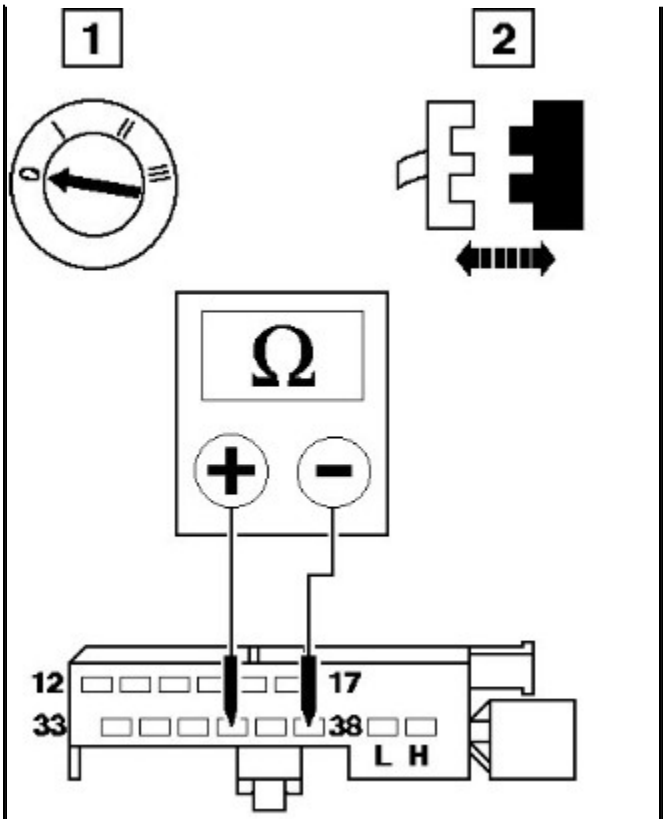
	1 With EM062 and GB001 disconnected, measure the resistance between EM062/036 and EM061/029
	2 Repeat for EM062/037 and EM061/029
	Is the resistance > 10M OHM? **Yes** GO to D7 **No** Inspect EM062 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

D7: CHECK HARNESS SHORT TO GROUND



	1 With EM062 and GB001 disconnected, measure the resistance between EM062/036 and EM008R
	2 Repeat for EM062/037 and EM008R
	Is the resistance > 10 MOHM? **Yes** GO to D8 **No** Inspect EM062 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

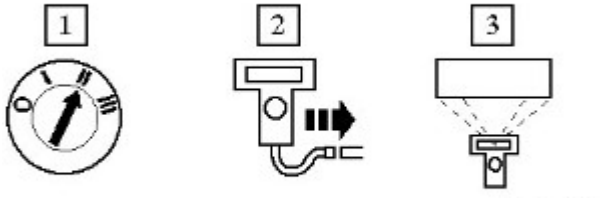
D8: CHECK INTERNAL HARNESS AND COMPONENT CONTINUITY - PRESSURE REGULATORS



	1 With EM062 disconnected, measure the resistance between the following, noting the relevant DTC
	2 For P0702 or P0748 EM062/38 and EM062/036
	3 For P0702 or P1748 EM062/38 and EM062/037
	Is the resistance 16 to 18 kOHM? **Yes** Reconnect EM062 GO to D9 **No** Renew the Valve Body Assembly; refer to 44.40.01. Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. GO to D9
D9: END	
	1 Cycle the ignition ON - (OFF for 2 minutes) - ON, start the engine and run >1600 rpm
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test E: P0702

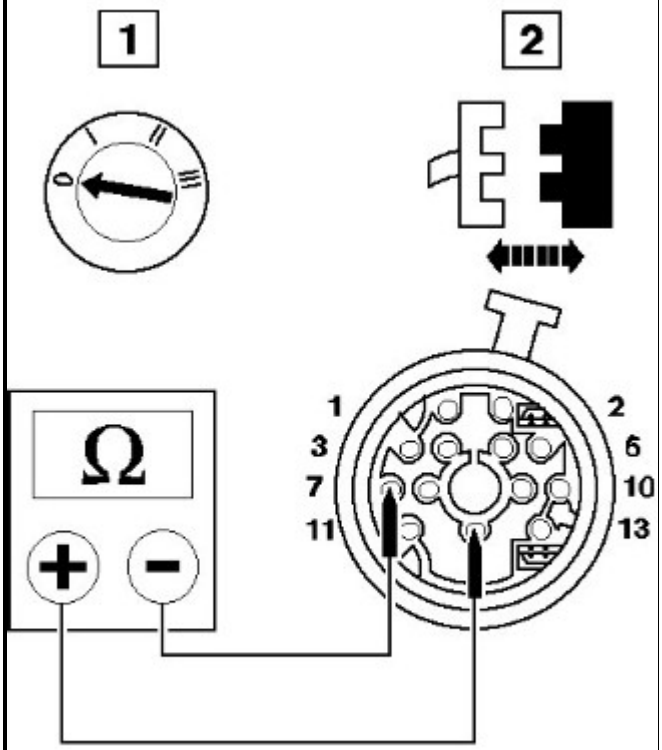
PINPOINT TEST E : P0702	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to E2

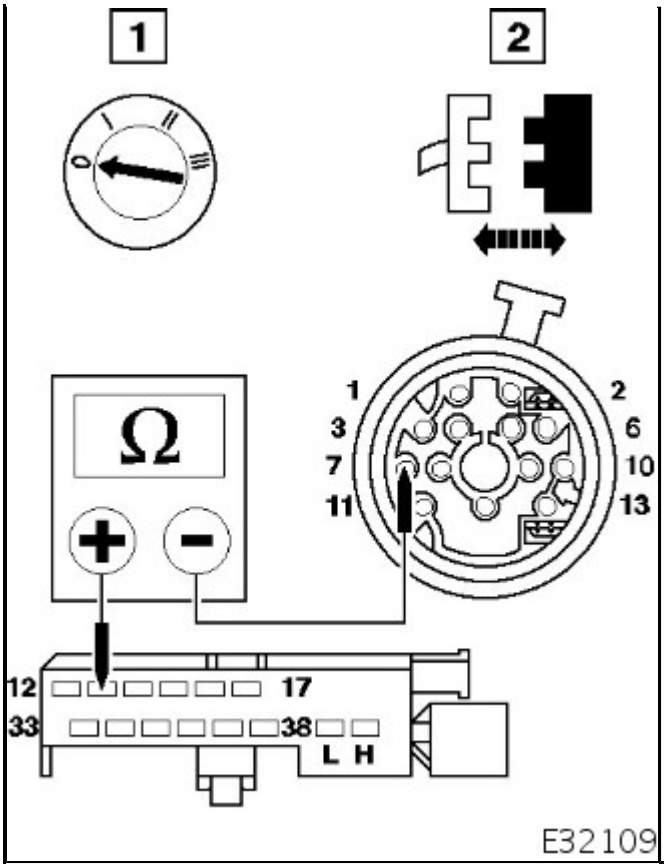
E2: CHECK SENSOR SUPPLY VOLTAGE



E32107

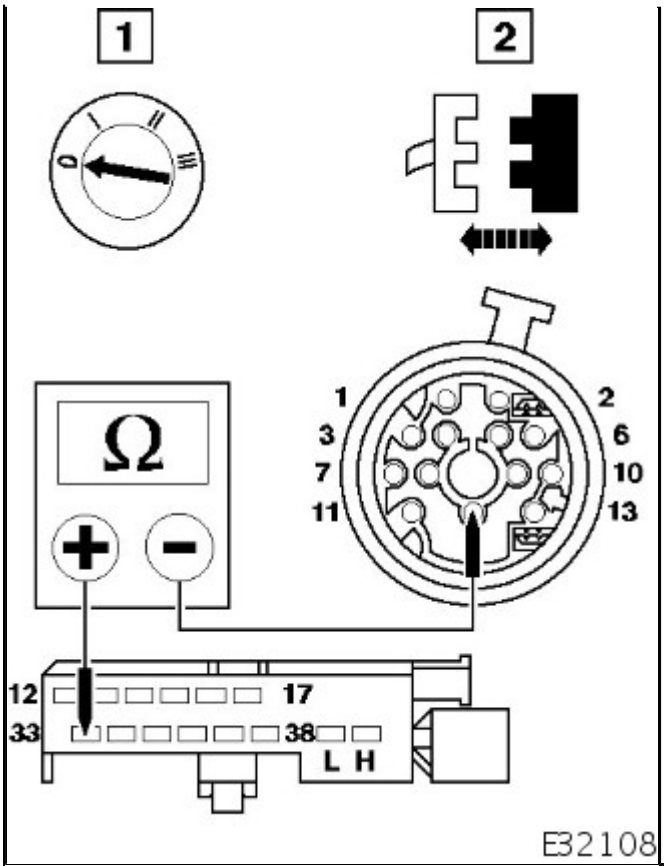
	1 With GB001 disconnected, measure the voltage between GB001/007 and GB001/012
	Is voltage B+? **Yes** Reconnect GB001 GO to E5 **No** GO to E3

E3: CHECK HARNESS +VE CONTINUITY



	1 With EM062 and GB001 disconnected, measure the resistance between GB001/007 and EM062/013
	Is the resistance < 0.5 OHM? **Yes** Reconnect GB001 GO to E4 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

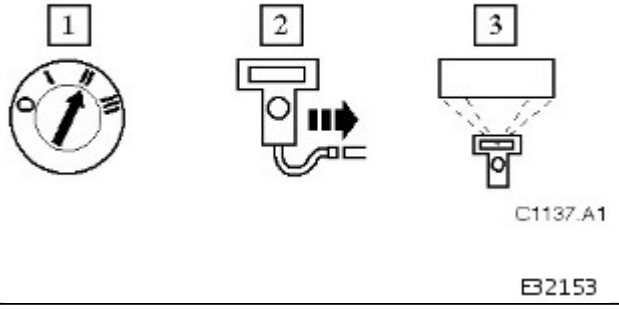
E4: CHECK HARNESS -VE CONTINUITY



	1 With EM062 and GB001 disconnected, measure the resistance between GB001/012 and EM062/033
	Is the resistance < 0.5 OHM? **Yes** GO to E5 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
E5: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

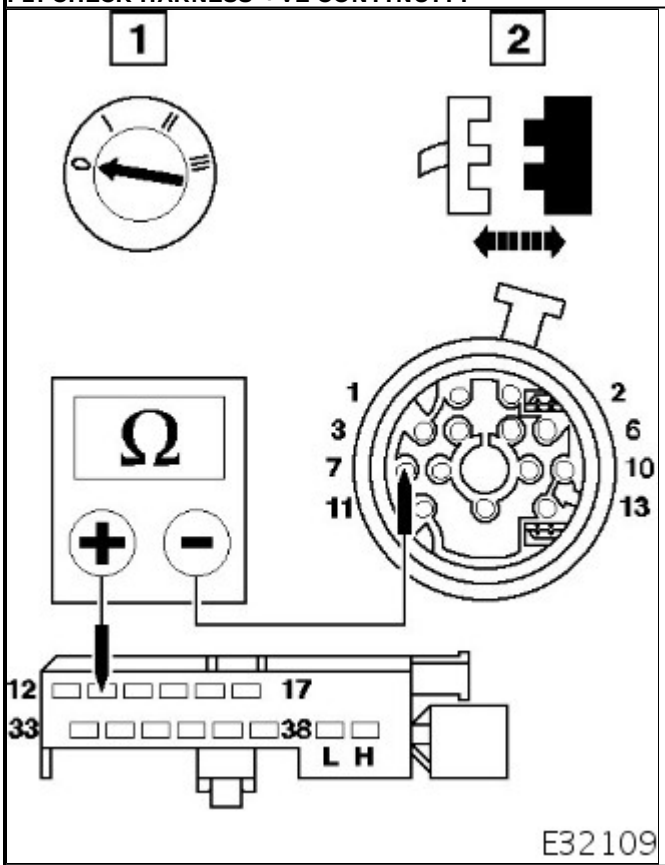
Pinpoint test F: P0715

PINPOINT TEST F : P0715	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



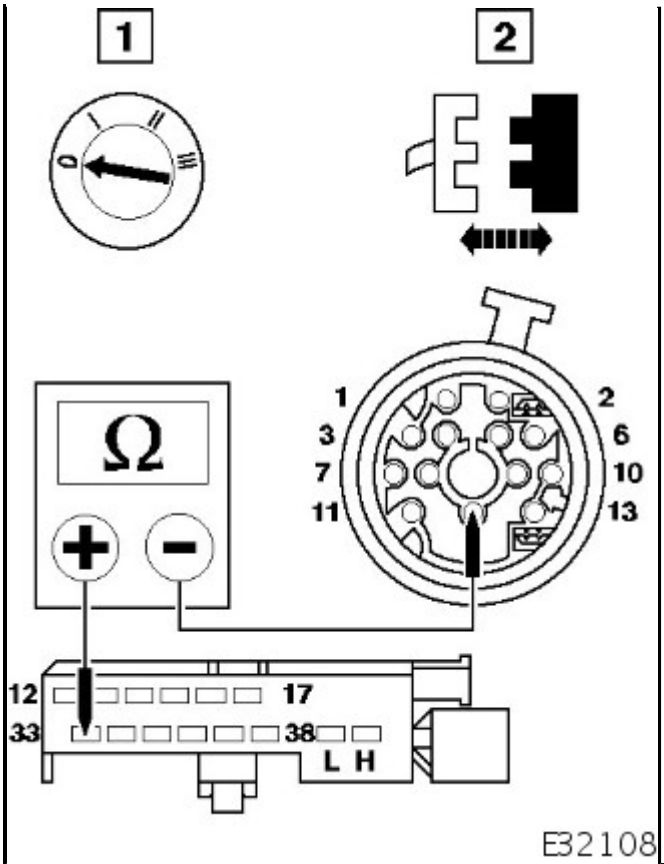
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to F2

F2: CHECK HARNESS +VE CONTINUITY

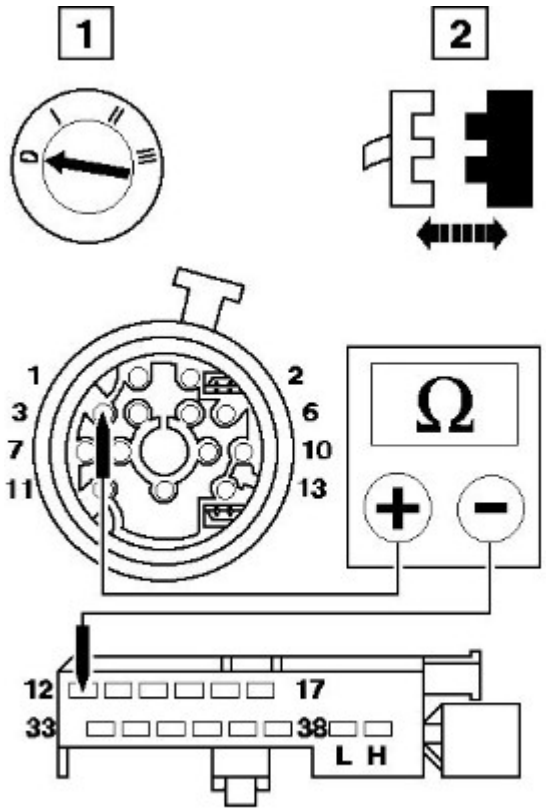


	1 With EM062 and GB001 disconnected, measure the resistance between GB001/007 and EM062/013
	Is the resistance < 0.5 OHM? **Yes** Reconnect GB001 GO to F3 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

F3: CHECK HARNESS -VE CONTINUITY

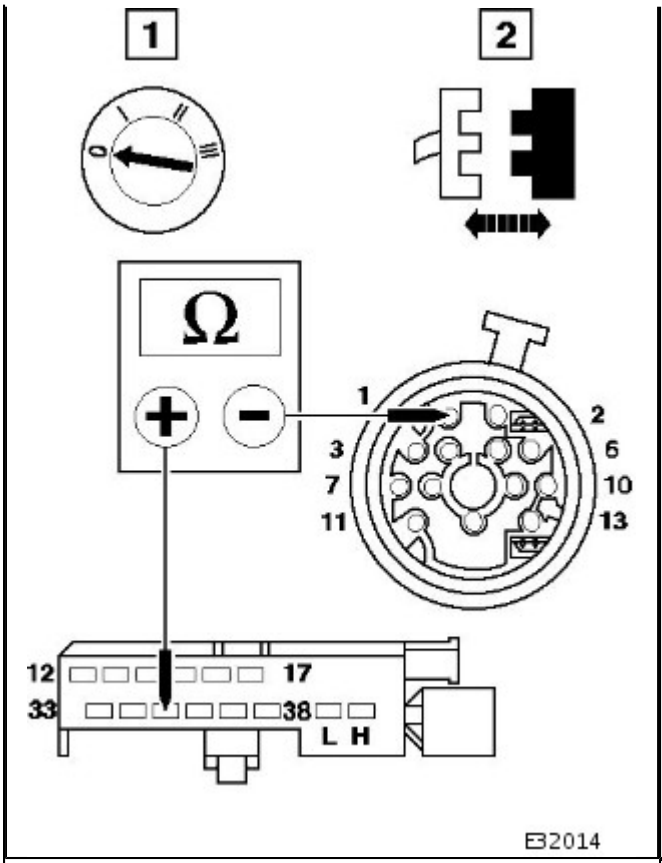


	1 With EM062 and GB001 disconnected, measure the resistance between GB001/012 and EM062/033
	Is the resistance < 0.5 OHM? **Yes** GO to F4 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
F4: CHECK SIGNAL CONTINUITY (N2 SPEED SENSOR)	



	1 With EM062 and GB001 disconnected, measure the resistance between GB001/003 and EM062/012
	Is the resistance < 0.5 OHM? **Yes** Reconnect GB001 GO to F5 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.

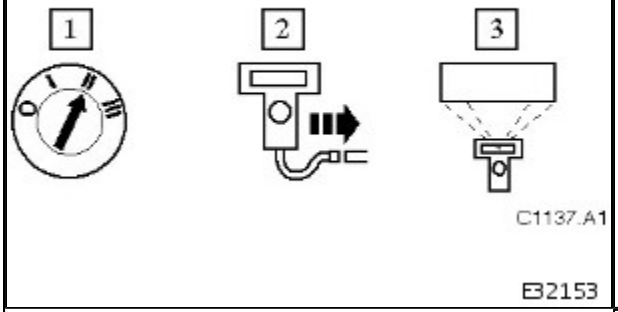
F5: CHECK SIGNAL CONTINUITY (N3 SPEED SENSOR)



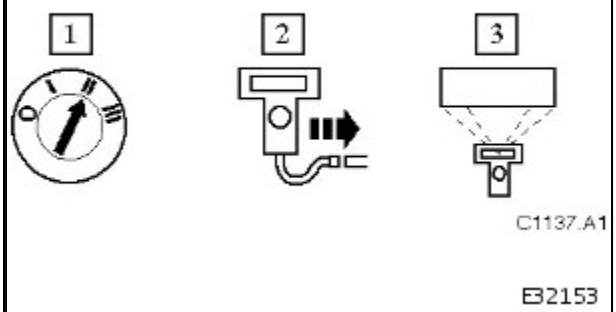
	1 With EM062 and GB001 disconnected, measure the resistance between GB001/001 and EM062/035
	Is the resistance < 0.5 OHM? **Yes** GO to F6 **No** Inspect EM062, EM044 and GB001 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
F6: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test G: P1601

PINPOINT TEST G : P1601	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: RETRIEVE DTCS	
• NOTE: Following ECM power-down, the DTC will be lost and may only be displayed when the ignition is energized.	

	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to G2
G2: RENEW TCM	
	1 Renew the TCM Has the TCM been renewed? **Yes** GO to G3
G3: END	
• NOTE: The following step must be carried out in order that system adaptions can take place.	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

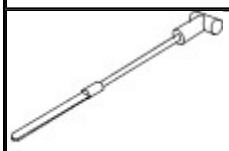
Pinpoint test H: P0730, P0780

PINPOINT TEST H : P0730, P0780	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool Have the DTC(s) and freeze frame data been recorded? **Yes** GO to H2
H2: RENEW VALVE BODY ASSEMBLY	
	1 Renew the valve body assembly 2 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC Has the fault code cleared?

	Yes STOP **No** GO to H3
H3: RENEW TRANSMISSION	
	1 Renew the transmission
	Has the transmission been renewed? **Yes** GO to H4
H4: END	
	1 Drive the vehicle for a period from cold to include idle, brisk acceleration and steady state cruising up to and including normal engine temperature. Check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Fluid Drain and Refill

General Procedures

Special Tool(s)	
 E31840	Dipstick 307-379

1. Disconnect the battery ground lead.

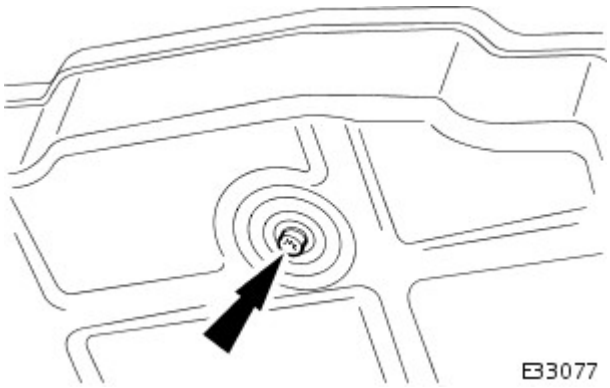
2. Raise the vehicle for access.

3. NOTE: This procedure will not remove residual fluid from the torque converter.

Drain the transmission fluid.

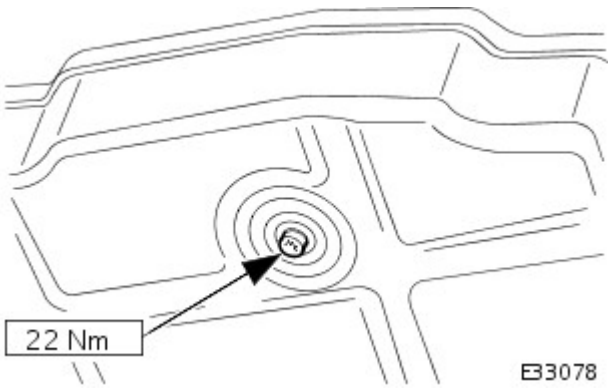
3. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED AND THAT THE RECEPTACLE FOR WASTE HAS SUFFICIENT CAPACITY.

- Carefully remove the drain plug and discard the sealing washer.



4. Refit the drain plug and tighten to the specified torque figure.

- Use a new sealing washer.

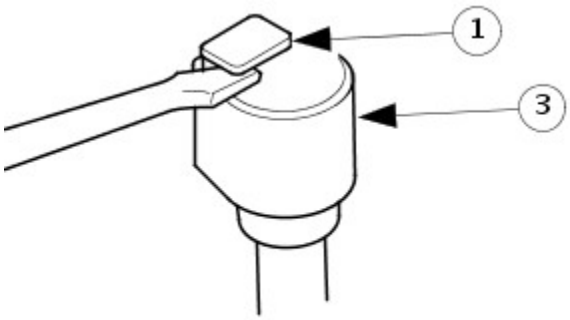


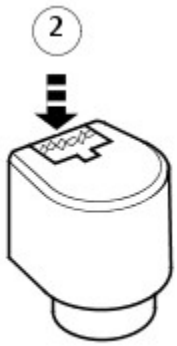
5. Connect the PDU to monitor the fluid temperature.

6. Access the dipstick tube.

1. Break off the dipstick tube plug locking plate.
2. Push the locking pin downward, into the plug.
3. Remove the dipstick tube plug.

- Push the locking pin through the tube plug and discard the pin.





E33079



E33080

7. CAUTION: It is essential that only the specified fluid is used.

Pour approximately 4,0 liters of fluid into the transmission.



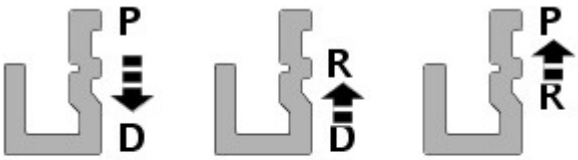
E33003

8. Select P and start the engine.

9. Pour approximately 3,0 liters of fluid into the transmission.



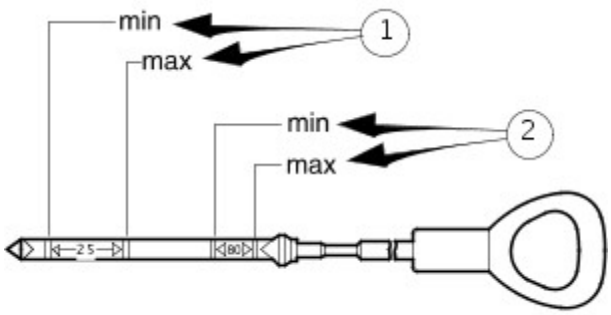
E33080



E33017

10. Cycle the gear selector:

- From P to D.
- From D to R.
- From R to P.

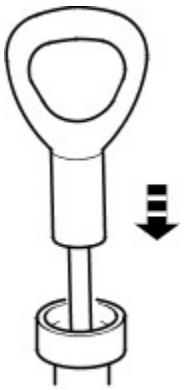


E33081

11. NOTE: Temperature will ONLY be displayed in D or R.

Check the transmission fluid temperature to select the appropriate dipstick calibration.

1. MAX and MIN marks at 25°C fluid temperature.
2. MAX and MIN marks at 80°C fluid temperature.



E33082

12. Check the transmission fluid level.

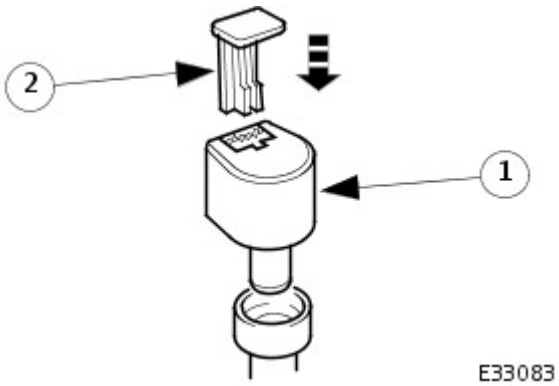
- Insert the dipstick (special tool 307 - 379) until it stops (tip contact with the fluid pan).
- Remove the dipstick and check the level.
  - NOTE: Only use a lint free cloth to wipe the dipstick.
- Repeat this operation.

13. Correct the fluid level as required, noting that excess fluid MUST be removed.

14. STOP the engine and remove the dipstick.

15. Seal the dipstick tube.

1. Seat the tube plug.
2. Engage and fully seat the new locking pin.



16. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Extension Housing Seal

In-vehicle Repair

Special Tool(s)	
 E31839	Oil seal replacer 307-378
 E36392	Driveshaft wrench 205-053

Removal

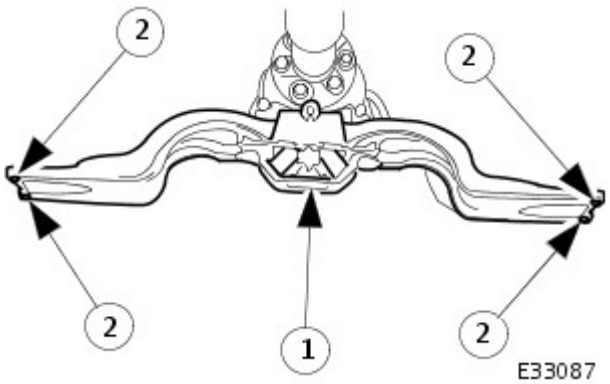
1. Disconnect the battery ground lead.

2. Select N and choc the road wheels.

3. Remove the front muffler, refer to Operation 30.10.18.

4. Remove the engine rear mounting bracket.

1. Support the transmission.
2. Remove the bolt, engine rear mounting to transmission.
3. Remove the four bolts which secure the mounting cross member to the body.



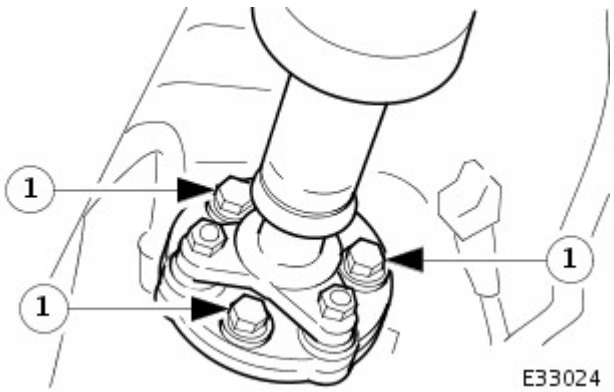
E33087

5. Detach the driveshaft from the transmission drive flange.

1. If the transmission is to be refitted, mark the position of the coupling relative to the drive flange.

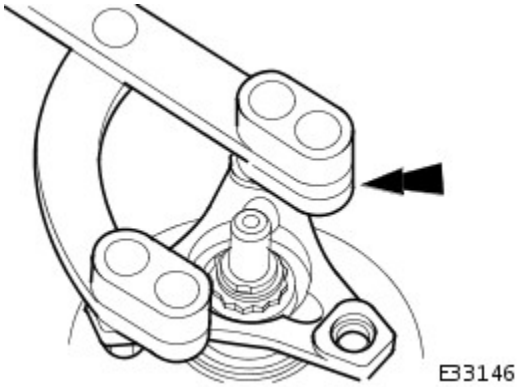
5. CAUTION: Under no circumstances remove the driveshaft to flexible coupling fixings.

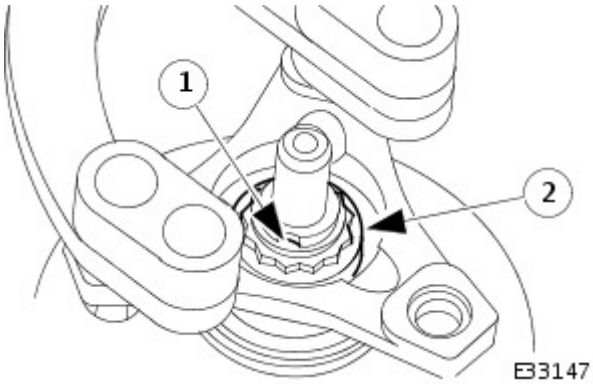
2. Remove the three bolts, transmission drive flange to flexible coupling.



E33024

6. Secure the driveshaft wrench 205 - 053 to the output shaft flange.

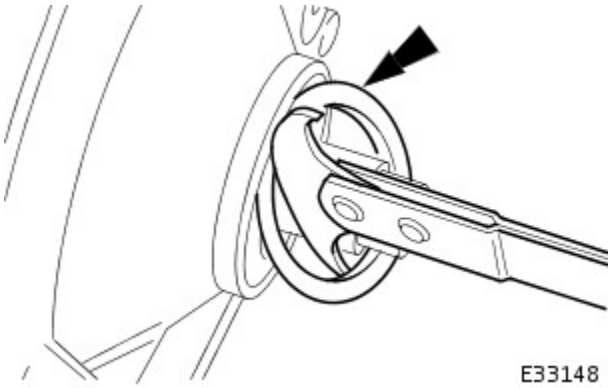




7. Remove the output shaft flange.

1. Using a suitable tool, relieve the 'staked' portion from the output shaft keyway.
2. Remove and discard the flange nut using a suitable socket and resisting rotation with special tool 205 - 053.

- Check the flange seal diameter for damage and renew if necessary.

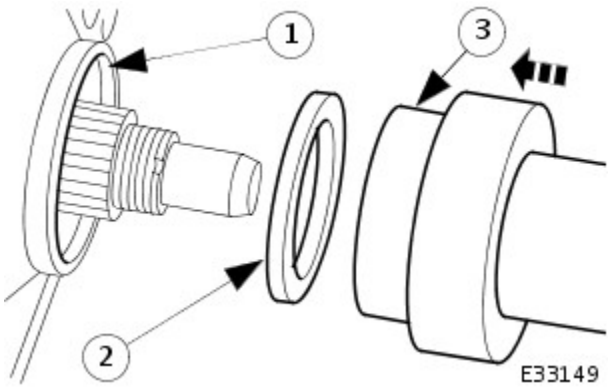


8. Remove and discard the oil seal.

- Use a proprietary seal removing tool, taking care NOT to damage either the shaft or the housing.

Installation

1. Installation is the reverse of the removal procedure noting the following:

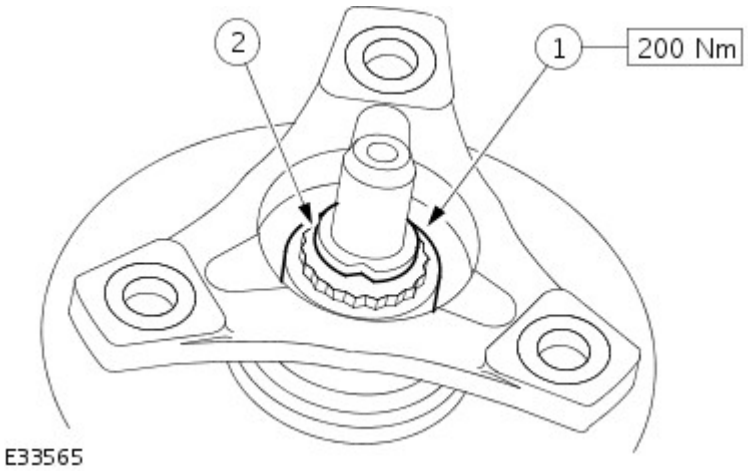


2. Fit the oil seal.

1. Lubricate the housing seal bore.
2. Lubricate the outside diameter of the seal.
3. Using seal replacer 307-378 drive the seal squarely into position.

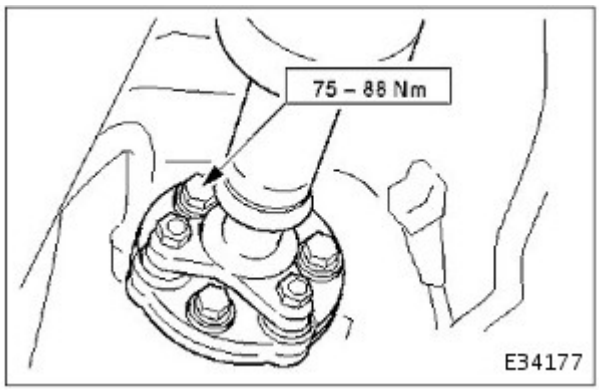
3. Refit the drive flange.

1. Use a new nut. Tighten the flange nut to

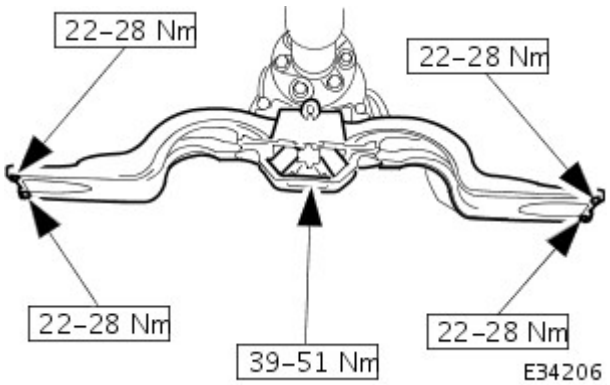


the specified torque figure.

2. Stake the nut to the output shaft.



4. Refit the bolts securing the driveshaft and tighten to the specified torque figure.



5. Refit the the rear mounting crossmember and tighten the securing bolts to the specified torque figures.

6. Refer to Operation 44.24.02 for fluid fill procedure.

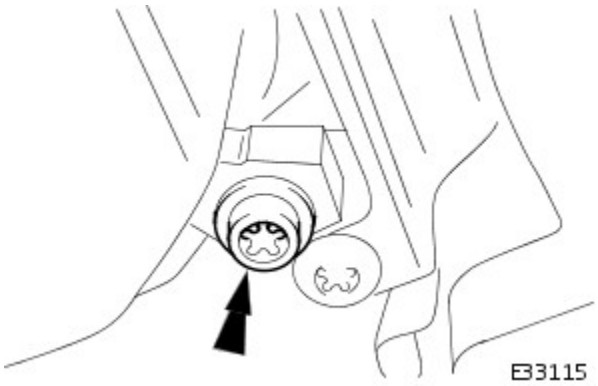
7. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Main Control Valve Body

In-vehicle Repair

Removal

• NOTE: This procedure will not remove residual fluid from the torque converter.



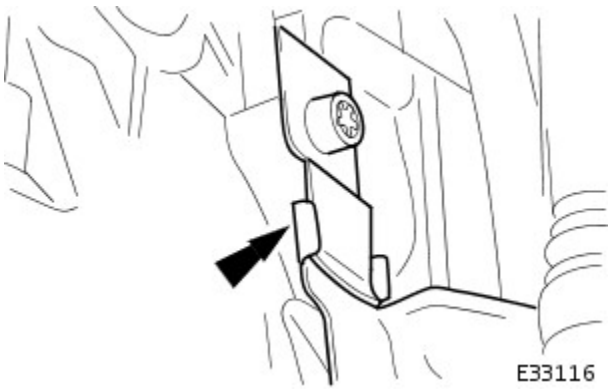
1. Disconnect the battery ground lead.

2. Raise the vehicle for access.

3. Remove the RH catalytic converter; refer to Operation 17.50.10.

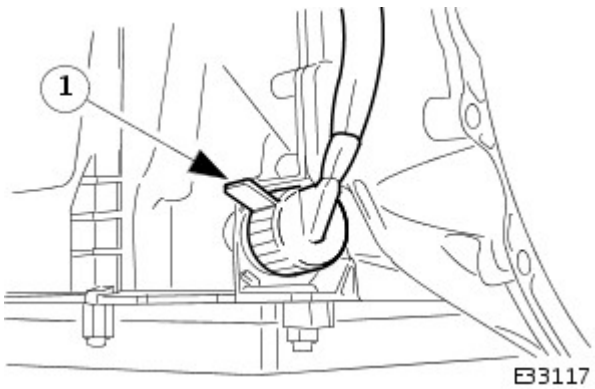
4. Remove the harness heatshield lower fixing.

- Remove the screw heatshield / fluid pan clamp.



5. Remove the harness heatshield.

- Pull the heatshield from under the clip.

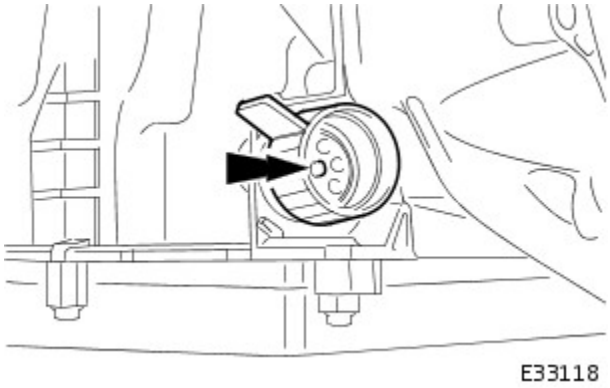


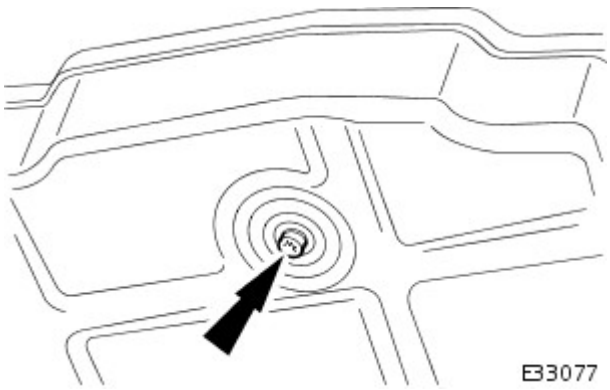
6. Disconnect the transmission link harness connector.

1. Release the locking lever.

7. Release the (transmission case mounted) female connector.

- Remove the (center) retaining bolt.



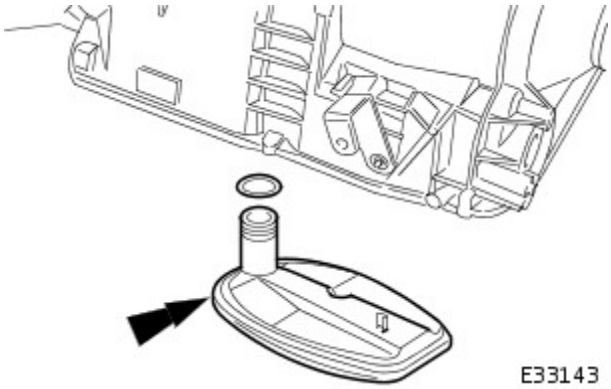


8. Drain the transmission fluid.

8. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED AND THAT THE RECEPTACLE FOR WASTE HAS SUFFICIENT CAPACITY.

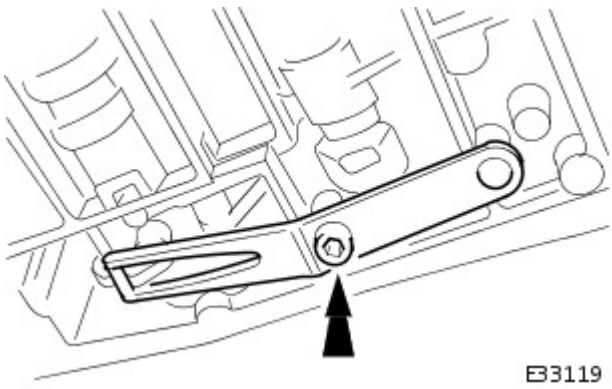
- Carefully remove the drain plug and discard the sealing washer.

9. Remove the fluid pan; refer to Operation 44.24.05,



10. Remove the fluid filter.

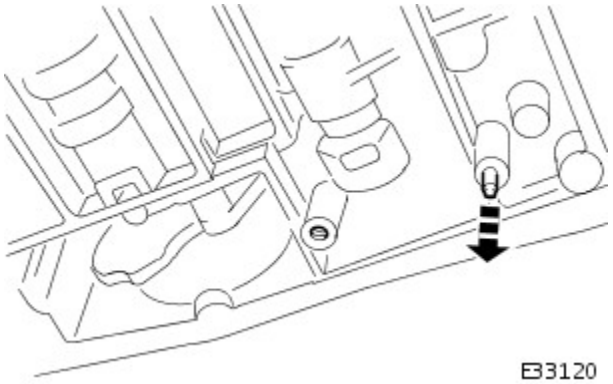
- Pull the filter squarely to disengage the pick-up 'O' ring and location tang - there is NO mechanical retention.

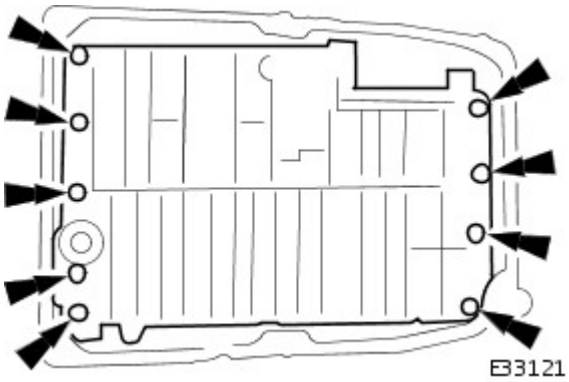


11. Remove the selector detent leaf spring.

- Remove the screw.

12. Remove the dowel - leaf spring to valve body.





13. Remove the valve body assembly.

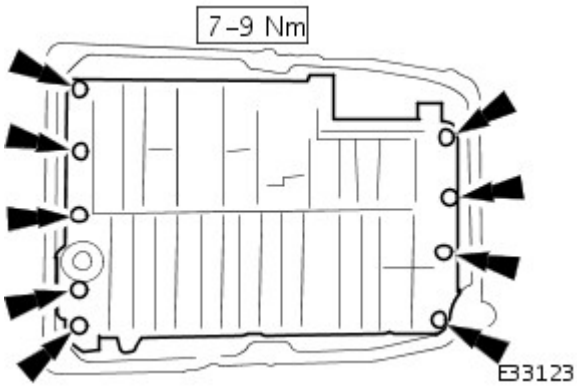
- Remove the nine bolts which retain the valve body to the transmission case.

Installation

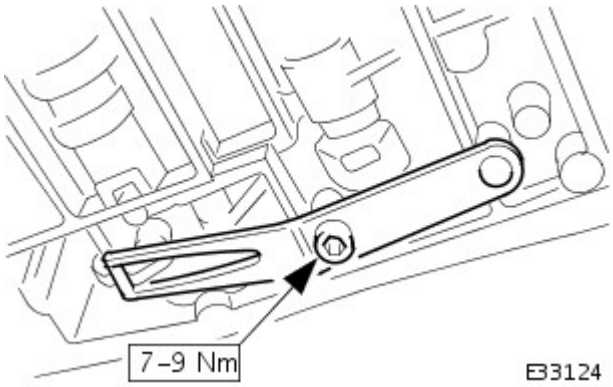
1. Installation is the reverse of the removal procedure, noting the following:

2. Clean all mating faces and relevant parts.

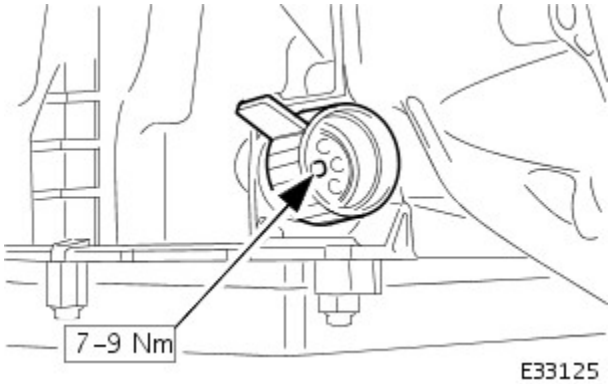
3. Tighten the nine bolts securing the valve body, to the specified torque figure.



4. Refit the dowel (leaf spring to valve body) and the leaf spring. Fit and tighten the securing bolt to the specified torque figure.



5. Tighten the centre retaining bolt of the electrical connector to the specified torque figure.

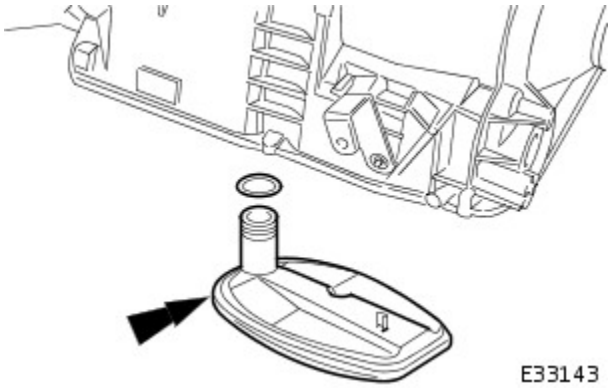


6. Refer to Operation 44.24.02 for fluid fill procedure.

7. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Fluid Filter

In-vehicle Repair



1. Disconnect the battery ground lead.
2. Raise the vehicle for access.
3. Remove the fluid pan, refer to Operation 44.24.04.
4. Remove the fluid filter.
   - Pull the filter squarely to disengage the pick-up 'O' ring and location tang - there is NO mechanical retention.

Installation

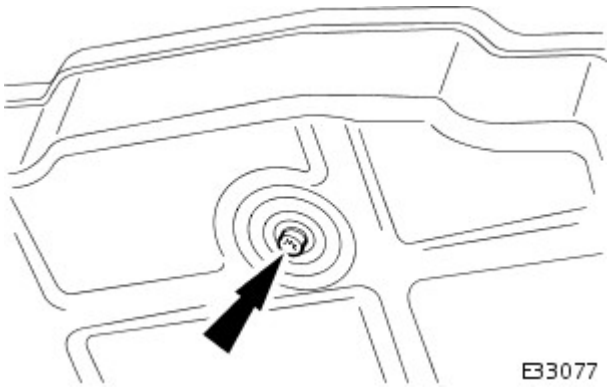
1. Installation is the reverse of the removal procedure noting that:
2. Renew the 'O' ring.
3. Refer to Operation 44.24.02 for fluid fill procedure.
4. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Fluid Pan Gasket

In-vehicle Repair

Removal

• NOTE: This procedure will not remove residual fluid from the torque converter.



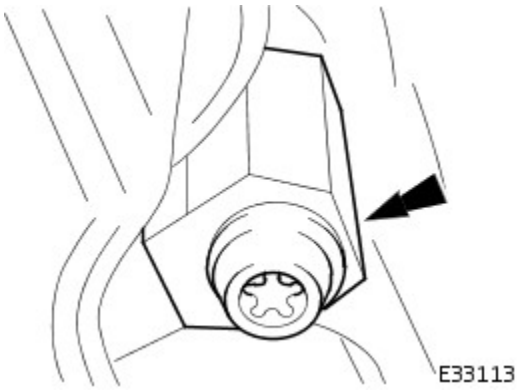
1. Disconnect the battery ground lead.

2. Raise the vehicle for access.

3. Drain the transmission fluid.

3. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED AND THAT THE RECEPTACLE FOR WASTE HAS SUFFICIENT CAPACITY.

- Carefully remove the drain plug and discard the sealing washer.

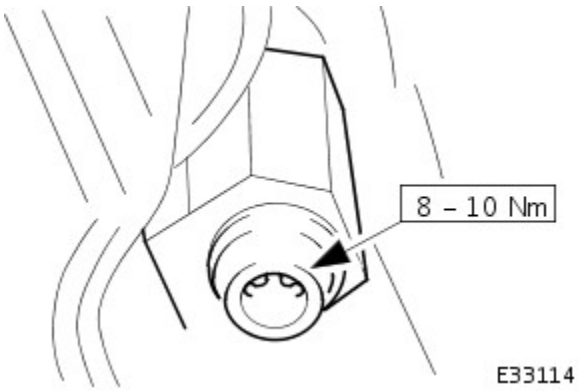


4. Remove the fluid pan.

• NOTE: The harness heatshield upper edge is retained by a clip.

- Remove the six bolts and clamps which secure the fluid pan to the transmission.

Installation

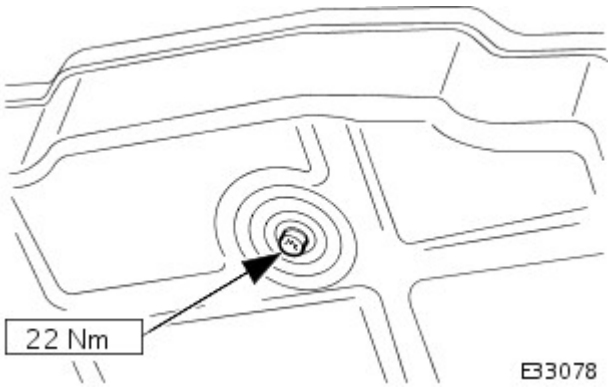


1. Installation is the reverse of the removal procedure.

- Tighten the fluid pan retaining bolts to the specified torque figure.

2. Refit and tighten the drain plug to the specified torque figure.

- Use a new sealing washer.



3. Refer to Operation 44.24.02 for fluid fill procedure.

4. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Internal Wiring Harness Electrical Connector O-Ring Seals

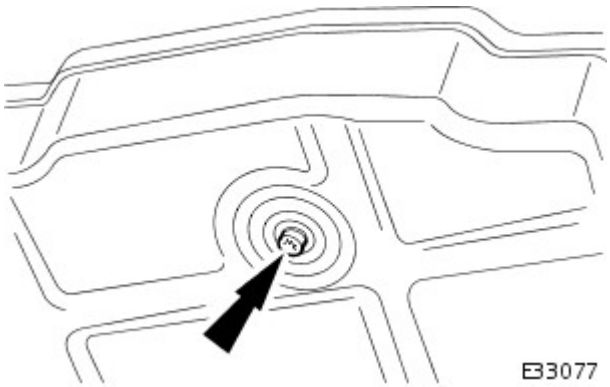
In-vehicle Repair

Removal

1. Disconnect the battery ground cable.

2. Open the engine compartment and fit paint protection sheets.

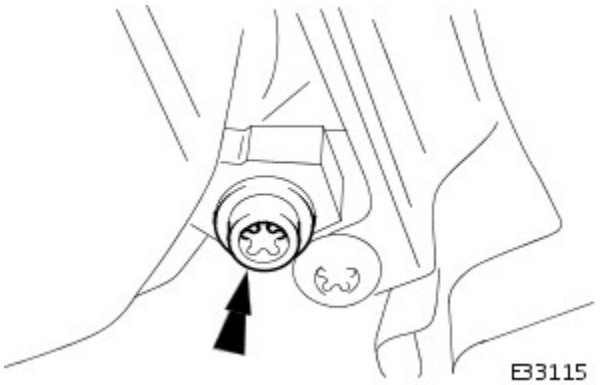
3. Raise the vehicle for access.



4. WARNING: TRANSMISSION FLUID MAY CAUSE SEVERE BURNS, ENSURE THAT ALL SAFETY PROCEDURES ARE OBSERVED AND THAT THE RECEPTACLE FOR WASTE HAS SUFFICIENT CAPACITY.

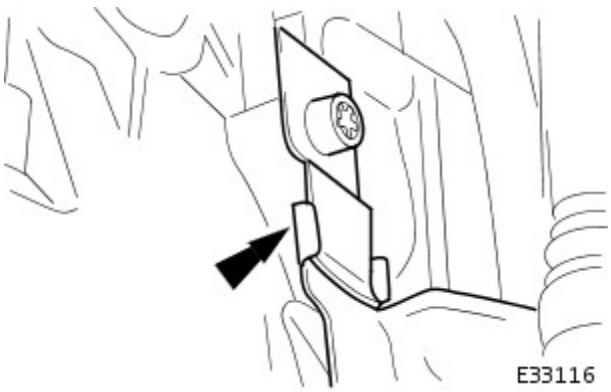
Drain the transmission fluid.

- Carefully remove the drain plug and discard the sealing washer.



5. Remove the harness heatshield lower fixing.

- Remove the screw heatshield / fluid pan clamp.

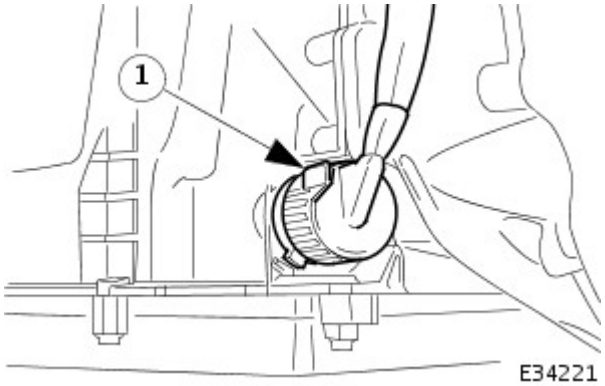


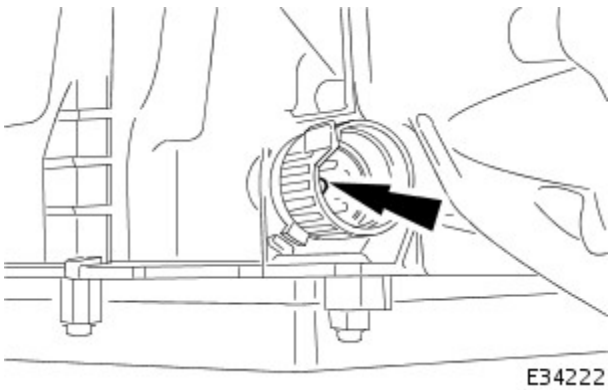
6. Remove the harness heatshield.

- Pull the heatshield from under the clip.

7. Disconnect the transmission link harness connector.

1. Release the locking lever on the guide bush and disconnect the harness connector.





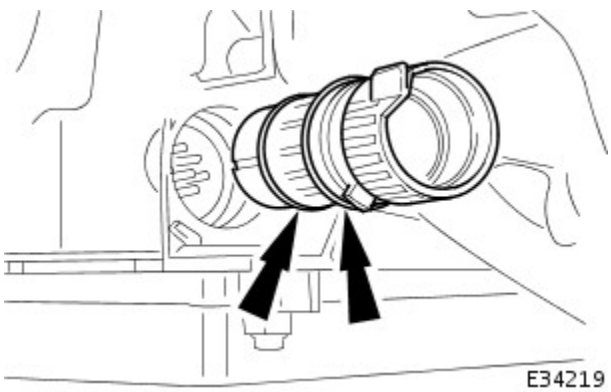
8. Release the connector guide bush from the transmission case.

- Release the (center) retaining bolt; remains captive in the guide bush.



9. Remove the guide bush from the transmission casing.

- Very carefully, pry the guide bush from the transmission casing using a screwdriver against the cast lug on the casing.



10. Remove and discard the sealing rings.

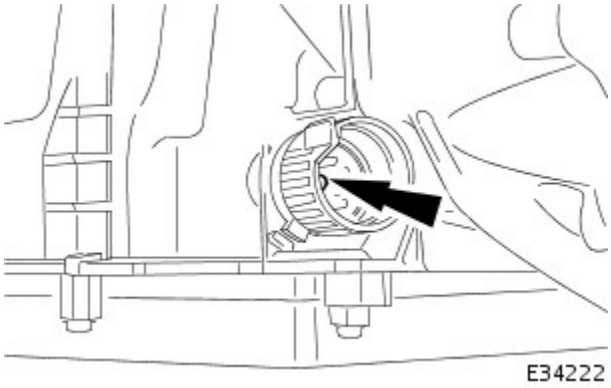
- Note the position and size of each ring.

Installation

1. Installation is the reverse of the removal procedure, noting the following:

2. Clean all mating faces and relevant parts.

3. Lubricate the new sealing rings using clean transmission fluid.



4. Tighten the centre retaining bolt of the electrical connector guide bush to 2.25 to 2.75 Nm.

5. Perform the Battery Reconnection Procedure described in Operation 86.15.15.

6. Refer to Operation 44.24.02 for fluid fill procedure.

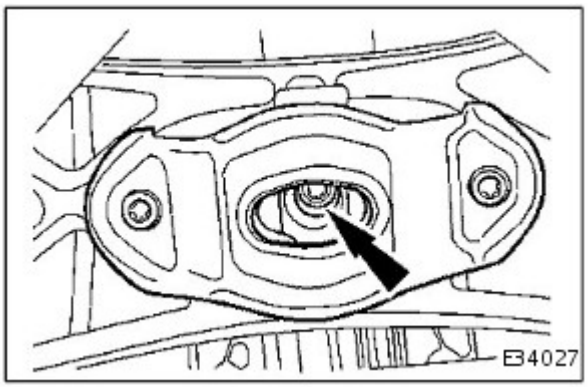
7. Check for leaks and remove spilt fluid.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission Support Insulator

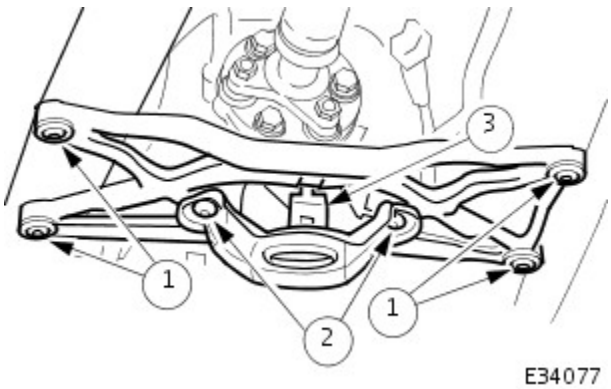
In-vehicle Repair

Removal

1. Raise the vehicle on a ramp to a suitable height for working on the rear mounting.
2. Remove the bolt which secures the engine rear mounting rubber to the transmission.

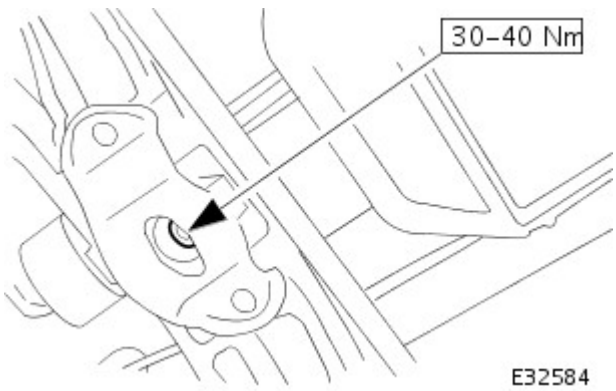


3. Position a transmission jack under the transmission casing. Take the weight of the transmission on the jack.
4. Remove the rear mounting rubber.

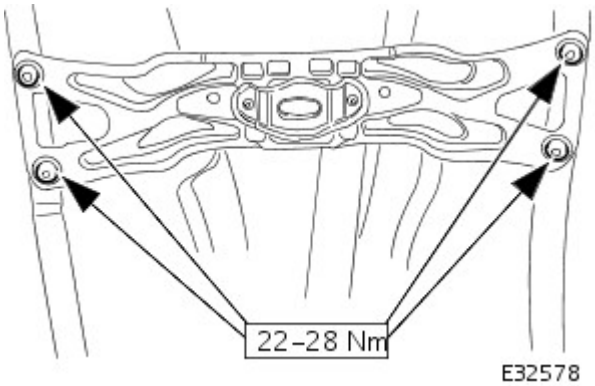


1. Slacken the four bolts which secure the rear crossmember to the vehicle floor.
2. Remove the two bolts which secure the mounting rubber to the crossmember.
3. Remove the mounting rubber.

Installation



1. Fit the mounting rubber assembly to position and tighten the centre bolt to 30-40 Nm .
2. Tighten the crossmember to body bolts and the mounting rubber to crossmember bolts to 22-28 Nm.


22–28 Nm
E32578

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission

Removal

Special Tool(s)	
 E36400	Engine support 303-021
 E36403	Engine lifting brackets 303-536

Removal

1. Select N gear position.

2. Disconnect the battery ground lead.

3. Remove the engine covers. Refer to Operation 12.30.06.

4. Remove the air intake tube, MAFM and air cleaner cover assembly. Refer to Operation 19.10.30.

5. Disconnect the transmission link lead connector.

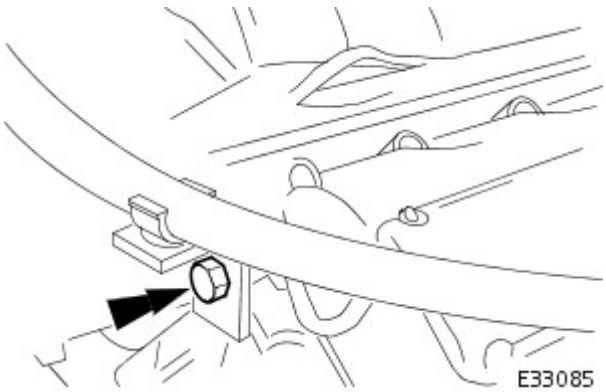
1. Release the connector from its mounting bracket.

2. Disconnect the multiplug.

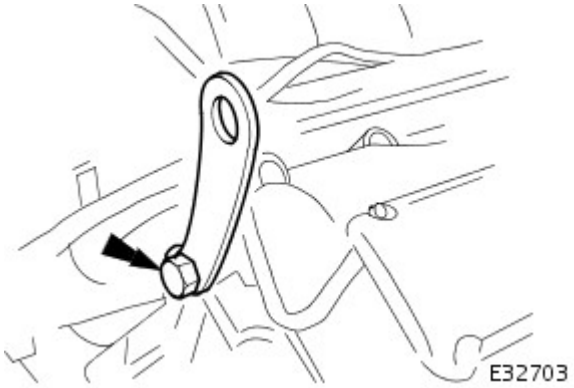


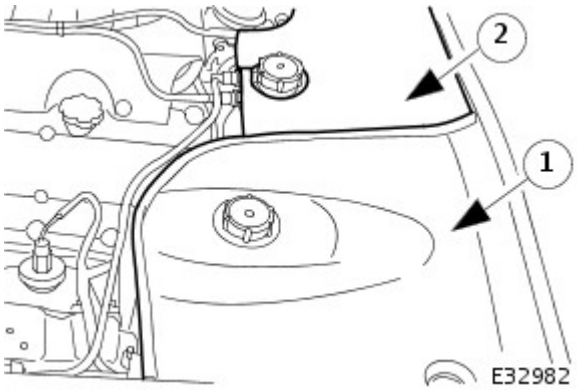
6. Remove the EMS harness mounting bracket.

- Release the bolt, bracket to cylinder head.



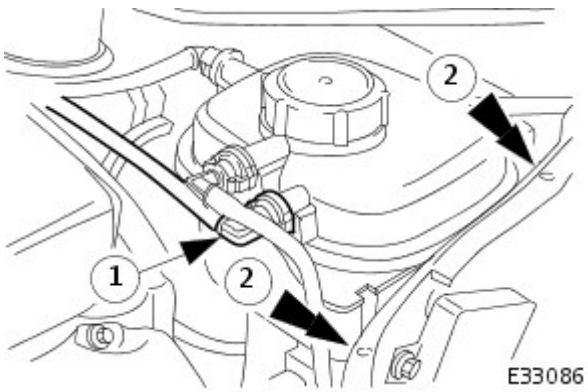
7. Fit engine lifting bracket 307 - 536 at the rear RH.





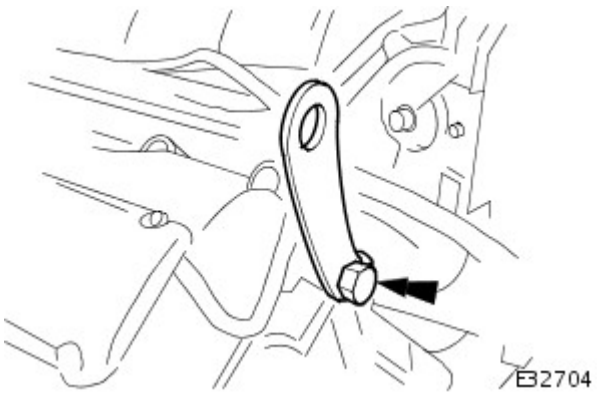
8. Remove the centre trim panel from the engine compartment.

1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.



9. Move the coolant header tank for access.

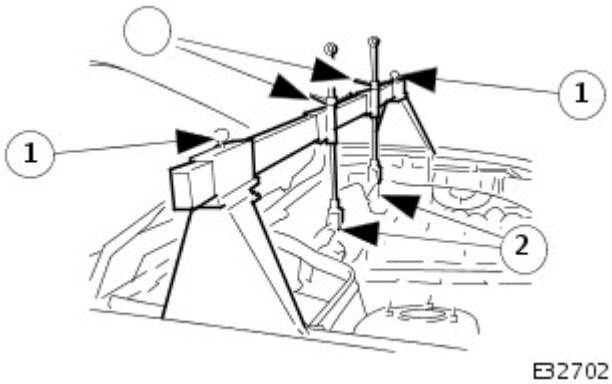
1. Disconnect the bleed pipe, header tank to radiator .
2. Remove the header tank fixings.



10. Fit engine lifting bracket 307 - 536 at the rear LH.

11. Support the engine using 307 - 021.

1. Adjust and locate the side support brackets to fit into the LH and RH body channels and tighten the beam fixings.
2. Engage the support hooks into the engine rear lifting



brackets.

3. Tighten the support hook adjusters to take the weight of the engine.

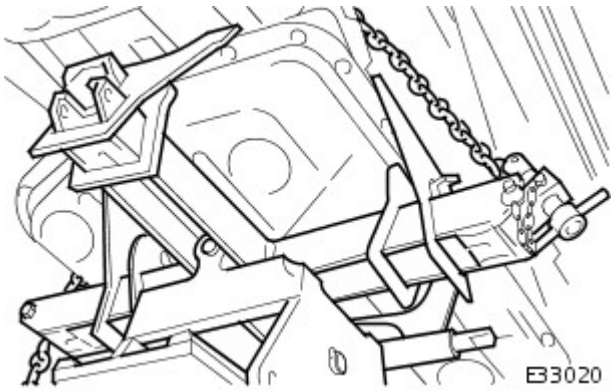
12. Raise the vehicle for access.

13. Remove the LH downpipe catalytic converter. Refer to Operation 17.50.09.

14. Remove the front muffler. Refer to Operation 30.10.18.

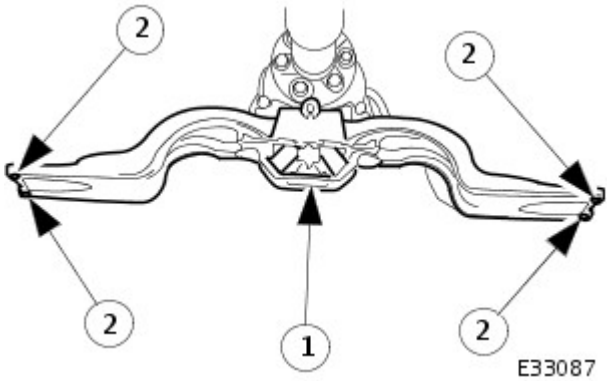
15. Remove the RH downpipe catalytic converter. Refer to Operation 17.50.09 and 17.50.10.

16. Drain the transmission fluid. Refer to Operation 44.24.02.



17. Locate an Epco V-100, or similar lift, under the transmission unit.

- Adjust the angle of the lift to suit the transmission.
- Secure the side clamps.
- Pass the safety chain over the transmission unit and tighten the clamp to secure the assembly.



18. Remove the rear engine mounting bracket.

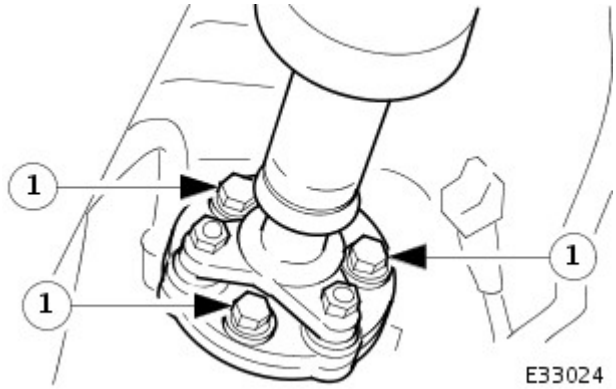
1. Remove the centre bolt from the engine/transmission mounting.
2. Remove the four bolts which secure the mounting bracket to the body.

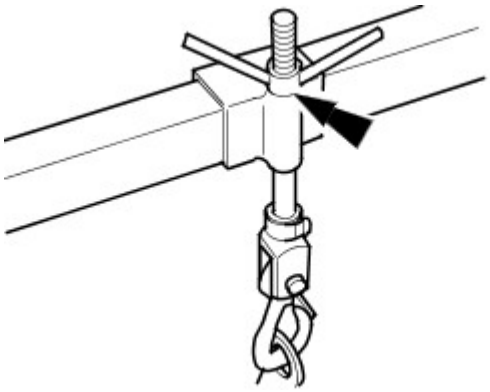
19. Detach the driveshaft (prop-shaft) from the transmission drive flange.

- If the transmission is to be refitted, mark the position of the coupling relative to the drive flange.

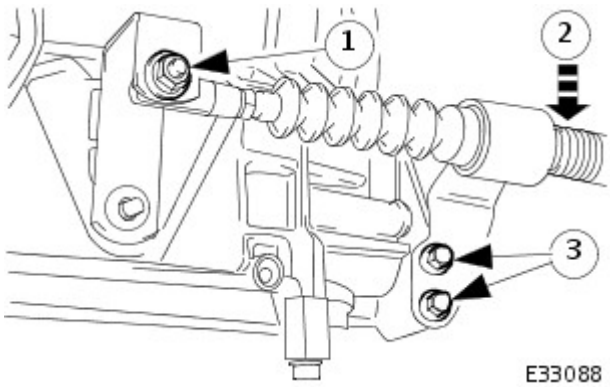
19. CAUTION: Under no circumstances remove the driveshaft to flexible coupling fixings.

1. Remove the transmission drive flange to flexible coupling fixings.



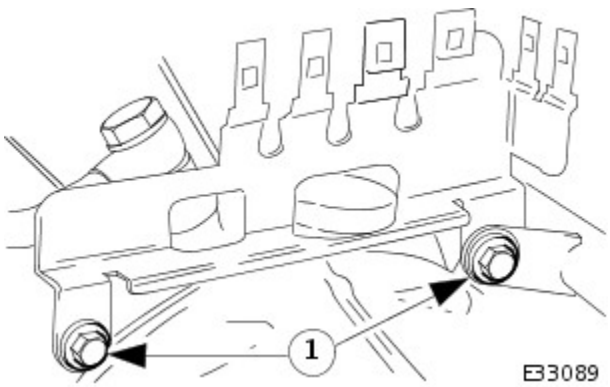


20. Lower the transmission unit.



21. Detach the gear selector cable from the transmission unit.

1. Remove the selector cable ball pin to selector lever nut.
2. Lower the transmission lift for access.
3. Remove the selector cable to transmission casing bolts.

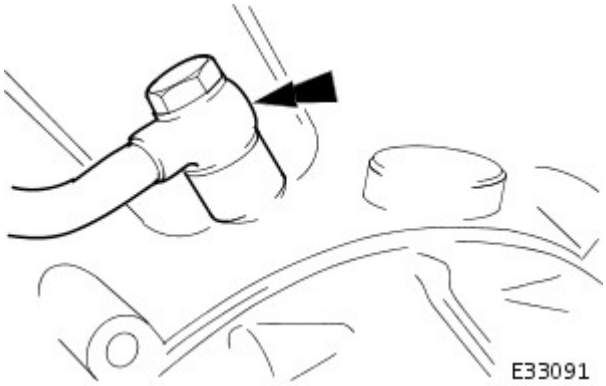


22. Release the transmission harness multiplug bracket.

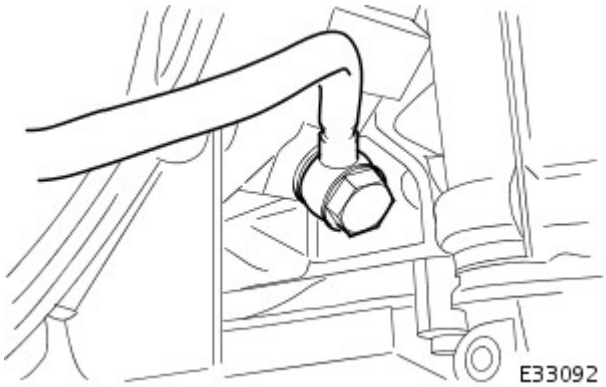
1. Remove the two bolts which secure the bracket to the transmission case, noting that one bolt also retains the dipstick tube.

23. Disconnect the fluid cooler upper pipe.

- Remove the bolt which secures the pipe to the cylinder block and remove the bracket.
- Remove the 'banjo' bolt.

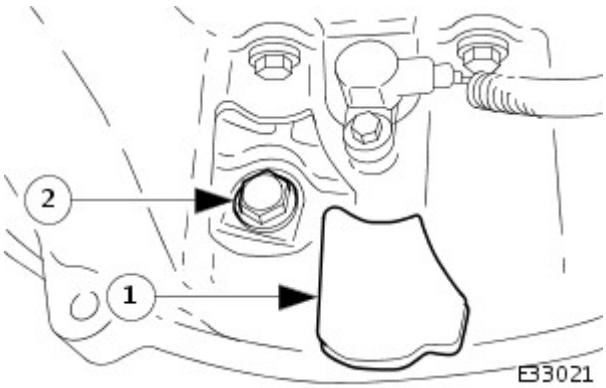


- Discard the Dowty seals.
- Fit blanking plugs to the pipe and transmission.



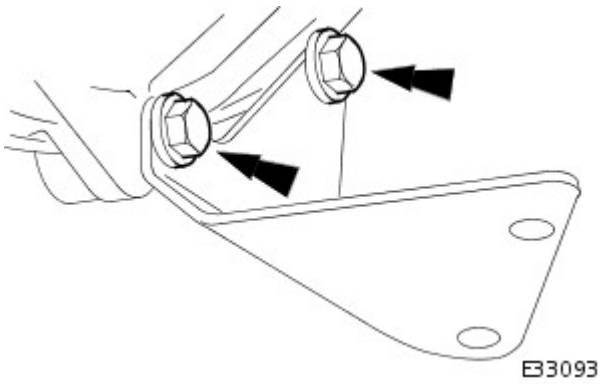
24. Disconnect the fluid cooler lower pipe.

- Remove the 'banjo' bolt.
- Discard the Dowty seals.
- Fit blanking plugs to the pipe and transmission.



25. Remove the three bolts which secure the torque converter to the drive plate.

1. Remove the access cover.
2. Rotate the crankshaft for access to each bolt and hold to prevent movement. Remove each bolt.



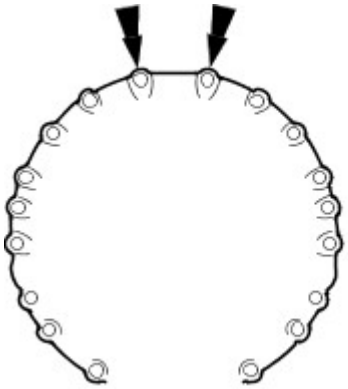
26. Remove the LH and RH catalyst mounting brackets from the transmission case.

- Remove the two bolts from each side.

27. On the RH side, clear the cooler pipe for access.

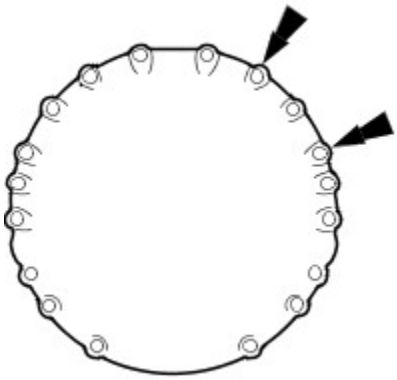
28. NOTE: Viewed from the rear of the vehicle.

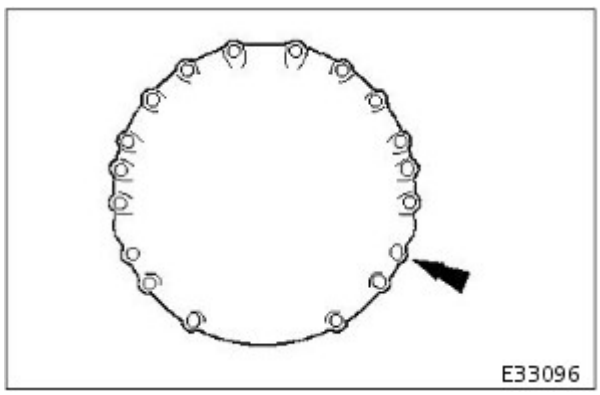
Remove the two upper bolts, as indicated, transmission to engine.



29. NOTE: Viewed from the rear of the vehicle.

Remove the two bolts which secure the starter motor power cable clip.





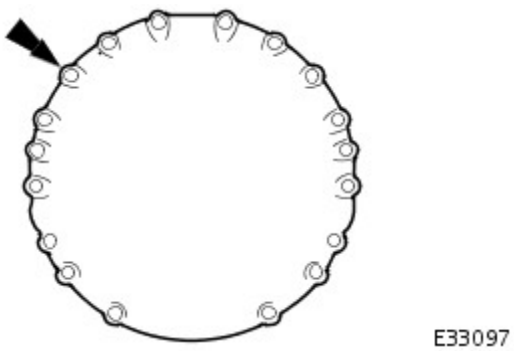
30. NOTE: Viewed from the rear of the vehicle.

Remove the ground lead bolt.

31. On the LH side.

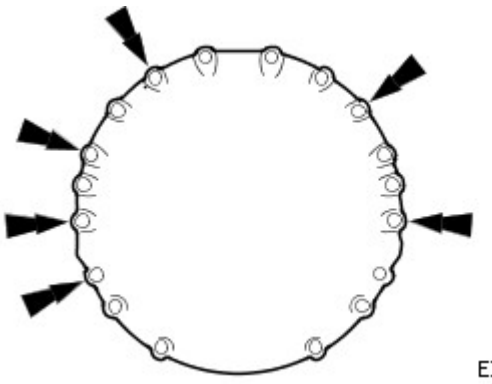
32. NOTE: Viewed from the rear of the vehicle.

Remove the bolt which secures the cooler upper pipe clip to the transmission case.



33. NOTE: Viewed from the rear of the vehicle.

Remove the six remaining bolts from the transmission case to cylinder block.


E33098


E33099

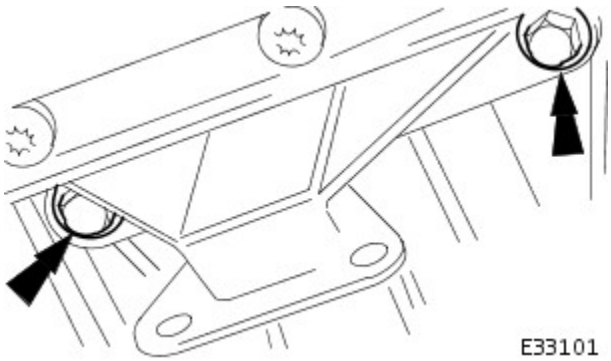
34. NOTE: Do not allow the converter to detach from the transmission.

Remove the transmission / converter assembly from the vehicle.

- Lower the lift and remove the transmission, ensuring that the torque converter spigot disengages cleanly.


E33100

35. Remove the side clamps and chain for access.


E33101

36. Remove the front muffler mounting bracket.

- Remove the two bolts which secure the bracket to the transmission case.

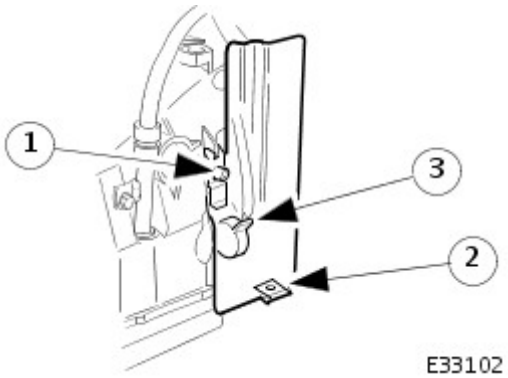
37. Remove the transmission dipstick tube.

1. Remove the fixing which secures the tube to the case.

- Discard the filler tube 'O' ring.

2. Fit a blanking plug to the transmission casing orifice.





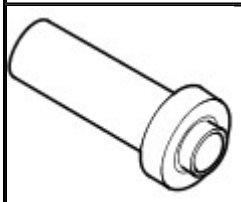
38. Remove the harness link lead.

1. If required, slacken the harness heatshield spring clamp bolt.
2. Remove the heatshield lower bolt.
3. Release the harness multi-lock lever, disconnect and remove the harness.

39. If appropriate, fit retaining straps to the converter / transmission assembly.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Input Shaft Seal

Disassembly and Assembly of Subassemblies

Special Tool(s)	
 E31839	Oil seal replacer 307-378

1. Disconnect the battery ground lead.

2. Remove the air intake / MAFM assembly, refer to Operation 19.10.30.

3. Raise the vehicle for access.

4. Remove the front muffler, 30.10.18

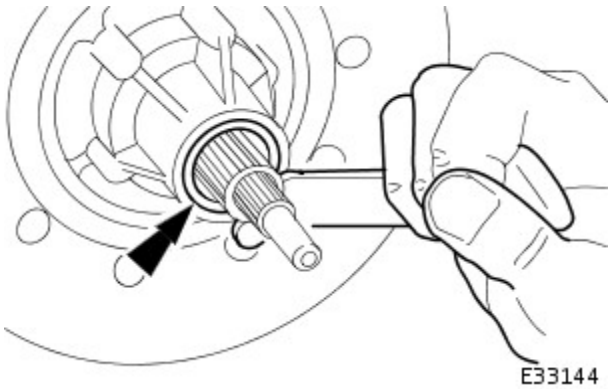
5. Remove the RH and LH catalytic converters, refer to Operation 17.50.09 and 17.50.10.

6. Drain the transmission fluid, refer to Operation 44.24.02.

7. Remove the transmission unit, refer to Operation 44.20.01.

8. Remove the torque converter from the transmission unit, refer to Operation 44.17.07.

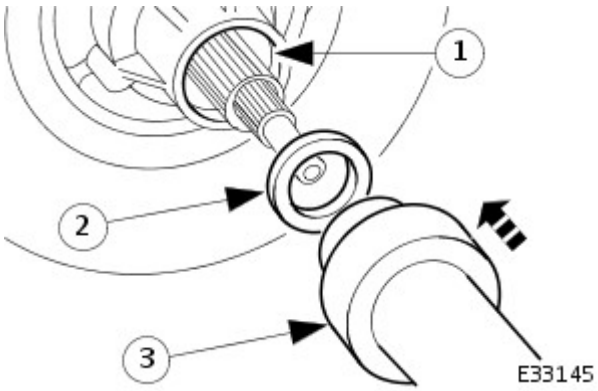
9. Remove the front oil seal.



- Using a proprietary tool remove the seal, taking care not to damage the shaft or bore diameters.

10. Installation is the reverse of the removal procedure noting that:

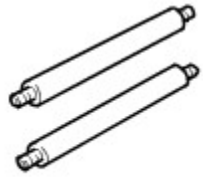
11. Fit the oil seal.



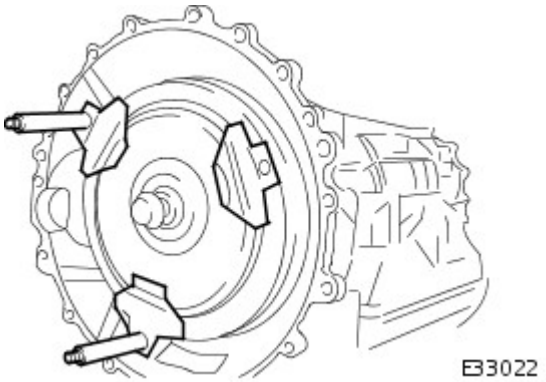
1. Lubricate the housing seal bore.
2. Lubricate the outside diameter of the seal.
3. Using seal replacer 307 - 379, drive the seal squarely into place.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Torque Converter

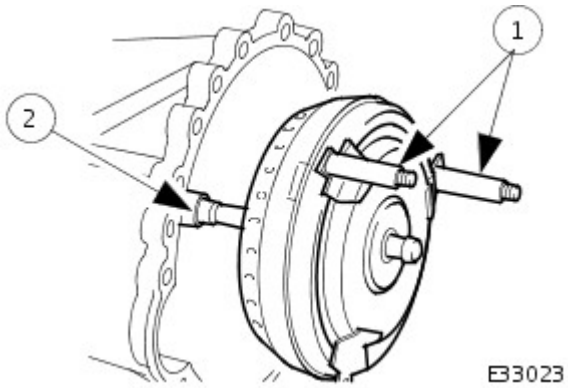
Disassembly and Assembly of Subassemblies

Special Tool(s)	
 E36441	Torque converter lifting handles 307-139

CAUTION: If the transmission is to be renewed, renew the torque converter also.


E33022

1. Remove the transmission unit from the vehicle; refer to Operation 44.20.01.
2. Remove the torque converter from the transmission unit.
   - Fit lifting handles 307 - 139 (JD-105).
3. Remove lifting handles 307 - 139 (JD-105) from the torque converter.
4. Clean the torque converter and mating faces.
5. CAUTIONS:



E33023

Use extreme care NOT to damage the oil seal with the converter spigot.

Ensure that the converter is fully located.

Fit the torque converter.

1. Fit lifting handles 307 - 139 (JD-105).
2. Lubricate the front pump seal.

   - To facilitate location, rotate the converter as it is being fitted and feel for the engagement of the splines and of the oil pump drive.

6. Check that the converter fixing boss faces are approximately 8,0 mm proud of the transmission mounting face.
7. Remove the lifting handles from the torque converter.
8. Install the transmission unit; refer to Operation 44.20.01.

Automatic Transmission / Transaxle - 4.0L SC V8 - AJ26 - Transmission

Installation

Special Tool(s)	
 E36400	Engine support 303-021
 E36403	Engine lifting brackets 303-536

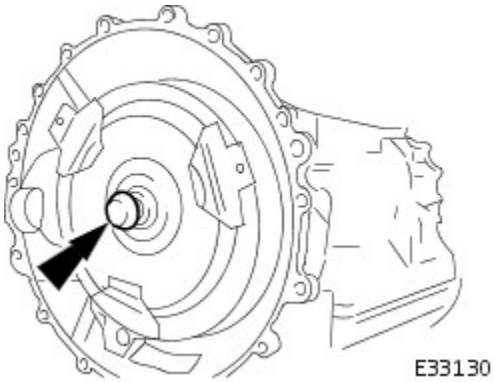
Installation

1. CAUTION: A new transmission requires a NEW torque converter.

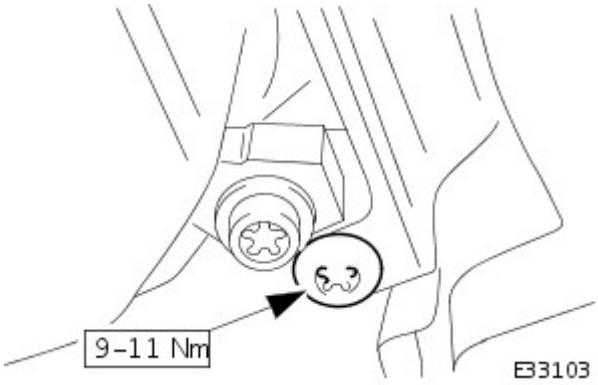
Installation is the reverse of the removal procedure, noting the following:

2. Clean all mating faces and relevant parts.

3. Apply lubricant, MOLYCOTE or equivalent to the torque converter spigot.


E33130

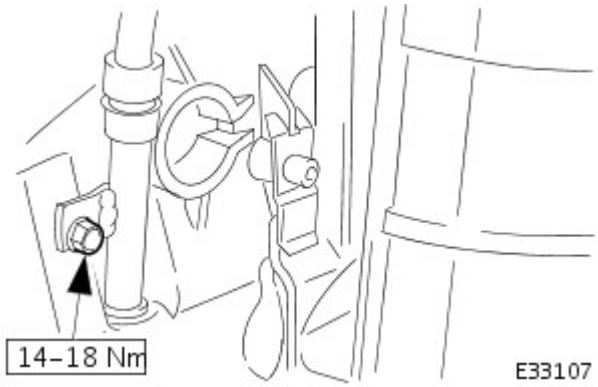
4. Fit the screw (lower) securing the harness link lead heatshield. Tighten to the specified torque figure.

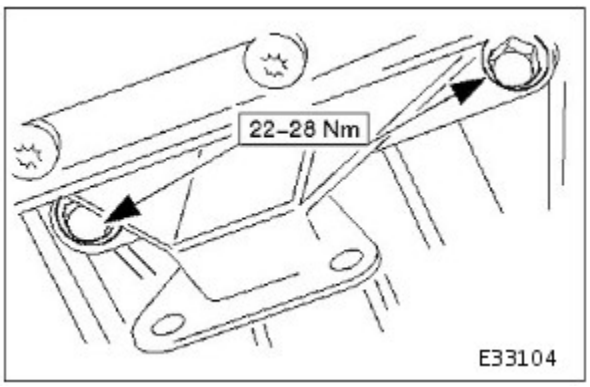


E33103

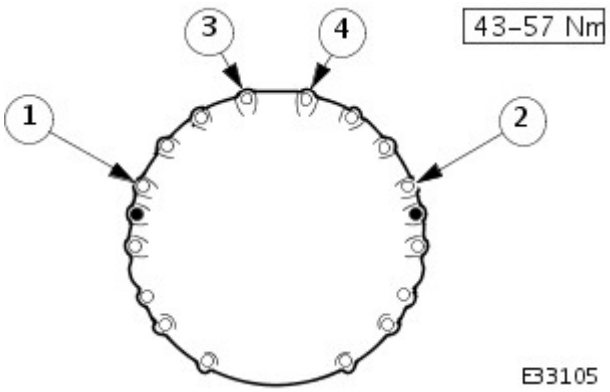
5. Fit the dipstick lower tube.

- Remove the blanking plug and fit a new O-ring seal. Tighten the bolt to the specified torque figure.



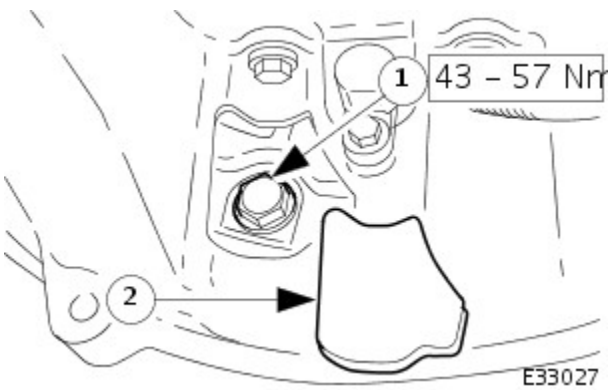


6. Fit the mounting bracket for the front muffler. Tighten the two bolts to the specified torque figure.



7. Secure the transmission to the engine.

- Loosely assemble - Cooler pipe clip bolt.
- Loosely assemble - Ground lead bolt.
- Loosely assemble - Starter cable clips, two bolts.
- Loosely assemble - Catalyst bracket bolts, two each side.
- Loosely assemble - Remaining eight bolts.
- Refer to the illustration - tighten in sequence 1,2,3,4 then in any order.



8. Secure the torque converter to the engine.

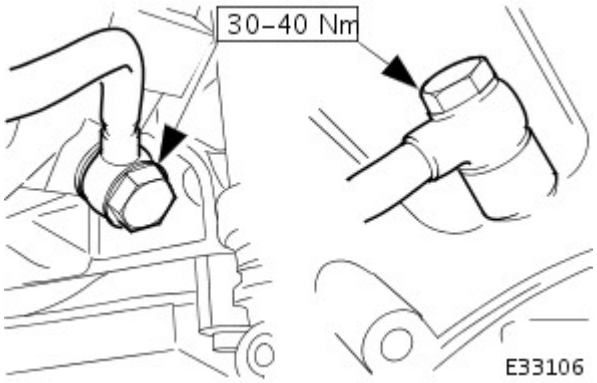
1. Fit, but do not tighten, the three bolts which secure the torque converter to the drive plate.

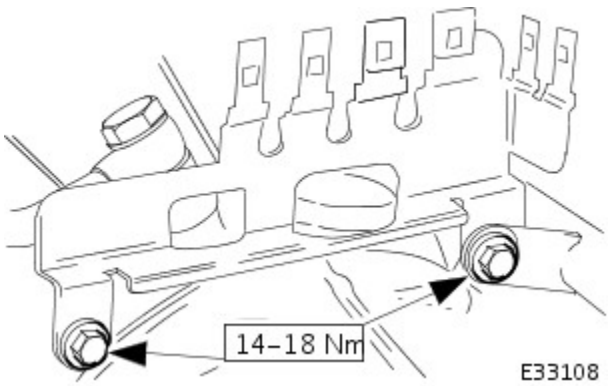
- Prevent crankshaft rotation and tighten ALL converter bolts to the specified torque figure.

2. Fit the blanking plug to the cylinder block access aperture.

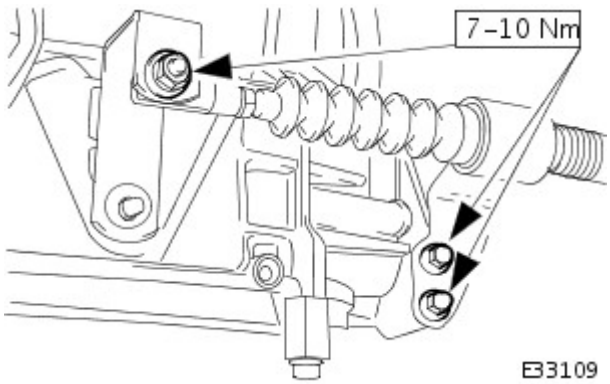
9. Secure the oil cooler pipes.

- Fit new Dowty washers to each union. Connect the upper and lower cooler pipes.
- Tighten to the specified torque figure.

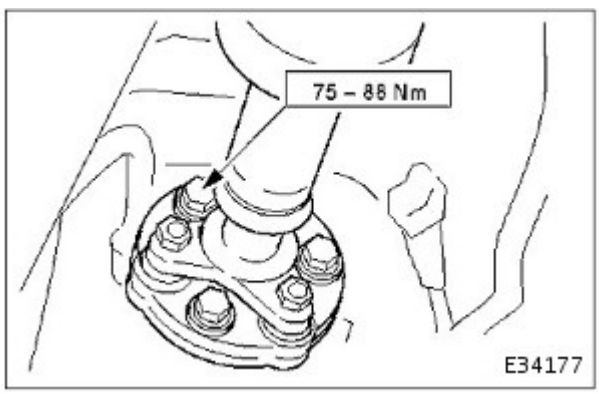




10. Refit the harness connector support bracket and tighten the two bolts to the specified torque figure, noting that one fixing also retains the dipstick upper tube.

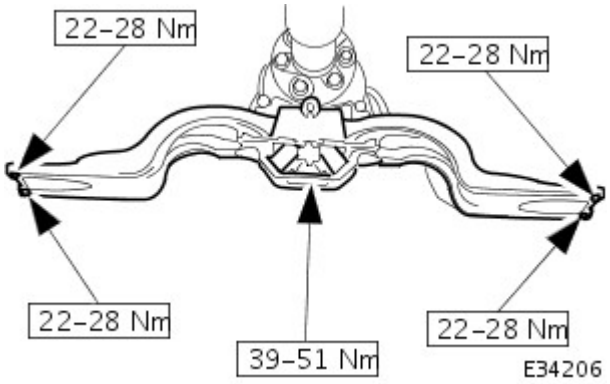


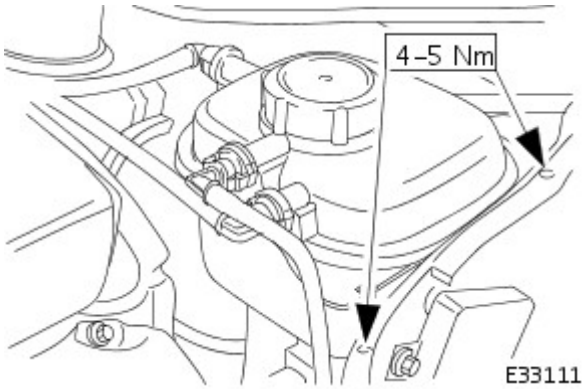
11. Connect the selector cable. Tighten the bolts and one nut to the specified torque figure.



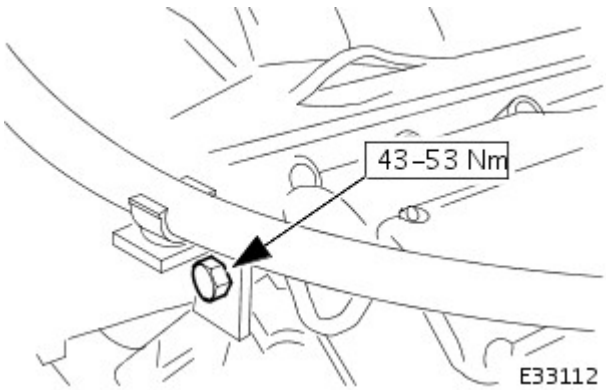
12. Connect the driveshaft (prop-shaft) aligning the marks made when it was removed. Tighten the bolts to the specified torque figure.

13. Fit the rear crossmember. Tighten the bolts to the specified torque figure.





14. Refit the coolant header tank. Tighten to the specified torque figure.



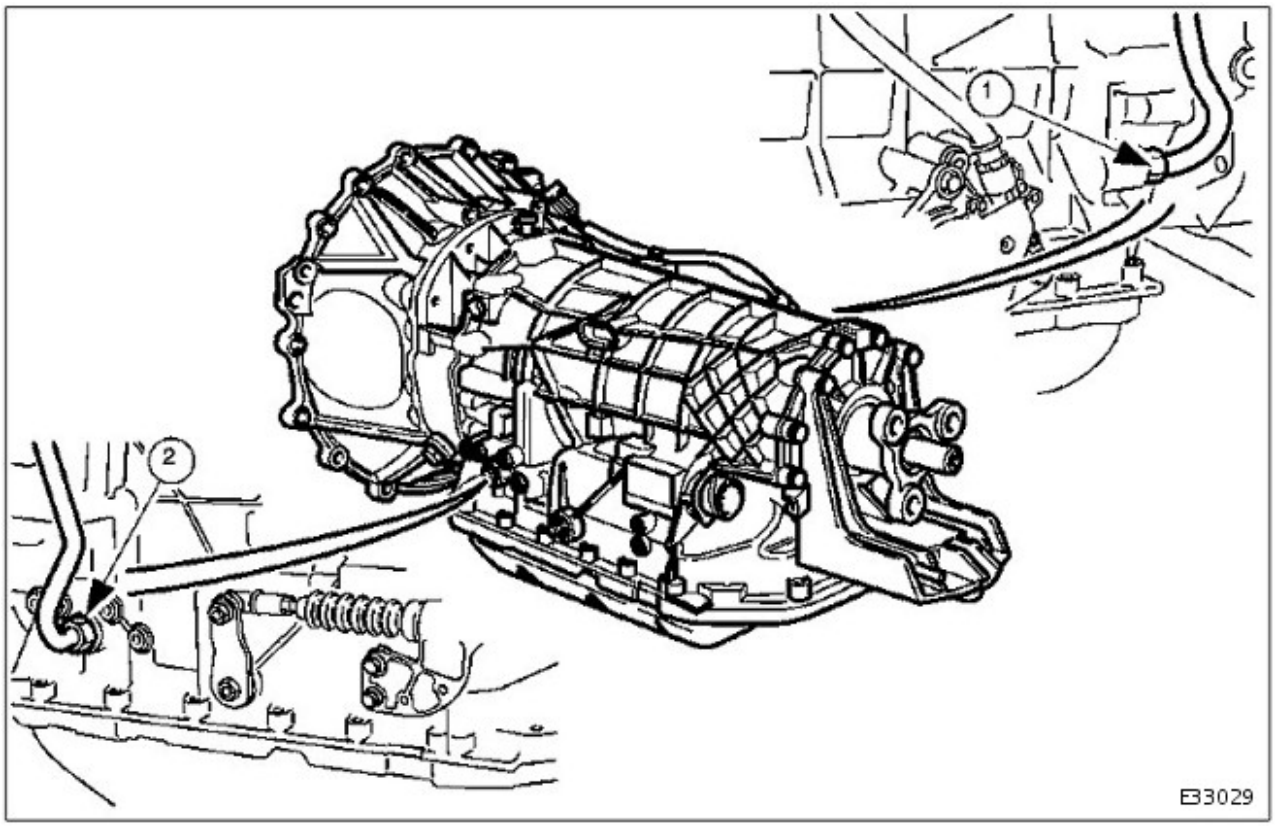
15. Fit the harness and clip (transmission link harness) to the rear of the cylinder head. Tighten to the specified torque figure.

16. Refer to Operation 44.24.02 for fluid fill procedure.

Transmission / Transaxle Cooling - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Transmission Cooling

Description and Operation

The transmission fluid cooling system maintains fluid temperature within specified limits.



Parts List

Item	Part Number	Description
1	—	Fluid pipe, oil FROM cooler
2	—	Fluid pipe, oil TO cooler

Component Descriptions

The transmission fluid pipes:

- Transfer fluid from the transmission to the cooler under the action of the hydraulic system pump.
- Return the cooled fluid from the cooler to the transmission.

The transmission fluid cooler:

- Is a plate type made from aluminum.
- Is mounted in the engine cooling radiator right-hand end tank.

Overheating Protection

If the engine coolant or transmission fluid temperatures exceed their predefined limits, the transmission control module locks the torque converter clutch. By reducing slip, this minimises the amount of heat transferred to the engine cooling system from the transmission fluid.

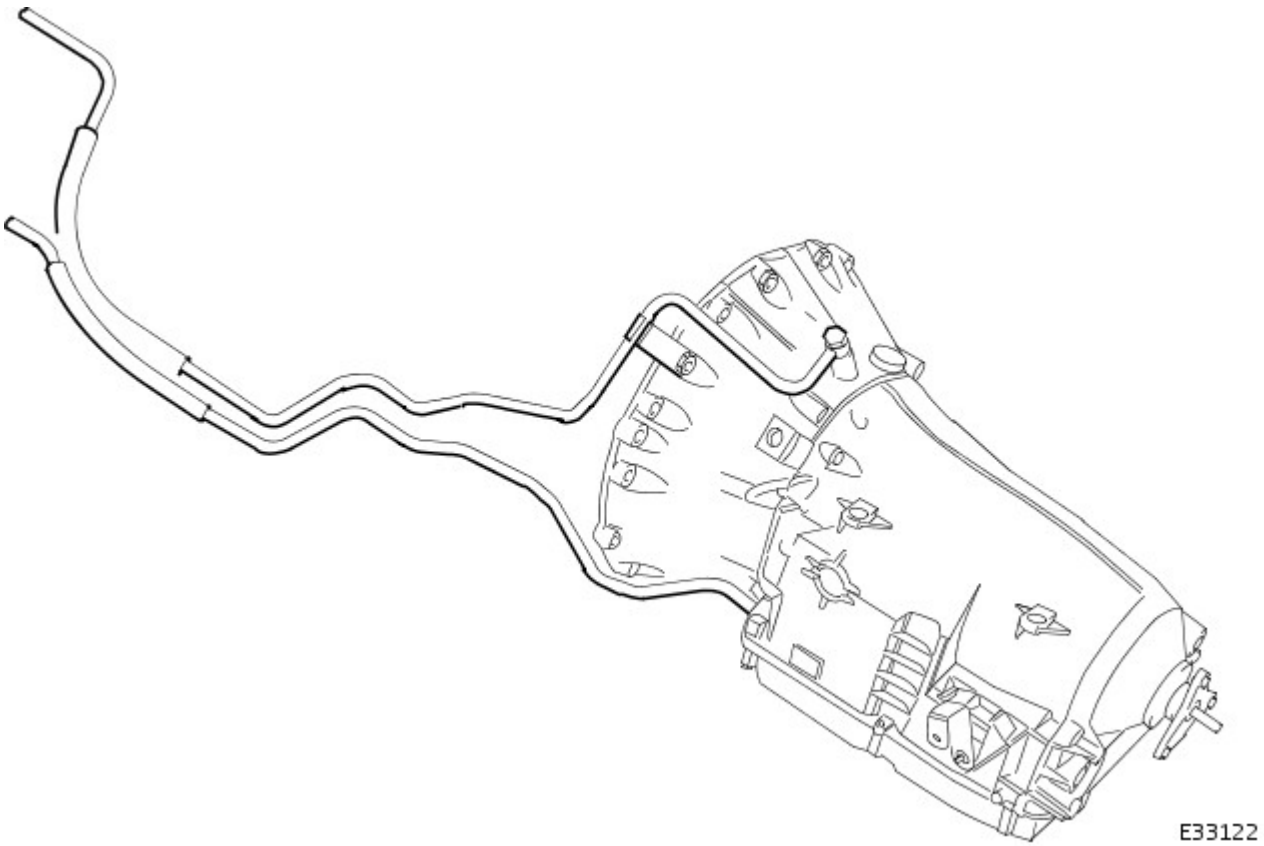
Transmission / Transaxle Cooling - 4.0L SC V8 - AJ26 - Transmission Cooling

Description and Operation

The transmission fluid cooling system maintains the fluid temperature within specified limits. The cooling element is located in the engine cooling radiator LH end tank.

Fluid is circulated, under pressure, by the transmission pump to the cooler.

General Layout



Overheating Protection

If the engine coolant or transmission fluid temperatures exceed their predefined limits, the transmission control module locks the torque converter clutch. By reducing slip, this minimises the amount of heat transferred to the engine cooling system from the transmission fluid.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - External Controls

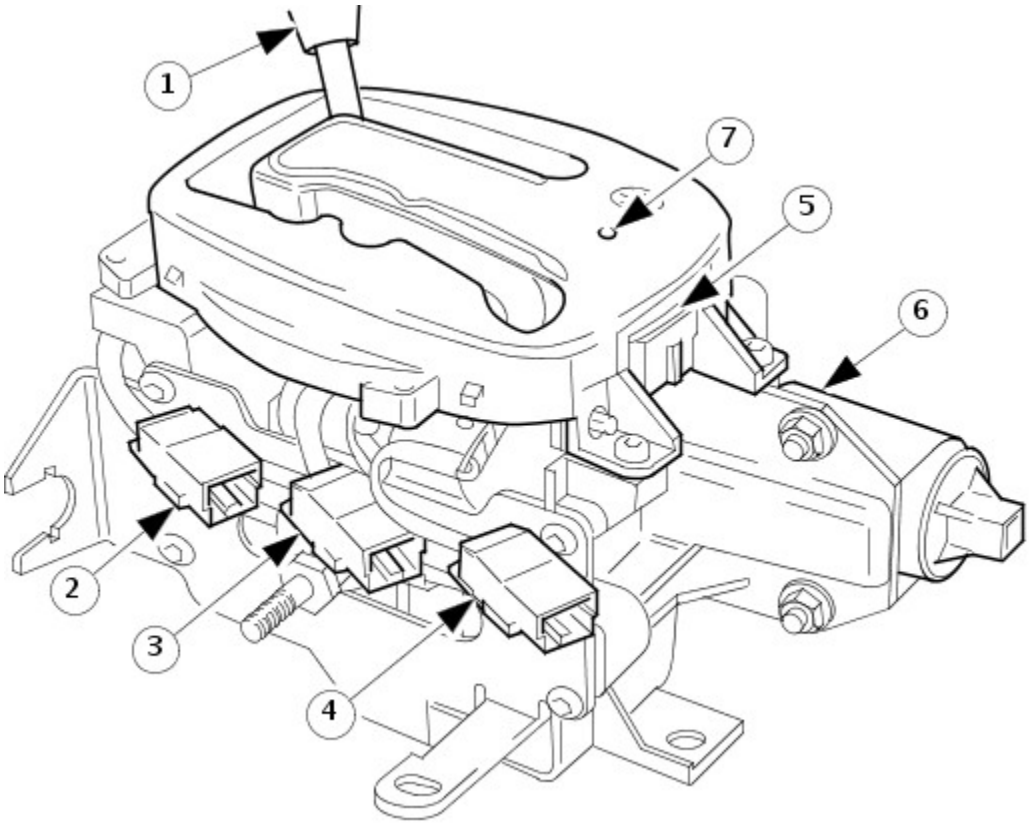
Description and Operation

Introduction

Driver gearshift control is effected by:

- The gear shift lever.
- The accelerator pedal position.
- The kickdown switch (where fitted).
- The performance mode pushbutton.

Driver's Selector Module ('J' Gate)



Item	Part Number	Description
1	—	Gear selector lever
2	—	Drive-to-fourth switch connector
3	—	Neutral position switch connector
4	—	Park position switch connector
5	—	Gear selector illumination module
6	—	Gear selector interlock solenoid
7	—	Security system Active LED

The gear selector lever:

- Has seven positions: Park, Reverse, Neutral, Drive, Fourth, Third and Second.
- Operates the transmission selector shaft and rotary switch, in all positions (except Drive-to-fourth) by means of a Bowden cable.
- Passes driver gearshift requests to the transmission control module via the rotary switch.

The Drive-to-fourth switch:

- Detects when the gear selector lever is moved from Drive to Fourth.
- Is hard-wired to the transmission control module.

The Neutral position switch:

- Is hard-wired to the body processor module.
- Detects when the gear selector lever is moved to the Neutral position.

The Park position switch:

- Is hard-wired to the body processor module.
- Detects when the gear selector lever is moved to the Park position.

The gear selector module:

- Provides illumination of the gear selector surround, which is dimmable via a CAN signal from the instrument cluster.
- Provides red illumination, on the gear selector surround, of the gear selected, by CAN signals from the instrument cluster.
- Illuminates the security system Active LED on the gear selector surround, in response to an input from the body processor module.
- Is connected to the fascia harness via a 12-way connector. Refer to Connector Pins Identification, 307-01A.

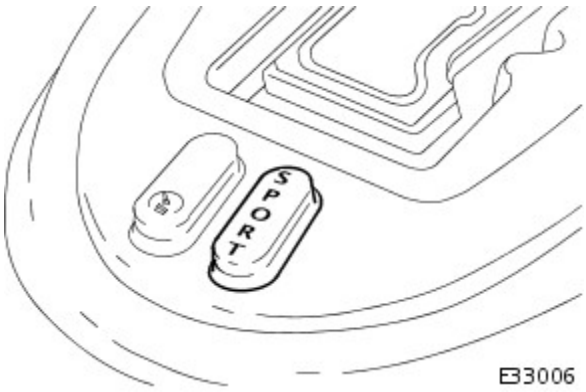
The gear selector interlock solenoid:

- Prevents the gear selector lever from being moved from the Park position, unless the ignition switch is in position II, and the brake pedal is depressed.
- Is controlled by an input from the body processor module.

The seven gear selector positions are:

- P : The transmission is mechanically locked (starting available).
- R : Reverse gear.
- N : No power to the rear wheels (starting available).
- D : All 5 forward gears available.
- 4 : Upshift to 4th gear only.
- 3 : Upshift to 3rd gear only.
- 2 : Upshift to 2nd gear only.

Performance Mode Pushbutton

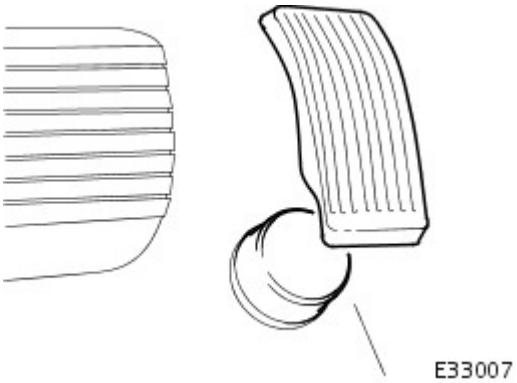


The performance mode pushbutton:

- Is mounted on the gear selector surround.
- Selects Normal or Sport mode when pressed by the driver.
- Is illuminated when Sport mode is selected.

- Is hard-wired to the transmission control module.

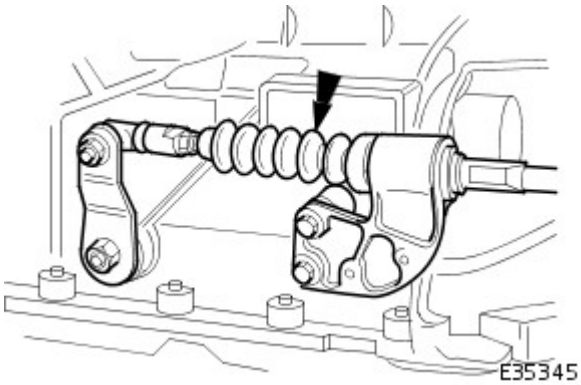
Kickdown Switch (where fitted)



The kickdown switch:

- Is floor mounted under the accelerator pedal.
- Is operated by pressing the pedal to the full throttle position.
- Provides maximum acceleration on driver demand, by signalling the transmission control module to select the lowest gear to give maximum wheel torque.

Transmission Unit Gear Selector

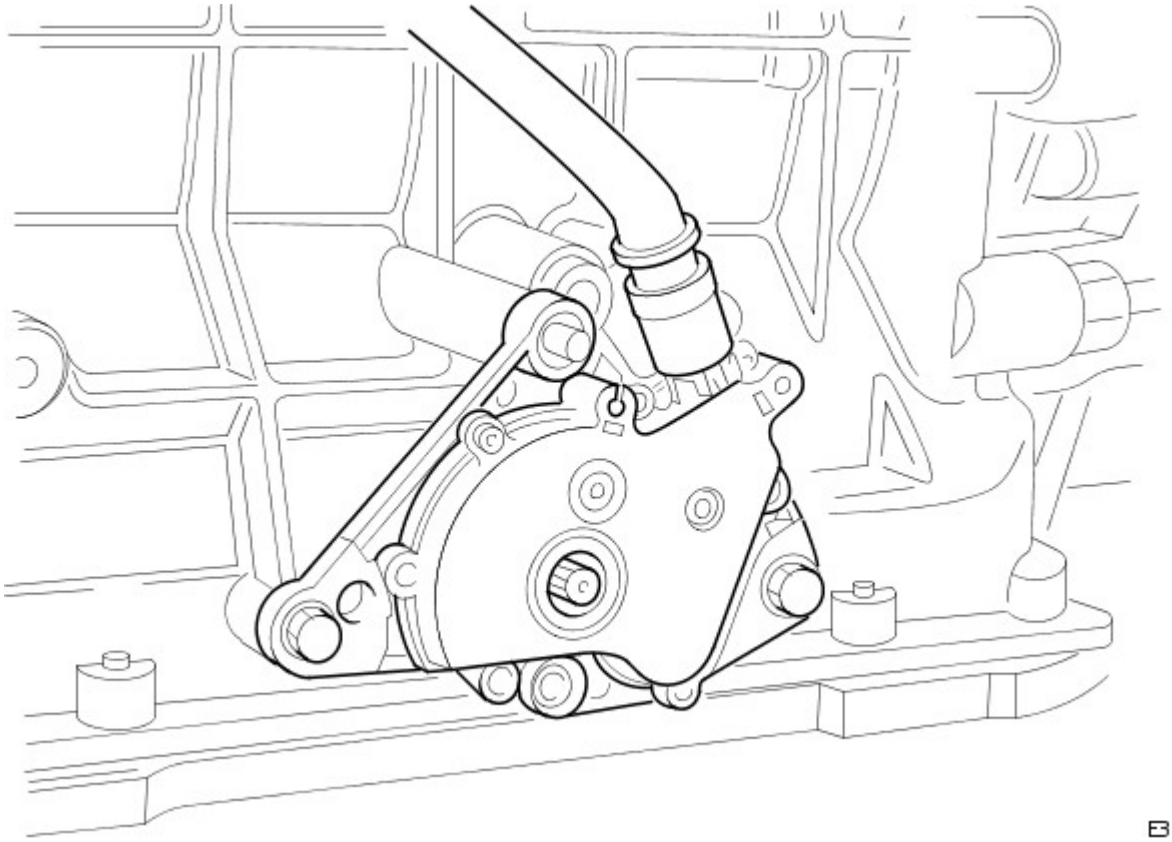


The gear selector at the transmission unit:

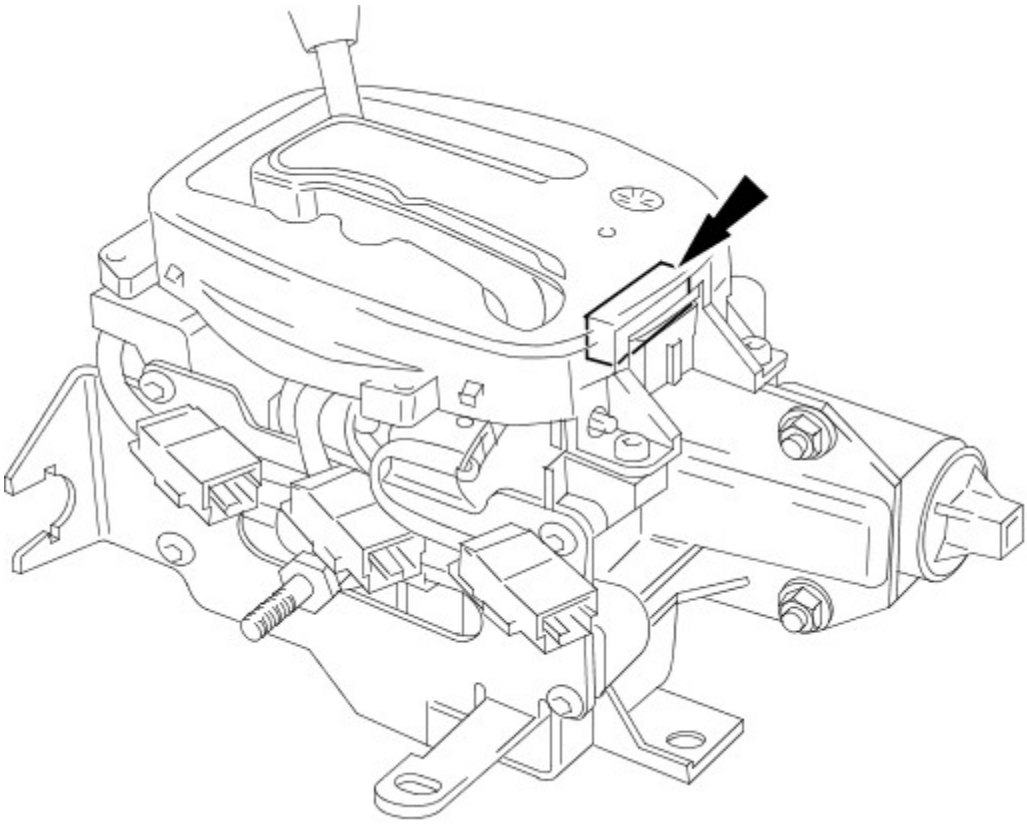
- Is connected to the driver's selector module by a Bowden cable.
- Operates the manual selector valve, which is part of the electro-hydraulic control unit.
- Operates the rotary switch, which is connected to the transmission control module.

Transmission Switches

Location, Rotary Switch



Location, Drive to 4th Switch



Operation

• NOTE: The rotary position switch is NOT adjustable.

The position of the gear selector lever is detected by the range sensor; a system which consists of two sensors (switch systems).

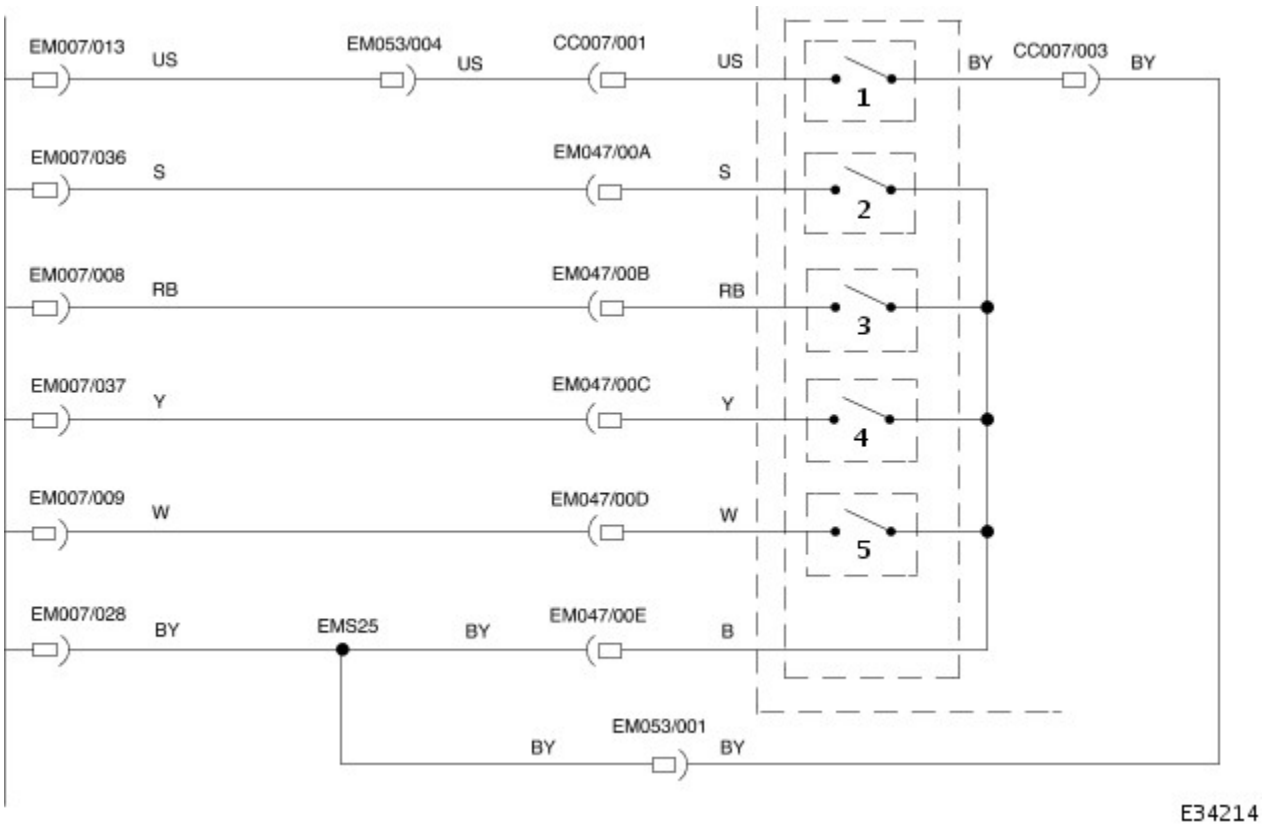
1. **1.** The rotary position switch, which is located on the RH side of the transmission case and is coaxial with the selector shaft.

2. **2.** The D to 4 (micro) switch, which is mounted in the 'J gate' assembly.

When the selector is moved across the gate to engage 4, or back from that side towards D the selector cable does not move. In order that this change of state be registered by the TCM the D to 4 switch is incorporated.

The rotary switch in isolation provides a 4-bit code, which, when added to the D to 4 switch becomes a 5-bit code. The TCM will make a failure judgement if it detects an 'illegal' code.

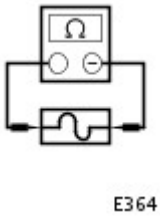
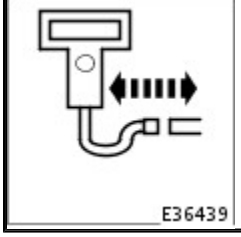
Circuit Diagram, Rotary and Drive to 4th Switches / TCM



Item	Description
1	Drive to 4th switch
2	Switch L1
3	Switch L2
4	Switch L3
5	Switch L4

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - External Controls

Diagnosis and Testing

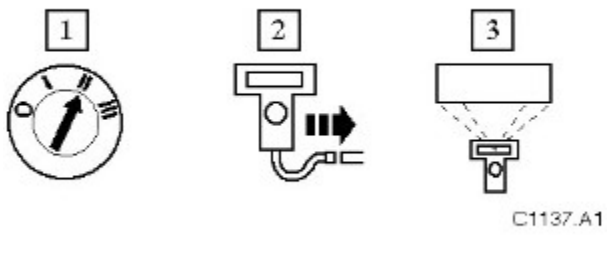
Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scantool

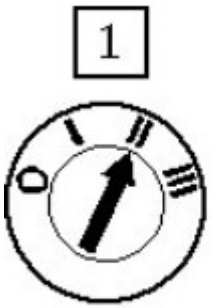
Symptom Chart

Symptom Chart

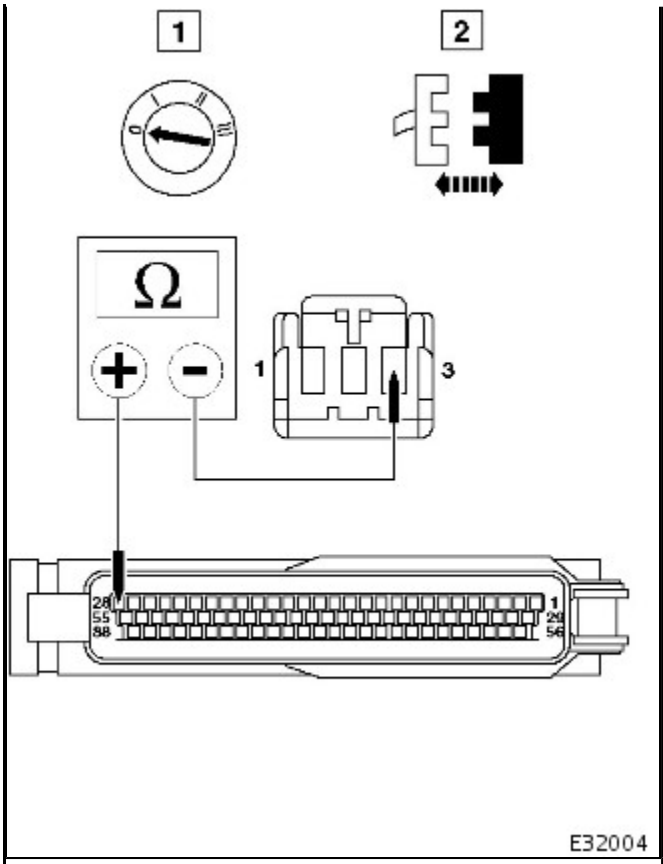
Symptom	Possible Sources	Action
DTC P0706 Transmission range sensor circuit range / performance	* Selector cable maladjusted * Rotary switch fault * D to 4 switch fault * Rotary position switch fault * Harness fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test A

Pinpoint test A: P0706

PINPOINT TEST A : P0706	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
 C1137.A1 E32153	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2
A2: STATUS / RELATIONSHIP CHECK	



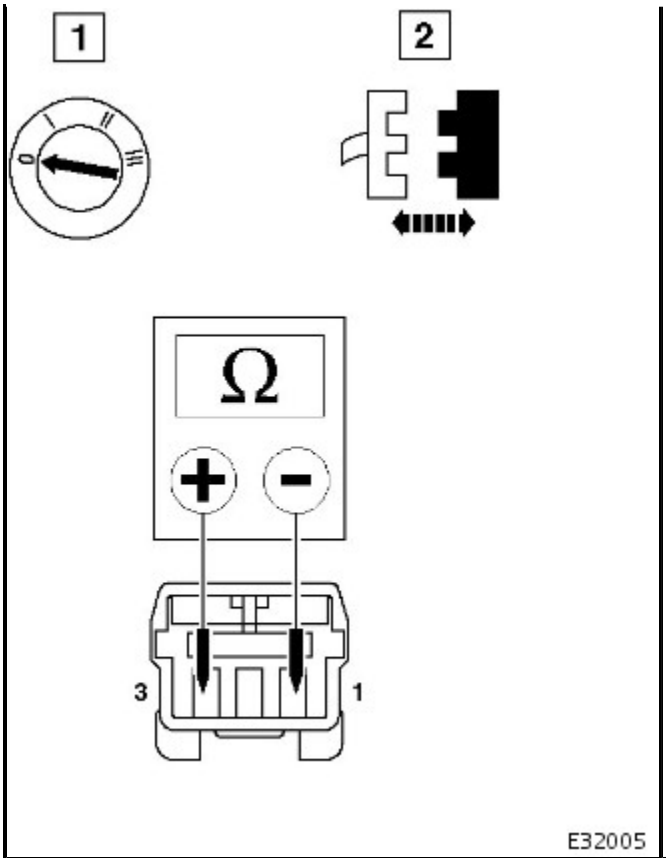
	1 Move the selector lever slowly from P to 2 and back, noting the illumination / position relationship as follows:
	Does state illumination match the lever position in each direction of travel? **Yes** GO to A4 **No** GO to A3 **No** With lever at D (when moving from 2 to P) is 3 or 4 illuminated? **Yes** GO to A3 **No** GO to A5 **No** With lever moved from P , to position 4 , is D illuminated? **Yes** GO to A4 **No** GO to A5
A3: CHECK SELECTOR CABLE ADJUSTMENT	
	1 Verify and correct as required the selector cable adjustment
	OK? **Yes** GO to A4 **No** Correct adjustment error, see 44.15.07 Workshop Manual 307-05A and test the system for normal operation.
A4: CHECK HARNESS SIGNAL CONTINUITY - D TO 4 SWITCH	



	1 With EM007 and CC007 disconnected, measure the resistance between CC007/003 and EM007/028 • Repeat for 2 CC007/001 and EM007/013 Is the resistance < 0.5 OHM? **Yes** GO to A5 **No** Inspect EM007 and CC007 EM053 for corrosion, bent / pushed back pins or locate harness / splice EMS25 and CCS20. Repair as necessary and test the system for normal operation.

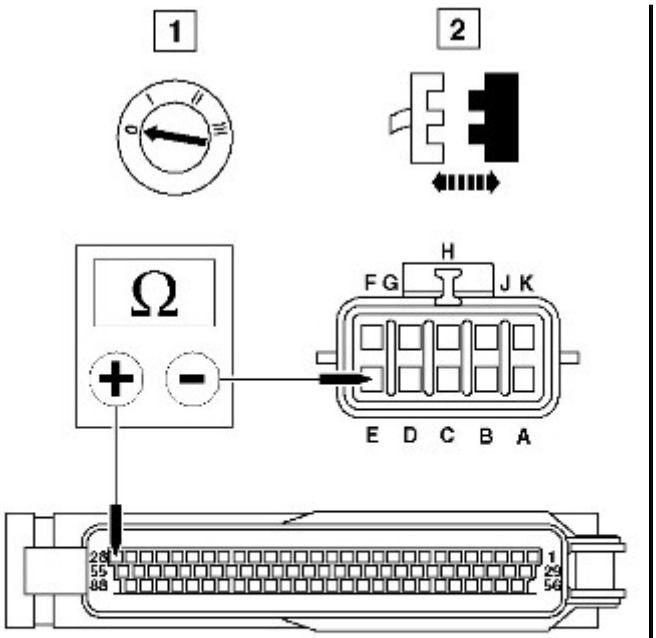
A5: CHECK D TO 4 SWITCH

• NOTE: Engage position 2 firmly



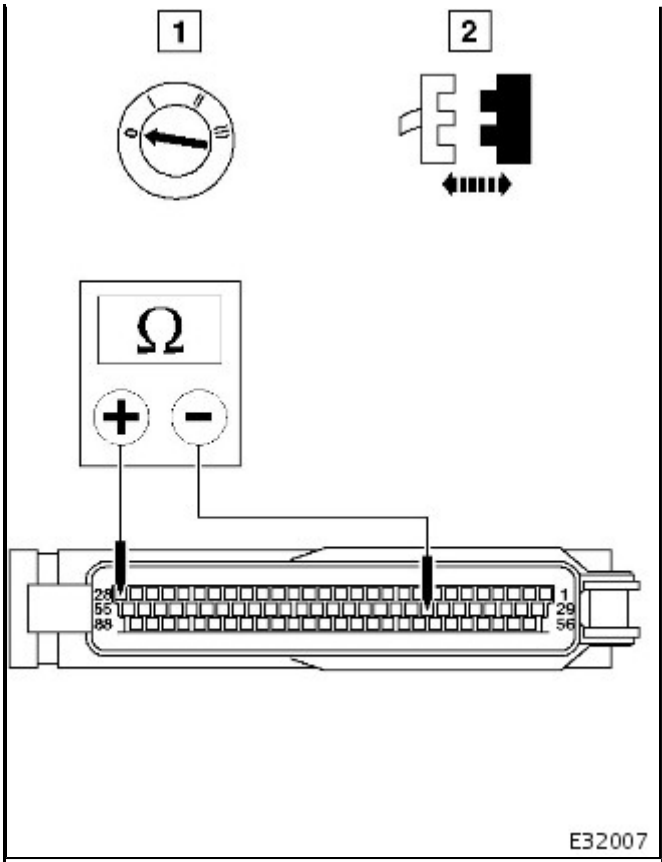
	1 With CC007 disconnected, measure the resistance between switch pins 001 and 003
	With the selector lever at 4, 3, 2 is the resistance < 0.5 OHM? With the selector lever at P, R, N, D is the resistance < >50 KOHM? **Yes** GO to A6 **No** Renew D to 4 switch and test the system for normal operation.

A6: CHECK HARNESS DIGITAL GROUND CONTINUITY



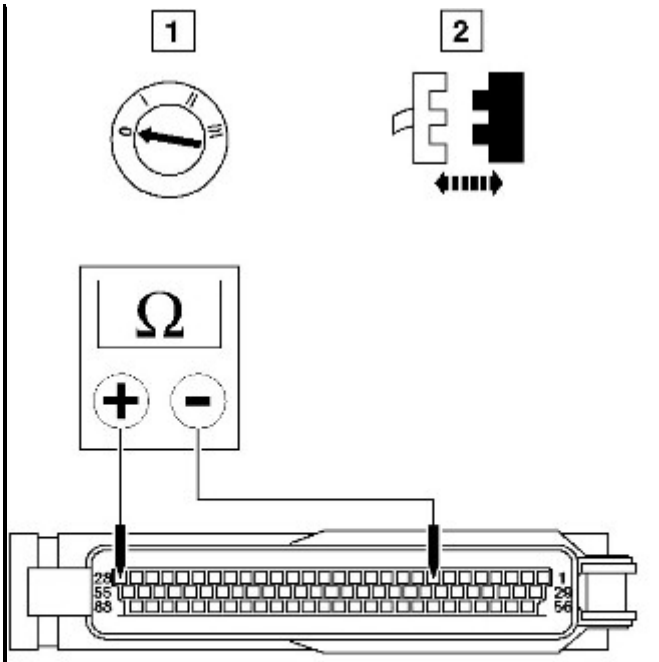
	1 With EM007, EM047, CC007 and CC018 (kickdown switch) disconnected, measure the resistance between EM007/028 to EM047/00E
	Is the resistance < 0.5 OHM? **Yes** GO to A7 **No** Inspect EM007, EM047 and CC007 for corrosion, bent / pushed back pins or locate harness / splice EMS25. Repair as necessary and test the system for normal operation.

A7: CHECK SWITCH L1



	1 With EM007 disconnected, measure the resistance between EM007/028 and EM007/036
	With the selector lever at P, N, D, 4 is the resistance < 0.5 OHM?With the selector lever at R, 3, 2 is the resistance >50 KOHM? **Yes** GO to A8 **No** Inspect EM007 and EM047 for corrosion, bent / pushed back pins or locate and repair the harness EM007/036 to EM047/00A **No** OK, but fault still present? **Yes** Renew rotary position switch and test the system for normal operation.

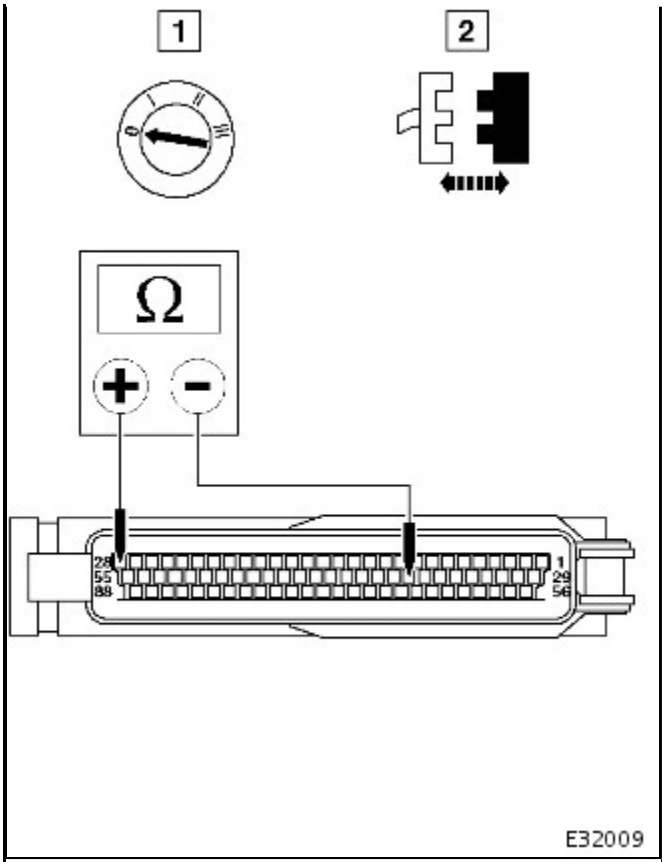
A8: CHECK SWITCH L2



E32008

	1 With EM007 disconnected, measure the resistance between EM007/028 and EM007/008
	With the selector lever at R, N, 3 is the resistance < 0.5 OHM? With the selector lever at P, D, 4, 2 is the resistance >50 KOHM? **Yes** GO to A9 **No** Inspect EM007 and EM047 for corrosion, bent / pushed back pins or locate and repair the harness EM007/008 to EM047/00B - test the system for normal operation **No** OK, but fault still present? **Yes** Renew rotary position switch and test the system for normal operation.

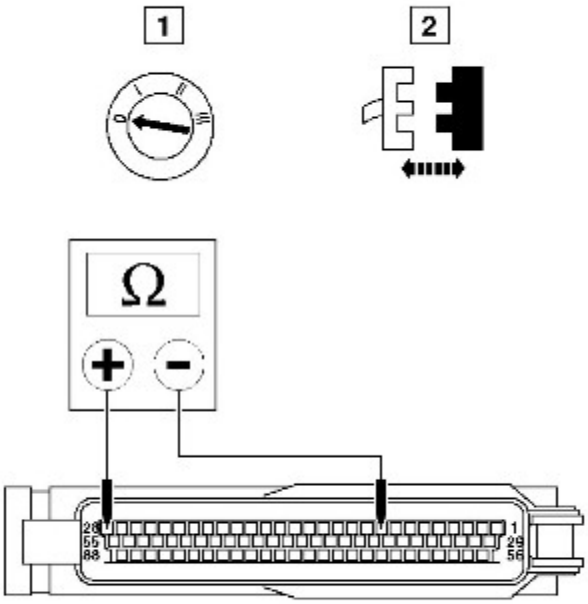
A9: CHECK SWITCH L3



E32009

	1 With EM007 disconnected, measure the resistance between EM007/028 and EM007/037
	With the selector lever at N, D, 4, 3 is the resistance < 0.5 OHM?With the selector lever at P, R, 2 is the resistance >50 KOHM? **Yes** GO to A10 **No** Inspect EM007 and EM047 for corrosion, bent / pushed back pins or locate and repair the harness EM007/037 to EM047/00C - test the system for normal operation **No** OK, but fault still present? **Yes** Renew rotary position switch and test the system for normal operation.

A10: CHECK SWITCH L4

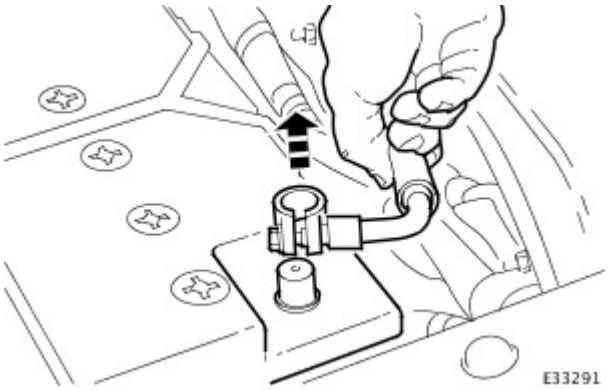


E32003

	1 With EM007 disconnected, measure the resistance between EM007/028 and EM007/009
	With the selector lever at D, 4, 3, 2 is the resistance < 0.5 OHM?With the selector lever at P, R, N is the resistance >50 KOHM? **Yes** GO to A11 **No** Inspect EM007 and EM047 for corrosion, bent / pushed back pins or locate and repair the harness EM007/009 to EM047/00D - test the system for normal operation. **No** OK, but fault still present? **Yes** Renew rotary position switch and test the system for normal operation.
A11: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Brake Shift Interlock Actuator Adjustment

General Procedures



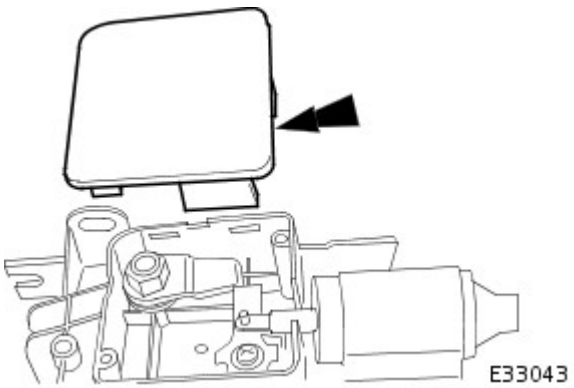
1. Disconnect battery ground cable.

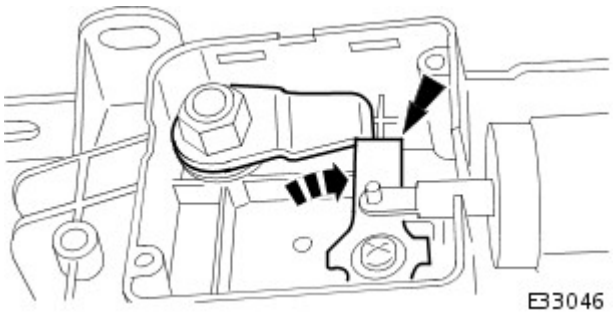
- Remove the battery cover.

2. Remove the J-gate surround, Section 501-05.

3. Remove the console finisher veneer panel, Section 501-12.

4. Remove the interlock solenoid actuating lever cover.





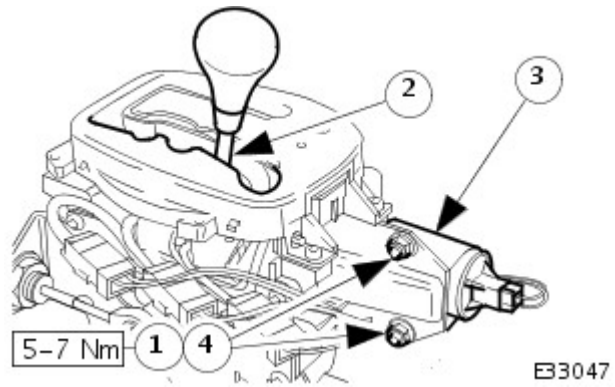
5. Move the shift lever to N.

- Operate the gearshift interlock latch manually to release the selector lever from P .

6. NOTE: Assistance from another person is required.

Adjust the gearshift interlock solenoid.

1. Slacken the solenoid fixings.
2. Hold the selector lever midway between P and R .
3. Move the solenoid rearwards, against spring pressure, to take up the free play.
4. Tighten the solenoid securing nuts.
5. Ensure that the interlock actuating lever has no free play with the selector lever midway between P and



R .

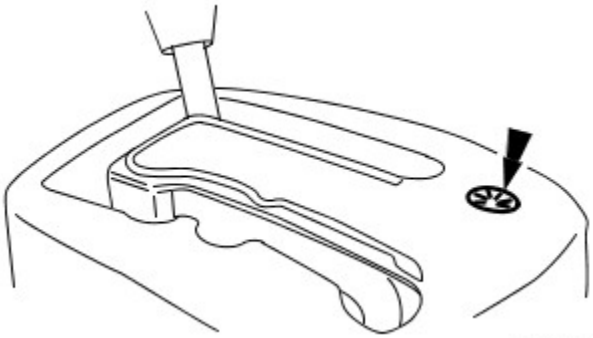
7. Further installation is the reverse of the removal procedure.

8. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Brake Shift Interlock Actuator Manual Override

General Procedures

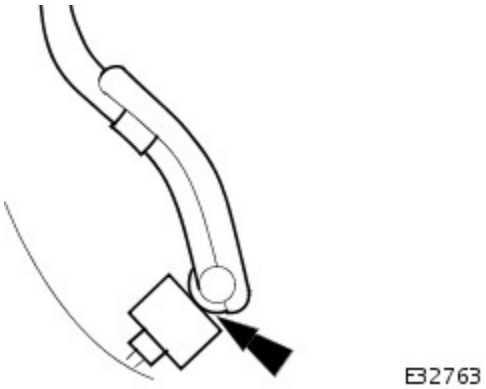


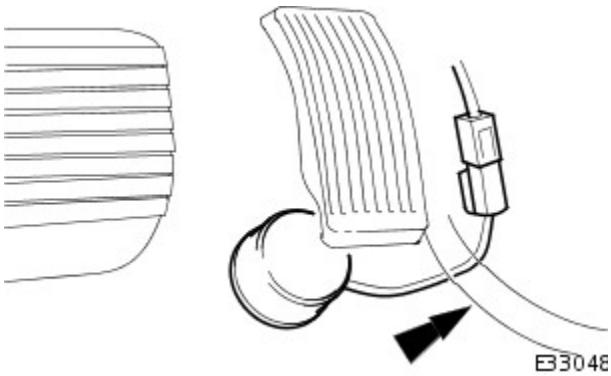
1. To override the gearshift interlock:

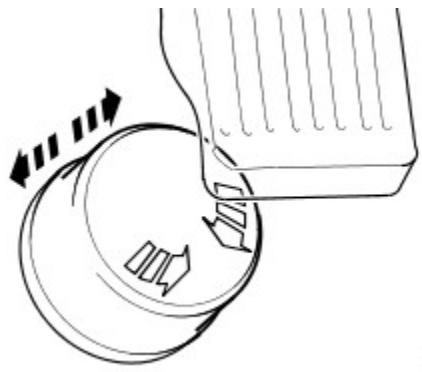
1. Unscrew the release catch blanking plug.
2. Insert the ignition key into the aperture, depress the release catch and simultaneously move the gear selector lever from the Park position. The lever will only move approximately 25 mm with the key inserted.
3. Remove the ignition key and replace the blanking plug.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Kickdown Switch Adjustment

General Procedures







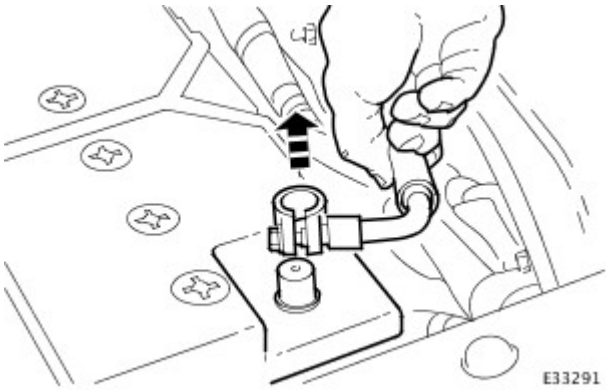
1. Ensure that the throttle cable is correctly adjusted, see 19.20.06.
2. See the PDU User Guide for relevant software - 1040.
3. With PDU connected, running and the message 'EXISTING COMPONENTS TO BE TESTED YES / NO' displayed;
    1. Select YES.
    2. Select ENTER.
    3. Follow the messages given on the screen.
4. Press ENTER on the PDU screen.
5. Following the PDU instruction;
    1. Push the throttle pedal until light contact is made with the kickdown switch and hold.
    2. Press ENTER on the display.
    3. Note the percentage throttle open data (displayed as a bar graph).

    • NOTE: Ensure that contact with the switch does not result in switch movement.

    4. Release the throttle pedal.
6. If the target 90% throttle open specification is NOT achieved the switch must be adjusted as follows:
7. Disconnect the kickdown switch multiplug.
    - Move the carpet for access.
8. Adjust the kickdown switch to the value as defined in step #6.
    - Rotate the switch in the required direction.
9. Verify the setting.
10. With the PDU instructions completed, connect the Kickdown switch multiplug.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Cable Adjustment

General Procedures



1. Disconnect battery ground cable.

- Remove the battery cover.

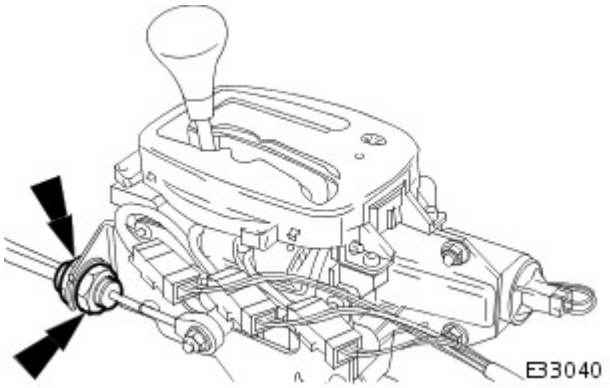
2. Position the shift to N.

3. Remove the J-gate surround, Section 501-05.

4. Remove the console finisher veneer panel, Section 501-12.

5. Remove the center console assembly, Section 501-12.

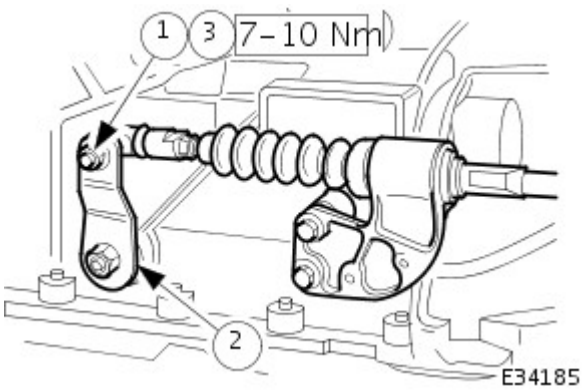
6. Slacken the selector cable locking nuts away from the abutment.



7. Raise the vehicle for access.

8. Verify the transmission selector position (N)

1. At the transmission, detach the inner cable from the selector lever.
2. With the lever moved fully rearward, push the lever forward two detents to achieve N.
3. Reconnect the inner cable.

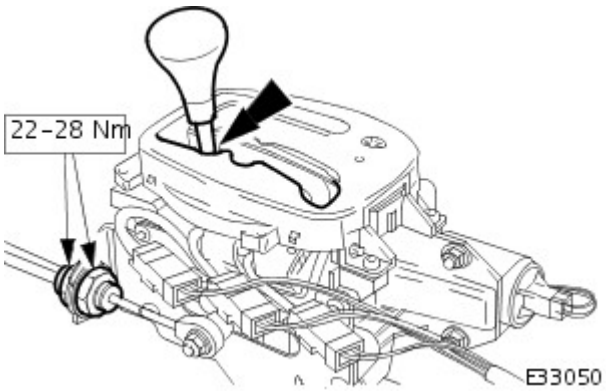


9. From inside the vehicle.

10. NOTE: When setting the selector cable, ensure that the transmission selector does not move from the N position.

Adjust the selector cable.

1. Position the shift in the N detent
2. Adjust the nuts to lock against the bracket without



moving the set position of either the shift lever or the selector lever.

3. Tighten the locknuts to the specified torque figure

4. Verify the N setting.

11. Further installation is the reverse of the removal procedure.

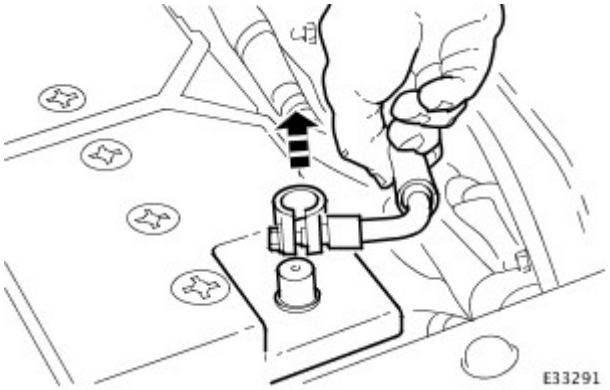
12. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Brake Shift Interlock Actuator

Removal and Installation

Removal



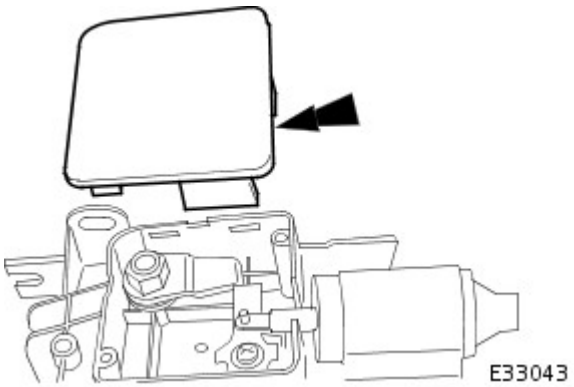
1. Disconnect battery ground cable.

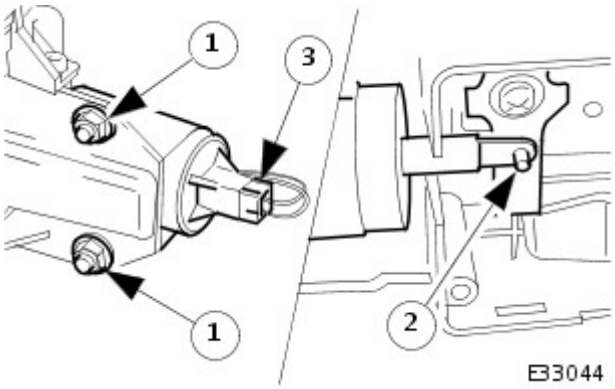
- Remove the battery cover.

2. Remove the J-gate surround, Section 501-05.

3. Remove the console finisher veneer panel, Section 501-12.

4. Remove the interlock solenoid lever cover.





5. Remove the gearshift interlock solenoid.

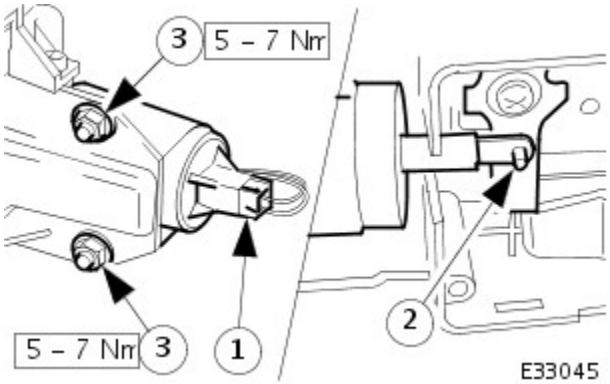
1. Remove the solenoid nuts.
2. Detach the solenoid from the latch pin.
3. Disconnect the solenoid multiplug.

Installation

1. Installation is the reverse of the removal procedure.

2. Fit the gearshift interlock solenoid.

1. Connect the solenoid multiplug.
2. Locate the solenoid on the latch pin.
3. Fit the solenoid securing nuts.



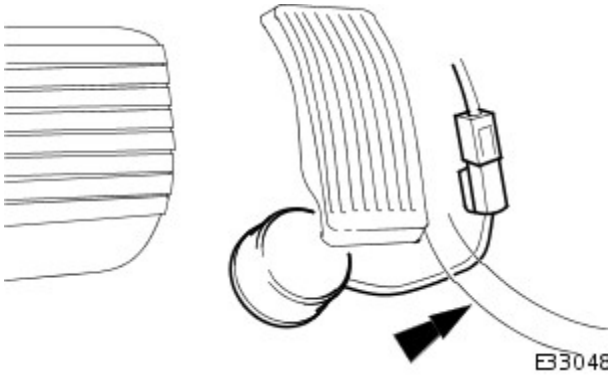
3. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

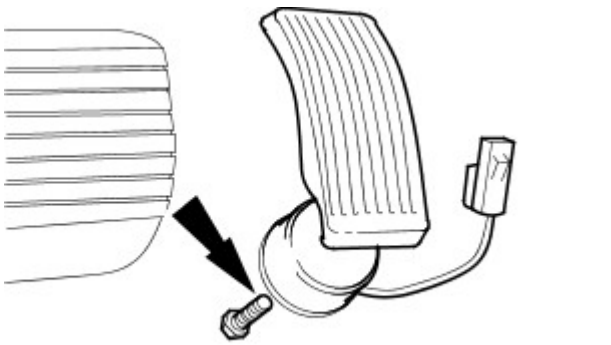
Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Kickdown Switch

Removal and Installation

Removal



1. Disconnect the kickdown switch multiplug.
   - Move the carpet for access.



2. Remove the kickdown switch.
   - Rotate counter-clockwise.

Installation

1. Installation is the reverse of the removal procedure.
2. The kickdown switch MUST be adjusted in accordance with (44.15.38).

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Cable and Bracket

Removal and Installation

Removal

1. Position the selector to N.

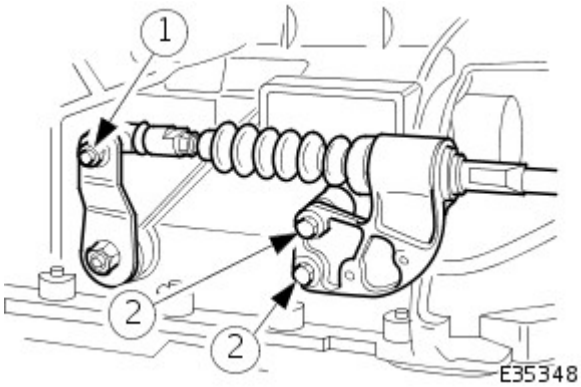
2. Remove the J-gate surround, Section 501-05.

3. Remove the console finisher veneer panel, Section 501-12.

4. Remove the center console assembly, Section 501-12.

5. Raise the vehicle for access.

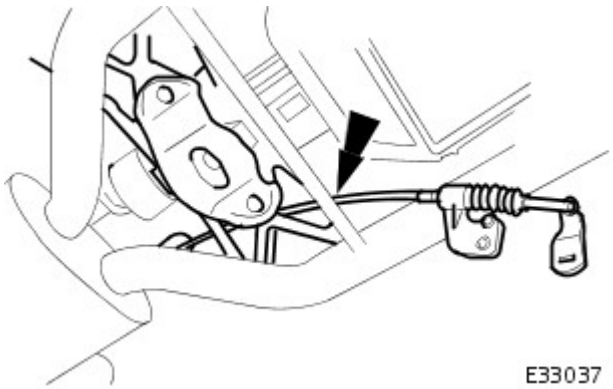
6. Detach the selector cable from the transmission unit.



1. Remove the cable inner to selector lever nut.

2. Remove the cable to transmission casing fixings.

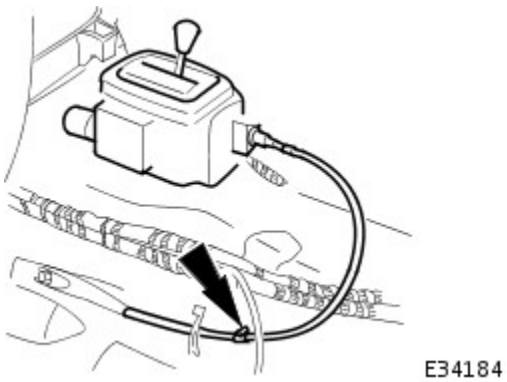
7. Reposition the selector cable.



8. Remove the LH front seat, Section 501-10.

9. Reposition the LH floor carpet for access.

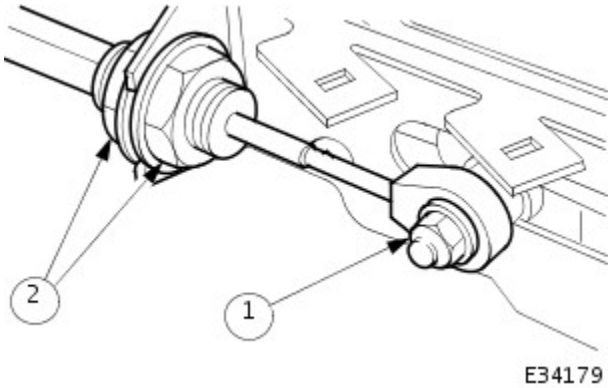
10. Remove the selector cable to tunnel clip tie strap.

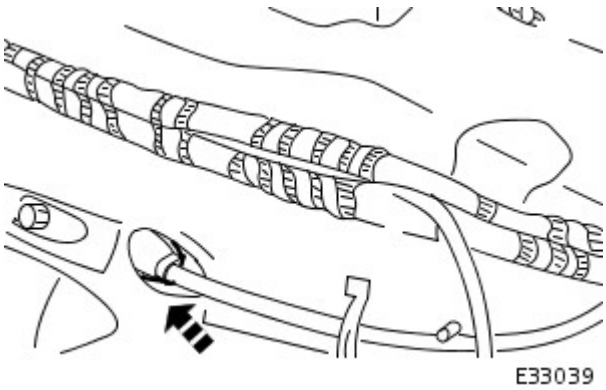


11. Detach the selector cable from the gear shift assembly.

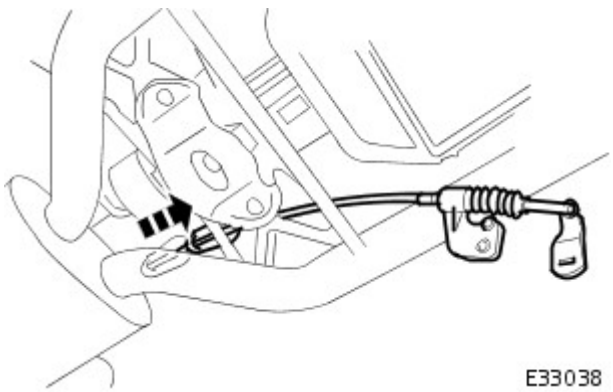
1. Remove the inner cable to shift lever nut.

2. Slacken the outer cable locknuts.



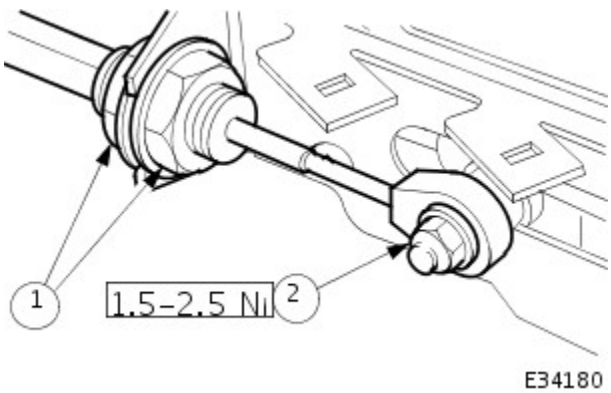


12. Push the outer cable grommet through the transmission tunnel aperture.



13. Remove the selector cable assembly from the vehicle.

Installation

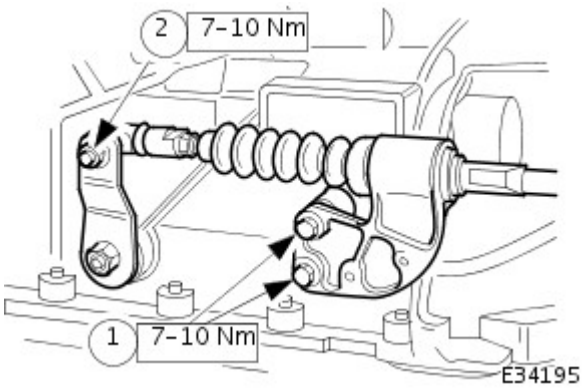


1. Assemble the cable to the gear shift assembly.

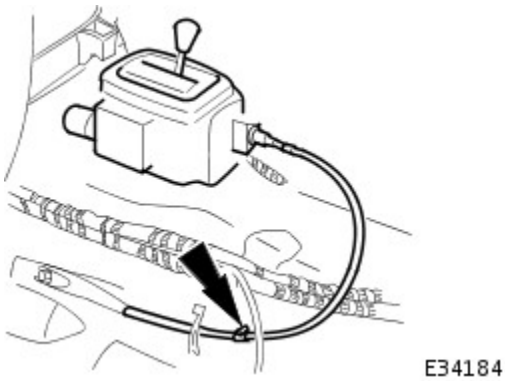
1. Locate the outer cable.
2. Fit and tighten the cable securing nut to the specified torque figure.

2. Connect the selector cable to the transmission.

1. Fit the bolts which secure the cable to the transmission casing and tighten to the specified torque figure.



2. Fit and tighten the inner cable securing nut to the specified torque figure.



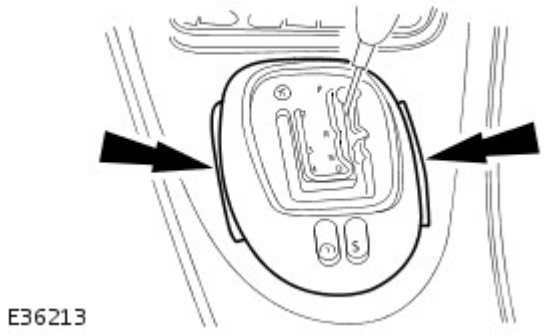
3. Secure the outer cable.

4. Adjust the selector cable in accordance with 44.15.07.

5. Further installation is the reverse of the removal procedure.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Gate Finish Panel

Removal and Installation



Removal

1. Apply protective tape to veneer along each side of 'J' gate finisher.
2. Using a screwdriver in the slot in front of the finisher, carefully lift the finisher and ease it from the 'J' gate surround.

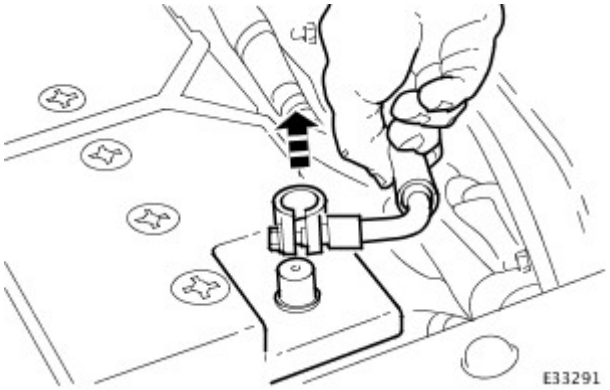
Installation

1. Position finisher over gear selector.
2. Firmly seat finisher on veneer panel.
3. Remove protective tape from veneer panel and using a suitable cleaner, remove any residual adhesive.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Indicator Assembly

Removal and Installation

Removal



1. Disconnect battery ground cable.

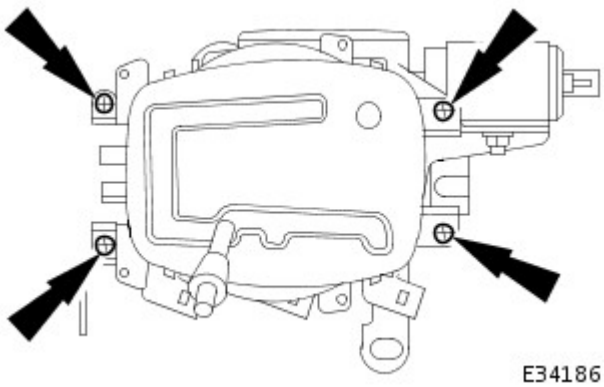
- Remove the battery cover.

2. Remove the selector lever knob, 44.15.06.

3. Remove the J-gate surround, Section 501-05.

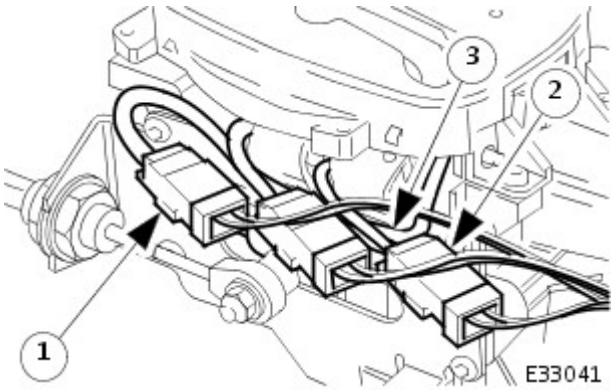
4. Remove the console finisher veneer panel, Section 501-12.

5. Remove the selector indicator module screws.



6. Remove the selector indicator module.

1. Free the D to 4 switch harness multiplug from the mounting bracket and disconnect the multiplug.
2. Displace the P switch multiplug from the mounting bracket.
3. Route the D to 4 harness from under the P switch harness.



Installation

1. Installation is the reverse of the removal procedure

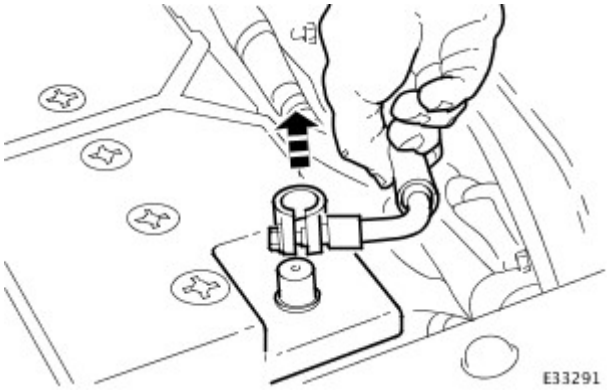
2. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

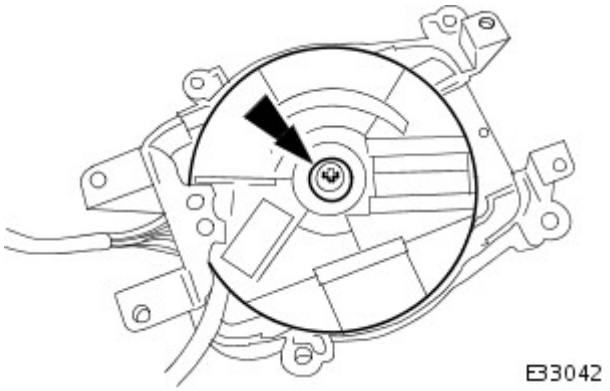
Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Indicator Disc

Removal and Installation

Removal



1. Disconnect battery ground cable.
    - Remove the battery cover.
2. Remove the selector indicator module; 44.15.14.
3. Remove the selector indicator module disc.
    - Remove the disc retaining screw.



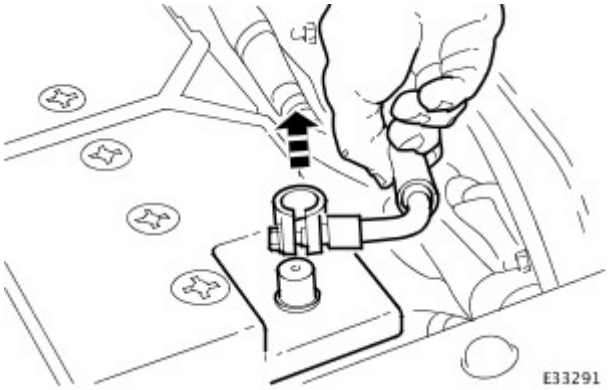
Installation

1. Installation is the reverse of the removal procedure.
2. Connect the battery and fit the battery cover.
    - Reset the radio and the clock.

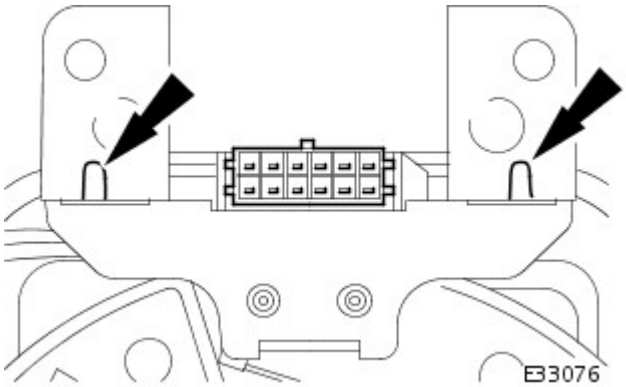
Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Switch

Removal and Installation

Removal



1. Disconnect battery ground cable.
   - Remove the battery cover.
2. Remove the gear shift knob, (44.15.06).
3. Remove the console finisher veneer panel, (76.47.26).
4. Remove the 'J Gate' surround for access, (76.25.24).
5. Remove the D to 4 switch.
   - Press the retaining tangs to release.



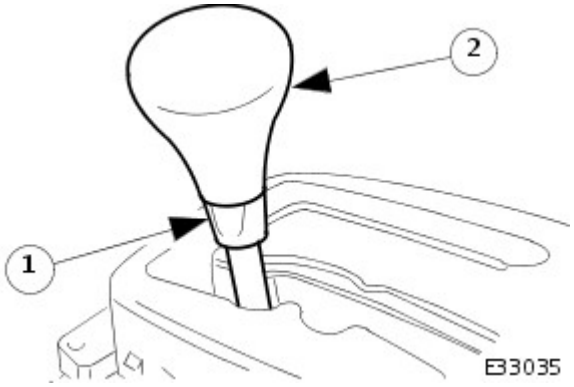
Installation

1. Fitting a new D to 4 switch is the reverse of the removal procedure.
2. Connect the battery and fit the battery cover.
   - Reset the radio and the clock.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Knob

Removal and Installation

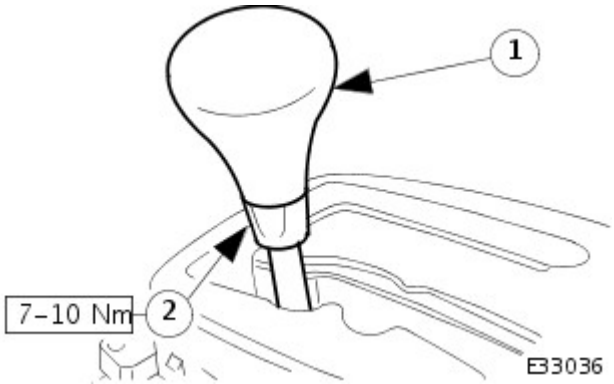
Removal



1. Remove the selector lever knob.

1. Slacken the ferrule, rotate clock-wise.
2. Rotate the knob counter-clockwise to remove.

Installation

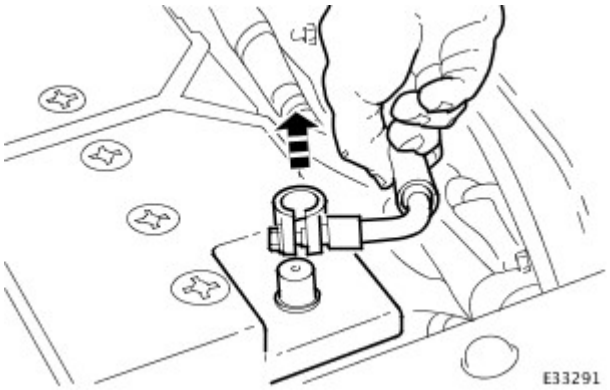


1. Refer to the illustration

1. Fit the knob.
2. Tighten the ferrule to the specified torque figure.

Automatic Transmission / Transaxle External Controls - 4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26 - Selector Lever Assembly

Disassembly and Assembly



1. Disconnect battery ground cable.

- Remove the battery cover.

2. Remove the shift lever knob, 44.15.06.

3. Remove the J-gate surround, Section 501-05.

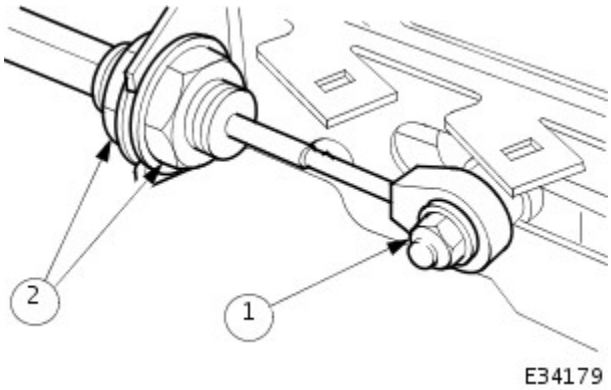
4. Remove the console finisher veneer panel, Section 501-12.

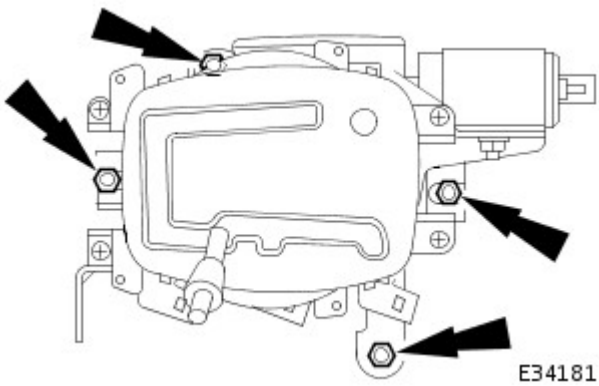
5. Remove the center console assembly, Section 501-12.

6. Remove the indicator module, 44.15.14.

7. Detach the selector cable from the gear shift assembly.

1. Remove the inner cable to selector lever nut.
2. Slacken one outer cable locknut, keeping one positioned for reference on reassembly.



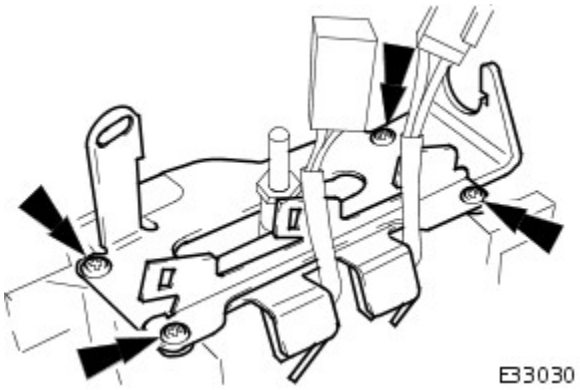


8. Remove the gear shift assembly.

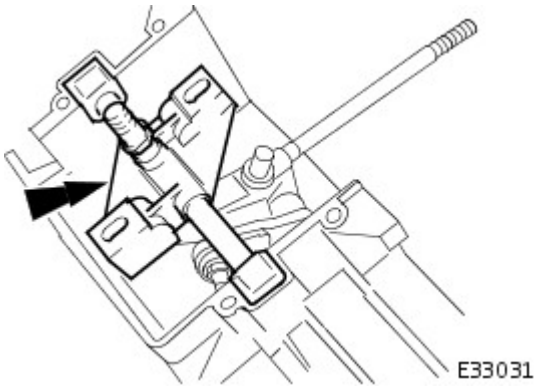
- Remove the four fixings.

9. Remove the slide plate.

- Remove the four screws.

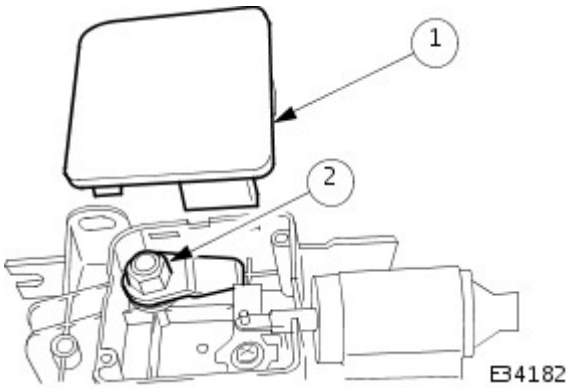


10. Remove the slide block/shaft assembly.



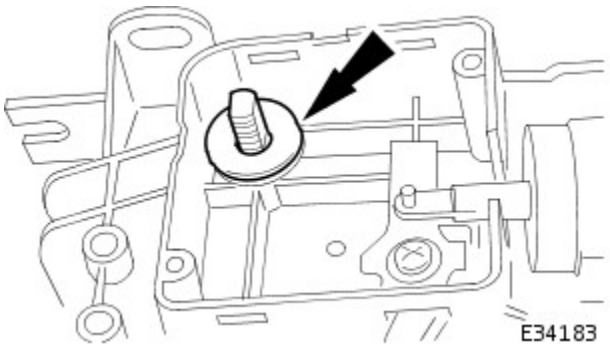
11. Remove the gearshift interlock solenoid actuating lever.

1. Remove the actuating lever cover.
2. Remove the actuating lever securing nut.



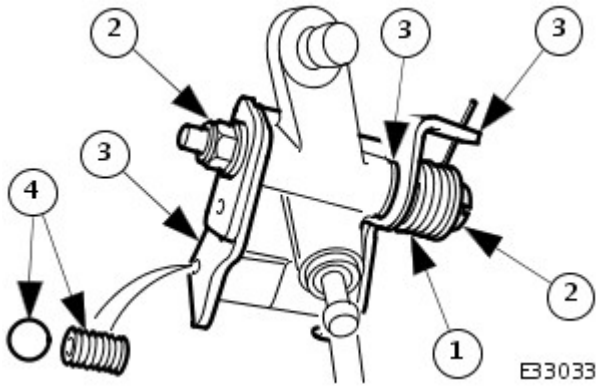
12. Remove the shift lever assembly from the housing.

- Remove the washer from the pivot shaft.



13. Disassemble the shift mechanism.

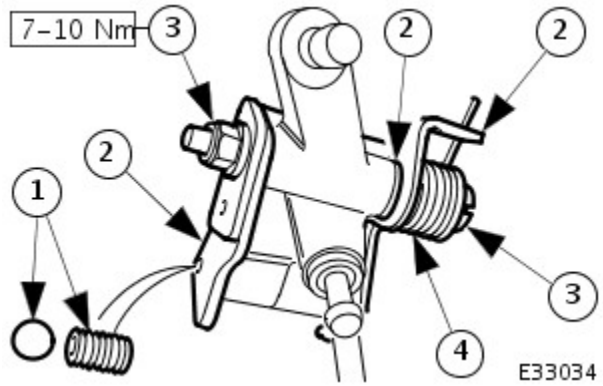
1. Remove the return spring.
2. Remove the pivot shaft nut, washer and pivot shaft.
3. Remove the pivot bracket, detent plate and washer.



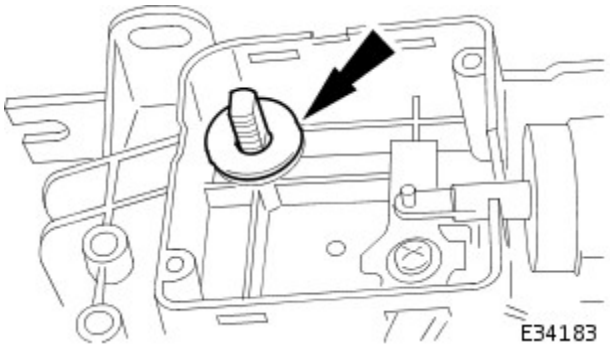
4. Remove the ball and spring.

14. Clean all components.

15. Reassemble the shift mechanism.

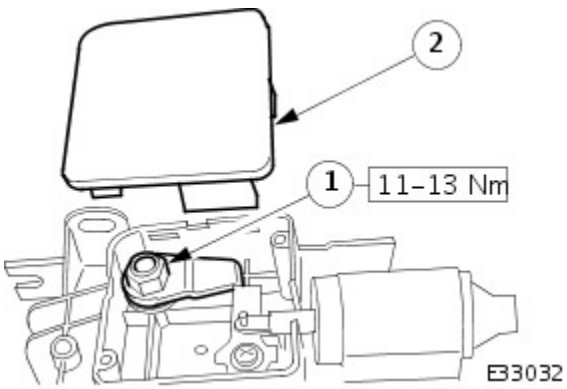


1. Apply grease and install the detent ball and spring.
2. Apply grease to the pivot bracket and install the bracket, detent plate and washer.
3. Install the pivot shaft, washer and nut.
4. Apply grease and locate the return spring.



16. Fit the shift lever assembly to the housing.

- Apply grease to the lever pivot and install the pivot washer.

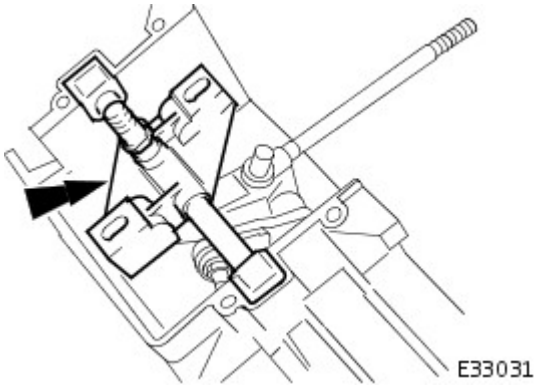


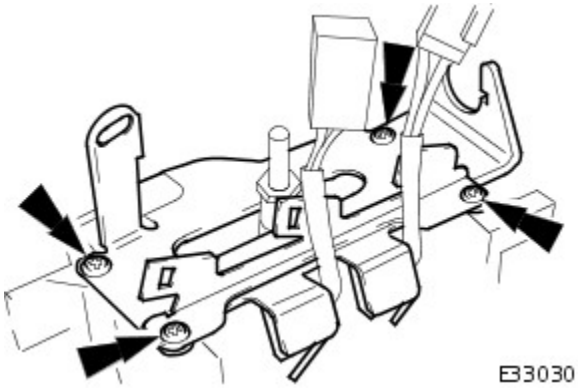
17. Install the gearshift interlock solenoid actuating lever.

1. Secure the actuating lever nut.
2. Fit the actuating lever cover.

18. Install the slide block / shaft assembly.

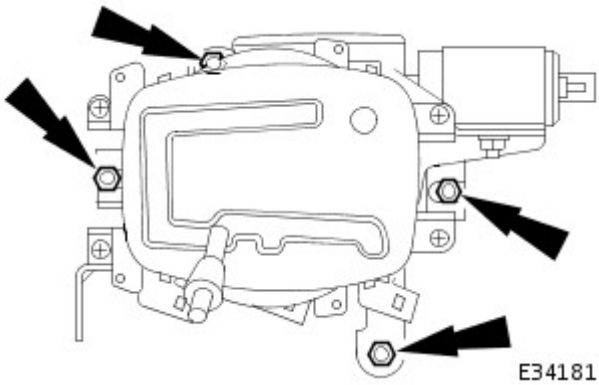
- Clean the slide block and shaft.
- Apply grease to the shaft.





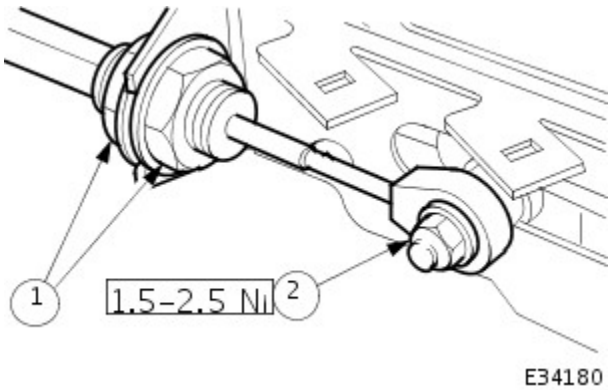
19. Install the slide plate.

- Install the four slide plate screws.



20. Fit the gear shift assembly.

- Install the four nuts.



21. Assemble the cable to the gear shift assembly.

1. Locate the outer cable.
2. Fit and tighten the cable securing nut to the specified torque figure.

22. Adjust, or verify, the cable in accordance with 44.15.07.

23. Further installation is the reverse of the removal procedure.

24. Connect the battery and fit the battery cover.

- Reset the radio and the clock.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - External Controls

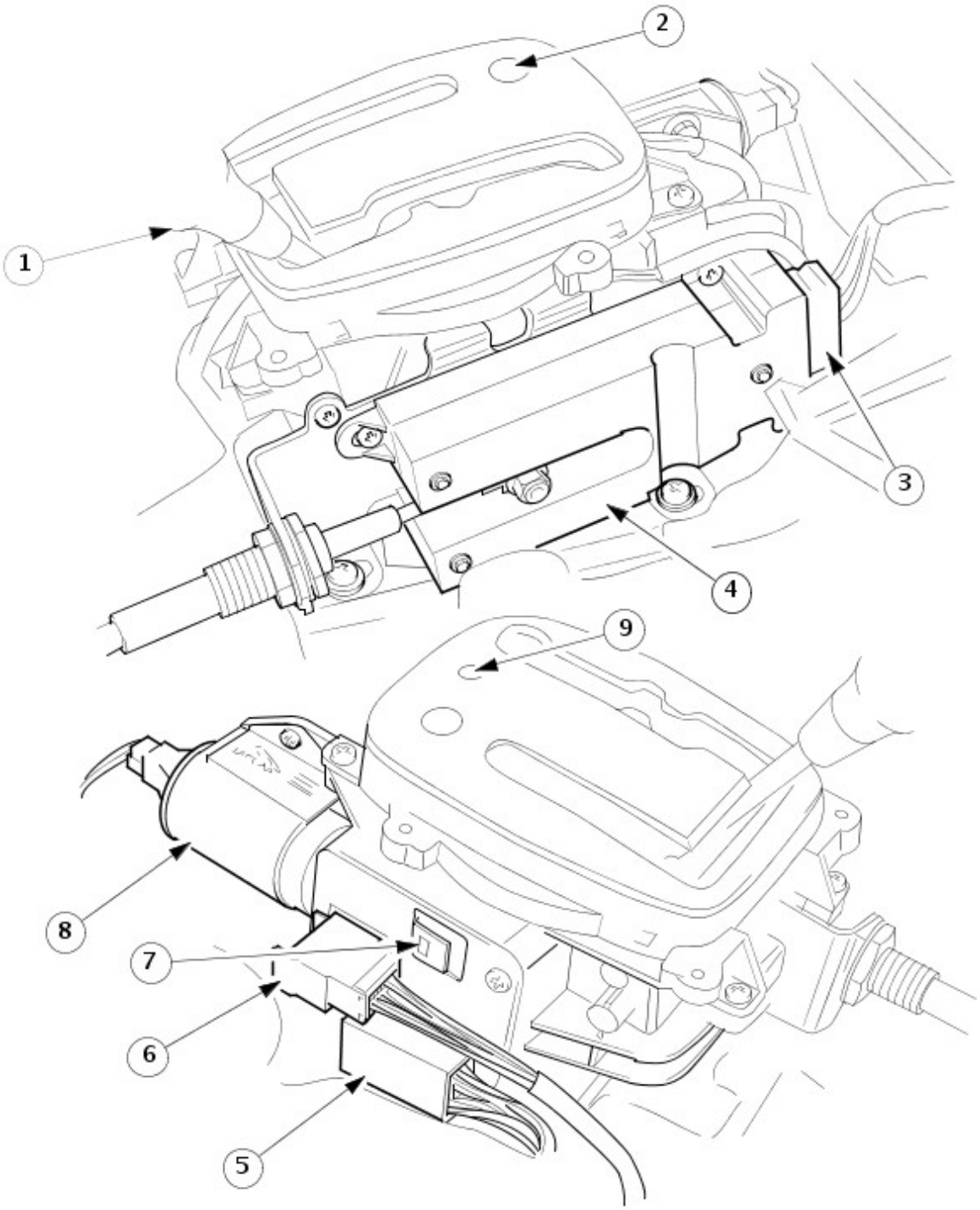
Description and Operation

Introduction

Operator gearshift control is effected by:

- The selector lever
- Accelerator pedal position
- Kickdown
- The mode switch

Operator's Selector Module ('J' Gate)



E34198

Item	Part Number	Description
1	—	Gear selector lever
2	—	Access blank - Gear-shift interlock solenoid
3	—	Connector - DLS
4	—	Dual Linear Switch (DLS)
5	—	Connector - Park position switch
6	—	Connector - Illumination module

7	—	Connector - Climate control
8	—	Solenoid - Gear selector
9	—	Security system Active LED

Selector lever:

Gear selector positions are:

- P Transmission mechanically locked, starting available *
- R Reverse gear
- N Neutral gear, no power to the rear wheels (starting available)
- D Drive gear, all 5 forward gears available (see Performance Mode Pushbutton)
- 4 Upshift to 4th gear only
- 3 Upshift to 3rd gear only
- 2 Upshift to 2nd gear only

Gearshift Interlock Manual Override*

The interlock system which locks the selector in P and prevents the ignition key from being removed except when P is selected, may be manually overridden in the event of an emergency.

1. **1.** With the parking brake applied
2. **2.** Remove the access blank using a suitable Torx bit
3. **3.** Insert a small screwdriver into the vacated hole
4. **4.** Push the screwdriver downwards, gently, and hold whilst simultaneously moving the selector from P towards R , but do not engage R until the tool has been removed
5. **5.** An audible warning may be heard when operation 4 is carried out
6. **6.** With the selector in N and the access blank replaced, the vehicle may be started

Range Selection

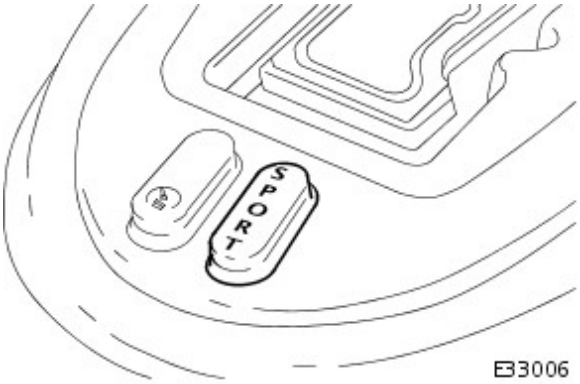
- The selector lever transmits operator demand to the transmission and TCM by means of a cable and Dual-Linear Switch (DLS).
- The lever operates the transmission assembly selector shaft, only for P R N D , by means of a cable. Movement of the lever across the gate to 4, 3 and 2 positions disengages the cable from the selector lever and engages the DLS which controls gear selection electronically.

Gear selector module:

- Provides illumination of the decal relevant to the gear selected. This information is provided by CAN from the TCM.
- Illuminates the security system Active LED on the gear selector surround, in response to an output from the BPM.

Transmission Switches

Performance Mode Pushbutton



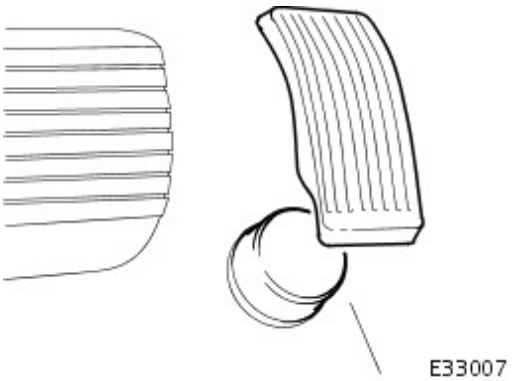
The performance mode pushbutton:

- Is mounted on the 'J' gate surround.
- This 'push-on push-off' switch selects Normal or Sport mode (push-on for Sport)
- Is illuminated when Sport mode is selected.
- Is hard-wired to the transmission control module.

With 'Normal' selected the transmission will start off in 2 nd gear with kickdown to 1 st being available.

'Sport' mode allows 1 st gear engagement from rest and modifies values in the TCM shift point calculations to provide higher upshift speeds and enhanced availability of downshifts.

Kickdown Switch



The kickdown switch:

- Is floor mounted under the accelerator pedal.
- Is operated by pressing the pedal beyond the full throttle position.
- Provides maximum acceleration on driver demand, by signalling the TCM to select the lowest gear to give maximum wheel torque.

Gear selector interlock solenoid:

- Prevents the gear selector lever from being moved from P , unless the ignition switch is in position II, and the brake pedal is depressed.
- Is controlled by an output from the BPM

Park position switch:

- Is hard-wired to the BPM
- Detects when the gear selector lever is moved to the Park position

Dual-Linear Switch (DLS)

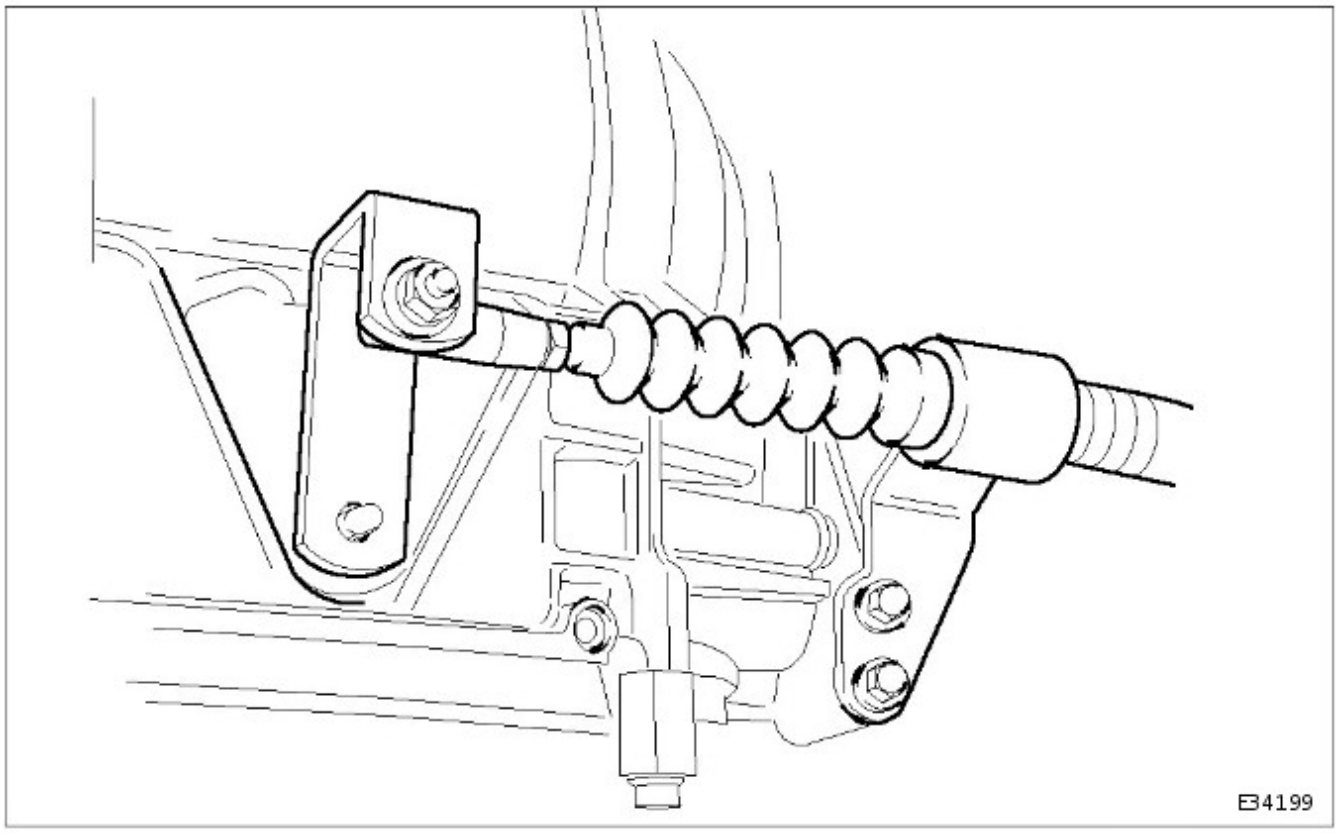
The TCM detects gear selection by means of a switch fitted to the 'J' gate; the DLS contains two multi-track slider switches, of which the upper controls P R N D and the lower 4 3 2 .

Output from the DLS is changed as the selector lever is moved, thus indicating selected gear position. The parallel signal is input to the TCM by 4 discrete logic wires W0, W1, W2 and W3. The particular sequence, or gray code, will indicate which shift position is selected, as shown in the following table where 0 = low and 1 = high:

Gray code

Selector Position	W3	W2	W1	W0
P	0	1	1	1
R	1	1	1	0
N	1	1	0	1
D	0	1	0	0
4	1	0	0	0
3	0	0	1	0
2	0	0	0	1

Transmission Unit Gear Selector

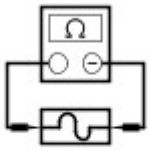
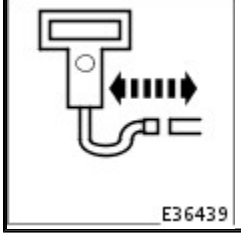


The gear selector at the transmission unit:

- Is connected to the operator's selector module by cable
- Operates the selector valve, at the electro-hydraulic control unit

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - External Controls

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scan tool

Problem Solving - Transmission Shift

Quick Reference Fault Chart

Symptom	Possible Sources	Action
Shift stuck in P	* Selector cable seized	* GO to 44.15.08
	* Interlock solenoid not operating	* GO to PDU
	* Interlock latch seized * Transmission faulty	* Mechanical check
	* Operator sequence error	* Correct the sequence
Vehicle rolls on P	* Incorrect cable adjustment	* GO 44.15.07
	* Faulty parking pawl (transmission internal)	* Mechanical check
R does not engage	* Incorrect cable adjustment	* GO to 44.15.07
	* Transmission fluid level incorrect	* GO to 44.24.02
N not achieved	* Incorrect cable adjustment * Transmission faulty	* GO to 44.15.07
D does not engage	* Incorrect cable adjustment	* GO to 44.15.07
	* Transmission fluid level incorrect	* GO to 44.24.02
	* Transmission faulty	* Mechanical check
Lower ratios will not hold	* Excessive engine temperature * DLS fault	* GO to PDU
Shift lever position not visually correct	* Incorrect DLS adjustment	* GO to 44.15.07
Shift lever has no effect upon the transmission and resistance cannot be felt	* Cable disconnected or broken * Transmission selector problem * Shift lever drive pin adrift	* Mechanical check
Shift lever position not align correctly following manual selection of lower ratios	* Sliding block drive pin displaced - following road debris contact	* Mechanical check. Renew the selector if damaged, or re-align the drive pin and sliding block
Shift lever detent indistinct in 3 causing poor location	* DLS detent fault	* GO to Renew the DLS
Shift may be moved from P without brake pedal operation	* Interlock latch fault	* Mechanical check
	* Solenoid permanently activated	* GO to PDU
Engine may be started in positions other than P or N	* Incorrect cable adjustment * DLS fault	* GO to 44.15.07
Shift lever vibration	* Loose selector assembly * Cable isolation fault	* Mechanical check
Noise / rattle from 'J' gate	* Debris in the mechanism	* Clean
	* Worn 'J' gate track gasket allowing lever and moulding to contact	* GO to 44.15.05

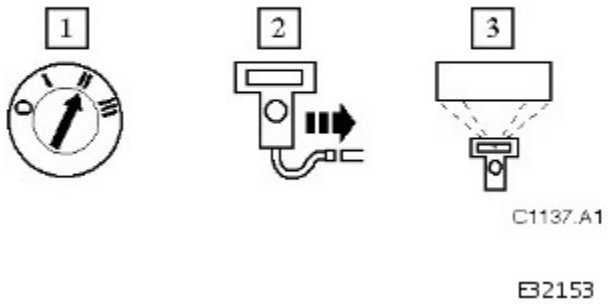
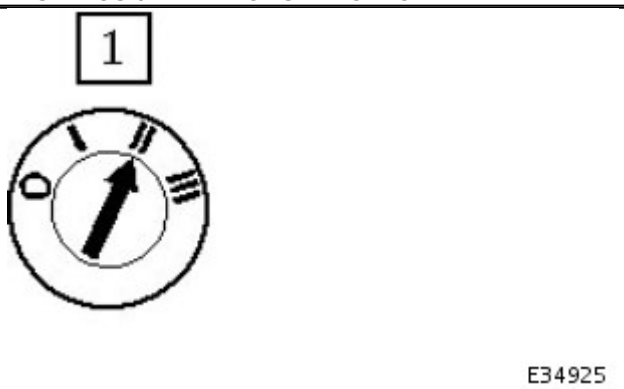
	* Loose selector disc seal	

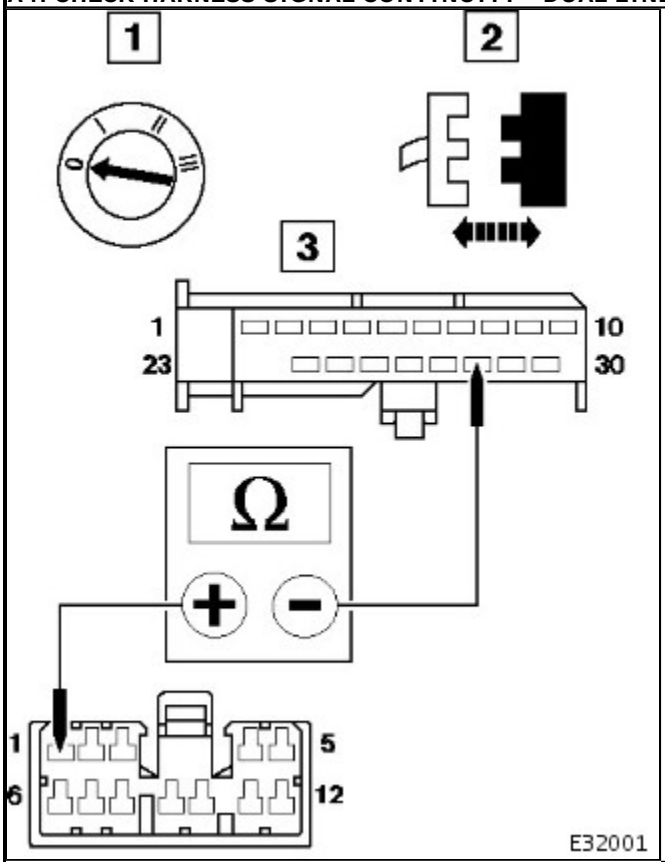
Shift Selection and Gear Position

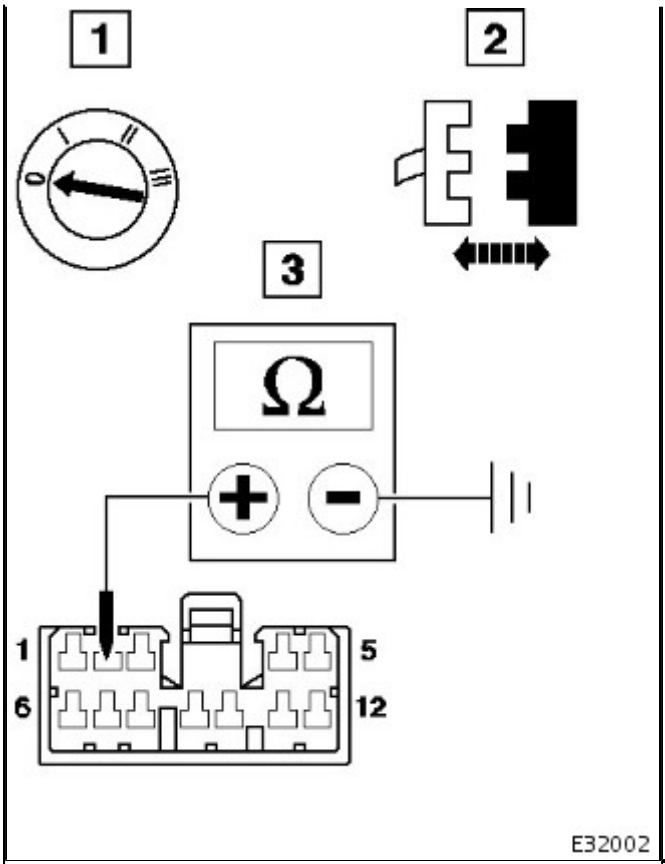
Symptom Chart

Symptom	Possible Sources	Action
DTC P0705 Transmission range sensor circuit malfunction	* Selector cable maladjusted * Linear switch maladjusted * Linear position switch fault * Harness fault * Connector pins(s) bent, loose or corroded	* GO to Pinpoint Test A

Pinpoint test A: P0705

PINPOINT TEST A : P0705	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	
	
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2
A2: STATUS / RELATIONSHIP CHECK	
	
	1 Move the selector lever slowly from P to 2 and back, noting the illumination / position relationship as follows:
	Does state illumination match the lever position in each direction of travel? **Yes** GO to A4 **No** GO to A3 **No** With lever at D (when moving from 2 to P) is 3 or 4 illuminated? **Yes** GO to A3

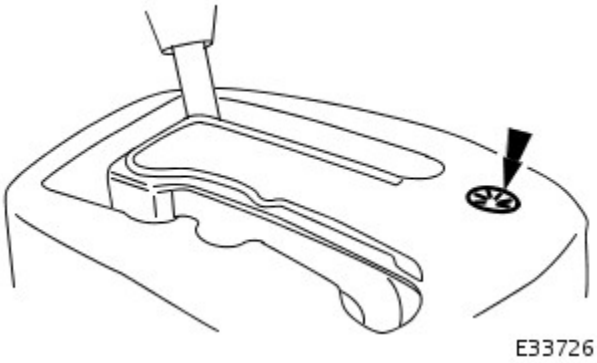
	No GO to A5 **No** With lever moved from P , to position 4 , is D illuminated? **Yes** GO to A4 **No** GO to A5
A3: CHECK SELECTOR CABLE OR LINEAR SWITCH ADJUSTMENT	
	1 Verify and correct as required the selector cable or linear switch adjustment
	OK? **Yes** GO to A4 **No** Correct adjustment error, see 44.15.07 Workshop Manual 307-05B and test the system for normal operation.
A4: CHECK HARNESS SIGNAL CONTINUITY - DUAL LINEAR SWITCH	
	
	1 With EM0 61 and CC008 disconnected, measure the resistance between CC00 8/001 and EM061 /028 • Repeat for
	2 CC008/008 and EM061/027
	3 CC008/006 and EM061/026
	4 CC008/007 and EM061/025
	Is the resistance < 0.5 OHM? **Yes** GO to A5 **No** Inspect EM061, EM063 and CC008 for corrosion, bent / pushed back pins or locate harness. Repair as necessary and test the system for normal operation.
A5: CHECK HARNESS SWITCH GROUND CONTINUITY	



	1 With EM061 and CC008 disconnected, measure the resistance between CC008/002 and EM008R
	Is the resistance < 0.5 OHM? **Yes** GO to A6 **No** Inspect CC008 and EM063 for corrosion, bent / pushed back pins or locate harness / ground EM8R, splices EMS017 and EMS004. Repair as necessary and test the system for normal operation.
A6: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Brake Shift Interlock Actuator Manual Override

General Procedures

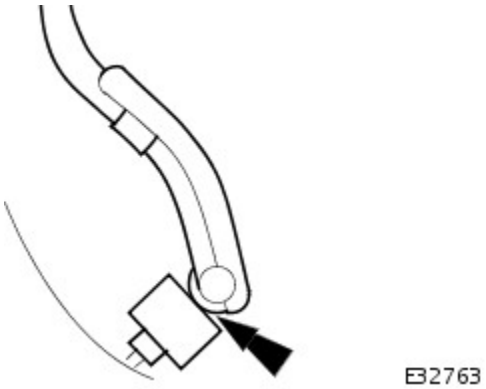


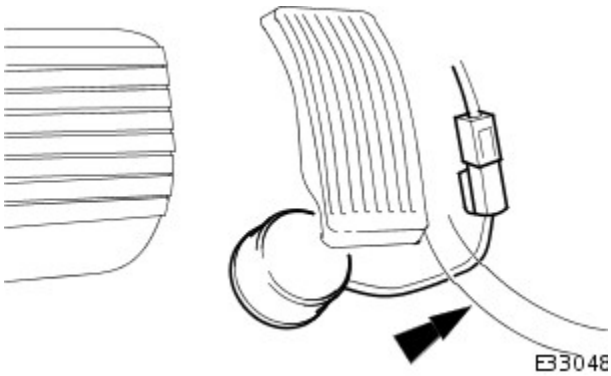
1. To override the gearshift interlock:

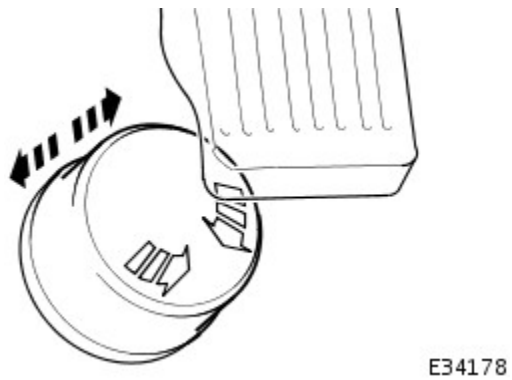
1. Unscrew the release catch blanking plug.
2. Insert the ignition key into the aperture, depress the release catch and simultaneously move the gear selector lever from the Park position. The lever will only move approximately 25 mm with the key inserted.
3. Remove the ignition key and replace the blanking plug.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Kickdown Switch Adjustment

General Procedures





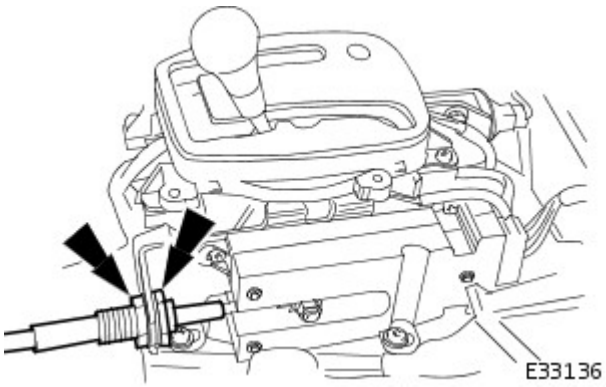


1. Ensure that the throttle cable is correctly adjusted; refer to Operation 19.20.06.
2. Refer to the PDU User Guide for relevant software - 1040.
3. With PDU connected, running and the message 'EXISTING COMPONENTS TO BE TESTED YES / NO' displayed:
   - Select YES.
   - Select ENTER.
   - Follow the messages given on the screen.
4. Press ENTER on the PDU screen.
5. Following the PDU instructions:
   - Push the throttle pedal until light contact is made with the kickdown switch and hold in this position.
   - Press ENTER on the display.
   - Note the percentage throttle open data (displayed as a bar graph).

     • NOTE: Ensure that contact with the switch does not result in movement of the switch.
   - Release the throttle pedal.
6. If the target 90% throttle open specification is NOT achieved the switch must be adjusted as follows.
7. Disconnect the kickdown switch multiplug.
   - Move the carpet for access.
8. Adjust the kickdown switch to the value as defined in step 6.
   - Rotate the switch in the required direction.
9. Verify the setting.
10. With the PDU instructions completed, connect the kickdown switch multiplug.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Selector Lever Cable Adjustment

General Procedures



1. Disconnect the vehicle battery ground lead.

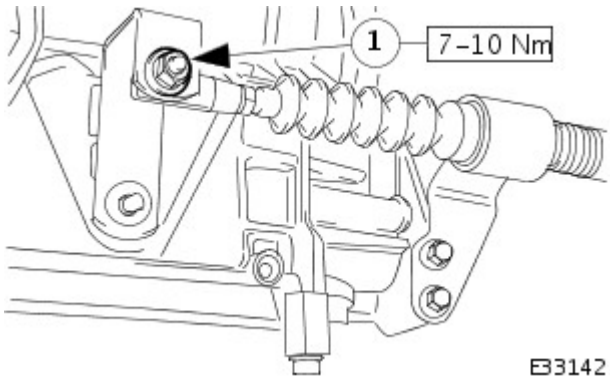
2. Position the gear selector lever to N.

3. Remove the J-gate surround, Section 501-05.

4. Remove the console finisher veneer panel, Section 501-12.

5. Remove the center console assembly, Section 501-12.

6. Slacken the selector cable locking nuts and screw them away from the abutment.

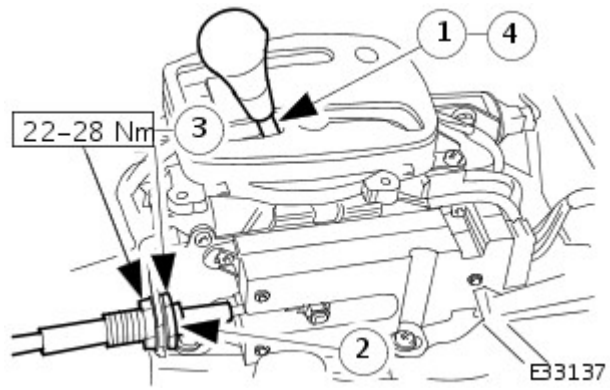


7. Raise the vehicle for access.

8. Verify that the transmission selector lever is at position (N).

- At the transmission, detach the inner cable from the selector lever.
- With the lever moved fully rearward, push the lever forward two detents to achieve N.

1. Reconnect the inner cable.



9. NOTE: When setting the selector cable, ensure that the transmission selector does not move from the (N) position.

Adjust the selector cable from inside the vehicle.

1. Position the gear selector lever to the N detent.
2. Adjust the nuts to lock against the bracket without moving the set position of either the gear selector lever or the selector lever on the transmission case.
3. Tighten to specification.
4. Verify the (N) setting.

10. Further installation is the reverse of the removal procedure.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Brake Shift Interlock Actuator

Removal and Installation

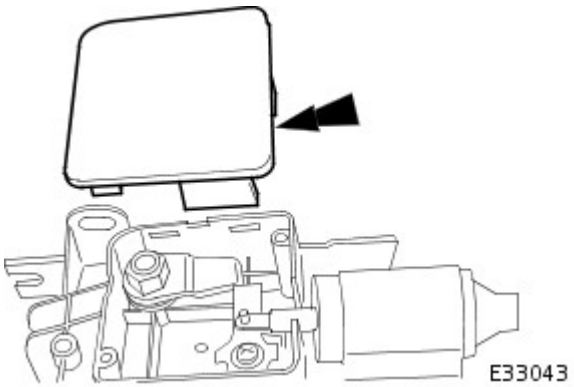
Removal

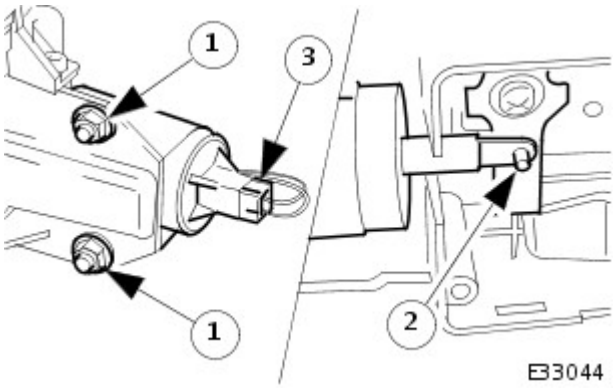
1. Disconnect the vehicle battery ground lead.

2. Remove the J-gate surround, Section 501-05.

3. Remove the console finisher veneer panel, Section 501-12.

4. Remove the interlock solenoid lever cover.





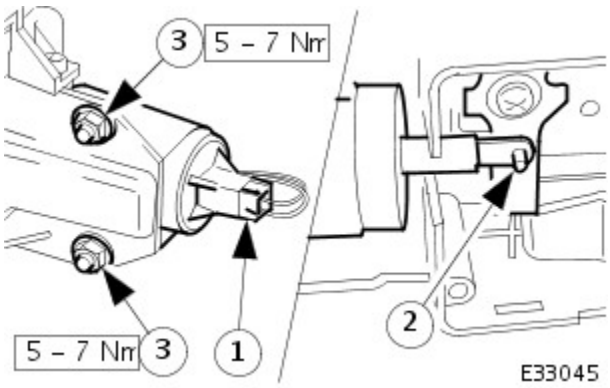
5. Remove the gearshift interlock solenoid.

1. Remove the (2) solenoid nuts.
2. Detach the solenoid from the latch pin.
3. Disconnect the solenoid multiplug.

Installation

1. Installation is the reverse of the removal procedure.

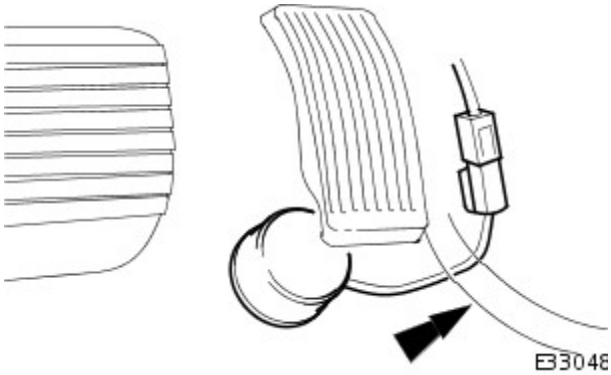
2. Refer to the illustration.



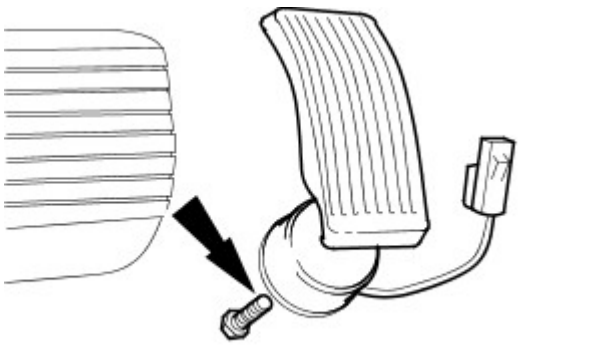
Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Kickdown Switch

Removal and Installation

Removal



1. Disconnect the kickdown switch multiplug.
   - Move the carpet for access.



2. Remove the kickdown switch.
   - Rotate counter-clockwise.

Installation

1. Installation is the reverse of the removal procedure.
2. The kickdown switch MUST be adjusted in accordance with (44.15.38).

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Selector Lever Cable and Bracket

Removal and Installation

Removal

1. Disconnect the vehicle battery ground lead.

2. Position the selector to N.

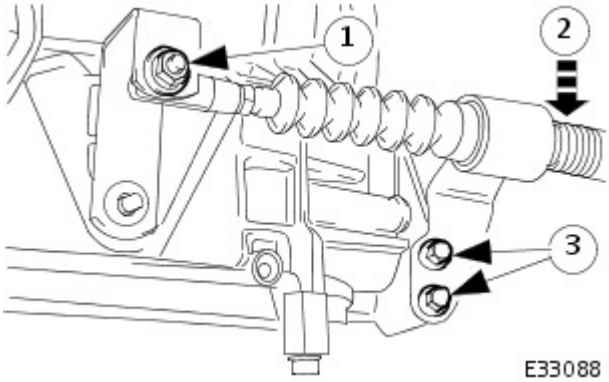
3. Remove the J-gate surround, Section 501-05.

4. Remove the console finisher veneer panel, Section 501-12.

5. Remove the center console assembly, Section 501-12.

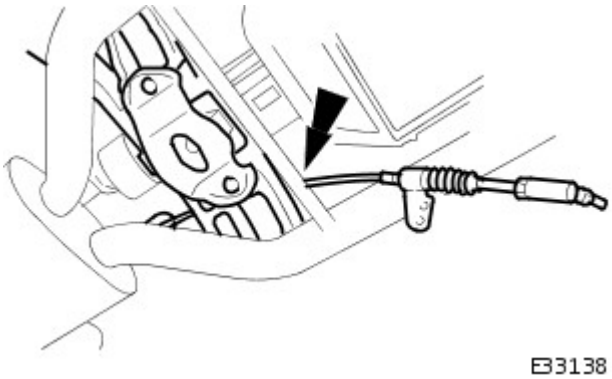
6. Raise the vehicle for access.

7. Detach the gear selector cable from the transmission unit.



1. Remove the nut which secures the selector cable ball pin to the selector lever.
2. Lower the transmission lift for access.
3. Remove the bolts which secure the selector cable to the transmission casing.

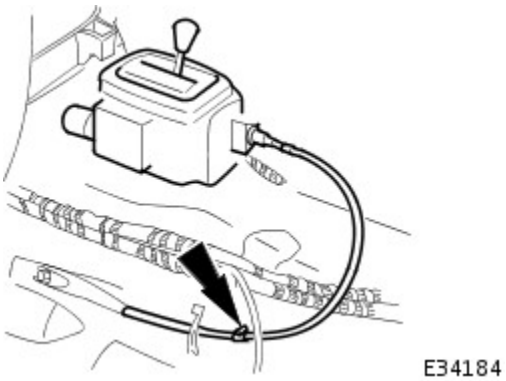
8. Reposition the selector cable.



9. Remove the LH front seat, Section 501-10.

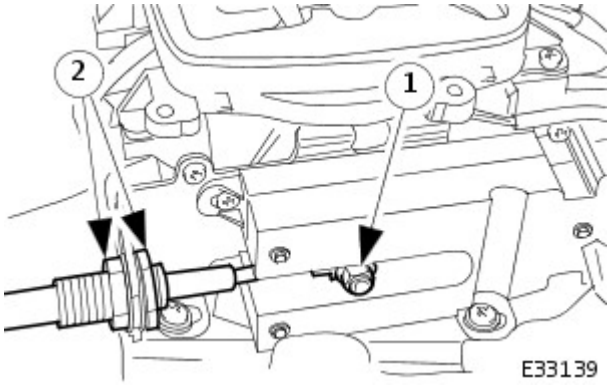
10. Reposition the LH floor carpet for access.

11. Remove the selector cable to tunnel clip tie strap.

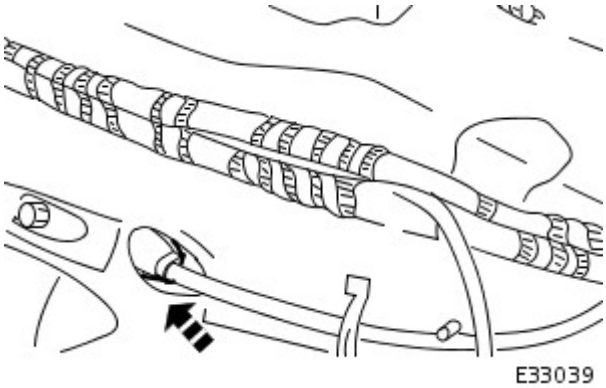


12. Detach the selector cable from the gear shift assembly.

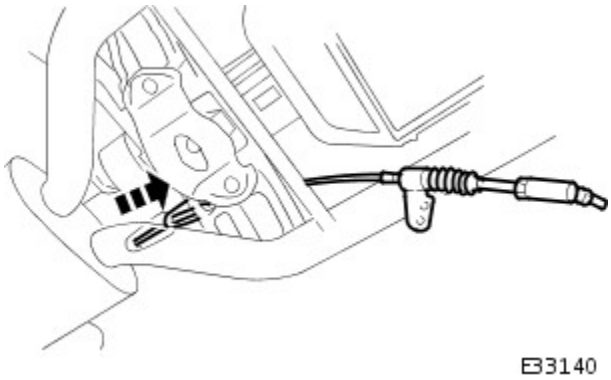
1. Remove the inner cable to shift lever nut.



2. Slacken the outer cable locknuts.

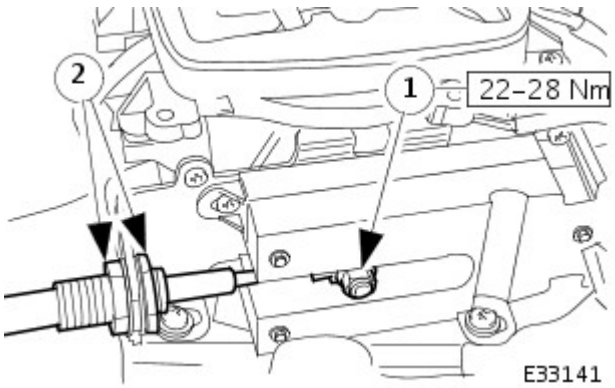


13. Push the outer cable grommet through the transmission tunnel aperture.



14. Remove the selector cable assembly from the vehicle.

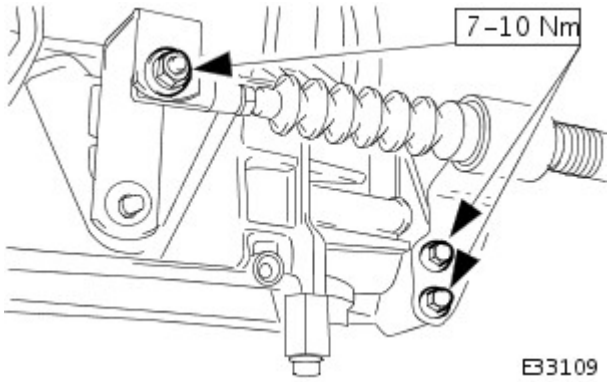
Installation

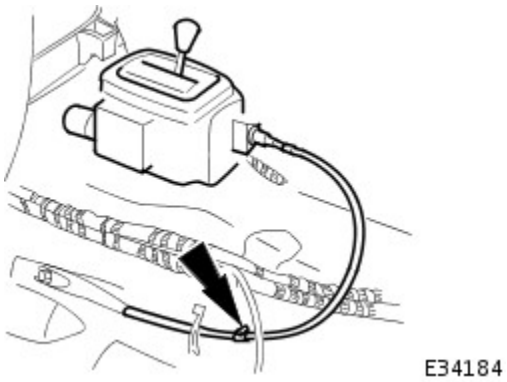


1. Assemble the cable to the gear shift assembly.

1. Locate the outer cable and fit the inner cable to the gear selector arm. Tighten to the specified torque figure.
2. Position the abutment nuts to the approximate position, but do not tighten.

2. Fit the cable to the transmission and tighten the fixings to the specified torque figure.





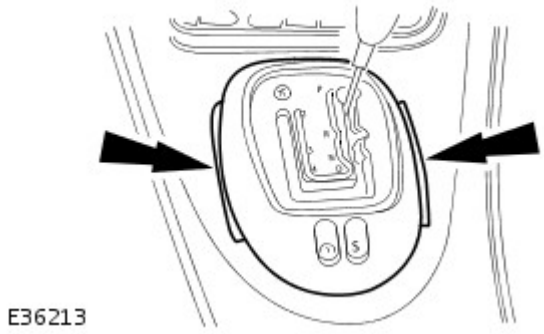
3. Secure the outer cable.

4. Adjust the selector cable in accordance with Operation 44.15.07.

5. Further installation is the reverse of the removal procedure.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Selector Lever Gate Finish Panel

Removal and Installation



Removal

1. Apply protective tape to veneer along each side of 'J' gate finisher.
2. Using a screwdriver in the slot in front of the finisher, carefully lift the finisher and ease it from the 'J' gate surround.

Installation

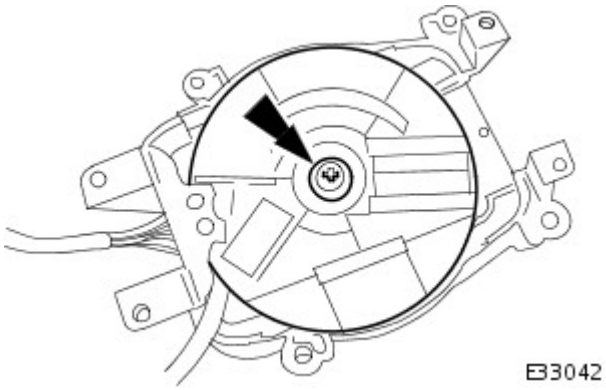
1. Position finisher over gear selector.
2. Firmly seat finisher on veneer panel.
3. Remove protective tape from veneer panel and using a suitable cleaner, remove any residual adhesive.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Selector Lever Indicator Disc

Removal and Installation

Removal

1. Disconnect the vehicle battery ground lead.
2. Remove the selector indicator module; Operation 44.15.14.
3. Remove the selector indicator module disc.
   - Remove the disc retaining screw.



Installation

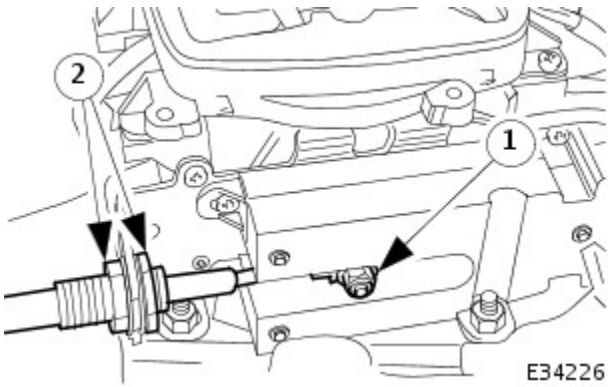
1. Installation is the reverse of the removal procedure.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Transmission Control Switch (TCS)

Removal and Installation

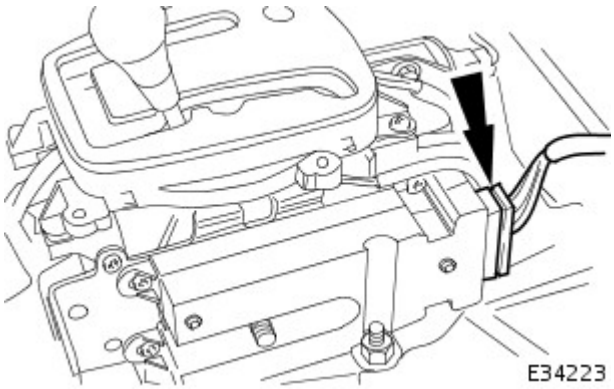
Removal

1. Position the gear selector to 'N' to provide clearance for removing the console.
2. Disconnect the vehicle battery ground lead.
3. Remove the J-gate surround, operation 76.25.24.
4. Remove the console finisher veneer panel, operation 76.47.26.
5. Remove the console assembly, operation 76.25.01.
6. Detach the selector cable from the gear shift assembly.

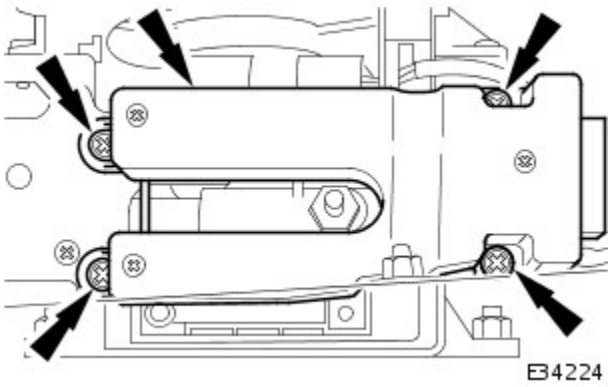


    1. Remove the nut which secures the inner cable to the shift lever.
    2. Slacken the outer cable locknuts. Move the cable clear.

7. Disconnect the electrical connector from the linear switch.



8. Position the selector to 'P' to align the mechanism for installing the new linear switch.
9. Remove the linear switch.

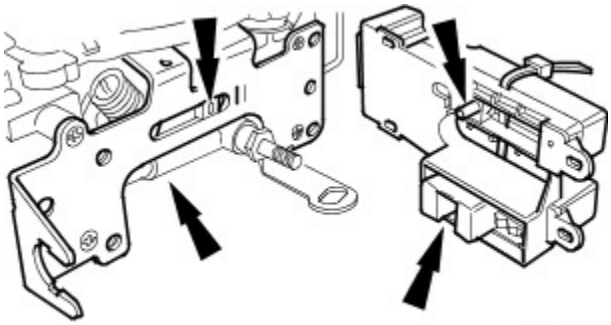


- Remove the four screws.
- Remove the linear switch from the mounting bracket.

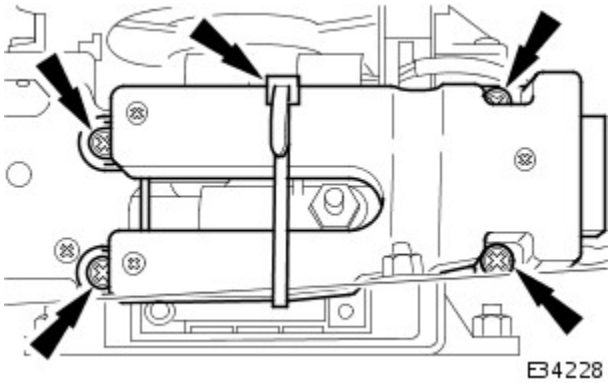
Installation

1. Install the linear switch.

- Position the linear switch to the mounting bracket.

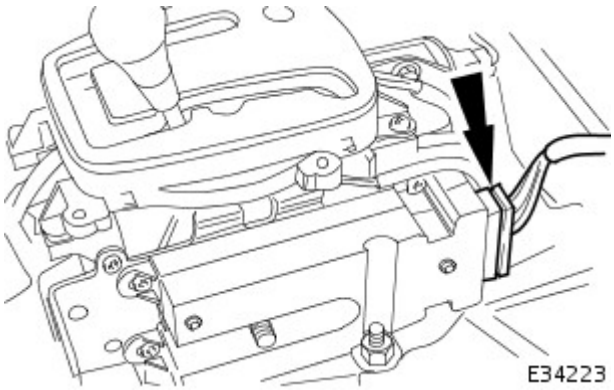


- Align the drive peg and lower sliding block of the switch to the mating components of the selector mechanism.

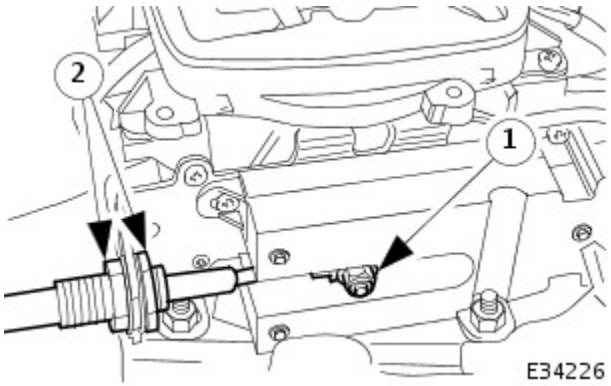


2. Install the four screws, but do not fully tighten.

- Remove the Ty-Strap from the dual linear switch.
- Use the manual release and reposition the selector to 'N' for installation of the selector cable.



3. Connect the electrical connector to the linear switch.



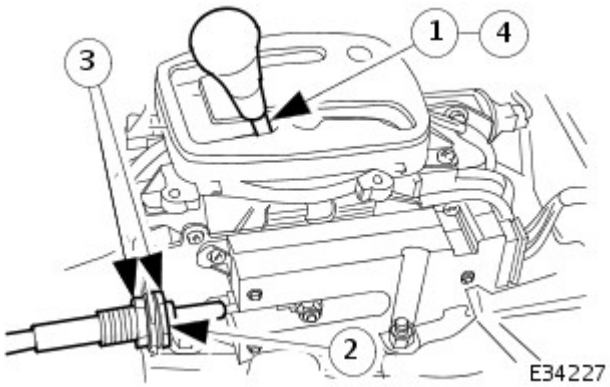
4. Assemble the cable to the gear shift assembly.

1. Locate the outer cable and fit the inner cable to the gear selector arm. Tighten to 22-28 Nm.
2. Position the abutment nuts to the approximate position, but do not tighten.

5. NOTE: When setting the selector cable, ensure that the selector lever on the transmission casing is still in the 'N' position.

Adjust the selector cable from inside the vehicle.

1. Confirm that the selector lever is in the 'N' position.
2. Adjust the nuts to lock against the bracket without



moving the set position of either the gear selector lever or the selector lever on the transmission casing.

3. Tighten to 22-28 Nm.

4. Verify the 'N' setting.

6. Check that all released connectors are safely insulated and connect the vehicle battery.

7. Switch ON the ignition.

8. Adjust the position of the linear switch so that the selector 'N' position graphic illuminates. Tighten the four screws to 0,7-1 Nm.

9. Move the gear selector to 'R' to confirm that the 'R' position graphic illuminates.

10. Check that the engine will start when the gear selector is in the 'N' and 'P' positions, but not in any other position.

11. Move the gear selector to 'N'.

12. Switch OFF the ignition.

13. Disconnect the battery.

14. Install the console assembly, operation 76.25.01.

15. Install the console finisher veneer panel, operation 76.47.26.

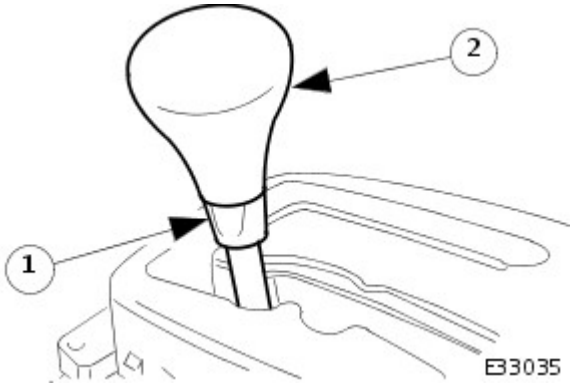
16. Install the J-gate surround, operation 76.25.24.

17. Perform the Battery Reconnection Procedure described in Operation 86.15.15.

Automatic Transmission / Transaxle External Controls - 4.0L SC V8 - AJ26 - Selector Lever Knob

Removal and Installation

Removal

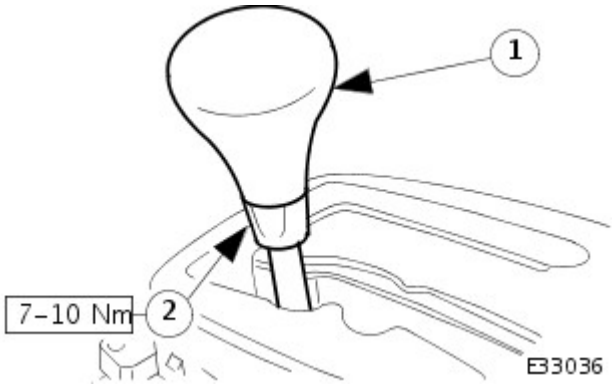


1. Disconnect the vehicle battery ground lead.

2. Remove the selector lever knob.

1. Slacken the ferrule, rotate clockwise.
2. Rotate the knob counter-clockwise to remove.

Installation



1. Refer to the illustration.

1. Fit the knob.
2. Refer to the illustration.

Exhaust System -

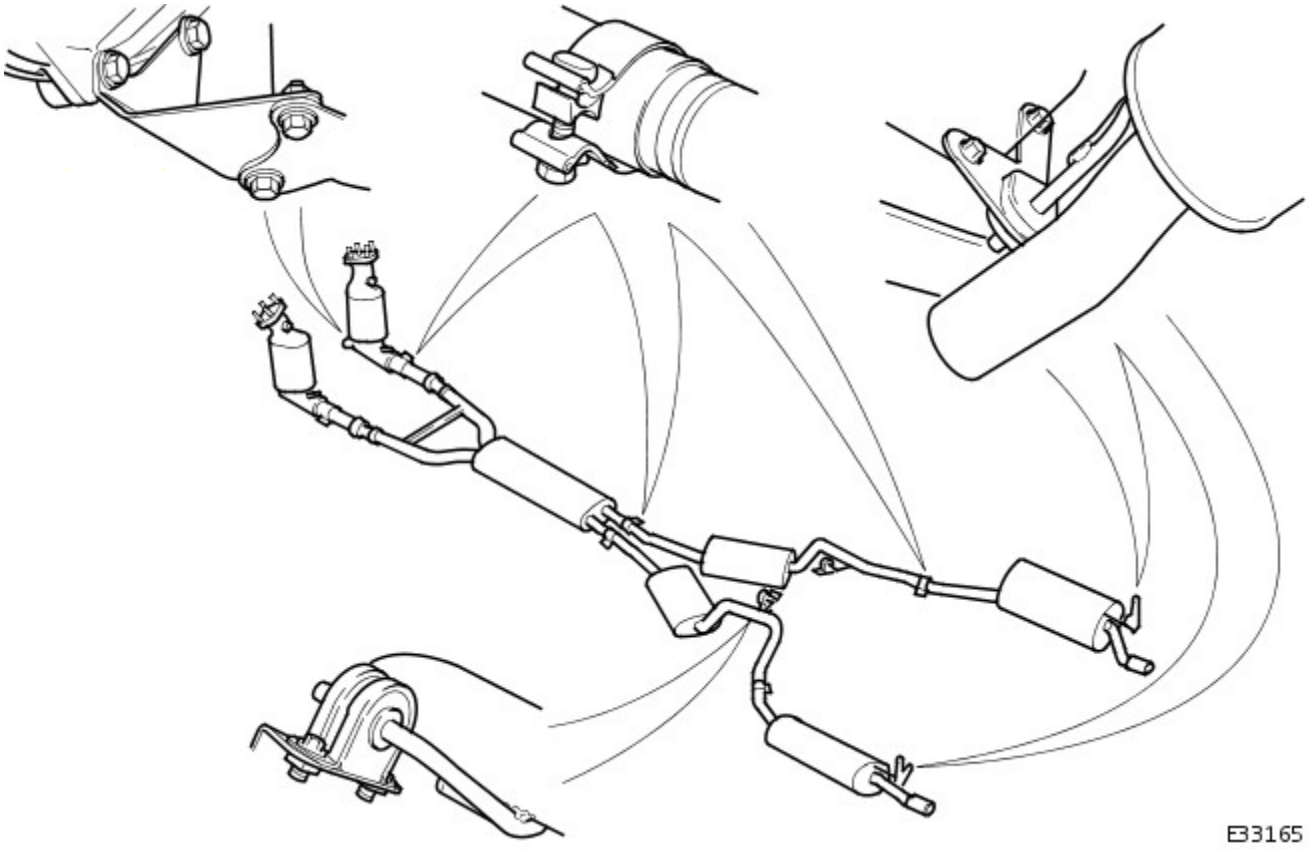
Torques

Component	Nm
Nut - Downpipe catalytic converter to exhaust manifold	14 - 18
Bolt - Downpipe catalytic converter to lower mounting bracket	39 - 51
Bolt - Front muffler mounting to gearbox (SC)	22 - 28
Bolt - Front muffler mounting to front muffler cross brace (SC)	22 - 28
Bolt - Over-axle mounting to rear suspension A-frame	22 - 28
Torca clamps	52 - 68
Oxygen sensor to downpipe	40 - 50

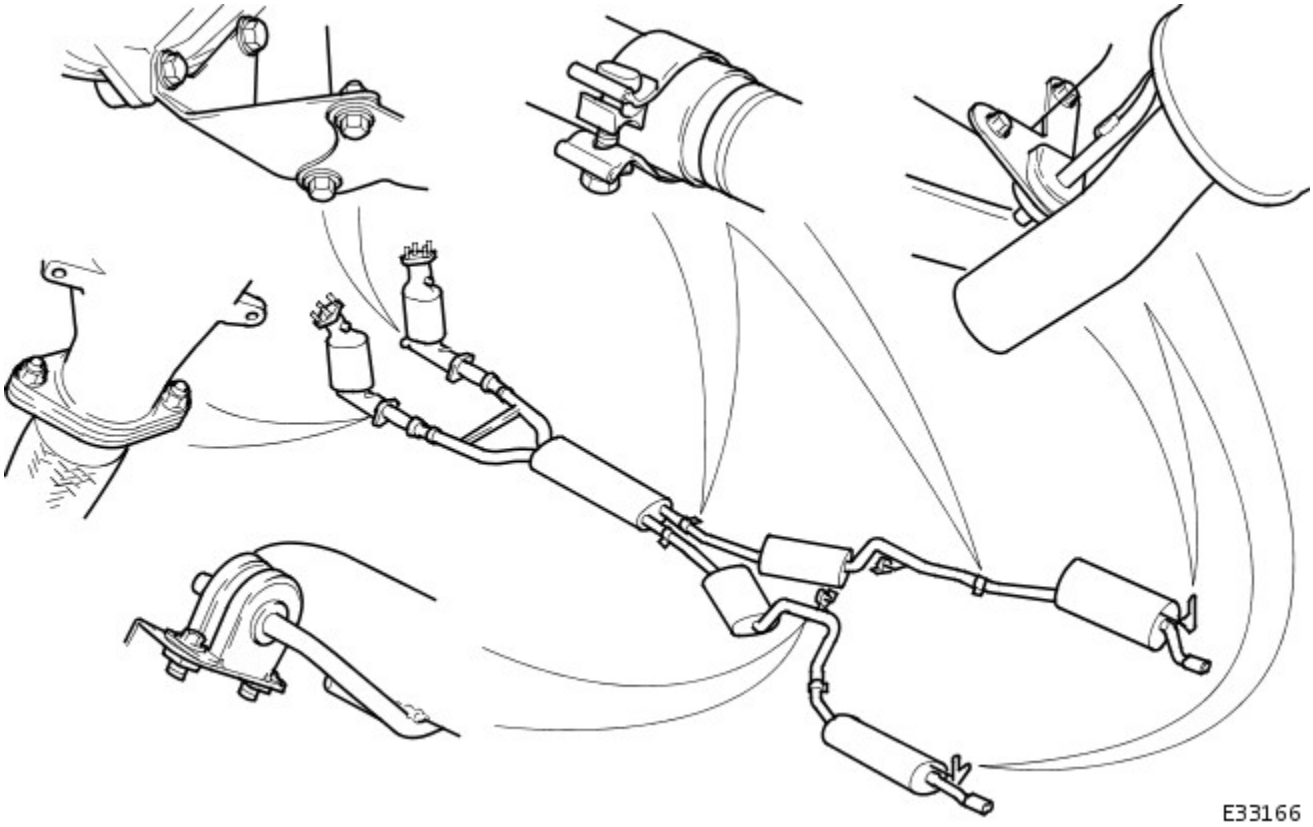
Exhaust System - Exhaust System

Description and Operation

Exhaust Components - Normally Aspirated Vehicles



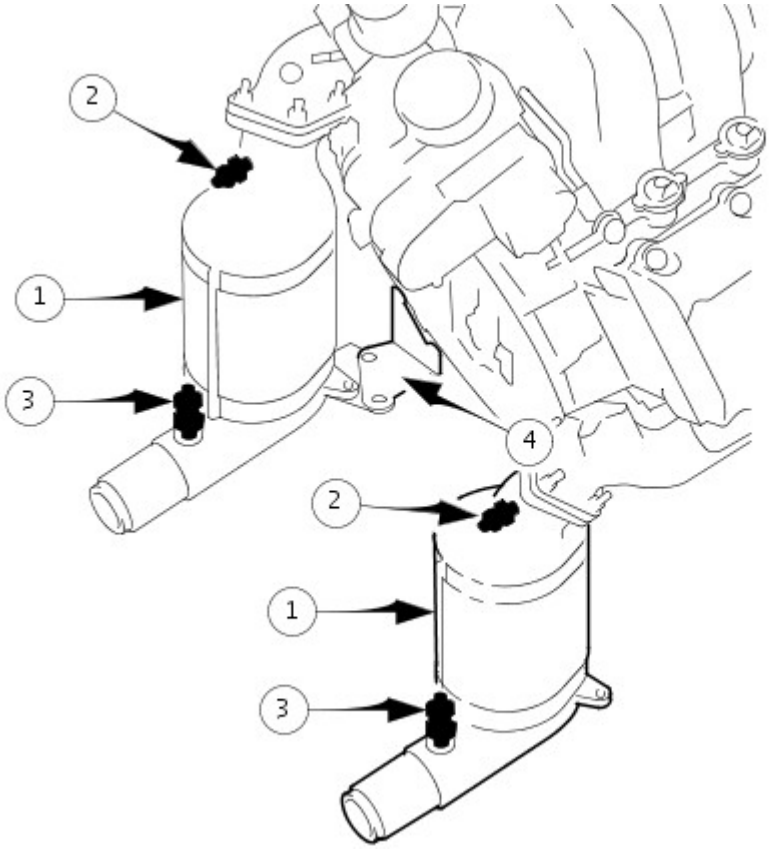
Exhaust Components - Supercharged Vehicles



All vehicles are fitted with a stainless steel exhaust system which features:

- Low back-pressure gas flow.
- Catalytic converters for markets having unleaded fuel.
- Front muffler common to the left-hand and right-hand engine cylinder banks.

Downpipe Catalytic Converter Assembly



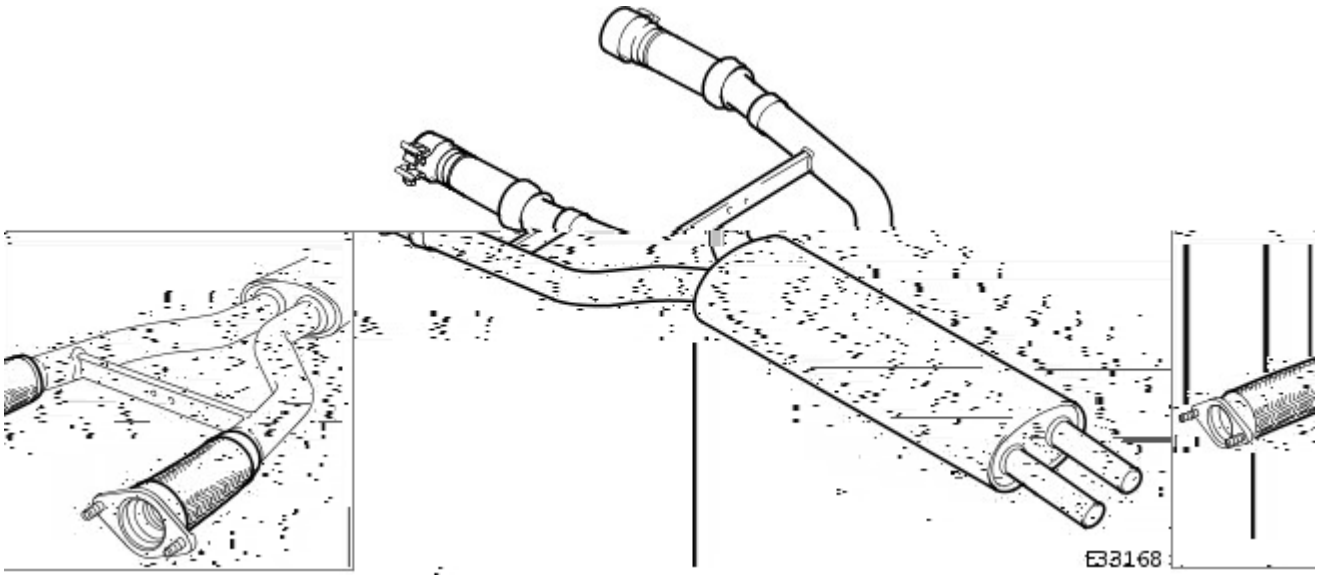
E3167

Item	Part Number	Description
1	—	Downpipe catalytic converter
2	—	Upstream heated oxygen sensor
3	—	Downstream oxygen sensor (North American markets only)
4	—	Engine mounting bracket (LHS and RHS)

The left-hand and right-hand downpipe assemblies feature:

- Catalytic converter with palladium / rhodium coated elements. The elements are uncoated for markets with only leaded fuel.
- Retained to the exhaust manifold flange by four threaded studs. Joint-to-joint sealing is with a gasket.
- Engine-mounted bracket providing downpipe mounting by two nuts to the torque converter housing and two bolts to the downpipe.

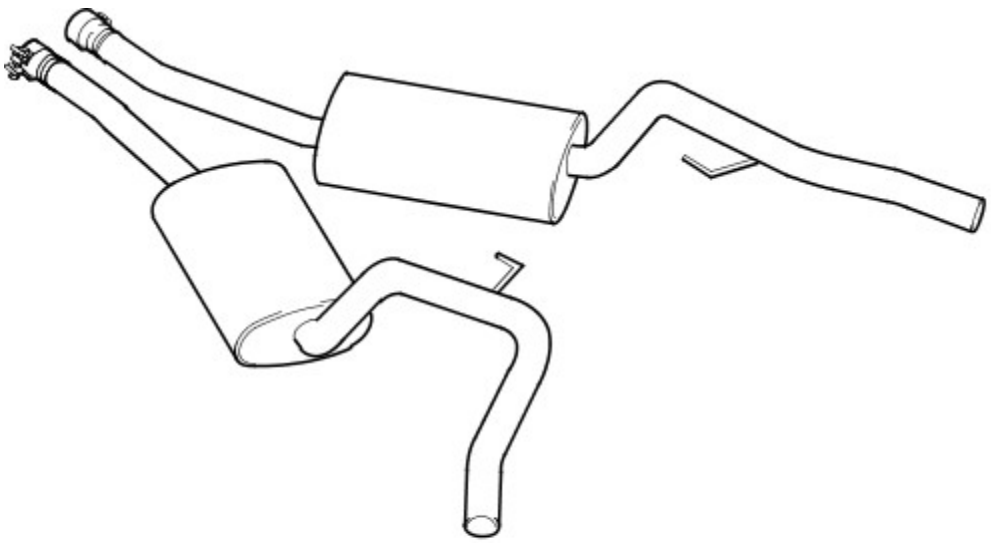
Front Muffler Assembly



The front muffler assembly features:

- Twin-pipe absorption type muffler.
- Pipe-to-pipe pressure damping.
- Inlet and outlet pipes welded to the muffler.
- Front joints are flanged on supercharged engines and a flexible pipe (not removable separately) is fitted behind each flange - refer to the inset above.

Intermediate Muffler Assembly

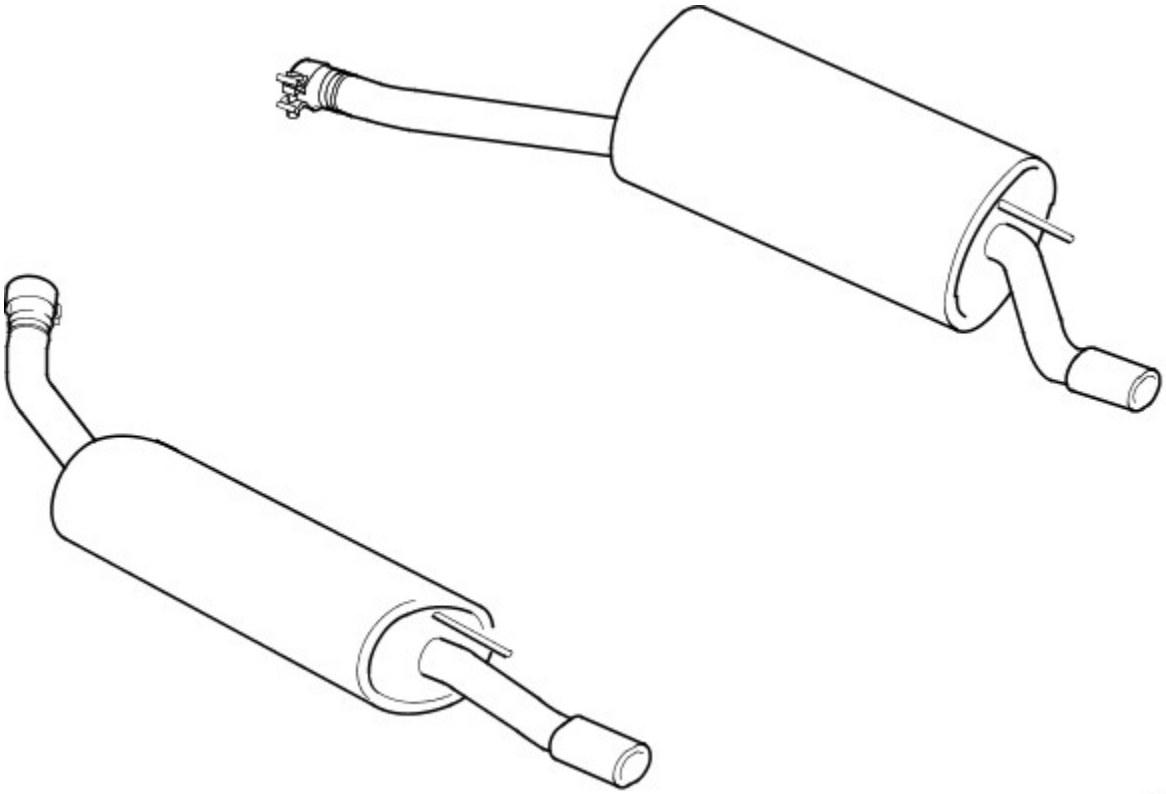


E33169

The left- and right-hand intermediate muffler assemblies comprise:

- Absorption type muffler.
- Inlet and outlet pipes welded to the muffler.

Rear Muffler Assembly

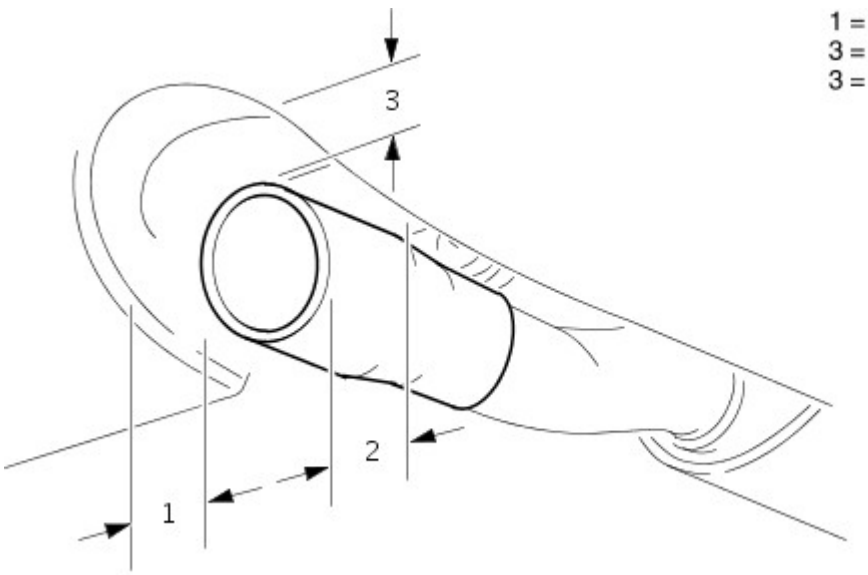


E3170

The left-hand and right-hand rear muffler assemblies comprise:

- Absorption type muffler.
- Inlet pipe and tailpipe welded to the muffler.
- Tailpipe bright finisher integral with the tailpipe.

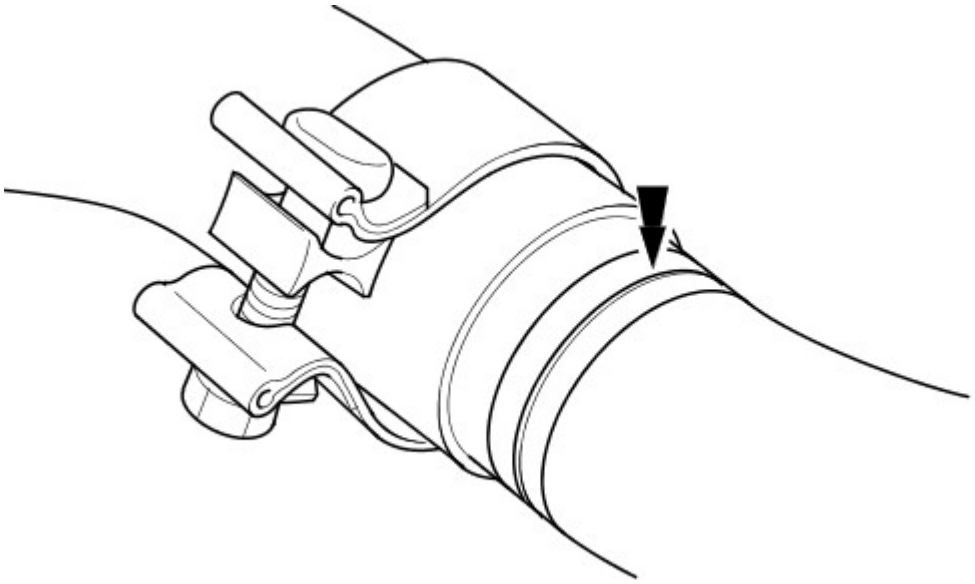
Tailpipe Clearance to Moulded Bumper



1 = 2 (±12 mm)
3 = 40 mm ±8 mm (NA)
3 = 25 mm ±8 mm (SC)

E3171

Joints and Clamps

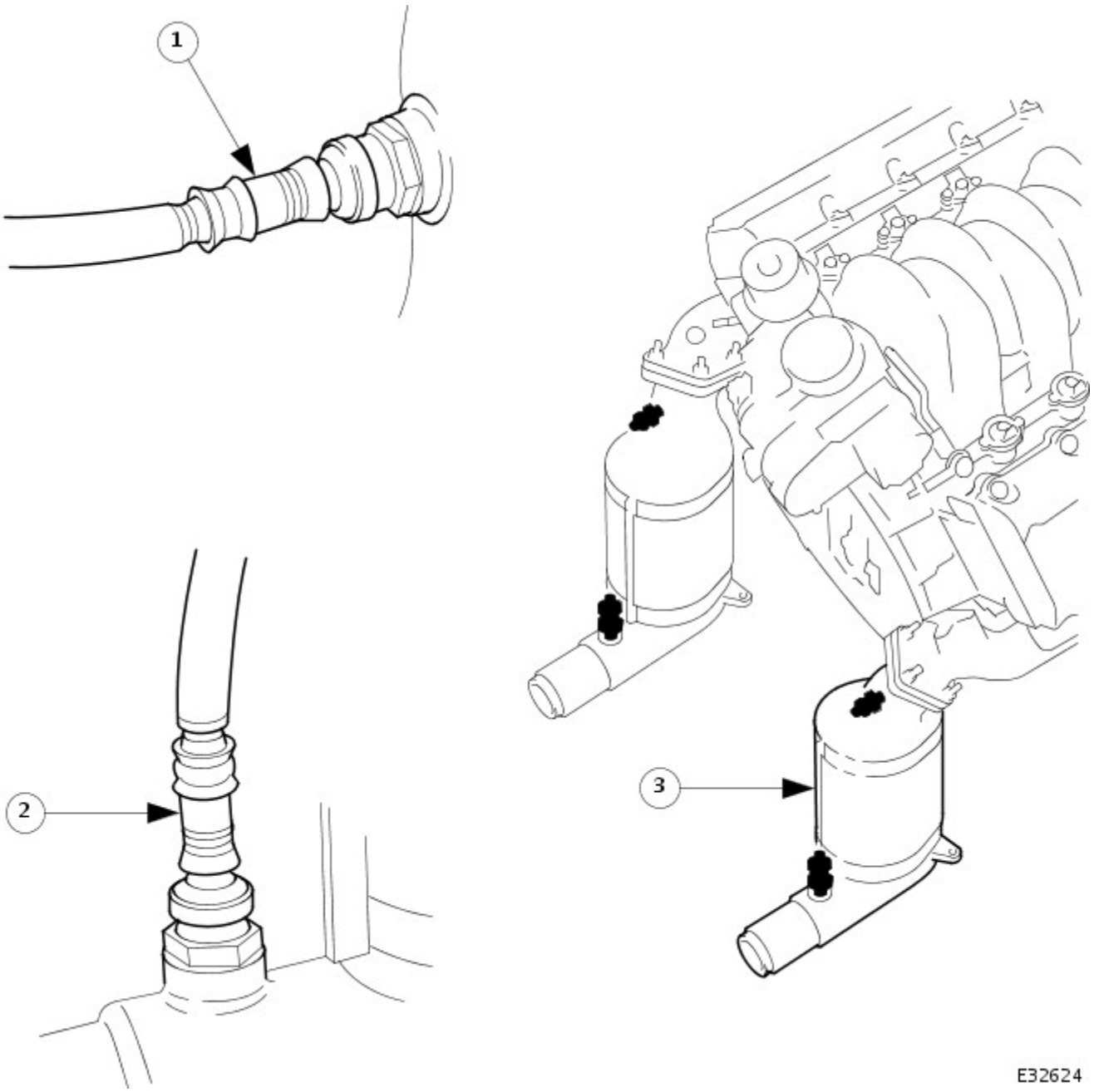


Pipe-to-pipe joints which are slip joints, feature:

- Clamping by Torca strap clamp.
- Indicator rings providing Maximum, Minimum and Nominal engagement marks.

Oxygen Sensor (O2)

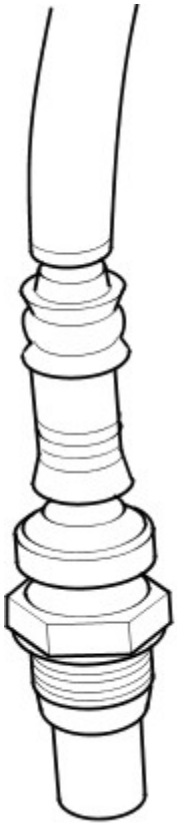
Location



Parts List

Item	Part Number	Description
1	—	Heated oxygen sensor (upstream)
2	—	Oxygen sensor (downstream)
3	—	Catalytic converter

Operation



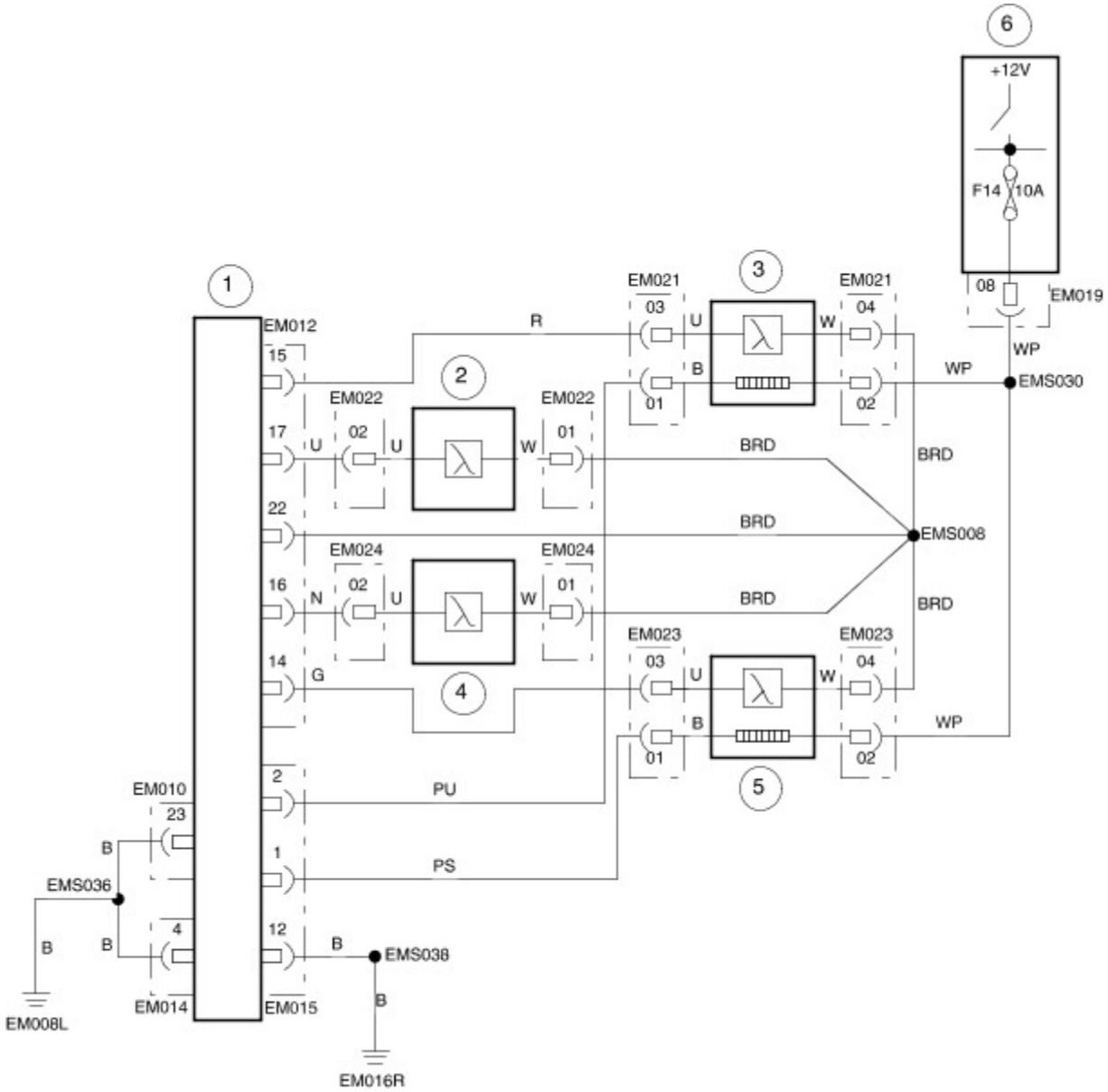
E34105

The upstream heated oxygen sensor is located at the catalytic converter inlet and detects the concentration of oxygen in the raw exhaust gases; an internal heater reduces the warm up time of the sensor output.

An oxygen sensor (without heater) is located at the converter outlet.

The ECM receives input signals from the sensors and varies the fuel injector duration (mixture) to provide optimum gas emissions.

Circuit Diagram, O2 Sensors / ECM



Item	Description
1	ECM
2	Downstream oxygen sensor (A)
3	Upstream heated oxygen sensor (A)
4	Downstream oxygen sensor (B)
5	Upstream heated oxygen sensor (B)
6	Engine management fuse box

Inspection and Verification

Vehicle Harness Check

1. **1.** Check for open and short circuit in harness connector faults between the O2 sensor and ECM.
2. **2.** Check for approximately 12V between heater harness.

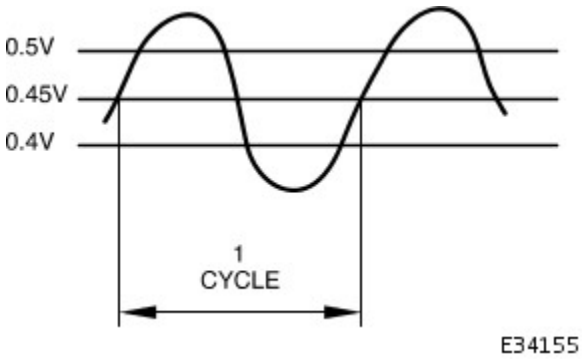
Heater Resistance Check

1. **1.** Verify that the resistance between the heater terminals is between 4OHM and 10OHM at -20°C to 100°C.

Performance Check

1. **1.** Run the engine at 2500 RPM for two minutes, to heat up the O2 sensor.

2. **2.** Check the voltage of the sensor output: Alternates between less than 0.4V at feed back engine conditions and in excess of 0.5V, see graph.



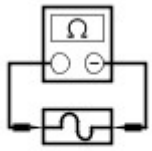
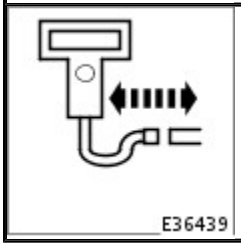
These voltages are for reference only.

3. **3.** Check that cycle of the upstream sensor output is in accordance with the appropriate pinpoint test.

4. **4.** Check that cycle of the downstream sensor output is in accordance with the appropriate pinpoint test.

Exhaust System - Exhaust System

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scantool

Symptom Chart

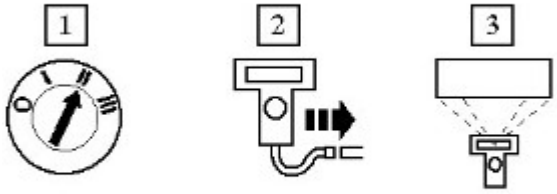
Symptom Chart

Symptom	Possible Sources	Action
DTC P0420 Catalyst system efficiency below threshold (Bank 1)	* Catalyst failure * Upstream O2 sensor failure * Downstream O2 sensor failure * O2 sensor heater failure * Associated harness / connector failure	* See DTC P0137, P0138 and P0140
DTC P0430 Catalyst system efficiency below threshold (Bank 2)	* Catalyst failure * Upstream O2 sensor failure * Downstream O2 sensor failure * O2 sensor heater failure * Associated harness / connector failure	* See DTC P0157, P0158 and P0160
DTC P0131 O2 sensor circuit low voltage (Bank 1 sensor 1)	* O2 sensor failure * Sensor ground fault * Harness failure * Connector pin(s) bent, loose or corroded	* GO to Pinpoint Test A
DTC P0132 O2 sensor circuit high voltage (Bank 1 sensor 1)	* O2 sensor failure to B+ * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * O2 sensor failure	* GO to Pinpoint Test A
DTC P0133 O2 sensor circuit slow response (Bank 1 sensor 1)	* O2 sensor heater failure / out of spec * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * Low exhaust temperature * O2 sensor failure	* GO to Pinpoint Test B
DTC P0135 O2 sensor heater circuit malfunction (Bank 1 sensor 1)	* O2 sensor failure * Harness failure * Connector pin(s) bent or tracking between connections. * ECM failure	* GO to Pinpoint Test A
DTC P0137 O2 sensor circuit low voltage (Bank 1 sensor 2)	* O2 sensor failure * Sensor ground fault * Harness failure * Connector pin(s) bent, loose or corroded	* GO to Pinpoint Test C
DTC P0138 O2 sensor circuit high voltage (Bank 1 sensor 2)	* O2 sensor failure to B+ * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking	* GO to Pinpoint Test C

	between connections. * ECM failure	
DTC P0140 O2 sensor circuit no activity detected (Bank 1 sensor 2)	* O2 sensor failure / out of spec * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * Low exhaust temperature	* GO to Pinpoint Test D
DTC P0420 Catalyst system efficiency below threshold (bank 1)	* Downstream O2 sensor failure * Catalyst failure * Catalyst low temperature caused by water splash	* GO to Pinpoint Test C * GO to Pinpoint Test D
DTC P0151 O2 sensor circuit low voltage (Bank 2 sensor 1)	* O2 sensor failure * Sensor ground fault * Harness failure * Connector pin(s) bent, loose or corroded	* GO to Pinpoint Test E
DTC P0152 O2 sensor circuit high voltage (Bank 2 sensor 1)	* O2 sensor failure to B+ * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * O2 sensor failure	* GO to Pinpoint Test E
DTC P0153 O2 sensor circuit slow response (Bank 2 sensor 1)	* O2 sensor heater failure / out of spec * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * Low exhaust temperature * O2 sensor failure	* GO to Pinpoint Test F
DTC P0155 O2 sensor heater circuit malfunction (Bank 2 sensor 1)	* O2 sensor failure * Harness failure * Connector pin(s) bent or tracking between connections. * ECM failure	* GO to Pinpoint Test E
DTC P0157 O2 sensor circuit low voltage (Bank 2 sensor 2)	* O2 sensor failure * Sensor ground fault * Harness failure * Connector pin(s) bent, loose or corroded	* GO to Pinpoint Test G
DTC P0158 O2 sensor circuit high voltage (Bank 2 sensor 2)	* O2 sensor failure to B+ * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * ECM failure	* GO to Pinpoint Test G
DTC P0160 O2 sensor circuit no activity detected (Bank 2 sensor 2)	* O2 sensor failure / out of spec * Sensor ground fault * Harness failure * Connector pin(s) bent or tracking between connections. * Low exhaust temperature	* GO to Pinpoint Test H
DTC P0430 Catalyst system efficiency below threshold (bank 2)	* Downstream O2 sensor failure * Catalyst failure * Catalyst low temperature caused by water splash	* GO to Pinpoint Test G * GO to Pinpoint Test H

Pinpoint test A: P0131, P0132, P0135

PINPOINT TEST A : P0131, P0132, P0135	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2

A2: CHECK O2 SENSOR HEATER CONTINUITY



E32125

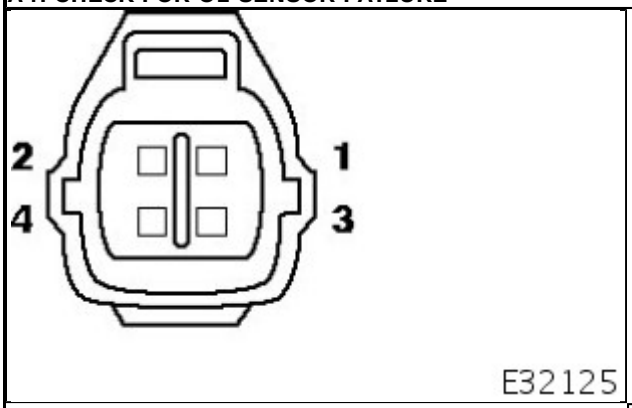
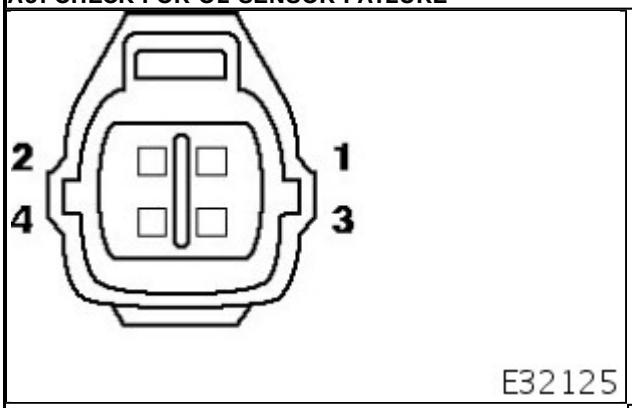
	1 Ignition switch to position 0
	2 Disconnect EM021 • Bracket on top of gearbox or Bulkhead rear of engine
	3 With EM021 disconnected, measure the resistance between EM021/001 and EM021/002.
	Is the resistance between 4 and 10 OHM? **Yes** GO to A3 **No** Renew O2 sensor; reconnect plug(s) GO to A6

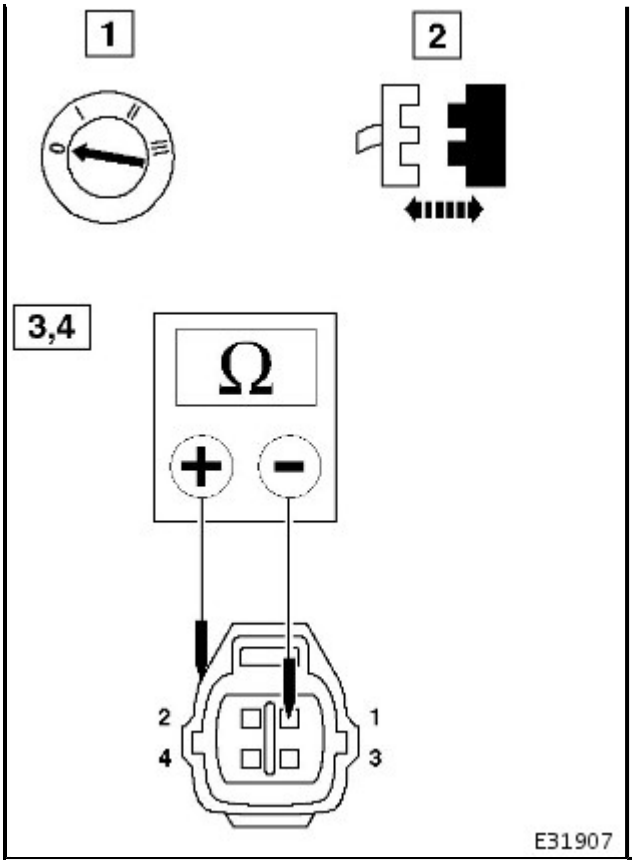
A3: CHECK FOR O2 SENSOR FAILURE



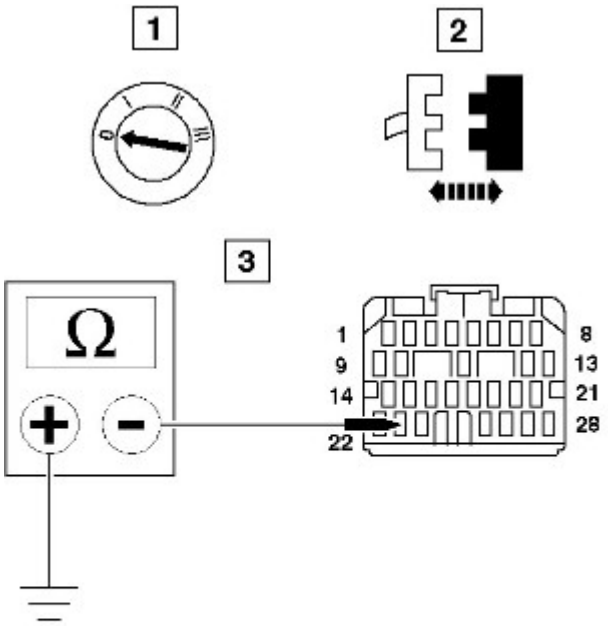
E32125

	1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	2 Disconnect EM021

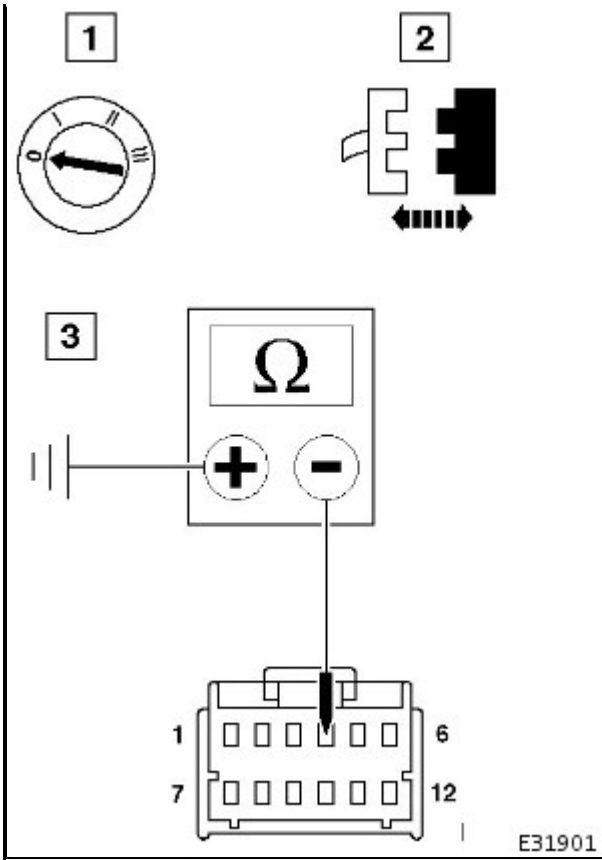
	• Bracket on top of gearbox or Bulkhead rear of engine
	3 With EM021 disconnected, measure the voltage between EM021/003 and EM021/004.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to A4 **No** Renew O2 sensor; reconnect plug(s) GO to A6
A4: CHECK FOR O2 SENSOR FAILURE	
	
	1 With the conditions held as A3, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes** GO to A5 **No** Renew O2 sensor; reconnect plug(s) GO to A6
A5: CHECK FOR O2 SENSOR FAILURE	
	
	1 With the conditions held as A4, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to A7 **No** Renew O2 sensor; reconnect plug(s) GO to A6
A6: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
A7: HEATED O2 SENSOR SHORT CIRCUIT TO GROUND	



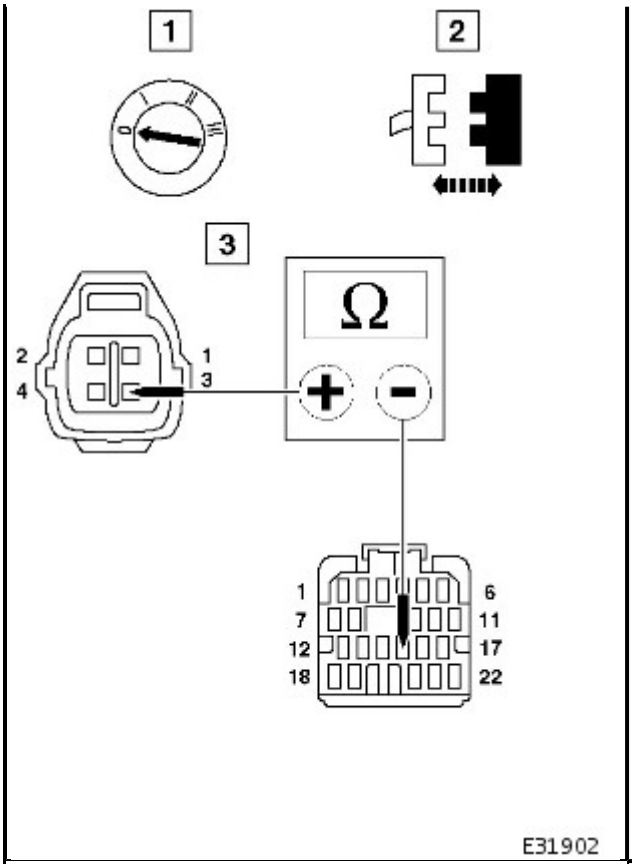
	1 Measure the insulation resistance between sensor pin 001 and sensor body 2 Repeat for pin 003 and sensor body Is the resistance > 10 MOHM? **Yes** GO to A9 **No** Renew the O2 sensor and reconnect plug(s) GO to A8
A8: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
A9: SIGNAL GROUND 1 CONTINUITY	



	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to A10 **No** Inspect connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion. Repair as required, harness, splice EMS36, connector or ground; reconnect plug(s). GO to A11
A10: SIGNAL GROUND 2 CONTINUITY	

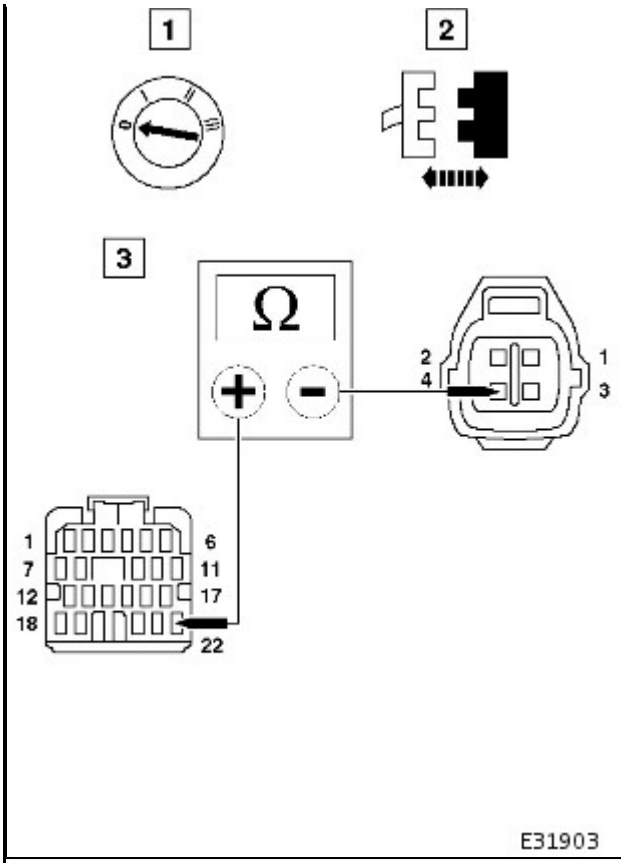


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to A12 **No** Inspect connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness, splice EMS36, connector or ground. Repair as required and reconnect plug(s). Repair as required and reconnect plug(s). GO to A11
A11: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
A12: CHECK FOR HEATED O2 SENSOR CONTINUITY	



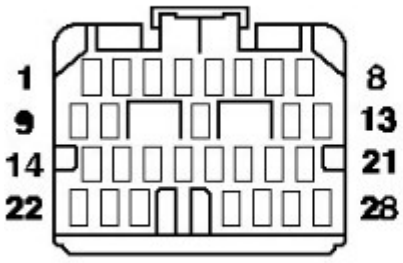
	1 With EM012 and EM021 disconnected, measure the resistance between EM012/015 and EM021/003
	Is the resistance < 0.5 OHM? **Yes** GO to A13 **No** Inspect harness / connectors EM012, and EM021 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to A18

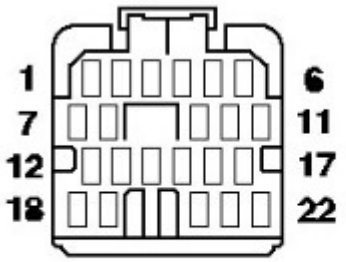
A13: HEATED O2 SENSOR SCREEN GROUND CONTINUITY



	1 With EM012 and EM021 disconnected, measure the resistance between EM012/022 and EM021/004
	Is the resistance < 0.5 OHM? **Yes** GO to A14 **No** Inspect harness / connectors EM012, EM021 and splice EMS08 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to A18

A14: CHECK FOR SHORT TO B+



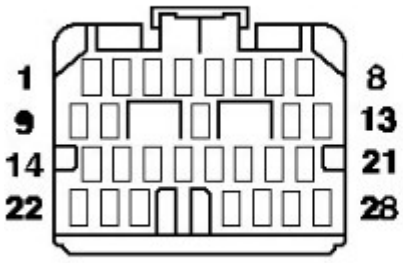


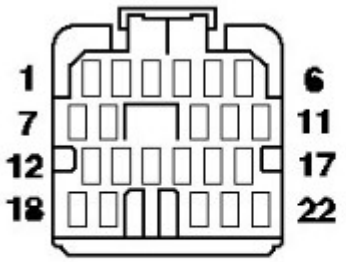
E32151

	1 Ignition switch to position 0 2 Disconnect EM010 and EM012 • Inside ECM housing 3 Ignition switch to position II 4 Measure the voltage between EM010/023 and EM012/015 Is the voltage 0 (zero) V? **Yes** GO to A15 **No** Inspect harness / connectors EM010, EM012, and EM021 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to A18

A15: CHECK FOR SHORT TO B+

	1 Measure the voltage between EM010/023 and EM012/022





E32151

Is the voltage 0 (zero) V?

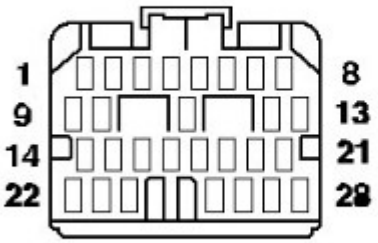
Yes

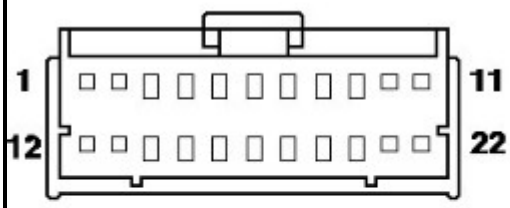
GO to A16

No

Inspect harness / connectors EM010, EM012, and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s).
GO to A18

A16: CHECK FOR SHORT TO B+ AT O2 SENSOR HEATER

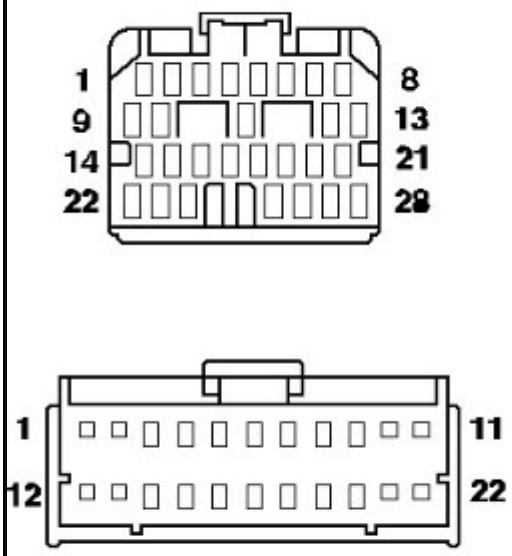




E32152

	1 Ignition switch to position 0 2 Remove EMS fuse F14 3 Disconnect EM010 and EM015 • Inside ECM housing 4 Using a link lead, bridge EM010/016 and EM010/022 5 Ignition switch to position II 6 Measure the voltage between EM010/023 and EM015/002 Is the voltage 0 (zero) V? **Yes** Replace EMS fuse F14 but retain link lead GO to A17 **No** Inspect harness / connectors EM010, EM015, and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s). GO to A18

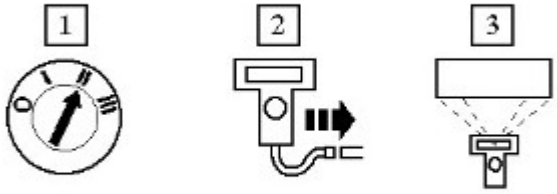
A17: CHECK B+ AT O2 SENSOR HEATER CIRCUIT



	1 Measure the voltage between EM010/023 and EM015/002
	Is the voltage B+? **Yes** Remove link lead and reconnect all connectors GO to A18 **No** Check EMS fuse F14 and that EMS control relay (relay 1) is energized and with all connections made. GO to A18
A18: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test B: P0133

PINPOINT TEST B : P0133	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to B2

B2: CHECK FOR LOW EXHAUST TEMPERATURE

	1 Check the engine and exhaust system for normal running temperature
	Is the engine and exhaust system up to normal running temperature? **Yes** GO to B3 **No** Rectify possible leaking exhaust manifold / catalyst, general causes of an over rich mixture and engine cooling system operation. Test the system for correct operation. GO to B8

B3: CHECK FOR O2 SENSOR HEATER CONTINUITY



E32125

	1 Ignition switch to position 0
	2 Disconnect EM021 ● Bracket on top of gearbox or Bulkhead rear of engine
	3 With EM021 disconnected, measure the resistance between EM021/001 and EM021/002.
	Is the resistance between 4 and 10 OHM? **Yes** GO to B4 **No** Renew O2 sensor, reconnect plug(s). GO to B8

B4: CHECK FOR O2 SENSOR FAILURE



1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.

2 Measure the voltage between EM021/003 and EM021/004.

Is the voltage between 600mV and 1.0 Volt?

Yes

GO to B5

No

Renew O2 sensor, reconnect plug(s).
GO to B8

B5: CHECK FOR O2 SENSOR FAILURE



1 With the conditions held as B4, suddenly decelerate to idle.

Has the voltage dropped to 400mV or less ?

Yes

GO to B6

No

Renew O2 sensor, reconnect plug(s).
GO to B8

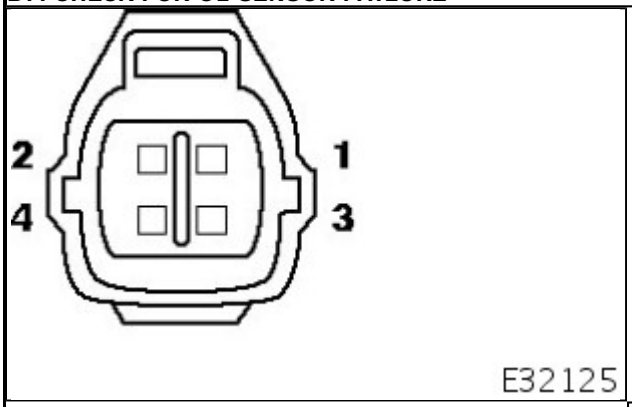
B6: CHECK FOR O2 SENSOR FAILURE

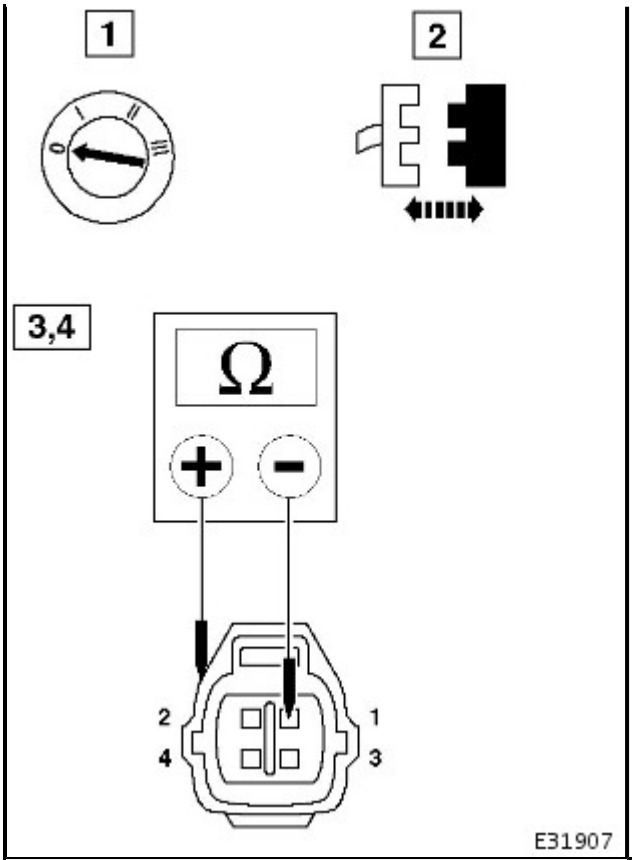


1 With the conditions held as B5, suddenly accelerate to approximately 2500 rpm.

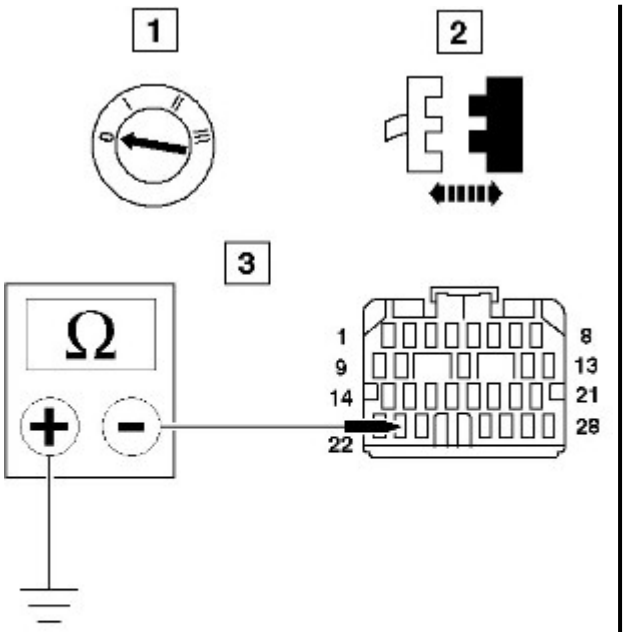
Has the voltage risen to between 600mV and 1 volt?

Yes

	GO to B7 **No** Renew O2 sensor, reconnect plug(s). GO to B8
B7: CHECK FOR O2 SENSOR FAILURE	
	
	1 With the conditions held as in B6, run the engine at 1500 rpm for approximately 2 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 4 seconds? **Yes** GO to B9 **No** Renew O2 sensor, reconnect plug(s). GO to B8
B8: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
B9: HEATED O2 SENSOR SHORT CIRCUIT TO GROUND	

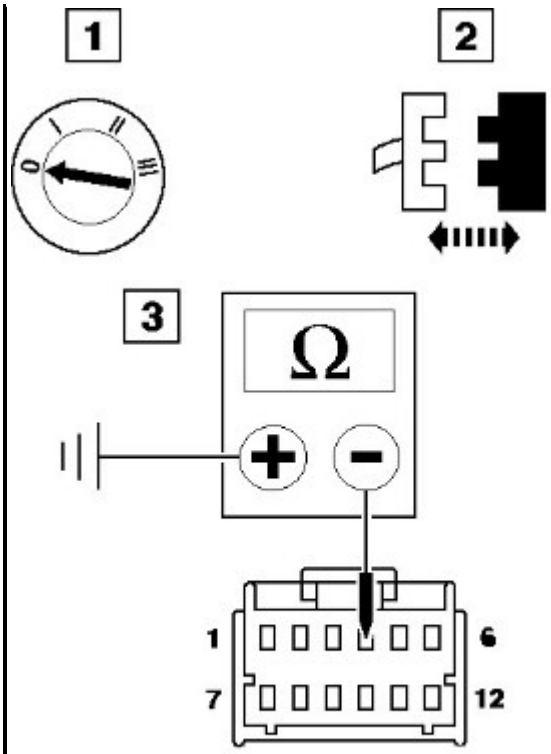


	1 With EM021 disconnected measure the insulation resistance between sensor pin 001 and sensor body. 2 Repeat for pin 003 and sensor body. Is the resistance > 10 MOHM? **Yes** GO to B11 **No** Renew the O2 sensor and reconnect plug(s). GO to B10
B10: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
B11: SIGNAL GROUND 1 CONTINUITY	



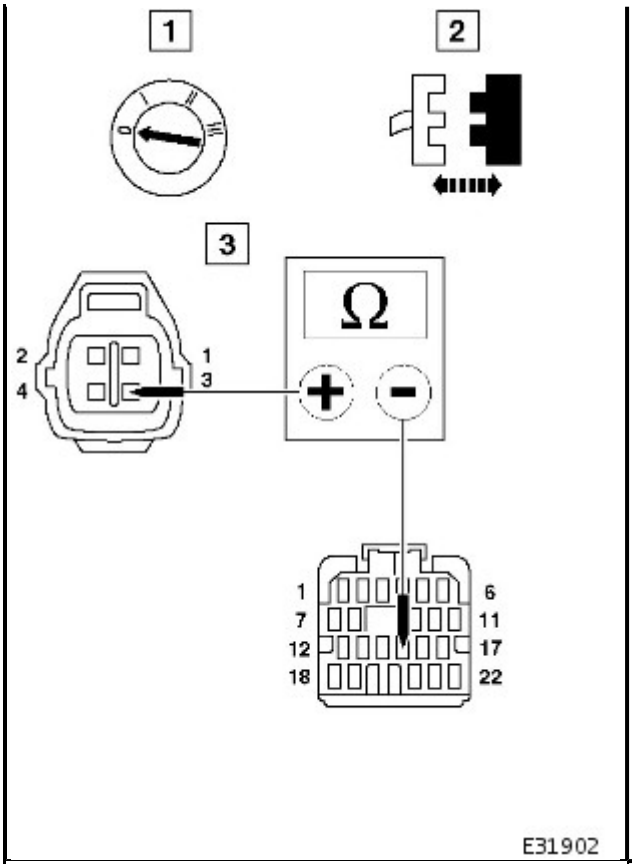
	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to B12 **No** Inspect connector EM010 for corrosion, damage, or pushed back pins. Inspect earthing stud EM008L for corrosion. Inspect harness, splice EMS36. Repair as required and reconnect plug(s). GO to B13

B12: SIGNAL GROUND 2 CONTINUITY



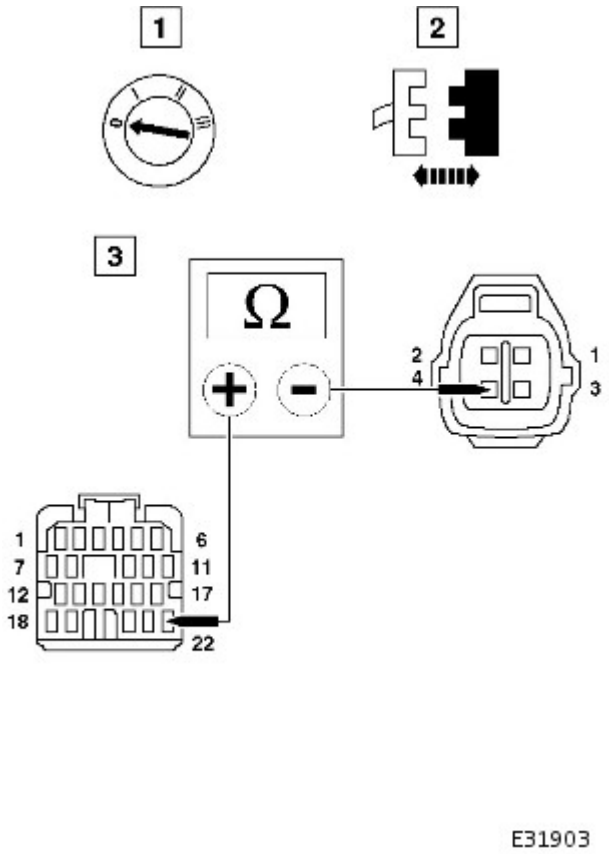
	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to B14 **No** Inspect connector EM014 for corrosion, damage, or pushed back pins. Inspect earthing stud EM008L for corrosion. Inspect harness, splice EMS36. Repair as required and reconnect plug(s). GO to B13

B13: CHECK FOR HEATED O2 SENSOR CONTINUITY



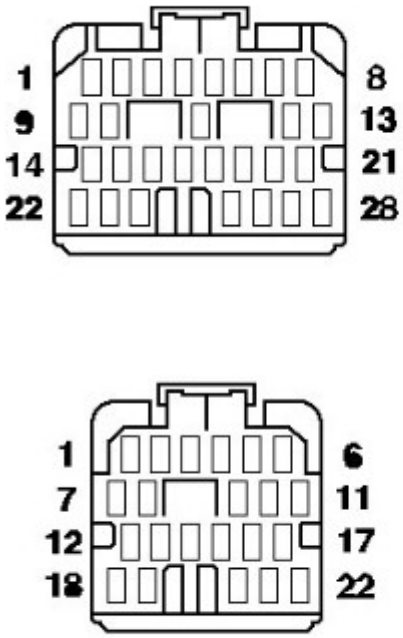
	1 With EM012 and EM021 disconnected, measure the resistance between EM012/015 and EM021/003.
	Is the resistance < 0.5 OHM? **Yes** GO to B14 **No** Inspect harness / connectors EM012 and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s). GO to B19

B14: HEATED O2 SENSOR SCREEN GROUND CONTINUITY



	1 With EM012 and EM021 disconnected, measure the resistance between EM012/022 and EM021/004.
	Is the resistance < 0.5 OHM? **Yes** GO to B15 **No** Inspect connectors EM012 and EM021 for corrosion, damaged / pushed back pins. Inspect harness / splice EMS08 for damage. Repair as necessary and reconnect plug(s). GO to B19

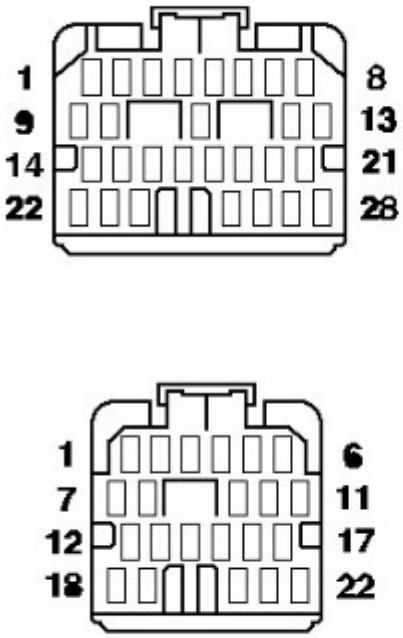
B15: CHECK FOR SHORT TO B+



	1 Ignition switch to position 0
	2 Disconnect EM010 • Inside ECM housing
	3 Disconnect EM012 • Inside ECM housing
	4 Ignition switch to position II
	5 Measure the voltage between EM010/023 and EM012/015.
	Is the voltage 0 (zero) V? **Yes** GO to B16 **No** Inspect harness / connectors EM010, EM012 and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s). GO to B19

B16: CHECK FOR SHORT TO B+

	1 Measure the voltage between EM010/023 and EM012/022



Is the voltage 0 (zero) V?

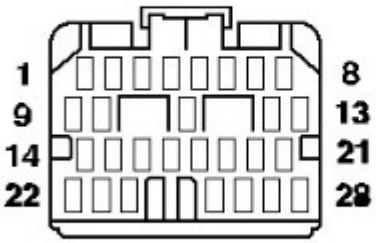
Yes

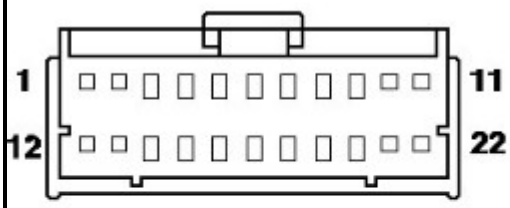
GO to B17

No

Inspect harness / connectors EM010, EM012 and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s).
GO to B19

B17: CHECK FOR SHORT TO B+ AT O2 SENSOR HEATER

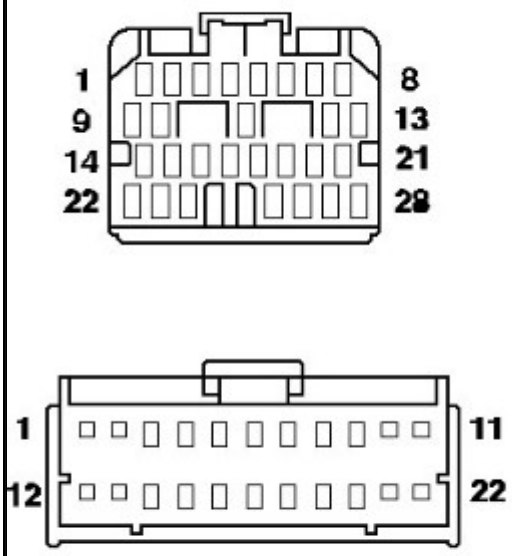




E32152

	1 Ignition switch to position 0
	2 Remove EMS fuse F14.
	3 Disconnect EM010 and EM015.
	4 Using a link lead, bridge EM010/016 and EM010/022.
	5 Ignition switch to position II
	6 Measure the voltage between EM010/023 and EM015/002.
	Is the voltage 0 (zero) V? **Yes** Replace EMS fuse F14 but retain link lead. GO to B18 **No** Inspect harness / connectors EM010, EM015 and EM021 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s). GO to B19

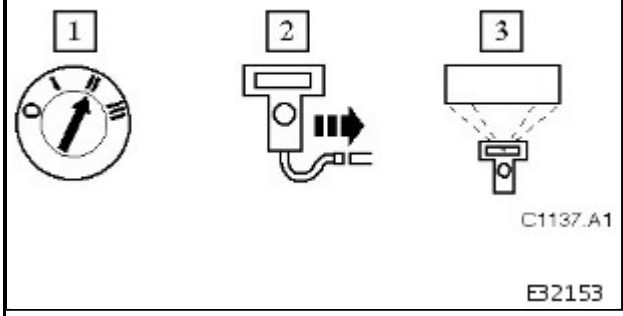
B18: CHECK B+ AT O2 SENSOR HEATER CIRCUIT



	1 Measure the voltage between EM010/023 and EM015/002.
	Is the voltage B+? **Yes** Remove link lead and reconnect all connectors. GO to B19 **No** Check EMS fuse F14 and that EMS control relay (relay 1) is energized and with all connections made. GO to B19
B19: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

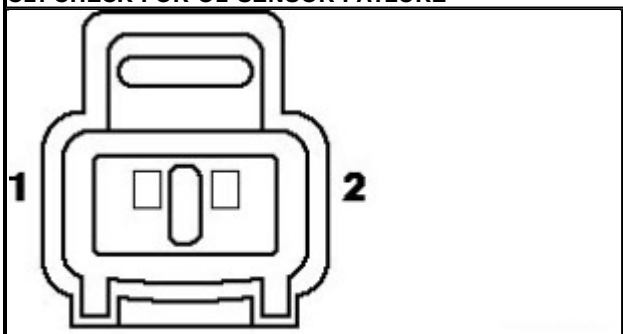
Pinpoint test C: P0137, P0138

PINPOINT TEST C : P0137, P0138	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



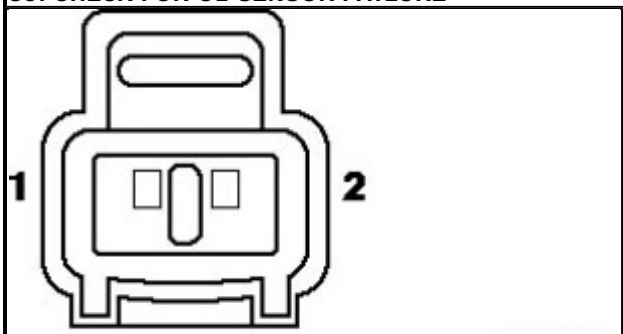
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to C2

C2: CHECK FOR O2 SENSOR FAILURE

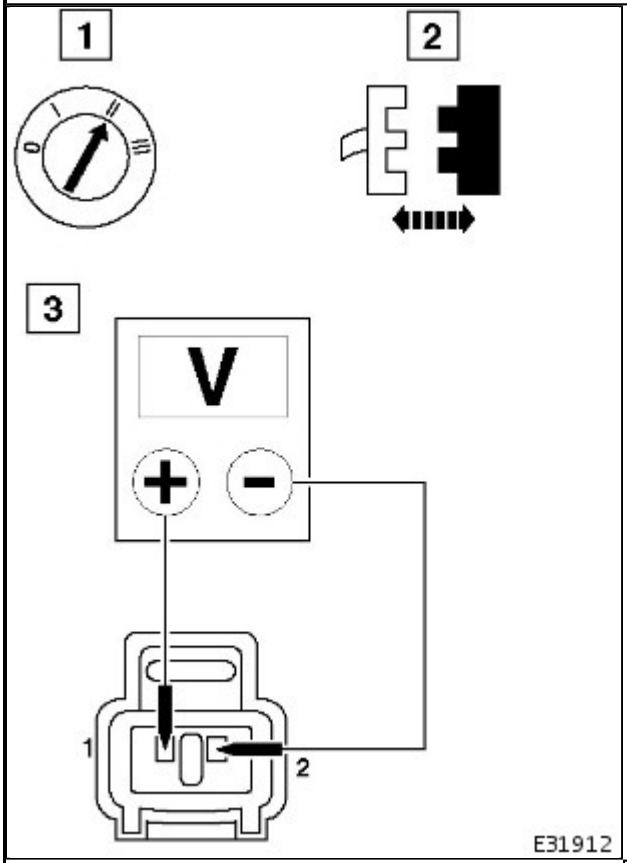


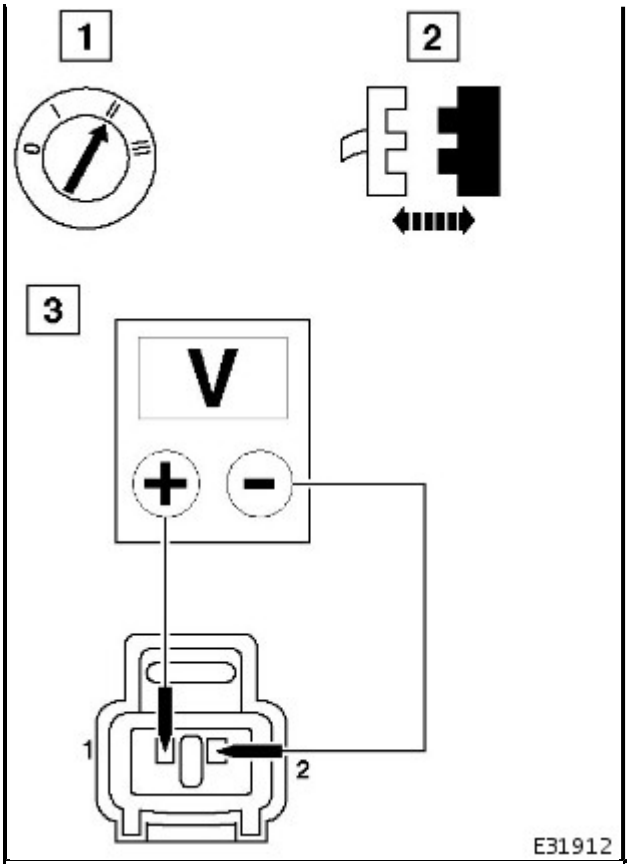
	1 Ignition switch to position II
	2 Disconnect EM022 • Bracket on top of gearbox or Bulkhead rear of engine
	3 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	4 Measure the voltage between EM022/001 and EM022/002.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to C3 **No** Renew O2 sensor and reconnect plug(s). GO to C6

C3: CHECK FOR O2 SENSOR FAILURE

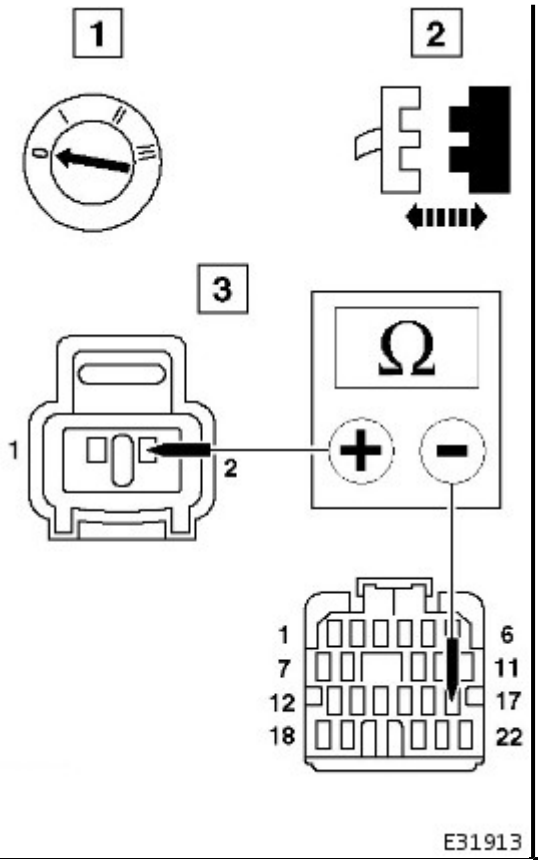


	1 With the conditions held as C2, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes**

	GO to C4 **No** Renew O2 sensor and reconnect plug(s). GO to C6
C4: CHECK FOR O2 SENSOR FAILURE	
	
	1 With the conditions held as C3, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to C5 **No** Renew O2 sensor and reconnect plug(s). GO to C6
C5: CHECK FOR O2 SENSOR FAILURE	

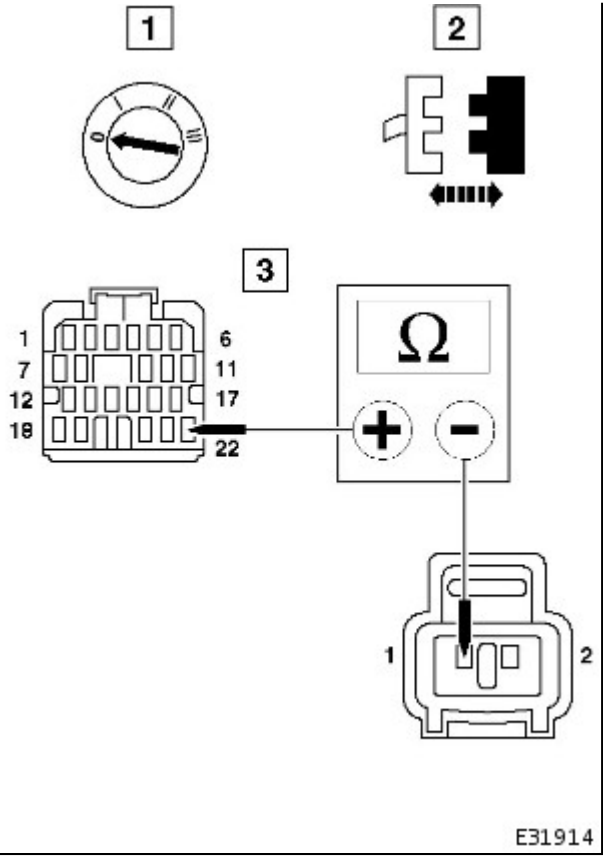


	1 With the conditions held as in C4, run the engine at 1500 rpm for approximately 3 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 180 seconds? **Yes** GO to C7 **No** Renew O2 sensor and reconnect plug(s). GO to C6
C6: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
C7: CHECK FOR O2 SENSOR CONTINUITY	



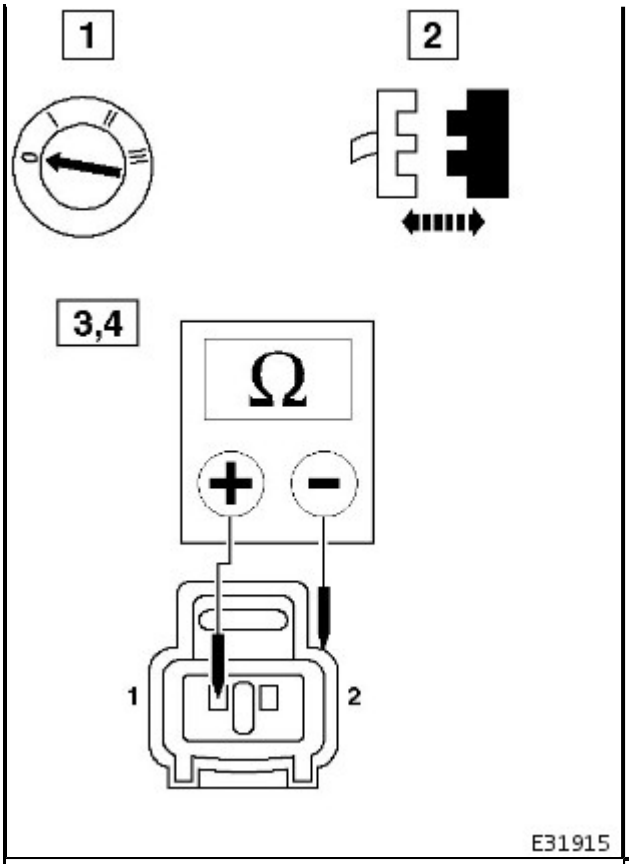
	1 With EM012 and EM022 disconnected, measure the resistance between EM012/017 and EM022/002.
	Is the resistance < 0.5 OHM? **Yes** GO to C8 **No** Inspect harness / connectors EM012 and EM022 for corrosion, damaged / pushed back pins. Repair as necessary and reconnect plug(s). GO to C10

C8: O2 SENSOR SCREEN GROUND CONTINUITY

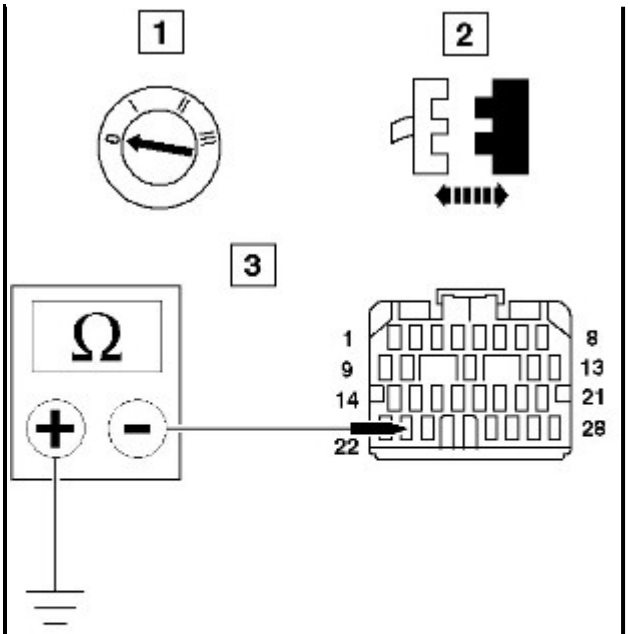


	1 With EM012 and EM022 disconnected, measure the resistance between EM012/022 and EM022/001.
	Is the resistance < 0.5 OHM? **Yes** GO to C9 **No** Inspect harness / connectors EM012 and EM022 for corrosion, damaged / pushed back pins. Inspect harness / splice EMS08 for damage. Repair as necessary and reconnect plug(s). GO to C10

C9: O2 SENSOR SHORT CIRCUIT TO GROUND

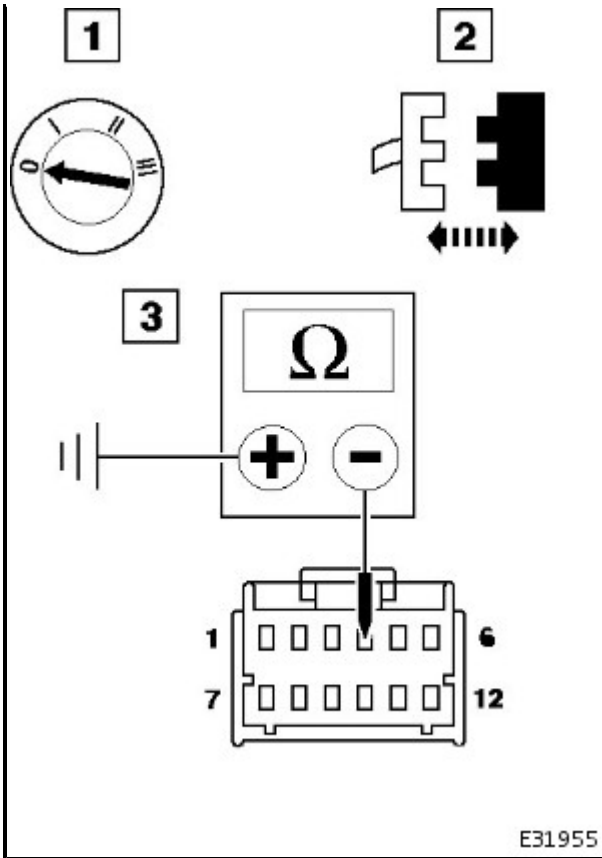


	1 With EM022 disconnected measure the insulation resistance between sensor pin 001 and sensor body.
	2 Repeat for pin 002 and sensor body.
	Is the resistance > 10 MOHM? **Yes** GO to C11 **No** Renew the O2 sensor and reconnect all plugs. GO to C10
C10: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
C11: SIGNAL GROUND 1 CONTINUITY	

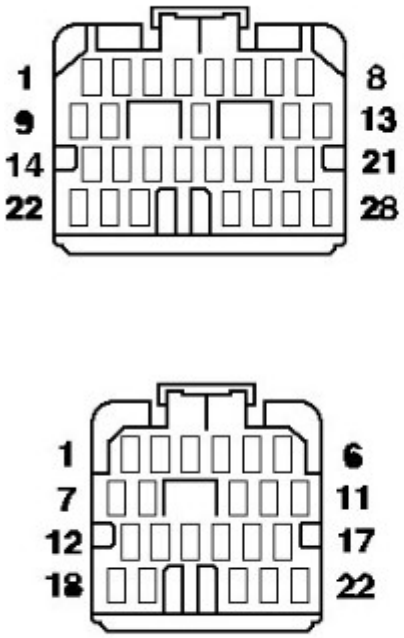


	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to C12 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for damage or corrosion. Inspect harness / splice EMS36 for damage. Repair as necessary and reconnect plug(s). GO to C13

C12: SIGNAL GROUND 2 CONTINUITY

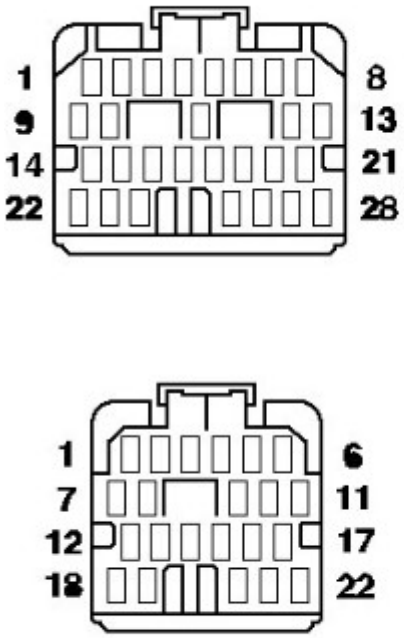


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to C14 **No** Inspect harness / connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect splice EMS36 for or damage. Repair as required and reconnect plug(s). GO to C13
C13: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
C14: CHECK FOR SHORT TO B+	



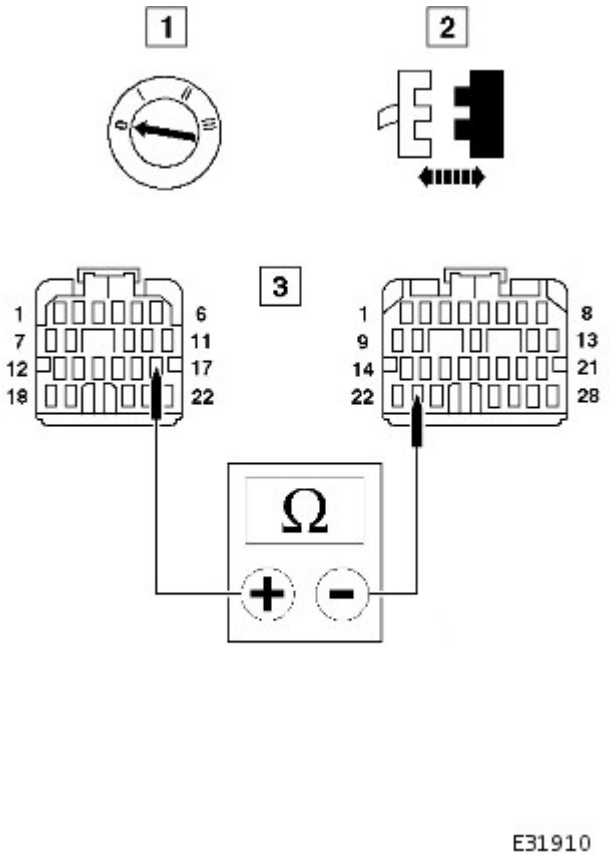
	1 Ignition switch to position 0 2 Disconnect EM010 • Inside ECM housing 3 Disconnect EM012 • Inside ECM housing 4 Measure the voltage between EM010/023 and EM012/017. 5 Ignition switch to position II Is the voltage 0 (zero) V? **Yes** GO to C15 **No** Inspect harness / connectors EM010, EM012, and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to C18

C15: CHECK FOR SHORT TO B+



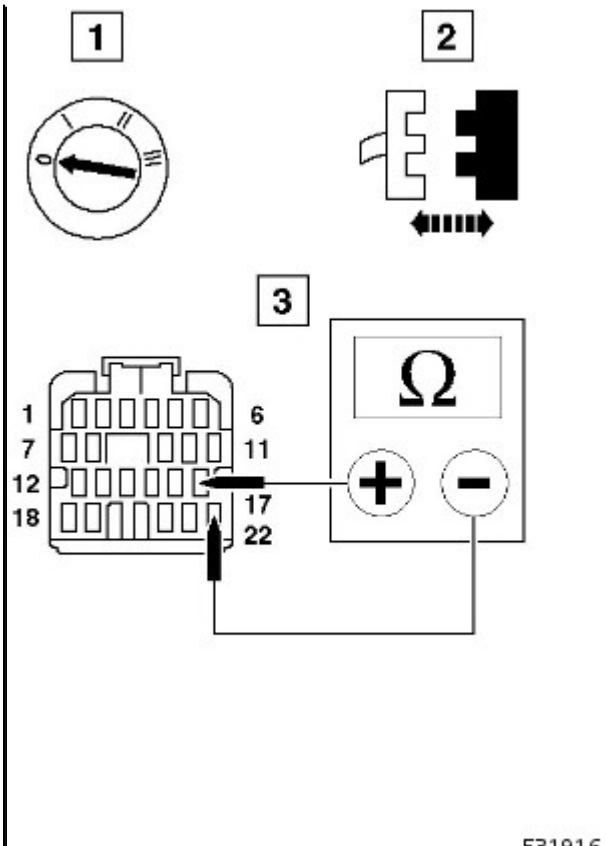
	1 Measure the voltage between EM010/023 and EM012/022. Is the voltage 0 (zero) V? **Yes** GO to C16 **No** Inspect harness / connectors EM010, EM012, and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to C18

C16: CHECK HARNESS SHORT TO GROUND



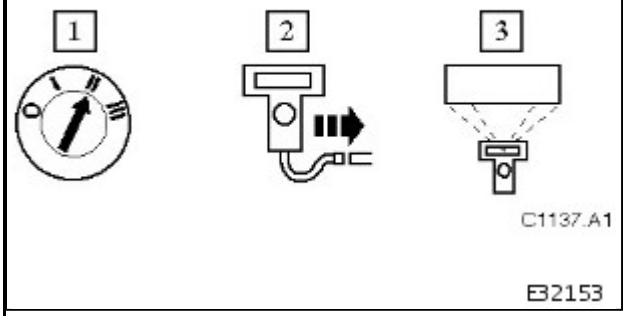
	1 Measure the insulation resistance between EM012/017 and ground EM010/023.
	Is the resistance > 10 MOHM? **Yes** GO to C17 **No** Inspect harness / connector EM012, EM022 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to C18

C17: CHECK HARNESS SHORT CORE TO CORE

	
	1 Measure the insulation resistance between EM012/017 and EM012/022.
	Is the resistance > 10 MOHM? **Yes** Reconnect all plugs GO to C18 **No** Inspect harness / connector EM012 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to C18
C18: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test D: P0140

PINPOINT TEST D : P0140	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	

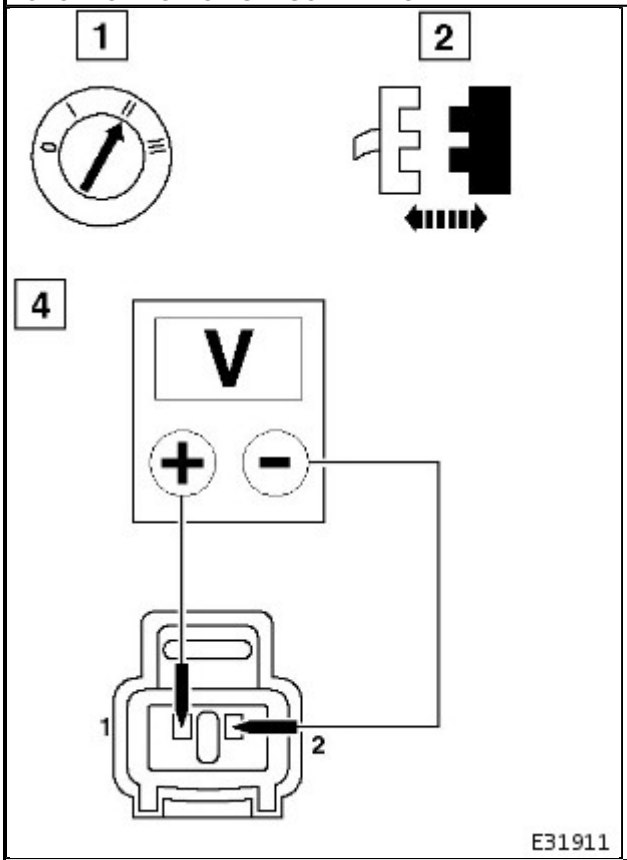


	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to D2

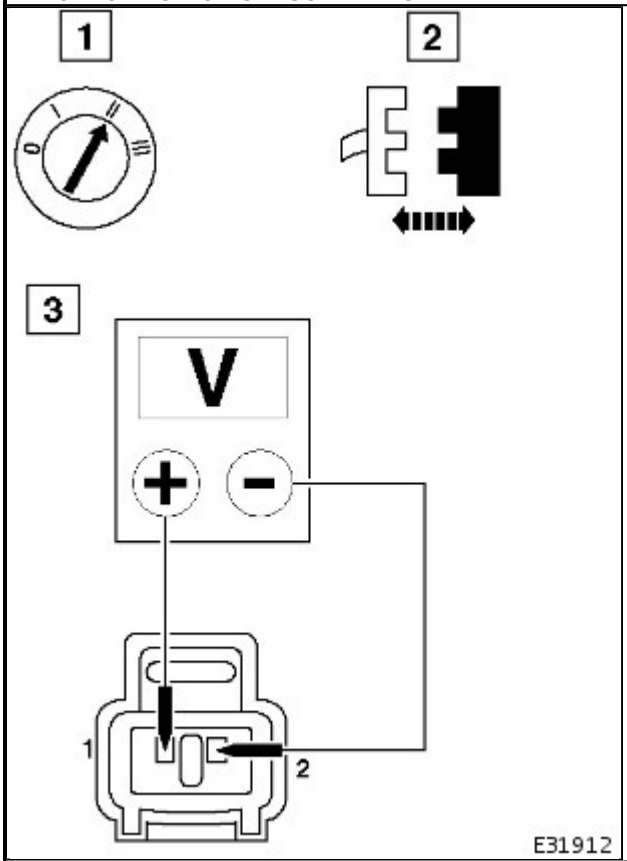
D2: CHECK FOR LOW EXHAUST TEMPERATURE

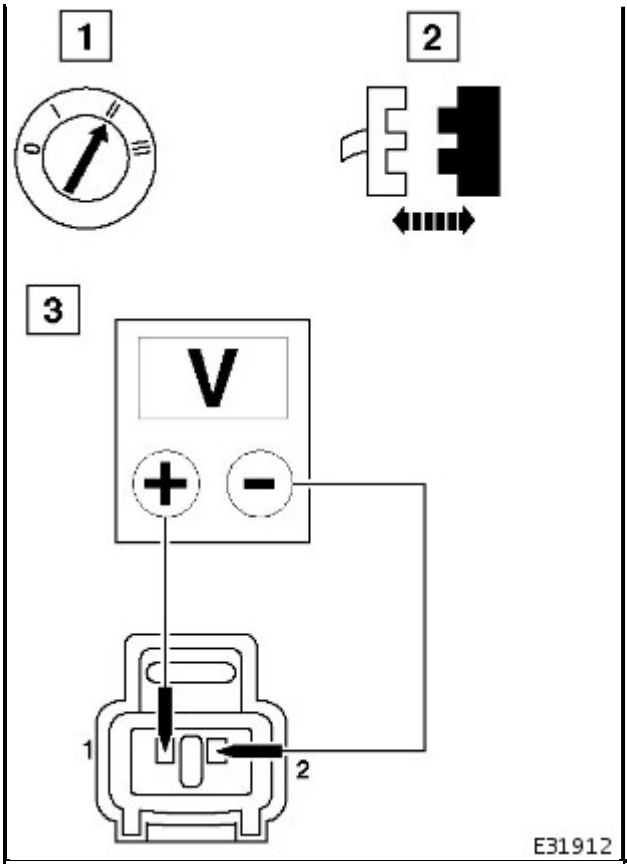
	1 Check the engine and exhaust system for correct operation and normal running temperature
	Is the engine and exhaust system operating correctly and up to normal running temperature? **Yes** GO to D3 **No** Rectify leaking exhaust manifold / catalyst, general causes of an over rich mixture and engine cooling system operation and test the system for correct operation. GO to D7

D3: CHECK FOR O2 SENSOR FAILURE



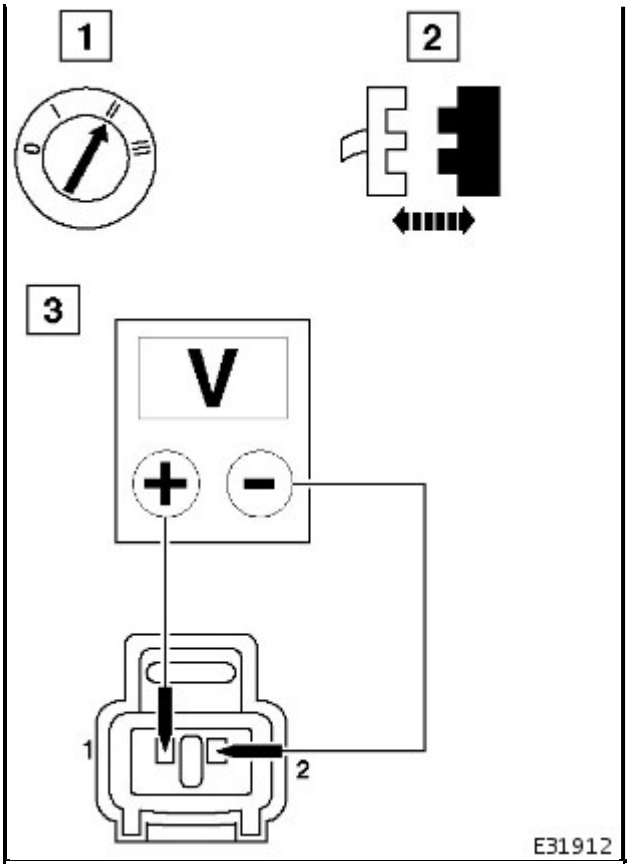
	1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	2 Measure the voltage between EM022/001 and EM022/002.

	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to D4 **No** Renew O2 sensor; reconnect plug(s). GO to D7
D4: CHECK FOR O2 SENSOR FAILURE	
	1 With the conditions held as D3, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes** Stop the engine GO to D5 **No** Renew O2 sensor. Reconnect plug(s) GO to D7
D5: CHECK FOR O2 SENSOR FAILURE	

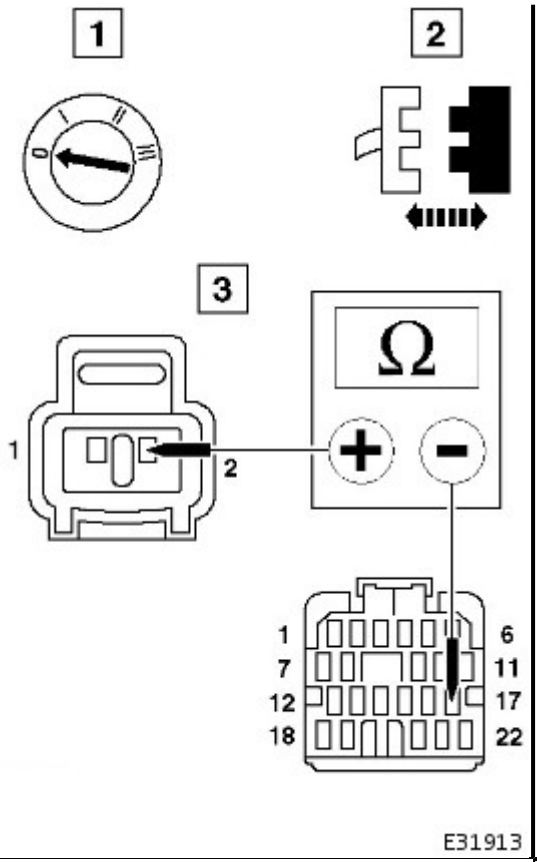


	1 With the conditions held as D4, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to D6 **No** Renew O2 sensor. Reconnect plug(s). GO to D7

D6: CHECK FOR O2 SENSOR FAILURE

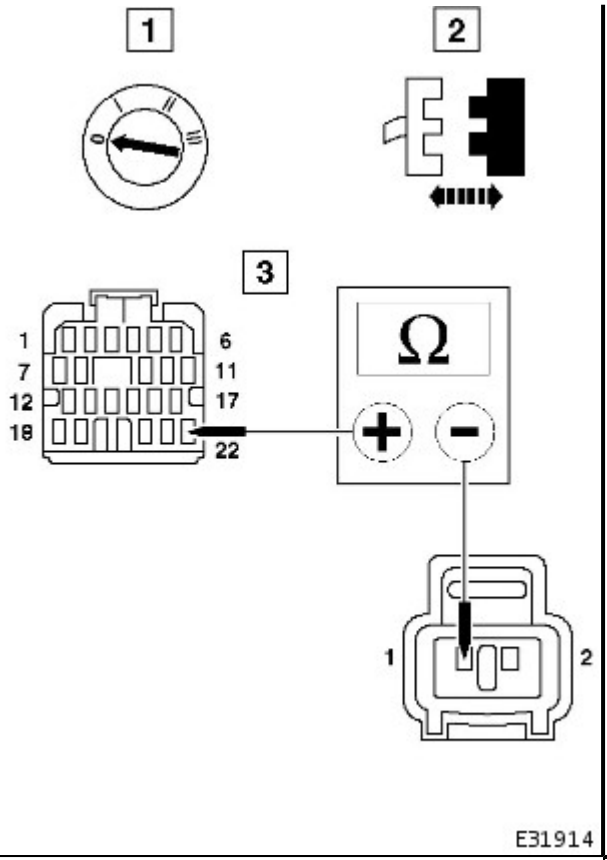


	1 With the conditions held as in D5, run the engine at 1500 rpm for approximately 3 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 180 seconds? **Yes** GO to D8 **No** Renew O2 sensor. Reconnect plug(s). GO to D7
D7: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
D8: CHECK FOR O2 SENSOR CONTINUITY	



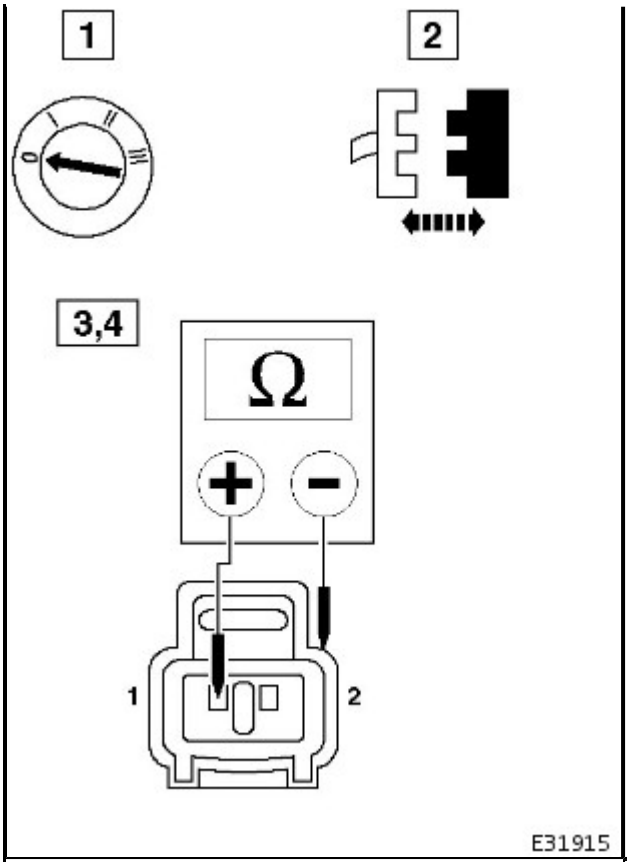
	1 With EM012 and EM022 disconnected, measure the resistance between EM012/017 and EM022/002.
	Is the resistance < 0.5 OHM **Yes** GO to D9 **No** Inspect harness / connectors EM012 and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to D11

D9: O2 SENSOR SCREEN GROUND CONTINUITY

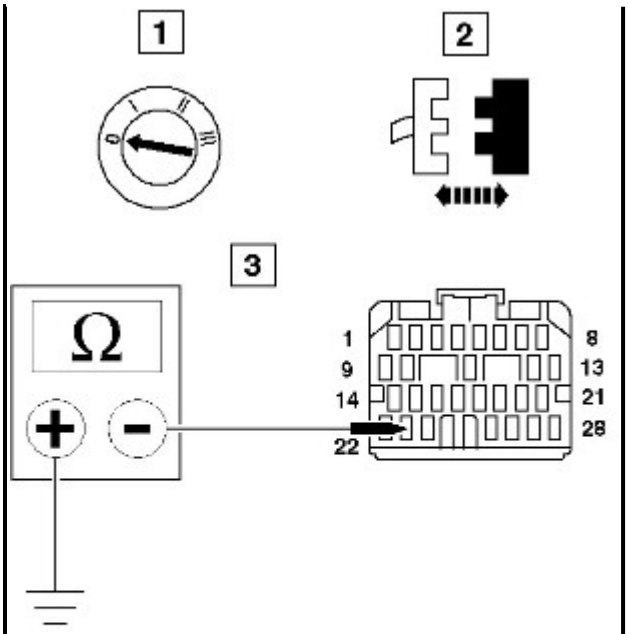


	1 With EM012 and EM022 disconnected, measure the resistance between EM012/022 and EM022/001.
	Is the resistance < 0.5 OHM? **Yes** GO to D10 **No** Inspect harness / connectors EM012 and EM022 for corrosion, damaged / pushed back pins. Inspect harness / splice EMS008 for damage. Repair as required and reconnect plug(s). GO to D11

D10: O2 SENSOR SHORT CIRCUIT TO GROUND

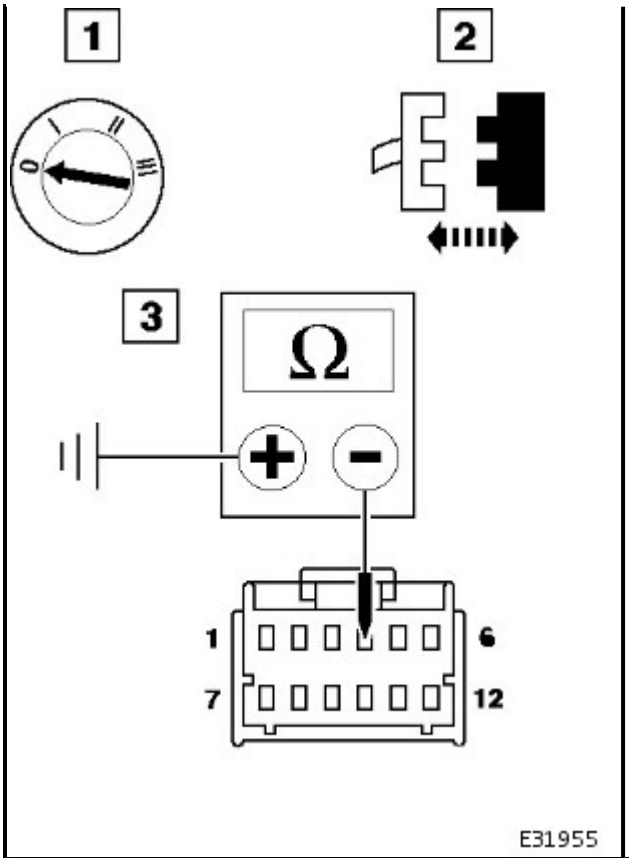


	1 With EM022 disconnected measure the insulation resistance between sensor pin 001 and sensor body.
	2 Repeat for pin 002 and sensor body.
	Is the resistance > 10 MOHM? **Yes** GO to D12 **No** Renew the O2 sensor and reconnect all plugs. GO to D11
D11: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
D12: SIGNAL GROUND 1 CONTINUITY	

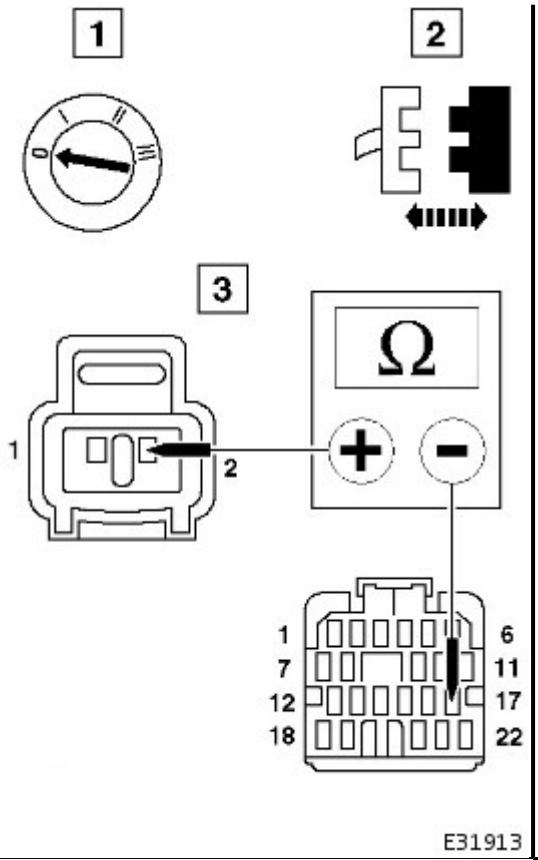


	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to D13 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to D14

D13: SIGNAL GROUND 2 CONTINUITY

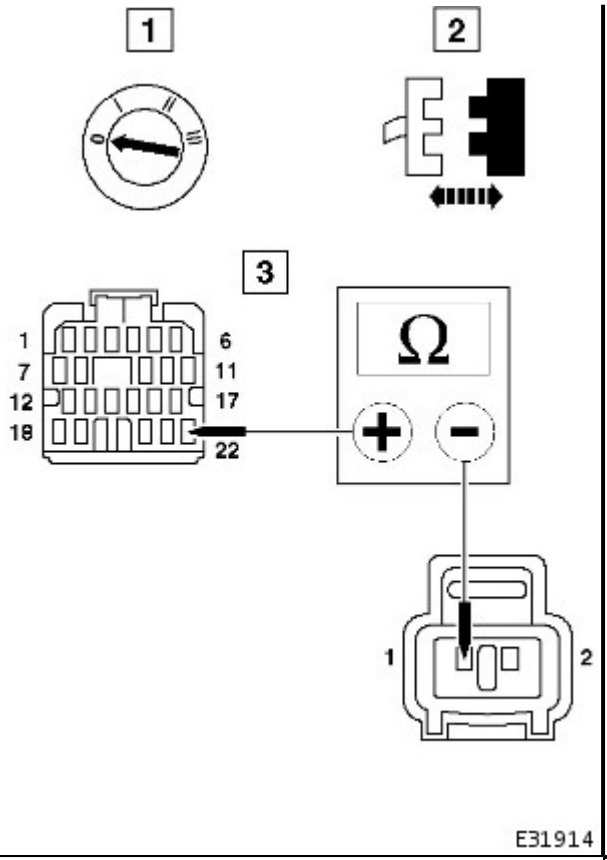


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to D15 **No** Inspect harness / connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to D14
D14: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
D15: CHECK FOR O2 SENSOR CONTINUITY	



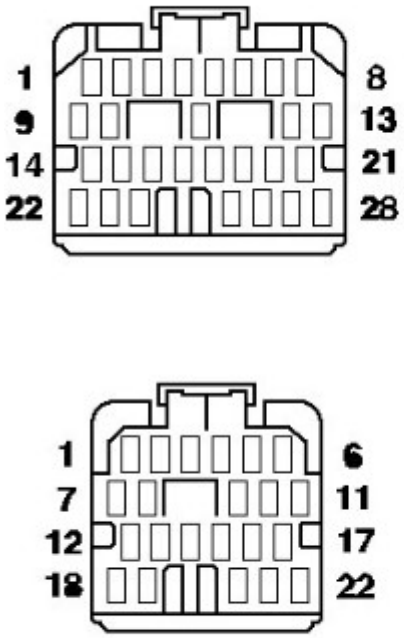
	1 With EM012 and EM022 disconnected, measure the resistance between EM012/017 and EM022/002.
	Is the resistance < 0.5 OHM? **Yes** GO to D16 **No** Inspect harness / connectors EM012 and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to D21

D16: O2 SENSOR SCREEN GROUND CONTINUITY



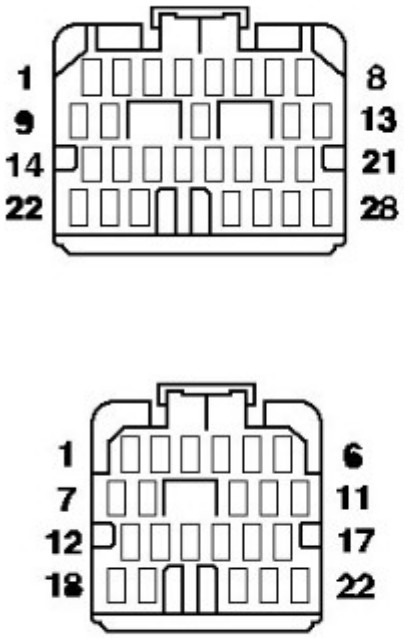
	1 With EM012 and EM022 disconnected, measure the resistance between EM012/022 and EM022/001.
	Is the resistance < 0.5 OHM? **Yes** GO to D17 **No** Inspect harness / connectors EM012, and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to D21

D17: CHECK FOR SHORT TO B+



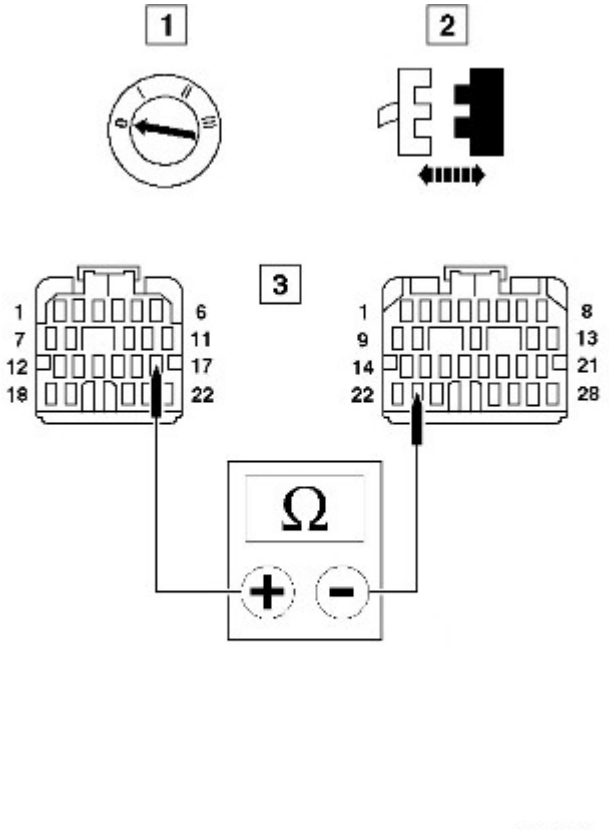
	1 Ignition switch to position 0
	2 Disconnect EM010 • Inside ECM housing
	3 Disconnect EM012 • Inside ECM housing
	4 Ignition switch to position II
	5 Measure the voltage between EM010/023 and EM012/015.
	Is the voltage 0V? **Yes** GO to D18 **No** Inspect harness / connectors EM010, EM012 and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to D21

D18: CHECK FOR SHORT TO B+



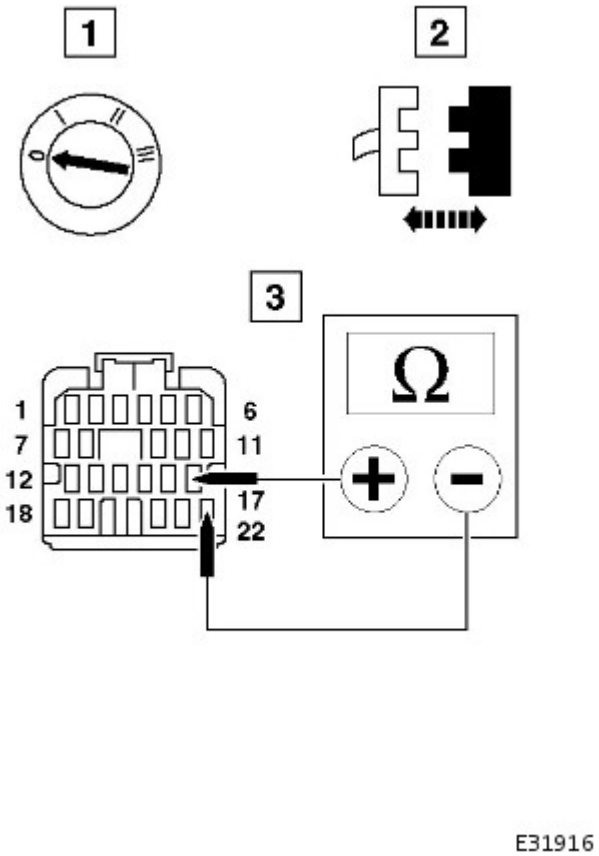
	1 Measure the voltage between EM010/023 and EM012/022.
	Is the voltage 0V? **Yes** GO to D19 **No** Inspect harness / connectors EM010, EM012 and EM022 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to D21

D19: CHECK HARNESS SHORT TO GROUND



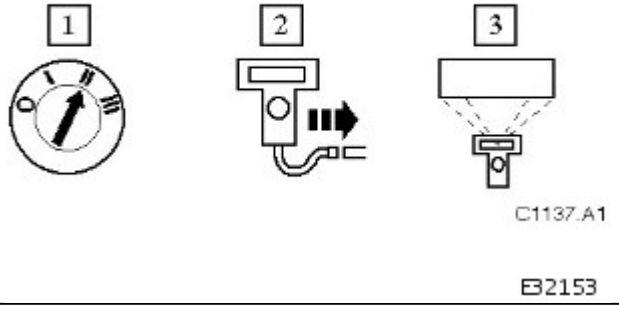
	1 With EM010 and EM012 and EM022 disconnected, measure the insulation resistance between EM012/017 and ground EM010/023.
	Is the resistance > 10 MOHM? **Yes** GO to D20 **No** Inspect harness / connector EM012, EM022 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to D21

D20: CHECK HARNESS SHORT CORE TO CORE

	
	1 Measure the insulation resistance between EM012/017 and EM012/022.
	Is the resistance > 10 MOHM? **Yes** Reconnect all plugs GO to D21 **No** Inspect harness / connector EM012, EM015 and EM022 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to D21
D21: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

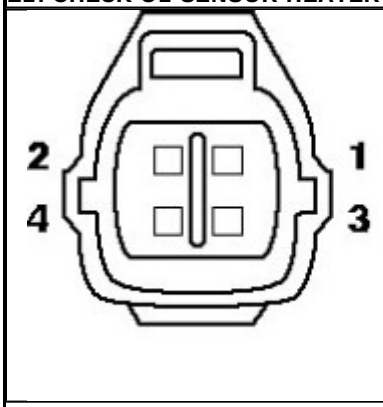
Pinpoint test E: P0151, P0152, P0155

PINPOINT TEST E : P0151, P0152, P0155	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



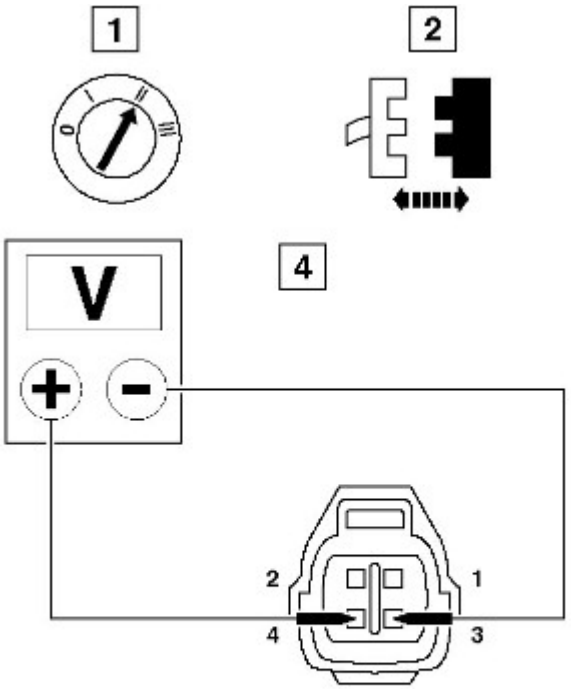
	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to E2

E2: CHECK O2 SENSOR HEATER CONTINUITY



	1 Ignition switch to position 0
	2 Disconnect EM023 • Bracket on top of gearbox or Bulkhead rear of engine
	3 Measure the resistance between EM023/001 and EM023/002.
	Is the resistance between 4 and 10 OHM? **Yes** GO to E3 **No** Renew O2 sensor. Reconnect plug(s) GO to E7

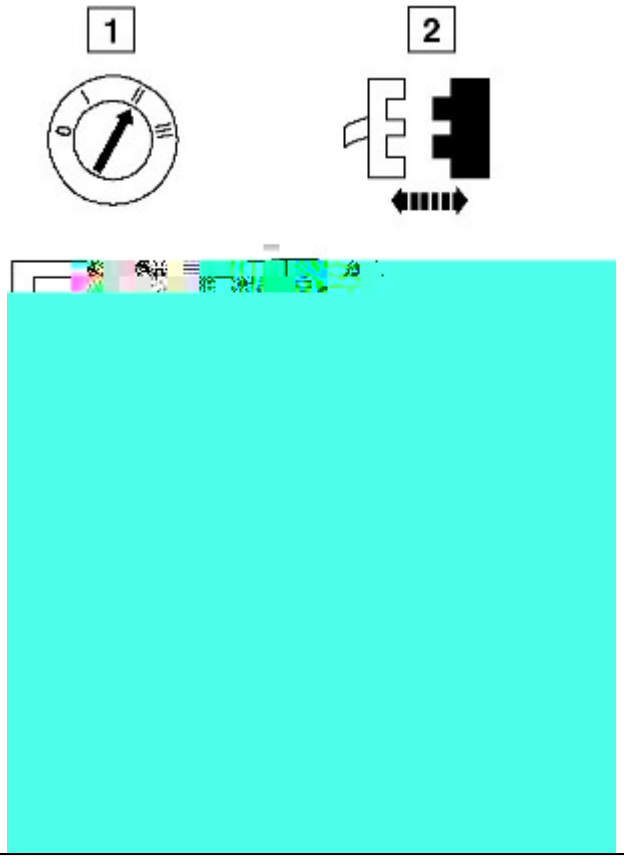
E3: CHECK FOR O2 SENSOR FAILURE



E31905

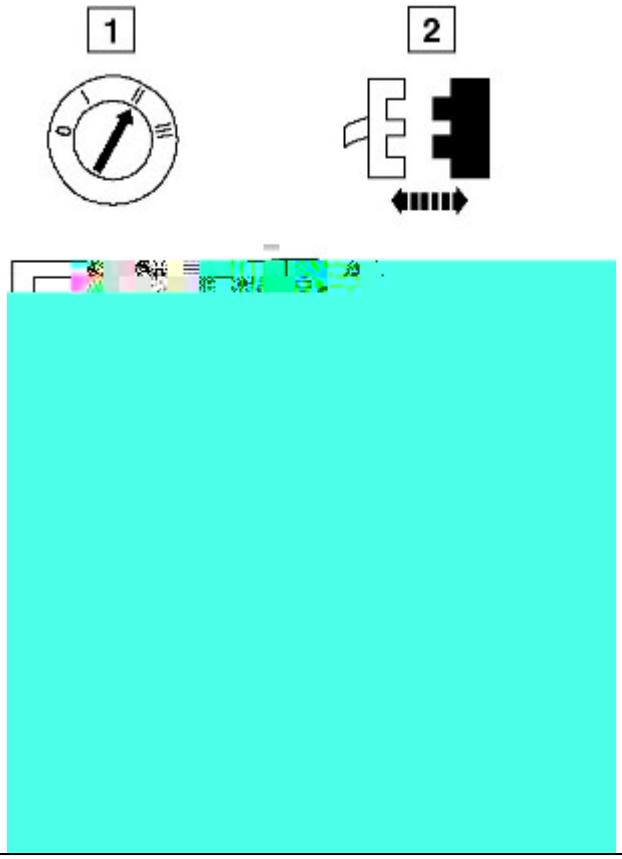
	1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	2 With EM023 disconnected, measure the voltage between EM023/003 and EM023/004.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to E4 **No** Renew O2 sensor. Reconnect plug(s) GO to E7

E4: CHECK FOR O2 SENSOR FAILURE



	1 With the conditions held as E3, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes** GO to E5 **No** Renew O2 sensor. Reconnect plug(s) GO to E7

E5: CHECK FOR O2 SENSOR FAILURE

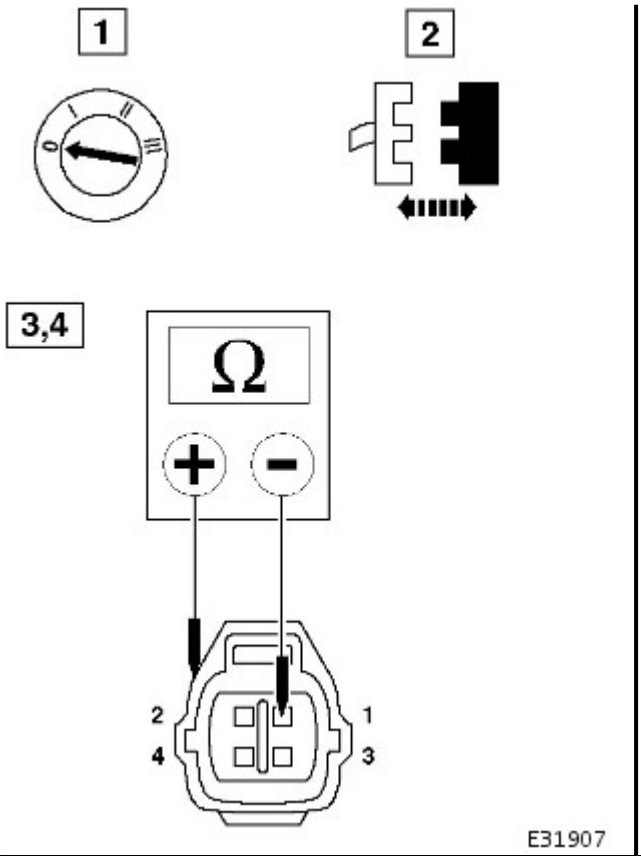


	1 With the conditions held as E4, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to E7 **No** Renew O2 sensor; reconnect plug(s) GO to E6

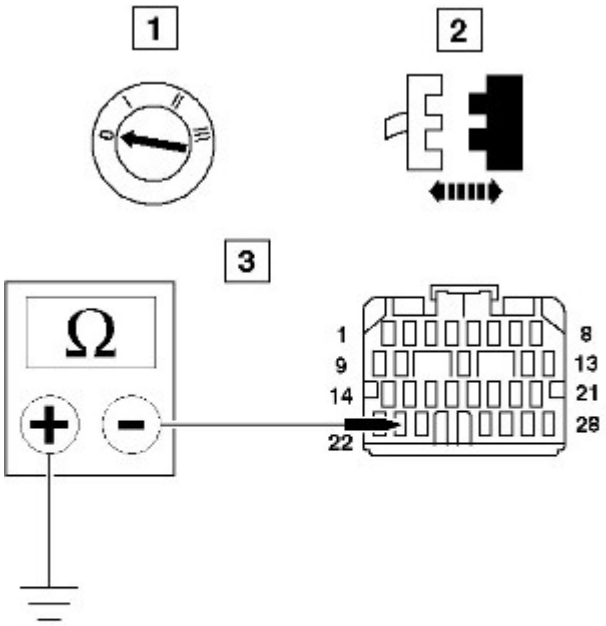
E6: STOP

	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

E7: HEATED O2 SENSOR SHORT CIRCUIT TO GROUND



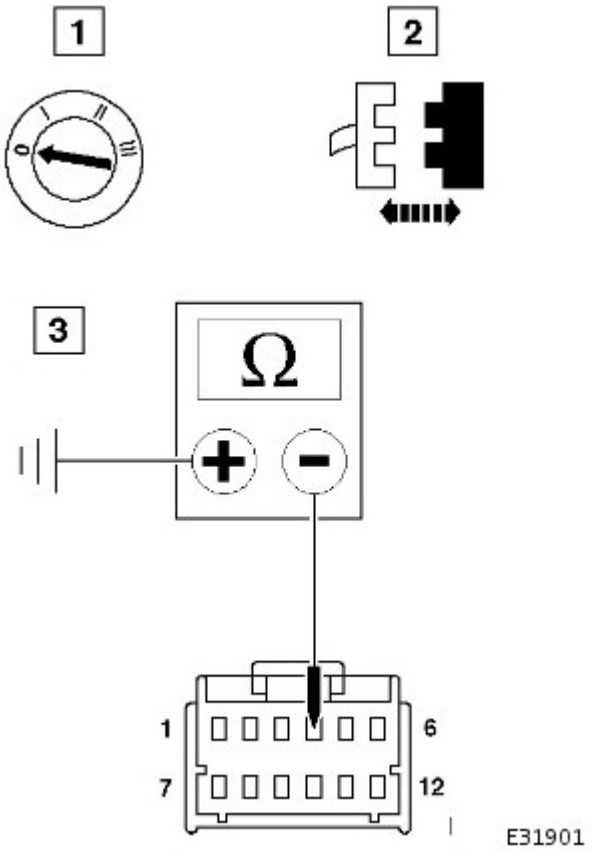
	1 With EM023 disconnected measure the insulation resistance between sensor pin 001 and sensor body. 2 Repeat for pin 003 and sensor body. Is the resistance > 10 MOHM? **Yes** GO to E9 **No** Renew the O2 sensor and reconnect plug(s) GO to E8
E8: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
E9: SIGNAL GROUND 1 CONTINUITY	



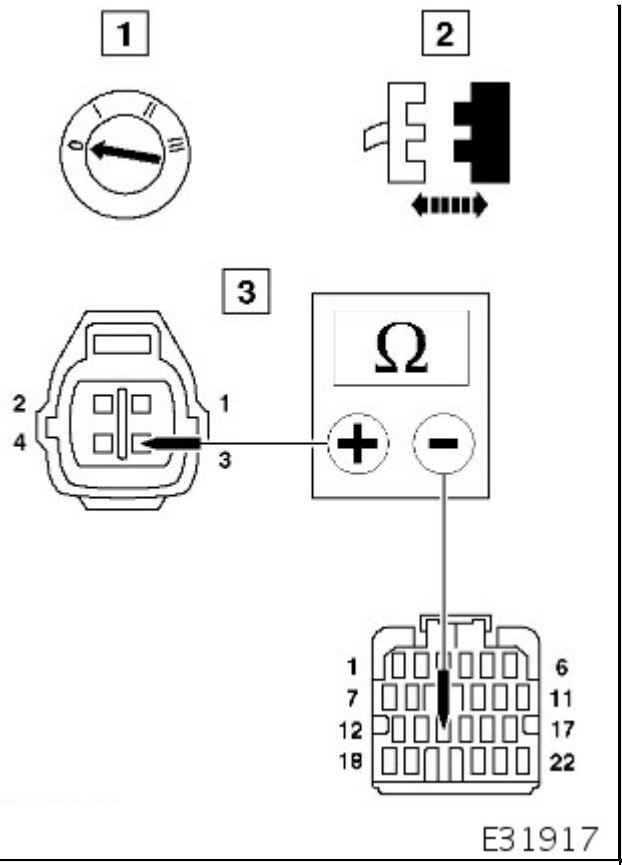
E31908

	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L
	Is the resistance < 0.5 OHM? **Yes** GO to E10 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to E11

E10: SIGNAL GROUND 2 CONTINUITY

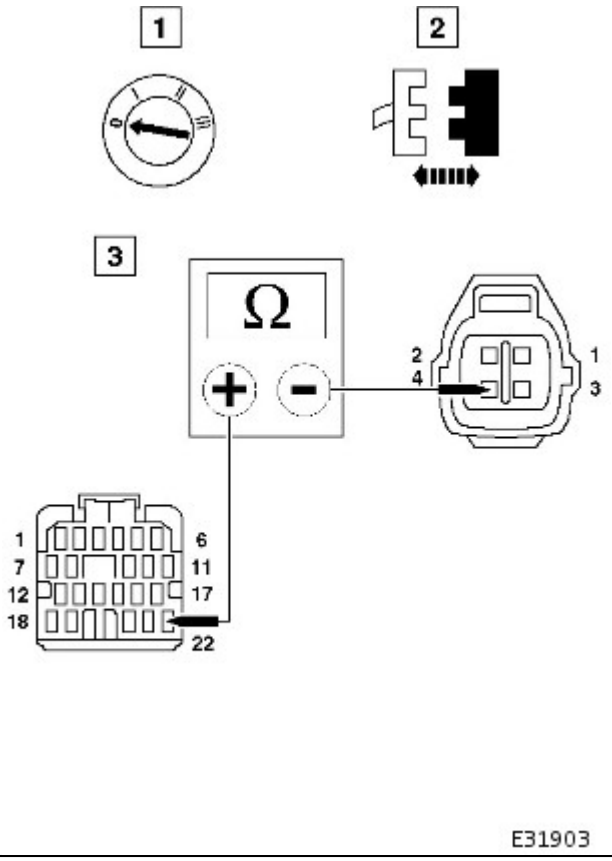


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to E12 **No** Inspect harness / connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to E11
E11: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
E12: CHECK FOR HEATED O2 SENSOR CONTINUITY	



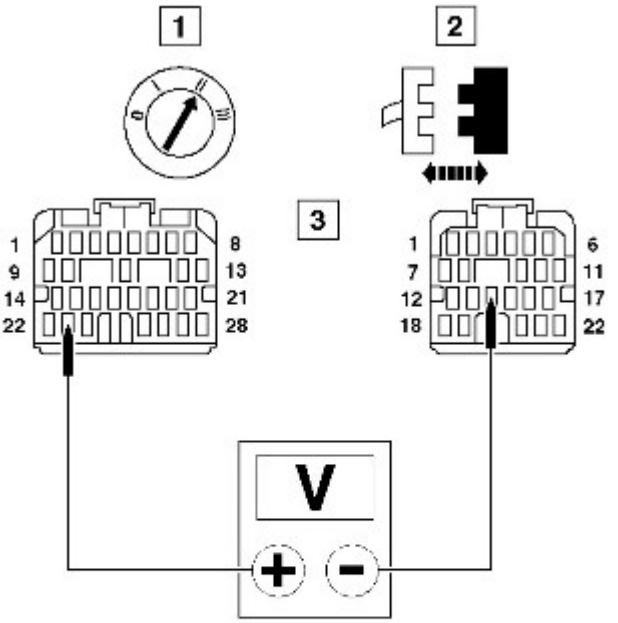
	1 With EM012 and EM023 disconnected, measure the resistance between EM012/014 and EM023/003.
	Is the resistance < 0.5 OHM? **Yes** GO to E13 **No** Inspect harness / connectors EM012, and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to E18

E13: HEATED O2 SENSOR SCREEN GROUND CONTINUITY



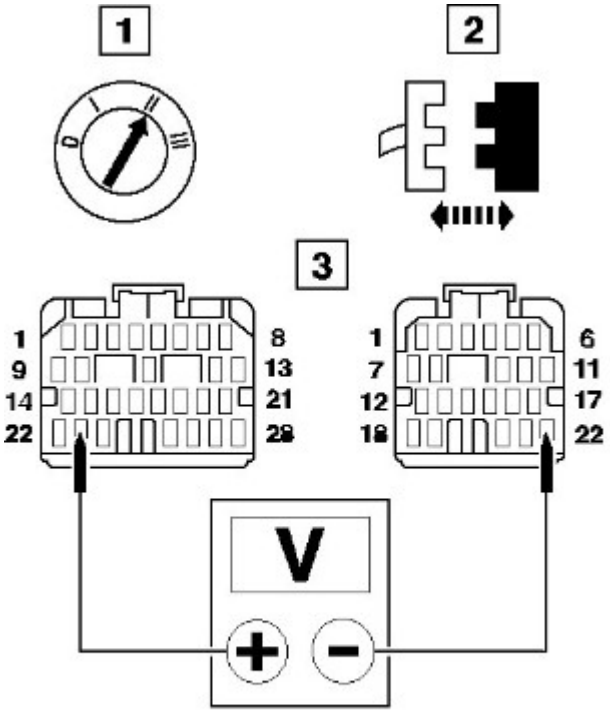
	1 With EM012 and EM023 disconnected, measure the resistance between EM012/022 and EM023/004.
	Is the resistance < 0.5 OHM? **Yes** GO to E14 **No** Inspect harness / connectors EM012, and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to E18

E14: CHECK FOR SHORT TO B+



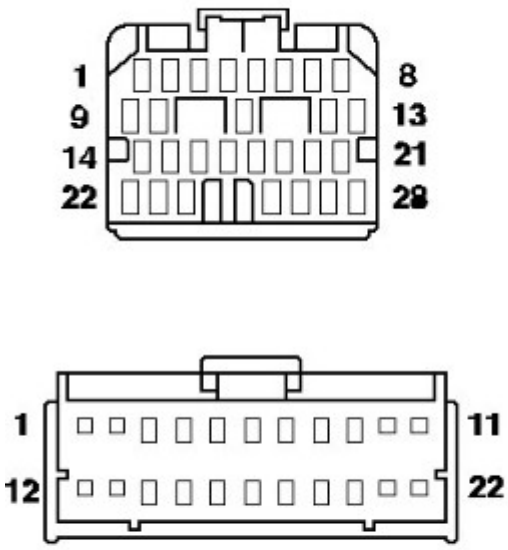
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/014
	Is the voltage 0 (zero) V? **Yes** GO to E15 **No** Inspect harness / connectors EM010, EM012, and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to E18

E15: CHECK FOR SHORT TO B+



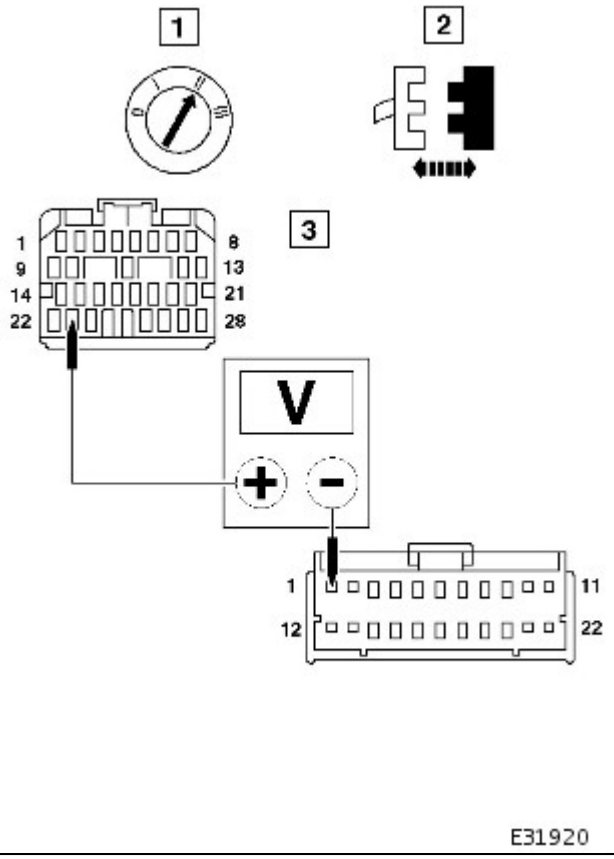
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/022.
	Is the voltage 0 (zero) V? **Yes** GO to E16 **No** Inspect harness / connectors EM010, EM012 and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to E18

E16: CHECK FOR SHORT TO B+ AT O2 SENSOR HEATER



	1 Ignition switch to position 0
	2 Remove EMS fuse F14.
	3 Disconnect EM010 and EM015.
	4 Using a link lead, bridge EM010/016 and EM010/022.
	5 Measure the voltage between EM010/023 and EM015/001.
	Is the voltage 0 (zero) V? **Yes** Replace EMS fuse F14 but retain link lead. GO to E17 **No** Inspect harness / connectors EM010, EM015, and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to E18

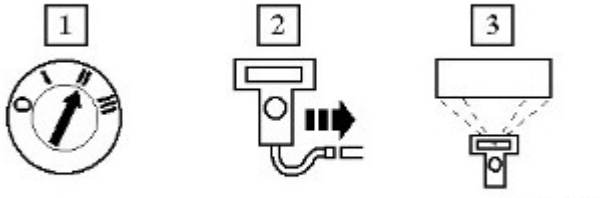
E17: CHECK B+ AT O2 SENSOR HEATER CIRCUIT



	1 With EM010 and EM015 disconnected, measure the voltage between EM010/023 and EM015/001.
	Is the voltage B+? **Yes** Remove link lead and reconnect all connectors. GO to E18 **No** Check integrity of EMS fuse F14, EMS control relay (relay 1) is energized and all connections are made. GO to E18
E18: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test F: P0153

PINPOINT TEST F : P0153	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to F2

F2: CHECK FOR LOW EXHAUST TEMPERATURE

	1 Check the engine and exhaust system for normal running temperature
	Is the engine and exhaust system up to normal running temperature? **Yes** GO to F3 **No** Rectify possible leaking exhaust manifold / catalyst, general causes of an over rich mixture and engine cooling system operation. Test the system for correct operation. GO to F8

F3: CHECK FOR O2 SENSOR HEATER CONTINUITY



E32125

	1 Ignition switch to position 0
	2 Disconnect EM023 • Bracket on top of gearbox or Bulkhead rear of engine
	3 Measure the resistance between EM023/001 and EM023/002.
	Is the resistance between 4 and 10 OHM? **Yes** GO to F4 **No** Renew O2 sensor. Reconnect plug(s). GO to F8

F4: CHECK FOR O2 SENSOR FAILURE



	1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	2 Measure the voltage between EM023/003 and EM023/004.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to F5 **No** Renew O2 sensor. Reconnect plug(s). GO to F8

F5: CHECK FOR O2 SENSOR FAILURE

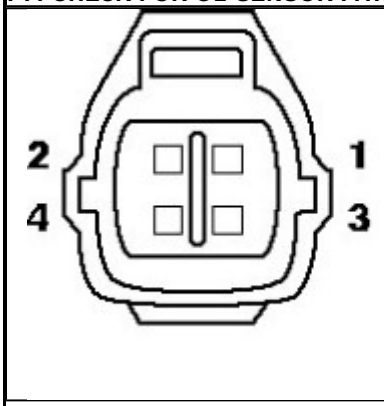


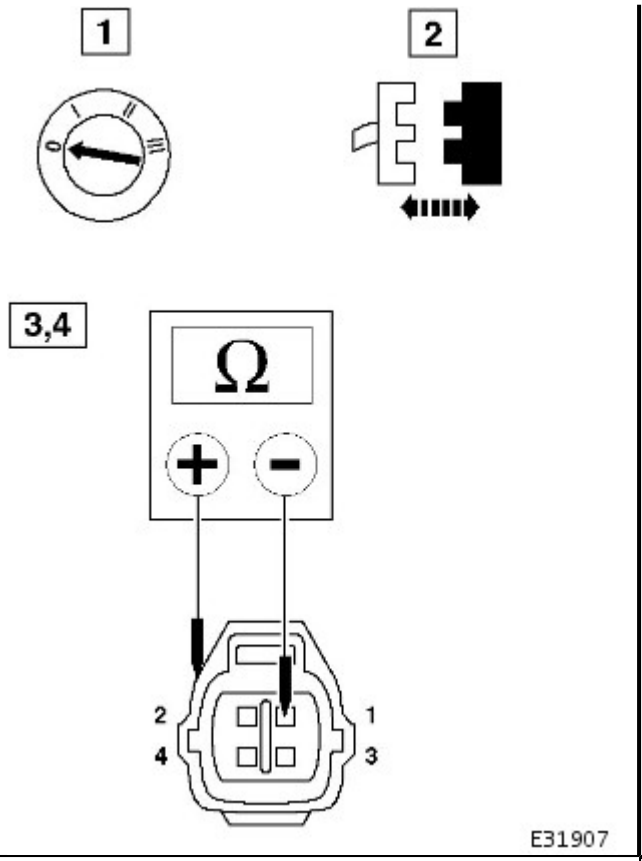
	1 With the conditions held as F4, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes** GO to F6 **No** Renew O2 sensor. Reconnect plug(s) GO to F8

F6: CHECK FOR O2 SENSOR FAILURE

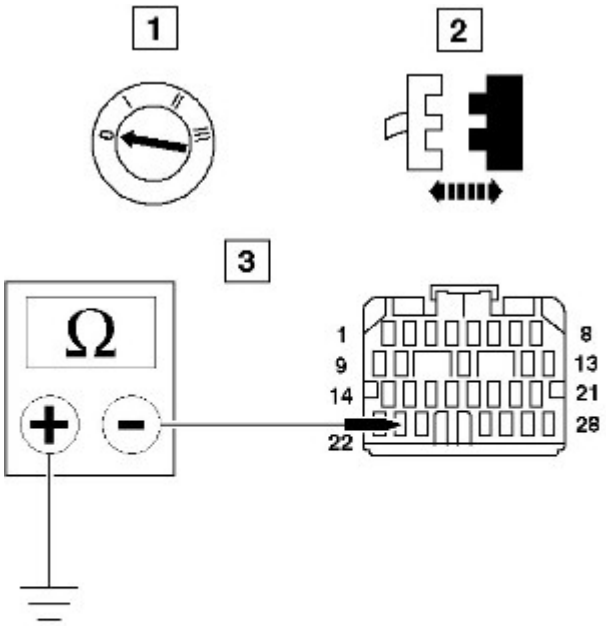


	1 With the conditions held as F5, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt?

	Yes GO to F7 **No** Renew O2 sensor. Reconnect plug(s) GO to F8
F7: CHECK FOR O2 SENSOR FAILURE	
	
	1 With the conditions held as in F6, run the engine at 1500 rpm for approximately 2 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 4 seconds? **Yes** GO to F9 **No** Renew O2 sensor. Reconnect plug(s) GO to F8
F8: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
F9: HEATED O2 SENSOR SHORT CIRCUIT TO GROUND	

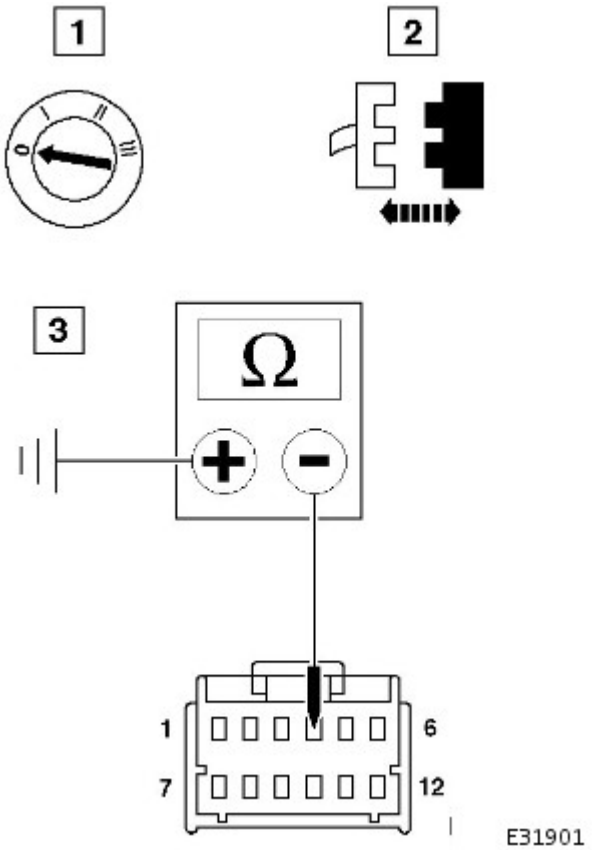


	1 With EM023 disconnected measure the insulation resistance between sensor pin 001 and sensor body. 2 Repeat for pin 003 and sensor body. Is the resistance > 10 MOHM? **Yes** GO to F11 **No** Renew the O2 sensor and reconnect plug(s). GO to F10
F10: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC. Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
F11: SIGNAL GROUND 1 CONTINUITY	



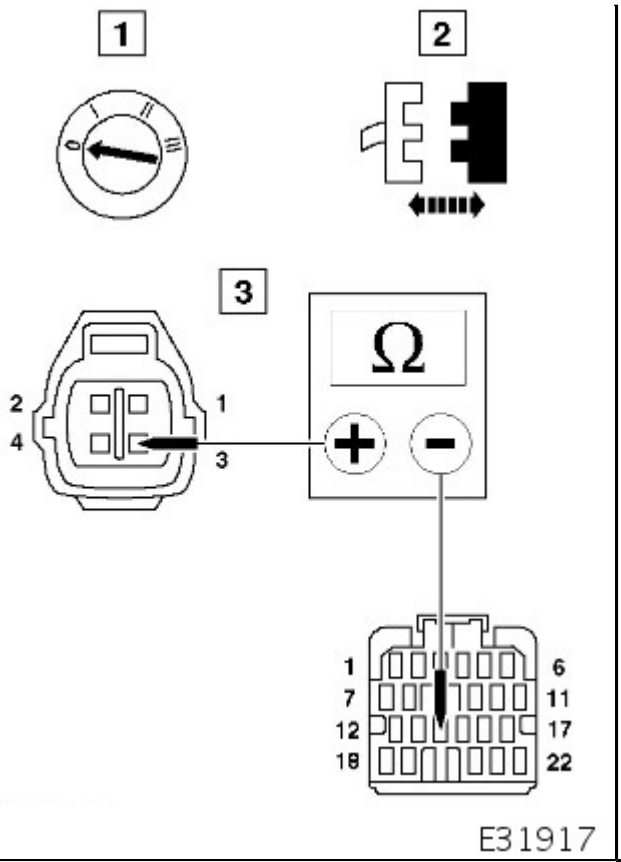
	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to F12 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect earthing stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to F13

F12: SIGNAL GROUND 2 CONTINUITY



	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to F14 **No** Inspect harness / connector EM014 for corrosion, damage, or pushed back pin. Inspect earthing stud EM008L for corrosion or damage. Inspect harness / splice EMS38 for damage. Repair as required and reconnect plug(s). GO to F13

F13: CHECK FOR HEATED O2 SENSOR CONTINUITY



1 With EM012 and EM023 disconnected, measure the resistance between EM012/014 and EM023/003.

Is the resistance < 0.5 OHM?

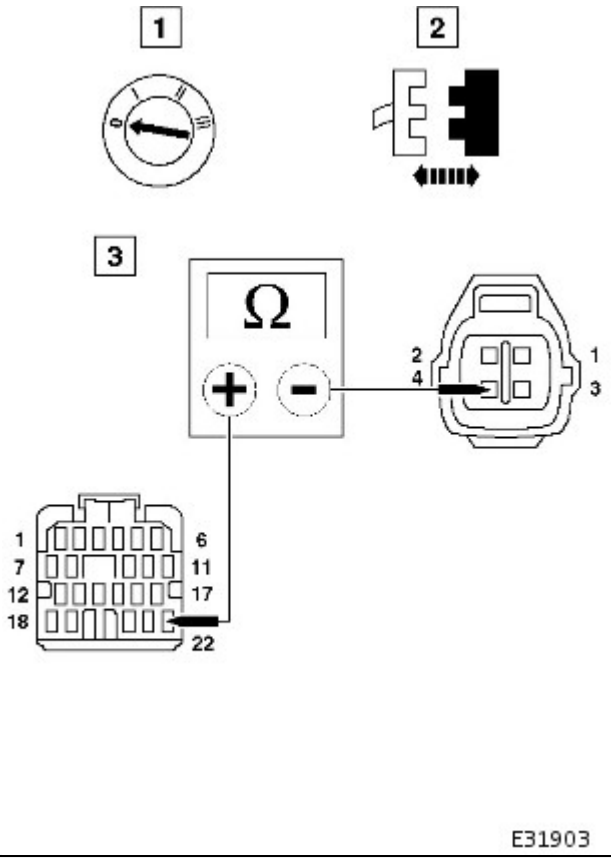
Yes

GO to F14

No

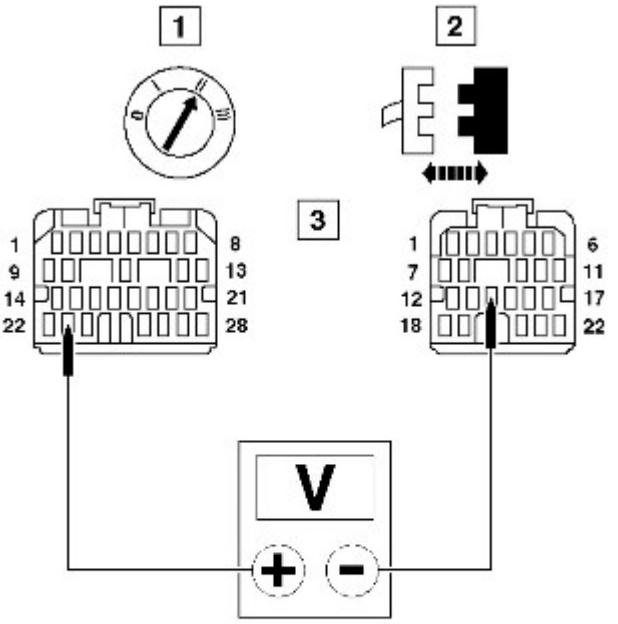
Inspect harness / connectors EM012 and EM023 for corrosion, damaged / pushed back pins.
Repair as required and reconnect plug(s).
GO to F19

F14: HEATED O2 SENSOR SCREEN GROUND CONTINUITY



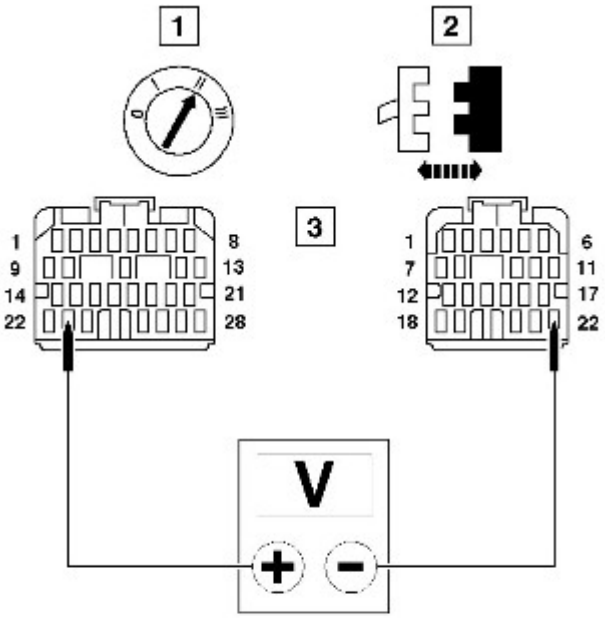
	1 With EM012 and EM023 disconnected, measure the resistance between EM012/022 and EM023/004.
	Is the resistance < 0.5 OHM? **Yes** GO to F15 **No** Inspect harness / connectors EM012 and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to F19

F15: CHECK FOR SHORT TO B+



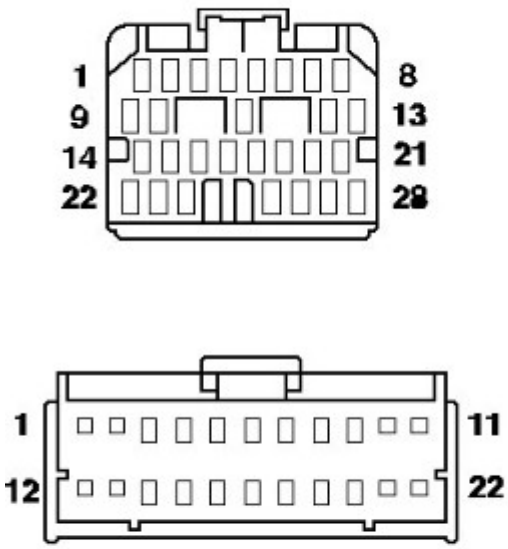
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/014.
	Is the voltage 0 (zero) V? **Yes** GO to F16 **No** Inspect harness / connectors EM010, EM012 and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to F19

F16: CHECK FOR SHORT TO B+



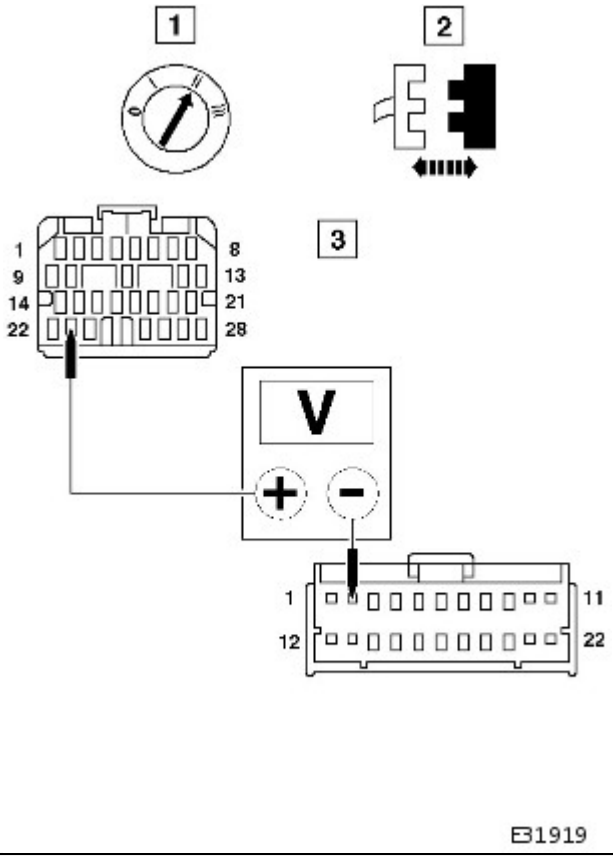
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/022.
	Is the voltatage 0 (zero) V? **Yes** GO to F17 **No** Inspect harness / connectors EM010, EM012 and EM023 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to F19

F17: CHECK FOR SHORT TO B+ AT O2 SENSOR HEATER



	1 Ignition switch to position 0
	2 Remove EMS fuse F14.
	3 Disconnect EM010 and EM015.
	4 Using a link lead, bridge EM010/016 and EM010/022.
	5 Measure the voltage between EM010/023 and EM015/001.
	Is the voltage 0 (zero) V? **Yes** Replace EMS fuse F14 but retain link lead GO to F18 **No** Inspect connectors EM010, EM015, and EM023 for corrosion, damaged / pushed back pins or repair the harness; reconnect plug(s). GO to F19

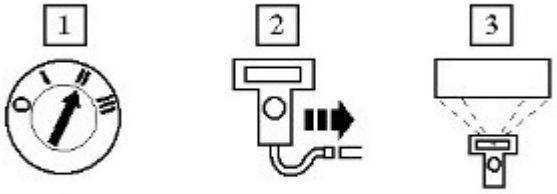
F18: CHECK B+ AT O2 SENSOR HEATER CIRCUIT



	1 With EM010 and EM015 disconnected, measure the voltage between EM010/023 and EM015/002.
	Is the voltage B+? **Yes** Remove link lead and reconnect all connectors. GO to F19 **No** Check integrity of EMS fuse F14, EMS control relay (relay 1) is energized and all connections made. GO to F19
F19: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test G: P0157, P0158

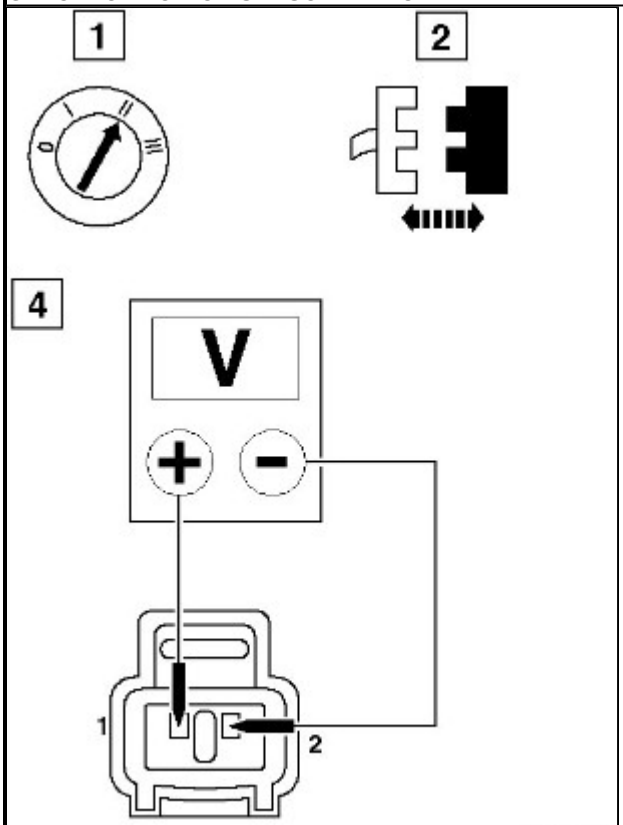
PINPOINT TEST G : P0157, P0158	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
G1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to G2

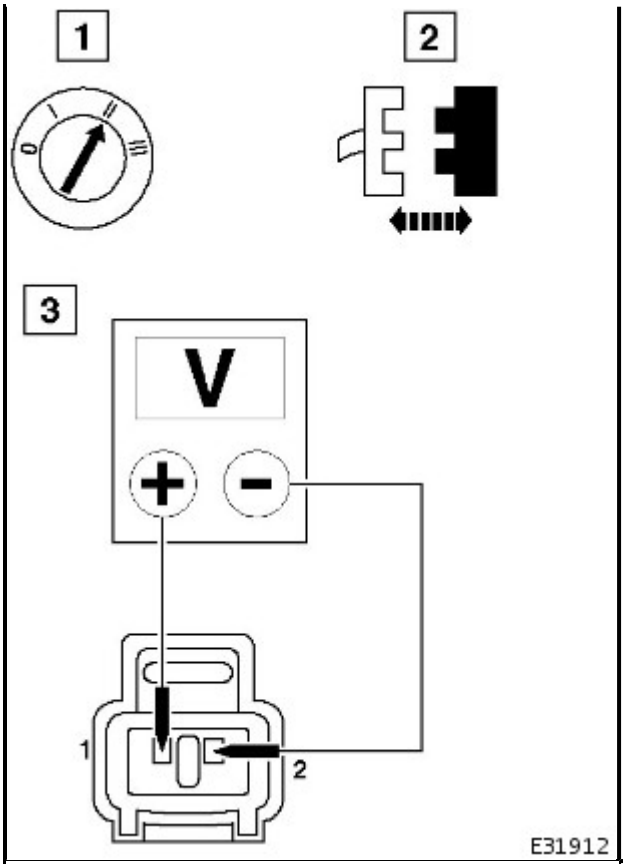
G2: CHECK FOR O2 SENSOR FAILURE



E31911

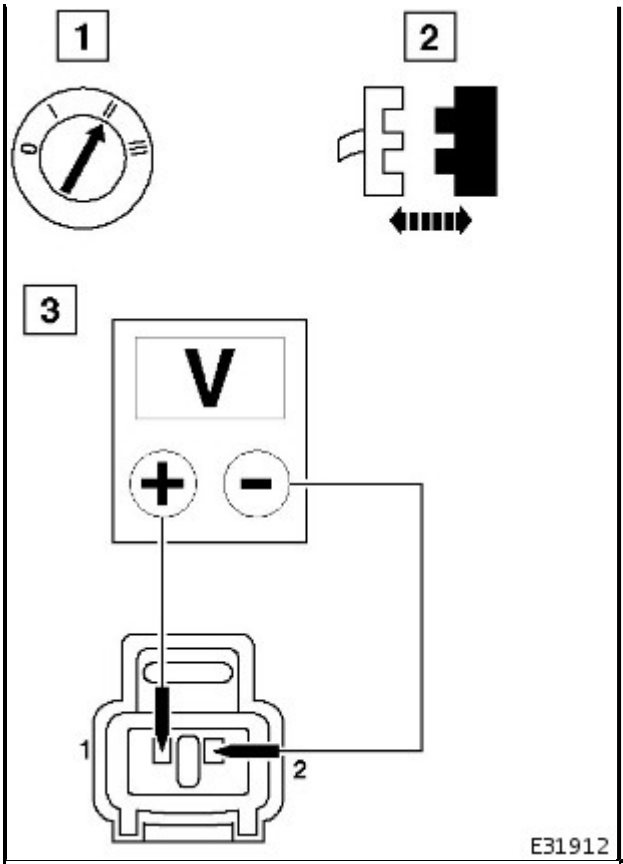
	1 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	2 Measure the voltage between EM024/001 and EM024/002.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to G3 **No** Renew O2 sensor and reconnect plug(s) GO to G6

G3: CHECK FOR O2 SENSOR FAILURE



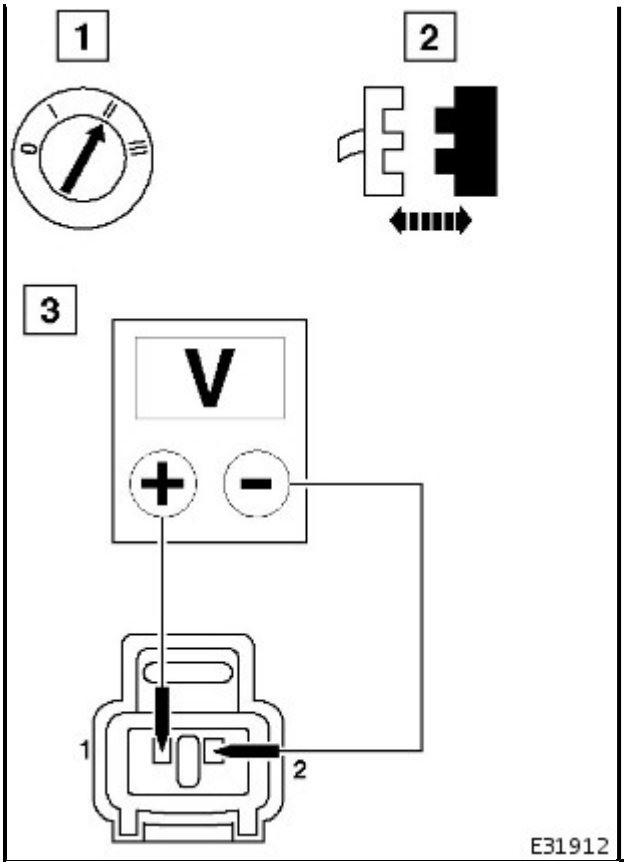
	1 With the conditions held as G2, suddenly decelerate to idle. Has the voltage dropped to 400mV or less ? **Yes** GO to G4 **No** Renew O2 sensor and reconnect plug(s). GO to G6

G4: CHECK FOR O2 SENSOR FAILURE

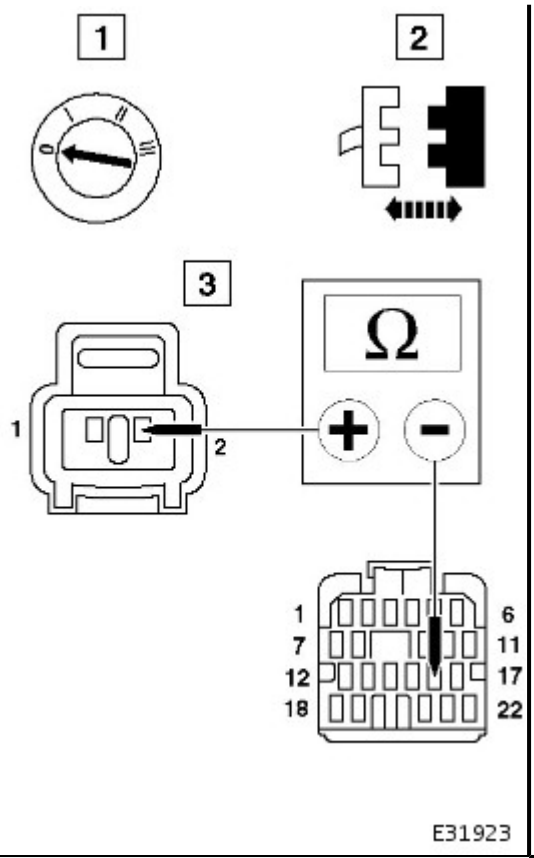


	1 With the conditions held as G3, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to G5 **No** Renew O2 sensor and reconnect plug(s). GO to G6

G5: CHECK FOR O2 SENSOR FAILURE

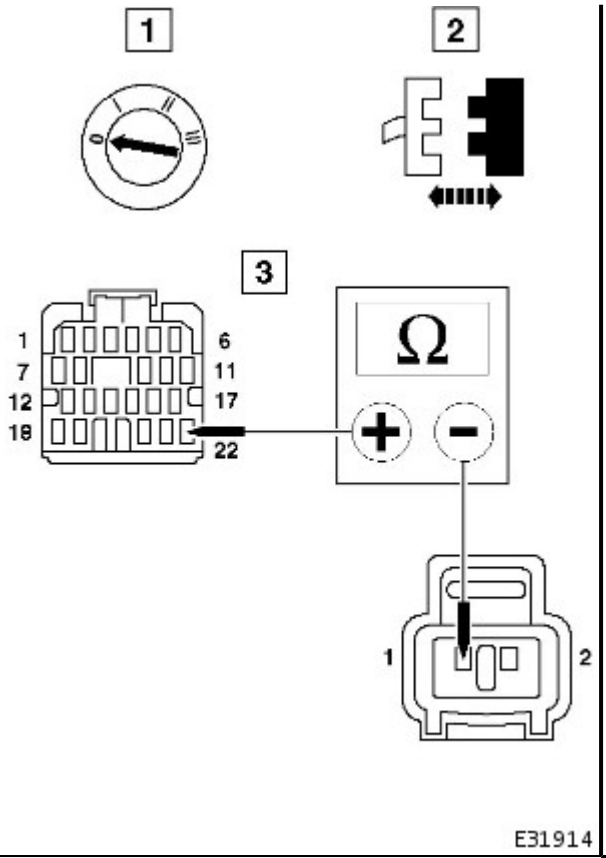


	1 With the conditions held as in G4, run the engine at 1500 rpm for approximately 3 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 180 seconds? **Yes** GO to G7 **No** Renew O2 sensor and reconnect plug(s). GO to G6
G6: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
G7: CHECK FOR O2 SENSOR CONTINUITY	



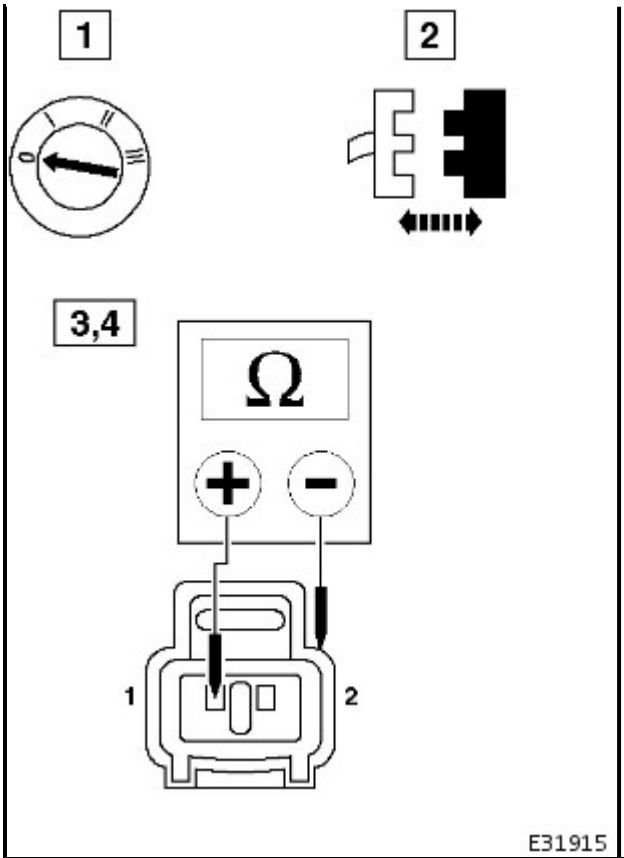
	1 With EM012 and EM024 disconnected, measure the resistance between EM012/016 and EM024/002.
	Is the resistance < 0.5 OHM? **Yes** GO to G8 **No** Inspect harness / connectors EM012, and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G10

G8: O2 SENSOR SCREEN GROUND CONTINUITY



	1 With EM012 and EM024 disconnected, measure the resistance between EM012/022 and EM024/001.
	Is the resistance < 0.5 OHM? **Yes** GO to G9 **No** Inspect harness / connectors EM012, and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G10

G9: O2 SENSOR SHORT CIRCUIT TO GROUND

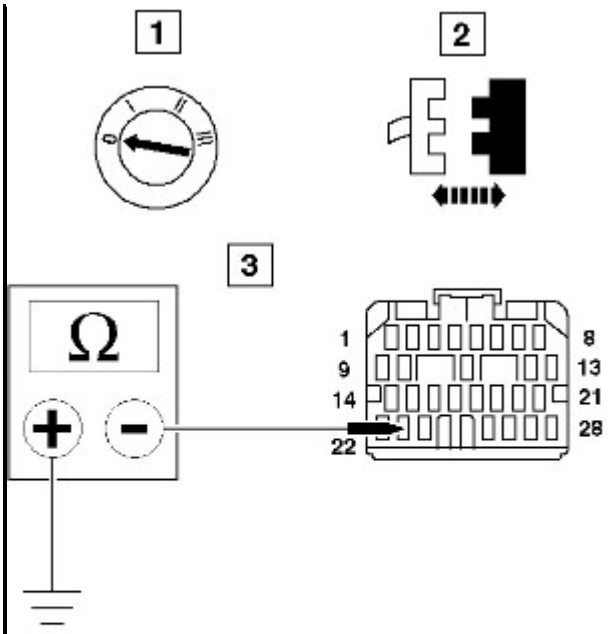


	1 With EM024 disconnected measure the insulation resistance between sensor pin 001 and sensor body.
	2 Repeat for pin 002 and sensor body.
	Is the resistance > 10 MOHM? **Yes** GO to G11 **No** Renew the O2 sensor and reconnect all plugs. GO to G10

G10: STOP

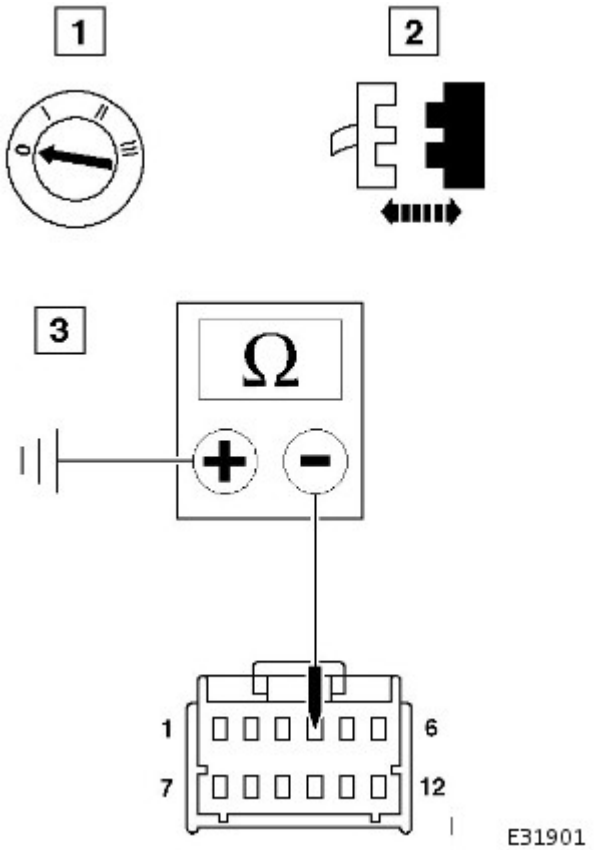
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

G11: SIGNAL GROUND 1 CONTINUITY

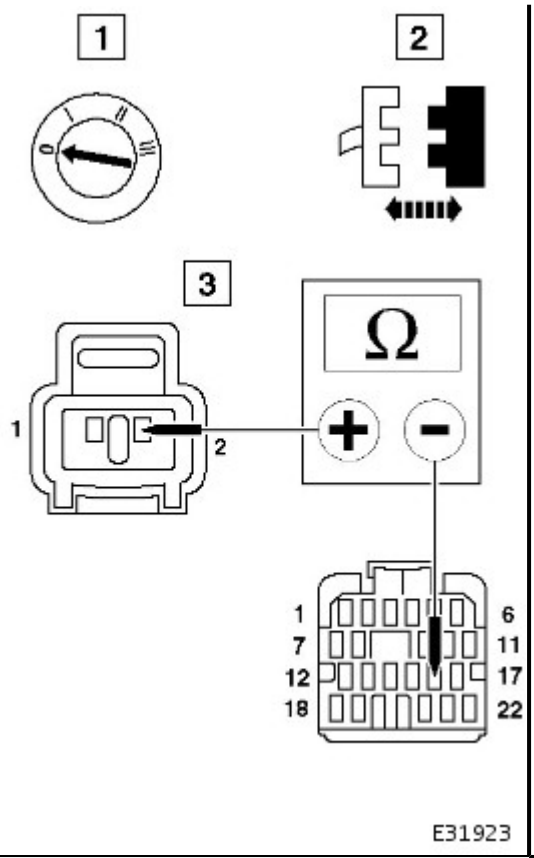


	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to G12 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to G13

G12: SIGNAL GROUND 2 CONTINUITY

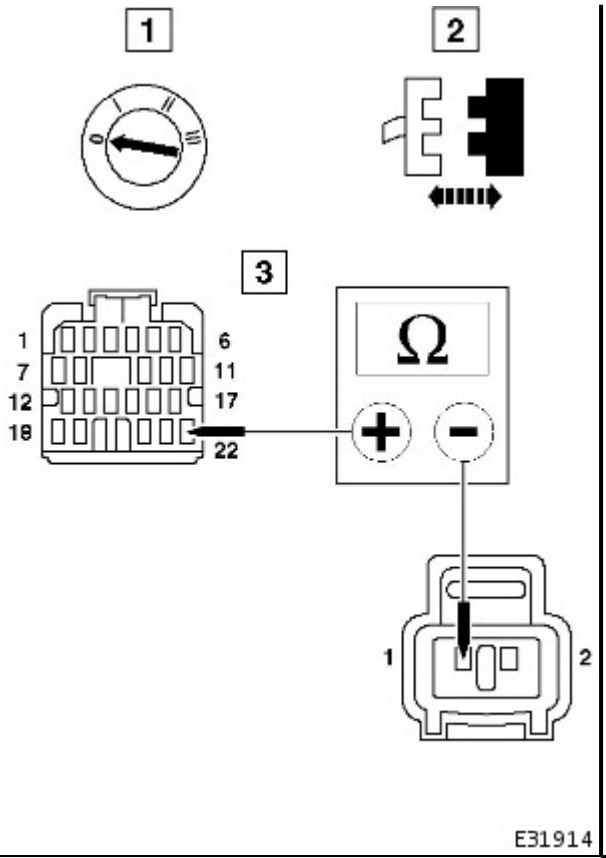


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to G14 **No** Inspect connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to G13
G13: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
G14: CHECK FOR O2 SENSOR CONTINUITY	



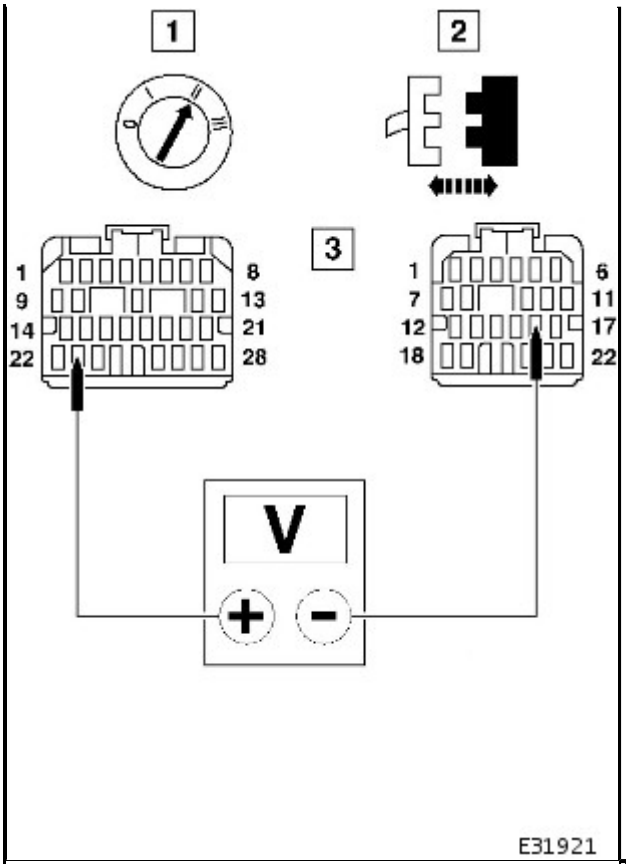
	1 With EM012 and EM024 disconnected, measure the resistance between EM012/016 and EM024/002.
	Is the resistance < 0.5 OHM? **Yes** GO to G15 **No** Inspect harness / connectors EM012, and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G20

G15: O2 SENSOR SCREEN GROUND CONTINUITY



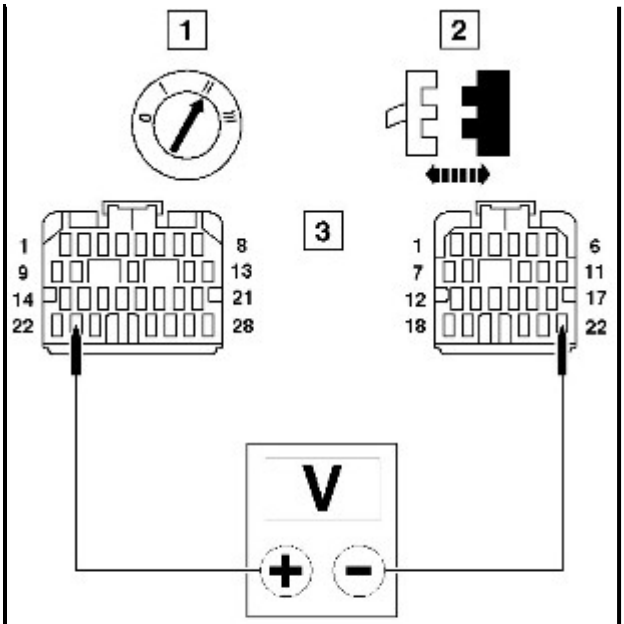
	1 With EM012 and EM024 disconnected, measure the resistance between EM012/022 and EM024/001.
	Is the resistance < 0.5 OHM? **Yes** GO to G16 **No** Inspect harness / connectors EM012, and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G20

G16: CHECK FOR SHORT TO B+



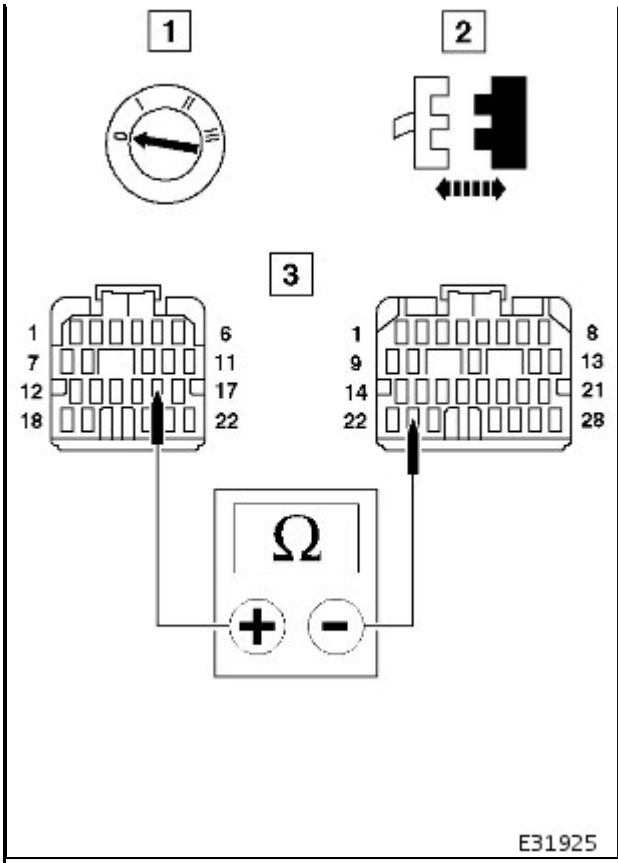
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/016.
	Is the voltage 0 (zero) V? **Yes** GO to G17 **No** Inspect harness / connectors EM010, EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G20

G17: CHECK FOR SHORT TO B+



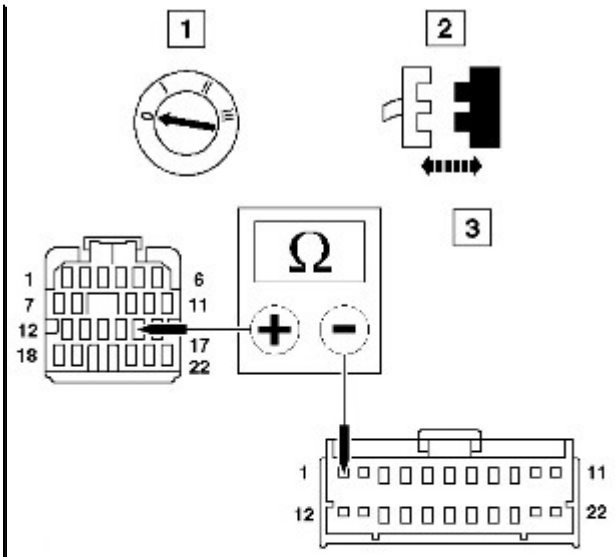
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/022
	Is the voltage 0 (zero) V? **Yes** GO to G18 **No** Inspect harness / connectors EM010, EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to G20

G18: CHECK HARNESS SHORT TO GROUND



	1 Measure the insulation resistance between EM012/016 and ground EM010/023.
	Is the resistance > 10 MOHM? **Yes** GO to G19 **No** Inspect harness / connectors EM012 and EM024 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to G20

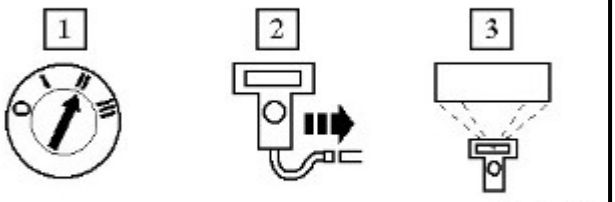
G19: CHECK HARNESS SHORT CORE TO CORE



	1 Measure the insulation resistance between EM012/016 and EM015/001.
	Is the resistance > 10 MOHM? **Yes** Reconnect all plugs. GO to G20 **No** Inspect harness / EM012, EM015 and EM024 for corrosion, bent / pushed back pins. Repair as necessary. GO to G20
G20: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test H: P0160

PINPOINT TEST H : P0160	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
H1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



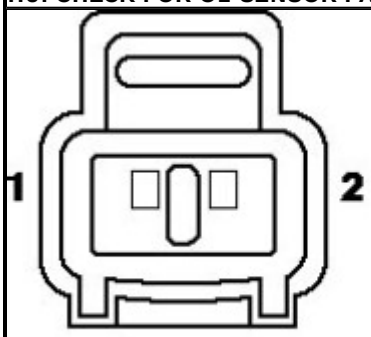
E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to H2

H2: CHECK FOR LOW EXHAUST TEMPERATURE

	1 Check the engine and exhaust system for correct operation and normal running temperature
	Is the engine and exhaust system operating correctly and up to normal running temperature? **Yes** GO to H3 **No** Rectify leaking exhaust manifold / catalyst, general causes of an over rich mixture and engine cooling system operation and test the system for correct operation. GO to H7

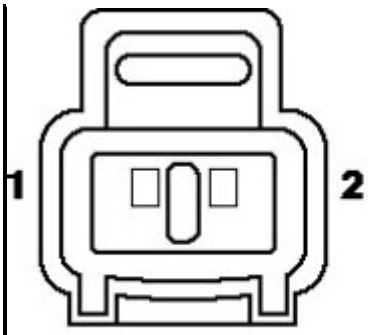
H3: CHECK FOR O2 SENSOR FAILURE



E32127

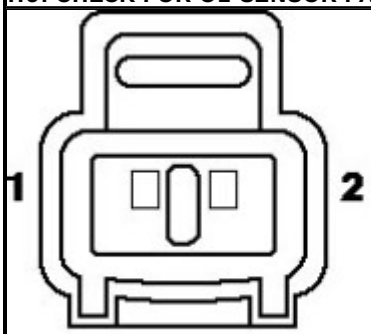
	1 Ignition switch to position 0
	2 Disconnect EM024 • Bracket on top of gearbox or Bulkhead rear of engine
	3 Run the engine for a period to warm the sensor and then maintain a steady speed of approximately 2500 rpm.
	4 With EM024 disconnected, measure the voltage between EM024/001 and EM024/002.
	Is the voltage between 600mV and 1.0 Volt? **Yes** GO to H4 **No** Renew O2 sensor. Reconnect plug(s). GO to H7

H4: CHECK FOR O2 SENSOR FAILURE



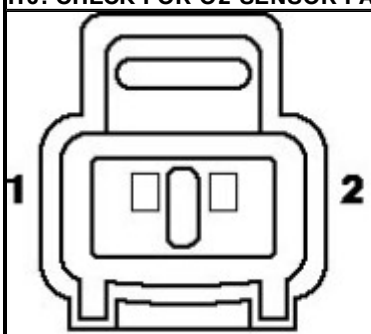
	1 With the conditions held as H3, suddenly decelerate to idle.
	Has the voltage dropped to 400mV or less ? **Yes** Stop the engine GO to H5 **No** Renew O2 sensor. Reconnect plug(s). GO to H7

H5: CHECK FOR O2 SENSOR FAILURE



	1 With the conditions held as H4, suddenly accelerate to approximately 2500 rpm.
	Has the voltage risen to between 600mV and 1 volt? **Yes** GO to H6 **No** Renew O2 sensor. Reconnect plug(s). GO to H7

H6: CHECK FOR O2 SENSOR FAILURE



	1 With the conditions held as in H5, run the engine at 1500 rpm for approximately 3 minutes.
	Does the displayed voltage drop below 400mV and rise above 500 mV, cycling approximately every 180 seconds? **Yes**

GO to H8

No

Renew O2 sensor. Reconnect plug(s)
GO to H7

H7: STOP

1 Perform appropriate service drive cycle and check for the presence of DTC.

Has the fault code cleared?

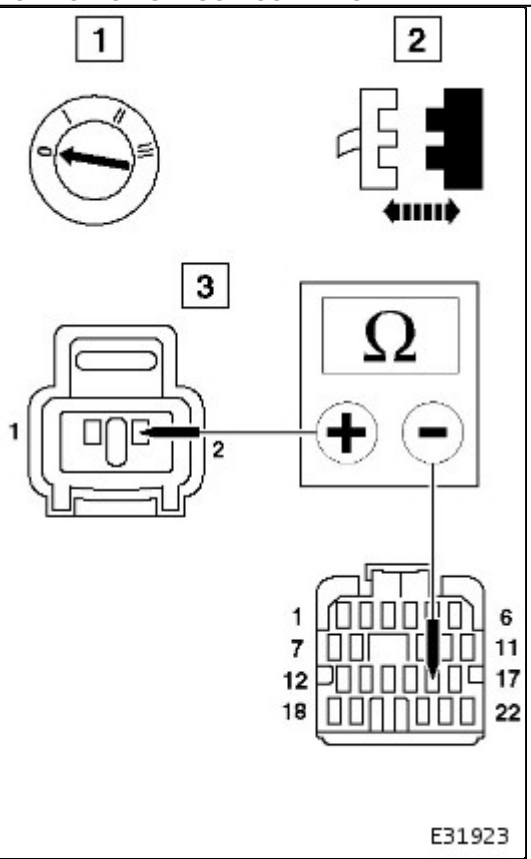
Yes

STOP

No

Contact Jaguar Service

H8: CHECK FOR O2 SENSOR CONTINUITY



1 With EM012 and EM024 disconnected, measure the resistance between EM012/016 and EM024/002.

Is the resistance < 0.5 OHM

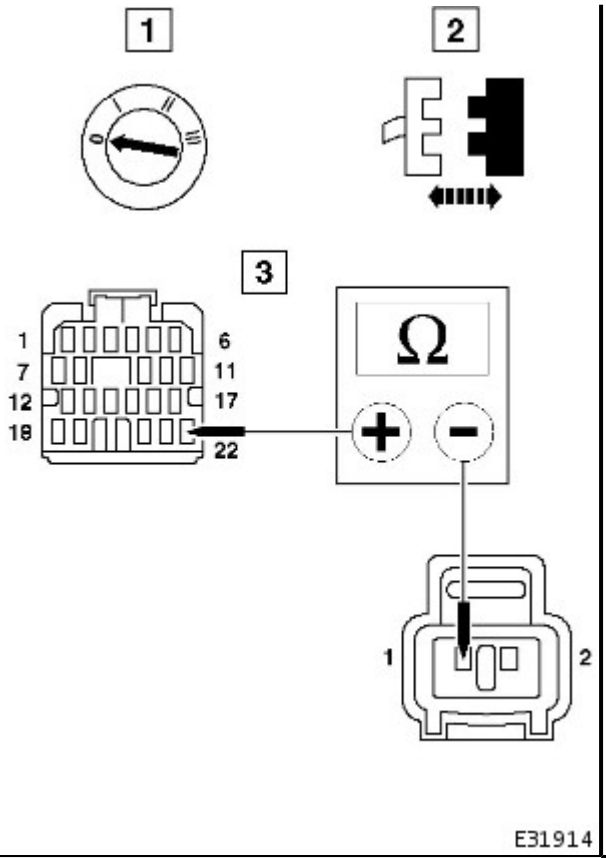
Yes

GO to H9

No

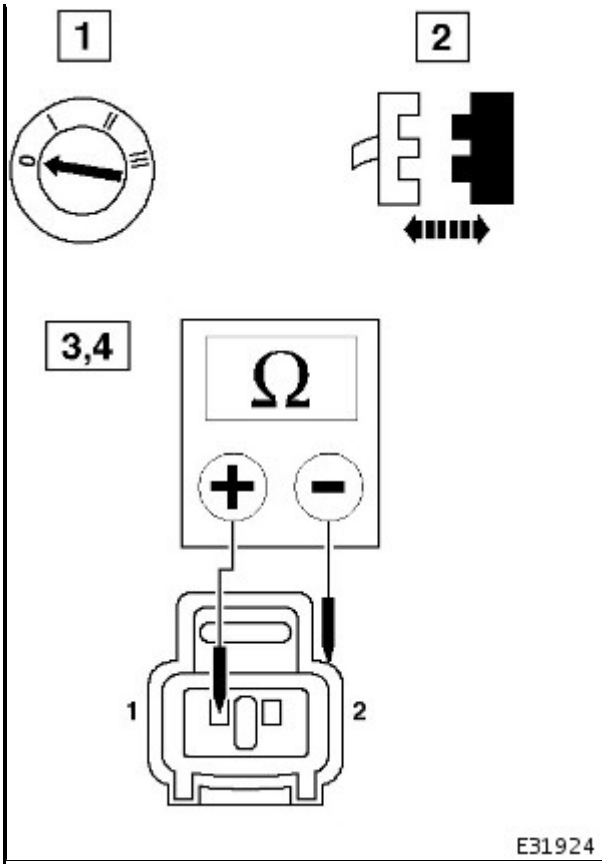
Inspect harness / connectors EM012 and EM024 for corrosion, damaged / pushed back pins.
Repair as required and reconnect plug(s).
GO to H11

H9: O2 SENSOR SCREEN GROUND CONTINUITY



	1 With EM012 and EM024 disconnected, measure the resistance between EM012/022 and EM024/001.
	Is the resistance < 0.5 OHM? **Yes** GO to H10 **No** Inspect harness / connectors EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to H11

H10: O2 SENSOR SHORT CIRCUIT TO GROUND

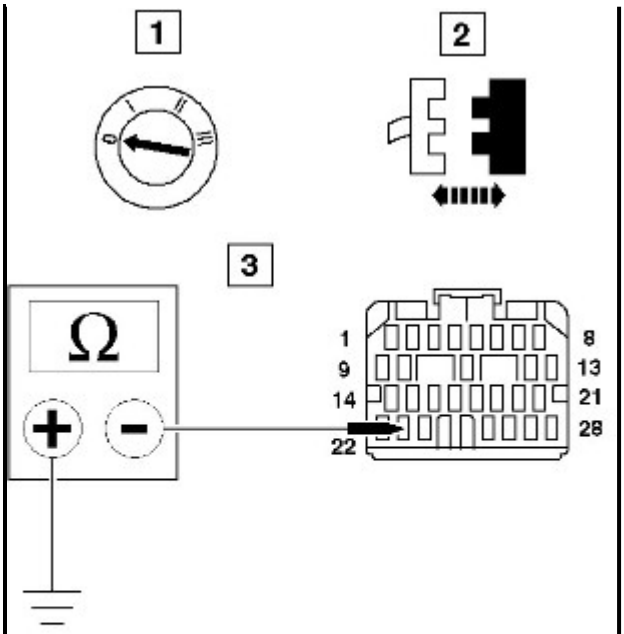


	1 With EM024 disconnected measure the insulation resistance between sensor pin 001 and sensor body.
	2 Repeat for pin 002 and sensor body.
	Is the resistance > 10 MOHM? **Yes** GO to H12 **No** Renew the O2 sensor and reconnect all plugs. GO to H11

H11: STOP

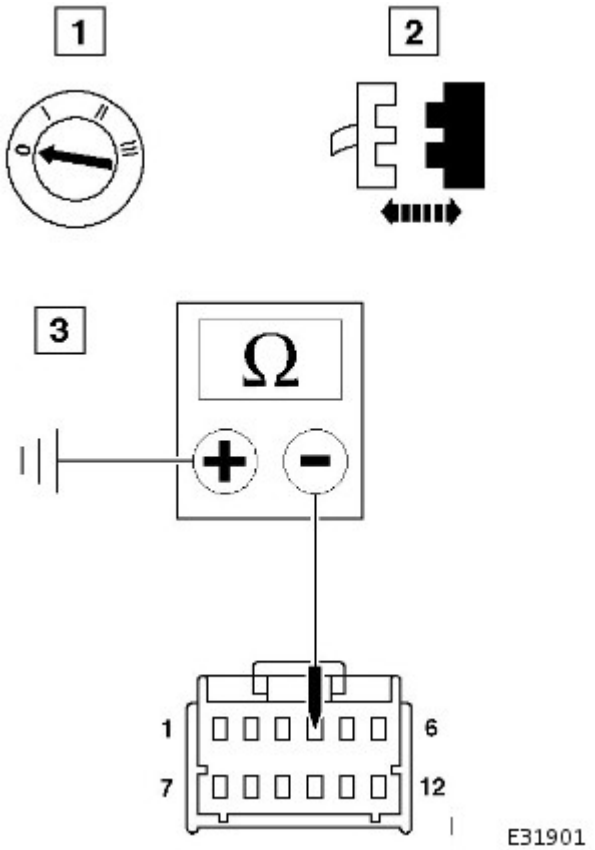
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

H12: SIGNAL GROUND 1 CONTINUITY

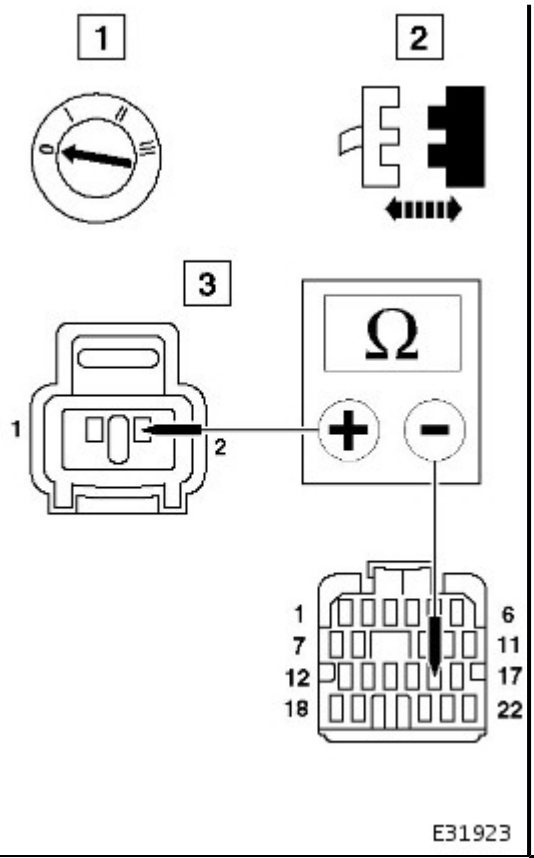


	1 With EM010 and EM014 disconnected, measure the resistance between EM010/023 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to H13 **No** Inspect harness / connector EM010 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to H14

H13: SIGNAL GROUND 2 CONTINUITY

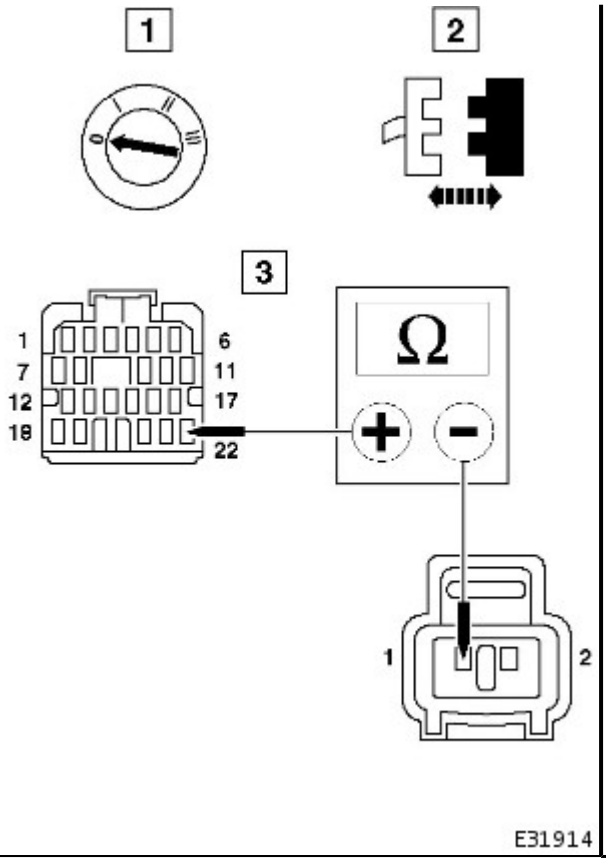


	1 With EM010 and EM014 disconnected, measure the resistance between EM014/004 and chassis ground EM008L.
	Is the resistance < 0.5 OHM? **Yes** GO to H15 **No** Inspect harness / connector EM014 for corrosion, damage, or pushed back pin. Inspect ground stud EM008L for corrosion or damage. Inspect harness / splice EMS36 for damage. Repair as required and reconnect plug(s). GO to H14
H14: STOP	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service
H15: CHECK FOR O2 SENSOR CONTINUITY	



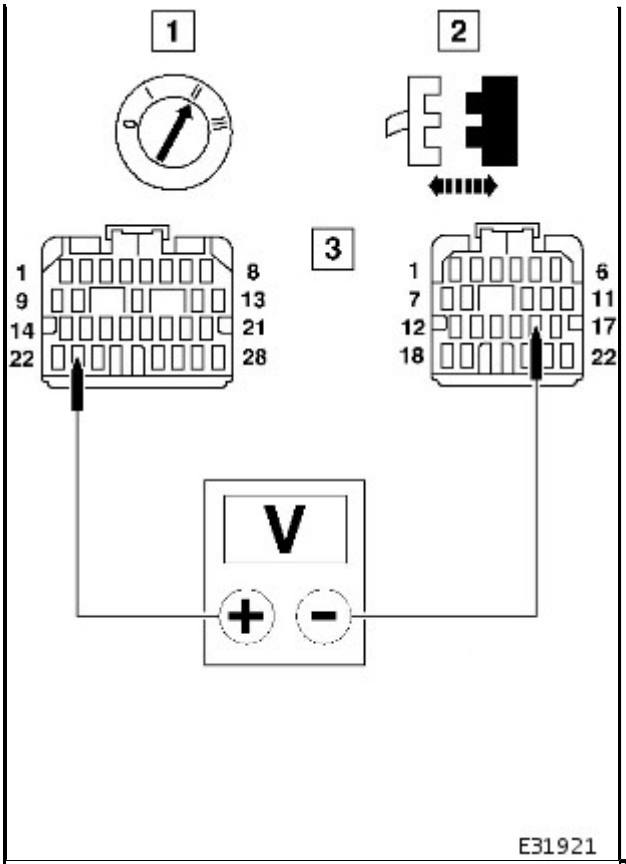
	1 With EM012 and EM024 disconnected, measure the resistance between EM012/016 and EM024/002.
	Is the resistance < 0.5 OHM? **Yes** GO to H16 **No** Inspect harness / connectors EM012, and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to H21

H16: O2 SENSOR SCREEN GROUND CONTINUITY



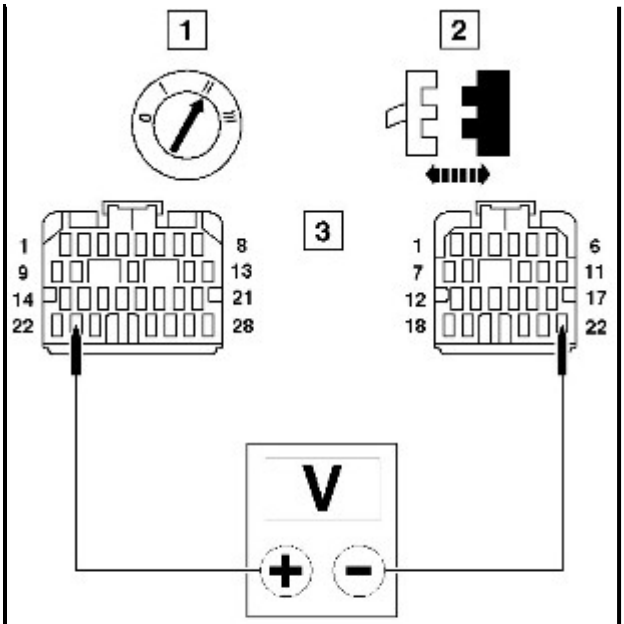
	1 With EM012 and EM024 disconnected, measure the resistance between EM012/022 and EM024/001.
	Is the resistance < 0.5 OHM? **Yes** GO to H17 **No** Inspect harness / connectors EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to H21

H17: CHECK FOR SHORT TO B+



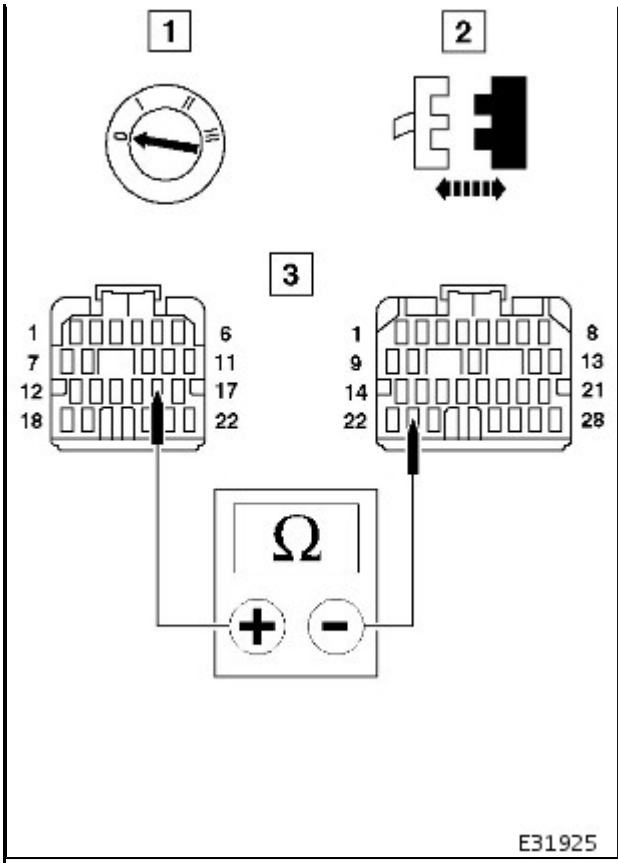
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/016.
	Is the voltage 0V? **Yes** GO to H18 **No** Inspect harness / connectors EM010, EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to H21

H18: CHECK FOR SHORT TO B+



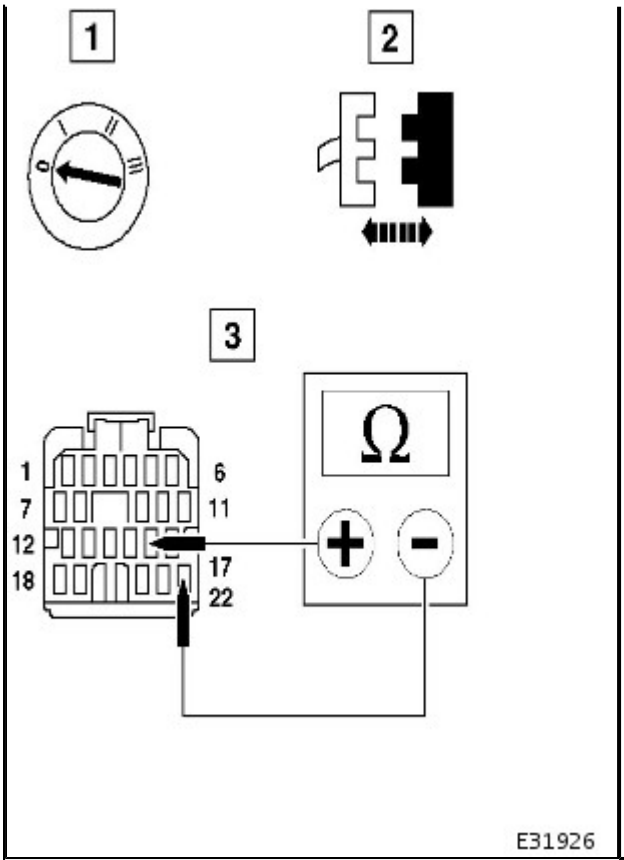
	1 With EM010 and EM012 disconnected, measure the voltage between EM010/023 and EM012/022.
	Is the voltage 0V? **Yes** GO to H19 **No** Inspect harness / connectors EM010, EM012 and EM024 for corrosion, damaged / pushed back pins. Repair as required and reconnect plug(s). GO to H21

H19: CHECK HARNESS SHORT TO GROUND



	1 With EM010, EM012 and EM024 disconnected, measure the insulation resistance between EM012/016 and ground EM010/023.
	Is the resistance > 10 MOHM? **Yes** GO to H20 **No** Inspect harness / connectors EM012, EM024 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to H21

H20: CHECK HARNESS SHORT CORE TO CORE



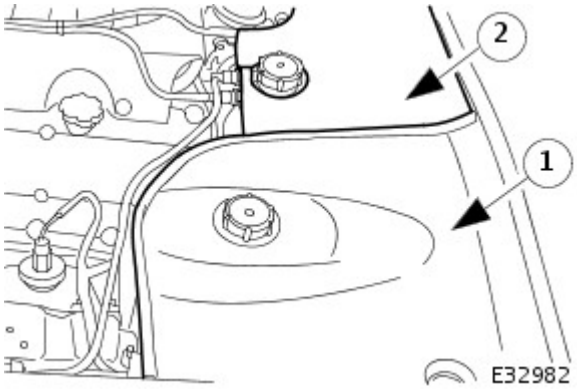
	1 Measure the insulation resistance between EM012/016 and EM012/022.
	Is the resistance > 10 MOHM? **Yes** Reconnect all plugs. GO to H21 **No** Inspect harness / connectors EM012, EM015 and EM024 for corrosion, bent / pushed back pins. Repair as required and reconnect plug(s). GO to H21
H21: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Exhaust System - Catalytic Converter LH4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

Removal and Installation

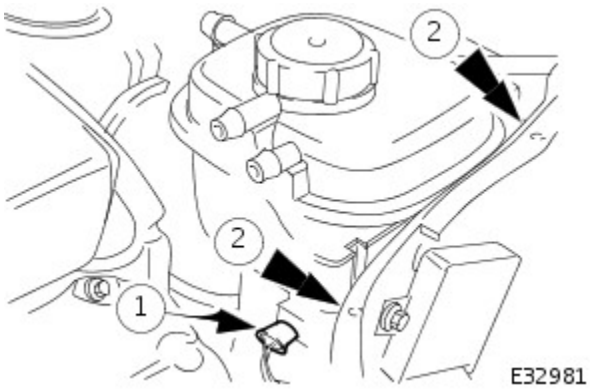
Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the front muffler; refer to Operation 30.10.18 in this section.
3. Remove the centre trim panel from the engine compartment.



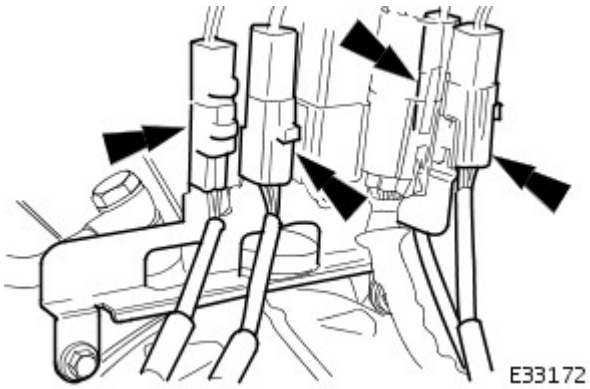
    1. Remove the left hand side enclosure panel.
    2. Remove the centre trim panel.

4. Reposition the expansion tank from the mounting.



    1. Disconnect the coolant level sensor connector.
    2. Remove the nuts which secures the tank.

5. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.



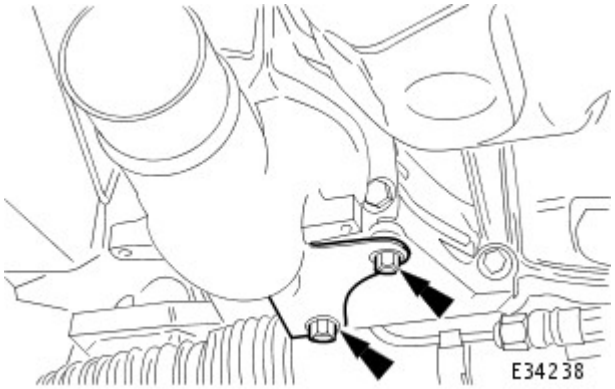
Disconnect the oxygen sensor multiplugs.

- Displace the multiplugs from the engine mounting bracket.
- Disconnect the plug(s) from the oxygen sensor(s)

6. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.



7. Raise the vehicle on a ramp.



8. Remove the downpipe catalytic converter.

- Remove the bolts which secure the downpipe lower mounting bracket.
- Remove the downpipe assembly.



9. Remove the oxygen sensor(s).

- The downstream sensor is fitted only for North American markets.

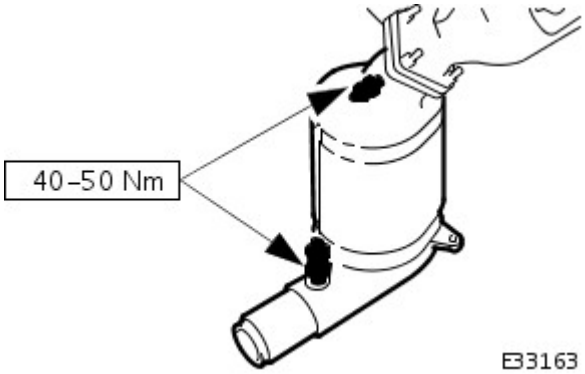
10. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

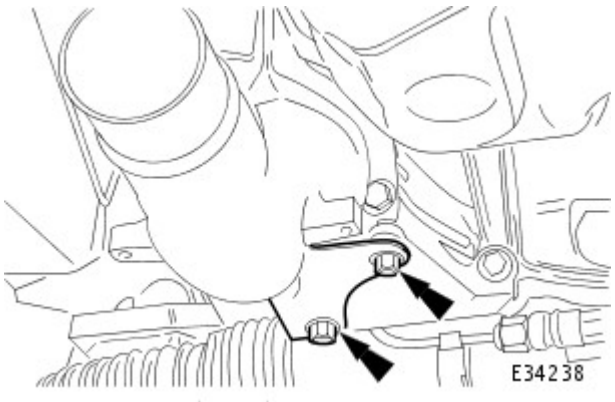
Installation

1. Fit the oxygen sensor(s).

- The downstream sensor is fitted only for North American markets.



2. Fit a new gasket to the manifold mating flange on the downpipe.

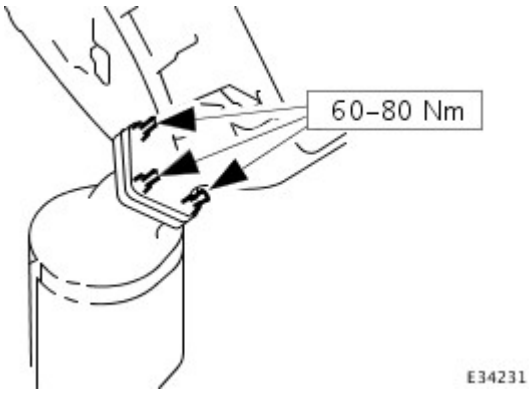


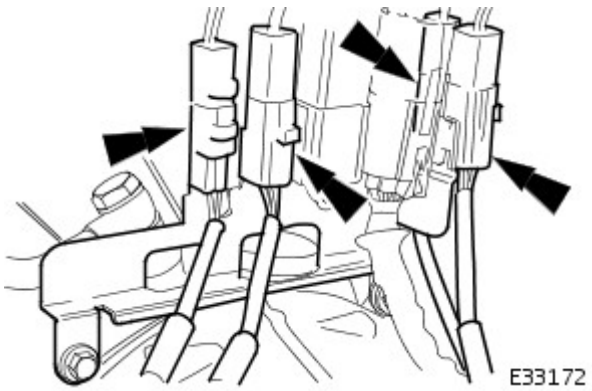
3. Fit the downpipe catalytic converter.

- Fit the downpipe assembly to the manifold.
- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)

4. Lower the ramp.

5. Tighten the nuts securing the downpipe flange to the manifold flange.



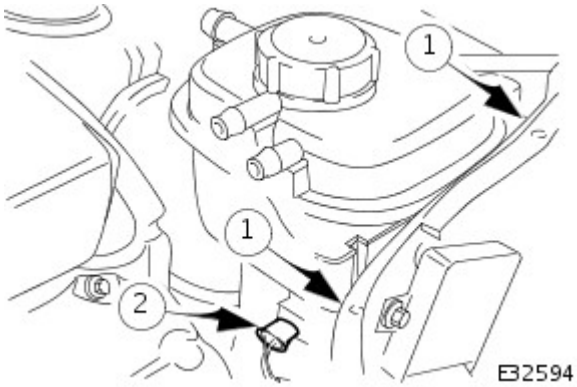


6. Connect the oxygen sensor multiplugs.

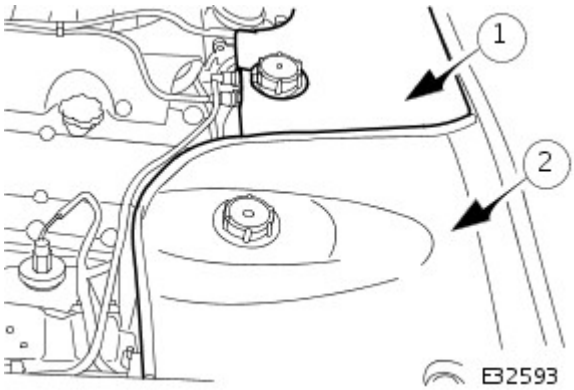
- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.

7. Fit the coolant header tank.

1. Reposition the tank and fit the securing nuts.



2. Connect the harness connector



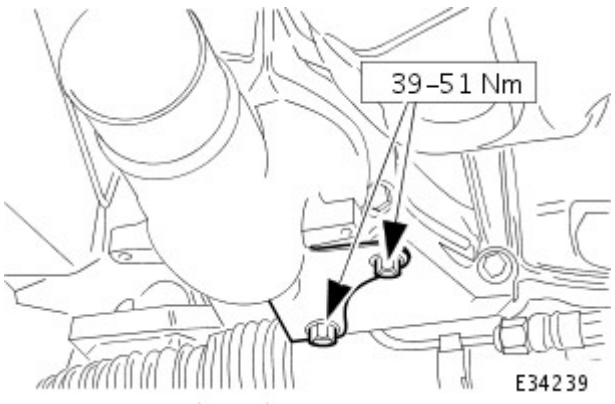
8. Refit the centre trim panel and the left hand enclosure panel to the engine compartment.

1. Refit the centre trim panel.

2. Refit the left hand enclosure panel.

9. Raise the ramp.

10. Tighten the mounting bracket securing bolts.



11. Fit the front muffler; refer to Operation 30.10.18.

12. Lower the ramp.

13. Remove the paintwork protection sheets and close the engine cover.

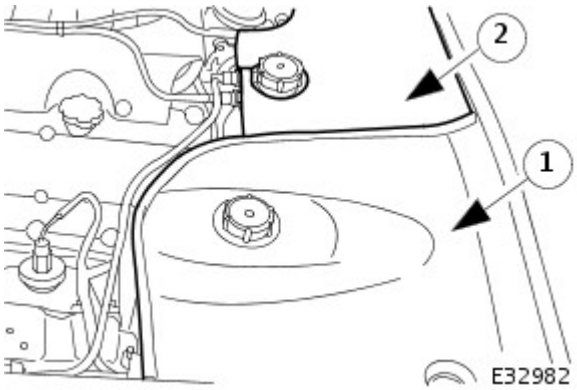
Exhaust System - Catalytic Converter LH4.0L SC V8 - AJ26

Removal and Installation

Removal

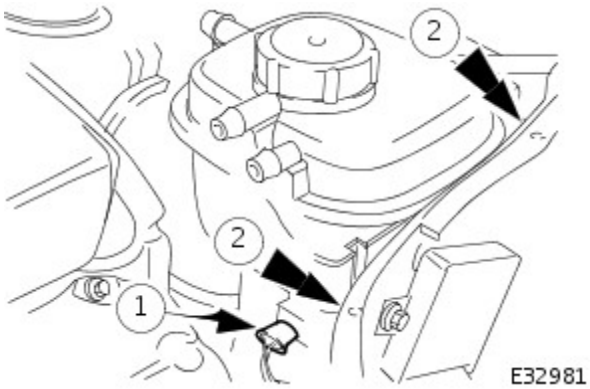
1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the centre trim panel from the engine compartment.



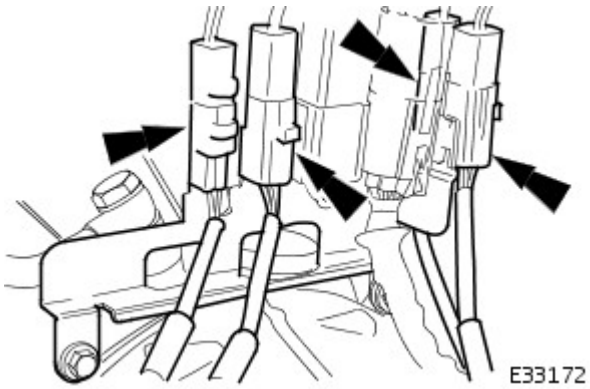
1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.

3. Reposition the expansion tank from the mounting.



1. Disconnect the coolant level sensor connector.
2. Remove the nuts which secures the tank.

4. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.



Disconnect the oxygen sensor multiplugs.

- Displace the multiplugs from the engine mounting bracket.
- Disconnect the plug(s) from the oxygen sensor(s)

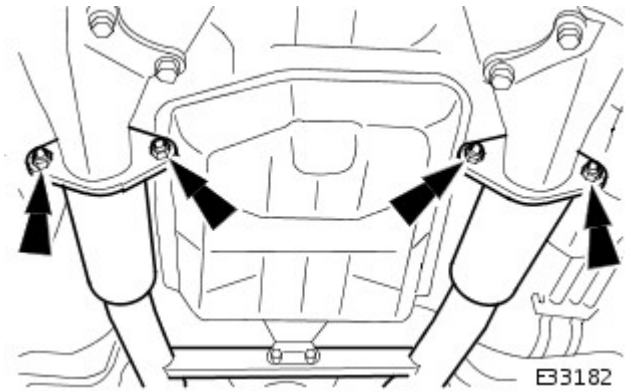
5. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.



6. Raise the vehicle on a ramp.

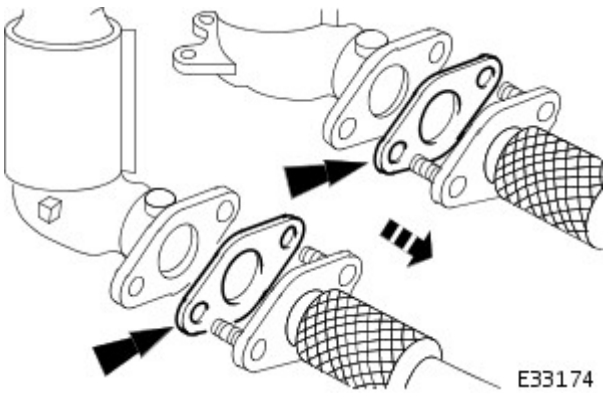


7. Remove the bolts which secure the rear of the front muffler assembly to the transmission rear mounting.



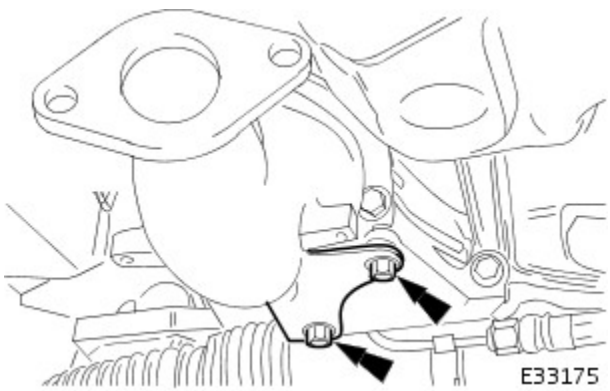
8. Remove the bolts which secure the front flange of the front muffler to the downpipe flange.

- Repeat for the flange bolts on the opposite side.



9. Remove the gasket from the front muffler flange at each side.

- Reposition the front silencer rearwards.
- Remove the gasket from each flange.

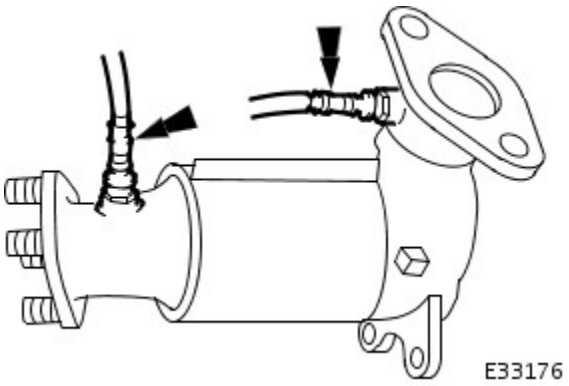


10. Remove the downpipe catalytic converter.

- Remove the bolts which secure the downpipe lower mounting bracket.
- Remove the downpipe assembly.

11. Remove the oxygen sensor(s).

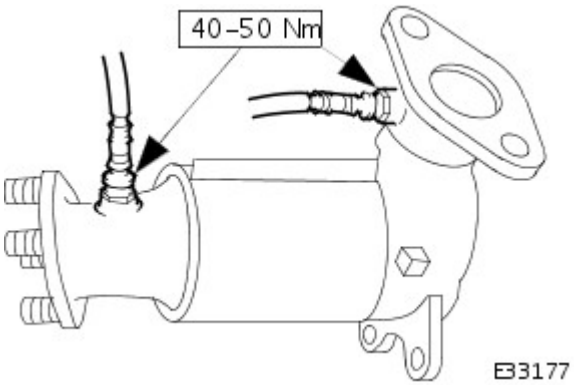
- The downstream sensor is fitted only for North American markets.



12. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

Installation



1. Fit the oxygen sensor(s).

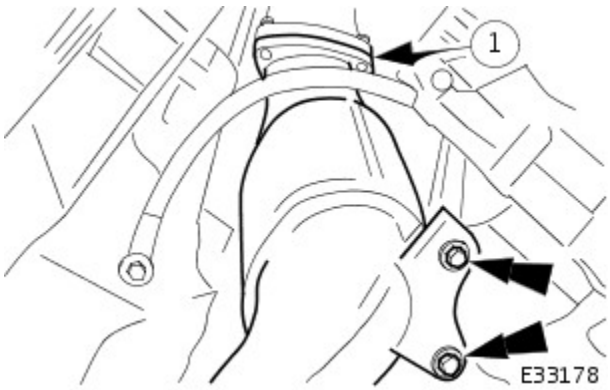
- The downstream sensor is fitted only for North American markets.

2. Fit a new gasket to the manifold mating flange on the downpipe.

3. Fit the downpipe catalytic converter.

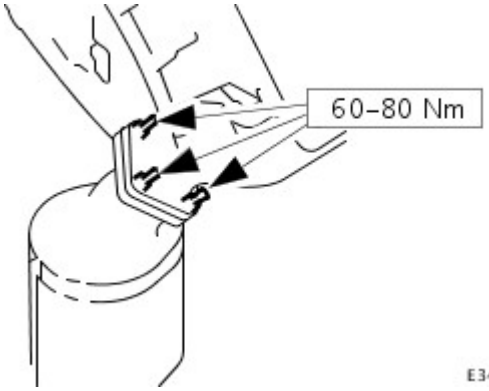
1. Fit the downpipe assembly to the manifold.

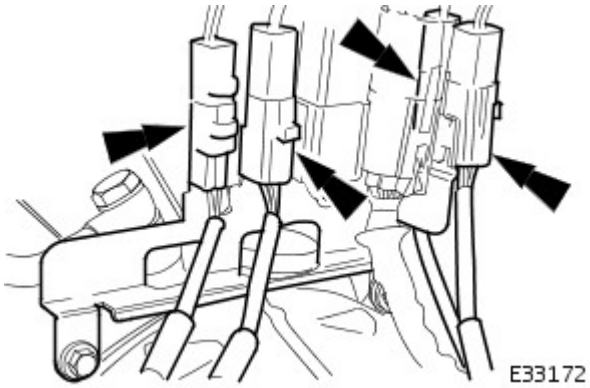
- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)



4. Lower the ramp.

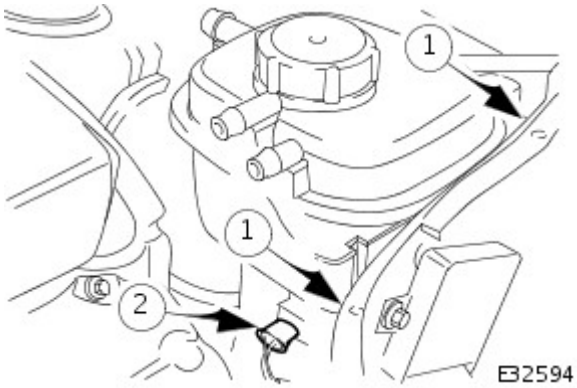
5. Tighten the nuts securing the downpipe flange to the manifold flange.





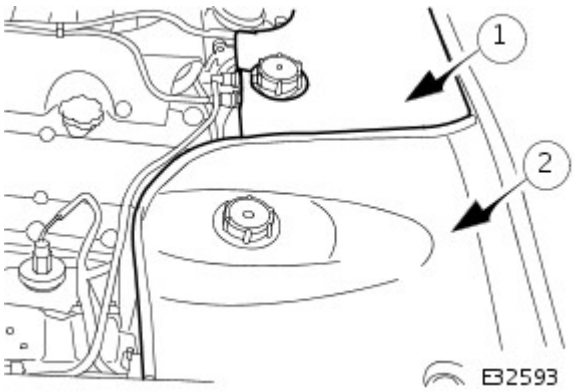
6. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.



7. Fit the coolant header tank.

1. Reposition the tank and fit the securing nuts.
2. Connect the harness connector

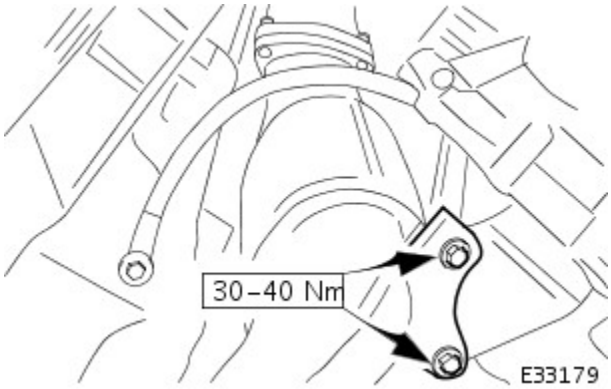


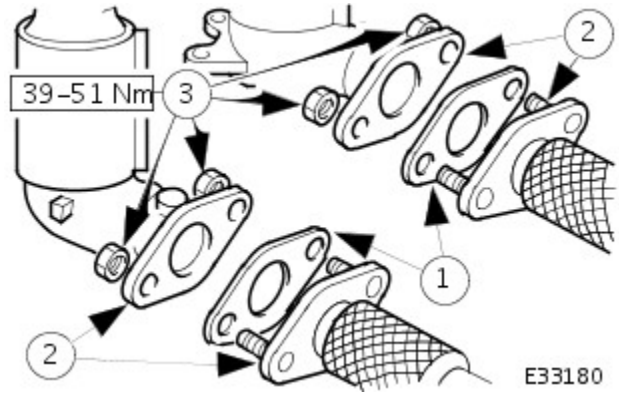
8. Refit the centre trim panel and the left hand enclosure panel to the engine compartment.

1. Refit the centre trim panel.
2. Refit the left hand enclosure panel.

9. Raise the vehicle on the ramp.

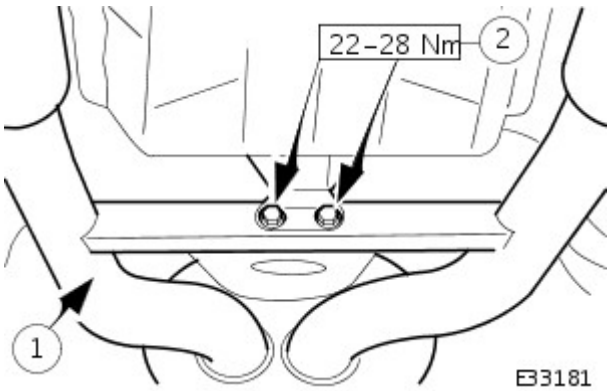
10. Tighten the mounting bracket securing bolts.





11. Connect the downpipe catalytic converter to the front muffler.

1. Position a new gasket to the flange studs at each side.
2. Connect the the front muffler assembly to each downpipe.
3. Fit and tighten the nuts to secure the muffler to the downpipes.



12. Fit the front muffler rear mounting.

1. Reposition the front muffler and align the rear mounting.
2. Fit and tighten the bolts; muffler to mounting bracket.

13. Lower the ramp.

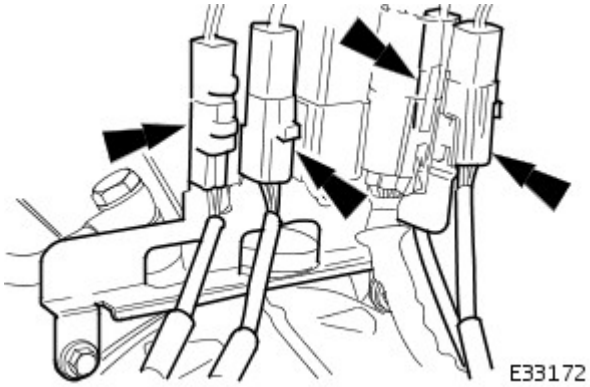
14. Remove the paintwork protection sheets and close the engine cover.

Exhaust System - Catalytic Converter RH4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the front muffler; refer to Operation 30.10.18 in this section.



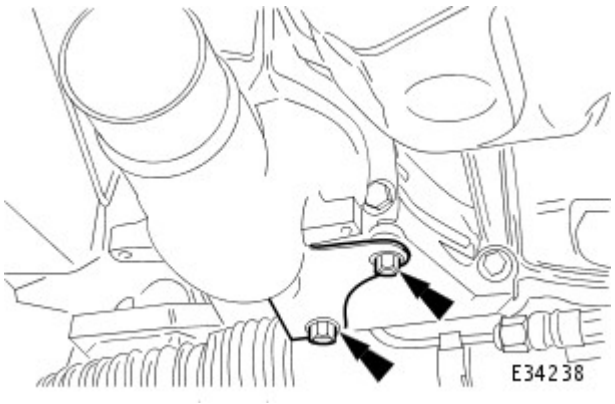
3. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.

   Disconnect the oxygen sensor multiplugs.

   - Displace the multiplugs from the engine mounting bracket.
   - Disconnect the plug(s) from the oxygen sensor(s)



4. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.
5. Raise the vehicle on a ramp.
6. Remove the downpipe catalytic converter.



   - Remove the bolts which secure the downpipe lower mounting bracket.
   - Remove the downpipe assembly.

7. Remove the oxygen sensor(s).

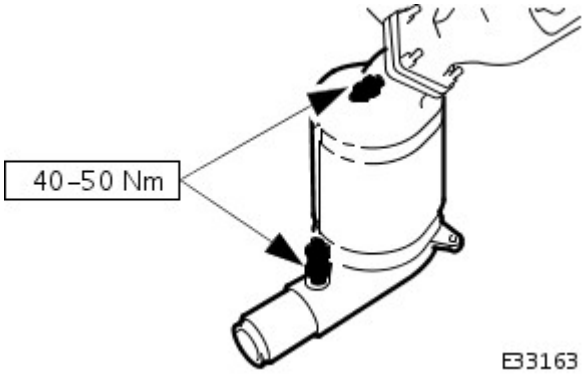
   - The downstream sensor is fitted only for North American markets.



8. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

Installation

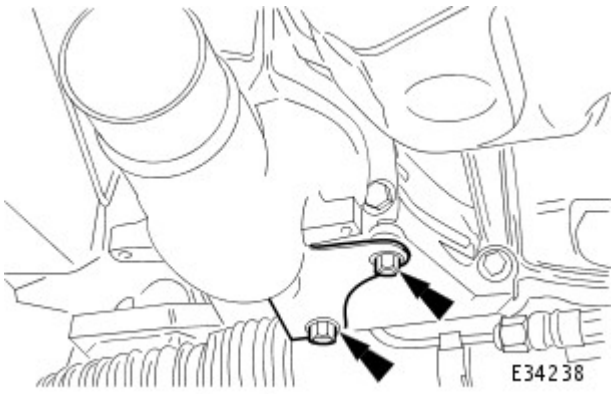


1. Fit the oxygen sensor(s).

- The downstream sensor is fitted only for North American markets.

2. Fit a new gasket to the manifold mating flange on the downpipe.

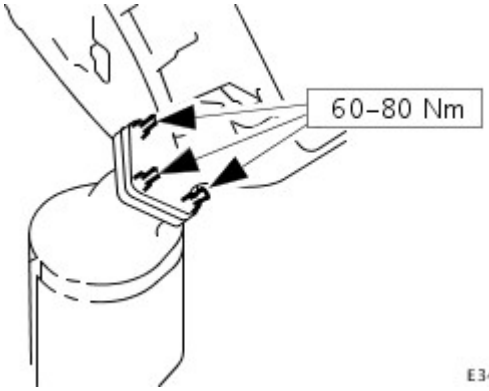
3. Fit the downpipe catalytic converter.

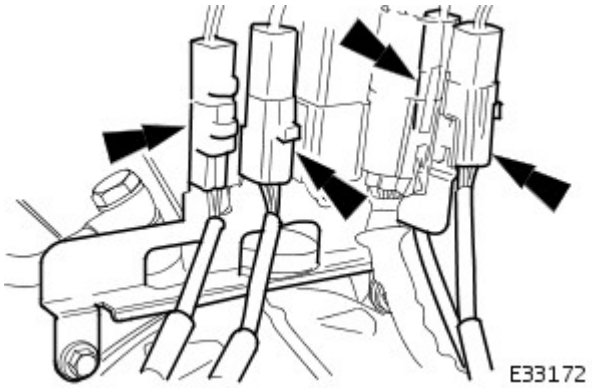


- Fit the downpipe assembly to the manifold.
- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)

4. Lower the ramp.

5. Tighten the nuts securing the downpipe flange to the manifold flange.



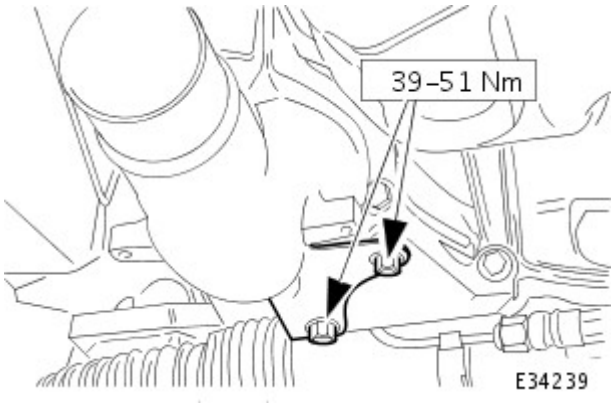


6. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.

7. Raise the ramp.

8. Tighten the mounting bracket securing bolts.



9. Fit the front muffler; refer to Operation 30.10.18.

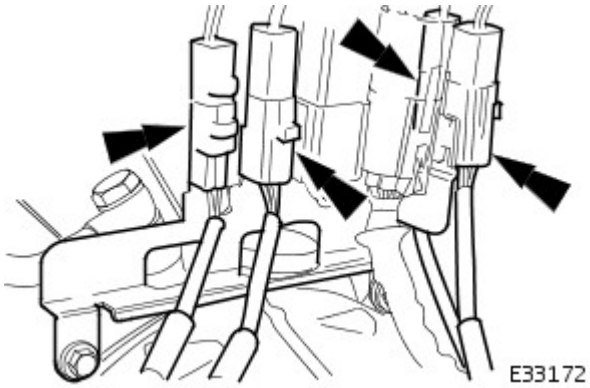
10. Lower the ramp.

11. Remove the paintwork protection sheets and close the engine cover.

Exhaust System - Catalytic Converter RH4.0L SC V8 - AJ26

Removal and Installation

Removal



1. Open the engine compartment and fit paintwork protection sheets.

2. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.

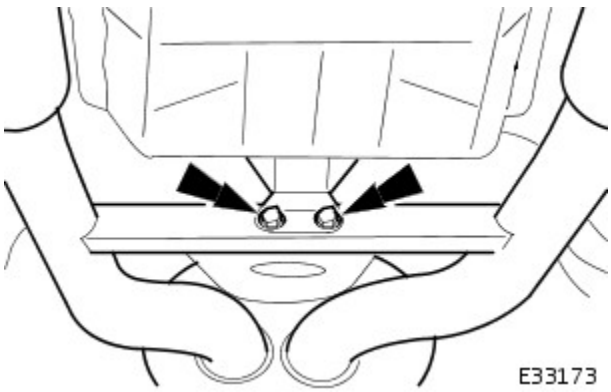
   Disconnect the oxygen sensor multiplugs.

   - Displace the multiplugs from the engine mounting bracket.
   - Disconnect the plug(s) from the oxygen sensor(s).



3. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.

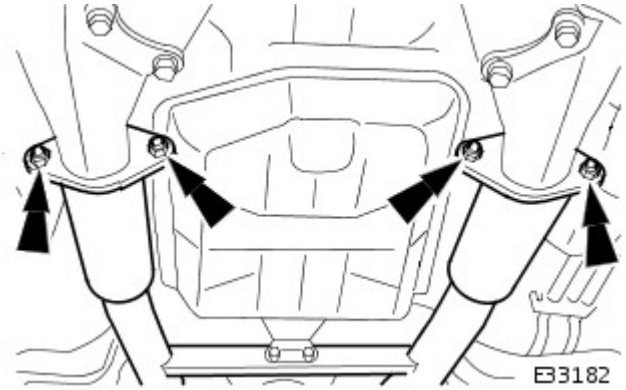
4. Raise the vehicle on a ramp.

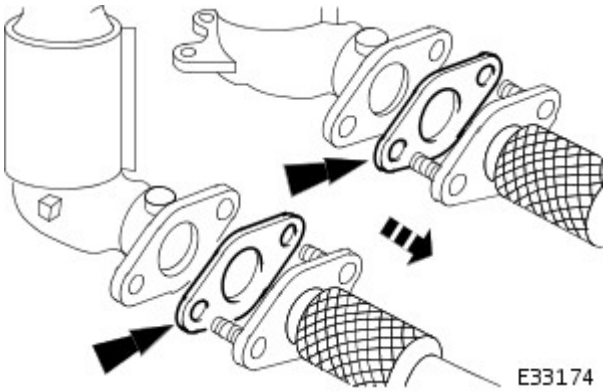


5. Remove the bolts which secure the rear of the front muffler assembly to the transmission rear mounting.

6. Remove the bolts which secure the front flange of the front muffler to the downpipe flange.

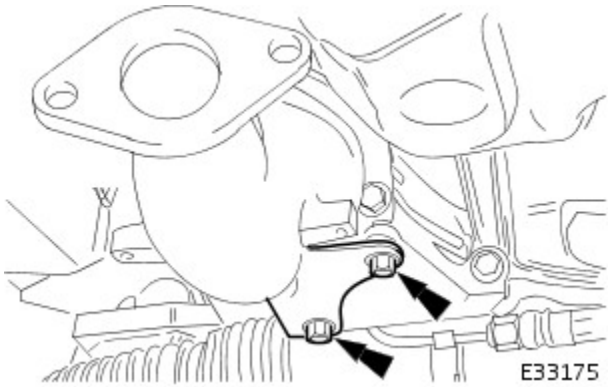
   - Repeat for the flange bolts on the opposite side.





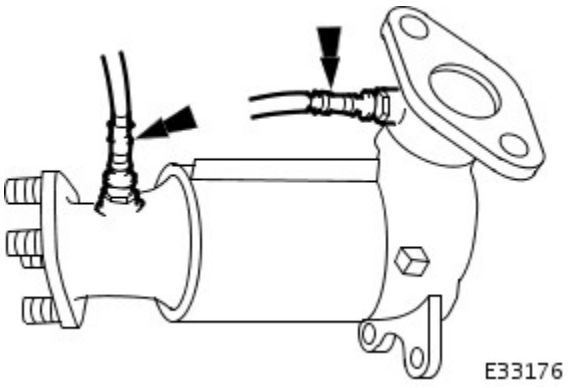
7. Remove the gasket from the front muffler flange at each side.

- Reposition the front silencer rearwards.
- Remove the gasket from each flange.



8. Remove the downpipe catalytic converter.

- Remove the bolts which secure the downpipe lower mounting bracket.
- Remove the downpipe assembly.



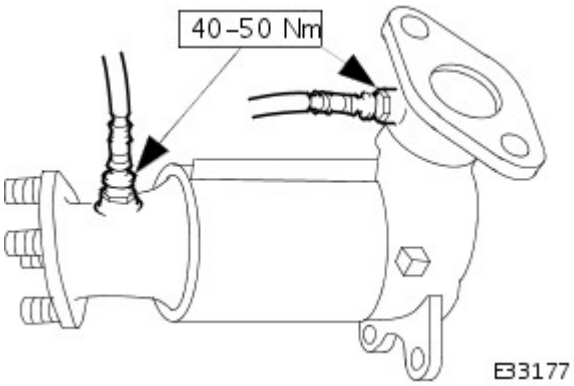
9. Remove the oxygen sensor(s).

- The downstream sensor is fitted only for North American markets.

10. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

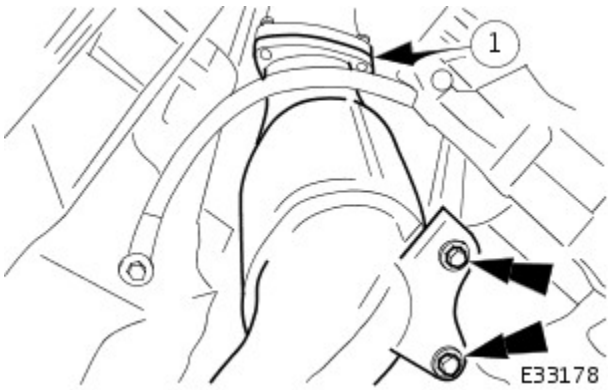
Installation



1. Fit the oxygen sensor(s).

- The downstream sensor is fitted only for North American markets.

2. Fit a new gasket to the manifold mating flange on the downpipe.



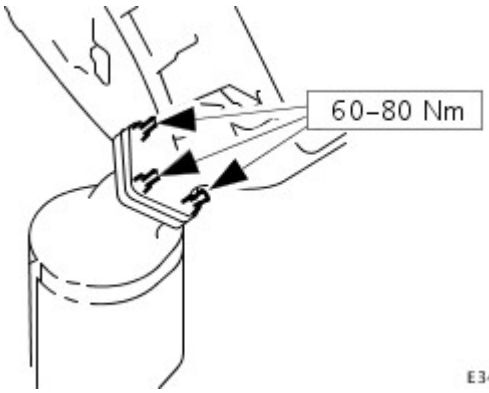
3. Fit the downpipe catalytic converter.

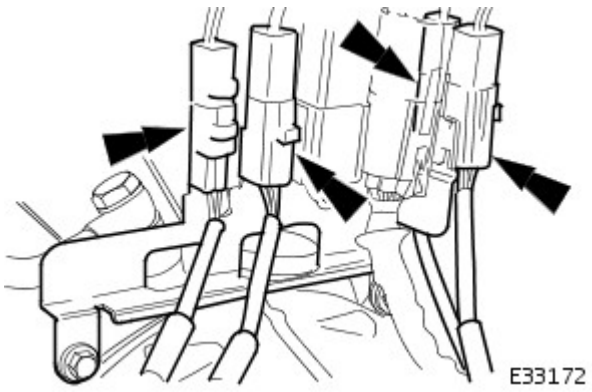
1. Fit the downpipe assembly to the manifold.

- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)

4. Lower the ramp.

5. Tighten the nuts securing the downpipe flange to the manifold flange..



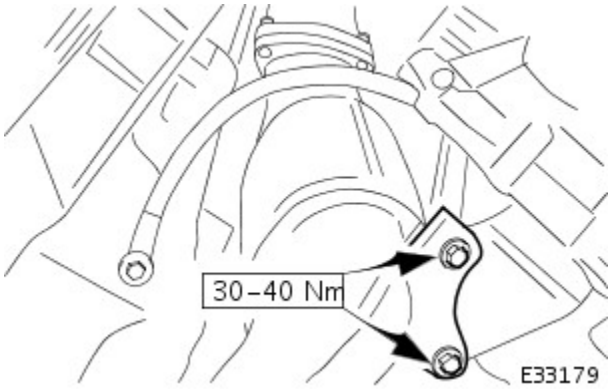


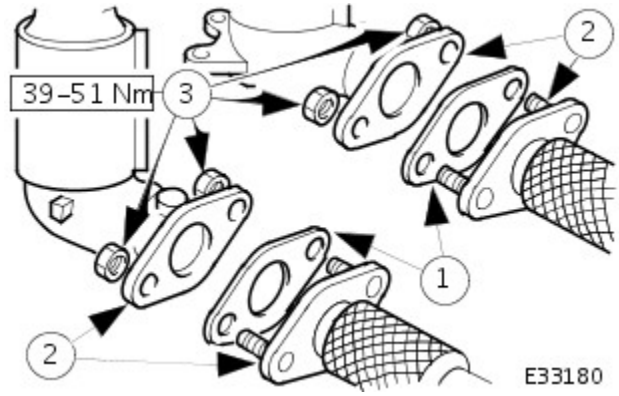
6. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.

7. Raise the vehicle on the ramp.

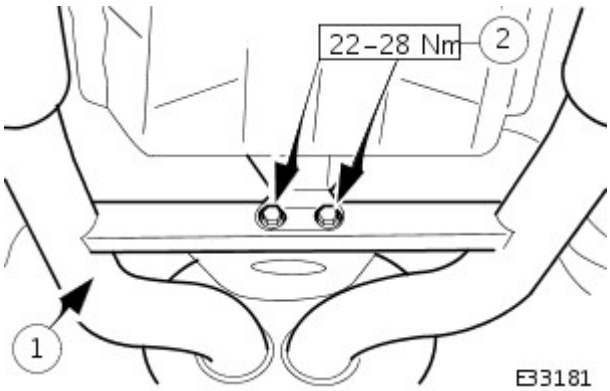
8. Tighten the mounting bracket securing bolts.





9. Connect the downpipe catalytic converter to the front muffler.

1. Position a new gasket to the flange studs at each side.
2. Connect the the front muffler assembly to each downpipe.
3. Fit and tighten the nuts to secure the muffler to the downpipes.



10. Fit the front muffler rear mounting.

1. Reposition the front muffler and align the rear mounting.
2. Fit and tighten the bolts; muffler to mounting bracket.

11. Lower the ramp.

12. Remove the paintwork protection sheets and close the engine cover.

Exhaust System - Catalytic Converter Gasket LH4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

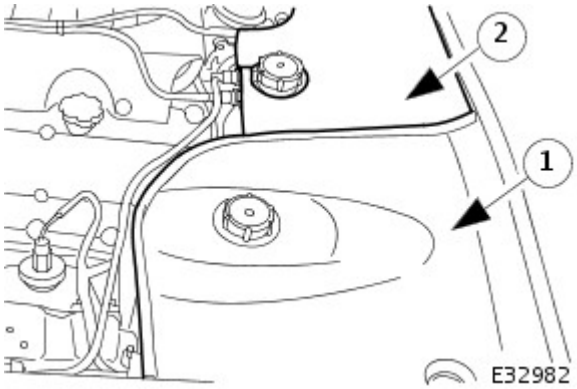
Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.

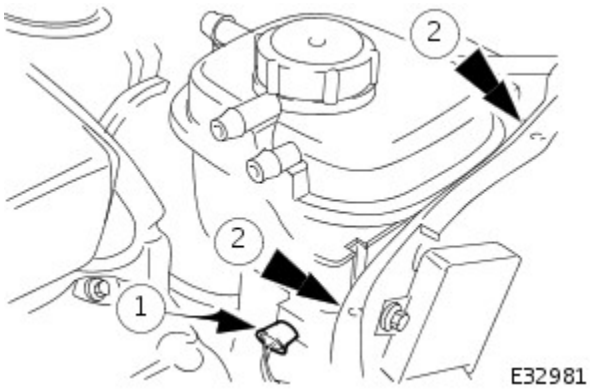
2. Remove the front muffler; refer to Operation 30.10.18 in this section.

3. Remove the centre trim panel from the engine compartment.



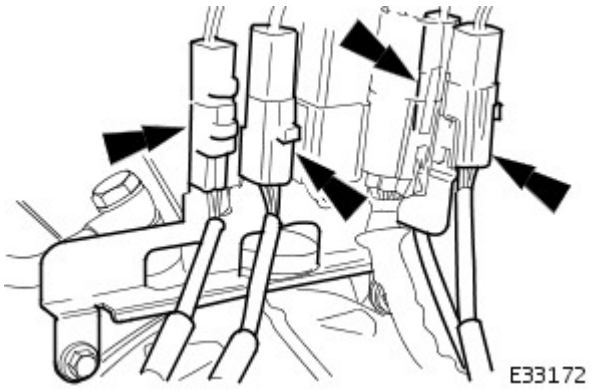
1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.

4. Reposition the expansion tank from the mounting.



1. Disconnect the coolant level sensor connector.
2. Remove the nuts which secures the tank.

5. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.



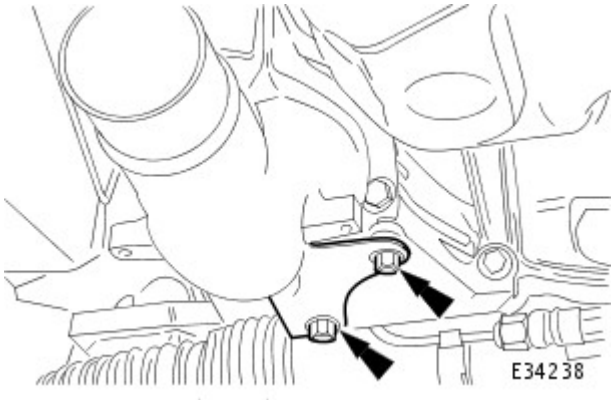
Disconnect the oxygen sensor multiplugs.

- Release the multiplugs from the engine mounting bracket.
- Disconnect the plug(s) from the oxygen sensor(s)

6. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.



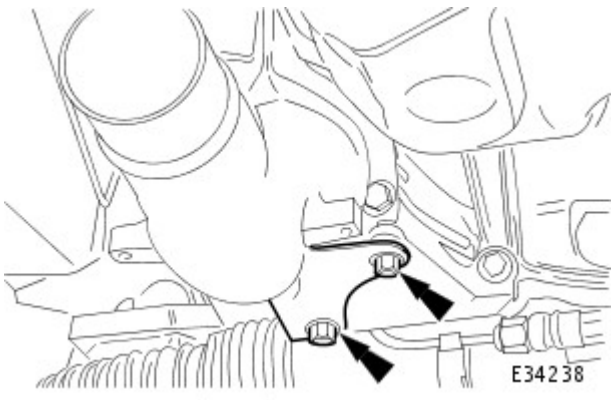
7. Raise the vehicle on a ramp.
8. Remove the downpipe catalytic converter.
   - Remove the bolts which secure the downpipe lower mounting bracket.
   - Remove the downpipe assembly.



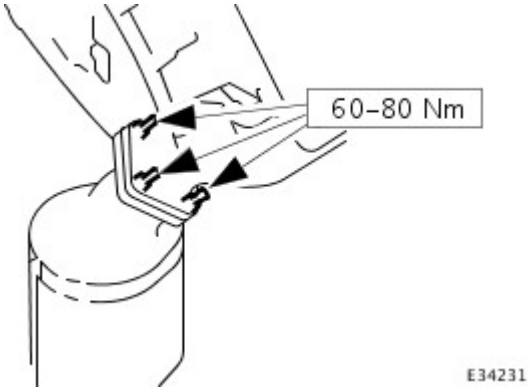
9. Remove gasket from the manifold flange.
   - Clean and inspect the manifold joint faces.
   - Clean and inspect the threads on the downpipe studs.

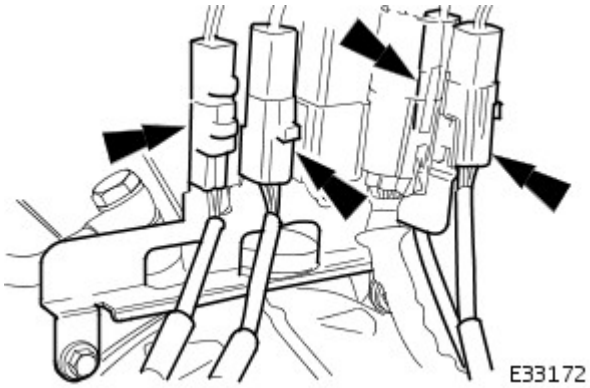
Installation

1. Fit a new gasket to the manifold mating flange on the downpipe.
2. Fit the downpipe catalytic converter.
   - Fit the downpipe assembly to the manifold
   - Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)



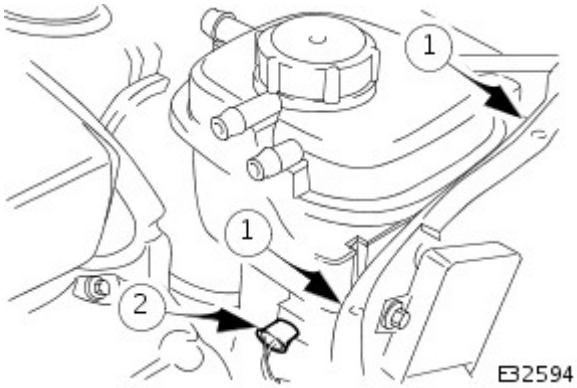
3. Lower the ramp.
4. Tighten the nuts securing the downpipe flange to the manifold flange.





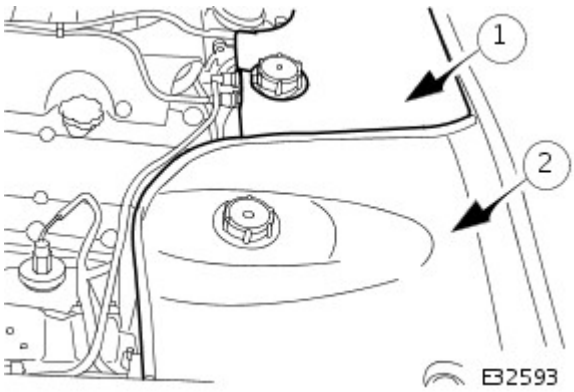
5. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.



6. Fit the coolant header tank.

1. Reposition the tank and fit the securing nuts.
2. Connect the harness connector

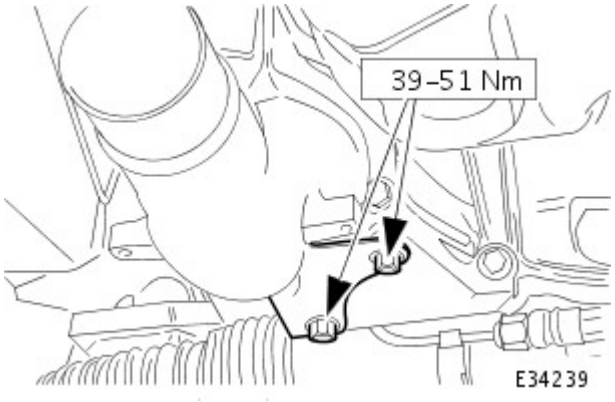


7. Refit the centre trim panel and the left hand enclosure panel to the engine compartment.

1. Refit the centre trim panel.
2. Refit the left hand enclosure panel.

8. Raise the ramp.

9. Tighten the mounting bracket securing bolts.



10. Fit the front muffler; refer to Operation 30.10.18.

11. Lower the ramp.

12. Remove the paintwork protection sheets and close the engine cover.

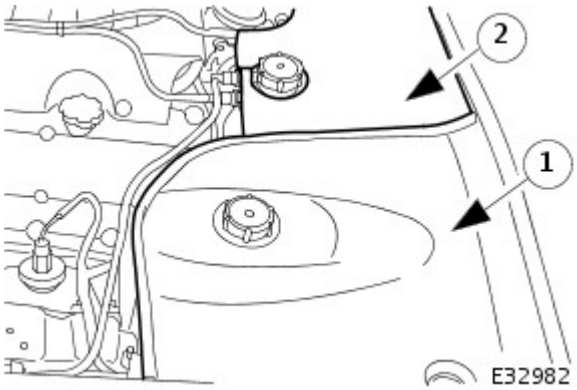
Exhaust System - Catalytic Converter Gasket LH4.0L SC V8 - AJ26

Removal and Installation

Removal

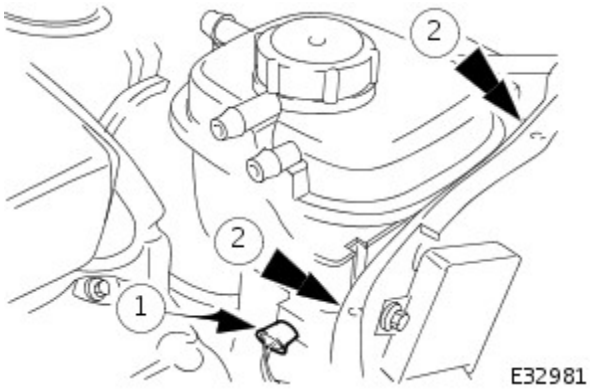
1. Open the engine compartment and fit paintwork protection sheets.

2. Remove the centre trim panel from the engine compartment.



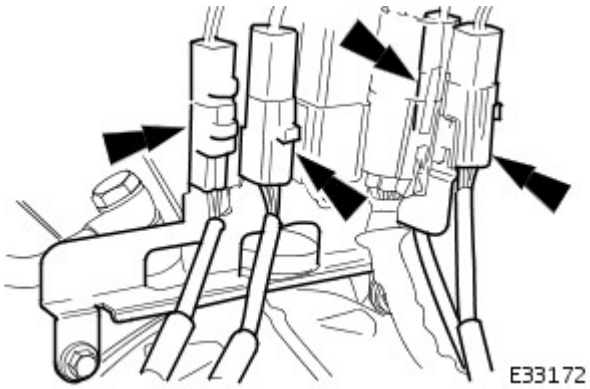
1. Remove the left hand side enclosure panel.
2. Remove the centre trim panel.

3. Reposition the expansion tank from the mounting.



1. Disconnect the coolant level sensor connector.
2. Remove the nuts which secures the tank.

4. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.



Disconnect the oxygen sensor multiplugs.

- Displace the multiplugs from the engine mounting bracket.
- Disconnect the plug(s) from the oxygen sensor(s).

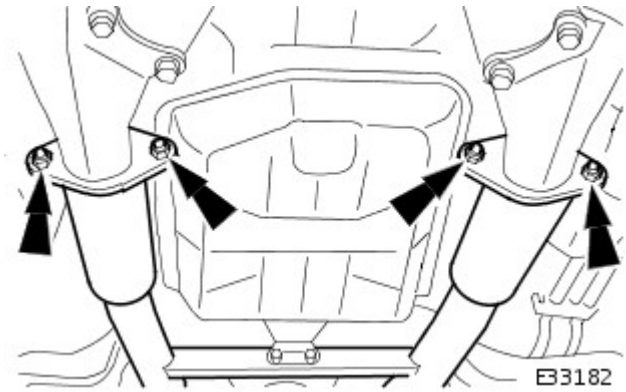
5. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.



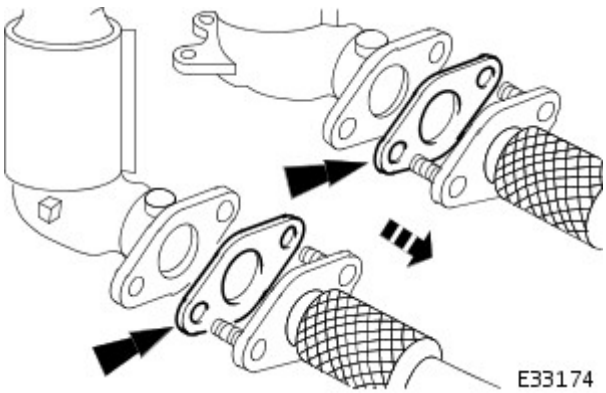
6. Raise the vehicle on a ramp.



7. Remove the bolts which secure the rear of the front muffler assembly to the engine rear mounting.

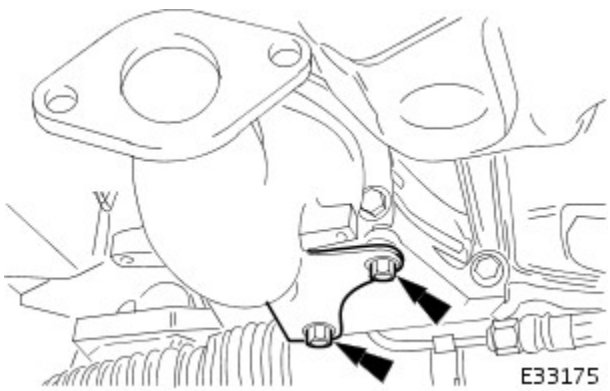


8. Remove the nuts which secure the front flanges of the front muffler to the downpipe flanges.



9. Remove the gasket from the front muffler flange at each side.

- Reposition the front silencer rearwards.
- Remove the gasket from each flange.



10. Remove the downpipe catalytic converter.

- Remove the bolts which secure the downpipe lower mounting bracket.
- Remove the downpipe assembly.

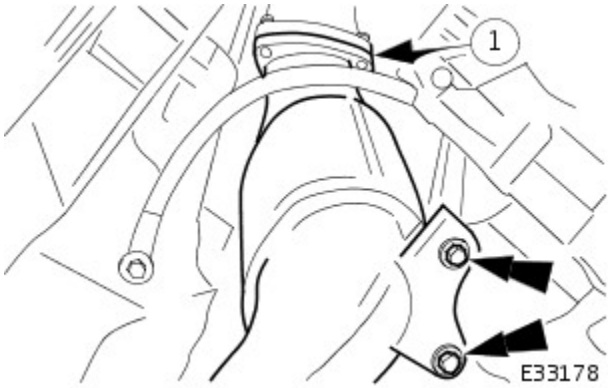
11. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

Installation

1. Fit a new gasket to the manifold mating flange on the downpipe.

2. Fit the downpipe catalytic converter.

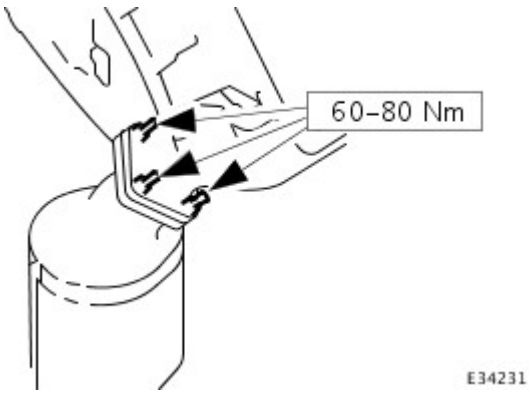


1. Fit the downpipe assembly to the manifold.

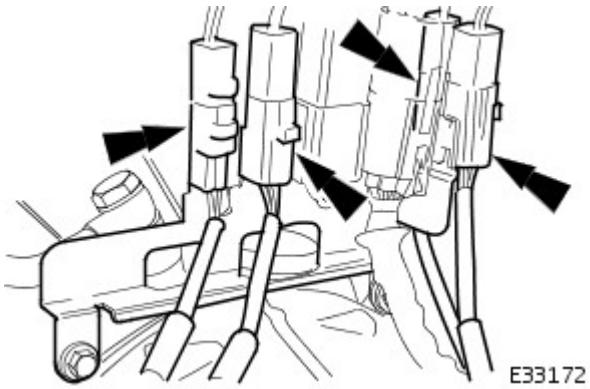
- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)

3. Lower the ramp.

4. Tighten the nuts securing the downpipe flange to the manifold flange.

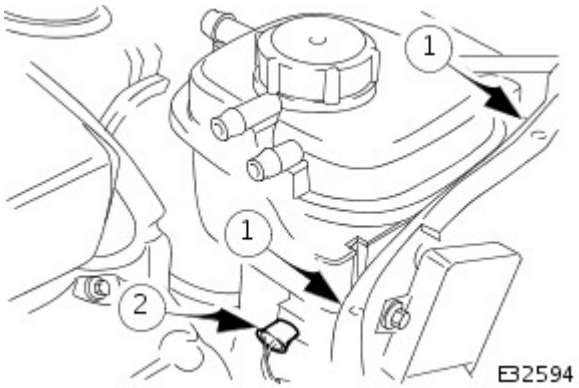


5. Connect the oxygen sensor multiplugs.



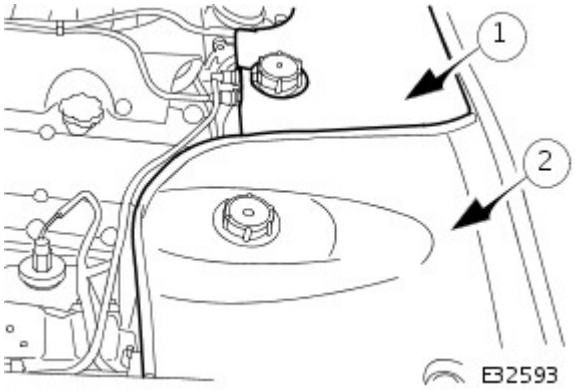
- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.

6. Fit the coolant header tank.



1. Reposition the tank and fit the securing nuts.
2. Connect the harness connector

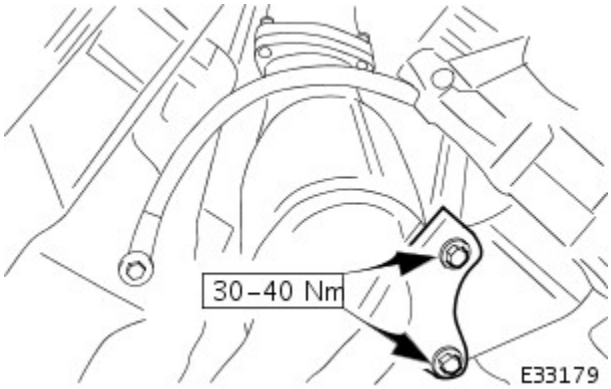
7. Refit the centre trim panel and the left hand enclosure panel to the engine compartment.



1. Refit the centre trim panel.
2. Refit the left hand enclosure panel.

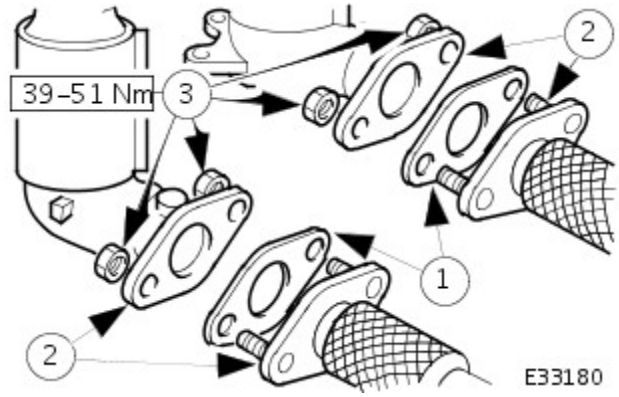
8. Raise the vehicle on the ramp.

9. Tighten the mounting bracket securing bolts.



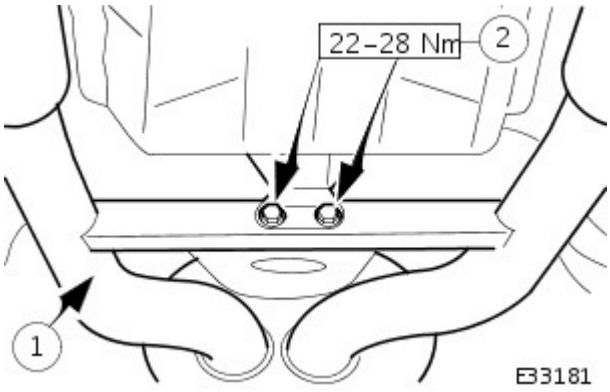
10. Connect the downpipe catalytic converter to the front muffler.

1. Position a new gasket to the flange studs at each side.
2. Connect the the front muffler assembly to each downpipe.
3. Fit and tighten the nuts to secure the muffler to the downpipes.



11. Fit the front muffler rear mounting.

1. Reposition the front muffler and align the rear mounting.
2. Fit and tighten the bolts; muffler to mounting bracket.



12. Lower the ramp.

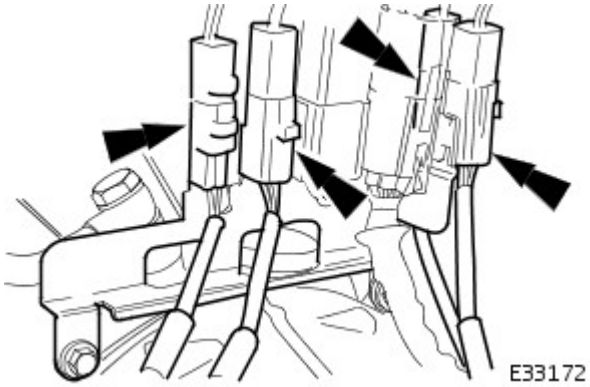
13. Remove the paintwork protection sheets and close the engine cover.

Exhaust System - Catalytic Converter Gasket RH4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal

1. Open the engine compartment and fit paintwork protection sheets.
2. Remove the front muffler; refer to Operation 30.10.18 in this section.



3. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.

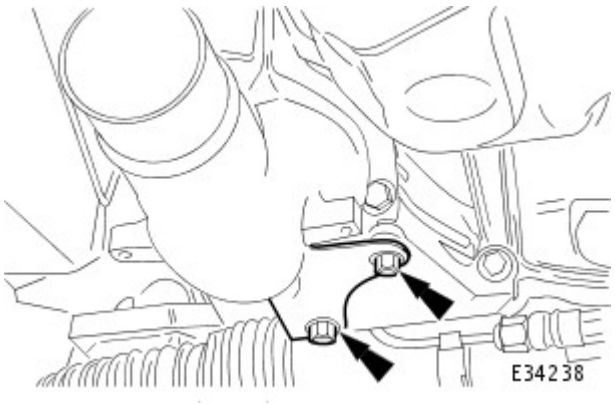
   Disconnect the oxygen sensor multiplugs.

   - Displace the multiplugs from the engine mounting bracket.
   - Disconnect the plug(s) from the oxygen sensor(s).



4. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.
5. Raise the vehicle on a ramp.
6. Remove the downpipe catalytic converter.

   - Remove the bolts which secure the downpipe lower mounting bracket.
   - Remove the downpipe assembly.



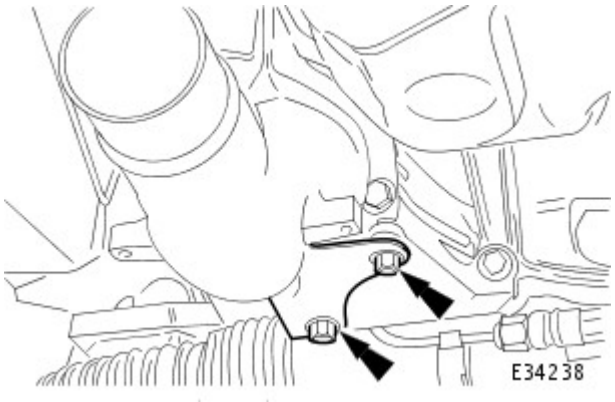
7. Remove gasket from the manifold flange.

   - Clean and inspect the manifold joint faces.
   - Clean and inspect the threads on the downpipe studs.

Installation

1. Fit a new gasket to the manifold mating flange on the

downpipe.

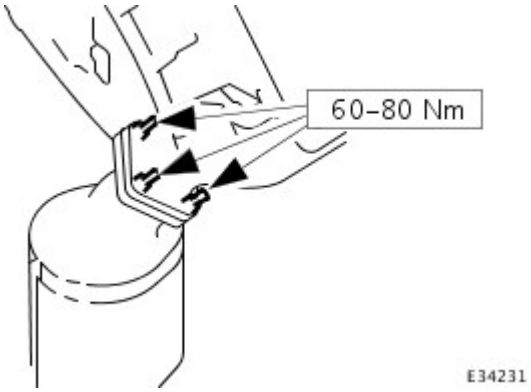


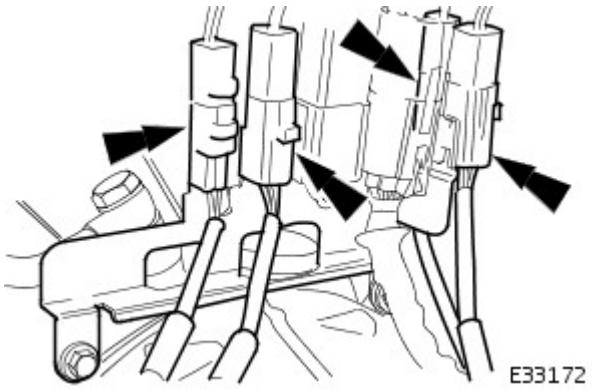
2. Fit the downpipe catalytic converter.

- Fit the downpipe assembly to the manifold
- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)

3. Lower the ramp.

4. Tighten the nuts securing the downpipe flange to the manifold flange..



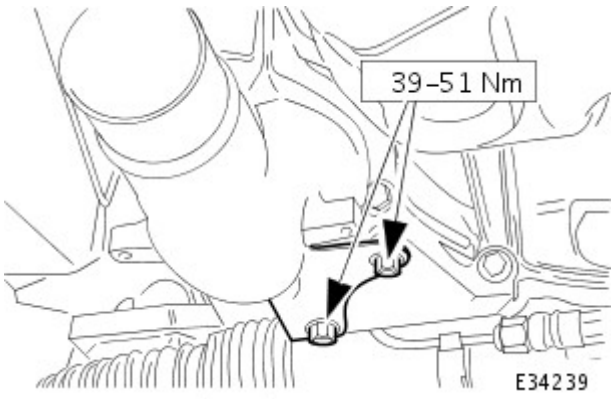


5. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.

6. Raise the ramp.

7. Tighten the mounting bracket securing bolts.



8. Fit the front muffler; refer to Operation 30.10.18.

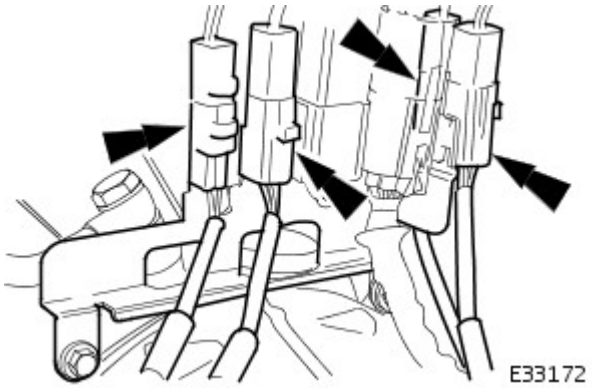
9. Lower the ramp.

10. Remove the paintwork protection sheets and close the engine cover.

Exhaust System - Catalytic Converter Gasket RH4.0L SC V8 - AJ26

Removal and Installation

Removal



1. Open the engine compartment and fit paintwork protection sheets.

2. CAUTION: Note the position of the upstream and downstream (where fitted) oxygen sensor multiplugs for reassembly.

   Disconnect the oxygen sensor multiplugs.

   - Displace the multiplugs from the engine mounting bracket.
   - Disconnect the plug(s) from the oxygen sensor(s)



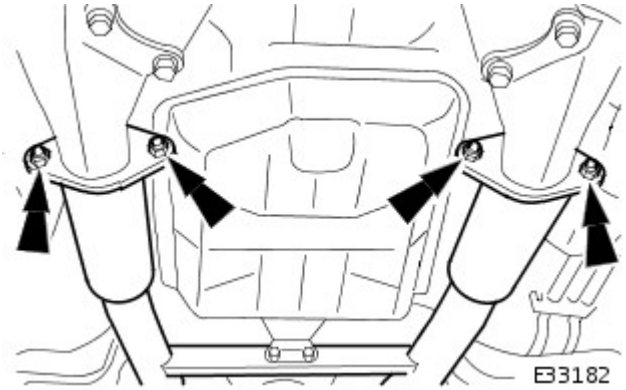
3. Remove the four nuts which secure the downpipe catalytic converter to the exhaust manifold.

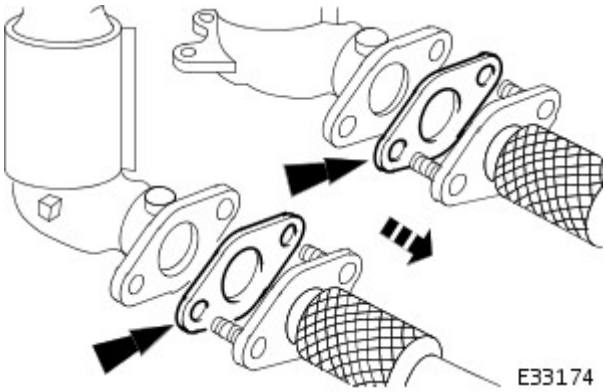
4. Raise the vehicle on a ramp.



5. Remove the bolts which secure the rear of the front muffler assembly to the engine rear mounting.

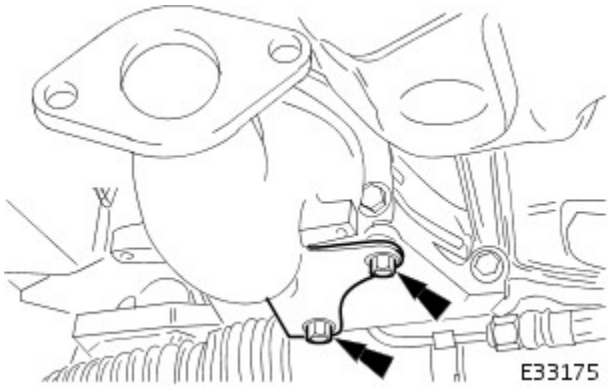
6. Remove the nuts which secure the front flanges of the front muffler to the downpipe flanges.





7. Remove the gasket from the front muffler flange at each side.

- Reposition the front silencer rearwards.
- Remove the gasket from each flange.



8. Remove the downpipe catalytic converter.

- Remove the bolts which secure the downpipe lower mounting bracket.
- Remove the downpipe assembly.

9. Remove gasket from the manifold flange.

- Clean and inspect the manifold joint faces.
- Clean and inspect the threads on the downpipe studs.

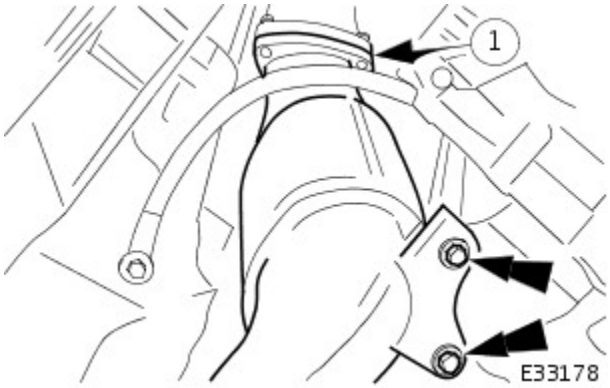
Installation

1. Fit a new gasket to the manifold mating flange on the downpipe.

2. Fit the downpipe catalytic converter.

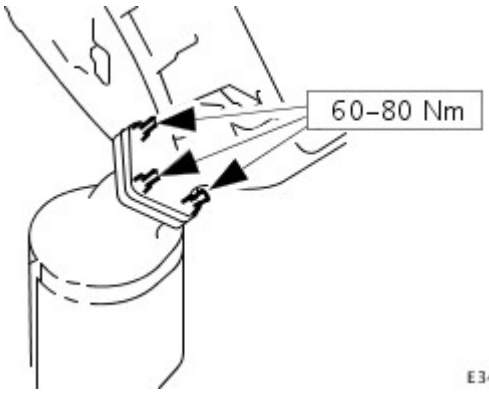
1. Fit the downpipe assembly to the manifold.

- Fit, but do not fully tighten, the mounting bracket securing bolts. (Leave loose until the nuts securing the downpipe to the exhaust manifold are fitted.)



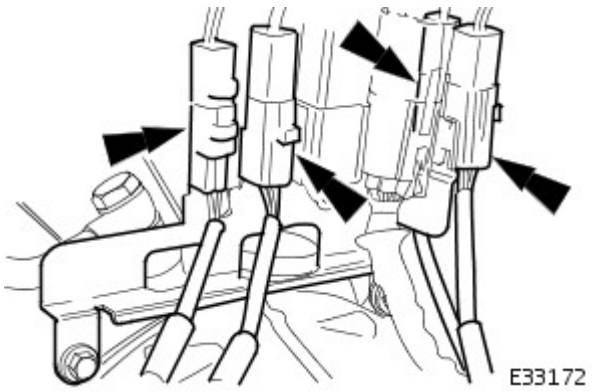
3. Lower the ramp.

4. Tighten the nuts securing the downpipe flange to the manifold flange.



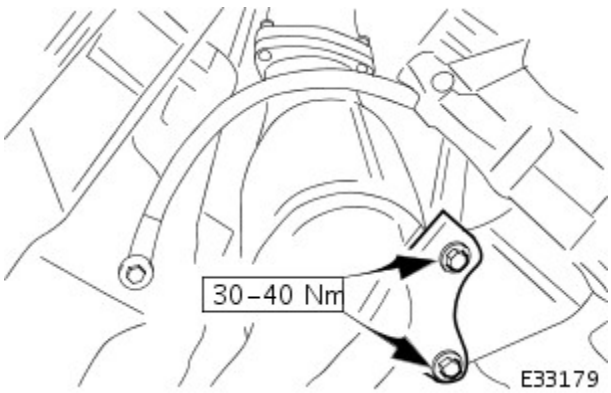
5. Connect the oxygen sensor multiplugs.

- Connect the plug(s) to the respective (previously noted) sensor(s).
- Correctly position the multiplugs on the mounting bracket.



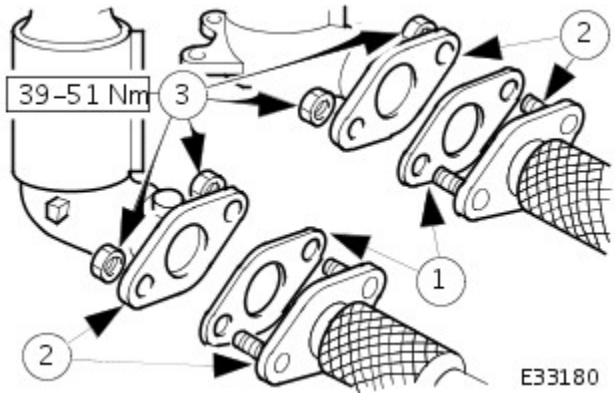
6. Raise the vehicle on the ramp.

7. Tighten the mounting bracket securing bolts.



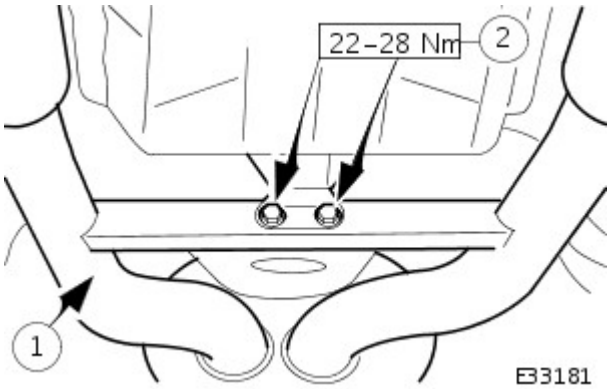
8. Connect the downpipe catalytic converter to the front muffler.

1. Position a new gasket to the flange studs at each side.



2. Connect the the front muffler assembly to each downpipe.

3. Fit and tighten the nuts to secure the muffler to the downpipes.



9. Fit the front muffler rear mounting.

1. Reposition the front muffler and align the rear mounting.

2. Fit and tighten the bolts; muffler to mounting bracket.

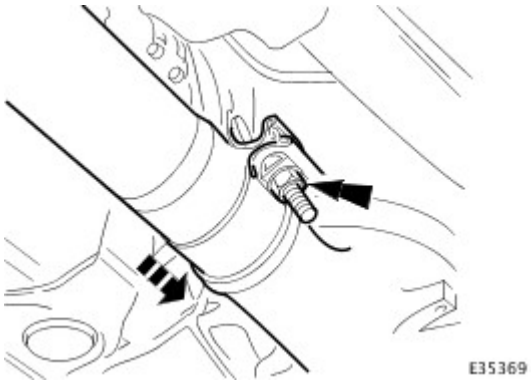
10. Lower the ramp.

11. Remove the paintwork protection sheets and close the engine cover.

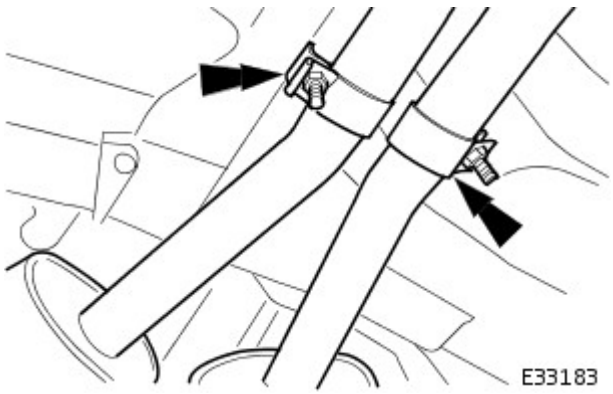
Exhaust System - Front Muffler4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal



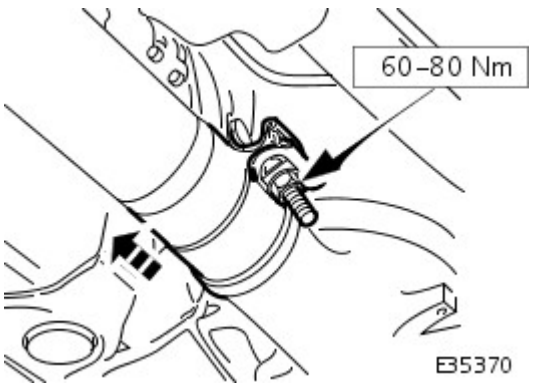
1. Raise the vehicle on a ramp.
2. Move the front muffler forward to allow the intermediate mufflers to be displaced.
    - Slacken the clamps (left-hand and right-hand sides), catalytic converter to front muffler.



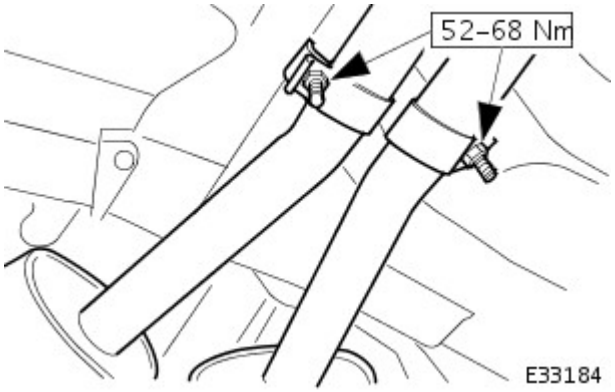
3. Slacken the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.
4. Remove the front muffler.
    - Disconnect the front muffler from the intermediate mufflers and then from the downpipe catalytic converters.
5. Clean and inspect all exhaust joints.

Installation

1. Fit the front muffler.
    - Fit the front muffler fully into the downpipe catalytic converters and then slide it rearward to engage the intermediate mufflers.



2. Correctly position the front muffler in the catalytic converters to align the correct reference / index indicator ring..
    - Tighten the clamps (left-hand and right-hand sides), front muffler to catalytic converters.
3. Correctly position the intermediate mufflers to the front muffler to align the correct reference / index indicator ring.



- Tighten the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.

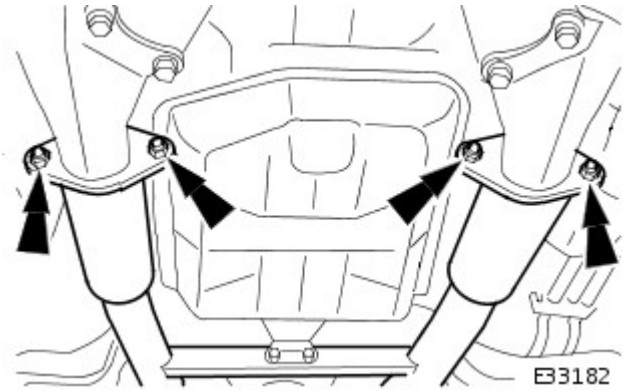
4. Lower the ramp.

Exhaust System - Front Muffler4.0L SC V8 - AJ26

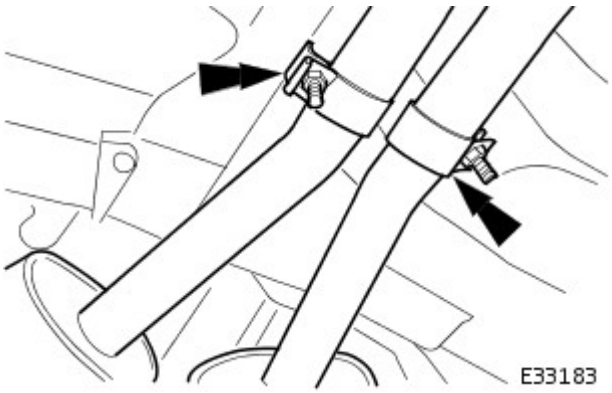
Removal and Installation

Removal

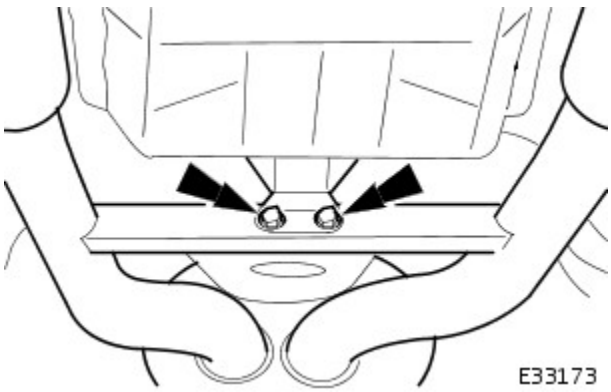
1. Raise the vehicle on a ramp.
2. Separate the front muffler flange joints from the downpipe catalytic converters.
   - Slacken the flange nuts (left-hand and right-hand sides), catalytic converter to front muffler.



3. Slacken the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.
   - Move both intermediate mufflers rearwards, as far as possible.



4. Remove the flange nuts (left-hand and right-hand sides), catalytic converter to front muffler.
5. Remove the bolts which secure the front muffler rear mounting to the rear of the gearbox.

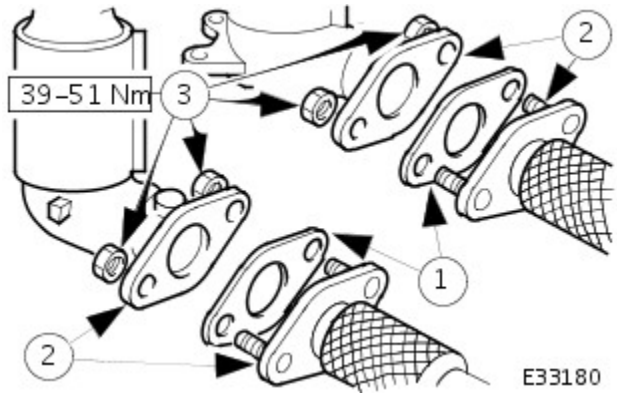


6. Remove the front muffler.
   - Disconnect the front muffler from each downpipe flange.
   - Disconnect the front muffler from the intermediate mufflers and remove it.
7. Remove the gasket from each front flange joint.
8. Clean and inspect all exhaust joints.

Installation

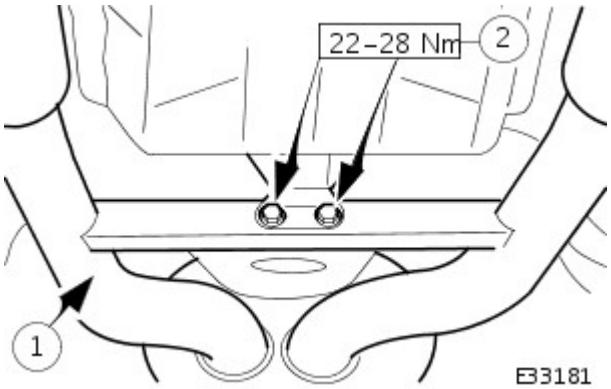
1. Fit the front muffler.

- Fit the front muffler fully into the intermediate mufflers.

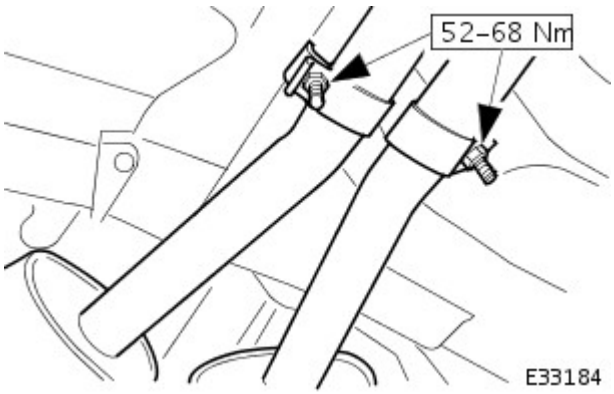


2. Connect the front muffler flanges to the catalytic converters.

- Fit a new gasket to each flange.
- Connect the front muffler flanges to the catalytic converters; move the front muffler / intermediate mufflers assembly forwards.
- Tighten the flange nuts (left-hand and right-hand sides), front muffler to catalytic converters.



3. Fit the bolts which secure the front muffler rear mounting to the rear of the gearbox.



4. Reposition the intermediate mufflers to the front muffler to align the correct reference / index indicator ring.

- Tighten the clamps (left-hand and right-hand sides), intermediate mufflers to front muffler.

5. Lower the ramp.

Exhaust System - Intermediate Muffler LH4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

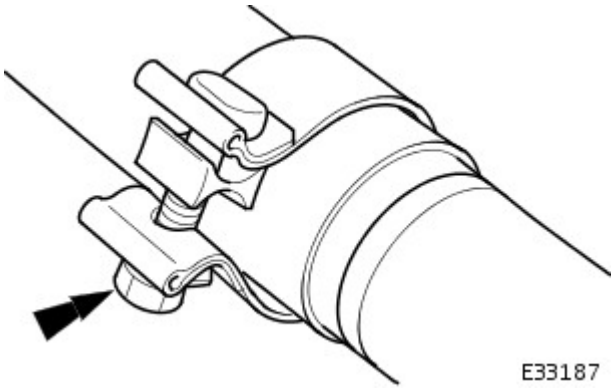
Removal and Installation

Removal

1. Raise the vehicle on a four-post ramp.

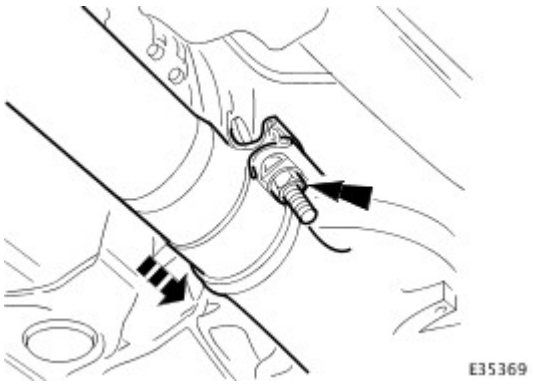
2. Raise the rear of the vehicle body and support on two stands, located under the rear jacking points.

3. Disconnect the intermediate muffler from the rear muffler.



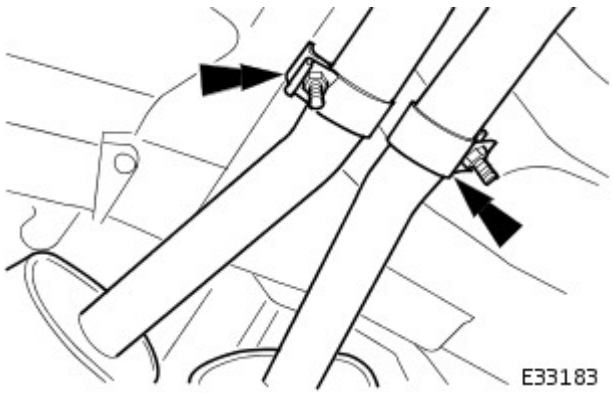
- Slacken the securing clamp, rear muffler to intermediate muffler and separate the intermediate muffler from the rear muffler.

4. Move the front muffler forward to allow the intermediate muffler to be removed.



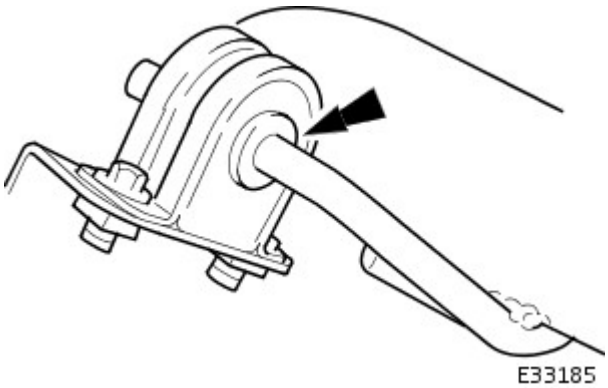
- Slacken the securing clamps (left-hand and right-hand sides) front muffler to downpipe catalytic converters.
- Move the front muffler assembly forward.

5. Remove the intermediate muffler.



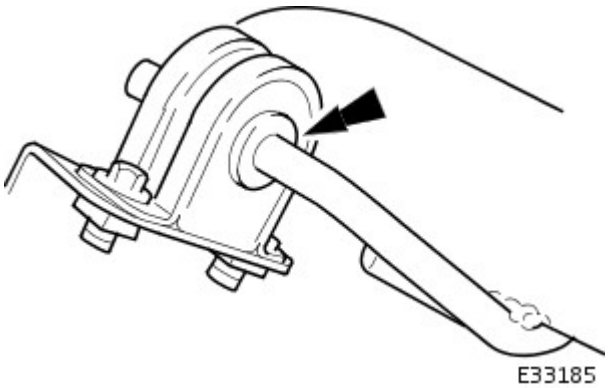
- Slacken the securing clamp, front muffler to intermediate muffler and separate the intermediate muffler from the front muffler.

6. Remove the muffler assembly from the axle carrier and from the over-axle mounting rubber.



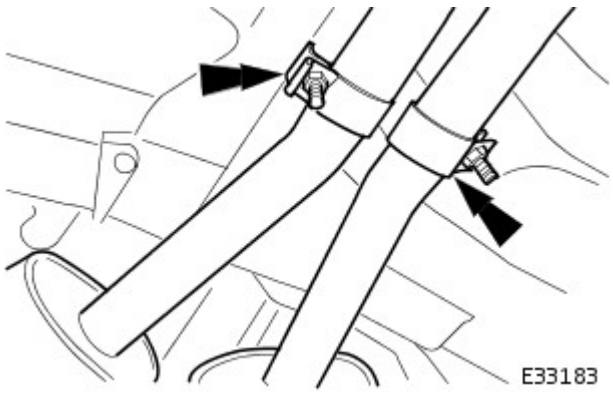
7. Clean and inspect all exhaust joints.

Installation

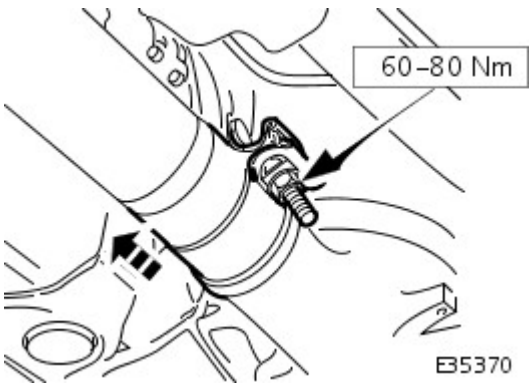


1. Fit the intermediate muffler assembly.

- Fit the muffler assembly to the axle carrier and to the over-axle mounting rubber.



2. Locate the intermediate muffler to the front muffler.

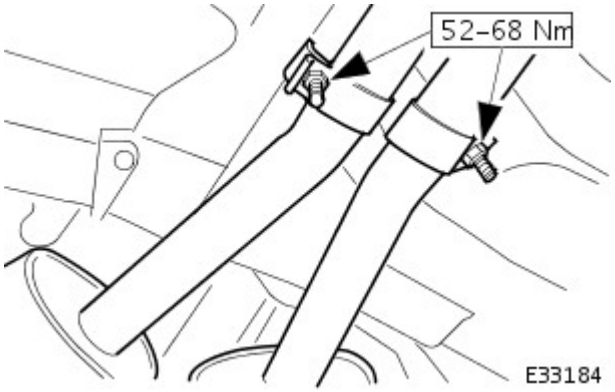


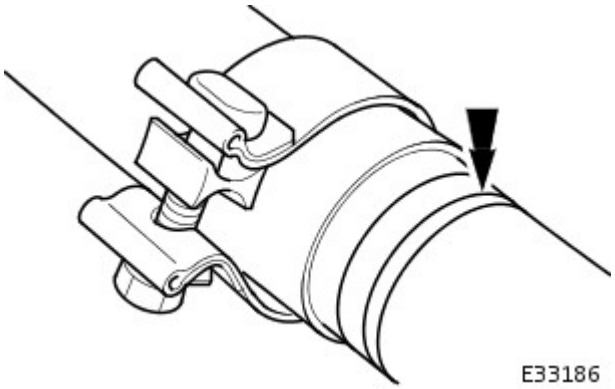
3. Correctly position the front muffler in the catalytic converters to align the correct reference / index indicator ring..

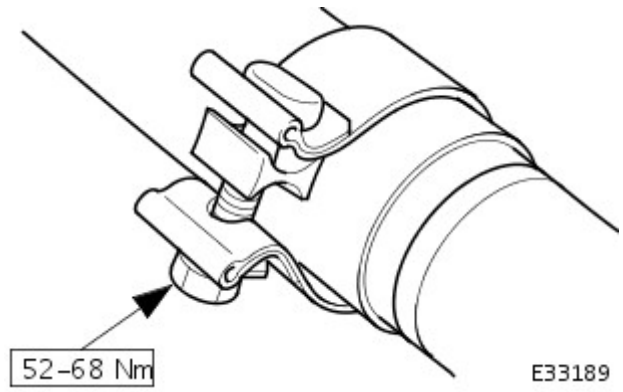
- Tighten the clamps (left-hand and right-hand sides), front muffler to catalytic converters.

4. Correctly position the intermediate muffler at the front muffler to align the correct reference / index indicator ring..

- Tighten the clamp, intermediate mufflers to front muffler.







5. NOTE: If necessary, loosen and rotate the intermediate muffler, at the front to intermediate muffler joint, to achieve the tailpipe trim settings. Refer to Specifications in this section.

Correctly position the rear muffler assembly.

- Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring, rotating back and forth to aid engagement.
- Check that the mounting is located correctly into the mounting rubber.
- Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary. Refer to Specifications in this section.

6. Tighten the securing clamp, intermediate muffler to rear muffler.

7. Remove the axle stands from beneath the rear jacking points.

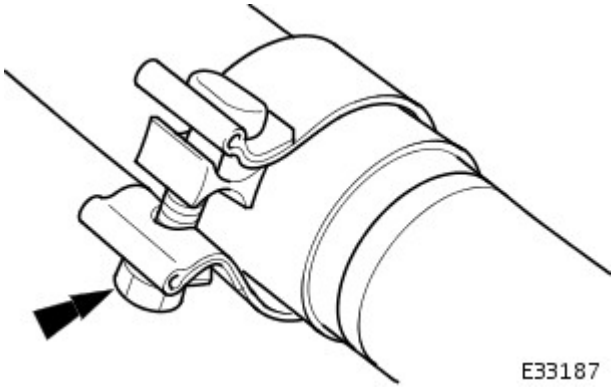
8. Lower the ramp.

Exhaust System - Intermediate Muffler LH4.0L SC V8 - AJ26

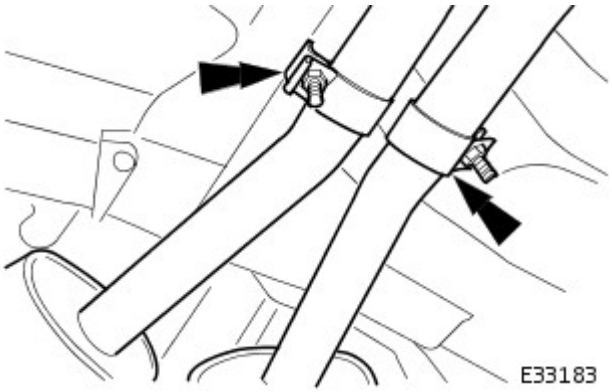
Removal and Installation

Removal

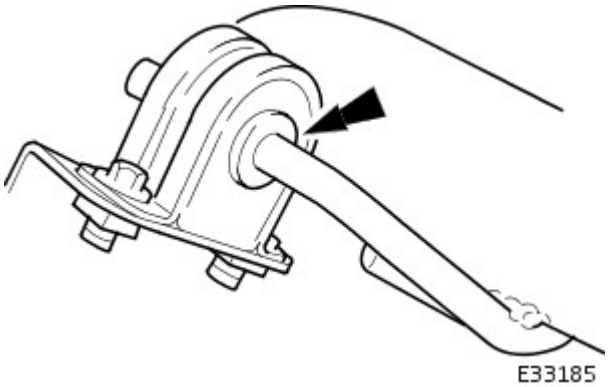
1. Raise the vehicle on a four-post ramp.
2. Raise the rear of the vehicle body and support on two stands, located under the rear jacking points.
3. Disconnect the intermediate muffler from the rear muffler.
   - Slacken the securing clamp, rear muffler to intermediate muffler and separate the intermediate muffler from the rear muffler.



4. Remove the intermediate muffler.
   - Slacken the securing clamp, front muffler to intermediate muffler and separate the intermediate muffler from the front muffler.



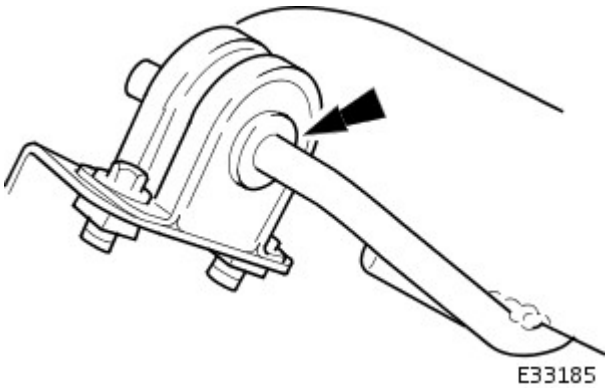
5. Remove the muffler assembly from the axle carrier and from the over-axle mounting rubber.

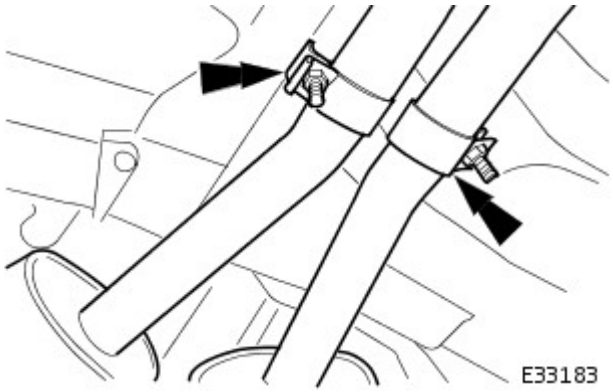


6. Clean and inspect all exhaust joints.

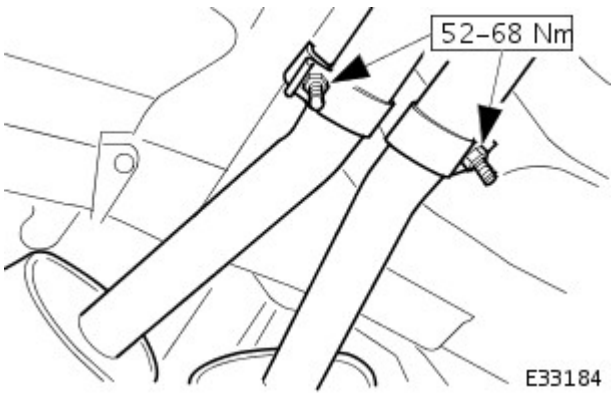
Installation

1. Fit the intermediate muffler assembly.
   - Fit the muffler assembly to the axle carrier and to the over-axle mounting rubber.



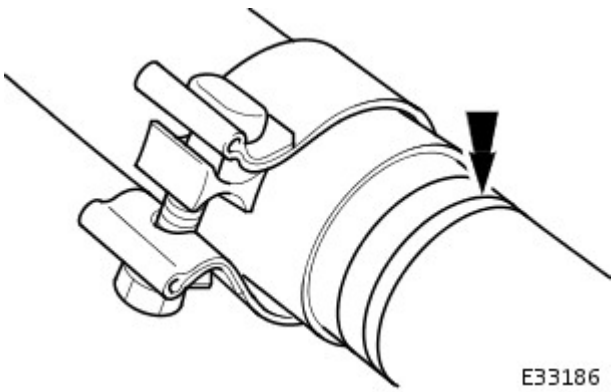


2. Locate the intermediate muffler to the front muffler.



3. Correctly position the intermediate muffler at the front muffler to align the correct reference / index indicator ring.

- Tighten the clamp, intermediate muffler to front muffler.

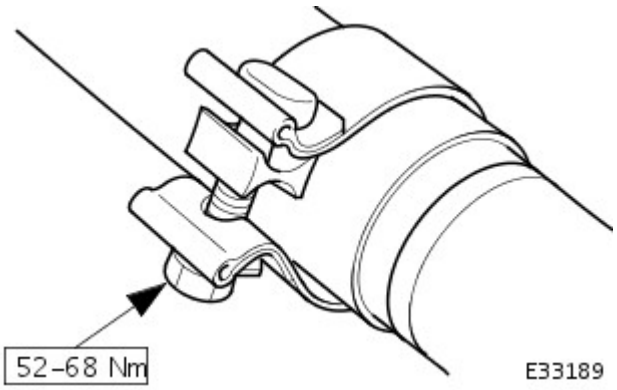


4. NOTE: If necessary, loosen and rotate the intermediate muffler, at the front to intermediate muffler joint, to achieve the tailpipe trim settings. Refer to Specifications in this section.

Correctly position the rear muffler assembly.

- Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring, rotating back and forth to aid engagement.
- Check that the mounting is located correctly into the mounting rubber.
- Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary. Refer to Specifications in this section.

5. Tighten the securing clamp, intermediate muffler to rear muffler.



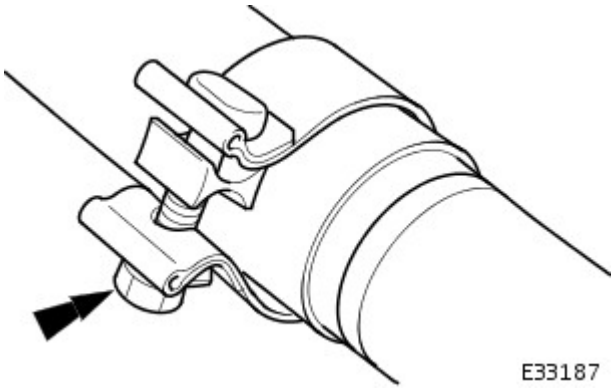
6. Remove the axle stands from beneath the rear jacking points.

7. Lower the ramp.

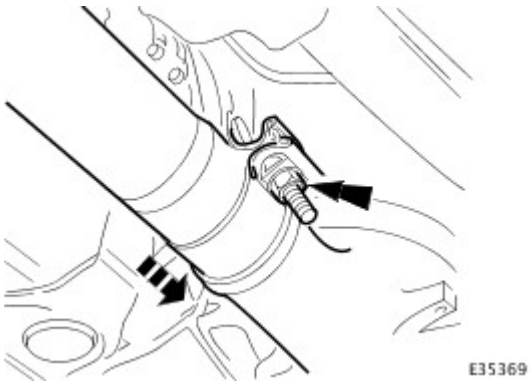
Exhaust System - Intermediate Muffler RH4.0L NA V8 - AJ27/3.2L NA V8 - AJ26

Removal and Installation

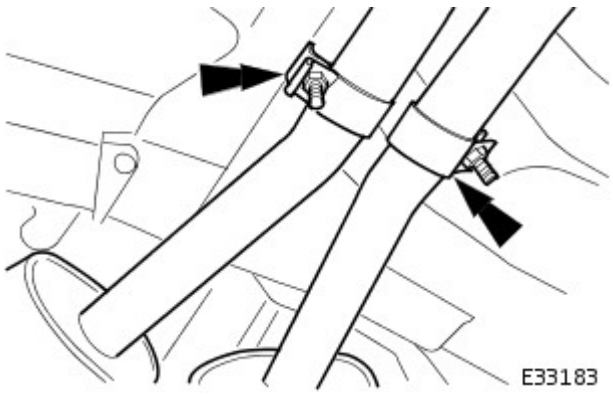
Removal



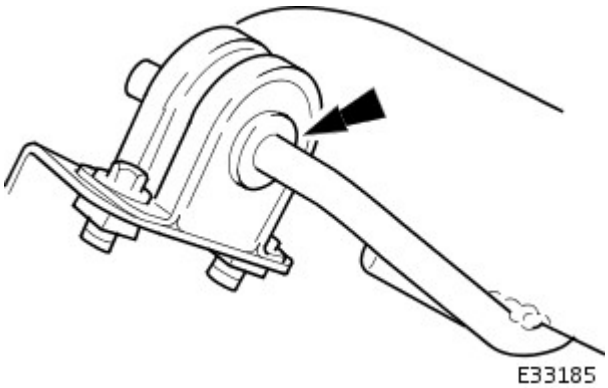
1. Raise the vehicle on a four-post ramp.
2. Raise the rear of the vehicle body and support on two stands, located under the rear jacking points.
3. Disconnect the intermediate muffler from the rear muffler.
   - Slacken the securing clamp, rear muffler to intermediate muffler and separate the intermediate muffler from the rear muffler.



4. Move the front muffler forward to allow the intermediate muffler to be removed.
   - Slacken the securing clamps (left-hand and right-hand sides) front muffler to downpipe catalytic converters.
   - Move the front muffler assembly forward.

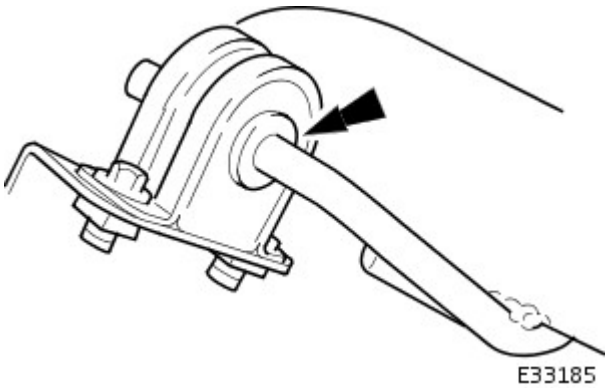


5. Remove the intermediate muffler.
   - Slacken the securing clamp, front muffler to intermediate muffler and separate the intermediate muffler from the front muffler.
6. Remove the muffler assembly from the axle carrier and from the over-axle mounting rubber.



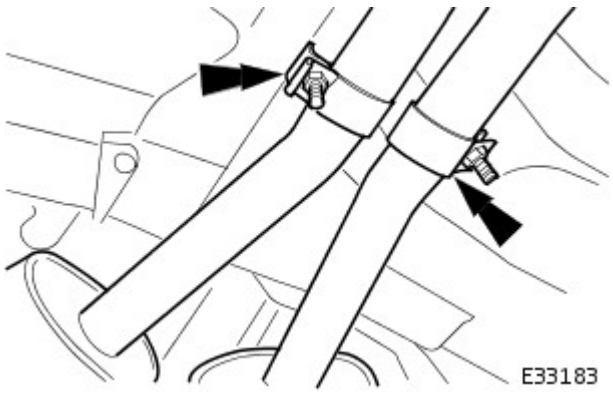
7. Clean and inspect all exhaust joints.

Installation

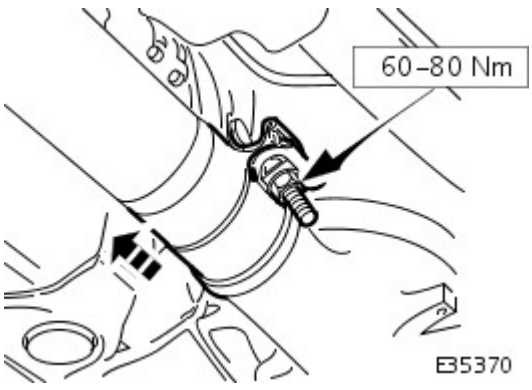


1. Fit the intermediate muffler assembly.

- Fit the muffler assembly to the axle carrier and to the over-axle mounting rubber.



2. Locate the intermediate muffler to the front muffler.

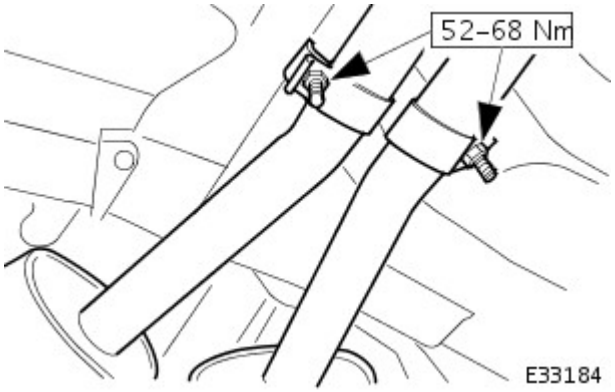


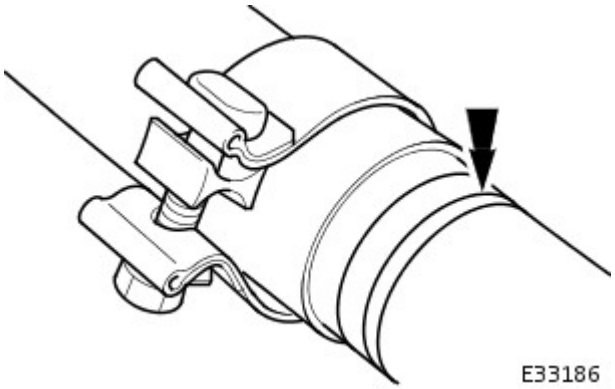
3. Correctly position the front muffler in the catalytic converters to align the correct reference / index indicator ring..

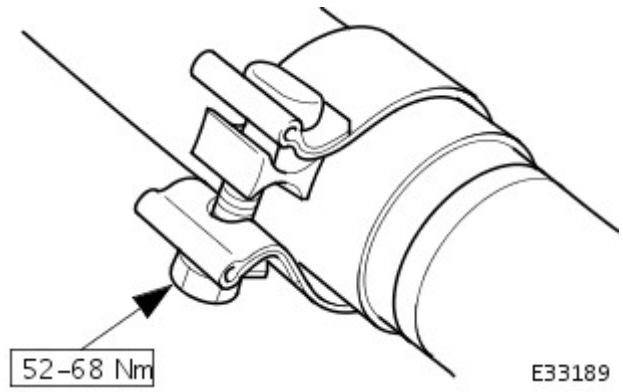
- Tighten the clamps (left-hand and right-hand sides), front muffler to catalytic converters.

4. Correctly position the intermediate muffler at the front muffler to align the correct reference / index indicator ring..

- Tighten the clamp, intermediate mufflers to front muffler.







5. NOTE: If necessary, loosen and rotate the intermediate muffler, at the front to intermediate muffler joint, to achieve the tailpipe trim settings. Refer to Specifications in this section.

Correctly position the rear muffler assembly.

- Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring, rotating back and forth to aid engagement.
- Check that the mounting is located correctly into the mounting rubber.
- Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary. Refer to Specifications in this section.

6. Tighten the securing clamp, intermediate muffler to rear muffler.

7. Remove the axle stands from beneath the rear jacking points.

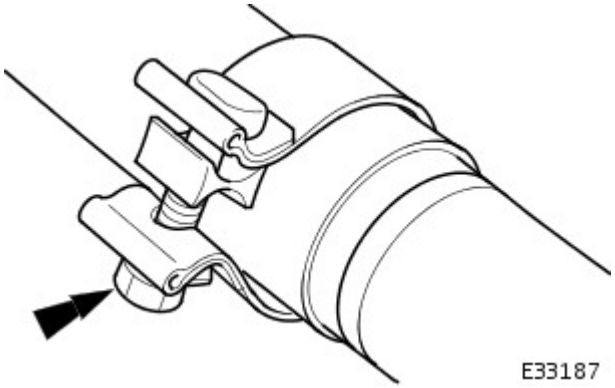
8. Lower the ramp.

Exhaust System - Intermediate Muffler RH4.0L SC V8 - AJ26

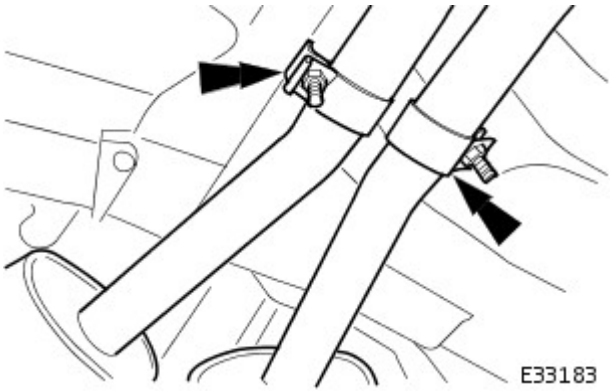
Removal and Installation

Removal

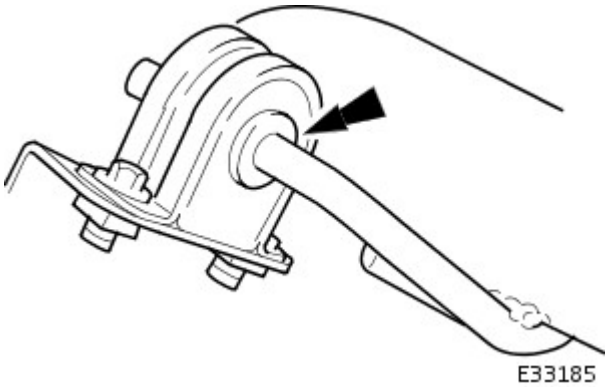
1. Raise the vehicle on a four-post ramp.
2. Raise the rear of the vehicle body and support on two stands, located under the rear jacking points.
3. Disconnect the intermediate muffler from the rear muffler.
   - Slacken the securing clamp, rear muffler to intermediate muffler and separate the intermediate muffler from the rear muffler.



4. Remove the intermediate muffler.
   - Slacken the securing clamp, front muffler to intermediate muffler and separate the intermediate muffler from the front muffler.



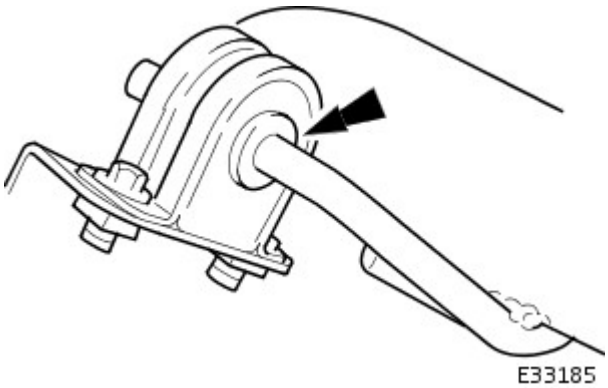
5. Remove the muffler assembly from the axle carrier and from the over-axle mounting rubber.

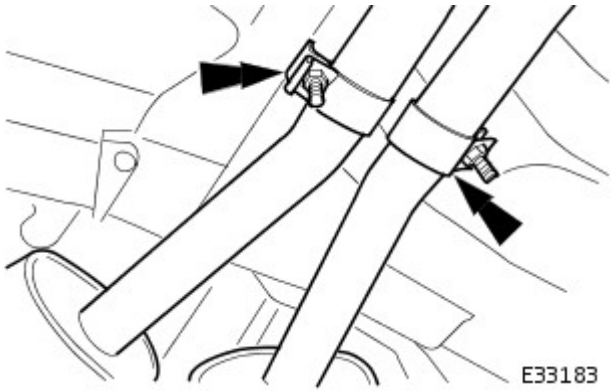


6. Clean and inspect all exhaust joints.

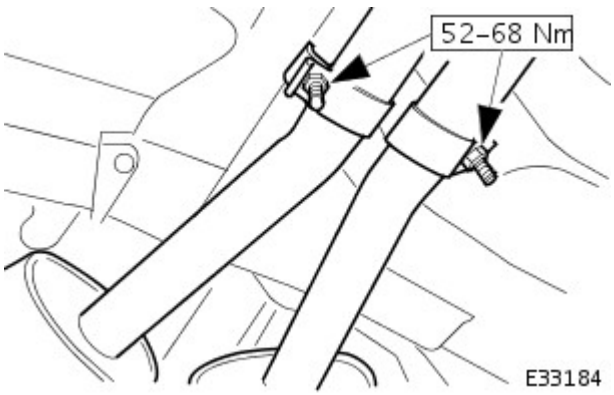
Installation

1. Fit the intermediate muffler assembly.
   - Fit the muffler assembly to the axle carrier and to the over-axle mounting rubber.



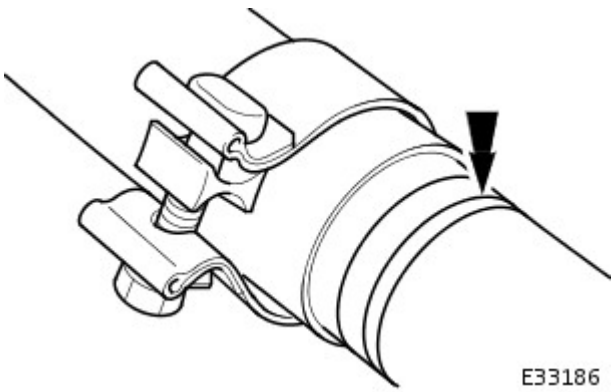


2. Locate the intermediate muffler to the front muffler.



3. Correctly position the intermediate muffler at the front muffler to align the correct reference / index indicator ring.

- Tighten the clamp, intermediate muffler to front muffler.

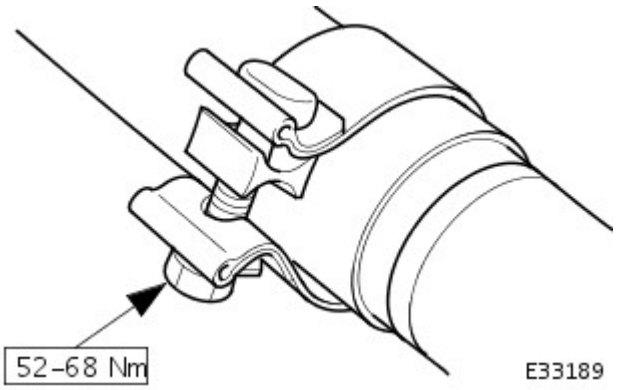


4. NOTE: If necessary, loosen and rotate the intermediate muffler, at the front to intermediate muffler joint, to achieve the tailpipe trim settings. Refer to Specifications in this section.

Correctly position the rear muffler assembly.

- Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring, rotating back and forth to aid engagement.
- Check that the mounting is located correctly into the mounting rubber.
- Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary. Refer to Specifications in this section.

5. Tighten the securing clamp, intermediate muffler to rear muffler.



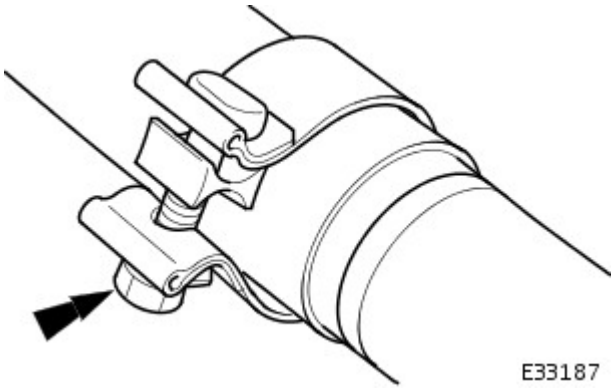
6. Remove the axle stands from beneath the rear jacking points.

7. Lower the ramp.

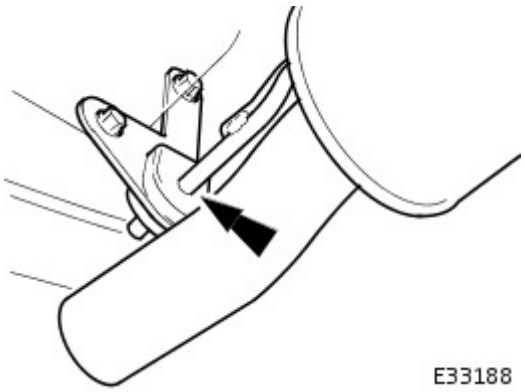
Exhaust System - Muffler and Tailpipe LH

Removal and Installation

Removal

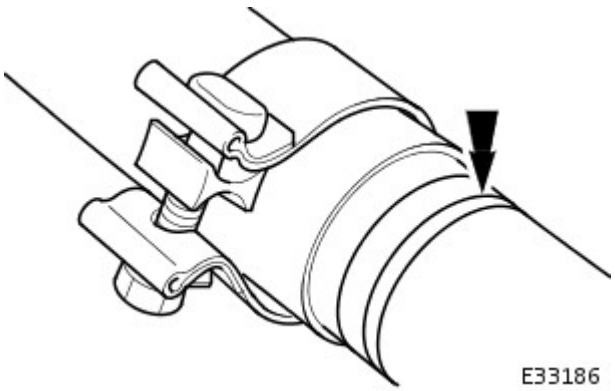


1. Raise the vehicle on a four-post ramp.
2. Slacken the securing clamp, rear muffler to intermediate muffler.

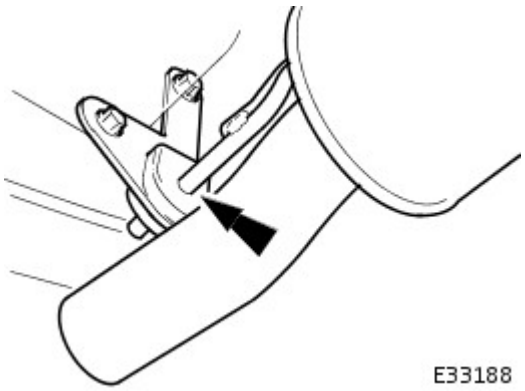


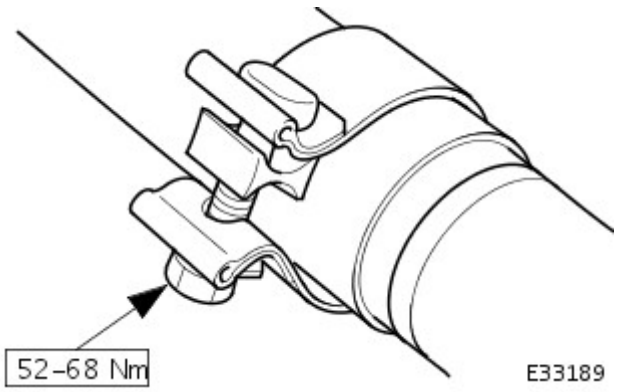
3. Remove the rear muffler and tailpipe assembly.
   - Separate the rear muffler from the intermediate muffler.
   - Disengage the rear muffler mounting peg from the mounting rubber.
   - Remove the rear muffler assembly. Rotate the assembly back and forth to aid removal.
4. Clean the exhaust joints.

Installation



1. Fit the rear muffler and tailpipe assembly.
   - Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring.
2. Position and align the rear muffler and tailpipe assembly.
   - Engage the peg with the mounting rubber.
   - Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary; refer to Specifications in this section.





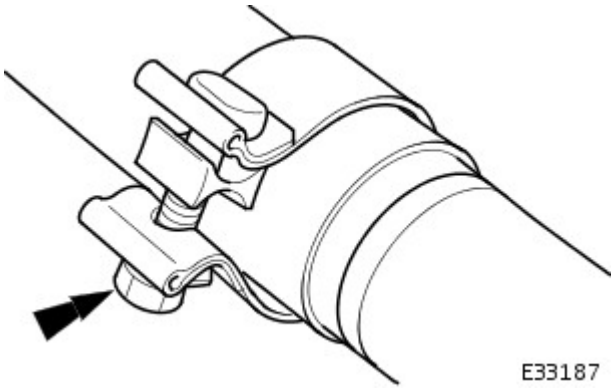
3. Tighten the securing clamp, rear muffler to intermediate muffler.

4. Lower the ramp.

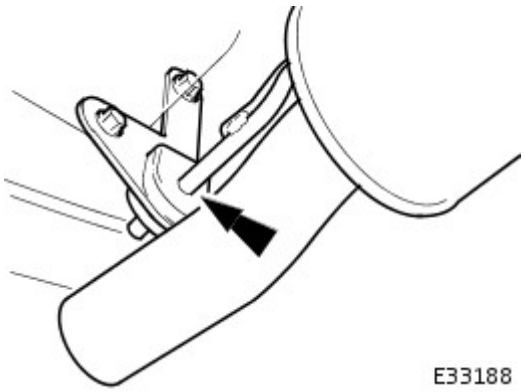
Exhaust System - Muffler and Tailpipe RH

Removal and Installation

Removal

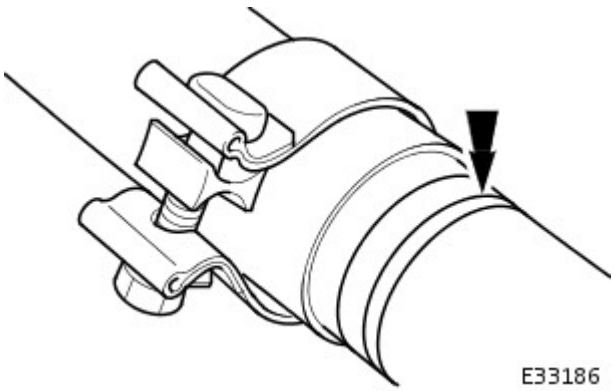


1. Raise the vehicle on a four-post ramp.
2. Slacken the securing clamp, rear muffler to intermediate muffler.

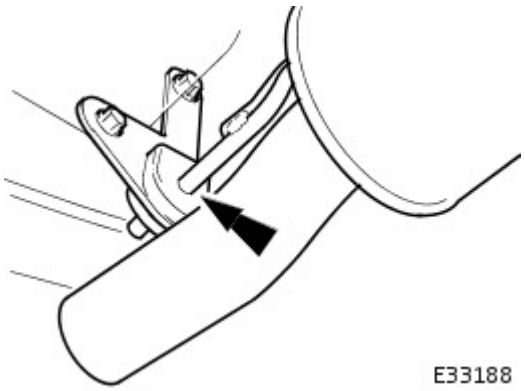


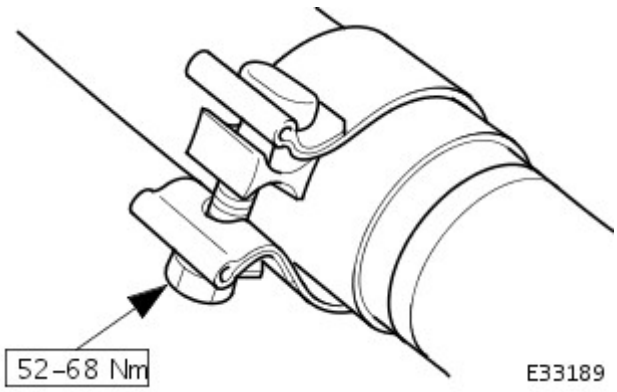
3. Remove the rear muffler and tailpipe assembly.
   - Separate the rear muffler from the intermediate muffler.
   - Disengage the rear muffler mounting peg from the mounting rubber.
   - Remove the rear muffler assembly. Rotate the assembly back and forth to aid removal.
4. Clean the exhaust joints.

Installation



1. Fit the rear muffler and tailpipe assembly.
   - Connect the rear muffler to the intermediate muffler and insert to the Nominal indicator ring.
2. Position and align the rear muffler and tailpipe assembly.
   - Engage the peg with the mounting rubber.
   - Check that the tailpipe position is within the specified settings, adjusting engagement within the Maximum and Minimum indicator rings if necessary; refer to Specifications in this section.





3. Tighten the securing clamp, rear muffler to intermediate muffler.

4. Lower the ramp.

Fuel System - General Information - Fuel System

Description and Operation

The fuel tank is mounted across the vehicle behind the passenger compartment bulkhead.

Fuel is drawn by the fuel pump from the tank and then supplied to the two fuel rails, via a filter.

Fuel injectors are installed in the fuel rails on each side of the intake manifold.

The amount of fuel injected into the engine is controlled by the ECM.

A cross-over pipe connects the two fuel rails together at the front of the manifold.

A test valve in the cross-over pipe allows the fuel rail to be pressurized and de-pressurized during the servicing and troubleshooting procedures.

A pressure regulator on the rear of the right fuel rail controls the pressure in the fuel rails.

A return line directs excess fuel from the pressure regulator back to the fuel tank.

Operation and service procedures

The fuel injectors, rails, pressure regulator and, where fitted, supercharger are described in greater detail in Section 303-04 together with servicing procedures.

The fuel tank, pump, fuel level senders and fuel lines are similarly covered in Section 310-01.

Fuel System - General Information - Fuel System Pressure Check

General Procedures

WARNING: Working on the fuel system results in fuel and fuel vapor being present in the atmosphere. Fuel vapor is extremely flammable, hence great care must be taken whilst working on the fuel system. Adhere strictly to the following precautions:

- Do not smoke in the work area
- Display **NO SMOKING** signs around the work area
- Disconnect the battery before working on the fuel system
- Avoid sparks
- Make sure suitable fire extinguishers are at hand
- Make sure absorbent material is at hand to soak up any spillage
- Make sure the work area is well ventilated
- Make sure that the gauge is correctly connected, and that all connections are secure **BEFORE** starting the engine
- **DO NOT** disconnect the gauge from the schrader valve while the engine is running
- Make sure the schrader valve reseals once the gauge is disconnected

1. Make sure the vehicle is in **Park** for vehicles with automatic transmission, **Neutral** for vehicles with manual transmission.
2. Apply the parking brake.
3. Place suitable absorbent material around the schrader valve to absorb any spillage when connecting the gauge set.
4. Remove the protective cap from the schrader valve.

• NOTE: Depending on the design of the gauge set, there may be a drain valve and tube. Make sure this valve is closed, and the drain tube placed in a suitable container **BEFORE** connecting the gauge to the schrader valve.

5. Connect the gauge, using adaptors if required.
6. Remove the absorbent material and dispose of safely.
7. Disconnect and plug the vacuum hose from the pressure regulator.
8. Start the engine and record the fuel pressure reading.
    - As a guide, the fuel pressure should be approximately **3.0 bar (44.1 psi)** with the regulator disconnected.
9. With the engine still running, reconnect the vacuum hose to the pressure regulator and record the reading.
    - The pressure should drop to approximately **2.6 bar (38 psi)** when the vacuum hose is reconnected.
10. Switch off the engine.
11. Place more absorbent material around the schrader valve.
12. Where fitted, open the drain valve and allow the fuel from the gauge and line to flow into the container to depressurize the system.
13. Disconnect and remove the gauge set and any adaptors.
14. Clean up any fuel which may have been spilt and remove the absorbent material. Dispose of safely.
15. Refit and secure the protective cap to the schrader valve.
16. Reconnect the fuel pressure regulator vacuum hose.
17. Start the engine and make sure there are no leaks.

Fuel System - General Information - Fuel System Pressure Release

General Procedures

Special Tool(s)	
 E36466	Test Equipment - Fuel Pressure Relief 310-058 (TE 7635A or JD 209)

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

Open engine compartment and fit paintwork protection sheets.

2. Carefully remove left hand engine cover, taking care not to damage the plastic fixings or the rubber inserts.


E35302

3. WARNING: MAKE SURE EQUIPMENT BLEED / DRAIN VALVE IS CLOSED.

• NOTE: Place a cloth under the valve to collect any spillage.

Depressurize fuel system.

- Make sure ignition is switched off.
- Remove cap from Schrader valve.
- Place a closed container, suitable for collecting fuel, adjacent to vehicle.
- Remove lid from container.
- Connect fuel injection pressure test equipment 310-058 (TE 7635A or other suitable type).
- Insert drain / bleed tube into fuel container.
- Read and follow manufacturer's instructions to depressurize fuel system.

4. Store drained fuel safely and make sure container lid is closed securely.

5. Remove equipment and discard cloth from beneath the valve.

6. Install valve cap.

7. Install left hand engine cover.

Fuel System - General Information - Fuel Tank Draining

General Procedures

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

Remove the battery. Refer to operation 86.15.01.

2. Depressurise the fuel system.

- Ensure that the ignition is switched off and remove the valve cap from the fuel cross-over pipe. Place a cloth under the valve to collect any spillage.
- Place a closed container, suitable for collecting fuel, adjacent to the vehicle. Remove the lid.





3. Connect the fuel injection pressure test equipment JD 209 (or other suitable type). Insert the drain / bleed tube into the fuel container. Follow the manufacturer's instructions and depressurise the fuel system.

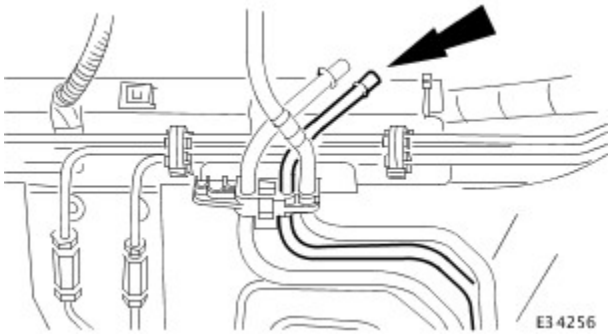
4. Store the drained fuel safely and ensure that the lid is closed securely. Remove the equipment and discard the cloth from beneath the valve. Refit the valve cap.

5. Use a suitable fuel storage tanker / pump system to drain the vehicle tank as described below.

6. Connect a ground cable between the vehicle and drain equipment and connect both to a suitable earth point.

7. At the engine bay bulkhead, locate the quick fit connector between the underfloor fuel feed pipe and the fuel pulse damper.

- Place a cloth under the pipes to absorb any spillage.
- Disconnect the fuel feed hose at the quick fit connector, using special tool JD 182.
- Connect the fuel drain equipment to the underfloor fuel feed pipe.

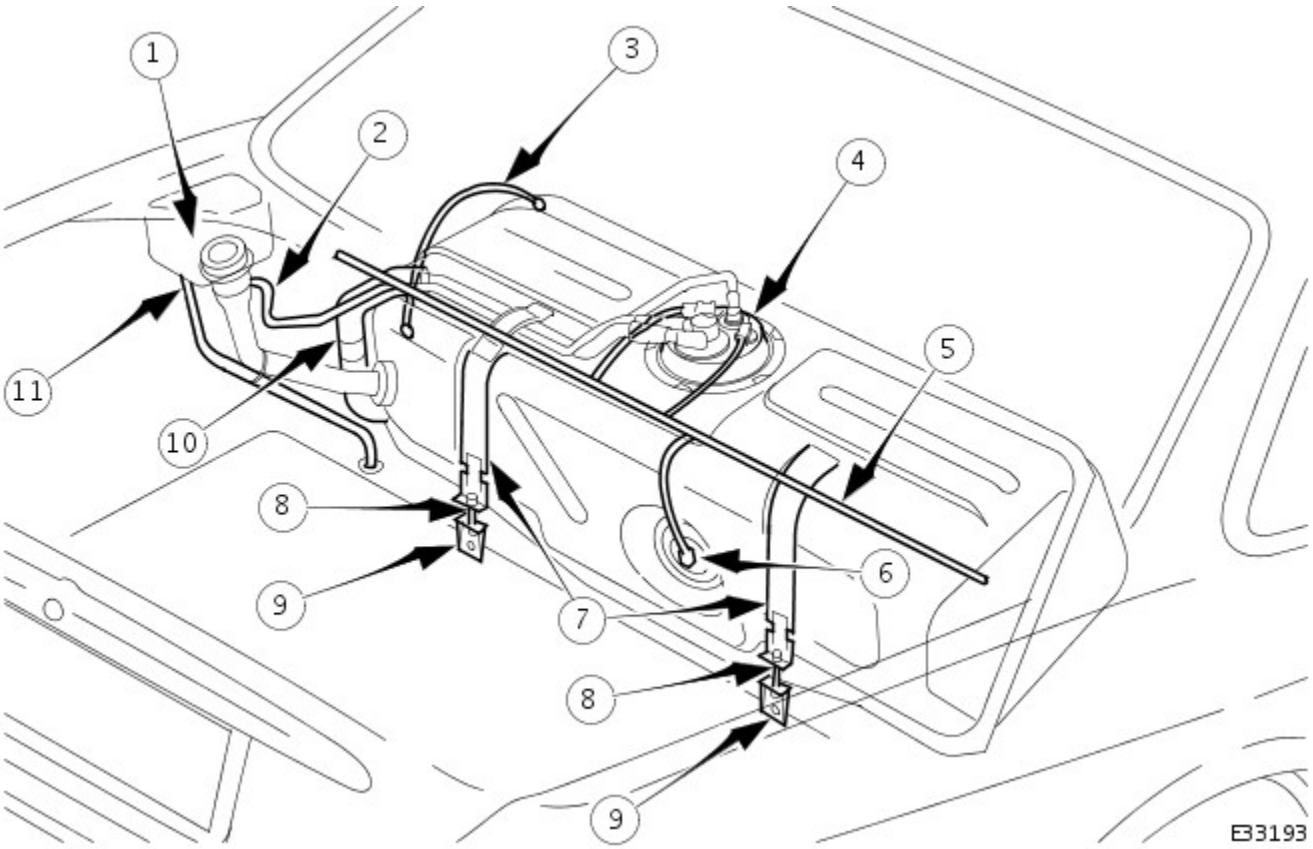


8. Drain the fuel tank in accordance with the equipment manufacturers instructions.

Fuel Tank and Lines - Fuel Tank and Lines

Description and Operation

Fuel Tank



Parts List

Item	Part Number	Description
1	—	Fuel filler latch box
2	—	Pressure relief pipe, ORVR (shown) / tank breather pipe on non-ORVR systems
3	—	Tank grounding cable
4	—	Evaporative flange assembly (ORVR type shown)
5	—	Trunk electrical harness (part of)
6	—	Fuel level sensor flange/connector
7	—	Fuel tank retaining straps
8	—	Fuel tank retaining straps adjustable clamps
9	—	Fuel tank retaining straps lower brackets
10	—	Tank vapor outlet pipe to underfloor pipe quick-fit connector
11	—	Fuel filler latch box water drain pipe

The steel fuel tank is located inside the trunk and mounted across the vehicle behind the passenger compartment bulkhead. The fuel tank is held in position by two retaining straps fitted to body-mounted brackets.

The fuel tank has an integral non-adjustable filler pipe and integral breather and vapor pipework.

A single fuel pump is mounted inside the tank on vehicles with normally aspirated engines. For vehicles with supercharged engines, two pumps are fitted in the tank. Fuel is drawn by the pump(s) from the fuel tank and supplied via the fuel lines and 70 micron filter to the fuel rails.

The fuel lines run from front-to-rear down the vehicle's left-hand-side.

Filler Cap and Pipe

The fuel filler cap with bayonet-type fixing is located beneath a remote-release spring-latched lid on the rear saddle panel on the left-hand-side of the vehicle.

Fuel Pump

The fuel pump(s) is energized by an ECM controlled relay. Fuel is drawn by this pump and supplied to the fuel injectors via the fuel line, filter and fuel rails.

Servicing of the fuel pump requires fuel tank removal.

Evaporative Loss Flange Assembly

The evaporative-loss flange assembly is mounted centrally on top of the tank. The flange assembly consists of a removeable steel cap which mounts the evaporative emissions system vapor outlet valves and, if applicable, a pressure sensor. The external electrical supply to the fuel pump(s) is also made via a connector on the flange.

The flange assembly is fixed to the tank by a locking ring which is turned using special tool JD-174. A seal is fitted between the flange assembly and the tank. Three different flange assemblies are applicable according to the evaporative emission system fitted to the vehicle. The flange size and fixing are identical for the three systems, as described.

Removal of the evaporative flange assembly is necessary to gain access to the fuel pump(s) and other internal components. To remove the evaporative flange assembly the fuel tank must first be removed.

The evaporative flange variant assemblies are described, together with service information, in Section 303-13.

Fuel Return

Excess fuel is directed back to the fuel tank via a return line.

Fuel Pump Relay

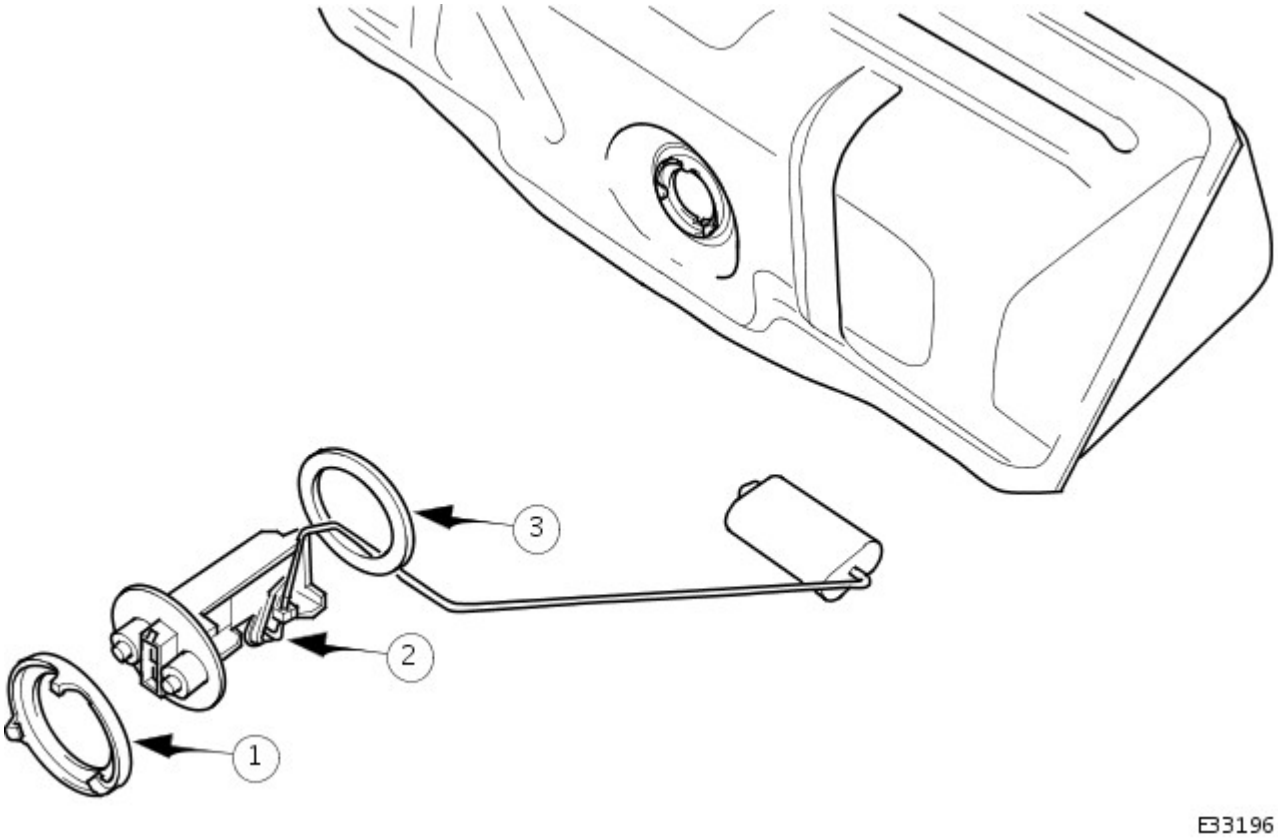
The fuel pump relay, under control of the ECM, switches power to the fuel pump motor.

Inertia Fuel Shutoff (IFS) Switch

The IFS switch is located in the right-hand side footwell behind the footboard carpet. When activated the switch isolates the ignition system and fuel pump, releases any locked doors and disables unnecessary electrical systems. The system can be reset by pressing down the flexible cover on the top of the switch.

• NOTE: The doors will not unlock if the IFS switch is tripped when the ignition switch is in position '0'.

Fuel Level Sensor



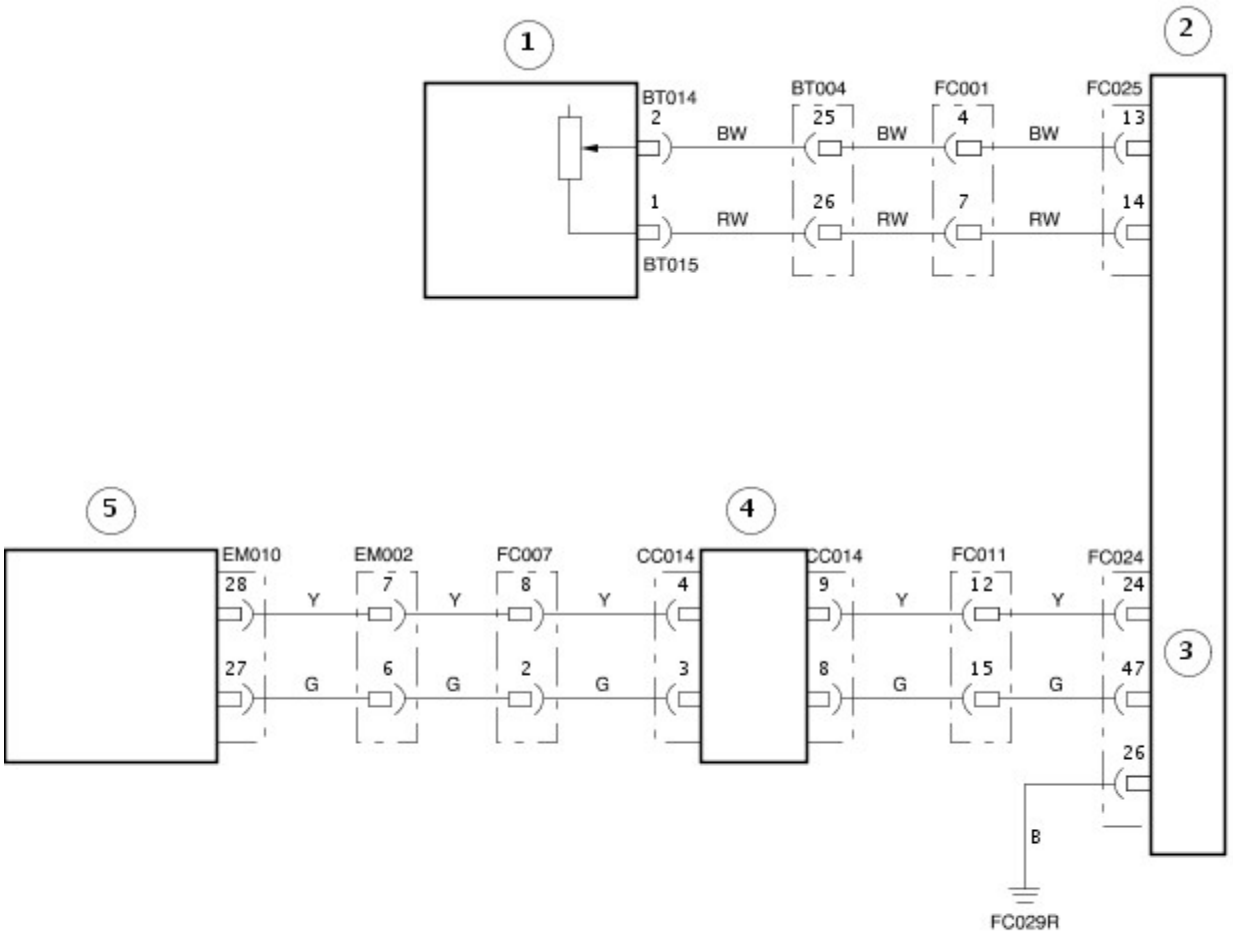
Parts List

Item	Part Number	Description
1	—	Locking ring
2	—	Fuel level sensor
3	—	Seal

The fuel level sensor is mounted on the fuel tank vertical face and reacts to level changes via a float and pivot which is connected to a potentiometer. As the fuel level drops the resistance increases.

The fuel level sensor can be serviced without removing the tank.

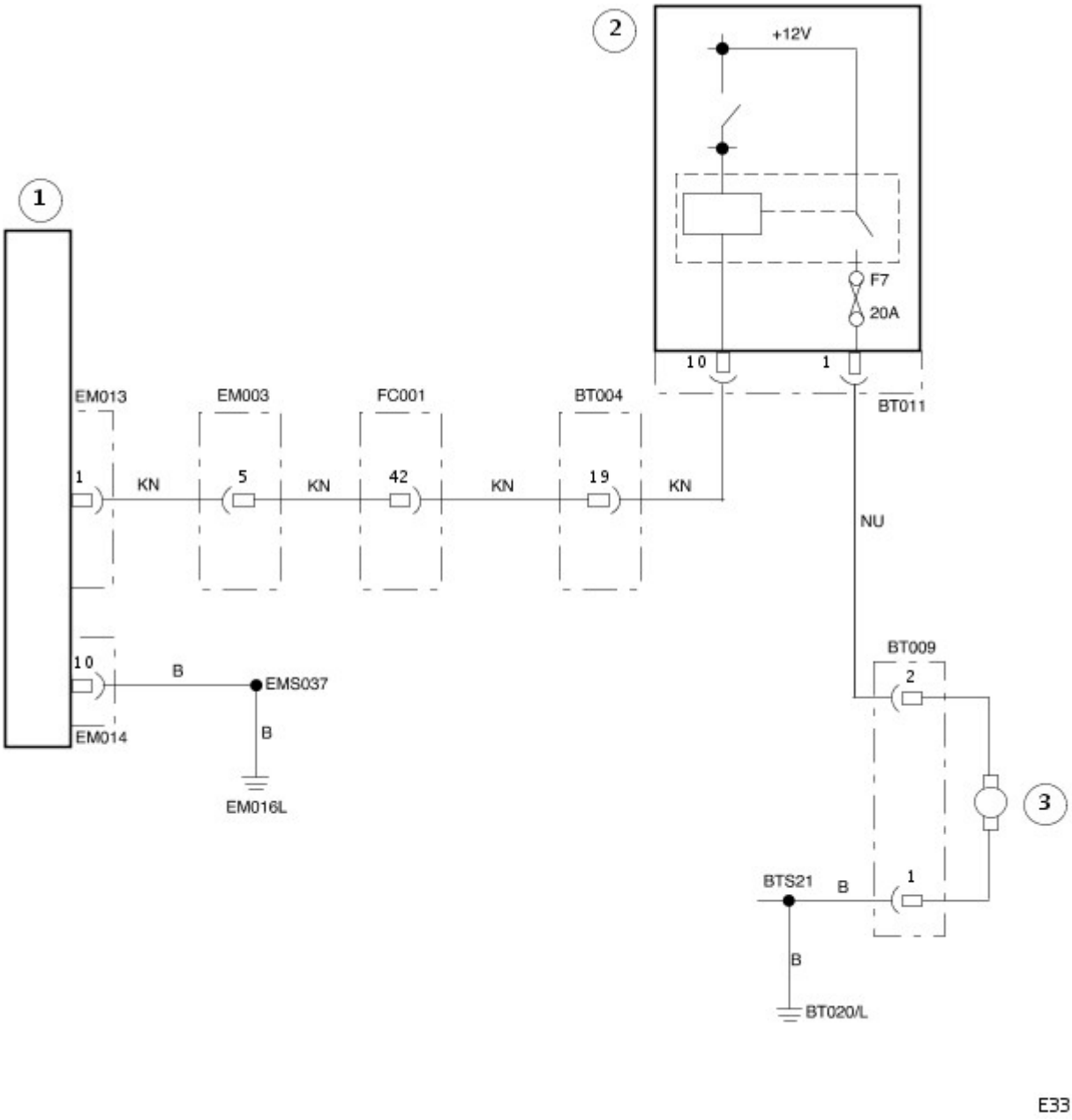
Fuel Level Sensor Circuit Diagram



E33926

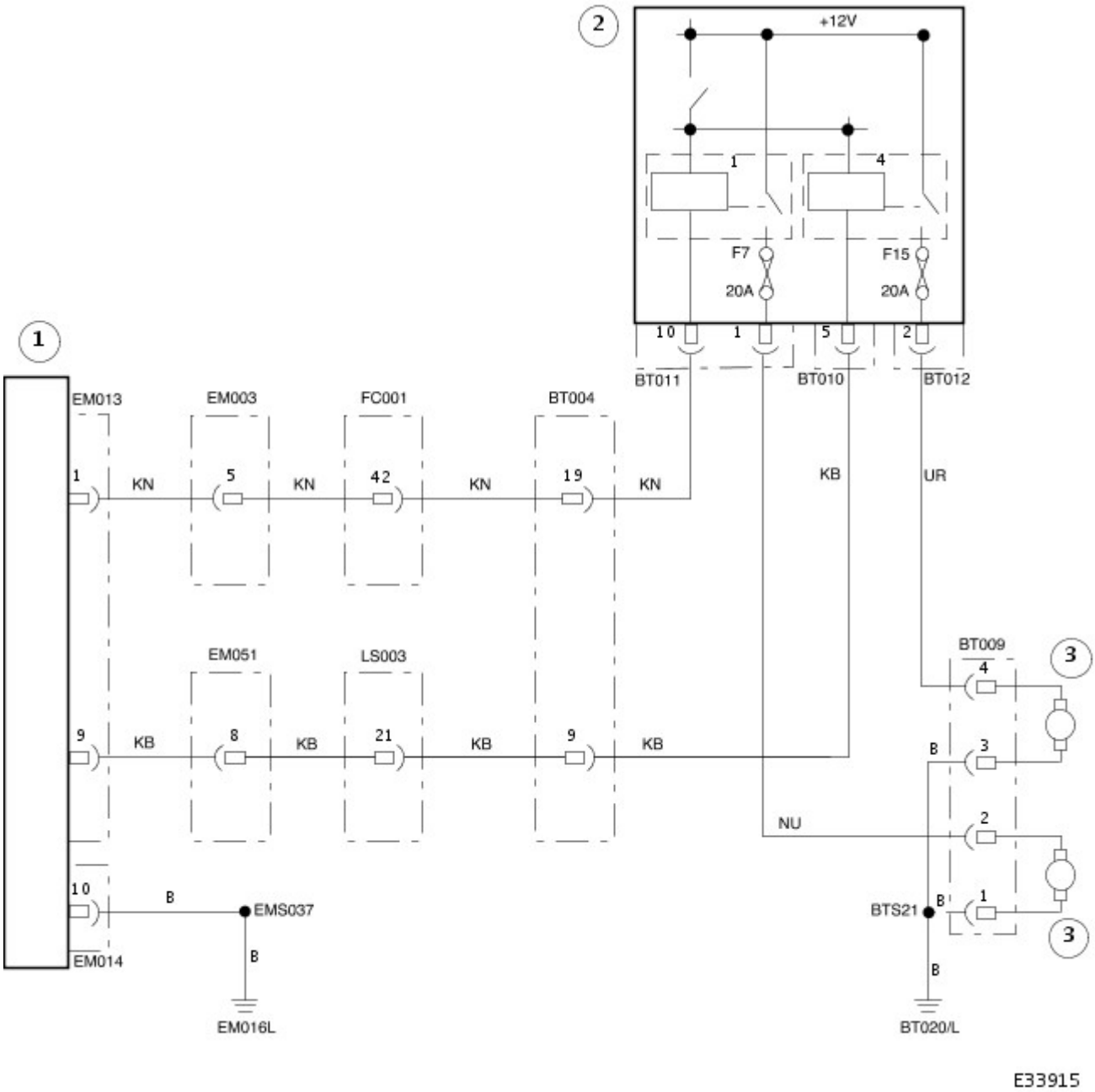
Item	Part Number	Description
1	—	Fuel level sensor
2	—	Instrument pack
3	—	CAN IN
4	—	J-gate
5	—	Engine management ECM

Circuit Diagram, Fuel Pump - Normally Aspirated Vehicles



Item	Part Number	Description
1	—	Engine management ECM
2	—	Boot fuse box
3	—	Fuel pump

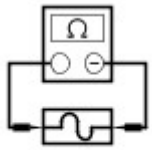
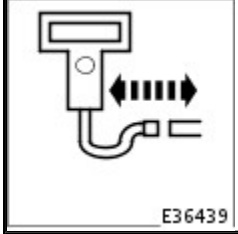
Circuit Diagram, Fuel Pump - Supercharged Vehicles



Item	Part Number	Description
1	—	Engine management ECM
2	—	Boot fuse box
3	—	Fuel pumps

Fuel Tank and Lines - Fuel Tank and Lines

Diagnosis and Testing

Special Tool(s)	
 E36420	Digital multimeter
 E36439	Generic scan tool
 E36414	Fuel tank sender (sensor) unit wrench 18G 1001

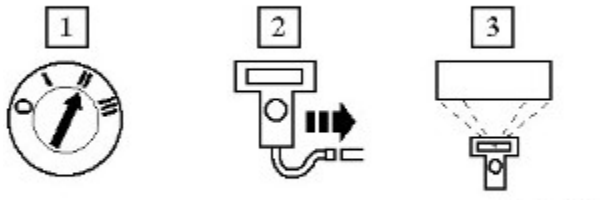
Symptom Chart

Symptom Chart

Symptom	Possible Sources	Action
DTC P1230 Fuel pump relay malfunction	* Relay failure * Harness fault * Connector loose or corroded * Connector pins(s) bent or tracking between connections * Ground failure	* GO to Pinpoint Test A
DTC P1646 Secondary fuel pump relay malfunction	* Relay failure * Harness fault * Connector loose or corroded * Connector pins(s) bent or tracking between connections * Ground failure	* GO to Pinpoint Test B
DTC P0460 Fuel level sensor circuit malfunction	* Worn or damaged sensor tracks * Harness fault * Connector loose or corroded * Connector pin/s bent or tracking between connections * Fuel level sensor to instrument pack circuits intermittent short or open circuit or high resistance. * Fuel level sensor failure * Instrument pack fault (incorrect fuel level data)	* GO to Pinpoint Test C

Pinpoint test A: P1230

PINPOINT TEST A : A: P1230	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
A1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	

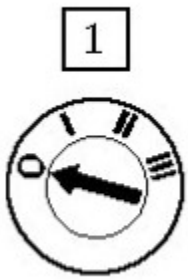


E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to A2

A2: CHECK FUSE

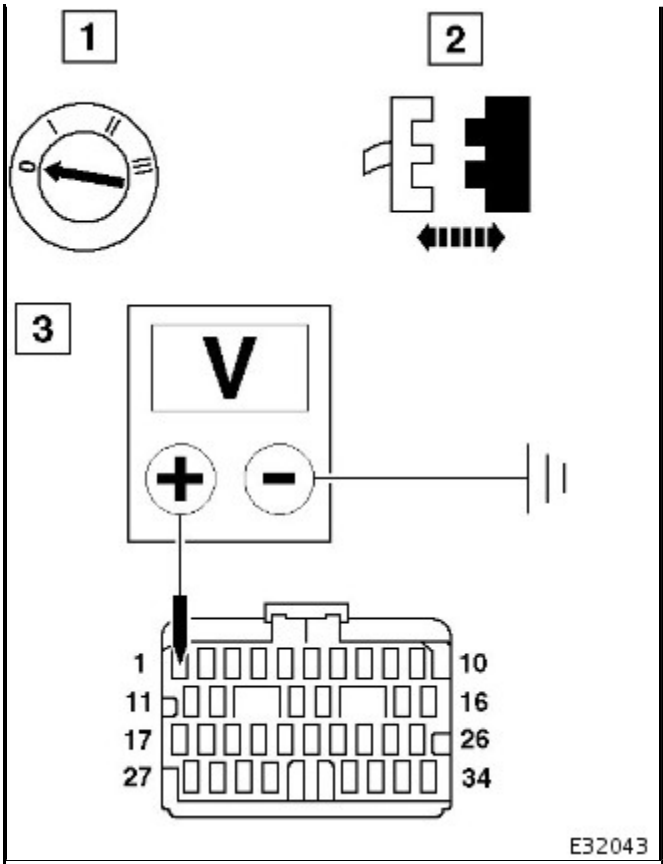
• NOTE: See further steps for possible cause of fuse failure.



E32154

	1 Check fuse F7 integrity (located in the trunk).
	OK? **Yes** GO to A3 **No** Renew fuse and test the system for normal operation.

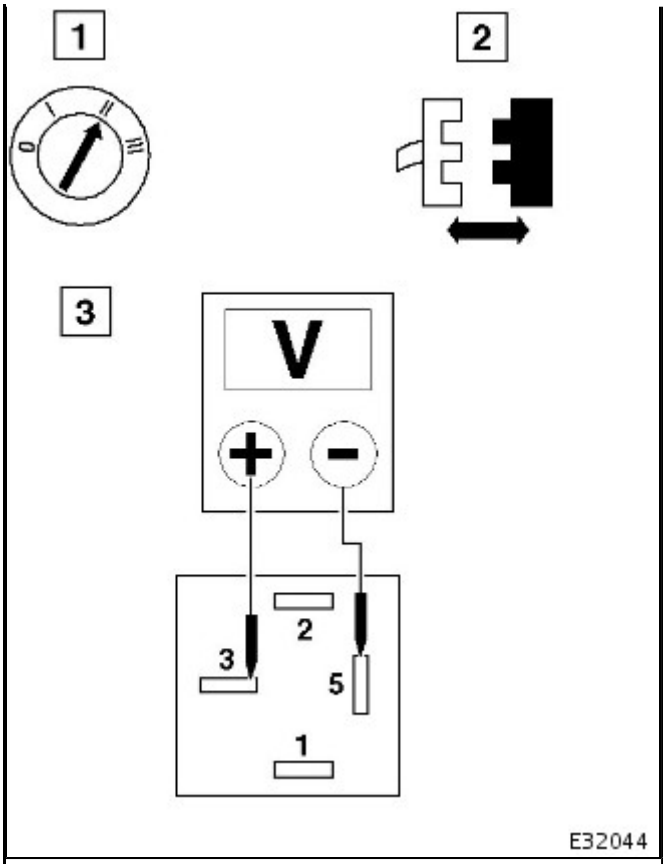
A3: CHECK SHORT TO SUPPLY



	1 With EM013 disconnected, check for battery voltage between EM013/001 and ground BT020L.
	B+ ? **Yes** GO to A13 **No** GO to A4

A4: CHECK SUPPLY VOLTAGE

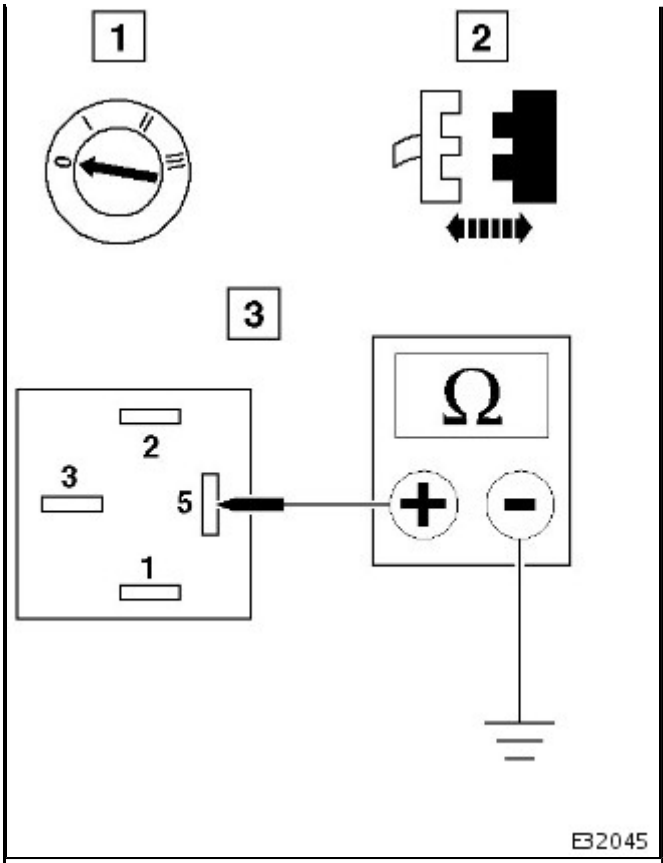
• NOTE: Do not replace relay.



	1 With relay 4 removed, check for battery voltage at relay socket between pins 3 and 5.
	B+ **Yes** GO to A5 **No** GO to A11

A5: CHECK CIRCUIT CONTINUITY

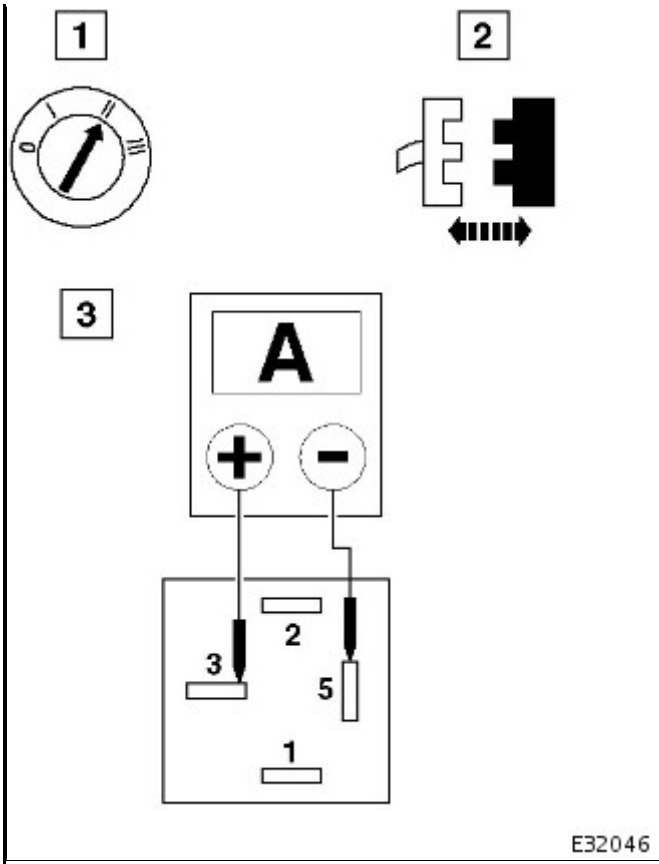
• NOTE: Do not replace relay.



	1 Measure the resistance between relay socket pin 5 and ground BT020L.
	Is the resistance < 10OHM? **Yes** GO to A6 **No** GO to A10

A6: CHECK FUEL PUMP DRAWN CURRENT

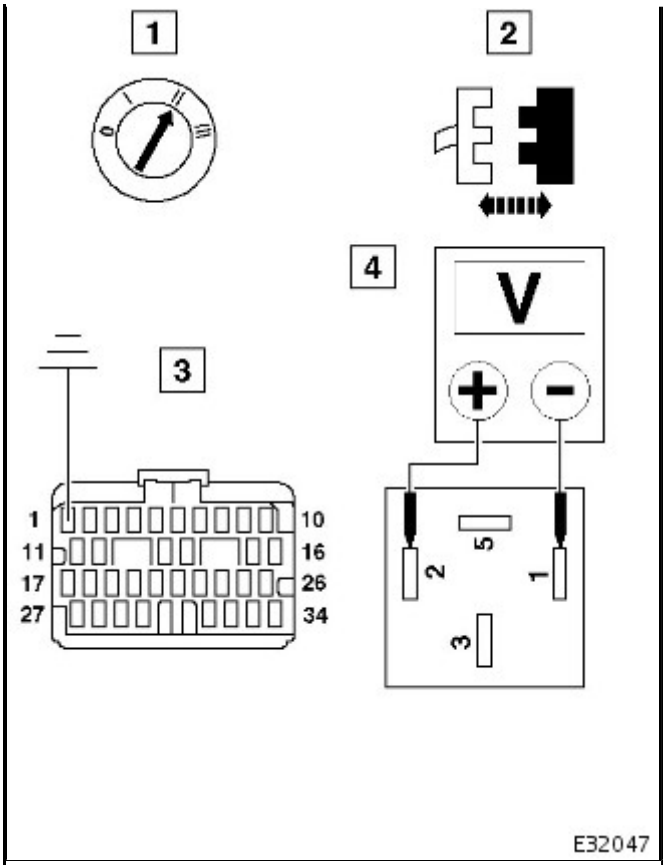
- NOTE: With EM013 disconnected this test will cause the pump to operate continuously. Do not exceed 10 sec running.
- NOTE: Do not replace relay.



	1 With the ignition energized, measure the current drawn between relay socket pins 3 and 5.
	Is the current between 2.5 and 9 A? **Yes** GO to A7 **No** GO to A10

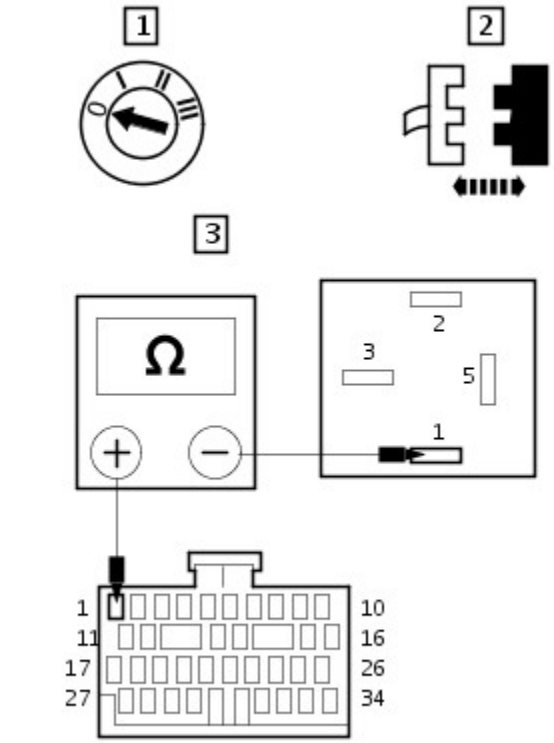
A7: CHECK B+ AT RELAY COIL

• NOTE: Do not replace relay.



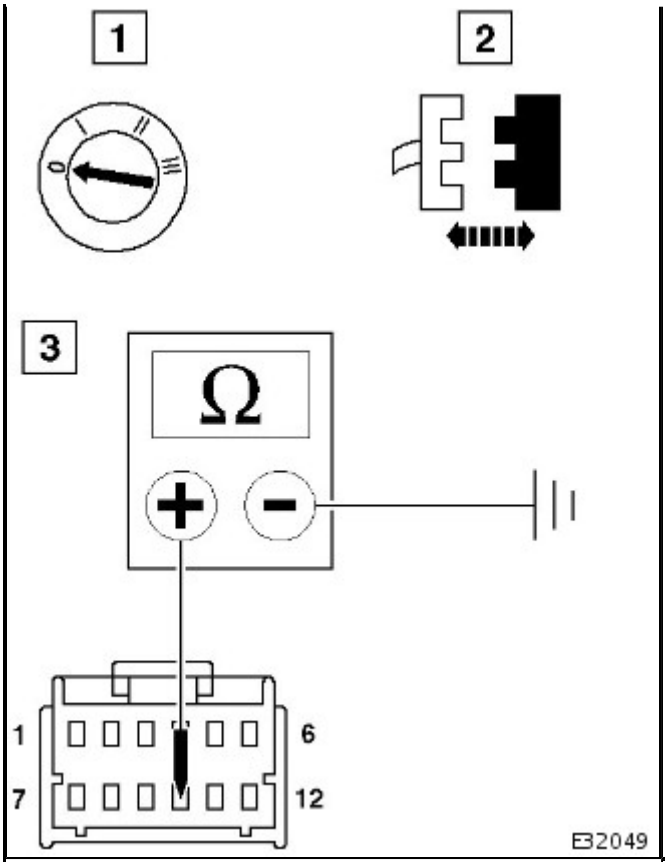
	1 Using a link lead, connect EM013/001 to ground BT020L.
	2 With ignition energized, check for battery voltage at relay socket between pins 2 and 1.
	B+? **Yes** GO to A10 **No** GO to A8

A8: CHECK RELAY COIL CIRCUIT CONTINUITY



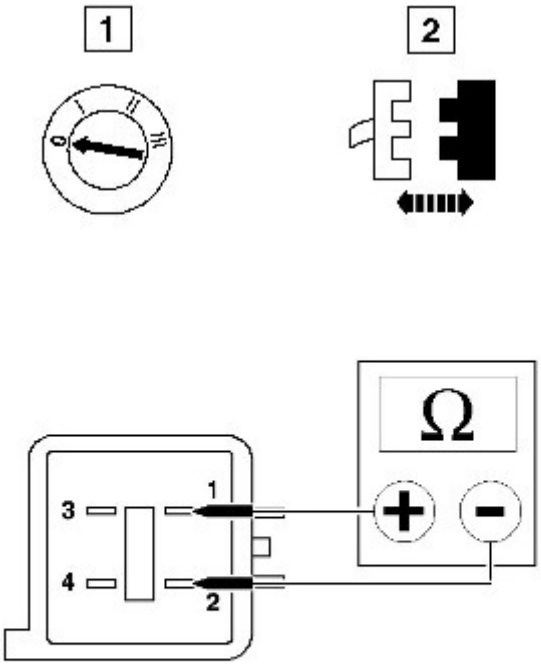
E32048

	1 With EM013 disconnected, measure the resistance between EM013/001 and relay socket pin 1.
	Is the resistance < 0.5 OHM? **Yes** GO to A9 **No** Inspect harness / connectors EM013, EM003/005, FC001/42, BT004/019 and BT011/010 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.
A9: CHECK ECM GROUND CONTINUITY	



	1 With EM014 disconnected, measure the resistance between EM014/010 and ground EM16L.
	Is the resistance < 0.5 OHM? **Yes** STOP, renew the relay and test the system for normal operation. **No** Inspect harness / connector EM014, splice EMS37 and ground EM16L for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

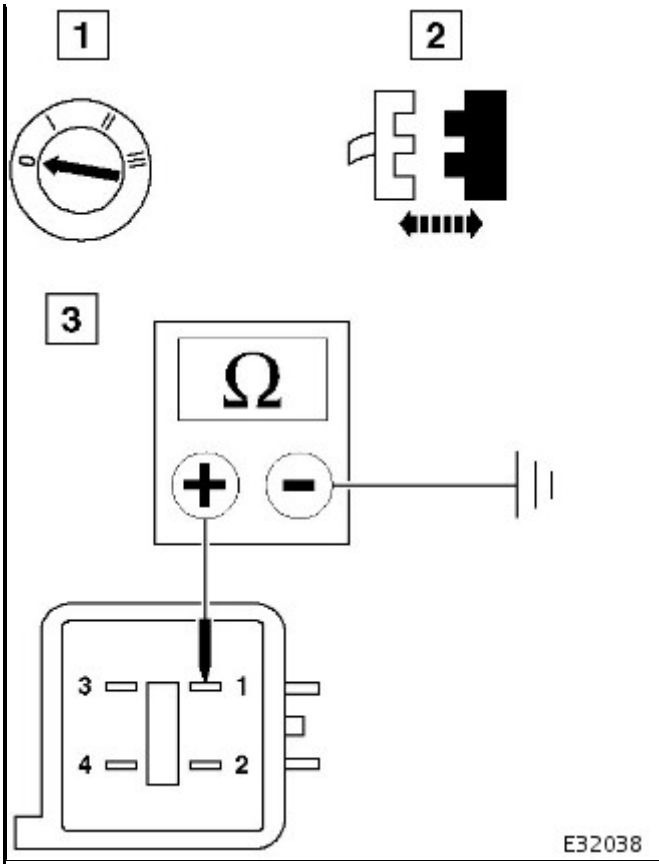
A10: CHECK FUEL PUMP CONTINUITY



E32037

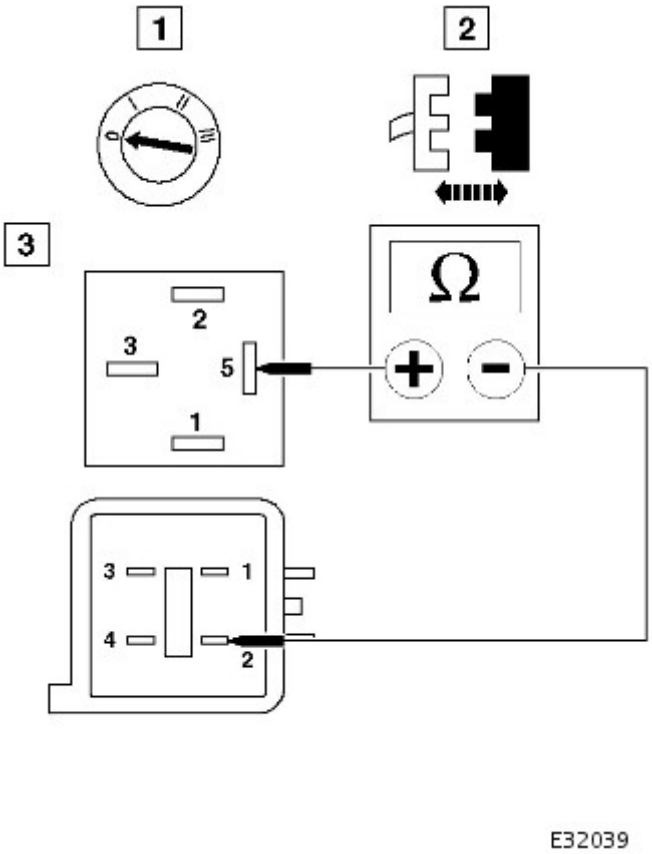
	1 With BT009 disconnected, measure the resistance across the fuel pump connectors reference BT009/001 and BT009/002.
	Is the resistance < 5 OHM? **Yes** GO to A11 **No** Renew the fuel pump and test the system for normal operation.

A11: CHECK FUEL PUMP GROUND CONTINUITY



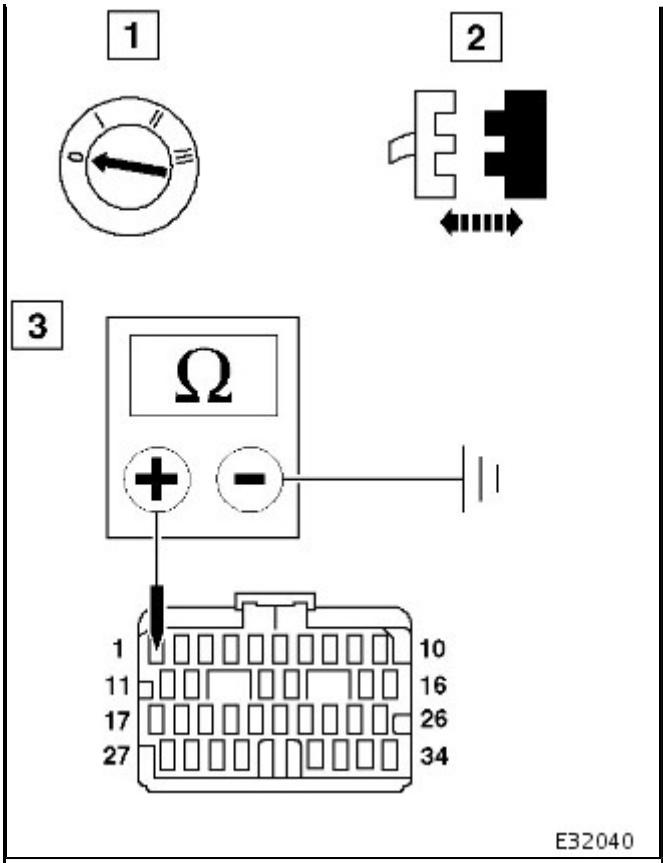
	1 With BT009 disconnected, measure the resistance between BT009/001 and ground BT020L.
	Is the resistance < 0.5 OHM? **Yes** GO to A12 **No** Inspect harness / connector BT009, splice BTS021 and ground BT020L for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

A12: CHECK CIRCUIT CONTINUITY



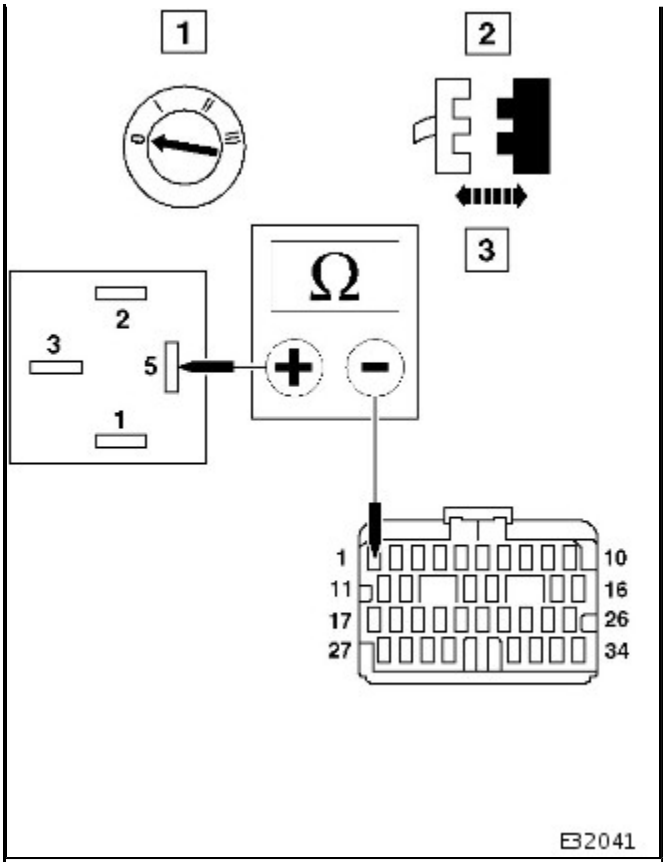
	1 With BT009 disconnected and relay 4 removed, measure the resistance between BT009/002 and relay socket pin 5.
	Is the resistance < 0.5 OHM? **Yes** GO to A13 **No** Inspect harness / connector BT009, fuse holder F7 and BT011/001 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

A13: CHECK HARNESS SHORT TO GROUND



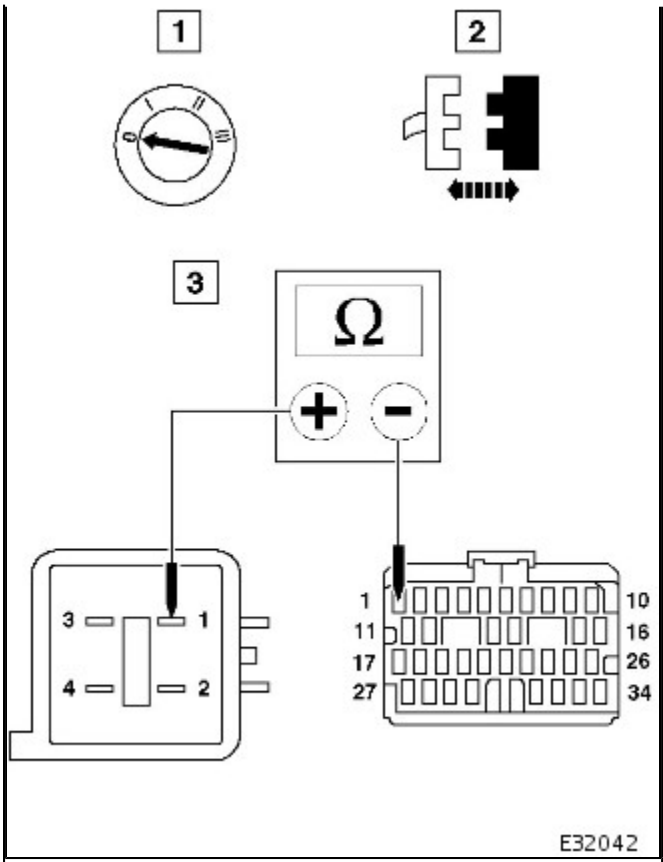
	1 With EM013 and BT009 disconnected, measure the insulation resistance between EM013/001 and ground BT020L.
	Is the resistance > 10M OHM? **Yes** Do not replace relay or reconnect connectors. GO to A14 **No** Inspect harness / connectors EM013, EM003/005, FC001/042, BT004/019 and BT011/010 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

A14: CHECK CORE TO CORE INSULATION



	1 With conditions as A13, measure the insulation resistance between EM013/001 and relay socket pin 5.
	Is the resistance > 10M OHM? **Yes** GO to A16 **No** Inspect harness / connectors EM013, EM003/005, FC001/042, BT004/019, BT011/001, BT009/002 and BT011/010 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

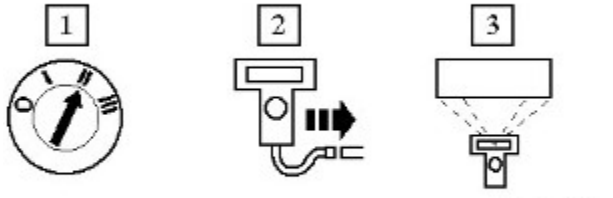
A15: CHECK CORE TO CORE INSULATION



	1 With conditions as in A14, measure the insulation resistance between EM013/001 and BT009/001.
	Is the resistance > 10M OHM? **Yes** Reconnect all plugs and replace relay 4. GO to A16 **No**
A16: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test B: P1646

PINPOINT TEST B : B: P1646	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	

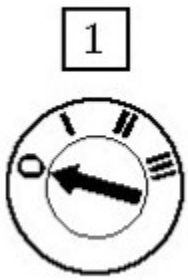


E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to B2

B2: CHECK FUSE

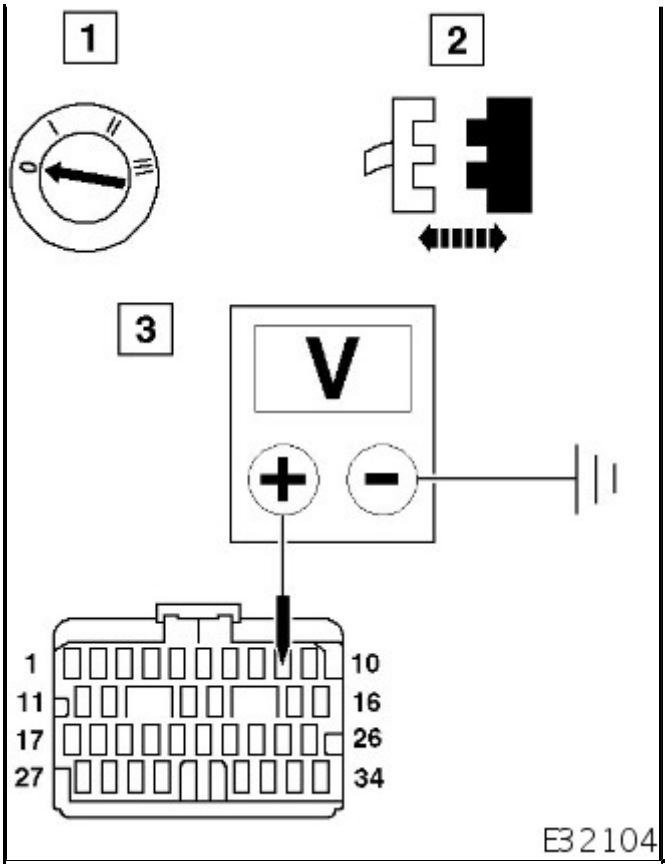
• NOTE: See further steps for possible cause of fuse failure.



E32154

	1 Check fuse 15 integrity (located in the trunk)
	OK? **Yes** GO to B3 **No** Renew fuse and test the system for normal operation.

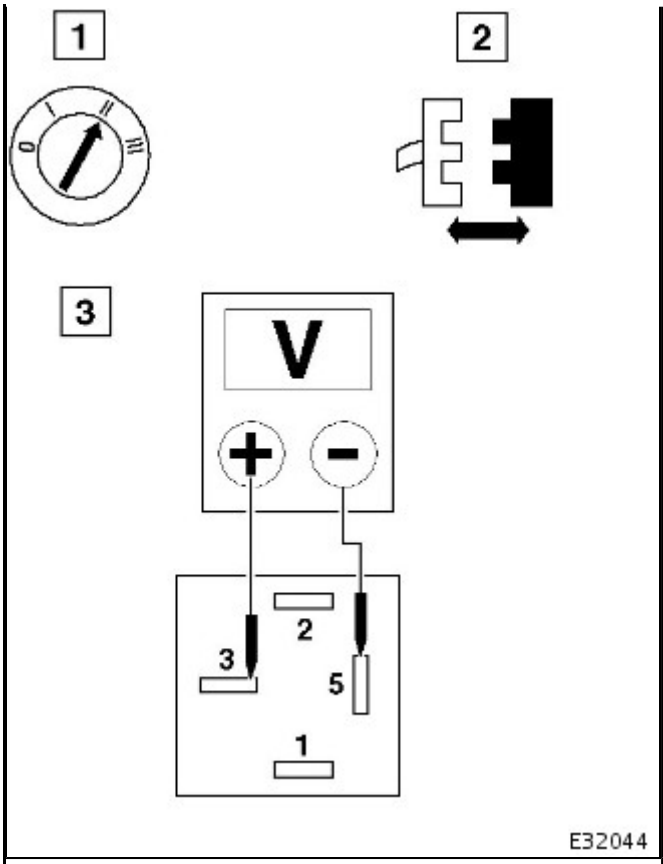
B3: CHECK SHORT TO SUPPLY



	1 With EM013 disconnected, check for battery voltage between EM013/009 and ground BT020L.
	B+ ? **Yes** GO to B13 **No** GO to B4

B4: CHECK SUPPLY VOLTAGE

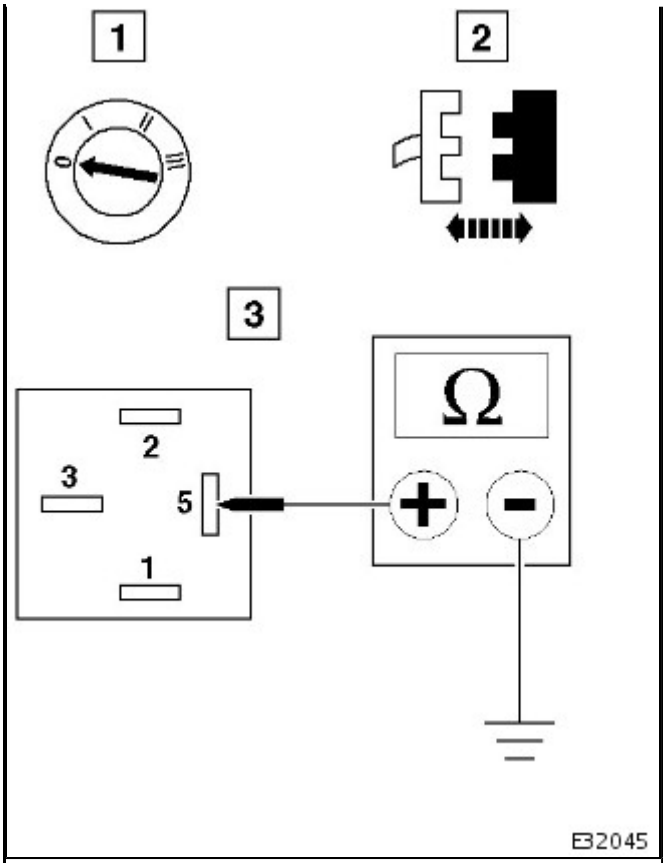
• NOTE: Do not replace relay.



	1 With relay 1 removed, check for battery voltage at relay socket between pins 3 and 5.
	B+ **Yes** GO to B5 **No** GO to B11

B5: CHECK CIRCUIT CONTINUITY

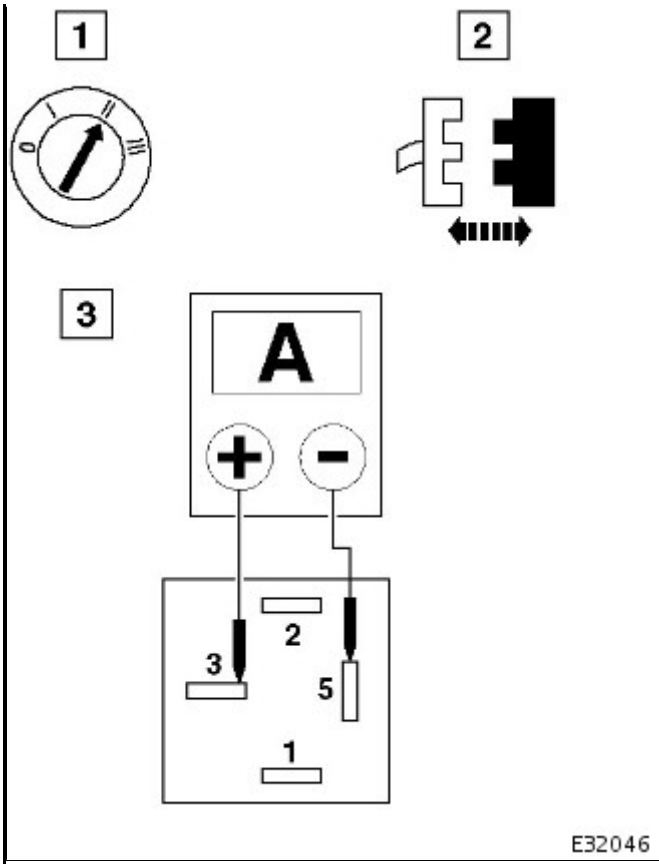
• NOTE: Do not replace relay.



	1 Measure the resistance between relay socket pin 5 and ground BT020L.
	Is the resistance < 10OHM? **Yes** GO to B6 **No** GO to B10

B6: CHECK FUEL PUMP DRAWN CURRENT

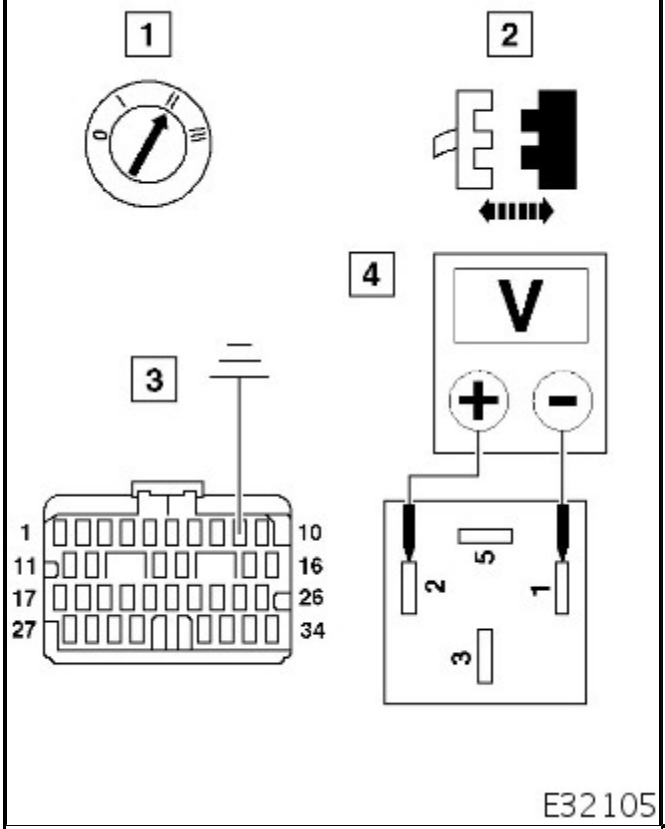
- NOTE: With EM013 disconnected this test will cause the pump to operate continuously. Do not exceed 10 sec running.
- NOTE: Do not replace relay.



	1 With the ignition energized, measure the current drawn between relay socket pins 3 and 5.
	Is the current between 2.5 and 9 A? **Yes** GO to B7 **No** GO to B10

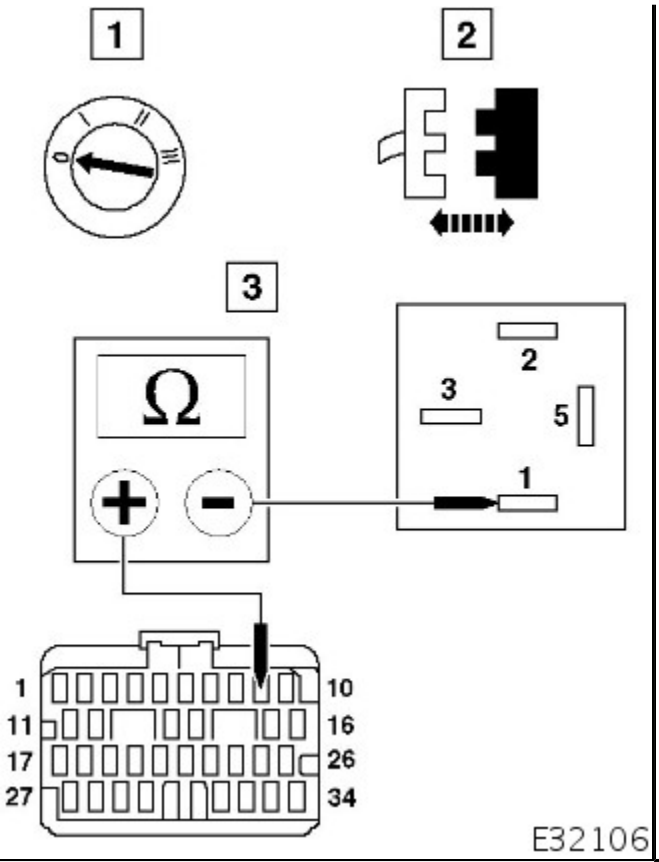
B7: CHECK B+ AT RELAY COIL

- NOTE: Do not replace relay



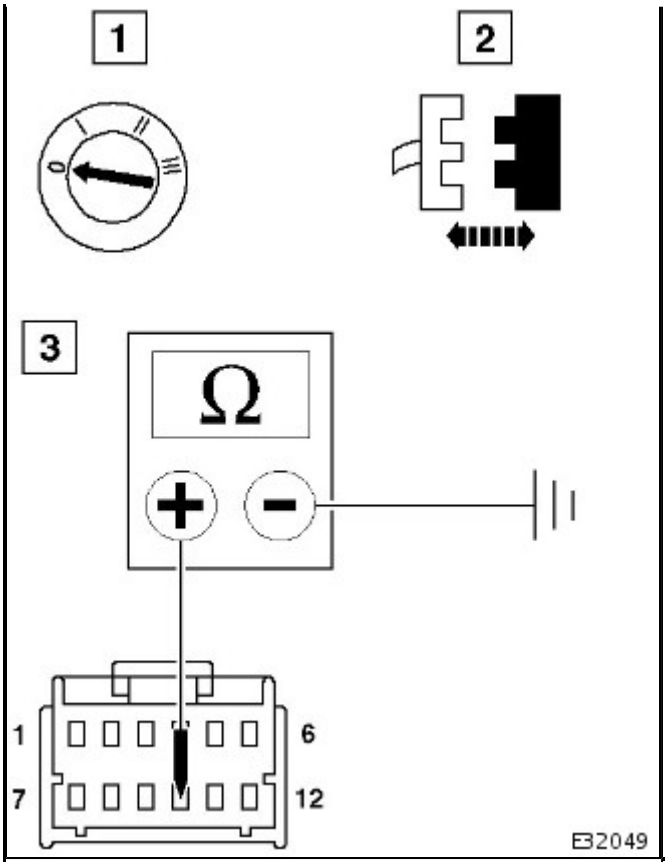
	1 Using a link lead, connect EM013/009 to ground BT020L.
	2 With ignition energized, check for battery voltage at relay socket between pins 2 and 1.
	B+? **Yes** GO to B10 **No** GO to B8

B8: CHECK RELAY COIL CIRCUIT CONTINUITY



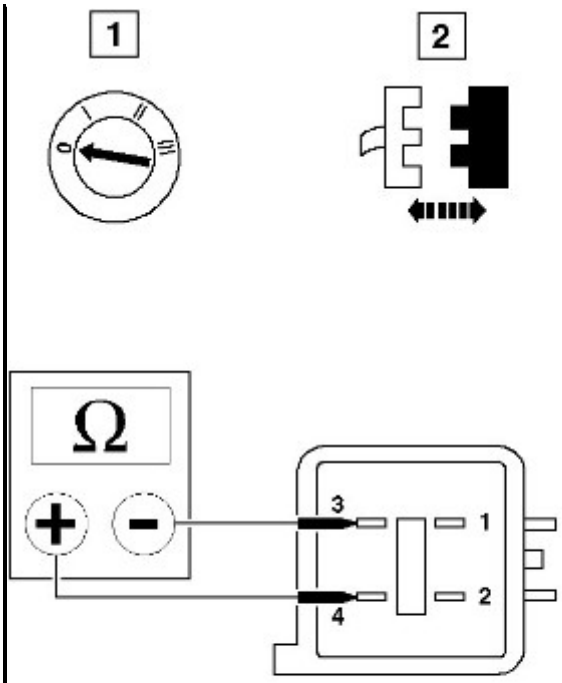
	1 With EM013 disconnected, measure the resistance between EM013/009 and relay socket pin 1
	Is the resistance < 0.5 OHM? **Yes** GO to B9 **No** Inspect connectors EM013, EM051/008, LS003/21, BT004/009 and BT010/005 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation

B9: CHECK ECM GROUND CONTINUITY



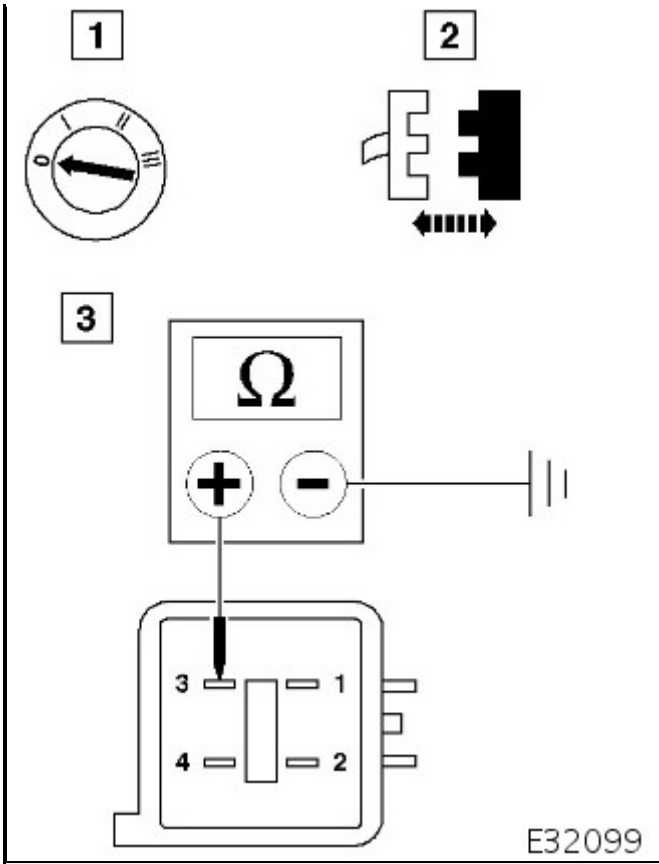
	1 With EM014 disconnected, measure the resistance between EM014/010 and ground EM016L.
	Is the resistance < 0.5 OHM? **Yes** STOP, renew the relay and test the system for normal operation. **No** Inspect harness / connectors EM014, splice EMS37 and ground EM016L for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

B10: CHECK FUEL PUMP CONTINUITY



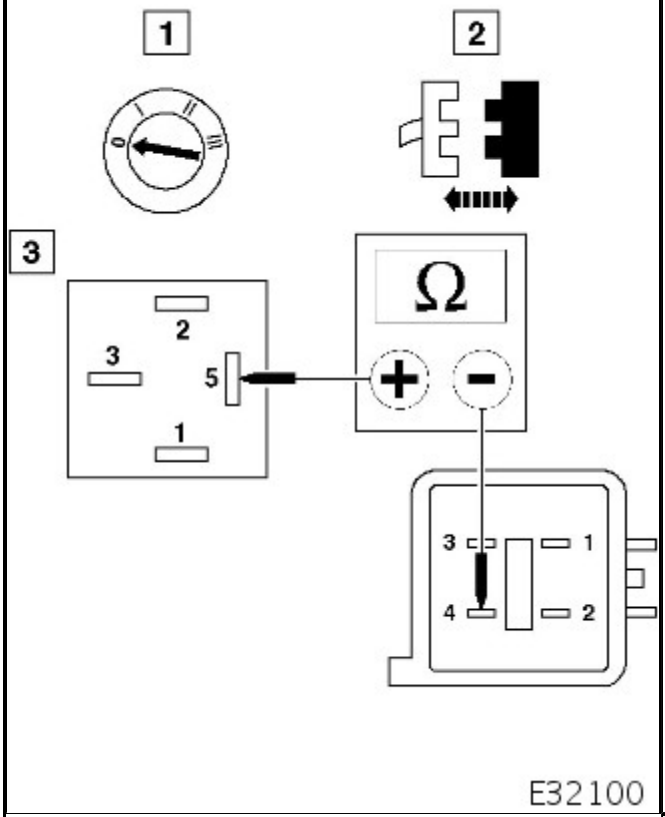
	1 With BT009 disconnected, measure the resistance across the fuel pump connectors reference BT009/003 and BT009/004.
	Is the resistance < 5 OHM? **Yes** GO to B11 **No** Renew the fuel pump and test the system for normal operation.

B11: CHECK FUEL PUMP GROUND CONTINUITY



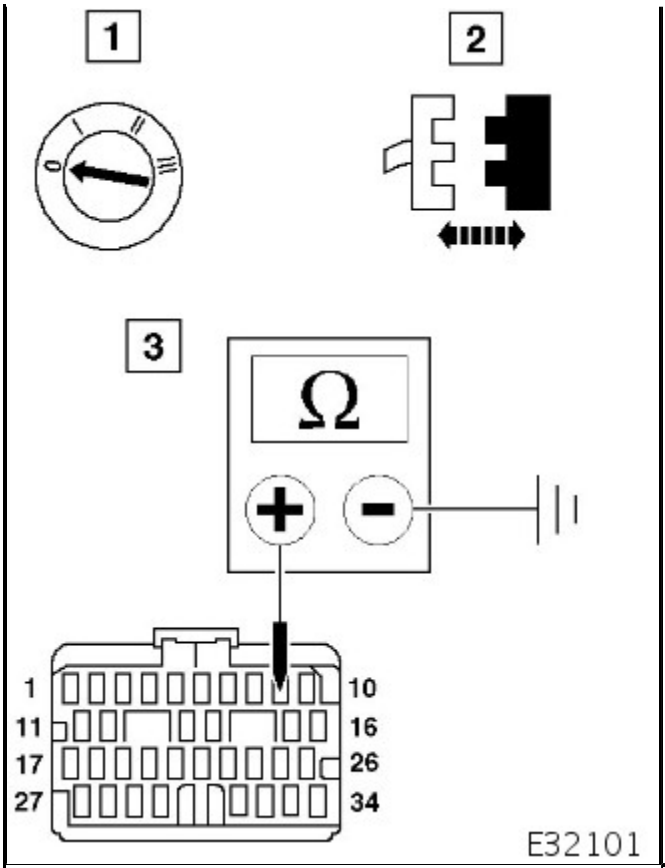
	1 With BT009 disconnected, measure the resistance between BT009/003 and ground BT020L.
	Is the resistance < 0.5 OHM? **Yes** GO to B12 **No** Inspect harness / connector BT009, splice BTS021 and ground BT020L for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

B12: CHECK CIRCUIT CONTINUITY



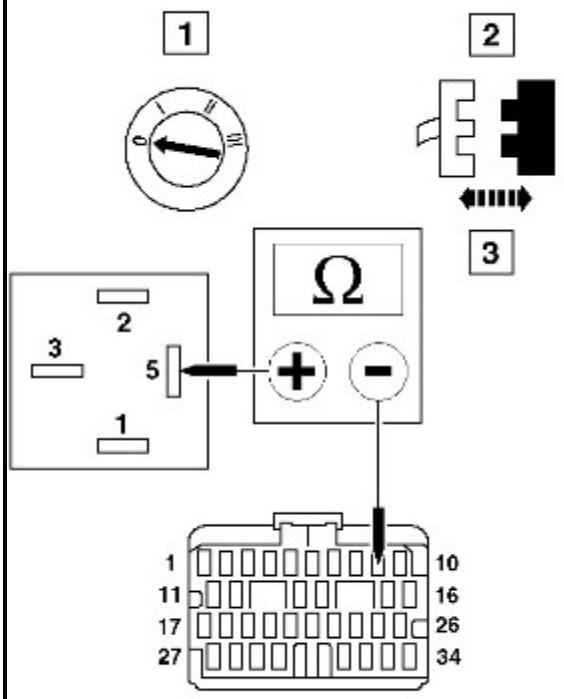
	1 With BT009 disconnected and relay 1 removed, measure the resistance between BT009/004 and relay socket pin 5.
	Is the resistance < 0.5 OHM? **Yes** GO to B13 **No** Inspect harness / connector BT009, fuse holder F15 and BT012/002 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

B13: CHECK HARNESS SHORT TO GROUND



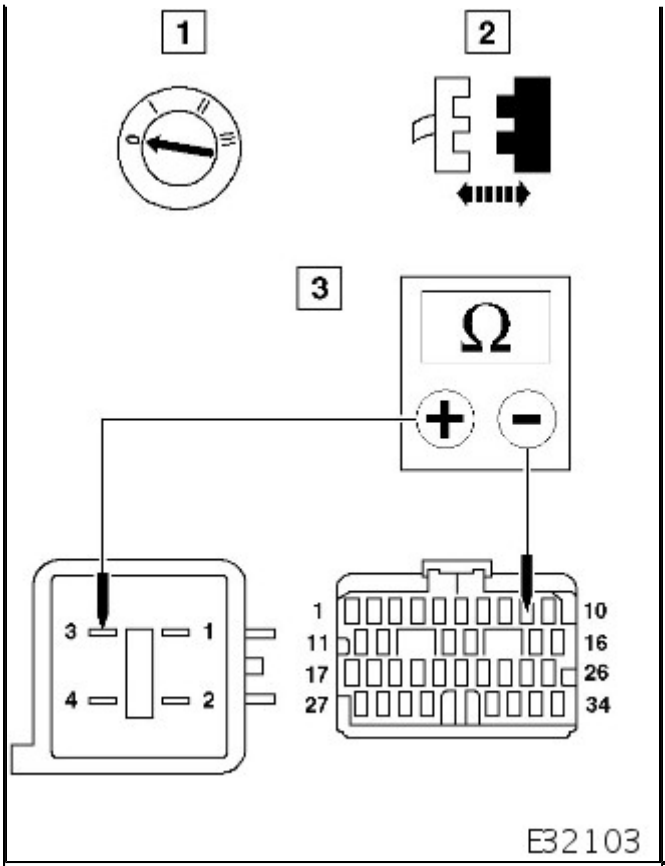
	1 With EM013 and BT009 disconnected, measure the insulation resistance between EM013/009 and ground BT020L.
	Is the resistance > 10M OHM? **Yes** Do not replace relay or reconnect connectors GO to B14 **No** Inspect harness / connectors EM013, EM051/008, LS003/021, BT004/009 and BT010/005 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

B14: CHECK CORE TO CORE INSULATION



	1 With conditions as B13, measure the insulation resistance between EM013/009 and relay socket pin 5.
	Is the resistance > 10M OHM? **Yes** GO to B16 **No** Inspect harness / connectors EM013, EM051/008, LS003/021, BT004/009, BT012/002, BT009/004 and BT010/005 for corrosion, damage, bent or pushed back pins and repair as required. Test the system for normal operation

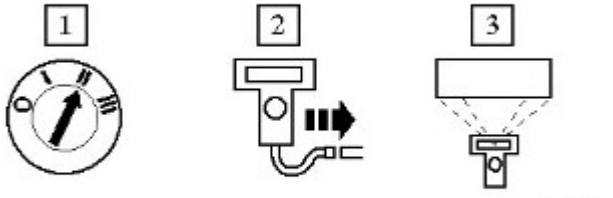
B15: CHECK CORE TO CORE INSULATION



	1 With conditions as in B14, measure the insulation resistance between EM013/009 and BT009/003.
	Is the resistance > 10M OHM? **Yes** Reconnect all plugs and replace relay 1. GO to B16 **No**
B16: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Pinpoint test C: P0460

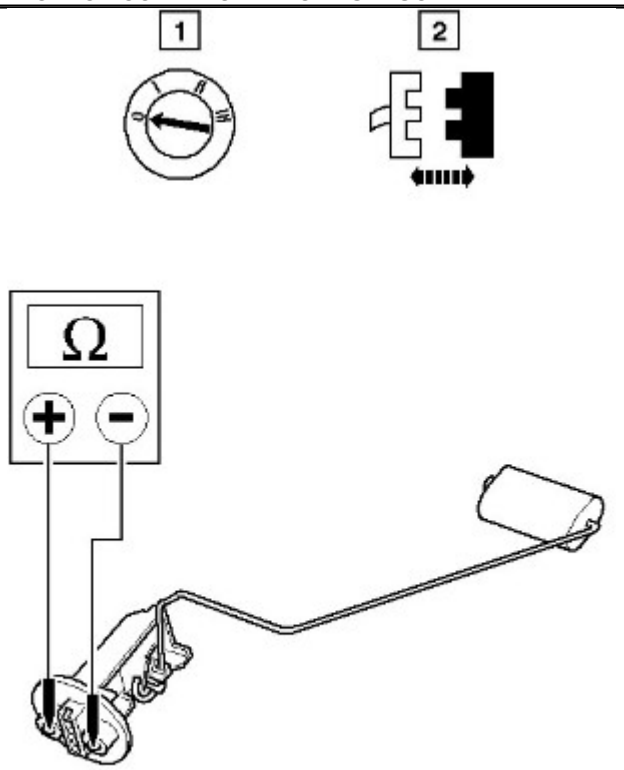
PINPOINT TEST C : C: P0460	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: RETRIEVE DTCS	
• NOTE: Battery and or ECM disconnection prior to scanning will erase all data, ensure that the correct DTC is present.	



E32153

	1 Connect the scan tool
	Have the DTC(s) and freeze frame data been recorded? **Yes** GO to C2

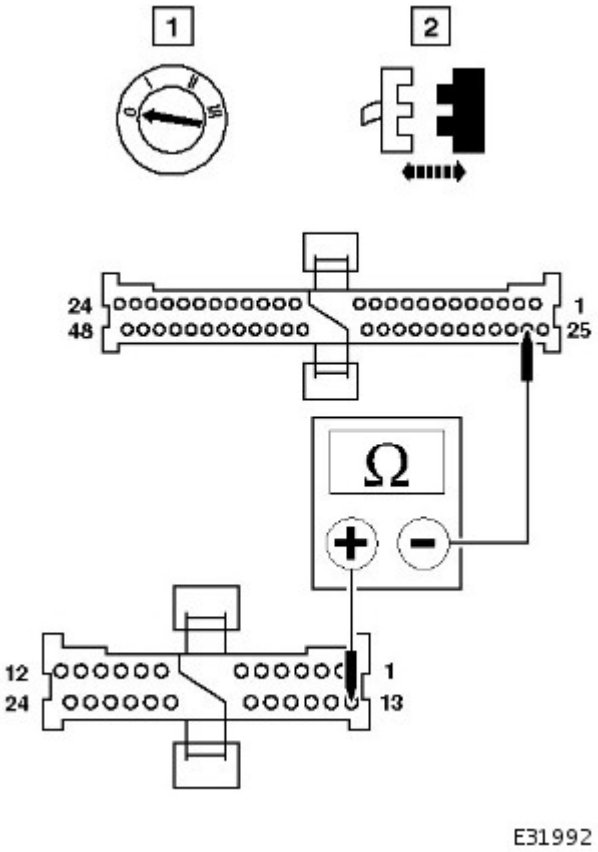
C2: CHECK CONTINUITY FUEL SENSOR



E31991

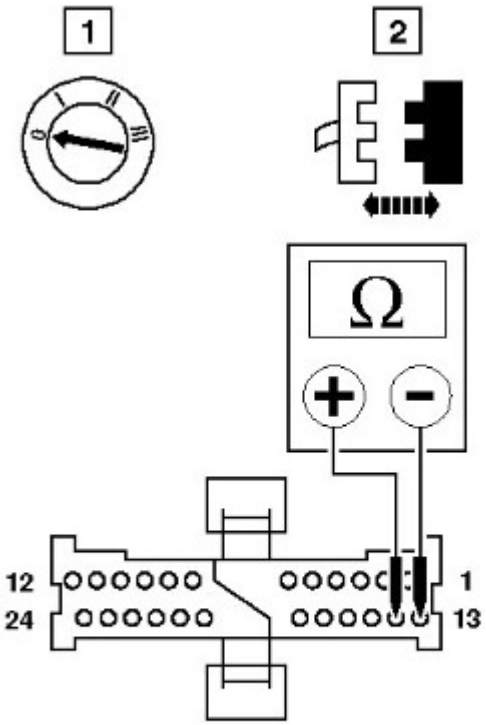
	1 With connectors BT014 and BT015 disconnected check the resistance between the fuel level sensor pins.
	Is the resistance >70 and <1000 OHM? **Yes** GO to C3 **No** Renew the level sensor and test the system for normal operation.

C3: CHECK FOR SHORT TO GROUND



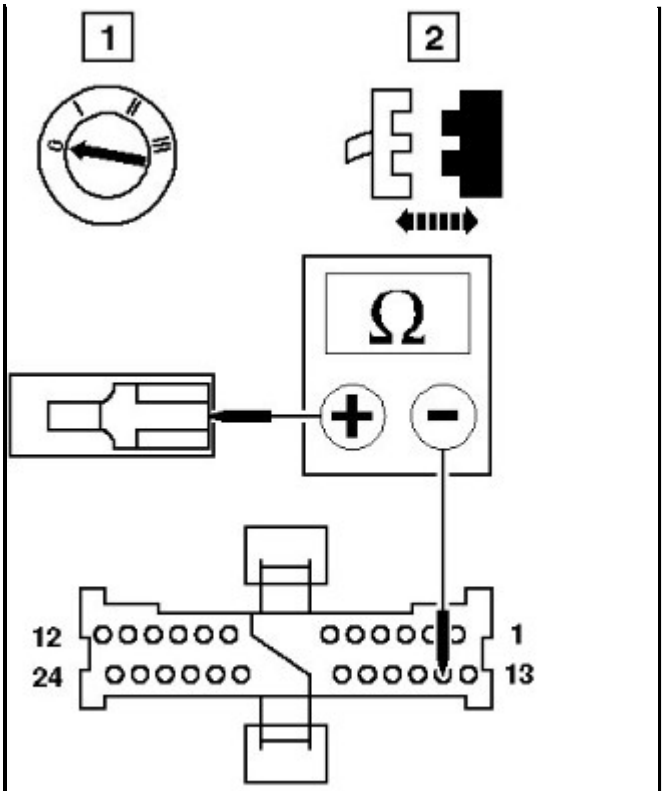
	1 With connectors FC025, FC024, BT014 and BT015 disconnected measure the insulation resistance between FC025/013 and FC024/026.
	2 Repeat for FC025/014 and FC024/026
	Is the resistance > 10 MOHM? **Yes** GO to C4 **No** Inspect harness / connectors FC025, FC024, FC001, BT004, BT014 and BT015 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

C4: CHECK CORE TO CORE INSULATION



	1 With connectors FC025, FC024, BT014 and BT015 disconnected measure the insulation resistance between FC025/013 and FC025/014.
	Is the resistance > 10 MOHM? **Yes** GO to C5 **No** Inspect harness / connectors FC025, FC024, FC001, BT004, BT014 and BT015 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

C5: CHECK GROUND CONTINUITY



1 With connectors FC025, FC024 and BT015 disconnected measure the resistance between FC025/014 and BT015.

Is the resistance < 0.5 OHM?

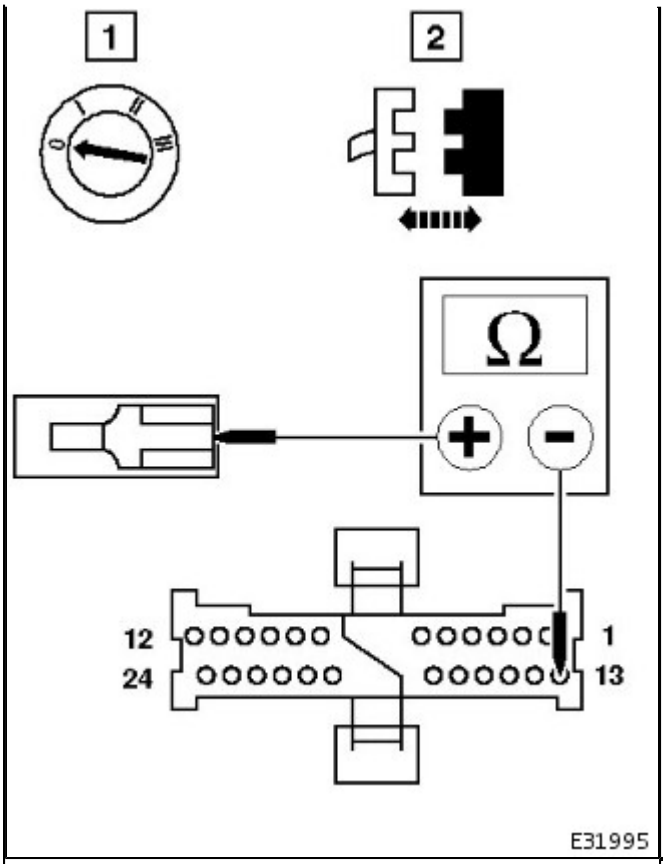
Yes

GO to C6

No

Inspect harness / connectors / pins FC025, FC001/007, BT004/026 and BT015 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.

C6: CHECK SIGNAL CONTINUITY



	1 With connectors FC025, FC024, and BT014 disconnected measure the resistance between FC025/013 and BT014.
	Is the resistance < 0.5 OHM? **Yes** GO to C7 **No** Inspect harness / connectors / pins FC024, FC001/004, BT004/025 and BT014 for corrosion, damage, bent or pushed back pins. Repair as required and test the system for normal operation.
C7: END	
	1 Perform appropriate service drive cycle and check for the presence of DTC.
	Has the fault code cleared? **Yes** STOP **No** Contact Jaguar Service

Fuel Tank and Lines - Fuel Level Sensor

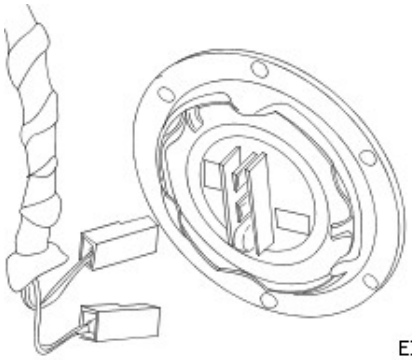
Removal and Installation

Removal

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

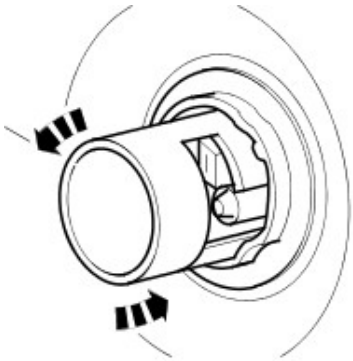
   Remove the battery. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. Drain the fuel tank using a suitable suction pump/tanker. If the On-board Refueling Vapour Recovery (ORVR) system is fitted, refer to Section 310-00 Fuel System - General Information.
3. Remove the trunk front liner. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
4. Disconnect the harness connections to the sensor.



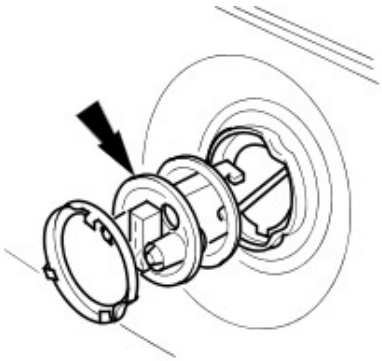
E35293

5. Using special tool 18G 1001, remove the sensor retaining ring.



E35297

6. Remove the sensor assembly and discard the seal.



E35299

Installation

1. Fitting a new level sensor is the reverse of the removal procedure, noting that a new seal must be fitted.

Fuel Tank and Lines - Fuel Pump

Removal and Installation

Removal

1. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

Remove the battery. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

2. Drain the fuel tank using a suitable suction pump/tanker. If the On-board Refueling Vapour Recovery (ORVR) system is fitted, refer to Section 310-00 Fuel System - General Information.

3. Remove the fuel tank. For additional information, refer to Fuel Tank in this section.

4. Remove the fuel tank evaporative loss flange sealing ring. For additional information, refer to Section 303-13 .

5. Remove fuel feed hose from tank.

- Using special tool JD175, slacken fuel feed hose to tank stub securing clip.
- Disconnect hose from tank stub.

6. Remove fuel pump assembly.

- Release bolt securing fuel pump mounting bracket and place assembly to front.
- Slacken securing clip and disconnect hose from fuel pump.
- Remove link lead from fuel pump.
- Remove pump.

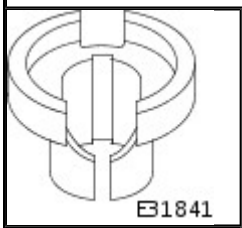
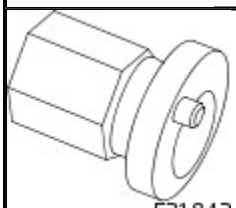
Installation

1. NOTE: Install new sealing ring to evaporative loss flange. For additional information, refer to Section 303-13 .

Installation is the reverse of the removal procedure.

Fuel Tank and Lines - Fuel Tank

Removal and Installation

Special Tool(s)	
 E31841	Release tool 5/16" snap coupling 310-054
 E31842	Fuel tank retaining strap cam adjuster 310-094

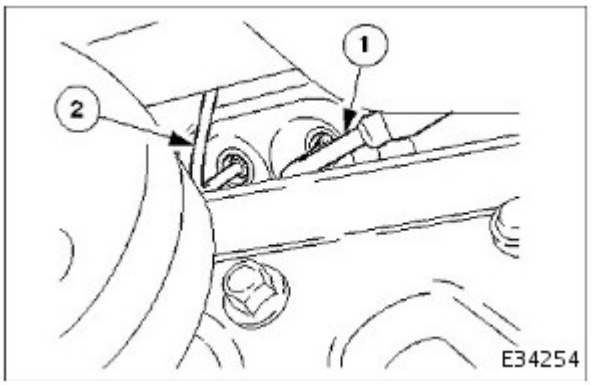
Removal

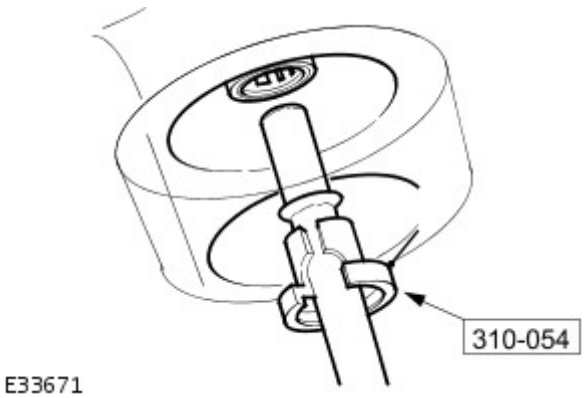
• NOTE: This removal/installation procedure is applicable to all tank assembly variants.

1. Remove the battery. For additional information, refer to Section 414-01 Battery, Mounting and Cables.
2. Remove the trunk floor carpet.
3. Remove the trunk front liner. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
4. Remove the rear lamp assembly interior trim finisher. For additional information, refer to Section 417-01 Exterior Lighting.
5. Remove the trunk seal retainer. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
6. Remove the trunk side liner, lefthand. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
7. WARNING: BEFORE PROCEEDING, IT IS ESSENTIAL THAT THE WARNING NOTES GIVEN IN SECTION 100-00 (UNDER THE HEADING 'SAFETY PRECAUTIONS') ARE READ AND UNDERSTOOD.

   Remove the trunk side liner, righthand. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.
8. Drain the fuel tank using a suitable suction pump/tanker. If the On-board Refueling Vapour Recovery (ORVR) system is fitted, refer to Section 310-00 Fuel System - General Information.
9. From under the vehicle, identify the fuel feed and return tank/pipe connections which are located above and slightly to the rear of the rear axle assembly.

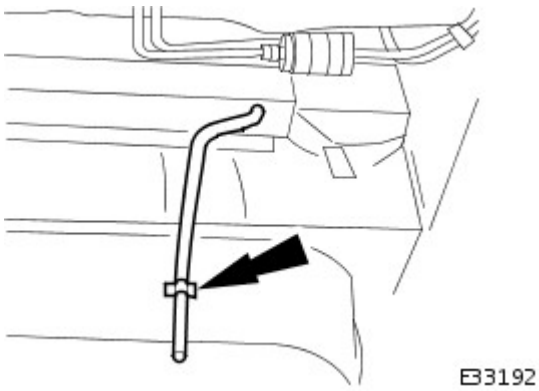
   1. Locate the fuel feed pipe.
   2. Locate the fuel return pipe.



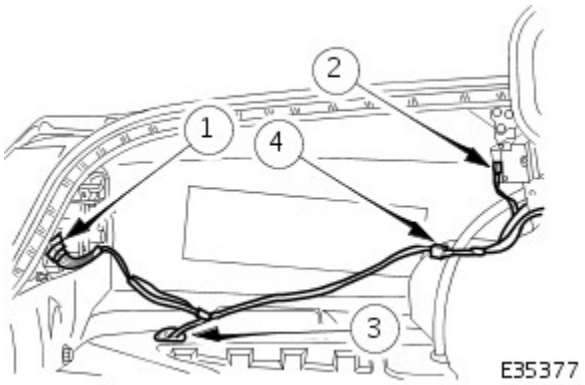


10. Disconnect the fuel feed and return pipes from the fuel tank

- Fit special tool JD-203 around the pipe as shown. Press the tool in between the fuel pipe and tank connector to release the quick-fit tangs. While holding the tool firmly in, pull out the fuel pipe.
- Repeat for the second pipe.
- Plug the tank outlet connectors and the fuel pipes.



11. From the underside of the vehicle, release the fuel filler latch box drain pipe from the clip on the spare wheel well.

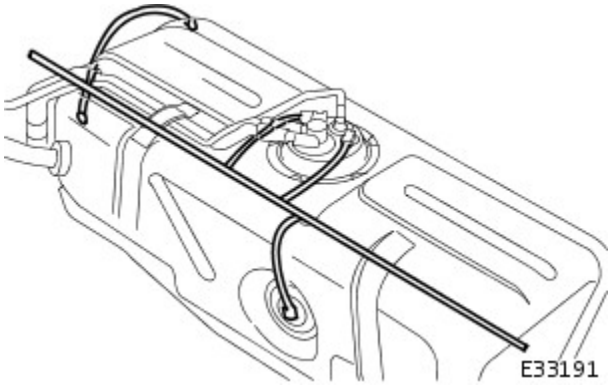


12. Disconnect and reposition the trunk harness if it is routed between the filler tube and the tank breather or pressure relief pipe.

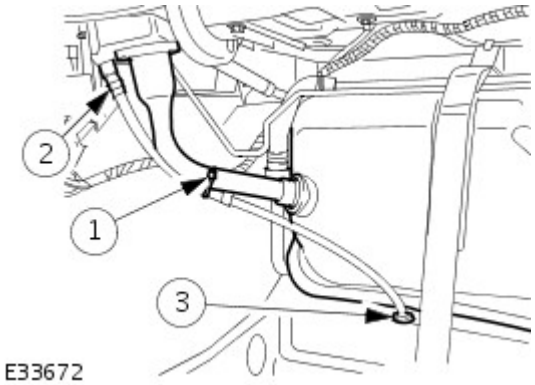
1. Disconnect the lefthand rear lamp harness connector.
2. Disconnect the fuel flap lock actuator connector.
3. If fitted, disconnect the lefthand side marker lamp connector and harness from the underside of the vehicle. Withdraw the marker lamp harness and grommet through the trunk floor access hole.
4. Release the harness securing clip from the mounting bracket.

- Withdraw the trunk harness from between the filler tube and the breather pipe or pressure relief pipe.

13. Disconnect the tank harness connections.

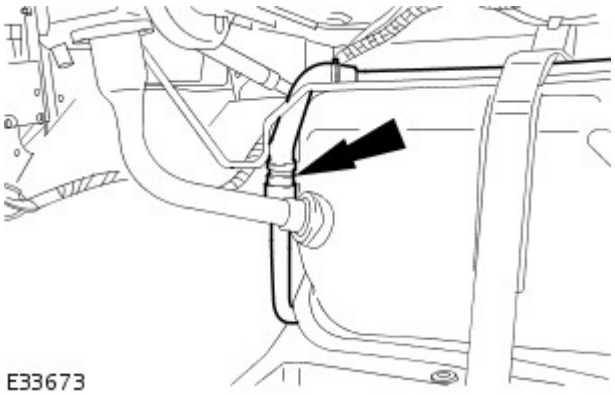


1. If fitted, disconnect the wiring to the accelerometer.
2. Disconnect the wiring to the fuel level sensor harness.
3. Disconnect the wiring to the fuel pump connector.
4. If fitted, disconnect the wiring to the pressure sensor connector.



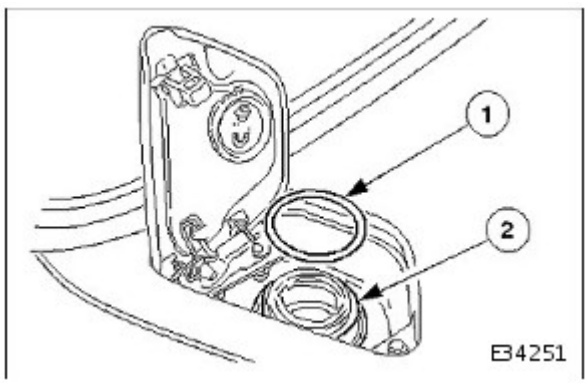
14. Remove fuel filler latch box drain pipe.

1. Cut and remove the ratchet strap securing the drain pipe to the filler tube.
2. Disconnect the drain pipe from the fuel filler latch box.
3. Pull the drain pipe through the body grommet and remove.



15. Disconnect the vapour outlet pipe.

- Release the quick-fit coupling .
- Plug the vapour pipes.



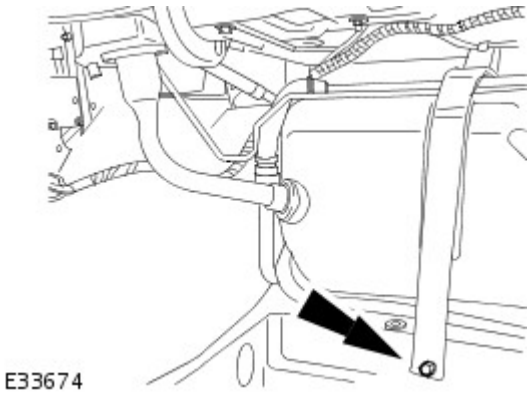
16. Disconnect the fuel filler latch box from the filler tube.

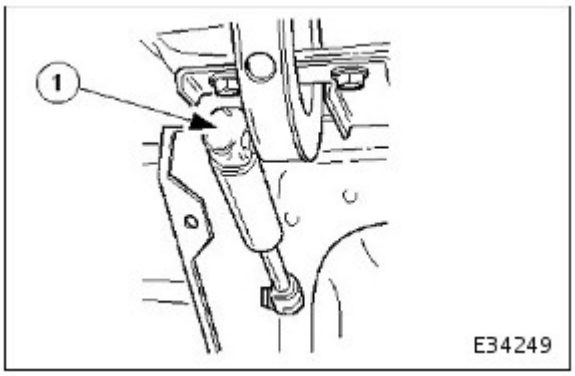
- Open the fuel filler flap and remove the filler cap.

1. Remove the spring ring securing the fuel filler latch box to the filler neck.
2. Pull the fuel filler latch box free of the filler tube.

17. Detach the tank retaining straps.

- Tape or tie the two retaining straps/brackets to the rear scuttle to allow tank removal.

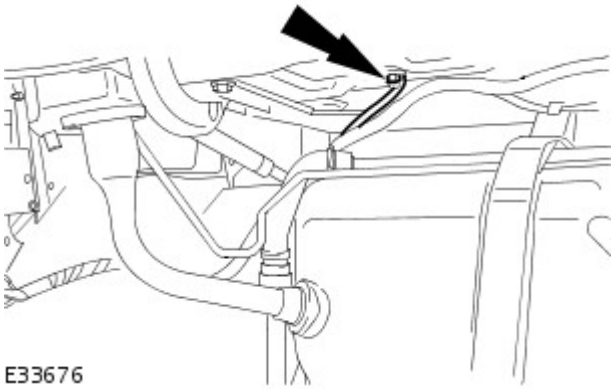

E33674



18. On non-ORVR vehicles, disconnect the trunk lid lefthand strut rear pivot.

- Place a suitable support under trunk lid or tie to exterior mirror.

1. Using a screwdriver, release clip at rear end of strut, withdraw end from trunk lid pivot and lower strut.

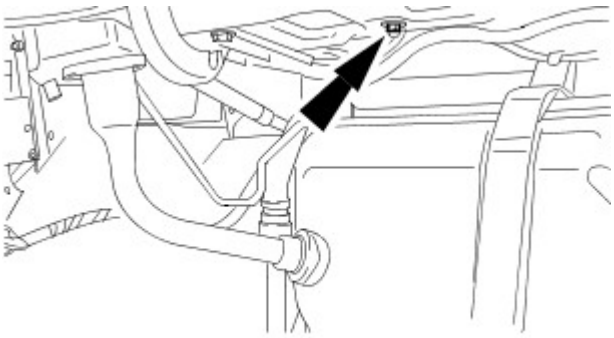

E33676

19. Disconnect the tank ground cable from the vehicle body.

20. Remove the tank from the vehicle.

21. Drain any remaining fuel from the tank.

Installation


E33675

1. Fit the fuel tank assembly.

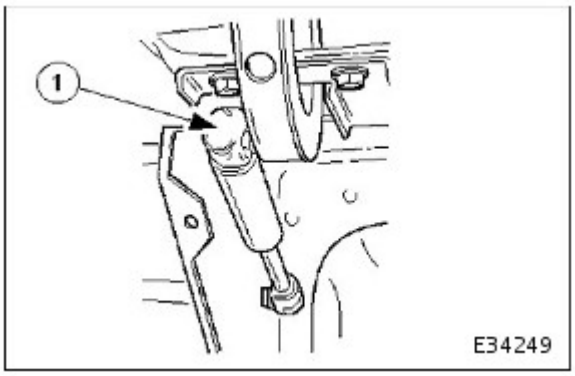
2. Re-connect the tank ground cable to the vehicle.

- Tighten to 12 Nm.

3. On non-ORVR fuel tanks, position the trunk lid lefthand strut between the filler tube and the breather pipe.

4. Fully seat the tank into position, ensuring that no harness wiring is trapped.

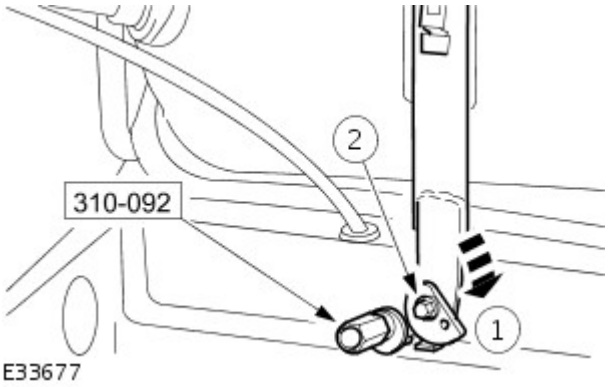
5. On non-ORVR vehicles, reconnect the trunk lid lefthand strut rear pivot.



1. Fit the retaining clip on to the end of the trunk lid strut and fit the strut to the trunk lid pivot. Re-position retaining clip to secure the strut.

- Remove any temporary trunk lid supports and check that the lid operates correctly.

6. NOTE: Make sure the special tool locating peg is correctly installed to the cam.



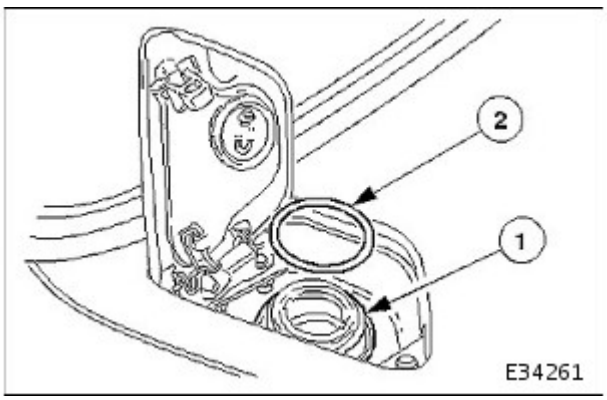
Using the special tool, tighten the fuel tank retaining straps.

1. Rotate the cam clockwise to a torque of 6 Nm.

• NOTE: Using an open ended wrench, maintain the torque on the special tool.

2. Tighten the fuel tank retaining strap bolt to 25 Nm.

7. Connect the filler neck to the fuel filler latch box seal.

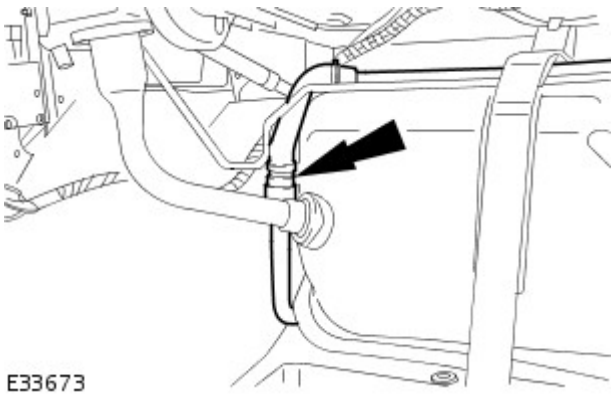


1. Fit the fuel filler latch box seal over the filler neck.

2. Secure with the spring ring

- Fit the fuel filler cap.

8. Connect the vapour outlet pipe.



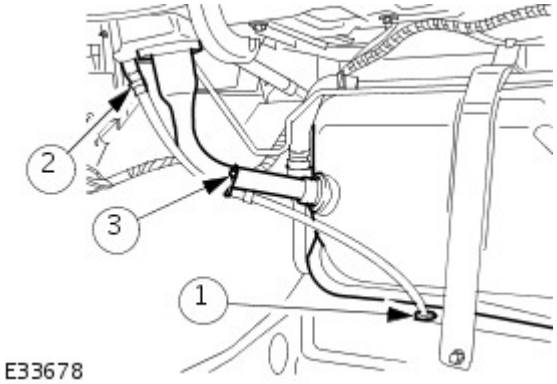
- Unplug the vapour pipes.

- Reconnect the tank and underfloor vapour pipes via the quick-fit coupling .

9. Fit the fuel filler latch box drain pipe.

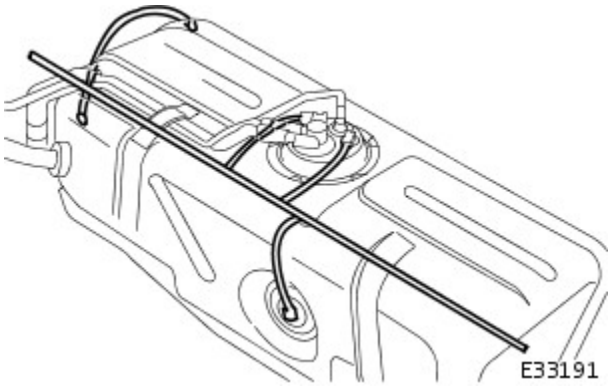
1. Feed the drain pipe through the floor grommet.

2. Connect the drain pipe to the fuel filler latch box stub



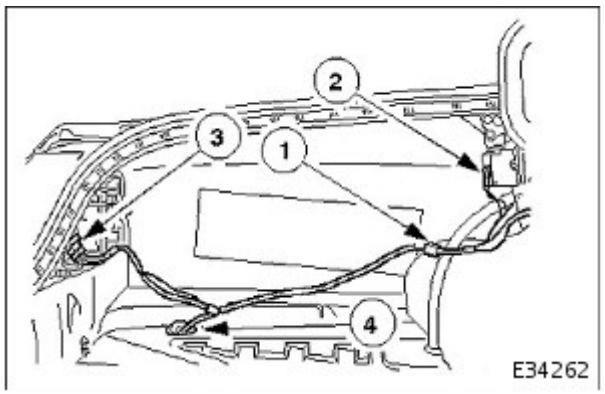
pipe.

3. Tie the drain pipe to the filler tube using a ratchet strap. Trim strap.



10. Reconnect the trunk harness connections.

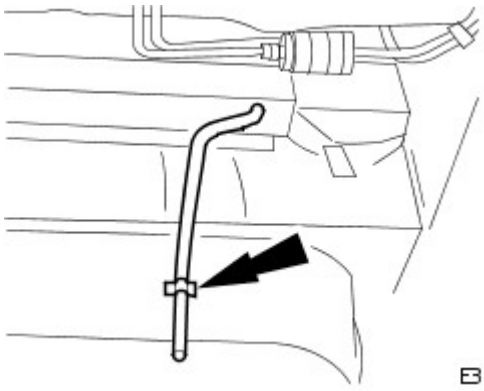
1. If fitted, connect the wiring to the accelerometer.
2. Connect the wiring to the fuel level sensor harness.
3. Connect the wiring to the fuel pump connector.
4. If fitted, connect the wiring to the pressure sensor connector.



11. Reconnect the lefthand side trunk harness if it has been necessary to move it for access. Route the harness behind both the filler tube and breather or pressure relief pipe.

1. Fit the harness securing clip to the mounting bracket.
2. Connect the fuel flap lock actuator connector.
3. Connect the lefthand rear lamp harness connector.
4. If applicable, feed the side marker lamp harness through the access hole in the floor and reseat the sealing grommet.

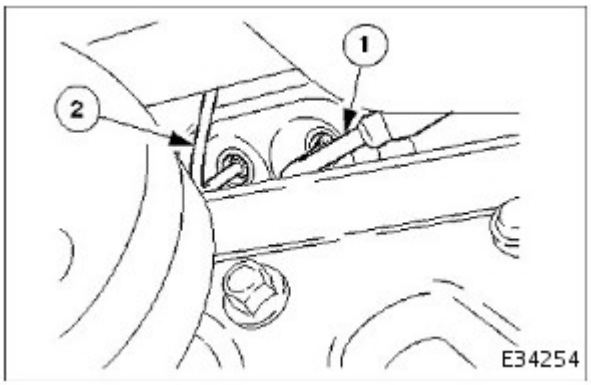
- On the underside of the vehicle, fit the side marker lamp connector and fix the harness to the securing clips.



12. On the underside of the vehicle, fit the drain pipe to the securing clip.

13. On the underside of the vehicle, reconnect the fuel feed and return pipes.

- Remove the plugs from the tank and fuel feed and return



pipes.

1. Push the fuel feed pipe into the quick-fit tank connector. Ensure the pipe is fully home.
2. Push the fuel return pipe into the quick-fit tank connector. Ensure the pipe is fully home.

14. Fit the trunk side liner, lefthand. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

15. Fit the trunk side liner, righthand. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

16. Fit the trunk seal retainer. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

17. Fit the rear lamp assembly interior trim finisher. For additional information, refer to Section 417-01 Exterior Lighting.

18. Fit the trunk front liner. For additional information, refer to Section 501-05 Interior Trim and Ornamentation.

19. Fit the trunk floor carpet.

20. Ensure that the fuel feed pipes in the engine compartment are reconnected after tank draining.

21. Re-fit the battery. For additional information, refer to Section 414-01 Battery, Mounting and Cables.

22. Carry out a leak test of the evaporative emissions system.

Acceleration Control - Accelerator Cable

Removal and Installation

Removal

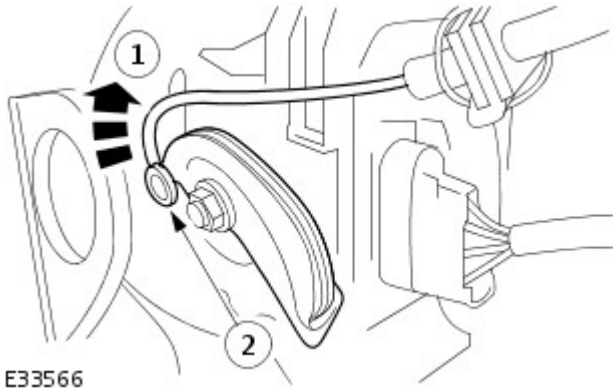
1. Disconnect the battery ground cable.

2. Remove the windshield and wiper arm assembly.

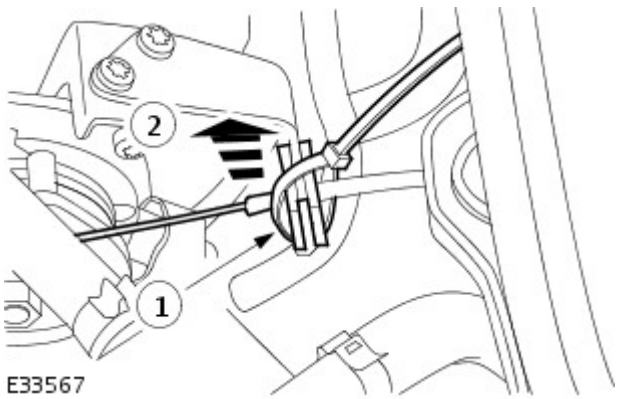
3. Remove the plenum chamber finisher, refer to 76.10.01.

4. Disconnect the throttle cable from the electronic throttle assembly quadrant.

1. Rotate the throttle quadrant to release the cable.
2. Disconnect the throttle cable from the electronic throttle assembly quadrant.



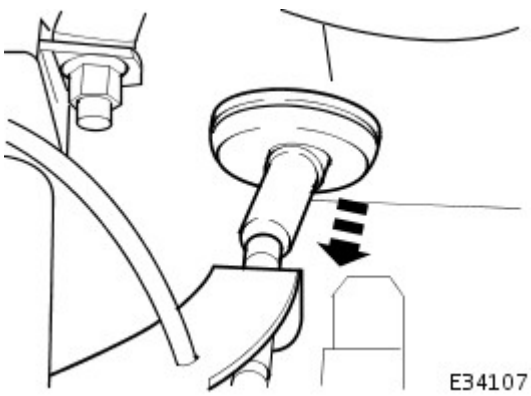
E33566



E33567

5. Displace the outer cable from the abutment bracket.

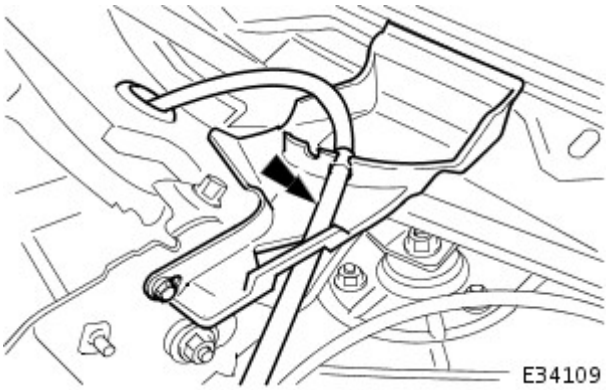
1. Cut the retaining strap.
2. Displace the outer cable from the abutment bracket.


E34107

6. Release the grommet from the plenum chamber closing plate and route the cable/grommet through the aperture.

7. Remove the throttle cable from the bulkhead retaining clip.



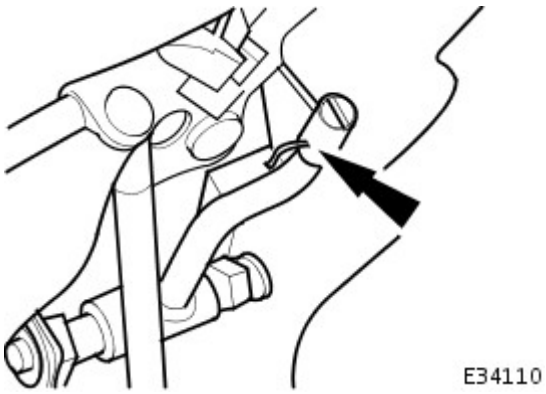


8. Route the throttle cable through the water deflector bracket.

9. Ensure the drivers seat is fully rearward.

10. Remove the A-Pillar lower trim pad.

11. Disconnect the throttle cable from the pedal.



1. Remove the throttle cable split pin.
2. Remove the throttle cable retaining sleeve.
3. Disconnect the throttle cable.

12. From under the hood, remove the cable from the vehicle.

Installation

1. Installation is the reverse of the removal procedure.

- Adjust the throttle cable, refer to 19.20.08.

Acceleration Control - Accelerator Cable Adjustment

General Procedures

1. Load the Approved Jaguar Diagnostic System with power train data logger.
2. Connect the Approved Jaguar Diagnostic System to the vehicle.
3. With 'Disable Network Integrity Test - YES/ NO' displayed on the screen select YES.
4. With new menu displayed on the screen, select ' Engine Management'.
5. Turn the ignition to ON.
   - Remove any previously selected data logger parameters.
6. On data logger select PPS11 and PPS2 (Pedal demand sensors 1 and 2).
7. On Sedan models only, remove the bulkhead covers on both sides and the engine compartment rear cover.
8. Cut, remove and discard the ratchet strap which retains the throttle cable to the abutment bracket.
9. Ensure there is no tension on the throttle cable by releasing the throttle cable adjustment nut from the abutment bracket.
10. Record the voltages for both sensors, PPS11 and PPS2.
11. Partially insert the throttle cable adjustment nut into the abutment bracket.
12. Recheck the voltages for both sensors, PPS11 and PPS2.
13. Where the voltages at step 12 are higher than the voltages taken at step 10, continue to step 15 below.
14. Where the voltages at step 12 are the same as the voltages taken at step 10, continue to step 16 below.
15. Rotate the adjustment nut clockwise (as viewed from the front of the vehicle) until the same voltages are indicated as in step 10. Continue to turn through a part revolution until the sides of the nut are vertical. Turn through a further 90 degrees, then fully insert the nut into the abutment bracket.
16. Rotate the adjustment nut anti-clockwise (as viewed from the front of the vehicle) until the indicated voltage starts to increase. Then rotate the nut clockwise through a part revolution until the sides are vertical. Turn through a further 90 degrees, then fully insert the nut into the abutment bracket.
17. Fit a new ratchet strap to secure the throttle cable adjusting nut to the abutment bracket.
18. Operate the throttle pedal through 20 full cycles to settle the cable. Check the voltages now shown, remain the same as in steps 15 and 16.
19. Check and where necessary adjust the kickdown switch. For additional information, refer to Section 307-05A Automatic Transmission/Transaxle External ControlsSection 307-05B Automatic Transmission/Transaxle External Controls.
20. On Sedan models only, refit the engine compartment rear cover and the bulkhead covers on both sides.
21. Switch the ignition OFF and disconnect the Approved Jaguar Diagnostic System.

Speed Control - Speed Control

Diagnosis and Testing

Principles of operation

The speed (cruise) control system is activated by an **ON / OFF** master switch in the J-gate surround, which has an integral LED to indicate status.

The steering wheel switches allow the driver to set the speed, increase or decrease the selected speed, cancel and resume the facility without his/her hand ever leaving the steering wheel

The vehicle speed can be increased and decreased in increments of 2 kmh (1 mph) by briefly pressing the **+** or **-** buttons up to a maximum of five times.

Alternatively, the **+** or **-** button can be held until the desired speed is reached.

The selected speed (by whichever method) will be displayed in the message center.

The system will not function at speeds below 26 kmh (16 mph), and can be cancelled from the master switch, the steering wheel switches, and by depressing the brake pedal. The system can be overridden by accelerating as normal.

Inspection and Verification

1. **1.** Verify the customer concern.
2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.
3. **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. **4.** If the cause is not visually evident, verify the symptom, check for DTCs and follow the routines in this section.

Visual Inspection Chart

Mechanical	Electrical
• Throttle body mechanism	• Throttle body actuator • Module • Switch(es) • Instrument cluster

Diagnostic Trouble Code (DTC) index

DTC	Description	Possible Source	Action
P0566	Speed control **CANCEL** switch ON fault	• Speed control switches internal steering wheel short circuit to ground • Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **CANCEL** switch failure (stuck ON)	For **CANCEL** switch circuit tests,GO to Pinpoint Test A.
P0567	Speed control **RESUME** switch ON fault	• Speed control switches internal steering wheel short circuit to ground • Steering wheel cassette reel short circuit to ground • Cassette reel to ECM circuit short circuit to ground • **RESUME** switch failure (stuck ON)	For **RESUME** switch circuit tests,GO to Pinpoint Test B.
P0568	Speed control switch ground malfunction	• Speed control switches internal steering wheel open circuit • Steering wheel cassette reel open circuit or high resistance • Cassette reel to ECM circuit open circuit or high	For **ACCEL / DECEL** switch circuit tests,GO to Pinpoint Test C.

		resistance ● **ACCEL / DECEL** switch failure	
P0569	Speed control **DECEL / SET (SET-)** switch ON fault	● Speed control switches internal steering wheel short circuit to ground ● Steering wheel cassette reel short circuit to ground ● Cassette reel to ECM circuit short circuit to ground ● **DECEL / SET** switch failure (stuck ON)	For **DECEL / SET (SET-)** switch circuit tests,GO to Pinpoint Test D.
P0570	Speed control **ACCEL / SET (SET+)** switch ON fault	● Speed control switches internal steering wheel short circuit to ground ● Steering wheel cassette reel short circuit to ground ● Cassette reel to ECM circuit short circuit to ground ● **ACCEL / SET** switch failure (stuck ON)	For **ACCEL / SET** circuit tests,GO to Pinpoint Test E.
P1571	Brake switch malfunction	● Brake switch to ECM circuit open circuit, short circuit to ground, high resistance ● Brake switch ignition switched ground circuit open circuit ● Brake switch failure ● Brake cancel switch to ECM circuit open circuit, short circuit to ground, high resistance ● Brake cancel switch to speed control switch circuit open circuit, short circuit to ground, high resistance ● Brake cancel switch ignition switched power supply open circuit ● Brake cancel switch failure ● Speed control switch failure	For brake switch circuit tests,GO to Pinpoint Test F.

Pinpoint tests

PINPOINT TEST A : DTC P0566; SPEED CONTROL CANCEL SWITCH ON FAULT	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS / RESULTS / ACTIONS**
A1: CHECK THE SPEED CONTROL SWITCHPACK INTERNAL CIRCUITS FOR SHORT TO GROUND	
	1 Disconnect the battery negative terminal.
	2 Disconnect the speed control switchpack electrical connector, SW02.
	3 Reconnect the battery negative terminal.
	4 Measure the resistance between SW02, pin 06 (BO) and GROUND.
	5 Measure the resistance between SW02, pin 03 (SG) and GROUND.
	Is either 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 A2.
A2: CHECK THE SPEED CONTROL CASSETTE REEL FOR SHORT TO GROUND	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM11.
	3 Reconnect the battery negative terminal.
	4 Measure the resistance between SW02, pin 06 (at the cassette reel side of the connector) and GROUND.
	5 Measure the resistance between SW02, pin 03 (at the cassette reel side of the connector) and GROUND.
	Is either 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 A3.
A3: CHECK THE SPEED CONTROL CANCEL SWITCH ACTION	
	1 Measure the resistance between SW02, pin 06 (BO) and SW02, pin 03 (SG).
	2 Operate the speed control **CANCEL** switch.
	Does the resistance vary by 680 ohms? **Yes** Recheck DTCs. No short found. Possible intermittent fault. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST B : DTC P0567; SPEED CONTROL RESUME SWITCH ON FAULT	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
B1: CHECK THE SPEED CONTROL SWITCHPACK INTERNAL CIRCUITS FOR SHORT TO GROUND	
	1 Disconnect the speed control switchpack electrical connector, SW02.
	2 Measure the resistance between SW02, pin 06 (BO) and GROUND.
	3 Measure the resistance between SW02, pin 03 (SG) and GROUND.
	Is either 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 B2.
B2: CHECK THE SPEED CONTROL CASSETTE REEL FOR SHORT TO GROUND	
	1 Measure the resistance between SW02, pin 06 (at the cassette reel side of the connector) and GROUND.
	2 Measure the resistance between SW02, pin 03 (at the cassette reel side of the connector) and GROUND.
	Is either 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 B3.
B3: CHECK THE SPEED CONTROL RESUME SWITCH ACTION	
	1 Measure the resistance between SW02, pin 06 (BO) and SW02, pin 03 (SG).
	2 Operate the speed control **RESUME** switch.
	Does the resistance vary by 430 ohms? **Yes** Recheck DTCs. No short found. Possible intermittent fault. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST C : DTC P0568; SPEED CONTROL SWITCH GROUND MALFUNCTION	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
C1: CHECK FOR CONTINUITY THROUGH STEERING WHEEL CANCEL AND RESUME SWITCHES (SWITCHES OPEN)	
	1 Disconnect the speed control switchpack electrical connector, SW02.
	2 Check for continuity between SW02, pins 06 (BO) and 03 (SG) with the steering wheel switches inactive.

	Is the circuit continuous? **Yes** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation. **No** GO to C2.
C2: CHECK FOR CONTINUITY THROUGH STEERING WHEEL CANCEL SWITCH (SWITCH CLOSED)	
	1 Check for continuity between SW02, pins 06 (BO) and 03 (SG) with the steering wheel **CANCEL** switch operated.
	Is the circuit continuous? **Yes** GO to C3. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.
C3: CHECK FOR CONTINUITY THROUGH STEERING WHEEL RESUME SWITCH (SWITCH CLOSED)	
	1 Check for continuity between SW02, pins 06 (BO) and 03 (SG) with the steering wheel **RESUME** switch operated.
	Is the circuit continuous? **Yes** GO to C4. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.
C4: CHECK FOR CONTINUITY THROUGH STEERING WHEEL + AND - SWITCHES (SWITCHES OPEN)	
	1 Check for continuity between SW02, pins 06 (BO) and 04 (SR) with the steering wheel switches inactive.
	Is the circuit continuous? **Yes** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation. **No** GO to C5.
C5: CHECK FOR CONTINUITY THROUGH STEERING WHEEL + SWITCH (SWITCH CLOSED)	
	1 Check for continuity between SW02, pins 06 (BO) and 04 (SR) with the steering wheel **CANCEL** switch operated.
	Is the circuit continuous? **Yes** GO to C6. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.
C6: CHECK FOR CONTINUITY THROUGH STEERING WHEEL - SWITCH (SWITCH CLOSED)	
	1 Check for continuity between SW02, pins 06 (BO) and 04 (SR) with the steering wheel **CANCEL** switch operated.
	Is the circuit continuous? **Yes** GO to C7. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.
C7: CHECK THE STEERING WHEEL CASSETTE REEL FOR CONTINUITY (CIRCUIT #1)	
	1 Disconnect the steering wheel cassette electrical connector, SW01.
	2 Measure the resistance between SW01, pin 06 and SW02, pin 06 through the cassette reel.
	Is the cassette reel continuous? **Yes** GO to C8. **No** INSTALL a new steering wheel cassette. CLEAR the DTC. TEST the system for normal operation.
C8: CHECK THE STEERING WHEEL CASSETTE REEL FOR CONTINUITY (CIRCUIT 2)	
	1 Measure the resistance between SW01, pin 03 and SW02, pin 03 through the cassette reel.
	Is the cassette reel continuous? **Yes** GO to C9. **No** INSTALL a new steering wheel cassette. CLEAR the DTC. TEST the system for normal operation.
C9: CHECK THE ECM TO CASSETTE REEL CIRCUIT FOR CONTINUITY (CIRCUIT 1)	
	1 Disconnect the battery negative terminal.
	2 Disconnect the ECM electrical connector, EM11.
	3 Measure the resistance between EM11, pin 01 (SR) and SW01, pin 04 (SR).

	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to C10.
C10: CHECK THE ECM TO CASSETTE REEL CIRCUIT FOR CONTINUITY (CIRCUIT 2)	
	1 Measure the resistance between EM11, pin 05 (SG) and SW01, pin 03 (SG).
	Is the resistance greater than 5 ohms? **Yes** REPAIR the circuit. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** Contact dealer technical support for advice on possible ECM failure.

PINPOINT TEST D : DTC P0569; SPEED CONTROL DECEL/SET- SWITCH ON FAULT	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
D1: CHECK THE SPEED CONTROL SWITCHPACK INTERNAL CIRCUITS FOR SHORT TO GROUND	
	1 Disconnect the speed control switchpack electrical connector, SW02.
	2 Measure the resistance between SW02, pin 06 (BO) and GROUND.
	3 Measure the resistance between SW02, pin 04 (SR) and GROUND.
	Is either 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 D2.
D2: CHECK THE SPEED CONTROL CASSETTE REEL FOR SHORT TO GROUND	
	1 Measure the resistance between SW02, pin 06 (at the cassette reel side of the connector) and GROUND.
	2 Measure the resistance between SW02, pin 04 (at the cassette reel side of the connector) and GROUND.
	Is either 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 D3.
D3: CHECK THE SPEED CONTROL DECEL/SET- SWITCH ACTION	
	1 Measure the resistance between SW02, pin 06 (BO) and SW02, pin 04 (SR).
	2 Operate the speed control **DECEL/SET-** switch.
	Does the resistance vary by 680 ohms? **Yes** Recheck DTCs. No short found. Possible intermittent fault. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST E : DTC P0570; SPEED CONTROL "ACCEL/SET+" SWITCH "ON" FAULT	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
E1: CHECK THE SPEED CONTROL SWITCHPACK INTERNAL CIRCUITS FOR SHORT TO GROUND	
	1

	1 Disconnect the speed control switchpack electrical connector, SW02.
	2 Measure the resistance between SW02, pin 06 (BO) and GROUND.
	3 Measure the resistance between SW02, pin 04 (SR) and GROUND.
	Is either 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 E2.
E2: CHECK THE SPEED CONTROL CASSETTE REEL FOR SHORT TO GROUND	
	1 Measure the resistance between SW02, pin 06 (at the cassette reel side of the connector) and GROUND.
	2 Measure the resistance between SW02, pin 04 (at the cassette reel side of the connector) and GROUND.
	Is either 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 E3.
E3: CHECK THE SPEED CONTROL ACCEL/SET+ SWITCH ACTION	
	1 Measure the resistance between SW02, pin 06 (BO) and SW02, pin 04 (SR).
	2 Operate the cruise control **ACCEL/SET+** switch.
	Does the resistance vary by 430 ohms? **Yes** Recheck DTCs. No short found. Possible intermittent fault. CLEAR the DTC. TEST the system for normal operation. **No** INSTALL a new speed control switchpack. CLEAR the DTC. TEST the system for normal operation.

PINPOINT TEST F : DTC P1571; BRAKE SWITCH MALFUNCTION	
WARNING: Where tests involve the removal of the steering wheel, and/or disconnection of air bag connectors, the procedure for disarming air bags must be followed, REFER to: Air Bag Supplemental Restraint System (SRS) (501-20B Supplemental Restraint System, Description and Operation).	
TEST CONDITIONS	**DETAILS/RESULTS/ACTIONS**
F1: CHECK THE BRAKE SWITCH TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the brake switch electrical connector, AC24.
	3 Disconnect the ECM electrical connector, EM10.
	4 Measure the resistance between AC24, pin 01 (US) and EM10, pin 10 (US).
	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 F2.
F2: CHECK THE BRAKE SWITCH TO ECM CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between AC24, pin 01 (US) and GROUND.
	Is the voltage greater than 3 volts? **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 F3.
F3: CHECK THE BRAKE SWITCH TO ECM CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between AC24, pin 01 (US) and GROUND.

	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 F4.
F4: CHECK THE BRAKE SWITCH IGNITION SWITCHED GROUND CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the brake switch electrical connector, AC24.
	3 Disconnect the ignition switch electrical connector, FC04.
	4 Measure the resistance between AC24, pin 04 (WO) and FC04, pin 03 (WO).
	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 F5.
F5: CHECK THE BRAKE SWITCH OPERATION	
	1 Measure the resistance between AC24, pins 01 and 04.
	2 Operate the brake pedal up and down.
	Does the resistance switch between open circuit and continuity as the pedal is operated? **Yes** GO to F6. **No** INSTALL a new brake switch. CLEAR the DTC. TEST the system for normal operation.
F6: CHECK THE BRAKE CANCEL SWITCH TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the brake switch electrical connector, AC24.
	2 Disconnect the ECM electrical connector, EM10.
	3 Measure the resistance between AC24, pin 02 (PG) and EM10, pin 11 (PG).
	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 F7.
F7: CHECK THE BRAKE CANCEL SWITCH TO ECM CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between AC24, pin 02 (PG) and GROUND.
	Is the voltage greater than 3 volts? **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 F8.
F8: CHECK THE BRAKE CANCEL SWITCH TO ECM CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between AC24, pin 02 (PG) and GROUND.
	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 F9.
F9: CHECK THE BRAKE CANCEL SWITCH TO CRUISE CONTROL SWITCH TO ECM CIRCUIT FOR HIGH RESISTANCE	
	1 Disconnect the battery negative terminal.
	2 Disconnect the brake switch electrical connector, AC24.
	3 Disconnect the ECM electrical connector, EM11.
	4 Disconnect the speed control switch electrical connector, FC63.
	5 Measure the resistance between AC24, pin 03 (WU) and EM11, pin 04 (WU).
	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 F10.
F10: CHECK THE BRAKE CANCEL SWITCH TO CRUISE CONTROL SWITCH TO ECM CIRCUIT FOR SHORT TO HIGH VOLTAGE	
	1 Reconnect the battery negative terminal.
	2 Turn the ignition switch to the **ON** position.
	3 Measure the voltage between AC24, pin 03 (WU) and GROUND.
	Is the voltage greater than 3 volts? **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 F11.
F11: CHECK THE BRAKE CANCEL SWITCH TO CRUISE CONTROL SWITCH TO ECM CIRCUIT FOR SHORT TO GROUND	
	1 Turn the ignition switch to the **OFF** position.
	2 Measure the resistance between AC24, pin 03 (WU) and GROUND.
	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 F12.
F12: CHECK THE BRAKE CANCEL SWITCH IGNITION SWITCHED POWER SUPPLY	
	1 Turn the ignition switch to the **ON** position.
	2 Measure the voltage between AC24, pin 03 (WU) and GROUND.
	Is the voltage less than 10 volts? **Yes** REPAIR the circuit between the brake cancel switch and the ignition switch. For additional information, refer to the wiring diagrams. CLEAR the DTC. TEST the system for normal operation. **No** GO to F13.
F13: CHECK THE BRAKE CANCEL SWITCH OPERATION	
	1 Measure the resistance between AC24, pins 02 and 03.
	2 Operate the brake pedal up and down.
	Does the resistance switch between open circuit and continuity as the pedal is operated? **Yes** Recheck the DTCs. Failure of other cruise control circuits will set other DTCs, indicating the component at fault. **No** INSTALL a new brake cancel switch. CLEAR the DTC. TEST the system for normal operation.

Climate Control System - General Information -

Specification for Recovery / Recycle / Recharge Equipment

• NOTE: ppm = parts per million

Feature	Requirement
Recovery rate	0,014 - 0,062 m3 / min. (1,36 kg in 20 minutes)
Cleaning capability	15 ppm moisture; 4000 ppm oil; 330 ppm non-condensable gases in air
Oil separator	With hermetic compressor and automatic oil return
Moisture indicator	Sight-glass type, sensitive to 15 ppm minimum
Vacuum pump	Two-stage 0,07 - 0,127 m3 / min.
Filter	Replaceable, with moisture indicator
Charge	Selectable charge weight and automatic delivery
Hoses	Dedicated HFC 134A port connections
Charge pressure	Heating element to increase pressure

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
Refrigerant	HFC 134A
Compressor lubricant	Polyalkyleneglycol (PAG)

Capacities

Unit	Specification
Refrigerant charge weight	675 g ±25 g
Compressor lubricant capacity	160 - 200 ml

Climate Control System - General Information - Climate Control System

Description and Operation

CAUTION: Observe all relevant safety requirements. Wear suitable eye and skin protection Do not mix HFC 134A and CFC 12 refrigerants. Do not vent refrigerant directly to atmosphere and always use Jaguar approved recovery, recycle and recharge equipment. Note the amount of recovered refrigerant; it will indicate the state of the system.

Working Practices

Be aware of, and comply with all health and safety requirements, whether they be legislative or common sense. This applies to conditions set both for the operator and workshop.

Before commencing any repair or service procedure, disconnect the vehicle battery ground lead and protect the vehicle, where appropriate, from dirt or damage.

Work in a well ventilated, clean and tidy area.

Keep all components and tools clean.

Recovery, recycle and recharge equipment must meet, or exceed, the requirements detailed in the Specification sub-section.

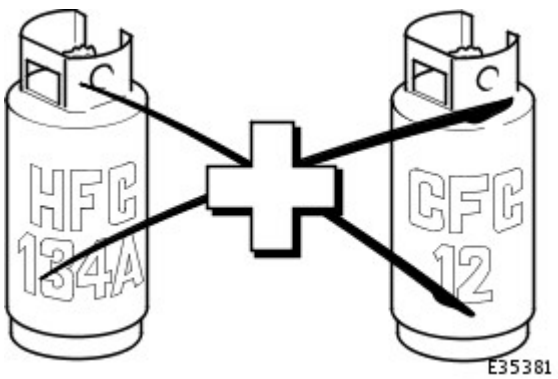
Handling Refrigerant

Wear eye protection at all times. Use gloves and keep all skin covered that may come into contact with refrigerant.

Should refrigerant come into contact with eyes or skin, wash the affected area with cool water and seek medical advice; do not attempt to treat the condition yourself.

Avoid breathing refrigerant vapor; it may cause irritation to the respiratory system.

CAUTION: Never use high pressure compressed air to flush out a system. Under certain circumstances a combination of HFC 134A refrigerant, compressed air and a source of combustion (welding and brazing operations in the vicinity), may result in an explosion and the release of potentially toxic compounds.



HFC 134A and CFC 12 refrigerants must never come into contact with each other. They will form an inseparable mixture which can only be disposed of by incineration.

Do not vent refrigerant directly to atmosphere; always use Jaguar approved recovery equipment. Never depress the charge or discharge port valves to check for the presence of refrigerant.

HFC 134A refrigerant is fully recycleable and it may be 'cleaned' by the recovery equipment and therefore re-used following removal from a system.

WARNING: NEVER USE A CFC 12 ANALYZER OR NAKED FLAME TYPE.

Leak tests should be carried out with a UV spot lamp or an electronic analyzer which is dedicated to HFC 134A refrigerant.

Handling Lubricating Oil

Avoid breathing lubricant mist; it can cause irritation to the respiratory system.

Always use fresh oil from a sealed container and do not leave oil exposed to the atmosphere for any reason other than to fill or empty a system. PAG oil is very hygroscopic (absorbs water) and will rapidly become contaminated by atmospheric moisture.



PAG oil is NOT compatible with previously used mineral based oils and must NEVER be mixed. Do not re-use oil when it has been separated from refrigerant, following a recovery cycle. Dispose of used oil safely.

System Maintenance

Plug pipes and units immediately after disconnection and do not remove the plugs until immediately before making the connection. Do not leave the system open to atmosphere.

The receiver drier must be renewed if the compressor has failed or if it is suspected that debris may be present in the system.

It is not always necessary to renew the receiver drier if the correct procedures have been followed. However, if a component or part of the system is left dismantled for more than five minutes, it may be advisable to renew the receiver drier. This guidance is based on UK average humidity levels; locations with lower humidity levels will be less critical to moisture contamination. It must be stressed however that there is not a safe period for work to be carried out in.

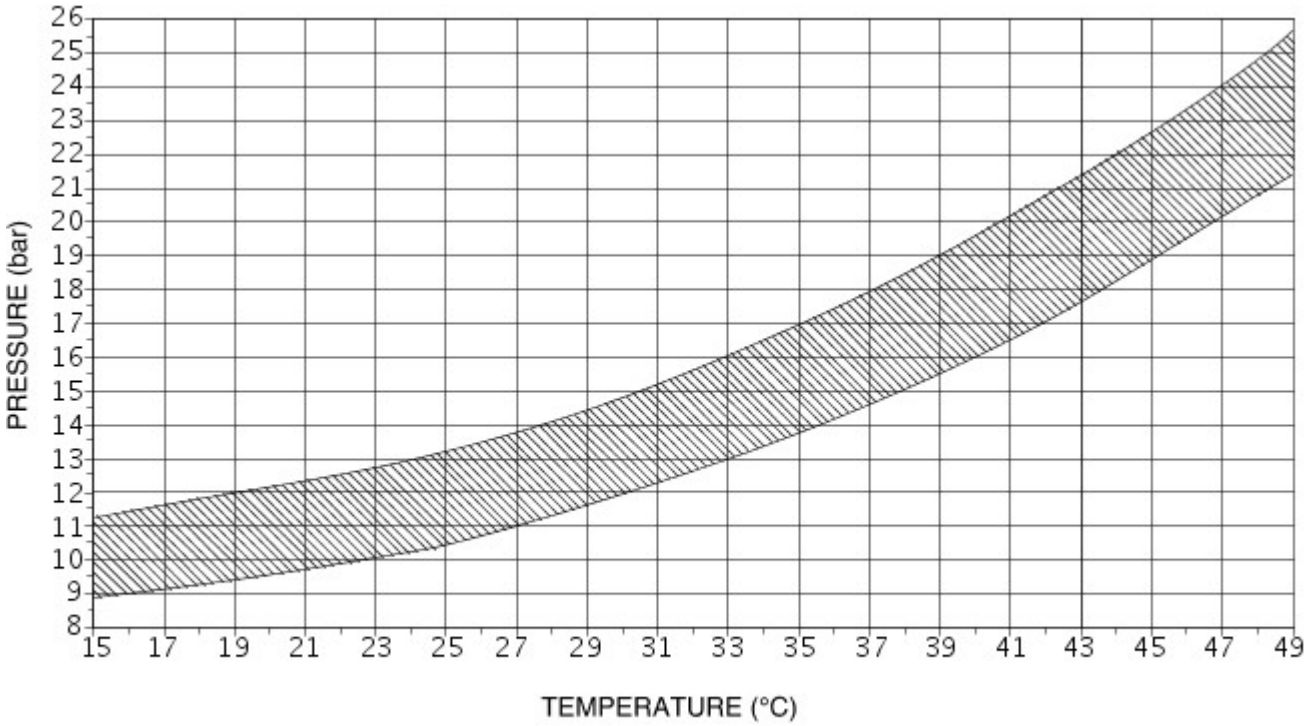
Do not use any replacement parts supplied without transit plugs and seals - return them to the supplier.

Diagnostic equipment for pressure, mass and volume should be calibrated regularly and certified by a third party organization.

Use extreme care when handling and securing aluminum fittings; always use a backing spanner and take special care when handling the evaporator.

Use only the correct or recommended tools for the job and apply the manufacturer's torque specifications.

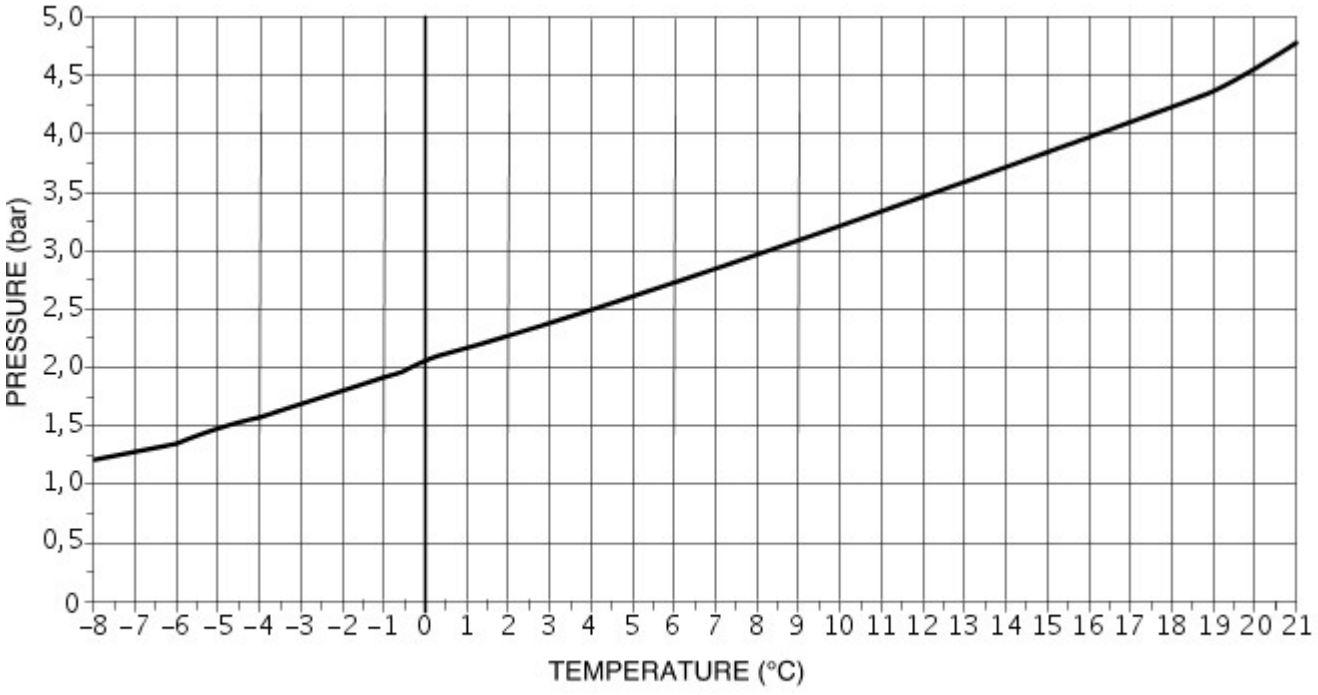
Graph - High Side Pressure against Ambient Temperature



E33262

The 'Normal' condition is that which is relevant to the prevailing ambient temperature.

Graph - Low Side Pressure against Evaporator Temperature



E33263

(To obtain lbf / in2 from bar, multiply the figure by 14.5)

Probable causes of faults may be found by comparing actual system pressures, registered on your manifold gauge set or recovery / recharge / recycle station, and the relevant pressure to temperature relationship graph. The following chart shows the interpretation that may be made by this difference.

• NOTE: The A/CCM will disengage the compressor clutch should the evaporator temperature fall to 0°C.

• NOTE: Graphs are typical for HFC 134A

The 'Normal' condition is that which is relevant to the prevailing evaporator temperature.

System Pressure Fault Classification

• NOTE: If erratic or unusual gauge movements occur, check the equipment against a known (calibrated) manifold gauge set.

This table should be used in conjunction with the graphical representations of 'High side' pressure / ambient temperature and 'Low side' pressure / evaporator temperature.

Low side gauge reading	High side gauge reading	Fault	Cause
Normal	Normal	Discharge air initially cool then warms up	Moisture in system
Normal to low	Normal	As above	As above
Low	Low	Discharge air slightly cool	Refrigerant charge low
Low	Low	Discharge air warm	Refrigerant charge very low
Low	Low	Discharge air slightly cool or frost build up at expansion valve	Expansion valve stuck closed
Low	Low	Discharge air slightly cool, sweating or frost after point of restriction	Restriction in High side of system
High	Low	Compressor noisy	Defective compressor reed valve
High	High	Discharge air warm and high side pipes hot	Refrigerant charge high or inefficient condenser cooling due to air flow blockage or engine cooling fans not working
High	High	Discharge air warm / Sweating or frost at evaporator	Expansion valve stuck open

Leak Test

Faults associated with low refrigerant charge weight and low pressure may be caused by leakage. Leaks traced to mechanical connections may be caused by torque relaxation or joint face contamination. Evidence of oil around such areas is an indicator of leakage.

Models that have fluorescent tracer dye incorporated into the refrigeration system can be checked for non-apparent leaks by scanning with a high intensity ultraviolet lamp. The location of leaks can be pinpointed by the bright yellow glow of the tracer dye.

CAUTION: Observe ALL safety precautions associated with ultraviolet equipment.

Should a leak be traced to a joint, check that the fixing is secured to the correct tightening torque before taking any other action.

When examining the system for leaks, check the compressor shaft seal and evaporator.

Charge Recovery (system depressurization)

The process of charge recovery will depend on the basic characteristics of your chosen recovery / recycle / recharge equipment, therefore, follow the manufacturer's instructions carefully.

Remember that compressor oil may be drawn out during this process, take note of the quantity recovered so that it may be

replaced.

Evacuating the System

This process, the removal of unwanted air and moisture, is critical to the correct operation of the air conditioning system.

Moisture in the system can be highly destructive and may cause internal blockages due to freezing; water suspended in the lubricating oil will damage the compressor. Once the system has been dismantled, or the refrigerant charge recovered, all traces of moisture must be removed before recharging.

Specific procedures will vary depending on the individual characteristics of the recovery / recycle / recharge equipment, and must be carried out exactly in accordance with the manufacturer's instructions. However, it is recommended that initially only the high-side valve be opened at the start of the procedure. After a short time a small depression should be seen on the low-side, at which point the low-side valve may be opened and the evacuation process completed. If a vacuum is not registered on the low-side, it may indicate that the expansion valve is permanently closed or that the system is blocked. This simple check may save time and effort when the system is recharged.

Climate Control System - General Information - Climate Control System

Diagnosis and Testing

Introduction

It is very important to positively identify the area of concern before starting a rectification procedure. A little time spent with your customer to identify the conditions under which a problem occurs will be beneficial. See below for example:

Symptom Chart

Symptom	Possible Sources	Action
No defrost	* No airflow to windshield	* Check blowers and flaps
	* No function in defrost mode	* Check A/CCM
	* Mode selection not available	* Check control panel communication
	* Airflow OK but no heat	* Check water pump and valve

Relevant criteria are: Weather conditions, ambient temperature, intermittent or continuous fault, airflow fault, temperature control fault, distribution fault and air inlet problem.

Functional Check

This simple 'first line check' will allow you to ascertain whether the system is operating within its design parameters, without recourse to PDU.

1. **1.** With the engine at normal running temperature.
2. **2.** Presss AUTO to display selected temperature and illuminate AUTO and A/C state lamps.
3. **3.** Rotate FAN to increase or decrease lower speed, verify bar graph representation.
4. **4.** Select A/C to toggle on or off. (The compressor may be inhibited by the ECM should either the engine temperature NOT be normal or the ambient be < 2° C).
5. **5.** Select RECIRC , state lamp should be lit and the recirculation flaps open.
6. **6.** Select distribution buttons in turn, verify correct air distribution and relevant state lamp.
7. **7.** Select DEFROST , check max fans and air to the windshield.
8. **8.** Cycle TEMPERATURE to ' HI ' and ' LO ' to verify demanded variations and display operation. Note that extremes will provide max heat or cold independent of in-car temperature.
9. **9.** Select EXT to toggle between ambient and control temperatures.
10. **10.** Select F (where fitted) and R - noting exterior mirror; verify timer and operation (glass may be warm to the touch)
11. **11.** Initiate system 'Self Test' to display stored faults should any of the above not perform as stated.

System Symptoms

There are five basic symptoms associated with air conditioning fault diagnosis.

The following conditions are not in order of priority.

Symptom #1

Symptom #1

Symptom	Possible Sources	Action
No cooling	* Compressor seized * Compressor seal failure * Compressor valve or piston damage	* Renew compressor
	* Compressor clutch / circuit faulty	* Refer to PDU
	* Drive belt slack / broken	* Adjust or renew
	* Blower motor / circuit faulty * Pressure switch / circuit fault	* Refer to PDU
	* Total loss of refrigerant caused by broken pipe or joint	* Repair / renew. Check code 23
	* Partial loss of refrigerant caused by leaking joint or pipe	* Repair / renew, check fault code #23
	* Condenser damage	* Renew, check fault code #23
	* Blocked receiver / drier filter	* Renew receiver / drier
	* Evaporator sensor / circuit faulty	* Refer to PDU, check fault code #13
	* Blocked pollen filter (if fitted)	* Clean or renew

Symptom #2

Symptom #2

• NOTE: Should a leak or low refrigerant be established as the cause of INSUFFICIENT COOLING, follow the procedures Recovery / Recycle / Recharge, this section, and observe all refrigerant and oil handling instructions.

Symptom	Possible Sources	Action
Insufficient cooling	* Compressor clutch slipping	* Renew clutch assembly
	* Flaps or vents closed / seized	* Check fault codes #41 to 46
	* Blower circuit fault	* Refer to PDU
	* Blocked condenser matrix / fins	* Check high / low side pressures / renew. Check / clean fins
	* Blocked evaporator matrix	* Check high / low side pressures / renew
	* Blocked pollen filter (if fitted)	* Clean or renew
	* Evaporator temperature sensor faulty	* Refer to PDU
	* Partial loss of refrigerant caused by leaking joint or pipe	* Repair / renew
	* Blocked expansion valve	* Check high / low side pressures / renew
	* Expansion valve fault	* Check system pressure differential
	* Collapsed air conditioning hose hose	* Check high / low side pressures / renew
	* Moisture or air in the system	* Check system pressures
	* Low refrigerant charge	* Initiate recovery procedure, check fault code #23
	* Coolant flow valve open	* Check operation

Symptom #3

Symptom #3

Symptom	Possible Sources	Action
Intermittent cooling	* Compressor clutch slipping	* Renew clutch assembly
	* Compressor clutch circuit faulty * Blower(s) circuit faulty	* Refer to PDU
	* Motorized in-car aspirator faulty	* Refer to PDU, check fault code #11
	* Evaporator temperature sensor faulty	* Refer to PDU, check fault code #13
	* Blocked condenser matrix / fins	* Check high / low side pressures / renew. Check / clean fins
	* Blocked evaporator matrix	* Check high / low side pressures / renew

Symptom #4

Symptom #4

Symptom	Possible Sources	Action
Noisy system	* Loose or damaged compressor drive belt	* Adjust or renew
	* Loose compressor mountings	* Check for damage, tighten to specification if OK
	* Compressor oil level low	* Look for evidence of leakage and rectify as required
	* Compressor internal damage	* Check for debris, renew compressor and receiver drier
	* Blower motor noise	* Renew motor (assuming no fan interference)
	* Excessive refrigerant charge	* Check for vibration or 'thumping' in high pressure line; may be witnessed by high pressure on both HIGH and LOW sides. Recover / recharge
	* Low refrigerant charge	* Check for 'hissing' at expansion valve; may be witnessed by low HIGH side pressure. Recover / recharge
	* Moisture or air in the system	* Check system pressures
	* Heater circuit air-lock	* Refer section 303-03 for fill / bleed procedure
	* Suction pipe touching bank 1 (A) cylinder head (rubber isolator missing)	* Check the pipe cluster for correct fitting

Symptom #5

Symptom #5

• NOTE: Electrical faults may be more rapidly traced using PDU

Symptom	Possible Sources	Action
Insufficient heating	* Coolant flow valve stuck 'closed' * Coolant flow valve stuck 'open' allowing recirculation of coolant at engine idle	* Renew valve
	* Motorized in-car aspirator seized	* Renew aspirator
	* Cool air bypass damper stuck open	* Renew, check fault code #43
	* Blocked air inlet / pollen filter	* Check / clean / renew
	* Blower speed low	* Check performance range
	* Low coolant level	* Adjust as required (verify and correct reason for loss)
	* Engine thermostat faulty	* Check engine running temperature
	* Heater water pump seized	* Check operation
	* Heater matrix blocked	* Renew matrix
	* Heater circuit air-lock	* Refer section 303-03 for fill / bleed procedure

Climate Control System - General Information - Air Conditioning (A/C) System Check - Retail Procedure

General Procedures

Evacuating the Manifold Gauge Set

1. Attach the center (service) hose to a vacuum pump and start the pump. Open fully both high and low valves and allow the vacuum to remove air and moisture from the manifold set for at least five minutes.

CAUTION: It is imperative that the vacuum pump is not subjected to a positive pressure of any degree. Therefore the pump must be fitted with an isolation valve at the center (service hose) connection and this valve must be closed before the pump is switched off. This operation replaces the 'purge' procedure used on previous systems. Observe the manufacturer's recommendation with regard to vacuum pump oil changes.

Turn the vacuum pump off and isolate it from the center service hose but do not open the hose to atmosphere.

Connecting the Manifold Gauge Set

CAUTION: Only use hoses with connectors which are dedicated to HFC 134A charge ports.

1. Attachment of the hose quick release connectors to the high and low side system ports is straightforward, provided that the high and low valves are closed and the system is NOT operational.

WARNING: UNDER NO CIRCUMSTANCES SHOULD THE CONNECTIONS BE MADE WITH THE SYSTEM IN OPERATION OR THE VALVES OPEN. SHOULD THE VALVES BE OPEN AND A VACUUM PUMP OR REFRIGERANT CONTAINER ATTACHED, AN EXPLOSION COULD OCCUR AS A RESULT OF HIGH PRESSURE REFRIGERANT BEING FORCED BACK INTO THE VACUUM PUMP OR CONTAINER.

Assessment of system operating efficiency and fault classification may be achieved by using the facilities on your Recovery / Recharging / Recycling station, follow the manufacturer's instructions implicitly and observe all safety considerations.

Stabilizing the System

1. Accurate test gauge data will only be attained if the system temperatures and pressures are stabilized.

- Ensure that equipment and hoses cannot come into contact with engine moving parts or sources of heat.
- It is recommended that a free standing air mover is placed in front of the vehicle to provide air flow through the condenser / cooling system.
- Start the engine, allow it to attain normal working temperature and set at fast idle (typically 1200 to 1500 rpm).
- Select full air conditioning performance.
- With all temperatures and pressures stable, or displaying symptoms of faults; begin relevant test procedures.

Climate Control System - General Information - Air Conditioning (A/C) System Recovery, Evacuation and Charging

General Procedures

Recover / Reclaim

1. CAUTION: Read the procedures and instructions supplied by the manufacturer of the air conditioning service center before commencing any process requiring the handling of refrigerant. In addition to the manufacturer's information, observe all safety precautions and advice detailed in this section.

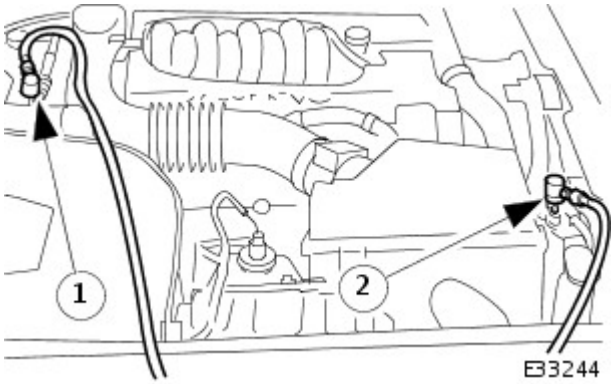
Disconnect battery ground lead; refer to 86.15.19.

2. Remove passenger side firewall cover.

3. Remove driver side firewall cover.

4. Remove engine compartment rear cover.

5. Remove vehicle charge port protective caps and connect equipment pressure hoses to vehicle.



1. BLUE hose = low pressure.

2. RED hose = high pressure.

6. Complete procedure in accordance with equipment manufacturer's instructions.

Evacuation

1. Complete procedure in accordance with equipment manufacturer's instructions.

- This process will typically take 30 minutes, but will depend upon the equipment and the extent of repairs carried out to the system.

Charging

1. Set the appropriate charge weight, see Specifications in this section.

2. Complete procedure in accordance with equipment manufacturer's instructions.

3. Disconnect hoses from vehicle and replace charge port protective caps.

4. Reconnect battery ground lead; refer to 86.15.15.

5. Check system for correct operation.

Climate Control System - General Information - Contaminated Refrigerant Handling

General Procedures

1. CAUTION: If contaminated refrigerant is detected DO NOT recover the refrigerant into your R-134a OR R-12 recovery/recycling equipment. Take the follow actions:

   Repeat the test to verify contaminated refrigerant is present.

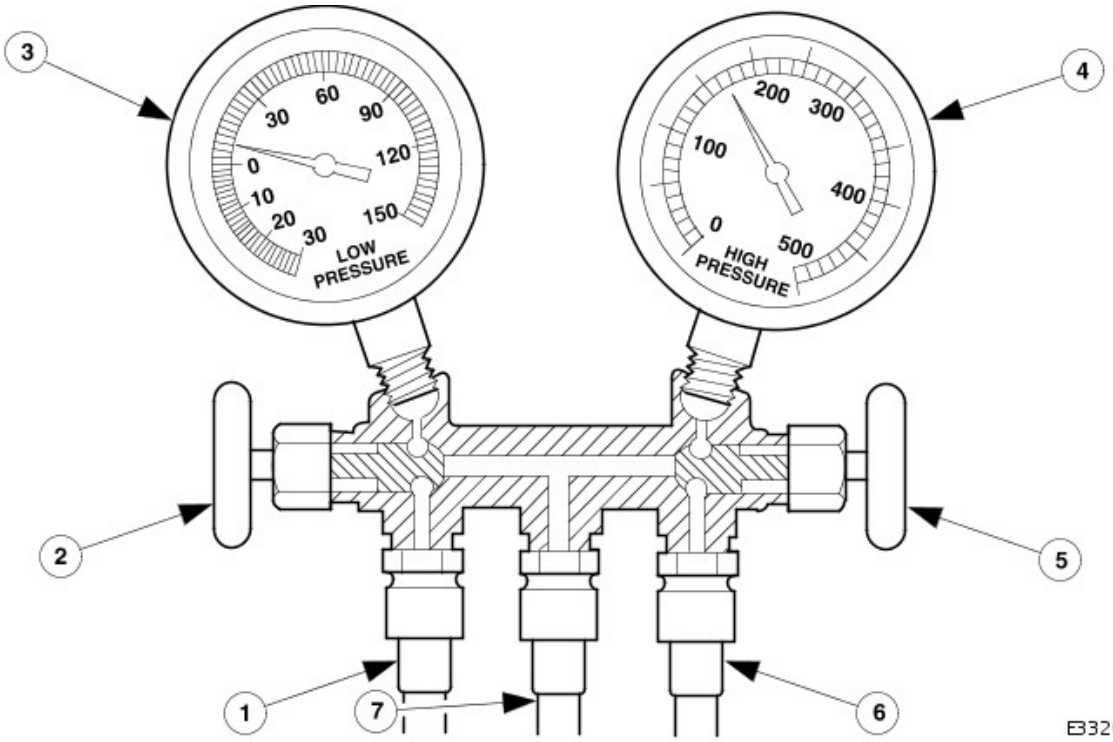
2. Advise the customer of the contaminated A/C system and any additional cost to repair the system. The customer may wish to return to the repair facility performing the last A/C repair.
3. Recover the contaminated refrigerant using suitable recovery only equipment designed for capturing and storing 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.

Climate Control System - General Information - Manifold Gauge Set Connection

General Procedures

1. The 'manifold gauge set' is a most important tool for tracing faults and system efficiency assessment. The relationship between HIGH and LOW pressures and their correlation to AMBIENT and EVAPORATOR temperatures must be compared to determine system status (see Pressure / Temperature graphs).

Because of the heavy reliance upon this piece of equipment for service diagnosis, ensure that the gauges are calibrated regularly and the equipment is treated with care.



2.

Parts List

Item	Description
1	LOW side service hose - BLUE
2	LOW side hand valve - BLUE
3	LOW pressure compound gauge _ BLUE
4	HIGH pressure gauge _ RED
5	HIGH side hand valve - RED
6	HIGH side service hose - RED
7	System service hose - Neutral color, commonly YELLOW

Manifold.

1. The manifold is designed to control refrigerant flow. When connected into the system, pressure is registered on both gauges at all times. During system tests both the high and low side hand valves should be closed (rotate clockwise to seat the valves). The hand valves isolate the low and the high sides from the center (service) hose.

Low Side Pressure Gauge.

1. This compound gauge, is designed to register positive and negative pressure and may be typically calibrated - Full Scale Deflection, 0 to 10 bar (0 to 150 lbf / in2) pressure in a clockwise direction; 0 to 1000 mbar (0 to 30 in Hg) FSD negative pressure in a counter clockwise direction.

High Side Pressure Gauge.

1. This pressure gauge may be typically calibrated from 0 to 30 bar (0 to 500 lbf / in2) FSD in a clockwise direction. Depending on the manufacturer, this gauge may also be of the compound type.

Climate Control System - General Information - Refrigerant Adding

General Procedures

CAUTION: If oil was drawn out during the recovery process, the correct amount may be added directly from the recovery, recycle and recharge station (if so equipped) prior to the charging process. It must be stressed that the need to protect compressor oil from moisture is vital, observe the procedures in HANDLING LUBRICATING OIL and those concerning excessive engine speed.

1. In order that the air conditioning system may operate efficiently it must contain a full refrigerant charge. The indications of some system defects, and the results of certain tests, will show that a low charge is the most probable cause of the fault. In such cases the charge should be recovered from the system, the weight noted, and the correct amount added.

Should refrigerant be added in liquid form, the engine speed must not exceed 2000 rpm for a period of two minutes after first running the compressor. If the engine speed is excessive, compressor damage may occur due to the lubricating oil and the liquid refrigerant being initially forced around the system as a 'slug', thus taking oil away from the compressor. These marginal lubrication conditions in the compressor will cease as the refrigerant becomes gaseous.

Never attempt to estimate the amount of refrigerant in a system. Always recover and recharge with the correct charge weight; this is the only accurate method.

Climate Control System - General Information - Refrigerant Oil Adding

General Procedures

CAUTION: Always decant fresh oil from a sealed container and do not leave oil exposed to the atmosphere. PAG oil is very hygroscopic (absorbs water) and will rapidly attract atmospheric moisture. PAG oil must NEVER be mixed with mineral based oils. Do not re-use oil following a recovery cycle, dispose of it safely.

1. The amount of oil drawn out during a recovery procedure will be dependent on the state of the system and the rate of recovery. The quantity will be approximately 30 to 40 ml.; this may vary, and the figure is given only for guidance.

   The oil separator vessel in the recovery equipment must be clean and empty at the start of the process, so that the quantity of oil which is drawn out may be accurately measured.

• NOTE: The equipment manufacturer's instructions must be followed when adding oil directly into an original, or new unit, owing to rectification work to the existing compressor, or the need to fit a new compressor.

Oil may be added to the system either via the recovery, recycle and recharge station or by using a proprietary oil injector. Alternatively, if the compressor has been removed from the vehicle, the oil may be added directly to the compressor.

Original Compressor

1. From an existing compressor, drain the oil into a measuring cylinder and record the amount. Flush the unit out with fresh oil and drain thoroughly. Replenish the compressor with the same amount of oil that was originally drained out and immediately plug all orifices ready for refitting to the vehicle.

New Compressor

1. Drain and discard the transit lubricating oil from the new compressor before it is be fitted.

   To avoid over-filling the system, an allowance must be made for the quantity of oil found in the original compressor and the quantity deposited in the recovery equipment oil separator from the charge recovery operation.

   Typical example:

   - Drained from original compressor - 50 ml.
   - Recovered from oil separator - 40 ml.
   - Quantity to be put in new compressor - 50 + 40 = 90 ml.

2. The difference between the combined total quantity of recovered and drained oil and the nominal capacity of the system (180 ml.), is due to the quantity of oil remaining in components such as the condenser, receiver drier or evaporator. This oil is not normally recoverable.

   The same procedure may be followed if a problem has occurred due to oil leakage, as the amount of oil lost is generally small. If the recovery process has not been necessary, because refrigerant has also been lost, then only the quantity drained from the original compressor needs to be replaced.

System Components

1. Should a major component such as condenser, receiver drier or evaporator be renewed, then an adjustment to the system oil content must be made. This may be carried out in the same way as the examples for the compressor, except for the fact that trapped oil within any of these components cannot normally be recovered. An extra quantity of oil should be added, in addition to that recovered from the recovery station separator, as follows:

    - Condenser - Add 40 ml.
    - Evaporator - Add 40 ml.
    - Receiver drier - No addition.

Climate Control System - General Information - Refrigerant System Tests

General Procedures

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.

CAUTION: The A/C refrigerant analyzer must be used before the recovery of any vehicle's A/C refrigerant. Failure to do so puts workshop 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. To prevent possible personal injury, for all equipment, follow the equipment manufacturer's procedures and instructions.

• 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 equipment during any A/C system repair and recharge procedure which requires that the system be evacuated.

1. Use UL-approved recovery/recycling equipment to evacuate and recover the A/C system.
    - Follow the equipment manufacturer's procedures and instructions for use of equipment.

Air Distribution and Filtering - Air Distribution and Filtering

Description and Operation

Air Distribution

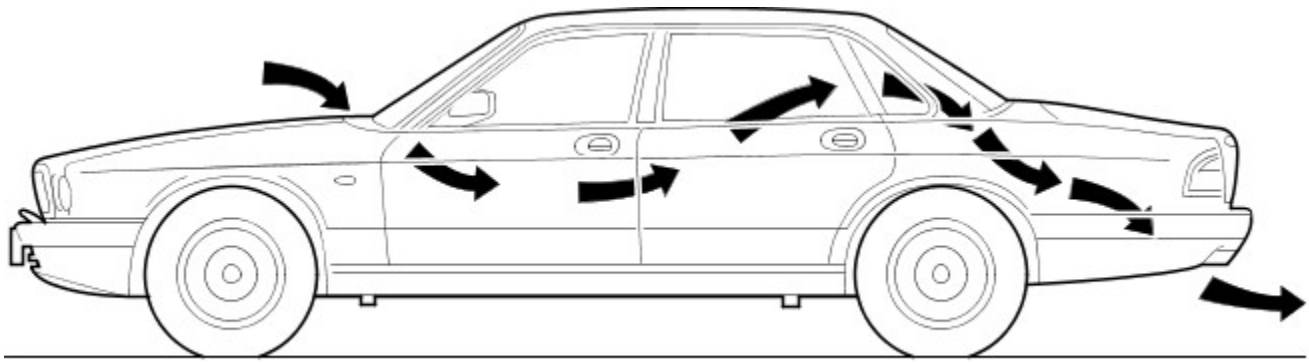
Outside air enters the plenum via four inlets in the lower windshield panel.

If the air conditioning system is operating in FRESH mode (not recirculation mode), then air is drawn through the four plenum apertures (and particle filters where fitted) and into the air conditioning unit via the blower interconnecting ducts in the LH and RH blower assemblies. Air is cooled and dehumidified as it passes through the evaporator and is then 'reheated' to the required temperature as it passes through the heater matrix.

In RECIRCULATION mode, the air in the passenger compartment is drawn into the air conditioning unit via the recirculation air inlets on the blower assemblies.

In FRESH mode, air flows from the cabin into the trunk through a gap between the backlight and the parcel shelf. The air is exhausted from the vehicle through extraction vent assemblies (incorporating one way flaps) whose outlets are above the rear mufflers.

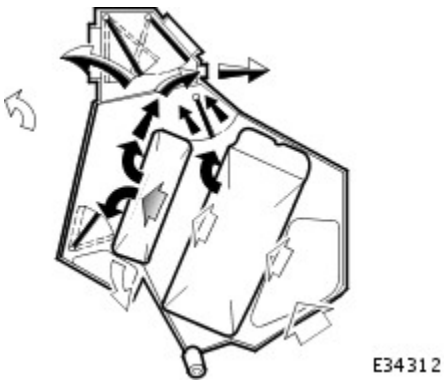
Air Flow Path



E33202

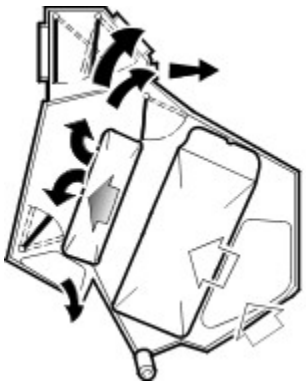
Air Distribution Modes

Bi-level mode



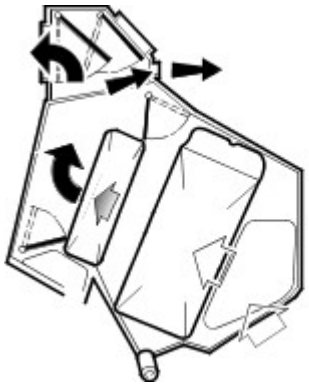
E34312

Foot / defog mode



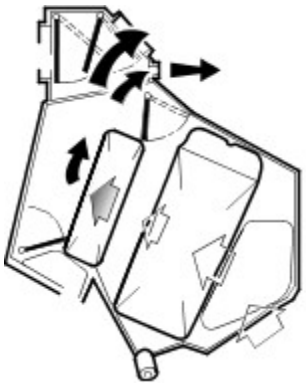
E34313

Face mode



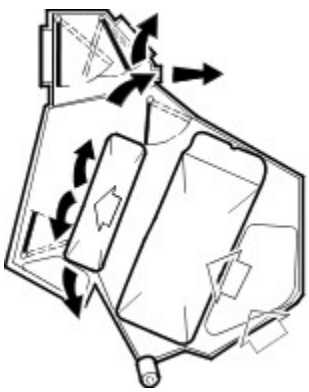
E34314

Defog mode



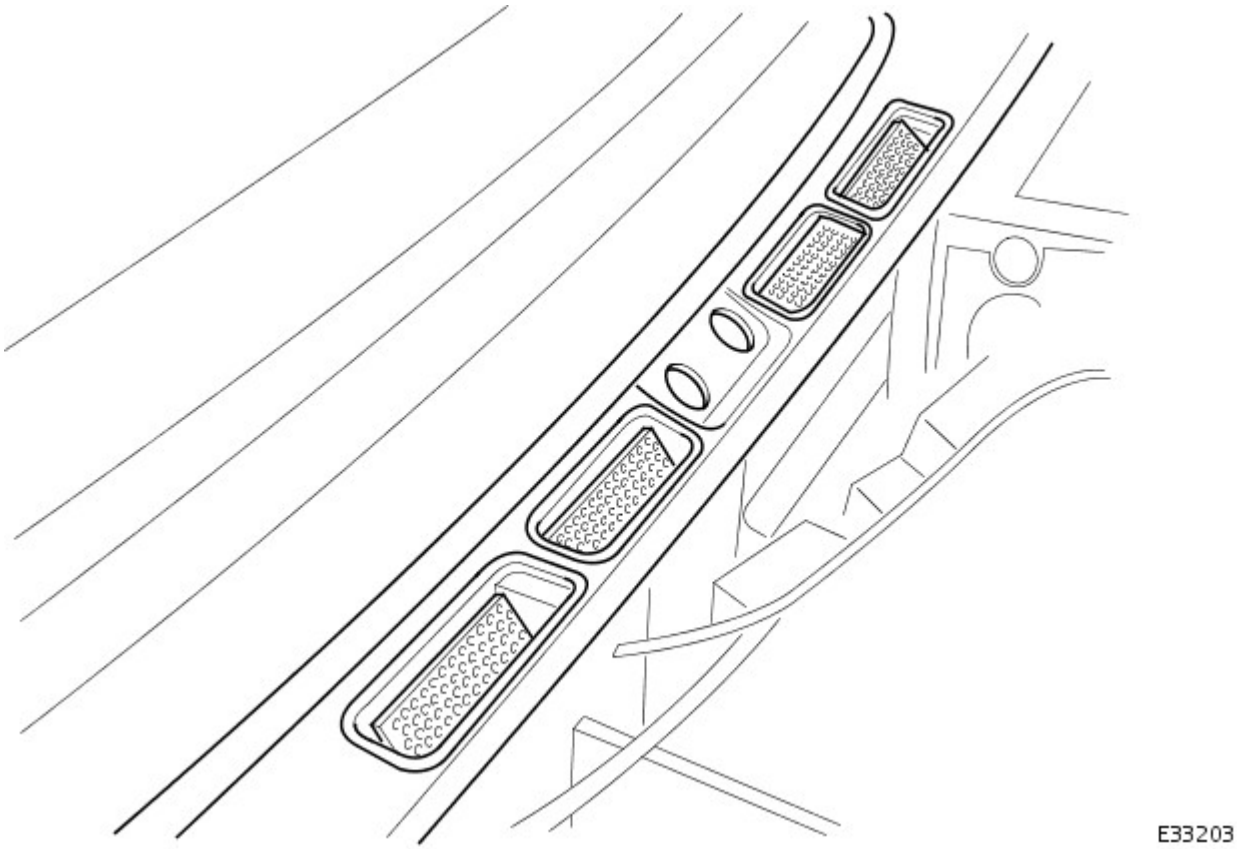
E34315

Foot mode.(with automatic air bleed to the windshield)



E34316

Air Particle Filter



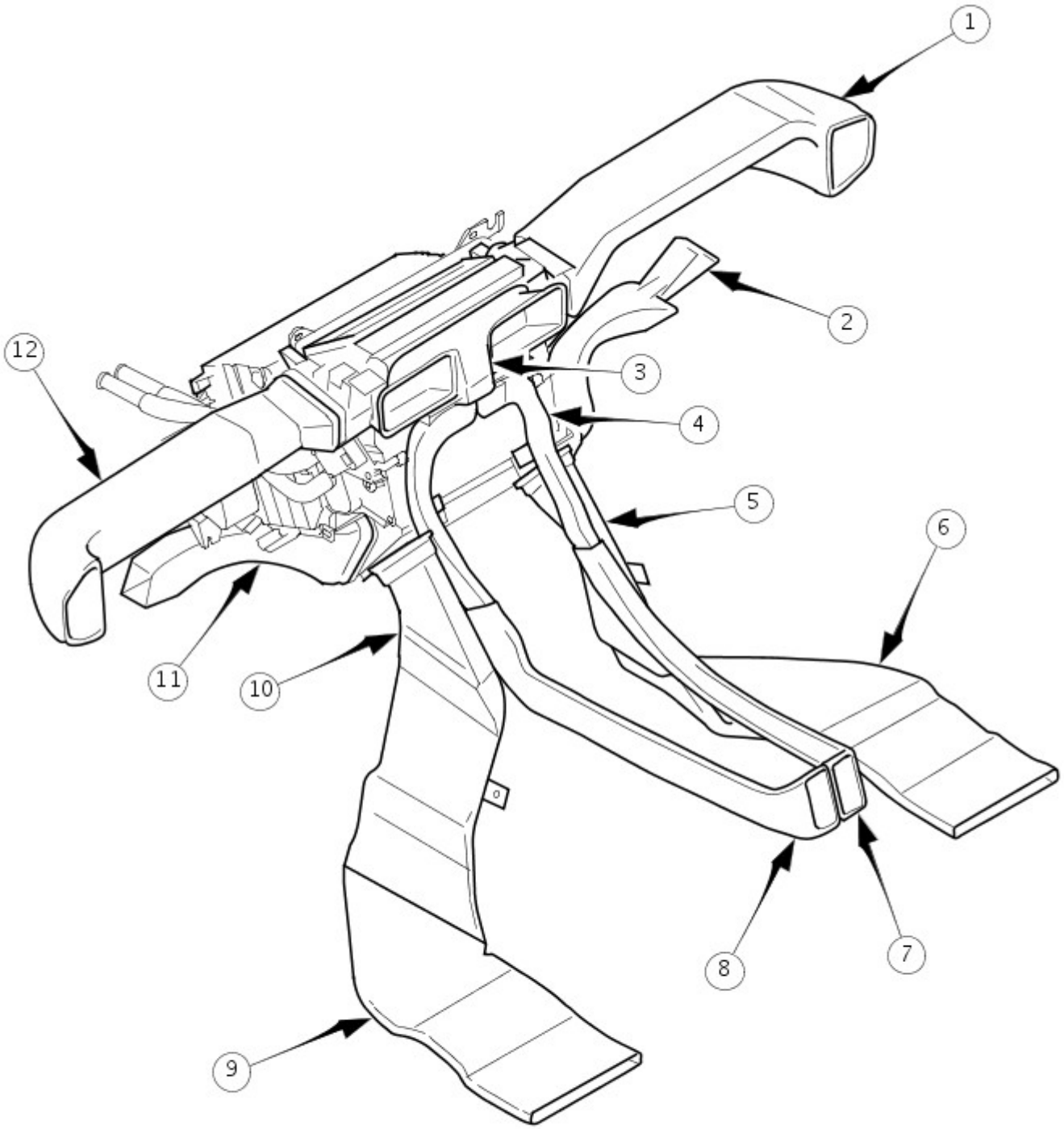
The air particle filter system (where fitted) is located in the plenum below the windshield .

• NOTE: Refer to 'Filter Compensation', Section 412-04.

The filter elements are retained by adhesive strip which is attached to the filter moulding; the filter is fitted with the light, flocked surface towards the engine.

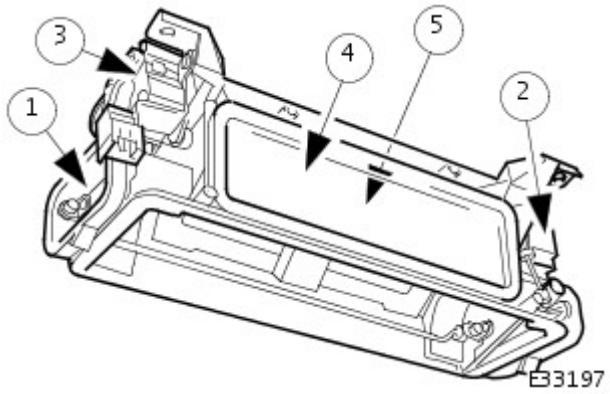
Location of Air Distribution Ducts

LHD shown


1
2
3
4
5
6
7
8
9
10
11
12
E33253

Item	Description
1	Face level duct - RH
2	Passenger footwell duct - LHD
3	Face level duct - center
4	Rear face primary duct
5	Rear intermediate footwell duct - RH
6	Rear footwell duct - RH
7	Rear face duct - RH
8	Rear face duct - LH
9	Rear footwell duct - LH
10	Rear intermediate footwell duct - LH
11	Driver footwell duct - LHD
12	Face level duct - LH

Air Distribution Box (ADB)



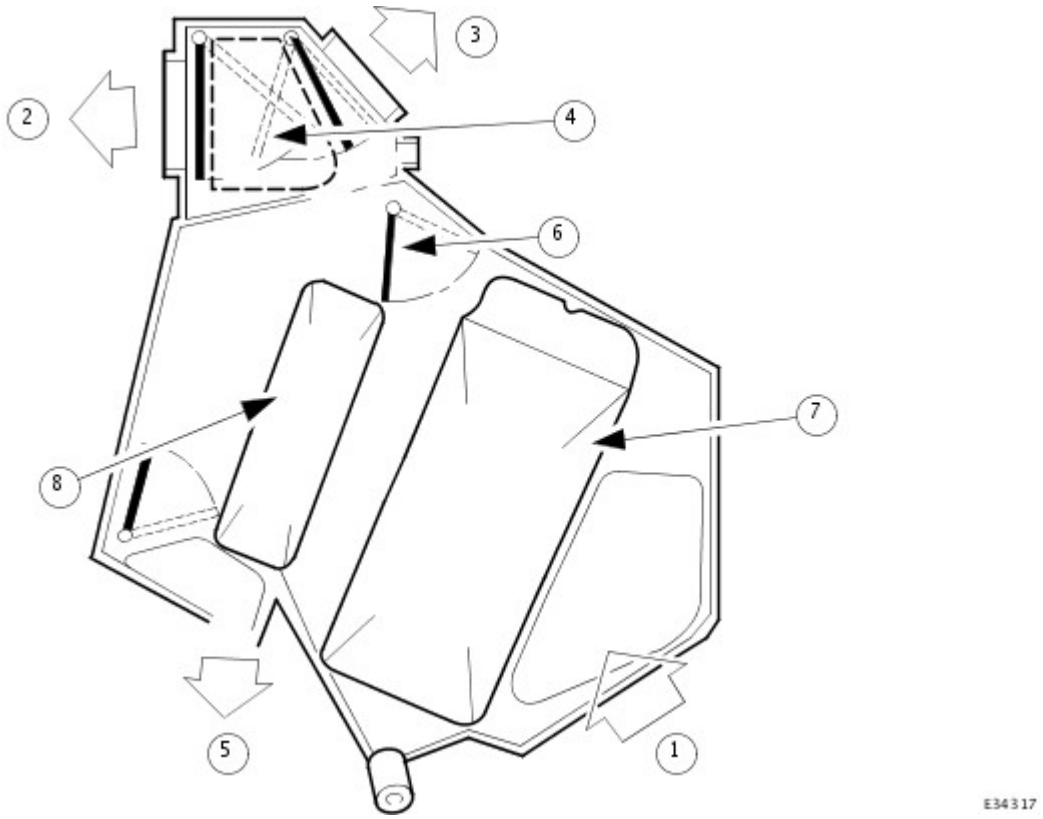
Item	Description
1	Air outlet - side vent
2	Servo motor - instrument panel center vent
3	Servo motor - defog vent
4	Air outlet - instrument panel center vent
5	Air outlet - defog vent

The upper air distribution box ADB, is fixed to the defog duct and instrument panel assembly, and seals by contact pressure to the outlet (top) of the air conditioning unit. The ADB incorporates two servo motor operated flaps which regulate airflow to:

- Windshield and door drop glass
- Instrument panel - center, left hand and right hand vents

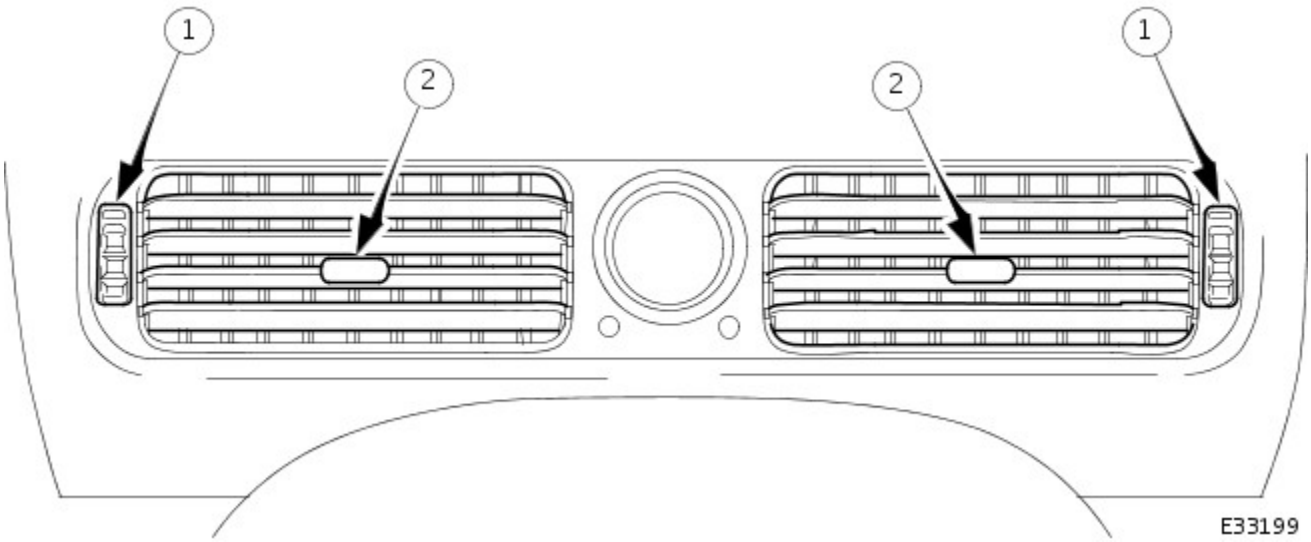
The center vent duct incorporates a baffle plate which balances the volume of air flow between the center and right and left hand vents.

Internal Components and Air Flow



Item	Description
1	Air inlet - from RH blower (LH opposite, not shown)
2	Air outlet - instrument panel center vents
3	Air outlet - defog
4	Air outlet - instrument panel LH and RH side vents
5	Air outlet - footwell
6	Flap - cool air bypass
7	Evaporator
8	Matrix - heater

Instrument Panel Air Outlets



Item	Description
1	Air flow control
2	Air direction control

Air temperature from the center, right and left hand vents is slightly cooler than the foot outlets; however this temperature cannot be varied independently.

The instrument panel side vents, not shown, feature similar controls.

Air Distribution and Filtering - Air Distribution and Filtering

Diagnosis and Testing

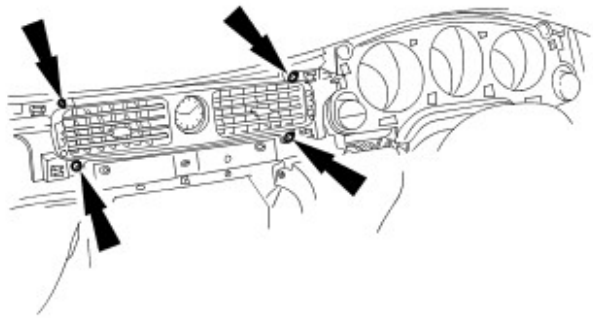
Refer to section 412-00.

Air Distribution and Filtering - Center Registers

Removal and Installation

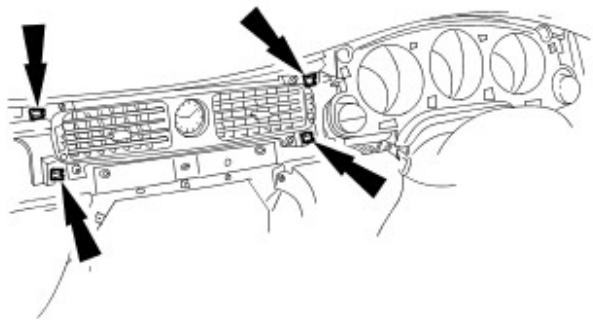
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove passenger airbag deployment door for access. Refer to Section 501-20.
3. Remove major gauge module veneer panel for access. Refer to 76.47.24.
4. Carefully withdraw fascia centre veneer panel.
5. Slacken and remove four screws securing centre vent assembly to fascia.



E36341

6. Withdraw centre vent assembly for access, disconnect clock harness multiplug, release clock retaining tangs and remove clock from vent assembly.
7. Remove and discard the four veneer panel to fascia securing clips.



E36342

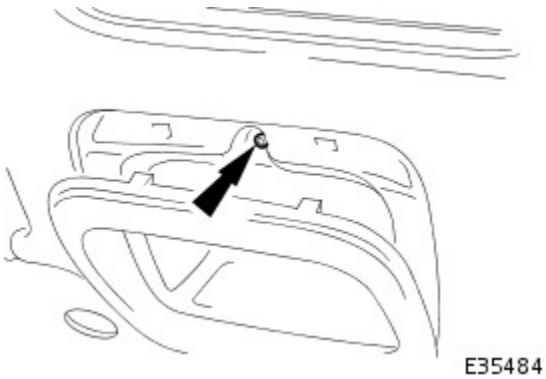
Installation

1. Fit and fully seat new veneer panel retaining clips to fascia.
2. Fit clock to centre vent assembly, ensuring retaining tangs are fully seated.
3. Position centre vent assembly at fascia and connect clock harness multiplug.
4. Fully seat vent assembly in fascia and fit and tighten securing screws.
5. Fit and fully seat centre veneer panel.
6. Fit major gauge module veneer panel. Refer to 76.47.24.
7. Fit passenger airbag deployment door. Refer to Section 501-20.
8. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

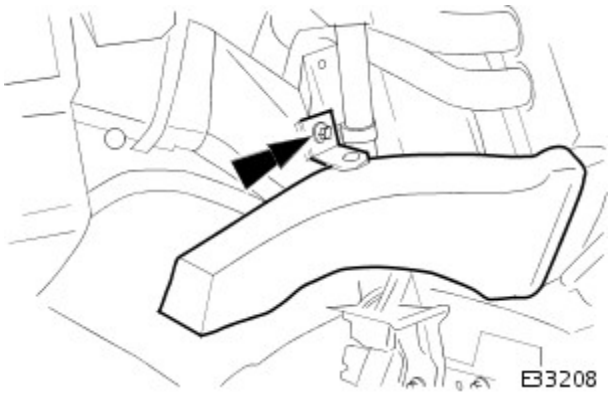
Air Distribution and Filtering - Driver Side Blower Motor

Removal and Installation

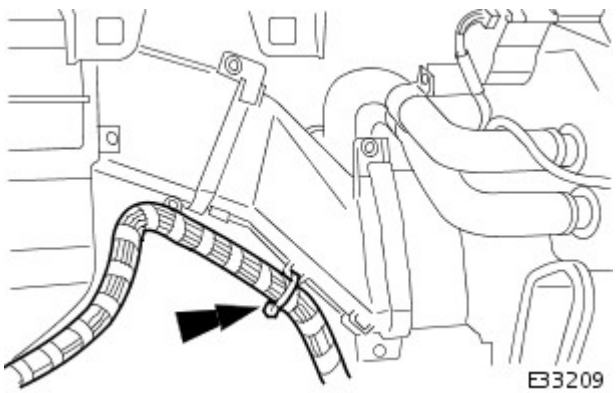
Removal



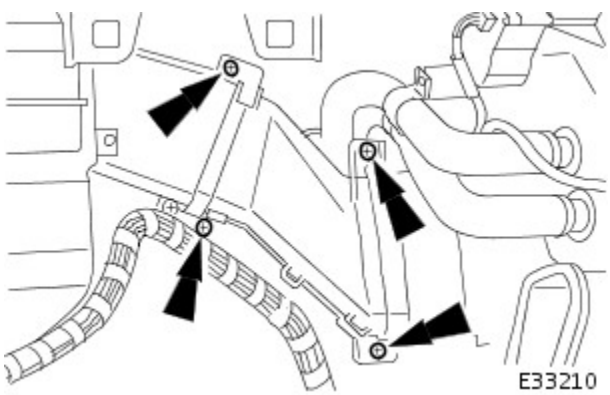
1. Remove upper steering column; refer to 57.40.02.
2. Remove driver stowage compartment.
   - Remove screw.
   - Remove compartment.



3. Remove driver footwell duct.
   - Remove screw.
   - Remove duct.

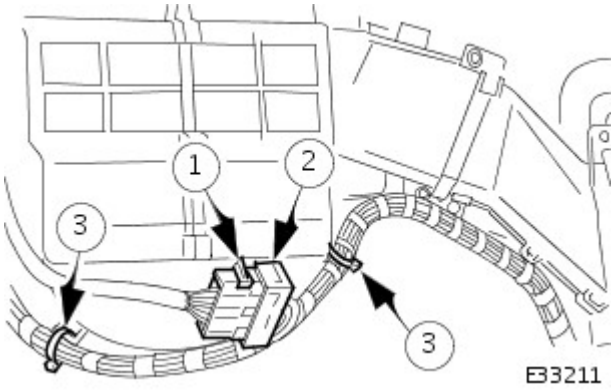


4. Remove cable tie.

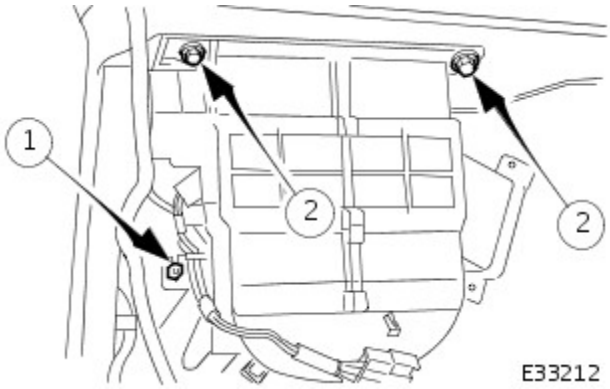


5. Remove duct connecting blower assembly to heater / cooler unit.
   - Remove screws.
   - Remove duct.

6. Disconnect harness connector from blower assembly.



1. Detach connector from mounting.
2. Disconnect connector.
3. Discard cable ties.



7. Remove blower assembly.

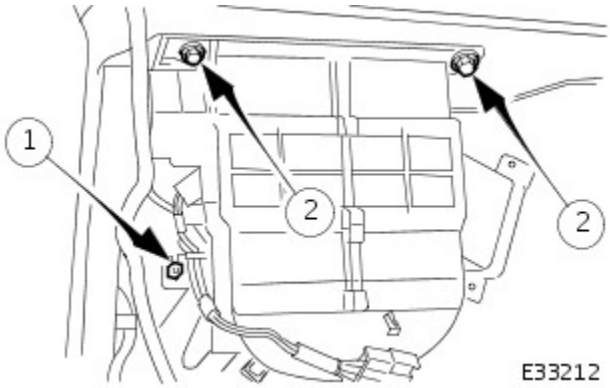
1. Slacken nut.
2. Slacken bolt ('A' post side), remove remaining bolt.

- Remove blower.

Installation

1. Installation is a reversal of the removal procedure.

2. Tighten nuts to specification.



1. 5-7 Nm.
2. 5-7 Nm.

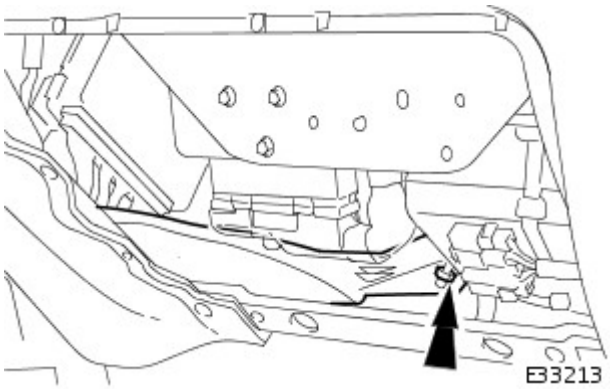
Air Distribution and Filtering - Passenger Side Blower Motor

Removal and Installation

Removal

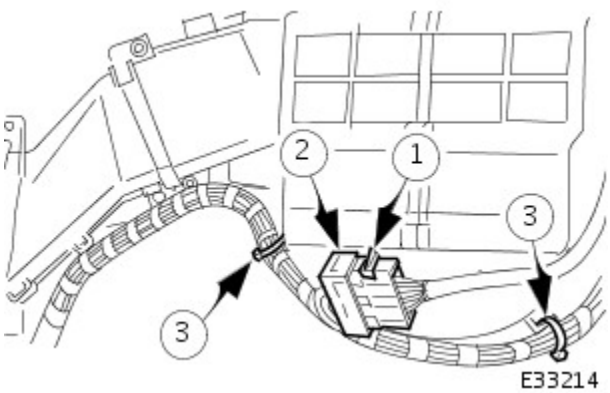
1. Remove instrument panel; refer to 76.46.01.

2. Remove passenger footwell duct.



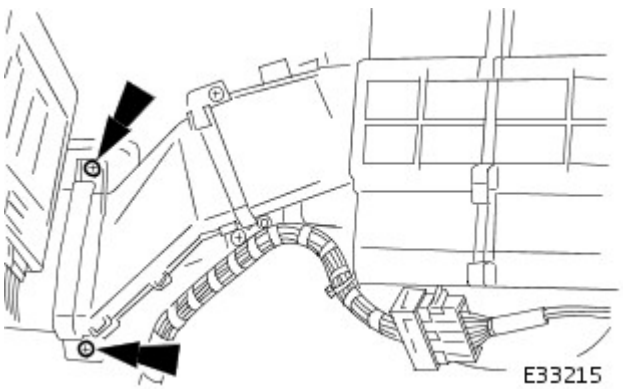
- Remove nut.

3. Disconnect harness connector from blower assembly.



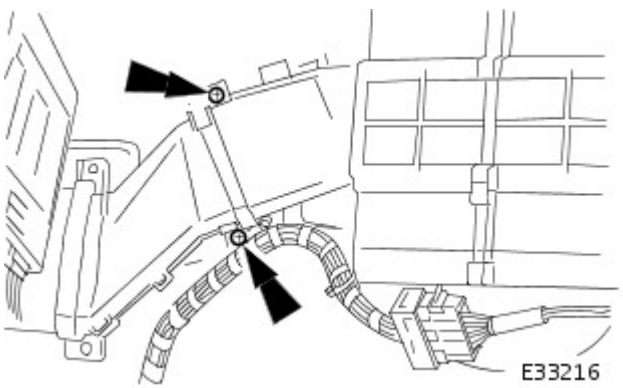
1. Detach connector from mounting.
2. Disconnect connector.
3. Discard cable ties.

4. Remove fasteners securing duct to heater / cooler unit.



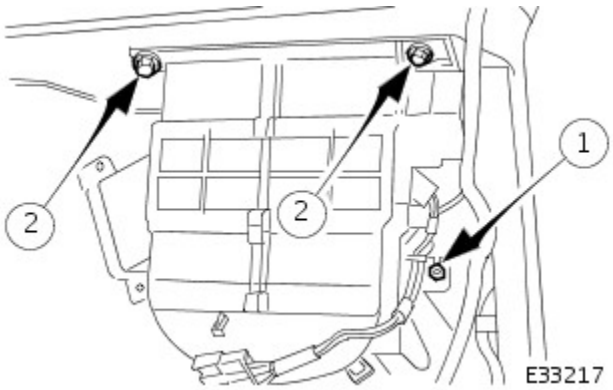
- Remove screws.

5. Remove duct connecting blower to heater / cooler unit.



- Remove screws.
- Remove duct.

6. Remove blower assembly.



1. Slacken nut.
2. Slacken bolt ('A' post side), remove remaining bolt.

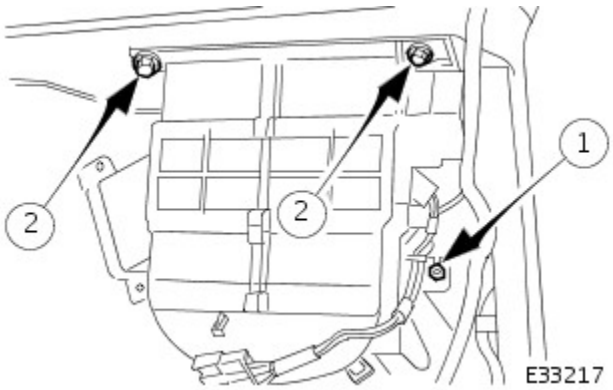
- Remove blower.

Installation

1. Installation is a reversal of the removal procedure.

2. Tighten nuts to specification.

1. 5-7 Nm.
2. 5-7 Nm.



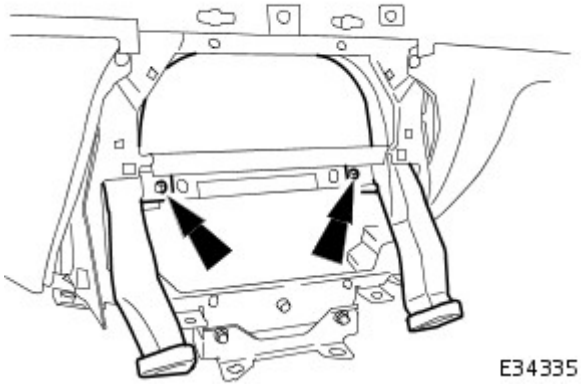
Air Distribution and Filtering - Plenum Chamber

Removal and Installation

Removal

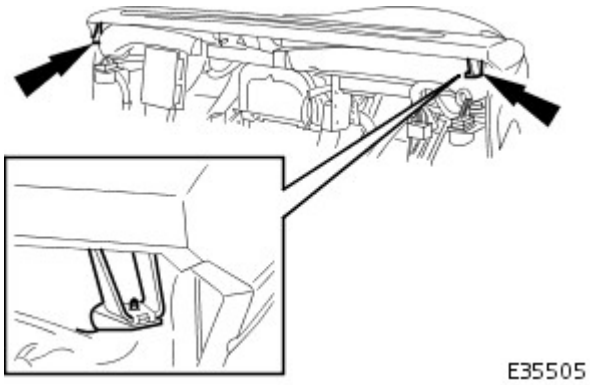
1. Remove instrument panel for access; refer to 76.46.01.

2. Remove rear face primary duct.



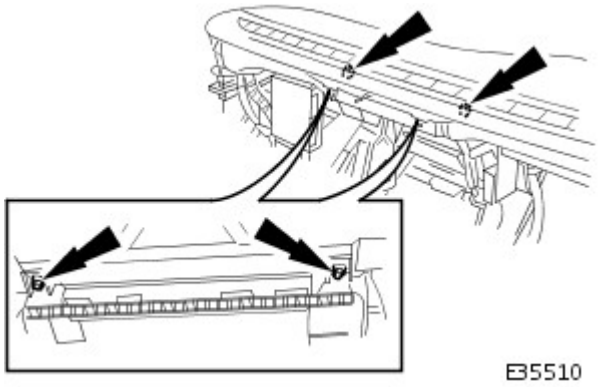
- Remove fasteners.
- Remove duct.

3. Remove right and left hand air distribution box ducts from instrument panel.



- Remove screws.
- Remove ducts.

4. Remove air distribution box from instrument panel.



- Remove nuts.
- Position air distribution box for access to connector.
- Disconnect connector.
- Remove air distribution box.

5. Remove center vent servo motor; refer to 82.20.83.

6. Remove defog vent servo motor; refer to 82.20.84.

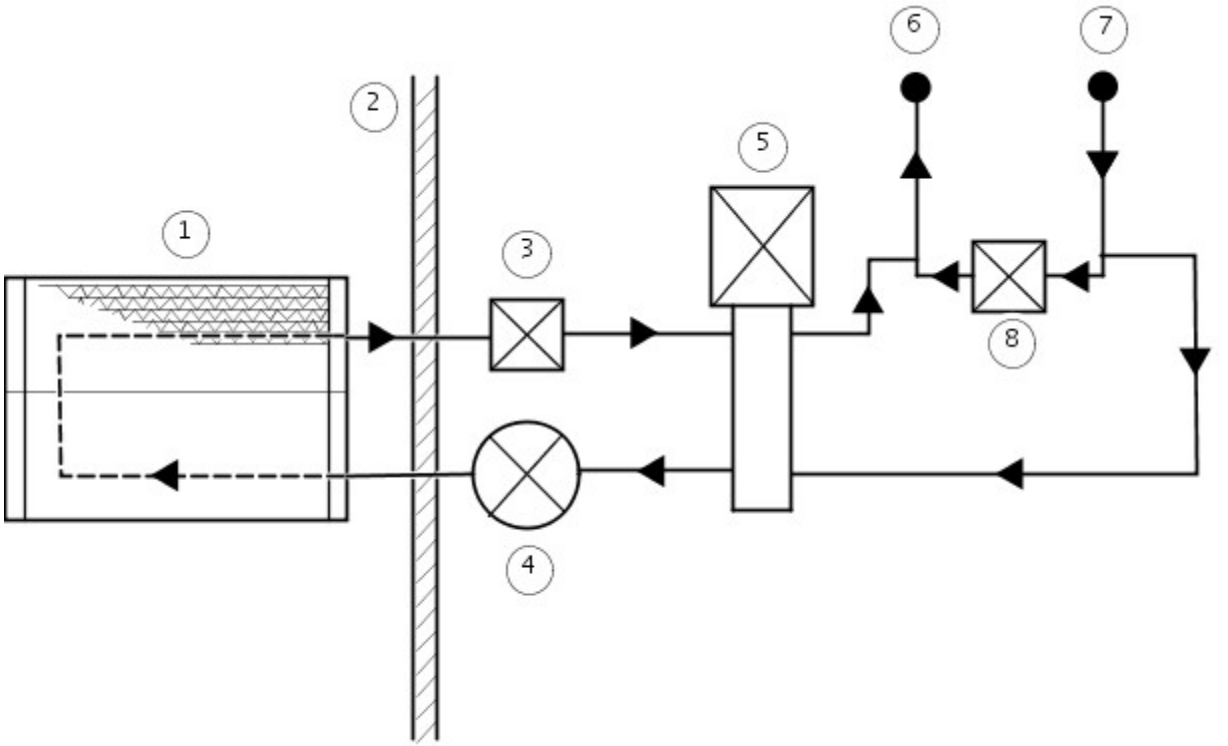
Installation

1. Installation is a reversal of the removal procedure.

Heating and Ventilation - Heating and Ventilation

Description and Operation

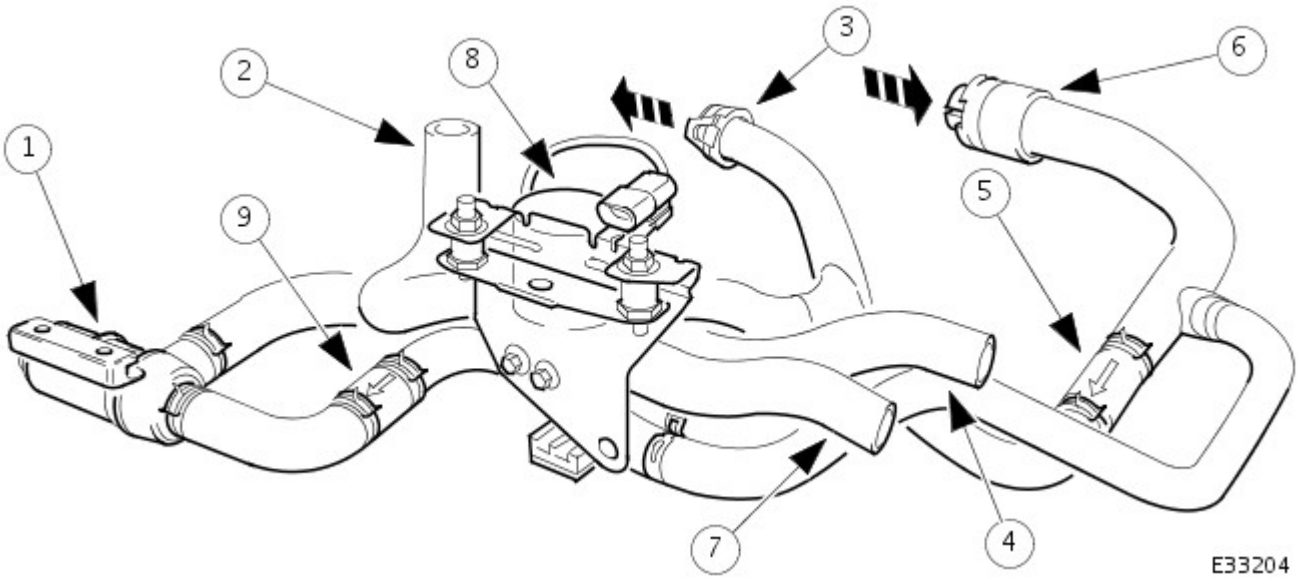
Schematic Diagram



Parts List

Item	Part Number	Description
1	—	Heater matrix
2	—	Firewall
3	—	Non return valve
4	—	Water pump
5	—	Water valve
6	—	Return to engine
7	—	Feed from engine
8	—	Non return valve (heater bypass)

Heater System Components



Parts List

Item	Part Number	Description
1	—	Assembly pump - water
2	—	Hose - from header tank
3	—	Hose / connector - return to engine
4	—	Hose - heater feed to matrix
5	—	Valve - non return (by-pass)
6	—	Hose / connector - feed from engine
7	—	Hose - heater return from matrix
8	—	Assembly valve - water
9	—	Valve - non return

The heater circuit 'scavenges' coolant from the engine cooling system by means of an electric water pump. The water pump has a protection circuit to inhibit operation when the coolant temperature is <16°C; this is to prevent possible damage to the impeller due to the presence of coolant borne ice particles. Coolant is drawn from the engine system through the water valve inlet port into the heater matrix. The coolant passes through the bottom section of the heater matrix from left to right filling the end tank of the matrix before returning through the top half of the matrix and through the outlet ports of the water valve and back into the engine cooling system.

Non return valves are located in the heater bypass hose and the hose between the water pump and valve. These valves are required to prevent coolant flowing in the wrong direction at low engine speeds and restrict convected flow through the heater after the engine is switched off.

When the exterior ambient temperature is > 0°C the refrigeration system automatically operates cooling and dehumidifying incoming air before it is re-heated by the heater matrix.

Water Valve Assembly

Location

The water valve assembly is located above the water pump, in the engine compartment and is secured to the firewall by a bracket. The valve operates by means of an electrical solenoid which oscillates the valve stem between the inlet and outlet ports.

When in automatic mode, the water valve duty cycle is influenced by the following inputs to the A/CCM:

- Outlet air temperature
- 'Air off' heater matrix temperature
- External ambient
- Coolant temperature

- Engine speed (valve closed with the engine not running)
- Demand (set) temperature
- In-car temperature sensor
- Solar sensor

Re-heating of the refrigerated air is controlled by the time that the water valve is open (i.e. not energised) over a six second interval. The duty cycle of the water valve, the time open / time closed, is controlled by the A/CCM.

Maximum heating demand will cause the water valve to be fully open (not energised) to allow maximum coolant flow through the heater matrix.

At Maximum cooling, the water valve will be fully closed (energised) to prevent hot (engine temperature) coolant entering the heater circuit; the pump however will continue to circulate coolant through both the heater matrix and water valve bypass.

The water valve defaults open when the ignition is OFF.

Under engine stall conditions, when ignition is ON, the water valve will be open.

Water Pump Assembly

Located in the same area as the water valve, the water pump continually circulates coolant through the heater matrix except when the conditions below apply:

- The engine coolant is below 16°C.
- The ignition is OFF.
- Under engine stall conditions, when ignition is ON.
- Control panel OFF

Non return valves

The heater bypass hose has a non-return valve, located between the engine feed and return hoses. The valve prevents the water pump from recirculating coolant from the heater at low engine speeds.

The flow indicator arrow embossed on the valve body MUST point towards the coolant header tank.

CAUTION: Coolant flow will be compromised if either valve is fitted incorrectly. Observe the correct direction.

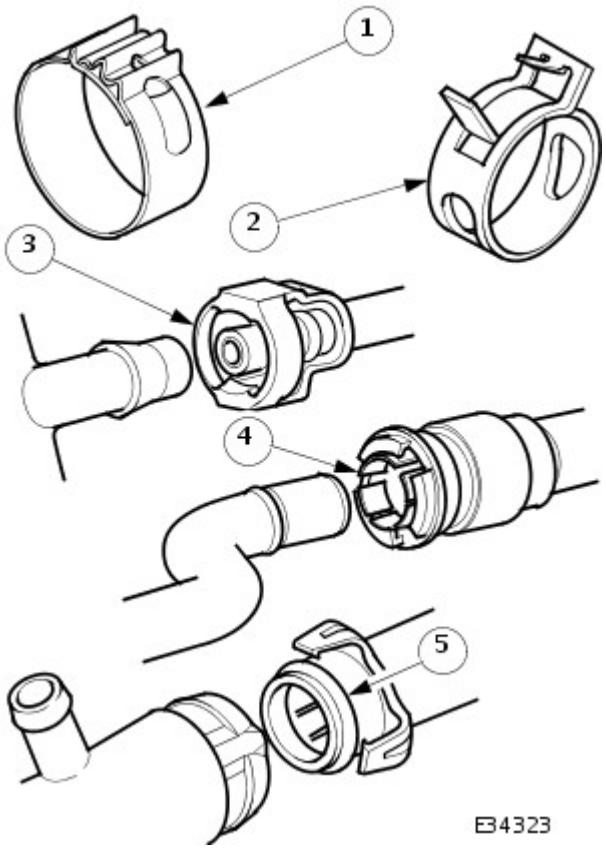
A second non-return valve is located between the water pump and water valve. This valve prevents hot coolant from flowing into the heater with the engine switched off. The flow indicator arrow MUST point towards the water pump.

Heater feed and return hoses

The heater feed and return hoses are connected to the engine feed and return hoses by 'Quick-Fit' connection unions. The feed hose has a Norma R20 connector and the return hose a Norma push and seal connector. The coolant system bleed joints have Cobra clamps. All remaining hose connections have spring band hose clamps.

The engine feed hose is connected to the engine bypass housing and the engine return hose is connected to the engine water pump.

Clamp Identification



Parts List

Item	Part Number	Description
1	—	Cobra
2	—	Spring band
3	—	Quick-fit
4	—	Norma push and seal 'R' type
5	—	Norma push and seal 15

Heating and Ventilation - Heater Core

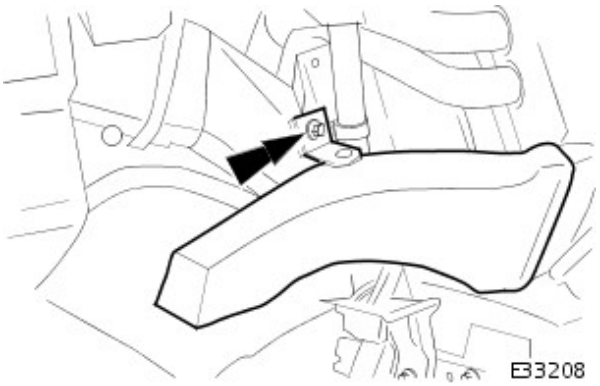
Removal and Installation

Removal

1. Drain radiator coolant only; refer to 26.10.01 or (SC) 26.10.01.

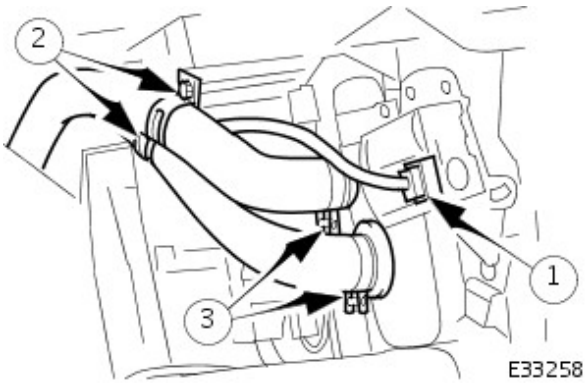
2. Remove instrument panel for access; refer to 76.46.01.

3. Remove driver footwell duct.



- Remove screw.
- Remove duct.

4. Disconnect cool air bypass servo motor connector and heater matrix pipes.



1. Disconnect connector.

• NOTE: Position suitable cloth to absorb coolant leakage before disconnecting pipes.

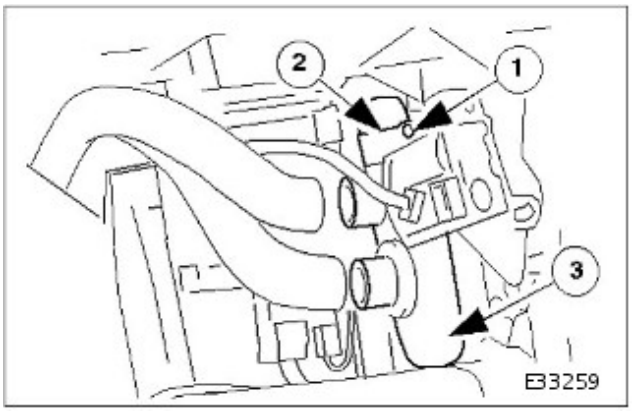
2. Remove screws and retaining brackets.

3. Remove screws and matrix clamps.

• NOTE: Discard O-ring seals from pipes; fit suitable blanking plugs.

- Detach pipes from matrix.

5. Remove heater matrix from heater/cooler assembly.



1. Remove screw.

2. Remove retaining plate.

- Reposition instrument panel support bracket to permit removal of heater matrix (RHD only).

3. Remove heater matrix.

Installation

1. NOTE: Lubricate and install new O-ring seals.

Installation is the reverse of removal procedure.

Heating and Ventilation - Heater Core and Evaporator Core Housing

Removal and Installation

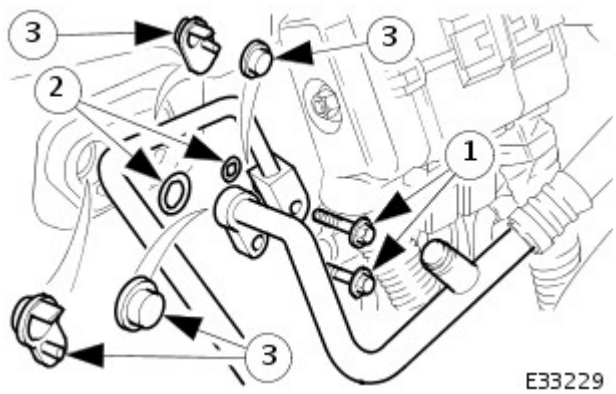
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).

2. Recover refrigerant from air conditioning system; refer to 82.30.30.

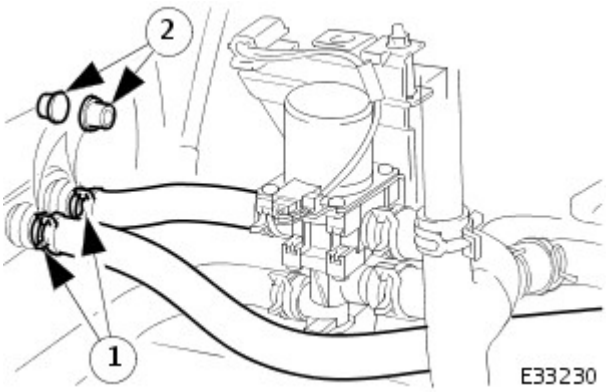
3. Drain radiator coolant only; refer to 26.10.01 or (SC) 26.10.01.

4. Remove instrument panel for access, refer to 76.46.01.



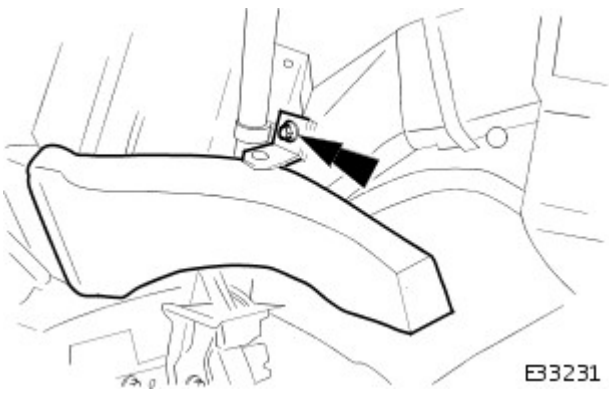
5. From under the hood: Disconnect air conditioning pipes at the evaporator.

1. Remove bolts.
2. Discard O-rings.
3. Install suitable blanking plugs.



6. Disconnect heater hoses from heater matrix pipes.

1. Release spring band clips and disconnect heater hoses.
2. Install suitable blanking plugs.

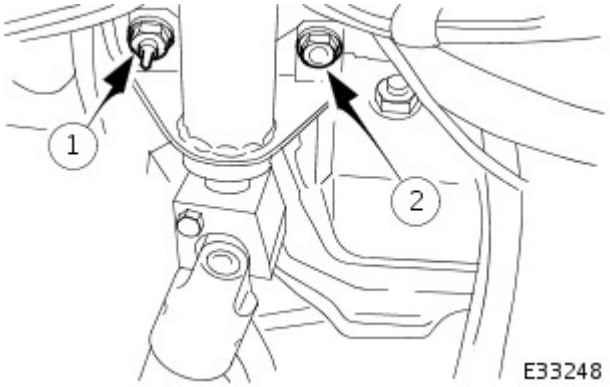


7. From inside the vehicle: remove driver footwell duct.

- Remove screw.
- Remove duct.

8. Remove upper steering column lower fixings.

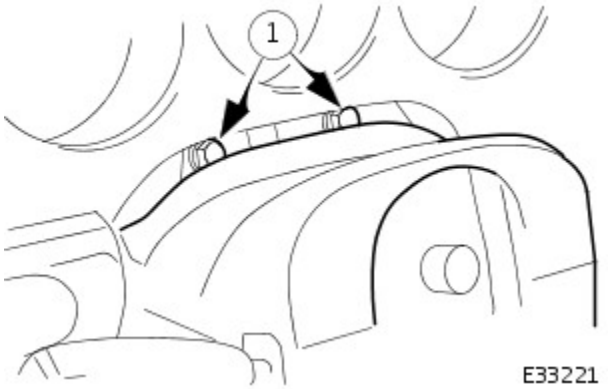
1. Remove nut.
2. Remove bolt.

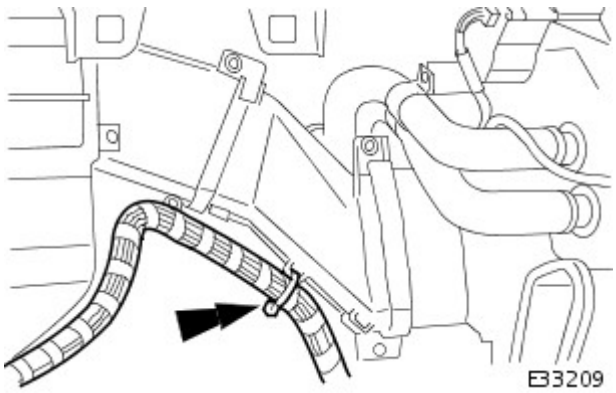


9. Remove upper steering column upper fixings.

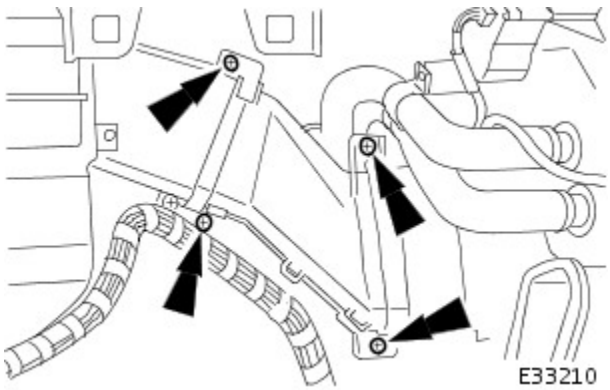
1. Remove bolts.

- Allow column to rest on the floor





10. Cut cable tie which secures console harness to LH blower duct.

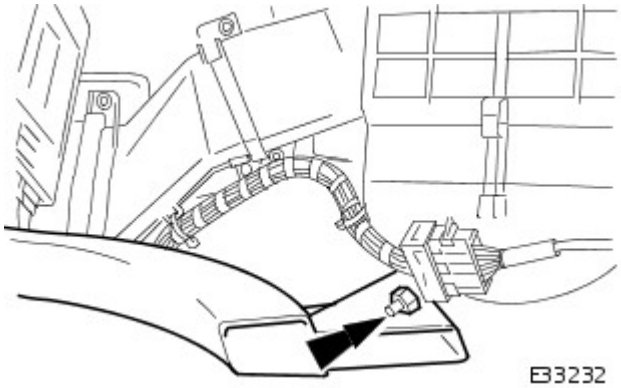


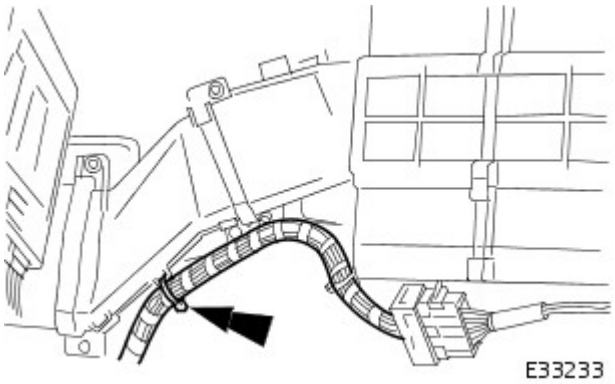
11. Remove LH fan motor duct.

- Remove screws.
- Remove duct.

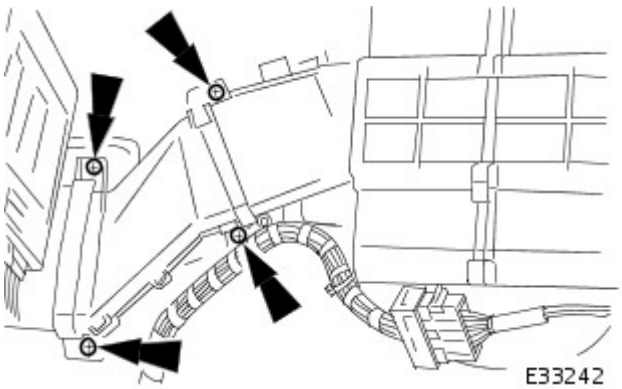
12. Remove passenger side footwell vent.

- Remove nut.
- Remove vent.



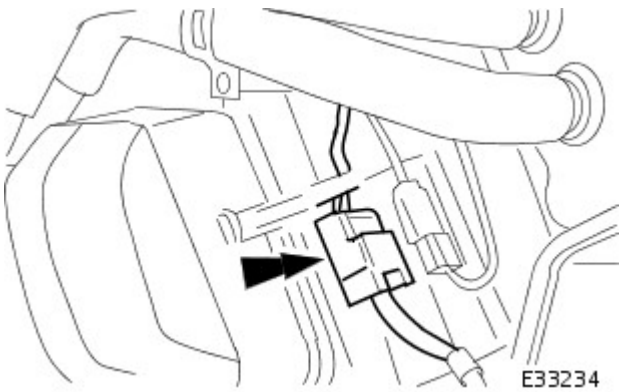


13. Cut cable tie which secures console harness to RH blower duct.



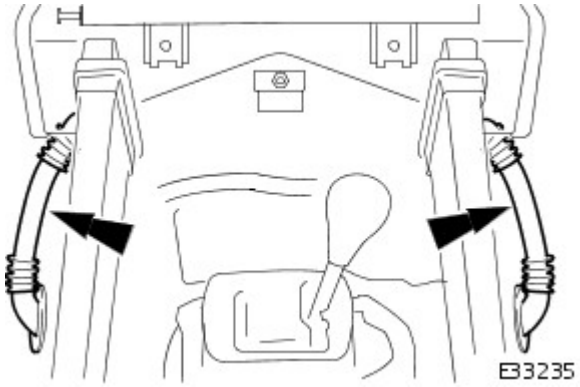
14. Remove RH fan motor duct.

- Remove screws.
- Remove duct.

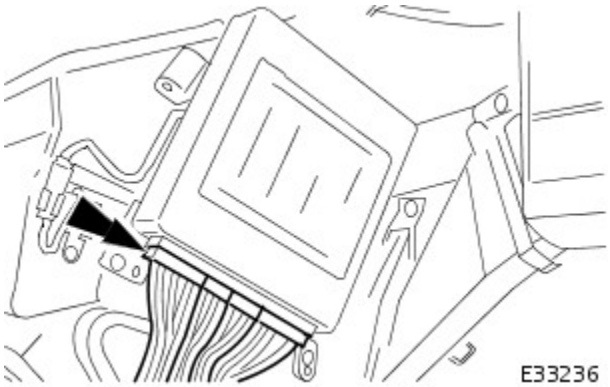


15. Disconnect heater / cooler assembly electrical connector.

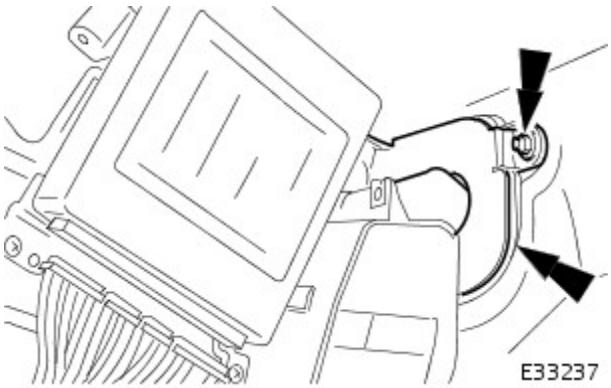
16. Disconnect condensate drain tubes from heater / cooler assembly.



17. Disconnect A/CCM connectors.

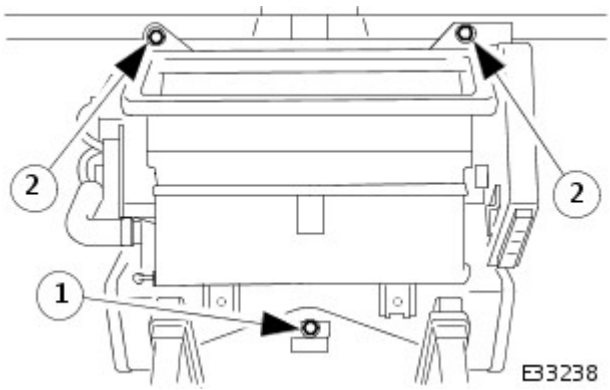


18. Remove evaporator pipe support bracket fixing.



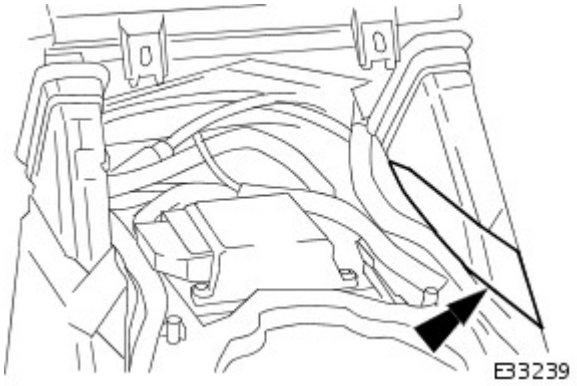
19. Remove heater / cooler assembly fixings.

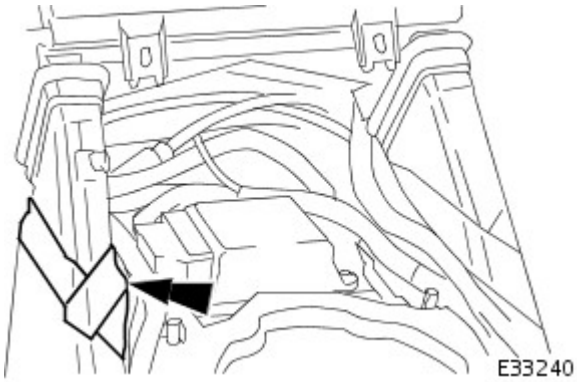
1. Remove lower nut.
2. Remove upper nuts.



20. Remove tape securing RH rear footwell intermediate duct to rear duct joint.

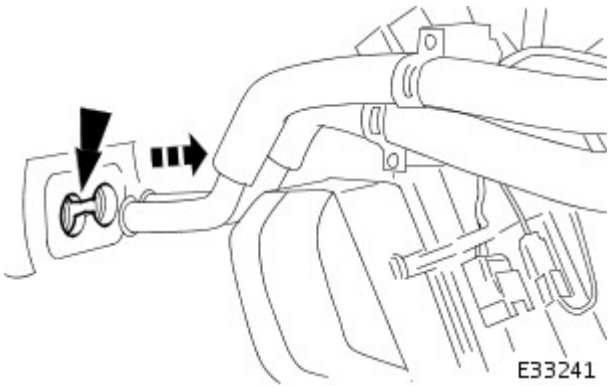
- Displace duct to clear heater / cooler assembly.





21. Remove tape securing LH rear footwell intermediate duct to rear duct joint.

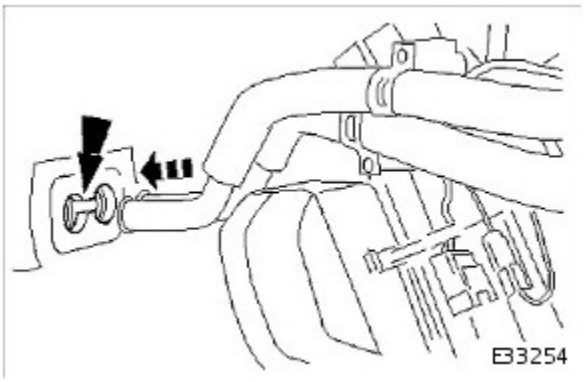
- Displace duct to clear heater / cooler assembly.



22. Remove heater / cooler assembly from vehicle.

- Guide matrix heater pipe stubs through firewall grommet and remove assembly.

Installation

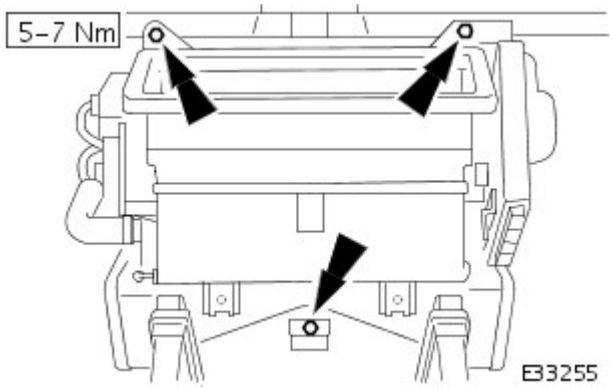


1. Install heater / cooler assembly into vehicle.

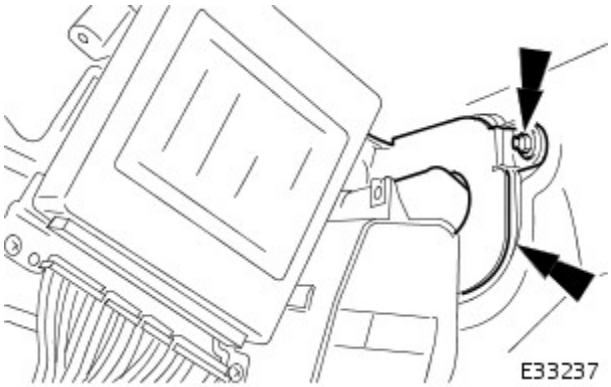
- Guide matrix heater pipe stubs through firewall grommet.
- Position heater / cooler assembly against firewall.

2. Install heater / cooler assembly fixings.

- Install upper fixing nuts.
- Install lower fixing nut.

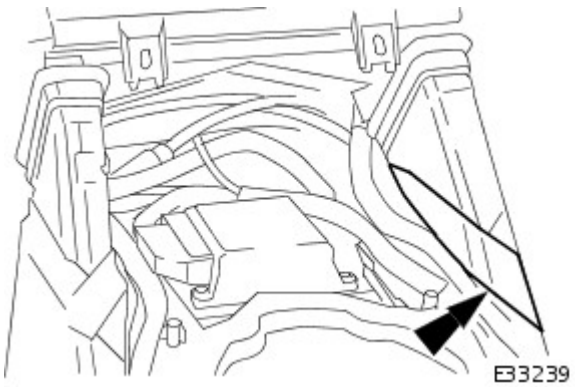


3. Install evaporator pipe support bracket fixing.

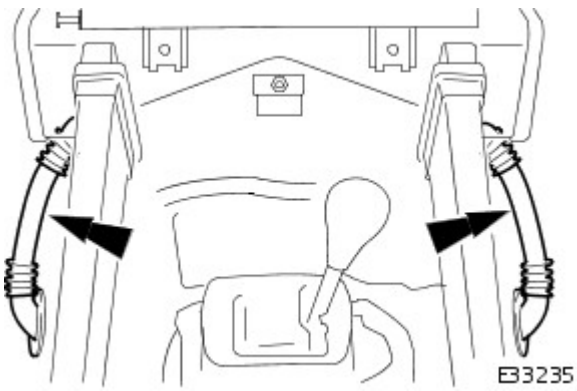


4. Position RH rear footwell intermediate duct to rear duct.

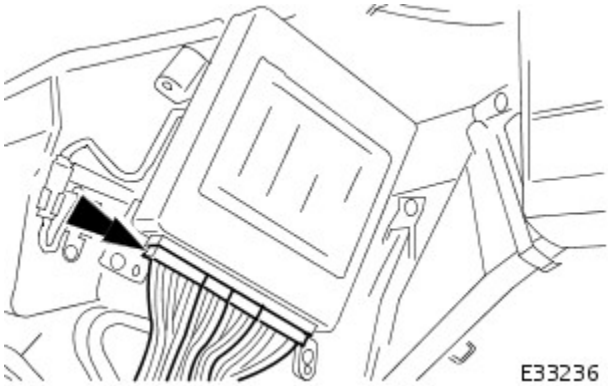
- Secure with suitable cloth tape.

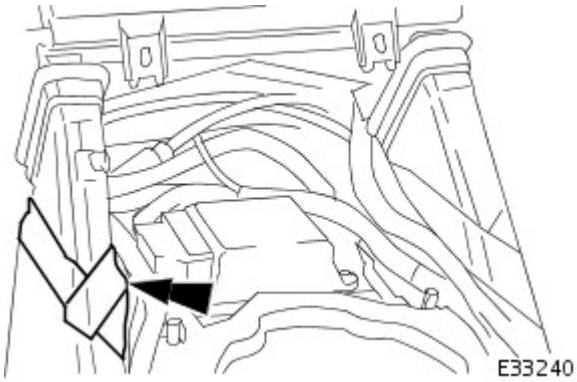


5. Connect condensate drain tubes from heater / cooler assembly.



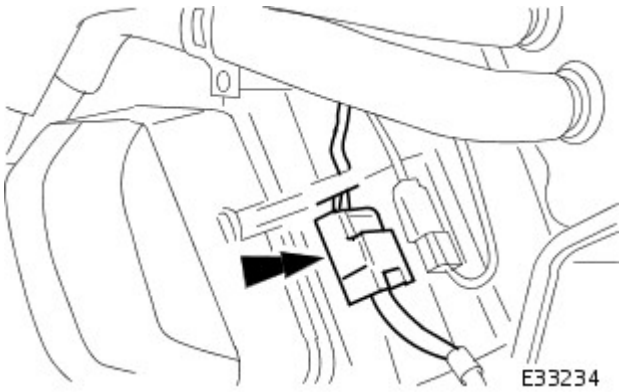
6. Connect A/CCM connectors.



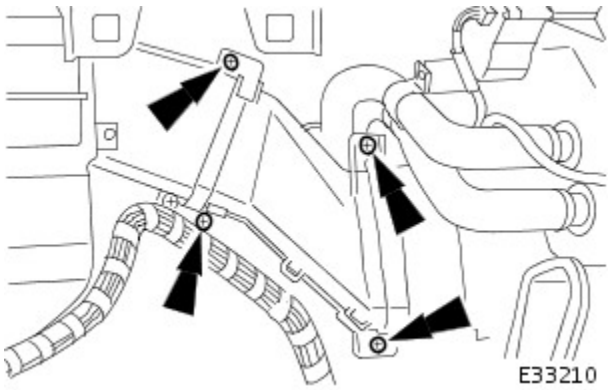


7. Position LH rear footwell intermediate duct to rear duct.

- Secure with suitable cloth tape.



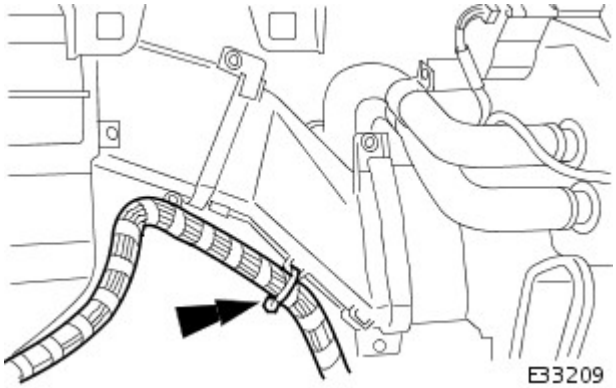
8. Connect heater / cooler assembly electrical connector.

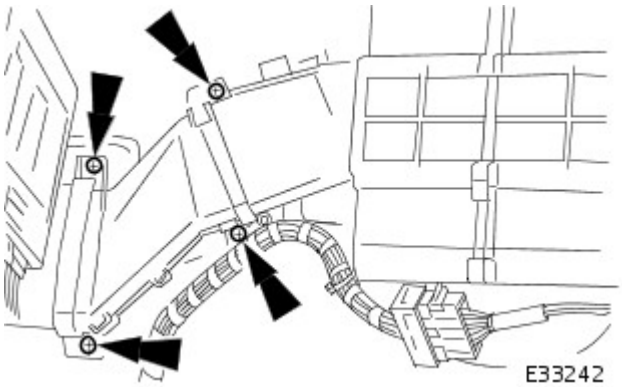


9. Install LH fan motor duct.

- Install duct.
- Install screws.

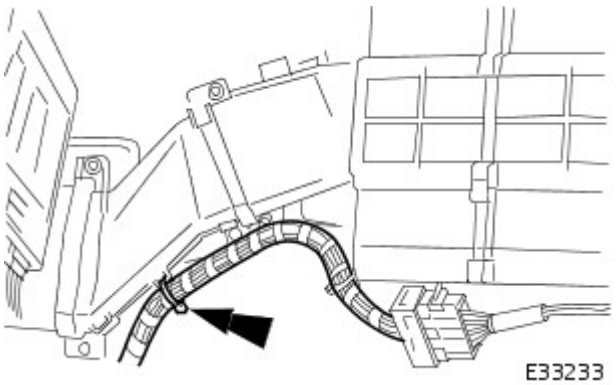
10. Install cable tie to secure console harness to LH blower duct.



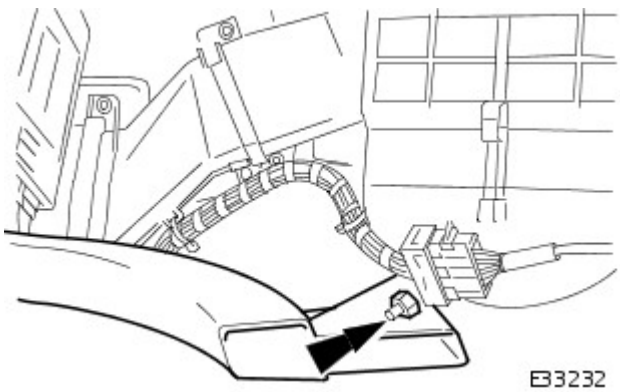


11. Install RH fan motor duct.

- Install duct.
- Install screws.



12. Install cable tie to secure console harness to RH blower duct.



13. Install passenger side footwell vent.

- Install vent.
- Install nut.

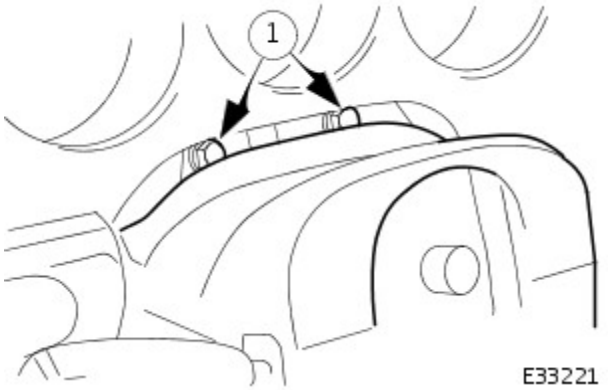
14. Install driver footwell duct.

- Install duct.
- Install screw.



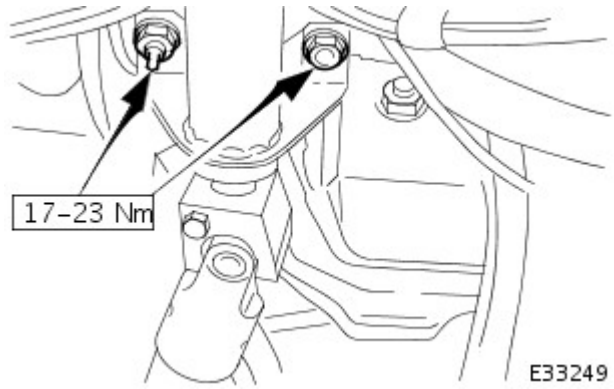
15. Position upper steering column and install upper fixings.

1. Install bolts, do not tighten.

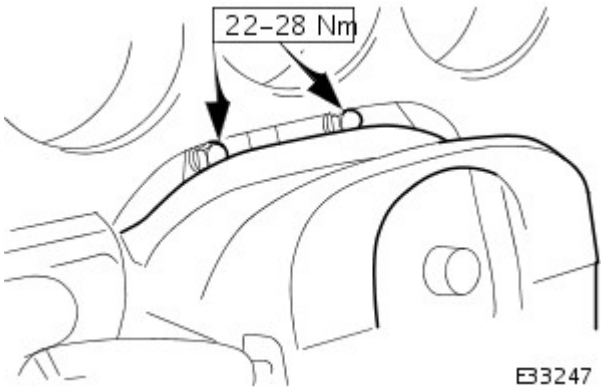


16. Install upper steering column lower fixings.

- Tighten fixings.

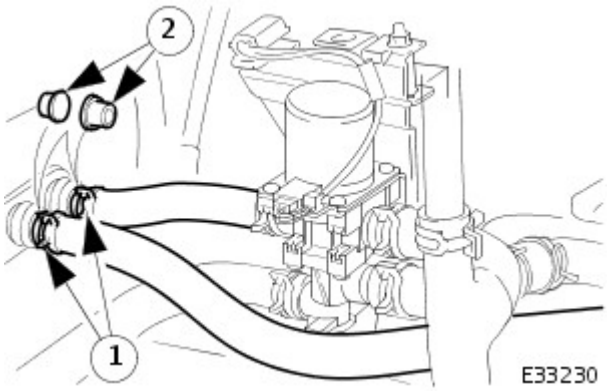


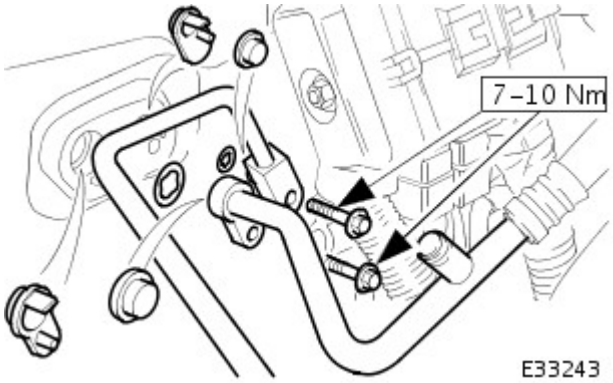
17. Tighten upper fixing bolts.



18. Under hood: reconnect heater hoses to heater matrix pipes.

- Remove blanking plugs.
- Reconnect heater hoses and secure with spring band clips.





19. Reconnect air conditioning pipes at the evaporator.

- Remove blanking plugs.
- Install, fully seat and lubricate new O-ring seals.
- Install bolts.

20. Install instrument panel; refer to 76.46.01.

21. Recharge air conditioning system; refer to 82.30.30.

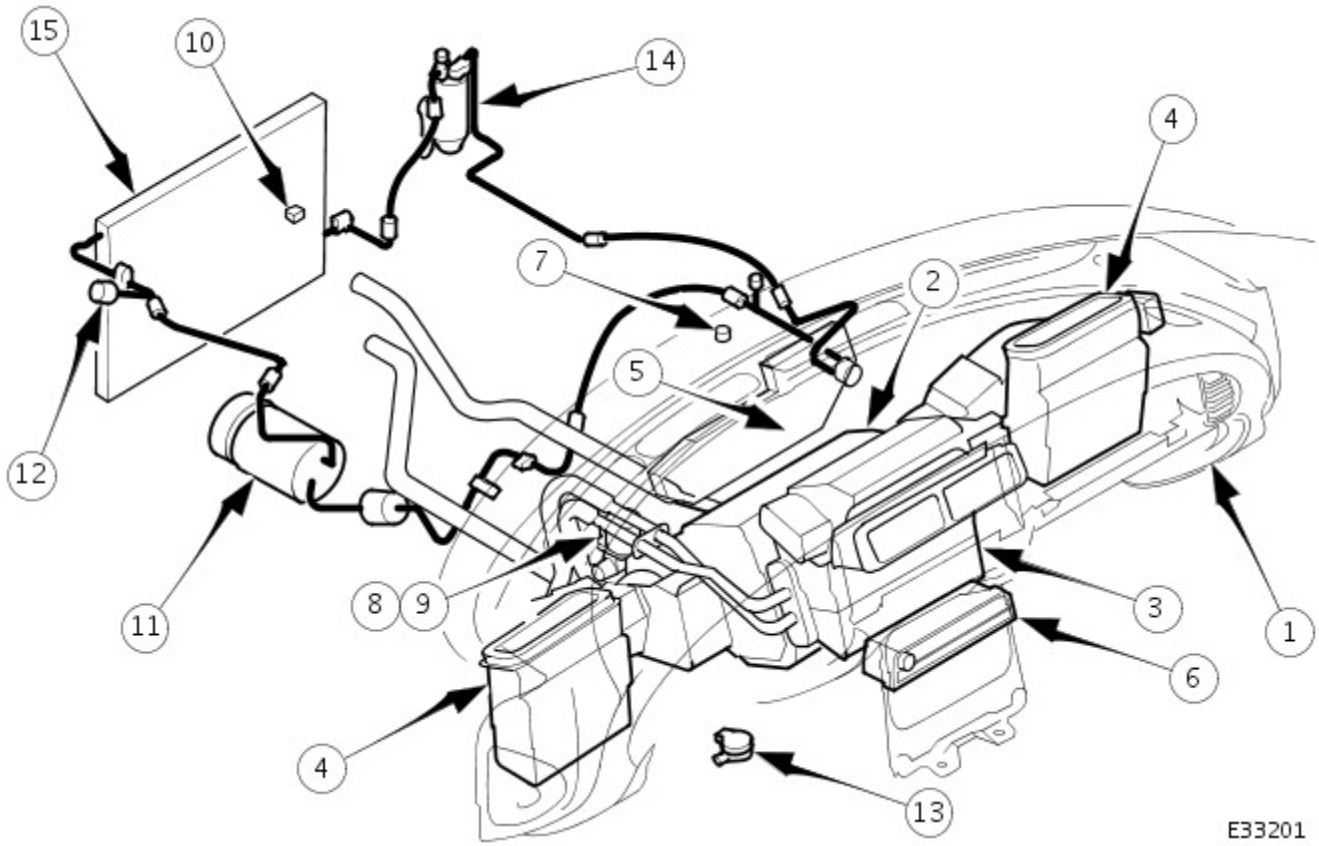
22. Re-fill cooling system; refer to 26.10.01 or (SC) 26.10.01.

23. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Air Conditioning - Air Conditioning

Description and Operation

Introduction



Parts List

Item	Part Number	Description
1	—	Fascia panel with integral ducting
2	—	Heater / cooler assembly
3	—	A/CCM
4	—	Blower LH and RH
5	—	Plenum
6	—	Control panel
7	—	Solar sensor
8	—	Assembly valve - water
9	—	Assembly pump - water
10	—	Temperature sensor - external
11	—	Compressor
12	—	Pressure switch - 4 level
13	—	Motorized in-car aspirator (LHD shown)
14	—	Receiver drier
15	—	Condenser

The climate control system features fully automatic control of temperature, blower speed (airflow) and air distribution to maintain optimum comfort under most driving conditions.

Manual controls are provided to allow the operator to over-ride automatic operation.

System Features

- Twin blower assemblies
- Center mounted evaporator, heater and air distribution unit
- Electric solenoid water valve controlled heating
- Electric water pump assembly
- Servo motor driven air distribution flaps
- Dedicated side glass defrost / demist vents
- External temperature sensor
- Motorised in-car aspirator
- Solar sensor

Electronic Control Panel

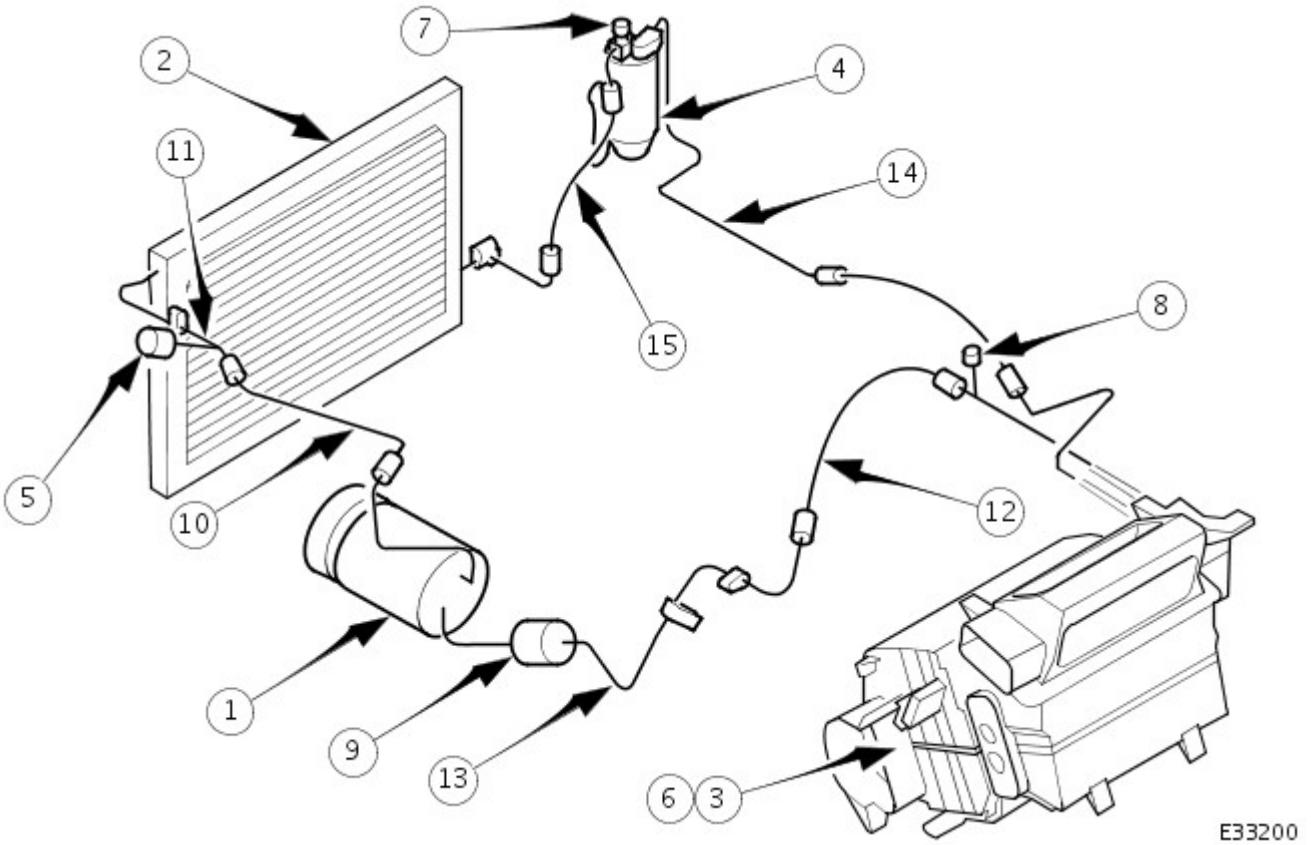
- Liquid Crystal Display (LCD)
- Digital temperature display
- Manual fan speed level
- External temperature display
- Celsius / Fahrenheit selection
- Heated windshield switch (where fitted)
- Heated backlight switch
- Defrost switch
- Manual airflow distribution overrides (4)
- Access to self diagnostic system and error codes

Sensors

- External ambient temperature sensor
- Motorized in-car aspirator
- Heater matrix temperature sensor
- Evaporator temperature sensor
- Solar sensor

These sensors feedback information to the Air Conditioning Control Module (A/CCM) which automatically adjusts air temperature, airflow volume and distribution from the air conditioning unit to maintain a stable passenger compartment average temperature under changing weather conditions.

Major Components



Item	Part Number	Description
1	—	Compressor assembly
2	—	Condenser
3	—	Evaporator and heater matrix (internal)
4	—	Receiver drier
5	—	4-level pressure switch
6	—	Expansion valve (internal)
7	—	High-side charge port
8	—	Low-side charge port
9	—	Suction muffler
10	—	Discharge hose
11	—	Discharge pipe
12	—	Suction hose
13	—	Suction pipe
14	—	Liquid line
15	—	Jumper hose (condenser hose)

Compressor:

Features

- Engine mounted, driven by the accessory drive belt.
- Fixed displacement type.
- High-pressure relief valve, to avoid system over-pressure.
- ECM controlled clutch energized via a relay.

Receiver drier:

- Vertically mounted on the right-hand side of the engine compartment next to the engine coolant radiator.
- Fitted with the high-side charge port.
- Includes a fluorescent tracer dye mechanism to aid leak detection.

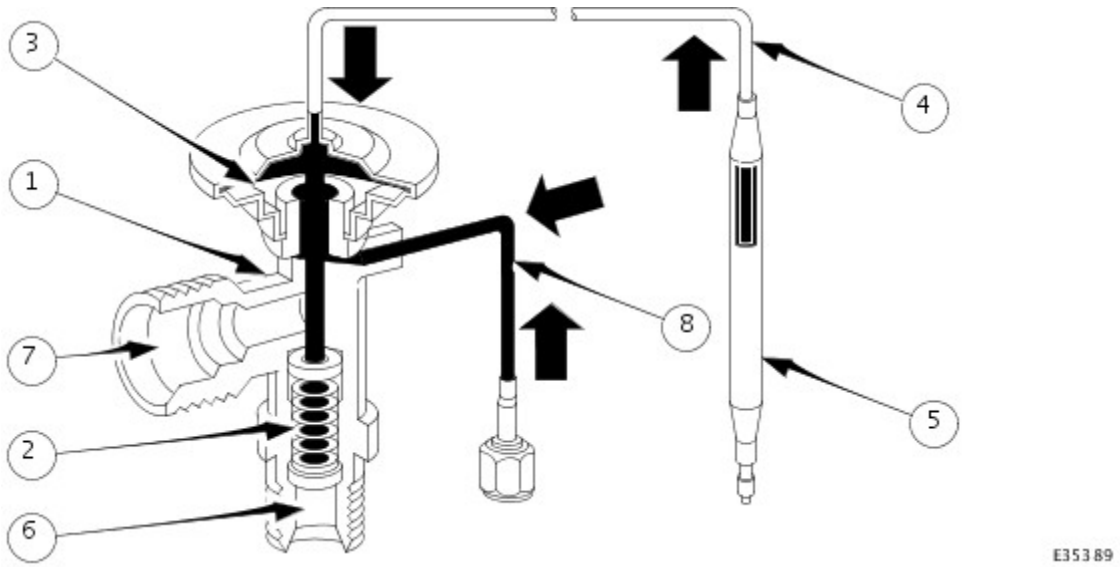
Condenser:

- Multi-pass fin-over-tube type, mounted in front of the engine cooling pack and directly to the radiator.

Pressure (Bitron) switch:

- Located in the discharge pipe.
- Provides a signal, via the A/CCM, to the ECM, to disengage the compressor clutch should the refrigerant pressure be < 2 bar or > 30 bar.
- Provides a hard-wired signal to the ECM, to switch the cooling fans to HIGH speed at 22 bar rising pressure and to LOW speed at 17,5 bar falling pressure.
- Provides a hard-wired signal to the ECM, to switch the radiator cooling fans to LOW speed at 12 bar rising pressure and to switch the fans OFF at 8 bar falling pressure.

Expansion Valve

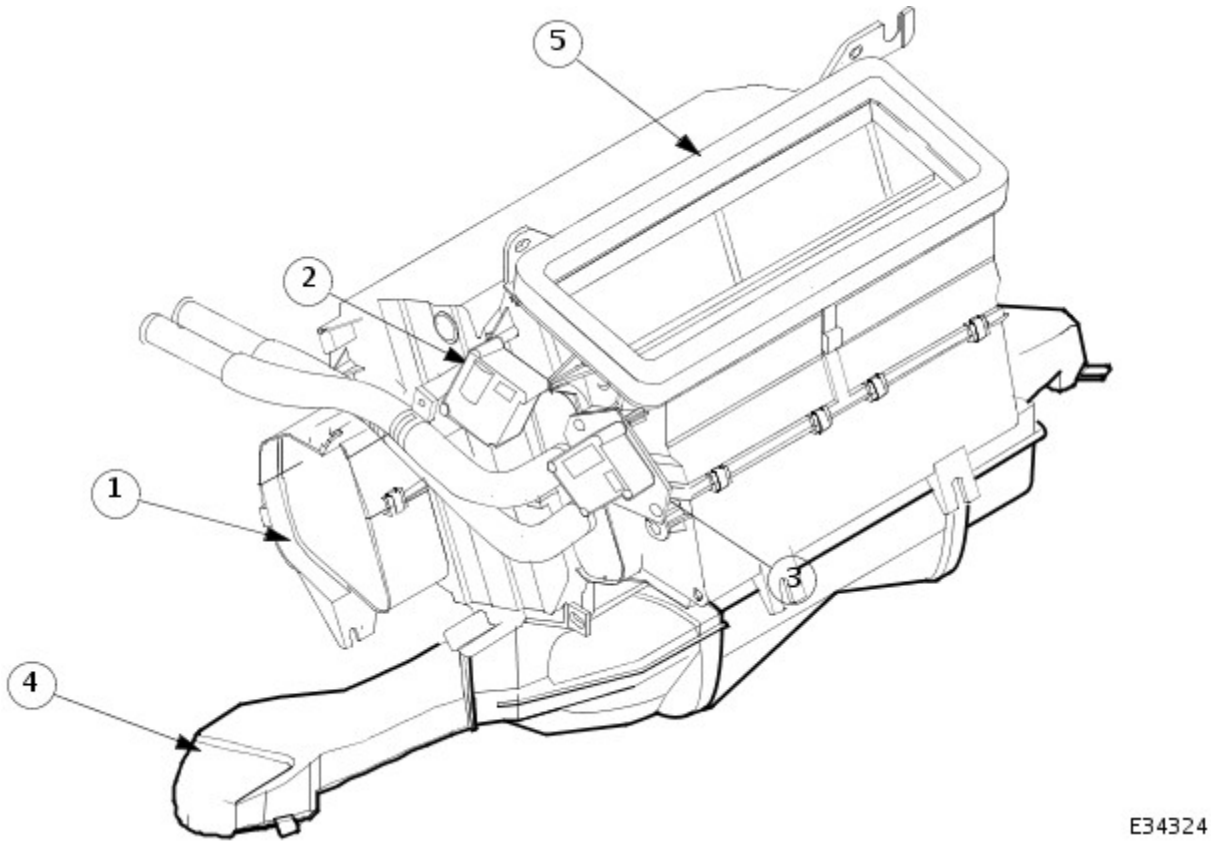


Parts List

Item	Part Number	Description
1	—	Valve body
2	—	Pressure spring
3	—	Diaphragm
4	—	Capillary tube
5	—	Temperature sensing bulb
6	—	Valve inlet
7	—	Valve outlet
8	—	Equalizer pipe

The expansion valve is located inside the heater / air conditioning unit and comprises of a diaphragm, connected by a capillary tube to a temperature sensing bulb, which regulates the valve according to temperature variations at the evaporator outlet pipe. This component is NOT serviceable. See 'Refrigeration Cycle'

Air Conditioning (Heater / Cooler) Unit



Parts List

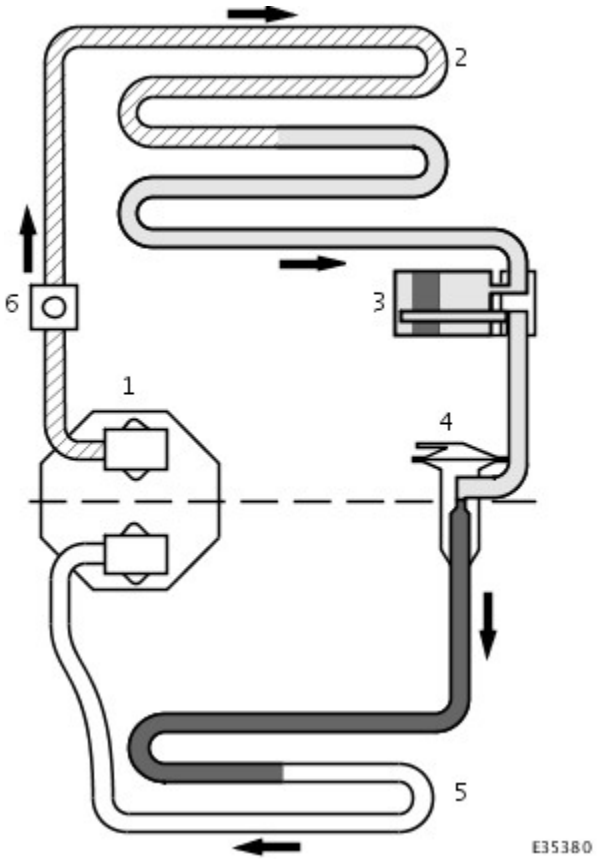
Item	Part Number	Description
1	—	Air inlet - LH (RH opposite, not shown)
2	—	Servomotor - cool air bypass
3	—	Servomotor - footwell outlet
4	—	Air outlet - footwell
5	—	Air outlet - ADB (with foam seal)

The air conditioning unit houses the evaporator, heater matrix and their temperature sensors. The unit also incorporates two servo motor operated air distribution flaps which regulate airflow to the front and rear footwells and the quantity of airflow through the cool air bypass (air which by-passes heater matrix) up to the upper air distribution box (ADB).

When the footwell flap is open, air is ducted to the front and rear footwell areas via the lower air distribution duct (LADD) and appropriate ducts. The LADD is clipped to the bottom of the air conditioning unit case and the front foot ducts clipped onto the outlets of the LADD.

Condensate (water) which forms on the evaporator fins is drained out of the unit case through two drains, located either side of the unit underneath the evaporator. The liquid is routed to the vehicle exterior via flexible tubes which are located behind the firewall heatshield.

Refrigeration Cycle



Item	Part Number	Description
1	—	Compressor
2	—	Condenser
3	—	Receiver drier
4	—	Expansion valve
5	—	Evaporator
6	—	4-level pressure switch

Refrigeration Cycle

The Compressor draws low pressure, low temperature, refrigerant from the evaporator and, by compression, raises the refrigerant temperature and pressure. High pressure, hot, vaporized refrigerant enters the condenser, where it is cooled by the flow of ambient air. A change of state occurs as the refrigerant cools in the condenser and it becomes a reduced temperature, high pressure, liquid.

From the condenser, the liquid passes into the receiver drier which has three functions:

- Storage vessel for varying system refrigerant demand.
- Filter to remove system contaminants.
- Moisture removal via the dessicant.

With the passage through the receiver drier completed, the liquid refrigerant, still at high pressure, enters the expansion valve where it is metered through a controlled orifice, which has the effect of reducing the pressure and temperature. The refrigerant, now in a cold atomized state, flows into the evaporator and cools the air passing through the matrix.

As heat is absorbed by the refrigerant, it once again changes state, into a vapor, and returns to the compressor for the cycle to be repeated.

An automatic safety valve is incorporated in the compressor, which will operate if the system pressure rises above 41 bar. The valve will reseat when the pressure drops below 27,6 bar.

The terms 'high' and 'low' pressure (or side) refer to the pressure differential between the compressor and expansion valve ports. This differential is critical to system fault diagnosis and efficiency checks.

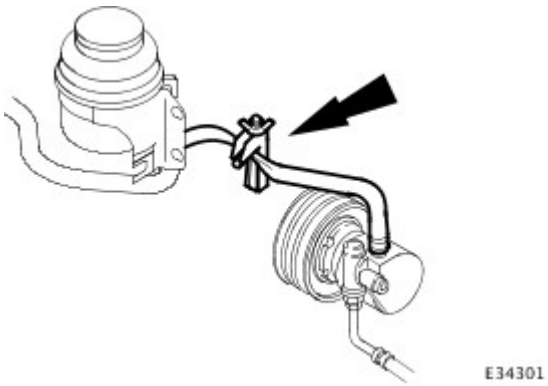
Air Conditioning - Air Conditioning (A/C) Compressor

Removal and Installation

Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Recover refrigerant from air conditioning system; refer to 82.30.30.
3. Remove supercharger drive belt (where fitted); refer to 18.50.08.
4. Remove front end accessory drive belt; refer to 12.10.40 or (SC) 12.10.40.
5. NOTE: A commercially available brake pipe clamp is recommended. Do not over tighten.

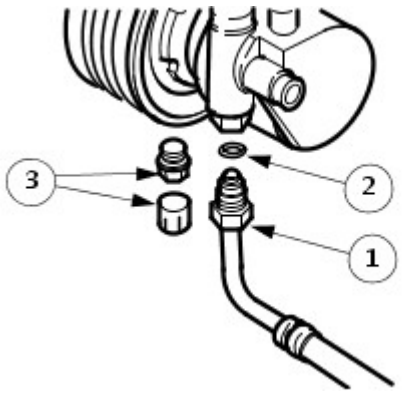
   Clamp power steering reservoir to pump feed hose.



6. Raise vehicle for access
7. NOTE: Position drain tin to collect the fluid when union nut is released.

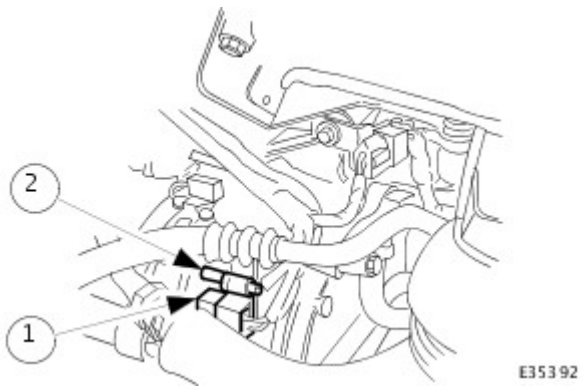
   Disconnect steering rack hose from pump.

   1. Release union nut.
   2. Discard O-ring.
   3. Install suitable blanking plugs.



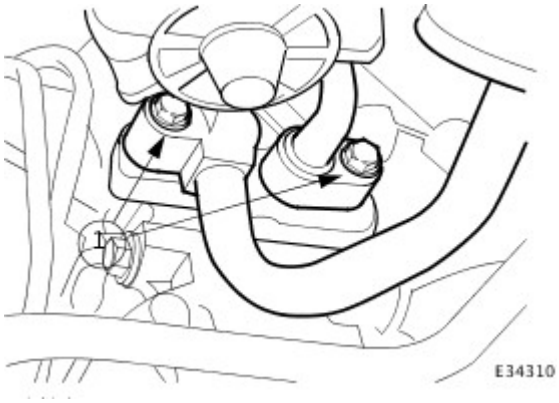
8. Disconnect clutch harness connector from compressor.

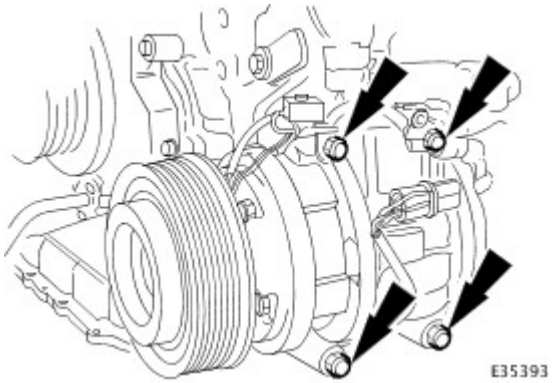
   1. Disconnect connector.



9. Disconnect lines from compressor.

   - Discard O-rings.
   - Install suitable blanking plugs.





10. NOTE: Reposition compressor after releasing the fixings to allow removal.

Remove compressor.

- Remove bolts.

11. NOTE: This step is not necessary in the case of refrigerant loss.

Measure amount of oil held in compressor.

- Remove blanking plugs from the compressor.
- Pour oil from compressor into a suitable measuring container. Note amount and discard the oil.
- Install blanking plugs to compressor.

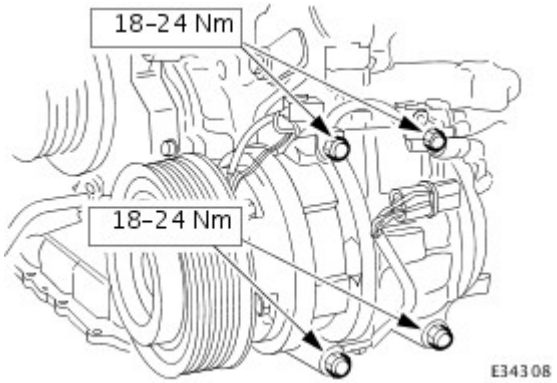
Installation

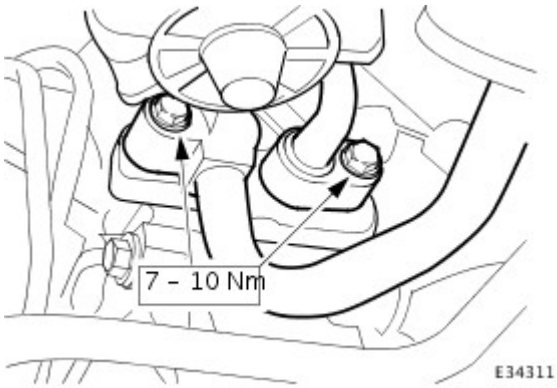
1. Fill new compressor with correct amount of oil.

- Remove blanking plugs from compressor.
- Pour oil from compressor into a suitable container.
- Fill compressor with the same amount of oil that was removed from original compressor, plus amount recovered from recovery equipment.
- Install blanking plugs to compressor.

2. Install compressor.

- Tighten fixings.





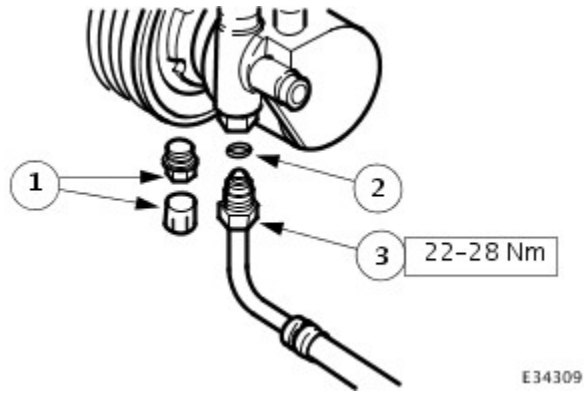
3. Install lines to compressor.

- Install new O-ring seal and lubricate with clean compressor oil.



4. Connect clutch harness connector to compressor.

1. Connect clutch connector.

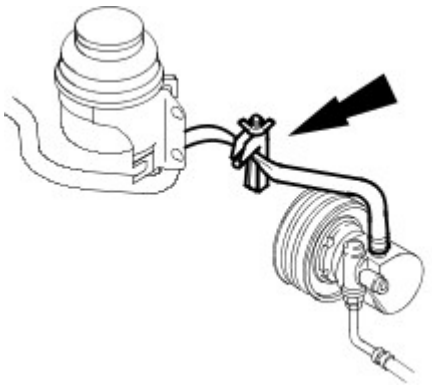


5. Connect power steering hose to pump.

1. Remove blanking plugs.
2. Install new O-ring seal and lubricate with clean compressor oil.
3. Tighten union nut.

6. Lower ramp.

7. Unclamp power steering reservoir to pump feed hose.



E34301

8. Install front end accessory drive belt; refer to 12.10.40 or (SC) 12.10.40.

9. Install supercharger drive belt (where fitted); refer to 18.50.08.

10. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

11. Recharge air conditioning system; refer to 82.30.30.

12. Check / bleed / top up power steering fluid reservoir; refer to 211-02.

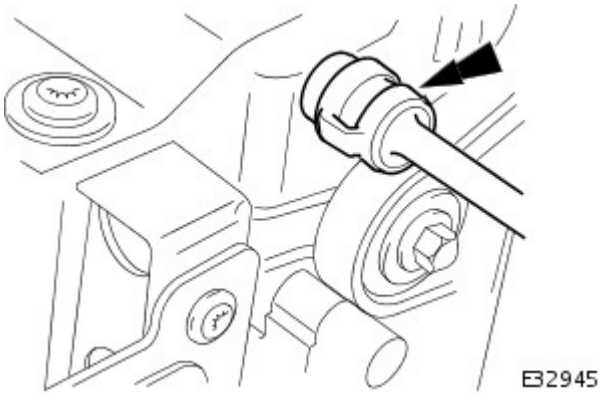
Air Conditioning - Condenser Core

Removal and Installation

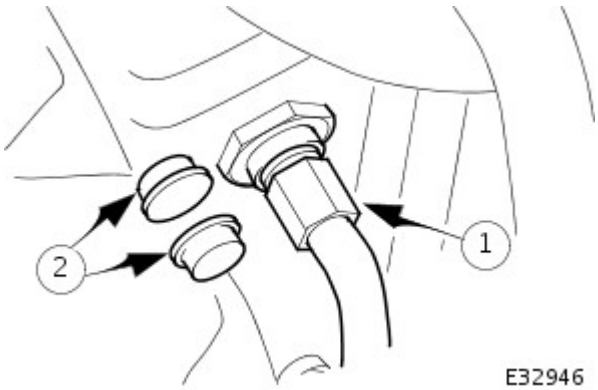
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Drain radiator coolant only; refer to 26.10.01 or (SC) 26.10.01.
3. Recover refrigerant from air conditioning system; refer to 82.30.30.
4. Release both gas struts, set the engine cover fully forward to the service access position and support with a wooden (or similar) strut.
5. CAUTION: Take care not to damage hood or radiator grille.

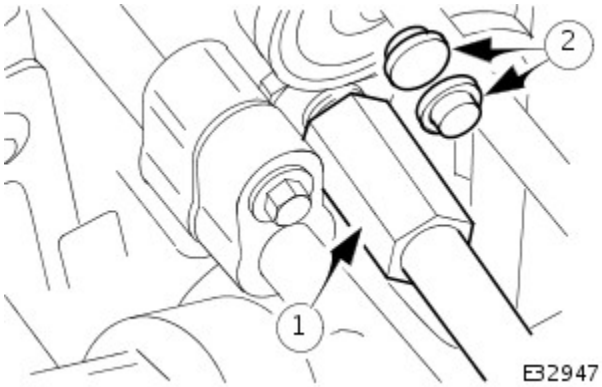
   Remove twin fan and motor assembly; refer to 26.25.12.
6. Disconnect radiator bleed hose.



   - Release connection.
7. Remove retaining clip which secures transmission oil cooler upper and lower pipes.
8. Disconnect transmission oil cooler lower pipe from radiator.

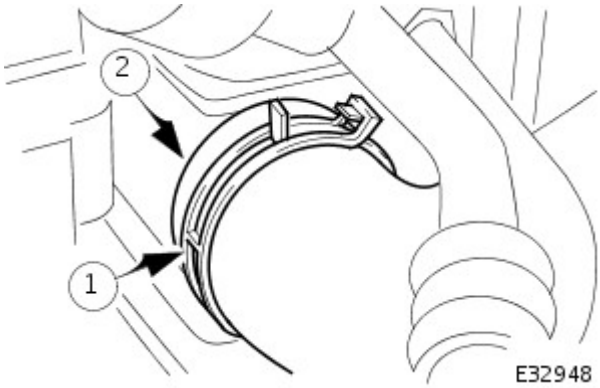


   1. Release union nut and disconnect pipe.
   - Discard O-ring seal.
   2. Install suitable blanking plugs.
9. From above the vehicle, disconnect transmission oil cooler upper pipe from radiator.
   1. Release union nut and disconnect pipe.
   - Discard O-ring seal.
   2. Install suitable blanking plugs.



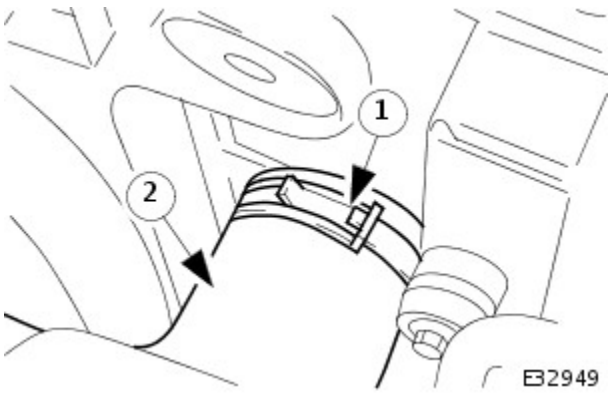
10. Disconnect radiator bottom hose.

1. Release hose retaining clip.
2. Disconnect hose.

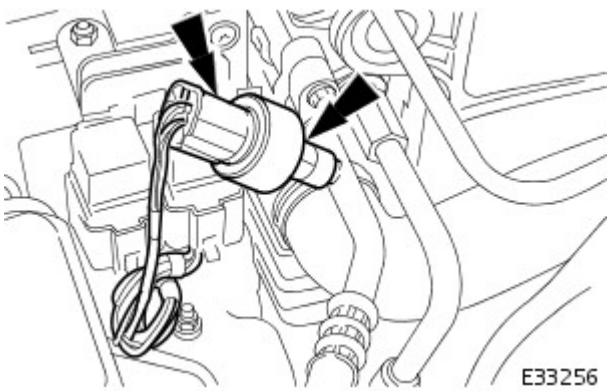


11. Disconnect radiator top hose.

1. Release hose retaining clip.
2. Disconnect hose.

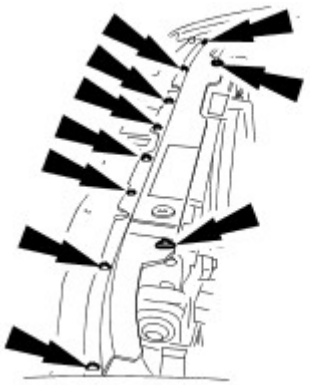


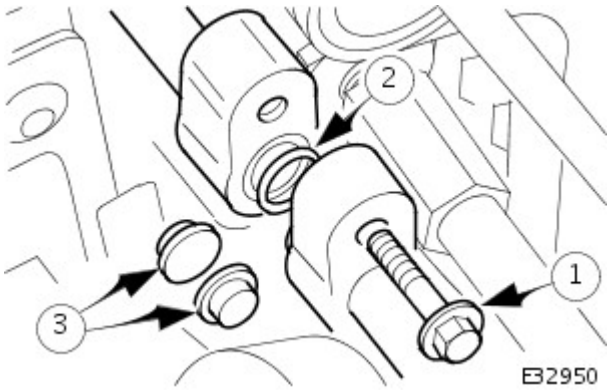
12. Disconnect connector from pressure switch.



13. Release radiator top retaining panel.

- Remove bolts.

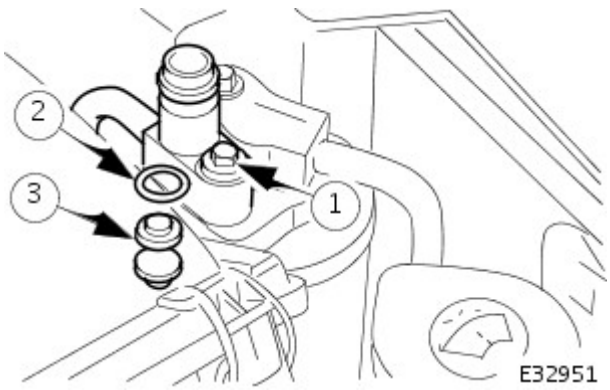

E35477



E32950

14. Disconnect compressor to condenser discharge line from condenser.

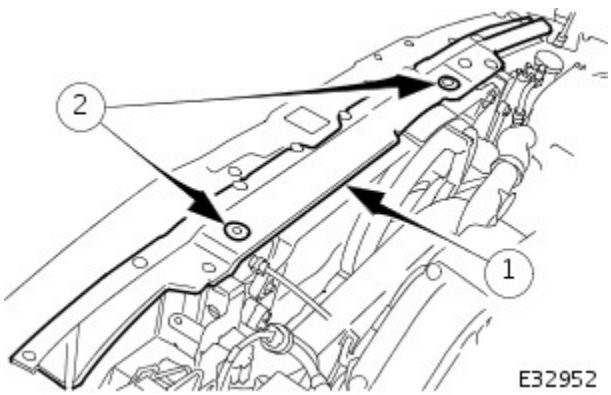
1. Remove bolt.
2. Discard O-ring seal.
3. Install suitable blanking plugs.



E32951

15. Disconnect condenser to receiver / drier line from receiver / drier.

1. Remove bolt.
2. Discard O-ring seal.
3. Install suitable blanking plugs.

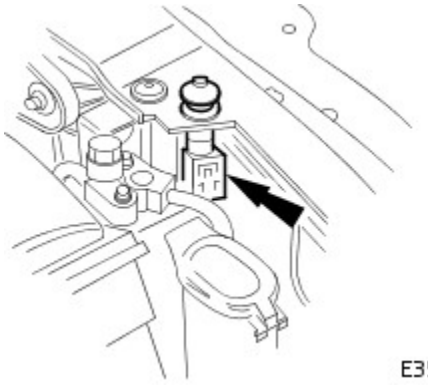


E32952

16. Remove radiator retaining panel.

1. Remove panel.
2. Remove mounting bushes.

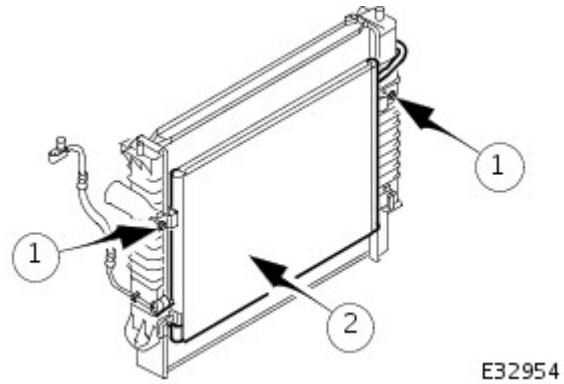
17. Disconnect hood switch harness connector.





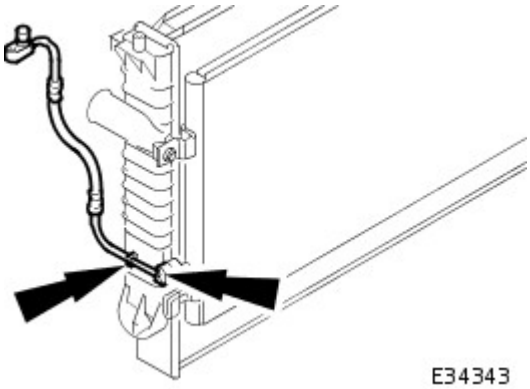
18. Remove radiator / condenser assembly.

- Clean coolant spillage from radiator lower carrier panel.



19. Separate condenser from radiator.

1. Remove bolts.
2. Remove condenser.

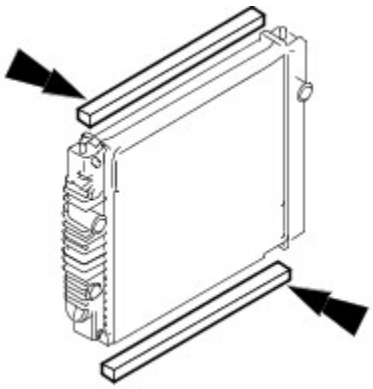


20. If necessary, remove condenser to receiver / drier line from condenser.

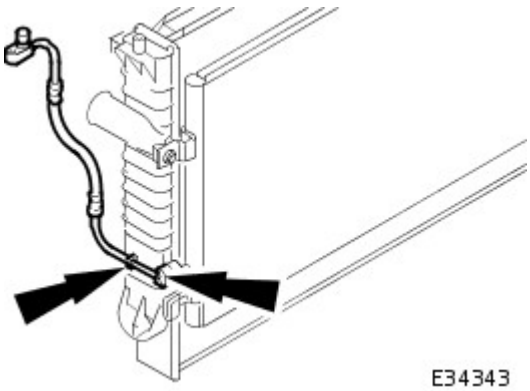
- Remove bolt.
- Detach hose from clip.
- Discard O-ring seal.
- Install suitable blanking plugs.

Installation

1. If necessary, renew radiator top and bottom foam sealing strips.



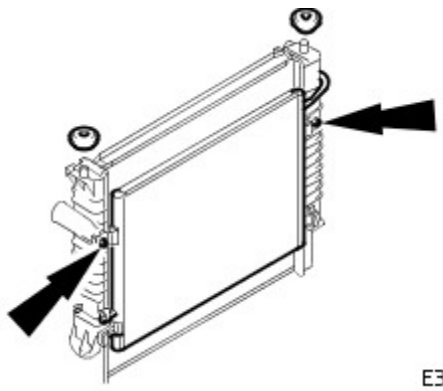
E32955



E34343

2. If previously removed, install condenser to receiver / drier line at condenser.

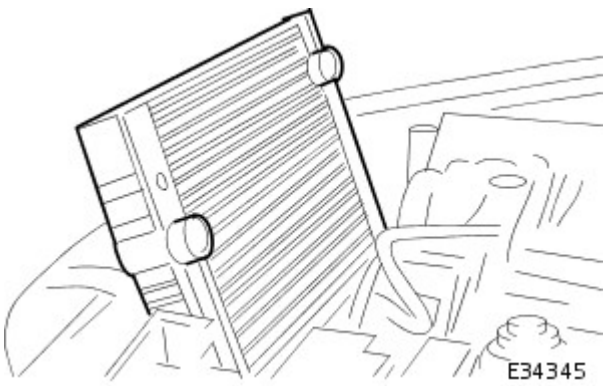
- Remove blanking plugs.
- Install new O-ring seal and lubricate with clean compressor oil.
- Install bolt (8-10 Nm).
- Locate hose to clip.



E34344

3. Install condenser to radiator.

- Install bolts (8-10 Nm).

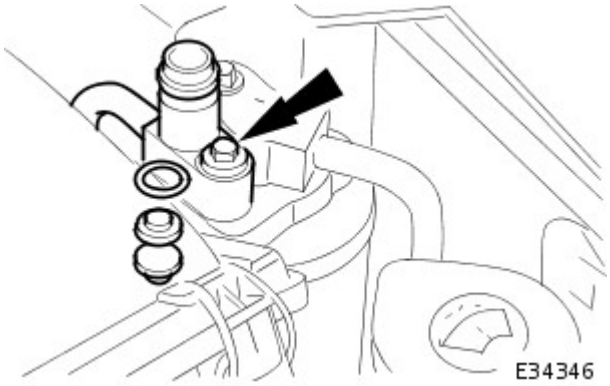


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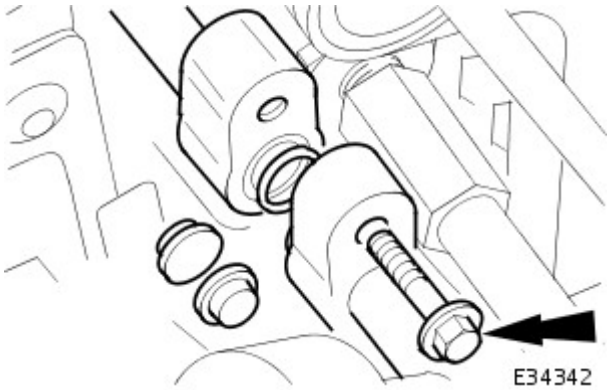
4. Install radiator / condenser assembly.

5. Connect condenser to receiver / drier line at receiver / drier.

- Remove blanking plugs.
- Install new O-ring seal and lubricate with clean A/C compressor oil.

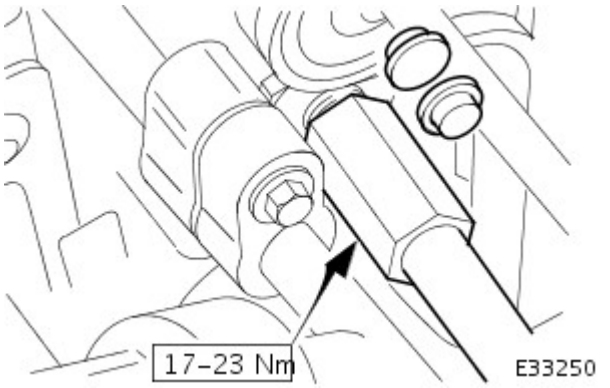


- Connect hose.
- Install bolt (8-10 Nm).



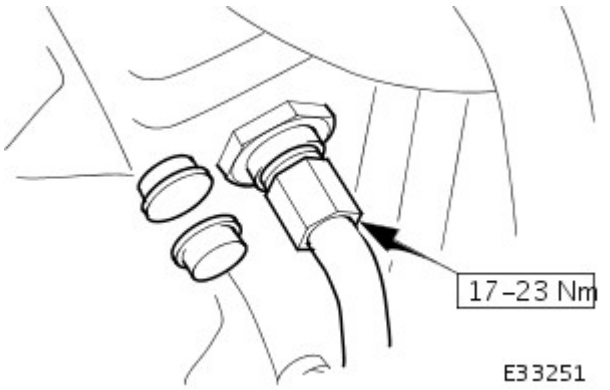
6. Connect compressor to condenser discharge line at condenser.

- Remove blanking plugs.
- Install new O-ring seal and lubricate with clean A/C compressor oil.
- Connect hose.
- Install bolt (8-10 Nm).



7. Connect transmission oil cooler upper pipe.

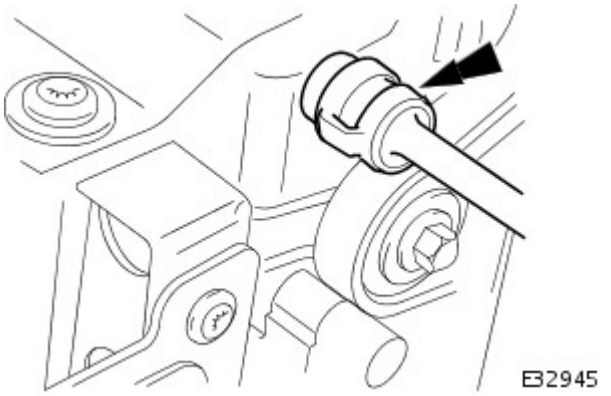
- Remove blanking plugs.
- Install new O-ring seal and lubricate with clean automatic transmission fluid.
- Connect union nut to radiator and tighten.



8. Connect transmission oil cooler lower pipe.

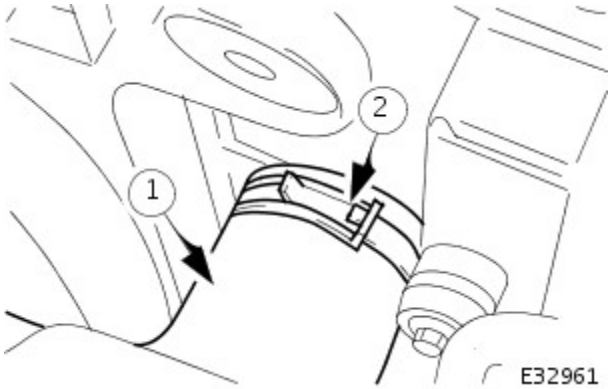
- Remove blanking plugs.
- Install new O-ring seal and lubricate with clean automatic transmission fluid.

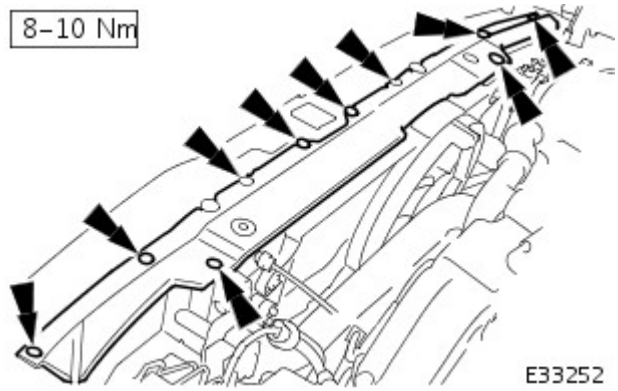
9. Connect radiator bleed hose to radiator.



10. Connect radiator top hose to radiator.

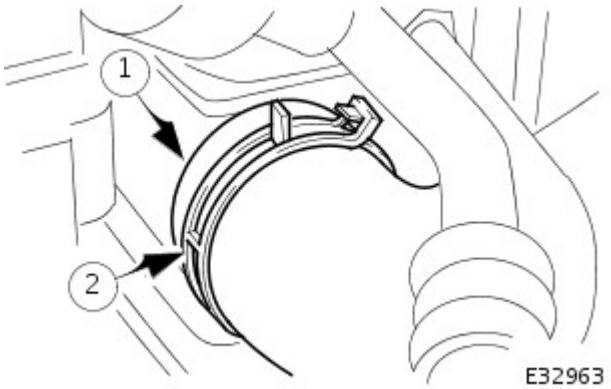
1. Connect top hose.
2. Reposition and tighten hose clip.





11. Install radiator retaining panel.

- Install bolts and sequentially tighten from center outwards.

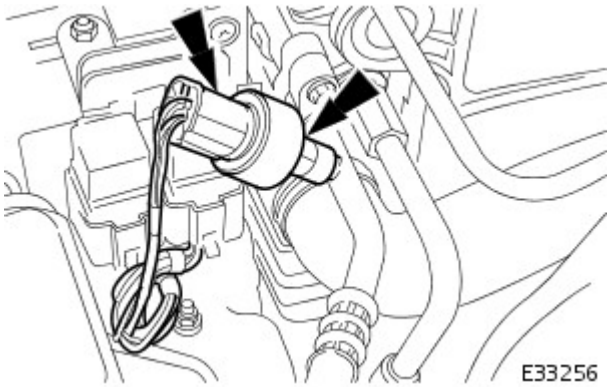


12. Connect radiator bottom hose to radiator.

1. Connect bottom hose.
2. Reposition and tighten hose clip.

13. Install twin fan and motor assembly; refer to 26.25.12.

14. Connect pressure switch.



15. Remove the temporary wooden support strut and reconnect gas struts to the hood.

16. Check transmission fluid level and top up as required; refer to 307A-01 (N/A) or 307B-01 (S/C), operation 44.24.02.

17. Refill the cooling system; refer to 26.10.01 or (SC) 26.10.01.

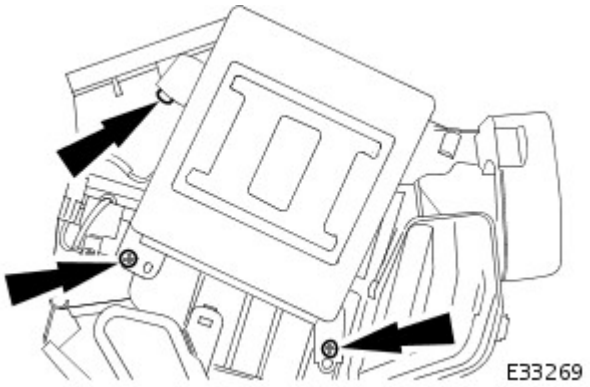
18. Recharge air conditioning system; refer to 82.30.30.

19. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

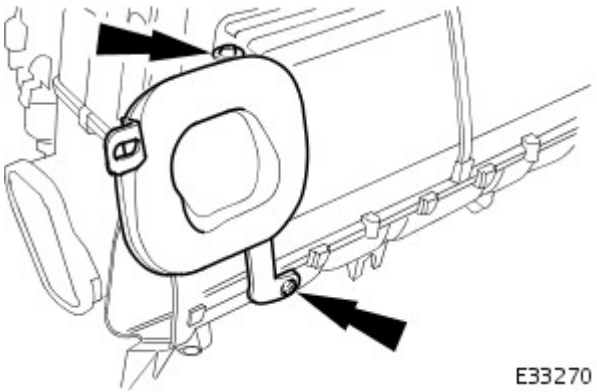
Air Conditioning - Evaporator Core

Removal and Installation

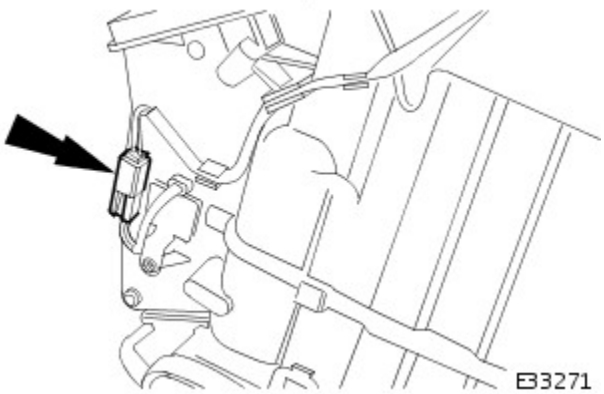
Removal



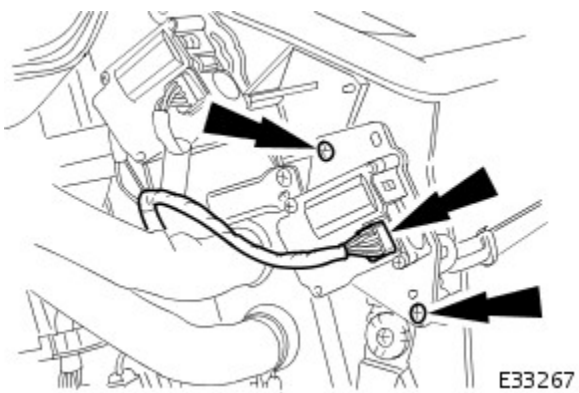
1. Remove heater / cooler unit; refer to 82.25.21.
2. Remove air conditioning control module from heater / cooler unit.
   - Slacken upper fixing.
   - Remove lower fixings.



3. Remove evaporator pipe firewall seal plate.
   - Remove screws.
   - Remove plate.

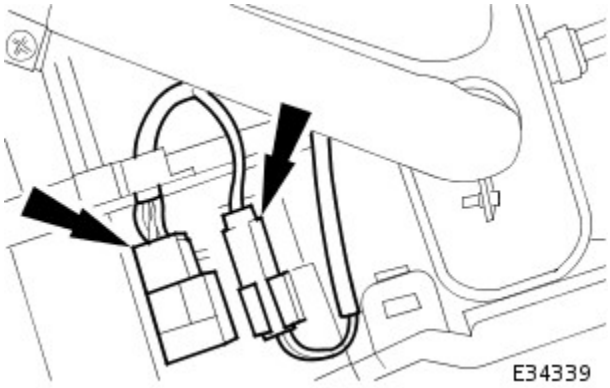


4. Disconnect heater matrix temperature sensor.
   - Detach heater matrix temperature sensor connector from unit.
   - Disconnect connector.

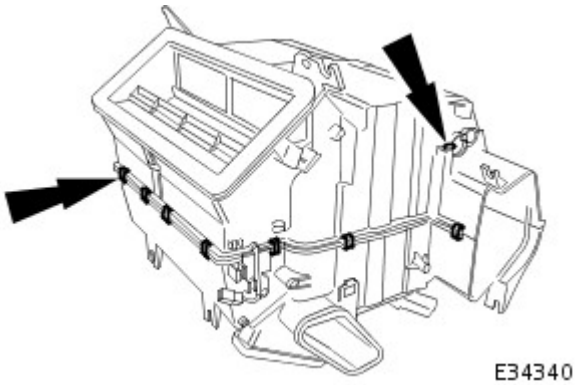


5. Remove footwell servo motor from heater / cooler unit.
   - Disconnect connector.
   - Remove screws.
   - Remove motor complete with bracket.

6. Disconnect evaporator sensor connector.

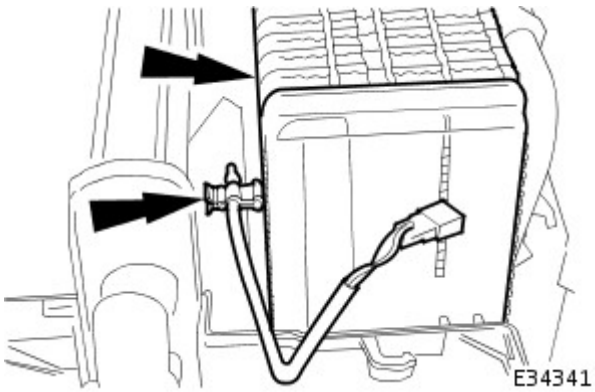


- Detach heater / cooler unit connector.
- Detach evaporator sensor connector.
- Disconnect connector.



7. Remove heater / cooler unit upper case from lower case.

- Remove screw.
- Remove 15 clips.
- Remove upper case from lower case.



8. Remove evaporator from case.

- Remove sensor and clip.
- Remove evaporator.

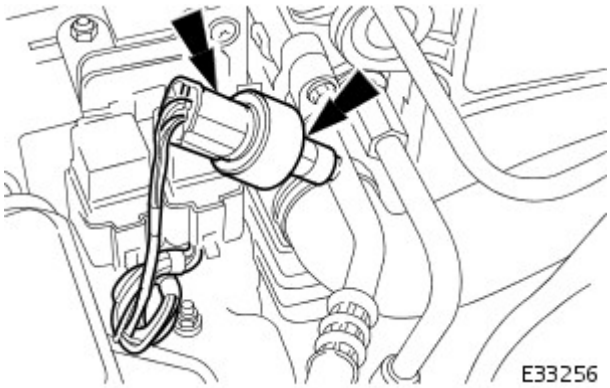
Installation

1. Installation is the reverse of removal.

Air Conditioning - Pressure Cutoff Switch

Removal and Installation

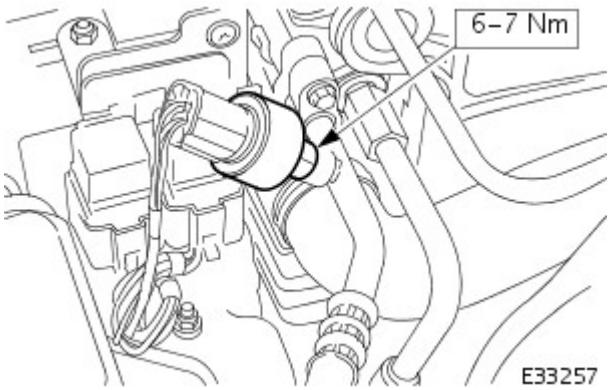
Removal



1. Remove pressure switch.

- Disconnect connector.
  - NOTE: Discard O-ring seal.
- Remove switch.

Installation



1. NOTE: Clean mating faces, install new O-ring seal and lubricate with clean compressor oil.

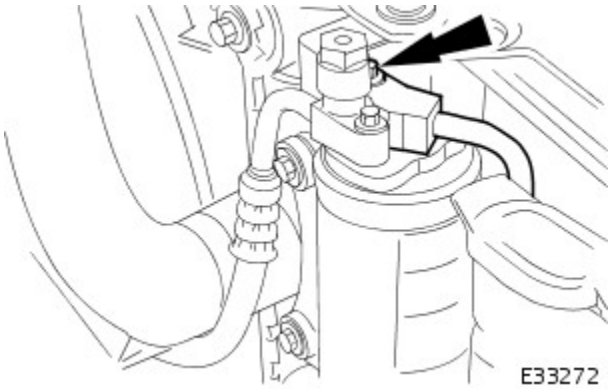
Installation is a reversal of the removal procedure.

Air Conditioning - Receiver Drier

Removal and Installation

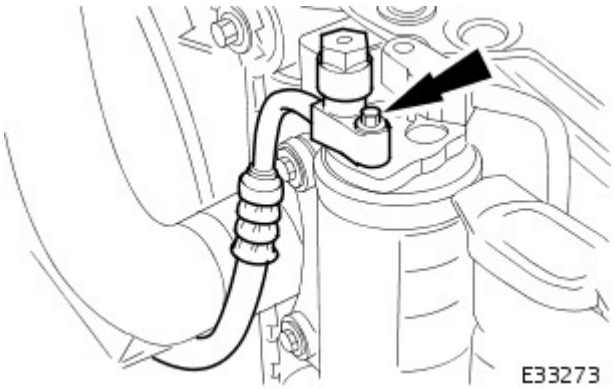
Removal

1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove air cleaner assembly; refer to 19.10.05.
3. Recover refrigerant from air conditioning system; refer to 82.30.30.
4. Disconnect receiver / drier to evaporator line from receiver / drier bottle.



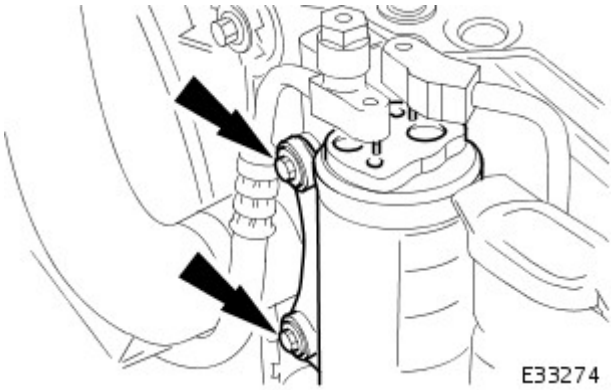
- Remove bolt.
- Disconnect hose and discard O-ring seal.
- Install suitable blanking plugs.

5. Disconnect condenser to receiver / drier line from receiver / drier bottle.



- Remove bolt.
- Disconnect hose and discard O-ring seal.
- Install suitable blanking plugs.

6. Remove drier bottle assembly.



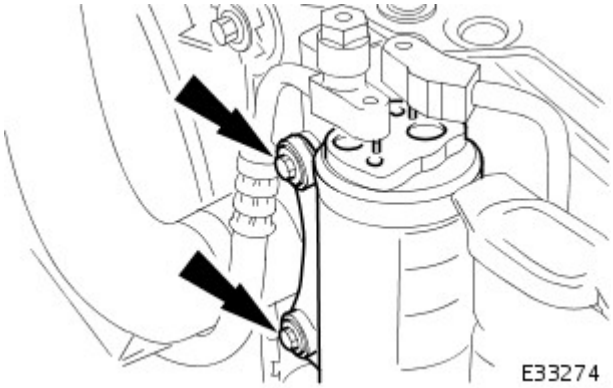
- Remove bolts.
- Remove assembly.
- Remove mounting rubbers.

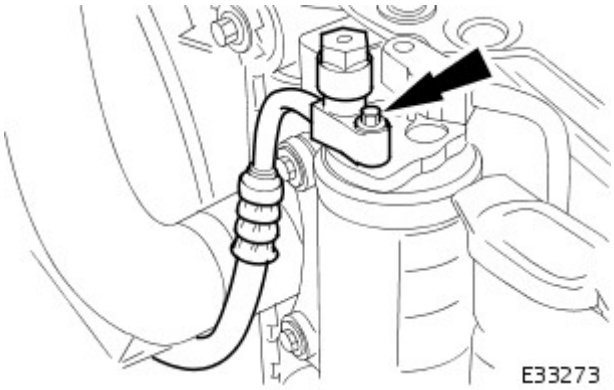
Installation

1. NOTE: Install new O-ring seals and lubricate with clean compressor oil.

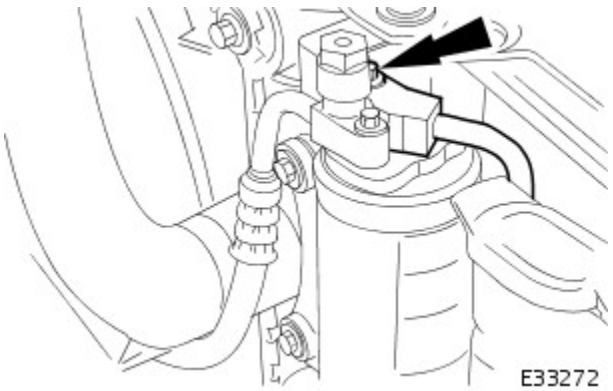
Installation is reverse of removal procedure.

2. Tighten fixings to specification (8-10 Nm).





3. Tighten fixings to specification (8-10 Nm).



4. Tighten fixings to specification (8-10 Nm).

5. Recharge air conditioning system; refer to 82.30.30.

Control Components - Control Components

Description and Operation

System Controls

The climate control system is controlled by :

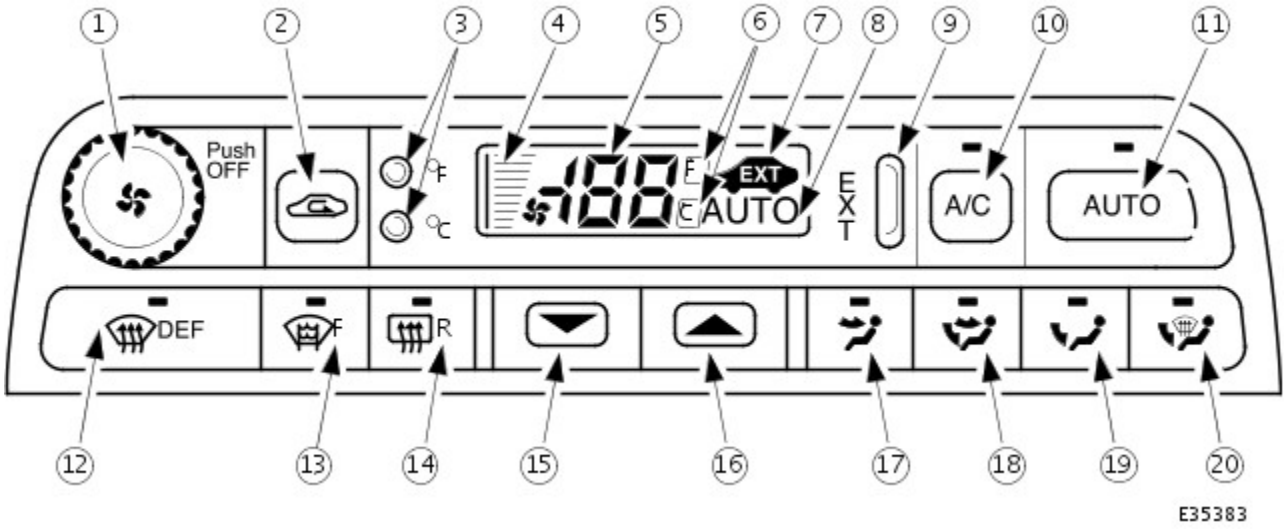
1. **1.** Manual input from the operator, via the center console located control panel.
2. **2.** Automatically by means of the A/CCM.

Output is based upon input from the following devices:

- Motorized In-car aspirator
- External air temperature sensor
- Coolant temperature sensor
- Heater 'air-off' (the temperature of the air leaving the matrix fins) temperature sensor
- Evaporator 'air-off' (the temperature of the air leaving the evaporator fins) temperature sensor
- Solar sensor
- Left hand blower recirculation / fresh air flap potentiometer
- Right hand blower recirculation / fresh air flap potentiometer
- Upper air distribution box (ADB) center and side face flap servomotor potentiometer
- ADB defrost flap servomotor potentiometer
- Air conditioning unit Foot flap servomotor potentiometer
- Air conditioning unit Cool Air Bypass flap servomotor potentiometer
- Thumbwheel controls on the facia vent assemblies which provide manual adjustment of the airflow volume.
- Road and engine speed signals input to the A/CCM

Climate Control Panel

Communication between the control panel and the A/CCM is via a serial data communications link.



Switching the Climate Control system ON

The climate control system can be switched ON by pressing one of the following :

Ref #1 On / Off (resumes the system on in the previous settings).

Ref #10 A / C (resumes the system on in the previous settings).

Ref #11 AUTO (resumes the system on at the previous temperature setting).

Ref #12 DEF (resumes the system on at the previous temperature setting).

Button (switch) logic

All buttons with an integral LED state lamp conform to the following operating logic.

When the state lamp is lit the relevant function is operational. From this condition, pressing the button will de-activate the function, confirmed by the LED being de-energized and the presence of a single audible 'beep'. A single 'beep' will accompany the state lamp to confirm function re-selection.

1. **1.** ON / OFF and manual fan speed.

Pressing this knob activates the system ON at the last setting or switches the system OFF. Rotate the knob clockwise to increase and anti-clockwise to decrease fan speed and thus airflow.

With the system OFF, ram air is available by the selected air distribution mode (indicated by state lamp). Air flow will NOT occur unless a manual air distribution mode is selected, this air being unconditioned and flow dependent upon vehicle speed.

• NOTE: The blowers are inhibited until the engine coolant temperature is > 35°C, unless DEFROST, FACE or DEMIST modes are selected.

2. **2.** Manual Air Recirculation

Closes the outside air intakes of the blower assemblies and recirculates air within the vehicle.

Two options of control are available :

- Timed Recirculation. Pressing the button for less than 1.5 seconds lights up the LED (confirmed by a single bleep). This provides recirculation of interior air for a period of approximately 5 minutes. Pressing the button within five minutes returns the system to fresh air intake mode.
- Continuous Recirculation. Pressing and holding the button for more than 1.5 seconds lights up the LED (confirmed by two beeps). This provides continuous recirculation of interior air. Pressing the button returns the system to fresh air intake mode.

• NOTE: Avoid using manual air recirculation for prolonged periods in cold weather, this may result in interior misting of glass.

3. **3.** Temperature Scale Selection

Press the appropriate button to display temperatures in degrees Celsius or Fahrenheit.

4. **4.** Manual Fan Speed

Rotating the fan speed control knob (to vary fan speed) will display a proportional number of horizontal bars on the LCD. There are total of eleven manual fan speeds available.

5. **5.** Temperature Display

Indicator of internal demand temperature or external ambient temperature. The external ambient is updated every 4 seconds when the road speed > 25 km / h.

6. **6.** Scale

Selected temperature scale, Celsius or Fahrenheit.

7. **7.** External temperature

Symbol indicates when this option is selected

8. **8.** Automatic

Symbol indicates when the control of, temperature, fan speed and air distribution are all in Auto mode.

9. **9.** External

There are two modes of external ambient temperature selection;

- Quick Display. Pressing the button for <1.5 seconds (confirmed by a single bleep) will display the external temperature for 4 seconds.
- Continuous Display. Pressing and holding the button for >1.5 seconds (confirmed by two beeps) displays the external ambient temperature continuously, the value of which will be updated every 4 seconds given that vehicle road speed is > 25 km/h. Pressing the button again for <1.5 seconds resets to the previous display.

• NOTE: Continuous external temperature display will be cancelled when the ignition is switched OFF but not during engine cranking.

10. **10.** A/C

This push-on / push-off button will either select or deselect (as indicated by the state lamp) the refrigeration system.

The refrigeration system is automatically engaged when the Auto button is pressed.

• NOTE: Interior misting of screens may be reduced by continuous operation of the refrigeration system.

11. **11.** Auto

When selected and the state lamp lit, A/C mode will be operational and control of vent outlet temperature, fans speed and air distribution will be automatic.

AUTO mode will disengage should manual air distribution or defrost buttons be operated or the manual fan speed knob be rotated.

• NOTE: Automatic temperature control is constantly maintained irrespective of selected manual overrides.

12. **12.** Defrost

Push-on push-off button, which when engaged will direct all air to the front and side glass at maximum fan speed. The heated windshield (if fitted) will also be energized for a timed cycle of 6,5 minutes, but may be cancelled by pressing the HEATED WINDSHIELD (F) button. Pressing 'DEF' again will return to the last setting with automatic temperature control being maintained.

Directing warm and humid air onto a cold screen can produce interior misting of screens. Operating the climate control system without the refrigeration system operating will exacerbate this problem.

• NOTE: Directing cold air onto the screen in warm humid conditions can produce external condensation.

13. **13.** Heated Windshield (F)

Pressing the heated windshield button (where fitted) will energize the electrically heated windshield elements for a timed cycle of 6,5 minutes; pressing the button again will cancel the request. Should the engine stall or the ignition be turned OFF, the timer will be cleared and the function cancelled.

• NOTE: The heated windshield may be activated with the climate control system OFF but the engine must be running.

In very cold ambient temperatures, icing of the interior of the glass is possible when the climate control system is operating in AUTO mode; to reduce this possibility the A/CCM provides automatic operation of the heated windshield.

With the following conditions met, the heated windshield will automatically energize but the state lamp will NOT be lit.

- External temperature < -10 °C
- Vehicle speed > 65 km / h
- The first two conditions exist > 2 minutes.
- Engine speed > 50 revs / min

14. **14.** Heated Backlight (R)

Pressing the heated backlight button will simultaneously energize the heater elements for timed cycles of;

- 21 minutes backlight
- 11 minutes exterior mirrors

Pressing the button again within the 21 minute timer will cancel the request.

If the engine is stalled, or the ignition switched OFF, the backlight and door mirror timers will be cleared, resulting in both functions being switched off.

• NOTE: Both the backlight and door mirrors may be activated with the climate control system OFF, but the engine must be running.

15. **15.** Temperature Decrease

Pressing this button (BLUE symbol) decreases the interior temperature setting in 1° increments. Should the button be pressed when the setting temperature is below the lower automatic control temperature limit, the display will indicate 'LO'.

16. **16.** Temperature Increase

Pressing this button (RED symbol) will raise the temperature setting in 1° increments Should the button be pressed when the setting temperature is above the upper automatic control temperature limit, the display will indicate 'HI'.

Automatic Temperature Control Range

°C	**°F**
LO	LO
17	61 62
18	63 64
19	65 66
20	67 68
21	69 70
22	71 72
23	73 74
24	75 76
25	77 78
26	79 80
27	81 82
28	83 84
29	85 86
30	87 88
31	89

	90
HI	HI

LO demands the maximum COOLING performance from the system with the blowers operating automatically at maximum speed.

HI demands the maximum HEATING performance from the system with the blowers operating automatically at maximum speed.

Pressing and holding either temperature selection button continuously changes the setting temperature by steps of 1°, every 0.4 seconds.

• NOTE: The interior temperature does not change when the temperature scale is changed between Celsius and Fahrenheit, however the temperature display will change to the nearest equivalent number.

Examples:

- 17C 61F 17C
- 66F 19C 66F

• NOTE: When operating in HI or LO mode and the AUTO button is pressed, the system will adopt the nearest automatic control temperature setting:

- LO AUTO DISPLAY INDICATES 17° C or 61° F
- HI AUTO DISPLAY INDICATES 31° C or 90° F

• NOTE: When switching the system on using the AUTO button, the system will display the previous temperature setting, except under the following conditions:

- LO, system OFF, auto display indicates 17° C or 61° F
- HI, system OFF, auto display indicates 31° C or 90° F

17. **17.** Face

Pressing this button will direct all airflow to the center and side face vents only; pressing again will return the system to automatic control mode.

• NOTE: When in AUTO mode and in a hot climate, a bleed of cold air is delivered to foot level. This bleed automatically shuts off when the interior temperature has cooled sufficiently.

18. **18.** Bi-Level

This push-on / push-off button will direct air to the center and side face vents and the front footwells. Pressing the button (off) will return the system to automatic control mode.

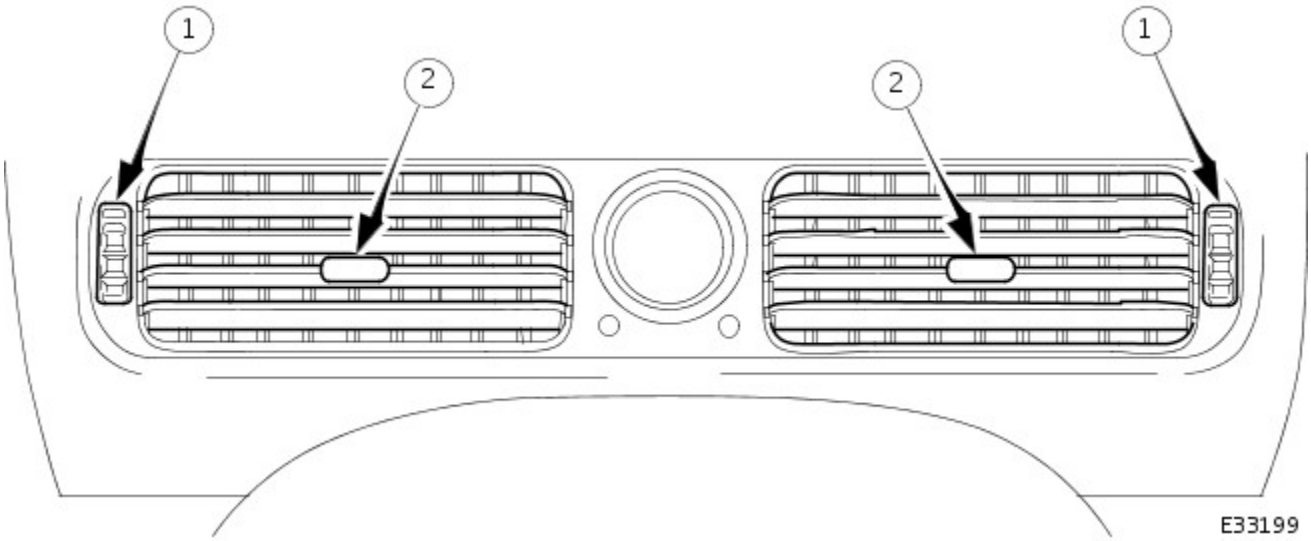
19. **19.** Foot

This push-on / push-off button will direct the majority of airflow to the front footwells with a small bleed of air to the front and side screens. Pressing the button (off) will return the system to automatic control mode.

20. **20.** Demist

Pressing this button will direct air to the front and side screens and the front footwells. Pressing the button (off) will return the system to automatic control mode.

Fascia Air Outlets



Parts List

Item	Part Number	Description
1	—	Airflow control
2	—	Air direction control

Air temperature from the centre (and EOD) vents is slightly cooler than the foot outlets; however this temperature cannot be varied independently.

The EOD vents, not shown, feature similar controls.

Automatic Operation

Initial setting

Should a new A/CCM be fitted, it will 'power-up' in the OFF mode; switching ON will result in the following settings:

Feature	Status
Setting temperature	24°C or 75°F
LH and RH blower assembly recirculation / fresh flap	Fresh mode
Control mode	Automatic 'AUTO' displayed
Blower	Auto
Compressor output	A/C ON
Heated windshield and mirrors	OFF
Water valve	Auto temperature control

After initial start up the system operating conditions will be stored in the A/CCM to the conditions which prevailed prior to ignition OFF.

Maximum Heating / Cooling

Maximum Heating (temperature setting HI)

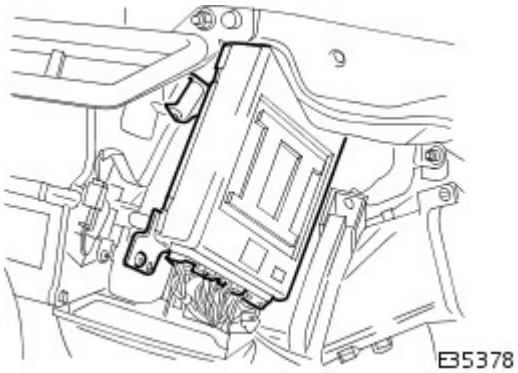
Item	Control	Override Allowed
Water valve	Fully open (not energised)	-
Blower	Maximum	Yes
Fresh / recirc	Fresh	Yes
Air distribution	Feet (state lamp OFF)	Yes
A/C system	OFF	Yes
Cool air by-pass	Fully closed	-

Maximum Cooling (temperature setting LO)

Item	Control	Override Allowed
Water valve	Fully closed (energised)	-
Blower	Maximum	Yes
Fresh / recirc	Recirculation	Yes
Air distribution	Face (state lamp OFF)	Yes
A/C system	ON	Yes
Cool air by-pass	Fully open	-

Air Conditioning Control Module (A/CCM)

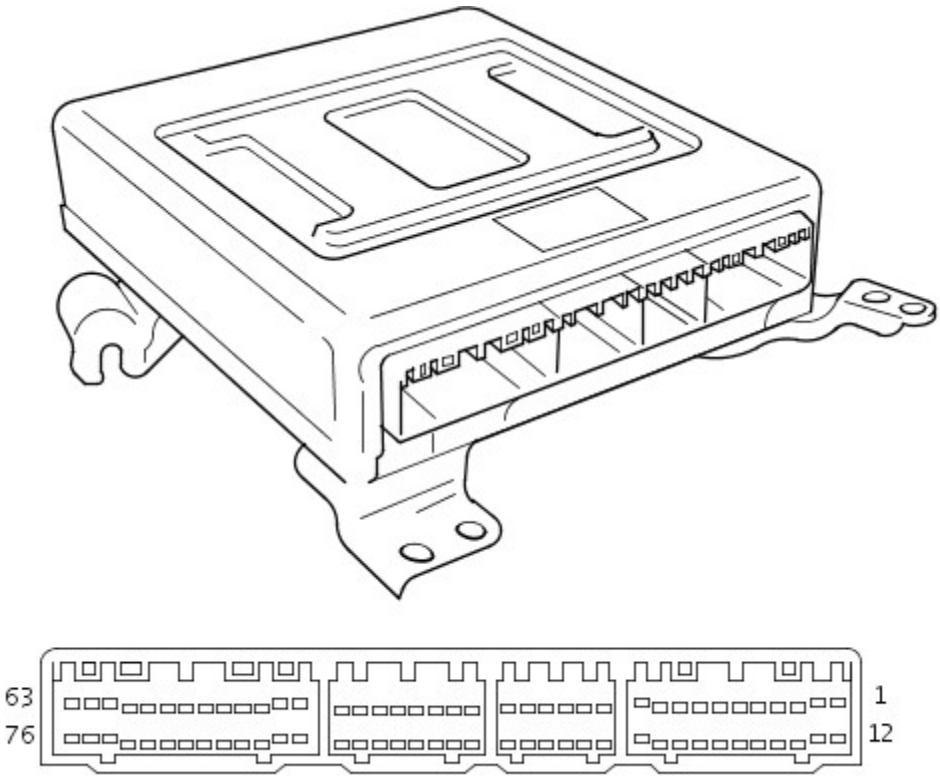
Location



The A/CCM is located on the right hand side of the air conditioning unit and controls all system functions.

The temperature within the passenger compartment is continually compared with the temperature selected on the control panel LCD. The A/CCM receives data input signals and compares these with signals from the system temperature sensors and feedback devices. Based on this information the A/CCM adjusts the air outlet temperature, airflow and distribution from the air conditioning system into the passenger compartment.

Identification



Inputs / Outputs

1. **1.** Engine speed:

- Input to the A/CCM from the ECM.
- Heated windshield and backlight will be inhibited when engine speed < 50 RPM.

2. **2.** Vehicle speed:

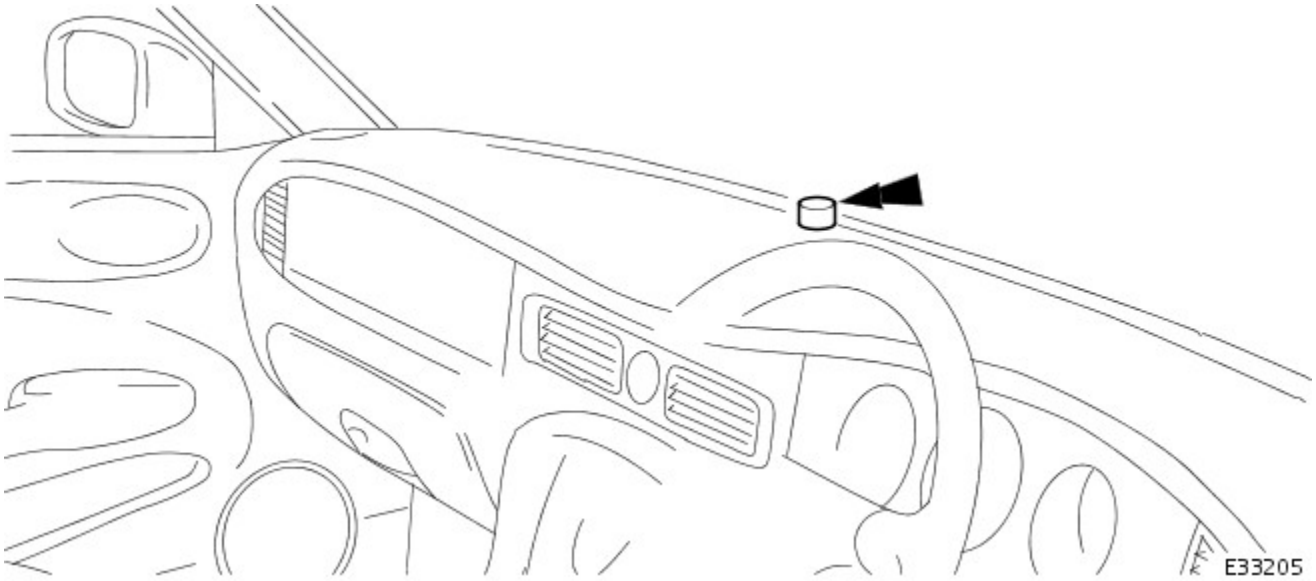
- Input from the instrument cluster.
- Blower speed control to minimise the effects of ram air. Road speed compensation is inhibited when maximum cooling LO, or maximum heating HI, is selected; also inhibited in defrost mode with airflow set to maximum.
- Used to determine the frequency at which the exterior temperature display is updated.

3. **3.** Coolant temperature (signal derived from ECM via instrument cluster):

- Input from the heater matrix temperature sensor used to control water valve and thus vent temperatures.
- Used to monitor the temperature of coolant at the heater matrix to assist the control of air outlet temperature.
- Used to inhibit the blowers when heating is selected and the engine coolant temperature is below 30°C.
- Is used to provide progressive increase in blower speed up to 60°C.
- To inhibit the water valve and pump when the coolant temperature is = < 10°C

Sensors and Controls

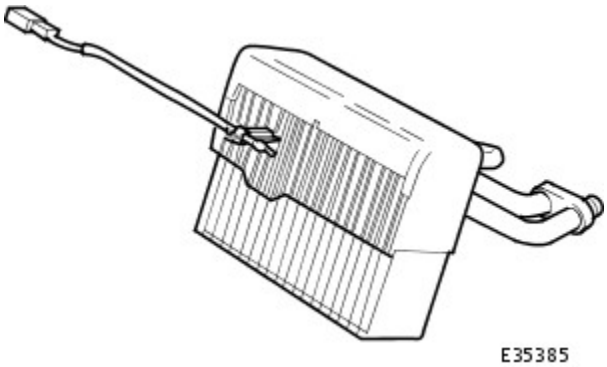
Solar Sensor



The solar sensor is mounted on the top surface of the fascia between the defrost outlets.

The sensor is a photo-diode which is calibrated to measure direct sunlight. It provides an output signal to the A/CCM which automatically reduces air temperature and increases fan speed (airflow volume) to compensate for solar heating.

Evaporator Sensor



This thermistor device changes electrical resistance as a result of temperature variations.

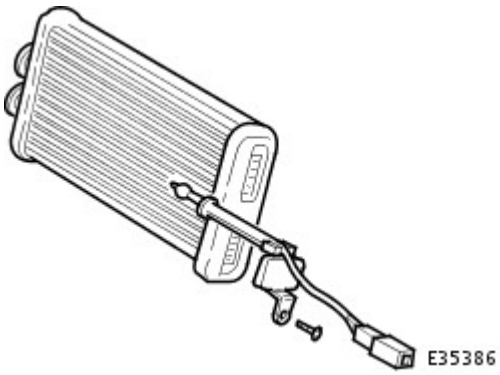
The sensor is positioned next to the evaporator fins and measures air temperature after it has passed through the evaporator. The sensor inputs a signal to the A/CCM which controls the compressor (see table) when the refrigeration system is operating.

The sensor's connector is located on the LH side of the air conditioning unit, in front of the main power connector.

Evaporator Temperature Signal	Compressor State
3°C	ON - clutch engaged
2°C	OFF - clutch disengaged

The A/CCM disengages the compressor clutch when the temperature of the air off the evaporator is 2° C or less. This is to prevent the moisture which may collect between the cooling fins of the evaporator from freezing and thus restricting airflow.

Heater Matrix Temperature Sensor

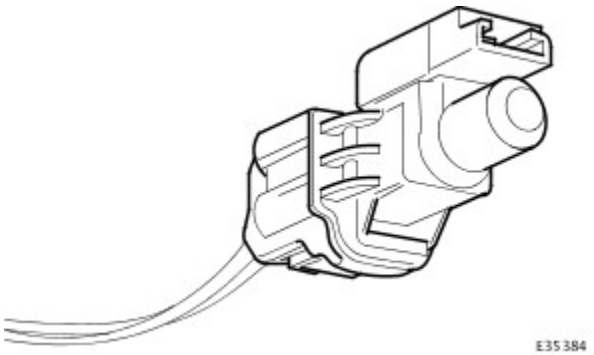


The heater matrix temperature sensor is a thermistor which changes its electrical resistance in response to changes in air temperature converting a temperature rating to an electrical signal.

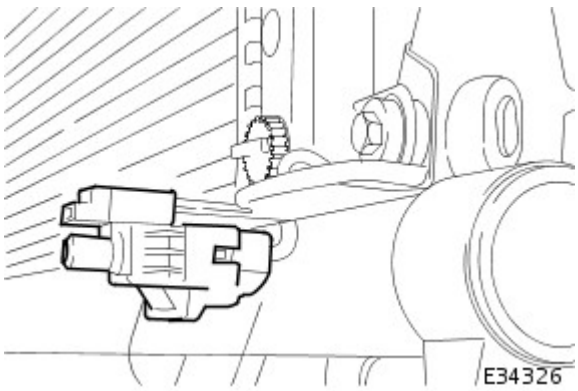
The sensor connector is located on the RH SIDE of the air conditioning unit. The sensor bead is located inside the unit down-stream from the heater matrix and measures the 'post-heater' air temperature, before the air is distributed to the cabin The sensor provides a signal to the A/CCM which adjusts the duty ratio of the water valve to provide the required air temperature from the heater.

Ambient Temperature Sensor

The sensor is a thermistor which changes its electrical resistance in response to changes in air temperature, converting a temperature rating to an electrical signal.



The ambient temperature sensor measures exterior air temperature and is mounted on the crossbeam, in front of the condenser on the LH side.



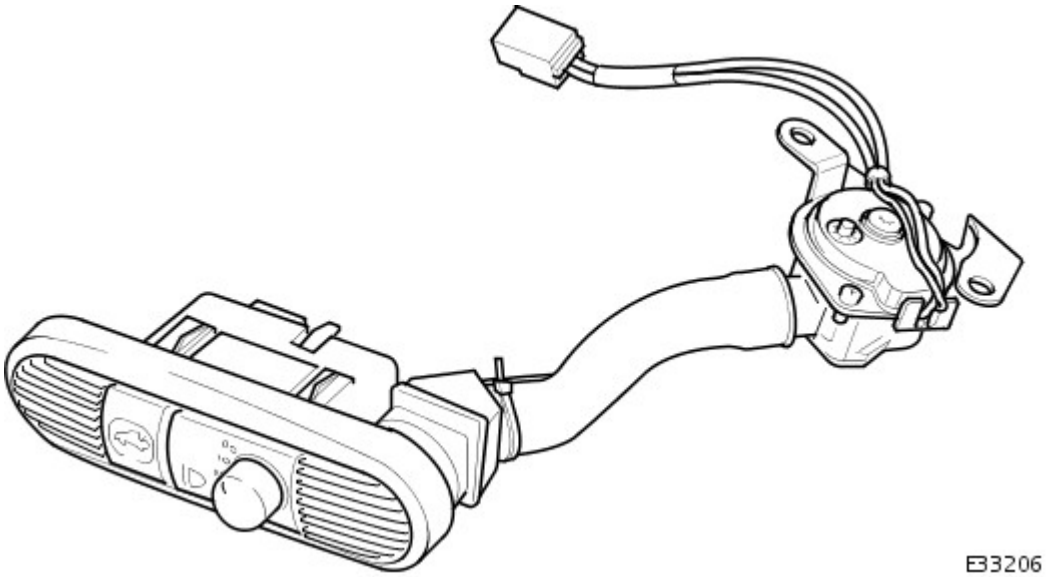
The signal from the ambient sensor allows the A/CCM to compensate for the ambient conditions and to display the information on the control panel - updated every four (4) seconds.

Sensor response is 'damped' by the A/CCM and therefore does not appear to react to temperature changes as quickly as the

other sensors. This feature prevents the effects of sudden changes in air outlet temperatures due to factors such as:

- Recirculating air from the engine cooling pack at low vehicle speeds
- Sudden changes in ambient temperature
- The effects of water splash

Motorised In-car Aspirator.



An intake grille (mounted on the fascia, outboard of the steering column and below the EOD vent) houses the aspirator thermister. The remotely mounted motor / fan assembly draws cabin air through the grille and thus over the thermistor; a flexible hose connects both components.

The electrical resistance of the thermistor changes in response to variations in air temperature, this change being converted into an electrical signal. The A/CCM uses this signal to adjust the temperature, airflow and air distribution from the air conditioning unit.

Coolant Temperature Signal.

This signal is supplied to the A/CCM from the instrument cluster, the input being required to:

- Provide blower inhibit control , to avoid the system in heating mode delivering cold air when the coolant temperature is below 35°C unless DEFROST is selected.
- To progressively increase the fan speed up to maximum blower speed during warm up control.
- To assist in the control of the outlet temperature.
- To avoid possible pump or valve damage caused by ice particles in the coolant.

Compressor ON Signal.

This signal monitors the compressor relay to confirm the compressor operating state and so provide relevant fault information.

Servo Motor Control.

Flap position, which directs the flow of air through the system, is controlled by servo motors; these may be driven in either a clockwise or anti-clockwise direction by signals from the A/CCM. Motor, thus flap position, is monitored via a feedback potentiometer which is situated within the motor housing.

Servo motors control the following flaps:

- RH and LH Air Intake (Fresh / Recirc)
- Center Vent
- Defrost
- Foot
- Cool Air Bypass

Blower Motor Control.

The A/CCM controls the speed of two blower motors which deliver airflow to the air conditioning unit. The blower motors are regulated by power transistor modules which provide a linear variation of blower speed.

Filter Compensation

Where particle filters are fitted as 'after market' items the A/CCM program must be changed to allow higher AUTO blower speeds; this compensates for the slight loss of air flow. Access to the program is by PDU.

Vehicles with filters fitted OEM will have this facility enabled by Jaguars Cars Ltd.

Relationship Manual Control Blower Speed / Voltage

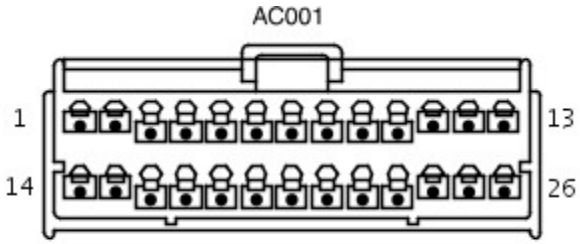
• NOTE: Blower motors are inhibited when the engine coolant temperature is below 35°C and heating is demanded, unless DEFROST / DEMIST is selected.

Blower Mode	Display Output - No of Bars	Blower Motor Voltage (V)
OFF	Nil	0.0
Manual LO	1	4.00
	2	4.33
Manual M1	2	4.67
	3	5.00
Manual M2	3	5.33
	4	5.67
	4	6.00
Manual M3	4	6.33
	5	6.67
Manual M4	5	7.00
	6	7.33
	6	7.67
Manual M5	6	8.00
	7	8.33
	7	8.67
Manual M6	7	9.00
	8	9.33
	8	9.67
Manual M7	8	10.00
	9	10.33
Manual M8	9	10.67
	10	11.00
Manual M9	10	11.33
	11	11.67
Manual HI and DEFROST	11	12.00

Control Components - Control Components

Diagnosis and Testing

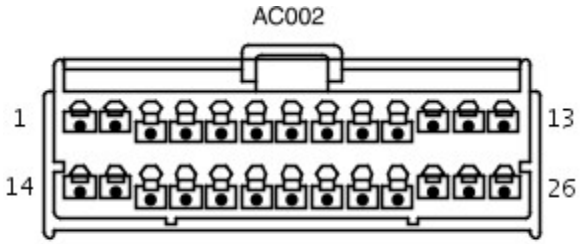
Connector Pin Identity Chart for AC001



E34303

Pin Number	Circuit	Circuit Function
001		Compressor ON signal
002		Coolant valve
003		RH Blower motor relay
004		Heated windshield relays (where fitted)
005		Heated door mirror relay
006		Defrost servomotor (positive)
007		Center vent servomotor (positive)
008		LH air intake servomotor fresh / recirculation (positive)
009		RH air intake servomotor fresh / recirculation (positive)
010		Not used
011		Not used
012		Foot servomotor (positive)
013		Cool air bypass servomotor (positive)
014		Not used
015		Not used
016		LH Blower motor relay
017		Coolant pump motor relay
018		Heated backlight relay
019		Defrost servomotor (negative)
020		Center vent servomotor (negative)
021		LH air intake servomotor fresh / recirculation (negative)
022		RH air intake servomotor fresh / recirculation (negative)
023		Not used
024		Not used
025		Foot servomotor (negative)
026		Cool air bypass servomotor (negative)

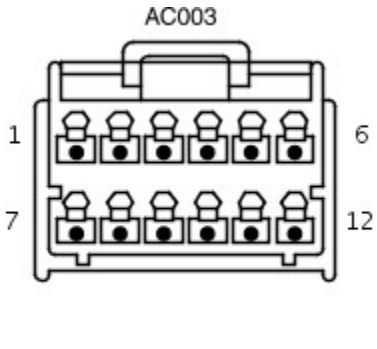
Connector Pin Identity Chart for AC002



E34304

Pin Number	Circuit	Circuit Function
001		Solar sensor
002		Center vent servomotor feedback potentiometer
003		RH air intake servomotor feedback potentiometer fresh / recirculation
004		Not used
005		Cool air bypass servomotor feedback potentiometer
006		Coolant temperature signal
007		RH blower motor voltage feedback
008		RH blower motor drive signal
009		Not used
010		Defrost servomotor feedback potentiometer
011		LH air intake servomotor feedback potentiometer fresh / recirculation
012		Not used
013		Foot servomotor feedback potentiometer
014		Not used
015		LH blower motor voltage feedback
016		LH blower motor drive signal

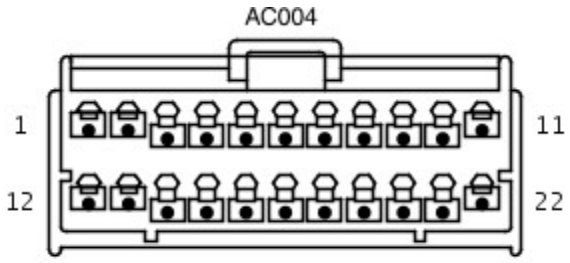
Connector Pin Identity Chart for AC003



E34305

Pin Number	Circuit	Circuit Function
001		Screen request to ECM
002		CLOCK signal to control panel
003		DATA OUT signal to control panel
004		Compressor lock signal
005		Exterior air temperature sensor
006		Heater matrix temperature sensor
007		DATA IN signal from control panel
008		START signal to control panel
009		Not used
010		Compressor lock select
011		In-car temperature sensor
012		Evaporator temperature sensor

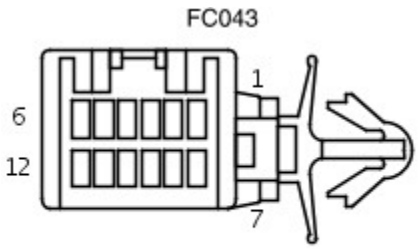
Connector Pin Identity Chart for AC004



E34306

Pin Number	Circuit	Circuit Function
001		Ignition positive supply
002		Battery isolate supply
003		Auxiliary ground
004		Auxiliary ground to control panel
005		Battery supply
006		Engine speed input
007		Electrical load drive inhibit
008		+5V sensors
009		Clutch request to ECM
010		Diagnostic L-line
011		Not used
012		Ignition (positive) to control panel
013		System ground
014		Ground to control panel
015		Air conditioning isolation relay
016		Vehicle speed
017		Pressure switch
018		Aspirator motor (In-car sensor)
019		Sensor ground
020		Logic ground for diagnostic lines
021		Diagnostic K-line
022		Not used

Connector Pin Identity Chart for FC043



E34307

Pin Number	Circuit	Circuit Function
1		Input CLOCK
2		Input START
3		Input DATA IN
4		Output DATA OUT
5		Input ignition (positive)
6		Input auxiliary (negative)
7		Ground
8		Dimmer
9		Dimmer override
10		Not used
11		Not used
12		Not used

Control Panel Communication

The control panel provides operator interface with the climate control system.

Control panel operation is described in detail in the D section.

Control Panel Inputs (I/P) / Outputs (O/P)

Pin #	Description	Cable color
1	O/P clock	Slate
2	O/P start	Slate / Red
3	I/P data	Slate / Yellow
4	O/P data	Slate / Green
5	O/P ignition +ve	White / Red
6	O/P auxiliary +ve	White / Blue
7	O/P ground	Black
8	Dimmer	Red
9	Dimmer override	Red / Green
10	Not used	n/a
11	Not used	n/a
12	Not used	n/a

System Self-test

Control Panel Interrogation Procedure

The control panel has a self-diagnosis feature, and is capable of displaying and clearing stored fault codes.

Climate control is an integrated system, therefore it is recommended that the PDU is used for fault diagnosis. The fault codes displayed with the control panel self-diagnosis feature are not as comprehensive as those of the PDU. The PDU will display the relevant fault code, fault code description and information of the system peripherals at the time the fault occurred.

Fault Code Extraction and Deletion Procedure

Error information is stored in the A/CCM up to a maximum of 5 faults. Should a sensor fault occur there will be an audible beep and the message Er will be displayed on the control panel display for 5 seconds after ignition on. Please note that this will happen only once in any ignition switch cycle. The error source may be accessed by the following procedure

This procedure must be completed through one complete cycle, 1 through 6

Step	Result
#1 Simultaneously hold AUTO and RECIRC - Switch ignition to ON	Display element check
#2 Press AUTO	Display of stored fault (NUMERIC) code. If ZERO appears, there are no stored codes
#3 Press FACE	Scroll through stored faults (maximum of 5)
#4 Simultaneously press FACE and R	Clear stored fault codes (may need to be repeated for each fault)
#5 Press RECIRC (Press FAN to skip actuator check)	Initiate actuator check (Actuator codes 20 through 27 *)
#6 Press FAN	Exit error check mode

• NOTE: * Actuator codes do NOT equate to system fault codes.

• NOTE: Only codes 11, 15 and 21 (see Fault Code Listing) will cause audible beep and 'Er' display.

• NOTE: If '0' is displayed, there are no stored fault codes, wait 30 seconds to allow system self-test.

- The control panel display will flash repeatedly indicating a list of two digit numbers (see table for code analysis).
- Should a code be displayed accompanied by an audible beep, the fault is current and therefore still present within the system. A code displayed without an accompanying 'beep' indicates a fault had previously occurred but is not present within the system.

• NOTE: It is advisable to check all areas indicated with cleared fault codes. Such faults may re-occur if intermittent problems are present in the system.

- To delete stored and cleared fault codes press 'R' and 'FACE' buttons simultaneously.
- After investigating and correcting all stored faults, press the 'Push Off' button to restore normal operation with default panel settings, ie AUTO at 24°C.

System Self-test

Control Panel Fault Code Listing

• NOTE: Reference fault code #23*: In ambient temperatures below 0° C, this code may be logged because the low ambient causes a temporary low gas pressure.

• NOTE: Where the ambient temperature rises above 40° C, with the engine close to overheating, electrical feed to the compressor clutch may be cut and code #23 registered.

Symptom	Possible Sources	Action
0 Normal operation no fault codes present	* None	* Wait 30 seconds for system self-check.
11 Motorized in-car aspirator malfunction	* Harness / connector fault * Sensor open / short circuit	* Panel fault codes are not stored for motorized in-car aspirator motor failure.
12 Ambient temperature sensor malfunction	* Harness / connector fault * Sensor open / short circuit	* After rectification, disconnect the vehicle battery for 10 seconds to reset the system.
13 Evaporator temperature sensor malfunction	* Harness / connector fault * Sensor open / short circuit	* Refer to PDU
14 Water temperature input malfunction	* Instrument cluster output	* Refer to PDU
15 Heater matrix temperature sensor malfunction	* Harness / connector fault * Sensor open / short circuit	* Refer to PDU
21 Solar sensor	* Sensor open /short circuit	* Refer to PDU
22 Compressor lock signal fault	* Low refrigerant charge, low compressor oil level, loose drive belt * Harness / connector fault	* Adjust items as required
23 Refrigerant pressure switch malfunction	* Harness / connector fault * Switch open / short circuit	* Refer to PDU
23 Refrigerant pressure low refrigerant charge *	* Leak from damaged pipe or joint	* Rectify as required and recharge system
24 Face vent demand potentiometer fault	* Potentiometer open / short circuit * Harness / connector fault	* Refer to PDU
31 LH fresh / recirc. potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
32 RH fresh / recirc. potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
33 Cool air by-pass potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
34 Defrost vent potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
35 Centre vent potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
36 Foot vent potentiometer fault	* Harness / connector fault * In certain circumstances the servo motor may over-travel and cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	* Refer to PDU
41 LH fresh / recirc. motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU
42 RH fresh / recirc. motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU

43 Cool air by-pass motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU
43 Cool Air by-pass motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU
44 Defrost vent motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU
45 Centre vent motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU
46 Foot vent motor fault	* Harness / connector fault * Servo motor seized or sticking * Flap seized or sticking	* Refer to PDU

System Self-test

Other conditions which may exist but will NOT log fault codes:

Associated Faults

Symptom	Possible Sources	Action
No heat	* Airlock in system.	* Refer section 303-03 for fill / bleed procedure
	* Heater water pump inoperative * Coolant flow valve stuck closed	* Check operation and circuit
	* Faulty engine coolant thermostat	* Renew as required
One vent failing to open / close	* Broken linkage.	* Renew as required
Poor airflow	* Blower motors - incorrect operation	* Check operation and circuit

System Self-test

Panel Communication Check

The panel communication check verifies the inputs and outputs from the control panel to the A/CCM.

Item	Check LED	Condition
Ignition	Defrost	IGN input at 12V, check LED is illuminated
Auxiliary	Face	AUX input at 12V, check LED is illuminated
Clock	Feet / face	Clock input normal, check LED is illuminated
Start input	Foot	Start input normal, check LED is illuminated
Data out	Screen / foot	Data out input normal, check LED is illuminated
Dimmer override	Recirc.	Dimmer override input ON, check LED is illuminated

Actuator Check Procedure

The system self test procedure drives all the actuator motors, to check their operation. If an actuator is operating incorrectly or operating outside of its limits then a fault code will be present.

Before commencing with the actuator check procedure, ensure the car is operating under normal conditions.

1. **1.** Switch ignition OFF.

2. **2.** Press and hold the RECIRC and AUTO buttons simultaneously, switch ignition ON and run the engine.

3. **3.** All the control panel LEDs and all LCD segments will flash on and off. Any function LED indicator which does not flash on / off suggests a fault condition within that area of the panel or, with the LED.

- Any LCD element which fails to flash on / off indicates a fault within the display element or panel.

4. **4.** Press AUTO

5. **5.** Press RECIRC button to instigate actuator check mode.
6. **6.** Press FACE to cycle through the actuator mode conditions 20 to 27.
7. **7.** Press the FAN button to restore normal operation with default panel settings, ie AUTO @ 24°C.

Actuator Fault Codes

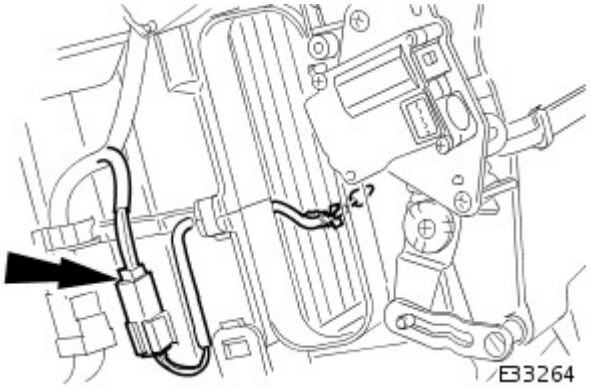
• NOTE: * The water valve operates on a 6 second pulse, ie 3 seconds ON, 3 seconds OFF.

		Outlet							
Code	Blower Level	Centre vent	Foot	Defrost	Cool air by-pass	Fresh / Recirc.	Compressor	Water valve	Water pump
20	0	open	closed	closed	closed	fresh	OFF	closed	OFF
21	1	open	closed	closed	closed	fresh	OFF	closed	ON
22	10	open	closed	closed	open	half open	A/C ON	closed	ON
23	17	bleed	half open	closed	half open	half open	A/C ON	6s pulse *	ON
24	17	bleed	half open	closed	closed	recirc.	A/C ON	6s pulse *	ON
25	23	closed	open	bleed	closed	recirc.	A/C ON	open	ON
26	23	closed	half open	half open	closed	recirc.	A/C ON	open	ON
27	31	closed	closed	open	closed	open	A/C ON	open	ON

Control Components - Air Discharge Temperature Sensor

Removal and Installation

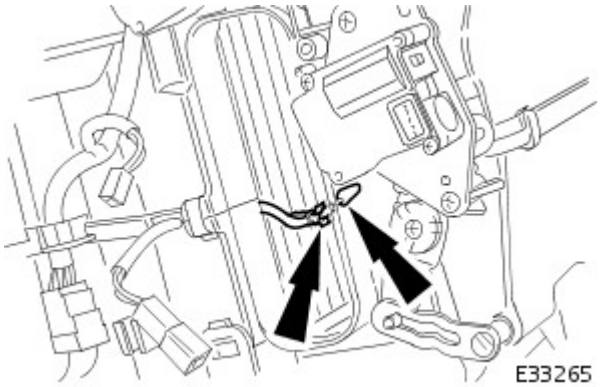
Removal



1. Remove heater matrix for access; refer to 82.25.10.

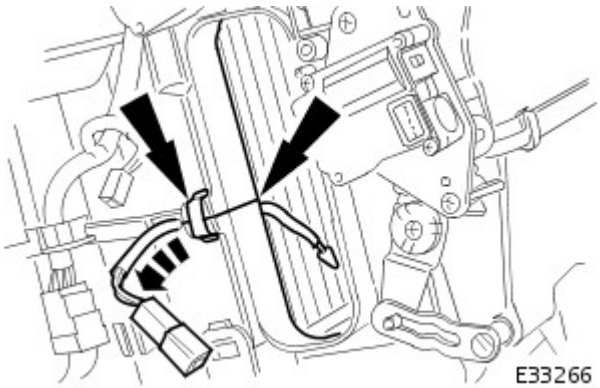
2. Detach sensor connector from heater / cooler assembly.

- Disconnect connector.



3. Detach clip and sensor from evaporator.

- Remove clip.



4. Remove sensor from heater / cooler assembly.

- Remove clip.
- Lever case apart sufficient enough to withdraw sensor through aperture.

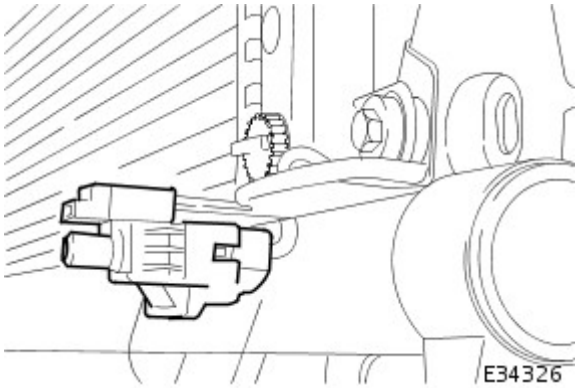
Installation

1. Installation is a reversal of the removal procedure.

Control Components - Ambient Air Temperature Sensor

Removal and Installation

Removal



1. NOTE: The ambient temperature sensor is accessed through the bumper vane.

Detach sensor from bracket and disconnect connector.

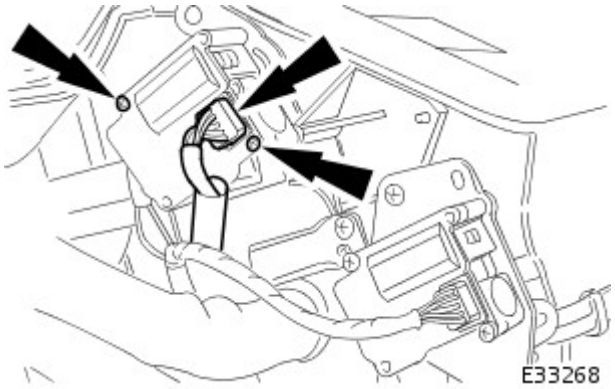
Installation

1. Installation is a reversal of the removal procedure.

Control Components - Cold Air Bypass Blend Door Actuator

Removal and Installation

Removal



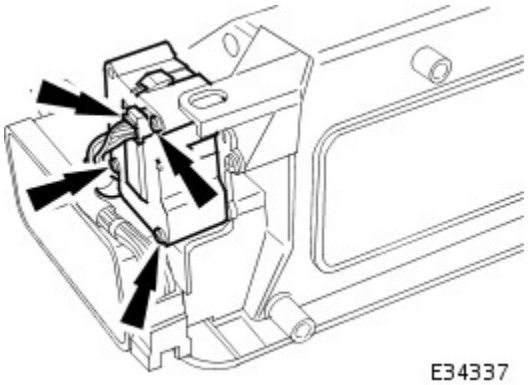
1. Remove instrument panel for access; refer to 76.46.01.
2. Remove motor from heater / cooler assembly.
   - Remove connector.
   - Remove screws.
   - Remove motor.

Installation

1. Installation is a reversal of the removal procedure.

Control Components - Defrost Vent/Register Blend Door Actuator

Removal and Installation



Removal

1. Remove air distribution box; refer to 82.20.87.
2. Remove motor from air distribution box.
   - Remove connector.
   - Remove screws.
   - Remove motor.

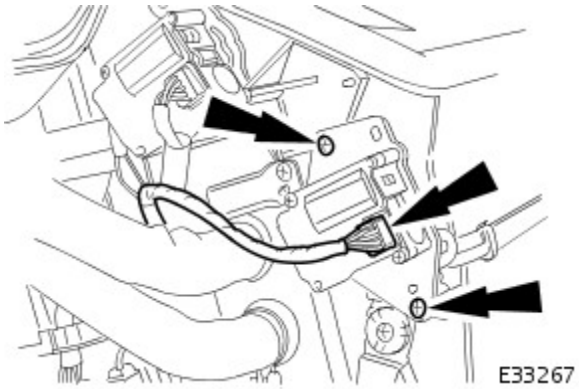
Installation

1. Installation is a reversal of the removal procedure.

Control Components - Footwell Vent / Duct Blend Door Actuator

Removal and Installation

Removal



1. Remove instrument panel for access; refer to 76.46.01.
2. Remove motor from heater / cooler assembly.
   - Remove connector.
   - Remove screws.
   - Remove motor complete with bracket.
   - Remove motor.

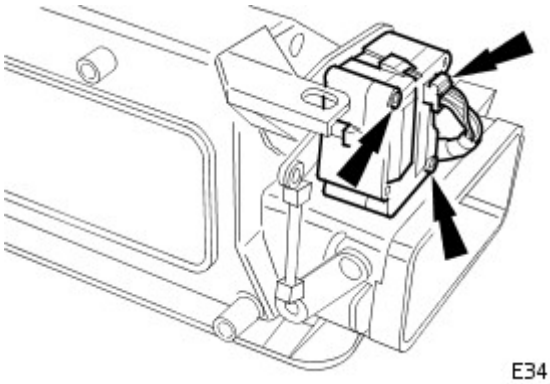
Installation

1. Installation is a reversal of the removal procedure.

Control Components - Instrument Panel Blend Door Actuator

Removal and Installation

Removal



1. Remove air distribution box; refer to 82.20.87.
2. Remove motor from air distribution box.
   - Remove connector.
   - Remove screws.
   - Remove motor.

Installation

1. Installation is a reversal of the removal procedure.

Control Components - Remote Climate Control ModuleLHD RWD

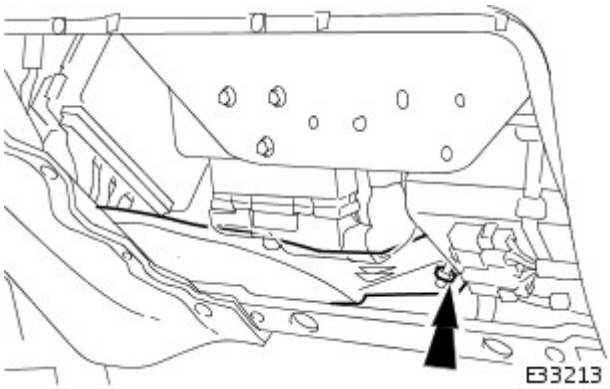
Removal and Installation

Removal

1. Position the driver's seat fully rearward

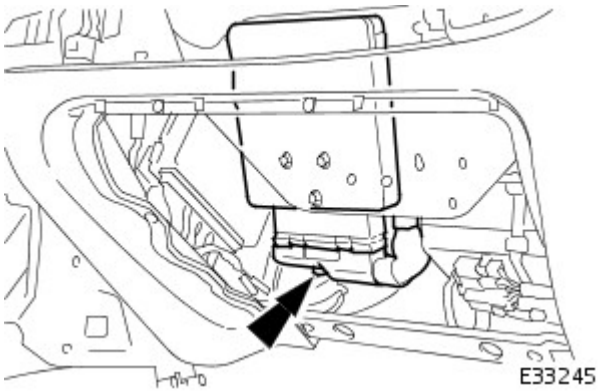
2. Glove box, 76.52.03

3. Remove the duct - passenger footwell



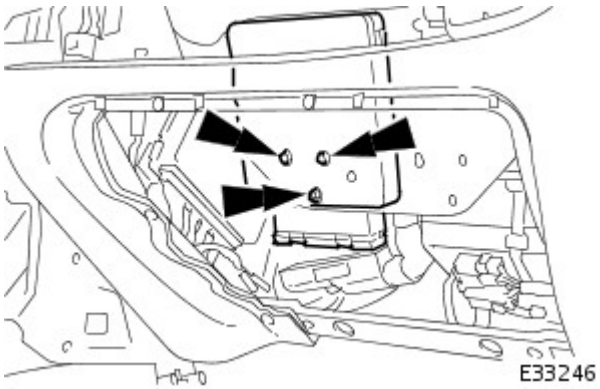
- Remove the nut (1) duct to blower

4. Disconnect the BPM multiplug



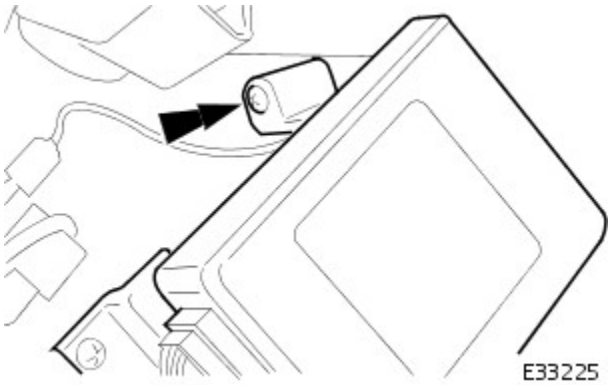
- Slacken the bolt (1), noting that it is captive in the multiplug
- Disconnect the multiplug

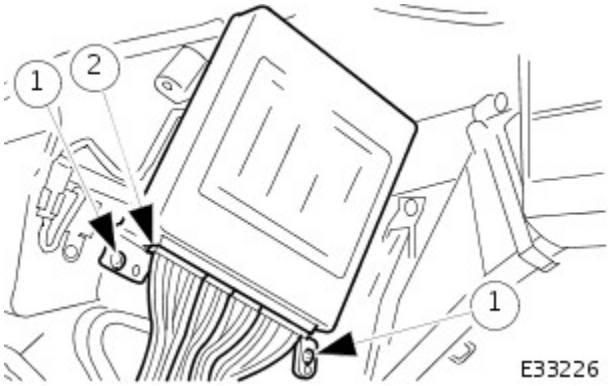
5. Remove the BPM



1. Remove the fixings (3), BPM to fascia reinforcement
2. Remove the BPM

6. Slacken the A/CCM upper fixing using a 'Snap-On' SDP 11 stubby screwdriver, or similar





7. Remove the A/CCM

1. Remove the lower fixings (2), A/CCM to heater / cooler case
2. Reposition the A/CCM to disconnect (4) multiplugs

Installation

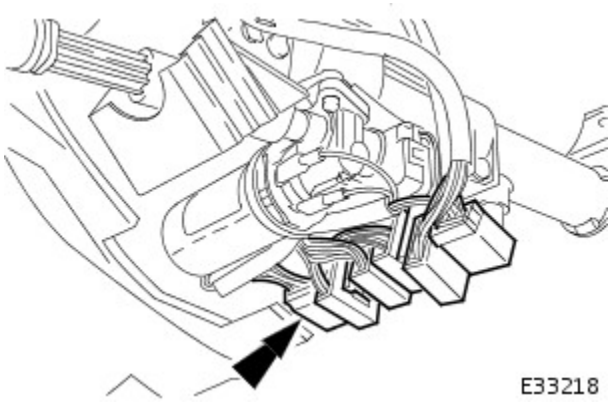
1. Installation is the reverse of the removal procedure

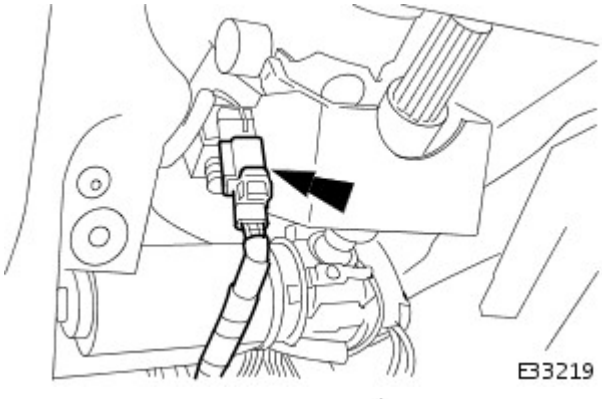
Control Components - Remote Climate Control ModuleRHD RWD

Removal and Installation

Removal

1. Position the driver's seat fully rearward
2. Position the steering column DOWN and fully EXTENDED
3. Disconnect the battery ground lead
4. Lower steering column cowl 76.46.03
5. Upper steering column cowl 76.46.02
6. Knee bolster, driver's side 76.46.11
7. Position the steering in the 'straight ahead'
8. Disconnect ALL (6) multiplugs attached to the upper column bracket



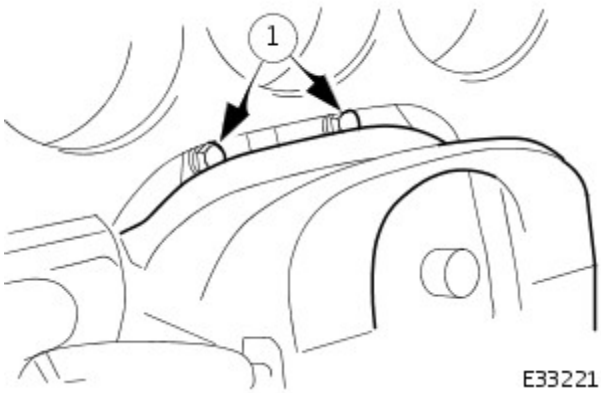


9. WARNING: OBSERVE THE RELATED SAFETY PROCEDURES, SEE SECTION 501-20

   Disconnect the airbag multiplug

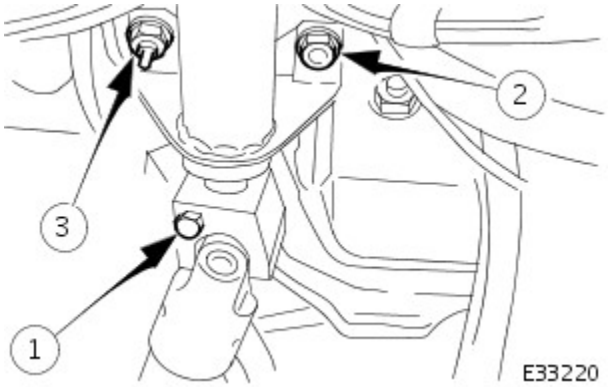
10. Detach the steering column - upper

    1. Remove the bolts (2) upper mounting bracket



11. Detach the steering column - upper

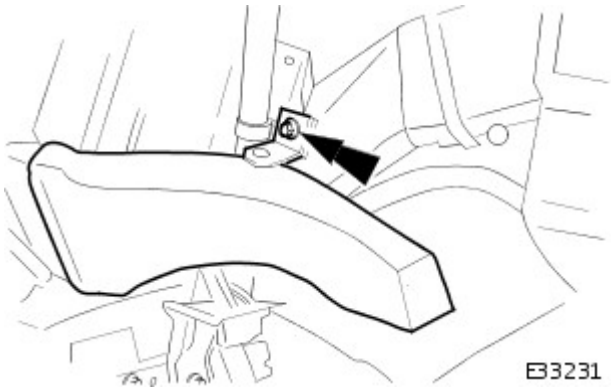
    1. Remove the pinch bolt (1) intermediate to upper column



2. Remove the bolt (1) lower fixing

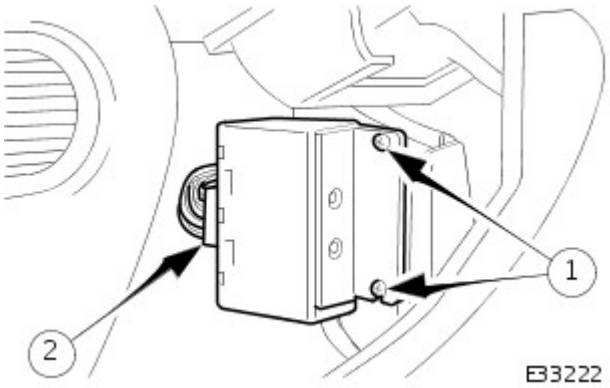
3. Remove the nut (1) lower fixing

- Remove the column assembly from the vehicle



12. Remove the duct - driver footwell

- Remove screw (1)

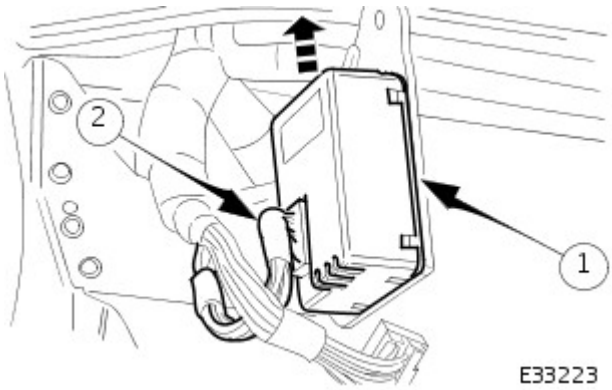


13. Remove the key transponder module

1. Remove the screws (2) module to fascia bracket

2. Disconnect the multiplug

- Reposition the transponder to gain access



14. Remove the illumination module

1. Release the module from its location

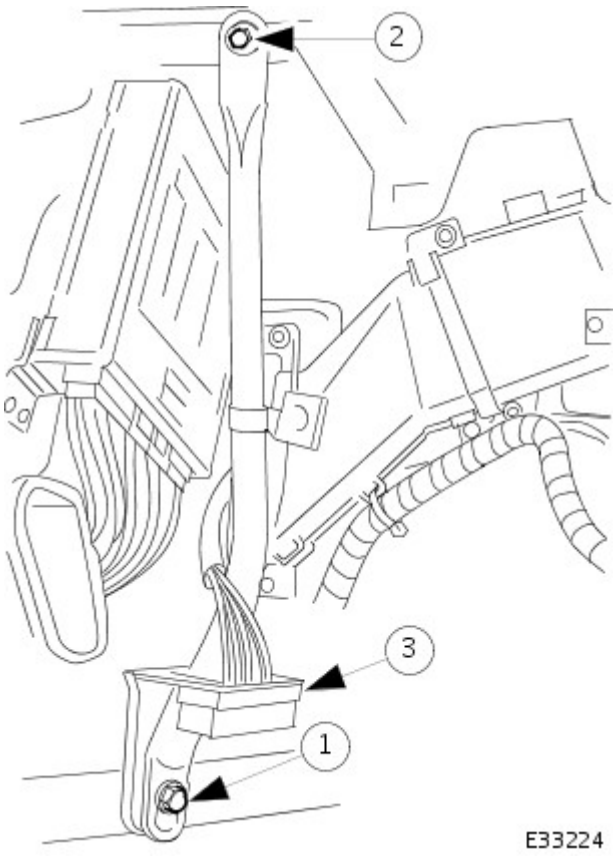
2. Disconnect the multiplug

15. Remove the plenum brace

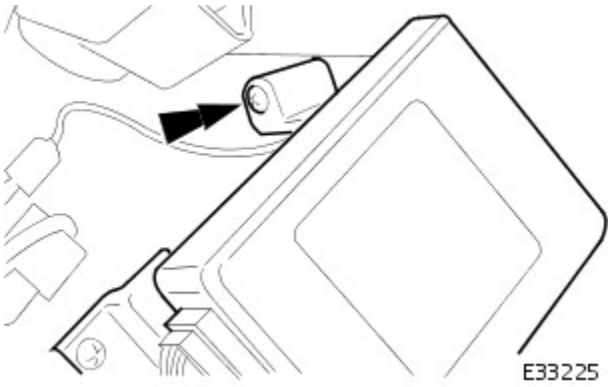
1. Remove the bolt (1) tunnel fixing

2. Remove the bolt (1) upper fixing

3. Slide the diagnostic socket off the brace

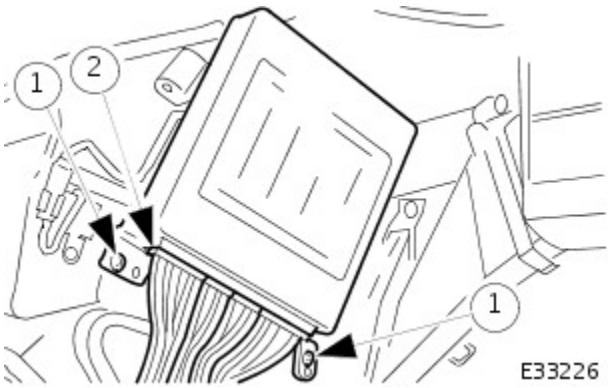


16. Slacken the A/CCM upper fixing using a 'Snap-On' SDP 11 stubby screwdriver, or similar



17. Remove the A/CCM

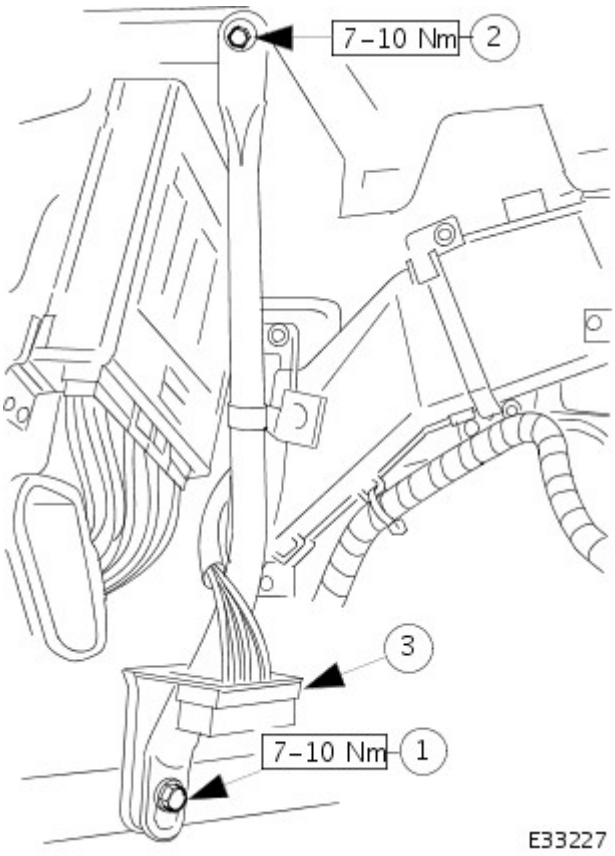
1. Remove the lower fixings (2), A/CCM to heater / cooler case
2. Reposition the A/CCM to disconnect (4) multiplugs



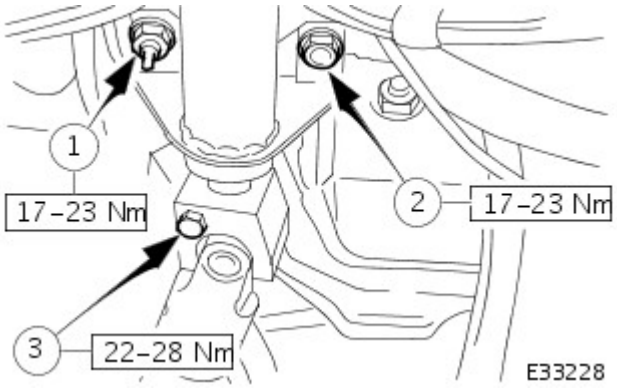
Installation

1. Installation is the reverse of the removal procedure, noting that

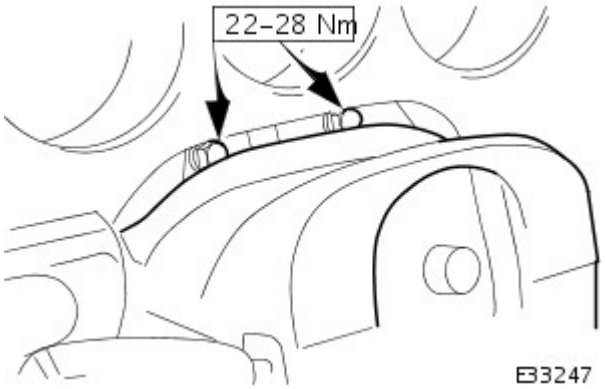
2. Refer to the illustration



3. Refer to the illustration



4. Refer to the illustration



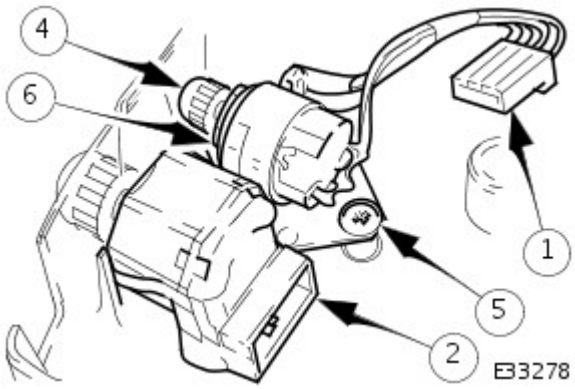
Instrument Cluster and Panel Illumination - Instrument Cluster and Panel Illumination

Description and Operation

Details on the Instrument Cluster and Panel Illumination can be found in sections 413-01, 413-06, 413-07 and 413-08.

Instrument Cluster and Panel Illumination - Instrument Panel Dimmer Switch

Removal and Installation



Removal

1. Move driver seat fully rearward.

2. Disconnect battery ground lead; refer to 86.15.19.

3. Displace lower cowl for access; refer to 76.46.03.

4. Remove rheostat switch from cowl.

1. Disconnect dimmer module to rheostat switch connector.
2. Disconnect column tilt switch connector.
3. Remove lower cowl.
4. Pull adjusting knob from switch.
5. Remove screw.
6. Remove switch.

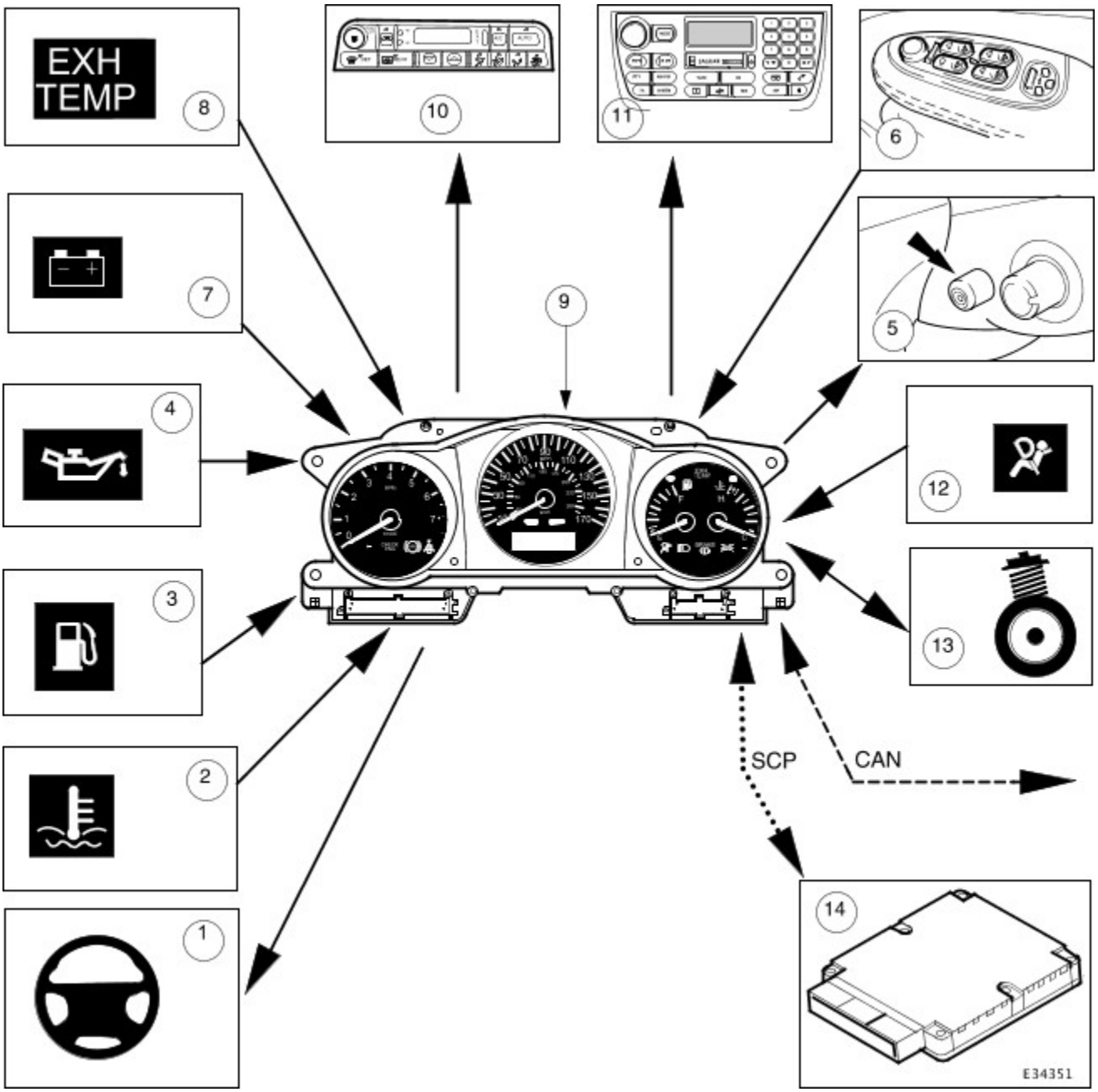
Installation

1. Installation is reverse of removal.

2. Reconnect battery ground lead; refer to 86.15.15.

Instrument Cluster - Instrument Cluster

Description and Operation



Item	Description
1	Variable Power Steering
2	Coolant Level
3	Fuel Level
4	Oil Pressure
5	Lamp Dimmer
6	Driver's Switchpack
7	Generator (Charge Warning Lamp)
8	Catalyst Overheat
9	Instrument Cluster
10	Climate Control (Signal to Module)
11	ICE Head Unit

12	Airbag Circuit Integrity
13	Adaptive Damping
14	Body Processor Module

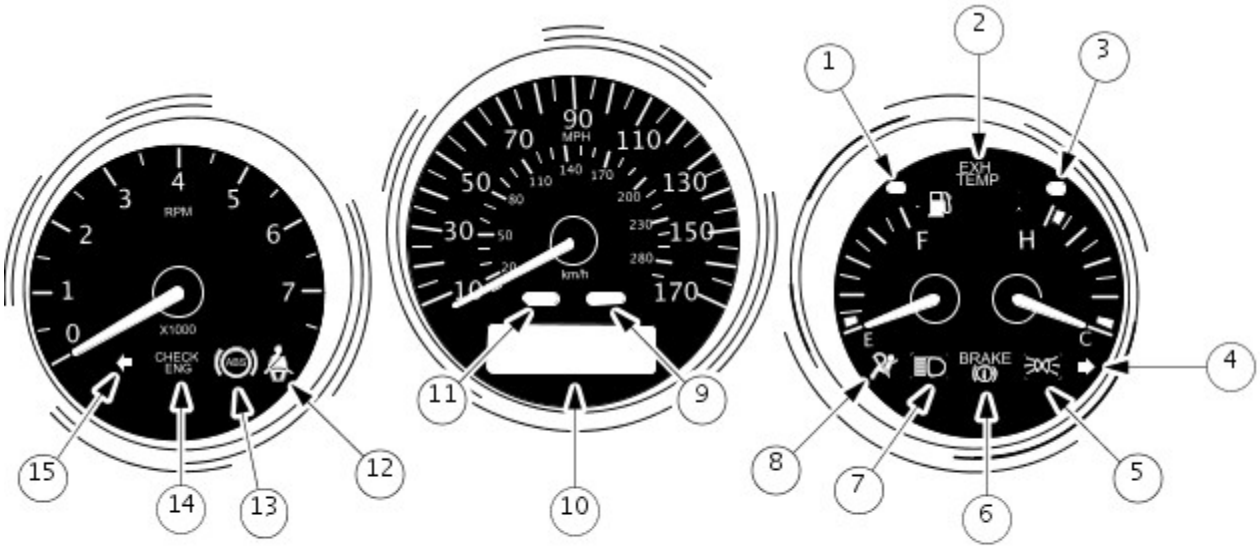
The Instrument Cluster is the primary electronic control module for the speedometer, tachometer, coolant temperature, fuel level, driver information (Message Centre) and warning lamps.

The Instrument Cluster also:

- provides input / output information signals for use by other modules.

- acts as a protocol converter (software language translator - the languages used on each network are very similar, but neither can be directly interpreted by the opposite system) for communication between all modules on both the CAN and SCP multiplexed networks. The Instrument Cluster is the only module on the vehicle which communicates between the two networks.

Instrument Cluster Gauges



E34347

Item	Description
1	Low Fuel Level
2	Exhaust System Temperature *
3	Engine Coolant High Temperature
4	Direction Indicator Right Hand
5	Side / Parking Lamps
6	Handbrake ON / Low Brake Fluid Level
7	Main Beam
8	Airbag / Airbag System Fault
9	High Priority Text Message Displayed
10	Message Centre (Text Messages)
11	Low Priority Text Message Displayed
12	Seat Belt Not Fastened (Driver's)
13	ABS Integrity
14	EMS Fault
15	Direction Indicator Left Hand

*Not used on all markets. Refer to the Drivers Handbook.

Although the gauges look like conventional analogue gauges, each pointer is driven by a stepper motor to provide more accurate readings.

Refer to Section 413-08 for details of the Driver Information / Message Center.

Instrument Cluster - Instrument Cluster

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the Instrument Cluster and the two multiplexed communication networks which are connected to it, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the Instrument Cluster and associated circuits.

The PDU systematically tests and analyses all functions of the Instrument Cluster, the various systems controlled by it and individual sensors which are attached to each separate system.

Where a fault involving a remote sensor e.g. water temperature sensor, is indicated, before replacing the component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Diagnostics using the PDU is via the CAN network, accessed at the diagnostic connector on the car.

Replaceable Parts

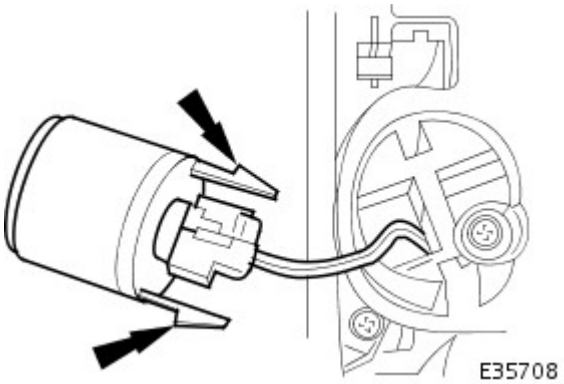
The only replaceable parts are, General Illumination Bulbs, Direction Indicator Warning Bulbs and Main Beam Warning Bulb, which are all of the conventional filament type. Other warning lamps are LEDs and are not replaceable.

Instrument Cluster - Instrument Cluster

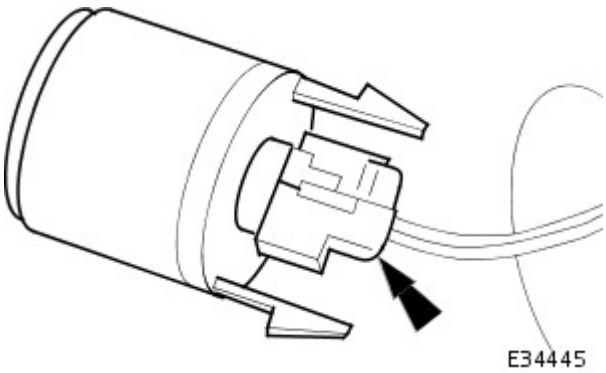
Removal and Installation

Removal

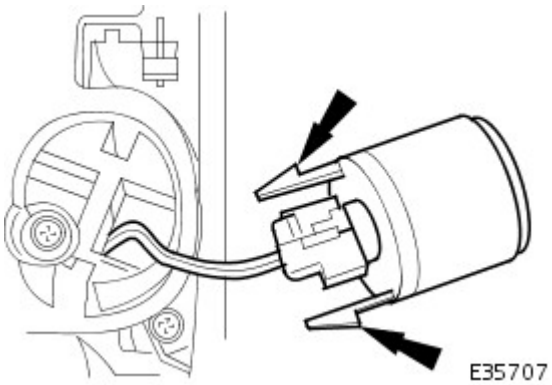
1. Adjust steering column to fully extended and lowered position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove veneer from instrument panel. Refer to 76.47.24.
4. Using a small screwdriver, depress fog lamp switch upper retaining tang and release switch from gauge surround.



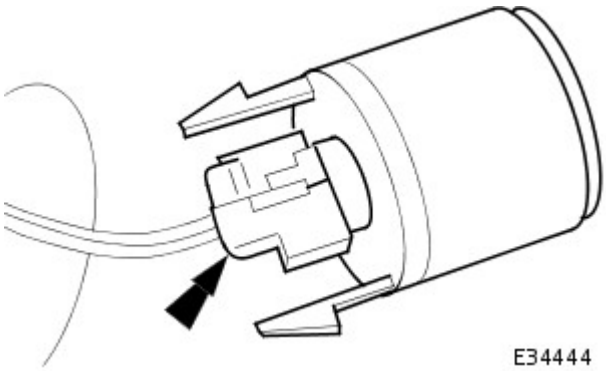
5. Position fog lamp switch for access, disconnect harness multiplug and remove switch.

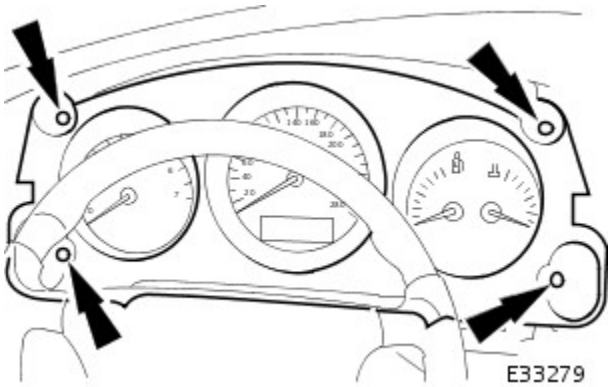


6. Using a small screwdriver, depress trip keyboard upper retaining tang and release keyboard from gauge surround.

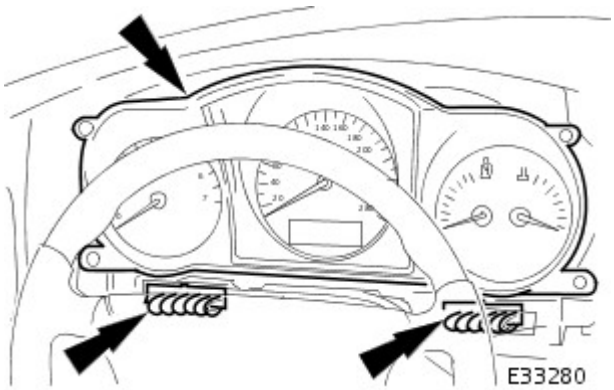


7. Position trip keyboard for access and disconnect harness multiplug.





8. Slacken and remove four screws securing major gauge module/surround to fascia and withdraw surround.



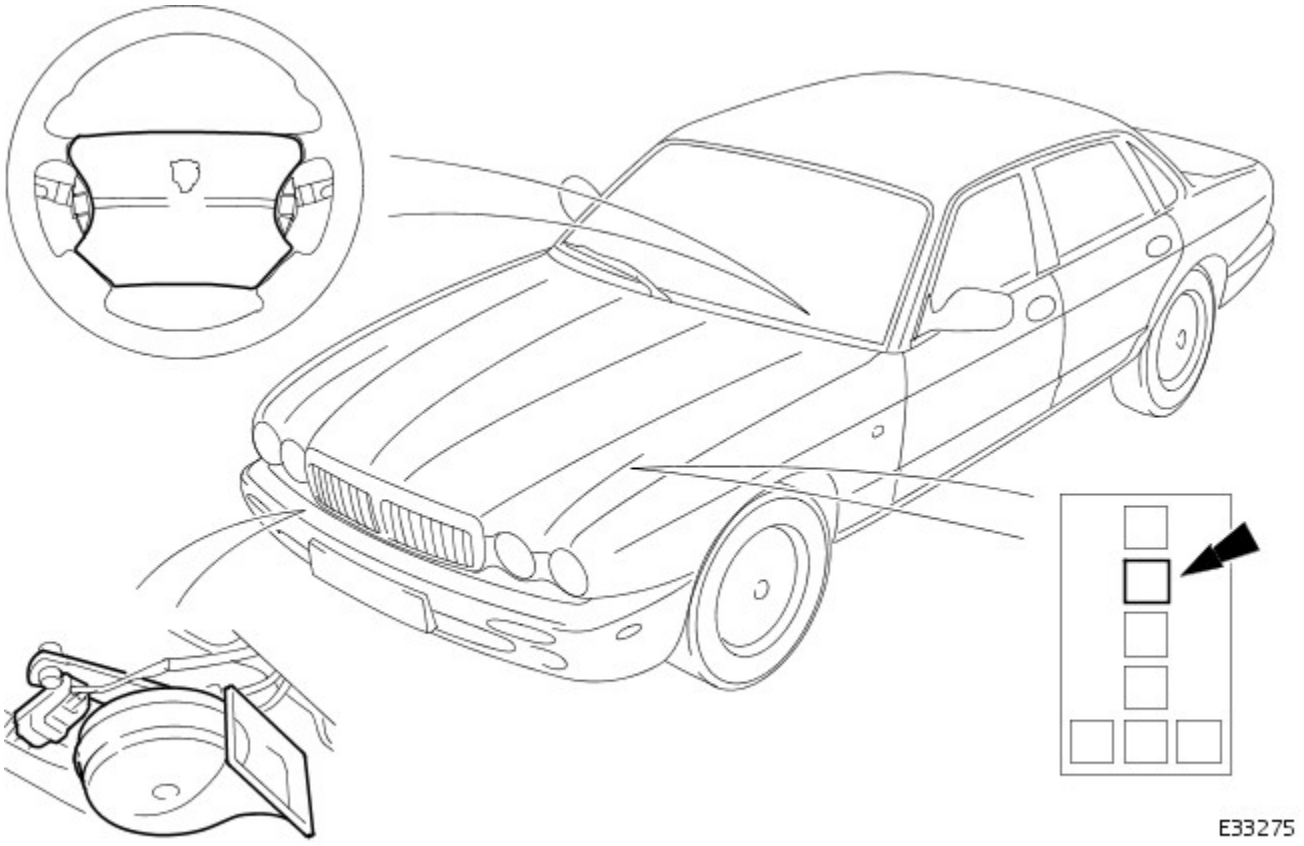
9. Withdraw major gauge module for access, disconnect the two harness multiplugs and remove gauge module from fascia.

Installation

1. Position major gauge module in fascia and connect both harness multiplugs.
2. Position major gauge surround on panel, routing harness multiplugs through apertures.
3. Fit and tighten screws securing major gauge module/surround to fascia.
4. Connect harness multiplug to trip keyboard and fit and fully seat keyboard in gauge surround, ensuring correct location of retaining tangs
5. Connect harness multiplug to fog lamp switch and fit and fully seat switch in gauge surround, ensuring correct location of tangs.
6. Fit veneer panel. Refer to 76.47.24.
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
8. Return steering column to original position.

Horn - Horn

Description and Operation



The horns, located behind the radiator grille, each side of the radiator, are controlled by the Body Processor Module (BPM), as described below.

The switch, located on the steering wheel pad, is operated, it signals the BPM to sound the horn. The BPM responds by providing an earth from the horn-output to the horn relay coil. The relay contacts are subsequently closed and the horns sound.

The horn operating relay, R6 is located in the engine compartment fusebox at the left hand side of the engine compartment.

Horn - Horn

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

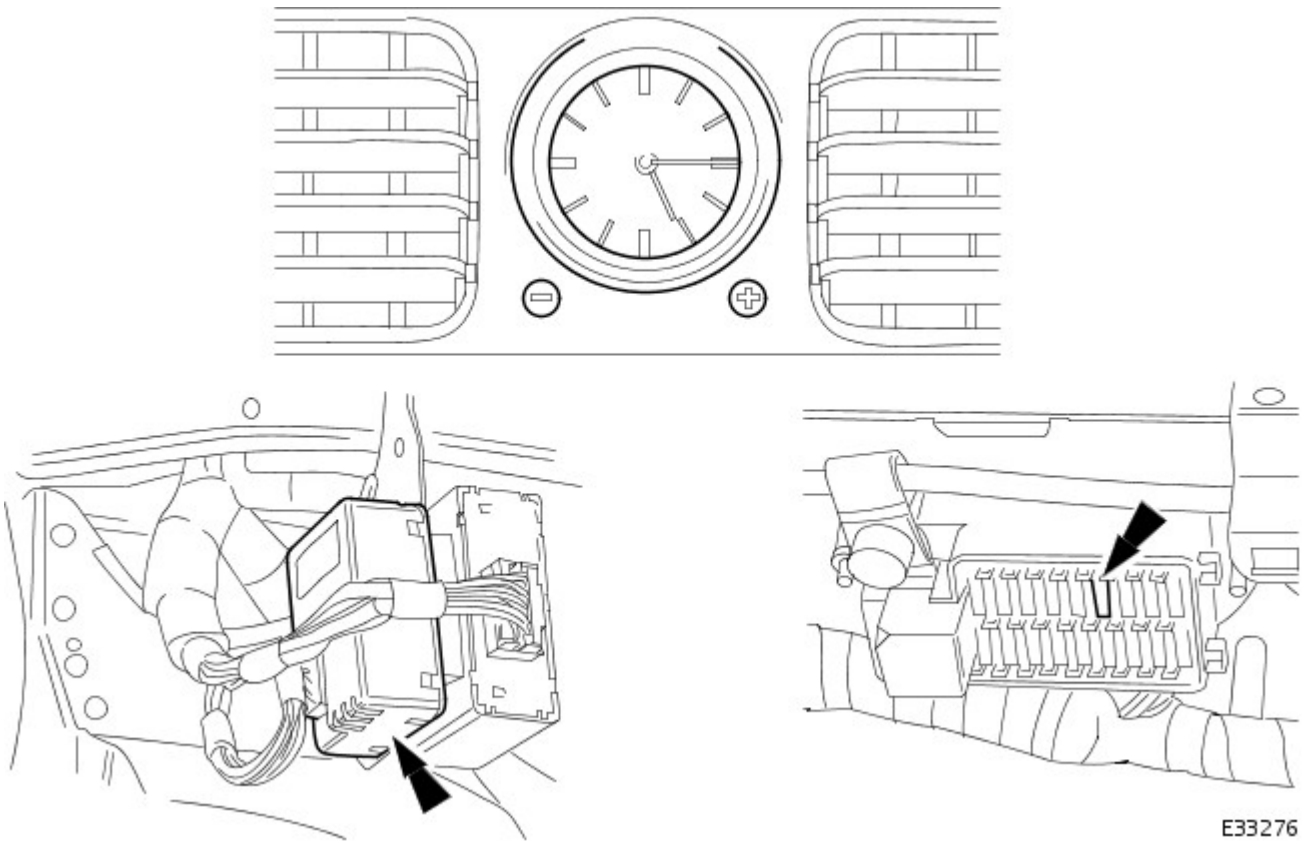
The complexity of the electronics involved with the various Electronic Control Modules and the multiplexed communication networks, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the horn circuit.

The PDU systematically tests and analyses all functions of the horn, the horn relay, the body processor module and the operating switch.

Where a fault involving the horn, relay or switch is indicated by the PDU, before replacing the component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Clock - Clock

Description and Operation



The analogue clock is mounted in the center of fascia vent assembly and can only be removed after withdrawal of the fascia vent assembly.

The clock is protected by a 5A fuse in location F6 of the LH heelboard fusebox and illumination is controlled by the dimmer module in the same manner as the other instruments.

The time displayed can be advanced using the positive button and retarded using the minus button.

Clock - Clock

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the various Electronic Control Modules and the two multiplexed communication networks, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the clock circuit.

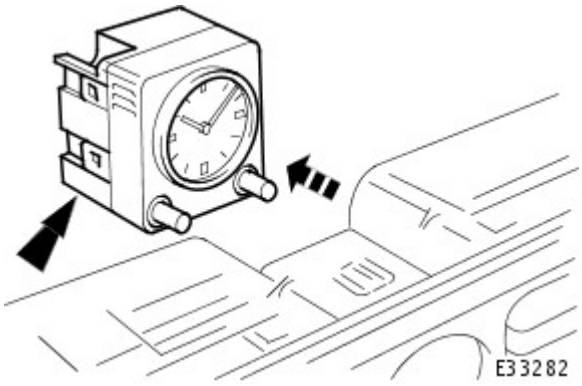
The PDU systematically tests and analyses the clock and the electrucal connections to it.

Where a fault involving the clock is indicated by the PDU, before replacing the clock, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Clock - Clock

Removal and Installation

Removal



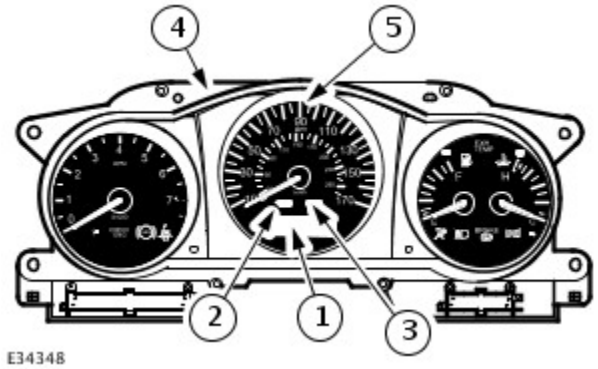
1. Disconnect battery ground cable; refer to 86.15.19.
2. Remove fascia center vent assembly; refer to 82.20.38.
3. Remove clock from fascia center vent assembly.
    - Displace clock retaining tangs and remove clock.

Installation

1. Installation is reverse of removal.

Information and Message Center - Information and Message Center

Description and Operation



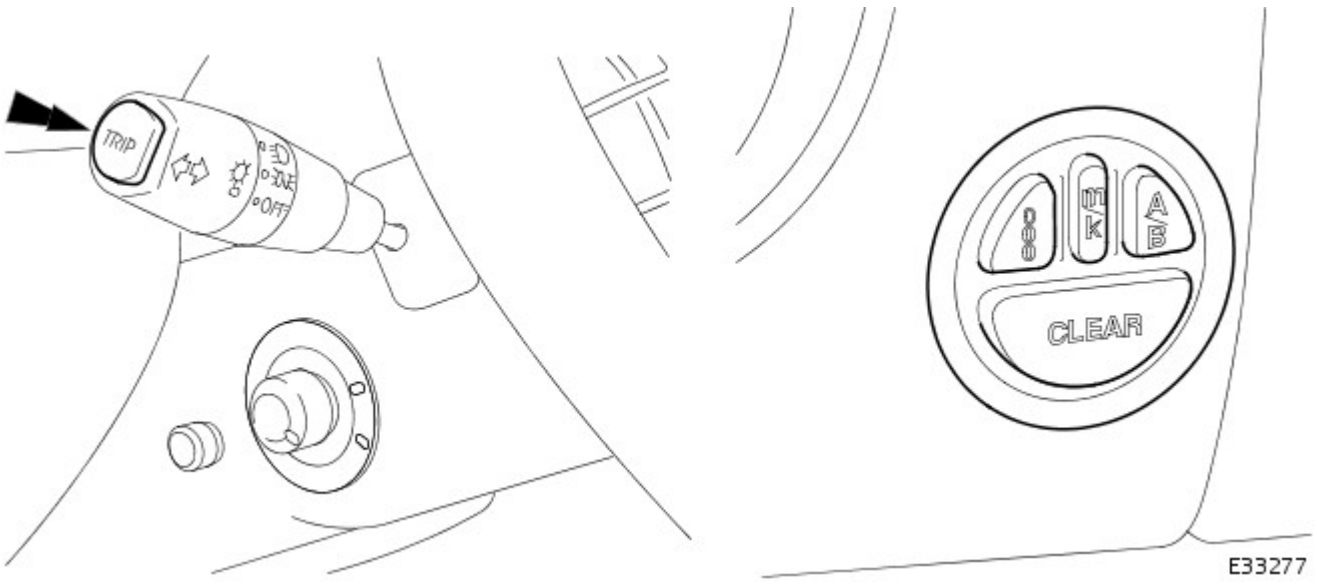
Item	Description
1	Driver's Information / Message Center
2	Amber Warning Lamp
3	Red Warning Lamp
4	Major Instrument Cluster
5	Speedometer

The Driver's Information / Message Center has a liquid crystal display and is located at the lower area of the Major Instrument Cluster.

The message center displays messages in text form for the driver, including odometer readings and trip computer data. It can also provide information normally covered by conventional warning lamps or typically indicate that a feature such as the Automatic Stability Control is operating.

Located above the message center are two lamps, red for warning and amber for caution. When a message is displayed, the appropriate lamp will illuminate to attract the driver's attention and to signify the importance of the message. The lamps also illuminate simultaneously for some warnings and for some non-text warnings - refer to the Drivers Handbook for variations in local markets.

Trip Computer



Pressing the trip switch on the left stalk of the steering column switch assembly activates the trip computer which displays trip data on the message center. Warning and Information messages have priority over trip data; if a driver information message is displayed prior to activation of the trip computer, the trip data will appear for 10 seconds only, before being

replaced by the original message.

Each successive press of the trip switch causes the computer to continually cycle through the stored data which is then displayed on the message center.

The trip computer switch pack, mounted on the fascia is only enabled while the trip computer output is displayed. Refer to the Drivers Handbook for full operating instructions.

Information and Message Center - Information and Message Center

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the speedometer and instrument cluster, of which the Message Center is a part, and the two multiplexed communication networks which are connected to it preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the speedometer and odometer.

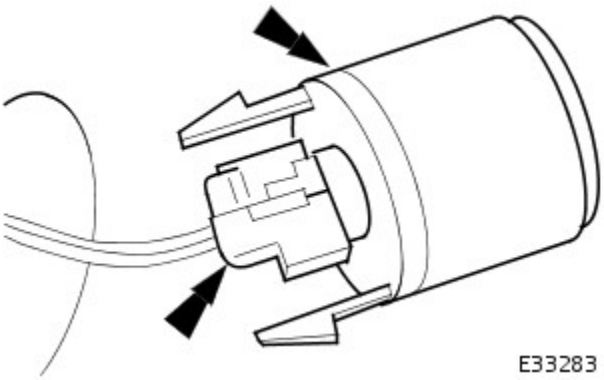
The PDU systematically tests and analyses all functions and the various systems affected by it.

Where a fault is indicated, before replacing a component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Information and Message Center - Message Center Switch

Removal and Installation

Removal



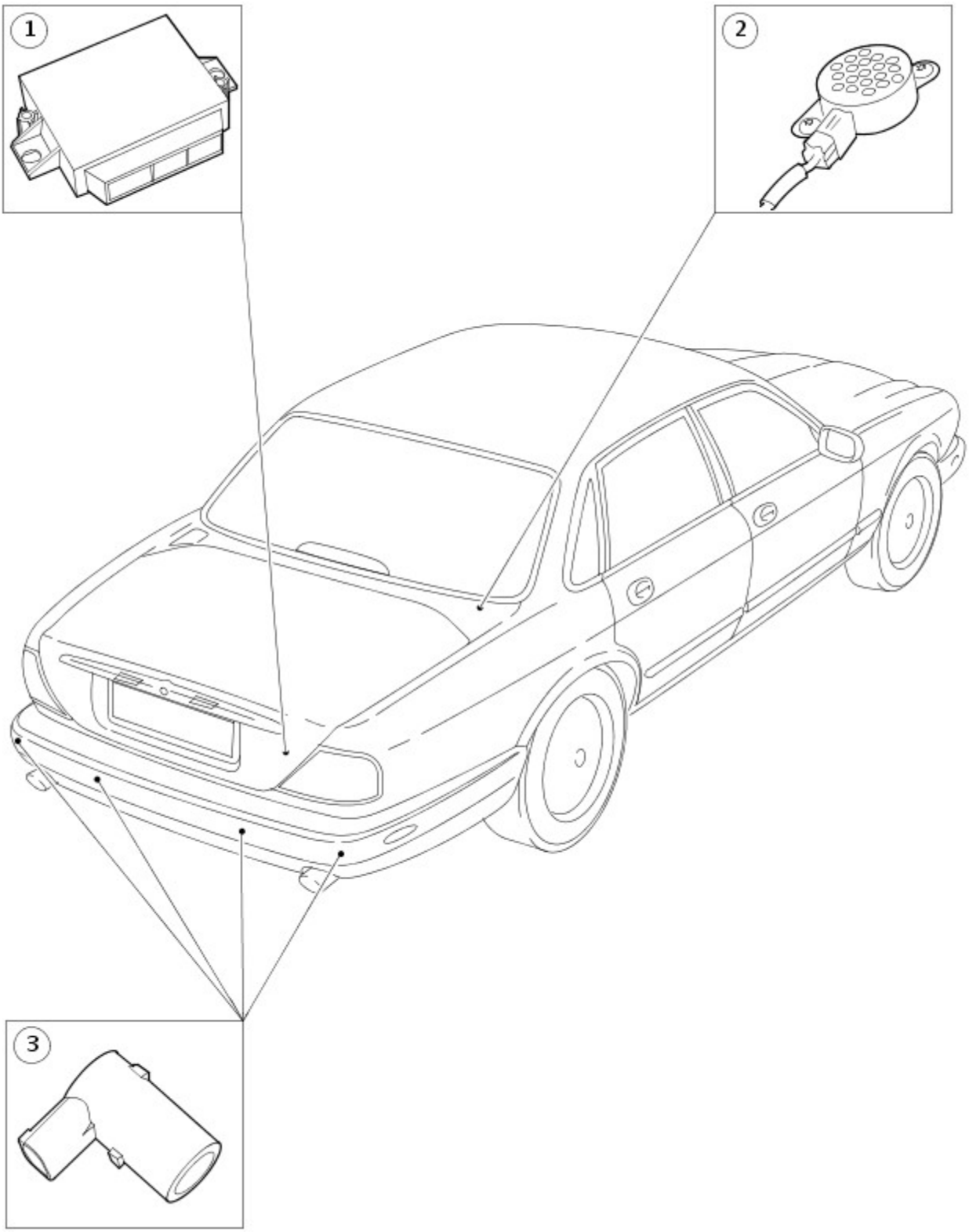
1. Disconnect battery ground cable; refer to 86.15.19.
2. Remove instrument panel veneer panel; refer to 76.47.24.
3. Remove trip computer switch pack.
   - Use suitable small screwdriver to displace upper retaining tang.
   - Reposition switch pack for access to connector.
   - Disconnect connector and remove switch pack.

Installation

1. Installation is reverse of removal.

Parking Aid - Parking Aid

Description and Operation



E57009

Item	Part Number	Description
1	—	Parking aid module
2	—	Rear parking aid speaker
3	—	Rear parking aid sensors

The function of the parking aid is to provide an audible warning to the driver of the distance to obstacles near the rear bumper of the vehicle when parking or travelling at a slow speed. The system provides an assistance to the driver when parking in order to help avoid collision with obstacles.

The sensor range at the rear of the vehicle should be 1.8 meters. This should extend the full width of the rear bumper and reduce to 50 cm at the vehicle corners. The vertical range is adequate to protect the highest and lowest points of the rear of the vehicle. The system will detect curbs with heights of at least 18 cm. Obstacles, such as curbs, that are low enough to pass under the vehicle until they make contact with the tires will not be detected.

The system activates a specific speaker with a tone signifying the distance to the obstacle. The tone consists of a beep and defined space ratio which varies depending on the calculated distance. When the distance to the obstacle is less than 20 cm the speaker tone is continuous.

The parking aid is continuously in operation, unless towing when the system automatically switches off. If the reverse aid develops a fault the tone will sound continuously for three seconds when the ignition is switched on or the reverse gear is selected.

The parking aid system comprises of:

- a module mounted in the battery junction box (BJB).
- four rear bumper mounted sensors which have a 90° angled electrical connector.
- an audible speaker, mounted on the rear parcel shelf.

Parking Aid - Parking Aid

Diagnosis and Testing

Inspection and Verification

1. **1.** Verify the customer concern.

2. **2.** Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Electrical
• Fuse(s) • Relay(s) • Wiring Harness • Electrical connector(s) • Rear parking aid sensor(s) • Rear parking aid speaker • Reversing lamp switch • Parking aid module

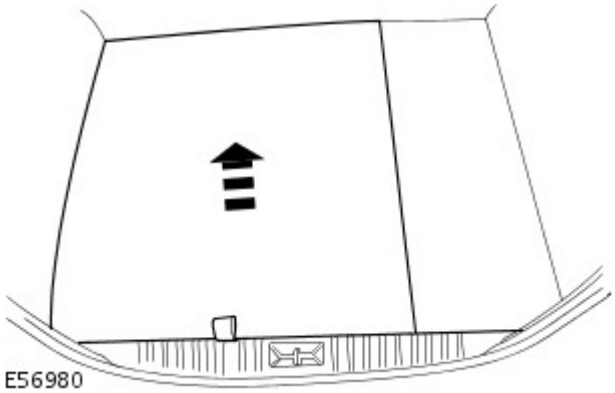
3. **3.** If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

4. **4.** If the cause is not visually evident, verify the symptom and refer to the Jaguar approved diagnostic system.

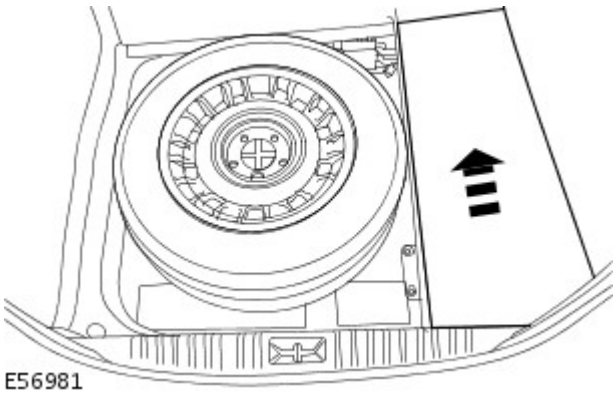
Parking Aid - Parking Aid Module

Removal and Installation

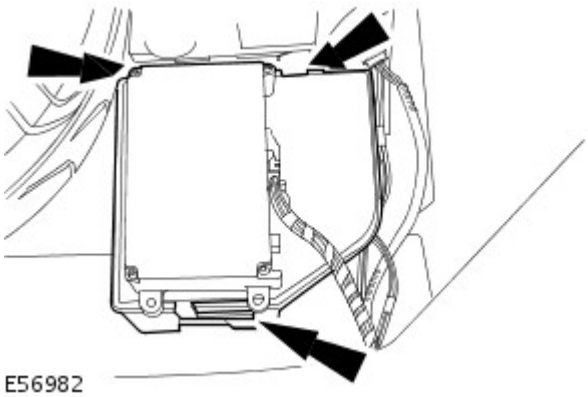
Removal


E56980

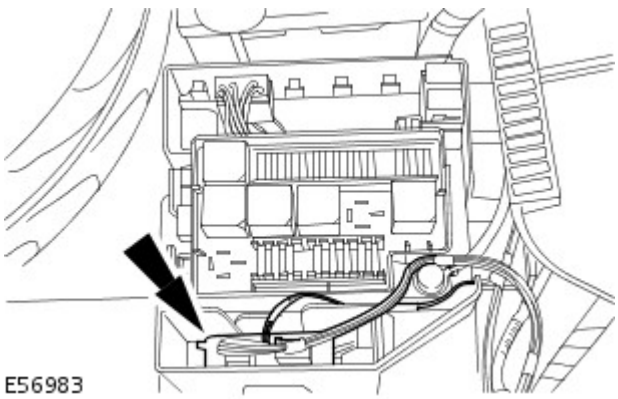
1. Remove the luggage compartment floor panel.


E56981

2. Remove the battery cover.

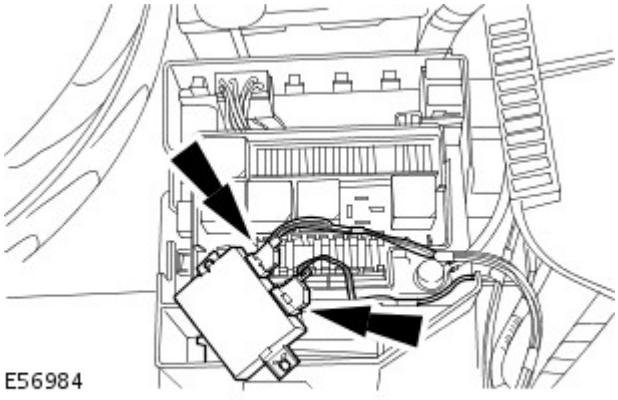

E56982

3. Reposition the cover from the battery junction box (BJB).


E56983

4. Reposition the parking aid module.

5. Remove the parking aid module.



- Disconnect the electrical connectors.

Installation

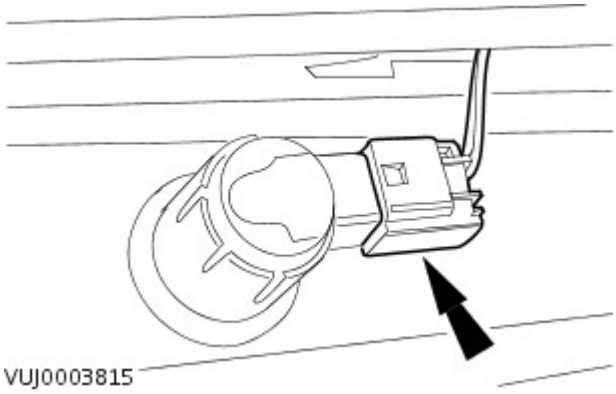
1. To install, reverse the removal procedure.

Parking Aid - Rear Parking Aid Sensor

Removal and Installation

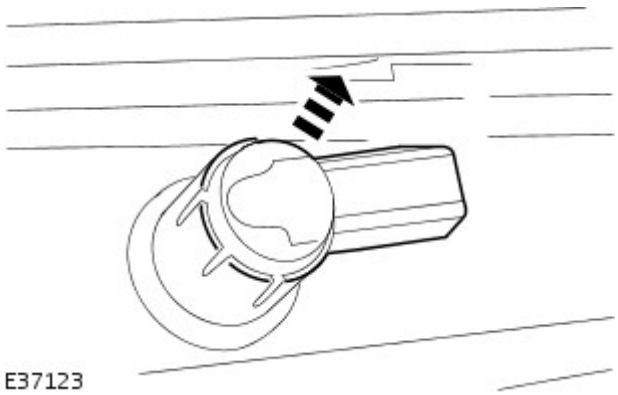
Removal

1. Raise and support the vehicle.
   For additional information, refer to: Jacking (100-02 Jacking and Lifting, Description and Operation).
2. Disconnect the electrical connector.



3. CAUTION: Make sure excessive pressure or tools are not used when removing the parking aid sensor from the housing.

   Remove the rear parking aid sensor.



Installation

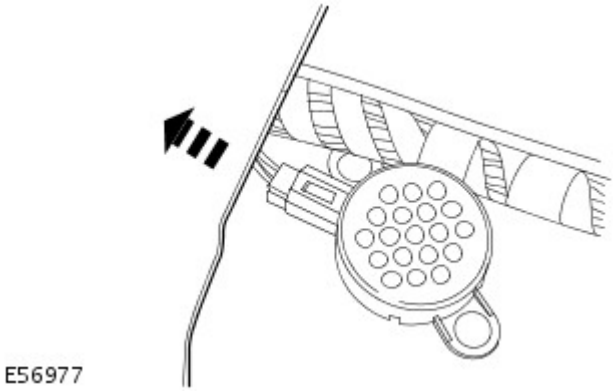
1. To install, reverse the removal procedure.

Parking Aid - Rear Parking Aid Speaker

Removal and Installation

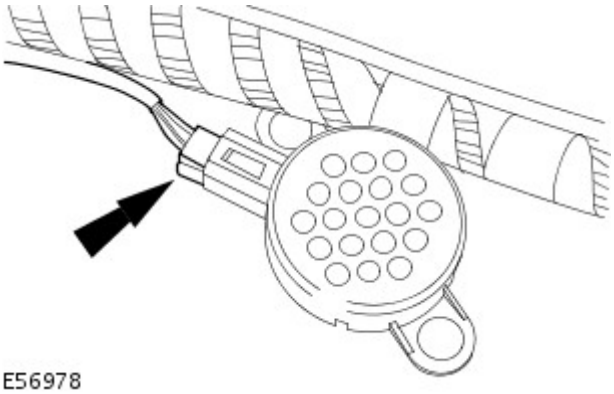
Removal

1. Remove the parcel shelf.
   For additional information, refer to: Parcel Shelf (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Reposition the sound insulation.



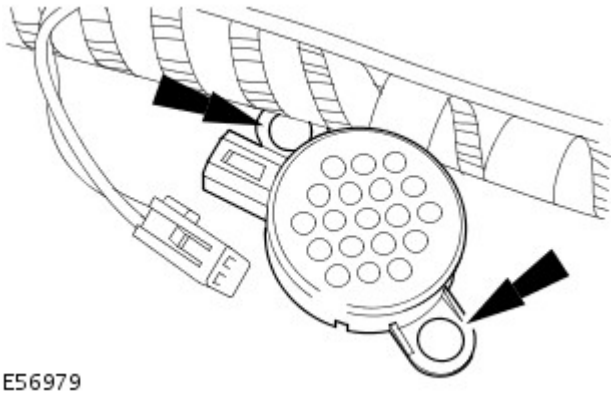
E56977

3. Disconnect the electrical connector.



E56978

4. Remove the rear parking aid speaker.



E56979

Installation

1. To install, reverse the removal procedure.

Charging System - General Information - Charging System

Description and Operation

Details of the Charging System can be found in sections 414-01 and 414-02.

Battery, Mounting and Cables - Battery and Cables

Description and Operation

The battery has been designed specifically for Jaguar. It provides the high output which is required for this vehicle, but with a substantial saving in weight. It is a low maintenance battery, located on the right hand side of the luggage compartment floor.

The negative (Ground) lead is connected to the vehicle body. The positive lead is connected to a high power protection module; from here power is connected to the starter motor and distributed to other systems on the vehicle.

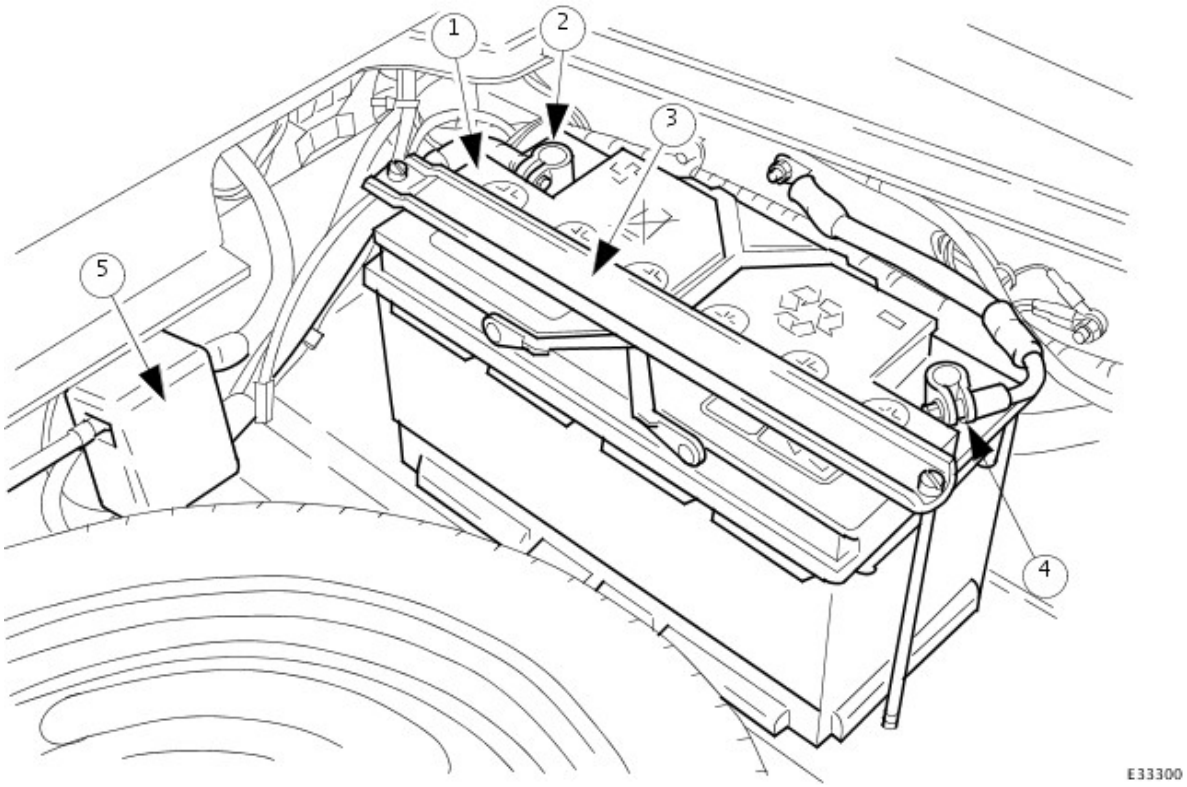
The high power protection module comprises three fuses, each of 250A capacity. Two fuses are connected in parallel to provide protection for the starter circuit. The third one provides high level protection for fusebox supply circuits .

PDU is unable to diagnose the overall condition of the battery - only that it is present and supplying battery voltage to the system.

To test the battery, follow the test procedure described in Section 414-02 Generator and Regulator of this Manual.

Although these tests will not actually test the battery, they will confirm that the generator, regulator and connecting cables are working correctly and that consequently, the battery may be at fault. Alternatively, the tests may indicate that the fault lies in the generator, regulator or wiring and not in the battery.

Battery



Parts List

Item	Part Number	Description
1	—	Battery
2	—	Positive Lead
3	—	Battery Hold-Down Clamp
4	—	Negative (Ground) Lead
5	—	High Power Protection Module (Fuses)

Battery, Mounting and Cables - Battery Connect

General Procedures

1. NOTE: Whether one, or both, cables are disconnected, a minimum of 30 seconds MUST elapse between disconnection of the FIRST cable and reconnection of the LAST cable. A clean final connection must be made; do not allow temporary contact.

Connect the battery terminal(s).

2. Reset the clock.

3. Enter the radio security code. If necessary, refer to the Sound System Handbook.

Battery, Mounting and Cables - Battery

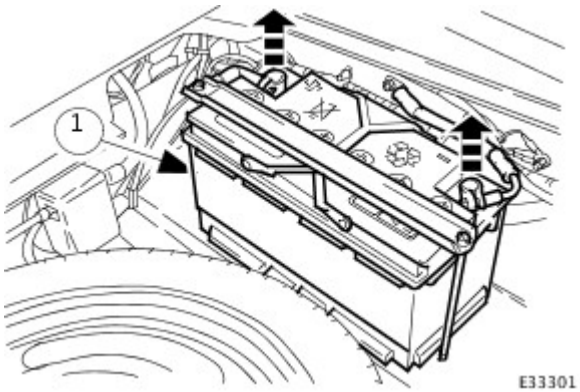
Removal and Installation

Removal

1. Remove the luggage compartment floor panel (when standard size spare wheel is supplied) and the cover from the battery.

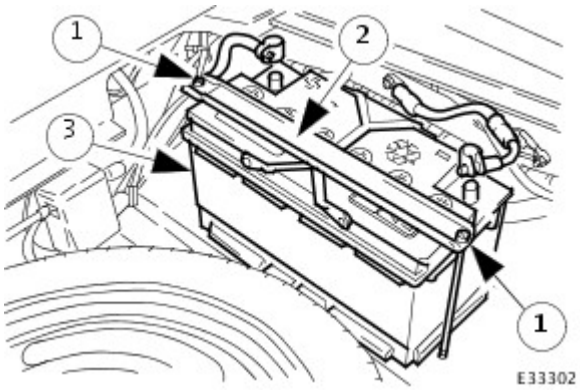
2. Disconnect the battery cables.

- Disconnect the ground cable.
- Disconnect the positive cable.



1. Disconnect the vent pipe.

3. Remove the battery.



1. Remove the two bolts which secure the battery clamp.
2. Remove the clamp.
3. Remove the battery.

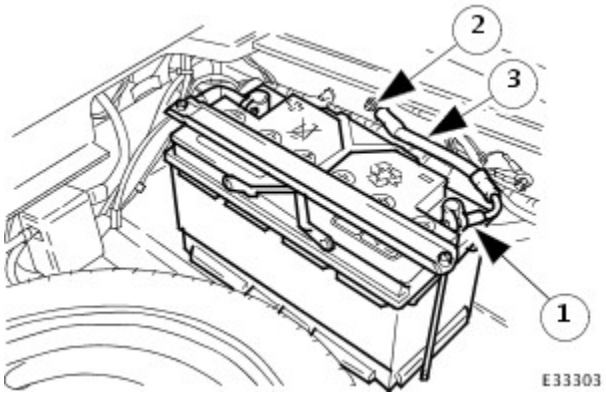
Installation

1. Installation is the reverse of removal.

2. Perform the Battery Reconnection Procedure described in this section.

Battery, Mounting and Cables - Battery Ground Cable

Removal and Installation



Removal

1. Remove the luggage compartment floor panel (when standard size spare wheel is supplied) and the cover from the battery.
2. Remove the negative lead.

- Reposition the front edge of the side trim for access to the ground stud.

1. Slacken the clamp of the negative lead at the battery terminal. Disconnect the negative lead from the battery terminal.
2. Remove the nut from the ground stud.
3. Remove the negative lead.

Installation

1. Installation is the reverse of removal.
2. Perform the Battery Reconnection Procedure described in this section.

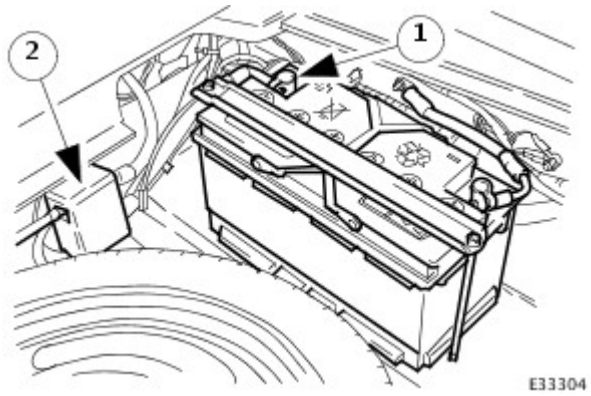
Battery, Mounting and Cables - Battery Positive Cable

Removal and Installation

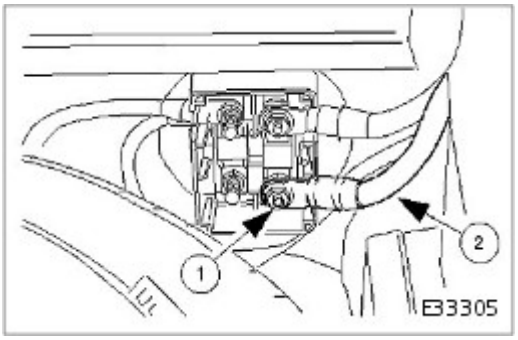
Removal

1. Remove the luggage compartment floor panel (when standard size spare wheel is supplied) and the cover from the battery.

2. Disconnect the positive lead.



1. Slacken the clamp of the positive lead at the battery terminal. Disconnect the positive lead from the battery terminal.
2. Remove the cover from the high power protection module for access to the positive supply stud.



3. Remove the positive lead.

1. Remove the nut from the positive supply stud.
2. Remove the positive lead.

Installation

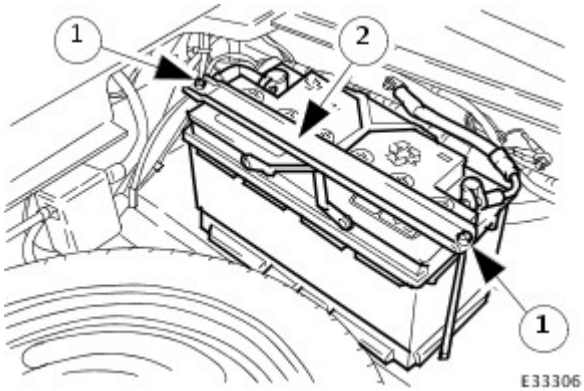
1. Installation is the reverse of removal.

2. Perform the Battery Reconnection Procedure described in this section.

Battery, Mounting and Cables - Battery Retaining Bracket

Removal and Installation

Removal



1. Remove the luggage compartment floor panel (when standard size spare wheel is supplied) and the cover from the battery.
2. Disconnect the battery terminal ground cable.
3. Remove the battery hold-down clamp.
    1. Remove the two bolts which secure the battery hold-down clamp.
    2. Remove the hold-down clamp.

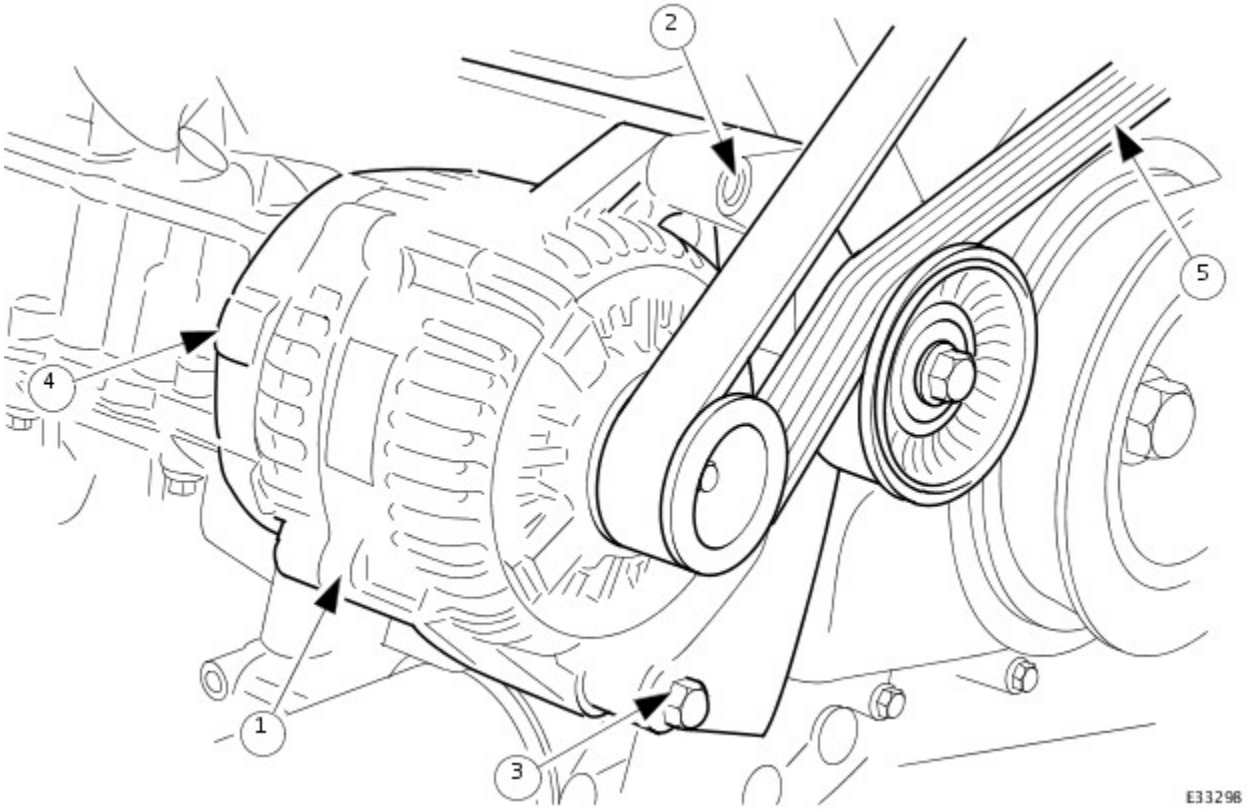
Installation

1. Installation is the reverse of removal.
2. Perform the Battery Reconnection Procedure described in this section.

Generator and Regulator - Generator

Description and Operation

Generator - General View



Item	Part Number	Description
1	—	Generator
2	—	Bolt - Mounting Upper
3	—	Bolt - Mounting Lower
4	—	Voltage Regulator (Internal component)
5	—	Drive Belt - Multi-Ribbed

Features

- Manufacturer - Denso
- Type - L3B-HE
- Drive Ratio - 3.04:1
- Output - 120 Amps at 5000 rpm (generator speed) at 25° C

The generator is fitted at the front right hand side of the engine, to a separate mounting bracket, which in turn is bolted to the cylinder block. Two bolts secure the generator to the mounting bracket; one is reached from above and one from below the vehicle.

The voltage regulator is integral with the generator body. Battery charging capability has been optimised for charging a battery which is located remotely, in the luggage compartment. The design of the generator and regulator has been finely matched, to generate charging current with very low ripple. This provides the best electrical refinement to the system.

The generator is driven by a single, multi-ribbed belt which also drives all other front-end accessories; except for the supercharger (where fitted).

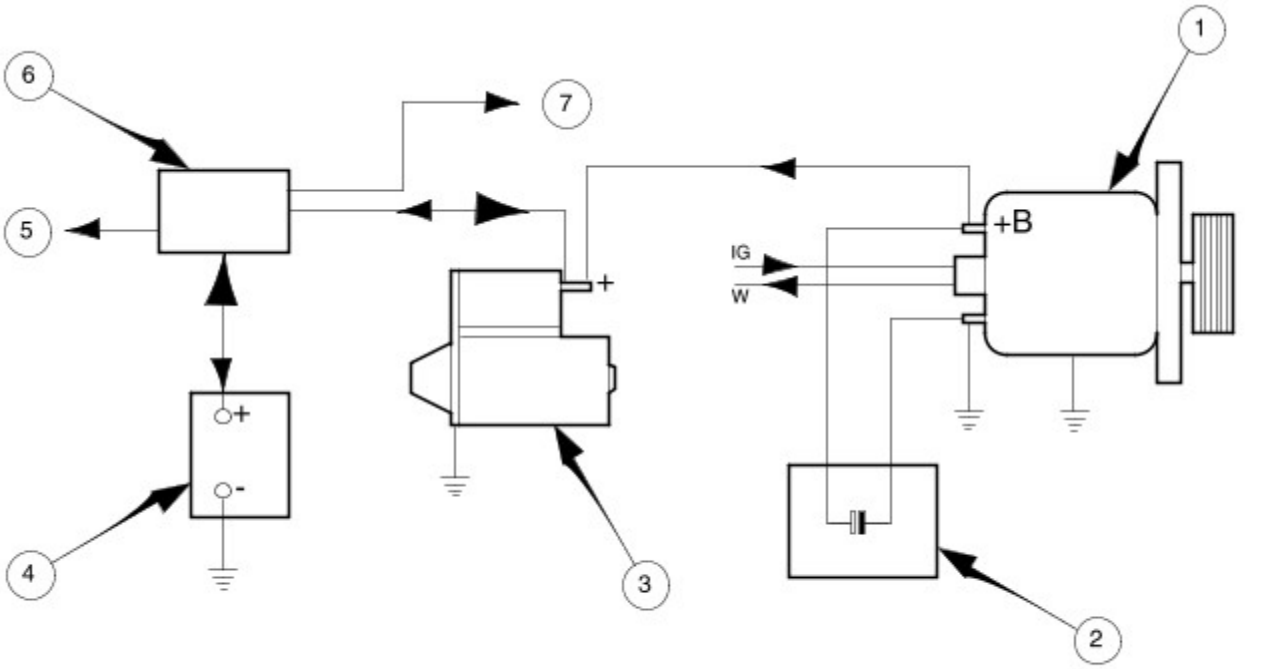
No special service tools are required to remove the generator from the vehicle.

Belt tension is achieved by an automatic tensioner; neither the belt nor the tensioner require service apart from checking the belt wear indicators at each normal service interval.

The minimum service life of the drive belt is 100,000 miles.

Never apply oil to the belt or to the belt tensioner.

Generator - Charging Circuit



E3 3308

Parts List

Item	Part Number	Description
1	—	Generator
2	—	Suppression Module
3	—	Starter Motor
4	—	Battery
5	—	Power Cable to Rear Fuse Box
6	—	High Power Protection Module
7	—	Power Cable to Front Fuse Boxes

The main components of the charging system are shown above.

The output from the generator 'B+' main terminal passes to the battery via the main terminal on the starter motor and then the power cable to the high power protection module located in the luggage compartment. From this module, a short main power cable supplies the battery positive terminal.

The return circuit is through the vehicle body and supplementary ground cables.

The high power protection module comprises four fuses, each rated at 250 Amps.

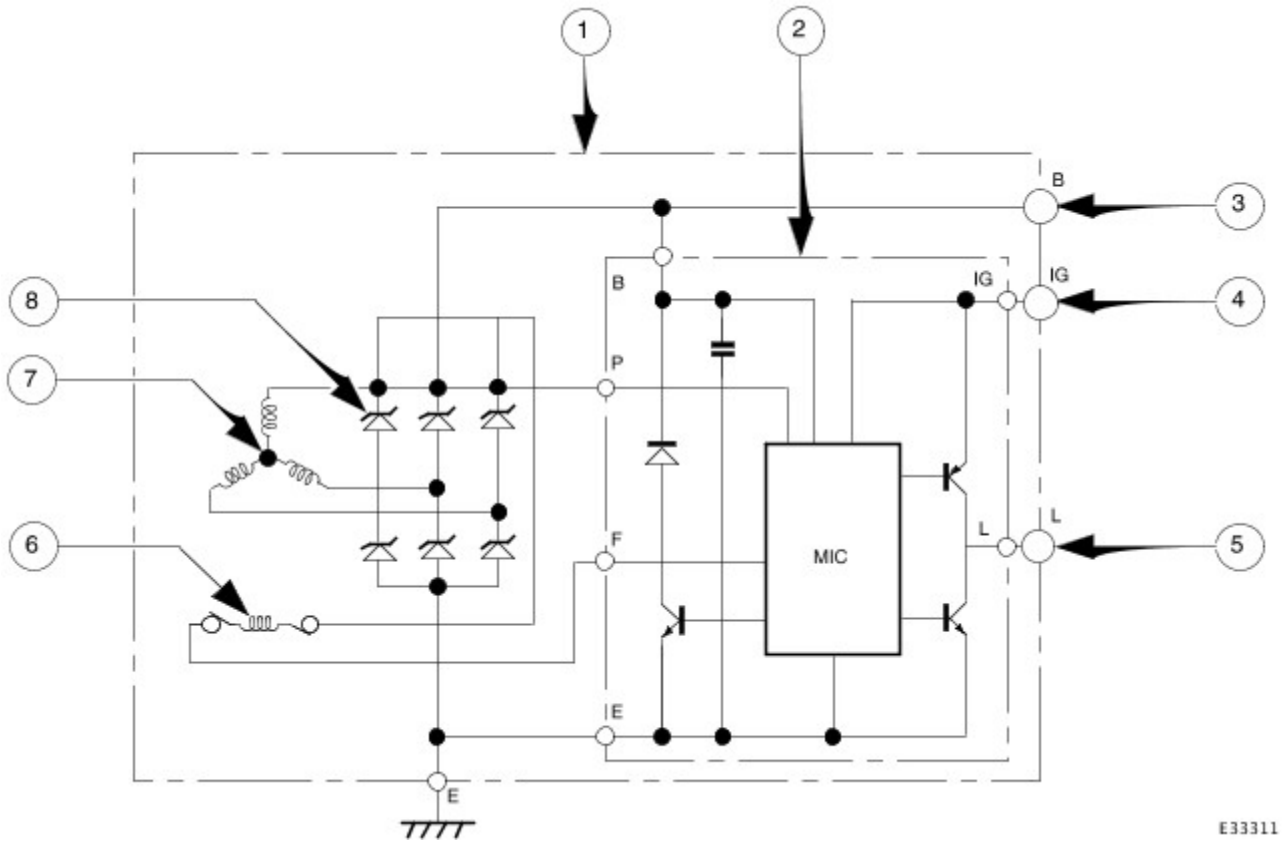
Battery output uses the same power cable as the charging circuit, to the high power protection module and to the starter motor main terminal. Two similar cables, but not such a high rating, supply battery power from the high power protection module to the fuse box in the luggage compartment and to the fuse boxes at the front of the vehicle.

The interference suppression module (where fitted) connects to the generator main terminal 'B+' and a ground stud on the rear face of the generator.

A multi-plug (3 pin) is connected to the rear of the generator:

- Pin 1 not connected.
- Pin 2 ignition supply to the regulator.
- Pin 3 output to the charge warning lamp.

Generator - Internal Circuit Diagram



Item	Description
1	Generator Assembly
2	Voltage Regulator
3	Main Terminal 'B+'
4	Ignition Supply Terminal 'IG' to Rotor
5	Output Terminal L to Charge Lamp
6	Rotor
7	Stator
8	Rectifier Pack

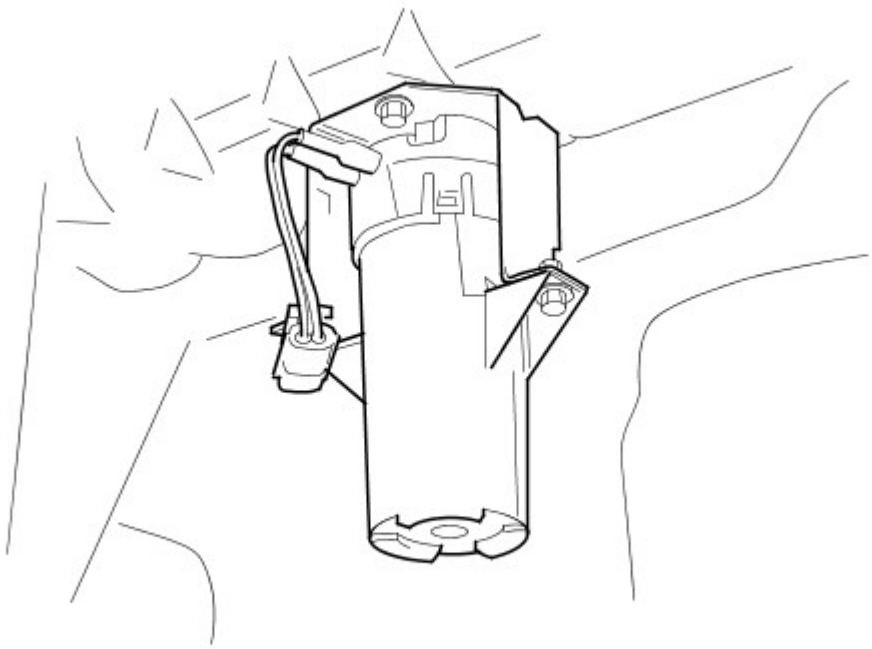
As with most vehicle ac generators, there is only minimal residual magnetism in the field (rotor) windings. To compensate for this and to achieve high current output at low engine speed, the field is excited by battery voltage supplied to the generator at the 'IG' terminal.

To control the level of field excitation and ultimately, generator output, the voltage supplied to the field (rotor) is controlled by the voltage regulator.

The voltage regulator senses (at the 'B' terminal) battery terminal voltage, which within limits is proportional to the state of charge of the battery. The regulator then adjusts the supplied voltage between the 'IG' terminal and the regulator 'F' terminal (a continuously variable process) to maintain the 'B+' output at a constant level.

If the field were not controlled, the 'B+' output would rise to a level which could damage bulbs and ECMs. The regulator compares the output voltage to an internal voltage reference circuit to achieve the controlled output of the generator.

Suppression Module



E33314

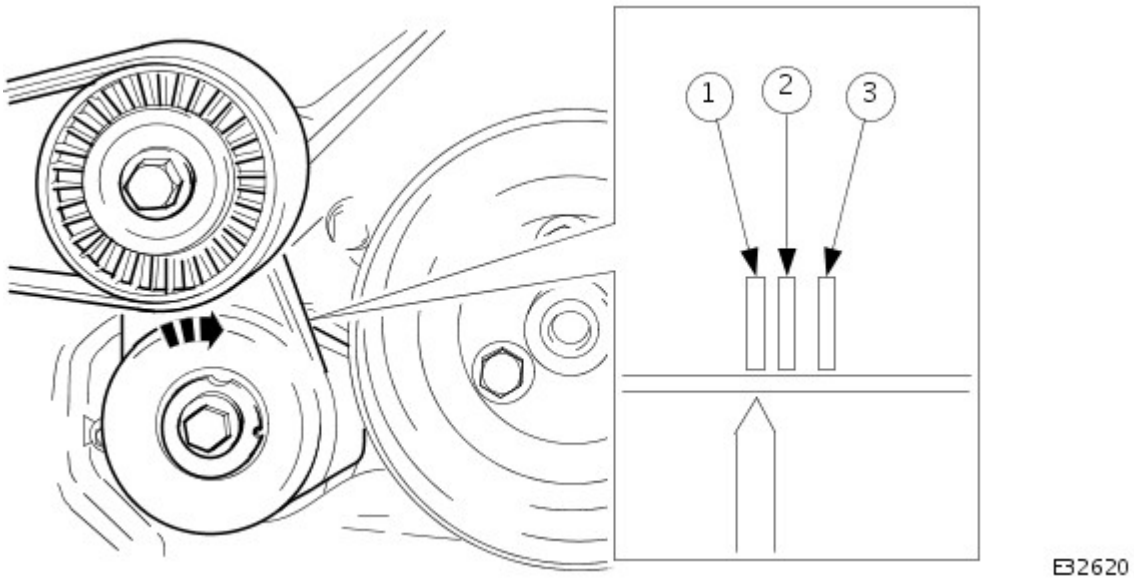
Although the output from the generator is finely controlled and relatively smooth, it is still a pulsed DC output at a varying frequency proportional to engine speed.

The suppression module damps out any ripple which may be sensed on the main output of the generator. This prevents possible interference via the power supply, affecting the radio reception or, where fitted, the telephone.

The module is located on the right hand side of the engine compartment, on the inner panel just above the chassis leg, adjacent to the generator. It is secured to two anti-vibration rubber mountings. The illustration shows the suppression module viewed from below the vehicle.

A fuse is fitted internally to the suppression module to protect the generator output in the event of a short circuit within the suppression module.

Drive Belt Automatic Tensioner



Item	Description
1	New Belt - Minimum Length
2	New Belt - Maximum Length
3	Replace the Belt

Belt tension is achieved by an automatic tensioner; neither the belt nor the tensioner require service apart from checking the belt wear indicators at each normal service interval.

The minimum service life of the drive belt is 100,000 miles.

Never apply oil to the belt or to the belt tensioner.

Generator and Regulator - Generator

Diagnosis and Testing

Refer to PDU User Guide

Refer to the PDU User Manual for detailed instructions on testing the charging circuit.

When diagnosing the charging circuit, the PDU indicates only whether the generator is charging or not charging. The reason for this is that the PDU cannot handle the potential full charging current and that the voltage control circuits are located within the generator assembly, making them inaccessible by the PDU directly.

It is possible that the battery has failed. In this case, the voltage output at the generator could be correct, but the voltage at the battery terminals, and therefore the rest of the vehicle system, will be adversely affected by the faulty battery.

The same result is given by the PDU if the battery is faulty (generator not faulty), wiring fault (damaged or severe corrosion at the terminals) or if the generator is at fault.

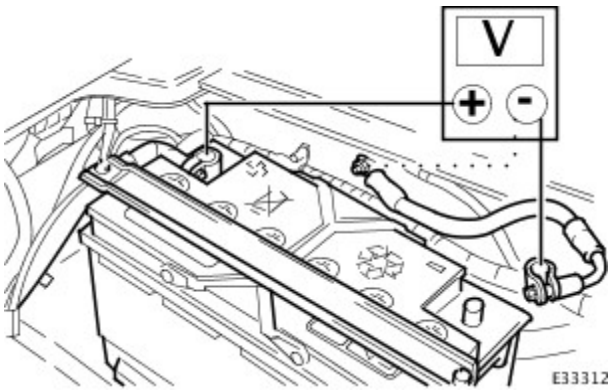
Inspection and Verification

The following manual tests help to pinpoint which component is at fault.

Mechanical	Electrical
Visually check the condition of the drive belt	Connections on the rear face of the generator are fully located?
Check that the belt wear indicator, located on the automatic belt tensioner, is within the limit marks	

Testing the Battery Circuit

Using the Vehicle Battery



Remove the battery cover.

Ensure that all electrical loads are switched OFF and that the engine is cool.

Start the engine and allow to IDLE.

Whilst the engine is idling, disconnect the battery negative terminal and, using a digital multimeter (DMM), measure the voltage between the terminal on the battery negative cable and the battery positive terminal. If the generator is working, the measured voltage should be within the range 13V to 15V.

This indicates the system voltage without the battery in circuit. If the generator is inoperative, the engine will stall when the ground lead is disconnected.

Repeat the test, using the ground bolt, as indicated (shown dotted on the illustration). There should be hardly any

detectable difference in the voltage reading (due to minimal current flow); if there is a detectable difference, clean the cable terminal and the adjacent area of the body.

When the voltage has been measured, STOP THE ENGINE.

Reconnect the battery or fit a new battery if it was established that the battery was at fault (Refer to 414-01).

If the cooling fans operate during the above test, the large demand of current will overload the generator and cause the engine to stall.

If the battery is in a low state of charge the voltage will rise momentarily when the battery is disconnected. However, the maximum that the voltage can increase to with this new generator is 25V and then only for a maximum time of 200 mS.

Using a Substitute Battery

A substitute battery may be fitted for the tests. This battery must be a known good example and must have been off-charge for at least twelve hours, with a terminal voltage of approximately 12.8V.

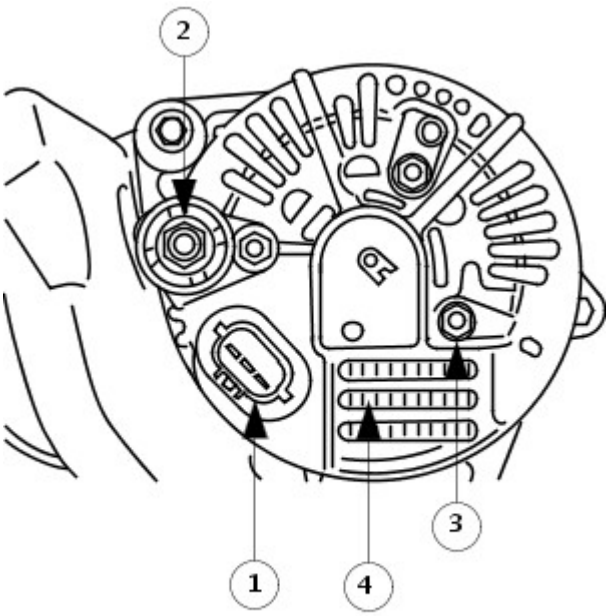
Ensure that all electrical loads are switched OFF and that the engine is cool.

Start the engine and allow to IDLE.

Measure the voltage across the battery terminals. It should have dropped a little due to the large start current and then risen to a value of between 13V and 15V.

If the above test (whichever one used) indicates that the generator is not working then the connections on the rear face of the generator should be checked. If there is a faulty connection, then the generator will not perform correctly no matter how fast it is driven.

Checking Generator Connections



E33309

Item	Description
1	Multi-Plug Connector
2	B+ Main Output Terminal

3	Ground Stud for Suppression Module
4	Heatsink for Voltage Regulator

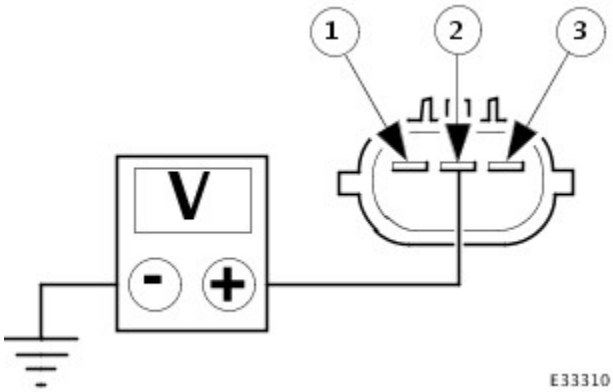
CAUTION: The engine must not be running when multiplugs are connected or disconnected.

Check that the main B+ terminal is clean and tight.

Check that the IG terminal is clean and making good contact; if this connection is faulty, the generator will never function correctly.

Disconnect the multi-plug at the rear of the generator. With the engine not running and with the ignition switched on, use a DMM to check for battery voltage between the centre pin on the multi-plug connector and a good vehicle ground. If the measured voltage is correct, switch off the ignition and reconnect the multi-plug.

Multiplug Connector



Item	Description
1	Not Connected
2	IG - Ignition Supply to Generator
3	WL - Output to Charge Warning Lamp

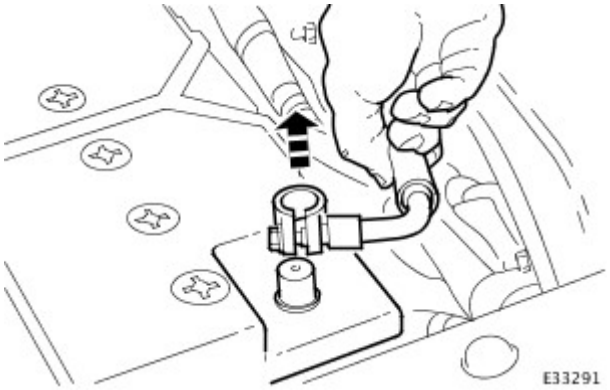
If no voltage or low voltage is indicated, check for continuity of the harness between the multi-plug and Fuse 5 (10A) in the Engine Compartment Fusebox - Left Hand Side. Repair any damage to the harness if necessary. It should be noted that if Fuse 5 has blown, the starter motor will not operate and the Engine Control Module will not receive an ignition supply. Consequently, the engine will not start, even with a slave battery.

Start the engine and test for correct charge or voltage level; check as described previously. If not charging and the generator is being driven ie. no belt slipping - renew the generator.

Generator and Regulator - Generator4.0L NA V8 - AJ27 / 3.2L NA V8 - AJ26

Removal and Installation

Removal



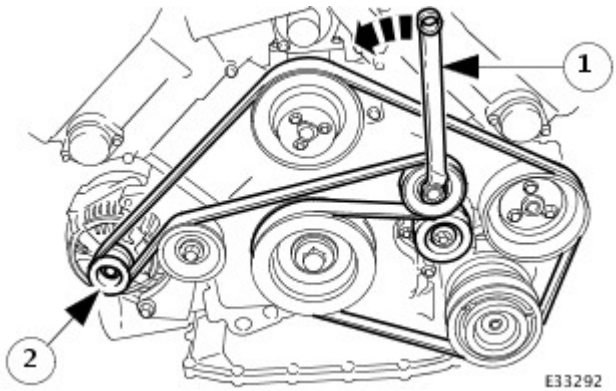
1. Disconnect the battery ground cable.

- Remove the battery cover.

2. Remove the air cleaner assembly (including fit body paintwork protection sheets to the adjacent working area); refer to operation 19.10.05.

3. Remove the twin fan and motor assembly from behind the radiator; refer to operation 26.25.12.

4. Check that the belt wear indicator is within the limit marks.

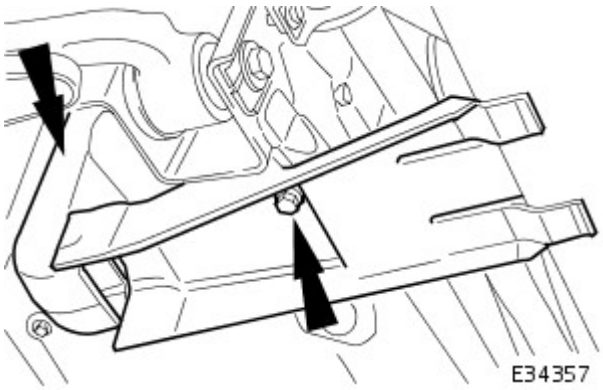


5. Remove the drive belt from the generator and accessory drive,

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.
2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

- Disconnect the belt from the other pulleys, as necessary, to move it clear of the generator.

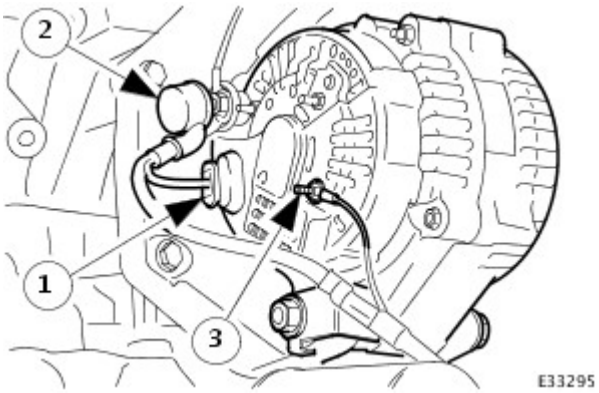
6. Raise the vehicle on a ramp; refer to Section 100-02



7. Remove the air intake ducting from the generator. The ducting comprises two sections; the upper section is retained by two screws to the sump body assembly and the lower (horizontal) section is retained by one screw.

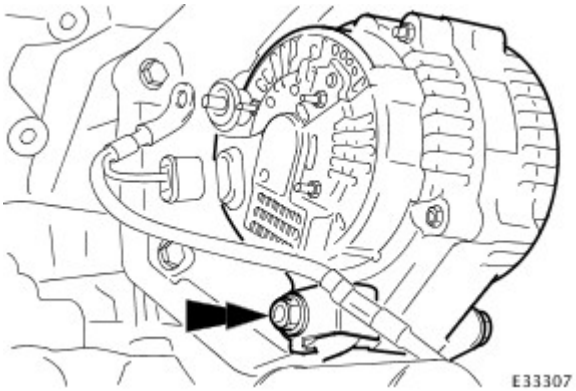
8. Disconnect the generator harness.

1. Disconnect the harness multi-plug.
2. Remove the protective boot from the positive terminal, remove the terminal nut and disconnect the cable from the terminal. Where fitted, disconnect the

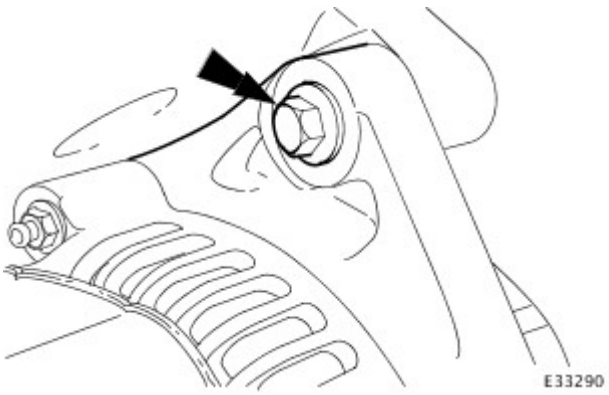


suppression module positive cable from the positive terminal.

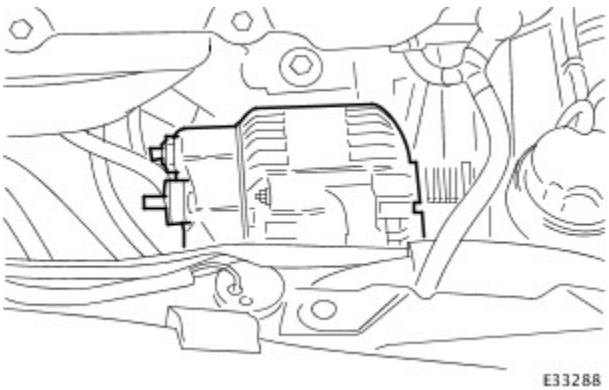
3. Where fitted, remove the nut which secures the suppression module negative cable and disconnect the cable from the generator. Reposition the suppression module harness clear of the generator.



9. Remove the lower mounting bolt and reposition the harness mounting bracket.

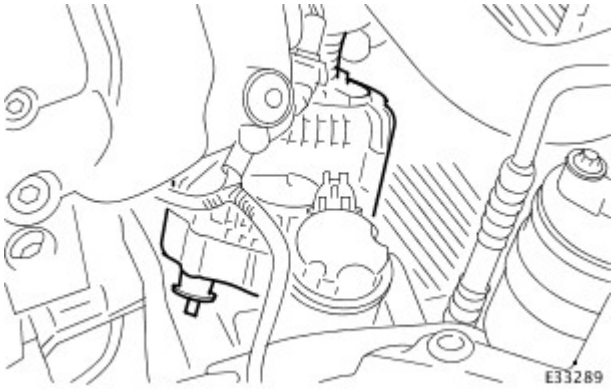


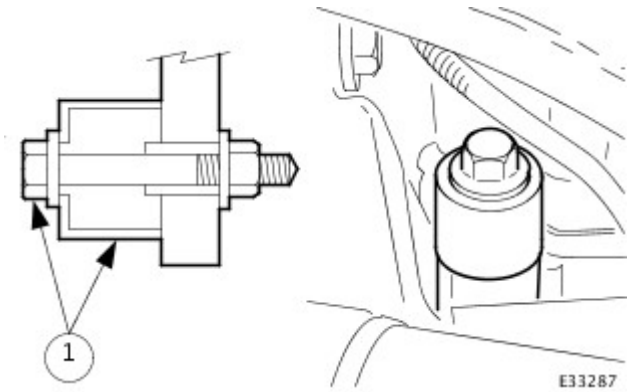
10. Remove the upper securing bolt and withdraw the generator from the mounting bracket.



11. Carefully, manoeuvre the generator forward towards the radiator.

12. Change the position of the generator and remove it upwards between the engine and the radiator.

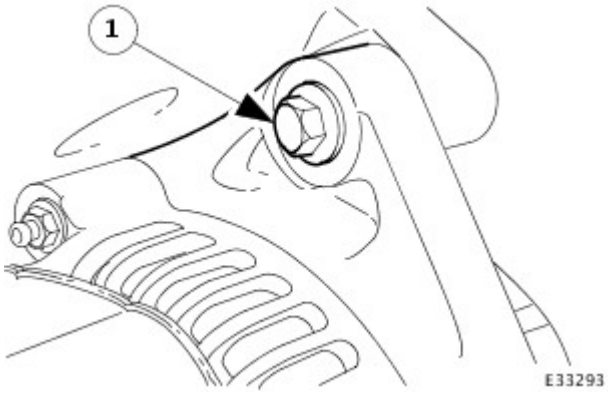




13. Move the spacing bush rearwards slightly in the generator mounting bracket, to ease fitting the new generator.

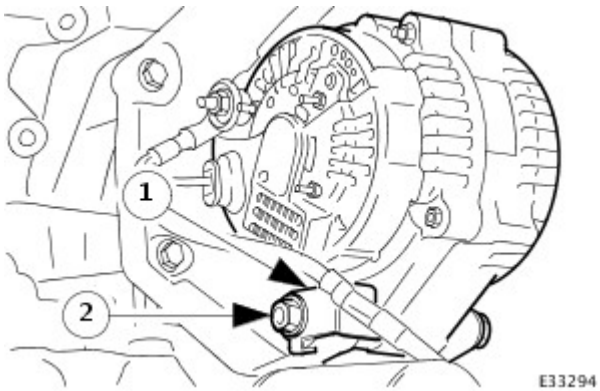
1. Position a suitable length bolt through the bush, fit a tubular spacer or socket spanner, fit a nut and tighten the assembly to move the bush slightly. Remove the nut, bolt and spacer.

Installation



1. Fit the generator to the engine.

1. From above, position the generator and fit the upper mounting bolt and nut, but do not fully tighten.

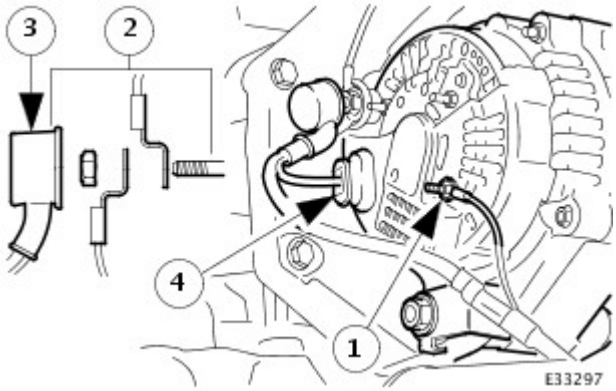


2. Fit the generator lower mounting.

1. From below, reposition and align the harness clip to the generator lower mounting.
2. Fit the lower mounting bolt and nut, tighten to 38-48 Nm.

3. Connect the harness.

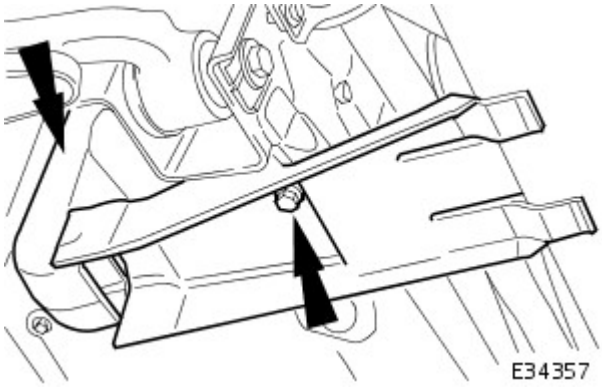
1. Reposition the suppression module harness and connect the negative cable to the generator negative terminal. Fit and tighten the terminal nut.



2. Secure the suppression module positive cable and main positive cable to the generator positive terminal.

3. Fit the boot to the terminal.

4. Reconnect the generator harness multi-plug.

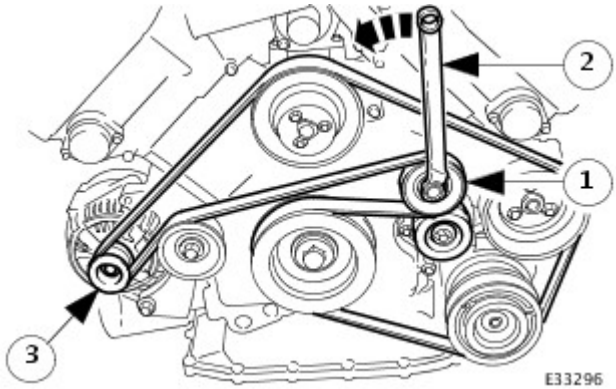


4. Refit the air intake ducting to the generator. The upper section is retained by two screws to the sump body assembly and the lower (horizontal) section is retained by one screw.

5. Lower the vehicle on the ramp; refer to Section 100-02.

6. Fully tighten the generator upper mounting bolt, to 18-24 Nm.

7. Refit the drive belt to the generator.



1. Pass the drive belt around the idler pulley.

2. Using spanner)Churchill JD-230 or Snap On XDHM 1415) on the centre bolt of the belt tensioner idler pulley, rotate the adjuster against spring tension.

3. Whilst holding the tensioner against spring tension, pass the drive belt over the generator pulley and check that it is correctly located on the other pulleys. Release the tensioner slowly and remove the spanner. Check the alignment of the belt.

8. Refit the fan and motor assembly; refer to Operation 26.25.12.

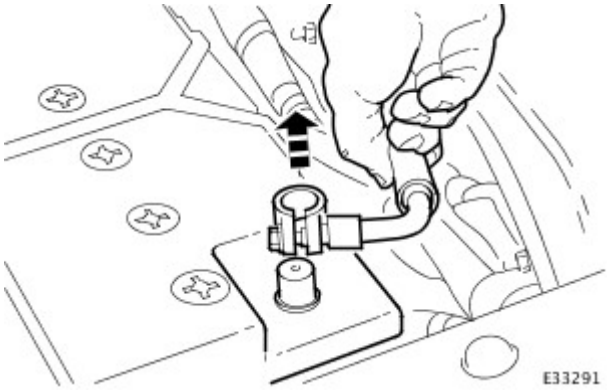
9. Refit the air cleaner assembly; refer to Operation 19.10.05.

10. Reconnect the battery ground cable and fit the battery cover. Reset the radio information and the clock.

Generator and Regulator - Generator4.0L SC V8 - AJ26

Removal and Installation

Removal



1. Disconnect the battery ground cable.

- Remove the battery cover.

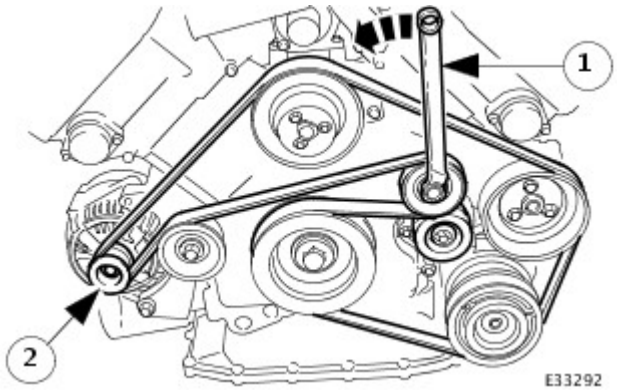
2. Remove the air cleaner assembly (including fit body paintwork protection sheets to the adjacent working area); refer to operation 19.10.05.

3. Remove the twin fan and motor assembly from behind the radiator; refer to operation 26.25.12.

4. Remove the supercharger drive belt; refer to operation 18.50.08.

5. Remove the supercharger drive belt tensioner; refer to operation 18.50.24.

6. Check that the belt wear indicator (accessory drive) is within the limit marks.



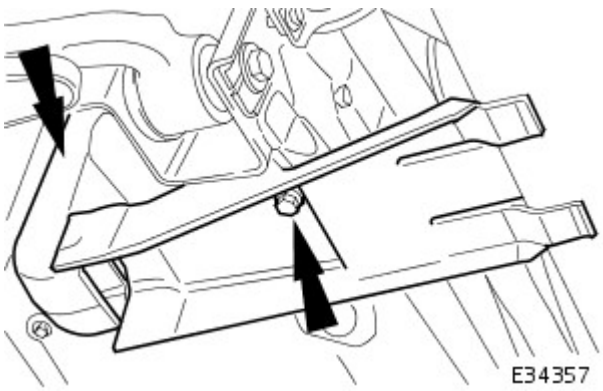
7. Remove the drive belt from the generator and accessory drive,

1. Use a spanner e.g. Churchill JD-230 or Snap On XDHM 1415, on the centre bolt of the belt tensioner idler pulley, to turn the adjuster assembly to the left against spring tension.

2. Whilst holding the tensioner against spring tension, remove the drive belt from the generator pulley. Release the tensioner slowly and remove the spanner.

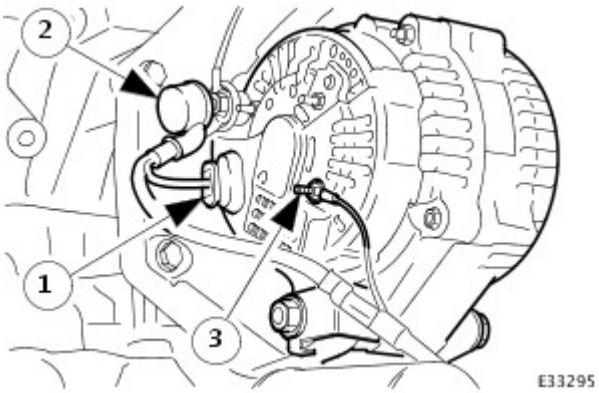
- Disconnect the belt from the other pulleys, as necessary, to move it clear of the generator.

8. Raise the vehicle on a ramp; refer to Section 100-02

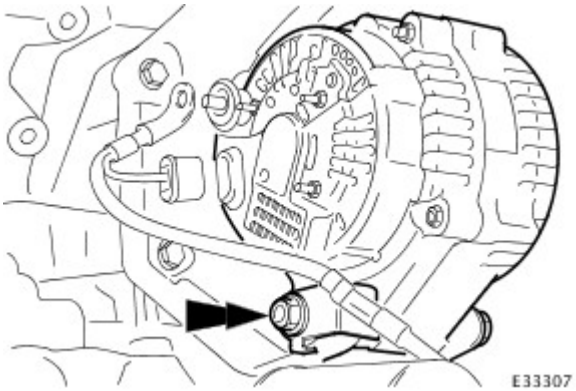


9. Remove the air intake ducting from the generator. The ducting comprises two sections; the upper section is retained by two screws to the sump body assembly and the lower (horizontal) section is retained by one screw.

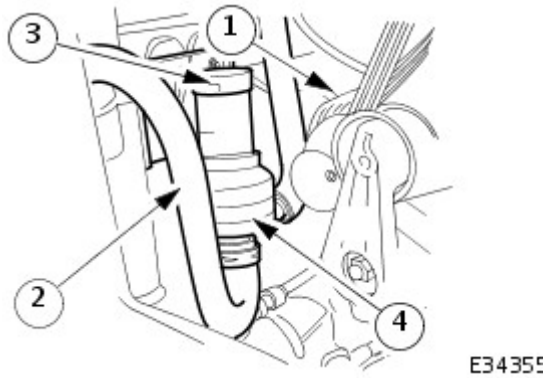
10. Disconnect the generator harness.



1. Disconnect the harness multi-plug.
2. Remove the protective boot from the positive terminal, remove the terminal nut and disconnect the cable from the terminal.



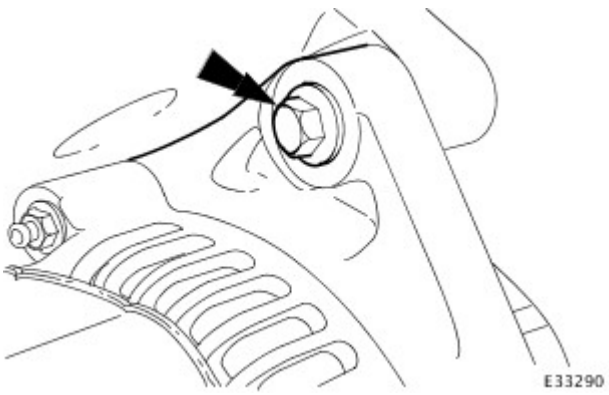
11. Remove the lower mounting bolt and reposition the harness mounting bracket.



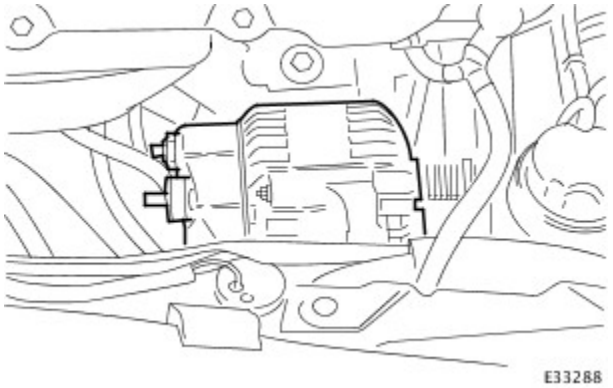
12. From above the vehicle, reposition the supercharger water pump for access.

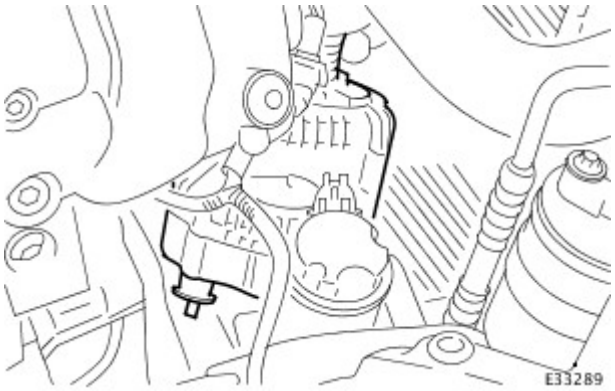
1. Reposition the pump harness multiplug from the retaining bracket.
2. Remove the two nuts which secure the U-bracket around the pump.
3. Remove the U-bracket from the pump.
4. Reposition the pump to allow access for removing the generator.

13. Remove the upper securing bolt and withdraw the generator from the mounting bracket.

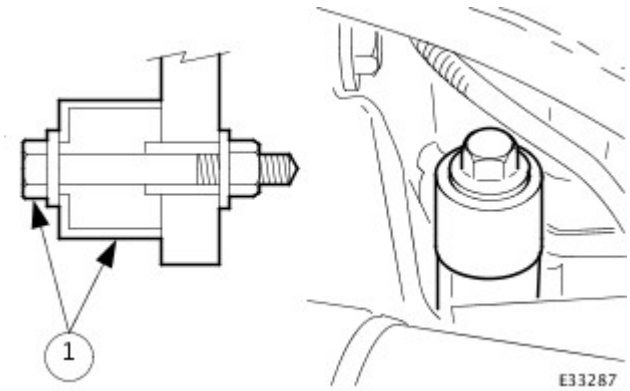


14. Carefully, manoeuvre the generator forward towards the radiator.





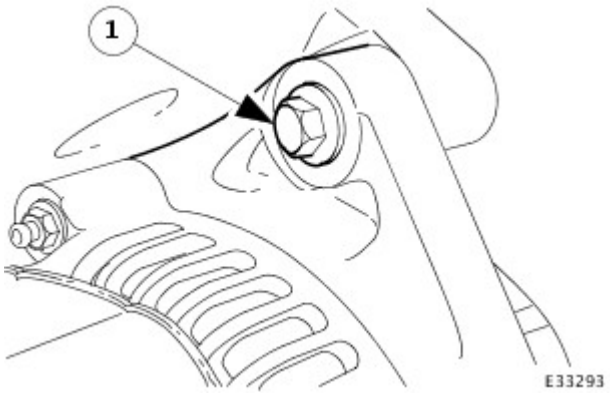
15. Change the position of the generator and remove it upwards between the engine and the radiator.



16. Move the spacing bush rearwards slightly in the generator mounting bracket, to ease fitting the new generator.

1. Position a suitable length bolt through the bush, fit a tubular spacer or socket spanner, fit a nut and tighten the assembly to move the bush slightly. Remove the nut, bolt and spacer.

Installation

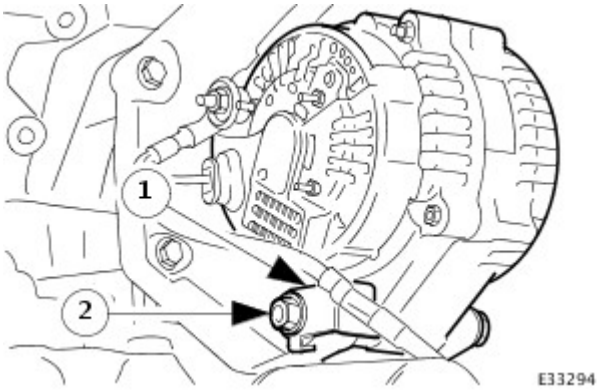


1. Fit the generator to the engine.

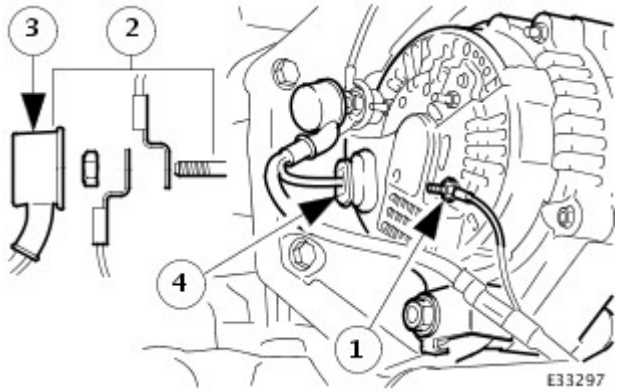
1. From above, position the generator and fit the upper mounting bolt and nut, but do not fully tighten.

2. Fit the generator lower mounting.

1. From below, reposition and align the harness clip to the generator lower mounting.

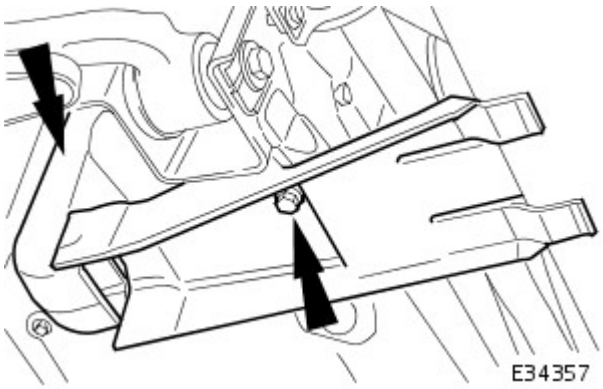


2. Fit the lower mounting bolt and nut, tighten to 38-48 Nm.



3. Connect the harness.

1. Secure the main positive cable to the generator positive terminal.
2. Fit the boot to the terminal.
3. Reconnect the generator harness multi-plug.

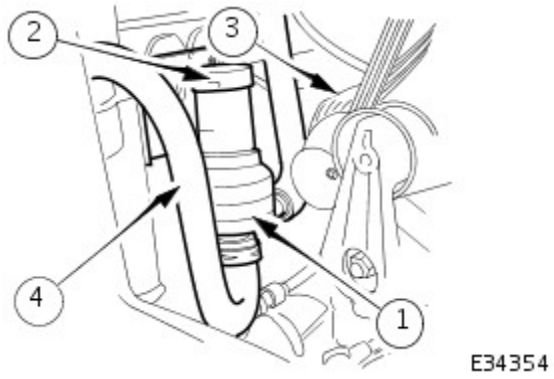


4. Refit the air intake ducting to the generator. The upper section is retained by two screws to the sump body assembly and the lower (horizontal) section is retained by one screw.

5. Lower the vehicle on the ramp; refer to Section 100-02.

6. Fully tighten the generator upper mounting bolt, to 18-24 Nm.

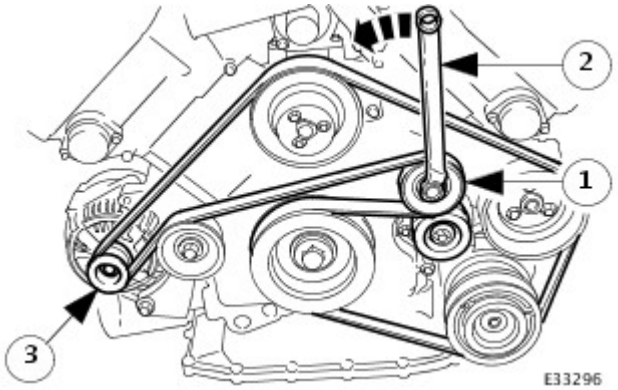
7. Reposition the supercharger water pump.



1. Reposition the pump to the mounting bracket.
2. Fit the U-bracket to the pump.
3. Fit the two nuts which secure the U-bracket around the pump.
4. Reposition the pump harness multiplug to the retaining bracket.

8. Refit the drive belt to the generator.

1. Pass the drive belt around the idler pulley.
2. Using spanner)Churchill JD-230 or Snap On XDHM



1415) on the centre bolt of the belt tensioner idler pulley, rotate the adjuster against spring tension.

3. Whilst holding the tensioner against spring tension, pass the drive belt over the generator pulley and check that it is correctly located on the other pulleys. Release the tensioner slowly and remove the spanner. Check the alignment of the belt.

9. Fit the supercharger drive belt tensioner; refer to operation 18.50.24.

10. Fit the supercharger drive belt; refer to operation 18.50.08.

11. Refit the fan and motor assembly; refer to Operation 26.25.12.

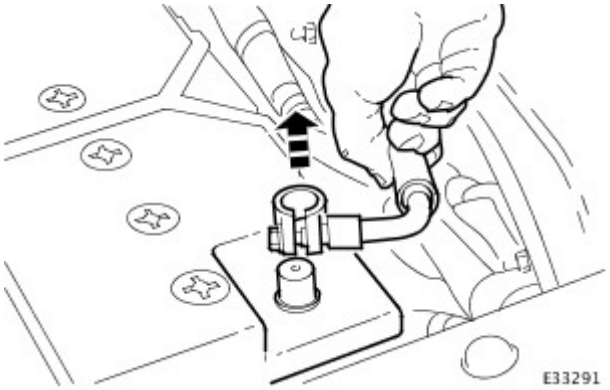
12. Refit the air cleaner assembly; refer to Operation 19.10.05.

13. Reconnect the battery ground cable and fit the battery cover. Reset the radio information and the clock.

Generator and Regulator - Voltage Regulator

Removal and Installation

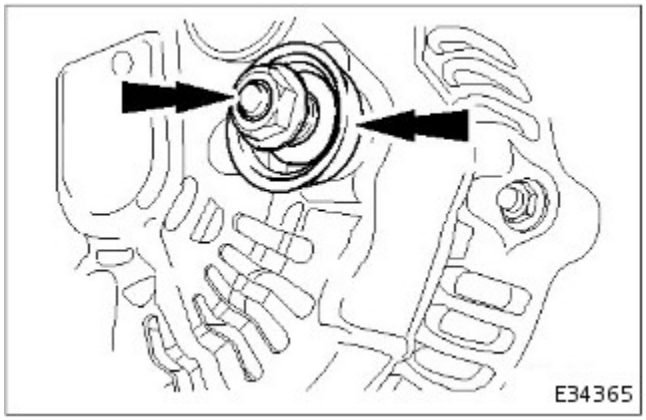
Removal



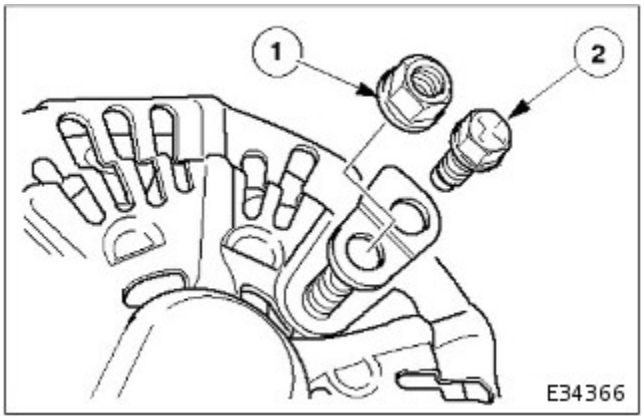
1. Disconnect the battery ground cable.

- Remove the battery cover.

2. Remove the generator from the vehicle. Refer to Operation 86.10.02.



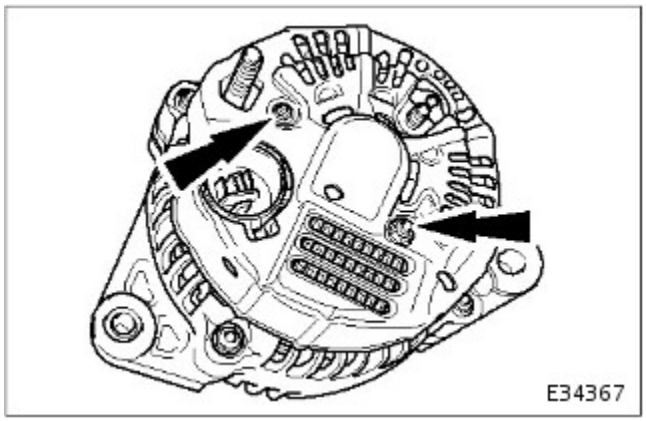
3. Remove the nut from the main terminal and remove the insulator.

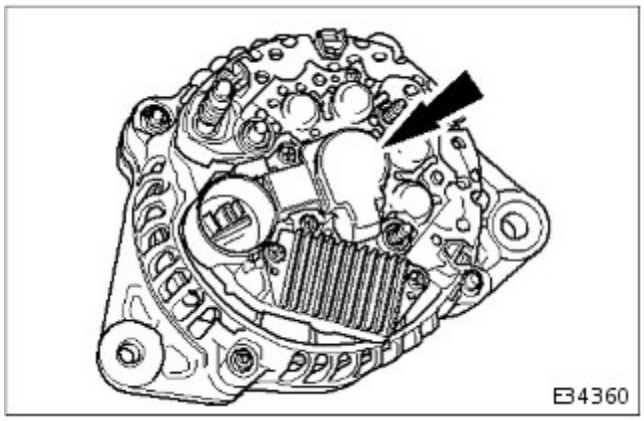


4. Remove the ground tag.

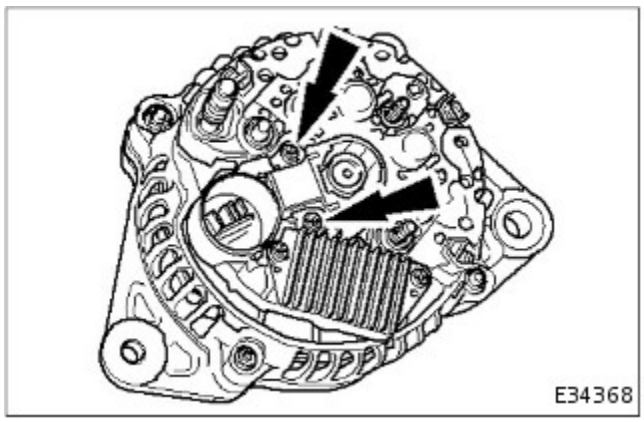
1. Remove the nut which secures the ground tag.
2. Remove the screw which secures the ground tag and remove the tag.

5. Remove the two remaining nuts which secure the rear cover and remove the cover.



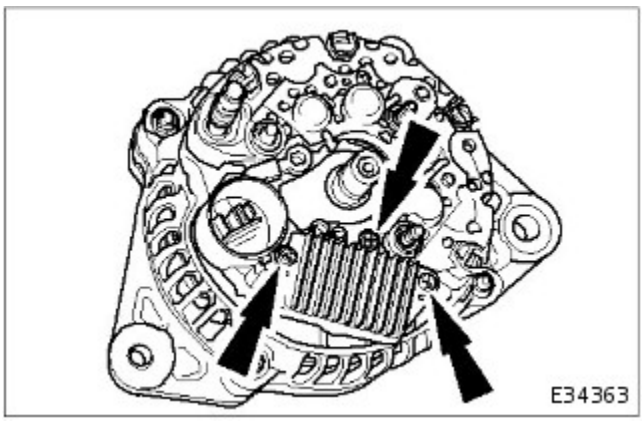


6. Remove the rubber cover from the brush holder.



7. Remove the screws which secure the brush holder.

- Remove the brush holder, taking care not to damage the brushes.

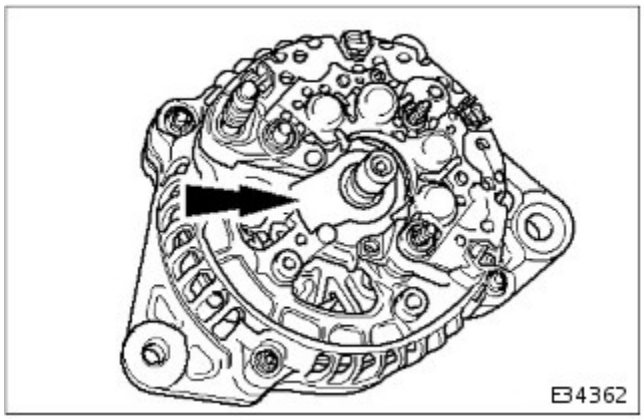


8. Remove the screws, two long and one short, from the regulator.

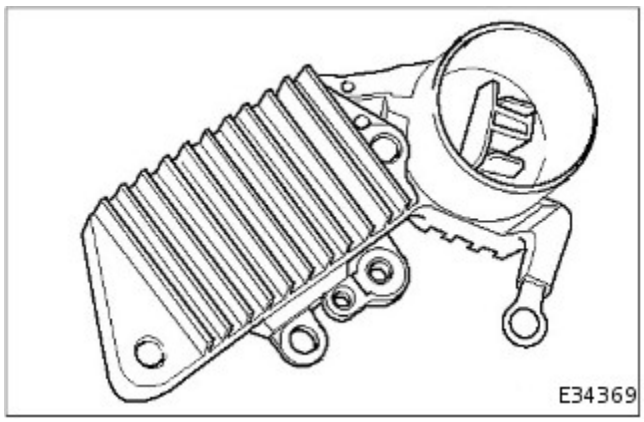
- Remove the regulator.

Installation

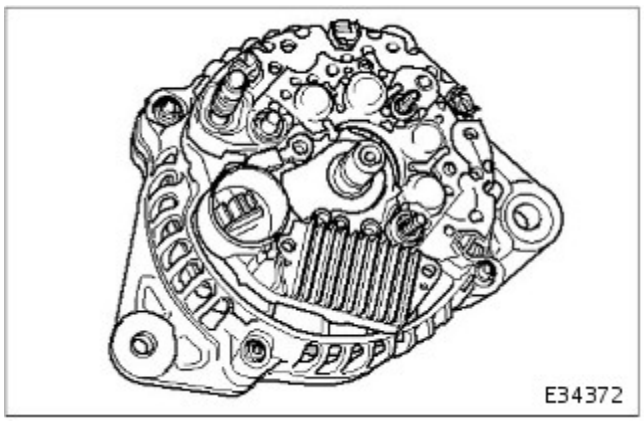
1. Check that the rubber gasket for the brush holder is



correctly located.

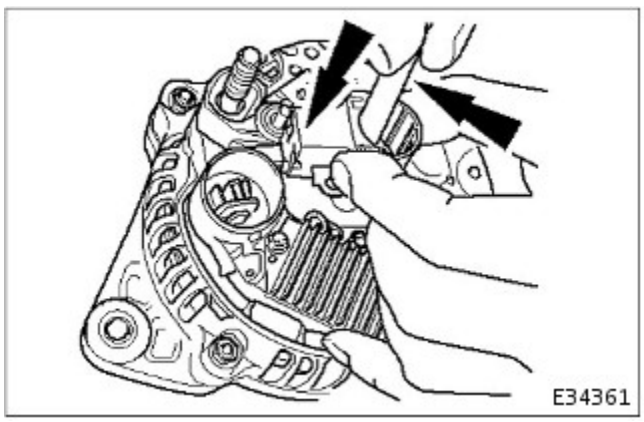


2. Check that the new regulator is of the same type and is not damaged.



3. Locate and align the new regulator.

- Install, but do not tighten the screws, two long and one short, to secure the regulator.

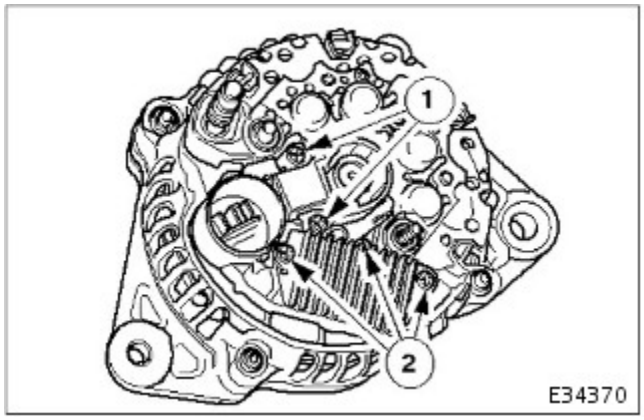


4. Install the brush holder; do not damage the brushes.

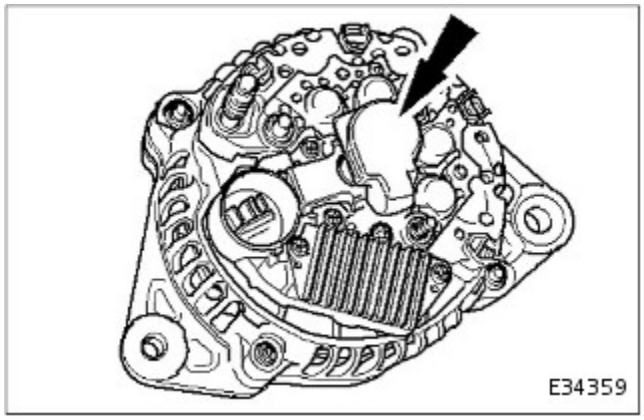
- Hold the brushes fully into the brush holder using a plastic rod, and very carefully slide the holder into position.

5. Install the screws which secure the brush holder.

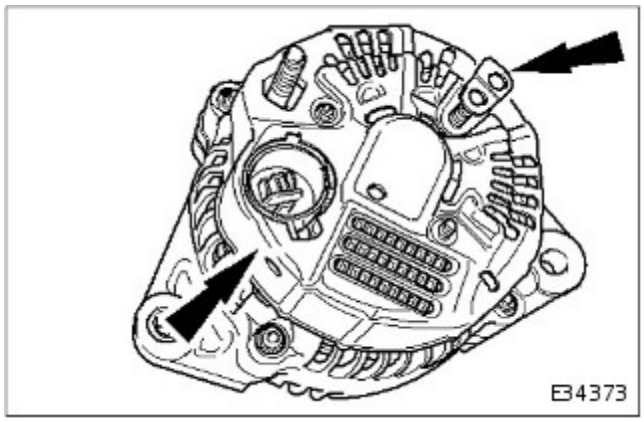
1. Tighten the screws which secure the brush holder.



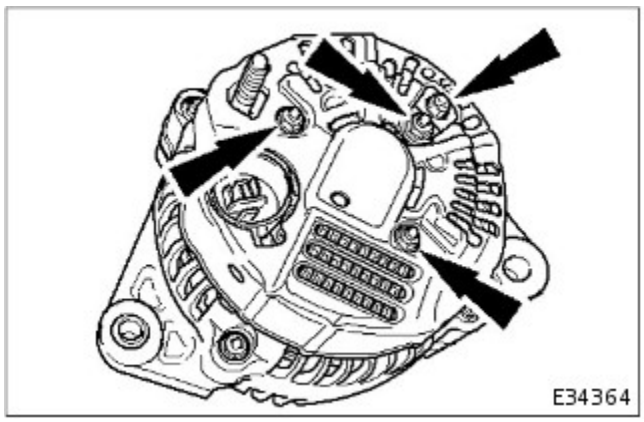
2. Tighten the screws which secure the regulator.



6. Install the rubber cover to the brush holder.



7. Install the rear cover and the ground tag.

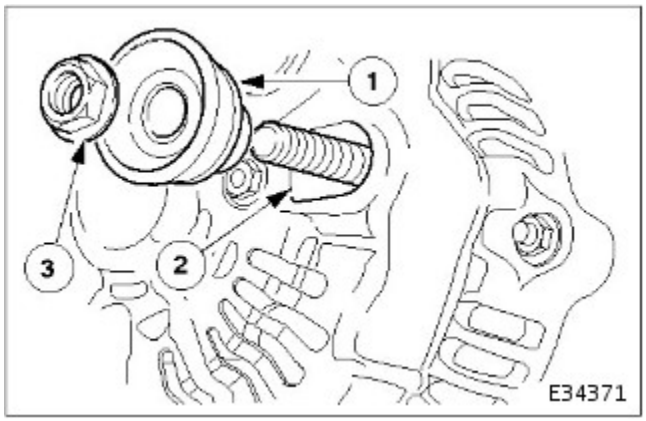


8. Install the screw to secure the ground tag and install the three nuts to secure the rear cover.

- Tighten the four fixings.

9. Install the insulator to the main terminal.

1. Slide the insulator onto the main terminal.



2. Note the locating flat on the insulator and in the rear cover.

3. Install the nut to the main terminal.

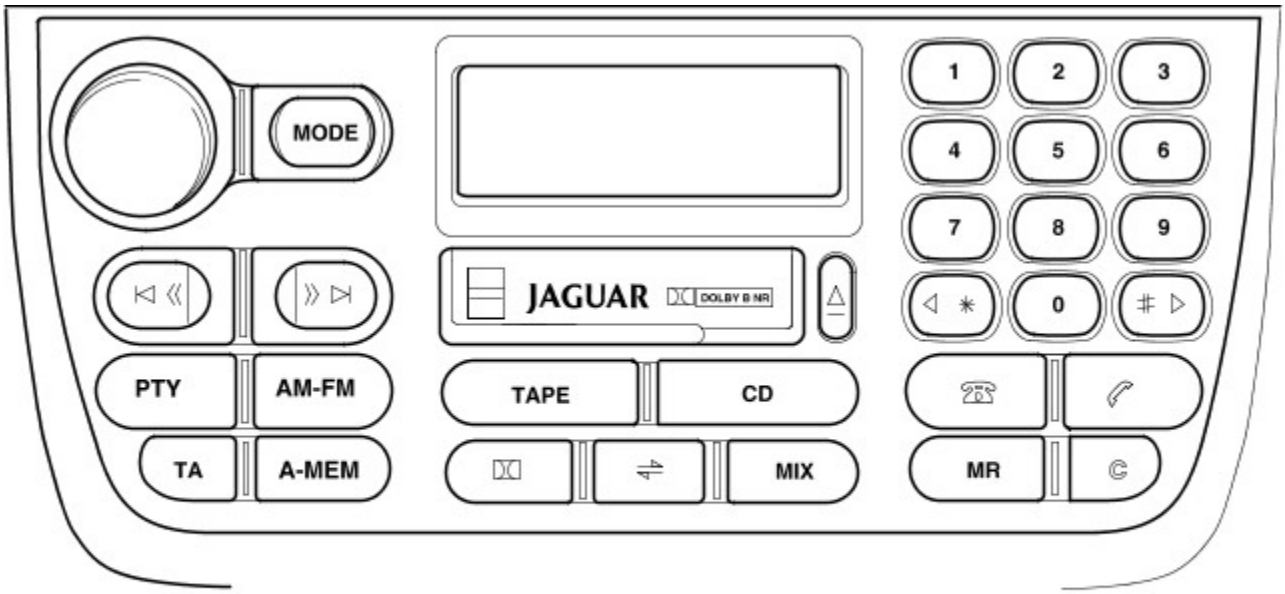
10. Install the generator to the vehicle. Refer to Operation 86.10.02.

11. Connect the battery and install the battery cover.

- Refer to the Battery Reconnection Procedure 86.15.15.

Audio Unit - Audio System

Description and Operation



The choice of two entertainment systems is available; base or premium.

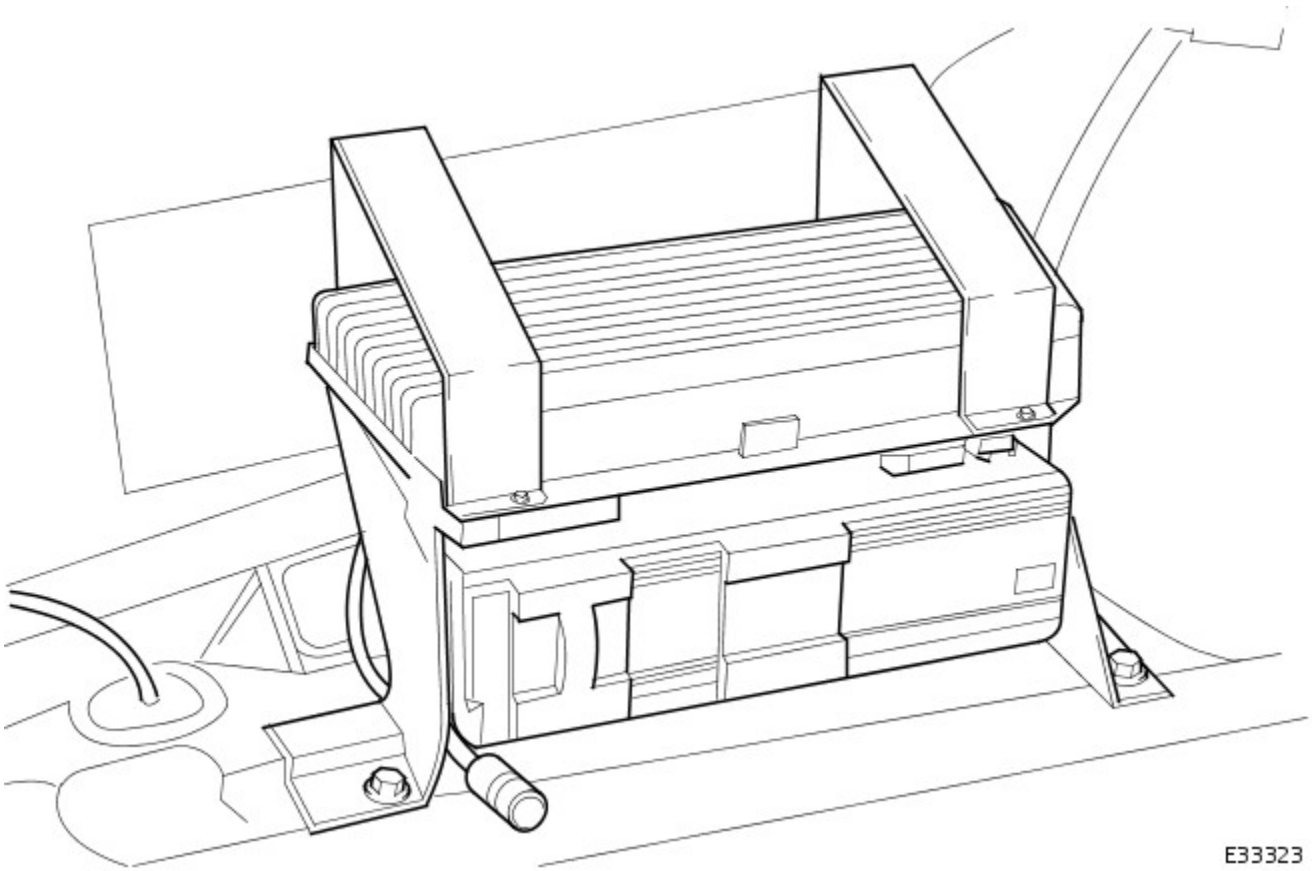
The base system comprises a radio cassette player with integral message display and "Phone Ready" controls for an accessory telephone; door speakers and tweeters.

The premium system has the following additional components: power amplifier, CD autochanger, sub-woofer and 'A' post tweeters fitted instead of front door tweeters.

Both systems can be operated remotely by use of switches located on the steering wheel and have an electrically operated aerial.

Telephone controls incorporated in the radio cassette unit facilitate inclusion of the GSM hands free telephone system available as optional equipment.

After diagnostic or repair operations, refer to the Sound System Handbook for setting-up procedures and operation.



The CD Autochanger and amplifier are mounted on a bracket as a single assembly located at the left hand side of the trunk. The complete assembly must be removed before the CD Autochanger and amplifier can be separated.

When the CD option is selected, the CD unit cycles through a self-check sequence and indicates the current status on the message display. Refer to the Sound System Handbook for complete operating instructions.

Audio Unit - Audio System

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

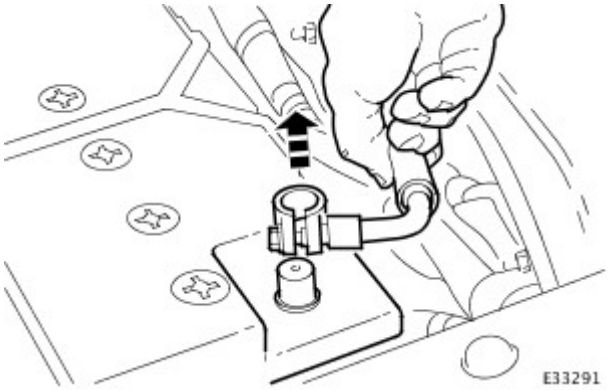
The PDU is unable to diagnose radio head, CD autochanger or amplifier faults; there are no self-diagnostics associated with these components.

PDU is able to test the speakers and the antenna, along with associated wiring and connections, therefore by a process of elimination, the other components can be diagnosed.

Audio Unit - Capacitor

Removal and Installation

Removal

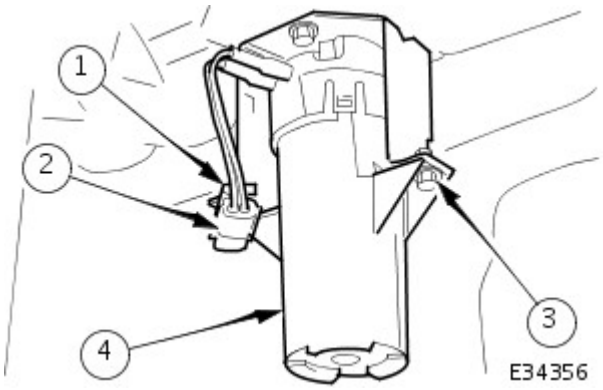


1. Disconnect the battery ground cable.

- Remove the battery cover.

2. Raise the vehicle on a ramp.

3. Remove the suppression module.



1. Disconnect the multi-plug from the mounting bracket clip.
2. Disconnect the multi-plug.
3. Remove the bolts which secure the suppression module to the mounting bracket.
4. Remove the suppression module.

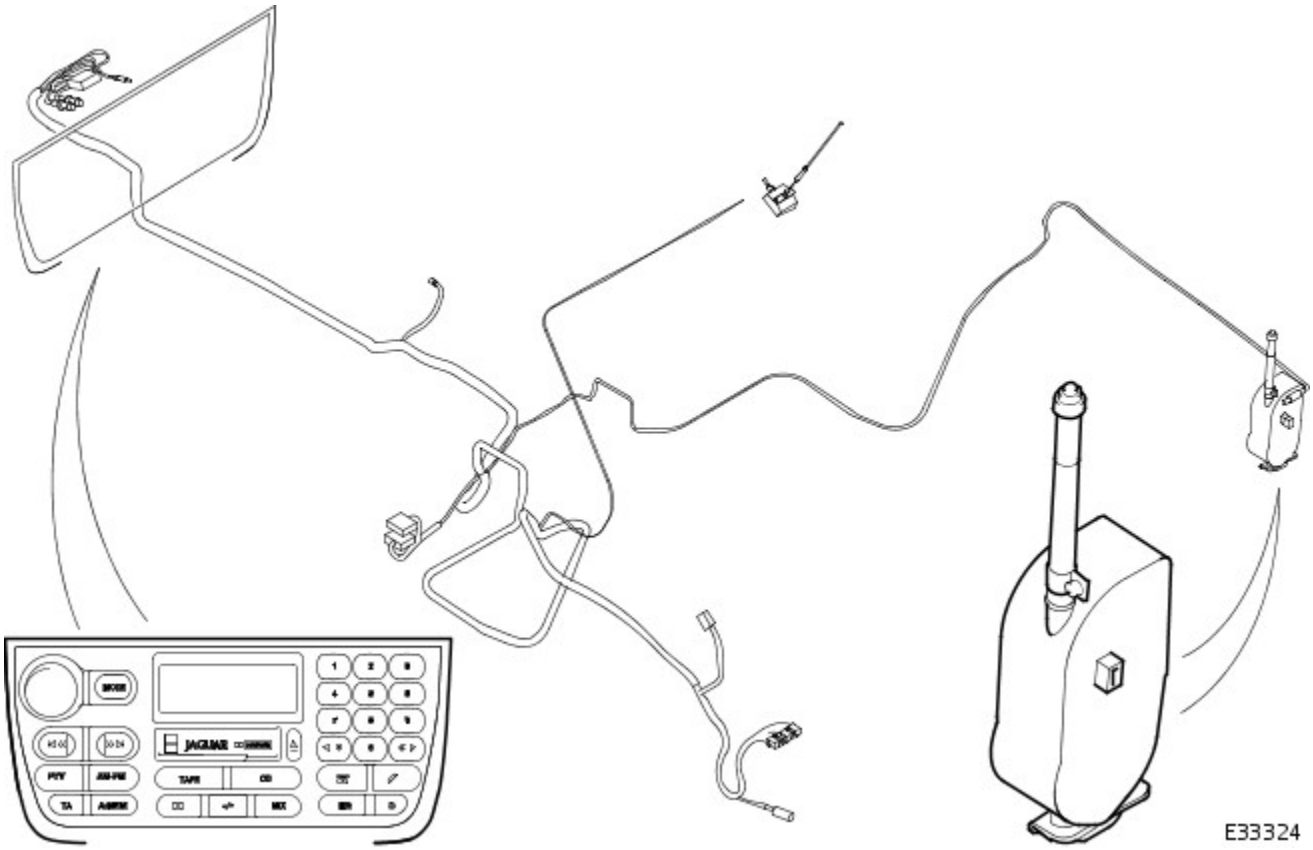
Installation

1. Installation is the reverse of the removal procedure.

2. Reconnect the battery ground cable and fit the battery cover. Reset the radio information and the clock.

Antenna - Antenna

Description and Operation



The electrically operated antenna operates automatically when the Ignition switch is set to position 1 or 2, and the radio cassette player is switched on, regardless of the status of the tape or CD mode switch.

The antenna motor is protected by a 10A fuse, F9, located in the trunk fuse-box.

Antenna - Antenna

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

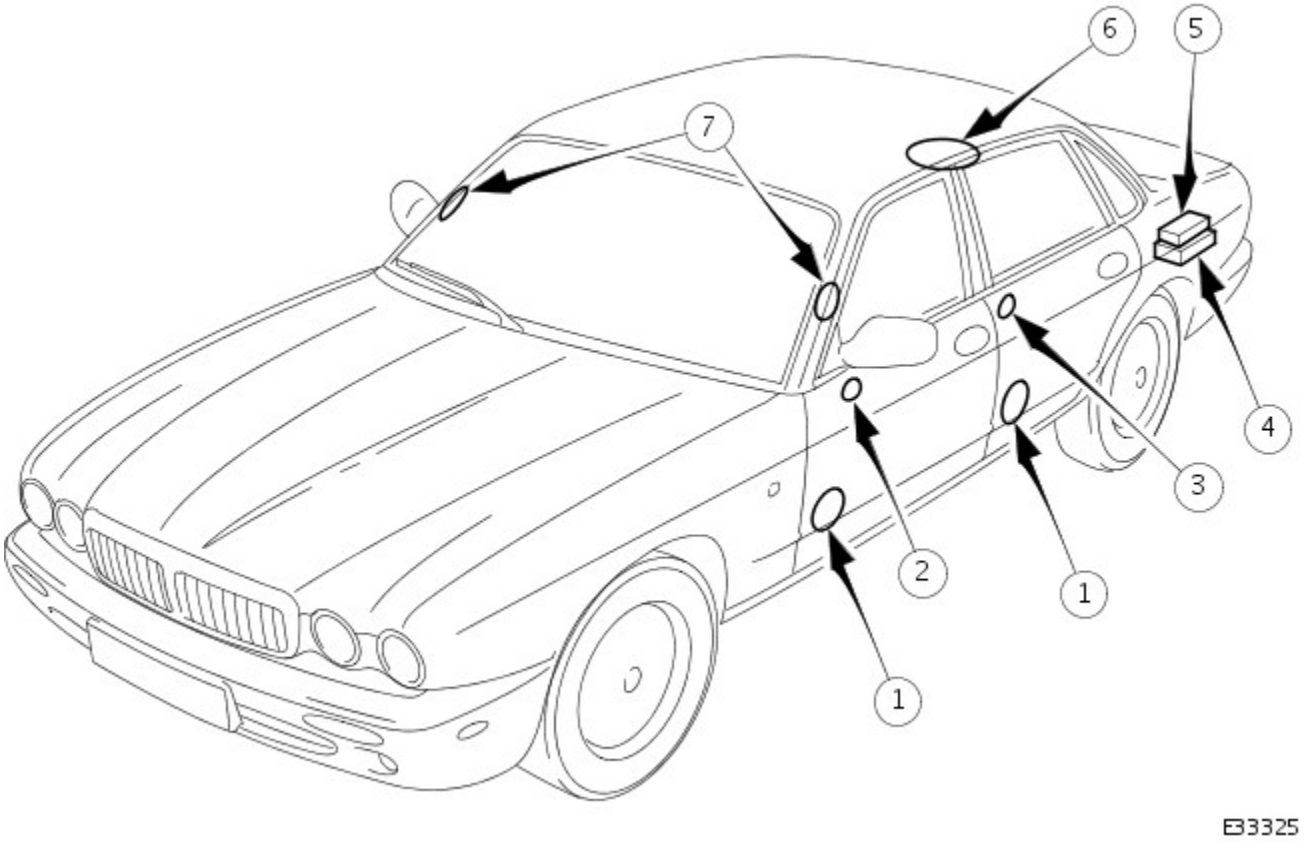
Refer to PDU User Guide

The PDU tests whether or not the antenna raises and lowers correctly. Although it is obvious if the antenna is not operating, the PDU analyses why it is not operating and indicates problems such as a faulty radio head signal output, faulty wiring, loss of power due to a blown fuse.

Speakers - Speakers

Description and Operation

Speaker Location



Parts List

Item	Part Number	Description
1	—	Door Speaker
2	—	Front Door Tweeter (Base System)
3	—	Rear Door Tweeter
4	—	CD Autochanger (Premium System)
5	—	Amplifier (Premium System)
6	—	Sub-woofer (Premium System)
7	—	'A' Post Tweeter (Premium System)

Speakers - Speakers

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

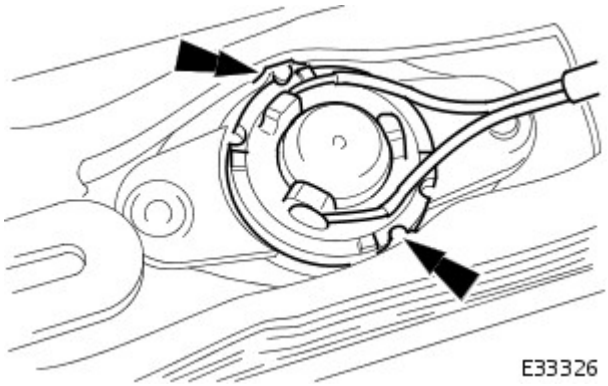
PDU can test for correct operation of each speaker and can provide fault guidance for any that fail to function.

PDU can indicate problems such as a faulty radio head output power signal, faulty power amplifier (where fitted), faulty wiring, loss of power due to a blown fuse.

Speakers - A-Pillar Tweeter Speaker LH

Removal and Installation

Removal



1. Remove passenger side cantrail and upper 'A' post trim pad; refer to 76.13.19.
2. Remove tweeter from trim.
   - Rotate tweeter clockwise to align cut-outs with locating pegs.
   - Remove tweeter.

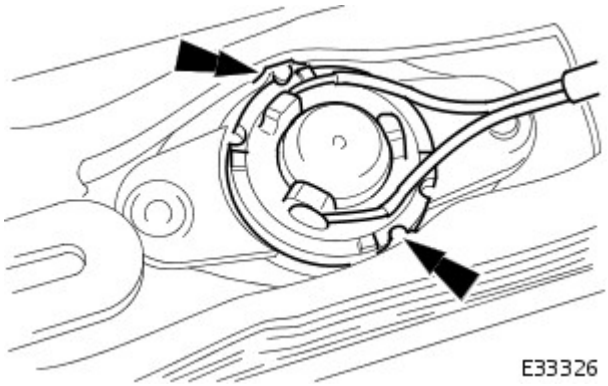
Installation

1. Installation is a reversal of the removal procedure.

Speakers - A-Pillar Tweeter Speaker RH

Removal and Installation

Removal



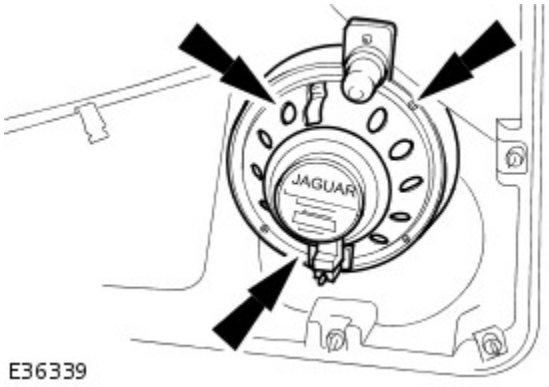
1. Remove driver side cantrail and upper 'A' post trim pad; refer to 76.13.20.
2. Remove tweeter from trim.
   - Rotate tweeter clockwise to align cut-outs with locating pegs.
   - Remove tweeter.

Installation

1. Installation is a reversal of the removal procedure.

Speakers - Door Speaker

Removal and Installation



Removal

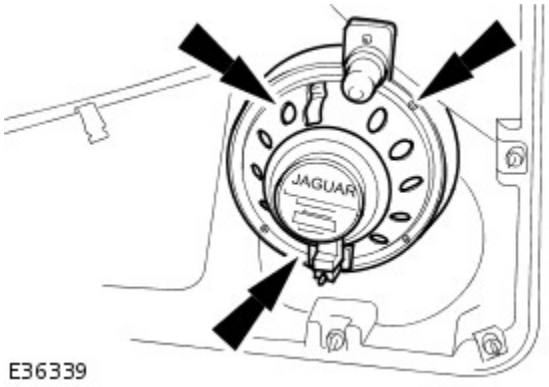
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove door casing; refer to 76.34.01.
3. Remove speaker from door casing.
   - Remove four screws.
   - Remove speaker.

Installation

1. Installation is a reversal of the removal procedure.
2. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Speakers - Rear Door Speaker

Removal and Installation



Removal

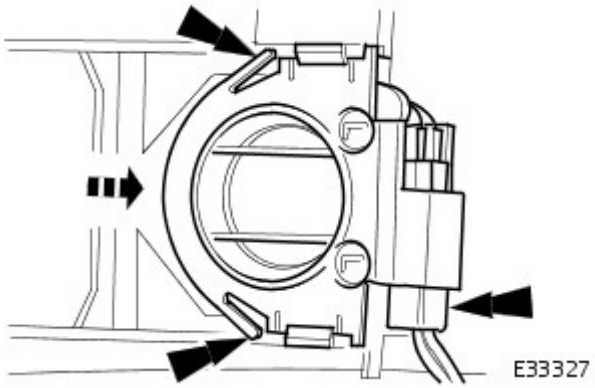
1. Disconnect battery ground cable (IMPORTANT, see SRO 86.15.19 for further information).
2. Remove door casing; refer to 76.34.04.
3. Remove speaker from door casing.
   - Remove four screws.
   - Remove speaker.

Installation

1. Installation is a reversal of the removal procedure.
2. Reconnect battery ground cable (IMPORTANT, see SRO 86.15.15 for further information).

Speakers - Rear Door Tweeter Speaker

Removal and Installation



Removal

1. Remove rear door casing for access; refer to 76.34.04.

2. Remove tweeter.

- Disconnect connector.
- Simultaneously depress retaining clips and slide tweeter away from location.

Installation

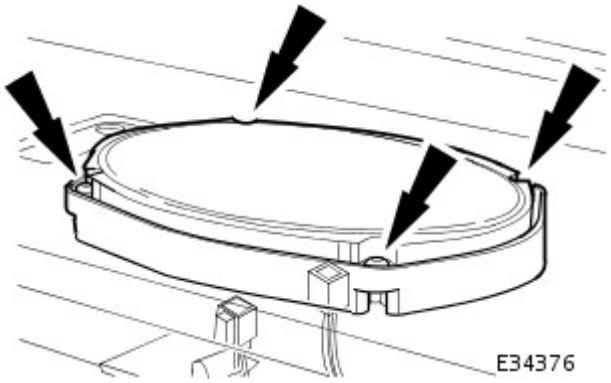
1. CAUTION: Misalignment of tweeter during installation could result in the retaining clips being broken. Position tweeter in front of location and push into position.

Installation is a reversal of the removal procedure.

Speakers - Subwoofer Speaker

Removal and Installation

Removal



1. Remove rear parcel tray for access; refer to 76.67.06.90.
2. Remove rear sub-woofer speaker.
   - Remove screws.
   - Reposition speaker for access to connectors.
   - Disconnect connectors.
   - Remove speaker.

Installation

1. Installation is a reversal of the removal procedure.

Exterior Lighting -

Bulbs

Description	Capacity	Type
Flasher Side Repeater	12V 5W	Capless Long Life
Fog Lamp - Front	12V 51W	Halogen HB4 Long Life
Fog Lamp - Rear Guard	12V 21W	P21W, Bayonet Long Life
Front Direction Indicator	12V 21W	Bayonet Amber Long Life
Front Parking (side) Lamp	12V 5W	Capless Long Life
Headlamp - Main	12V 55W	Halogen H7
Headlamp - Dip	12V 55W	Halogen H7
High Mounted Stop Lamp	12V 5W	Capless Long Life
License Plate Lamp	12V 5W	Festoon Long Life
Rear Direction Indicator	12V 21W	PY21W, Bayonet Amber Long Life
Reverse Lamp	12V 21W	P21W, Bayonet Long Life
Side Marker Lamp	12V 5W	Capless Long Life
Stop/Tail Lamp	12V 21/5W	Twin Filament Bayonet Long Life

Torques

Component	Nm
Rear Lamp Assembly to Body	3

Exterior Lighting - Exterior Lighting

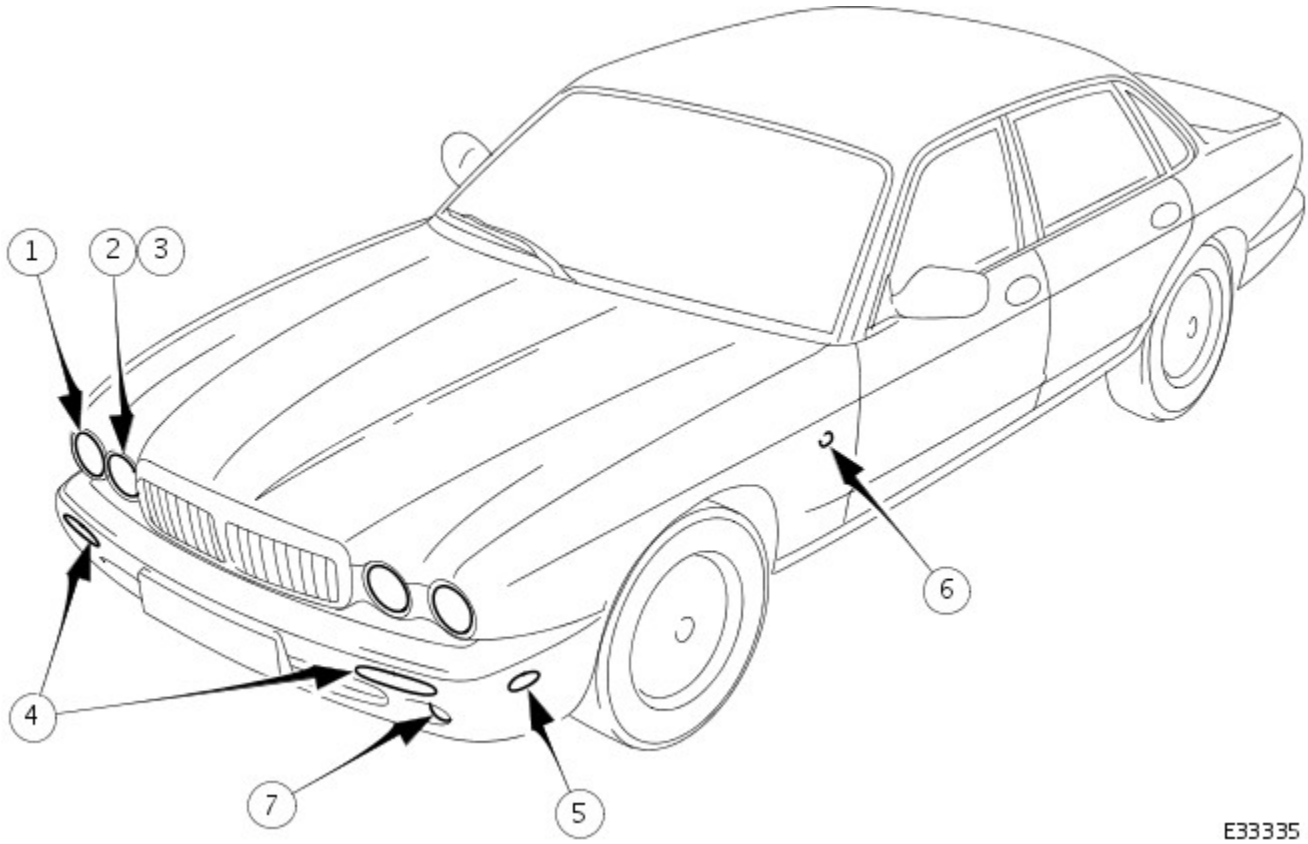
Description and Operation

A multi-function switch located on the left stalk of the steering column switch assembly permits selection of either parking (side), headlamps, auto-headlamp or off. Selection of a particular mode provides the appropriate input to the body processor module (BPM).

Where the auto headlamp function is incorporated, a light sensor in the interior rear view mirror monitors ambient light and provides an input to the BPM. The BPM responds by switching the low beam headlamps on or off as appropriate for the prevailing light conditions.

The front and rear fog lamp switch is located on the fascia outboard of the steering column.

Front Lamps



Item	Part Number	Description
1	—	Headlamp (dip beam)
2	—	Headlamp (main beam)
3	—	Front Parking (side) Lamp
4	—	Front Direction Indicator
5	—	Front Side Marker
6	—	Side Repeater Lamp
7	—	Fog Lamp

Headlamp assembly

Each headlamp assembly consists of two headlamp units. The dipped beam lamp unit is located outboard and the main beam lamp unit located inboard also carries the front parking (side) lamp. Access for bulb replacement is from the engine compartment.

Direction indicator and side marker lamps

Each front direction indicator and side marker lamp is retained in the bumper cover by a lug at one end and a spring clip at the other end. The side marker lamps are not electrically connected for certain markets.

The side repeater lamps are secured by spring clips on the lower edge of the lamp unit. In certain markets Jaguar leaper badges are substituted for side repeater lamps.

Fog lamps

The fog lamps are located in recesses in the front bumper and secured by three screws. The lamps which are not interchangeable left to right, are accessed from the rear of the bumper.

Operation

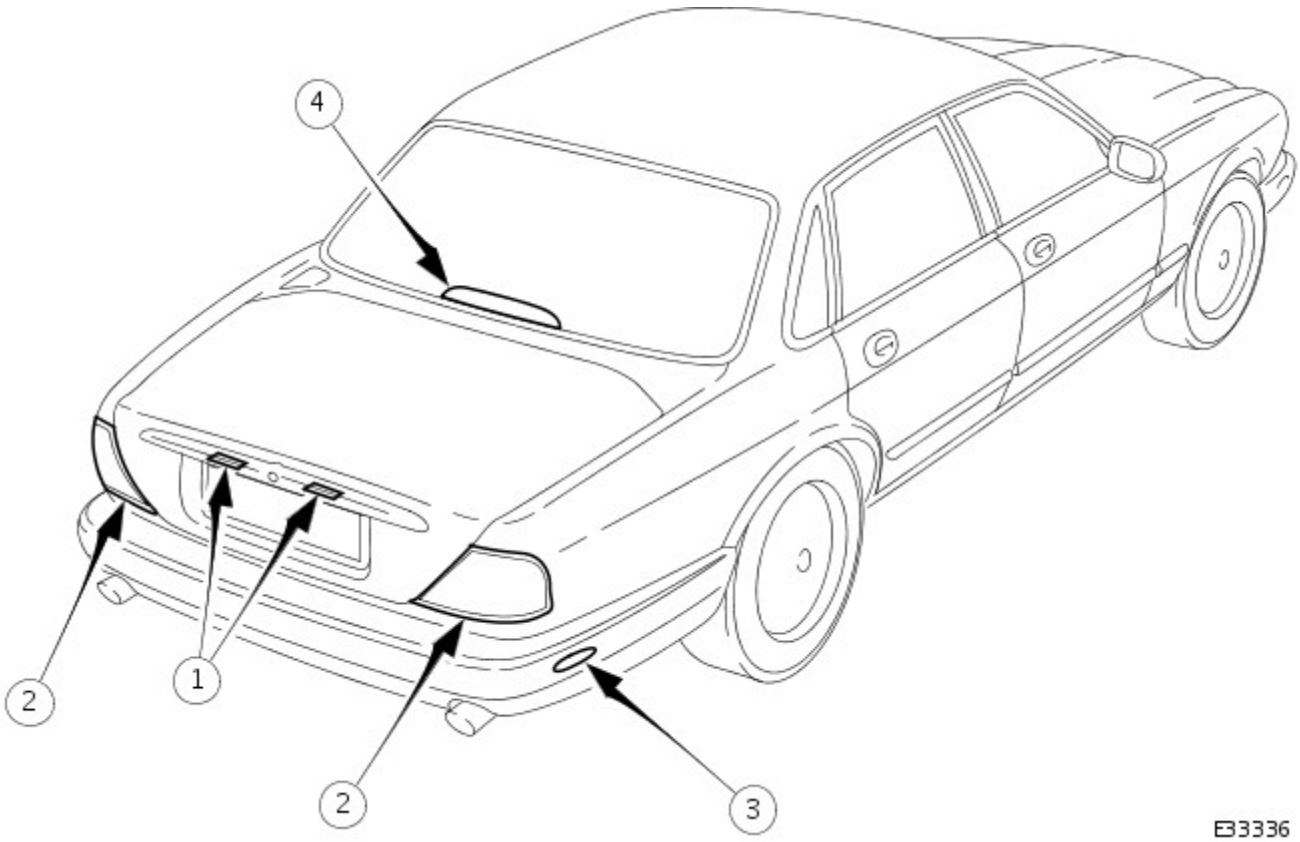
All lamps are controlled by the BPM which provides an appropriate output in response to an input received when a selected switch is operated.

All lamps receive an input direct from the BPM with the exception of the main beam, dip beam and front fog lamps which receive an input from the BPM via the respective relays and fuses; refer to section 418-01.

Fault analysis must be undertaken using the PDU. Refer to Diagnosis and Testing.

Consult the relevant Electrical Guide for details of circuit operation.

Rear Lamps



Item	Part Number	Description
1	—	License Plate Lamps

2	—	Rear Lamp Assembly
3	—	Rear Side Marker
4	—	High Mounted Stop Lamp

License plate lamps

Each license plate bulb is accessible after removing the relevant lens. The license plate lamps can be accessed following removal of the trunk lid liner and upper trim finisher.

Rear lamp assembly

Each rear lamp assembly incorporates a stop/tail lamp, a fog lamp, a reversing lamp and a direction indicator lamp. Access for bulb replacement is from the trunk.

Side markers

Each side marker is retained in the bumper cover by a lug on one end of the unit and a spring clip at the other end. The unit is not electrically connected for all markets.

High mounted stop lamp

The high mounted stop lamp (HMSL) is secured to studs on the center lower edge of the backlight and provides illumination using five bulbs.

Operation

All lamps are controlled by the BPM which provides an appropriate output in response to an input received when a selected switch is operated.

The side marker lamps receive an input from the BPM via relay 3 and fuse F21. The license plate lamps receive an input from the BPM via relay 3 and fuse F19. The relay and fuses are located in the trunk fuse-box.

The tail lamps receive an input direct from the BPM.

The stop, reversing and rear fog lamps are controlled by the security and locking module (SLM) which receives inputs via the SCP network from the BPM.

The HMSL is not controlled by the SLM; it receives input from the brake switch via relay 5 and fuse F8 in the trunk fuse-box.

The BPM and SLM monitor the stop lamps (not HMSL) and tail lamps for failure.

Fault analysis must be undertaken using the PDU, refer to Diagnosis and Testing.

Consult the relevant Electrical Guide for details of circuit operation.

Exterior Lighting - Exterior Lighting

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the various Electronic Control Modules and the multiplexed communication networks, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the exterior lamps and circuits.

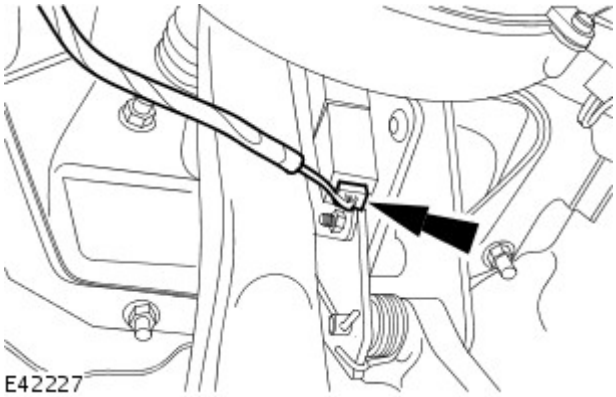
The PDU systematically tests and analyses the lamp assemblies, the bulbs and the electrical connections to them. It should be noted that the lamps are not wired directly to the switches. Actuation of a switch provides an input signal to the Body Processor which interprets the signal as a request to switch output from the Body Processor, either directly or indirectly to a specific lamp.

Where a fault involving a lamp is indicated by the PDU, before replacing the component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

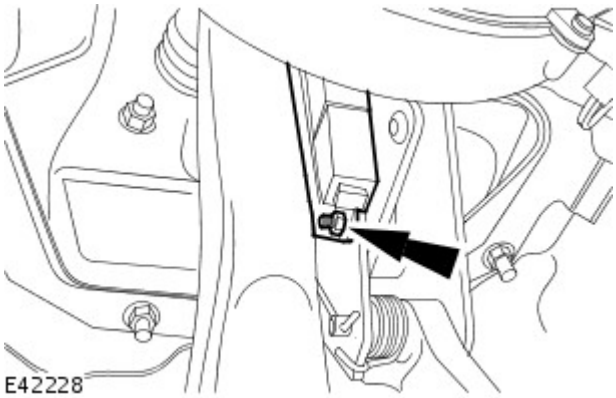
Exterior Lighting - Brake Pedal Position (BPP) Switch

Removal and Installation

Removal

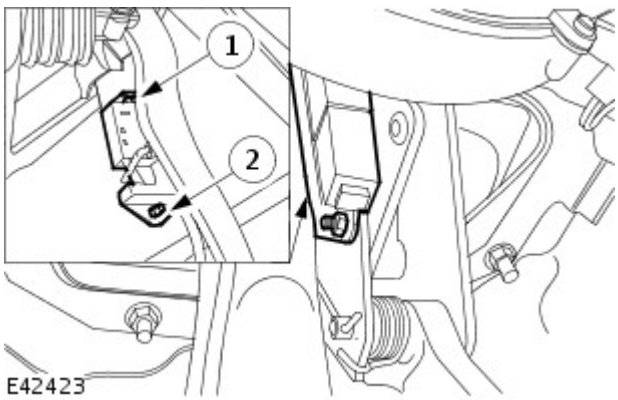


1. Disconnect the brake pedal position (BPP) switch electrical connector.



2. Remove the BPP switch.

Installation



1. Press and hold down the brake pedal.
2. CAUTIONS:

Make sure the brake pedal is held clear of the BPP switch ratchet mechanism during installation. Failure to follow this instruction may result in incorrect adjustment of the BPP switch.

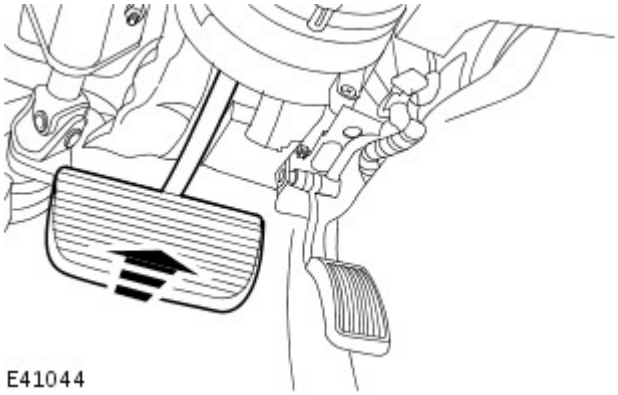
Make sure the BPP switch is correctly installed to the upper locating point.

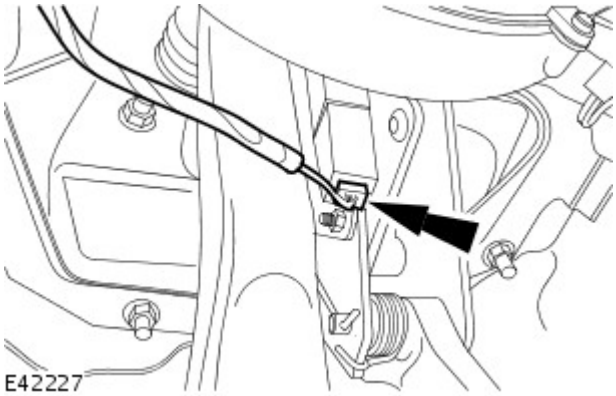
Install the BPP switch.

1. Align the BPP switch to the upper locating point.
2. Install the BPP switch.

3. Release the brake pedal.
4. CAUTION: Make sure the brake pedal is fully raised. Failure to follow this instruction may result in incorrect adjustment of the BPP switch.

Fully raise the brake pedal.



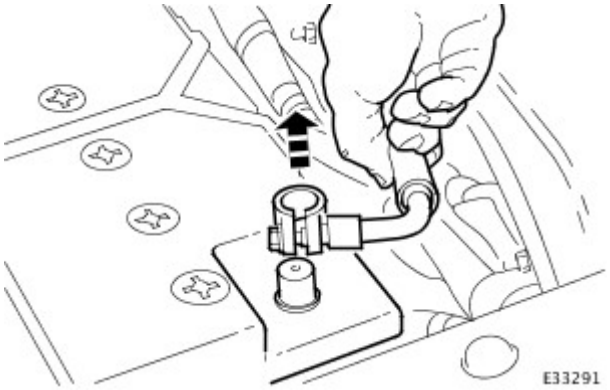


5. Connect the BPP switch electrical connector.

Exterior Lighting - Fog Lamp Switch

Removal and Installation

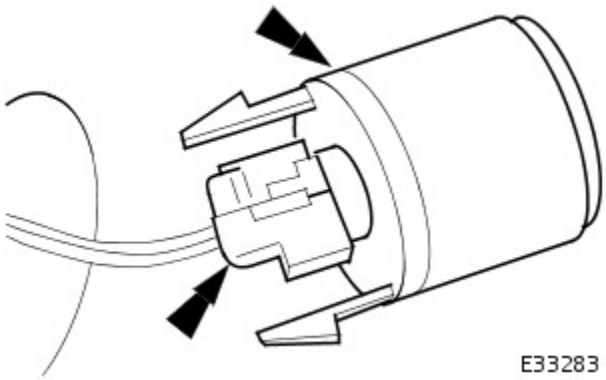
Removal



1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove instrument panel veneer panel. Refer to 76.47.24.

3. Remove combined front and rear fog lamp switch pack.



- Use a small screwdriver to release upper retaining tag.
- Position switch for access to connector.
- Disconnect connector and remove switch.

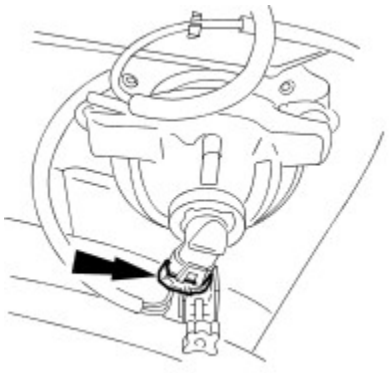
Installation

1. Position switch pack at instrument panel.
2. Connect harness connector to switch pack
3. Install switch pack in panel, ensuring that retaining tangs are fully seated.
4. Install instrument panel veneer panel. Refer to 76.47.24.
5. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.

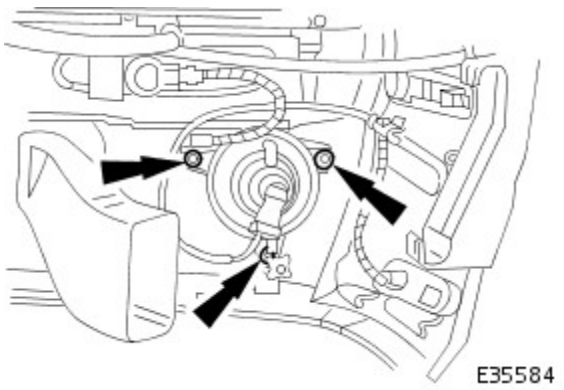
Exterior Lighting - Front Fog Lamp

Removal and Installation

Removal



1. Remove undertray for access. Refer to 76.22.90.
2. Disconnect fog lamp harness multiplug.



3. Remove the three fog lamp securing bolts.
4. Withdraw fog lamp assembly from rear of bumper.

Installation

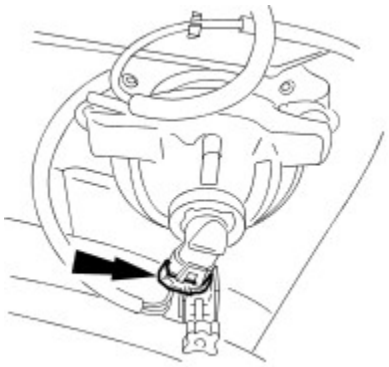
1. NOTE: Vertical alignment of the fog lamp is pre-set. No attempt must be made to alter this setting.

   Position fog lamp assembly on bumper.
2. Install fog lamp securing bolts.
3. Connect fog lamp harness multiplug.
4. Install undertray. Refer to 76.22.90.

Exterior Lighting - Front Fog Lamp Bulb

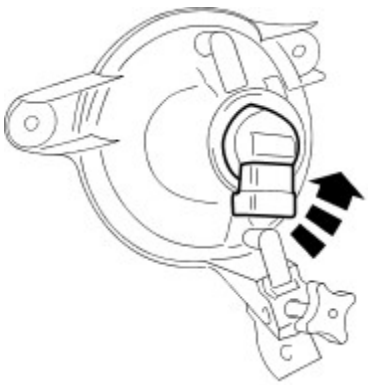
Removal and Installation

Removal



E35930

1. Remove undertray for access. Refer to 76.22.90.
2. Disconnect fog lamp harness multiplug.



E35931

3. Rotate bulb holder 1/4 turn counter-clockwise to release and remove from lamp assembly.

4. CAUTION: If bulb is to be re-fitted, the glass must not be touched with the bare hand. Failure to observe this caution will result in premature bulb failure.

   Remove bulb from holder.

Installation

1. CAUTION: Fog lamp bulbs are of the halogen type and must not be touched with bare hands. Failure to observe this caution will result in premature bulb failure.

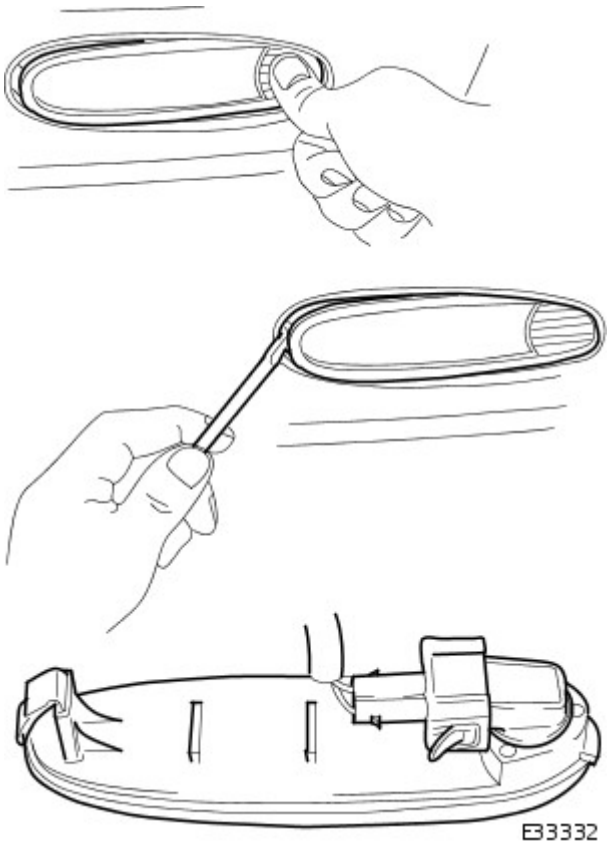
   Install bulb in holder.

2. Install bulb holder in lamp assembly and rotate 1/4 turn clockwise to fully seat and engage.
3. Connect fog lamp harness multiplug.
4. Install undertray. Refer to 76.22.90.

Exterior Lighting - Front Side Marker Lamp

Removal and Installation

Removal



1. Remove lamp unit.

- Apply gentle thumb pressure to front end of lamp lens.
- Exercising care to avoid damaging paintwork, compress rear spring clip to release lamp unit.
- Disconnect harness connector.

Installation

1. Position lamp at bumper and connect harness connector.

2. Engage lamp front tang in bumper aperture.

3. Pivot lamp, compress rear clip and fully seat lamp in bumper.

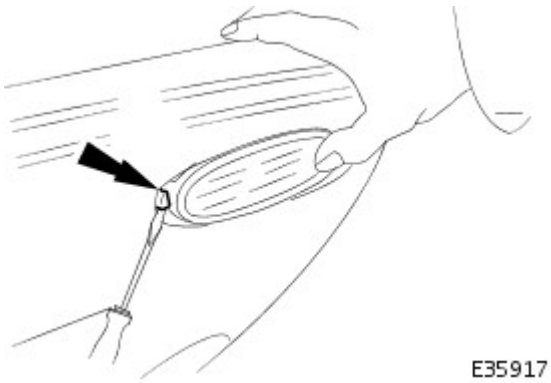
Exterior Lighting - Front Side Marker Lamp Bulb

Removal and Installation

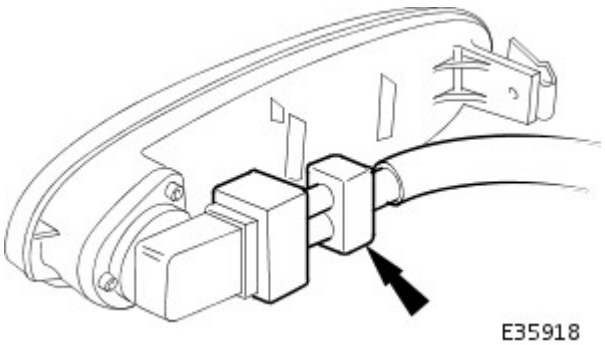
Removal


E35916

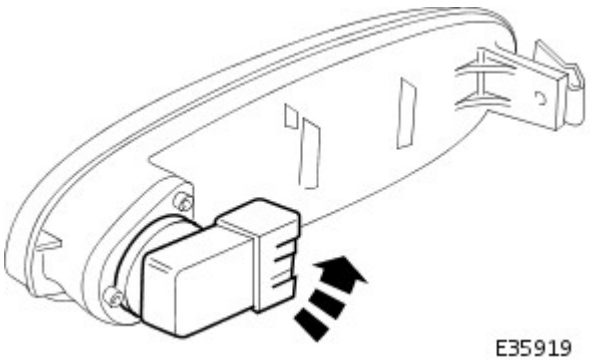
1. Applying firm hand pressure to front end, pivot lamp assembly for access to rear end.


E35917

2. Exercising care to avoid damaging paintwork, use a small screwdriver at rear end of lamp, to press and release retaining tang.

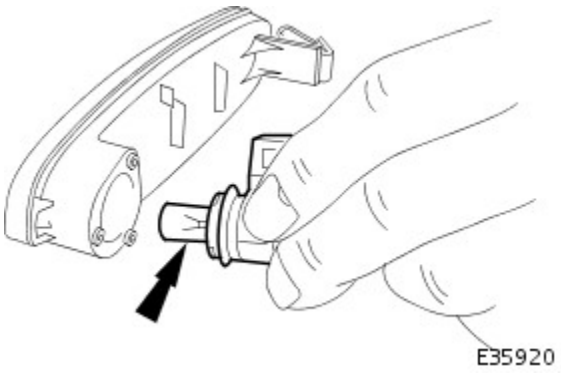

E35918

3. Withdraw lamp from bumper for access and disconnect harness multiplug.


E35919

4. Rotate bulb holder 1/4 turn counter-clockwise to release it from lamp assembly.

5. Withdraw bulb from holder.



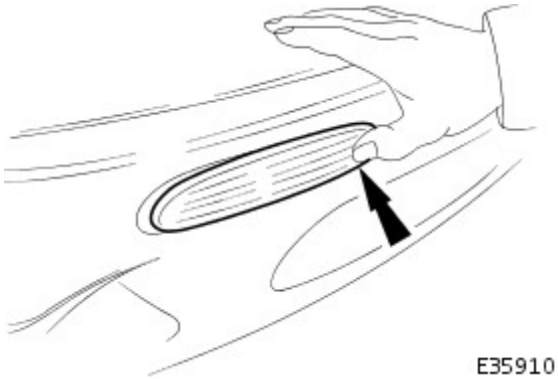
Installation

1. Install bulb in holder.
2. Install bulb and bulb holder in lamp assembly and rotate 1/4 turn clockwise to seat and retain.
3. Position direction lamp at bumper aperture and connect harness multiplug.
4. Engage front end tang of lamp in bumper aperture.
5. Pivot lamp assembly and firmly seat rear retaining clip in bumper aperture.

Exterior Lighting - Front Turn Signal Lamp Bulb

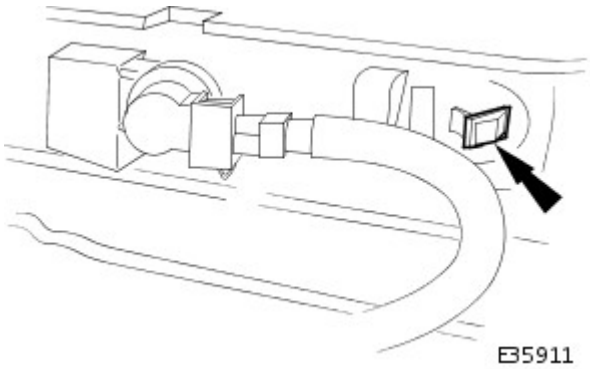
Removal and Installation

Removal



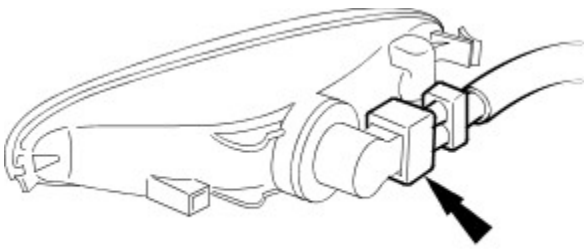
E35910

1. Applying firm hand pressure to inner end, pivot indicator lamp assembly for access to outer end.



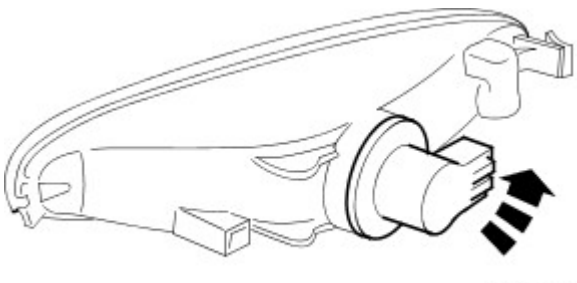
E35911

2. Exercising care to avoid damaging paintwork, use a small screwdriver at outer end of lamp, to press and release retaining clip.



E35912

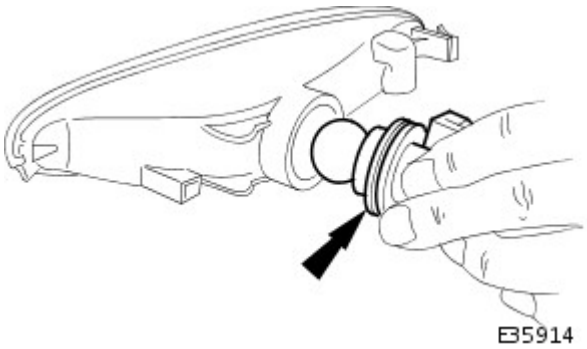
3. Withdraw lamp from bumper for access and disconnect harness multiplug.



E35913

4. Rotate bulb holder 1/8 turn to release it from lamp assembly.

5. Withdraw bulb holder and remove bulb.



Installation

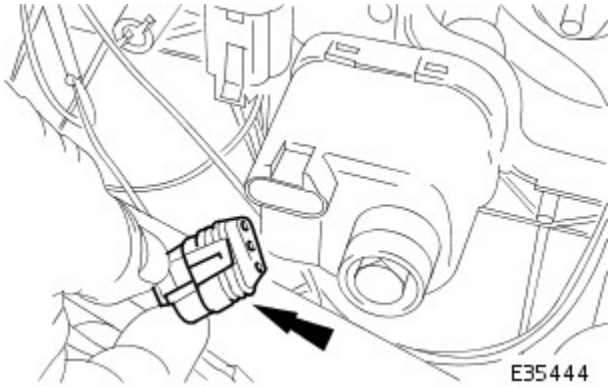
1. Install bulb in holder.
2. Install bulb and bulb holder in lamp assembly and rotate 1/4 turn to seat and retain.
3. Position direction indicator lamp at bumper aperture and connect harness multiplug.
4. Engage inner end tang of lamp in bumper aperture.
5. Pivot lamp assembly and firmly seat outer retaining clip in bumper aperture.

Exterior Lighting - Headlamp Assembly

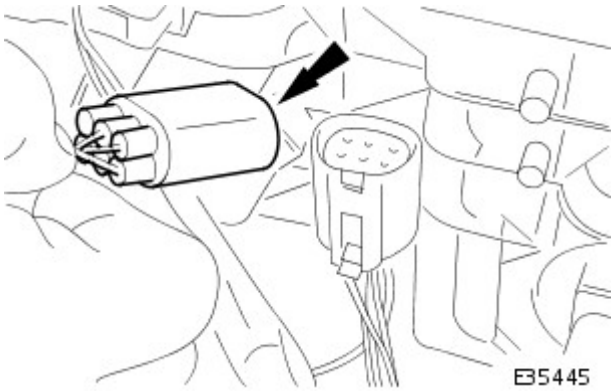
Removal and Installation

Removal

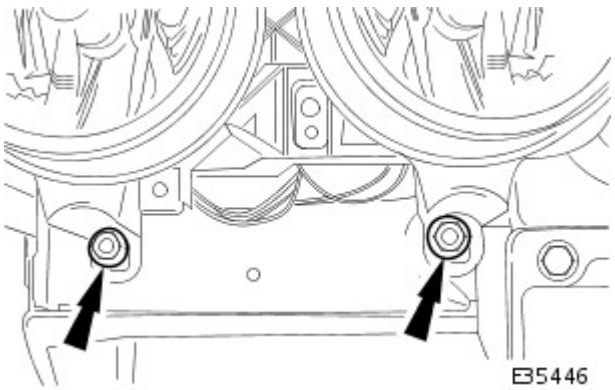
1. Remove radiator grill. Refer to 76.55.03.
2. Remove radiator grill surround. Refer to 76.55.15.
3. Remove headlamp trim panel. Refer to 76.11.23.
4. Disconnect headlamp levelling actuator if fitted.



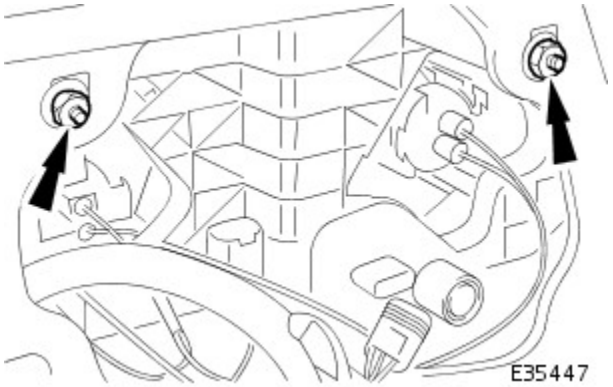
5. Disconnect headlamp assembly harness connector.



6. Remove headlamp assembly to body lower nuts.

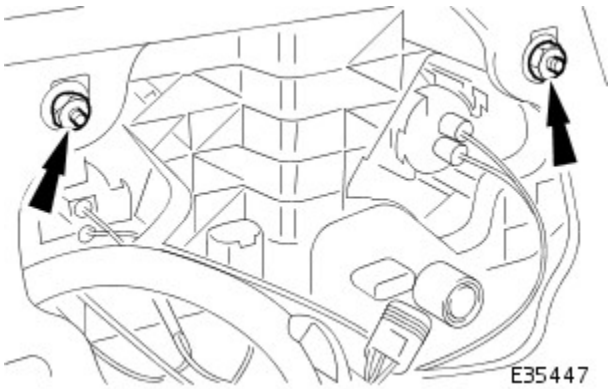


7. Remove headlamp to body upper nuts.

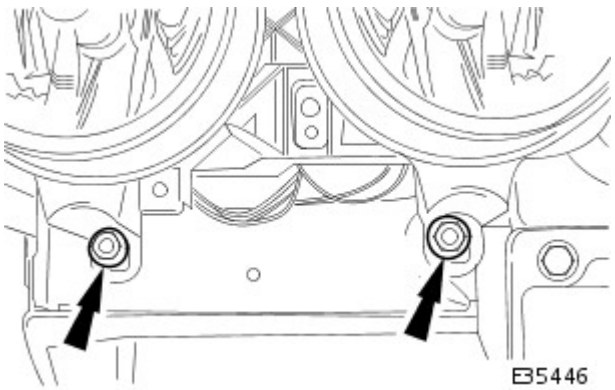


8. Remove headlamp assembly from vehicle.

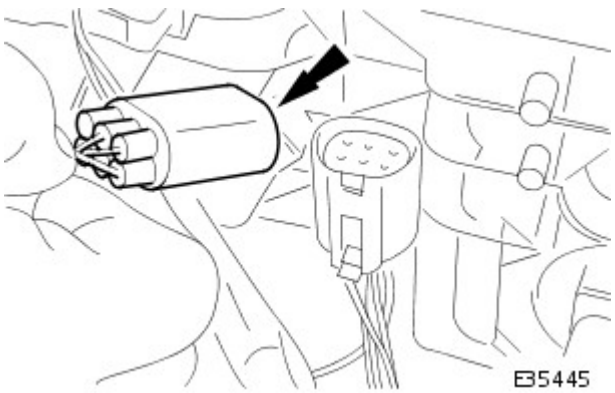
Installation



1. Position headlamp assembly on body and install upper nuts.

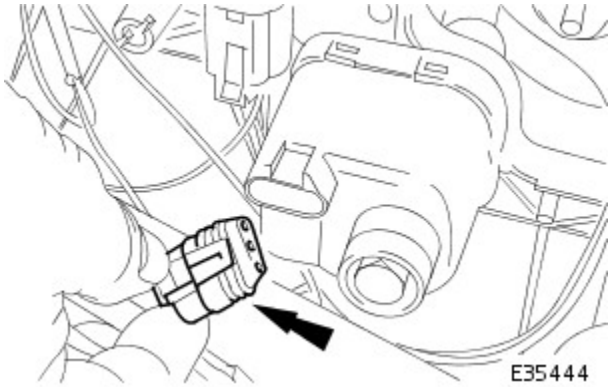


2. Install headlamp to body lower nuts.



3. Connect headlamp assembly harness connector.

4. Connect headlamp levelling actuator harness connector if fitted.



5. Align headlamp beams.

6. Install headlamp trim panel. Refer to 76.11.23.

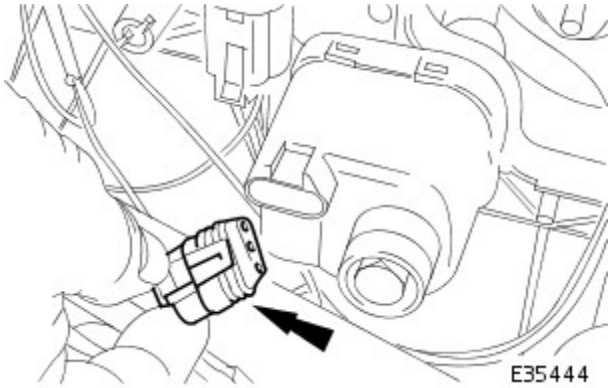
7. Install radiator grill surround. Refer to 76.55.15.

8. Install radiator grill. Refer to 76.55.03.

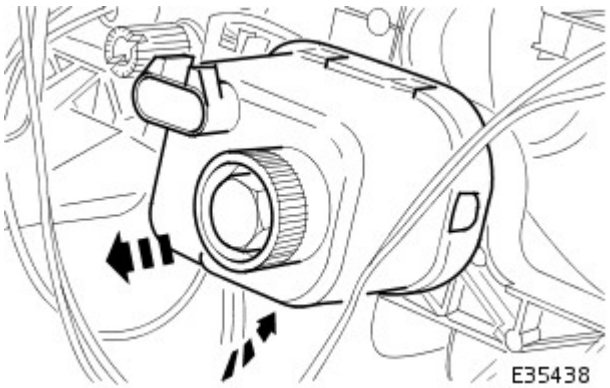
Exterior Lighting - Headlamp Leveling Motor

Removal and Installation

Removal



1. Disconnect harness multiplug from headlamp levelling actuator.



2. Rotate actuator 1/4 turn inwards, tilt forward end downward and withdraw assembly from headlamp.

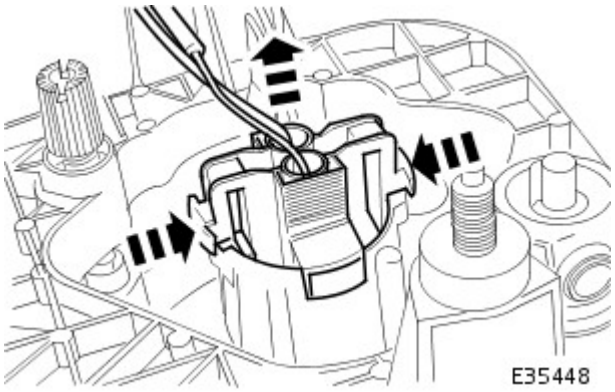
Installation

1. With forward end tilted downward, position actuator assembly on headlamp.
2. Align actuator with headlamp and rotate it 1/4 turn outwards to engage and fully seat.
3. Connect harness multiplug to actuator.
4. Carry out headlamp beam alignment to the appropriate alignment equipment instructions.

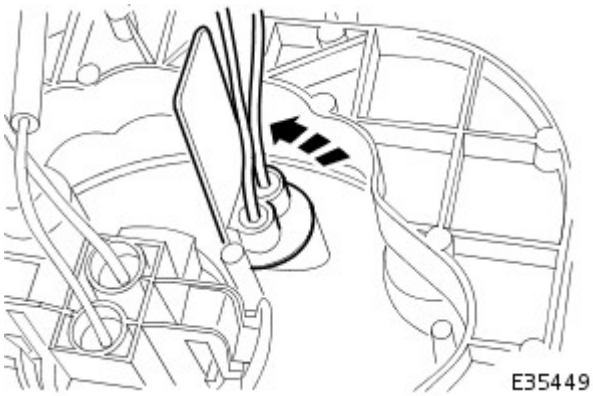
Exterior Lighting - High Beam Headlamp

Removal and Installation

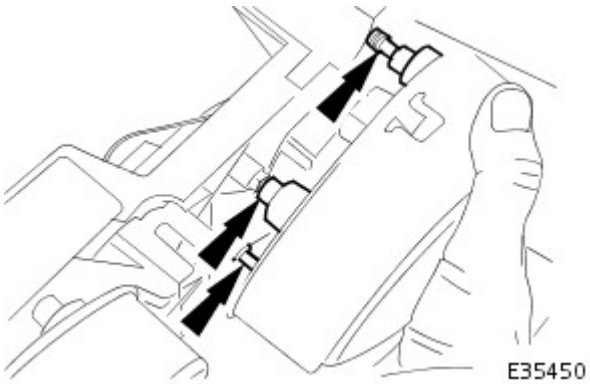
Removal



1. Remove headlamp assembly for access. Refer to 86.41.33.
2. Release bulb holder securing tangs and position holder for access.

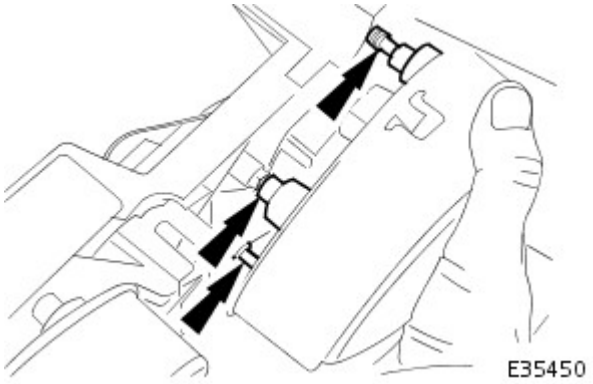


3. Rotate pilot bulb holder 1/4 turn and withdraw holder.
4. Invert headlamp assembly.
5. Release headlamp unit adjusting screws and pivot.

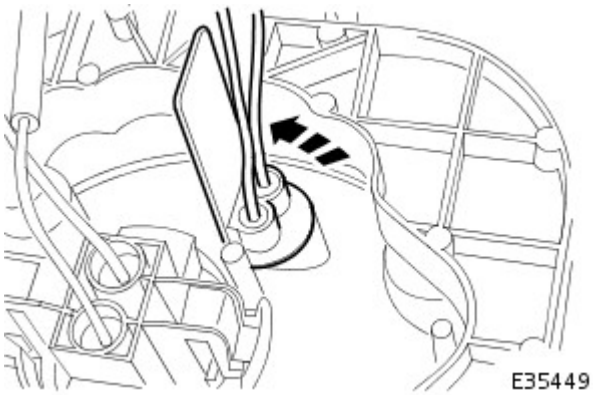


Installation

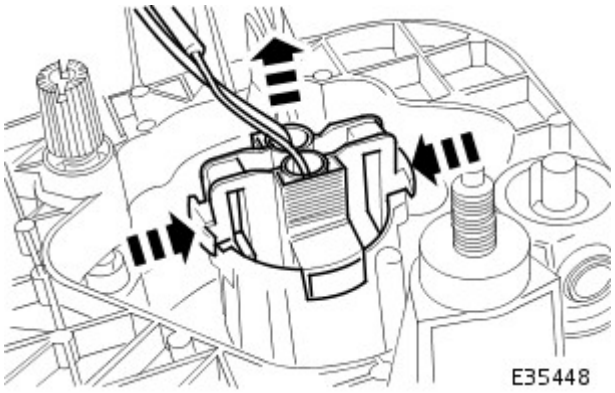
1. Install headlamp unit on adjusting screw and pivot seats.



2. Invert headlamp assembly.



3. Install pilot bulb holder in headlamp unit and rotate 1/4 turn to secure.



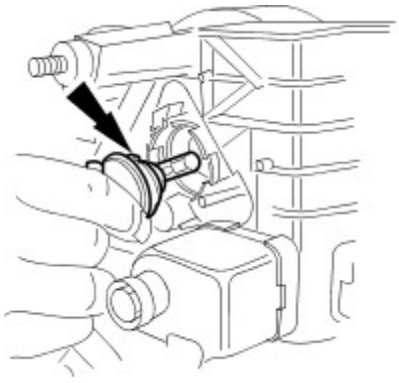
4. Install headlamp assembly bulb holder.

5. Install headlamp assembly. Refer to 86.41.33.

6. Align headlamp beams.

Exterior Lighting - High Beam Headlamp Bulb

Removal and Installation



Removal

1. Open hood and install fender cover.
2. Release headlamp bulb holder locking tangs and remove holder from headlamp.

3. CAUTION: If the bulb is to be re-fitted, the glass must not be touched with the bare hand. Failure to observe this caution will result in premature bulb failure

   Position bulb holder for access and remove bulb.

Installation

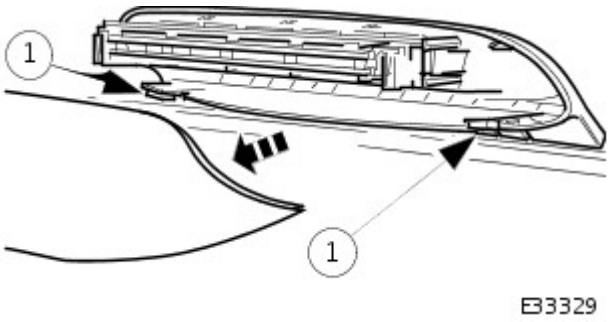
1. CAUTION: Headlamp bulbs are of the halogen type and must not be handled with bare hands. Failure to observe this caution will result in premature bulb failure.

   Install headlamp bulb in holder.
2. Install bulb holder in headlamp ensuring that securing tangs are fully seated.
3. Remove fender cover and close hood.

Exterior Lighting - High Mounted Stoplamp

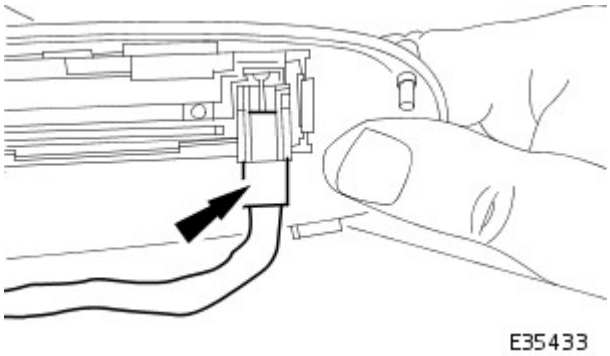
Removal and Installation

Removal



1. Remove lamp cover.

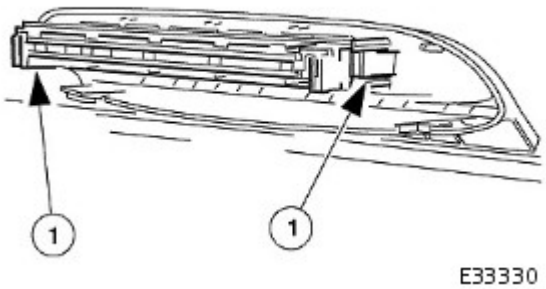
1. Depress two tangs at base of lamp carrier and withdraw cover.

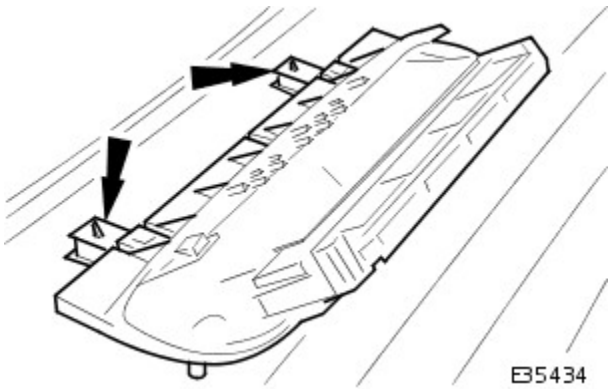


2. Disconnect lamp harness connector.

3. Remove module.

1. Release spring clips at each end of lamp lens module and withdraw module from carrier.



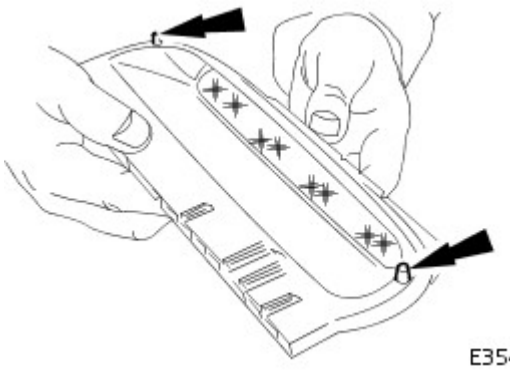


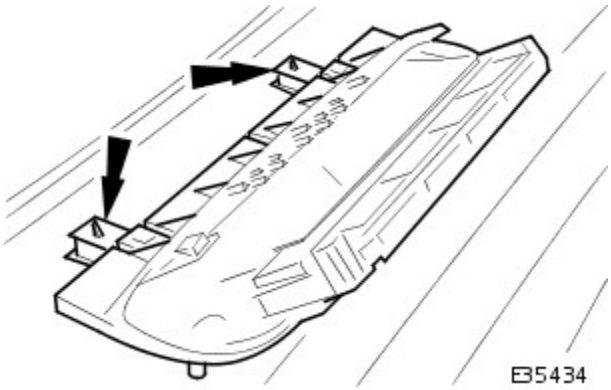
4. Remove lamp carrier.

- Release lamp carrier lower securing tangs.
- Slide carrier upwards to release and remove carrier from backlight.

Installation

1. Ensure that rubber insulating pads are installed on lamp carrier.

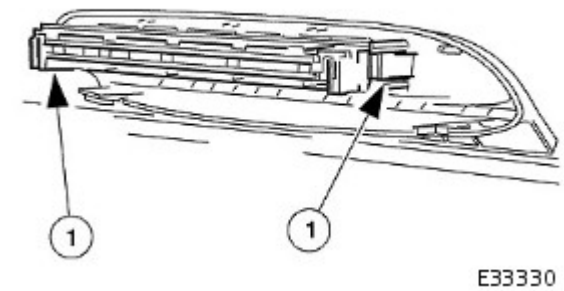


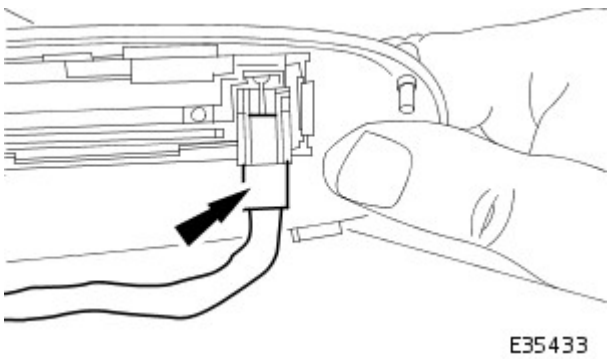


2. Install lamp carrier on backlight mountings, ensuring retaining tangs seat correctly.

3. Install lamp module.

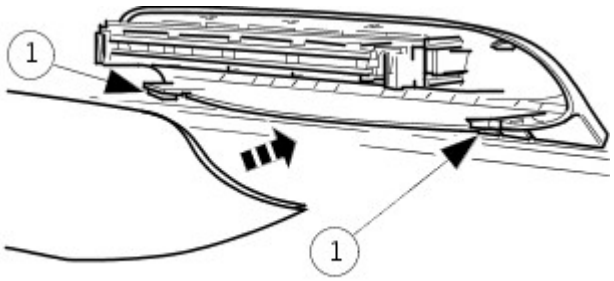
1. Slide lamp module into carrier ensuring retaining clips seat correctly.





4. Connect harness connector to lamp assembly.

5. Install cover on lamp ensuring tangs locate correctly in carrier.

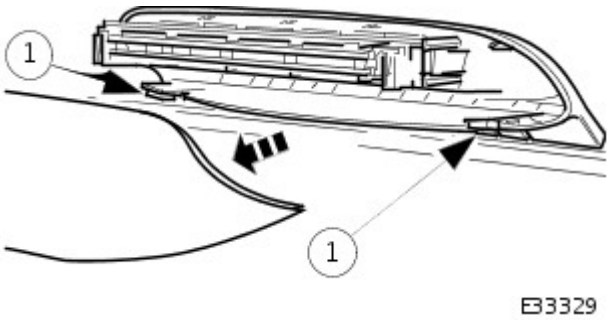


E34389

Exterior Lighting - High Mounted Stoplamp Bulb

Removal and Installation

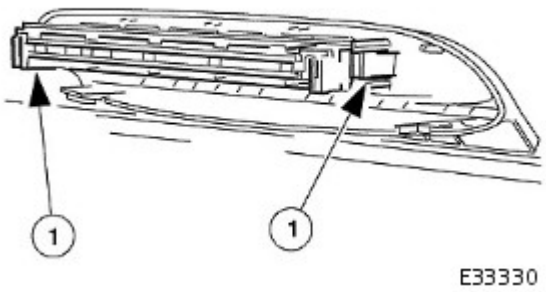
Removal



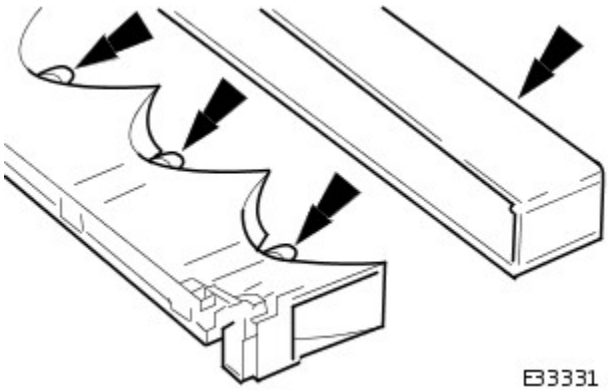
1. Remove cover from stop lamp.

1. Depress two tangs at base of lamp cover and withdraw cover.

2. Remove lamp module.



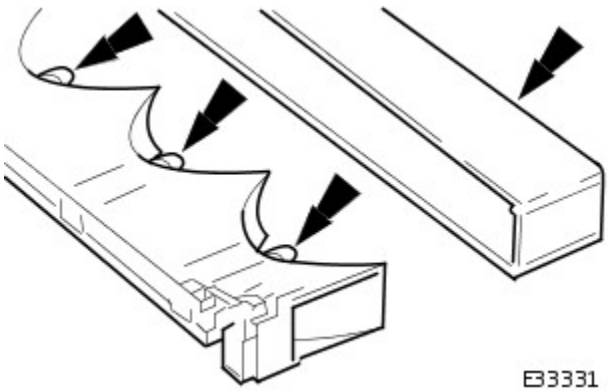
1. Release spring clips at each end and remove lamp module from carrier.



3. CAUTION: Exercise care to avoid contact with reflective surfaces.

Withdraw lens and remove relevant bulb from module.

Installation



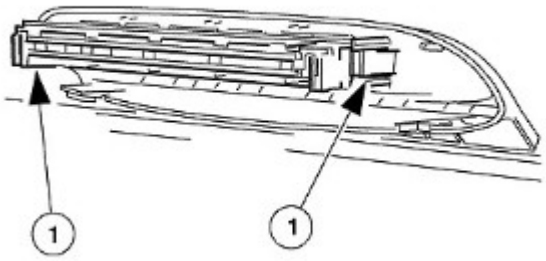
1. CAUTION: Exercise care to avoid contact with reflective surfaces.

Install new bulbs as necessary and install lens.

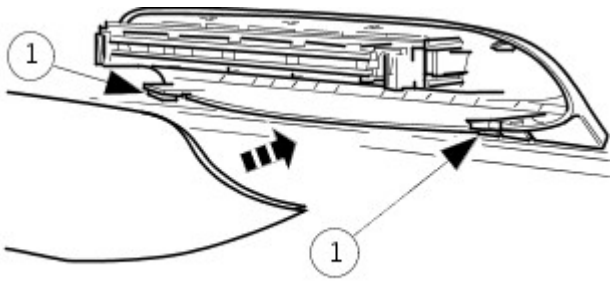
2. Install module.

1. Slide module into carrier and seat securing clip at

each end.



E33330



E34389

3. Install lamp cover.

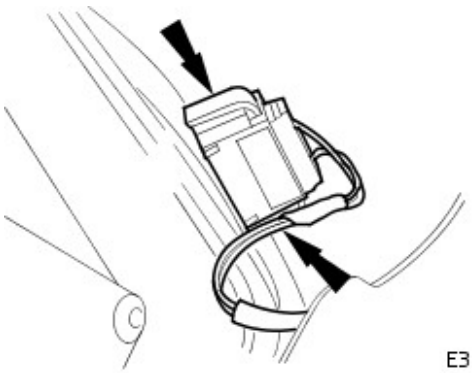
1. Position cover over module and seat lower retaining clips in carrier.

Exterior Lighting - License Plate Lamp

Removal and Installation

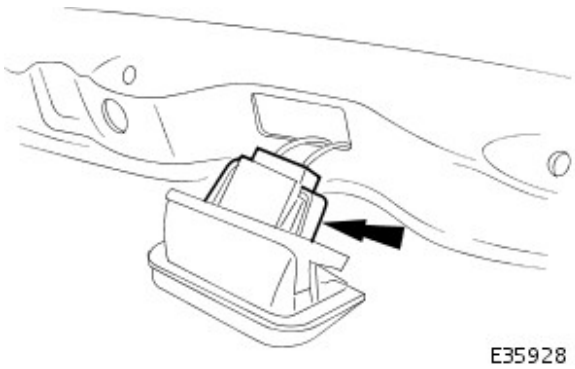
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove trunk lamp assemblies. Refer to 86.45.16
3. Remove trunk lid upper trim finisher. Refer to 76.43.79.
4. From inside trunk lid, press tang at each side of lamp and push lamp outwards.



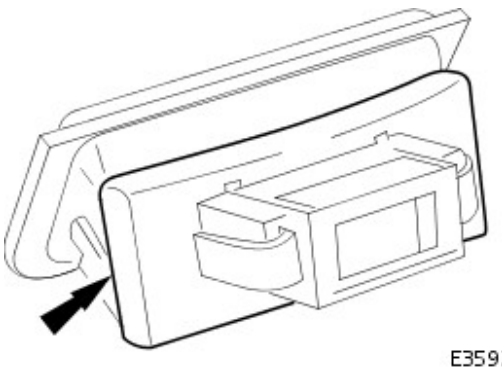
E35927

5. Withdraw number plate lamp from trunk lid for access and disconnect lamp harness multiplug.



E35928

6. Remove and discard foam seal from lamp.



E35929

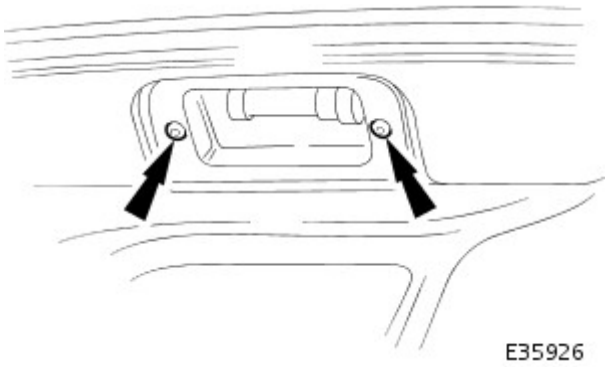
Installation

1. Install new foam seal to number plate lamp.
2. Position number plate lamp at trunk lid and connect harness multiplug.
3. Install number plate lamp in trunk lid aperture ensuring that seal seats correctly.
4. Install trunk upper trim finisher. Refer to 76.43.79.
5. Install trunk lamp assemblies. Refer to 86.45.16.
6. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Exterior Lighting - License Plate Lamp Bulb

Removal and Installation

Removal



1. Remove the two number plate lamp lens securing screws.
2. Remove lens from lamp assembly and discard gasket.
3. Remove bulb from lamp assembly.

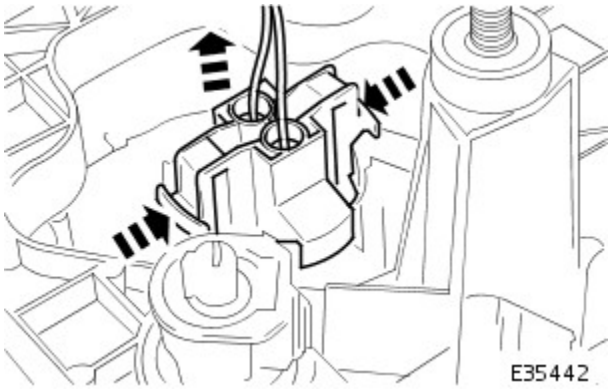
Installation

1. Install bulb in lamp assembly.
2. Install new lens gasket to lamp assembly.
3. Ensuring that gasket is correctly positioned, install lens on lamp assembly.
4. Install lens securing screws.

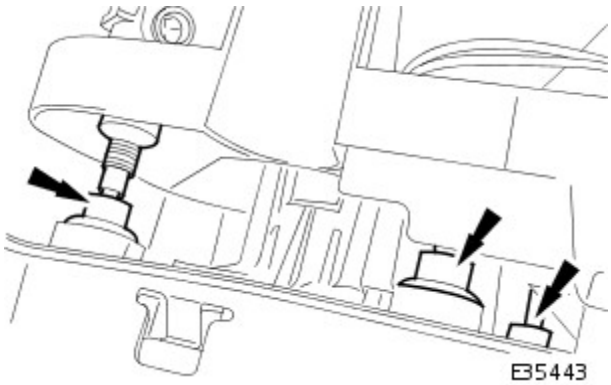
Exterior Lighting - Low Beam HeadlampVehicles Without: Headlamp Leveling

Removal and Installation

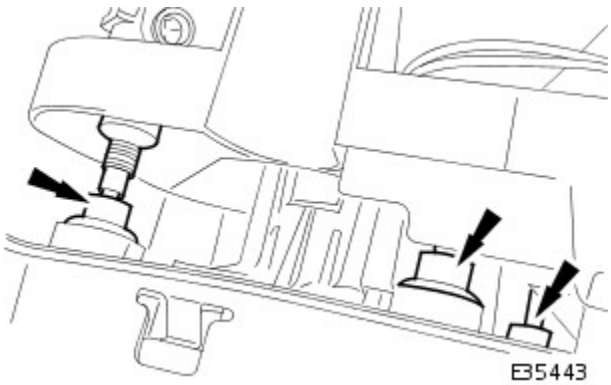
Removal



1. Remove headlamp assembly for access. Refer to 86.41.33.
2. Release bulb holder securing tangs and withdraw holder for access.
3. Invert headlamp assembly.
4. Release headlamp unit adjusting screws and pivot.



Installation



1. Install headlamp unit adjusting screws and pivot in locating seats.
2. Invert headlamp assembly.
3. Install headlamp assembly bulb holder.



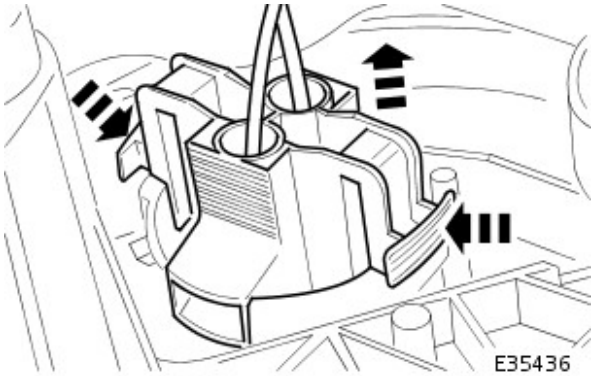
4. Install headlamp assembly. Refer to 86.41.33.

5. Align headlamp beams.

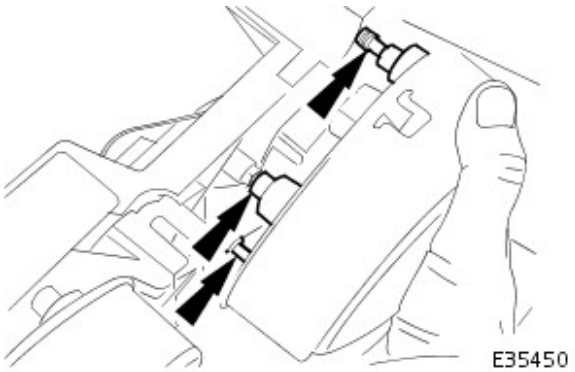
Exterior Lighting - Low Beam HeadlampVehicles With: Headlamp Leveling

Removal and Installation

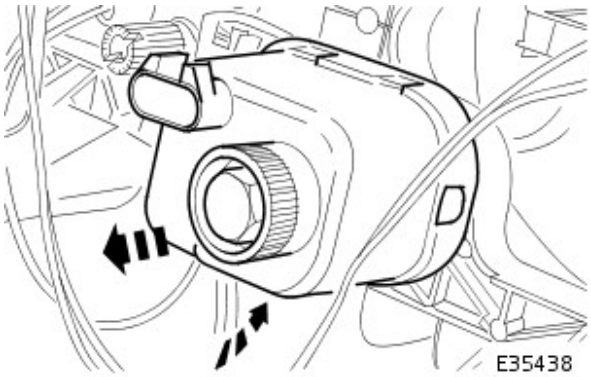
Removal



1. Remove headlamp assembly for access. Refer to 86.41.33.
2. Release bulb holder securing tangs and withdraw holder for access.



3. Invert headlamp assembly.
4. Release headlamp unit adjusting screws and pivot.



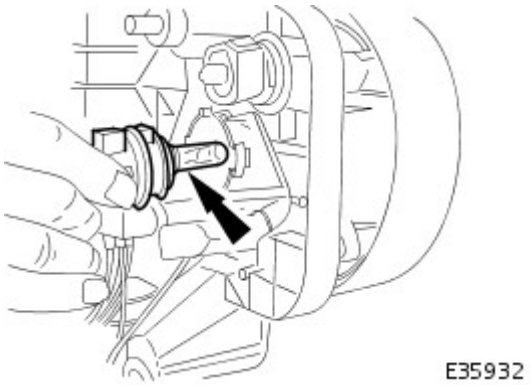
5. Remove actuator.
    1. Release headlamp unit from leveling actuator adjusting screw.
    2. Rotate actuator 1/4 turn inward, tilt forward end downward and withdraw assembly from headlamp.

Installation

1. Install headlamp unit adjusting screws and pivot in locating seats.
2. Invert headlamp assembly and install bulb holder.
3. With forward end tilted downward, position actuator assembly on headlamp mounting.
4. Align actuator with headlamp and rotate it 1/4 turn outwards to engage and fully seat in mounting.
5. Install headlamp assembly. Refer to 86.41.33.
6. Align headlamp beams.

Exterior Lighting - Low Beam Headlamp Bulb

Removal and Installation



Removal

1. Open hood and install fender cover.
2. Release headlamp bulb holder locking tangs and remove holder from headlamp.

3. CAUTION: If bulb is to be re-fitted, the glass must not be touched with the bare hand. Failure to observe this caution will result in premature bulb failure.

   Position bulb holder for access and remove bulb.

Installation

1. CAUTION: Headlamp bulbs are of the halogen type and must not be handled with bare hands. Failure to observe this caution will result in premature bulb failure.

   Install headlamp bulb in holder.
2. Install bulb holder in headlamp ensuring that securing tangs are fully seated.
3. Remove fender cover and close hood.

Exterior Lighting - Rear Lamp Assembly

Removal and Installation

Removal



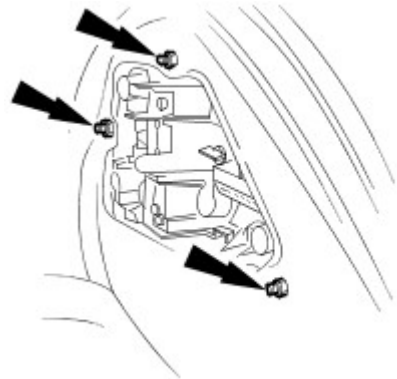
E35923

1. Depress retaining tang and remove rear lamp interior trim finisher.



E35924

2. Disconnect rear lamp harness multiplug.



E35925

3. Remove three nuts securing rear lamp assembly to BIW and remove lamp from vehicle.

Installation

1. Check that rubber seals are undamaged and correctly positioned on rear lamp assembly.
2. Install rear lamp assembly in BIW aperture, ensuring that rubber seals seat correctly.
3. Install three nuts securing lamp assembly to BIW.
4. Connect harness multiplug to rear lamp assembly.
5. Install interior trim finisher on rear lamp assembly ensuring that retaining tang engages correctly.

Exterior Lighting - Rear Lamp Assembly Bulb

Removal and Installation

Removal



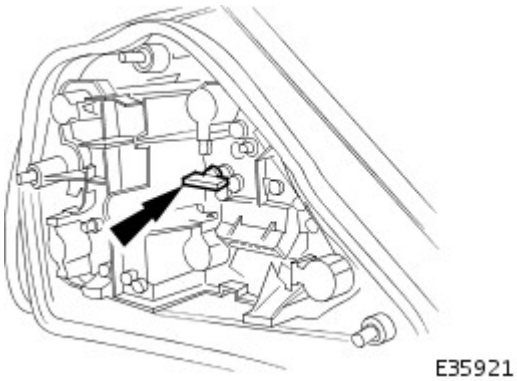
E35923

1. Depress retaining tab and remove rear lamp interior trim finisher.



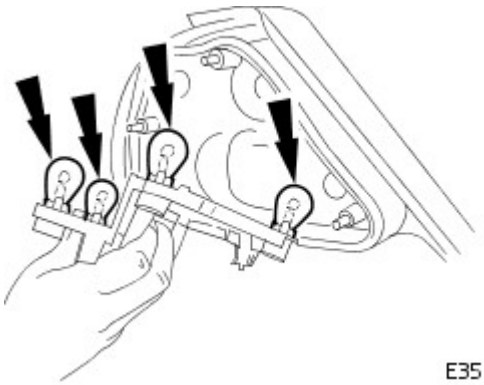
E35924

2. Disconnect rear lamp harness multiplug.



E35921

3. Rotate bulb holder retaining fastener 1/4 turn counter-clockwise and withdraw holder from rear lamp lens.



E35922

4. Remove bulbs from holder as necessary.

Installation

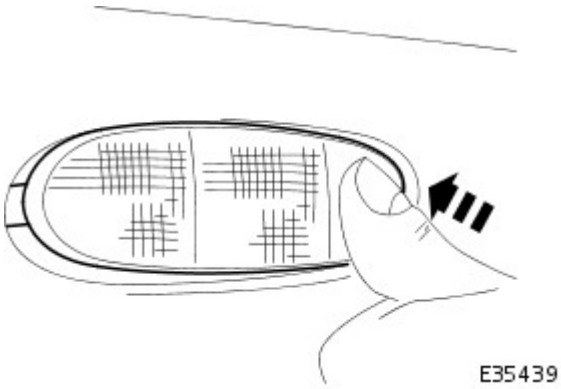
1. Install bulbs in holder as necessary.

2. Position bulb holder assembly on rear lamp lens and rotate fastener 1/4 turn clockwise to secure.
3. Connect rear lamp harness multiplug.
4. Install rear lamp interior trim finisher.

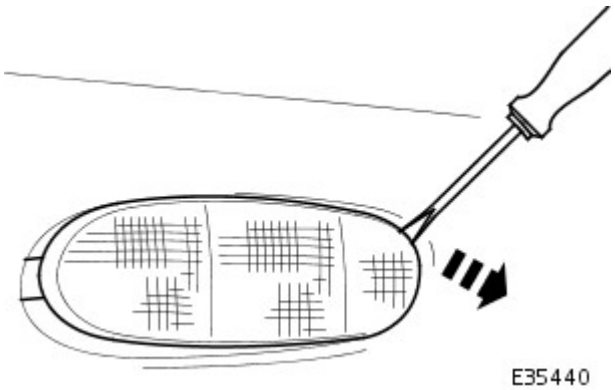
Exterior Lighting - Rear Side Marker Lamp

Removal and Installation

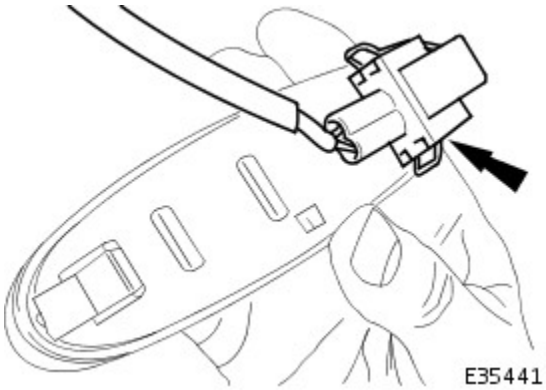
Removal



1. Applying firm thumb pressure to front of lens, pivot lamp assembly for access to rear end.



2. Exercising care to avoid damaging paintwork, use a small screwdriver to press and release rear retaining clip.



3. Withdraw lamp from bumper for access and disconnect harness connector.

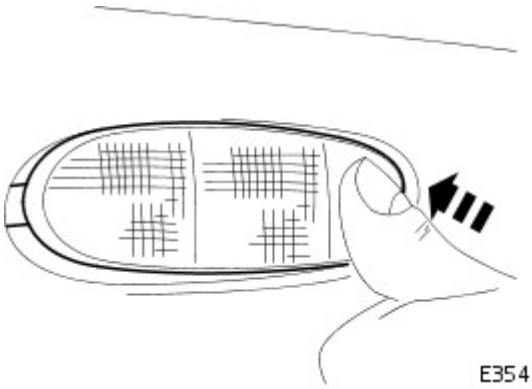
Installation

1. Position lamp at bumper aperture and connect harness connector.
2. Engage front end tang of lamp in bumper aperture.
3. Pivot lamp assembly and firmly seat rear retaining clip in bumper aperture.

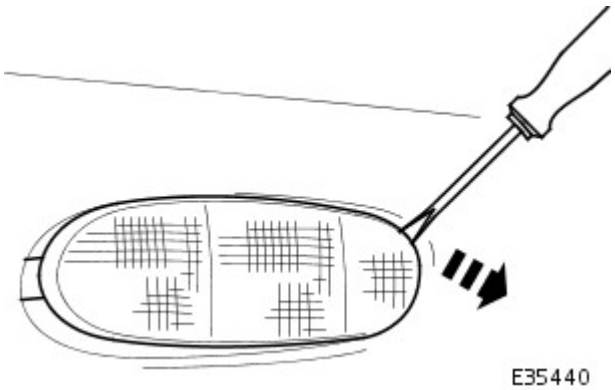
Exterior Lighting - Rear Side Marker Lamp Bulb

Removal and Installation

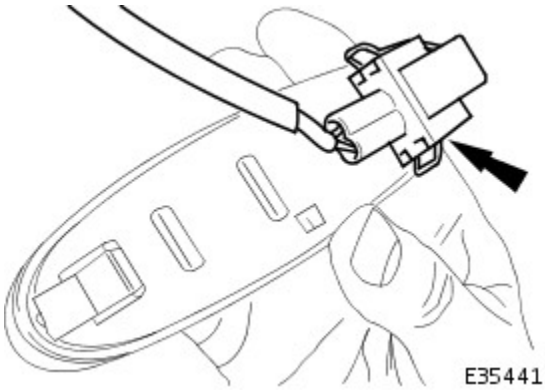
Removal



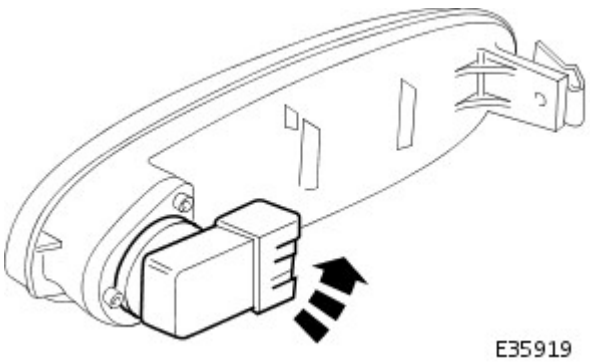
1. Applying firm thumb pressure to front of lens, pivot lamp assembly for access to rear end.



2. Exercising care to avoid damaging paintwork, use a small screwdriver to press and release rear retaining clip.

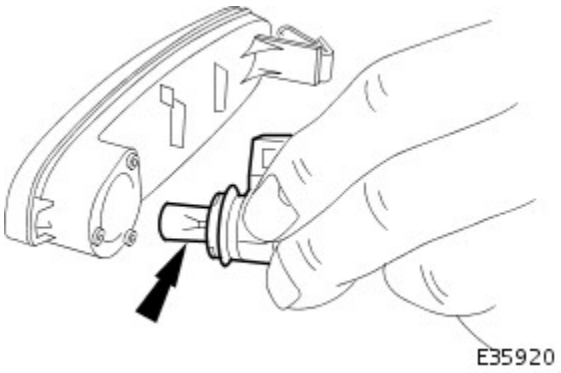


3. Withdraw lamp from bumper for access and disconnect harness connector.



4. Rotate bulb holder 1/4 turn counter-clockwise to release it from lamp assembly.

5. Withdraw bulb from holder.

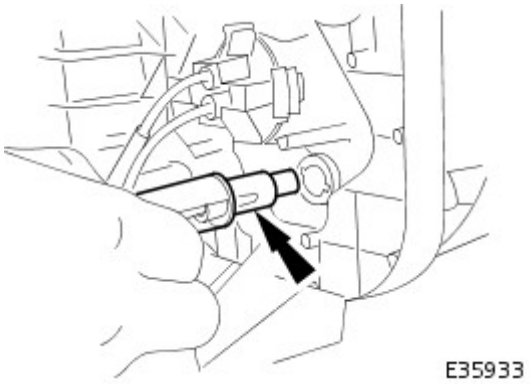


Installation

1. Install bulb in holder.
2. Install bulb and bulb holder in lamp assembly and rotate 1/4 turn clockwise to seat and retain.
3. Position lamp at bumper aperture and connect harness connector.
4. Engage front end tang in bumper aperture.
5. Pivot lamp assembly and firmly seat rear retaining clip in bumper aperture.

Exterior Lighting - Side Lamp Bulb

Removal and Installation



Removal

1. Open hood and install fender cover.
2. Rotate bulb holder 1/4 turn counter-clockwise and remove from headlamp
3. Position bulb holder and harness for access and withdraw bulb from holder.

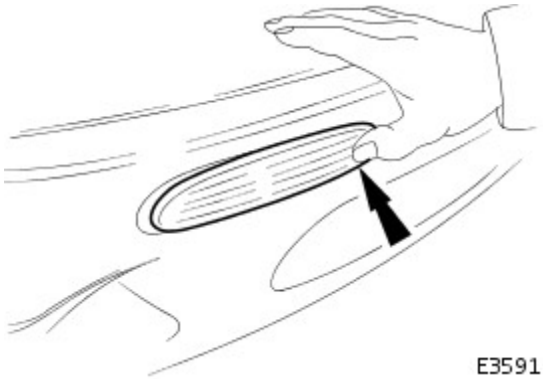
Installation

1. Install parking/sidelamp bulb in bulb holder
2. Position bulb and holder in headlamp, and rotate 1/4 turn clockwise to fully seat.
3. Remove fender cover and close hood.

Exterior Lighting - Side Lamp/Front Turn Signal Lamp

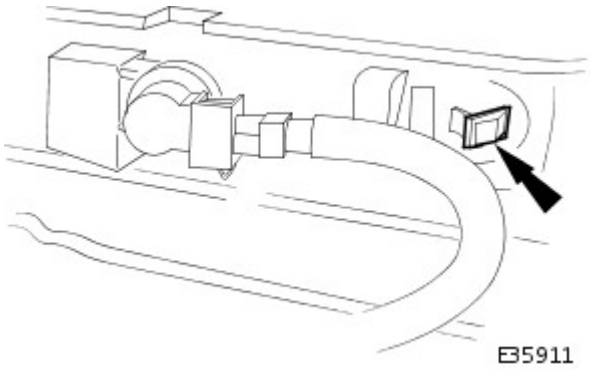
Removal and Installation

Removal



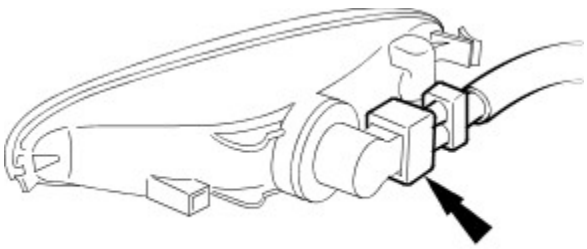
E35910

1. Applying firm hand pressure to inner end, pivot indicator lamp assembly for access to outer end.



E35911

2. Exercising care to avoid damaging paintwork, use a small screwdriver at outer end of lamp, to press and release retaining clip.



E35912

3. Withdraw lamp from bumper for access and disconnect harness multiplug.

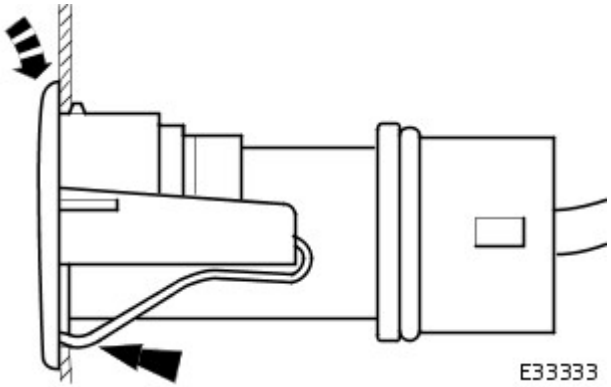
Installation

1. Position direction indicator lamp at bumper aperture and connect harness multiplug.
2. Engage inner end tang of lamp in bumper aperture.
3. Pivot lamp assembly and firmly seat outer retaining clip in bumper aperture.

Exterior Lighting - Side Turn Signal Lamp

Removal and Installation

Removal



1. Remove side repeater lamp.
   - Applying downward pressure, compress retaining clips and release lamp upper edge from fender.
   - Withdraw lamp from panel and disconnect harness connector.

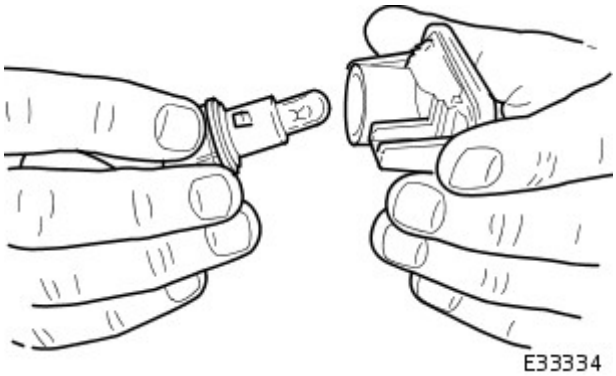
Installation

1. Position lamp at fender and connect harness connector.
2. Position lower edge of lamp in fender aperture and apply downward pressure to compress clip.
3. Pivot lamp to seat upper edge in fender.

Exterior Lighting - Side Turn Signal Lamp Bulb

Removal and Installation

Removal



1. Remove indicator repeater lamp assembly. Refer to 86.41.41.

2. Remove lamp. Refer to this section.

- Twist bulb holder anti-clockwise and remove.
- Remove bulb and replace with new one of correct type.

Installation

1. Installation is reverse of removal.

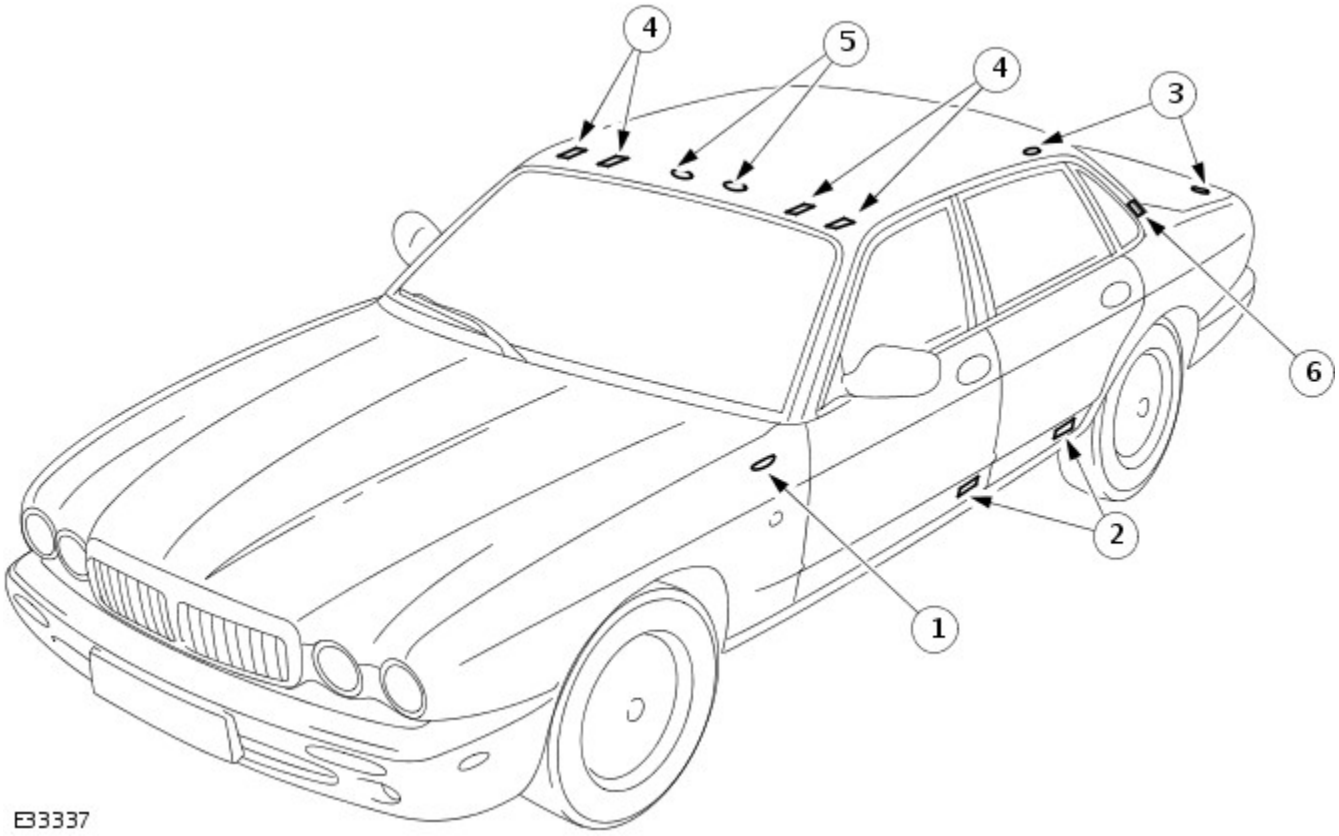
Interior Lighting -

Bulbs

Description	Capacity	Type
Door Guard / Puddle Lamps	12V 5W	Capless Long Life
Glovebox Lamp	12V 4W	Bayonet Long Life
Luggage Compartment Lamp	12V 5W	Capless Long Life
Roof Console Central Courtesy Lamp	12V 5W	Capless Long Life
Roof Console Map Lamp	12V 6W	Capless
Rear Quarter Courtesy Lamp (lower section)	12V 5W	Capless Long Life
Rear Quarter Reading Lamp (upper section)	12V 6W	Capless Long Life
Sun Visor Vanity Mirror Lamp	12V 1.2W	Capless 286

Interior Lighting - Interior Lighting

Description and Operation



Parts List

Item	Part Number	Description
1	—	Glovebox Lamp
2	—	Door Guard / Puddle Lamp
3	—	Luggage Compartment Lamp
4	—	Sun Visor Vanity Mirror Lamp
5	—	Roof Console Map / Courtesy Lamp
6	—	Rear Quarter Reading / Courtesy Lamp

Glovebox lamp

The glovebox lamp operates whenever the glovebox door is opened. The lamp comprises a combined switch and bulb holder assembly. The bulb aperture in the glovebox is covered by a white lens.

Door guard/puddle lamps

A door guard/puddle lamp, fitted to the rear lower corner of each door, operates automatically whenever the corresponding door is opened. Each lamp assembly has a double lens; red to project rearwards to warn oncoming traffic that the door is open and white to illuminate the passenger 'step-out' area.

Front courtesy/ map lamps

The roof console comprises a module with integral switches which permits operation of the driver and front passenger courtesy and map lamps.

Where appropriate, the module also controls operation of the sun roof and garage door opener.

Rear courtesy / reading lamps

Each rear quarter of the passenger compartment is fitted with combined lighting units comprising; a rear courtesy lamp and reading lamp. The courtesy lamps operate automatically whenever a rear door is opened; the reading lamps function when the integral switches are operated by occupants of the vehicle.

Trunk lamps

The trunk trim panel is fitted with lamps which operate automatically whenever the trunk lid is opened; the switch is incorporated within the latch mechanism.

Vanity mirror lamps

The vanity mirror lamps, two on each sun visor, operate automatically when the mirror flap is opened, provided the sun visor spindle is engaged in the stowage clip.

Operation

The BPM provides an enable signal for the glovebox, vanity mirror, trunk lid and map lamps. Actuation of the relevant switch provides an earth path to the lamp.

The rear passenger reading lamps receive a supply direct from fuse F10 in the RH heelboard fuse-box.

The front and rear courtesy lamps have separate fade functions controlled by the BPM.

The door hazard / puddle lamps are controlled locally by the relevant Door Module.

Fault analysis must be undertaken using the PDU, refer to Diagnosis and Testing.

Refer to the relevant Electrical Guide for details of circuit operation.

Interior Lighting - Interior Lighting

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the various Electronic Control Modules and the multiplexed communication networks, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the interior lamps and circuits.

The PDU systematically tests and analyses the lamp assemblies, the bulbs and the electrical connections to them. It should be noted that the lamps are not wired directly to the switches.

The lamps are controlled directly by the Body Processor (it has a sufficient number of high power output stages to drive the lamps / relays compared to other modules) except for the door guard / puddle lamps and the rear passenger reading lamps.

The Body Processor Module receives messages on the SCP network from the door modules relating to door ajar / closed / locked status, sensed by the door courtesy switch(es).

Where a fault involving a lamp is indicated by the PDU, before replacing suspect components, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Interior Lighting - Door Courtesy Lamp

Removal and Installation

Removal

1. Remove front door casing for access. Refer to 76.34.01.
2. Remove the two lamp assembly securing screws.



E36340

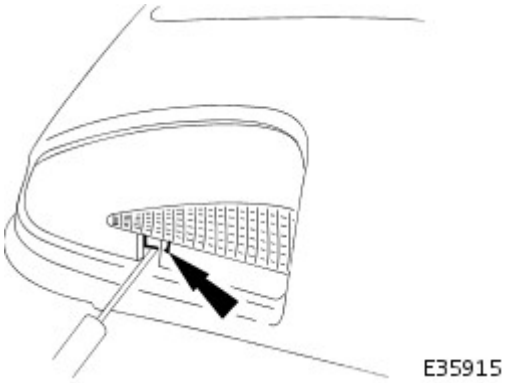
3. Withdraw lamp assembly from door casing.

Installation

1. Position lamp assembly on door casing.
2. Install lamp securing screws.
3. Install door casing. Refer to 76.34.01.

Interior Lighting - Door Courtesy Lamp Bulb

Removal and Installation



Removal

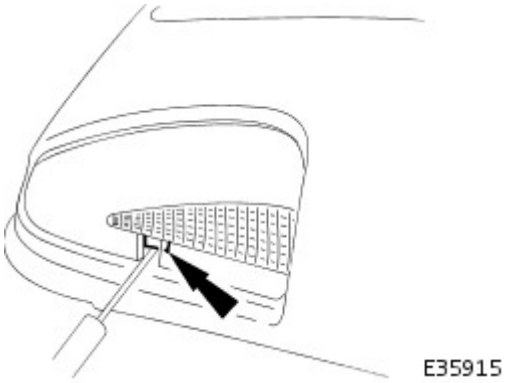
1. Using a thin plastic blade, carefully release lens retaining tang from guard lamp assembly.
2. Withdraw lens from guard lamp assembly.
3. Remove bulb from bulb holder.

Installation

1. Install bulb in holder.
2. Position lens on guard lamp assembly.
3. Press lens firmly to fully seat securing tang in guard lamp assembly..

Interior Lighting - Door Courtesy Lamp Lens

Removal and Installation



Removal

1. Using a thin plastic blade, carefully release lens retaining tang from guard lamp assembly.
2. Withdraw lens from guard lamp assembly.

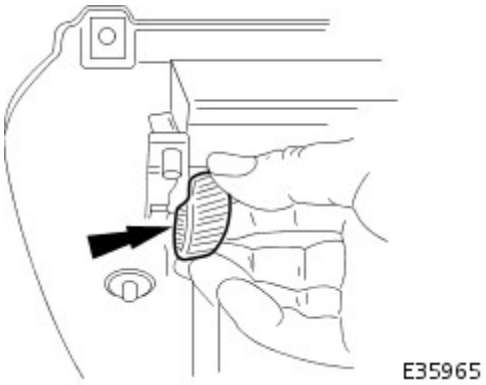
Installation

1. Position lens on guard lamp assembly.
2. Press lens firmly to fully seat securing tang in guard lamp assembly..

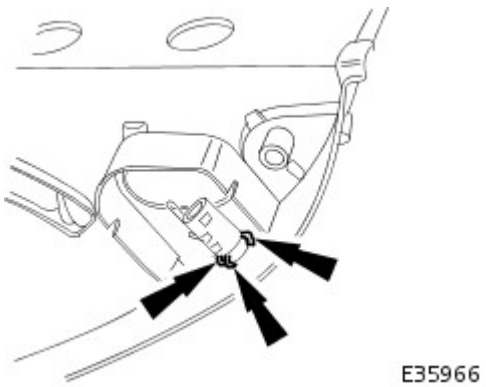
Interior Lighting - Glove Compartment Lamp

Removal and Installation

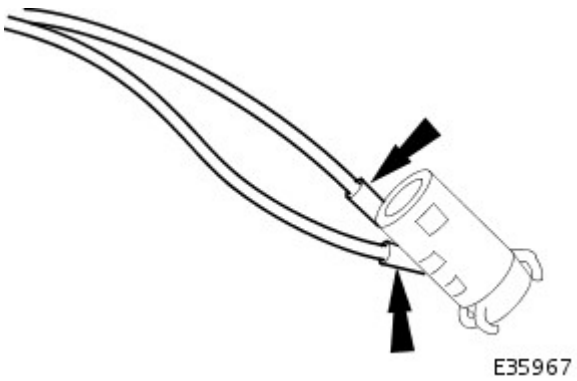
Removal


E35965

1. Open glovebox lid.
2. Carefully release and remove plastic lens from glovebox light.


E35966

3. Remove bulb from glovebox light.
4. Release light/switch assembly retaining tangs and partially withdraw assembly from glovebox exterior.


E35967

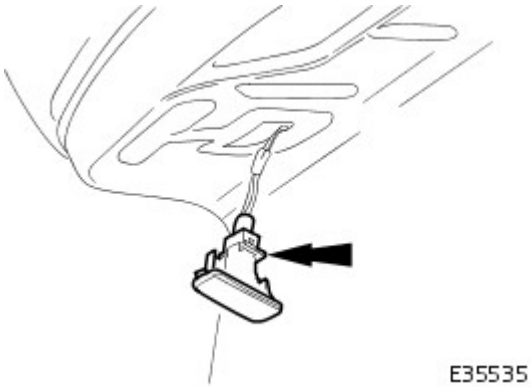
5. Position light/switch assembly for access, disconnect harness spade connectors and remove assembly from glovebox aperture.

Installation

1. Position light/switch assembly at glovebox aperture and connect harness spade connectors.
2. Install assembly in aperture, ensuring that retaining tangs are fully seated.
3. Install bulb in light/switch assembly and check that harness leads are clear of bulb.
4. Install plastic lens to light/switch assembly.
5. Close glovebox lid.

Interior Lighting - Luggage Compartment Lamp

Removal and Installation



Removal

1. Remove battery cover and disconnect ground cable from battery terminal.Refer to 86.15.19.
2. Carefully release lamp tangs from trunk lid trim, position lamp for access, disconnect harness multiplug and remove lamp from trunk.

Installation

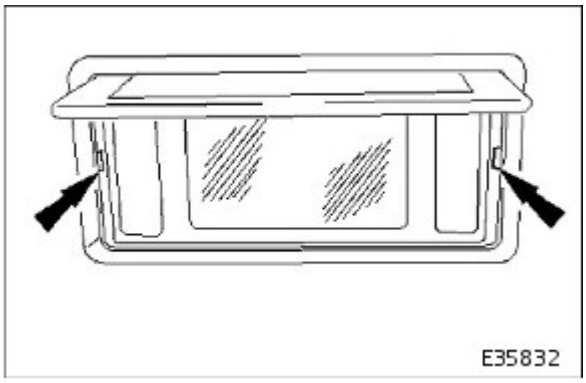
1. Position lamp at trunk lid and connect harness multiplug.
2. Ensuring that harness is routed correctly, finally position and fully seat lamp in trunk lid liner.
3. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Interior Lighting - Vanity Mirror Lamp

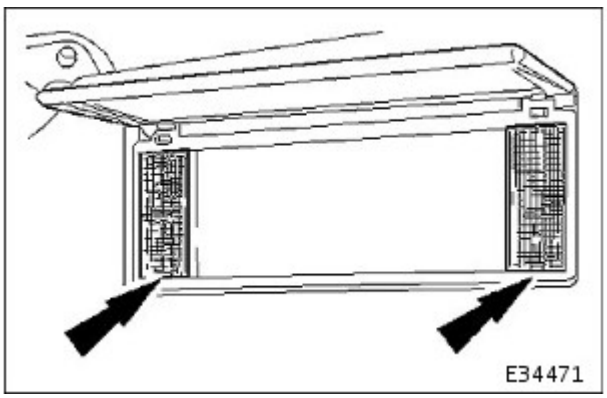
Removal and Installation

Removal

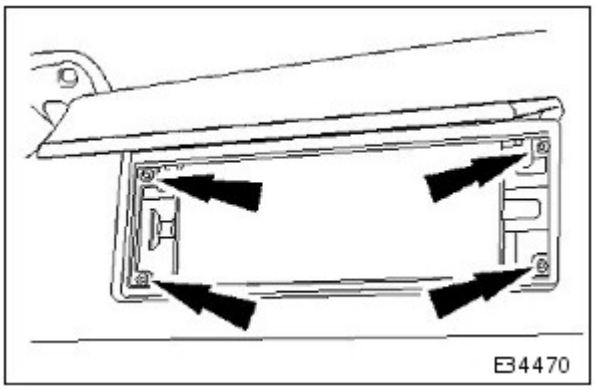
1. Release sun visor from retention bezel to isolate from electrical supply.



2. Move sun visor to downward position and turn mirror cover upwards.



3. Using a small screwdriver, carefully release illumination lens tangs from vanity assembly.



4. Supporting vanity assembly, slacken and remove securing screws and remove assembly from sun visor.

Installation

1. Ensure that bulb holders and switch contactors are correctly positioned and seated.
2. Position and fully seat vanity assembly on sun visor and fit and tighten securing screws.
3. Fit and fully seat mirror illumination lenses.
4. Turn mirror cover downwards.
5. Reposition sun visor in retention bezel and return to upward position.

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Description and Operation

Refer to the Drivers Handbook for details which are specific to the intended market - Canada and Scandinavia.

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the Body Processor and the multiplexed communication networks which are associated with it, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing the Daytime Running Function.

The Daytime Running function is exactly the same as for the normal operation of the side lamps (or dipped beam, where specified) in as much as the body processor drives the same lamps from the same outputs.

The body processor has been programmed to respond to an alternative set of conditions in order to operate the lamps, instead of waiting for a signal from the normal light switch.

The conditions which have to be set are; ignition switch set to position II or III and sidelight switch set to OFF. The sidelights, side marker lamps (if fitted and enabled), tail lights and number plate lights will all be switched ON.

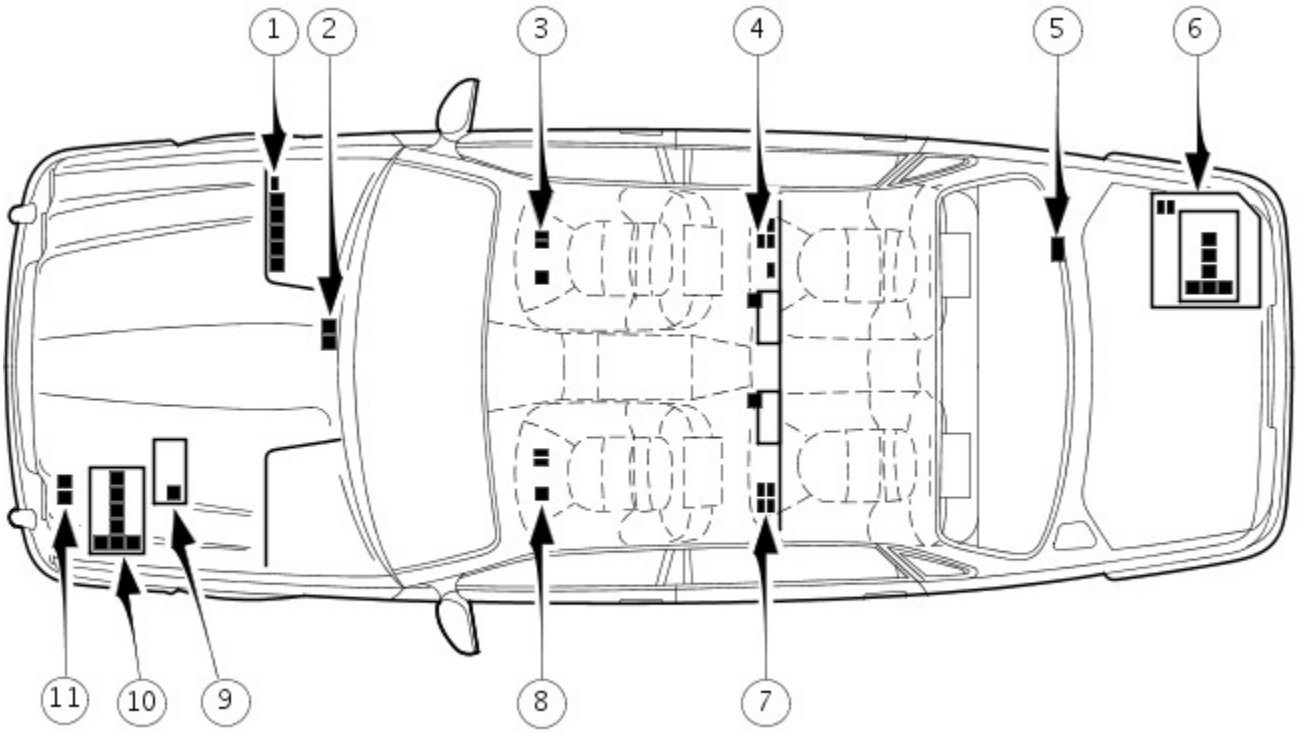
The PDU systematically tests and analyses all functions of the daytime running lamps.

Where a fault is indicated, before replacing a component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

Module Communications Network - Communications Network

Description and Operation

Fuse Boxes and Relays (LH Steering)



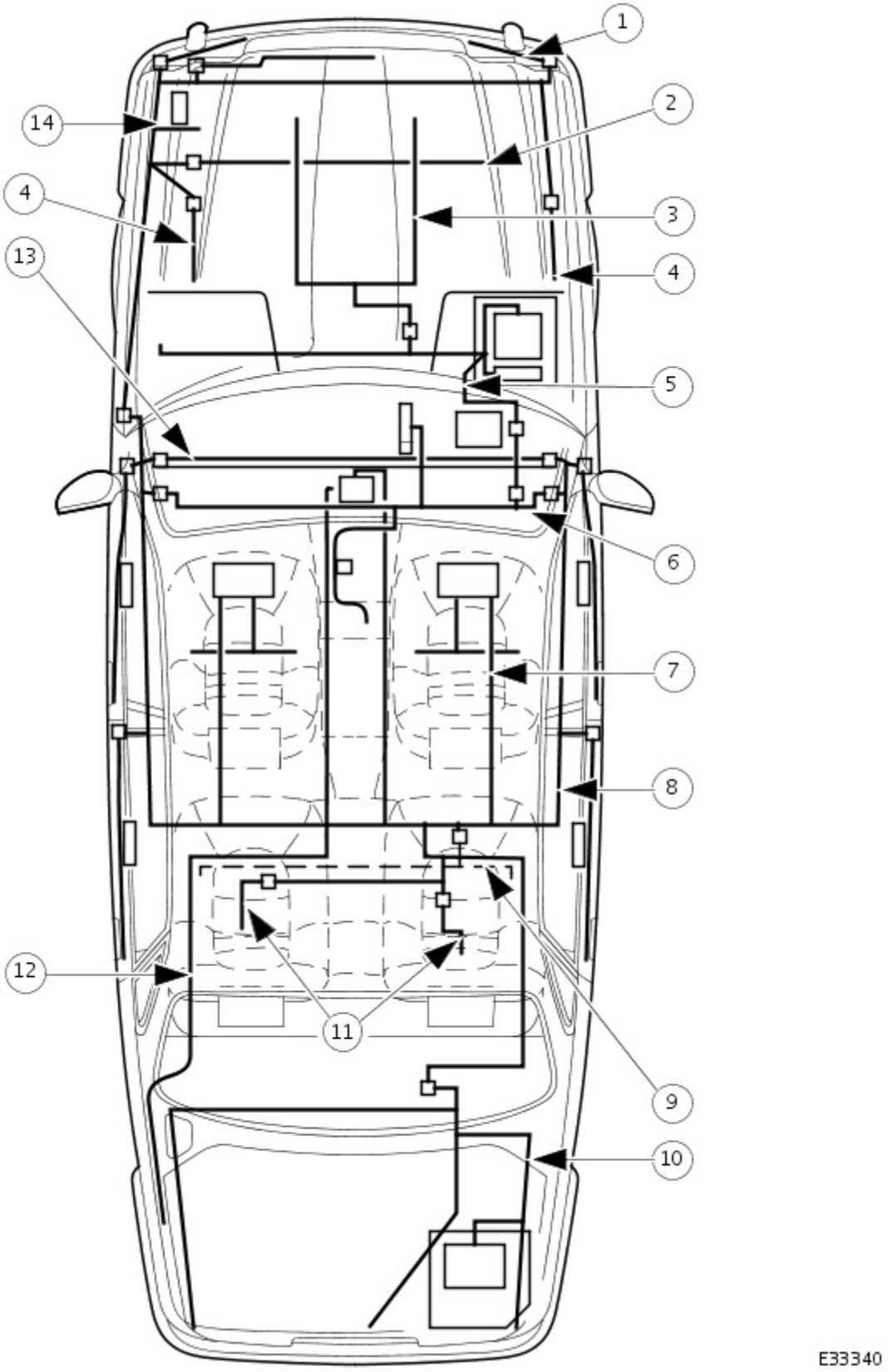
E33339

Parts List

Item	Part Number	Description
1	—	Engine and Transmission Control Module Compartment Relays (RH Steering opposite)
2	—	Front Firewall Relays
3	—	Front Seat Relays - Right Hand Side
4	—	Heelboard - Right Hand Side
5	—	High Power Protection Module
6	—	Trunk Fuse Box
7	—	Heelboard - Left Hand Side
8	—	Front Seat Relays - Left Hand Side
9	—	Engine Management Fuse Box
10	—	Engine Compartment Fuse Box
11	—	Engine Compartment Front Relays

There are six fuse box assemblies per vehicle, five of which have conventional, replaceable fuses. The High Power Protection Module does not have conventional fuses, it comprises three 250 Amp fusible links to protect the starting circuit (two connected in parallel) and the battery positive supply to the other fuse boxes.

Wiring Harnesses



Parts List

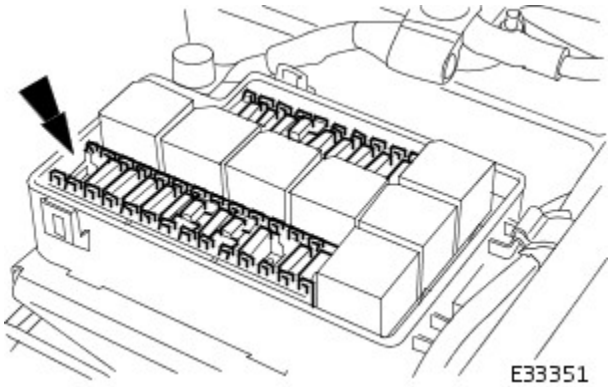
Item	Part Number	Description
1	—	Bumper

2	—	Power Steering Link
3	—	Engine
4	—	Front Axle
5	—	Engine Management
6	—	Console
7	—	Seat
8	—	Cabin
9	—	Rear Electric Seat Link (optional)
10	—	Trunk
11	—	Rear Axle
12	—	ICE
13	—	Fascia
14	—	Forward

Location of J1962 socket

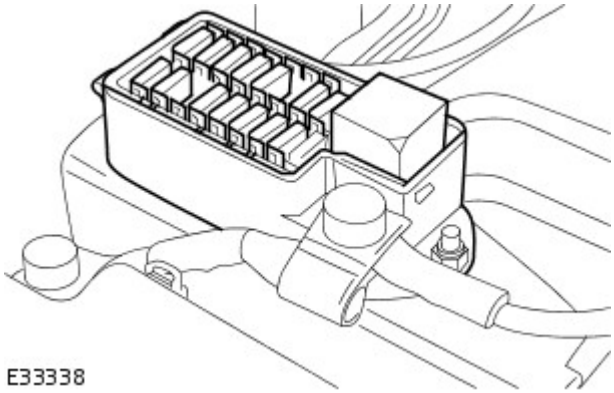
The J1962 socket is located at the driver side inboard footwell.

Fuse Box Details



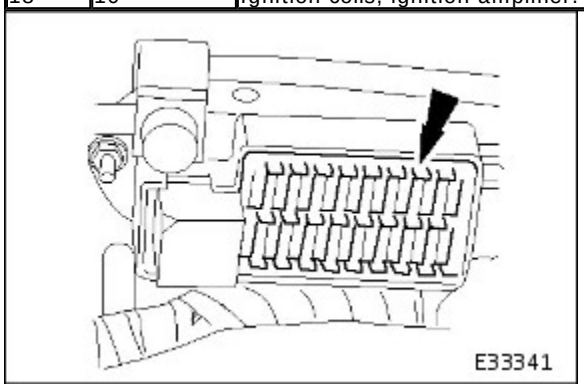
Engine Compartment Fuse Box

Fuse No	Rating (amps)	Circuit
1	10	Transmission control module.
2	5	Screen heaters relay, alternator regulator.
3	10	Security sounder, headlamp levelling, ignition coils +Ve, fog lamp switches.
4	5	ABS control module.
5	10	Adaptive damping, starter relay coil, engine management control module and relays.
6	10	Right-hand low beam headlamp.
7	30	Power wash pump.
8	10	Left-hand low beam headlamp.
9	10	Security sounder.
10	-	Not used.
11	10	Right-hand horn.
12	30	Radiator cooling fans series/right-hand fast.
13	10	Left-hand horn
14	30	Cooling fans left-hand fast.
15	10	Air conditioning coolant pump.
16	30	ABS pump control.
17	15	Front fog lamps.
18	30	ABS pump motor.
19	10	Right-hand high beam headlamp.
20	-	Not used.
21	10	Left-hand high beam headlamp.
22	30	Wiper motor.



Engine Management Fuse Box

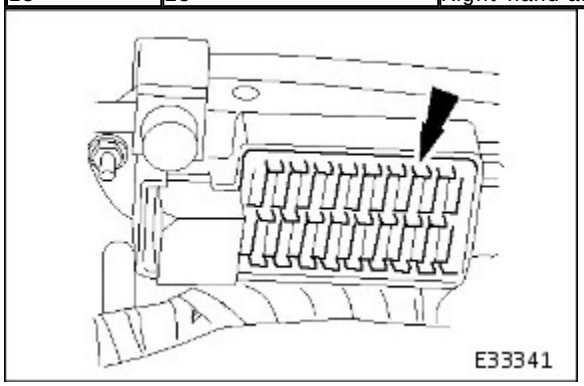
Fuse No	Rating (amps)	Circuit
1	20	Adaptive damping
2	15	Intercooler water pump (Supercharger)
3	25	Starter solenoid.
4	5	Engine control module.
5	10	Fuel injectors.
6	5	Transmission control module
7	-	Not used.
8	10	Air conditioning compressor clutch.
9	30	Throttle motor.
10	5	Engine control module, Park/Neutral switch, cruise control VSV 1 and 2 (where fitted), EGR valves.
11	-	Not used.
12	10	Air flowmeter, VVT solenoids.
13	-	Not used.
14	10	HO2S sensor heaters (where fitted), EVAP valve, ignition coils relay, throttle motor relay, AC compressor clutch relay, radiator fans control module, CCV.
15	30	Windscreen left-hand heater.
16	5	Control module compartment cooling fan.
17	30	Windscreen right-hand heater.
18	10	Ignition coils, ignition amplifier.



Heelboard Fuse Box - Right hand side

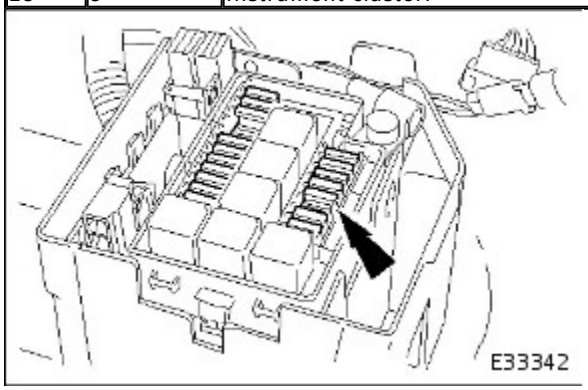
Fuse No	Rating (amps)	Circuit
1	20	Left-hand seat control module.
2	15	Door lock relay, door locking actuators.
3	15	Body processor module.
4	10	Door mirror heaters, mirror foldback.
5	5	Radio telephone.
6	10	Air conditioning.
7	20	Body processor module (column motor power).
8	5	Rear window switchpack, passenger door switchpack.
9	5	Passenger seat switchpack.

10	5	Radio telephone, rear courtesy lamp/map light.
11	20	Air conditioning right-hand blower relay.
12	5	In-car entertainment.
13	25	Right-hand rear door control module.
14	25	Cigar lighters.
15	25	Right-hand door control module.
16	-	Not used.
17	15	Sunroof.
18	25	Right-hand and left-hand seat heaters.



Heelboard Fuse Box - Left hand side

Fuse No	Rating (amps)	Circuit
1	20	Right-hand seat control module.
2	5	Rear window switchpack, driver door key barrel, driver door switchpack and memory.
3	5	Dimmer module.
4	5	Diagnostic connector.
5	15	Body processor module.
6	5	Centre console switchpack, reader exciter ECM
7	15	Body processor module (battery supply for solenoids, lamps and motors).
8	5	Steering column adjust switch, driver seat switchpack.
9	10	Radio/cassette head unit.
10	5	Airbag/SRS
11	20	Air conditioning left-hand blower motor.
12	10	Door mirror heaters relay, air conditioning, blower motor relays, power steering control module.
13	25	Left-hand rear window
14	10	Cruise control switch, instrument cluster, catalytic converter over temperature warning.
15	25	Left-hand door control module.
16	5	Electrochromic interior mirror (where fitted), centre console switchpack, gear selector, traction control switch illumination, J-gate mode switch illumination, pins A9 and D8 trunk fusebox.
17	10	Accessory supply.
18	5	Instrument cluster.

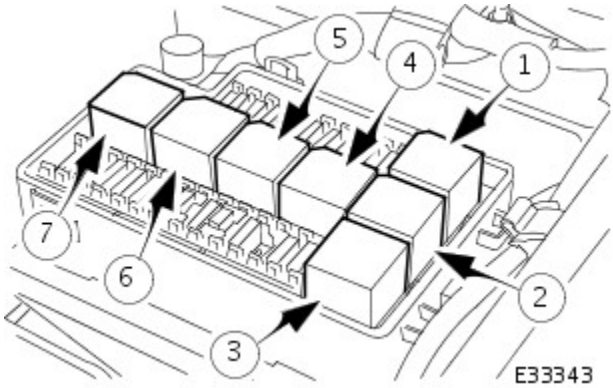


Trunk Fuse Box

Fuse	Rating	

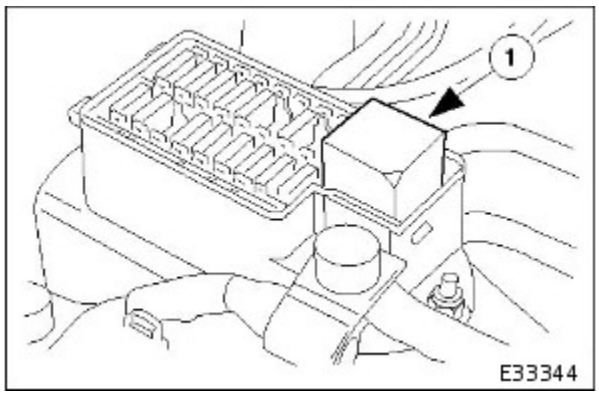
No	(amps)	Circuit
1	10	Security and locking control module (Reversing lamps, rear fog lamps, stop lamps, electrochromic mirror).
2	5	Fuel filler flap.
3	10	F16 left-hand heelboard (where fitted).
4	5	Diagnostic connector.
5	5	Right-hand and left-hand seat timer (rear).
6	-	Not used.
7	20	Fuel pump.
8	10	High mounted stop lamp, caravan/trailer stop lamps
9	10	Antenna motor.
10	10	Security and locking control module (trunk release, caravan/trailer direction indicators, fuel filler flap relay).
11	10	Accessory sockets.
12	15	In-car entertainment power amplifier.
13	-	Not used.
14	-	Not used.
15	20	Fuel pump (supercharger, where fitted).
16	20	Caravan/trailer connector.
17	25	Heated rear screen.
18	20	Rear seat movement.
19	5	Right-hand side lamps, left-hand and right-hand number plate lights, caravan/trailer.
20	20	Rear seat movement.
21	5	Left-hand side lamps, left-hand and right-hand sidemarker lights, caravan/trailer.
22	20	Rear seat heaters.

Relay Details



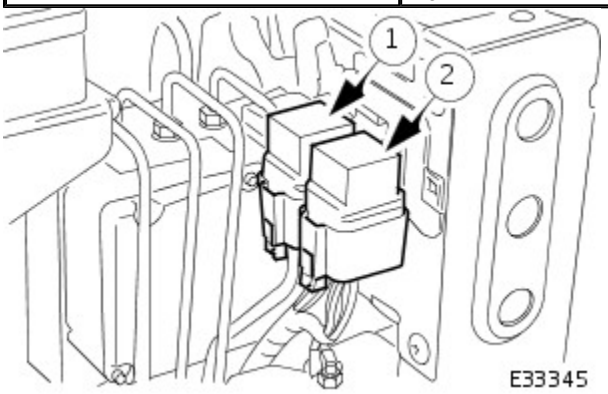
Engine Compartment Fuse Box Relays

Relay No	Color	Circuit
1	Brown	Air conditioning coolant pump
2	Brown	Front fog lamps
3	Brown	Headlamps - high beam
4	Brown	Headlamps - power wash pump (where fitted)
5	Brown	Headlamps - low beam
6	Brown	Horns
7	Brown	Ignition +



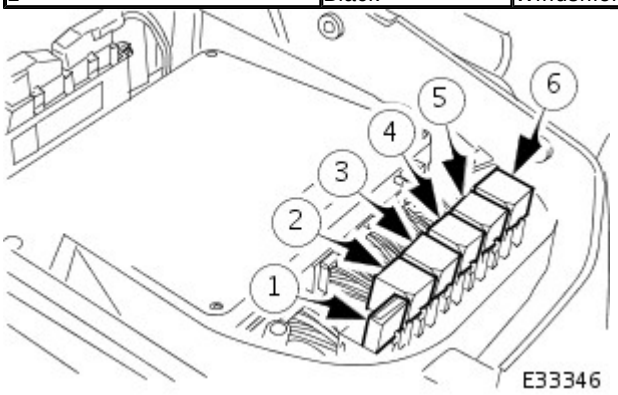
Engine Management Fuse Box Relay

Relay No	Color	Circuit
1	Brown	EMS control relay



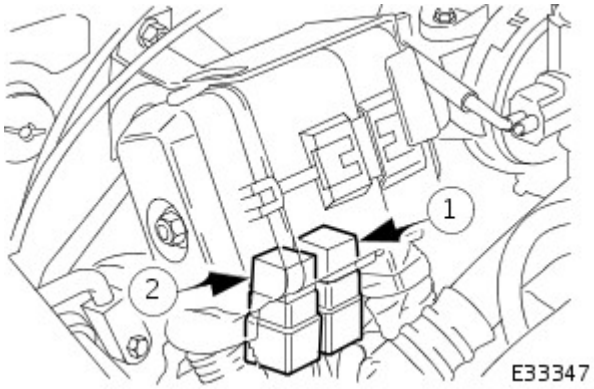
Engine Compartment - Front Relays

Relay No	Color	Circuit
1	Black	Windshield wiper fast/slow
2	Black	Windshield wiper on/off



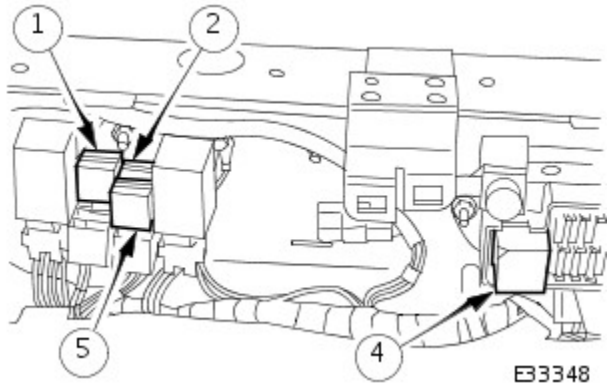
Engine and Transmission Control Module Compartment Relays

Relay No	Color	Circuit
1	Blue	SC coolant water pump
2	Brown	Fuel injection main
3	Brown	Ignition coils
4	Brown	Throttle motor
5	Brown	Starter solenoid
6	Brown	Air conditioning compressor clutch



Front Firewall Relays

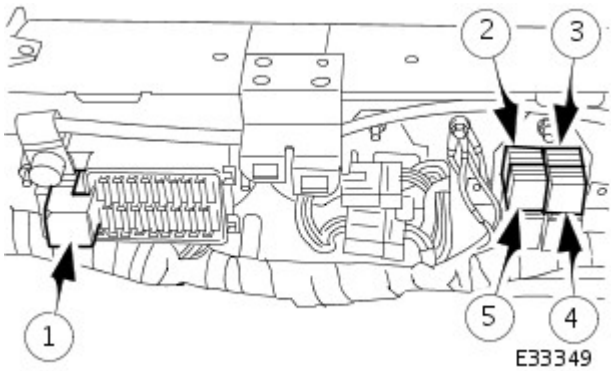
Relay No	Color	Circuit
1	Black	Windshield RH heater (where fitted)
2	Black	Windshield LH heater (where fitted)



Heelboard Fuse Box Relays - Right hand side

Relay No	Color	Circuit
1	Blue	Door mirror heater
2	Blue	Air conditioning RH blower
3	Blue	Left rear seat lumbar deflate (where fitted) *
4	Brown	Auxiliary +
5	Blue	Air conditioning LH blower

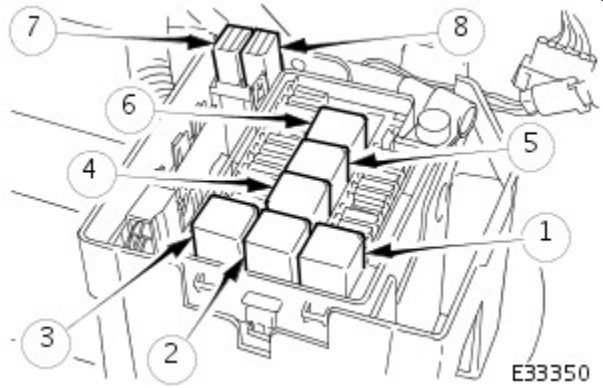
* not illustrated



Heelboard Fuse Box Relays - Left hand side

Relay No	Color	Circuit
1	Brown	Ignition +
2	Violet	Door mirror fold flat (where fitted)
3	Violet	Air conditioning isolate
4	Violet	Door locks

5	Violet	Door mirror fold out (where fitted)



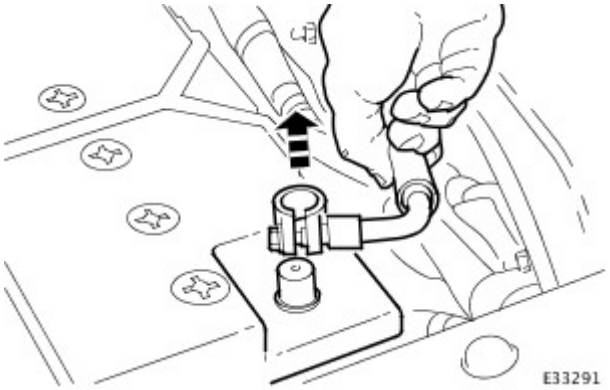
Trunk Fuse Box Relays

Relay No	Color	Circuit
1	Brown	Second fuel pump (SC models only)
2	Brown	Rear window defroster
3	Brown	Side marker, license plate and trailer rear lamps
4	Brown	Fuel pump
5	Brown	Stop lamps (HMSL and trailer only)
6	Violet	Accessory socket (where fitted)
7	Violet	Fuel filler flap lock
8	Violet	Fuel filler flap unlock

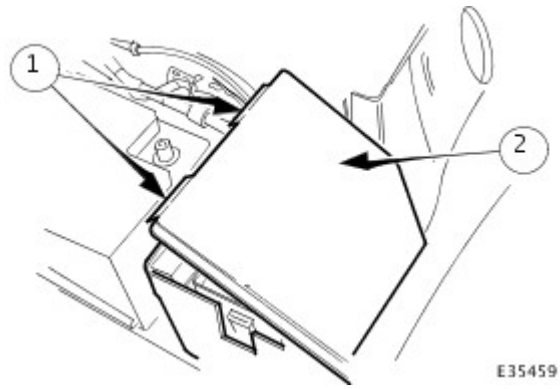
Module Communications Network - Battery Junction Box (BJB)

Removal and Installation

Removal

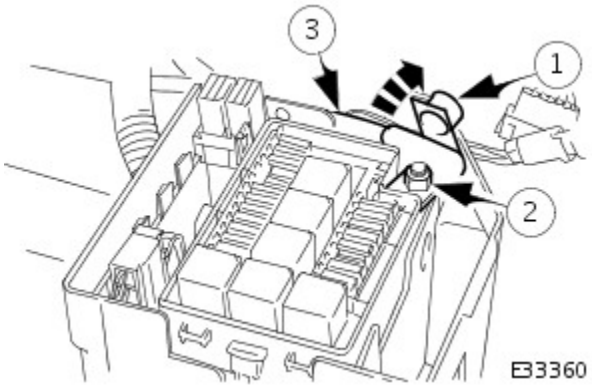


1. Disconnect battery ground cable; refer to 86.15.19.



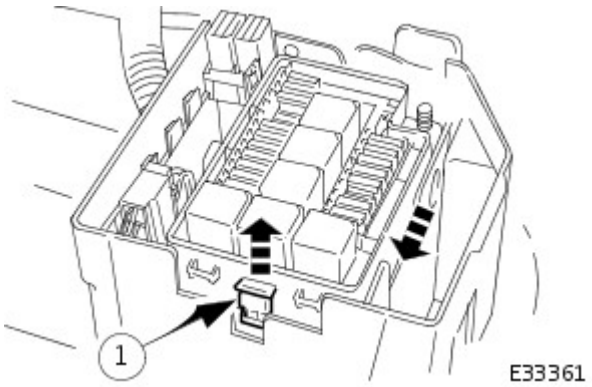
2. Remove cover from fuse box.

1. Release securing tangs.
2. Remove cover.



3. Remove positive supply power cable.

1. Displace cover.
2. Remove nut.
3. Disconnect cable.



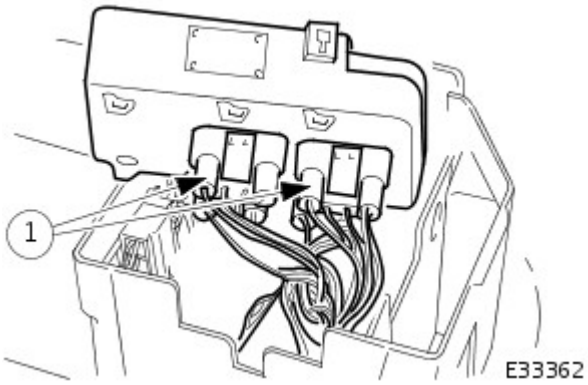
4. Displace fuse box from mounting panel for access.

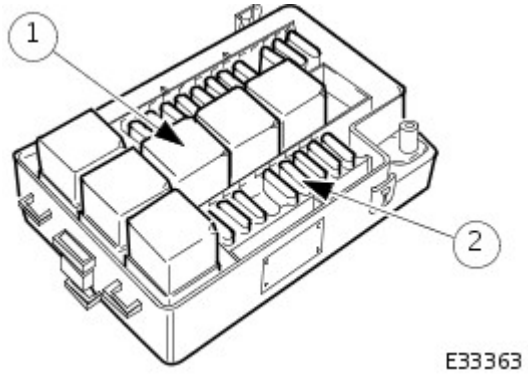
1. Release securing latch, upwards.

- Release fuse box from mounting panel by displacement towards spare wheel.

5. Remove fuse box.

1. Identify and disconnect harness connectors.





6. Remove fuses and relays.

1. Note position of each relay and remove them.
2. Identify each fuse and remove them.

- The value and position of each fuse is illustrated on the lid of the trunk compartment fuse box - for all fuse boxes on the vehicle.

Installation

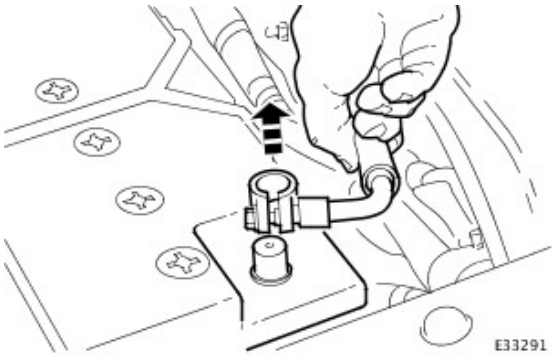
1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Module Communications Network - Central Junction Box (CJB)

Removal and Installation

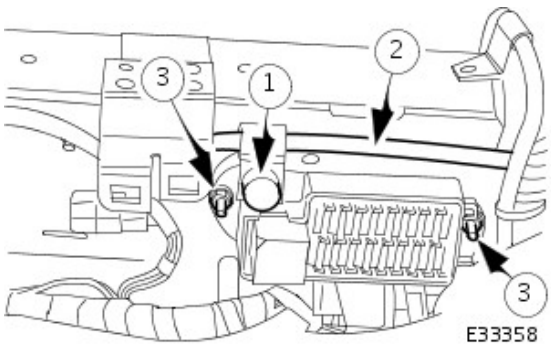
Removal



1. Disconnect battery ground cable; refer to 86.15.19.

2. Remove heelboard trim panel.

3. Remove positive supply power cable and displace fuse box.



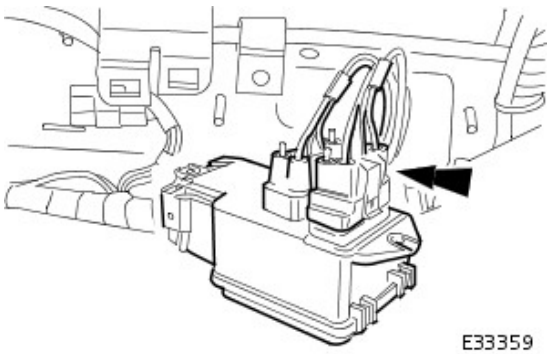
1. Displace cover.

- Remove nut which secures positive cable to fuse box.

2. Disconnect cable.

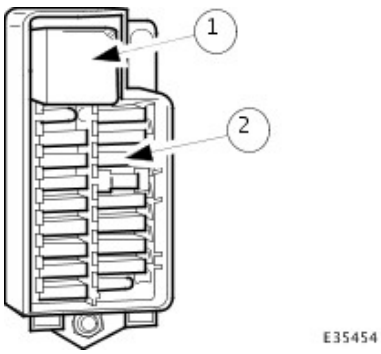
3. Remove nuts.

4. Remove fuse box.



- Identify and disconnect harness connectors.

5. Remove fuses and relay.



1. Remove relay.

2. Identify each fuse and remove them.

- The value and position of each fuse is illustrated on the lid of the trunk compartment fuse box - for all fuse boxes on the vehicle.

Installation

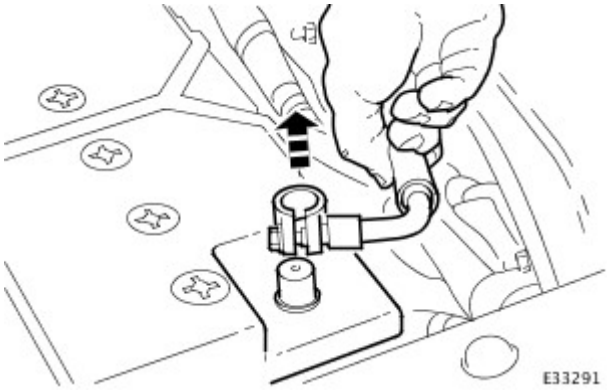
1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Module Communications Network - Front Auxiliary Junction Box

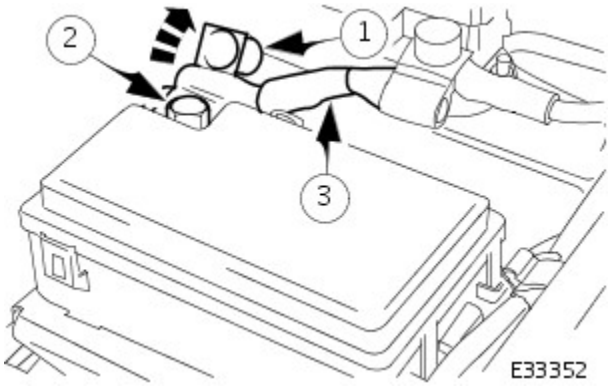
Removal and Installation

Removal



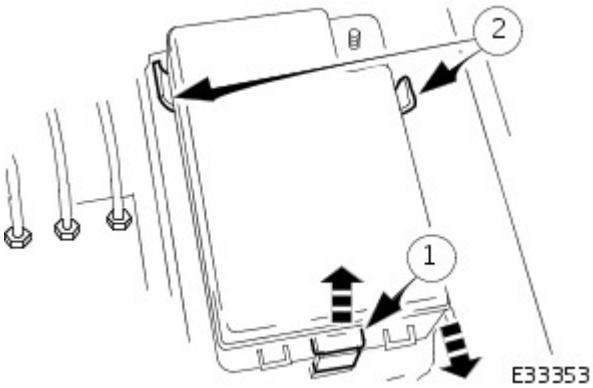
1. Disconnect battery ground cable; refer to 86.15.19.

2. Open bonnet and fit body paintwork protection sheets.



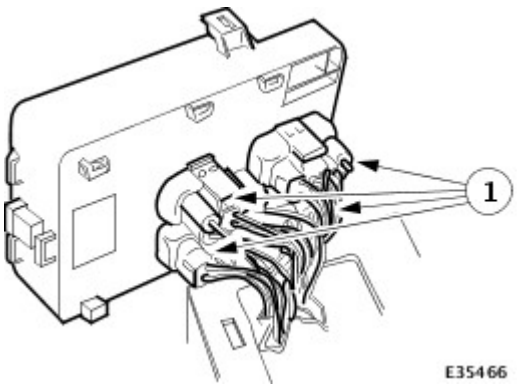
3. Remove positive supply power cable.

1. Displace cover.
2. Remove nut.
3. Disconnect cable.



4. Remove fuse box from mounting panel.

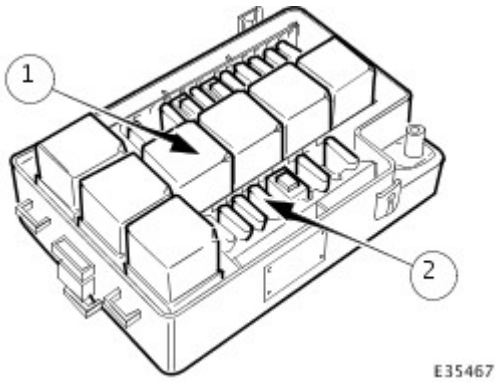
1. Release securing latch, upwards, displace fuse box outwards and remove from mounting panel.
2. Release securing tangs and remove cover.



5. Remove fuse box.

1. Identify and disconnect harness connectors.

6. Remove fuses and relays.



1. Note position of each relay and remove them.

2. Identify each fuse and remove them.

- The value and position of each fuse is illustrated on the lid of the trunk compartment fuse box - for all fuse boxes on the vehicle.

Installation

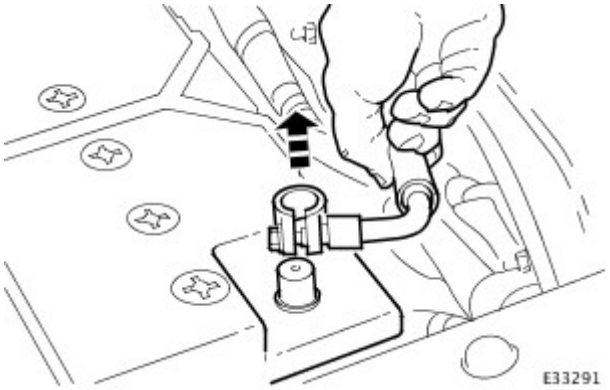
1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Module Communications Network - Rear Auxiliary Junction Box

Removal and Installation

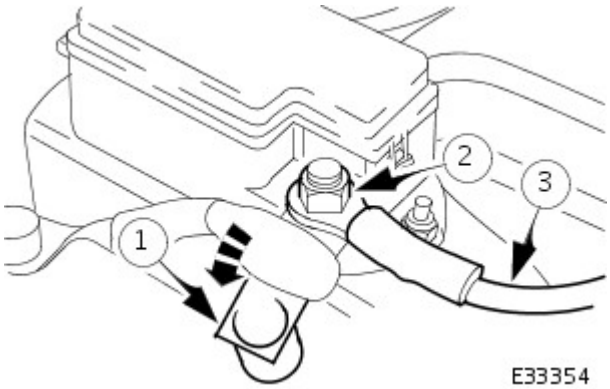
Removal



1. Disconnect battery ground cable; refer to 86.15.19.

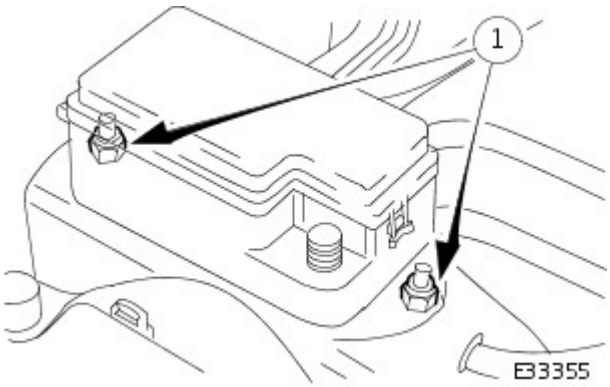
2. Open bonnet and fit body paintwork protection sheets.

3. Remove positive supply power cable.



1. Displace cover.
2. Remove nut.
3. Disconnect cable.

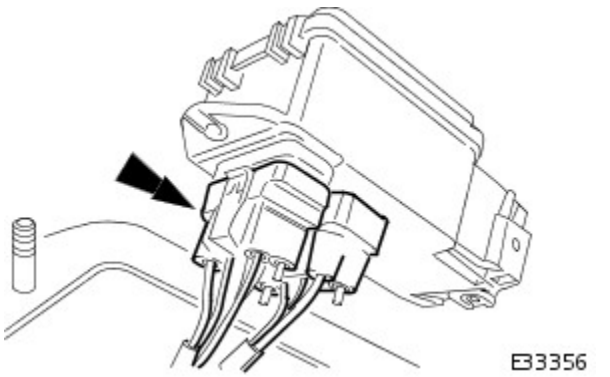
4. Remove fuse box from mounting panel.



1. Remove nuts.

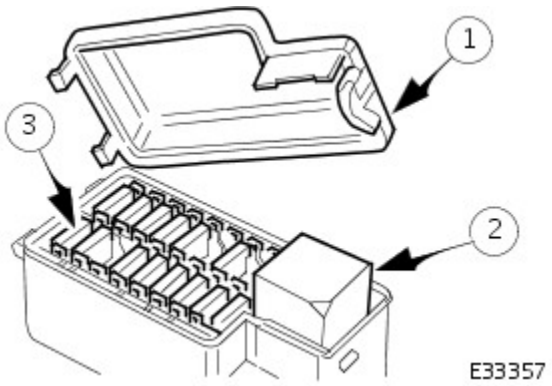
- Reposition fuse box for access to connectors.

5. Remove fuse box.



- Identify and disconnect harness connectors.

6. Remove fuses and relay.



1. Release securing tangs and remove cover.
2. Remove relay.
3. Identify each fuse and remove them.

- The value and position of each fuse is illustrated on the lid of the trunk compartment fuse box - for all fuse boxes on the vehicle.

Installation

1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Wiring Harnesses - Wiring Harness

Description and Operation

Introduction

CAUTION: Do **not** use any other heat shrink sleeve other than the approved glue lined heat shrink sleeve mentioned in the repair procedure.

The purpose of this document is to promote quick and efficient minor repair to harness connectors or cables using approved methods and the wiring harness repair kit. Repairs may only be made to cables and connectors which have been mechanically, **not electrically** damaged. It also applies where the whole extent of the damage can be clearly identified and rectified.

Care and neatness are essential requirements in making a perfect repair.

Caution:

At the time of this first issue of the Harness Repair Guide, do not approve repairs to any of the following circuits:

- Any media orientated system transport network harnesses.
- Supplement restraint system (SRS) firing circuits (Air bags).
- Link lead assembles, which are unique to safety critical circuits such as anti-lock brake system (ABS) and thermocouple circuits. An example of this is the ABS wheel speed sensors with moulded connectors.
- 4. Screened cables, leads and wiring harness(s).

If any harness(s) with defective electrical connector terminals or wires from the above circuits are a concern, new components must be installed.

Repair Kit

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

The wiring harness repair kit has been produced which comprises:

- Pre-terminated wiring harness(s) of different sizes and types
- Three sizes of butt splice connectors
- A selection of colored cable identification sleeves
- Two sizes of glue lined heat shrink sleeves
- Crimping pliers
- A wire cutter and insulation stripper
- An electrical connector terminal extraction handle and tips

A suitable heat source, for shrinking heat shrink sleeves will be required.

The pre-insulated diamond grip range of electrical connector terminals and in-line, butt splice connectors contained within the wiring harness repair kit are the **only** acceptable product for the repairs of wiring harnesses. The butt connectors not only grip the wire but also the insulation, making a very secure joint.

If an electrical connector terminal is not included in the wiring harness repair kit then approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

Pre-Terminated Wiring Harness(s) and Butt Splice Connectors

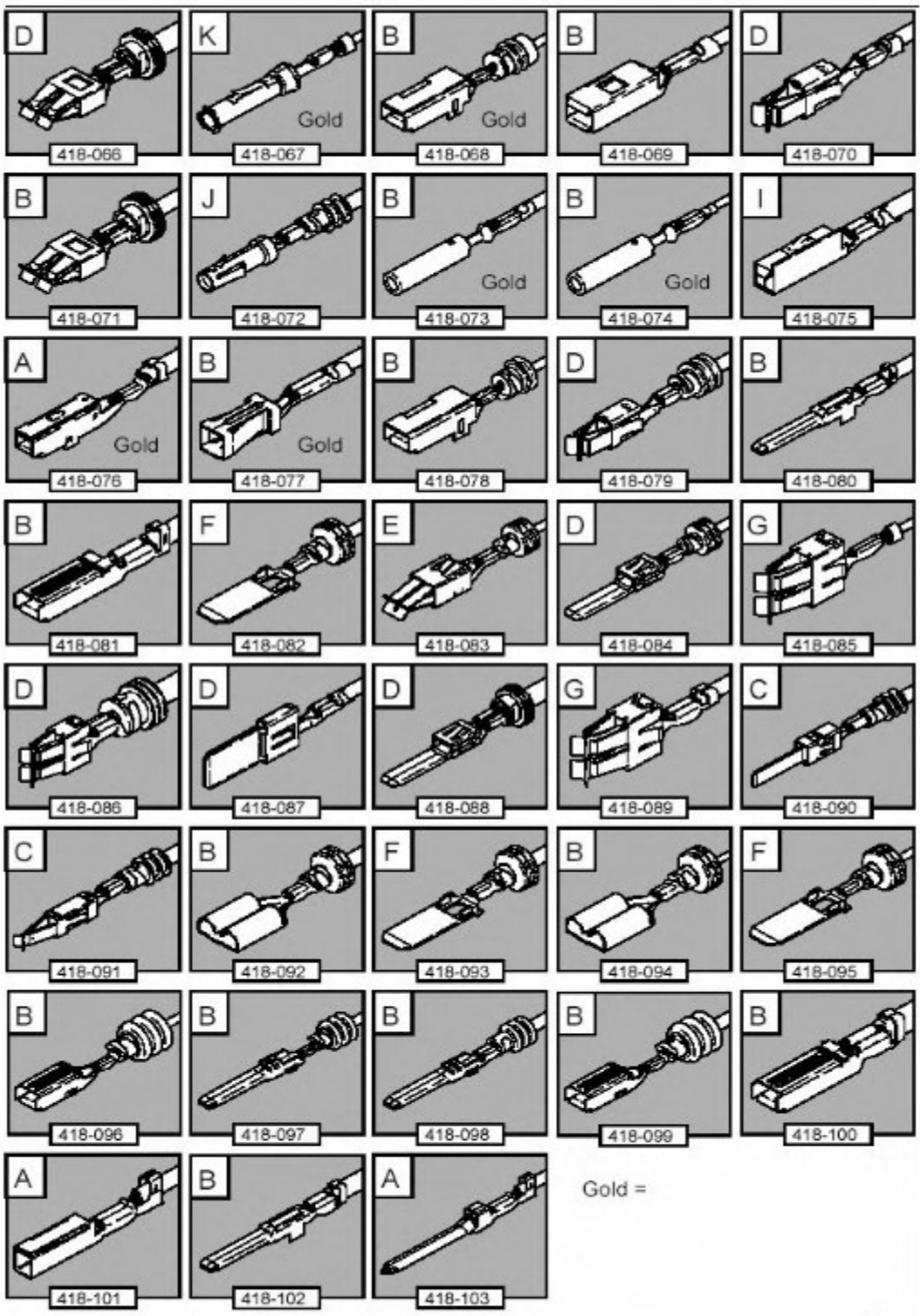
All pre-terminated wiring harness(s) and butt splice connectors in the wiring harness repair kit are contained in bags which can be resealed after use. Each bag is marked with the part number of the items stored within the bag. Each storage compartment in the wiring harness repair kit is identified with the corresponding part number. Make sure that pre-terminated wiring harness(s) and connectors are not mixed up it is advisable to only open one bag at a time and to reseal

the bag securely before opening another bag. Also, replace the bag in its mating part number compartment within the case.

The pre-terminated wiring harness(s) are supplied with the insulation in one of three colors, red, blue or yellow. The colors do not apply to any particular circuit but to the harness wire size. See the Relationship Table in the Repair Method section.

Butt splice connectors are also supplied with red, blue or yellow coverings, which must be matched to the pre-terminated wiring harness insulation color.

Pre-Terminated Wiring Harness(s)



E130741

The illustration shows:

- The pre-terminated wiring harness(s) which are included in the wiring harness repair kit

- The part number of the pre-terminated wiring harness
- The letter showing the extractor tip which must be used to remove this type of electrical connector terminal
- Those electrical connector terminals which are gold

Some of the pre-terminated wiring harness(s) have seals installed to the insulation for sealed connector applications. It is essential for prevention of moisture ingress that a sealed pre-terminated wiring harness must be used where a sealed terminal was removed.

CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Two sizes of heat shrink sleeving are supplied in the wiring harness repair kit. Each heat shrink sleeve contains a sealant glue. These must be used when connecting wiring harness(s) or electrical connector terminal(s) at all times. The smaller diameter heat shrink sleeve is to be used with the red and blue butt splice connectors and the larger diameter sleeve with the yellow butt splice connectors.

For ease and speed, some of the pre-terminated wiring harness(s) may already have the insulation partly stripped at the splice end. If the repair requires insulation to be stripped from the cable, refer to the Relationship Table for the correct length of insulation to be stripped.

The Pre-Terminated Wiring Harness(s) illustration shows the electrical connector terminal type, the part number of the pre-terminated wiring harness and the letter of the extractor tip which must be used to extract the electrical connector terminal from the connector housing. Additionally, those electrical connector terminal(s) which are gold are identified, all others are therefore, tinned and not gold.

Wiring Harness Cable Identification Sleeves

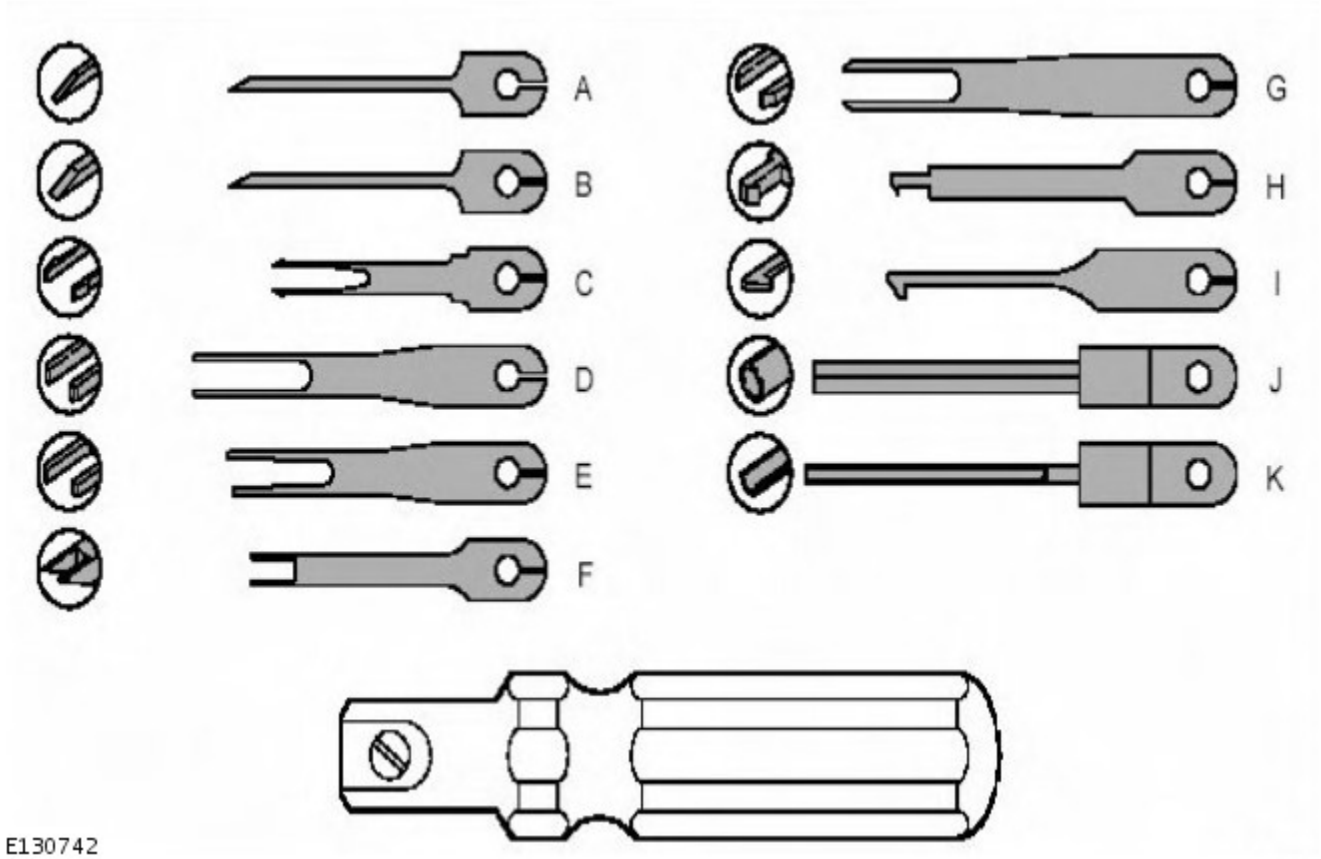
A selection of colored sleeves are contained in the wiring harness repair kit for maintaining the wiring harness cable identification on the pre-terminated wiring harness. Place the correct colored sleeve(s) over the pre-terminated wiring harness insulation as near to the electrical connector as possible with the main wiring harness cable color nearest to the electrical connector.

For example, if the original wiring harness cable color is pink with a black trace put the pink wiring harness cable identification sleeve on the pre-terminated wiring harness first followed by a black sleeve, and slide both along the wiring harness cable to the electrical connector terminal.

Extraction Handle and Tips

The extraction handle, in conjunction with the correct tip, is used to remove a terminal from an electrical connector. Each tip contained in the wiring harness repair kit is marked with an identification letter, A to K inclusive. Each tip has been specially designed to extract a particular type of electrical connector terminal. The use of any other tool is **not** recommended and is liable to cause damage to the electrical connector. The tip is fastened to the handle by a screw which holds the tip firmly yet allows it to be easily replaced.

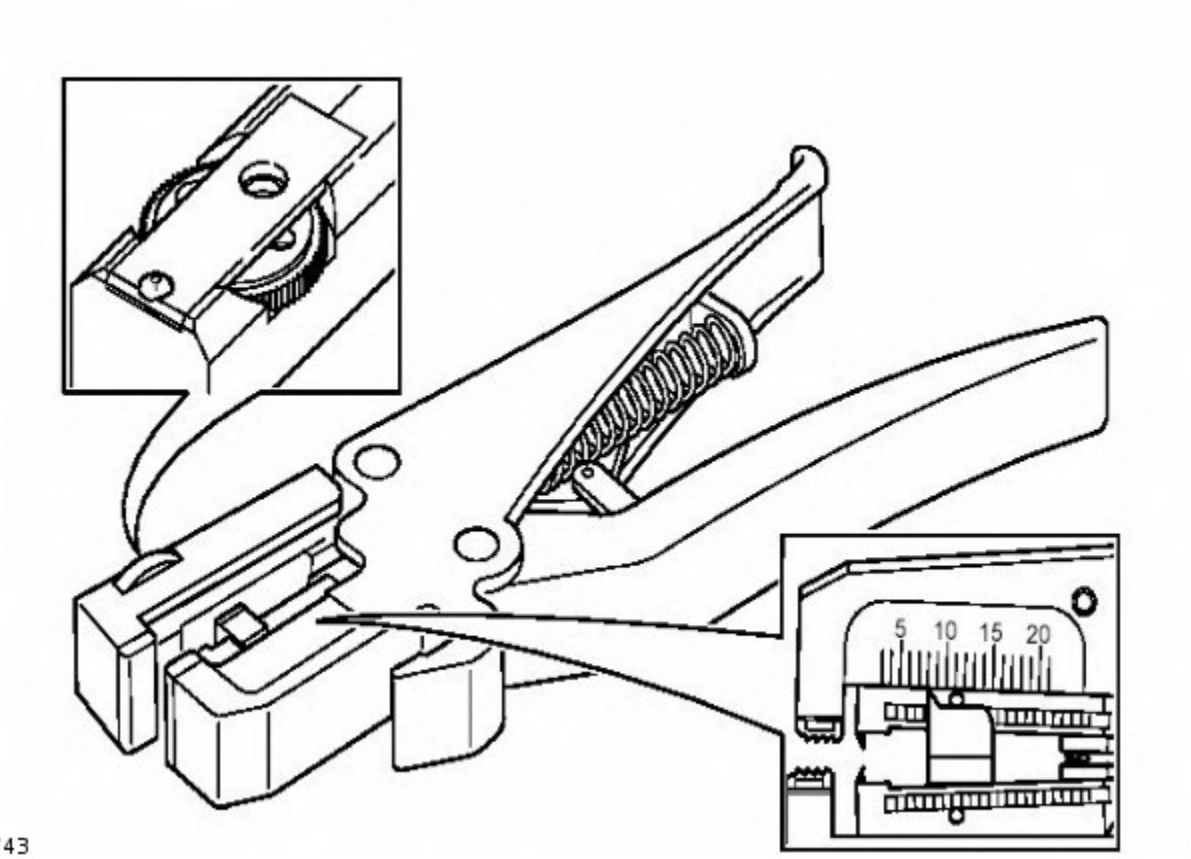
Extraction Handle and Tips



Insulation Stripper

The moving jaw has an adjuster wheel which has a series of holes in it. Turning the wheel and placing the cable in the matching size hole will automatically adjust the jaw to the correct pressure. Note that some wiring harness(s) may have a harder insulation and slight adjustment of the wheel may be needed to make a clean strip but exercise care not to damage the wire.

Insulation Stripper

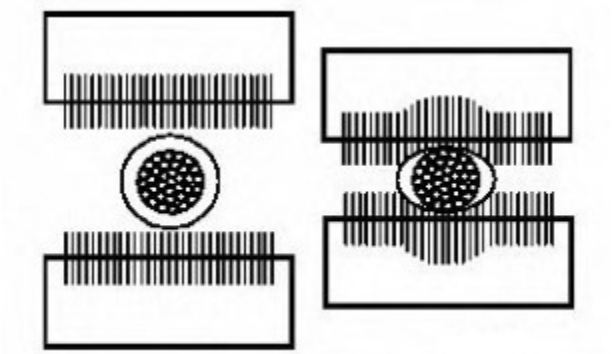


E130743

By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the pre-terminated wiring harness or wiring harness wire. The adjuster has a position indicator to align with a graduated scale and this sets the correct length in millimetres, of insulation to be stripped. The amount of insulation to be stripped is shown in the Relationship Table.

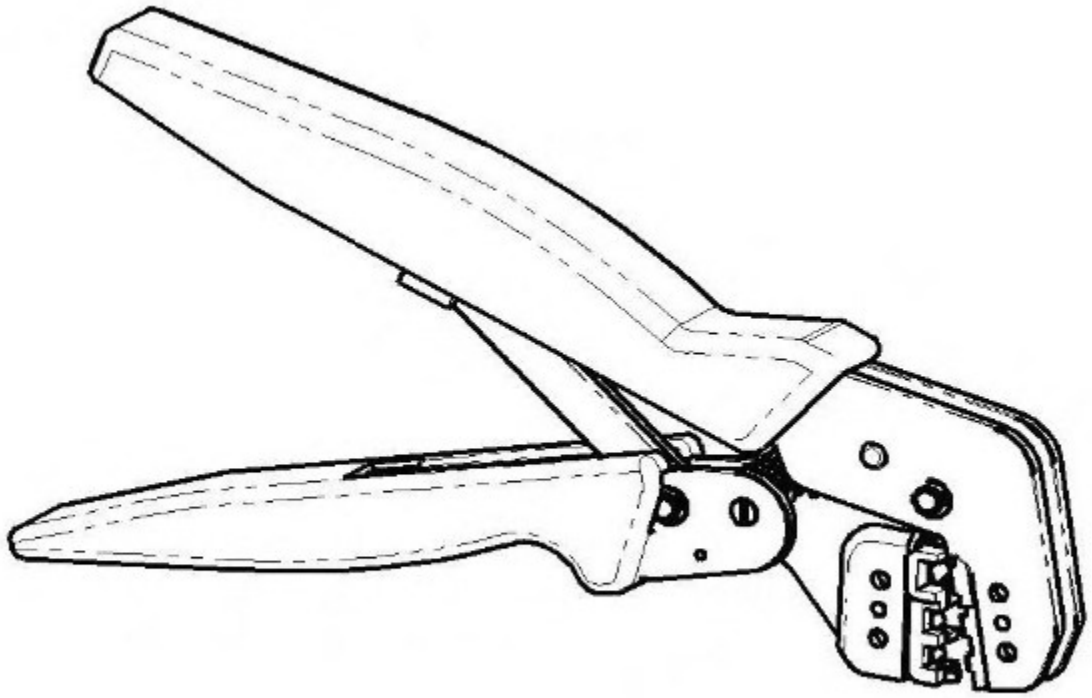
The illustration shows the insulation stripper tool and a wiring harness correctly gripped in the jaws. A wire cutter is provided on the outer side of the fixed jaw.

Cable Correctly Gripped in Stripper Blades


E130744

Crimping Pliers

Crimping Pliers



E130745

The crimping pliers have a moving jaw and a stationary jaw, with three different sized crimping enclosures. Each of the enclosures is identified by a red, blue or yellow coloured dot which corresponds to the three colours of the pre-terminated wiring harness(s) and butt splice connector colors.

List of Parts

Description	Part Number	Quantity
Wiring Harness Repair Kit	418-S065	1
Pre-Terminated Wiring Harness(s)	418-066 to 418-103 inclusive	10 each
Glue Lined Heat Shrink Pack – small diameter	418-104	25 per pack
Glue Lined Heat Shrink Pack – larger diameter	418-105	10 per pack
Case Assembly Comprising – carry case, lid, inner lid, base, insert, trays foam spacers	418-106	1
Butt Splice Connector – Red	418-107	50 per pack
Butt Splice Connector – Blue	418-108	50 per pack
Butt Splice Connector – Yellow	418-109	20 per pack
Extraction Tool Handle	418-110	1
Extraction Tip Pack consists of 2 spare screws plus	418-S111	1
Tip A	418-118	1
Tip B	418-119	1
Tip C	418-120	1
Tip D	418-121	1
Tip E	418-122	1
Tip F	418-123	1

Tip G	418-124	1
Tip H	418-125	1
Tip I	418-126	1
Tip J	418-127	1
Tip K	418-128	1
Sleeve Identification Pack – for Red insulation	418-112	500
Sleeve Identification Pack – for Blue insulation	418-113	500
Sleeve Identification Pack – for Yellow insulation	418-114	500
Instruction Manual	JTP 593	1
Crimping Pliers	YRW500010	1
Wire Stripping Tool	418-117	1

Items can be ordered from:

SPX United Kingdom Limited

Ironstone Way

Brixworth

Northants

NN6 9UD

United Kingdom

Telephone: +44 (0) 1327 704461

Fax: +44 (0) 1327 706632

Repair Methods

CAUTION: **Several different types and sizes of terminal may be found in a single electrical connector housing.**

It is necessary to identify:

- The conductor (wire) size of the affected wiring harness
- The electrical connector range from which the damaged wiring harness is to be removed
- The terminal type

Use of the approved diagnostic tool will greatly assist in the quick identification of electrical connectors and faulty pin terminal(s).

Reference can also be made to the vehicle Electrical Guides, held by Dealers, to identify wiring harness(s) and electrical connector(s).

By using the Relationship Table, the wiring harness conductor (wire) size can be related to a suitable pre-terminated wiring harness by the color of the insulation. Also, the correct length of insulation to be stripped from the wiring harness lead is identified.

Relationship Table

CABLE RANGE	SPLICE	STRIP LENGTH
0.35 mm² to 1.50 mm²	RED	6.00 to 7.00 mm
1.00 mm² to 2.50 mm²	BLUE	6.00 to 7.00 mm
4.00 mm² to 6.00 mm²	YELLOW	9.00 to 9.50 mm

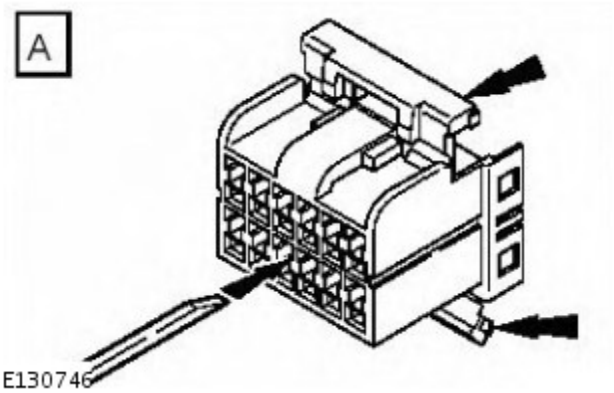
Electrical Connector Terminal Extraction

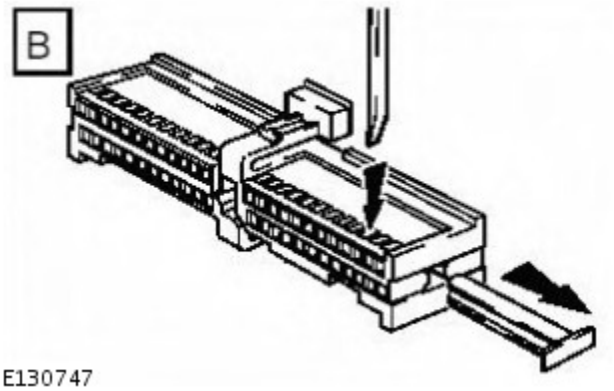
It must be noted that some electrical connector(s) have anti-backout devices which prevent the terminals from being removed from the electrical connector. Some examples of these are shown in following illustrations. The anti-backout device must be released before attempting to remove the terminal from the electrical connector. Some anti-backout devices require a special tip to release the device and these have been included in the kit. Most can be released by carefully using a suitable small screwdriver.

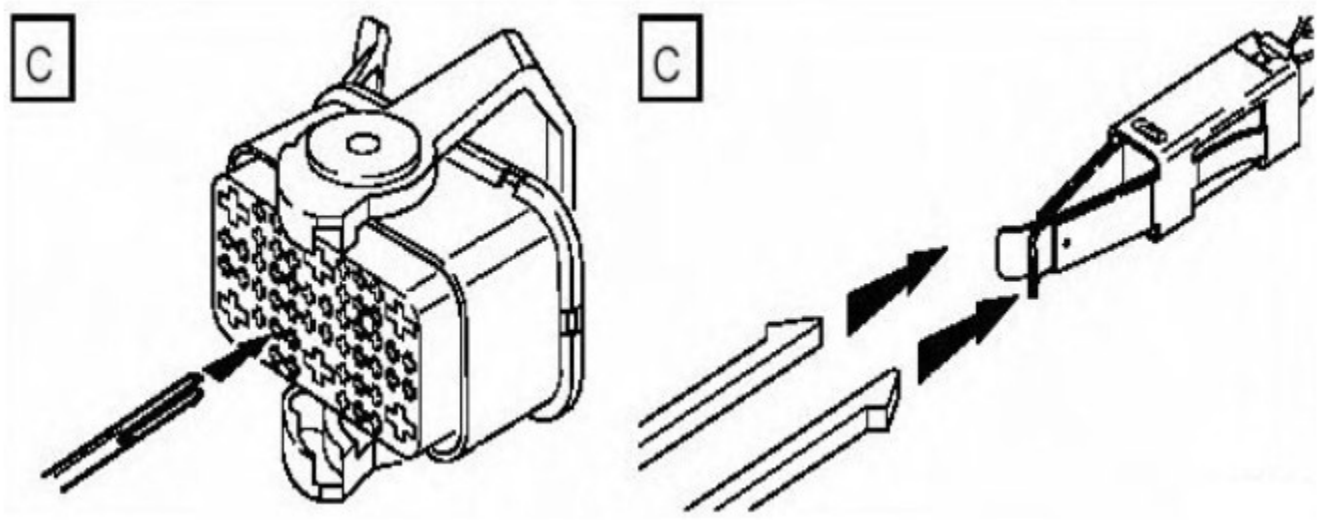
Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

The illustrations show examples of each tip used on different types of electrical connector(s). There are a large number of different types of electrical connector used on vehicles therefore only one example using each tip is shown. Technicians experience and judgement will dictate which type of tip should be used for those electrical connector(s) which are not shown. Care should be exercised to avoid further damage when removing the terminals from the electrical connector.

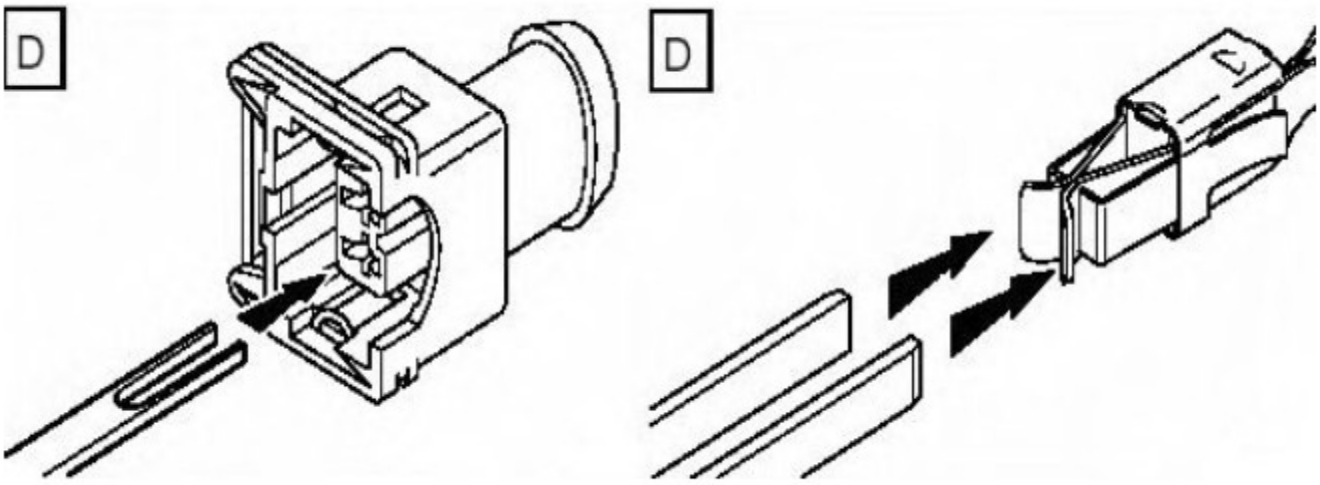
• NOTE: **Examples of the extraction tips and anti-backout tips.**



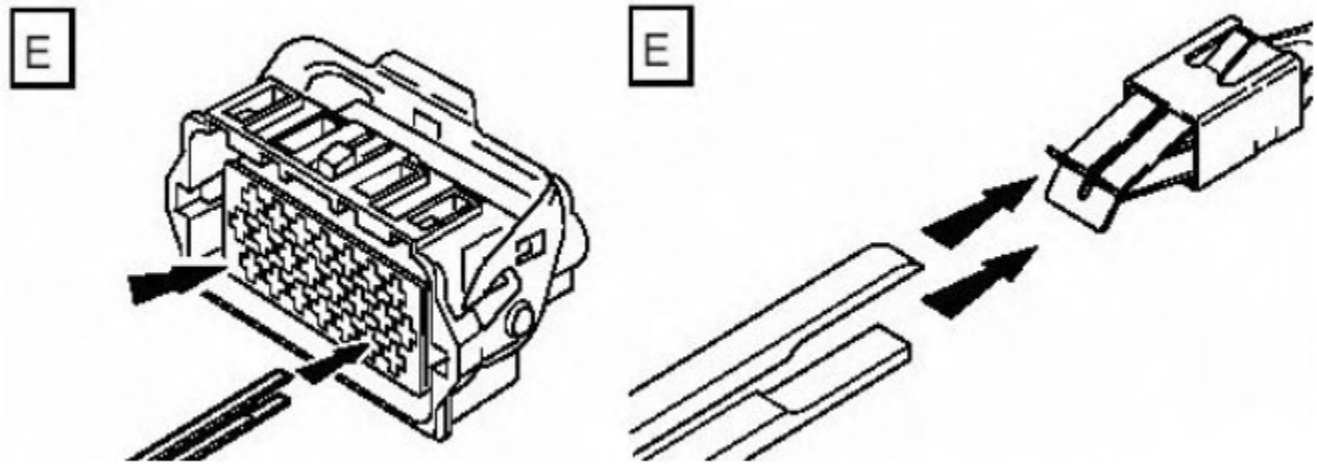




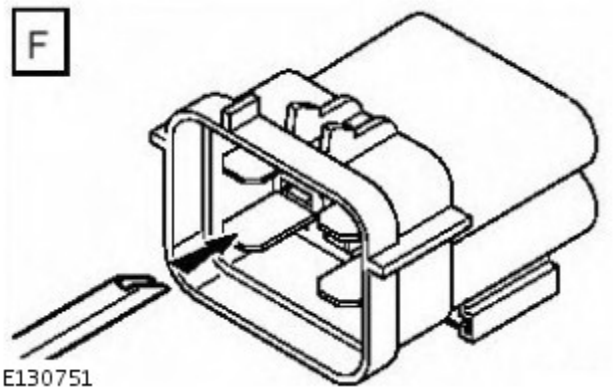
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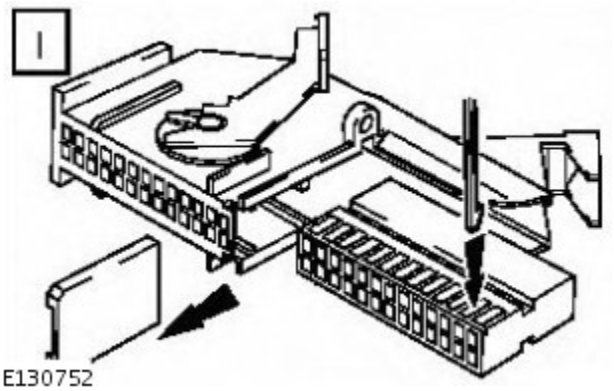
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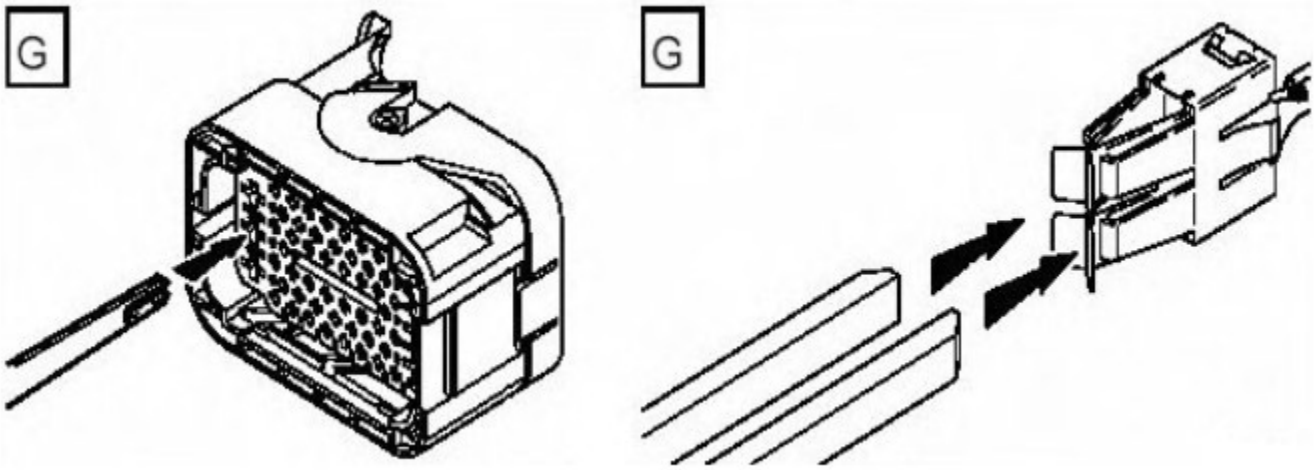
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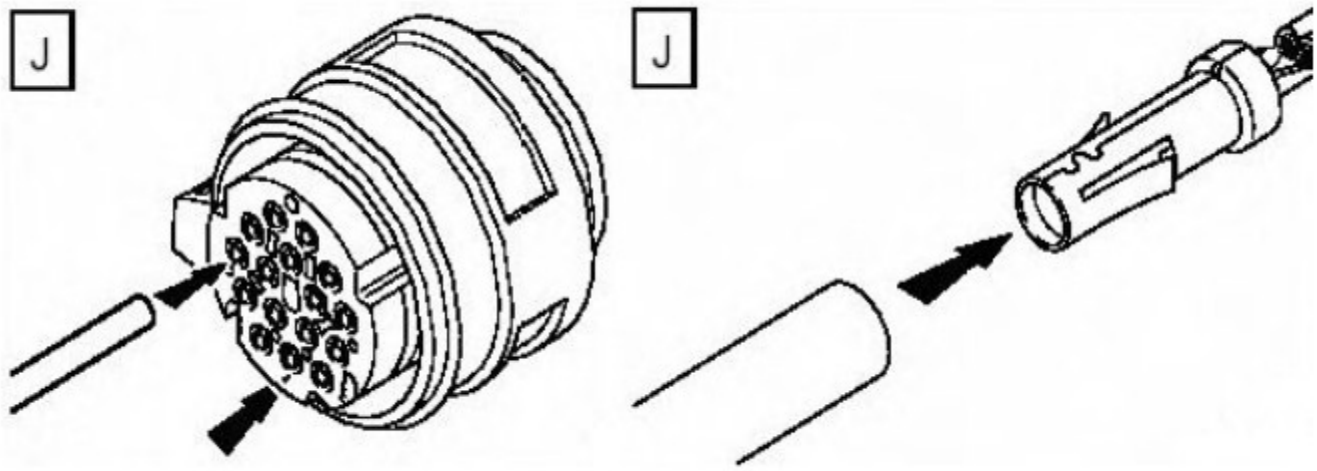
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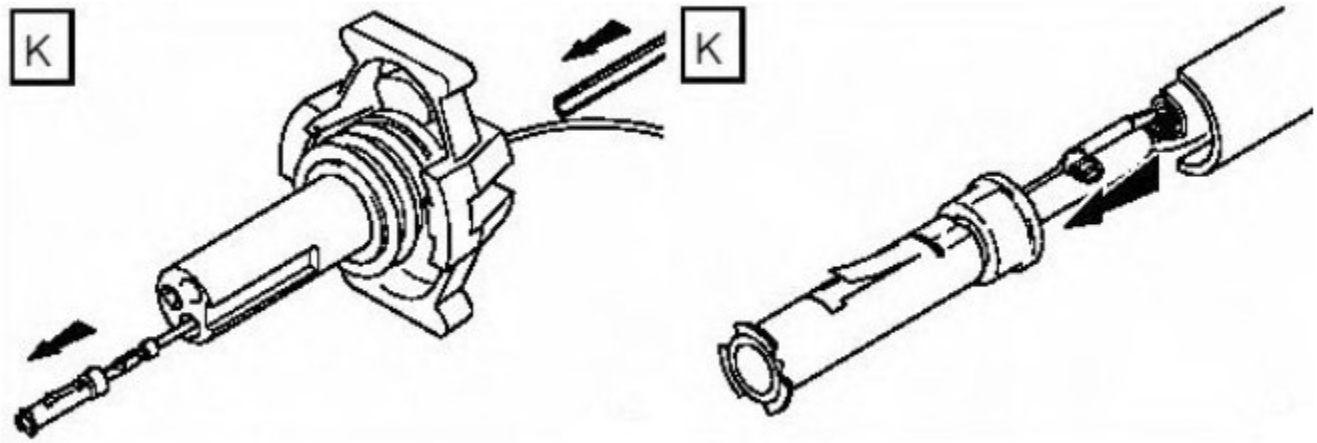
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E130754



E130755

• NOTE: The chart shows the electrical connector types, terminal pins/sockets, extractor tip and anti-backout tip.

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Mulitlock 040 series	D	A	
Mulitlock 040 series	B	A	
Mulitlock 070 series	B	B	
Mulitlock 040 series	D	B	
Econoseal III 070 series	D	B	
Econoseal III 070 series	B	B	
Econoseal III 070 series	B	B	
Econoseal III J2	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Micro-timer II 1.5mm	D	C	
Micro-timer II 1.5mm	B	C	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Std power timer 5.8 flat	B	D	
Std power timer 2.8 flat	D	D	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Ford 2.8 flat	D	E	H
Mulitlock 070 series	D	B	
Mulitlock 070 series	B	B	
Junior power timer 2.8 flat	D	D	
Sumitomo TS90 connector	B	B	H
Modu IV gold plated	D	B	
Mulitlock 040 series gold plated	D	A	
Micro qualock	D	I	
EECV	D	B	
EECV	D	B	
Kostal dia 1.50 series	D	J	
AMP 6.3 flat	D	B	
Junior power timer 2.8 flat	D	D	
2.8 series	D	B	I
Sumitomo TS90 connector	D	B	H
Ducon 0.60 gold plated	D	K	

AMP 6.3 flat	D	D	
Econoseal III 250 series	B	F	

Repair Procedure

• CAUTIONS:

 Do not use crimping pliers, insulation strippers, butt splice connectors, heat shrink sleeves or pre-terminated wiring harness(s) that are not supplied with the Jaguar wiring harness repair kit. Each part has been designed to be used only with the other parts in this wiring harness repair kit.

 Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

It is not correct to make more than five repair joints on the wiring harness to any electrical connector and if more damage is found at the same electrical connector then a new wiring harness must be installed.

- Remove the faulty terminal from the electrical connector using the extractor tool and correct tip. Make sure that any anti-backout device is released before trying to remove the terminal.
- CAUTION: : A number of electrical connector terminals are gold plated or gold flashed. When defective, they must be installed with a gold pre-terminated wiring harness(s) from the wiring harness repair kit. It is not always easy to identify the female as gold but the male pins are visually easier, therefore always check both male and female terminals to identify those which are gold. Under no circumstances are gold and tin terminals to be mixed as this will lead to early failure of the electrical contact.

  • NOTE: Never use a harness lead with a smaller diameter than the original harness lead.

  Select the correct size and type of pre-terminated wiring harness and butt splice connector from the wiring harness repair kit.
- Using the wire cutter on the stripping tool, cut the pre-terminated wiring harness and the harness cable to the required length.
- • NOTE: See illustration: **Stripping Insulation**

  From the Relationship Table, find the correct length of insulation to be stripped from the pre-terminated wiring harness and set the adjustable cable length stop to the correct length. Place the pre-terminated wiring harness in the wire stripper and remove the insulation.
- Put the cable identification sleeve(s) on to the wiring harness with the main cable colour nearest to the terminal.
- During this next step do not overtighten. Place the selected butt splice connector in the crimping tool, matching the aperture and the butt connector colours. Make sure that the window indentation in the butt connector is resting over the guide bar on the lower jaw. Partially close the grip until the butt connector is securely held in the aperture. This will give support to the butt connector while the pre-terminated wiring harness is inserted into it.
- • NOTE: See illustration: **Spice Correctly Located**

  Insert the pre-terminated wiring harness into the butt connector and make sure that the wire is against the wire stop. Close the grip firmly, crimping the lead to the butt connector. When the handles have been completely closed the butt connector will be freed from the tool as the handles are released. If the handles have not been completely closed then the jaws will hold the butt connector and it cannot be removed from the tool until the crimp is fully made by closing the handles completely.
- Make sure that the harness cable has been squarely cut and the correct length of insulation removed. If more than one splice is needed the butt connectors must be not be crimped to the wiring harness at the same distance from the connector. The splices must be staggered to prevent a bulk of splices in the same area of the wiring harness.
- It is preferable to cover the butt splice joint with heat shrink sleeve. This is desirable not essential, except where the electrical connector is a sealed electrical connector. Use the smaller diameter sleeve for red and blue pre-terminated wiring harness(s) and the large diameter sleeve for the yellow pre-terminated wiring harness(s). It is advisable to place the heat shrink over the completed joint but in some instances the sleeve will not pass over the terminal. Check, and if required, place the correct size sleeve onto the harness cable or pre-terminated wiring harness before crimping the butt splice to the wiring harness.
- Place the harness cable into the butt splice with the splice window over the guide bar. Make sure that the cable harness wire is against the stop in the butt splice, crimp the butt splice connector to the wiring harness.
- Gently pull the harness cables each side of the butt splice to make sure that a secure joint has been made.

- WARNING: Do not use a naked flame in areas where fuel or oil have been spilt. Clean the area of residual oil and fuel and wait until the fuel spill has fully evaporated.

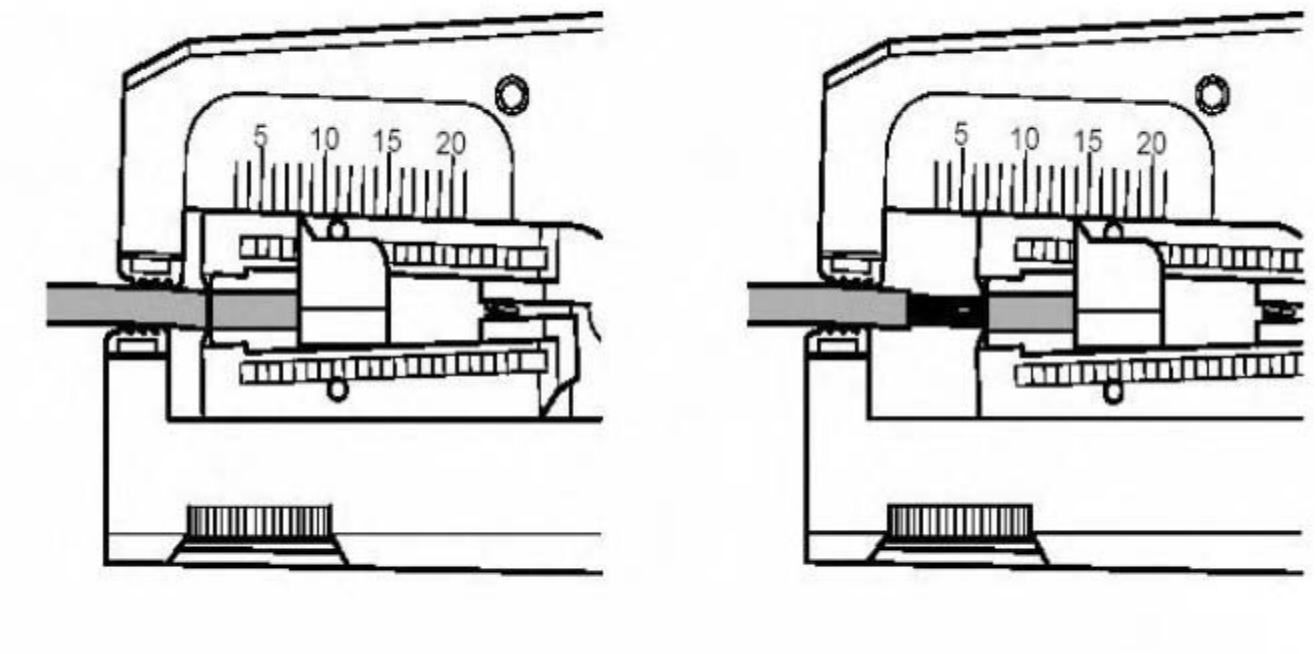
  • CAUTIONS:

  When using a heat source make sure that it is localised and causes no damage to surrounding materials.

  Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

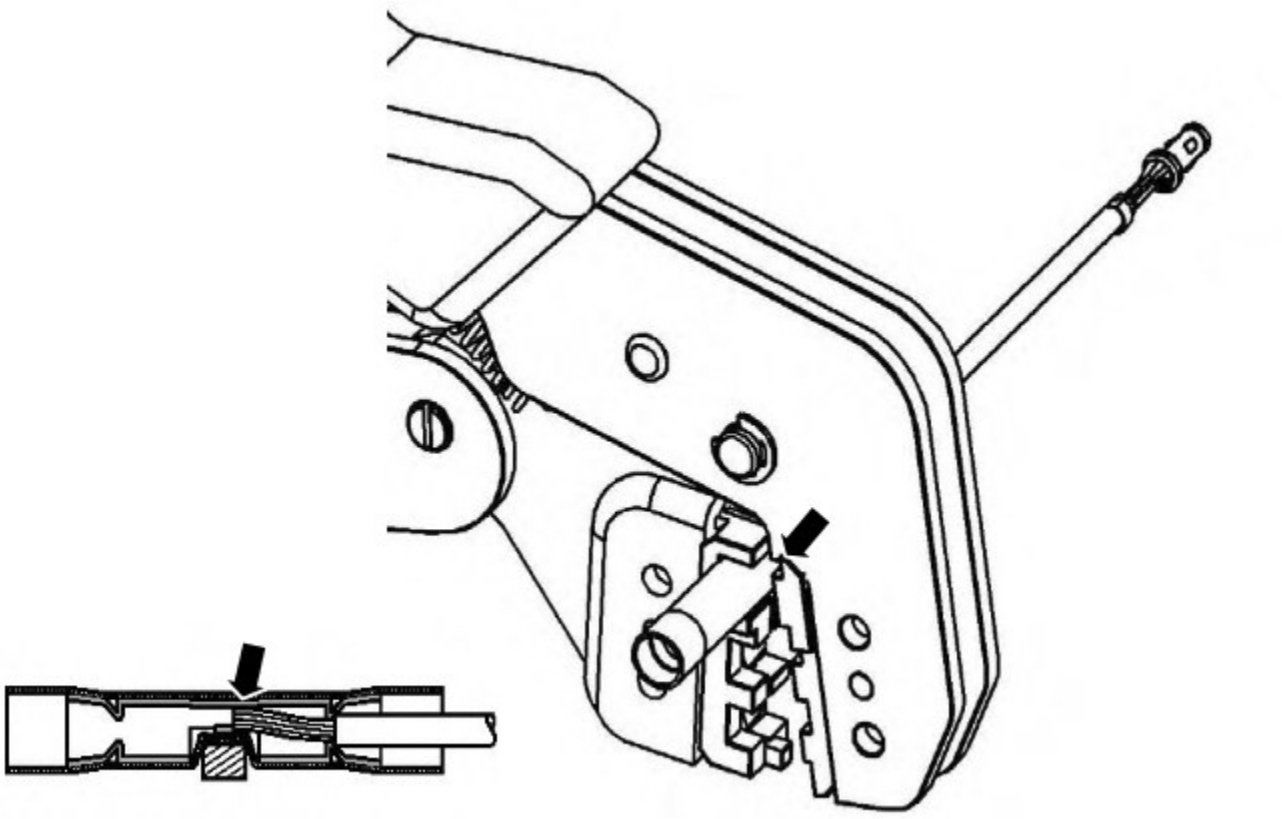
  Using a suitable heat source, shrink the sleeve over the butt splice.
- If further pre-terminated wiring harness(s) are to be installed to the same electrical connector, make sure that the lead is cut at a different length to the previous joint. This makes sure that the splices will, where possible, be staggered on the wiring harness and prevent a bulk of splices in one area.
- When all of the splices have been made, fit the terminal(s) to the electrical connector, taking care that the terminals are correctly orientated.
- Install the wiring harness cover and secure with adhesive electrical tape. Do not cover the wiring harness right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

Stripping Insulation



E130756

Spice Correctly Located



E130757

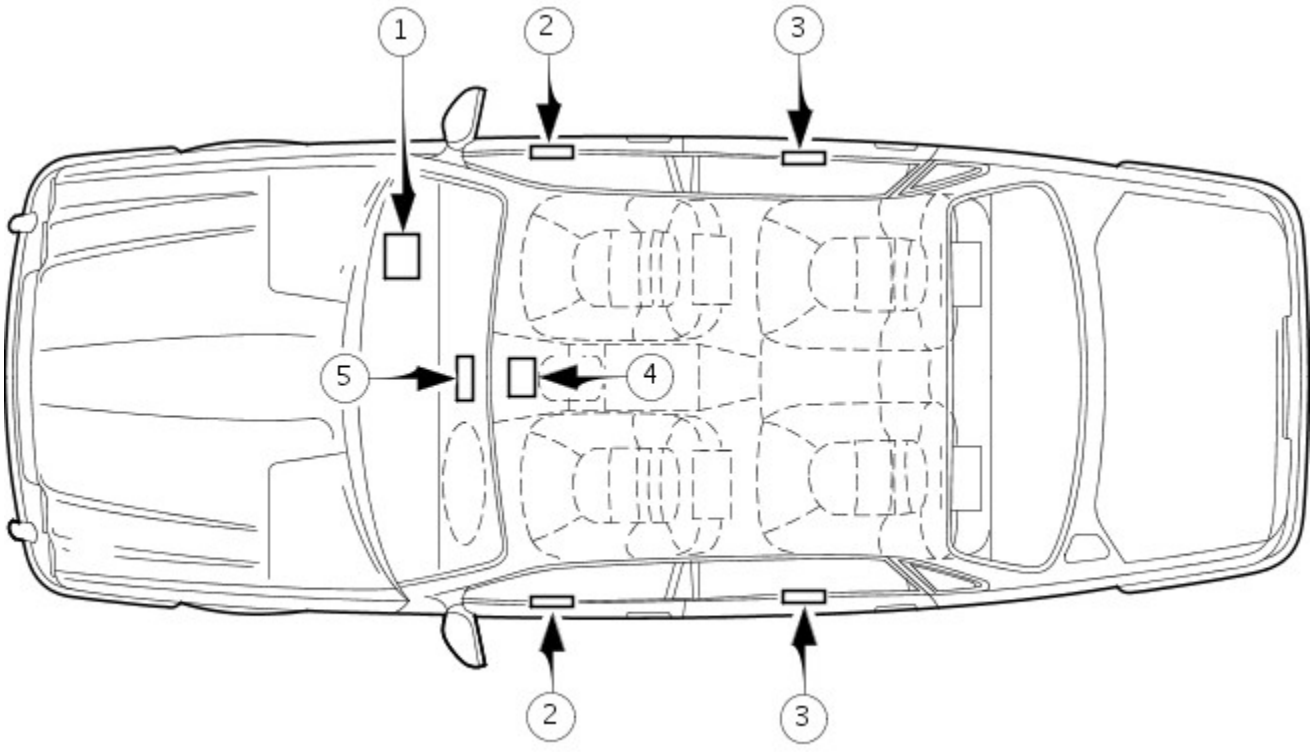
Wiring Harnesses - Wiring Harness Repair

General Procedures

1. For additional information, refer to: Wiring Harness (418-02 Wiring Harnesses, Description and Operation).

Multifunction Electronic Modules - Module Controlled Functions

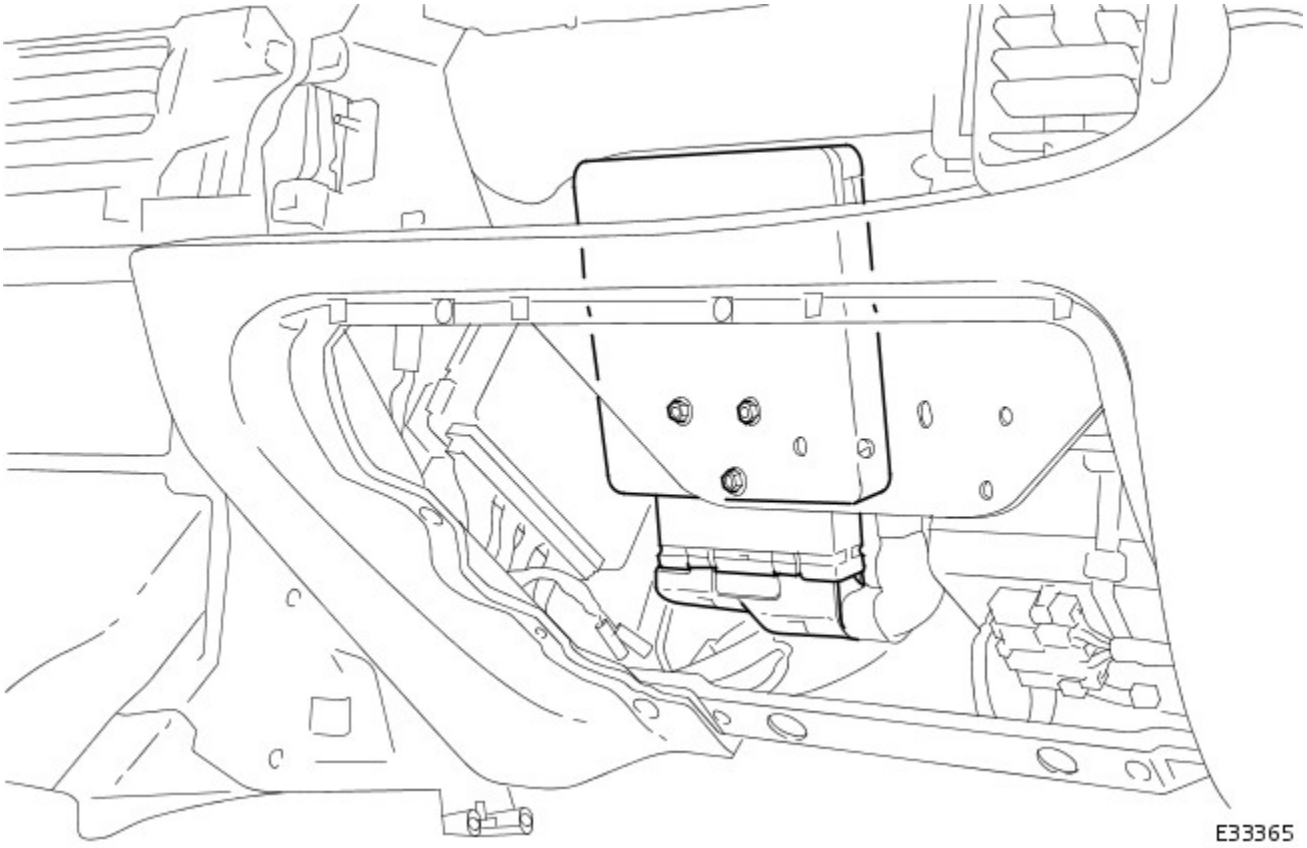
Description and Operation



E33364

Item	Part Number	Description
1	—	Body Processor Module
2	—	Front Door Control Module
3	—	Rear Door Control Module
4	—	Roof Console Switch Module
5	—	Center Console Switch Module

Body Processor Module (BPM)



The BPM electronically controls many vehicle functions. It responds when a switch is actuated by providing output signals to the appropriate devices, either directly or indirectly via relays. In addition the BPM establishes an ISO network link with the Security and Locking Control Module (SLCM) and utilizes the SCP network to exchange data between the body system modules.

The following tables are published for guidance purposes and only provide a rough indication of the correlation between circuit inputs and outputs; due to the complexity and necessary functional interaction required for the vehicle there are many circuits where inputs and outputs overlap.

Malfunction of modules must always be analyzed using the PDU as recommended in Diagnosis and Testing.

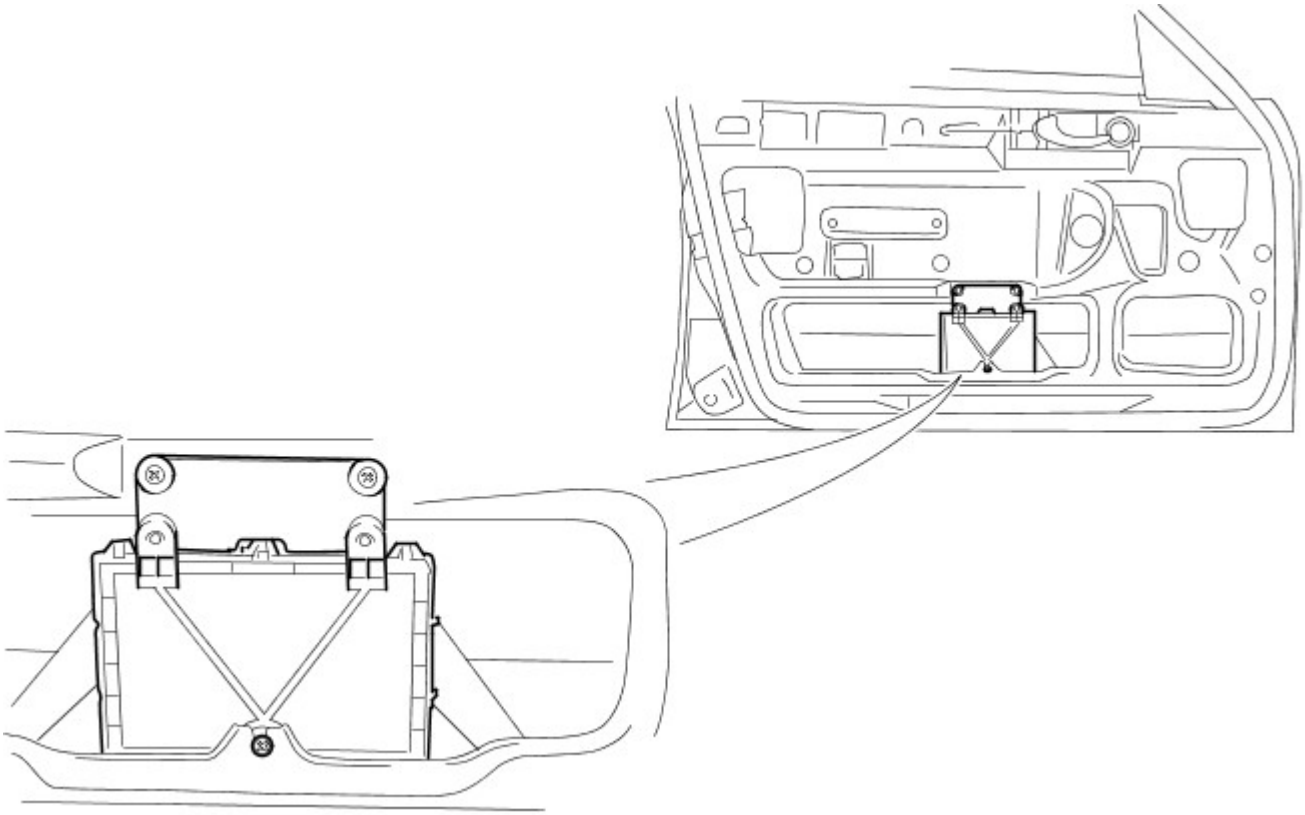
Inputs/outputs

Exterior lights circuit	
BPM inputs from:	BPM outputs to:
• Front fog switch • Rear fog switch • Low beam switch • High beam switch • Side lights switch • Headlamp flash switch • Direction indicator switch • Hazard switch	• Front fog relay • Low beam relay • High beam relay • Side marker and license plate relay • Side and tail lights • Direction indicators • Hazard status bulb • Indicators via SCP • Front fog • Low beam • High beam • Side light • Direction • Hazard warning • Status LEDS • Front fog • Rear fog

• NOTE: The reverse lights and rear fog lights are NOT controlled by the BPM; refer to Security and Locking Control Module.

Interior lights circuit	
BPM inputs from:	BPM outputs to:
Header console courtesy light switch SCP	• Instrument and switch illumination. • Fade 1 (Header console courtesy lamps) • Fade 2 (E-post courtesy lamps) • Map lights • Sun visor lamps • Glovebox lamp • Trunk lamps
Washer / wiper circuit	
• Wiper park switch • Low screen wash switch • Wiper slow speed switch • Wiper fast speed switch • Wiper intermittent switch • Wash/wipe switch	• Power wash relay • Wiper motor run • Screen wash pump • Wiper fast/slow speed
Ignition circuit	
• Ignition position • Auxiliary position	• Transit relay • Mirror fold out • Mirror fold flat
Central door locking circuit	
• Central locking button • Valet switch • SCP (door modules)	• Central door locking relay • SCP (door modules, security and locking control module) • Sun roof ECU
Security system circuit	
• Hood security switch • Horn switches • Central locking button • SCP (door modules, security and locking control module) • ISO link (key transponder module)	• Horn relay • Active security sounder • Passive security sounder • Security status LED • Central door locking relay • SCP (door modules, security and locking control module) • ISO link (key transponder module)
Steering column adjustment circuit	
Column adjustment switches	• Column tilt motor • Column reach motor
Gear shift interlock circuit	
• Neutral switch • J-gate not in park	• Keylock solenoid • Gearshift interlock solenoid
Seat heaters circuit	
Seat heater switches	• Seat heater relay • Status LED
Seat buckle circuit	
Seat buckle	• Audible warning • SCP

Driver Door Module (DDM)



The DDM is an integral part of the vehicle security system. In conjunction with the BPM and SLCM via the SCP network, it controls door locking, interior lighting, door window position and door mirror position. The DDM also provides an interface via the SCP network, between the driver door switchpack and all door control modules which permits remote control of all door window positions.

The following table is published for guidance purposes only; for fault finding, always use the PDU as recommended in Diagnosis and Testing:

Inputs/outputs

DDM inputs from:	DDM outputs to:
• Driver door switch • Driver door switchpack (window switches) • Driver door switchpack (mirror switches) • Driver door switchpack (memory switches)	• Driver door window lift motor • Driver rear door window lift motor via SCP • Passenger door window lift motor via SCP • Passenger rear door window lift motor via SCP • Driver door mirror motors • Passenger door mirror motors via SCP • Driver seat module via SCP

Passenger Door Module (PDM)

The Passenger Door Module provides local control of the passenger door window position and puddle lamp. Door locking and unlocking is controlled by the BPM via the CDL relay.

The following table is published for guidance purposes only; for fault finding, always use the PDU as recommended in Diagnosis and Testing:

Inputs/outputs

PDM inputs from:	PDM outputs to:
• Passenger door switch • Passenger window lift switch • DDM via SCP	• Passenger door actuator unlock • Passenger door actuator superlock • Puddle lamp • Passenger door window lift motor • BPM via SCP

Driver Rear Door Module (DRDM)

The Driver Rear Door Module provides local control of the driver rear door window position and puddle lamp. Door locking and unlocking is controlled by the BPM via the CDL relay.

The following table is published for guidance purposes only; for fault finding, always use the PDU as recommended in Diagnosis and Testing:

Inputs/outputs

DRDM inputs from:	DRDM outputs to:
• Driver rear door switch • Driver rear window lift switch • DDM via SCP	• Driver rear door actuator unlock • Driver rear door actuator superlock • Puddle lamp • Driver rear door window lift motor • BPM via SCP

Passenger Rear Door Module (PRDM)

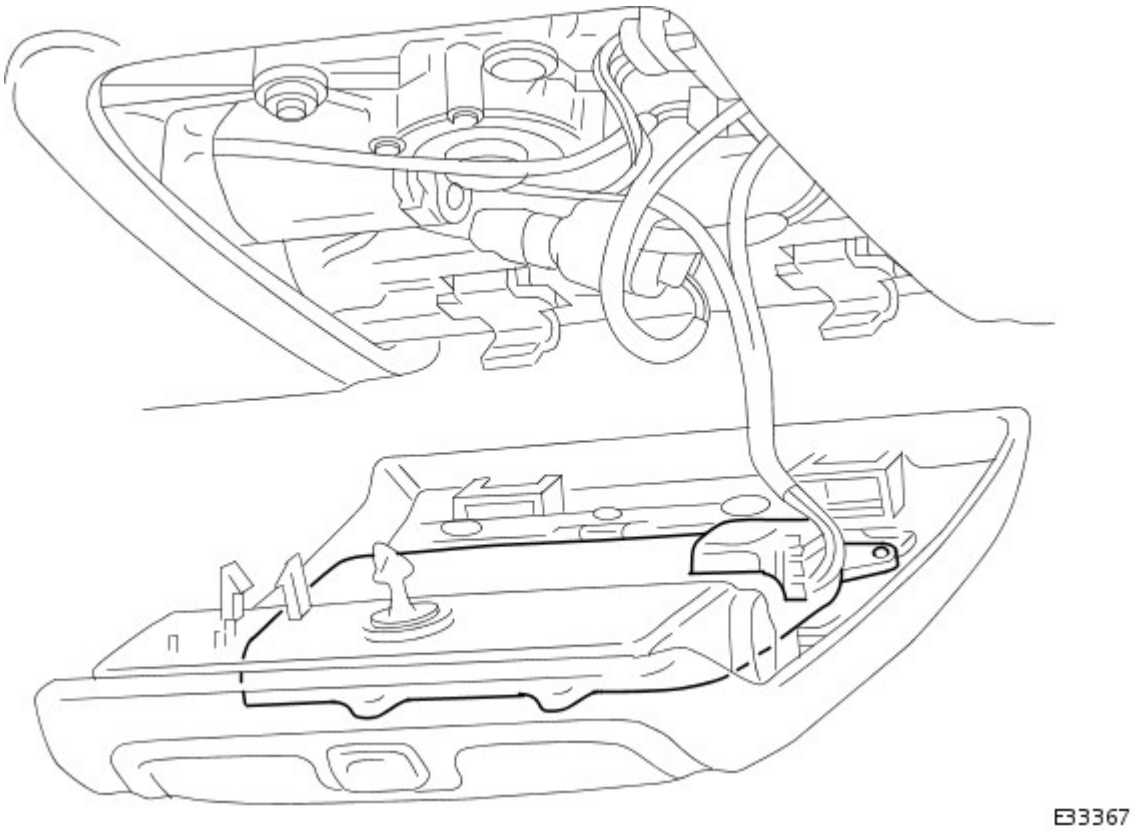
The Passenger Rear Door Module provides local control of the passenger rear door window position and puddle lamp. Door locking and unlocking is controlled by the BPM via the CDL relay.

The following table is published for guidance purposes only; for fault finding, always use the PDU as recommended in Diagnosis and Testing:

Inputs/outputs

PRDM inputs from:	PRDM outputs to:
• Passenger rear door switch • Passenger rear window lift switch • DDM via SCP	• Passenger rear door actuator unlock • Passenger rear door actuator superlock • Puddle lamp • Passenger rear door window lift motor • BPM via SCP

Roof Console Switch Module (RCSM)



The Roof Console Switch Module comprises integral switches which control the following:

Driver and passenger map lights

Main courtesy light

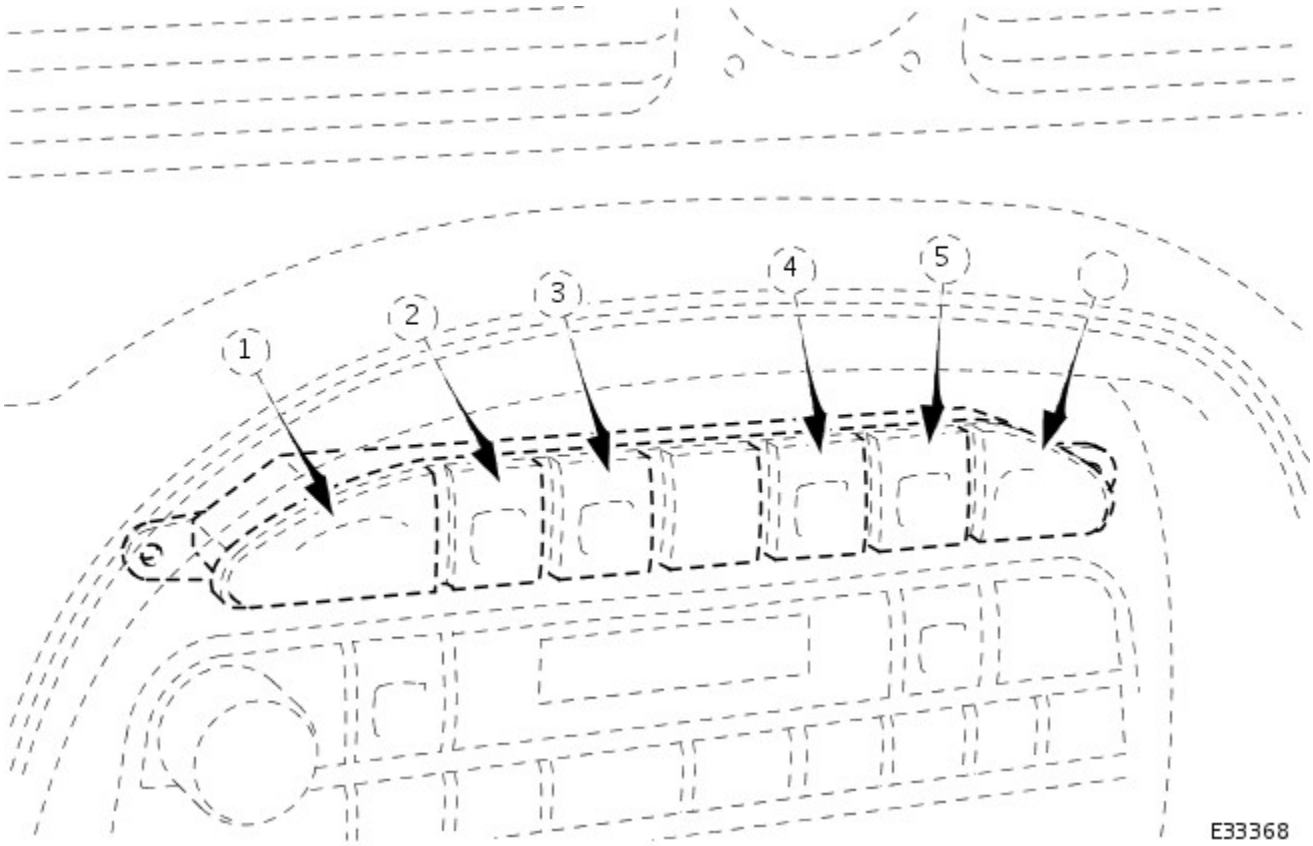
Garage door opener (where applicable)

The following table is published for guidance purposes only; for fault finding, always use the PDU as recommended in Diagnosis and Testing:

Inputs/outputs

RCSM inputs from:	RCSM outputs to:
• Illumination enable (BPM) • Interior light fade 1 (BPM)	BPM (master illumination light switch)

Center Console Switch Module (CCSM)



Parts List

Item	Part Number	Description
1	—	Central locking switch
2	—	Valet switch
3	—	Left hand seat heater switch (where fitted)
4	—	Right hand seat heater switch (where fitted)
5	—	Traction control switch (where fitted)
6	—	Hazard warning switch

The Center Console Switch Module comprises the integral switches identified in the illustration above. All switches with the exception of the Traction Control Switch are connected to BPM inputs. The Traction Control Switch is connected to an ABS unit input.

Multifunction Electronic Modules - Multifunction Electronic Module

Diagnosis and Testing

Tests Using the Portable Diagnostic Unit

Refer to PDU User Guide

The complexity of the electronics involved with the various Electronic Control Modules and the multiplexed communication networks, preclude the use of workshop general electrical test equipment. Therefore, reference should be made to the PDU User Guide for detailed instructions on testing control modules.

The PDU systematically tests and analyses the control modules and the associated electrical connections.

Where a fault involving a control module is indicated by the PDU, before replacing the component, some basic diagnostic methods may be necessary to confirm that connections are good and that wiring is not damaged.

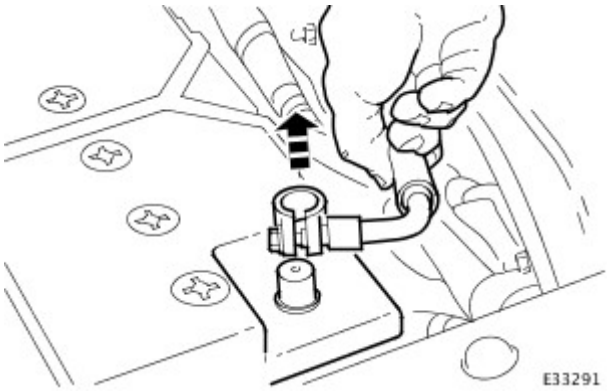
Multifunction Electronic Modules - Front Door Module (FDM)

Removal and Installation

Removal

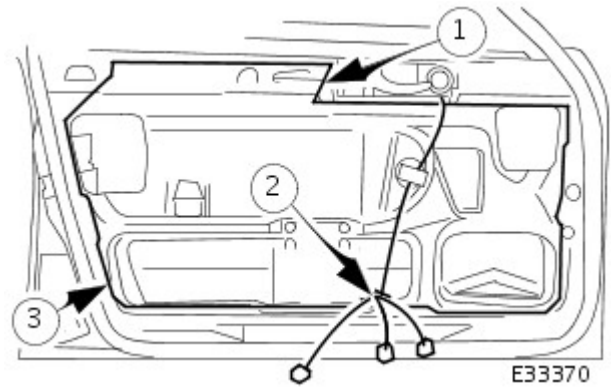
1. Disconnect battery ground cable; refer to 86.15.19.

2. Remove door casing; refer to 76.34.01.



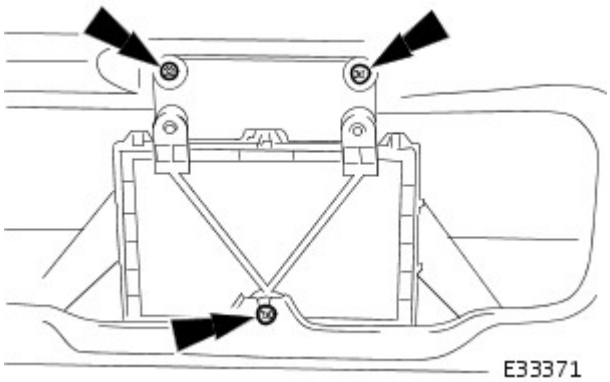
3. Remove primary water shedder.

1. Displace primary water shedder from door.
2. Feed door harness through water shedder.
3. Remove water shedder.



4. Remove door module.

- Remove screws which secure module to door.
- Reposition module to allow access to connectors.
- Disconnect connector.
- Remove module complete with bracket.



5. Remove mounting bracket.

- Remove screws securing bracket to module.

Installation

1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Multifunction Electronic Modules - Driver Seat Module (DSM)

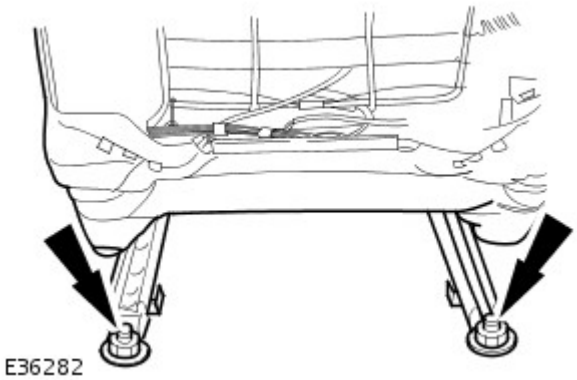
Removal and Installation

Removal

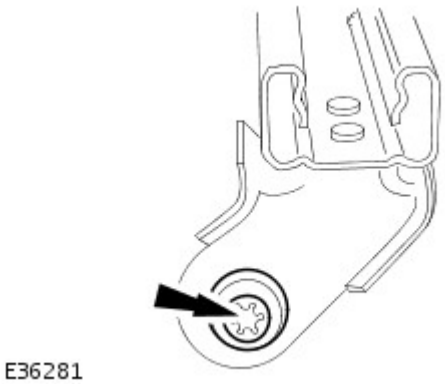
1. Power steering column to fully forward position. (Driver side only)
2. Power seat to fully forward and upward position.
3. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

   Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

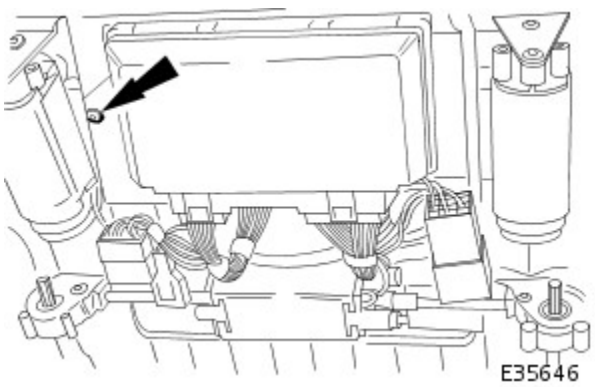
4. Slacken and remove seat rear securing bolts.



5. Slacken and remove seat front securing bolts.

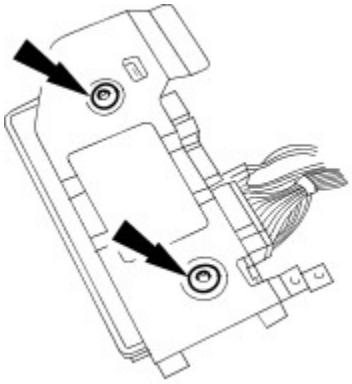


6. With assistance and exercising care to avoid tensioning harness, tilt seat backwards and support for access.
7. Slacken and remove module mounting bracket to seat frame securing screw.

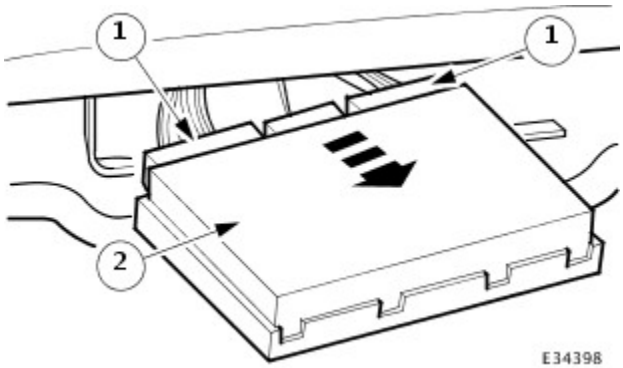


8. Position module/mounting bracket assembly for access and

slacken and remove module to bracket securing screws.



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9. Remove seat control module.

1. Disconnect harness multiplugs from module.
2. Withdraw module from seat

Installation

1. Position control module at seat and connect harness multiplugs.

2. Position control module on mounting bracket and fit and tighten securing screws.

3. Position control module/mounting bracket assembly on seat frame and fit and tighten securing screw.

4. Position seat over securing bolt holes.

5. Fit and tighten seat front securing bolts

6. Fit and tighten seat rear securing bolts.

7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

8. Return seat to original position.

9. Return steering column to original position.

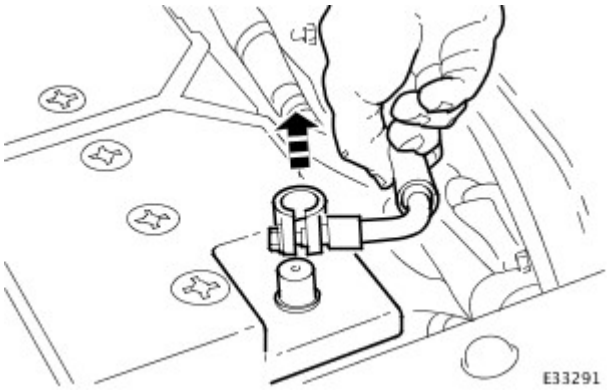
Multifunction Electronic Modules - Multifunction Electronic Module

Removal and Installation

Removal

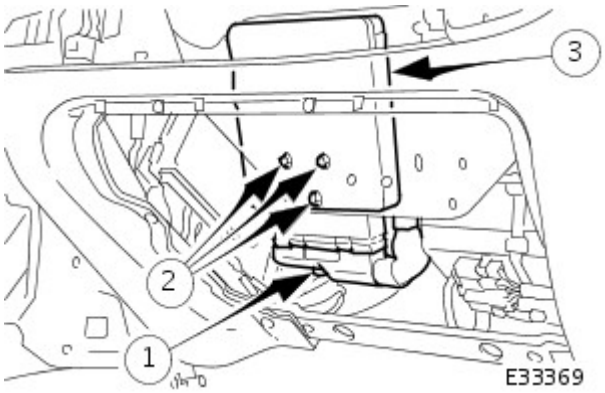
1. Switch ON ignition. Move passenger seat fully rearwards. Switch OFF ignition.

2. Disconnect battery ground cable; refer to 86.15.19.



3. Remove glove box; refer to 76.52.03.

4. Remove body processor module.



1. Release bolt and disconnect harness connector.
2. Remove three nuts which secure module to fascia.
3. Remove module.

Installation

1. Installation is reverse of removal.

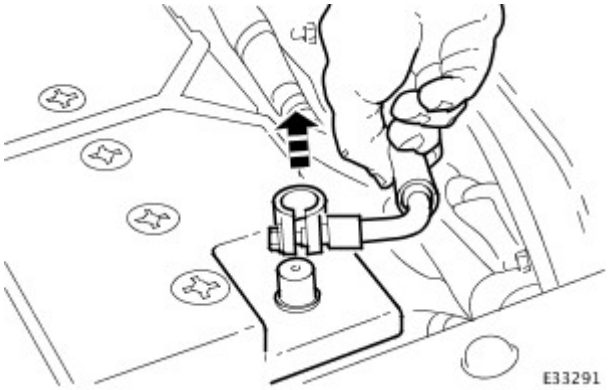
2. Reconnect battery ground cable; refer to 86.15.15.

3. Synchronize ECM, KTM, BPM using PDU.

Multifunction Electronic Modules - Rear Door Module (RDM)

Removal and Installation

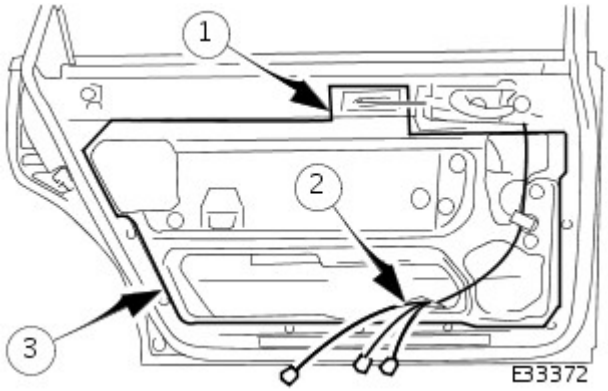
Removal



1. Disconnect battery ground cable; refer to 86.15.19.

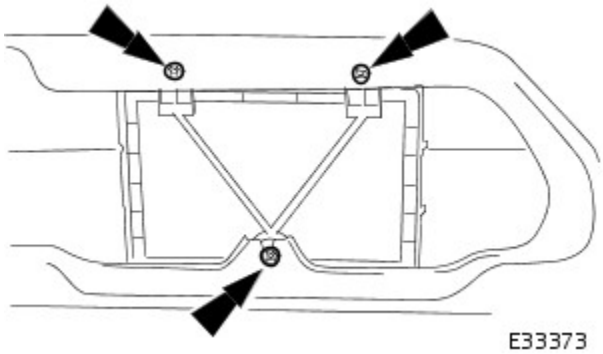
2. Remove door casing; refer to 76.34.04.

3. Remove primary water shedder.



1. Displace primary water shedder from door.
2. Feed door harness through water shedder.
3. Remove water shedder.

4. Remove door module.



- Remove screws which secure module to door.
- Reposition module to allow access to connectors.
- Disconnect connectors.

Installation

1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Body System - General Information -

Lubricants, Fluids, Sealants and Adhesives

Unit	Specification
For removal of water-based stains from carpets.	'Fibrefresh' carpet shampoo
	'1001' Foam Shampoo
	'Novatreat'
For removal of grease or oil based stains from carpets.	'Genklene' (Trichloroethane)
	'Spot Remover'

Torques

Component	Nm
Fascia	
Instrument pack to support panel	1.8
Fascia to support bracket	22 - 28
Fascia to console	3
Tunnel bracket to body	22 - 28
Bolster to tunnel bracket	1.5
Instrument pack to fascia	3.0
Strut to fascia	2.0
Fascia support strut to body	7 - 10
CPU bracket to fascia	5 - 7
Fascia demister bracket to fascia	1.5
Fascia and air con. location to body	1.0
Air dist. box duct to air dist. box	1.0
Airbag carrier mounting bracket to fascia	5 - 7
Instrument pack support bracket to fascia	5 - 7
Airbag bracket to fascia	2.0
Air dist. box to fascia	2.0
Inst. pack support bracket to fascia	5 - 7
Fascia assembly to body	22 - 28
Airbag door brackets to fascia	5 - 7
Airbag door bracket to fascia and strut	4.0
Airbag door bracket to door frame assembly	4.0
Hood	
Hood lock to body	7 - 10
Hood buffer assembly	7 - 10
Gas strut - ball pin to weld nut	7 - 10
Hood lever	5 - 7
Clamp - hood adjust cable	6 - 8
Interior	
Sun Visor fixings	1.8
Sunblind to parcel shelf	Tighten to prevailing torque.
Sunblind bezel assembly	1.0
Coat hook	3.0
Seat belts	
Front belt buckle to bracket fixing	30 - 40
Front belt reel bracket to body fixing	30 - 40
Front belt anchor fixing	30 - 40
Front belt upper guide fixing	7 - 10
Height adjuster to 'B' post screws	23 - 27
Height adjuster to seat belt anchor retaining nut	30 - 40
Rear inertia belt anchor fixing	30 - 40
Rear inertia belt bracket to body fixing	30 - 40
Rear inertia belt reel securing bracket to body fixing	30 - 40
Rear inertia belt buckle bracket to body fixing	30 - 40
Sliding Roof Panel	
Sliding roof assembly frame to BIW roof	4 - 5
Sliding roof panel to frame	4 - 5
Trunk	
Compact disc autochanger bracket to body	9 - 11

Battery clamp to tray	7 - 10
Warning triangle lower bracket to trunk lid inner panel	1.5
Trunk lock barrel to lid	4 - 5
Trunk latch to lid and striker to body	7 - 10
Trunk latch motor to bracket	7 - 10
Trunk latch motor mounting bracket to lid	7-10
Electrical carrier box to body	5 - 7
Load floor support block to body	9 - 11
Trunk seal retainer to body	9 - 11

Body System - General Information - Body

Description and Operation

This section covers the following areas of the vehicle body:

Front end body panels

Body closures

Aperture seals

Door seals

Instrument panel, console and radio

Centre console

Handles, locks, latches and mechanisms

Wipers and washers

Glass, frames and mechanisms

Fascia

Fuel filler flap assembly

Sun visors

Seating

Interior trim and ornamentation

Exterior trim and ornamentation

Rear view mirrors

Rear parcel tray

Roof console

Bumpers

Occupant restraints

Sliding roof

Steering column cowl

Underscuttle pad

Front End Body Panels

A false bulkhead together with two insulation covers, are installed between the engine compartment and the BIW front bulkhead to provide optimum insulation against noise and heat intrusion. Two plenum braces bolted between the BIW upper toeboards and the plenum further increase bodyshell structural integrity. The plastic radiator grill and vane block achieve weight reductions over steel parts and provide high resistance to front end corrosion.

Body closures

Each front and rear door consists of a welded, mild steel inner frame and an outer panel. The outer panel is welded to the waist rail and cheater of the inner frame, then bonded and clinched to form the door assembly. Cosmetic PVC bead is applied to all clinch joints. Sponge rubber seals are mounted on the doors. Internal insulation is provided by a foam water shedder attached to the door by double-sided adhesive tape.

The door aperture B/C posts are reinforced over their full height to fully satisfy all forthcoming European and Federal side impact legislation. The hood consists of one piece inner and outer panels clinched and bonded together, with cosmetic bead PVC sealant applied to all clinch joints. The hood pivots at the front on two hinges each secured by bolts to the hood front underside and the BIW front upper crossmember. Two gas struts secured to the hood by pivot pins and snap-on couplings, support the hood in the open position. A full width insulating pad is secured by screws to the underside of the hood. A sponge rubber tubular seal is mounted transversely towards the front of the hood underside. The trunk lid is of similar construction to the hood, consisting of inner and outer panels clinched and bonded together and PVC bead sealed. Incorporating a removable moulded liner and two trunk illumination lights, the trunk lid is supported when open, by two gas struts, each secured to the inner wheel arch and trunk hinge by snap fittings. For some markets, a warning triangle is attached to a bracket on the trunk lid underside and is retained in the open position by a rubber block.

Fascia

One-piece slush-moulded fascia on injection moulded armature and steel cross-rail reinforcement. Fascia support brackets set with BIW to achieve close tolerance fit of fascia to body eliminate necessity for adjustment following removal and installation..

Fuel Filler Flap

The fuel filler comprising a hinged flap attached to the body decking panel by two nuts, incorporates a rubber buffer, snap-in striker, hinge spring and fuel cap stowage magnet. The rubber fuel bowl moulding is attached via a steel armature to the body reinforcement panel by five M5 nuts and is retained at the filler neck by a clip. The mating drain tube is fitted with an internal filter. The fuel filler flap latch mechanism attached to the fuel bowl armature by two M5 nuts, includes a locking pin and actuator which are both serviceable items. The latch actuator operates independently from the central locking system; it is driven directly by the security and locking control module. Locking of the fuel filler flap is achieved only by operation of the key or by the remote rf transmitter.

Seating

All front seats are equipped with electric height adjustment. In addition, both seats are available with manual or power forward and rearward adjustment, manual or power operated headrest adjustment, 12 way electric adjustment, memory controlled 12 way seat adjustment and integral seat heating. A side air bag module is installed in the outboard squab wing of each front seat. Each front seat has a non-handed, one-piece frame incorporating cushion and squab frames, side air bag support bracket and seat adjuster mechanisms. Seat switchpacks are installed on the outboard side of driver and passenger seats and control modules are installed in the base of each seat. The standard rear seat is of fixed, bench type with full width removable cushion. For certain markets, two individual rear seats are available as an option on long wheelbase models. Both types of rear seat are available with thermostatically controlled heating of the cushion and squab. Individual rear seats are electrically adjustable for squab re cline (via cushion fore and aft movement), head restraint height and lumbar support. Separate motors provide adjustment of each seat cushion and head restraint and an electrically driven air compressor provides variation of lumbar support. Seat adjustment is controlled via switches installed on a panel in an extension to the centre console.Both the driver and front passenger seat are secured to the vehicle floor at four points.

Interior Trim

The one-piece door casings are trimmed in UEV to match the seating, with wood veneer at the waistline and a carpet insert at the front lower corner. Each casing is secured to the door inner panel by fir tree fasteners along the lower section, two armrest fixings at the centre and veneer panel dowels and fixings at the top. The armrests which are common to front and rear doors, are trimmed in matching leather or UEV according to specification. Switchpacks dedicated to driver and front or rear passenger, are incorporated in the armrests. A speaker is installed in the lower section of each door and a tweeter is incorporated behind each interior door handle escutcheon. where premium ICE is fitted, the front tweeters are installed in the upper A posts. On each side, a grained UEV finisher trimmed to match the headlining is secured to the 'A' post and cantrail by fir tree fasteners locating in BIW apertures. The upper 'D' post finisher is trimmed and secured in the same manner. The single piece'B' post finishers, also finished in grained matching UEV, each have a front seat belt exit aperture and are secured to the BIW by four spring clips and two fir tree fasteners. The one-piece headlining consists of a 6mm thick polyurethane foam membrane covered with suede effect knitted polyester. The headlining is secured to the BIW roof by body tangs, the roof console, sun visors, combined grab handles and coat hooks, the cantrail finishers and where fitted, the

sliding roof finisher and clips. Carpet covered trims line the trunk and are secured by fir tree fasteners to the sides and front inner panel.

Rear View Mirrors

The.interior rear view mirror is an electrochromic unit that automatically darkens to prevent glare from following vehicle lights. This automatic function is selected by pressing the switch at the bottom of the mirror. Pressing the switch again cancels this function. An LED then illuminates when automatic dipping is operative. The light sensing unit for the Night Sentinel automatic lamp operating system is also incorporated in the mirror casing.

The door mirrors are cheater mounted, color-keyed units, remote electrically adjustable and heated. Adjustment of both mirrors is carried out from the driver's door switchpack.A slider switch selects the mirror to be adjusted, and a disc switch adjusts the selected mirror to the required position. Mirror adjustment can only be made when the ignition switch is in position I or II or the driver's door is open, and the selector switch is moved from the central position. The door mirrors also automatically darken under control of the electrochromic interior rear view mirror. Mirror heating elements operate on selection of backlight heating.

Automatic dipping of passenger door mirror for kerb view when reversing, is fitted as part of the memory pack. With the ignition switch in position II, the mirror selector switch in the left or right position and reverse gear selected, automatic dipping is initiated by moving the mirror toggle switch rearwards and releasing. On receipt of the dip signal, the passenger door mirror is driven downwards either 7 degrees, bottom of travel, or 4,5 to 5,5 seconds, whichever occurs first. Subsequent rearward movement of the toggle switch achieves further dipping of the mirror in the same increments and sequence. The mirror can be manually returned to the normal memorised position by moving the toggle switch forward with reverse gear selected. The mirror will automatically return to memorised position on deselection of reverse gear, or moving ignition switch from position II.

Door mirror fold-back where fitted, to facilitate parking in confined spaces, can be initiated when the ignition switch is in position I or II, the mirror selector switch is in the central position and vehicle speed is below 19 km/h (12 mph). Mirror fold-back is then initiated by moving the toggle switch rearwards and releasing it. The door mirrors are returned to the normal driving position by again moving toggle switch rearwards. There is no speed constraint on this operation. In the event of a fold-back mirror becoming 'out of position' due to accidental impact, it must only be re-positioned by initiating the fold-back sequence.

Loss of power supplies will result in loss of mirror fold-back memory. In the event of such a memory loss with mirrors in the normal position, fold-back will operate on second movement of the toggle switch. On loss of memory with mirrors in the fold-back position, they will return to the normal position on next fold-back operation.

Bumpers

Each bumper comprises a beam mounted to the body via two strut assemblies, and a moulded polypropylene cover incorporating side armatures and chrome plated blades. Each strut is secured to the BIW by three bolts and supports the beam on a single bolt/height adjuster. The front bumper cover which is moulded to form a lower air intake for the cooling pack, also incorporates left and right handed twin fog lamps, brake cooling ducts. Side marker lamps fitted for some markets serve only as reflectors for UK and Europe. A plastic undertray secured to the lower edge of the front bumper, improves airflow and minimises the ingress of road grime in that area. Standard bumpers have glass mat thermoplastic (GMT) beams mounted on GMT struts. For certain markets, aluminium bumper beams are installed on menasco energy absorbing struts. Whilst both types of front bumper provide a fully integrated 'soft front end' that satisfies bumper impact requirements, the energy absorbing front and rear bumpers are further designed to withstand 5mph (8kph) impacts with no visible damage sustained. Side markers/reflectors, and direction indicators are designed for ease of access from the outside of the bumper. For adjustment and bulb change, the fog lamps are accessed from the bumper interior. The bumper covers are body coloured and matched. Replacement covers are supplied complete with side armatures and are finished in primer

Trunk

The trunk houses the spare wheel, the battery, an electrical carrier containing electrical fuses, relays and modules and a compact disc auto-changer attached to body bracketry. The trunk is fitted with push-fit liners to the sides and front inner panel.The carpet covered floor is in two removable sections, one covering the spare wheel and wheel changing equipment, the other covering the battery and electrical carrier. The front and rear edges of the floor board locate in blocks on the fuel tank backboard and the rear of the body, which provide two height settings to accommodate the difference in thickness between the space saver and full sized spare wheels. A moulded finisher covering the rear of the trunk below the sill is secured to the rear panel by tabs and fir tree fasteners. Finisher panels fitted over the rear lamp units provide for access from the trunk. Finisher panels fitted to the rear lamp units provide trunk interior access to the lamps. The trunk lid underside is fitted with a removable mo ulded liner and two trunk illumination lights. Trunk locking is based on a central latch and striker, operated electrically through the central locking system by an adjacent actuator or by key in a barrel lock

located behind the trunk lid badge.

Occupant Restraints

Inertia reel seat belts with electronically controlled pre-tensioners are installed at the front seats. Supplementary occupant restraint is provided for driver and front seat passenger by front airbags, and side air bags installed in the outer wing of each front seat. Standard inertia reel type belts are fitted to all three rear seat positions. The front seat belts are provided with height adjuster units which are attached one to each of the 'B' posts. Where emergency locking retractor/automatic locking retractor seat belts are provided, the belts have two operating modes.The inertia reel mode with emergency locking retractor is for adult passenger use only and operates to allow the occupant some freedom of torso movement under normal travel conditions.. The static reel mode which prevents belt payout and must be used when a child seat is installed, is activated by fully extending the belt to engage the ratchet mechanism,.then releasing the belt. Operation of the ratchet will then be felt and the belt w ill become locked in that position. To revert to inertia reel (adult passenger) mode, pay the belt back into the reel to the fully retracted position.

Body Structure

The XJ8 sedan body is produced in monocoque standard and long wheelbase form. 70% of the body panels are zinc coated to achieve optimum corrosion protection and a further 8% are constructed in high strength steels to provide high torsional strength and passenger impact protection.

Doors

Each front and rear door consists of a welded, mild steel inner frame and an outer panel. The outer panel is welded to the waist rail and cheater of the inner frame, then bonded and clinched to form the door assembly. Cosmetic PVC bead is applied to all clinch joints

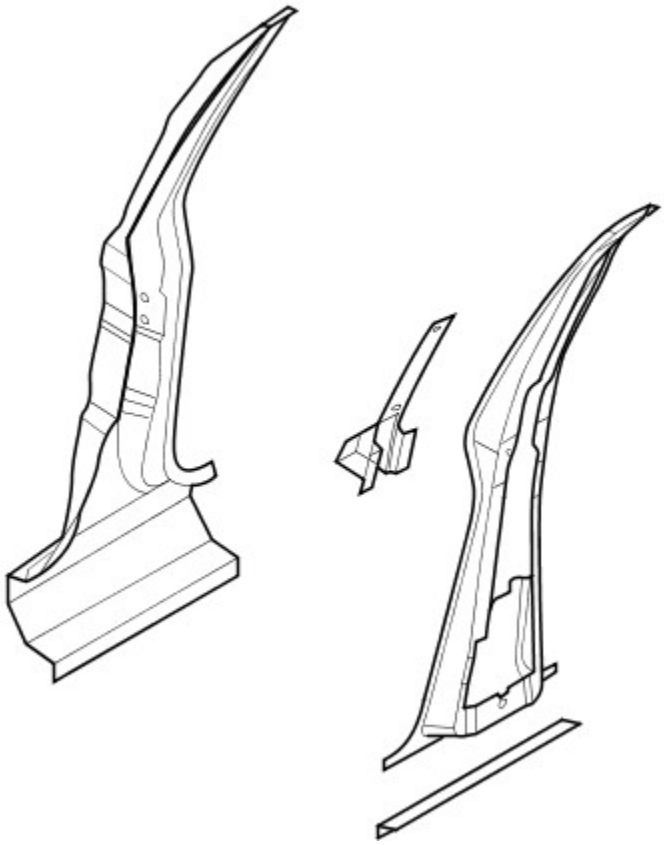
Hood

The hood consists of one piece inner and outer panels clinched and bonded together, with cosmetic bead PVC sealant applied to all clinch joints. The hood pivots at the front on two hinges each secured by bolts to the hood front underside and the BIW front upper crossmember. Two gas struts secured to the hood by pivot pins and snap-on couplings, support the hood in the open position.

Trunk

The trunk lid is of similar construction to the hood, consisting of inner and outer panels clinched and bonded together and PVC bead sealed. The trunk accommodates the spare wheel, the battery, an electrical carrier containing electrical fuses, relays and modules and where premium ICE is fitted, a compact disc auto-changer mounted on body bracketry. Carpet covered trims line the trunk sides and front inner panel and a polyurethane rear finisher is secured to the rear panel by spring clips and fir tree fasteners.

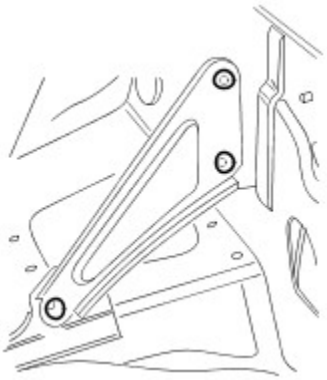
B and C Post Reinforcement



E36348

The B and C posts and closing panels of both models are extensively reinforced to satisfy all forthcoming global legislation on side impact protection.

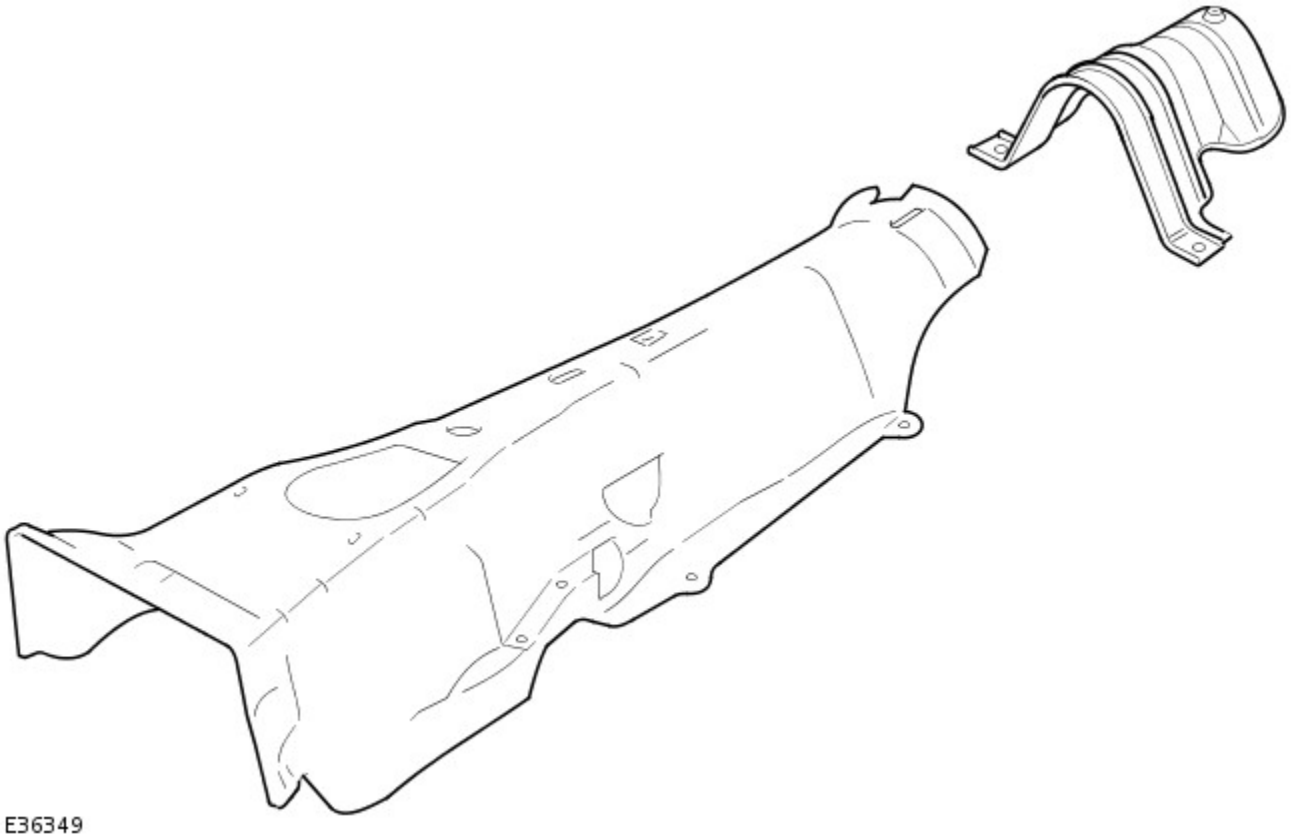
Plenum Braces



E35565

Braces bolted to welded brackets on the upper toeboard and plenum at each side of the BIW, achieve high structural integrity and frontal crash performance.

Centre Bearing Support

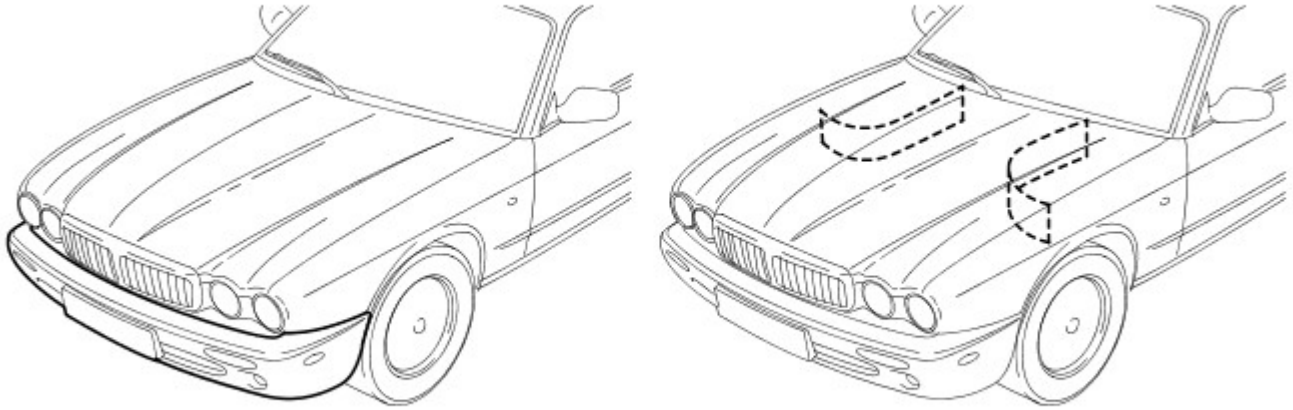


Drive shaft centre bearing support mounted in forward position, minimises NVH and further increases floor stiffness.

Front End Body Panels - Front End Body Panels

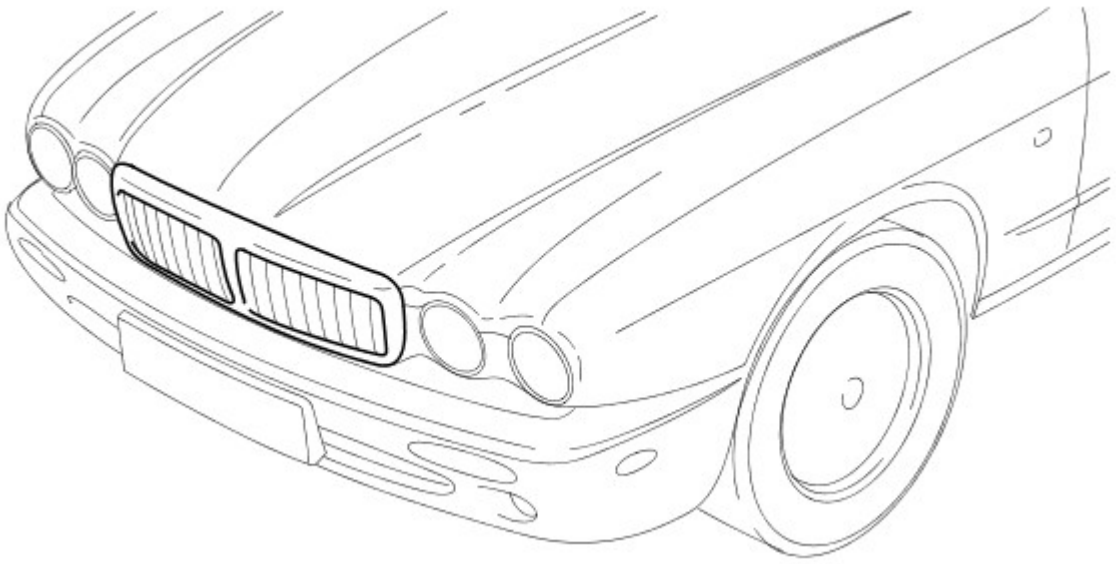
Description and Operation

The front body structure is designed to satisfy bumper impact requirements. The front bumper assembly forms a major front structure component and is fully described in Section 501-19. The front fenders which are bolted to the front valances, are fully described in the Body and Paint Repair manual.



E36247

Left and right hand false bulkheads together with insulation covers, installed between the engine compartment and the BIW front bulkhead, provide optimum insulation against noise and heat intrusion. Two plenum braces bolted between the BIW upper toeboard and the plenum, increase bodyshell structural integrity.

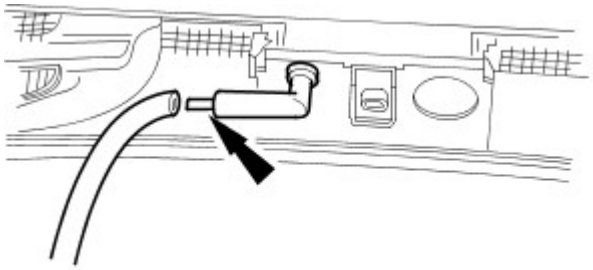


E36248

The plastic radiator grill and vane block achieve weight reductions over steel components and provide high resistance to front end corrosion.

Front End Body Panels - Cowl Panel Grille

Removal and Installation



E35527

1. Open the hood and fit fender covers.
2. Remove the wiper arm and blade assembly. Refer to 84.15.44.90.
3. Slacken and remove the five plenum cover securing screws.
4. Position the plenum cover for access and disconnect windshield washer pump tube from plenum cover connector.
5. Remove plenum cover from vehicle.
6. Remove screenwasher connector from plenum cover.
7. Remove plenum cover spacers,

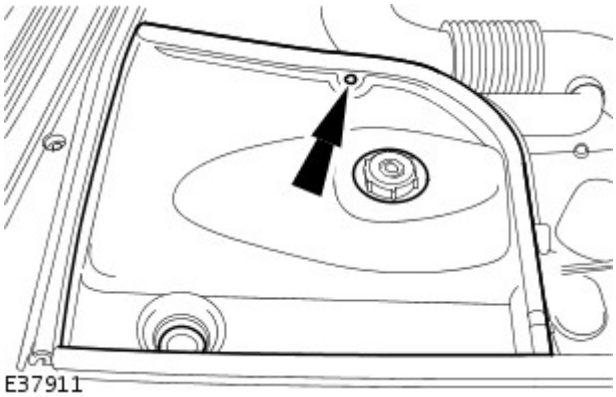
Installation

1. Fit washer hose connector to plenum cover.
2. Fit and fully seat plenum cover spacers.
3. Position plenum cover for access and fit windshield washer pump to plenum connector hose.
4. Fit plenum cover ensuring that it seats correctly in upper seal.
5. Fit and tighten securing screws.
6. Fit washer hose to plenum connector.
7. Fit wiper arm and blade. Refer to 84.15.44.90.
8. Close hood and remove fender covers.

Front End Body Panels - Driver Side Bulkhead Cover

Removal and Installation

Removal



1. CAUTION: Make sure the driver side bulkhead cover locating peg is not damaged during removal. Failure to follow this instruction may result in damage to the vehicle.

Remove the driver side bulkhead cover.

Installation

1. To install, reverse the removal procedure.

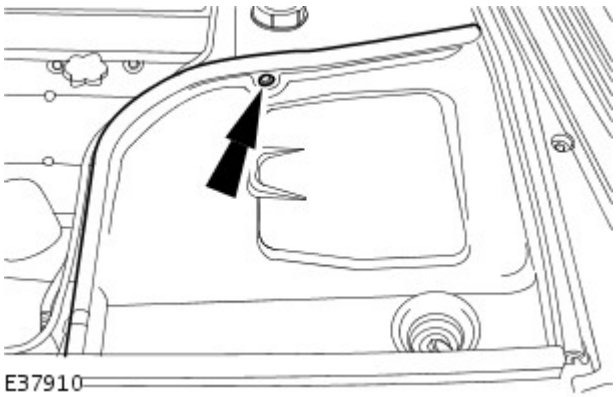
Front End Body Panels - Passenger Side Bulkhead Cover

Removal and Installation

Removal



1. Lift and withdraw tool tray cover, and remove tools.



2. CAUTION: Make sure the passenger side bulkhead cover locating peg is not damaged during removal. Failure to follow this instruction may result in damage to the vehicle.

Remove the passenger side bulkhead cover.

Installation

1. To install, reverse the removal procedure.

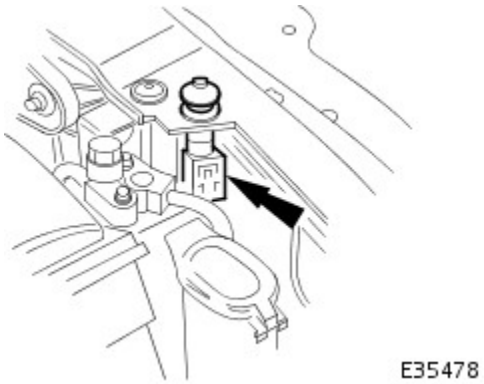
Front End Body Panels - Radiator Grille Opening Panel

Removal and Installation

Removal



1. Open hood and fit fender covers.
2. Slacken and remove the ten closing panel securing bolts.



3. Position closing panel for access and disconnect hood switch harness multiplug.
4. Remove closing panel from vehicle.
5. Remove and discard the two rubber grommets locating top of radiator.

Installation

1. Fit and secure hood switch to closing panel.
2. Fit new rubber grommets to closing panel.
3. Position closing panel for access and connect hood harness multiplug.
4. Fully seat closing panel and fit and tighten securing bolts.
5. Close hood and remove fender covers.

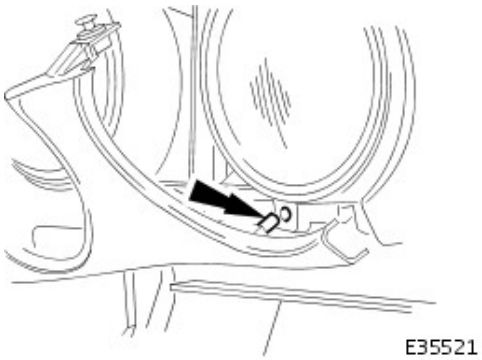
Front End Body Panels - Radiator Grille Opening Panel Reinforcement

Removal and Installation

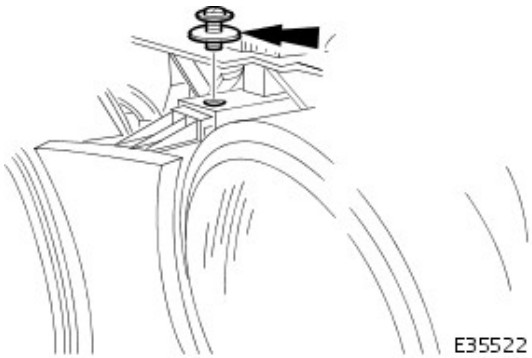
Removal

1. Remove radiator grilles. Refer to 76.55.03.
2. Remove radiator grille surround. (Refer to 76.55.15)
3. Open hood.
4. Fit front fender cover.
5. Slacken headlamp trim panel to headlamp securing screw.





6. Carefully release headlamp trim panel fir tree fastener from BIW and remove panel from vehicle.



7. Remove securing screw from trim panel and remove and discard fir tree fastener.

Installation

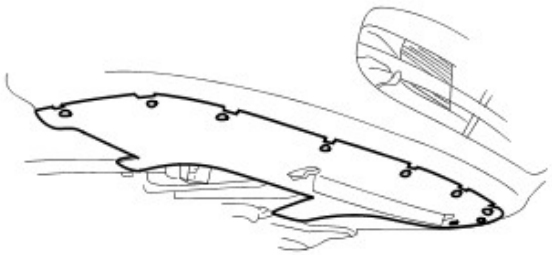
1. Fit new fir tree fastener to headlamp trim panel.
2. Fit but do not tighten securing screw to headlamp trim panel.
3. Position headlamp trim panel on BIW front panel, locating securing screw in headlamp slot.
4. Fully seat fir tree fastener in BIW front panel.
5. Finally tighten headlamp trim panel securing screw.
6. Close hood and remove fender cover.
7. Fit radiator grill surround. Refer to 76.55.15
8. Fit radiator grilles. Refer to 76.55.03.

Front End Body Panels - Radiator Splash Shield

Removal and Installation

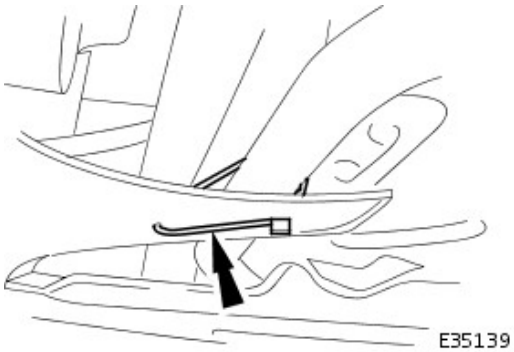
Removal

1. Raise front of vehicle and support on stands.
2. Remove and discard seven scrivets securing undertray to bumper cover.



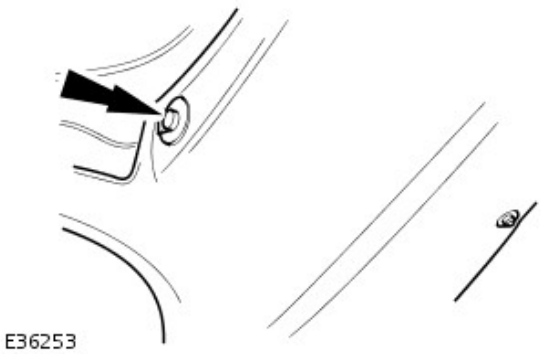
E36252

3. Remove and discard tiestrap securing undertray to crossbeam front brace.



E35139

4. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.



E36253

5. Remove undertray and wind deflectors from vehicle.
6. Remove and discard plastic scrivets securing wind deflectors to undertray.

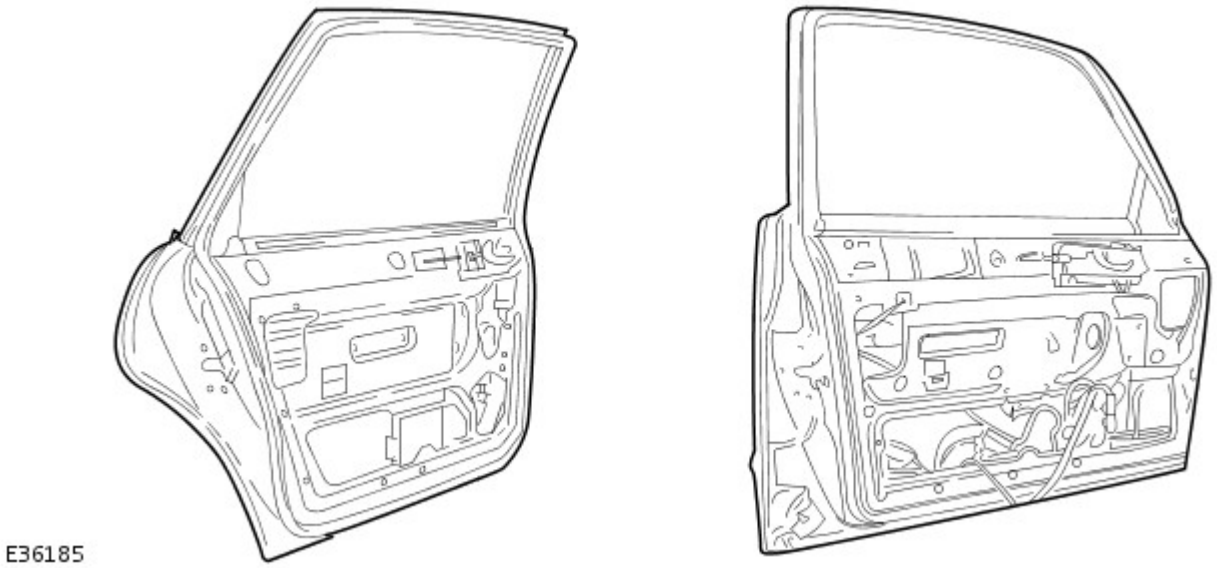
Installation

1. Position wind deflector on undertray and secure with new scrivets.
2. Position liners in wheelarches.
3. Position undertray assembly under vehicle and using new plastic fixings, secure assembly to wheelarch liners.
4. Position undertray/wind deflector assembly on vehicle and secure to front bumper using new plastic scrivets.
5. Fit road wheels.
6. Lower vehicle from stands.

Body Closures - Body Closures

Description and Operation

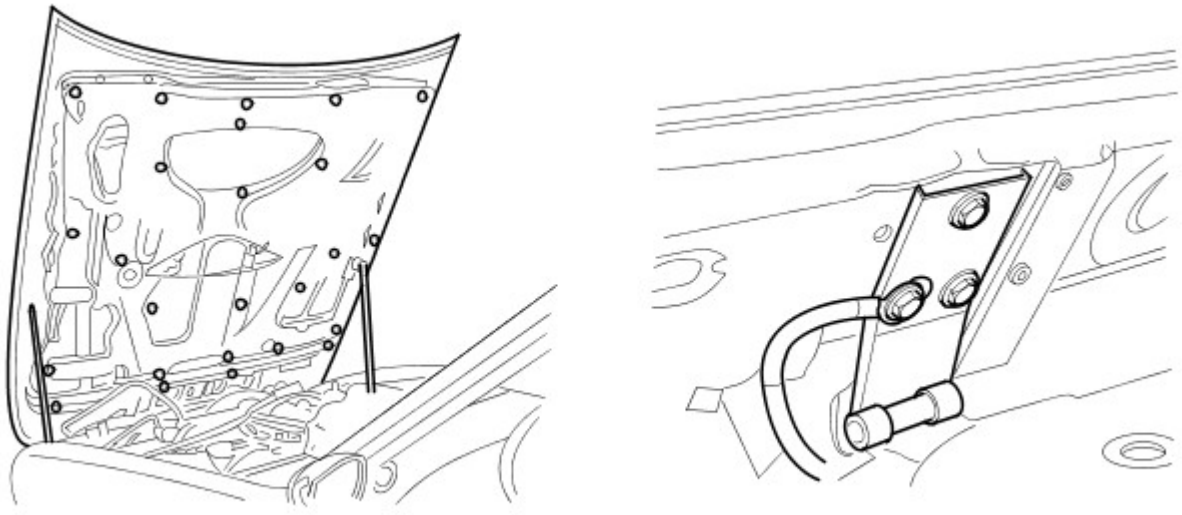
Front and Rear Doors



E36185

Each front and rear door consists of a welded, mild steel inner frame and an outer panel. The outer panel is welded to the waist rail and cheater of the inner frame, then bonded and clinched to form the door assembly. Cosmetic PVC bead is applied to all clinch joints. Sponge rubber primary and secondary seals are mounted on the doors. Internal insulation is provided by a foam water shedder attached to the door by double-sided adhesive tape. Front and rear door armrests are secured by internal and external screws to support brackets riveted to each door frame. All external armrest securing screws are concealed. Each door casing complete with door pocket is secured to the door by clips and screws. Multi-plug connectors facilitate connection of the electrical harness to guard lamps, window lift switches, speakers, external mirrors and regulator, all of which are accommodated within the doors.

Hood

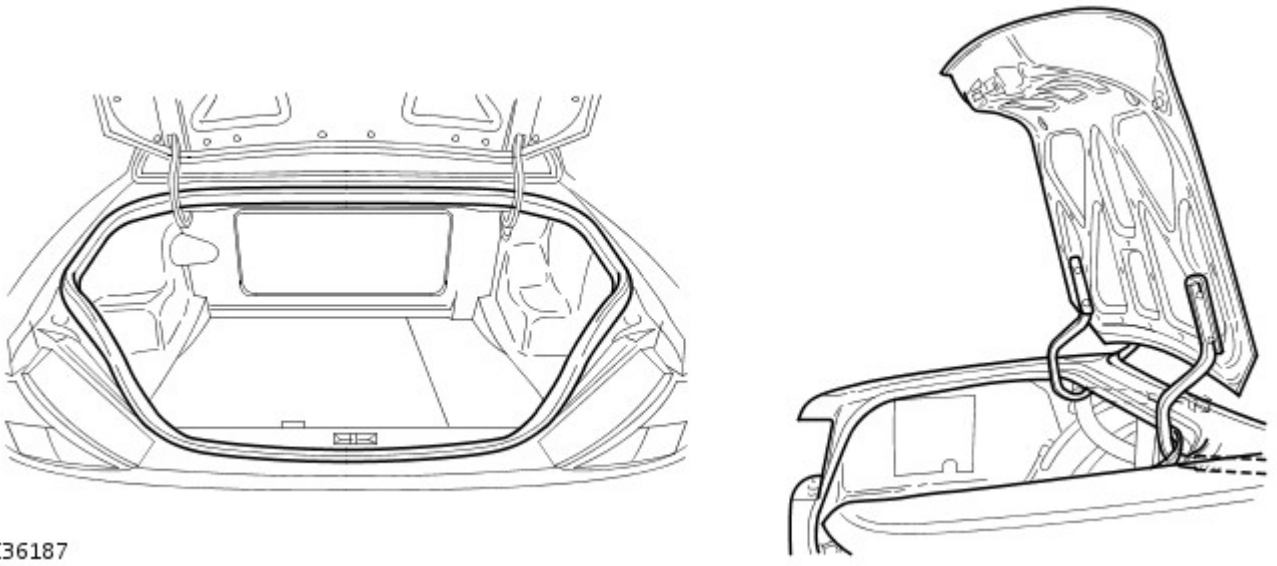


E36186

The hood consists of one piece inner and outer panels clinched and bonded together, with cosmetic bead PVC sealant applied to all clinch joints. The hood pivots at the front on two hinges each secured by bolts to the hood front underside and

the BIW front upper crossmember. Two gas struts secured to the hood by pivot pins and snap-on couplings, support the hood in the open position. A full width insulating pad is secured by screws to the underside of the hood. A sponge rubber tubular seal is mounted transversely towards the front of the hood underside.

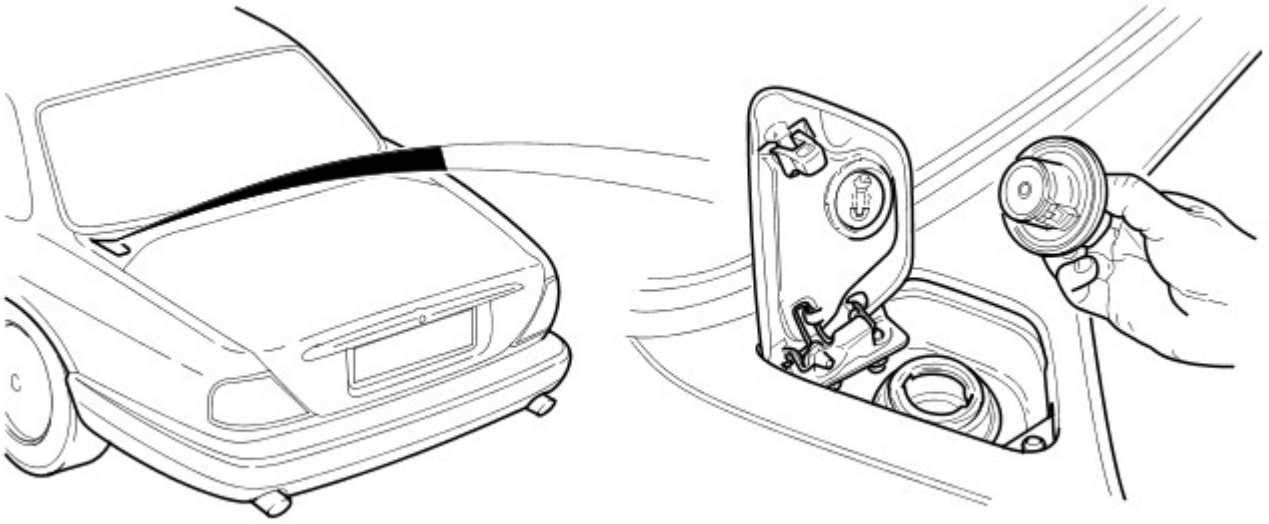
Trunk



E36187

The trunk lid is of similar construction to the hood, consisting of inner and outer panels clinched and bonded together and PVC bead sealed. The trunk accommodates the spare wheel, the battery, an electrical carrier containing electrical fuses, relays and modules and where premium ICE is fitted, a compact disc auto-changer mounted on body bracketry. Carpet covered trims line the trunk and are secured by push-fit fasteners to the sides and front inner panel. The carpet covered, two-section, removable trunk floor provides access to the spare wheel and wheel changing equipment, the battery and electrical carrier. The floor board rests on the spare wheel, with the front and rear edges locating in blocks on the fuel tank backboard and the rear of the body. The support blocks provide for two floor height settings to accommodate either a space saver or full size spare wheel.A trunk seal retainer covers the rear of the trunk below the sill. Finisher panels fitted to the rear lamp units provide for trunk inte rior access to the lamps. The trunk lid underside is fitted with a removable moulded liner and two trunk illumination lights. Two gas struts fitted between the inner wheel arches and trunk hinges support the trunk lid in the open position. For some markets, a warning triangle is attached to a bracket on the trunk lid underside. The trunk is locked by a central latch and striker operated by an adjacent electrical actuator, via the central locking system, or by key operation of a barrel lock located behind the trunk lid badge.

Fuel Filler Flap

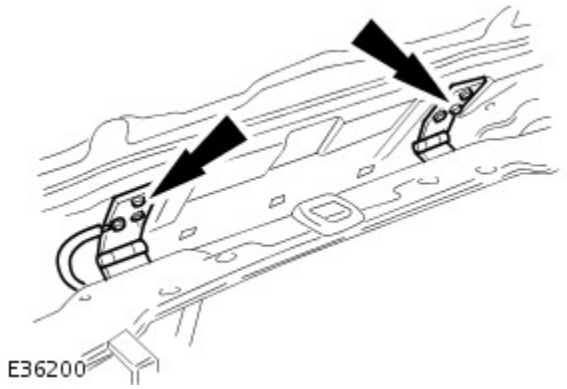


E36188

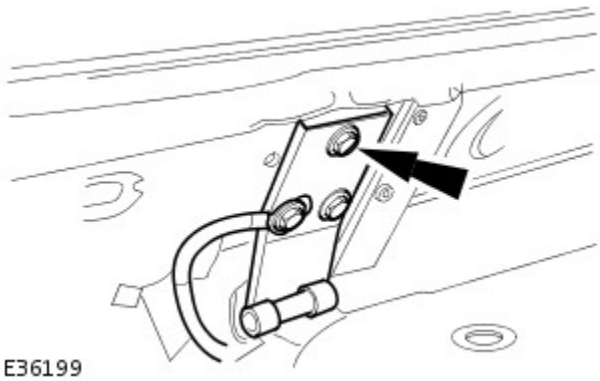
The hinged fuel filler flap which is attached to the rear saddle panel by two nuts, incorporates a rubber buffer, snap-in striker, hinge spring and fuel cap stowage magnet. The rubber fuel bowl moulding attached via a steel armature to the body reinforcement panel, is retained at the filler neck by a clip. A mating drain tube is fitted with an internal filter. The filler flap latch mechanism which is secured by nuts to the fuel bowl armature, comprises a locking pin and actuator. The actuator, driven directly by the security and locking control module, operates independently from the central locking system. Locking of the fuel filler flap can only be achieved by operation of the key or the remote rf transmitter.

Body Closures - Hood Alignment

General Procedures



1. Open hood and fit fender covers.
2. Slacken hood to hinge securing bolts. just sufficiently to permit movement of hood.



3. Adjust position of hood on hinges and tighten one bolt on each hinge.
4. Carefully close hood and check alignment.
5. Repeat steps 2 to 4 as necessary to achieve satisfactory hood alignment.
6. Fully tighten all hood hinge bolts.
7. Close hood and remove fender covers.

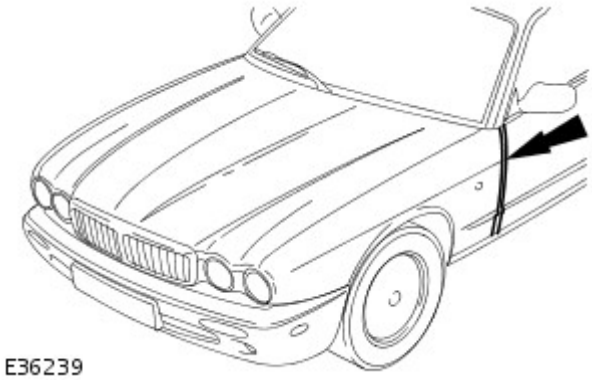
Body Closures - Door

Removal and Installation

Removal

1. Remove battery cover, and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Apply protective masking tape to overlap front edge of door.



E36239

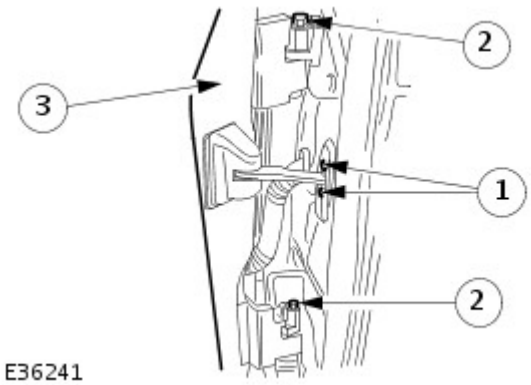
3. Fully open door, withdraw harness gaiter from 'A' post, disconnect multiplugs and position them clear of 'A' post aperture.



E36240

4. Remove door.

1. Slacken and remove the two screws securing check arm to 'A' post and fully retract check arm into door.
2. Slacken, remove and discard hinge locking screws.
3. With assistance, lift door to clear hinge pins and remove door from vehicle exercising care to avoid damaging paintwork.



E36241

Installation

WARNING: FOLLOWING REPAIR OR RENEWAL OF A FRONT DOOR, IT MUST BE ENSURED THAT A SIDE AIRBAG WARNING LABEL IS AFFIXED TO THE REAR FACE OF THE DOOR.

• NOTE: The hinges are set during manufacture to achieve correct door fitment. This setting should only require adjustment in the event of damage at the body or door hinge locations.

1. Using a thread chaser or grooved slave bolt, remove any residual thread locking compound from locking screw locations.

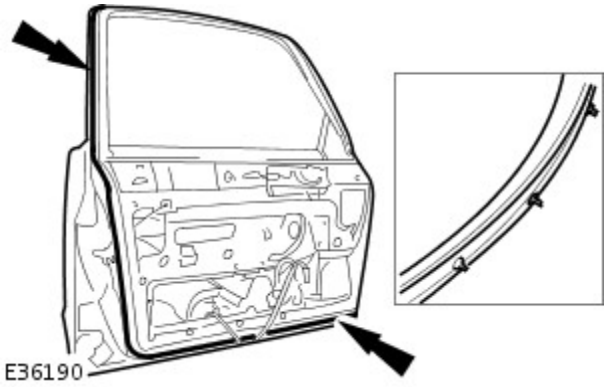
2. Ensure that multiplugs are clear of door front edge, and check arm is fully retracted, then with assistance, lift door into position and locate hinge pins.
3. Fit and fully tighten new hinge locking screws.
4. Position check arm bracket on 'A' post and fit and tighten securing screws.
5. Fully open door and apply a thin coat of grease to both sides of check arm.
6. Connect door harness multiplugs and fit and fully seat harness gaiter in 'A' post.
7. Remove masking tape from front edge of door.
8. Check that door shuts correctly.
9. Wipe any excess grease from check arm.
10. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Body Closures - Front Door Opening Weatherstrip

Removal and Installation

Removal

• NOTE: Door seals should only be removed when absolutely necessary, as removal may result in damage and the necessity for renewal.



1. Remove seal from door.

1. Using a trim removal tool, carefully pull seal complete with securing pegs away from lower section of door.
2. Pull seal from channelling at top of door.

2. Clean door upper channelling.

Installation

1. Apply a suitable lubricant to upper section of seal.

2. Slide upper section of seal into channelling at top of door.

3. Check that seal is correctly positioned, then press and fully seat the eight securing pegs into door locations.

4. Clean any excess lubricant from external surfaces and check that door shuts correctly.

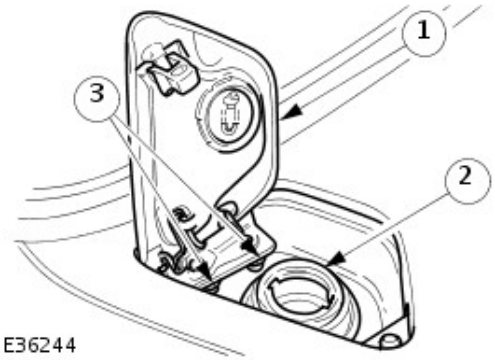
Body Closures - Fuel Filler Door

Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to Section 86.15.19.

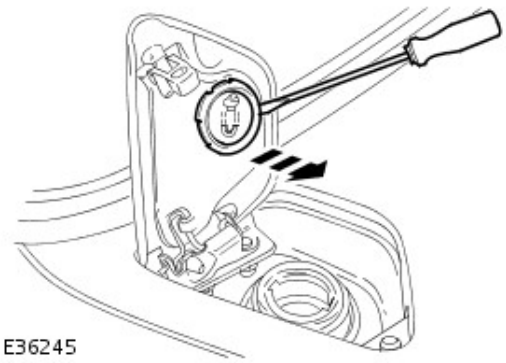
2. Remove fuel filler flap and hinge assembly.



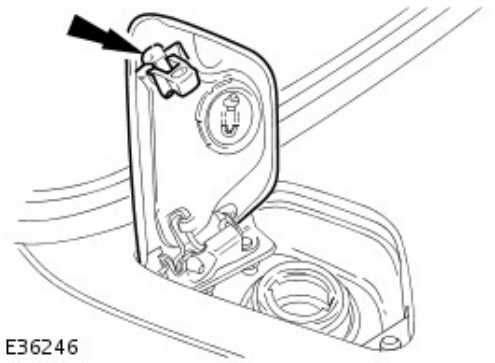
E36244

1. Open filler flap
2. Remove fuel filler cap but do not stow on lid.
3. Slacken and remove the two filler flap hinge securing nuts and remove flap assembly from vehicle.

3. Using a flat-bladed screwdriver, carefully ease magnet snap-fit mounting from filler flap.


E36245

4. Depress the filler flap striker retaining tang and remove the striker assembly.


E36246

5. Remove and discard rubber buffer from filler flap.

Installation

1. Fit new rubber buffer to filler flap.

2. Fit striker to filler flap.

3. Ensure that magnet location is clean and snap-fit magnet to filler flap.

4. Locate filler flap studs in hinge plate and fit and tighten securing nuts.

5. Connect ground cable to battery terminal and fit battery cover. Refer to Section 86.15.15.

Body Closures - Hood

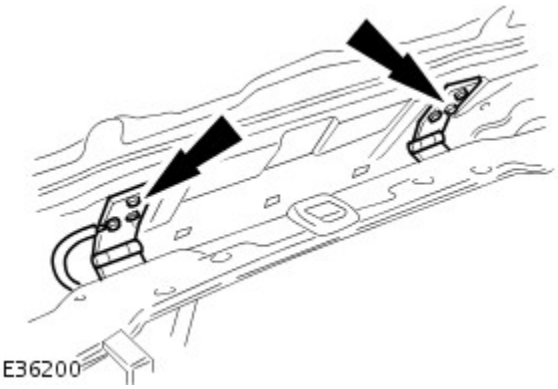
Removal and Installation

Removal

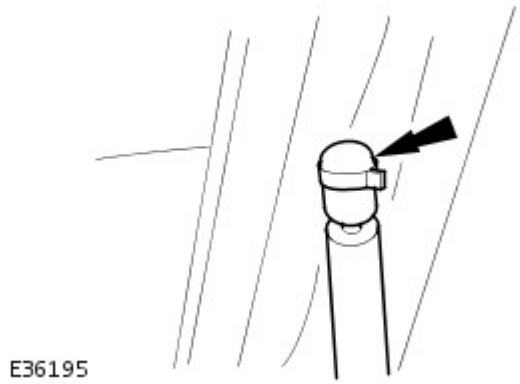
1. CAUTION: The hood assembly must be fully supported throughout the following procedure.

Fit fender covers.

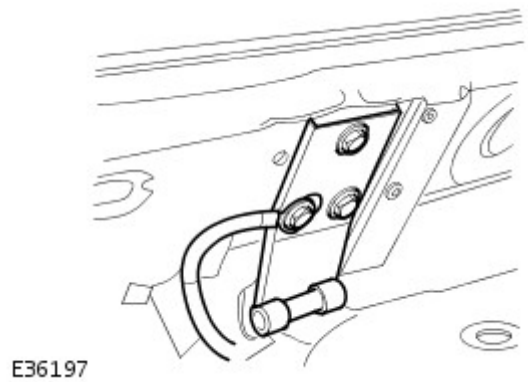
2. Open hood and apply protective masking tape to forward edge of hood. at rear of radiator grill surround.
3. Ensure that the hood is adequately supported.
4. Slacken the six hood to hinge securing bolts.



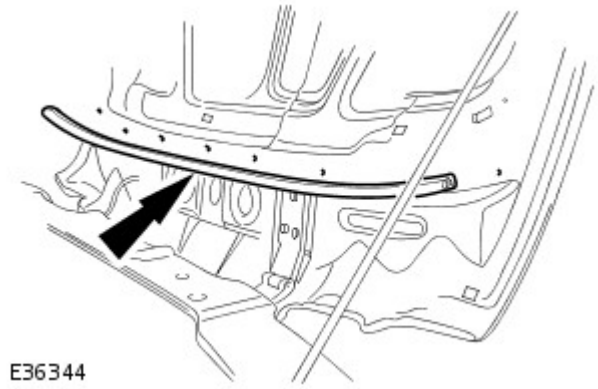
5. Disconnect upper end of each gas strut from hood pivot.

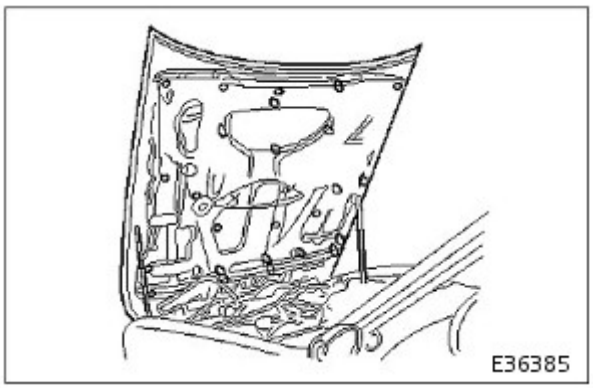


6. With the hood fully supported, remove the securing bolts and position ground strap clear of hood.



7. Remove hood from vehicle.
8. Release hood front seal securing pegs and remove seal from hood.



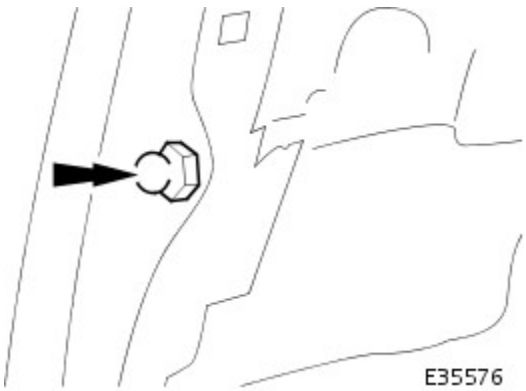


9. Remove hood insulation pad.

- Slacken and remove the hood insulation pad securing screws and remove insulation pad from hood.
- Remove and discard the screw inserts

10. Remove hood striker assemblies. Refer to 76.16.24.

11. Slacken and remove strut pivots from hood inserts.



12. Remove masking tape from hood.

Installation

1. Fit and fully tighten strut pivots in hood inserts.

2. Fit but do not tighten hood striker assemblies. Refer to 76.16.24.

3. Fit new insulating pad retaining screw inserts.

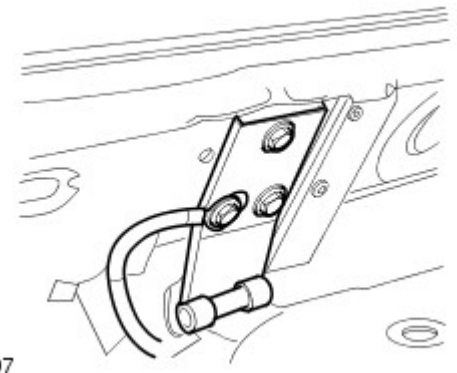
4. Position insulating pad on hood underside and secure with screws.

5. Apply protective masking tape to forward edge of hood behind radiator grill.

6. Position hood front seal and fit and fully seat retaining pegs.

7. Position and fully support hood on vehicle.

8. Fit but do not tighten hinge securing bolts, ensuring that ground strap is attached to correct bolt on LH hinge.



E36197

9. Fit gas struts to hood ensuring that securing clips fully seat.

10. Remove any temporary supports, carefully lower hood and check and adjust alignment. Refer to 76.16.02.

11. Fully tighten all hood securing bolts.

12. Close hood and remove masking tape from forward edge.

13. Remove fender covers.

Body Closures - Hood Hinge

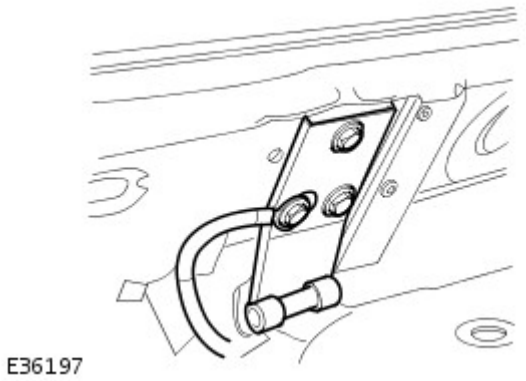
Removal and Installation

Removal

1. CAUTION: Before slackening hinge bolts, ensure that the hood is sufficiently supported to prevent damage to paintwork and gas support struts.

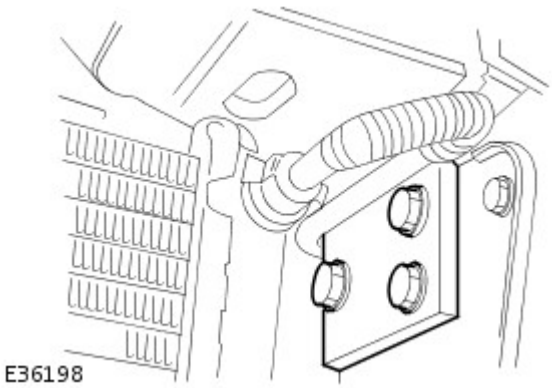
Remove cover from battery and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Open hood and fit fender covers.
3. Remove radiator grille. Refer to 76.55.03.
4. Remove hinge to hood securing bolts.


E36197

- Note position of ground strap.
- Ensuring that the hood is adequately supported, .slacken and remove bolts securing hood to hinge and ground strap to hood.

5. Slacken and remove bolts securing hinge to BIW front upper crossmember and remove hinge from vehicle.

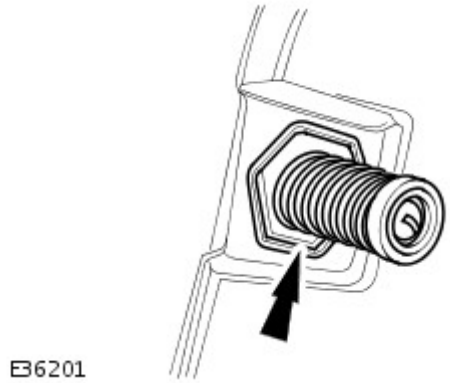

E36198

Installation

1. Fit and tighten bolts securing hinge to BIW front upper crossmember.
2. Fit ground strap eyelet to the lower LH bolt (LH hinge only) securing hinge to hood, then fit but do not tighten bolts.
3. Check and if necessary adjust alignment of hood. Refer to 76.16.02.
4. Fully tighten hinge to hood securing bolts.
5. Fit radiator grill. Refer to 76.55.03.
6. Close hood and remove fender covers.
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Body Closures - Hood Striker

Removal and Installation



Removal

1. Raise hood and fit fender covers.
2. Slacken locknut and screw striker assembly out of nylon insert.

Installation

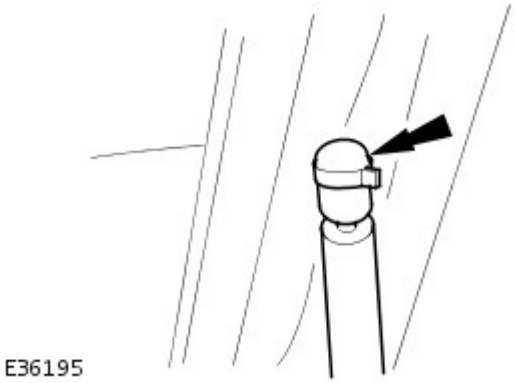
1. Screw striker assembly 13 turns into hood insert for initial setting. Do not tighten locknut.
2. Carefully lower hood, check latching height relative to fenders and adjust as necessary.
3. Tighten striker locknut.

Body Closures - Hood Strut

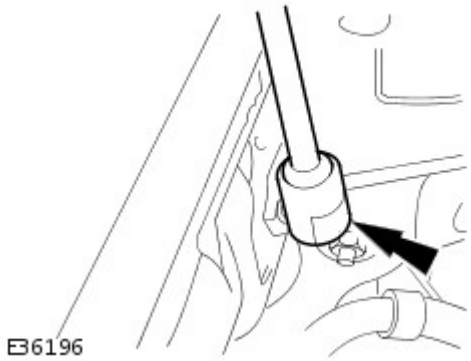
Removal and Installation

Removal

1. Open hood and fit fender covers.
2. Install suitable supports for hood.
3. Release retaining clip in strut upper end and disconnect end from pivot.



4. Release retaining clip at strut lower end and disconnect end from pivot.



5. Remove strut from vehicle.

Installation

1. Fit strut body end to lower pivot ensuring that clip fully seats.
2. Fit strut rod end to upper pivot ensuring that clip fully seats.
3. Remove hood supports and check that hood closes correctly.
4. Remove fender covers.

Body Closures - Luggage Compartment Lid Hinge

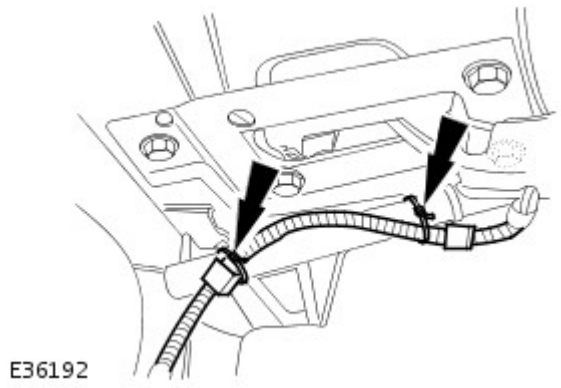
Removal and Installation

Removal

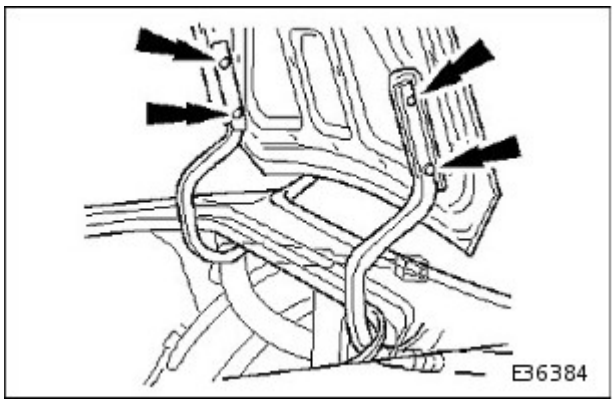
1. CAUTION: Before slackening hinge securing bolts, ensure that trunk lid is sufficiently supported to prevent paintwork damage .

Remove hinge cover.

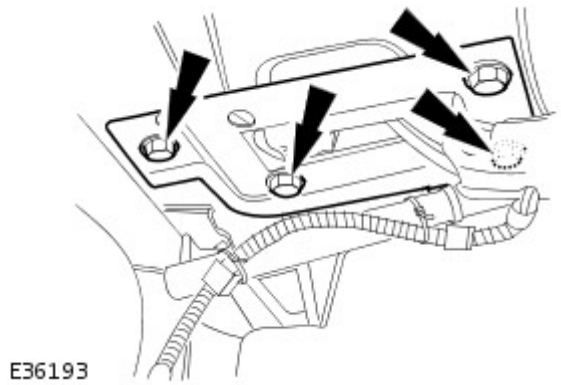
2. Sever and discard tie straps securing harness to hinge (RH hinge only) and position harness clear of hinge.



3. Disconnect gas strut rod end from from hinge pivot. Refer to 76.19.27.
4. Slacken and remove bolts securing hinge to trunk lid.



5. Slacken and remove bolts securing hinge to underside of BIW saddle panel.



6. Remove hinge from vehicle.

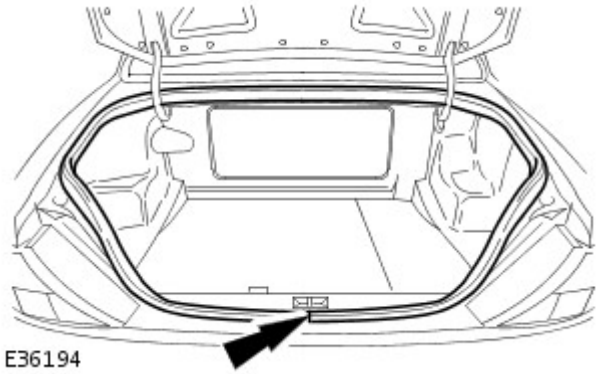
Installation

1. Fit and tighten bolts securing hinge to BIW saddle panel.
2. Fit but do not tighten bolts securing hing to trunk lid.

3. Ensuring that harness is clear (RH hinge only), carefully close trunk lid and check and adjust lid alignment as necessary..
4. Tighten bolts securing hinge to trunk lid.
5. Fit gas strut rod end to hinge pivot ensuring that securing clip fully seats.
6. Using new tie straps, secure harness to trunk hinge (RH hinge only).
7. Fit cover to hinge.

Body Closures - Luggage Compartment Lid Opening Weatherstrip

Removal and Installation



Removal

1. Remove trunk rear finisher. Refer to 76.19.44.
2. Commencing at front of trunk aperture, withdraw seal from flange, exercising care on reaching bonded joint at latch striker.
3. Clean trunk flange.

Installation

1. Commencing with bonded joint at latch striker, press seal onto trunk flange.
2. Applying light tension, progress around trunk aperture firmly seating seal onto flange.
3. Check that seal is free from kinks and trunk lid closes correctly.
4. Fit trunk rear finisher. Refer to 76.19.44.

Body Closures - Luggage Compartment Lid Striker

Removal and Installation

Removal

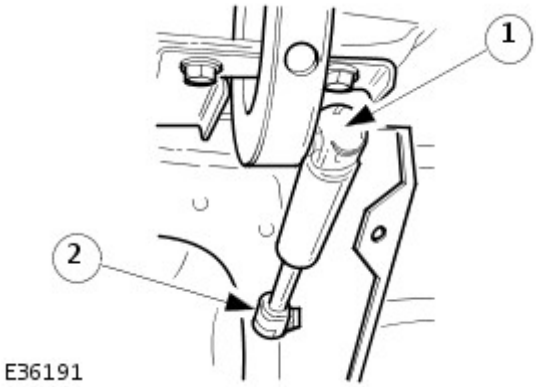
1. Remove rear finisher. Refer to 76.19.44.
2. Lightly mark position of striker top edge on rear panel.
3. Slacken and remove the two bolts and spring washers securing striker to trunk rear panel.
4. Remove striker from rear panel.

Installation

1. Position striker on rear panel, aligning top edge with mark.
2. Fit and lightly tighten securing bolts with spring washers.
3. Shut trunk lid and check alignment with rear fenders.
4. If necessary, slacken securing bolts and adjust striker position as required.
5. Fit trunk rear finisher. Refer to 76.19.44.

Body Closures - Luggage Compartment Lid Strut

Removal and Installation



Removal

1. Remove trunk front liner. Refer to 76.19.31.
2. Place a suitable support under trunk lid.
3. Release strut from pivots.
    1. Using a screwdriver, release clip at rear end of strut, withdraw end from trunk lid pivot and lower strut for access.
    2. Using a long screwdriver, release clip at front end of strut, withdraw end from pivot and remove strut from vehicle.

Installation

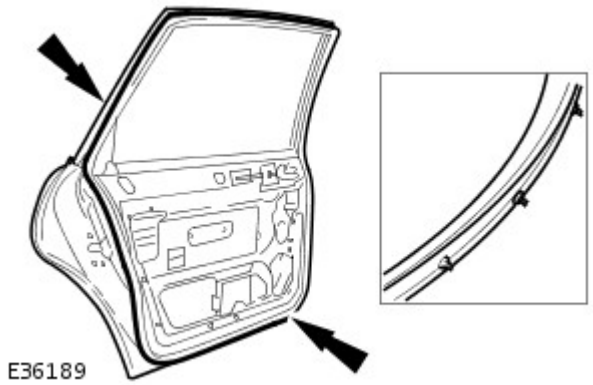
1. Extend strut and fit front end onto pivot ensuring that retaining clip fully seats.
2. Fit rear end of strut onto lid pivot ensuring that retaining clip fully seats.
3. Remove lid support and check that lid closes correctly.
4. Fit trunk front liner. Refer to 76.19.31.

Body Closures - Rear Door Opening Weatherstrip

Removal and Installation

Removal

• NOTE: Door seals should only be removed when absolutely necessary, as removal may result in damage and the necessity for renewal.



1. Remove seal from door.

1. Using a trim removal tool, carefully pull seal complete with securing pegs away from lower section of door.
2. Pull seal from channelling at top of door.

2. Clean door upper channelling.

Installation

1. Apply a suitable lubricant to upper section of seal.

2. Slide upper section of seal into channelling at top of door.

3. Check that seal is correctly positioned, then press and fully seat the eight securing pegs into door locations.

4. Clean any excess lubricant from external surfaces and check that door shuts correctly.

Interior Trim and Ornamentation - Interior Trim

Description and Operation

Carpets

The passenger compartment carpet is a one piece moulded construction with integral sound deadening material, heel mats and driver's footrest. The carpet is attached to the vehicle floor by plastic clips fitted below the door treadplates. Removal of the carpet necessitates removal of the front seats, lifting of the centre console rear extension and removal of the heelboard carpet.

Fascia

The full width, slush moulded, soft feel PVC fascia is mounted on an injection moulded armature and is faced with wood veneer. In addition to the air conditioning and central, outer and demisting vents, it accepts instrument packs dedicated to market requirements and a centrally mounted analogue clock.

Doors

The one-piece door casings are trimmed in UEV to match the seating, with wood veneer at the waistline and a carpet insert at the front lower corner. Each casing is secured to the door inner panel by fir tree press fasteners along the lower section, two armrest fixings at the centre and veneer panel dowels and fixings at the top. The armrests which are common to front and rear doors, are trimmed in matching leather or UEV according to specification. The door switchpacks, dedicated to driver and front or rear passenger, are incorporated in the armrests. A speaker is installed in the lower section of each door and a tweeter is incorporated behind each interior door handle escutcheon. Where premium ICE is fitted, the front tweeters are installed in the upper A posts.

A, B, C and D Posts

On each side,a grained UEV finisher trimmed to match the headlining is secured to the 'A' post and cantrail by fir tree fasteners locating in BIW apertures. The upper 'D' post finisher is trimmed and secured in the same manner. The single piece'B/C' post finishers, also finished in grained matching UEV, each have a front seat belt exit aperture and are secured to the BIW by four spring clips and two fir tree fasteners.

Headlining

The one-piece headlining consists of a 6mm thick polyurethane foam membrane covered with suede effect knitted polyester. The headlining is secured to the BIW roof by body tangs, the roof console, sun visors, combined grab handles and coat hooks, the cantrail finishers and where fitted, the sliding roof finisher and clips.

Trunk

Carpet covered trims line the trunk and are secured by fir tree fasteners to the sides and front inner panel. The carpet covered, two-section, removable trunk floor provides access to the spare wheel and wheel changing equipment, the battery and electrical carrier. The floor board rests on the spare wheel, with the front and rear edges locating in blocks on the fuel tank backboard and the rear of the body. The support blocks provide for two floor height settings to accommodate either a space saver or full size spare wheel.A moulded finisher covering the rear of the trunk below the sill is secured to the rear panel by tabs and fir tree fasteners. Finisher panels fitted to the rear lamp units provide trunk interior access to the lamps. The trunk lid underside is fitted with a removable moulded liner and two trunk illumination lights.

Interior Trim and Ornamentation - A-Pillar Trim Panel

Removal and Installation

Removal

1. Remove the passenger assist handle.
   For additional information, refer to: Passenger Assist Handle (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Detach the door aperture weatherstrip.



3. Remove the A-pillar trim panel.
   - Remove and discard the A-pillar trim panel fir tree fasteners.



Installation

1. To install, reverse the removal procedure.
   - Install new fir tree fasteners to the A-pillar trim panel.

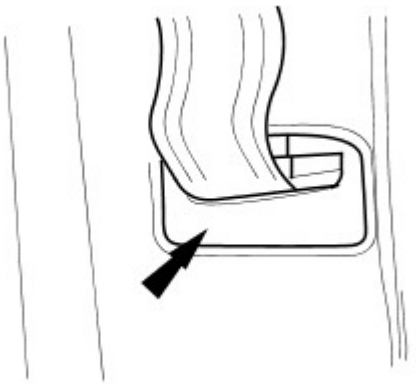


Interior Trim and Ornamentation - B-Pillar Trim Panel

Removal and Installation

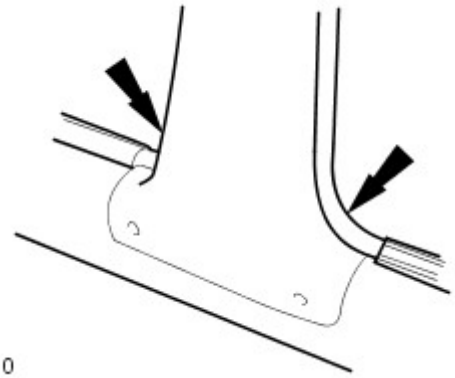
Removal

1. Position front seat and squab fully forward.
2. Remove front seat belt upper and lower anchorages. Refer to 76.73.10.
3. Remove escutcheon from trim pad aperture and seat belt.



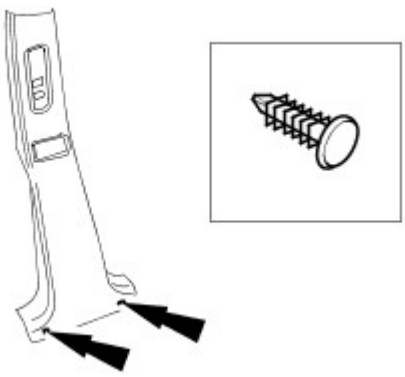
E36219

4. Remove draught welts from adjacent door aperture flanges.



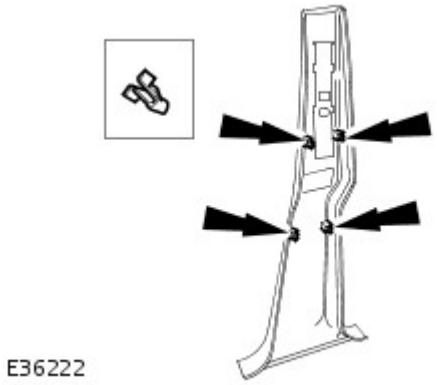
E36220

5. Using a trim removal tool and exercising care to avoid damage, remove and discard the two fir tree fasteners from bottom of trim.

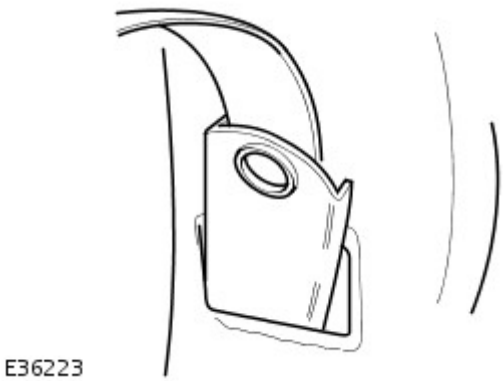


E36221

6. Carefully ease centre of trim pad inwards to release four spring clips.



E36222



E36223

7. Pass seat belt and fittings through trim pad aperture.

8. Remove trim pad from vehicle.

Installation

1. Position trim pad at B/C post and pass seat belt and fittings through aperture.
2. Firmly press centre of trim pad to fully seat spring clips.
3. Ensuring that adjacent dowels are correctly located in B/C post, fit and fully seat new fir tree fasteners to secure bottom of trim pad
4. Fit draught welts to adjacent door aperture flanges.
5. Fit seat belt upper and lower anchorages. Refer to 76.73.10.
6. Return seat to original position.

Interior Trim and Ornamentation - Cowl Side Trim Panel

Removal and Installation

Removal

1. Remove draught welt from adjacent section of door aperture flange.
2. Remove and discard fir tree fastener from'A' post lower trim pad.
3. Pull trim pad rearwards to disengage clips and remove pad from lower 'A' post.

Installation

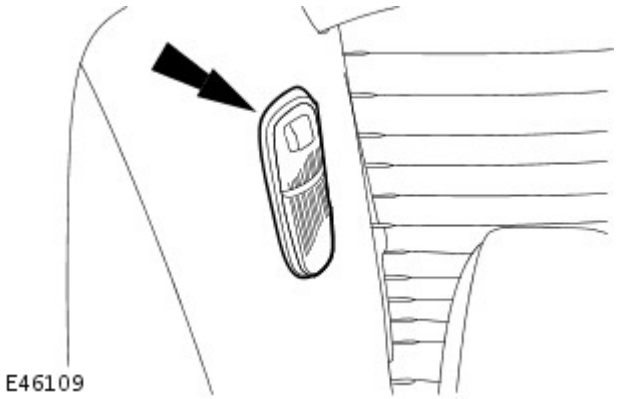
1. Position trim pad on 'A' post and press outwards and forward to engage retaining clips.
2. Fit and fully seat new fir tree fastener.
3. Fit draught welt to door aperture flange.
4. Fit and fully seat new fir tree fastener to secure trim pad.
5. Fit draught welt to adjacent door aperture flange.

Interior Trim and Ornamentation - C-Pillar Trim Panel

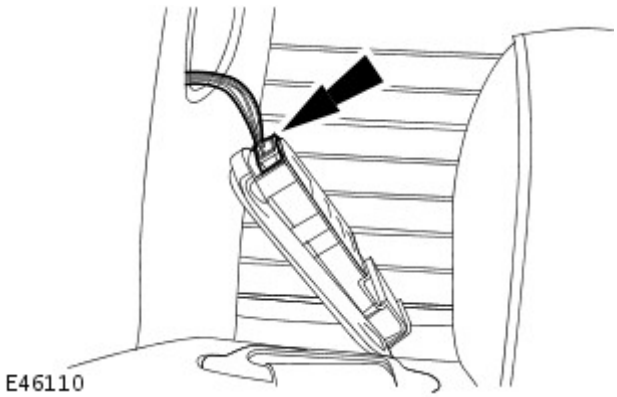
Removal and Installation

Removal

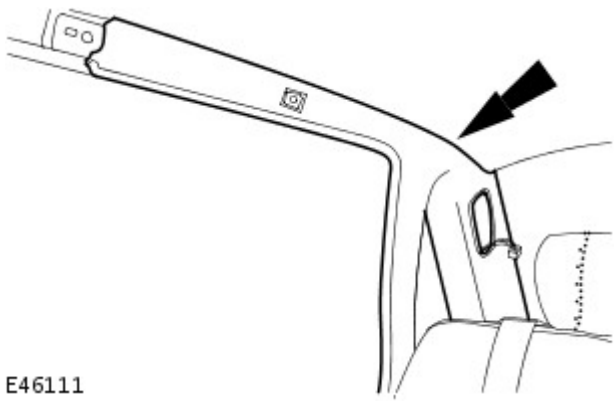
1. Remove the passenger assist handle.
   For additional information, refer to: Passenger Assist Handle (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Detach the rear courtesy/reading light.



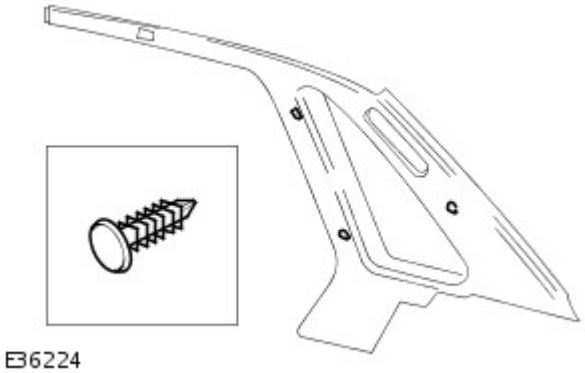
3. Remove the rear courtesy/reading light.
   - Disconnect the electrical connector.



4. Detach the door aperture weatherstrip.
5. Detach the C-pillar trim panel fir tree fasteners from the BIW.

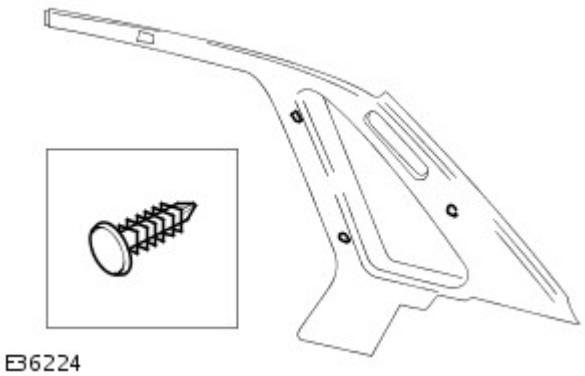


6. Remove the C-pillar trim panel and discard the fir tree fasteners.



E36224

Installation



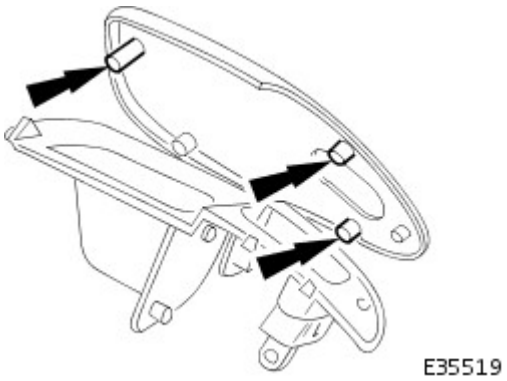
E36224

1. To install, reverse the removal procedure.

- Fit new fir tree fasteners to the C-pillar trim panel.

Interior Trim and Ornamentation - Door Window Control Switch Finish Panel

Removal and Installation



Removal

1. Remove door casing veneer panel. Refer to 76.47.11.
2. Remove door casing. Refer to 76.34.01.
3. Remove door armrest and remove switchpack assembly from armrest. Refer to 76.34.22.
4. Slacken and remove three screws securing door glass lift switch veneer panel to switchpack.
5. Remove veneer panel from switch assembly.

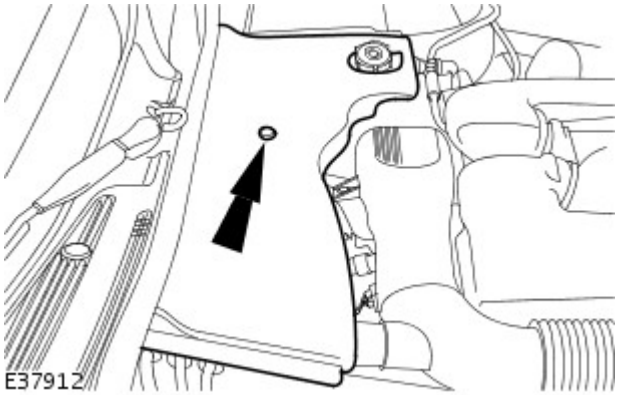
Installation

1. Position veneer panel over switch assembly and fit and tighten securing screws.
2. Position switchpack assembly on armrest and fit and tighten securing screws.
3. Fit armrest to door casing. Refer to 76.34.22.

Interior Trim and Ornamentation - Engine Cover

Removal and Installation

Removal



1. Remove the passenger side and driver side bulkhead covers. For additional information, refer to Section 501-02 Front End Body Panels.
2. Remove the engine cover.

Installation

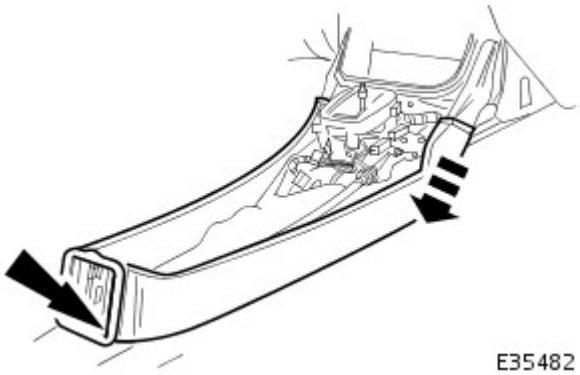
1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Floor Covering

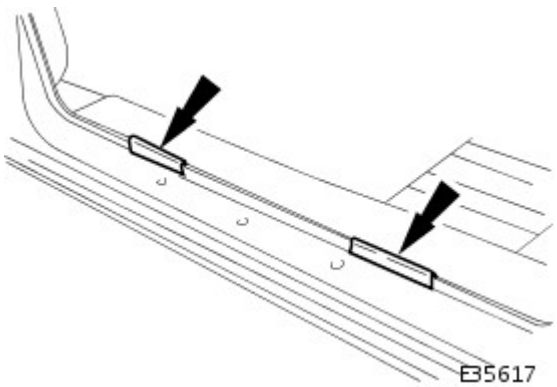
Removal and Installation

Removal

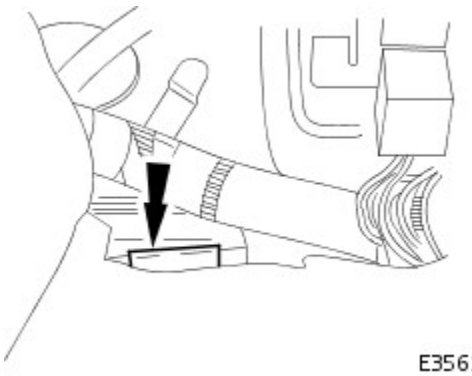
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove rear seat cushion. Refer to 76.70.37.
3. Remove front seats. Refer to 76.70.01
4. Remove 'J' gate surround. Refer to 76.25.24.
5. Remove centre console finisher veneer panel. Refer to 76.47.26.
6. Remove fascia centre veneer panel. Refer to 76.47.06.
7. Remove centre console assembly. Refer to 76.25.01.
8. Remove 'A' post lower trim pads. Refer to 76.13.30.
9. Remove 'B' post trim pads. Refer to operations in this section.
10. Slacken and remove centre console heater ducting securing screw and remove ducting from vehicle..



11. Rotate heelboard fasteners 1/4 turn and remove both heelboards from vehicle.
12. Remove front sill treadplates. Refer to operations in this section.
13. Remove rear sill treadplates. Refer to operations in this section.
14. Release the carpet retainers from BIW flanges at each side.



15. Release the two carpet rear retainers from BIW brackets.

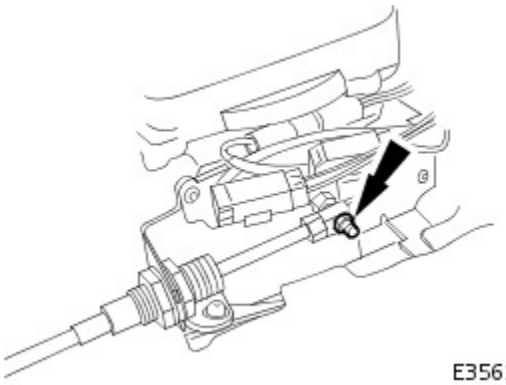


E35618

16. Remove handbrake trim finisher. Refer to 76.13.63.

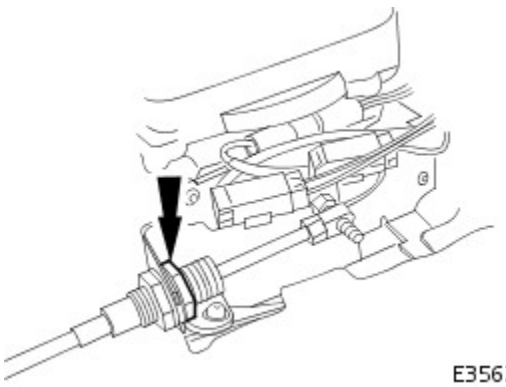
17. Move gear selector to position'R'.

18. Slacken and remove nut securing gear selector inner cable to 'J' gate stud.



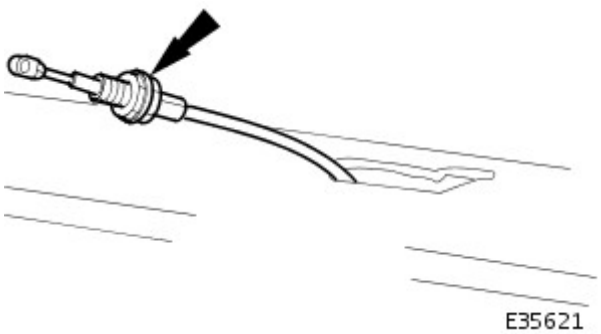
E35619

19. Slacken gear selector outer cable adjustment nut at front of support bracket.



E35620

20. Release cable from'J' gate and position to pemit carpet withdrawal.

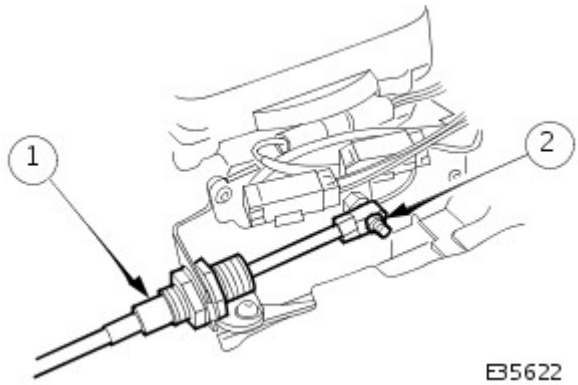


E35621

21. With assistance lift and remove carpet, exercising care to avoid damaging adjacent fittings.

Installation

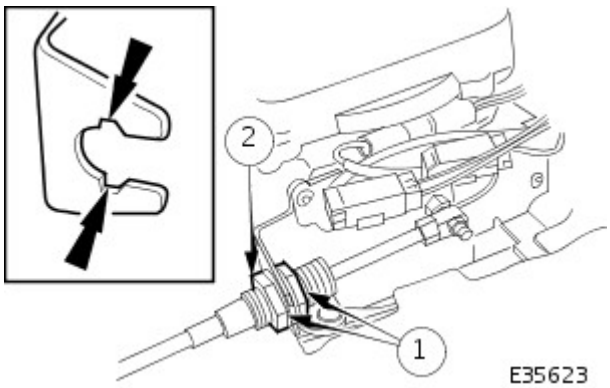
1. With assistance, position carpet in vehicle ensuring that seat harness and handbrake lever are correctly positioned in apertures.



2. Ensure that gear selector is in position 'R'.

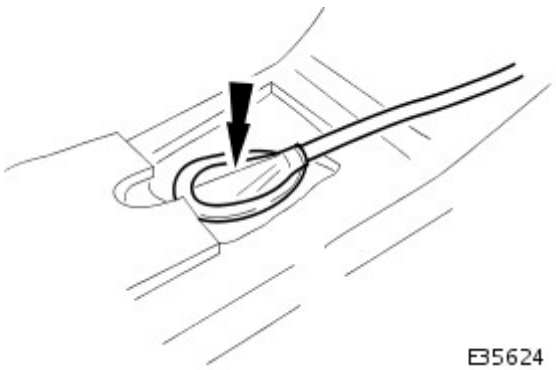
3. Install gear selector cable in 'J' gate.

1. Position gear selector cable in support bracket.
2. Connect inner cable to 'J' gate stud and fit and tighten securing nut.



4. Adjust gear selector cable.

1. Adjust selector cable nuts so that selector lever freely moves to 'R' position in gate.
2. Tighten gear selector cable locknut, ensuring that tabwasher tangs engage in bracket slots.



5. Ensure that gear selector cable to tunnel grommet is correctly seated.

6. Fit and secure handbrake trim finisher. Refer to 76.13.63.

7. Fully seat carpet side and rear retaining clips.

8. Fit front sill treadplates. Refer to operations in this section.

9. Fit rear sill treadplates. Refer to operations in this section.

10. Position and fully seat rear heel boards and rotate 1/4 turn fasteners to secure.

11. Install console heater ducting and fit and tighten securing screw.

12. Fit 'B' post trim pads. Refer to operations in this section.

13. Fit lower 'A' post trim pads. Refer to 76.13.30.

14. Fit centre console assembly. Refer to 76.25.01.

15. Fit fascia centre vent veneer panel. Refer to 76.47.06.

16. Fit centre console finisher veneer panel. Refer to 76.47.26.

17. Fit 'J' gate surround. Refer to 76.25.24.

18. Fit rear seat cushion. Refer to 76.70.37.

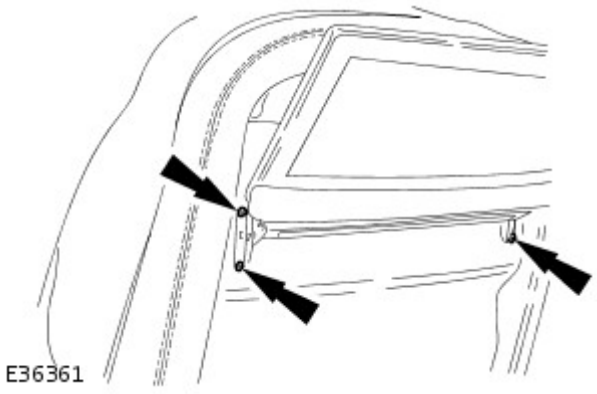
19. Fit front seats. Refer to 76.70.01.

20. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

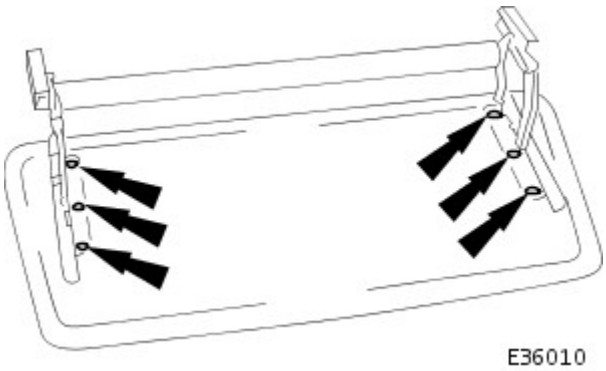
Interior Trim and Ornamentation - Folding Tray

Removal and Installation

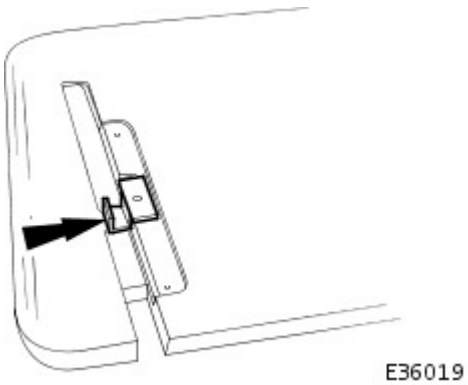
Removal



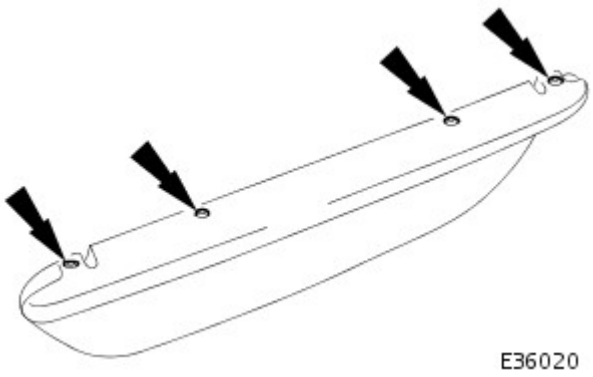
1. Remove screws securing picnic tray hinges to seat back finisher and remove tray from seat.



2. Remove screws securing hinges to picnic tray. and remove hinges from tray



3. Remove clips from hinge centre securing screw positions.



4. Remove trim securing screws and remove trim from veneer panel.

Installation

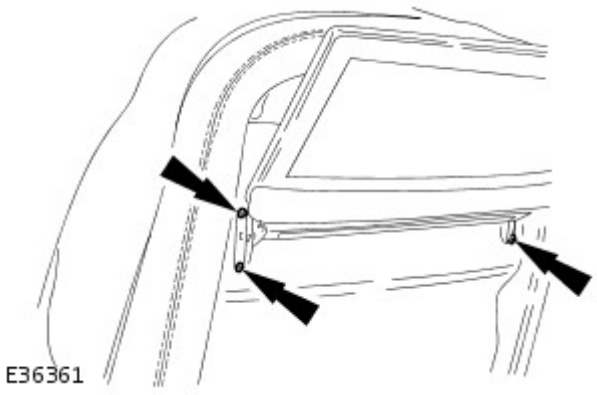
1. Position trim on veneer panel and install trim securing screws.

2. Install clips at hinge centre securing screw positions.
3. Position hinges on veneer panel and install securing screws.
4. Position hinges on seat back finisher and install securing screws.

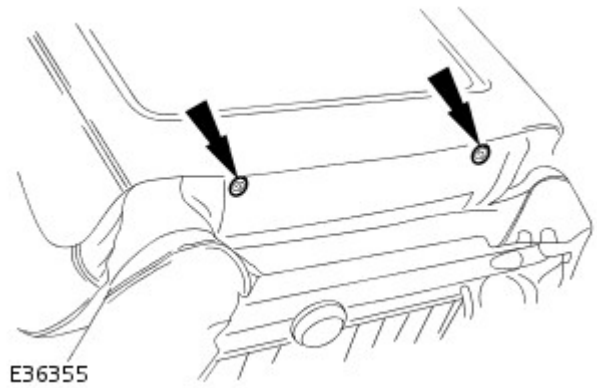
Interior Trim and Ornamentation - Folding Tray Finish Panel

Removal and Installation

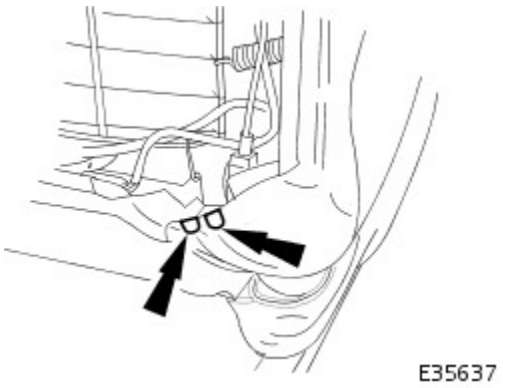
Removal



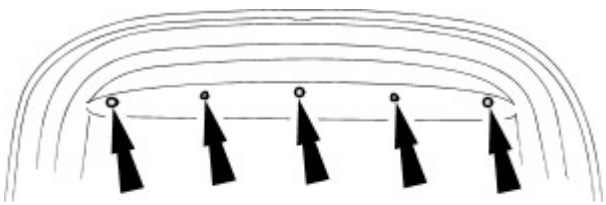
1. Move picnic tray to fully down position.
2. Remove screws securing picnic tray hinges to back finisher and remove tray from seat.



3. Remove the two back finisher to seat securing screws.



4. Release finisher from side mounting clips and remove finisher from seat.



5. Remove three screws securing picnic tray top rail veneer panel to seat finisher and remove veneer panel.

Installation

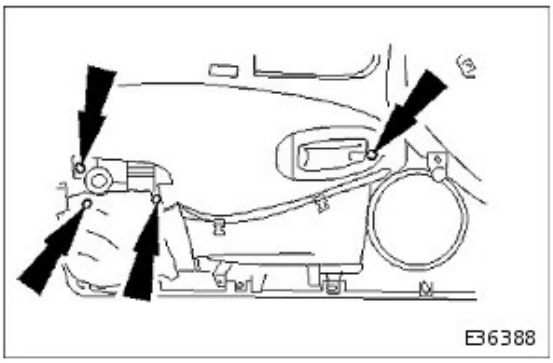
1. Position top rail veneer panel on finisher, locate two dowels and install securing screws.
2. Position back finisher on seat and install lower securing screws.
3. Position and fully seat finisher side securing clips.
4. Position picnic tray on back finisher and install hinge securing screws.
5. Move picnic tray to up position.

Interior Trim and Ornamentation - Front Door Armrest

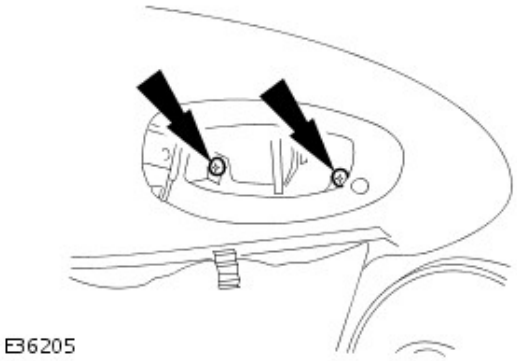
Removal and Installation

Removal

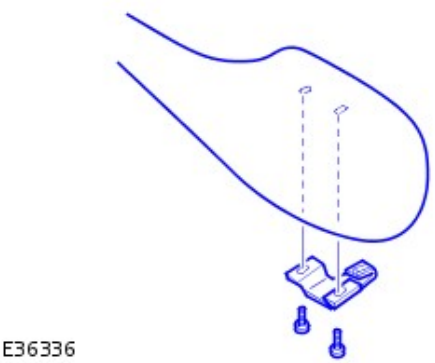
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove door casing. Refer to 76.34.01.
3. Slacken and remove four screws securing armrest to door casing and remove armrest from casing.



4. Remove switchpack from armrest.
    1. Slacken and remove two screws securing switchpack and finisher to armrest.
    2. Remove switchpack and finisher from armrest.



5. Slacken and remove two screws securing armrest retaining clip and remove clip from armrest.



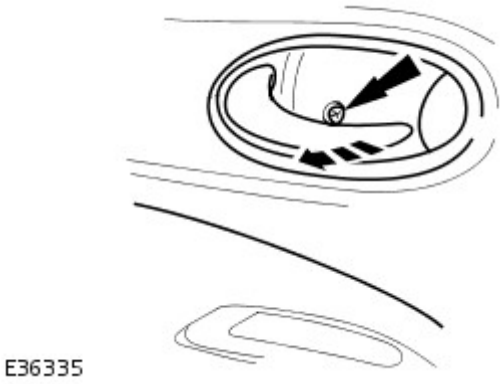
Installation

1. Position retaining clip on armrest and fit and tighten securing screws.
2. Position switchpack and finisher on armrest and fit and tighten securing screws.
3. Position armrest on casing and fit and tighten four securing screws.
4. Fit casing to door. Refer to 76.34.01.
5. Connect ground cable to battery and fit battery cover. Refer to 86.15.15.

Interior Trim and Ornamentation - Front Door Trim Panel Finish Panel

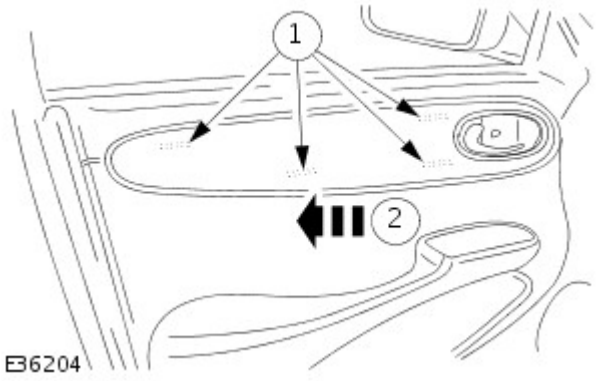
Removal and Installation

Removal



1. Remove interior door handle escutcheon.

- Remove cover from door handle escutcheon securing screw and slacken and remove screw.
- Pull door handle inwards and exercising care to avoid damaging tweeter, remove escutcheon from casing.



2. Remove veneer panel from casing.

1. Using a thin plastic lever, carefully ease rear of veneer panel inwards to release the two rear securing tangs.
2. Slide veneer panel rearwards to release front retainers.

Installation

1. Position veneer panel on casing and slide forward to engage front retainers.

2. Using a soft pad or cloth, press rear of panel firmly to seat the securing tangs.

3. Fit door handle escutcheon.

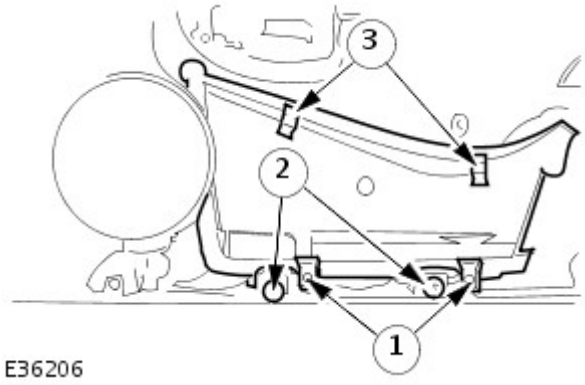
Interior Trim and Ornamentation - Front Door Stowage Compartment

Removal and Installation

Removal

1. Remove door casing for access. Refer to 76.34.01.

2. Remove pocket from door casing.



1. Release puddle lamp harness from clips at base of door pocket.
2. Slacken and remove the two screws securing bottom of pocket to casing.
3. Remove two spring clips securing top of pocket to casing.

3. Lift pocket out of casing .

Installation

1. Position pocket in casing and secure with screws and spring clips.

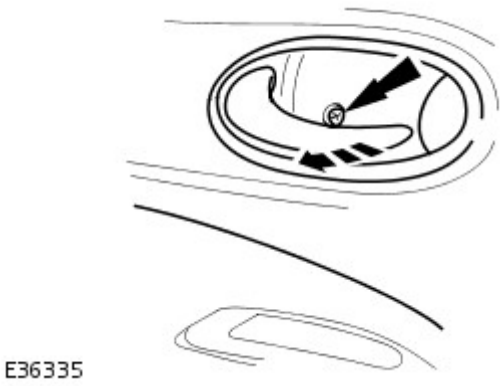
2. Position puddle lamp harness in pocket clips.

3. Fit door casing. Refer to 76.34.01.

Interior Trim and Ornamentation - Front Door Trim Panel

Removal and Installation

Removal

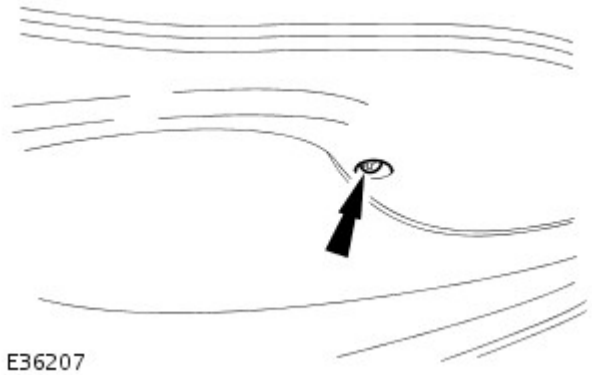


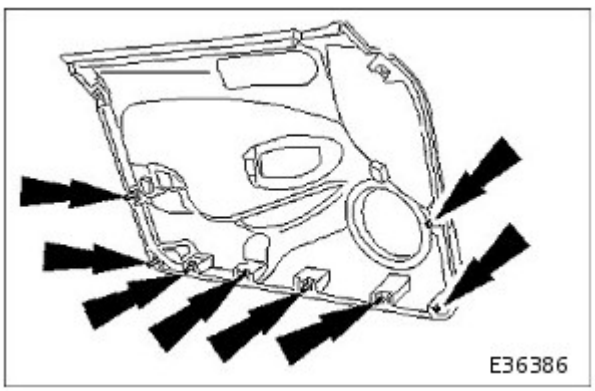
1. Remove interior door handle escutcheon.

- Remove cover from door handle escutcheon securing screw and slacken and remove screw.
- Pull door handle inwards and exercising care to avoid damaging tweeter, remove escutcheon from casing.

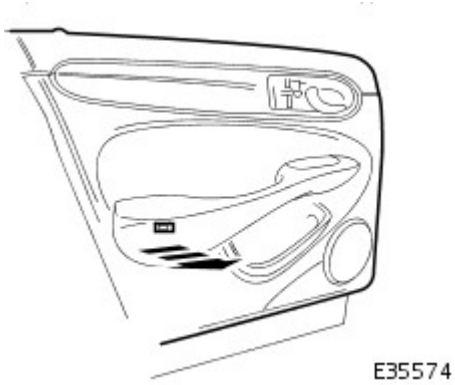
2. Remove door casing veneer panel. Refer to 76.47.11.

3. Slacken and remove the armrest centre securing screw.

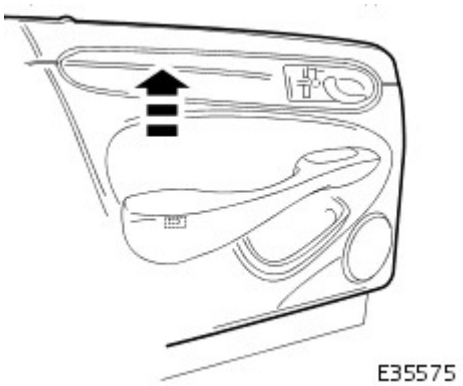




4. Carefully release the eight fasteners securing lower section of casing to door.



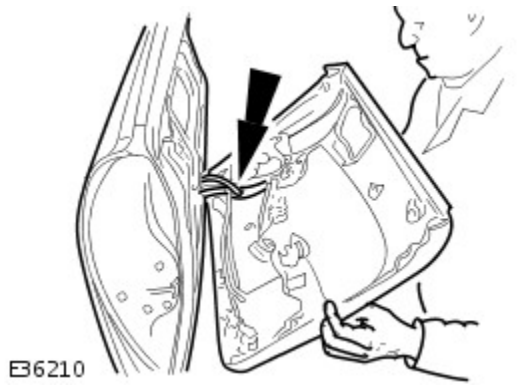
5. Lift rear edge of door casing to release retaining clip housing from door panel.



6. Lift casing clear of door waist flange and lock button and withdraw for access.

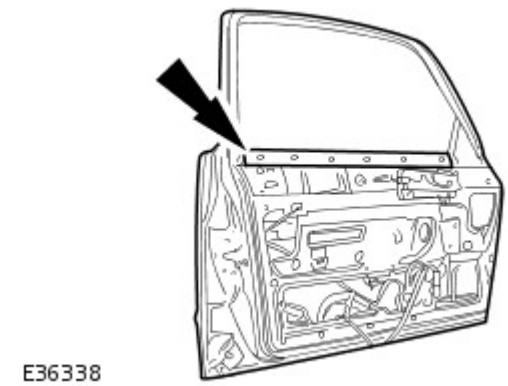
7. Using pliers, remove housing from clip and fit to door panel.

8. Disconnect tweeter, speaker, puddle lamp and switchpack harness multiplugs.



9. Remove armrest lower securing clip housing from casing. and refit to door.

10. Remove door inner waist seal from holder, slacken and remove screws securing waist seal holder and remove seal holder.

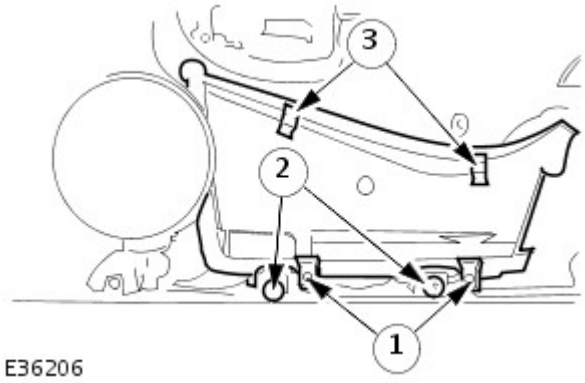


11. Remove armrest from door casing. Refer to 76.34.22.

12. Slacken and remove puddle lamp securing screws and remove lamp assembly from casing.

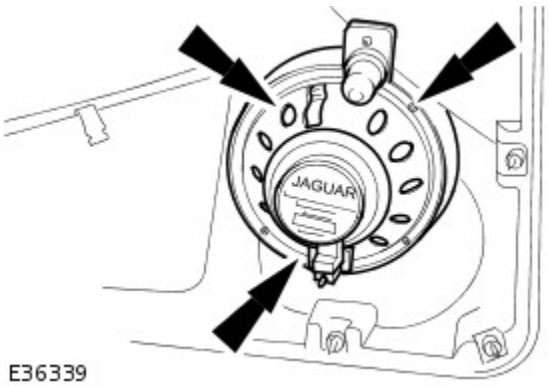


13. Remove pocket from door casing.



E36206

1. Release puddle lamp harness from clips at base of door pocket.
2. Slacken and remove the two screws securing bottom of pocket to casing.
3. Remove two spring clips securing top of pocket to casing.



E36339

14. Lift pocket from casing.

15. Slacken and remove door speaker securing screws and remove speaker from casing.

Installation

1. Fit and fully seat casing securing clips.

2. Position speaker grill in casing align speaker and fit and tighten securing screws.

3. Position pocket in casing and secure with screws and spring clips.

4. Fit puddle lamp to casing, fit and tighten securing screws and position harness in pocket clips.

5. Fit door armrest to casing. Refer to 76.34.23.

6. Fit inner waist seal holder to casing and fit and tighten the securing screws.

7. Align and fit inner waist seal.

8. Fit door armrest to casing. Refer to .

9. Check that armrest tang locater and screw insert are correctly positioned in door panel.

10. Position casing for access and connect tweeter, speaker, puddle lamp and switchpack harnesses.

11. Finally position casing locating fold over waist flange and firmly press armrest to locate retaining tang in door panel.

12. Commencing at front, press and firmly seat casing lower fasteners in door inserts.

13. Fit and tighten armrest centre securing screw in door insert.

14. Fit door casing veneer panel. Refer to 76.47.11.

15. Position door handle escutcheon on casing, fit and tighten securing screw and fit cover over screw.

Interior Trim and Ornamentation - Headliner

Removal and Installation

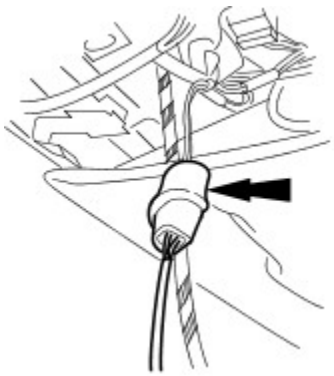
Removal

Vehicles with roof opening panel

1. Remove the roof opening panel trim.
   For additional information, refer to: Roof Opening Panel Trim (501-17 Roof Opening Panel, Removal and Installation).

All vehicles

2. Remove both C-pillar trim panels.
   For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove both A-pillar trim panels.
   For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove the overhead console.
   For additional information, refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
5. Remove the rear window glass.
   For additional information, refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
6. Disconnect the anti-theft sensors electrical connector.



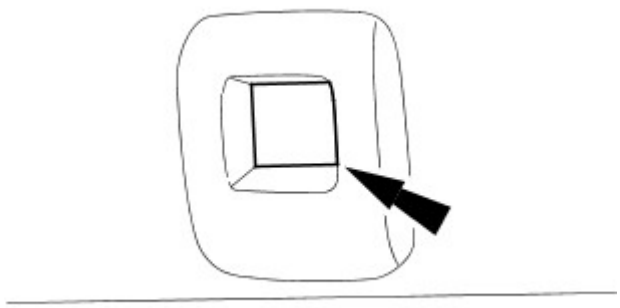
E35629

7. CAUTION: With the aid of another technician, support the headliner to ensure it is not folded or creased during removal.

   Remove both sun visors.
   For additional information, refer to: Sun Visor (501-05 Interior Trim and Ornamentation, Removal and Installation).

8. NOTE: Left-hand shown, right-hand similar.

   Detach the retaining screw cover from the headliner retaining trim.



E41740

9. NOTE: Left-hand shown, right-hand similar.

   Remove the headliner retaining trim.

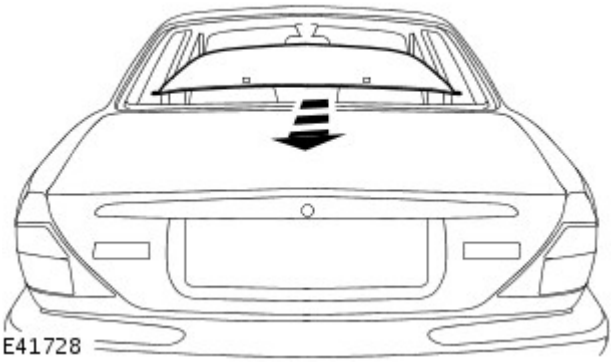
- Remove the retaining screw.



E41739

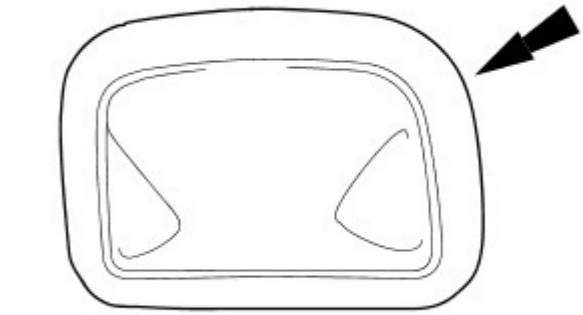
10. With the aid of another technician, lower the headliner.

11. With the aid of another technician, remove the headliner.



E41728

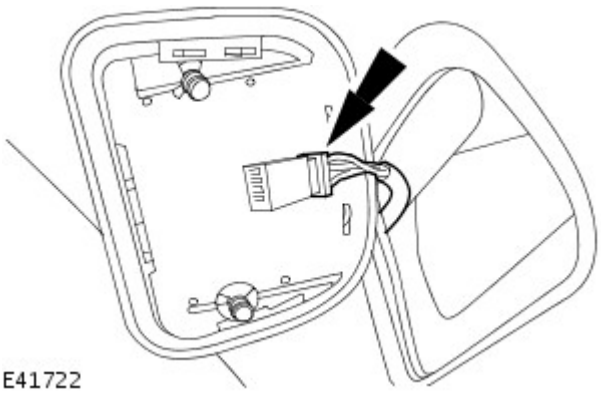
12. NOTE: Left-hand shown, right-hand similar.



E41847

Detach the anti-theft sensors.

13. NOTE: Left-hand shown, right-hand similar.



E41722

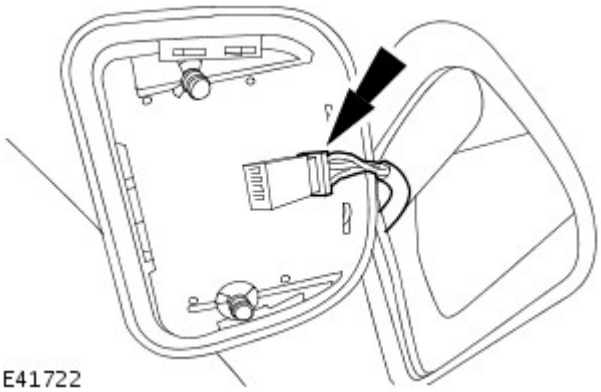
Remove the anti-theft sensors.

1. Disconnect the electrical connector.

Installation

All vehicles

1. NOTE: Left-hand shown, right-hand similar.

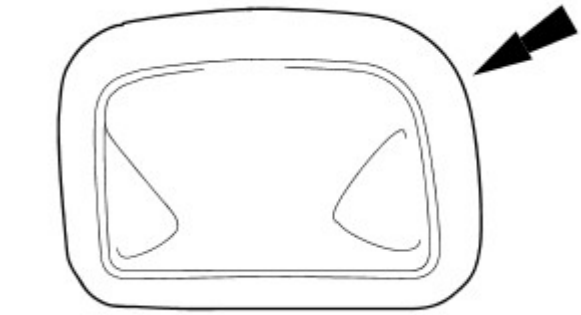


E41722

Install the anti-theft sensors.

1. Connect the electrical connector.

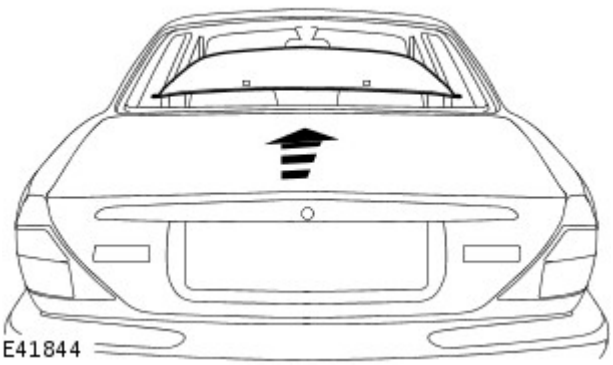
2. NOTE: Left-hand shown, right-hand similar.



E41847

Attach the anti-theft sensors.

3. CAUTION: With the aid of another technician, support the headliner.



E41844

Install the headliner.

4. With the aid of another technician, raise the headliner.

5. CAUTION: Support the headliner to ensure it is not folded or creased during installation.



E41739

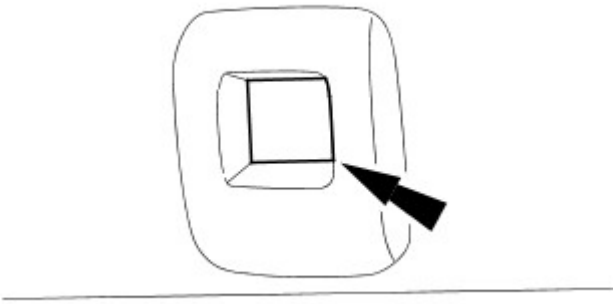
• NOTE: Left-hand shown, right-hand similar.

Install the headliner retaining trims.

- Install the retaining screw.

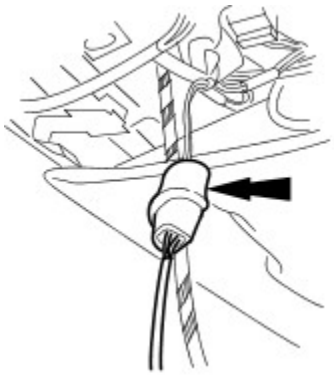
6. NOTE: Left-hand shown, right-hand similar.

Attach the screw cover.



E41740

7. Install both sun visors.
   For additional information, refer to: Sun Visor (501-05 Interior Trim and Ornamentation, Removal and Installation).
8. Install the rear window glass.
   For additional information, refer to: Rear Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
9. Fit the electrical connectors into the retaining clips at the overhead console location.



E35629

10. Install the overhead console.
    For additional information, refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
11. Install both C-pillar trim panels.
    For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Install both A-pillar trim panels.
    For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

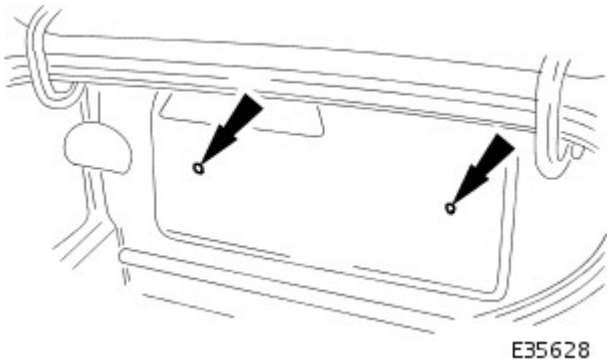
Vehicles with roof opening panel

13. Install the roof opening panel trim.
    For additional information, refer to: Roof Opening Panel Trim (501-17 Roof Opening Panel, Removal and Installation).

Interior Trim and Ornamentation - Luggage Compartment Front Trim Panel

Removal and Installation

Removal



1. Remove battery cover.
2. Remove trunk floor carpet.
3. Remove and discard the two fir tree fasteners securing the front liner.
4. Remove liner from trunk.

Installation

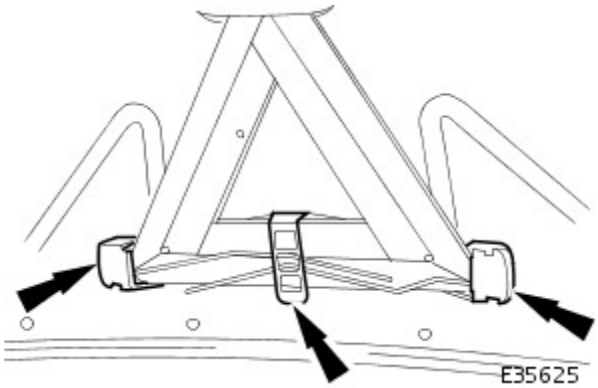
1. Position liner in trunk.
2. Using new fir tree fasteners, secure liner to front of trunk.
3. Fit trunk floor carpet.
4. Fit battery cover.

Interior Trim and Ornamentation - Luggage Compartment Lid Trim Panel

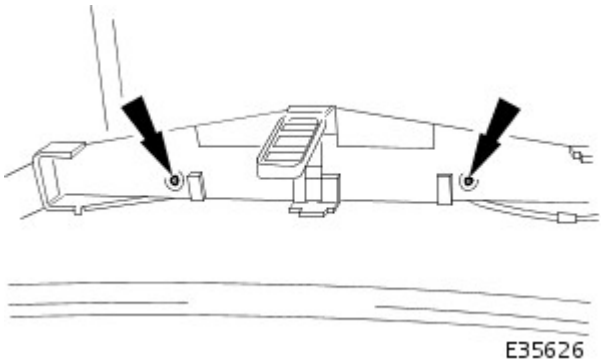
Removal and Installation

Removal

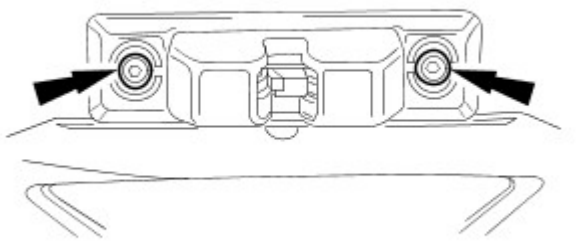
1. Remove trunk lamp assemblies. Refer to 86.45.16.
2. Release the three warning triangle securing clips and remove warning triangle.



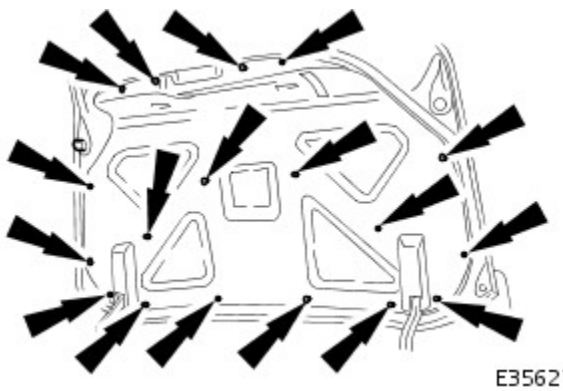
3. Slacken and remove warning triangle mounting bracket securing screws and remove bracket.



4. Remove covers from trunk latch finisher securing bolts, slacken and remove bolts and remove finisher.



5. Remove and discard the eighteeen trunk lid liner fasteners and remove liner from vehicle.



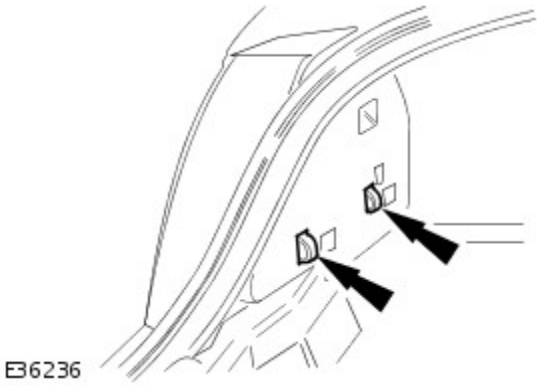
Installation

1. Position liner on trunk lid and pass lamp harness multiplugs through apertures.
2. Align and fully seat liner on trunk lid and secure with new fasteners.
3. Position finisher over trunk lid latch, fit and tighten securing bolts and fit bolt covers..
4. Position warning triangle mounting bracket and fit and tighten securing screws.
5. Install triangle on mounting bracket and secure with clips.
6. Install trunk lamp assemblies. Refer to 86.45.16.

Interior Trim and Ornamentation - Luggage Compartment Rear Trim Panel

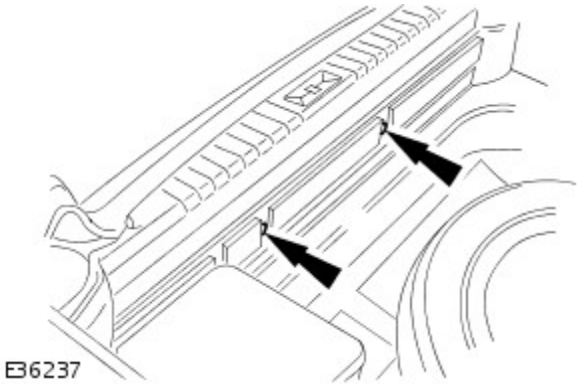
Removal and Installation

Removal

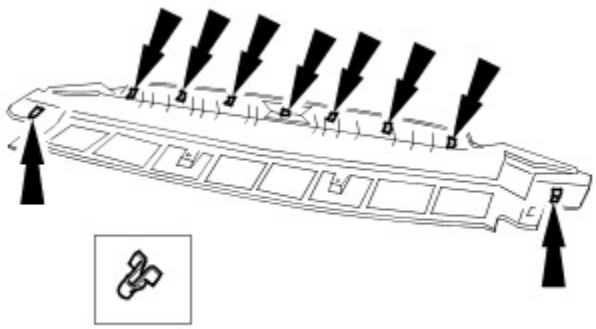

E36236

1. Remove tail lamp covers.

2. Remove trunk floor and battery cover. Refer to operations in this section.
3. Remove and discard the two fir tree fasteners securing finisher to trunk rear panel.


E36237

4. Pull rear finisher upwards to release upper spring clips and remove finisher from trunk.


E36238

Installation

1. Position finisher on trunk rear panel and press firmly downwards to engage spring clips.
2. Fit and fully seat fir tree fasteners.
3. Fit trunk floor and battery cover. Refer to operations in this section.
4. Fit tail lamp covers.

Interior Trim and Ornamentation - Luggage Compartment Side Trim Panel

Removal and Installation

Removal

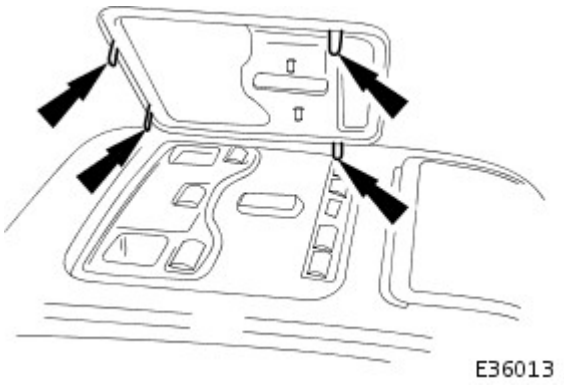
1. Remove trunk floor carpet.
2. Remove trunk front liner. Refer to 76.19.31.
3. Remove trunk rear finisher. Refer to 76.19.44.
4. Remove literature pack from trunk side liner (RH side only).
5. Remove side liner from trunk.

Installation

1. Position and fully seat side liner in trunk.
2. Install literature pack on side liner (RH side only).
3. Fit trunk rear finisher.Refer to 76.19.44.
4. Fit trunk front liner. Refer to 76.19.31.
5. Fit trunk floor carpet.

Interior Trim and Ornamentation - Overhead Console Finish Panel

Removal and Installation



Removal

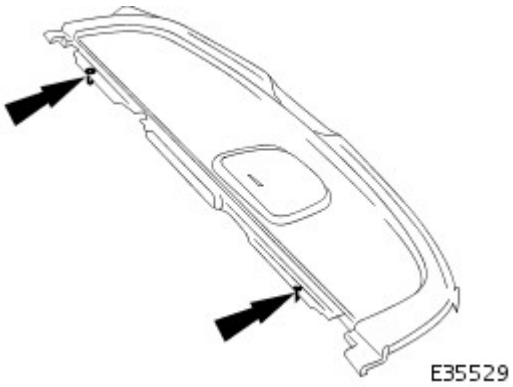
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove roof console. Refer to 76.13.69.90.
3. Bend back veneer panel retaining tangs from console and using a thin blade, carefully release panel from console.

Installation

1. Remove backing paper and apply adhesive pad to back of panel.
2. Position and fully seat veneer panel on console.
3. Bend retaining tangs to secure veneer panel to console.
4. Install roof console. Refer to 76.13.69.90.
5. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.

Interior Trim and Ornamentation - Parcel Shelf

Removal and Installation



Removal

1. Open both rear doors.
2. Remove rear seat cushion. Refer to 76.70.37.
3. Remove rear seat squab. Refer to 76.70.38.
4. Remove and discard the two fir tree fasteners securing front of tray to parcel shelf.
5. Remove parcel tray.
   - Slightly raise front of shelf trim and lift rear fold clear of body flange.
   - Exercising care to avoid damaging sun blind (if fitted) and rear quarter trims, or dislodging high level stop lamp, slide trim from shelf, twist slightly and remove from vehicle via rear doors.

Installation

1. Exercising care to avoid damaging sun blind (if fitted) and rear quarter trims, or dislodging high level stop lamp, slide trim onto shelf, engaging rear fold on body flange.
2. Secure front of trim to shelf using two new fir tree fasteners.
3. Fit rear seat squab. Refer to 76.70.38.
4. Fit rear seat cushion. Refer to 76.70.37.

Interior Trim and Ornamentation - Parcel Shelf Support

Removal and Installation

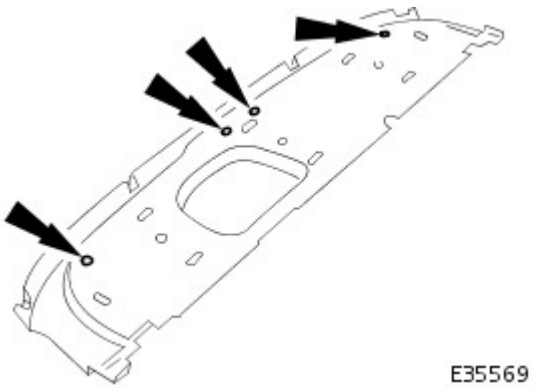
Removal

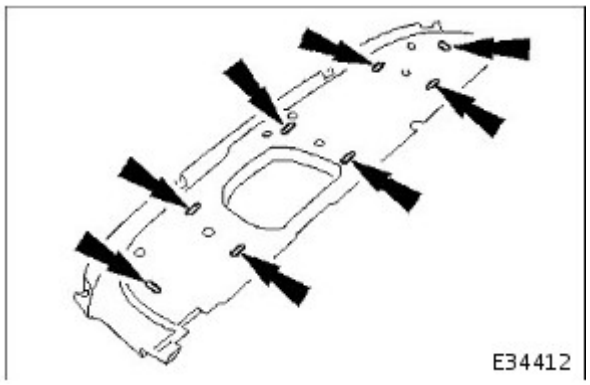
1. Remove rear parcel tray. Refer to 76.67.06.90

2. Place parcel tray face down on clean bench.

3. Where sun blinds are fitted:

1. Slacken and remove nuts securing sun blind to parcel tray.
2. Remove washers.
3. Remove sun blind from parcel tray.





4. Remove eight clips securing parcel tray outer panel to inner panel and separate panels.

Installation

1. Align outer panel to inner panel

2. Secure panels together with eight clips.

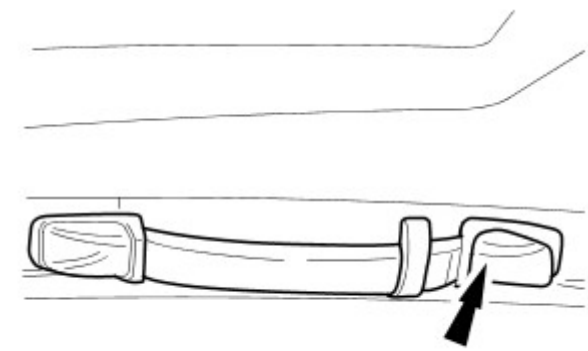
3. Where sun blinds are to be fitted, position rollers on underside of parcel tray, fit washers and fit and tighten nuts to 5-7Nm.

4. Fit parcel tray. Refer to 76.67.06.90.

Interior Trim and Ornamentation - Passenger Assist Handle

Removal and Installation

Removal



E36225

1. Using a piece of wood or similarly soft material, press inner end of each screw cover to release outer clip.
2. Remove screw covers, slacken and remove securing screws and remove grab handle from cantrail.

Installation

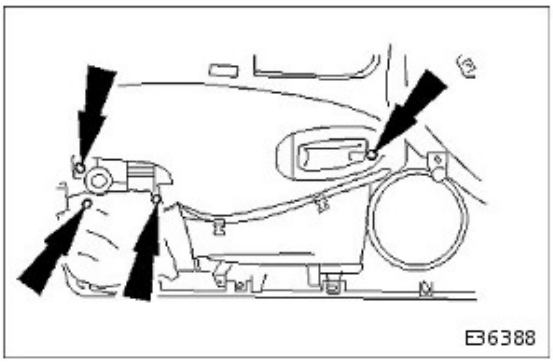
1. Position grab handle and coat hanger hook at cantrail
2. Ensuring that cantrail trim pads are correctly aligned, fit and tighten the grab handle securing screws.
3. Slide each screw cover inner end foremost, onto end of grab handle and press outer end to engage clip.

Interior Trim and Ornamentation - Rear Door Armrest

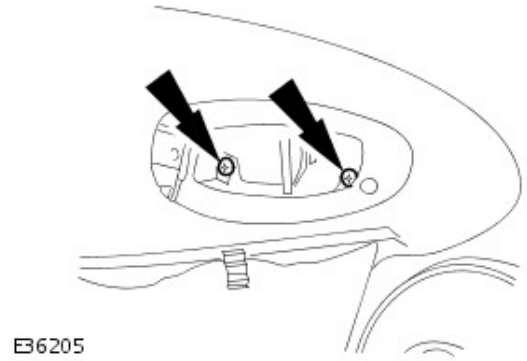
Removal and Installation

Removal

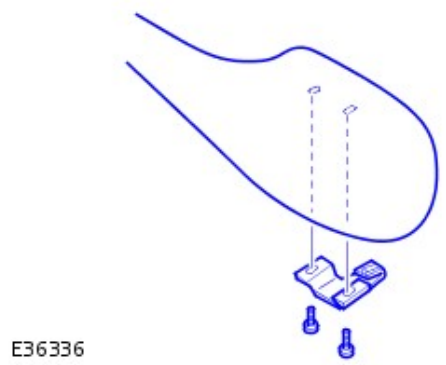
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove door casing. Refer to 76.34.01.
3. Slacken and remove four screws securing armrest to door casing and remove armrest from casing.



4. Remove switchpack/ashtray from armrest.
    1. Slacken and remove two screws securing switchpack/ashtray and finisher to armrest.
    2. Remove switchpack/ashtray and finisher from armrest.



5. Slacken and remove two screws securing armrest retaining clip and remove clip from armrest.



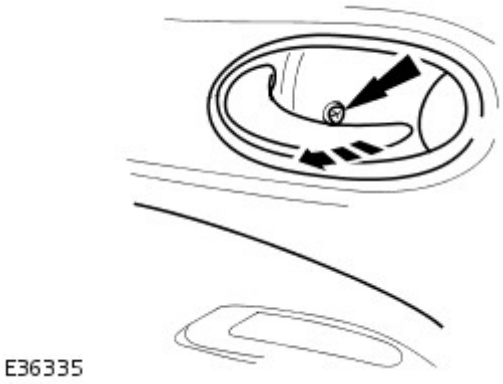
Installation

1. Position retaining clip on armrest and fit and tighten securing screws.
2. Position switchpack/ashtray and finisher on armrest and fit and tighten securing screws
3. Position armrest on casing and fit and tighten four securing screws.
4. Fit casing to door. Refer to 76.34.04.
5. Connect ground cable to battery and fit battery cover. Refer to 86.15.15.

Interior Trim and Ornamentation - Rear Door Trim Panel Finish Panel

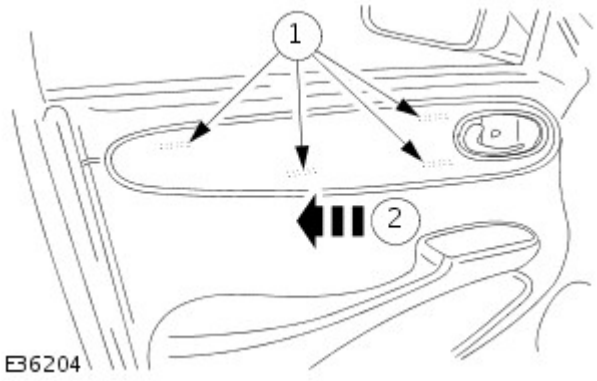
Removal and Installation

Removal



1. Remove interior door handle escutcheon.

- Remove cover from door handle escutcheon securing screw and slacken and remove screw.
- Pull door handle inwards and exercising care to avoid damaging tweeter, remove escutcheon from casing.



2. Remove veneer panel from casing.

1. Using a thin plastic lever, carefully ease rear of veneer panel inwards to release the two rear securing tangs.
2. Slide veneer panel rearwards to release front retainers.

Installation

1. Position veneer panel on casing and slide forward to engage front retainers.

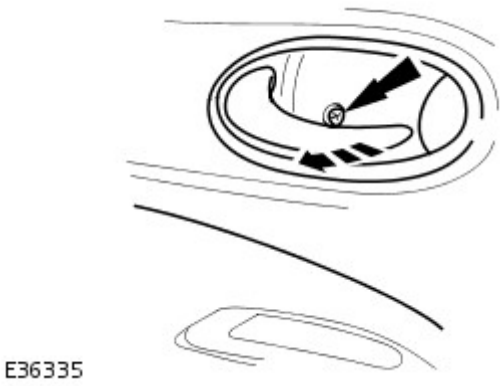
2. Using a soft pad or cloth, press rear of panel firmly to seat the securing tangs.

3. Position door handle escutcheon on casing, fit and tighten securing screw and fit cover over screw.

Interior Trim and Ornamentation - Rear Door Trim Panel

Removal and Installation

Removal

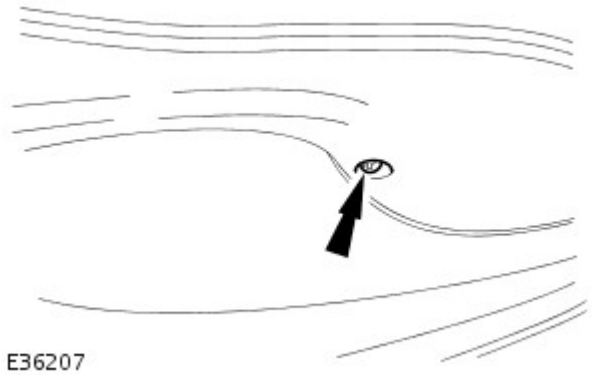


1. Remove interior door handle escutcheon.

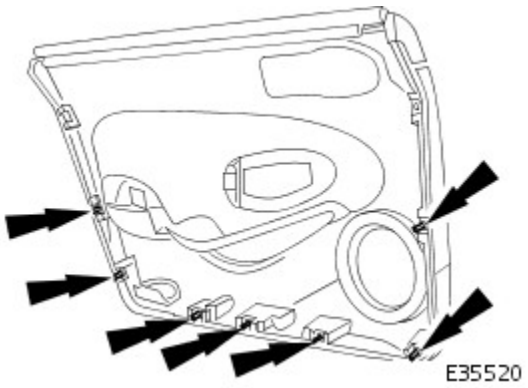
1. Remove cover from door handle escutcheon securing screw and slacken and remove screw.
2. Pull door handle inwards and exercising care to avoid damaging tweeter, remove escutcheon from casing.

2. Remove door casing veneer panel. Refer to 76.47.12.

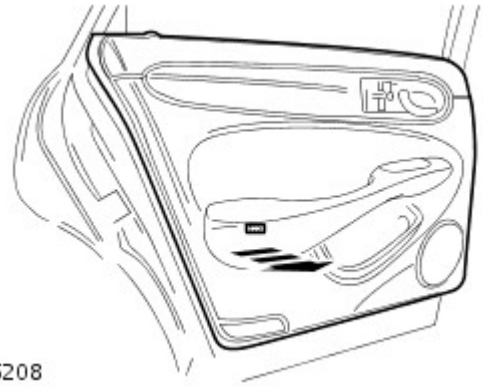
3. Slacken and remove the armrest centre securing screw.



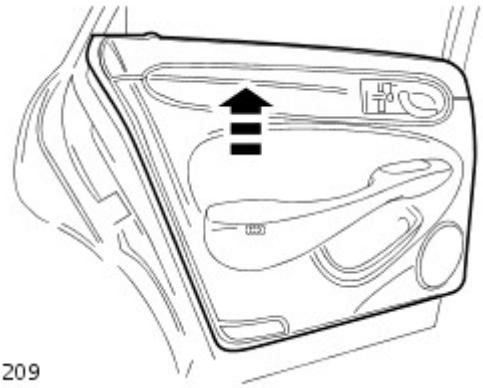
4. Carefully release the six fasteners (seven on long wheelbase) securing lower section of casing to door.



5. Lift rear edge of door casing to release retaining clip housing from door panel.

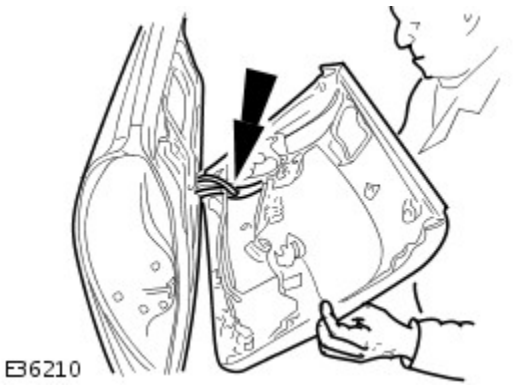


E36208



E36209

6. Lift casing clear of door waist flange and lock button and withdraw for access.



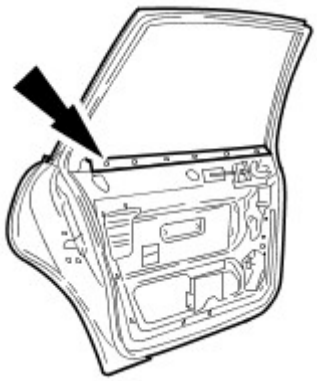
E36210

7. Disconnect speaker, puddle lamp and switchpack harness multiplugs.

8. Remove armrest lower securing clip housing from casing. and refit to door.

9. Remove door inner waist seal from holder.

- Slacken and remove screws securing waist seal holder and remove seal holder.



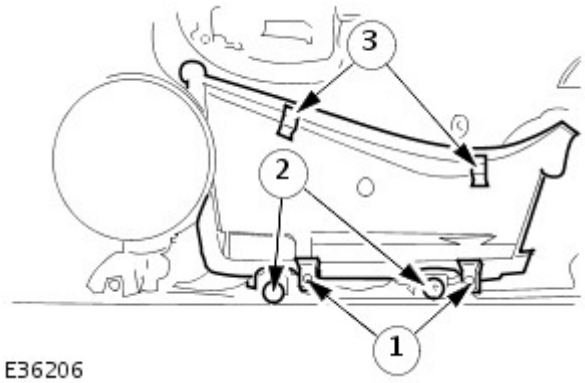
E36337

10. Remove armrest from casing. Refer to 76.34.23.

11. Slacken and remove puddle lamp securing screws and remove lamp assembly from casing.



E36340



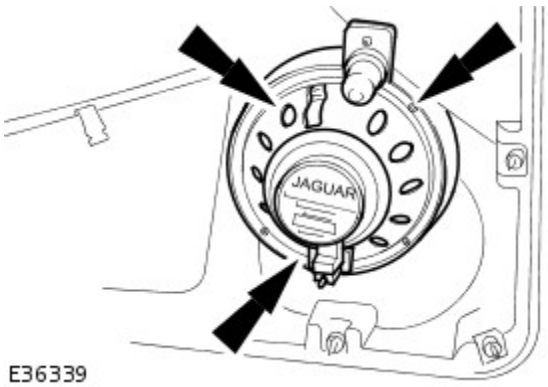
E36206

12. Remove pocket from door casing.

1. Release puddle lamp harness from clips at base of door pocket.
2. Slacken and remove the two screws securing bottom of pocket to casing.
3. Remove two spring clips securing top of pocket to casing.

13. Lift pocket from casing

14. Slacken and remove door speaker securing screws and remove speaker from casing.



E36339

15. Remove speakere grill from casing

16. Remove casing to to door securing clips.

Installation

1. Fit and fully seat casing securing clips.

2. Position speaker grill in casing align speaker and fit and tighten securing screws.

3. Position pocket in casing and secure with screws and spring clips.

4. Fit puddle lamp to casing, fit and tighten securing screws and position harness in pocket clips.

5. Fit door armrest to casing. Refer to 76.34.23.

6. Fit inner waist seal holder to casing and fit and tighten the six securing screws.

7. CAUTION: Before installing door casing, ensure that

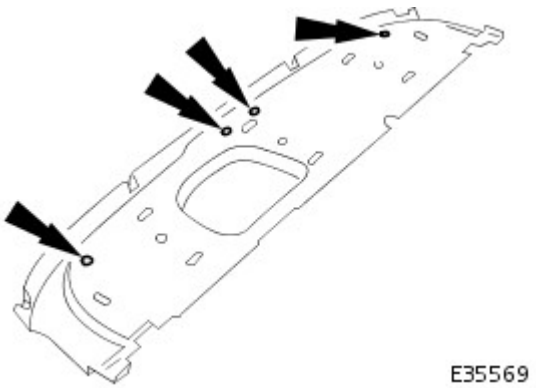
primary water shedder is undamaged and correctly attached to door inner panel.

Align and fit inner waist seal.

8. Check that armrest tang locater and screw insert are correctly positioned in door panel.
9. Position casing for access and connect speaker, puddle lamp and switchpack harnesses.
10. Finally position casing locating fold over waist flange and firmly press armrest to locate retaining tang in door panel.
11. Commencing at front, press and firmly seat casing lower fasteners in door inserts
12. Fit and tighten armrest centre securing screw in door insert.
13. Fit door veneer panel. Refer to 76.47.12.
14. Position door handle escutcheon on casing, fit and tighten securing screw and fit cover over screw.

Interior Trim and Ornamentation - Rear Window Blind

Removal and Installation



Removal

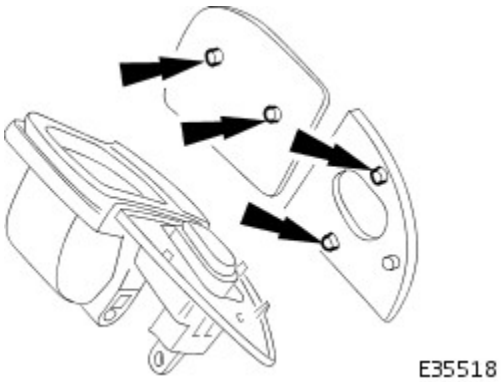
1. Remove rear seat cushion. Refer to 76.73.18.
2. Remove rear seat squab. Refer to 76.70.38.
3. Remove rear parcel tray. Refer to 76.67.06.90
4. Place parcel tray face down on clean bench.
5. Remove sunblind assembly.
   - Slacken and remove nuts securing sunblind to parcel tray.
   - Remove washers.
   - Remove sunblind from parcel tray.
   - Repeat procedure to remove opposite side sunblind.

Installation

1. Position sunblind on parcel tray.
2. Install washers on sunblind studs.
3. Install nuts on sunblind studs and tighten nuts to 5-7Nm.
4. Repeat above procedure to install opposite side sunblind.
5. Install parcel tray/sunblind assembly. Refer to 76.67.06.90.
6. Install rear seat squab. Refer to 76.70.38.
7. Install rear seat cushion. Refer to 76.73.18.

Interior Trim and Ornamentation - Rear Door Window Control Switch Finish Panel

Removal and Installation



Removal

1. Remove door casing veneer panel. Refer to 76.47.12.
2. Remove door casing. Refer to 76.34.04.
3. Remove door armrest and remove switch/ashtray assembly from armrest. Refer to 76.34.23.
4. Slacken and remove screws securing veneer panels to door glass switch/ashtray assembly.
5. Remove veneer panels from switch/ashtray assembly.

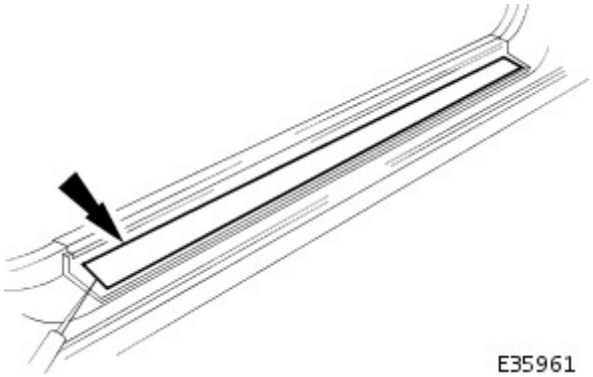
Installation

1. Position veneer panel over switch/ashtray assembly and fit and tighten securing screws.
2. Position switch/ashtray assembly on armrest and fit and tighten the two securing screws.
3. Fit armrest to door casing. Refer to 76.34.23.
4. Fit casing to door. Refer to 76.34.04.

Interior Trim and Ornamentation - Scuff Plate Trim Panel

Removal and Installation

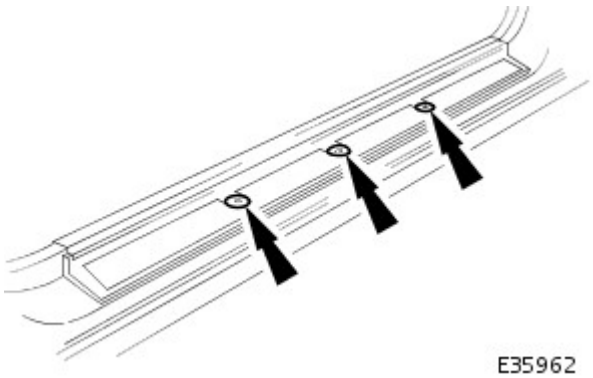
Removal



E35961

1. NOTE: The finisher can be easily damaged, care must therefore be exercised during removal.

Using a thin plastic lever and starting at one end, carefully remove the treadplate finisher and place face uppermost on sheet of clean dry polythene.



E35962

2. Remove treadplate securing screws and remove treadplate.

Installation

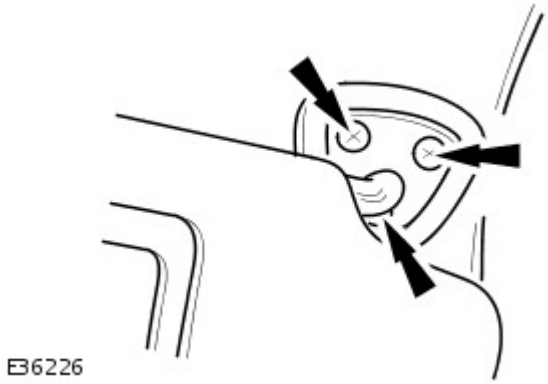
1. Ensure that draught welt is correctly positioned and fully seated on aperture flange.
2. Position sill tread plate and install three securing screws.
3. Ensure that sill contact area is clean and dry.
4. Install treadplate finisher, pressing firmly into place. If finisher has been renewed, remove protective film.

Interior Trim and Ornamentation - Sun Visor

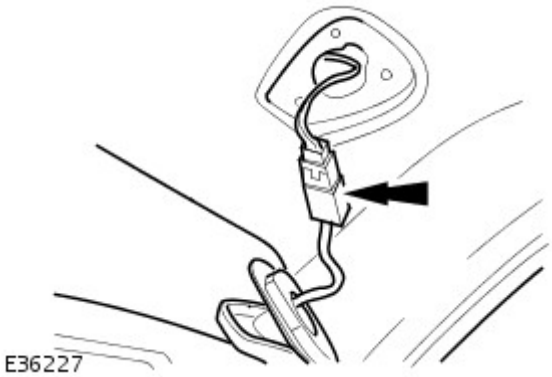
Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Release sun visor from support and turn downwards.
3. Supporting the sun visor, slacken and remove the three screws securing the mounting to the header.



4. Disconnect the harness multiplug situated behind the headlining and remove the sun visor.



5. Slacken and remove screw securing sunvisor support, and remove support from header.

Installation

1. Position sun visor at header.
2. Connect multiplug and position it behind headlining.
3. Correctly position and firmly seat sun visor mounting on header and fit and tighten securing screws.
4. Position sun visor support at header and fit and tighten securing screw.
5. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Exterior Trim and Ornamentation - Exterior Trim

Description and Operation



Body Front

The thermoplastic front bumper incorporates chromed plastic upper quarter blades and where fitted, chromed covers for the headlamp powerwash jet assemblies. The bumper lower air intake aperture is specifically profiled to achieve optimum cooling of the AJV8 engine. A splitter vane installed in the lower air intake, is chromed on Daimler and Vanden Plas vehicles and colour-keyed on all other models. An ovoidal sidemarker lens or reflector is installed in each side of the bumper cover.

The low profile plastic radiator grill surround is colour-keyed on Sport and XJR models, chromed and fluted on Daimler and chromed plain on all other models.A Jaguar 'growler' badge is fitted in the upper central position of the grill surround. For certain markets, a spring-loaded chromed Jaguar 'leaper' mascot is installed centrally on the front of the hood. Radiator grills are chromed mesh on the XJR, dark grey vertical vanes on the Sport, and chromed vertical vanes on all other models.

Body Sides

For certain markets, a Jaguar 'leaper' badge fitted in place of the direction indicator side repeater, is surface mounted in a shallow recess on the rear of each front fender. Three-piece colour-keyed body side mouldings surface mounted on the lower section of each door and front fender align with bumper upper extremities. A brightwork inset is incorporated in the upper edge of side mouldings on Daimler and Vanden Plas models. On Daimler models, a 'Daimler' script badge is mounted on the upper section of the B post. A 'V8' badge is fitted in the same position on all other models.

All models have coachlines painted on the front fenders, the doors and rear fenders. Sport and XJR models have upper and lower coachlines 1.5mm and 3mm wide respectively, XJ8 has a 1.5mm single upper coachline and all other models have a single upper coachline 3mm wide.

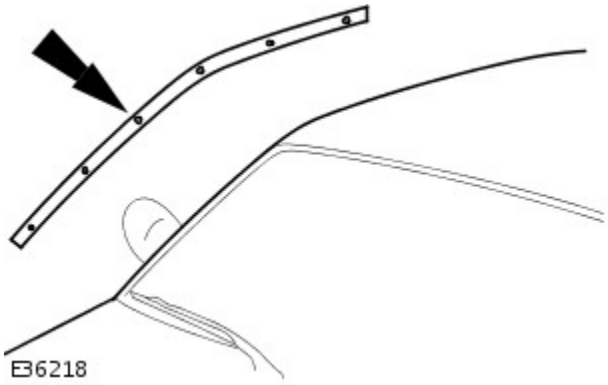
Body Rear

The themoplastic rear bumper also incorporates chromed plastic upper quarter blades and ovoidal sidemarker lenses or reflectors. The trunk lid trim is colour-keyed on Sport and XJR models, chromed fluted on Daimler and chromed plain on all other models.

With the exception of Daimlers, the trunk lid rear carries a 'Jaguar' badge on the LH side. Daimlers carry a script 'Daimler' badge in the same location. On the RH side, Jaguar models carry an 'XJ8', '3.2 Sport', '4.0 Sport', 'Sovereign 8', 'XJR', or 'Vanden Plas' badge as applicable. Daimlers carry a 'V8' badge in the same position.

Exterior Trim and Ornamentation - A-Pillar Moulding LH

Removal and Installation



Removal

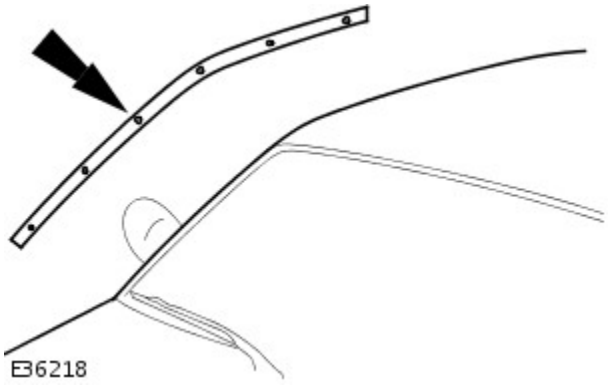
1. Remove front and rear grab handles. Refer to 76.58.30
2. Remove draught welt from adjacent section of door aperture flange.
3. Using a trim removal tool, carefully ease the six trim pad fir tree fasteners from cantrail and upper'A' post locations.
4. If premium ICE is fitted, carefully withdraw trim pad for access and disconnect tweeter connectors.
5. Remove trim pad from vehicle and remove tweeter. Refer to 415-03.
6. Remove and discard fir tree fasteners.

Installation

1. Fit new fir tree fasteners to the trim pad.
2. Fit tweeter to trim pad. Refer to Section 415.
3. Position trim pad for access and connect tweeter to harness.
4. Commencing at top of 'A' post and working rearwards, fully seat three fir tree fasteners.
5. Fully seat remaining three fir tree fasteners in upper'A' post.
6. Fit front and rear combined grab handles. Refer to 76.58.30
7. Fit draught welt to adjacent section of door aperture flange.

Exterior Trim and Ornamentation - A-Pillar Moulding RH

Removal and Installation



Removal

1. Remove rear grab handle. Refer to 76.58.30.
2. Remove draught welt from adjacent section of door aperture flange.
3. Using a trim removal tool, carefully ease the six trim pad fir tree fasteners from cantrail and upper'A' post locations.
4. If premium ICE is fitted, carefully withdraw trim pad for access and disconnect tweeter connectors.
5. Remove trim pad from vehicle and remove tweeter. Refer to 415-03.
6. Remove and discard fir tree fasteners.

Installation

1. Fit new fir tree fasteners to the trim pad.
2. Fit tweeter to trim pad. Refer to Section 415.
3. Position trim pad for access and connect tweeter to harness.
4. Commencing at top of 'A' post and working rearwards, fully seat three fir tree fasteners.
5. Fully seat remaining three fir tree fasteners in upper'A' post.
6. Fit grab handle. Refer to 76.58.30.
7. Fit draught welt to adjacent section of door aperture flange.

Exterior Trim and Ornamentation - Coachlines

Removal and Installation

Removal

1. For removal of painted coachlines, refer to Section 501-18 of this manual.

Installation

1. For position and application of painted coachlines, refer to Section 501-18 of this manual.

Exterior Trim and Ornamentation - Door Moulding

Removal and Installation

Removal

1. Apply suitable protective tape to immediately adjacent areas of paintwork.
2. Using a hand-held heat gun, appply heat uniformly along moulding length.
3. Applying local heat at one end and using a suitable thin lever to avoid damaging paintwork, progressively ease moulding away from door panel.
4. Discard moulding and remove protective tape.
5. Remove any residual adhesive and thoroughly clean area using white spirit.

Installation

1. NOTE: Optimum adhesion is achieved by warming body panel and moulding to 65deg C.

   Using white spirit ensure that mounting area is clean, dry and de-greased.
2. Remove protective backing tape from moulding.
3. NOTE: Do not allow moulding to contact the body panel until it is correctly aligned.

   Heat moulding and mounting area to 65degC.)
4. Aligning with adjacent mouldings or to match opposite side of vehicle, press new moulding firmly onto body panel.
5. Apply hand pressure along moulding length to ensure satisfactory adhesion.
6. Allow moulding and door panel to cool , then thoroughly clean both using white spirit.
7. Apply a coat of suitable polish to moulding and body panel.

Exterior Trim and Ornamentation - Front Fender Moulding

Removal and Installation

Removal

1. Apply suitable protective tape to immediately adjacent areas of paintwork.
2. Using a hand-held heat gun, appply heat uniformly along moulding length.
3. Applying local heat at one end and using a suitable thin lever to avoid damaging paintwork, progressively ease moulding away from fender.
4. Discard moulding and remove protective tape.
5. Remove any residual adhesive and thoroughly clean area using white spirit.

Installation

1. NOTE: Optimum adhesion is achieved by warming body panel and moulding to 65deg C.

   Using white spirit ensure that mounting area is clean, dry and de-greased.
2. Remove protective backing tape from moulding.
3. NOTE: Do not allow moulding to contact the fender until it is correctly aligned.

   Heat moulding and mounting area to 65deg C.
4. Aligning with adjacent mouldings or to match opposite side of vehicle, press new moulding firmly onto fender.
5. Apply hand pressure along moulding length to ensure satisfactory adhesion.
6. Allow moulding and fender to cool , then thoroughly clean both using white spirit.
7. Apply a coat of suitable polish to moulding and fender.

Exterior Trim and Ornamentation - Luggage Compartment Lid Badges

Removal and Installation

Removal

1. Apply protective tape to area immediately surrounding and up to the badge edge.
2. Using a thin plastic lever and a fulcrum of suitable material positioned on the taped area, carefully ease the badge free.
3. Remove protective tape.
4. Using white spirit, remove any residual adhesive.

Installation

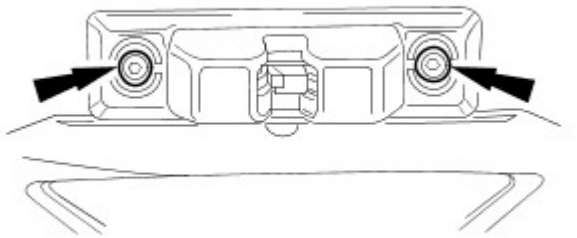
1. Ensure that contact area is clean and dry.
2. Remove backing sheet from badge.
3. Ensuring correct alignment with trunk lid recess and where applicable lock aperture and press badge firmly into position.
4. Clean affected area and apply suitable polish to trunk lid and badge.

Exterior Trim and Ornamentation - Luggage Compartment Lid Moulding

Removal and Installation

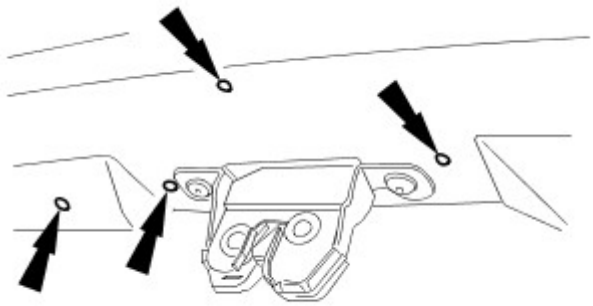
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Disconnect and remove trunk lamp assemblies. Refer to 86.45.16.
3. Remove covers from trunk latch finisher securing bolts, slacken and remove bolts and remove finisher.



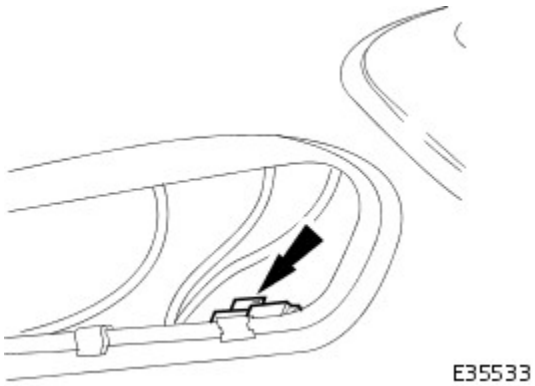
E36304

4. Remove and discard trunk lid liner rear fasteners and position liner for access.



E36310

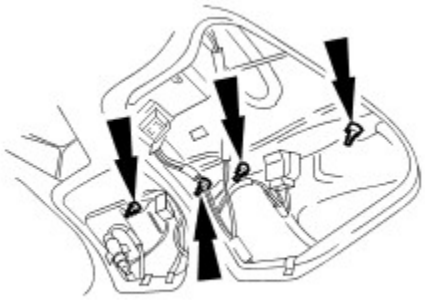
5. Free trunk lid release button harness from retaining clip and disconnect multiplug.



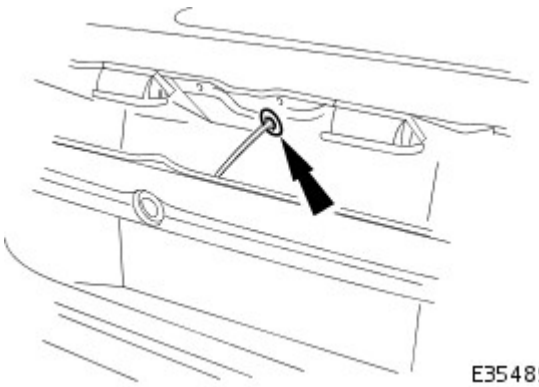
E35533

6. NOTE: The pressed steel fasteners fitted to Jaguar models should be discarded on removal.

Slacken and remove nuts/fasteners securing trim finisher to trunk lid.



E35534

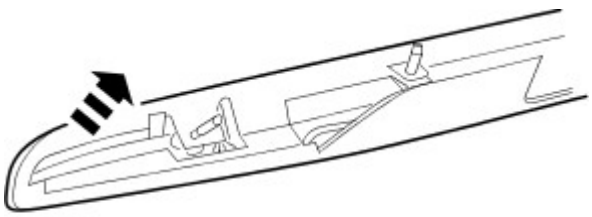


E35489

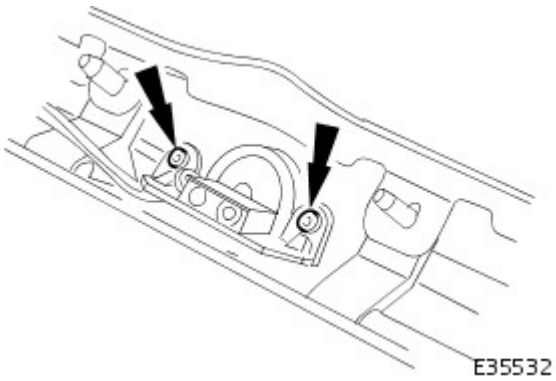
7. Position trim finisher for access and withdraw and discard release button harness grommet from trunk lid.

8. Remove trim finisher from trunk lid.

9. Carefully remove seal from trim finisher.



E35523



E35532

10. Slacken and remove screws securing release button assembly to trim finisher and remove release button from finisher.

Installation

1. Fit and fully seat release button in trim finisher and fit and tighten securing screws.

2. Apply suitable adhesive to contact area of trim finisher and fit and align seal to finisher.

3. Position trim finisher and pass release button harness through trunk lid aperture.

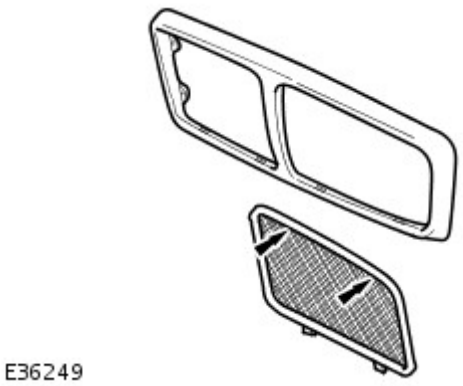
4. Fit and fully seat a new harness grommet in trunk lid.
5. NOTE: Fit new pressed steel fasteners on Jaguar models.

   Align and fully seat trim finisher on trunk lid and fit and fully tighten securing nuts/fasteners.
6. Connect release button harness multiplug and position harness in retaining clip.
7. Position and fully seat trunk lid trim pad and secure with new fir tree fasteners.
8. Fit finisher over trunk latch, fit and tighten securing bolts and fit bolt covers..
9. Fit trunk lamp assemblies. Refer to 86.45.16.
10. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Exterior Trim and Ornamentation - Radiator Grille

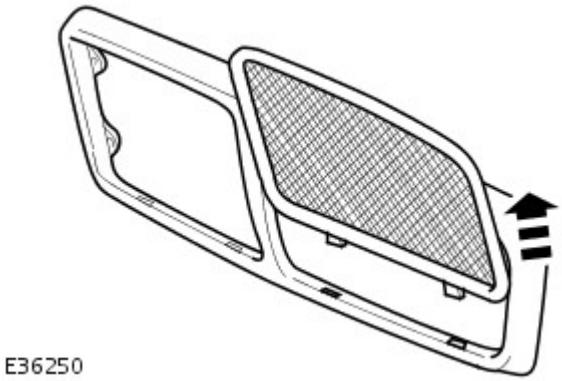
Removal and Installation

Removal



E36249

1. Slacken and remove the two screws securing top of grill to surround.



E36250

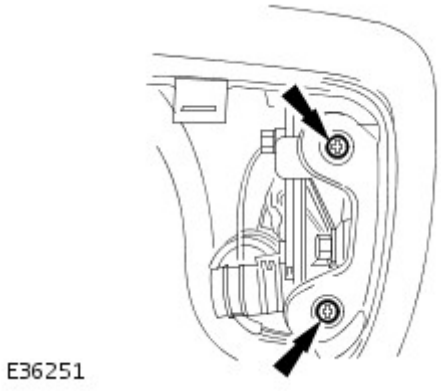
2. Lift grill to withdraw retaining lugs from slots and remove grill from vehicle.
3. Remove and discard the two nylon screw inserts from top of surround (adapters for supercharged models).
4. Repeat above steps to remove grill on opposite side.

Installation

1. Fit new screw inserts/adapters to top of grill surround.
2. Fit grill lower lugs into suurround slots.
3. Fit and tighten the two screws securing top of grill to surround.
4. Repeat above steps to install grill on opposite side.

Exterior Trim and Ornamentation - Radiator Grille Bezel

Removal and Installation



Removal

1. Remove radiator grills for access. Refer to 76.55.03.
2. Slacken and remove the two screws securing each end of surround to BIW and remove surround from vehicle.
3. Remove and discard the two nylon screw inserts from each side of BIW.

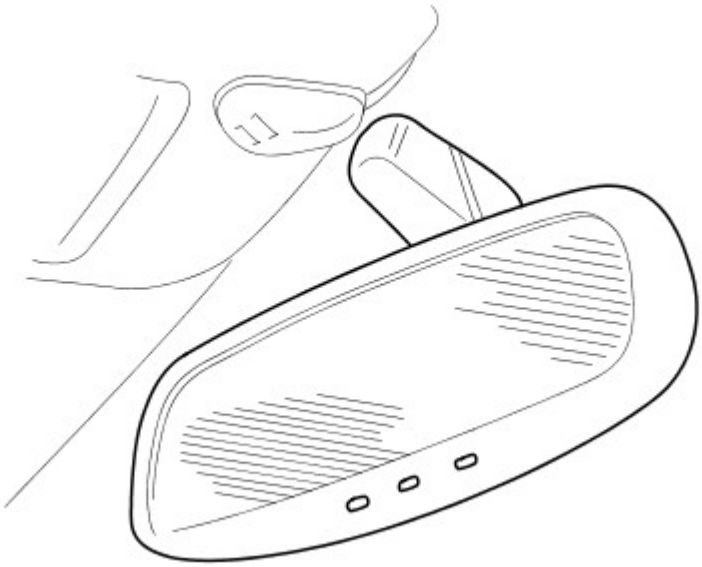
Installation

1. Fit new screw inserts to BIW locations.
2. Position grill surround on BIW and fit and tighten securing screws.
3. Fit radiator grills. Refer to 76.55.03.

Rear View Mirrors - Rear View Mirrors

Description and Operation

Interior Rear View Mirror

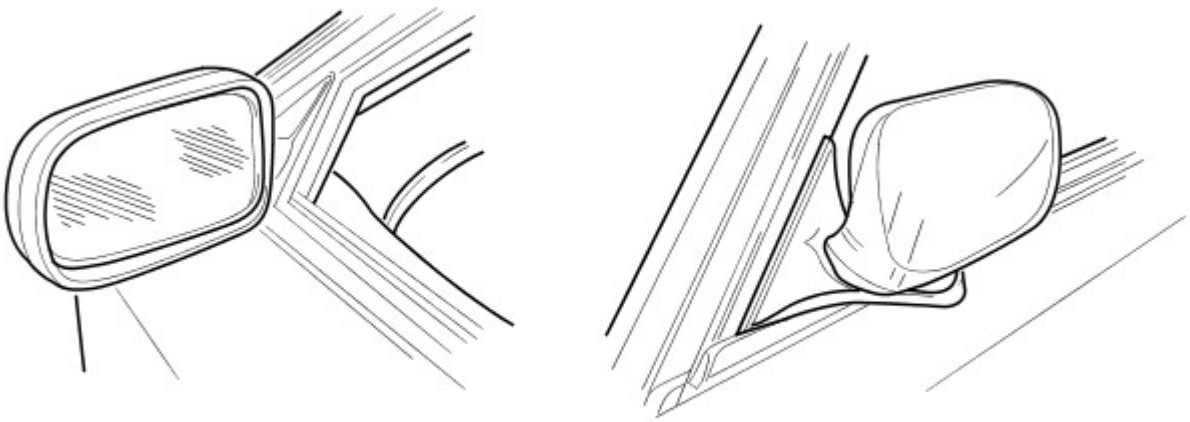


E36242

The interior rear view mirror is an electrochromic unit that automatically darkens to prevent glare from following vehicle lights. This automatic function is selected by pressing the switch at the bottom of the mirror. Pressing the switch again cancels this function. An LED then illuminates when automatic dipping is operative.

A Night Sentinel light sensing unit also incorporated in the mirror casing, provides for automatic control of the vehicle lights.

Door Rear View Mirrors



E36243

The door mirrors are cheater mounted, color-keyed units, remote electrically adjustable and heated. Adjustment of both mirrors is carried out from the driver's door switchpack. A slider switch selects the mirror to be adjusted, and a disc switch adjusts the selected mirror to the required position.

Mirror adjustment can only be made when the ignition switch is in position I or II or the driver's door is open, and the selector switch is moved from the central position.

When fitted, electrochromic door mirrors automatically darken under control of the interior rear view mirror. Mirror heating elements operate on selection of backlight heating.

Automatic dipping of passenger door mirror for kerb view when reversing, is fitted as part of the memory pack. With the ignition switch in position II, the mirror selector switch in the left or right position and reverse gear selected, automatic dipping is initiated by moving the mirror toggle switch rearwards and releasing.

On receipt of the dip signal, the passenger door mirror is driven downwards either 7 degrees, bottom of travel, or 4,5 to 5,5 seconds, whichever occurs first. Subsequent rearward movement of the toggle switch achieves further dipping of the mirror in the same increments and sequence.

The mirror can be manually returned to the normal memorised position by moving the toggle switch forward with reverse gear selected. The mirror will automatically return to memorised position on deselection of reverse gear, or moving ignition switch from position II.

Door mirror fold-back where fitted, to facilitate parking in confined spaces, can be initiated when the ignition switch is in position I or II, the mirror selector switch is in the central position and vehicle speed is below 19 km/h (12 mph). Mirror fold-back is then initiated by moving the toggle switch rearwards and releasing it. The door mirrors are returned to the normal driving position by again moving toggle switch rearwards. There is no speed constraint on this operation.

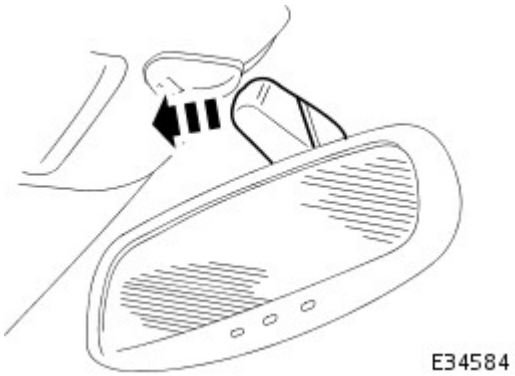
In the event of a fold-back mirror becoming 'out of position' due to accidental impact, it must only be re-positioned by initiating the fold-back sequence.

Loss of power supplies will result in loss of mirror fold-back memory. In the event of such a memory loss with mirrors in the normal position, fold-back will operate on second movement of the toggle switch. On loss of memory with mirrors in the fold-back position, they will return to the normal position on next fold-back operation.

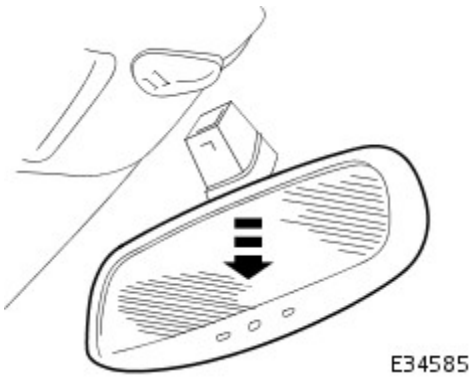
Rear View Mirrors - Auto-Dimming Interior Mirror

Removal and Installation

Removal



1. Remove roof console for access and disconnect interior mirror harness multiplugs. Refer to 76.13.69.90.
2. Remove upper cover from mirror stem.
3. Remove rain sensor unit. Refer to Section 501.16.



4. CAUTION: When removing mirror from base, care must be exercised to ensure that base is not detached from windshield.

   Applying firm downward pressure, remove mirror assembly from base.

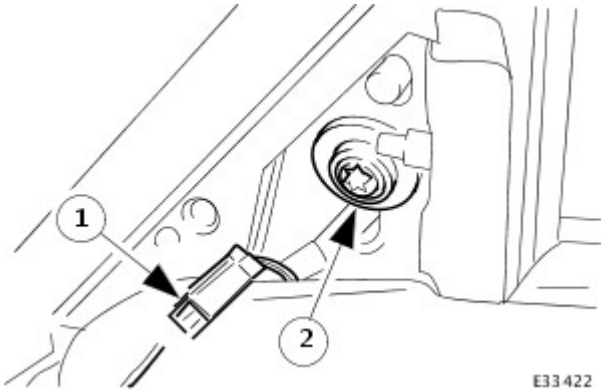
Installation

1. Position mirror at bottom of base and apply firm upward pressure to fully seat and secure in position.
2. Install upper cover to mirror stem.
3. Position roof console at header and connect mirror harness multiplugs.
4. Install rain sensor unit. Refer to Section 501.16.
5. Install roof console. Refer to 76.13.69.

Rear View Mirrors - Exterior Mirror

Removal and Installation

Removal



1. Fully open door glass and ease top of door casing away from door Refer to 76.34.01.
2. Remove door frame cheater trim and memory foam for access.
3. Remove mirror assembly from door.
    1. Disconnect mirror harness multiplug.
    2. Supporting mirror, slacken and remove securing screw and remove mirror assembly from door.

Installation

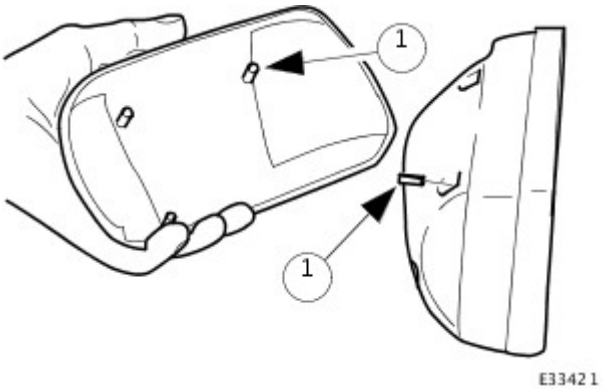


1. Fit exterior mirror assembly to door.
    1. Pass harness and multiplug through cheater aperture and position mirror foot on cheater, locating the two dowels correctly and ensuring correct seating on seal.
    - Fit and tighten the mirror assembly securing screw.
    - Connect mirror assembly harness multiplug, position in door and reposition door foam.
2. Fit memory foam and door frame cheater trim.
3. Close door glass.
4. Fit top of door casing. Refer to 76.34.01.

Rear View Mirrors - Exterior Mirror Cover

Removal and Installation

Removal



E33421

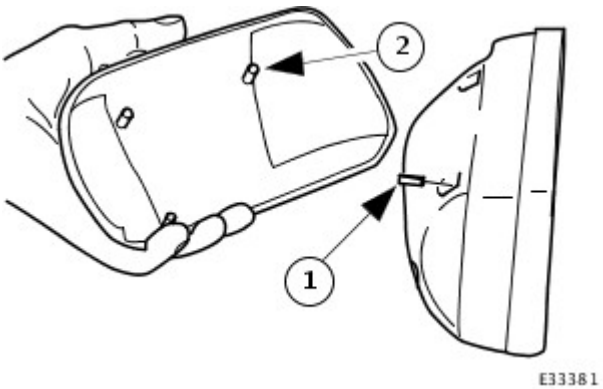
1. Remove exterior mirror glass. Refer to 76.10.53.

2. Remove exterior mirror cap.

1. From housing interior, press out the three cap dowels complete with securing clips.

- Remove mirror cap from casing.
- Remove and discard the securing clips.

Installation



E33381

1. Fit cap to mirror housing.

1. Fit and fully seat new cap securing clips in mirror base.
2. Align mirror cap dowels with the securing clips and press firmly into place.

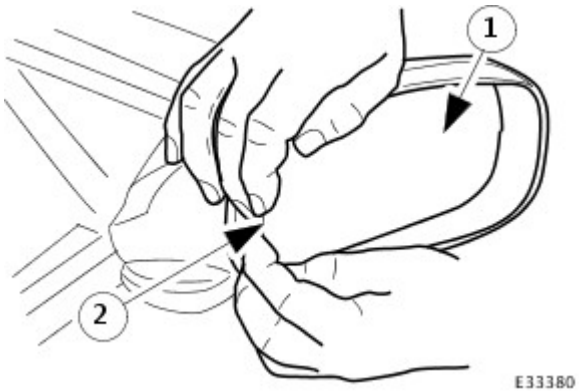
2. Fit mirror glass. Refer to 76.10.53.

Rear View Mirrors - Exterior Mirror Glass

Removal and Installation

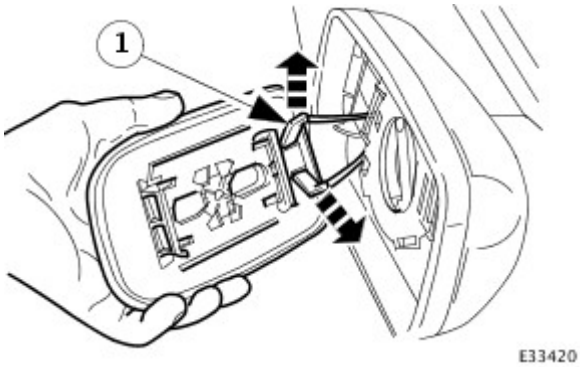
Removal

CAUTION: If as a result of accidental impact, a powered fold-back mirror is moved 'out of position', it must only be re-positioned by initiating the fold-back sequence as described in this section. No attempt must be made to manually return the mirror to the normal position. Failure to adopt this procedure will result in vibration of the unlocked mirror head and consequent loss or distortion of rear vision.



1. Remove exterior mirror glass.

1. Motor glass to fully inward position.
2. Pressing inner edge of glass outwards, ease outer extremity rearwards away from mirror housing.



2. Disconnect and remove mirror glass.

1. Ease glass clear of base, disconnect the two spade connectors and remove glass from mirror housing.

Installation



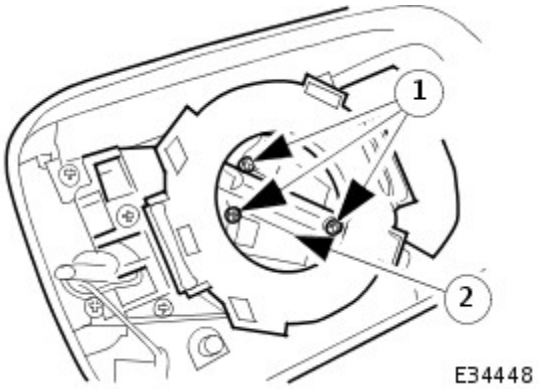
1. Fit glass to mirror housing.

- Holding glass in position, connect the two spade connectors.
- Engage the mirror inner retainer on the motor lug and press the mirror outer edge forward to engage the outer retainer.

Rear View Mirrors - Exterior Mirror Motor

Removal and Installation

Removal

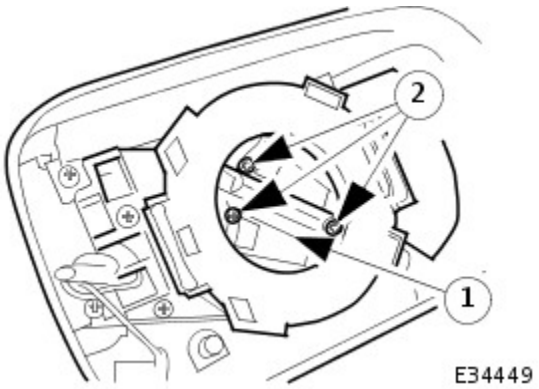


1. Remove exterior mirror glass. Refer to 76.10.53.

2. Remove movement motor pack from housing.

1. Slacken and remove the three self tapping screws securing motor pack to housing.
2. Partially withdraw motor pack, disconnect multiplug and remove motor pack from mirror housing.

Installation



1. Fit glass movement motor pack to housing.

1. Connect multiplug and position motor pack in housing ensuring that harness is correctly routed and not trapped.
2. Fit and tighten the three self tapping screws securing motor pack to housing and fold-back mounting.

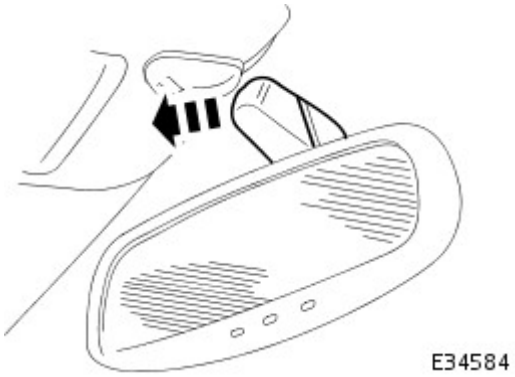
2. Fit exterior mirror glass. Refer to 76.10.53.

Rear View Mirrors - Interior Mirror

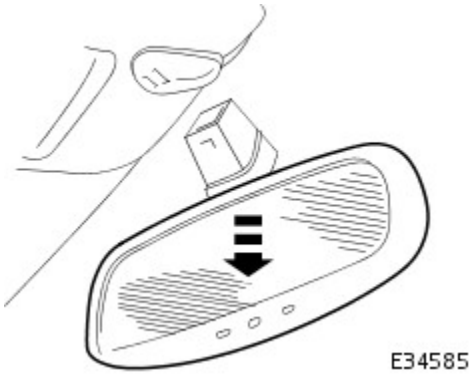
Removal and Installation

Removal

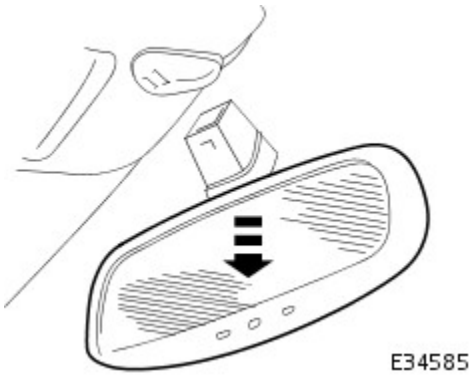
CAUTION: When removing mirror from base, care must be exercised to ensure that base is not detached from windshield.



1. Remove upper cover from mirror stem.



2. Remove rain sensor unit. Refer to Section 501.16.



3. Applying firm downward pressure, remove mirror assembly from base.

Installation

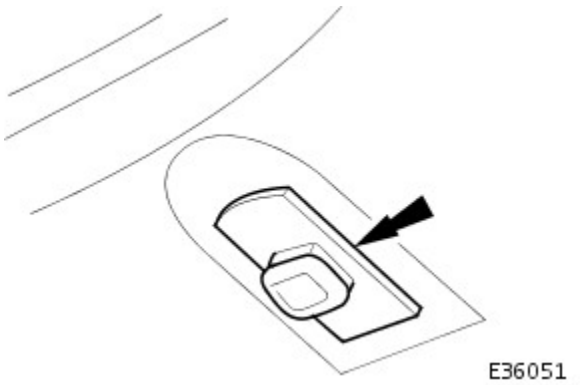
1. Position mirror at bottom of base and apply firm upward pressure to fully seat and secure in position.
2. Install rain sensor unit. Refer to Section 501.16.
3. Install upper cover to mirror stem.

Rear View Mirrors - Interior Mirror Mounting Block

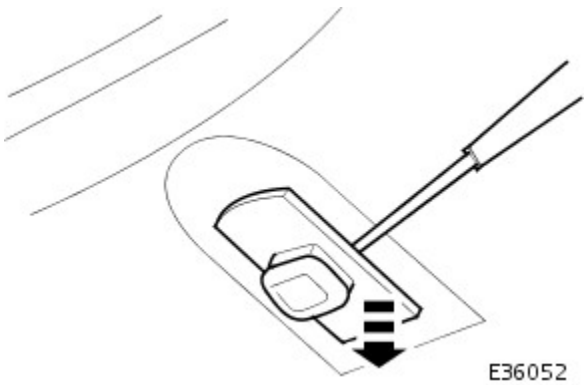
Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Position a protective cover over top of facia.
3. Remove roof console for access. Refer to 76.13.69.90.
4. Remove rain sensor unit. Refer to Section 501.16.
5. Remove mirror from mounting block. Refer to 76.10.51 or 76.10.56 (electrochromic).
6. Apply a suitable solvent around edge of mounting block.



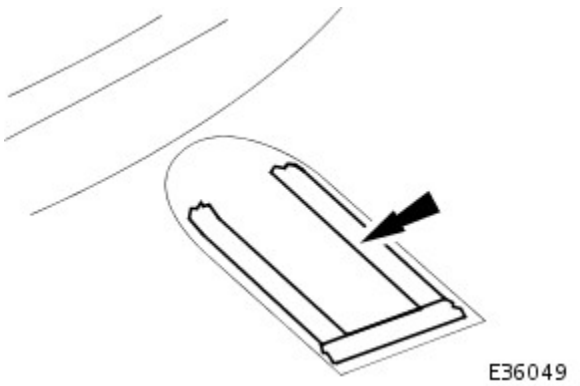
7. Commencing at the top and exercising care to avoid windshield damage, use a thin plastic knife to ease block free.



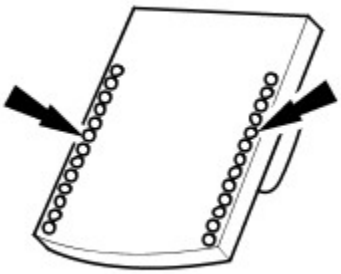
8. Using a suitable solvent, clean residual adhesive from block mounting area.

Installation

1. Using masking tape, mark block mounting area on windshield.



2. Apply Permabond F Grade 5 Initiator to mounting area of windshield.
3. Apply a bead of Permabond F246 to bottom and each vertical side of block over 2/3 of block height.



E36050



E36053

4. Press mounting block onto marked area and hold in position for one minute.

5. After a period of 15 minutes, remove and discard masking tape.

6. Using a scraper, carefully remove any excess adhesive.

7. NOTE: The following time is the MINIMUM PERIOD required for adhesive curing. Failure to allow this period will result in bonding failure, necessitating repeat of the complete procedure.

After a further period of at least 6 hours, install mirror on mounting block. Refer to 76.10.51 or 76.10.56.

8. Install roof console. Refer to 76.13.69.90.

9. Install rain sensor unit. Refer to Section 501.16.

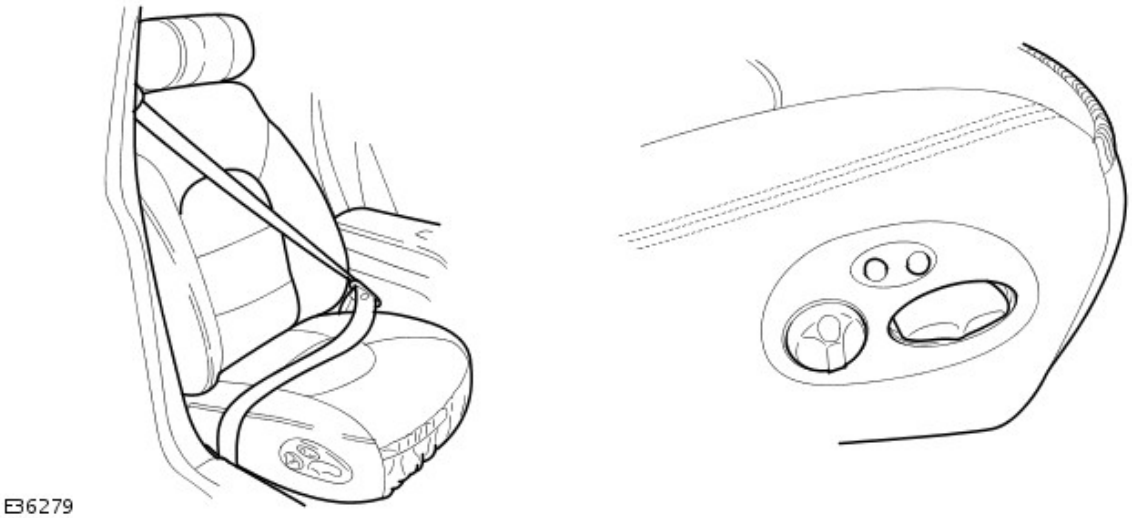
10. Remove protective cover from facia.

11. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.

Seating - Seats

Description and Operation

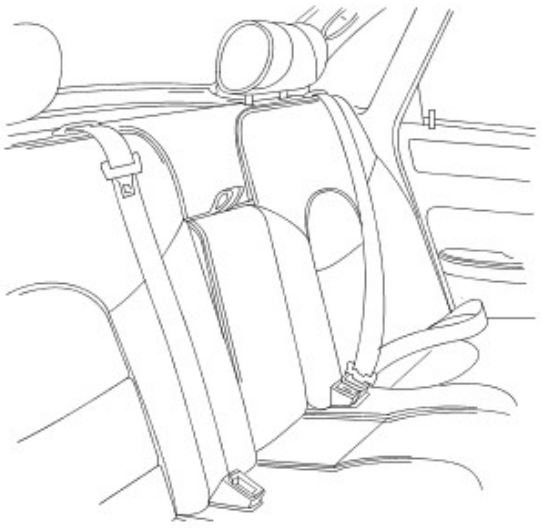
Front Seats



E36279

All front seats are equipped with electric height adjustment. In addition, both front seats are available with manual or power forward and rearward adjustment, manual or power operated headrest adjustment, 12 way electric adjustment, memory controlled 12 way adjustment and integral seat heating. A side air bag module is installed in the outboard squab wing of each front seat. Each seat has a non-handed, one-piece frame incorporating cushion and squab frames, side air bag suppoort bracket and seat adjuster mechanisms. Sear switchpacks are installed on the outboard side of driver and passenger seats, and control modules are installed in the base of each seat. Both the driver and front passenger seat are secured to the vehicle floor at four points.

Rear Seats



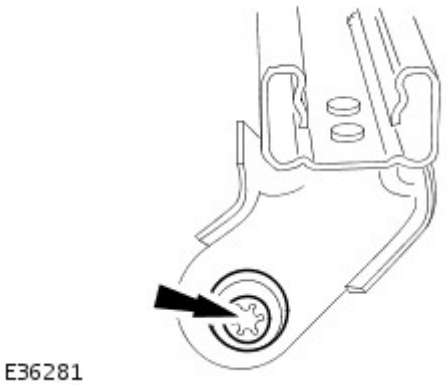
E36280

The standard rear seat is of the fixed, bench type with full width removable cushion. Two individual rear seats are fitted to certain long wheelbase models. Both types of rear seat are available with thermostatically controlled heating of the cushion and squab. Individual rear seats are electrically adjustable for squab recline (via fore and aft movement), head restraint height and lumbar support. Separate motors provide adjustment of each seat cushion and head restraint and an electrically-driven air compressor provides variation of lumbar support. Seat adjustment is controlled via switches installed on a panel in a rear extension to the centre console.

Seating - Front Seat

Removal and Installation

Removal



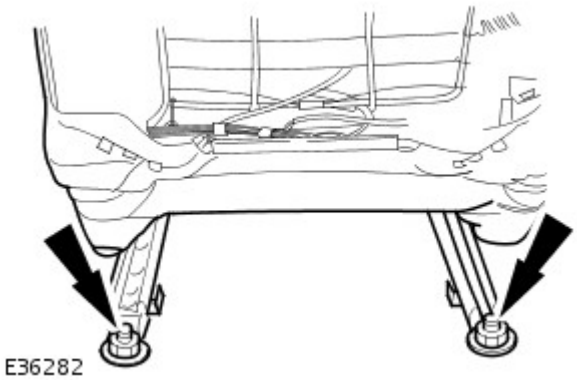
1. Move the seat fully rearward and slacken and remove the front securing bolts.

2. Move steering wheel to fully forward position.

3. Ensure that squab is fully upright, then move the seat fully forward.

4. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.



5. Remove the slider covers and slacken and remove the two rear securing bolts.

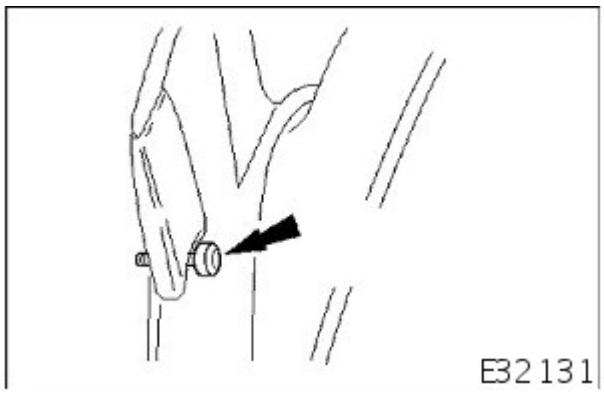


6. Supporting and positioning the seat for access, disconnect multiplugs.

- Disconnect side air bag harness multiplug.
- Release from retaining brackets and disconnect seat harness multiplugs.
- Disconnect seat control module harness multiplug.
- Cut through and remove any ties securing harnesses to seat frame.

7. NOTE: Securing bolt remains captive with belt anchor.

Slacken and remove seat belt anchor securing bolt.



8. Exercising care to avoid damaging side air bag, remove seat from vehicle.

Installation

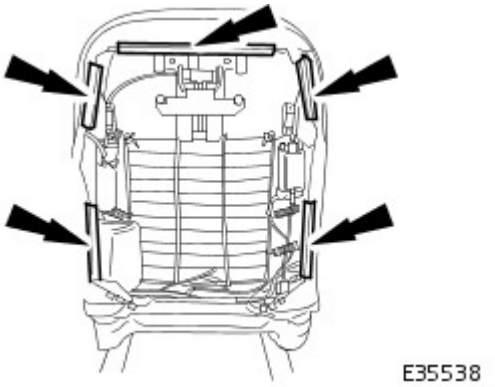
1. Position seat in vehicle, align seatbelt anchor and fit and tighten seat belt securing bolt.
2. Supporting seat for access, connect seat and side airbag harness multiplugs and secure harnesses to seat frame using new ties.
3. Fit, but do not fully tighten rear securing bolts.
4. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
5. Position seat fully rearward and fit and tighten front securing bolts
6. Position seat fully forward, fully tighten rear securing bolts and fit slider covers.
7. Return seat to original position.

Seating - Front Seat Backrest

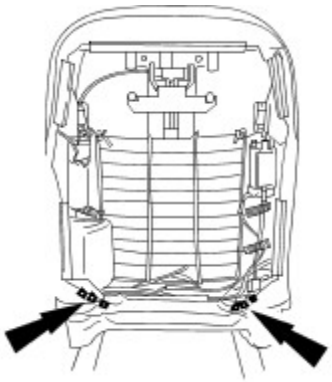
Removal and Installation

Removal

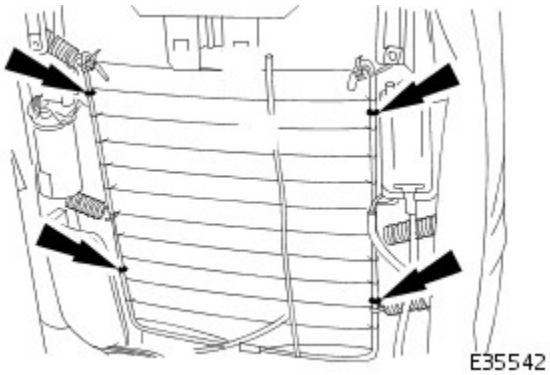
1. Remove front seat for access. Refer to 76.70.01.
2. Remove seat back finisher. Refer to 76.70.09.
3. Remove front seat headrest. Refer to 76.70.14.
4. Release the five squab cover to seat frame securing strips.



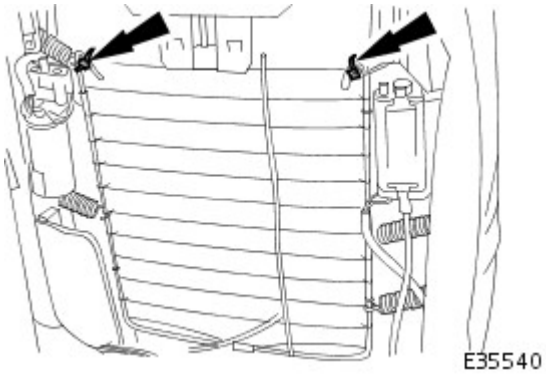
5. Release the squab cover to seat frame lower securing clips.



6. Remove the four squab pad to squab suspension hog rings.



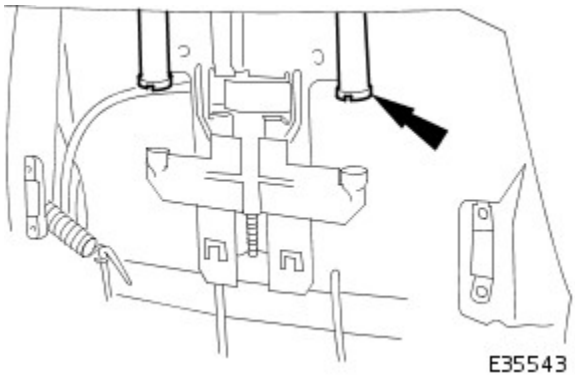
7. Sever the two ratchet straps securing squab pad to squab suspension.



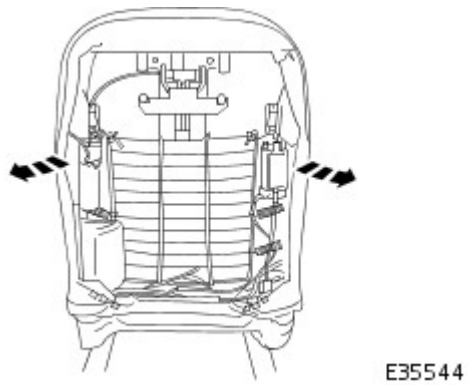


8. Disconnect the squab heater element harness multiplug.

9. Release the lower part of squab cover and pad from seat frame.



10. Release seat headrest guides from seat frame and remove squab cover and pad.



11. Position squab cover sides for access and remove the eighteen squab cover to pad hog rings.

12. Remove squab pad and heater element from squab cover.

13. Remove heater element from squab pad.

Installation

1. Install heater element on squab pad.

2. Position squab pad and heater element in squab cover, ensuring that headrest guides pass through pad.

3. Using the eighteen hog rings, secure squab cover to pad.

4. Pull squab cover sides over squab pad.

5. Fit but do not secure ratchet straps to squab pad.

6. Position squab cover and pad on seat frame and fully seat headrest guides in frame.

7. Position lower part of squab cover on seat frame and secure ratchet straps to squab suspension.

8. Position lower edge of squab cover to seat frame and secure with nine retaining clips.

9. Position and fit squab cover to seat frame retaining strips.

10. Fit and tighten squab cover upper securing screws.
11. Fit headrest. Refer to 76.70.14.
12. Fit seat back finisher. Refer to 76.70.09.
13. Install front seat in vehicle. Refer to 76.70.01.

Seating - Front Seat Backrest Cover

Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

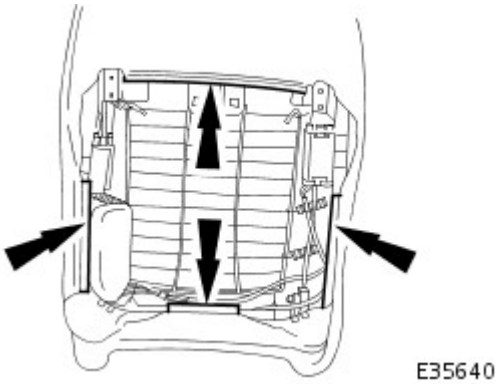
Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove front seat for access. Refer to 76.70.01.

3. Remove Seat back finisher. Refer to 76.70.09.

4. Remove front seat headrest.

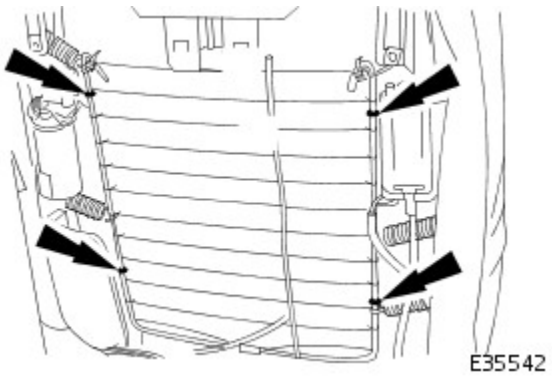
5. Release the squab cover to seat frame securing strips (6 on Vanden Plas models)



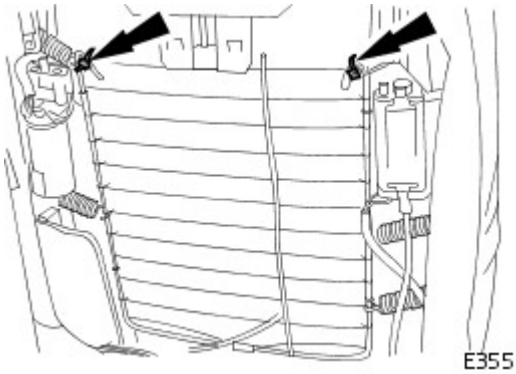
6. Release the squab cover to seat frame lower securing clips.

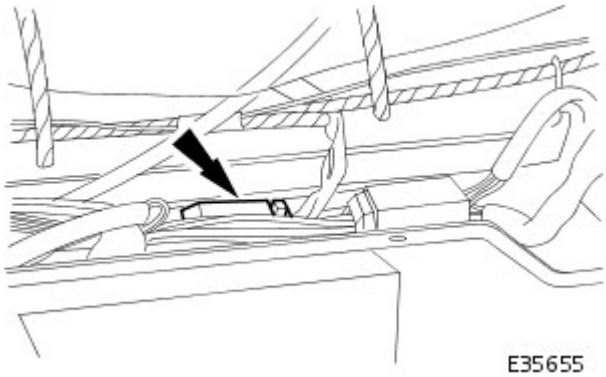


7. Remove the four squab pad to squab suspension hog rings.



8. On Vanden Plas models only, sever the two ratchet straps securing squab pad to squab suspension.

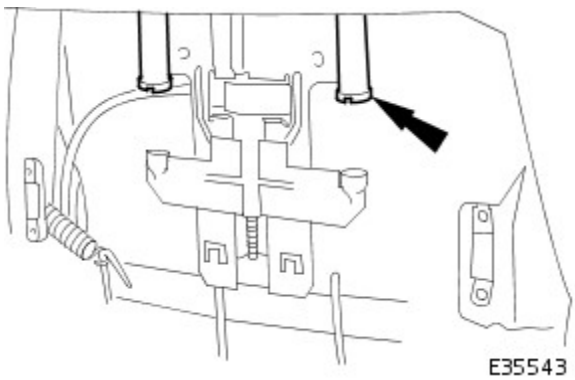


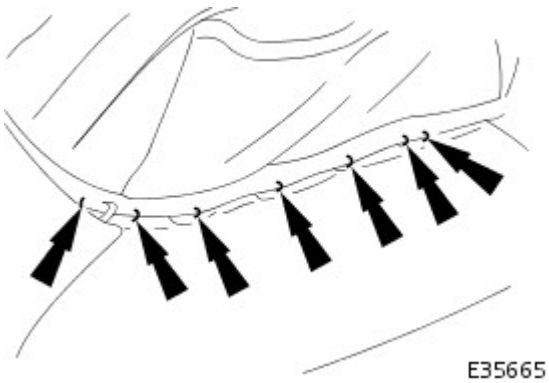


9. Disconnect the squab heater element harness multiplug (grey).

10. Release the lower part of squab cover and pad from seat frame.

11. Release seat headrest guides from seat frame and remove squab cover and pad.





12. Position squab cover sides for access and remove the eighteen squab cover to pad hog rings.

13. Remove staples securing squab cover to squab pad and heater element.

14. Remove headrest guides from squab cover.

Installation

1. Fit and fully seat headrest guides to squab cover.

2. Position squab pad and heater element in squab cover, ensuring that headrest guides pass through pad.
3. Using the eighteen hog rings, secure squab cover to pad.
4. Puul squab cover sides over squab pad.
5. Fit but do not secure ratchet straps to squab pad.
6. Position squab cover and pad on seat frame and fully seat headrest guides in frame.
7. Position lower part of squab cover on seat frame and secure ratchet straps to squab suspension.
8. Position lower edge of squab cover to seat frame and secure with nine retaining clips.
9. Position and fit squab cover to seat frame retaining strips.
10. Fit and tighten squab cover upper securing screws.
11. Fit headrest.
12. Fit seat back finisher. Refer to 76.70.09.
13. Install front seat in vehicle. Refer to 76.70.01.
14. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15

Seating - Front Seat Backrest Heater Mat

Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

   Remove battery cover and disconnect ground cable from battery. Refer to 86.15.19.

2. Remove front seat for access. Refer to 76.70.01.
3. Remove seat back finisher. Refer to 76.70.09.
4. Remove front seat headrest. Refer to 76.70.14.
5. Remove front seat squab cover. Refer to 76.70.15.
6. Routing multiplug through aperture, carefully release squab heater adhesive strips from squab pad.

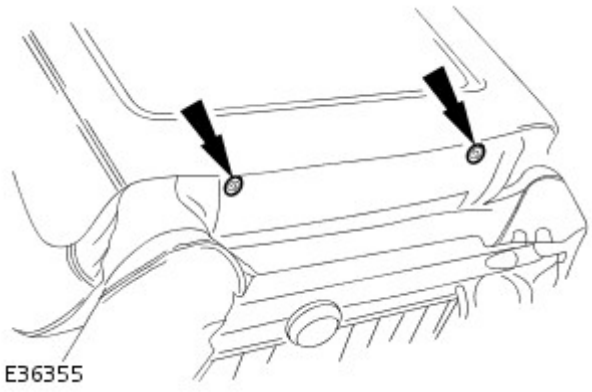
Installation

1. Remove protective backing paper from heater self adhesive strips.
2. Align heater to pad and apply firm pressure to ensure adhesion.
3. Route heater harness through pad aperture.
4. Position squab cover over squab pad and heater element, ensuring that headrest guides pass through pad.
5. Connect heater harness multiplug and position multiplug in mounting bracket.
6. Fit squab cover and pad. Refer to 76.70.15.
7. Fit seat back finisher. Refer to 76.70.09.
8. Fit headrest. Refer to 76.70.14.
9. Install front seat in vehicle. Refer to 76.70.01.
10. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

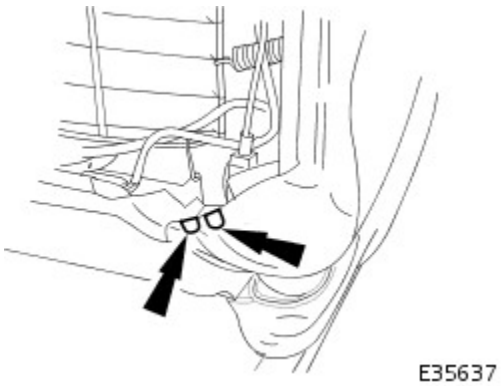
Seating - Front Seat Backrest Trim Panel

Removal and Installation

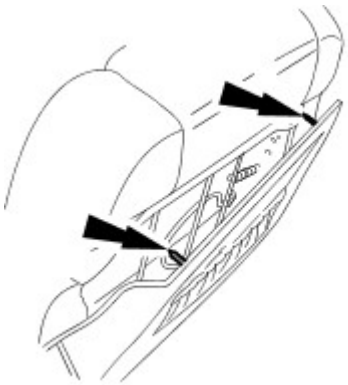
Removal



1. Slacken and remove the two back finisher lower securing screws.



2. Release back finisher from the side securing clips.



3. Release back finisher upper fir tree fasteners and remove back finisher from seat.

Installation

1. Fit and align back finisher to seat.
2. Fully seat back finisher upper securing studs.
3. Position and fully seat finisher side securing clips.
4. Fit and tighten the two back finisher lower securing screws.

Seating - Front Seat Cushion

Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

   Remove battery cover and disconnect ground cable from battery. Refer to 86.15.19.

2. Remove seat back finisher. Refer to 76.70.09.
3. Remove seat cushion cover/pad assembly. Refer to 76.70.33.
4. Fold cushion sides inwards for access and remove cushion cover to cushion pad hog rings.



E35645

5. Separate cushion cover from cushion pad/heater element.
6. Separate cushion pad from heater element, routing harness multiplug through cushion pad.

Installation

1. Position heater element in cushion pad and route harness multiplug through the pad.
2. Position cushion cover on cushion pad/heater element and secure with hog rings.
3. Position cushion cover sides over cushion pad and staple cushion cover to lower edge of seat switch mounting bracket.
4. Position cushion pad and cover assembly on seat frame, aligning switch mounting bracket with frame.
5. Fit and tighten the three switch mounting bracket to seat frame securing screws.
6. Fit and fully seat switch in mounting bracket.
7. Lift cushion pad for access, connect switch harness multiplug and reposition cushion pad.
8. Secure cushion cover front retaining straps to seat frame.
9. Pull cover over cushion pad and fit and fully seat cover edge retaining strip on seat frame.
10. Return seat to upright position .
11. Connect cushion heater harness multiplug and fit multiplug onto retaining bracket.
12. Fit cushion cover to seat frame rear retaining strip.
13. Align rear edge of cushion cover with frame and fit and fully seat six retaining clips.
14. Fit seat back finisher. Refer to76. 70.09.
15. Fit seat to vehicle. refer to 76. 70.01.

16. Fit seat back finisher. Refer to76. 70.09.

17. Fit seat to vehicle. refer to 76. 70.01.

18. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15

Seating - Front Seat Cushion Cover

Removal and Installation

Removal

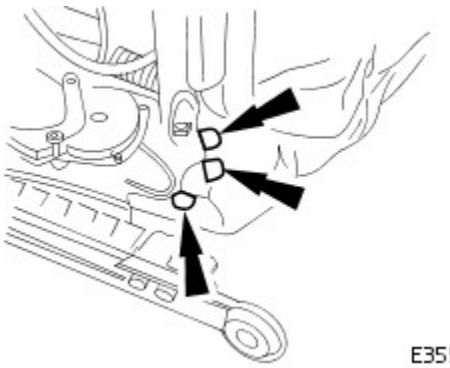
1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove front seat from vehicle. Refer to 76.70.01.

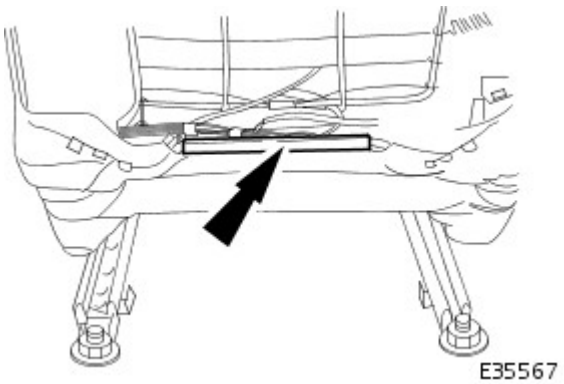
3. Remove seat back finisher. Refer to 76.70.09 (76.70.09.50 for Daimler models).

4. Remove the six cushion cover to seat frame retaining clips.



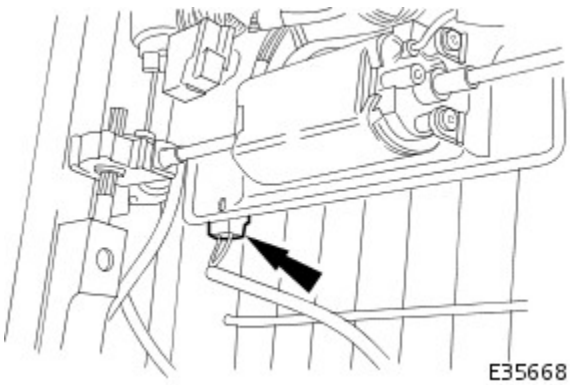
E35566

5. Release cushion cover retaining strip from rear of seat frame.



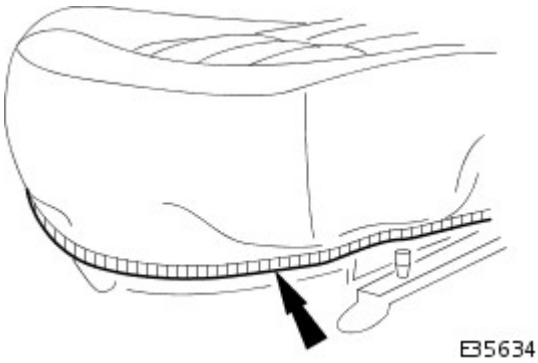
E35567

6. Invert seat for access to underside, remove cushion heater harness multiplug from retaining bracket and disconnect multiplug.

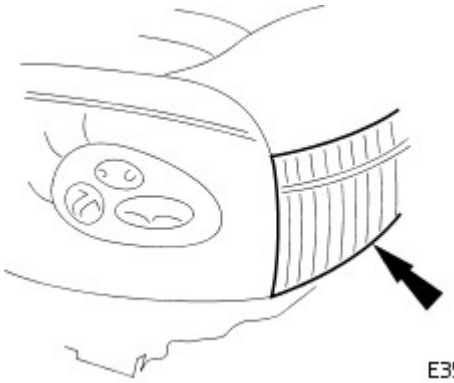


E35668

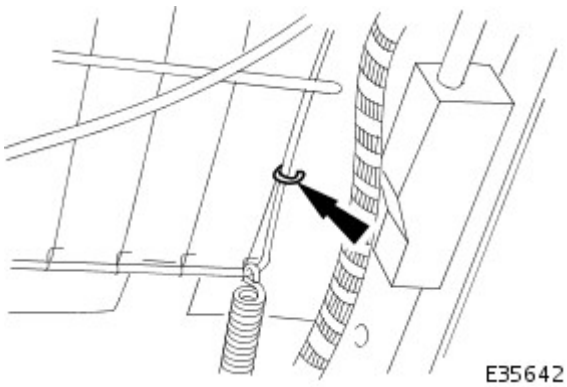
7. Release cushion cover front retaining straps from seat frame.



8. Detach cushion cover front elastic retaining straps from seat frame.



9. Remove seat cushion pad to cushion suspension hog rings.

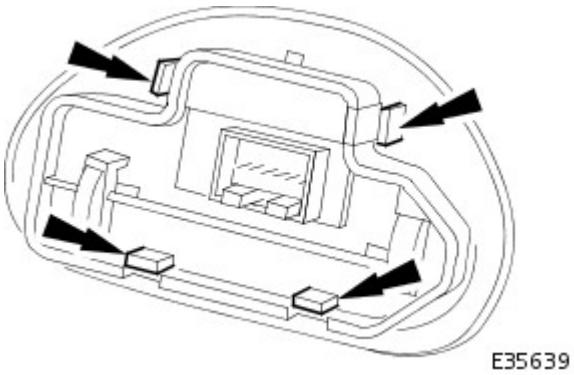


10. Reposition cushion cover sides, lift and hold cushion pad for access to rear of seat switch and disconnect harness multiplug.

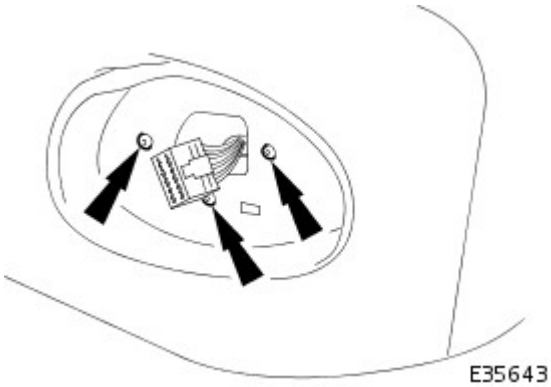


11. Remove seat switch.

- Release seat switchpack upper retaining tangs.
- Release switchpack lower retaining tangs adjacent to seat runners and remove switch.



E35639

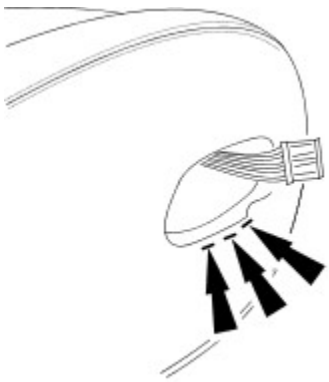


E35643

12. Slacken and remove the three switchpack mounting bracket to seat frame securing screws.

13. Remove cushion cover/cushion pad assembly from seat frame.

14. Remove staples securing cover to seat switch mounting bracket.



E35644



E35645

15. Fold cushion sides inwards for access and remove cushion cover to cushion pad hog rings.

16. Remove seat cushion cover from seat cushion pad/heater element assembly.

Installation

1. Position cushion cover on cushion pad/heater element and secure with hog rings.

2. Position cushion cover sides over cushion pad and staple cushion cover to lower edge of seat switch mounting bracket.
3. Position cushion pad and cover assembly on seat frame, aligning switchpack mounting bracket with frame
4. Fit and tighten the three switchpack mounting bracket to seat frame securing screws.
5. Fit and fully seat swtchpack in mounting bracket.
6. Lift cushion pad for access, connect switchpack harness multiplug and reposition cushion pad
7. Secure cushion cover front retaining straps to seat frame.
8. Pull cover over cushion pad and fit and fully seat cover edge retaining strip on seat frame.
9. Return seat to upright position
10. Connect cushion heater harness multiplug and fit multiplug onto retaining bracket.
11. Fit cushion cover to seat frame rear retaining strip.
12. Align rear edge of cushion cover with frame and fit and fully seat six retaining clips.
13. Fit seat back finisher. Refer to 76.70.09.
14. Fit seat to vehicle. Refer to 76.70.01.
15. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15

Seating - Front Seat Cushion Heater Mat

Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

   Remove battery cover and disconnect ground cable from battery. Refer to 86.15.19.

2. Remove front seat from vehicle. Refer to 76.70.01
3. Remove seat back finisher. Refer to 76.70.09.
4. Remove seat cushion cover assembly. Refer to 76.70.33.
5. Fold cushion sides inwards for access and remove cushion cover to cushion pad hog rings.



E35645

6. Remove cushion cover from cushion pad/heater element.
7. Separate heater element from cushion pad, routing harness multiplug through pad.

Installation

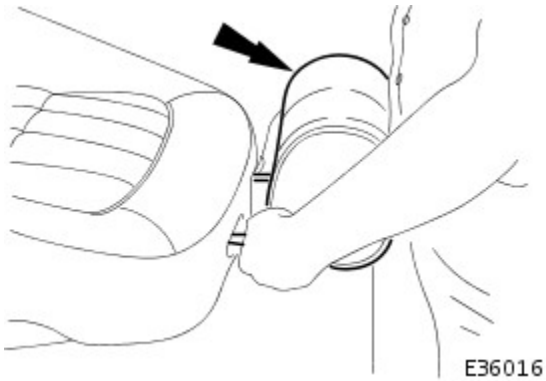
1. Position heater element in cushion pad and route harness multiplug through the pad.
2. Position cushion cover on pad/heater element and secure with hog rings.
3. Position cushion cover sides over cushion pad and staple cushion cover to lower edge of seat switch mounting bracket.
4. Position cushion pad and cover assembly on seat frame, aligning switch mounting bracket with frame.
5. Fit and tighten the three switch mounting bracket to seat frame securing screws.
6. Fit and fully seat switch in mounting bracket.
7. Lift cushion pad for access, connect switch harness multiplug and reposition cushion pad.
8. Secure cushion cover front retaining straps to seat frame.
9. Pull cover over cushion pad and fit and fully seat cover edge retaining strip on seat frame.
10. Return seat to upright position.
11. Connect cushion heater harness multiplug and fit multiplug onto retaining bracket.
12. Fit cushion cover to seat frame rear retaining strip.
13. Align rear edge of cushion cover with frame and fit and fully seat six retaining clips.
14. Fit seat back finisher. Refer to76. 70.09.

15. Fit seat to vehicle. refer to 76. 70.01.
16. Fit seat back finisher. Refer to76. 70.09.
17. Fit seat to vehicle. refer to 76. 70.01.
18. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15

Seating - Front Seat Head Restraint

Removal and Installation

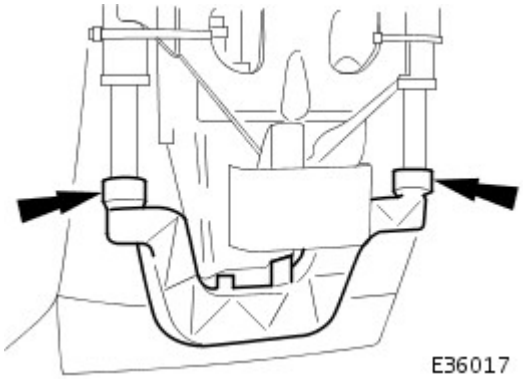
Removal



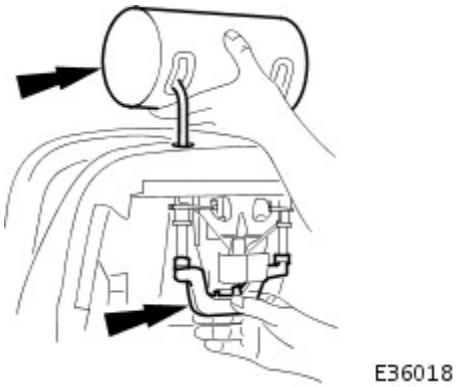
1. Motor seat to fully forward and fully reclined position.
2. Motor headrest to fully raised position.
3. CAUTION: Do not use excessive force when removing headrest as this can damage or misalign the internal retaining cups. If difficulty is experienced, proceed to steps 3 to 8.

   From rear seat, grasp stems and pull firmly and evenly to withdraw headrest from seat squab.

4. Motor seat to partly upright position.
5. Remove seat back finisher for access. Refer to 76.70.09, or 76.70.09.50 for Daimler and Vanden Plas models.



6. Re-position retaining cups and ensure that headrest stems are correctly aligned.



7. Supporting retaining cups, partially withdraw headrest ensuring that it does not contact headlining.
8. Motor seat to fully reclined position.
9. Pulling evenly on stems, completely withdraw headrest from seat.

Installation

1. Position headrest on seat squab.
2. NOTE: If back finisher is installed and difficulty is experienced in seating headrest stems in cups, remove back finisher to facilitate alignment. Refer to 76.70.09 or 76.70.09.50

Slide headrest stems evenly into seat squab ensuring that stems locate correctly in retaining cups.

3. Motor seat to upright position.
4. If seat back finisher has been removed for access, refer to 76.70.09 or 76.70.09.50 for installation.
5. Motor seat and headrest to original positions.

Seating - Front Seat Head Restraint Motor

Removal and Installation

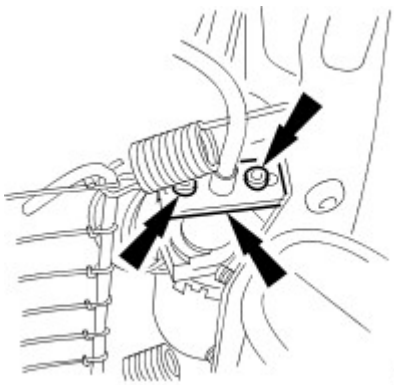
Removal

1. Power seat fully forward and position squab in fully upright position.
2. Remove front seat back finisher. Refer to 76.70.09.
3. Remove battery cover and disconnect ground cable from battery terminal. (Refer to 86.15.19)
4. Release and remove seat tensioner spring.



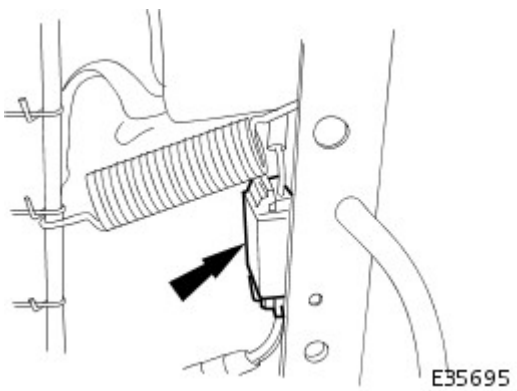
E35691

5. Slacken and remove headrest motor securing screws and remove drive cable retaining plate.



E35692

6. Withdraw drive cable from motor.
7. Release motor harness multiplug (yellow) from mounting bracket, position motor for access and disconnect multiplug.



E35695

8. Remove headrest motor from seat.

Installation

1. Position motor in seat frame, connect harness multiplug and seat multiplug in mounting bracket.
2. Install motor on headrest drive cable and align with mounting bracket.
3. Fit motor securing screws and drive cable retaining plate.

4. Tighten motor securing screws.
5. Install seat tensioner spring.
6. Fit seat back finisher. Refer to 76.70.09.
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Seating - Front Seat Recliner Motor

Removal and Installation

Removal

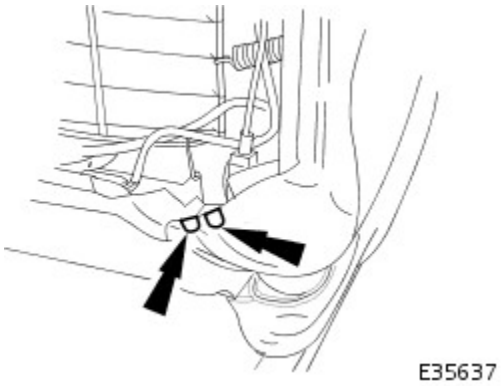
1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86,.15.19.

2. Remove front seat and position for access. Refer to 76.70.01.

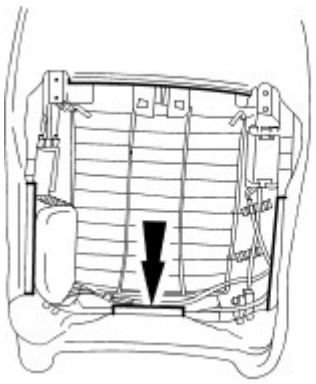
3. Remove front seat back finisher. Refer to 76.70.09.

4. Release seat squab cover securing clips from frame.



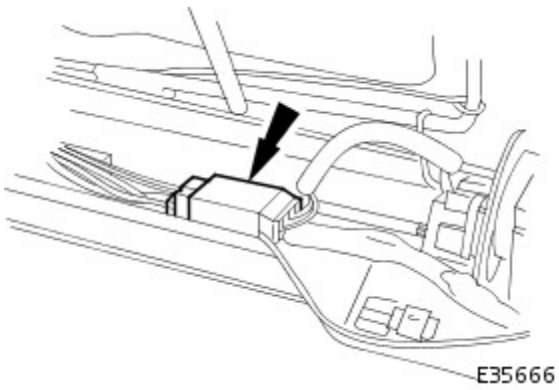
E35637

5. Release seat squab cover lower edge retaining strip from frame.



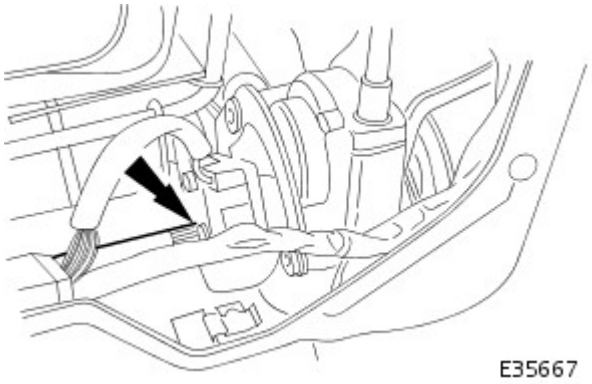
E34450

6. Disconnect recline motor/potentiometer harness multiplug (white).

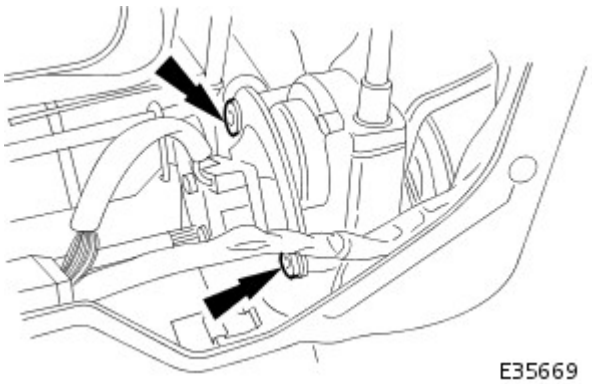


E35666

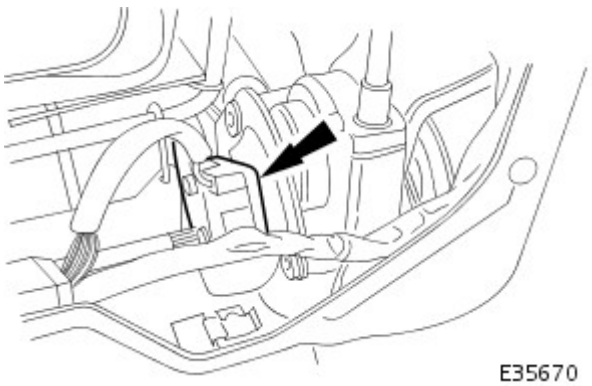
7. Remove and discard gearbox RH drive shaft end securing clip.



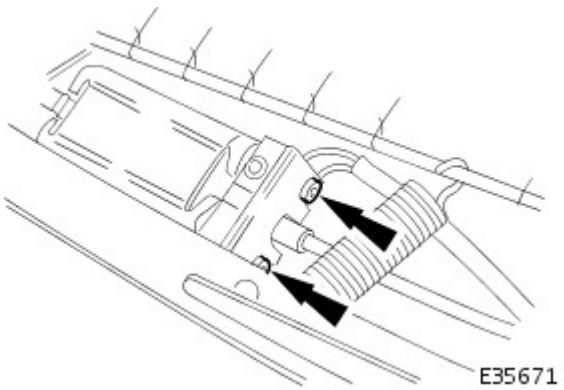
8. Using a suitable soft drift, release drive shaft from gearbox and potentiometer.



9. Slacken and remove bolts securing potentiometer/gearbox to seat frame



10. Rotate potentiometer to release it from retaining plate tang.



11. Slacken and remove bolts securing recline motor to seat frame.

12. Remove recline motor/potentiometer/gearbox assembly from seat.

Installation

1. Position recline motor on seat frame mounting and fit and

tighten securing bolts.

2. Position potentiometer on gearbox.

3. Engage drive shaft in potentiometer and gearbox.

4. Install potentiometer retaining plate.

5. Rotate potentiometer to engage retaining plate tang.

6. Fit and tighten retaining plate/gearbox securing bolts.

7. Fit and fully seat new gearbox drive shaft securing clip

8. Fit seat cover RH side to seat frame and fully seat securing clips.

9. Fit seat cover LH side to seat frame and fully seat securing clips.

10. Fit seat cover to lower frame retaining strip.

11. Position seat for acces and fit seat back finisher. Refer to 76.70.09.

12. Install seat in vehicle. Refer to 76.70.01.

13. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

14. Motor seat fully forward and fully rearward, checking for satisfactory operation.

15. Return seat to original position.

Seating - Front Seat Track

Removal and Installation

Removal

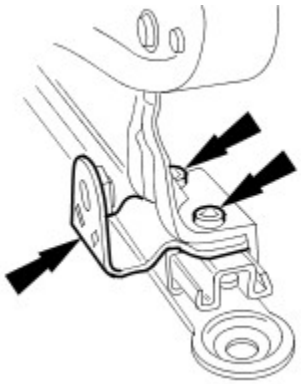
1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86,.15.19.

2. Remove front seat from vehicle. Refer to 76.70.01.

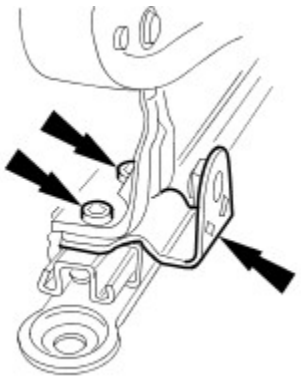
3. Invert seat for access.

4. Slacken and remove LH slide securing bolts and remove seat belt anchor mounting bracket.



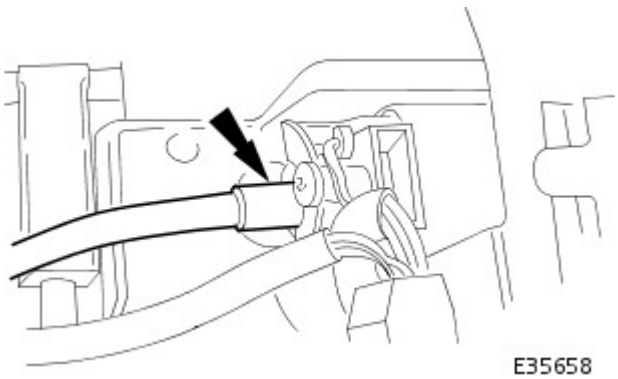
E35654

5. Slacken and remove RH slide securing bolts and remove seat belt buckle mounting bracket.



E35656

6. Disconnect seat cushion tilt motor drive cables.

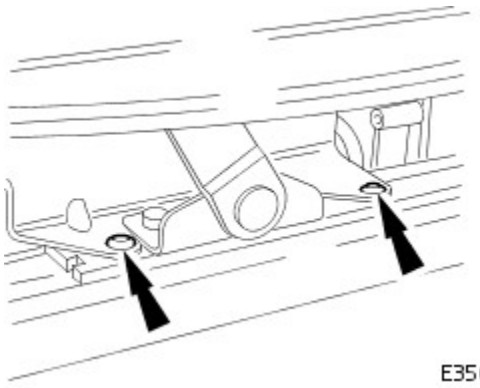


E35658

7. Remove slide assembly.

1. Position slide/motor assembly for access and release seat harness securing clips.

2. Drill out pop rivets securing slide to motor frame.



8. Withdraw LH slide from seat motor potentiometer/gearbox assembly.

Installation

1. Fit and fully seat slide to potentiometer/gearbox assembly.
2. Position motor frame on slide assembly and secure with new pop rivets.
3. Connect seat cushion tilt motor drive cables.
4. Secure seat harness in clips.
5. Position slide assembly on seat.
6. Fit and align RH seat belt buckle mounting bracket between slide and seat pivot bracket and fit but do not tighten securing bolts.
7. Fit and align LH seat belt anchor bracket between slide and seat pivot bracket and fit but do not tighten securing bolts.
8. Fit but do not tighten RH and LH slide front securing bolts.
9. Finally tighten slide front and rear securing bolts.
10. Fit front seat to vehicle. Refer to 76.70.01.

Seating - Front Seat Track Motor

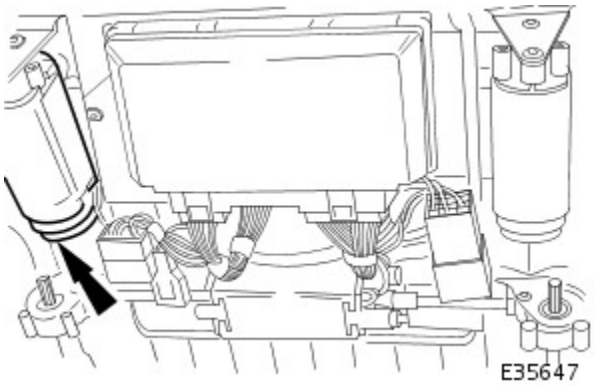
Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE WORKING ON A FRONT SEAT WITH A SIDE AIRBAG FITTED.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

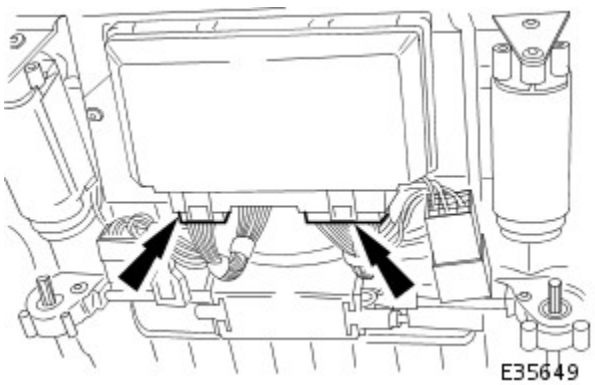
2. Remove front seat from vehicle and place inverted on clean work surface. Refer to 76.70.01.



3. Release rearward (RH) tilt motor harness multiplug from retaining bracket and disconnect multiplug.



4. Release forward (LH) tilt motor harness multiplug from retaining bracket and disconnect multiplug.



5. Disconnect seat control module harness multiplugs.

6. Release heater relay (brown) from retaining bracket.





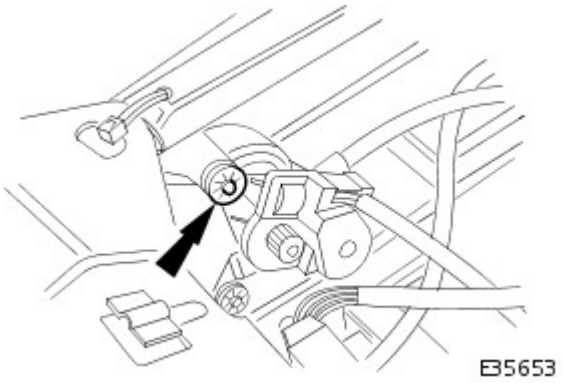
7. Release side airbag harness multiplug (black) from retaining bracket.



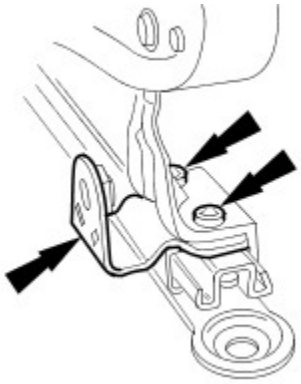
8. Release seat harness main multiplug (white) from retaining bracket.

9. Remove clips securing harness to seat sliders.

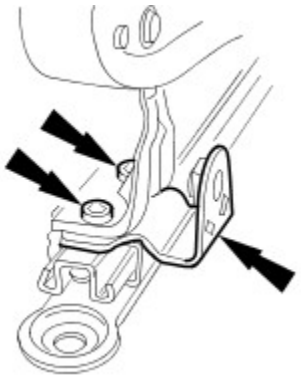
10. Remove and discard forward tilt potentiometer retaining clip and withdraw potentiometer from drive shaft.



11. Slacken and remove LH seat slider securing bolts and remove seatbelt anchor mounting bracket.

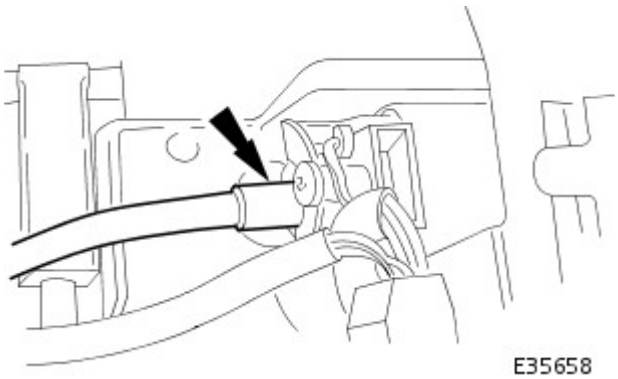


E35654



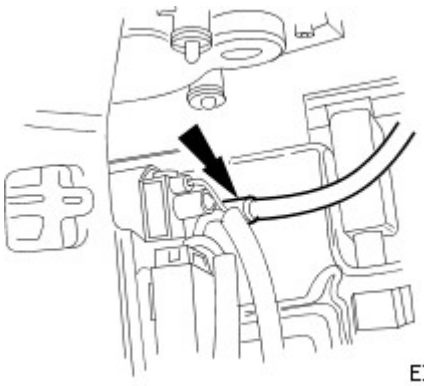
E35656

12. Slacken and remove RH seat slider securing bolts and remove seatbelt buckle mounting bracket.



E35658

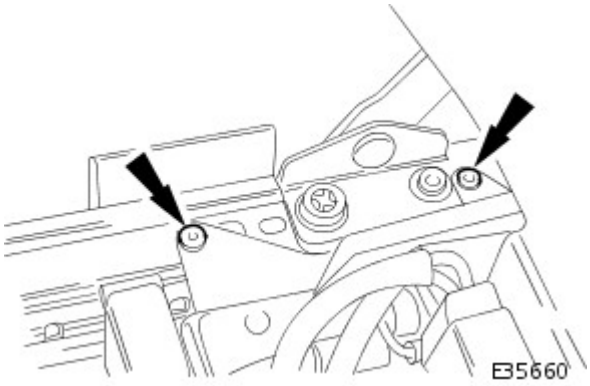
13. Disconnect seat cushion forward tilt motor drive cable.

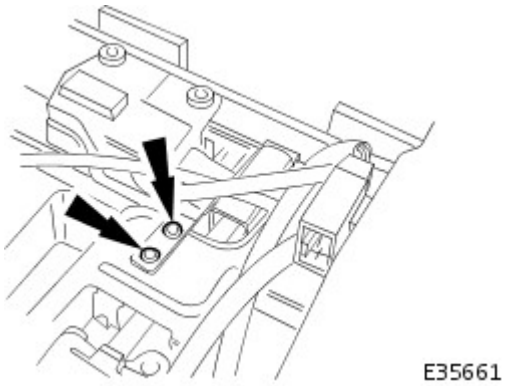


E35659

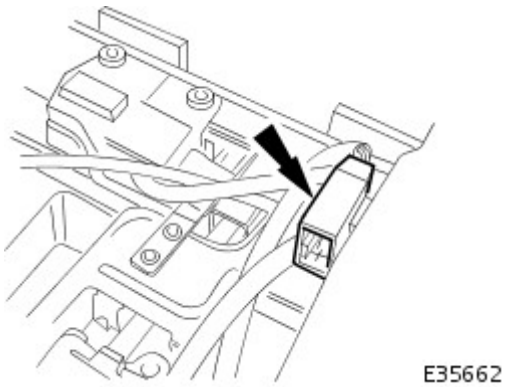
14. Disconnect seat cushion rearward tilt motor drive cable.

15. Position slider/motor assembly and seat frame for access and drill out pop rivets securing LH slider to seat frame.

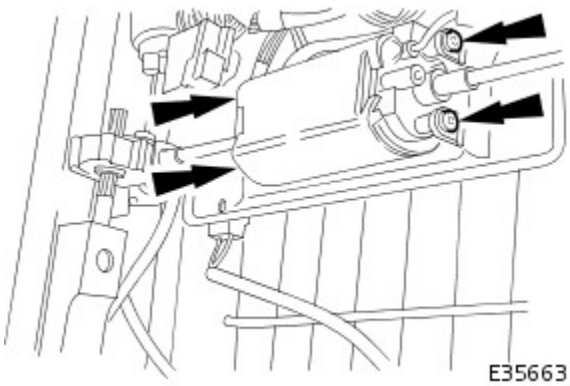




16. Slacken and remove bolt securing motor/ potentiometer and gearbox to LH slider and remove LH slider assembly.

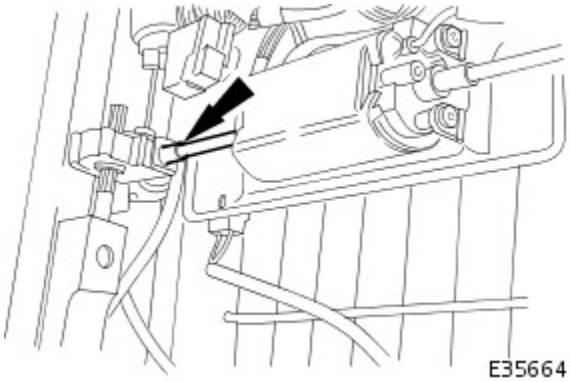


17. Release motor/potentiometer and gearbox harness multiplug from mounting bracket and disconnect multiplug.



18. Slacken and remove motor/potentiometer to frame securing bolts.

19. Disconnect RH seat slider gearbox drive cable from motor/potentiometer.



20. Disconnect drive cable and gearbox assembly from motor/potentiometer and remove motor/potentiometer from seat.

Installation

1. Position motor/potentiometer at seat and connect drive cable/gearbox assembly

2. Connect RH drive cable to motor.

3. Seat motor/potentiometer on frame and fit and tighten motor securing bolts.

4. Align potentiometer with gearbox and fit and tighten gearbox securing bolt.

5. Position and fully seat slider assembly to potentiometer and gearbox.

6. Position motor frame on LH slider and secure with new pop rivets.

7. Connect motor/potentiometer harness multiplug and install in mounting bracket.

8. Connect seat cushion rearward tilt motor drive cable.

9. Connect seat cushion forward tilt motor drive cable.

10. Place seat upright in mounting position.

11. Position RH seat buckle mounting bracket between runner and seat pivot bracket and fit but do not tighten securing bolt.

12. Position LH seat buckle mounting bracket between runner and seat pivot bracket and fit but do not tighten securing bolt.

13. Fit but do not tighten slider front securing bolts.

14. Fit and tighten slider rear securing bolts

15. Tighten slider front securing bolts.

16. Install forward tilt potentiometer on drive shaft and fit and fully seat retaining clip.

17. Position seat harness in frame retaining clips.

18. Fit seat harness main multiplug to retaining bracket.

19. Fit seat heater relay to retaining bracket.

20. Connect seat control module harness multiplugs.

21. Connect forward tilt motor harness multiplug and fit multiplug in retaining bracket.

22. Connect rearward tilt motor harness multiplug and fit multiplug in retaining bracket.

23. Install seat in vehicle. Refer to 76.70.01.

24. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

25. Power seat fully forward and rearward ensuring satisfactory operation.

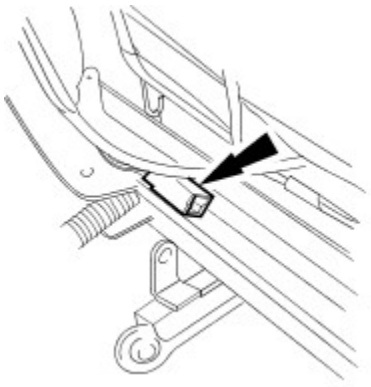
26. Return seat to original position.

Seating - Lumbar Motor

Removal and Installation

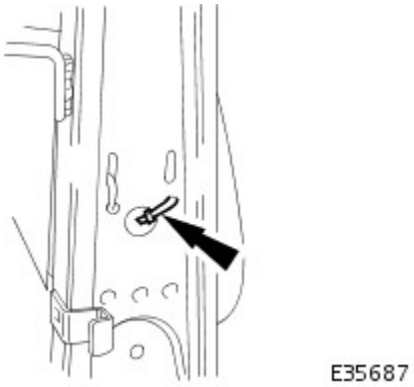
Removal

1. Power seat fully forward and position squab in fully upright position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove seat back finisher. Refer to 76.70.09
4. Remove lumbar support motor harness multiplug (yellow) from mounting bracket and disconnect multiplug.



E35686

5. Sever and remove motor/cover bag to seat frame tie straps.



E35687

6. Release motor/cover bag from seat vertical support rod.
7. Sever and remove tie straps securing lumbar support bag to squab suspension and guiding bag through squab suspension, remove motor/bag assembly.

Installation

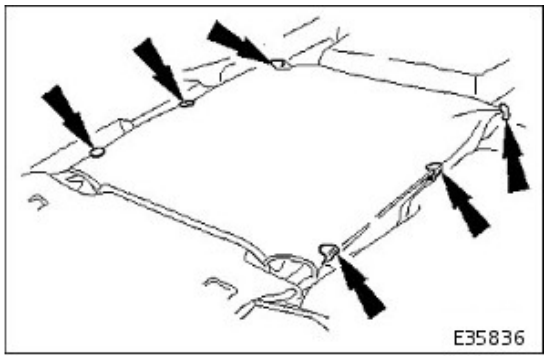
1. Position motor/bag assembly in seat and pass lumbar support bag through squab suspension.
2. Using new tie straps, secure lumbar support bag to squab suspension.
3. Position new tie strap on seat vertical support rod.
4. Position motor/bag assembly on seat frame support rod and fit and tighten tie strap to secure.
5. Connect motor harness multiplug and fully seat in mounting bracket.
6. Fit seat back finisher. Refer to 76.70.09.
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
8. Return seat to original position.

Seating - Rear Seat Armrest

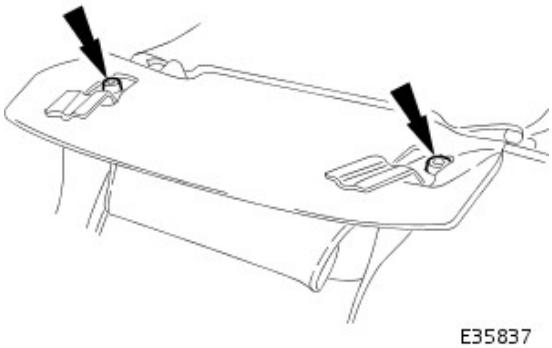
Removal and Installation

Removal

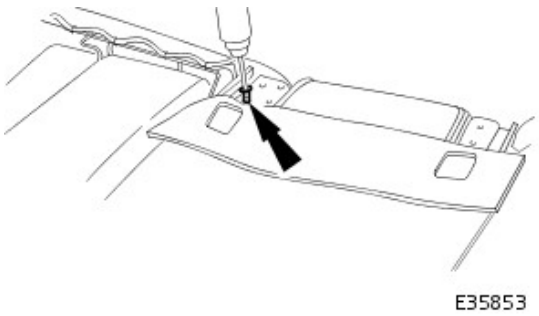
1. Remove rear heel boards.
2. Remove rear seat cushion. Refer to 76.70.37.
3. Remove rear seat belt escutcheon. Refer to 76.73.18.
4. Remove rear seat squab. Refer to 76.70.38.
5. Place squab inverted on clean work surface and remove clips securing armrest rear cover to frame.



6. Slacken and remove the two squab mounting bracket securing screws and remove brackets from squab.



7. Position armrest rear cover for access and slacken and remove two screws securing armrest to seat squab.



8. Remove armrest assembly from seat squab.

Installation

1. Position armrest on seat squab.
2. Position seat squab mounting brackets.
3. Fit and tighten the four armrest and squab bracket securing screws.0
4. Position armrest rear cover on squab frame and fully seat securing clips.
5. Fit rear seat squab assembly. Refer to 76.70.38.
6. Fit rear seat belt escutcheons. Refer to 76.73.18.
7. Fit rear seat cushion. Refer to 76.70.37.
8. Fit rear heel boards.

Seating - Rear Seat Backrest

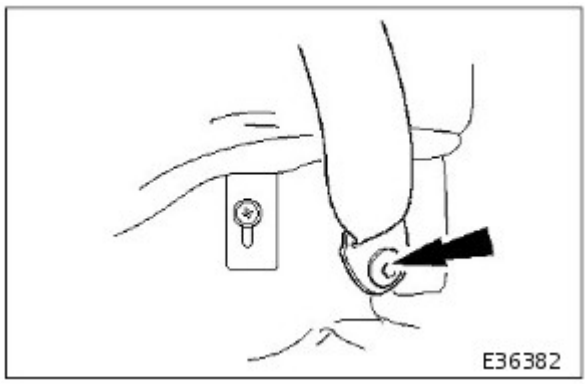
Removal and Installation

Removal

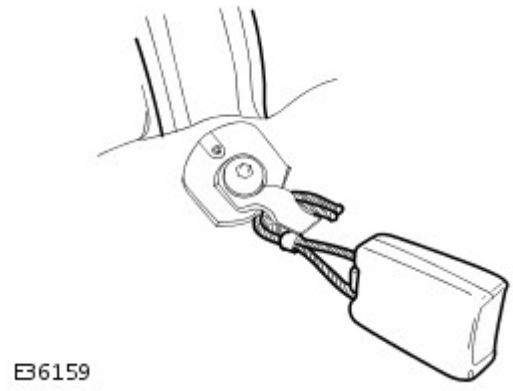
1. Heated seat only. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove rear seat cushion. Refer to 76.70.37.

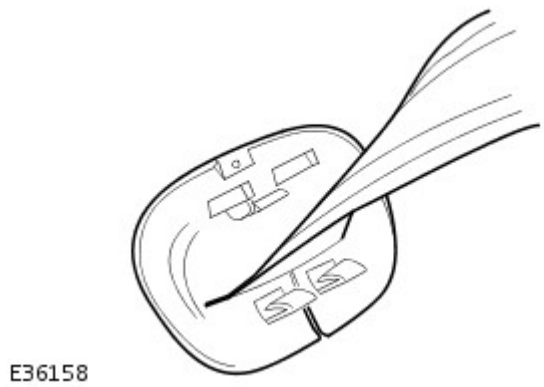
3. Remove rear head restraints.



4. Slacken and remove outer seat belt lower anchor securing bolts.



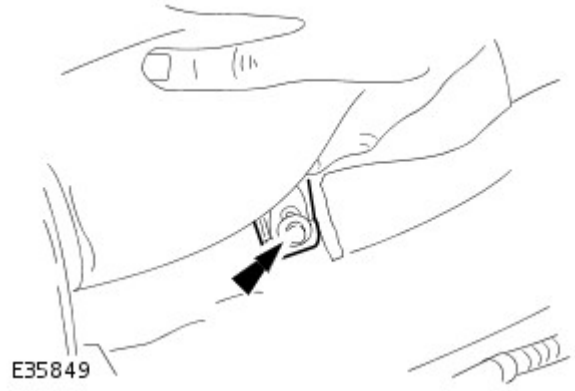
5. Slacken and remove bolt securing centre seat belt lower anchor plate and buckle cable to seat pan.

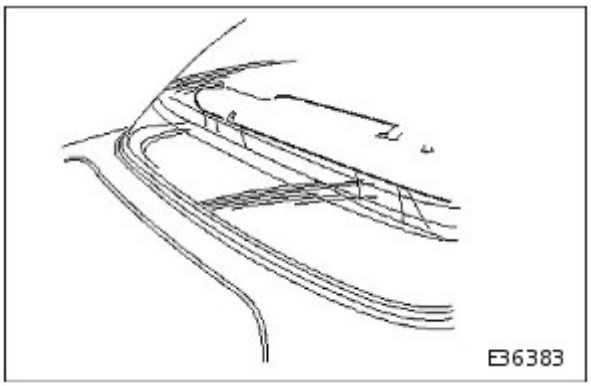


6. Remove seat belt escutcheon.

1. Using a flat-bladed screwdriver in the two rectangular apertures, carefully withdraw escutcheon from squab top roll.
2. Remove escutcheon from belt via split in moulding.

7. Slacken and remove the four seat squab securing screws.





8. Remove seat squab.

- Lift squab clear of inertia reel assemblies withdrawing dowels from top panel.
- Carefully feed seat belt anchor plates and tongues through squab apertures.

9. Disconnect heater element harness multiplugs (if fitted) and remove seat squab via rear passenger door.

Installation

1. Position squab in vehicle and pass seat belt tongues and anchor plates through apertures.

2. Lift squab top roll over inertia reel assemblies, locate dowels in panel apertures and lower and fully seat squab.

3. Fit and tighten the four squab securing screws.

4. Fit seat belt escutcheons to squab top roll.

5. Fit and fully tighten outer seat belt lower anchor securing bolts.

6. Fit and fully tighten bolts securing centre seat belt lower anchor plate and buckle cable.

7. Fit rear cushion. Refer to 76.70.37.

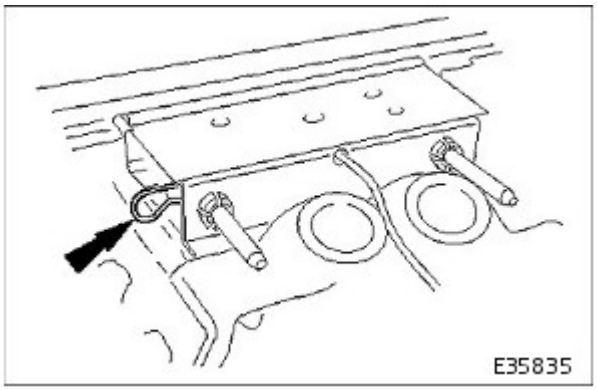
8. Fit rear head restraints.

Seating - Rear Seat Backrest Cover

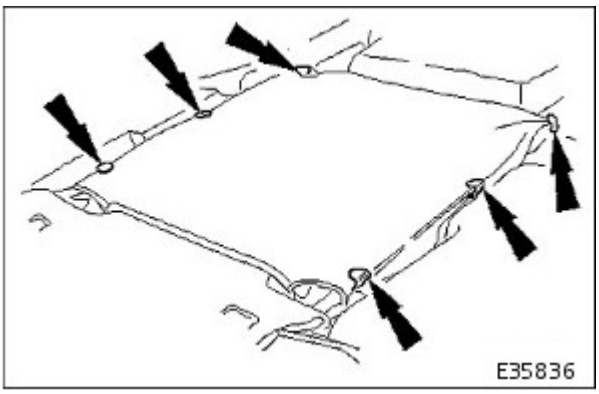
Removal and Installation

Removal

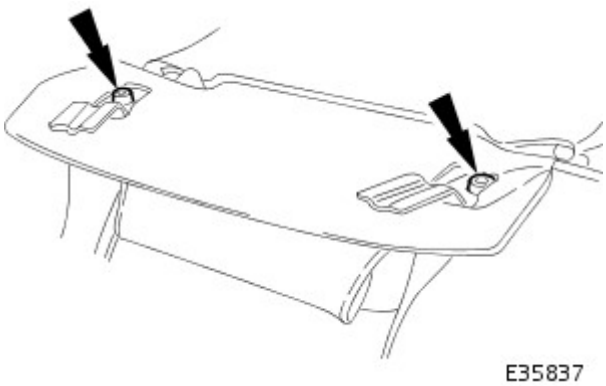
1. Remove rear heel boards.
2. Remove rear seat cushion. Refer to 76.70.37.
3. Remove rear seat belt ecutcheon. Refer to 76.73.18.
4. Remove rear seat squab. Refer to 76.70.38.
5. Place seat squab inverted on clean work surface.



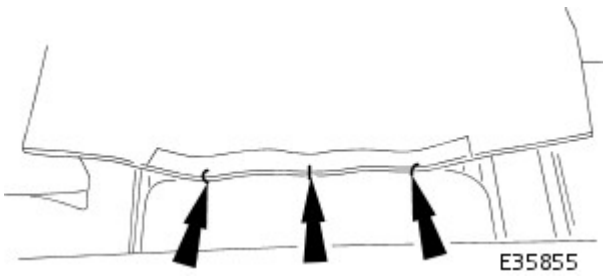
6. Withdraw clips from headrest supports and remove headrests from seat squab.



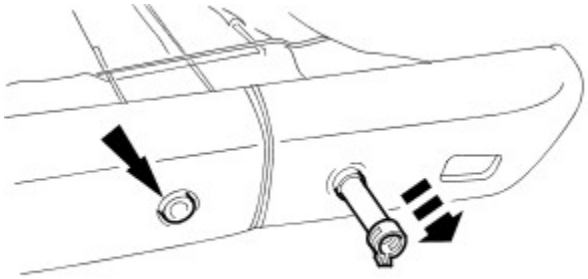
7. Remove the six clips securing rear seat armrest aperture cover to frame and position cover for access.



8. Slacken and remove the two squab mounting bracket screws and remove brackets from frame.

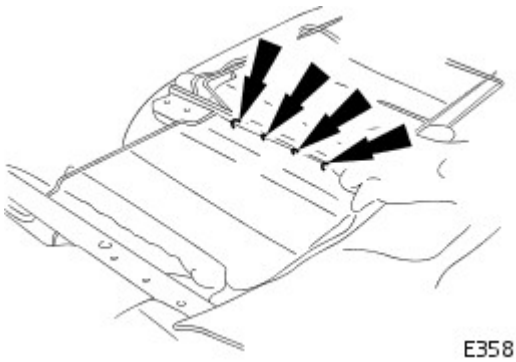


9. Remove and discard the three hog rings securing armrest rear cover retaining strip, release strip from frame and remove arm rest.



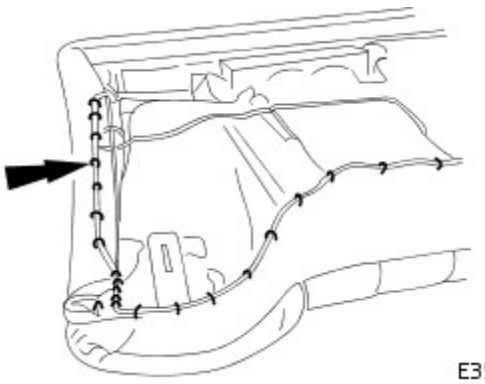
E35867

10. Releasing lower ends, withdraw headrest guide tubes and trims from support boxes.



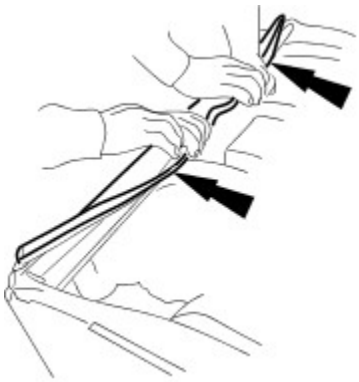
E35866

11. Release squab cover from the eight armrest aperture securing tangs.



E35847

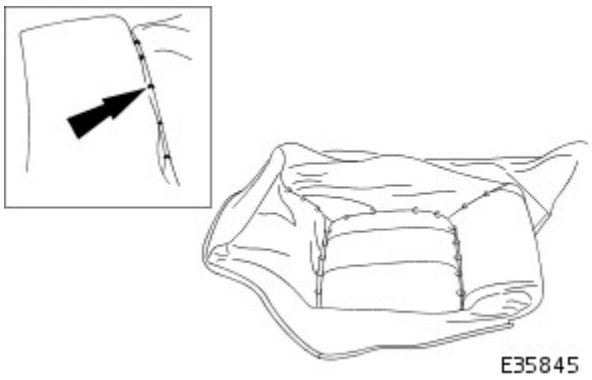
12. Remove and discard all hog rings securing cover to outer edge of frame.



E35844

13. Release cover retaining strip from frame top and free cover from cushion edges.

14. Position cover for access and remove and discard 17 hog rings securing cover left hand panel to frame.

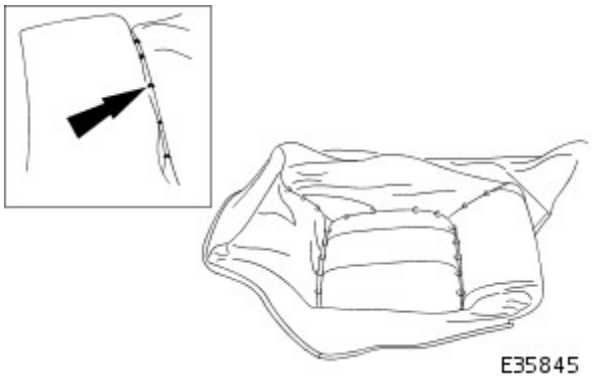


15. Position cover for access and remove and discard 17 hog rings securing cover right hand panel to frame.

16. Remove cover from seat squab.

Installation

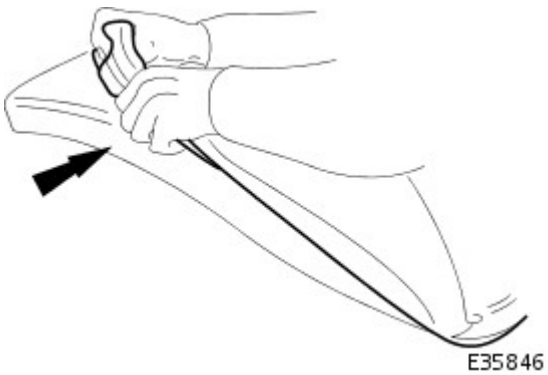
1. Position cover on front of squab.

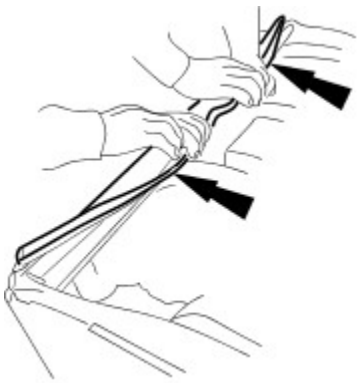


2. Secure cover right hand panel to frame using 17 hog rings.

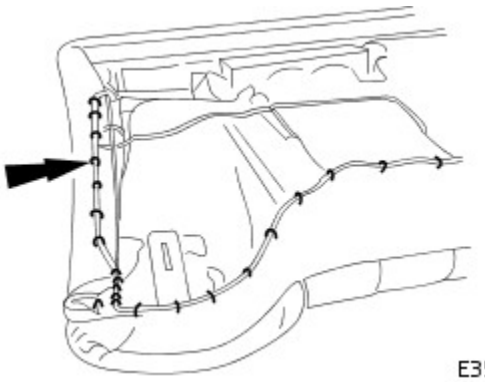
3. Secure cover left hand panel to frame using 17 hog rings.

4. Position squab for access and pull cover over squab pad.



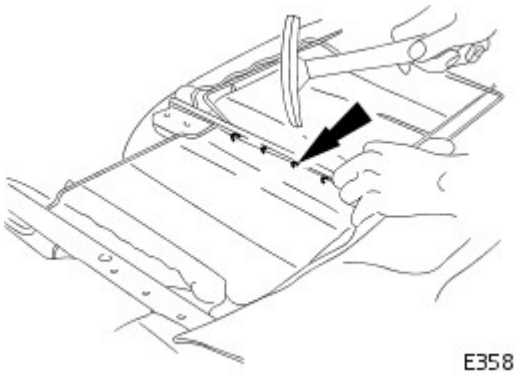


5. Ensuring that top of cover is evenly tensioned, fit and fully seat retaining strip on frame.



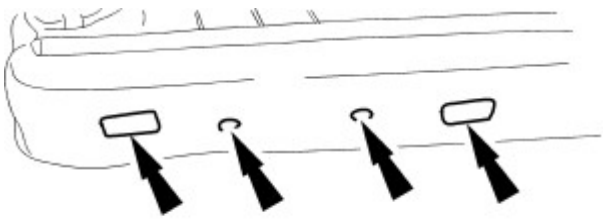
E35847

6. Using 44 hog rings, secure cover to outer edges of frame.



E35848

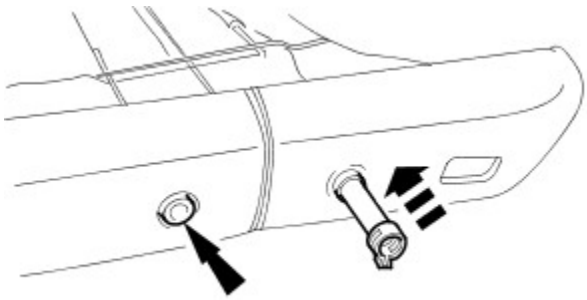
7. Position cover inside armrest aperture and secure on the eight armrest aperture tangs.



E35850

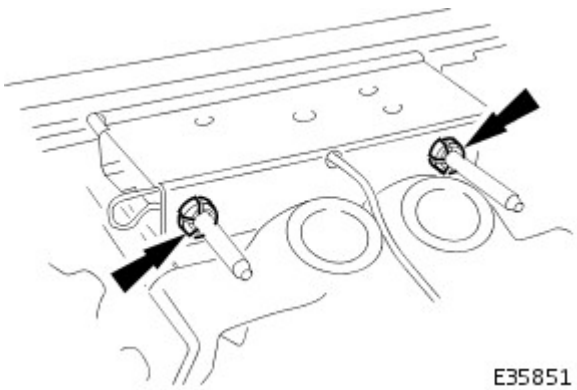
8. CAUTION: The apertures in the foam are over-size and must not be used for guidance when cutting seat belt escutcheon apertures in cover.

Using a suitable knife, carefully cut around headrest support box and seat belt apertures.



E35852

9. With keyways facing forward, fit headrest guide tubes in support boxes.

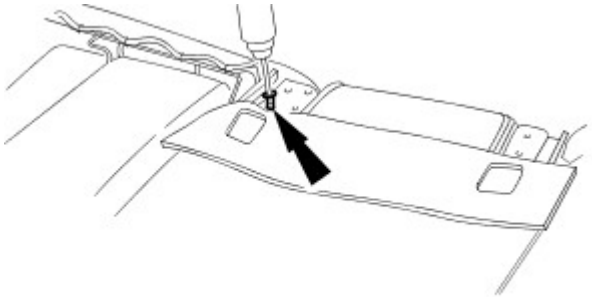


E35851

10. Ensure that lower segmented end of each headrest guide tube fully seats on lower flange of support box.

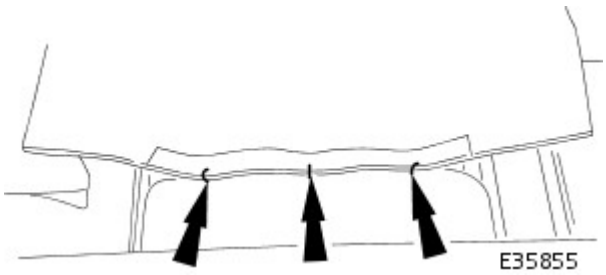
11. Fit chrome finisher rings to upper ends of headrest guide tubes.

12. Position armrest on seat squab and fit and tighten two securing screws.



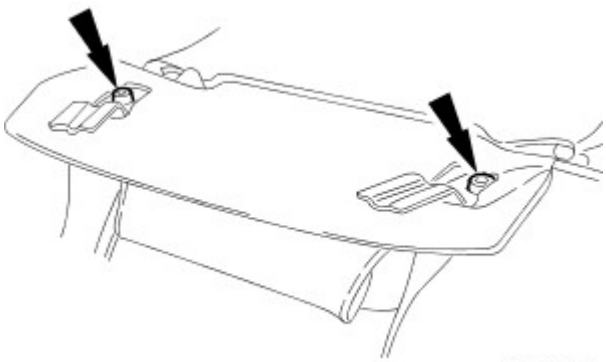
E35853

13. Position armrest rear cover on frame fully seat upper retaining strip and secure with three hog rings.



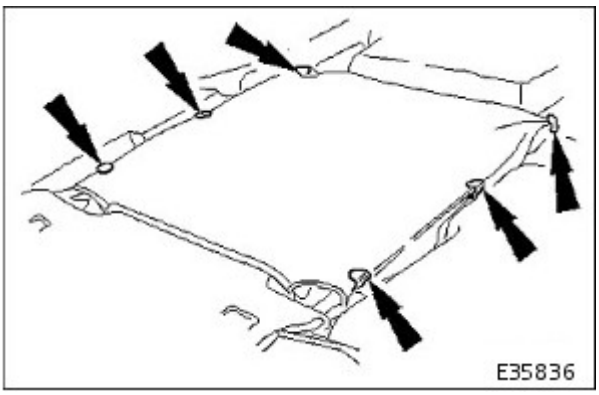
E35855

14. Position squab mounting brackets and fit and tighten securing screws.



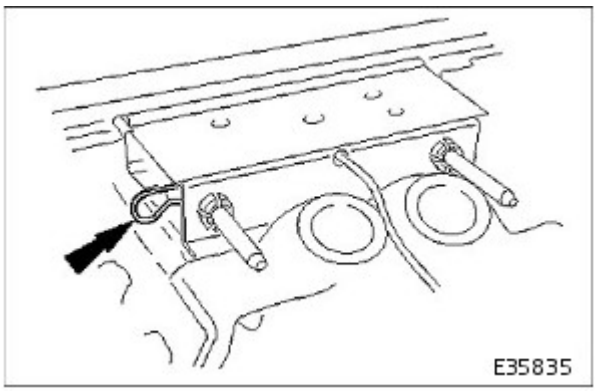
E35837

15. Fit and fully seat the six armrest rear aperture cover spring clips.



E35836

16. Fit and fully seat headrests in guide tubes and fit securing clips.



17. Fit rear seat squab . Refer to 76.70.38.

18. Fit rear seat belt escutcheons. Refer to 76.73.18.

19. Fit rear seat cushion. Refer to 76.70.37.

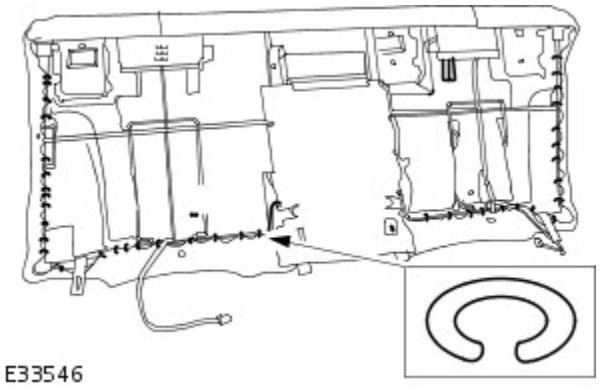
20. Fit rear heel boards.

Seating - Rear Seat Backrest Heater Mat

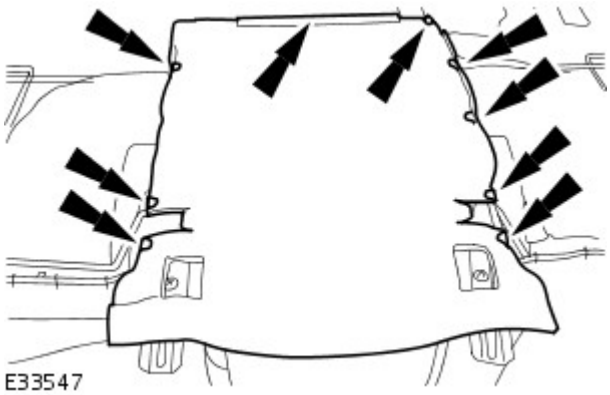
Removal and Installation

Removal

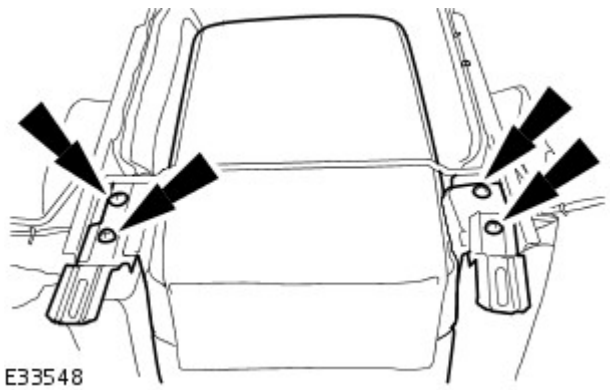
1. Remove the rear seat squab. For additional information, refer to the procedure in this section: Rear Seat Backrest.
2. Remove the seat squab cover.


E33546

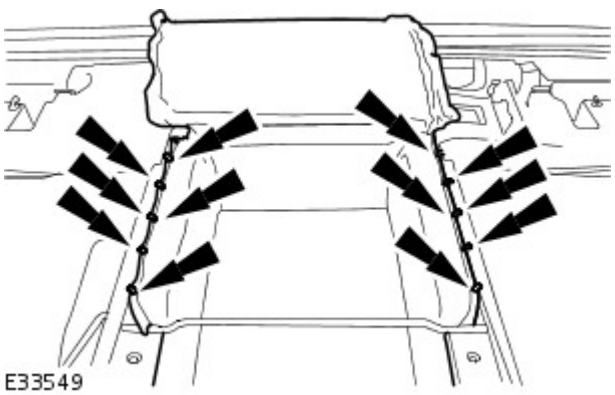
3. Detach the seat armrest cover.

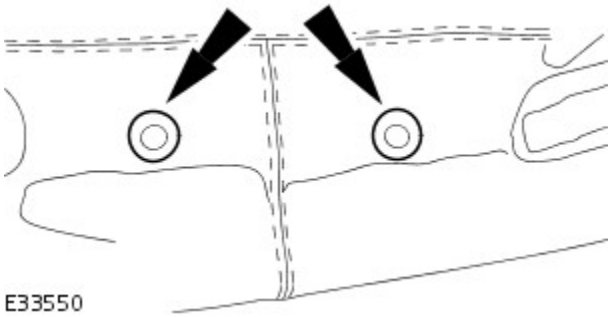

E33547

4. Remove the seat armrest.


E33548

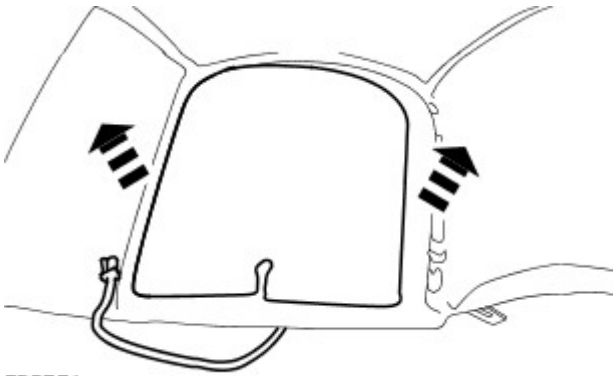
5. Detach the seat squab cover.


E33549


E33550

6. Remove the seat squab cover.

- Remove the seat headrest guides.


E33551

7. Remove the seat squab heater element.

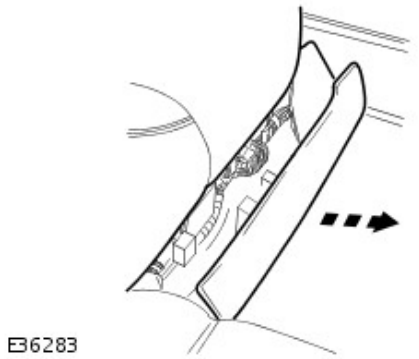
Installation

1. To install, reverse the removal procedure.

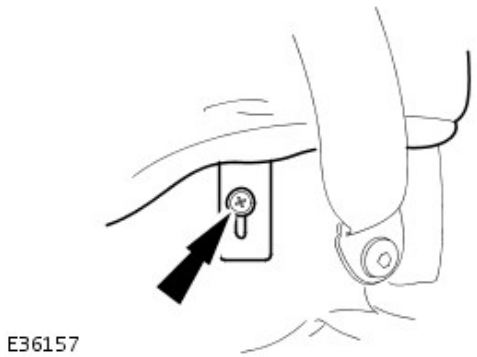
Seating - Rear Seat Cushion

Removal and Installation

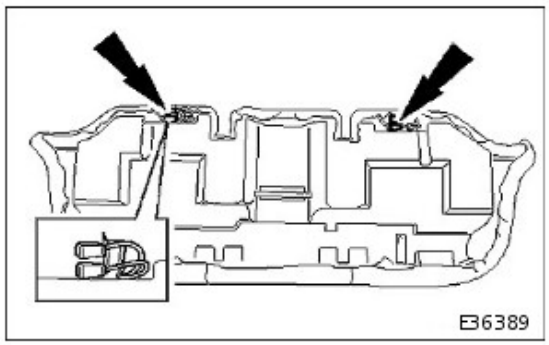
Removal



1. Heated rear seat only. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Slacken, remove and discard 1/4 turn fastener securing each heelboard trim panel and withdraw both panels for access.



3. Slacken and remove the seat cushion securing screws.



4. Raise rear of cushion, disconnect heater element harness multiplugs (if fitted), and move cushion forward carefully feeding seat belt buckles past cushion cut-outs.
5. Remove seat cushion from vehicle.

Installation

1. Holding outer seat belts clear, position cushion in vehicle with rear edge raised.
2. Position buckle assemblies and carefully feed them past cut-outs in cushion.
3. Heated seat only. Connect heater element harness multiplugs.
4. Fit and fully tighten cushion front securing screws.
5. Using new 1/4 turn fasteners, fit and secure heelboard trims.
6. Reposition seatbelts.
7. Heated seat only. Fit ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Seating - Rear Seat Cushion Cover

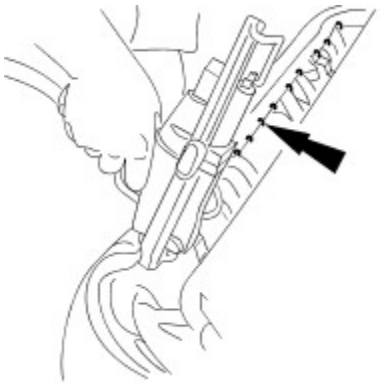
Removal and Installation

Removal

1. Remove rear heel boards.
2. Remove rear seat cushion. Refer to 76.70.37.
3. Place seat cushion inverted on clean work surface.
4. Remove and discard the eight hog rings securing cover at each seat belt anchor aperture.

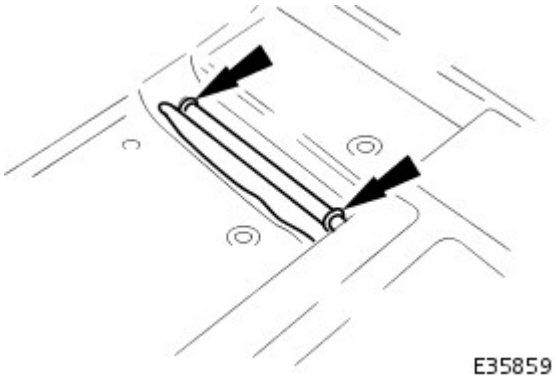


E35860



E35861

5. Remove and discard hog rings securing outer edges of cover and cushion to frame.



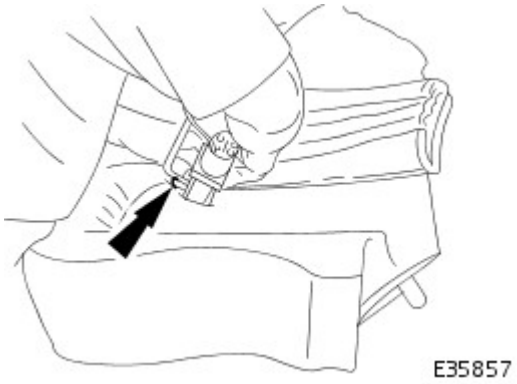
E35859

6. Remove and discard two hog rings securing centre panel overlap plastic edge fastener and release fastener from frame.



E35858

7. Withdraw centre overlap through cushion for access.and remove and discard hog rings securing horizontal seam of right hand panel to cushion.



E35857

8. Remove and discard the six hog rings securing right hand panel to centre of cushion.

9. Remove and discard seven hog rings securing outer side of cover left hand panel to cushion.

10. Remove and discard the four hog rings securing horizontal seam of left hand panel to cushion.

11. Remove and discard the six hog rings securing securing cover left hand panel to centre of cushion.

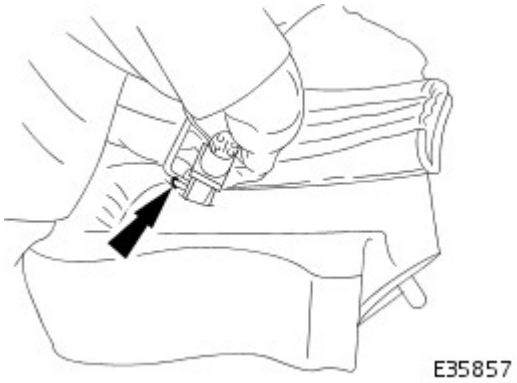
12. Withdraw cover from seat belt anchor apertures.

13. Remove cover from cushion.

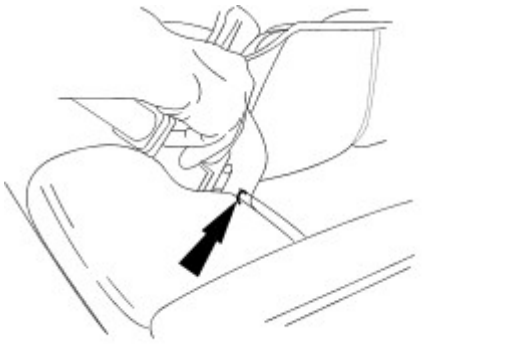
Installation

1. Position cover on cushion.

2. Secure cover right hand panel to centre of cushion using six hog rings .



E35857

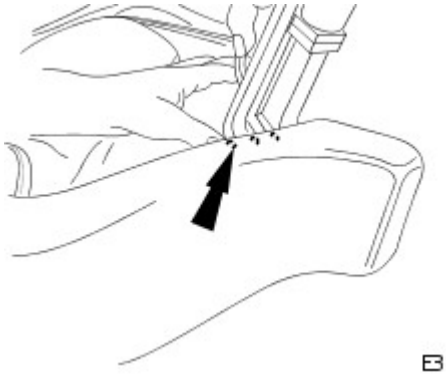


E35858

3. Position cover right hand hand panel through cushion seat belt anchor aperture and secure horizontal seam to cushion using four hog rings.

4. Position cover and pass centre overlap through cushion.

5. Secure outer side of cover right hand panel to cushion using seven hog rings.



E35856

6. Secure cover left hand panel to centre of cushion using six hog rings.

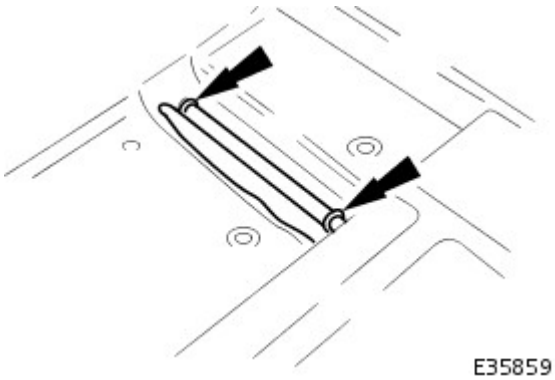
7. Position cover left hand panel through cushion seat belt anchor aperture.

8. Secure horizontal seam of cover left hand panel to cushion using four hog rings.

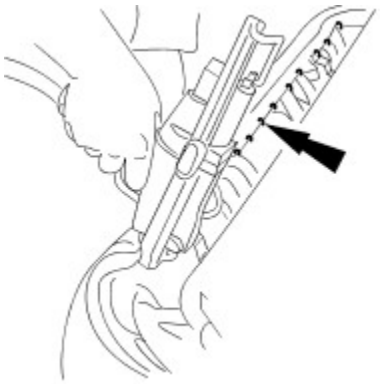
9. Position cover and pass centre overlap through cushion.

10. Secure outer side of cover left hand panel to cushion using seven hog rings.

11. Invert cushion assembly, fully seat cover centre panel overlap plastic edge fastener on frame and secure with two hog rings



E35859



E35861

12. Ensuring even tensioning, secure outer edges of cover and cushion to frame using hog rings.

13. Position cover at seat belt anchor apertures and secure each with eight hog rings.



E35860

14. Fit rear seat cushion to vehicle. Refer to 76.70.37.

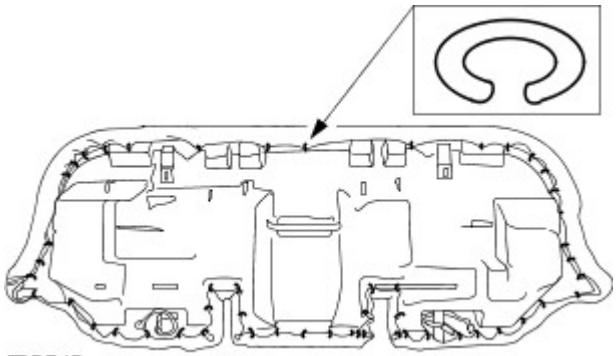
15. Fit rear heel boards.

Seating - Rear Seat Cushion Heater Mat

Removal and Installation

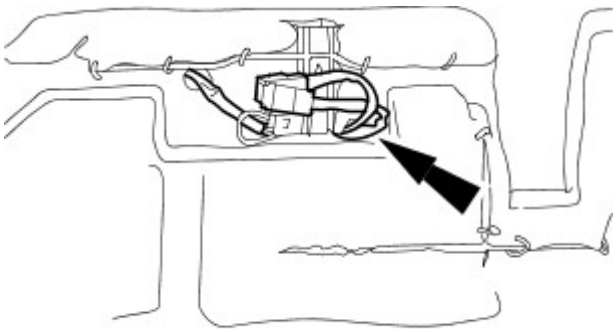
Removal

1. Remove the rear seat cushion. For additional information, refer to the procedure in this section: Rear Seat Cushion.
2. Remove the seat cushion cover.



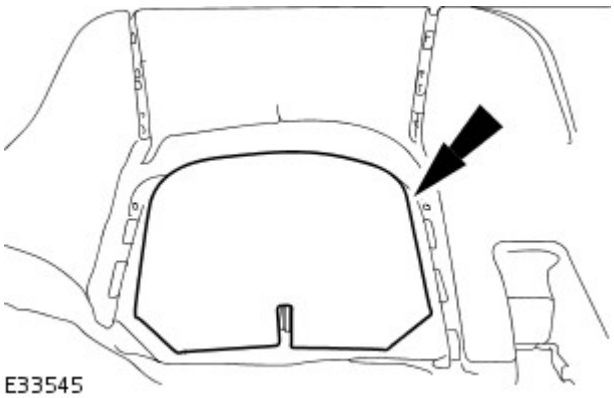
E33543

3. Detach the seat cushion heater element electrical connectors.



E33544

4. Remove the seat cushion heater element.



E33545

Installation

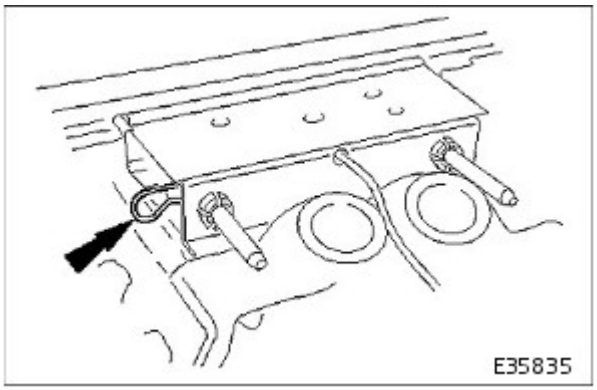
1. To install, reverse the removal procedure.

Seating - Rear Seat Head Restraint

Removal and Installation

Removal

1. Remove rear heel boards.
2. Remove rear seat cushion.
3. Remove rear seat belt escutcheon. Refer to 76.73.18.
4. Fully lower headrests.
5. Remove rear seat squab. Refer to 76.70.38.
6. Place seat squab inverted on clean work surface and remove headrest retaining clips.



7. Withdraw headrest from seat squab.

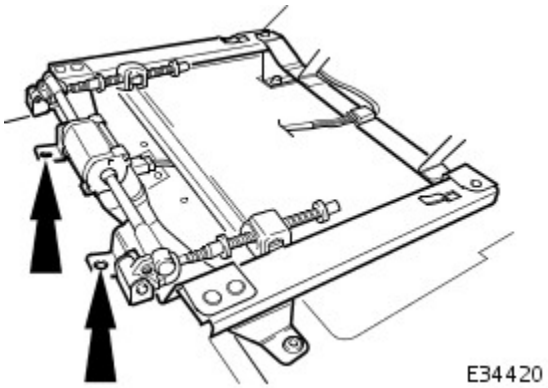
Installation

1. Position headrest fully lowered on seat squab.
2. Fit and fully seat headrest retaining clips.
3. Fit rear seat squab assembly. Refer to 76.70.38.
4. Fit rear seat belt escutcheons. Refer to 76.73.18.
5. Fit rear seat cushion. refer to 76.70.37.
6. Fit rear heel boards.
7. Raise headrests to original positions.

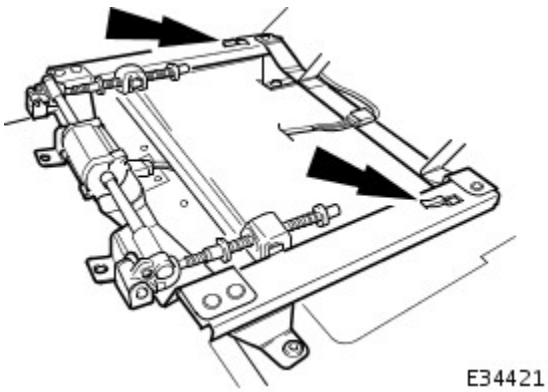
Seating - Rear Seat Track

Removal and Installation

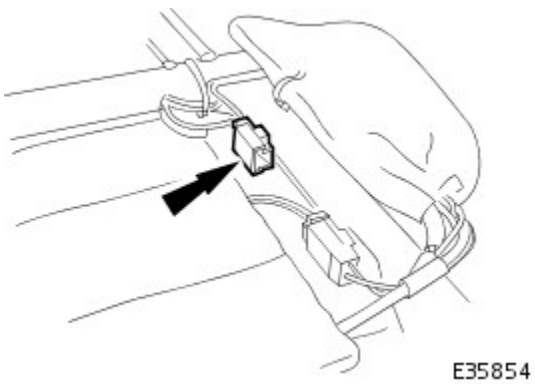
Removal



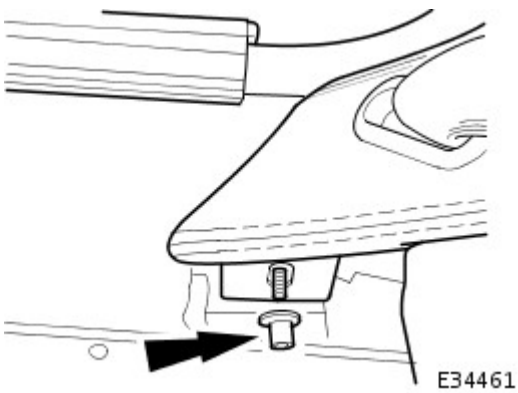
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Slacken and remove the two seat cushion front securing bolts and nuts.



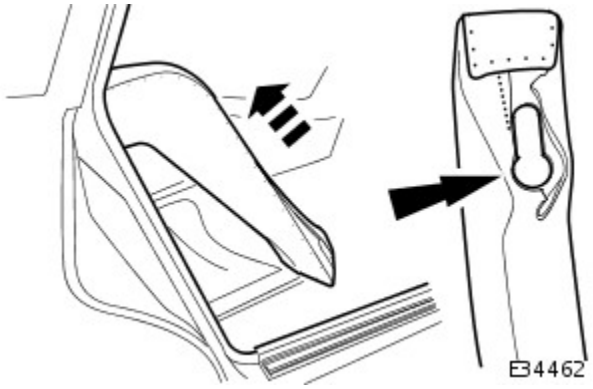
3. Move the seat cushion forward to release it from the two frame rear tangs.



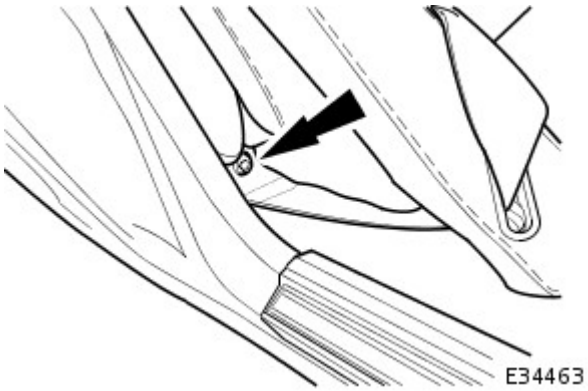
4. Disconnect the cushion heater harness multiplug and remove cushion from seat frame.



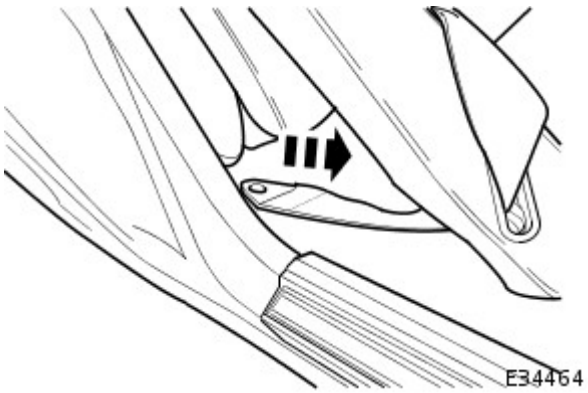
5. Remove and discard plastic scrivet securing lower end of side trim to inner wheelarch stud and withdraw trim from stud.



6. Push trim upwards to release keyhole aperture from squab fixing and partially withdraw trim for access.

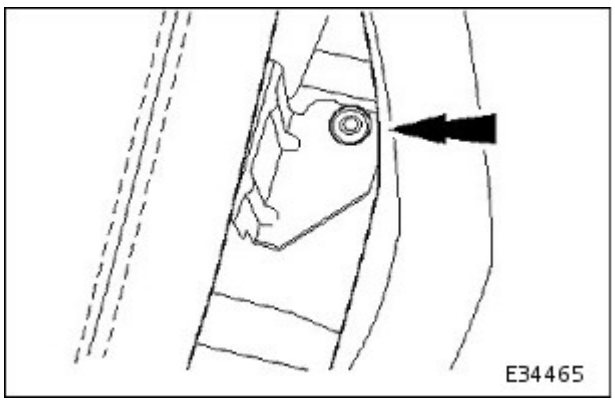


7. Slacken and remove seat belt lower anchor securing bolt.



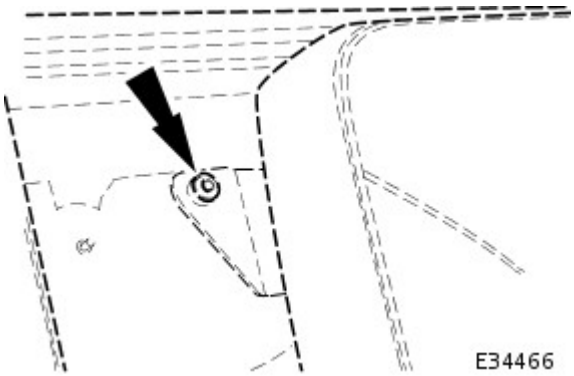
8. Carefully withdraw seat belt and anchor plate through trim aperture and escutcheon.

9. Remove side trim panel from vehicle.

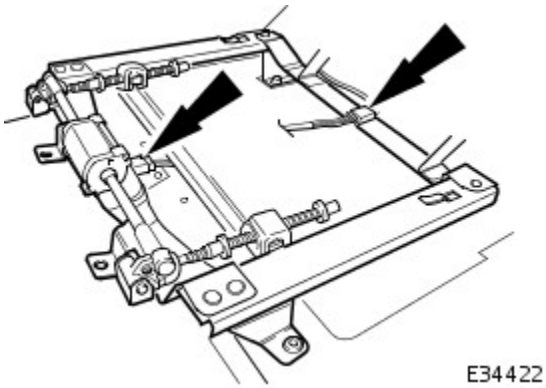


10. Slacken and remove the seat squab outer securing bolt.

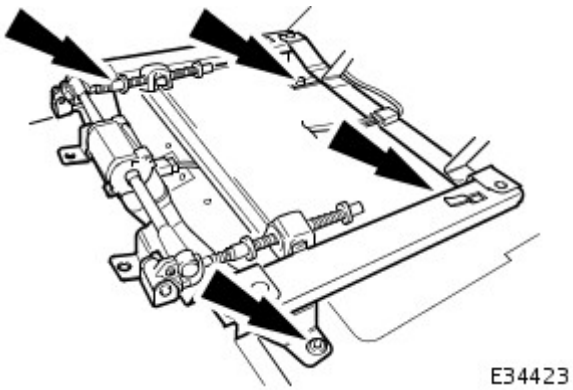
11. Slacken and remove the seat squab inner securing bolt.



12. Disconnect seat motor and squab heater harness multiplugs.



13. Slacken and remove four bolts securing seat frame to floor and remove seat from vehicle.



Installation

1. Position seat in vehicle and fit but do not tighten four bolts securing frame to floor.

2. Fit and fully tighten the two bolts securing squab frame to rear panel.

3. Fully tighten bolts securing frame to floor.

4. Connect seat motor and squab heater harness multiplugs.

5. Position side trim panel and carefully pass seat belt lower anchor through escutcheon and trim aperture.

6. Fit and tighten seat belt anchor securing bolt.

7. Position side trim and push downwards to engage keyhole on squab outer fixing.

8. Position trim lower end over stud and fit and fully seat new scrivet.

9. Position seat cushion for access and connect cushion heater harness multiplug.

10. Push seat cushion rearwards to engage it in rear securing lugs.

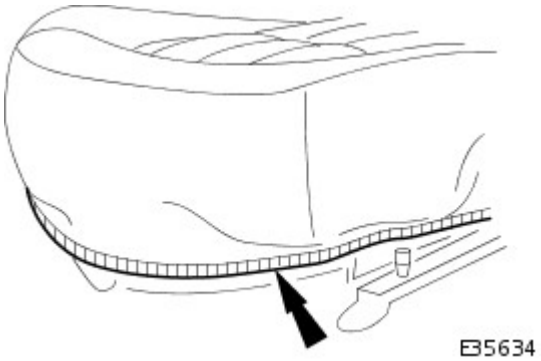
11. Fit and tighten cushion front securing bolts and nuts.
12. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
13. Return seat to original position.

Seating - Seat Control Switch

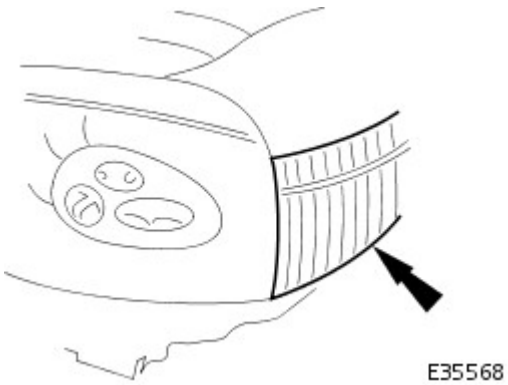
Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove front seat for access. Refer to 76.70.01.
3. Place seat inverted on clean working surface for access to underside.
4. Release cushion cover retaining strip from edge of seat frame.



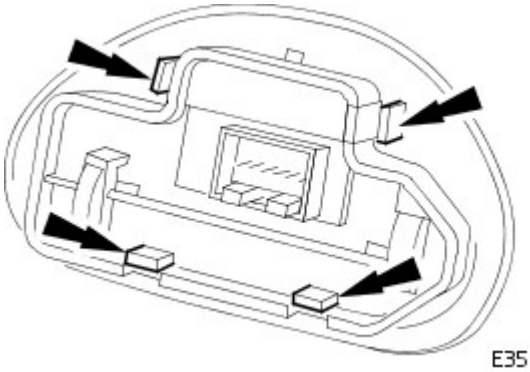
5. Release cushion cover front elastic retaining straps from seat frame.



6. Position cushion cover sides for access to cushion pad, raise pad to access back of switchpack and disconnect harness multiplug.



7. Release switchpack upper retaining tangs, and lower retaining tangs situated by seat sliders and remove switchpack from seat.



Installation

1. Install and fully seat switchpack in seat mounting.
2. Raise cushion pad for access to rear of switchpack and connect harness multiplug.
3. Release cushion pad and secure cushion cover front elastic retaining straps to seat frame.
4. Pull cushion cover over cushion pad and fully seat edge retaining strip on seat frame.
5. Install seat in vehicle. Refer to 76.70.01.
6. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

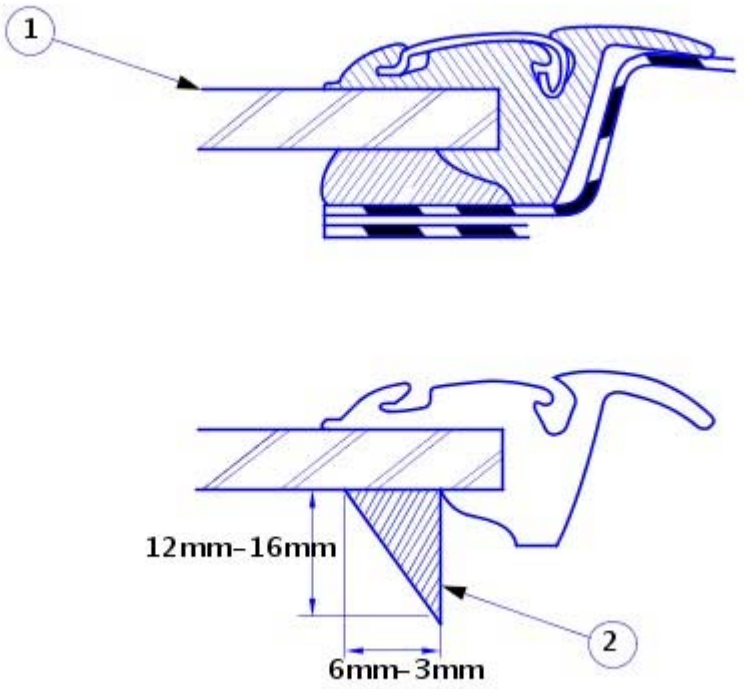
Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Description and Operation

Fixed Glass

The 5 mm thick laminated and tinted glass windshield is supplied with a moulded rubber seal and stainless trim.The inner face of the glass adjacent to the seal is directly bonded to the windshield aperture flange, to form a stressed member of the bodyshell. The 4 mm thick toughened and tinted glass backlight which is similarly bonded to the BIW, incorporates a heating element and a mounting for the high level stop lamp. The 5 mm tempered and tinted glass quarter light which is supplied as a complete assembly with stainless trim and seals, is directly bonded to the BIW aperture flanges.

Windshield and Backlight Adhesive Application



E36330

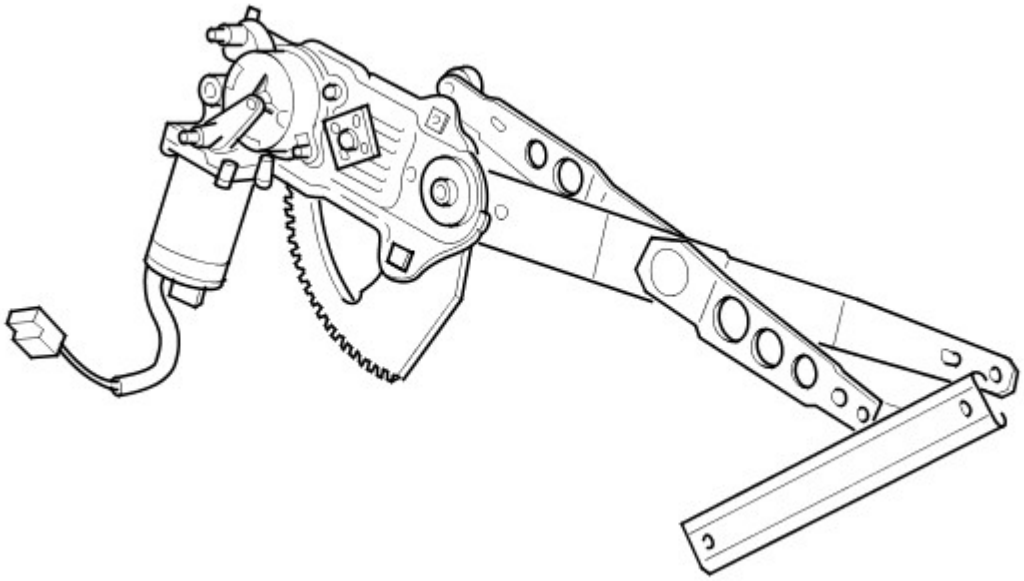
Key to Adhesive Application Drawing

1	Fitted condition
2	Bead application

Door Glass.

The 5 mm tempered and tinted door glass forms part of a fully framed electrically operated system. A switchpack installed in each door casing provides control of lowering and raising of that particular door glass with additional 'one-shot' fast lowering . The driver's door switchpack also provides for independent control of each passenger door glass and total isolation of all passenger door glass control. Each door glass is raised and lowered by an electrically operated scissor mechanism. All door glass can only be operated when the ignition switch is in position I or II.

Door Glass operating Mechanism



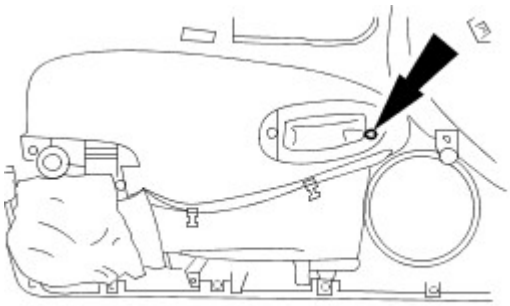
E36353

Glass, Frames and Mechanisms - Door Window Control Switch Bulb

Removal and Installation

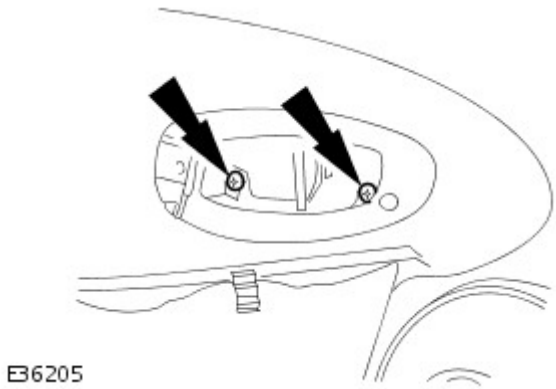
Removal

1. Remove casing/armrest assembly from door. Refer to 76.34.01.
2. Slacken and remove armrest front securing screw



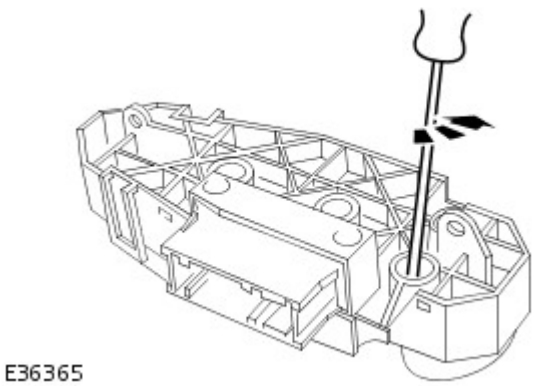
E34424

3. Position armrest for access, slacken and remove two switchpack securing screws and remove switchpack assembly from armrest.



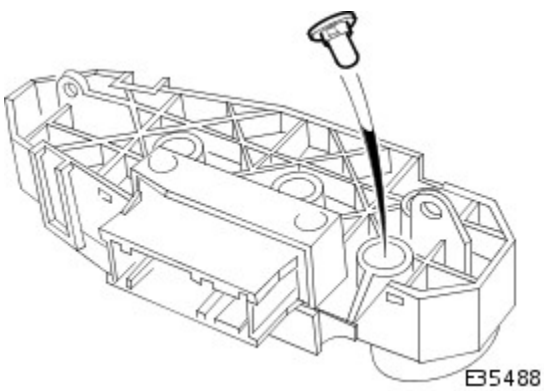
E36205

4. Invert switchpack and using a small flat bladed screwdriver rotate bulb holder 1/8 turn counterclockwise.



E36365

5. Remove bulb from switchpack base.



E35488

Installation

1. Fit illumination bulb in switchpack base and using a small flat bladed screwdriver, rotate it 1/8 turn clockwise to fully seat.
2. Fit switchpack to armrest. Refer to 86.25.03.
3. Fit casing/armrest assembly to door. Refer to 76.34.01.

Glass, Frames and Mechanisms - Front Door Window Glass

Removal and Installation

Removal

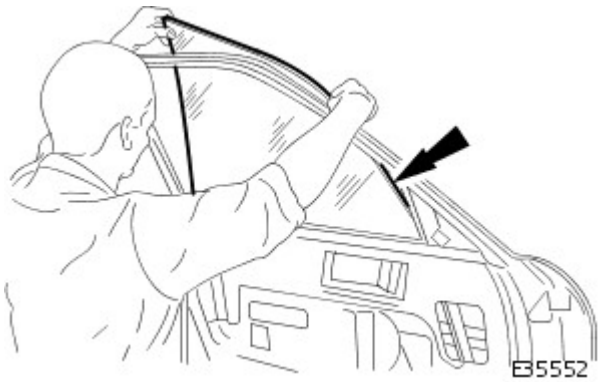
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove front door casing. Refer to 76.34.01.
3. Remove water shedder carefully guiding harness through penetration, and place adhesive face down on clean polythene sheet.
4. Position PVC weathershield for access.
5. Remove front door module. Refer to 86.80.34.
6. Remove front door glass lift motor and regulator assembly. Refer to 86.25.04.
7. Supporting glass, remove tape securing it to top of door for motor removal.
8. Withdraw glass upwards through aperture and out via outboard side of frame.



E35561

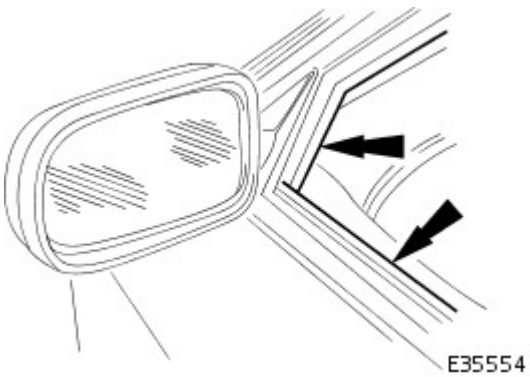
Installation

1. Position glass in frame aperture.
2. Locate leading edge of glass in seal of front channel.



E35552

3. Carefully slide glass into position, ensuring that seals are not deformed into channels.



E35554

4. Fully raise glass and using linen tape, secure to top of door frame.
5. Fit door glass lift motor. Refer to 86.25.04.
6. Fit door module. Refer to 86.80.34.
7. Reposition PVC inner weathershield.
8. Position water shedder and carefully pass harness multiplugs through penetration.
9. Ensuring door mating surfaces are clean and dry, firmly seat water shedder.
10. Fit door casing. Refer to 76.34.01.
11. Connect ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Glass, Frames and Mechanisms - Front Door Window Glass Weatherstrip

Removal and Installation

Removal

1. Pull seal out of door frame channelling and discard seal.
2. Clean channelling ensuring that any residual adhesive is removed.

Installation

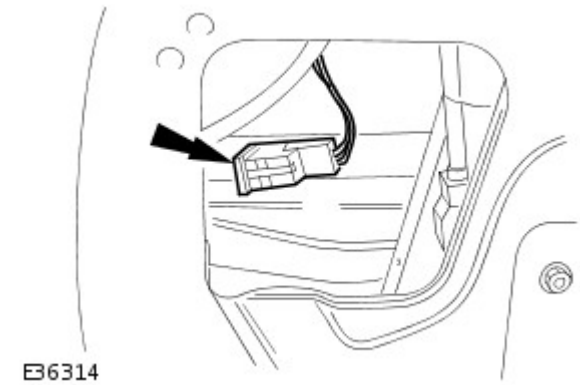
1. Avoiding adhesive at ends, apply a suitable dry lubricant to seal.
2. Commencing at front of frame, feed seal into channelling ensuring it is uniformly tensioned and free from kinks.
3. Wipe residual lubricant from adhesive contact areas.
4. Remove protective tape from ends and press adhesive firmly onto frame.
5. Clean any excess lubricant from external surfaces and check that door shuts correctly.

Glass, Frames and Mechanisms - Front Door Window Regulator and Motor

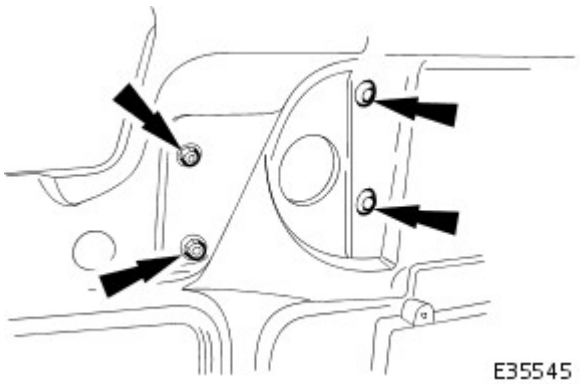
Removal and Installation

Removal

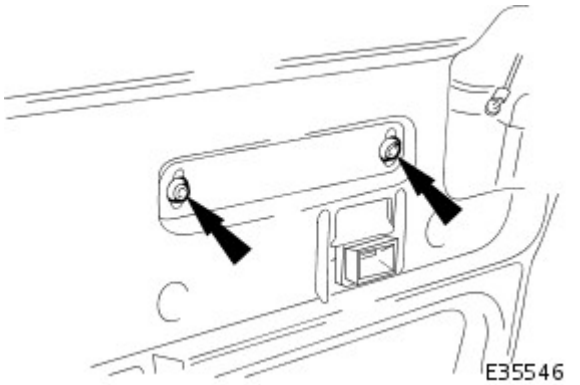
1. Ensure that door glass is in fully up position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove casing/armrest assembly from door. Refer to 76.34.01.
4. Remove water shedder carefully guiding harness through penetration, and place adhesive face down on clean polythene sheet.
5. Position PVC inner weathershield for access.
6. Remove front door module. Refer to 86.80.34.
7. Using linen tape, secure top of glass to door frame.
8. Disconnect harness multiplug from lift motor.



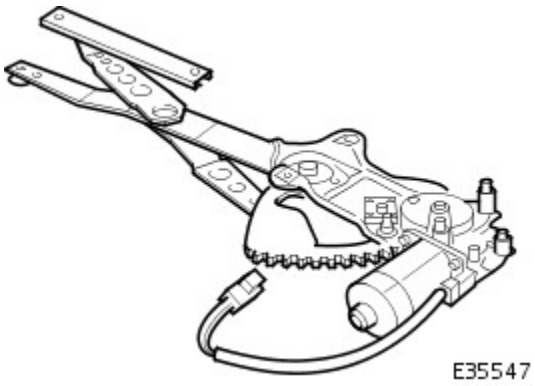
9. Slacken and remove screws and nuts securing lift motor to door.



10. Mark position of door glass guide securing screws and slacken and remove screws.

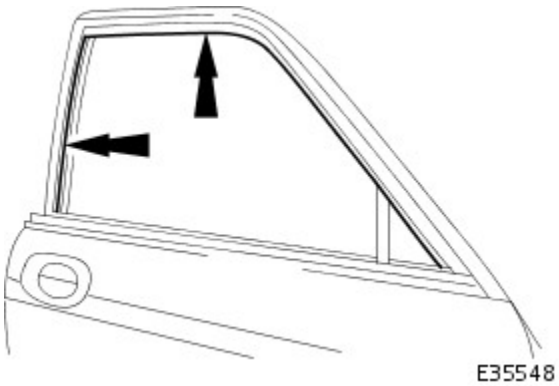


11. Separate motor/regulator assembly from glass, lower into bottom of door and remove assembly from door.



Installation

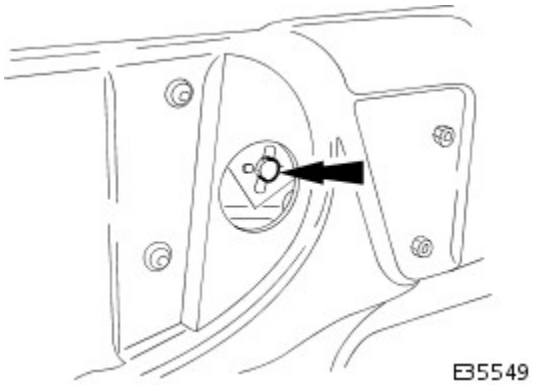
1. Position motor/regulator assembly in door and fit onto glass.
2. Align motor with door holes and fit and tighten securing screws and nuts.
3. Position glass lift guide and fit but do not tighten securing screws.
4. Align glass lift guide with marked screw positions and fully tighten screws.
5. Remove tape securing glass to door frame.
6. Connect a 12volt supply to the motor multiplug and power the glass fully down and up.
7. Draw lines on the glass exterior as follows:
   - Horizontally along the line of the door frame top.
   - Vertically along the line of the B post.



8. Power glass down and check that lines indicate it is seating squarely in the seal.
9. If necessary adjust the glass position as follows:
   - Slacken the glass lift guide rear securing screw.

     • NOTE: If glass is inclined rearwards, move guide downwards in slot. If glass is inclined forwards, move guide upwards in slot.

   - Reposition the lift guide and tighten the securing screw.
   - Re-check glass alignment.
10. Clean lines from glass.
11. Power window to fully up position
12. Repeat steps 7 and 8.
13. When glass alignment is satisfactory, thoroughly clean off lines.
14. Power window to fully closed position and disconnect 12volt



supply from motor multiplug.

15. Adjust regulator up stop.

- Slacken stop securing bolt.
- Move stop rearwards to abut regulator quadrant.
- Tighten stop securing bolt.

16. Reconnect harness multiplug to lift motor.

17. Fit door module. Refer to 86.80.34.

18. Reposition PVC weathershield.

19. Position water shedder and carefully pass harness multiplugs through penetration.

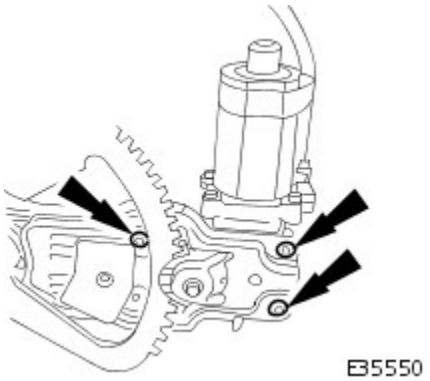
20. Ensuring door mating surfaces are clean and dry, firmly seat water shedder.

21. Fit casing/armrest assembly to door. Refer to 76.34.01.

22. Connect ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Glass, Frames and Mechanisms - Front Door Window Regulator Motor

Removal and Installation



Removal

1. Remove lift motor and regulator assembly from door. Refer to 86.25.04.
2. Slacken and remove three screws securing motor to regulator.
3. Remove lift motor from regulator.

Installation

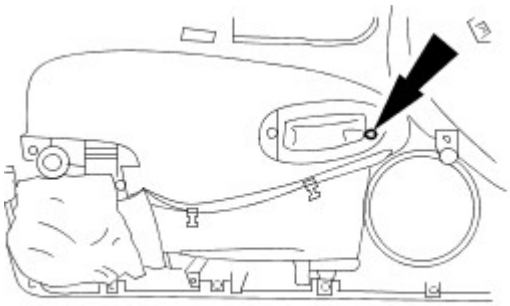
1. Position lift motor on regulator and fit and tighten securing screws.
2. Fit lift motor and regulator assembly in door. Refer to 86.25.04.

Glass, Frames and Mechanisms - Front Door Window Control Switch

Removal and Installation

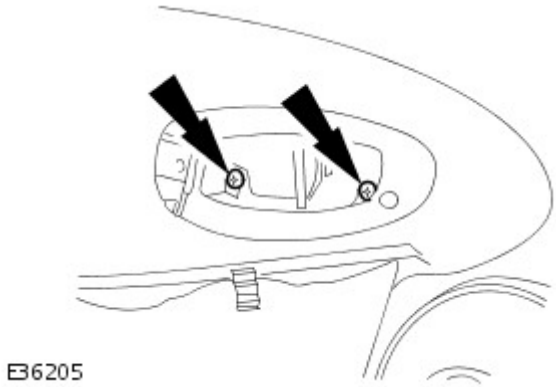
Removal

1. Remove casing/armrest assembly from door. Refer to 76.34.01.
2. Slacken and remove armrest front securing screw.



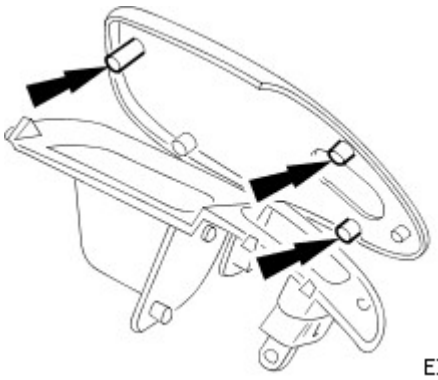
E34424

3. Position armrest for access, slacken and remove two switchpack securing screws and remove switchpack assembly from armrest.



E36205

4. Slacken and remove screws securing veneer panel to switchpack.



E35519

Installation

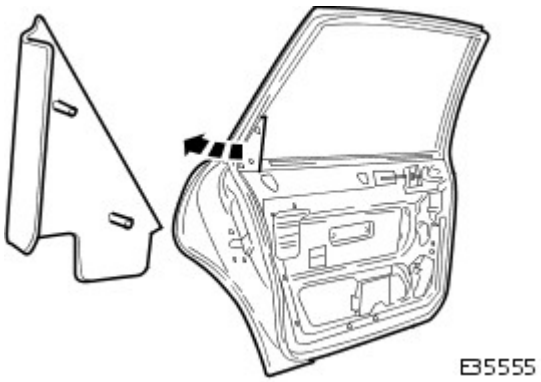
1. Position veneer panel on switchpack and fit and tighten securing screws.
2. Position switchpack assembly on armrest and fit and tighten securing screws.
3. Fit and tighten screw securing front of armrest to door casing.
4. Fit casing/armrest assembly to door. Refer to 76.34.01.

Glass, Frames and Mechanisms - Rear Door Window Glass

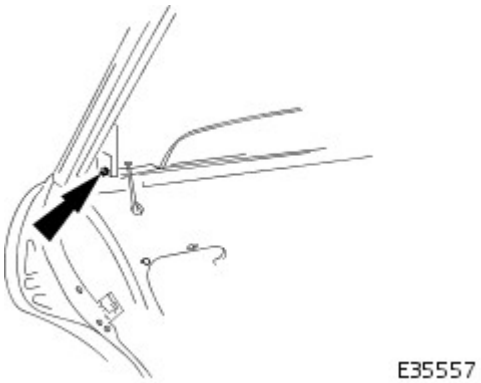
Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove door casing/armrest assembly for access. Refer to 76.34.04
3. Remove water shedder carefully guiding harness through penetration, and place adhesive face down on clean polythene sheet.
4. Position PVC weathershield for access.
5. Remove rear door module. Refer to 86.80.33.
6. Using linen tape, secure top of door glass to door frame.
7. Remove rear door glass lift motor. Refer to 86.25.09.
8. Remove inner cheater finisher.
   - Exercising care to avoid damaging paintwork, use a plastic lever to withdraw finisher dowels from door inserts.
   - Remove and discard plastic inserts from cheater.



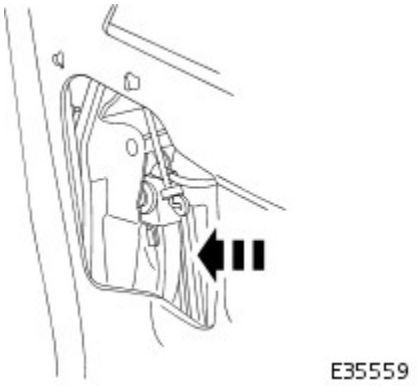
9. Slacken and remove glass rear guide leg upper securing bolt.



10. Exercising care to avoid damaging paintwork, remove door outer waist rail and rear outer finisher.



11. Supporting glass, remove tape from top and carefully lower glass into door.
12. Move rear guide leg rearwards to, facilitate glass removal.





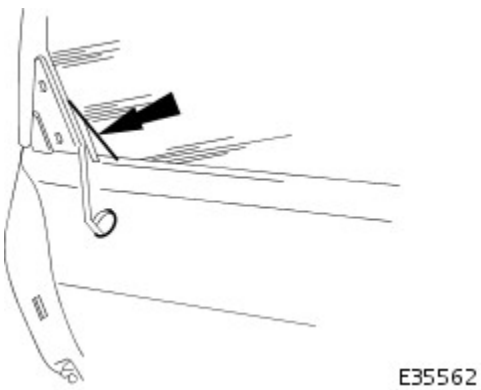
13. Withdraw glass upwards through aperture and out via outboard side of frame.

Installation



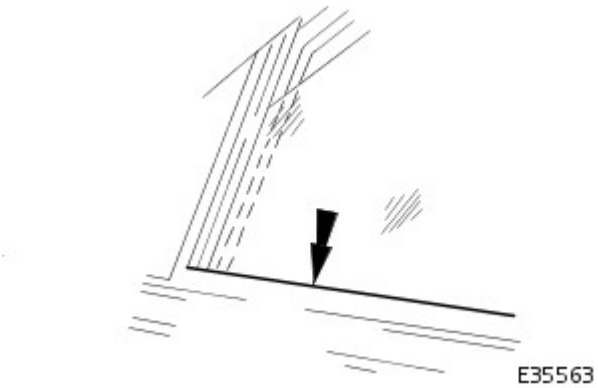
1. Position glass in aperture.

2. Locate leading edge of glass in seal of front channel.



3. Engage lower rear corner of glass in seal at top of rear guide leg.

4. Carefully lower glass into door, ensuring that seals are not deformed into channels.



5. Fully raise glass and secure to top of door frame using linen tape.

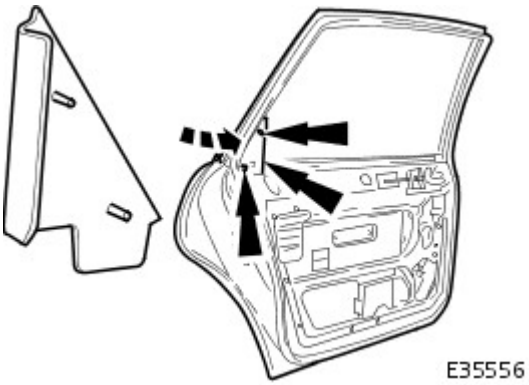
6. Correctly position glass rear guide and fit and tighten upper securing bolt.

7. Fit and fully seat door outer finisher.

8. Fit and fully seat door outer waist rail.

9. Fit cheater inner finisher.

- Fit new plastic inserts to cheater.
- Apply sealant to front edge of cheater.
- Fit cheater inner trim, fully seating dowels in inserts.



10. Fit and connect door glass lift motor. Refer to 86.25.09.

11. Fit and connect door control module. Refer to 86.80.33.

12. Reposition PVC weathershield.

13. Position water shedder and carefully pass harness multiplugs through penetration.

14. Ensuring door mating surfaces are clean and dry, firmly seat water shedder.

15. Fit casing/armrest assembly to door. Refer to 76.34.04.

16. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Glass, Frames and Mechanisms - Rear Door Window Glass Weatherstrip

Removal and Installation

Removal

1. Pull seal out of door frame channelling and discard seal.
2. Clean channelling ensuring that any residual adhesive is removed.

Installation

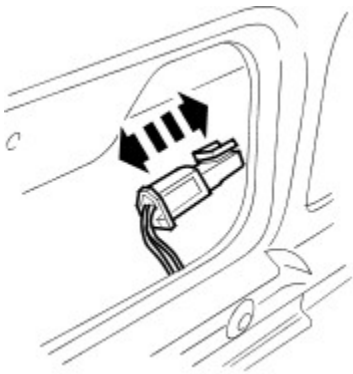
1. Avoiding adhesive at ends, apply a suitable dry lubricant to seal.
2. Commencing at front of frame, feed seal into channelling ensuring it is uniformly tensioned and free from kinks.
3. Wipe residual lubricant from adhesive contact areas.
4. Remove protective tape from ends and press adhesive firmly onto frame.
5. Clean any excess lubricant from external surfaces and check that door shuts correctly.

Glass, Frames and Mechanisms - Rear Door Window Regulator and Motor

Removal and Installation

Removal

1. Ensure that door glass is in fully up position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove casing/armrest assembly from door. Refer to 76.34.01.
4. Remove water shedder carefully guiding harness through penetration, and place adhesive face down on clean polythene sheet.
5. Position PVC inner weathershield for access.
6. Remove rear door module. Refer to 86.80.34.
7. Using linen tape, secure top of glass to door frame.
8. Disconnect harness multiplug from lift motor.



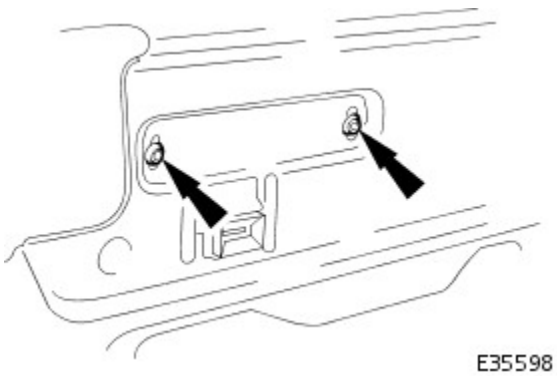
E35596

9. Slacken and remove screws and nuts securing lift motor to door.



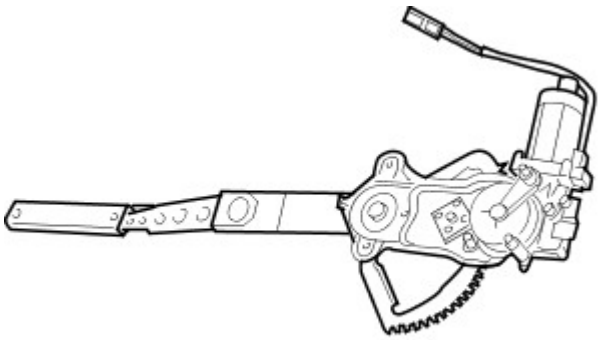
E35597

10. Mark position of door glass guide securing screws and slacken and remove screws.



E35598

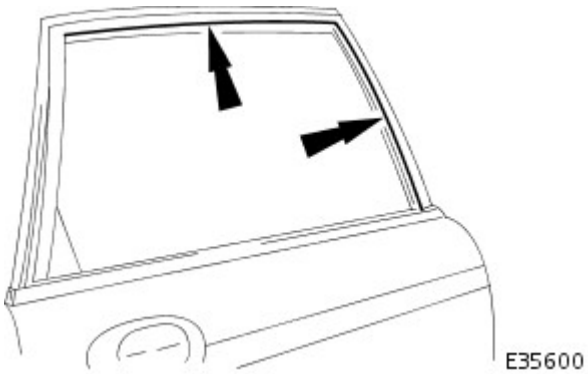
11. Separate motor/regulator assembly from glass, lower into bottom of door and remove assembly from door.



E35599

Installation

1. Position motor/regulator assembly in door and fit onto glass.
2. Align motor with door holes and fit and tighten securing screws and nuts.
3. Position glass lift guide and fit but do not tighten securing screws.
4. Align glass lift guide with marked screw positions and fully tighten screws.
5. Remove tape securing glass to top of door frame.
6. Connect a 12volt supply to the motor multiplug and power the glass fully down and up.
7. Draw lines on the glass exterior as follows:
   - Horizontally, along the line of the door frame top.
   - Vertically along the line of the 'B' post.

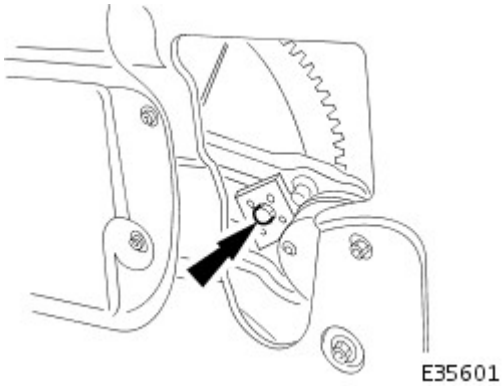


E35600

8. Power glass down and check that it is seating squarely in the seal.
9. If necessary adjust the glass position as follows:
   - Slacken the glass lift guide rear securing screw.

     • NOTE: If glass is inclined rearwards, move guide downwards in slot. If glass is inclined forwards, move guide upwards in slot.

   - Reposition the lift guide and tighten the securing screw.
   - Re-check glass alignment.
10. Clean lines from glass.
11. Power window to fully up position
12. Repeat steps 7 and 8.
13. When glass alignment is satisfactory, thoroughly clean off all lines.
14. Power window to fully closed position and disconnect 12volt supply from motor multiplug.



15. Adjust regulator up stop.

- Slacken stop securing bolt.
- Move stop rearwards to abut regulator quadrant.
- Tighten stop securing bolt and apply waterproof tape to aperture in water shedder.

16. Reconnect harness multiplug to lift motor.

17. Fit door module. Refer to 86.80.34.

18. Reposition PVC weathershield.

19. Position water shedder and carefully pass harness multiplugs through penetration.

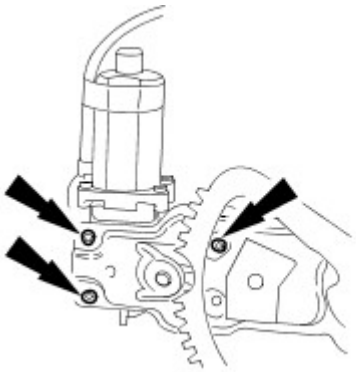
20. Ensuring door mating surfaces are clean and dry, firmly seat water shedder.

21. Fit casing/armrest assembly to door. Refer to 76.34.01.

22. Connect ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Glass, Frames and Mechanisms - Rear Door Window Regulator Motor

Removal and Installation



E35602

Removal

1. Remove lift motor and regulator assembly from door. Refer to 86.25.09.
2. Slacken and remove three screws securing motor to regulator.
3. Remove lift motor from regulator.

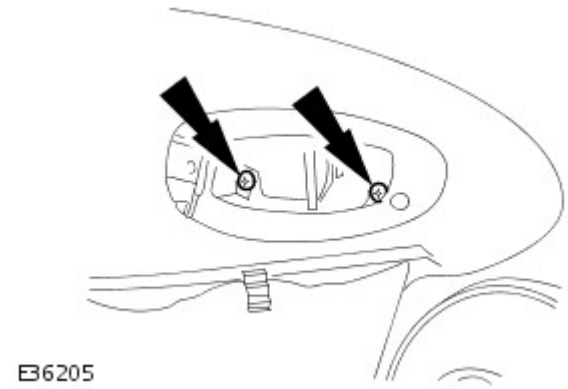
Installation

1. Position lift motor on regulator and fit and tighten securing screws.
2. Fit lift motor and regulator assembly in door. Refer to 86.25.09.

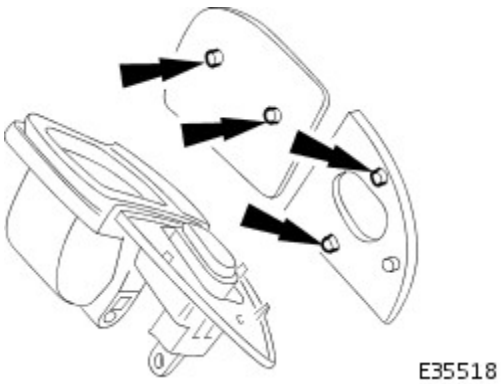
Glass, Frames and Mechanisms - Rear Door Window Control Switch

Removal and Installation

Removal



1. Remove casing/armrest assembly from door. Refer to 76.34.04.
2. Remove armrest from casing. Refer to 76.34.23.
3. Position armrest for access, slacken and remove two switchpack securing screws and remove switchpack assembly from armrest.



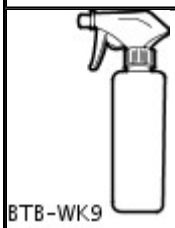
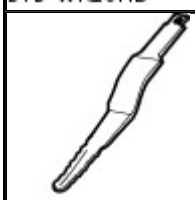
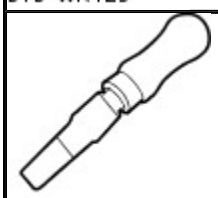
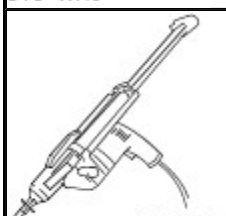
4. Slacken and remove screws securing veneer panels to switch and ashtray.

Installation

1. Position veneer panels on switch and ashtray, and fit and tighten securing screws.
2. Position switch/ashtray assembly on armrest and fit and tighten securing screws.
3. Fit armrest to door casing. Refer to 76.34.23.
4. Fit casing/armrest assembly to door. Refer to 76.34.04.

Glass, Frames and Mechanisms - Rear Quarter Window Glass

Removal and Installation

Special Tool(s)	
 BTB-WK9	Spray Bottle WK9
 BTB-WK9L	Lubricant Concentrate WK9L
 BTB-WK10HD	Power Cutting Tool WK10HD
 BTB-WK4ZS	Cutting Blade - Side WK4ZS
 BTB-WK6	Adhesive Removal Blade - Body WK6
 E43759	Betagun pneumatic application gun Betagun 111

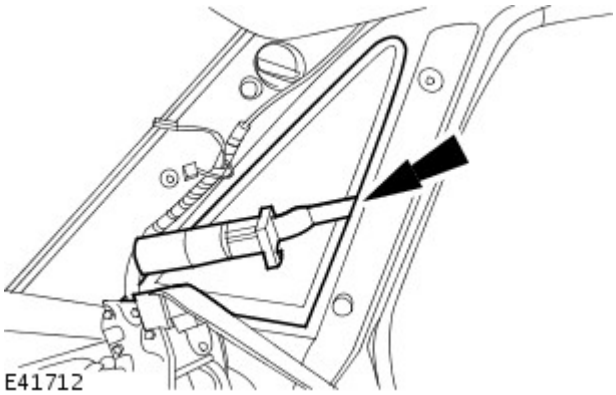
Removal

1. Remove the rear seat backrest.
   For additional information, refer to: Rear Seat Backrest (501-10 Seating, Removal and Installation).
2. Remove both C-pillar trim panels.
   For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Place a suitable protective sheet over the parcel shelf and place a protecting board over sheet.
4. Dispense 20ml of WK9L lubricant into the WK9 spray bottle, fill

the spray bottle with water and mix.

5. Apply cutting lubricant to the rear quarter window glass adhesive.

6. Install the cutting tool blade BTB-WK4ZS to the cutting tool BTB-WK10HD.



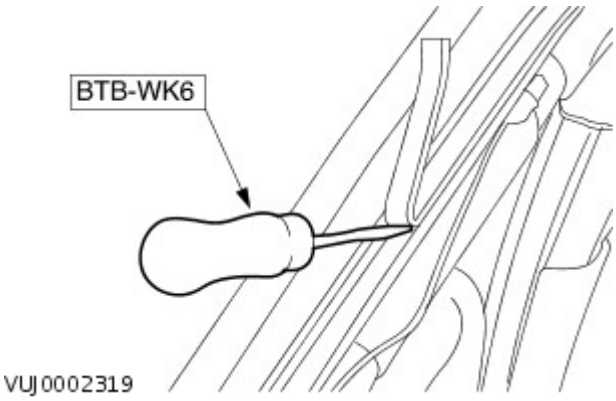
7. WARNING: When removing the rear quarter window glass, personal protection must be worn. Failure to follow this instruction may result in personal injury.

• NOTE: Apply cutting lubricant to the cutting tool frequently through out the cutting process.

Using the special tool cut through the rear quarter window glass adhesive.

8. Remove the rear quarter window glass.

Installation



1. WARNINGS:

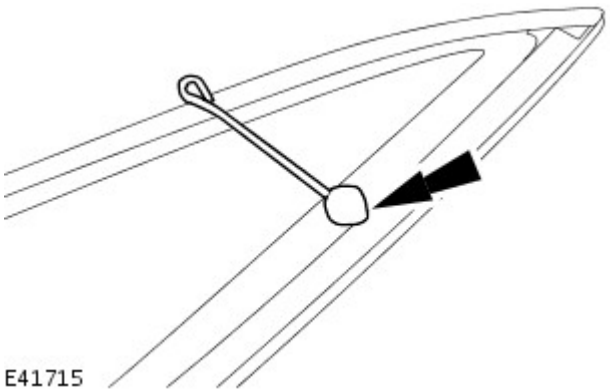
If the rear quarter window glass is being installed at a temperature of 23°C (73°F) or above make sure the vehicle is not driven for at least 1 hour after installation.

If the rear quarter window glass is being installed at a temperature of 11°C (52°F) make sure the vehicle is not driven for at least 1.5 hours after installation.

If the rear quarter window glass is being installed at a temperature of 5°C (41°F) make sure the vehicle is not driven for at least 2 hours after installation.

If the rear quarter window glass is being installed at a temperature below 5°C (41°F) use heat and make sure the windshield glass adhesive has set before the vehicle is driven.

Using the special tool, remove any residual adhesive from the body aperture.

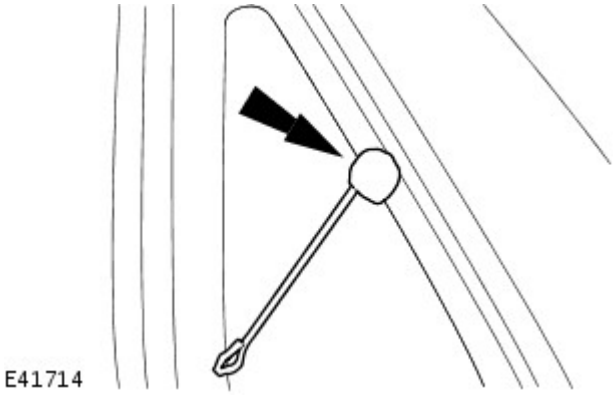


2. NOTE: If the original rear quarter window glass is to be installed remove the residual adhesive from rear quarter window glass mating surface using the special tool.

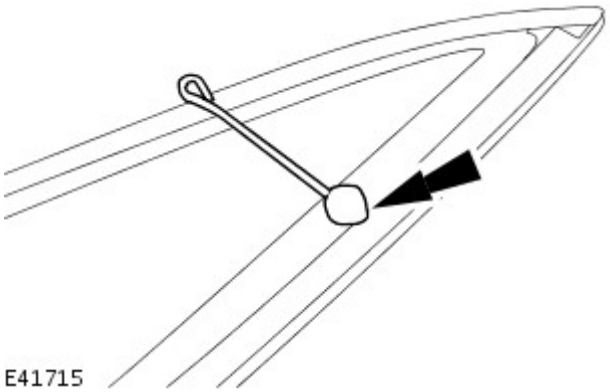
Thoroughly clean rear quarter window glass surface using Betawipe spirit.

3. Thoroughly clean the mating face of the body using Betawipe

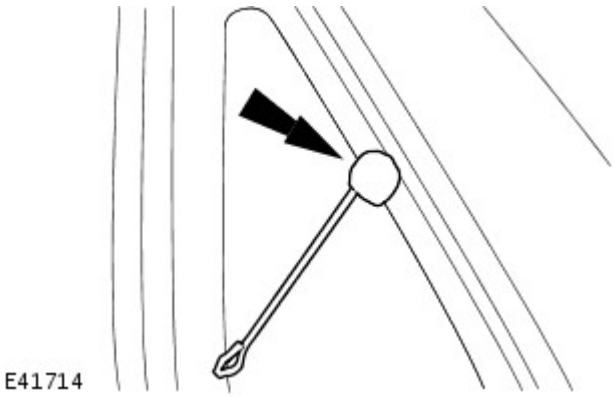
spirit.



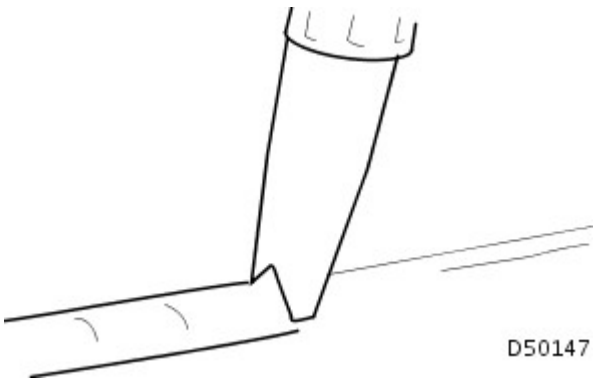
4. Apply primer to the mating face of the glass.



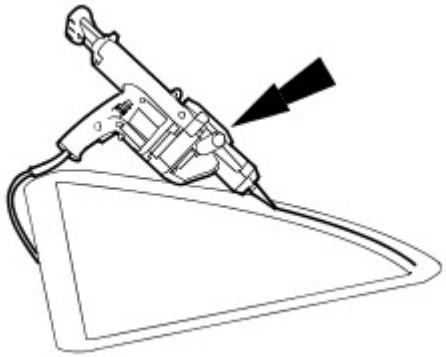
5. Apply primer to the mating face of the body.



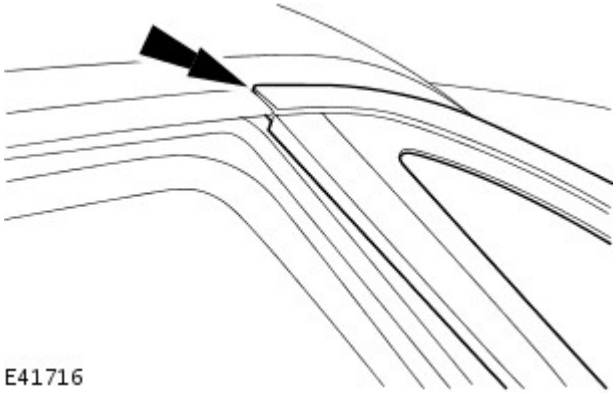
6. Cut the nozzle of the JLM20452 glass bonding adhesive to achieve a triangular section bead 8 mm (0.32 in) wide by 10 mm (0.4 in) high.



7. Using the special tool, apply a uniform bead of adhesive to the rear quarter window glass edge commencing at the bottom center and overlapping the ends approximately 14 mm (0.56 in).



E42689



E41716

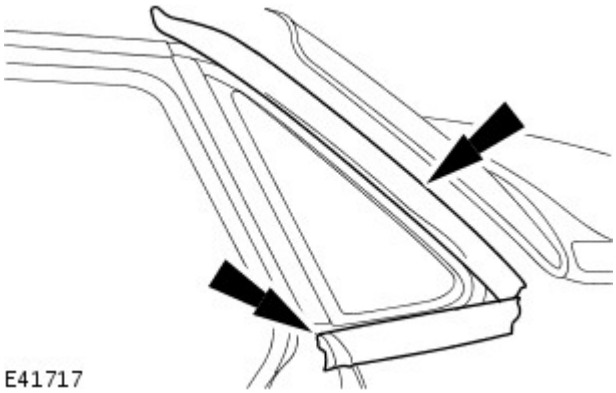
8. CAUTIONS:

⚠ When installing the rear quarter window glass, do not strike it in any way as this will crack the rear quarter window glass.

⚠ Make sure the rear quarter window glass does not move out of position in the body aperture.

• NOTE: Left-hand shown, right-hand similar.

Install the rear quarter window glass into the aperture. Make sure the rear quarter window glass finisher is correctly located to the roof moulding and press firmly into place.



E41717

9. ⚠ CAUTION: Make sure the rear quarter window glass does not move out of position in the rear quarter window glass aperture.

• NOTE: Left-hand shown, right-hand similar.

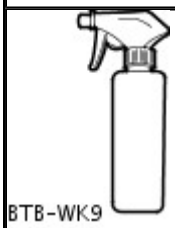
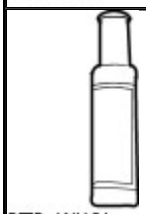
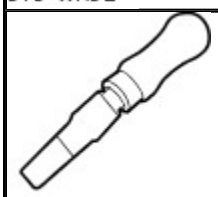
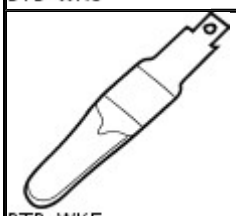
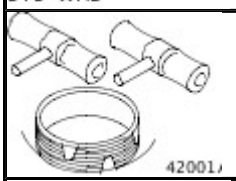
Apply suitable tape to the top of the rear quarter window glass.

10. Install both C-pillar trim panels.
For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

11. Install the rear seat backrest.
For additional information, refer to: Rear Seat Backrest (501-10 Seating, Removal and Installation).

Glass, Frames and Mechanisms - Rear Window Glass

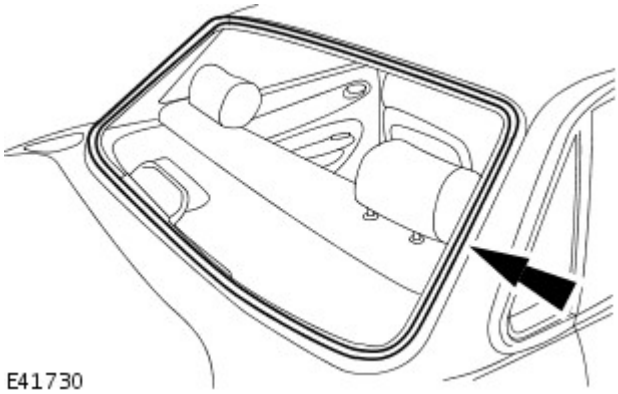
Removal and Installation

Special Tool(s)	
 BTB-WK9	Spray Bottle WK9
 BTB-WK9L	Lubricant Concentrate WK9L
 BTB-WK6	Adhesive Removal Blade - Body WK6
 BTB-WK5	Adhesive Removal Blade - Glass WK5
 42001	Cheese Wire Handles and Cheese Wire 42-001A and 42-001A-01
 E43759	Betagun pneumatic application gun Betagun 111

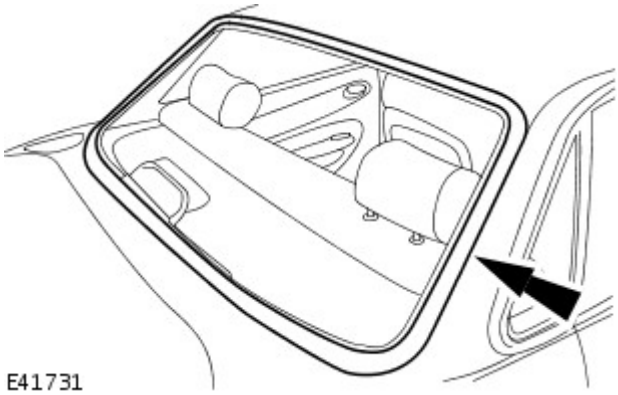
Removal

1. CAUTION: Make sure the rear window finisher insert is not bent on removal. Failure to follow this instruction may result in damage to the component.

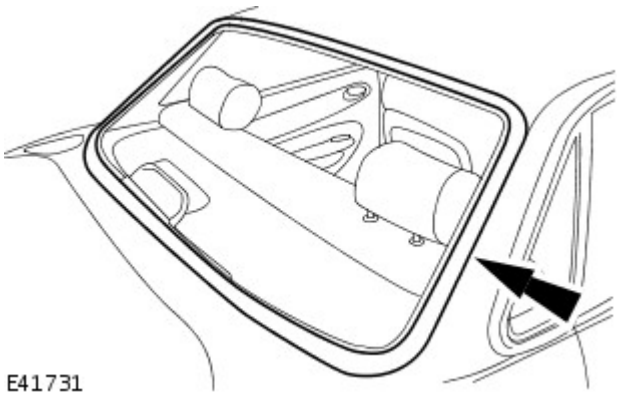
Remove the rear window finisher insert.



2. Remove the rear window finisher.



3. Apply protective tape around rear window glass aperture.



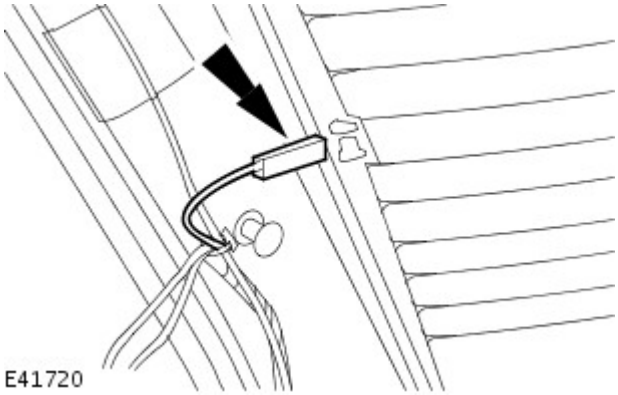
4. Remove the high mounted stoplamp.
For additional information, refer to: High Mounted Stoplamp (417-01 Exterior Lighting, Removal and Installation).

5. Remove both C-pillar trim panels.
For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

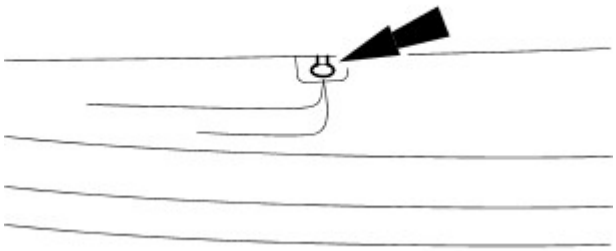
6. Remove the parcel shelf.
For additional information, refer to: Parcel Shelf (501-05 Interior Trim and Ornamentation, Removal and Installation).

7. NOTE: Right-hand shown, left-hand similar.

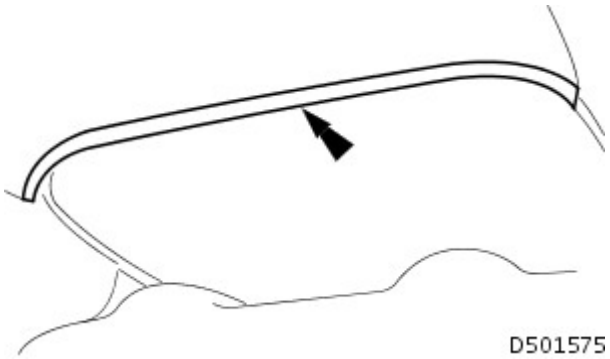
Disconnect the electrical connector.



8. Disconnect the radio antenna electrical connector.



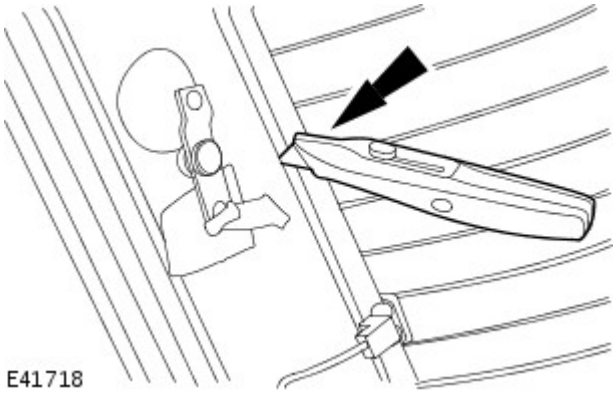
9. Apply suitable protective tape to the upper edge of the headlining.

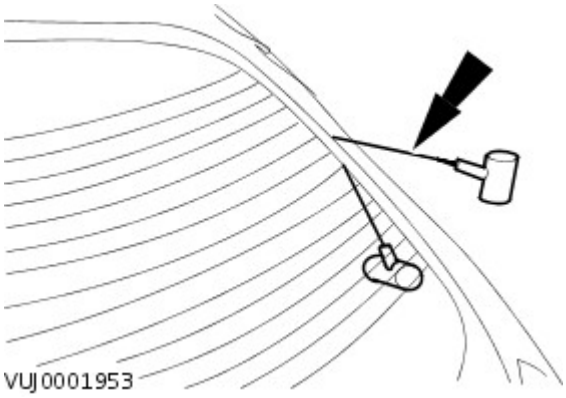


10. Prepare cheese wire and cutting handle.

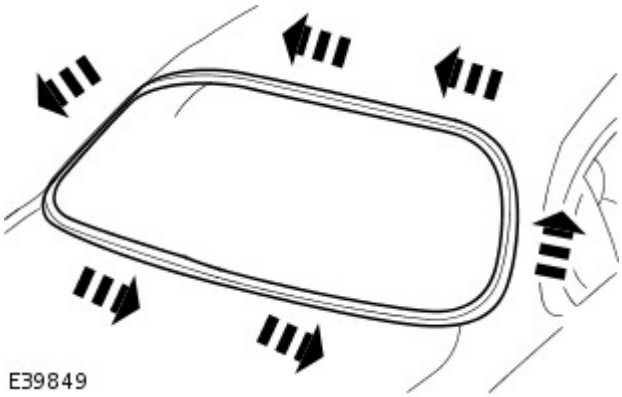
- Position cutting handle central tube fully upwards in handle.
- Cut a suitable length of cheese wire and pass one end through handle tube and locating aperture.
- Move cutting handle central tube downwards to secure cheese wire.

11. Using a suitable long bladed tool, penetrate the rear window adhesive approximately 150mm from the top of one rear pillar.





12. Pass free end of cheese wire through penetration and install second cutting handle.



13. WARNING: When removing the rear window glass, personal protection must be worn. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

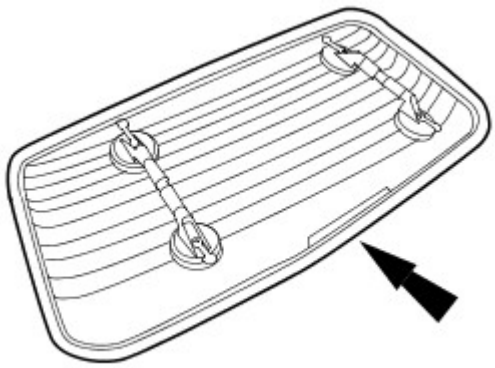
Make sure the cheese wire cannot contact the paintwork while the the rear window glass adhesive is being cut. Failure to follow this instruction may result in damage to the vehicle.

When cutting, do not allow cheese wire to contact edge of window glass as this will crack the window glass.

• NOTE: Apply cutting lubricant to the cheese wire frequently through out the cutting process.

With assistance and exercising care to avoid damaging the paintwork, cut around the rear window glass commencing upwards and along the top.

14. Install the lifting handles to the windshield glass, and with assistance carefully remove the rear window glass from the vehicle.

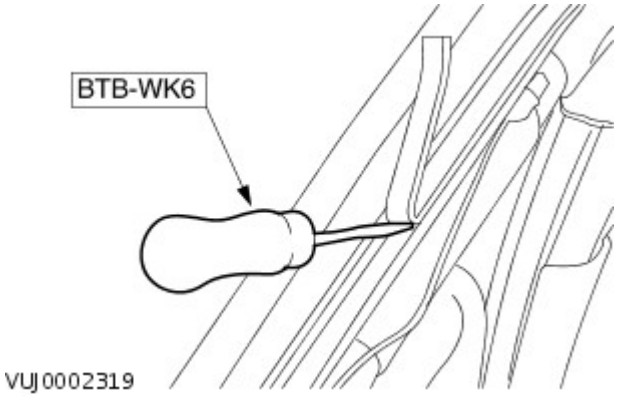


E41732

15. Remove the lifting handles from the rear window glass.

16. Remove cheese wire cutting tool from the vehicle, separate handles by moving centre tubes upwards and discard cheese wire.

Installation



VUJ0002319

1. WARNINGS:

If the rear window glass is being installed at a temperature of 23°C (73°F) or above make sure the vehicle is not driven for at least 1 hour after installation.

If the rear window glass is being installed at a temperature of 11°C (52°F) make sure the vehicle is not driven for at least 1.5 hours after installation.

If the rear window glass is being installed at a temperature of 5°C (41°F) make sure the vehicle is not driven for at least 2 hours after installation.

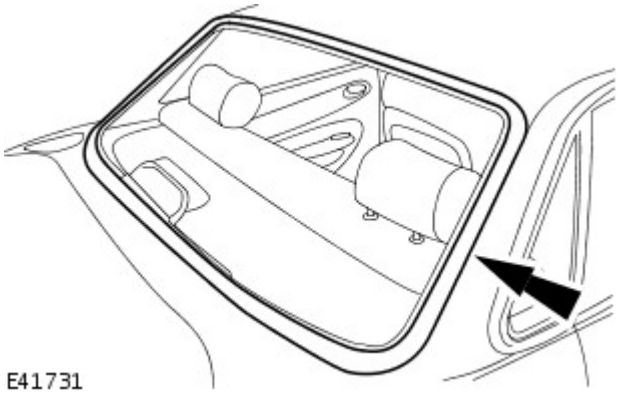
If the rear window glass is being installed at a temperature below 5°C (41°F) use heat and make sure the rear window glass adhesive has set before the vehicle is driven.

• NOTE: To aid bonding of a new rear window glass, make sure at least 1 mm (0.04 in) of residual adhesive remains on the body flange.

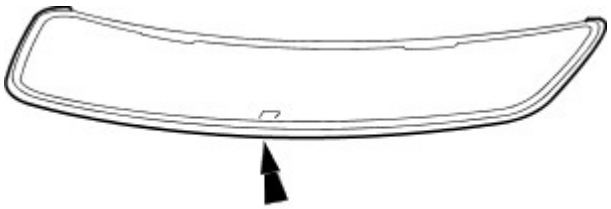
• NOTE: If the original rear window glass is to be installed remove the residual adhesive from rear window glass mating surface using a suitable scraper.

Using the special tool, remove any residual adhesive from the body.

2. Remove protective tape from around rear window glass aperture.

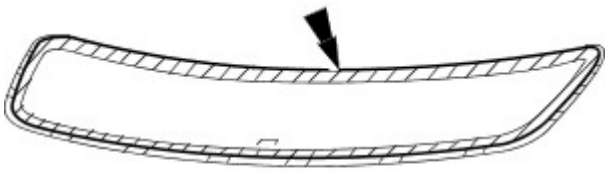


E41731



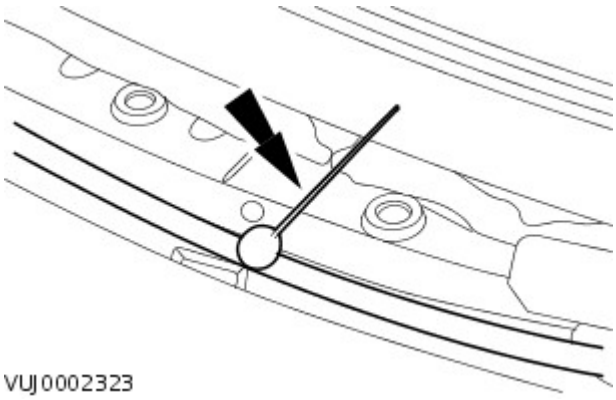
D501501

3. Thoroughly clean rear window glass surface using Betawipe spirit.



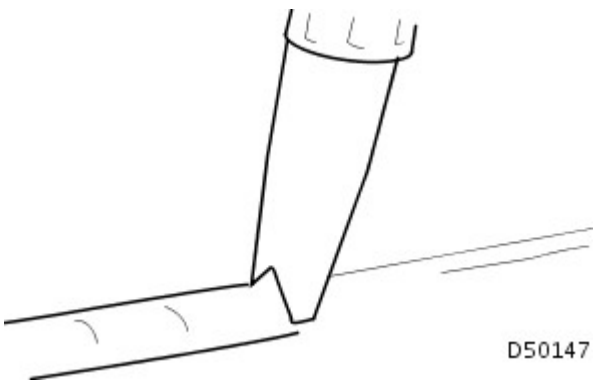
D501503

4. Apply primer to mating face of rear window glass.



VUJ0002323

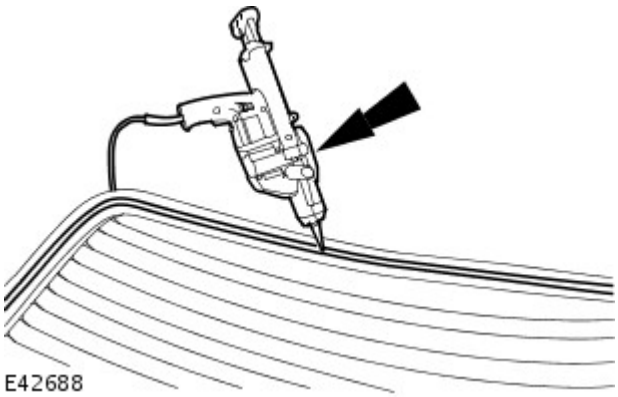
5. Apply glass primer to the mating face of the body flange.

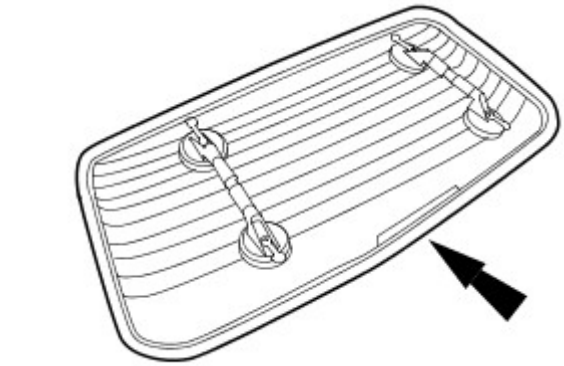


D50147

6. Cut the nozzle of the JLM20452 glass bonding adhesive to achieve a triangular section bead 8mm (0.32 in) wide by 10mm (0.4 in) high.

7. Using the special tool, apply a uniform bead of adhesive to the rear window glass edge, commencing at bottom center and overlapping the ends approximately 14 mm (0.56 in).


E42688


E41732

8. CAUTIONS:

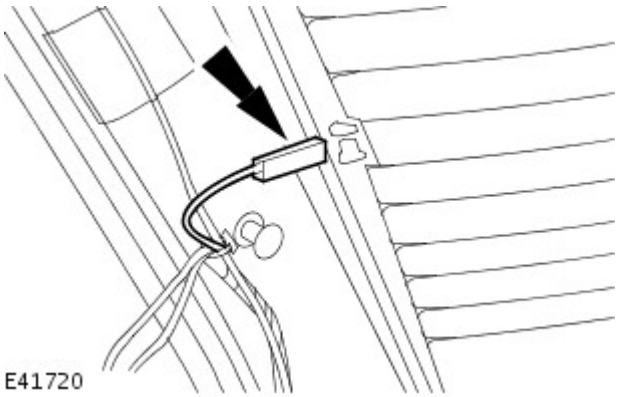
⚠ When installing the rear window glass, do not strike it in any way as this will crack the rear window glass.

⚠ Make sure the rear window glass does not move out of position in the rear window glass aperture.

With assistance carefully install the rear window glass into the aperture. Align the rear window glass with the body markings and press firmly into place.

9. Remove the lifting handles.

10. Remove protective tape from rear edge of headlining.


E41720

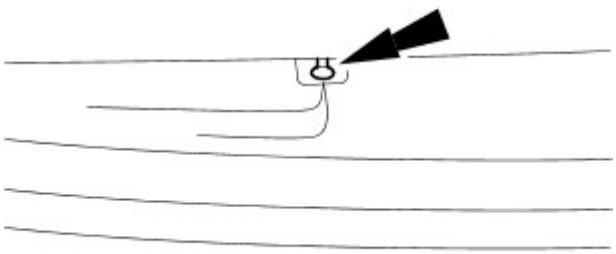
11. ⚠ CAUTION: Do not connect the electrical connectors for at least 1 hour after installation of the rear window glass. Failure to follow these instructions may result in damage to the rear window glass adhesive.

• NOTE: Left-hand shown, right-hand similar.

Connect the electrical connector.

12. ⚠ CAUTION: Do not connect the electrical connectors for at least 1 hour after installation of the rear window glass. Failure to follow these instructions may result in damage to the rear window glass adhesive.

Connect the radio antenna electrical connector.


E41719

13. Install the parcel shelf.
For additional information, refer to: Parcel Shelf (501-05 Interior Trim and Ornamentation, Removal and Installation).

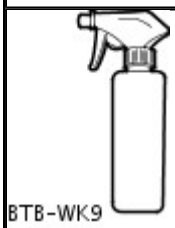
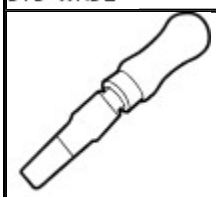
14. Install the C-pillar trim panel.

For additional information, refer to: C-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

15. Install the high mounted stoplamp.
For additional information, refer to: High Mounted Stoplamp (417-01 Exterior Lighting, Removal and Installation).

Glass, Frames and Mechanisms - Windshield Glass

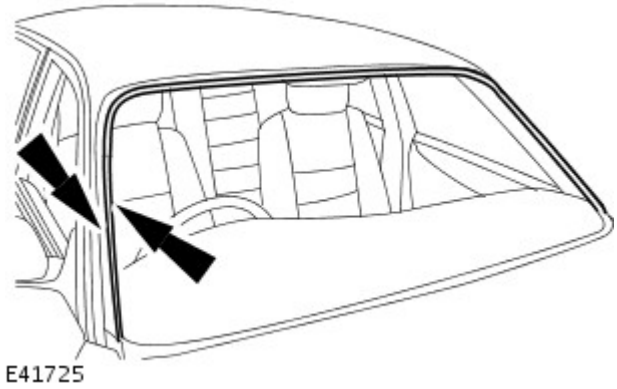
Removal and Installation

Special Tool(s)	
 BTB-WK9	Spray Bottle WK9
 BTB-WK9L	Lubricant Concentrate WK9L
 BTB-WK6	Adhesive Removal Blade - Body WK6 Adhesive Removal Blade - Glass WK5
 E43759	Betagun Pneumatic Application Gun Betagun 111

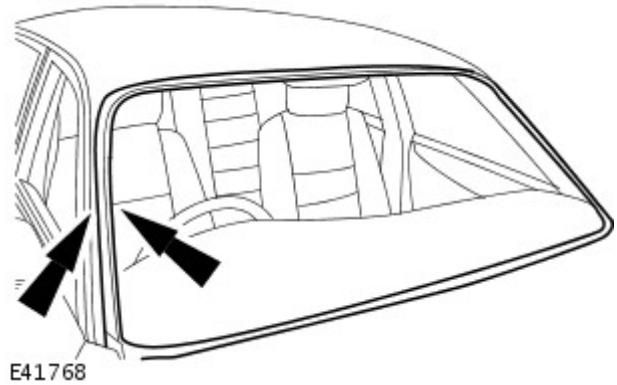
Removal

1. Remove both A- pillar trim panels.
   For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Remove both sun visors.
   For additional information, refer to: Sun Visor (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the overhead console.
   For additional information, refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
4. Remove the wiper pivot arm.
   For additional information, refer to: Wiper Pivot Arm (501-16 Wipers and Washers, Removal and Installation).
5. Remove the cowl panel grille.
   For additional information, refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).
6. CAUTION: Make sure the front windshield finisher insert is not bent on removal. Failure to follow this instruction may result in damage to the component.

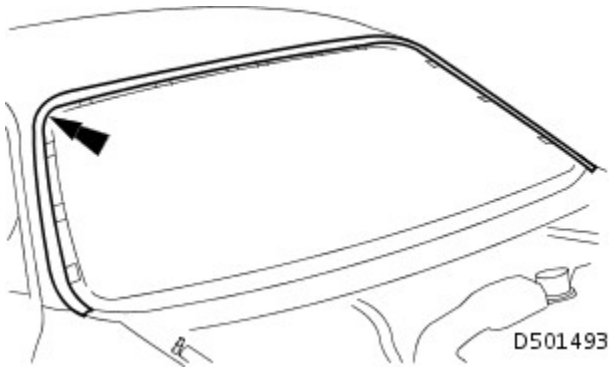
   Remove the windshield finisher insert.



7. Remove the windshield finisher.

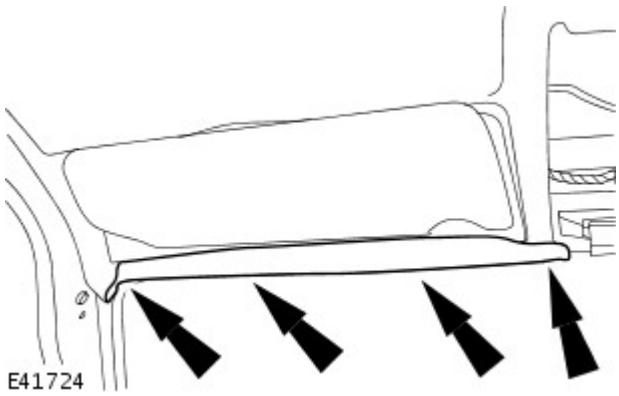


8. Apply a suitable protective tape around windshield glass aperture to protect paintwork.



9. NOTE: Left-hand shown, right-hand similar

Apply a suitable protective tape to leading edge of headlining.

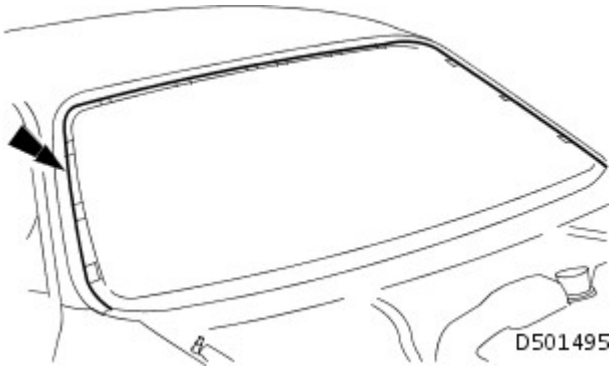


10. Place a suitable protective sheet over fascia and place a protecting board over sheet

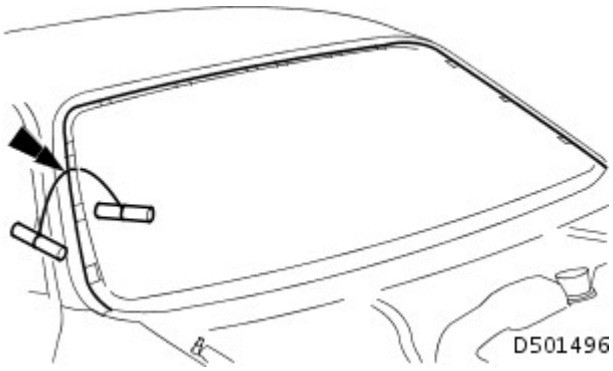
11. Prepare the cheese wire and cutting handle.

- Position cutting handle central tube fully upwards in handle.

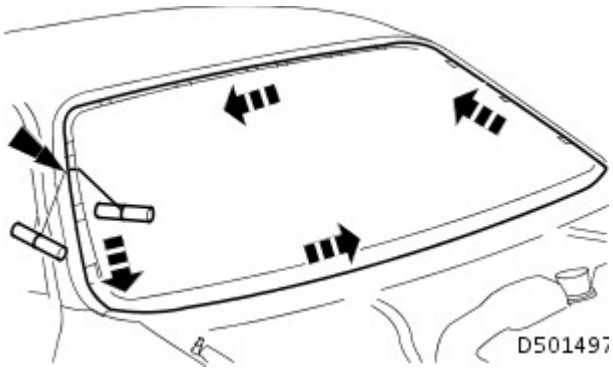
- Cut a suitable length of cheese wire and pass one end through handle tube and locating aperture.
- Move cutting handle central tube downwards to secure cheese wire.



12. Using a suitable long bladed tool, penetrate Betaseal approximately 150mm from the top of one A pillar.



13. Pass free end of cheese wire through penetration and install second cutting handle.



14. WARNING: When removing the windshield glass, personal protection must be worn. Failure to follow this instruction may result in personal injury.

• CAUTIONS:

Make sure the cheese wire cannot contact the paintwork while the the windshield adhesive is being cut. Failure to follow this instruction may result in damage to the vehicle.

Make sure the cheese wire cannot contact the instrument panel while the the windshield adhesive is being cut. Failure to follow this instruction may result in damage to the vehicle.

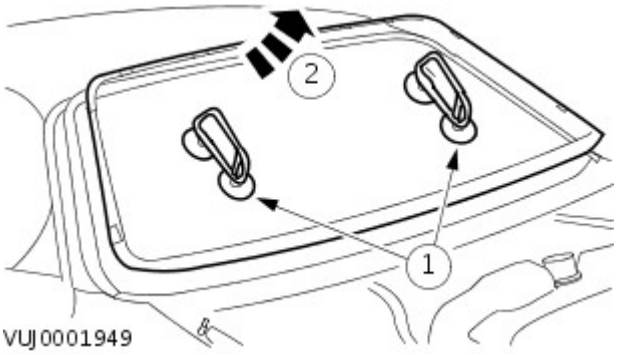
Make sure the cheese wire passes the Vehicle Identification Number (VIN) plate on the correct side. Failure to follow this instruction may result in damage to the component.

When cutting, do not allow cheese wire to contact edge of windshield glass as this will crack the windshield glass.

• NOTE: Apply cutting lubricant to the cheese wire frequently through out the cutting process.

With assistance and exercising care at the corners to avoid damaging paintwork, cut around the windshield glass

commencing downwards and along the bottom.



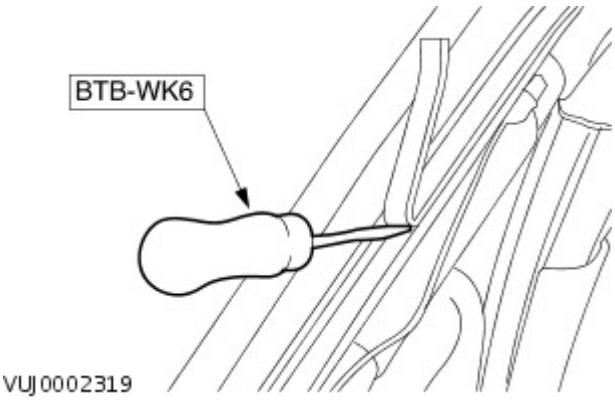
15. With assistance and exercising care, remove the windshield glass.

1. Attach lifting handles to windshield glass.
2. Remove the windshield glass.

16. Remove lifting handles from windshield glass.

17. Remove cheese wire cutter from windshield glass aperture, remove cutting handles and discard cheese wire.

Installation



1. WARNINGS:

If the windshield glass is being installed at a temperature of 23°C (73°F) or above make sure the vehicle is not driven for at least 1 hour after installation.

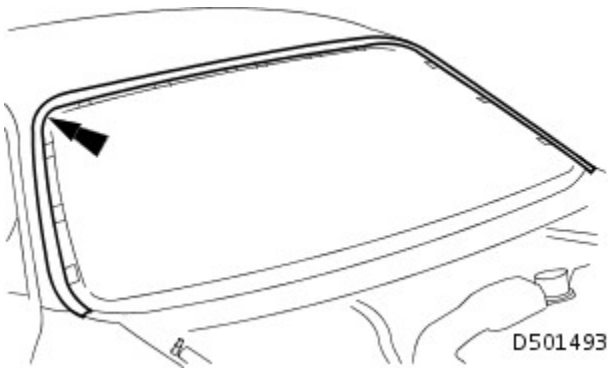
If the windshield glass is being installed at a temperature of 11°C (52°F) make sure the vehicle is not driven for at least 1.5 hours after installation.

If the windshield glass is being installed at a temperature of 5°C (41°F) make sure the vehicle is not driven for at least 2 hours after installation.

If the windshield glass is being installed at a temperature below 5°C (41°F) use heat and make sure the windshield glass adhesive has set before the vehicle is driven.

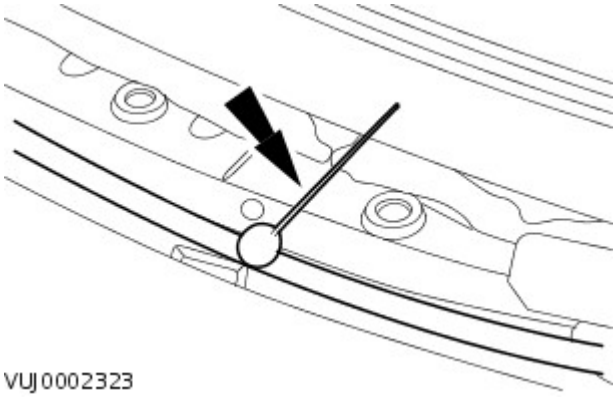
• NOTE: If the original windshield glass is to be installed remove the residual adhesive from windshield glass mating surface using the special tool.

Using the special tool, remove any residual adhesive from the body.

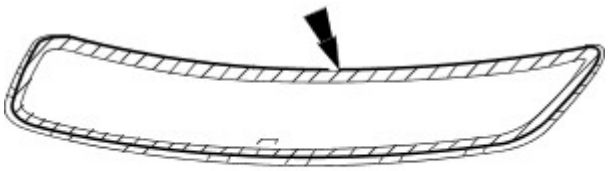


2. Remove the protective tape from around windshield glass aperture.

3. Apply glass primer to the mating face of the body flange.

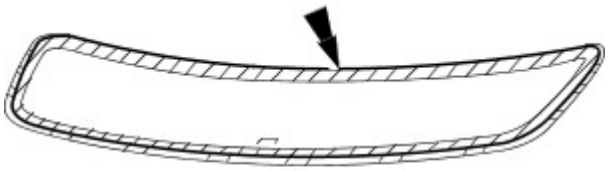


VUJ0002323



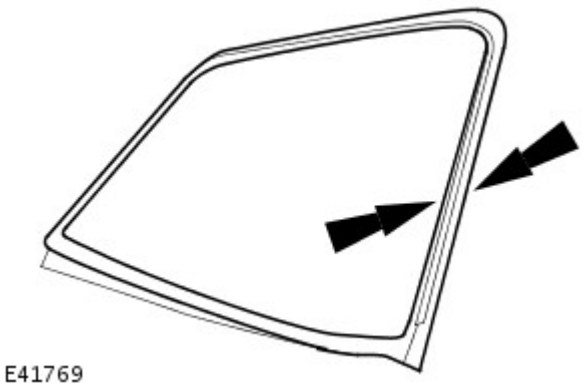
D501503

4. Thoroughly clean windshield glass surface using Betawipe spirit.



D501503

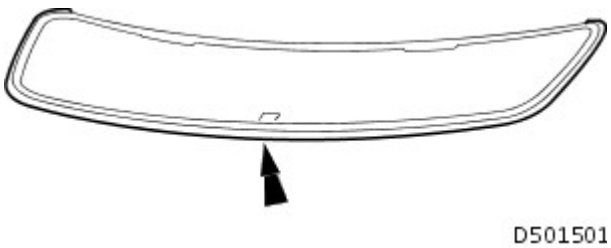
5. Apply primer to mating face of windshield glass.



E41769

6. CAUTION: Make sure the front windshield finisher insert is not bent on installation. Failure to follow this instruction may result in damage to the component.

Install the insert to the windshield finisher.

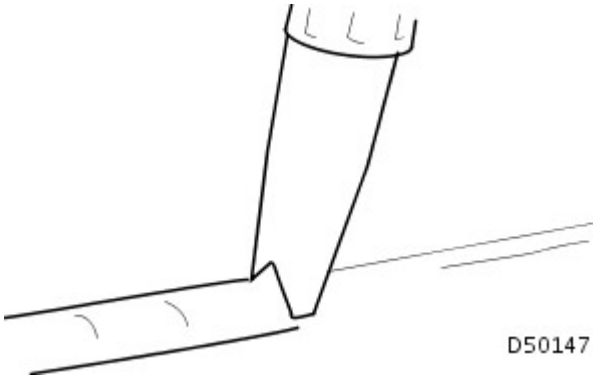


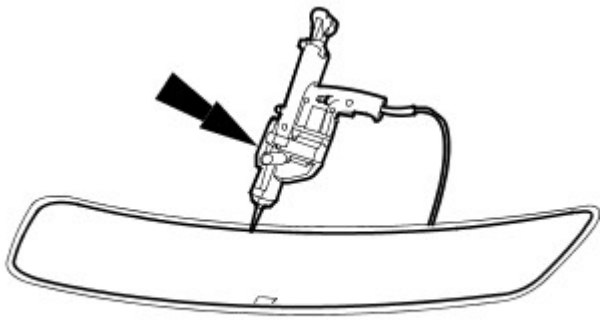
D501501

7. CAUTION: Make sure the front windshield finisher insert is not bent on installation. Failure to follow this instruction may result in damage to the component.

Install the windshield finisher to the windshield.

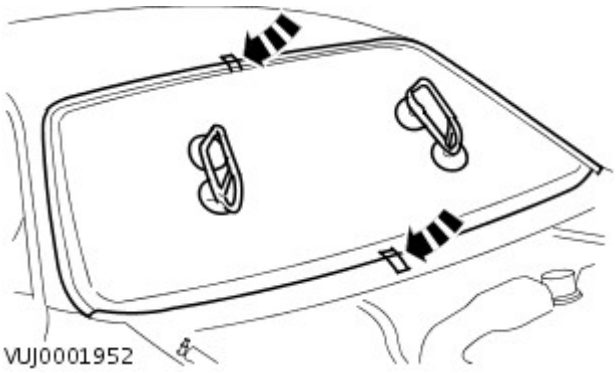
8. Cut the nozzle of the JLM20452 glass bonding adhesive to achieve a triangular section bead 8mm (0.32 in) wide by 10mm (0.4 in) high.





9. NOTE: Follow the manufacturers operating instructions.

Using the special tool, apply a uniform bead of adhesive to the windshield glass edge commencing at bottom center and overlapping the ends approximately 14 mm (0.56 in).



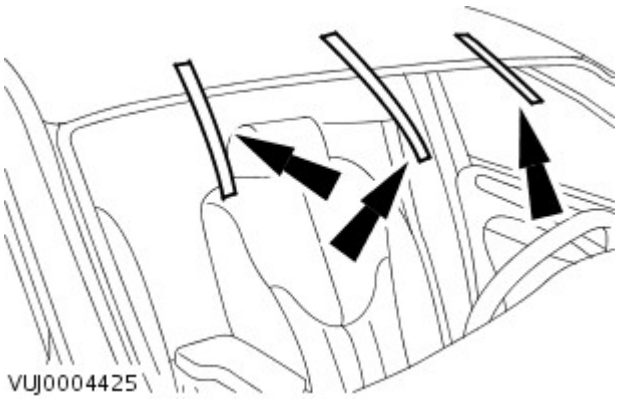
10. CAUTIONS:

⚠ When installing the windshield glass, do not strike it in any way as this will crack the windshield glass.

⚠ Make sure the windshield glass does not move out of position in the windshield glass aperture.

With assistance carefully install windshield glass into the aperture. Align the windshield glass with the body markings and press firmly into place.

11. Remove the lifting handles.

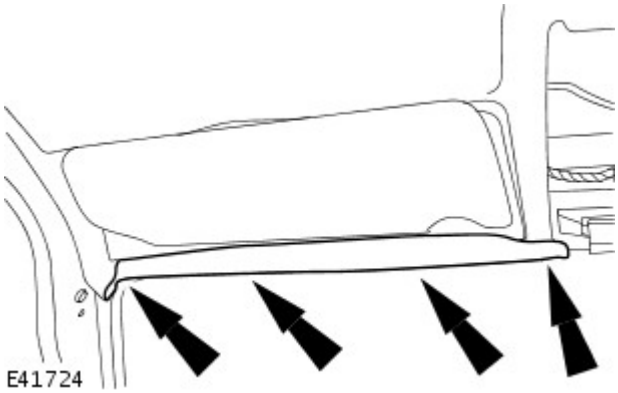


12. ⚠ CAUTION: Make sure the windshield glass does not move out of position in the windshield glass aperture.

Apply suitable tape to the top of the windshield glass.

13. Install the cowl panel grille.
For additional information, refer to: Cowl Panel Grille (501-02 Front End Body Panels, Removal and Installation).

14. Install the wiper pivot arm.
For additional information, refer to: Wiper Pivot Arm (501-16 Wipers and Washers, Removal and Installation).



15. Remove protective tape from leading edge of headlining.

16. Remove the protective sheet and the protective board from the fascia.

17. Install the overhead console.
For additional information, refer to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).

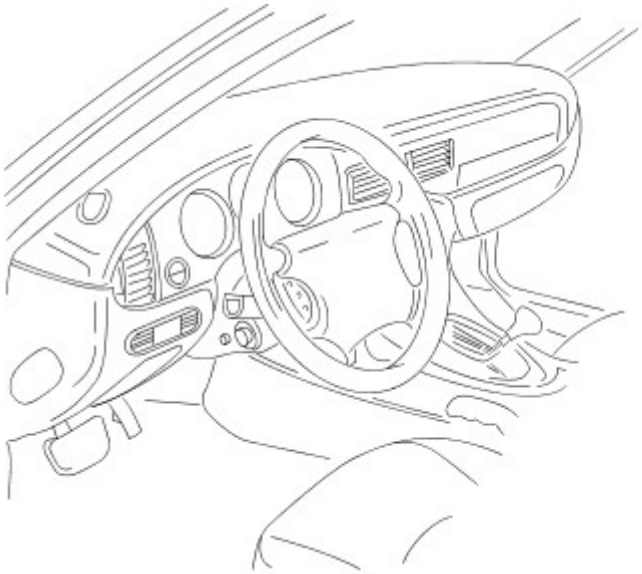
18. Install both sun visors.
For additional information, refer to: Sun Visor (501-05 Interior Trim and Ornamentation, Removal and Installation).

19. Install both A-pillar trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

Instrument Panel and Console - Instrument Panel and Instrument Panel Console

Description and Operation

Fascia



E35483

The one-piece slush-moulded fascia has an injection-moulded armature and incorporates a steel transverse reinforcing rail. Fascia side support brackets pre-set to the BIW, determine fascia fore and aft, and height positions and a bush installed in a BIW bracket centrally positioned on the upper fascia panel, similarly determines the correct transverse location of a fascia dowel. These mountings together with access panels at each end of the fascia and brackets at the top and sides of the BIW tunnel, facilitate fascia removal and installation without the necessity for special tools or an alignment procedure. The fascia houses the main instrument panel, passenger air bag module glovebox, air conditioning outlet vents and a centrally mounted analogue clock, all of which can be readily removed without disturbing the fascia. The fascia harness is located in the nose of the fascia assembly to facilitate easy installation in vehicle. The fascia must be removed from the vehicle to access the harness.

Centre Console

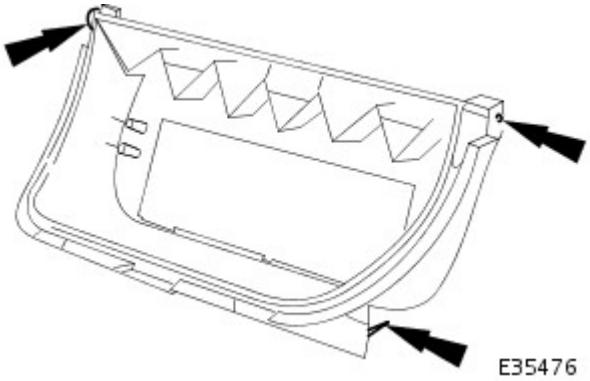
The centre console is an injection moulded armature trimmed in matching ambla or leather with a wood veneer top finisher. An iluminated smoker's compendium with press and release lid is fitted at the rear of the 'J' gate. The centre section of the console forms a deep stowage box with rear hinged lid which is padded to form a central arm rest. A hinged cup holder is incorporated in the front end of the stowage box lid. A colour-keyed 'J' gate finisher surmounts the veneer top finisher and the 'SPORT' mode and cruise control 'ON/OFF' selector switches are situated immediately to the rear of the 'J' gate. The rear of the standard centre console houses a rear air distribution grill and controls. On Daimler and 'Super 8' models, the centre console incorporates a rear extension with rear seat heating controls.

Instrument Panel and Console - Audio Unit Housing

Removal and Installation

Removal

1. Remove centre console veneer panel. Refer to operations in this section.
2. Withdraw radio from console for access, disconnect multiplugs and aerial lead and remove radio from vehicle.
3. Remove console for access.



1. Slacken and remove two screws securing radio console to fascia, release two dowels and withdraw console for access.
2. Release clip retaining air conditioning panel harness.

4. Tilt bottom of radio console upwards and remove console from vehicle.

Installation

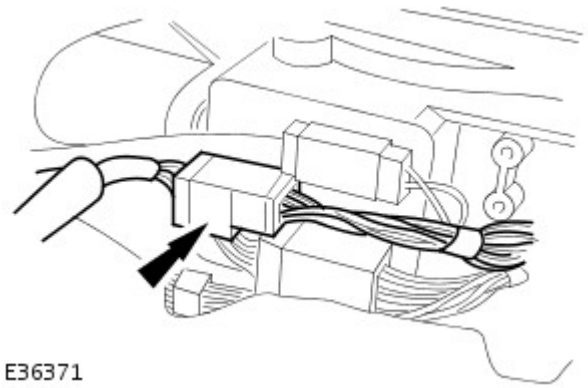
1. Position radio console for access and secure air conditioning harness in LH clip behind console.
2. Fit console to BIW and fit and tighten securing screws.
3. Position radio at console and connect multiplugs and ground and aerial leads.
4. Fully seat radio in console.
5. Fit centre console veneer panel.Refer to 76.47.26.
6. Fit 'J' gate finisher retaining panel. Refer to 76.25.26.
7. Fit 'J' gate finisher. Refer to 76.25.24.
8. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Instrument Panel and Console - Climate Control Assembly Housing

Removal and Installation

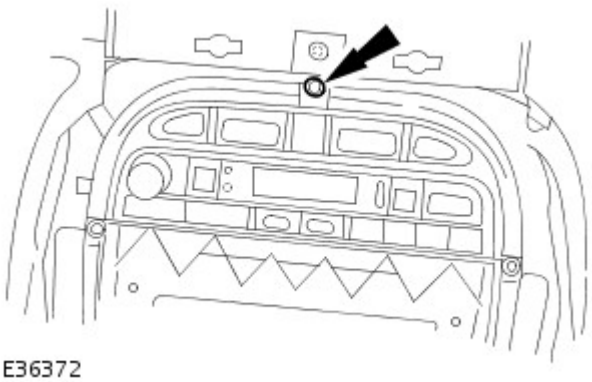
Removal

1. Move 'J' gate selector to position 'D.'
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove 'J' gate finisher. Refer to 76.25.24.
4. Remove 'J' gate finisher retaining plate.Refer to 76.25.26.
5. Remove centre console veneer panel. Refer to 76.47.26.
6. Remove radio and console. Refer to operations in this section.
7. Disconnect air conditioning panel flying lead multiplug (blue) in LH side of transmission tunnel.



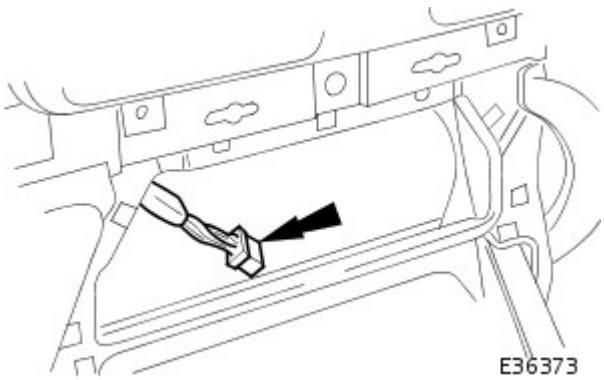
E36371

8. Slacken and remove remaining screw securing air conditioning panel console to BIW.



E36372

9. Withdraw air conditioning panel and console for access and disconnect the harness multiplug behind panel.



E36373

10. Remove air conditioning panel from vehicle.
11. Remove panel from console.

Installation

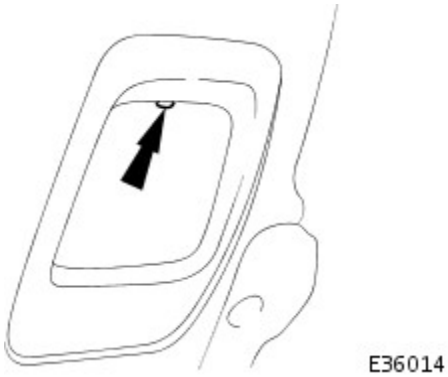
1. Fit air conditioning panel to console.

2. Position air conditioning panel and console at centre console and connect multiplugs.
3. Fully seat air conditioning panel and console on BIW bracket and fit and tighten securing screw.
4. Fit radio and console. Refer to operations in this section.
5. Fit centre console veneer panel. Refer to operations in this section.
6. Fit 'J' gate surround. Refer to operations in this section.
7. Fit 'J' gate finisher. Refer to operations in this section.
8. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
9. Return 'J' gate selector to position 'P'.

Instrument Panel and Console - Coin Stowage Compartment

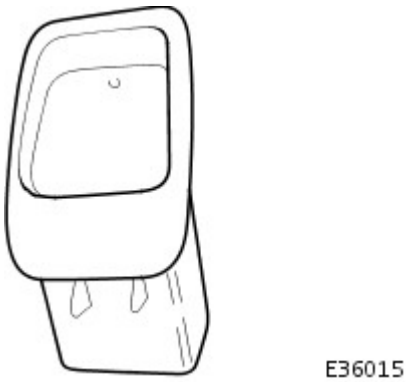
Removal and Installation

Removal



E36014

1. Slacken and remove screw securing driver stowage compartment to fascia.



E36015

2. Withdraw stowage compartment from fascia and remove from vehicle.

Installation

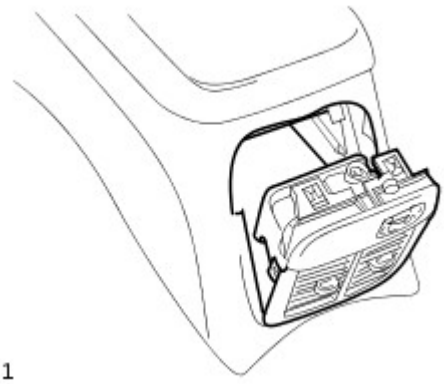
1. Position driver stowage compartment in fascia recess.
2. Install stowage compartment to fascia securing screw.

Instrument Panel and Console - Floor Console

Removal and Installation

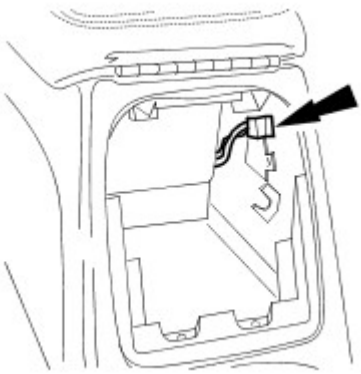
Removal

1. Turn ignition switch to position II and apply footbrake.
2. Move gear selector to the the 'D' position. and release footbrake.
3. Turn ignition switch to position'O'
4. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
5. Where fitted, remove centre console rear extension. Refer to 76.25.05.
6. Remove fascia centre veneer panel. Refer to 76.47.06.
7. Using a thin plastic lever, carefully release the rear air distribution control grill tangs at top and sides and remove grill complete with veneer panel and control.



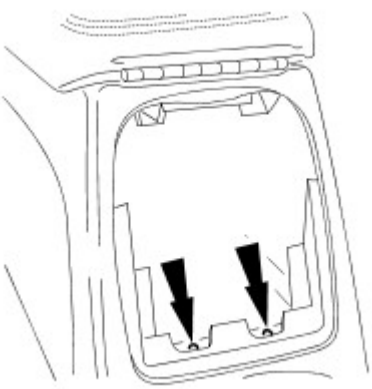
E36211

8. Disconnect cigar lighter and ashtray illumination harness (white) multiplug at RH rear. of console.



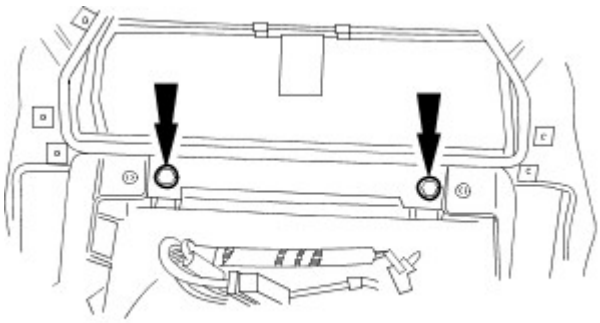
E36212

9. Slacken and remove the two console rear securing screws.



E36216

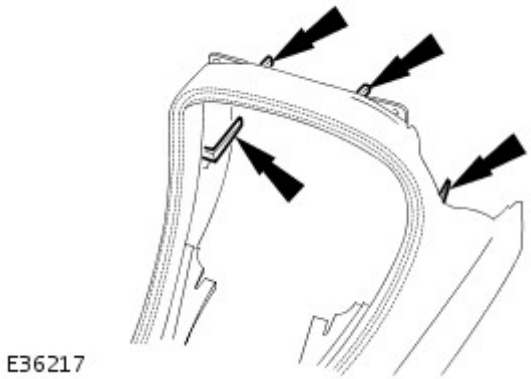
10. Remove 'J' gate finisher and veneer panel. Refer to 76.25.24 and 76.25.26.
11. Remove fascia centre veneer panel. Refer to 76.47.06.



E35490

12. Slacken and remove the two centre console front securing screws.

13. Ensuring that harness is clear, pull console rearwards to withdraw front dowels from tunnel locations.



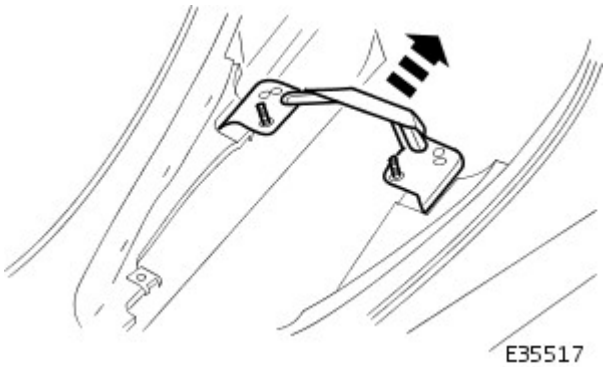
E36217

14. Remove console from vehicle.

15. Remove console ashtray. Refer to 76.25.25.

16. Remove glovebox and lid. Refer to 76.25.16 and 76.25.18.

17. Slide stud mounting plate off front of console.



E35517

Installation

1. Fit stud mounting plate to front of console.

2. Ensure that harness is correctly positioned.

3. Fit centre console ashtray. Refer to 76.25.25.

4. Fit glovebox and lid to centre console. Refer to 76.25.16 and 76.25.18.

5. Position console in vehicle, align correctly and push forward to engage front dowels.

6. Fit and tighten the console front securing screws.

7. Fit fascia centre veneer panel. Refer to 76.47.06.

8. Fit and tighten the console rear securing screws.

9. Fit 'J' gate veneer panel and finisher. Refer to 76.25.24 and 76.25.26.

10. Connect cigar lighter and ashtray illumination harness

multiplug.

11. Where applicable, install console rear extension. Refer to 76.25.05.

12. Fit and firmly seat air distribution control grill to rear of console.

13. Move 'J' gate selector to 'P'.

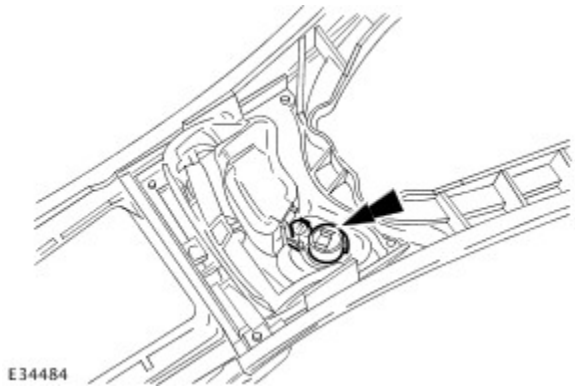
14. Connect ground cable to battery terminal and fit battery cover. refer to 86.15.15.

Instrument Panel and Console - Floor Console Ashtray

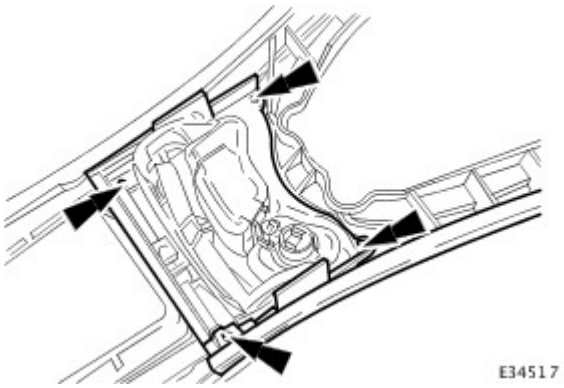
Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove center console for access. Refer to operations in this section.
3. Open ashtray lid and remove cigar lighter.
4. Remove cigar lighter housing.
   - Remove tape securing harness to console underside..
   - Slacken and remove retaining ring from underside and remove housing complete with cable.



5. Release bulb housing tangs and withdraw bulb and housing from underside complete with flying lead.
6. Position console for access, slacken and remove the four ashtray securing screws and remove ashtray from console.



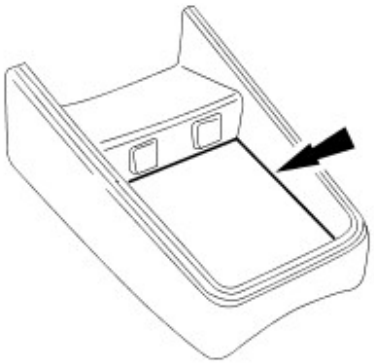
Installation

1. Position ashtray on center console.
2. Fit and tighten the four ashtray securing screws.
3. Fit and fully seat cigar lighter housing in ashtray and fit and tighten retaining ring.
4. Fit cigar lighter housing and illumination bulb.
5. Tape cables to underside of console.
6. Fit cigar lighter in housing.
7. Close ashtray lid.
8. Fit center console assembly. Refer to 76..
9. Connect multiplug at rear of centre console.
10. Fit centre console rear air distribution control grill.
11. Connect earth cable to battery terminal and fit battery cover. Refer to 86.15.15.

Instrument Panel and Console - Floor Console Extension

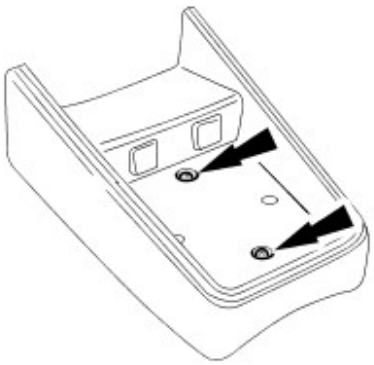
Removal and Installation

Removal



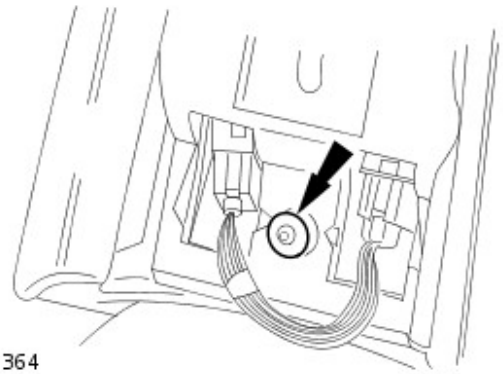
E36362

1. Using a thin plastic lever at the edge and exercising care to avoid damage to surface, remove veneer panel from rear extension.



E36363

2. Slacken and remove the two rear extension securing screws.



E36364

3. Remove rear seat heater switches.
   - Position rear extension for access and slacken and remove screw retaining switches.
   - Mark both harness multiplugs to ensure correct reconnection and disconnect multiplugs.
4. Remove heater switches.

Installation

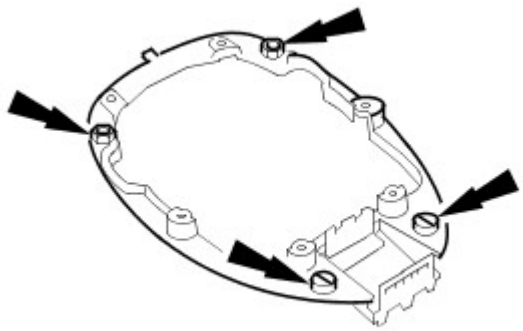
1. Position rear seat heater switches in rear extension.
2. Noting identity of multiplugs as marked during removal, connect harness multiplugs to heater switches.
3. Position switches in console extension and fit and tighten retaining screw.
4. Position and fully seat extension at rear of console and fit and tighten securing screws.
5. Carefully fit veneer panel to rear extension.

Instrument Panel and Console - Floor Console Finish Panel

Removal and Installation

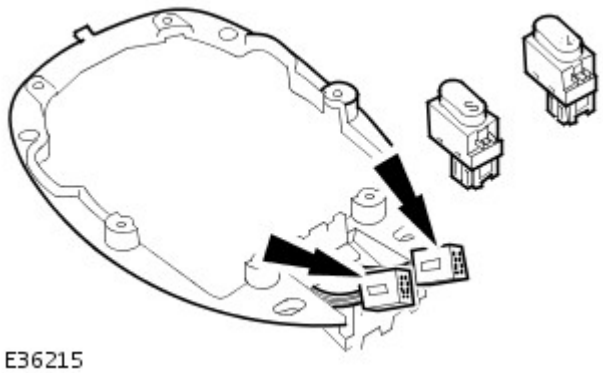
Removal

1. Apply handbrake and turn ignition key to II.
2. Depress brake pedal, move gear selector to position N and turn ignition key to O.
3. Remove battery cover and disconnect cable from earth terminal. Refer to Section 86.15.19.
4. Remove 'J 'gate finisher. Refer to 76.25.24.
5. Slacken and remove the two nuts and two screws securing the retaining panel.



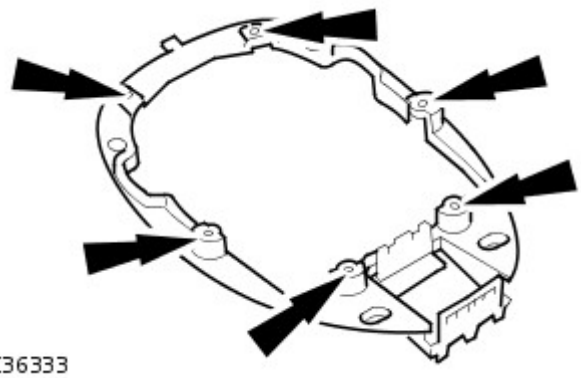
E36214

6. Position retaining panel for access, disconnect SPORT mode and cruise control ON/OFF switch multiplugs and remove retaining panel complete with switches.



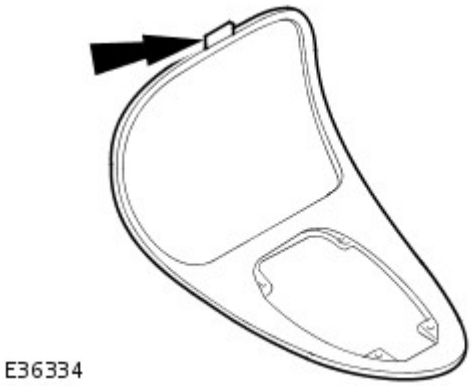
E36215

7. Remove and discard bushes from retaining plate.



E36333

8. Carefully withdraw veneer panel, releasing front locating tongue from upper slot in comsole.



E36334

Installation

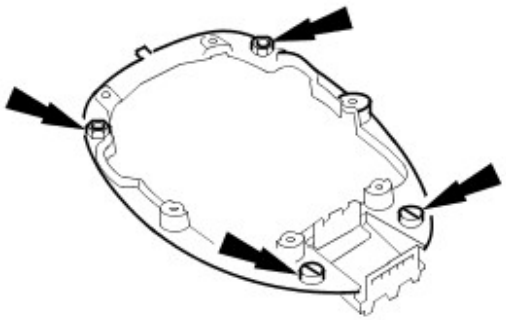
1. Position veneer panel on console, ensuring that front tongue locates correctly in console upper slot.
2. Fit and fully seat new bushes in retaining panel.
3. Position retaining panel complete with SPORT mode and cruise control ON/OFF switches for access and connect multiplugs.
4. fully seat retaining panel and fit and tighten securing nuts and screws.
5. Fit 'J' gate surround finisher. Refer to 76.25.24.
6. Move gear selector to position P.
7. Connect cable to battery earth terminal and fit battery cover. Refer to Section 86.15.15.

Instrument Panel and Console - Floor Console Finish Panel Bracket

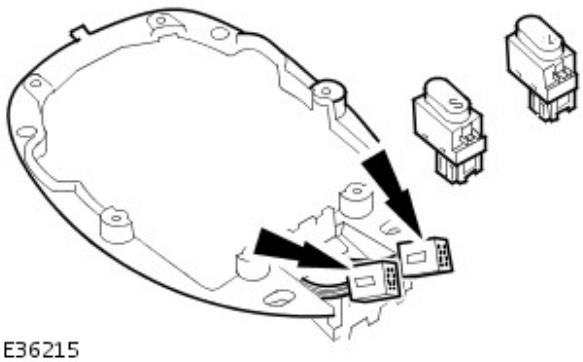
Removal and Installation

Removal

1. Remove 'J' gate finisher. Refer to 76.25.24.
2. Slacken and remove the two front nuts and two rear screws securing the retaining panel.

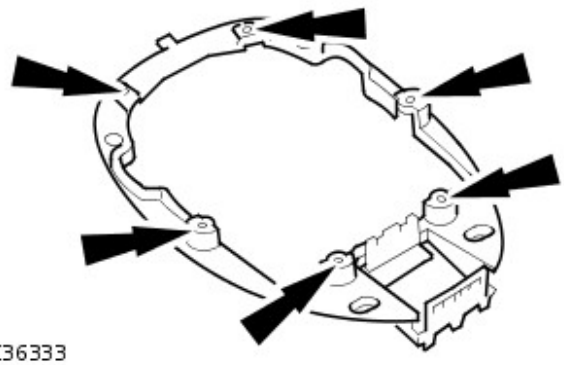


E36214



E36215

3. Position retaining panel for access, disconnect SPORT mode and cruise control ON/OFF switch multiplugs and remove retaining panel complete with switches.
4. Remove switches from retaining panel.
5. Remove and discard bushes from retaining panel.



E36333

Installation

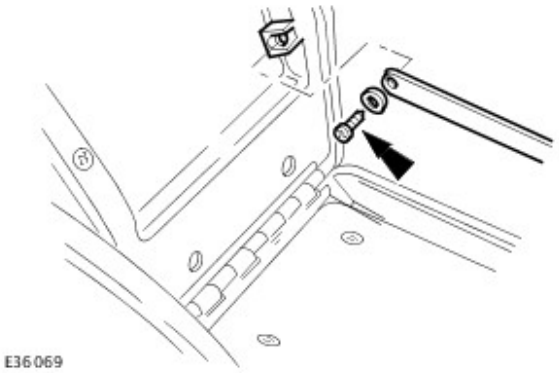
1. Fit and fully seat new bushes in retaining panel.
2. Fit and fully seat SPORT mode and cruise control ON/OFF switches in retaining panel.
3. Position retaining panel for access and connect SPORT mode and cruise control ON/OFF switch multiplugs.
4. Fully seat retaining panel and fit and tighten securing nuts and screws.
5. Fit 'J' gate surround finisher. Refer to 76.25.24.

Instrument Panel and Console - Floor Console Stowage Compartment

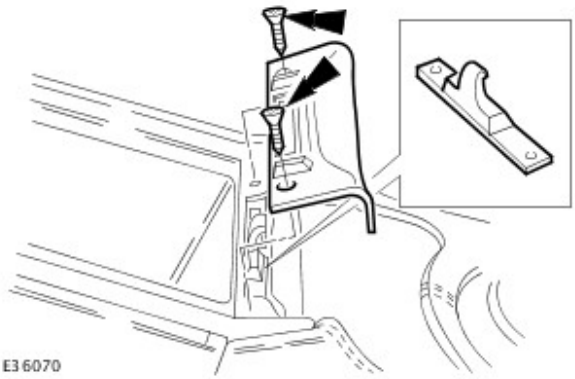
Removal and Installation

Removal

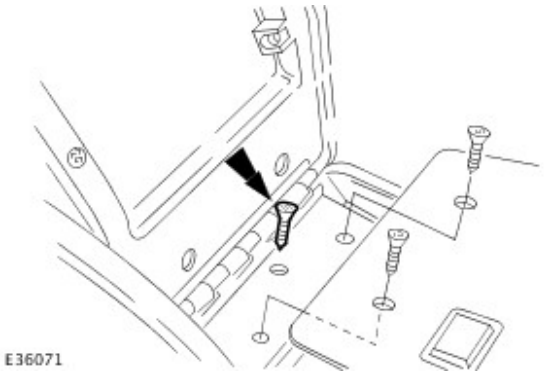
1. Open console glove box lid.
2. Slacken and remove the glove box lid stay securing screw and remove lid stay.



3. Slacken and remove glove box latch securing screws and remove latch assembly.



4. Slacken and remove glovebox liner rear securing screws.



5. Remove glovebox liner from vehicle.

Installation

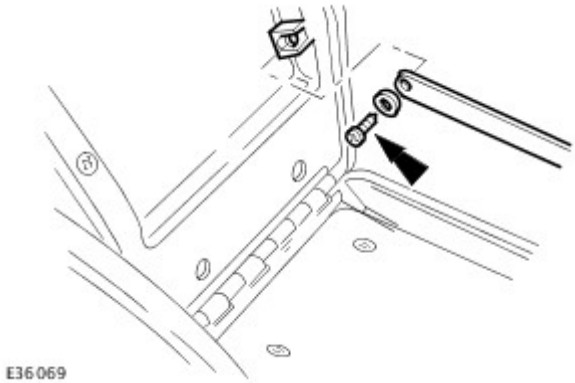
1. Position glovebox liner in console.
2. Fit and tighten liner rear securing screws.
3. Position latch assembly on liner and fit and tighten securing screws.
4. Fit and tighten check arm to lid securing screw.
5. Position lid to stay and fit and tighten securing screw.
6. Close glovebox lid.

Instrument Panel and Console - Floor Console Stowage Compartment Lid

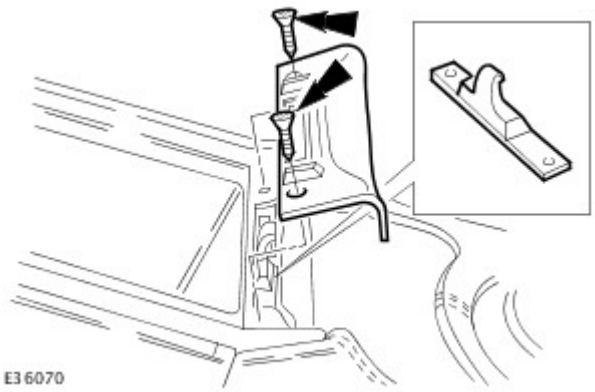
Removal and Installation

Removal

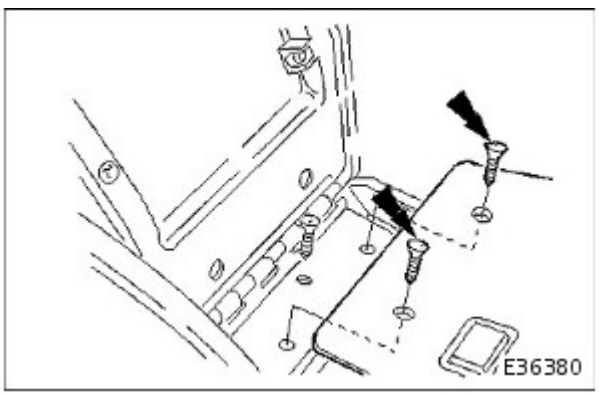
1. Open glovebox lid.
2. Slacken and remove lid stay securing screw and remove stay from lid.



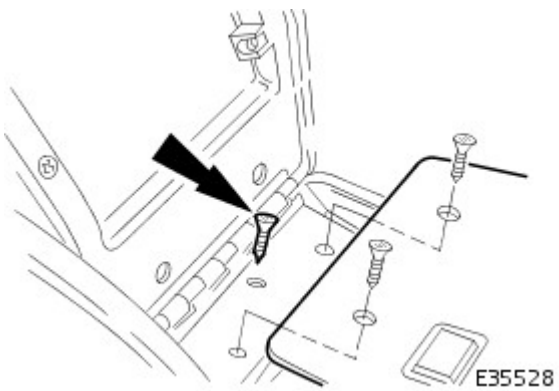
3. Slacken and remove glovebox latch securing screws and remove latch from glovebox.



4. Slacken and remove glovebox liner rear securing screws and remove liner for access.



5. Slacken and remove remaining glovebox hinge securing screw.



6. Slacken and remove screws securing hinge to lid and remove hinge.

Installation

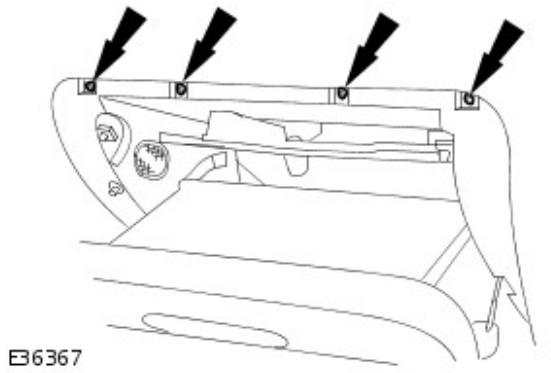
1. Position hinge on console lid and fit and tighten securing screws.
2. Position glovebox lid on centre comsole and fit and tighten securing screw.
3. Fully seat liner in centre console and fit and tighten rear securing screws.
4. Fit glovebox latch to liner and fit and tighten securing screws.
5. Position glovebox to lid stay, fit and tighten securing screw and close glovebox lid.

Instrument Panel and Console - Glove Compartment

Removal and Installation

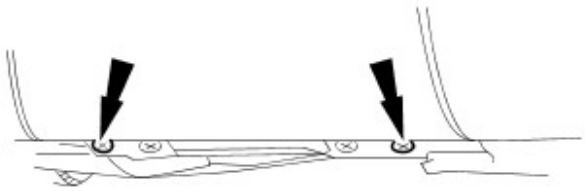
Removal

1. Open glovebox.
2. Supporting the glovebox, slacken and remove the four top securing screws.



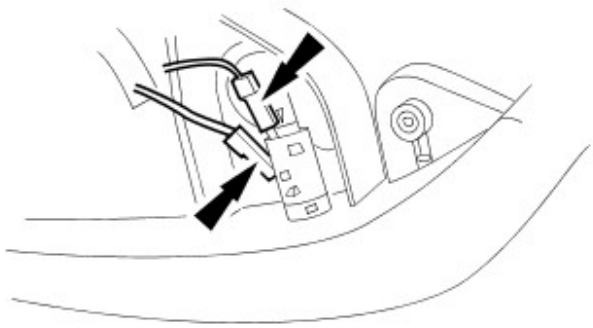
E36367

3. Slacken and remove the two glovebox lower outer securing screws.



E36368

4. Withdraw glovebox for access and disconnect the two illumination harness connectors.



E36369

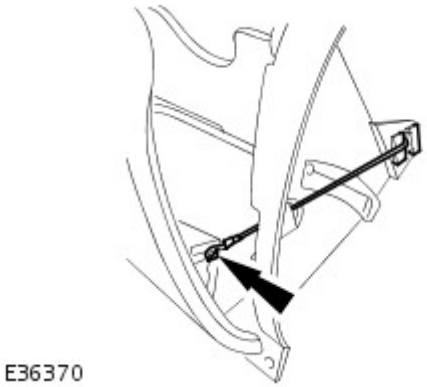
5. Remove glovebox from vehicle.

Installation

1. Position glovebox for access and connect illumination harness.
2. Position and fully seat glovebox.
3. Fit but do not tighten the lower securing screws.
4. Fit and fully tighten the upper securing screws.
5. Close glovebox lid.
6. Fully tighten the lower securing screws.

Instrument Panel and Console - Glove Compartment Lid

Removal and Installation



E36370

Removal

1. Remove glovebox. Refer to 76.52.03.
2. Open glovebox lid and lift barbed hook to release damper cord loop from lid..
3. Slacken and remove the two lid hinge securing nuts.
4. Remove glovebox lid.

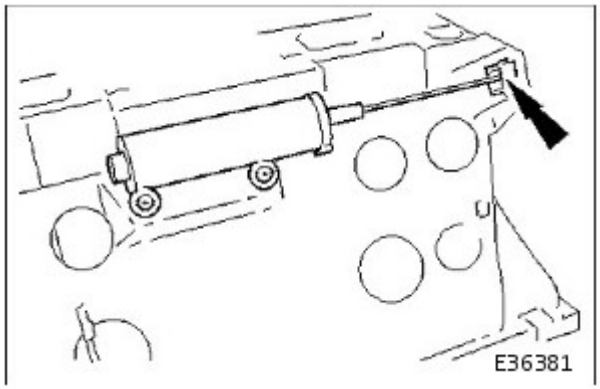
Installation

1. Fit glovebox lid to liner.
2. Position lid on hinges and fit but do not tighten securing screws.
3. Fit damper cord loop to lid.
4. Position and fit glovebox. Refer to 76.52.03.
5. Adjust lid position to achieve satisfactory all-round clearance and catch operation.
6. Fully tighten hinge securing screws.

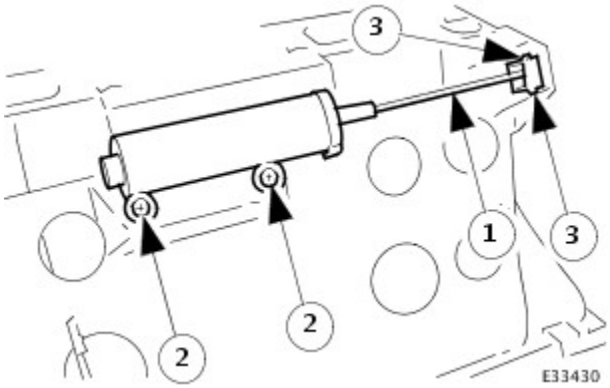
Instrument Panel and Console - Glove Compartment Lid Damper

Removal and Installation

Removal



1. remove glovebox assembly. Refer to 76.52.03.
2. Disconnect glovebox damper cord end loop from damper and route cord through the liner guide.



3. Slacken and remove the two damper securing nuts and remove damper from liner.

Installation

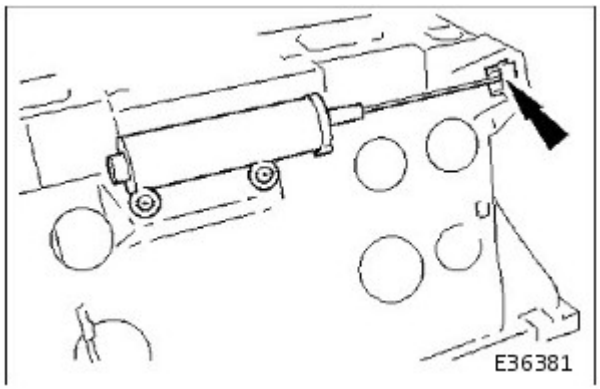
1. Position damper on liner
2. Fit and tighten damper securing nuts.
3. Route damper cord through liner guide and connect end loop to damper.

Instrument Panel and Console - Glove Compartment Liner

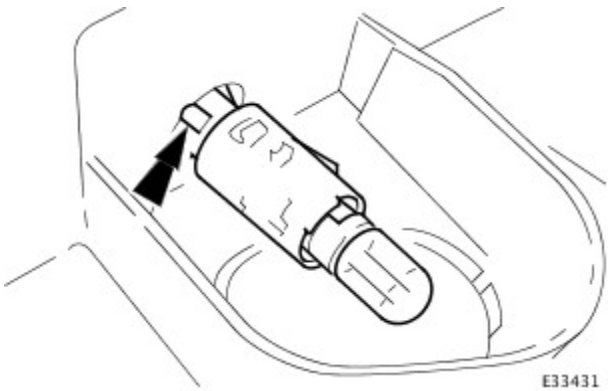
Removal and Installation

Removal

1. Remove glovebox refer to 76.52.03.
2. Remove glovebox lid. Tefer to 76.52.02.
3. Remove glovebox damper. Refer to 76.52.22.
4. Release damper cord guide retaining tangs and remove guide from bracket.



5. Position liner for access and carefully remove switch assembly from housing.



Installation

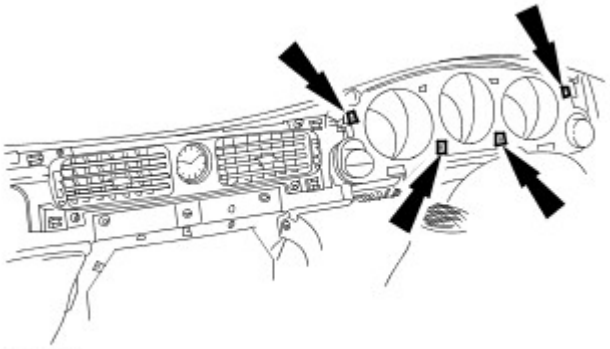
1. Route illumination switch harness into switch housing.
2. Connect switch to harness multiplugs and fit and fully seat switch in housing.
3. Secure harness in liner clips.
4. Fit lid damper to liner. Refer to 76.52.22.
5. Fit damper cord guide to bracket.
6. Route damper cord through guide and connect to damper.
7. Fit glovebox lid. refer to 76.52.02.
8. Fit glovebox. Refer to 76.52.03.

Instrument Panel and Console - Instrument Cluster Finish Panel

Removal and Installation

Removal

1. Turn ignition key to position II.
2. Move steering column to lowest and fully extended position.
3. Turn ignition key to position 'O'.
4. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.15.
5. Release veneer panel from retaining clips.



E36343

6. Remove veneer panel from vehicle.
7. Remove and discard all retaining clips.

Installation

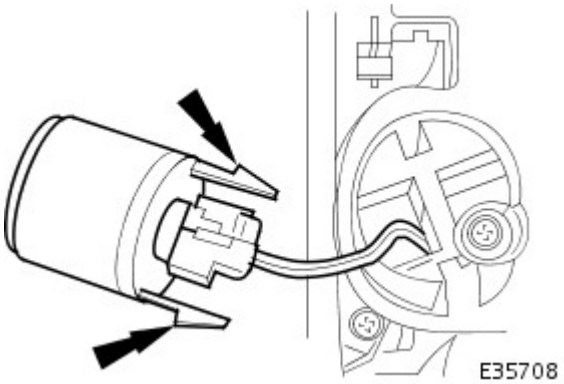
1. Fit new retaining clips to instrument surround.
2. Fit and fully seat veneer panel to instrument surround.
3. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
4. Turn ignition key to position II.
5. Return steering column to original position.
6. Turn ignition key to position 'O'.

Instrument Panel and Console - Instrument Cluster Finish Panel Bezel

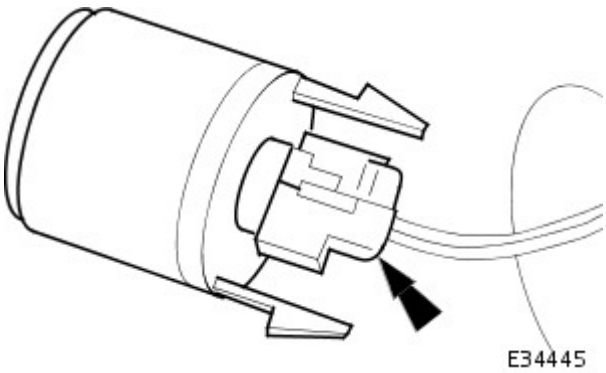
Removal and Installation

Removal

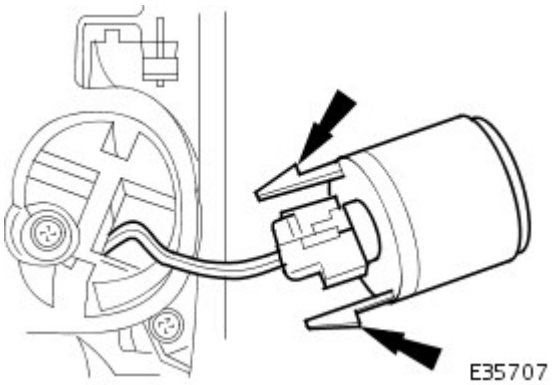
1. Adjust steering column to fully extended and lowered position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove veneer from instrument panel. Refer to 76.47.24.
4. Using a small screwdriver, depress fog lamp switch upper retaining tang and release switch from gauge surround.



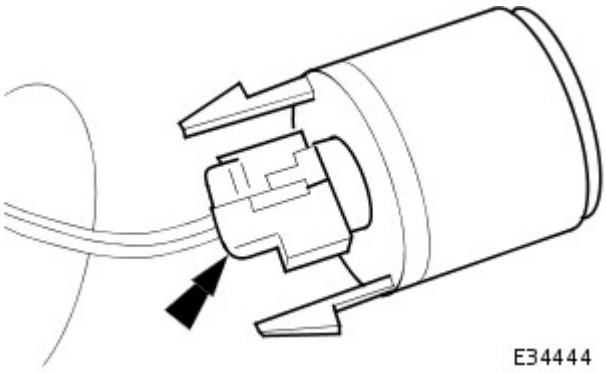
5. Position fog lamp switch for access, disconnect harness multiplug and remove switch.

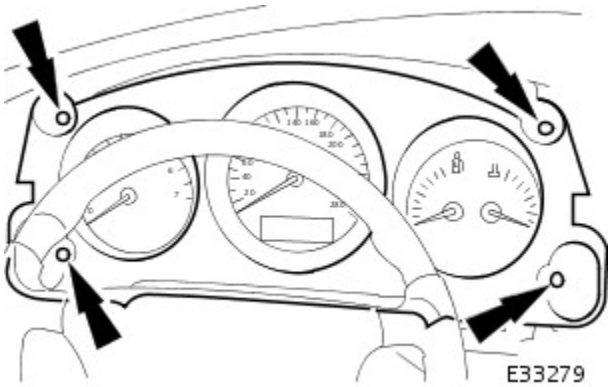


6. Using a small screwdriver, depress trip keyboard upper retaining tang and release keyboard from gauge surround.



7. Position trip keyboard for access and disconnect harness multiplug.





8. Slacken and remove four screws securing major gauge module/surround to fascia and withdraw surround.

Installation

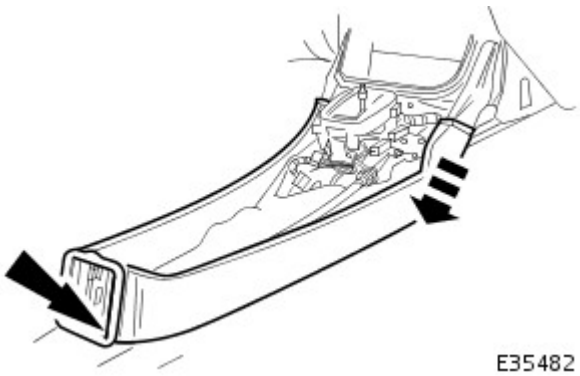
1. Position major gauge surround on panel, routing harness multiplugs through apertures.
2. Fit and tighten screws securing major gauge module/surround to fascia.
3. Connect harness multiplug to trip keyboard and fit and fully seat keyboard in gauge surround, ensuring correct location of retaining tangs
4. Connect harness multiplug to fog lamp switch and fit and fully seat switch in gauge surround, ensuring correct location of tangs.
5. Fit veneer panel. Refer to 76.47.24.
6. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
7. Return steering column to original position.

Instrument Panel and Console - Instrument Panel

Removal and Installation

Removal

1. Turn ignition switch to position II.
2. Motor driver and front passenger seats rearward.
3. Position steering wheel in straight ahead position and fully lower and extend steering column.
4. Turn ignition switch to position O.
5. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
6. Remove 'J' gate finisher. Refer to 76.25.24.
7. Remove 'J' gate finisher retaining panel. Refer to 76.25.26.
8. Remove centre console veneer panel. Refer to 76.47.26.
9. Disconnect and remove radio.
10. Remove centre console switch module. Refer to 86.80.32.
11. Remove centre console. Refer to 76.25.01.
12. Slacken and remove centre console vent duct rear securing screw and withdraw duct assembly from air conditioning unit manifold.

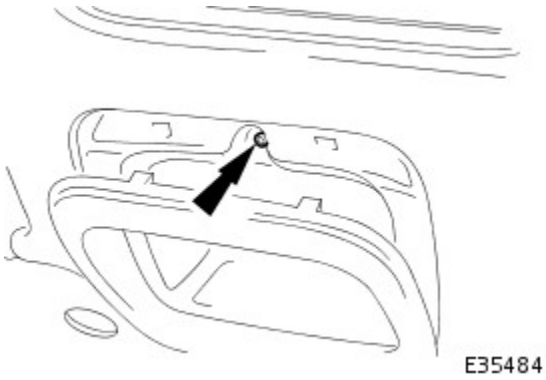


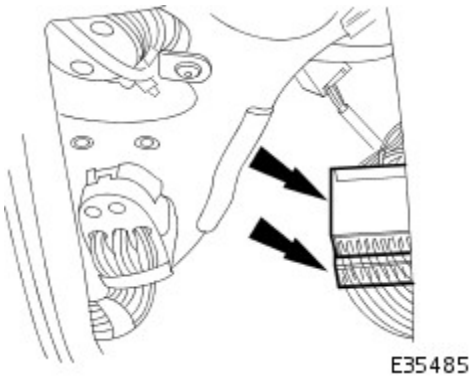
E35482

13. WARNING: BEFORE ANY AIRBAG/SRS SERVICE IS PERFORMED, AT LEAST ONE MINUTE MUST ELAPSE AFTER DISCONNECTION OF THE BATTERY CABLE, TO ALLOW DISSIPATION OF BACK-UP POWER SUPPLY ENERGY.

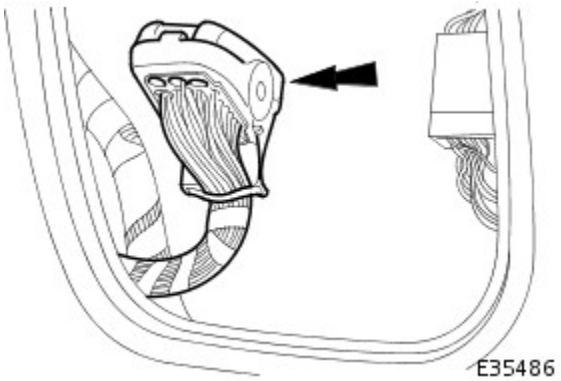
Remove driver airbag. Refer to 76.73.39.

14. Remove steering wheel. Refer to Section 211-04.
15. Remove steering column lower cowl. Refer to 76.46.03.
16. Remove steering column upper cowl. Refer to 76.46.02.
17. Remove driver side underscuttle. Refer to 76.46.11.
18. Remove combined windshield wiper/washer switch and audible warning speaker assembly. Refer to 86.65.42.
19. Remove glovebox. Refer to 76.52.03.
20. Remove 'A' post lower trim pads. refer to 76.13.30.
21. Carefully withdraw driver stowage bin trim, remove bin securing screw and remove bin from facia.

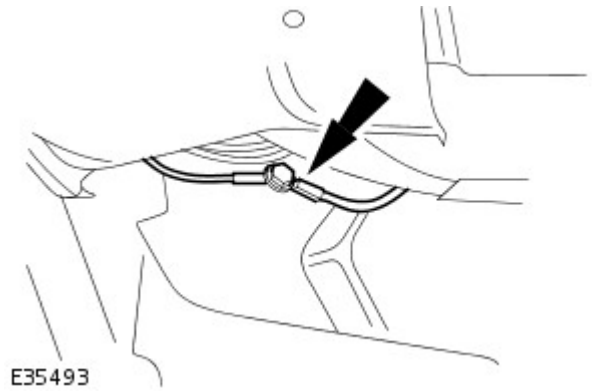




22. Accessing via driver stowage bin aperture, disconnect facia harness to centre console harness multiplugs.

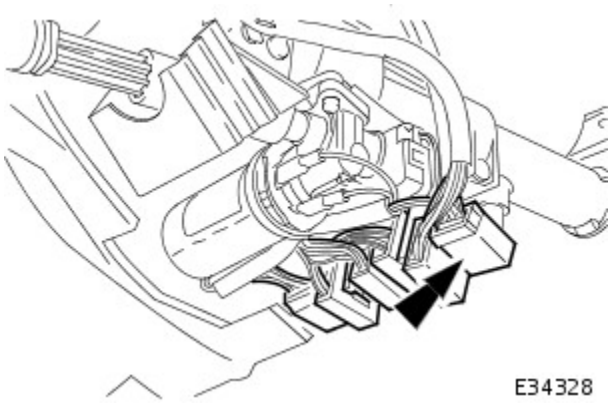


23. Release driver side facia harness to passenger compartment harness multiplug retaining lever and disconnect multiplug.

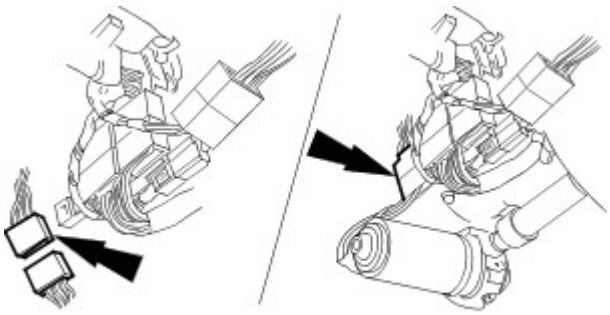


24. From RH side footwell, remove nut securing facia harness ground eyelet to tunnel front stud and disconnect eyelet from stud.

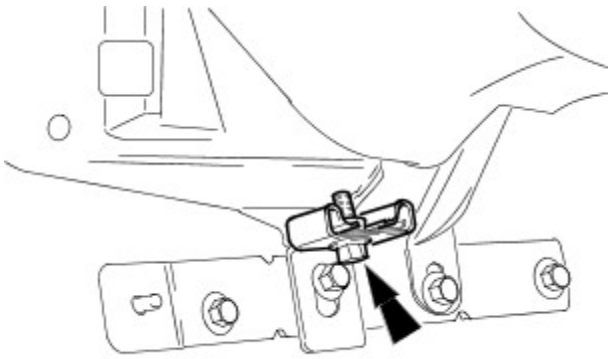
25. Remove steering column reach adjustment motor harness multiplug (yellow) from retaining bracket and disconnect multiplug.



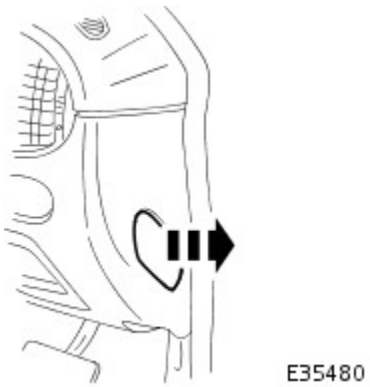
26. Remove steering column tilt adjustment motor harness multiplug from retaining bracket and disconnect multiplug.



27. Remove bolt securing facia mounting bracket to RH side of tunnel.

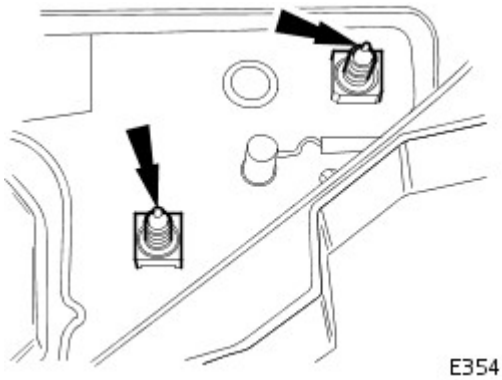


28. Remove facia RH end aperture trim pad.

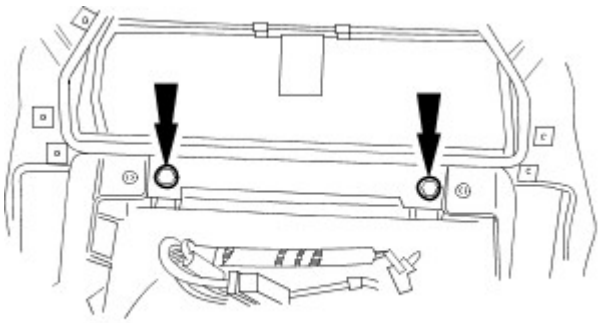


29. CAUTION: The 'A' post facia mounting brackets are pre-set to the body and must not under any circumstances be disturbed.

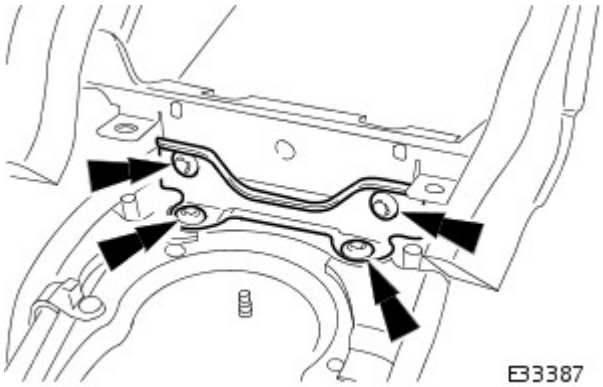
Remove two bolts securing facia to RH 'A' post mounting bracket.



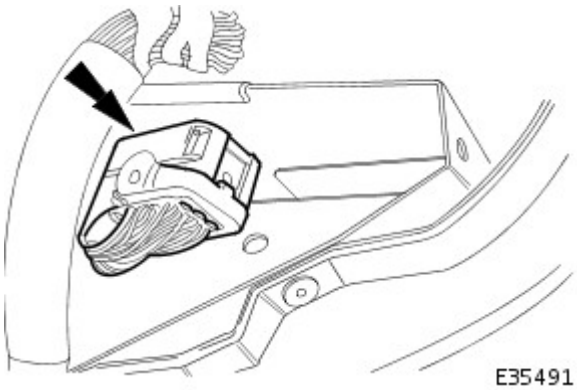
30. Disconnect and remove 'J' gate assembly for access. Refer to Section 307-05A N/A or 307-05B (S/C).



31. Remove two screws securing facia to air conditioning unit.

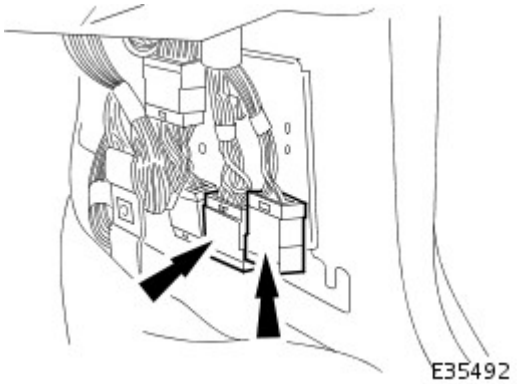


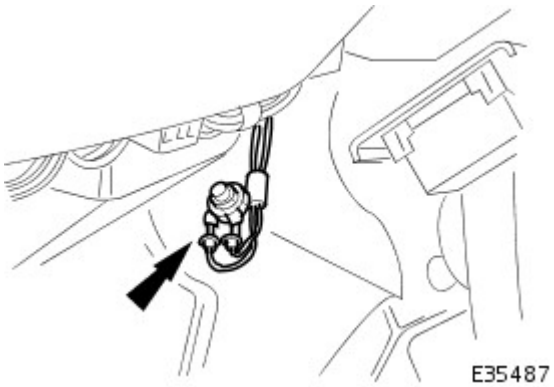
32. Remove bolts securing facia to tunnel upper bracket and bracket to tunnel and remove bracket.



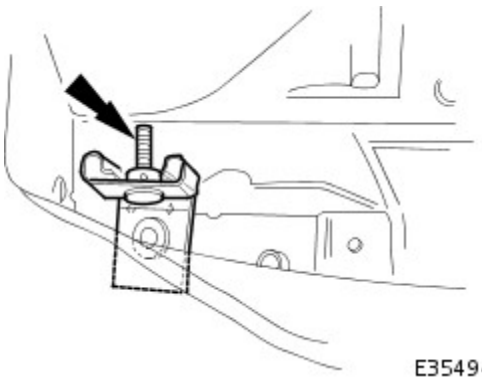
33. On passenger side, release facia harness to passenger compartment harness multiplug retaining lever and disconnect multiplug.

34. Remove facia harness to engine management harness multiplugs (grey and white) from 'A' post lower retaining bracket and disconnect multiplugs.

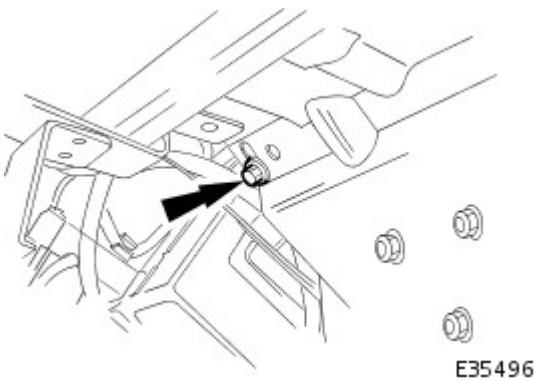




35. From LH side footwell, remove nut securing facia harness ground eyelet to tunnel front stud and disconnect eyelet from stud.



36. Remove bolt securing facia mounting bracket to LH side of tunnel.

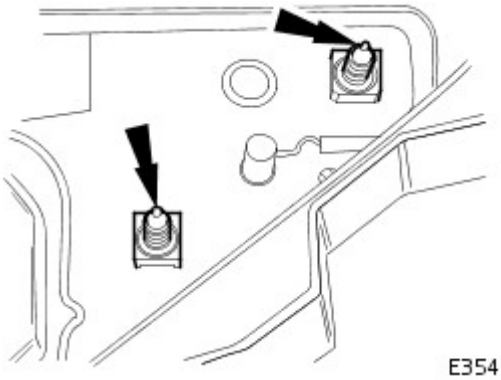


37. Remove bolt securing facia to bulkhead upper mounting bracket (between air conditioning control and body processor modules).

38. Remove facia LH end aperture trim pad.



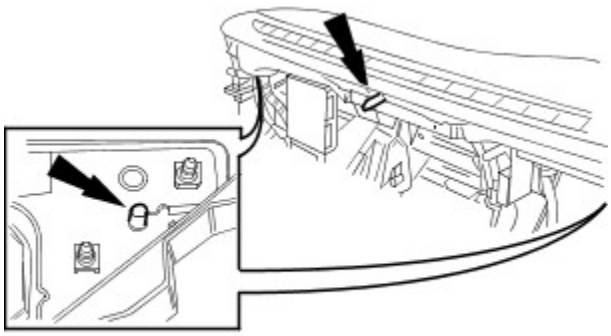
E35481



E35497

39. CAUTION: The 'A' post facia mounting brackets are pre-set to the body and must not under any circumstances be disturbed.

Remove two bolts securing facia to LH'A' post mounting bracket.



E35498

40. With assistance, carefully pull facia assembly rearwards, withdrawing centre locating pin from front bulkhead and disengaging side dowels from slots in'A' post brackets.

41. Remove facia assembly from vehicle and place on clean bench correct way up, with back facing outward.

42. Disconnect key transponder module harness multiplug.



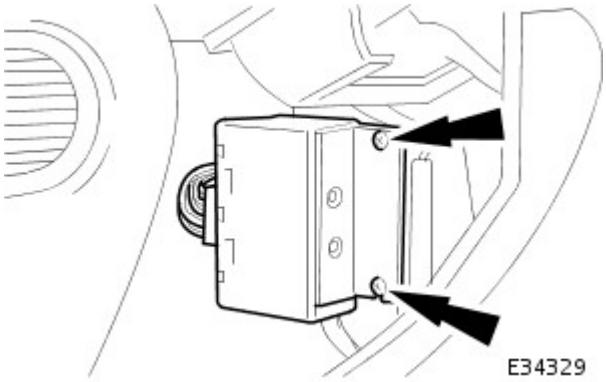
E35479

43. Remove key transponder module.

1. Remove two screws securing key transponder module to facia and remove transponder module.

2. Remove and discard plastic inserts from facia steel

reinforcement.

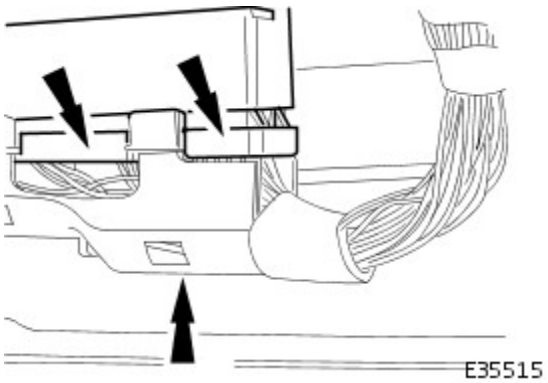


44. Remove illumination control module.

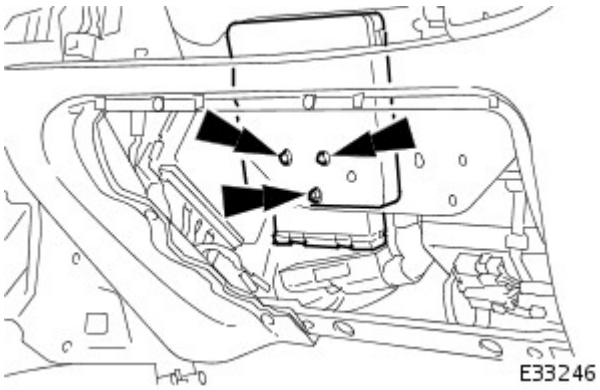
1. Disconnect illumination control module harness multiplug.
2. Slide module upwards to release it from facia.



45. Remove captive bolt retaining body processor module harness multiplug and disconnect multiplug.



46. Remove three nuts securing body processor module to facia and remove module.



47. Turn facia around to face outwards on bench.

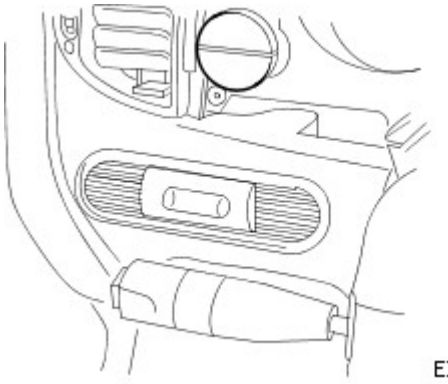
48. Remove instrument panel veneer. Refer to 76.47.24.

49. Remove major gauge module. Refer to 88.20.24.

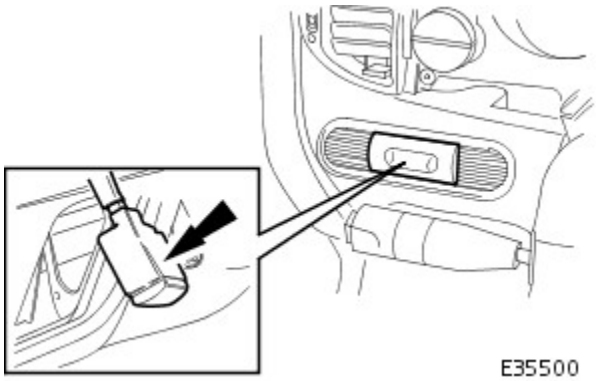
50. Remove and discard instrument panel veneer retaining plastic inserts from facia.

51. Release in-car sensor/trunk release switch assembly from facia for access and disconnect trunk release switch harness

multiplug.

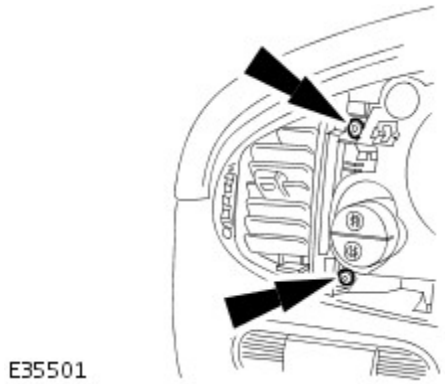

E35499

52. Withdraw in-car sensor from housing and remove housing/trunk release switch assembly.


E35500

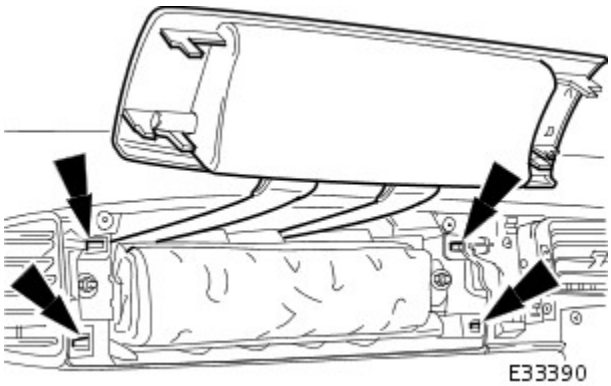
53. Remove LH vent/duct assembly from facia.

- Remove two screws securing vent/duct assembly to facia and remove assembly. Remove and discard screw retaining plastic inserts from facia.

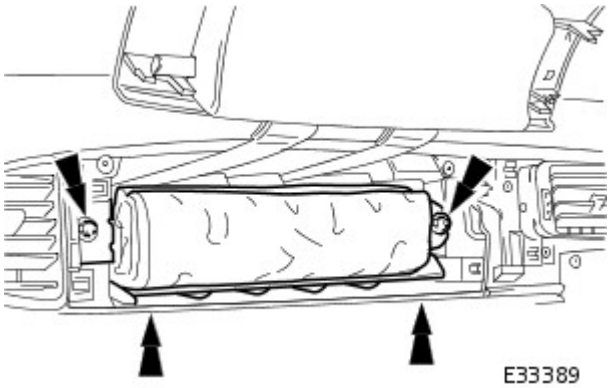

E35501

54. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG MODULE.

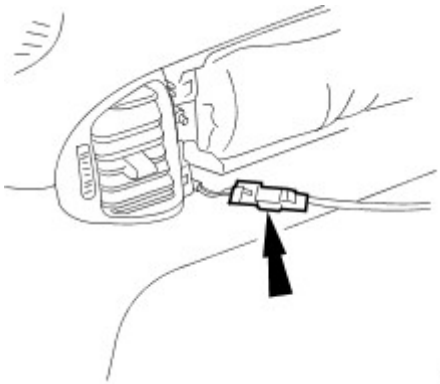
Remove passenger air bag deployment door for access, and remove and discard deployment door retaining clips from facia.


E33390

55. Remove and discard four nuts securing passenger air bag module to facia.

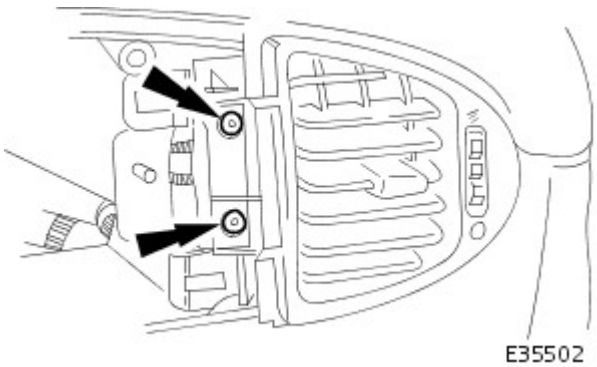


56. Partially withdraw airbag module, disconnect link harness multiplug and remove airbag from facia.



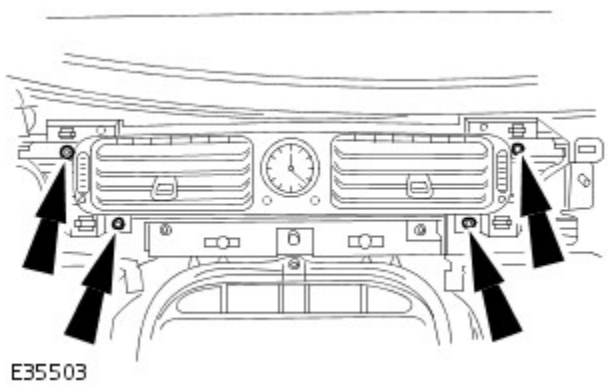
57. Remove RH vent/duct assembly from facia.

- Remove two screws securing vent/duct assembly to facia and remove assembly. Remove and discard securing screw plastic inserts from facia.



58. Carefully withdraw centre vent veneer panel.

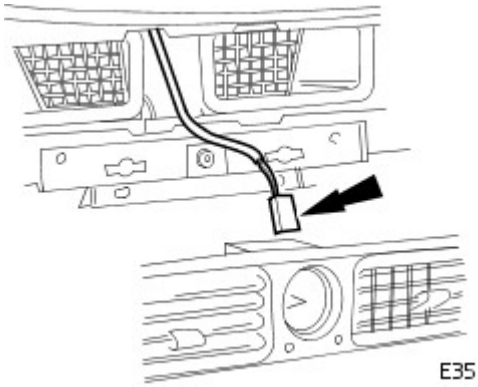
59. Remove four screws securing centre vent to facia.



60. Remove centre vent.

- Withdraw centre vent for access, disconnect clock harness multiplug and remove vent.

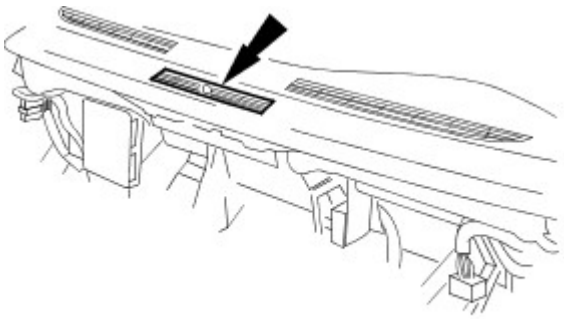
- Remove and discard centre vent retaining screw plastic inserts from facia.

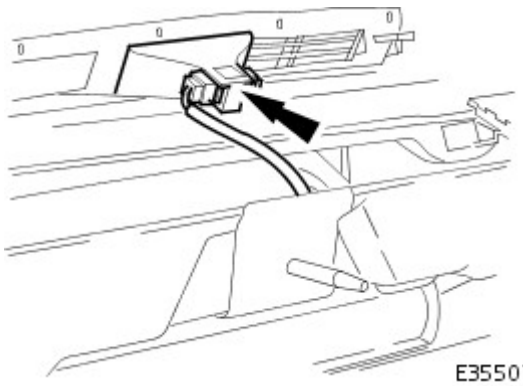

E35504

- Remove clock from centre vent.

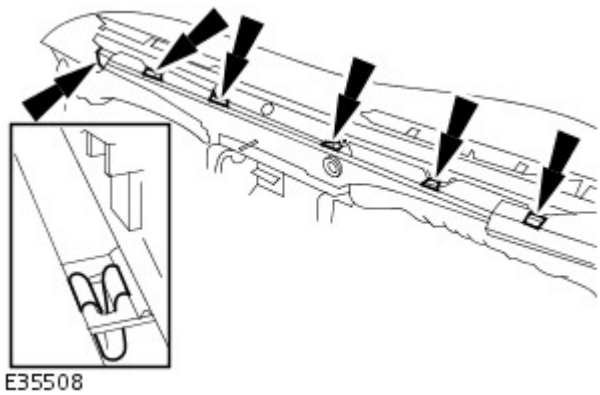
61. Reposition facia face down on bench.

62. Withdraw centre defrost vent for access, release solar sensor harness multiplug from retaining clip and disconnect multiplug.


E35506

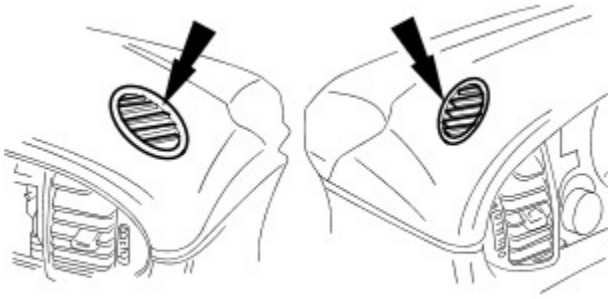

E35507

63. Remove centre defrost vent complete with solar sensor, and remove vent retaining clips from facia.

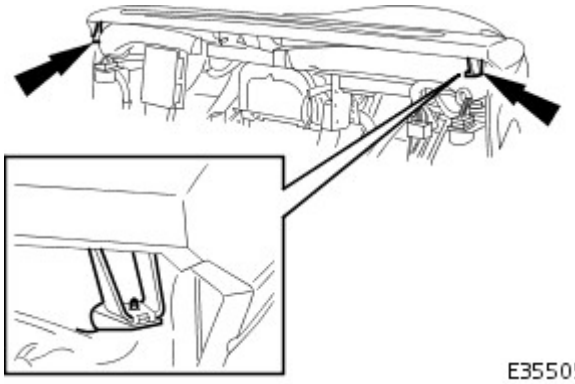

E35508

64. Carefully remove left and right hand defrost vents from facia and remove vent retaining clips from facia.

65. Carefully remove left and right hand top vents from facia.

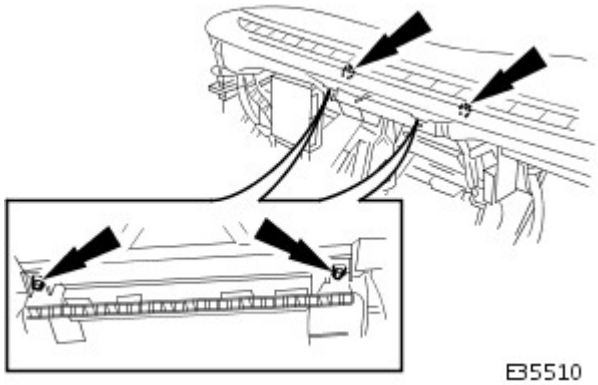


E35509



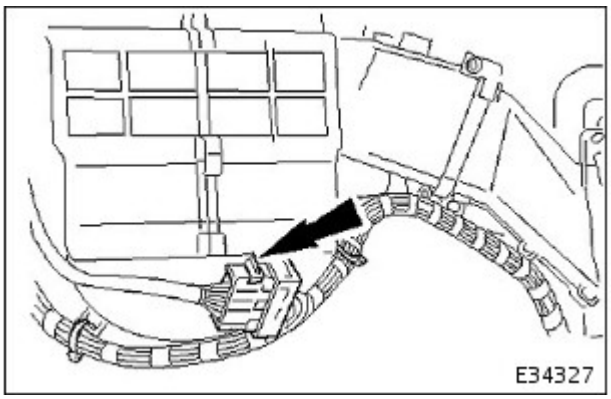
E35505

66. Remove screws securing LH and RH face level air ducts to facia and remove ducts.



E35510

67. Remove four nuts securing air distribution box to facia.



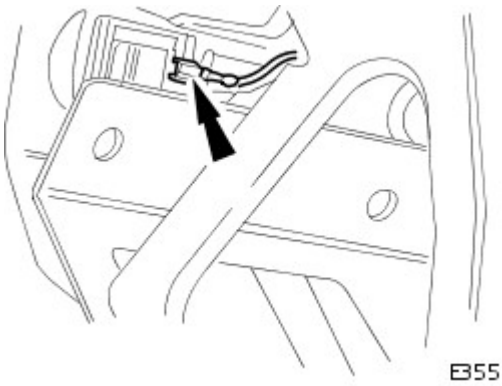
E34327

68. Position air distribution box for access, disconnect multiplug and remove air distribution box from facia.

69. Remove two screws securing aspirator motor assembly to facia



E35511



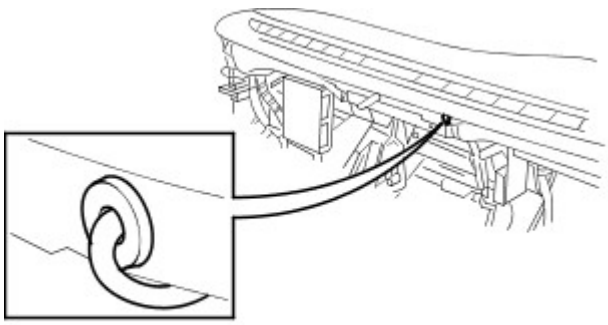
E35512

70. Disconnect aspirator harness multiplug and remove aspirator, carefully routing hose through facia aperture.



E35513

71. Release facia harness multiplugs from retaining brackets on RH side of facia and slacken and remove two nuts securing harness to facia.



E35514

72. Remove solar sensor harness grommet from facia and route harness multiplug through aperture. Release multiplug from retaining bracket on LH side of facia

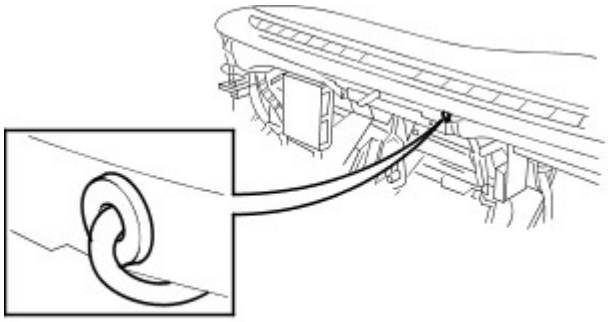
73. Noting positions, remove all harness retaining clips from facia.

74. Note layout of harness, then remove harness from facia.

Installation

1. Route harness in facia as previously noted.

2. Install all harness to facia retaining clips.



E35514

3. Install solar sensor harness multiplug on LH retaining bracket.

4. Pass solar sensor harness multiplug through facia aperture. Install solar sensor harness grommet.



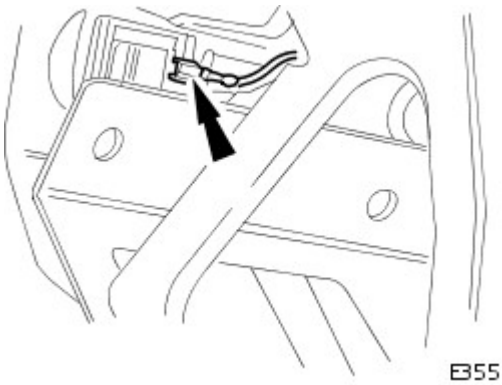
E35513

5. Install facia harness multiplugs to RH retaining brackets and install harness securing nuts.



E35511

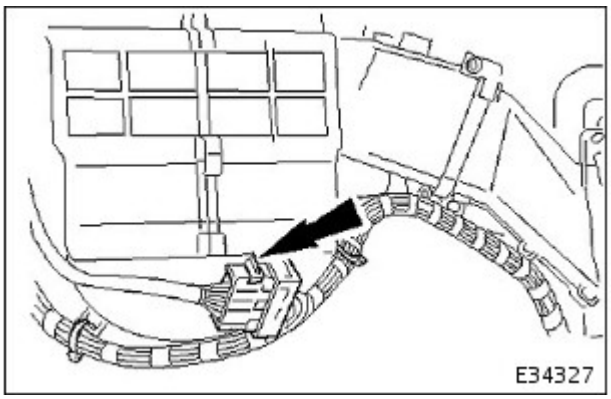
6. Install aspirator motor assembly in facia, routing hose through aperture, and install securing screws.

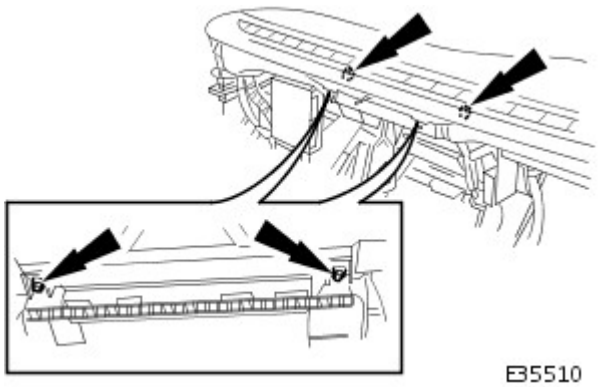


E35512

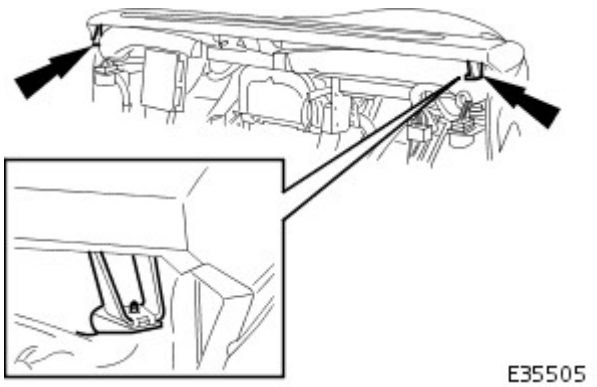
7. Connect aspirator harness multiplug to facia harness.

8. Position air distribution box in facia and connect multiplug to facia harness.





9. Fully seat air distribution box and install securing nuts.

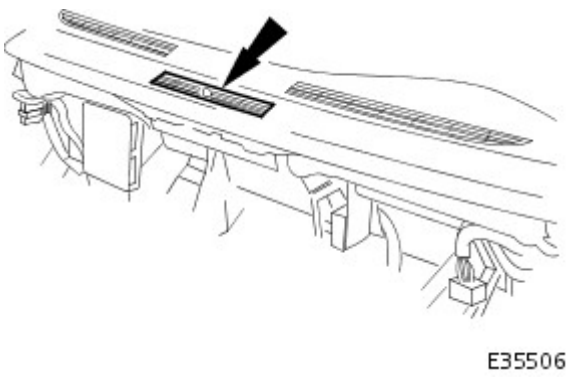


10. Install LH and RH air distribution box/facia side vent ducts and install securing screws.

11. Install LH and RH top vents on facia.

12. Install all defrost vent retaining clips to facia.

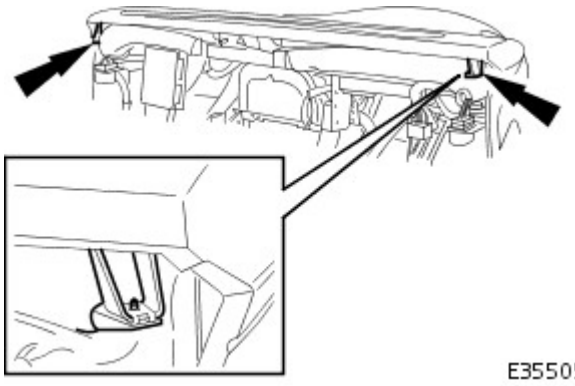
13. Install LH and RH windshield defrost vents to facia

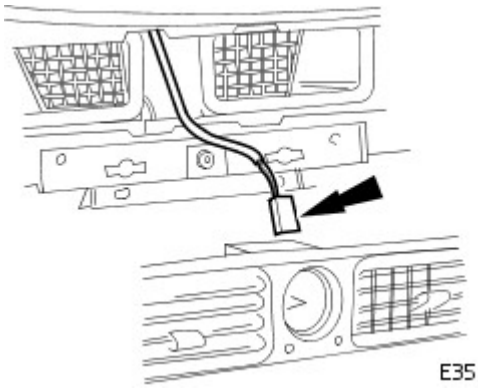


14. Position centre defrost vent/solar sensor assembly, connect sensor harness multiplug to facia harness, install multiplug on retaining clip and fully seat assembly in facia.

15. Reposition facia right way up on bench.

16. Position face level air ducts in facia and install securing screws.

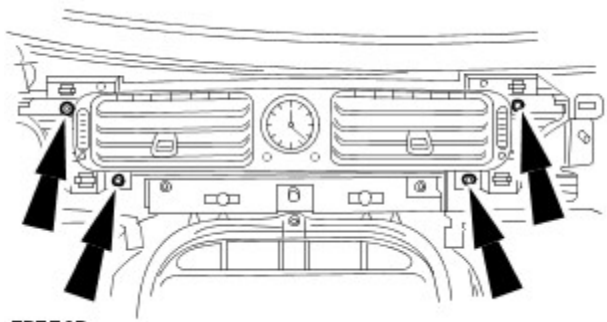

E35505

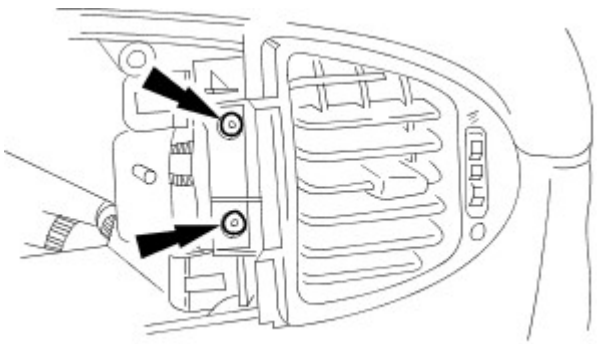

E35504

17. Install centre vent/clock assembly.

1. Install new centre vent retaining screw inserts in facia.
2. Position centre vent/clock assembly at facia and connect clock harness multiplug to facia harness.

18. Position centre vent/clock assembly in facia and install securing screws.


E35503


E35502

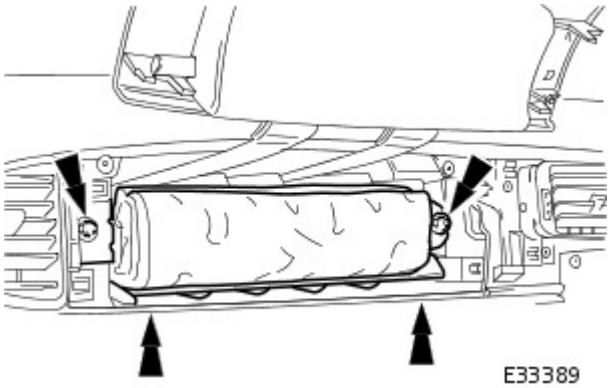
19. Install RH side vent/duct assembly.

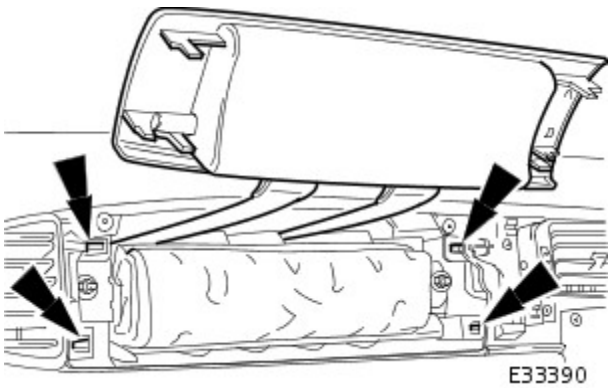
1. Install new RH side vent/duct retaining screw inserts in facia.
2. Position RH side vent in facia and install securing screws.

20. Install new LH side vent/duct retaining screw inserts in facia.

21. Position LH side vent/duct in facia and install securing screws.

22. Position passenger air bag module and deployment door assembly in facia aperture. and install four new securing nuts.

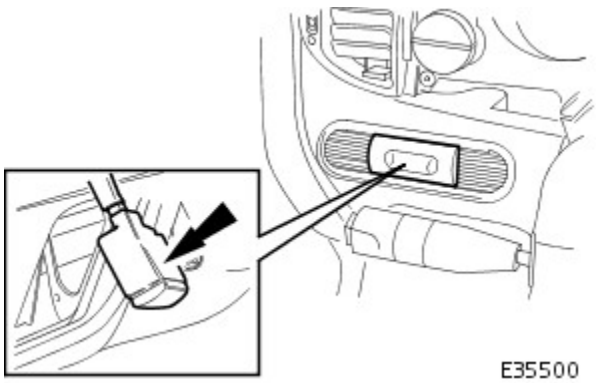




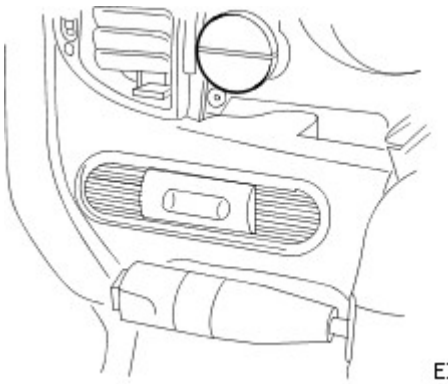
23. WARNING: ENSURE THAT THE AIR BAG AND RETAINING CLIPS ARE FULLY SEATED.

Install deployment door.

- Install and fully seat deployment door retaining clips in facia.
- Install and fully seat deployment door in clips.



24. Position trunk release switch/housing at facia and connect in-car sensor to housing.



25. Connect trunk release switch multiplug to facia harness and install in-car sensor/trunk release switch assembly to facia.

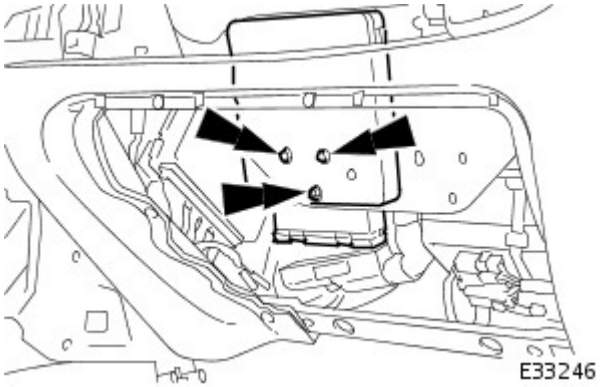
26. Install new major gauge module retaining screw inserts to facia.

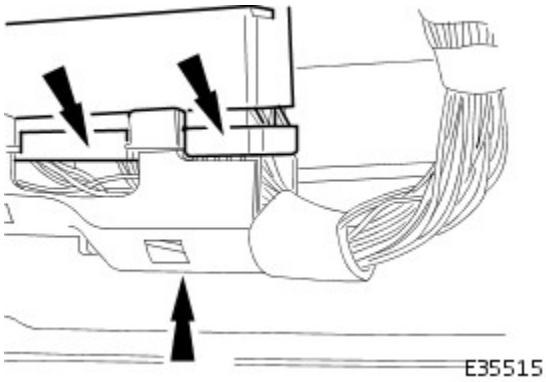
27. Install major gauge module in facia. Refer to 88.20.24.

28. Install instrument panel veneer panel. Refer to 76.47.24.

29. Reposition facia on bench with back facing outwards.

30. Position body processor module in facia and install securing nuts.



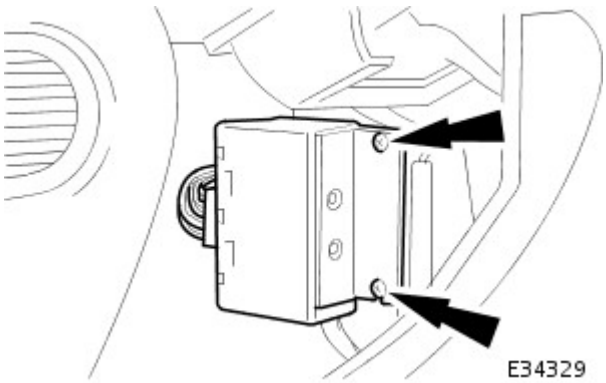


31. Connect body processor module harness multiplug to facia harness and tighten captive securing bolt.



32. Install illumination control module on facia. mounting.

1. Connect module to facia harness multiplug.
2. Slide module downward to secure on mounting bracket.

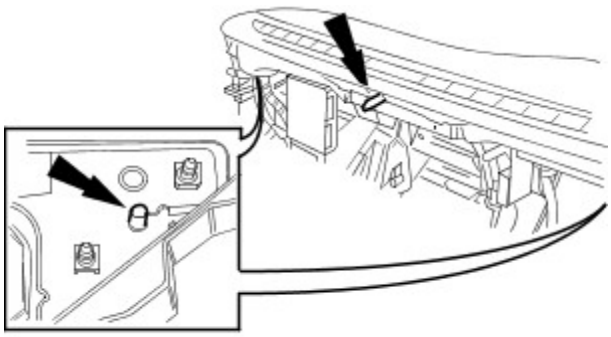


33. Install new key transponder module securing screw plastic inserts to facia. Position key transponder module in facia and install securing screws.

34. Connect key transponder module harness multiplug to facia harness.

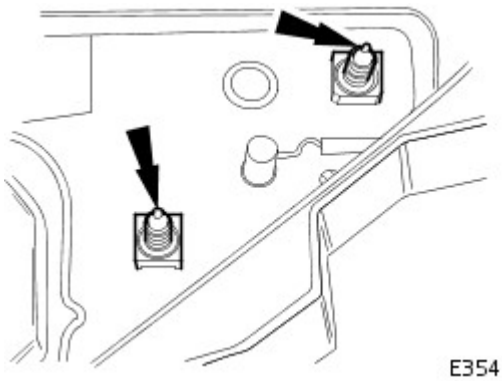


E35479



E35498

35. With assistance, position facia in vehicle, align side dowels with slots in 'A' post brackets, and centre pin wth bulkhead aperture, and push fully forward.



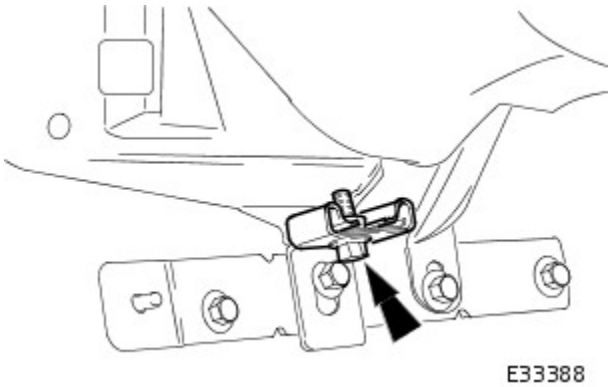
E35497

36. CAUTION: The 'A' post facia mounting brackets are pre-set to the body and must not under any circumstances be disturbed.

Install bolts securing facia to RH 'A' post bracket and tighten to 22-28Nm.

37. Install trim pad on facia RH end aperture.

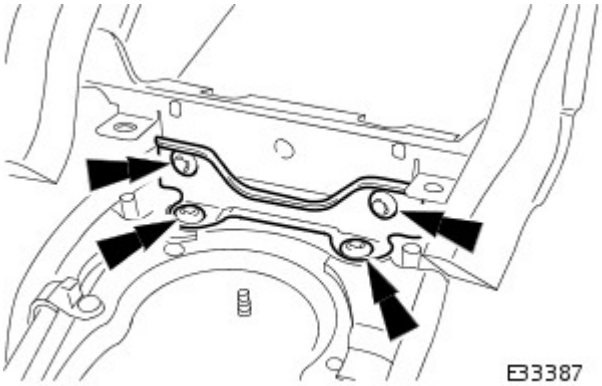
38. Install bolt securing facia bracket to RH side of tunnel and tighten to 7-10Nm.



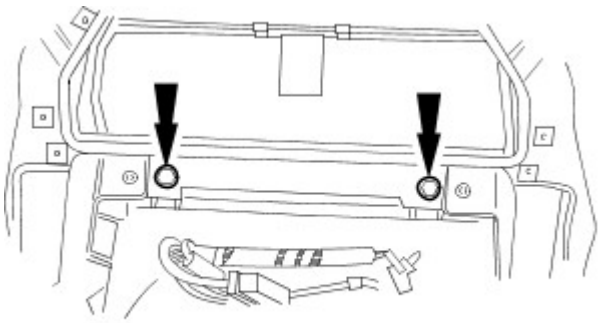
E33388

39. Install facia centre support bracket.

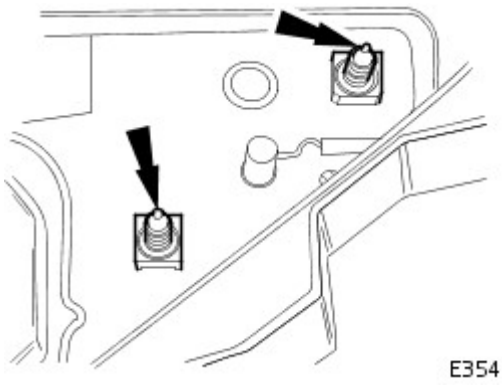
- Position centre bracket on top of tunnel and install but do not tighten securing bolts.
- Install facia to centre mounting bracket bolts and tighten to 22-28Nm.



- Finally tighten centre mounting bracket to tunnel securing bolts to 22-28Nm.



40. Install facia to air conditioning unit securing screws.

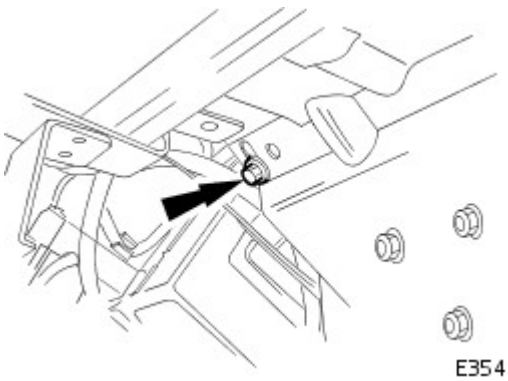


41. CAUTION: The 'A' post facia mounting brackets are pre-set to the body and must not under any circumstances be disturbed.

Install bolts securing facia to LH 'A' post bracket and tighten to 22-28Nm.

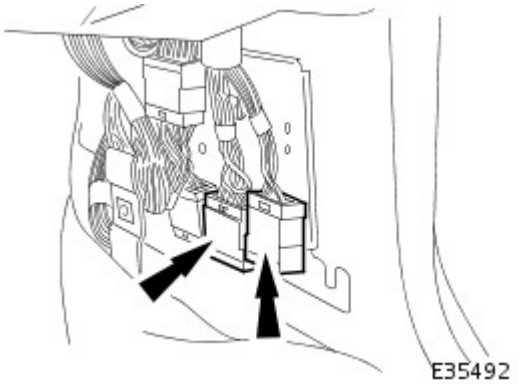
42. Instal seat trim pad to facia RH end aperture.

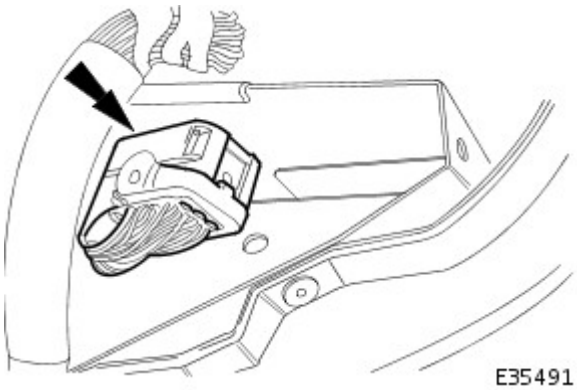
43. Install bolt securing facia mounting bracket to bulkhead adjacent to body processor.



44. Position ground cable eyelet on LH 'A' post stud and install securing nut.

45. Connect passenger side facia harness to engine management harness multiplugs (white and grey) and install multiplugs on lower 'A' post retaining bracket.

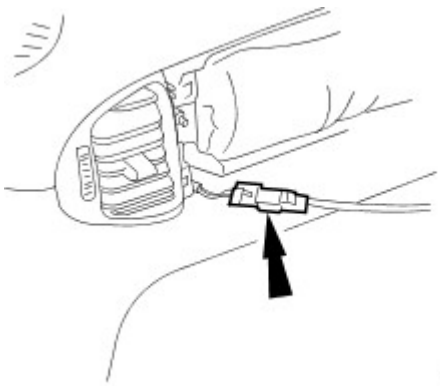




46. Connect passenger side facia harness to passenger compartment harness multiplug and secure with retaining lever.

47. Install trim pad on passenger side lower 'A' post. Refer to 76.13.30.

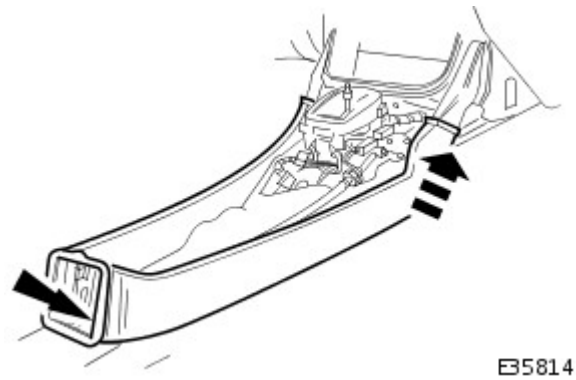
48. Connect passenger air bag link harness multiplug.



49. Install passenger glovebox assembly. Refer to 76.52.03.

50. Install 'J' gate assembly. Refer to 76.25.24 and 76.25.26.

51. Position centre console rear vent duct in air conditioning unit and install rear securing screw.



52. Install centre console. Refer to 76.25.01.

53. Install centre console switch module. Refer to 76.13.30.

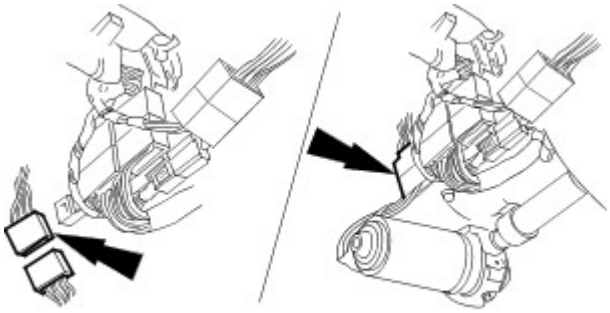
54. Install radio. Refer to 86.50.03.

55. Install facia centre veneer panel. Refer to 76.47.06.

56. Install centre console veneer panel. Refer to 76.47.26.

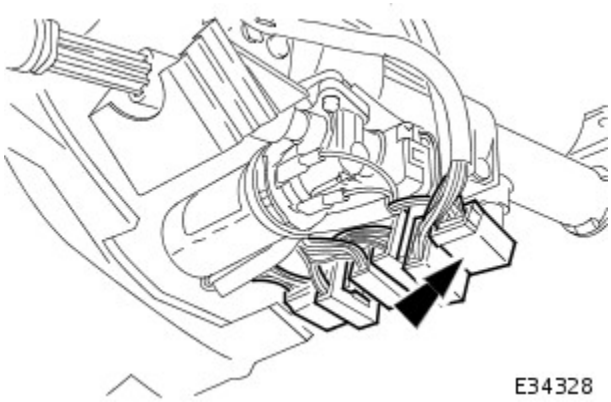
57. Install 'J' gate finisher retaining panel. Refer to 76.25.26.

58. Install 'J' gate surround. Refer to 76.25.24, Section 307-05A (N/A), 307-05B (S/C).



E35280

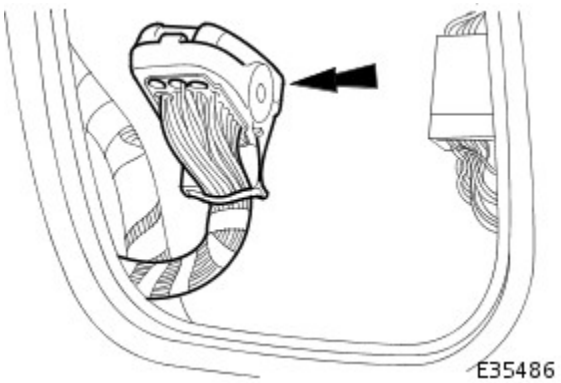
59. Connect steering column tilt motor harness multiplug and install multiplug on retaining bracket.



E34328

60. Connect steering column reach motor harness multiplug and install multiplug on retaining bracket.

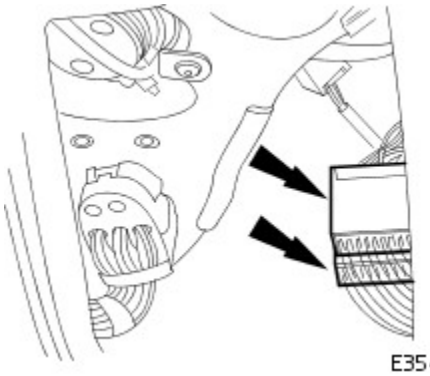
61. Position ground cable eyelet on RH 'A' post stud and install securing nut.



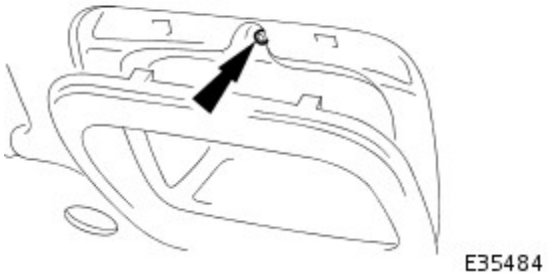
E35486

62. Connect driver side facia harness to passenger compartment harness multiplug and secure with retaining lever.

63. Connect driver side facia harness to console harness multiplugs.


E35485

64. Position driver stowage bin in facia, install securing screw and fully seat trim.


E35484

65. Install trim pad on driver side lower 'A' post. Refer to 76.13.30.

66. Install driver side underscuttle. Refer to 76.46.11.

67. Install combined windshield wiper/washer switch and audible warning speaker assembly. Refer to 86.65.42.

68. Install steering column upper cowl. Refer to 76.46.02.

69. Install steering column lower cowl. Refer to 76.46.03.

70. Install steering wheel. Refer to 211-04.

71. Install driver side airbag. Refer to 76.73.39.

Instrument Panel and Console - Instrument Panel Finish Panel

Removal and Installation

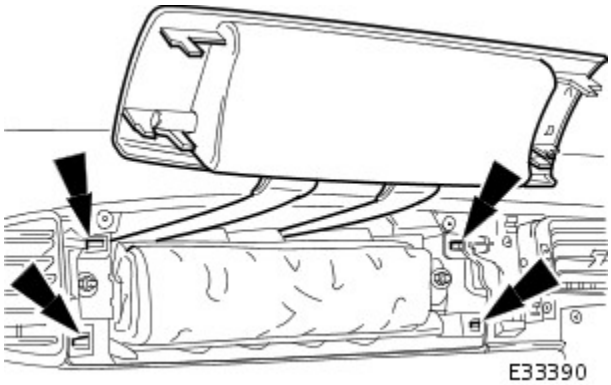
Removal

1. WARNINGS:

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG MODULE.

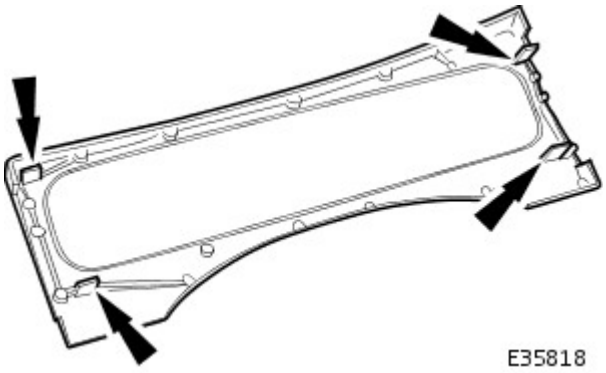
IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.

Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.



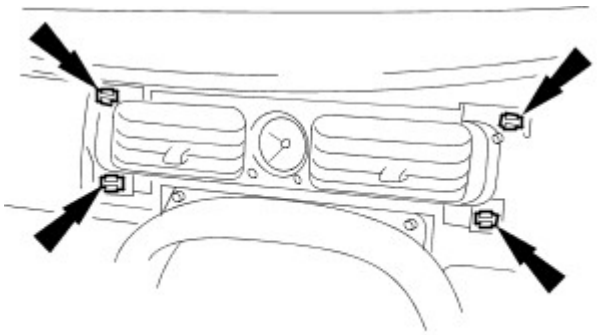
2. Using a plastic lever, carefully release passenger airbag deployment door from mounting clips, position for access and remove and discard retaining clips.

3. Remove major gauge module veneer panel for access. Refer to 76.47.24.



4. Using a thin plastic lever, carefully release the four centre veneer panel dowels from fascia clips.

5. Remove and discard the veneer panel to fascia securing clips.



E35819

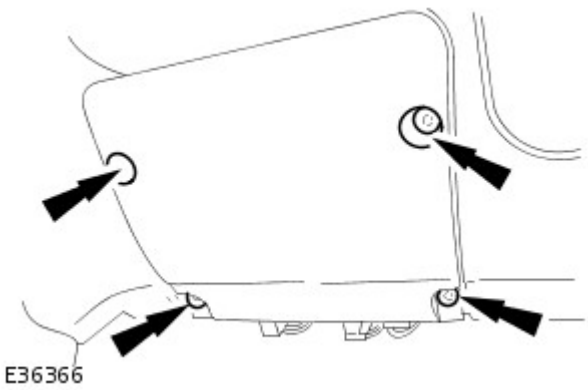
Installation

1. Fit and fully seat new veneer panel securing clips to fascia.
2. Position center veneer panel on fascia, align dowels with clips and press firmly at edges to fully seat.
3. Fit major gauge module veneer panel. Refer to 76.47.24.
4. Using new retaining clips, fit and fully seat passenger airbag deployment door.
5. Connect ground cable to battery terrminal and fit battery cover. Refer to 86.15.15.

Instrument Panel and Console - Instrument Panel Lower Trim Panel

Removal and Installation

Removal



1. Turn ignition switch to position 'II.'
2. Motor driver seat fully rearwards.
3. Turn ignition switch to position 'O.'
4. Slacken and remove the four underscuttle securing screws.
5. Remove and discard securing clips from screw locations.
6. Remove underscuttle from vehicle.

Installation

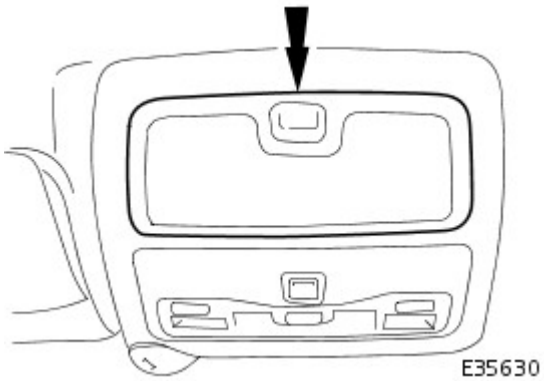
1. Fit new securing clips to screw locations.
2. Position and fully seat underscuttle below fascia and fit and tighten securing screws.
3. Return driver seat to original position.

Instrument Panel and Console - Overhead Console

Removal and Installation

Removal

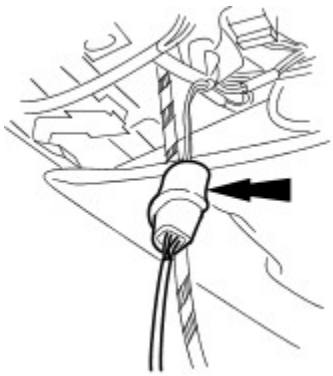
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Open roof console sun glasses compartment.



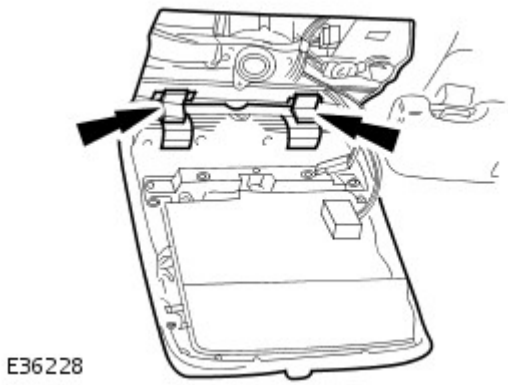
3. Rotate fastener 1/4 turn to release console.



4. Lower console from roof and disconnect lighting module harness multiplug and hands-free microphone harness multiplug if telephone is fitted.



5. Release roof console from retaining clips and remove from vehicle.



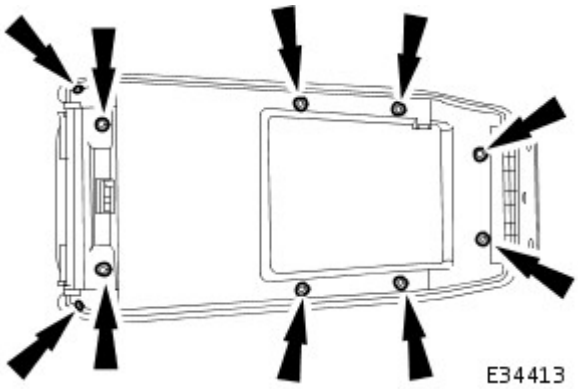
Installation

1. Position roof console at headlining and connect lighting harness multiplug and hands-free microphone multiplug if fitted.
2. Engage console in retaining clips.
3. Aligning with headlining aperture, seat console and rotate fastener 1/4 turn to secure.
4. Close sunglasses compartment.
5. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

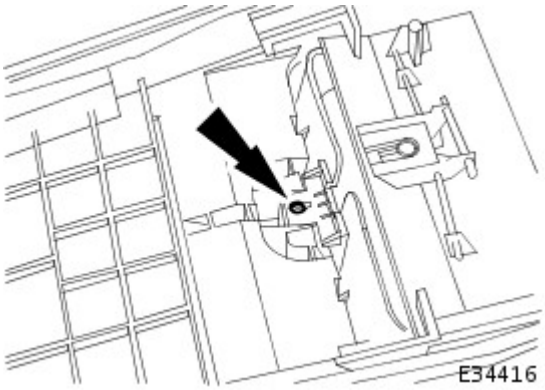
Instrument Panel and Console - Rear Cup Holder

Removal and Installation

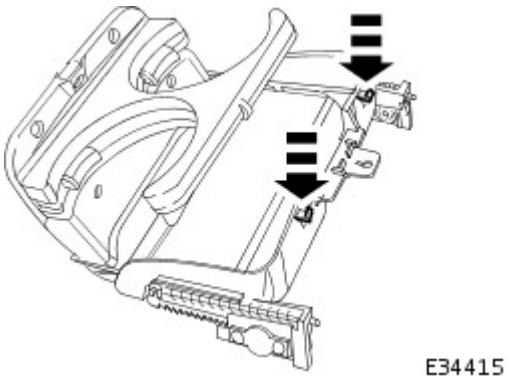
Removal



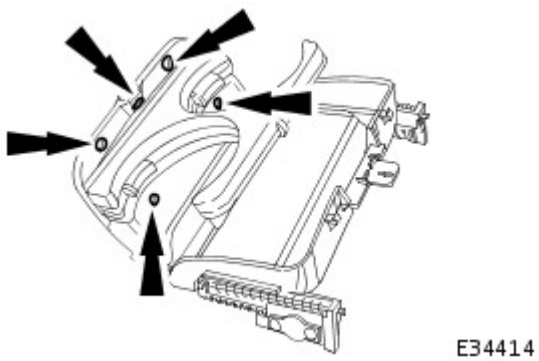
1. Remove the console glove box lid. Refer to 76.25.18.
2. Slacken and remove the ten inner lid securing screws. and remove the inner lid.



3. Slacken and remove cupholder latch securing screw and remove latch assembly.



4. Open cupholder, depress tang each side of latch location and withdraw cupholder assembly. from base.



5. Slacken and remove the cupholder trim panel securing screws.

Installation

1. Fit trim panel assenbly to cupholder mechanism.
2. Fit and tighten the trim panel securing screws.
3. Fit and fully seat cupholder mechanism, ensuring tangs are fully engaged.
4. Fit and tighten lid inner securing screws.
5. Fit cupholder latch and tighten securing screw.
6. Fit glovebox lid. Refer to 76.25.18.

Instrument Panel and Console - Steering Column Lower Shroud

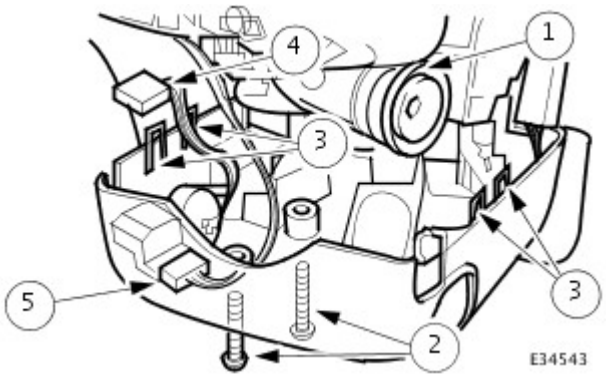
Removal and Installation

Removal

1. Move driver seat fully rearward.

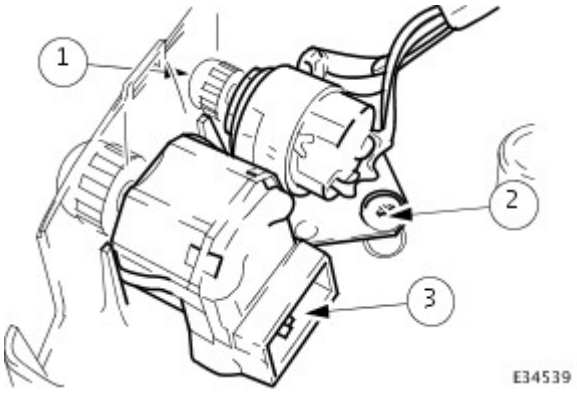
2. Remove battery cover and disconnect ground cable from battery terminal.Refer to 86.15.19.

3. Remove cowl from steering column.



1. Remove key from ignition switch.
2. Slacken and remove cowl securing screws.
3. Separate lower cowl from upper cowl (four tabs) and move lower cowl forward to access multiplugs.
4. Disconnect rheostat harness multiplug.
5. Disconnect tilt column harness multiplug.

4. Remove rheostat and column adjustment switch from cowl.



1. Remove adjusting knob from rheostat.
2. Slacken and remove rheostat securing screw.
3. Release column adjustment switch retaining tangs and remove switch from cowl.

Installation

1. Fit and fully seat column adjustment switch in cowl.

2. Position and align rheostat and fit and tighten securing screws.

3. Fit and fully seat rheostat adjusting knob.

4. Position cowl for access and connect rheostat and column switch harness multiplugs.

5. Finally position lower cowl locating four retaining tabs and fit and tighten securing screws.

6. Fit key to ignition switch.

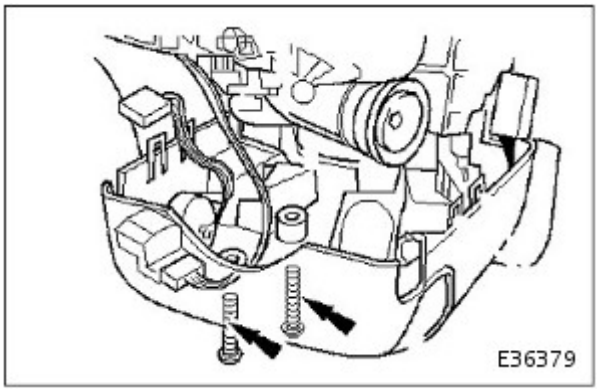
7. Connect ground cable to battery terminal and fit battery cover. Refer 86.15.15.

8. Return driver seat to original position.

Instrument Panel and Console - Steering Column Upper Shroud

Removal and Installation

Removal



1. Move driver seat fully rearward.
2. Slacken and remove screws securing upper cowl to lower cowl and separate the two cowls.
3. Move steering column to fully down position.
4. Remove upper cowl from steering column.

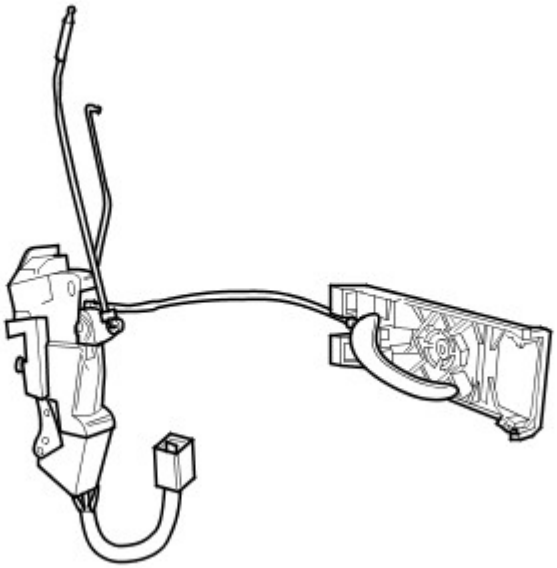
Installation

1. Position upper cowl on steering column.
2. Move column to the fully up position.
3. Fit upper cowl to lower cowl locating the four tabs, and fit and tighten securing screws..
4. Return driver seat and column to original positions.

Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems

Description and Operation

Door Lock Mechanism



E36296

For most markets, the remote central locking system also, incorporates deadlocking facilities for optimum security. Door locks are eight disc, bayonet fixing barrels with integral lock / unlock switches. Keys include 'in-key' transponders which are programmed to the vehicle via the Jaguar Diagnostic System and operate the engine immobilisation system.

The central locking system employs single key access to the driver's door, trunk lid and ignition switch/steering column lock. An additional green headed valet or parking services key permits access via the driver's door, and ignition/start-up, but denies access to the trunk and glovebox.A valet switch located on the centre console switch panel above the radio, precludes normal internal access to the trunk.When the vehicle is not locked, each door catch can be externally released by the corresponding external door handle which operates via a single rod. When unlocked, or 'single action' locked, the door catches can also be released via the interior handles, each of which operates via a single cable. Operation of the front door interior handles will also unlock the rear doors. Use of either key in the external door barrel, operates the lock via a short rod to provide locking of the door latch. These locking functions can also be achieved by use of the remote transmitter.The trunk lid can be independently unlatched via a switch located on the driver's side underscuttle. This will only operate at vehicle speeds up to 8 km/h (5 mph).

All doors and the trunk can be manually locked simultaneously from inside by pressing the driver or front passenger door sill button down. Each rear door can be independently locked by similarly depressing the sill button and in some markets can be released by operating the internal door handle.

For most markets, a 'drive-away door locking' feature automatically locks all doors and the trunk when the gear selector is moved from the Park position.

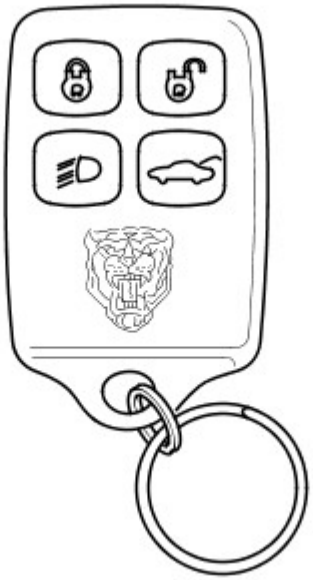
Key Operation

To 'single action' lock or unlock the vehicle, the key is inserted in the door lock, turned towards the front or rear of the vehicle respectively, and released. Holding the key in the lock position will close all windows. Releasing the key stops all operations. 'single action' locking of the vehicle locks all doors, the trunk lid and the fuel filler flap, and sets the alarm system.

In addition to all of the above functions, deadlocking prevents door opening from the interior. To deadlock the vehicle, the key is inserted in the door lock and turned to the unlock (rearward) position, then within three seconds, turned to the lock (forward) position and released.

Remote Operation

Remote Central Locking Transmitter Unit



E36122

A four-button transmitter unit provides for remote controlled central locking of the vehicle.

The button bearing a red closed padlock symbol locks the vehicle and arms the security system. To remote 'single action' lock, the transmitter is pointed towards the vehicle and this button is pressed and released. To deadlock the vehicle, the above operation is repeated within three seconds. This function can also be used to remote close any windows. Completion of deadlocking is indicated by an audible 'chirp' from the security system and a single flash from the direction indicators. The vehicle is unlocked and the security system disarmed by pressing the button with the open padlock symbol.

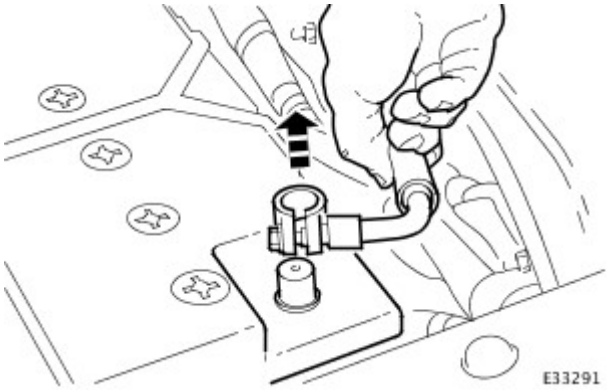
The trunk lock can also be remotely released by operating the button bearing the trunk lid open symbol.

The button with dipped headlamp symbol is for emergency use. When depressed three times within three seconds, it switches the headlamps on for 25 seconds and operates the vehicle alarm 5 times.

Handles, Locks, Latches and Entry Systems - Door Lock Control Switch

Removal and Installation

Removal

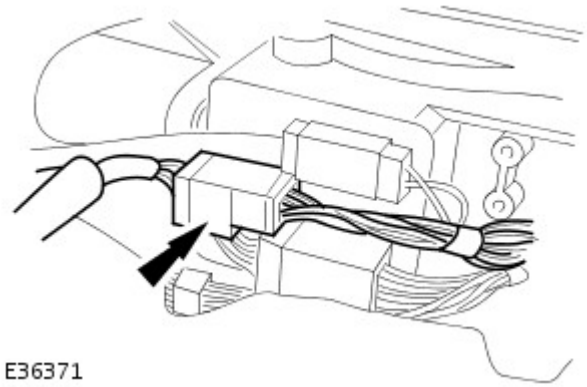


1. Disconnect battery ground cable; refer to 86.15.19.

2. Remove center console veneer panel; refer to 76.47.26.

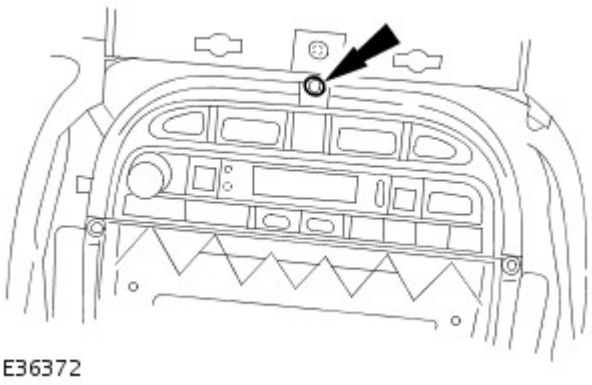
3. Displace radio for access; refer to 86.50.03.

4. Disconnect air conditioning control module flying lead connector (blue) from harness connector located at side of 'J' gate.



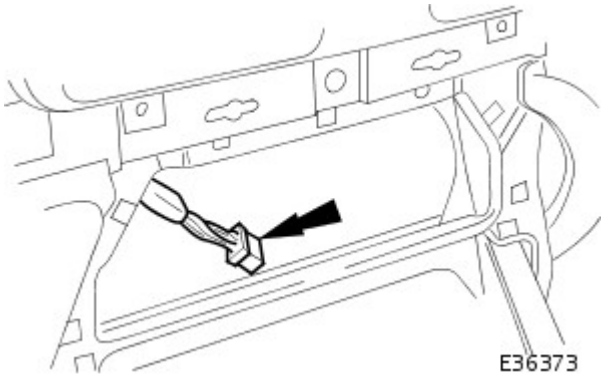
5. Displace air conditioning switch module / center console switch module assembly.

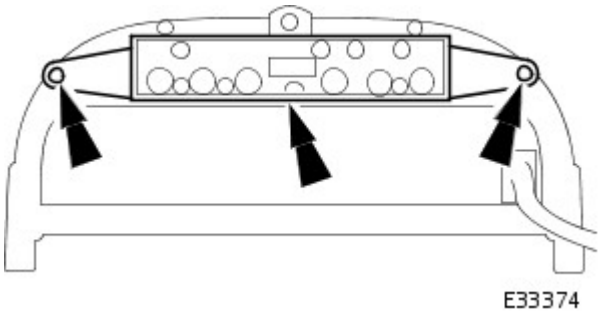
   - Remove screw.
   - Reposition assembly for access to connector.



6. Remove air conditioning switch module / center console switch module assembly.

   - Disconnect center console switch module harness connector.
   - Remove assembly.





7. Remove center console switch module.

- Remove two screws.
- Remove module.

Installation

1. Installation is reverse of removal.

2. Reconnect battery ground cable; refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Exterior Driver Door Handle

Removal and Installation

Removal

1. Motor door glass to fully up position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove door casing veneer panel. Refer to 76.47.11.
4. Remove door casing for access. Refer to 76.34.01.
5. Feeding electrical harness through water shedder, carefully peel shedder from door and place adhesive face down on a clean dry polythene sheet.



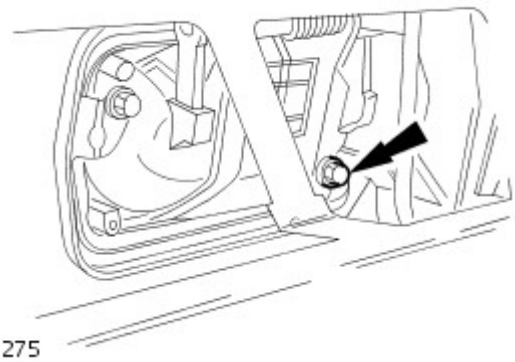
E36273

6. Position PVC inner sheet for access.
7. Disconnect outer handle link rod from lock assembly.



E36274

8. Slacken and remove outer handle rear securing bolt.



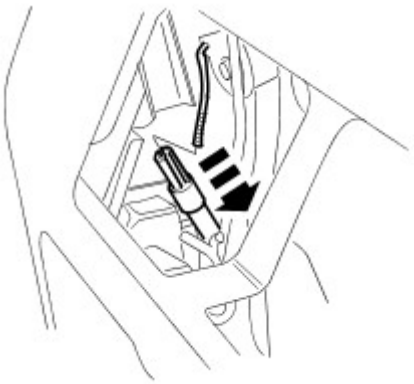
E36275

9. Slacken and remove security guard lower securing bolt and remove guard from door.



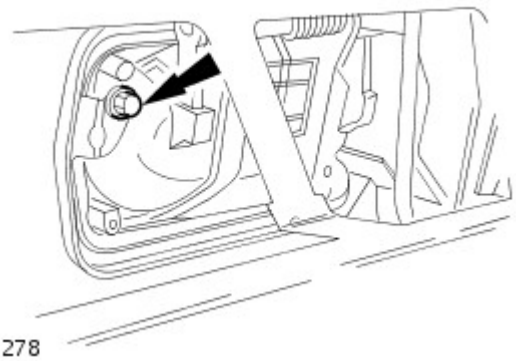
E36276

10. Pull door barrel to lock link rod locking collar downward to release link rod.



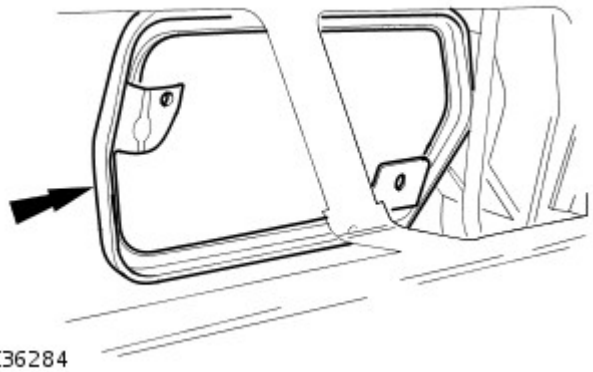
E36277

11. Holding handle firmly in position, slacken and remove front securing bolt and remove handle assembly from door.



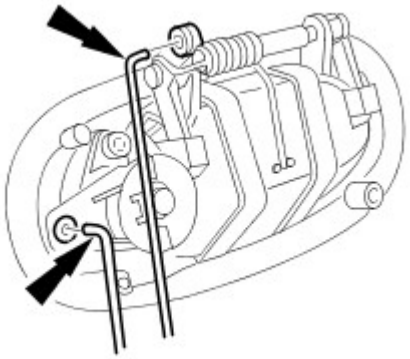
E36278

12. Remove door handle clamping plate.

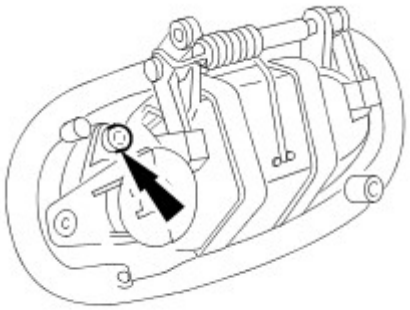


E36284

13. Remove link rods from door handle assembly.



E36285



E36286

14. Slacken and remove lock barrel securing screw and remove lock barrel from handle.

Installation

1. Align and fit lock barrel to door handle and fit and tighten securing screw.
2. Fit link rods to door handle assembly.
3. Align and fit handle assembly to door
4. Position clamping plate inside door, and holding handle in position, fit and tighten securing bolts.
5. Position barrel link rod on lock assembly and secure with locking collar.
6. Check for satisfactory door handle operation.
7. Slacken and remove door handle rear securing bolt.
8. Position door lock security guard and fit and hand tighten lower securing bolt.
9. Fit and tighten door handle rear/security guard upper securing bolt.
10. Fully tighten security guard lower securing bolt.
11. Connect lock link rod to door handle.
12. Reposition PVC inner sheet.
13. Connect ground cable to battery terminal. Refer to 86.15.15.
14. Check for satisfactory operation of locking system
15. Disconnect ground cable from battery terminal. Refer to 86.15.15.
16. Ensure that shedder contact area of door is clean and dry.
17. Position water shedder at door and carefully pass harness through.
18. Fit and firmly seat water shedder on door ensuring satisfactory adhesion.

19. Fit door casing. Refer to 76.34.01.

20. Fit door casing veneer panel. Refer to 76.47.11.

21. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Driver Door Latch

Removal and Installation

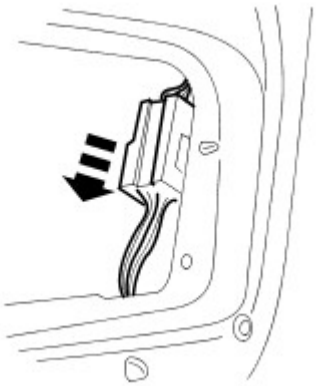
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove driver door casing. Refer to 76.34.01.
3. Position water shedder for access and feed door harness through water shedder.



E36273

4. Carefully remove water shedder from door and place adhesive side down on a clean dry plastic sheet.
5. Release door lock actuator harness multiplug from mounting bracket and disconnect multiplug.



E36287

6. Position plastic inner sheet for access.
7. Disconnect outer door handle operating rod from lock mechanism.

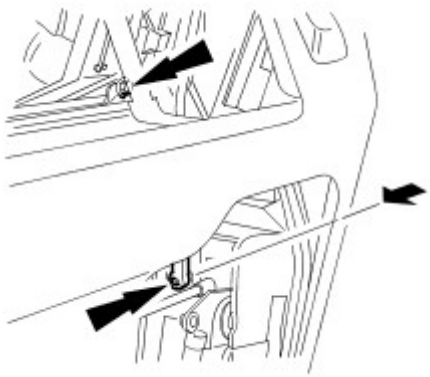


E36274

8. Disconnect inner door lock operating rod from lock mechanism and remove rod assembly.

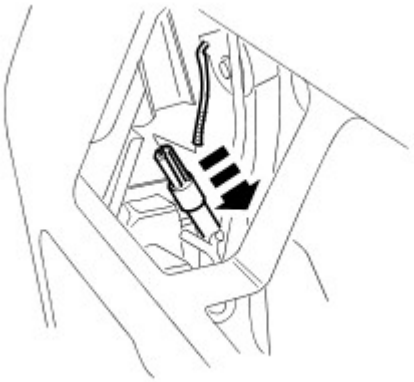


E36288



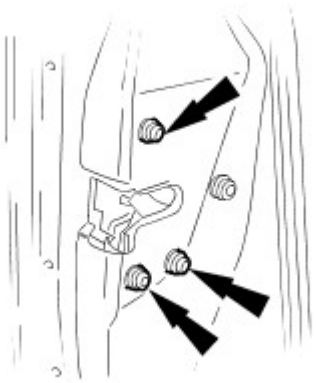
E36290

9. Slacken and remove the two security guard securing bolts and remove shield from door.



E36277

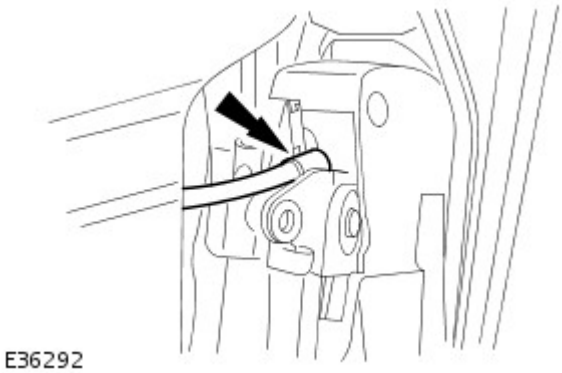
10. Withdraw locking sleeve to release door lock barrel link rod, and remove link rod.



E36291

11. Slacken and remove the three lock securing bolts.

12. Remove remote control cable abutment securing clip, disconnect cable from lock assembly and remove lock from door.



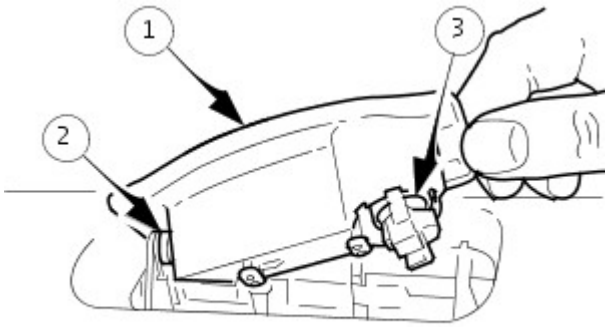
Installation

1. Position lock assembly in door, connect remote cable and fit and fully seat securing clip.
2. Align lock assembly in door and fit and tighten the three securing bolts.
3. Connect barrel to lock link rod and secure with locking sleeve.
4. Position security guard in door and fit but do not tighten lower securing bolt.
5. Fit and tighten outer handle/security guard upper securing bolt.
6. Finally tighten security guard lower securing bolt.
7. Position inner lock operating rod in door and connect rod to lock assembly.
8. Connect door outer handle operating rod to lock assembly.
9. Check for satisfactory door handle operation.
10. Reposition plastic inner sheet.
11. Connect lock actuator harness multiplug and fit multiplug to mounting bracket.
12. Connect ground cable to battery terminal. Refer to 86.15.15.
13. Check for satisfactory door locking operation.
14. Disconnect ground cable from battery terminal. Refer to 86.15.15.
15. Ensure that water shedder contact area of door is clean and dry.
16. Pass door harness through water shedder.
17. Fit and firmly seat water shedder on door ensuring satisfactory adhesion.
18. Fit door casing. Refer to 76.34.01
19. Connect ground cable to battery terminal and fit cover to batery. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Glove Compartment Lid Handle

Removal and Installation

Removal



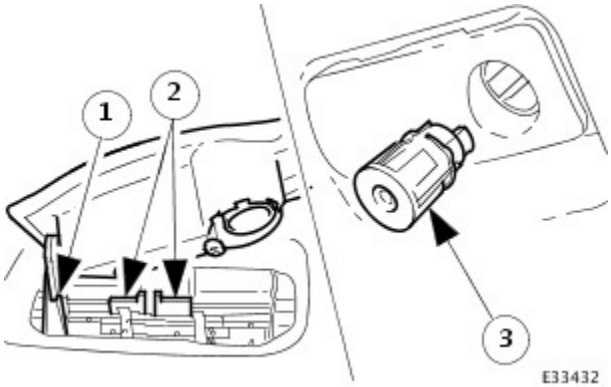
E33429

1. Remove glovebox lid. Refer to 76.52.02.

2. Remove the glove box handle and lock barrel.

1. Holding the handle in the open position, remove it from the mounting bracket by carefully prising the RH support outwards.
2. Remove the handle return spring.
3. Releasing the retaining tangs, remove the lock barrel.

Installation



E33432

1. Install glove box handle and lock barrel to lid.

1. Install handle return spring ensuring that it engages in the lid mounting slot.
2. Position lock rods inwards and Install and fully seat handle in right-hand mounting bracket.
3. Install lock barrel to lid.

2. Install glovebox lid. Refer to 76.52.02.

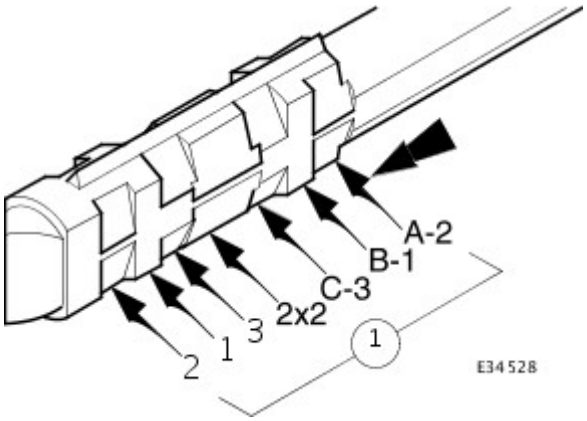
Handles, Locks, Latches and Entry Systems - Glove Compartment Lid Lock Cylinder

Removal and Installation

Removal

1. Remove glovebox handle and lock assembly. Refer to 76.52.08.
2. Remove plastic lock rod operating bush from lock barrel.
3. Remove operating bush bias spring from lock barrel.
4. Slacken and remove screw securing barrel to housing and remove barrel from lock housing.
5. Thoroughly clean lock housing.

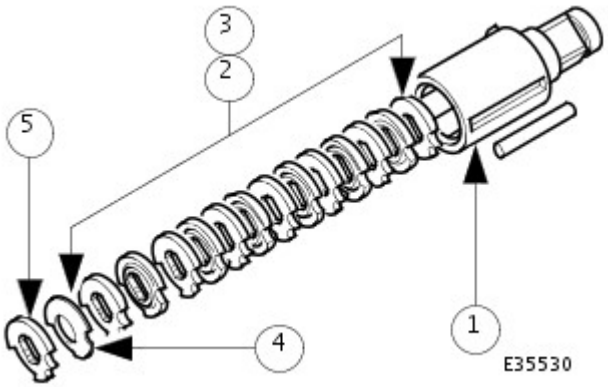
Installation



1. NOTE: For re-fitting of original lock barrel, refer to operations 4 to 9.

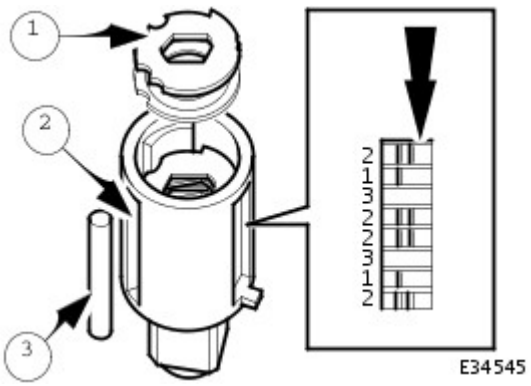
Identify key cut code.

1. Hold key so that cut outs can be identified and commencing at key grip, note and record cut out sequence.



2. Fit lock discs to barrel.

1. Grease bore of lock barrel.
2. Ensure lock discs match recorded key code.
3. Grease the first seven discs and install them in the barrel in sequence with embossed spacers in between and orientated to align roller locations.
4. Fit wavy spring spacer.
5. Grease and fit final disc.



3. Fit shutter assembly and roller to barrel.

1. Grease shutter assembly and fit to barrel.
2. Align recesses in discs and spacers to accept the steel roller.
3. Grease steel roller and fit into recesses via barrel slot.

- Via adjacent barrel slot, check discs for correct sequence and orientation.

4. Align and fit barrel into lock housing.

5. Fit plastic securing ring to barrel and rotate to engage locking tangs.

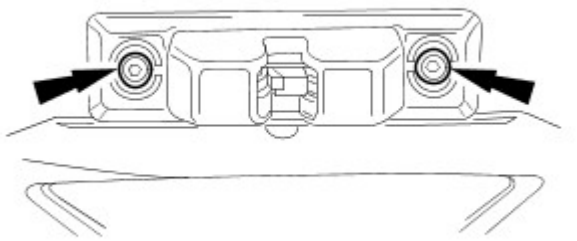
6. Fit bias spring to operating arm ensuring it is fully seated and tensioned, with ends positioned each side of pillar.
7. Fit operating arm and bias spring assembly to barrel and secure with 'C' clip.
8. Fit lock barrel assembly to housing.
9. Position lock assembly in handle and fit and tighten securing screw.
10. Fit key and check lock function.
11. Remove key from lock.
12. Fit handle and lock assembly to glovebox lid.. Refer to 76.52 08.

Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid Latch

Removal and Installation

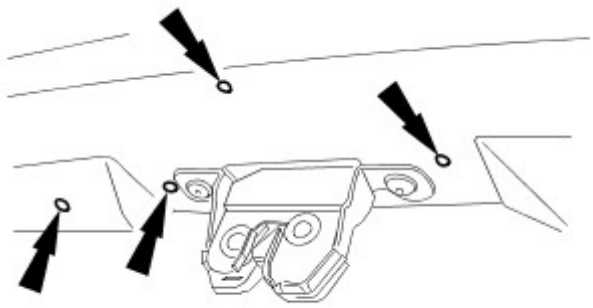
Removal

1. Remove trunk lamp assemblies. Refer to 86.45.16.
2. Remove covers from the two trunk latch finisher securing bolts and slacken and remove securing bolts.



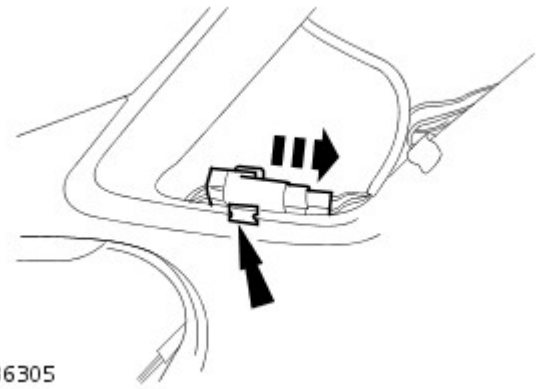
E36304

3. Remove latch finisher from trunk.
4. Release and discard the four trunk lid liner rear fasteners and position liner for access.



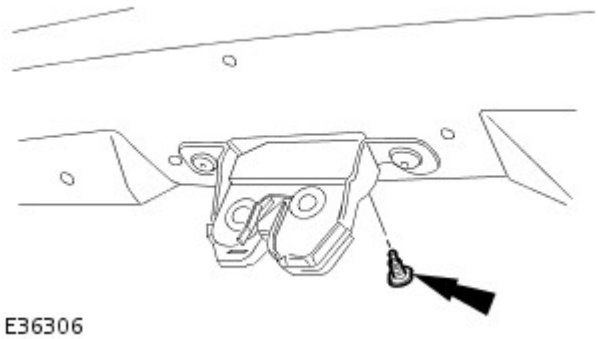
E36289

5. Release trunk open switch multiplug from retaining clip and disconnect multiplug.



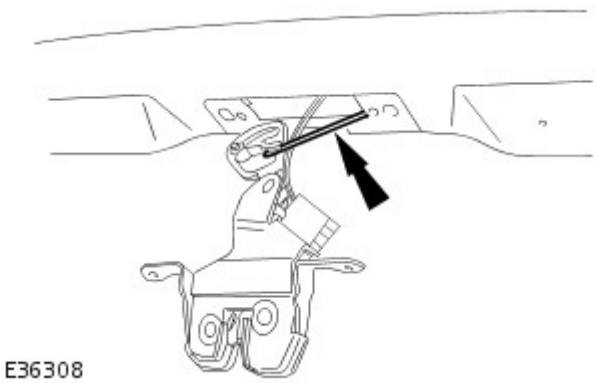
E36305

6. Slacken and remove the latch assembly securing bolt.



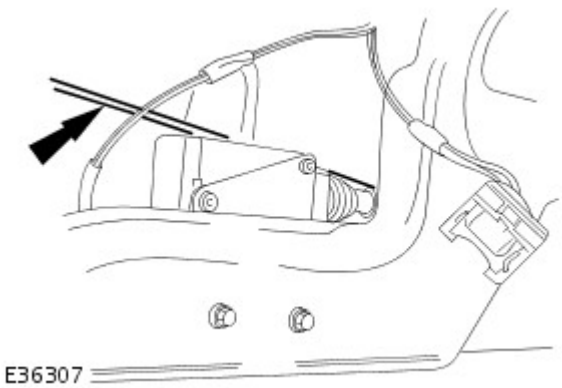
E36306

7. Disconnect lock barrel link rod.



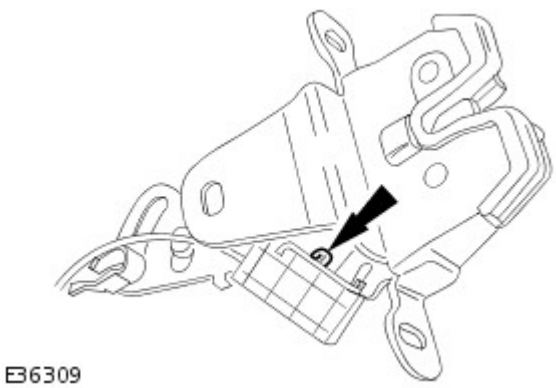
E36308

8. Disconnect lock motor link rod.



E36307

9. Withdraw lock assembly from trunk , release trunk open switch retaining tang and remove switch from lock assembly.



E36309

Installation

1. Fit and fully seat trunk open switch to lock assembly.

2. Position lock assembly in trunk and connect lock barrel and

lock motor link rods.

3. Fit and tighten lock assembly securing bolt.

4. Connect lock switch multiplug and install in mounting clip.

5. Reposition trunk lid liner and secure with new fasteners.

6. Position lock finisher and fit and tighten securing bolts.

7. Fit and fully seat covers over finisher securing bolts.

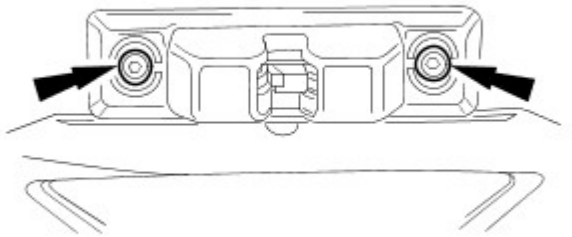
8. Fit trunk light. Refer to 86.45.16.

Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid Latch Actuator

Removal and Installation

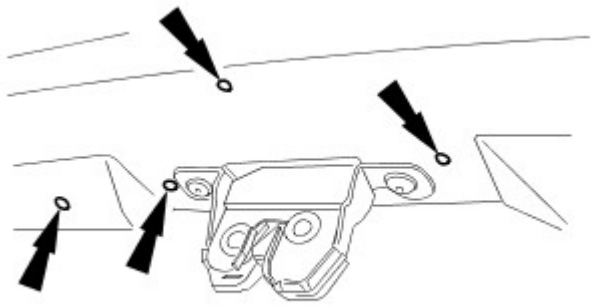
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove trunk lamp assemblies. Refer to 86.45.16.
3. Remove covers from trunk latch finisher securing bolts and slacken and remove bolts.



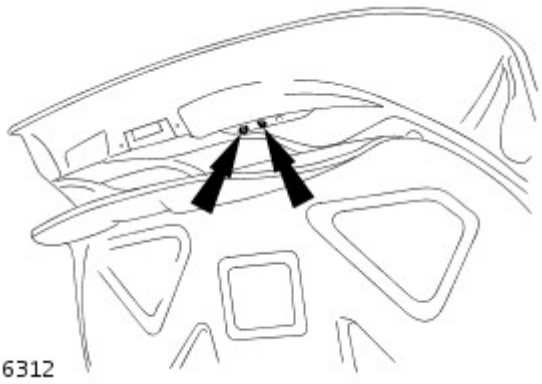
E36304

4. Remove trunk latch finisher.
5. Remove and discard sufficient trunk lid liner fasteners to permit access to motor.



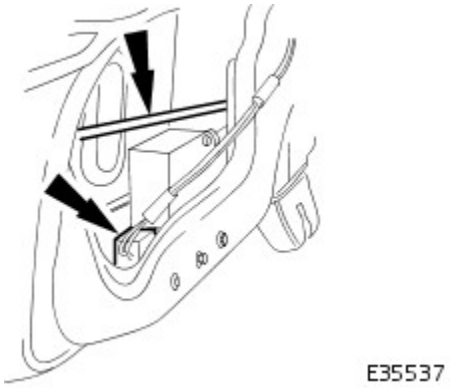
E36310

6. Positioning the trunk lid liner for access, slacken and remove the lock motor mounting bracket securing bolts.



E36312

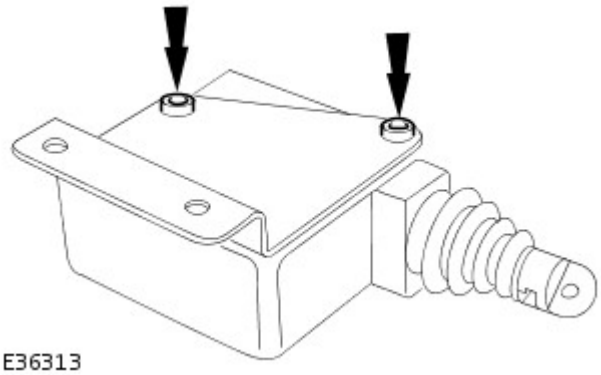
7. Position and support lock motor for access and disconnect harness multiplug and lock link rod.



E35537

8. Remove motor and bracket assembly from trunk lid

9. Slacken and remove bolts securing lock motor to mounting bracket and separate motor from bracket.



E36313

Installation

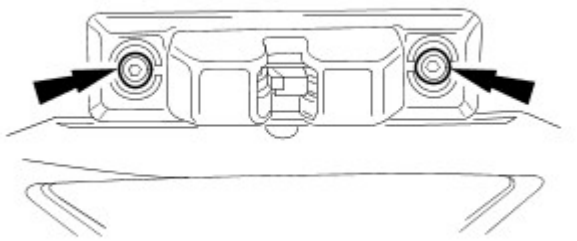
1. Position motor on mounting bracket and fit and tighten securing bolts.
2. Position motor/bracket assembly in trunk lid and connect lock link rod and harness multiplug.
3. Finally position motor/bracket assembly in trunk lid and fit and tighten securing bolts.
4. Position trunk lid liner and fit and fully seat new fasteners.
5. Position finisher over trunk lock.
6. Fit and tighten finisher securing bolts and fit bolt covers..
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid Release Switch

Removal and Installation

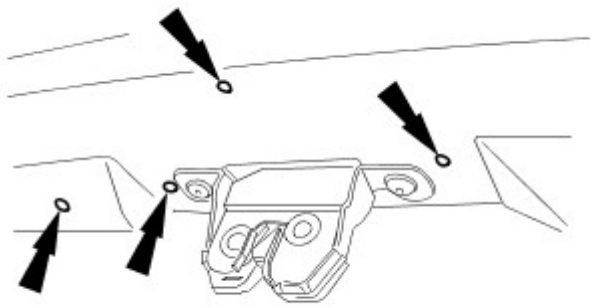
Removal

1. Remove trunk lamp assemblies. Refer to 86.45.16.
2. Remove covers from the two trunk latch finisher securing bolts and slacken and remove bolts.



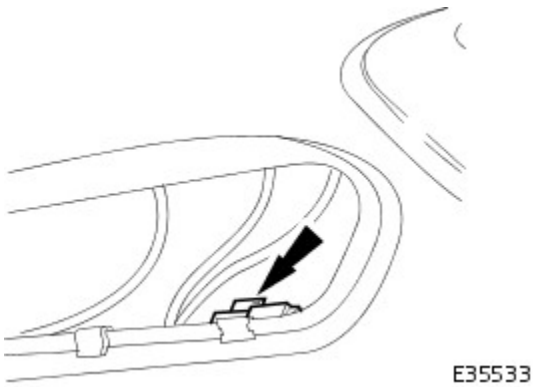
E36304

3. Remove latch finisher from trunk.
4. Remove and discard the four fasteners securing rear of trunk lid liner and position liner for access.



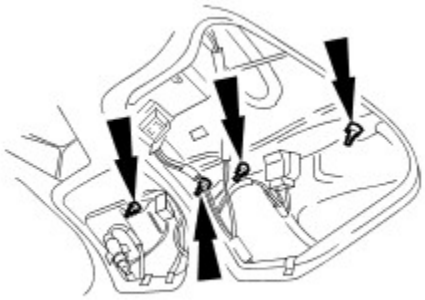
E36289

5. Release trunk release button harness connector from retaining clip and disconnect connector.

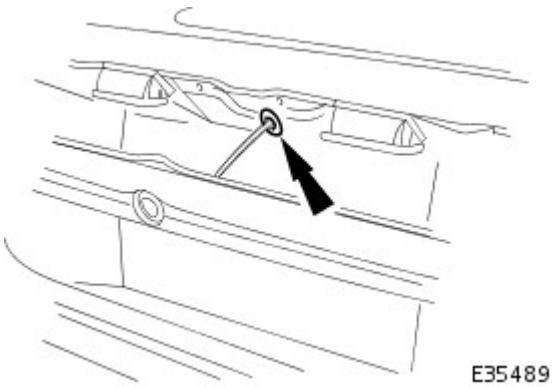


E35533

6. Slacken and remove the trunk upper trim finisher securing nuts.

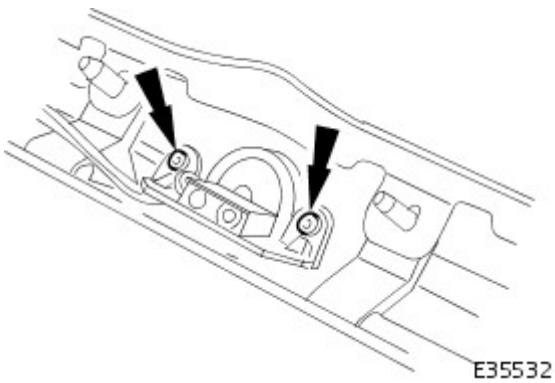


E35534



E35489

7. Position upper trim finisher for access and withdraw release button harness grommet from trunk lid aperture.



E35532

8. Position upper trim finisher for access and slacken and remove release button securing screws.

9. Withdraw release button assembly from trim finisher.

Installation

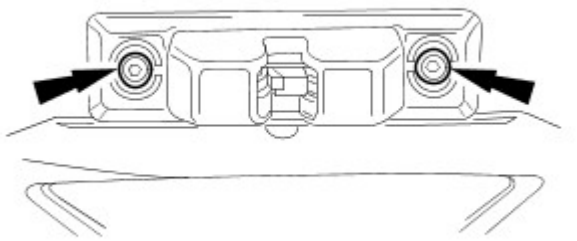
1. Position trunk release button assembly on trim finisher and install securing screws.
2. Position trim finisher/release button assembly at trunk lid and route harness through lid aperture.
3. Position grommet over harness and install in trunk lid aperture.
4. Position trim finisher/release button assembly on trunk lid and install securing nuts.
5. Connect release button harness connector and install on retaining clip.
6. Reposition rear of trunk lid liner and secure with new fasteners.
7. Position lock finisher and install securing bolts.
8. Install covers over finisher securing bolts.
9. Install trunk lights. Refer to 86.45.16.

Handles, Locks, Latches and Entry Systems - Luggage Compartment Lid Warning Indicator Switch

Removal and Installation

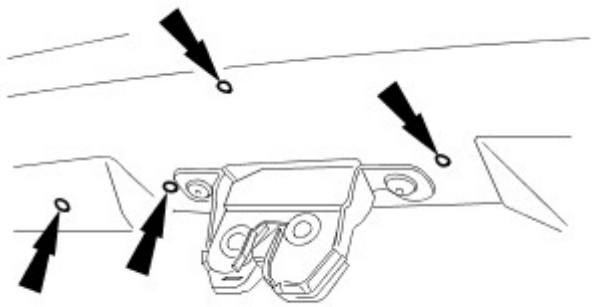
Removal

1. Remove trunk lamp assemblies. Refer to 86.45.16.
2. Remove covers from the two trunk latch finisher securing bolts and slacken and remove securing bolts.



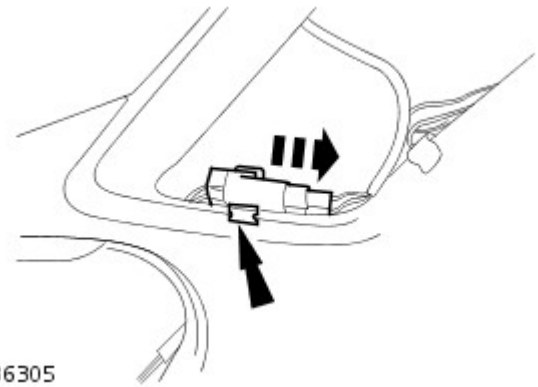
E36304

3. Remove latch finisher from trunk.
4. Release and discard the four trunk lid liner rear fasteners and position liner for access.



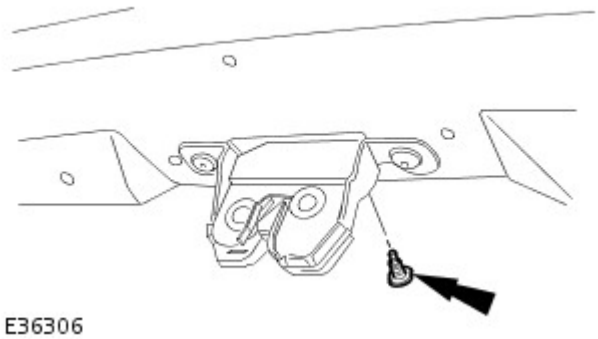
E36289

5. Release trunk open switch multiplug from retaining clip and disconnect multiplug.



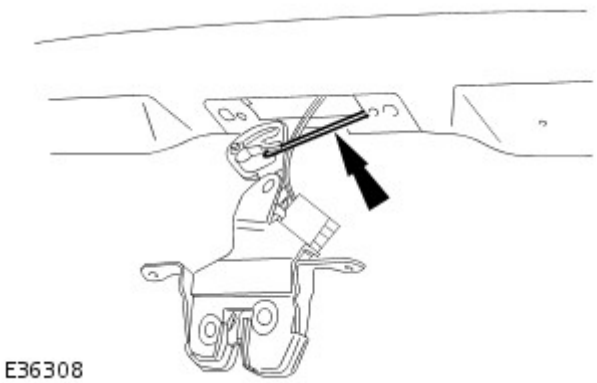
E36305

6. Remove the latch assembly securing bolt.



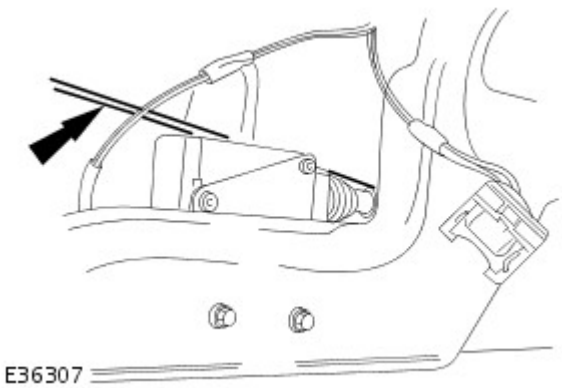
E36306

7. Disconnect lock barrel link rod.



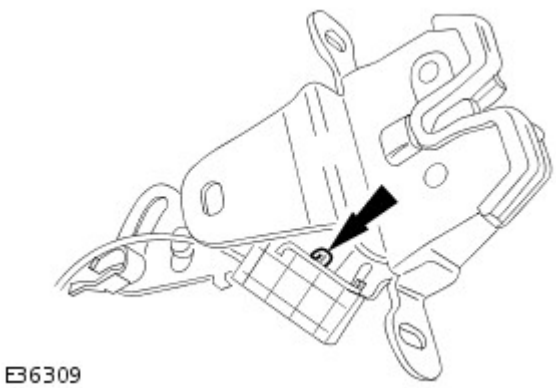
E36308

8. Disconnect lock motor link rod.



E36307

9. Withdraw lock assembly from trunk , release trunk open switch retaining tang and remove switch from lock assembly.



E36309

Installation

1. Install and fully seat trunk open switch to lock assembly.

2. Position lock assembly in trunk and connect lock barrel and

lock motor link rods.

3. Install lock assembly securing bolt.

4. Connect lock switch multiplug and install on mounting clip.

5. Reposition trunk lid liner and secure with new fasteners.

6. Position lock finisher and install securing bolts.

7. Install covers over finisher securing bolts.

8. Install trunk light. Refer to 86.45.16.

Handles, Locks, Latches and Entry Systems - Exterior Passenger Door Handle

Removal and Installation

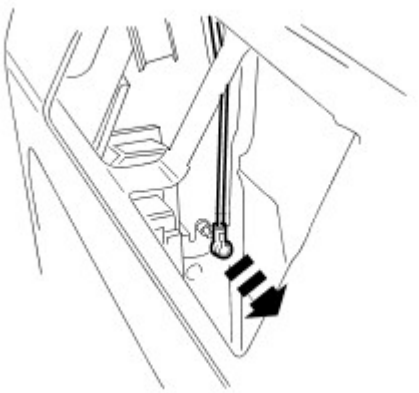
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove door casing veneer panel. Refer to 76.47.11.
3. Remove door casing for access. Refer to 76.34.01.
4. Feeding electrical harness through water shedder, carefully peel shedder from door and place adhesive face down on a clean dry polythene sheet.



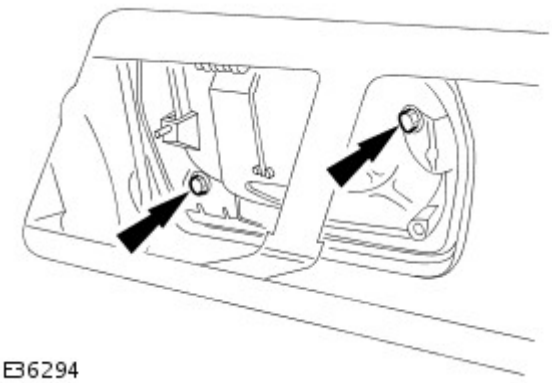
E36273

5. Position PVC inner sheet for access.
6. Disconnect door handle operating link rod from lock assembly.



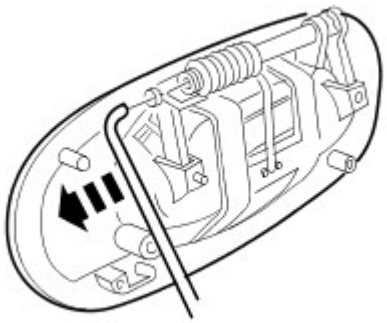
E36293

7. Slacken and remove the two handle mounting bracket securing bolts and remove bracket from door.



E36294

8. Withdraw handle assembly from door and remove link rod from handle.



E36295

Installation

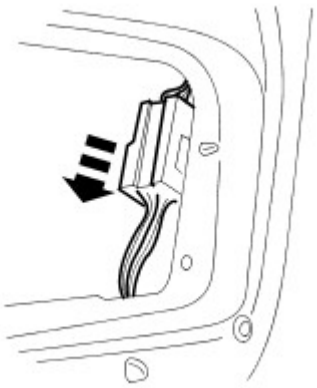
1. Fit link rod to door handle.
2. Position handle assembly on door.
3. Position mounting bracket on inside of door and connect lock link rod.
4. Fit and tighten mounting bracket securing bolts.
5. Reposition PVC inner sheet in door.
6. Check for satisfactory door handle operation.
7. Connect ground cable to battery terminal. Refer to 86.15.15.
8. Check for satisfactory operation of locking system.
9. Disconnect ground cable from battery terminal. Refer to 86.15.15.
10. Ensure that water shedder contact area of door is clean and dry.
11. Position water shedder at door and carefully pass harness through.
12. Fit and firmly seat water shedder on door ensuring satisfactory adhesion.
13. Fit door casing. Refer to 76.34.01.
14. Fit door casing veneer panel. Refer to 76.47.11.
15. Fit ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Passenger Door Latch

Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove front door casing. Refer to 76.34.01.
3. Position water shedder for access and feed door harness through water shedder.
4. Carefully remove water shedder from door and place adhesive side down on a clean dry plastic sheet.
5. Release door lock actuator harness multiplug from mounting bracket and disconnect multiplug.



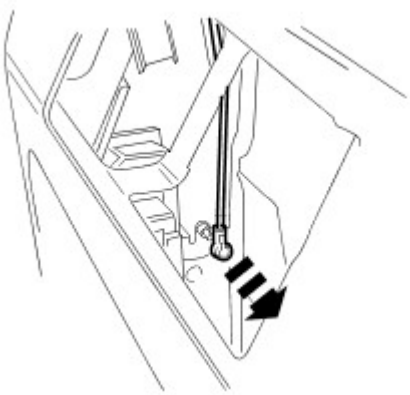
E36287

6. Position plastic inner sheet for access.
7. Disconnect outer door handle operating rod from lock mechanism.



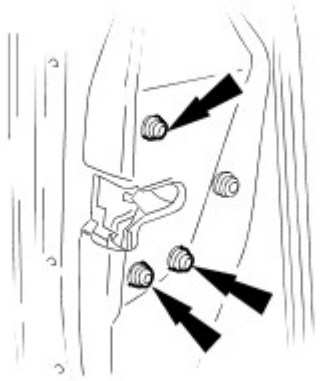
E36288

8. Disconnect inner door lock operating rod from lock mechanism and remove rod assembly.

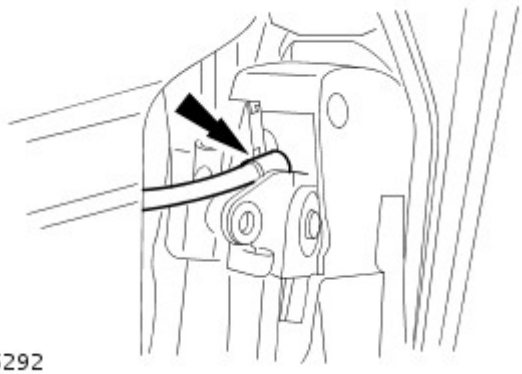


E36293

9. Slacken and remove the three lock securing bolts.



E36291



E36292

10. Remove lock assembly from door.

- Position lock assembly for access and remove operating cable rear abutment securing clip.
- Disconnect cable from lock assembly and remove lock from door.

Installation

1. Position lock assembly in door, connect remote cable and fit and fully seat securing clip.

2. Align lock assembly in door and fit and tighten the three securing bolts.

3. Position inner lock operating rod in door and connect rod to lock assembly.

4. Connect door outer handle operating rod to lock assembly.

5. Check for satisfactory door handle operation.

6. Reposition plastic inner sheet.

7. Connect lock actuator harness multiplug and fit multiplug to mounting bracket.

8. Connect ground cable to battery terminal. Refer to 86.15.15.

9. Check for satisfactory operation of locking system.

10. Disconnect ground cable from battery terminal. Refer to 86.15.15.

11. Position water shedder at door and pass door harness through water shedder.

12. Fit and firmly seat water shedder on door ensuring satisfactory adhesion.

13. Fit door casing. Refer to 76.34.01

14. Connect ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Exterior Rear Door Handle

Removal and Installation

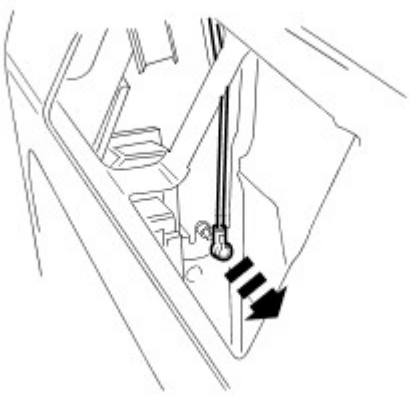
Removal

1. Remove battery cover and disconnect earth cable from battery terminal. Refer to 86.15.19.
2. Remove rear door casing. Refer to 76.34.04.
3. Carefully withdraw water shedder passing harness through it and remove water shedder from door.



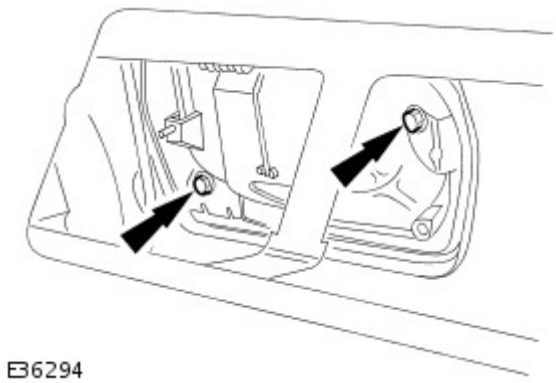
E36273

4. Place water shedder adhesive face down on clean dry plastic sheet.
5. Disconnect door handle operating link from lock assembly.



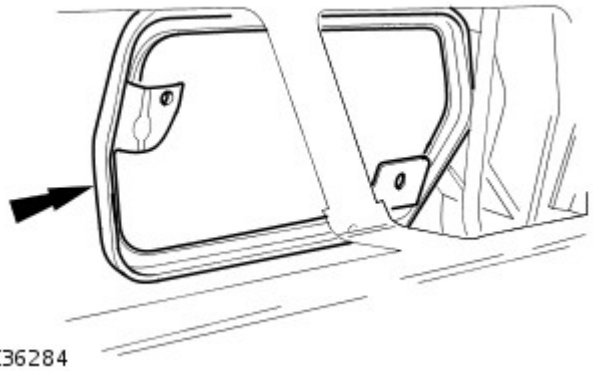
E36293

6. Firmly holding door handle, slacken and remove the two securing bolts.



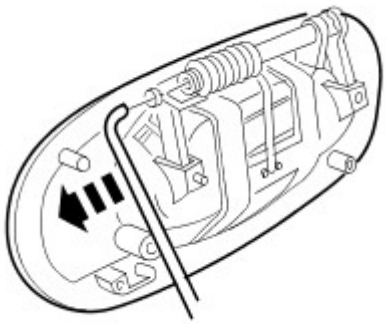
E36294

7. Withdraw handle mounting bracket from door interior and remove handle from door.



E36284

8. Remove lock link rod from door handle assembly.



E36295

Installation

1. Fit link rod to handle assembly.

2. Position handle assembly on door.

3. Position mounting bracket on inside of door and connect lock link rod.

4. Fit and tighten mounting bracket securing bolts.

5. Reposition PVC inner sheet in door.

6. Check for satisfactory door handle operation.

7. Connect ground cable to battery terminal. Refer to 86.15.15.

8. From driver door check for satisfactory operation of locking system.

9. Disconnect ground cable from battery terminal. Refer to 86.15.15.

10. Ensure that water shedder contact area of door is clean and dry.

11. Position water shedder at door and carefully pass harness through.

12. Fit and firmly seat water shedder on door ensuring satisfactory adhesion.

13. Fit door casing. Refer to 76.34.01.

14. Fit door casing veneer panel. Refer to 76.47.11.

15. Fit ground cable to battery terminal and fit cover to battery. Refer to 86.15.15.

Handles, Locks, Latches and Entry Systems - Rear Door Latch

Removal and Installation

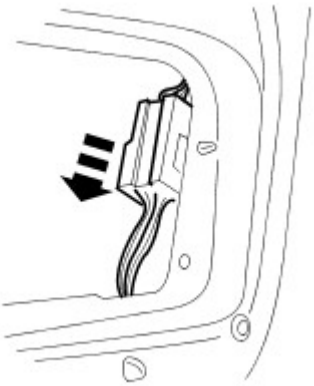
Removal

1. Remove battery cover and disconnect earth cable from battery terminal. Refer to 86.15.19.
2. Remove rear door casing veneer panel. Refer to 76.47.12.
3. Remove rear door casing. Refer to 76.34.04.
4. Carefully withdraw water shedder passing harness through it and remove water shedder from door.



E36273

5. Place water shedder adhesive face down on clean dry plastic sheet.
6. Release door lock actuator harness multiplug from mounting bracket and disconnect multiplug.



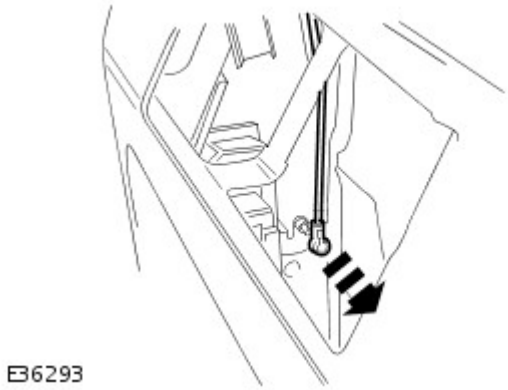
E36287

7. Position PVC inner sheet for access and disconnect door outer handle operating rod from lock mechanism.



E36288

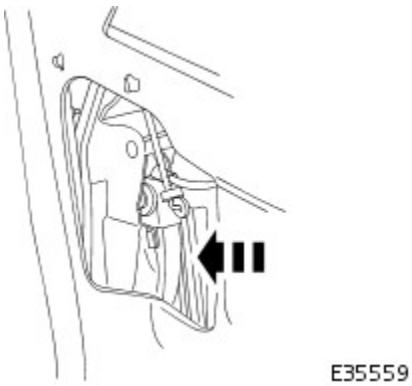
8. Disconnect inner door lock operating rod from lock mechanism and remove rod assembly.



E36293

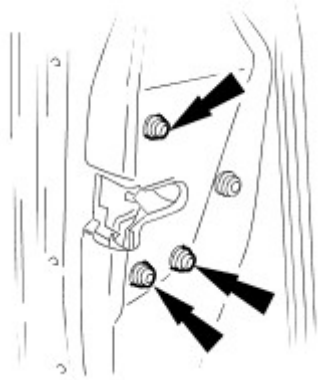
9. Remove door inner cheater finisher.

10. Slacken and remove the door glass guide securing bolts and position guide for access.



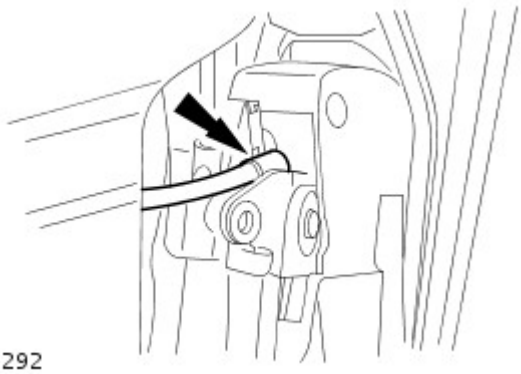
E35559

11. Slacken and remove lock mechanism securing bolts.



E36291

12. Carefully withdraw lock mechanism from door, remove cable rear abutment clip and disconnect cable.



E36292

13. Remove lock mechanism from vehicle.

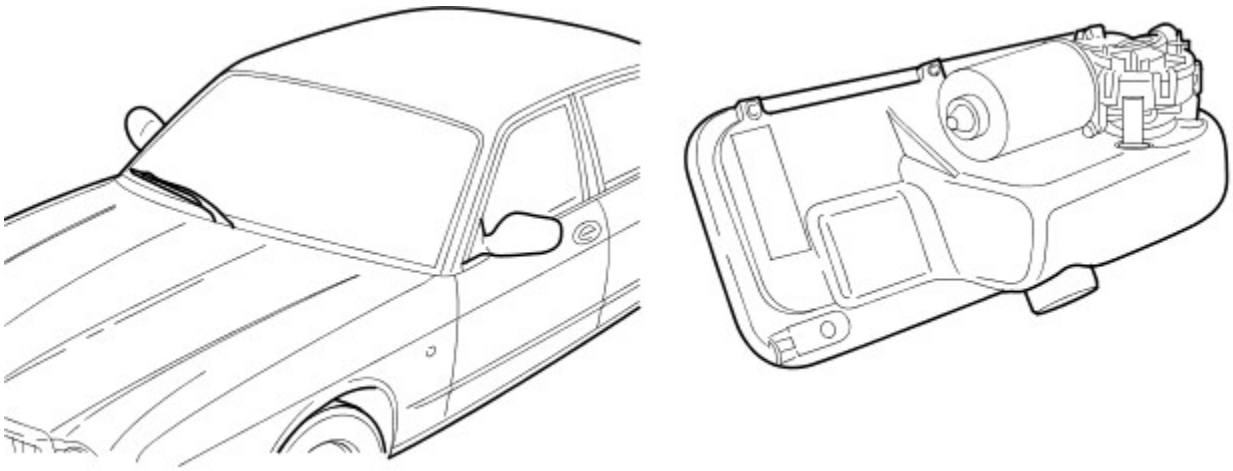
Installation

1. Position lock mechanism at door and connect operating cable.
2. Fit and fully seat cable rear abutment securing clip.
3. Fit and fully seat lock mechanism in door and fit and tighten securing bolts.
4. Align glass guide and fit and tighten securing bolts.
5. Fit and fully seat inner cheater finisher.
6. Align and connect inner operating rod to lock mechanism.
7. Fit outer door handle operating rod to lock
8. Check for satisfactory door handle operation.
9. Reposition inner plastic sheet.
10. Connect lock actuator harness multiplug and fit to mounting bracket.
11. Connect ground cable to battery terminal. Refer to 86.15.15.
12. From driver door, check for satisfactory operation of locking system.
13. Disconnect ground cable from battery terminal. Refer to 86.15.19.
14. Ensure that water shedder contact area of door is clean and dry.
15. Position water shedder at door and carefully pass door harness through.
16. Fit and firmly seat water shedder on door ensuring satifactory adhesion.
17. Fit door casing. Refer to 76.34.04.
18. Fit door casing veneer panel. Refer to 76.47.12.
19. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Wipers and Washers - Wipers and Washers

Description and Operation

Windshield Wiper

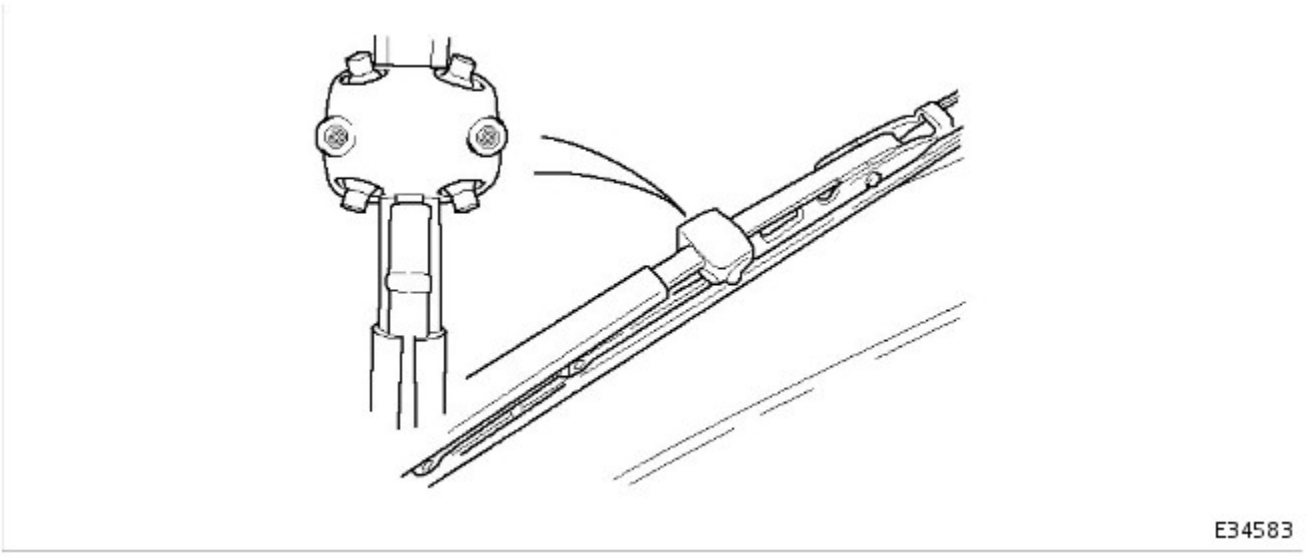


E35796

The single wiper system is driven via a short linkage, by an electric motor installed in (external on later models) a moulded plastic weatherproof housing off the plenum wet area. The motor and housing are secured to the BIW bulkhead by three bolts at the top and three screws (two on later models) with locking clips at the bottom. The complete assembly is handed for left or right hand drive installation.

The windshield wiper is operated via the RH control column stalk switch. Operating modes are normal, high speed, flick wipe and six settings of intermittent operation with delays ranging from 2 to 20 seconds.

Windshield Washer



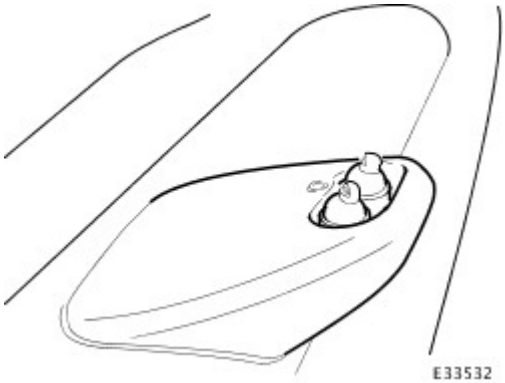
E34583

The windshield washer is of wiper arm mounted running jet configuration. The jet assembly comprises two conventional nozzles plus four nozzles of silicone rubber 'duckbill' design. If the system is initially operated at low ambient temperatures, the 'duckbill' nozzles permit any frozen residual washer fluid to be ejected under pump pressure. The washer jet feed tube supplied assembled to the wiper arm, fits at its lower end onto a central connector on the plenum cover. Washer fluid is conveyed by a rubber tube, from the washer pump to the jet assembly via a manifold on the underside of the plenum cover. The windshield washer pump is installed on the rear face of the washer fluid reservoir. The 6.3 liter washer reservoir is installed on the RH side of the vehicle in a cavity formed by the front bumper, the front wheel arch liner and the brake

cooling duct.

The windshield washer is operated by pressing the button at the end of the wiper control stalk switch. Pressing and releasing the button operates the washer for 1 to 1.4 seconds and the wiper completes three sweeps. An optional drip wipe function adds a further sweep of the wiper after a 4 second delay, to clear residual fluid from the windshield. If the button is held depressed, the washer and wiper will operate continuously for up to 20 seconds. When the button is released, the wiper will again complete three further sweeps.

Headlamp Powerwash



The headlamp powerwash system incorporates a chromed twin nozzle assembly mounted on the chromed bumper blade immediately in front of each pair of headlamps. Each nozzle assembly is connected via snap fittings to a powerwash pump mounted adjacent to the windshield wash pump on the rear face of the washer fluid reservoir.The powerwash system operates in conjunction with the windshield washers when the ignition switch is in position II and the headlamp switch is in the dip or main beam position. When powerwash is initially activated, a wash cycle commences, consisting of two 400 ms pulses separated by a three second delay. If powerwash is still selected on completion of this cycle, it will continue to operate at the same frequency for a maximum period of 20 seconds. To conserve washer fluid, headlamp powerwash will only function on every sixth operation of the windshield wash switch.When the 'WASHER FLUID LOW' message is illuminated, the windshield washer will continue to operate for a limited period but the headlamp powerwash will not function until the fluid level is restored.

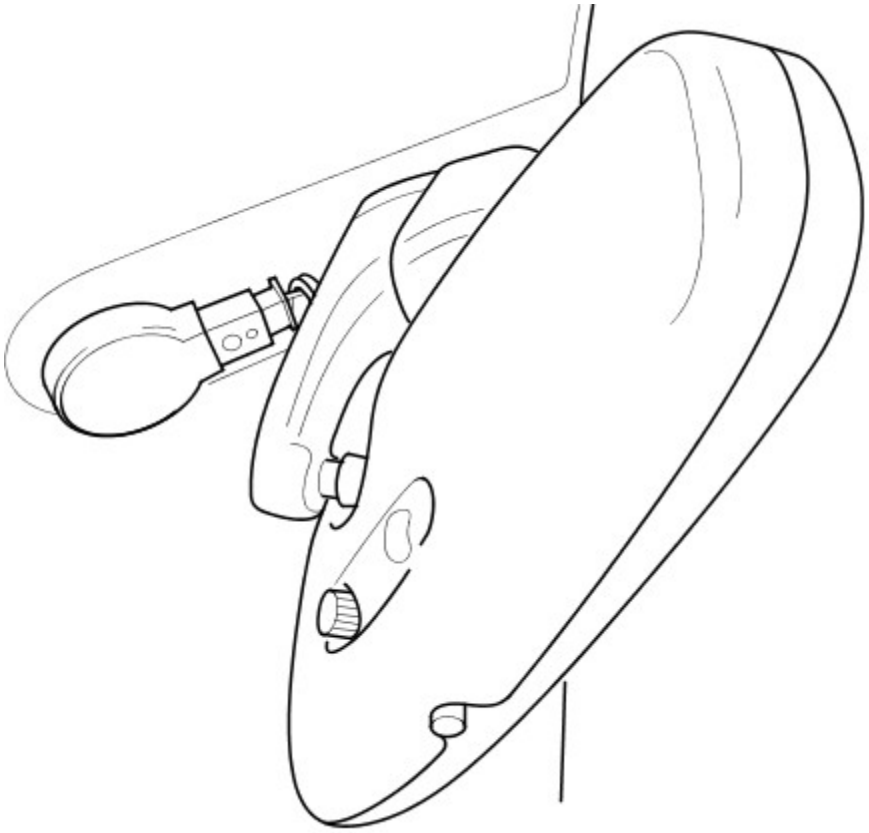
Rain Sensing System

The rain sensing system installed form some markets, provides automatic wiper operation when rain is detected on the windshield. The system detects differing levels of rainfall and varies wiper operation ranging from intermittent to maximum continuous, to suit prevailing requirements.

The system which is brought into operation by selecting AUTO on the wiper control switch bezel, does not preclude normal manual control of wiper operation.

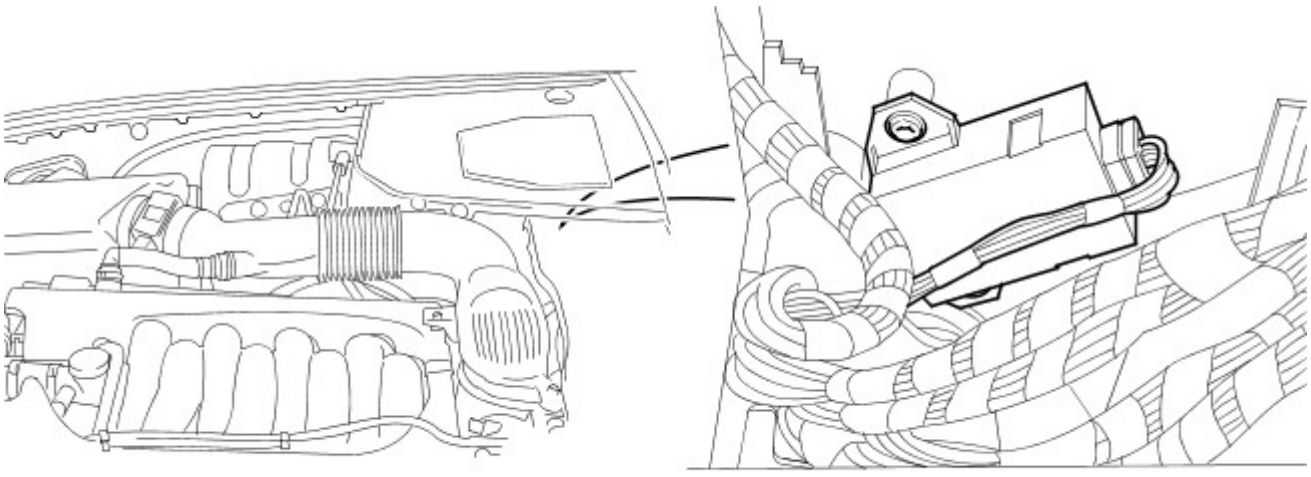
The system consists of a rain sensor, an electronic control module and a dedicated wiper control switch.

The rain sensor is an optical transducer that is sensitive to changes in infra-red light penetration of the windshield created by the refractive effects of water droplets. The sensor elements consist of two groups of light emitting diodes which alternately project infra-red light onto the windshield and a photo-diode that receives resulting reflections from the glass. All of the infra-red light is reflected back from a moisture-free windshield, resulting in a contact 5V output signal from the sensor and no wiper activation. Rain falling on the light sensing area of the windshield results in refraction and diffusion of a proportion of the projected light with a corresponding imbalance of light received by the photodiode. This results in pulsed outputs from the sensor, the frequency and duration of which are directly proportional to the number and size of water droplets respectively. These pulses together with wiper switch position signals are received by the sensor control module and processed to mimic column switch gear operation. In this recognisable form, signals are input to the body processor module (BPM) where they are interpreted as normal wiper operation requests.



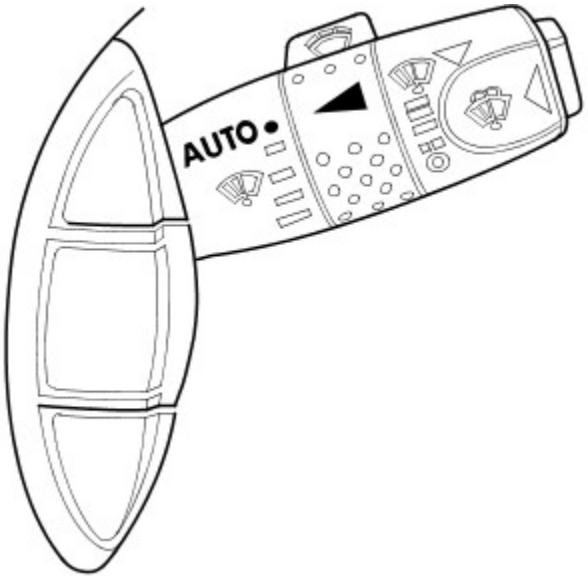
E36054

The rain sensor unit is installed on the inside of the windshield within the rear view mirror stem cover. The unit is secured to the glass by a special adhesive that facilitates service removal. When installing a rain sensor unit, it must be positioned in the clear circle within the obscuration band.



E34482

The rain sensor control module is a non-serviceable unit installed in the engine bay cool box and connected to the rain sensor unit and the body processor module.



E34479

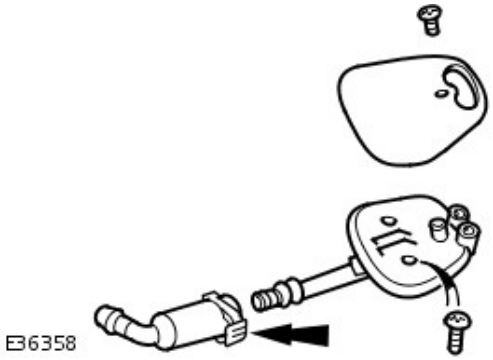
The column mounted wiper control stalk switch on vehicles with rain sensing installed, has an AUTO position (this replaces the first intermittent setting on non rain-sensing wiper controls), five intermittent settings, and normal, high speed and flick wipe positions.

Wipers and Washers - Headlamp Washer Jet

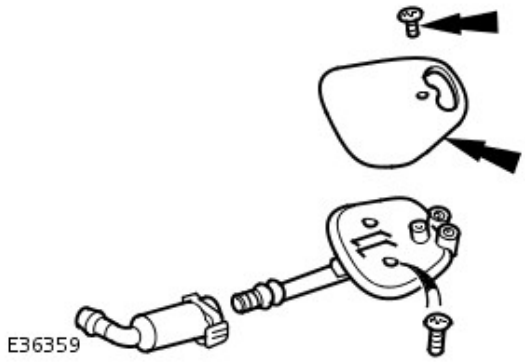
Removal and Installation

Removal

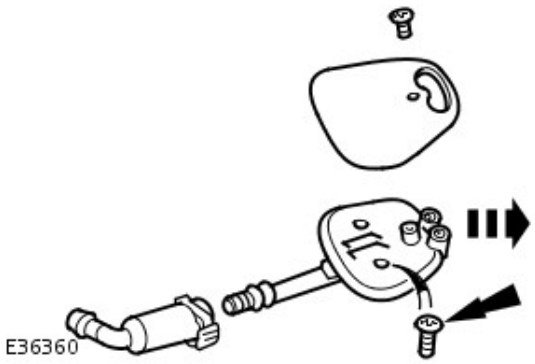
1. Raise front of vehicle and support on stands.
2. Remove RH front wheel.
3. Remove RH front wheelarch liner. Refer to Section 501-02.
4. Remove and discard plastic clip from washer fluid hose and disconnect hose from rear of jet assembly.



5. Slacken and remove screw securing cover to jet assembly and remove cover.



6. Remove jet assembly from bumper.
    1. Slacken and remove screws securing jet assembly to bumper.
    2. Slide jet assembly forward and remove from bumper.



Installation

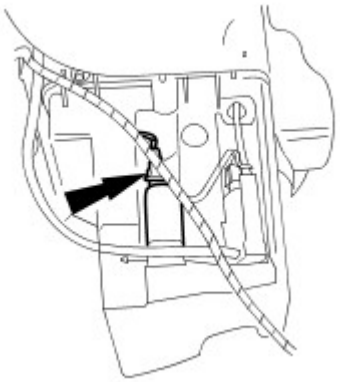
1. Position jet assembly in bumper and fit and tighten securing screws.
2. Fit cover over jet assembly and fit and tighten securing screw.
3. Connect hose onto rear of jet assembly and secure with new plastic clip.
4. Fit wheelarch liner. Refer to Section 501-02.
5. Fit road wheel.
6. Remove stands and lower vehicle onto wheels.

Wipers and Washers - Headlamp Washer Pump

Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Raise front of vehicle and support on stands.
3. Remove RH front wheel.
4. Remove RH wheelarch liner. Refer to Section 501-02.
5. Position a suitable drain receptacle under washer reservoir.
6. Supporting reservoir, carefully withdraw pump.
7. Allow fluid to drain from reservoir.
8. Disconnect pump hoses and harness multiplug.



E36357

9. Remove and discard pump to reservoir sealing washers. and clean surrounding area of reservoir.
10. Remove drain receptacle.

Installation

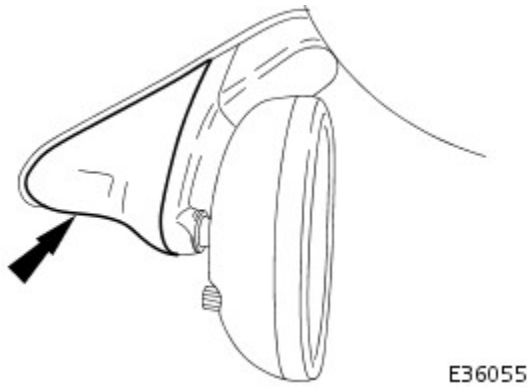
1. Fit and fully seat new sealing washers on reservoir.
2. Apply suitable lubricant to outer face of sealing washers.
3. Position pump at reservoir and press firmly into sealing washers ensuring that it is fully seated.
4. Connect hoses to pump and reservoir.
5. Open hood and refill washer reservoir with correct fluid.
6. Check that seals are free from leakage.
7. Close hood.
8. Connect harness multiplug to pump.
9. Fit wheelarch liner. Refer to Section 501-02.
10. Fit road wheel.
11. Remove stands and lower vehicle onto wheels.
12. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Wipers and Washers - Rain Sensor

Removal and Installation

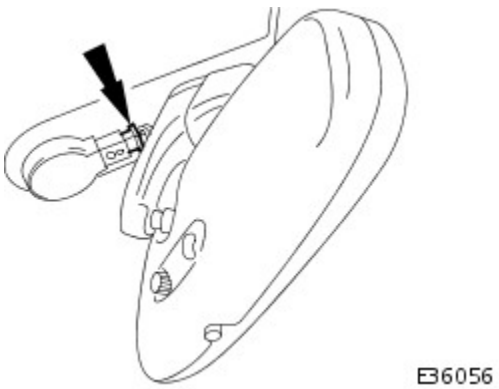
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove cover from rear view mirror base.



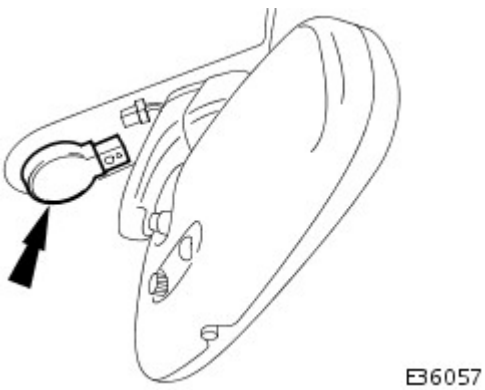
E36055

3. Disconnect flying lead from sensor unit connector.



E36056

4. Using a thin plastic blade, carefully remove sensor unit from windshield.



E36057

5. Using an approved solvent, remove residual adhesive from windshield.
6. If sensor is to be re-used, remove adhesive pad and clean base of unit using an approved solvent.

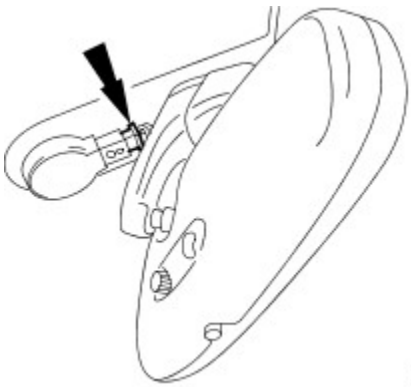
Installation

1. Install new adhesive pad.
   - Peel backing paper from one side of new adhesive pad.
   - Position pad correctly in clear area of obscuration band and press firmly to fully seat.

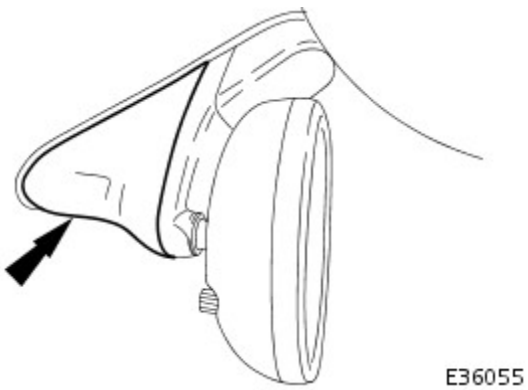
- Peel remaining backing paper from adhesive pad.


E36057

2. Ensuring sensor is correctly orientated, press firmly into position on adhesive pad.


E36056

3. Connect flying lead connector to sensor unit.


E36055

4. Install cover over sensor and mirror base ensuring tangs fully engage.

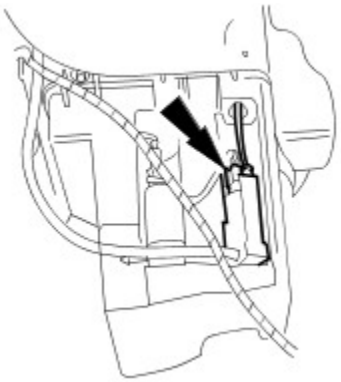
5. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.

Wipers and Washers - Windshield Washer Pump

Removal and Installation

Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Raise front of vehicle and support on stands.
3. Remove RH front wheel.
4. Remove RH wheelarch liner. Refer to Section 501-02.
5. Position a suitable drain receptacle under washer reservoir.
6. Supporting reservoir, carefully withdraw pump.
7. Allow fluid to drain from reservoir.
8. Disconnect pump hoses and harness multiplug.



E36356

9. Remove and discard pump to reservoir sealing washers. and clean surrounding area of reservoir.
10. Remove drain receptacle.

Installation

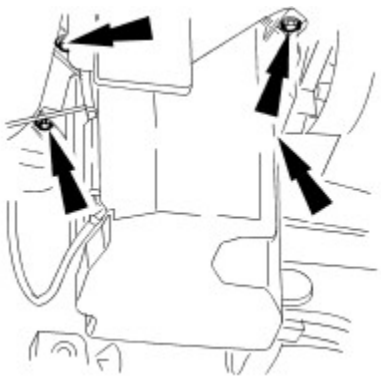
1. Fit and fully seat new sealing washers on reservoir.
2. Apply suitable lubricant to outer face of sealing washers.
3. Position pump at reservoir and press firmly into sealing washers ensuring that it is fully seated.
4. Connect hoses to pump and reservoir.
5. Open hood and refill washer reservoir with correct fluid.
6. Check that seals are free from leakage.
7. Close hood.
8. Connect harness multiplug to pump.
9. Fit wheelarch liner. Refer to Section 501-02.
10. Fit road wheel.
11. Remove stands and lower vehicle onto wheels.
12. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Wipers and Washers - Windshield Washer Reservoir

Removal and Installation

Removal

1. Open hood and fit fender cover.
2. Raise front of vehicle and support on stands.
3. Remove RH front wheel.
4. Remove RH front wheel arch liner. Refer to Section 501-02.
5. Remove front undertray. Refer to Section 501-02.
6. Remove windshield washer and headlamp powerwash pumps from reservoir. Refer to operations in this section.
7. Disconnect Low Level indicator multiplug. Refer to operations in this section.
8. Carefully remove filler cap from reservoir filler neck.
9. Slacken and remove the four reservoir to BIW securing bolts remove reservoir from vehicle, guiding filler neck through BIW aperture



E36354

Installation

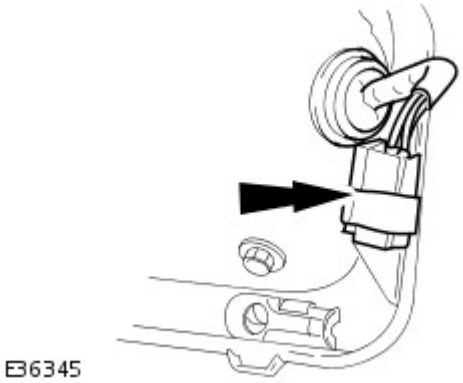
1. Position reservoir aligning with BIW holes and fit and tighten the four securing bolts.
2. Clean pump seal locations.
3. Fit and fully seat new windshield washer and powerwash pump sealing washers to reservoir apertures.
4. Apply suitable lubricant to sealing washers.
5. Fit windshield washer and powerwash pumps to reservoir. Refer to operations in this section.
6. Fill reservoir with correct fluid mixture.
7. Check that all seals are free from leakage.
8. Fit and fully seat filler cap on reservoir filler neck.
9. Fit RH front wheel arch liner. Refer to Section 501-02.
10. Fit front undertray. Refer to Section 501-02.
11. Fit front RH road wheel.
12. Raise front of vehicle, remove stands and lower vehicle onto wheels.
13. Remove fender cover and close hood.

Wipers and Washers - Windshield Wiper MotorVehicles Built Up To: 10/1997

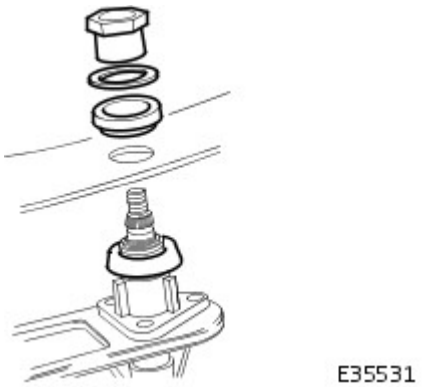
Removal and Installation

Removal

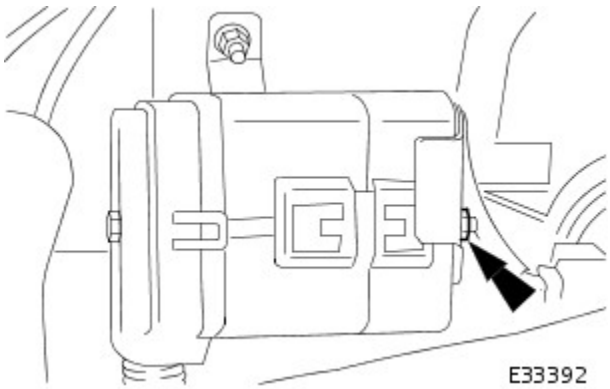
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove top covers from LH and RH bulkheads and rear of engine compartment. Refer to 76.11.33 and 76.11.35.
3. Remove wiper arm and blade assembly. Refer to 84.15.44.90.
4. Remove plenum cover. Refer to 76.10.01
5. Remove motor harness multiplug from clip, disconnect multiplug and position harness clear of clip.



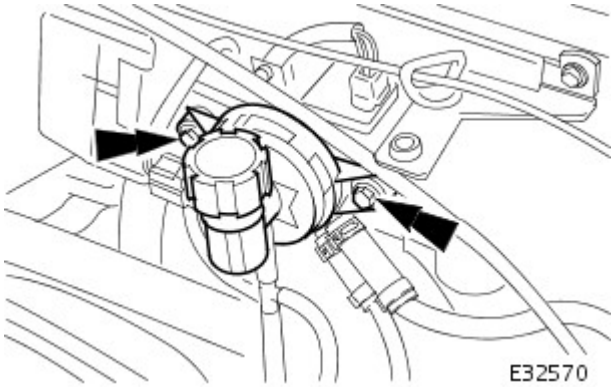
6. Slacken and remove nut securing wiper spindle to top of plenum, remove washer and seal and discard seal.



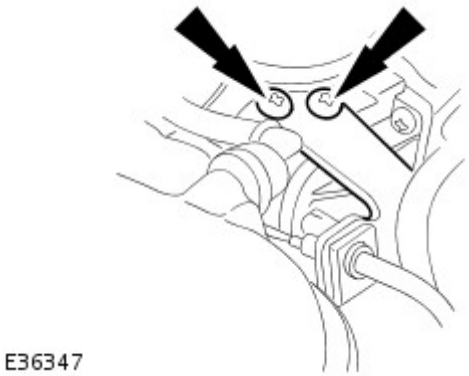
7. Slacken and remove nut securing engine harness main multiplug to mounting bracket and position multiplug for access.



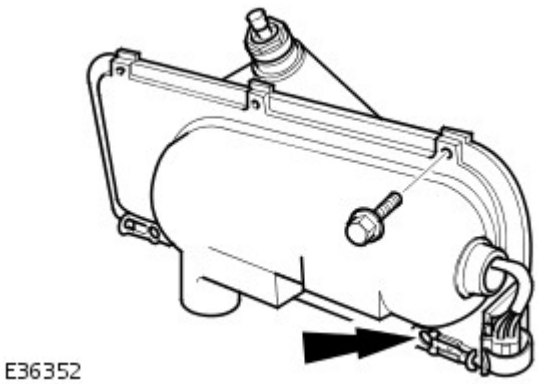
8. Slacken and remove two nuts and bolts securing purge valve mounting bracket to bulkhead and position assembly for access.



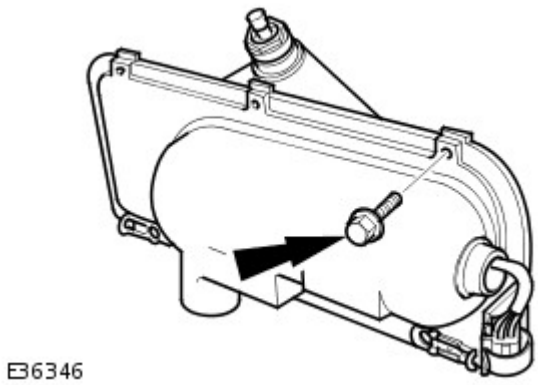
9. Slacken and remove two bolts securing throttle cable adjustment bracket to throttle body.



10. Release locking clips and slacken and remove the three screws securing bottom of motor housing to bulkhead.



11. Slacken and remove three bolts securing top of motor housing to bulkhead.



12. Holding the purge valve bracket and capillary clear, carefully withdraw housing complete with motor, and linkage assembly.

13. Remove and discard inner seal from motor spindle.

14. Slacken and remove two nuts and bolts securing motor to housing and remove motor.

Installation

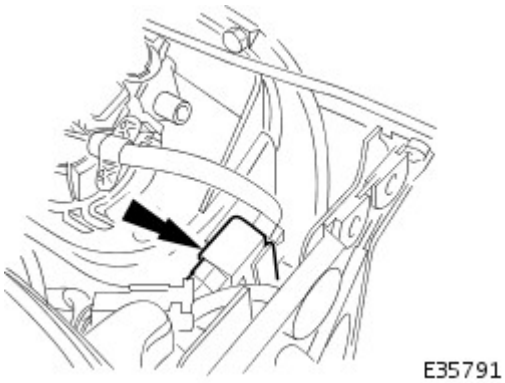
1. Position motor in housing and fit and tighten securing nuts and bolts.
2. Apply suitable lubricant to bore of new spindle inner seal and fit seal over motor spindle.
3. Holding the capillary and purge valve clear, position motor/housing assembly on bulkhead.
4. Seat motor spindle seal correctly in upper plenum aperture and ensure that housing locates on lower studs.
5. Fit and tighten the housing upper securing bolts.
6. Fit and tighten the housing lower securing screws and slide locking clips inwards.
7. Position throttle cable adjustment bracket on throttle body and fit and tighten securing bolts.
8. Position purge valve bracket at bulkhead and fit and tighten securing bolt and nuts.
9. Position engine harness multiplug on mounting bracket and fit and tighten securing nut.
10. Connect motor harness multiplug and locate in retaining clip.
11. Apply suitable lubricant to bore of new outer seal and fit with washer to motor spindle.
12. Fit and fully tighten collar nut on motor spindle.
13. Fit plenum cover. Refer to 76.10.01.
14. Fit wiper arm and blade. Refer to 84.15.44.90.
15. Fit top covers to LH and RH bulkheads and rear of engine compartment. refer to 76.11.33 and 76.11.35.
16. Fit ground cable to battery terminal and cover to battery. Refer to 86.15.15.

Wipers and Washers - Windshield Wiper MotorVehicles Built From: 10/1997

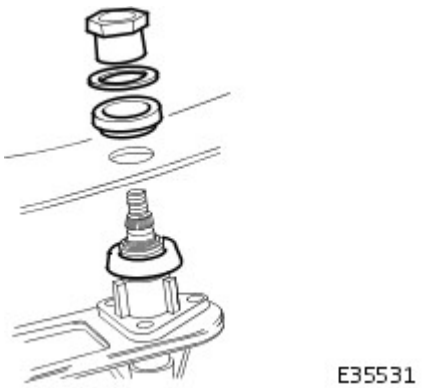
Removal and Installation

Removal

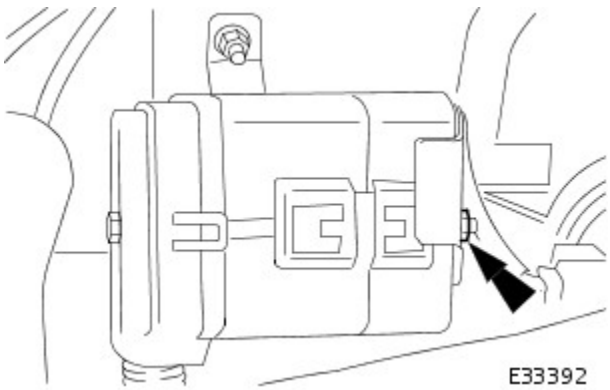
1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove top covers from LH and RH bulkheads and rear of engine compartment. Refer to 76.11.33 and 76.11.35.
3. Remove wiper arm and blade assembly. Refer to 84.15.44.90.
4. Remove plenum cover. Refer to 76.10.01
5. Remove motor harness multiplug from clip, disconnect multiplug and position harness clear of clip.



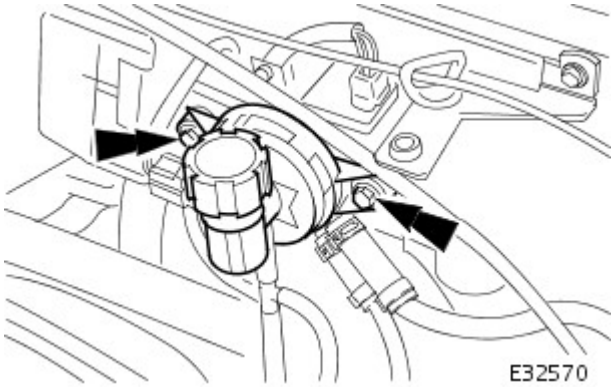
6. Slacken and remove nut securing wiper spindle to top of plenum, remove washer and seal and discard seal.



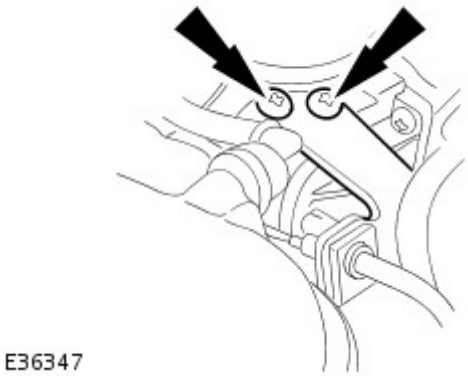
7. Slacken and remove nut securing engine harness main multiplug to mounting bracket and position multiplug for access.

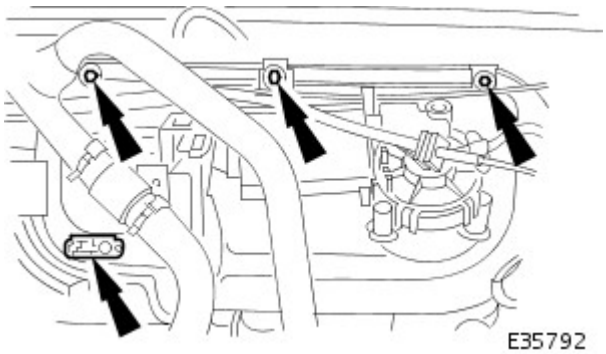


8. Slacken and remove two nuts and bolt securing purge valve mounting bracket to bulkhead and position assembly for access.



9. Slacken and remove two bolts securing throttle cable adjustment bracket to throttle body.





10. Release lower clips and slacken and remove the screws and upper bolts securing plenum closure panel/wiper motor assembly to BIW.

11. Guiding wiper spindle through BIW aperture, remove closure panel/wiper motor assembly from vehicle.

Installation

E35793

E35794

1. Ensure that closure panel rubber gasket is correctly seated.

2. Guiding wiper spindle through BIW aperture, position closure panel on plenum wall, swivelling motor/linkage assembly on rubber seat to achieve optimum spindle to BIW alignment.

3. Fit and tighten securing bolts and screws and slide retaining clips inwards to lock screws.

4. Position throttle cable adjustment bracket on throttle body and fit and tighten securing bolts.

5. Position purge valve bracket at bulkhead and fit and tighten securing bolt and nuts.

6. Position engine harness multiplug on mounting bracket and fit and tighten securing nut.

7. Connect motor harness multiplug and locate in retaining clip.

8. Apply suitable lubricant to bore of new outer seal and fit with washer to motor spindle.

9. Fit and fully tighten collar nut on motor spindle.

10. Fit plenum cover. Refer to 76.10.01.

11. Fit wiper arm and blade. Refer to 84.15.44.90.

12. Fit top covers to LH and RH bulkheads and rear of engine compartment. refer to 76.11.33 and 76.11.35.

13. Fit ground cable to battery terminal and cover to battery. Refer to 86.15.15.

Wipers and Washers - Windshield Wiper / Washer Switch

Removal and Installation

Removal

1. Ensure that steering wheel is in the straight ahead, fully lowered and fully extended position.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. WARNINGS:

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG MODULE.

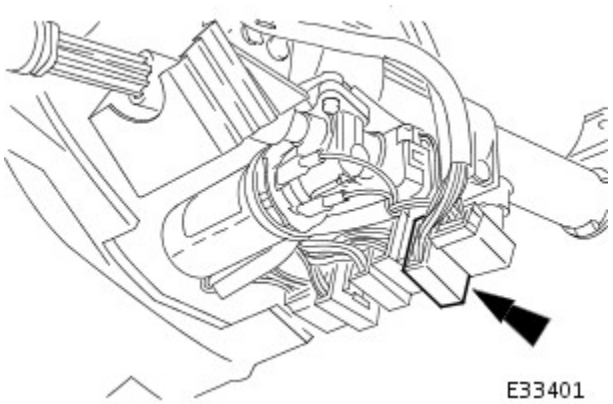
FOLLOWING TEN YEARS IN SERVICE, AN AIR BAG MODULE MUST BE REMOVED AND DISPOSED OF IN THE APPROVED MANNER, AND A NEW AIR BAG MUST BE FITTED.

AIR BAGS CONTAIN A CHEMICAL IRRITANT. IF AN AIR BAG IS RENEWED, THE ORIGINAL UNIT MUST BE DISPOSED OF IN ACCORDANCE WITH CURRENT SAFETY PROCEDURES.

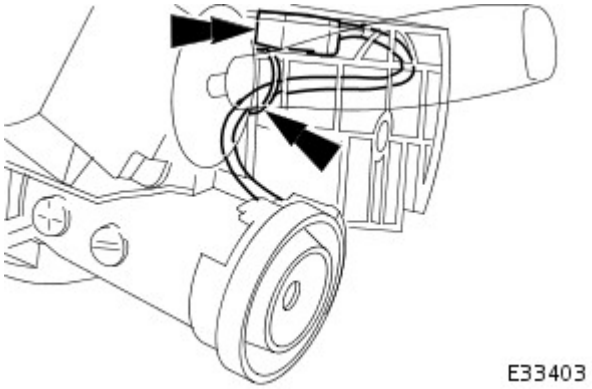
IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.

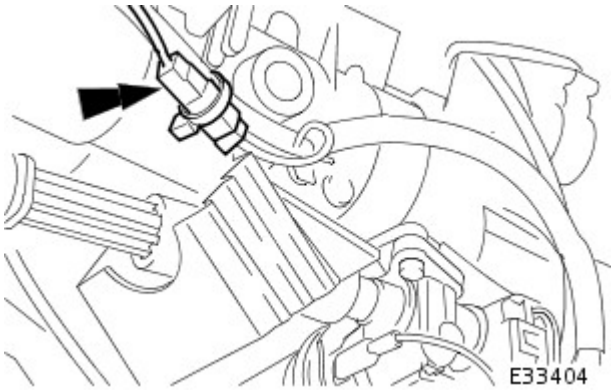
Remove driver airbag. Refer to 76.73.39.

4. Remove steering wheel.
5. Remove steering column lower cowl. Refer to 76.46.03.
6. Remove steering column upper cowl. Refer to 76.46.02.
7. Remove driver side underscuttle. Refer to 76.46.11.
8. Release wipe/washer switch multiplug from retaining bracket and disconnect multiplug.

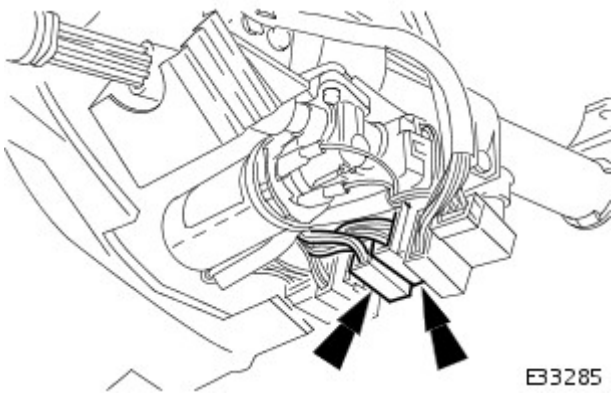


9. Sever and discard tie straps securing key transponder exciter coil multiplug to harness and disconnect multiplug.

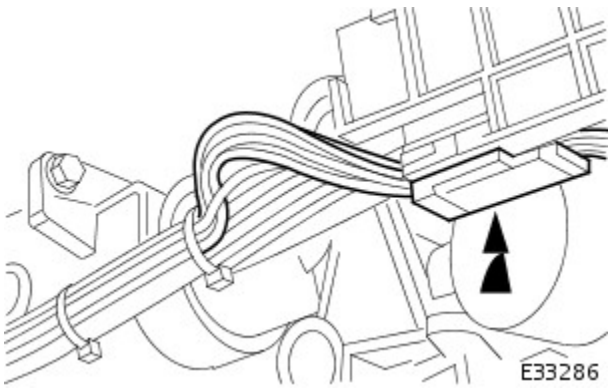




10. Disconnect key interlock solenoid harness multiplug.

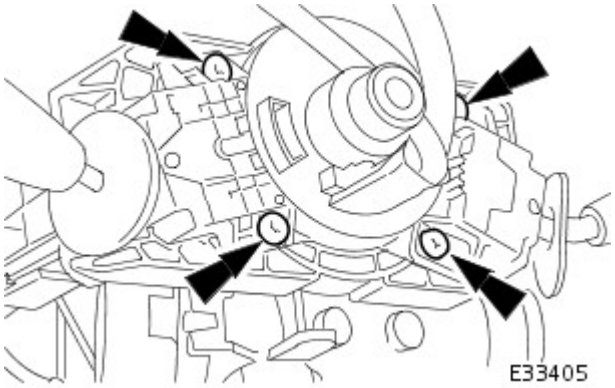


11. Release flasher/lamp/trip switch harness multiplugs from retaining bracket and disconnect multiplugs.

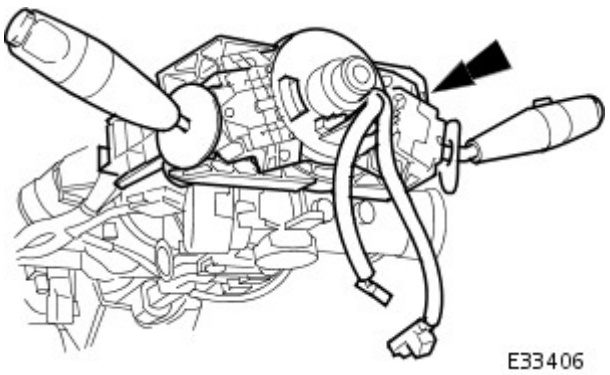


12. Disconnect cancellation module harness multiplugs.

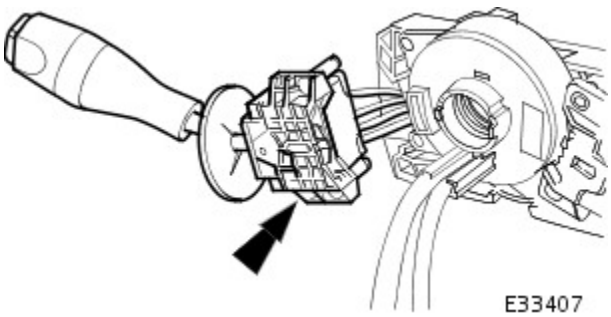
13. Slacken and remove bolts securing switch assemblies/cancellation module to column.



14. Remove steering column switchgear assembly for access.

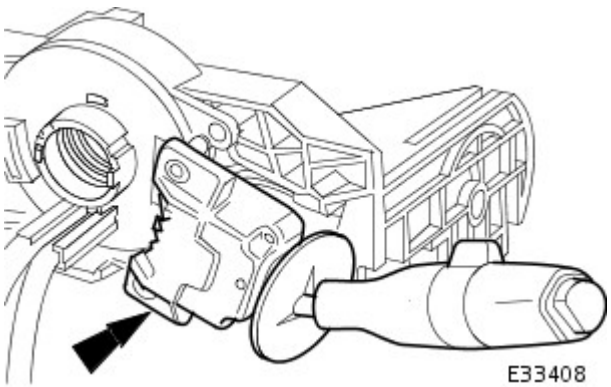


15. Remove flasher/lamp/trip switch assembly from switchgear bracket.

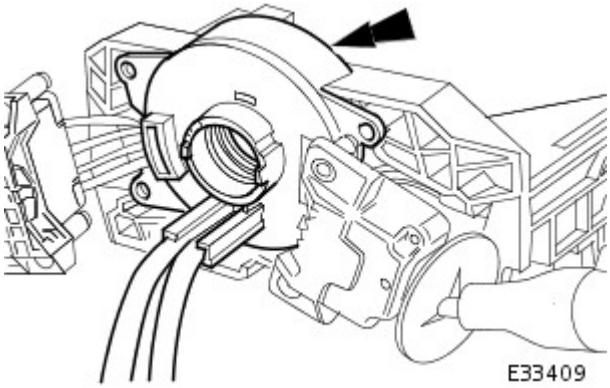


16. NOTE: Due to soldered connections, it is not possible to remove wiper/washer switch at this stage.

Release windshield wiper/washer switch from switchgear bracket and position for access.



17. Remove cancellation module from mounting bracket.



18. Remove windshield wiper/washer switch/mounting bracket/audible warning speaker assembly from vehicle.

Installation

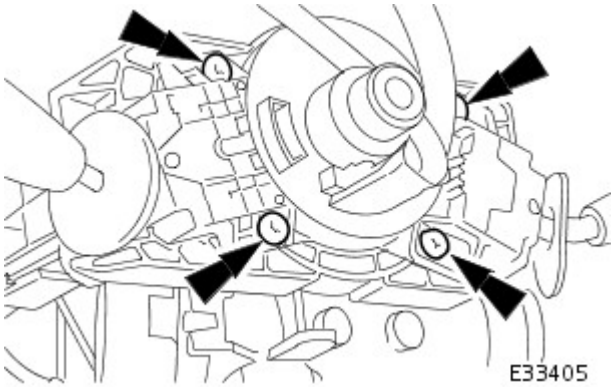
1. Position windshield wiper/washer switch/mounting bracket/audible warning speaker assembly for access in vehicle.

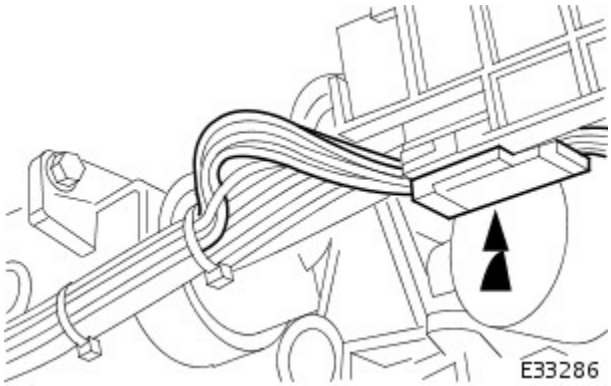
2. Fit cancellation module to mounting bracket.

3. Fit wiper/washer switch to cancellation module/mounting bracket.

4. Fit flasher/lamp/trip switch to cancellation module/mounting bracket.

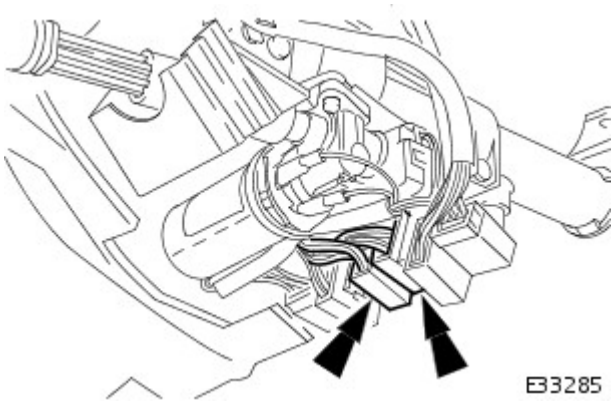
5. Position switchgear assembly on steering column and fit and tighten securing bolts.

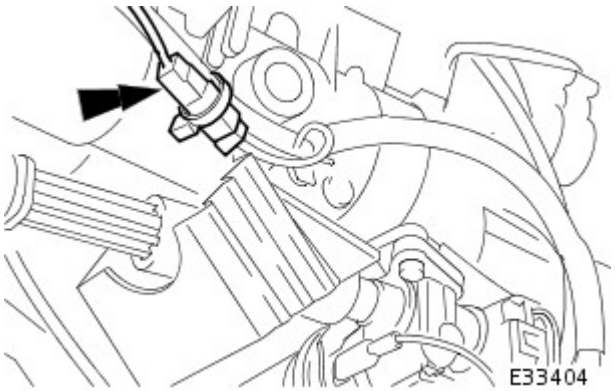




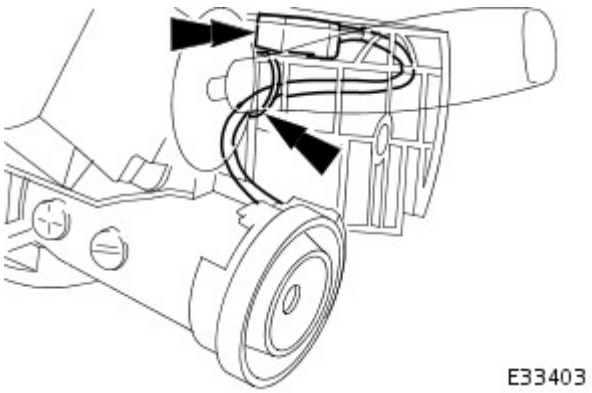
6. Connect cancellation module harness multiplugs and fit multiplugs to retaining bracket.

7. Connect flasher/lamp/trip switch harness multiplugs and fit multiplugs to retaining bracket.

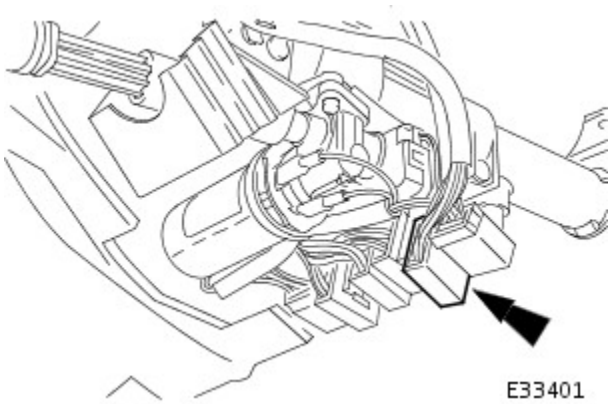




8. Connect key interlock solenoid harness multiplug.



9. Connect key transponder exciter coil multiplug and using new tie straps, secure multiplug to harness.



10. Connect wiper/washer switch multiplug, and fit multiplug onto retaining bracket.

11. Fit driver side underscuttle. Refer to 76.46.11.

12. Fit steering column upper cowl. Refer to 76.46.02.

13. Fit steering column lower cowl. Refer to 76.46.03

14. Fit steering wheel.

15. Fit driver airbag module. Refer to 76.73.39.

16. Fit ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Wipers and Washers - Wiper Pivot Arm

Removal and Installation

Removal

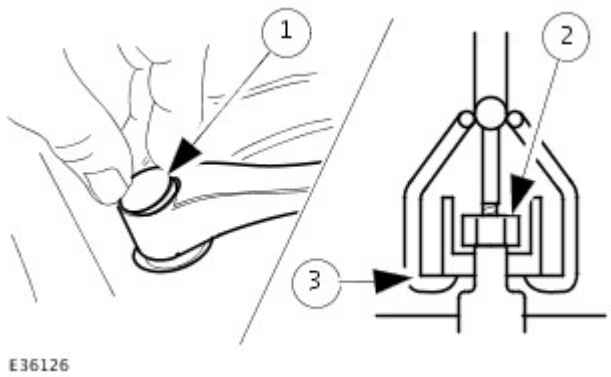
1. Fit fender covers.

2. Disconnect windshield washer tube from plenum cover connector.



3. Using tape, mark position of wiper blade on windshield.

4. Withdraw wiper arm and blade from spindle.



1. Remove plastic cover from wiper arm securing nut.
2. Slacken but do not remove wiper arm nut.
3. Fit extractor 18G2 and ensuring that wiper and plenum cover are not damaged, release wiper arm from tapered spindle.

5. Remove extractor, remove wiper arm securing nut and lift wiper arm off spindle.

Installation

1. Fit wiper arm and blade assembly onto spindle splines aligning blade with marked position on windshield.

2. Fit wiper arm securing nut.

3. Supporting the wiper arm, carefully tighten the securing nut to press arm onto tapered splines.

4. Fit plastic cover over securing nut.

5. Connect washer tubing to plenum cover connector.

6. Remove marking tape from windshield and clean windshield.

7. Remove fender covers.

Roof Opening Panel - Roof Opening Panel

Description and Operation

General Description

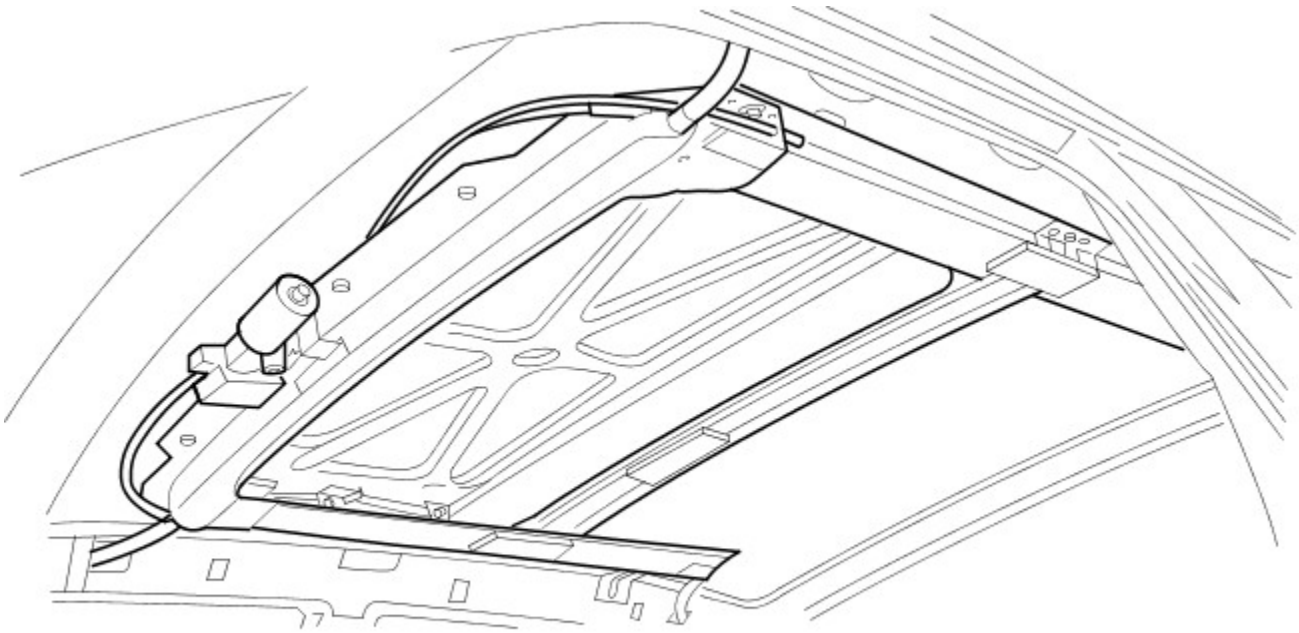
The steel sliding roof panel which is externally painted to match the vehicle and internally trimmed to match the headlining, is of electrically operated tilt and slide design. Driven by a single electric motor via a cable and lever mechanism, the sliding roof panel is operated via a switch on the roof console and controlled by the sliding roof control module (SRCM).

Both the electric motor and SRCM are mounted on an extension of the sliding roof panel frame and are accessed by removing the roof console.

Operation

The sliding roof panel is a multi-feature unit providing tilt, one touch slide opening and closing, and slide position selection on opening and closing. Additionally, on operation of the vehicle automatic locking system with the roof panel open, an input from the security and locking module will close it. On slide opening of the roof panel, a wind deflector elevates at the aperture leading edge. In the event of electrical failure, the sliding roof can be manually operated by removing the roof console and using a key or wide bladed screwdriver in the slot in the motor spindle.

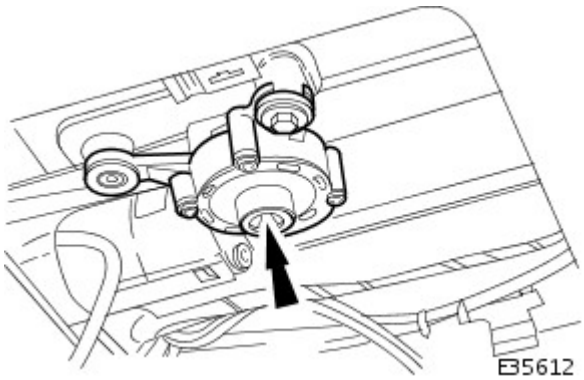
• NOTE: Following manual operation of the sliding roof panel, the motor drive must be re-engaged by manually turning the spindle 1/4 turn counter-clockwise if the panel is open or clockwise if the panel is closed.



E35615

Roof Opening Panel - Motor Synchronization

General Procedures



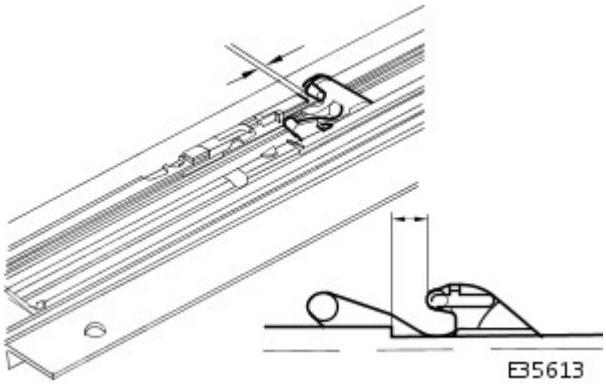
1. Remove sliding roof trim panel for access. Refer to 76.82.19.

2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

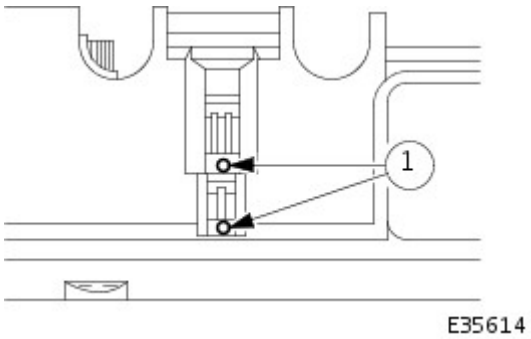
3. Remove roof console for access. Refer to 76.13.69.90.

4. Remove sliding roof panel control module. Refer to 86.76.07.

5. Using a drive key or screwdriver in the motor gearbox slot, manually move the sliding roof towards the closed position.



6. Position the sliding roof with an 8mm gap between the driven lever and the guide rail step.



7. Index control module gears.

1. Viewing gears through aperture in control module, rotate adjuster wheel until white indexing marks on gears are aligned.

8. Fit control module to sliding roof frame. Refer to 86.76.07.

9. Using a drive key or screwdriver in the motor gearbox slot, manually rotate the spindle 1/4 turn counter-clockwise to re-engage the motor drive.

10. Fit roof console. Refer to 76.13.69.90.

11. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

12. Check for satisfactory operation of sliding roof panel by fully opening and closing.

Roof Opening Panel - Roof Opening Panel Alignment

General Procedures

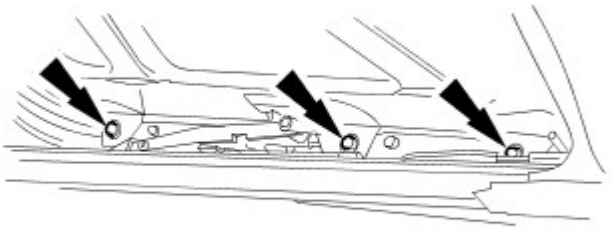
1. Remove sliding roof trim panel for access. Refer to 76.82.19.

2. Turn ignition switch to position II.

3. Fully close sliding roof.

4. Turn ignition switch to position O and remove key.

5. Slacken sliding panel to frame securing bolts.

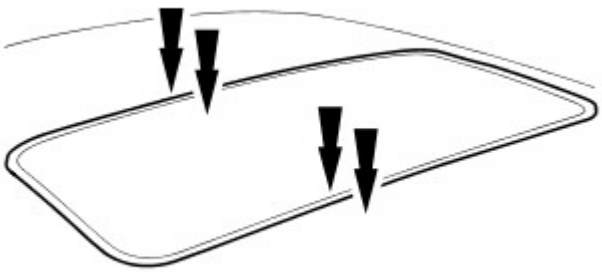


E36300

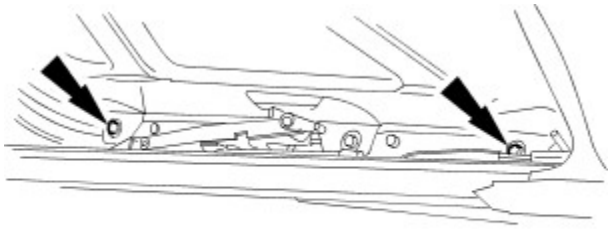
6. Ensuring that seal is not compressed, press sliding panel forward.

7. Align sliding panel with roof contour.

- Adjust front edge of panel to align with roof contour within -1 +0 mm.
- Adjust rear edge of panel to align with roof contour within -0 +1 mm.



E36301



E34582

8. Ensuring that roof panel setting is not disturbed, tighten the outer four sliding panel to frame securing bolts.

9. Insert key and turn ignition switch to II.

10. Check for satisfactory fit and operation by opening and closing roof panel and re-adjust as necessary.

11. Turn ignition switch to position O.

12. Tighten all sliding panel to frame securing screws

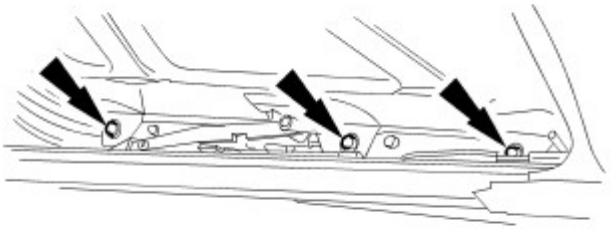
13. Fit trim panel. Refer to 76.82.19.

Roof Opening Panel - Roof Opening Panel

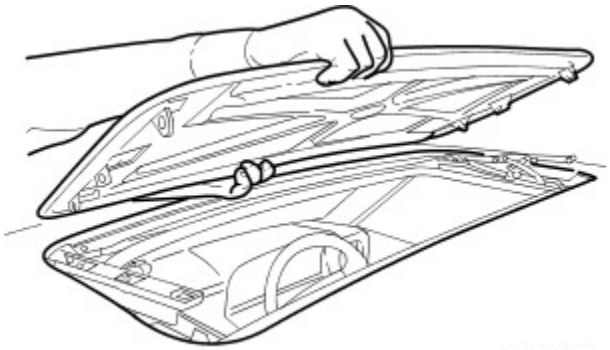
Removal and Installation

Removal

1. Remove sliding roof trim panel for access. Refer to 76.82.19.
2. Slacken and remove sliding roof panel securing bolts.



E36300



E35611

3. Carefully withdraw sliding roof panel and seal from aperture.

Installation

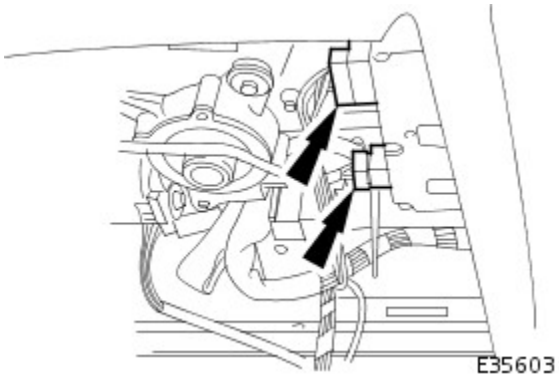
1. If sliding roof panel is being renewed. fit new seal as detailed in 76.82.05.
2. Carefully position sliding roof panel in aperture.
3. Fit and tighten panel securing screws.
4. Fit trim panel. Refer to 76.82.19.

Roof Opening Panel - Roof Opening Panel Frame

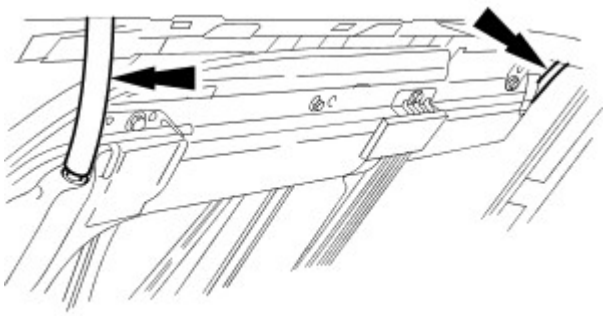
Removal and Installation

Removal

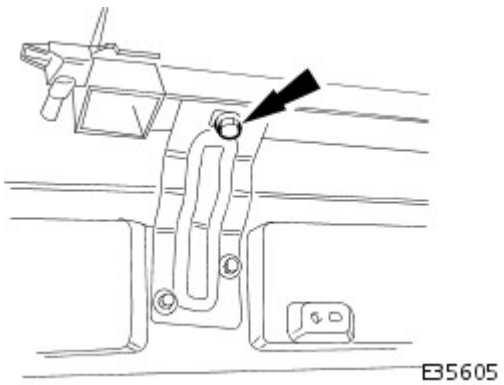
1. Adjust front passenger seat fully rearwards and fully recline seat squab.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove sliding roof flange finisher. Refer to 76.82.23.
4. Remove sliding roof trim panel. Refer to 76.82.19.
5. Remove grab handles. Refer to 501-05.
6. Remove roof console. Refer to 76.13.69.90.
7. Remove sun visors. Refer to 501-05.
8. Remove cantrail/upper A post trims. Refer to 76.13.20.
9. Remove rear quarter trims. Refer to 76.13.13.
10. Remove front half headlining for access. refer to 76.64.15.90.
11. Disconnect harness multiplugs from sliding roof control module.



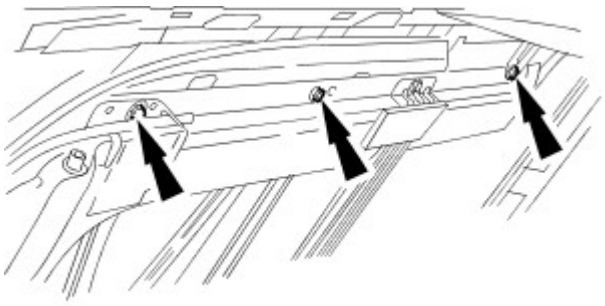
12. Disconnect drain hoses from stub pipes at each corner of sliding roof frame.



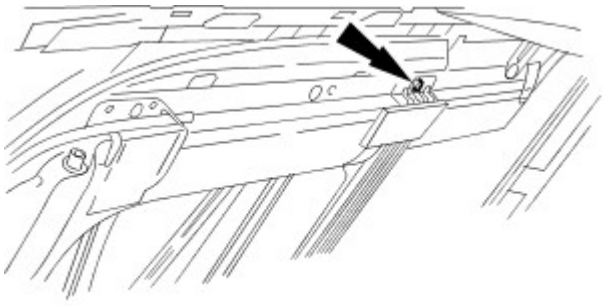
13. Slacken and remove bolts securing rear support brackets to sliding roof frame and BIW and remove brackets.



14. Leaving centre bolt on each side, slacken and remove bolts together with plastic washers, securing sliding roof frame to BIW.



E35606



E35607

15. With assistance, support sliding roof assembly and slacken and remove the remaining securing bolt and washer at each side of frame.

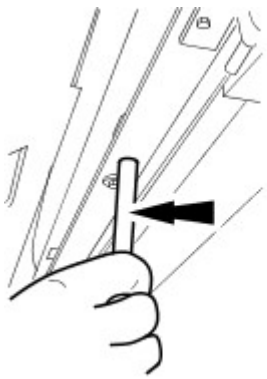


E35608

16. With assistance, lower sliding roof assembly and carefully remove it via the front passenger door.

Installation

1. With assistance, carefully pass sliding roof assembly through front passenger door and position at BIW roof.
2. With assistance fit and hand tighten centre bolts and plastic washers securing sliding roof frame to BIW.
3. Fit and hand tighten remaining securing bolts with plastic washers.
4. Inserting a 15mm drill shank or similar tool, align circular apertures in sliding roof frame and BIW at each side.



E35609

5. Finally tighten all sliding roof frame to BIW securing bolts.
6. Position sliding roof rear support brackets and fit and hand

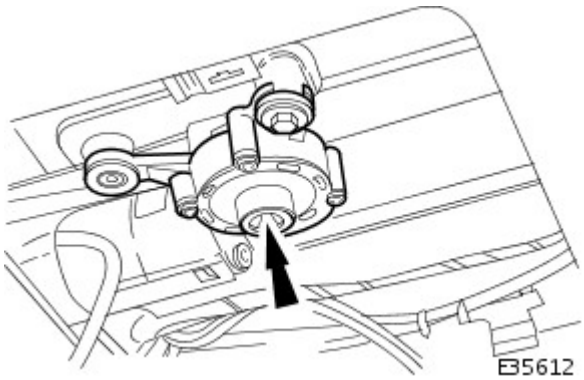
tighten securing bolts.

7. Align rear support brackets and tighten securing bolts.
8. Connect drain hoses to sliding roof frame stub pipes.
9. Fit headlining. Refer to 76.64.15.90.
10. Fit rear quarter trims. Refer to 76.13.13.
11. Fit cantrail/upper A post trims. Refer to 76.13.20.
12. Fit sun visors. Refer to 501-05.
13. Fit roof console. Refer to 76.13.69.90.
14. Fit grab handles. Refer to 501-05.
15. Fit sliding roof trim panel. Refer to 76.82.19.
16. Fit sliding roof flange finisher. Refer to 76.82.23.
17. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
18. Return front passenger seat to original positions.

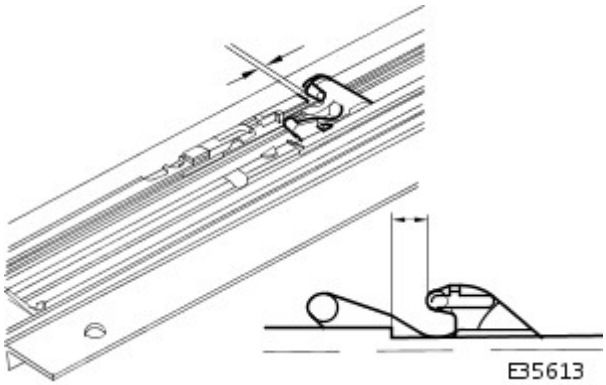
Roof Opening Panel - Roof Opening Panel Module

Removal and Installation

Removal

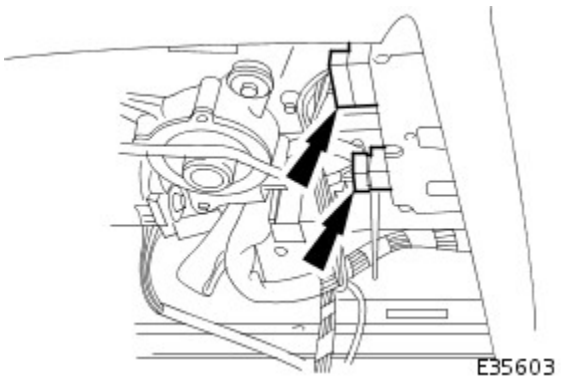


1. Remove cover from battery and disconnect ground cable from battery terminal.
2. Remove sliding roof trim panel for access. Refer to 76.82.19.
3. Using a drive key or screwdriver in the motor gearbox slot, manually move the sliding roof towards the closed position.



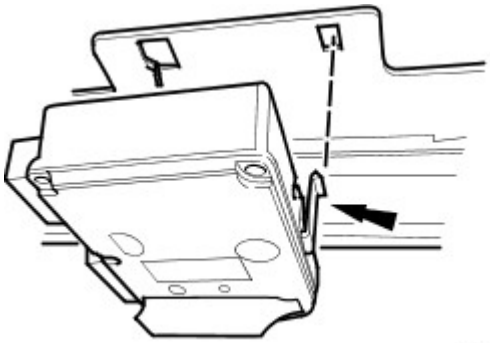
4. Position the sliding roof with an 8mm gap between the driven lever and the guide rail step.

5. Remove roof console for access. Refer to 76.13.69.90.
6. Release sun visor from support and position at cantrail.
7. Remove visor support securing screw and remove support from header.



8. Disconnect harness multiplugs from sliding roof control module.

9. Carefully withdraw adjacent section of flange finisher and edge of headlining sufficient to provide access to control module.
10. Depressing retaining tang on RH side of module, lower that side and release from tang on sliding roof frame.



E34419

Installation

1. Synchronise control module gears. Refer to 76.82.48.
2. Exercising care to avoid damaging edge, lower front of headlining for access.
3. Install control module ensuring tang on RH side fully seats.
4. Connect harness multiplugs to control unit.
5. Carefully install front edge of headlining.
6. Position RH sun visor support block and install securing screw.
7. NOTE: Gearbox slotted boss descends until flush with gearbox casing when drive is re-engaged.

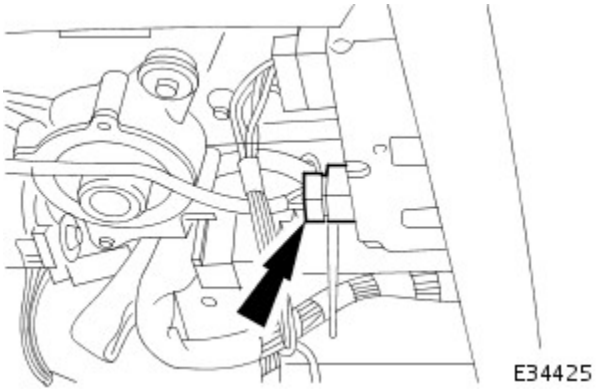
   Using a drive key or screwdriver in the motor gearbox slot, manually rotate the spindle 1/4 turn counter-clockwise to re-engage the motor drive.
8. Install roof console. Refer to 76.13.69.90.
9. Position RH sun visor in support block.
10. Install sliding roof trim panel. Refer to 76.82.19.
11. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.
12. Turn ignition switch to position II.
13. Check for satisfactory operation of sliding roof panel by fully opening and closing twice.
14. Turn ignition switch to position O.

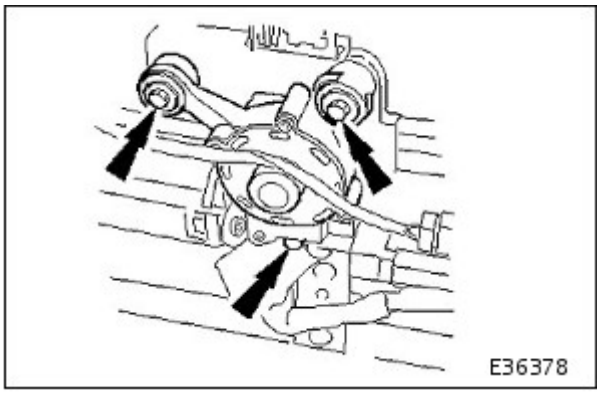
Roof Opening Panel - Roof Opening Panel Motor

Removal and Installation

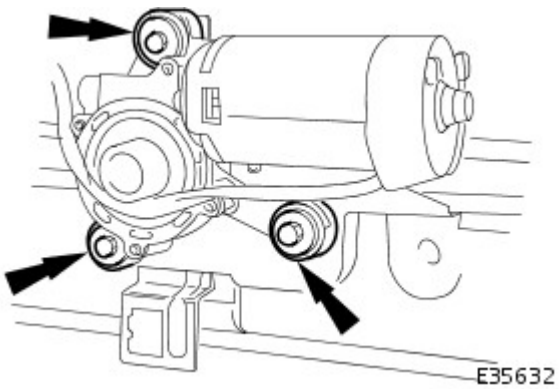
Removal

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove roof console for access. Refer to 76.13.69.90.
3. Disconnect sliding roof panel motor multiplug from control module.





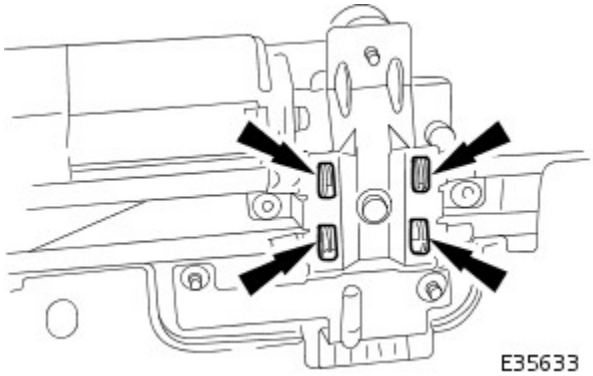
4. slacken and remove sliding roof panel motor securing screws.



5. Withdraw motor assembly and remove plastic mountings.

Installation

1. Fit plastic mountings to motor.
2. Position and align motor in sliding roof frame, ensuring that motor body locates in outer tubes and gear engages inner cables.



3. Fit and tighten motor securing screws.
4. Connect motor harness multiplug to control module.
5. Using a drive key or screwdriver in the motor gearbox slot, manually rotate the spindle 1/4 turn counter-clockwise to re-engage the motor drive.
6. Fit roof console. Refer to 76.13.69.90.
7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

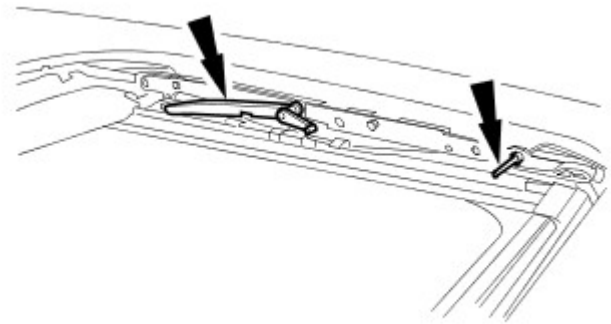
Roof Opening Panel - Roof Opening Panel Shield

Removal and Installation

Removal

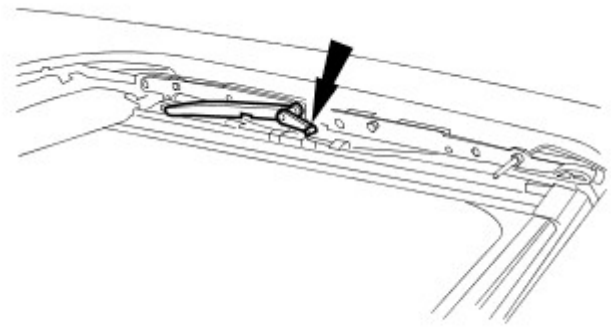
1. Turn ignition switch to position II.
2. Open sliding roof to fully tilted position.
3. Turn ignition switch to position O and remove key.
4. NOTE: A detent spring is fitted at panel front corner for slider peg engagement.

   Pulling trim panel rearwards, release panel front corners from slider mechanism pegs.



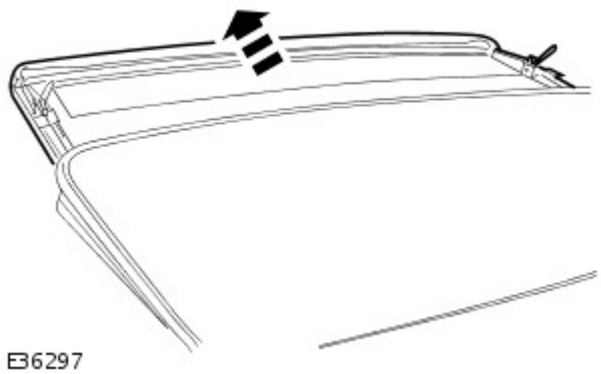
E36311

5. Ensure central guide lugs are above mechanism tilt levers.



E36298

6. Carefully withdraw trim panel rearwards through roof aperture.



E36297

Installation

1. Ensuring central guide lugs are above tilt levers, carefully slide trim panel into position through roof aperture.
2. Pull trim panel forward and position and fully seat front corners over slider pegs.
3. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
4. Insert key and turn ignition switch to position II.

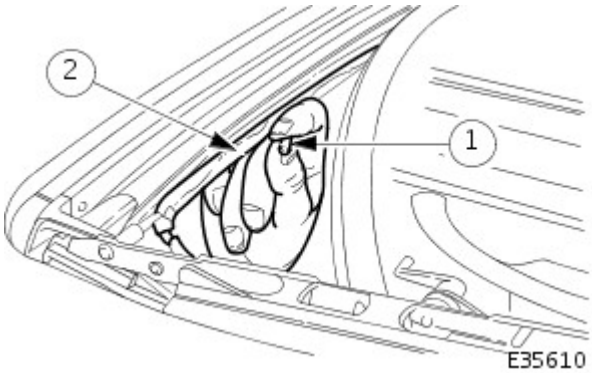
5. Fully close sliding roof, checking that operation is satisfactory and trim panel remains correctly fitted.
6. Turn ignition switch to position O.

Roof Opening Panel - Roof Opening Panel Trim

Removal and Installation

Removal

1. Remove sliding roof trim panel for access. Refer to 76.82.19.
2. Turn ignition switch to position II.
3. Fully open sliding roof panel.
4. Turn ignition switch to O and remove key.
5. Remove finisher.



1. Exercising care to avoid damaging edge of headlining, remove aperture trim finisher from flange.
2. Release headlining from BIW aperture flange.

Installation

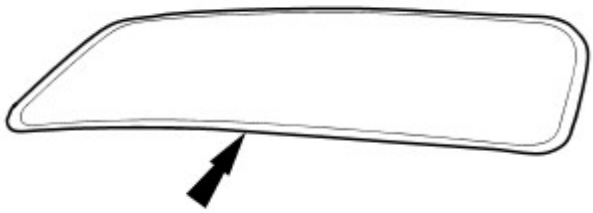
1. Fit edge of headlining over BIW aperture flange.
2. Fit and fully seat trim finisher to flange.
3. Insert key and turn ignition switch to II.
4. Close sliding roof panel.
5. Turn ignition switch to O.
6. Fit sliding roof trim panel. Refer to 76.82.19.

Roof Opening Panel - Roof Opening Panel Weatherstrip

Removal and Installation

Removal

1. Remove sliding roof trim panel for access. Refer to 76.82.19.
2. Remove sliding roof panel for access. Refer to 76.82.05.
3. Remove and discard seal from roof panel flange and thoroughly clean flange.



E36299

Installation

1. Commencing at central rear position, fit and firmly seat new seal to panel flange.
2. Ensure that the seal is evenly tensioned and free from ripples.
3. Carefully cut off any excess seal and ensure that ends butt correctly and remain central.
4. Using tool JD 200, crimp seal into position along entire length.
5. Changing commencing position slightly, repeat above step to ensure continuous crimping of seal.
6. Fit sliding roof panel. Refer to 76.82.05.
7. Fit sliding roof trim panel. Refer to 76.82.19.

Bumpers -

Torques

Component	Nm
Bolts securing bumper beam to strut	39 - 51
Bolts securing bumper guide to body	15,5 - 20,5
Bolts securing energy absorbing strut to body	22 - 28
Bolts securing non-energy absorbing strut to body	15,5 - 20,5

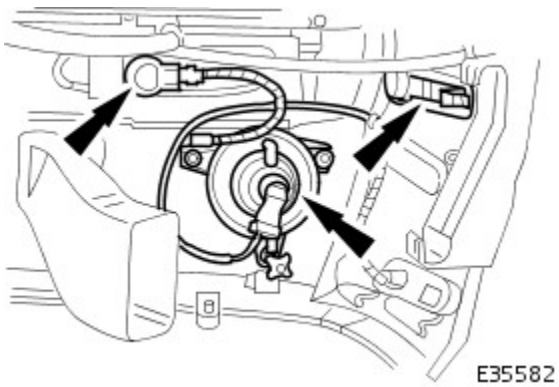
Bumpers - Front Bumper

Removal and Installation

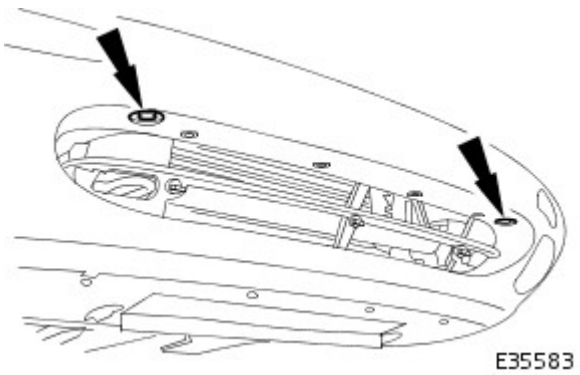
Removal

WARNING: ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF AREA BEFORE OPERATING RAMP.

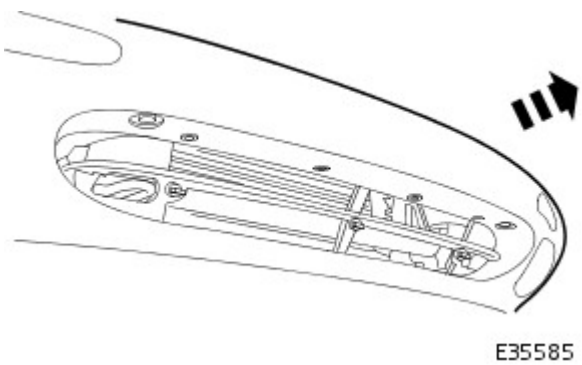
1. Position vehicle on 4-post ramp.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19
3. Remove radiator surround and grill. Refer to 76.55.15 and 76.55.03.
4. Raise ramp to working height.
5. Using wheel-free lifts, remove front wheels.
6. Remove wheelarch liners for access.
7. Remove undertray. Refer to 76.22.90.
8. At each side of vehicle:
   - Disconnect fog lamp, direction indicator and sidemarker lamp (where fitted) harness multiplugs.
   - If headlamp powerwash is fitted, remove and discard plastic clip from hose and disconnect hose at RH side of bumper.



9. Slacken and remove bolts securing bumper assembly to mounting struts.

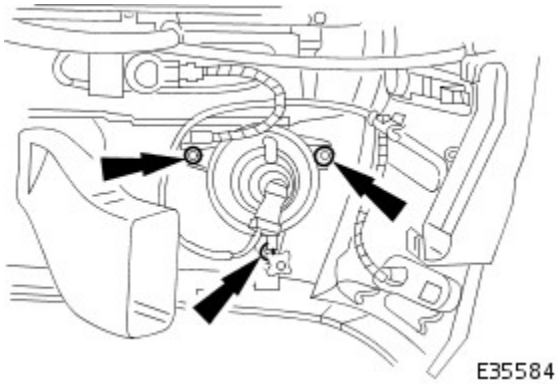


10. Lower 4-post ramp.
11. Carefully withdraw bumper casing and beam assembly forward to clear guide blocks and remove assembly from vehicle.

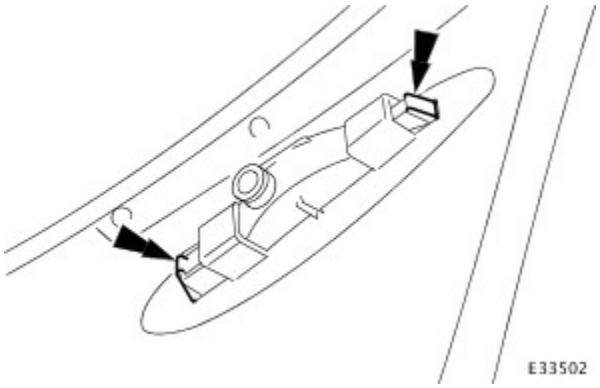


12. Remove number plate and plinth from bumper cover.
13. Slacken and remove three bolts securing each fog lamp to

bumper cover and remove both lamps from cover.



14. Release sidemarker lamp/reflector clips and remove both lamps/reflectors from bumper cover.

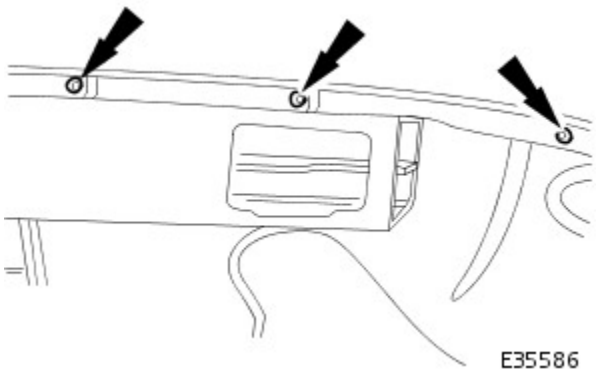


15. Remove direction indicators from bumper assembly. Refer to Section 417.01.

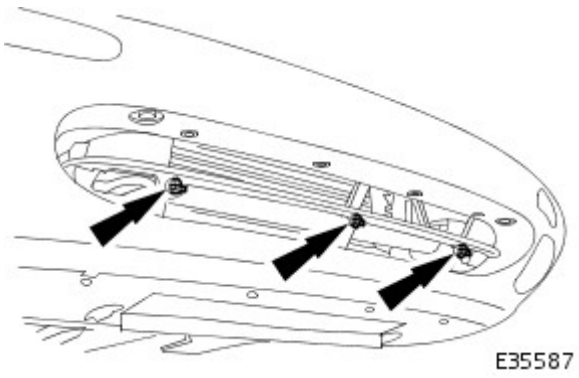
16. Remove powerwash jet assemblies and hoses from top of bumper assembly. Refer to Section 501-16.

17. Remove bumper blades.

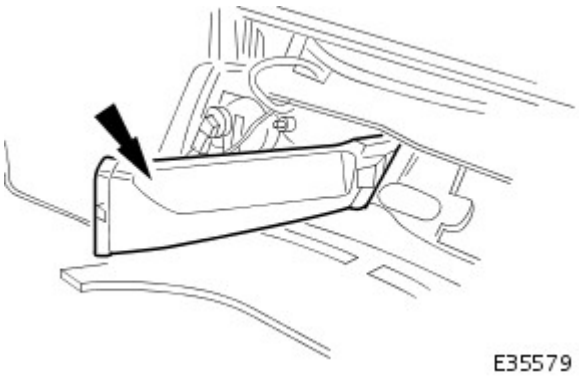
1. Slacken and remove three screws securing each blade to bumper cover.
2. Slide each blade forward to release two side tangs from cover and remove blade from bumper.



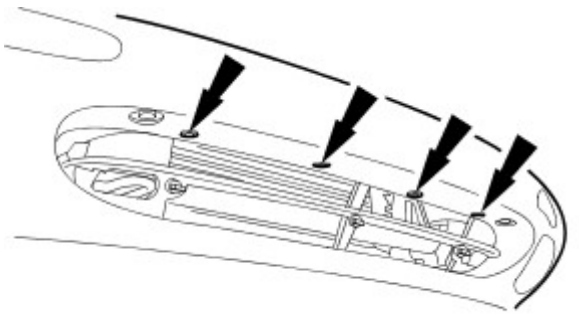
18. Rotate three splitter vane fasteners 1/4 turn counter-clockwise and remove splitter vane from air intake.



19. Release tangs securing brake cooling ducts to cover and remove ducts from bumper.

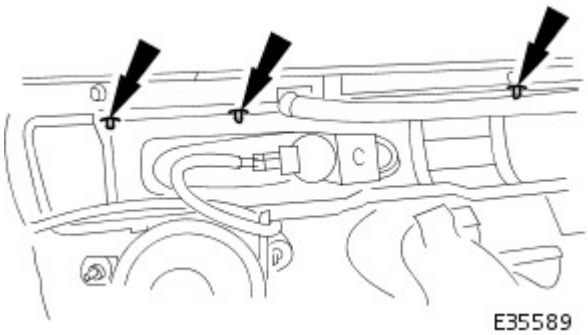


E35579



E35588

20. Remove and discard four scrivets securing upper section of air intake to beam.



E35589

21. Drill out rivets securing upper section of cover to bumper beam.

22. Withdraw bumper beam from cover.

Installation

1. Position beam in cover, ensuring that tangs locate correctly in beam slots.

2. Using new fir tree fasteners, scrivets and rivets, secure beam to bumper cover.

3. Install fog lights, direction indicators, and side marker lamps/reflectors in bumper cover.

4. Fit chrome blades to top of casing locating tangs in slots and fit and tighten securing screws.

5. Fit powerwash jet assemblies to bumper cover. Refer to Section 501.16.

6. Fit bumper assembly to vehicle. Refer to operations in this section.

7. Position splitter vane in air intake and secure by rotating fasteners 1/4 turn clockwise.

8. Fit number plate and plinth.

9. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

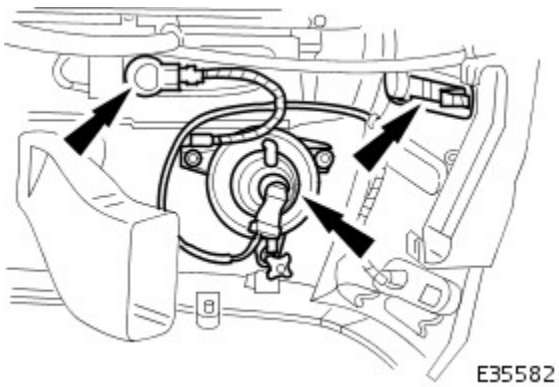
Bumpers - Front Bumper and Bumper Cover

Removal and Installation

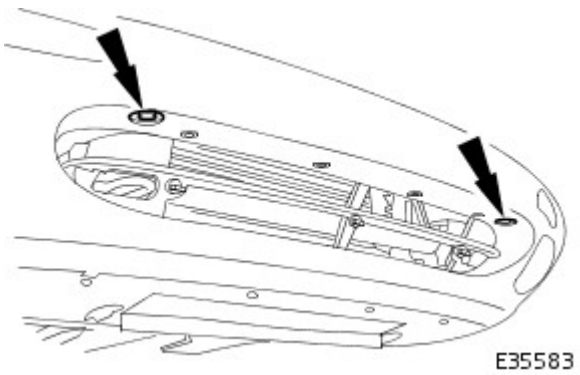
Removal

WARNING: ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF AREA BEFORE OPERATING RAMP.

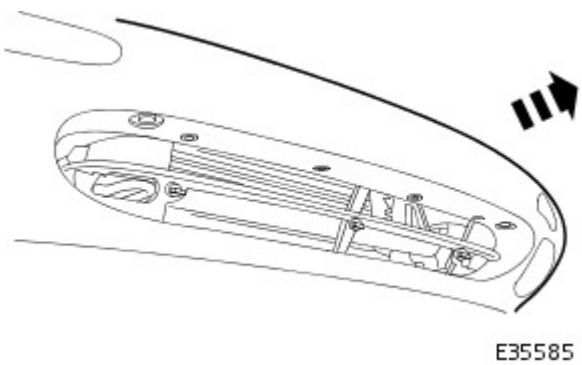
1. Position vehicle on 4-post ramp.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove radiator surround and grill. Refer to 76.55.15 and 76.55.03.
4. Raise ramp to working height.
5. Using wheel-free lifts, remove front wheels.
6. Remove wheelarch liners for access.
7. Remove undertray. Refer to 76.22.90.
8. At each side of vehicle:
   - Disconnect fog lamp, direction indicator and sidemarker lamp (where fitted) harness multiplugs.
   - If headlamp powerwash is fitted, remove and discard plastic clip from hose and disconnect hose on RH side of bumper.


E35582

9. Remove bolts securing bumper assembly to mounting struts.


E35583

10. Lower 4-post ramp.
11. Carefully withdraw bumper casing and beam assembly forward to clear guide blocks and remove assembly from vehicle.


E35585

Installation

1. WARNING: ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF AREA BEFORE OPERATING RAMP.

Carefully slide bumper assembly onto fender guide blocks.

2. Raise ramp to working height.

3. Install but do not fully tighten bolts securing bumper to struts.

4. Check clearance between top of bumper and bottom of fender. If necessary, remove bumper, adjust guide blocks to achieve correct clearance and refit bumper.

5. Connect harness multiplugs to foglamps, direction indicators and where fitted side marker lamps.

6. Install harnesses in retaining clips at each side of cover.

7. Install powerwash hoses to jet assemblies and secure with new plastic clips. Refer to Section 501.16.

8. Install radiator grill and surround. refer to 76.55.03 and 76.55.15.

9. Check and as necessary adjust bumper cover to fender, headlamps and radiator grill surround clearances. Refer to Description and Operation in this section.

10. Fully tighten bumper assembly to strut securing bolts.

11. Install wheelarch liners.

12. Install undertray. Refer to 76.22.90.

13. Lower 4-post ramp.

14. Install road wheels and lower wheel-free lifts.

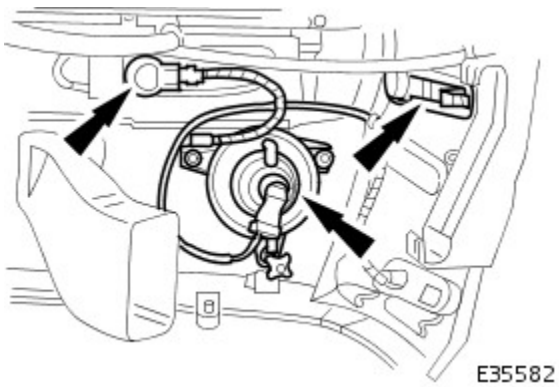
Bumpers - Front Bumper Cover

Removal and Installation

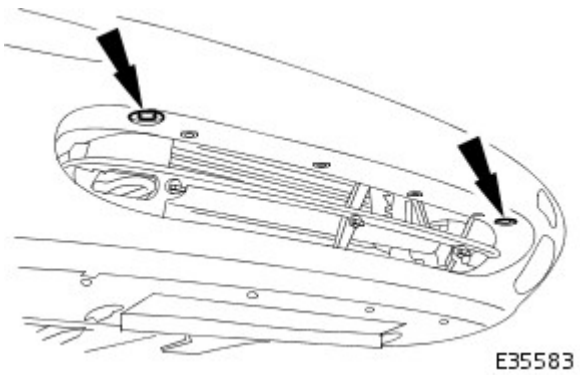
Removal

WARNING: ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF AREA BEFORE OPERATING RAMP.

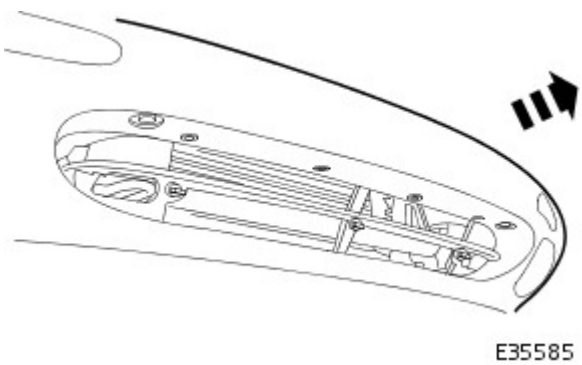
1. Position vehicle on 4-post ramp.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove radiator surround and grill. Refer to 76.55.15 and 76.55.03.
4. Raise ramp to working height.
5. Using wheel-free lifts, remove front wheels.
6. Remove wheelarch liners for access.
7. Remove undertray. Refer to 76.22.90.
8. At each side of vehicle:
   - Disconnect fog lamp, direction indicator and sidemarker lamp (where fitted) harness multiplugs.
   - If headlamp powerwash is fitted, remove and discard plastic clip from hose and disconnect hose on RH side of bumper.


E35582

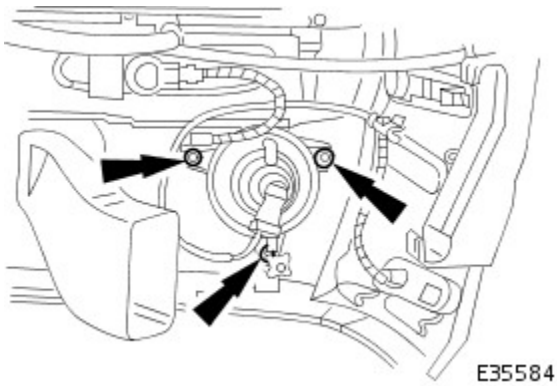
9. Remove bolts securing bumper assembly to mounting struts.

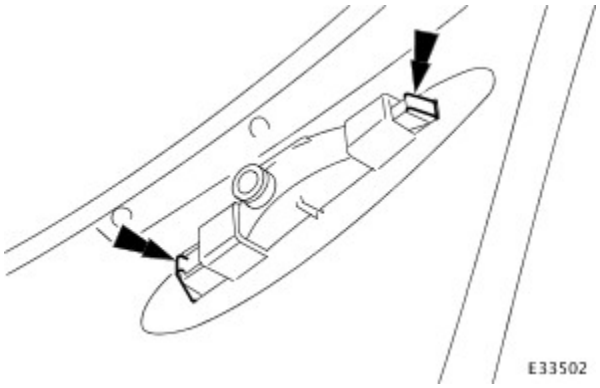

E35583

10. Lower 4-post ramp.
11. Carefully withdraw bumper casing and beam assembly forward to clear guide blocks and remove assembly from vehicle.


E35585

12. Remove three bolts securing each fog lamp to bumper cover and remove both lamps from cover.





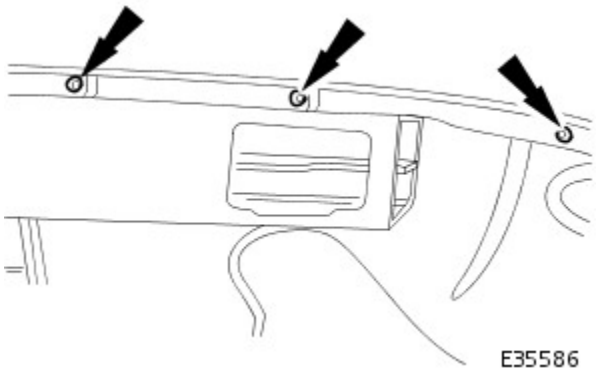
13. Release sidemarker lamp/reflector clips and remove both lamps/reflectors from bumper cover.

14. Remove direction indicators from bumper assembly. Refer to Section 417.

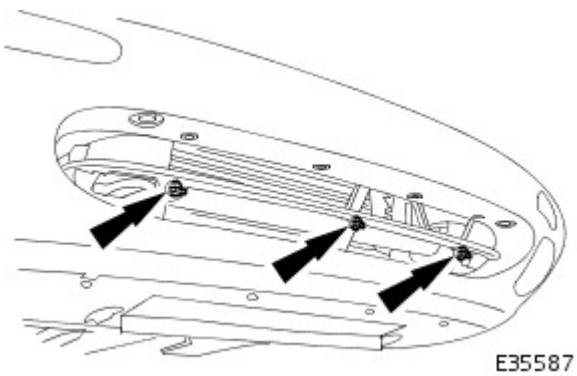
15. Release tangs securing brake cooling ducts to bumper cover and remove ducts.

16. Remove powerwash jet assemblies and hoses from top of bumper assembly. Refer to 84.20.08.

17. Remove bumper blades.



1. Remove three screws securing each blade to bumper cover.
2. Slide each blade forward to release two side tangs from cover and remove blades from bumper.

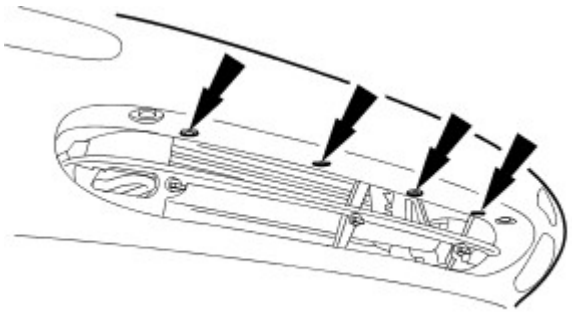


18. Rotate three splitter vane fasteners 1/4 turn counter-clockwise and remove splitter vane from air intake.

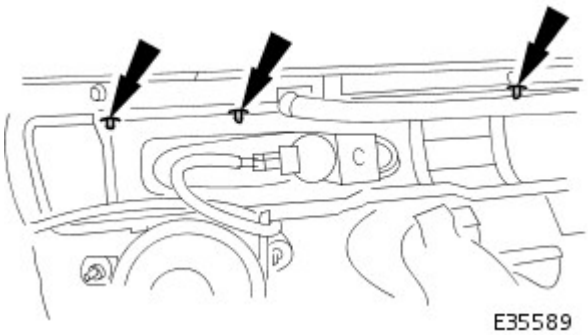
19. Remove number plate and plinth.

20. Remove and discard four scrivets securing upper section of

air intake to beam.



E35588



E35589

21. Drill out rivets securing beam to upper section of bumper cover.

22. Withdraw cover from beam.

Installation

1. Position cover over bumper beam and secure with new fir tree fasteners, scrivets and rivets.

2. Install fog lights, direction indicators, and side marker lamps/reflectors in bumper cover.

3. Position chrome blades on top of cover, locating tangs in slots and install securing screws.

4. Install powerwash jet assemblies on bumper cover. Refer to 84.20.08.

5. Position splitter vane in air intake and secure by rotating fasteners 1/4 turn clockwise.

6. WARNING: ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR OF AREA BEFORE OPERATING RAMP.

Carefully slide bumper assembly onto fender guide blocks.

7. Raise ramp to working height.

8. Install but do not fully tighten bolts securing bumper to struts.

9. Check clearance between top of bumper and bottom of fender. If necessary, remove bumper, adjust guide blocks to achieve correct clearance and refit bumper.

10. Connect harness multiplugs to foglamps, direction indicators and where fitted side marker lamps.

11. Install harnesses into retaining clips at each side of cover.

12. Install powerwash hoses to jet assemblies and secure with new plastic clips. Refer to 84.20.08.

13. Install radiator grill and surround. refer to 76.55.03 and 76.55.15.

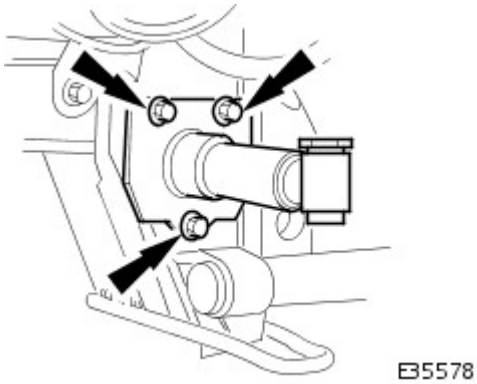
14. Check and as necessary adjust bumper cover to fender, headlamps and radiator grill surround clearances. Refer to Description and Operation in this section.

15. Fully tighten bumper assembly to strut securing bolts.

16. Install wheelarch liners.
17. Install undertray. Refer to 76.22.90.
18. Lower 4-post ramp.
19. Install road wheels and lower wheel-free lifts.
20. Position number plate plinth on bumper and install securing screws.
21. Install number plate.
22. Connect ground cable to battery terminal and install battery cover. Refer to 86.15.15.

Bumpers - Front Bumper Isolator

Removal and Installation



Removal

1. Remove front bumper assembly. Refer to 76.22.08.
2. Slacken and remove three bolts securing strut to front lower cross-member, remove strut from vehicle and discard gasket.

Installation

1. Position strut and new gasket on cross-member and fit and tighten securing bolts.
2. Fit bumper assembly to struts. Refer to 76.22.08.

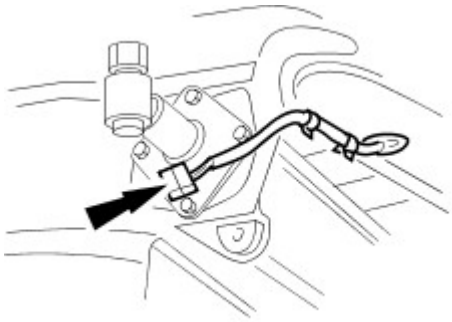
Bumpers - Rear Bumper

Removal and Installation

Removal

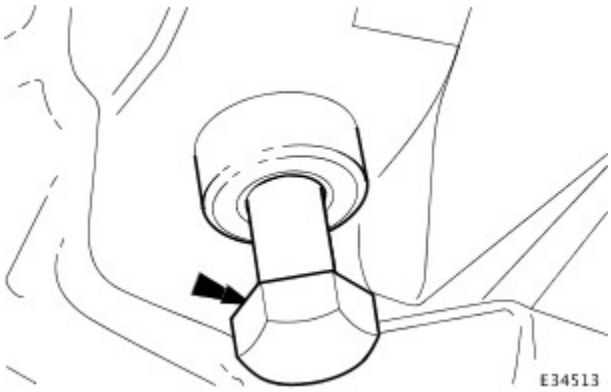
1. Position vehicle on 4-post lift.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. WARNING: THE REAR BUMPER IS CLOSE TO THE EXHAUST PIPES WHICH MAY BE HOT. CARE MUST THEREFORE BE EXERCISED WHEN WORKING IN THIS VICINITY.

   Raise vehicle to working height.
4. Disconnect sidemarker lamp harness multiplugs and position clear of armatures.



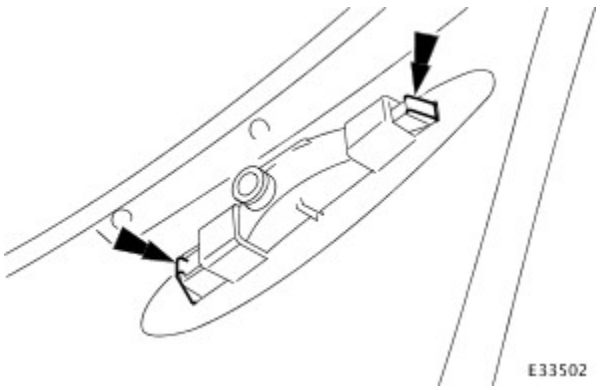
E35580

5. Slacken and remove bumper to strut securing bolts.



E34513

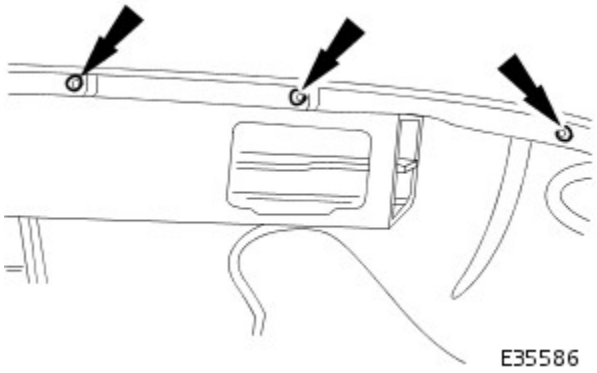
6. With assistance, carefully slide bumper clear of guide blocks and remove from vehicle.
7. Release retaining clips and remove sidemarker lamps/reflectors from bumper.



E33502

8. Remove bumper blades.

   1. Slacken and remove three screws securing each blade to bumper cover.



2. Slide each blade forward to release three side tangs from cover and remove blades from bumper.

9. Drill out rivets securing beam to bumper cover.

10. Withdraw beam from bumper cover.

Installation

1. Position beam in bumper cover and secure with new fir tree fasteners and rivets.

2. Fit and fully seat sidemarker lamps/reflectors in bumper cover.

3. Fit chrome blades to top of cover locating tangs in slots and fit and tighten securing screws.

4. Fit bumper assembly to vehicle. Refer to operations in this section.

5. Fit ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

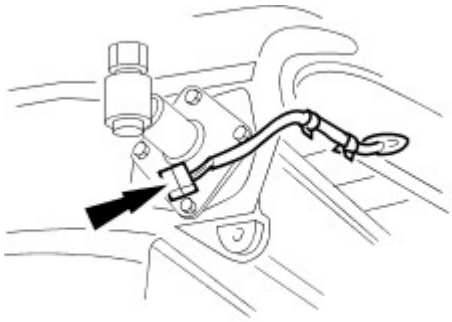
Bumpers - Rear Bumper Cover

Removal and Installation

Removal

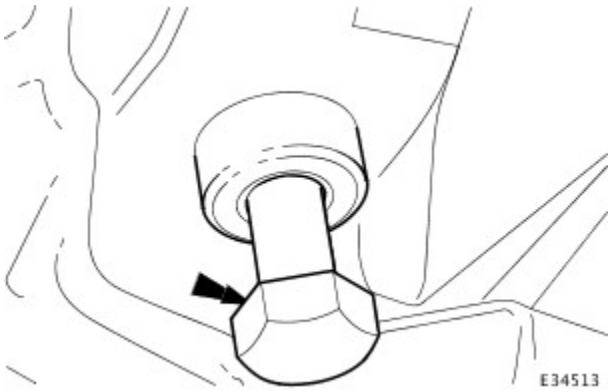
1. Position vehicle on 4-post lift.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. WARNING: THE REAR BUMPER IS CLOSE TO THE EXHAUST PIPES WHICH MAY BE HOT. CARE MUST THEREFORE BE EXERCISED WHEN WORKING IN THIS VICINITY.

   Raise vehicle to working height.
4. If fitted, disconnect sidemarker lamp harness multiplugs and position clear of armatures.



E35580

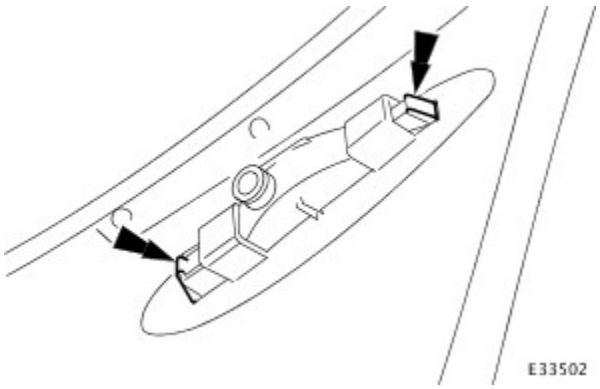
5. Slacken and remove bumper to strut securing bolts.



E34513

6. With assistance, carefully slide bumper clear of guide blocks and remove from vehicle.

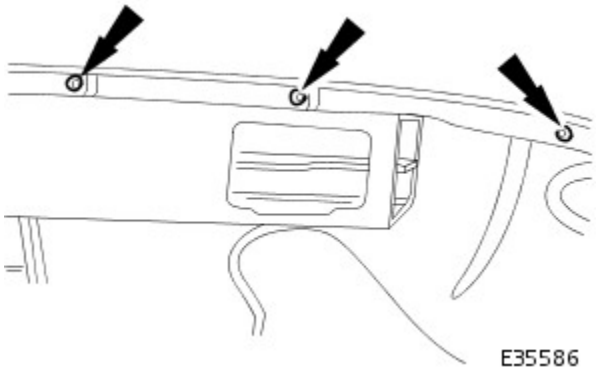
Installation



E33502

1. Release retaining clips and remove sidemarker lamps/reflectors from bumper.
2. Remove bumper blades.

   1. Slacken and remove three screws securing each blade



to bumper cover.

2. Slide each blade forward to release three side tangs from cover and remove blades from bumper.

3. Drill out rivets securing cover to bumper beam.

4. Withdraw cover from bumper beam.

Installation

1. Position cover over bumper beam and secure with new fir tree fasteners and rivets.

2. Fit and fully seat sidemarker lamps/reflectors in bumper cover.

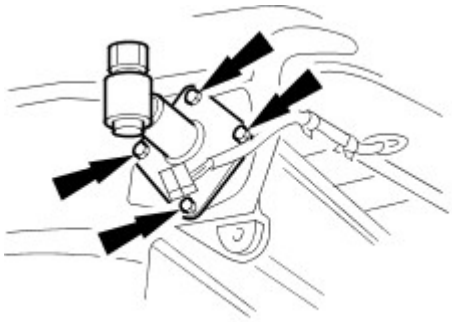
3. Fit chrome blades to top of cover locating tangs in slots and fit and tighten securing screws.

4. Fit bumper assembly to vehicle. Refer to operations in this section.

5. Fit ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Bumpers - Rear Bumper Isolator

Removal and Installation



E35577

Removal

1. Remove rear bumper assembly. Refer to 76.22.77 and 76.22.27.
2. Remove four nuts securing strut to rear cross-member, remove strut from vehicle and discard gasket.

Installation

1. Position strut and new gasket on cross-member and fit and tighten securing nuts on studs.
2. Fit bumper assembly to struts. Refer to 76.22.27 and 76.22.77.

Safety Belt System -

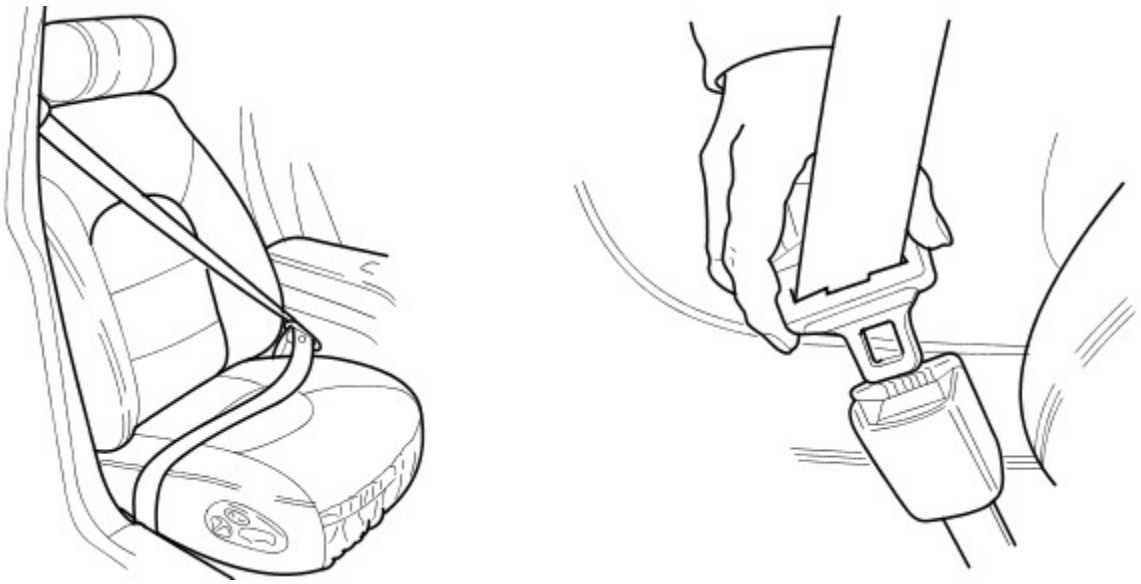
Torques

Component	Nm
Screws, front seat belt height adjuster to B/C post LH and RH	24 - 26
Nut, seat belt upper anchor to height adjuster LH and RH	30 - 40
Bolt, LH and RH rear seat belt lower anchor to BIW	30 - 40
Bolt, centre rear seat belt lower anchor to BIW	30 - 40
Bolts, rear seat belt automatic locking retractor LH, RH and centre to squab panel	30 - 40
Bolt, rear seat belt buckle LH, RH and centre to BIW	30 - 40
Bolt, front seat belt buckle LH and RH to seat rail	30 - 40
Bolt, front seat belt lower anchor LH and RH to seat rail	30 - 40
Bolts, front seat belt automatic locking retractor/pretensioner to B post	30 - 40
Bolts, side airbag to seat frame	9 - 11
Screws, front seat belt guide to B/C post	8 - 10
Screws, single point sensor to tunnel	5 - 7
Screws, side impact sensing module to 'B' post	5 - 7

Safety Belt System - Safety Belt System

Description and Operation

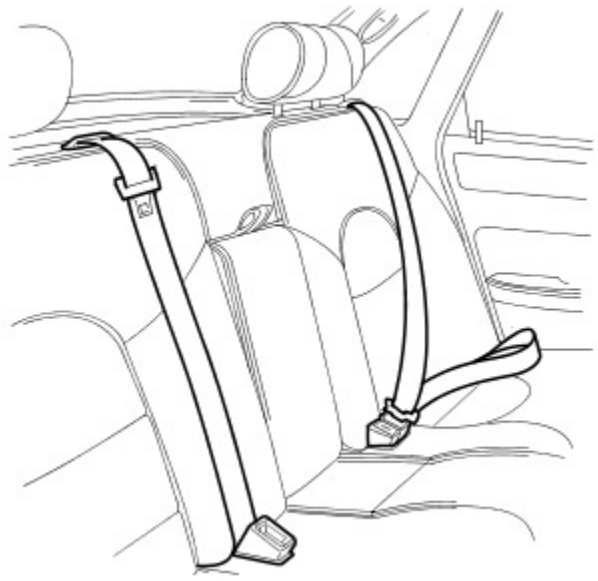
Front Seat Belts



E36271

Each front seat belt has three anchorage points, and a height adjuster installed in each 'B' post provides four shoulder strap positions. The belts are left and right handed and have plastic moulding on the running loop and tongue. A pyrotechnic pre-tensioning device installed at the lower mounting point in each'B' post, removes excess slack from the seat belt in the event of a heavy frontal impact.

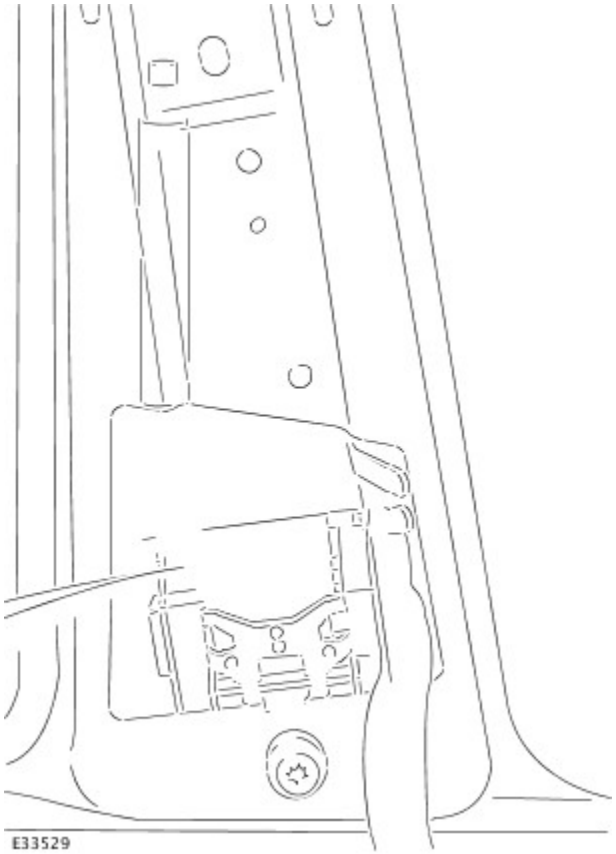
Rear Seat Belts



E36272

A standard inertia reel type belt is installed at each rear seat position. Each of these belts has three anchorage points. The lower end of each outer belt is bolted to the front lower section of the inner wheelarch, whilst the lower end of the centre belt is bolted to the seat pan. All three inertia reel assemblies are bolted to the upper section of the squab panel. Two buckle assemblies serving the three belts, are each bolted to the seat pan. A cable mounted single buckle provides for fastening of the RH outer belt and a twin buckle assembly mounted on two cables serves the centre and LH outer belts.

Pyrotechnic Seatbelt Pre-tensioning



A pyrotechnic front seat belt pre-tensioning device with independent electronic sensing and retractor unit is installed at the base of each 'B' post. In the event of severe frontal impact, this provides additional front occupant protection by removing any excess slack from the seat belt. Seat belt pre-tensioning activates when a frontal impact of sufficient force occurs within 30 degrees of vehicle center line. Under such an impact, electronic sensors in the retractor unit fire, igniting the pre-tensioner gas generator. The gas generator initiates a chemical reaction, producing gases under pressure. Gas pressure drives the piston/cable up a tube, rotating the retractor spindle and removing excess slack from the seat belt. When the pre-tensioner unit has been activated, the seat belt will lock and cannot be retracted or pulled from the reel.If a seat belt pre-tensioner activates, a small quantity (less than 1 liter) of gas is produced containing nitrogen, oxygen and water vapor.

Safety Belt System - Front Safety Belt Retractor

Removal and Installation

Removal

• WARNINGS:

IF A SEAT BELT PRETENSIONING UNIT IS INADVERTENTLY RUPTURED AND INGESTION AND/OR INHALATION OCCURS, FIRST AID MUST BE APPLIED AND MEDICAL ADVICE SOUGHT.

NO ATTEMPT MUST BE MADE TO DISMANTLE A PRETENSIONING RETRACTOR UNIT. THERE ARE NO SERVICEABLE PARTS.

WHEN HANDLING A RETRACTOR UNIT PISTON HOUSING, THE PISTON MUST ALWAYS BE POINTED DOWNWARDS AND AWAY FROM ONE'S SELF AND OTHER PERSONNEL AND FINGERS MUST BE KEPT AWAY FOM THE TAKE-UP SPOOL MECHANISM.

ANY PRETENSIONING UNIT DROPPED FROM A HEIGHT GREATER THAN 0.3M (12 INCHES) MUST NOT BE FITTED TO A VEHICLE.

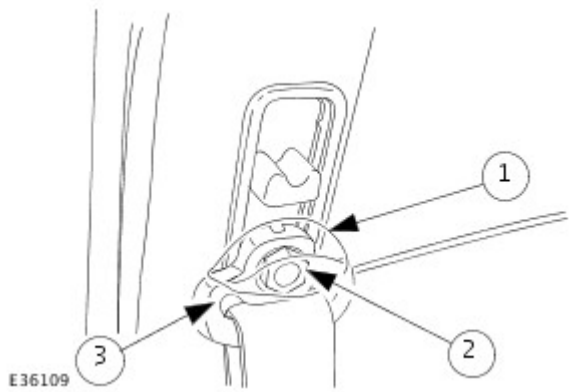
UNACTIVATED PRE-TENSIONING UNIT COMPONENTS CONTAIN A SOLID, FLAMMABLE MATERIAL.

1. Position seat fully forward for access.

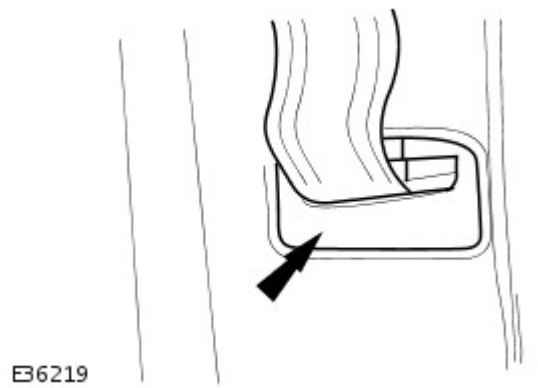
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

3. Remove front seat belt upper anchor and trim.

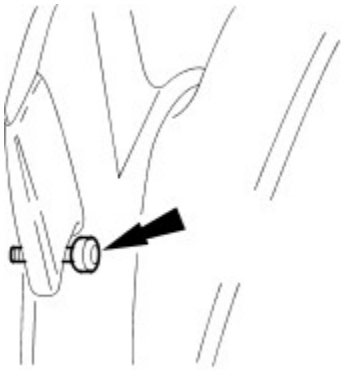
1. Unclip front seat belt upper anchor plastic cover and position for access to securing nut.
2. Slacken and remove seat belt upper anchor securing nut.
3. Remove seat belt upper anchor and plastic cover. Remove and discard felt washer from slider stud.



4. Remove front seat belt escutcheon.

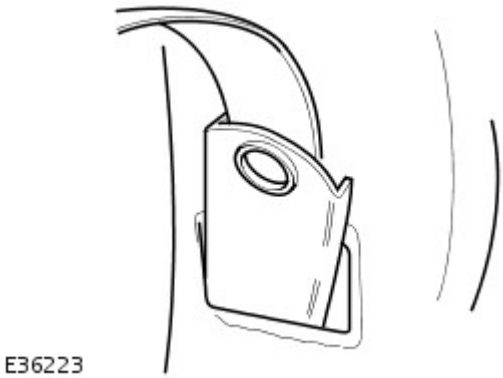


5. Slacken seat belt lower anchor securing bolt and remove with wavy washer, spacer and card washer.

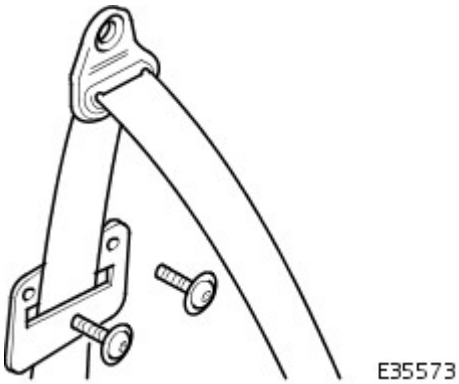

E34458

6. Remove 'B' post casing for access. Refer to 76.13.08.

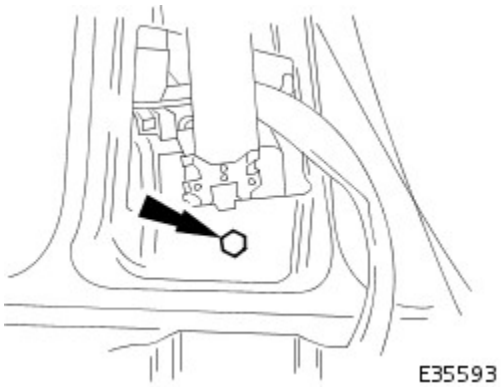
7. Pass seat belt anchor plate through 'B' post casing and remove casing from vehicle.


E36223

8. Slacken and remove two screws securing seat belt guide to 'B' post and position belt guide along seat belt.


E35573

9. Slacken and remove bolt securing seat belt pretensioner to 'B' post.


E35593

10. Withdraw belt and pretensioner assembly from 'B' post and remove from vehicle.

Installation

1. Position pretensioner in 'B' post, align with fixing holes and fit

and fully tighten securing bolts.

2. Position seat belt guide on 'B' post and fit and fully tighten the two securing screws.
3. Position 'B' post casing in vehicle and pass seat belt anchor plates and tongue through aperture.
4. Fit 'B' post casing. Refer to 76.13.08.
5. Fit securing bolt and wavy washer to seat belt anchor. Fit spacer and card washer to bolt and fit and fully tighten securing bolt.
6. Fit felt washer with paper backing outwards, onto height adjuster stud
7. Position upper anchor on height adjuster stud, fit and tighten securing nut and fit plastic cap over nut.
8. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.
9. Return seat to original position.

Safety Belt System - Rear Safety Belt Retractor

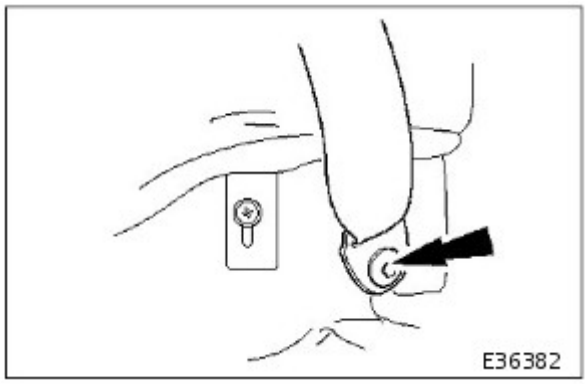
Removal and Installation

Removal

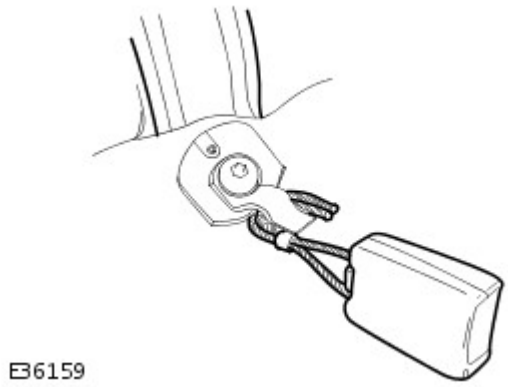
1. Remove rear seat cushion. Refer to 76.70.37.

2. Remove rear headrests.

3. Slacken and remove bolt securing lower anchor to front of inner wheel arch.



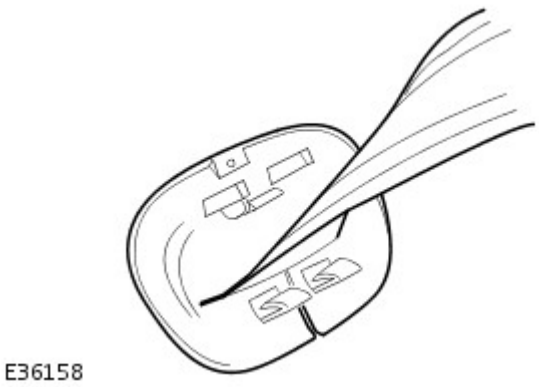
4. Slacken and remove bolt securing belt buckle cable to seat pan and remove belt buckle assembly from vehicle.



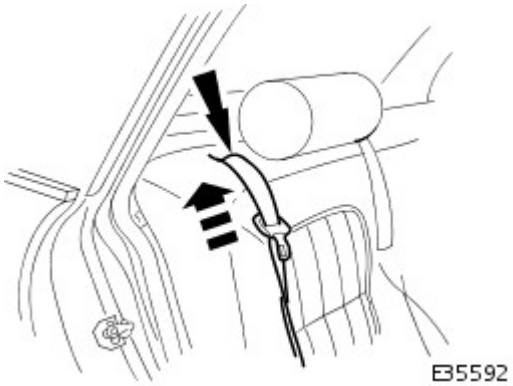
5. Remove escutcheon.

1. Using a flat-bladed screwdriver in the two rectangular apertures, carefully withdraw escutcheon from top of seat squab.

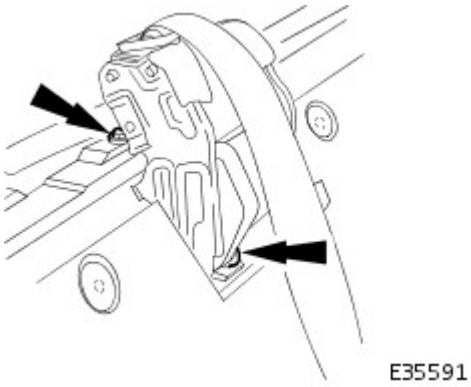
2. Remove escutcheon from belt via split in moulding.



6. Pass seat belt lower anchor plate and tongue through squab aperture.



7. Remove seat squab for access using extension of undisturbed belts to achieve clearance from inertia reels. Refer to 76.70.38.
8. Slacken and remove two bolts and washer securing inertia reel assembly to top of squab panel and remove belt assembly from vehicle.



Installation

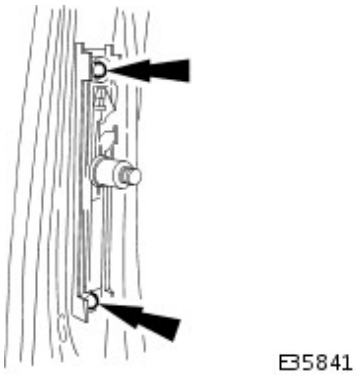
1. Position inertia reel assembly at top of squab panel and fit and tighten securing bolts.
2. Pass belt tongue and lower anchor plate through aperture at top of seat.
3. Fit escutcheon over seat belt and fit and firmly seat in squab aperture.
4. Position lower anchor plate at inner wheelarch (seat pan for centre seat belt) and fit and tighten securing bolt.
5. Position buckle assembly (and lower anchor plate if centre belt) on seat pan and fit and tighten cable securing bolt.
6. Position and secure rear seat squab. Refer to 76.70.38.
7. Fit rear seat cushion. Refer to 76.70.37

Safety Belt System - Safety Belt Shoulder Height Adjuster

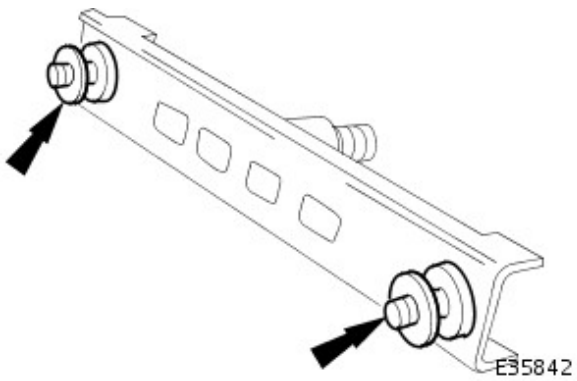
Removal and Installation

Removal

1. Position front seat forward for access.
2. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
3. Remove seat belt upper anchor. Refer to 76.73.10
4. Remove 'B'post trim. Refer to 76.13.08.
5. Slacken and remove seat belt height adjuster securing bolts and remove adjuster from 'B' post.

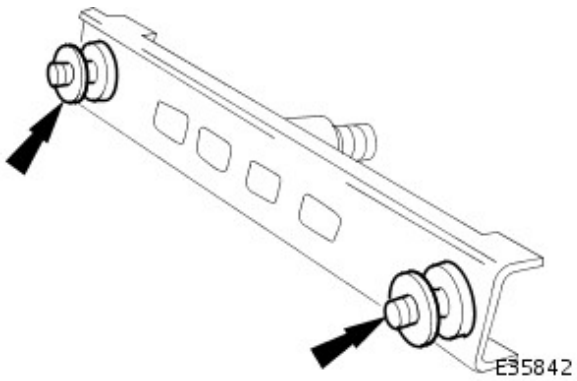


6. Remove fibre washers, spacers and bolts from height adjuster.



Installation

1. Fit securing bolts, spacers and fibre washers to height adjuster.



2. Position adjuster on 'B' post and fit and tighten securing bolts.
3. Fit 'B' post trim pad. Refer to 76.13.08.
4. Fit seat belt upper anchor. Refer to 76.73.10
5. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Supplemental Restraint System -

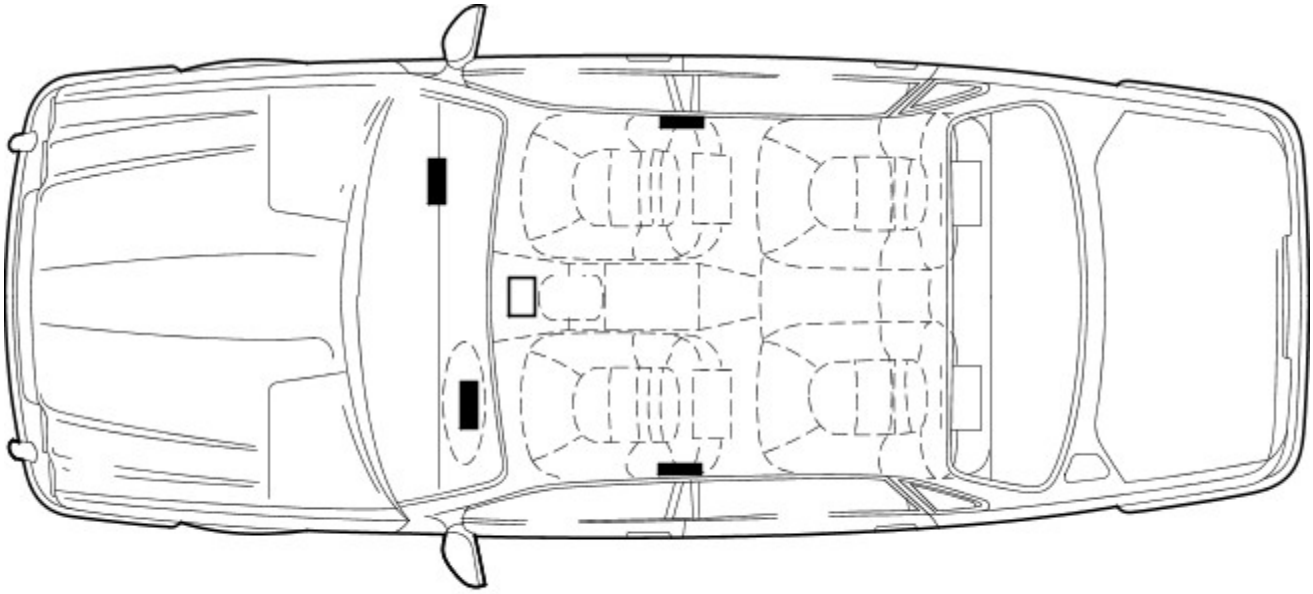
Torques

Component	Nm
Screws, front seat belt height adjuster to B/C post LH and RH	24 - 26
Nut, seat belt upper anchor to height adjuster LH and RH	30 - 40
Bolt, LH and RH rear seat belt lower anchor to BIW	30 - 40
Bolt, centre rear seat belt lower anchor to BIW	30 - 40
Bolts, rear seat belt automatic locking retractor LH, RH and centre to squab panel	30 - 40
Bolt, rear seat belt buckle LH, RH and centre to BIW	30 - 40
Bolt, front seat belt buckle LH and RH to seat rail	30 - 40
Bolt, front seat belt lower anchor LH and RH to seat rail	30 - 40
Bolts, front seat belt automatic locking retractor/pretensioner to B post	30 - 40
Bolts, side airbag to seat frame	9 - 11
Screws, front seat belt guide to B/C post	8 - 10
Screws, single point sensor to tunnel	5 - 7
Screws, side impact sensing module to 'B' post	5 - 7

Supplemental Restraint System - Air Bag Supplemental Restraint System (SRS)

Description and Operation

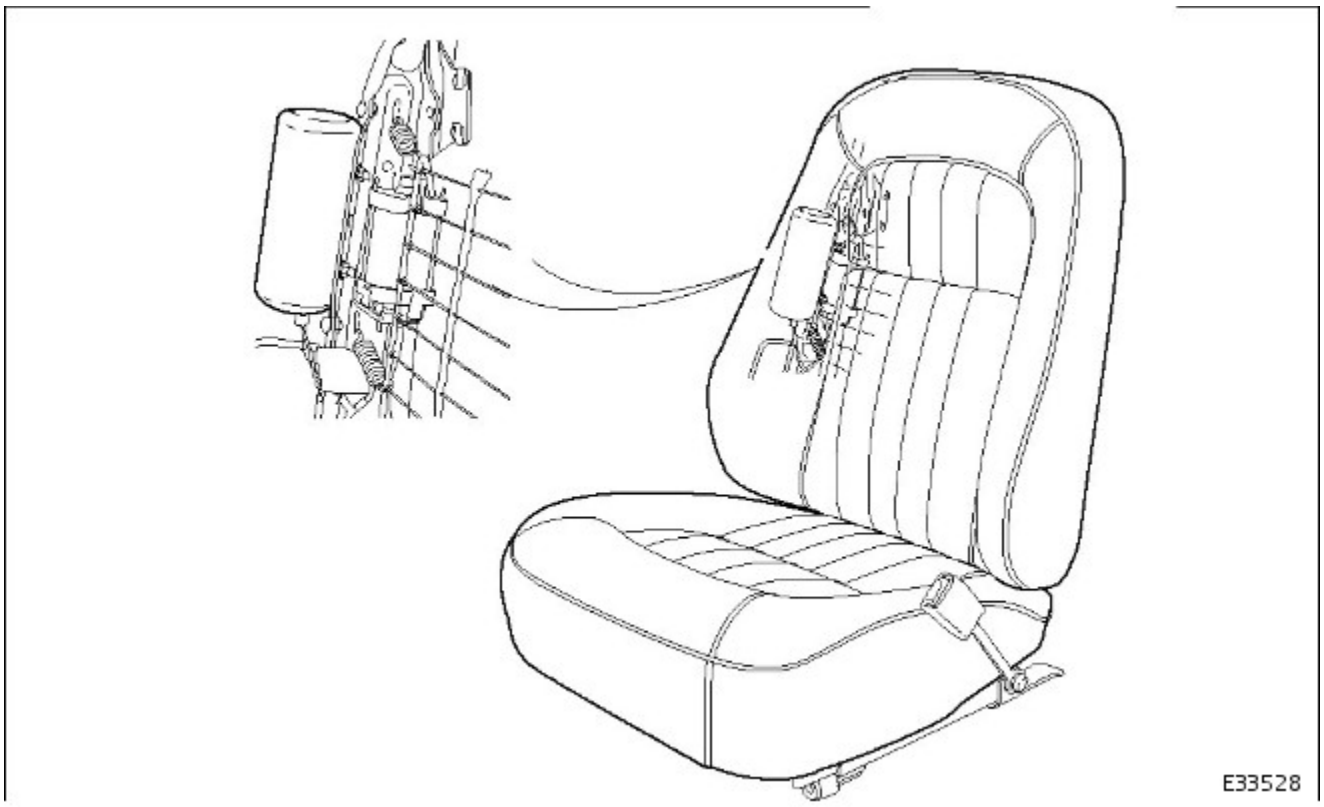
Supplementary Restraint Air Bag System



E34400

Airbag/SRS units provided for driver and front seat passemger protection, are installed in the center of the steering wheel, the passenger side fascia and the outer wing of each front seat. A single point sensing unit (SPS) mounted on the transmission tunnel, below the radio, provides fully electronic impact sensing, control and diagnostics for the front airbags Deployment of each side airbag is initiated by a side impact sensing module (SISM) installed in the adjacent 'B' post. Each SISM senses and electronically processes a crash pulse and if this exceeds the 'must fire' threshold, transmits a fire signal to the SPS unit. The SPS unit monitors whole vehicle motion and on confirmation of a crash condition, transmits a firing current pulse to the appropriate airbags. In the event of a side only impact, the SPS will send a current pulse to the airbag on the struck only. Neither the non-struck side airbag nor the frontal restraint system will be deployed under these conditions. The airbag system can only be activated when the ignition switch is in position II or III.

Side Air Bags



Side airbags provide front seat occupants with additional protection under side impact conditions. In a side impact above a pre-determined severity, the airbag on the impacted side inflates between the occupant and the door at approximately chest height. Each side air bag is installed in a cavity formed by the foam padding in the outboard wing of its respective seat, and is secured to the seat back frame. A slit incorporated in the foam on the forward side of the cavity, directs the expanding air bag to the required exit point in the seat trim.

Supplemental Restraint System - Air Bag Control Module

Removal and Installation

Removal

1. WARNING: FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG SYSTEM COMPONENT.

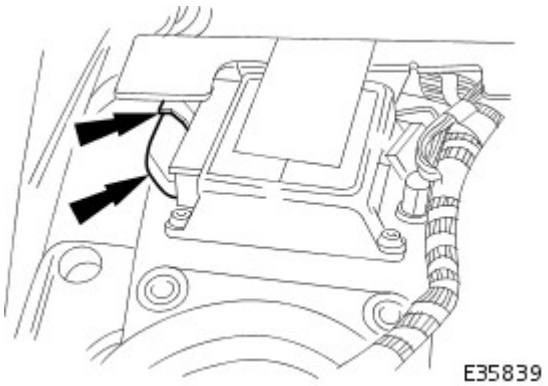
Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove 'J' gate surround. Refer to 76.25.24.

3. Remove centre console veneer panel. Refer to 76.47.26.

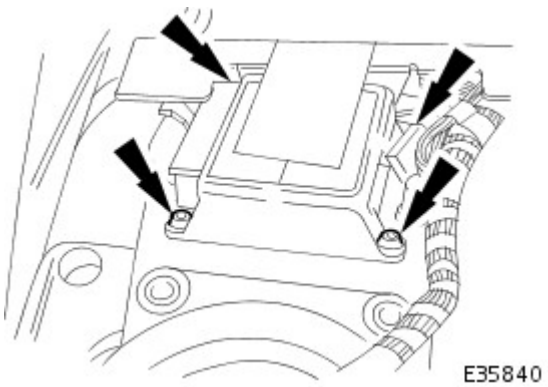
4. Remove radio. Refer to 86.50.03.

5. Release single point sensor harness multiplug retaining lever and disconnect multiplug.



6. NOTE: The serial numbers of all supplementary restraint system components must always be recorded against the VIN of the vehicle.

Slacken and remove single point sensor securing bolts and remove sensor from vehicle.



Installation

1. Position sensor on tunnel and fit and tighten securing bolts.

2. Connect single point sensor harness multiplug and secure with retaining lever.

3. Fit radio.Refer to 86.50.03.

4. Fit centre console veneer panel. Refer to 76.47.26.

5. Fit 'J' gate surround. Refer to 76.25.24.

6. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Supplemental Restraint System - Driver Air Bag Module

Removal and Installation

Removal

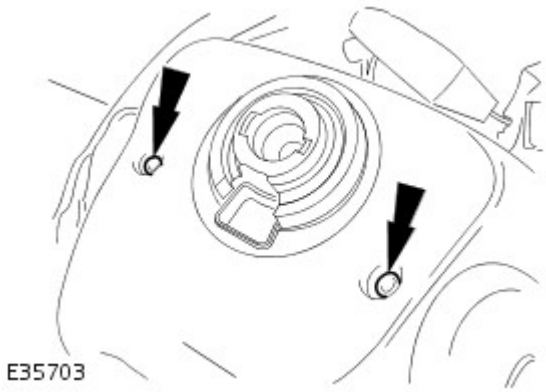
• WARNINGS:

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG MODULE.

FOLLOWING TEN YEARS IN SERVICE, AN AIR BAG MODULE MUST BE REMOVED AND DISPOSED OF IN THE APPROVED MANNER, AND A NEW AIR BAG MUST BE FITTED.

AIR BAGS CONTAIN A CHEMICAL IRRITANT. IF AN AIR BAG IS RENEWED, THE ORIGINAL UNIT MUST BE DISPOSED OF IN ACCORDANCE WITH CURRENT SAFETY PROCEDURES.

IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.

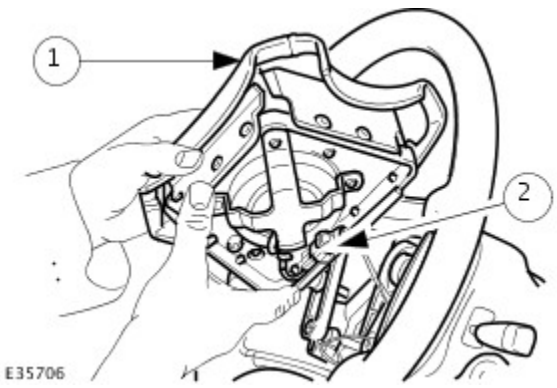


1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove air bag module securing bolts.

1. Turn steering wheel 90 degrees to the left to provide access to module LH securing bolt.
2. Fully slacken captive securing bolt

- Turn steering wheel 180 degrees to the right to provide access to module RH securing bolt.
- Fully slacken captive securing bolt.



3. Remove air bag module from steering wheel.

1. Carefully withdraw airbag module from steering wheel and position for access.
2. Release air bag harness multiplug from retaining clip and disconnect multiplug.

Installation

1. Position air bag module and connect harness multiplug.

2. Fit multiplug onto retaining clip.

3. Carefully install airbag module in steering wheel.

4. Turn steering wheel 90 degrees to right and partially tighten module RH securing bolt.

5. Turn steering wheel 90 degrees to left and partially tighten module LH securing bolt.
6. Repeat steps 3 and 4 to fully tighten securing bolts and return steering wheel to central position.
7. Fit ground cable to battery terminal. Refer to 86.15.15.

Supplemental Restraint System - Passenger Air Bag Module

Removal and Installation

Removal

• WARNINGS:

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST ONE MINUTE MUST BE ALLOWED TO ELAPSE BEFORE ANY WORK IS CARRIED OUT ON AN AIR BAG MODULE.

FOLLOWING TEN YEARS IN SERVICE, AN AIR BAG MODULE MUST BE REMOVED AND DISPOSED OF IN THE APPROVED MANNER, AND A NEW AIR BAG MUST BE FITTED.

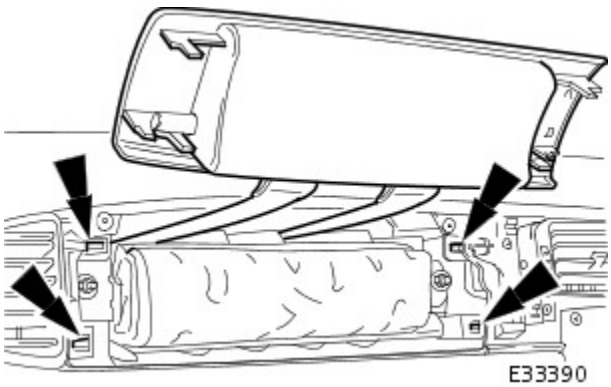
AIR BAGS CONTAIN A CHEMICAL IRRITANT. IF AN AIR BAG IS RENEWED, THE ORIGINAL UNIT MUST BE DISPOSED OF IN ACCORDANCE WITH CURRENT SAFETY PROCEDURES.

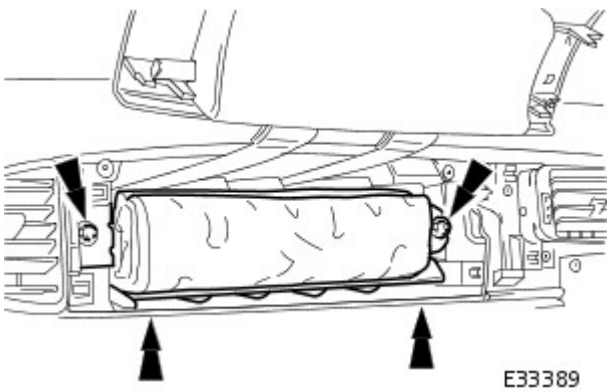
IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.

1. Remove battery cover and disconnect ground cable from terminal. Refer to 86.15.19.

2. Remove glove box. Refer to 76.52.03.

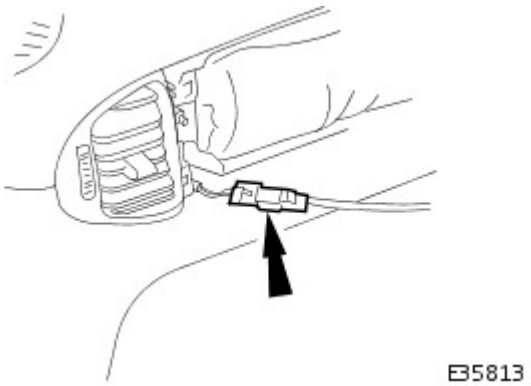
3. Remove deployment door from mounting clips, position for access and remove and discard retaining clips..

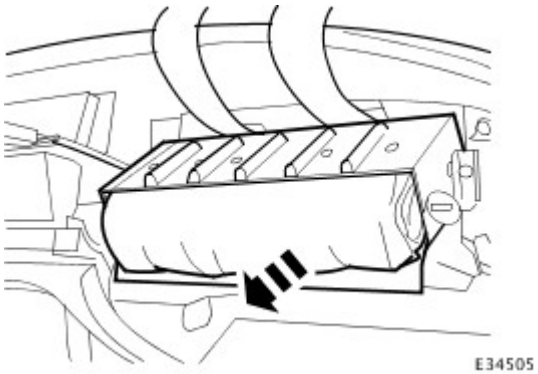




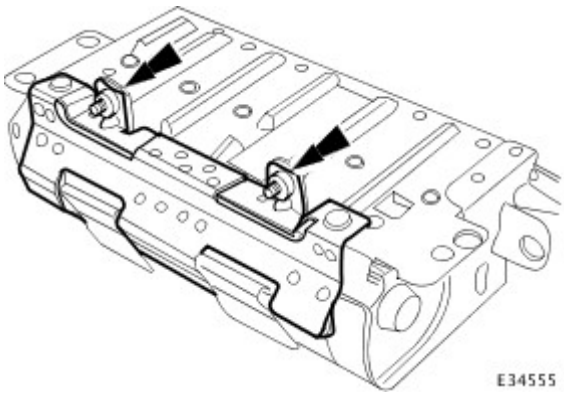
4. Slacken, remove and discard four nuts and washers securing air bag module and tether bracket to fascia.

5. Disconnect air bag module multiplug.





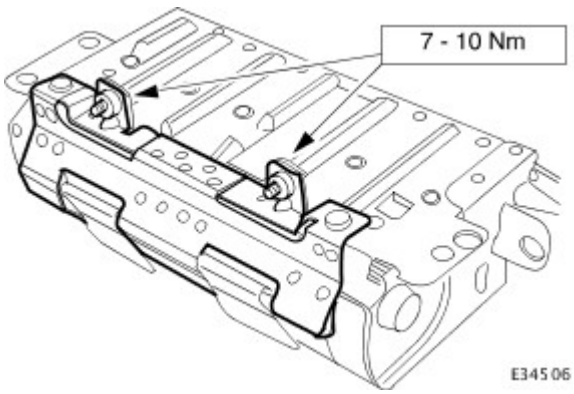
6. Withdraw air bag module and remove from vehicle.



7. Slacken, remove and discard two bolts securing air bag tether bracket to air bag module.

Installation

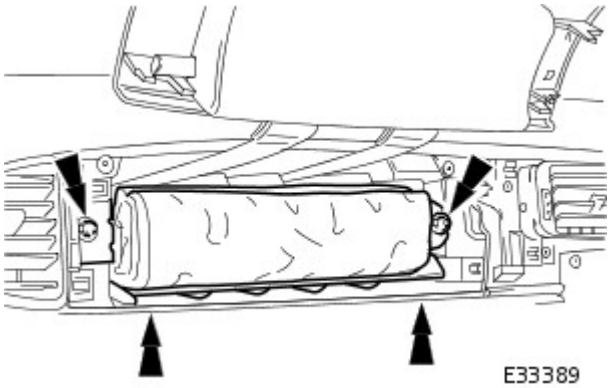
• NOTE: The serial numbers of all supplementary restraint system components must always be recorded against the VIN of the vehicle.



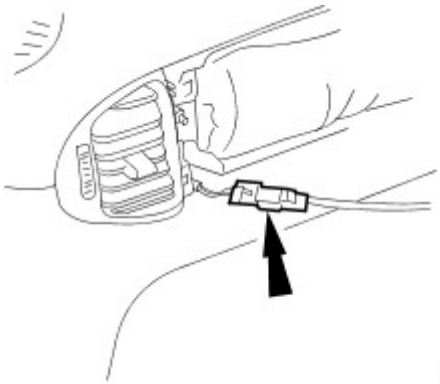
1. Position air bag module on tether bracket and fit and tighten two new securing bolts.

2. Position air bag module and deployment door mounting bracket in fascia.

3. Fit and tighten four new nuts and washers securing air bag



module and tether bracket to fascia.



4. Connect airbag module multiplug.

5. Fit air bag deployment door into mounting clips.

6. Fit glove box. Refer to Section 501-05.

7. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Supplemental Restraint System - Side Air Bag Module

Removal and Installation

Removal

• WARNINGS:

A SIDE AIR BAG MUST ONLY BE RENEWED IF A FAULT FLAG HAS OCCURRED. IN THE EVENT OF SIDE AIR BAG DEPLOYMENT DUE TO SIDE IMPACT, THE COMPLETE SEAT MUST BE RENEWED.

FOLLOWING TEN YEARS IN SERVICE, AN AIR BAG MODULE MUST BE REMOVED AND DISPOSED OF IN THE APPROVED MANNER, AND A NEW AIR BAG MUST BE FITTED.

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST FIFTEEN MINUTES MUST BE ALLOWED TO ELAPSE BEFORE DISCONNECTING THE SINGLE-POINT SENSING (SPS) UNIT AND AN ELAPSE OF 2 MINUTES ALLOWED BEFORE DISCONNECTING ANY OTHER SUPPLEMENTARY RESTRAINT SYSTEM COMPONENT.

AIR BAGS CONTAIN A CHEMICAL IRRITANT. IF AN AIR BAG IS RENEWED, THE DISCARDED UNIT MUST BE DISPOSED OF IN ACCORDANCE WITH CURRENT SAFETY PROCEDURES.

IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.

1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.

2. Remove seat from vehicle. Refer to 76.70.01.

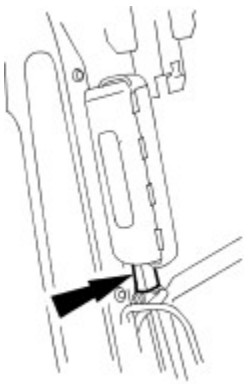
3. Remove seat back finisher. Refer to 76.70.09.

4. Partially remove squab cover and foam pad for access. Refer to 76.70.15

5. Disconnect side air bag harness.

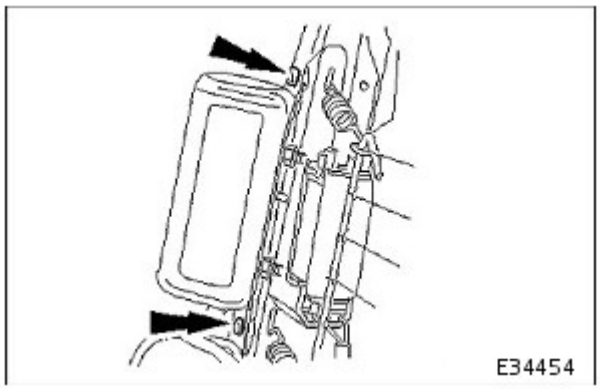
1. Release multiplug from retaining clip.

2. Disconnect air bag harness multiplug.



E35590

6. Slacken and remove the two air bag module mounting bracket to seat frame securing bolts.



7. Remove air bag module from seat and arrange for disposal in approved manner.

Installation

1. CAUTION: Side air bags are dedicated to either LH or RH seat installation. When the air bag module is installed, the multiplug connector must face the seat base.

   Position air bag module on the seat frame ensuring that harness connector faces the seat base.

2. Fit and tighten the securing bolts.
3. Connect the air bag harness multiplug and fit multiplug onto retaining clip.
4. CAUTIONS:

   Hog rings removed during the following procedure must not be re-used. Do not commence the following procedure unless new hog rings are available. Use of used or non-Jaguar parts can impair air bag deployment and cause serious personal injury.

   Hog ring pliers must be used to install new hog rings. Use of ordinary pliers will result in ring deformation, leading to possible failure and personal injury during airbag deployment.

   Fit the seat squab cover. Refer to 76.70.15.

5. Fit the seat back finisher. Refer to 76.70.09.
6. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Supplemental Restraint System - Side Impact Sensor

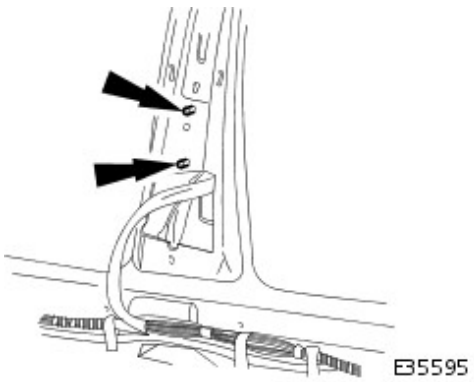
Removal and Installation

Removal

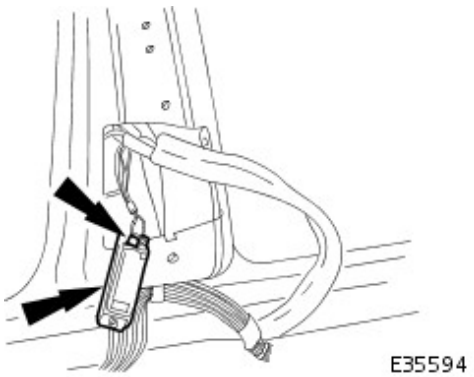
• WARNINGS:

FOLLOWING DISCONNECTION OF THE BATTERY, A PERIOD OF AT LEAST FIFTEEN MINUTES MUST BE ALLOWED TO ELAPSE BEFORE DISCONNECTING THE SINGLE-POINT SENSING (SPS) UNIT.

IN THE EVENT OF A FAULT RUPTURING THE 10A BATTERY SUPPLY FUSE (F4 LOCATED IN THE FUSE-BOX AT THE DRIVER'S END OF THE FASCIA), THE FUSE MUST NOT BE RENEWED UNTIL THE AIRBAG/SRS SYSTEM HAS BEEN DE-ACTIVATED. FUSES OF ANY OTHER VALUE MUST NEVER BE USED, AS THIS CAN CAUSE DISARM FAILURE.



1. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
2. Remove'B' post trim pad. Refer to 76.13.08.
3. Remove seat belt upper anchor and seat belt guide. Refer to 76.73.10
4. Slacken and remove two nuts securing sensor unit to lower section of 'B' post.



5. Lower sensor for access, disconnect multiplug and remove sensor.

Installation

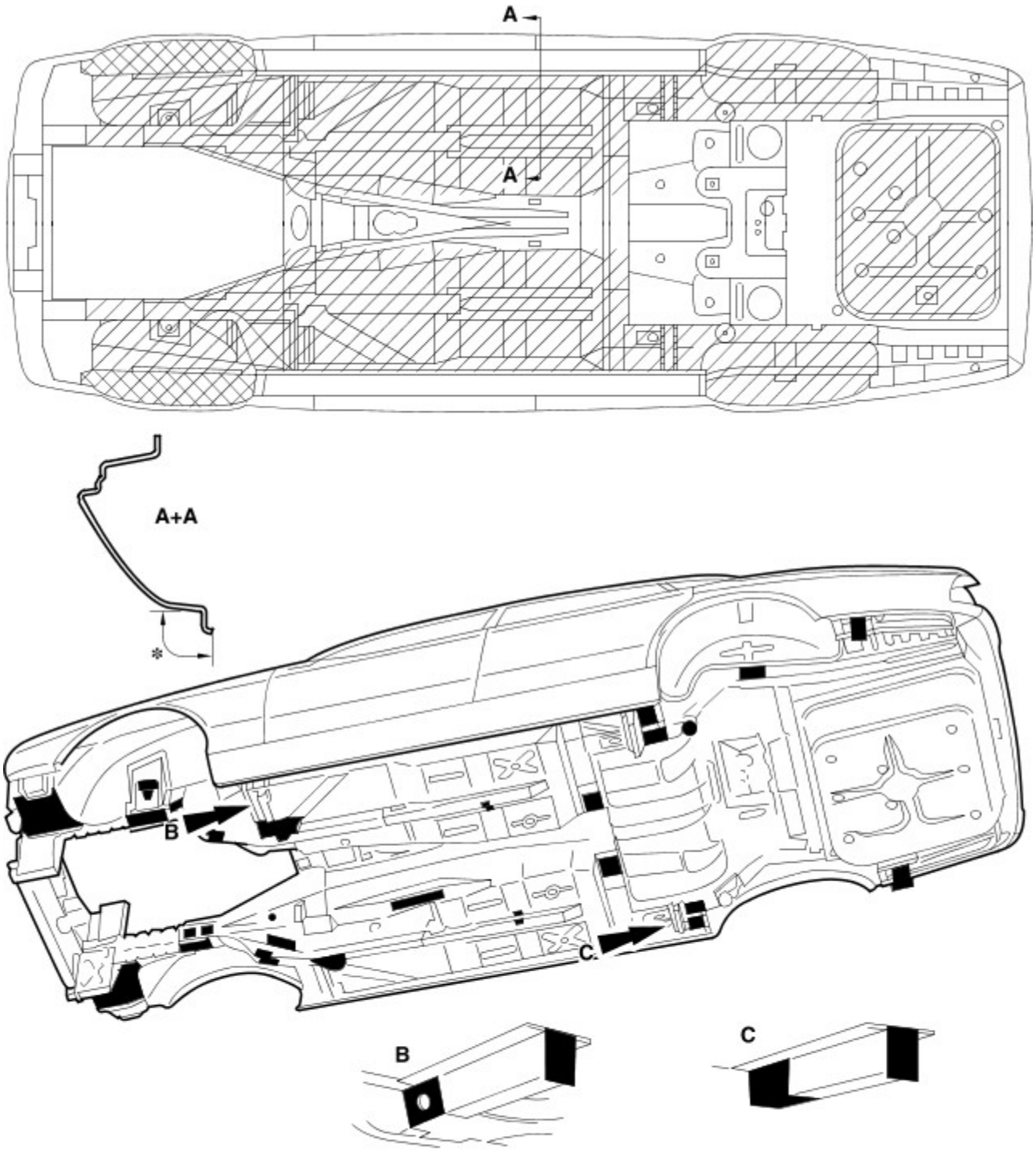
1. Position sensor at base of 'B' post and connect harness multiplug.
2. Lift sensor into position and fit and tighten securing bolts.
3. Fit seat belt guide and and seat belt upper anchor. Refer to 76.73.10.
4. Fit 'B' post trim pad. Refer to 76.13.08.
5. Connect ground cable to battery terminal and fit battery cover. Refer to 86.15.15.

Body Repairs - General Information - Body Repairs

Description and Operation

Body Pre-treatment, Painting and Sealing

PVC Coated Underside



E36322

The body is pre-treated to ensure high resistance to corrosion and stone chip damage. Prior to the first major pre-treatment process, the body shell is high-pressure washed to remove any metal dust and residual oil.

The first major pre-treatment process consists of phosphate and electro-paint deposition, which together with zinc coating, forms the basis of the corrosion protection. This process includes high pressure knock-off, alkali de-greasing, zinc phosphate conversion of body steel (dissolving iron and coating with zinc phosphate crystals), trivalent chrome rinsing and demineralized water rinsing, sealing all chemicals and impurities.

Both dip and spray techniques are employed and the bodies are submerged to the waistline during the first and third rinses of the main phosphate clean. Chemical strengths and solution temperatures are continuously monitored and accurately controlled throughout the process.

An 80% water primer is then cathodic electro-deposition applied to the thoroughly cleansed bodies in a uniform 'sag-free' film 18 to 32 micron thick. Optimum durability of the electroprimer is achieved by finally curing in a stoving oven at 165 °C for a period of 20 minutes.

All underbody seams of the fully primed bodies are then manually sealed, to prevent water and dust ingress into the vehicle and to enhance corrosion protection.

An 800 to 1000 g/m2 PVC coating is semi-automatic airless spray applied to the underside of the main floor panels, trunk floor and rear wheel arches (ref. illustration above).

The upper panels of primed and externally sealed bodyshells are next lightly scuffed to remove imperfections and a PVC coating is applied to all internal seams by an airless spray technique. A PVC bead seal is also applied to the doors, hood and trunk clinch joints.

Following anti-corrosion, sealing and priming treatment, the bodies enter the first stage of 'cosmetic' painting. This consists of the application of two coats of a highly chip resistant polyester surfacer, employing high voltage electrostatic 'spinning bells', to achieve a final film thickness of 35 to 50 micron. Between surfacer coats, a polyurethane coat is automatically applied to the sills to impart even greater resistance to stone chipping.

All interior panels are then painted using a color keyed sealer, wet-on-wet with a surfacer material, after which the bodyshells are stoved at 160 °C for a period of 20 minutes. Further protection against corrosion is provided by a medium solids black pigmented wax which is airless spray applied to vehicle undersides.

Wax Injected Box Sections

Critical body box-sections are similarly protected by spray injecting a high solids wax. This is then re-flowed at 70 to 90 °C to achieve optimum seam/joint penetration and form a resilient and durable internal coating (ref. illustration above).

After full wet sanding, rinsing and drying to provide a good substrate, a color-keyed semi-matt sealer coat is applied using electrostatic bells to achieve a film build of 25 to 35 micron. The bodies are then stoved for a further 20 minutes at a temperature of 145 °C and subjected to a local 'seek-and-find' de-nib operation prior to the final two coat process. The final top coat finish is achieved by using polyester base coat colors and an acrylic sag resistant clear coat. This clear over base (COB) process produces a high gloss, durable paint finish with a film thickness of 50 to 65 micron, which is finally cured at a temperature of 135°C for 20 minutes.

The Munsell three dimensional system of color management is employed to achieve highly accurate control of vehicle colors. This system ensures that paint pigmentations are accurately maintained and facilitates vigorous final checking of finished vehicles for color match. The hue of individual panels such as trunk lids, doors and hoods is in some instances adjusted to offset the effects of differing light angles. Where applicable, coachlines are manually applied and radiant heat cured on the completed and valeted vehicle prior to hand spray application of a protective wax coat.

Introduction

All repairs, whether structural or cosmetic must return the vehicle to the original manufactured condition with regard to occupant safety, dimensional accuracy, finish and corrosion protection, and ensure continuation of the Paint Surface and Corrosion warranty where applicable.

Similarly, repaired vehicles must be fully checked, and where appropriate reset, with regard to steering, suspension, braking, and occupant restraint systems.

Health and Safety

It is the duty of both employer and employee to ensure safe working conditions and practices. Correct safety procedures and equipment must be applied to any potential hazards that are notified, or identified by an operator.

Employees must observe local legislation governing working conditions and practices at all times and must always act in a responsible manner in the workplace. In the event of personal injury resulting from any workshop activity, medical help should be obtained as soon as possible. Self-treatment other than by first aid, should not be attempted.

WARNING: READ AND UNDERSTAND WORKING PRACTICES CONCERNING CLIMATE CONTROL SYSTEMS, SECTION 412, WITH SPECIAL REGARD TO: REFRIGERANT MUST NEVER BE DIRECTLY VENTED TO ATMOSPHERE. ALWAYS USE JAGUAR APPROVED RECOVERY / RECYCLE / RECHARGE EQUIPMENT, WEAR SUITABLE EYE AND SKIN PROTECTION AND OBSERVE ALL APPLICABLE SAFETY REQUIREMENTS.

With the constant introduction of new materials in the manufacture of vehicles, an awareness of the potential risks and appropriate precautions is important.

Notification of Hazards

Symbols, which convey important information, will be positioned at the beginning of any specific operation or text. Standard symbols will be used where repairs or service procedures are detailed. All symbols will conform to standard ANSI Z535.3 (American National Standards Institute). The surround shape of the symbol will indicate the basis of the message to be conveyed (see top three elements of ?) The icon depicting the message will be within the surrounding shape. Once nominated the icon will retain its meaning.

POTENTIAL RISKS

Paint

Organic solvents, found in paints, may cause damage or severe irritation to liver, kidneys, digestive tracts and respiratory system if inhaled over long periods of time. Prolonged exposure to isocyanates can cause lung sensitization with asthma-like symptoms developing on subsequent exposure to even low concentrations of isocyanates. Solvent inhalation can cause dizziness or loss of consciousness and inhalation of spray dust and sanding debris may cause lung damage.

Spillage or splashes of solvents, paint activators and additives can cause dermatitis or eye injury. Contact with peroxide or acid catalysts can cause serious burns.

Applied Heat (Welding)

There is considerable risk of damage to eyes and skin if welding or flame cutting is attempted without using the correct protective equipment. Many materials or fluids within vehicles are highly flammable and toxic and dangerous fumes may also be liberated if heat is applied to expanded foam, corrosion protection, trim and seat materials, paints containing isocyanates, and adhesive and sealing compounds.

When heated to a temperature of 300°C, polyurethane based compounds may liberate small quantities of isocyanate. Many types of nitrogen containing chemicals may be liberated as breakdown products which can contain isocyanates, oxides of nitrogen and hydrogen cyanide.

Potentially toxic or asphyxiant fumes and gases produced when welding include zinc oxide from zinc coated panels, and ozone gas from the MIG process.

Metal Repair

There is considerable risk of damage to eyes, ears and skin when cutting, forming, or dressing metal. Soldering operations can also be hazardous due to heat generated fumes and the risk of skin contact with hot materials.

PRECAUTIONS

Paint

The inhalation of sprays, fumes, or dust during paint application or sanding processes should always be avoided. Ensure that there is efficient ventilation / extraction at all times. Paint spraying should be confined as far as possible to spray booths. Personnel with a history of asthma should not be employed in any process involving the use of isocyanates. Operators working in a spray booth where isocyanate material is present must use air-fed breathing equipment with air supplied to the visor at the recommended pressure and filtered to remove oil, water, and fumes. Operators involved in handling mixing or spraying should wear protective clothing including gloves and goggles, to avoid skin and eye contact. Particle masks or canister type respiratosr should be worn when sanding.

Applied Heat

When welding, flame cutting, brazing etc, the operator should use as appropriate, goggles, mask / fume extractor and flameproof protective clothing. It is especially important when working with polyurethane compounds to use air-fed breathing equipment. Appropriate fire fighting equipment and personnel trained in its use must always be available.

Metal Repair

Appropriate eye and hand protection should be worn when sanding, drilling, cutting, chiselling, flatting or welding. Face masks or air-fed visors should also be worn when sanding or flatting either body solder or fillers. On completion of a soldering operation, swarf must be removed from the work area and the operator must wash his hands thoroughly.

GENERAL REPAIR NOTES

The following advice should be noted before any repair work is carried out.

Disconnect the vehicle battery ground lead (disconnect the alternator where electric welding is used) and take note of the reconnection procedures as detailed in 86.15.15.

Where structural parts are straightened or renewed, a body alignment / straightening jig must be used. The application of heat, especially excessive heat, reduces the strength of steels, where appropriate therefore, structural sections should be straightened by cold processes.

Repairs may only be carried out successfully, and any warranties protected, if genuine Jaguar replacement parts and Jaguar approved materials are used.

The correct tools, procedures and facilities must always be used. The quality of the work must not be compromised by using inappropriate methods or equipment.

All trim and electrical components in the locality of the repair must be removed or disconnected prior to panel removal / replacement; this is especially important where hollow sections may contain harnesses, tubes or foam, see section A4.3.5.

WARNING: DO NOT WORK IN THE VICINITY OF A LIVE AIR BAG, REMOVE IT COMPLETELY. READ WORKING PRACTICES AIR BAG, SECTION 20. ANY SEAT BELT WHICH HAS BEEN WORN IN AN ACCIDENT MUST BE RENEWED.

CAUTION: Electric arc welding should not be used on Jaguar vehicles. The high voltages produced by this process will cause irreparable damage to the electrical control and microprocessor systems.

The following welding and gas processes are the only ones recommended by Jaguar Cars Ltd.

Welding and Gas Processes

Resistance spot welding, MIG welding and all gas processes may only be carried out on bare, unpainted or unplated metal.

The flanges of panels to be welded together, must be clean, corrosion free and treated as appropriate, with either weld-through primer or inter-weld sealer. Only materials and processes specified in the 'Body Sealing and Preservation Manual' should be used in the relevant application areas detailed in this section. Refer to 'Zinc Coated Panels' Section

Generally, resistance spot welding equipment used in the motor vehicle repair industry does not produce welds of equivalent strength to those achieved during manufacture. The expression 'single row of resistance spot welds' indicates that the spots should be spaced on a pitch of 19mm to 25mm, which normally results in more spot welds than those produced in the original factory joint.

Resistance spot welds should be removed using a resistance spot weld cutter. If the new joint is to be MIG plug welded, old resistance spot welds should be cut from the panel to be retained and the resulting holes used for plug welding. Suitable holes may also be drilled or punched; 8,0 mm dia for sections up to 1,6 mm, and 10,0 mm dia for thicker sections.

PLASTICS-EXPLANATORY NOTES

Plastic component and trim materials

This table, in conjunction with the illustrations on the following pages will enable rapid identification of the particular material of any major plastic part.

• NOTE: Only those components suitable for economic reclamation are identified.

Term	Material Name
abs	Acrylonitrile Butadiene Styrene
abs / pa	Acrylonitrile Butadiene Styrene and Polyamide (nylon) blend
abs / pc	Acrylonitrile Butadiene Styrene and Polycarbonate blend
ABS / PBT	Acrylonitrile Styrene Acrylate and Polybutylene Terephthalate
pa	Polyamide (nylon)
pc	Polycarbonate
pe	Polyethylene
pmma	Polymethyl Methacrylate
pom	Polyoxymethylene (acetal)
pp	Polypropylene
ppo	Modified Polyphenylene Oxide
pur	Polyurethane
pvc	Polyvinylchloride
SMA	Styrene Maleic Anhydride

Plastics - Handling Notes

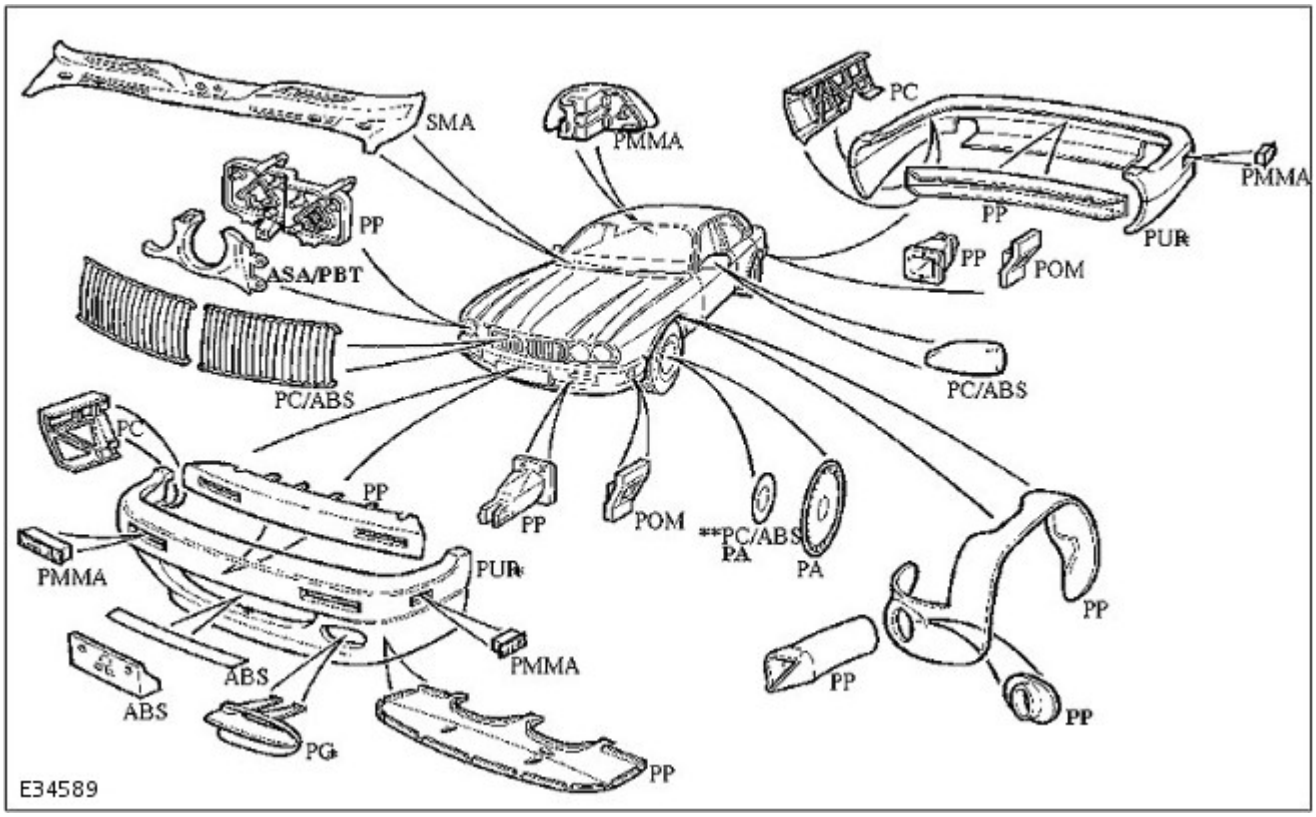
The exterior panel temperature of a vehicle must not exceed 95°C at any time and may only be held at this level for a maximum of two hours. Similarly, interior vehicle temperature must be limited to 86°C for a maximum duration of two hours. Exposure to temperatures above those specified may result in distorted or permanently damaged components. If there is doubt concerning temperature limitations, components that may be adversely affected by exposure to heat should be removed from the vehicle.

Plastic components that become greasy may be cleaned with an 'SBP 3' spirit wipe, or equivalent.

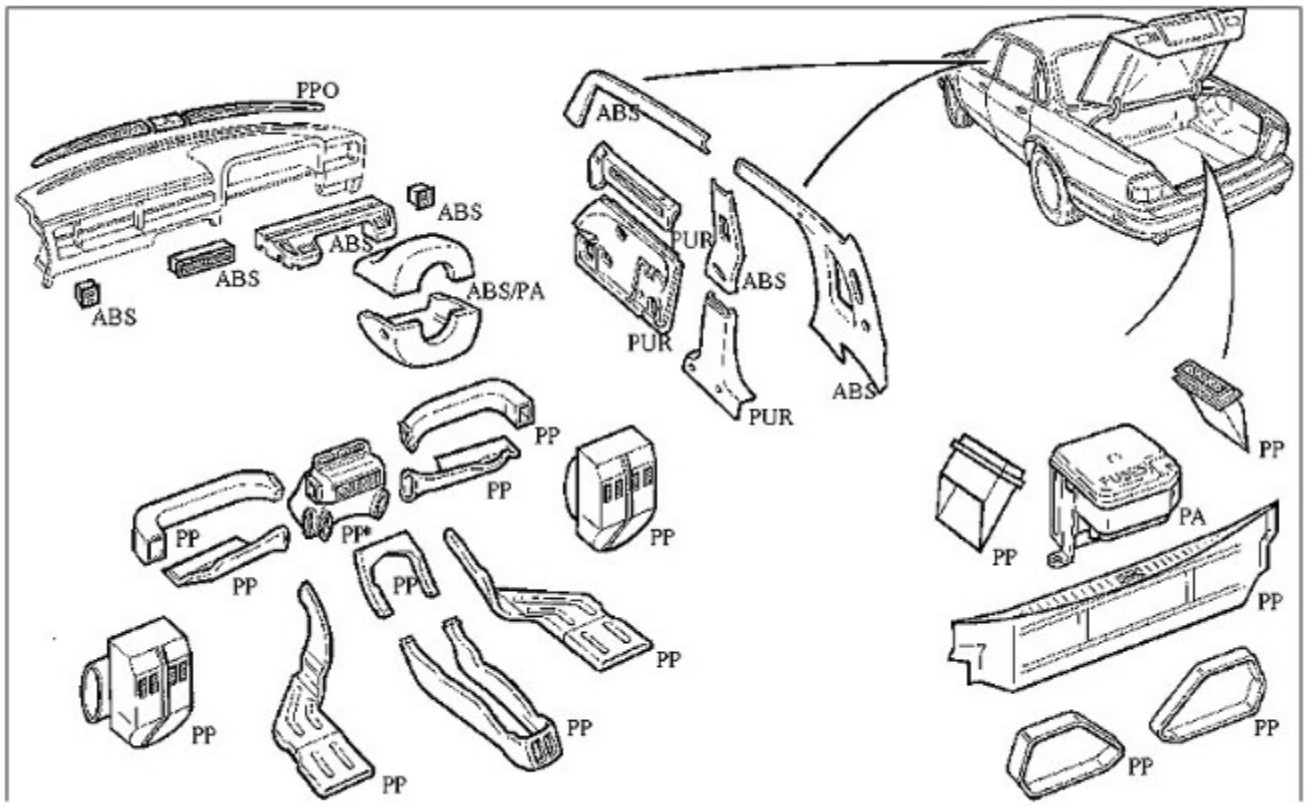
Recycled Materials

Any of the materials listed in this section, may be recycled provided that they are not contaminated by other incompatible plastics or metals. For instance, the air conditioning unit case, manufactured from PP (polypropylene), must be separated from the heater matrix, evaporator, control devices (electronic and mechanical) and all fixings before it can be considered for recycling. After removal, the case must only be placed for disposal with materials of the same generic type. Bumper cover assemblies similarly have side armatures of dissimilar materials rivetted to them, these together with their fixings must be removed prior to recycling. Components manufactured from 'blended' materials must not be recycled with pure materials. For example do not mix PC/ABS (wheel trim) with ABS ('B' pillar upper trim).

Plastics, Component Location and Type - External



Plastics, Component Location and Type - Internal



Body Structure

Introduction

The standard wheelbase Jaguar sedan has a unit construction monocoque body structure with bolt-on front fenders and welded rear fenders. The doors feature lift-off hinges and welded drop-glass frames.

Constructional Steel Classification

Material	Application
High strength low alloy (HLSA).	Impact prone areas, ie. seat frame and bumper mountings.
Double sided zinc plated mild steel.	Exterior body panels subject to severe conditions such as stone chipping and weather exposure (excluding roof panel).
Boron steel	Door intrusion beams
Mild steel.	Internal brackets, fillets and strengtheners.

BODY ALIGNMENT

The Body Dimensions Plan, and Body Dimensions Side View, provide specified BIW dimensions to facilitate damage assessment and location of replacement parts. These dimensions must be strictly applied when used for damage assessment, component location or post repair verification.

• NOTE: The right-hand side is always looking towards the front, from the rear of the vehicle.

The nominated plan view master datums are on the right-hand side of the body with the left-hand datums dimensioned from them. Right-hand datums must therefore be known to be correct before any other cross-car dimensions are checked.

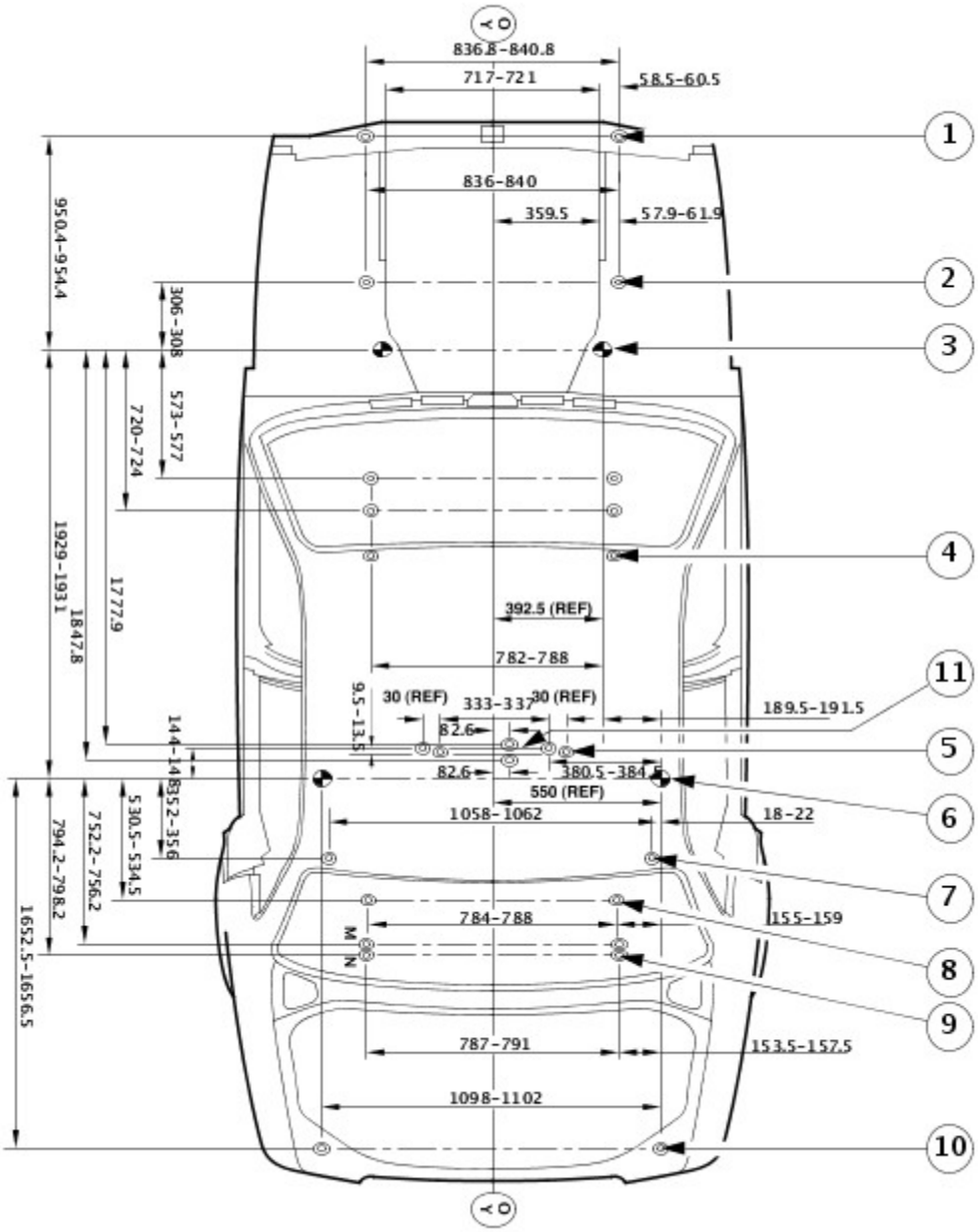
Datum location, Example

The Front Master Datum (front crossmember rear mounting at the inner face of the main floor RH longitudinal) is nominally 359,5mm to the right-hand side of the body center line. The LH side front datum is measured 717,0 / 721,0mm from the RH. Refer to the Body Dimensions Plan.

Expressed as a true position in three planes, the front master datum is:

Datum	Location	Position
Front Master Datum Plan	Centre line of the front crossmember rear mounting, at the main floor RH longitudinal	• X 300,0 • Y 359,5 • Z -50,0

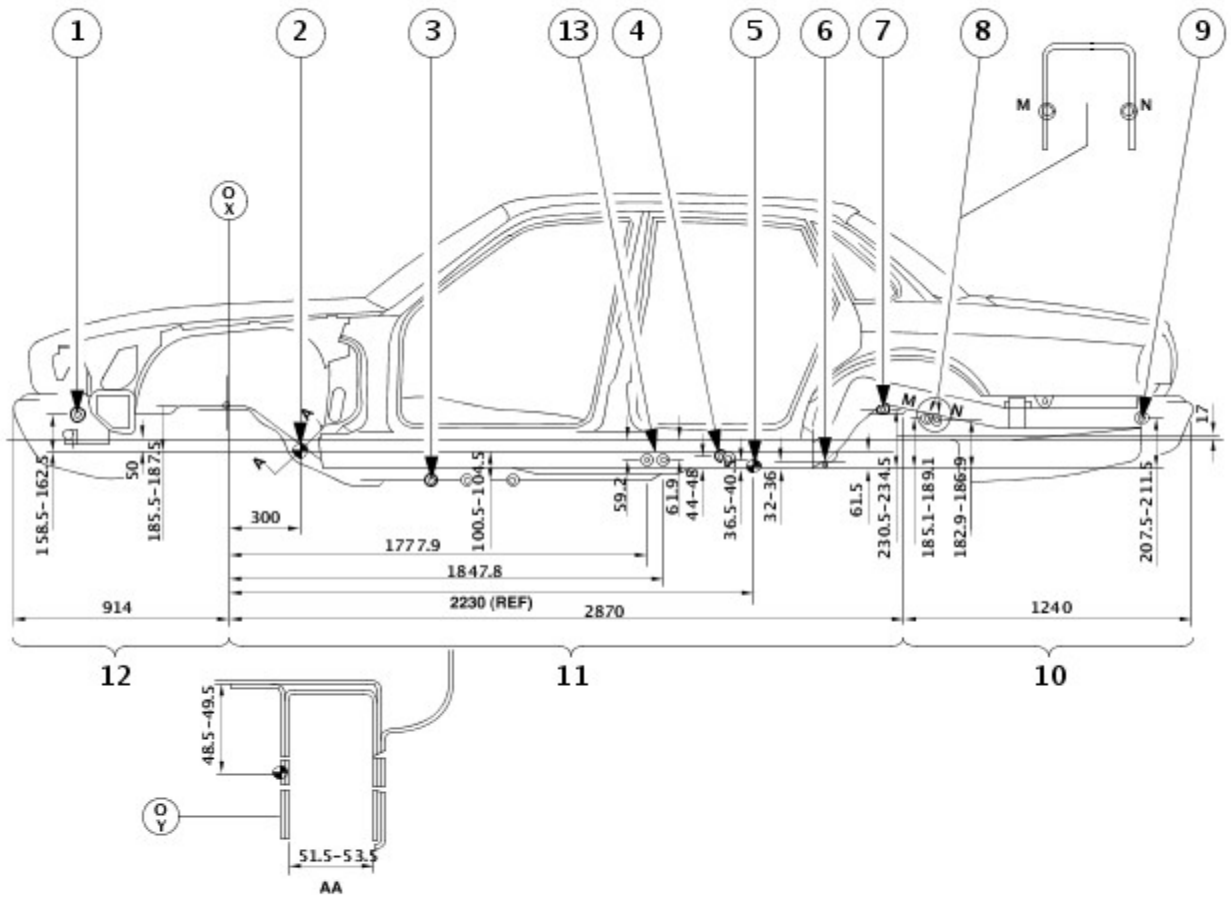
Standard Wheelbase Body Dimensions-Plan



Key to Plan

Key	Location
1	Front face body-bumper strut/mounting point
2	Rearmost hole, vee-mount to crush tube
3	Front Master Datum Plan, centre line of front crossmember rear mounting at main floor RH longitudinal
4	Rearmost hole, transmission mounting at main floor RH longitudinal
5	Handbrake rear lever bracket fixings
6	Rear Master Datum Plan, rear longitudinal
7	Tapped boss, rear suspension 'A' frame mounting bush
8	Rear suspension spring-pan damper mounting
9	Rear suspension differential strut mounting
10	Rear face body-bumper strut/mounting point
11	Driveshaft centre bearing mounting

Standard Wheelbase Body Dimensions- Side View

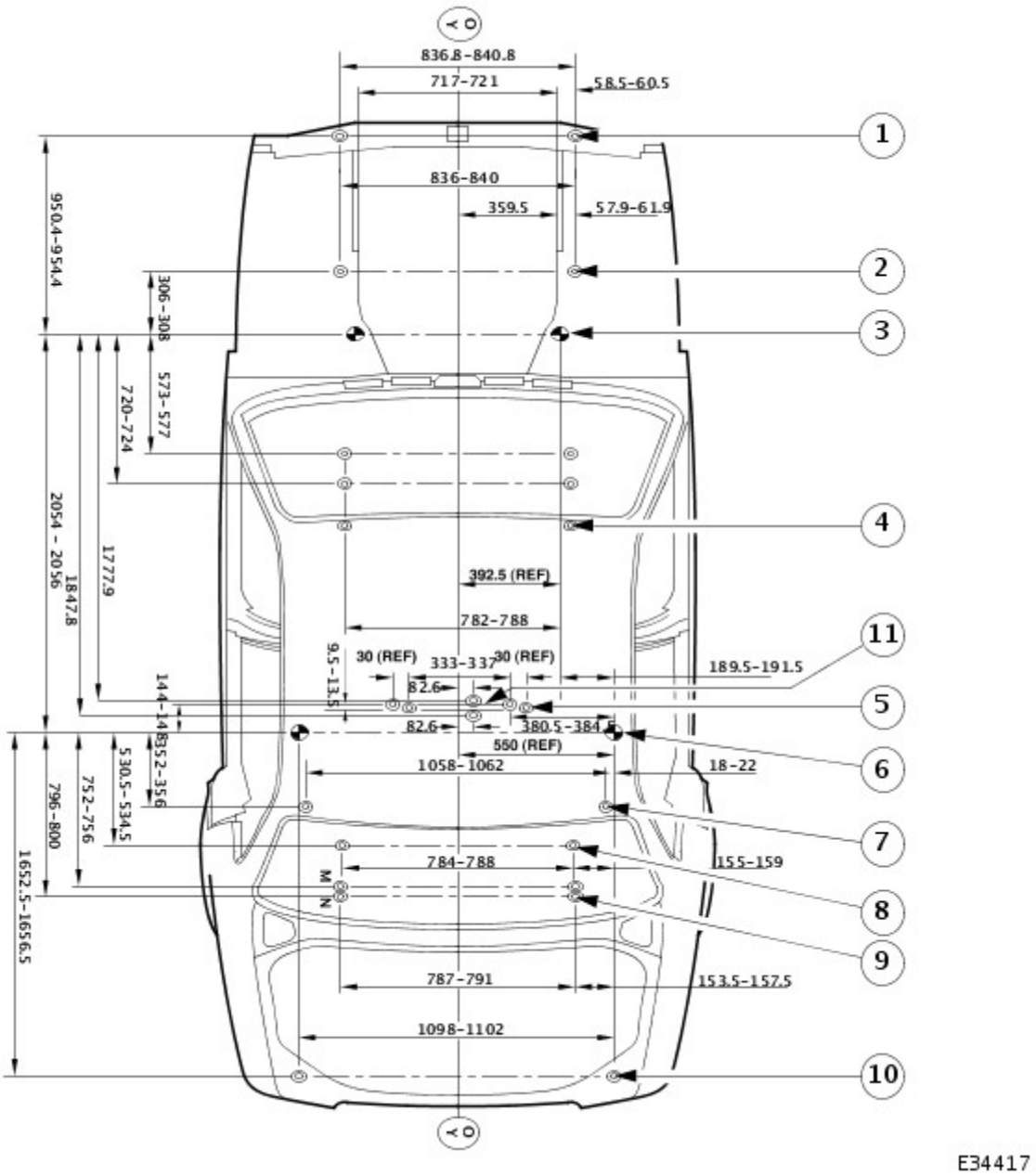


E34410

Key to SideView

Key	Location
1	Front face body-bumper strut/mounting point
2	Front Master Datum Vertical, centre line of front crossmember rear mounting
3	Transmission mountings at the main floor longitudinal
4	Handbrake rear lever bracket fixings
5	Rear Master Datum Vertical,, rear longitudinal
6	Tapped boss, rear suspension 'A' frame mounting bush
7	Rear suspension spring-pan damper mounting
8	Rear suspension differential strut mounting
9	Rear face body-bumper strut/mounting point
10	Wheel centre to bumper cover face
11	Wheelbase
12	Wheel Centre to Bumper Cover Face
13	Driveshaft centre bearing mounting

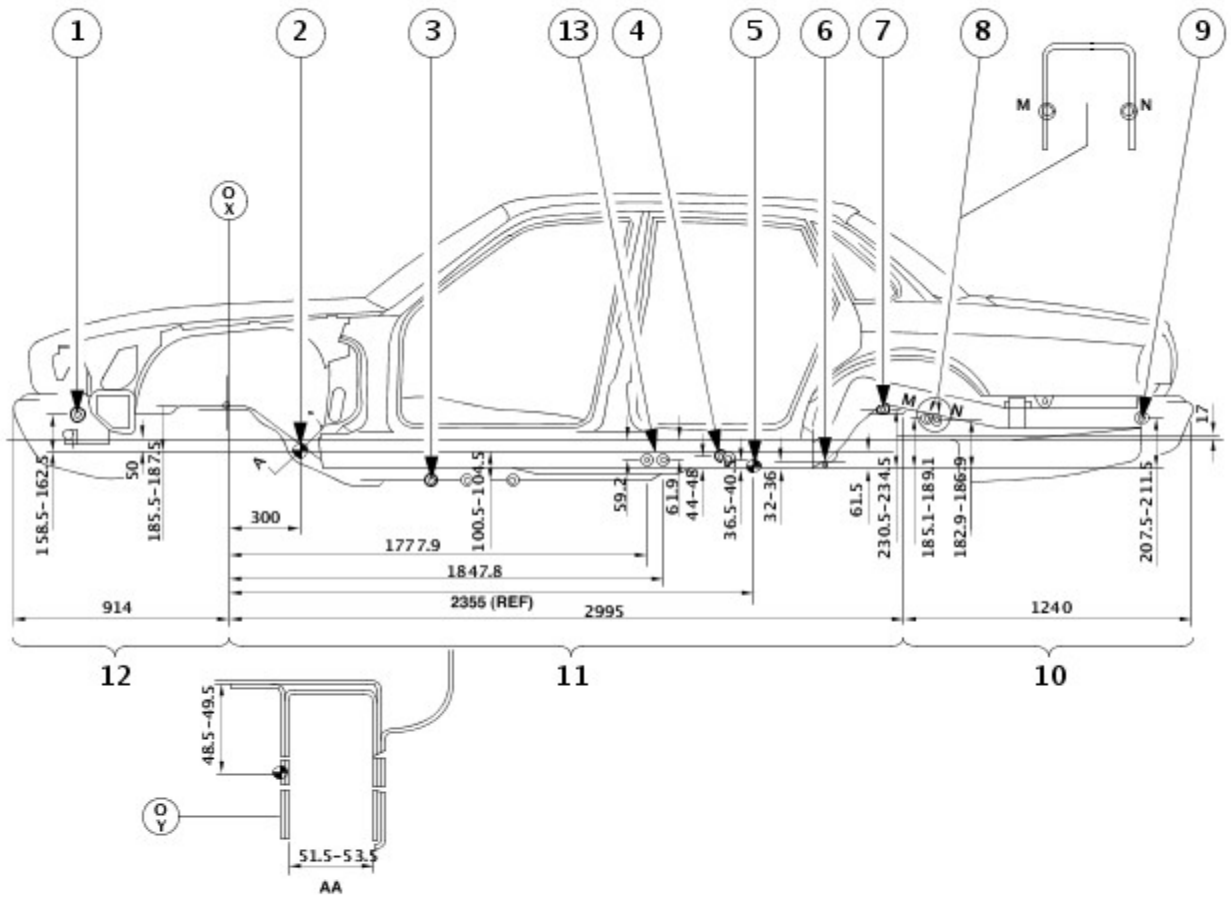
Long Wheelbase Body Dimensions-Plan



Key to Plan

Key	Location
1	Front face body-bumper strut/mounting point
2	Rearmost hole, vee-mount to crush tube
3	Front Master Datum Plan, centre line of front crossmember rear mounting at main floor RH longitudinal
4	Rearmost hole, transmission mounting at main floor RH longitudinal
5	Handbrake rear lever bracket fixings
6	Rear Master Datum Plan, rear longitudinal
7	Tapped boss, rear suspension 'A' frame mounting bush
8	Rear suspension spring-pan damper mounting
9	Rear suspension differential strut mounting
10	Rear face body-bumper strut/mounting point
11	Driveshaft centre bearing mounting

Long Wheelbase Body Dimensions- Side View



E34418

Key to SideView

Key	Location
1	Front face body-bumper strut/mounting point
2	Front Master Datum Vertical, centre line of front crossmember rear mounting
3	Transmission mountings at the main floor longitudinal
4	Handbrake rear lever bracket fixings
5	Rear Master Datum Vertical,, rear longitudinal
6	Tapped boss, rear suspension 'A' frame mounting bush
7	Rear suspension spring-pan damper mounting
8	Rear suspension differential strut mounting
9	Rear face body-bumper strut/mounting point
10	Wheel centre to bumper cover face
11	Wheelbase
12	Wheel Centre to Bumper Cover Face
13	Driveshaft centre bearing mounting

ZINC COATED PANELS

Description

Approximately 70% of the 'body in white' (BIW) mass is made up of zinc coated panels.

• NOTE: To maintain the protective qualities of the zinc treatment, repairs to any damaged coated area must be made as soon as possible after the damage has occurred.

All exterior skin panels, with the exception of the roof, are double side zinc plated and this coating (nominally 7,5 microns) provides two way corrosion protection. Should the outer layer of paint become chipped with the zinc coating remain intact, the zinc will oxidize on contact with air and being impermeable, this coat of oxidation will prevent corrosion damage of the base metal. If the outer layer of paint and the zinc coating become damaged, the zinc rather than the base metal will react with the air and 'sacrifice' itself to corrosion as a 'sacrificial anode'.

Welding Preparation

Contamination of the weld with resultant reduction in joint strength increase and increased electrode tip dressing frequency will occur zinc coating is not removed. In exceptional cases where the zinc coating must remain intact, the tip pressure and welding current should be increased by 10 to 20%.

Where 'resistance spot welding' is employed, the zinc coating should be lightly abraded away on the mating surfaces and those in contact with the electrode tips. Do not remove more zinc coating than is absolutely necessary.

Before welding, a weld-through primer or inter-weld sealer should be applied, as detailed in the Body Sealing and Preservation manual.

Where MIG welding is used as an alternative to resistance spot welding for plug and butt welds or due to limited access, the problems caused by the presence of zinc coating are much the same, with the added complication of increased weld spatter and nozzle contamination.

Body Fillers

Conventional polyester fillers do not adhere satisfactorily to zinc plated panels, it is therefore important that only those products specifically designed for this application are used and the manufacturer's recommendations are followed.

Refinishing

Use only those products approved by Jaguar Cars Ltd and exercise special care on zinc coated panels.

As replacement panels are supplied ready primed, the only bare metal that needs to be exposed are those areas prepared for welding etc, as decribed in 'Welding Preparation. Where any part of a panel is dressed back to the bare surface, it should be treated with a zinc rich primer compatible with the paint application system.

GENERAL PREPARATION OF PANELS

Removal of Panels and Welds

• NOTE: Where other components must be removed for access, refer to the relevant manual section for guidance. This is particularly important where steering, braking, suspension, electrical and safety systems are affected.

Expose all resistance spot welds, using a rotary wire brush fitted to an air drill or a hand held wire brush on those that are not clearly visible (1).

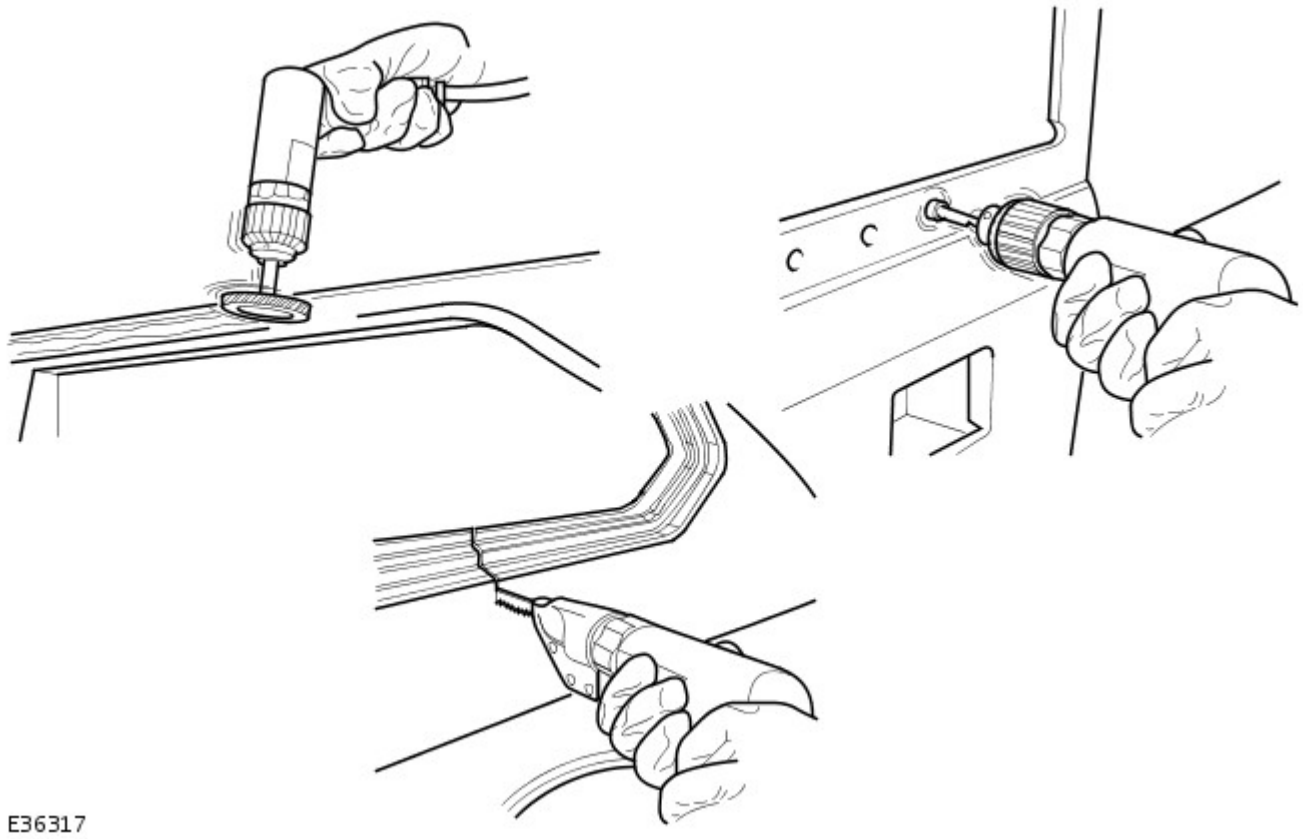
WARNING: DO NOT BURN UNDERSEAL OFF. USE A 'HOT KNIFE' OR SUITABLE SOLVENT.

Cut out spot welds using a Zipcutter or Roto-Bor (2). At this point it may be necessary to cut out the bulk of the panel using

a pneumatic saw (3).

• NOTE: On some panels, before removing the bulk with a pneumatic saw, it may be necessary to remove brazed areas and MIG welded seams. Separate spot welded joints and remove the panel remnants.

Removal of Panels and Welds



PREPARATION OF PANEL SURFACES

WARNING: DO NOT BURN UNDERSEAL OFF. USE A 'HOT KNIFE' OR SUITABLE SOLVENT.

• NOTE: Observe all appropriate safety procedures.

Remove weld nuggets with a sander and 36 grit disc and clean all flanges to a bright smooth finish (1). Straighten existing panel joint edges as required.

Mark off the area of new panel and cut to size leaving approximately two inches overlap on the existing panel. Offer up new panel or section, align with associated parts, i.e. new rear fender aligned with door / luggage compartment lid / backlight aperture and clamp the panel into position.Where necessary, cut the new and original panels to form a butt joint.

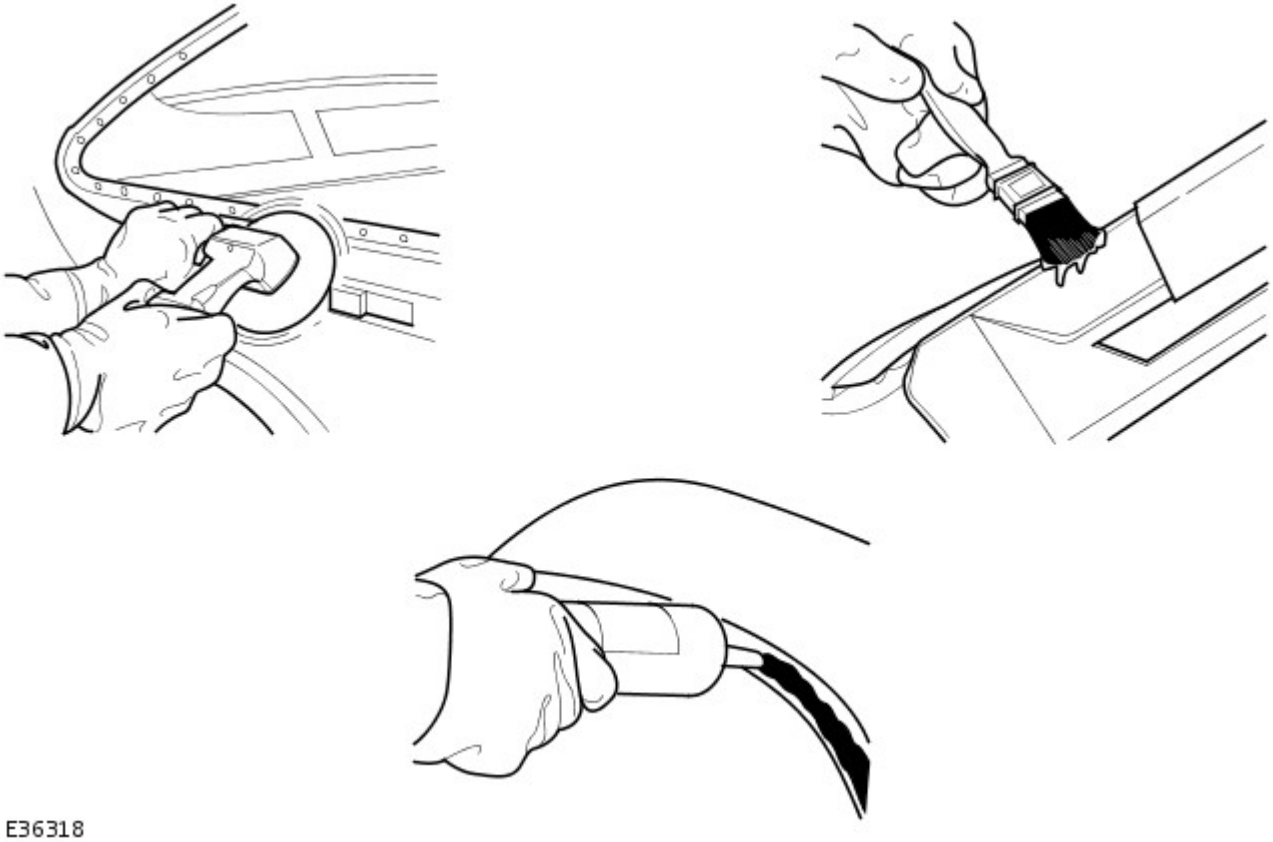
Release all clamps and remove the new panel. If required, apply inner panel protection and or sound insulation.

Prepare the new panel joint edges, including interior and exterior, for welding by cleaning to bright metal (1).

Apply weld-through primer or interweld sealer(2) to all surfaces to be resistance spot welded.

Where appropriate, apply metal-to-metal adhesive or sealer (3) in accordance with the manufacturer's instructions.

Panel Surface Preparation



E36318

ALIGNING AND WELDING PANELS

• NOTE: Observe all appropriate safety procedures.

Apply appropriate sealer or joint preparation.

Align the replacement panel with adjacent panels, secure with clamps, MIG tack welds or self tapping screws. Finally check panel alignment and contours and re-adjust as necessary.

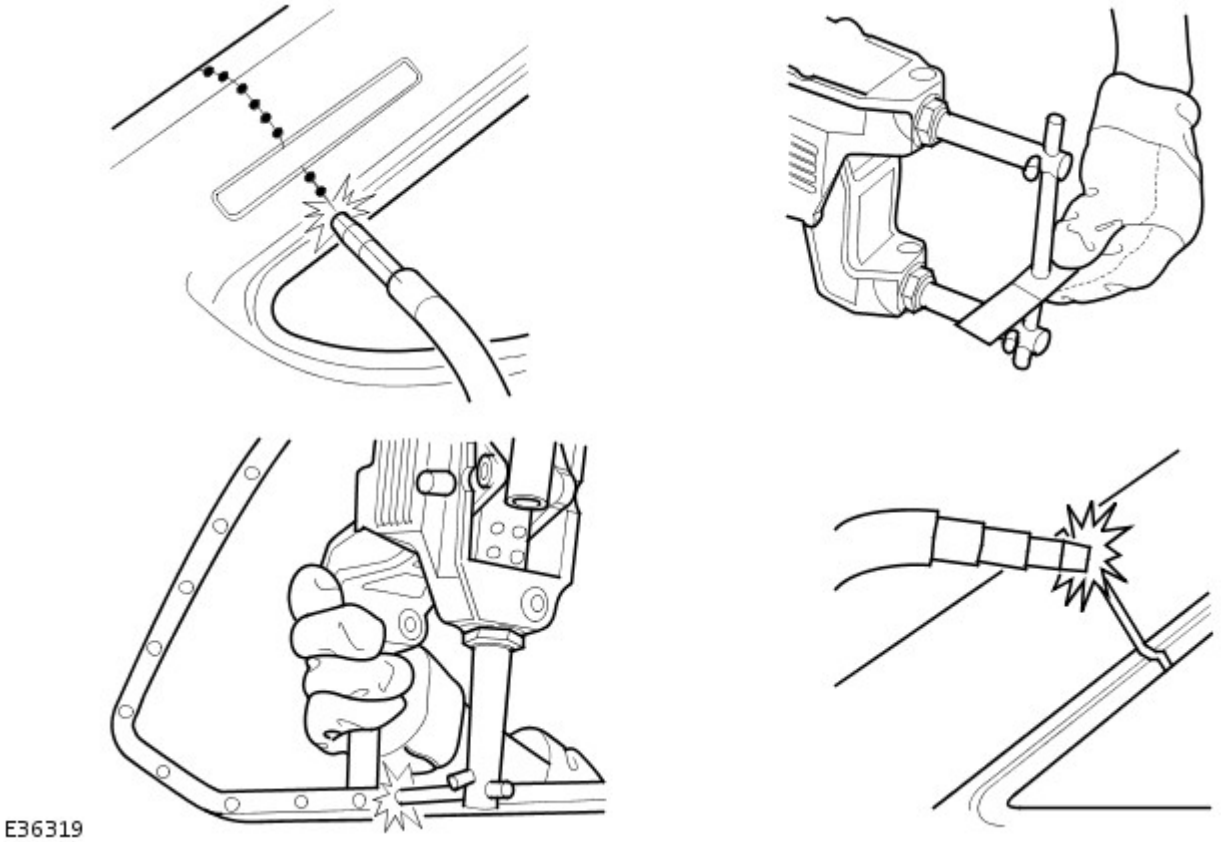
Select the correct 'arms' for resistance spot welding and ensure that tips are correctly trimmed.

• NOTE: It is recommended that 'arms' of not more than 300 mm (12 in.) long are used and the equipment is tested for satisfactory operation by producing test samples (2). In the absence of test equipment, a satisfactory weld can be verified by pulling the test samples apart and viewing the weld condition.

Prepare zinc coated panels as detailed in this section and resistance spot weld where required (3).

Dress back all tack welds, then MIG seam-weld the butt joints (4). Finally dress all welds as necessary and final braze and fill prior to paint preparation.

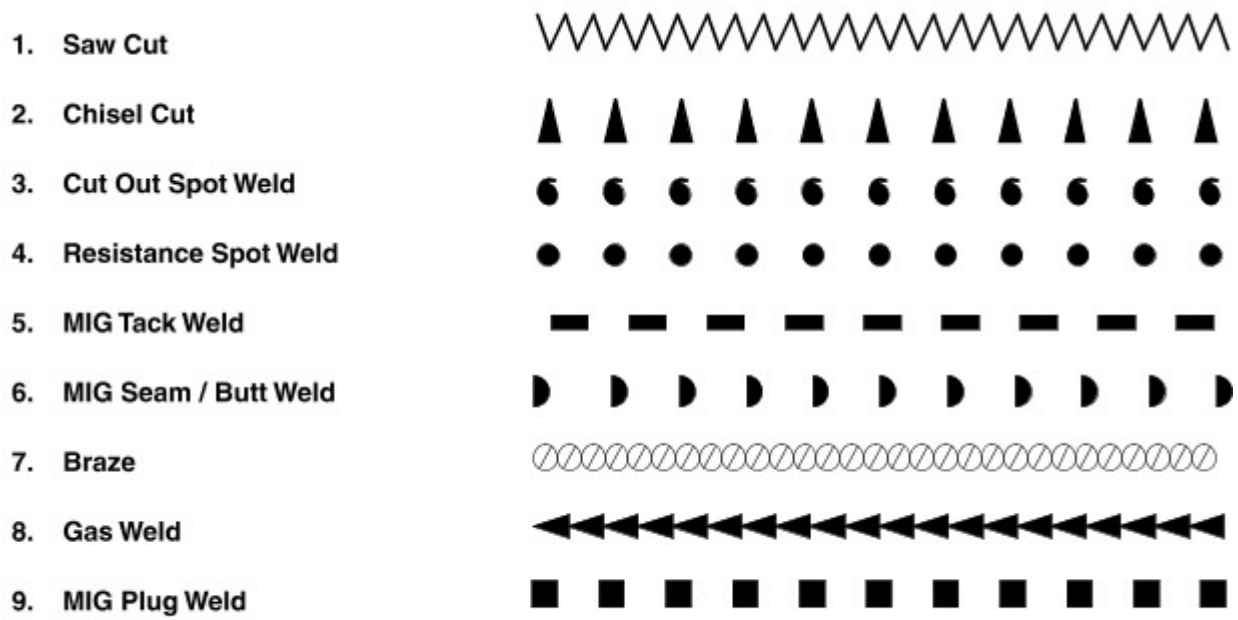
Aligning and Welding Panels



E36319

Cutting and Welding Symbols

CAUTION: Reference should always be made to the welding tables and illustrations in the relevant procedures. Observe all safety precautions with respect to yourself, other people, your equipment and the workplace.



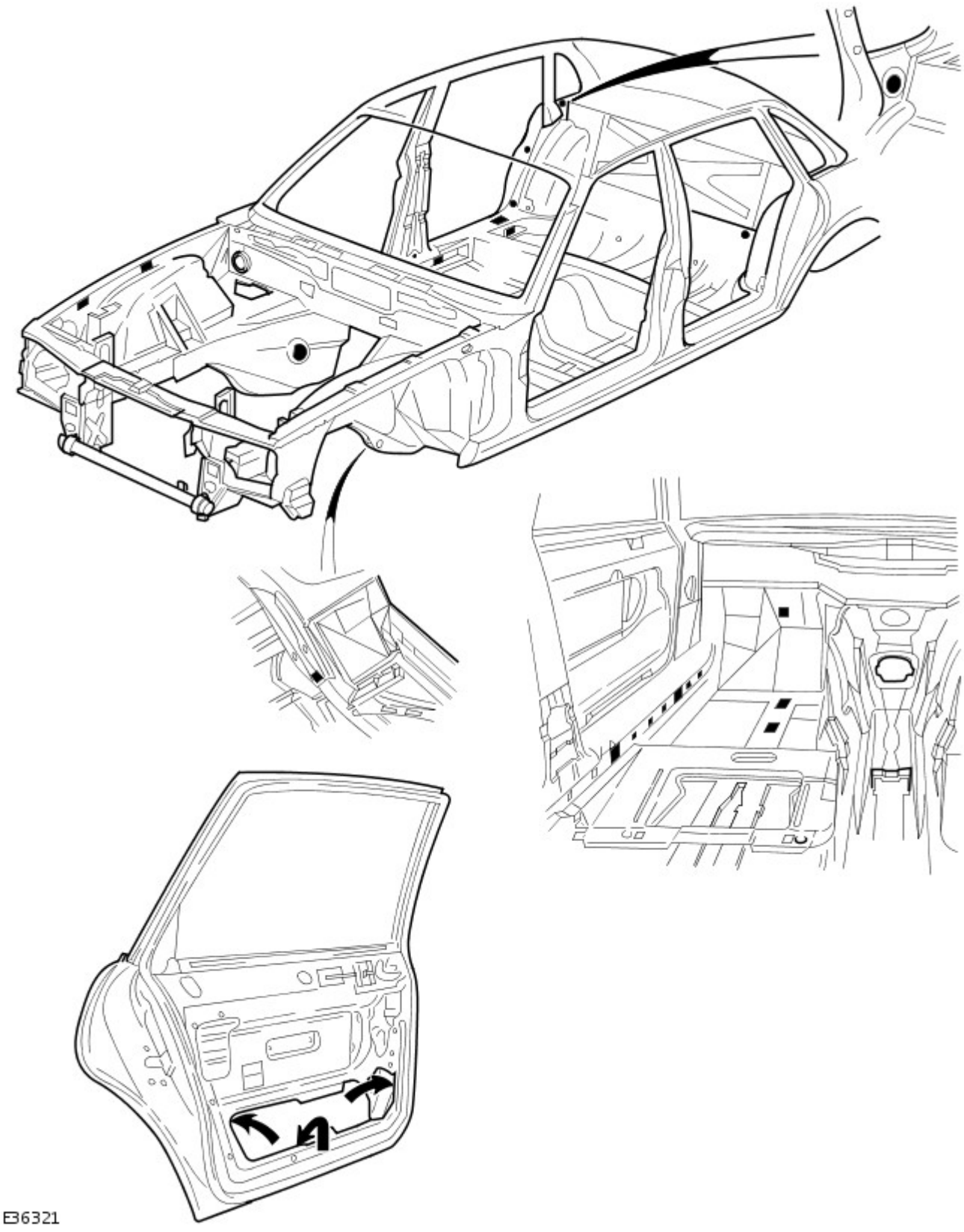
E36320

Item	Description
1.	Saw Cut
2.	Chisel Cut
3.	Cut out Spot Weld
4.	Resistance Spot Weld
5.	MIG Tack Weld
6.	MIG Seam/Butt Weld
7.	Braze
8.	Gas Weld
9.	MIG Plug Weld

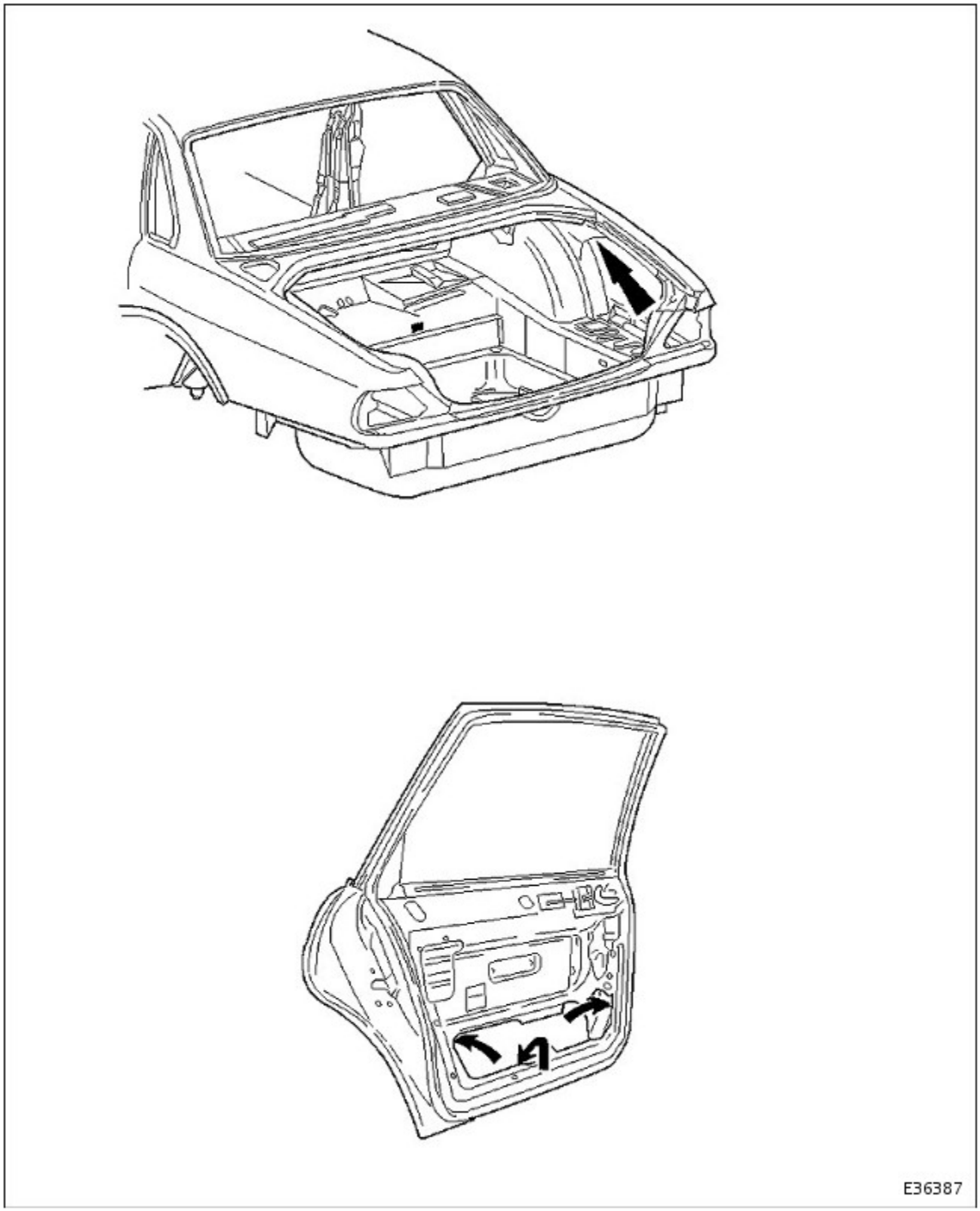
CAVITY WAX INJECTION - APPROVED ADHESIVES, SEALERS AND BODY PROTECTION SYSTEMS

• NOTE: Cavity wax processes should only be applied on completion of all other refinishing and protection procedures.

Cavity Wax Injection Points - Front



Cavity Wax Injection Points-Rear

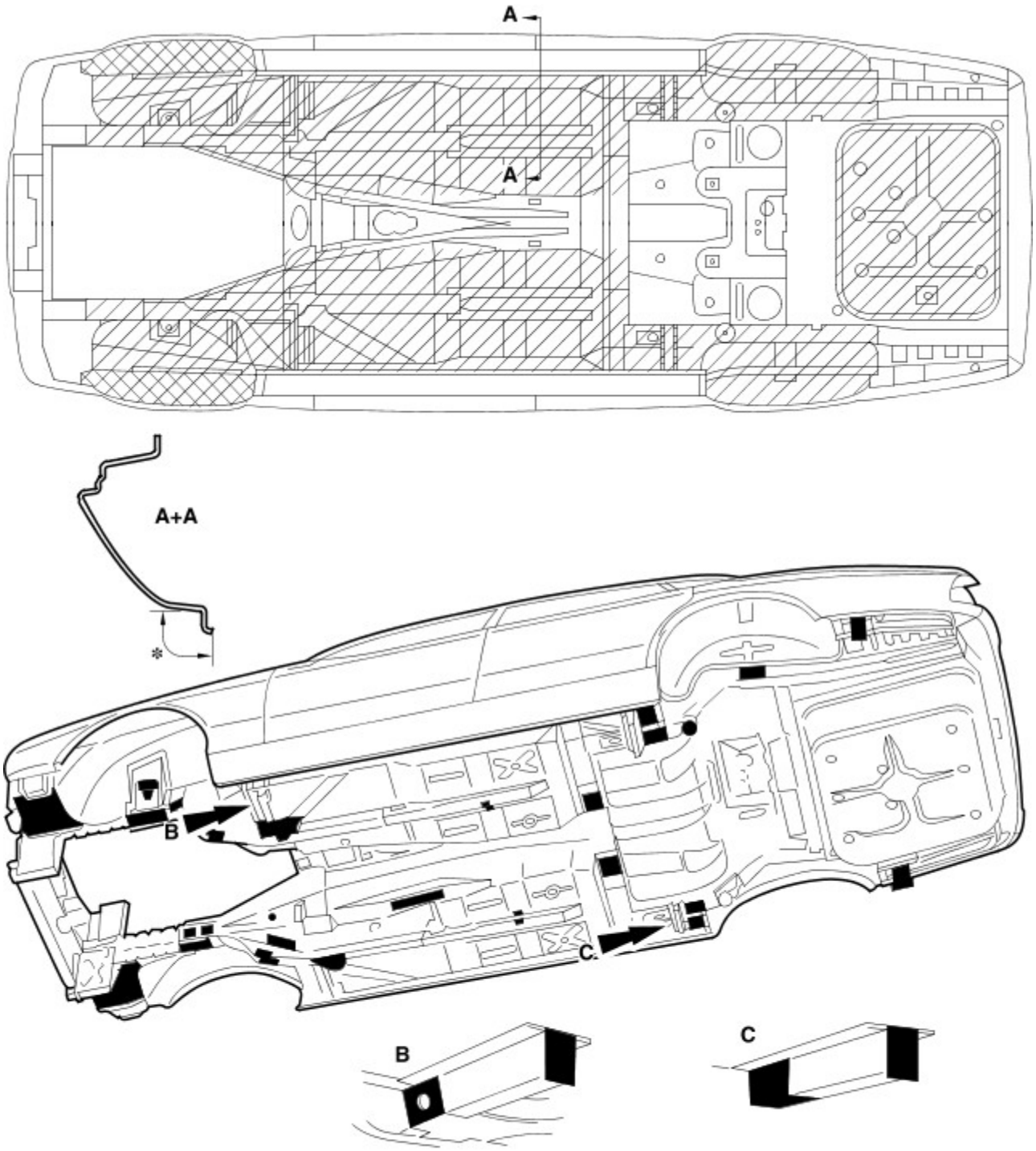


UNDERSEAL APPLICATION

Underseal should be applied as indicated by the hatching and omitted from areas indicated in solid black.

CAUTION: Do not apply underseal to rotating or hot components.

Underseal Application

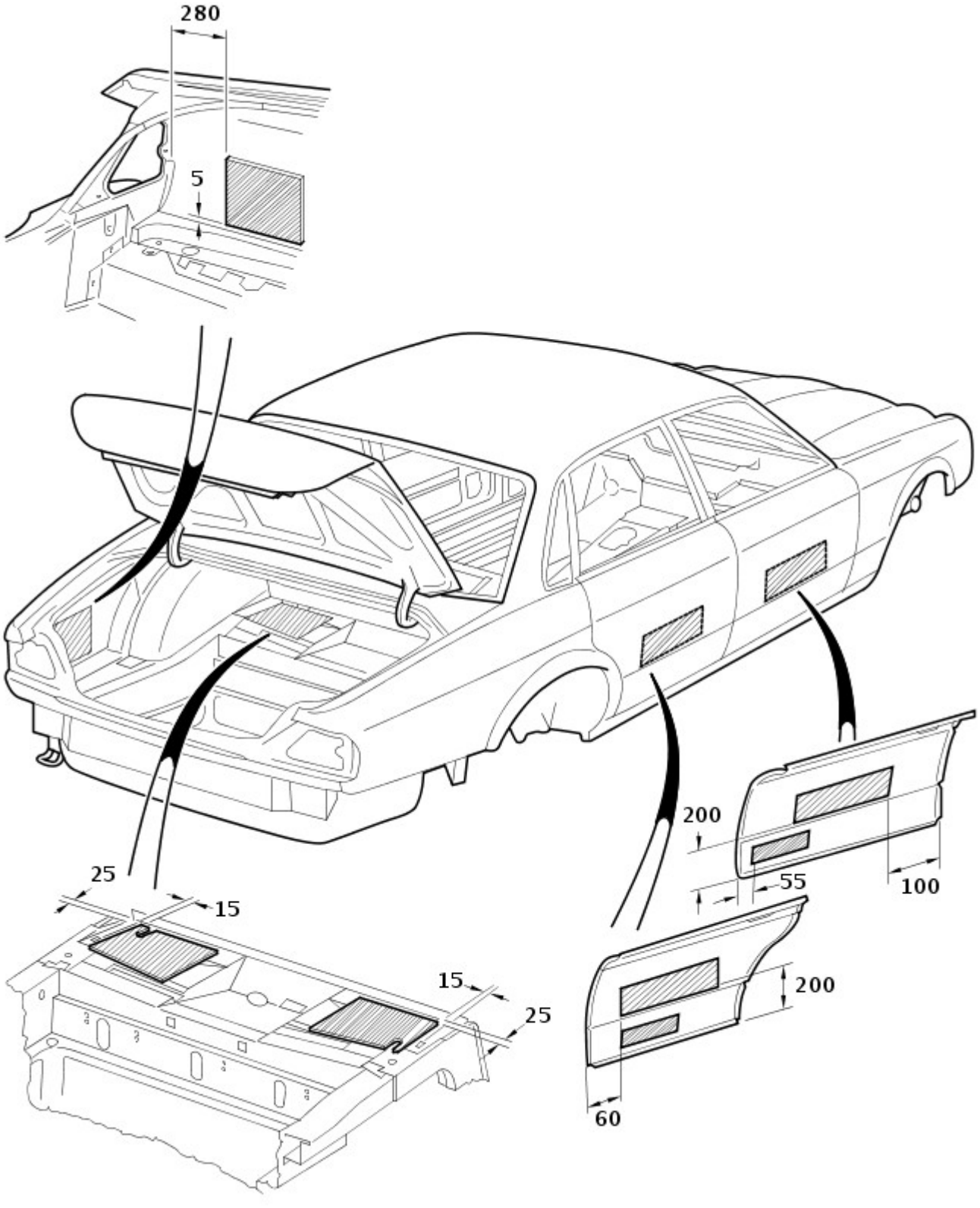


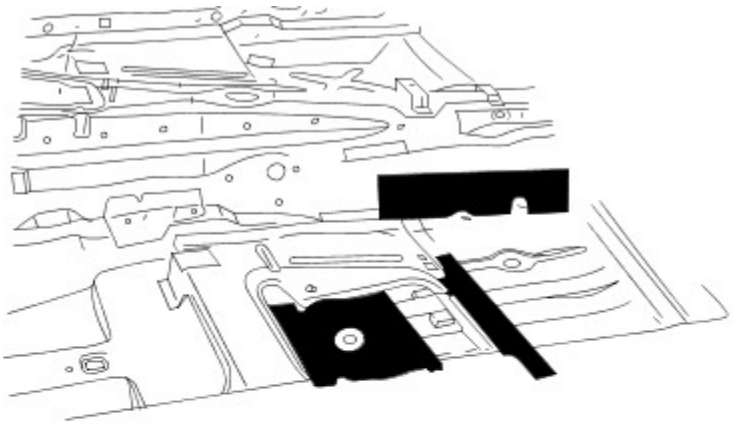
E36322

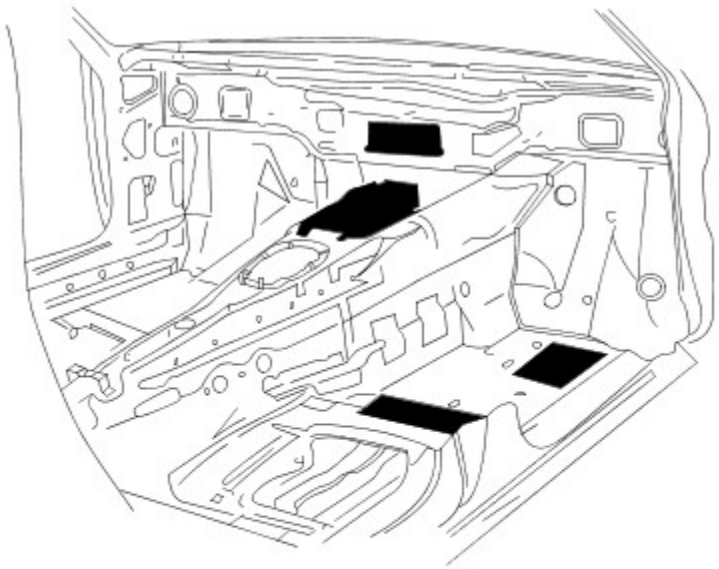
INSULATION PADS

Insulation pads should be installed in the areas indicated by hatching.

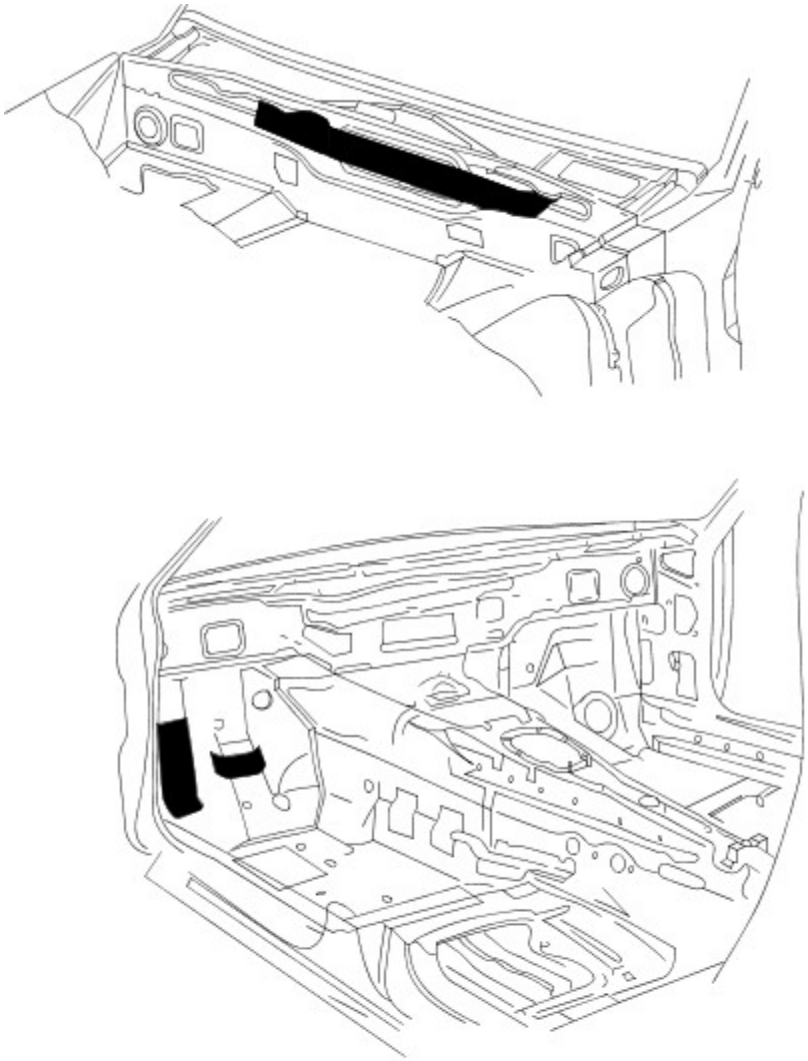
Insulation Pads



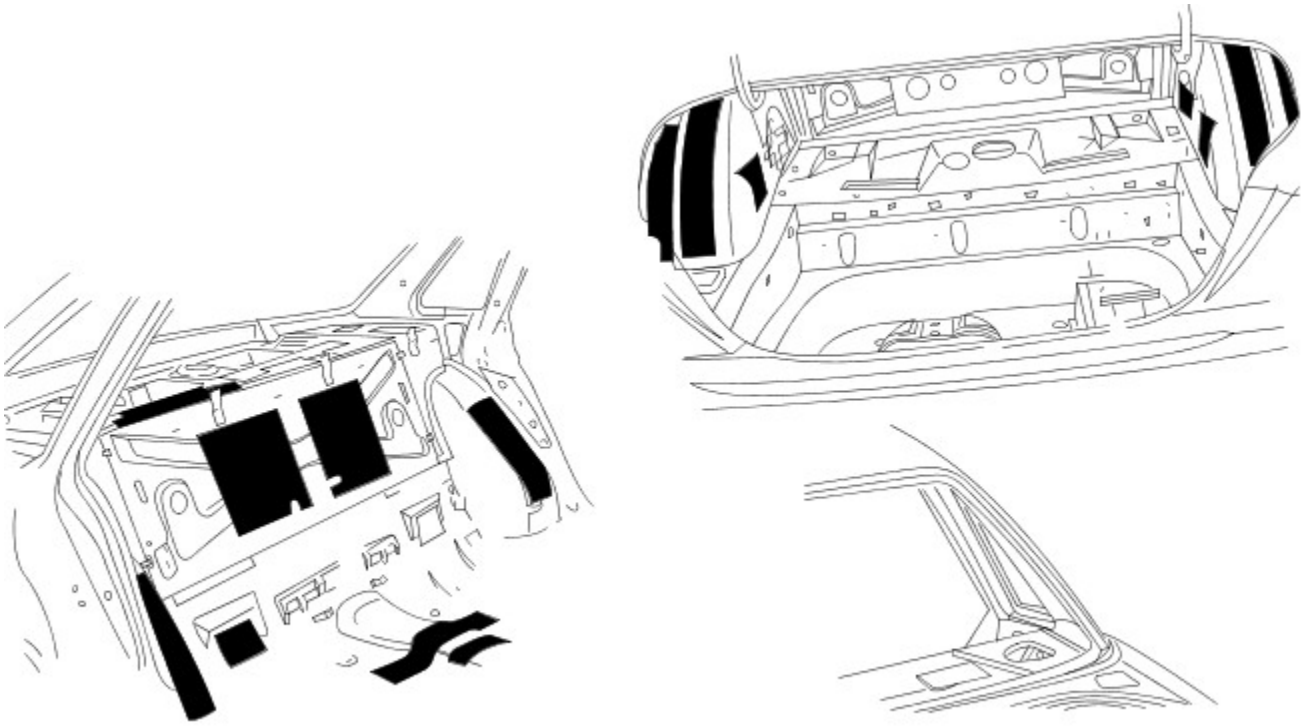




E35525



E35526

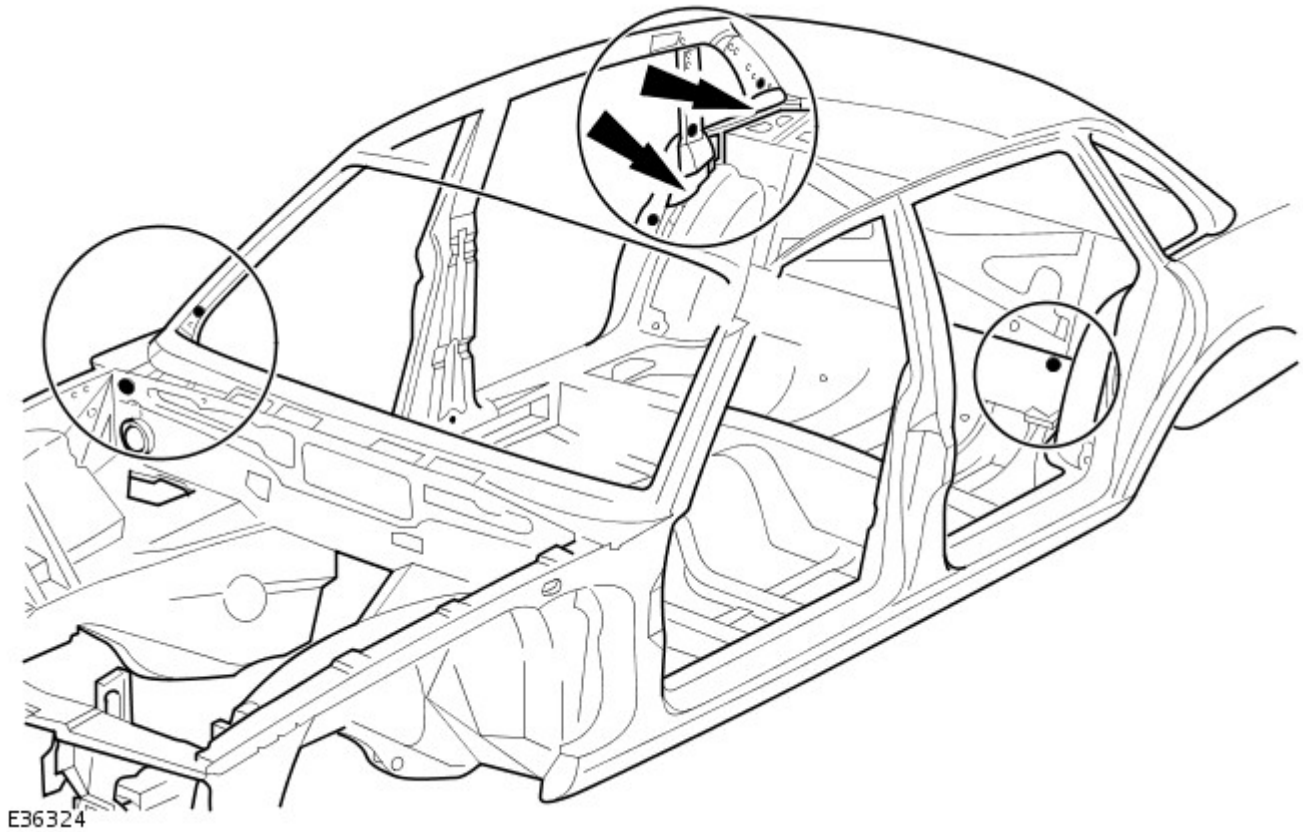


E35524

FOAM INJECTION

Where any of the sections shown in the illustration are renewed, expanded foam must be introduced into the area on completion of all other repair / refinishing / protective processes. Tape should be applied to the areas indicated by arrows to ensure full travel of foam along the hollow sections.Expanded foam should be introduced at the points circled. Items such as sliding roof drain tubes and the harness from the rear left-hand bulkhead through to the luggage compartment, must be in position before the introduction of foam.

Foam Injection Points



APPROVED PAINT SYSTEMS

The manufacturer's paint systems listed below are currently approved for refinishing Jaguar vehicles.

• NOTE: * Not available in certain markets but alternatives may be used, provided that they comply with the following company standards.

Manufacturer	Bare metal etch primer	Primer surfacer	Base color coat	Clear lacquer
Akzo Sikkens	Washprimer	Autocryl / Autonova	Autobase	Autoclear 1000 - 3000 Automat
Dupont			Centari 600*	Centari 600*
Glasurit	Wash Etch+		System 54 (solid/metallic) System 56 (micatallic) System 59 and 69 (pearl)	Clear lacquer 923-85
Herberts	Metal pre-treatment and rust remover 301.2595		Standox Basislak	Standox Clearlak
ICI				Autocolor
PPG	Galvaprep D840	Wash primer D831 Hi-build primer D855 Epoxy surfacer DP40 Deltron / non Isocyanate Primer D828	Deltron HS 2	Deltron Concept 2001 HS clear D880
R - M	Eurofill	R-M Prof / Maxfill	Diamont Basecoat	Diamont Clearcoat

CAUTION: To avoid damage to the vehicle interior, trim and plastic items, effective panel temperature must not exceed 95°C during paint cure process.

Product type	Applicable Standard
Bare metal etch primer	JMS 20.29.06

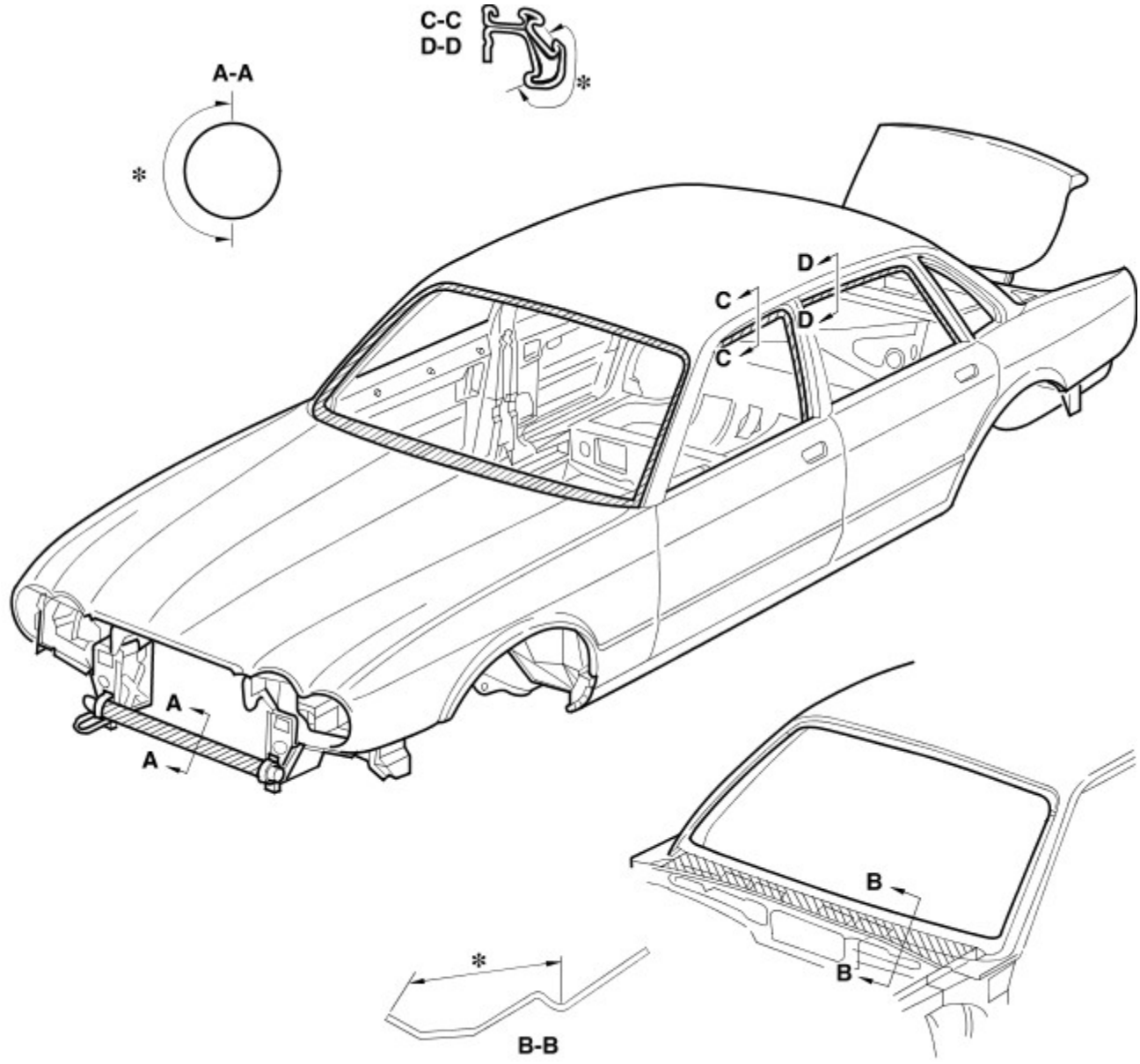
Primer surfacer	JMS 20.29.11
Base color and clear lacquer	JMS 20.29.09

OBSCURATION BANDS

To mask unsightly areas between panels, through gaps and under bonded glass, matt black paint with heat resistance of 40° to 120°C is applied in the areas indicated by hatching and asterisks.

• NOTE: This process is not required on dark colored vehicles.

Obscuration Bands



E36325

ANTI-THEFT LABELS

Original Components

On North American specification vehicles, the VIN is marked on all major external panels, certain structural members and power / transmission units. The labels carrying this information are known as 'Label-Anti-theft VIN (USA body panel only)' or 'Label-Anti-theft-Engine and Gearbox (U.S.A. only),' drawing reference A .

Replacement Components

Only genuine Jaguar replacement parts must be used in the repair of a vehicle. Furthermore, any new parts replacing items carrying a VIN label must have either 'Label-Anti-theft Replacement Part (USA body panel only)' or 'Label-Anti-theft Replacement Part-Engine and Gearbox (U.S.A. only),' drawing reference B , fitted in a different location to the previous label.

A protective mask used to prevent the replacement part label from being damaged or obscured during the refinishing / protection processes, must be removed prior to customer hand-over.

Procurement

Anti-theft labels may only be ordered from Jaguar Cars through :

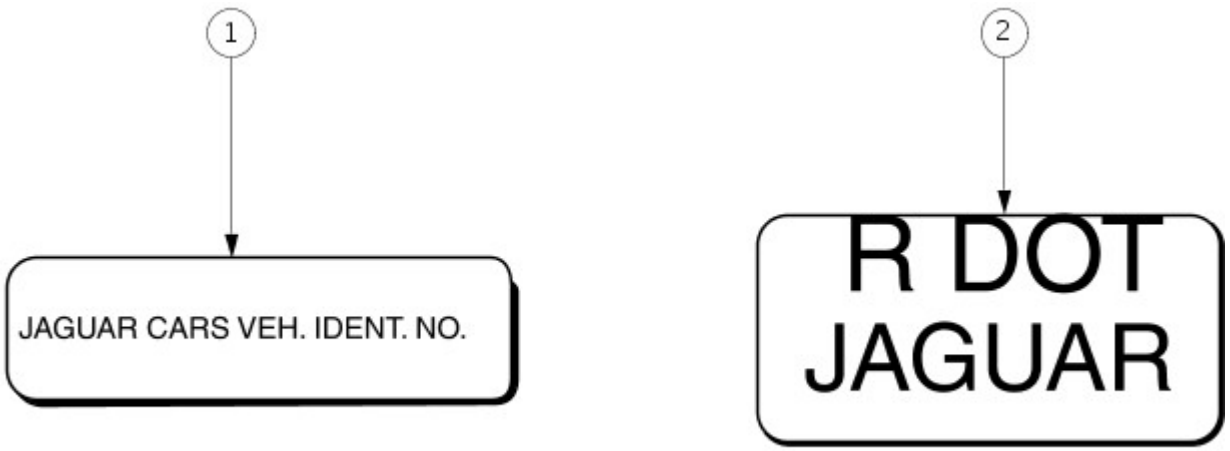
Product Compliance Dept.,

Jaguar Inc.,

555 MacArthur Blvd.,

Mahwah

NJ 07430



E36326

Label Fitting Process

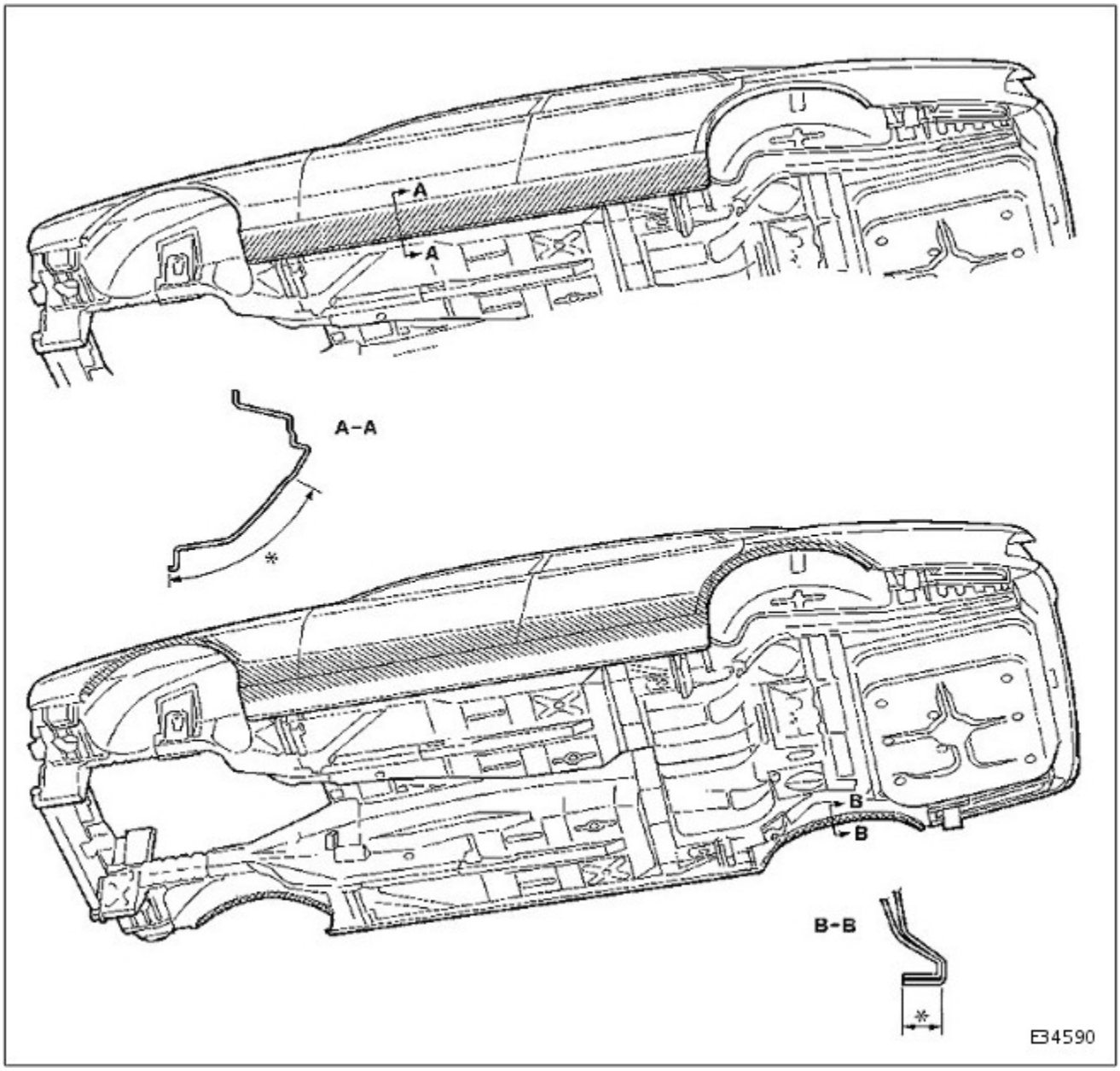
CAUTION: It is a requirement of United States of America federal law that the protective mask is removed from all anti-theft labels after performing painting and rustproofing operations. Failure to comply with this requirement may render both the manufacturer and the dealer in violation of the law.

• NOTE: Any attempt to remove an anti-theft label will destroy that label. Ensure correct location before affixing.

Using a suitable solvent clean the area where the anti-theft label is to be affixed. Peel the backing from the label and position on the panel. Carry out all refinishing / protection processes. Remove the anti-theft label protective mask prior to vehicle handover to the customer.

APPLICATION OF STONE CHIP PROTECTION

Apply approved material to the areas indicated by hatching.



REPAIR OF PAINTED COACHLINES

Panel Preparation

Existing painted coachlines can be removed using a suitable soft cloth moistened with thinners and/or acetone.

New coachlines must be applied over the lacquer coat, using two-pack 'solid' paints (ie non-metallic).

• NOTE: Lacquer must not be applied over the coachlines.

Where applicable, refinish the repaired panel (s), following Jaguar approved paint re-finishing procedures, including application and drying of the two-pack lacquer coat.

For coachline specifications, see page? .

Tape Application

Apply a suitable length of 3M "Fine Line Striping Tape" to the panel. Having suitably applied the tape, which is slit into 8 strips, each 3mm wide, the appropriate strip may then be peeled away to expose the lacquer coat below (Refer to Application of Striping Tape Drawing). The paint may then be applied by hand brush or a suitable air-brush. The remaining tape provides masking during paint application and drying. Careful positioning of the masking tape is necessary, particularly when the repair is confined to a single panel and the newly painted coachline must conform to coachlines on adjacent panels.

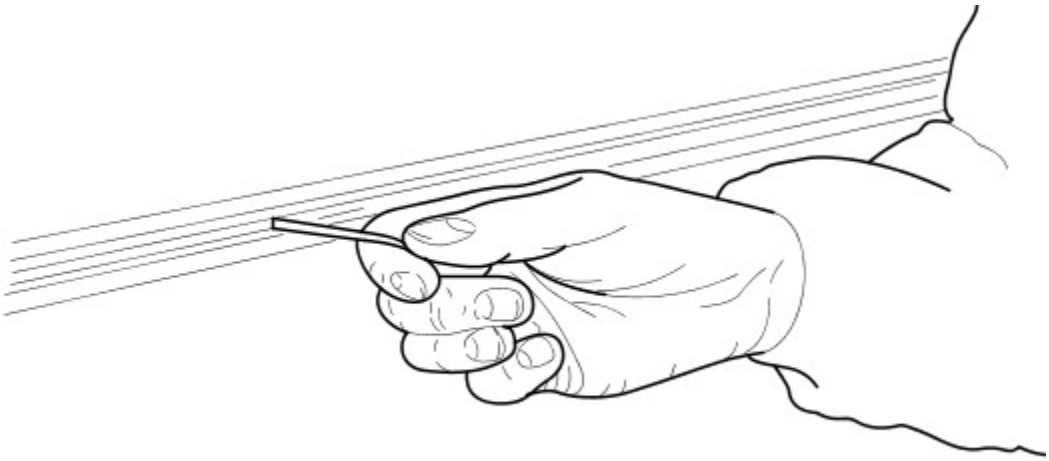
Where it is necessary to match an existing 1.5mm coachline, two techniques are available:

Proceed as above, to expose a 3mm strip of lacquer coat. Using either a standard masking tape, or a 3M "Fine Line Masking Tape" applied over the striping tape, reduce the width of the exposed strip to 1.5mm.

Use a suitable combination of standard masking tape, together with 3M "Fine Line Striping Tape" if desired, to achieve an unmasked strip 1.5mm wide in the correct position on the panel.

After application of the tape, use a fine-grit wet-and-dry paper to lightly 'flat' the exposed surface, before application of paint.

Application of Striping Tape

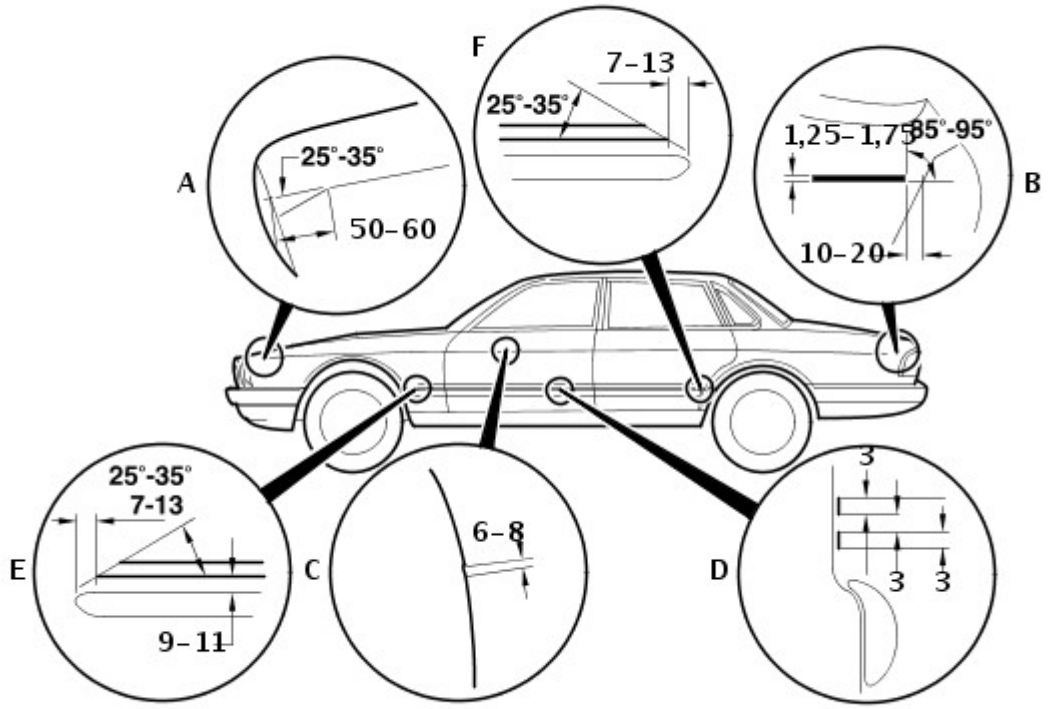


E36327

Coachline Locations

The coachline locations on the side of XJ Sport and supercharged models are illustrated below, for all other models refer to the drawing under 'Other Models'.

XJ Sport and XJR8



E36328

Inset A, shows the 25° - 35°angled cut-away at front edge. The front end of the coachlines should terminate 50mm - 60mm behind the headlamp apertures and the two sides must be symmetrical.

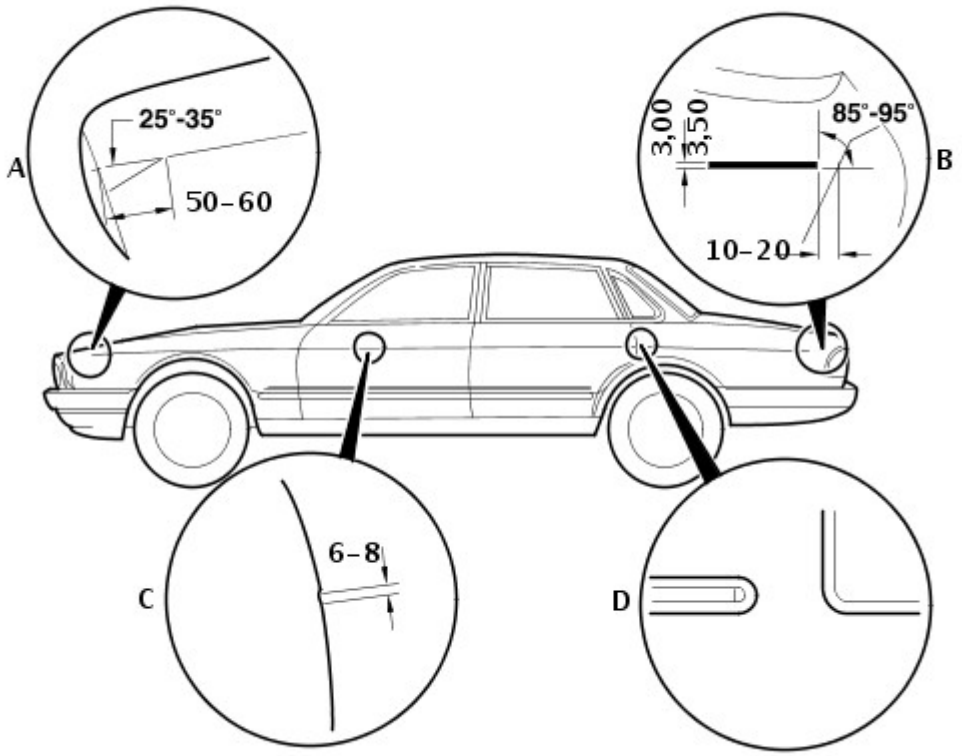
The 1.25mm - 1.75mm wide coachline (inset B), terminates with vertical face and ends 10mm - 20mm forward of tail lamp aperture.

Inset C shows the upper edge of the coachline positioned 6mm - 8mm below feature line along the body side. Inset D shows gap dimensions and lower coachline width.

Details of front end lower coachlines, including position of the lower coachline relative to door mouldings and front wings are shown in Inset E.

Inset F shows lower coachline rear end detail.

Other Models



E36329

Inset A, shows the angled cut-away at 25° - 35° at front edge. The front end of coachlines terminate 50mm - 60mm behind the headlamp apertures.The two sides must be symmetrical.

The 3mm - 3.5mm wide coachline shown in Inset B, terminates with vertical face and ends 10mm - 20mm forward of tail lamp aperture.

Inset C shows the upper edge of the coachline positioned 6mm - 8mm below the body side feature line.

Paint

Two-pack solid color paint can be applied. Following application of paint by hand brush or suitable air brush, allow the paint to dry fully before peeling away the remaining strips of Striping Tape. The paint takes in excess of 12 hours to air dry and fully harden, curing can however be accelerated by careful application of heat from infra-red lamps..

• NOTE: Masking tape must only be removed when the paint has hardened.

For the repair of minor damage (cuts, etc.), Paint Touch-up Pens in the colours required, are available via Jaguar Parts Operations.

Coachline Dimensions

XJ8	DAIMLER,SOVEREIGN, EXECUTIVE AND SUPER 8	XJ SPORT XJR8
1.5mm Upper	3.0mm Upper	1.5mm Upper 3.0mm Lower

Coachline Colours

• NOTE: The above table refers to water borne paint introduced on 1998MY vehicles. This paint is identified by a four figure number commencing with a 1. Solvent-based paint is identified by the same succeeding three figures, but this is followed by three different letters. E.G. JBC1712 JHG Westminster Blue is a water-borne paint. JBC712 JFG Westminster Blue is a solvent-borne paint.

Vehicle Colour	XJ8	Daimler, Sovereign, Executive, and Super 8	XJ Sport and XJR8
JBC1712 JHG Westminster Blue	JSC156 Mid Blue	JSC156 Mid Blue	JSC156 Mid Blue
JBC1732 NEE Spindrift	JBC 851 LGA grey	JBC 851 LGA grey	JSC158 Black Cherry
JBC1753 HGD British Racing Green	JSC155 Light Green	JSC155 Light Green	JSC155 Light Green
JBC1806 JHE Sapphire Blue	JSC154 Light Blue	JSC154 Light Blue	JSC154 Light Blue
JBC1807 PEC Black	JBC 851 Grey	JBC 851 Grey	
JBC1810 LGL Titanium	JSC156 Mid Blue	JSC156 Mid Blue	JSC156 Mid Blue
JBC1811 CGG Carnival	JSC153 Light Beige	JSC153 Light Beige	JSC153 Light Beige
JBC1820 SEC Topaz	JSC158 Black Cherry	JSC158 Black Cherry	JSC158 Black Cherry
JBC1823 HGL Spruce	JSC155 Light Green	JSC155 Light Green	JSC155 Light Green
JBC1835 HGE Sherwood	JSC153 Light Beige	JSC153 Light Beige	JSC153 Light Beige
JBC1839 JHF Aquamarine	JSC155 Light Green	JSC155 Light Green	JSC155 Light Green
JBC1840 JHH Antigua	JSC154 Light Blue	JSC154 Light Blue	JSC154 Light Blue
JBC1859 PED Anthracite	JBC851 LGA Grey	JBC851 LGA Grey	JBC851 LGA Grey
JBC1860 MDV Seafrost	JSC158 Black Cherry	JSC158 Black Cherry	JSC158 Black Cherry
JBC1861 JHJ Mistral	JBC851 LGA Grey	JBC851 LGA Grey	JBC851 LGA Grey
JBC1862 KDK Amaranth	JBC851 LGA Grey	JBC851 LGA Grey	JBC851 LGA Grey
JBC1881 CGH Madeira	JSC153 Light Beige	JSC153 Light Beige	JSC153 Light Beige
JBC1911 MDX Meteorite	JSC153 Light Beige	JSC153 Light Beige	JSC153 Light Beige

GLAZING

In order that the design condition of the vehicle is preserved when direct glazing repairs are carried out, it is essential that only approved materials and processes are employed.

Glass and Body Preparation

Betaseal HV3 System methods and materials, are used on all Jaguar vehicles. Ease of working and extended process time can however be gained by ensuring that the vehicle body and replacement glass are at a minimum room temperature of 20° C prior to adhesive application and fitting.

In the event of damage to the body flange finish, rectify as appropriate with the full paint refinishing process as described in the Paint Refinishing Manual.

Adhesive Application Temperature

The specified adhesive has a high viscosity and is not easily applied at 'room temperature' using conventional methods. When the adhesive is applied it chills rapidly on contact with the body and reverts to the hard condition, providing retention strength within minutes.

Raising the temperature of the adhesive will reduce viscosity and speed up the flow. It is recommended that the adhesive is pre-warmed in a heated cabinet for a minimum of twenty minutes and applied with an extrusion gun incorporating integral heating elements.

Temperature Effect	Temperature Range	Application time - including positioning
Optimum	60°C - 70°C	4 minutes
Maximum	75°C	4 minutes
Minimum	35°C	Will not bond

Adhesive Application

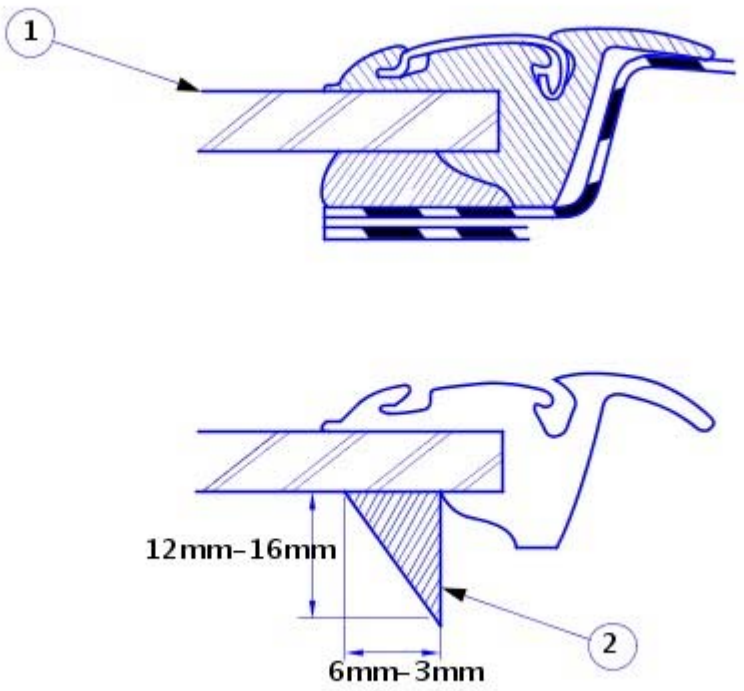
CAUTION: The glass will not bond to the body if the time taken to apply the adhesive and position the glass, exceeds the stated limit.

It is recommended that the bead of adhesive conforms to the shape and dimensions shown in the Adhesive Application

illustration and is positioned along the edge of the rubber.

• NOTE: The depth of the glass and thus the thickness of the adhesive, is controlled by the screen rubber contacting the body flange.

Adhesive Application



E36330

Key to Adhesive Application Drawing

1	Fitted condition
2	Bead application

Adhesive Curing

The specified adhesive cures by exposure to moisture (not by heat). Cure times may vary considerably dependent upon ambient humidity levels. Initial 'chill off' will occur within 1 to 4 minutes (dependent upon the application temperature and rate of cooling), after which the screen must not be moved.

BUMPER REPAIR\RENEWAL

Bumper Description

Each bumper comprises a beam mounted to the body via two strut assemblies and a moulded polypropylene cover incorporating side armatures and chrome plated plastic upper trims. The front bumper cover which is moulded to form a lower air intake for the cooling pack, also incorporates twin fog lamps, brake cooling ducts and side marker lamps or reflectors (dependent upon market). A plastic undertray secured to the lower edge of the front bumper and the BIW improves airflow and minimises the ingress of road grime in that area. Standard bumpers have glass mat thermoplastic (GMT) beams mounted on GMT struts. For certain markets, aluminium bumper beams are installed on menasco energy absorbing struts.

Bumper Cover Repair

Prior to commencing any work, bumper damage should be assessed for repairability and categorized in accordance with the following guidelines. Bumper covers that are torn or holed are not repairable and must be discarded.

CAUTION: Cosmetic appearance must not jeopardise safety. No attempt must be made to repair bumper covers damaged beyond category three. Damage of this extent will compromise the protective performance of the cover and it must be renewed. The thermo-setting nature of the cover material, precludes the repair of splits by heat or welding techniques.

Category	Damage
Cosmetic	Abrasion to surface paint finish only
Substrate surface	Deep scratches, gouges or localized radial stress cracks.
Substrate penetration	Splits not exceeding 100mm. Splits radiating from a gouge and accompanied by localized stress cracks.

Repair Materials

Repair of accepted damage for categories 2 and 3 may be carried out using 3M '5900 FPRM' (Flexible part repair material) or Kent Industries 'Urepatch'. Repair product manufacturers' recommendations and procedures must always be strictly followed.

Bumper Cover Refinishing

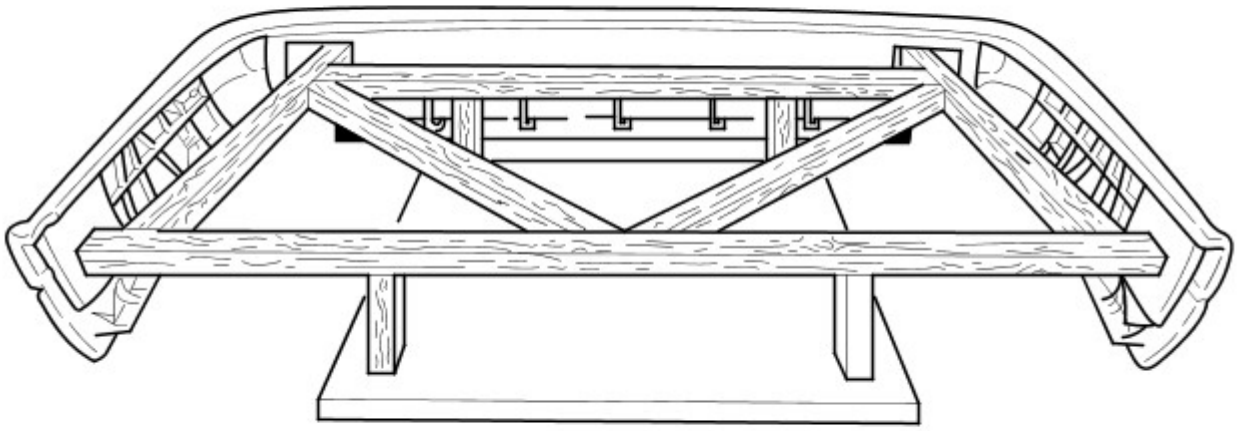
The paint refinishing system must be approved by Jaguar Cars Ltd., and be appropriate for polyurethane substrate application. It is essential that the finishing clear lacquer includes a plasticising ingredient (mixed to the manufacturer's recommendation) that will achieve the 'semi-flex' condition of the factory finished item.

Bumper Cover Support

Exposure to heat decreases bumper cover rigidity. Covers removed for repair must therefore be supported to prevent distortion and sagging during the paint curing process. Where the original bumper cover has been repaired, the beam will provide sufficient support for the centre section. It is recommended that the side armatures are supported as they would be on the vehicle. If a new cover is required, the beam may be temporarily fitted to provide the necessary support during refinishing.

CAUTION: During heat cure, the effective panel temperature must not exceed 95°C.

Simple Jig Construction for Bumper Cover Support



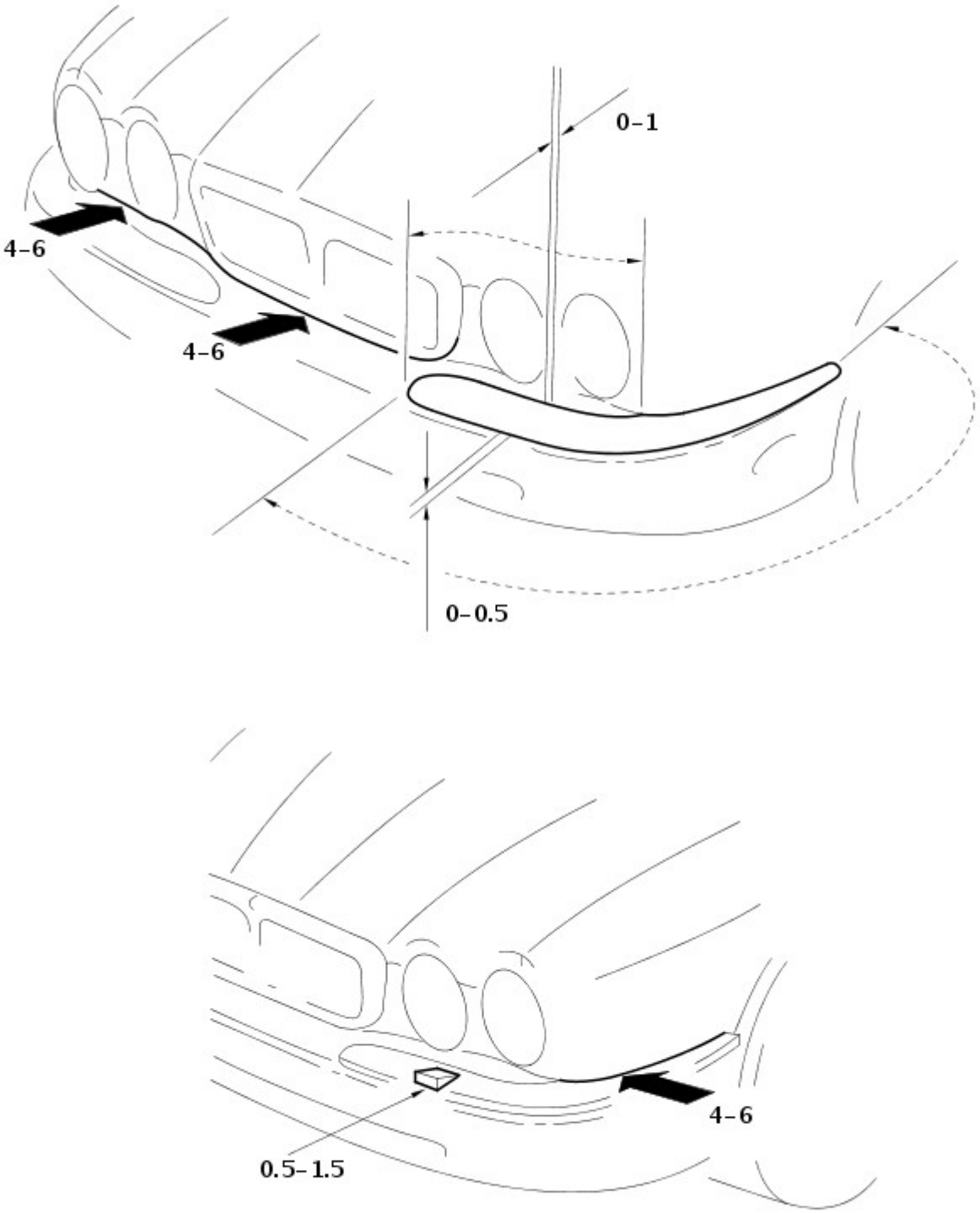
E36331

Replacement Bumper Covers

Replacement covers are supplied in a primed condition and must be finished to match the vehicle in accordance with the procedures included in this section..

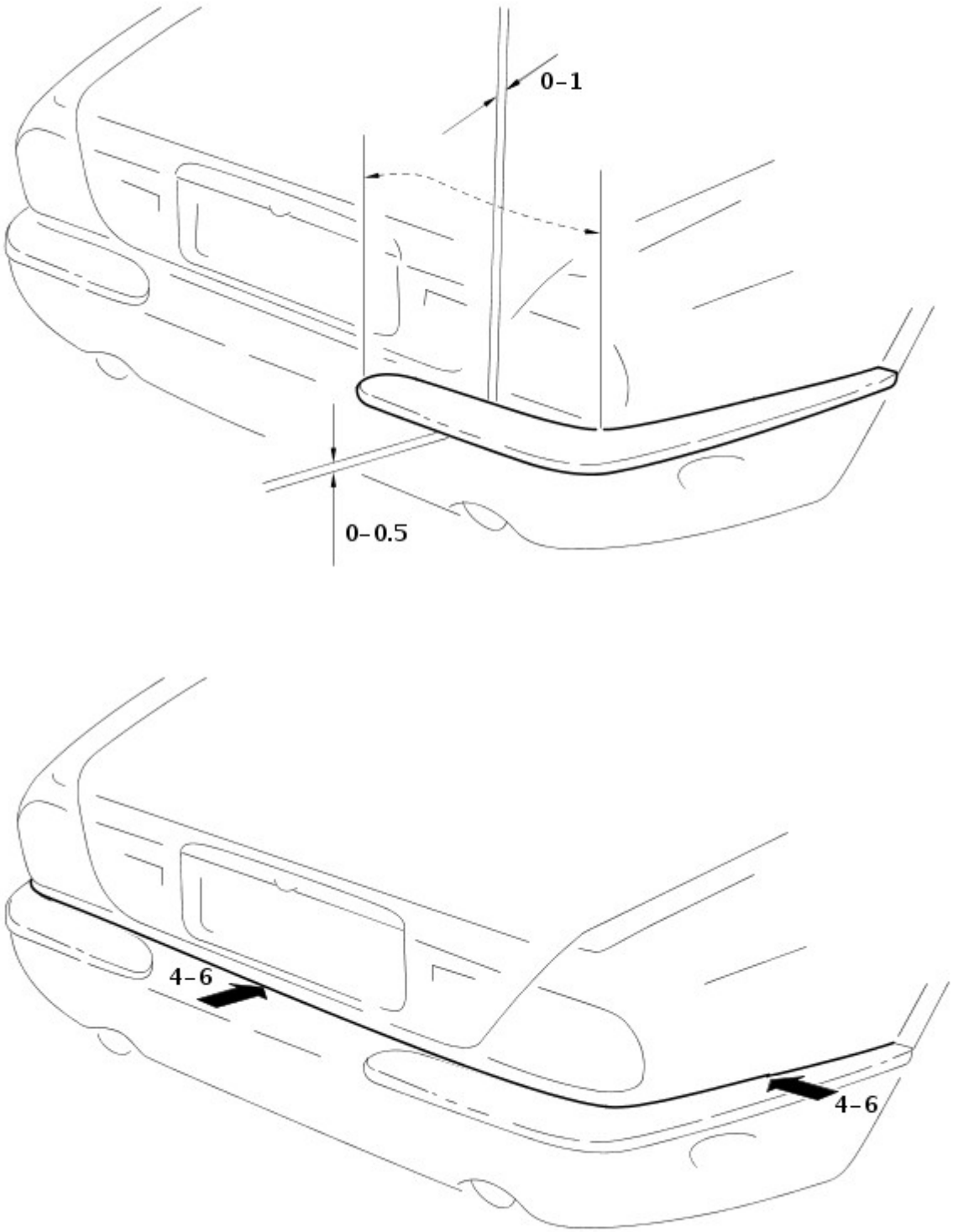
New bumper covers and replacement fixings such as bumper beam adjusters and guide blocks must be fitted and adjusted as detailed in the Bumper Setting Dimensions drawings.

Front Bumper Setting Dimensions



E36315

Rear Bumper Setting Dimensions



E36316

Recycling of Bumper Materials

The aluminium bumper beams fitted for some markets, should not be over-looked as components suitable for recycling.

Replacement bumper cover assemblies includer side armatures, which should be removed from discarded bumper assemblies and routed for recycling.

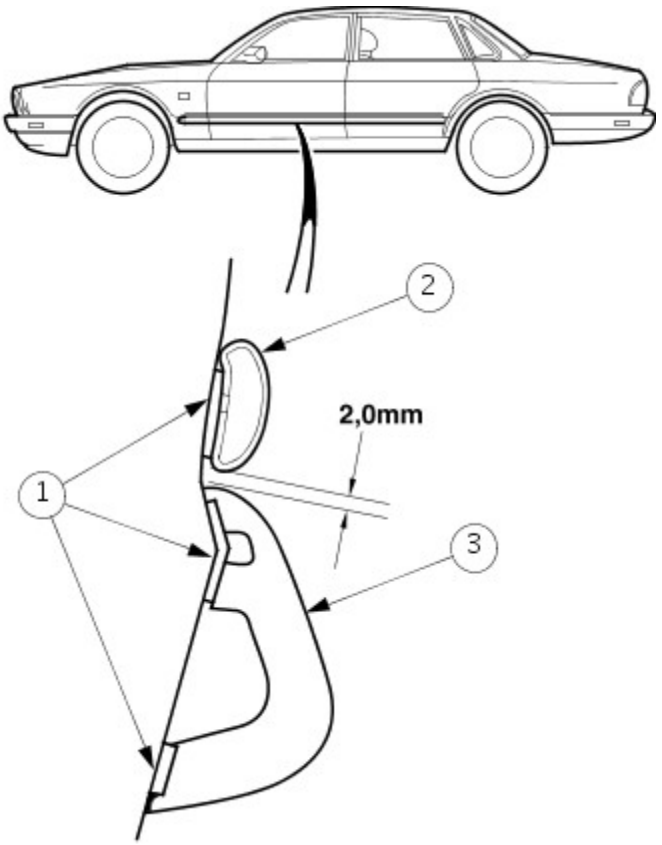
BODY SIDE MOULDINGS

Description

Two types of moulding are fitted to the standard wheelbase sedan. The lower mouldings are positioned on the body / door lower feature lines. Where applicable, the upper mouldings are positioned using the lower mouldings as data. Replacement lower mouldings are supplied in a primed condition and must be finished as detailed in this section.

Location	Finish	Application	Fixing method
Upper	Polished stainless steel	Daimler / VDP	Self adhesive
Lower	Body color	All models	Self adhesive

Side Moulding Positions



E36332

1	Adhesive tape
2	Moulding, Daimler/VDP
3	Moulding all models

Body Closures

Clearances and Alignments

When any panel, closure or body component is renewed, refitted or reset, the specified clearances and alignments must be restored. This ensures that vehicle appearance and operation fully satisfy design intent and the customer.

Clearances

Gaps should be uniform around body panel contours and must be parallel to within 1mm in a 400mm linear measurement.

Panels centered between two adjacent panels must have equal gaps on either side. For exceptions to this, refer to the appropriate specification. Gaps between adjacent panels or components must not expose harnesses, labels, brackets or visually poor joint or assembly conditions.

• NOTE: Sliding roof panel clearances are specified without the edge seal installed.

Areas of particular concern are, fuel filler flap, trunk lid to fenders and saddle panels, hood to fenders, grill and headlamps, sliding roof to main roof panel, door gaps at fenders, B\C posts, roof drip rail and rocker panel, and bumper cover to fenders and cross car assemblies

Alignment

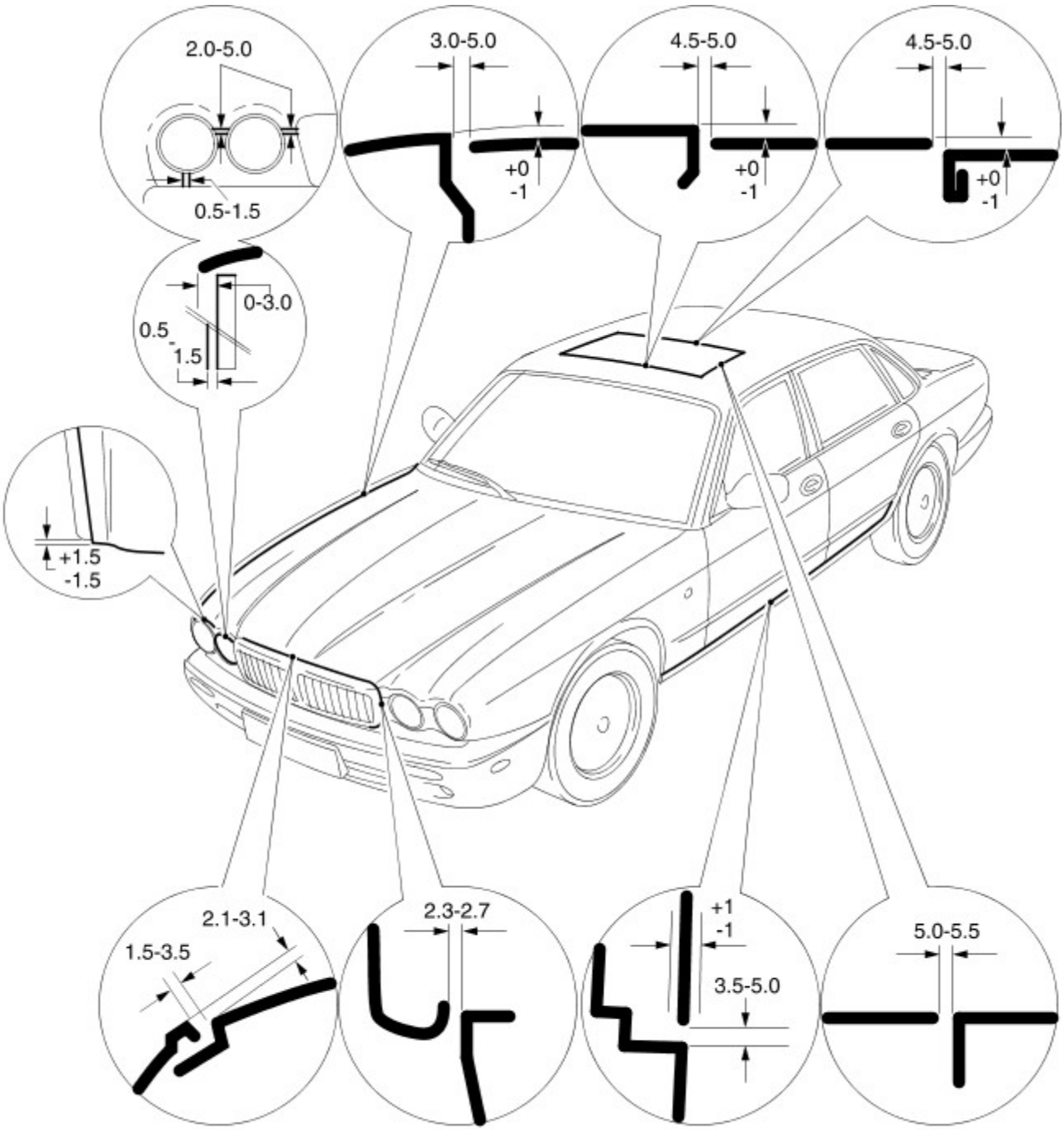
Panels must be correctly profiled to maintain cosmetic appearance, and ensure correct seating of seals with minimal wind noise. Areas of particular concern are hood to fenders, trunk lid to fenders and saddle panels, doors to apertures, doors to fenders and adjacent doors and relationship of the sliding roof panel leading and trailing edges to the main roof panel.

Exterior Fitments

Bezels, trims and lamps must be concentric with apertures and have equal clearances with adjacent panels.

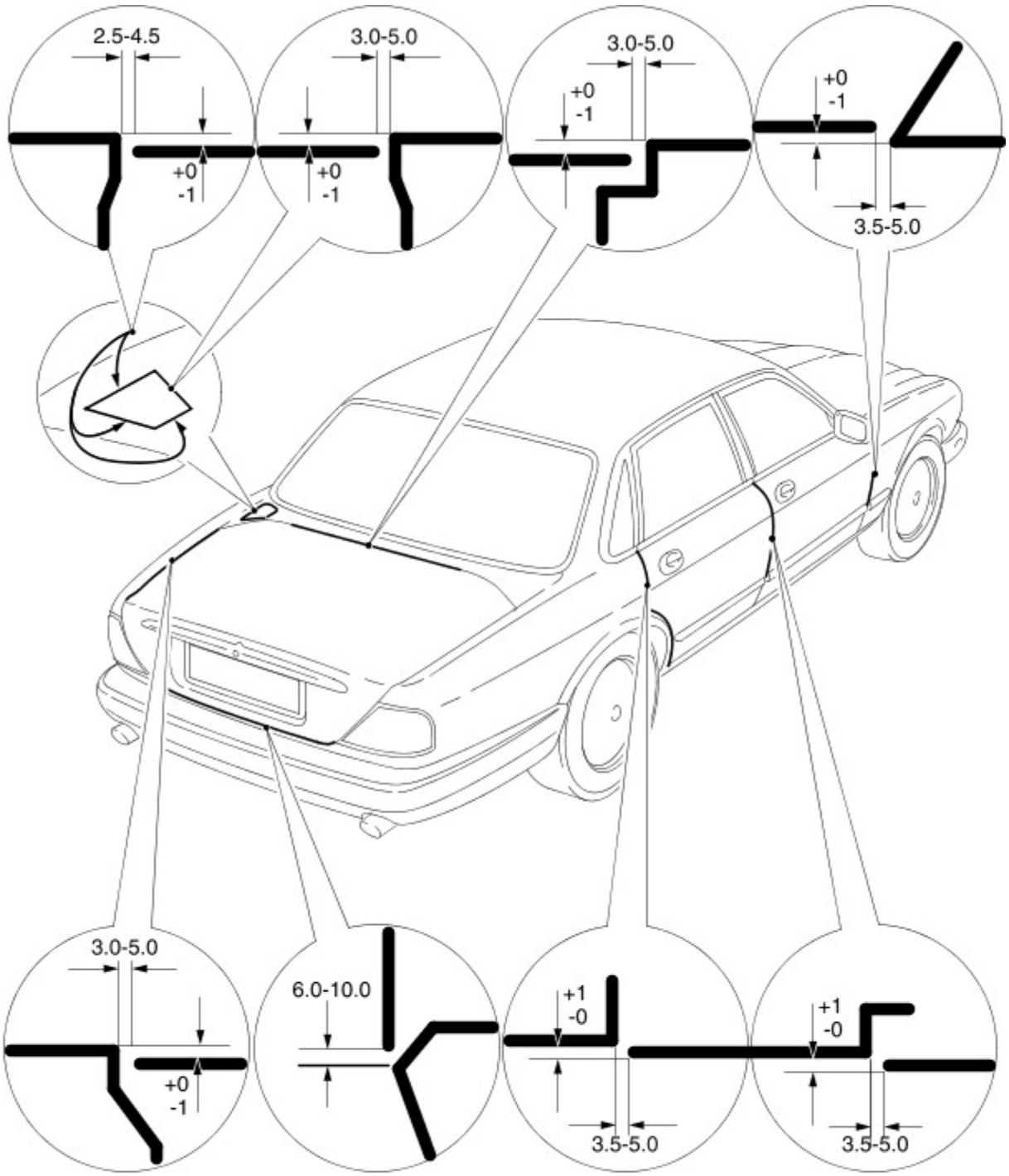
Areas of particular concern are headlamp to hood, fender and trim panel, exhaust tailpipe trim to bumper cover cut-out, rear lamp assembly to trunk lid, fender and bumper cover trim, and side feature lines including body side mouldings, fender to door and door to door.

Exterior Clearances and Alignments-Front



E36202

Exterior Clearances and Alignments-Rear



E36203

Sliding Roof

Description

Sliding roof operating features include a tilt facility, one touch slide opening and closing, intermediate slide position closing (this also operates from tilt openings of less than 4mm), and a wind deflector. The sliding roof is operated by a cable and

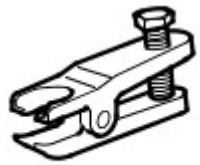
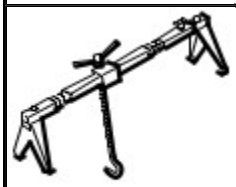
lever mechanism driven by an electric motor. A sliding roof control module (SRCM) controls the motor in response to selections made on the roof console switch , or input from the security system for automatic closing. Both the motor and the SRCM are accessed by removing the roof console.In the event of an electrical failure the sliding roof can be manually operated. This is achieved by inserting a wide bladed screwdriver into a slot in the motor drive gear and turning clockwise to open or counter clockwise to close the sliding roof.

• NOTE: The drive gear becomes disengaged from the motor during manual operation. Before restoring electrical operation the drive gear must be rotated one quarter turn in the reverse direction to re-engage the motor.

The SRCM is held in position by clips and has two electrical connectors interfacing with the motor and the roof console switch/security system. Prior to installing a new SRCM, the sun roof must be in a neutral closed position. This provides the SRCM with a sliding roof datum, to ensure accurate and consistent operation. Obstacle sensing operates on closing in the slide mode only. If the sliding roof lid encounters an obstruction between 4mm and 200mm from the closed position, the SRCM detects increased motor load and reverses the motor, driving the sliding roof to the fully open position. The sliding roof lid surround seal has a metal inner section which will deform on removal. If removed, this seal must be discarded and a new seal must be installed on the lid using a Jaguar approved crimping tool.

Uni-Body, Subframe and Mounting System - Front Axle Crossmember

Removal and Installation

Special Tool(s)	
 E36397	Tie-Rod-End Taper Separator 211-098 (JD 100)
 E36400	Engine Support Beam 303-021 (MS 53D)

Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.

1. Position vehicle on a four-post lift.

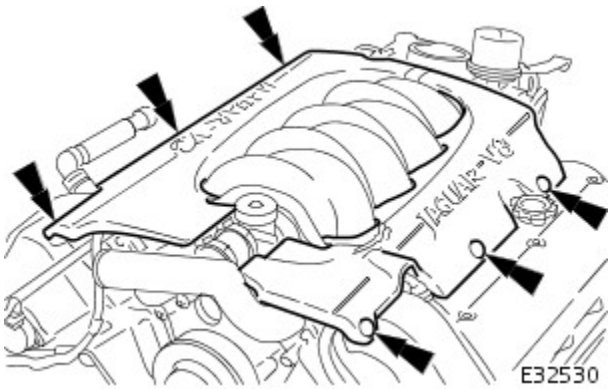
2. Raise front of vehicle and support on stands.

3. Remove battery cover and disconnect ground cable from battery terminal. Refer to section 86.15.15.

4. Open hood to service position, and fit covers to fenders.

5. Remove both engine covers (normally aspirated vehicles only).

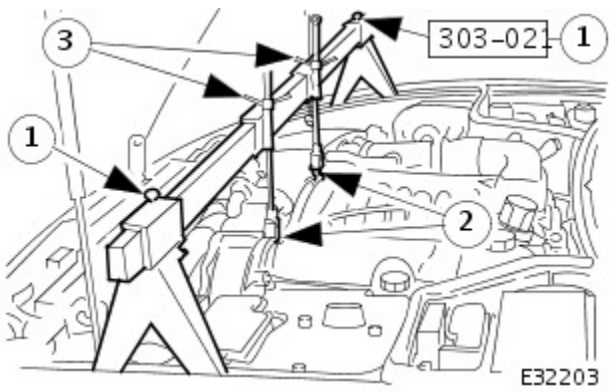
- Release pegs.
- Remove covers.

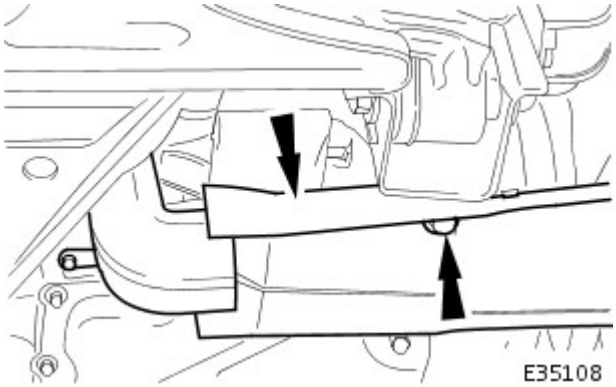


6. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30

7. Support weight of engine.

1. Position special tool 303-021 in RH and LH fender channels and tighten beam fixings.
2. Engage hooks in the engine front lifting eyes.
3. Tighten hook adjustment nuts until weight of engine is supported.

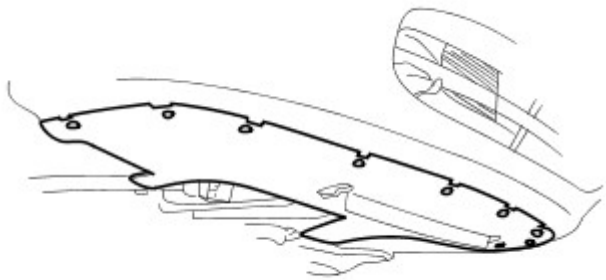




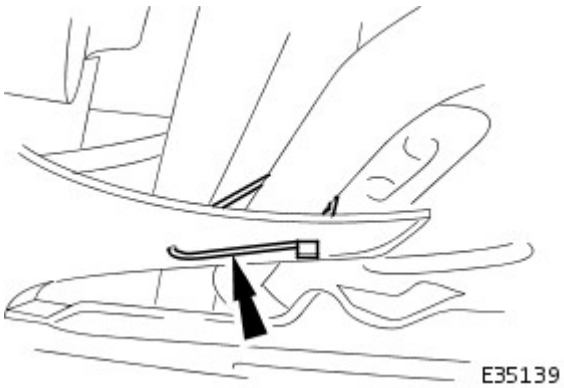
8. Remove generator front cooling duct.

- Remove bolt.
- Move duct rearwards to release tang from undertray.
- Release front duct from rear vertical duct.

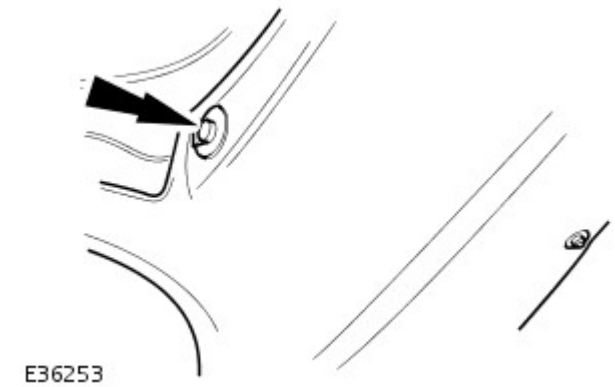
9. Remove scrivets or screws securing undertray to bumper cover. Discard scrivets.



E36252



10. Remove and discard tiestrap securing undertray to body brace.



E36253

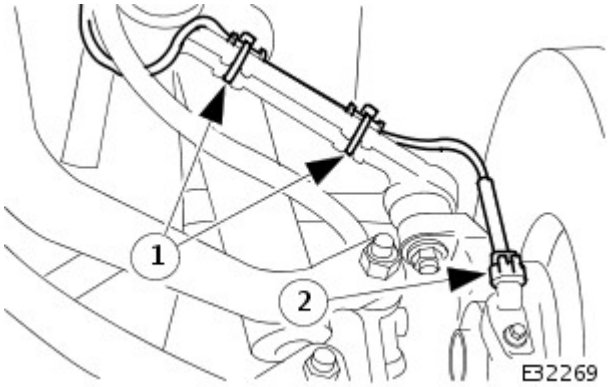
11. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.

12. Remove undertray from vehicle.

13. Remove both front road wheels. Refer to Section 100-02.

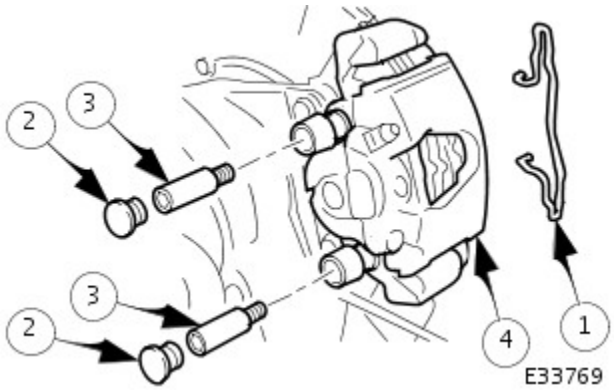
14. Remove both front road springs. Refer to 60. 20.02.

15. Disconnect wheel speed sensor harness connectors.



1. Sever and discard tiestraps securing front wheel speed sensor harness to upper wishbone.
2. Disconnect harness connector from sensor.

- Repeat procedure to disconnect opposite side wheel speed sensor harness.



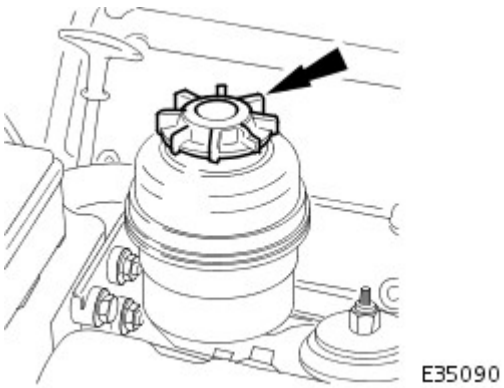
16. CAUTION: Do not suspend caliper from brake hose as this will damage the hose.

Remove brake calipers from carriers.

1. Remove caliper spring clip.
2. Remove guide pin dust caps.
3. Slacken and withdraw guide pins.
4. Remove caliper from carrier and tie to suspension mounting bracket.

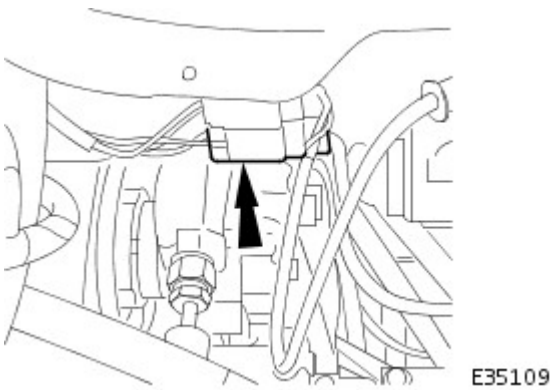
- Repeat procedure to remove opposite side front brake caliper.

17. Remove filler cap from power steering fluid reservoir.

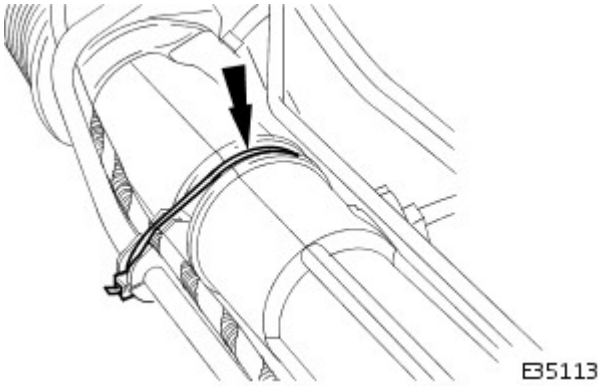


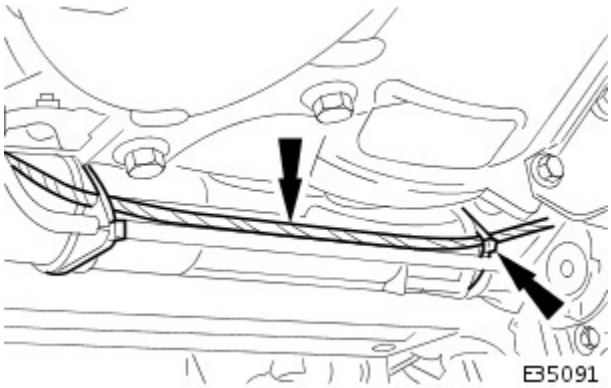
18. Disconnect steering rack transducer harness front connector.

- Release harness connector from body retaining clip.
- Disconnect connector.



19. Sever and discard tiestrap securing return pipe, harness (RHD only) and rubber support to steering rack.



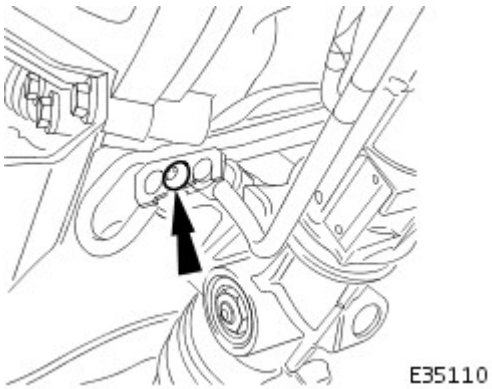


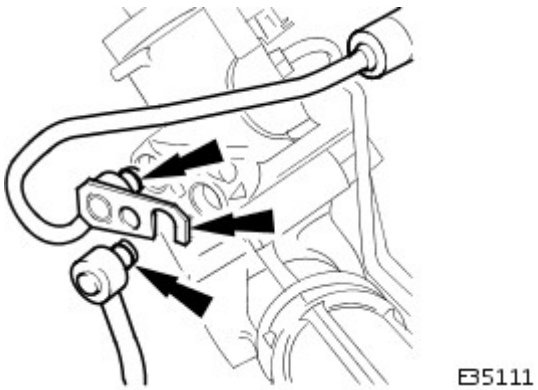
20. RHD vehicles. Sever and discard tiestrap securing harness to steering rack.

21. Route harness from behind steering return pipe.

22. Position a drain receptacle below pinion housing.

23. Remove pipe retaining plate securing bolt and withdraw plate.





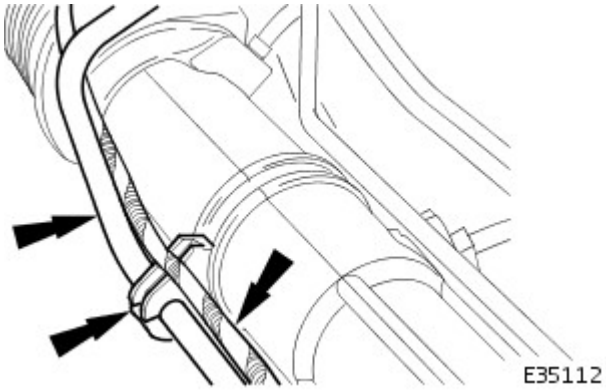
24. Drain power steering fluid.

- Disconnect pipes and allow fluid to drain.
- Remove and discard 'O'-ring seals from pipe connectors.
- Fit blanking plugs to pipe connectors and pinion housing ports.

25. Remove drain receptacle.

26. Remove pipe support from steering rack.

- Release return pipe from support.



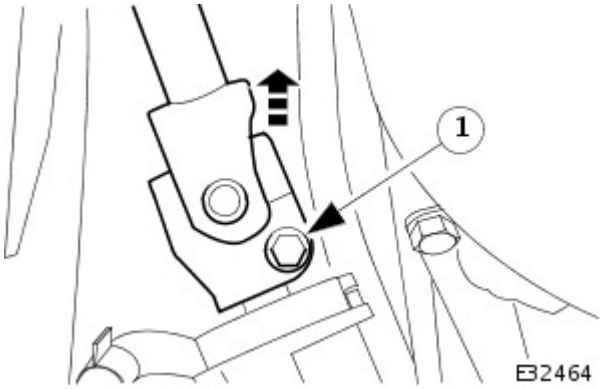
- Remove support from rack.

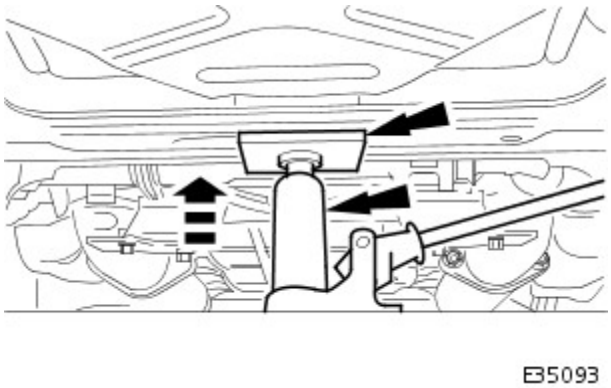
27. Ensure that steering is in central position.

28. Release lower steering column from pinion shaft.

1. Remove lower steering column securing nut and bolt.

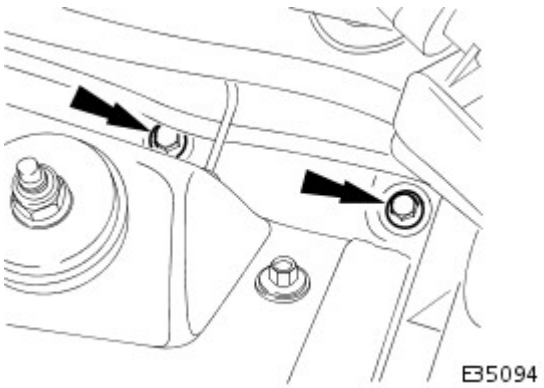
- Move column upwards to release it from pinion shaft.





29. Support weight of crossbeam.

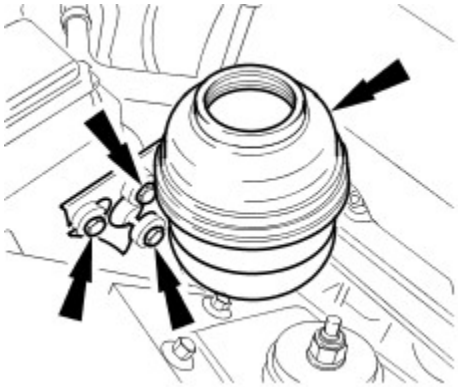
- Position a jack under crossbeam.
- Place a piece of wood between jack and crossbeam.
- Raise jack to just support crossbeam.

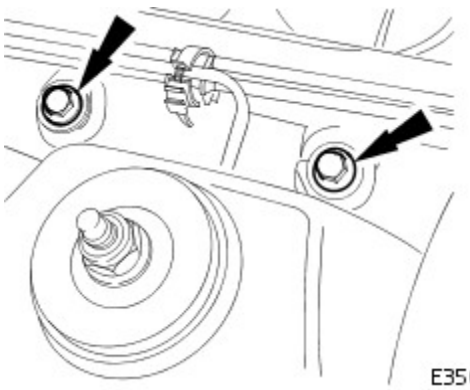


30. From engine compartment, remove crossbeam front RH securing bolts.

31. Remove power steering fluid reservoir for access.

- Remove reservoir securing nuts and bolts.
- Position reservoir for access.


E35095

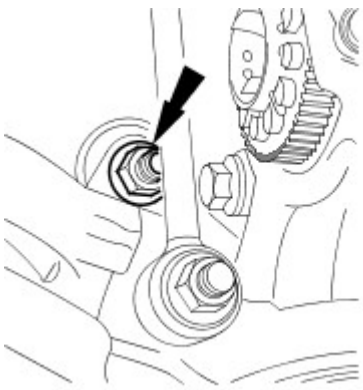

E35096

32. From engine compartment, remove crossbeam front LH securing bolts.


E35097

33. Remove crossbeam to engine Hydramount securing bolts.

- Remove bolt securing crossmember to Hydramount.
- Fully withdraw bolt into crossmember insert.
- Repeat procedure to remove and withdraw bolt on opposite side


E35098

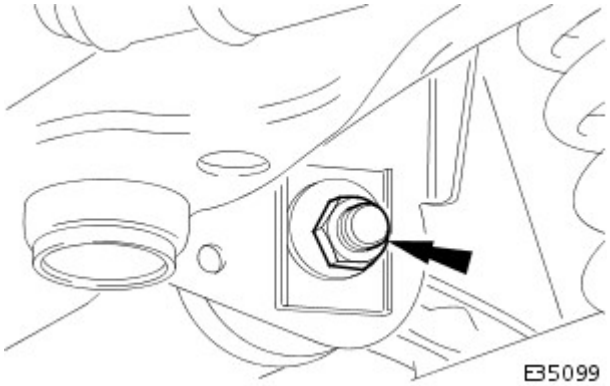
34. CAUTION: To prevent damage to ball joints, secure each hub assembly to suspension turret using strong wire.

Remove lower nut and bolt from front shock absorber.

- Repeat procedure to remove bolt from opposite side shock absorber.

35. Remove crossbeam rear securing bolts.

- Remove bolt from crossbeam LH rear mounting.
- Repeat procedure to remove bolt from crossbeam RH rear mounting.

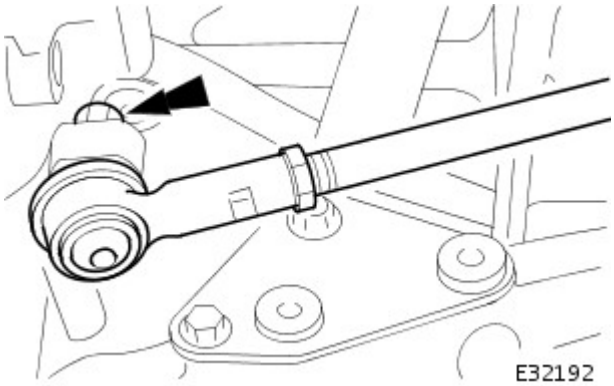


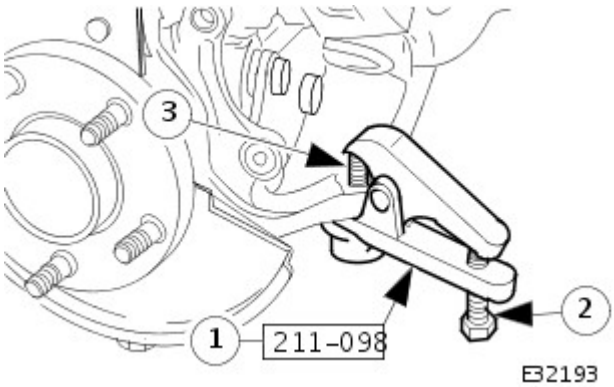
36. Ensure that steering transducer harness is clear of return pipe and LH side body.

37. Lower and traverse front suspension assembly clear of vehicle.

38. With assistance, lift front suspension assembly onto bench.

39. Remove nut securing each tie rod outer ball joint to steering arm.

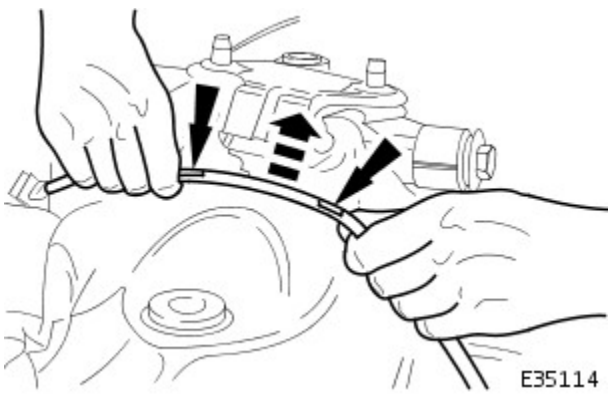




40. Release tie rod ball joint from steering arm.

1. Install special tool 211-098 on tie rod outer ball joint.
2. Tighten tool bolt to release ball joint taper pin.
3. Remove tool and release tie rod from steering arm.

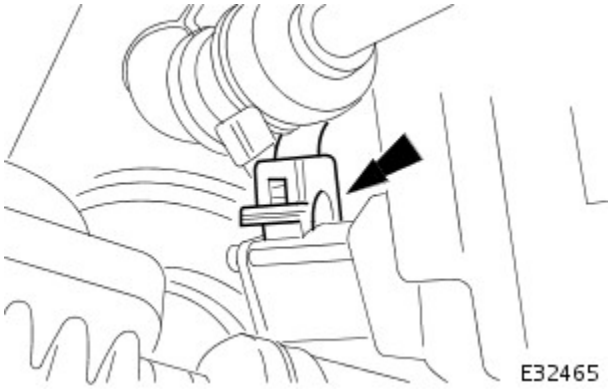
- Repeat procedure to release opposite side tie rod ball joint.



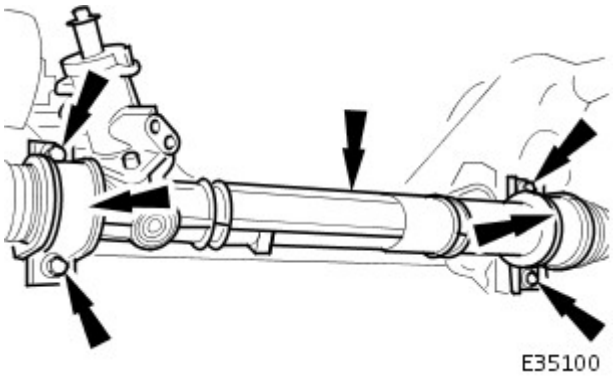
41. Remove steering harness from LH suspension turret.

- Release harness securing clips from suspension turret.
- Mark position of clips on harness.
- Remove tape securing clips to harness and discard clips.

42. Disconnect and remove steering harness.

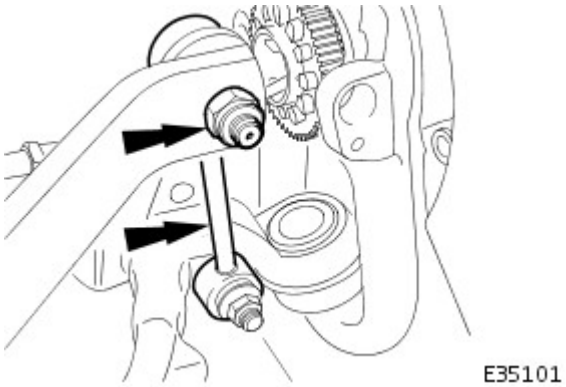


- Disconnect harness connector from transducer.
- Remove harness from suspension assembly.



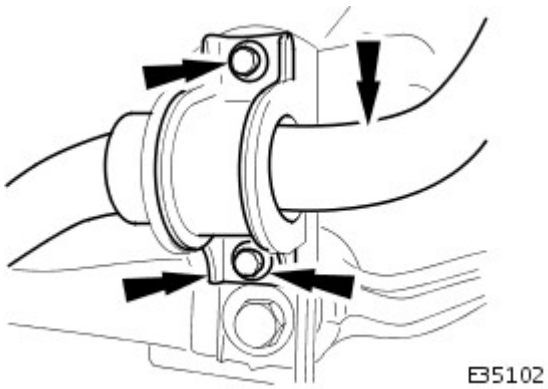
43. Remove steering rack from crossbeam.

1. Remove steering rack securing bolts.
2. Remove steering rack and mounting brackets.



44. Release stabilizer bar from link arms.

- Remove link arm to stabilizer bar securing nut.
- Release link arm from stabilizer bar.
- Repeat procedure to release opposite end of stabilizer bar from link arm.

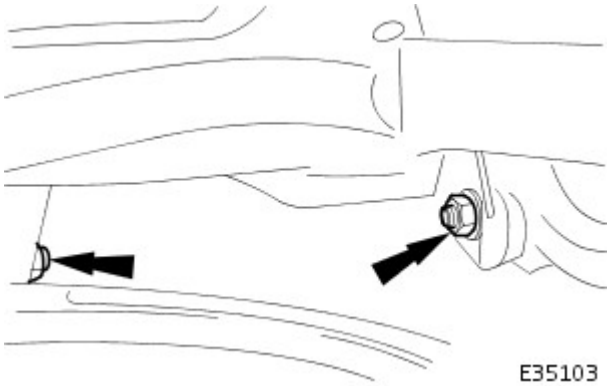


45. Remove stabilizer bar from crossbeam.

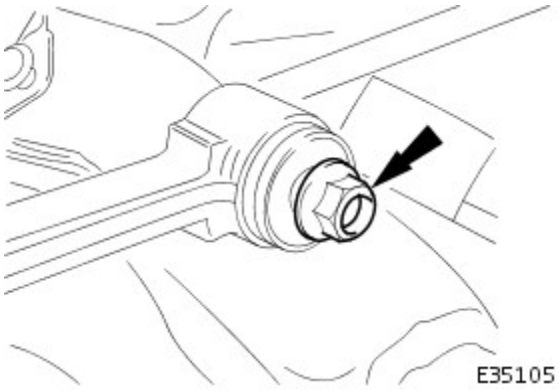
- Remove stabilizer bar securing bolts.
- Remove stabilizer bar mounting brackets and remove bar from crossbeam.

46. Remove wishbone securing nuts.

1. Remove lower wishbone front arm eccentric bolt securing nut.
2. Remove lower wishbone rear arm eccentric bolt securing nut.



- Repeat procedure to remove wishbone securing nuts from opposite side.

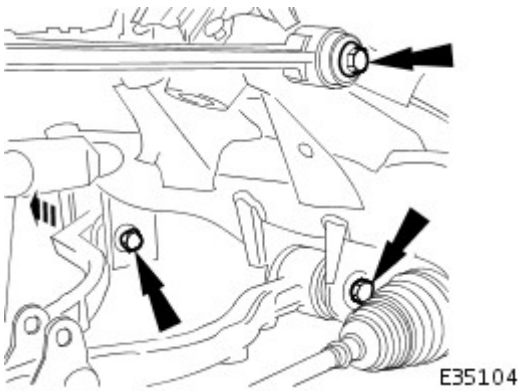


47. Remove upper wishbone fulcrum shaft securing nut.

- Repeat procedure to remove securing nut from opposite side fulcrum shaft .

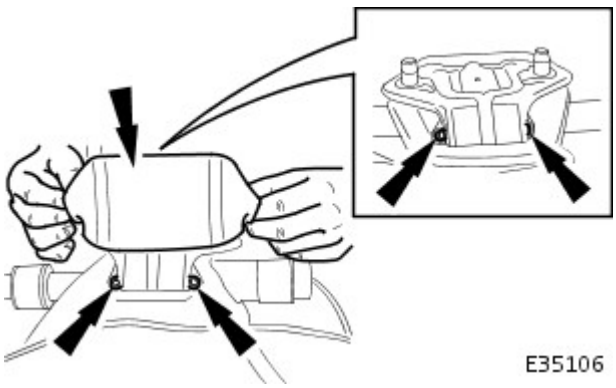
48. Remove wire temporarily supporting hub assembly.

49. Remove wishbone/hub assembly from crossbeam.



- Supporting hub assembly, withdraw lower wishbone eccentric bolts.
- Supporting hub assembly, withdraw fulcrum shaft from upper wishbone.
- Remove wishbone/hub assembly from crossbeam.
- Repeat procedure to remove wishbone/hub assembly on opposite side.

50. Remove crossbeam front mountings.

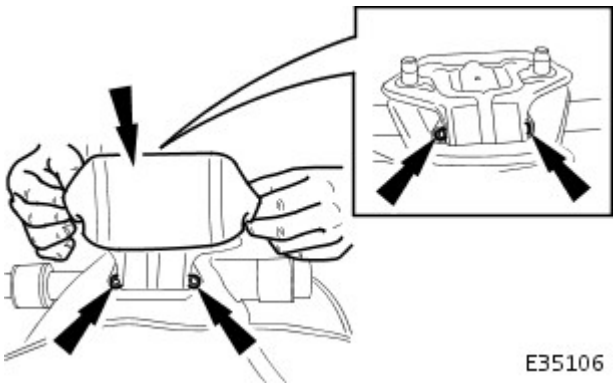


- Remove front mounting heatshield.
- Remove four bolts securing mounting to crossbeam.
- Repeat procedure to remove mounting on opposite side.

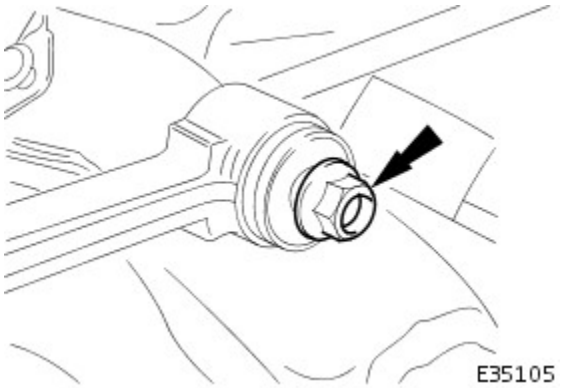
Installation

1. Install front mounting brackets.

- Position and fully seat mounting bracket on crossbeam.

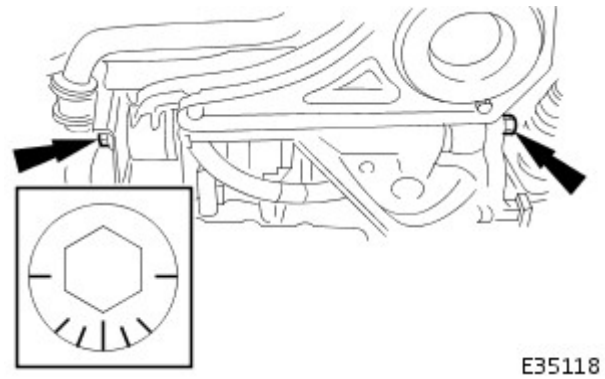


- Install the four bolts and tighten to 22-28Nm.
- Install heatshield .
- Repeat procedure to install mounting bracket on opposite side of crossbeam.



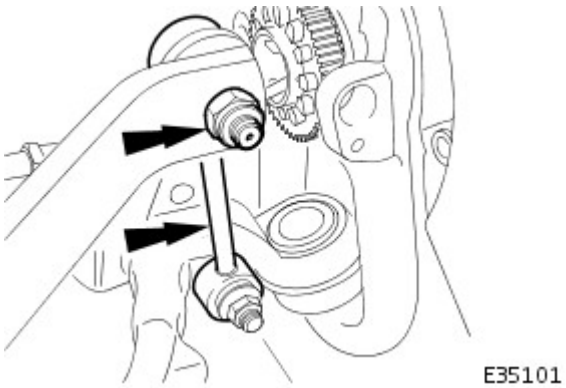
2. Install upper wishbone/hub assemblies on crossbeam.

- Position upper wishbone on crossbeam.
- Install fulcrum shaft threaded end facing rearward.
- Install fulcrum shaft securing nut and tighten to 60-80Nm.
- Repeat procedure to install opposite side upper wishbone/hub assembly.



3. Install lower wishbone assemblies.

- Position lower wishbone on crossbeam.
- Install but do not tighten wishbone front and rear arm eccentric bolts and nuts.
- Rotate each eccentric bolt to position largest graduation mark vertically.
- Ensuring that eccentric bolts do not rotate out of position, partially tighten securing nuts.
- Repeat procedure to install opposite side upper wishbone/hub assembly.



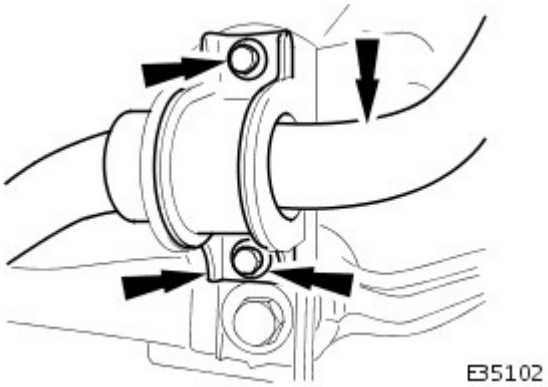
4. Install stabilizer bar to link arms.

1. Position stabilizer bar and install link arm pin in bar.
2. Install but do not tighten link arm pin to stabilizer bar securing nut.

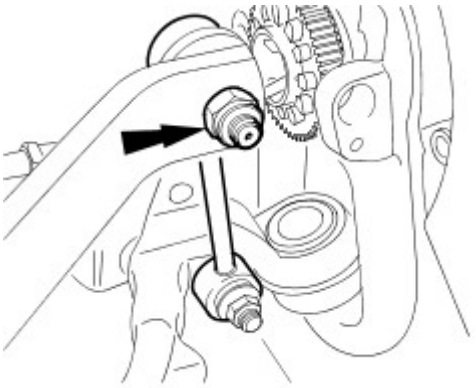
- Repeat procedure to install link arm at opposite end of stabilizer bar.

5. Install stabilizer bar to crossbeam.

- Ensure bushes are correctly positioned on stabilizer bar.
- Install support brackets over bushes.

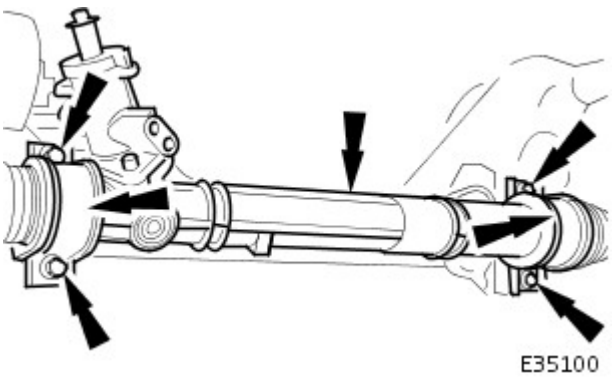


- Position stabilizer bar on crossbeam.
- Install and tighten bolts to 30-40Nm.
- Repeat procedure at opposite end of stabilizer bar.



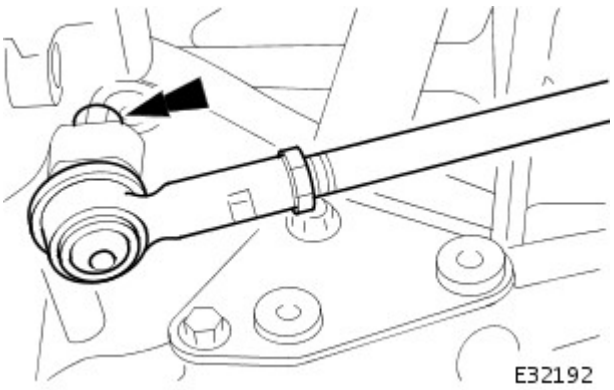
6. Tighten link arm to stabilizer bar securing nut to 60-80Nm.

- Repeat procedure at opposite end of stabilizer bar.



7. Install steering rack on crossbeam.

- Ensure that bushes are correctly positioned on steering rack.
- Position steering rack on crossbeam.
- Position support brackets over bushes.
- Install mounting bracket bolts and tighten to 40-54Nm.

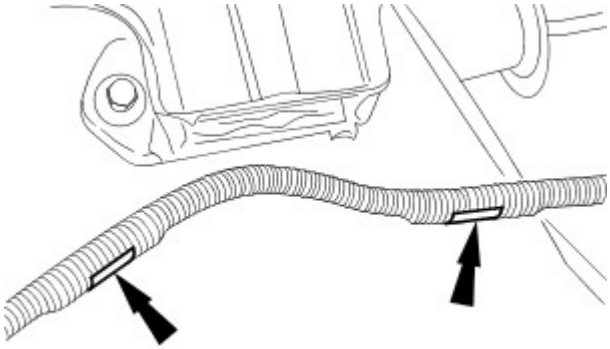


8. Install tie rods on steering arms.

- Position and fully seat tie rod ball joint taper pin on steering arm.
- Install tie rod ball joint nut and tighten to 71-85Nm.
- Repeat procedure to install opposite side tie rod ball joint.

9. Install harness on suspension turret.

- Noting positions marked during removal, tape new securing clips to steering harness.
- Install securing clips/harness on LH turret.



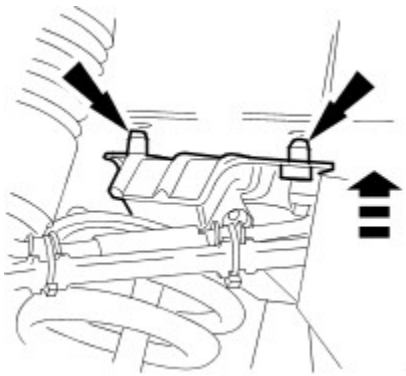
E35092

10. With assistance position crossbeam/suspension assembly on jack with protective wood under.

11. Traverse assembly into position below vehicle.

12. Ensure steering harness connector is positioned to avoid damage during crossbeam lift .

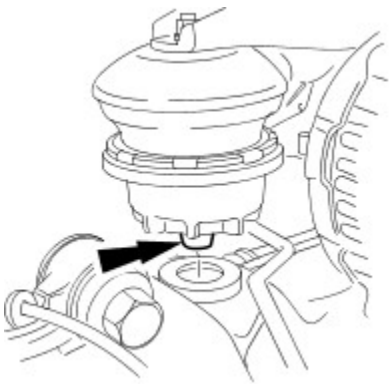
13. NOTE: It may be necessary to use a hammer and drift to finally align new mounting with body location.



E35149

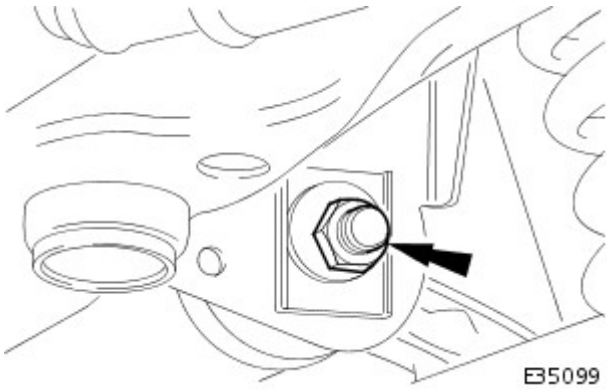
Carefully raise crossbeam assembly into position.

- Ensure that dowels of both crossbeam mountings are correctly seated in body locations.



E35128

14. Ensure that both engine hydramounts are correctly seated in crossbeam locations.

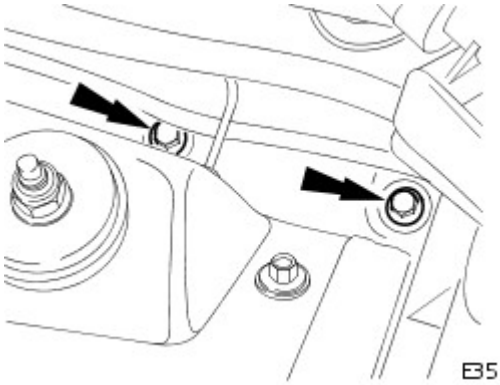


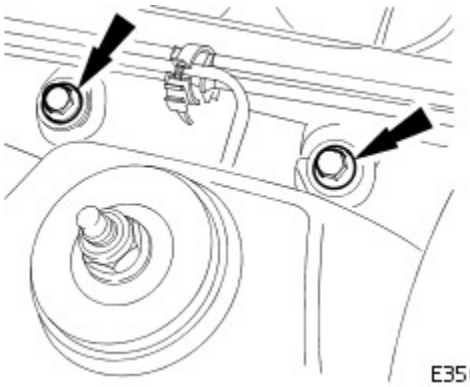
E35099

15. Install crossbeam rear mountings.

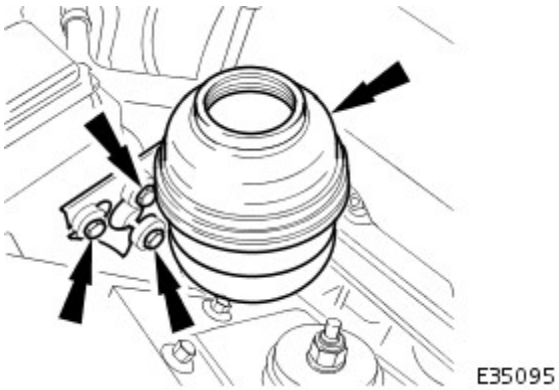
- Align rear mounting rubber with body location.
- Install rear mounting securing bolt and nut and tighten nut to 131-185 Nm.
- Repeat procedure to install opposite side rear mounting bolt and nut.

16. From engine compartment, install but do not tighten crossbeam front RH bolts.



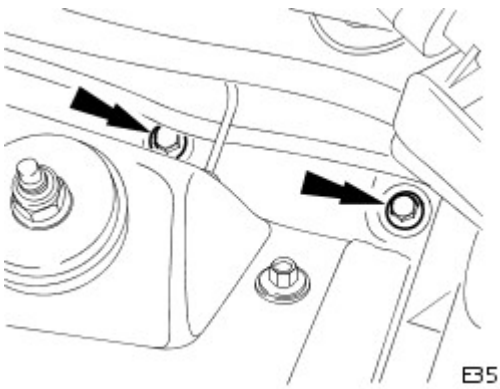


17. From engine compartment, install crossbeam front LH bolts and tighten to 22-28Nm..



18. Install power steering fluid reservoir.

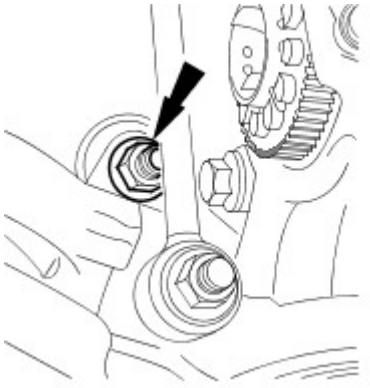
- Position reservoir on mounting bracket.
- Install reservoir securing nuts and bolts.



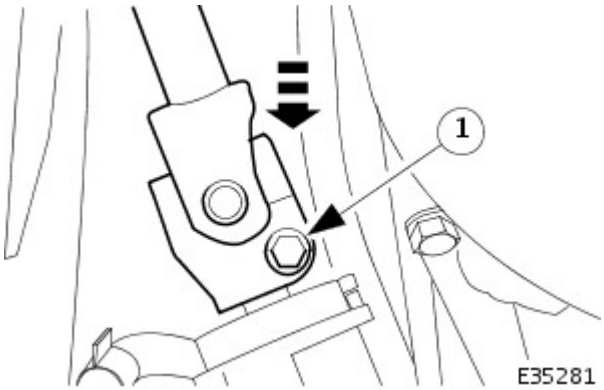
19. From engine compartment, tighten crossbeam front RH bolts to 22-28Nm.

20. Install shock absorber on lower wishbone.

- Lift lower wishbone to align shock absorber lower mounting.
- Install bolt and nut and tighten nut to 43-57Nm.



- Repeat procedure to install opposite side shock absorber.



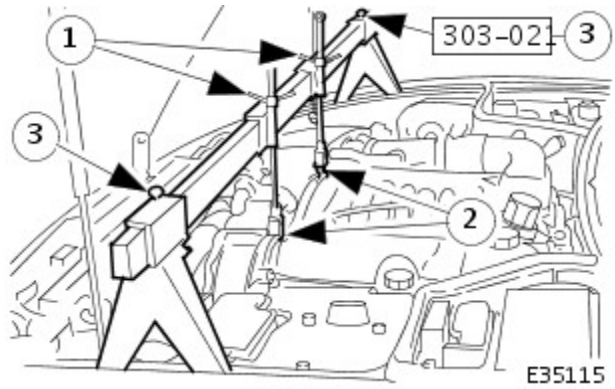
21. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.

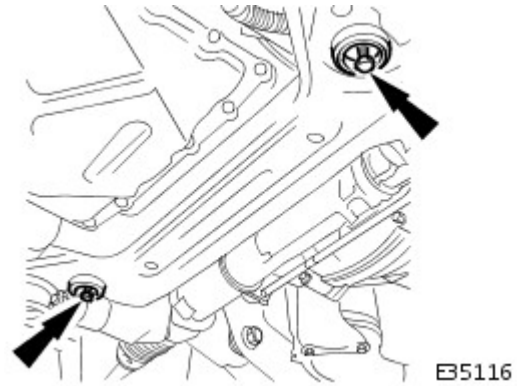
1. Install nut and bolt and tighten to 22-28Nm.

22. Lower and withdraw jack from crossbeam.

23. Release engine from support tool.



1. Slacken hook adjustment nuts until weight of engine is released.
2. Remove hooks from engine front lifting eyes.
3. Remove special tool 303-021 from fender channel.

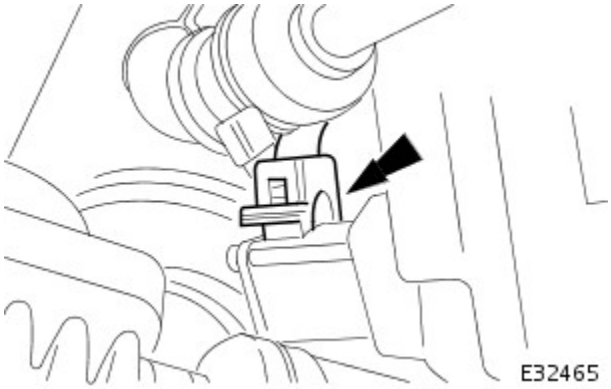


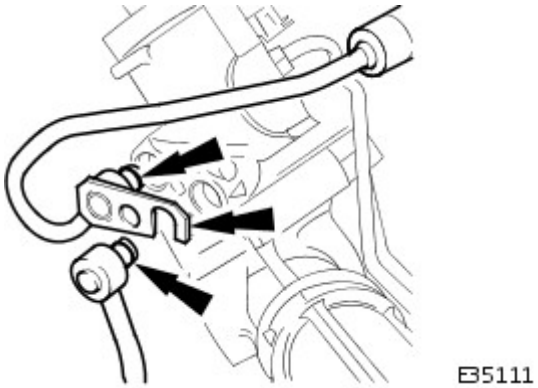
24. Install crossbeam to engine Hydramount securing bolts.

- Install bolt securing Hydramount to crossmember and tighten to 22-28Nm.
- Repeat procedure to install crossmember opposite side securing bolt.

25. Position and connect harness to steering transducer.

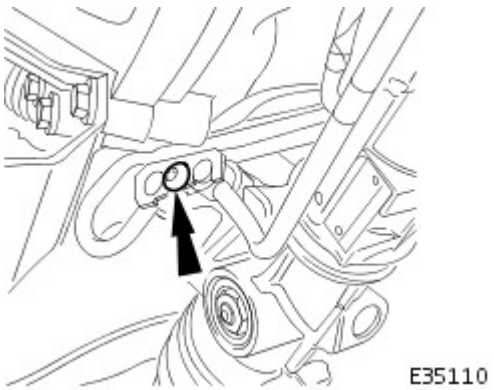
- RHD vehicles. Position steering harness behind return pipe.
- Connect harness to transducer.





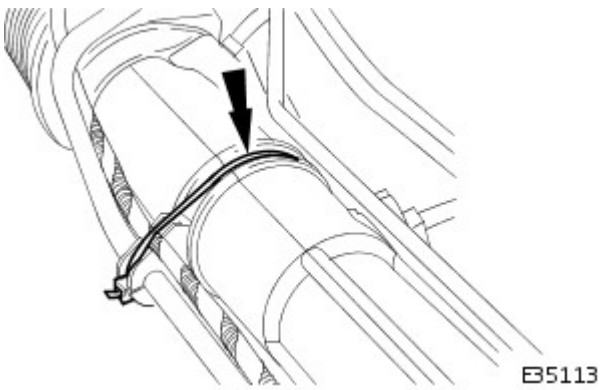
26. Install power steering pipes on pinion housing.

- Remove blanks and install new 'O'-ring seals in pipe connectors.
- Apply power steering fluid to 'O' ring seals.
- Remove blanking plugs from pinion housing ports.
- Position pipes on pinion ports and seat 'O' rings.



27. Secure pipes to pinion housing.

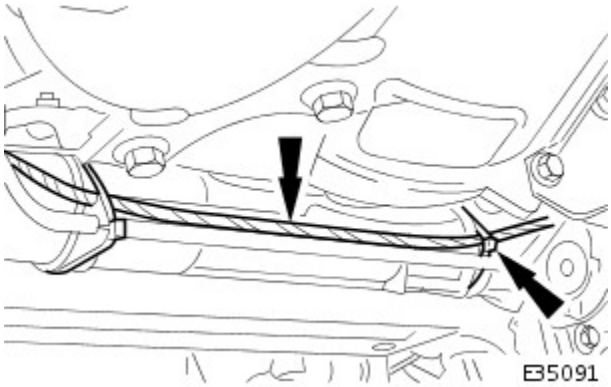
- Ensure pipes and retaining plate are correctly seated.
- Install bolt and tighten to 9-12Nm.



28. Secure return pipe on steering rack.

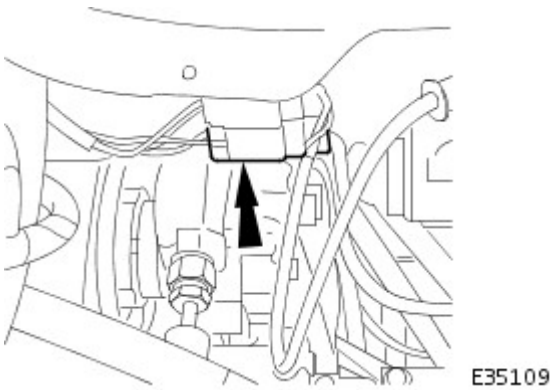
1. Position pipe rubber support on steering rack.
2. Position pipe on support .
3. RHD vehicles. Position harness on pipe support rubber.
4. Secure pipe and harness to support with new tiestrap.

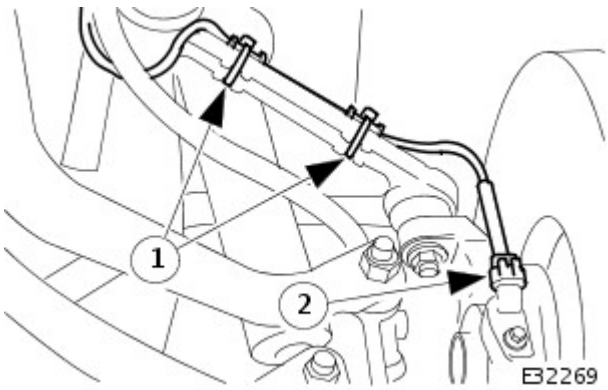
29. RHD vehicles. Using new tiestrap, secure harness to steering rack.



30. Connect steering harness.

- Route harness connector to body front location.
- Connect steering harness connector.
- Install connector in body retaining clip.

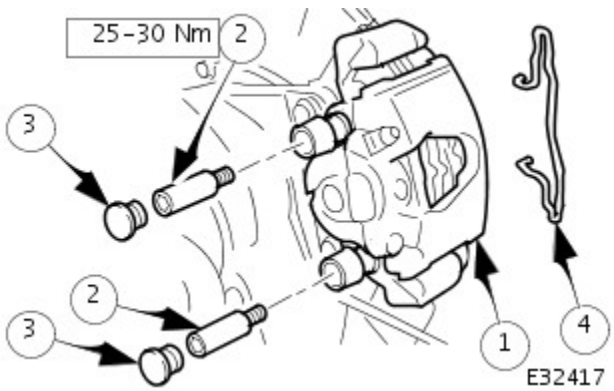




31. Connect wheel speed sensor harness.

1. Connect wheel speed sensor harness to sensor.
2. Using new tiestraps secure wheel speed sensor harness to upper wishbone.

- Repeat procedure to connect opposite side wheel speed sensor.



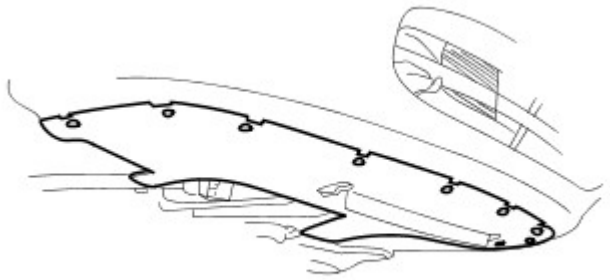
32. Install brake calipers.

1. Install caliper on carrier.
2. Install guide pins.
3. Install guide pin dust caps.
4. Install caliper spring clip.

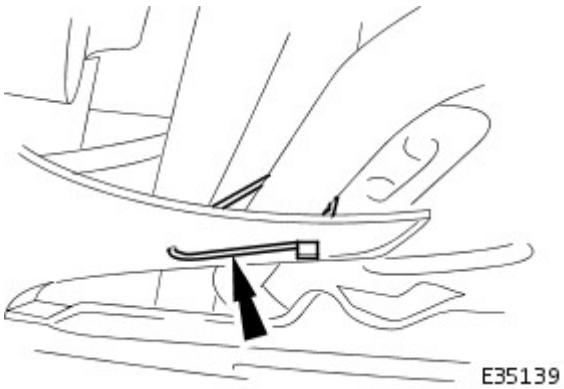
- Repeat procedure to install opposite side front brake caliper.

33. Install both front road springs. Refer to 60. 20.02.

34. Using screws or new scrivets, secure undertray to front bumper cover.

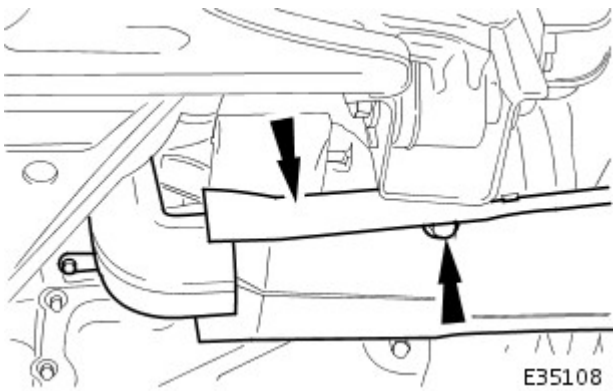


E36252



E35139

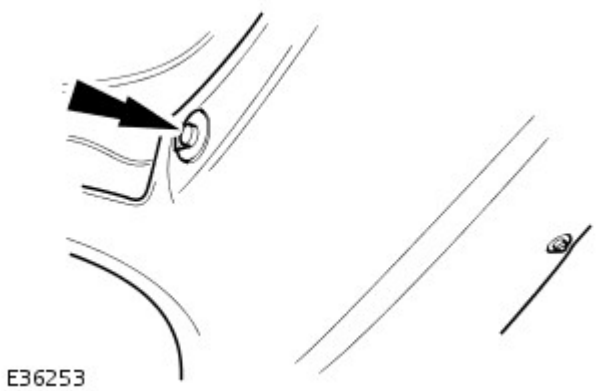
35. Using new tiestrap, secure undertray to crossbeam brace.



E35108

36. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Slide deflector forward to engage center tang over undertray.
- Install bolt and tighten to 17-23Nm.



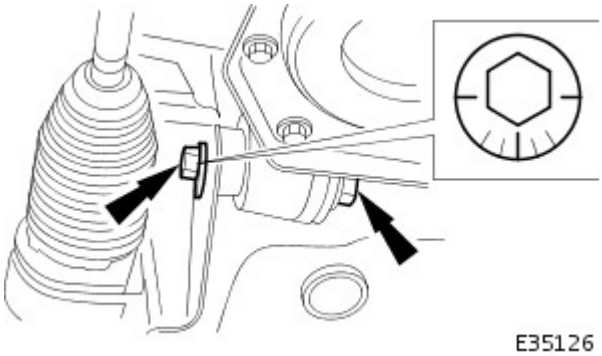
E36253

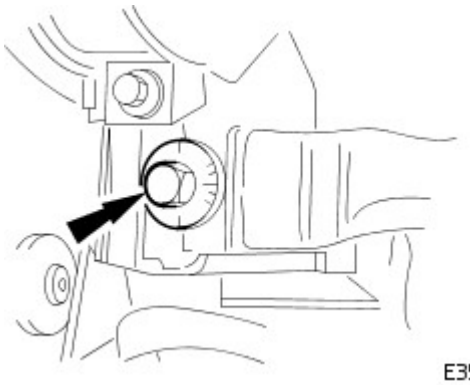
37. Using new scrivets, secure undertray to each wheelarch liner.

38. Install both front road wheels. Refer to Section 100-02.

39. Raise vehicle, remove stands and lower vehicle.

40. Ensuring graduation mark remains aligned, finally tighten wishbone rear eccentric bolt to 113-153Nm.



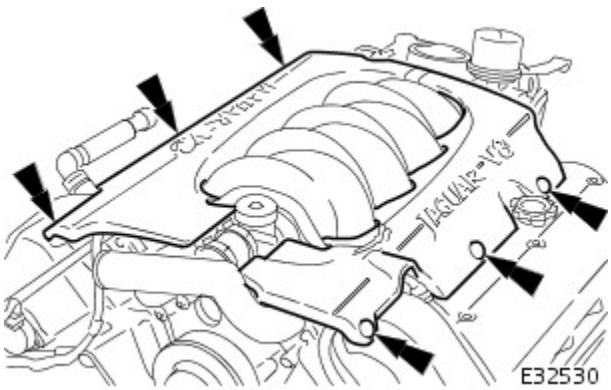


41. Ensuring graduation mark remains aligned, finally tighten wishbone front eccentric bolt to 113-153Nm.

42. Install air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30

43. Install both engine covers (normally aspirated vehicles only).

- Position covers over engine.
- Install securing pegs.



44. Fill power steering system. Refer to Section 211-02.

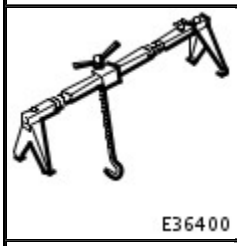
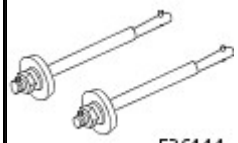
45. Remove fender covers and close hood.

46. Connect ground cable to battery terminal and fit battery cover. Refer 86.15.19.

47. Carry out steering geometry and wheel alignment checks and adjust as necessary. Refer to 57.65.03

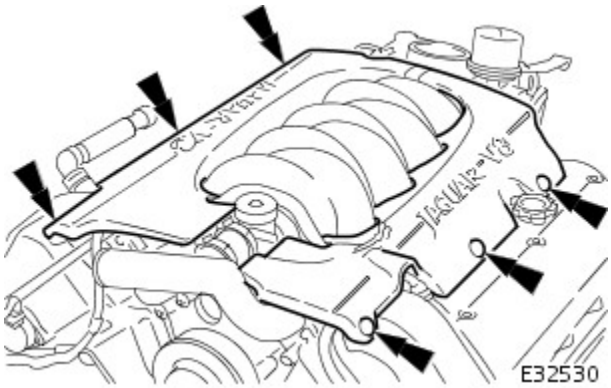
Uni-Body, Subframe and Mounting System - Front Axle Crossmember Front Bushing

Removal and Installation

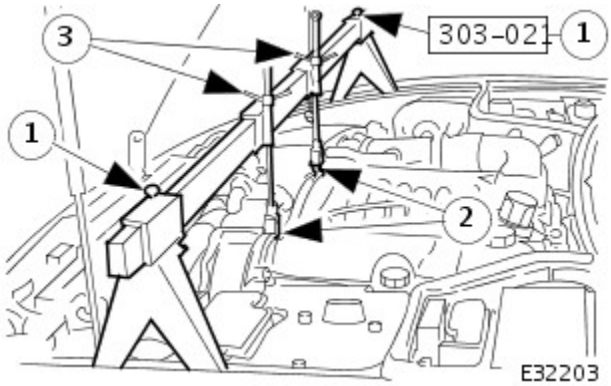
Special Tool(s)	
 E36400	Engine Support Beam 303-021 (MS 53D)
 E36444	Front Camber Tie-down Link 204-114 (JD 133)

Removal

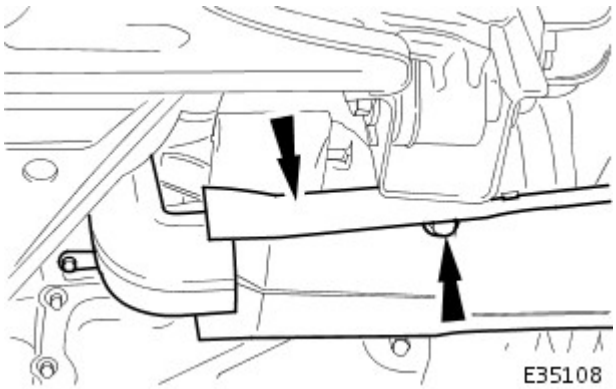
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See Section 100-00 for information.


E32530

1. Position vehicle on a four-post lift.
2. Remove ignition key and engage steering column lock.
3. Open hood to service position, and fit covers to fenders.
4. Remove battery cover and disconnect ground cable from battery terminal. Refer to 86.15.19.
5. Remove both engine covers (normally aspirated vehicles only).
   - Release pegs.
   - Remove covers.
6. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30
7. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30
8. Support weight of engine.
   1. Position special tool 303-021 in RH and LH fender channels and tighten beam fixings.
   2. Engage hooks in the engine front lifting eyes.
   3. Tighten hook adjustment nuts until weight of engine is supported.



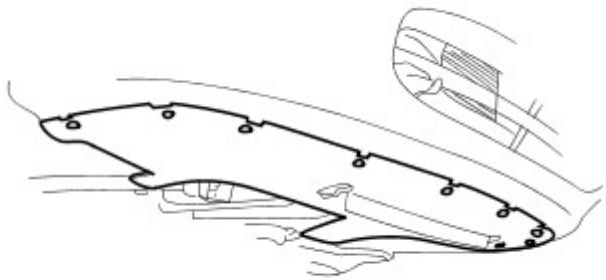
9. Raise front of vehicle.



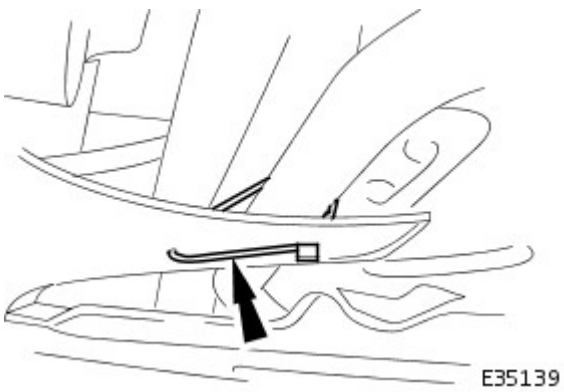
10. Remove generator cooling duct deflector.

- Remove bolt.
- Move deflector rearwards to release tangs from undertray.
- Release deflector from rear vertical duct.

11. Remove screws or scrivets securing undertray to bumper cover. Discard scrivets.

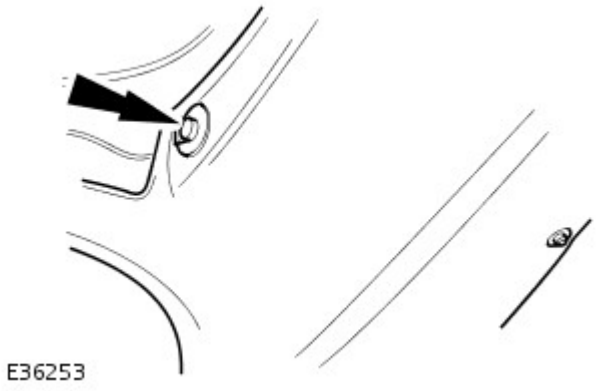


E36252



12. Remove and discard tiestrap securing undertray to body brace.

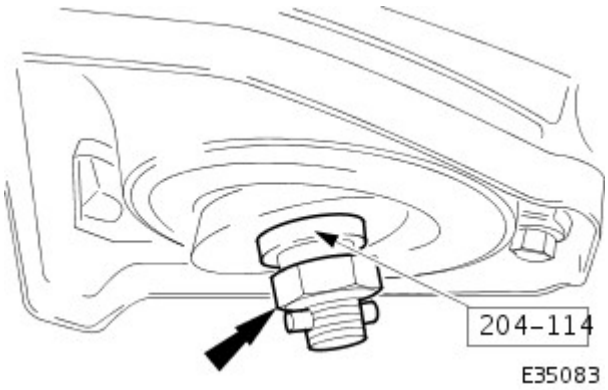
13. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.



14. Remove undertray from vehicle.

15. Position camber tie down special tool 204-114 on suspension.

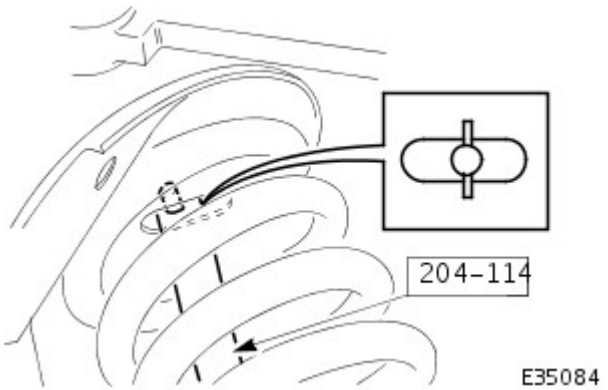
- Fully slacken tool adjuster nut.
- Position tool in center of road spring and pass upper dowel through slot in suspension turret.



16. Lower front of vehicle.

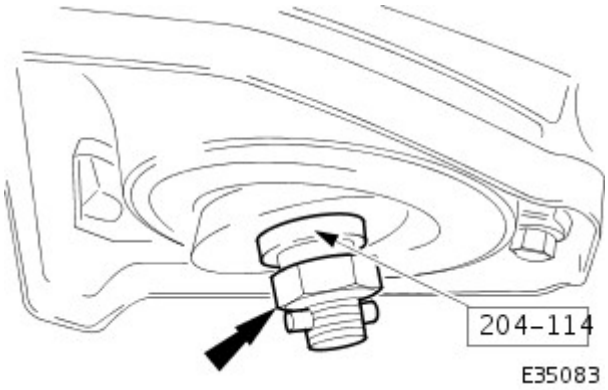
17. WARNING: ENSURE THAT THE DOWEL OF TOOL 204-114 IS CORRECTLY POSITIONED ACROSS THE SUSPENSION TURRET SLOT.

Rotate stem of special tool 204-114 to correctly position dowel in suspension turret slot.



18. WARNING: WHEN TIGHTENING TOOL NUT, USE LOWER DOWEL AS A GUIDE TO ENSURE THAT THE TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Tighten nut of special tool 204-114 to full extent, to achieve suspension mid-laden position.



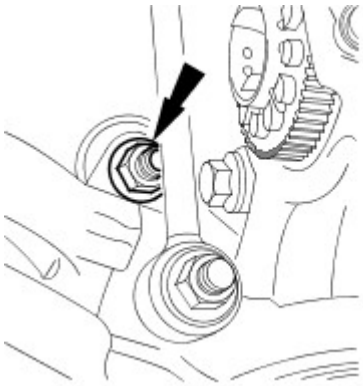
19. Raise front of vehicle and support on stands. refer to Section 100-02.

20. Remove front road wheels. Refer to Section 100-02.



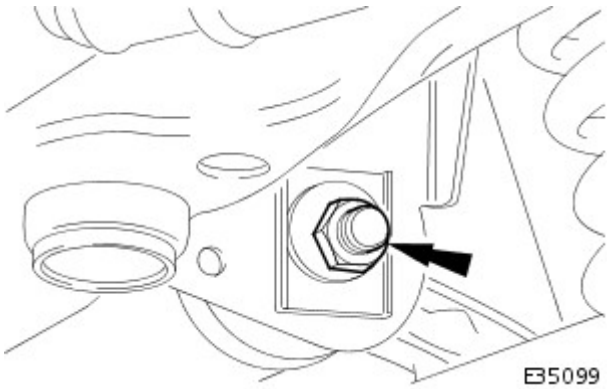
21. Remove crossbeam to engine Hydramount bolts.

- Remove bolt securing crossbeam to Hydramount.
- Fully withdraw bolt into crossbeam insert.
- Repeat procedure to remove and withdraw bolt on opposite side



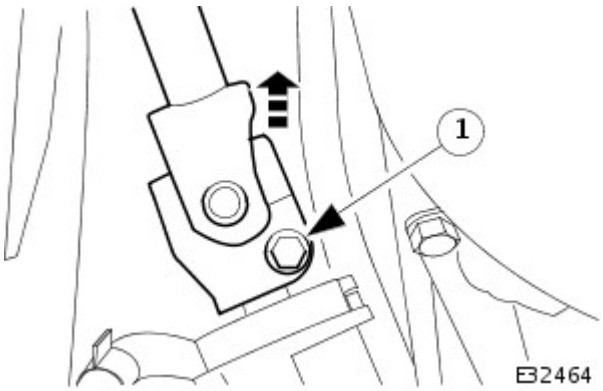
22. Remove lower nut and bolt from front shock absorber.

- Repeat procedure to remove bolt from opposite side shock absorber.



23. Slacken but do not remove crossbeam rear bolt and nuts.

- Slacken crossbeam LH rear mounting bolt and nut.
- Repeat procedure to slacken crossbeam RH rear mounting nut.



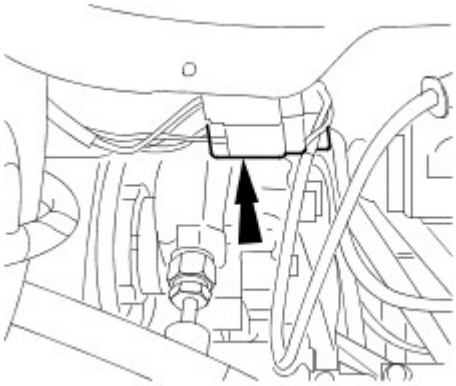
24. Release lower steering column from pinion shaft.

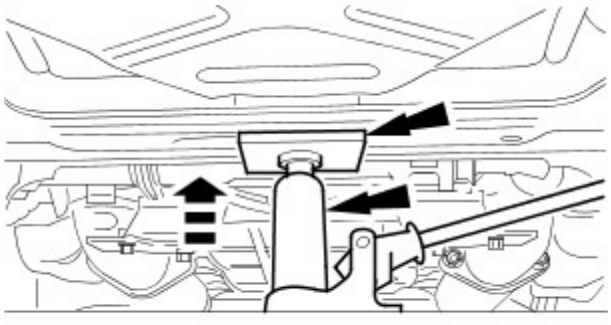
1. Remove lower steering column nut and bolt.

- Move column upwards to release it from pinion shaft.

25. Disconnect steering rack transducer harness front connector.

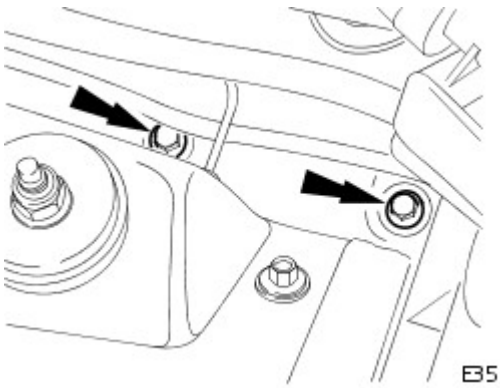
- Release harness connector from body retaining clip.
- Disconnect connector.



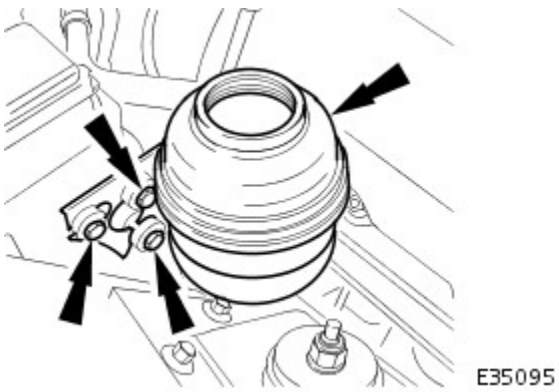


26. Support weight of crossbeam.

- Position a jack under crossbeam.
- Place a piece of wood between jack and crossbeam.
- Raise jack to just support crossbeam.



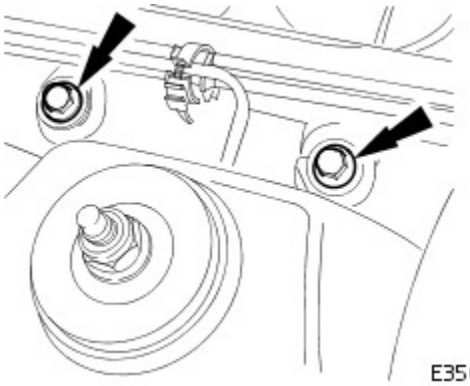
27. From engine compartment, remove crossbeam front RH bolts.

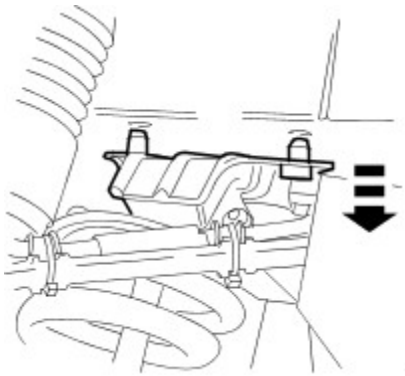


28. Remove power steering fluid reservoir for access.

- Remove reservoir securing nuts and bolts.
- Position reservoir for access.

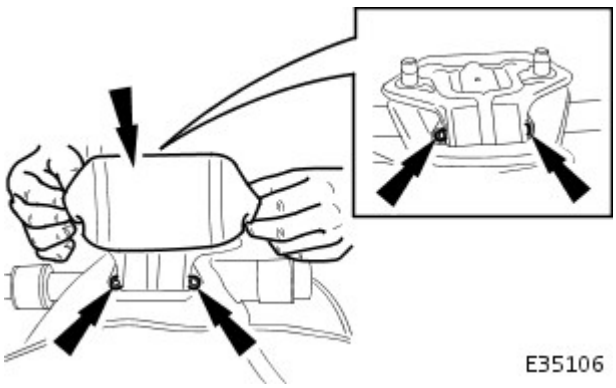
29. From engine compartment, remove crossbeam front LH bolts.





30. CAUTION: Slowly lower the crossbeam just sufficient to provide the required clearance. Lowering the crossbeam excessively can damage the suspension and steering pipes.

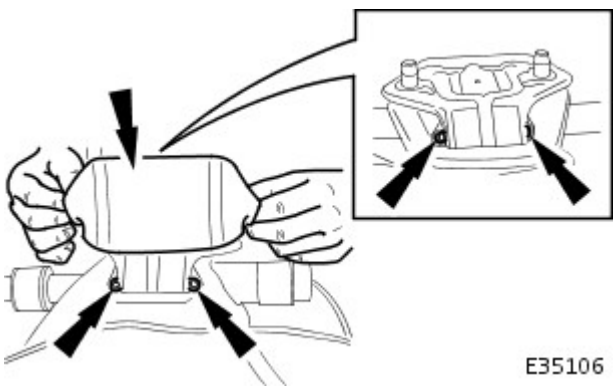
Carefully lower crossbeam to provide sufficient clearance between front mounting and body.



31. Remove crossbeam front mounting.

- Remove front mounting heatshield.
- Remove four bolts securing mounting to crossbeam.

Installation



1. Install crossbeam front mounting.

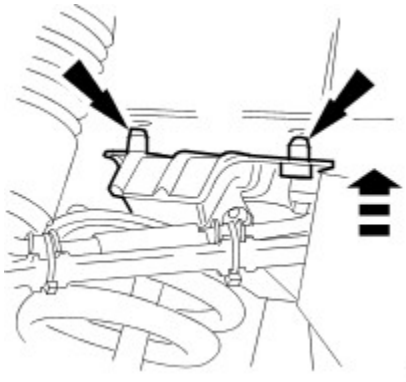
- Position new mounting on crossbeam.
- Install four bolts securing mounting to crossbeam and tighten to 22-28Nm.
- Install front mounting heatshield.

2. NOTE: It may be necessary to use a hammer and drift to finally align new mounting with body location.

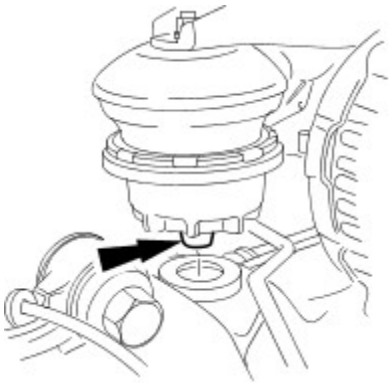
Carefully raise crossbeam assembly into position.

- Ensure that dowels of both crossbeam mountings are

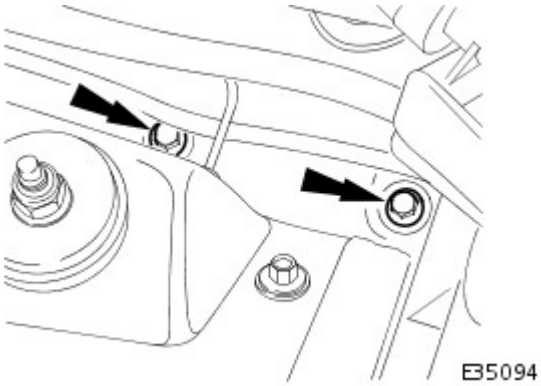
correctly seated in body locations.



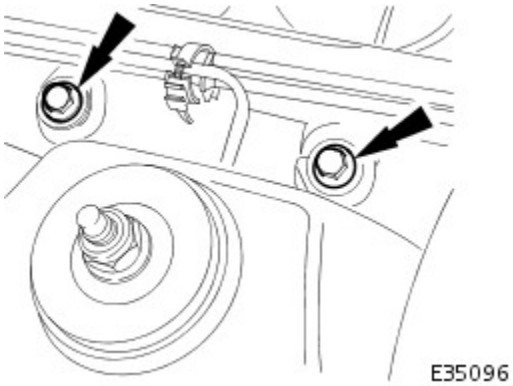
3. Ensure that both engine hydramounts are correctly seated in crossbeam locations.



4. From engine compartment, install but do not tighten crossbeam front RH bolts.

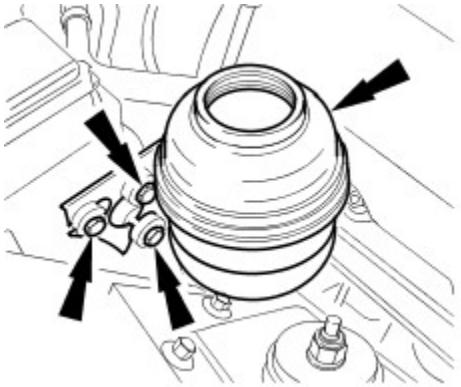


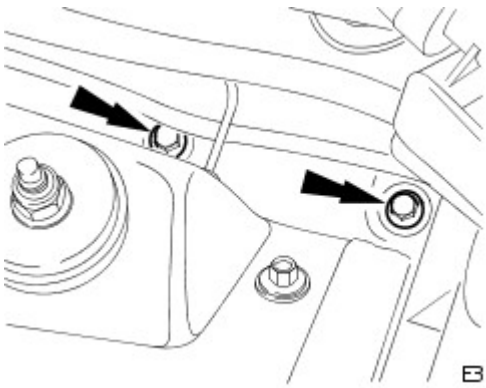
5. From engine compartment, install crossbeam front LH bolts and tighten to 22-28Nm.



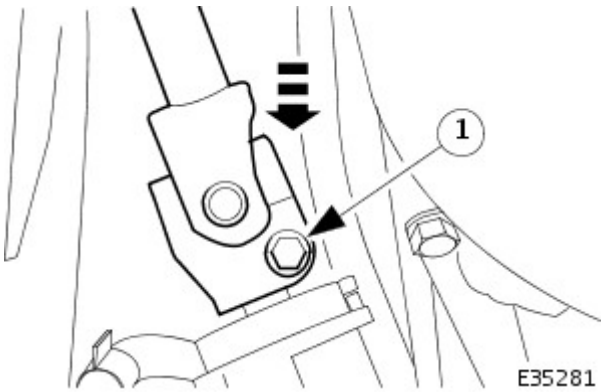
6. Install power steering fluid reservoir.

- Position reservoir on mounting bracket.
- Install reservoir securing nuts and bolts.





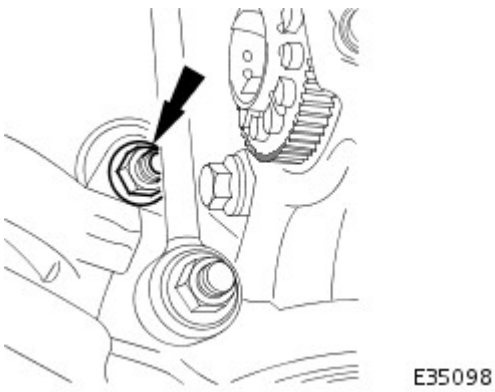
7. From engine compartment, tighten crossbeam front RH bolts to 22-28Nm.



8. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.

1. Install nut and bolt and tighten to 22-28Nm.

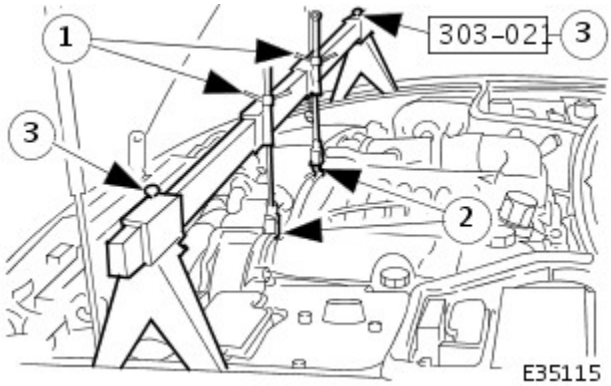


9. Install shock absorber on lower wishbone.

- Lift lower wishbone to align shock absorber lower mounting.
- Install bolt and nut and tighten nut to 43-57Nm.
- Repeat procedure to install opposite side shock absorber.

10. Release engine from support tool.

1. Slacken hook adjustment nuts until weight of engine is released.
2. Remove hooks from engine front lifting eyes.

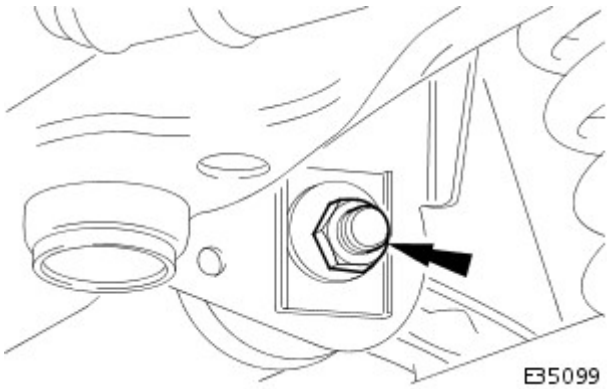


3. Remove special tool 303-021 from fender channel.



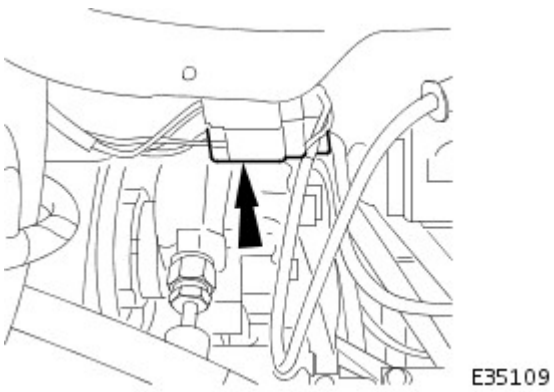
11. Install crossbeam to engine Hydramount bolts.

- Install bolt securing Hydramount to crossbeam and tighten to 34-46Nm.
- Repeat procedure to install crossbeam opposite side bolt.



12. Tighten rear mounting bolt and nut to 131-185 Nm.

- Repeat procedure to tighten opposite side rear mounting bolt and nut.

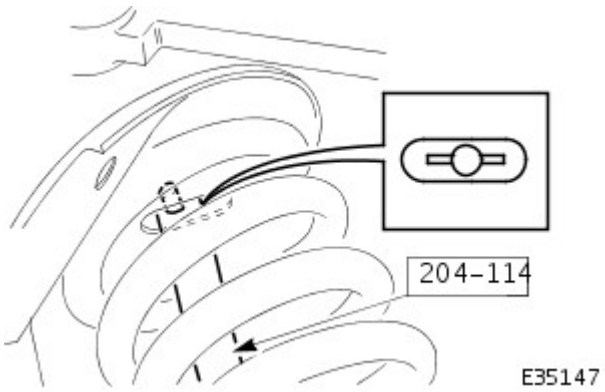


13. Connect steering rack transducer harness front connector.

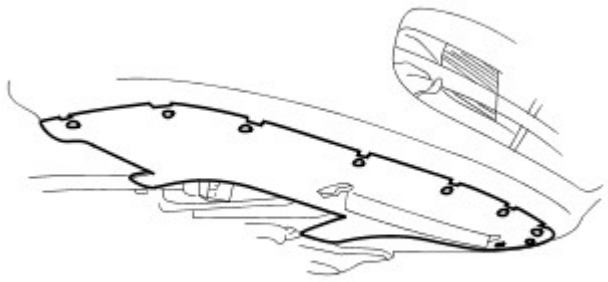
- Connect steering harness connector.
- Install harness connector on body retaining clip.

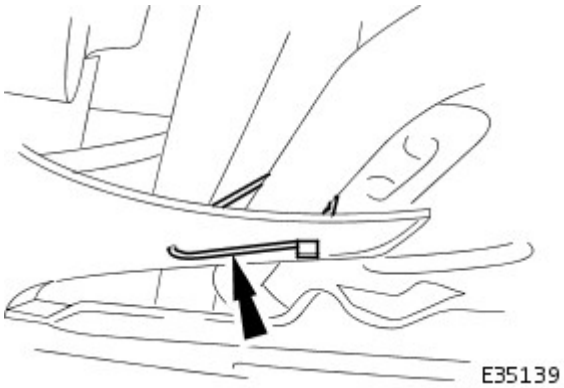
14. Slacken adjuster nut and remove camber tie down tool 204-114 from suspension.

- Repeat procedure to remove tie down tool from opposite side.

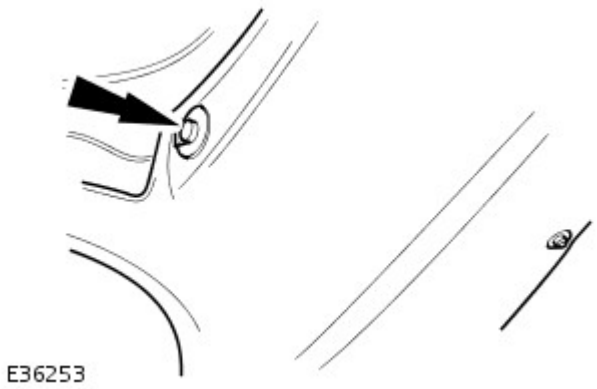


15. Using screws or new scrivets, secure undertray to front bumper cover.





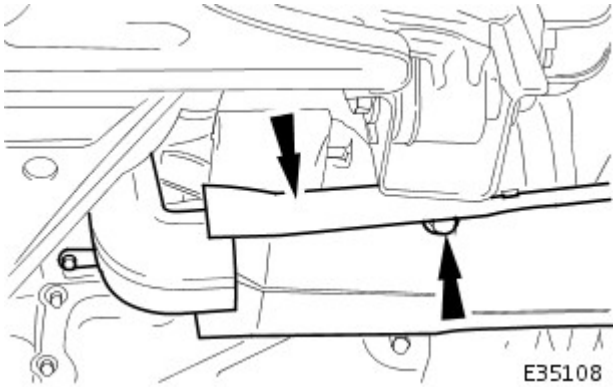
16. Using new tiestrap, secure undertray to crossbeam brace.



17. Using new scrivets, secure undertray to each wheelarch liner.

18. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Move deflector forward to engage center tang over



undertray.

- Install bolt and tighten to 17-23Nm.

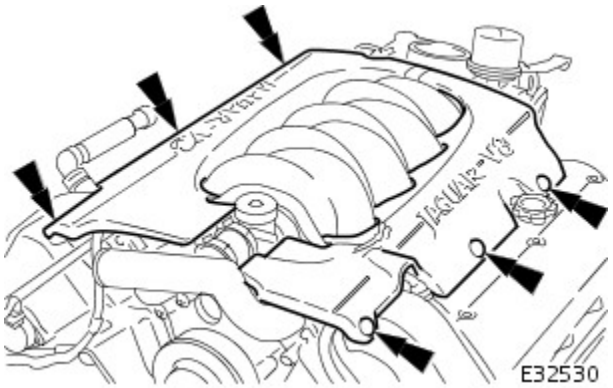
19. Install both front road wheels. Refer to Section 204-04.

20. Raise vehicle, remove stands and lower vehicle.

21. Remove special tool MS53 from vehicle.

22. Install both engine covers (normally aspirated vehicles only).

- Position covers over engine.
- Install securing pegs.



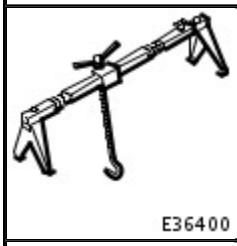
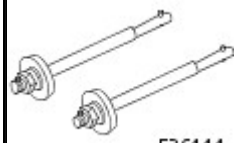
23. Install air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30

24. Remove fender covers and close hood.

25. Connect ground cable to battery terminal and fit battery cover. Refer 86.15.15.

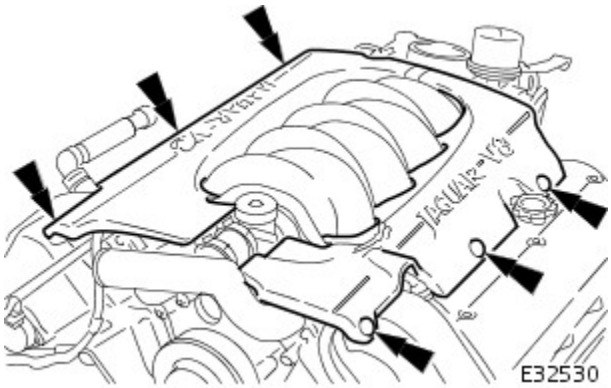
Uni-Body, Subframe and Mounting System - Front Axle Crossmember Front Bushing Heat Shield

Removal and Installation

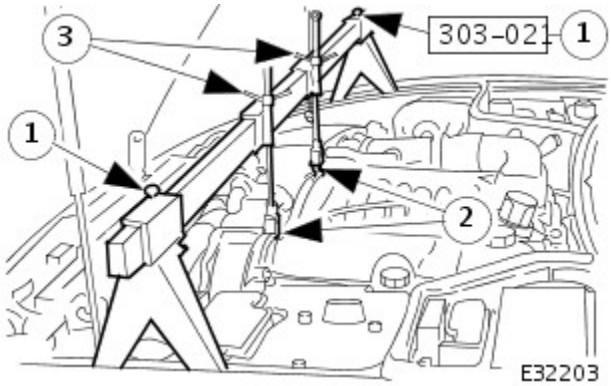
Special Tool(s)	
 E36400	Engine Support Beam 303-021 (MS 53D)
 E36444	Front Camber Tie-down Link 204-114 (JD 133)

Removal

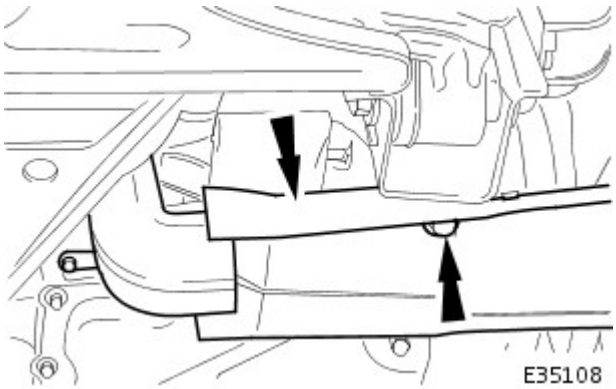
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See Section 100-00 for information.


E32530

1. Position vehicle on a four-post lift.
2. Remove ignition key and engage steering column lock.
3. Open hood to service position, and fit covers to fenders.
4. Remove battery cover and disconnect ground cable from battery terminal. Refer to section 86.15.15.
5. Remove both engine covers (normally aspirated vehicles only).
   - Release pegs.
   - Remove covers.
6. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30
7. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30
8. Support weight of engine.
   1. Position special tool 303-021 in RH and LH fender channels and tighten beam fixings.
   2. Engage hooks in the engine front lifting eyes.
   3. Tighten hook adjustment nuts until weight of engine is supported.



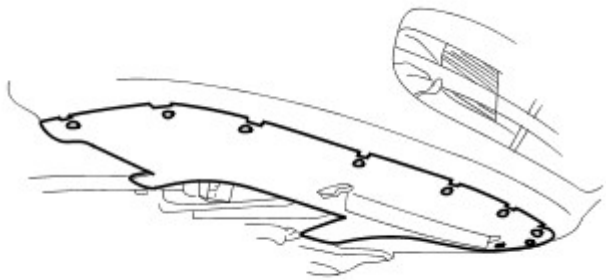
9. Raise front of vehicle.



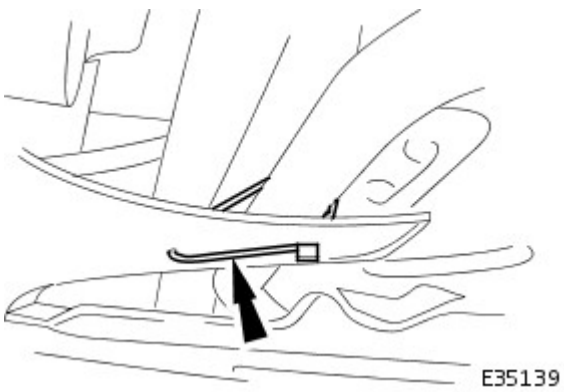
10. Remove generator cooling duct deflector.

- Remove bolt.
- Move deflector rearwards to release tangs from undertray.
- Release deflector from rear vertical duct.

11. Remove screws or scrivets securing undertray to bumper cover. Discard scrivets.

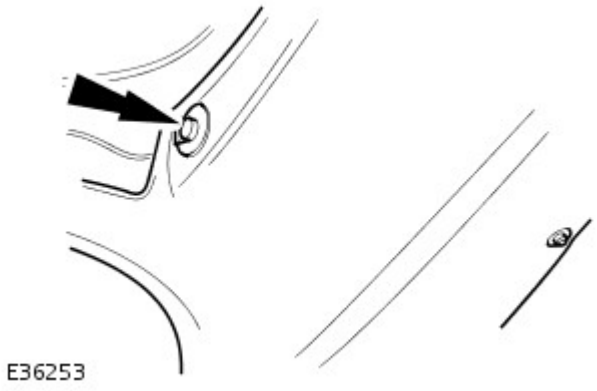


E36252



12. Remove and discard tiestrap securing undertray to body brace.

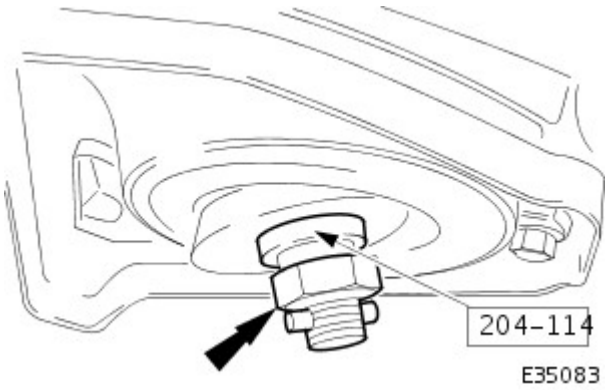
13. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.



14. Remove undertray from vehicle.

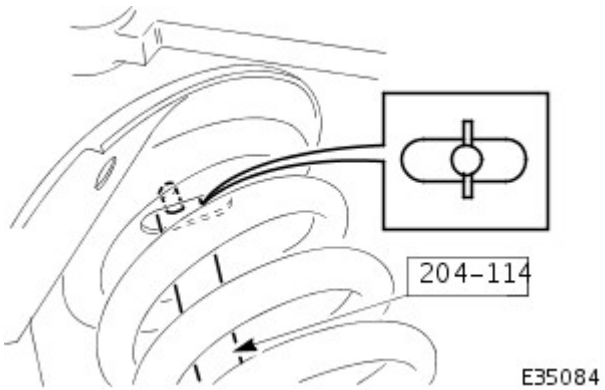
15. Position camber tie down special tool 204-114 on suspension.

- Fully slacken tool adjuster nut.
- Position tool in road spring and pass upper dowel through slot in suspension turret.



16. Lower front of vehicle.

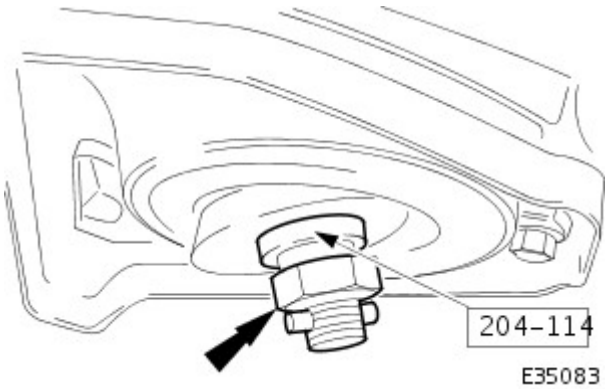
17. Rotate stem of special tool 204-114 to locate dowel in suspension turret slot.



18. Lower front of vehicle.

19. WARNING: WHEN TIGHTENING TOOL NUT, USE LOWER DOWEL AS A GUIDE TO ENSURE THAT THE TOOL STEM DOES NOT ROTATE AND DISTURB POSITION OF DOWEL IN SUSPENSION TURRET.

Tighten nut of special tool 204-114 to full extent, to achieve suspension mid-laden position.



20. Raise front of vehicle and support on stands. refer to Section 100-02.

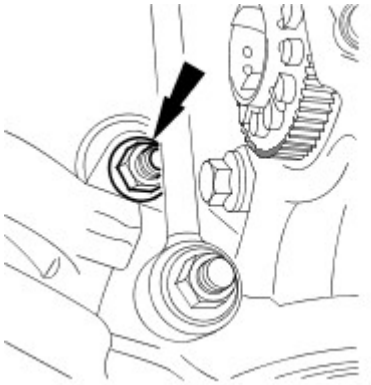
21. Remove front road wheels. Refer to Section 100-02.

22. Remove crossbeam to engine Hydramount securing bolts.



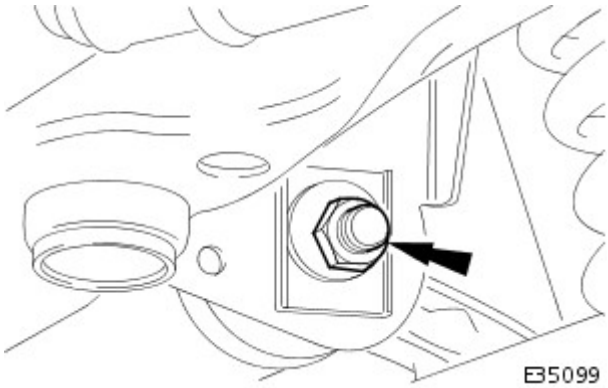
- Remove bolt securing crossbeam to Hydramount.
- Fully withdraw bolt into crossbeam insert.
- Repeat procedure to remove and withdraw bolt on opposite side

23. Remove lower nut and bolt from front shock absorber.



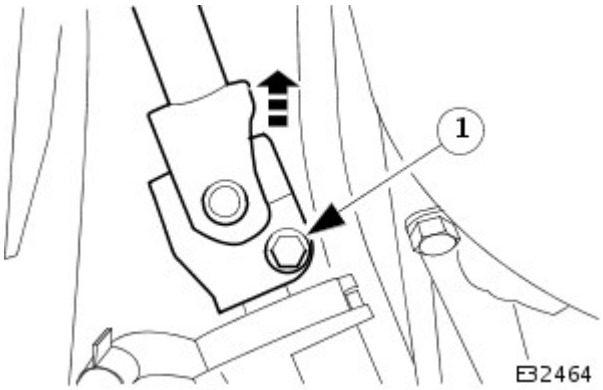
- Repeat procedure to remove bolt from opposite side shock absorber.

24. Slacken but do not remove crossbeam rear nuts.



- Slacken crossbeam LH rear mounting nut.
- Repeat procedure to slacken crossbeam RH rear mounting nut.

25. Release lower steering column from pinion shaft.

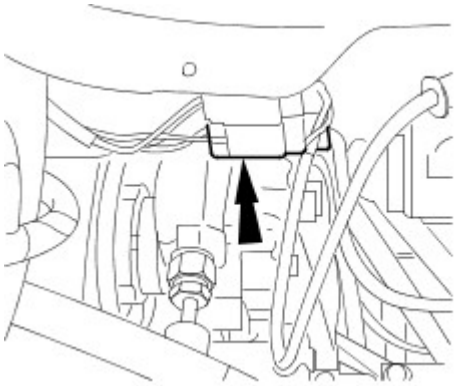


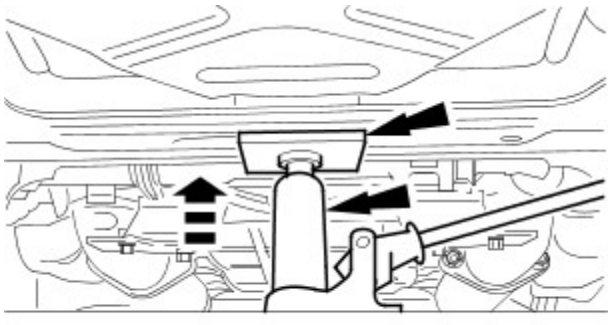
1. Remove lower steering column nut and bolt.

- Move column upwards to release it from pinion shaft.

26. Disconnect steering rack transducer harness front connector.

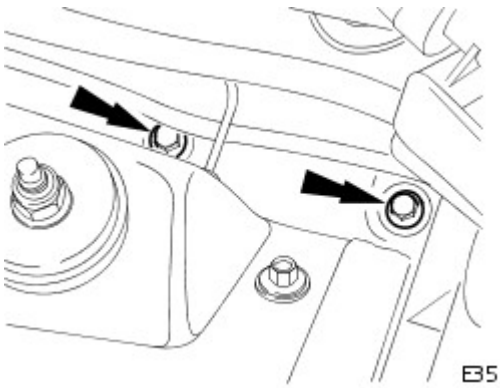
- Release harness connector from body retaining clip.
- Disconnect connector.



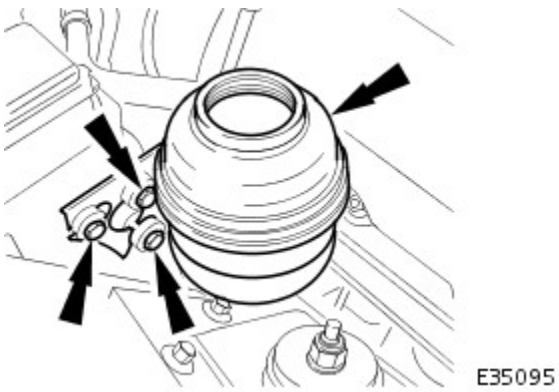


27. Support weight of crossbeam.

- Position a jack under crossbeam.
- Place a piece of wood between jack and crossbeam.
- Raise jack to just support crossbeam.



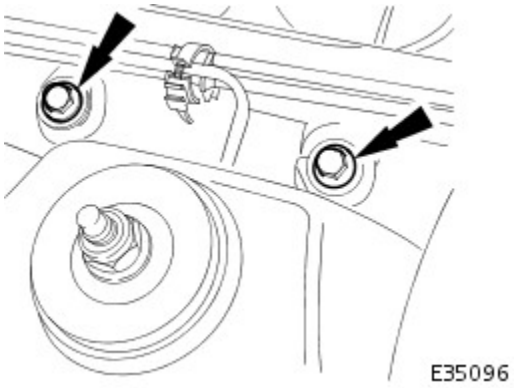
28. From engine compartment, remove crossbeam front RH bolts.

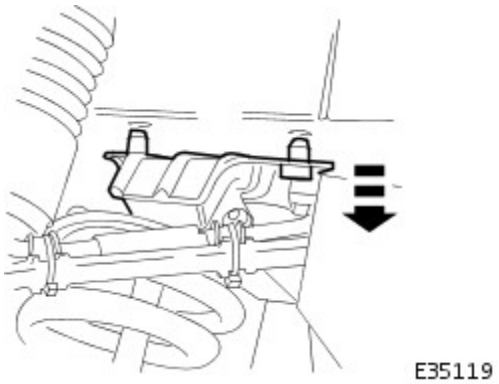


29. Remove power steering fluid reservoir for access.

- Remove reservoir nuts and bolts.
- Position reservoir for access.

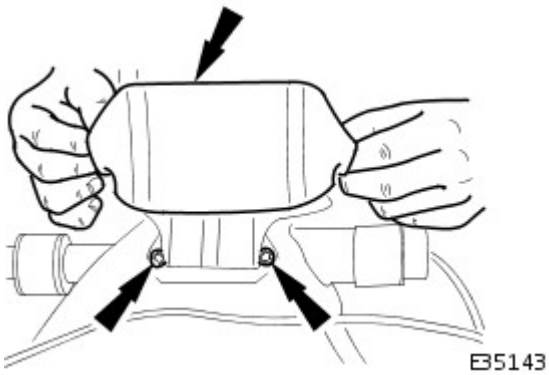
30. From engine compartment, remove crossbeam front LH bolts.





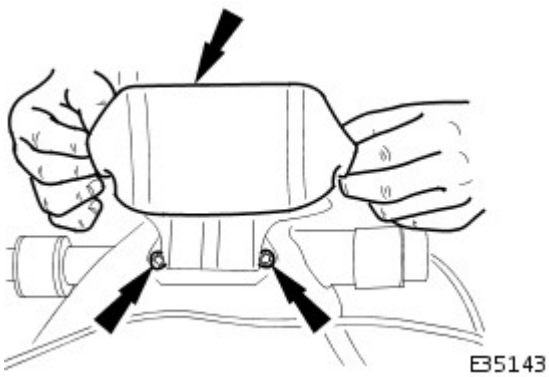
31. CAUTION: Slowly lower the crossbeam just sufficient to provide the required clearance. Lowering the crossbeam excessively can damage the suspension and steering pipes.

Carefully lower crossbeam to provide sufficient clearance between front mounting and body.



32. Remove and discard heatshield from front mounting.

Installation



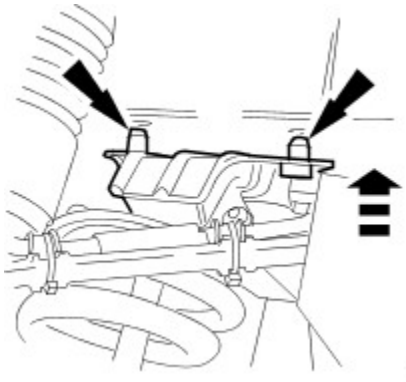
1. Install new heatshield over front mounting.

2. NOTE: It may be necessary to use a hammer and drift to finally align new mounting with body location.

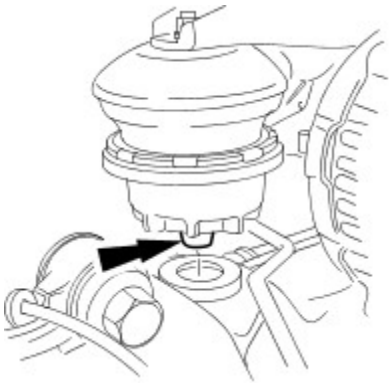
Carefully raise crossbeam assembly into position.

- Ensure that dowels of both crossbeam mountings are

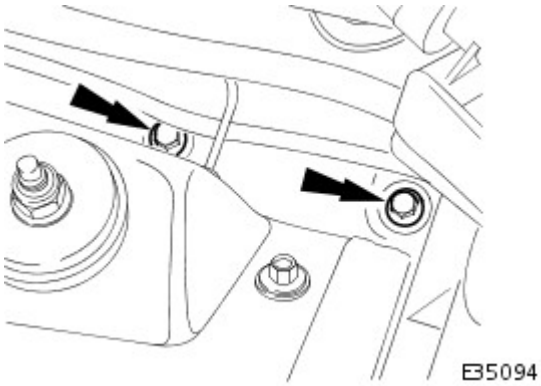
correctly seated in body locations.



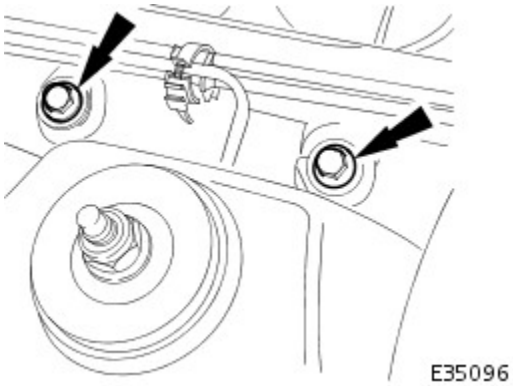
3. Ensure that both engine hydramounts are correctly seated in crossbeam locations.



4. From engine compartment, install but do not tighten crossbeam front RH bolts.

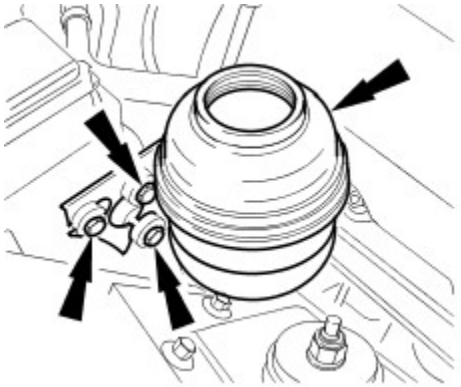


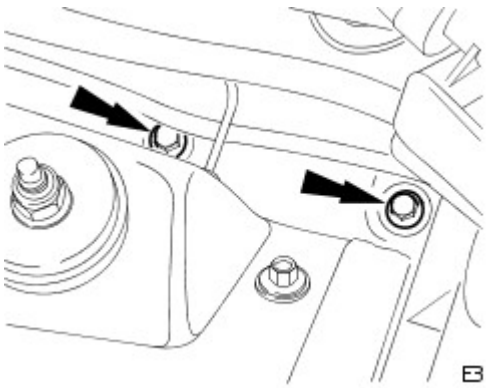
5. From engine compartment, install crossbeam front LH bolts and tighten to 22-28Nm.



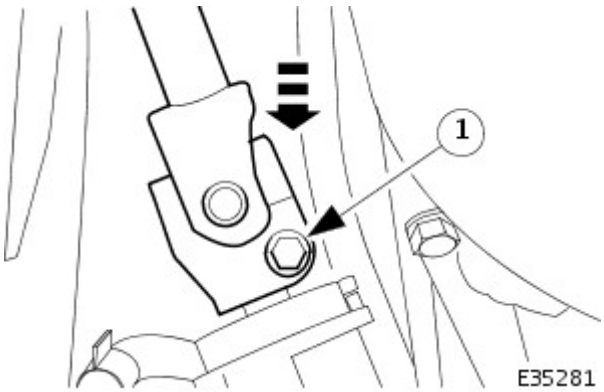
6. Install power steering fluid reservoir.

- Position reservoir on mounting bracket.
- Install reservoir securing nuts and bolts.





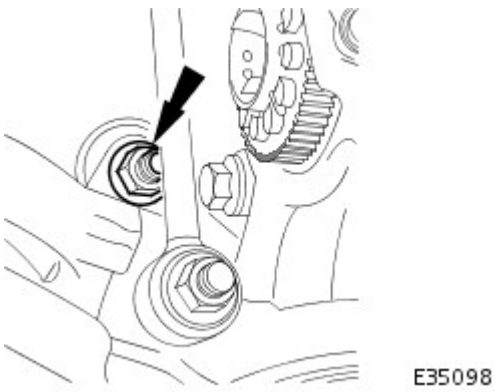
7. From engine compartment, tighten crossbeam front RH bolts to 22-28Nm.



8. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.

1. Install nut and bolt and tighten to 22-28Nm.

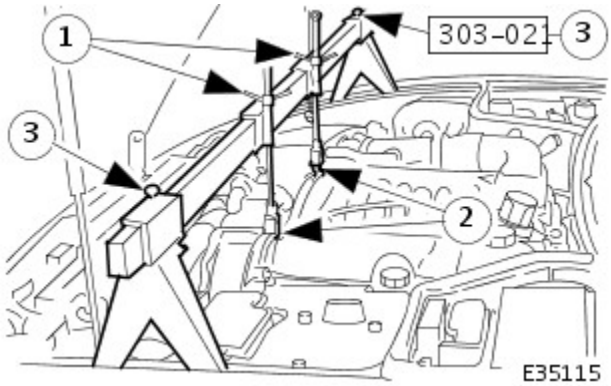


9. Install shock absorber on lower wishbone.

- Lift lower wishbone to align shock absorber lower mounting.
- Install bolt and nut and tighten nut to 43-57Nm.
- Repeat procedure to install opposite side shock absorber.

10. Release engine from support tool.

1. Slacken hook adjustment nuts until weight of engine is released.
2. Remove hooks from engine front lifting eyes.

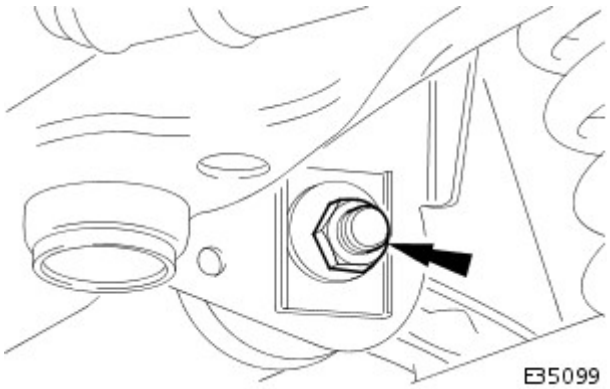


3. Remove special tool 303-021 from fender channel.



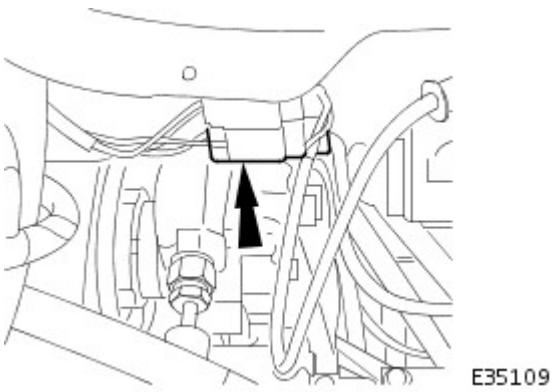
11. Install crossbeam to engine Hydramount bolts.

- Install bolt securing Hydramount to crossbeam and tighten to 34-46Nm.
- Repeat procedure to install crossbeam opposite side bolt.



12. Tighten rear mounting bolt and nut to 131-185 Nm.

- Repeat procedure to tighten opposite side rear mounting bolt and nut.

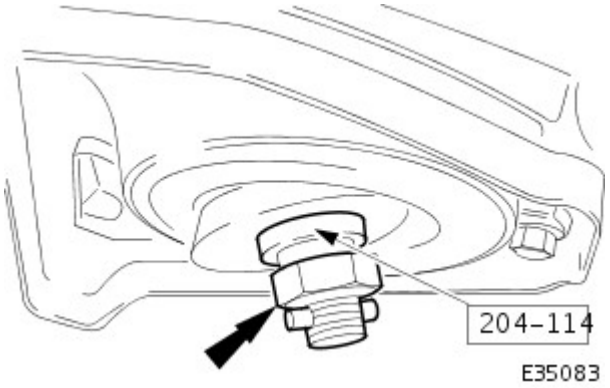


13. Connect steering rack transducer harness front connector.

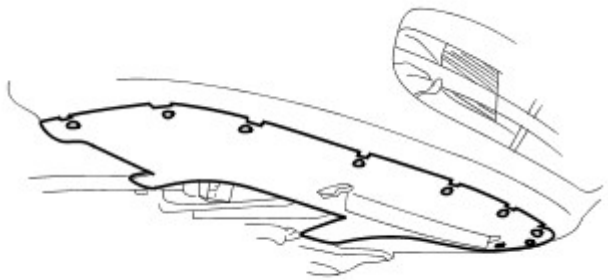
- Connect steering harness connector.
- Install harness connector on body retaining clip.

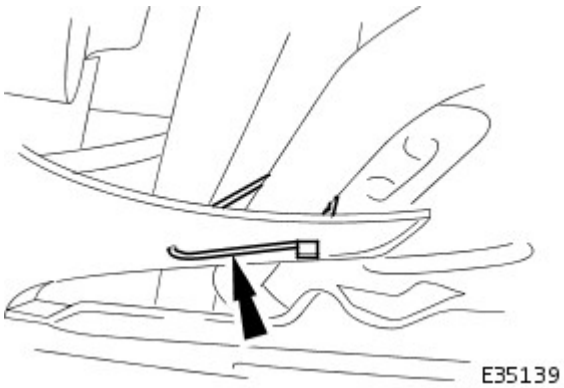
14. Slacken adjuster nut and remove camber tie down tool 204-114 from suspension.

- Repeat procedure to remove tie down tool from opposite side.

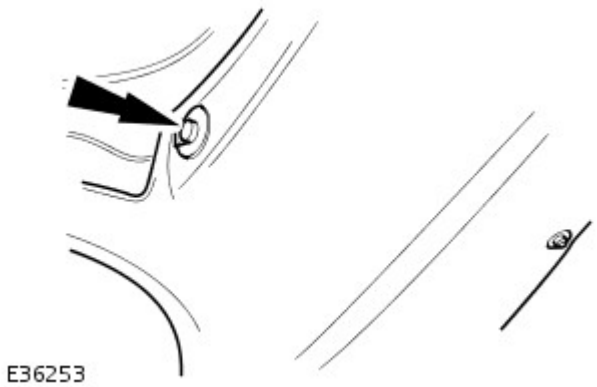


15. Using screws or new scrivets, secure undertray to front bumper cover.





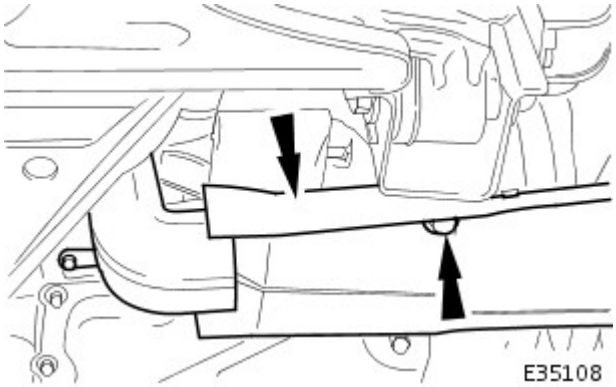
16. Using new tiestrap, secure undertray to crossbeam brace.



17. Using new scrivets, secure undertray to each wheelarch liner.

18. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Move deflector forward to engage center tang over undertray.



- Install bolt and tighten to 17-23Nm.

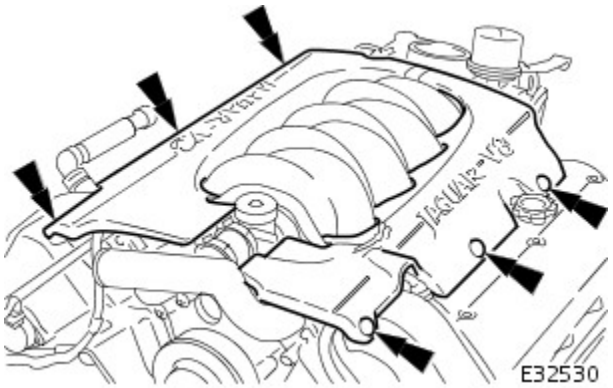
19. Install both front road wheels. Refer to Section 204-04.

20. Raise vehicle, remove stands and lower vehicle.

21. Remove special tool MS53 from vehicle.

22. Install both engine covers (normally aspirated vehicles only).

- Position covers over engine.
- Install securing pegs.



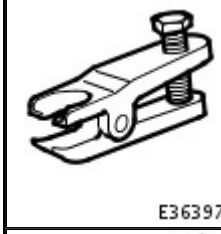
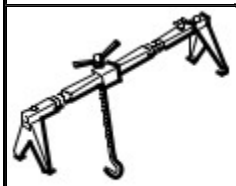
23. Install air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30

24. Remove fender covers and close hood.

25. Connect ground cable to battery terminal and fit battery cover. Refer 86.15.19.

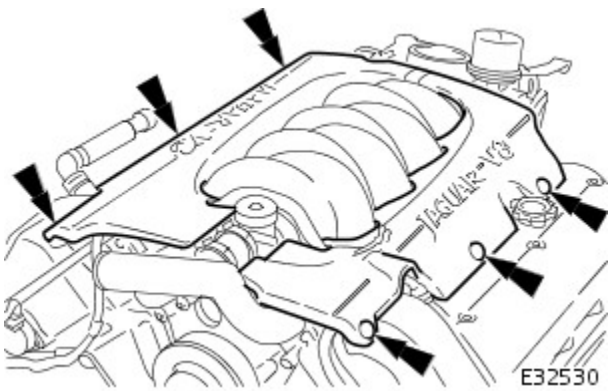
Uni-Body, Subframe and Mounting System - Front Axle Crossmember Rear Bushing

Removal and Installation

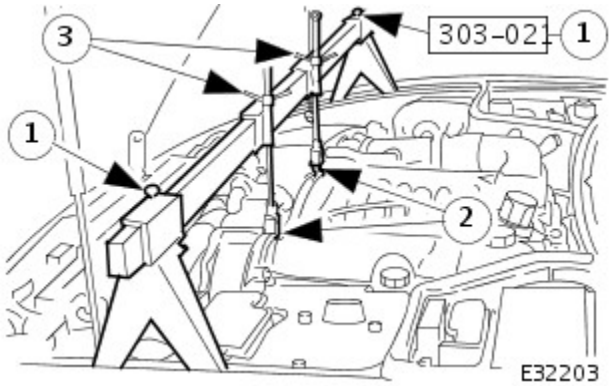
Special Tool(s)	
 E36397	Tie-Rod-End Taper Separator 211-098 (JD 100)
 E36400	Engine Support Beam 303-021 (MS 53D)

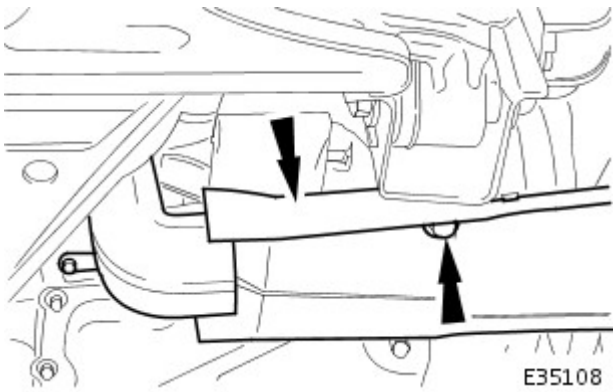
Removal

CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



1. Position vehicle on a four-post lift.
2. Raise front of vehicle and support on stands.
3. Remove battery cover and disconnect ground cable from battery terminal. Refer to section 86.15.15.
4. Open hood to service position, and fit covers to fenders.
5. Remove both engine covers (normally aspirated vehicles only).
   - Release pegs.
   - Remove covers.
6. Remove air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30
7. Support weight of engine.
   1. Position special tool 303-021 in RH and LH fender channels and tighten beam fixings.
   2. Engage hooks in the engine front lifting eyes.
   3. Tighten hook adjustment nuts until weight of engine is supported.

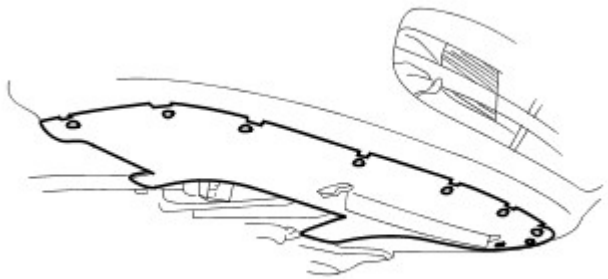




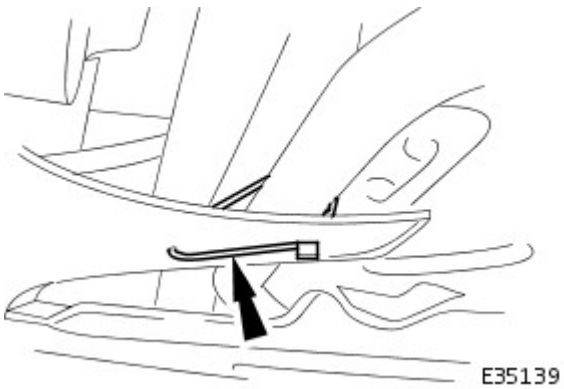
8. Remove generator front cooling duct.

- Remove bolt.
- Move duct rearwards to release tang from undertray.
- Release front duct from rear vertical duct.

9. Remove scrivets or screws securing undertray to bumper cover. Discard scrivets.

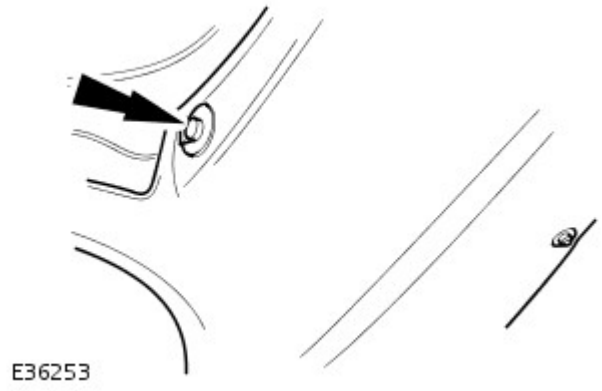


E36252



10. Remove and discard tiestrap securing undertray to crossbeam front brace.

11. At each side of vehicle, remove and discard scrivet securing undertray to wheelarch liner.

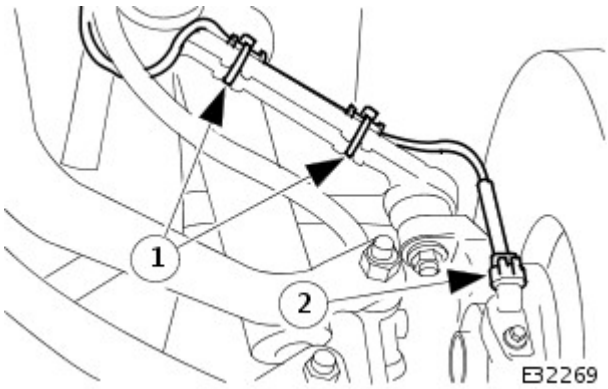


12. Remove undertray from vehicle.

13. Remove both front road wheels. Refer to Section 204-04.

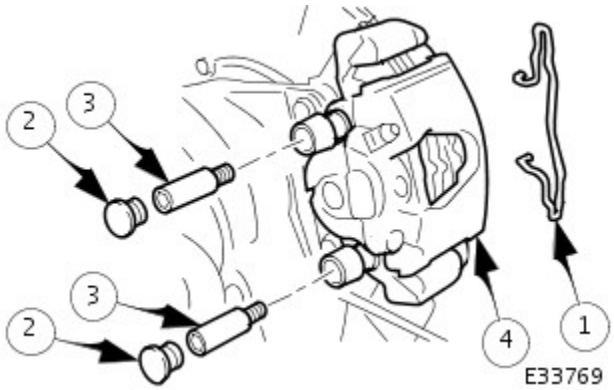
14. Remove both front road springs. Refer to 60. 20.02.

15. Disconnect wheel speed sensor harness connectors.



1. Sever and discard tiestraps securing front wheel speed sensor harness to upper wishbone.
2. Disconnect harness connector from sensor.

- Repeat procedure to disconnect opposite side wheel speed sensor harness.



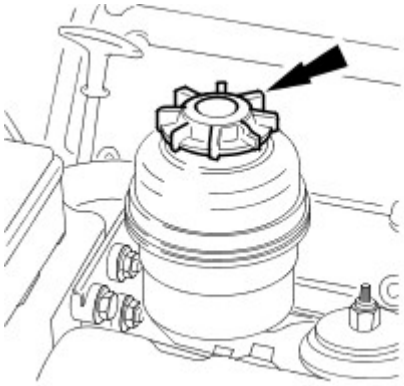
16. CAUTION: Do not suspend caliper from brake hose as this will damage the hose.

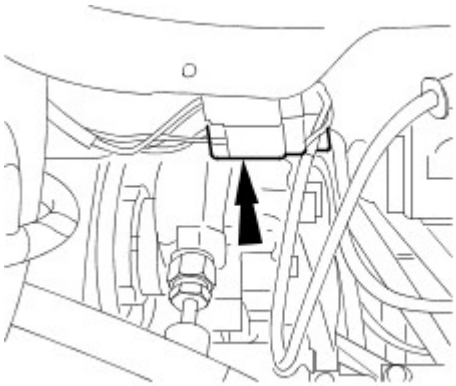
Remove brake calipers from carriers.

1. Remove caliper spring clip.
2. Remove guide pin dust caps.
3. Slacken and withdraw guide pins.
4. Remove caliper from carrier and tie to suspension mounting bracket.

- Repeat procedure to remove opposite side front brake caliper.

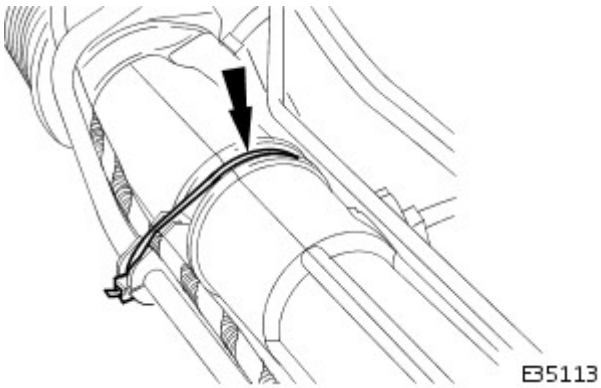
17. Remove filler cap from power steering fluid reservoir.



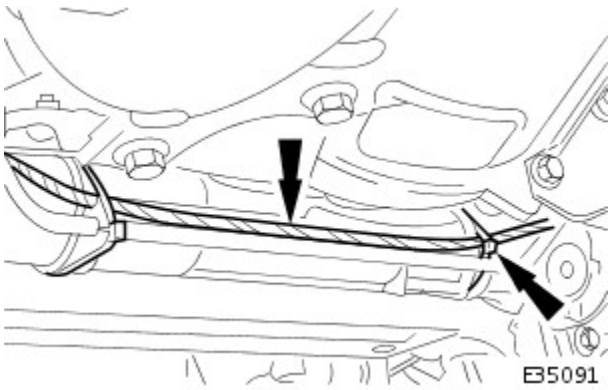


18. Disconnect steering rack transducer harness front connector.

- Release harness connector from body retaining clip.
- Disconnect connector.



19. Sever and discard tiestrap securing return pipe, harness (RHD only) and rubber support to steering rack.

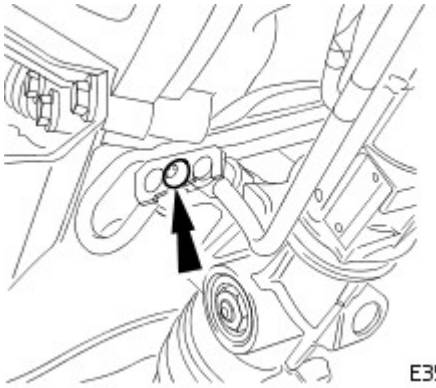


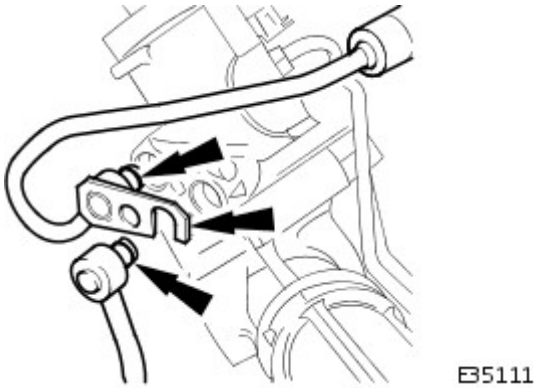
20. RHD vehicles. Sever and discard tiestrap securing harness to steering rack.

21. Route harness from behind steering return pipe.

22. Position a drain receptacle below pinion housing.

23. Remove pipe retaining plate securing bolt and withdraw plate.



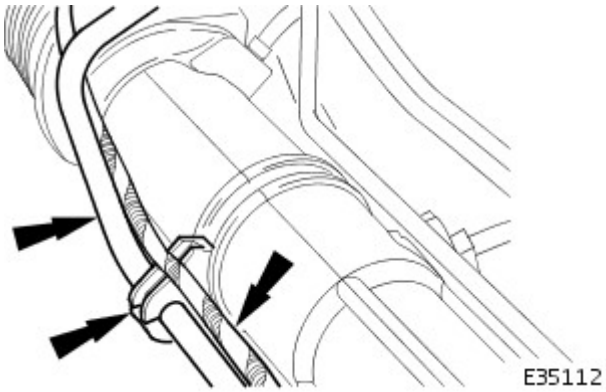


24. Drain power steering fluid.

- Disconnect pipes and allow fluid to drain.
- Remove and discard 'O'-ring seals from pipe connectors.
- Fit blanking plugs to pipe connectors and pinion housing ports.

25. Remove drain receptacle.

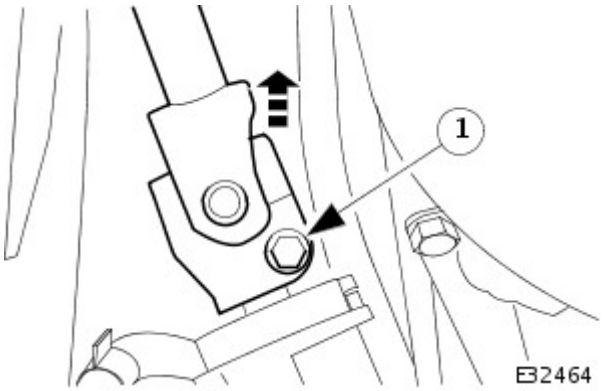
26. Remove pipe support from steering rack.



- Release return pipe from support.
- Remove support from rack.

27. Ensure that steering is in central position.

28. Release lower steering column from pinion shaft.

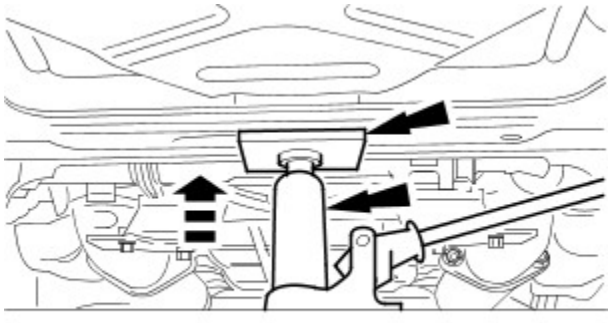


1. Remove lower steering column securing nut and bolt.

- Move column upwards to release it from pinion shaft.

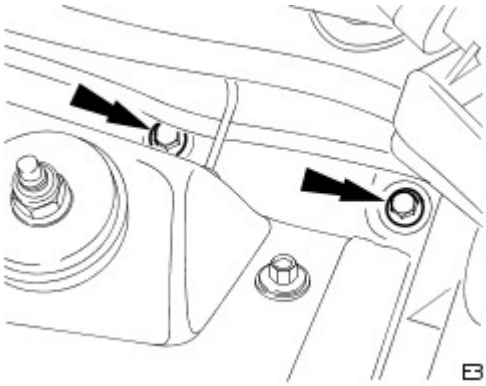
29. Support weight of crossbeam.

- Position a jack under crossbeam.



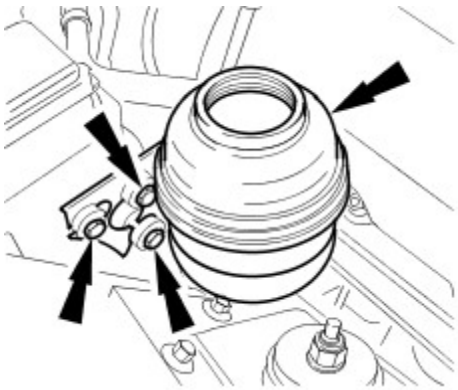
E35093

- Place a piece of wood between jack and crossbeam.
- Raise jack to just support crossbeam.



E35094

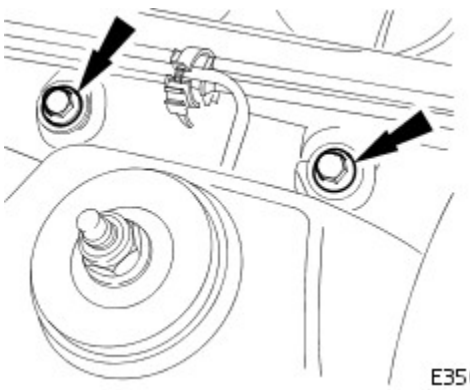
30. From engine compartment, remove crossbeam front RH securing bolts.



E35095

31. Remove power steering fluid reservoir for access.

- Remove reservoir securing nuts and bolts.
- Position reservoir for access.



E35096

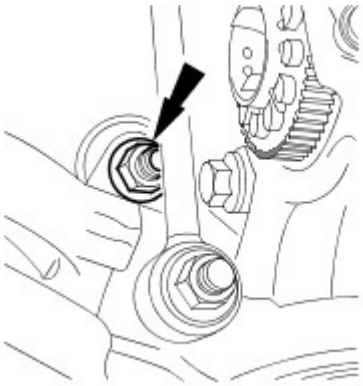
32. From engine compartment, remove crossbeam front LH securing bolts.

33. Remove crossbeam to engine Hydramount securing bolts.

- Remove bolt securing crossmember to Hydramount.
- Fully withdraw bolt into crossmember insert.
- Repeat procedure to remove and withdraw bolt on

opposite side

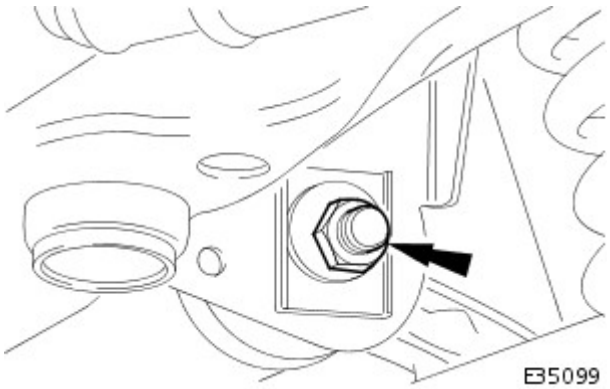

E35097


E35098

34. CAUTION: To prevent damage to ball joints, secure each hub assembly to suspension turret using strong wire.

Remove lower securing nut and bolt from front shock absorber.

- Repeat procedure to remove securing bolt from opposite side shock absorber.


E35099

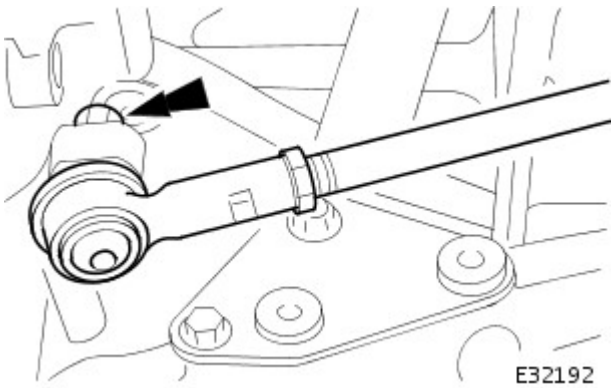
35. Remove crossbeam rear securing bolts.

- Remove securing bolt from crossbeam LH rear mounting.
- Repeat procedure to remove securing bolt from crossbeam RH rear mounting.

36. Ensure that steering transducer harness is clear of return pipe and LH side body.

37. Lower and traverse front suspension assembly clear of vehicle.

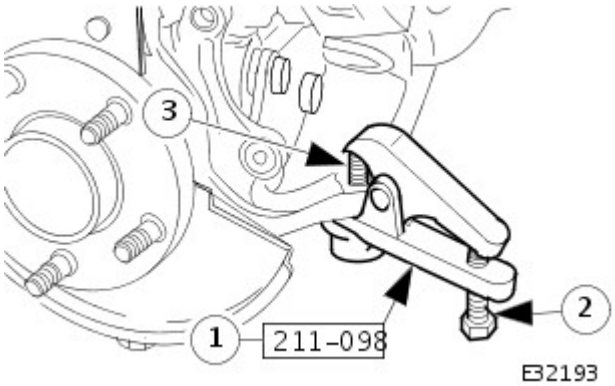
38. With assistance, lift front suspension assembly onto bench.


E32192

39. Remove nut securing tie rod outer ball joint to steering arm.

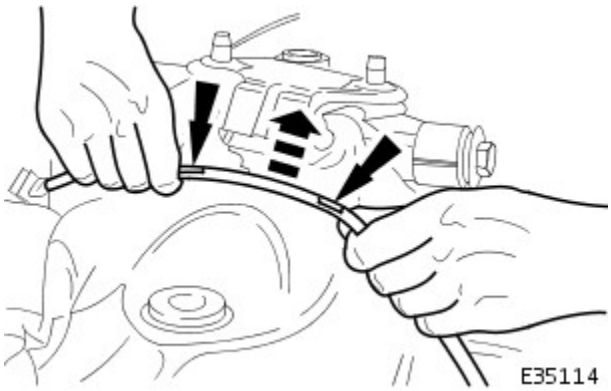
- Repeat procedure to opposite side tie rod ball joint.

40. Release tie rod ball joint from steering arm.



1. Fit special tool 211-098 to tie rod ball joint.
2. Tighten tool bolt to release ball joint taper pin.
3. Remove tool and release tie rod from steering arm.

- Repeat procedure to release opposite side tie rod ball joint.



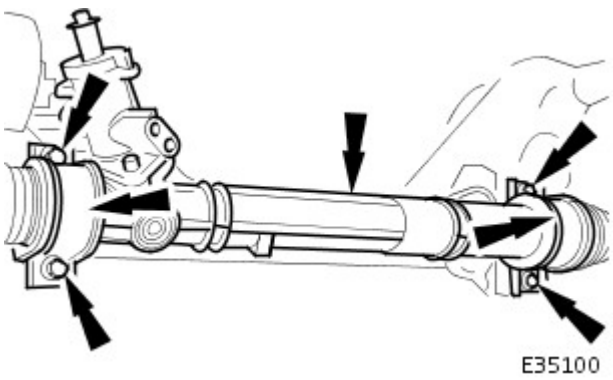
41. Remove steering harness from LH suspension turret.

- Release harness securing clips from suspension turret.
- Mark position of clips on harness.
- Remove tape securing clips to harness and discard clips.



42. Disconnect and remove steering harness.

- Disconnect harness connector from transducer.
- Remove harness from suspension assembly.



43. Remove steering rack from crossbeam.

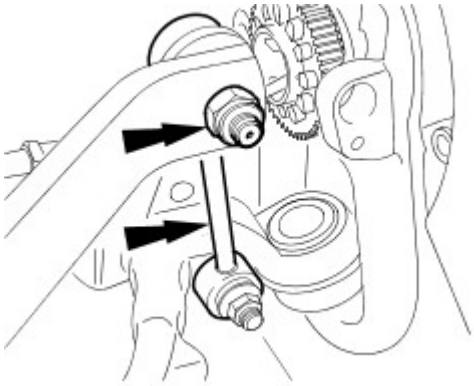
1. Remove steering rack securing bolts.
2. Remove steering rack and mounting brackets.

44. Release stabilizer bar from link arms.

1. Remove link arm to stabilizer bar securing nut.
2. Release stabilizer bar from link arm.

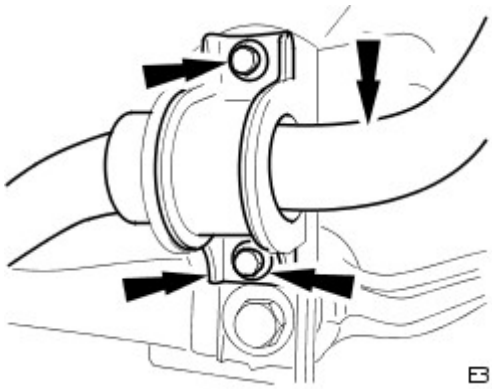
- Repeat procedure to release opposite end of stabilizer bar

from link arm.



45. Remove stabilizer bar from crossbeam.

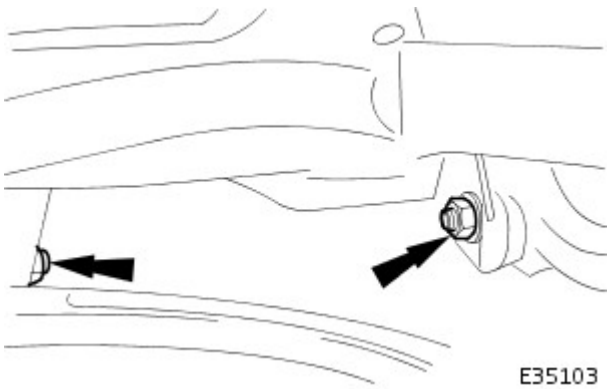
- Remove stabilizer bar securing bolts.
- Remove stabilizer bar mounting brackets and remove bar from crossbeam.



46. Remove wishbone securing nuts.

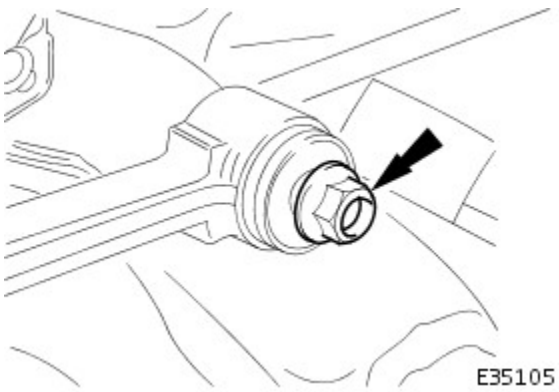
1. Remove lower wishbone front arm eccentric bolt securing nut.
2. Remove lower wishbone rear arm eccentric bolt securing nut.

- Repeat procedure to remove wishbone securing nuts from opposite side.



47. Remove upper wishbone fulcrum shaft securing nut.

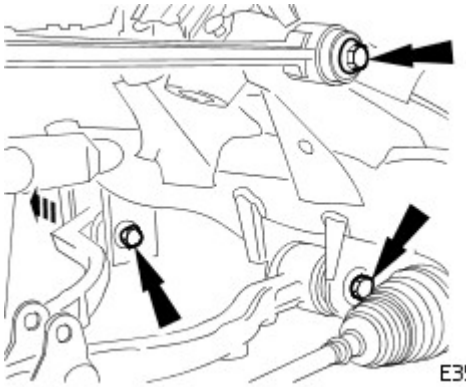
- Repeat procedure to remove securing nut from opposite side fulcrum shaft .



48. Remove wire temporarily supporting hub assembly.

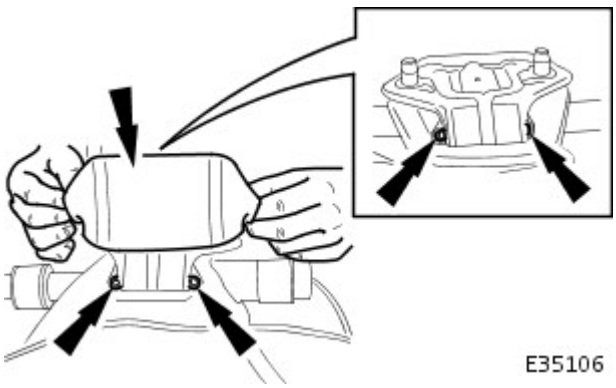
49. Remove wishbone/hub assembly from crossbeam.

- Supporting hub assembly, withdraw lower wishbone eccentric bolts.
- Supporting hub assembly, withdraw fulcrum shaft from



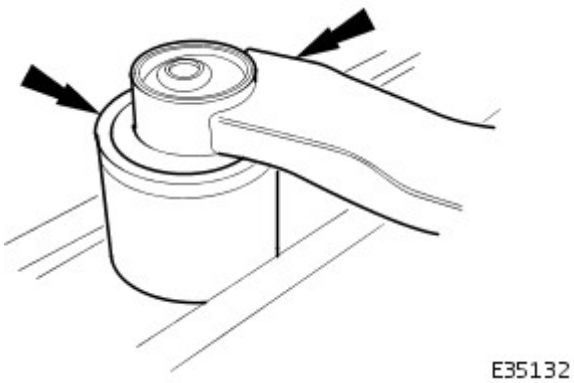
upper wishbone.

- Remove wishbone/hub assembly from crossbeam.
- Repeat procedure to remove wishbone/hub assembly on opposite side.



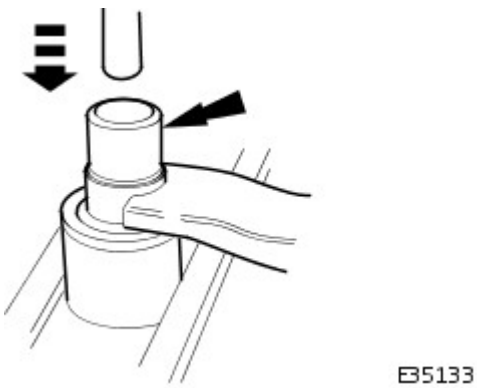
50. Remove crossbeam front mountings.

- Remove front mounting heatshield.
- Remove four bolts securing mounting to crossbeam.
- Repeat procedure to remove mounting on opposite side.



51. With assistance position crossbeam on hydraulic press.

- Place a suitable support on press bed.
- Position and align crossbeam/bush on support.

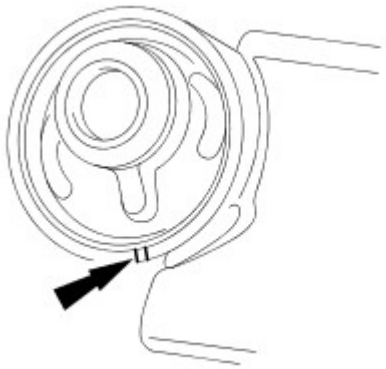


52. Position a suitable mandrel on top of bush and operate press to remove bush from crossbeam.

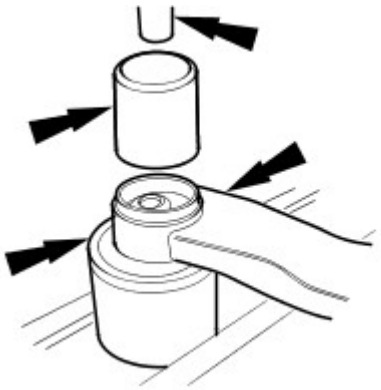
Installation

1. Place crossbeam on press bed.

2. Position bush on crossbeam, aligning moulded pointer with small recess.

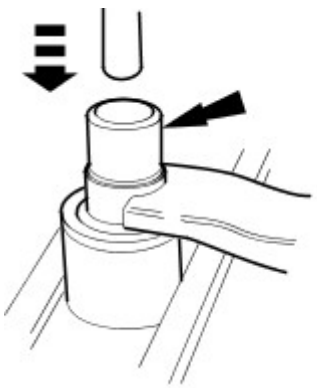


E35141



E35134

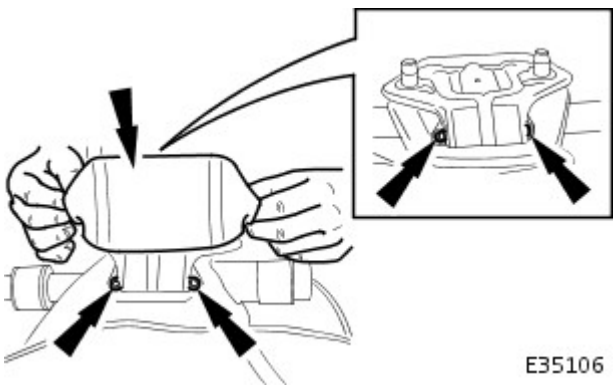
3. Using a suitable mandrel, press and partly seat bush in crossbeam.



E35133

4. Fully seat bush in crossbeam.

- Position a suitable support on press bed.
- Place crossbeam/bush on support.
- Position a suitable mandrel on bush.
- Ensuring bush remains aligned with crossbeam, operate press to fully seat bush.



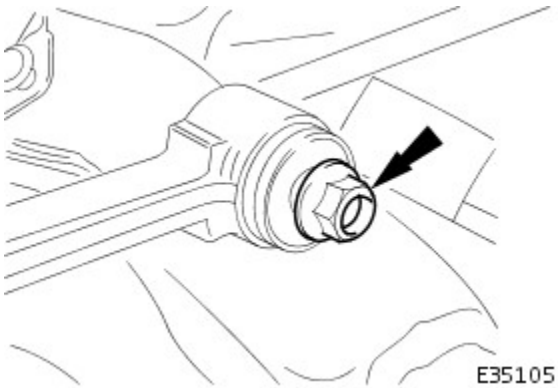
E35106

5. Install front mounting brackets.

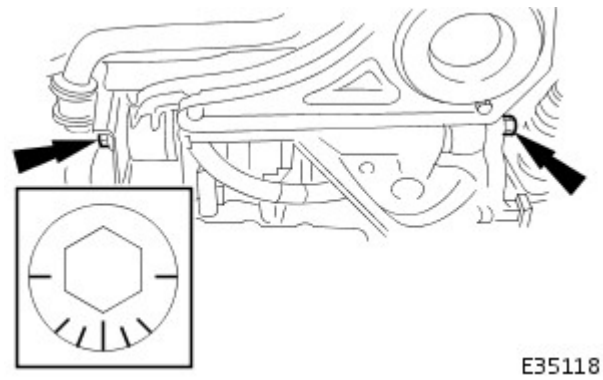
- Position and fully seat mounting bracket on crossbeam.
- Install the four bolts and tighten to 22-28Nm.
- .Install heatshield .
- Repeat procedure to install mounting bracket on opposite side of crossbeam.

6. Install upper wishbone/hub assemblies on crossbeam.

- Position upper wishbone on crossbeam.
- Install fulcrum shaft threaded end facing rearward.
- Install fulcrum shaft securing nut and tighten to 60-80Nm.

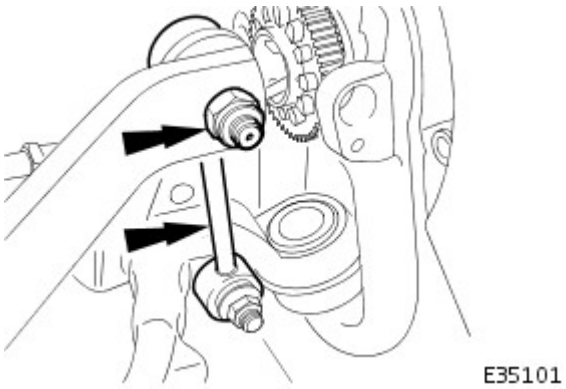


- Repeat procedure to install opposite side upper wishbone/hub assembly.



7. Install lower wishbone assemblies.

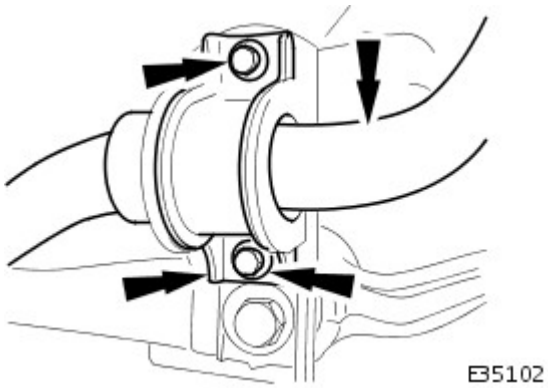
- Position lower wishbone on crossbeam.
- Install but do not tighten wishbone front and rear arm eccentric bolts and nuts.
- Rotate each eccentric bolt to position largest graduation mark vertically.
- Ensuring that eccentric bolts do not rotate out of position, partially tighten nuts.
- Repeat procedure to install opposite side upper wishbone/hub assembly.



8. Install stabilizer bar to link arms.

1. Position stabilizer bar and install link arm ball joint stud in bar.
2. Install but do not tighten link arm stud to stabilizer bar securing nut.

- Repeat procedure to install link arm at opposite end of stabilizer bar.

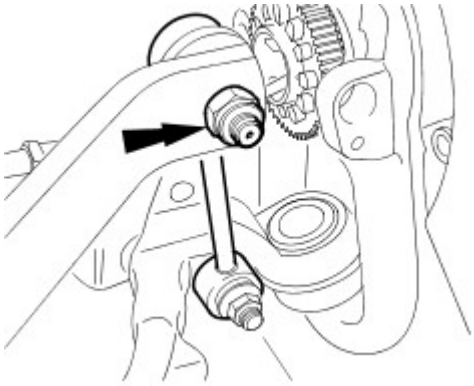


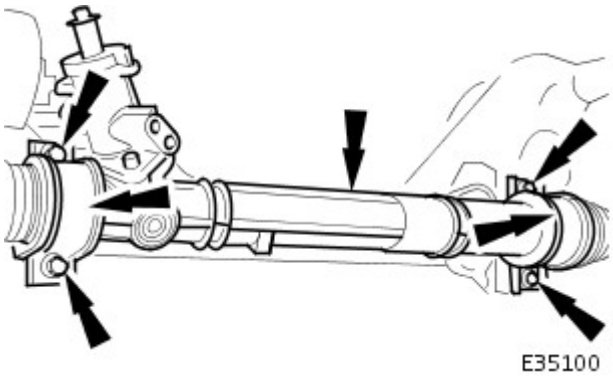
9. Install stabilizer bar to crossbeam.

- Ensure bushes are correctly positioned on stabilizer bar.
- Install support brackets over bushes.
- Position stabilizer bar on crossbeam.
- Install and tighten bolts to 30-40Nm.
- Repeat procedure at opposite end of stabilizer bar.

10. Tighten link to stabilizer bar securing nut to 60-80Nm.

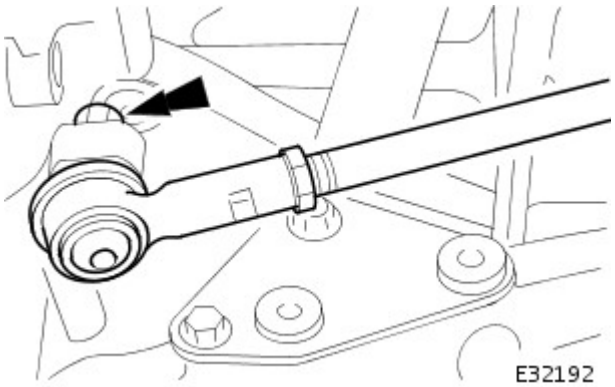
- Repeat procedure at opposite end of stabilizer bar.





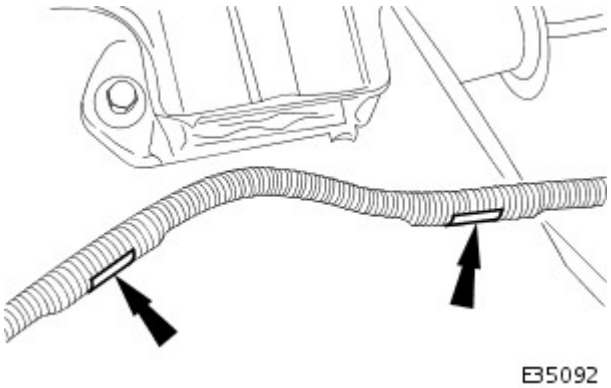
11. Install steering rack on crossbeam.

- Ensure that bushes are correctly positioned on steering rack.
- Position steering rack on crossbeam.
- Position support brackets over bushes.
- Install mounting bracket bolts and tighten to 41-54Nm.



12. Install tie rods on steering arms.

- Position and fully seat tie rod ball joint taper pin on steering arm.
- Install tie rod ball joint nut and tighten to 71-85Nm.
- Repeat procedure to install opposite side tie rod ball joint.



13. Install steering harness on suspension turret.

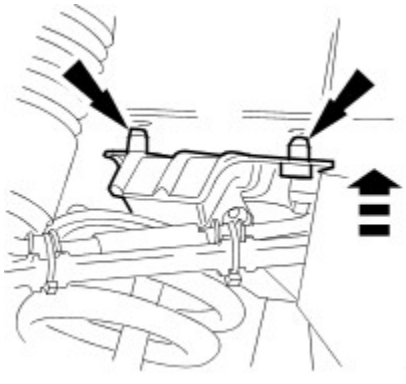
- Noting positions marked during removal, tape new securing clips to steering harness.
- Install securing clips/harness on LH turret.

14. With assistance position crossbeam/suspension assembly on jack with protective wood under.

15. Traverse assembly into position below vehicle.

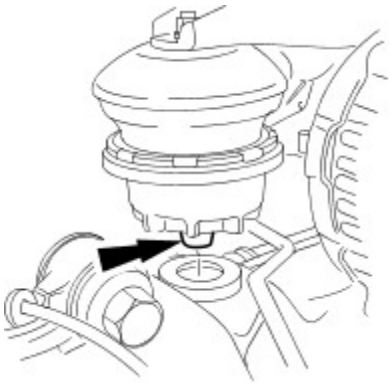
16. Ensure steering harness connector is positioned to avoid damage during crossbeam lift .

17. NOTE: It may be necessary to use a hammer and drift to finally align new mounting with body location.

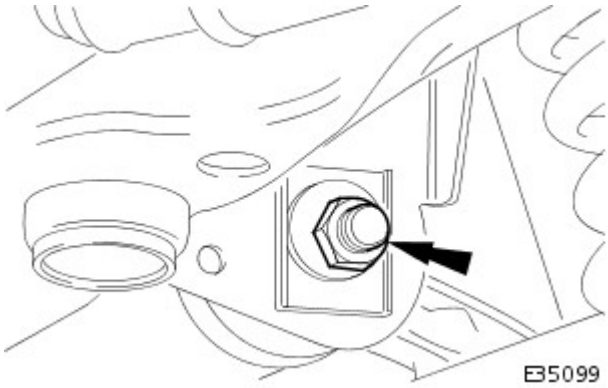


Carefully raise crossbeam assembly into position.

- Ensure that dowels of both crossbeam mountings seat correctly in body locations.

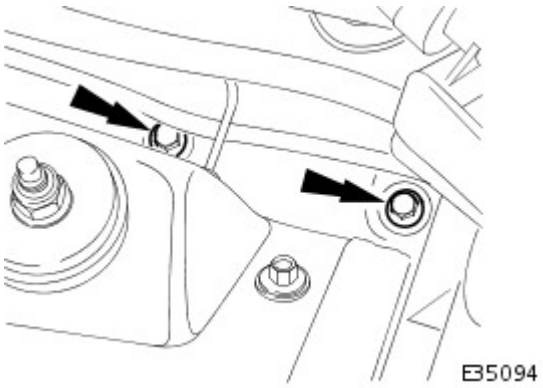


18. Ensure that both engine hydramounts seat correctly in crossbeam locations.



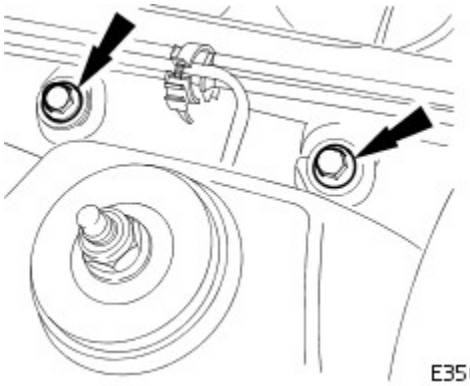
19. Install crossbeam rear mountings.

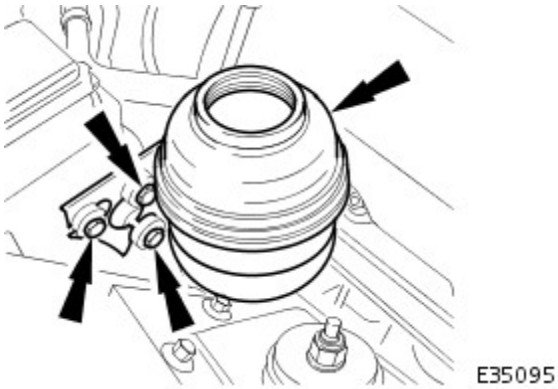
- Align rear mounting rubber with body location.
- Install rear mounting securing bolt and nut and tighten nut to 131-185 Nm.
- Repeat procedure to install opposite side rear mounting securing bolt and nut.



20. From engine compartment, install but do not tighten crossbeam front RH bolts.

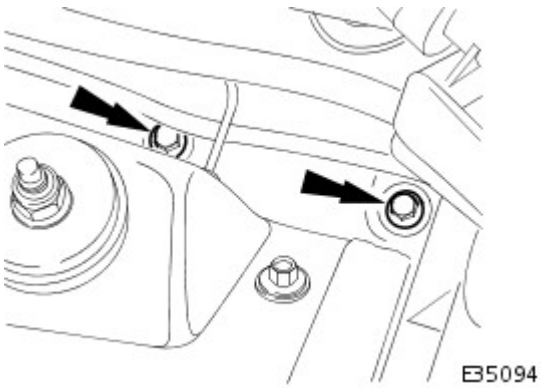
21. From engine compartment, install crossbeam front LH bolts and tighten to 22-28Nm.



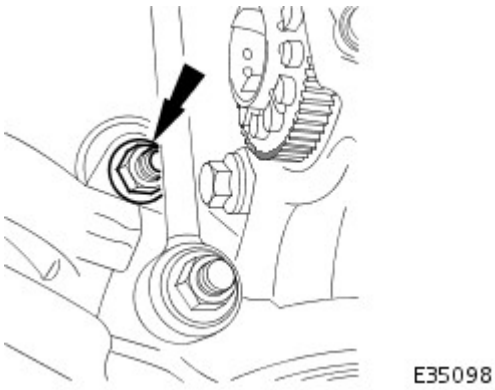


22. Install power steering fluid reservoir.

- Position reservoir on mounting bracket.
- Install reservoir securing nuts and bolts.



23. From engine compartment, tighten crossbeam front RH bolts to 22-28Nm.



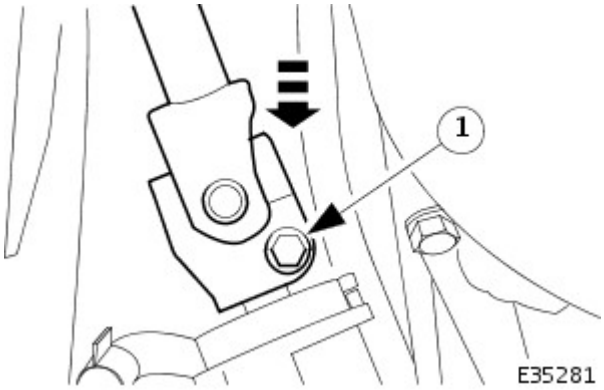
24. Install shock absorber on lower wishbone.

- Lift lower wishbone to align shock absorber lower mounting.
- Install bolt and nut and tighten nut to 43-57Nm.
- Repeat procedure to install opposite side shock absorber.

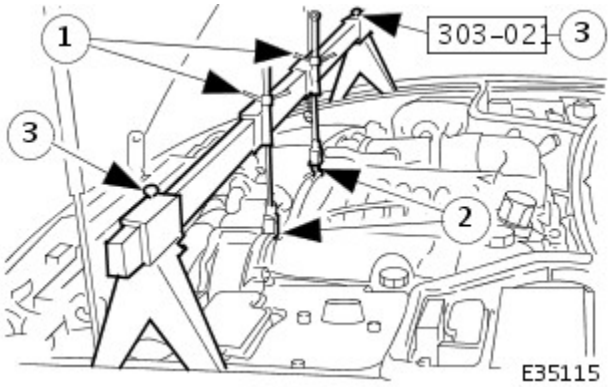
25. Install lower steering column on pinion shaft.

- Move column downwards to engage coupling splines on pinion shaft.

1. Install nut and bolt and tighten to 22-28Nm.

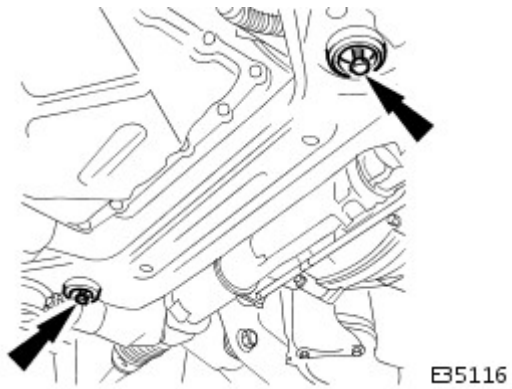


26. Lower and withdraw jack from crossbeam.



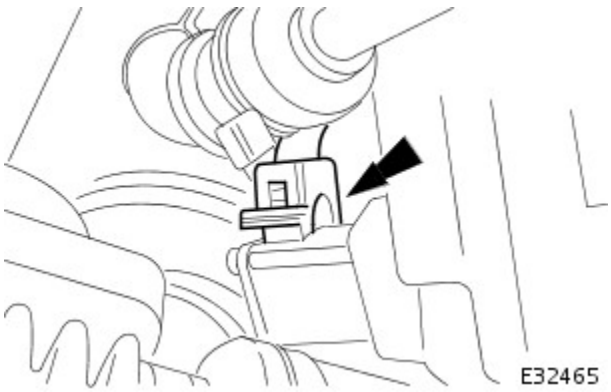
27. Release engine from support tool.

1. Slacken hook adjustment nuts until weight of engine is released.
2. Remove hooks from engine front lifting eyes.
3. Remove special tool 303-021 from fender channel.



28. Install crossbeam to engine Hydramount bolts.

- Install bolt securing Hydramount to crossmember and tighten to 22-28Nm.
- Repeat procedure to install crossmember opposite side securing bolt.

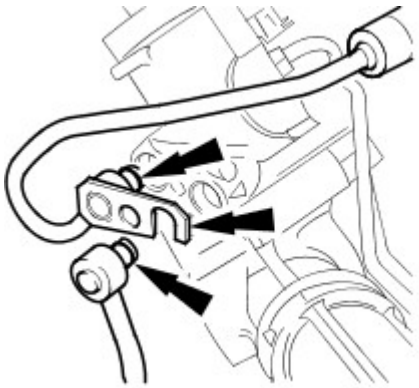


29. Position and connect harness to steering transducer.

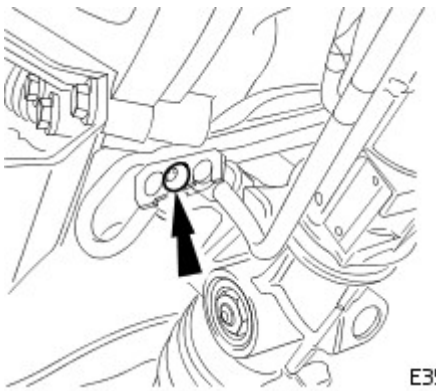
- RHD vehicles. Position steering harness behind return pipe.
- Connect harness to transducer.

30. Install power steering pipes on pinion housing.

- Remove blanks and install new 'O'-ring seals in pipe connectors.
- Apply power steering fluid to 'O' ring seals.

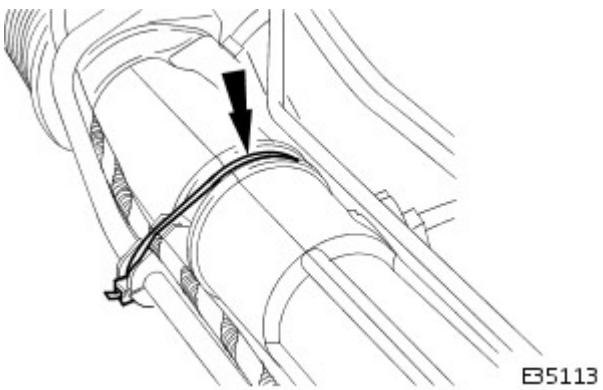

E35111

- Remove blanking plugs from pinion housing ports.
- Position pipes on pinion ports and seat 'O' rings.


E35110

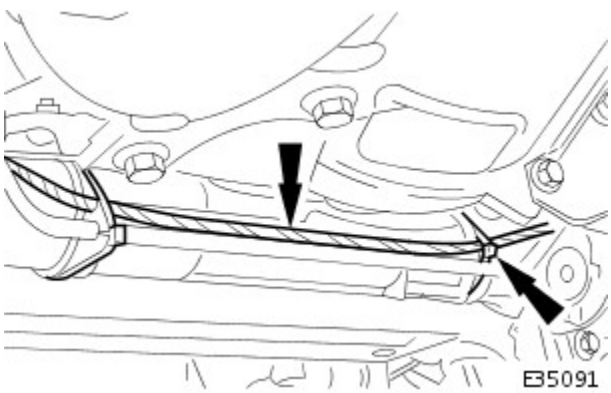
31. Secure pipes to pinion housing.

- Ensure pipes and retaining plate are correctly seated.
- Install bolt and tighten to 9-12Nm.


E35113

32. Secure return pipe on steering rack.

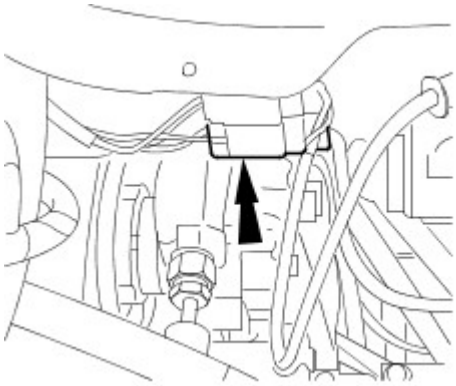
1. Position pipe rubber support on steering rack.
2. Position pipe on support .
3. RHD vehicles. Position harness on pipe support rubber.
4. Secure pipe and harness to support with new tiestrap.

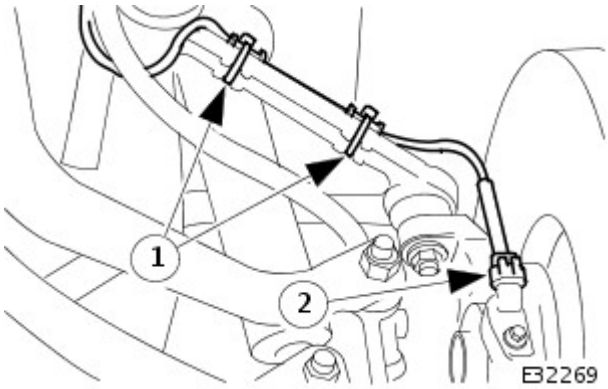

E35091

33. RHD vehicles. Using new tiestrap, secure harness to steering rack.

34. Connect steering harness.

- Route harness connector to body front location.
- Connect steering harness connector.
- Install connector in body retaining clip.

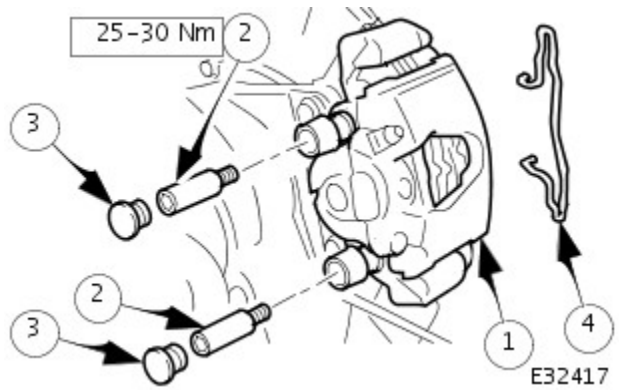




35. Connect wheel speed sensor harness.

1. Connect wheel speed sensor harness to sensor.
2. Using new tiestraps secure wheel speed sensor harness to upper wishbone.

- Repeat procedure to connect opposite side wheel speed sensor.



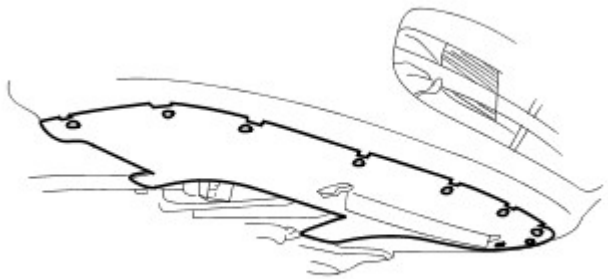
36. Install brake calipers.

1. Install caliper on carrier.
2. Install guide pins and tighten to 25-30Nm.
3. Install guide pin dust caps.
4. Install caliper spring clip.

- Repeat procedure to install opposite side front brake caliper.

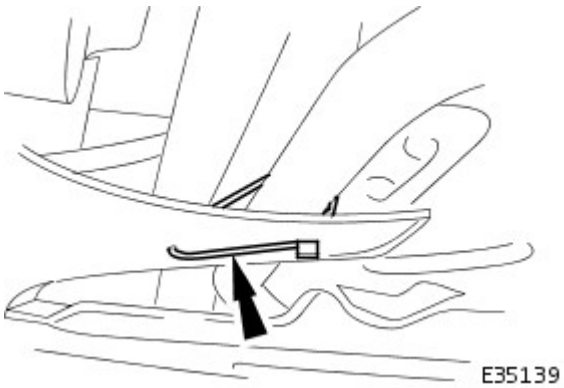
37. Install both front road springs. Refer to 60. 20.02.

38. Using screws or new scrivets, secure undertray to front bumper cover.

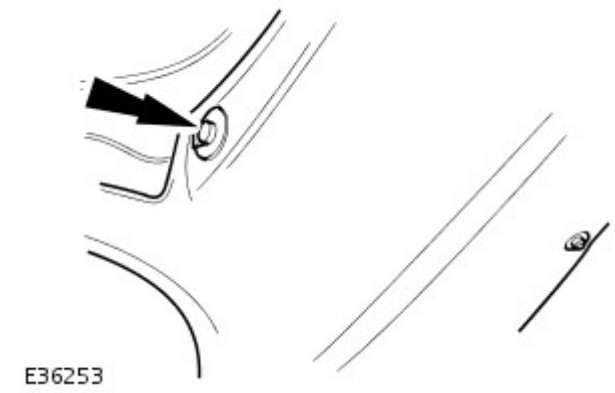


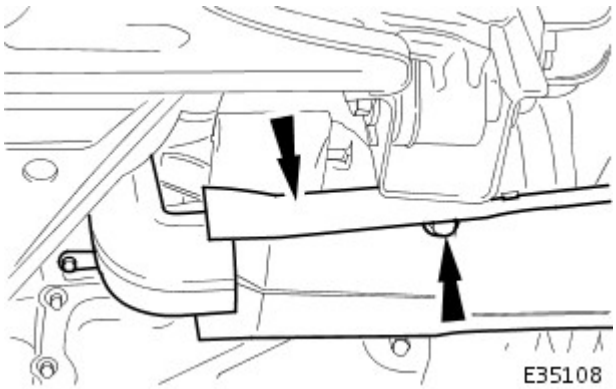
E36252

39. Using a new tiestrap, secure undertray to crossbeam front brace.



40. Using new scrivets, secure undertray to each wheelarch liner.





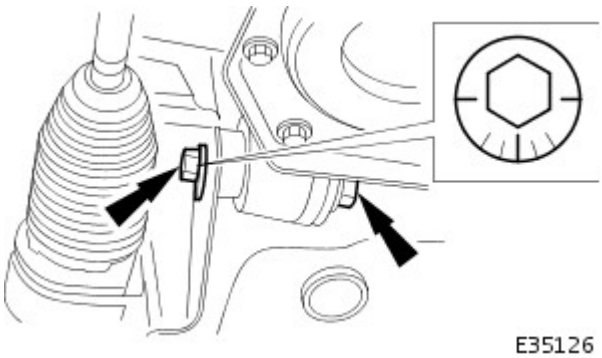
41. Install generator cooling duct deflector.

- Position deflector over rear vertical duct.
- Slide deflector forward to engage center tang over undertray.
- Install bolt and tighten to 17-23Nm.

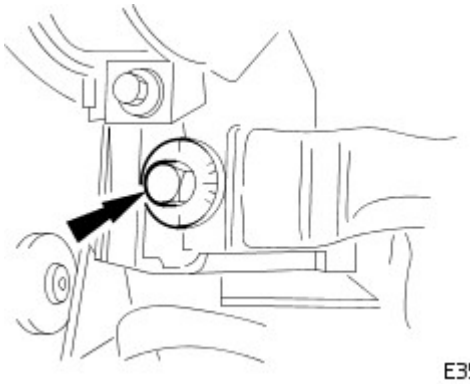
42. Install both front road wheels. Refer to Section 204-04.

43. Raise vehicle, remove stands and lower vehicle.

44. Ensuring graduation mark remains aligned, finally tighten wishbone rear eccentric bolt to 113-153Nm.



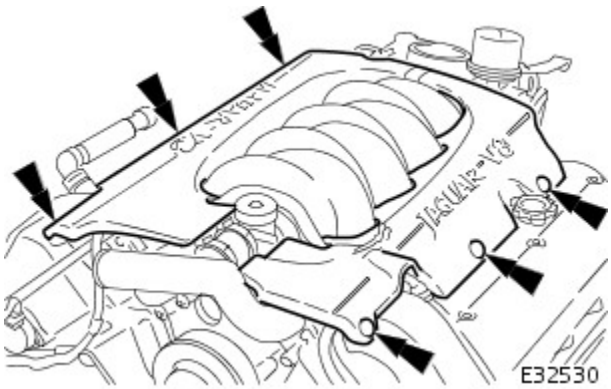
45. Ensuring graduation mark remains aligned, finally tighten wishbone front eccentric bolt to 113-153Nm.



46. Install air intake tube/meter/ cleaner cover assembly. Refer to 19.10.30

47. Install both engine covers (normally aspirated vehicles only).

- Position covers over engine.
- Install securing pegs.



48. Fill power steering system. Refer to Section 211-02.

49. Remove fender covers and close hood.

50. Connect ground cable to battery terminal and fit battery cover. Refer 86.15.19.

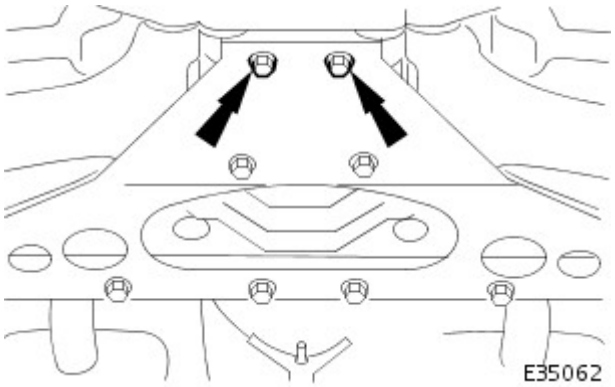
51. Carry out steering geometry and wheel alignment checks and adjust as necessary. Refer to 57.65.03

Uni-Body, Subframe and Mounting System - Rear Axle Crossmember

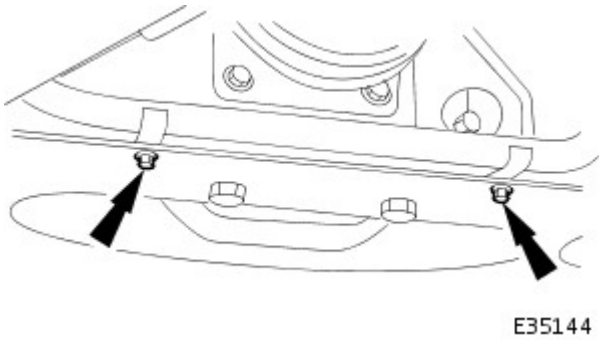
Removal and Installation

Removal

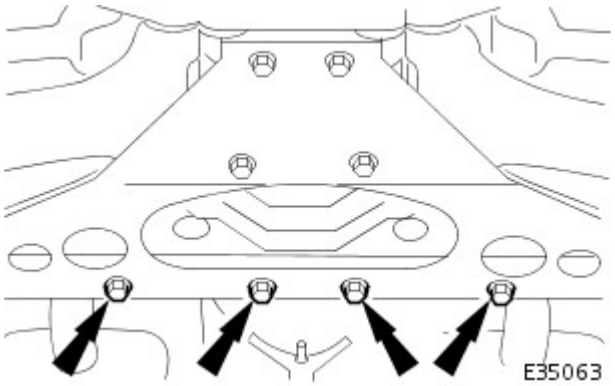
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



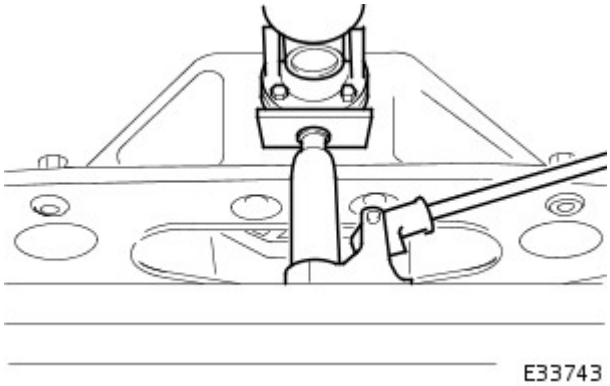
1. Raise vehicle on a four-post lift. Refer to section 100-02.
2. Remove subframe to differential-casing rear bracket bolts.

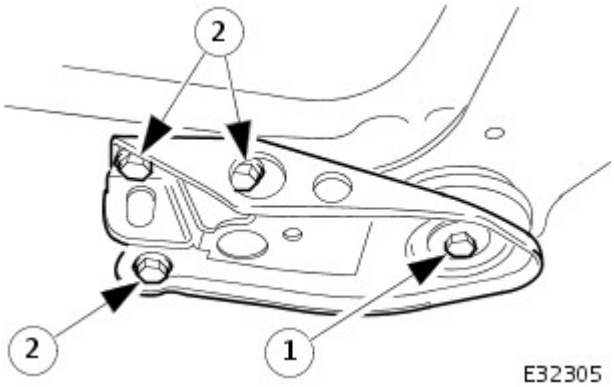


3. Where fitted, remove bolts securing fuel vapor pipe to subframe.



4. Remove subframe to differential bracket front nuts and bolts.
5. Support the differential assembly.
   - Position a jack under the differential drive coupling.
   - Position a piece of wood between the jack and the differential drive coupling.
   - Raise the jack until the differential is just supported.





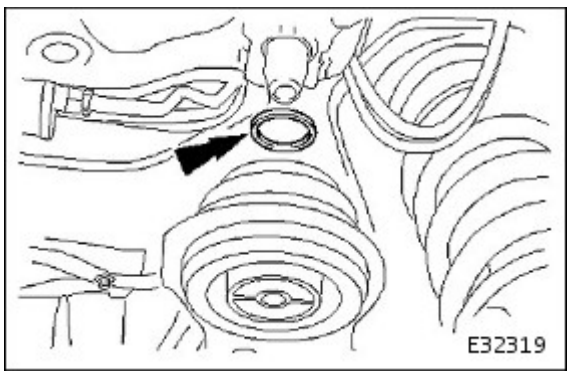
6. Remove both mounting brackets from the suspension subframe.

1. Remove bush center bolt from bracket.
2. Remove bolts securing bracket to body.

- Remove bracket.
- Following the same procedure, remove bracket on opposite side.

7. To permit access, lower jack approximately 25 mm.

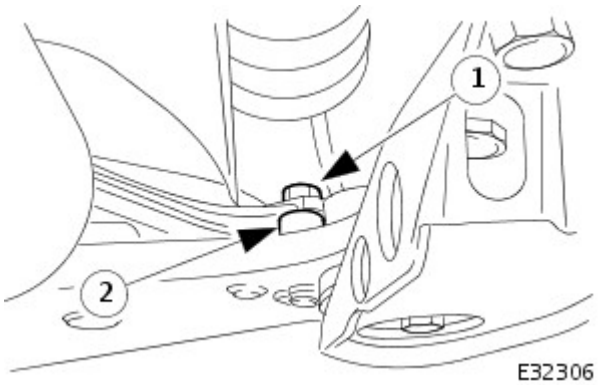
8. Remove and retain spacer from top of each bush.



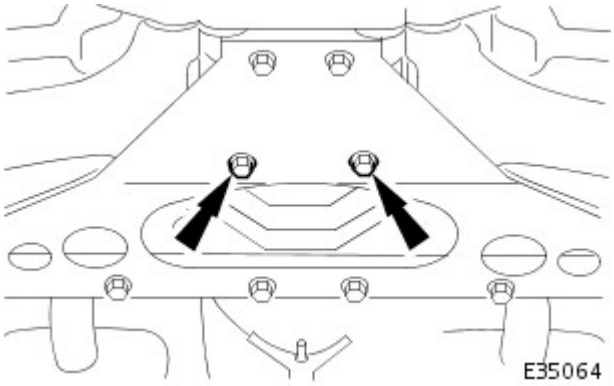
9. Remove bolts securing link assemblies to suspension subframe.

1. Remove bolt.
2. Ensure spacer remains captive in bracket.

- Following the same procedure, remove bolt from opposite side of subframe.



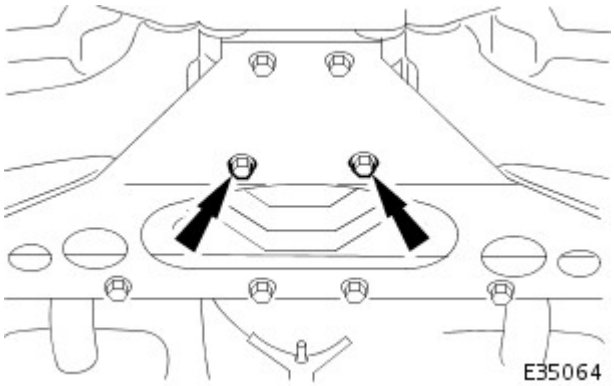
10. With assistance to support subframe, remove the subframe center to differential casing bolts.



11. Remove subframe from vehicle.

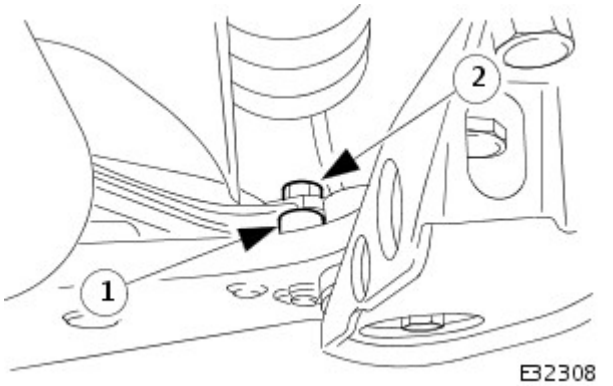
12. Clean relevant components and mating faces.

Installation



1. With assistance fit suspension subframe to vehicle.

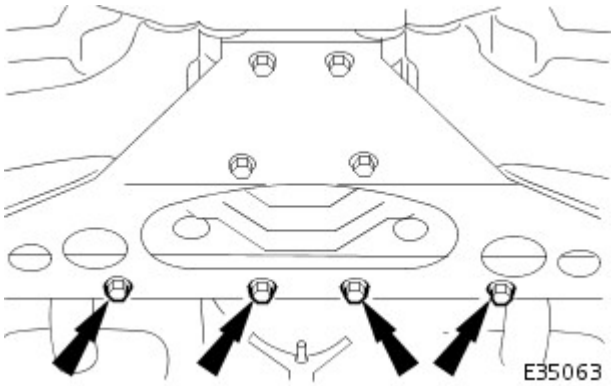
- Position subframe on vehicle, ensuring that fuel evaporation pipe is not trapped.
- Install but do not tighten subframe center to differential casing bolts.



2. Install link assemblies to suspension subframe bolts

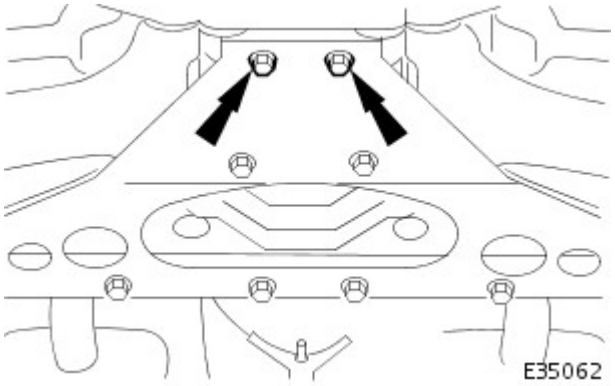
1. Ensure spacer is in position.
2. Install but do not tighten bolt.

- Following the same procedure, install bolt on opposite side of subframe.

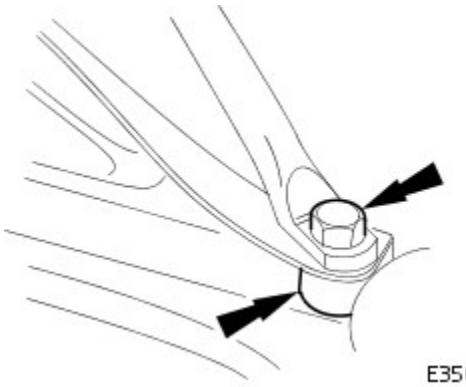


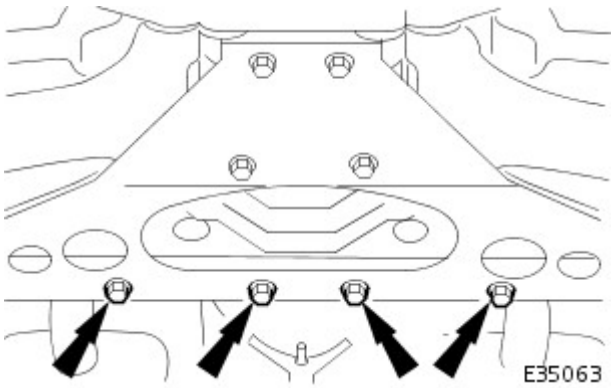
3. Install but do not tighten subframe front to differential bracket nuts and bolts

4. Install and tighten subframe to differential rear bracket bolts to 88-118Nm.

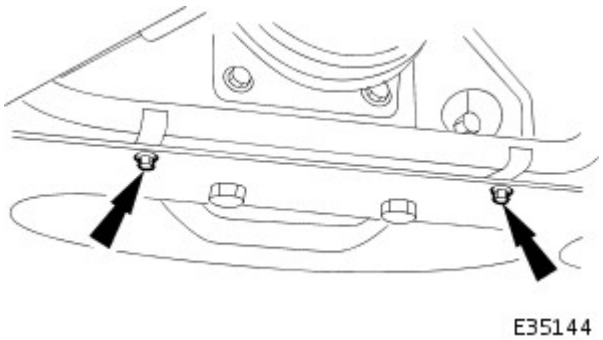


5. Tighten link assembly bolts to 88-118Nm.



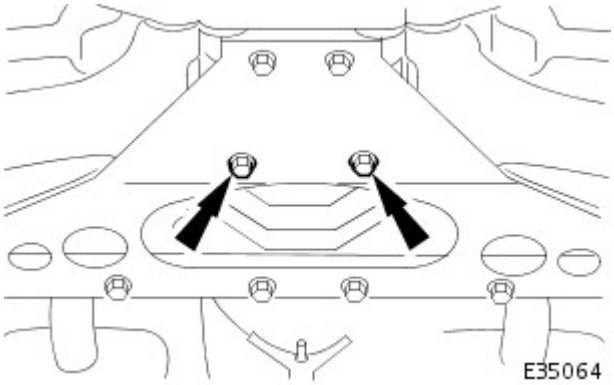


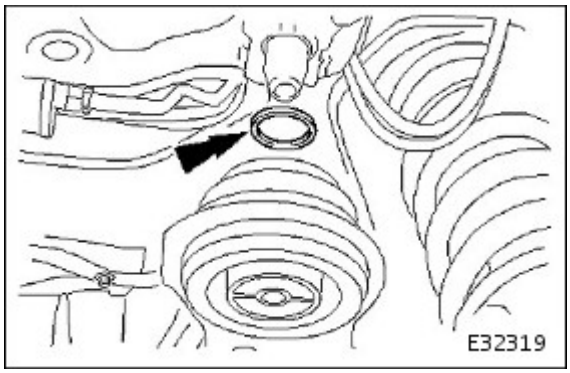
6. Tighten subframe front to differential bracket nuts and bolts to 69-92Nm.



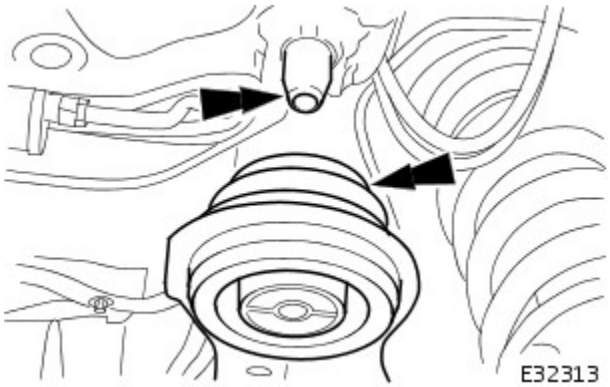
7. Where fitted, install fuel vapor pipe to subframe bolts.

8. Tighten subframe center to differential casing bolts to 88-118Nm.

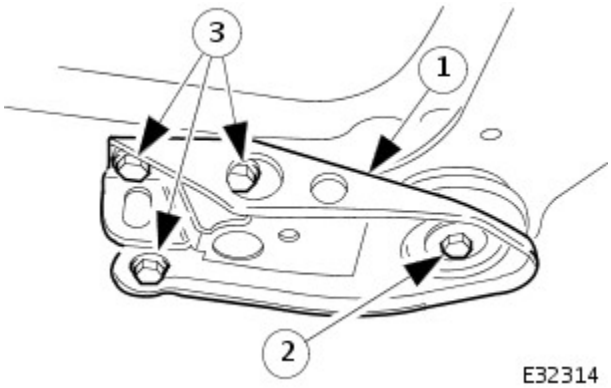




9. Position spacer in the recess of each subframe bush.



10. Raise jack to locate subframe bushes on the body tapered locations.



11. CAUTION: When installing subframe bracket ensure that wheel speed sensor harness is clear.

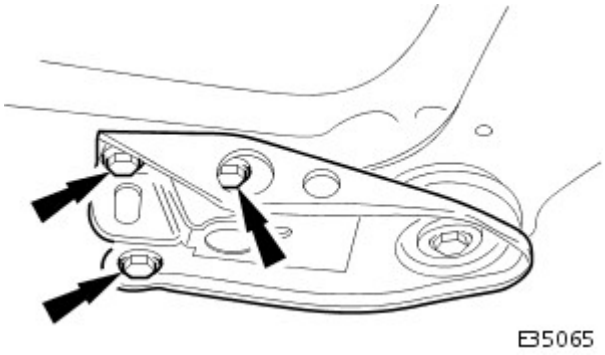
Fit suspension subframe mounting-brackets.

1. Position bracket to subframe.
2. Install but do not tighten bush center bolt.
3. Install but do not tighten bolts securing bracket to body.

- Following same procedure, install mounting bracket on opposite side.

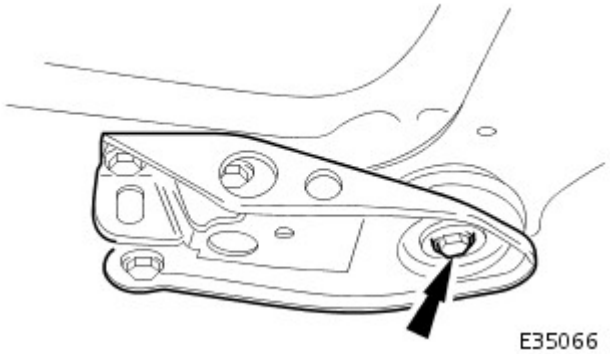
12. Tighten mounting bracket to body bolts to 80-100Nm.

- Following same procedure, tighten mounting bracket bolts on opposite side.



13. Tighten mounting bracket bush center bolt to 80-100Nm.

- Following same procedure, tighten mounting bracket bush center bolt on opposite side.

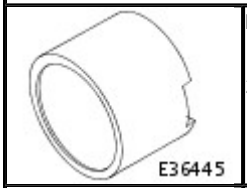
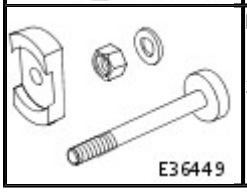


14. Lower and remove jack.

15. Lower four-post lift.

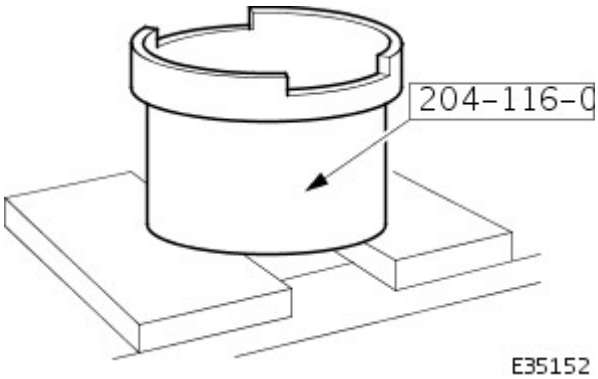
Uni-Body, Subframe and Mounting System - Rear Axle Crossmember Bushing

Removal and Installation

Special Tool(s)	
 E36445	Remover/Replacer Suspension Bushes 204-116 (JD 143A)
 E36449	Remover/Replacer Adaptor 204-116-06 (JD143-6B)

Removal

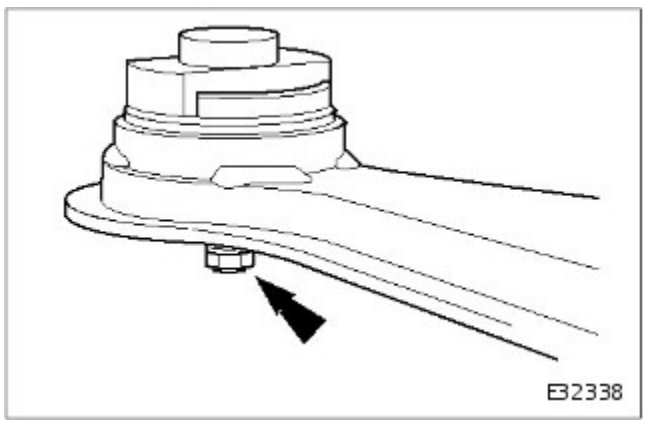
CAUTION: Replacement of nuts and bolts: Various thread-locking devices are used on nuts and bolts throughout the vehicle. These devices restrict the number of times a nut or bolt can be used. See section 100-00 for information.



E35152

1. Remove suspension subframe from vehicle. Refer to 64.25.20.

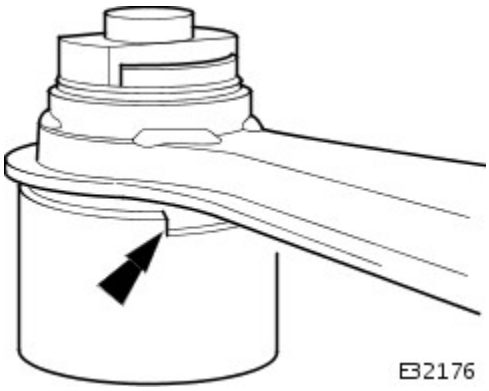
2. Position special tool 204-116 on the press-bed, with recesses uppermost.

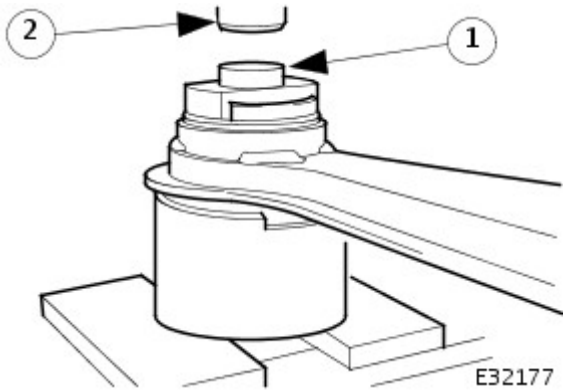

E32338

3. Remove nut and washer from tool.

- Position tool on bush with recesses accommodating the bush rebound stops.
- Fit washer to tool and fit and finger tighten nut.

4. Invert subframe and position assembly on special tool 204-116, with subframe located in the recess.

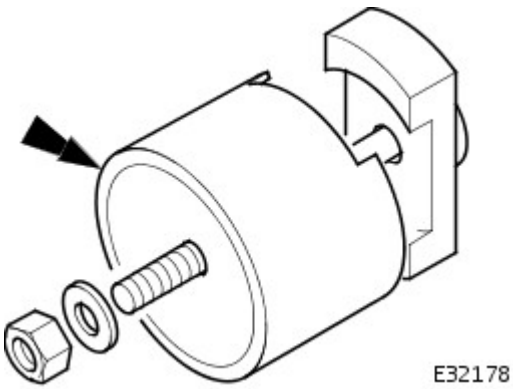




5. CAUTION: Ensure special tool 204-116-06 is correctly aligned and does not contact the bush housing bore.

Remove bush from subframe.

1. Align the top of special tool 204-116-06 with the press-ram.
2. Operate press to remove bush.



6. Remove bush from special tool and discard bush.

7. Thoroughly clean the bush-housing bore.

Installation

1. Use a coarse grade emery cloth to roughen the bush-housing bore, and mating surface of the bush.

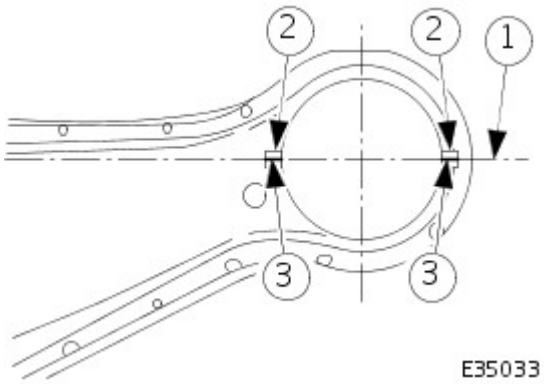
2. Using an air line, remove residual dust from bush and housing mating surfaces.

3. Clean the bush-housing bore and bush with cleaning solvent (SPB3 Solvent 30) or equivalent.

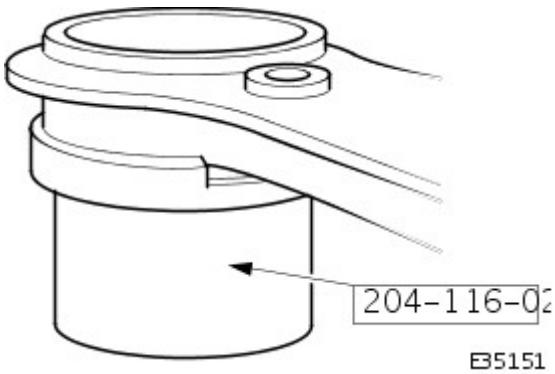
4. Invert suspension subframe.

5. Mark bush position on sub-frame.

1. Stretch a length of thin cord across the center line of each bush location.
2. Below the string, place two pieces of masking tape diametrically opposite on the bore periphery.
3. Mark string position on the masking tape.



E35033



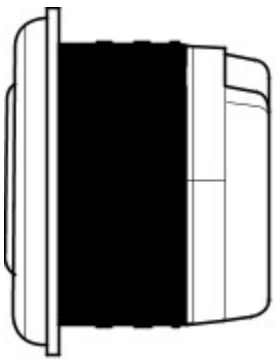
E35151

6. NOTE: New bushes are bonded in position using a rapid drying adhesive Application of this adhesive and fitting of the bush must be completed within 3 minutes. It is therefore strongly recommended that the procedure is rehearsed to ensure it can be completed within that period.

Position subframe on a hydraulic-press.

- Position special tool 204-116-02 on press-bed, with recesses uppermost.
- Position subframe on top of tool.

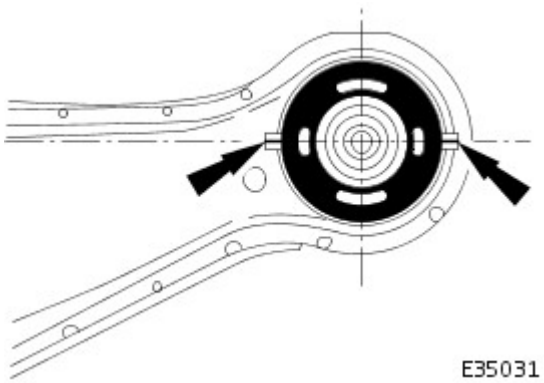
7. Apply 'Alphabond Rapid 101' epoxy adhesive to the shaded area of the bush shown, and the corresponding area of the bush-housing bore.


E35081

8. CAUTION: A four-void type of bush is fitted to all vehicles with Comfort specification suspension. A three-void type of bush is fitted to XJR and vehicles with Sport specification suspension. To ensure satisfactory performance it is essential that the correct type of bush is installed and both types of bush are correctly positioned in the subframe.

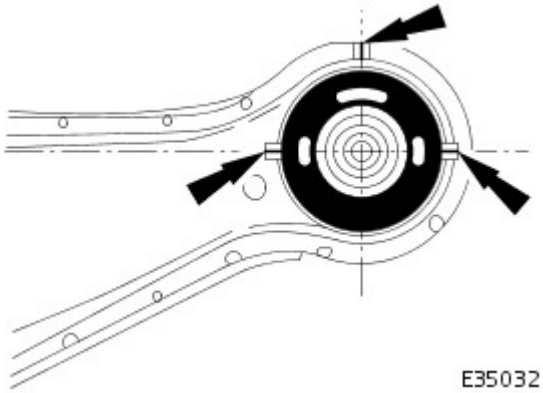
Aligning four-void bush with subframe (Comfort suspension).

- Align centers of small voids with masking tape markers.

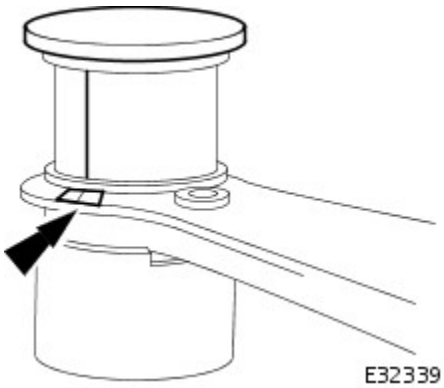

E35031

9. Aligning three-void bush with subframe (XJR and Sport suspension).

- Position bush with large single void facing forward.
- Align small void centers with masking tape markers.



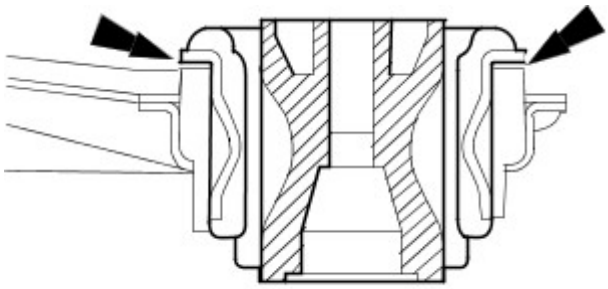
E35032



E32339

10. Install bush in housing.

- Position a steel plate over the bush, ensuring the plate is large enough to cover the rubber flange.
- Operate the press to install the bush.



E32340

11. Ensure bush is fully seated in subframe.

- The clearance between the bush flange and subframe must not exceed 1.5 mm.

12. Ensure bush is aligned correctly in subframe as detailed in Step 8 or 9 as appropriate.

13. Wipe off all excess adhesive from subframe and bush, and remove masking tape.

14. NOTE: Allow adhesive at least 30 minutes to cure, before installing subframe on vehicle.

Install suspension subframe on vehicle. Refer to 64..25.20.