MG TF

WORKSHOP MANUAL

This manual should be used in conjunction with the following overhaul manuals.

RCL 0057 'K' Series Engine
RCL 0124 'PG1' Manual Gearbox

Publication Part No. RCL0493ENG - 1st Edition
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INTRODUCTION

How to use this Manual

To assist in the use of this Manual the section title is given at the top and the relevant sub-section is given at the bottom each page.

Each major section starts with a contents page, listing the information contained in the relevant sub-sections. To assist filing of revised information each sub-section is numbered from page 1.

The individual items comprising repair operations are to be followed in the sequence in which they appear. Item numbers in illustrations are referred to in the text.

Adjustment and repair operations include reference to Service tool numbers and the associated illustration depicts the tool. Where usage is not obvious the tool is shown in use. Adjustment and repair operations also include reference to wear limits, relevant data, torque figures, and specialist information and useful assembly details. Each adjustment or repair operation is given a Repair Operation Time number.

WARNINGS, CAUTIONS and NOTES have the following meanings:

WARNING: Procedures which must be followed precisely to avoid the possibility of injury.

CAUTION: Calls attention to procedures which must be followed to avoid damage to components.

NOTE: Gives helpful information.

References

References to the LH or RH side given in this Manual are made when viewing the vehicle from the rear. With the engine and gearbox assembly removed, the crankshaft pulley end of the engine is referred to as the front.

Operations covered in this Manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out particularly where safety related items are concerned.

Dimensions

The dimensions quoted are to design engineering specification with Service limits where applicable.

REPAIRS AND REPLACEMENTS

When replacement parts are required it is essential that only MG Rover recommended parts are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features and corrosion prevention treatments embodied in the car may be impaired if other than MG Rover recommended parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the manufacturer's specification. Torque wrench setting figures given in this Manual must be used. 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 car conform to legal requirements.

The Terms of the vehicle Warranty may be invalidated by the fitting of other than MG Rover recommended parts.

All MG Rover recommended parts have the full backing of the vehicle Warranty.

MG Rover Dealers are obliged to supply only MG Rover recommended parts.

SPECIFICATION

MG Rover are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

This Manual does not constitute an offer for sale of any particular vehicle. MG Rover Dealers are not agents of MG Rover and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

ABBREVIATIONS AND SYMBOLS

After Bottom Dead Centre	ABDC
After Top Dead Centre	ATDC
Air Conditioning	A/C
Air Fuel Ratio	AFR
Alternating Current	ac
Ambient Air Temperature	AAT
Amperes	A
Anti-Lock Brake System	ABS
Before Bottom Dead Centre	BBDC
Before Top Dead Centre	BTDC
Bottom Dead Centre	BDC
Brake proportioning valve	BPV
British Standards	BS
Camshaft Position	CMP
Carbon Dioxide	CO_2
Carbon Monoxide	CO
Celsius (Centigrade)	C
Centimetre	cm
Chlorofluorocarbons	CFC's
Crankshaft Position	CKP
Cubic Centimetres	cm^3
Degree (angle)	deg. or °
Degree (temperature)	deg. or °
Diagnostic Control Unit	DCU
Dial Test Indicator	DTI
Diameter	dia.
Direct Current	dc
Double Overhead Camshaft	DOHC
Engine Coolant Temperature	ECT
Electric Power Assisted Steering	EPAS
Electrically Eraseable Programmable Read Only Memory	EEPROM
Electronic Control Unit	ECU
Electronic Air Control Valve	EACV
Electro Mechanical - Continuously Variable Transmission	Em-CVT
Electromotive force	e.m.f.
Engine Control Module	ECM
Exhaust Gas Recirculation	EGR
Evaporative Emission	EVAP
Field Effect Transistor	FET
Gramme (mass)	g
Gearbox Interface Unit	GIU
Heated Oxygen Sensor	HO_2S
Hertz	Hz
High Compression	hc
High Tension (electrical)	h.t.
Hour	h
Hydraulic Control Unit	HCU
Hydrocarbons	HC
Hydrofluorocarbon	HFC
Inches	in
Idle Air Control	IAC
Instant Mobility System	IMS
Inertia Fuel Shutoff	IFS
Intake Air Temperature	IAT
Internal Diameter	i.dia.
International Organisation for Standardization	ISO
Kilogramme	kg
Kilometre	km
Kilometres per hour	km/h
KiloOhms	kΩ
KiloWatts	kW
Left-Hand	LH
Left-Hand Drive	LHD
Light Emitting Diode	LED
Liquid Crystal Display	LCD
Litre	l
Low Compression	lc
Low tension	lt
Malfunction Indicator Lamp	MIL
Manifold Absolute Pressure	MAP
Maximum	max
MegaWatts	MW
Mercury	Hg
Metre	m
Miles Per Hour	mph
Milliamp	mA
Millimetre	mm
Minimum	min
Minus (of tolerance)	-
Minute (angle)	'
Modular Engine Management System	MEMS
Model Year	MY
Multi-Function Unit	MFU
Multi-Point Injection	MPi

Negative (electrical)	-
Negative Temperature Coefficient	NTC
Newton Metre	Nm
Nitrous Oxide	NO_x
Number	No.
On Board Diagnostics	OBD
Ohms	Ω
Organic Acid Technology	OAT
Outside Diameter	o.dia.
Percentage	%
Plus or Minus	±
Plus (tolerance)	+
Positive (electrical)	+
Positive Crankcase Ventilation	PCV
Positive Temperature Coefficient	PTC
Pounds Per Square Inch	lbf/in^2
Pounds Per Square Inch	psi
Pounds (mass)	lb
Pulse Width Modulation	PWM
Radius	r
Ratio	:
Reference	ref
Revolutions Per Minute	rev/min or rpm
Right-Hand	RH
Right-Hand Drive	RHD
Rover Engineering Standards	RES
Second (angle)	"
Single Overhead Camshaft	SOHC
Specific Gravity	sp.gr
Square Centimetres	cm^2
Square inches	in^2
Standard	std.
Supplementary Restraint System	SRS
Synchronizer/Synchromesh	synchro
Thousand	k
Throttle Position	TP
Top Dead Centre	TDC
United Kingdom	UK
United States	US
Variable Valve Control	VVC
Vehicle Identification Number	VIN
Volt	V
Water	H_2O
Watt	W

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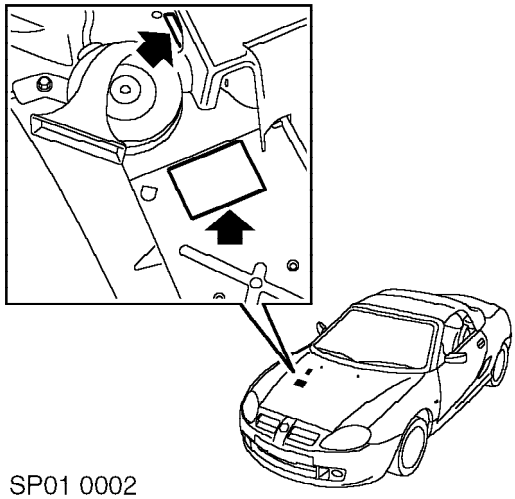
VEHICLE IDENTIFICATION NUMBER

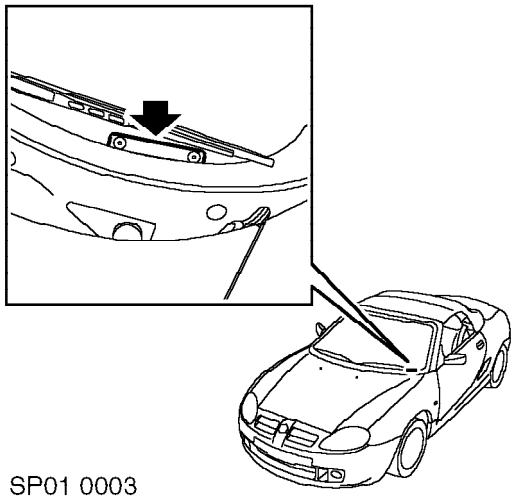
Location

The Vehicle Identification Number (VIN) is provided at the following locations:



SP01 0002

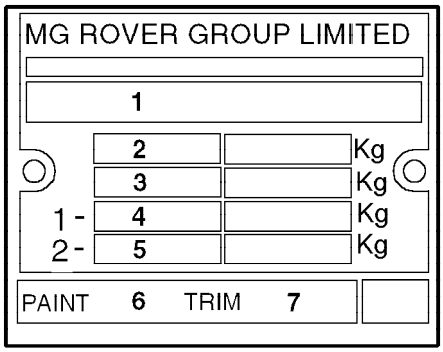
Stamped on a plate attached to the RH side of the under bonnet compartment and stamped into the body above the RH front suspension strut.



SP01 0003

Behind the LH lower corner of the windscreen.

VIN plate details



SP01 0001

The VIN plate contains the following information:

1. Vehicle Identification Number (VIN)
2. Gross Vehicle Weight (GVW)
3. Gross train weight (GTW)
4. Maximum front axle load
5. Maximum rear axle load
6. Paint code
7. Trim code

VIN code key

Example: **S A R R D L B K J 2 D 000001**

SAR = World Identifier : MG Rover Group (UK)

RD = Model: MG TF

L = Trim Level: 7.1

B = Body Style (2 door convertible)

K = Engine: K1.8 MPi, 100 kW

J = Steering and transmission: RHD CVT

2 = Model Year: 2002

D = Assembly Plant: Longbridge

6 figures = Serial number: 000001

Paint and Trim colour codes

3-letter codes identifying the original Paint and Trim colours are stamped on the VIN plate

Paint

K M N

K = Basic colour

M = Mark identifier

N = Colour/Shade name

Trim

L Q P

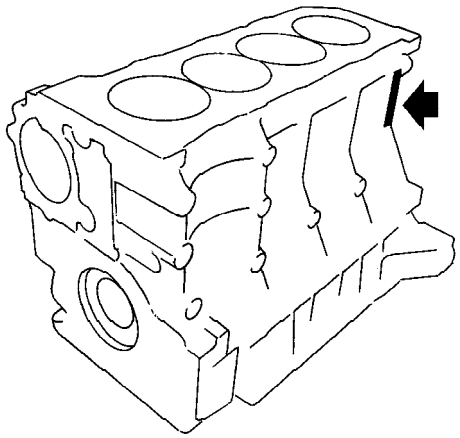
L = Basic colour

Q = Mark identifier

P = Colour/Shade name

IDENTIFICATION NUMBER LOCATIONS

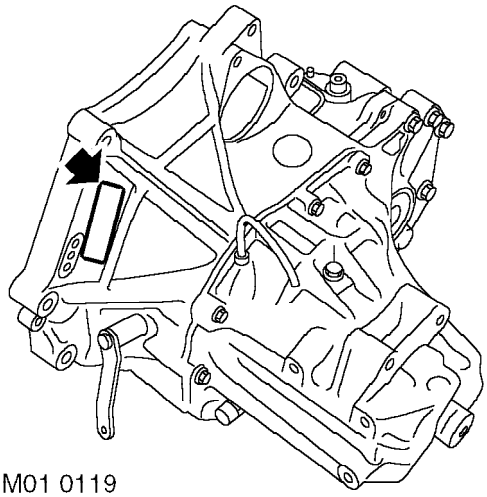
Engine number



M01 0117

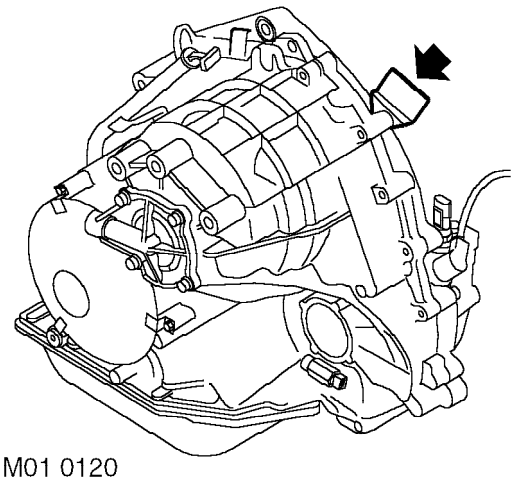
'K' Series Engine: Stamped on the front face of the cylinder block adjacent to the gearbox.

Gearbox number



M01 0119

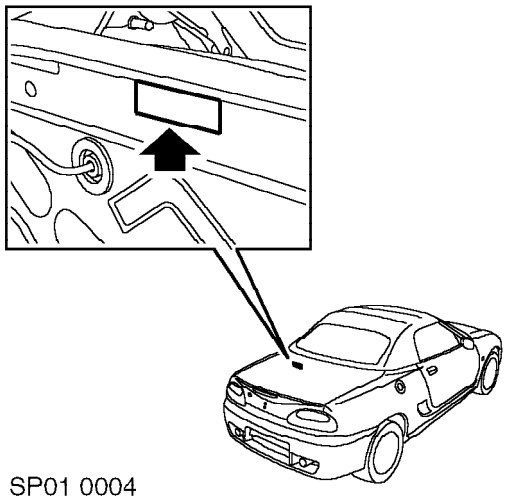
Manual Gearbox: Stamped on a label attached to the front face of the clutch housing.



M01 0120

Automatic Gearbox (Em-CVT): Stamped on a label attached by the gearbox to engine mounting bolt.

Body number



SP01 0004

The body number is stamped on the bulkhead at the back of the boot.

DANGEROUS SUBSTANCES

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment.

WARNING: Many liquids and other substances used in motor vehicles are poisonous and should not be consumed under any circumstances. As far as possible, ensure such substances are prevented from contact with the skin. These liquids and substances include but are not limited to: acid, anti-freeze, asbestos, brake fluid, fuel, windscreen washer additives, lubricants, refrigerant and various adhesives.

WARNING: Always read the instructions printed on labels or stamped on components and obey them implicitly. Such instructions are included for reasons of your health and personal safety. Never disregard them.

Synthetic rubber

Many 'O' rings, seals, hoses, flexible pipes and other similar items which appear to be natural rubber, are in fact made of synthetic materials called Fluoroelastomers. Under normal operating conditions this material is safe and does not present a health hazard. However, if the material is damaged by fire or excessive heating, it can break down and produce highly corrosive Hydrofluoric acid.

Contact with Hydrofluoric acid can cause serious burns on contact with skin. If skin contact does occur:

- Remove any contaminated clothing immediately.
- Irrigate affected area of skin with a copious amount of cold water or limewater for 15 to 60 minutes.
- Obtain medical assistance immediately.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing (seamless industrial gloves, protective apron etc.).

Decontaminate and dispose of gloves immediately after use.

Lubricating oils

Avoid excessive skin contact with used lubricating oils and always adhere to the health protection precautions.

WARNING: Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.

WARNING: Avoid excessive skin contact with mineral oil. Mineral oils remove the natural fats from the skin, leading to dryness, irritation and dermatitis.

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags in pockets.
- Avoid contaminating clothes (particularly those next to the skin) with oil.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds.
- Apply barrier creams before each work period, to help prevent lubricating oil from contaminating the skin.
- Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help).
- Use moisturisers after cleaning; preparations containing lanolin help replace the skin's natural oils which have been removed.
- Do not use petrol/gasoline, kerosene, diesel fuel, oil, thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay.
- Where practicable, degrease components prior to handling.
- Wear eye protection (e.g. goggles or face shield) if there is a risk of eye contamination. Eye wash facilities should be provided in close vicinity of the work area.

ENVIRONMENTAL PRECAUTIONS

General

This section provides general information which if observed, can help reduce environmental damage caused by activities carried out in workshops.

Emissions to air

Many of the activities that are carried out in workshops emit gases and fumes which contribute to global warming, depletion of the ozone layer and/or the formation of photochemical smog at ground level. By considering how the workshop activities are carried out, these gases and fumes can be minimised, thus reducing the impact on the environment.

Exhaust fumes

Running car engines is an essential part of workshop activities and exhaust fumes need to be ventilated to atmosphere. However, the amount of time engines are running and the position of the vehicle should be carefully considered at all times, to reduce the release of poisonous gases and minimise the inconvenience to people living nearby.

Solvents

Some of the cleaning agents used are solvent based and will evaporate to atmosphere if used carelessly, or if cans are left unsealed. All solvent containers should be firmly closed when not being used and solvent should be used sparingly. Suitable alternative methods may be available to replace some of the commonly used solvents. Similarly, many paints are solvent based and the spray should be minimised to reduce solvent emissions.

Refrigerant

It is illegal to release any refrigerants into the atmosphere. Discharge and replacement of these materials from air conditioning units should only be carried out using the correct equipment.

Checklist

Always adhere to the following:

Engines:
- Don't leave engines running unnecessarily.
- Minimise testing times and check where the exhaust fumes are being blown.

Materials:
- Keep lids on containers of solvents.
- Only use the minimum quantity.
- Consider alternative materials.
- Minimise over-spray when painting.

Gases:
- Use the correct equipment for collecting refrigerants.
- Don't burn rubbish on site.

Discharges to water

Most sites will have two systems for discharging water: storm drains and foul drains. Storm drains should only receive clean water, foul drains will take dirty water.

The foul drain will accept many of the normal waste waters such as washing water, detergents and domestic type wastes but oil, petrol, solvent, acids, hydraulic oil, antifreeze and other such substances should never be poured down the drain. If in any doubt, consult the Water Authority responsible for your locality first.

Every precaution must be taken to prevent spillage of oil, fuel, solvents etc. reaching the drains. All handling of such materials must take place well away from the drains and preferably in an area with a kerb or wall around it, to prevent discharge into the drain. If a spillage occurs, it should be soaked up immediately. Having a spill kit available will make this easier.

Additional precautions

Check whether the surface water drains are connected to an oil/water separator, this could reduce the pollution if an incident was to occur. Oil/water separators do need regular maintenance to ensure effectiveness.

Checklist

Always adhere to the following:

Disposal:
- Never pour anything down a drain without first checking that it is environmentally safe to do so, and that it does not contravene any local regulations or bye-laws.
- Have oil traps emptied regularly.

Spillage prevention:
- Store liquids in a walled area.
- Make sure that taps on liquid containers are secure and cannot be accidently turned on.
- Protect bulk storage tanks from vandalism by locking the valves.
- Transfer liquids from one container to another in an area away from open drains.
- Ensure lids are replaced securely on containers.
- Have spill kits available near to points of storage and handling of liquids.

Spill kits

Special materials are available to absorb a number of different substances. They can be in granular form, ready to use and bought in convenient containers for storage. Disposal of used spill-absorbing material is dealt with in the **'Waste Management'** section.

Land contamination

Oil, fuels and solvents etc. can contaminate any soil that they are allowed to contact. Such materials should never be disposed of by pouring onto soil and every precaution must be taken to prevent spillage reaching soil. Waste materials stored on open ground could also leak, or have polluting substances washed off them that would contaminate the land. Always store these materials in suitable skips or other similarly robust containers.

Checklist

Always adhere to the following:

- Don't pour or spill anything onto the soil or bare ground.
- Don't store waste materials on bare ground, see 'Spillage prevention' list in **'Additional Precautions Checklist'**.

Legal compliance

Some sites may have a discharge consent for effluent discharge to the foul drain for a car wash etc. It is important to know what materials are allowed in the drain and to check the results of any monitoring carried out by the local Water authority.

Where paint-spraying operations are carried out, it may be necessary to apply to the Local Authority for an air emissions licence to operate the plant. If such a licence is in operation, additional precautions will be necessary to comply with the requirements, and the results of any air quality monitoring must be checked regularly.

Checklist

Always adhere to the following:

- Know what legal consents and licences apply to the operations.
- Check that the emissions and discharges comply with legal requirements.

Local issues

A number of environmental issues will be of particular concern to residents and other neighbours close to the site. The sensitivity of these issues will depend on the proximity of the site and the layout and amount of activity conducted at the site.

Noise is a major concern and therefore consideration should be given to the time spent carrying out noisy activities and the location of those activities that can cause excessive noise.

Car alarm testing, panel beating, hammering and other such noisy activities should, whenever possible, be carried out indoors with doors and windows shut, or as far away as possible from local residents and others who may be affected by the disturbance.

Running vehicle engines may be an outside activity which could cause nuisance to neighbours because of noise and smell.

Be sensitive with regards the time of day when these activities are performed, and minimise the time of the noisy operation, particularly in the early morning and late evening.

Another local concern will be the smell from the various materials used. Using less solvent, paint and petrol could help prevent this annoyance.

Local residents and other business users will also be concerned about traffic congestion, noise and exhaust fumes, be sensitive to these concerns and try to minimise inconvenience caused by deliveries, customers and servicing operations.

Checklist

Always adhere to the following:

- Identify where the neighbours who are likely to be affected are situated.
- Minimise noise, smell and traffic nuisance.
- Prevent litter by putting waste in the correct containers.
- Have waste skips emptied regularly.

Use of resource

Another environmental concern is the waste of materials and energy that can occur in day to day activities.

Electricity for heating, lighting and compressed air uses resources and releases pollution during its generation.

Fuel used for heating, running cars or vans and mobile plant is another limited resource which consumes large amounts of energy during its extraction and refining processes.

Water has to be cleaned, piped to site and disposed of; all of which creates more potential pollution.

Oil, spares, paint etc., have all produced pollution in the process of manufacture and they become a waste disposal problem if discarded.

Checklist

Always adhere to the following:

Electricity and heating:
- Keep doors and windows closed in the Winter.
- Switch off machinery or lights when not needed.
- Use energy efficient heating systems.
- Switch off computers and photocopiers when not needed.

Fuel:
- Don't run engines unnecessarily
- Think about whether journeys are necessary and drive to conserve fuel.

Water:
- Don't leave taps and hose pipes running.
- Mend leaks quickly, don't be wasteful.

Compressed air:
- Don't leave valves open.
- Mend leaks quickly.
- Don't leave the compressor running when not needed.

Use of environmentally damaging materials:
- Check whether a less toxic material is available.

Handling and storage of materials:
- Have the correct facilities available for handling liquids to prevent spillage and wastage as listed above.
- Provide suitable locations for storage to prevent frost damage or other deterioration.

Burning used engine oil

Burning of used engine oil in small space heaters or boilers can be recommended only for units of approved design. The heating system must meet the regulatory standards for small burners(s) with a net rated thermal input of less than 3MW. The use of waste oil burners must be licensed by the local authority.

Waste Management

One of the major ways that pollution can be reduced is by the careful handling, storage and disposal of all waste materials that occur on sites. Legislation makes it illegal to dispose of waste materials other than to licensed waste carriers and disposal sites. This means that it is necessary to not only know what the waste materials are, but also to have the necessary documentation and licenses.

Handling and storage of waste

Ensure that waste materials are not poured down the drain or onto soils. They should be stored in such a way as to prevent the escape of the material to land, water or air.

They must also be segregated into different types of waste e.g. oil, metals, batteries, used vehicle components. This will prevent any reaction between different materials and assist in disposal.

Disposal of waste

Disposal of waste materials must only be to waste carriers who are licensed to carry those particular waste materials and all the necessary documentation must be completed. The waste carrier is responsible for ensuring that the waste is taken to the correct disposal sites.

Dispose of waste in accordance with the following guidelines:

- **Fuel, hydraulic fluid, anti-freeze and oil:** keep separate and dispose of to specialist contractor.
- **Refrigerant:** collect in specialist equipment and reuse.
- **Detergents:** safe to pour down the foul drain if diluted.
- **Paint, thinners:** keep separate and dispose of to specialist contractor.
- **Components:** send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- **Small parts:** reuse any suitable parts, dispose of the remainder in ordinary waste.
- **Metals:** can be sold if kept separate from general waste.
- **Tyres:** keep separate and dispose of to specialist contractor.
- **Packaging:** compact as much as possible and dispose of in ordinary waste.
- **Asbestos-containing:** keep separate and dispose of to specialist contractor.
- **Oily and fuel wastes (e.g. rags, used spill kit material):** keep separate and dispose of to specialist contractor.
- **Air filters:** keep separate and dispose of to specialist contractor.
- **Rubber/plastics:** dispose of in ordinary waste.
- **Hoses:** dispose of in ordinary waste.
- **Batteries:** keep separate and dispose of to specialist contractor.
- **Airbags - explosives:** keep separate and dispose of to specialist contractor.
- **Electrical components:** send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- **Electronic components:** send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- **Catalysts:** can be sold if kept separate from general waste.
- **Used spill-absorbing material:** keep separate and dispose of to specialist contractor.
- **Office waste:** recycle paper and toner and ink cartridges, dispose of the remainder in ordinary waste.

PRECAUTIONS AGAINST DAMAGE

Always fit wing and seat covers before commencing work.

Avoid spilling brake fluid or battery acid on paintwork. Wash off with water immediately if this occurs.

Disconnect the battery earth lead before starting work, see **ELECTRICAL PRECAUTIONS.**

Always use the recommended service tool or a satisfactory equivalent where specified.

Protect exposed bearing and sealing surfaces and screw threads from damage.

SAFETY INSTRUCTIONS

Jacking

The recommended jacking points are given in **LIFTING AND TOWING**.

Always ensure that any lifting apparatus has adequate load and safety capacity for the weight to be lifted.

Ensure the vehicle is standing on level ground prior to lifting or jacking.

Apply the handbrake and chock the wheels.

Never rely on a jack as the sole means of support when working beneath the vehicle. Use additional safety supports beneath the vehicle.

Do not leave tools, lifting equipment, spilt oil, etc. around or on the work bench area.

Brake shoes and pads

WARNING: Always fit the correct grade and specification of brake linings and renew brake pads and brake shoes in axle sets only.

Brake hydraulics

Observe the following recommendations when working on the brake system:

- Always use two spanners when loosening or tightening brake pipe or hose connections.
- Ensure that hoses run in a natural curve and are not kinked or twisted.
- Fit brake pipes securely in their retaining clips and ensure that the pipe cannot contact a potential chafing point.
- Containers used for hydraulic fluid must be kept absolutely clean.
- Do not store hydraulic brake fluid in an unsealed container, it will absorb water and in this condition would be dangerous to use due to a lowering of its boiling point.
- Do not allow hydraulic brake fluid to be contaminated with mineral oil, or put new brake fluid in a container which has previously contained mineral oil.
- Do not re-use brake fluid removed from the system.
- Always use clean brake fluid or a recommended alternative to clean hydraulic components.
- After disconnection of brake pipes and hoses, immediately fit suitable blanking caps or plugs to prevent the ingress of dirt.
- Only use the correct brake fittings with compatible threads.
- Absolute cleanliness must be observed when working with hydraulic components.

WARNING: It is imperative that the correct brake fittings are used and that threads of components are compatible.

Cooling system caps and plugs

Extreme care is necessary when removing engine coolant caps and plugs when the engine is hot and especially if it is overheated. To avoid the possibility of scalding allow the engine to cool before attempting coolant cap or plug removal.

GENERAL FITTING INSTRUCTIONS

Component removal

Whenever possible, clean components and surrounding area before removal.

- Blank off openings exposed by component removal.
- Immediately seal fuel, oil or hydraulic lines when apertures are exposed; use plastic caps or plugs to prevent loss of fluid and ingress of dirt.
- Close the open ends of oilways exposed by component removal with tapered hardwood plugs or conspicuous plastic plugs.
- Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
- Clean bench and provide marking materials, labels and containers before dismantling a component.

Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when brake, fuel or hydraulic system parts are being worked on. A particle of dirt or a cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oilways and fluid passages with an air line. Ensure that any 'O' rings used for sealing are correctly replaced or renewed, if disturbed during the process.
- Use marking ink to identify mating parts and ensure correct reassembly. Do not use a centre punch or scriber to mark parts, they could initiate cracks or distortion in marked components.
- Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
- Wire labels on to all parts which are to be renewed, and to parts requiring further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
- Do not discard a part due for renewal until after comparing it with a new part, to ensure that its correct replacement has been obtained.

Cleaning components

Always use the recommended cleaning agent or equivalent.

Ensure that adequate ventilation is provided when volatile degreasing agents are being used.

Do not use degreasing equipment for components containing items which could be damaged by the use of this process.

Whenever possible clean components and the area surrounding them before removal. Always observe scrupulous cleanliness when cleaning dismantled components.

General inspection

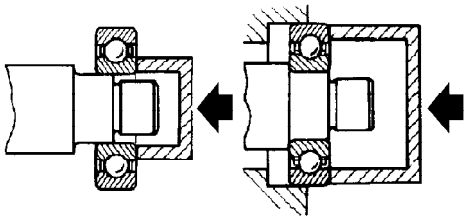
All components should be inspected for wear or damage before being reassembled.

- Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal an incipient failure.
- When a component is to be checked dimensionally against recommended values, use the appropriate measuring equipment (surface plates, micrometers, dial gauges etc.). Ensure the measuring equipment is calibrated and in good serviceable condition.
- Reject a component if its dimensions are outside the specified tolerances, or if it appears to be damaged.
- A part may be refitted if its critical dimension is exactly to its tolerance limit and it appears to be in satisfactory condition. Use 'Plastigauge' 12 Type PG-1 for checking bearing surface clearances.

Ball and Roller Bearings

When removing and installing bearings, ensure that the following practices are observed to ensure component serviceability.

- Remove all traces of lubricant from bearing under inspection by cleaning with a suitable degreasant; maintain absolute cleanliness throughout operations.
- Conduct a visual inspection for markings on rolling elements, raceways, outer surface of outer rings or inner surface of inner rings. Reject any bearings found to be marked, since marking in these areas indicates onset of wear.
- Hold inner race of bearing between finger and thumb of one hand and spin outer race to check that it rotates absolutely smoothly. Repeat, holding outer race and spinning inner race.
- Rotate outer ring gently with a reciprocating motion, while holding inner ring; feel for any check or obstruction to rotation. Reject bearing if action is not perfectly smooth.
- Lubricate bearing with generous amounts of lubricant appropriate to installation.
- Inspect shaft and bearing housing for discoloration or other markings which indicate movement between bearing and seatings.
- Ensure that shaft and housing are clean and free from burrs before fitting bearing.
- If one bearing of a pair shows an imperfection, it is advisable to replace both with new bearings; an exception could be if the faulty bearing had covered a low mileage, and it can be established that damage is confined to only one bearing.
- Never refit a ball or roller bearing without first ensuring that it is in a fully serviceable condition.
- When hub bearings are removed or displaced, new bearings must be fitted; do not attempt to refit the old hub bearings.



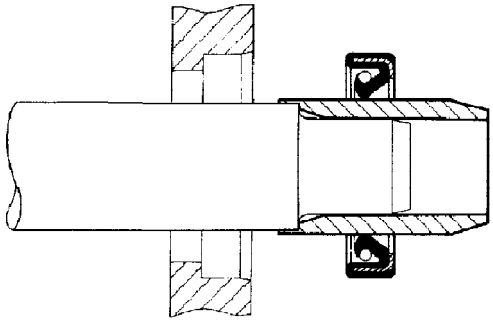
M01 0123

- When fitting a bearing to a shaft, only apply force to the inner ring of the bearing. When fitting a bearing into a housing, only apply force to the outer ring of the bearing.
- In the case of grease lubricated bearings (e.g. hub bearings) fill the space between bearing and outer seal with the recommended grade of grease before fitting seal.
- Always mark components of separable bearings (e.g. taper roller bearings) when dismantling, to ensure correct reassembly. Never fit new rollers in a used outer ring; always fit a complete new bearing assembly.

Oil seals

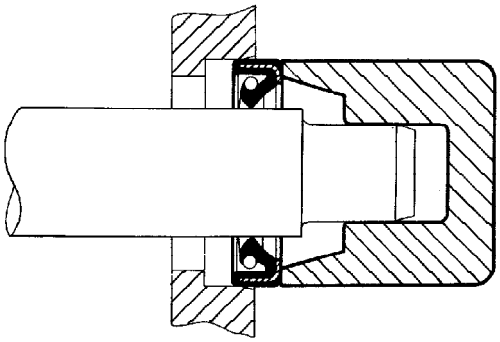
Always renew oil seals which have been removed from their working location (whether as an individual component or as part of an assembly). NEVER use a seal which has been improperly stored or handled, such as hung on a hook or nail.

- Carefully examine seal before fitting to ensure that it is clean and undamaged.
- Ensure the surface on which the new seal is to run is free of burrs or scratches. Renew the component if the original sealing surface cannot be completely restored.
- Protect the seal from any surface which it has to pass when being fitted. Use a protective sleeve or tape to cover the relevant surface.
- Lubricate the sealing lips with a recommended lubricant before use to prevent damage during initial use. On dual lipped seals, smear the area between the lips with grease. **Note:** some oil seals are coated with a protective wax and must be fitted dry, unless instructed otherwise.
- If a seal spring is provided, ensure that it is fitted correctly. Place lip of seal towards fluid to be sealed and slide into position on shaft. Use fitting sleeve where possible to protect sealing lip from damage by sharp corners, threads or splines. If a fitting sleeve is not available, use plastic tube or tape to prevent damage to the sealing lip.



M01 0124

- Grease outside diameter of seal, place square to housing recess and press into position using great care, and if possible a 'bell piece' to ensure the seal is not tilted. In some cases it may be preferable to fit seal to housing before fitting to shaft. Never let weight of unsupported shaft rest in seal.



M01 0125

- Use the recommended service tool to fit an oil seal. If the correct service tool is not available, use a suitable tube approximately 0.4 mm (0.015 in) smaller than the outside diameter of the seal. Use a hammer **VERY GENTLY** on drift if a suitable press is not available.
- Press or drift the seal in to the depth of its housing, with the sealing lip facing the lubricant to be retained if the housing is shouldered, or flush with the face of the housing where no shoulder is provided. Ensure that the seal does not enter the housing in a tilted position.

Joints and joint faces

Fit joints dry unless specified otherwise.

- When jointing compound is used, apply in a thin uniform film to metal surfaces; take care to prevent jointing compound from entering oilways, pipes or blind tapped holes.
- If gaskets and/or jointing compound is recommended for use; remove all traces of old jointing material prior to reassembly. Do not use a tool which will damage the joint faces and smooth out any scratches or burrs on the joint faces using an oil stone. Do not allow dirt or jointing material to enter any tapped holes or enclosed parts.
- Prior to reassembly, blow through any pipes, channels or crevices with compressed air.

Locking Devices

Always replace locking devices with one of the same design.

Tab washers - always release locking tabs and fit new locking washers. Do not re-use locking tabs.

Locking nuts - always use a backing spanner when loosening or tightening locking nuts, brake and fuel pipe unions.

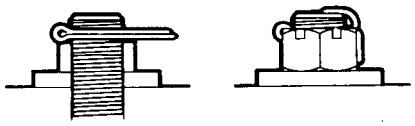
Roll pins - always fit new roll pins of an interference fit in the hole.

Circlips - always fit new circlips of the correct size for the groove.

Keys and keyways - remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.

Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

Split pins -



1M0057

Always fit new split-pins of the correct size for the hole in the bolt or stud. **Do not slacken back nut to enter split-pin.**

Screw threads

Metric threads to ISO standards are used.

Damaged nuts, bolts and screws must always be discarded.

Cleaning up damaged threads with a die or tap impairs the strength and closeness of fit of the threads and is not recommended.

Castellated nuts must not be slackened back to accept a split-pin, except in those recommended cases when this forms part of an adjustment.

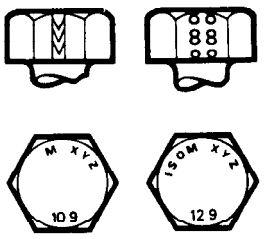
Do not allow oil or grease to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.

Always tighten a nut or bolt to the recommended torque figure. Damaged or corroded threads can affect the torque reading.

To check or re-tighten a bolt or screw to a specified torque figure, first slacken a quarter of a turn, then retighten to the correct torque figure.

Oil thread lightly before tightening to ensure a free running thread, except in the case of threads treated with sealant/lubricant, and self-locking nuts.

Bolt identification

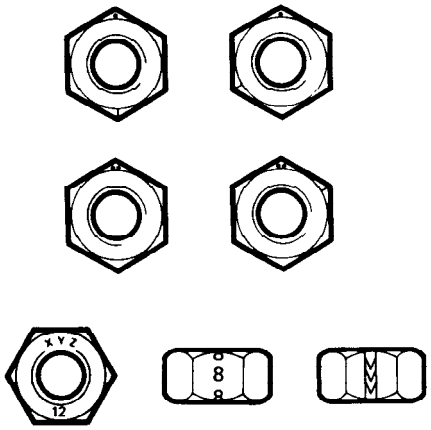


1M0055

An ISO metric bolt or screw made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the head.

In addition to marks to identify the manufacturer, the head is also marked with symbols to indicate the strength grade, e.g. 8.8; 10.9; 12.9; 14.9. As an alternative, some bolts and screws have the M and strength grade symbol on the flats of the hexagon.

Nut identification



1M0056

A nut with an ISO metric thread is marked on one face or on one of the flats of the hexagon with the strength grade symbol 8, 12, or 14. Some nuts with a strength grade 4, 5 or 6 are also marked and some have the metric symbol M on the flat opposite the strength grade marking.

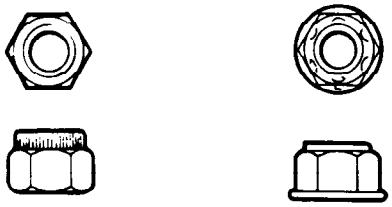
A clock face system is used as an alternative method of indicating the strength grade. The external chamfers or a face of the nut is marked in a position relative to the appropriate hour mark on a clock face to indicate the strength grade.

A dot is used to locate the 12 o'clock position and a dash to indicate the strength grade. If the grade is above 12, two dots identify the 12 o'clock position.

When tightening a slotted or castellated nut, never loosen it to insert a split pin except where recommended as part of an adjustment. If difficulty is experienced, alternative washers or nuts should be selected, or the washer thickness reduced.

Where bearing pre-load is involved, nuts should be tightened in accordance with special instructions.

Self-locking nuts

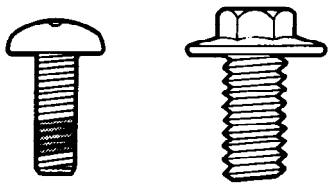


1M0058

Self-locking nuts, i.e. nylon insert or metal stiff nuts can be re-used providing resistance can be felt when the locking portion of the nut passes over the thread of the bolt or stud.

Where self-locking nuts have been removed, it is advisable to replace them with new ones of the same type.

Self-locking bolts and screws



1M0059

Self-locking bolts and screws, i.e. nylon patched or trilobular thread can be re-used providing resistance can be felt when the locking portion enters the female thread.

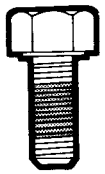
Nylon patched bolts and screws have a locking agent pre-applied to the threads. They are identified by the presence of a coloured section of thread which extends for up to 180° around the thread.

Trilobular i.e. Powerlok bolts have a special thread form which creates a slight interference in the tapped hole or threads of the nut into which it is screwed.

DO NOT re-use self-locking fasteners in critical locations (eg. engine bearings). Always use the correct replacement self-locking nut, bolt or screw.

DO NOT fit non self-locking fasteners in applications where a self-locking nut, bolt or screw is specified.

Encapsulated bolts and screws



1M0062

Encapsulated bolts and screws have a micro-encapsulated locking agent pre-applied to the thread. They are identified by the presence of a coloured section of thread which extends completely around the thread - 360°. The locking agent is released and activated by the assembly process and is then chemically cured to provide the locking action.

Unless a specific repair procedure states otherwise, encapsulated bolts may be re-used providing the threads are undamaged and the following procedure is adopted.

- Remove loose adhesive from the bolt and housing threads.
- Ensure threads are clean and free of oil and grease.
- Apply an approved locking agent.

An encapsulated bolt may be replaced with a bolt of equivalent specification provided it is treated with an approved locking agent.

FLEXIBLE PIPES AND HOSES

General

When removing and installing flexible hydraulic pipes and hoses, ensure that the following practices are observed to ensure component serviceability.

- Before removing and refitting brake or power steering hose, clean end fittings and area surrounding them as thoroughly as possible.
- Obtain appropriate plugs or caps before detaching hose end fittings, so that the ports can be immediately covered to prevent the ingress of dirt.
- Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any faulty hoses.
- When refitting a hose, ensure that no unnecessary bends are introduced, and that the hose is not twisted before or during tightening of union nuts.
- Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
- Absolute cleanliness must be observed with hydraulic components at all times.
- After any work on hydraulic systems, carefully inspect for leaks underneath the vehicle while a second operator applies maximum brake pressure to the brakes (engine running) and operates the steering.

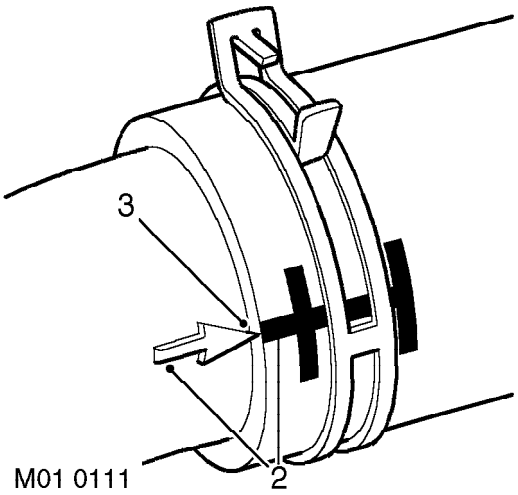
Fuel system hoses

All fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. If any of the fuel system hoses have been disconnected, it is imperative that the internal bore is inspected to ensure that the viton lining has not become separated from the armoured outer sleeve. A new hose must be fitted if separation is evident.

Cooling system hoses

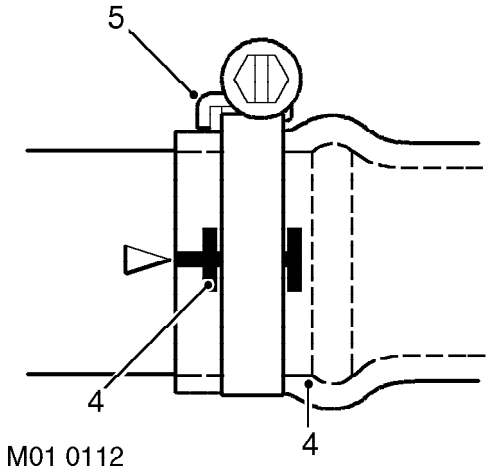
The following precautions MUST be followed to ensure the integrity of cooling hoses and their connections to system components are maintained.

Hose orientation and connection



Correct orientation of cooling hoses is important in ensuring that the hose does not become fatigued or damaged through contact with adjacent components. Where 'timing' marks (2) are provided on the hose and corresponding connection, these must be used to ensure correct orientation. Hoses must be pushed fully onto their connection points. Usually, a moulded form (3) on the stub pipe provides a positive indicator.

Hose clips



Markings (4) are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub as shown. Worm drive clips should be oriented with the crimped side of the drive housing (5) facing towards the end of the hose, or the hose may become pinched between the clip and the stub pipe retaining lip. Worm drive clips should be tightened to 3 Nm (2lbf.ft) unless otherwise stated. Ensure that hose clips do not foul adjacent components.

Heat protection

Always ensure that heatshields and protective sheathing are in good condition. Replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components, such as the exhaust manifold. Hoses will deflect slightly when hot; ensure this movement is taken into account when routing and securing hoses.

SERVICE TOOLS

General

Special service tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of special tools also helps prevent the potential for damage to components.

Some operations described in this Manual cannot be carried out properly without the aid of the relevant service tools.

Special service tools can be obtained from the following suppliers:

Cartool (UK) Limited
Unit 3, Sterling Business Park
Salthouse Road
Brackmills
Northampton
NN4 7EX
England

TEL: +44 (0) 1604 760099
FAX: +44 (0) 1604 760017
e-mail: sales@cartooluk.co.uk

CARTOOL GmbH
Straussenlettenstrasse 15
85053 Ingolstadt
Germany

TEL: +49 (0) 841 9650080
FAX: +49 (0) 841 9650090
e-mail: i.amann@cartool.de

TestBook

TestBook is a computerised workshop tool which provides your dealership with instant access to the very latest Technical Information from MG ROVER, allowing for accurate and effective fault diagnosis and repair of all MG Rover Vehicles.

Where specific garage equipment is required for diagnosis and repair, reference should be made to the Service Tools and Equipment Programme where details of the equipment recommended by MG Rover Service may be found.

Body repairs

Any damage found, that would affect the corrosion resistance of the vehicle during the Warranty period must be rectified by an authorised MG Rover Dealer to the standards, and by the methods, detailed in the Body Repair Manual.

Replacement body panels

Body panels are supplied coated in cathodic electrocoat primer.

DYNAMOMETER TESTING

General

IMPORTANT: Use a four wheel dynamometer for brake testing if possible.

WARNING: Do not attempt to test an ABS function on a dynamometer.

Four wheel dynamometers

Provided that front and rear rollers are rotating at identical speeds and that normal workshop safety standards are applied, there is no speed restriction during testing except any that may apply to the tyres.

Before testing a vehicle with anti-lock brakes on a four wheel dynamometer, disconnect the ABS modulator. The ABS function will not work, the ABS warning light will illuminate. Normal braking will be available.

Two wheel dynamometers

ABS will not function on a two wheel dynamometer. The ABS light will illuminate during testing. Normal braking will be available.

If brake testing on a two wheel dynamometer is necessary, the following precautions should be taken:

- Traction control must be disabled
- Neutral selected in gearbox

When checking brakes, run engine at idle speed to maintain servo-vacuum.

FUEL HANDLING PRECAUTIONS

General

The following information provides basic precautions which must be observed if petrol (gasoline) is to be handled safely. It also outlines other areas of risk which must not be ignored. This information is issued for basic guidance only, if in doubt consult your local Fire Officer.

Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. The vapour is heavier than air and will always fall to the lowest level. The vapour can be easily distributed throughout a workshop by air currents; consequently, even a small spillage of fuel is potentially very dangerous.

Always have a fire extinguisher containing FOAM, CO_2, GAS or POWDER close at hand when handling or draining fuel or when dismantling fuel systems. Fire extinguishers should also be located in areas where fuel containers are stored.

Always disconnect the vehicle battery before carrying out dismantling or draining work on a fuel system.

Whenever fuel is being handled, drained or stored, or when fuel systems are being dismantled, all forms of ignition must be extinguished or removed; any leadlamps must be flameproof and kept clear of spillage.

WARNING: No one should be permitted to repair components associated with fuel without first having specialist training.

WARNING: Do not remove fuel system components while the vehicle is over a pit.

Fuel tank draining

Fuel tank draining should be carried out in accordance with the procedure outlined in the **'FUEL DELIVERY'** section of this manual and observing the following precautions:

WARNING: Fuel must not be extracted or drained from any vehicle whilst it is over a pit.
Draining or extraction of fuel must be carried out in a well ventilated area.
The capacity of containers for fuel must be more than adequate for the full amount of fuel to be extracted or drained. The container should be clearly marked with its contents and placed in a safe storage area which meets the requirements of local authority regulations.

CAUTION: When fuel has been extracted or drained from a fuel tank the precautions governing naked lights and ignition sources should be maintained.

Fuel tank removal

When the fuel line is secured to the fuel tank outlet by a spring steel clip, the clip must be released before the fuel line is disconnected or the fuel tank is removed. This procedure will avoid the possibility of residual fumes in the fuel tank being ignited when the clip is released.

As an added precaution fuel tanks should have a 'FUEL VAPOUR' warning label attached to them as soon as they are removed from the vehicle.

Fuel tank repairs

No attempt should be made to repair a plastic fuel tank. If the structure of the tank is damaged, a new tank must be fitted.

Body repairs

Plastic fuel pipes are particularly susceptible to heat, even at relatively low temperature, and can be melted by heat conducted from some distance away.

When body repairs involve the use of heat, all fuel pipes which run in the vicinity of the repair area must be removed, and the tank outlet plugged, BEFORE HEAT IS APPLIED. If the repair is in the vicinity of the fuel tank, the tank must be removed.

WARNING: If welding is to be carried out in the vicinity of the fuel tank, the fuel system must be drained and the tank removed before welding commences.

Quick fit fuel hose connectors

WARNING: Hose connections between the fuel pump and the fuel rail contain fuel under pressure, which MUST be relieved prior to disconnection of the hoses. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Adjustments.***

1. Wipe connection and surrounding area using a lint free cloth.

NOTE: If the connection is heavily soiled with road salt and dirt, gently twist connector while spraying with WD40.

2. If necessary use an air line to remove contaminates from the retainer area of the connector.
3. Depress collar and disconnect hose.
4. Ensure pipe end is clean and free from corrosion.
5. Lubricate pipe end with clean engine oil.
6. Connect hose to pipe and push firmly into position until a click is heard.
7. Check security of connection by pulling on connector.

CAUTION: When checking security of connector pull on connector body NOT on the hose.

ELECTRICAL PRECAUTIONS

General

The following guidelines are intended to ensure the safety of the operator whilst preventing damage to the electrical and electronic components fitted to the vehicle. Where necessary, specific precautions are detailed in the relevant sections of this Manual which should be referred to prior to commencing repair operations.

Equipment

Prior to commencing any test procedure on the vehicle, ensure that the relevant test equipment is working correctly and any harness or connectors are in good condition. It is particularly important to check the condition of the lead and plugs of mains operated equipment.

Polarity

Never reverse connect the vehicle battery and always ensure the correct polarity when connecting test equipment.

High Voltage Circuits

Whenever disconnecting live ht circuits, always use insulated pliers and never allow the open end of the ht lead to contact other components, particularly ECU's. Exercise caution when measuring the voltage on the coil terminals while the engine is running, high voltage spikes can occur on these terminals.

Connectors and Harness

The engine compartment of a vehicle is a particularly hostile environment for electrical components and connectors:

- Always ensure electrically related items are dry and oil free before disconnecting and connecting test equipment.
- Ensure disconnected multiplugs and sensors are protected from being contaminated with oil, coolant or other solutions. Contamination could impair performance or result in catastrophic failure.
- Never force connectors apart using tools to prise apart or by pulling on the wiring harness.
- Always ensure locking tabs are disengaged before disconnection, and match orientation to enable correct reconnection.
- Ensure that any protection (covers, insulation etc.) is replaced if disturbed.

Having confirmed a component to be faulty:

- Switch off the ignition and disconnect the battery.
- Remove the component and support the disconnected harness.
- When replacing the component keep oily hands away from electrical connection areas and push connectors home until any locking tabs fully engage.

Battery disconnection

Before disconnecting the battery, disable the alarm system and switch off all electrical equipment. If the radio is to be serviced, ensure the security code has been deactivated.

CAUTION: To prevent damage to electrical components, ALWAYS disconnect the battery when working on the vehicle's electrical system. The ground lead must be disconnected first and reconnected last. Always ensure that battery leads are routed correctly and are not close to any potential chafing points.

Battery charging

Only recharge the battery with it removed from the vehicle. Always ensure any battery charging area is well ventilated and that every precaution is taken to avoid naked flames and sparks.

Ignition system safety precautions

The vehicle's ignition system produces high voltage and the following precautions should be observed before carrying out any work on the system.

WARNING: Before commencing work on an ignition system, ensure all high tension terminals, adapters and diagnostic equipment are adequately insulated and shielded to prevent accidental personal contacts and minimise the risk of shock.

WARNING: Wearers of surgically implanted pacemaker devices should not be in close proximity of ignition circuits or diagnostic equipment.

Disciplines

Switch off the ignition prior to making any connection or disconnection in the system to prevent electrical surges caused by disconnecting 'live' connections damaging electronic components.

Ensure hands and work surfaces are clean and free of grease, swarf, etc. Grease collects dirt which can cause electrical tracking (short-circuits) or high-resistance contacts.

When handling printed circuit boards, treat with care and hold by the edges only; note that some electronic components are susceptible to body static.

Connectors should never be subjected to forced removal or refit, especially inter-board connectors. Damaged contacts can cause short- circuit and open-circuit fault conditions.

Prior to commencing test, and periodically during a test, touch a good vehicle body earth to discharge static. Some electronic components are vulnerable to static electricity that may be generated by the operator.

Grease for electrical connectors

Some under bonnet and under body connectors may be protected against corrosion by the application of a special grease during vehicle production. Should connectors be disturbed in service, repaired or replaced, additional grease should be applied: Part No. BAU 5811, available in 150 g tubs.

NOTE: The use of greases other than BAU 5811 must be avoided as they can migrate into relays, switches etc. contaminating the contacts and leading to intermittent operation or failure.

SUPPLEMENTARY RESTRAINT SYSTEM PRECAUTIONS

General

The SRS system contains components which could be potentially hazardous to the service engineer if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of SRS components fitted to the vehicle.

WARNING: Always follow the 'SRS Precautions' and the correct procedures for working on SRS components. Persons working on SRS systems must be fully trained and have been issued with copies of the safety guidelines.

WARNING: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

WARNING: Some airbag modules contain sodium azide which is poisonous and extremely flammable. Contact with water, acid or heavy metals may produce harmful or explosive compounds. Do not dismantle, incinerate or bring into contact with electricity, before the unit has been deployed.

WARNING: Always replace a seat belt assembly that has withstood the strain of a severe vehicle impact, or if the webbing shows signs of fraying.

WARNING: Always disconnect the vehicle battery before carrying out any electrical welding on a vehicle fitted with an SRS system.

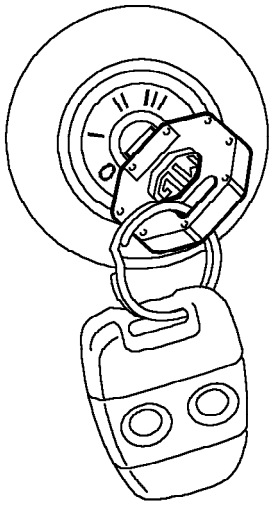
CAUTION: Do not expose an airbag module or seat belt pre-tensioner to heat exceeding 85°C (185°F).

It should be noted that these precautions are not restricted to operations performed when servicing the SRS system, the same care should be exercised when working on ancillary systems and components located in the vicinity of SRS components; these include, but are not limited to:

- **Steering system** - steering wheel airbag, rotary coupler
- **Front fascia** - passenger front airbag (where fitted)
- **Centre console** - SRS DCU and SRS harnesses.
- **Electrical system** - SRS harnesses, link leads and connectors

Making the system safe

Before working on, or in the vicinity of SRS components, ensure the system is rendered safe by performing the following procedures:



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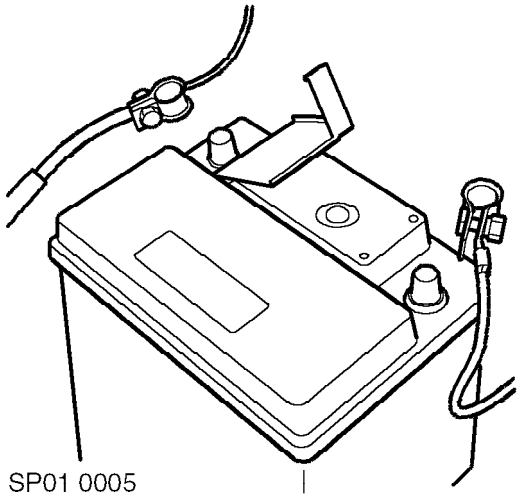
- Remove the ignition key from the ignition switch.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- Disconnect both battery leads, earth lead first before beginning work.
- Wait 10 minutes for the SRS DCU back-up power circuit to discharge.

The SRS system uses energy reserve capacitors to keep the system active in the event of electrical supply failure under crash conditions. It is necessary to allow the capacitor sufficient time to discharge (10 minutes) in order to avoid the risk of accidental deployment.

WARNING: Always disconnect both battery leads before beginning work on the SRS system. Disconnect the negative battery lead first. Never reverse connect the battery.

INSTALLATION

In order to assure system integrity, it is essential that the SRS system is regularly checked and maintained so that it is ready for effective operation in the event of a collision. Carefully inspect SRS components before installation. Do not install a part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.

WARNING: The integrity of the SRS system components are critical for safety reasons. Ensure the following precautions are always adhered to:

- **Never install used SRS components from another vehicle or attempt to repair an SRS component.**
- **When repairing an SRS system, only use genuine new parts.**
- **Never apply electrical power to an SRS component unless instructed to do so as part of an approved test procedure.**
- **Special Torx bolts are necessary for installing the airbag module - do not use other bolts. Ensure bolts are tightened to the correct torque.**
- **Always use new fixings when replacing an SRS component.**
- **Ensure the SRS Diagnostic Control Unit (DCU) is always installed correctly. There must not be any gap between the DCU and the bracket to which it is mounted. An incorrectly mounted DCU could cause the system to malfunction.**

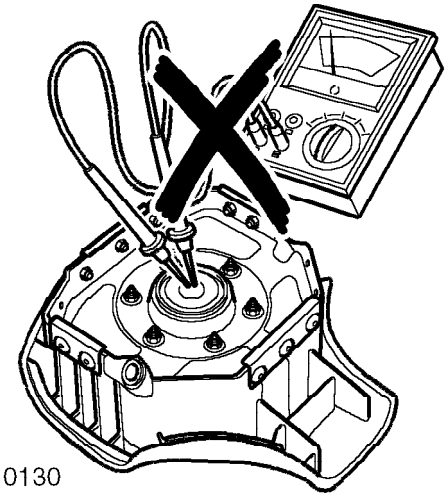
CAUTION: Ensure SRS components are not contaminated with oil, grease, detergent or water.

CAUTION: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

SRS component testing precautions

The SRS components are triggered using relatively low operating currents, always adhere to the following precautions:

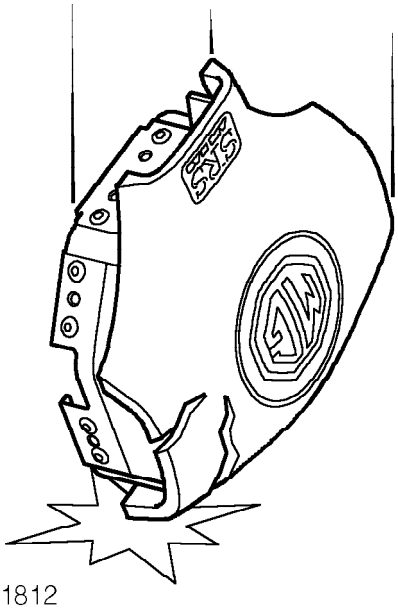


M01 0130

WARNING: Do not use a multimeter or other general purpose test equipment on SRS system components or accidental deployment may occur. Only use 'Testbook' to diagnose SRS system faults.

WARNING: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS system components. It may cause accidental deployment and personal injury.

Handling and storage



76M1812

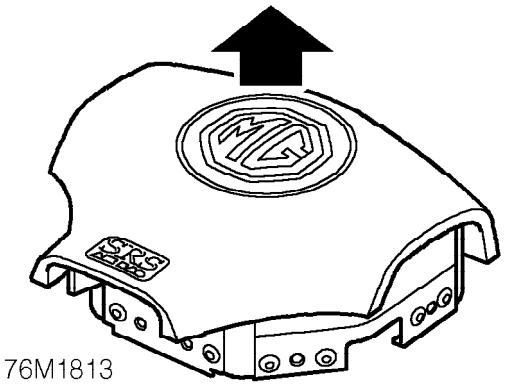
There are regulations for the safe storage of SRS components which must be observed, consult your local authority for details.

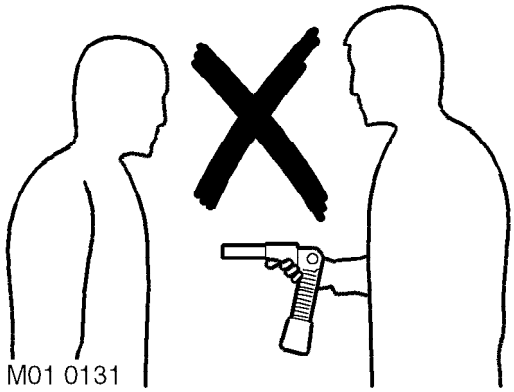
WARNING: The SRS components are sensitive and potentially hazardous if not handled correctly; always comply with the following handling precautions:

- **Never drop a SRS component. The airbag diagnostic control unit is a particularly shock sensitive device and must be handled with extreme care. Airbag modules could deploy if subjected to a strong shock.**
- **Never wrap your arms around an airbag module. If an airbag module has to be carried, hold it by the cover, with the cover uppermost and the base away from your body.**
- **Never transport airbag modules in the cabin of a vehicle. Always use the luggage compartment of the vehicle for carrying airbag modules.**

WARNING: Never attach anything to an airbag cover or any trim component covering an airbag module. Do not allow anything to rest on top of an airbag module.

WARNING: Always keep components cool, dry and free from contamination.





WARNING: Store airbag modules with the deployment side uppermost. If airbag modules are stored deployment side down, accidental deployment will propel the airbag module with enough force to cause serious injury.

WARNING: Airbag modules are classed as explosive devices. For overnight and longer term storage, they must me stored in a secure steel cabinet which has been approved as suitable for the purpose and has been registered by the local authority.

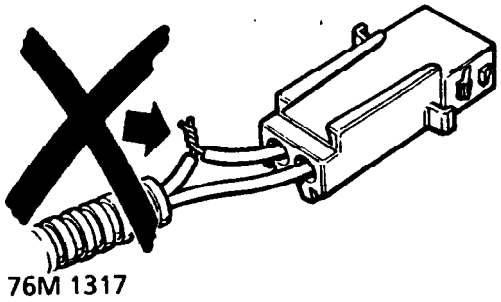
WARNING: Store the airbag module in a designated storage area. If there is no designated storage area available, store in the locked luggage compartment/loadspace of the the vehicle and inform the workshop supervisor.

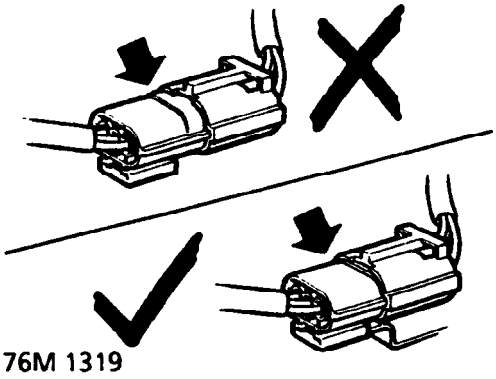
CAUTION: Improper handling or storage can internally damage the airbag module, making it inoperative. If you suspect the airbag module has been damaged, install a new module and refer to the Deployment/Disposal Procedures to determine the correct method for disposal of the damaged module.

WARNING: When handling front seat belt buckle pre-tensioners, hold by the piston tube, with the open end of the piston tube pointing towards the ground and the buckle facing away from your body.

- **DO NOT cover the end of the piston tube.**
- **DO NOT hold buckle pre-tensioners by the bracket assembly or steel cable.**
- **NEVER point the piston tube towards your body or other people.**

SRS Harnesses and Connectors

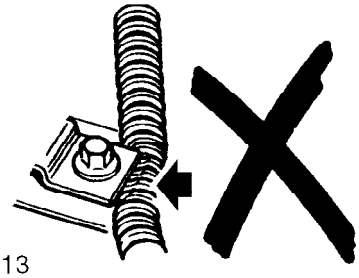

76M 1317


76M 1319

CAUTION: Always observe the following precautions with regards to the SRS system electrical wiring:

- **Never attempt to modify, splice or repair SRS wiring.**
- **Never install electronic equipment (such as a mobile telephone, two-way radio or in-car entertainment system) in such a way that it could generate electrical interference in the SRS system harness. Seek specialist advice when installing such equipment.**

NOTE: SRS system wiring can usually be identified by a special yellow outer sleeve protecting the wires (black with yellow stripe protective coverings are sometimes used).


M01 0213

WARNING: Always ensure SRS wiring is routed correctly. Be careful to avoid trapping or pinching the SRS wiring. Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible points of chafing.

CAUTION: Ensure all SRS component harness connectors are mated correctly and securely fastened. Do not leave the connectors hanging loose.

Rotary Coupler Precautions

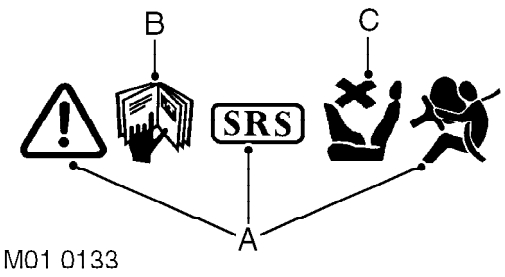
CAUTION: Always follow the procedure for fitting and checking the rotary coupler as instructed in the 'SRS Repairs' section of this manual. Comply with all safety and installation procedures to ensure the system functions correctly. Observe the following precautions:

- **Do not unlock and rotate the rotary coupler when it is removed from the vehicle.**
- **Do not turn the road wheels when the rotary coupler is removed from the vehicle.**
- **Always ensure the rotary coupler is removed and installed in its centered position and with the front road wheels in a straight ahead position - refer to the 'SRS Repairs' section of this manual for the correct removal and installation procedure.**
- **If a new rotary coupler is being installed, ensure the locking tab holding the coupler's rotational position is not broken; units with a broken locking tab should not be used.**

WARNING LABELS

Warning symbols relating to the SRS system are displayed at various positions in the vehicle. SRS components have additional warning labels displayed on them to indicate that particular care is needed when handling them. These include airbag modules, DCU and the rotary coupler.

The following warning labels may be displayed together or individually at various locations on the vehicle:



M01 0133

A - The need for caution when working in close proximity to SRS components.

B - Refer to the publication where the procedures, instructions and advice can be found (usually Workshop Manual or Owner's Handbook) for working on the SRS system.

C - Do not use rear facing child seats in the front passenger seat if the vehicle is fitted with a passenger airbag.

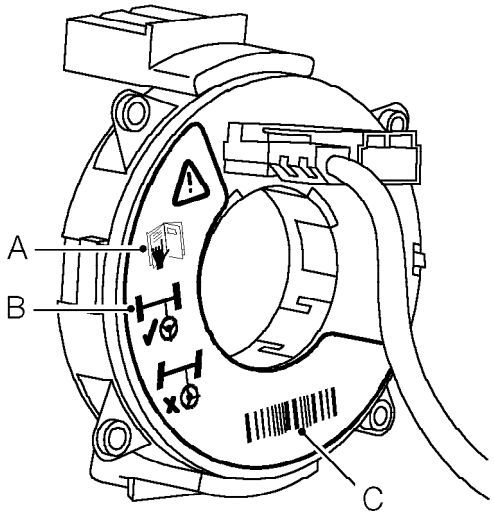
WARNING: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

NOTE: The following list indicates current locations for warning labels. Exact positions may vary dependent on legislation and market trends.

Bonnet locking platform

Refer to the Owner's Handbook for information on the airbag system

Rotary Coupler



76M2319

A - SRS - Refer to the Workshop Manual for detailed instructions.

B - Ensure wheels are in the straight ahead position before removal and refitting of the rotary coupler.

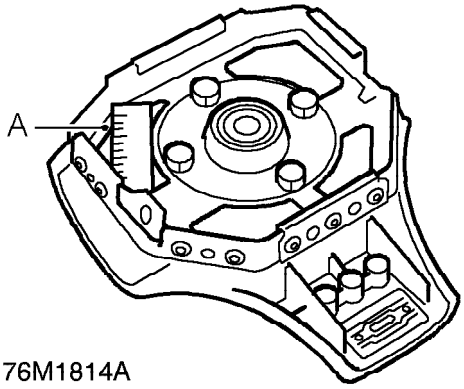
C - MG Rover Part number/Bar code: the code number must be recorded if the rotary coupler is to be replaced.

CAUTION: DO NOT ROTATE THE ROTARY COUPLER MECHANISM

Door glass

Refer to the Owner's Handbook for information on the airbag system.

Airbag module - driver

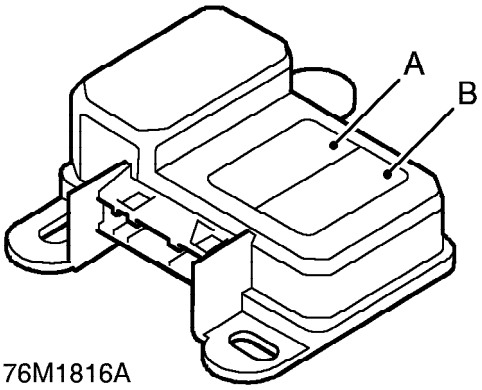


76M1814A

A - MG Rover Part Number / Bar Code - The code number must be quoted when ordering a replacement module.

An 'SRS AIRBAG' legend is also moulded into the centre pad to identify the presence of a driver's airbag.

Diagnostic Control Unit

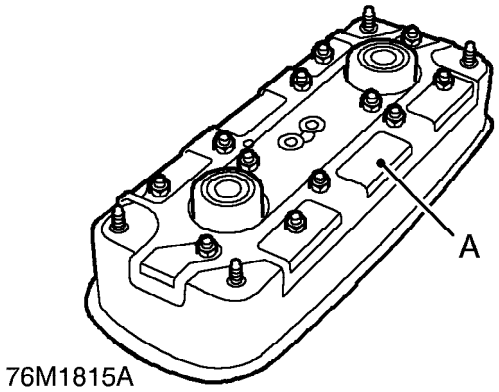


76M1816A

A - Refer to the Workshop Manual for information on the airbag system.

B - MG Rover Part Number / Bar Code - The code number must be recorded if the airbag control and diagnostic unit is to be replaced.

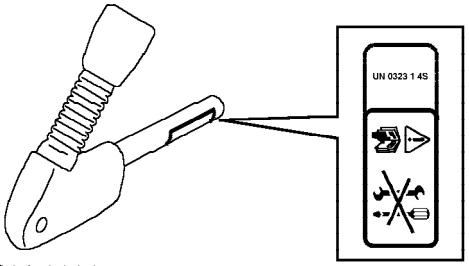
Airbag module - passenger



76M1815A

A - MG Rover Part Number / Bar code - The code number must be quoted when ordering a replacement module.

Front seat belt pre-tensioners



SP01 0006

- Exercise caution.
- Refer to the publication where the procedures, instructions and advice can be found (usually Workshop Manual or Owner's Handbook) for working on the SRS system.
- Do not attempt to repair or disassemble.

Bar codes

Bar codes are fitted to SRS components and other components which are critically related to SRS operation. The code number(s) must be recorded if the component is to be replaced.

VEHICLE RECOVERY

Towing - SRS components not deployed:

Normal towing procedures are unlikely to cause an airbag to deploy. However, as a precaution, switch the ignition off and then disconnect both battery leads. Disconnect the '-ve' lead first.

Towing - SRS components deployed:

If the driver's airbag has been deployed, the vehicle must have a suspended tow. However, as a precaution, switch the ignition off and then disconnect both battery leads. Disconnect the '-ve' lead first.

SRS COMPONENT DEPLOYMENT

If a vehicle is to be scrapped and it contains an undeployed airbag or seat belt pre-tensioner module, the module must be manually deployed. Always observe the following precautions:

WARNING: Only personnel who have undergone the appropriate training should undertake deployment of air bag and seat belt pre-tensioner modules.

WARNING: A deployed airbag or seat belt pre-tensioner is very hot, DO NOT return to a deployed airbag module or seat belt pre-tensioner until at least 30 minutes have elapsed since deployment.

WARNING: Only use approved deployment equipment, and only deploy SRS components in a well ventilated and specially designated area. Ensure SRS components are not damaged or ruptured before deployment. Notify the relevant authorities.

WARNING: If a vehicle is to be scrapped, undeployed airbag modules and seat belt pre-tensioner units must be deployed in accordance with the instructions provided in this manual.

WARNING: Contact with chemicals from deployed and damaged SRS components could present a health hazard, wear protective clothing when handling. DO NOT eat, drink or smoke when handling SRS components.

WARNING: Deployment of airbag modules and seat belt pre-tensioners can cause injury to personnel in the close vicinity of the deploying unit. In case of injury seek urgent medical advice. Possible sources of injury include:

- **Impact - due to inflating airbag or deploying seat belt pre-tensioner operation causing component 'kick'.**
- **Hearing - due to noise produced by deploying airbags and seat belt pre-tensioner units.**
- **Burns - hot component parts and gases.**
- **Irritation to eyes and lungs - from deploying gases or combustion residue.**

WARNING: Ensure the SRS component to be deployed is securely fastened to its mounting.

WARNING: Deployment procedures detailed in this manual should be strictly adhered to. Compliance with the following precautions MUST be ensured:

- **Only use deployment equipment approved for the intended purpose.**
- **Before commencing deployment procedure, ensure the deployment tool functions properly by performing the self test procedure detailed in the 'SRS Repairs' section of this manual.**
- **Deployment of airbag / seat belt pre-tensioner modules should be performed in a well ventilated area which has been specially designated for the purpose.**
- **Ensure the airbag / seat belt pre-tensioner modules are not damaged or ruptured before attempting to deploy**
- **Notify the relevant authorities of the intention to deploy airbag and seat belt pre-tensioner units.**
- **When deploying airbag and seat belt pre-tensioner units, ensure that all personnel are at least 15 metres way from the deployment zone.**
- **Ensure the deployment tool is connected correctly, in compliance with the instructions detailed in this manual. In particular, ensure the deployment tool is not connected to the battery supply before connecting to the airbag or seat belt pre-tensioner module connector.**
- **When deploying seat belt pre-tensioners in the vehicle, ensure the pre-tensioner unit is fully secured to its fixing point.**
- **When removing deployed airbag and seat belt pre-tensioner modules, wear protective clothing. Use gloves and seal deployed units in a plastic bag.**
- **Following deployment of any component of the SRS system within the vehicle, all SRS components must be replaced. DO NOT re-use or salvage any parts of the SRS system.**
- **Do not lean over airbag modules or seat belt pre-tensioner units when connecting deployment equipment.**

SRS COMPONENT REPLACEMENT POLICY

The following information details the policy for replacement of SRS components; either as a result of a vehicle accident or as a result of vehicle age.

Impacts which do not deploy the airbags or seat belt pre-tensioners

Check for structural damage in the area of the impact, paying particular attention to bumper armatures, longitudinals, crash cans and bracketry.

Impacts which deploy the airbags or pre-tensioners

The replacement and inspection policy is dependent on the type and severity of the crash condition. The following guidelines are the minimum that should be exercised as a result of the deployment of specific SRS components.

Front airbag deployment (driver and passenger)

If the front airbags are deployed, the following parts must be replaced:

- Driver airbag module
- Passenger airbag module (where fitted)
- Flyleads (where applicable) connecting front airbag modules to SRS harness
- Front seat buckle pre-tensioners
- Driver's seat belt retractor
- Rotary coupler
- SRS DCU

In addition, the following should be inspected for damage and replaced as necessary.

- Front passenger's seat belt retractor (webbing, tongue latching and anchorage point)
- Fascia moulding adjacent to passenger airbag module (where fitted)
- Steering wheel (if damage is evident)
- Front seat frames and head restraints (if there is evidence of damage to the seat frame or cushion pan)
- Steering column (if adjustment is lost or there are signs of collapse)

Rear impacts

Rear impacts may cause the seat belt pre-tensioners to deploy. If this occurs, both pre-tensioner units must be replaced. In addition, the following components should be inspected for damage and replaced as necessary:

- Seat frames
- Seat belts (retractors, webbing, tongue latching and body anchorage points)
- SRS DCU

Periodic replacement of SRS components

The performance of the propellants within airbags and pre-tensioners will deteriorate over a period of time. As a result, it is essential that the airbags and pre-tensioners are periodically replaced to maintain occupant safety. Airbags, seat belt pre-tensioners and the rotary coupler should be replaced at 15 year intervals.

AIR CONDITIONING SYSTEM PRECAUTIONS

General

The air conditioning system contains fluids and components which could be potentially hazardous to the service engineer or the environment if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of the Air Conditioning operating conditions and components fitted to the vehicle.

Where necessary, additional specific precautions are detailed in the relevant sections of this Manual, which should be referred to prior to commencing repair operations.

The refrigerant used in the air conditioning system is HFC-134a (Hydrofluorocarbon) R134a.

WARNING: Servicing must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

WARNING: R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing, consisting of face protection, heat proof gloves, rubber boots and rubber apron or waterproof overalls, must be worn when carrying out operations on the air conditioning system.

Remedial actions

If an accident involving R134a should occur, conduct the following remedial actions:

- If liquid R134a enters the eye, do not rub it. Gently run large quantities of eye wash over the affected eye to raise the temperature. If an eye wash is not available, cool clean water may be used to flush the eye. After rinsing, cover the eye with a clean pad and seek immediate medical attention.
- If liquid R134a is splashed onto the skin, run large quantities of water over the affected area to raise the temperature. Implement the same action if the skin comes in contact with discharging cylinders. Wrap the contaminated body parts in blankets (or similar materials) and seek immediate medical attention.
- If the debilitating effects of inhalation of R134a vapour is suspected, seek fresh air. If the affected person is unconscious, move them away from the contaminated area to fresh air and apply artificial respiration and / or oxygen and seek immediate medical attention.

WARNING: Due to its low evaporating temperature, R134a must be handled with care. R134a splashed on any part of the body will cause immediate freezing of that area. Also, refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.

Service precautions

Observe the following precautions when handling components used in the air conditioning system:

- Air conditioning units must not be lifted by their hoses, pipes or capillary lines.
- Hoses and lines must not be subjected to any twist or stress; the efficiency of the system will be impaired by kinks or restrictions. Ensure that hoses are correctly positioned before tightening couplings, and ensure that all clips and supports are utilised.
- Flexible hoses should not be positioned close to the exhaust manifold (less than 100 mm) unless protected by heat shielding.
- Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of components and panels may transmit noise and so must be eliminated.
- The appropriate torque wrench must be used when tightening refrigerant connections to the stipulated value. An additional spanner must be used to hold the union to prevent twisting of the pipe when tightening connections.
- Before connecting any hose or pipe, ensure that refrigerant oil is applied to the seat of the new 'O' rings **BUT NOT** to the threads of the connection.
- All protective plugs must remain in place to seal the component until immediately prior to connection.
- Ensure components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters it.
- Components must not remain uncapped for longer than 15 minutes. In the event of a delay, the caps must be fitted.
- When disconnecting, immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.
- The receiver / drier contains dessicant which absorbs moisture. It must be positively sealed at all times. A receiver / drier that has been left uncapped must not be used, fit a new unit.
- The receiver / drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.
- Whenever the refrigerant system is opened, the receiver / drier must be renewed immediately before evacuating and recharging the system.
- Use alcohol and a clean lint-free cloth to clean dirty connections.
- Ensure that all new parts are marked for use with R13a.

When a major repair has been completed, a leak test should be conducted; refer to the 'AIR CONDITIONING' section of this manual for the correct procedure.

AIR CONDITIONING COMPRESSOR REPLACEMENT

Air Conditioning Compressor Replacement

A new compressor is supplied filled with a full charge of (X cm^3) of refrigerant oil. **Refer to the 'CAPACITIES, FLUIDS AND LUBRICANTS' section of this manual for the actual capacities.**

A calculated quantity of oil must be drained from the new compressor before fitting. To calculate the quantity of oil to be drained:

1. Remove the drain plug from the old compressor.
2. Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to ensure the compressor is completely drained.
3. Note the quantity of oil drained (Y cm^3).
4. Calculate the quantity of oil to be drained from the new compressor using the following formula:
   X cm^3 - (Y cm^3 + 20 cm^3) = Q cm^3
5. Remove the drain plug from the new compressor and drain Q $cm^3$of oil.
6. Fit and tighten the compressor drain plug.

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ENGINE - K SERIES

1.6 MPi

Type	16 valve DOHC
Cylinder arrangement	4 in line - transverse, No.1 cylinder at front of engine
Bore - liner	80.00 mm
Stroke	79.00 mm
Capacity	1589 cm^3
Firing order	1 - 3 - 4 - 2
Rotation	Clockwise, viewed from the front of the engine
Compression ratio	10.5 : 1
Idle speed	
1.6 MPi MEMS 3	825 ± 50 rpm
Maximum power	85 kW (114 bhp) @ 6,250 rev/min.
Maximum torque	145 Nm @ 4,700 rev/min.
Maximum engine speed	6,800 rev/min.

1.8 MPi

Type	16 valve DOHC
Cylinder arrangement	4 in line - transverse, No.1 cylinder at front of engine
Bore - liner	80.00 mm
Stroke	89.30 mm
Capacity	1796 cm^3
Firing order	1 - 3 - 4 - 2
Rotation	Clockwise, viewed from the front of the engine
Compression ratio	10.5 : 1
Idle speed	
1.8 MPi MEMS 3 (Manual and Stepspeed)	825 ± 50 rpm
Maximum power:	
Manual Transmission	100 kW (134 bhp) @ 6,750 rev/min.
Stepspeed (Em-CVT)	88 kW (118 bhp) @ 5,500 rev/min.
Maximum torque:	
Manual Transmission	165 Nm @ 5,000 rev/min.
Stepspeed (Em-CVT)	165 Nm @ 3,000 rev/min.
Maximum engine speed:	
Manual transmission	6,800 rev/min.
Stepspeed (Em-CVT)	6,000 rev/min.

1.8 VVC

Type	16 valve DOHC with Variable Valve Control on inlet valves
Cylinder arrangement	4 in line - transverse, No.1 cylinder at front of engine
Bore - liner	80.00 mm
Stroke	89.30 mm
Capacity	1796 cm^3
Firing order	1 - 3 - 4 - 2
Rotation	Clockwise, viewed from the front of the engine
Compression ratio	10.6 : 1
Idle speed	
1.8 VVC MEMS3	925 ± 50 rpm
Maximum power	118 kW (158 bhp) @ 6,900 rev/min.
Maximum torque	174 Nm @ 4,700 rev/min.
Maximum engine speed	7,100 rev/min.

Engine weight - nominal (fully dressed, wet)	108 kg

Engine dimensions:

Length (nominal	654 mm
Width (nominal)	600 mm
Height (nominal)	615 mm

Cylinder block

Material	Aluminium alloy
Cylinder liner type	Damp, bottom half stepped - sliding fit into lower part of cylinder block
Cylinder liner bore:	
RED grade A	80.000 - 80.015 mm
BLUE grade B	80.016 - 80.030 mm

Cylinder head

Material	Aluminium alloy
Maximum warp	0.05 mm
Cylinder head height (New)	118.95 - 119.50 mm
Reface limit	0.20 mm

Crankshaft

End-float	0.10 - 0.25 mm
Service limit	0.34 mm

Main bearings

Quantity	5
Type	Steel backed, aluminium / tin lined, oil grooves in upper halves, plain in bearing caps
Thrust washers	Halves at No.3 main bearing
Thrust washer halves thickness	2.61 - 2.65 mm
Main journal tolerance:	
Grade 1	48.000 - 48.007 mm
Grade 2	47.993 - 48.000 mm
Grade 3	47.986 - 47.993 mm
Clearance in bearings	0.013 - 0.043 mm
Maximum out of round	0.010 mm

Big-end bearings

1.6:

Big-end journal diameter	47.986 - 48.007 mm
Big-end journal tolerances:	
- Grade A	43.000 - 43.007 mm
- Grade B	42.993 - 43.000 mm
- Grade C	42.986 - 42.993 mm
Clearance in bearings	0.021 - 0.049 mm
Maximum out of round	0.010 mm

1.8:

Big-end journal diameter	47.986 - 48.007
Big-end journal tolerances:	
- Grade A	48.000 - 48.007 mm
- Grade B	47.993 - 48.000 mm
- Grade C	47.986 - 47.993 mm
Clearance in bearings	0.021 - 0.049 mm
Maximum out of round	0.010 mm

Connecting rods

Type	Horizontally split big-end, plain small end
Big-end bearing / Connecting rod end-float	0.10 - 0.25 mm

Pistons

Type	Aluminium alloy, tin plated, thermal expansion with offset gudgeon pin
Piston diameter:	
Grade A	79.975 - 79.990 mm
Grade B	79.991 - 80.005 mm
Clearance in bore	0.01 - 0.04 mm
Maximum ovality	0.30 mm

Piston rings

Type:	
Top compression ring	Barrel faced, granulite coated
2nd compression ring	Tapered, phosphate coated
Oil control ring	Nitrided ring with radii and spring
New ring to groove clearance:	
Top compression ring	0.040 - 0.072 mm
2nd compression ring	0.030 - 0.062 mm
Oil control ring	0.010 - 0.180 mm
Ring fitted gap 20 mm from top of bore:	
Top compression ring	0.20 - 0.35 mm
2nd compression ring	0.28 - 0.48 mm
Oil control ring	0.15 - 0.40 mm
Piston ring width:	
Top compression ring	0.978 - 0.990 mm
2nd compression ring	1.178 - 1.190 mm
Oil control ring	0.33 - 0.38 mm

Gudgeon pins

Type	Semi-floating, off-set towards thrust side
Fit in connecting rod	Interference fit
Diameter:	
RED	17.997 - 18.000 mm
GREEN	17.994 - 17.997 mm
Length	52.3 - 52.6 mm

Camshaft

1.6 & 1.8 without VVC:

Camshaft position	Camshaft incorporates target / reluctor ring for camshaft sensor
Drive	Toothed belt driven from crankshaft gear, automatically tensioned
Bearings	6 per camshaft, direct line bored
Bearing clearance	0.060 - 0.094 mm
- Service limit	0.15 mm
End-float	0.06 - 0.19 mm
- Service limit	0.3 mm

1.8 with VVC:

Inlet camshaft end-float	0.03 - 0.15 mm
- Service limit	0.25 mm
Exhaust camshaft end-float	0.06 - 0.19 mm
- Service limit	0.3 mm
Bearing clearance:	
Inlet camshaft (25 mm diameter journals)	0.025 - 0.60 mm
- Service limit	0.1 mm
Inlet camshaft (40 mm diameter journals)	0.03 - 0.07 mm
- Service limit	0.1 mm
Exhaust camshaft	0.060 - 0.094 mm
- Service limit	0.15 mm

Tappets

Type	Self-adjusting lightweight hydraulic tappets operated directly from camshafts
Tappet outside diameter	32.959 - 32.975 mm

Valve Springs

K16 without VVC

Colour code	Plain
Free length	50.0 mm
Fitted length	37.0 mm
Load - valve closed	250 ± 12 N
Load - valve open	450 ± 18 N

K16 - with VVC:

Colour code	Blue
Free length	47.6 mm
Fitted length	37.0 mm
Load - valve closed	210 ± 13 N
Load - valve open	440 ± 22 N

Valves

Inlet valve stem diameter	5.952 - 5.967 mm
Exhaust valve stem diameter	5.947 - 5.962 mm
Valve guide inside diameter	6.000 - 6.025 mm
Inlet valve stem to guide clearance	0.033 - 0.063 mm
- Service limit	0.07 mm
Exhaust valve stem to guide clearance	0.038 - 0.078 mm
-Service limit	0.11 mm
Valve guide fitted height	6.00 mm
Valve stem fitted height	38.93 - 39.84 mm
-Service limit	40.10 mm
Valve face angle	45°
Valve seat angle (inlet and exhaust)	45°
Valve seat width (inlet)	1.2 mm
Valve seat width (exhaust)	1.6 mm

Valve timing 1.6 & 1.8 MPi

Inlet	
Opens	11° BTDC
Closes	61° ABDC
Exhaust	
Opens	21° BBDC
Closes	51° ATDC
Valve open period	252°
Maximum valve lift	9.5 mm - inlet
	9.5 mm - exhaust

Valve timing - 1.8 VVC

Inlet	
Opens	0° ATDC at minimum period
Closes	40° ABDC at minimum period
Exhaust	
Opens	51° BBDC
Closes	21° ATDC
Valve open period	
Variable period - inlet	220° to 295°
Valve period - exhaust	252°
Variable overlap	21° to 58°
Valve lift	9.5 mm - inlet
	9.2 mm - exhaust

ENGINE - LUBRICATION

System type	Wet sump, crankshaft driven eccentric rotor pump
Pump outer rotor to housing clearance	0.28 - 0.36 mm
Pump inner rotor tip clearance	0.05 - 0.13 mm
Pump rotor end-float	0.02 - 0.06 mm
Relief valve opening pressure	4.1 bar
Oil pressure at idle	1.7 to 3.5 bar
Relief valve spring length	38.9 mm
Maximum oil pressure at 6500 rev/min	7.0 bar (below 40° C)
Oil pressure warning light switch opens	0.3 - 0.5 bar
Oil filter	Full flow disposable screw-on canister

FUEL SYSTEM

System	Returnless Multipoint Fuel Injection, electronically controlled with electro-mechanical fuel injectors.
Electronic fuel injection data	***See Engine tuning data.***
Fuel pump	
Type	Continuous flow, electrically driven roller vane pump submerged in fuel tank.
Pump maximum pressure at 13.5 V	3.5 bar
Regulated injection pressure	3.0 ±0.2 bar
Fuel pump delivery	39 litres @ 3.0 bar
Fuel filter	In-tank lifetime fit; mesh area 584 cm^2 , mesh size 8 to 10 microns
Air cleaner	Paper element type
Fuel grade	95 RON minimum - **UNLEADED** fuel to EN228 specification

CAUTION: Serious damage to the engine may occur if a lower octane number fuel than recommended is used. Serious damage to the catalyst will occur if LEADED fuel is used.

COOLING SYSTEM

Pressure cap opens	1.03 bar
Thermostat	
starts to open	86 to 90° C
fully open	102° C
Cooling fan switch, operating temperature	ON - 102° C, OFF - 96° C
Second cooling fan switch, operating temperature	ON - 117° C, OFF - 112° C
Engine bay fan switch, operating temperature	ON - 75° C, OFF - 65° C
Engine bay ambient air, warning light switch:	
MPi	ON - 130° C, OFF - 110° C
VVC	ON - 85° C, OFF - 75° C

CLUTCH

Type	Single plate diaphragm spring, hydraulically operated
Clutch plate diameter	
1.6 MPi	200 mm
1.8 MPi & VVC	215 mm
Diaphragm finger clearance	1.00 mm
Diaphragm finger height	
New	29.1 - 32.0 mm
Service limit	36.5 mm
Clutch plate thickness	
New	7.40 - 6.90 mm
Service limit	5.60
Rivet depth	
New	1.00 mm
Service limit	0.20 mm
Clutch plate run-out	
New	0.80 mm
Service limit	1.00 mm
Pressure plate warping - service limit	0.18 mm

MANUAL GEARBOX

1.6 MPi

Gearbox code	C6 BP
Gear ratios	
Fifth	0.765 : 1
Fourth	1.033 : 1
Third	1.308 : 1
Second	1.842 : 1
First	3.167 : 1
Reverse	3.000 : 1

1.8 MPi

Gearbox code	C4 BP
Gear ratios	
Fifth	0.765 : 1
Fourth	1.033 : 1
Third	1.308 : 1
Second	1.842 : 1
First	3.167 : 1
Reverse	3.000 : 1

1.8 VVC

Gearbox code	C4 BP
Gear ratios	
Fifth	0.765 : 1
Fourth	1.033 : 1
Third	1.308 : 1
Second	1.842 : 1
First	3.167 : 1
Reverse	3.000 : 1

STEPSPEED (Em-CVT) GEARBOX

1.8 MPi

Gearbox code	VT1-11A
Gear ratios (Stepspeed manual mode only)	
Sixth	0.518 : 1
Fifth	0.681 : 1
Fourth	0.845 : 1
Third	1.123 : 1
Second	1.520 : 1
First	2.416 : 1
Reverse	2.658 : 1
Em-CVT max.	0.443 : 1

GEARBOX - LUBRICATION

Manual Gearbox

Capacities

Refill	2.2 litres
Dry	2.4 litres

Fluids and Lubricants

Gearbox oil specification	Texaco MTF 94 Caltex MTF94 Unipart MTF94
Gear linkage grease specification	Unipart multi-purpose lithium grease or equivalent.

Stepspeed (Em-CVT)

Capacities

Refill - gearbox only	4.5 litres
Fluid cooler and lines	1.0 litre

Fluids and Lubricants

Gearbox fluid specification	Esso EZL799 Unipart CVT Esso CVT

FINAL DRIVE

Manual gearbox - 1.6 MPi

Gearbox code	C6 BP	
Ratio	3.938 : 1	
Road speed at 1000 rev/min		
Fifth	35.6 km/h	22.2 mph
Fourth	26.4 km/h	16.4 mph
Third	20.8 km/h	13.0 mph
Second	14.8 km/h	9.2 mph
First	8.6 km/h	5.4 mph

Manual gearbox - 1.8 MPi

Gearbox code	C4 BP	
Ratio	4.200 : 1	
Road speed at 1000 rev/min (Vehicles with 205 tyres)		
Fifth	35.6 km/h	22.2 mph
Fourth	26.4 km/h	16.4 mph
Third	20.8 km/h	13.0 mph
Second	14.8 km/h	9.2 mph
First	8.6 km/h	5.4 mph
Road speed at 1000 rev/min (Vehicles with 215 tyres)		
Fifth	35.1 km/h	21.8 mph
Fourth	26.0 km/h	16.2 mph
Third	20.5 km/h	12.8 mph
Second	14.6 km/h	9.1 mph
First	8.5 km/h	5.3 mph

Manual gearbox - 1.8 VVC

Gearbox code	C4 BP	
Ratio	4.200 : 1	
Road speed at 1000 rev/min (Vehicles with 205 tyres)		
Fifth	33.4 km/h	20.8 mph
Fourth	24.8 km/h	15.4 mph
Third	19.5 km/h	12.1 mph
Second	13.9 km/h	8.6 mph
First	8.1 km/h	5.0 mph
Road speed at 1000 rev/min (Vehicles with 215 tyres)		
Fifth	32.9 km/h	20.5 mph
Fourth	24.4 km/h	15.1 mph
Third	19.2 km/h	12.0 mph
Second	13.7 km/h	8.5 mph
First	7.9 km/h	4.9 mph

Stepspeed (Em-CVT) - 1.8 MPi

Gearbox code	VT1-11A
Ratio (Manual mode)	5.763 : 1

Road speed at 1000 rev/min
(Stepspeed mode with 205 tyres only)

Sixth	35.9 km/h	22.3 mph
Fifth	27.4 km/h	17.0 mph
Fourth	22.1 km/h	13.7 mph
Third	16.6 km/h	10.3 mph
Second	12.3 km/h	7.6 mph
First	7.7 km/h	4.8 mph

Road speed at 1000 rev/min
(Stepspeed mode with 215 tyres only)

Sixth	35.4 km/h	22.0 mph
Fifth	27.0 km/h	16.8 mph
Fourth	21.7 km/h	13.5 mph
Third	16.3 km/h	10.2 mph
Second	12.1 km/h	7.5 mph
First	7.6 km/h	4.7 mph

STEERING

NOTE: The following steering geometry settings are given in degrees and minutes, decimal parts of a degree and millimetres. Steering and suspension geometry settings are for a vehicle at unladen weight.

Type	Speed sensitive, electric power assisted rack and pinion	
Front wheel alignment - toe out - per side	0° 0' ±0° 6'	0° ±0.1° 0 mm ±0.665 mm (15" wheels) 0 mm ±0.709 mm (16" wheels)
Front wheel camber - negative	0° 30' ±0° 30'	0.50° ±0.50° 3.315 mm ±0.315 mm
Front wheel caster - positive	4° 50' ±1°	4.83° ±1.0° 29.98 mm ±6.71
King pin inclination	11° 40'	11.71° 78.71 mm
Overall steering ratio	17.0 : 1	
Rear wheel alignment - toe-in - per side	0° 15' ±0° 6'	0.25° ±0.1° 1.662 mm ±0.67 mm (15" wheels) 1.772 mm ±0.71 mm (16" wheels)
Rear wheel camber - negative	1° 0' ±0° 30'	1.0° ±0.50° 6.71 mm ±0.315 mm
Steering wheel diameter	360 mm	

Power Assisted Steering

Type	'Quick' rack and pinion assembly with electric motor power assistance to provide Speed Sensitive Steering controlled by a dedicated Electronic Control Unit (ECU) using a torque sensor signal and road speed signal to compute level of steering assistance.

FRONT SUSPENSION

Type	Coil spring over gas filled damper, located by double wishbones and with anti-roll bar.
Trim height*	
Standard suspension	358 mm ± 10 mm
Sports suspension	348 mm ± 10 mm
Front damper colour codes	Blue
Front coil spring data:	
Total coils	7.7
Active coils	6.45
Wire diameter	12 mm
Free length	241.9 mm
Anti-roll bar diameter	20 mm

* = Height to wheel arch from hub centre at unladen weight

REAR SUSPENSION

Type	4-link with coil spring over gas-filled damper and with anti-roll bar.
Trim height*	
Standard suspension	353 mm ± 10 mm
Sports suspension	343 mm ± 10 mm
Rear damper colour codes	Red
Front coil spring data:	
Total coils	7.7
Active coils	6.45
Wire diameter	14 mm
Free length	228.3 mm
Anti-roll bar diameter	18 mm

* = Height to wheel arch from hub centre at unladen weight

BRAKES

Front brakes (Standard)

Type	Ventilated disc with 2 pin-slider caliper
Piston diameter	48 mm
Disc diameter	240 mm
Disc thickness new	22 mm
Disc minimum thickness	20 mm
Pad minimum thickness	3 mm

Front brakes (Sports)

Type	Ventilated disc with 4 pin-slider (opposed) caliper
Piston diameter	32 mm
Disc diameter	304 mm
Disc thickness new	24 mm
Disc minimum thickness	22 mm
Pad minimum thickness	2.5 mm

Rear brakes

Type	Solid discs with 2 pin-slider caliper
Piston diameter	38 mm
Disc diameter	240 mm
Disc thickness new	10 mm
Disc minimum thickness	8 mm
Pad minimum thickness	3 mm

Brake servo

Servo boost ratio	4.6 : 1
Anti-lock brake system (where fitted)	Bosch ABS5.3 three-channel electronically controlled
ABS sensor to reluctor ring clearance	0.5 mm

Brake master cylinder

Bore diameter	23.8 mm

Handbrake

Type	Cable operated on rear discs
Caliper clearance per side	1 - 2 mm

WHEELS

Front	6.0J x 15 alloy 7.0J x 16 alloy
Rear	6.0J x 15 alloy 7.0J x 16 alloy
Spare*	5.5J x 14 steel 7.0J x 16 alloy
Road wheel nut torque	70 Nm

TYRE SIZES

Front	185/55 R15 82V 195/45 R16 84V
Rear	205/50 R15 86V 215/40 ZR16 82W
Spare*	
5.5J x 14 steel	175/65 R14 82T
7.0J x 16 alloy	195/45 R16 84V

NOTE: * Some vehicles are not fitted with a spare wheel, but come equipped with an Instant Mobility System (IMS) instead. Refer to the Owner's Handbook for details of how to use the IMS.

CAUTION: The space-saver spare wheel is for temporary use only. Maximum road speed should be limited to 50 mph (80 km/h) when a space-saver tyre is in use. No more than one temporary space-saver spare wheel may be fitted at any one time.

CAUTION: Refer to the Owner's Manual for all Cautions and Warnings related to the IMS. Always keep to the recommended speed and adhere to the precautions stipulated when a defective tyre has been inflated using the IMS.

TYRE PRESSURES

Normal driving conditions:

Front	1.8 bar	26 lbf/in^2
Rear	2.5 bar	36 lbf/in^2
Spare	2.2 bar	32 lbf/in^2

High Speed:

Front	1.9 bar	28 lbf/in^2
Rear	2.5 bar	36 lbf/in^2

Normal driving conditions: - up to two passengers and luggage
High Speed: - driving at speeds in excess of 100 mph (160 km/h)

WARNING: The steel spare wheel supplied with cars fitted with alloy wheels is for temporary use only and must be changed as soon as possible after fitting. The car MUST be driven with caution and speed MUST NOT exceed 50 mph (80 km/h) with the spare wheel fitted. No more than one temporary spare wheel may be fitted at any one time. Replacement tyres fitted to the temporary use spare wheel must be of the same make and specification as those originally fitted.

CAUTION: Refer to the Owner's Manual for all Cautions and Warnings related to the IMS. Always keep to the recommended speed and adhere to the precautions stipulated when a defective tyre has been inflated using the IMS.

AIR CONDITIONING

Type	CFC free, sealed, closed loop system incorporating pressure and temperature sensors
Refrigerant type	HFC - R134a
Refrigerant charge quantity*:	
Manual gearbox	620 ± 10 grammes
Em-CVT gearbox	720 ± 10 grammes
Lubricating oil	Seiko Seiki SK-20, Unipart SK-20, Idemitsu SK-20
System oil fill quantity	170 cm^3
Trinary switch operating pressures:	
Low	
Closing pressure	2.0 bar (200 kPa, 29 lbf.in^2)
Opening Pressure	2.4 bar (240 kPa, 34.8 lbf.in^2)
Cooling fans switched ON in parallel	19 bar (1.90 MPa, 275.5 lbf.in^2
High	
Opening Pressure	27 bar (2.7 MPa, 391.5 lbf.in^2)
Closing Pressure	21 bar (2.1 MPa, 304.5 lbf.in^2)

ELECTRICAL

System	12 volt, negative earth

Battery

Type	YUASA H4 sealed for life
Capacity	45 Ah

Alternator

Type	Magnetti Marelli 11 5i 85
Maximum output	85 amp

Starter motor

Type	M79
Power	1.4 kW

DIMENSIONS

Overall length	3943 mm	155.2 in
Overall width (excluding door mirrors)	1626 mm	64 in
Overall width (including door mirrors)	1807 mm	71.1 in
Overall height*		
Standard specification		
Soft top	1261 mm	49.7 in
Hard Top	1264 mm	49.8 in
Sports specification		
Soft Top	1249 mm	49.2 in
Hard Top	1252 mm	49.3 in
Ground clearance*		
Standard specification	124 mm	4.9 in
Sports specification	114 mm	4.5 in
Wheelbase	2375 mm	93.5 in
Turning circle, kerb to kerb	10.56 m	34 ft 7.8 in
Track (except for models fitted with ultralight wheels)		
Front		
Standard suspension	1403 mm	55.2 in
Sports suspension	1405 mm	55.3 in
Rear		
Standard suspension	1409 mm	55.5 in
Sports suspension	1410 mm	55.5 in
Track (models fitted with ultralight wheels)		
Front		
Standard suspension	1407 mm	55.4 in
Sports suspension	1409 mm	55.5 in
Rear		
Standard suspension	1413 mm	55.6 in
Sports suspension	1414 mm	55.7 in
Overhang		
Front	841 mm	33.1 in
Rear	726 mm	28.6 in

* = at unladen weight

WEIGHTS

Unladen vehicle weight[1]		
1.6 MPi	1095 - 1150 kg	2414 - 2536 lb
1.8 MPi with manual gearbox	1105 - 1150 kg	2435 - 2535 lb
1.8 VVC	1115 - 1285 kg	2455 - 2830 lb
1.8 MPi Stepspeed (Em-CVT)	1150 - 1240 kg	2535 - 2730 lb
Maximum gross vehicle weight (GVW)		
1.6 & 1.8 MPi (with manual gearbox)	1320 kg	2911 lb
1.8 VVC & 1.8 MPi with Stepspeed (Em-CVT)	1390 kg	3065 lb
Maximum front axle load		
1.6 & 1.8 MPi (with manual gearbox)	600 kg	1323 lb
1.8 VVC & 1.8 MPi with Stepspeed (Em-CVT)	610 kg	1345 lb
Maximum rear axle load		
1.6 & 1.8 MPi (with manual gearbox	740 kg	1632 lb
1.8 VVC & 1.8 MPi with Stepspeed (Em-CVT)	790 kg	1742 lb
Maximum bootlid load[2]	20 kg	45 lb
Optional hard-top weight	20 kg	45 lb

[1] = no occupants and fuel tank 90% full
[2] = when approved luggage rack is fitted

BULBS

Bulb location	Bulb specification
Headlamp dip beam	12V 55W H7 Halogen
Head lamp main beam	12V 55W H1 Halogen
Side light	12V 5W
Front direction indicator	12V 21W
Rear direction indicator	12V 21W
Licence plate	12V 5W
Brake light[1]	12V 21W
Front fog light	12V 55W H1 Halogen
Rear fog light	12V 21W
Reverse light	12V 21W
Tail light	12V 5W
Footwell	12V 5W
Glovebox	12V 5W
Front load space	12V 10W
Rear load space	12V 10W
Side repeater lamps	12V 5W
Interior/courtesy lamp	12V 5W

[1] = the centre high mounted stop lamp (CHMSL) uses LEDs

ENGINE TUNING DATA

Model:1.6 MPi, 1.8 MPi and VVC MEMS 3

Engine

Type/Capacity	
1.6 MPi	1.6 K16 / 1589 cm^3
1.8 MPi & VVC	1.8 K16 / 1796 cm^3
Firing order	1-3-4-2
Compression ratio	10.5 : 1 ±0.5
Exhaust gas CO content at idle	0.5 % - maximum
Ignition timing at idle *	
vacuum connected	12° BTDC

Ignition Coil

Type	Nippon Denso
Part number	NEC 100730
Primary resistance	0.7 Ω
Secondary resistance	10 kΩ

Spark Plugs

Type	Unipart GSP 66527
Gap	1.0 ±0.05 mm

Engine Management System

Type	MEMS 3 breakerless, electronic
Fuel injection	Indirect multi-port fuel injection
MEMS ECM	Rover/Motorola NNN 100901
Injectors	MJY 100550
Fuel pump	WFX 100670
Fuel pressure regulator	MKW 10016
fuel pressure	3.0 ±0.2 bar
Throttle position sensor	MJC 100020
Sensor Values:	
Total track resistance	4 kΩ ±20%
Sensor supply	5 Volts ±4%
Intake air temperature sensor	NNK 10001
Engine coolant temperature sensor	MEK 100170
Crankshaft position sensor	NSC 100630
Camshaft position sensor	NSC 100610+0
Oxygen sensor	MHK 100720
Manifold absolute pressure sensor	MHK 100820
Oil temperature sensor	
MPi MEMS3	MEK 100170
VVC MEMS3 (HCU)	MEK 100160
Ambient air (engine bay) temperature sensor	MHK 100520
Fuel grade	95 RON minimum - **UNLEADED** fuel

CAUTION: Serious damage to the engine may occur if a lower octane number fuel than recommended is used. Serious damage to the catalyst will occur if LEADED fuel is used.

* = Ignition timing in crankshaft degrees.

Refer to appropriate section heading for component torque figures, e.g.
Road wheel nuts - refer to **SUSPENSION**
Exhaust front pipe to manifold - refer to **MANIFOLD AND EXHAUST**

ENGINE

Camshaft cover, bolts	9 Nm *
Camshaft Cover Plate	12 Nm
Camshaft gear bolt	
8 mm bolts	33 Nm
10 mm bolts	65 Nm
Crankshaft pulley bolt	205 Nm
Cylinder head bolts, tighten progressively	
1st stage	20 Nm *
2nd stage	180°*
3rd stage	180°*
Dipstick/filler tube mounting bracket	10 Nm
Engine earth lead to cylinder block bolt	25 Nm
Engine harness to oil pump bolt	10 Nm
Flywheel to crankshaft bolts	85 Nm *
Flywheel cover plate	9 Nm
Lifting bracket	9 Nm
Oil cooler to cylinder block (VVC)	25 Nm
Oil cooler unions (VVC)	18 Nm
Oil pressure relief valve sealing plug	25 Nm
Oil pressure switch	12 Nm
Oil pump to cylinder block bolts	10 Nm +
Sump bolts	25 Nm *
Sump to gearbox, bolts	45 Nm
Sump drain plug	25 Nm
Tensioner pulley backplate bolt -	
Manual timing belt tensioner (VVC)	10 Nm
Tensioner pulley Allen screw -	
Manual timing belt tensioner (VVC)	45 Nm
Timing belt tensioner bolt -	
Automatic timing belt tensioner	25 Nm +
Timing belt, upper front cover	9 Nm
Timing belt, front lower cover	9 Nm
Timing belt rear cover	9 Nm
Torsion damper to flywheel	22 Nm *

* Tighten in sequence
+ New Patchlok bolt must be fitted.

Engine Mountings

Engine LH mounting to bracket bolts	45 Nm
Engine LH mounting bracket to gearbox bolts (manual gearbox models)	45 Nm
Engine LH mounting centre bolt (manual gearbox models)	82 Nm
Engine mounting restraining loop bolts	45 Nm
Gearbox mounting to LH buttress nut and bolt (Em-CVT only)	82 Nm
LH mounting to engine	45 Nm
LH buttress to subframe	45 Nm
LH mounting to gearbox bracket (Em-CVT only)	45 Nm
Rear engine steady to bracket on sump	85 Nm
Rear engine steady to subframe	85 Nm
Rear engine mounting tie-rod	45 Nm
Rear engine mount to subframe bolts	85 Nm
Rear engine mount to sump	80 Nm
RH buttress to subframe	45 Nm
RH engine mounting bracket to hydramount	82 Nm
RH engine steady to buttress	85 Nm
RH engine steady to engine mounting bracket	85 Nm
Top arm to engine	100 Nm
Top arm to hydramount	82 Nm

* Tighten in sequence
+ New Patchlok bolt must be fitted.

MODULAR ENGINE MANAGEMENT SYSTEM - MEMS 3

Camshaft position sensor	9 Nm
Crankshaft position sensor	6 Nm
ECM bracket bolts	8 Nm
Engine coolant temperature sensor	6 Nm
Fuel filter, inlet and outlet union	30 Nm
Fuel pump cover bolts	10 Nm
Fuel pump locking ring	35 Nm
Fuel rail to inlet manifold	10 Nm
Fuel rail to fuel feed pipe	8 Nm
HO_2 Sensors (pre and post catalyst)	55 Nm
Hydraulic Control Unit Solenoid nuts (VVC)	12 Nm
Idle air control valve	1.5 Nm
Ignition coil bolts	8 Nm
Ignition coil and ht lead cover bolts	8 Nm
Intake air temperature sensor	7 Nm
Manifold absolute pressure sensor (VVC)	3 Nm
Oil temperature sensor - VVC	15 Nm
Spark plugs	27 Nm
Throttle body	9 Nm *
Throttle position sensor screws	1.5 Nm

Catalytic Converter

Catalyst overheat sensor	30 Nm
Catalytic converter to front pipe	50 Nm
Catalytic converter to silencer	50 Nm

Fuel Tank

Bulkhead closing panel	9 Nm
Filler hose to tank	3 Nm
Filler neck to wing	3 Nm
Fuel pump cover to body	10 Nm
Fuel pump lock ring	35 Nm
Fuel tank retaining strap	10 Nm

Throttle Cable

Throttle pedal to bulkhead fixing	6 Nm
Throttle pedal bracket to pedal box	22 Nm

COOLING

Coolant pump to cylinder block	10 Nm
Coolant pump to timing belt rear cover	10 Nm
Coolant rail to cylinder block	9 Nm
Engine bay cooling fan to body	9 Nm
Expansion tank to mounting bracket	8 Nm
Radiator to fan motor	3 Nm
Thermostat housing cover	9 Nm
Thermostat housing to cylinder block	9 Nm

Bleed points

Radiator bleed screw	5 Nm
Heater bleed screw	7 Nm
Radiator return line, bleed screw	9 Nm

MANIFOLD AND EXHAUST

Alternator heat shield	9 Nm
Catalyst to silencer	50 Nm
Coolant hose heat shield	9 Nm
Exhaust manifold heat shield	
Nut	25 Nm
Bolts	10 Nm
Exhaust manifold to cylinder head	45 Nm *
Exhaust manifold to front pipe flange nuts	50 Nm
Exhaust mountings to body	25 Nm
Inlet manifold to cylinder head nuts and bolts	25 Nm *
Inlet manifold support bracket - VVC	25 Nm
Inlet manifold to manifold chamber - VVC	25 Nm
Silencer clamp, nut	30 Nm
Silencer clamp to flange studs	50 Nm
Silencer RH mounting bracket	15 Nm
Silencer heat shield	10 Nm
Stepper motor to inlet manifold	1.5 Nm
Throttle housing to manifold chamber - VVC	9 Nm *

* Tighten in sequence

CLUTCH

Clutch damper to bracket (VVC only)	15 Nm
Master cylinder to pedal box	25 Nm
Master cylinder pipe union	18 Nm
Pressure plate to flywheel	25 Nm *
Slave cylinder to mounting bracket	25 Nm
Slave cylinder pipe union	18 Nm
Slave cylinder bleed screw	7 Nm

* Tighten in sequence

MANUAL GEARBOX

Drain plug	45 Nm
Filler / level plug	35 Nm
Flywheel closing panel	80 Nm
Gear lever assembly to body	9 Nm
Gearbox to engine	80 Nm
Gearbox to sump	45 Nm
Selector cable abutment bracket to gearbox lower bracket	45 Nm
Road speed transducer	12 Nm

STEPSPEED (Em-CVT) GEARBOX

Connecting rod to selector lever nut	6 Nm
Differential speed sensor	9 Nm
Dipstick tube retaining bolt	25 Nm
Drain plug	30 Nm
Fluid cooler pipe clamp bolt	10 Nm
Fluid cooler pipe to cooler bolt	10 Nm
Fluid cooler unions	14 Nm
Fluid pan bolts	10 Nm *
Fluid pump bolts	10 Nm *
Flywheel closing panel bolts	9 Nm
Gear selector lever assembly to body	10 Nm
Gear shaft speed sensor retaining bolt	9 Nm
Gearbox to engine	80 Nm
Gearbox mounting to gearbox	48 Nm
Hydraulic control unit mounting bolts	10 Nm
Lever to support bracket bolts	10 Nm
Park/Neutral switch	12 Nm
Park solenoid bolts	15 Nm
Pitot chamber bolts	10 Nm
Primary bearing nut	180 Nm
Primary cover bolts	10 Nm
Ratio control motor harness connector nut	9 Nm
Road speed transducer retaining bolt	9 Nm
Secondary cover bolts	10 Nm
Selector cable bracket to gearbox	25 Nm
Selector quadrant detent lever bolt	10 Nm
Selector valve bolts	10 Nm
Sequential gear change microswitch bolts	12 Nm
Shift lock solenoid	15 Nm
Starter/Inhibitor/Reverse switch	12 Nm
Valve body bolts	10 Nm +

* Tighten in sequence
+ Fit new bolts/nuts

DRIVE SHAFTS

Drive shaft nut	210 Nm, stake nut

STEERING

EPAS ECU to bracket	10 Nm
EPAS ECU bracket to fascia rail	25 Nm
Ignition lock to steering column	Shear bolts
Pinion cover	8 Nm
Steering rack clamp	22 Nm
Steering rack 'U' bolt	22 Nm
Steering rack to intermediate shaft	22 Nm
Steering column to intermediate shaft	22 Nm
Steering column mounting brackets	22 Nm
Steering wheel to column	63 Nm
Track-rod end to steering arm	30 Nm
Track-rod end lock nut	50 Nm
Universal joint to steering rack pinion	20 Nm

SUSPENSION

Front Suspension

Anti-roll bar clamp bracket	22 Nm
Anti-roll bar link	35 Nm **
Damper upper mounting	45 Nm
Damper lower mounting	100 Nm **
Damper rod self locking nut	25 Nm
Hub nut	210 Nm
Lower arm to subframe	85 Nm **
Lower ball joint to hub	45 Nm
Lower ball joint to lower arm	40 Nm
Upper arm pivot shaft retaining plate	10 Nm
Upper arm pivot shaft	74 Nm
Upper ball joint nut	54 Nm
Upper ball joint to hub	105 Nm

Rear Suspension

Anti-roll bar clamp bracket	22 Nm
Anti-roll bar to link	35 Nm **
Anti-roll bar link to trailing arm	35 Nm **
Damper upper mounting	45 Nm
Damper lower mounting to upper arms	100 Nm **
Damper rod self locking nut	25 Nm
Lower link to hub	100 Nm **
Lower link to subframe	85 Nm **
Track control arm adjuster	50 Nm
Track control arm to hub	38 Nm
Track control arm to subframe	60 Nm
Trailing arm to hub	60 Nm
Trailing arm compliance bush	100 Nm
Upper arm pivot shaft retaining plate	10 Nm
Upper arm pivot shaft	100 Nm
Upper ball joint nut	54 Nm
Upper ball joint to hub	105 Nm

** = Tighten with suspension at nominal trim height

Front Subframe

Cross brace centre mounting to body	45 Nm
Cross brace to front subframe	45 Nm
Cross brace to rear subframe	45 Nm
Crash can to subframe	45 Nm
Front mounting to body	30 Nm
Front mounting to subframe	100 Nm
Rear mounting to body	45 Nm
Rear mounting to subframe	100 Nm

Rear Subframe

Front subframe mounting to body	30 Nm
Front centre mounting to subframe	100 Nm
Rear subframe mounting to body	45 Nm
Rear mounting to subframe	100 Nm
Splash guard mounting bracket to subframe	30 Nm
Trailing arm compliance bush to subframe	100 Nm

Wheel Nuts

Alloy wheel, nuts	70 Nm *
Spare wheel, nuts	70 Nm *

* = Tighten in sequence

BRAKES

ABS ECU to modulator	8 Nm
ABS ECU to mounting spigot	15 Nm
ABS harness support bracket	30 Nm
ABS hydraulic modulator to bracket	10 Nm
ABS sensor bolts	10 Nm
Master cylinder to servo	20 Nm
Master cylinder to pipe union	14 Nm
Pedal box mounting bracket to top plate nuts and bolts	22 Nm
Pedal box mounting bracket to bulkhead bolts	22 Nm
Pedal crosstube bracket to bulkhead nut	22 Nm
Pedal pivot shaft to pedal box end bracket nut	22 Nm
Proportioning valve to body	10 Nm
Proportioning valve to pipe union	14 Nm
Servo to bracket	20 Nm
Servo bracket to body	20 Nm
Servo bracket to body bracket	30 Nm

Front Brakes

ABS speed sensor to hub	10 Nm
Bleed nipple	10 Nm
Brake pipe unions	15 Nm
Brake pipes to subframe turrets	25 Nm
Caliper body to carrier guide pin	45 Nm
Caliper carrier to hub	85 Nm
Disc to drive flange	7 Nm
Hose to caliper	30 Nm

Rear Brakes

ABS speed sensor to hub	10 Nm
Bleed nipple	10 Nm
Brake pipe unions	15 Nm
Caliper to hub	85 Nm
Caliper body to carrier guide pin	45 Nm
Disc to drive flange	7 Nm
Hose to caliper	30 Nm

Handbrake

Handbrake lever bracket to body	25 Nm
Handbrake assembly to bracket	25 Nm
Handbrake abutment bracket to mounting bracket	25 Nm
Handbrake cable to luggage bay bulk head	10 Nm

SUPPLEMENTARY RESTRAINT SYSTEM

SRS DCU bracket to body	10 Nm
SRS DCU to bracket	10 Nm

Airbags

Passenger airbag to fascia bracket	8 Nm
Drivers airbag to steering wheel	8 Nm
Passenger airbag module bracket to fascia	9 Nm

Seat Belts

Seat belt assembly to body	35 Nm
Seat belt assembly to seat	30 Nm
Seat belt pre-tensioner to seat	45 Nm

BODY

'A' post trim	6 Nm
Crossmember to floorpan	22 Nm
Engine compartment cross-bracing centre mounting	25 Nm
Header trim	6 Nm
Headlamp to body	6 Nm
Underbelly panel	22 Nm
Splash guard mounting bracket to front subframe	30 Nm

Bonnet

Bonnet locking platform	10 Nm
Bonnet to hinges	9 Nm
Bonnet lock plate to body	25 Nm
Bonnet release lever to bulkhead	9 Nm

Boot

Boot lid to hinges	9 Nm
Boot lid striker to body	10 Nm
Boot latch to boot lid	10 Nm

Bumpers

Crash can to body	25 Nm
Front bumper armature to body	25 Nm
Front bumper valance to bumper armature	25 Nm
Front bumper to crash can	25 Nm
Rear bumper armature to body	22 Nm
Rear bumper valance to armature	25 Nm

Doors

Door finishers	10 Nm
Door glass regulator to door	7 Nm
Door handle to door	2.5 Nm
Door striker screws	18 Nm
Latch assembly to door	5 Nm

Hood

Soft Top

Hood frame hinge to body	45 Nm
Hood catch to header rail	20 Nm
Hood header strikers	6 Nm

Hard Top

Front top catch to hard top	10 Nm

Seats

Seat runners	45 Nm
Squab frame to cushion frame	45 Nm

HEATING AND VENTILATION

Fascia rail support bracket	10 Nm
Heater mountings	10 Nm
Intake duct to body	10 Nm

AIR CONDITIONING

Compressor

Compressor to mounting bracket	45 Nm
Compressor to pipe union	25 Nm

Condenser

Mounting bracket to striker plate panel	17 Nm
Air conditioning pipe to condenser	5 Nm

Evaporator

Evaporator to heater - clamp	3 Nm
Evaporator to lower dash panel	9 Nm

Receiver Drier

Air conditioning pipe to receiver drier	5 Nm

Thermostatic Expansion Valve

Evaporator pipe clamp to expansion valve	5 Nm
Evaporator pipe, bracket	7 Nm

Trinary switch	10 Nm

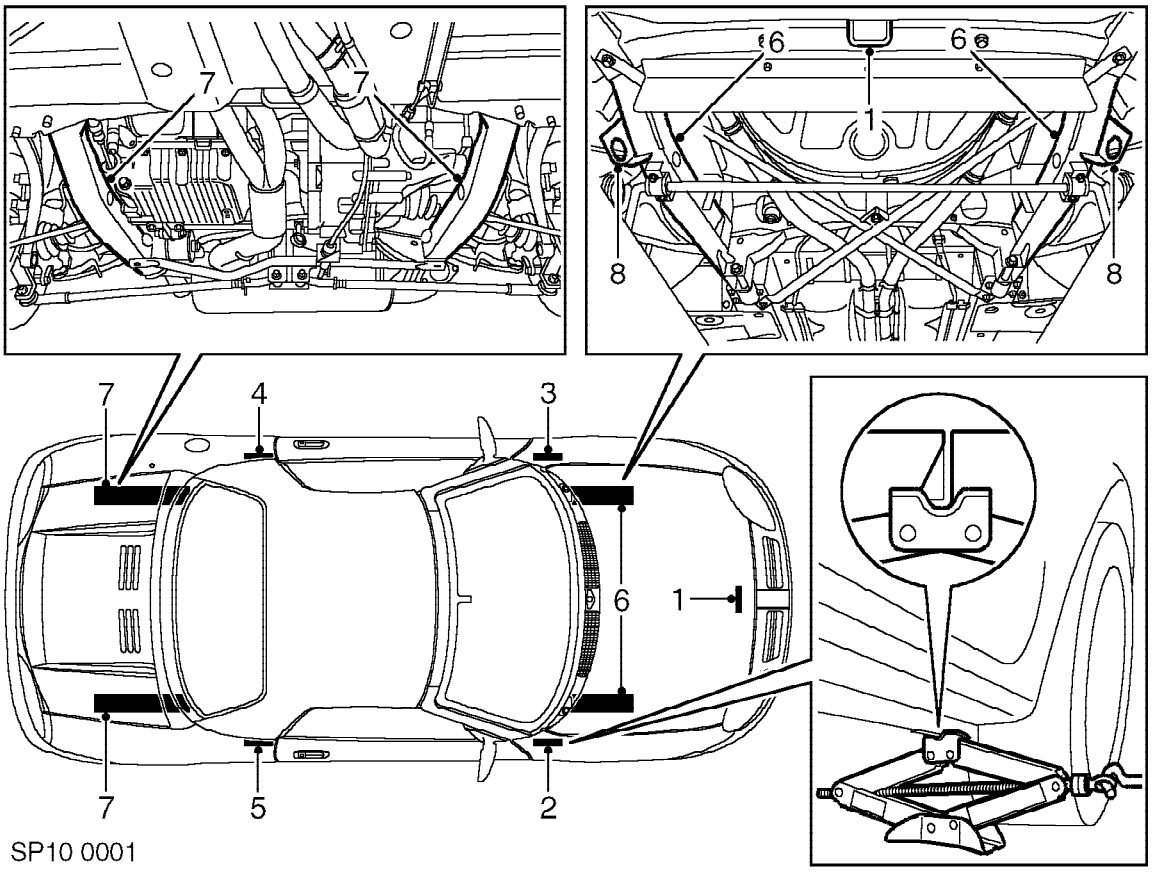
WIPERS AND WASHERS

Wiper arm to spindle	20 Nm
Motor and linkage assembly to scuttle	10 Nm
Motor to linkage bracket	12 Nm
Crank to motor spindle	18 Nm

ELECTRICAL

Aerial locking nut	3 Nm
Alarm ECU	4 Nm
Alternator to pulley	25 Nm
Alternator to engine mounting clamp bolts	45 Nm
Alternator adjustment tensioner bracket bolts	25 Nm
Alternator tensioner pulley nut (A/C models only)	25 Nm
CD autochanger to vehicle	5 Nm
Central locking motor to door	5 Nm
Fusebox to body	10 Nm
EPAS ECU to mounting	10 Nm
Headlamp to front panel	10 Nm
Horn to valance	8 Nm
Starter motor securing bolts	80 Nm
Tail Lamp to body	2 Nm

JACKING, SUPPORTING AND TOWING



SP10 0001

1. Central jacking point - front
2. RH sill reinforced bracket - front
3. LH sill reinforced bracket - front
4. LH sill reinforced bracket - rear
5. RH sill reinforced bracket - rear
6. Subframe longitudinal members - front
7. Subframe longitudinal members - rear
8. Front towing eyes

To jack up the rear of the car, use the rear sill jacking points (4 & 5), then place safety support stands under the sill or subframe longitudinals.

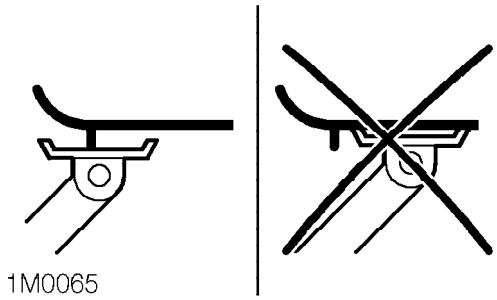
WARNING: To avoid potential damage to the rear suspension links, DO NOT use a trolley jack from the rear of the car.

WARNING: In accordance with normal workshop practice, and to avoid the possibility of damage or personal injury, work must not be carried out, on or under a vehicle when it is supported solely on a jack. Place safety supports under the sill reinforced jacking areas (2, 3, 4 or 5).

WARNING: Do not position a jack, jack stand or wheel free support under the suspension attachment points.

WARNING: Do not attempt to jack under suspension attachment points.

CAUTION: When lifting the side of the vehicle with a workshop jack, ensure that the jack head is positioned under the reinforced area of the sill, as shown.



WORKSHOP JACK

Front: Locate the jack head under the central location bracket (1).
Position safety supports under both front sill reinforced brackets (2 and 3).

Rear: Locate the jack head under the rear sill jacking points (4 & 5), then place safety support stands under the sill or subframe longitudinals.

Side Front: Locate the jack head under the sill reinforced bracket (2 or 3) and position safety support under front subframe longitudinal member (6).

Side rear: Locate the jack head under the sill reinforced bracket (4 or 5) and position safety support under rear subframe longitudinal member (7).

WHEEL-FREE LIFT

If crossbeams are available, locate the pads under the sill reinforced jacking brackets (2, 3) and (4, 5).

If longitudinal beams are available, locate the beams under the subframe longitudinals with lifting pads at the front and rear positions (6 and 7). Raise the lift a few inches and ensure the vehicle is firmly supported. Raise the lift to full height and inspect the lifting points for security.

RECOVERY

Manual gearbox models

It is recommended that a recovery trailer or two wheel car ambulance be used. In an emergency, the car may be towed on its own wheels using the front lashing/towing eyes (8).

Automatic (Em-CVT) gearbox models

It is recommended that a recovery trailer or a two wheel car ambulance is used on the rear wheels. In an emergency, the car may be towed a short distance on its own wheels using the front lashing/towing eyes (8).

Suspended tow

CAUTION: A front suspended tow must not be attempted on a vehicle with an automatic gearbox. Serious damage to the transmission will occur.

A suspended tow cannot be carried out without incurring damage. If additional damage is immaterial because of existing crash damage, lifting chains can be attached to the towing eyes.

Before towing commences release the handbrake, place the gear lever in neutral and the ignition switch at **'I'**. Do not tow at a greater speed than 30 mph, 50 km/h.

On no account should the vehicle be towed with the rear wheels on the ground if the transmission is faulty, the transmission fluid level is low, or the towing distance exceeds 30 miles or 50 km.

WARNING: MG TF models have a lower ground clearance than most other cars, vehicle recovery should ONLY be carried out by a qualified recovery specialist using a transporter or trailer. Other methods of vehicle recovery, including the use of wheel lift equipment to suspend the front or rear wheels, and towing with rope, bar or chain , will cause damage to the front of the vehicle and are not recommended.

Transporter or trailer lashing

Use the front towing eyes, and specific lashing points for rear of car. DO NOT secure lashing hooks or trailer fixings to other parts of the car.

CAUTION: Some of the information included in the recovery section DOES NOT apply to MG TF models. Please take note of the information below.

Because the MG TF model has a lower ground clearance than most other cars, vehicle recovery should ONLY be carried out by a qualified recovery specialist using a transporter or trailer.

Other methods of vehicle recovery, including the use of wheel lift equipment to suspend the front or rear wheels, and towing with rope, bar or chain, may cause damage to the front of the vehicle and is NOT recommended.

TOWING

General

Use the front lashing/towing eyes (8) for towing the vehicle on all four wheels from the front.

WARNING: To ensure that the steering does not lock when the vehicle is being towed, it is essential that the ignition key is turned to position 'I', and remains there while the vehicle is moving.
Ensure the following precautions are observed:
Do not tow if the gearbox or a drive shaft is faulty.
Do not tow if a wheel or drive shafts are touching the body or frame.
Ensure the gear lever is in neutral and the handbrake is released.
Remember that greater effort than normal will be necessary to apply the brakes if the vehicle is being towed without the engine running.

Stepspeed (Em-CVT) gearbox models

When a car with automatic gearbox is to be towed on four wheels from the front, the following precautions must be observed:

The gearbox fluid level must be correct before starting to tow.

The selector must be at **'N'**.

The car must not be towed at speeds greater than 30 mph, 50 km/h or for distances which exceed 30 miles, 50 km.

CAUTION: A front suspended tow must not be attempted as serious damage will be caused to the automatic transmission.

NOTE: A vehicle fitted with an automatic gearbox cannot be started by towing or pushing.

CAPACITIES

Fuel tank	50 litres
Engine oil refill and filter change:	4.5 litres
Engine oil refill from dry:	5 litres
Manual gearbox:	
Refill	2.2 litres
From dry	2.4 litres
Stepspeed (Em-CVT) Gearbox:	
Refill - Gearbox only	4.5 litres
Fluid cooler and lines	1.0 litre
Cooling system from dry:	10.5 litres
Washer reservoir:	2.2 litres

FLUIDS

Brake Fluid

Use only AP New Premium Super DOT 4 brake/clutch fluid or Castrol Universal DOT 4 brake/clutch fluid. DO NOT use any other type of fluid.

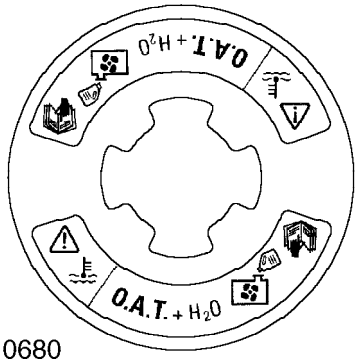
Anti-Freeze Solutions

The overall anti-freeze concentration should not fall, by volume, below 50% to ensure that the anti-corrosion properties of the coolant is maintained. Anti-freeze concentrations greater than 60% are not recommended as cooling efficiency will be impaired.

Organic Acid Technology (OAT) anti-freeze

Vehicles use **Unipart OAT (or Havoline XLC)** coolant which is **Orange/Pink** in colour. Vehicles using OAT anti-freeze are identified by a label attached around the expansion tank filler neck - see illustration.

CAUTION: The anti-freeze used in the cooling system contains OAT corrosion inhibitors. This anti-freeze must not be used with any other anti-freeze and must not be used as a replacement in cooling systems of other vehicles which previously contained anti-freeze not of this type.



M26 0680

Use UNIPART OAT or Havoline XLC Anti-freeze and Summer Coolant or any ethylene glycol based anti-freeze (containing no methanol) with only OAT corrosion inhibitors, to protect the cooling system.

Only anti-freeze containing OAT corrosion inhibitors should be used. Do not top-up or refill cooling system with any other type of anti-freeze.

In an emergency, if anti-freeze to this specification is not available, top-up the cooling system with clean water only, but be aware of the resultant reduction in frost protection. The correct anti-freeze concentration must be restored as soon as possible.

Replacing coolant

The cooling system should be drained, flushed and refilled with the correct amount of anti-freeze solution at the intervals given on the Service Maintenance Check Sheet.

After filling with anti-freeze solution, attach a warning label to a prominent position on the vehicle stating the type of anti-freeze contained in the cooling system to ensure that the correct type is used for topping-up.

The recommended quantities of anti-freeze for different degrees of frost protection are:

Solution	Amount of anti-freeze	Commences freezing		Frozen solid	
50%	Litres	°C	°F	°C	°F
	5.25	-36	-33	-48	-53

LUBRICATION

The engine and other lubricating systems are filled with high performance lubricants giving prolonged life.

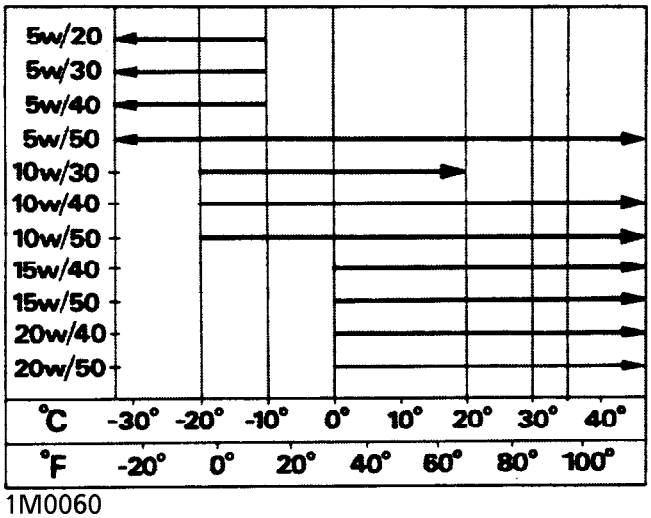
CAUTION: You should always use a high quality oil of the correct viscosity range in the engine and gearbox during maintenance and when topping-up. The use of oil not to the correct specification can lead to high oil and fuel consumption and ultimately to damaged components.

Oil to the correct specification contains additives which disperse the corrosive acids formed by combustion and prevent the formation of sludge which can block the oil ways. Additional oil additives should not be used.
Always adhere to the recommended servicing intervals.

Engine oil

Use oil meeting specification ACEA A2 or A3 and having a viscosity band recommended for the temperature range of your locality (e.g (10W/40). Where oils to these MG Rover and European specifications are not available, well known brands of oils meeting API SH or SJ quality should be used.

NOTE: Oils meeting specification ACEA A1 can be used if necessary, EXCEPT for vehicles with VVC engines.



1M0060

Manual gearbox

Use Texaco MTF 94, Unipart MTF94 or Caltex MTF94 for refill and topping-up.

Stepspeed (Em-CVT) gearbox

Use EZL799, Esso CVT or Unipart CVT for refilling or topping up.

Gear linkage

Use Unipart Multi-purpose Lithium Grease or equivalent.

General greasing

Use Unipart Multi-purpose Lithium Grease or equivalent.

Boot hinges

Lubricate with Rocol Ultralube.

Locks, latches and hinges

Use Door Lock and Latch Lubricant,
Part No. CYL 100020.

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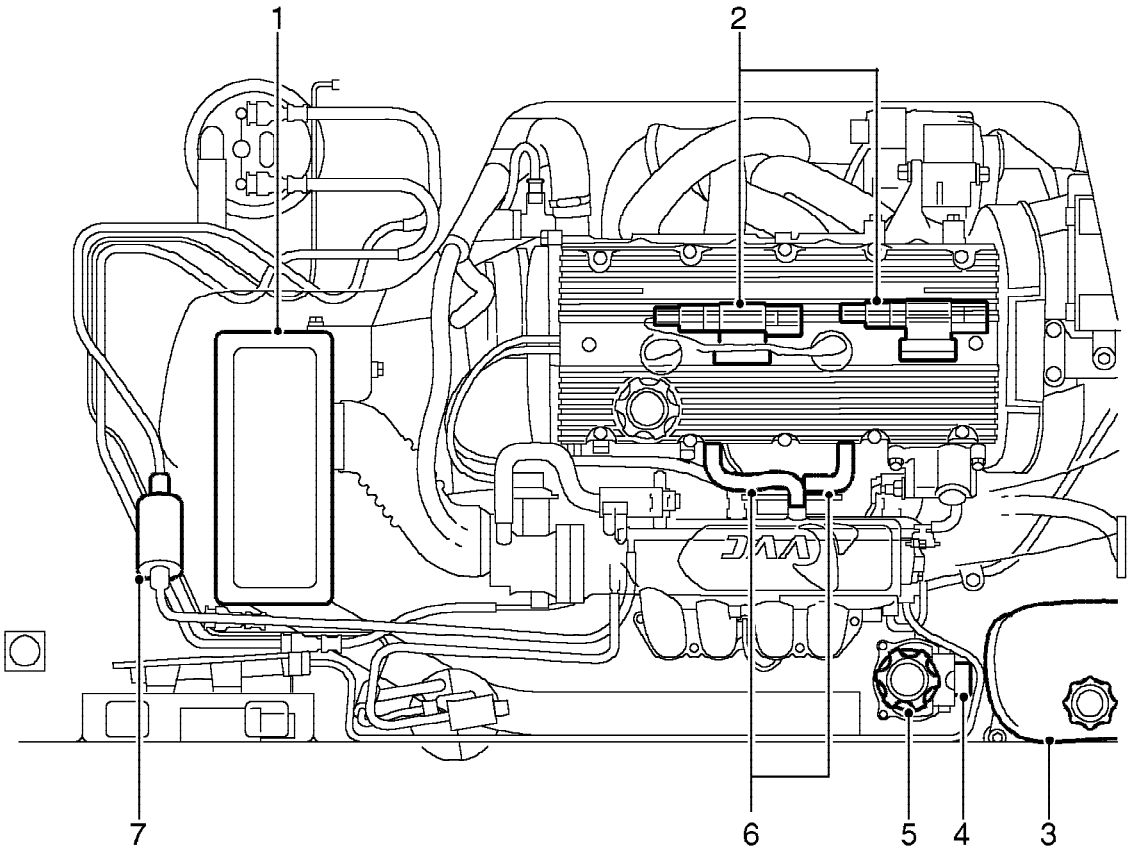
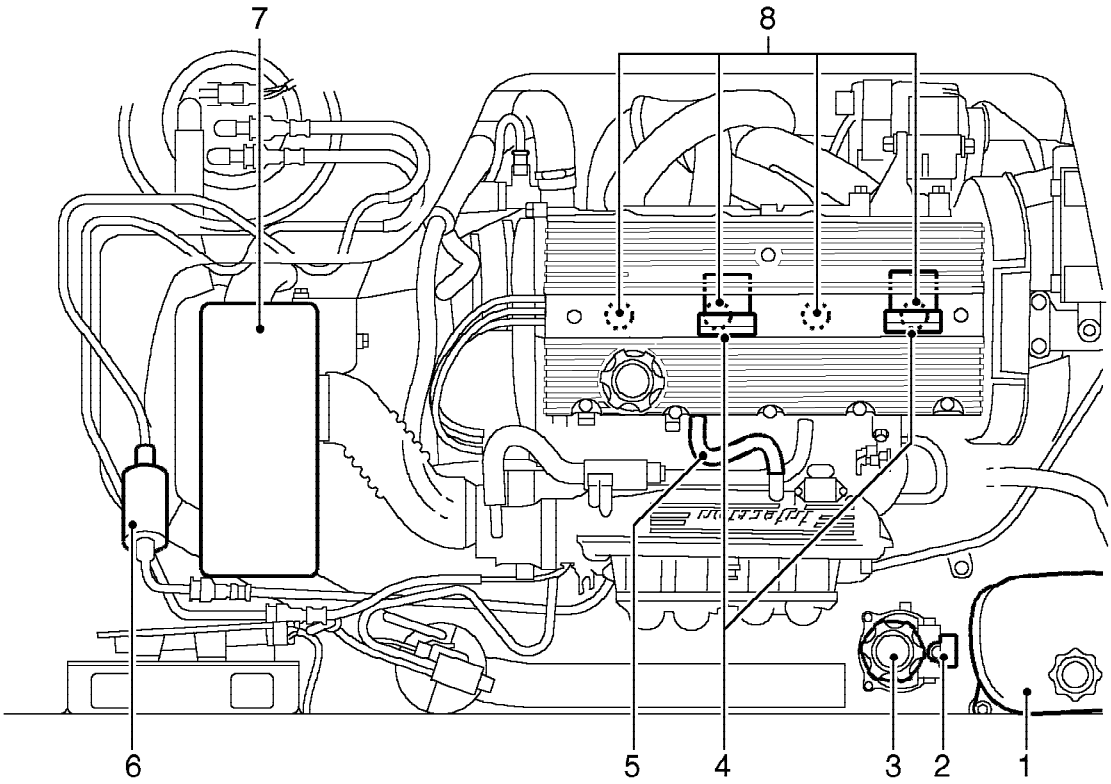
ENGINE COMPARTMENT LOCATIONS - VVC MEMS 3



M10 0778

1. Air cleaner
2. Ignition coils
3. Coolant expansion tank and cap
4. Engine oil dipstick
5. Engine oil filler cap
6. Crankcase ventilation hoses
7. Fuel filter

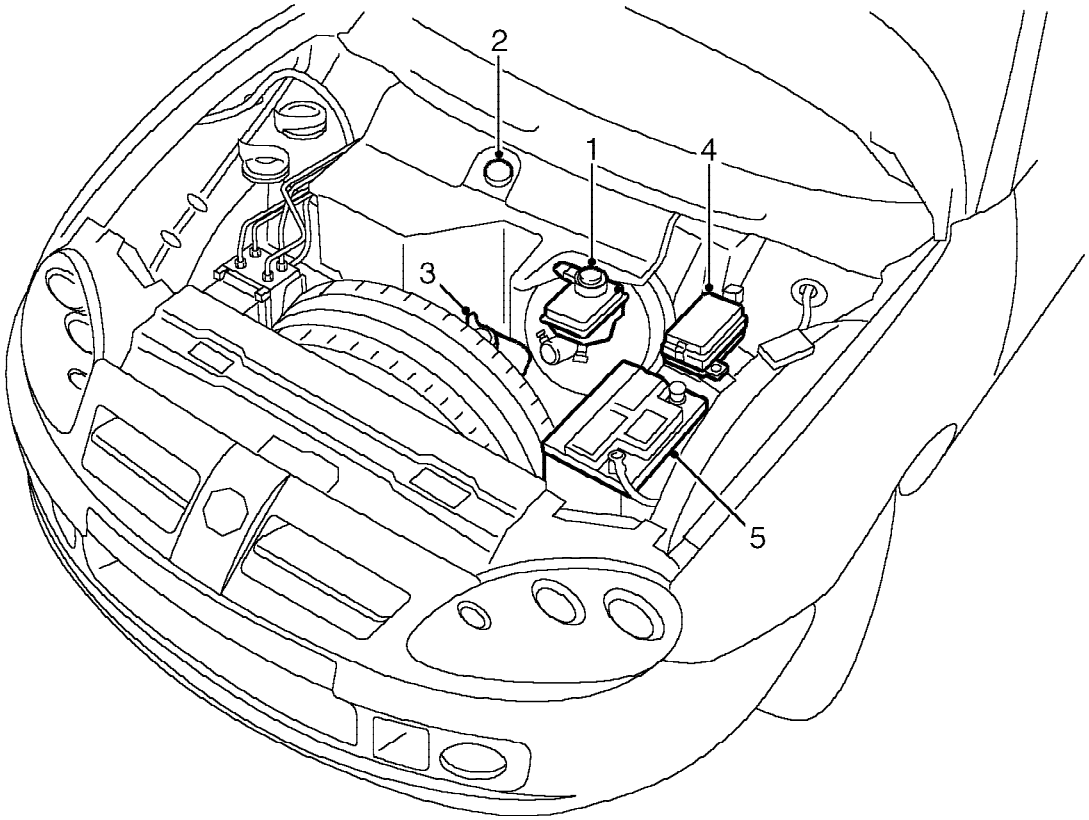
ENGINE COMPARTMENT LOCATIONS - MPi MEMS 3



M10 0713

1. Coolant expansion tank and cap
2. Engine oil dipstick
3. Engine oil filler cap
4. Ignition coils
5. Crankcase ventilation hoses
6. Fuel filter
7. Air cleaner
8. Spark plugs

UNDERBONNET LOCATIONS



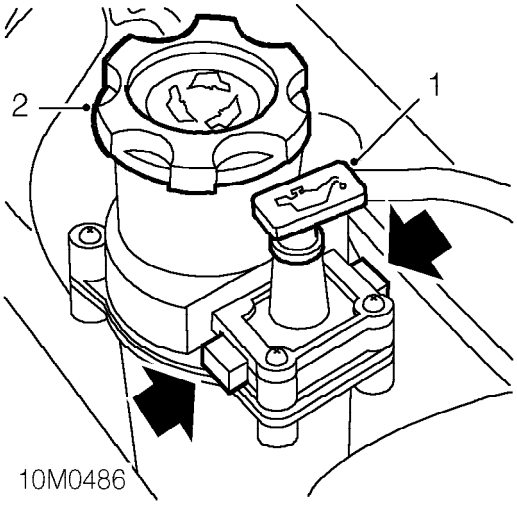
SP10 0002

1. Brake fluid reservoir
2. Clutch fluid reservoir
3. Windscreen washer reservoir
4. Fusebox
5. Battery

ENGINE OIL

Oil level check

Always check oil level and drain oil with vehicle standing on level ground and use engine oil of specification 10W/40 for topping up and refilling.

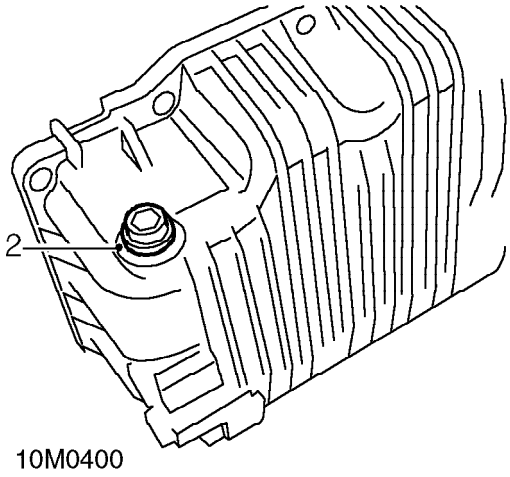


1. Pull the dipstick out, wiping the blade clean as it is withdrawn by squeezing the dipstick wiping mechanism (arrowed) between finger and thumb. Re-insert dipstick fully and withdraw again, this time releasing the dipstick wiping mechanism. Check the oil level which must be maintained between minimum mark **'MIN'** and maximum mark **'MAX'** on dipstick.
2. If required, remove filler cap, REMOVE DIPSTICK and top-up with new engine oil to specification 10W/40. ***See INFORMATION, Capacities, fluids and lubricants.***

Oil drain and refill

The oil should be drained when engine is warm. The oil filter can be renewed while oil is being drained.

WARNING: Observe due care when draining engine oil as the oil can be very hot.
Prolonged and repeated contact with used engine oil may cause serious skin disorders. Wash thoroughly after contact. Keep out of reach of children.



1. Place a container under sump.
2. Remove drain plug and sealing washer, allow oil to drain.
3. Clean the drain plug, fit NEW sealing washer and refit drain plug. Tighten to 25 Nm.
4. Remove filler cap, REMOVE DIPSTICK refill with new engine oil to specification 10W/40. Re-check oil level.

OIL FILTER RENEWAL

See ENGINE, Repairs.

CAMSHAFT TIMING BELT MPi & VVC

See ENGINE, Adjustments.

FUEL FILTER

See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.

AIR CLEANER ELEMENT

See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.

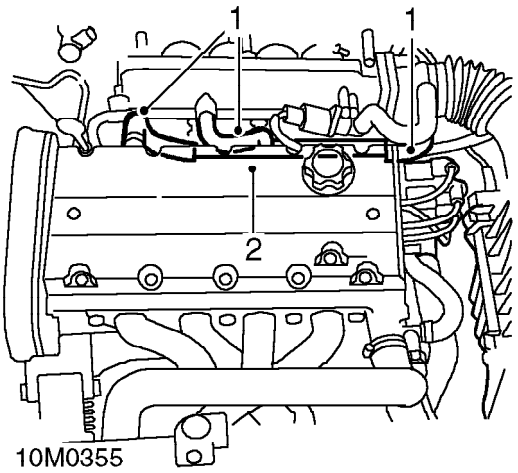
ENGINE TUNING

Tuning must be carried out using TestBook.

SPARK PLUGS

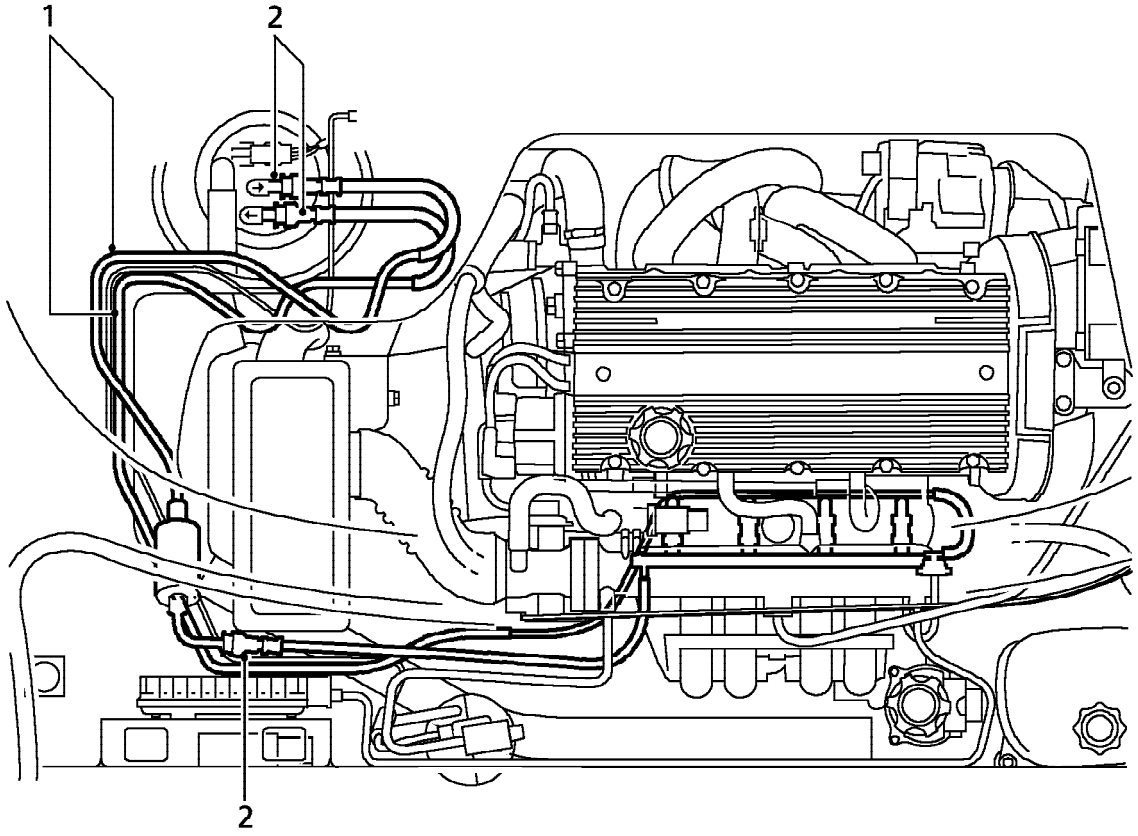
See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.

CRANKCASE VENT HOSES



1. Check crankcase ventilation hoses for signs of splitting and general condition.
2. Check hoses are routed correctly, secure and serviceable.

FUEL SYSTEM HOSES, PIPES AND UNIONS



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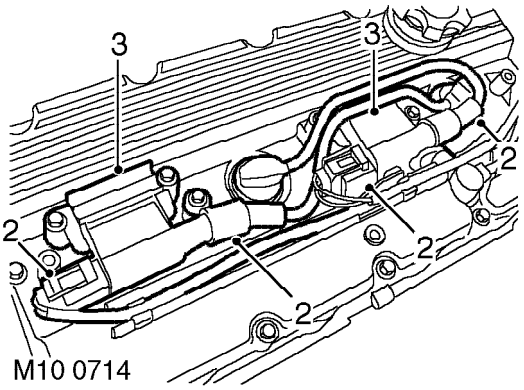
1. Check fuel pipes and connections for chafing and leakage.
2. Check pipes are securely clipped.
3. Check fuel tank is free from leaks.

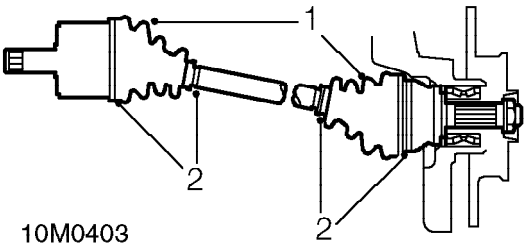
IGNITION COILS - MPi / VVC MEMS 3

1. Remove coil cover.



2. Check h.t. cables and multiplugs for security.
3. Clean each coil.

DRIVE SHAFT GAITERS



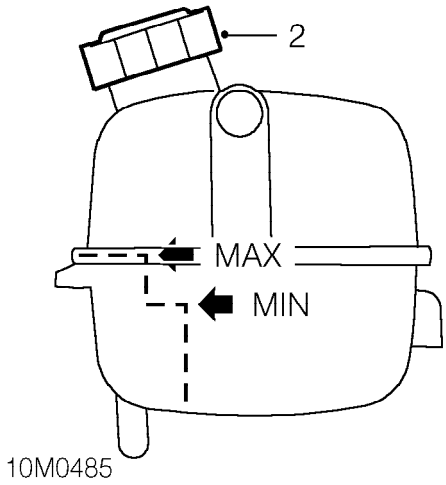
1. Check that drive shaft gaiters are not twisted, split or damaged.
2. Check clips are secure.

COOLING SYSTEM

WARNING: To prevent injury such as scalding caused by escaping steam or coolant, do not remove pressure relief cap from expansion tank while system is hot.

Check level and top-up

CAUTION: The coolant level should only be checked when the system is cold.



1. Visually check that coolant level is between the two steps of the level marker inside the expansion tank. If level is appreciably low, suspect leakage or overheating.

CAUTION: If coolant is not visible in expansion tank, the system must be refilled in accordance with Refilling procedure.

2. If required, remove coolant expansion tank cap and top-up with anti-freeze mixture. ***See INFORMATION, Capacities, fluids and lubricants.***

CAUTION: The coolant must not exceed the expansion tank flange.

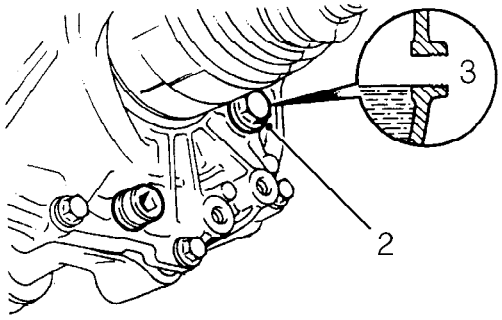
3. Check specific gravity of coolant. The overall anti-freeze concentration must not be below 50% by volume and must not exceed 60% by volume.
4. Refit expansion tank cap.
5. For cooling system drain and refill. ***See COOLING SYSTEM, Adjustments.***

EXHAUST SYSTEM

1. Check for damage and signs of leakage.
2. Check security of system.
3. Check mountings and correct alignment.
4. Check security of heat shields.

GEARBOX FLUID - MANUAL MODELS

Fluid level check and top-up



10M0402

1. Ensure vehicle is standing on level surface.
2. Wipe clean area around filler/level plug and remove plug and sealing washer. Discard sealing washer.
3. Check that fluid is level with bottom of level plug hole.

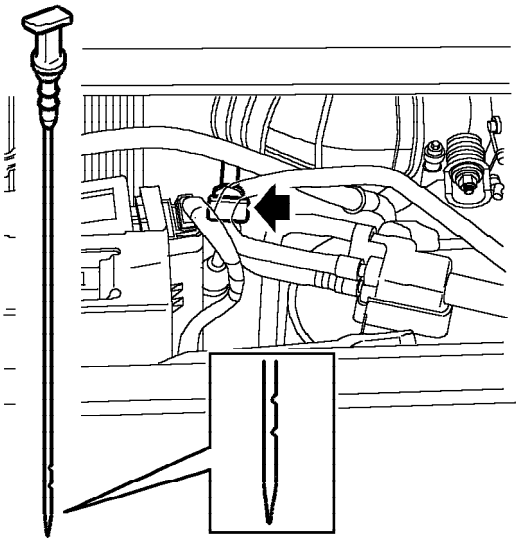
CAUTION: Fluid lodged behind level plug will trickle out when plug is removed and can give impression that level is correct.

4. Top-up, if required, until fluid just runs from hole. Allow sufficient time for fluid to flow and reach a common level within gearbox. Use Texaco MTF 94 transmission oil. ***See INFORMATION, Capacities, fluids and lubricants.***
5. Refit filler/level plug and new sealing washer and tighten to 35 Nm.

GEARBOX FLUID - STEPSPEED (Em-CVT) MODELS

Fluid level check and top-up

NOTE: Always check fluid level with vehicle standing on level ground and gearbox at operating temperature.



M10 0712

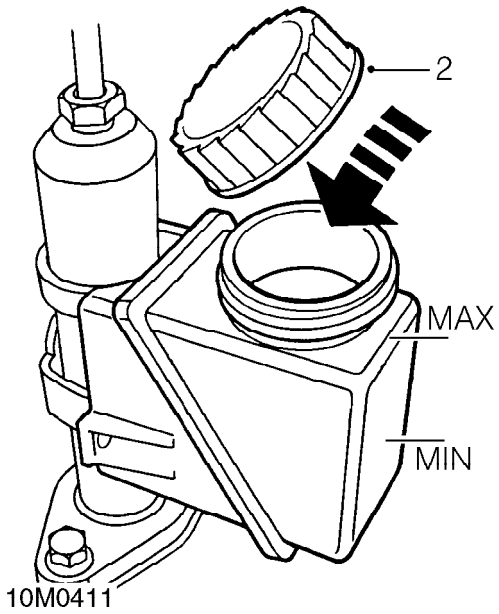
1. With engine running at idle speed and handbrake applied, select 'P' or 'N'. Withdraw dipstick and wipe blade with clean lint free cloth.
2. Re-insert dipstick fully, withdraw and check fluid level which must be maintained between minimum and maximum marks on dipstick.
3. Switch off engine and top-up to maximum mark if required. ***See AUTOMATIC GEARBOX - 'Em-CVT', Adjustments.***
4. Refit dipstick.

CLUTCH FLUID

WARNING: Do not allow dirt or foreign liquids to enter reservoir when topping up. Use only AP New Premium Super DOT 4 or Castrol Universal DOT 4 clutch fluid from airtight containers.

CAUTION: Do not allow clutch fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with warm water.

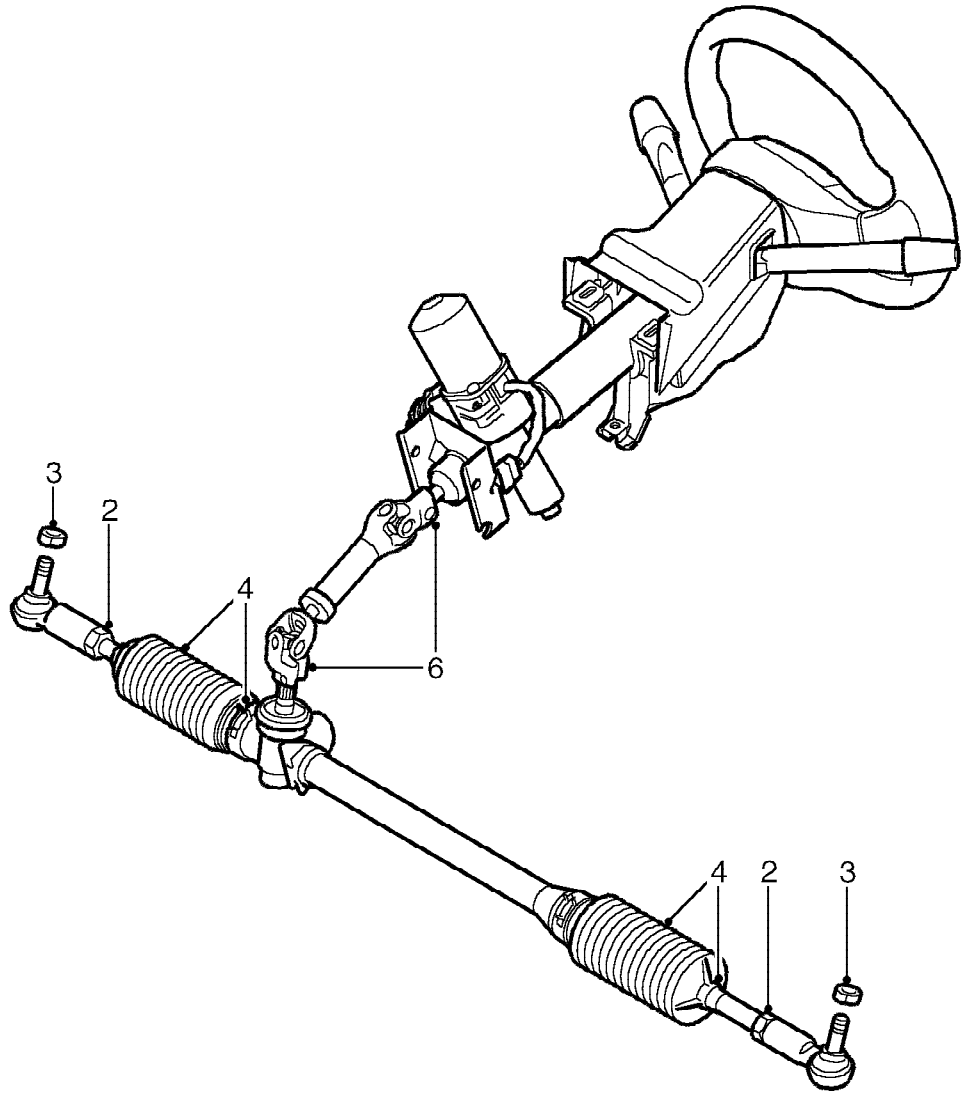
Level check



1. Wipe reservoir body and filler cap, and check level visually.
2. Remove filler cap and top-up, until fluid reaches bottom of reservoir filler neck.
3. The baffle plate halfway up the reservoir acts as the the clutch fluid minimum level.

STEERING

Steering column, rack, joints and gaiters

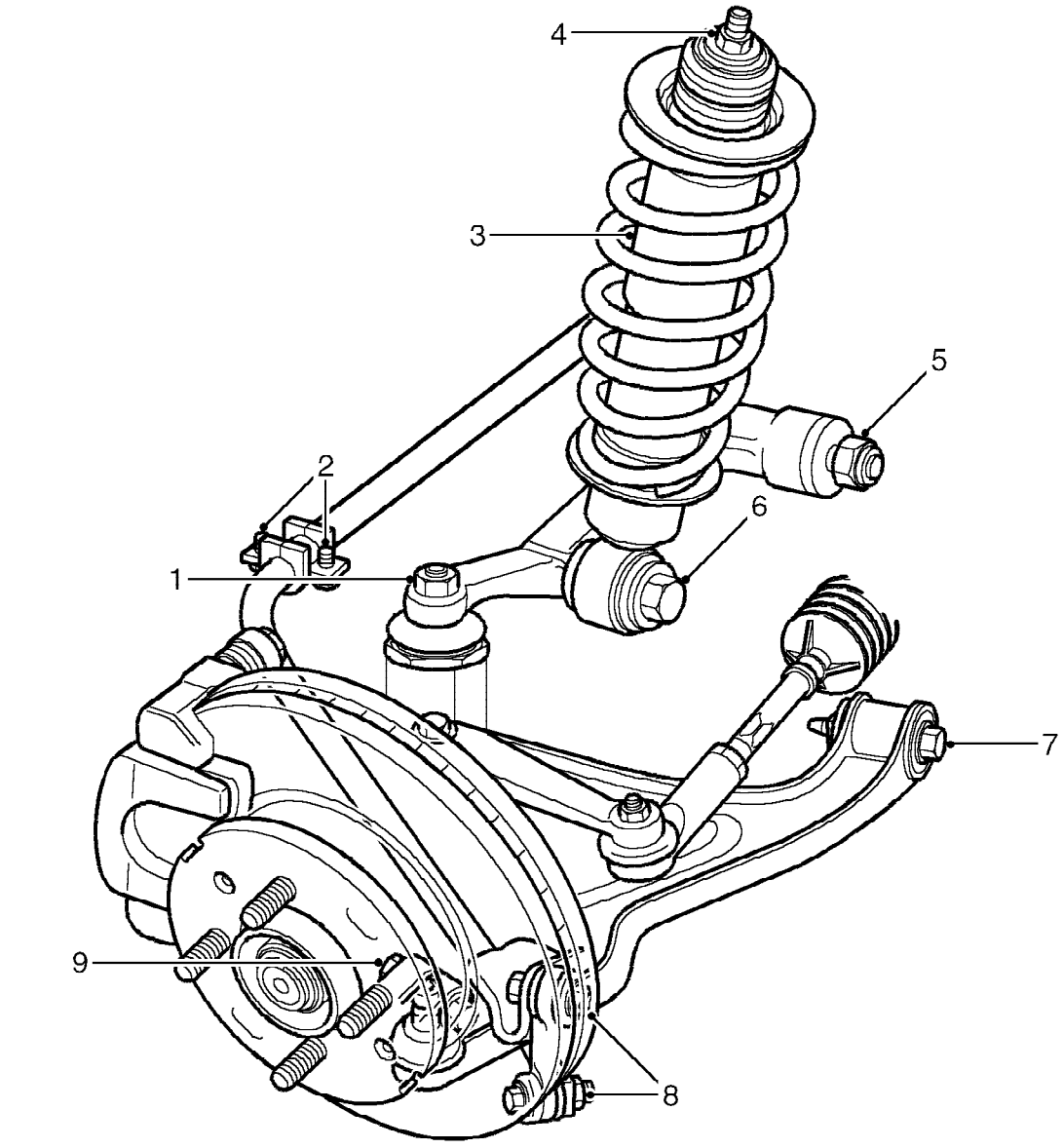


SP10 0004

1. Check security of steering rack, two mounting fixings, tighten nuts to 22 Nm.
2. Restrain ball joint movement and check that steering track rod, locknuts are tightened to 50 Nm.
3. Check security of 2 track rod end nuts, tighten to 30 Nm.
4. Visually check that the rack sealing gaiters are not twisted or damaged and clips are secure.
5. Check for signs of lubricant leakage.
6. Check intermediate shaft bolts are tightened to 22 Nm.

SUSPENSION DAMPERS, BALL JOINTS, FIXINGS AND GAITERS

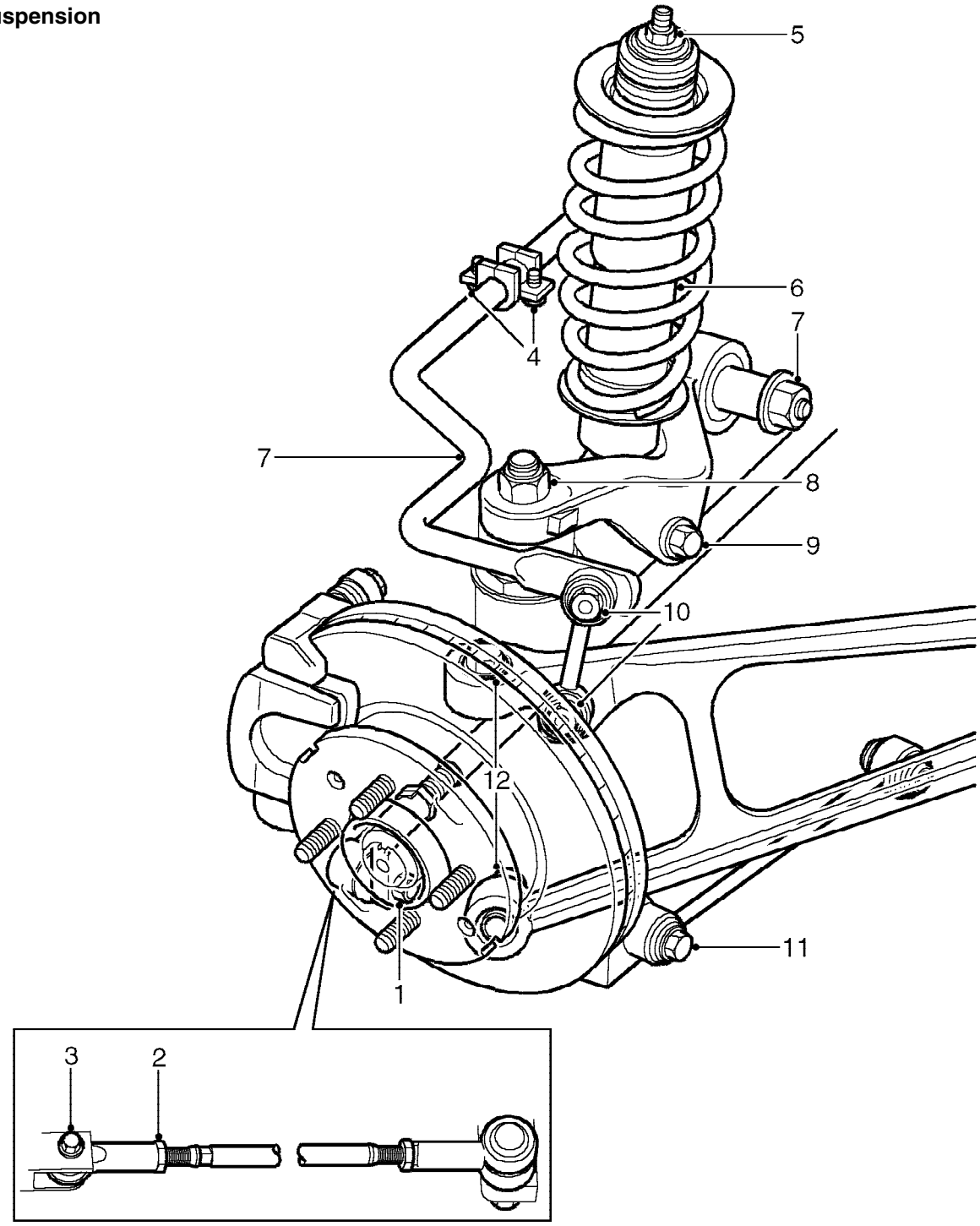
Front suspension



SP10 0005

1. Check upper ball joint nut - 54 Nm.
2. Check anti-roll bar clamp, bushes and bolts - 22 Nm.
3. Check suspension dampers for oil leaks.
4. Check suspension damper top mounting, bushes and nuts - 45 Nm
5. Check upper arm spindle bolt - 74 Nm
6. Check suspension damper lower mounting to upper arm bushes and bolts - 100 Nm
7. Check lower arm to subframe, mounting bushes and bolts - 85 Nm
8. Check anti-roll bar to lower arm link bushes and bolts - 35 Nm
9. Check lower ball joint, clamp bolt - 45 Nm

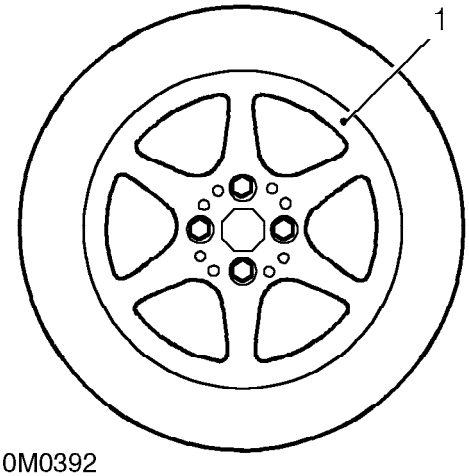
Rear suspension



SP10 0006

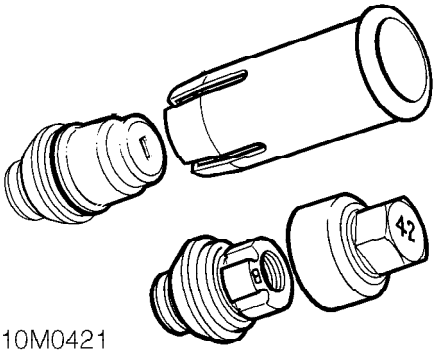
1. Check track control arm to hub nut - 38 Nm.
2. Check track control arm adjuster nuts - 50 Nm.
3. Check track control arm to subframe bushes and bolts - 60 Nm.
4. Check anti-roll bar clamp, bushes and bolts - 22 Nm.
5. Check suspension damper, top mounting bushes and nuts - 45 Nm.
6. Check suspension dampers for oil leaks.
7. Check upper arm to subframe, pivot shaft bushes and bolts - 83 Nm.
8. Check upper arm to hub ball joint nuts - 54 Nm.
9. Check suspension damper lower mounting bushes and bolts - 100 Nm.
10. Check anti-roll bar to trailing arm, link bushes and bolts - 35 Nm.
11. Check lower link to hub, bushes and bolts - 100 Nm.
12. Check trailing arm to hub bolts - 60 Nm.
13. Check trailing arm to compliance bush assembly (not shown) - 100 Nm.

ROAD WHEELS AND FASTENINGS



10M0392

1. Check condition of road wheels including spare (where fitted) for signs of buckling and rim damage.



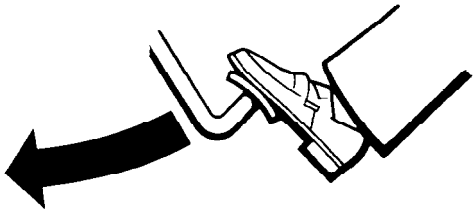
10M0421

2. Push extractor tool over head of nut cover and pull to remove.
3. Fit key socket over locking wheel nut, then fit wheel nut spanner over key socket and unscrew.
4. Working in a diagonal sequence slacken each nut $^1/_2$ turn and then tighten to 70 Nm.

TYRE PRESSURES AND CONDITION

1. Check for signs of tyre wear indicator in tread pattern.
2. Check all tyres including spare (where fitted) for uneven wear, external cuts in fabric, exposure of ply or cord structure, lumps and bulges.
3. Check and adjust tyre pressures. ***See INFORMATION, General data.***

FOOTBRAKE

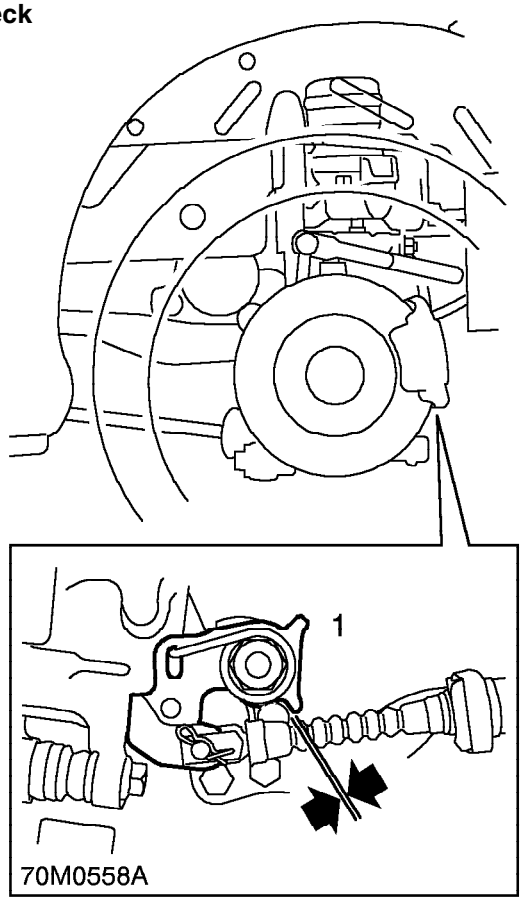


10M0338

1. Press brake pedal and check for firm resistance after short pedal movement.

HANDBRAKE

Check



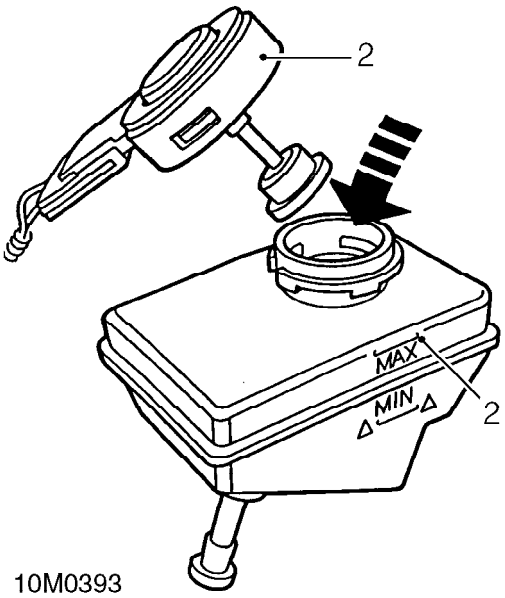
1. Check caliper clearance is between 1 and 2 mm, each side.
2. If the handbrake requires adjustment. ***See BRAKES, Adjustments.***

BRAKE FLUID

WARNING: Do not allow dirt or foreign liquids to enter reservoir when topping-up. Use only new AP New Premium Super DOT 4 or Castrol Universal DOT 4 brake fluid from airtight containers.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

Level check



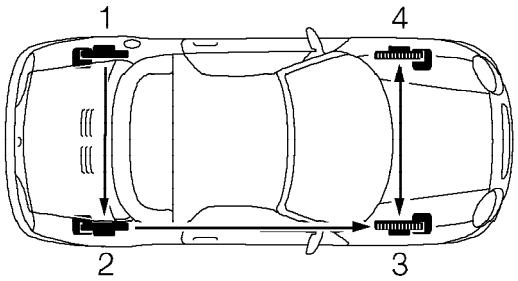
1. Wipe reservoir body and filler cap clean and check level visually.
2. Remove filler cap and top-up to 'MAX' mark, if required.

Renew fluid, ABS and Non-ABS brake systems.

1. Raise vehicle on four post lift.

CAUTION: Ensure that fluid level in reservoir is maintained during the complete operational sequence using new brake fluid.

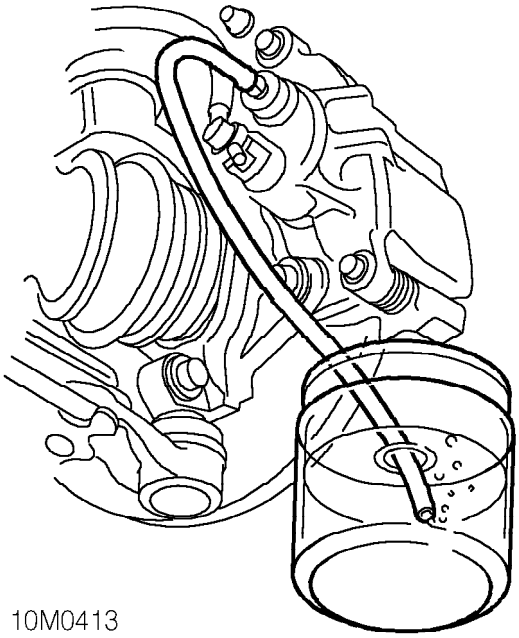
CAUTION: Never re-use fluid that has been bled from system.



10M0414

Bleed sequence - non ABS and ABS systems
LH rear to RH rear.
RH front to LH front.

CAUTION: Braking efficiency may be seriously impaired if wrong bleed sequence is used.



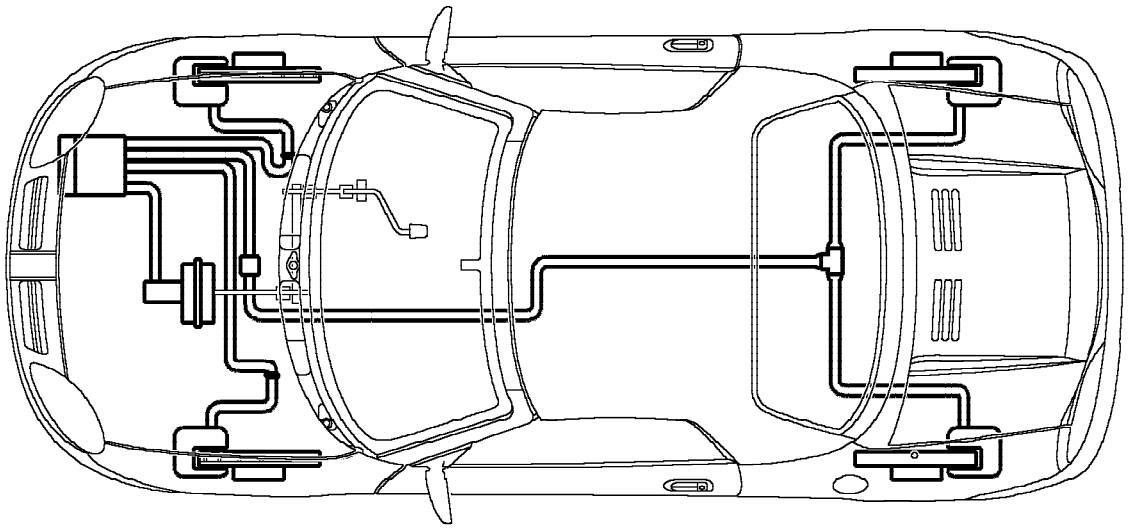
10M0413

2. Attach a bleed tube to LH rear bleed nipple. Submerge free end of tube into jar containing brake fluid.

WARNING: Ensure vehicle is in neutral before starting engine.

3. Start engine to build up vacuum in the brake servo, keep engine running while carrying out bleeding procedure.
4. Open bleed nipple, use an assistant to press brake pedal to the floor and hold.
5. Close bleed nipple, and then release brake pedal.
6. Repeat procedures 4 and 5 until no more air bubbles can be seen flowing from the bleed hose.
7. Hold pedal to floor and tighten bleed screw to 10 Nm.
8. Release brake pedal.
9. Repeat forgoing procedure at each wheel in sequence illustrated, until clean, bubble free fluid flows from the bleed hose at each sequence stage.
10. Remove bleed tube. Apply brakes and check for leakage.
11. Lower vehicle.
12. Check brake pedal for short firm travel when brakes are applied.
13. Check/top up brake fluid level.

BRAKE HOSES AND PIPES

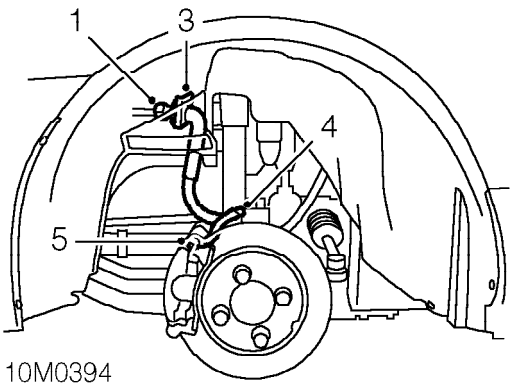


SP10 0007

1. Visually check all brake fluid pipes, hoses and connections for correct routing and security.
2. Check for signs of chafing, leakage and corrosion.

NOTE: Vehicles without ABS have a Brake Proportioning Valve (BPV) included in-line in the brake hydraulic system.

Renew brake hose - front



Remove

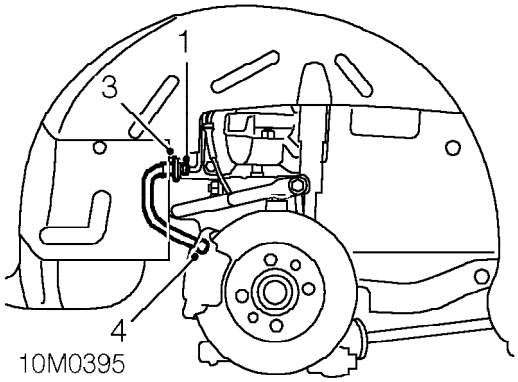
NOTE: Disconnect hose at end nearest to master cylinder first.

1. Release brake pipe union from hose using correct union spanner.
2. Fit plug to pipe end to prevent excessive fluid loss.
3. Withdraw brake hose clip from upper bracket.
4. Remove banjo bolt at caliper end of hose and discard 2 sealing washers.
5. Remove hose and discard.

Refit

1. Fit banjo end of hose to caliper with banjo bolt and 2 new sealing washers and tighten to 30 Nm.
2. Fit union end of hose to top bracket and secure with clip.
3. Remove plug from pipe end, connect brake pipe to hose and tighten union to 15 Nm.
4. Bleed brake system. ***See BRAKES, Adjustments.***

Renew brake hose - rear



Remove

NOTE: Disconnect hose at end nearest to master assembly first.

1. Release brake pipe union from hose using correct union spanner.
2. Fit plug to pipe end to prevent excessive fluid loss.
3. Withdraw brake hose clip from bracket.
4. Remove banjo bolt at caliper end of hose and discard 2 sealing washers.
5. Remove hose and discard.

Refit

1. Fit banjo end of hose to caliper with banjo bolt and 2 new sealing washers and tighten to 30 Nm.
2. Fit union end of hose to rear bracket and secure with clip.
3. Remove plug from pipe end, connect brake pipe to hose and tighten union to 15 Nm.
4. Bleed brake system. ***See BRAKES, Adjustments.***

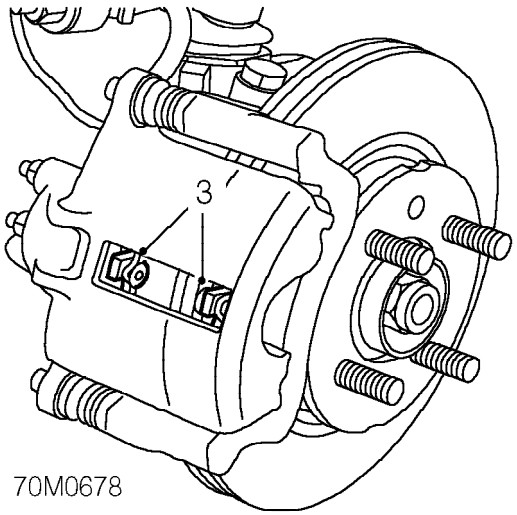
FRONT DISC BRAKES

Check

1. Raise front of vehicle.

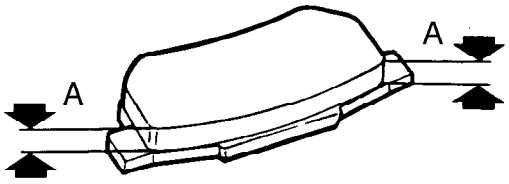
WARNING: Support on safety stands.

2. Remove both front road wheels.



70M0678

3. Check brake pads visually and assess lining thickness.



10M0396

Minimum brake pad thickness (Dimension A):
Standard = 3 mm
Sports = 2.5 mm

NOTE: Measurement does not include pad backing thickness.

4. If the brake pads need to be renewed. ***See BRAKES, Repairs.***
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.
7. Depress footbrake several times in order to give correct pad to disc clearance before road testing.

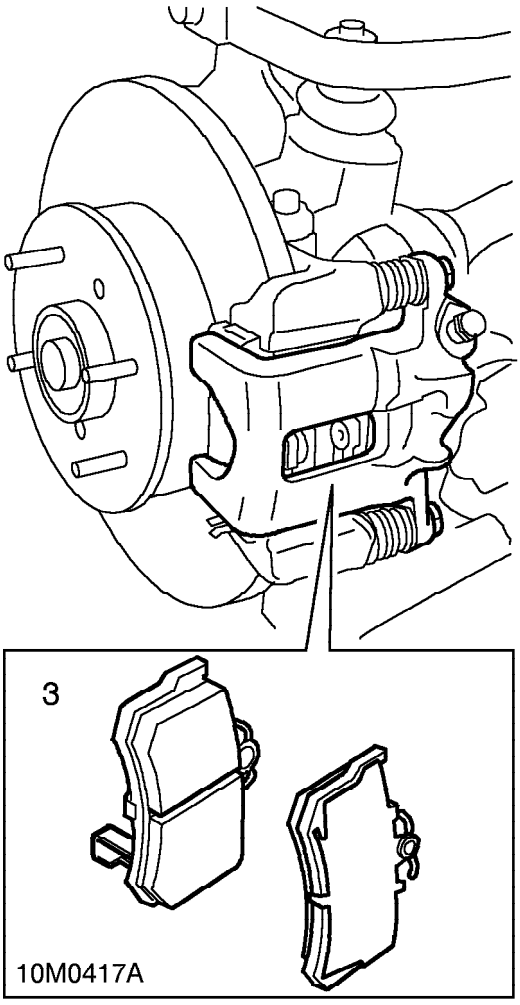
REAR DISC BRAKES

Check

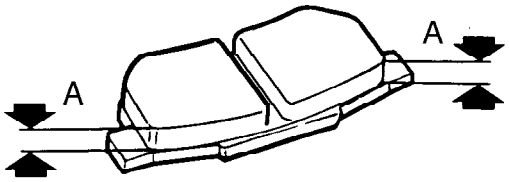
1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Remove both rear road wheels.



3. Check brake pads visually and assess pad thickness.



10M0397

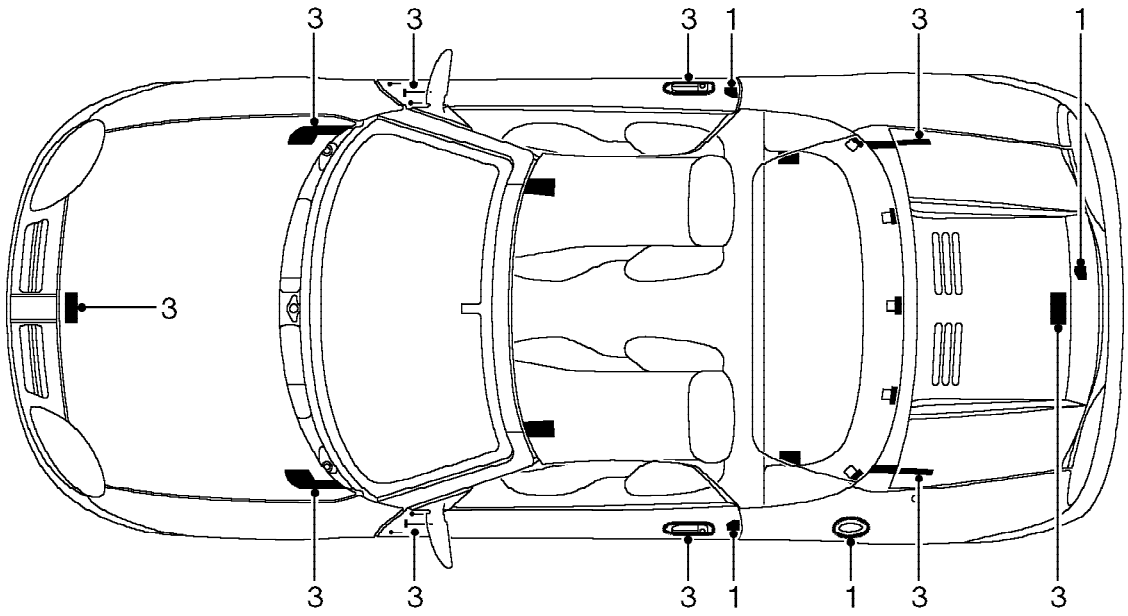
Minimum brake pad thickness:
Dimension A = 3 mm.

NOTE: Measurement does not include pad backing thickness.

4. If the brake pads need to be renewed. ***See BRAKES, Repairs.***
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.
7. Depress footbrake several times in order to give correct pad to disc clearance before road testing.

BODY

Locks, hinges and latch mechanism (not steering lock)



SP10 0008

1. Functionally check operation of all locks.
2. Operate driver's door lock and check that electric central door locking operates.
3. Ensure that all locks, hinges and latch mechanisms are lubricated using Door Lock and Latch Lubricant, Part No. CYL 100020. Inject grease sparingly into lock barrels. Clean off any surplus grease.
   DO NOT lubricate the steering lock.

NOTE: Use Rocol Ultralube on the boot hinges.

Exterior paintwork and body panels

1. Visually check paintwork and body panels for damage and corrosion.

Underbody sealer

1. Visually check underbody sealer for damage and continuity.

DRIVER AIR BAG MODULE

1. Visually check for signs of damage.
2. To renew an air bag. ***See RESTRAINT SYSTEMS, Repairs.***

PASSENGER AIR BAG MODULE

1. Visually check for signs of damage.
2. To renew an air bag. ***See RESTRAINT SYSTEMS, Repairs.***

AIR BAG ROTARY COUPLER

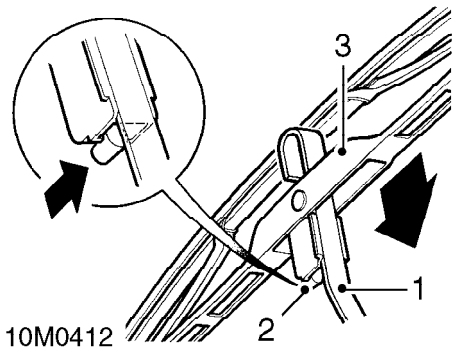
1. Rotate steering wheel one half turn in each direction and check for noise from the rotary coupler.
2. To renew the rotary coupler. ***See RESTRAINT SYSTEMS, Repairs.***

SEATS AND SEAT BELTS

1. Check seat frames are secured to floor and show no signs of movement.
2. Check operation of seat slide and tilt mechanisms, ensuring there is no excessive play between seat cushion and seat back.
3. Check tightness of all seat belt anchorage points.
4. Fully extract each seat belt and allow it to return under its own recoil mechanism.
5. Connect each seat belt to its respective buckle and check the seat belt buckle and tongue are secure.
6. Check entire length of seat belt webbing for signs of fraying and damage, replace seat belt if fraying or damage is evident. ***See RESTRAINT SYSTEMS, Repairs.***

SCREEN WIPERS AND BLADES

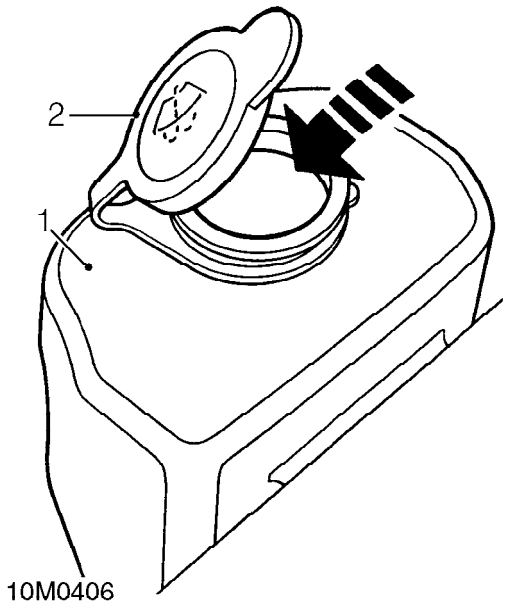
1. Operate front screen wiper.
2. Check that blades wipe screen without smearing.
3. Check that wipers park correctly.
4. Operate wiper switch in all modes.
5. Check that wipers operate at speeds selected.



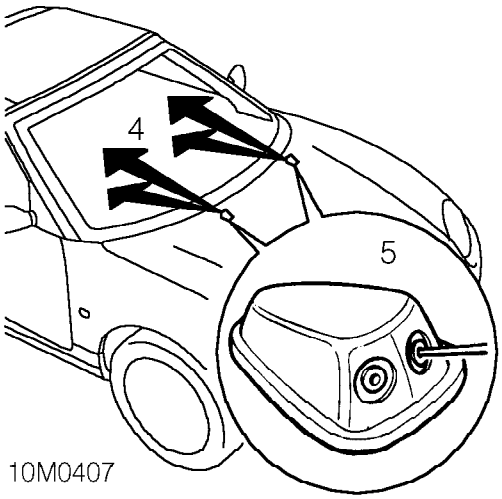
Renew blade

1. Lift wiper arm.
2. Press retaining lever.
3. Slide blade down arm.
4. Withdraw blade assembly from arm.
5. Position new blade to wiper arm.
6. Push blade into engagement with arm.
7. Check that it is retained.

WINDSCREEN WASHERS



1. Visually check mixture level in reservoir.
2. Top-up by removing filler cap and adding required concentration mixture of water and 'Screenwash'.
3. Clean windscreen washer jets using thin wire as a probe.



4. Operate windscreen washer and check that jets strike top and centre of area to be wiped.
5. Adjust jet by inserting a needle into jet hole and repositioning.
6. Check operation of wash/wipe.
7. Observe that washer and wipers operate correctly.
8. Recheck level in reservoir after adjustments.

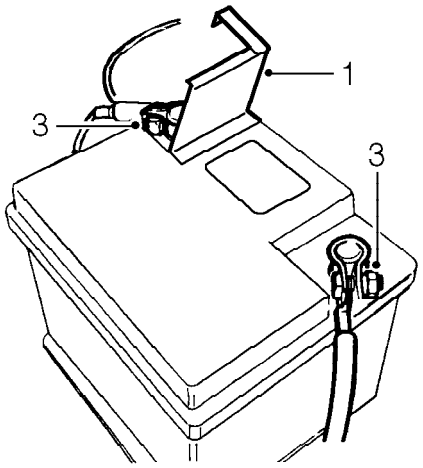
LAMPS, HORNS AND WARNING INDICATORS

1. Switch on sidelamps, and check that sidelamps, tail lamps, rear number plate lamps, and instrument lights illuminate.
2. Switch on headlamps, operate dip switch and check that headlamps function in both dip and main beam, and panel main beam indicator operates.
3. Operate flash switch and check that headlamps flash.
4. Open doors and check interior lamps illuminate.
5. Open bonnet, and rear luggage compartment and check lights illuminate.
6. Press horn and check that horn operates.
7. Switch on ignition and depress brake pedal, check brake lights illuminate including Centre High Mounted Stop Lamp (CHMSL).
8. Switch on ignition and operate direction indicator switch to right and left and check that the relative warning indicators flash at front and rear.
9. Operate hazard warning switch and check that all warning indicators flash.

HEATER BLOWER

1. Check operation of heater blower control switch.
2. Open all vents and ensure air is flowing freely when the relative selection is made on the air distribution control panel. Remove any obstruction from vents.

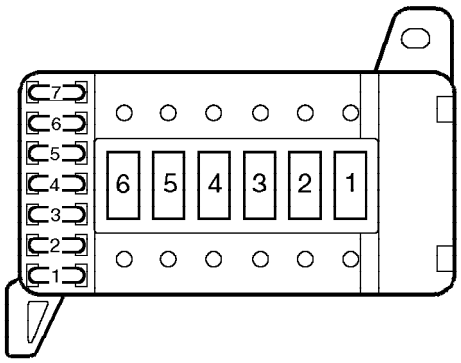
BATTERY CONNECTIONS



10M0408A

1. Lift flap covering positive terminal.
2. Wipe battery top clean and dry, smear terminal posts with petroleum jelly.
3. Ensure terminals are tight.
4. Replace flap.

FUSEBOX



M10 0715

Underbonnet fuse box

1. Release and lift off cover.
2. Check security of fusible link and power lead connections.
3. Refit cover and secure.

ROAD TEST

Park/Neutral (inhibitor) switch - Stepspeed (Em-CVT)

1. Select 'D' selector lever position.
2. Check that engine will not start.
3. Select 'R' selector lever position and repeat start check.
4. Check that engine will start with the selector lever in the 'P' and 'N' positions.

Selector cable - Stepspeed (Em-CVT)

1. Move selector lever through positions P R N and D and check for correct setting of selector cable.

Engine start and fast idle speed

1. Start engine from cold and check that fast engine idle speed is maintained until normal engine temperature is reached.

Engine performance and throttle operation

1. Start engine and check that it starts easily.
2. Check that 'oil pressure' and 'no charge' warning lamps extinguish.
3. Check that throttle pedal movement is free and unrestricted.
4. Check that engine is responsive to throttle movement.

Clutch and gear selection - manual transmission. Normal driving conditions

1. Check that clutch engages smoothly without judder, slipping or noise.
2. Check for abnormal transmission noise.
3. Check for smooth, quiet gear change and that gear selected engages easily.

Gear selector and parking pawl engagement - Stepspeed (Em-CVT). Normal driving conditions.

1. Select position 'R' and check for smooth take-up.
2. Select 'D', drive away and check for smooth ratio change from rest.
3. Check for abnormal transmission noise.
4. Slow vehicle down and check for smooth ratio change.
5. Select 'Sport', drive away and operate selector lever and steering wheel switches in plus (+) position from rest. Check for smooth up-changes of ratio from rest.
6. Slow vehicle down and operate selector lever and steering wheel switches in minus (-) position. Check for smooth down-changes of ratio.
7. Stop the vehicle on a slope.
8. Select position 'P' and release handbrake.
9. Check that vehicle does not move and selector lever does not slip from 'P' position.
10. Complete the above check with the vehicle facing in the opposite direction.

Steering

1. Check for noise, effort required, free play and self-centering.

Suspension

1. Check for noise, irregularity in ride (e.g dampers) and wheel imbalance.

Footbrake

1. Check for pedal effort, travel, braking efficiency, pulling and binding.

Instruments

1. Check that all instruments operate.
2. Check speedometer for steady operation, noise and operation of distance recorder.

Body

1. Check for abnormal body noise.

Seat belts

1. Check for operation of inertia reels and condition of belt webbing.

Handbrake

1. Apply handbrake firmly, check ratchet travel is less than 5 clicks. Check handbrake is not binding when released.

CONTENTS

Page

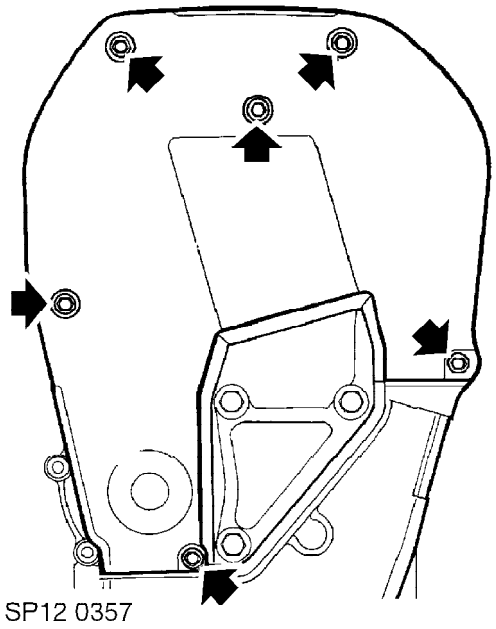
REPAIRS

OIL SEAL - FRONT - EXHAUST CAMSHAFT - FRONT/LH - Em-CVT MODELS

Service repair no - 12.13.07

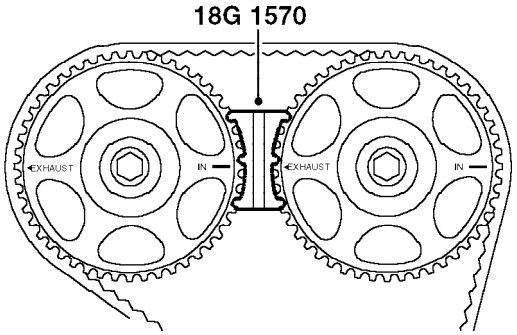
Remove

1. Disconnect battery earth lead.
2. Remove RH engine hydramount. ***See this section.***



SP12 0357

3. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
4. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.

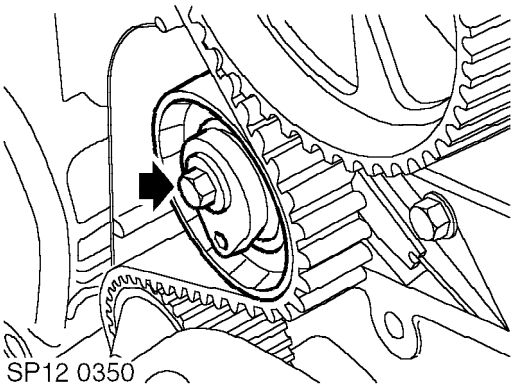


SP12 0349

5. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90° BTDC. Fit camshaft locking tool **18G 1570,** between gears.

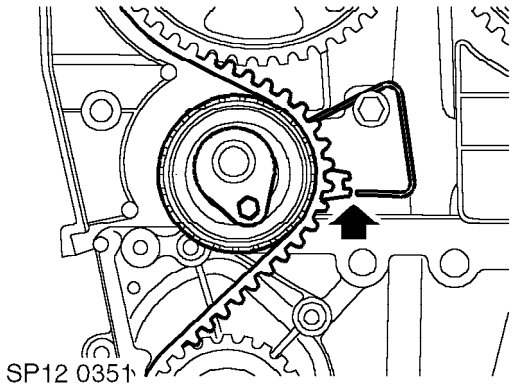
CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

6. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.



SP12 0350

7. Remove and discard timing belt tensioner bolt.

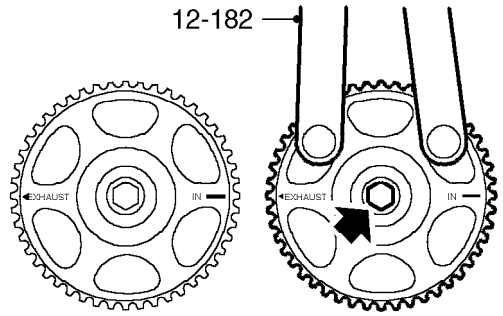


SP12 0351

8. Disengage index wire from its fitted position, at the same time removing timing belt tensioner.
9. With care, release timing belt from camshaft gears.

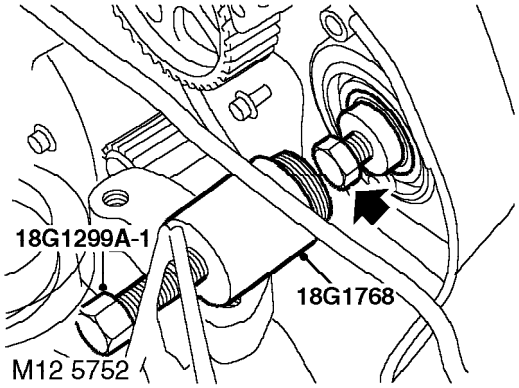
CAUTION: Ease timing belt from gears using fingers only, metal levers may damage timing belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted. Examine timing belt for signs of wear or contamination. Replace a worn or contaminated timing belt.

10. Remove camshaft gear locking tool, **18G 1570** from camshaft gears.



M12 5757

11. Using tool **12-182,** restrain camshaft gear and remove bolt and plain washer securing camshaft gear to camshaft.
12. Release and remove camshaft gear from camshaft.
13. Position cloth under camshaft oil seal area to collect any oil spillage.



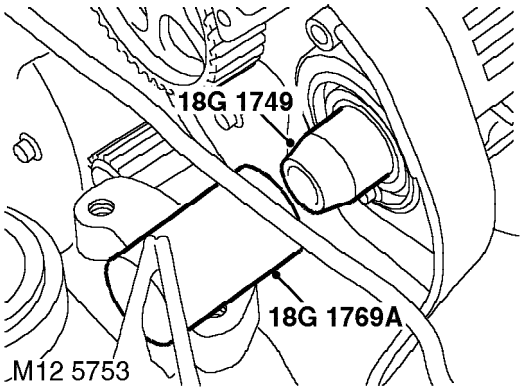
M12 5752

14. Fit camshaft gear retaining bolt to camshaft.
15. Remove camshaft oil seal using **18G 1768** and centre bolt **18G 1299A-1.**
16. Remove and discard oil seal from **18G 1768.**
17. Remove camshaft gear retaining bolt from camshaft.

Refit

1. Clean oil seal recess in camshaft carrier and cylinder head ensuring that all traces of rubber are removed.

CAUTION: To prevent damage to machined surfaces; Do Not use a metal scraper.



M12 5753

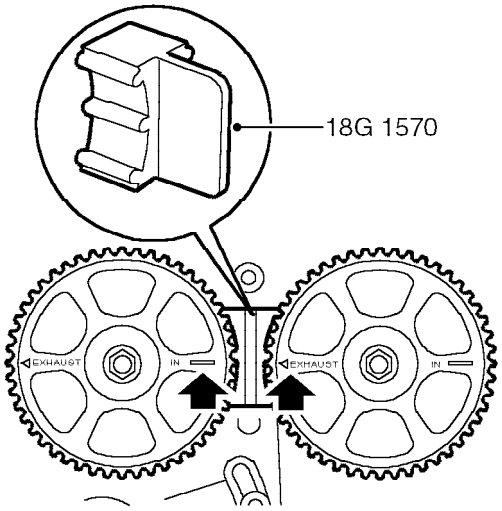
2. Fit oil seal protector, **18G 1749** to end of camshaft. Position new oil seal and carefully drift into position using **18G 1769A.**

CAUTION: Oil seals are waxed and must not be lubricated prior to fitting.

3. Clean camshaft gear and mating face.

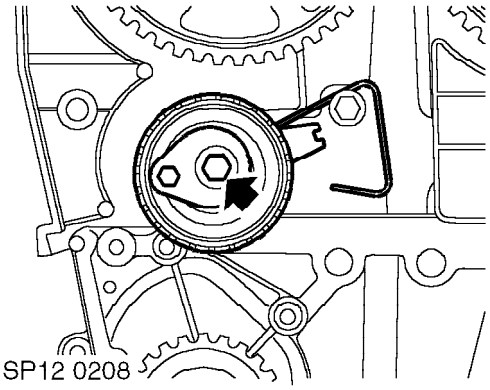
CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.

4. Position camshaft gear to camshaft ensuring that the drive pin is located in correct slot in gear. Fit and lightly tighten retaining bolt and plain washer.



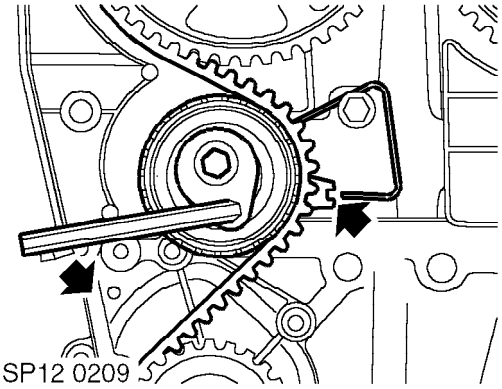
SP12 0358

5. Using **12-182,** align camshaft gear timing marks and fit camshaft gear locking tool, **18G 1570.**
6. Restrain camshaft gear using tool **12-182** and tighten retaining bolt to 65 Nm.
7. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.



SP12 0208

8. Position timing belt tensioner ensuring that the index wire is located over pillar bolt and that tensioner lever is at 9 o'clock position.
9. Fit new tensioner Patchlok bolt, tighten bolt until it is just possible to move tensioner lever.
10. Using fingers only, position timing belt to camshaft gears, tensioner and coolant pump drive gear, keeping the timing belt taut from crankshaft gear and between camshaft gears.
11. Check that timing belt is positioned centrally around all gears and tensioner pulley.
12. Remove camshaft gear locking tool,**18G 1570** from camshaft gears.



SP12 0209

13. Using a 6 mm Allen key, rotate tensioner anti-clockwise to align pointer to index wire. If original timing belt is being refitted, align index wire to lower land of pointer.

CAUTION: It is imperative that the pointer approaches the index wire from above. If the pointer passes the index wire, the tension must be fully released and the tensioning procedure must be repeated.

14. Ensuring that the pointer maintains correct position, tighten tensioner bolt to 25 Nm.
15. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

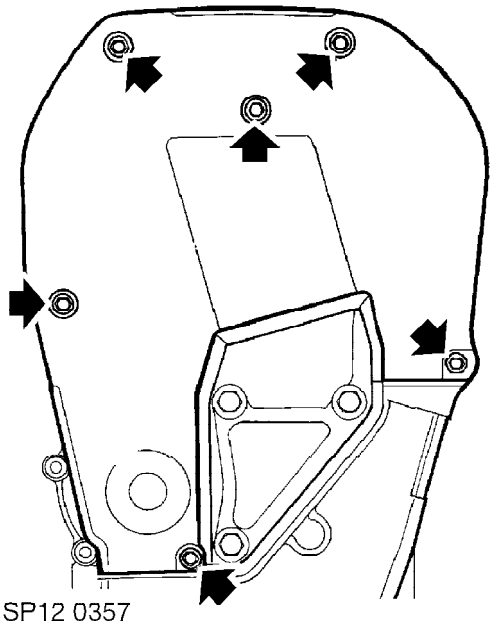
16. Check that pointer is correctly aligned with index wire.
17. Clean timing belt upper cover.
18. Position timing belt upper cover and seal, fit and tighten bolts to 5 Nm.
19. Fit RH engine hydramount. ***See this section.***
20. Connect battery earth lead.

OIL SEAL - FRONT - EXHAUST CAMSHAFT - FRONT/LH - VVC MODELS

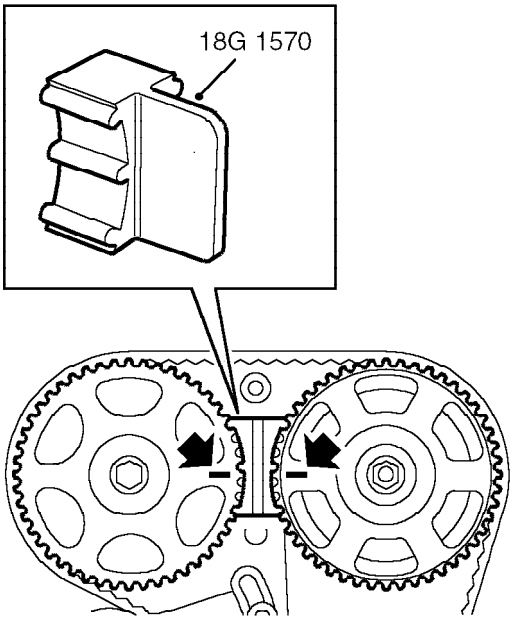
Service repair no - 12.13.07

Remove

1. Disconnect battery earth lead.
2. Remove RH engine hydramount. ***See this section.***


SP12 0357

3. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
4. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.

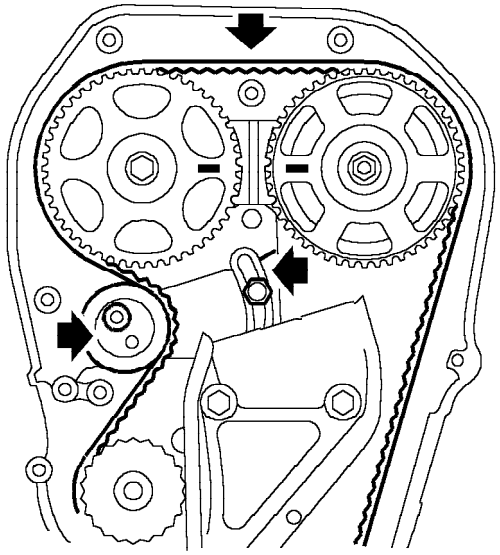


M12 6168

5. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90° BTDC. Fit camshaft locking tool, **18G 1570** between gears.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

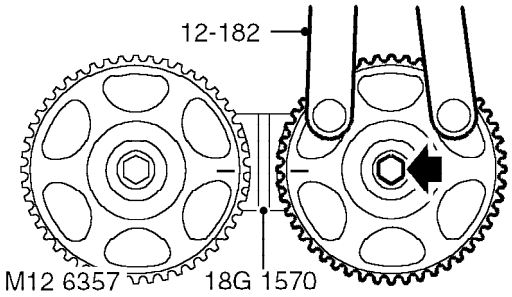
6. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.



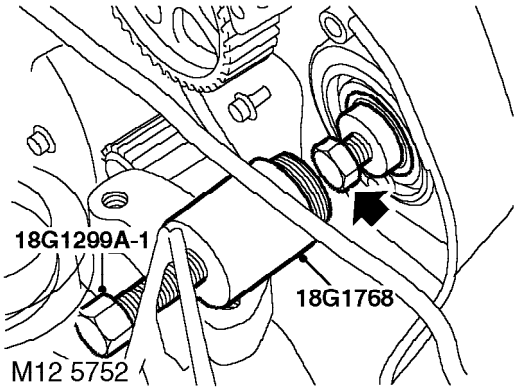
M12 6170

7. Mark position of tensioner backplate to cylinder head for timing belt tensioning reference.
8. Loosen timing belt tensioner pulley Allen bolt 1/2 turn.
9. Loosen timing belt tensioner backplate bolt 1/2 turn.
10. Push tensioner pulley down to fully OFF position and tighten backplate bolt to 10 Nm.
11. With care, release timing belt from camshaft gears.

CAUTION: Ease timing belt from gears using fingers only, metal levers may damage timing belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted. Examine timing belt for signs of wear or contamination. Replace a worn or contaminated timing belt.



12. Remove camshaft gear locking tool,**18G 1570** from camshaft gears.
13. Using tool **12-182,** restrain camshaft gear and remove bolt and plain washer securing camshaft gear to camshaft.
14. Release and remove camshaft gear from camshaft.
15. Position cloth under camshaft oil seal area to collect any oil spillage.

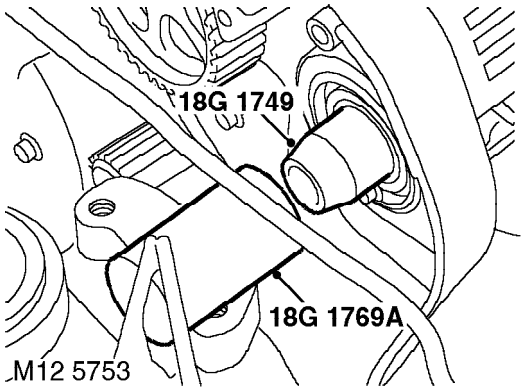


16. Fit camshaft gear retaining bolt to camshaft.
17. Remove camshaft oil seal using **18G 1768,** and centre bolt **18G 1299A-1.**
18. Remove and discard oil seal from **18G 1768.**
19. Remove camshaft gear retaining bolt from camshaft.

Refit

1. Clean oil seal recess in camshaft carrier and cylinder head ensuring that all traces of rubber are removed.

CAUTION: To prevent damage to machined surfaces; Do Not use a metal scraper.



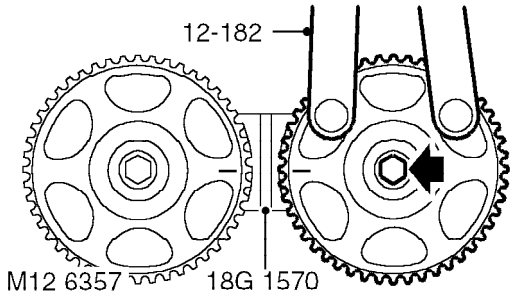
2. Fit oil seal protector, **18G 1749** to end of camshaft, position new oil seal and carefully drift into position using **18G 1769A.**

CAUTION: Oil seals are waxed and must not be lubricated prior to fitting.

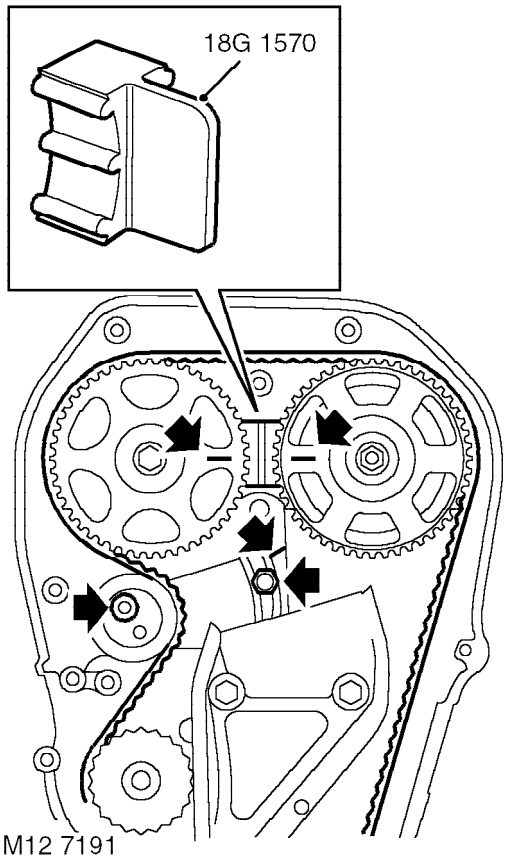
3. Clean camshaft gear and mating face.

CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.

4. Position camshaft gear to camshaft ensuring that the drive pin is located in correct slot in gear. Fit and lightly tighten retaining bolt and plain washer.



5. Using**12-182,** align camshaft gear timing marks and fit camshaft gear locking tool, **18G 1570.**
6. Restrain camshaft gear using tool **12-182,** and tighten retaining bolt to 65 Nm.
7. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.
8. Using fingers only, position timing belt to camshaft gears, tensioner and coolant pump drive gear, keeping the timing belt taut from crankshaft gear and between camshaft gears.
9. Check that timing belt is positioned centrally around all gears and tensioner pulley.



10. Loosen timing belt tensioner backplate bolt 1/2 turn.
11. Position tensioner, align to reference mark on backplate and cylinder head. Tighten tensioner backplate bolt to 10 Nm.
12. Tighten tensioner pulley Allen bolt to 45 Nm.
13. Remove camshaft gear locking tool,**18G 1570,** from camshaft gears.
14. Rotate crankshaft 2 complete turns clockwise and check that the timing marks on the camshaft gears and crankshaft pulley are correctly aligned.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

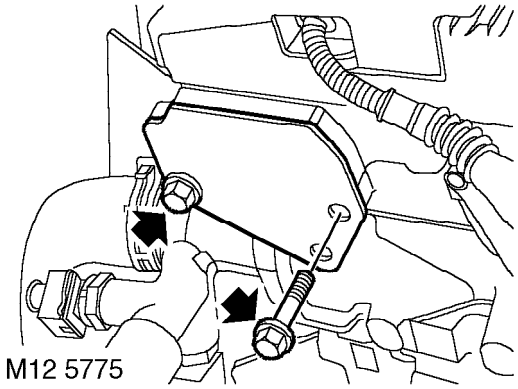
15. Clean timing belt upper cover.
16. Position timing belt upper cover and seal, fit and tighten bolts to 5 Nm.
17. Fit RH engine hydramount. ***See this section.***
18. Connect battery earth lead.

CAMSHAFT REAR OIL SEAL - EXHAUST

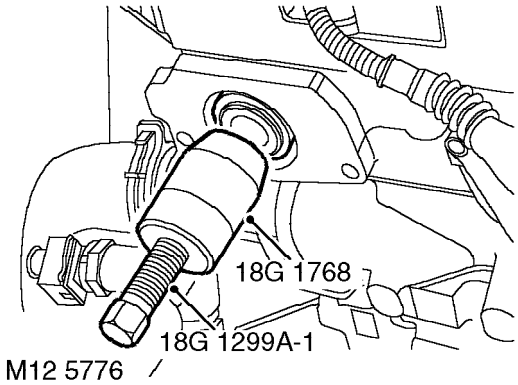
Service repair no - 12.13.08

Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See this section.***
3. Position absorbent cloth beneath vehicle to catch any oil spillage.



4. Remove 2 bolts securing oil seal cover to cylinder head and remove cover.

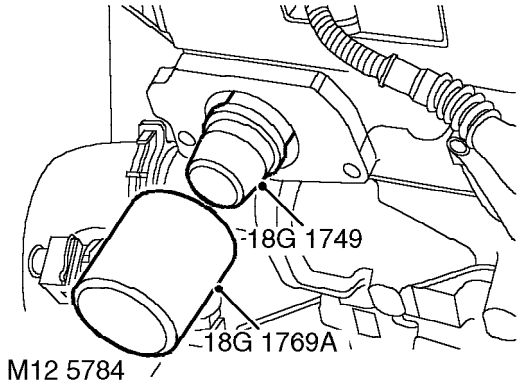


5. Remove camshaft oil seal using **18G 1768** and centre bolt **18G 1299A-1.**
6. Discard camshaft oil seal.

Refit

1. Clean oil seal recess, ensuring all traces of rubber are removed.

CAUTION: Do not use a metal scraper or the machined surfaces may be damaged.



2. Fit **18G 1749** to end of camshaft to protect seal and fit new camshaft oil seal using **18G 1769A.**

CAUTION: Oil seal must be fitted dry. DO NOT USE 18G 1769.

NOTE: Rear oil seals are red.

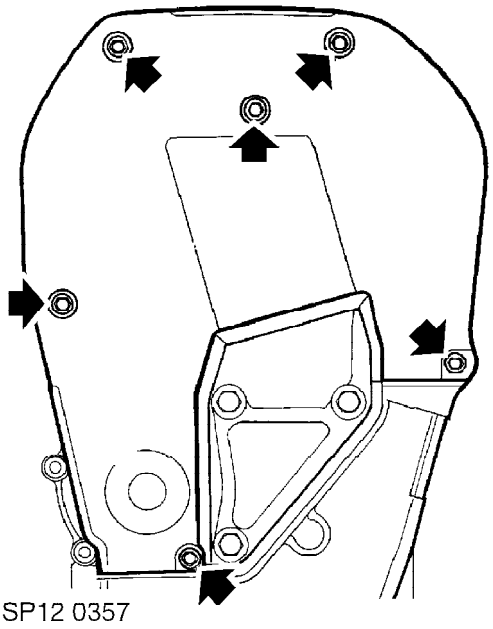
3. Ensure area around camshaft oil seal is clean and free from oil.
4. Position cover plate, fit bolts and tighten to 12 Nm.
5. Fit engine cover. ***See this section.***
6. Connect battery earth lead.

OIL SEAL - FRONT - INLET CAMSHAFT - REAR/RH - Em-CVT MODELS

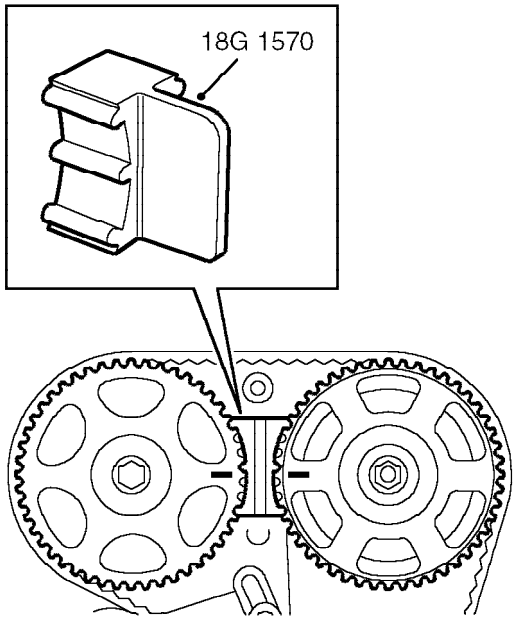
Service repair no - 12.13.09

Remove

1. Disconnect battery earth lead.
2. Remove RH engine hydramount. ***See this section.***

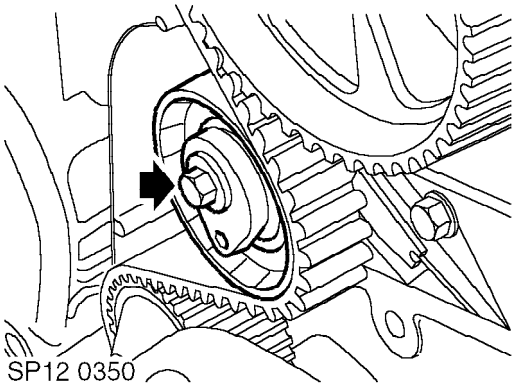


3. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
4. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.



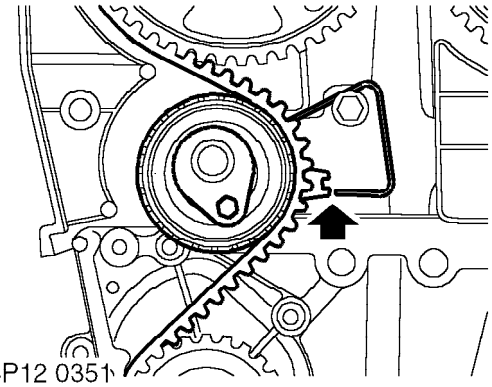
SP12 0342

5. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90° BTDC. Fit camshaft locking tool **18G 1570,** between gears. Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.
6. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.



SP12 0350

7. Remove and discard timing belt tensioner bolt.

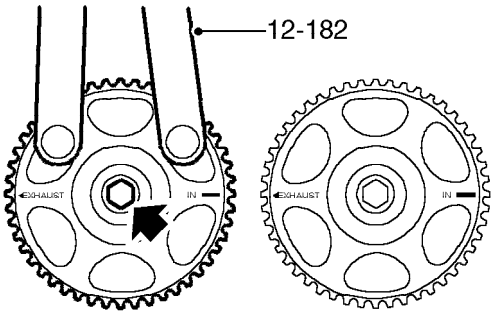


SP12 0351

8. Disengage index wire from its fitted position, at the same time removing timing belt tensioner.
9. With care, release timing belt from camshaft gears.

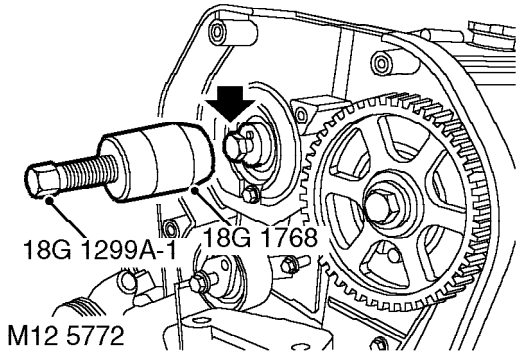
CAUTION: Ease timing belt from gears using fingers only, metal levers may damage timing belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted. Examine timing belt for signs of wear or contamination. Replace a worn or contaminated timing belt.

10. Remove camshaft gear locking tool **18G 1570,** from camshaft gears.



M12 5743

11. Using tool **12-182,** restrain camshaft gear and remove bolt and plain washer securing camshaft gear to camshaft.
12. Release and remove camshaft gear from camshaft.
13. Position cloth under camshaft oil seal area to collect any oil spillage.

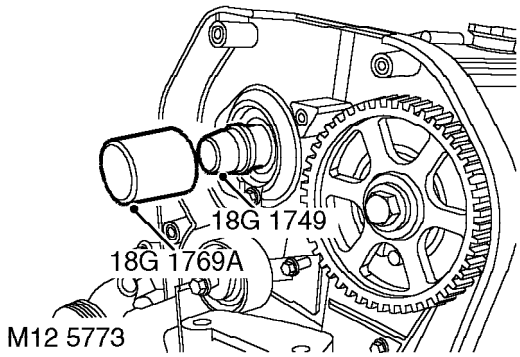


14. Fit camshaft gear retaining bolt to camshaft.
15. Remove camshaft oil seal using **18G 1768** and centre bolt **18G 1299A-1.**
16. Remove and discard oil seal from **18G 1768.**
17. Remove camshaft gear retaining bolt from camshaft.

Refit

1. Clean oil seal recess in camshaft carrier and cylinder head ensuring that all traces of rubber are removed.

CAUTION: To prevent damage to machined surfaces; Do Not use a metal scraper.



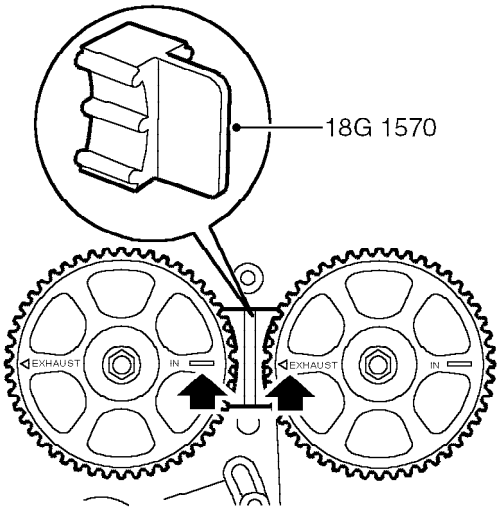
2. Fit oil seal protector,**18G 1749** to end of camshaft. Position new oil seal and carefully drift into position using **18G 1769A.**

CAUTION: Oil seals are waxed and must not be lubricated prior to fitting.

3. Clean camshaft gear and mating face.

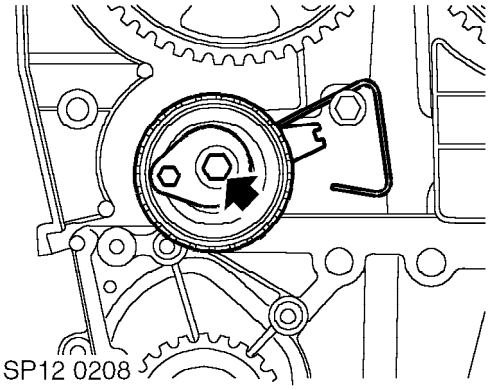
CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.

4. Position camshaft gear to camshaft ensuring that the drive pin is located in correct slot in gear. Fit and lightly tighten retaining bolt and plain washer.



SP12 0358

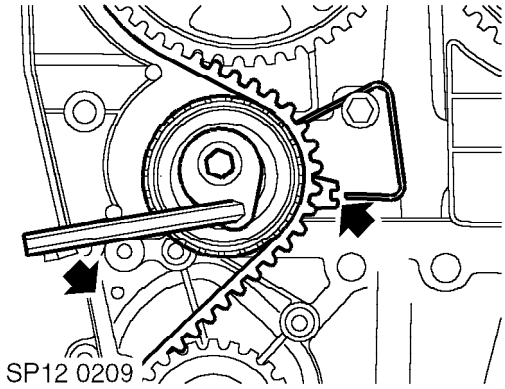
5. Using **12-182,** align camshaft gear timing marks and fit camshaft gear locking tool, **18G 1570.**
6. Restrain camshaft gear using tool **12-182** and tighten retaining bolt to 65 Nm.
7. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.



SP12 0208

8. Position timing belt tensioner ensuring that the index wire is located over pillar bolt and that tensioner lever is at 9 o'clock position.
9. Fit new tensioner Patchlok bolt, tighten bolt until it is just possible to move tensioner lever.

10. Using fingers only, position timing belt to camshaft gears, tensioner and coolant pump drive gear, keeping the timing belt taut from crankshaft gear and between camshaft gears.
11. Check that timing belt is positioned centrally around all gears and tensioner pulley.
12. Remove camshaft gear locking tool, **18G 1570** from camshaft gears.


SP12 0209

13. Using a 6 mm Allen key, rotate tensioner anti-clockwise to align pointer to index wire. If original timing belt is being refitted, align index wire to lower land of pointer.

CAUTION: It is imperative that the pointer approaches the index wire from above. If the pointer passes the index wire, the tension must be fully released and the tensioning procedure must be repeated.

14. Ensuring that the pointer maintains correct position, tighten tensioner bolt to 25 Nm.
15. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

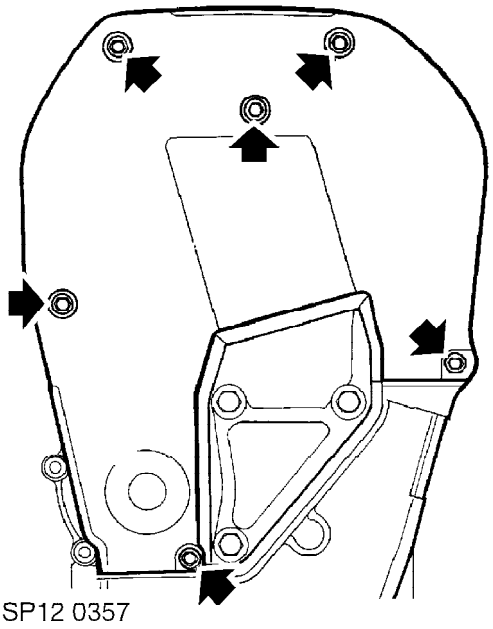
16. Check that pointer is correctly aligned with index wire.
17. Clean timing belt upper cover.
18. Position timing belt upper cover and seal, fit and tighten bolts to 5 Nm.
19. Fit RH engine hydramount. ***See this section.***
20. Connect battery earth lead.

OIL SEAL - FRONT - INLET CAMSHAFT - REAR/RH - VVC MODELS

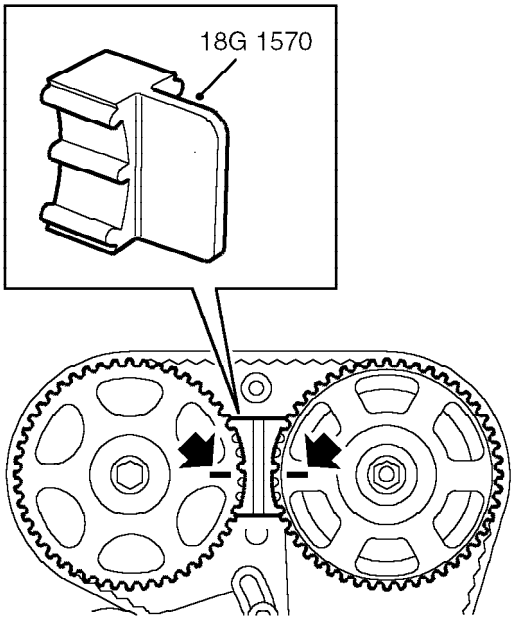
Service repair no - 12.13.09

Remove

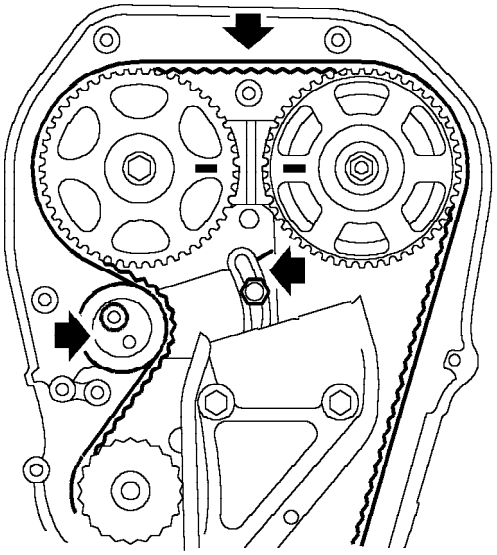
1. Disconnect battery earth lead.
2. Remove RH engine hydramount. ***See this section.***


SP12 0357

3. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
4. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.



M12 6168



M12 6170

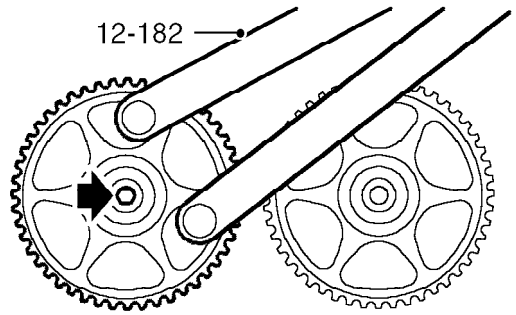
5. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90° BTDC. Fit camshaft locking tool **18G 1570,** between gears.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

6. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.
7. Mark position of tensioner backplate to cylinder head for timing belt tensioning reference.
8. Loosen timing belt tensioner pulley Allen bolt 1/2 turn.
9. Loosen timing belt tensioner backplate bolt 1/2 turn.
10. Push tensioner pulley down to fully OFF position and tighten backplate bolt to 10 Nm.
11. With care, release timing belt from camshaft gears.

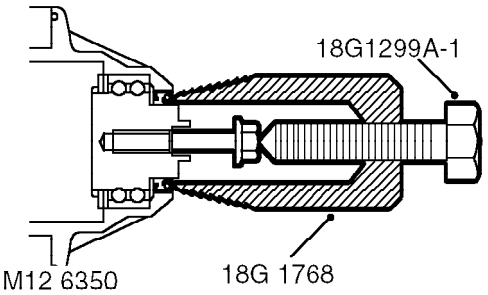
CAUTION: Ease timing belt from gears using fingers only, metal levers may damage timing belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted. Examine timing belt for signs of wear or contamination. Replace a worn or contaminated timing belt.

12. Remove camshaft gear locking tool, **18G 1570,** from camshaft gears.



M12 6349

13. Using tool **12-182,** restrain camshaft gear and remove bolt and plain washer securing camshaft gear to camshaft.
14. Release and remove camshaft gear from camshaft.
15. Position cloth under camshaft oil seal area to collect any oil spillage.

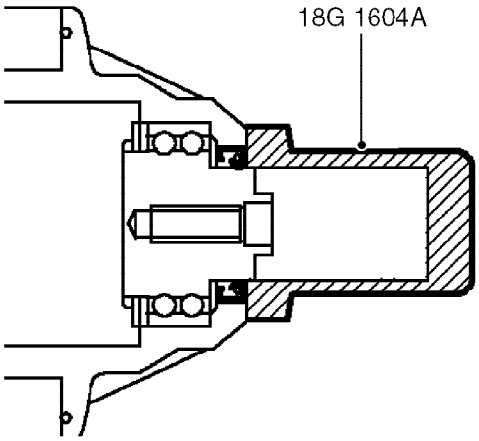


16. Fit camshaft gear retaining bolt to camshaft.
17. Remove camshaft oil seal using **18G 1768** and centre bolt **18G 1299A-1.**
18. Remove and discard oil seal from **18G 1768.**
19. Remove camshaft gear retaining bolt from camshaft.

Refit

1. Clean end of camshaft and oil seal recess in VVC mechanism housing.

CAUTION: To prevent damage to machined surfaces; Do Not use a metal scraper.



SP12 0365

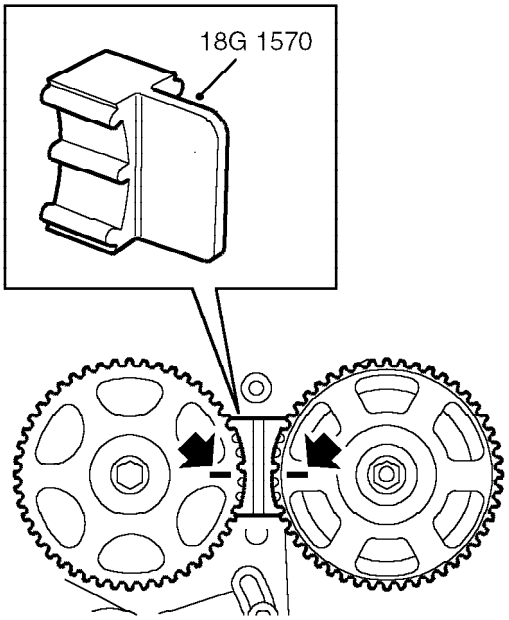
2. Fit new camshaft oil seal using tool **18G 1604A,** carefully drifting the oil seal into the VVC mechanism housing until flush with the housing face.

CAUTION: Oil seals are waxed and must not be lubricated prior to fitting.

3. Clean camshaft gear and mating face.

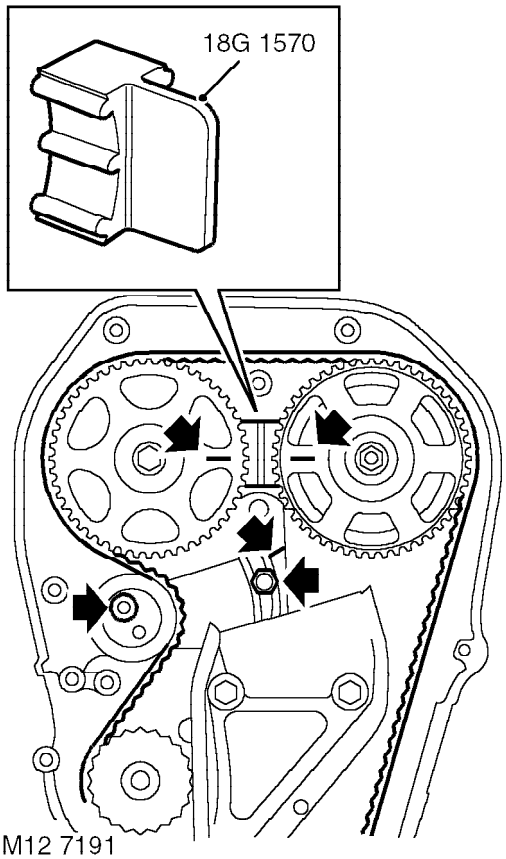
CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.

4. Position camshaft gear to camshaft ensuring that the drive pin is located in correct slot in gear. Fit and lightly tighten retaining bolt and plain washer.



M12 6171

5. Using **12-182,** align camshaft gear timing marks and fit camshaft gear locking tool, **18G 1570** .
6. Restrain camshaft gear using tool **12-182** and tighten retaining bolt to 65 Nm.
7. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.
8. Using fingers only, position timing belt to camshaft gears, tensioner and coolant pump drive gear, keeping the timing belt taut from crankshaft gear and between camshaft gears.
9. Check that timing belt is positioned centrally around all gears and tensioner pulley.



M12 7191

10. Loosen timing belt tensioner backplate bolt 1/2 turn.
11. Position tensioner, align to reference mark on backplate and cylinder head. Tighten tensioner backplate bolt to 10 Nm.
12. Tighten tensioner pulley Allen bolt to 45 Nm.
13. Remove camshaft gear locking tool,**18G 1570,** from camshaft gears.
14. Rotate crankshaft 2 complete turns clockwise and check that the timing marks on the camshaft gears and crankshaft pulley are correctly aligned.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

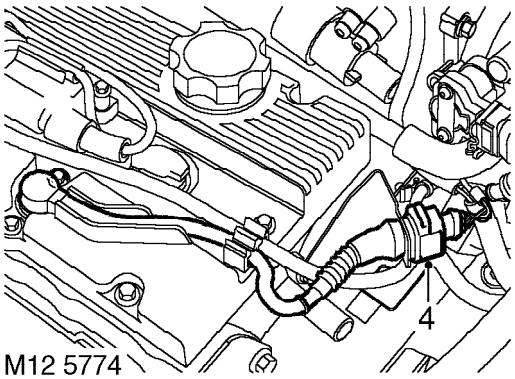
15. Clean timing belt upper cover.
16. Position timing belt upper cover and seal,fit and tighten bolts to 5 Nm.
17. Fit RH engine hydramount. ***See this section.***
18. Connect battery earth lead.

CAMSHAFT REAR OIL SEAL - INLET

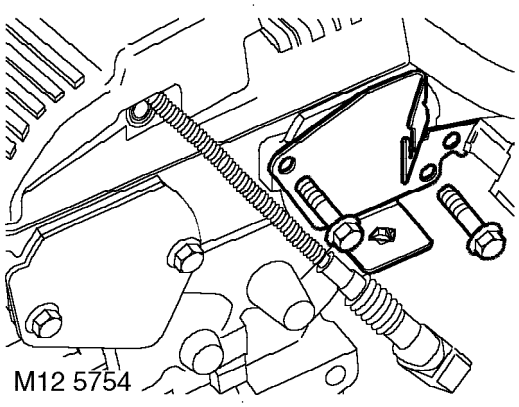
Service repair no - 12.13.10

Remove

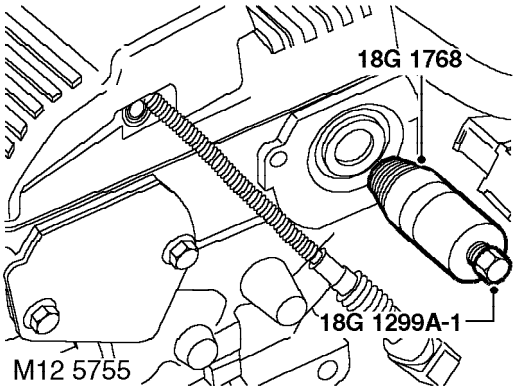
1. Disconnect battery earth lead.
2. Remove engine cover. ***See this section.***
3. Position absorbent cloth beneath vehicle to catch any oil spillage.



4. Disconnect CMP sensor multiplug and release CMP harness from oil seal cover.



5. Remove 2 bolts securing oil seal cover to cylinder head and position cover aside.

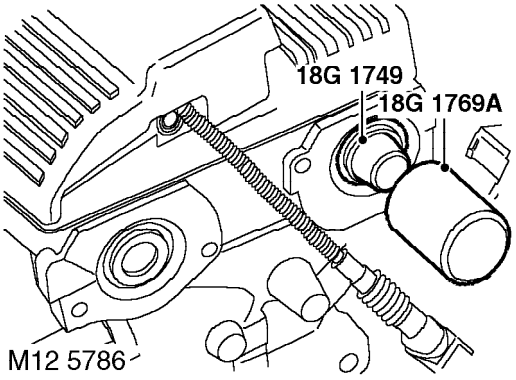


6. Remove camshaft oil seal using **18G 1768** and centre bolt **18G 1299A-1.**
7. Discard camshaft oil seal.

Refit

1. Clean oil seal recess, ensuring all traces of rubber are removed.

CAUTION: Do not use a metal scraper or machined surfaces may be damaged.



2. Fit **18G 1749** to end of camshaft to protect seal and fit new camshaft oil seal using **18G 1769A.** DO NOT USE **18G 1769.**

NOTE: Oil seals are red.

3. Ensure area around camshaft oil seal is clean and free from oil.
4. Position cover plate, fit bolts and tighten to 12 Nm.
5. Secure CMP harness to cover plate and connect CMP multiplug.
6. Fit engine cover. ***See this section.***
7. Connect battery earth lead.

PULLEY - CRANKSHAFT - MANUAL GEARBOX MODELS

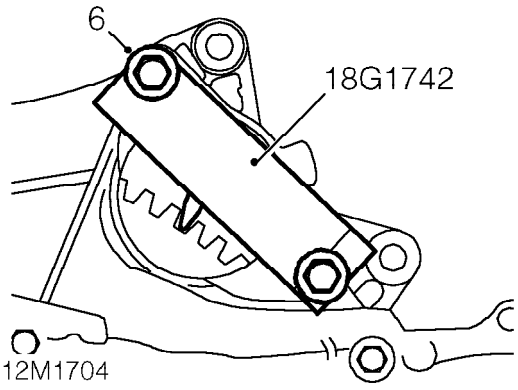
Service repair no - 12.21.01

Remove

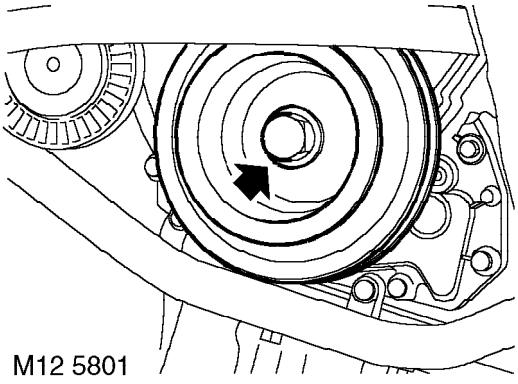
1. Disconnect battery earth lead.
2. Raise rear of vehicle.

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

3. Remove road wheel.
4. Remove auxiliary drive belt. ***See ELECTRICAL, Repairs.***
5. Remove starter motor. ***See ELECTRICAL, Repairs.***



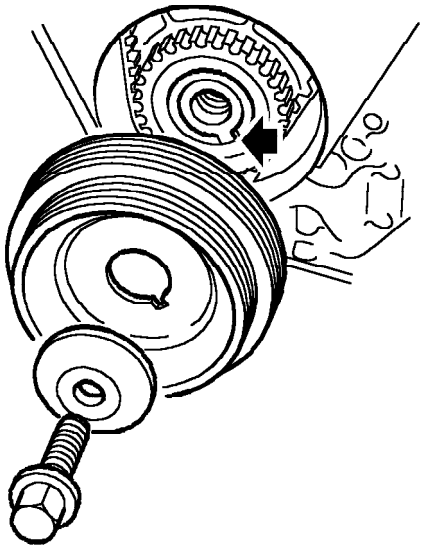
6. Lock crankshaft using tool **18G 1742** .



7. Remove bolt securing crankshaft pulley and collect washer.
8. Remove crankshaft pulley.

Refit

1. Clean crankshaft to pulley mating faces.



12M1703A

2. Fit crankshaft pulley to crankshaft, ensuring that indent on pulley locates over lug on gear.
3. Fit washer and bolt securing crankshaft pulley to crankshaft and tighten to 205 Nm.
4. Remove crankshaft locking tool **18G 1742** .
5. Fit starter motor. ***See ELECTRICAL, Repairs.***
6. Fit auxiliary drive belt. ***See ELECTRICAL, Repairs.***
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stands and lower vehicle.
9. Connect battery earth lead.

PULLEY - CRANKSHAFT - STEPSPEED (Em-CVT) MODELS

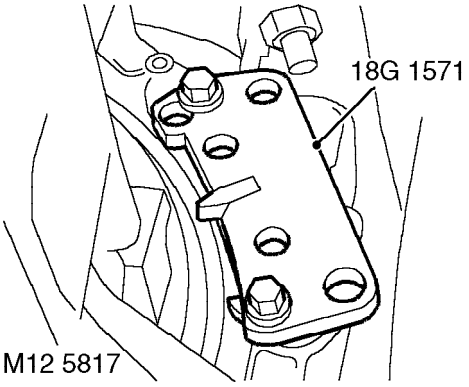
Service repair no - 12.21.01

Remove

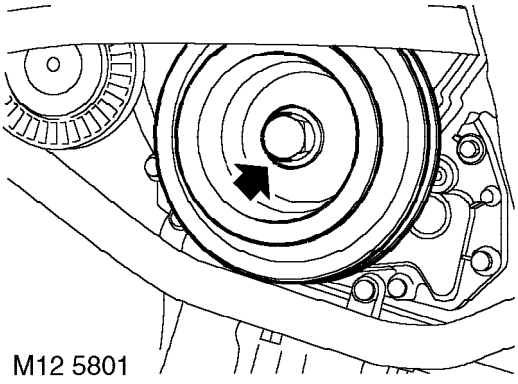
1. Disconnect battery earth lead.
2. Raise rear of vehicle.

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

3. Remove road wheel.
4. Remove auxiliary drive belt. ***See ELECTRICAL, Repairs.***
5. Remove starter motor. ***See ELECTRICAL, Repairs.***



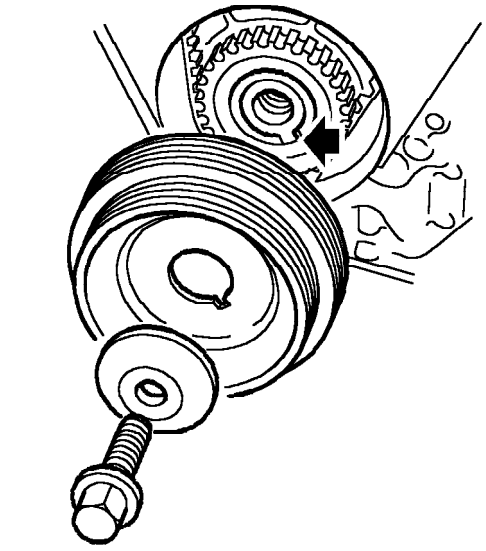
6. Lock crankshaft using tool **18G 1571** .



7. Remove bolt securing crankshaft pulley and collect washer.
8. Remove crankshaft pulley.

Refit

1. Clean crankshaft to pulley mating faces.



12M1703A

2. Fit crankshaft pulley to crankshaft, ensuring that indent on pulley locates over lug on gear.
3. Fit washer and bolt securing crankshaft pulley to crankshaft and tighten to 205 Nm.
4. Remove flywheel locking tool **18G 1571** .
5. Fit starter motor. ***See ELECTRICAL, Repairs.***
6. Fit auxiliary drive belt. ***See ELECTRICAL, Repairs.***
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stands and lower vehicle.
9. Connect battery earth lead.

PULLEY - CRANKSHAFT - VVC MODELS

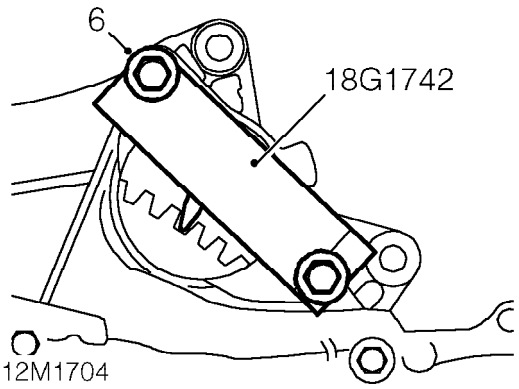
Service repair no - 12.21.01

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

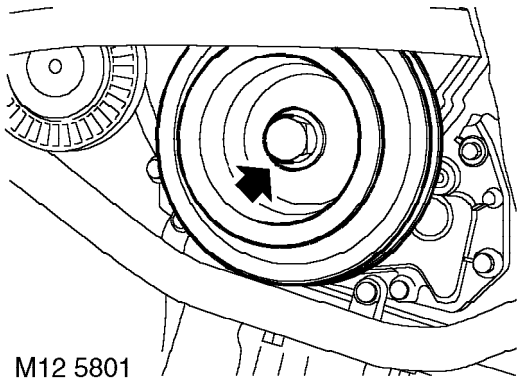
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

3. Remove road wheel.
4. Remove auxiliary drive belt. ***See ELECTRICAL, Repairs.***
5. Remove starter motor. ***See ELECTRICAL, Repairs.***



12M1704

6. Lock crankshaft using tool **1742** .

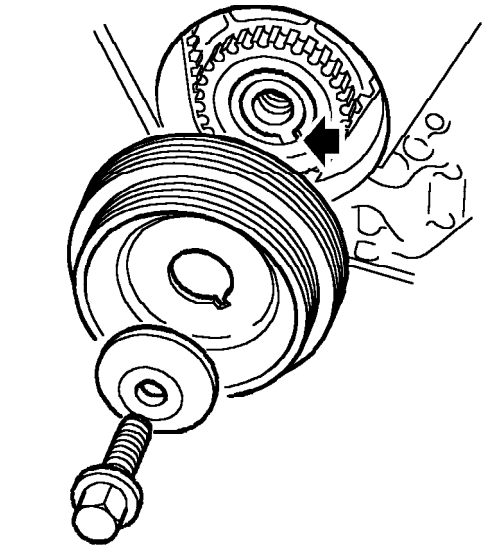


M12 5801

7. Remove bolt securing crankshaft pulley and collect washer.
8. Remove crankshaft pulley.

Refit

1. Clean crankshaft to pulley mating faces.



12M1703A

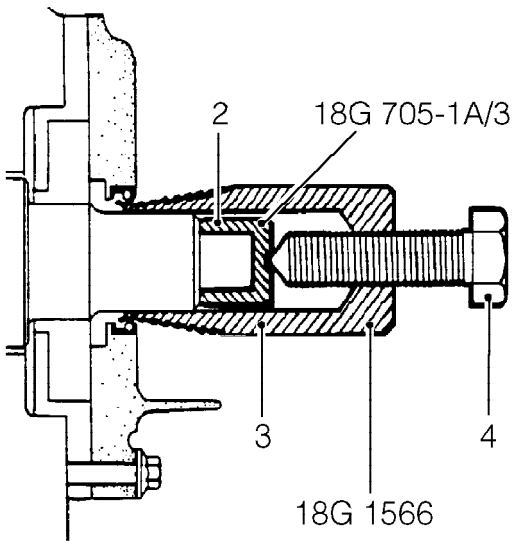
2. Fit crankshaft pulley to crankshaft, ensuring that indent on pulley locates over lug on gear.
3. Fit washer and bolt securing crankshaft pulley to crankshaft and tighten to 205 Nm.
4. Remove crankshaft locking tool **18G 1742.**
5. Fit starter motor. ***See ELECTRICAL, Repairs.***
6. Fit auxiliary drive belt. ***See ELECTRICAL, Repairs.***
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stands and lower vehicle.
9. Connect battery earth lead.

CRANKSHAFT FRONT OIL SEAL

Service repair no - 12.21.14

Remove

1. Remove crankshaft timing belt gear. ***See this section.***

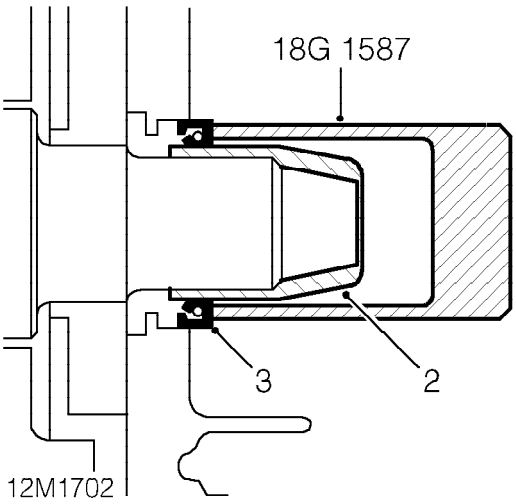


12M1438

2. Fit thrust button tool **18G 705-1A/3** to crankshaft.
3. Ensure bore of tool is burr free, fit and tighten tool **18G 1566.** into crankshaft front oil seal.
4. Tighten centre screw of tool to remove oil seal.
5. Remove thrust button from crankshaft.

Refit

1. Use lint free cloth to thoroughly clean seal recess in oil pump and running surface on crankshaft.
   Clean crankshaft pulley and gear.



2. Fit protector, from oil seal kit, over crankshaft end.
3. Fit new oil seal to crankshaft using tool **18G 1587** . Remove protector.

CAUTION: Oil seal must be fitted dry.

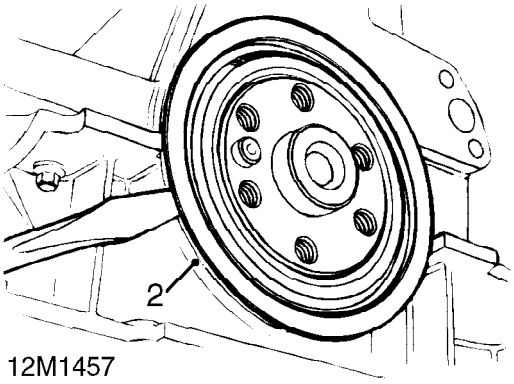
4. Fit crankshaft timing belt gear. ***See this section.***

CRANKSHAFT REAR OIL SEAL

Service repair no - 12.21.20

Remove

1. Remove flywheel. ***See this section.***

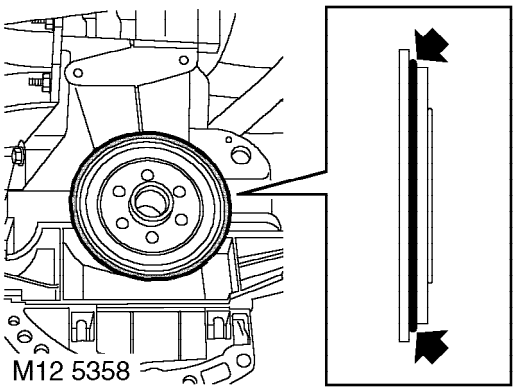


2. Using a burr free flat ended screwdriver, ease crankshaft rear oil seal from cylinder block, remove and discard seal.

CAUTION: Do not mark sealing surface on crankshaft.

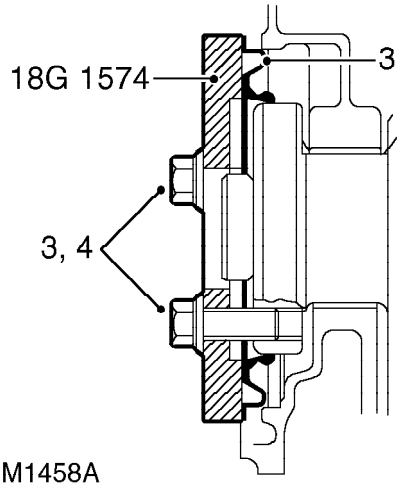
Refit

1. Remove all traces of oil and sealant from cylinder block, oil seal recess and running surface of crankshaft.



2. Apply a continuous bead of sealant, Part No. GAC 8000 to replacement oil seal as shown.

CAUTION: Do not apply oil or grease to any part of oil seal or running surface of crankshaft. Seal must be fitted immediately after applying sealant.



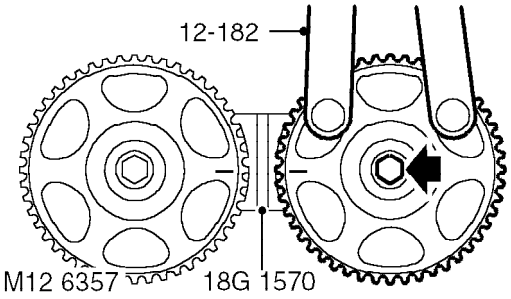
3. Position oil seal to cylinder block and fit oil seal replacer tool **18G 1574,** retain tool using 3 slave bolts.
4. Evenly tighten oil seal replacer bolts to press oil seal squarely into cylinder block.
5. Leave oil seal replacer tool and oil seal in clamped position for one minute to allow oil seal to relax.
6. Remove oil seal replacer tool.
7. Allow sealant to cure for a minimum of 30 minutes before topping-up oil or rotating crankshaft.
8. Fit flywheel. ***See this section.***

GASKET - CYLINDER HEAD - VVC MODELS

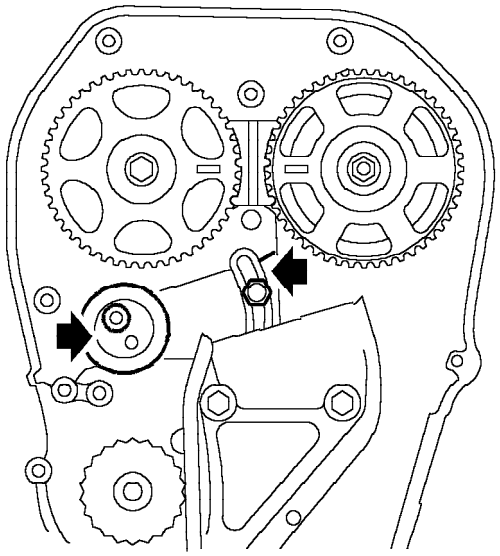
Service repair no - 12.29.02

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access cover.
3. Remove inlet manifold gasket. ***See this section.***
4. Remove camshaft timing belt. ***See this section.***

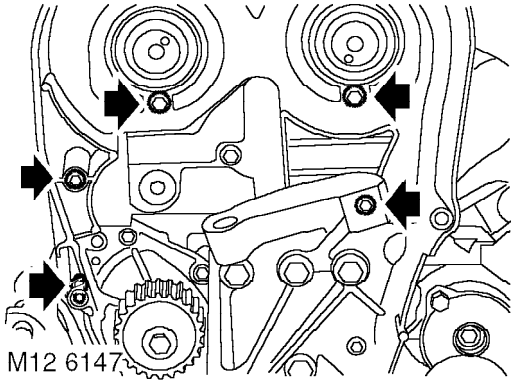


5. Restrain camshaft gears using **12-182** and remove bolts and plain washers securing camshaft gears to camshafts. Remove **18G 1570** from between camshaft gears.
6. Mark camshaft gears for assembly purposes. Remove camshaft gears.

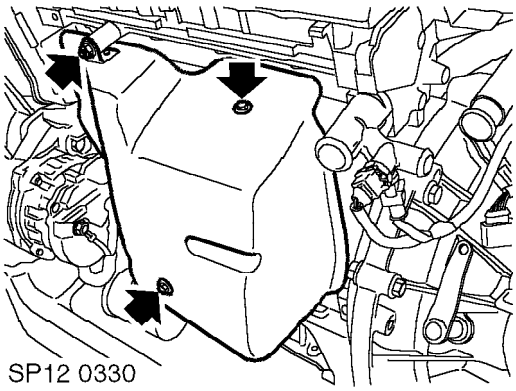


M12 6227

7. Remove bolt securing timing belt tensioner backplate to cylinder head.
8. Remove Allen bolt securing camshaft timing belt tensioner pulley to cylinder head and remove timing belt tensioner.

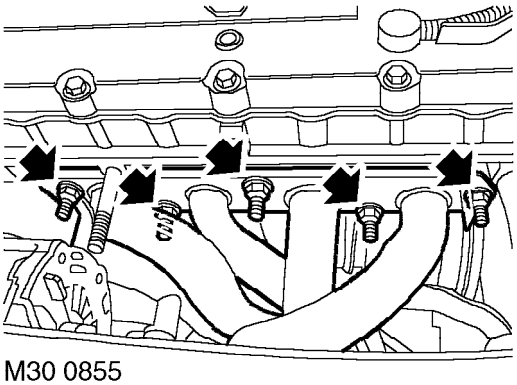


9. Remove 5 bolts securing camshaft timing belt rear cover to cylinder head and cylinder block. Remove rear cover.
10. Remove camshaft cover gasket. ***See this section.***



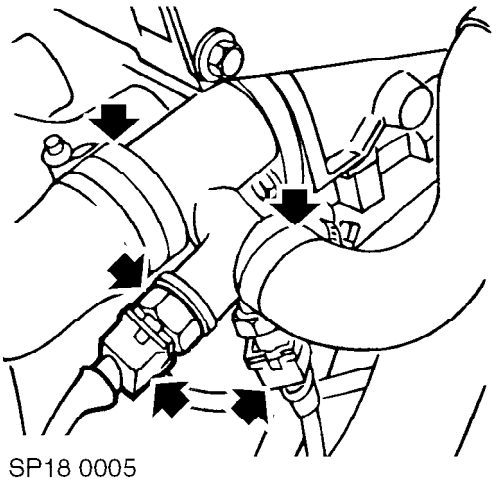
11. Remove nut and 2 speed bolts securing heat shield to cylinder head and exhaust manifold, remove heat shield.

12. Remove spacer from heat shield retaining stud.



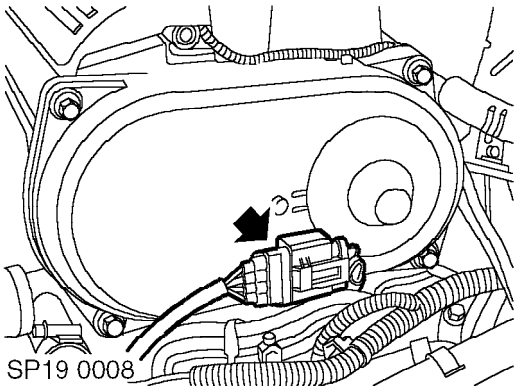
M30 0855

13. Remove 5 nuts securing exhaust manifold to cylinder head, release exhaust manifold from studs and position aside. Remove and discard exhaust manifold gasket.



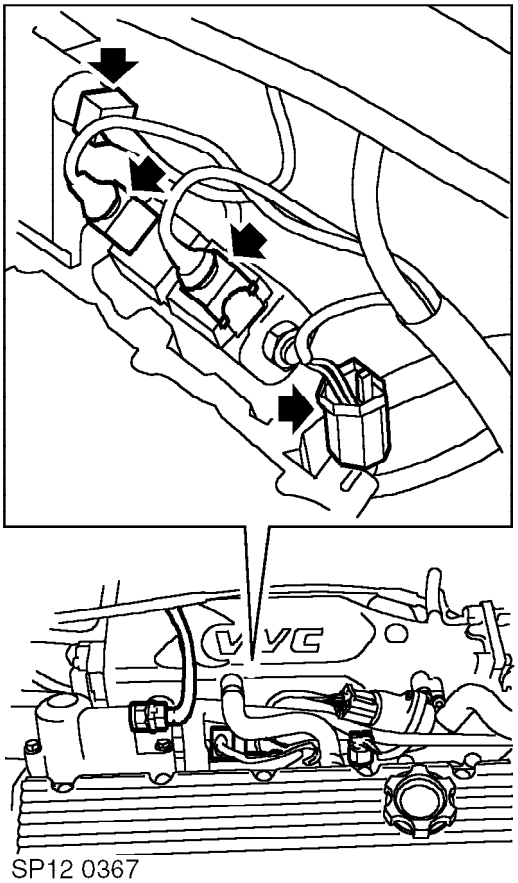
SP18 0005

14. Disconnect multiplugs from coolant temperature sensors.
15. Loosen 2 clips and disconnect coolant hoses from elbow on cylinder head.



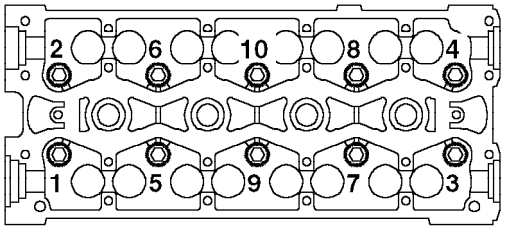
SP19 0008

16. Release HO2S multiplug from bracket at rear of cylinder head.



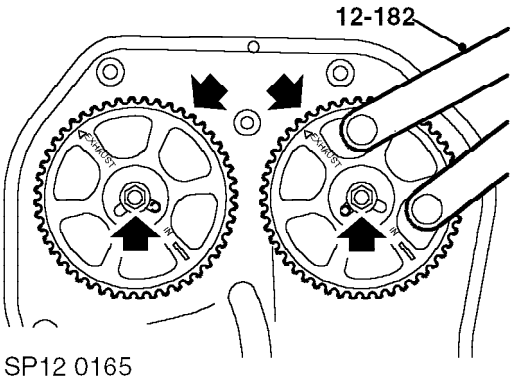
SP12 0367

17. Disconnect multiplug from CMP sensor.
18. Disconnect oil temperature sensor multiplug.
19. Disconnect 2 multiplugs from hydraulic control solenoids.
20. Temporarily fit camshaft timing gears, fit and lightly tighten bolts.



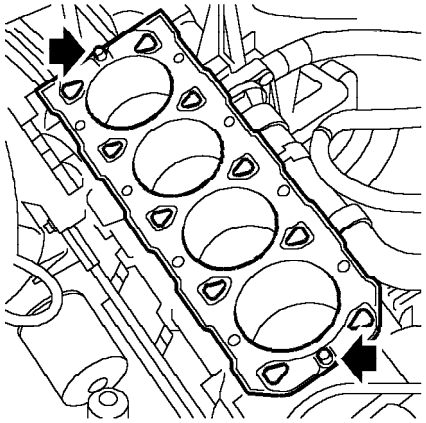
SP12 0164

21. Progressively loosen cylinder head to oil rail bolts numbers 1 to 6 in sequence shown.



SP12 0165

22. Using tool **12-182,** rotate camshafts to gain access to cylinder head bolts beneath camshaft reluctor rings.
23. Working in the sequence shown, progressively loosen cylinder head bolt numbers 7 to 10.
24. Remove camshaft gears.
25. Remove cylinder head bolts and store in fitted order.
26. With assistance, remove cylinder head assembly from cylinder block and support on wooden blocks.

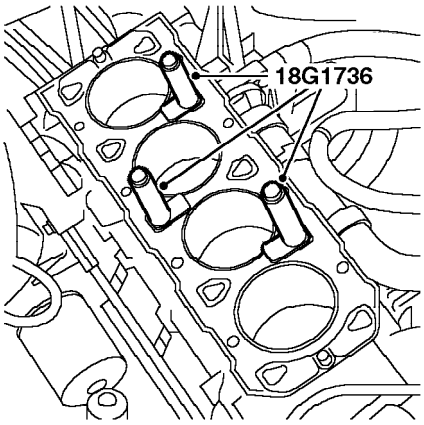


M12 5694

27. Remove and discard cylinder head gasket from cylinder block.

CAUTION: Do not rotate crankshaft with cylinder head removed.

28. Remove cylinder head location dowels.



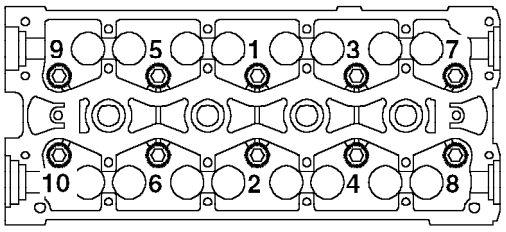
M12 5695

29. Fit cylinder liner clamps **18G 1736** to cylinder block and secure with cylinder head bolts.

CAUTION: Ensure that cylinder head bolts used are those originally fitted in that location.

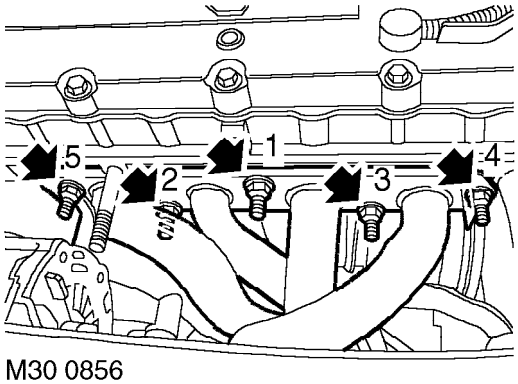
Refit

1. Remove bolts securing cylinder liner clamps **18G 1736** to cylinder block and remove clamps.
2. If necessary, decarbonise piston crowns and combustion chambers.
3. Clean mating faces of cylinder head and cylinder block.
4. Clean oil and coolant passages.
5. Clean inlet and exhaust manifold mating faces on cylinder head.
6. Clean location dowels and fit to cylinder block.
7. Clean cylinder head bolts and wipe dry. Apply clean engine oil to bolt threads and under head of bolts.
8. Fit new cylinder head gasket, dry, to cylinder block.
9. With assistance, fit cylinder head onto cylinder block, ensure that dowels are correctly located.
10. Carefully enter cylinder head bolts, **DO NOT DROP. Screw bolts into place by hand.**
11. Temporarily fit camshaft timing gears, fit and lightly tighten bolts.
12. Using tool **12-182,** rotate camshafts to gain access to cylinder head bolts beneath camshaft reluctor rings.



SP12 0172

13. Working in the sequence shown, progressively tighten the cylinder head bolts to 20 Nm. Use a suitable angle torque gauge and tighten all bolts in sequence 180˚. Then tighten all bolts in sequence a further 180˚.
14. Remove camshaft gears.
15. Fit camshaft cover gasket. ***See this section.***
16. Connect multiplugs to hydraulic control solenoids.
17. Connect multiplug to CMP sensor.
18. Connect multiplug to oil temperature sensor.
19. Connect multiplugs to coolant temperature sensors.
20. Connect hoses to coolant elbow on cylinder head and tighten clips.



M30 0856

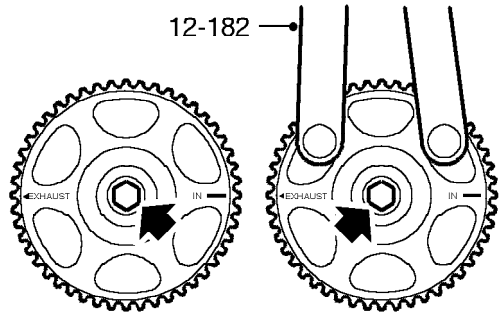
21. Fit new exhaust manifold gasket, position exhaust manifold, fit and tighten nuts in the sequence shown to 45 Nm.
22. Secure HO2S multiplug in bracket at rear of cylinder head.
23. Fit spacer onto stud, position heat shield on exhaust manifold. Fit and tighten nut to 25 Nm and speed bolts to 10 Nm.
24. Position camshaft front timing belt rear cover, fit bolts and tighten to 9 Nm.
25. Position camshaft timing belt tensioner pulley to cylinder head, fit Allen bolt but do not tighten at this stage.
26. Fit tensioner backplate bolt, hold tensioner in the fully OFF position, tighten tensioner backplate bolt to 10 Nm.
27. Clean camshaft gears and mating faces on camshafts.
28. Fit camshaft gears to their respective camshafts, ensuring that the drive pins are located in correct slots on gears.
29. Fit bolts and washers securing camshaft gears to camshafts. Using tool **12-182** restrain camshaft gears and tighten bolts to 65 Nm.
30. Using **12-182,** align camshaft gear timing marks and fit camshaft gear locking tool, **18G 1570.**
31. Fit camshaft timing belt. ***See this section.***
32. Fit inlet manifold gasket. ***See this section.***
33. Fit engine compartment access cover.
34. Connect battery earth lead.

GASKET - CYLINDER HEAD - Em-CVT MODELS

Service repair no - 12.29.02

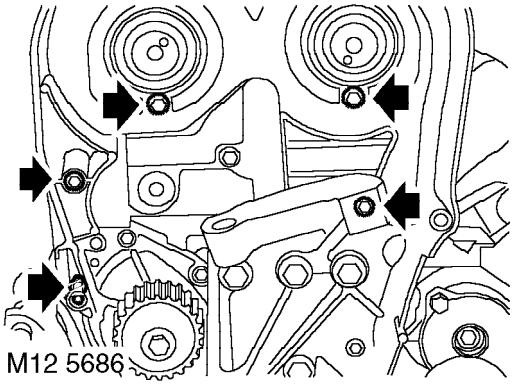
Remove

1. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***
2. Remove camshaft timing belt. ***See this section.***
3. Remove inlet manifold gasket. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***



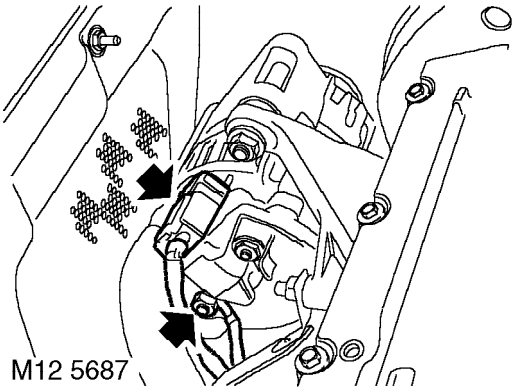
M12 5758

4. Using **12-182** to restrain camshaft gears, remove bolts securing camshaft gears and collect washers.
5. Remove camshaft gears.



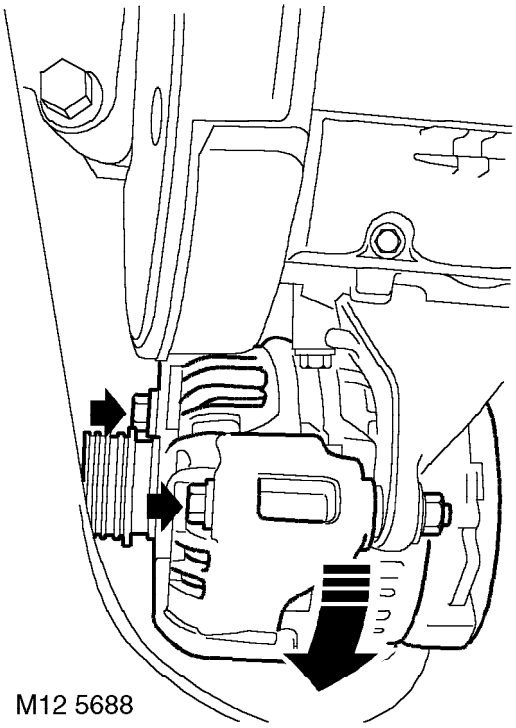
M12 5686

6. Remove 5 bolts from timing belt rear cover.
7. Remove rear cover.
8. Remove camshaft cover gasket. ***See this section.***



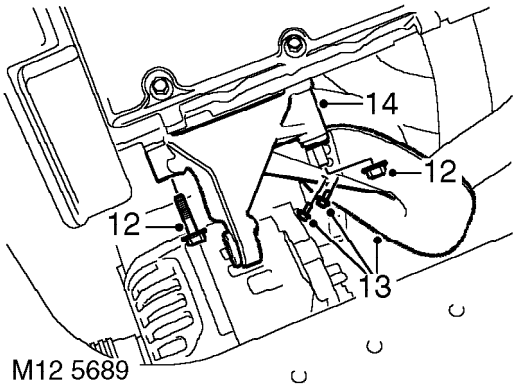
M12 5687

9. Remove nut securing alternator lead and release lead, disconnect alternator multiplug.

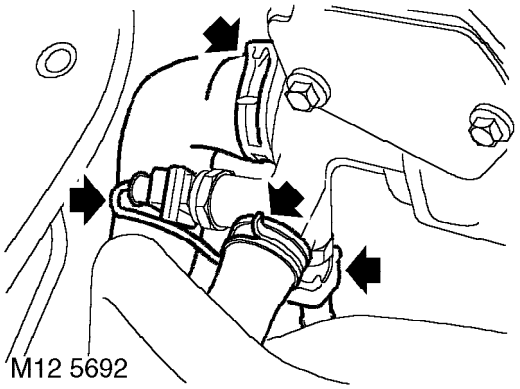


M12 5688

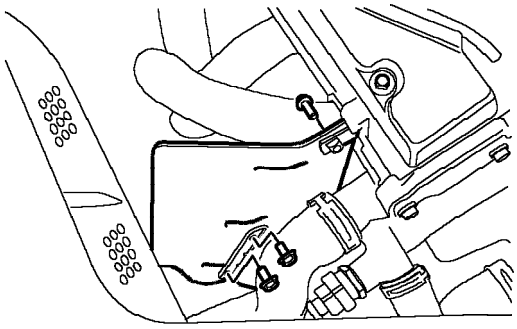
10. Remove alternator top bolt and loosen lower bolt.
11. Position alternator forwards to access alternator bracket.



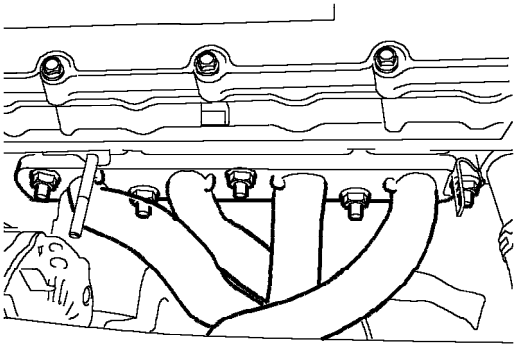
M12 5689


M12 5692

12. Remove nut and bolt securing alternator bracket.
13. Remove 2 bolts securing exhaust heat shield and remove heat shield.
14. Collect alternator bracket.

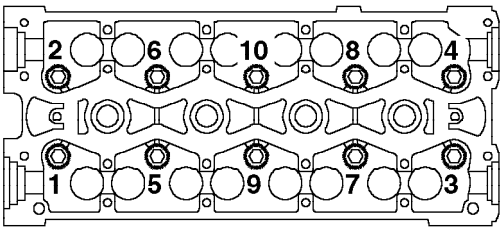

M12 5690

15. Remove 3 bolts securing coolant hose heat shield and remove heat shield.


M12 5691

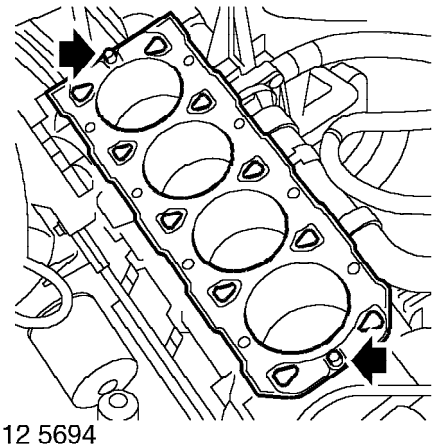
16. Remove 5 flange nuts securing exhaust manifold to cylinder head.
17. Release exhaust manifold from cylinder head. Position manifold aside, remove and discard gasket.

18. Loosen clips and disconnect 2 coolant hoses from cylinder head.
19. Disconnect 2 multiplugs from coolant sensors.



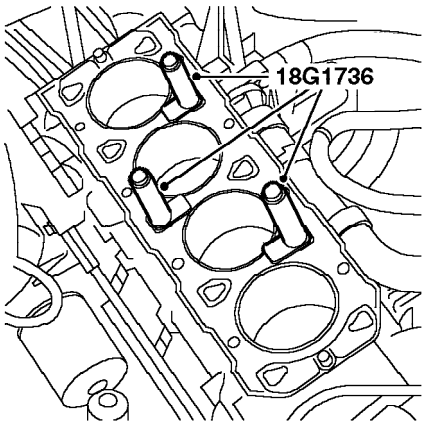
M12 5693

20. Loosen 10 x E12 cylinder head to oil rail bolts in sequence shown. Remove bolts and store in fitted order.
21. Remove cylinder head assembly from cylinder block, use assistance.


M12 5694

22. Remove cylinder head gasket from cylinder block and discard.

CAUTION: Do not rotate crankshaft with cylinder head removed.

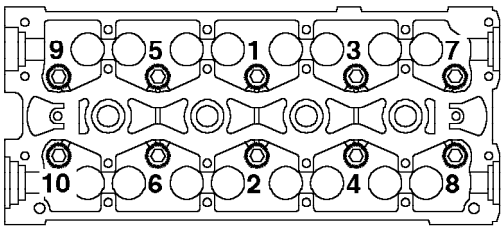


M12 5695

23. Fit tool **18G 1736** to cylinder block and secure using head bolts as shown.

Refit

1. Remove head bolts and tools **18G 1736** from cylinder block.
2. Clean joint surfaces on cylinder head and block, clean oil and coolant passages. Clean exhaust manifold and cylinder head joint surfaces. De-carbonise piston crowns and cylinder head if necessary.
3. Inspect cylinder head bolts, ***See this section.***
4. Wash cylinder head bolts and wipe dry. Oil threads and under head of bolts.
5. Fit new cylinder head gasket to cylinder block.
6. Fit cylinder head to cylinder block carefully locating dowels, use assistance.
7. Carefully enter cylinder head bolts, **DO NOT DROP.** Screw bolts into place by hand.

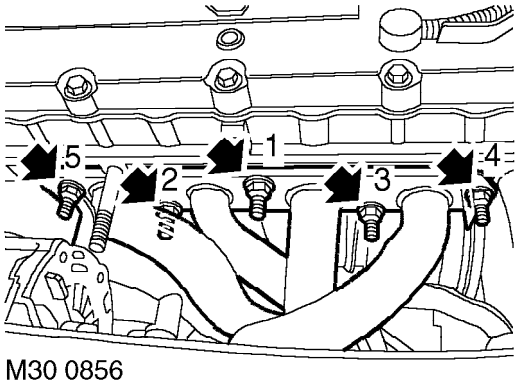


M12 5696

8. Working in the sequence shown,progressively tighten the cylinder head bolts to 20 Nm. Use a suitable angle torque gauge and tighten all bolts in sequence 180˚. Then tighten all bolts in sequence a further 180˚.

CAUTION: If bolt is overtightened, back off 90° and realign.

9. Connect multiplugs to coolant sensors.
10. Position coolant hoses to cylinder head and tighten clips.
11. Fit new exhaust manifold gasket to cylinder head.



M30 0856

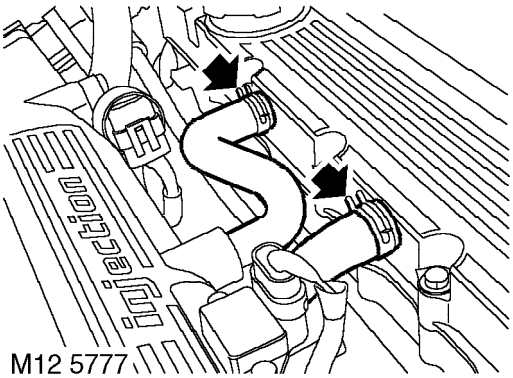
12. Position manifold and working in the sequence shown, tighten nuts to 45 Nm.
13. Position coolant hose heat shield, fit bolts and tighten to 9 Nm.
14. Position alternator bracket.
15. Position exhaust heat shield, fit bolts and tighten to 9 Nm.
16. Tighten alternator bracket nut and bolt to 25 Nm.
17. Align alternator to bracket, fit top bolt, tighten both bolts to 45 Nm.
18. Connect alternator multiplug and lead, secure lead with nut.
19. Fit timing belt rear cover and secure with bolts.
20. Fit camshaft cover gasket. ***See this section.***
21. Clean mating surfaces of camshaft and gears.
22. Fit gears to camshafts.
23. Using tool **12-182** to restrain gears, fit bolts and washers and tighten to 65 Nm.
24. Check timing of gears and adjust if necessary.
25. Fit tool **18G 1570** to gears.
26. Fit inlet manifold gasket. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
27. Fit camshaft timing belt. ***See this section.***
28. Refill cooling system. ***See COOLING SYSTEM, Adjustments.***

GASKET - CAMSHAFT COVER

Service repair no - 12.29.40

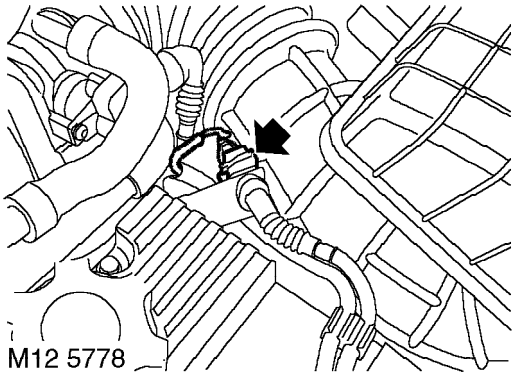
Remove

1. Disconnect battery earth lead.
2. Remove coil set. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***

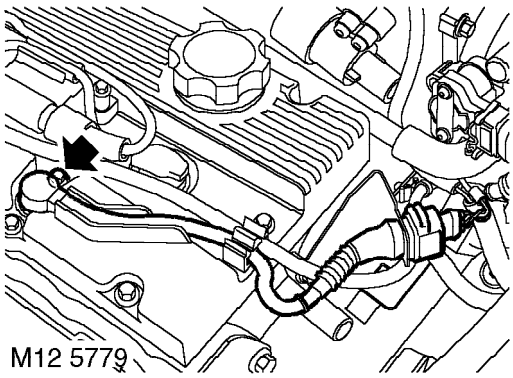


M12 5777

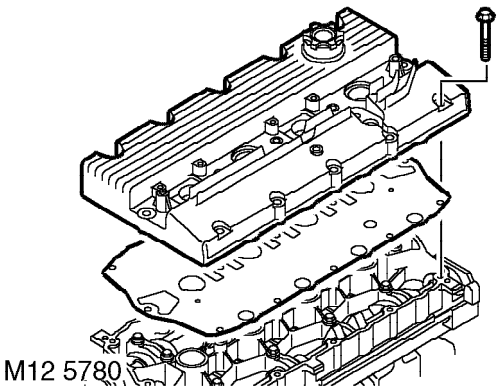
3. Release 2 clips and disconnect 2 breather hoses from camshaft cover.


M12 5778

4. Release coil harness from support bracket and position aside.


M12 5779

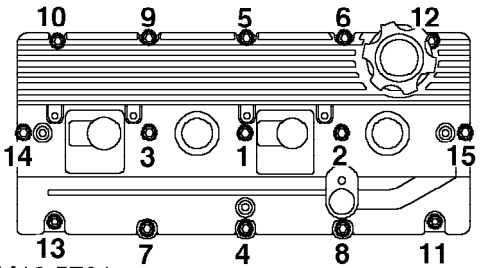
5. Remove bolt securing CMP sensor to cylinder head and position aside.


M12 5780

6. Progressively loosen and remove 15 bolts securing camshaft cover.
7. Remove camshaft cover.
8. Remove gasket.

Refit

1. Clean mating surfaces of camshaft cover and carrier.
2. Clean inside of camshaft cover. If necessary, wash oil separator elements in solvent and blow dry.
3. Fit new gasket with **'EXHAUST MAN SIDE'** mark towards exhaust manifold.
4. Fit camshaft cover to camshaft carrier.



M12 5781

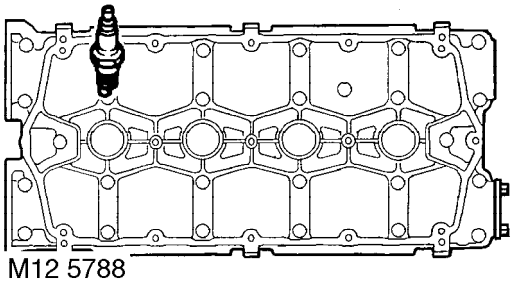
5. Fit bolts and working in sequence illustrated, tighten progressively to 9 Nm.
6. Fit CMP sensor, fit bolt and tighten to 9 Nm.
7. Fit coil set. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***
8. Fit coil harness to support bracket.
9. Connect breather hoses and secure with clips.
10. Connect battery earth lead.

VALVE STEM OIL SEAL

Service repair no - 12.30.26

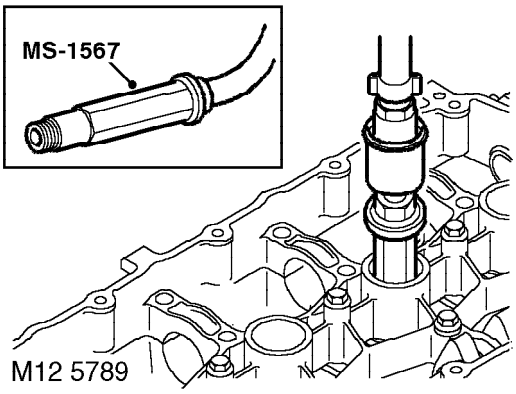
Remove

1. Disconnect battery earth lead.
2. Remove inlet and exhaust camshafts. See **'K' Series Engine Overhaul Manual - Overhaul.**



M12 5788

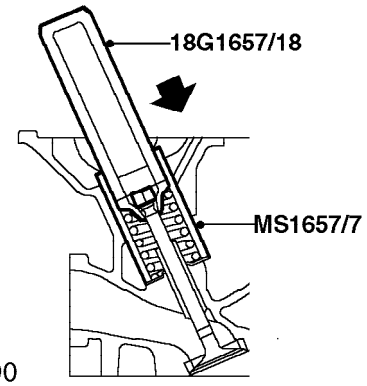
3. Using a 16 mm spark plug socket, remove 4 spark plugs.



M12 5789

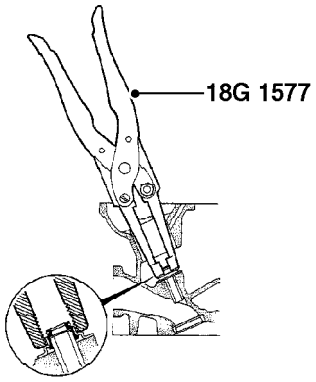
4. Fit and tighten air line adaptor tool **MS 1567** into spark plug hole.
5. Connect an airline to adaptor and apply air pressure.
6. Remove hydraulic tappet from each exhaust valve.

CAUTION: Retain tappets in fitted order and store inverted to prevent oil loss.



M12 5790

7. Fit tool **18G 1657/18** and tool **MS 1657/7** to valve spring cap.
8. Strike head of tool firmly with hammer to release valve spring collets.
9. Remove collets from magnetic end of tool.
10. Remove valve spring cap and spring.

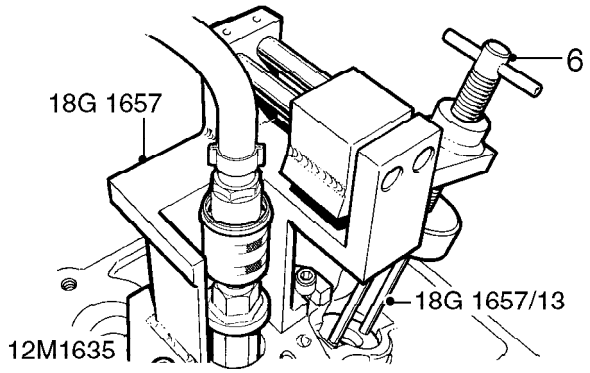


M12 5820

11. Use tool **18G 1577** to remove valve stem oil seal.
12. Repeat operations to remove second exhaust valve oil seal.

Refit

1. Lubricate new valve stem oil seal with engine oil.
2. Use tool **18G 1577** to fit new oil seals.
3. Fit valve spring and spring cap to each valve.



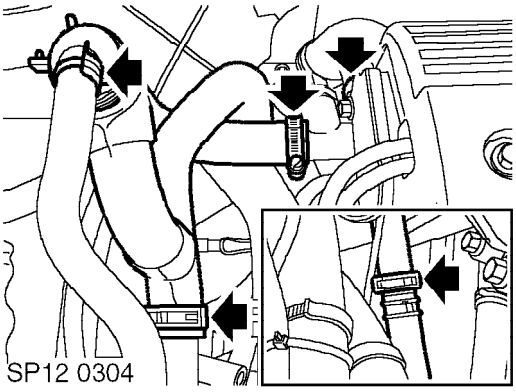
4. Assemble tool **18G 1657** over exhaust valve.
5. Locate valve spring cap with compressor tool **18G 1657/13** .
6. Screw down valve spring compressor until valve stem collet groove is level with top face of spring cap.
7. Attach collets to end of a small flat screwdriver with grease and locate collets in valve stem groove.
8. Unscrew valve spring compressor ensuring collets are correctly located in valve spring cap.
9. Slide head of tool **18G 1657** along to second exhaust valve position.
10. Repeat refit operations on second valve.
11. Remove valve spring compressor tool **18G 1657** .
12. Lubricate tappets with clean engine oil and refit in original positions.
13. Disconnect air line from adaptor tool **MS 1567** .
14. Remove air line adaptor tool **MS 1567** .
15. Clean spark plugs and set gaps to 1.00 mm.
16. Fit inlet and exhaust camshafts. ***See this section.***
17. Connect battery earth lead.

ENGINE & GEARBOX ASSEMBLY - REMOVE - FOR ACCESS & REFIT - STEPSPEED (Em-CVT) MODELS

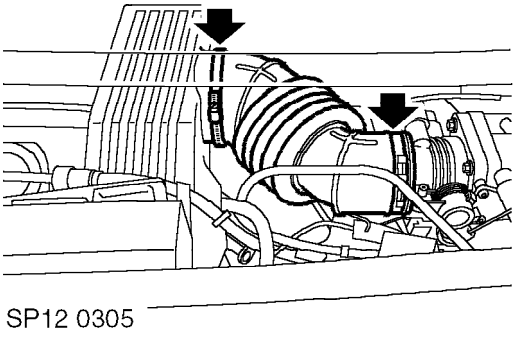
Service repair no - 12.37.01.99

Remove

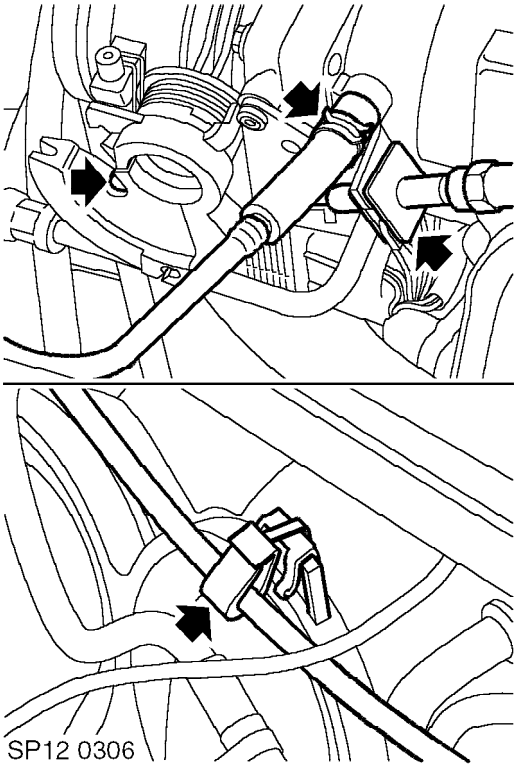
1. Position vehicle on a 2 post ramp.
2. Disconnect battery earth lead.
3. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
4. Remove engine cover. ***See this section.***
5. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***



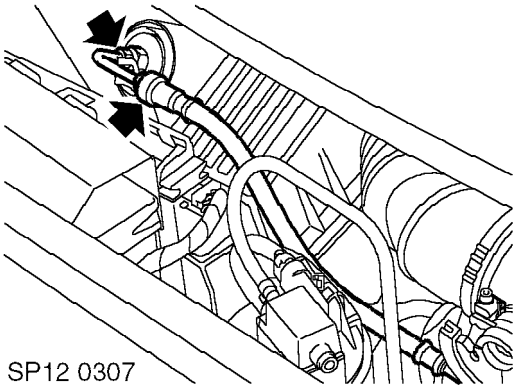
6. Release clip and disconnect hose from coolant outlet elbow on cylinder head.
7. Release 3 clips and disconnect coolant hose assembly between coolant outlet elbow, heater coolant rail and feed hose to expansion tank.
8. Release clip and disconnect hose from coolant rail.



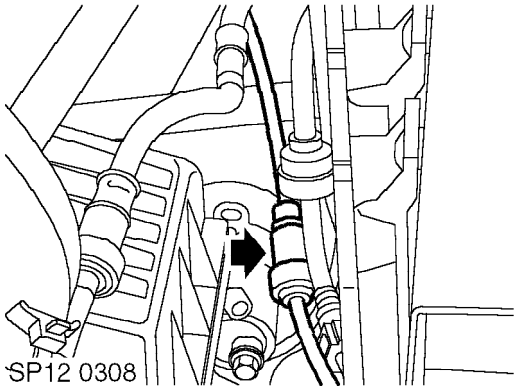
9. Release clips securing air intake hose between air cleaner and throttle body, remove intake hose.


SP12 0306

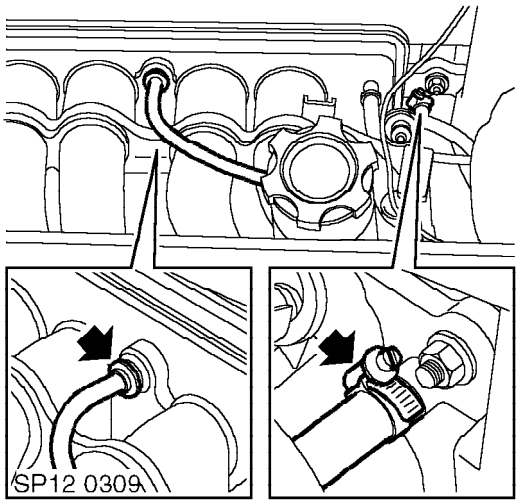
10. Release clip and evaporative emission pipe from throttle body.
11. Disconnect throttle cable from abutment bracket and throttle cam.
12. Release throttle cable from inlet manifold clip and position cable aside.


SP12 0307

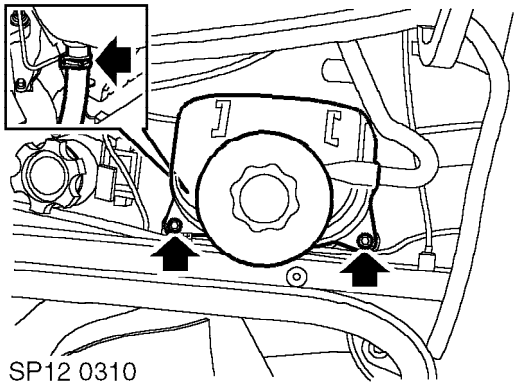
13. Position absorbent cloth around fuel filter, loosen union to relieve fuel pressure, retighten union to 30 Nm.
14. Release quick release connector securing fuel hose to fuel filter outlet pipe.


SP12 0308

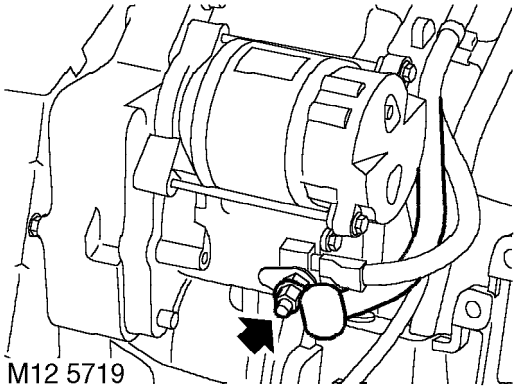
15. Release quick release connector securing fuel return hose to fuel return pipe.


SP12 0309

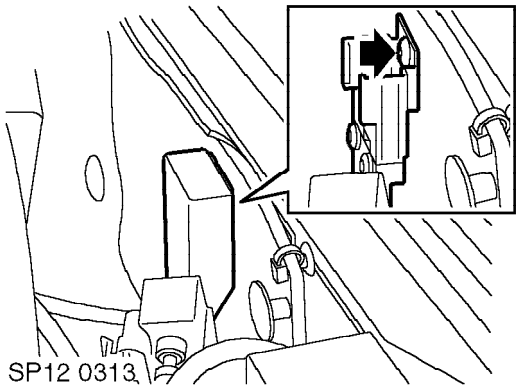
16. Depress locking collar and release brake servo pipe from inlet manifold.
17. Release clip and coolant hose from inlet manifold.


SP12 0310

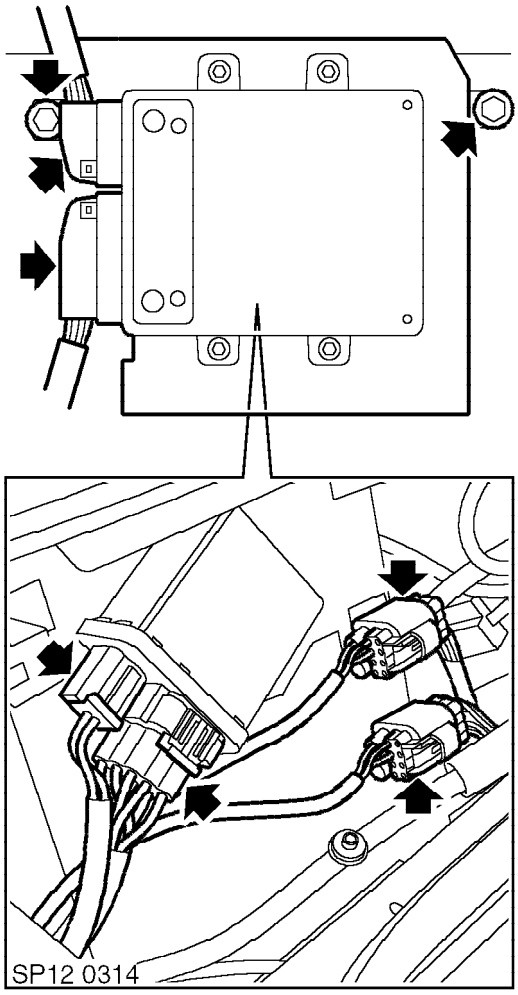
18. Remove 2 bolts securing expansion tank to body, raise expansion tank, release clip and disconnect hose from expansion tank.



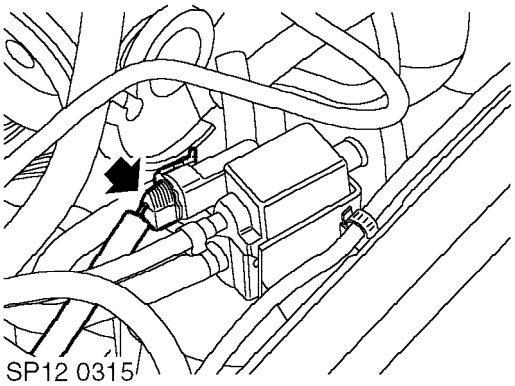
19. Disconnect Lucar connector from starter motor solenoid.
20. Remove nut and disconnect battery lead from starter motor solenoid.



21. Remove cover and main fuse from fuse holder. Remove screw securing fuse holder to body, position fuse holder aside.

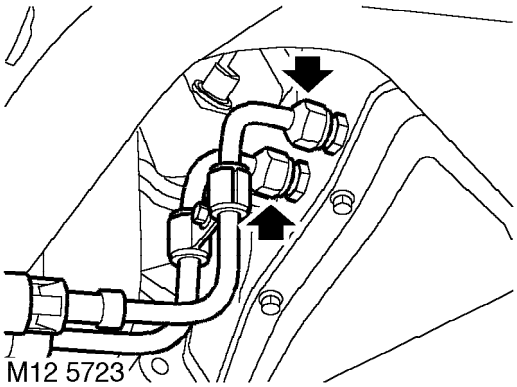


22. Remove inner bolt and loosen outer bolt securing ECM mounting bracket.
23. Disconnect multiplugs from ECM.
24. Disconnect engine harness and relay unit multiplugs.



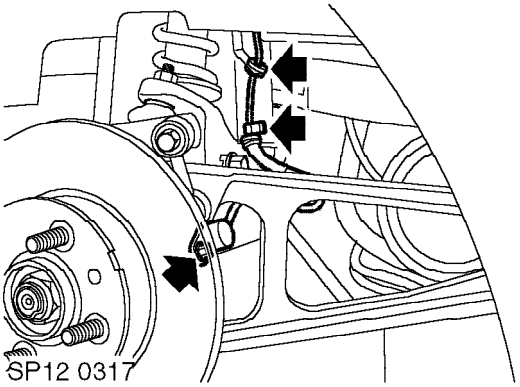
25. Disconnect multiplug from emission canister purge control valve.
26. Raise vehicle on ramp.

27. Drain transmission fluid. ***See AUTOMATIC GEARBOX - 'CVT', Information.***
28. Remove road wheel(s).

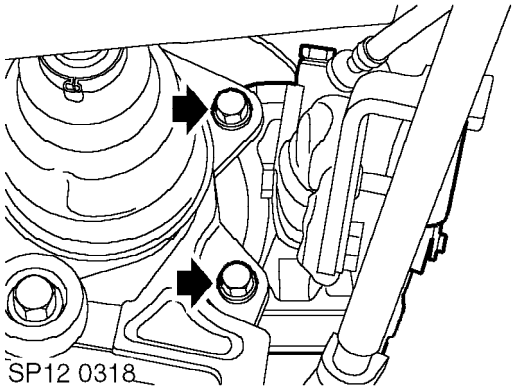


29. Loosen unions and disconnect fluid cooler pipes from gearbox.

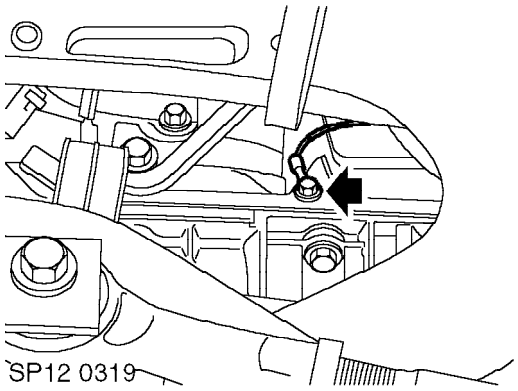
CAUTION: Always fit plugs to open connections to prevent contamination.



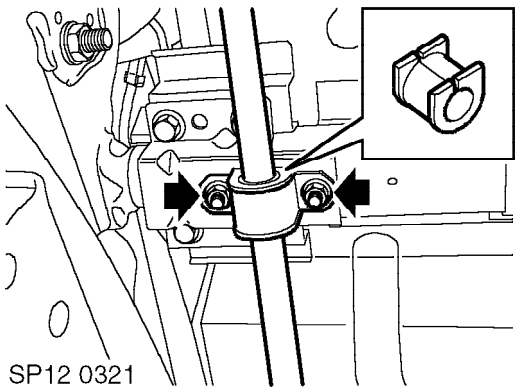
30. Remove bolts securing LH and RH ABS sensors, release sensors and collect sensor spacers.
31. Release LH and RH ABS sensor leads from brackets on upper suspension arms, clips and grommets on each subframe turret.



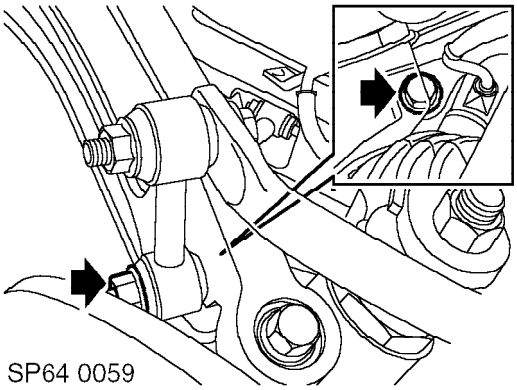
32. Remove bolts securing LH and RH brake calipers to hubs. Release calipers and tie aside.
33. Remove heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***



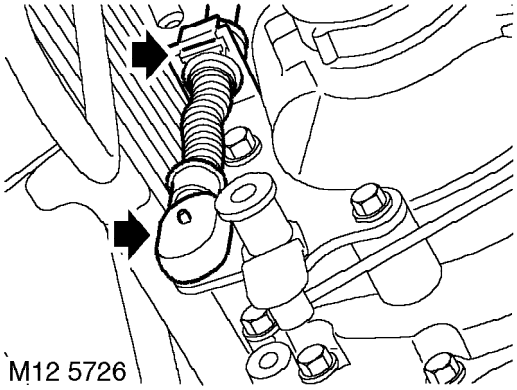
34. Remove bolt securing engine earth lead to cylinder block, position earth lead aside.



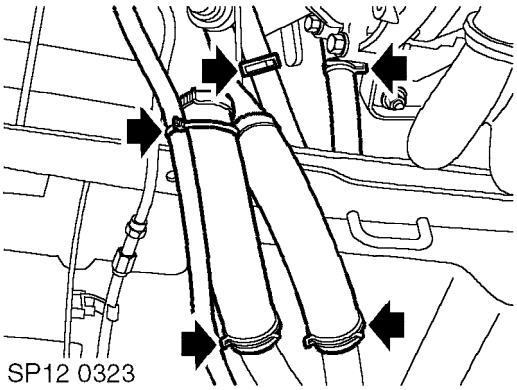
35. Remove 4 nuts securing anti-roll bar clamps and rubber mountings to subframe. Collect clamps and rubber mountings.


SP64 0059

36. Remove nuts and bolts securing LH and RH anti-roll bar links to trailing arms and remove anti-roll bar.

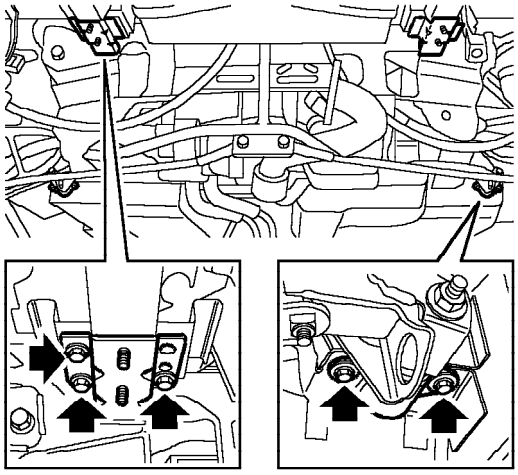

M12 5726

37. Release selector cable from selector linkage and abutment bracket, position cable aside.


SP12 0323

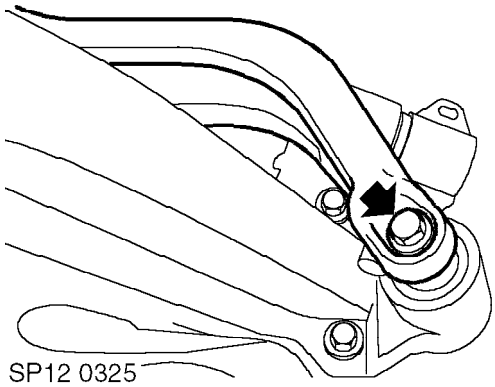
38. Remove cable tie securing battery cable to coolant hose, position battery cable aside.
39. Release clips and disconnect coolant hoses from coolant rail underneath vehicle.
40. Release clips and disconnect heater hoses from underneath vehicle.

41. Position engine table underneath rear of vehicle, lower ramp sufficiently until engine and subframe are supported by table.

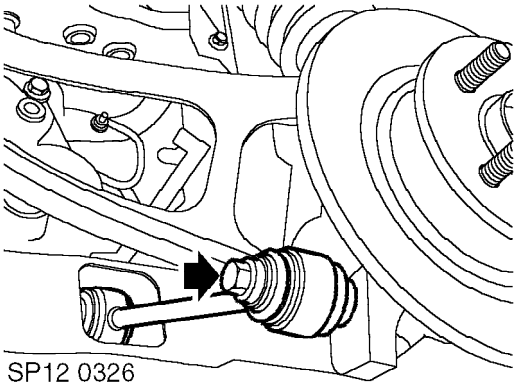

SP12 0324

42. Remove 4 front bolts and 6 rear bolts securing subframe mountings to body.
43. Collect anti-roll bar mounting brackets.
44. Carefully raise ramp and guide engine and subframe from body.

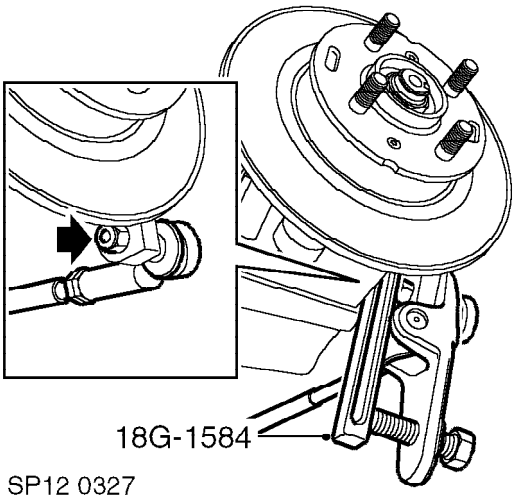
CAUTION: Ensure that subframe/engine assembly is positioned securely on engine table.


SP12 0325

45. Remove nut and bolt securing trailing arm to trailing arm bush.

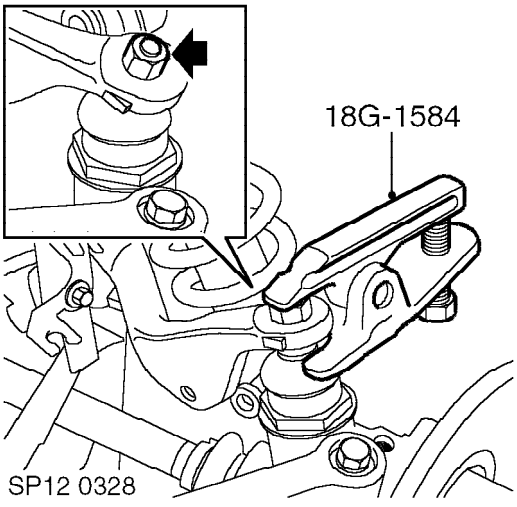

SP12 0326

46. Remove bolt securing lower link to rear hub.



SP12 0327

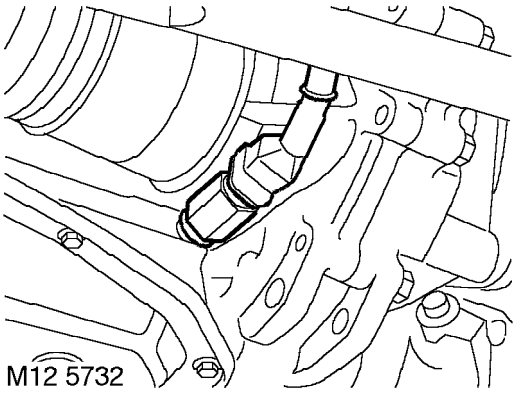
47. Remove nut securing track control arm to hub.
48. Release track control arm taper joint from hub using **18G-1584.**



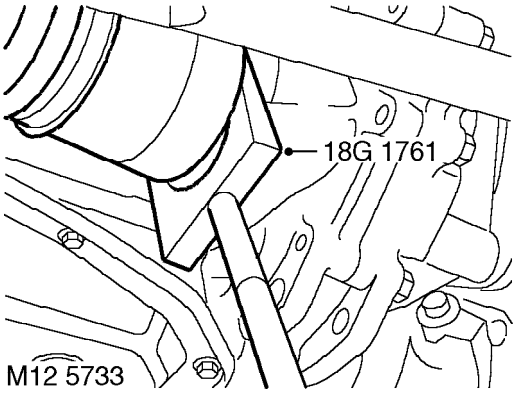
SP12 0328

49. Remove and discard lock nut securing ball joint to upper suspension arm.

50. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.

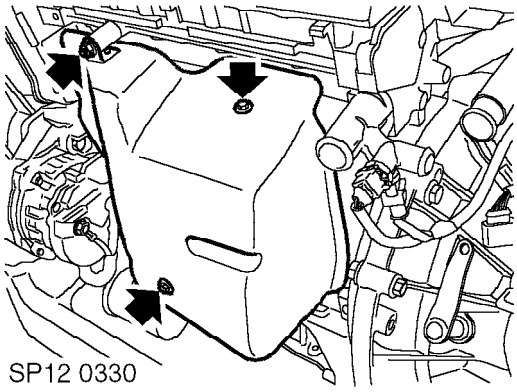

M12 5732

51. Disconnect multiplug from starter inhibitor switch and release lead from clip.
52. Remove starter inhibitor switch from gearbox.

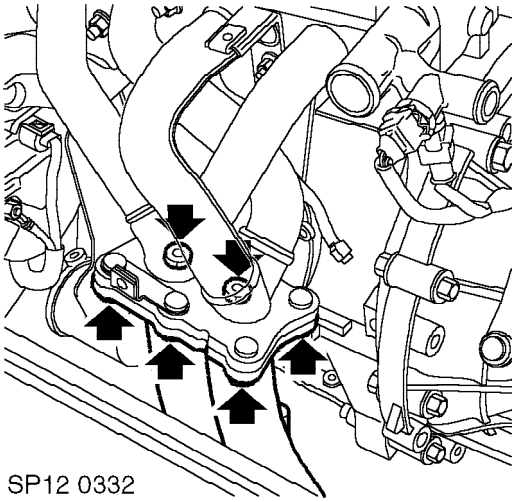


M12 5733

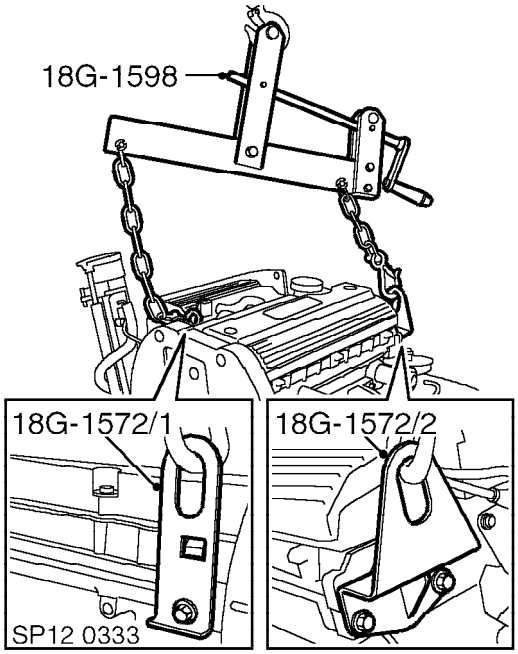
53. Release drive shaft inner joint from gearbox using **18G-1761.**
54. Remove hub assembly and drive shaft.
55. Remove and discard circlip from drive shaft.
56. Repeat operations for opposite hub assembly.


SP12 0330

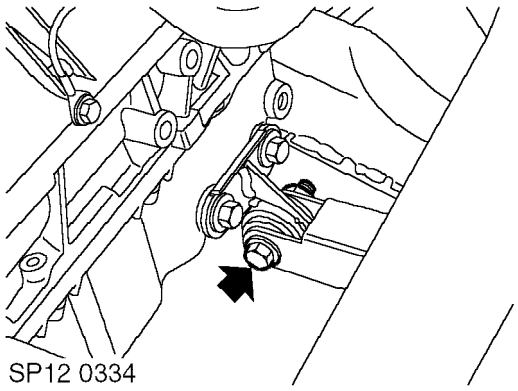
57. Remove nut and 2 speed bolts securing heat shield to cylinder head and exhaust manifold, remove heat shield.
58. Release HO2S multiplug from bracket at rear of cylinder head and disconnect multiplug.
59. Release HO2S harness from clip on cylinder block bracket.


SP12 0332

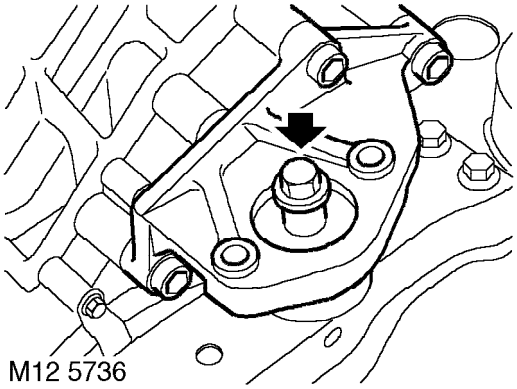
60. Remove 6 nuts securing front pipe to exhaust manifold.
61. Release front pipe from exhaust manifold and support rubber, remove front pipe, remove and discard gasket.



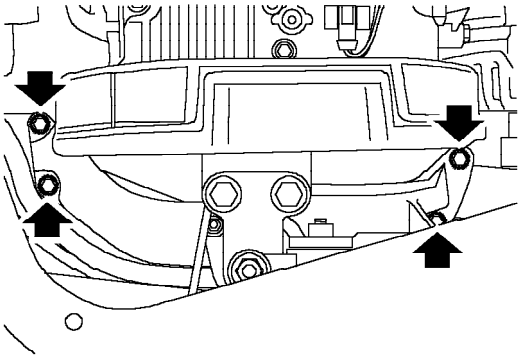
62. Remove 2 bolts securing exhaust camshaft rear oil seal cover plate and remove cover plate.
63. Position lifting brackets **18G-1572/1** and **18G-1572/2** to cylinder head and secure with bolts.
64. Position adjustable lifting equipment, **18G-1598** to lifting brackets.
65. Connect hoist to **18G-1598,** raise hoist to take weight of engine and gearbox.


SP12 0334

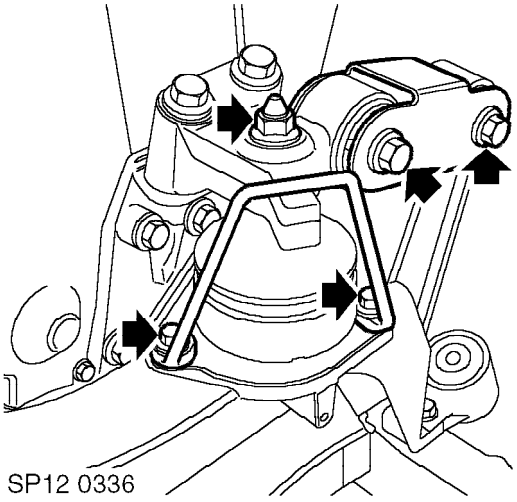
66. Remove bolt securing rear engine steady to bracket on sump.


M12 5736

67. Remove nut and bolt securing gearbox mounting to LH buttress.


M12 5737

68. Remove 4 bolts securing LH buttress to subframe and remove buttress.


SP12 0336

69. Remove nut securing RH engine mounting bracket to hydramount.

70. Remove bolt securing RH engine steady to engine mounting bracket. Loosen bolt securing engine steady to RH buttress, pivot engine steady from mounting bracket.
71. Remove bolt, loosen remaining bolt and move engine mounting restraining loop aside.
72. With assistance, raise and remove engine and gearbox from subframe.
73. Lower engine and gearbox assembly, disconnect hoist from **18G-1598** .

Refit

1. Connect hoist to **18G-1598** , raise engine and gearbox assembly.
2. Position subframe assembly under engine.
3. Lower engine and gearbox assembly onto subframe, correctly position LH buttress and gearbox mounting.
4. Fit and tighten bolts securing LH buttress to subframe to 45 Nm.
5. Fit and tighten nut and bolt securing gearbox mounting to LH buttress to 82 Nm.
6. Position engine mounting restraining loop, fit and tighten bolts to 45 Nm.
7. Fit and tighten nut securing RH engine mounting bracket to hydramount to 82 Nm.
8. Position RH engine steady to engine mounting bracket, fit and tighten bolt to 85 Nm.
9. Tighten nut and bolt securing RH engine steady to buttress to 85 Nm.
10. Position rear engine steady to bracket on sump, fit and tighten bolt to 85 Nm.
11. Lower hoist and remove **18G-1598** , remove lifting brackets **18G-1572/1 and 18G-1572/2** .
12. Position exhaust camshaft rear oil seal cover plate, fit bolts and tighten to 12 Nm.
13. Fit a new gasket, position front pipe to exhaust manifold. Fit and tighten nuts to 50 Nm. Engage front pipe in support rubber.
14. Position heat shield, fit nut and bolts, tighten nut to 25 Nm and bolts to 10 Nm.
15. Connect HO2S multiplug, secure multiplug in support bracket.
16. Secure HO2S harness in clip on cylinder block bracket.
17. Clean ends of both drive shafts.
18. Fit new circlip to groove on drive shaft inner joint.
19. Wipe taper joints of both hub ball joints and upper arms.
20. Fit both hub assemblies to upper arms and engage both drive shafts in differential.

CAUTION: Pull outwards on drive shaft inner joints to check for full engagement in differential.

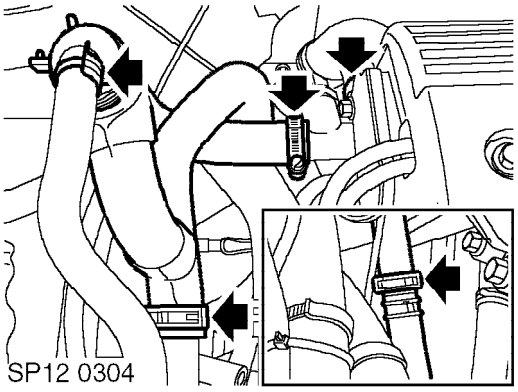
21. Position ball joint to upper suspension arm, fit and tighten new lock nut to 54 Nm.
22. Position lower link to rear hub, fit, but do not tighten bolt at this stage
23. Wipe tapers and seats of track control arms and hubs.
24. Position track control arms to both rear hubs, fit and tighten nuts to 38 Nm.
25. Fit bolt and nut securing trailing arm to trailing arm bush and tighten to 100 Nm.
26. Fit and tighten starter inhibitor switch to 12 Nm.
27. Connect multiplug to starter inhibitor switch, secure lead in clip.
28. Position engine table under body, carefully lower ramp over engine and gearbox assembly.
29. Align subframe mountings to body, position anti-roll bar mounting brackets and loosely fit bolts.
30. Carefully lower body remaining distance onto subframe mountings, tighten front mounting bolts to 30 Nm and rear mounting bolts to 45 Nm.
31. Raise vehicle on ramp and remove table.
32. Fit mounting rubbers to anti-roll bar, position anti-roll bar to subframe. Position clamps, fit and tighten nuts to 22 Nm.
33. Position anti-roll bar, align links to LH and RH trailing arms. Fit nuts and bolts but do not tighten at this stage.
34. Clean brake calipers and mating faces.
35. Position LH and RH brake calipers to hubs, fit and tighten bolts to 85 Nm.
36. Clean ABS sensors and mating faces.
37. Position ABS sensors and spacers, fit and tighten bolts to 10 Nm.
38. Secure LH and RH ABS lead grommets and leads into brackets and clips on each subframe turret and upper suspension arms.
39. Position engine earth lead to cylinder block, fit and tighten bolt to 25 Nm.
40. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
41. Clean gearbox fluid cooler pipe connections and mating faces on gearbox.
42. Connect and tighten gearbox fluid cooler pipe unions to 14 Nm.
43. Position selector cable to gearbox abutment bracket and selector linkage, secure with clips.
44. Connect hoses to coolant rail on underside of vehicle and secure with clips.
45. Connect heater hoses and secure with clips.
46. Secure battery cable to coolant hose with cable tie.
47. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
48. Lower vehicle on ramp.
49. With the weight of the vehicle on the rear suspension, tighten bolts securing lower links to rear hubs to 100 Nm.
50. With the weight of the vehicle on the rear suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
51. Connect road speed transducer multiplug.
52. Connect multiplug to emission canister purge control valve.
53. Connect engine harness and relay unit multiplugs.
54. Connect ECM multiplugs.
55. Position ECM bracket, fit and tighten bolts to 8 Nm.
56. Position main fuse holder to body and secure with screw. Fit main fuse and cover.
57. Connect battery lead to starter motor solenoid, fit and tighten terminal nut.
58. Connect Lucar to starter motor solenoid.
59. Connect coolant hose to expansion tank and secure with clip. Position expansion tank, fit and tighten bolts to 8 Nm.
60. Connect coolant hose to inlet manifold and secure with clip.
61. Connect brake servo vacuum pipe to inlet manifold.
62. Connect fuel return hose to fuel return pipe.
63. Connect fuel hose to fuel filter outlet pipe.
64. Connect throttle cable to throttle cam and abutment bracket.
65. Secure throttle cable in clip on inlet manifold.
66. Connect evaporative emission pipe to throttle body and secure with clip.
67. Position air intake hose and secure with clips.
68. Connect hose to coolant rail and secure with clip.
69. Connect hose assembly between coolant outlet elbow, heater coolant rail and expansion tank. Secure hoses with clips.
70. Connect hose to coolant elbow on cylinder head and secure with clip.
71. Refill transmission with fluid. ***See AUTOMATIC GEARBOX - 'CVT', Information.***
72. Fill cooling system. ***See COOLING SYSTEM, Repairs.***
73. Fit engine cover. ***See this section.***
74. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
75. Connect battery earth lead.

ENGINE & GEARBOX ASSEMBLY - REMOVE FOR ACCESS & REFIT - MANUAL GEARBOX MODELS

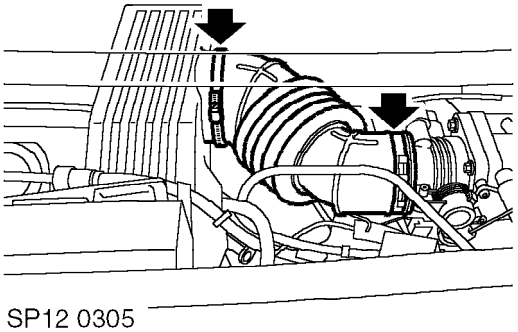
Remove

Service repair no - 12.37.01.99

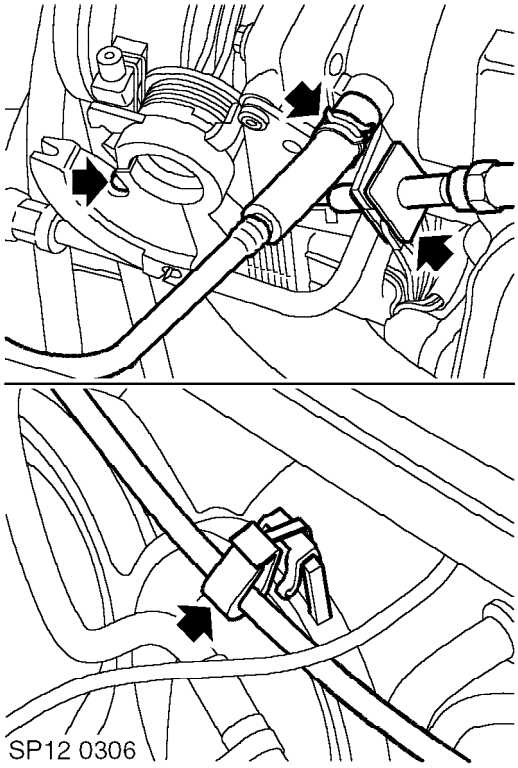
1. Position vehicle on a 2 post ramp.
2. Disconnect battery earth lead.
3. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
4. Remove engine cover. ***See this section.***
5. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***


SP12 0304

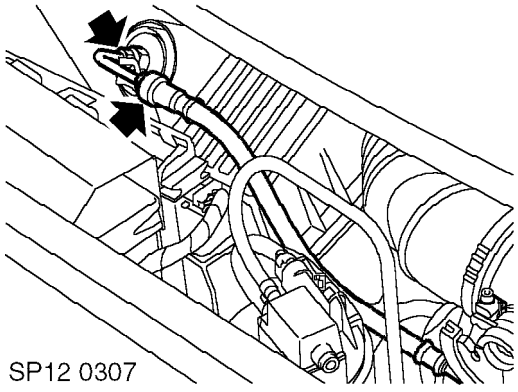
6. Release clip and disconnect hose from coolant outlet elbow on cylinder head.
7. Release 3 clips and disconnect coolant hose assembly between coolant outlet elbow, heater coolant rail and feed hose to expansion tank.
8. Release clip and disconnect hose from coolant rail.


SP12 0305

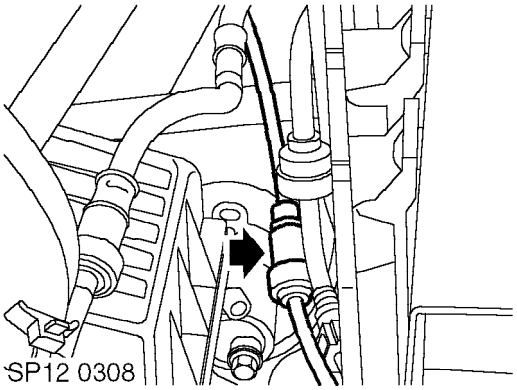
9. Release clips securing air intake hose between air cleaner and throttle body, remove intake hose.


SP12 0306

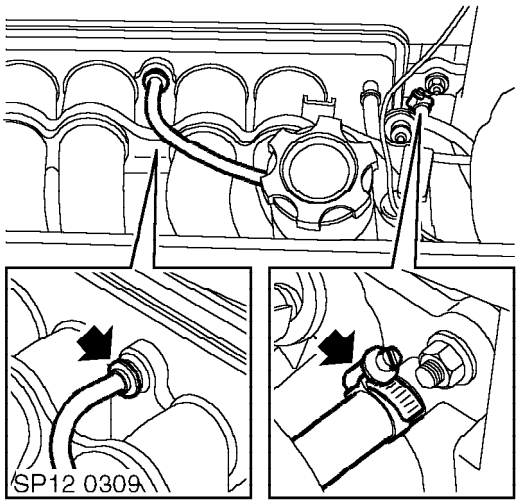
10. Release clip and evaporative emission hose from throttle body.
11. Disconnect throttle cable from abutment bracket and throttle cam.
12. Release throttle cable from inlet manifold clip and position cable aside.


SP12 0307

13. Position absorbent cloth around fuel filter, loosen union to relieve fuel pressure, retighten union to 30 Nm.
14. Release quick release connector securing fuel hose to fuel filter outlet pipe.

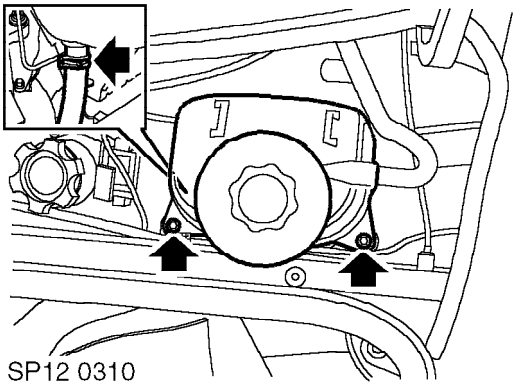

SP12 0308

15. Release quick release connector securing fuel return hose to fuel return pipe.

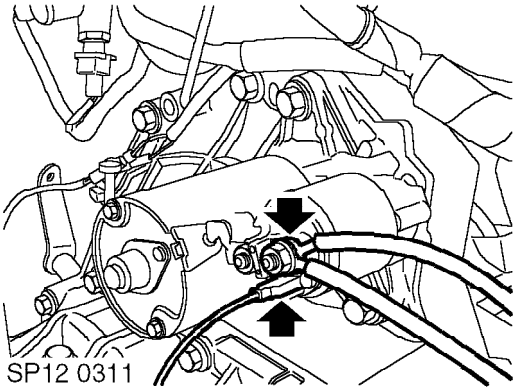

SP12 0309

16. Depress locking collar and release brake servo pipe from inlet manifold.

17. Release clip and coolant hose from inlet manifold.

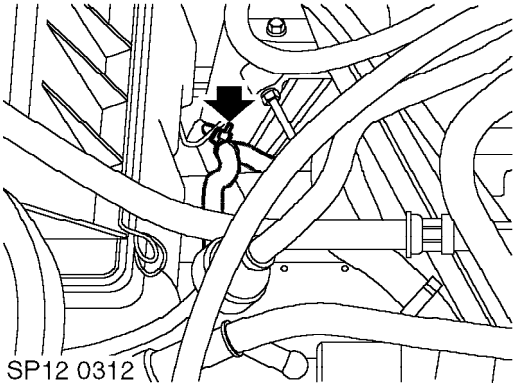

SP12 0310

18. Remove 2 bolts securing expansion tank to body, raise expansion tank, release clip and disconnect hose from expansion tank.

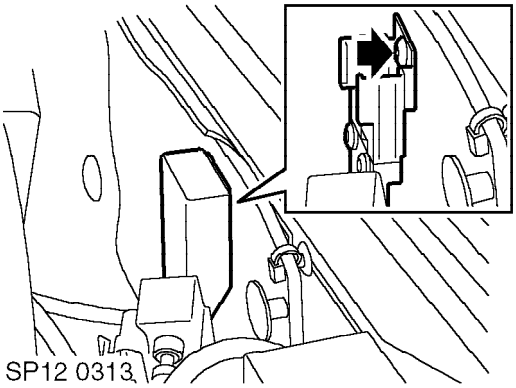

SP12 0311

19. Remove nut and disconnect battery lead from starter motor solenoid.

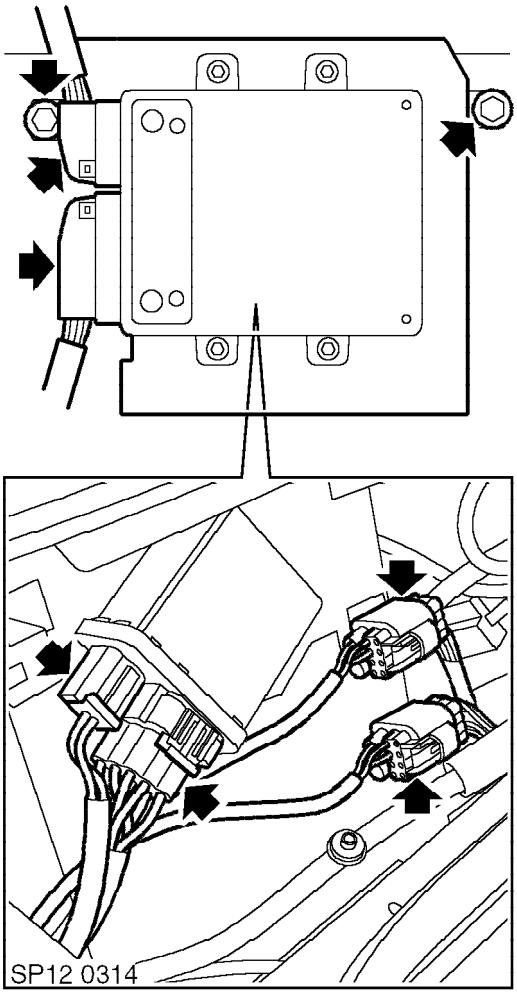
20. Disconnect Lucar connector from starter motor solenoid.


SP12 0312

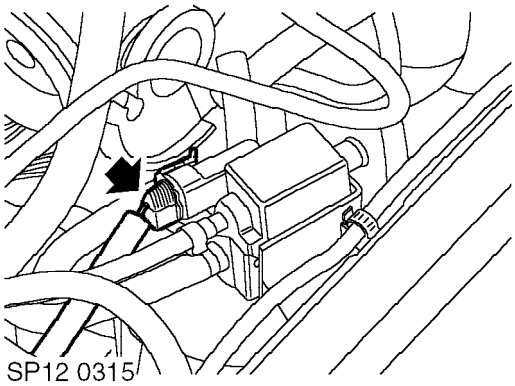
21. Release clip securing battery lead to clutch slave cylinder mounting bracket.


SP12 0313

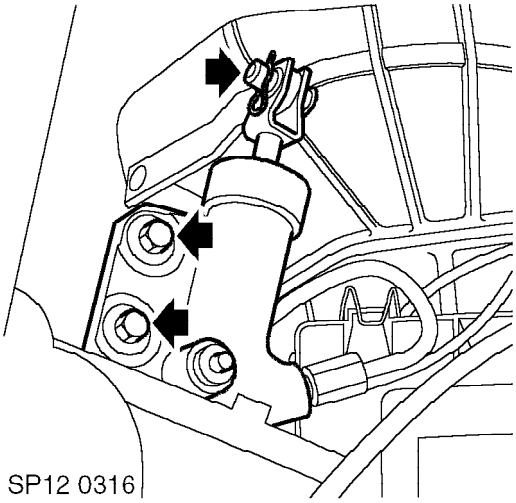
22. Remove cover and main fuse from fuse holder. Remove screw securing fuse holder to body, position fuse holder aside.



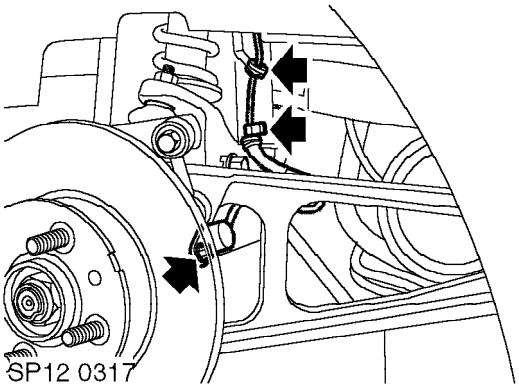
23. Remove inner bolt and loosen outer bolt securing ECM mounting bracket.
24. Disconnect multiplugs from ECM.
25. Disconnect engine harness and relay unit multiplugs.



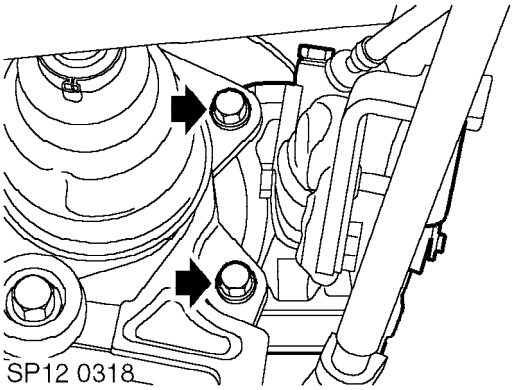
26. Disconnect multiplug from emission canister purge control valve.



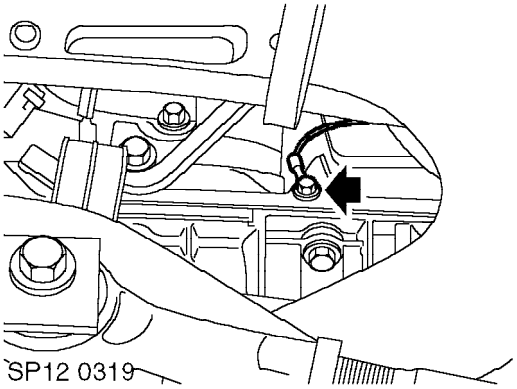
27. Remove 'R' clip, washer and clevis pin securing clutch slave cylinder push rod to release lever and remove push rod.
28. Remove 2 bolts securing clutch slave cylinder to mounting bracket, position slave cylinder aside.
29. Raise vehicle on ramp.
30. Remove road wheel(s).
31. Drain gearbox oil.



32. Remove bolts securing LH and RH ABS sensors to hubs, release sensors and collect sensor spacers.
33. Release LH and RH ABS sensor lead grommets and sensor leads into brackets and clips on each subframe turret and upper suspension arms.

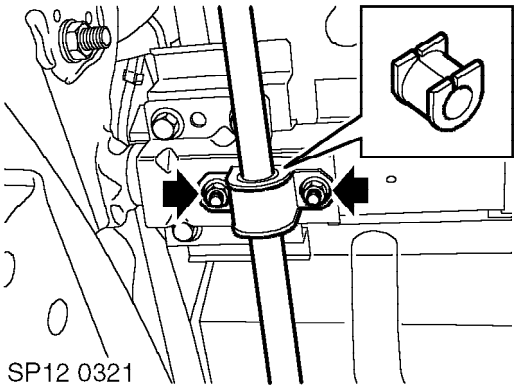

SP12 0318

34. Remove bolts securing LH and RH brake calipers to hubs. Release calipers and tie aside.

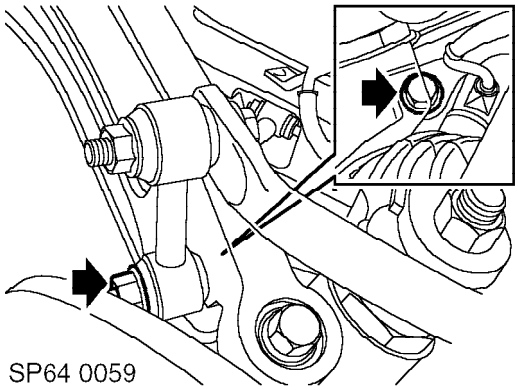

SP12 0319

35. Remove bolt securing engine earth lead to cylinder block, position earth lead aside.

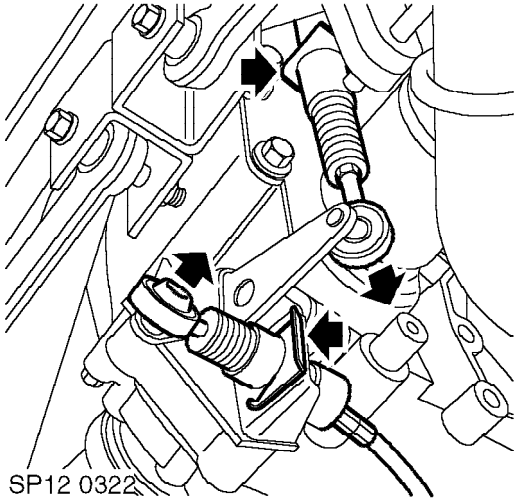
36. Remove heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***


SP12 0321

37. Remove 4 nuts securing anti-roll bar clamps and rubber mountings to subframe. Collect clamps and rubber mountings.

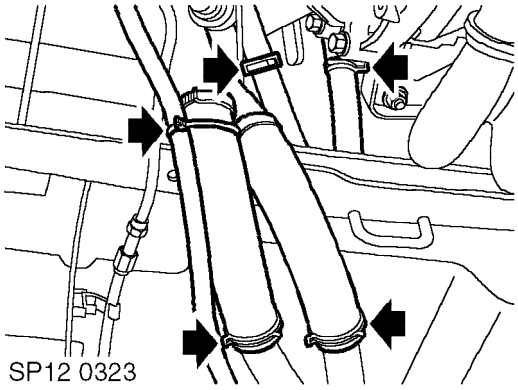

SP64 0059

38. Remove nuts and bolts securing LH and RH anti-roll bar links to trailing arms and remove anti-roll bar.


SP12 0322

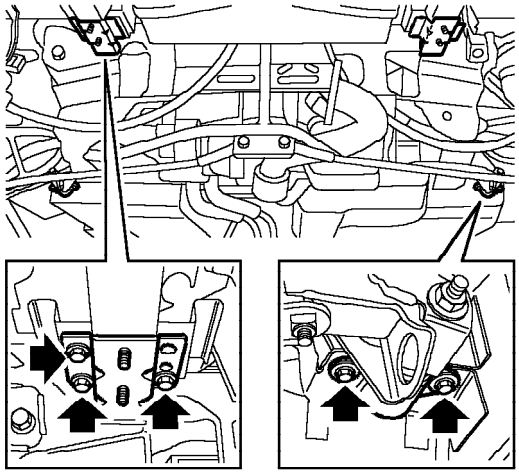
39. Remove and discard clips securing selector cables to gearbox abutment brackets.

40. Release selector cables from selector linkage and position cables aside.


SP12 0323

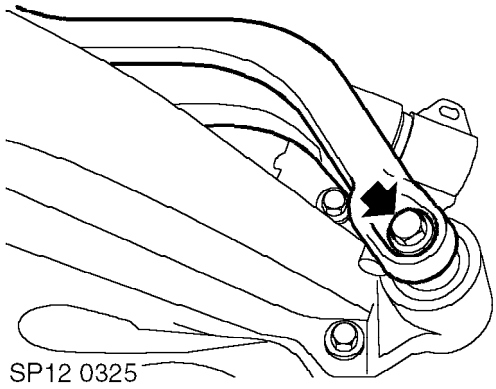
41. Release clips and disconnect coolant hoses from coolant rail underneath vehicle.

42. Release clips and disconnect heater hoses from underneath vehicle.
43. Remove cable tie securing battery cable to coolant hose, position battery cable aside.
44. Position engine table underneath rear of vehicle, lower ramp sufficiently until engine and subframe are supported by table.

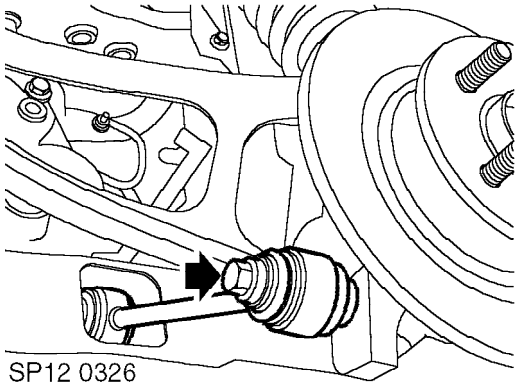

SP12 0324

45. Remove 4 front bolts and 6 rear bolts securing subframe mountings to body.
46. Collect anti-roll bar mounting brackets.
47. Carefully raise ramp and guide engine and subframe from body.

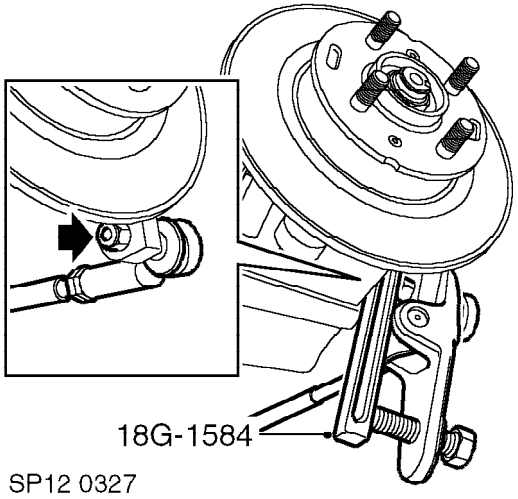
CAUTION: Ensure that subframe/engine assembly is positioned securely on engine table.


SP12 0325

48. Remove nut and bolt securing trailing arm to trailing arm bush.

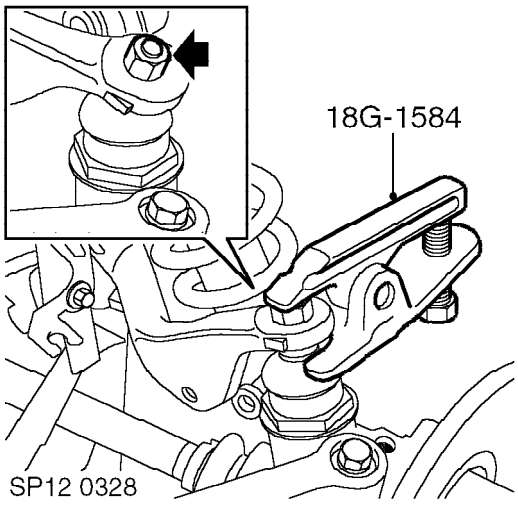

SP12 0326

49. Remove bolt securing lower link to rear hub.



SP12 0327

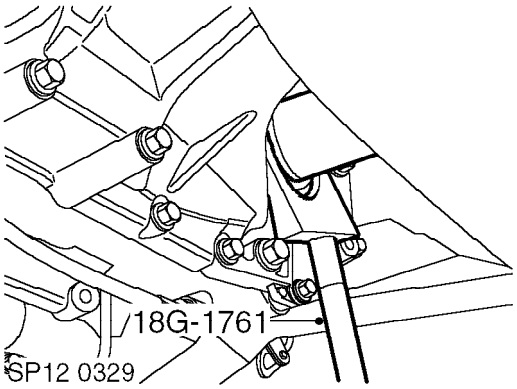
50. Remove nut securing track control rod to hub.
51. Release track control rod taper joint from hub using **18G-1584** .



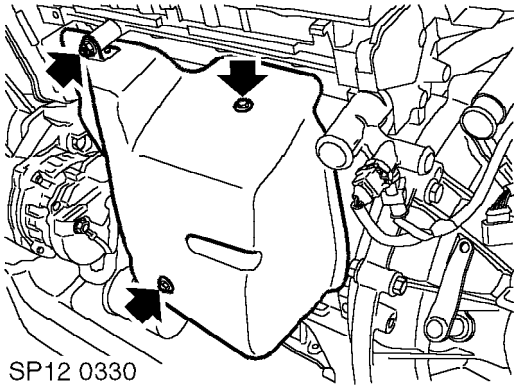
SP12 0328

52. Remove and discard lock nut securing ball joint to upper suspension arm.

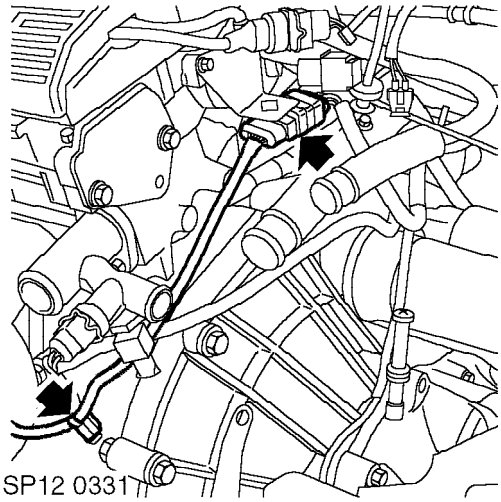
53. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.



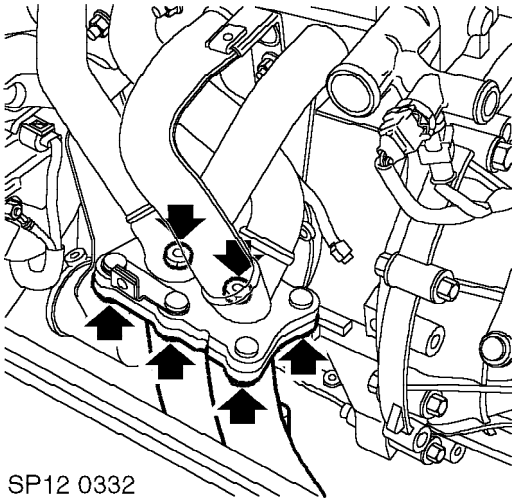
54. Release drive shaft inner joint from gearbox using **18G-1761** .
55. Remove hub assembly and drive shaft.
56. Remove and discard circlip from drive shaft.
57. Repeat operations for opposite hub assembly.



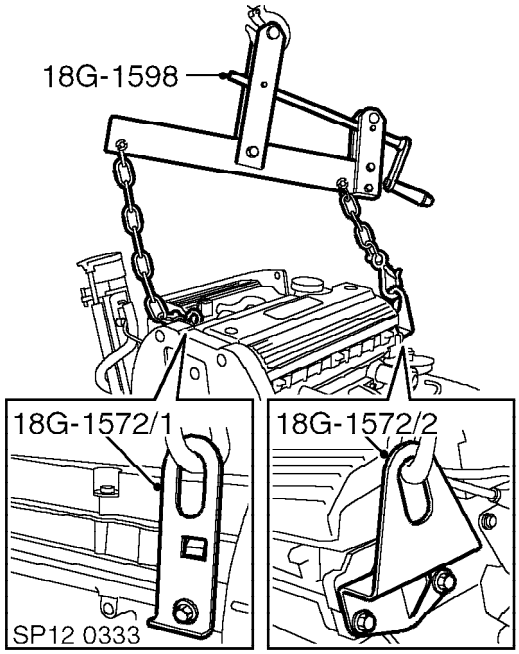
58. Remove nut and 2 speed bolts securing heat shield to cylinder head and exhaust manifold, remove heat shield.

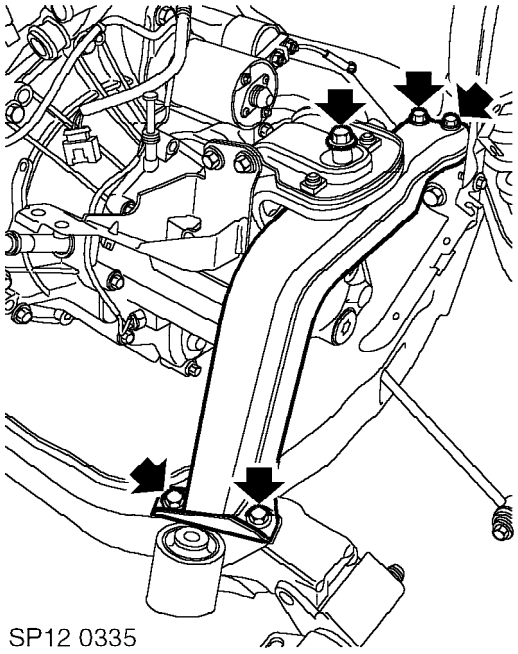


59. Release HO2S multiplug from bracket at rear of cylinder head and disconnect multiplug.
60. Release HO2S harness from clip on cylinder block bracket.

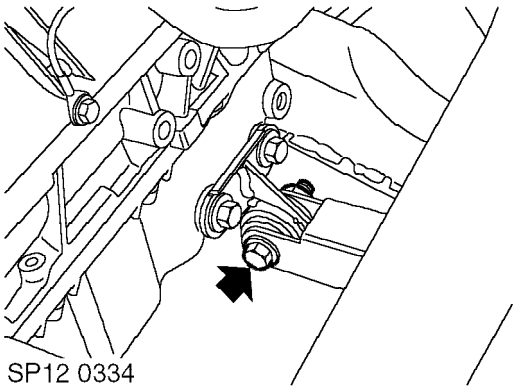


61. Remove 6 nuts securing front pipe to exhaust manifold.
62. Release front pipe from exhaust manifold and support rubber, remove front pipe, remove and discard gasket.



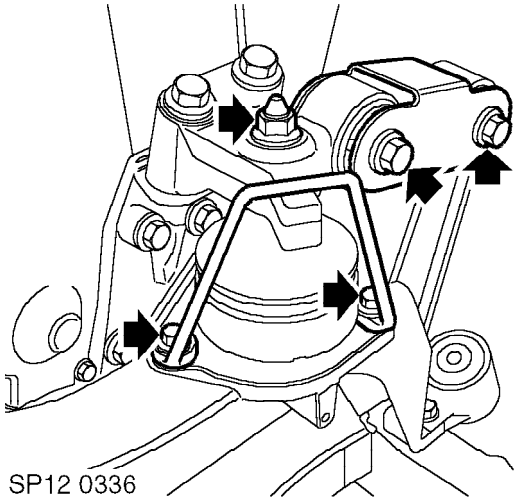


63. Remove 2 bolts securing exhaust camshaft rear oil seal cover plate and remove cover plate.
64. Position lifting brackets **18G-1572/1 and 18G-1572/2** to cylinder head and secure with bolts.
65. Position adjustable lifting equipment, **18G-1598** to lifting brackets.
66. Connect hoist to **18G-1598,** raise hoist to take weight of engine and gearbox.



67. Remove bolt securing rear engine steady to bracket on sump.

68. Remove nut and bolt securing gearbox mounting to LH buttress.
69. Remove 4 bolts securing LH buttress to subframe and remove buttress.



70. Remove nut securing RH engine mounting bracket to hydramount.
71. Remove bolt securing RH engine steady to engine mounting bracket. Loosen nut and bolt securing engine steady to RH buttress, pivot engine steady from mounting bracket.
72. Remove bolt, loosen remaining bolt and move engine mounting restraining loop aside.
73. With assistance, raise and remove engine and gearbox from subframe.
74. Lower engine and gearbox assembly, disconnect hoist from **18G-1598** .

Refit

1. Connect hoist to **18G-1598,** raise engine and gearbox assembly.
2. Position subframe assembly under engine.
3. Lower engine and gearbox assembly onto subframe, correctly position LH buttress and gearbox mounting.
4. Fit and tighten bolts securing LH buttress to subframe to 45 Nm.
5. Fit and tighten nut and bolt securing gearbox mounting to LH buttress to 82 Nm.
6. Position engine mounting restraining loop,fit and tighten bolts to 45 Nm.
7. Fit and tighten nut securing RH engine mounting bracket to hydramount to 82 Nm.
8. Position RH engine steady to engine mounting bracket, fit and tighten bolt to 85 Nm.
9. Tighten nut and bolt securing RH engine steady to buttress to 85 Nm.
10. Position rear engine steady to bracket on sump, fit and tighten bolt to 85 Nm.
11. Lower hoist and remove **18G-1598,** remove lifting brackets **18G-1572/1 and 18G-1572/2** .
12. Position exhaust camshaft rear oil seal cover plate, fit bolts and tighten to 12 Nm.
13. Fit a new gasket, position front pipe to exhaust manifold. Fit and tighten nuts to 50 Nm. Engage front pipe in support rubber.
14. Position heat shield, fit nut and bolts, tighten nut to 25 Nm and bolts to 10 Nm.
15. Connect HO2S multiplug, secure multiplug in support bracket.
16. Secure HO2S harness in clip on cylinder block bracket.
17. Clean ends of both drive shafts.
18. Fit new circlip to groove on drive shaft inner joint.
19. Wipe taper joints of both hub ball joints and upper arms.
20. Fit both hub assemblies to upper arms and engage both drive shafts in differential.

CAUTION: Pull outwards on drive shaft inner joints to check for full engagement in differential.

21. Position ball joint to upper suspension arm, fit and tighten new lock nut to 54 Nm.
22. Position lower link to rear hub, fit, but do not tighten bolt at this stage
23. Wipe tapers and seats of track control arms and hubs.
24. Position track control arms to both rear hubs, fit and tighten nuts to 38 Nm.
25. Fit bolt and nut securing trailing arm to trailing arm bush and tighten to 100 Nm.
26. Position engine table under body, carefully lower ramp over engine and gearbox assembly.
27. Align subframe mountings to body, position anti-roll bar mounting brackets and loosely fit bolts.
28. Carefully lower body remaining distance onto subframe mountings, tighten front mounting bolts to 30 Nm and rear mounting bolts to 45 Nm.
29. Raise vehicle on ramp and remove table.
30. Fit mounting rubbers to anti-roll bar, position anti-roll bar to subframe. Position clamps, fit and tighten nuts to 22 Nm.
31. Position anti-roll bar, align links to LH and RH trailing arms. Fit nuts and bolts but do not tighten at this stage.
32. Clean brake calipers and mating faces.
33. Position LH and RH brake calipers to hubs, fit and tighten bolts to 85 Nm.
34. Clean ABS sensors and mating faces.
35. Position ABS sensors and spacers, fit and tighten bolts to 10 Nm.
36. Secure LH and RH ABS lead grommets and leads into brackets and clips on each subframe turret and upper suspension arms.
37. Position engine earth lead to cylinder block, fit and tighten bolt to 25 Nm.
38. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
39. Position selector cables to gearbox abutment brackets and secure with new spring clips. Connect selector cables in gearbox linkages.
40. Connect hoses to coolant rail on underside of vehicle and secure with clips.
41. Connect heater hoses and secure with clips.
42. Secure battery cable to coolant hose with cable tie.
43. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
44. Lower vehicle on ramp.
45. With the weight of the vehicle on the rear suspension, tighten bolts securing lower links to rear hubs to 100 Nm.
46. With the weight of the vehicle on the rear suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
47. Connect road speed transducer multiplug.
48. Position clutch slave cylinder to mounting bracket, fit and tighten bolts to 25 Nm.
49. Position push rod to slave cylinder, fit clevis pin and washer through push rod and release lever and secure with 'R' clip.
50. Connect multiplug to emission canister purge control valve.
51. Connect engine harness and relay unit multiplugs.

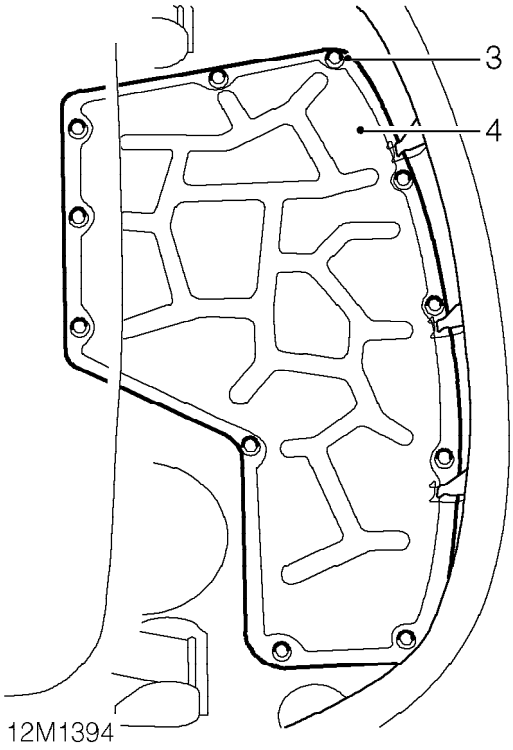
52. Connect ECM multiplugs.
53. Position ECM bracket, fit and tighten bolts to 8 Nm.
54. Position main fuse holder to body and secure with screw. Fit main fuse and cover.
55. Connect battery lead to starter motor solenoid, fit and tighten terminal nut.
56. Connect Lucar to starter motor solenoid.
57. Position battery cable to clutch slave cylinder mounting bracket and secure with clip.
58. Connect coolant hose to expansion tank and secure with clip. Position expansion tank, fit and tighten bolts to 8 Nm.
59. Connect coolant hose to inlet manifold and secure with clip.
60. Connect vacuum pipe to inlet manifold.
61. Connect fuel hose to fuel filter outlet pipe.
62. Connect fuel return hose to fuel return pipe.
63. Connect throttle cable to throttle cam and abutment bracket.
64. Secure throttle cable in clip on inlet manifold.
65. Connect evaporative emission pipe to throttle body and secure with clip.
66. Position air intake hose and secure with clips.
67. Connect hose to coolant rail and secure with clip.
68. Connect hose assembly between coolant outlet elbow, heater coolant rail and expansion tank. Secure hoses with clips.
69. Connect hose to coolant elbow on cylinder head and secure with clip.
70. Fill gearbox with oil.
71. Fill cooling system. ***See COOLING SYSTEM, Adjustments.***
72. Fit engine cover. ***See this section.***
73. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
74. Connect battery earth lead.

ENGINE COVER

Service repair no - 12.37.04/99

Remove

1. Remove hoodwell trim. ***See BODY, Interior trim components.***
2. Remove sound deadener pad.



3. Remove 11 bolts securing engine cover.
4. Remove engine cover.

Refit

1. Position cover and secure with bolts.
2. Fit sound deadener pad.
3. Fit hoodwell trim. ***See BODY, Interior trim components.***

ENGINE MOUNTING - REAR

Service repair no - 12.45.17

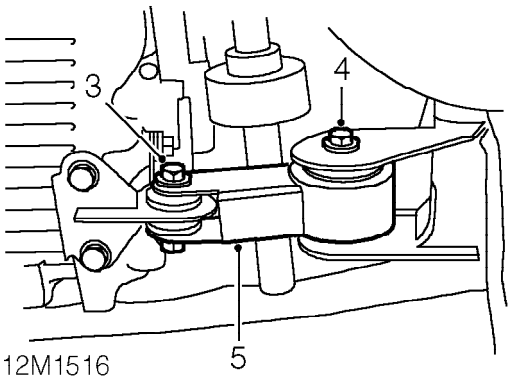
Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Support engine on jack.

CAUTION: Place block of wood between sump and jack to avoid damage occurring.



3. Remove nut and bolt securing mounting to sump.
4. Remove bolt securing mounting to subframe.
5. Remove mounting.

Refit

1. Position mounting to subframe, fit bolt but do not tighten.
2. Align mounting to sump bracket, fit bolt and tighten to 85 Nm.
3. Tighten bolt securing mounting to subframe to 85 Nm.
4. Remove jack.
5. Remove stand(s) and lower vehicle.

MOUNTING BRACKET - LH - MANUAL GEARBOX MODELS

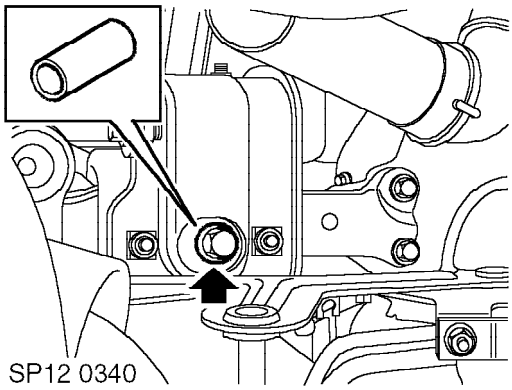
Service repair no - 12.45.11

Remove

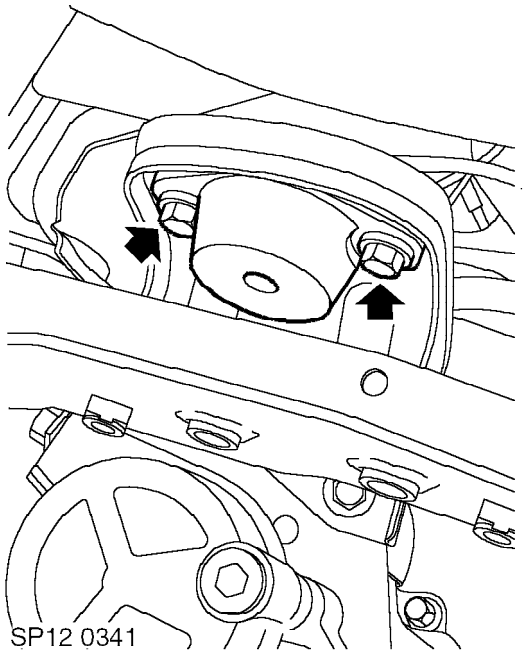
1. Disconnect battery earth lead.
2. Remove air cleaner assembly. ***See this section.***
3. Raise rear of vehicle and support on stand(s).

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

4. Remove LH rear road wheel.
5. Fit wooden block to jack and position jack to support gearbox.



6. Remove centre nut and bolt securing mounting to LH buttress.
7. Remove distance piece from centre of mounting.
8. Raise jack sufficiently to gain access to bolts securing mounting to gearbox bracket.


SP12 0341

9. Remove 2 bolts securing mounting to gearbox bracket and remove mounting.

Refit

1. Position mounting to gearbox bracket, fit and tighten bolts to 45 Nm.
2. Lower and remove jack from under gearbox.
3. Fit distance piece into centre of mounting.
4. Align mounting to LH buttress, position centre bolt, fit nut, tighten nut and bolt to 82 Nm.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stand(s) and lower vehicle.
7. Fit air cleaner assembly. ***See this section.***
8. Connect battery earth lead.

MOUNTING BRACKET - LH - STEPSPEED (Em-CVT) MODELS

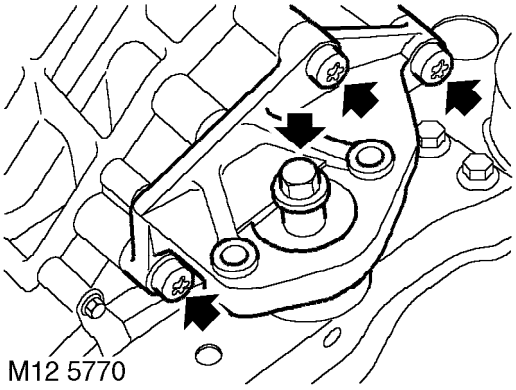
Service repair no - 12.45.11

Remove

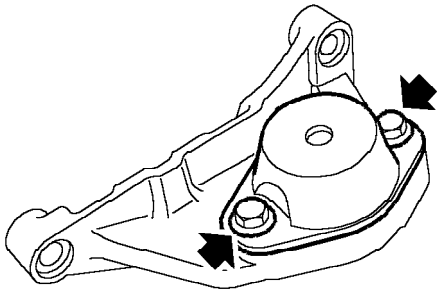
1. Disconnect battery earth lead.
2. Remove air cleaner assembly. ***See this section.***
3. Raise rear of vehicle and support on stand(s).

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

4. Remove LH rear road wheel.
5. Fit wooden block to jack and position jack to support gearbox.


M12 5770

6. Remove centre nut and bolt securing mounting to LH buttress.
7. Remove distance piece from centre of mounting.
8. Raise jack sufficiently to gain access to bolts securing mounting to gearbox bracket.


M12 5771

9. Remove 2 bolts securing mounting to gearbox bracket and remove mounting.

Refit

1. Position mounting to gearbox bracket, fit and tighten bolts to 45 Nm.
2. Lower and remove jack from under gearbox.
3. Fit distance piece into centre of mounting.
4. Align mounting to LH buttress, position centre bolt, fit nut, tighten nut and bolt to 82 Nm.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stand(s) and lower vehicle.
7. Fit air cleaner assembly. ***See this section.***
8. Connect battery earth lead.

MOUNTING BRACKET - RH - ALL MODELS

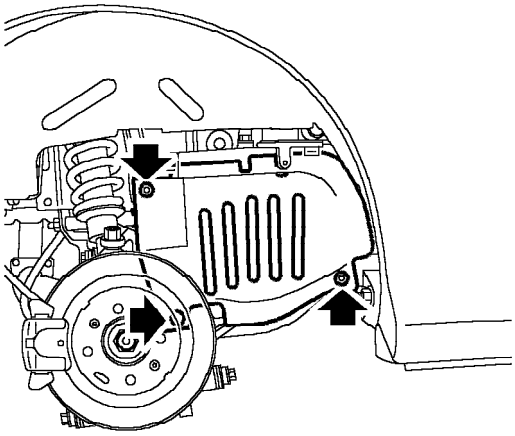
Service repair no - 12.45.12

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access grille. ***See BODY, Exterior fittings.***
3. Remove engine compartment access cover. ***See this section.***
4. Raise rear of vehicle and support on stand(s).

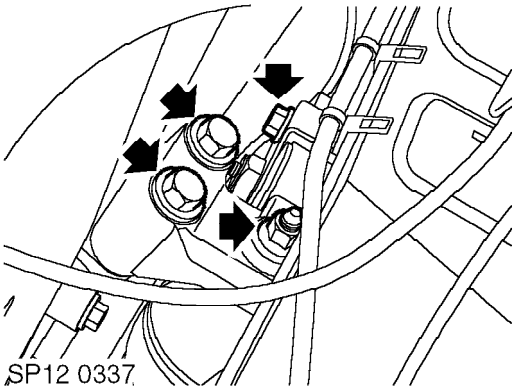
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

5. Remove RH rear road wheel.

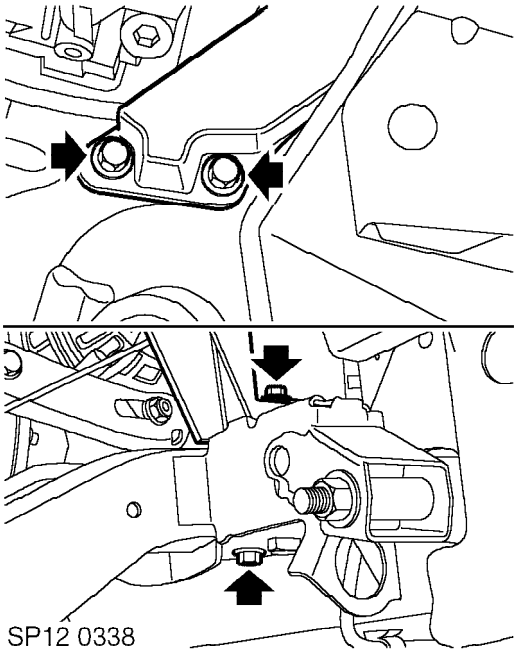


SP12 0348

6. Remove fixings securing closing panel and remove panel.
7. Remove trailing arm. ***See REAR SUSPENSION, Repairs.***
8. Fit wooden block to jack and position jack to support engine.

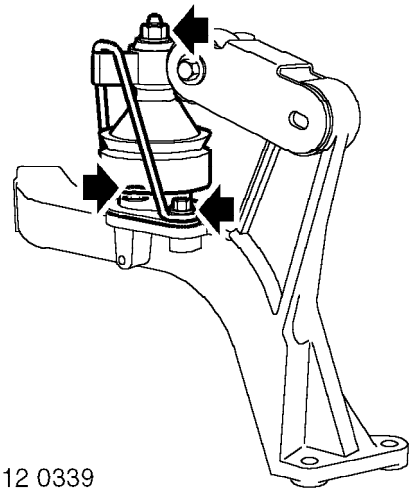

SP12 0337

9. Remove nut and bolt securing engine steady to RH buttress.
10. Loosen nut securing engine top arm bracket to RH engine hydramount.
11. Remove 2 bolts securing top arm to engine.


SP12 0338

12. Remove 4 bolts securing RH buttress to subframe.
13. Raise engine on jack sufficiently and manoeuvre RH buttress and engine mount assembly from vehicle.

NOTE: Do not carry out further dismantling if component is removed for access only.


SP12 0339

14. Remove 2 bolts securing hydramount to buttress, collect restraining loop and remove hydramount.
15. Remove nut and top arm bracket from hydramount.

Refit

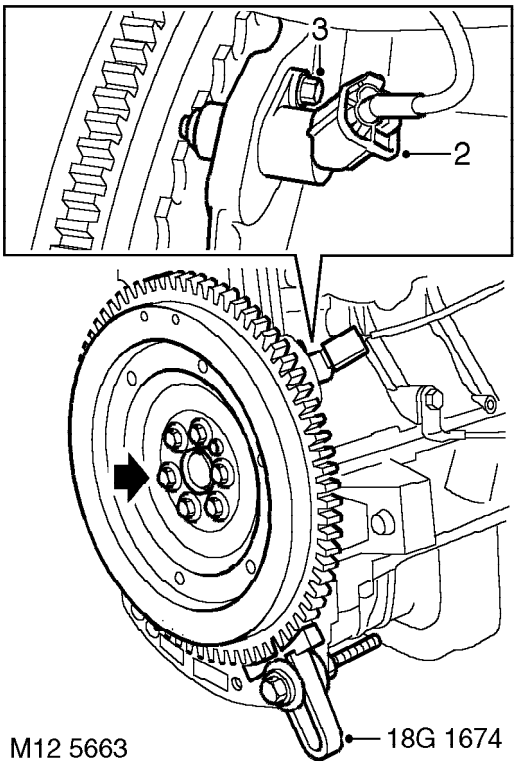
1. Clean hydramount and mating face on buttress.
2. Position top arm bracket to hydramount, fit nut but do not tighten at this stage.
3. Position hydramount and restraining loop to buttress. fit and tighten bolts to 45 Nm.
4. Position engine steady to buttress, fit nut and bolt but do not tighten at this stage.
5. Position buttress assembly to subframe and manoeuvre into position.
6. With assistance, manoeuvre engine and align top arm to engine, fit bolts but do not tighten at this stage.
7. Lower engine on jack, align buttress to bolt holes. Fit and tighten bolts securing buttress to subframe to 45 Nm.
8. Tighten bolts securing top arm to engine to 100 Nm.
9. Tighten nut securing top arm to hydramount to 82 Nm.
10. Tighten nut and bolt securing engine steady to buttress to 85 Nm.
11. Remove jack from underneath engine.
12. Fit trailing arm. ***See REAR SUSPENSION, Repairs.***
13. Position closing panel and secure with fixings.
14. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
15. Remove stand(s) and lower vehicle.
16. Fit engine compartment access cover. ***See this section.***
17. Fit engine compartment access grille. ***See BODY, Exterior fittings.***
18. Connect battery earth lead.

FLYWHEEL - MANUAL GEARBOX MODELS

Service repair no - 12.53.07

Remove

1. Remove clutch assembly. ***See CLUTCH, Repairs.***



M12 5663

2. Disconnect multiplug from CKP sensor.
3. Remove bolt securing CKP sensor, release and remove sensor.
4. Fit flywheel locking tool **18G 1674,** to cylinder block and secure with bolt.
5. Remove and discard 6 bolts securing flywheel to crankshaft.
6. Remove bolt and flywheel locking tool, **18G 1674,** from cylinder block.
7. Remove flywheel from crankshaft.

Refit

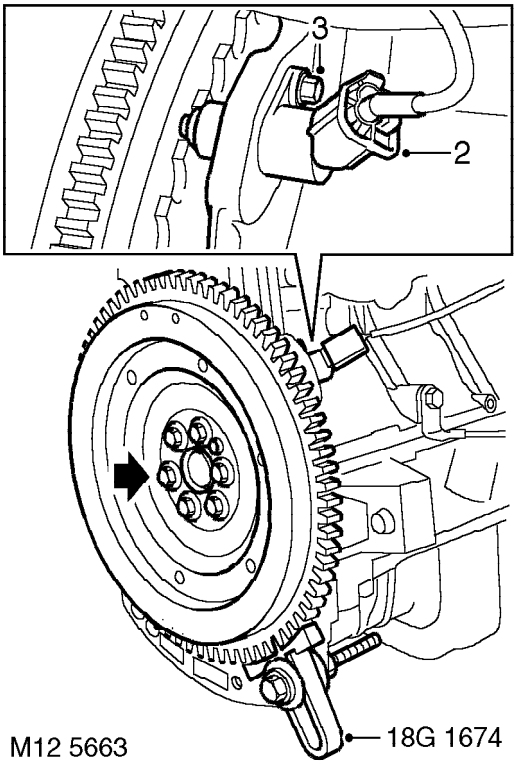
1. Clean adhesive from threads of flywheel bolt holes in crankshaft using an old flywheel bolt, with 2 saw cuts at an angle of 45° to the bolt shank.
2. Clean flywheel and mating face of crankshaft.
3. Fit flywheel to crankshaft.
4. Fit new bolts securing flywheel to crankshaft but do not tighten at this stage.
5. Fit flywheel locking tool **18G 1674** to cylinder block and secure with bolt.
6. Working in a diagonal sequence, tighten flywheel bolts to 85 Nm.
7. Clean CKP sensor and mating face.
8. Fit CKP sensor to cylinder block, fit bolt and tighten to 6 Nm.
9. Connect multiplug to CKP sensor.
10. Fit clutch assembly. ***See CLUTCH, Repairs.***

FLYWHEEL - STEPSPEED (Em-CVT) MODELS

Service repair no - 12.53.07

Remove

1. Remove torsion damper. ***See this section.***



2. Disconnect multiplug from CKP sensor.
3. Remove bolt securing CKP sensor to cylinder block and remove sensor.
4. Fit flywheel locking tool **18G 1674** to sump and secure with bolt.
5. Remove and discard 6 bolts securing flywheel to crankshaft.
6. Remove flywheel locking tool **18G 1674** .
7. Remove flywheel from crankshaft.

Refit

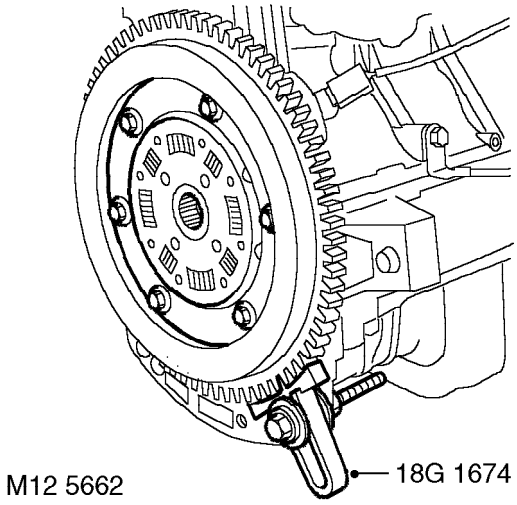
1. Clean bolt holes in crankshaft using an old flywheel bolt with two saw cuts at an angle of 45° to the bolt shank.
2. Clean flywheel and mating face of crankshaft.
3. Fit flywheel to crankshaft.
4. Fit new bolts, but do not tighten at this stage.
5. Fit flywheel locking tool **18G 1674** and secure with bolt.
6. Working in a diagonal sequence tighten flywheel bolts to 85 Nm.
7. Remove flywheel locking tool **18G 1674** .
8. Fit CKP sensor to cylinder block, fit bolt and tighten to 6 Nm.
9. Connect multiplug to CKP sensor.
10. Fit torsion damper. ***See this section.***

TORSION DAMPER - STEPSPEED (Em-CVT) MODELS

Service repair no - 12.53.13

Remove

1. Remove automatic gearbox assembly. ***See AUTOMATIC GEARBOX - 'Em-CVT', Repairs.***



2. Fit flywheel locking tool **18G 1674** to sump and tighten bolt.
3. Progressively loosen and then remove 6 bolts securing torsion damper to flywheel.
4. Remove torsion damper.

Refit

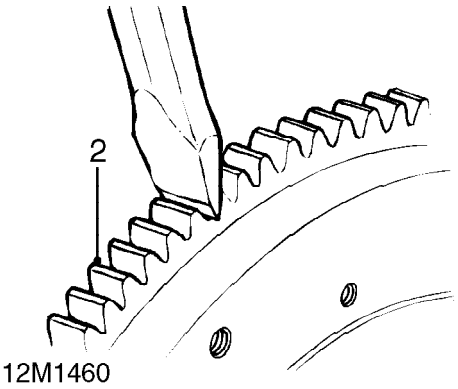
1. Clean torsion damper and flywheel mating faces.
2. Position torsion damper to flywheel, fit bolts but do not tighten at this stage.
3. Working in a diagonal sequence, progressively tighten bolts to 22 Nm.
4. Remove bolt securing flywheel locking tool and remove tool.
5. Refit automatic gearbox assembly. ***See AUTOMATIC GEARBOX - 'Em-CVT', Repairs.***

FLYWHEEL STARTER RING GEAR

Service repair no - 12.53.19

Remove

1. Remove flywheel. ***See this section.***



2. Apply a cold chisel in root of one of ring gear teeth, strike chisel with hammer to break ring gear.
3. Remove starter ring gear.

Refit

1. Clean flywheel and new starter ring gear.
2. Heat new starter ring gear evenly to approximately 350°C, indicated when the ring is a light blue colour.
3. Locate ring gear on flywheel and press ring gear hard against flange on flywheel.
4. Ensure ring gear is correctly seated around the complete circumference of flywheel and allow to cool.
5. Fit flywheel. ***See this section.***

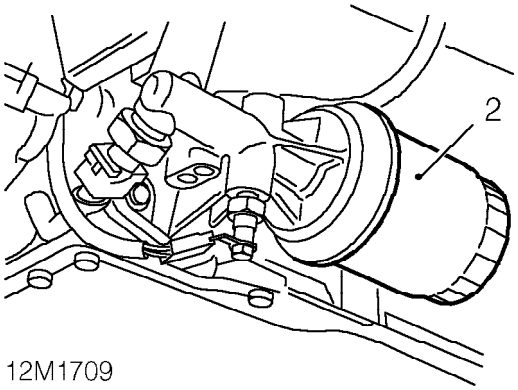
OIL FILTER

Service repair no - 12.60.04

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.



2. Clean area around filter head and place a container beneath engine.
3. Using a strap wrench, unscrew and discard filter.

Refit

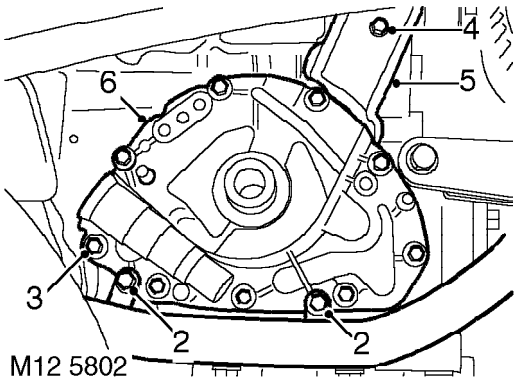
1. Clean mating face of filter head.
2. Lubricate sealing ring of new filter with clean engine oil.
3. Fit new filter and tighten by hand until it seats then tighten a further half turn.
4. Remove stand(s) and lower vehicle.
5. Top up engine with oil to specification 10w/40 until level is correct.
6. Start and run engine and check for oil leaks.
7. Stop engine, wait a few minutes, then check oil level. Top up if necessary.

GASKET - OIL PUMP

Service repair no - 12.60.25

Remove

1. Remove camshaft timing belt. ***See this section.***

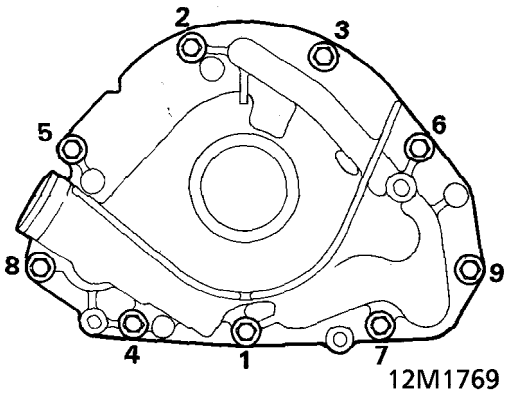


2. Remove 2 bolts securing engine harness to oil pump and move harness clear of pump.
3. Remove 9 bolts securing oil pump to cylinder block.
4. Remove lower bolt from timing belt rear cover.
5. Release rear cover to facilitate pump removal.
6. Remove pump and discard gasket.

Refit

1. Clean oil pump bolt holes in cylinder block.
2. Clean oil seal running surface on crankshaft.
3. Fit new oil pump gasket to cylinder block, align and fit oil pump.

CAUTION: Do not lubricate crankshaft front oil seal or running surface of crankshaft.



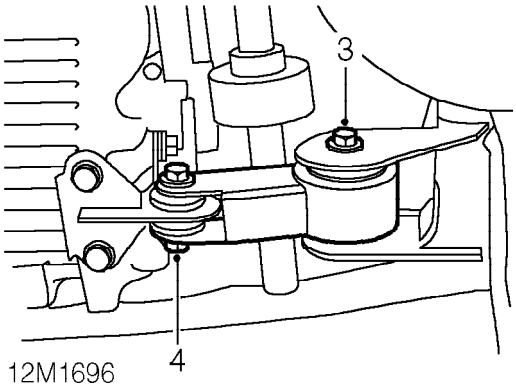
4. Fit new Patchlok bolts and tighten in sequence shown to 10 Nm.
5. Fit and tighten bolt securing timing belt rear cover to 9 Nm.
6. Align engine harness to oil pump, fit bolts and tighten to 10 Nm.
7. Fit camshaft timing belt. ***See this section.***

OIL SUMP

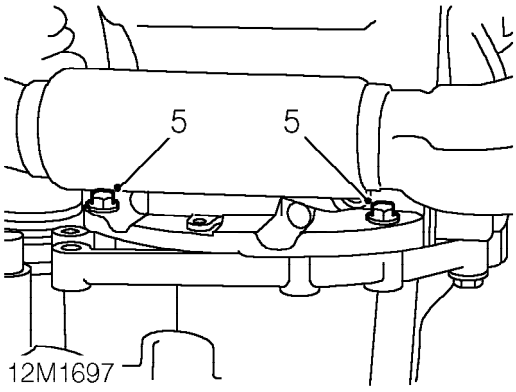
Service repair no - 12.60.38

Remove

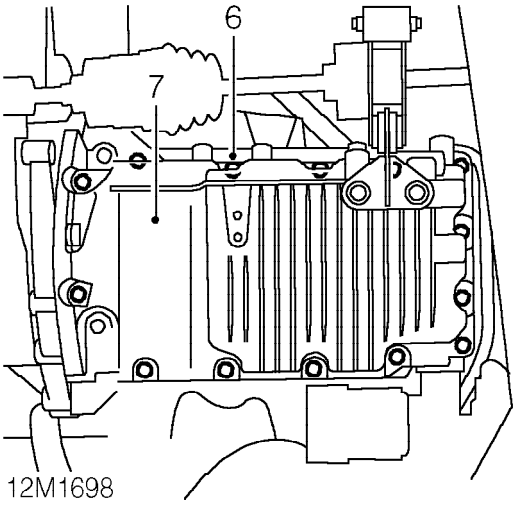
1. Remove exhaust front pipe. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
2. Drain engine oil. ***See MAINTENANCE.***



3. Loosen bolt securing engine rear mount to subframe.
4. Remove nut and bolt securing engine rear mount to engine.



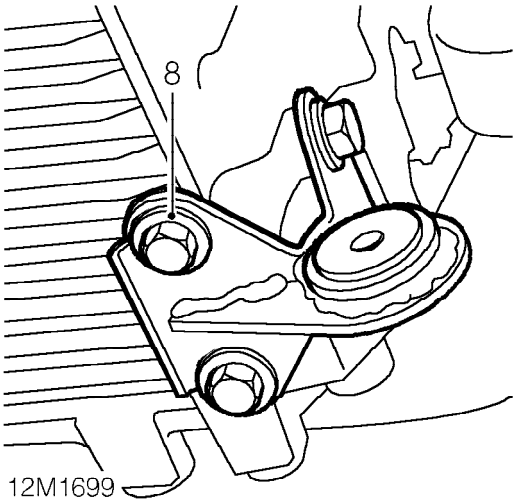
5. Remove 2 bolts securing oil sump to gearbox.



6. Remove 14 bolts securing oil sump to bearing ladder noting the fitted positions of 2 longest bolts.
7. Using a mallet, gently tap sump sideways to release sealant bond; remove sump.

CAUTION: Do not lever between sump flange and bearing ladder.

Do not carry out further dismantling if component is removed for access only.

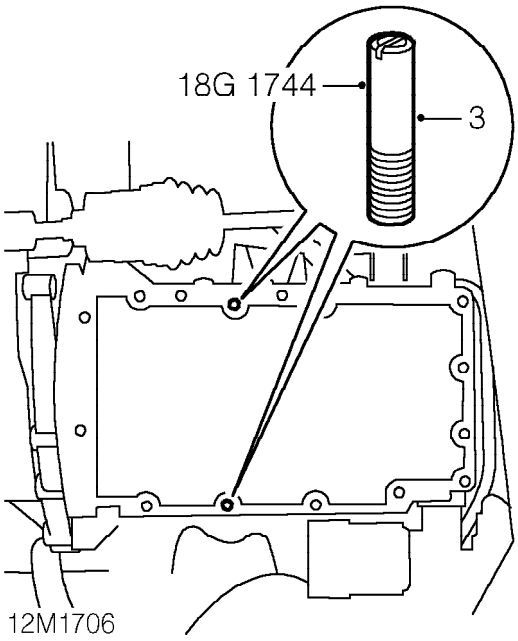


8. Remove 4 bolts securing engine rear mount to sump, remove mount.

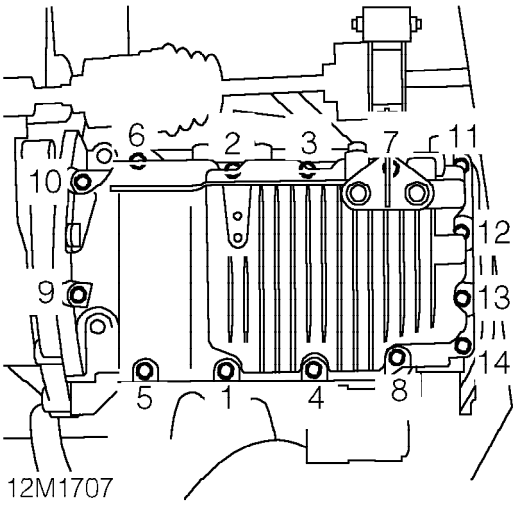
Refit

1. Clean inside of sump. Remove all traces of sealant using a suitable solvent.
2. Fit mount to sump, fit bolts and tighten to 80 Nm.
3. Apply sealant from kit, Part No. GUG 705963GM to sump joint face and spread to an even film using a brush or roller.

CAUTION: To avoid contamination, assembly should be completed immediately after application of sealant. Do not use RTV or any sealant other than that supplied with kit.



4. Fit sump alignment pins **18G 1744** to bearing ladder as shown.



5. Position sump to alignment pins, fit 2 bolts at positions 5 and 6, tighten bolts to 4 Nm.
6. Fit 10 bolts into remaining holes ensuring that 2 longest bolts are in original fitted positions, finger tighten bolts.
7. Remove alignment pins **18G 1744,** fit and finger tighten remaining 2 bolts.
8. Progressively tighten sump bolts in sequence shown to 25 Nm.
   Tighten sump to gearbox bolts to 45 Nm.
9. Position engine rear mount to subframe, fit bolt and tighten to 85 Nm.
10. Tighten engine rear mount to oil sump bolt to 85 Nm.
11. Fit exhaust front pipe. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
12. Fill engine with oil. ***See MAINTENANCE.***

SWITCH - OIL PRESSURE

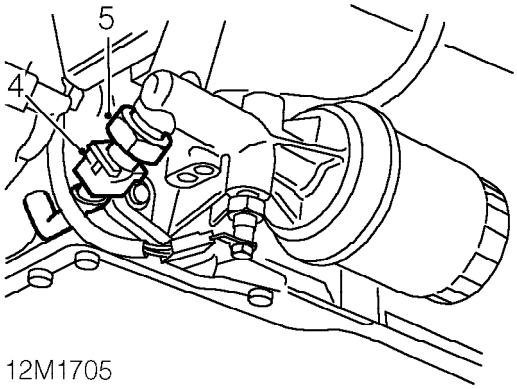
Service repair no - 12.60.50

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

WARNING: Support on safety stands.

3. Position container below engine oil filter to collect spillage.



4. Disconnect multiplug from oil pressure switch.
5. Remove oil pressure switch.

Refit

1. Clean oil pressure switch threads.
2. Fit oil pressure switch and tighten to 12 Nm.
3. Connect multiplug to oil pressure switch.
4. Remove stand(s) and lower vehicle.
5. Top-up engine oil. ***See MAINTENANCE.***
6. Connect battery earth lead.

OIL PRESSURE RELIEF VALVE

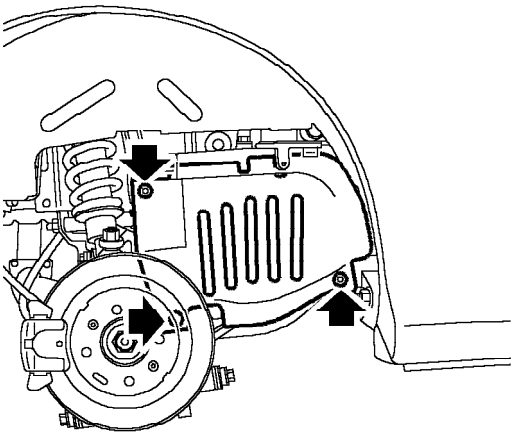
Service repair no - 12.60.56

Remove

1. Raise rear of vehicle.

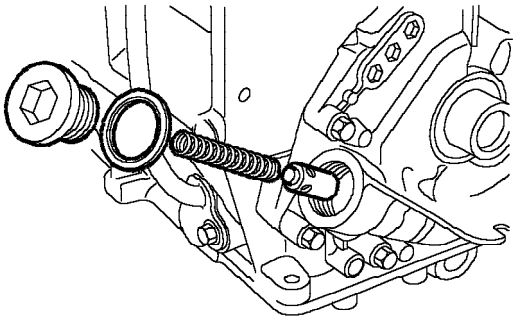
WARNING: Support on safety stands.

2. Remove road wheel(s).



SP12 0348

3. Remove fixings securing closing panel and remove panel.



M12 5804

4. Remove relief valve sealing plug and sealing washer.
5. Remove spring and relief valve.

Refit

1. Clean oil pump housing.
2. Clean valve spring, valve and sealing washer.
3. Lubricate relief valve. Fit valve and spring.
4. Fit new sealing washer, fit and tighten sealing plug to 25 Nm.
5. Fit closing panel and secure with fixings.
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stand(s) and lower vehicle.
8. Check and top up oil level. ***See MAINTENANCE.***

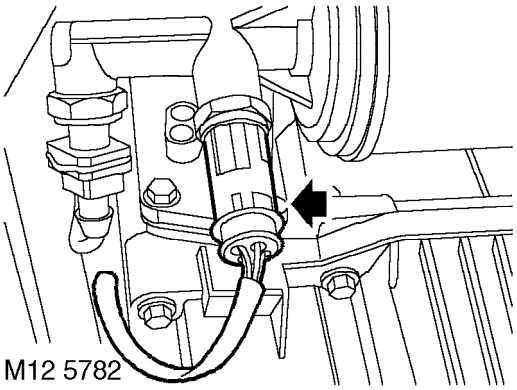
SENSOR - OIL TEMPERATURE

Service repair no - 12.60.65

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

WARNING: Support on safety stands.



3. Disconnect multiplug from oil temperature sensor.
4. Position drain tin below switch to catch oil spillage.
5. Remove oil temperature sensor.

Refit

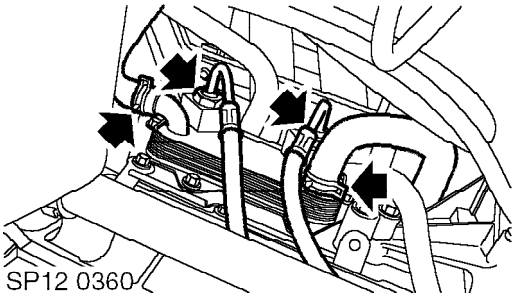
1. Clean oil temperature sensor threads.
2. Fit oil temperature sensor and tighten to 15 Nm.
3. Connect multiplug to oil temperature sensor.
4. Remove stand(s) and lower vehicle.
5. Connect battery earth lead.
6. Check and if necessary top up engine oil.

COOLER - ENGINE OIL - VVC

Service repair no - 12.60.68

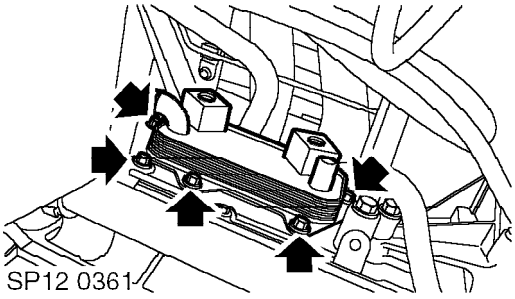
Remove

1. Disconnect battery earth lead.
2. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***
3. Raise the vehicle on a ramp.
4. Position drain tray under engine oil cooler to collect spillage.



5. Release clips and disconnect coolant hoses from engine oil cooler.
6. Loosen and remove engine oil cooler pipe unions from oil cooler, remove and discard 'O' rings.

CAUTION: Always fit plugs to open connections to prevent contamination.



7. Remove 5 bolts securing engine oil cooler to cylinder block and remove oil cooler.

Refit

1. Clean engine oil cooler and mating face on cylinder block.
2. Position engine oil cooler to cylinder block, fit and tighten bolts to 25 Nm.
3. Remove plugs from engine oil cooler and pipe unions.
4. Use a lint free cloth and wipe oil cooler and pipe unions.
5. Lubricate new 'O' rings with clean engine oil and fit to pipe unions.
6. Correctly position pipes to oil cooler and tighten unions to 18 Nm.
7. Connect coolant hoses to oil cooler and secure with clips.
8. Lower vehicle on ramp.
9. Fill cooling system. ***See COOLING SYSTEM, Adjustments.***
10. Connect battery earth lead.

TIMING BELT - CAMSHAFT - CONVENTIONAL VALVE CONTROL

Service repair no - 12.65.18

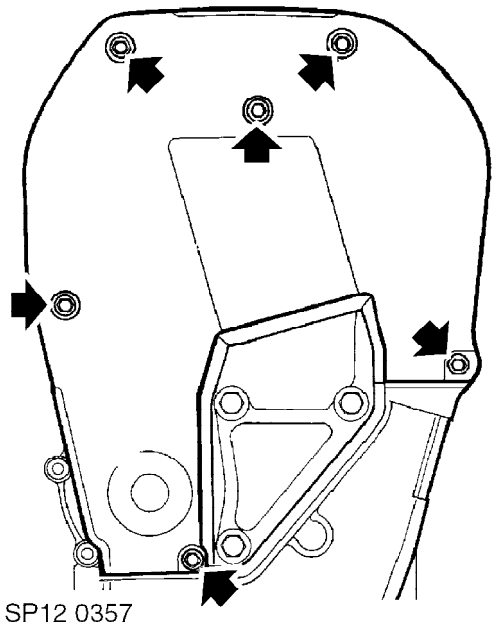
Remove

CAUTION: Timing belts must be replaced if cylinder head is to be removed or new timing gears are to be fitted.
Timing belts must be stored and handled with care.
Always store a timing belt on its edge with a bend radius greater than 50 mm.
Do not use a timing belt that has been twisted or bent double as this can damage the reinforcing fibres.
Do not use a timing belt if debris other than belt dust is found in the timing cover.
Do not use a timing belt if partial engine seizure has occurred.
Do not use a timing belt if belt milage exceeds 48,000 (77,000 km).
Do not use an oil contaminated timing belt. The cause of contamination MUST be rectified.

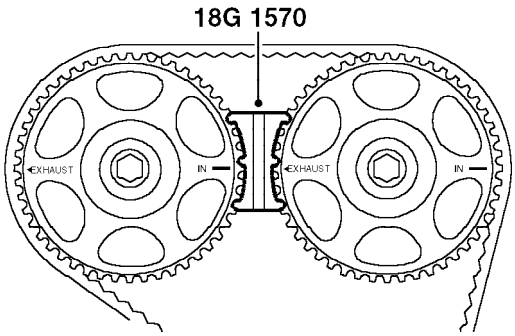
1. Disconnect battery earth lead.
2. Raise rear of vehicle and support on stand(s).

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

3. Remove RH rear road wheel.
4. Remove RH engine hydramount assembly. ***See this section.***


SP12 0357

5. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
6. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.

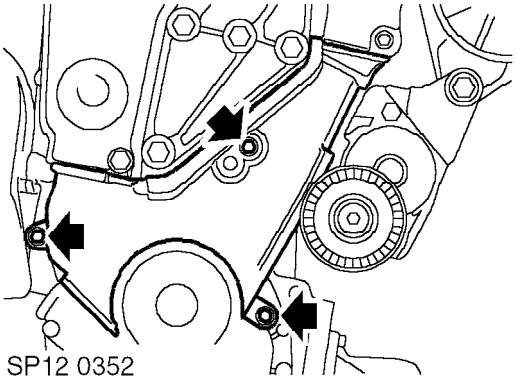


SP12 0349

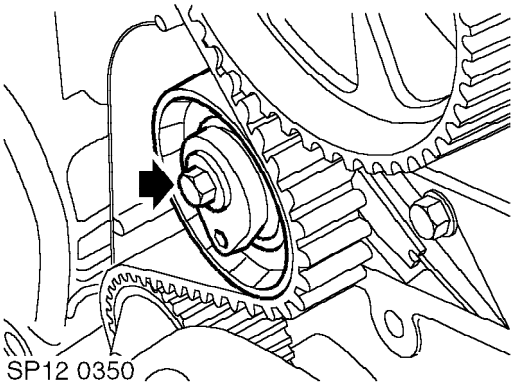
7. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90˚ BTDC. Fit camshaft locking tool, **18G 1570** between gears.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

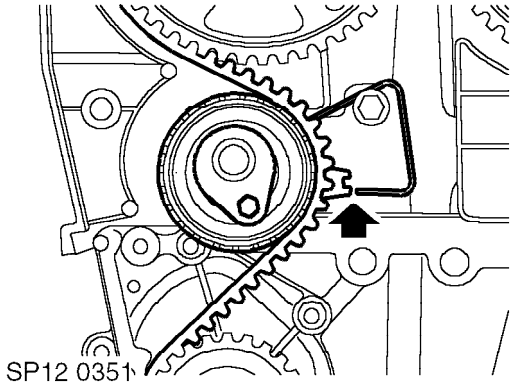
8. Check that the timing mark on the crankshaft pulley is aligned with mark on timing belt lower cover.
9. If camshaft timing belt is to be refitted, mark direction of rotation on timing belt.
10. Remove crankshaft pulley. ***See this section.***


SP12 0352

11. Remove 3 bolts securing timing belt lower cover to cylinder block, remove cover and rubber seal.


SP12 0350

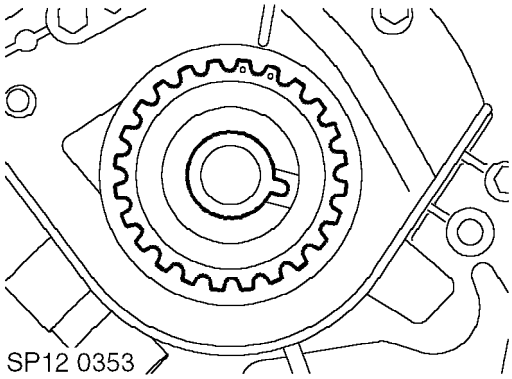
12. Remove and discard timing belt tensioner bolt.


SP12 0351

13. Disengage index wire from its fitted position, at the same time removing timing belt tensioner.

14. With care, release camshaft timing belt from gears and remove camshaft timing belt.

CAUTION: Ease the belt off gears using fingers only. Metal levers may damage the belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted.

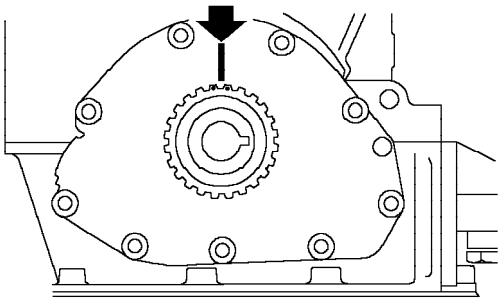


15. Remove timing belt drive gear from crankshaft.

Refit

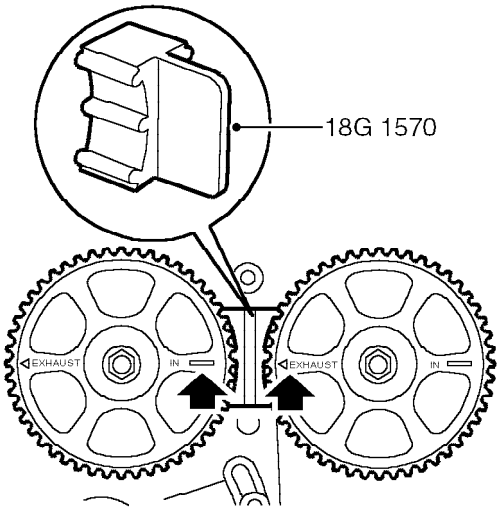
1. Clean crankshaft timing gear, camshaft timing gears, coolant pump drive gear and tensioner pulley.

CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.



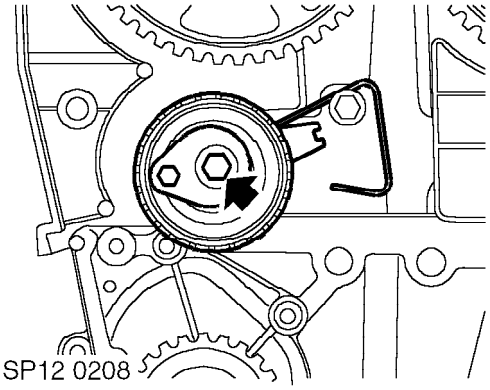
SP12 0345

2. Fit timing gear to crankshaft, ensure dots on timing gear are aligned to flange on oil pump housing.



SP12 0358

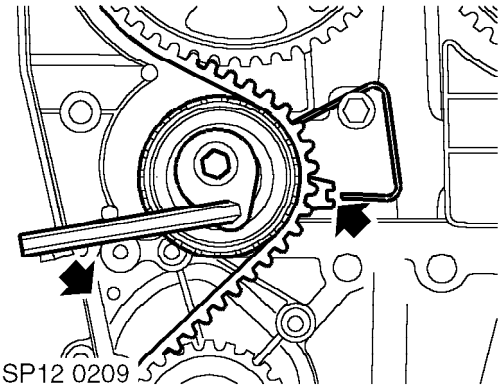
3. Check that the timing marks on the camshaft gears are correctly aligned and that **18G-1570,** is locking camshaft gears.


SP12 0208

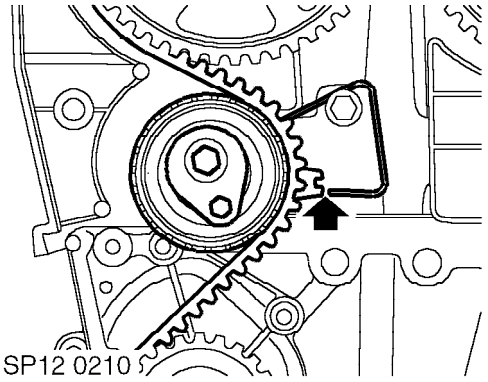
4. Position timing belt tensioner ensuring that the index wire is located over pillar bolt and that tensioner lever is at 9 o'clock position.
5. Fit new tensioner Patchlok bolt, tighten bolt until it is just possible to move tensioner lever.
6. Using fingers only, fit timing belt. Ensure belt run between the crankshaft gear and the exhaust camshaft gear is kept taut during the fitting procedure.

CAUTION: If the original timing belt is being refitted, ensure the direction of rotation mark is facing the correct way.

7. Check that timing belt is positioned centrally around all gears and tensioner pulley.
8. Fit rubber seal to timing belt lower cover, position cover to cylinder block, fit and tighten bolts to 9 Nm.
9. Fit crankshaft pulley. ***See this section.***
10. Remove camshaft gear alignment tool.


SP12 0209

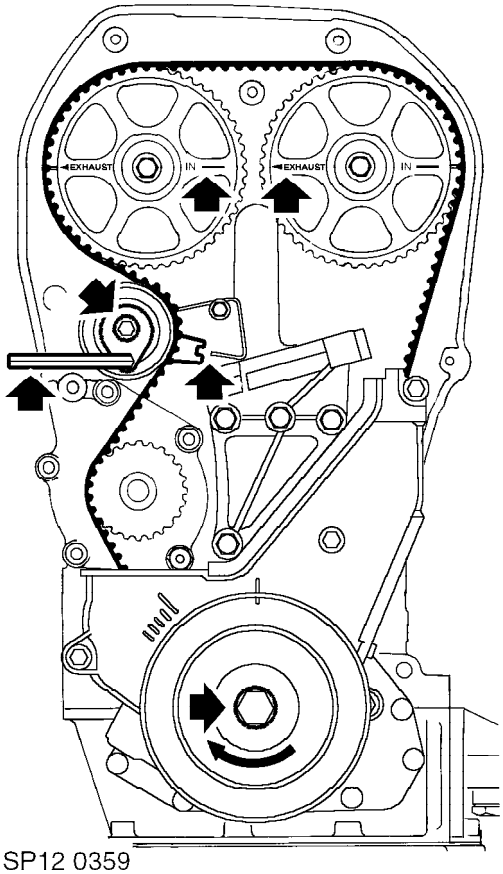
11. Use a 6mm Allen key to rotate tensioning lever in an anti-clockwise direction and align pointer to index wire as shown.


SP12 0210

12. If original belt is to be refitted then the pointer must be aligned so that the index wire is adjacent to lower land of pointer.

CAUTION: It is imperative that the pointer approaches the index wire from above. If the pointer passes the index wire, the tension must be fully released and the tensioning procedure must be repeated.

13. Ensuring that the pointer maintains correct position, tighten tensioner bolt to 25 Nm.



SP12 0359

14. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

15. Check alignment of pointer to index wire.

CAUTION: Ensure that the pointer approaches the index wire from above. Should the pointer go past index wire, release tension completely and repeat tensioning procedure.

16. If pointer is not correctly aligned, loosen bolt until it is just possible to move tensioning lever. Rotate tensioning lever clockwise until tension is completely backed off, then rotate tensioning lever anti-clockwise until pointer is aligned correctly to index wire.
17. Ensuring that the pointer maintains correct position, tighten tensioner bolt to 25 Nm.
18. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

19. Check that pointer is correctly aligned with index wire.
20. Clean timing belt upper cover.
21. Position timing belt upper cover and seal, fit and tighten bolts to 9 Nm.
22. Fit RH engine hydramount assembly. ***See this section.***
23. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
24. Remove stand(s) and lower vehicle.
25. Connect battery earth lead.

TIMING BELT - CAMSHAFT - VVC

Service repair no - 12.65.18

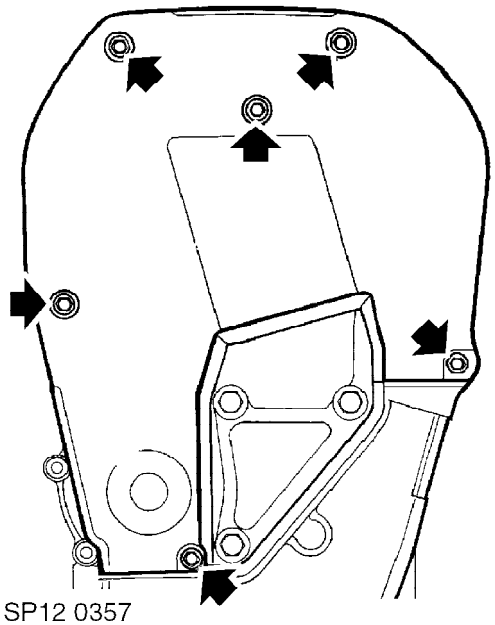
Remove

CAUTION: Timing belts must be replaced if cylinder head is to be removed or new timing gears are to be fitted.
Timing belts must be stored and handled with care.
Always store a timing belt on its edge with a bend radius greater than 50 mm.
Do not use a timing belt that has been twisted or bent double as this can damage the reinforcing fibres.
Do not use a timing belt if debris other than belt dust is found in the timing cover.
Do not use a timing belt if partial engine seizure has occurred.
Do not use a timing belt if belt milage exceeds 48,000 (77,000 km).
Do not use an oil contaminated timing belt. The cause of contamination MUST be rectified.

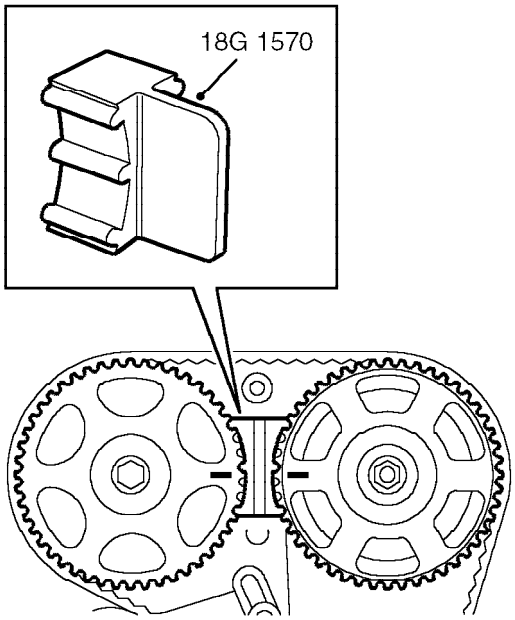
1. Disconnect battery earth lead.
2. Raise rear of vehicle and support on stand(s).

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

3. Remove RH engine hydramount assembly. ***See this section.***


SP12 0357

4. Remove 5 bolts securing camshaft timing belt upper cover to rear cover.
5. Loosen lower bolt securing timing belt upper cover, remove cover and collect seal.

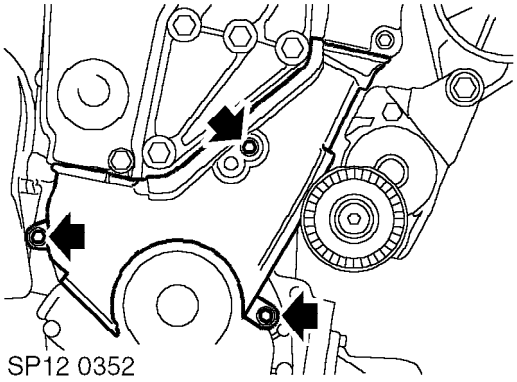


SP12 0342

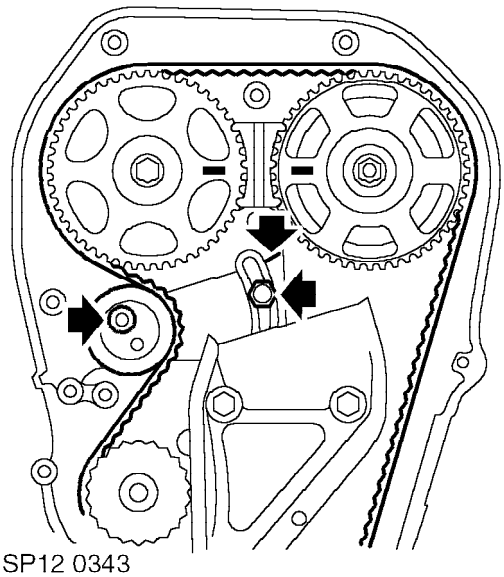
6. Using a socket and extension bar on crankshaft pulley bolt, rotate crankshaft clockwise to align camshaft gear timing marks - 90˚ BTDC. Fit camshaft locking tool **18G-1570,** between gears.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

7. Check that the timing mark on crankshaft pulley is aligned with mark on timing belt lower cover.
8. Remove crankshaft pulley. ***See this section.***

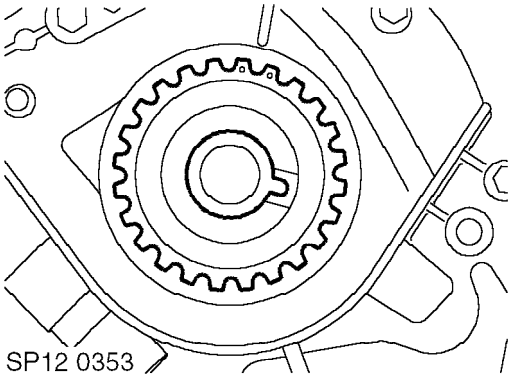

SP12 0352

9. Remove 3 bolts securing timing belt lower cover to cylinder block, remove cover and rubber seal.


SP12 0343

10. If camshaft timing belt is to be reused, Mark position of tensioner backplate to cylinder head for belt tensioning reference.
11. Loosen timing belt tensioner pulley Allen bolt 1/2 turn.
12. Loosen timing belt tensioner pulley bolt 1/2 turn.
13. Push tensioner pulley down to fully OFF position and tighten backplate bolt to 10 Nm.
14. With care, release camshaft timing belt from gears and remove camshaft timing belt.

CAUTION: Ease the belt off gears using fingers only. Metal levers may damage the belt and gears. Do not rotate crankshaft with timing belt removed and cylinder head fitted.

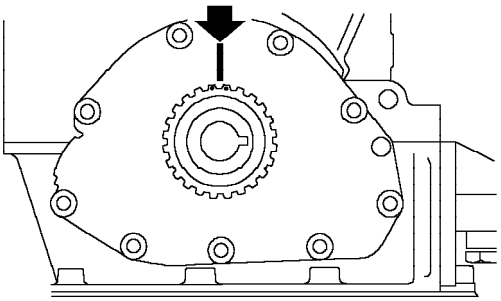

SP12 0353

15. Remove timing belt drive gear from crankshaft.

Refit

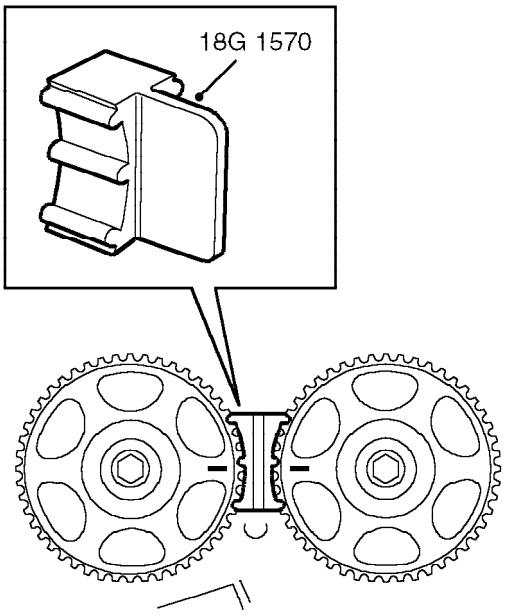
1. Clean crankshaft timing gear, camshaft timing gears, coolant pump drive gear and tensioner pulley.

CAUTION: If sintered gears have been subjected to prolonged oil contamination, they must be soaked in solvent and then thoroughly washed in clean solvent before refitting. Because of the porous construction of sintered material, oil impregnated in the gear will emerge and contaminate the belt.



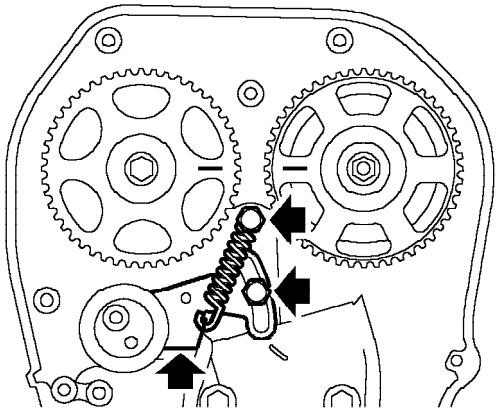
SP12 0345

2. Fit timing gear to crankshaft, ensure dots on timing gear are aligned to flange on oil pump housing.



SP12 0344

3. Check that the timing marks on the camshaft gears are correctly aligned and that **18G-1750,** is locking camshaft gears.



SP12 0346

4. Fit and tighten pillar bolt supplied with new replacement belt to cylinder head.
5. Connect tensioner spring, also supplied with replacement timing belt to pillar bolt and tensioner.

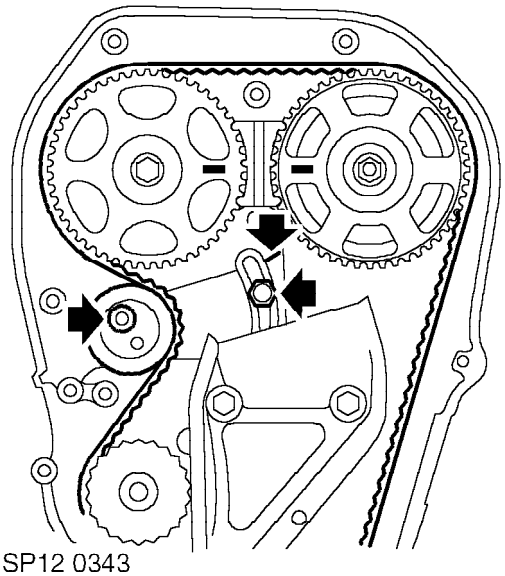
NOTE: The tensioner spring is not fitted with a rubber sleeve.

6. Loosen backplate bolt and ensure tensioner moves fully through its adjustment range and returns by spring tension.
7. Push tensioner pulley down to fully OFF position and tighten backplate bolt to 10 Nm.
8. Using fingers only, fit timing belt. Ensure belt run between the crankshaft gear and the exhaust camshaft gear is kept taut during the fitting procedure.

CAUTION: If the original timing belt is being refitted, ensure the direction of rotation mark is facing the correct way.

9. Check that timing belt is positioned centrally around all gears and tensioner pulley.
10. Clean timing belt lower cover.
11. Fit rubber seal to timing belt lower cover, position cover to cylinder block, fit and tighten bolts to 9 Nm
12. Fit crankshaft pulley. ***See this section.***

Tensioning an existing timing belt.

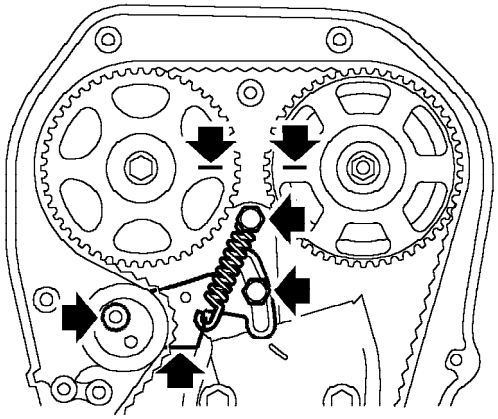


SP12 0343

13. Loosen tensioner pulley bolt and Allen bolt 1/2 turn. Position tensioner to reference mark on backplate and cylinder head.
14. Tighten tensioner backplate bolt to 10 Nm and tensioner Allen bolt to 45 Nm.
15. Remove camshaft gear alignment tool
16. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.

CAUTION: Never use the camshaft gear, the camshaft gear retaining bolts or the timing belt to turn the crankshaft.

Tensioning replacement timing belt.



SP12 0347

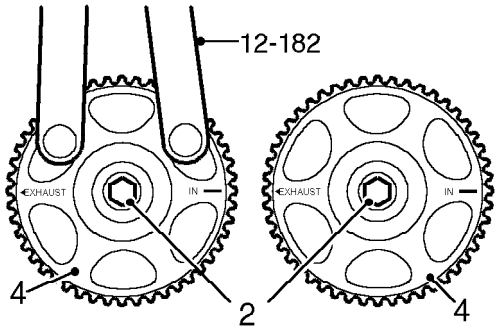
17. Loosen timing belt tensioner pulley Allen bolt 1/2 turn.
18. Loosen timing belt tensioner backplate bolt 1/2 turn.
19. Apply tension to belt by applying finger pressure to tensioner backplate.
20. With tensioner pulley against timing belt and backplate held in position, tighten tensioner backplate bolt to 10 Nm.
21. Remove camshaft gear alignment tool
22. Fit a suitable socket to crankshaft pulley bolt, rotate crankshaft clockwise 2 complete revolutions and align camshaft gear timing marks.
23. Loosen tensioner backplate bolt and check that the timing belt is being tensioned by tension spring.
24. Tighten tensioner backplate bolt to 10 Nm and tensioner Allen bolt to 45 Nm.
25. Release tensioner spring from pillar bolt and tensioner, discard spring.
26. Remove and discard pillar bolt.
27. Clean timing belt upper cover.
28. Position timing belt upper cover and seal, fit and tighten bolts to 9 Nm.
29. Fit RH engine hydramount assembly. ***See this section.***
30. Remove stand(s) and lower vehicle.
31. Connect battery earth lead.

CAMSHAFT TIMING BELT GEAR

Service repair no - 12.65.20

Remove

1. Remove and discard camshaft timing belt. ***See this section.***



M12 5012A

NOTE: MPi timing gears illustrated.

2. Restrain camshaft gear using tool **12-182,** remove bolt and plain washer from camshaft gear.
3. Remove tool **18G 1570.**
4. Remove camshaft gear.

Refit

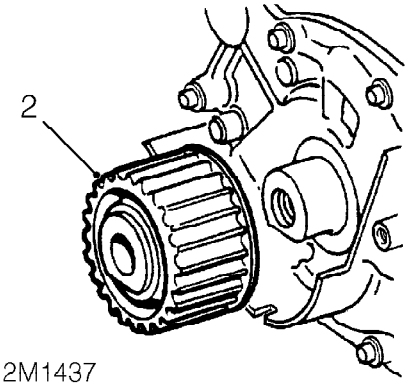
1. Clean gear to camshaft mating faces.
2. Fit camshaft gear and align timing marks using **12-182.**
3. Fit plain washer and bolt to camshaft gear, restrain gear using tool **12-182** and tighten bolt to:
   - M8 bolt - 33 Nm
   - M10 bolt - 65 Nm
4. Fit camshaft locking tool **18G 1570** .
5. Fit new camshaft timing belt. ***See this section.***

CRANKSHAFT TIMING BELT GEAR

Service repair no - 12.65.25

Remove

1. Remove and discard camshaft timing belt. ***See this section.***



12M1437

2. Remove crankshaft timing belt gear.

Refit

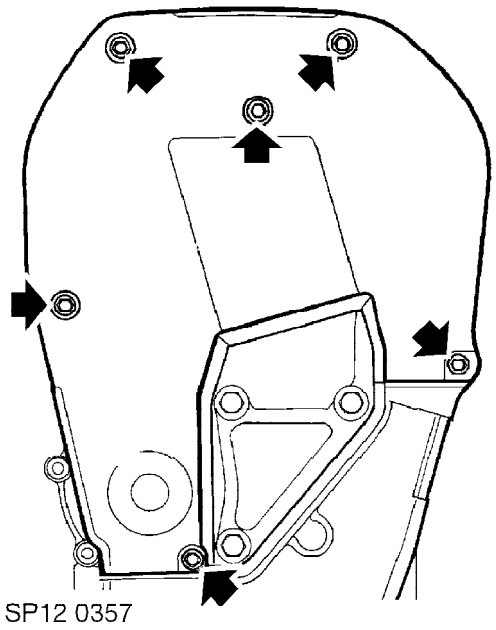
1. Clean timing gear mating faces.
2. Fit crankshaft timing belt gear.
3. Fit new camshaft timing belt. ***See this section.***

TIMING BELT UPPER FRONT COVER

Service repair no - 12.65.41

Remove

1. Remove engine cover. ***See this section.***


SP12 0357

2. Loosen lower fixing bolt securing timing belt upper front cover.
3. Remove 5 bolts from timing belt upper front cover.
4. Remove timing belt upper front cover and seal.

Refit

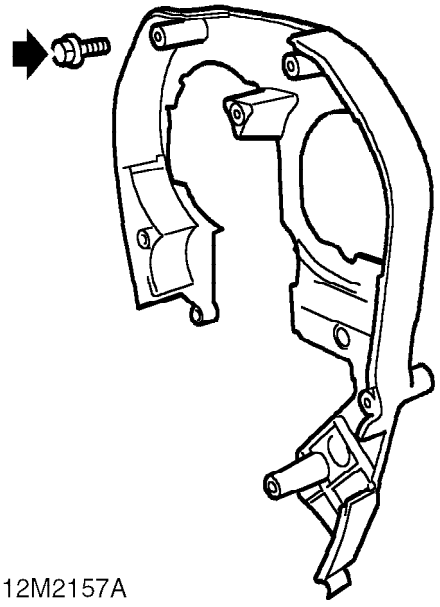
1. Fit timing belt upper front cover, ensuring seal is located correctly.
2. Fit bolts and tighten to 9 Nm .
3. Fit engine cover. ***See this section.***

CAMSHAFT TIMING BELT REAR COVER - MPi AND VVC - MANUAL GEARBOX MODELS

Service repair no - 12.65.42

Remove

1. Remove camshaft timing belt gear. ***See this section.***
2. Remove bolt securing second cam gear to camshaft and remove gear.


12M2157A

3. Remove 3 bolts securing rear cover to engine.
4. Remove timing belt rear cover.

Refit

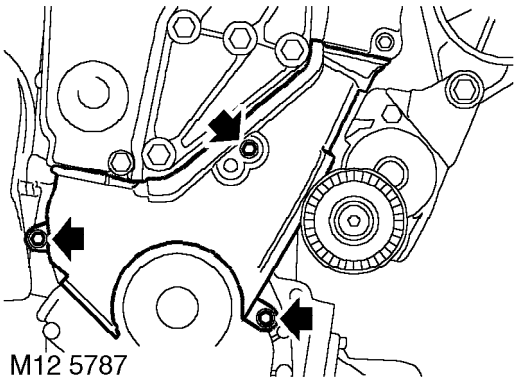
1. Fit timing belt rear cover.
2. Fit bolts and tighten to 9 Nm.
3. Fit camshaft gear and tighten bolt to 33 Nm (8mm) or 65 Nm. (10mm)
4. Fit camshaft timing belt gear. ***See this section.***
5. Connect battery earth lead.

COVER - TIMING BELT LOWER FRONT

Service repair no - 12.65.43

Remove

1. Disconnect battery earth lead.
2. Remove timing belt upper front cover. ***See this section.***
3. Remove crankshaft pulley. ***See this section.***



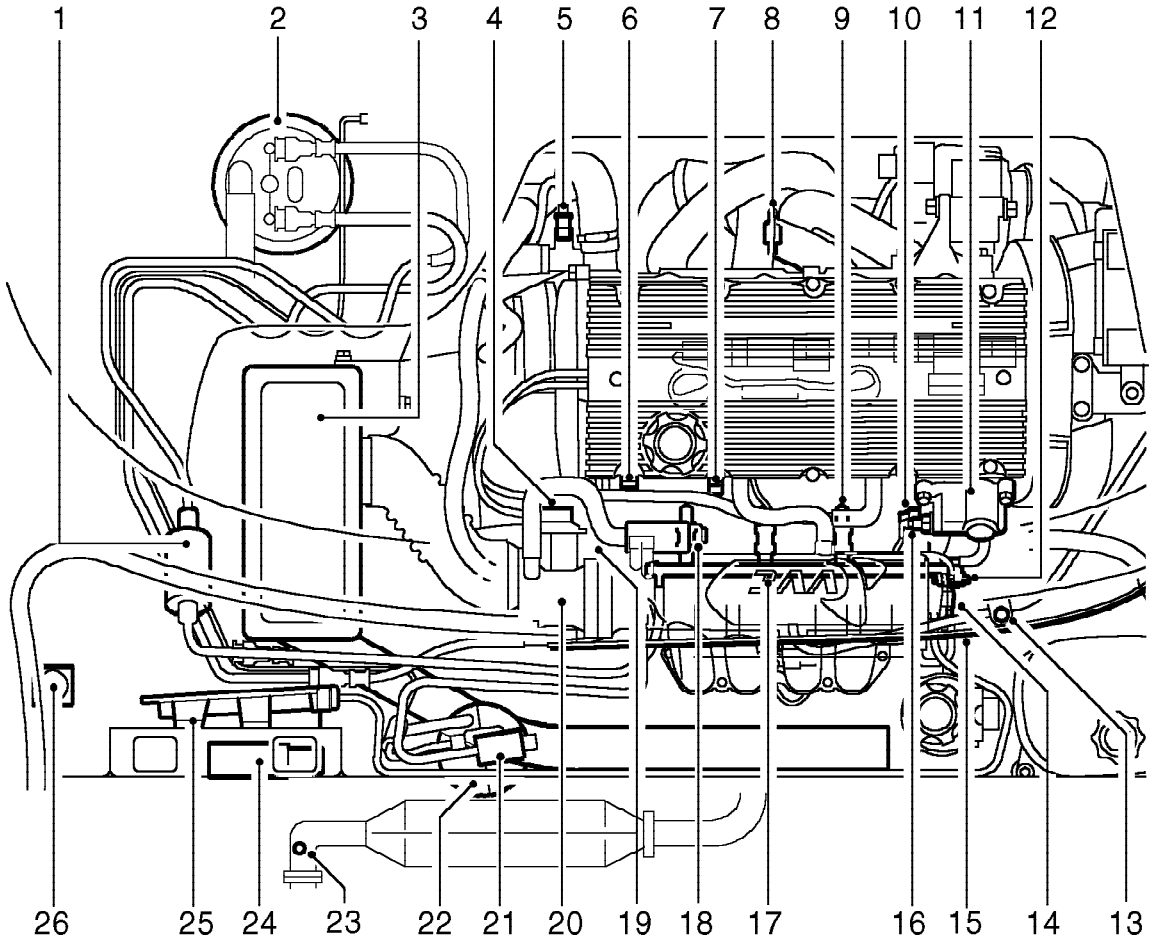
4. Remove 3 bolts securing lower front cover.
5. Remove lower cover.

Refit

1. Fit lower cover and tighten bolts to 9 Nm.
2. Fit crankshaft pulley. ***See this section.***
3. Fit timing belt upper front cover. ***See this section.***
4. Connect battery earth lead.

CONTENTS

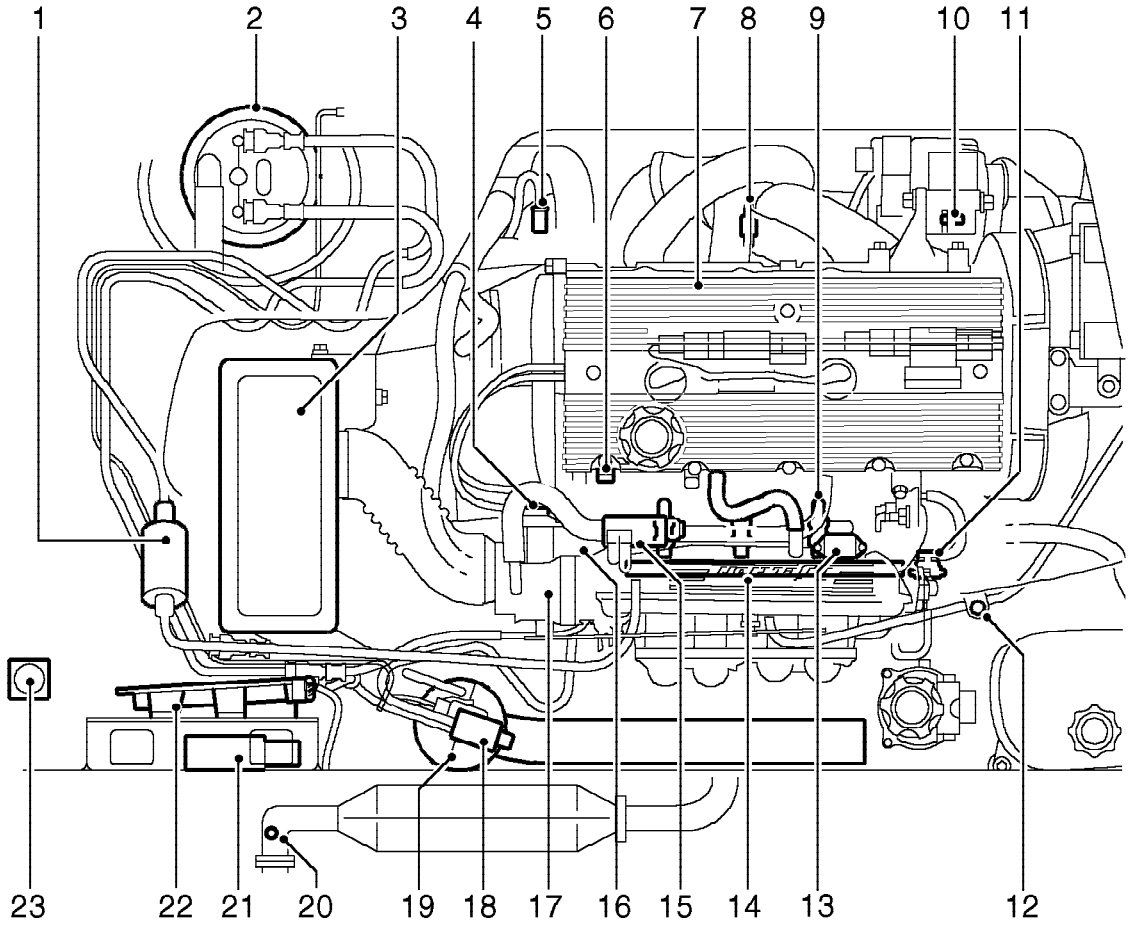
ENGINE COMPARTMENT COMPONENT LOCATIONS - VVC MEMS 3



M18 0696

1. Fuel filter
2. Fuel pump
3. Air filter
4. Throttle position (TP) sensor
5. Engine coolant temperature (ECT) sensor
6. Intake air temperature (IAT) sensor
7. Camshaft position (CMP) sensor
8. Upstream heated oxygen sensor ($H0_2S$)
9. Injector
10. Hydraulic control solenoid
11. Hydraulic control unit
12. Fuel pressure regulator
13. Ambient air temperature sensor
14. Manifold absolute pressure (MAP) sensor
15. Throttle cable
16. Oil temperature sensor
17. Fuel rail
18. Idle air control (IAC) valve
19. Crankshaft position (CKP) sensor
20. Throttle housing
21. Evaporative emission canister, purge valve
22. Evaporative emission canister
23. Downstream heated oxygen sensor ($H0_2S$)
24. Engine management relay module
25. Engine control module (ECM)
26. Inertia fuel shut-off switch

ENGINE COMPARTMENT COMPONENT LOCATIONS - MPi MEMS 3



M18 0704

1. Fuel filter
2. Fuel pump
3. Air filter
4. Throttle Position (TP) sensor
5. Engine Coolant Temperature (ECT) sensor
6. Intake Air Temperature (IAT) sensor
7. Camshaft Position (CMP) sensor
8. Upstream Heated Oxygen Sensor (HO_2S)
9. Injector
10. Engine oil temperature sensor
11. Fuel pressure regulator
12. Ambient air temperature sensor
13. Manifold Absolute Pressure (MAP) sensor
14. Fuel rail
15. Idle Air Control (IAC) valve
16. Crankshaft Position (CKP) sensor
17. Throttle housing
18. Evaporative emission canister, purge valve
19. Evaporative emission canister
20. Downstream $H0_2S$
21. Engine management relay module
22. Engine Control Module (ECM)
23. Inertia fuel shut-off switch

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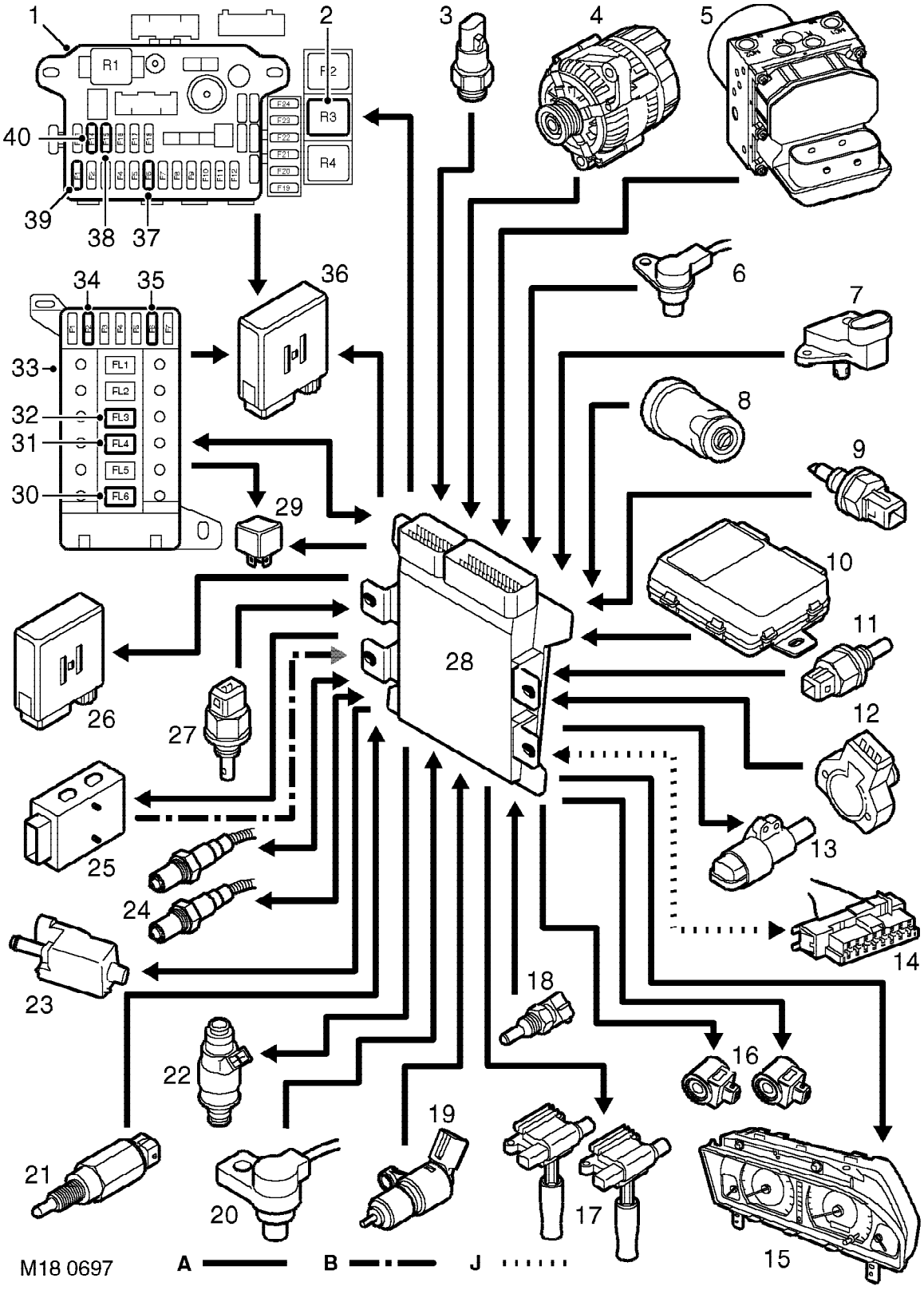
MPi/VVC MEMS 3 CONTROL DIAGRAM



A = Hardwired connection; B = Serial link; J = Diagnostic ISO 9141 K line bus

1. Passenger compartment fusebox
2. Engine bay cooling fan relay
3. A/C trinary switch
4. Alternator
5. ABS ECU
6. Gearbox differential speed sensor (Em-CVT)
7. MAP Sensor
8. Ignition switch
9. IAT sensor
10. Alarm ECU
11. ECT sensor
12. TP sensor
13. IAC valve
14. Diagnostic socket
15. Instrument pack
16. Hydraulic control solenoids (VVC)
17. Ignition coils
18. Engine oil temperature sensor
19. CKP sensor
20. CMP sensor
21. Park/Neutral switch (Em-CVT)
22. Injectors (4 of)
23. Purge valve
24. Heated oxygen sensors ($H0_2S$)
25. Gearbox Interface Unit (GIU)
26. Engine management relay module
27. Ambient Air Temperature (AAT) (engine bay) sensor
28. Engine Control Module (ECM)
29. Cooling fan relay (Non A/C vehicles only)
30. Fusible link FL6 (60A)
31. Fusible link FL4 (40A) Ignition switch
32. Fusible link FL3 (30A) Window lift relay, fuse 6 passenger fusebox, fuse 23 satellite fusebox
33. Under bonnet fusebox
34. Fuse 2 (30A) Engine management relay module, inertia switch
35. Fuse 6 (20A) Cooling fan relay (non A/C vehicles only) A/C relay pack (A/C vehicles only)
36. A/C relay pack (A/C vehicles only)
37. Fuse 6 (10A) Engine bay cooling fan relay, front window lift relay
38. Fuse 15 (20A) Cooling fan relay (non A/C vehicles only) A/C relay pack, A/C switch pack (A/C vehicles only)
39. Fuse 1 (10A) Instrument pack
40. Fuse 14 (15A) Alarm ECU, engine management relay module, ECM

ENGINE MANAGEMENT SYSTEM - MPi/VVC MEMS 3

DESCRIPTION

General

The Modular Engine Management System Version 3 (MEMS 3) is a sequential, multipoint fuel injection system controlled by the Engine Control Module (ECM).

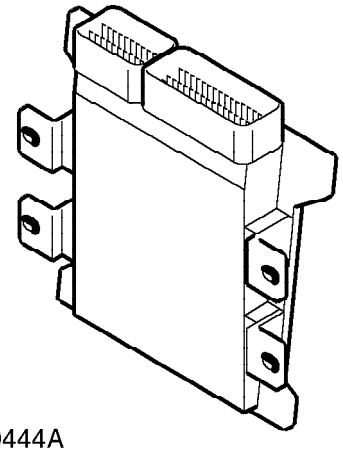
The ECM uses the components shown in the control diagram to control the operation of the:

- Fuel system
- Ignition system
- Variable Valve Control (VVC) system (where applicable)
- Evaporative Emissions (EVAP) system
- Engine cooling fan(s)
- Air Conditioning (A/C) (where applicable)
- Stepspeed Electro Mechanical Constantly Variable Transmission (Em-CVT) (where applicable)

The ECM uses the speed/density method of air flow measurement to calculate fuel delivery. This method calculates the density of intake air by measuring its pressure and temperature. The density signal, combined with the engine speed signal, allows the ECM to make a calculation of the air volume being inducted and determine the quantity of fuel to be injected to give the correct air/fuel ratio.

Engine Control Module (ECM)

The ECM is located on a bracket on the rear bulkhead in the engine compartment. Two harness connectors are used to connect the ECM to the main harness.



M18 0444A

The ECM electronic components are housed in an aluminium case for heat dissipation and protection from electro-magnetic interference.

The ECM is connected to earth via pins 59, 66 and 73. With the ignition off, the ECM is supplied with battery voltage to power the memory. The voltage is supplied from the battery positive terminal via the under bonnet fusebox - fuselink 6 and fuse 7 to pin 80 of the ECM.

When the ignition switch is in position II (ignition on), the ECM also receives battery voltage, via the passenger compartment fusebox fuse 14, at pin 61. The ECM energises the main relay by completing the earth path for the relay coil which is connected to the ECM at pin 54. The main relay provides battery voltage to various peripheral components and also to the ECM at pin 19.

When the ignition switch is turned to position II, the ECM primes the fuel system by running the fuel pump for approximately two seconds. This is achieved by completing the earth path for the fuel pump relay coil. The fuel pump relay coil is connected to battery voltage at the ignition switch, the earth being supplied by the ECM at pin 68. The ECM references the sensors and the IAC valve stepper motor prior to start up.

Security code information is exchanged between the ECM and the alarm ECU via a wire connected between pin 72 of the ECM and the alarm ECU.

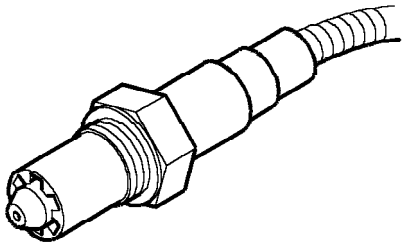
When the ignition is turned to position III (crank), the ECM communicates with the alarm ECU. If it receives authority to start, the ECM begins ignition and fuelling when CKP and CMP sensor signals are detected. The ECM will run the fuel pump continuously when CKP sensor signals are received (crank turning).

When the ignition switch is turned to position 0 (off), the ECM switches off ignition and fuelling to stop the engine. The ECM continues to hold the main relay in the on position until it has completed the power down functions. Power down functions include engine cooling and referencing the IAC valve stepper motor and also memorising data required for the next start up.

When the power down process is completed, the ECM switches off the main relay and enters a low power mode. During low power mode the ECM will consume less than 1mA.

If the ECM suffers an internal failure, such as a break down of the processor or driver circuits, there are no back up systems or limp home capability. If a sensor circuit fails to supply an input, this will result in a substitute or default value being adopted where possible. This enables the vehicle to function, but with reduced performance.

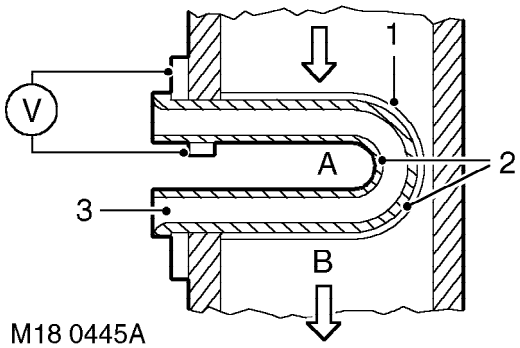
Heated Oxygen Sensor (HO_2S)



M18 0703

A HO_2S is located upstream of the catalytic converter, in the twin pipe section of the exhaust front pipe. A HO_2S is also installed in the downstream side of the catalytic converter. The upstream HO_2S provides a feedback signal to the ECM to enable closed loop fuelling control. The downstream HO_2S provides a feedback signal to enable the ECM to monitor the efficiency of the catalytic converter, by comparing the signals from the upstream and downstream HO_2S.

If the upstream $H0_2S$ fails, the ECM adopts an open loop fuelling strategy. If the downstream HO_2S fails, the ECM suspends catalytic converter monitoring.



M18 0445A

A. Ambient Air.
B. Exhaust Gases.

1. Protective ceramic coating.
2. Electrodes.
3. Zirconium Oxide.

CAUTION: HO_2 sensors are easily damaged by dropping, excessive heat or contamination. Care must be taken not to damage the sensor housing or tip.

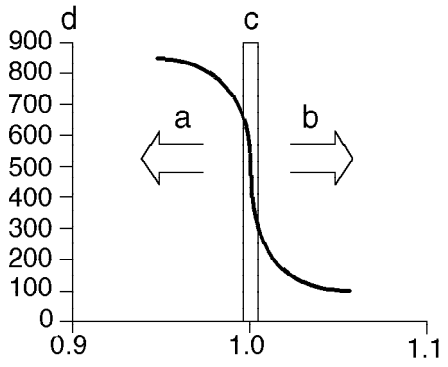
- **The $H0_2S$ becomes very hot, take care when working near it.**
- **Do not measure the resistance of the sensing element.**
- **Observe the correct torque tightening value when installing the HO_2S.**
- **Do not subject the HO_2S to mechanical shocks.**
- **The HO_2S may be contaminated if leaded fuel is used.**

The HO_2S consists of a sensing element, the outer surface of which is exposed to exhaust gases, whilst the inner surface is exposed to ambient air. The sensor has a ceramic coating to protect the sensing element from contamination and heat damage.

The amount of oxygen in ambient air is constant at approximately 20%. The oxygen content of the exhaust gases varies with the AFR with a typical value for exhaust gas of around 2%.

The difference in oxygen content of the two gases produces an electrical potential difference across the sensing element. Rich mixtures, which burn almost all of the available oxygen, produce high sensor voltages. During lean running, there is an excess of oxygen in the mixture and some of this oxygen leaves the combustion chamber unburnt.

In these conditions, there is less difference between the oxygen content of the exhaust gas and the ambient air, and a low potential difference (voltage) is output by the HO_2S.



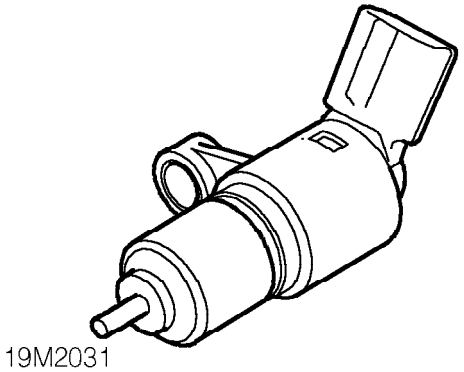
M18 0446A

a. Rich AFR
b. Lean AFR
c. Lambda window
d. HO_2S Output in mV.

The material used in the sensing element only becomes active at a temperature of 300 °C (572 °F), therefore it is necessary to provide additional heating via an electrical resistive element. The element uses a 12V supply provided by the ECM and allows a short warm up time and minimises emissions from start-up. The resistance of the heating element can be measured using a multimeter and should be 6 Ω at 20 °C (68 °F).

Crankshaft Position (CKP) Sensor

The variable reluctance CKP sensor is mounted at the rear of the engine with the sensor tip facing the engine face of the flywheel and is secured in the casting with a single screw. The sensor tip of the CKP sensor is adjacent to a profiled target ring formed on the inner face of the flywheel.



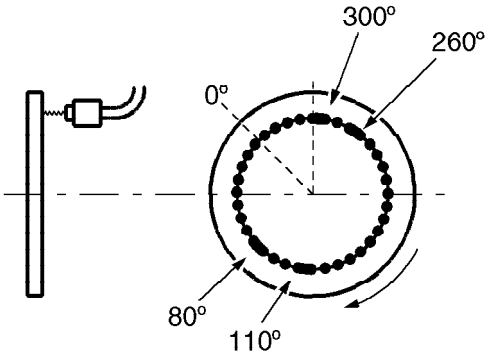
19M2031

The signal produced by the CKP sensor allows the ECM to calculate the rotational speed and angular position of the crankshaft. This information is required by the ECM to calculate ignition timing, fuel injection timing and fuel quantity during all conditions when the engine is cranking or running. If the CKP sensor signal is missing, the vehicle will not run as there is no substitute signal or default.

The CKP sensor is a variable reluctance sensor and provides an analogue voltage output to the ECM relative to the speed and position of the target on the flywheel. A permanent magnet inside the sensor applies a magnetic flux to a sensing coil winding. This creates an output voltage which is read by the ECM.

As the gaps between the poles of the target pass the sensor tip, the magnetic flux is interrupted and this causes a change to the output voltage (e.m.f.).

It is important to note that the ECM is unable to determine the exact position of the engine with its four stroke cycle from the CKP sensor alone: the CMP sensor must also be referenced to provide sufficient data for ignition control and sequential injection.



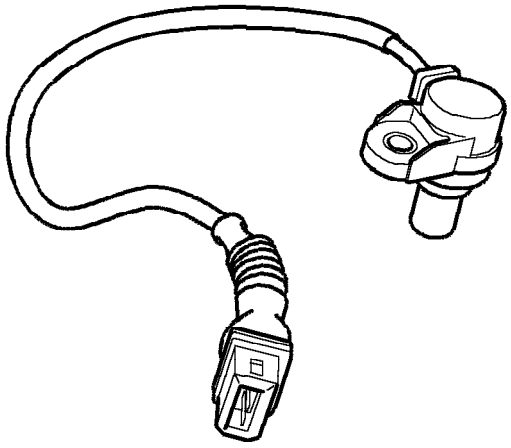
M18 0447B

The 'spaces' on the target are spaced at a rate of one hole per 10°. There are only 32 holes, this leaves four 'spaces' where a single hole is missing. When the crankshaft is positioned at TDC (cylinder number one firing position) the CKP sensor is positioned at 55° BTDC. The 'missing' holes are positioned at 80°, 110° , 260° and 300° before the CKP sensor position.

Camshaft Position (CMP) Sensor

The CMP sensor provides a signal which enables the ECM to determine the position of the camshaft relative to the crankshaft. This allows the ECM to synchronise fuel injection and, on VVC engines, monitor valve timing.

CMP Sensor - MPi Engines

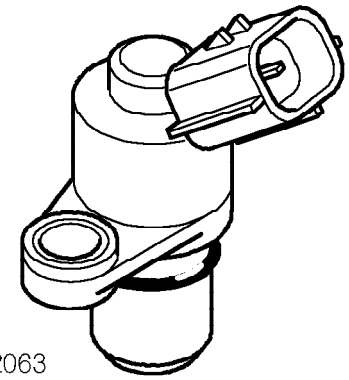


M18 0701

The CMP sensor on MPi engines is located on the camshaft cover (under the plastic cover) at the opposite end to the camshaft drive and reads off a reluctor on the exhaust camshaft.

The sensor is a Hall effect sensor which detects the reluctor mounted on the exhaust camshaft. The sensor receives a battery supply from the main relay. The sensor operates on the principle of a voltage generated when the sensor is exposed to a magnetic flux. This causes a potential difference in voltage as the reluctor passes the sensor which is detected as a digital signal by the ECM.

CMP Sensor - VVC Engines



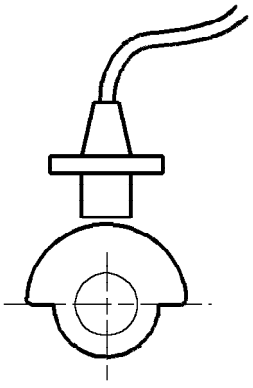
19M2063

The CMP sensor on VVC engines is located on the rear face of the cylinder head and reads off a reluctor on the inlet camshaft.

The CMP sensor is a variable reluctance sensor which does not require a power supply. The sensor consists of a permanent magnet and a sensing coil winding.

The signal is generated by changes which occur in the magnetic flux of the magnet. As the reluctor passes the sensor, an electromotive force (e.m.f.) is generated in the coil winding. The amplitude of the e.m.f. is proportional to the frequency of the change of magnetic flux which is detected by the ECM as an analogue signal.

CMP Reluctor - MPi and VVC Engines



M18 0448

The reluctor consists of a single 'tooth' design which extends over 180°of the camshaft's rotation, for this reason it is known as a half moon cam wheel.

The half moon cam wheel reluctor enables the ECM to provide sequential fuel injection at start up, but it cannot provide a back-up signal in cases of CKP sensor failure.

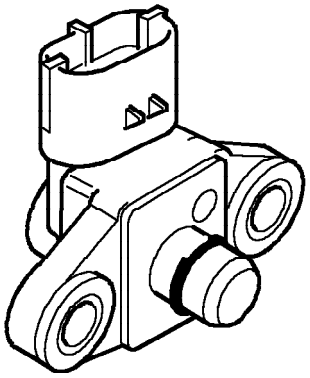
If the CMP sensor signal is missing, the engine will still start and run, but the fuel injection may be out of phase. This will be noticeable by a reduction in performance and driveability, together with an increase in fuel consumption and emissions.

As the camshaft rotates the signal will switch between the high and low voltages. The position of the half moon cam wheel relative to the camshaft is not adjustable. The air gap between the CMP sensor tip and the half moon cam wheel is not adjustable.

Manifold Absolute Pressure (MAP) Sensor

The output signal from the MAP sensor, together with the CKP and IAT sensors, is used by the ECM to calculate the amount of air induced into the cylinders. This enables the ECM to determine ignition timing and fuel injection duration values.

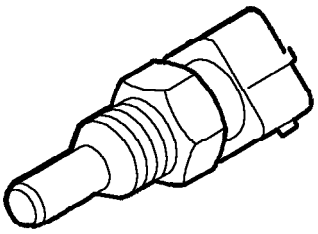
The MAP sensor receives a 5V ±4% supply voltage from the ECM and provides the ECM with an analogue signal which relates to the absolute manifold pressure and allows the ECM to calculate engine load.



19M2062

If the MAP signal is missing, the ECM will substitute a default manifold pressure reading based on crankshaft speed and throttle angle. The engine will continue to run with reduced driveability and increased emissions, although this may not be immediately apparent to the driver. The ECM will store fault codes which can be retrieved using TestBook.

Engine Coolant Temperature (ECT) Sensor



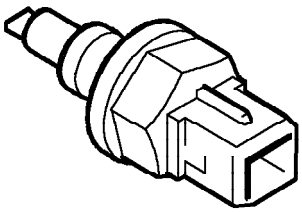
19M0847

The ECT sensor is located in the cooling system outlet elbow from the cylinder head and provides a signal to the ECM which allows the engine temperature to be determined.

The ECT sensor consists of an encapsulated negative temperature coefficient (NTC) thermistor which is in contact with the engine coolant. The ECM uses engine temperature to calculate fuelling and ignition timing parameters during start up. It is also used to provide a temperature correction for fuelling and ignition timing when the engine is warming up, running normally or overheating. The ECT signal is used by the ECM to control the engine cooling fans.

If the ECT sensor fails or becomes disconnected, the ECM will use a default value which is based on values from the engine oil temperature sensor. The driver may not notice that a fault is present although a fault code will be stored in the ECM which can be retrieved using TestBook. The default value will also include operation of the cooling fans in fast mode when the engine is running.

Intake Air Temperature (IAT) Sensor



19M0850

The IAT sensor is located in the intake manifold near cylinder number four fuel injector. The sensor consists of an NTC thermistor mounted in an open housing to allow air flow over the sensing element. The IAT sensor provides a signal which enables the ECM to adjust ignition timing and fuelling quantity according to the intake air temperature, thus ensuring optimum performance, driveability and low emissions.

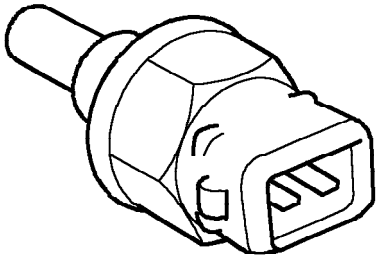
The IAT sensor is part of a voltage divider circuit which consists of a regulated 5 volt supply, and a fixed resistor (both are inside the ECM) and a temperature dependent variable resistor (the IAT sensor).

The IAT sensor operates in a similar manner to the ECT sensor. Refer to ECT sensor diagram and description for method of IAT sensor operation.

If the IAT sensor fails, or is disconnected, the vehicle will continue to run. The ECM will substitute a default value using the information from the speed/load map to run the engine, but adaptive fuelling will be disabled.

This condition would not be immediately apparent to the driver, but the ECM will store fault codes which can be retrieved using TestBook.

Engine Oil Temperature Sensor



19M2061

The engine oil temperature sensor is located in the oil filter housing on MPi engines and in the Hydraulic Control Unit (HCU) on VVC engines. The sensor provides a signal which allows the ECM to adjust fuelling values according to engine oil temperature, to produce optimum engine performance and minimum emissions during the engine warm up phase. On VVC engines, the ECM also uses the oil temperature to derive the viscosity of the oil passing through the HCU, which indicates how quickly the VVC mechanism will respond.

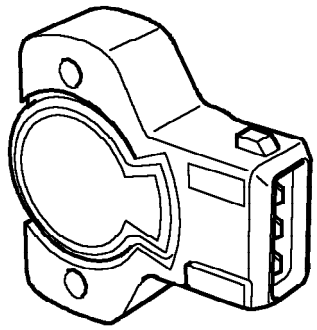
The engine oil temperature sensor consists of an encapsulated Negative Temperature Coefficient (NTC) thermistor which is in contact with the engine oil.

The engine oil temperature sensor operates in a similar manner to the ECT sensor.

If the engine oil temperature sensor fails, the ECM will substitute a default value which is ramped up 80°C (176°F). This condition will not be apparent to the driver, with the exception of the temperature gauge which will display incorrect readings depending on the sensor failure.

The vehicle will run but may suffer from reduced engine performance and increased emissions as adaptive fuelling is disabled. The ECM will store fault codes which can be retrieved using TestBook.

Throttle Position (TP) Sensor



19M2145

The TP sensor is mounted on the throttle body and is driven from the end of the throttle spindle. The TP sensor consists of a potentiometer which provides an analogue voltage that the ECM converts to throttle position information. The TP sensor signal is required for the following vehicle functions:

- Idle speed control
- Throttle damping
- Deceleration fuel cut off
- Engine load calculations
- Acceleration enrichment
- Full load enrichment
- Automatic gearbox shift points.

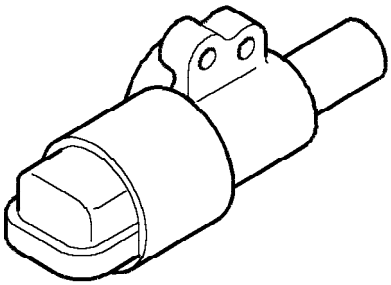
The TP sensor is a potentiometer which acts as a voltage divider in an external ECM circuit. The potentiometer consists of a 4kΩ ±20% resistive track and a wiper arm, driven by the throttle spindle, which sweeps over the track.

The track receives a regulated 5 V ±4% supply from the ECM, together with an earth path. As the wiper arm moves over the track it will connect to areas of different voltage ranging from 0 to 5 volts. The 'output' from the wiper arm is connected to the ECM to provide an analogue voltage signal.

The TP sensor requires no adjustment as the ECM will learn the lower voltage limit which correspond to closed throttle.

If the TP sensor signal is missing the vehicle will continue to run but may suffer from poor idle control and throttle response. The ECM will store fault codes which can be retrieved using TestBook.

Idle Air Control (IAC) Valve



M19 2984

The IAC valve is located on the inlet manifold. It allows the ECM to control the engine idling speed by regulating the amount of air which by-passes the throttle valve. It also allows the ECM to provide a damping function when the throttle is closed under deceleration, this reduces hydrocarbon (HC) emissions.

The IAC valve is controlled by the ECM using a stepper motor. This consists of a core which is rotated by magnetic fields produced by two electro-magnet bobbins set at 90° to each other.

The stepper motor controls the volume of air passing through a duct which leads from the inlet manifold to a pipe connected to the throttle body. The bobbins are connected to the ECM driver circuits. Each of the four connections can be connected to 12 volts or earth, enabling four 'phases' to be obtained. The ECM drives the four phases to obtain the desired idle speed.

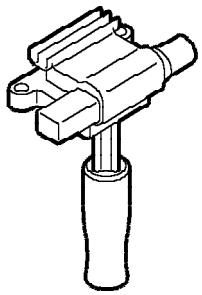
When the ignition is switched off the ECM enters a power down routine which includes 'referencing' the stepper motor. This means that the ECM will rotate the motor so that it can memorise the position when it next needs to start the engine.

The stepper motor referencing procedure can take from three to five seconds. If the ECM cannot reference the stepper motor during power down, it will do so at ignition on. If the stepper motor fails, there are no back up idle control systems. The idle speed may be too high or too low and if a load is placed on the engine it may stall. The ECM will store fault codes which can be retrieved by TestBook.

Ignition Coils

Two ignition coils are mounted on the camshaft cover above the spark plugs for cylinders 1 and 3 and secured with screws.

Each coil operates a pair of spark plugs using the wasted spark principle. The coil has a plug connection on its lower face and an ht lead which connects to the second plug.



M18 0449A

The coil fitted above cylinder 1 is attached to the spark plug for cylinder 1 and the ht lead connects to the spark plug for cylinder 4.

The coil fitted above cylinder 3 is attached to the spark plug for cylinder 3 and the ht lead connects to the spark plug for cylinder 2.

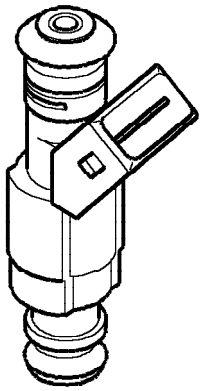
WARNING: The ht voltage of the ignition system is in excess of 50 kV and the lt voltage is in excess of 400 volts. Voltages this high can cause serious injury and may even be fatal. Never touch any ignition components while the engine is running or being cranked.

CAUTION: Never crank or run the engine with the ht leads disconnected from the ignition coils; failure of the ECM and/or the coil will result. Always disable the ignition system by disconnecting the lt connectors from the coil.

Each ignition coil consists of a pair of windings wrapped around a laminated iron core. The primary winding has a resistance of 0.7Ω and the secondary winding has a resistance of 10 kΩ .

Fuel Injectors

The fuel injectors are located directly under the fuel rail and connect to the intake manifold runners. Each injector delivers fuel to the engine in a targeted, atomised spray (onto the intake valve heads) which takes place once per cycle. Each injector opens during the intake stroke of the cylinder it supplies.



M18 0702

An injector consists of a pintle type needle and seat, and a solenoid winding which lifts the needle against a return spring. The injector nozzle delivers the fuel spray to precise areas of the intake ports to maximise the benefits of the swirl and turbulence in the manifold and head ports.

The solenoid winding has a resistance of 13 - 16Ω at 20°C (68°F). The fuel injectors operate at a regulated pressure of 3.5 bar (50 lbf/in^2). The regulator is located on the end of the fuel rail and excess fuel is returned to the swirl pot via a return line to the tank.

The injectors receive fuel under pressure from the fuel rail and a 12 volts supply from the main relay. To deliver fuel to the engine, the ECM has to lift the needle off the injector seat by energising the solenoid. To energise the solenoid the ECM supplies an earth path to the injector winding.

If an injector fails, the engine may lose power and driveability. The ECM will store fault codes which can be retrieved using TestBook.

Evaporative Emissions (EVAP) Canister Purge Valve

The EVAP canister purge valve is located in the engine compartment on the rear bulkhead. The purge valve is connected via a flexible pipe to the inlet manifold.

The canister purge valve consists of a solenoid operated valve which is controlled by the ECM using a 12 volts PWM signal. The EVAP canister purge valve controls the flow of fuel vapours from the EVAP canister to the intake manifold of the engine.

When the vehicle is being driven the ECM will purge the EVAP canister by opening the canister purge valve, this allows the vacuum present in the intake manifold to draw fuel vapour from the canister into the cylinders for combustion.

When fuel vapour is being removed from the canister, fresh air is allowed to enter via an automatic one-way valve, this makes the canister ready for the next 'absorption' phase.

The amount of fuel vapour which enters the cylinders can affect the overall AFR, therefore the ECM must only open the canister purge valve when it is able to compensate by reducing fuel injector duration. The canister purge valve will only operate under the following conditions:

- Engine at normal operating temperature
- Adaptive fuelling enabled
- Closed loop fuelling enabled.

Alternator

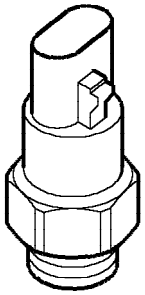
The alternator is located on a bracket which is attached to the cylinder block on the front RH side of the engine. The alternator is driven by a Polyvee belt from the crankshaft pulley. The alternator converts mechanical energy into electrical energy to power the electrical systems and maintain the battery charge.

The alternator outputs a signal to the ECM which represents the electrical load on the vehicle systems and the mechanical load exerted on the engine by the alternator. The signal output from the alternator is a variable PWM signal which is proportional to the load applied to the engine.

The ECM uses the load signal to provide idle speed compensation and to reduce engine speed fluctuations. If the load signal fails, the ECM uses a default value and stores a fault code which can be retrieved using TestBook.

Air Conditioning (A/C) Trinary Switch

The A/C trinary switch is located on the receiver/drier at the rear of the under bonnet compartment. It contains three pressure switches; high, low and medium. The medium switch completes an earth path between the ECM and an earth header joint. The high and low switches are connected between the A/C switch and the ECM.



M18 0451A

The trinary switch has three functions:

1. To disengage the A/C compressor clutch if the refrigerant pressure falls below the 'minimum' specified value.
2. To disengage the A/C compressor clutch if the refrigerant pressure exceeds the 'maximum' specified value.
3. To switch the cooling fan to high speed if the refrigerant pressure exceeds the 'high' specified value.

A/C Trinary Switch Pressure Settings

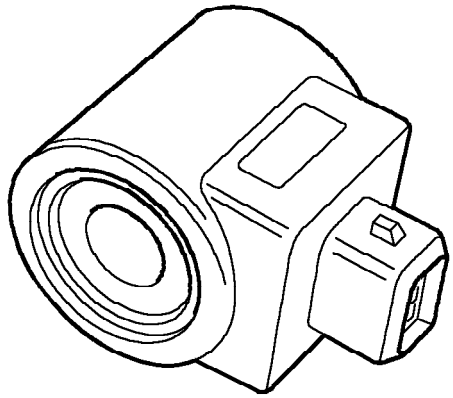
Switch	Opening Pressure bar (lbf/in^2)	Closing Pressure bar (lbf/in^2)
Low	1.96 (28) pressure decreasing	2.35 (34) pressure increasing
Medium	13.7 (198) pressure decreasing	18.6 (270) pressure increasing
High	28.4 (412) pressure increasing	22.6 (328) pressure decreasing

Functions 1 and 2 are performed by a single series circuit containing both minimum and maximum pressure switches. The switches are both normally closed, so if either threshold is exceeded the continuity of the earth path to the ECM is broken. This causes the ECM strategy to disengage the A/C compressor clutch on safety grounds.

Function 3 is performed by a separate circuit containing a single normally open pressure switch. This switch opens when the pressure exceeds a specified value indicating that extra cooling is required to reduce refrigerant pressure. this will cause the ECM to energise the condenser fan relay and start the fan.

VVC Mechanism Control (Where Applicable)

Hydraulic Control Solenoid



19M2356

The ECM controls two solenoids in order to control the VVC mechanism. Only one solenoid will be energised at a time to either drive the VVC mechanism towards minimum cam period, or towards maximum cam period. The desired cam period is calculated by the ECM using engine speed and manifold pressure (engine load). The current cam period is measured by the ECM using the camshaft position sensor. The ECM then energises the correct solenoid in order to move the mechanism towards the desired position.

Fault Detection

If the ECM detects any faults with cam period measurement during start up and initial running, the ECM will try and drive the mechanism to minimum cam period.

If the ECM loses the cam period signal during running, the cam period will remain frozen at the last valid period. Engine speed may be limited as low as 5500 rpm depending on cam period when the fault occurred. The engine idle speed will be raised and will remain raised for the rest of the journey.

Stepspeed (Em-CVT) Gearbox (Where Applicable)

The MEMS 3 ECM controls the Em-CVT unit in conjunction with the Gearbox Interface Unit (GIU) and several peripheral gearbox switches and sensors.

The GIU outputs gear selector lever position status, manual/sport selection and snow mode selection to the ECM. The ECM then provides an output to the instrument pack to display the appropriate gear position information in the LCD or illuminate the snow mode or gearbox fault warning lamps.

For further information on (Em-CVT) Stepspeed gearbox ***See AUTOMATIC GEARBOX - 'Em-CVT', Description and operation.***

Gearbox Interface Unit (GIU)

Electronic control of the Em-CVT Stepspeed gearbox operates as an integral part of the MEMS 3 system software. The ECM accepts inputs from the GIU, communicates with the GIU for gearbox control, accepts driver inputs for gear selection and communicates information to the driver via the instrument pack.

The GIU connection which supplies information to the ECM is a serial communication link. This supplies the ECM with all the driver inputs from the gearbox switches.

The ECM output to the GIU is a hardwired connection which instructs the GIU of the required ratio control motor position. This information is output in the form of 500 Hz PWM signals.

Gearbox Shaft Speed Sensor

The ECM receives an input from the Em-CVT gearbox differential speed sensor which is located at the rear of the gearbox. The sensor is a Hall effect sensor which reads off the differential crown wheel teeth to provide a road speed signal. This signal is used by the ECM to determine when the vehicle is stationary and to allow accurate calculation of the true gearbox ratio.

Park/Neutral Switch

The park/neutral switch is located at the rear of the gearbox and is operated by a cam which moves via a cable with the gear shift selector lever position. An output from the park/neutral switch is connected to the ECM to enable gearbox load compensation. The ECM will adjust the IAC valve stepper motor to the appropriate position to maintain the idle speed when the gearbox is moved into and out of drive or reverse.

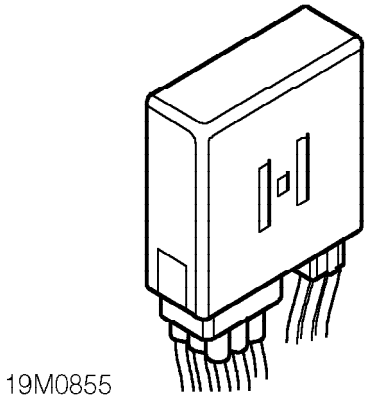
The park/neutral switch also operates the reverse lamps via a hardwired connection and controls a shift interlock solenoid which is fitted in selected markets only.

Ignition Switch Signal

A hardwired digital input to ECM pin 61 provides an ignition on signal. When the ECM has been idle for a period of time, it goes into 'sleep' (power saving) mode.

When the ECM receives an ignition on signal from the ignition switch, the ECM 'wakes up' and energises the main relay.

Main Relay



The main relay is located in the engine management relay module which is positioned behind the ECM mounting bracket. The relay module contains the main relay, the fuel pump relay and the starter relay.

The relay is normally open when the ignition is off. When the ignition is switched on to position II, the ECM provides an earth path for the relay coil which energises, closing the contacts.

A permanent battery supply is provided to the relay contacts from fuse 2 in the under bonnet fusebox. The relay supplies battery voltage to the following components:

- ECM pin 19
- HO_2S sensors
- CMP sensor
- Purge control valve
- Fuel injectors
- Ignition coils
- Speed transducer
- Gearbox Interface Unit (GIU) via an in-line 10A fuse (Em-CVT models only)
- Gearbox secondary speed sensor (Em-CVT models only)
- Hydraulic Control Solenoids (VVC models only)

If the main relay fails, power will not be supplied to the above components and the engine will not start. The ECM will store fault codes which can be retrieved using TestBook.

Fuel Pump Relay

The fuel pump relay is located in the engine management relay module which is positioned behind the ECM mounting bracket. The relay is normally open when the ignition is off.

When the ignition is switched on to position II, the ECM provides an earth path for the relay coil. With the ignition on the relay receives a feed, via the ignition switch, from fuse 14 in the passenger compartment fusebox which energises the relay coil, closing the contacts.

A permanent battery supply is provided to the relay contacts from fuse 2 in the under bonnet fusebox, via the inertia switch. The feed passes through the relay contacts and operates the fuel pump to pressurise the fuel system. The relay will be energised for a short time only to pressurise the fuel system.

When the ignition switch is moved to the crank position III, the ECM will energise the relay when the engine starts cranking and will remain energised until the engine stops.

If the engine stalls and the ECM stops receiving a signal from the CKP sensor, the ECM will remove the earth path for the relay, stopping the fuel pump.

WARNING: ALWAYS check for fuel leaks and the integrity of the fuel system before resetting the inertia switch.

The inertia switch, when tripped, cuts off the power supply to the relay contacts, disabling the fuel pump in the event of a sudden deceleration. If the fuel pump fails to operate, check that the inertia switch is not tripped. The switch is reset by depressing the rubber cap on the top of the switch.

If the fuel pump relay fails, power will not be supplied to the fuel pump and the engine will not start or will stop if already running due to fuel starvation. The ECM will store fault codes which can be retrieved using TestBook.

A/C Compressor Clutch Relay (Where Applicable)

On vehicles fitted with air conditioning, an A/C relay module is located under the bonnet adjacent to the under bonnet fusebox. When the engine is running and the driver requests A/C on, the ECM receives a signal from the A/C switch via the thermostat and trinary switch to pin 56 of the ECM.

If conditions are correct, the ECM grants the A/C request by completing an earth path from pin 53 to the A/C clutch relay coil. The A/C clutch relay coil receives a battery feed from the ignition switch position II. The feed is supplied via fuse 15 in the passenger compartment fusebox to the relay coil. The coil will energise closing the relay contacts.

A permanent battery supply, via fuse 5 in the under bonnet fusebox, passes through the relay contacts and operates the compressor clutch.

The ECM will disengage the A/C compressor clutch if the coolant temperature exceeds 118°C (244°F) and will re-engage the A/C compressor clutch when the coolant temperature falls to less than 114°C (237°F).

If the A/C clutch relay fails, the A/C will be inoperative and the ECM will store fault codes which can be retrieved using TestBook.

Cooling Fans

The cooling system comprises an engine coolant cooling fan which is located behind the radiator and an engine bay cooling fan located in the engine bay. On vehicles fitted with A/C, an additional cooling fan is located behind the radiator and A/C condenser.

An engine bay cooling fan is located in the engine bay. The fan is used to reduce engine bay temperatures especially when the vehicle is stationary. The fan draws air through the RH air intake into the engine bay.

On all vehicles the engine bay cooling fan relay is located adjacent to the passenger compartment fusebox.

On vehicles without A/C, the engine cooling fan relay is located behind the under bonnet fusebox. On vehicles with A/C, the engine cooling fan relay and the condenser fan relay are located in the A/C relay module which is located adjacent to the under bonnet fusebox.

Engine Coolant Cooling Fan

The engine cooling fan relay is energised by the ECM on receipt of an appropriate coolant temperature signal from the ECT sensor.

When the engine is running, the ECM will energise the relay to operate the fan at a coolant temperature of 104°C (219°F) and will go off when the coolant temperature decreases to less than 98°C (208°F).

When A/C is fitted, the engine cooling fan and the condenser fan can operate at two speeds, being operated in series or parallel by the ECM. Refer to the Air Conditioning section for condenser fan details.

Engine Bay Cooling Fan

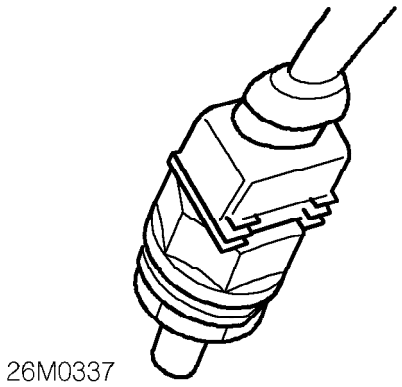
The engine bay cooling fan relay is energised by the ECM on receipt of an appropriate engine bay temperature signal from the ambient air temperature sensor.

When the engine is running, the ECM will energise the relay to operate the fan when an engine bay temperature of 75°C (167°F) is reached. The ECM has a timer which energises the relay for a predetermined period. If the temperature decreases to less than 60°C (140°F) before the timer has expired, the ECM will de-energise the relay.

If the engine bay temperature exceeds 130°C (266°F), the ECM will illuminate the engine bay overheat warning lamp in the instrument pack. The warning lamp informs the driver that the engine bay temperature is abnormally high or that a system fault has occurred. When the engine bay temperature falls below 110°C (230°F) the ECM will extinguish the warning lamp.

When the engine is off, the fan remains active for a predetermined period after the engine is switched off.

Ambient Air Temperature (AAT) Sensor (Engine Bay)



The AAT sensor is located in the engine bay on the header panel directly above the inlet manifold.

The AAT sensor receives a supply from ECM pin 21 and is earthed at ECM pins 37 and 71 which is a common earth. The AAT sensor operates the engine bay cooling fan as described in Cooling Fans.

If the AAT sensor fails, the engine bay cooling fan will operate at all times when the ignition is on and the engine bay overheat warning lamp in the instrument pack will be illuminated.

Engine Bay Cooling Fan Relay

The engine bay cooling fan relay is located adjacent to the passenger compartment fusebox and is the central relay in a block of three.

The relay coil and contacts receive a permanent battery feed via fusible link 3 in the under bonnet fusebox and fuse 6 in the passenger compartment fusebox. The relay coil is connected to ECM pin 74 which provides an earth path when cooling fan operation is required.

If the cooling fan relay fails, the cooling fan will not operate and engine bay overheat may occur. The ECM will store fault codes which can be retrieved using TestBook.

Engine Bay Overheat Warning Lamp

The engine bay overheat warning lamp is located in the centre warning lamp cluster in the instrument pack. If the engine bay temperature exceeds 130°C (275°F), the ECM will illuminate the warning lamp to inform the driver that the engine bay temperature is abnormally high. When the engine bay temperature falls below 110°C (230°F) the ECM will extinguish the warning lamp.

The ECM will also illuminate the warning lamp if a cooling fan, relay or AAT sensor fault is detected.

The warning lamp receives a feed from the ignition switch when the switch is in position II. When the ECM requires the warning lamp to be illuminated, it completes an earth path from the warning lamp to ECM pin 62.

Tachometer Drive

The ECM provides an output signal on pin 55 for engine speed, derived from the CKP sensor. The signal is passed to the instrument pack for tachometer operation and is also used by the EPAS ECU pin 15 for an engine speed signal.

Failure of this output will be shown by the tachometer not functioning. The ECM will record fault codes which can be retrieved using TestBook.

Vehicle Immobilisation

The vehicle immobilisation system operates by the alarm ECU transmitting a unique code to the ECM when the ignition is switched on. If the code is recognised by the ECM it will energise the injectors and allow the engine to start.

If no code is received or the code is incorrect, the ECM will disable the vehicle by not energising the fuel injectors.

The alarm ECU also controls the starter relay and will passively disarm the starter relay when the key is removed from the ignition switch. Rearming is performed by turning the ignition on which activates a coil around the ignition key barrel.

The coil transmits a waveform signal which excites the remote handset to transmit a re-mobilisation signal. When the signal is received by the alarm ECU, the starter relay will be enabled.

Replacement ECM's are supplied blank and must learn the alarm ECU security code for the vehicle to which it is fitted. When the ECM is connected to the vehicle, TestBook is required to enable the ECM to learn the alarm ECU code. If a new alarm ECU is fitted, the ECM will need to learn the new security code using TestBook.

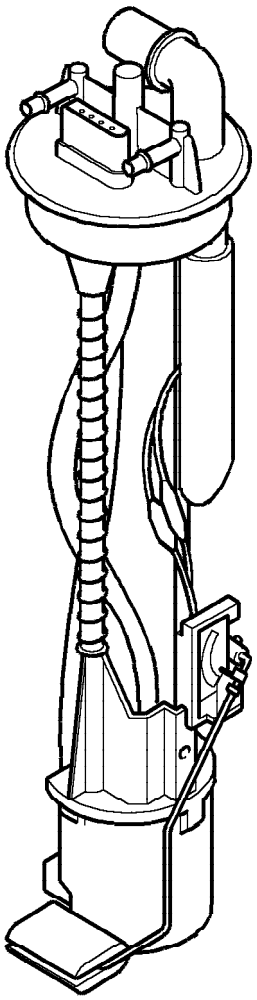
Rough Road Detection

MEMS 3 has a misfire detection facility which is part of the On-Board Diagnostics (OBD) system. Misfire detection is disabled when the ECM senses that the vehicle is on a 'rough road'. The system software can detect variations in the signal output and disable misfire detection to prevent incorrect faults being logged by the ECM.

The 'rough road' signal is passed from the ABS ECU on a hardwired output to the ECM pin 78. The signal is in the form of a square wave digital pulse train of between 0 and 5 V at 8000 pulses per mile.

On vehicles without ABS, an ABS reluctor ring is fitted to the LH rear wheel and provides 48 pulses per rotation of the wheel to a variable reluctance sensor. The output from the sensor is received by ECM pin 78 and the sensor is provided with a positive supply signal from ECM pin 64.

Fuel Pump

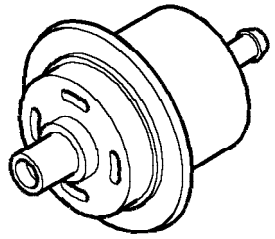


M18 0698

The electric fuel pump is located inside the fuel tank and is energised by the ECM via the fuel pump relay in the engine management relay module and the inertia switch.

The fuel pump delivers more fuel than the maximum load requirement for the engine, maintaining pressure in the fuel system under all conditions.

Fuel Pressure Regulator



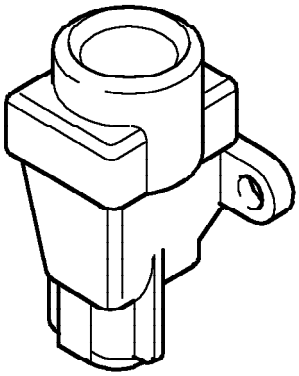
M18 0699

The fuel pressure regulator is a mechanical device mounted on the end of the fuel rail. Pressure is controlled by diaphragm spring pressure and is modified by a vacuum signal from the inlet manifold.

The regulator ensures that fuel pressure is maintained at a constant pressure difference to that in the inlet manifold. As manifold depression increases, the regulated fuel pressure is reduced in direct proportion.

When pressure exceeds the regulator setting, excess fuel is returned to the fuel tank swirl pot which contains the fuel pump pick-up.

Inertia Fuel Cut-Off Switch



19M0852

The electrical circuit for the fuel pump incorporates an inertia switch which, in the event of a sudden deceleration, breaks the circuit to the fuel pump preventing fuel being delivered to the engine. The switch is located adjacent to the ECM and can be reset by pressing the rubber top.

WARNING: ALWAYS check for fuel leaks and the integrity of the fuel system connections before resetting the switch.

Diagnostics

A diagnostic socket allows the exchange of information between the ECM and TestBook or a diagnostic tool using Keyword 2000 protocol.

The diagnostic socket is located in the passenger compartment fusebox which is located below the fascia on the driver's side.

A dedicated diagnostic (ISO 9141 K Line) bus is connected between the ECM and the diagnostic socket and allows the retrieval of diagnostic information and the programming of certain functions using TestBook.

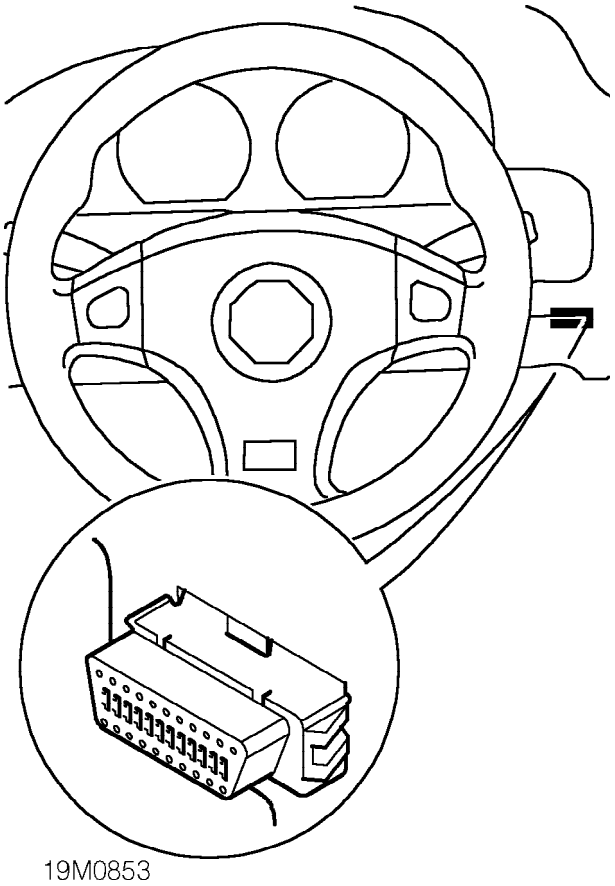
The ECM uses a 'P' code diagnostic strategy and can record faults relating to the engine management and Em-CVT gearbox interface unit functions.

The 'P' codes are qualified by one of the following failure types:

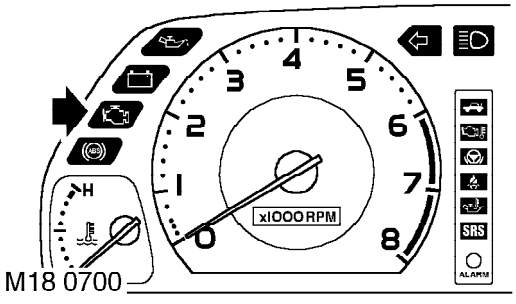
- Min - the minimum expected value has been exceeded
- Max - the maximum expected value has been exceeded
- Signal - the signal is not present
- Plaus - an implausible condition has been detected

After detecting a fault which causes an increase of emissions above the legislated threshold, in addition to storing a 'P' code the ECM also illuminates a Malfunction Indicator Lamp (MIL) in the instrument pack. The ECM performs a 2 seconds bulb check of the MIL each time the ignition is switched on.

Diagnostic socket


19M0853

Malfunction Indicator Lamp



M18 0700

ECM Harness Connector Details

The following tables give input/output information for the two harness connectors used on the ECM.

Connector C0914 - Black, 52 Pin

Pin No.	Description	Input/Output
1	Upstream HO_2S heater	Output
2	Not used	-
3	Downstream HO_2S positive	Output
4	CKP sensor positive	Output
5	CMP sensor screen earth (VVC only)	Input
6	Oil temperature unit earth; oil temperature switch earth (VVC only)	Input
7	ECT sensor earth	Input
8	IAT/MAP sensor supply +5V (Em-CVT gearbox only), MAP sensor supply +5V (non Em-CVT gearbox only)	Output
9	Gearbox differential speed sensor signal - (Em-CVT gearbox only)	Input
10	Oil temperature unit (VVC only)	Output
11	Not used	-
12	Decrease HCU solenoid valve (VVC only)	Output
13	IAC valve stepper motor phase B	Input/Output
14	Injector 3 earth	Input
15	Upstream $H0_2S$ positive	Output
16	CMP sensor signal	Input
17	CKP sensor screened earth	Input
18	IAT sensor earth	Input
19	Main relay supply signal	Input
20	TP sensor signal	Input
21	Engine bay temperature sensor signal	Input
22	Trinary switch A/C fan request (A/C vehicles only)	Input
23	Not used	-
24	IAC valve stepper motor phase D	Input/Output
25	Injector 1 earth	Input
26	Ignition coil 2 earth	Input

Connector C0914 - Continued

Pin No.	Description	Input/Output
27	Downstream HO_2S heater	Output
28	Upstream HO_2S screened earth	Input
29	Downstream HO_2S negative	Input
30	CKP sensor negative	Input
31	IAT/MAP sensor earth (Em-CVT gearbox only); MAP sensor earth (non Em-CVT gearbox only)	Input
32	Engine oil temperature unit signal (MPi only); Engine oil temperature switch signal (VVC only)	Input
33	ECT sensor signal	Input
34	TP sensor earth	Input
35	Alternator load signal	Input
36	Not used	-
37	Engine bay temperature sensor earth	Input
38	EVAP purge valve drive	Output
39	IAC valve stepper motor phase A	Input/Output
40	Injector 4 earth	Input
41	Upstream $H0_2S$ negative	Input
42	CMP sensor earth	Input
43	Not used	-
44	IAT sensor signal	Input
45	IAT/MAP sensor signal (Em-CVT gearbox only); MAP sensor signal (non Em-CVT gearbox only)	Input
46	TP sensor supply +5V	Output
47	Not used	-
48	Instrument pack - gearbox position display PWM signal (Em-CVT gearbox only)	Output
49	Increase HCU solenoid valve (VVC only)	Output
50	IAC valve stepper motor phase C	Input/Output
51	Injector 2 earth	Input
52	Ignition coil 1 earth	Input

Connector C0159 - Black, 28 Pin

Pin No.	Description	Input/Output
53	A/C clutch relay coil earth (A/C vehicles only)	Input
54	Main relay coil earth	Input
55	Instrument pack - tachometer drive	Output
56	A/C trinary switch hi/low (A/C vehicles only)	Input
57	Not used	-
58	Diagnostic ISO 9141 K Line	Input/Output
59	Main earth 1	Input
60	Cooling fan relay 2 coil earth (A/C vehicles only)	Input
61	Ignition switch via passenger compartment fusebox - fuse 14	Input
62	Instrument pack - engine bay overheat warning lamp	Output
63	Park/Neutral switch (Em-CVT gearbox only), Starter relay coil earth (Em-CVT gearbox only)	Input
64	Rough road sensor positive (non ABS only)	Input
65	Not used	-
66	Main earth 3	Input
67	Cooling fan relay 1 coil earth	Input
68	Fuel pump relay coil earth	Input
69	Malfunction Indicator Lamp (MIL)	Output
70	Not used	-
71	Engine bay temperature sensor earth	Input
72	Alarm ECU - immobilisation coded signal	Input
73	Main earth 2	Input
74	Engine bay cooling fan relay coil earth	Input
75	Gearbox Interface Unit (GIU) data transmit (Em-CVT gearbox only)	Output
76	Fuel tank gauge level signal (Em-CVT gearbox only)	Input
77	Gearbox Interface Unit (GIU) data receive (Em-CVT gearbox only)	Input
78	Road road sensor signal (non ABS); ABS modulator rough road signal (ABS)	Input
79	Not used	-
80	Battery permanent supply - under bonnet fusebox Fuselink 6 and Fuse 7	Input

OPERATION

Acceleration Enrichment

When the throttle pedal is depressed, the ECM receives a rising voltage from the TP sensor and detects a rise in manifold pressure from the MAP sensor. The ECM provides additional fuel by increasing the normal injector pulse width and also provides a number of extra additional pulses on rapid throttle openings.

Over-Run Fuel Cut-Off

The ECM implements over-run fuel cut-off when the engine speed is above 1600 rpm with the engine at normal operating temperature and the TP sensor in the closed position, i.e. when ECM senses that the vehicle is 'coasting' with the throttle pedal released. The ECM indexes the IAC valve open slightly to increase the air flow through the engine to maintain a constant manifold depression to keep emissions low.

Fuel is immediately reinstated if the throttle is opened. If the engine speed drops below 1600 rpm on over-run, fuel is progressively reinstated.

Over-Speed Fuel Cut-Off

To prevent damage at high engine speeds the ECM will implement fuel cut-off at engine speeds above approximately 7000 rpm. Fuel is reinstated as the engine speed falls.

Ignition Switch Off

In the first 10 seconds after the ignition is switched off, the ECM drives the IAC valve to its power down position (ready for the next engine start), and stores any required information.

The ECM then monitors the engine bay temperature using the ambient air temperature sensor. If the temperature is above a certain limit, the ECM will drive the engine bay fan for 8 minutes, and will then power down. If the engine bay temperature is below the limit, the ECM will power down after 10 seconds.

Fuel Quantity

The ECM controls fuel quantity by providing sequential injection to the cylinder head intake ports. Sequential injection allows each injector to deliver a precise amount of fuel to the cylinder intake ports, during the induction stroke, in cylinder firing order.

The CMP sensor and reluctor allows the ECM to synchronise injection at cranking speed for starting. The precise quantity of fuel delivered is controlled by adjusting the duration of the injector open time.

To achieve optimum performance the ECM is able to 'learn' the individual characteristics of an engine and adapt the fuelling strategy to suit. This capability is known as adaptive fuel strategy.

Adaptive fuel strategy must be maintained under all throttle positions except:
- Cold start
- Hot start
- Wide open throttle.

All of the above throttle positions are deemed to be 'open loop'. Open loop fuelling does not rely on information from the HO_2S, but sets the air/fuel ratio (AFR) according to the stored data in the ECM.

During a cold start, the ECM references the ECT sensor to calculate the appropriate amount of fuel required to support combustion and adjusts the idle speed to the correct 'fast idle' value. This strategy is maintained until the HO_2S is hot enough to provide an accurate feedback signal.

The specific nature of the other open loop conditions means that the HO_2S feedback is unsuitable as a control value for fuelling. Adaptive strategy also allows the ECM to compensate for wear in engine components and allow for production tolerances in mass produced components such as sensors.

To calculate the amount of fuel to be injected into each cylinder, the ECM has to determine the quantity of oxygen available in the cylinder to burn it. This can be calculated by processing information from the following sensors:

- MAP sensor
- CKP sensor
- ECT sensor
- TP sensor.

During one engine revolution, 2 of the 4 cylinders draw in air. The ECM uses the CKP sensor signal to determine the potential air intake volume in the cylinders.

The oxygen content of the air contained in the cylinders can be calculated by the ECM using information from the MAP sensor and the IAT sensor. The pressure of the air in the intake manifold will vary according to the following factors:

- The position of the throttle valve (driver input)
- The atmospheric pressure (altitude and weather conditions)
- The mechanical condition of the engine (volumetric efficiency).

The pressure in the intake manifold, downstream of the throttle valve, indicates how much air has flowed into the cylinders. This will decrease at higher altitudes as the air becomes 'thinner' or less dense. This will also mean that there will be less oxygen contained in the air which will be available for combustion of fuel.

The temperature of the air will also affect the oxygen content. Air which is cool has molecules packed closer together than hot air, therefore; cooler air contains more oxygen for any given volume than hotter air.

From the above information, the ECM can calculate how much air has been induced into the cylinders. By comparing these values to a fuelling map stored in the ECM memory, the amount of oxygen induced into the cylinders can be calculated. The values obtained from the ECT sensor, engine oil temperature sensor and TP sensor provide 'fine tuning' to the calculations.

To deliver the fuel the ECM completes an earth path to the injector coil, opening the injector for the precise amount of time required for the quantity determined. The correct cylinder order is determined by referencing the CMP sensor during start up to synchronise the CMP sensor signal to the CKP sensor signal. The fuel is injected into the inlet ports of the intake manifold and is drawn into the cylinder as an air and fuel mixture.

The ECM ensures that the amount of fuel injected is not affected by the variations in inlet manifold pressure. The ECM corrects the injector duration time, using MAP sensor information.

The ECM references battery voltage to adjust opening times to suit the state of battery charge. This is required because low battery voltage will mean slower response from the injectors, and could give a leaner AFR than intended.

Ignition Timing

The ignition timing is an important part of the ECM adaptive strategy. The ignition system consists of two double ended coils, mounted on the cam cover directly over the spark plugs, which operate using the wasted spark principle. Each coil is connected to a pair of spark plugs, 1 and 4, 2 and 3.

The spark plugs are connected in series with the secondary winding of the coil so a spark occurs in both cylinders at the same time. When a spark occurs in the cylinder which is on the compression stroke the air/fuel charge is ignited. The spark has no effect on the cylinder at the end of the exhaust stroke, hence the term 'wasted spark'.

The major advantage of this system is that a distributor cap and rotor arm are eliminated thereby improving performance and reliability. The timing of the spark will affect the quality of combustion and the power produced.

The ECM will reference all relevant sensors to achieve the optimum timing for any given condition. This electronically increases the primary coil charging time (dwell angle) as engine speed increases to maintain coil ht voltage at high engine speeds.

The ECM calculates ignition timing using inputs from the following:
- CKP sensor
- TP sensor
- ECT sensor
- IAT sensor.

The ECM calculates dwell angle using inputs from the following:
- CKP sensor
- Battery voltage.

At start up the ECM sets ignition timing by referencing the ECT sensor. After start up, the ignition timing will be controlled according to maps stored in the memory and modified according to additional sensor inputs.

The choice of ignition point is critical in maintaining engine power output with low emissions. Advancing the ignition may increase power output under certain conditions, but it also increases the amount of oxides of nitrogen (NOx) and carbon monoxide (CO) produced in the combustion chamber.

There is a narrow range of ignition points for all engine conditions which give an acceptable compromise between power output and emission control.

The ignition mapping contained within the ECM memory keeps the ignition timing within this narrow band. The ignition timing is used to control engine idle speed in conjunction with the IAC valve stepper motor.

As the MEMS 3 system does not have a knock sensor, ignition timing advance is controlled using different mapping at high engine and intake air temperatures in order to avoid detonation (pinking).

Idle Speed Control

The ECM regulates the engine speed at idling. The ECM uses two methods of idle speed control:
- Ignition timing adjustment
- IAC valve stepper motor.

When the engine idle speed fluctuates, and there are no additional loads on the engine, the ECM will vary the ignition timing and the IAC valve to regulate the idle speed.

This allows very rapid correction of out of tolerance idle speeds. When an additional load is placed on the engine, such as when the power steering is turned on full lock, the ECM uses the IAC valve stepper motor to control the idle speed to specification.

The idle speed is determined from the CKP sensor, but there are also inputs to the ECM from the following:
- Alternator
- Park/Neutral switch (Em-CVT)
- A/C system
- Cooling fan status.

If the ECM receives information from the above inputs that an extra load is being placed on the engine, it can immediately compensate and avoid engine poor idle or stall conditions.

The IAC valve stepper motor is mounted on the inlet manifold and controls a throttle valve air by-pass port.

To increase the idle speed, the stepper motor allows more air to by-pass the throttle and enter the cylinders. To decrease the idle speed, the stepper motor allows less air to enter the cylinders.

The stepper motor is a bi-polar type which consists of two windings controlled by pulse width modulated (PWM) signals from the ECM.

The position of the stepper motor is always referenced on power down of the ECM, this may take from three to five seconds. The stepper motor is also used to reduce manifold vacuum during deceleration to control emissions.

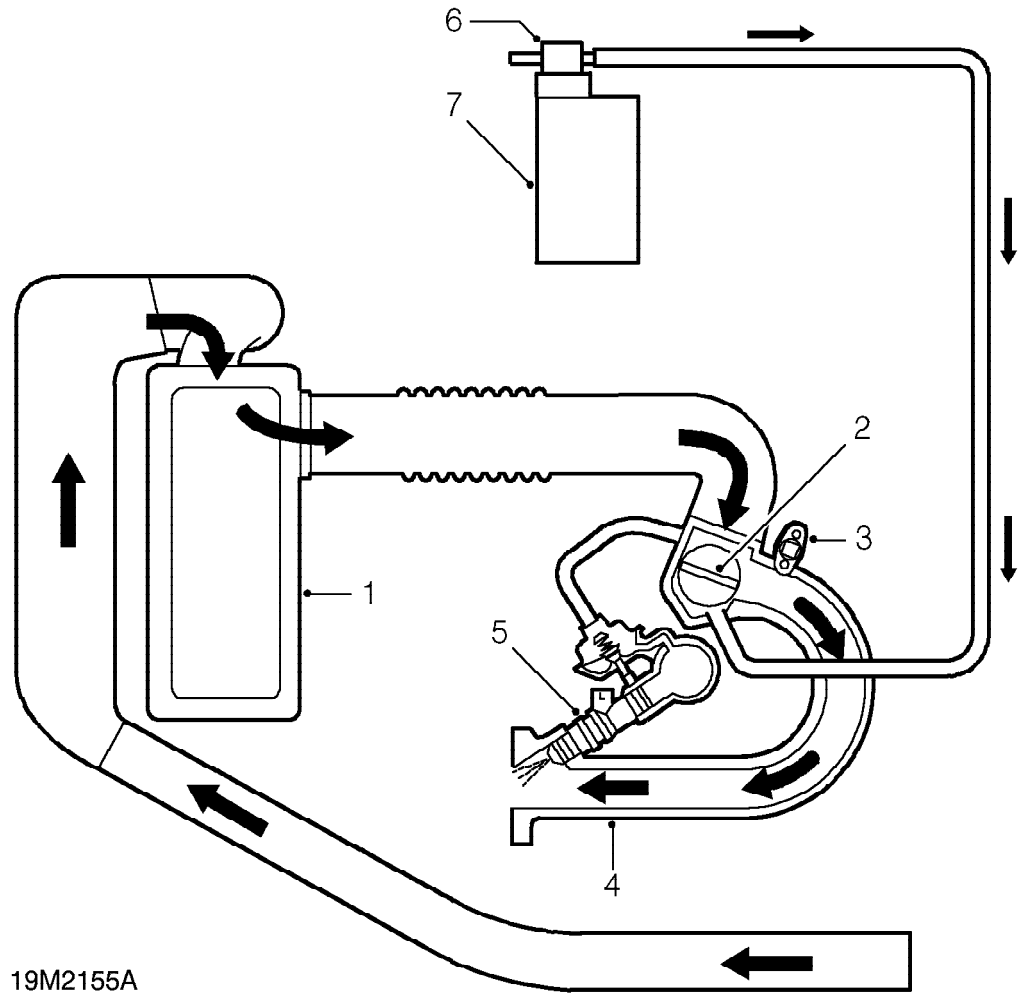
Evaporative Emissions (EVAP) Control System

The hydrocarbon vapour given off by petrol is harmful to health and the environment. Legislation limits the amount of hydrocarbons (HC) which can be emitted to atmosphere by a motor vehicle.

To meet the limits imposed, a charcoal canister is fitted to the fuel system to absorb fuel vapour from the tank when the vehicle is not in use. The charcoal canister has a finite capacity and therefore needs to be purged when the vehicle is driven.

This is achieved by drawing the fuel vapours out of the canister and into the cylinders of the engine. The HC vapours are converted into carbon dioxide (CO_2) and water (H_2O) by the combustion process and catalytic converter.

AIR INTAKE SYSTEM - MPi/VVC MEMS 3



1. Air cleaner element
2. Throttle disc
3. IAC valve
4. Inlet manifold
5. Injector
6. Evaporative emission canister purge valve
7. Evaporative emission canister

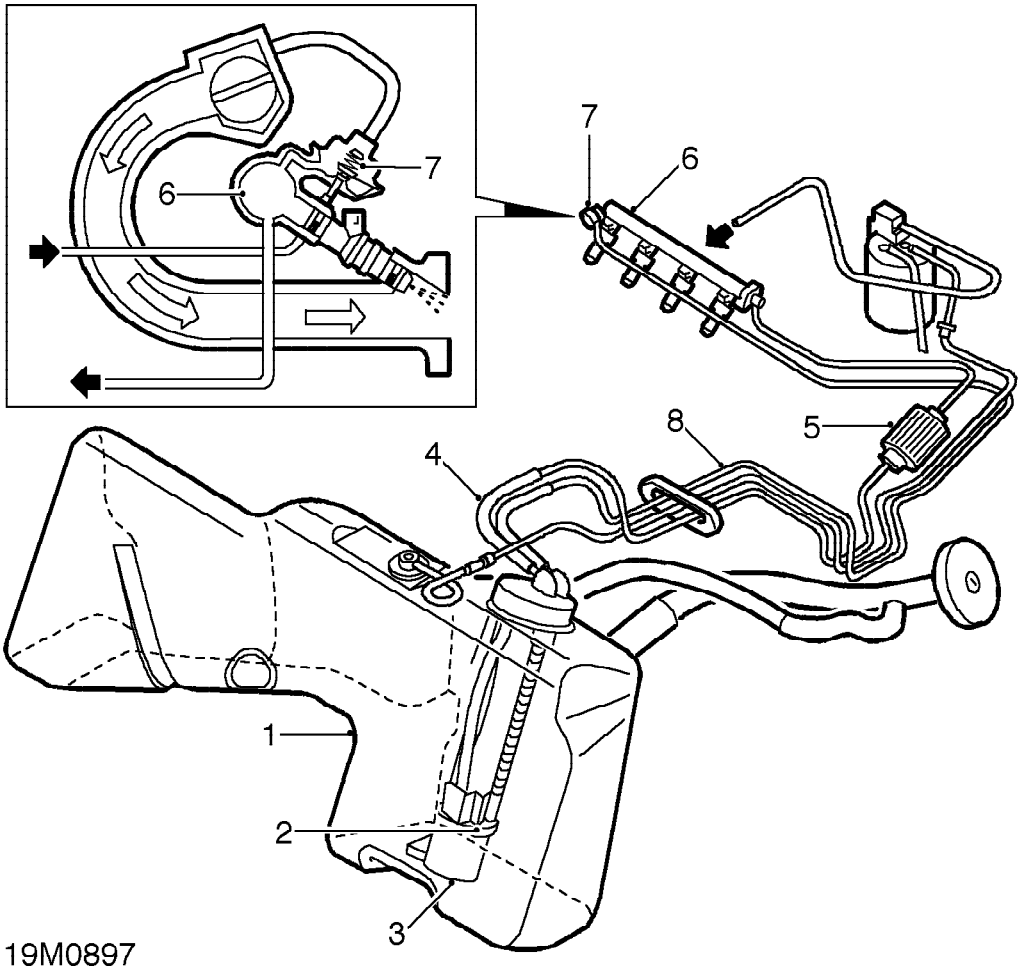
Intake air is drawn into the throttle housing through the air filter element. Incorporated in the throttle housing is the throttle disc and the TP sensor.

Air passes from the throttle housing via the manifold chamber into the inlet tracts. Fuel is sprayed into the inlet manifold by the injectors and the air/fuel mixture is drawn into the combustion chamber.

Inlet manifold depression is measured by the MAP sensor which is mounted near the end of the inlet manifold chamber. A signal from the MAP sensor is used by the ECM to calculate the amount of fuel to be delivered by the injectors.

FUEL DELIVERY SYSTEM

RECIRCULATING FUEL SYSTEM



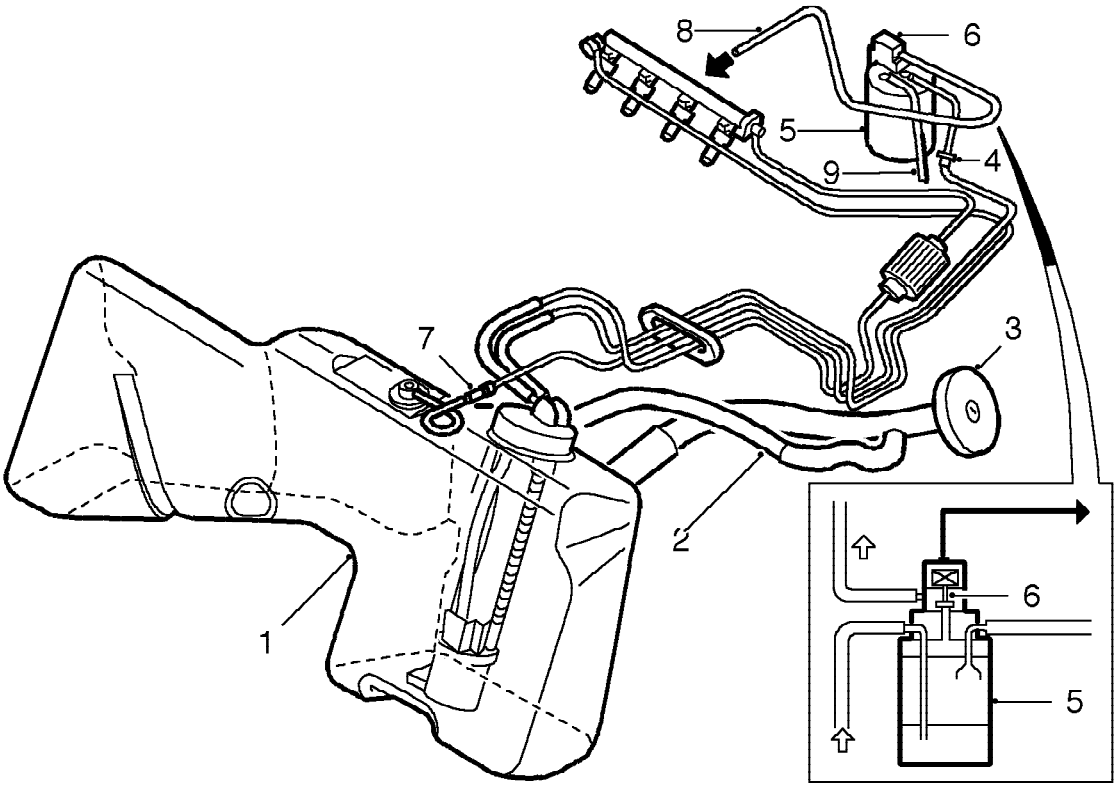
1. Fuel tank
2. Fuel pump
3. Swirl pot
4. Feed line
5. Fuel filter
6. Fuel rail
7. Fuel pressure regulator
8. Return line

A recirculating fuel system is used to supply fuel to the injectors at a constant pressure and return excess fuel to the fuel tank.

Fuel pressure is produced by an electric pump immersed in the fuel tank and operating in a swirl pot to maintain a constant fuel level around the pump pick-up.

Pressurised fuel is fed to an in-line fuel filter via a non-return valve which prevents fuel returning to the tank when the pump is not running. Fuel is delivered from the fuel filter to the fuel rail which supplies the injectors. A fuel pressure regulator mounted on the fuel rail controls the pressure of fuel in the rail and returns excess fuel to the swirl pot in the tank. A venturi in the fuel tank causes returning fuel to draw cool fuel into the swirl pot from the tank.

FUEL TANK BREATHING SYSTEM



19M0899

1. Fuel tank
2. Filler neck breather pipe
3. Filler cap
4. Two-way breather valve
5. Evaporative emission canister
6. Evaporative emission canister, purge valve
7. Vent line
8. Fuel release line
9. Air intake line

When filling the fuel tank, air trapped in the fuel tank by the rising fuel level is allowed to vent to the top of the filler neck by a separate breather pipe.

With the filler cap in place, fuel tank breathing is via a two-way breather valve which allows expanding fumes to exit the tank. From the two-way breather valve, fumes are directed to the evaporative emission canister where they can be purged into the engine via the evaporative emission canister purge valve.

EMISSION CONTROL SYSTEMS

The vehicle is fitted with various items of emission and evaporative control components to comply with emission regulation requirements.

Three control systems are used to reduce harmful emissions released into the atmosphere from the vehicle at all times, and under all conditions. These are:

1. Crankcase emission control
2. Exhaust emission control
3. Fuel vapour evaporative loss control

In many countries it is against the law for a vehicle owner or an unauthorised repair shop to modify or tamper with emission control equipment. In this event the vehicle owner and/or the repairer may be liable for prosecution.

The emission control system fitted to the vehicle is designed to keep the emissions within the legal limits provided that the engine is correctly maintained and is in good mechanical condition.

Crankcase Emission Control System

Gases from the crankcase are drawn into the throttle housing to be burnt in the combustion chambers with the fuel mixture. The system provides effective emission control while the engine is running under all circumstances.

There are two breather pipes connected to the throttle housing, one either side of the throttle disc. When the engine is running with the throttle disc open, both pipes are subject to manifold depression and draw crankcase fumes into the manifold. When the throttle disc is closed, only the pipe on the inlet manifold side of the disc is subject to manifold depression. This pipe incorporates a restrictor to prevent engine oil being drawn into the engine by the substantially greater manifold depression.

Exhaust Emission Control

The engine management system provides accurately metered quantities of fuel to the combustion chambers to ensure the most efficient air to fuel ratio under all conditions of operation. A further improvement to combustion is made by measuring the oxygen content of the exhaust gases to enable the quantity of fuel injected to be varied maintaining the ratio necessary for efficient gas conversion by the catalytic converter.

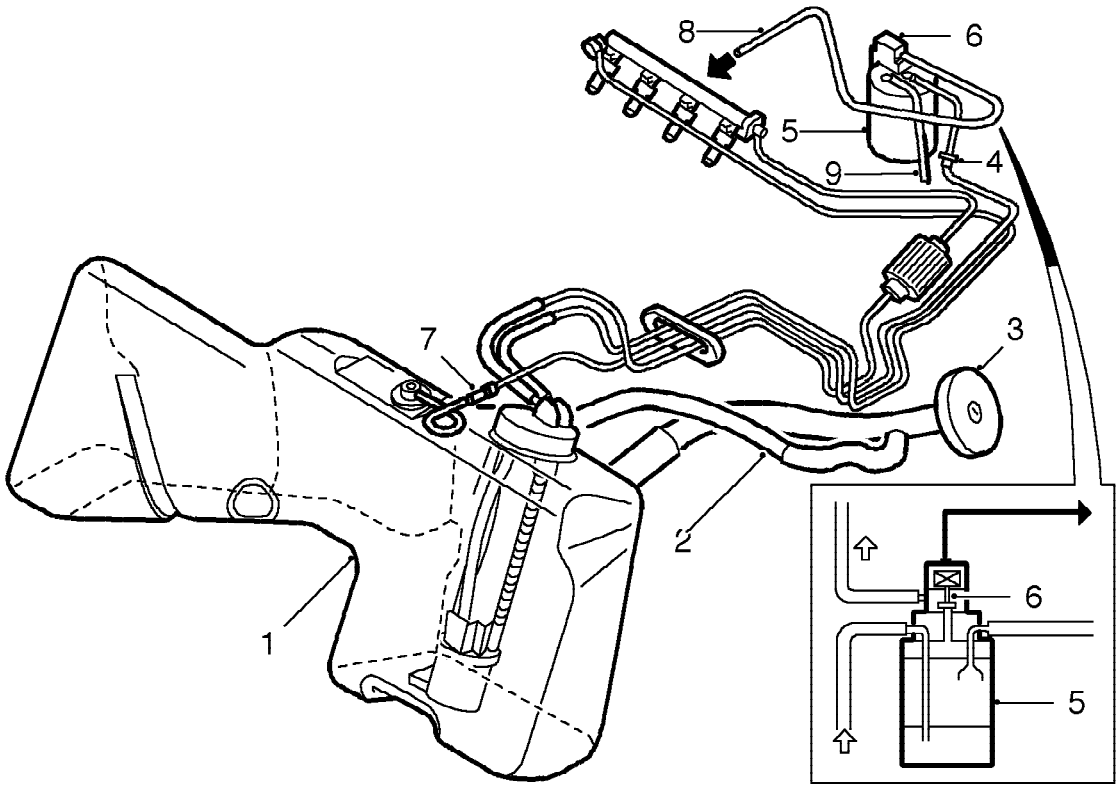
The catalytic converter is situated between the exhaust front pipe and exhaust silencer. The catalytic converter reduces the emission of Carbon Monoxide, Oxides of Nitrogen and Hydrocarbons released into the atmosphere. The active constituents of the converter are the precious metals Platinum and Rhodium.

The correct operation of the catalytic converter is dependent upon close control of the oxygen concentration in the exhaust gas entering the converter. The quantity of oxygen in the exhaust gas is determined by a heated oxygen sensor situated upstream of the catalytic converter, in the front pipe. The heated oxygen sensor provides the engine control module with a signal proportional to the oxygen content. The ECM can then determine whether any adjustment is required to the amount of fuel being injected to achieve the correct exhaust gas content, and implement the required changes.

A downstream heated oxygen sensor is installed in the outlet of the catalytic converter. By comparing the inputs from the upstream and downstream heated oxygen sensors, the ECM can monitor the efficiency of the catalytic converter.

CAUTION: Serious damage to the catalytic converter will occur if leaded fuel is used. The filler neck is designed to accommodate only unleaded fuel pump nozzles.

EVAPORATIVE EMISSION CONTROL



19M0899

1. Fuel tank
2. Filler neck breather pipe
3. Filler cap
4. Two-way breather valve
5. Evaporative emission canister
6. Evaporative emission canister, purge valve
7. Vent line
8. Fuel release line
9. Air intake line

Evaporative Emission Canister

The evaporative emission (EVAP) canister contains charcoal which absorbs and stores fuel vapour from the fuel tank while the engine is not running. When the engine is running the vapour is purged from the canister into the engine and burned.

The EVAP canister is purged when the EVAP canister purge valve is opened. Manifold depression draws fresh air into the canister through the charcoal, which releases fuel vapour into the throttle housing.

Evaporative Emission Canister, Purge Valve

An EVAP canister, purge valve is operated by the ECM. The purge valve remains closed when the engine is cold or at idling speed, to protect engine tune and catalyst performance. If the EVAP canister was purged during cold running or at idling speed, the additional enrichment in fuel mixture would delay catalyst light off time and cause erratic idling. When the engine is above 75°C, the purge valve solenoid will become operational (modulated ON and OFF) whenever the engine speed is above approximately 1800 rev/min. When the purge valve is opened, fuel vapour from the EVAP canister is drawn into the throttle housing for combustion.

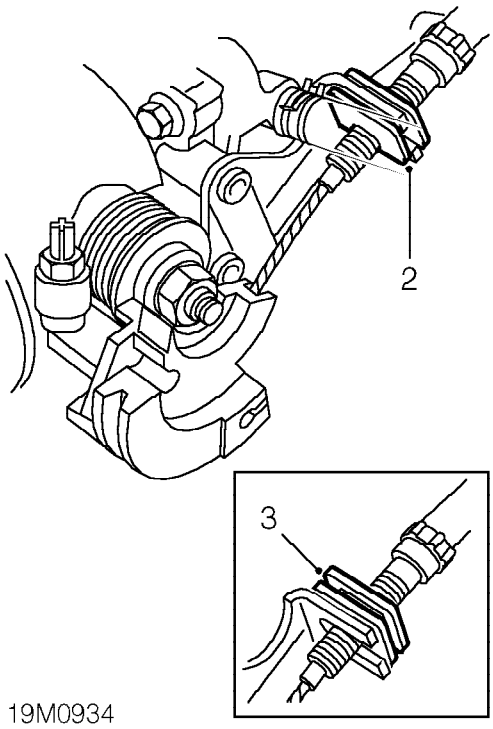
THROTTLE CABLE

Service repair no - 19.20.05

NOTE: Before adjustment, ensure the cable is correctly routed and located. Do not attempt to adjust the throttle cable or engine idle speed by means of the throttle stop screw.

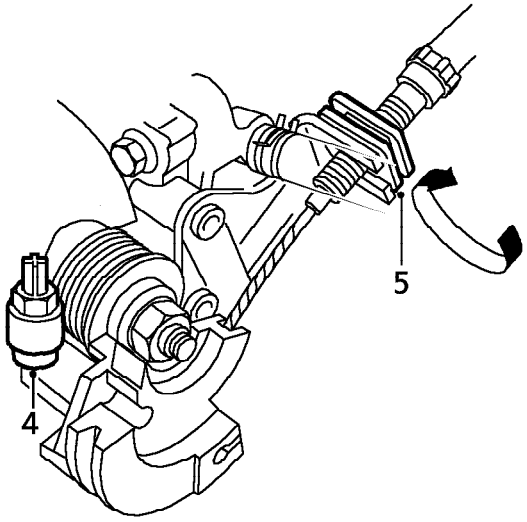
Adjust

1. Remove the engine compartment access panel. ***See BODY, Exterior fittings.***



19M0934

2. Release cable adjusting nut from abutment bracket.
3. Position outer cable to abutment bracket so that adjusting nut is in contact with top of abutment bracket.



19M0933A

4. Hold throttle cam in fully closed position, ensure throttle cam contacts throttle stop screw.
5. Rotate cable adjusting nut until all slack is taken out of inner cable. Ensure throttle does not open.
6. Locate throttle cable adjusting nut in abutment bracket.
7. Operate throttle pedal and ensure that full throttle pedal movement is available.
8. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

FUEL TANK DRAINING

Service repair no - 19.55.02

WARNING: The fuel tank must be drained before removing it from the vehicle. Ensure that both sides of the fuel tank are completely drained.

1. Disconnect battery earth lead.
2. Depressurise fuel system. ***See this section.***

Drain

WARNING: Petrol/gasoline vapour is highly flammable, and in contained spaces is also explosive and toxic. Always have a fire extinguisher containing FOAM, CO_2 GAS OR POWDER close at hand when handling or draining fuel.

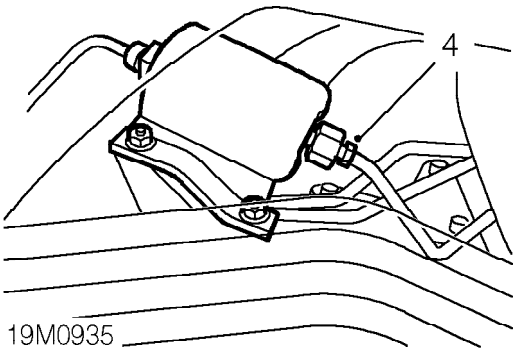
3. Remove fuel pump. ***See Repairs.***
4. Using a fuel recovery appliance, drain fuel from the tank into a sealed container. Follow the manufacturers instructions for the connection and safe use of the appliance.
5. Due to the construction of the fuel tank, it will be necessary to drain fuel from each side of the tank separately.

NOTE: Fuel vapour causes the fuel tank to swell, before attempting fuel tank removal, ensure fuel is completely drained and the tank is left in the drained condition for at least 2 hours. ***See Repairs.***

FUEL SYSTEM DEPRESSURISE

Service repair no - 19.50.02

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
3. Position absorbent cloth around fuel filter outlet union.



4. Loosen fuel filter outlet union to relieve fuel pressure.

CAUTION: To prevent damage to the fuel system pipes and components, use two spanners when loosening or tightening unions.

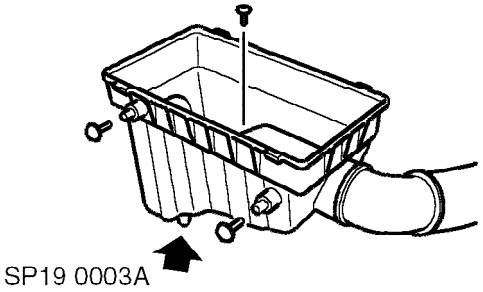
5. Tighten fuel filter outlet union to 30 Nm.
6. Remove absorbent cloth.
7. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
8. Connect battery earth lead.

AIR CLEANER

Service repair no - 19.10.01

Remove

1. Remove air cleaner element. ***See this section.***


SP19 0003A

2. Remove 2 retaining studs securing air cleaner to support bracket.
3. Release air cleaner from lower grommet.
4. Release front air intake hose.
5. Remove screw securing rear air intake hose.
6. Release rear air intake hose and manoeuvre air cleaner from engine bay.

Refit

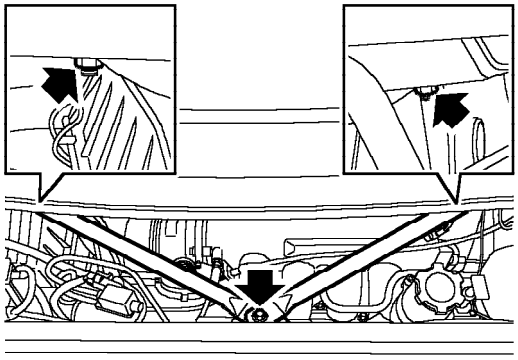
1. Position air cleaner and align rear air intake hose.
2. Fit and tighten screw securing rear air intake hose.
3. Align and connect front air intake hose.
4. Secure air cleaner in lower grommet.
5. Align air cleaner to support bracket and fit retaining studs.
6. Fit air cleaner element. ***See this section.***

ELEMENT - AIR CLEANER

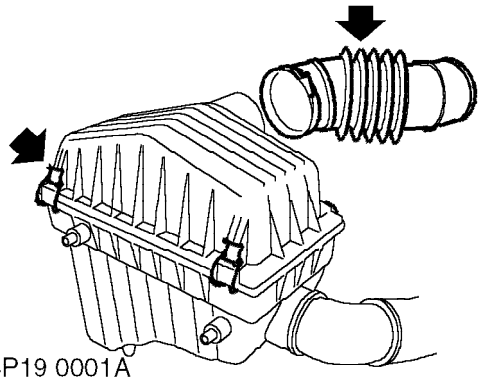
Service repair no - 19.10.10

Remove

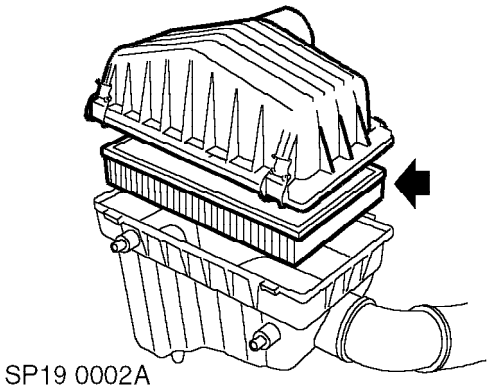
1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***
3. Remove engine compartment access cover. ***See BODY, Exterior fittings.***


SP12 0363

4. Remove nut securing LH cross bracing and remove and discard bolt securing cross bracing.
5. Remove LH cross bracing.


SP19 0001A

6. Release clip and disconnect air intake hose from throttle body.
7. Loosen clip securing air intake hose to air cleaner and remove hose.
8. Release 4 clips securing air cleaner cover.


SP19 0002A

9. Remove air cleaner cover and remove element.

Refit

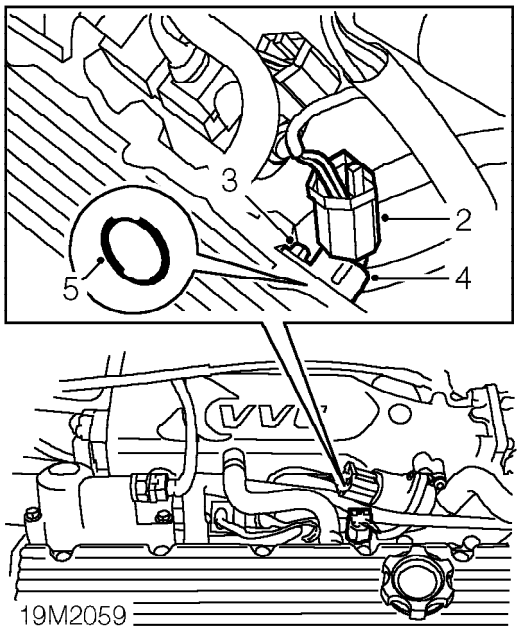
1. Clean inside of air cleaner.
2. Fit air cleaner element.
3. Fit air cleaner cover and secure clips.
4. Fit air intake hose to air cleaner and secure with clip.
5. Fit air intake hose to throttle body and secure with clip.
6. Position cross bracing, fit nut and new bolt and tighten to 25 Nm.
7. Fit engine compartment access cover. ***See BODY, Exterior fittings.***
8. Fit engine cover. ***See ENGINE, Repairs.***
9. Connect battery earth lead.

SENSOR - CAMSHAFT POSITION (CMP) - VVC

Service repair no - 18.30.24

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



2. Disconnect multiplug from CMP sensor.
3. Remove bolt securing CMP sensor to cylinder head.
4. Remove CMP sensor.
5. Remove 'O' ring seal from sensor.

Refit

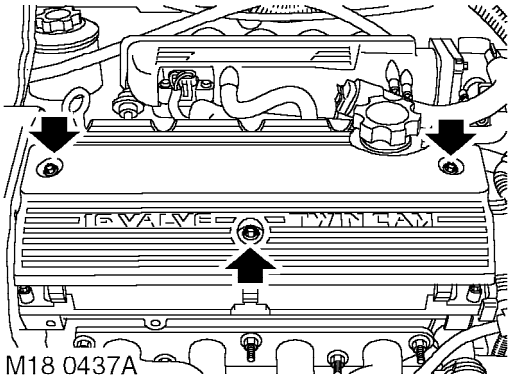
1. Clean sealing faces of sensor and cylinder head.
2. Fit new 'O' ring seal to CMP sensor.
3. Fit sensor to cylinder head and tighten bolt to 9 Nm.
4. Connect multiplug.
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

SENSOR - CAMSHAFT POSITION (CMP) - MPi

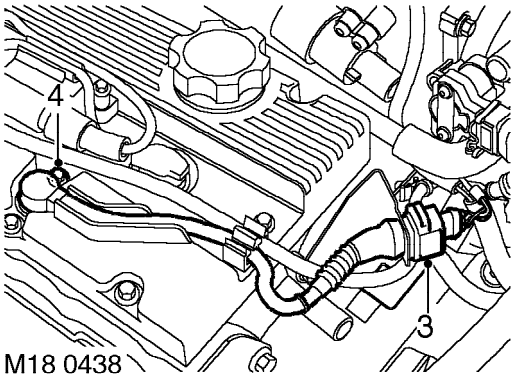
Service repair no - 18.30.24

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



2. Remove three bolts securing coil cover to engine and remove coil cover.



3. Release CMP multiplug from bracket and disconnect multiplug.
4. Release sensor cable from clip.
5. Remove bolt securing camshaft sensor and remove sensor.

Refit

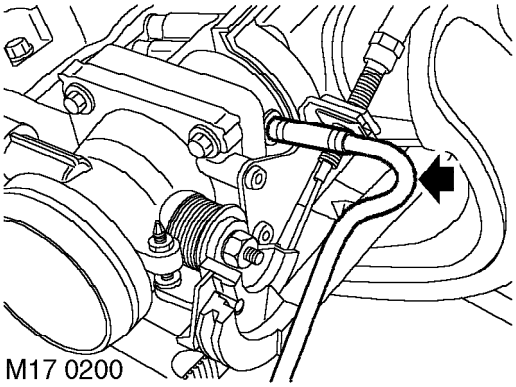
1. Clean camshaft sensor and mating face.
2. Fit camshaft sensor, fit bolt and tighten to 9 Nm.
3. Connect CMP multiplug and secure in bracket.
4. Fit coil cover, fit bolts and tighten to 8 Nm.
5. Fit engine cover. ***See ENGINE, Repairs.***

EVAPORATIVE EMISSION CANISTER

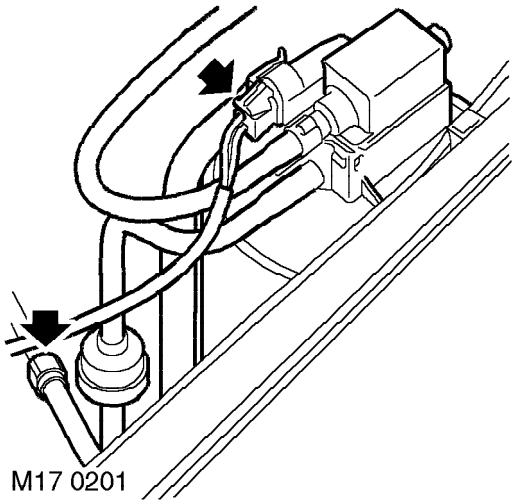
Service repair no - 17.15.13

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



3. Release clip and disconnect hose from inlet manifold.



4. Release and disconnect feed hose.
5. Disconnect multiplug from purge valve.
6. Release EVAP canister from support bracket and remove EVAP canister.

Refit

1. Position EVAP canister and secure in support bracket.
2. Connect hose to inlet manifold and secure with clip.
3. Connect feed hose.
4. Connect multiplug to purge valve.
5. Fit engine compartment access panel. ***See ENGINE, Repairs.***
6. Connect battery earth lead.

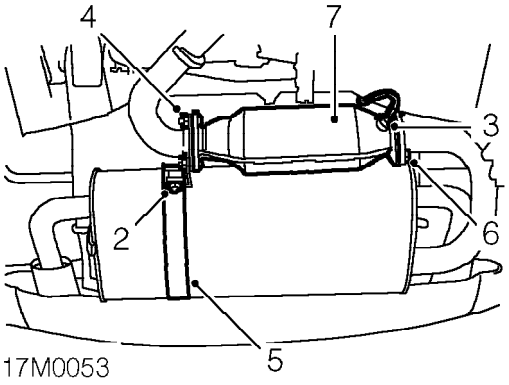
CATALYTIC CONVERTER

Service repair no - 17.50.01

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.



2. Remove nut and special washer securing rear silencer clamp.
3. Remove catalyst overheat sensor from catalyst *(if fitted)* .
4. Remove 3 flange nuts securing catalytic converter to front pipe.
5. Remove rear silencer clamp.
6. Remove 3 flange nuts securing catalytic converter to silencer.
7. Remove catalytic converter.
8. Remove and discard gaskets.

Refit

1. Clean flange mating faces of front pipe, silencer and catalytic converter.
2. Fit new gaskets to catalytic converter studs.
3. Fit catalytic converter to silencer, fit nuts and tighten to 50 Nm.
4. Clean catalyst overheat sensor and mating faces *(if fitted)* .
5. Fit and tighten catalyst overheat sensor to 30 Nm *(if fitted)* .
6. Position catalytic converter to front pipe.
7. Fit rear silencer clamp.
8. Fit nuts and tighten to 50 Nm.
9. Align rear silencer clamp strap, fit special washer, fit nut and tighten to 30 Nm.
10. Remove stand(s) and lower vehicle.

CAUTION: Ensure all joints are free from leaks. Exhaust gas leaks upstream of the catalyst could lead to internal failure of the catalyst.

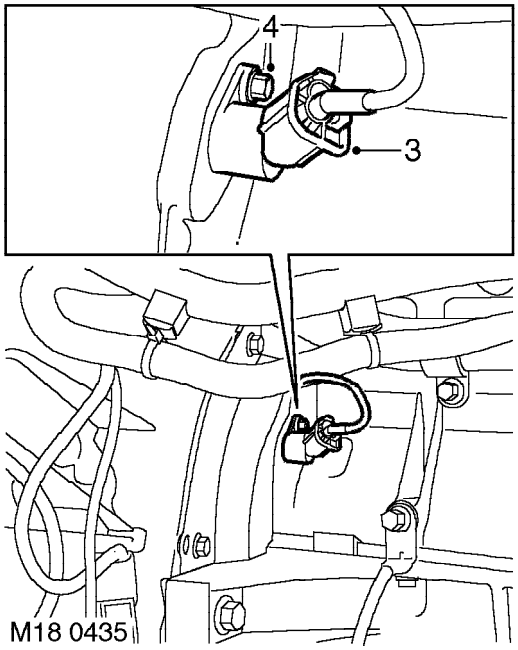
SENSOR - CRANKSHAFT POSITION (CKP)

Service repair no - 18.30.12

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

WARNING: Support on safety stands.



3. Disconnect multiplug from CKP sensor.
4. Remove bolt securing CKP sensor to flywheel housing.
5. Remove CKP sensor.

Refit

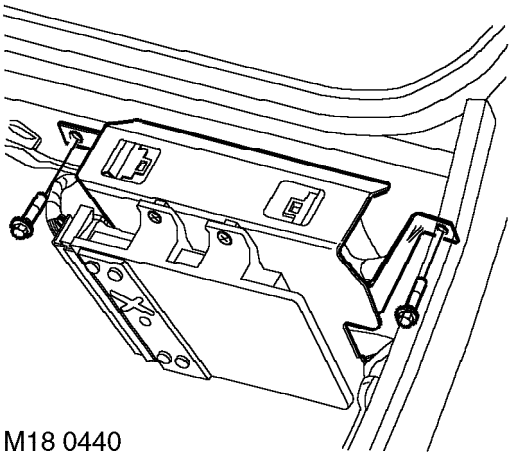
1. Clean CKP sensor and mating face of flywheel housing.
2. Position CKP sensor, fit bolt and tighten to 9 Nm.
3. Connect multiplug to CKP sensor.
4. Remove stand(s) and lower vehicle.
5. Connect battery earth lead.

ENGINE CONTROL MODULE (ECM) - MPi

Service repair no - 18.30.01

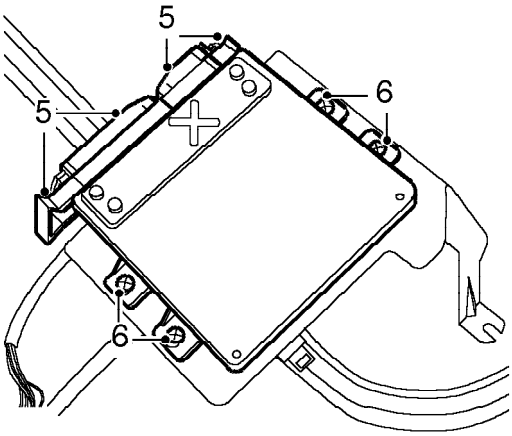
Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings. See ENGINE, Repairs.***



M18 0440

3. Remove 2 bolts securing ECM mounting bracket.
4. Release mounting bracket from support bracket and position to access ECM screws.



M18 0441

5. Release ECM multiplug catches and disconnect ECM multiplugs.
6. Remove 4 screws securing ECM to mounting bracket.
7. Remove ECM.

Refit

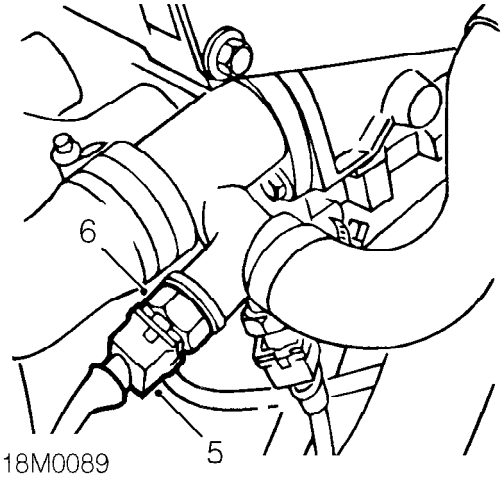
1. Locate ECM to mounting bracket, fit and tighten screws.
2. Connect multiplugs and secure multiplug catches.
3. Position mounting bracket in support bracket, fit bolts and tighten to 8 Nm.
4. Fit engine compartment access panel. ***See BODY, Exterior fittings. See ENGINE, Repairs.***
5. Connect battery earth lead.
6. Initiate ECM using TestBook.

SENSOR - ENGINE COOLANT TEMPERATURE (ECT)

Service repair no - 18.30.10

Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***
3. Raise vehicle on ramp.
4. Position container below sensor.



5. Disconnect sensor multiplug.
6. Remove sensor from top coolant hose adapter.

Refit

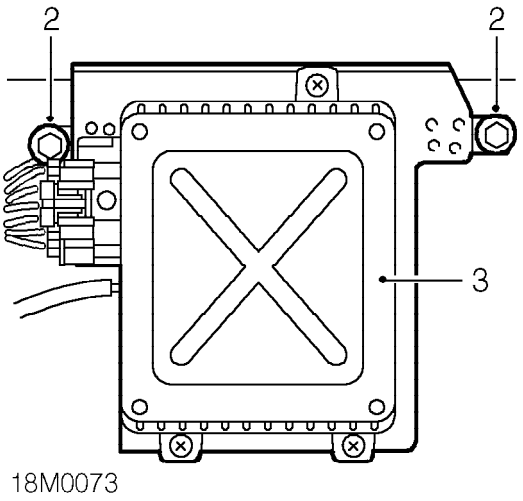
1. Clean sensor threads and mating faces.
2. Fit sensor and tighten to 6 Nm.
3. Connect multiplug to sensor.
4. Remove container, and lower vehicle.
5. Top-up cooling system. ***See MAINTENANCE.***
6. Fit engine cover. ***See ENGINE, Repairs.***
7. Connect battery earth lead.

ENGINE MANAGEMENT RELAY MODULE

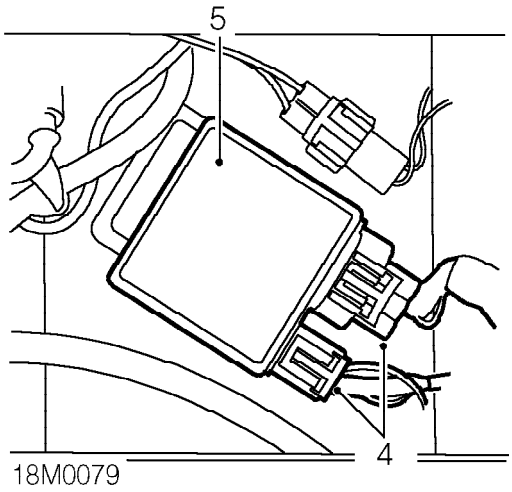
Service repair no - 18.30.06

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



2. Remove 2 bolts securing ECM mounting bracket.
3. Move bracket aside and release engine management relay module.



4. Disconnect 2 multiplugs from relay module.
5. Remove relay module.

Refit

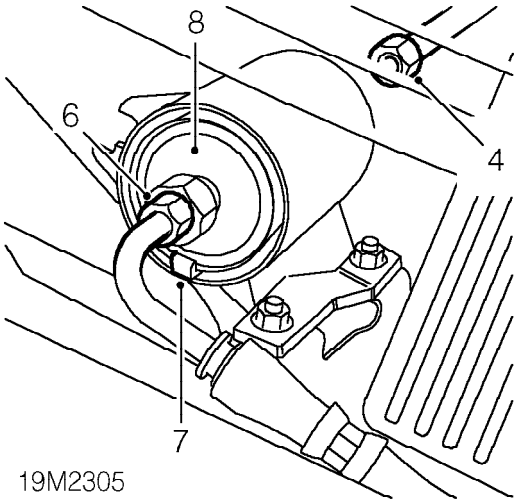
1. Connect multiplugs to relay module.
2. Secure relay module onto ECM mounting bracket.
3. Fit ECM mounting bracket and tighten bolts to 8 Nm.
4. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

FUEL FILTER

Service repair no - 19.25.02

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
3. Position cloth around fuel outlet union.



4. Loosen union to relieve fuel pressure and disconnect pipe.

CAUTION: Use two spanners when loosening or tightening unions.

5. Position cloth around fuel filter union.
6. Loosen union and disconnect fuel inlet pipe from fuel filter.
7. Release clip and remove filter from housing.
8. Discard fuel filter.

Refit

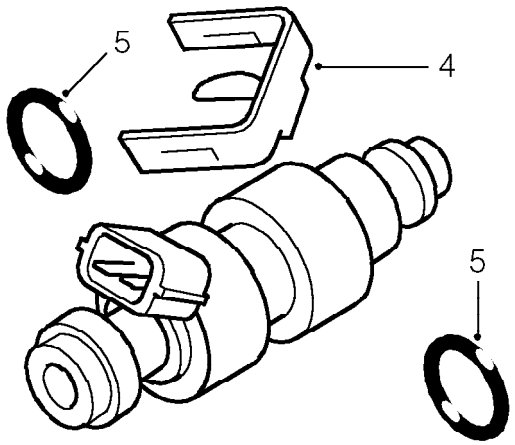
1. Clean fuel pipe unions.
2. With arrow on the fuel filter pointing rearwards position new filter into housing.
3. Tighten fuel inlet pipe to 30 Nm.
4. Connect fuel outlet pipe to fuel filter and tighten to 30 Nm.
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
6. Connect battery earth lead.

FUEL INJECTORS - MPi

Service repair no - 19.60.12

Remove

1. Disconnect battery earth lead.
2. Remove fuel rail. ***See this section.***
3. Release multiplugs from injectors.



19M0907

4. Release spring clips securing injectors to fuel rail.
5. Remove injectors and discard 2 'O' rings from each injector.
6. Fit protective caps to each injector.

Refit

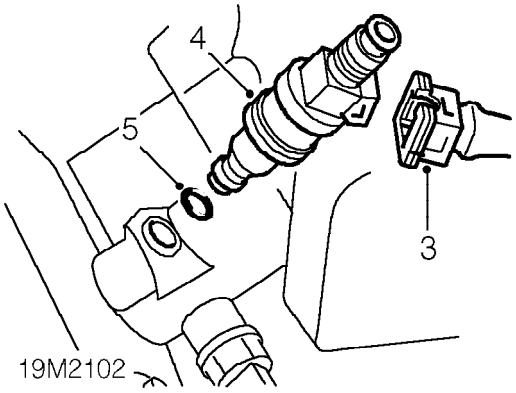
1. Clean injectors and injector recesses in fuel rail and inlet manifold.
2. Lubricate 8 new 'O' rings with castor oil and fit to injectors.
3. Fit fuel rail to injectors.
4. Fit spring clips to secure injectors to fuel rail.
5. Fit multiplugs to injectors.
6. Fit fuel rail. ***See this section.***
7. Connect battery earth lead.

FUEL INJECTORS - VVC

Service repair no - 19.60.12

Remove

1. Disconnect battery earth lead.
2. Remove fuel rail. ***See this section.***



3. Disconnect multiplugs from injectors.
4. Remove injectors from inlet manifold.
5. Remove and discard 'O' rings from injectors.

Refit

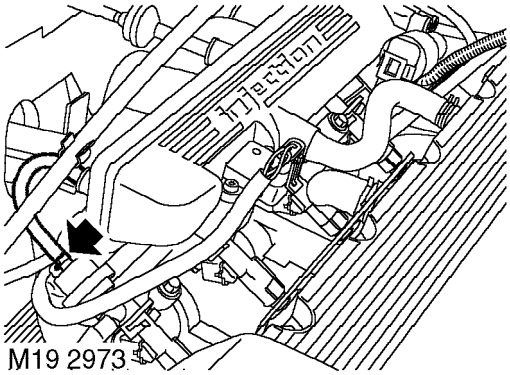
1. Lubricate new 'O' rings with castor oil and fit to injectors.
2. Fit injectors to fuel rail and connect multiplugs.
3. Fit fuel rail. ***See this section.***
4. Connect battery earth lead.

FUEL RAIL AND INJECTORS - MPi

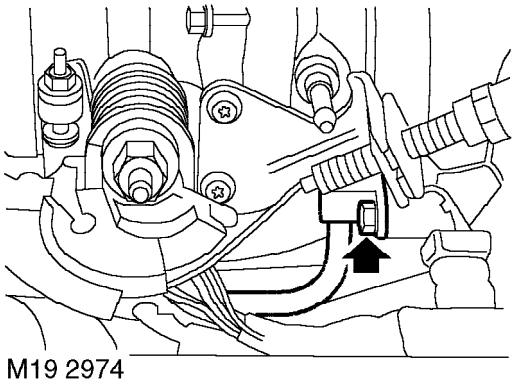
Service repair no - 19.60.12
Service repair no - 19.60.04

Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***

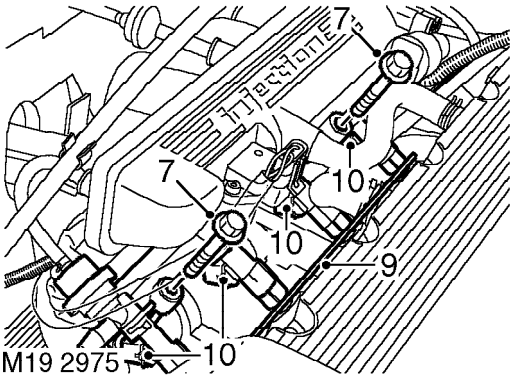

M19 2973

3. Release clip and disconnect vacuum pipe from fuel pressure regulator.
4. Position absorbent cloth beneath fuel rail.


M19 2974

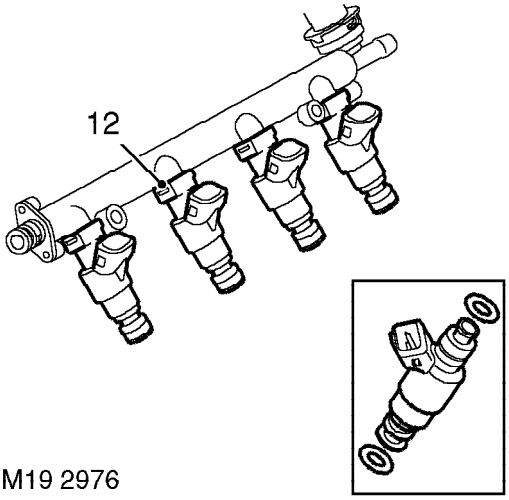
5. Remove 2 bolts securing fuel pipe to fuel rail.
6. Release fuel pipe from fuel rail, remove and discard 'O' ring.

CAUTION: Always fit plugs to open connections to prevent contamination.



M19 2975

7. Remove 2 bolts securing fuel rail to inlet manifold.
8. Release fuel rail and injectors from inlet manifold.
9. Release and remove injector spacer.
10. Disconnect multiplugs from injectors.
11. Remove the fuel rail complete with injectors.



M19 2976

12. Release spring clips securing injectors to fuel rail and remove fuel injectors.
13. Remove and discard 2 'O' rings from each injector.
14. Fit protective caps to each end of injectors.

Refit

1. Remove protective caps from each injector.
2. Clean injectors and recesses in fuel rail and inlet manifold.
3. Lubricate new 'O' rings with castor oil and fit to each end of injectors.
4. Fit injectors to fuel rail.
5. Secure injectors to fuel rail with spring clips.
6. Position fuel rail assembly and connect injector multiplugs.
7. Fit injector spacer.
8. Push each injector into inlet manifold.
9. Fit bolts securing fuel rail to inlet manifold and tighten to 10 Nm.
10. Using a new 'O' ring, connect fuel feed to fuel rail, fit bolts and tighten to 8 Nm.
11. Connect vacuum pipe to fuel pressure regulator and secure with clip.
12. Fit engine cover. ***See ENGINE, Repairs.***
13. Connect battery earth lead.

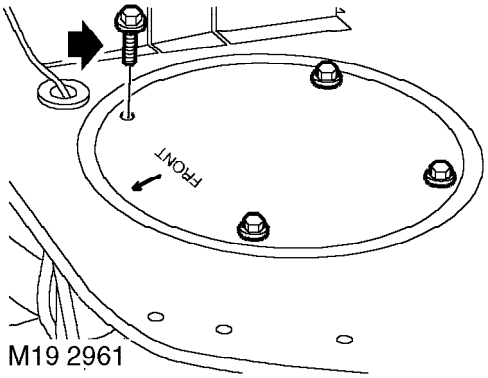
FUEL PUMP

Service repair no - 19.45.08

Remove

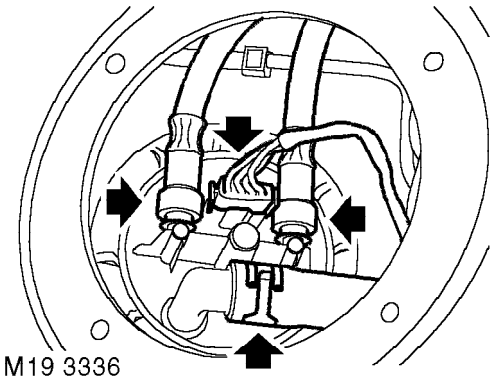
1. Disconnect battery earth lead.
2. Depressurise fuel system. ***See Adjustments.***
3. Remove subwoofer assembly. ***See ELECTRICAL, Repairs.***
4. Remove engine cover. ***See ENGINE, Repairs.***

WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



M19 2961

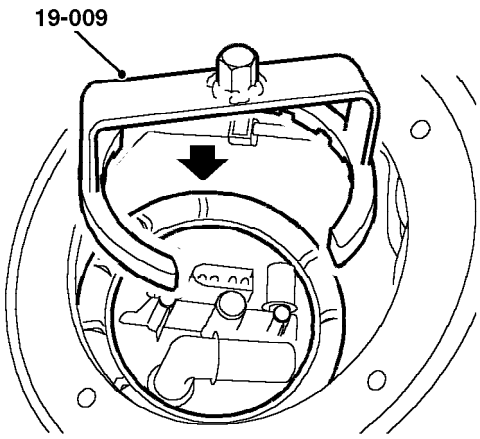
5. Remove 4 bolts securing fuel pump access cover to body and remove cover.


M19 3336

6. Release clip and disconnect hose securing fuel pump breather hose to fuel pump.

WARNING: Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. Always have a fire extinguisher containing foam, CO_2, gas or powder close at hand when handling or draining fuel.

7. Disconnect fuel pump multiplug.
8. Position absorbent cloth around fuel hoses to collect any fuel spillage.
9. Noting fitted position, release fuel feed and return hoses from pump.



M19 3338

10. Using tool **19-009,** loosen and remove fuel pump locking ring from tank.
11. Remove fuel pump retaining ring, release fuel pump and remove from tank. Discard fuel tank sealing ring.

Refit

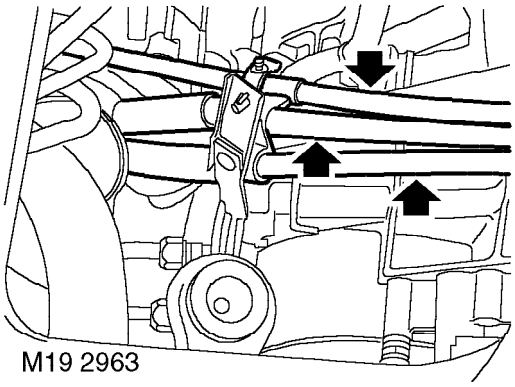
1. Clean fuel pump and mating face.
2. Fit new fuel pump seal to pump body, locate pump assembly through tank opening. Fit seal to tank, push pump fully home taking care not to dislodge the seal.
3. Fit fuel pump locking ring and using tool **19-009,** tighten to 35 Nm.
4. Connect fuel feed and return hoses to pump.
5. Connect multiplug to fuel pump.
6. Connect fuel pump breather hose and secure with clip.
7. Fit fuel pump access cover, fit and tighten bolts to 10 Nm.
8. Fit subwoofer assembly. ***See ELECTRICAL, Repairs.***
9. Fit engine cover. ***See ENGINE, Repairs.***
10. Connect battery earth lead.

FILLER NECK

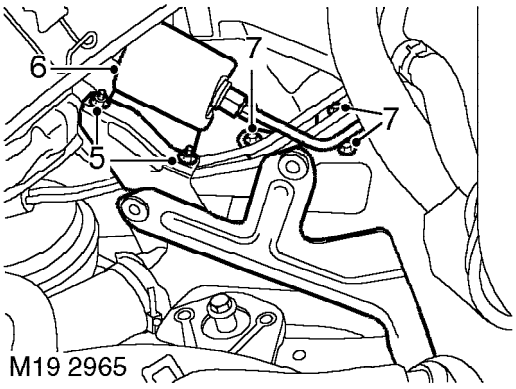
Service repair no - 19.55.07

Remove

1. Disconnect battery earth lead.
2. Remove air cleaner. ***See this section.***
3. Drain fuel tank. ***See Adjustments.***

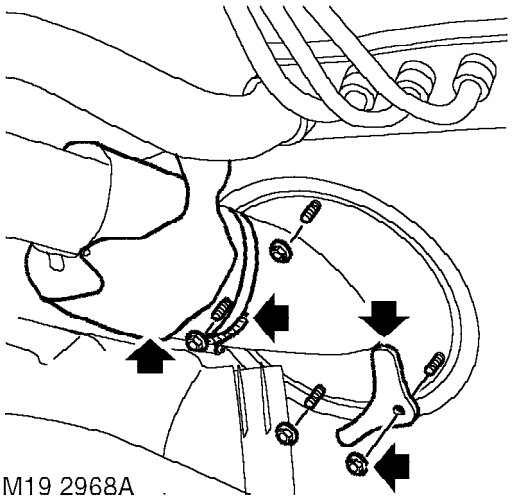

M19 2963

4. Release 3 cables from air cleaner support bracket.

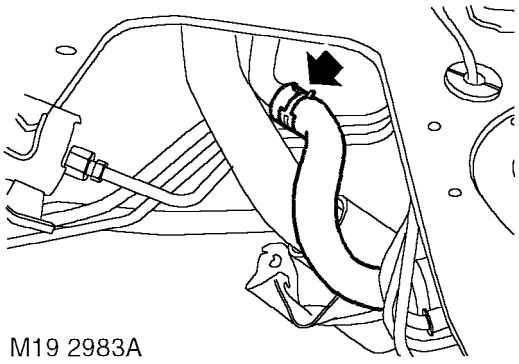


M19 2965

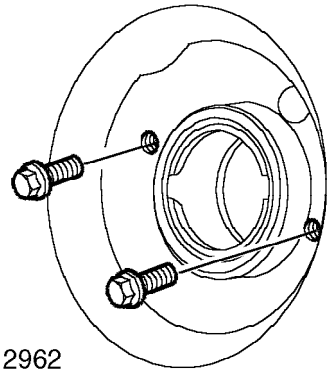
5. Remove 2 nuts securing fuel filter to air cleaner support bracket.
6. Release fuel filter from support bracket and position aside.
7. Remove 3 bolts securing air cleaner support bracket to body and remove bracket.


M19 2968A

8. Remove 4 nuts securing filler neck gaiter and collect gaiter clamp.
9. Slide gaiter up filler neck, loosen clip and release hose from filler neck.


M19 2983A

10. Release clip securing breather hose to filler neck and disconnect hose.
11. Remove fuel filler cap.


M19 2962

12. Remove 2 bolts securing filler neck to body and remove filler neck.

Refit

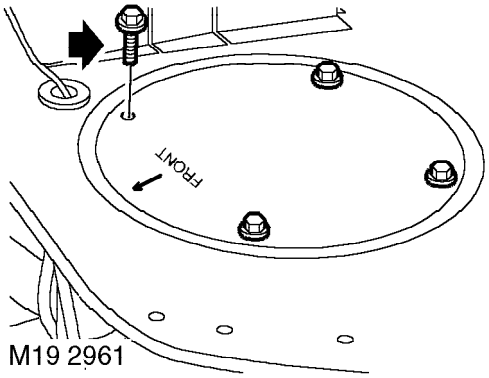
1. Position filler neck, fit and tighten 2 bolts securing neck to body.
2. Connect tank hose to filler neck and secure with clip.
3. Connect breather hose to filler neck and secure with clip.
4. Manoeuvre gaiter into position, fit clamping plate and secure with nuts.
5. Position air cleaner support bracket, fit and tighten bolts.
6. Connect cables to clips.
7. Fit fuel filter to support bracket and secure with nuts.
8. Refill fuel tank. ***See Adjustments.***
9. Fit fuel cap.
10. Fit air cleaner. ***See this section.***
11. Connect battery earth lead.

HOSE - BREATHER - TANK TO FILLER NECK

Service repair no - 19.55.14

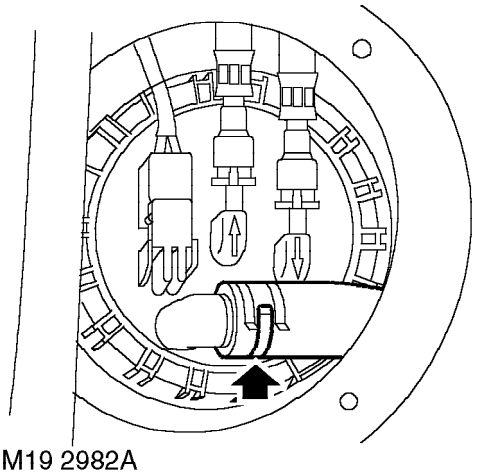
Remove

1. Disconnect battery earth lead.
2. If fitted, remove subwoofer assembly. ***See ELECTRICAL, Repairs.***
3. Remove hoodwell trim. ***See BODY, Interior trim components.***
4. Remove engine cover. ***See ENGINE, Repairs.***

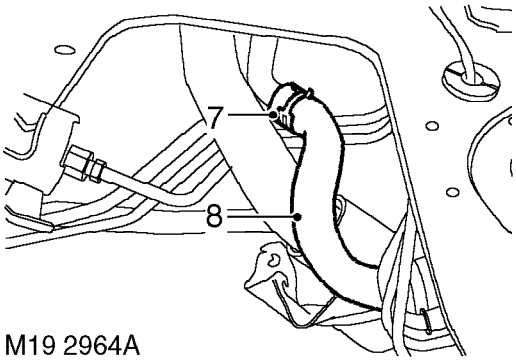


M19 2961

5. Remove 4 bolts securing fuel pump cover and remove cover.


M19 2982A

6. Release clip and disconnect breather hose from fuel pump.



M19 2964A

7. Release clip and disconnect breather hose from filler neck.
8. Remove breather hose.

Refit

1. Position hose and fit to filler neck and fuel pump.
2. Secure hose with clips.
3. Fit fuel pump cover and secure with bolts.
4. If fitted, fit subwoofer assembly. ***See ELECTRICAL, Repairs.***
5. Fit engine cover. ***See ENGINE, Repairs.***
6. Fit hoodwell trim. ***See BODY, Interior trim components.***
7. Connect battery earth lead.

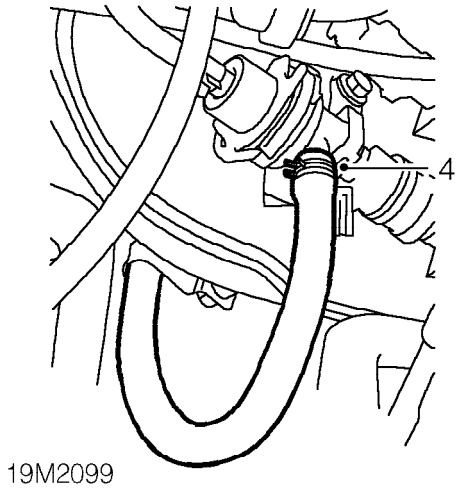
FUEL RAIL - VVC

Service repair no - 19.60.04

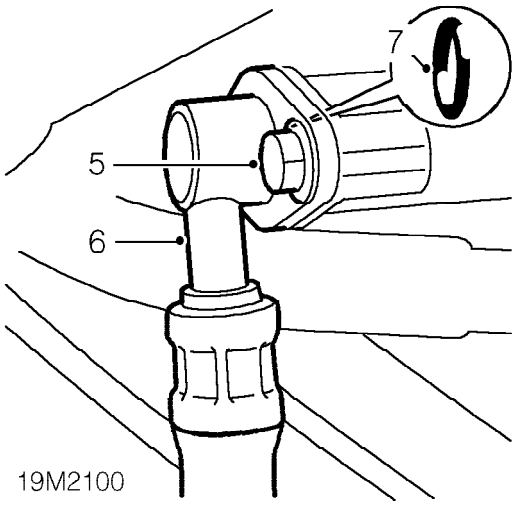
Remove

1. Disconnect battery earth lead.
2. Remove inlet manifold chamber. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
3. Position absorbent cloth around fuel filter outlet union. Slacken union to relieve fuel pressure. Retighten union to 30 Nm.

CAUTION: To prevent damage to fuel system pipes and components, use two spanners when loosening or tightening unions.

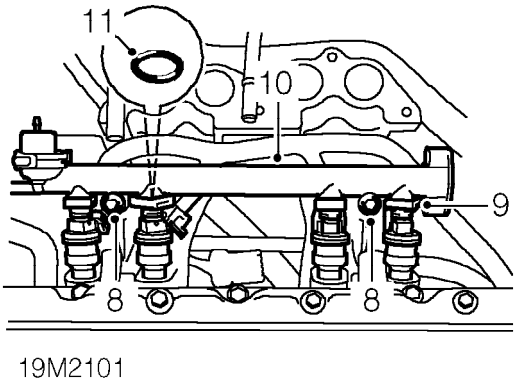


4. Release clip and release fuel return pipe from fuel rail.



5. Remove 2 bolts securing fuel feed pipe to fuel rail.
6. Release fuel feed pipe from fuel rail.
7. Remove and discard 'O' ring.

CAUTION: Always fit plugs to open connections to prevent contamination.



8. Remove 2 bolts securing fuel rail to inlet manifold.
9. Remove spring clips securing injectors to fuel rail.
10. Release fuel rail from injectors and remove.
11. Remove and discard 'O' rings from injectors.

Refit

1. Lubricate new 'O' rings with castor oil and fit to injectors.
2. Position fuel rail and fit to injectors.
3. Fit spring clips securing fuel rail to injectors.
4. Fit bolts securing fuel rail to inlet manifold and tighten to 10 Nm.
5. Connect fuel return pipe to fuel rail and secure with clip.
6. Remove plugs from fuel feed pipe and fuel rail.
7. Lubricate new 'O' ring with silicone grease and fit to fuel feed pipe.
8. Connect fuel feed pipe to fuel rail and tighten bolts to 8 Nm.
9. Fit inlet manifold chamber. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
10. Connect battery earth lead.

FUEL TANK

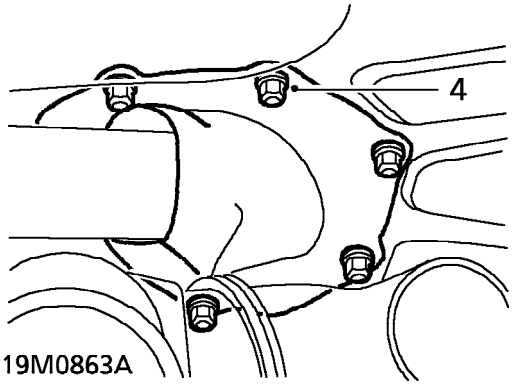
Service repair no - 19.55.01

WARNING: ***See RESTRAINT SYSTEMS, Precautions.***

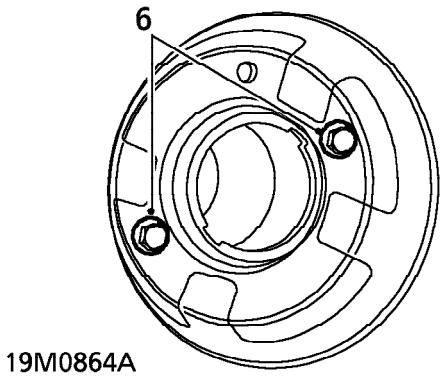
Remove

1. Make the SRS system safe. ***See RESTRAINT SYSTEMS, Precautions.***
2. Remove air cleaner. ***See this section.***
3. Drain fuel tank. ***See Adjustments.***

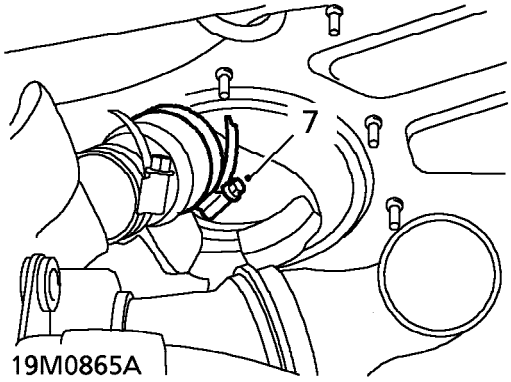
NOTE: Fuel vapour causes the fuel tank to swell, before attempting fuel tank removal ensure fuel is completely drained and the tank is left in the drained condition for at least 2 hours.



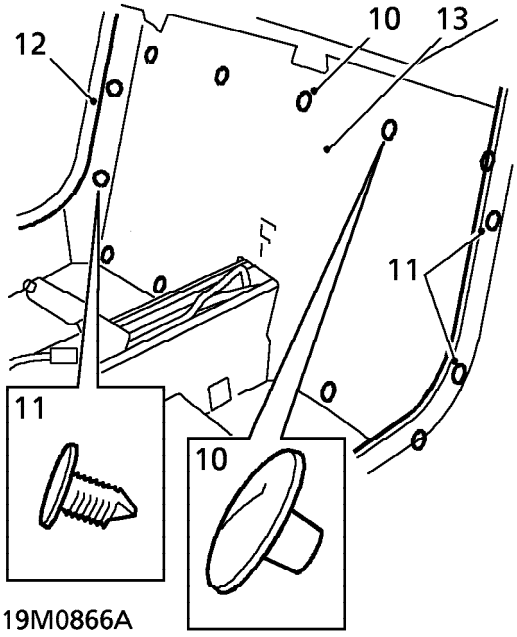
4. Remove 5 nuts securing fuel filler pipe gaiter to bulkhead.
5. Remove fuel filler cap.



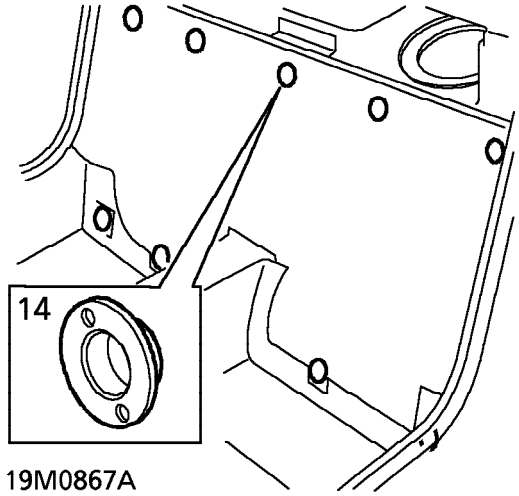
6. Loosen 2 bolts securing filler neck to rear wing.



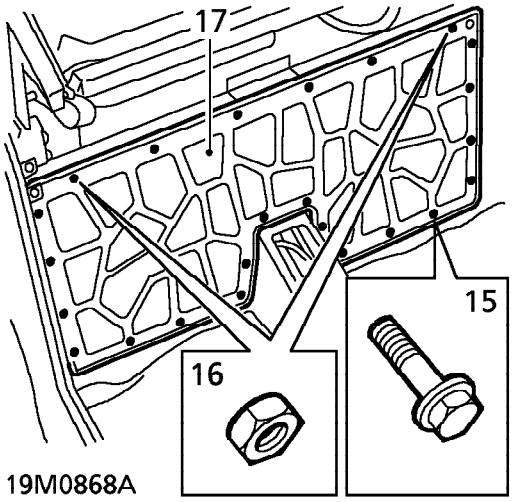
7. Release clip securing filler hose to fuel tank and position hose aside.
8. Remove front console. ***See BODY, Interior trim components.***
9. Lower hood.



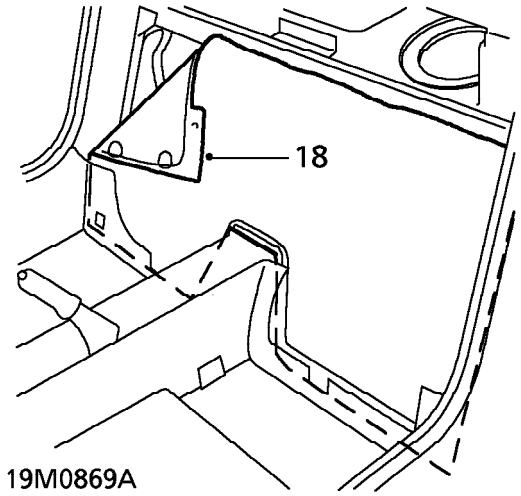
10. Remove 9 retaining studs securing carpet to rear bulkhead.
11. Remove 4 clips securing carpet to 'B' post.
12. Release carpet from door seals and velcro strips.
13. Remove carpet.



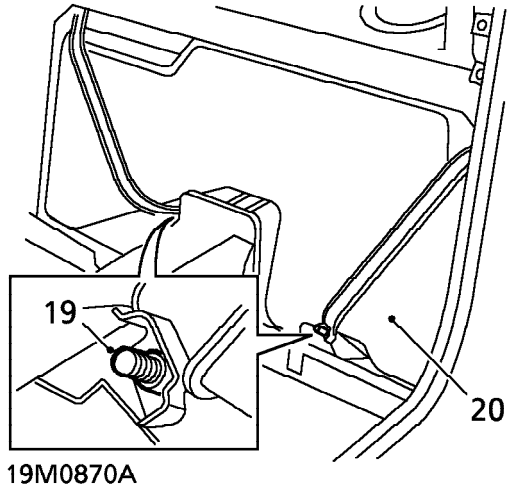
14. Remove 9 retaining studs securing felt pad to rear bulkhead and remove pad.



15. Remove 22 bolts securing closing panel to rear bulkhead.
16. Remove 2 nuts securing closing panel to rear bulkhead.
17. Remove closing panel.



18. Remove and discard plastic fuel tank sealing sheet.



19. Remove 2 nuts securing tank retaining straps to body and position aside.
20. Remove fuel tank.

Refit

1. Position fuel tank to body.
2. Align retaining straps to body and tighten nuts to 10 Nm.
3. Align new plastic sheet to bulkhead and press seal into place.
4. Fit bulkhead closing panel and tighten nuts and bolts to 9 Nm.
5. Fit felt pad and secure with studs.
6. Fit carpet and secure with studs.
7. Position carpet to velcro and behind door seal.
8. Fit front console. ***See BODY, Interior trim components.***
9. Raise rear of hood.

CAUTION: Do not use any lubricants on flexible filler hose to ease assembly.

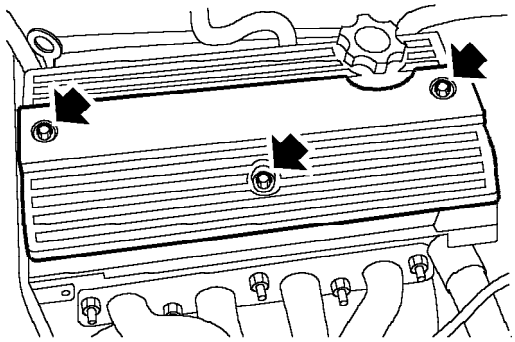
10. Position filler hose to tank and tighten clip to 3 Nm .
11. Fit bolts securing filler neck to wing and tighten to 3 Nm.
12. Fit filler cap.
13. Position filler gaiter to body studs and secure with nuts.
14. Fit air cleaner. ***See this section.***
15. Fit fuel pump. ***See this section.***

HT LEAD - SET - MPi

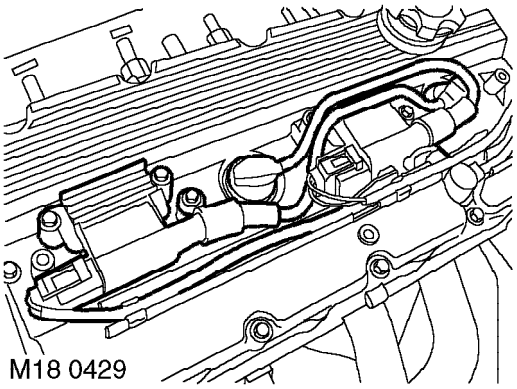
Service repair no - 18.20.11

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***


M18 0430

2. Remove screws securing coil cover and remove cover.


M18 0429

3. Disconnect ht leads from coils, release ht leads from retainers.
4. Disconnect ht leads from plugs and remove ht leads.

Refit

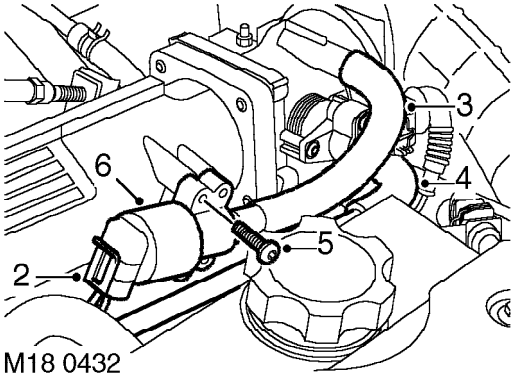
1. Connect ht leads to plugs.
2. Connect ht leads to coils and secure in retainers.
3. Fit coil cover and tighten screws to 8 Nm.
4. Fit engine cover. ***See ENGINE, Repairs.***

VALVE - IDLE AIR CONTROL (IAC) - MPi

Service repair no - 18.30.05

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



M18 0432

2. Disconnect multiplug from IAC valve.
3. Release bypass hose from IAC valve and remove from throttle body.
4. Release breather hose from throttle body and position aside.
5. Remove 4 Torx screws securing IAC valve to inlet manifold.
6. Remove IAC valve.
7. Remove and discard 'O' ring.

Refit

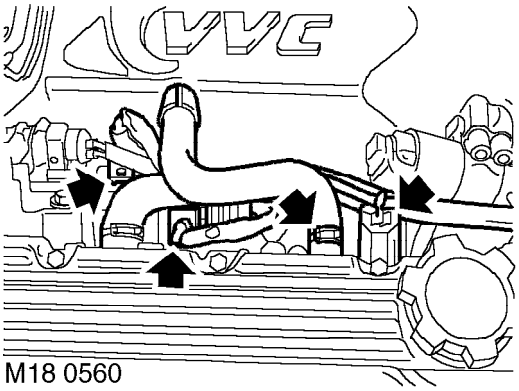
1. Clean mating faces of IAC valve and inlet manifold.
2. Lubricate new 'O' ring with silicone grease and fit to IAC valve.
3. Fit IAC valve to inlet manifold.
4. Tighten Torx screws to 1.5 Nm.
5. Connect breather hose to throttle body.
6. Connect air bypass hose to IAC valve and throttle body.
7. Connect multiplug to IAC valve.
8. Fit engine cover. ***See ENGINE, Repairs.***

HYDRAULIC CONTROL UNIT SOLENOIDS (HCU) - VVC

Service repair no - 18.30.39

Remove

1. Remove engine compartment access cover.***See ENGINE, Repairs.***
2. Disconnect battery earth lead.

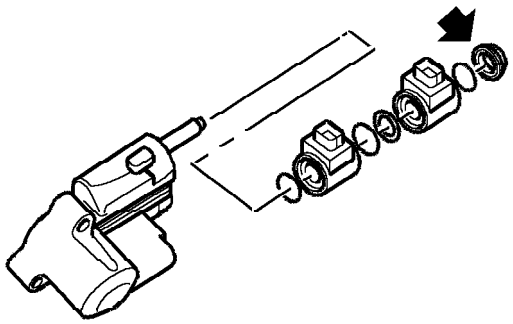


M18 0560

3. Release breather hose from inlet manifld chamber. Release clip and remove breather hose from camshaft cover.

CAUTION: Before disconnecting or removing components, ensure the immediate area around joint faces and connections are clean. Plug open connections to prevent contamination.

4. Disconnect multiplug from CMP sensor.
5. Release clip, disconnect breather hose from camshaft cover and position hose aside.
6. Disconnect multiplugs from HCU solenoids.
7. Note angle at which each solenoid is positioned relative to HCU.


M18 0561

8. Remove nut securing solenoids to HCU.
9. Remove 'O' ring.
10. Remove outer solenoid and 'O' ring.
11. Remove inner soleniod and 'O' ring.

Refit

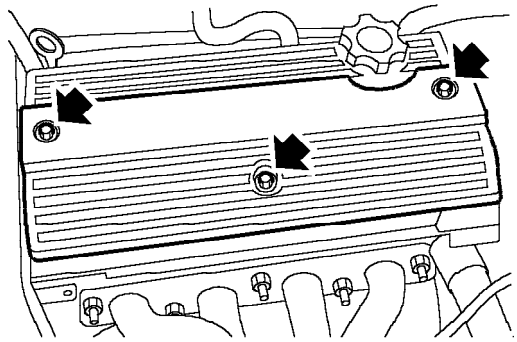
1. Clean soleniod mounting faces.
2. Fit 'O' ring to inner solenoid, fit solenoid ensuring end lettering faces away from HCU.
3. Fit 'O' ring to outer solenoid.
4. Fit outer soleniod ensuring lettering faces away from HCU, align solenoids, fit and tighten nut to 12 Nm.
5. Connect multiplugs to HCU solenoids.
6. Connect breather hose to camshaft cover and secure with clip.
7. Connect multiplug to CMP sensor.
8. Position breather hose to camshaft cover and inlet manifold chamber, secure with clip.
9. Connect battery earth lead.
10. Fit engine compartment access cover.***See ENGINE, Repairs.***

IGNITION COIL - MPi

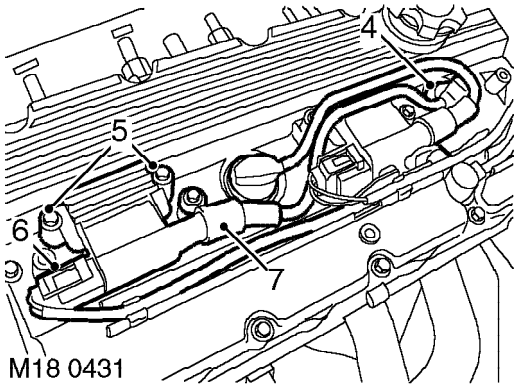
Service repair no - 18.20.44

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***


M18 0430

2. Remove 3 screws securing coil cover.
3. Remove cover.



M18 0431

4. Release ht lead from spark plug.
5. Remove 2 bolts securing coil and release coil from spark plug.
6. Disconnect multiplug from coil and remove coil.
7. Remove ht lead from coil.

Refit

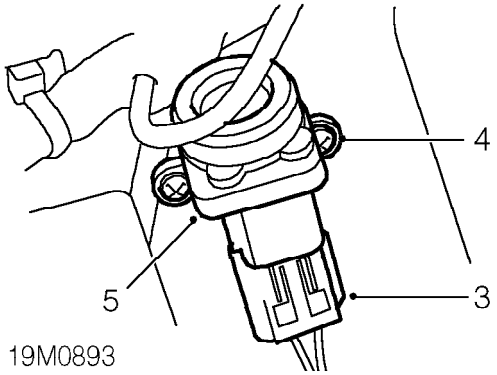
1. Fit ht lead to coil.
2. Fit coil and connect multiplug.
3. Fit and tighten bolts securing coil to 8 Nm.
4. Connect ht lead to spark plug and secure lead in clip.
5. Fit coil cover and tighten bolts to 8 Nm.
6. Fit engine cover. ***See ENGINE, Repairs.***

SWITCH - INERTIA FUEL SHUT-OFF

Service repair no - 19.22.09

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



19M0893

3. Disconnect multiplug from switch.
4. Remove 2 Torx screws securing switch to body.
5. Remove switch.

Refit

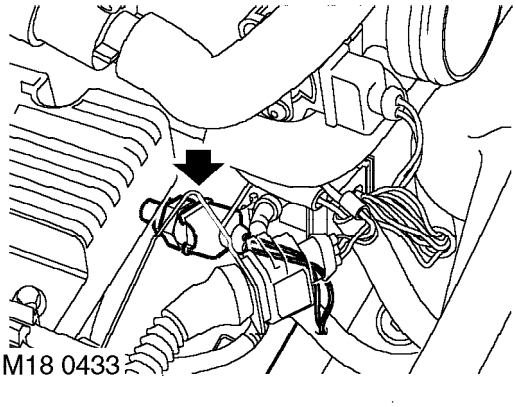
1. Fit switch and tighten screws.
2. Connect multiplug to switch.
3. To ensure switch is set in correct position, press down on top.
4. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
5. Connect battery earth lead.

SENSOR - INTAKE AIR TEMPERATURE (IAT) - MPi

Service repair no - 18.30.09

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***


M18 0433

2. Disconnect IAT sensor multiplug.
3. Loosen and remove IAT sensor.

Refit

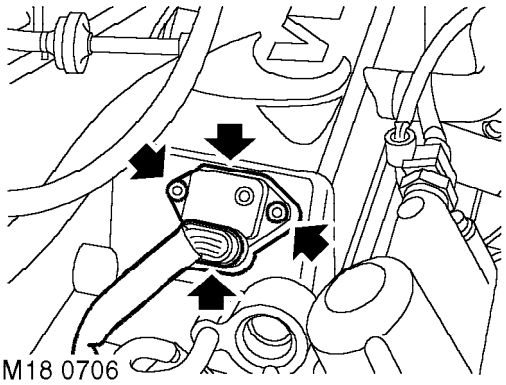
1. Fit and tighten IAT sensor.
2. Connect IAT sensor multiplug.
3. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP) - VVC

Service repair no - 18.30.56

Remove

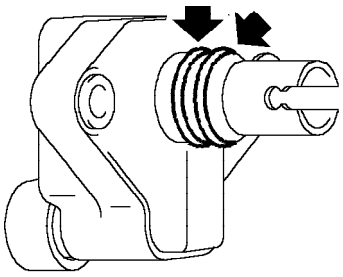
1. Disconnect battery earth lead.
2. Remove engine compartment access cover. ***See BODY, Exterior fittings.***


M18 0706

3. Disconnect MAP sensor multiplug.
4. Remove 2 Torx screws securing MAP sensor to inlet manifold.
5. Remove MAP sensor from manifold.

Refit

1. Clean MAP sensor and manifold mating faces.


M18 0707

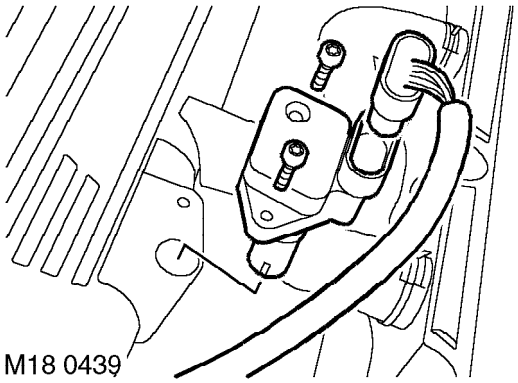
2. Ensure 2 'O' rings are fitted to sensor.
3. Fit sensor to manifold and tighten Torx screws to 3 Nm.
4. Connect multiplug to MAP sensor.
5. Fit engine compartment access cover. ***See BODY, Exterior fittings.***
6. Connect battery earth lead.

SENSOR - MANIFOLD ABSOLUTE PRESSURE (MAP) - MPi

Service repair no - 18.30.56

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



2. Disconnect MAP sensor multiplug.
3. Remove 2 Torx screws securing MAP sensor to inlet manifold.
4. Remove MAP sensor from manifold.

Refit

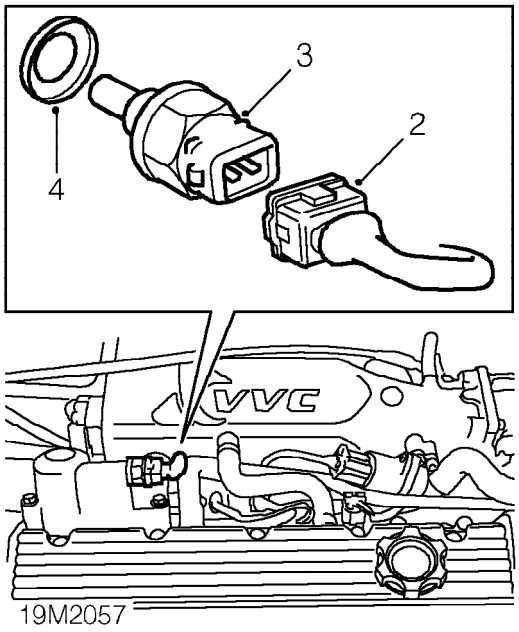
1. Clean MAP sensor and manifold mating faces.
2. Fit MAP sensor to inlet manifold, fit and tighten Torx screws.
3. Connect MAP sensor multiplug.
4. Fit engine cover. ***See ENGINE, Repairs.***

SENSOR - OIL TEMPERATURE - VVC

Service repair no - 18.30.41

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



2. Disconnect multiplug from oil temperature sensor.
3. Remove temperature sensor from hydraulic control unit.
4. Remove and discard seal.

Refit

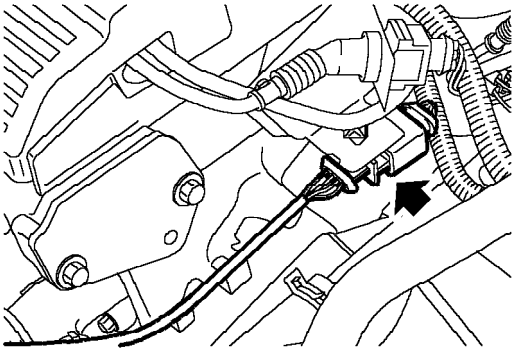
1. Clean sealing faces of sensor and hydraulic control unit.
2. Fit seal to sensor.
3. Fit sensor and tighten to 15 Nm.
4. Connect multiplug.
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

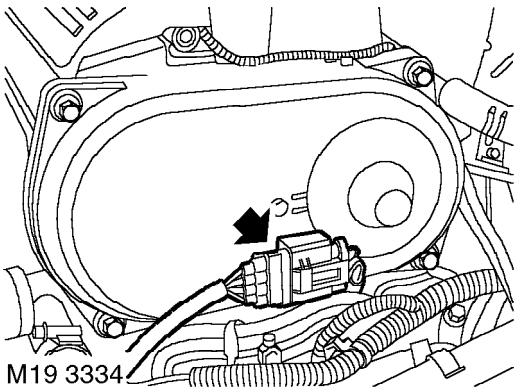
SENSOR - HEATED OXYGEN (HO_2S) - PRE CAT

Service repair no - 19.22.16

Remove

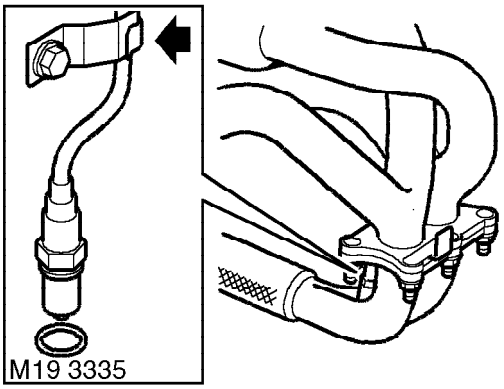
1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***





3. Rotate HO_2S sensor multiplug through 90° to release from mounting.
4. Disconnect HO_2S sensor multiplug from harness.
5. Raise rear of vehicle.

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



6. Remove HO_2S sensor lead from clip.
7. Using a 22 mm crows foot spanner, remove HO_2S sensor.

Refit

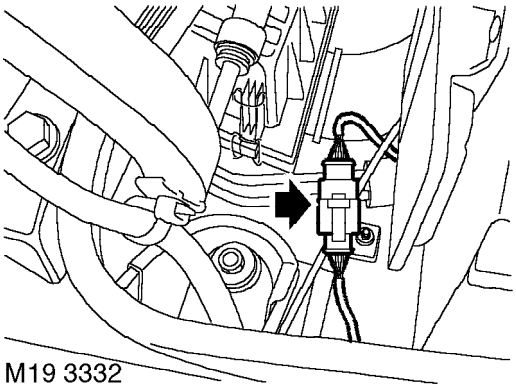
1. Fit HO_2S sensor and tighten to 55 Nm.
2. Fit HO_2S sensor lead to clip.
3. Connect multiplug and secure to mounting.
4. Fit engine cover. ***See ENGINE, Repairs.***
5. Remove stands and lower vehicle.
6. Connect battery earth lead.

SENSOR - HEATED OXYGEN (HO2S) - POST CAT

Service repair no - 19.22.71

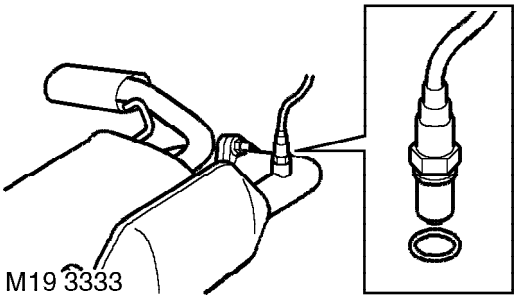
Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access cover. ***See BODY, Exterior fittings.***


M19 3332

3. Release HO_2S sensor multiplug from bracket and disconnect from harness.
4. Raise rear of vehicle.

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


M19 3333

5. Remove HO_2S sensor.

Refit

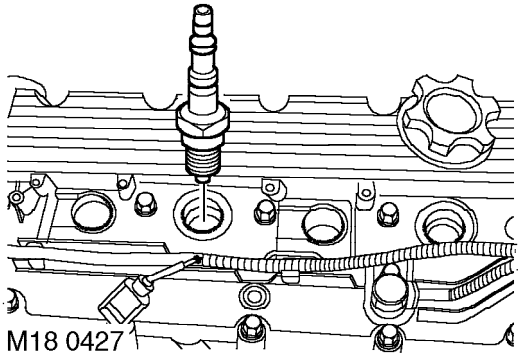
1. Fit HO_2S sensor and tighten to 55 Nm.
2. Connect and secure HO_2S sensor multiplug.
3. Fit engine compartment access cover. ***See BODY, Exterior fittings.***
4. Remove stands and lower vehicle.
5. Connect battery earth lead.

SPARK PLUGS

Service repair no - 18.20.02

Remove

1. Remove coils. ***See this section.***
2. Clean area around spark plugs.


M18 0427

3. Using a 16 mm spark plug socket remove 4 spark plugs.

Refit

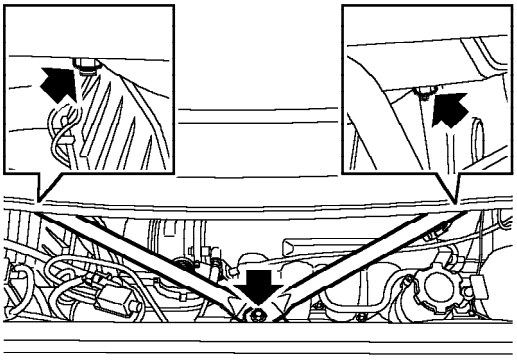
1. Fit terminals to new spark plugs.
2. Set gap of each new spark plug to 1.00 ± 0.05 mm.
3. Fit spark plugs and tighten to 27 Nm.
4. Refit coils. ***See this section.***

THROTTLE HOUSING - (INCLUDES TUNING)

Service repair no - 19.22.45

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel.***See BODY, Repairs.***

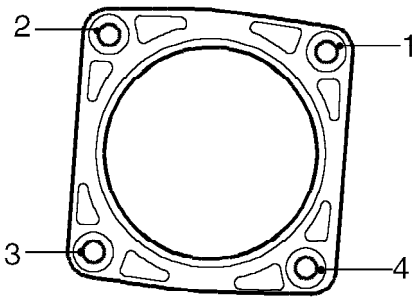


SP12 0363

3. Remove nuts securing cross bracing, remove and discard bolt securing cross bracing and remove cross bracing.
4. Release clips securing air intake hose and disconnect air intake hose from throttle housing and air cleaner, remove air intake hose.
5. Disconnect Idle Air Control valve hose from throttle housing.
6. Disconnect multiplug from throttle position sensor.
7. Release clip and disconnect breather hose from throttle housing.
8. Release throttle cable adjusting nut from abutment bracket.
9. Release throttle cable from cam.
10. Remove 4 bolts securing throttle housing to inlet manifold.
11. Remove throttle housing and position harness mounting bracket aside.
12. Remove and discard throttle housing 'O' ring.

Refit

1. Clean throttle housing and inlet manifold mating faces.
2. Lubricate new 'O' ring with silicone grease and fit to throttle housing.
3. Position throttle housing to inlet manifold, align harness bracket and fit bolts finger tight.



M19 3083

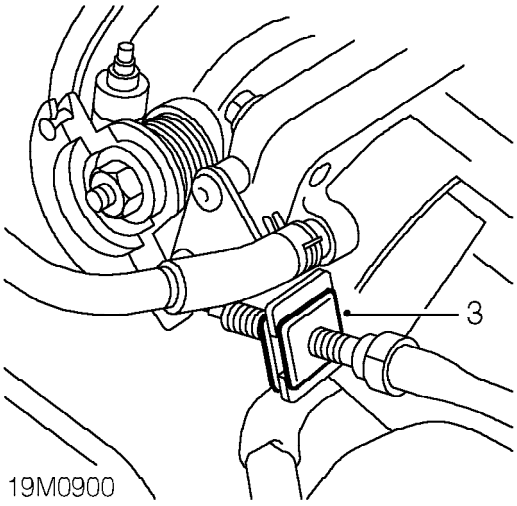
4. Tighten bolts in the sequence shown using the following procedure. 1. Tighten to 4 Nm. 2. Back off 1 flat. 3. Tighten to 9 Nm.
5. Connect throttle cable to throttle cam and abutment bracket.
6. Connect breather hose to throttle housing and secure clip.
7. Connect multiplug to throttle position sensor.
8. Connect Idle Air Control valve hose to throttle housing.
9. Adjust throttle cable.
10. Connect air intake hose to throttle housing and air cleaner and secure clips.
11. Position cross bracing, fit nuts and new bolt and tighten to 25 Nm.
12. Connect battery earth lead.
13. Retune using TestBook.
14. Fit engine compartment access panel.***See BODY, Repairs.***

THROTTLE CABLE

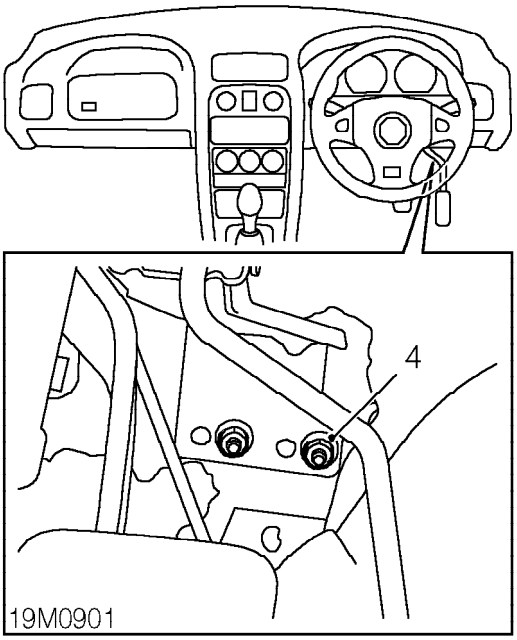
Service repair no - 19.20.06

Remove

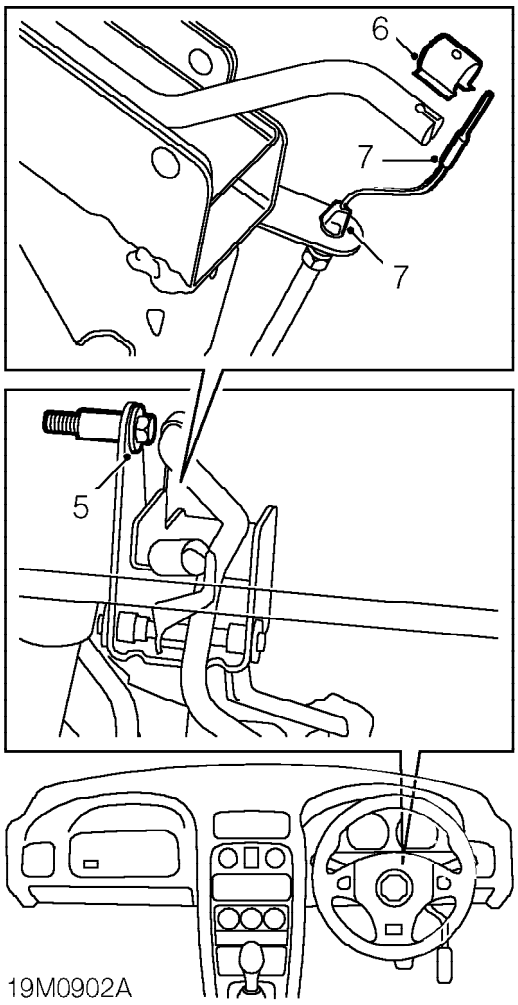
1. Remove engine cover. ***See ENGINE, Repairs.***
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



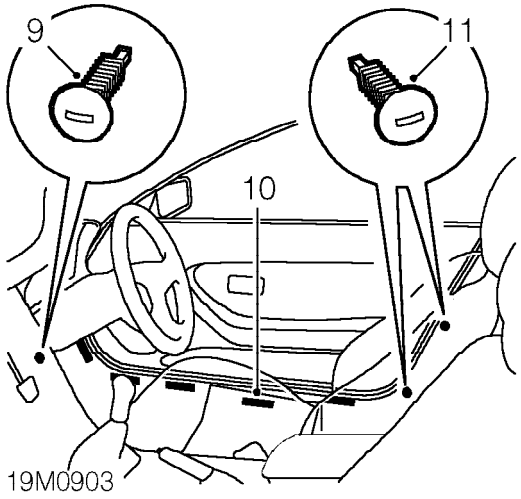
3. Disconnect throttle cable abutment from throttle bracket.



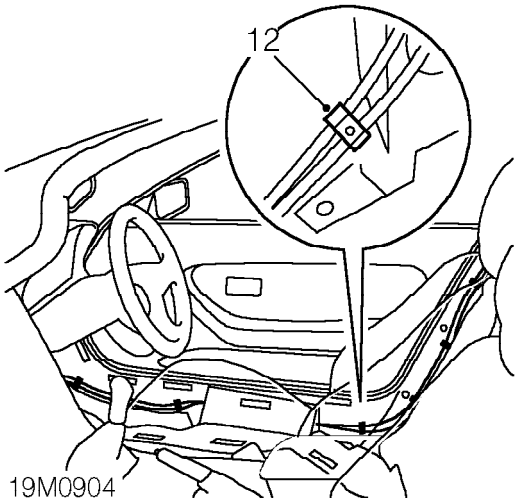
4. Remove 2 nuts securing throttle pedal bracket to bulkhead.



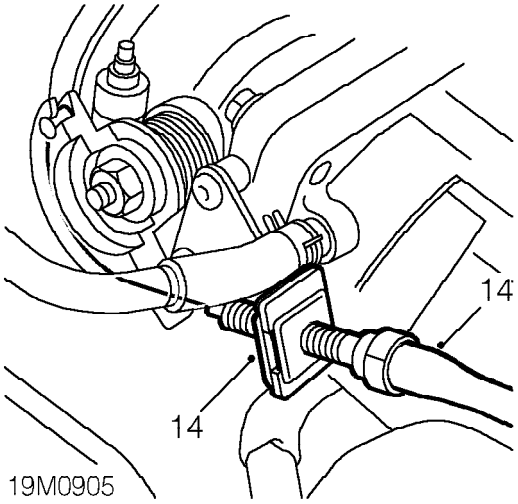
5. Remove bolt securing throttle pedal bracket to pedal box and collect spacer.
6. Position throttle pedal assembly and remove cable retaining clip.
7. Release cable nipple and abutment from throttle pedal.
8. Collect rubber washer.



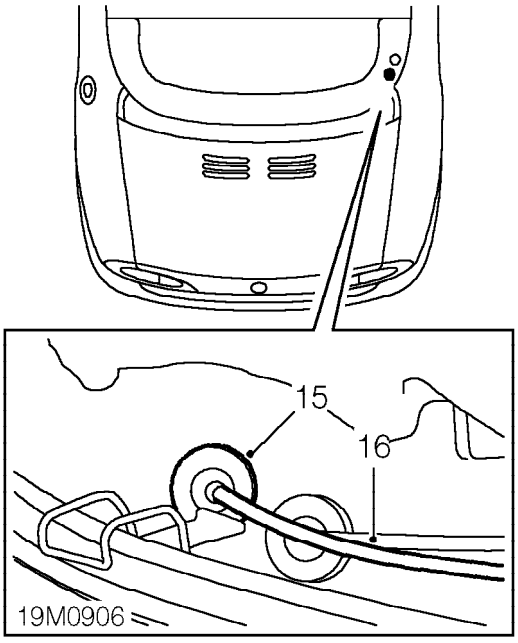
9. Remove stud securing carpet to inner wheel arch.
10. Release carpet from door seal and 5 velcro strips.
11. Remove 2 studs securing carpet to 'B' post and release carpet from door seal and velcro to reveal cables.



12. Release cable from 3 sill clips and 3 'B' post clips.
13. Release cable from floorpan crossmember.



14. Release throttle cable from throttle body abutment and cam and position aside.



15. Position hoodwell insulation aside and release cable grommet from hoodwell.
16. Remove throttle cable.

Refit

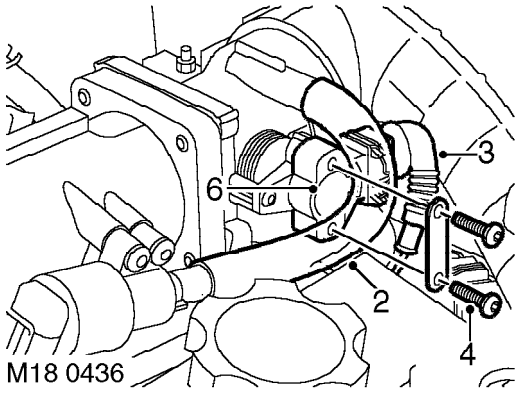
1. Feed cable through hoodwell panel and secure throttle cable to throttle body cam.
2. Engage grommet to hoodwell.
3. Position cable to 'B' post and sill and engage clips.
4. Position cable under insulation.
5. Fit rubber washer to cable abutment.
6. Fit cable abutment to throttle pedal bracket and engage cable nipple to pedal.
7. Fit cable retaining clip to pedal.
8. Align throttle pedal to bulkhead fixings and tighten nuts to 6 Nm.
9. Position harness clip to stud and secure with nut.
10. Fit bolt and spacer and tighten to 22 Nm.
11. Position carpets and secure with studs and velcro.
12. Position carpet beneath door seal.
13. Adjust cable length and fit cable abutment to throttle body.
14. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
15. Fit engine cover. ***See ENGINE, Repairs.***

SENSOR - THROTTLE POSITION (TP)

Service repair no - 18.30.17

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



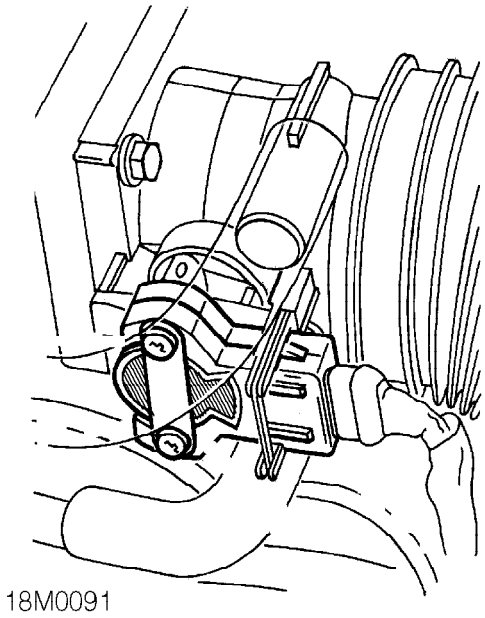
2. Release air bypass hose from IAC valve and remove from throttle body.
3. Disconnect multiplug from TP sensor.
4. Remove and discard 2 Torx screws and wave washers securing TP sensor to inlet manifold.
5. Remove TP sensor specification plate.
6. Pull TP sensor from throttle spindle.

CAUTION: DO NOT twist or apply leverage to TP sensor.

Refit

1. Clean mating faces of throttle housing and TP sensor.
2. Fit TP sensor to throttle spindle. Ensure that during fitting the machined flat on the throttle spindle is aligned with the mating portion of the TP sensor.

CAUTION: The TP sensor can easily be damaged during fitting. When pressing the sensor onto throttle spindle, use fingers only and apply pressure only to the area shown shaded in the illustration.


18M0091

3. Rotate TP sensor in an anti-clockwise direction to align fixing holes.

CAUTION: Do not rotate TP sensor in a clockwise direction and ensure that it is not rotated beyond it's internal stops.

4. Fit TP sensor specification plate.
5. Fit new Torx screws and wave washers, tighten Torx screws to 1.5 Nm.

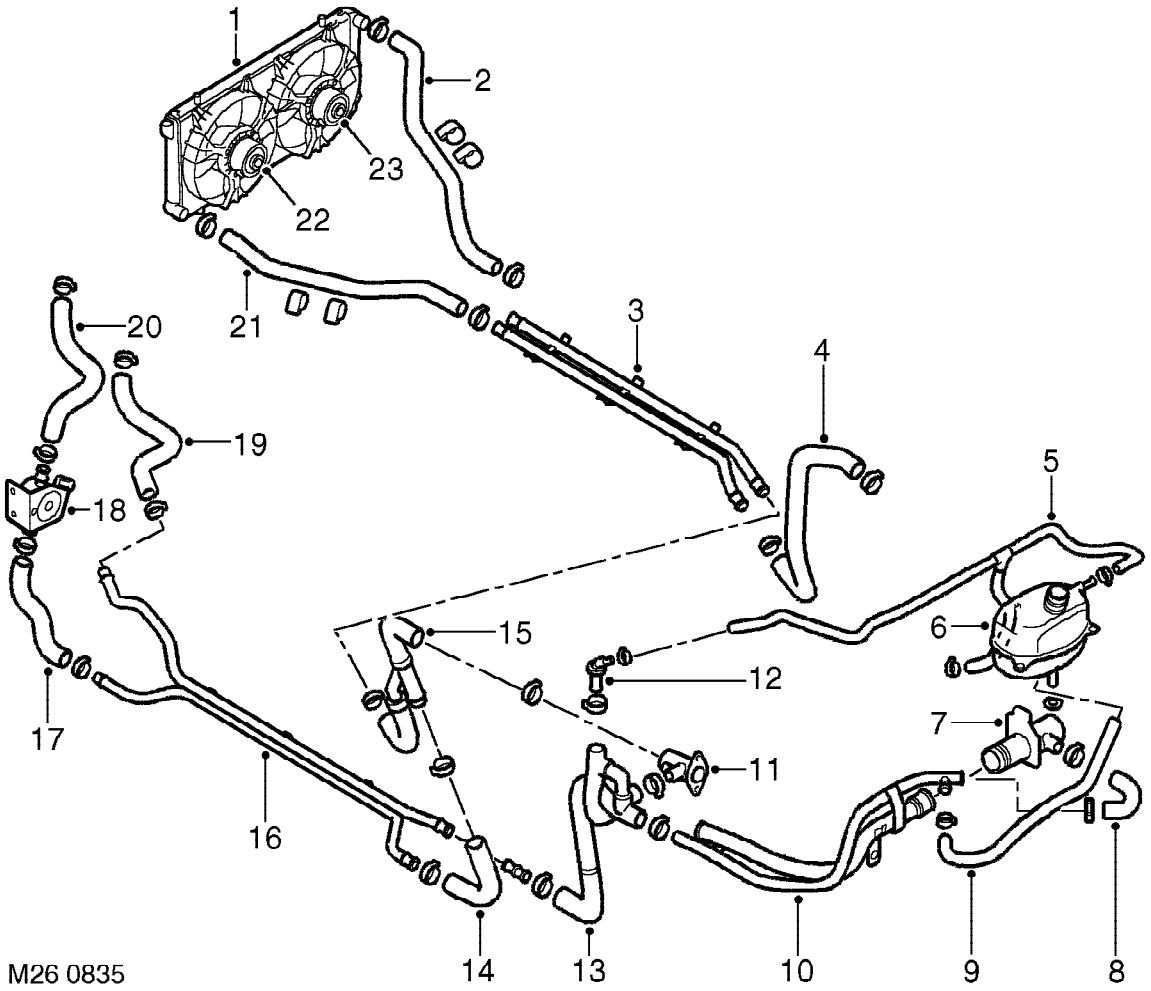
CAUTION: Do not exceed specified torque figure.

6. Connect multiplug to TP sensor.
7. Operate throttle cable cam 2 or 3 times and ensure that full travel to the throttle open and the throttle closed positions is available.
8. Fit air bypass hose to IAC valve and connect to throttle body.
9. Fit engine cover. ***See ENGINE, Repairs.***

NOTE: A 'throttle initialisation' procedure MUST be carried out using Testbook whenever the TP sensor is removed or renewed.

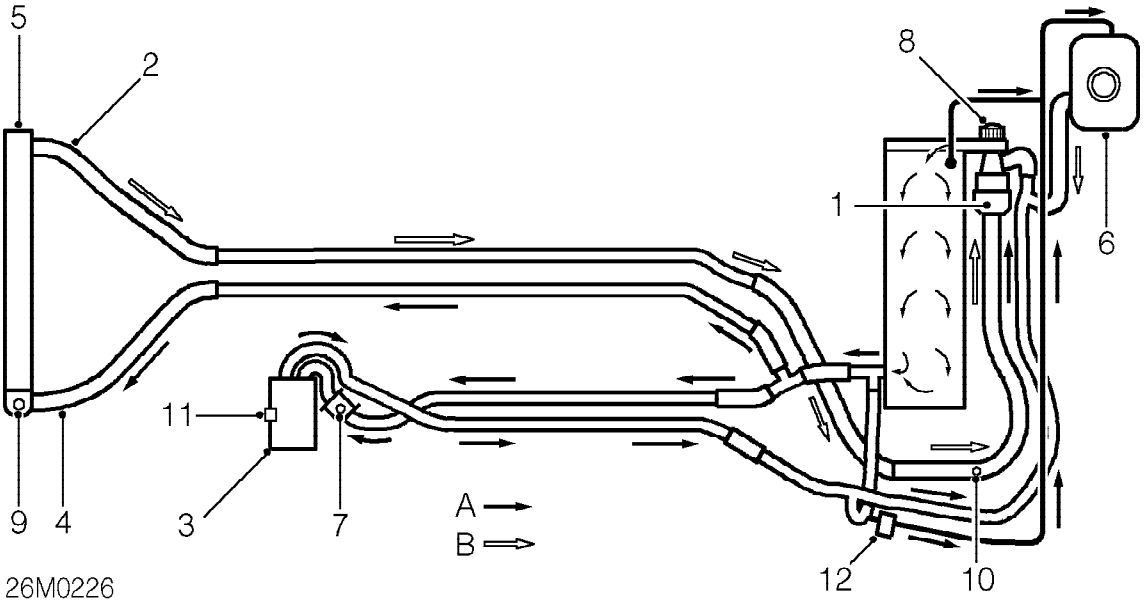
CONTENTS

COOLING SYSTEM COMPONENTS



1. Radiator
2. Hose - radiator top
3. Pipe assembly - underfloor
4. Hose - engine inlet
5. Hose - bleed line
6. Expansion tank
7. Adaptor
8. Hose - engine rail to thermostat housing
9. Hose - expansion tank to engine rail
10. Pipe assembly - engine rail/engine inlet
11. Adaptor
12. Jiggle valve
13. Hose assembly - bypass/heater return
14. Hose - engine outlet hose to heater feed pipe
15. Hose - engine outlet
16. Pipe assembly - heater feed and return
17. Hose - heater feed pipe to control valve
18. Control valve
19. Hose - heater matrix to heater return pipe
20. Hose - control valve to heater matrix
21. Hose - radiator bottom
22. Fan - radiator cooling
23. Fan - air conditioning vehicles only

COOLING SYSTEM OPERATION



A = HOT
B = COLD

1. Thermostat
2. Radiator top hose
3. Heater matrix
4. Radiator bottom hose
5. Radiator
6. Expansion tank
7. Heater valve
8. Water pump
9. Bleed screw
10. Bleed nipple
11. Bleed screw
12. Jiggle valve

The cooling system employed is the by-pass type, allowing coolant to circulate around the engine while the thermostat is closed. This prevents temperature build up in the cylinder head prior to the thermostat opening.

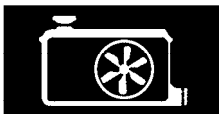
The siting of the thermostat in the inlet, rather than the outlet side of the system, provides a more stable control of coolant temperature in the engine.

When cold, the thermostat closes off the coolant feed from the radiator outlet. Coolant is able to circulate through the bypass and heater circuits, returning back to the engine via the thermostat bulb.

As temperature increases the thermostat gradually opens, bleeding cool fluid into the cylinder block and allowing hot coolant to flow to the radiator, balancing the flow of hot and cold fluid to maintain temperature. As the thermostat opens further, so the full flow of coolant passes through the radiator.

Any excess coolant created by heat expansion is returned to the expansion tank via the bleed line. A jiggle valve fitted at the start of the bleed line, prevents pressure build-up in the expansion tank by regulating the amount of returning coolant.

The coolant circulating pump is a rotor type drawing coolant directly from the thermostat, the pump is driven by a geared pulley from the camshaft timing belt.



The radiator positioned at the front of the vehicle, is a copper/brass cross - flow type with moulded plastic end tanks. The radiator is mounted in rubber bushes; the bottom of the radiator is located in the front body member, and the top is located in the bonnet locking platform. The hoses connecting the radiator to the engine run underneath the vehicle. Three bleed points are provided for bleeding the system.

For additional air flow through the radiator matrix, usually operational when the vehicle is stationary, an electric cooling fan is fitted to the rear of the radiator. The temperature of the cooling system is monitored by the ECM via signals from an engine coolant temperature sensor, which is mounted in the cylinder block, outlet elbow. When a temperature of 102°C is reached the ECM switches the fan on via a relay. The fan switches off at 96°C.

Vehicles fitted with air conditioning have 2 fans. These operate either in series or parallel according to engine coolant temperature or air conditioning requirements.

The ECM disengages the compressor's clutch when the coolant temperature exceeds 117 °C and re-engages when the coolant temperature drops below 112 °C.

ENGINE COMPARTMENT COOLING - Air cooling system.

In addition to the normal water cooling system an air cooling system is provided for the engine compartment. This is achieved by a fan mounted in the right hand side intake ducting, blowing cool air over the engine.

The temperature of the engine compartment is monitored by the ECM via signals from an ambient air temperature sensor. The sensor is mounted on the engine compartment header panel, directly above the inlet manifold.

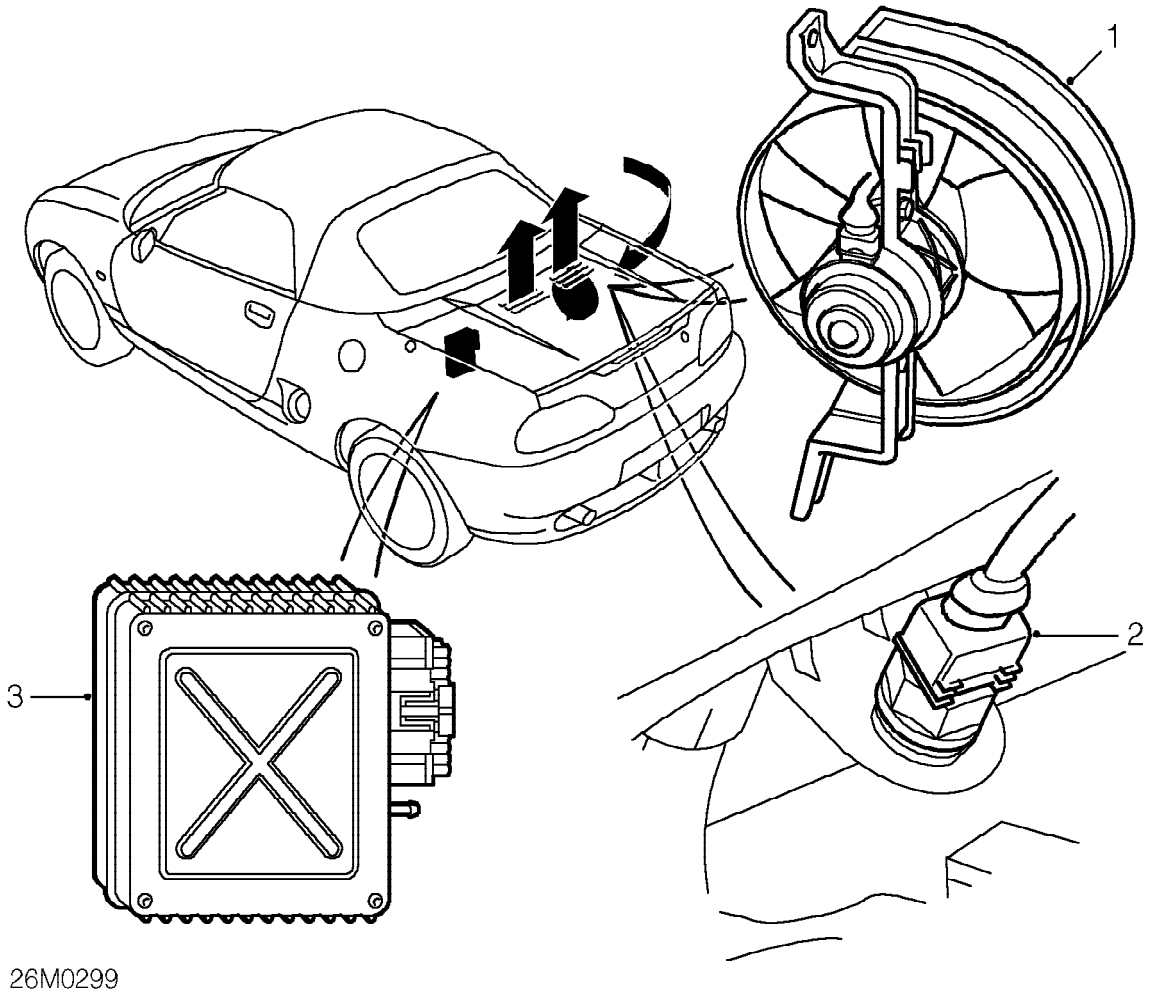
When a temperature of 75°C (85°C)* is reached in the engine compartment the ECM switches the fan on via a relay.

The engine compartment fan is controlled by a timer and will operate for three minutes. However, if a temperature of 65°C (75°C)* is reached before the pre-set time has elapsed the fan will switch off automatically.

If the engine compartment temperature rises to 130°C, the ECM will illuminate the engine compartment warning light in the instrument panel. This will warn the driver of abnormal engine compartment temperature or that a fault exists in the system. When the temperature drops below 110°C the warning light will extinguish.

The fan will operate for up to eight minutes after the ignition has been switched off to attain the required engine compartment temperature.

*** VVC temperatures are shown in brackets.**



26M0299

1. Engine compartment cooling fan
2. Ambient air temperature sensor
3. ECM

DRAIN AND REFILL

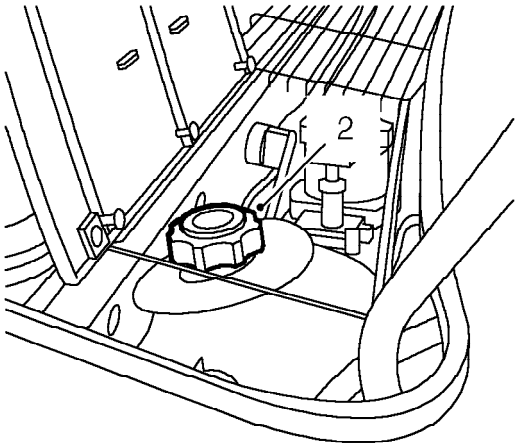
Service repair no - 26.10.01

Drain

WARNING: Do not remove expansion tank filler cap when the engine is hot. The cooling system is pressurised, accidental scalding could result.

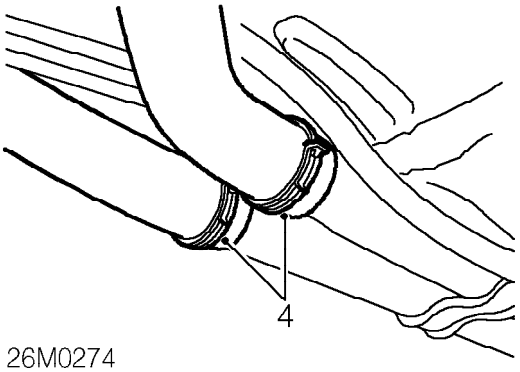
CAUTION: Any coolant spilt on the vehicle's body must be washed off immediately to prevent damage to the paint work.

1. Position heater temperature control to maximum heat position.



26M0273

2. Remove expansion tank filler cap.
3. Position container to collect coolant.



26M0274

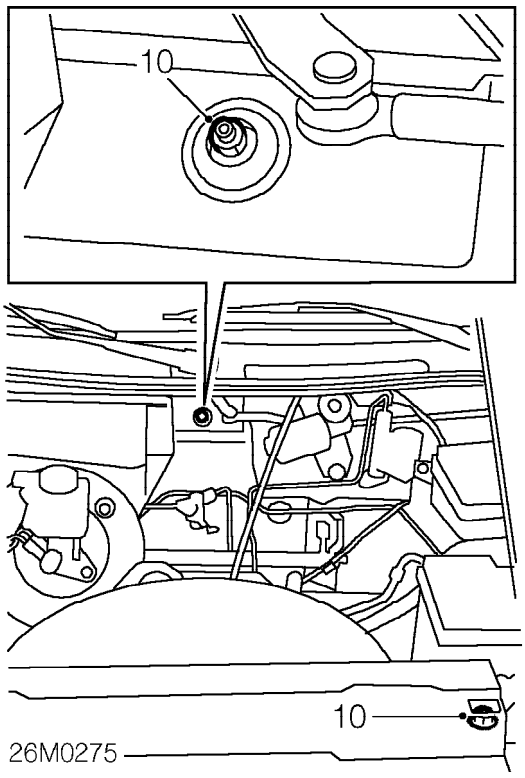
4. Release clip and disconnect coolant hoses at rear of under floor coolant rail.
5. Allow cooling system to drain.

Refill

6. Flush system with water under low pressure.

CAUTION: High pressure water could damage the radiator.

7. Connect coolant hoses at the rear of the underfloor coolant rail, secure with clips.
8. Prepare coolant to the required concentration. ***See INFORMATION, Capacities, fluids and lubricants.***
9. Turn heater temperature control to maximum heat position.



10. Remove bleed screw from radiator, and open heater bleed nipple.
11. Fill the system with coolant.

NOTE: To prevent introducing air into the system, keep the expansion tank filled.

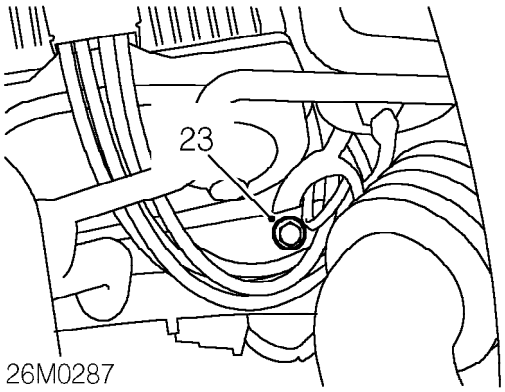
12. When a constant flow of coolant is being emitted from both bleed points, close bleed points and tighten to:
    Radiator bleed screw 5 Nm ,
    Heater bleed screw 7 Nm .
13. Fill expansion tank to the brim.
14. Fit expansion tank filler cap and start the engine.
15. Run the engine until the radiator cooling fan operates.

NOTE: DO NOT operate the air conditioning (if fitted).

16. Check the cooling system for leaks, and that the heater is emitting heat.
    If the heater is **NOT** emitting heat, see **Additional bleed.**
17. Switch off engine and allow to cool.
18. Check level of coolant, top-up to 'MAX' mark on expansion tank if necessary.

Additional bleed

19. Allow engine to cool.
20. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
21. Release clip and remove inlet air hose from throttle housing.
22. Top-up the expansion tank with coolant.



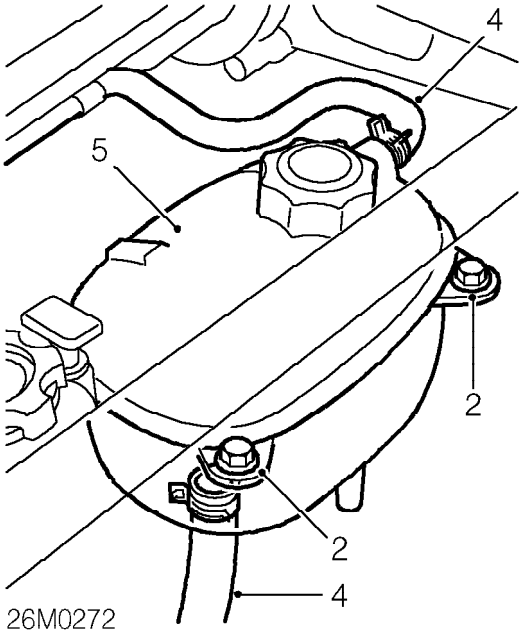
23. Remove bleed screw from radiator return rail.
24. When a constant flow of coolant is being emitted from bleed point, fit bleed screw and tighten to 9 Nm.
25. Fit inlet hose to throttle housing and secure with clip.
26. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
27. Check level of coolant, top-up to 'MAX' mark on expansion tank if necessary.

EXPANSION TANK

Service repair no - 26.15.01

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



26M0272

2. Remove 2 bolts securing tank to body.
3. Position container to catch spillage.
4. Release 2 hoses from tank and allow to drain.
5. Remove expansion tank.

Refit

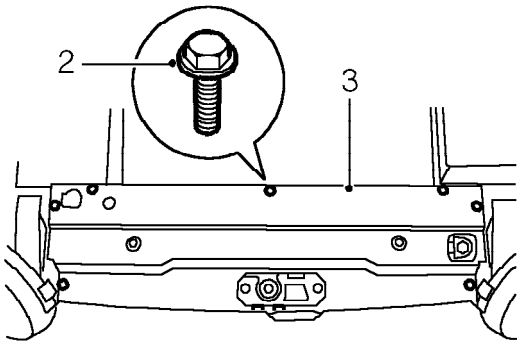
1. Fit tank.
2. Connect coolant hoses to tank and secure clips.
3. Position tank to body, fit and tighten bolts to 5 Nm.
4. Top-up cooling system. ***See MAINTENANCE.***
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

RADIATOR FAN AND MOTOR

Service repair no - 26.25.23

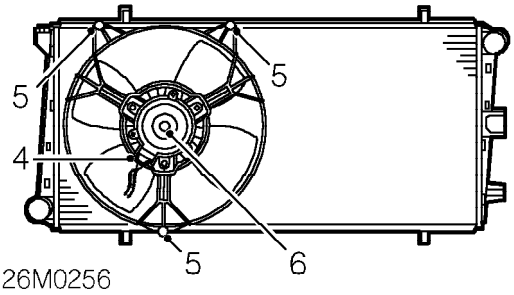
Remove

1. Remove front bumper valance. ***See BODY, Exterior fittings.***



26M0255

2. Remove 9 bolts securing bonnet locking panel.
3. Position panel aside.



26M0256

4. Disconnect multiplug from fan.
5. Remove 3 nuts securing fan cowl to radiator.
6. Remove fan assembly.

Refit

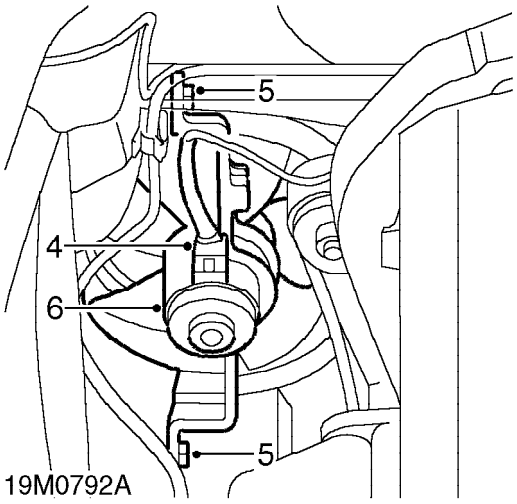
1. Fit fan assembly and tighten nuts to 3 Nm.
2. Connect multiplug.
3. Position bonnet locking panel and tighten bolts to 10 Nm.
4. Fit front bumper valance. ***See BODY, Exterior fittings.***

ENGINE COMPARTMENT COOLING FAN

Service repair no - 26.25.39
Service repair no - 26.25.39/20 A/C fitted

Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***
3. **Models with A/C:** Remove alternator. ***See ELECTRICAL, Repairs.***



4. Disconnect multiplug from motor.
5. Remove 2 nuts securing fan assembly to body.
6. Remove fan assembly.

Refit

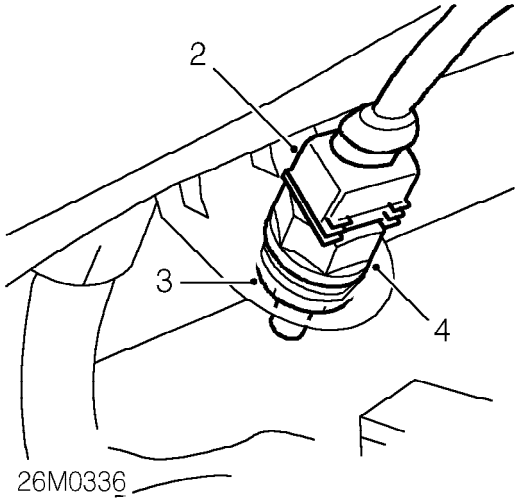
1. Fit fan assembly and tighten nuts to 9 Nm.
2. Connect multiplug.
3. **Models with A/C:** Fit alternator. ***See ELECTRICAL, Repairs.***
4. Fit engine cover. ***See ENGINE, Repairs.***
5. Connect battery earth lead.

ENGINE COMPARTMENT AMBIENT AIR TEMPERATURE (AAT) SENSOR

Service repair no - 26.25.40

Remove

1. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



2. Disconnect AAT sensor multiplug.
3. Remove nut securing AAT sensor to bracket.
4. Remove AAT sensor.

Refit

1. Fit AAT sensor and secure with nut.
2. Connect multiplug.
3. Fit engine compartment access panel. ***See BODY, Exterior fittings.*** **compartment**

RADIATOR

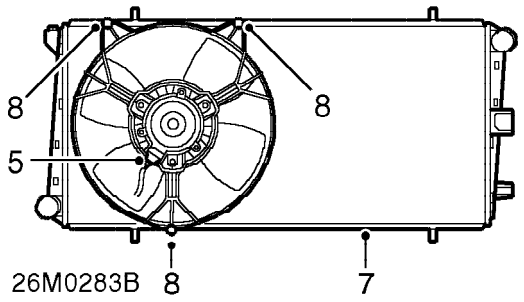
Service repair no - 26.40.01
Service repair no - 26.40.01/20 A/C fitted

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove bonnet locking platform. ***See BODY, Exterior fittings.***
3. Drain cooling system. ***See Adjustments.***
4. Release clips securing top and bottom hoses to radiator and remove hoses.



5. Disconnect multiplug from fan.
6. **Models with A/C:** Disconnect multiplugs from fans.
7. **All models:** Remove radiator assembly.
8. Remove 3 nuts securing fan to radiator and remove fan.
9. **Models with A/C:** Remove 6 nuts securing fans to radiator and remove fans.

Refit

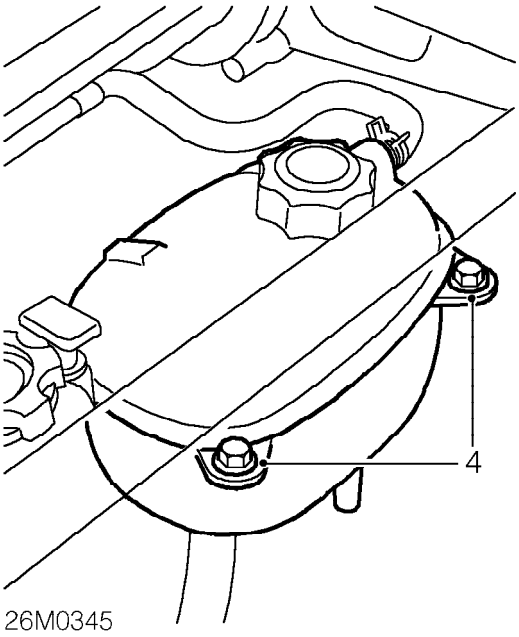
1. Fit fan/s to radiator and tighten nuts to 3 Nm.
2. Fit radiator to lower grommets.
3. Fit coolant hoses to radiator and secure with clips.
4. Connect multiplug.
5. **Models with A/C:** Connect multiplugs to fans.
6. Refill cooling system. ***See Adjustments.***
7. Fit bonnet locking platform. ***See BODY, Exterior fittings.***
8. Remove stand(s) and lower vehicle.

THERMOSTAT - VVC

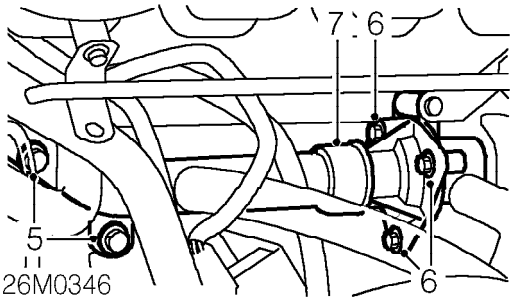
Service repair no - 26.45.09

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
3. Drain cooling system. ***See Adjustments.***



4. Remove 2 bolts securing expansion tank and position tank aside.



5. Remove 2 bolts securing coolant rail to cylinder block.
6. Remove 3 bolts securing thermostat housing cover.
7. Position coolant rail aside and remove thermostat.

Refit

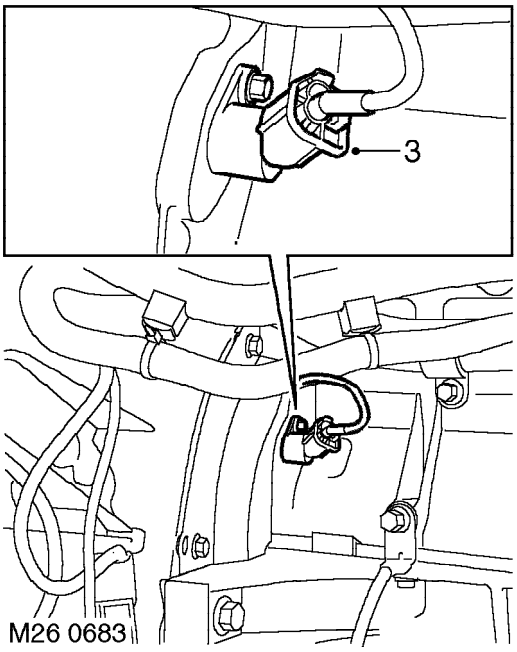
1. Clean sealing faces.
2. Fit thermostat.
3. Position housing and tighten bolts to 9 Nm.
4. Position coolant rail and tighten bolts to 9 Nm.
5. Position expansion tank, fit and tighten bolts to 5 Nm.
6. Connect battery earth lead.
7. Refill cooling system. ***See Adjustments.***
8. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

THERMOSTAT - MPi

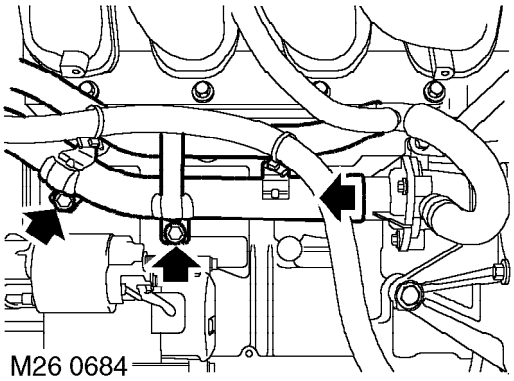
Service repair no - 26.45.09

Remove

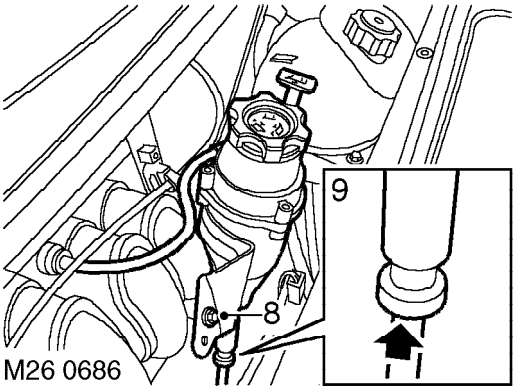
1. Disconnect battery earth lead.
2. Drain cooling system. ***See Adjustments.***



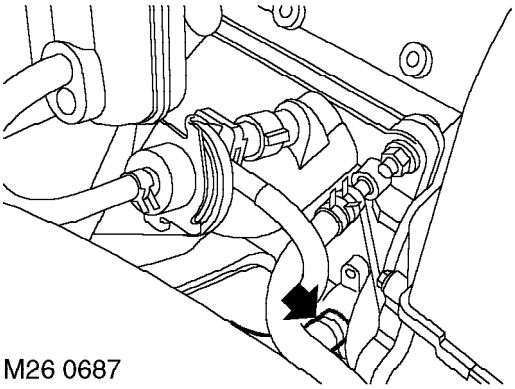
3. Disconnect multiplug from CKP sensor.



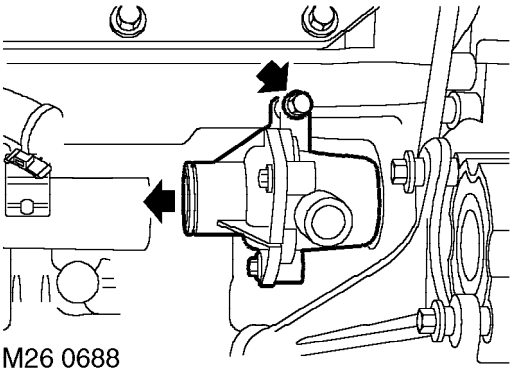
4. Remove 2 bolts securing coolant rail to cylinder block.
5. Release coolant rail from thermostat housing.
6. Lower vehicle.
7. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



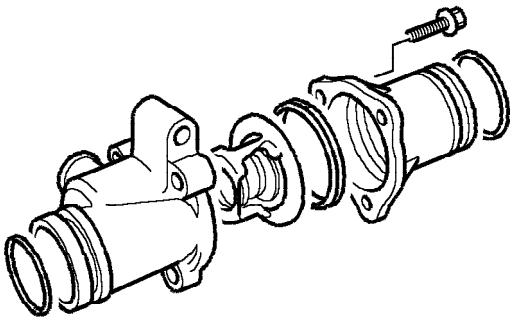
8. Remove bolt securing dipstick tube to inlet manifold.
9. Depress collar and remove upper part of dipstick tube.



10. Release clip and disconnect heater hose from thermostat housing.


M26 0688

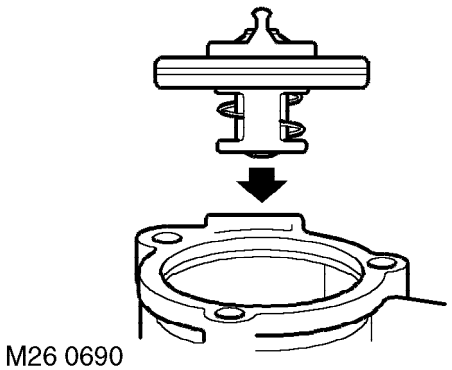
11. Remove bolt securing thermostat housing to cylinder block.
12. Release and remove thermostat housing.


M26 0689

13. Remove and discard 2 'O' rings from thermostat housing outlets.
14. Remove 3 bolts securing thermostat housing cover to thermostat housing.
15. Remove thermostat housing cover.
16. Remove thermostat from housing.
17. Remove rubber seal from thermostat.

Refit

1. Examine thermostat rubber seal for signs of deterioration or damage, renew if necessary.
2. Fit rubber seal to thermostat.
3. Clean mating faces of thermostat and cover.


M26 0690

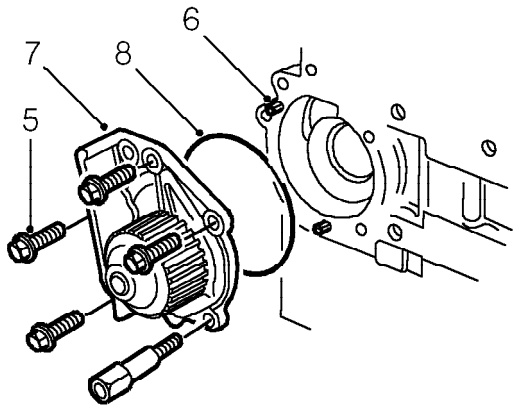
4. Align thermostat to shoulder in thermostat housing.
5. Fit thermostat housing cover and tighten bolts to 9 Nm.
6. Clean 'O' ring grooves on thermostat housing outlets.
7. Lubricate new 'O' rings with rubber grease and fit to thermostat housing outlets.
8. Position thermostat housing to coolant pump and push into place.
9. Fit bolt securing thermostat housing to cylinder block and tighten to 9 Nm.
10. Position upper part of dipstick tube and connect to lower part.
11. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
12. Raise vehicle.
13. Connect coolant rail to thermostat housing.
14. Align coolant rail to cylinder block, fit bolts and tighten to 9 Nm.
15. Connect CKP sensor multiplug.
16. Connect heater hose to thermostat housing and secure with clip.
17. Refill cooling system. ***See Adjustments.***
18. Connect battery earth lead.

ENGINE COOLANT PUMP

Service repair no - 26.50.01

Remove

1. Disconnect battery earth lead.
2. Remove camshaft timing belt. ***See ENGINE, Repairs.***
3. Drain cooling system. ***See Adjustments.***
4. Remove bolt securing timing belt rear cover to coolant pump.



26M0281A

5. Remove 5 bolts securing engine coolant pump to cylinder block.
6. Release pump from 2 dowels.
7. Remove engine coolant pump.
8. Remove 'O' ring seal from pump body and discard.

Refit

1. Clean pump and cylinder block mating faces.
2. Fit new 'O' ring seal to pump body and fit pump to cylinder block.
3. Fit bolts securing engine coolant pump to cylinder block and tighten to 10 Nm.
4. Fit bolt securing timing belt rear cover to engine coolant pump and tighten to 10 Nm.
5. Fit camshaft timing belt. ***See ENGINE, Repairs.***
6. Refill coolant system. ***See Adjustments.***

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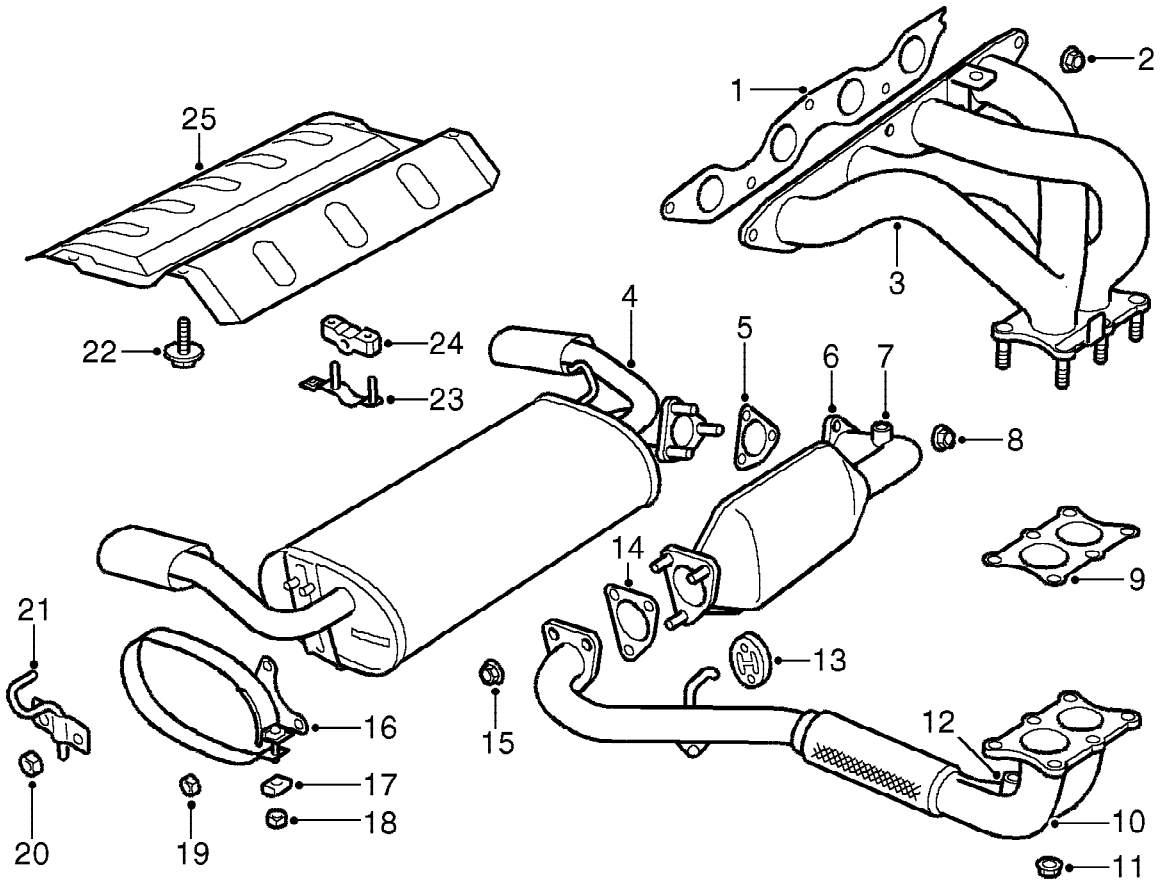
EXHAUST PIPE



M30 1064

1. Gasket - exhaust manifold
2. Flange nut - exhaust manifold to cylinder head - 5 off
3. Exhaust manifold
4. Exhaust silencer
5. Gasket - silencer to catalytic converter
6. Catalytic converter
7. Downstream HO_2S mounting boss
8. Flange nut - catalytic converter to silencer - 3 off
9. Gasket - manifold to front pipe
10. Exhaust front pipe
11. Flange nut - manifold to front pipe - 6 off
12. Upstream HO_2S mounting boss
13. Mounting rubber
14. Gasket - catalytic converter to front pipe
15. Flange nut - catalytic converter to front pipe - 3 off
16. Clamp bracket - silencer
17. Washer - clamp bracket
18. Nut - clamp bracket
19. Nut - clamp bracket attachment
20. Nut - silencer mounting bracket - 2 off
21. Mounting bracket - silencer
22. Bolt - heat shield - 4 off
23. Mounting bracket - 2 off
24. Mounting rubber - 2 off
25. Heat shield - silencer

EXHAUST MANIFOLD

The 4 branch fabricated steel exhaust manifold terminates in a flange with two outlet ports. The exhaust manifold flanges are sealed to the cylinder head and exhaust front pipe by gaskets.

EXHAUST SYSTEM

The exhaust system consists of a twin front pipe, terminating in an expansion chamber, a catalytic converter and a twin tail pipe which incorporates a large capacity silencer. The entire exhaust system is manufactured from stainless steel.

The silencer contains a series of expansion chambers, resonators and baffles designed to give an improved exhaust system, and reduce condensation to increase the life of the system.

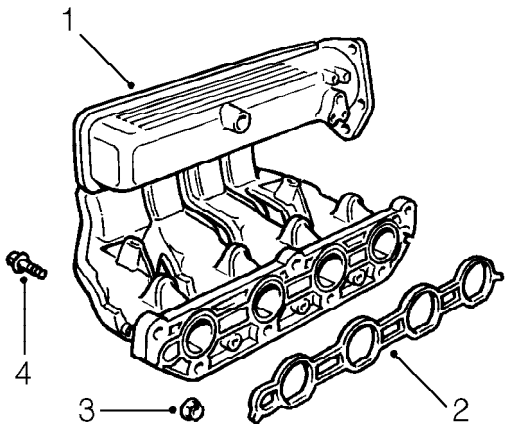
NOTE: Service repair tail pipes are available to allow repair without replacing the silencer.

Two HO_2S are installed in the exhaust system:

- One HO_2S is installed upstream of the catalytic converter, in a mounting boss in the front pipe
- The 2nd HO_2S is installed downstream of the catalytic converter, in a mounting boss in the catalytic converter outlet pipe

The catalytic converter operates in a closed loop system. The exhaust gases are monitored by the Engine Control Module (ECM) via signals sent from the upsteam HO_2S in the exhaust front pipe. The ECM adjusts the fueling to maintain emissions acceptable to the catalytic converter. The ECM uses the signal from the downstream HO_2S to monitor the condition of the catalytic converter. For information on the operation of the catalytic converter ***See ENGINE MANAGEMENT SYSTEM - MEMS, Information.***

INLET MANIFOLD - MPi

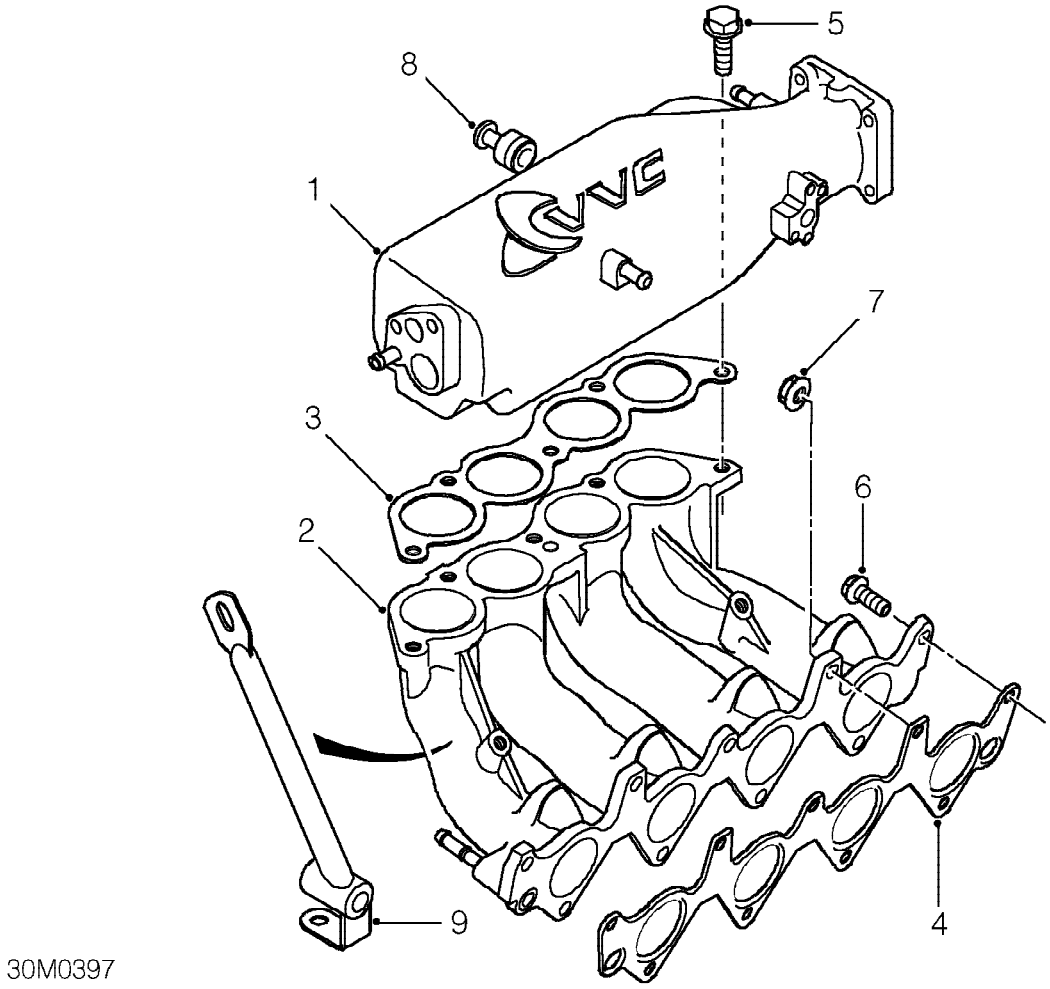


30M0286

1. Inlet manifold - plastic
2. Gasket - inlet manifold
3. Nut - inlet manifold - 3 off
4. Bolt - inlet manifold - 4 off

The inlet manifold is a one piece plastic moulding attached to the cylinder head with a gasket interposed between the two components The throttle housing is bolted to the manifold chamber, sealing being effected by means of an 'O' ring. The intake air temperature sensor is inserted above the pipe flange.

INLET MANIFOLD - VVC



1. Inlet manifold chamber
2. Inlet manifold
3. Gasket - manifold chamber to inlet manifold
4. Gasket - inlet manifold to cylinder head
5. Bolt - manifold chamber to inlet manifold
6. Bolt - inlet manifold to cylinder head
7. Nut - inlet manifold to cylinder head
8. Vacuum pipe union
9. Inlet manifold support stay

The alloy inlet manifold assembly comprises a manifold chamber bolted to the inlet manifold with a gasket interposed between the two components. The throttle housing is bolted to the manifold chamber and sealed with an 'O' ring.

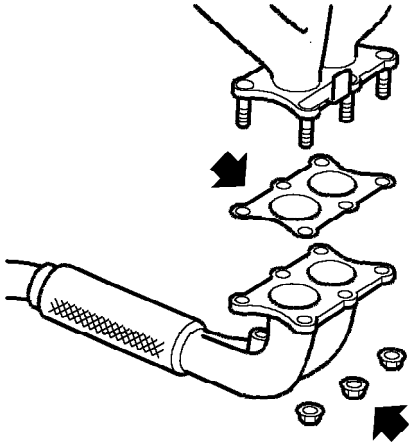
The manifold chamber incorporates the manifold absolute pressure sensor and brake servo vacuum hose union. The air intake temperature sensor is incorporated in the inlet manifold. The inlet manifold is attached to the cylinder head and sealed with a gasket. A strut between the inlet manifold and the cylinder block supports the inlet manifold assembly.

FRONT PIPE

Service repair no - 30.10.09

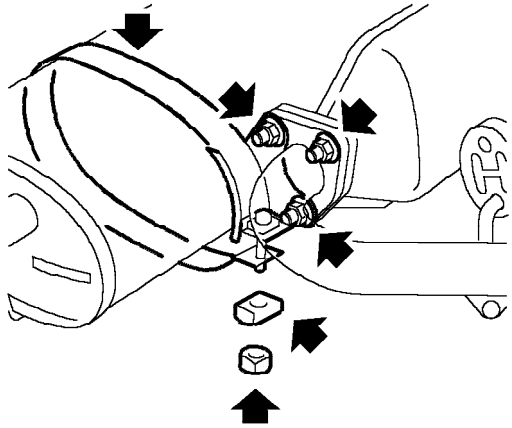
Remove

1. Disconnect battery earth lead.
2. Remove pre catalyst HO_2S. ***See FUEL DELIVERY SYSTEM, Repairs.***



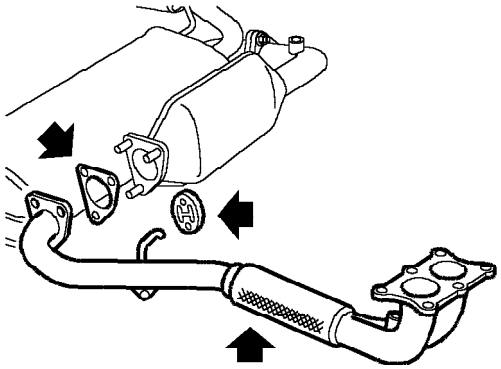
M30 1067

3. Remove 6 nuts, release front pipe from exhaust manifold and discard gasket.



M30 1068

4. Remove nut and washer from silencer clamp.
5. Remove 3 nuts securing front pipe to catalyst.
6. Remove clamp from silencer.



M30 1069

7. Release rubber mounting, remove front pipe and discard gasket.

Refit

1. Clean front pipe and mating faces.
2. Fit new gasket and tighten nuts securing front pipe to manifold to 50 Nm.
3. Fit silencer clamp and tighten nuts securing clamp to front pipe to 50 Nm.
4. Connect mounting to front pipe.
5. Fit washer and tighten silencer clamp nut to 30 Nm.
6. Fit pre catalyst HO_2S. ***See FUEL DELIVERY SYSTEM, Repairs.***
7. Connect battery earth lead.

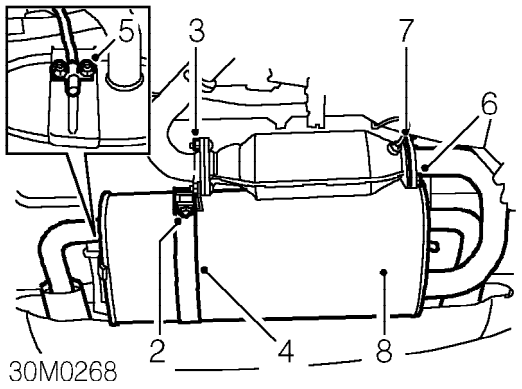
SILENCER

Service repair no - 30.10.22

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.



2. Remove nut and special washer securing silencer strap clamp.
3. Remove 2 flange nuts securing silencer strap clamp.
4. Remove strap clamp.
5. Remove 2 flange nuts securing silencer RH mounting bracket, remove mounting bracket.
6. Remove 3 flange nuts securing silencer to catalyst.
7. Release catalyst from silencer, remove and discard gasket.
8. Release silencer from LH mounting bracket, remove silencer.

Refit

1. Clean mating faces of silencer and catalytic converter.
2. Fit silencer to LH mounting bracket.
3. Fit silencer RH mounting bracket to mounting, fit nuts and tighten to 15 Nm.
4. Fit new gasket to catalyst.
5. Position catalyst to silencer, fit nuts and tighten to 50 Nm.
6. Fit rear silencer clamp to flange studs, fit nuts and tighten to 50 Nm.
7. Align rear silencer clamp strap, fit special washer, fit nut and tighten to 30 Nm.
8. Remove stand(s) and lower vehicle.

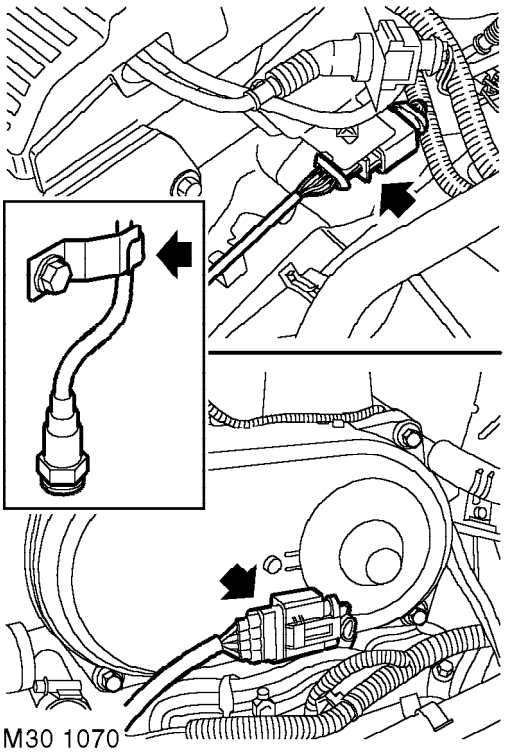
CAUTION: Ensure exhaust system is free from leaks. Exhaust gas leaks upstream of the catalyst could cause internal damage to the catalyst.

GASKET - EXHAUST MANIFOLD TO FRONT PIPE - VVC

Service repair no - 30.10.26

Remove

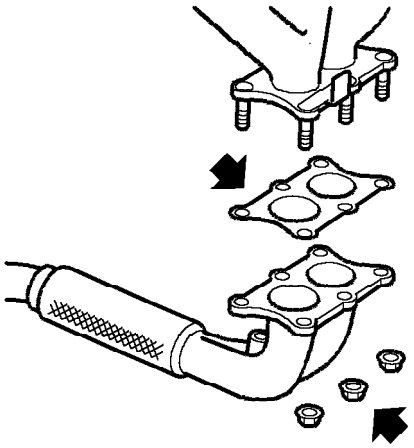
1. Disconnect battery earth lead.
2. Remove engine compartment access cover. ***See BODY, Exterior fittings.***


M30 1070

3. Rotate HO_2S multiplug through 90° to release from mounting.
4. Raise rear of vehicle.

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

5. Release HO_2S lead from clip.


M30 1067

6. Remove 6 nuts, release front pipe from exhaust manifold and discard gasket.

Refit

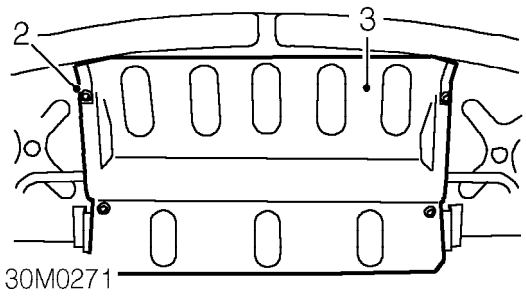
1. Clean front pipe and manifold mating faces.
2. Fit new gasket and tighten nuts securing front pipe to manifold to 50 Nm.
3. Fit HO_2S lead to clip.
4. Secure HO_2S multiplug to mounting.
5. Remove stand and lower vehicle.
6. Fit engine compartment access cover. ***See BODY, Exterior fittings.***
7. Connect battery earth lead.

SILENCER HEAT SHIELD

Service repair no - 30.10.44

Remove

1. Remove silencer. ***See this section.***



2. Remove 4 bolts securing silencer heat shield.
3. Remove heat shield.

Refit

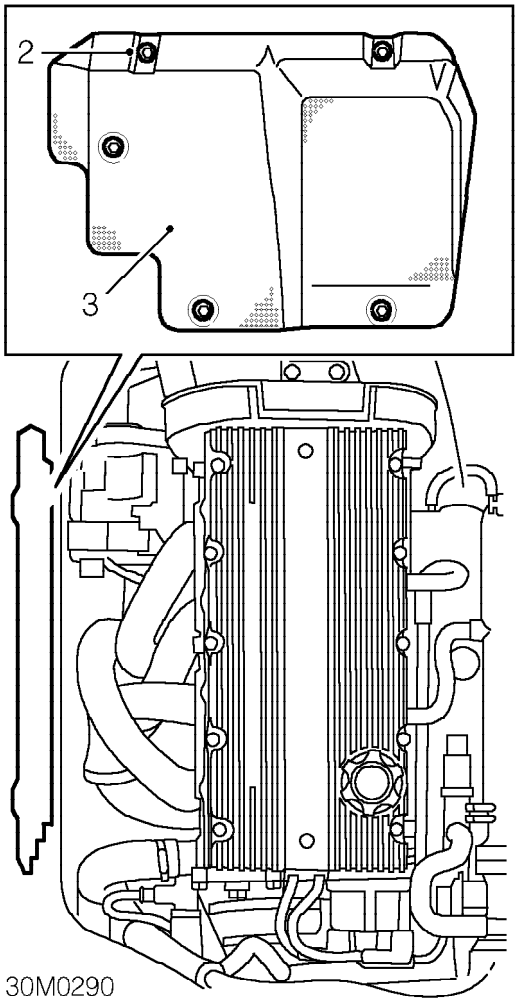
1. Fit heat shield to underside of vehicle, fit bolts and tighten to 10 Nm.
2. Fit silencer. ***See this section.***

FUEL TANK HEAT SHIELD

Service repair no - 30.10.64

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



2. Remove 5 nuts securing heat shield to bulkhead.
3. Remove heat shield.

Refit

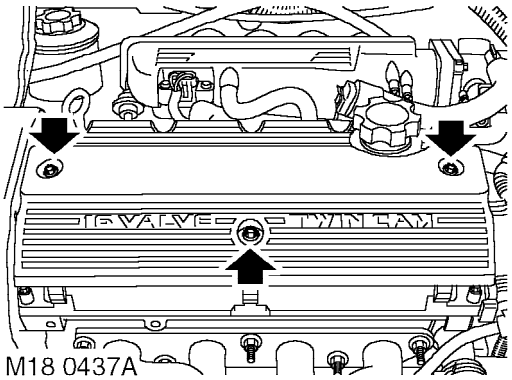
1. Fit heat shield and secure with nuts.
2. Fit engine cover. ***See ENGINE, Repairs.***

MANIFOLD - INLET - MPi

Service repair no - 30.15.02

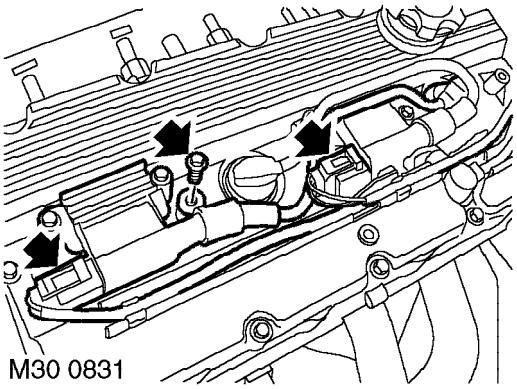
Remove

1. Remove inlet manifold gasket. ***See this section.***

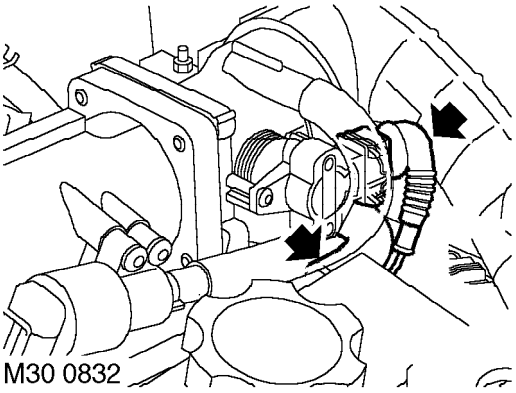


M18 0437A

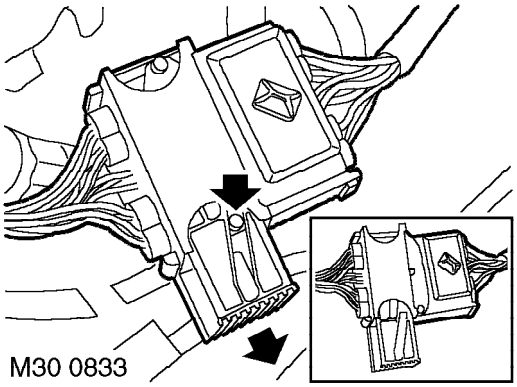
2. Remove 3 bolts securing coil cover and remove coil cover.


M30 0831

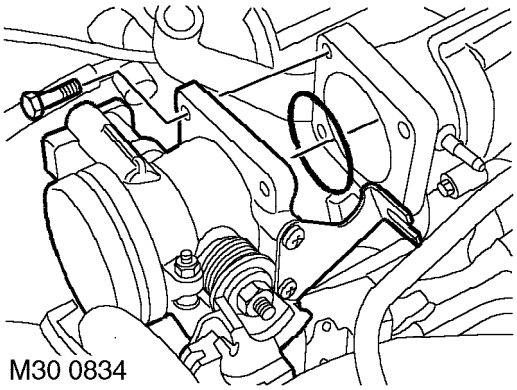
3. Remove bolt securing RH coil, release coil and disconnect coil multiplugs.
4. Release coil harness from harness clips.


M30 0832

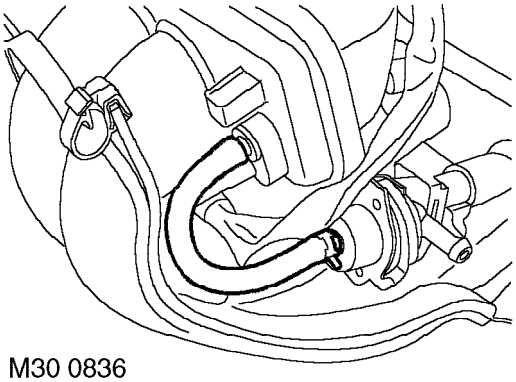
5. Disconnect IAC valve and TP sensor multiplugs.
6. Disconnect IAC valve hose.


M30 0833

7. Release and disconnect injector multiplug.
8. Manoeuvre inlet manifold to gain access to bolts securing throttle body to inlet manifold.

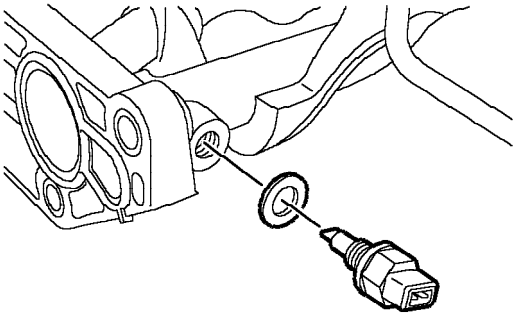


M30 0834



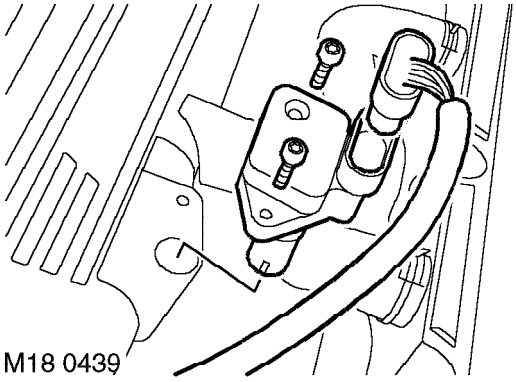
M30 0836

9. Remove 4 bolts securing throttle body to inlet manifold.
10. Remove throttle body from manifold.
11. Remove and discard 'O' ring seal from throttle body.
12. Remove air filter. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***
13. Manoeuvre inlet manifold and remove from engine compartment.



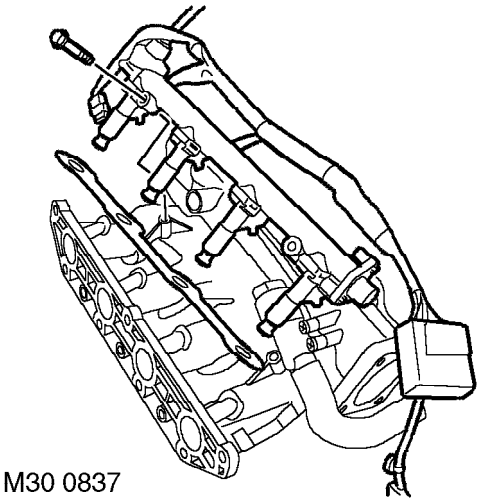
M30 0835

14. Remove air intake sensor from manifold.
15. Remove sealing washer from sensor.
16. Release pressure regulator vacuum hose from inlet manifold.



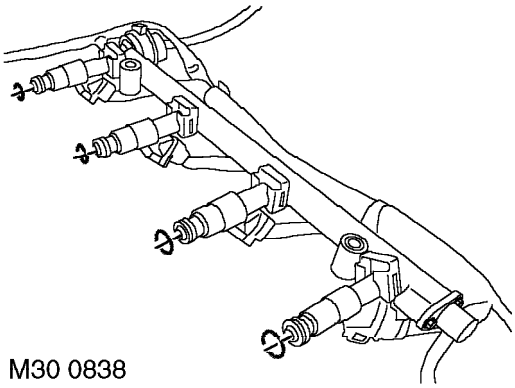
M18 0439

17. Remove 2 Torx screws securing MAP sensor and remove MAP sensor.



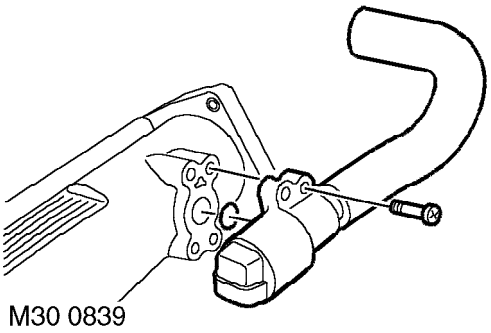
M30 0837

18. Remove 2 bolts securing fuel rail to inlet manifold.
19. Release 4 injectors from inlet manifold.
20. Collect injector spacer.
21. Remove fuel rail complete with injectors pressure regulator and harness.



M30 0838

22. Remove and discard lower 'O' rings from injectors.
23. Fit protective caps to each injector.

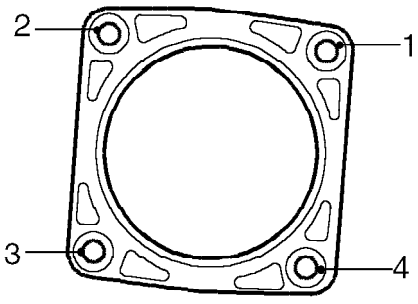


M30 0839

24. Remove 4 Torx screws securing IAC valve, remove IAC valve and collect 'O' ring.

Refit

1. Using a new 'O' ring, fit IAC valve and tighten Torx screws.
2. Clean fuel rail and temperature sensor mating surfaces.
3. Fit new seal to temperature sensor, fit sensor and tighten to 7 Nm.
4. Fit new 'O' ring seals to injectors.
5. Fit injector spacer.
6. Align injectors to inlet manifold and push fuel rail into position.
7. Fit fuel rail retaining bolts and tighten to 10 Nm.
8. Fit MAP sensor and tighten Torx screws.
9. Connect pressure regulator vacuum hose to inlet manifold.
10. Position manifold to engine compartment.
11. Clean throttle body to manifold mating faces.
12. Fit new seal to throttle body.



M19 3083

13. Tighten bolts in sequence shown, using the following procedure.
i. Tighten to 4 Nm.
ii. Back off one flat.
iii. Tighten to 9 Nm.

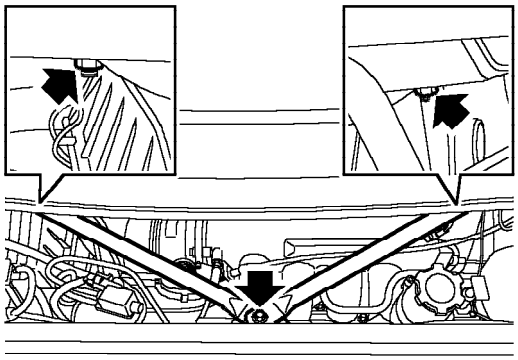
14. Fit air filter. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***
15. Fit stud and bolt securing air cleaner to mounting bracket.
16. Fit hose to throttle body and secure with clip.
17. Position hose to air cleaner and tighten clip screw.
18. Connect hose to IAC valve.
19. Connect and secure injector multiplug.
20. Connect IAC valve and TP sensor multiplugs.
21. Secure coil harness to harness clips.
22. Position coil and connect coil multiplugs, fit bolt and tighten to 8 Nm.
23. Position coil cover, fit bolts and tighten to 8 Nm.
24. Fit inlet manifold gasket. ***See this section.***

GASKET - INLET MANIFOLD - MPi

Service repair no - 30.15.08

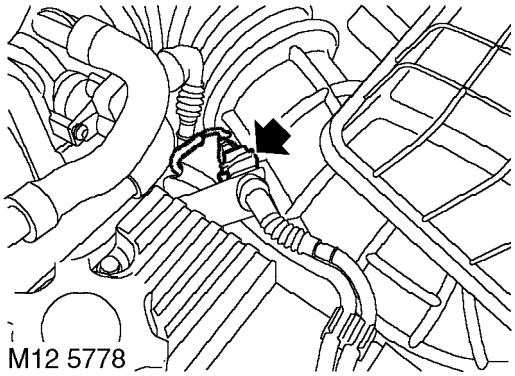
Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***



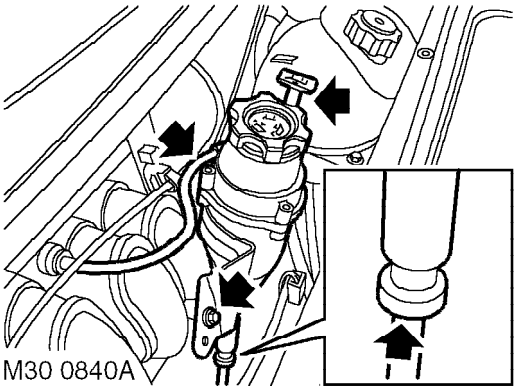
SP12 0363

3. Remove nut securing LH cross bracing and remove and discard bolt securing cross bracing.
4. Remove LH cross bracing.
5. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***

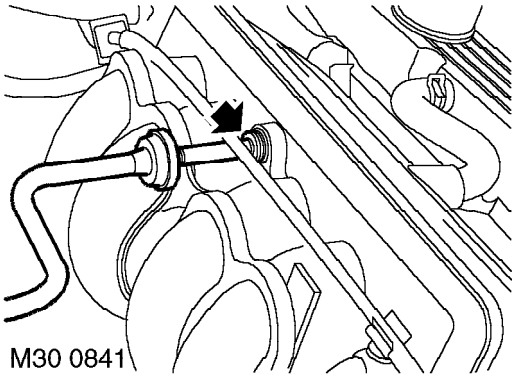


M12 5778

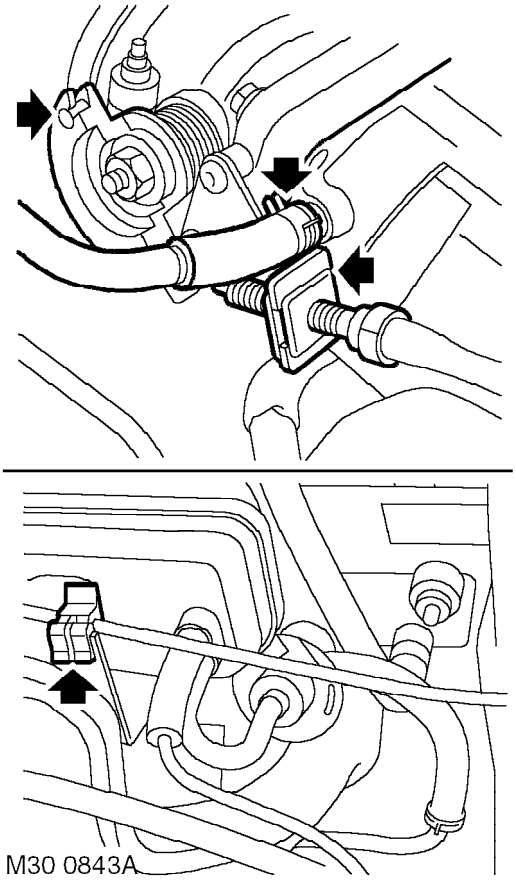
6. Release coil harness from harness support bracket.



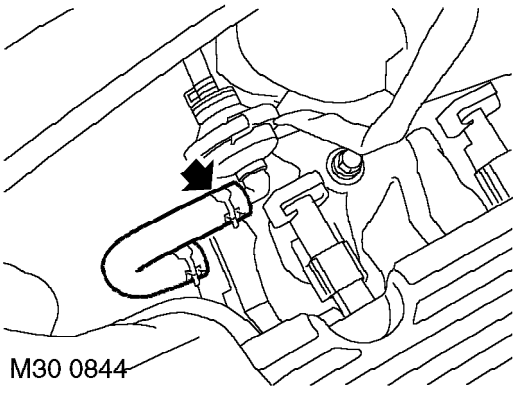
7. Remove dipstick.
8. Release vacuum pipe from dipstick/ oil filler tube.
9. Remove bolt securing engine oil level dipstick/filler tube bracket to manifold.
10. Release clip securing dipstick/filler tube to pipe and remove tube.



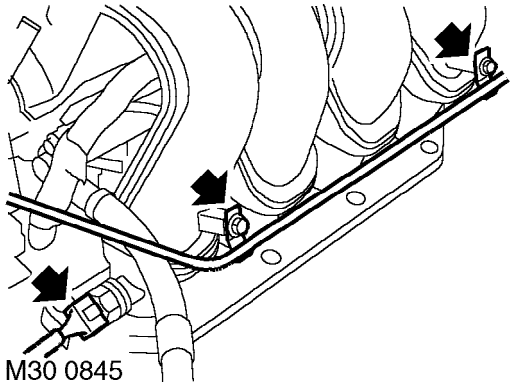
11. Release brake servo vacuum pipe from manifold chamber.

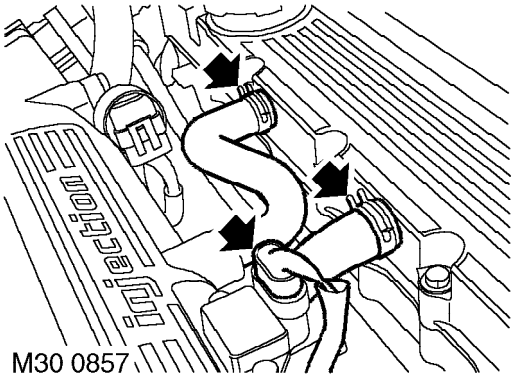


12. Release EVAP canister hose from inlet manifold chamber.
13. Release EVAP canister from support bracket and position canister aside.
14. Release throttle cable from manifold chamber clip.
15. Release throttle cable from abutment bracket.
16. Release inner cable from throttle cam.



17. Release clip securing fuel return hose to inlet manifold and release hose.

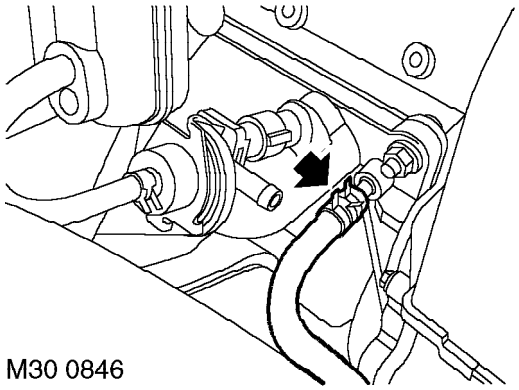

M30 0845



M30 0857

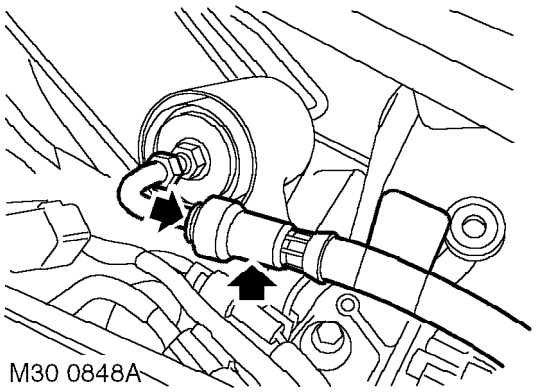
18. Remove 2 bolts securing return pipe to inlet manifold and position pipe aside.
19. Disconnect IAT sensor multiplug.

CAUTION: Always fit plugs to open connections to prevent contamination.


M30 0846

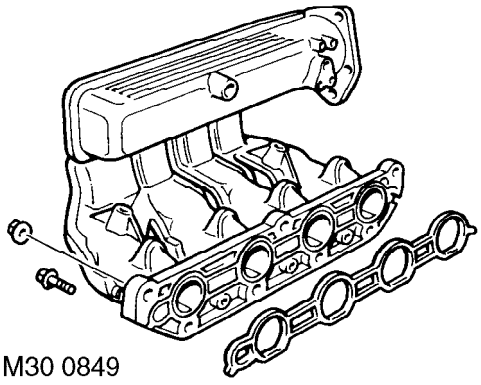
20. Release clip and disconnect coolant hose from inlet manifold.

21. Release 2 clips and 2 breather hoses from camshaft cover.
22. Disconnect MAP sensor multiplug.
23. Position absorbent cloth to collect any fuel spillage.


M30 0848A

24. Release fuel feed hose from fuel filter pipe.

CAUTION: Always fit plugs to open connections to prevent contamination.

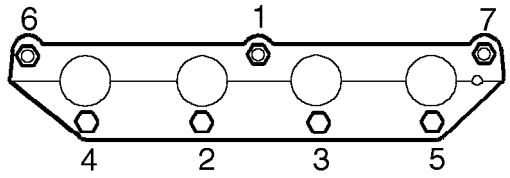

M30 0849

25. Remove 3 nuts and 4 bolts securing inlet manifold to cylinder head.

26. Release inlet manifold from cylinder head studs.
27. Remove and discard gasket seal from inlet manifold.

Refit

1. Clean manifold to cylinder head mating faces.
2. Fit new gasket seal to inlet manifold and position inlet manifold to cylinder head studs.



M30 0842

3. Fit nuts and bolts securing inlet manifold to cylinder head and tighten in sequence shown to 25 Nm.
4. Secure fuel feed hose to fuel filter pipe.
5. Connect MAP sensor multiplug.
6. Connect breather hoses to camshaft cover and secure with clips.
7. Connect coolant hose to inlet manifold and secure with clip.
8. Connect fuel return hose to manifold and secure with clip.
9. Fit and tighten bolts securing fuel return pipe to manifold.
10. Connect IAT sensor multiplugs.
11. Connect throttle inner cable to cam.
12. Secure throttle cable to abutment bracket.
13. Secure throttle cable to manifold clip.
14. Fit EVAP canister in support bracket.
15. Connect EVAP canister to inlet manifold hose and secure clip.
16. Connect brake servo vacuum hose to inlet manifold.
17. Fit dipstick/filler tube to pipe.
18. Align dipstick/filler tube mounting bracket, fit bolt and tighten to 10 Nm.
19. Fit dipstick.
20. Secure coil harness to support bracket.
21. Position cross bracing, fit nut and new bolt and tighten to 25 Nm.
22. Refill cooling system. ***See COOLING SYSTEM, Adjustments.***
23. Fit engine cover. ***See ENGINE, Repairs.***
24. Connect battery earth lead.

GASKET - INLET MANIFOLD - VVC

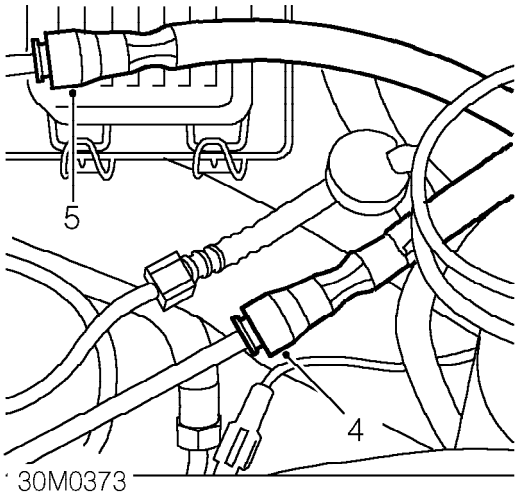
Service repair no - 30.15.08

Remove

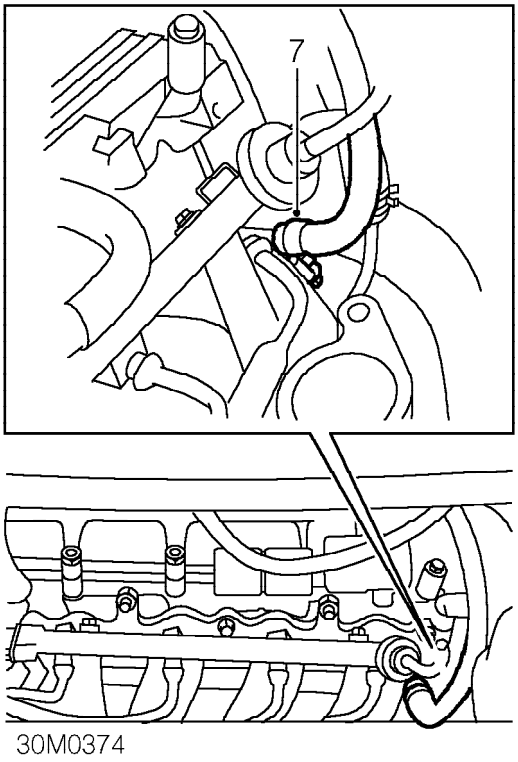
1. Remove manifold chamber gasket. ***See this section.***
2. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***

CAUTION: Depressurise fuel pressure before disconnecting fuel pipes. *See ENGINE MANAGEMENT SYSTEM - MEMS, Adjustments.*

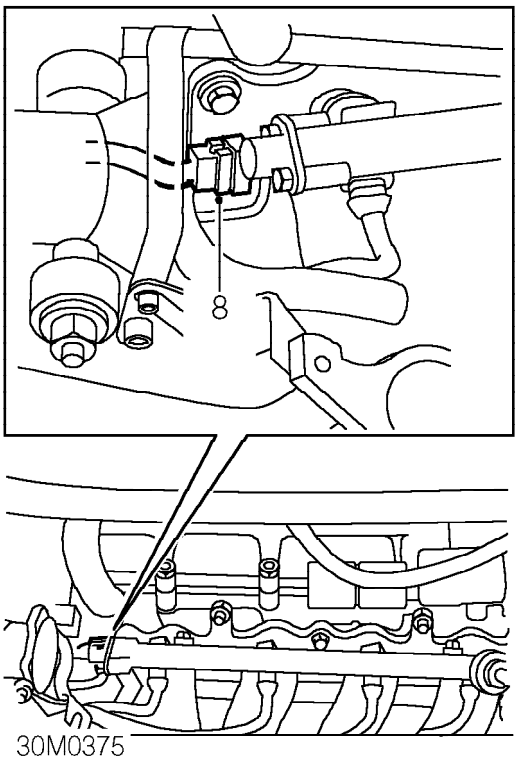
3. Position cloth to catch spillage.



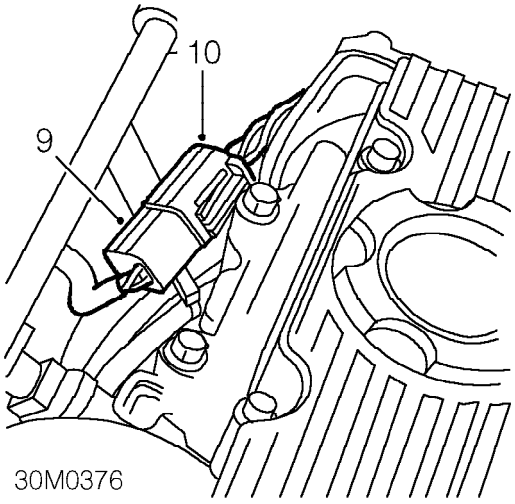
4. Release fuel return hose from fuel return pipe.
5. Release fuel feed hose from fuel filter pipe.
6. Position drainage tray to collect coolant spillage.



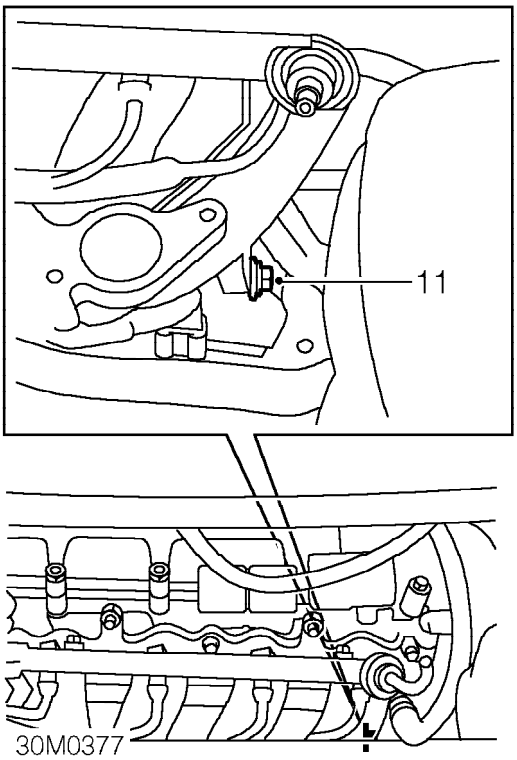
7. Loosen clip and disconnect coolant hose from inlet manifold.



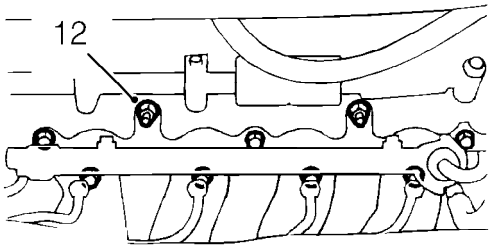
8. Disconnect air intake temperature sensor multiplug from manifold.



9. Disconnect injector harness multiplug.
10. Release injector multiplug from bracket.



11. Remove bolt securing inlet manifold to support bracket.

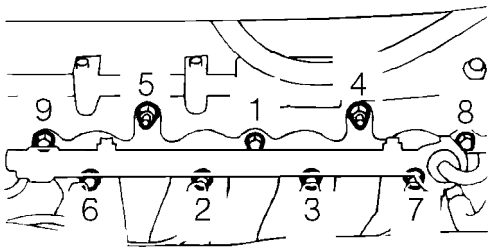


30M0378

12. Remove 2 nuts and 7 bolts securing inlet manifold to cylinder head.
13. Remove inlet manifold from cylinder head studs.
14. Remove and discard gasket seal from inlet manifold.

Refit

1. Clean manifold to cylinder head mating faces.
2. Fit new gasket seal to cylinder head.
3. Fit inlet manifold to studs.



30M0444

4. Fit nuts and bolts securing inlet manifold to cylinder head and tighten in sequence shown to 25 Nm.
5. Align support bracket and tighten bolt to 25 Nm.
6. Secure fuel feed hose to fuel filter pipe.
7. Secure fuel return hose to return pipe.
8. Connect air intake temperature sensor multiplug.
9. Connect injector harness multiplug.
10. Connect coolant hose to inlet manifold and secure clip.
11. Fit manifold chamber gasket. ***See this section.***
12. Refill cooling system. ***See COOLING SYSTEM, Adjustments.***

GASKET - EXHAUST MANIFOLD - MPi

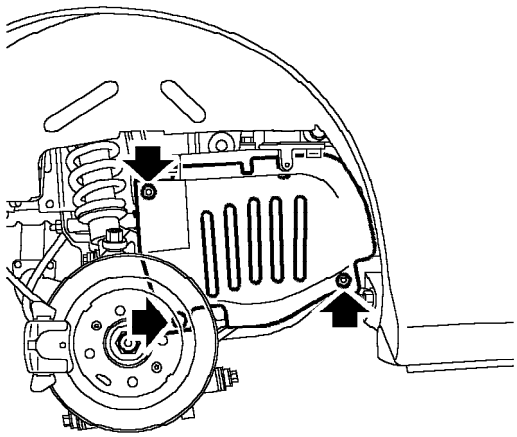
Service repair no - 30.15.12

Remove

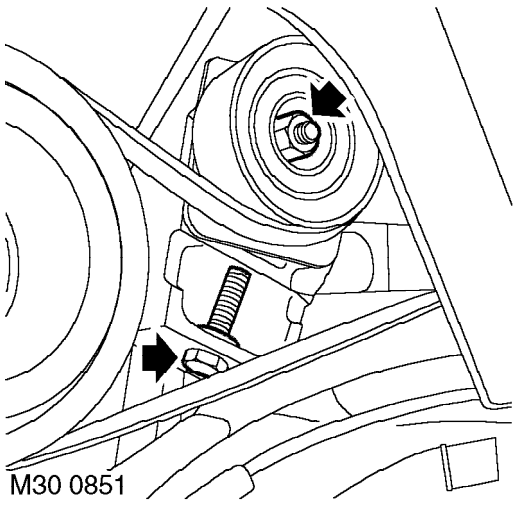
1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***
3. Raise rear of vehicle.

WARNING: Support on safety stands.

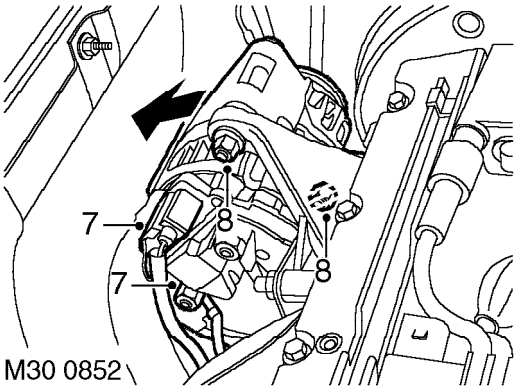
4. Remove LH road wheel.


SP12 0348

5. Remove 2 scrivets and 1 Torx screw closing splash panel and remove panel.

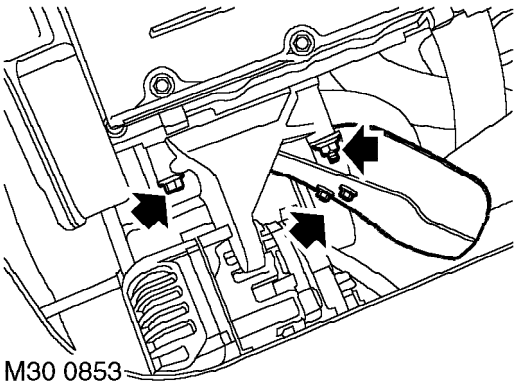

M30 0851

6. Release tension on alternator drive belt tensioner and remove drive belt.

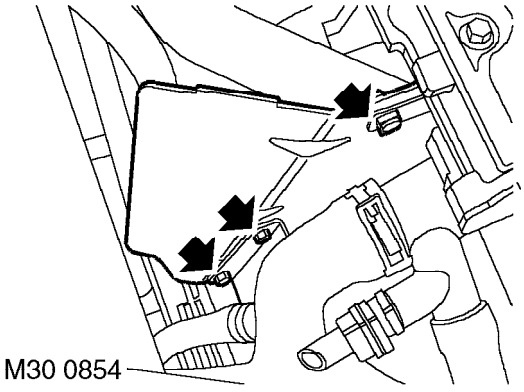


M30 0852

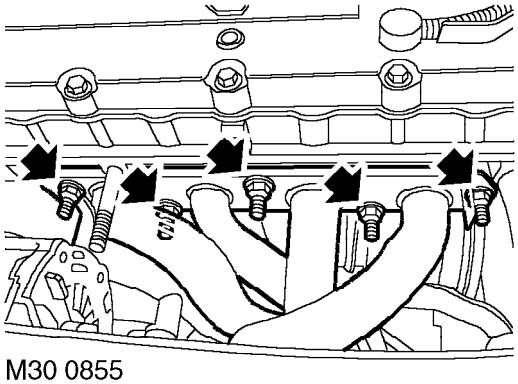
7. Remove nut securing alternator lead and release lead, disconnect alternator multiplug.
8. Remove alternator top bolt and loosen lower bolt.
9. Position alternator forwards to access alternator bracket.


M30 0853

10. Remove nut and bolt securing alternator bracket.
11. Remove 2 bolts securing alternator heat shield and remove heat shield.
12. Remove alternator bracket.


M30 0854

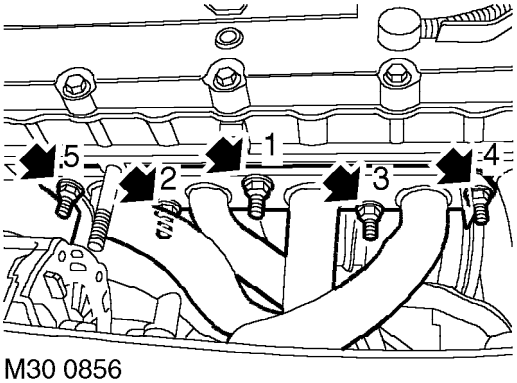
13. Remove 3 bolts securing coolant hose heat shield and remove heat shield.


M30 0855

14. Remove 5 flange nuts securing exhaust manifold to cylinder head.
15. Position manifold aside, remove and discard gasket.

Refit

1. Clean exhaust manifold and cylinder head mating faces.
2. Fit new exhaust manifold gasket to cylinder head.



M30 0856

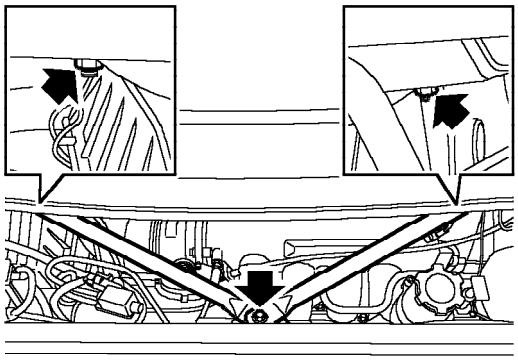
3. Position manifold and working in the sequence shown, tighten nuts to 45 Nm.
4. Position coolant hose heat shield, fit bolts and tighten to 9 Nm.
5. Position alternator bracket.
6. Position alternator heat shield, fit bolts and tighten to 9 Nm.
7. Tighten alternator bracket nut and bolt to 25 Nm.
8. Align alternator to bracket, fit top bolt, tighten both bolts to 45 Nm.
9. Connect alternator multiplug and lead, secure lead with nut.
10. Fit alternator drive belt and engage to tensioner. Ensure drive belt is located correctly on pulleys.
11. Adjust alternator drive belt tension. ***See ELECTRICAL, Adjustments.***
12. Position closing panel and secure with scrivets and Torx screw.
13. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
14. Fit engine cover. ***See ENGINE, Repairs.***
15. Remove stand(s) and lower vehicle.
16. Connect battery earth lead.

GASKET(S) - MANIFOLD CHAMBER - VVC

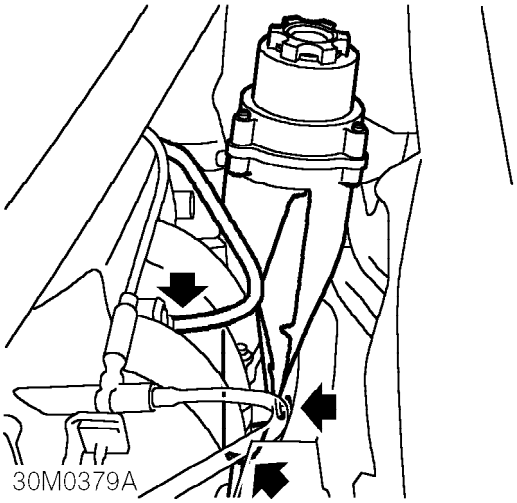
Service repair no - 30.15.37

Remove

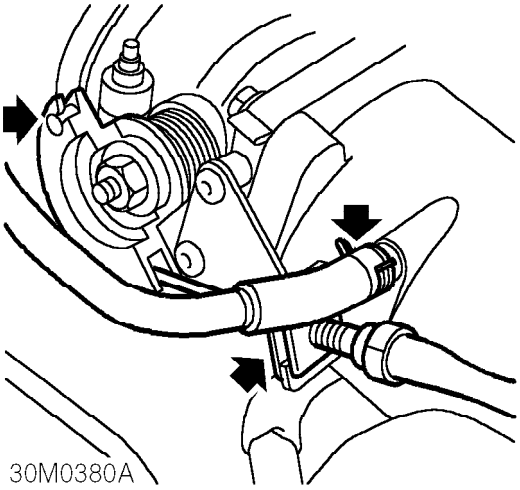
1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
3. Remove engine compartment access cover. ***See ENGINE, Repairs.***


SP12 0363

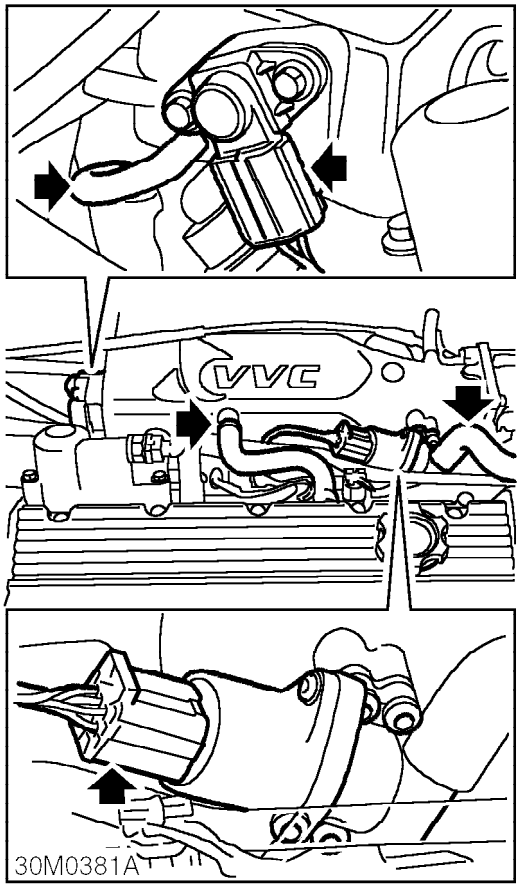
4. Remove nuts securing cross bracing, remove and discard bolt securing cross bracing and remove cross bracing.
5. Release brake servo vacuum hose from clip on dipstick/oil filler tube.



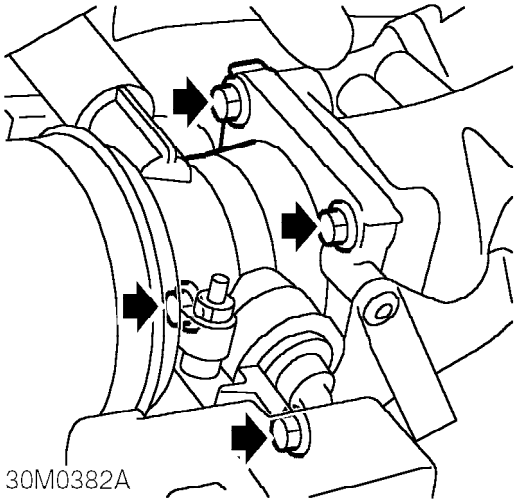
6. Remove bolt securing engine oil level dipstick/filler tube bracket to inlet manifold.
7. Depress locking collar and remove dipstick/oil filler from tube.
8. Depress locking collar and disconnect brake servo hose from inlet manifold chamber.



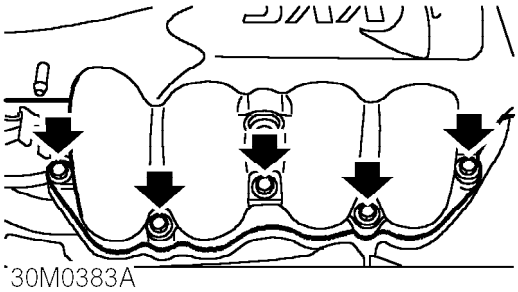
9. Release cable adjusting nut from abutment bracket.
10. Release inner cable from throttle cam.
11. Release clip and disconnect hose, EVAP canister to inlet manifold chamber.



12. Release clip and disconnect engine breather hose from camshaft cover.
13. Disconnect hose from IACV.
14. Disconnect multiplug from IACV.
15. Disconnect vacuum hose connecting fuel pressure regulator to inlet manifold chamber.
16. Disconnect MAP sensor multiplug.



17. Remove 4 bolts securing throttle housing to inlet manifold chamber. Position multiplug bracket aside and remove throttle housing.

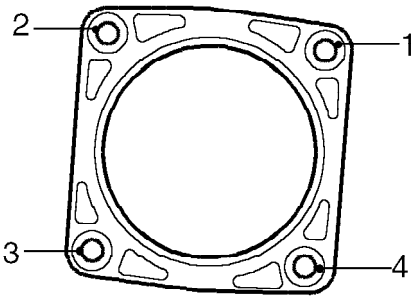


18. Remove 5 bolts securing inlet manifold chamber to inlet manifold and remove inlet manifold chamber.
19. Remove and discard gasket from inlet manifold chamber.
20. Remove and discard 'O' ring seal from throttle housing.

Refit

1. Clean inlet manifold chamber and inlet manifold mating faces.
2. Fit new 'O' ring seal to throttle housing.
3. Position new gasket seal to inlet manifold and fit inlet manifold chamber.
4. Fit and tighten bolts securing inlet manifold chamber to inlet manifold to 25 Nm.

5. Position throttle housing to inlet manifold chamber, align multiplug bracket, fit and lightly tighten bolts.



M19 3083

6. Tighten bolts in the sequence shown using the following procedure:
   i. Tighten to 4 Nm.
   ii. Back off one flat.
   iii. Tighten to 9 Nm.

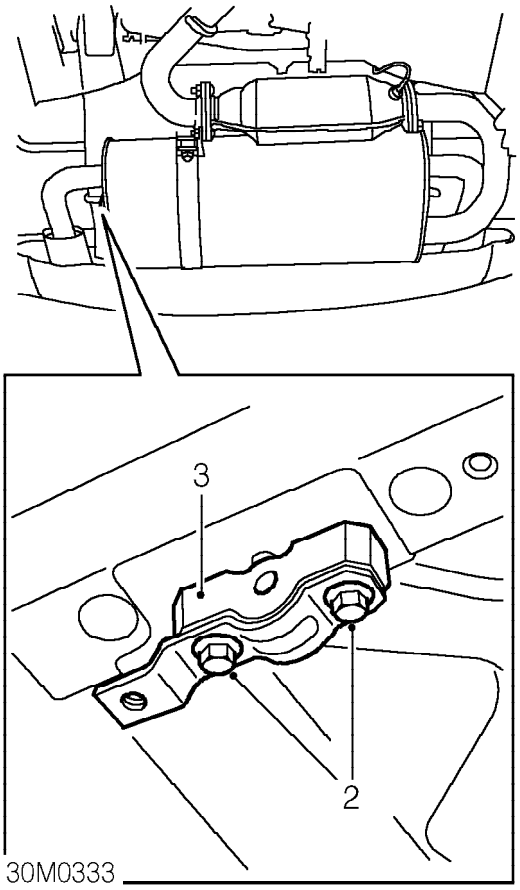
7. Connect MAP sensor multiplug.
8. Connect multiplug to IACV.
9. Connect hose to IACV.
10. Connect engine breather hose to camshaft cover and secure with clip.
11. Connect throttle cable to cam, abutment bracket and clips on inlet manifold chamber.
12. Connect EVAP canister hose to inlet manifold chamber and secure with clip.
13. Connect brake servo vacuum hose to inlet manifold chamber.
14. Position dipstick/filler tube, align support bracket to inlet manifold, fit and tighten bolt to 10 Nm.
15. Secure brake servo vacuum hose in clip on dipstick/oil filler tube.
16. Position cross bracing, fit nuts and new bolt and tighten to 25 Nm.
17. Fit engine compartment access cover. ***See ENGINE, Repairs.***
18. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
19. Connect battery earth lead.

EXHAUST MOUNTINGS

Service repair no - 30.20.06

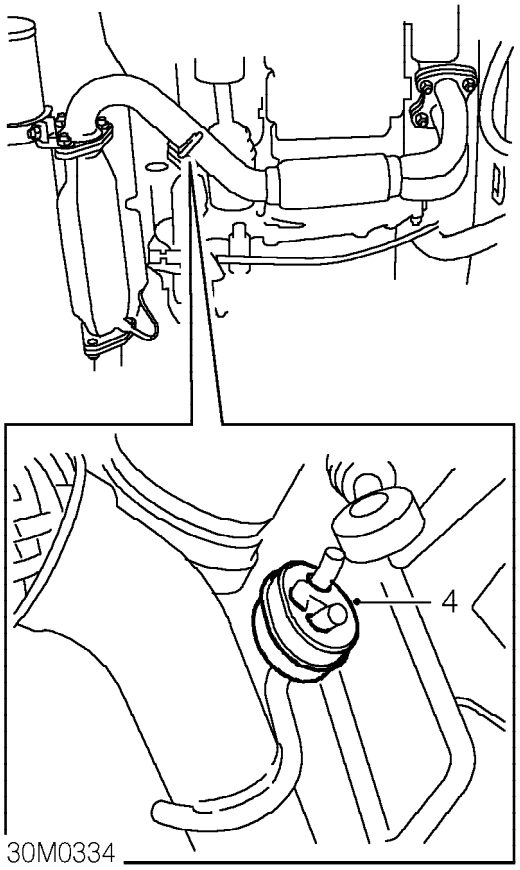
Remove

1. Remove silencer heat shield. ***See this section.***



30M0333

2. Remove 4 bolts securing LH and RH exhaust mountings.
3. Remove brackets and rubbers.



4. Remove mounting rubber securing front pipe to subframe.

Refit

1. Fit mounting rubber securing front pipe to subframe.
2. Fit LH and RH mounting rubbers and brackets, fit bolts and tighten to 25 Nm.
3. Fit silencer heat shield. ***See this section.***

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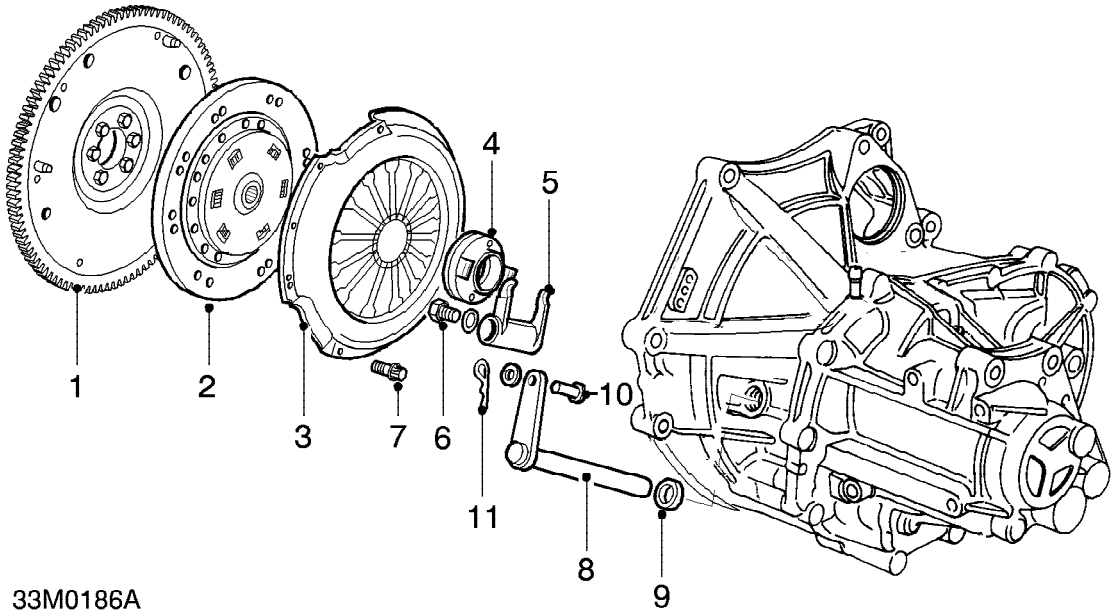
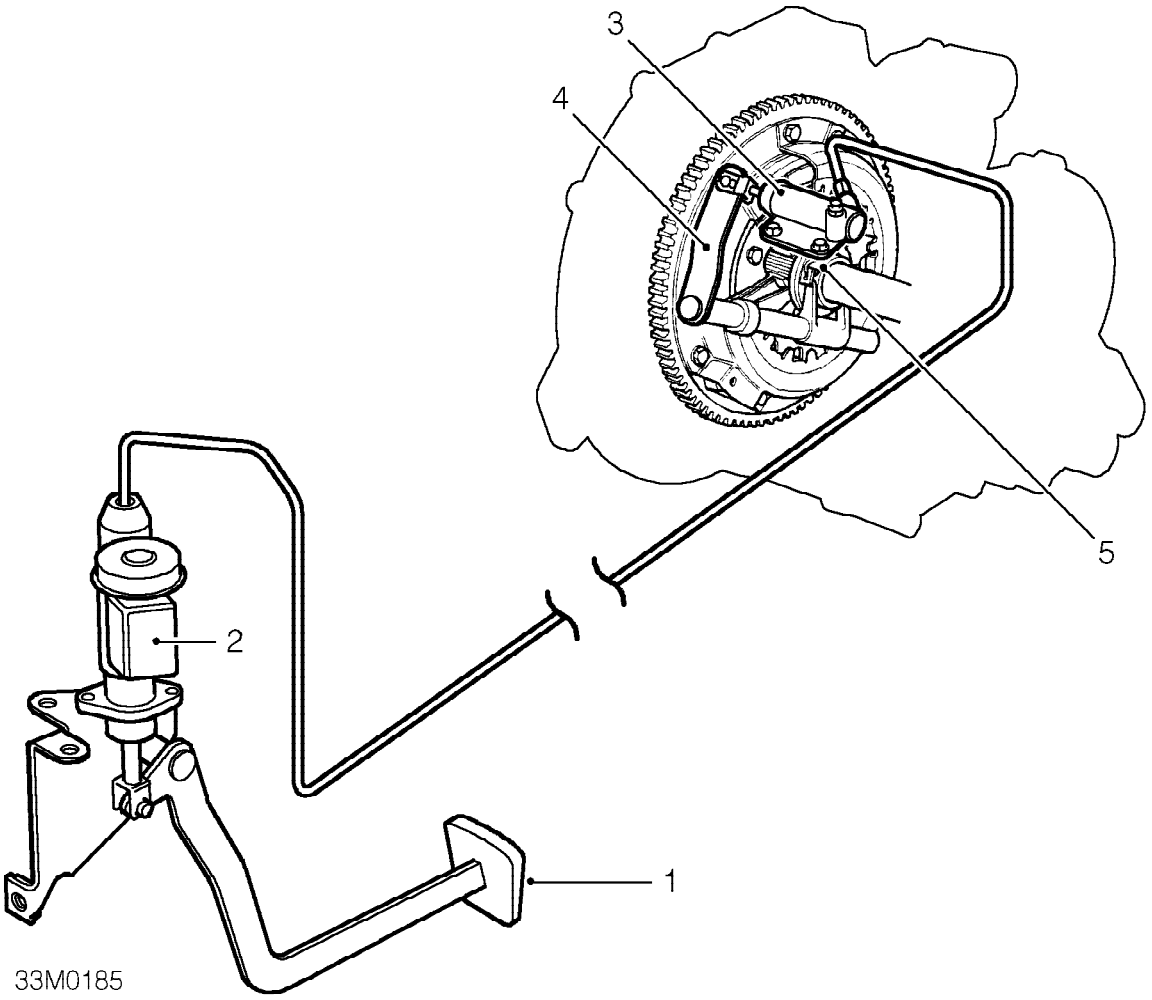
CLUTCH COMPONENTS



1. Flywheel
2. Clutch plate
3. Pressure plate
4. Release bearing
5. Release bearing fork
6. Fork retaining bolt
7. Pressure plate bolts
8. Clutch release shaft
9. Clutch release shaft, washer
10. Clevis pin
11. 'R' clip

HYDRAULIC CLUTCH SYSTEM



1. Clutch pedal
2. Master cylinder
3. Slave cylinder
4. Release arm
5. Release bearing

CLUTCH SYSTEM OPERATION

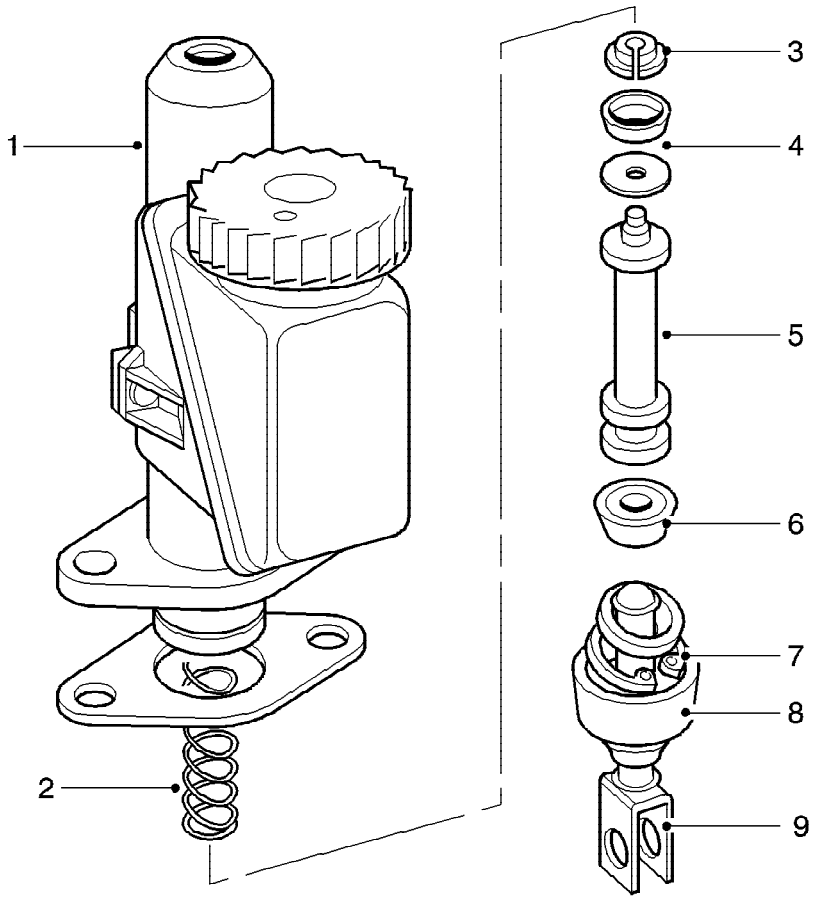
The diaphragm type clutch is operated via a hydraulic system.

When pressure is applied to the clutch pedal, fluid is pumped from the master cylinder to the slave cylinder causing the slave cylinder piston to apply pressure to the release lever. The release lever rotates the release fork and shaft.

The release fork changes rotary movement of the release lever into linear movement pushing the release bearing against the pressure plate diaphragm fingers, applying pressure to the drive plate springs and dis-engaging the clutch.

When pressure is released from the clutch pedal the master cylinder piston is returned by a spring which causes a pressure decrease. The drop in pressure allows the diaphragm fingers to push the release bearing back, decreasing the pressure on the drive plate springs and re-engaging the clutch.

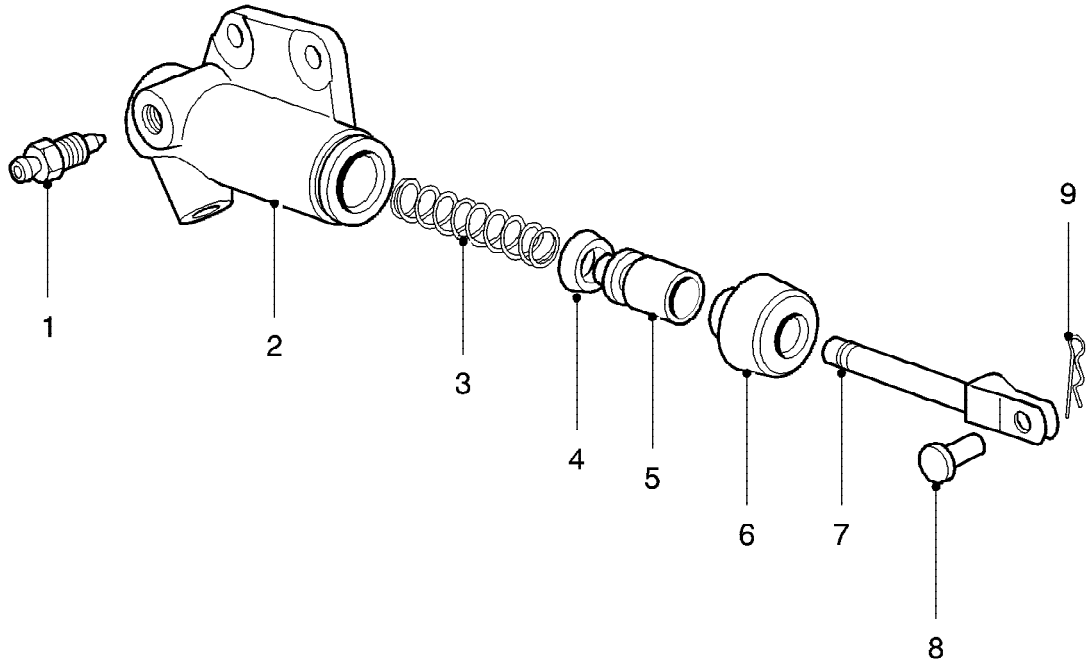
MASTER CYLINDER COMPONENTS



33M0188

1. Master cylinder
2. Spring
3. Spring seat
4. Seal and washer
5. Piston
6. Seal
7. Circlip
8. Boot
9. Push-rod

SLAVE CYLINDER COMPONENTS



33M0187

1. Bleed screw
2. Slave cylinder
3. Return spring
4. Seal
5. Piston assembly
6. Dust cover
7. Push-rod
8. Clevis pin
9. R-clip

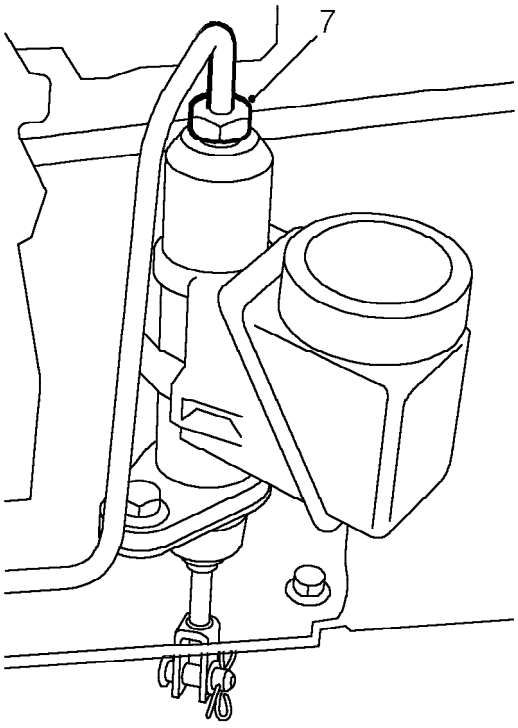
CLUTCH - BLEED

Service repair no - 33.15.01

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

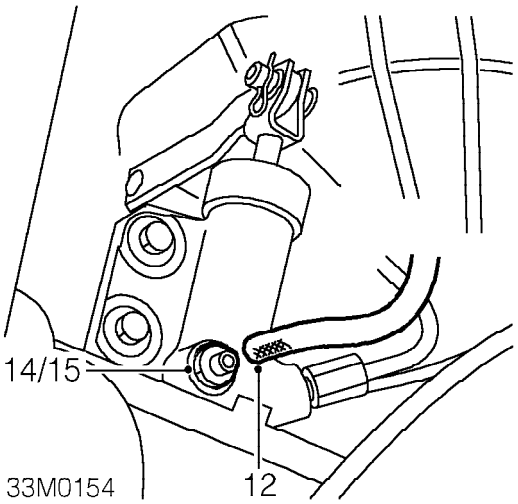
CAUTION: Ensure master cylinder is topped up at frequent intervals. Use only NEW fluid.

1. Open bonnet.
2. Open luggage compartment.
3. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
4. Position cloth around master cylinder to catch spillage.
5. Clean area around master cylinder pipe union.
6. Depress clutch pedal to floor and hold.



33M0153

7. Loosen master cylinder pipe union and allow air and fluid to escape.
8. Tighten pipe union.
9. Return clutch pedal to released position.
10. Repeat process until bubble free fluid emerges and tighten union to 18 Nm.



33M0154

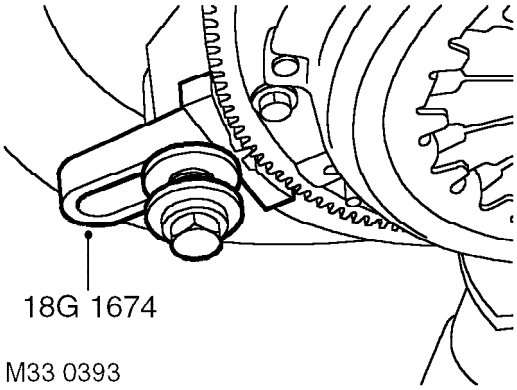
11. Clean area around slave cylinder bleed nipple.
12. Position bleed bottle and connect hose to bleed nipple.
13. Depress clutch pedal to floor and hold.
14. Loosen bleed nipple and allow air and fluid to escape.
15. Tighten nipple.
16. Return clutch pedal to released position.
17. Repeat process until bubble free fluid emerges.
18. Depress clutch pedal to floor and hold.
19. Open bleed nipple and by hand, pull clutch lever to fully released position.
20. Tighten nipple to 7 Nm.
21. Return clutch pedal to released position.
22. Remove bleed bottle.
23. Top up master cylinder.
24. Fit engine compartment access cover. ***See BODY, Exterior fittings.***

CLUTCH ASSEMBLY/DRIVE PLATE & RELEASE BEARING - MANUAL TRANSMISSION MODELS

Service repair no - 33.10.07

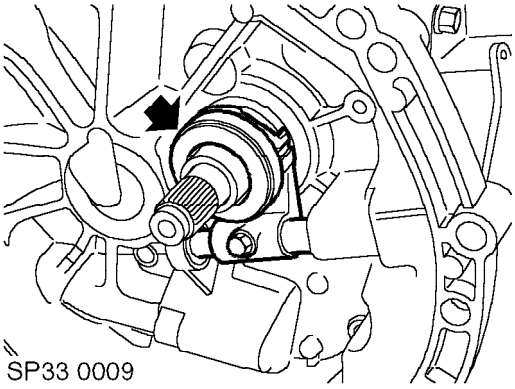
Remove

1. Disconnect battery earth lead.
2. Remove gearbox assembly. ***See MANUAL GEARBOX, Repairs.***



M33 0393

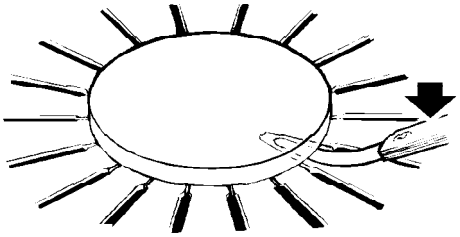
3. Fit flywheel locking tool **18G 1674** to cylinder block and secure with bolt.



SP33 0009

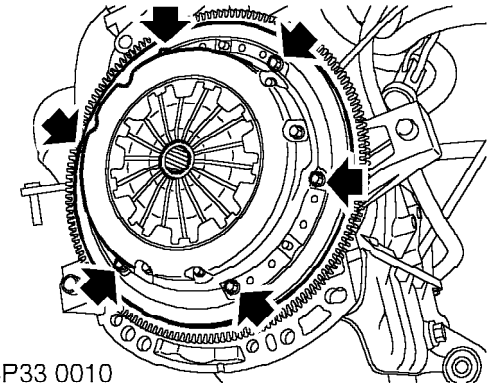
4. Remove clutch release bearing from guide sleeve and release fork.
5. Examine release bearing for signs of wear or damage, renew if necessary.

CAUTION: Bearing is packed with grease. Do not wash in solvent.



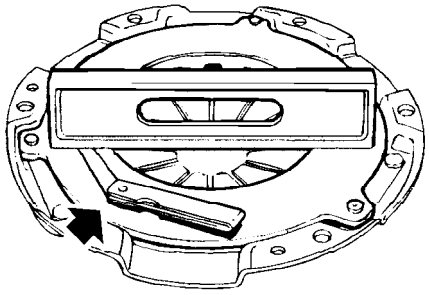
SP33 0007

6. Place a circular piece of flat plate across diaphragm fingers, insert feeler gauges between plate and each diaphragm finger, measure finger clearance which has a service limit of 1.0 mm. A single finger exceeding the service limit should be ignored.
7. Measure diaphragm finger height above bolted surface of pressure plate. Diaphragm finger height on a new pressure plate is 29.1 - 32.0 mm with a service limit of 36.5 mm. Renew pressure plate if clearances are outside service limit.



SP33 0010

8. Progressively loosen and remove 6 Torx bolts securing clutch pressure plate to flywheel.
9. Remove clutch pressure plate and collect drive plate.
10. Inspect clutch drive plate for signs of wear or oil contamination. Renew drive plate if necessary.
11. Check pressure plate for signs of wear or damage. Check for signs of overheating on drive straps (deep yellow to blue colour), renew pressure plate if necessary.

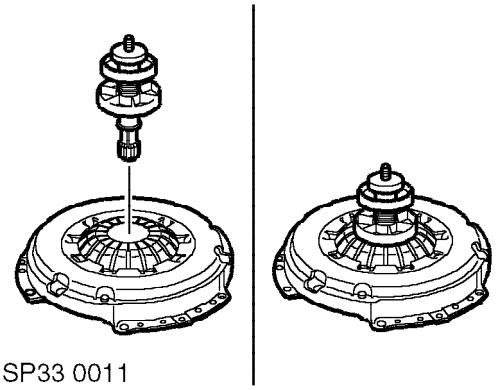


SP33 0008

12. Using a straight edge and feeler gauges, check the surface of the pressure plate for flatness at 4 separate points. Renew pressure plate if warping exceeds the service limit of 0.18 mm.

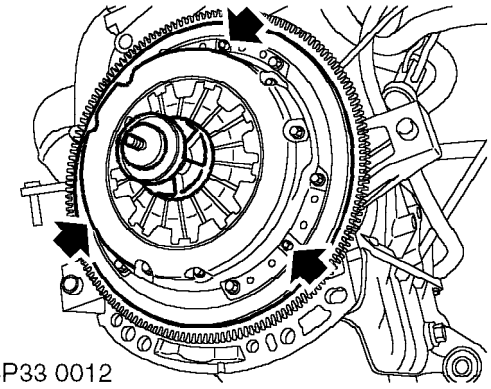
Refit

1. Clean pressure plate, flywheel dowels and dowel holes in flywheel.
2. Inspect flywheel for signs of scoring or other damage. Renew if worn or damaged.
3. Smear clutch drive plate splines with Molybdenum disulphide grease.
4. Position drive plate to pressure plate with 'GEARBOX SIDE' facing towards gearbox.



SP33 0011

5. Use **12-162** to align drive plate and pressure plate.
6. Ensure drive plate is aligned to centre of pressure plate.



SP33 0012

7. Fit clutch assembly to flywheel and locate on dowels.
8. Fit 6 bolts securing pressure plate to flywheel and tighten finger tight.
9. Progressively tighten clutch pressure plate bolts in a diagonal sequence to 25 Nm.
10. Remove drive plate alignment tool **12-162.**
11. Clean clutch release fork and release bearing guide sleeve.
12. Smear release fork shaft and bore of release bearing with Molybdenum disulphide grease.
13. Fit release bearing to release fork and slide onto guide sleeve.
14. Operate clutch release lever to ensure that release bearing is correctly located on release fork and slides smoothly on guide sleeve.
15. Remove bolt and flywheel locking tool, **18G 1674,** from cylinder block.
16. Fit gearbox assembly. ***See MANUAL GEARBOX, Repairs.***
17. Connect battery earth lead.

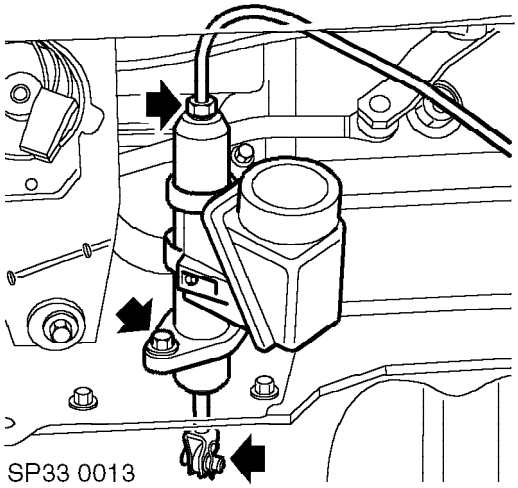
CLUTCH MASTER CYLINDER

Service repair no - 33.20.01

Remove

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

1. Remove underbonnet closing panel, ***See BODY, Exterior fittings.***



2. Remove clevis pin from clutch pedal.
3. Position cloth to catch spillage.
4. Loosen and release union securing fluid pipe to master cylinder, position fluid pipe aside.

CAUTION: Always fit plugs to open connections to prevent contamination.

5. Remove 2 bolts securing master cylinder to pedal box.
6. Remove master cylinder.
7. Remove and discard gasket.

Refit

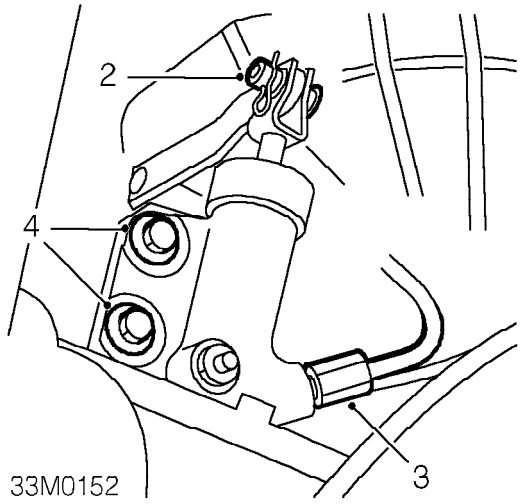
1. Using new gasket, fit master cylinder and tighten bolts to 25 Nm.
2. Position pipe and tighten union to 18 Nm.
3. Position clutch pedal to push rod, fit clevis pin.
4. Fit washer and clip.
5. Bleed clutch. ***See Adjustments.***
6. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

CLUTCH SLAVE CYLINDER

Service repair no - 33.35.01

Remove

1. Remove engine cover. ***See ENGINE, Repairs.***



2. Remove clevis pin from slave cylinder.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

3. Release pipe union from slave cylinder and position aside.

CAUTION: Always fit plugs to open connections to prevent contamination.

4. Remove 2 bolts securing slave cylinder to bracket and remove slave cylinder.

Refit

1. Fit slave cylinder and tighten bolts to 25 Nm.
2. Position pipe and tighten union to 18 Nm.
3. Position cylinder rod to lever and secure with clevis pin.
4. Bleed clutch. ***See Adjustments.***
5. Fit engine cover. ***See ENGINE, Repairs.***

DAMPER - CLUTCH - VVC

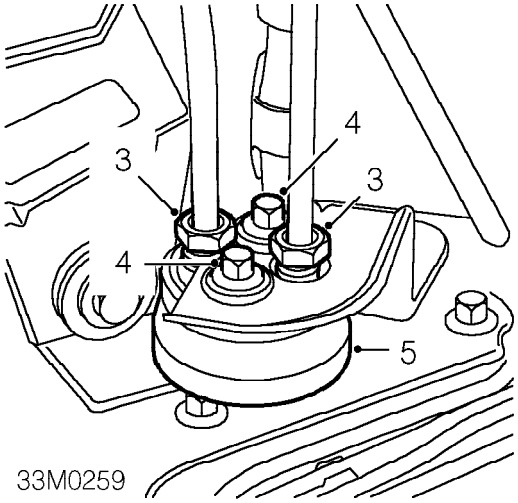
Service repair no - 33.15.05

Remove

1. Remove underbonnet closing panel, ***See BODY, Exterior fittings.***

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

2. Place container underneath clutch damper to collect fluid spillage.



3. Release 2 clutch pipe unions from clutch damper.
4. Remove 2 bolts securing clutch damper to bracket.
5. Collect clutch damper.

CAUTION: Always fit plugs to open connections to prevent contamination.

Refit

1. Position clutch damper to bracket.
2. Fit bolts securing clutch damper to bracket and tighten to 15 Nm.
3. Fit clutch pipe unions to clutch damper and tighten to 18 Nm.
4. Bleed clutch hydraulic system. ***See Adjustments.***
5. Collect drip tray.
6. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

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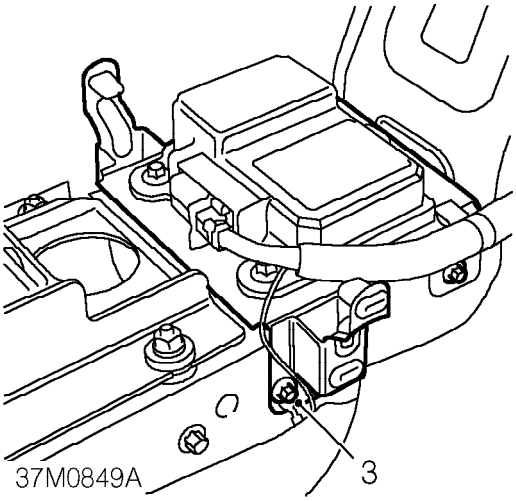
GEAR LEVER

Service repair no - 37.16.04

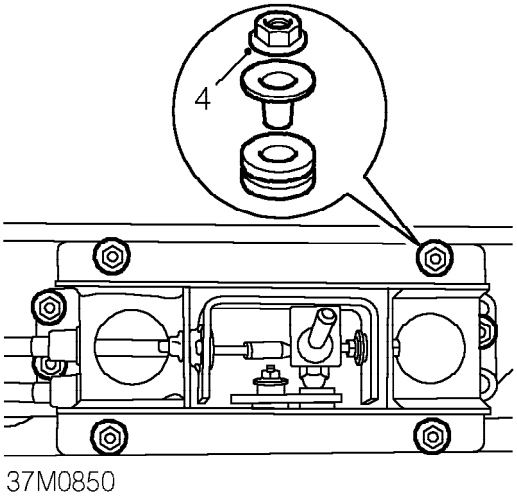
WARNING: ***See RESTRAINT SYSTEMS, Precautions.***

Remove

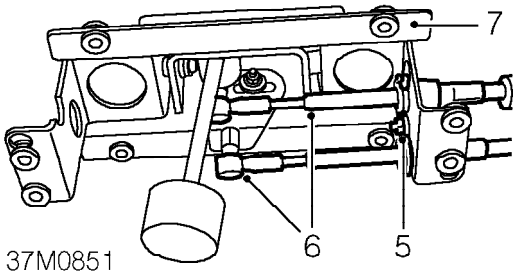
1. Disconnect battery earth lead.
2. Remove front console. ***See BODY, Interior trim components.***



3. Remove 4 T x 30 Torx bolts securing SRS DCU bracket to tunnel, position bracket aside.



4. Remove 4 nuts and 3 bolts securing lever assembly to tunnel.



5. Remove bolt securing cable abutment clip to lever assembly and release clip.
6. Release 2 cables from ball joints and lever assembly.
7. Remove lever assembly.

Refit

1. Connect cables to lever assembly.
2. Position outer cables and secure with clip.
3. Secure retaining clip with bolt.
4. Position gear lever assembly to body.
5. Fit and tighten nuts and bolts to 9 Nm.
6. Position SRS bracket to body, fit harness earth lead and tighten Torx bolts to 10 Nm.
7. Fit front console. ***See BODY, Interior trim components.***
8. Connect battery earth lead.

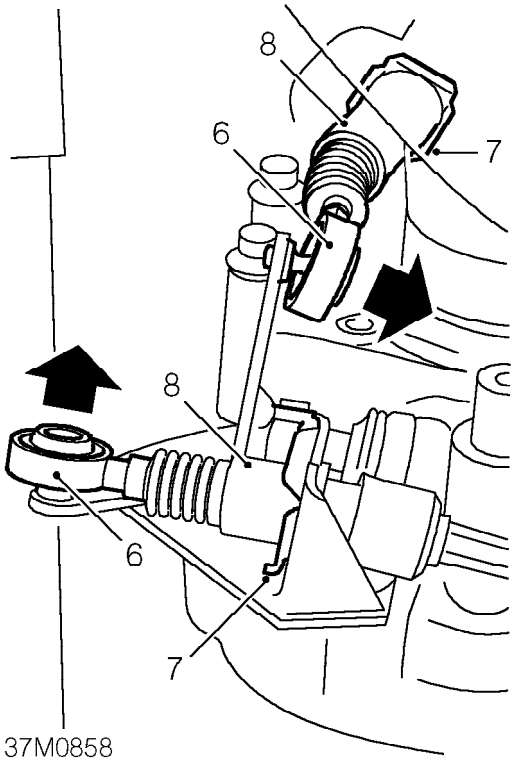
GEAR CHANGE CABLE

Service repair no - 37.16.16

WARNING: ***See RESTRAINT SYSTEMS, Precautions.***

Remove

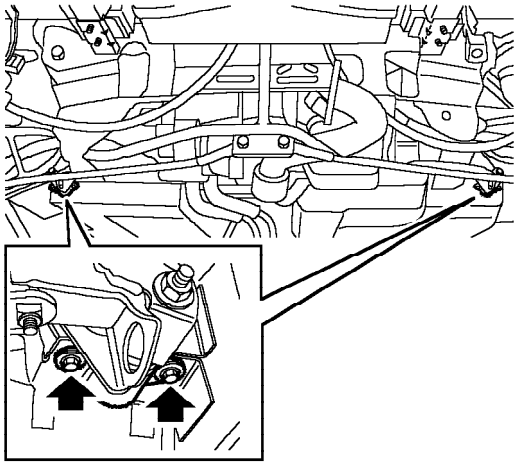
1. Position vehicle on a 2 post ramp.
2. Make the SRS system safe. ***See RESTRAINT SYSTEMS, Precautions.***
3. Remove engine cover. ***See ENGINE, Repairs.***
4. Drain engine coolant. ***See COOLING SYSTEM, Adjustments.***
5. Release handbrake to OFF position.



37M0858

6. Release gear change cable from gearbox linkage.
7. Remove and discard clip securing cable to abutment bracket.
8. Release cable from abutment bracket.
9. Place support jack underneath engine sump and support engine weight.

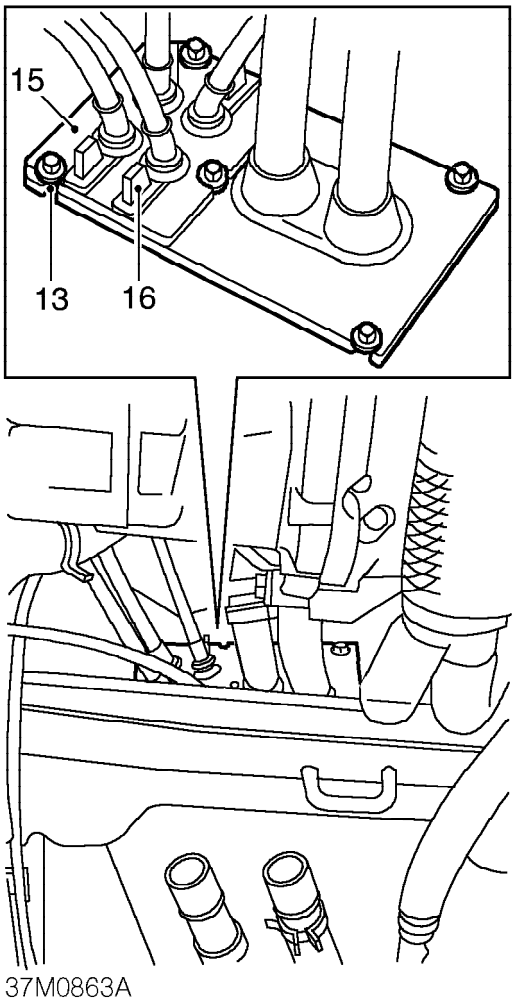
CAUTION: To prevent damage to sump place a piece of wood between jack and sump.


SP37 0010

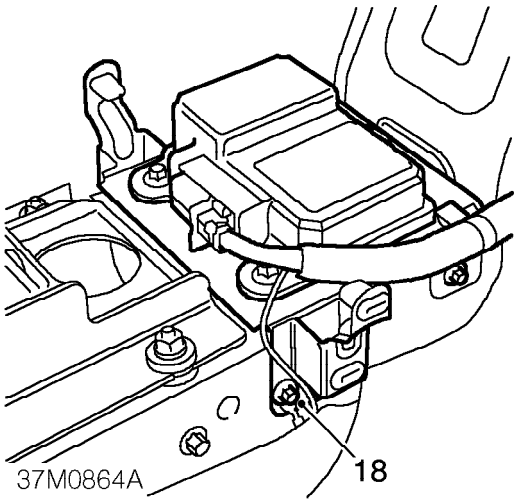
10. Remove 2 bolts securing each front subframe mounting to body brackets.
11. Lower jack carefully, to allow access to closing plate bolts.

CAUTION: Care must be taken that no cables or pipes are stretched when lowering front of subframe.

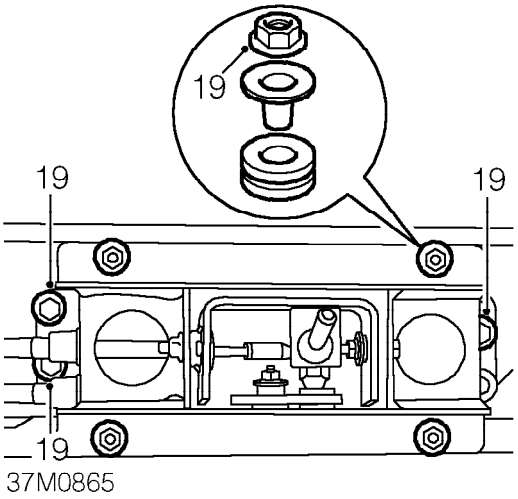
12. Tie coolant hoses aside to allow access to closing plate.



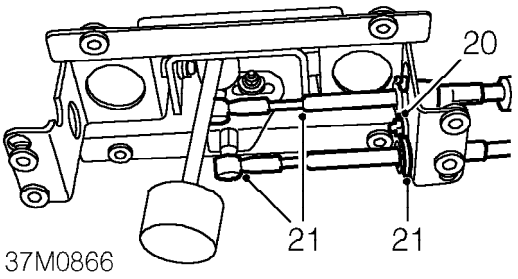
13. Release 2 upper bolts and remove 3 remaining bolts securing closing plate to bulkhead.
14. Apply soft soap to all four closing plate cables, to ease movement of closing plate.
15. Release closing plate from bulkhead and slide along cables.
16. Release gear change cable grommet from closing plate.
17. Remove front console. ***See BODY, Interior trim components.***



18. Remove 4 Torx bolts securing SRS DCU bracket to tunnel, position bracket aside.



19. Remove 4 nuts and 3 bolts securing gear selector assembly to tunnel.



20. Position gear selector assembly and remove bolt securing cable abutment clip to assembly.
21. Remove cable abutment clip and release cable from assembly.
22. Remove gear change cable from tunnel and engine compartment.

Refit

1. Position gear change cable to tunnel and feed through rear bulkhead.
2. Position cable in engine compartment.
3. Lubricate all four cables with soft soap to ease grommet movement on cables.
4. Position cable into closing plate slot and secure with grommet.
5. Align closing plate to bulkhead and secure with bolts.
6. Raise subframe on jack, fit subframe mounting bolts and tighten to 30 Nm .
7. Position cable to gear selector abutment bracket.
8. Engage cable to selector ball joint.
9. Fit new abutment bracket clip.
10. Fit cable to gear lever selector assembly.
11. Position cable to abutment, fit retaining clip and secure with bolt.
12. Position gear lever assembly to tunnel, fit and tighten nuts and bolts to 9 Nm.
13. Position SRS DCU bracket to tunnel, fit harness earth connector, tighten Torx bolts to 10 Nm .

WARNING: The crash sensor is incorporated inside the DCU, therefore it is imperative that the DCU bolts are tightened to their correct torque.

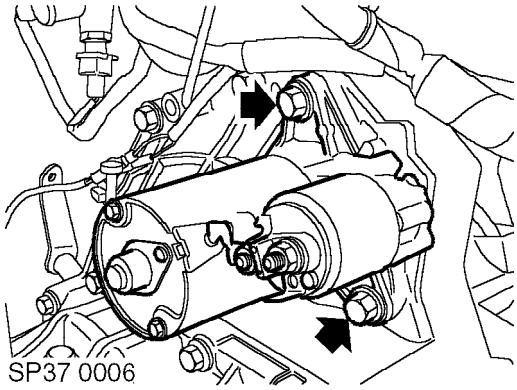
14. Fit front console. ***See BODY, Interior trim components.***
15. Untie and position coolant hoses.
16. Fill engine coolant system. ***See COOLING SYSTEM, Adjustments.***
17. Fit engine cover. ***See ENGINE, Repairs.***

GEARBOX - MANUAL - REMOVE FOR ACCESS & REFIT

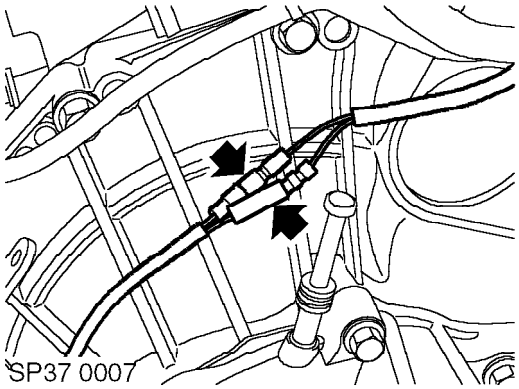
Service repair no - 37.20.02.99

Remove

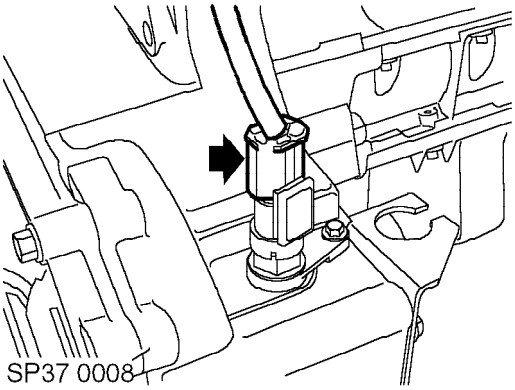
1. Disconnect battery earth lead.
2. Remove engine and gearbox assembly. ***See ENGINE, Repairs.***
3. Drain gearbox oil.


SP37 0006

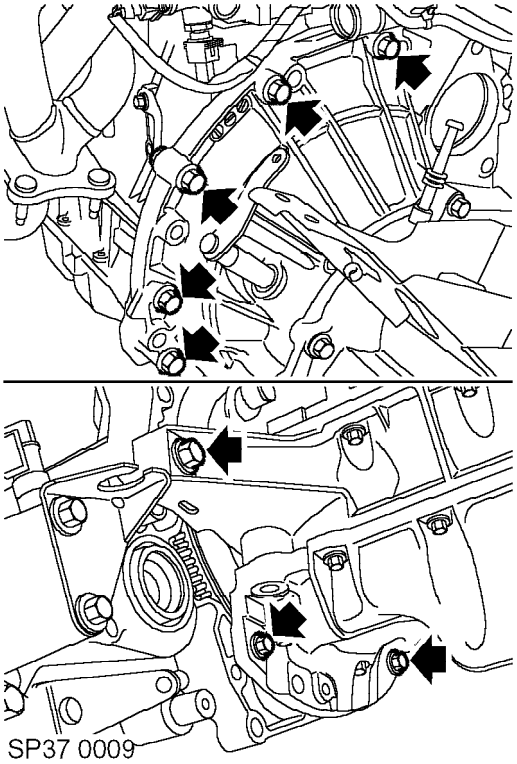
4. Remove 2 nuts and bolts securing starter motor, remove starter motor and collect rear closing plate.


SP37 0007

5. Disconnect reverse light switch connectors.


SP37 0008

6. Disconnect multiplug from road speed transducer.


SP37 0009

7. Remove 5 bolts and 3 nuts and bolts securing gearbox to engine.
8. Collect front closing plate.
9. With assistance remove gearbox from engine.

Refit

1. Clean mating faces of gearbox and engine, ensure locating dowels are fitted.
2. With assistance, fit gearbox, locate on dowels and secure to engine.
3. Position front closing plate.
4. Fit nuts and bolts securing gearbox to engine. Tighten gearbox to engine bolts to 80 Nm. Gearbox to sump bolts to 45 Nm.
5. Connect multiplug to transducer.
6. Connect reverse lamp switch wires.
7. Clean starter motor and mating face on gearbox housing.
8. Position rear closing plate.
9. Position starter motor to gearbox, fit and tighten nuts and bolts to 80 Nm.
10. Fill gearbox with oil.
11. Fit engine and gearbox assembly. ***See ENGINE, Repairs.***
12. Connect battery earth lead.

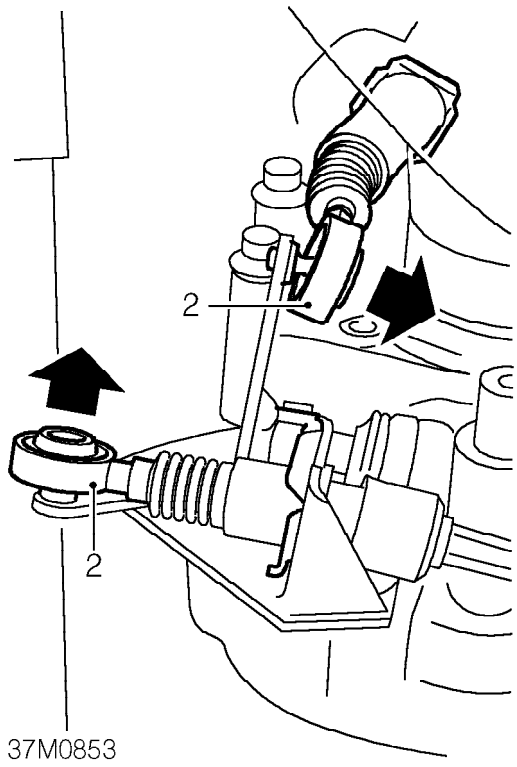
SELECTOR SHAFT OIL SEAL

Service repair no - 37.23.10

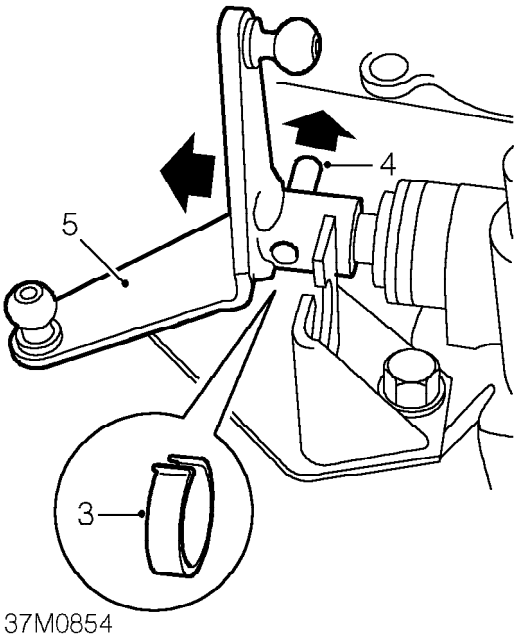
Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

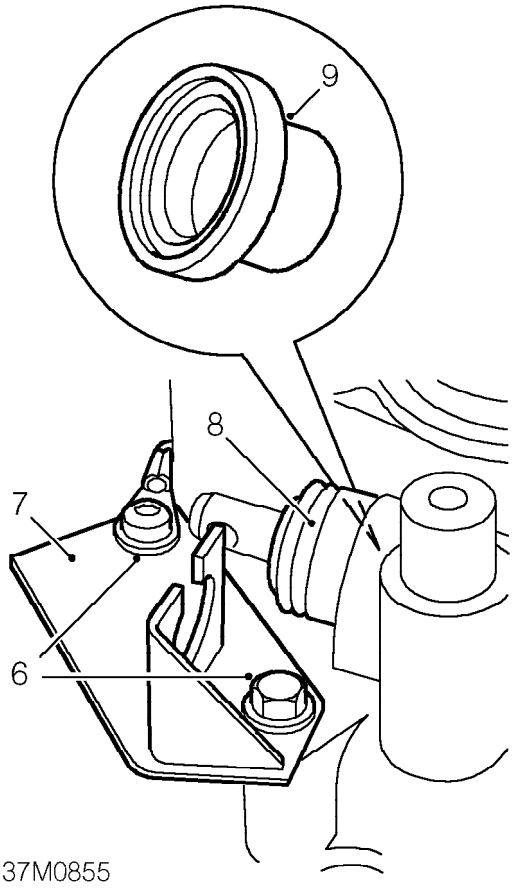


2. Release 2 gear change cables from selector linkage.



37M0854

3. Remove clip securing selector linkage roll pin.
4. Using a suitable punch, drive out roll pin from selector linkage and discard roll pin.
5. Remove selector linkage from shaft.



37M0855

6. Remove bolt and Torx screw securing lower gear change cable abutment bracket to gearbox.
7. Remove gear change cable abutment bracket.
8. Remove oil seal cover from selector shaft.
9. Using a flat screwdriver remove oil seal from gearbox and discard oil seal.

Refit

1. Clean oil seal housing and selector shaft.
2. Lubricate new seal using clean unused engine oil.
3. Fit oil seal to selector shaft.
4. Secure seal to gearbox using a deep socket.
5. Fit oil seal cover and secure to seal flange.
6. Fit gear change cable abutment bracket, fit bolts and tighten to 45 Nm.

NOTE: Position earth lead to abutment bracket retaining bolt.

7. Fit selector linkage to shaft, align holes, fit new roll pin and secure clip.
8. Secure gear change cables to selector linkage.
9. Remove stand(s) and lower vehicle.

REVERSE LAMP SWITCH

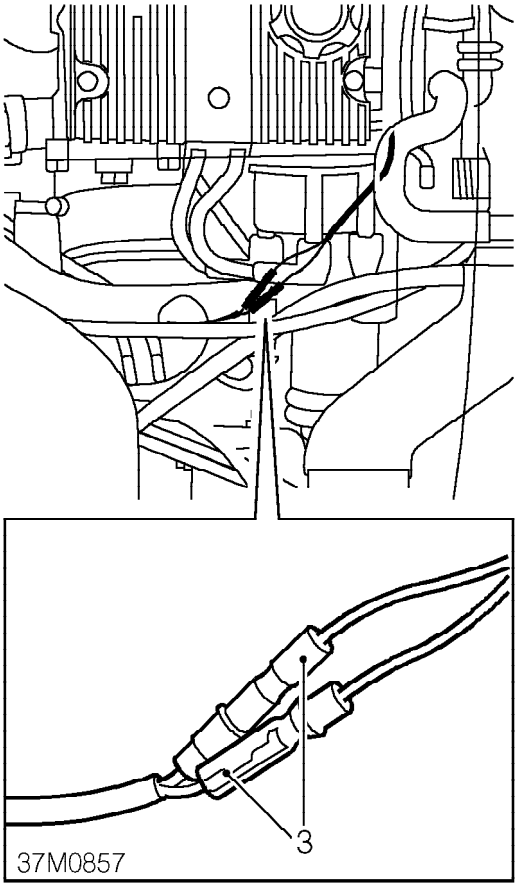
Service repair no - 37.27.01

Remove

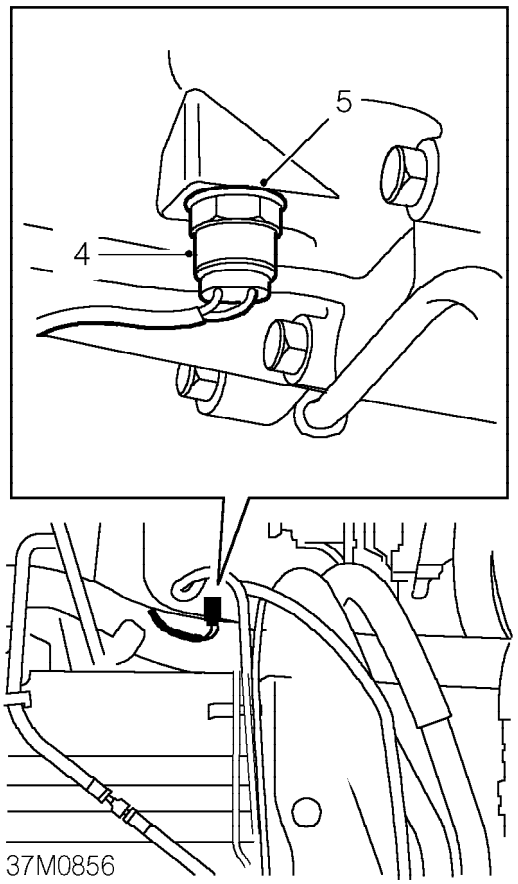
1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



3. Disconnect reverse lamp switch connectors.



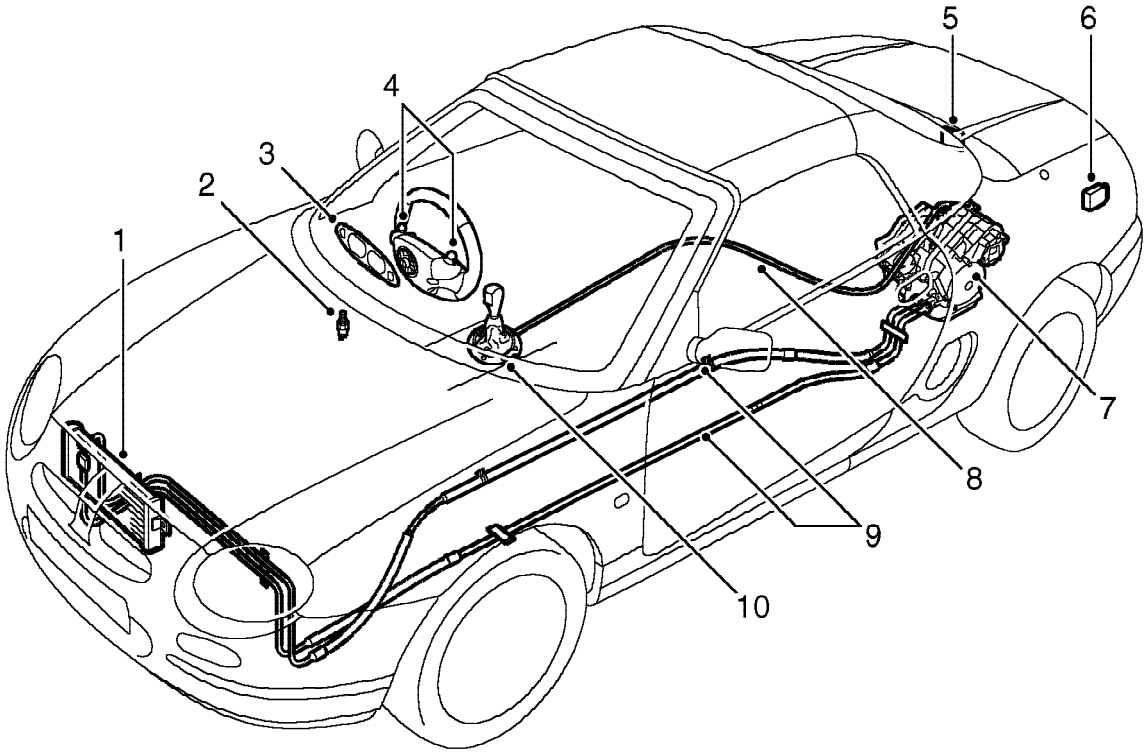
4. Remove reverse lamp switch.
5. Collect sealing washer and discard.

Refit

1. Clean threads and mating faces of reverse lamp switch.
2. Fit NEW sealing washer to reverse lamp switch.
3. Fit and tighten reverse lamp switch to gearbox.
4. Connect reverse lamp switch connectors.
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
6. Remove stand(s) and lower vehicle.

CONTENTS

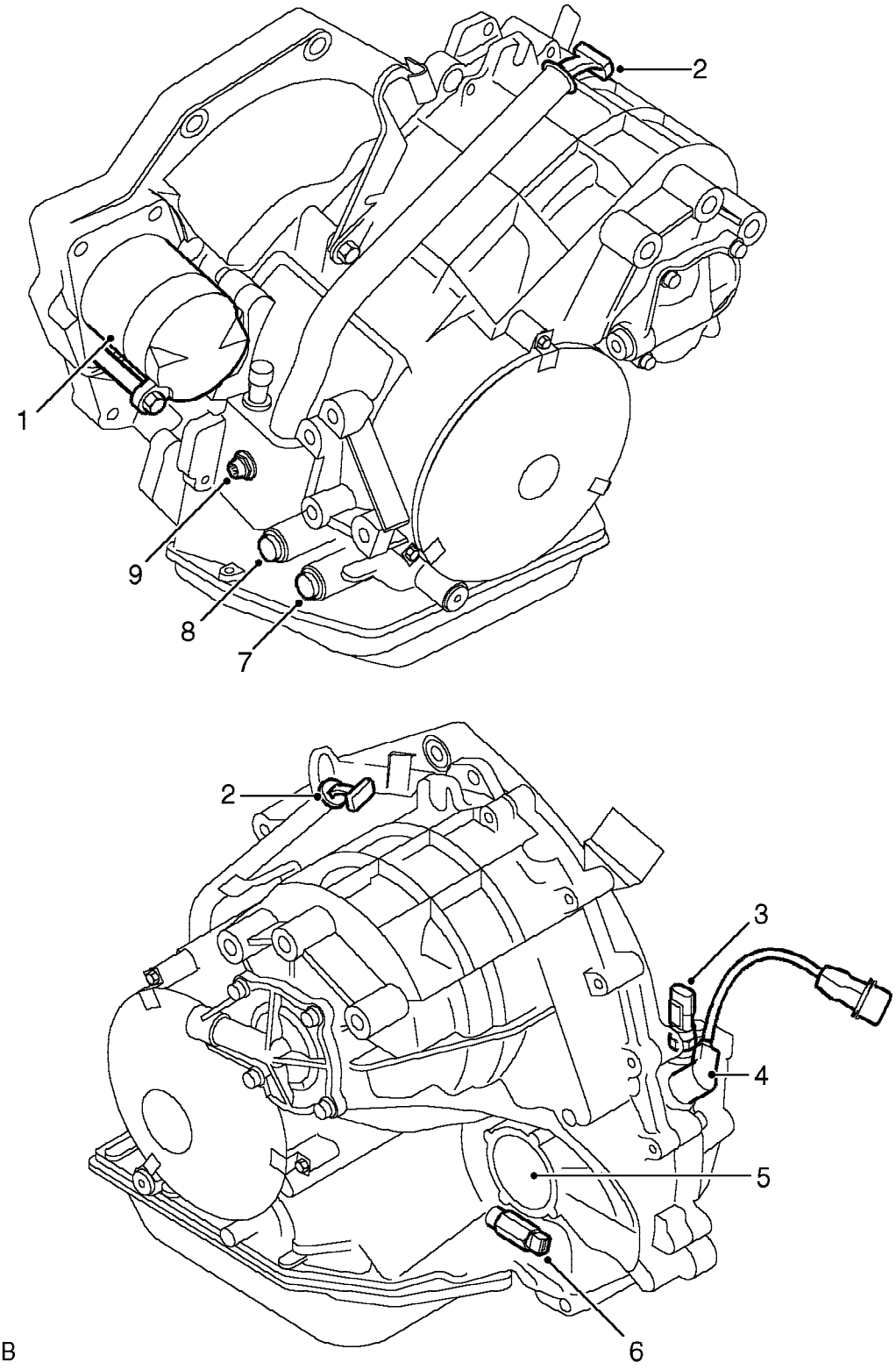
STEPSPEED (Em-CVT) COMPONENT LOCATION



M44 1303B

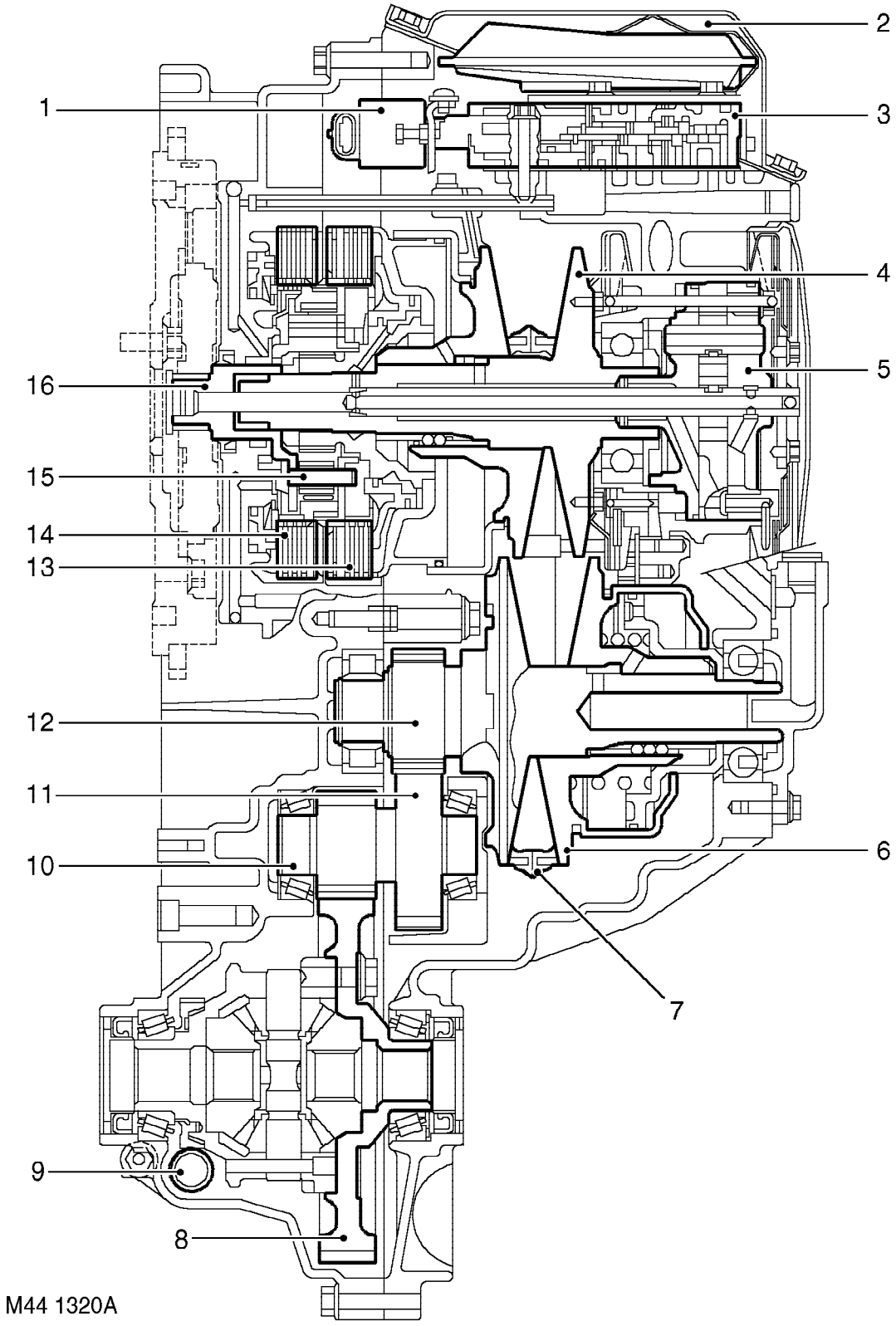
1. Fluid cooler
2. Brake switch
3. Instrument pack
4. Steering wheel switches
5. Engine Control Module (ECM)
6. Gearbox Interface Unit (GIU)
7. Stepspeed (Em-CVT) gearbox
8. Selector cable
9. Fluid cooler feed/return pipes
10. Gear selector lever

STEPSPEED (Em-CVT) GEARBOX



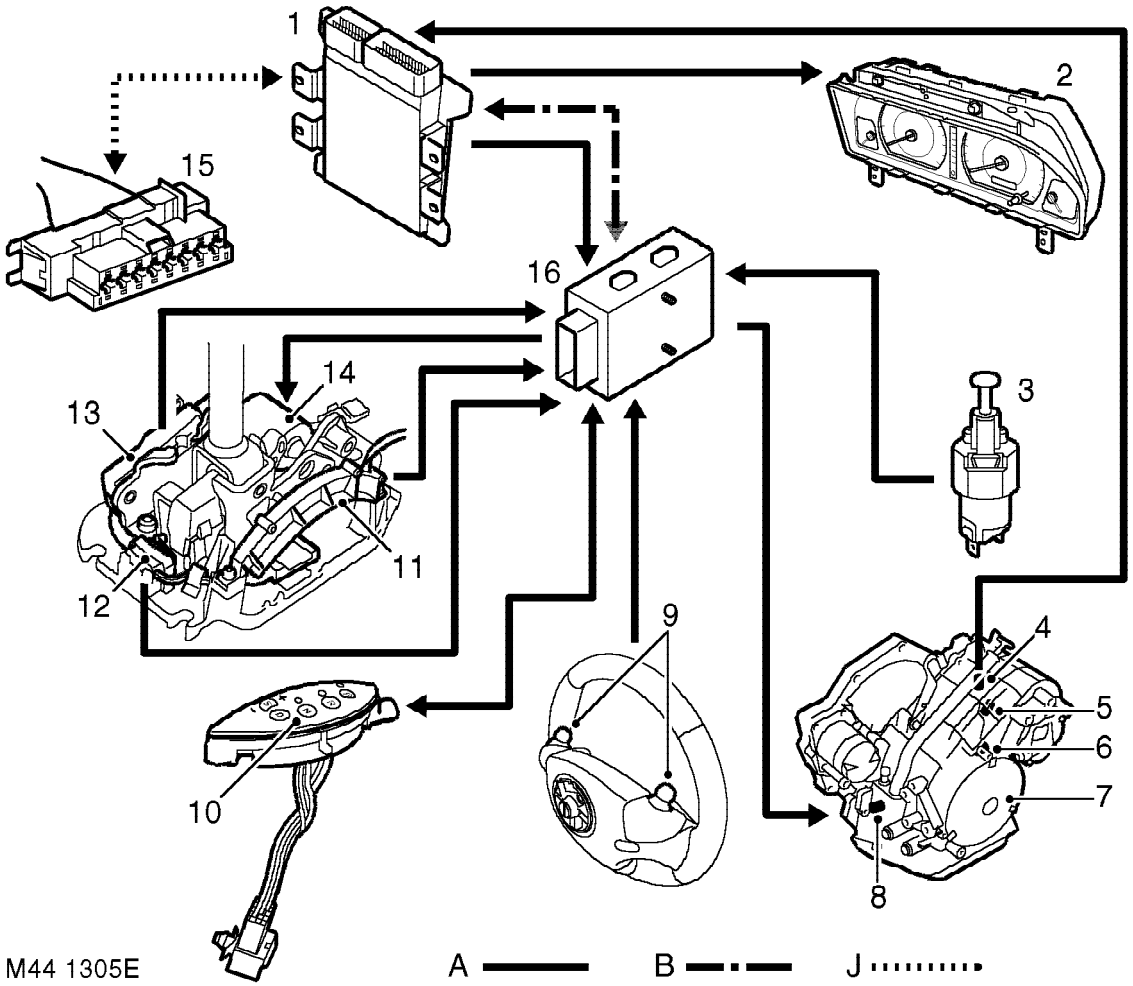
1. Starter motor
2. Fluid level dipstick
3. Road speed transducer
4. Gearbox differential speed sensor
5. LH drive shaft connection
6. Park/Neutral switch
7. Fluid cooler return connection
8. Fluid cooler feed connection
9. Ratio control motor connector

STEPSPEED (Em-CVT) GEARBOX - SECTIONAL VIEW



1. Ratio control motor
2. Fluid sump
3. Hydraulic control unit
4. Primary pulley
5. Fluid pump
6. Secondary pulley
7. Drive belt
8. Differential
9. Road speed transducer
10. Pinion shaft
11. Final drive reduction gear
12. Secondary reduction gear
13. Drive clutch
14. Reverse clutch
15. Planetary gear set
16. Input shaft

STEPSPEED (Em-CVT) CONTROL DIAGRAM



A= Hardwired; B= Serial link; J= Diagnostic ISO9141 K Line

1. Engine Control Module (ECM)
2. Instrument pack
3. Brake switch
4. Road speed transducer
5. Gearbox differential speed sensor
6. Park/Neutral switch
7. (Em-CVT) Stepspeed gearbox
8. Ratio control motor
9. Steering wheel switches
10. P R N D S LED module
11. P R N D switch
12. Manual/Sport switch
13. Sport +/- switch
14. Shift lock solenoid (if fitted)
15. Diagnostic socket
16. Gearbox Interface Unit (GIU)

DESCRIPTION

General

The Electro Mechanical - Continuously Variable Transmission (Em-CVT) is based on a standard CVT unit with electronic components fitted to control the gear ratio. This gives the driver a choice between an automatic gearbox and a semi-automatic Stepspeed manual gearbox.

The gearbox can be operated as a conventional CVT unit by selecting P, R, N or D on the selector lever. Moving the selector lever across the gate trips a microswitch and puts the gearbox into manual/sport mode.

In sport mode, the gearbox still operates as a conventional CVT unit, but becomes more responsive to changes in driver demands. Engine speed is higher in this mode which gives improved acceleration.

When in sport mode, if the selector lever or either of the steering wheel switches are moved to the + or - positions, the system changes to operate in manual mode. Manual gear changes can be performed sequentially using either the selector lever or the steering wheel switches. Movement of the selector lever in a forward direction (+) changes the gearbox up the gear ratios and movement in a rearward (-) direction changes the gearbox down the ratios. Either of the + and - switches on the steering wheel perform the same function as the selector lever when in sport mode.

Gearbox operation is controlled by a Gearbox Interface Unit (GIU) and the ECM which communicate via a dedicated serial link and a hardwired connection. The MEMS3 ECM is programmed with an Em-CVT control strategy to operate the gearbox in conjunction with the GIU.

Stepspeed Em-CVT unit

When in automatic mode, the Em-CVT provides an infinite number of ratios within its operating range. The stepless shifting pattern of the transmission provides a smooth transfer of power to the road wheels whilst allowing full vehicle performance to be available at all times.

In sport mode, the Em-CVT operates as in automatic mode but with a higher engine speed under all driving conditions which gives improved acceleration.

In manual mode, the Em-CVT provides electronic selection of six predetermined ratios. Selection is made by the driver using the selector lever or the steering wheel switches.

The Em-CVT unit comprises mechanical and electrical components which work together to provide the automatic and manual operation of the gearbox.

The following mechanical components comprise the Em-CVT unit (Refer to Em-CVT sectional view):

- Torsion damper
- Planetary gear set
- Clutches
- Pulleys and steel belt
- Pinion shaft
- Differential unit
- Hydraulic pump.

Torsion damper

The transmission is driven from the engine via a torsion damper. The torsion damper is attached to the flywheel with six bolts and is constructed similar to a conventional clutch drive plate, but without the clutch lining. The torsion damper has a splined hub which engages with the gearbox input shaft. The hub is located on an inner plate which contains compression springs. Engine power is transmitted from the flywheel and damper attachment to the hub via the compression springs which absorb torsional vibrations from the engine and provide a smooth power delivery to the gearbox.

Planetary gear set

The planetary gear set enables the gearbox to provide a rotational output to the drive shafts in two directions to provide the vehicle with forward and reverse selections.

Engine torque is transmitted from the engine and the torsional damper to the input shaft which is attached to the planet carrier.

When forward is selected, the carrier is connected directly to the sunwheel by the drive clutch. The epicyclic gear set rotates as one unit and engine torque is passed directly to the primary pulley.

When reverse is selected, the annulus of the planetary gear set is held stationary by the reverse clutch. Three pairs of planet gears then drive the sunwheel in the opposite direction rotating the primary pulley in the reverse direction.

Clutches

Each of the two clutches comprise a multiplate wet clutch pack. Each pack has three friction plates providing six friction surfaces. Hydraulic pressure controls the clutches to allow the vehicle to move away smoothly regardless of the degree of throttle opening. Fluid from the fluid cooler is directed to the clutch plates to prevent overheating of the friction surfaces.

Pulleys and steel belt

The major drive components of the gearbox are a pair of vee shaped pulleys and a steel drive belt. Each pulley comprises one fixed sheave and one moveable sheave. Both moveable sheaves are positioned diagonally opposite each other to prevent misalignment of the belt during shift changes. Each moveable sheave is operated by a hydraulic cylinder and piston, with hydraulic pressure controlled by the hydraulic control unit. The moveable sheaves are located on ball splines which prevents them rotating in relation to the fixed sheaves.

Rotation of the planetary gear set rotates the primary pulley. The V-belt transfers the primary pulley rotation to the secondary pulley whose torque and speed is controlled by the position of the V-belt on the two pulleys.

A 24 mm wide steel, push type V-belt is used to transfer engine torque between the two pulleys. The belt is cooled and lubricated by a fluid jet.

The belt comprises two steel bands each constructed from ten steel strips. The steel bands contain approximately 350 steel segments which abut each other to allow the belt to transmit torque by compression. The belt has several different thicknesses of steel segments which reduce the noise of the segments contacting the pulleys by changing the harmonic frequencies.

Pinion shaft

The pinion shaft, which is supported on two tapered bearings, provides location for two gears which provide a two step helical gear reduction between the secondary pulley and the differential crownwheel and provide the correct rotational direction of the drive shafts.

Differential

Drive from the final reduction gear is transferred to the differential crownwheel. The crownwheel is bolted to the differential case with eight bolts. Drive from the crownwheel is transferred via bevel gears to the drive shafts. The differential is supported on tapered bearings.

Hydraulic pump

The hydraulic pump is located on the opposite side of the gearbox to the planetary gear set. The pump is driven directly from the torsion damper via a shaft which is located through the centre of the input shaft. The shaft is splined to the planet carrier which always rotates at engine crankshaft speed.

The pump has a swept volume of 10.32 cc per revolution and can produce a pressure of up to 40 bar (580 lbf/in^2) for the highest torque requirement. The pressurized fluid from the pump is used for gearbox lubrication and transmission control.

The following electrical components are used on the Em-CVT unit:

- Ratio control motor
- Gearbox differential speed sensor
- Park/Neutral switch.

Ratio Control Motor

The ratio control motor operates to match the gear ratio to the target engine speed. In any mode, the motor position is varied to provide the 'kickdown' function of a conventional automatic transmission. In manual mode, the position of the motor is varied to control the engine speed, fixing the current gear ratio. The motor operates the hydraulic control unit to adjust the primary pulley.

The ratio control motor is located inside the gearbox, on one side of the hydraulic control unit. The motor is connected to the main harness via a circular seven way connector with four connections used for the motor operation. The connector is screwed into the forward face of the gearbox and is secured with a nut.

The ratio control motor is a linear actuator which is controlled by the GIU in response to PWM signals at 500 Hz from the ECM. The motor itself is a bi-polar stepper motor which contains two bobbins which create magnetic fields to move the motor to the required position.

Gearbox Differential Speed Sensor

The gearbox differential speed sensor is located in the rear face of the gearbox adjacent to the road speed transducer. The sensor is connected to the main harness via a fly lead with a three pin connector.

The gearbox differential speed sensor is a Hall effect sensor which uses an 81 tooth target wheel which is the teeth of the gearbox differential crown wheel. The sensor output is read directly by the ECM which calculates an accurate vehicle speed. The sensor output is unaffected by locking of the wheels due to the operation of the differential. The ECM vehicle speed calculation allows the Em-CVT system to calculate the current gear ratio.

Park/Neutral Switch

The park/neutral switch is screwed into the rear face of the gearbox below the LH drive shaft. The switch is connected to the main harness by a four pin connector.

The switch is operated by a cam which also operates the hydraulic control unit within the gearbox. The cam is controlled by the selector lever via a cable to the gearbox. The switch has two positions and performs several functions.

When the transmission is in any position other than the Park (P) or Neutral (N) positions, the switch interrupts the starter relay coil earth path to the alarm ECU preventing starter operation. This signal is also used by the ECM to adjust the stepper motor of the IAC valve to adjust the engine idle speed when Reverse (R) or Drive (D) is selected.

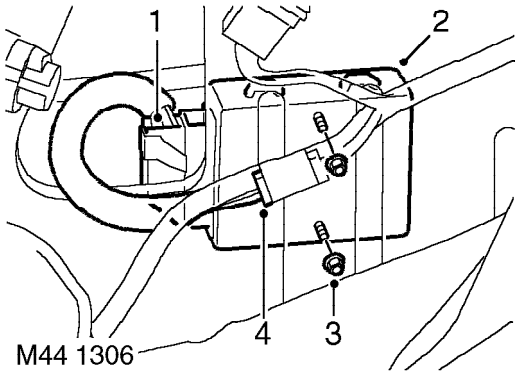
When Reverse (R) is selected, the switch moves to its second position and activates the reverse lamps.

In selected markets, when the selector lever is in the 'P' position and the ignition is switched on, the park/neutral switch input causes the GIU to energise a shift lock solenoid on the selector lever. This locks the lever in the 'P' position. The selector lever cannot be moved from the 'P' position until the ignition is switched on and the footbrake is applied. The shift lock solenoid is only active when the ignition is on.

Road speed transducer

The road speed transducer is located on the rear face of the gearbox, above the RH drive shaft, adjacent to the gearbox differential speed sensor. The transducer is used by the instrument pack for speedometer drive, the Electronic Power Assisted Steering (EPAS) system and the ECM.
See INSTRUMENTS, Information.
See STEERING, Information.

Gearbox Interface Unit (GIU)



1. Harness connector
2. GIU
3. Mounting nut (2 off)
4. GIU fuse (10A)

The GIU is located in the in the LH side of the luggage compartment behind the trim. The GIU has two captive studs which are secured to the body with two nuts.

When the engine control module relay is engaged uner the control of the ECM, battery voltage is supplied to the GIU from fuse 2 in the engine compartment fusebox via a 10 Amp in-line fuse located on the harness near the GIU connector.

The GIU responds to control messages from the ECM to control the gearbox operation. The GIU also passes messages to the ECM in response to driver input commands enabling the ECM to operate the gearbox accordingly.

The ECM and GIU have a programmed default strategy which is engaged when specific faults are detected. Any condition requiring the default strategy will be relayed to the driver by illumination of the gearbox fault lamp in the instrument pack.

The ECM will need to learn the ratio control motor position when a new ECM is fitted. This is performed automatically by the ECM using a fast adaptation procedure. Refer to Operation section for details.

A 'limp-home mode' is provided if the system detects a fault but is still able to control the gearbox ratio. In addition to the fault lamp illumination, the driver will experience the engine speed being limited to approximately 3000 rev/min.

If the system is unable to control the gearbox ratio, the ECM will be unable to implement the default strategy, the gearbox will remain in a single ratio and the fault lamp will illuminate. If in the lowest gear, the engine speed will increase rapidly to 6000 rev/min and vehicle speed will be limited to a maximum of 30 mph (48.3 km/h). If in the highest gear, the driver will experience very slow acceleration and engine speeds of approximately 2000 to 2250 rev/min at 50 mph (80.5 km/h).

A single multiplug provides all input and output connections to and from the GIU. The following table shows the harness connector pin numbers and input/output information.

GIU connector C0932 pin details

Pin No.	Description	Input/Output
1	Shift lock solenoid drive (digital signal)	Output
2	Not used	-
3	12V Battery voltage from ECM relay module	Input
4	Earth	Input
5	Ratio control motor - Phase 1A (digital signal)	Input/Output
6	Ratio control motor - Phase 1B (digital signal)	Input/Output
7	Ratio control motor - Phase 2A (digital signal)	Input/Output
8	Ratio control motor - Phase 2B (digital signal)	Input/Output
9	Not used	-
10	Not used	-
11	Not used	-
12	Not used	-
13	Brake switch	Input
14	Park/Neutral switch	Input
15	Not used	-
16	Not used	-
17	GIU to ECM serial link	Output
18	ECM to GIU (Ratio control motor position)	Input
19	Not used	-
20	Not used	-
21	Not used	-
22	Not used	-
23	Not used	-
24	Not used	-

Continued.....

Connector C0932 pin details (continued)

Pin No.	Description	Input/Output
25	Not used	-
26	Park (P) LED (digital)	Output
27	Reverse (R) LED (digital)	Output
28	Neutral (N) LED (digital)	Output
29	Drive (D) LED	Output
30	Manual (M) LED (digital)	Output
31	Park/Neutral switch	Input
32	Reverse switch	Input
33	Neutral switch	Input
34	Drive switch	Input
35	Manual/sport switch	Input
36	Selector lever manual UP (+) switch	Input
37	Steering wheel manual UP (+) switch	Input
38	Selector lever manual DOWN (-) switch	Input
39	Steering wheel manual DOWN (-) switch	Input
40	Not used	-
41	Not used	-
42	Not used	-

NOTE: Pins 1 and 22, 2 and 23 and, 4 and 25 are connected together inside the GIU.

Engine Control Module - Em-CVT control

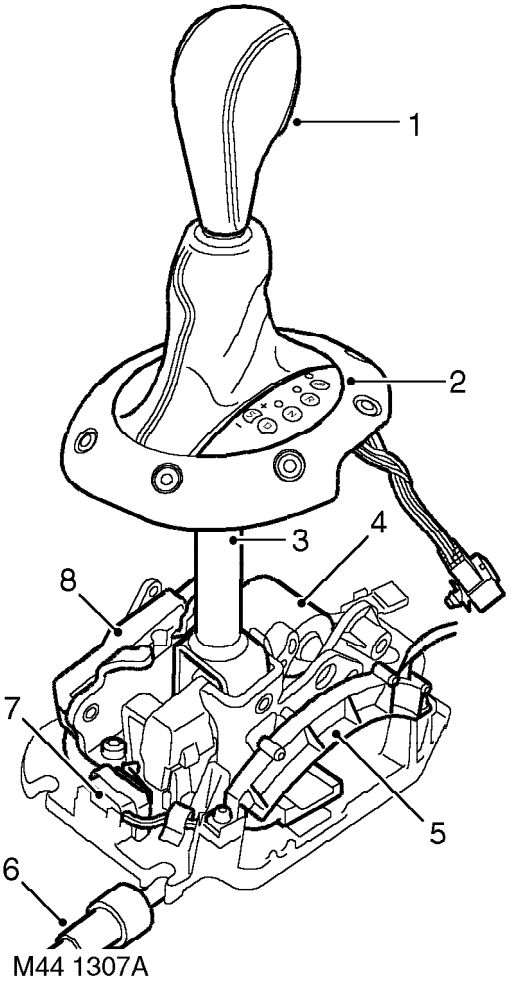
All electronic control of the Em-CVT operates as part of the MEMS3 ECM control strategy. The ECM receives an input from the gearbox differential speed sensor and communicates with the GIU to control the gearbox. The ECM also provides driver information via the LCD display in the instrument pack for gear ratio selected and automatic/sport mode selection.

The following input/output signals are used by the ECM for Em-CVT control.

- Crankshaft position (CKP) sensor
- Em-CVT Road speed transducer
- Throttle position (TP) sensor
- Engine coolant temperature (ECT) sensor
- Manifold absolute pressure (MAP) sensor
- Instrument pack gear/mode display
- Park/Neutral switch
- Em-CVT Ratio control motor position
- GIU serial link.

Refer to Engine Management for full ECM pin-out details. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Information.***

Gear Selector Lever assembly



1. Park/Reverse release button
2. LED module
3. Selector lever
4. Shift lock solenoid (if fitted)
5. PRND switch
6. Selector cable
7. Manual/Sport switch
8. Sport +/- switch

The gear selector lever assembly comprises a shift lock solenoid, LED module, manual/sport switch, sport +/- switch and PRND switch.

A die cast plate provides the attachment for the selector lever components. The plate is secured to a fabricated mounting with bolts, which in turn is secured to the floor pan with bolts and nuts. Rubber mounts between the mounting and the floor pan isolate vibrations from the selector lever.

The selector lever is attached to a gimbal mounting which allows gear selection in automatic and sport mode in a forward and backward direction and selection between automatic and sport in a left and right transverse direction.

Accidental selection of reverse (R) or park (P) is prevented by a locking mechanism on the lever. A button on the lever releases the mechanism allowing the lever to be moved to the 'P' or 'R' positions.

Shift Lock Solenoid (selected markets only)

When fitted, the shift lock solenoid is attached to a plate which is secured to the die cast plate with two screws in front of the selector lever. The solenoid is connected to the main harness by a two pin connector.

The solenoid is powered by the GIU. When the solenoid is energised, a pin is ejected which engages with a hole in the selector lever, locking it in the park position.

When the selector lever is in the 'P' position and the ignition is on, the solenoid will be energised until the footbrake is depressed. When the solenoid is de-energised the pin is retracted allowing the selector lever to be moved.

LED Module

The LED module is located in the selector lever gaiter surround and is secured with two screws. The module is connected to the main harness by an eight pin connector C0245.

The LED module illuminates the selector position display on the selector lever surround for the PRND and S positions. When the side lamps are switched on, all LED's are illuminated at a low intensity, with the selected LED illuminated at a higher intensity.

Manual/Sport Switch

The manual/sport switch is located on the die cast metal plate behind the selector lever and is secured to the plate with a metal strap. The switch is connected to the main harness by a four pin connector C0675 which is shared with the manual +/- switches. The manual/sport switch and the manual +/- switch can only be replaced a pair.

The manual/sport switch is a cam operated microswitch. A lever with a roller is attached to the switch body. When the selector lever is moved from automatic to the manual/sport position, the roller contacts a cam plate which depresses the lever and operates the switch. The switch contacts remain closed when the selector lever is in the sport position.

The operation of the switch is sensed by the GIU which switches the gearbox operation to manual/sport when 'S' is selected and deselects manual/sport mode when 'D' (automatic operation) is selected.

Stepspeed Manual (+/-) Switch

The manual +/- switch is located on the LH side of the selector lever and is secured to a bracket, which is secured to the die cast plate with two cap screws. The switch is connected to the main harness by a four pin connector C0675 which is shared with the manual/sport switch. The manual +/- switch and the manual/sport switch can only be replaced as a pair.

When the selector lever is moved to the manual/sport position, a dog engages with a slotted abutment on the switch. When the lever is moved to the + or - position the dog moves the switch completing a contact. This is sensed by the GIU which initiates the appropriate gear ratio selection.

PRND Switch

The PRND switch is located on the RH side of the selector lever and is secured to the die cast plate with two screws. The switch is connected to the main harness by a six pin connector.

The PRND switch has a sliding contact which moves with the selector lever. The switch has four contacts which correspond to the PRND positions. Each contact is connected to the GIU which then calculates the control strategy for the selection made.

Brake Switch GIU input (selected markets only)

The brake switch is located on the pedal box and is activated by operation of the brake pedal. The switch supplies an input to the GIU in addition to operating the brake lamps.

When the brake switch is operated, a 12V feed is sensed by the GIU. This is used by the GIU to de-energise the shift lock solenoid providing that the ignition is on.

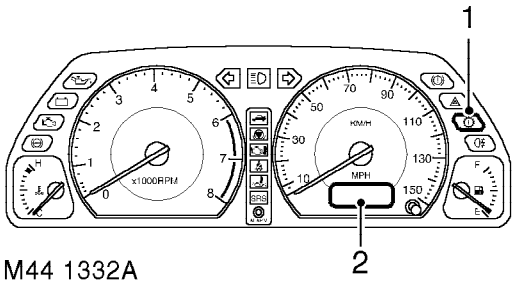
Steering Wheel Switches

Two additional selector switches are located on the steering wheel. Each switch is a three position, spring biased to centre switch. The switches can be pushed in either direction (+/-) to change the gearbox ratio. The switches provide the same functionality as the selector lever +/- switches and are only operative when the selector lever is in the manual/sport position.

Each switch is connected to the GIU via the rotary coupler. When either switch is operated in the +/- position, an earth path from the GIU is completed. This is sensed by the GIU which initiates the appropriate gear ratio selection.

Instrument Pack

The instrument pack displays gearbox selection and illuminates a fault lamp if a gearbox fault is detected.



M44 1332A

1. Gearbox fault lamp
2. Liquid crystal display

The gearbox related displays in the instrument pack are controlled by the ECM which transmits PWM signals to operate the lamps and the LCD.

Liquid Crystal Display (LCD)

The LCD is located below the speedometer on the instrument pack. In addition to displaying the odometer and trip meter, the LCD also displays the current gearbox status. The following table shows the characters displayed and their definition.

Character	Description
P	Park
R	Reverse
N	Neutral
D	Drive
D^{Sport}	Sport mode
1	Manual 1st ratio
2	Manual 2nd ratio
3	Manual 3rd ratio
4	Manual 4th ratio
5	Manual 5th ratio
6	Manual 6th ratio
F	Fast adaptation

When the ECM is replaced, the ECM EEPROM re-initialised by TestBook or the gearbox replaced, the LCD alternately flashes 'F' and the selected mode until the fast adaptation cycle is complete.

Gearbox fault lamp

The gearbox fault lamp is located in the instrument pack and is illuminated by the ECM when a gearbox fault is detected.

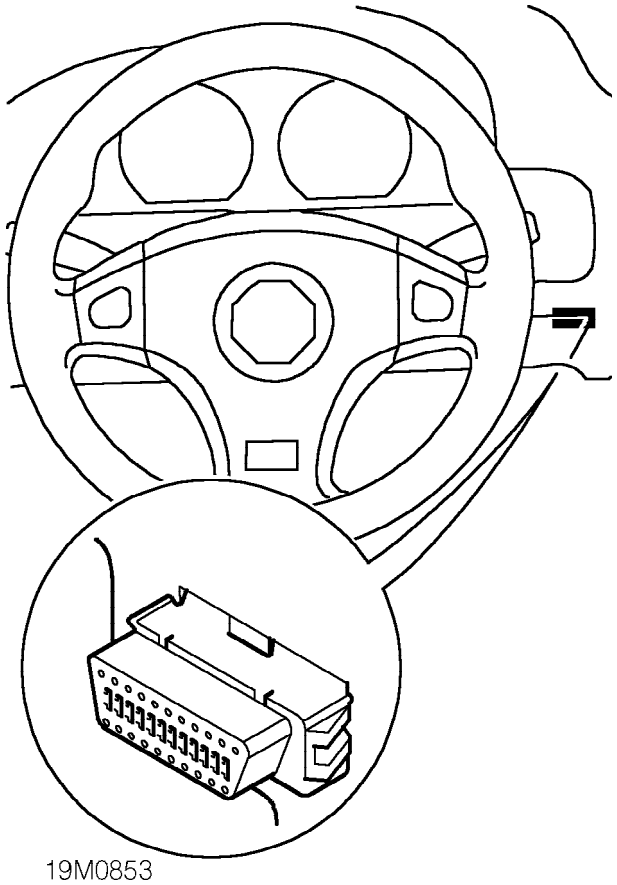
If a gearbox fault is detected by the ECM, in addition to the gearbox fault lamp being illuminated, the LCD transmission display is extinguished.

Fluid Cooler

The fluid cooler is located at the front of the vehicle behind the bumper, in front of the engine cooling radiator. The fluid cooler comprises eight horizontal cores which allow fluid to flow across from one side of the cooler to the other. Each core is joined by thin fins which aid heat dissipation.

Two fluid lines from the gearbox, comprising alloy pipes and flexible hoses, provide the feed and return to and from the fluid cooler.

Diagnostics



A diagnostic socket allows the exchange of information between the ECM and TestBook. The diagnostic socket is located in the passenger compartment fusebox which is below the fascia on the driver's side.

The diagnostic socket is connected to the ECM on an ISO9141 K Line. The system uses a 'P' code diagnostic strategy and can record faults relating to the gearbox differential speed sensor and the ratio control motor.

The GIU and ECM monitor all inputs and outputs relating to the Em-CVT system. If a fault is detected, a code applicable to that fault is stored in a fault log in the GIU. When TestBook is connected, GIU codes are accessed via the ECM diagnostic strategy.

The MEMS3 ECM is a major component in gearbox control. Functionality of engine sensors should be established to eliminate any ECM related faults from the gearbox diagnostics.

OPERATION

General

The transmission is driven from the engine via a torsion damper bolted to the flywheel. The torsion damper drives the input shaft which in turn drives the planet carrier. Depending on whether forward or reverse is selected, the primary pulley will rotate, transferring torque to the secondary pulley causing the vehicle to move in the required direction.

The steel belt is fitted between the primary and secondary pulleys. Each pulley consists of one fixed sheave and one axially moveable sheave. The moveable pulley sheaves are located diagonally opposite to each other to prevent misalignment of the belt during shift changes.

Each moving pulley sheave is connected to a hydraulic cylinder which is controlled by hydraulic pressure generated by the integral pump running at engine speed. Moving the pulley sheaves together increases their effective diameter and moving them apart decreases the diameter due to the conical faces of each pulley. In this way the gear ratios of the Em-CVT unit are achieved.

The Em-CVT unit has two multiplate wet clutch packs; one for forward and one for reverse. Each pack comprises three friction plates. The clutches are hydraulically controlled which enables the vehicle to move smoothly from standstill irrespective of the throttle position. The clutches are fed hydraulic fluid from the fluid cooler to prevent them overheating.

When the selector lever is in the Park (P) position, a spring and cone operated pawl mechanically locks the secondary pulley, consequentially locking the rear wheels. If 'P' is selected when the vehicle is moving, the pawl will not engage until the vehicle speed falls to below 4 mph (7 km/h). A rattling sound may be heard if 'P' is selected when the vehicle is moving.

Driving - Automatic mode

To pull away from a standstill a low ratio is required. The primary pulley is held fully open, reducing its diameter and allowing the belt to seat at the bottom of the pulley. The secondary pulley is held closed, forcing the belt to run in its increased diameter.

As the vehicle speed increases, higher ratios are required. As engine speed increases the fluid pressure generated by the pump increases. This increase in pressure is felt by the primary pulley cylinder which moves to gradually move the pulley sheaves together increasing its effective diameter.

Simultaneously, the secondary pulley sheaves move apart, reducing its diameter and increasing the gearbox ratio. When the primary pulley is closed and the secondary pulley is fully open, the gearbox operates in an overdrive ratio, with the secondary pulley rotating at approximately two and a half times the speed of the primary pulley.

When kickdown is required, the ECM transmits a message to the GIU to control the ratio control motor accordingly. The GIU adjusts the ratio control motor which, in turn, moves the hydraulic control valve to lower the gearbox ratio to achieve the required acceleration.

Driving - Manual/Sport mode

In manual/sport mode the gearbox functions as a conventional CVT unit or a semi-automatic manual transmission. In sport mode, the engine speed is higher under all driving conditions which gives improved acceleration.

By moving the selector lever to the + or - position, or pressing a steering wheel switch, the system is commanded to operate in manual mode. If required, the driver can make sequential gear selections using either the selector lever or the steering wheel mounted switches.

The ratio control motor operates to match the gear ratio to the target engine speed. In any mode, the motor position is varied to provide the 'kickdown' function of a conventional automatic transmission.

In manual mode, the position of the ratio control motor is varied to control engine speed, fixing the current gear ratio. The action of the motor operates the hydraulic control unit to adjust the primary pulley.

The GIU checks if a requested gear change made by the driver is permitted. Gear changes will be ignored if the driver requests a change which is dangerous or could damage the transmission.

If a shift up is required and the driver has not made the required selection using the selector lever or the steering wheel switches, the next higher gear will be selected when the engine speed reaches maximum rev/min.

If the driver does not make a required shift down when the vehicle is slowing, the next lower gear will be selected automatically. The LCD in the instrument pack will always display the current gear.

Manual/sport mode is deselected by moving the selector lever back to the 'D' (automatic) position.

Fast Adaptation Procedure

When a new gearbox is fitted, the ECM replaced or ECM EEPROM re-initialised by TestBook, the ECM needs to learn the positions of the ratio control motor for given engine speeds.The ECM will target twelve engine speeds between 1400 and 4500 rev/min in order to achieve fast adaptation.

Fast adaptation is performed as follows:

WARNING: Ensure that all road tests are conducted by suitably qualified drivers in a safe and legal manner, and where local traffic conditions allow.

- With the selector lever in position 'D', accelerate the vehicle up to 35 mph (55 km/h), then release the accelerator pedal and allow the vehicle to decelerate without braking.
- As the vehicle decelerates, the ECM will learn the ratio control motor adaptation points. This procedure should be complete before the vehicle stops moving.
- If the gearbox reaches its lowest ratio before the adaptation is complete, the engine speed will drop from the target speed to idle.
- To complete the procedure, accelerate up to a speed of more than 25 mph (40 km/h) and release the accelerator pedal again. Allow the vehicle to decelerate without braking to enable the ECM software to learn the remaining adaptation points.
- Fast adaptation is complete when the 'F' in the instrument pack LCD stops flashing and only the mode is displayed.

The ECM software continuously adapts to account for gearbox wear and fast adaptation errors. The driver will not be aware that any adaptation is taking place and normal driving will be maintained.

FAULT DIAGNOSIS

Before commencing any gearbox fault diagnosis check that:

- The engine is correctly tuned
- The gearbox fluid and fluid level is correct
- The selector cable is correctly adjusted
- All gearbox and GIU connectors are correctly assembled.

The following tables list possible faults and corrective action required. If the fault remains after the corrective action has been applied, then the gearbox must be replaced.

The tables show tests which can be carried out to determine the fault. The tests are detailed at the end of this section.

Fault: Engine will not start in 'P' or 'N'

Fault	Action	Test
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Park/Neutral switch fault	Check switch	Test 2
Park/Neutral switch open circuit	Check harness continuity	

Fault: Park lock does not hold vehicle

Fault	Action	Test
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Gearbox internal damage	Replace gearbox ***See Repairs.***	

Fault: Vehicle moves when 'N' is selected

Fault	Action	Test
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Forward or reverse clutch dragging	Check condition of fluid	Test 1

Fault: Engine can be started in 'D' or 'R' positions

Fault	Action	Test
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Park/Neutral switch fault	Check switch	Test 2

Fault: Engine can be started in all selector positions

Fault	Action	Test
Park/Neutral switch fault	Check switch	Test 2
Park/Neutral switch open circuit	Check harness continuity	

Fault: No drive when 'D' or 'R' is selected

Fault	Action	Test
Gearbox fluid level incorrect	Check and top up gearbox with correct fluid ***See MAINTENANCE.***	
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Gearbox internal damage	Replace gearbox ***See Repairs.***	

Fault: Vehicle moves above 6 mph (10 km/h) when 'D' or 'R' selected

Fault	Action	Test
Engine idle speed too high	Check and correct engine idle speed ***See INFORMATION, Engine tuning data.***	

Fault: Vehicle judders when 'D' or 'R' is selected with engine at idle

Fault	Action	Test
Gearbox fluid level incorrect	Check and top up gearbox with correct fluid ***See MAINTENANCE.***	
Engine idle speed too high	Check and correct engine idle speed ***See INFORMATION, Engine tuning data.***	
Gearbox internal damage	Check condition of fluid	Test 1

Fault: Acceleration poor but engine racing when cold only

Fault	Action	Test
Gearbox fluid level incorrect	Check and top up gearbox with correct fluid ***See MAINTENANCE.***	
Gearbox internal damage	Check condition of fluid	Test 1

Fault: Acceleration poor but engine racing when hot

Fault	Action	Test
Gearbox fluid level incorrect	Check and top up gearbox with correct fluid ***See MAINTENANCE.***	
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	
Gearbox internal damage	Check condition of fluid	Test 1

Fault: Engine stalls during braking

Fault	Action	Test
Engine idle speed too low	Check and correct engine idle speed ***See INFORMATION, Engine tuning data.***	

Fault: Kick down delayed or insufficient

NOTE: Verify this fault by performing Test 3.

Fault	Action	Test
Gearbox Interface Unit (GIU) electrical failure	Check harness connections and GIU remote fuse. Check for fault codes using TestBook.	
Ratio control motor failure	Measure resistance at gearbox connector pins. Measure between pins which correspond to the harness connector blue/yellow and blue/grey wires and the blue/red and blue/white wires. The resistance must be between 18 and 30 Ω .	

Fault: Delayed response when Sport selected from 'D' while vehicle moving

NOTE: Verify this fault by performing Test 4.

Fault	Action	Test
Electrical circuit failure	Check circuit continuity	

Fault: Delayed response when Manual mode is selected from 'D' Sport with vehicle moving

NOTE: Verify this fault by performing Test 5.

Fault	Action	Test
Electrical circuit failure	Check circuit continuity	

Fault: Vehicle moves forward or backward when starting in 'P' or 'N'

Fault	Action	Test
Selector cable out of adjustment	Adjust selector cable ***See Adjustments.***	

Fault: Hydraulic cavitation noises from gearbox

Fault	Action	Test
Gearbox fluid level incorrect	Check and top up gearbox with correct fluid ***See MAINTENANCE.***	
Fluid filter clogged or dirty	Replace Fluid filter ***See Repairs.***	
Air ingress via fluid filter connection	Replace 'O' ring ***See Repairs.***	
Gearbox internal damage	Check condition of fluid	Test 1

Fault: Fluid leaks from gearbox

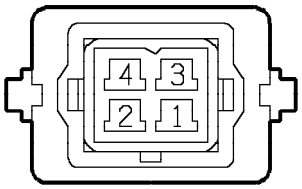
Fault	Action
Leak from fluid dipstick tube	Replace dipstick 'O' ring
Leak from gearbox fluid pan gasket	Ensure fluid pan bolts are correctly tightened Replace fluid pan gasket
Leak from Park/Neutral switch	Ensure switch is correctly tightened Replace switch 'O' ring
Leak from gearbox drain plug	Ensure plug is correctly tightened Replace drain plug sealing ring
Leak from speed transducer	Ensure transducer is correctly tightened Replace transducer 'O' ring
Leak from gearbox differential speed sensor	Ensure sensor is correctly tightened Replace sensor 'O' ring
Leak from primary cover	Ensure that cover is correctly tightened Replace 'O' ring
Leak from secondary cover	Ensure that cover is correctly tightened Replace cover 'O' rings
Leak from selector shaft lever	Replace selector shaft lever seal
Leak from fluid cooler pipe connections	Ensure that pipes are correctly tightened Replace pipe to gearbox connection 'O' rings
Leak from input shaft	Replace input shaft seal
Leak from differential oil seal(s)	Replace oil seals
Leak from fluid cooler pipe connections	Ensure that pipes are correctly tightened Replace pipe to fluid cooler connection 'O' rings

TESTS

TEST 1: Fluid condition check

1. Drain and examine gearbox fluid. ***See Adjustments.***
2. If fluid contains metallic particles, replace gearbox and flush fluid cooler and pipes.
3. If fluid is discoloured, burnt or contains water:
   - Fill gearbox with correct fluid to the correct level.
   - Test drive vehicle for at least 10 miles (16 km) using all selector positions.
   - If fault is still present, replace gearbox.
4. If drained fluid is in good condition, re-check selector cable adjustment.
5. If adjustments are correct and the fault is still present, replace the gearbox. ***See Repairs.***

TEST 2: Park/Neutral switch check



M44 1360

1. With engine stopped, disconnect multiplug from park/neutral switch.
2. Connect a circuit continuity tester between switch pins 4 and 2.
3. Move gear selector lever through all positions and observe continuity tester. Circuit continuity should only exist with selector in positions 'P' and 'N'.
4. Disconnect continuity tester and reconnect between switch pins 3 and 1.
5. Move gear selector lever through all positions and observe continuity tester. Circuit continuity should only exist with selector in position 'R'.
6. If park/neutral switch does not function as described in steps 3 and 5, replace switch. ***See Repairs.***

TEST 3: Kick-down check

A stop watch and the vehicle tachometer is required for this test.

1. With the gear selector lever in position 'D', accelerate the vehicle up to 50 mph (80 km/h).
2. When 50 mph (80 km/h) is reached, release the accelerator pedal and, without using the brakes, allow the vehicle to decelerate to 38 mph (61 km/h).
3. When the vehicle has reached 38 mph (61 km/h) apply full throttle to initiate kick-down.
4. If engine speed is between 3800 and 4200 rev/min within 1 to 2 seconds of reaching 38 mph (61 km/h), kick-down operation is satisfactory.

TEST 4: Delayed shift response

A stop watch and the vehicle tachometer is required for this test.

1. With gear selector lever in position 'D', apply full throttle until 50 mph (80 km/h) is reached.
2. At 50 mph (80 km/h) move the selector lever across the gate to the Sport position; the instrument pack LCD should display **'D^{Sport}'**.
3. When selector lever is moved to the Sport position, the engine speed should increase to 5500 rev/min within 1 to 2 seconds. If this response is achieved gearbox shift operation is satisfactory.

TEST 5: Manual mode response

A stop watch and the vehicle tachometer is required for this test.

1. With the selector lever in position 'D Sport', drive the vehicle at a steady 50 mph (80 km/h).
2. Release the throttle pedal and move the selector lever to the minus (-) position (manual mode). The instrument pack should display the gear ratio number and the engine speed should rise within 1 to 2 seconds. If this response is achieved, manual mode operation is satisfactory.

DRAIN AND REFILL

Service repair no - 44.24.02

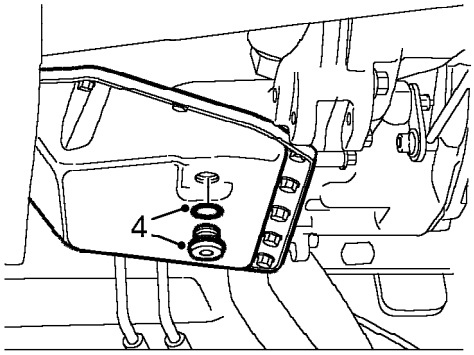
NOTE: The fluid should be drained with the gearbox at normal operating temperature.

WARNING: Observe due care when draining gearbox fluid, as the fluid will be very hot.

1. Remove dipstick.
2. Raise rear of vehicle.

WARNING: Support on safety stands.

3. Position container to collect fluid from gearbox.



M44 1323

4. Remove drain plug using an 5 mm Allen key and discard sealing washer.
5. Allow fluid to drain into container.

NOTE: Approximately 1 litre of fluid is retained in the primary and secondary cylinders of the gearbox.

Refill

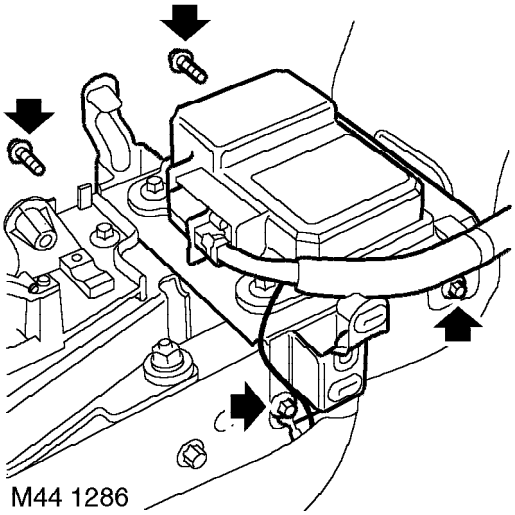
1. Clean drain plug and sealing face of gearbox.
2. Fit new sealing washer to drain plug, fit drain plug and tighten to 30 Nm.
3. Remove stand(s) and lower vehicle.
4. Remove dipstick and, using a funnel on the end of the dipstick tube, carefully fill gearbox to the minimum mark with new CVT fluid. ***See INFORMATION, Capacities, fluids and lubricants.***
5. Replace dipstick.
6. Start engine and run until normal operating temperature is achieved.
7. Operate gearbox through full range of selector positions 3 times to ensure fluid is in all parts of the system.
8. With the vehicle on horizontal ground, the selector lever in the 'N' position and the engine running at idle speed, check the oil level and add oil until the level lies between the minimum and maximum marks on the dipstick.

LEVER - GEAR CHANGE

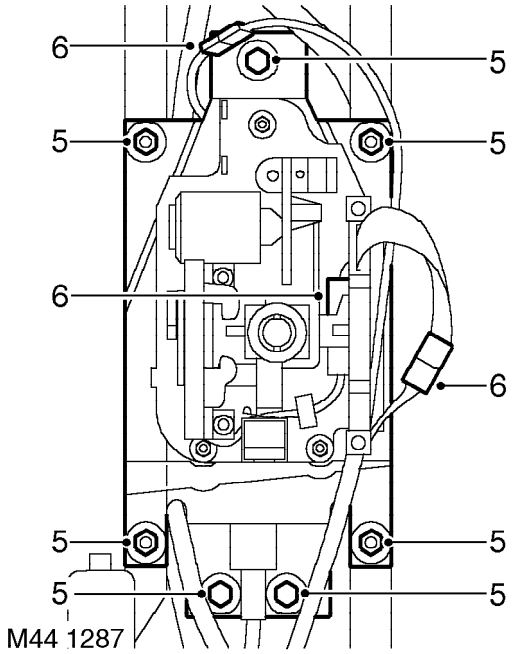
Service repair no - 44.15.04

Remove

1. Disconnect battery earth lead.
2. Make the SRS system safe. ***See RESTRAINT SYSTEMS, Precautions.***
3. Remove centre console. ***See BODY, Interior trim components.***

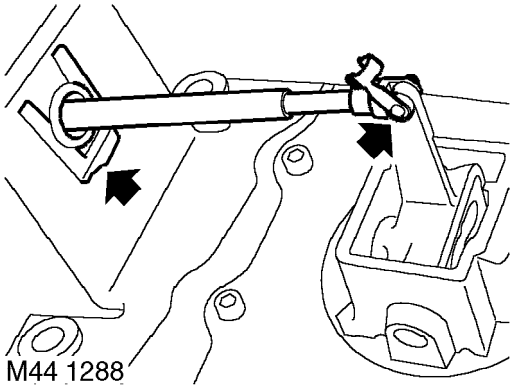

M44 1286

4. Remove 4 Torx bolts securing SRS DCU support bracket and release earth lead. Position support bracket aside.

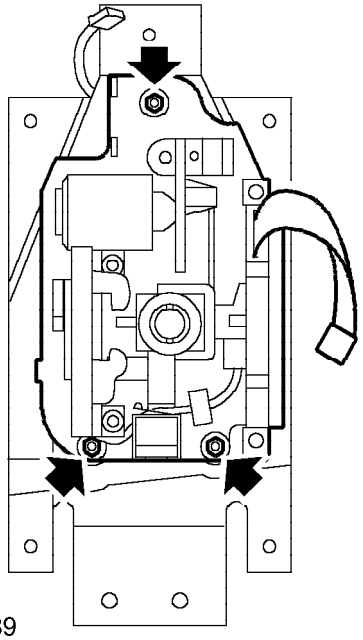


M44 1287

5. Remove 3 bolts and 4 nuts securing gear lever assembly.
6. Disconnect 3 multiplugs from gear lever assembly.
7. Release gear lever from floor tunnel to access gear change cable.

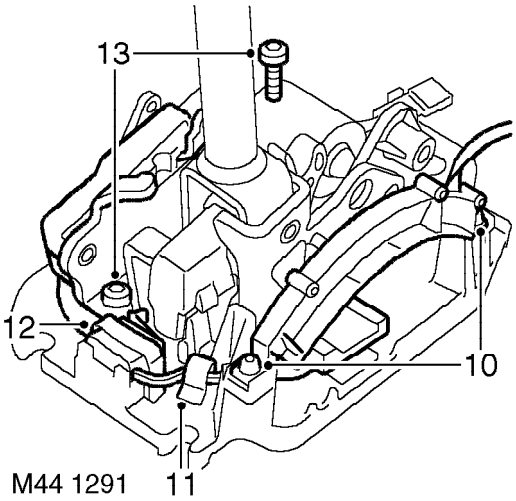

M44 1288

8. Remove clevis pin and 'C' washer securing cable to gear lever and remove gear lever assembly.



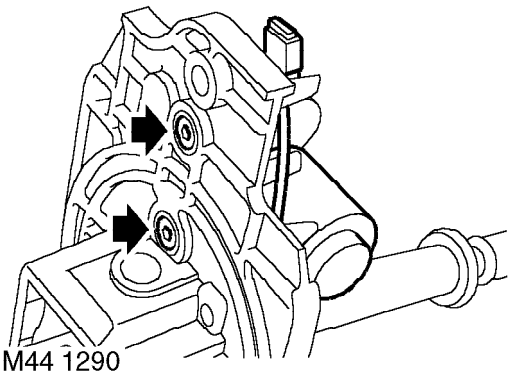
M44 1289

9. Remove 3 nuts and bolts securing gear lever to support bracket and remove lever.



M44 1291

10. Remove 2 screws securing selector slide mechanism and remove selector slide.
11. Remove microswitch harness clip from gear lever housing.
12. Remove clip securing microswitch and collect microswitch spacer.
13. Remove 2 bolts securing sequential gear change microswitch and remove microswitch assembly.



M44 1290

14. Remove 2 bolts securing park solenoid to gear lever.
15. Release park solenoid from gear lever and remove park solenoid.

Refit

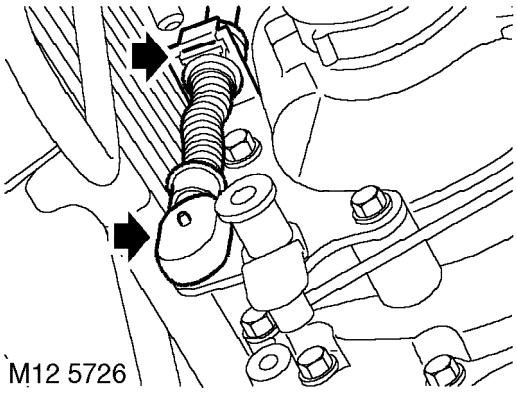
1. Fit sequential gear change microswitch. Fit bolts and tighten to 12 Nm.
2. Fit microswitch spacer, position microswitch and secure with clip.
3. Secure microswitch harness clip.
4. Position park solenoid, fit bolts and tighten to 15 Nm.
5. Position selector slide and secure with screws.
6. Position lever to support bracket. Fit bolts and tighten to 10 Nm.
7. Position lever assembly to cable and secure with 'C' washer and clevis pin.
8. Position lever assembly to tunnel and connect gear lever multiplugs.
9. Fit nuts and bolts securing lever assembly to floor and tighten to 10 Nm.
10. Position SRS DCU and align earth lead. Fit Torx bolts and tighten to 10 Nm.
11. Fit centre console. ***See BODY, Interior trim components.***
12. Connect battery earth lead.

CABLE - GEAR CHANGE

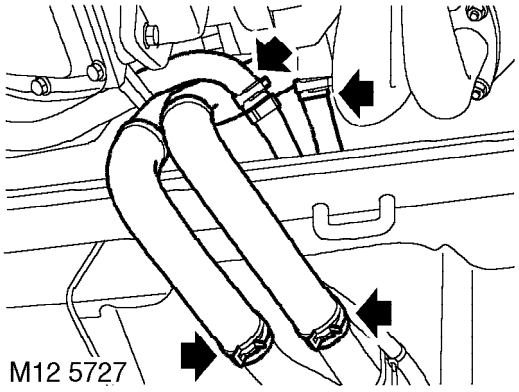
Service repair no - 44.15.08

Remove

1. Position vehicle on a 2 post ramp.
2. Make the SRS system safe. ***See RESTRAINT SYSTEMS, Precautions.***
3. Remove engine cover. ***See ENGINE, Repairs.***
4. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
5. Drain engine coolant. ***See COOLING SYSTEM, Adjustments.***

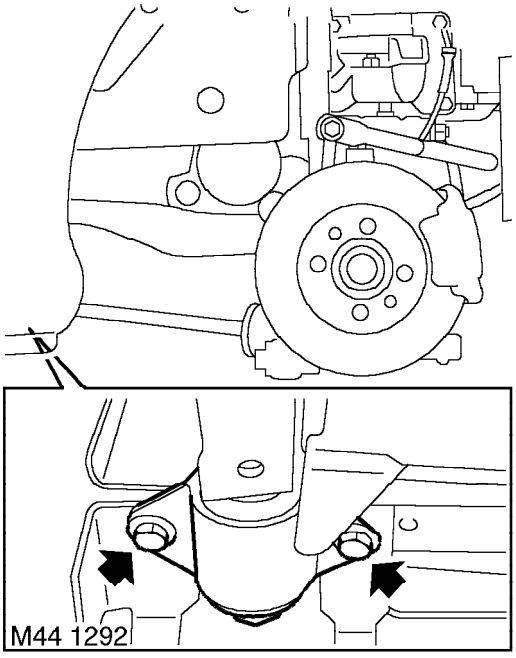


6. Disconnect cable from ball joint on gear change quadrant and release cable from support bracket on gearbox.
7. Remove gear change lever. ***See this section.***



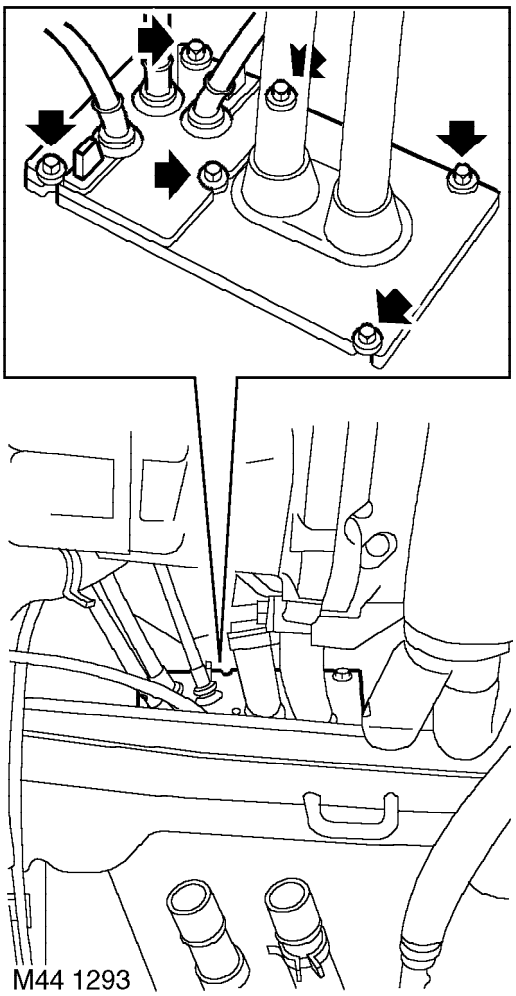
8. Release clips securing coolant hoses and heater hoses and disconnect hoses.
9. Tie coolant and heater hoses aside to access closing plate.
10. Place support jack underneath engine sump and support engine weight.

CAUTION: To prevent damage to sump place a piece of wood between jack and sump.



11. Remove 2 bolts securing both front subframe mountings to body brackets.
12. Lower jack carefully, to allow access to closing plate bolts.

CAUTION: Care must be taken when lowering front of subframe, that no cables or pipes are stretched.



13. Release 2 lower and remove 4 remaining bolts securing closing plate to bulkhead.
14. Apply soft soap to all closing plate cables, to ease movement of closing plate.
15. Release closing plate from bulkhead and slide along cables, release gear change cable from grommet.
16. Remove gear change cable from tunnel and engine compartment.

Refit

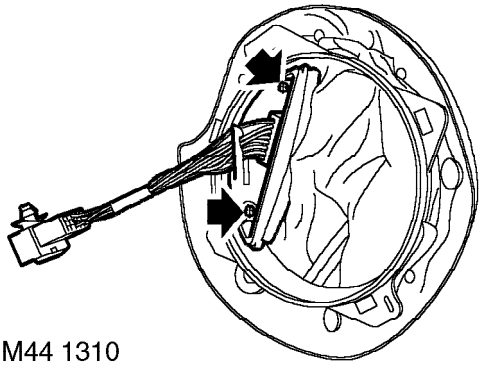
1. Position gear change cable to tunnel and feed through rear bulkhead.
2. Feed gear change cable into position in engine compartment.
3. Lubricate all cables with soft soap to ease grommet movement on cables.
4. Position gear change cable into closing plate slots and secure with grommets.
5. Align closing plate to bulkhead and secure with bolts.
6. Raise subframe on jack, fit subframe front mounting bolts and tighten to 30 Nm.
7. Connect coolant and heater hoses and secure with clips.
8. Fit gear change lever. ***See this section.***
9. Connect cable to support bracket on gear box and gear change quadrant.
10. Check cable adjustment. ***See Adjustments.***
11. Refill engine coolant. ***See COOLING SYSTEM, Adjustments.***
12. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
13. Fit engine cover. ***See ENGINE, Repairs.***
14. Connect battery earth lead.

LED MODULE - GEAR SELECTION

Service repair no - 44.15.10

Remove

1. Remove gearchange selector knob.
2. Release gaiter from centre console.



M44 1310

3. Disconnect LED module multiplug and remove gaiter.
4. Remove 2 screws securing LED module and remove module.

Refit

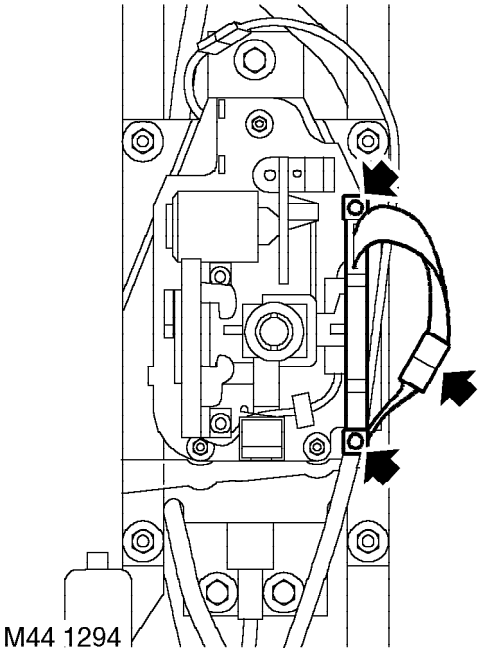
1. Position LED module to gaiter and secure with screws.
2. Position gaiter to centre console, connect multiplug and secure gaiter to centre console.
3. Fit gear selection knob.

SWITCH - PRND

Service repair no - 44.15.13

Remove

1. Remove centre console. ***See BODY, Interior trim components.***



M44 1294

2. Disconnect PRND switch multiplug.
3. Remove 2 screws securing PRND switch and remove switch.

Refit

1. Position PRND switch, engage pin to gear lever and secure switch with screws.
2. Connect PRND switch multiplug.
3. Fit centre console. ***See BODY, Interior trim components.***

PARK/NEUTRAL AND REVERSE LIGHT SWITCH

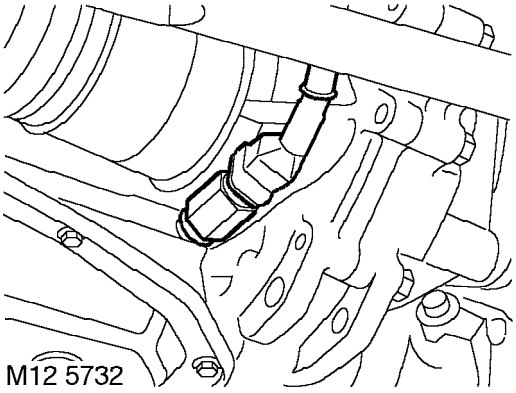
Service repair no - 44.15.15

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

WARNING: Support on safety stands.

3. Position container to collect fluid loss from gearbox.



4. Disconnect multiplug from switch.
5. Loosen and remove switch from gearbox.
6. Remove and discard 'O' ring from switch.

Refit

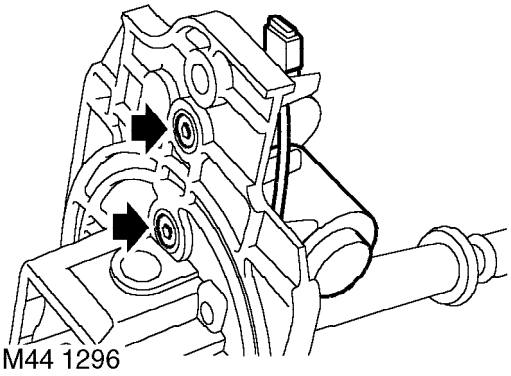
1. Clean switch and mating face of gearbox.
2. Lubricate new 'O' ring with gearbox fluid and fit to switch.
3. Fit switch to gearbox and tighten to 12 Nm.
4. Connect multiplug to switch.
5. Remove stand(s) and lower vehicle.
6. Top-up gearbox fluid level. ***See MAINTENANCE.***
7. Connect battery earth lead.

SOLENOID - SHIFT LOCK

Service repair no - 44.15.36

Remove

1. Remove gear lever assembly. ***See this section.***



2. Remove 2 Allen bolts securing shift lock solenoid.
3. Release shift lock solenoid from gear lever housing and remove solenoid.

Refit

1. Position shift lock solenoid and engage to gear lever housing.
2. Fit Allen bolts securing shift lock solenoid and tighten to 15 Nm.
3. Fit gear lever assembly. ***See this section.***

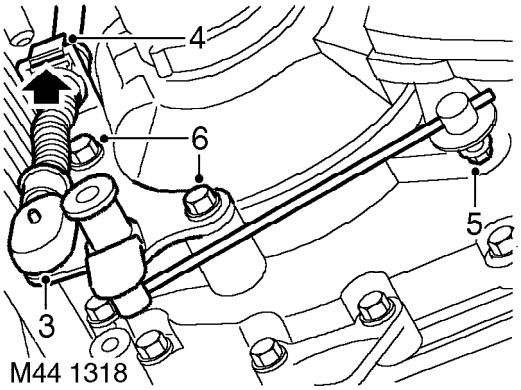
DIFFERENTIAL SPEED SENSOR

Service repair no - 44.15.47

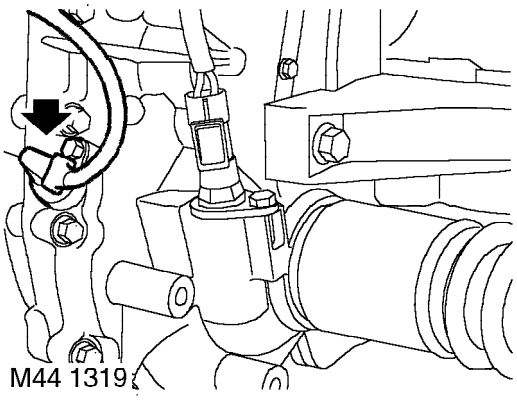
Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

WARNING: Support on safety stands.



3. Release gear selector cable from selector linkage.
4. Release selector cable from abutment bracket by pressing tab upwards as shown.
5. Loosen nut securing connecting rod to selector bracket.
6. Remove 2 bolts securing abutment bracket to gearbox, release connecting rod from selector bracket and remove abutment bracket.



7. Disconnect multiplug from speed sensor.
8. Remove bolt securing sensor to gearbox.
9. Remove sensor and discard 'O' ring.

Refit

1. Clean sealing faces of sensor and gearbox.
2. Lubricate new 'O' ring with gearbox fluid and fit to sensor.
3. Fit sensor to gearbox and tighten bolt to 9 Nm.
4. Connect multiplug to harness.
5. Fit abutment bracket to gearbox ensuring connecting rod is located into selector bracket. Tighten bolts to 25 Nm.
6. Tighten nut securing connecting rod to selector bracket to 6 Nm.

CAUTION: Do not exceed the specified torque.

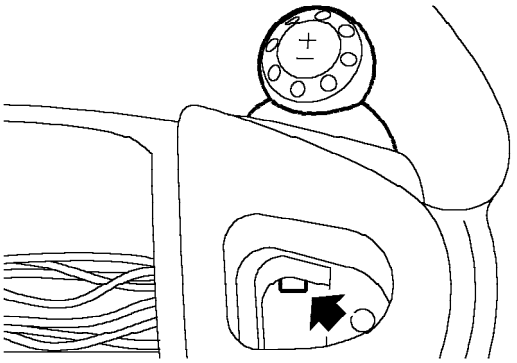
7. Connect gear selector cable to selector linkage.
8. Remove stand(s) and lower vehicle.
9. Connect battery earth lead.

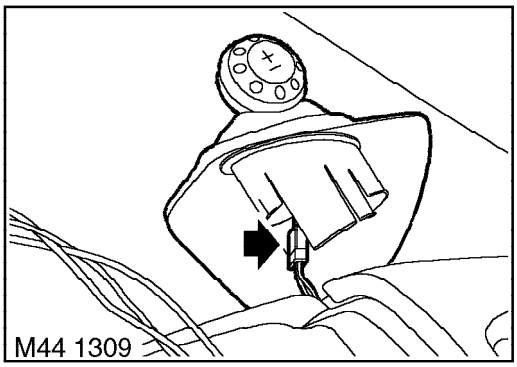
SWITCH - STEERING WHEEL REMOTE

Service repair no - 44.15.70

Remove

1. Disconnect battery earth lead.





2. Release horn switch from steering wheel and position aside.
3. Release clip securing remote switch and release switch from steering wheel.
4. Disconnect remote switch multiplug and remove switch from steering wheel.

Refit

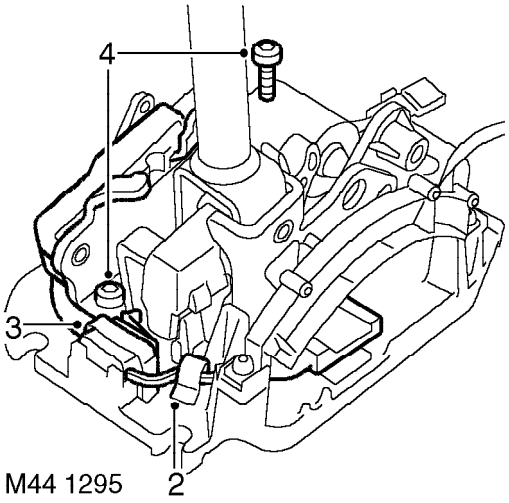
1. Position remote switch, connect multiplug and secure switch to steering wheel.
2. Position horn switch and secure in steering wheel.
3. Connect battery earth lead.

MICROSWITCH - MANUAL/SPORT AND +/- SWITCH

Service repair no - 44.15.72

Remove

1. Remove gear lever assembly. ***See this section.***



2. Release clip securing harness to gear lever housing.
3. Remove clip securing manual/sport microswitch and collect microswitch spacer.
4. Remove 2 Allen bolts securing +/- switch to gear lever housing and remove switch assembly.

Refit

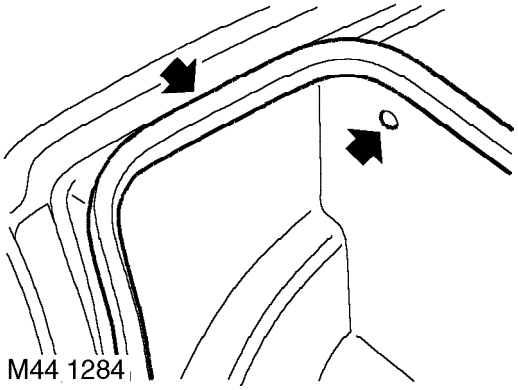
1. Position +/- switch to gear lever housing. Fit Allen bolts and tighten to 12 Nm.
2. Fit microswitch spacer, position manual/sport microswitch and secure with clip.
3. Secure harness clip to gear lever housing.
4. Fit gear lever assembly. ***See this section.***

GEARBOX INTERFACE UNIT (GIU)

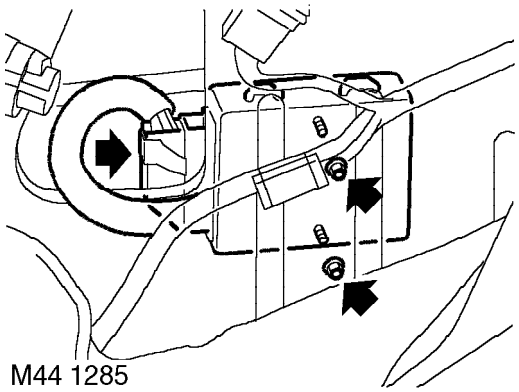
Service repair no - 44.15.81

Remove

1. Disconnect battery earth lead.



2. Release boot lid aperture seal from LH side of aperture flange.
3. Remove clip securing LH side of luggage compartment trim and release trim for access to GIU.



4. Remove 2 nuts securing GIU to body.
5. Release GIU, disconnect multiplug and remove GIU.

Refit

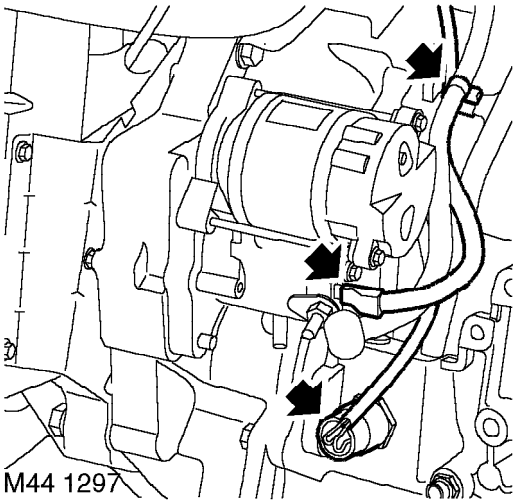
1. Position new GIU and connect multiplug.
2. Fit GIU to body and secure with nuts.
3. Refit trim and secure with clip.
4. Fit boot lid aperture seal to flange.
5. Connect battery earth lead.

GEARBOX & CONVERTER - STEPSPEED (Em-CVT) - REMOVE FOR ACCESS & REFIT

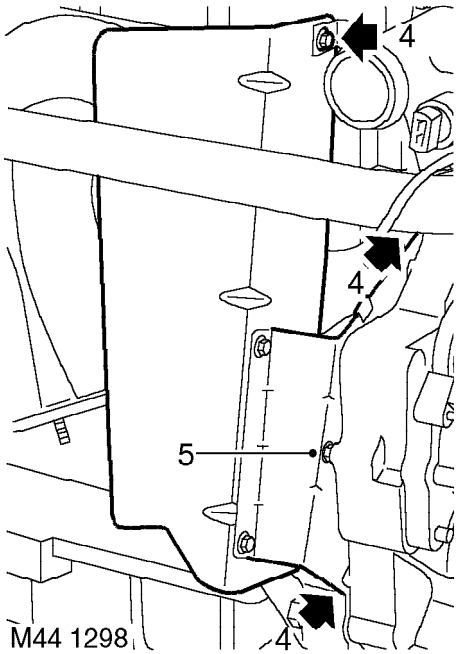
Service repair no - 44.20.02.99

Remove

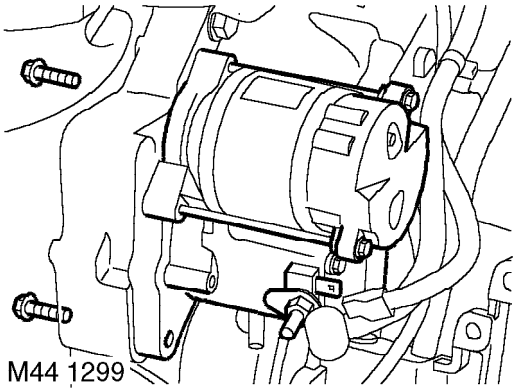
1. Remove engine and gearbox assembly. ***See ENGINE, Repairs.***



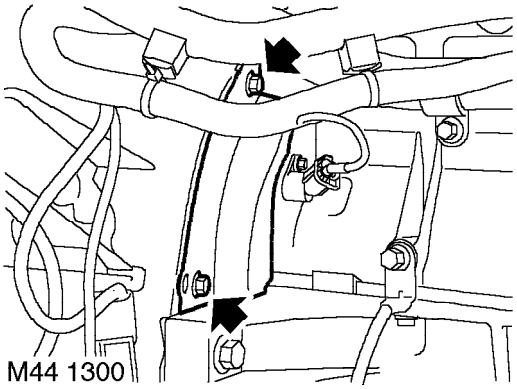
2. Disconnect Lucar from starter solenoid. Disconnect multiplug from actuator control motor and release lead from clip.



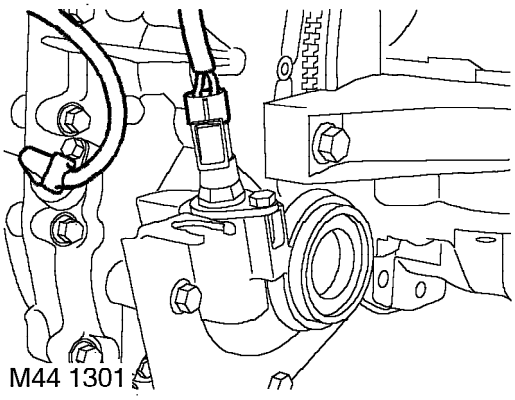
3. Remove 3 bolts securing exhaust heat shield and remove heat shield.
4. Remove bolt securing flywheel cover to gearbox and remove cover.



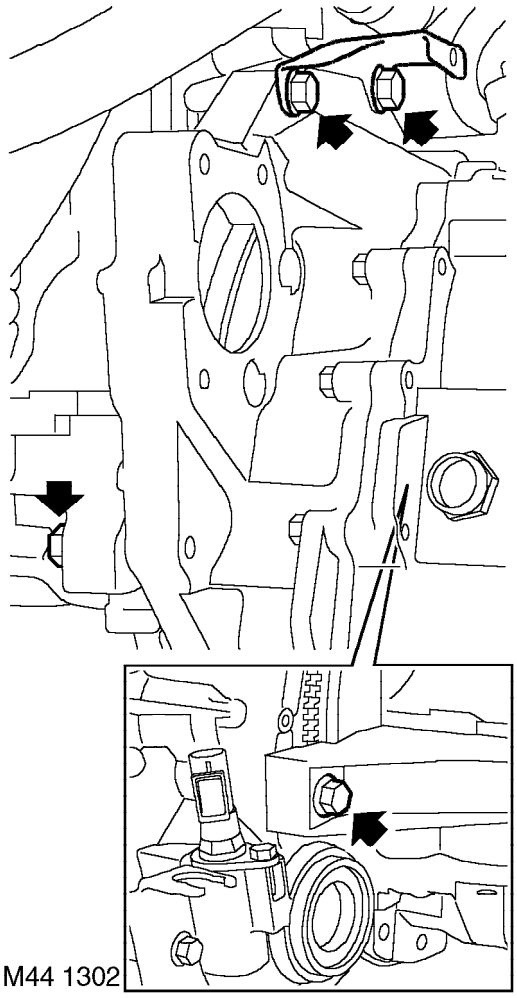
5. Remove 2 bolts securing starter motor to gearbox and remove starter motor.



6. Remove 2 bolts securing flywheel rear cover to gearbox and remove cover.



7. Disconnect multiplugs from speed sensor and speedometer transducer.


M44 1302

8. Remove 4 bolts securing gearbox to engine. Collect mounting plate.
9. With assistance remove gearbox from engine.

Refit

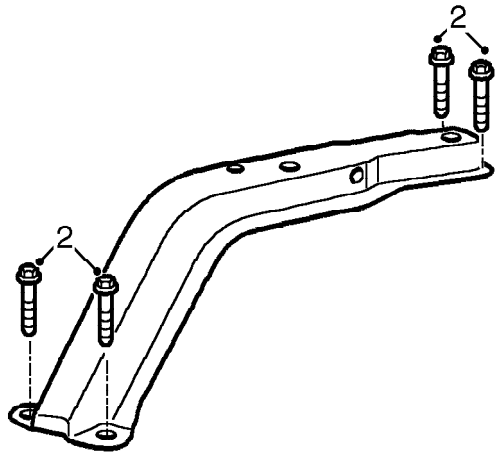
1. Clean mating faces of engine and gearbox, dowel and dowel holes.
2. With assistance, fit gearbox, locate on dowels and secure to engine.
3. Position mounting plate, fit bolts securing gearbox to engine and tighten to 80 Nm.
4. Connect speed sensor and speedometer transducer multiplugs.
5. Fit flywheel rear cover and secure with bolts.
6. Position starter motor to gearbox, fit and tighten bolts to 80 Nm.
7. Fit flywheel front cover to gearbox and secure with bolts.
8. Position exhaust heat shield and secure with bolts.
9. Connect multiplug to actuator control motor and secure lead to clip.
10. Fit engine and gearbox assembly. ***See ENGINE, Repairs.***

SECONDARY COVER SEALS

Service repair no - 44.20.33

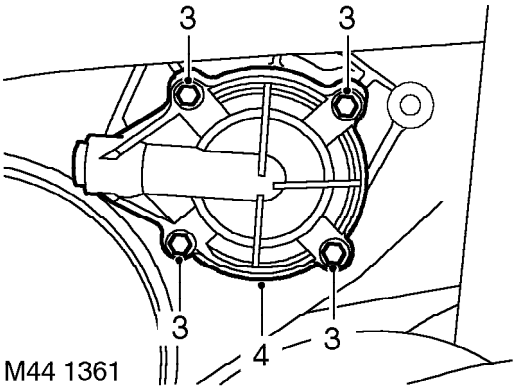
Remove

1. Remove LH engine mounting. ***See ENGINE, Repairs.***



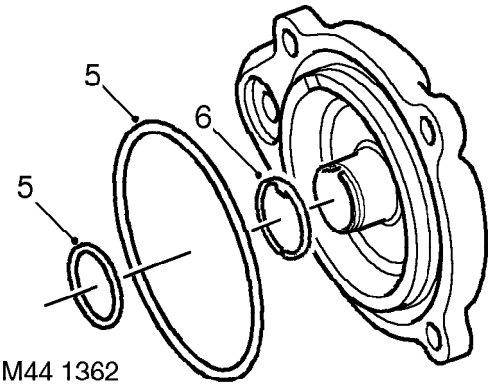
M44 1363

2. Remove 4 bolts securing LH buttress and manoeuvre buttress to access secondary cover.



M44 1361

3. Remove 4 bolts securing secondary cover to gearbox.
4. Remove secondary cover.



M44 1362

5. Remove and discard 2 'O' rings from cover.
6. Remove and discard split ring.

Refit

1. Clean secondary cover and mating faces of cover and gearbox.
2. Lubricate new 'O' rings with clean gearbox fluid and fit to secondary cover.
3. Fit new split ring to secondary cover.
4. Fit and align secondary cover to gearbox.
5. Fit bolts securing secondary cover to gearbox and tighten to 10 Nm.
6. Align LH buttress to subframe, fit bolts and tighten to 45 Nm.
7. Fit LH engine mounting. ***See ENGINE, Repairs.***

GASKET - FLUID PAN

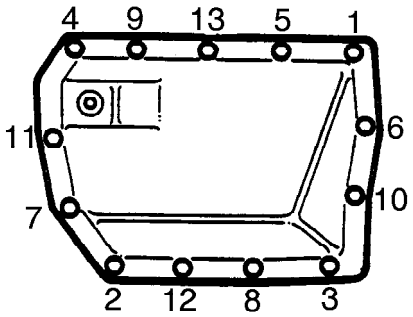
Service repair no - 44.24.05

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Drain gearbox fluid. ***See Adjustments.***



44M0880

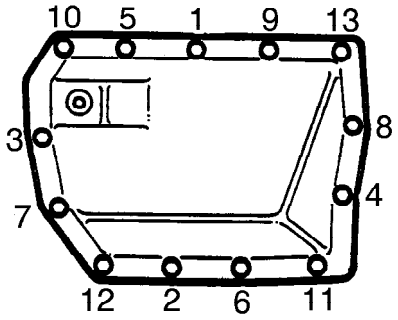
3. Working in the sequence illustrated, loosen then remove 13 bolts securing fluid pan to gearbox.
4. Release fluid pan from gearbox and filter, remove fluid pan.
5. Remove and discard gasket.

Refit

1. Clean mating faces of fluid pan and gearbox. Clean fluid pan.
2. Lubricate new gasket with gearbox fluid and fit to fluid pan.

CAUTION: Do not apply adhesive to gasket.

3. Position fluid pan to filter and gearbox.



44M0881

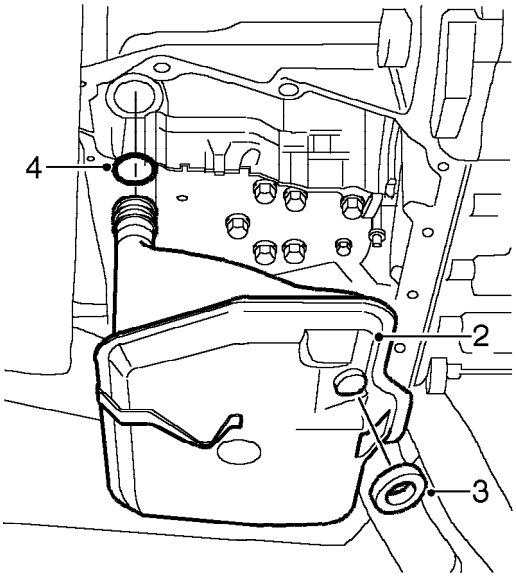
4. Fit bolts securing fluid pan to gearbox and working in the sequence illustrated, tighten to 10 Nm.
5. Refill gearbox with fluid. ***See Adjustments.***
6. Remove stand(s) and lower vehicle.

FILTER - GEARBOX FLUID

Service repair no - 44.24.07

Remove

1. Remove fluid pan. ***See this section.***



M44 1334

2. Release filter from valve block and remove filter.
3. Remove filter magnet.
4. Remove and discard 'O' ring.

Refit

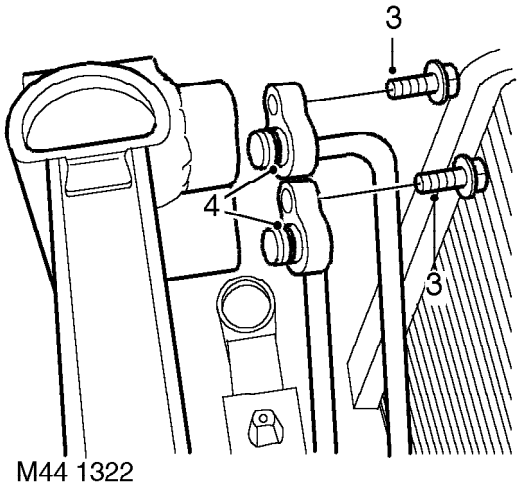
1. Clean magnet and fit to filter.
2. Lubricate new 'O' ring with clean gearbox fluid and fit to filter.
3. Position filter to valve block and engage 'O' ring in valve block.
4. Fit fluid pan. ***See this section.***

COOLER - GEARBOX FLUID

Service repair no - 44.24.10

Remove

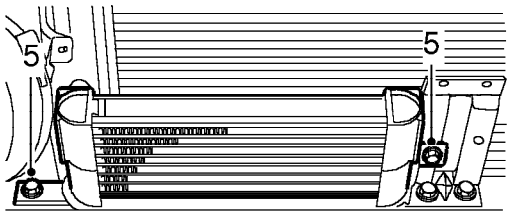
1. Remove bonnet locking platform. ***See BODY, Exterior fittings.***
2. Position container underneath gearbox fluid cooler connections to collect any spillage.



M44 1322

3. Remove 2 bolts securing fluid cooler pipe connections to fluid cooler.
4. Release connections from fluid cooler and discard 'O' rings.

CAUTION: Plug the connections.



M44 1321

5. Remove 2 bolts securing fluid cooler to body and remove cooler.

Refit

1. Clean fluid cooler and pipe connections.
2. Fit fluid cooler and secure with bolts.
3. Using new 'O' rings connect pipes to fluid cooler and tighten bolts to 14 Nm.
4. Fit bonnet locking platform. ***See BODY, Exterior fittings.***
5. Top-up gearbox fluid level. ***See MAINTENANCE.***

HOSE/PIPE - FEED - INTERMEDIATE TO FLUID COOLER

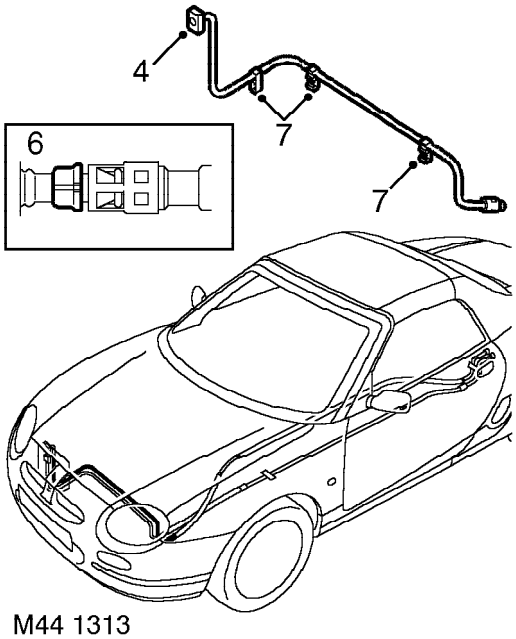
Service repair no - 44.24.26

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove bonnet locking platform. ***See BODY, Exterior fittings.***
3. Position container underneath gearbox fluid cooler connections to collect any spillage.



M44 1313

4. Remove bolt securing fluid cooler pipe connection to fluid cooler.
5. Release connection from fluid cooler and discard 'O' ring.
6. Remove release catch, refit in reverse position and release hose from intermediate pipe.
7. Remove pipe clamp clip, release pipe from clamp and remove pipe.
8. Refit release catch in safe position.

CAUTION: Plug the connections.

Refit

1. Clean pipe end and mating faces.
2. Connect hose to intermediate pipe.
3. Using new 'O' ring, align pipe to fluid cooler, fit bolt and tighten to 10 Nm.
4. Position pipe in clamp and secure clamp clip.
5. Fit bonnet locking platform. ***See BODY, Exterior fittings.***
6. Top-up gearbox fluid level. ***See MAINTENANCE.***
7. Remove stand(s) and lower vehicle.

HOSE/PIPE - RETURN - INTERMEDIATE TO FLUID COOLER

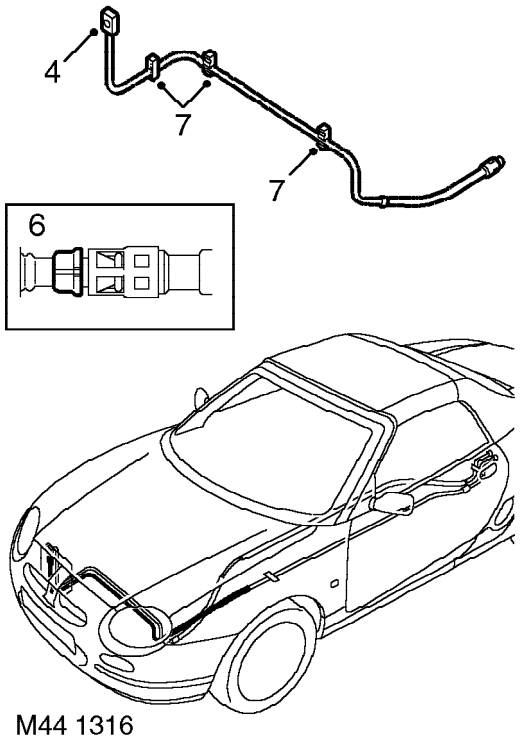
Service repair no - 44.24.27

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove bonnet locking platform. ***See BODY, Exterior fittings.***
3. Position container underneath gearbox fluid cooler connection to collect any spillage.



M44 1316

4. Remove bolt securing fluid cooler pipe connections to fluid cooler.
5. Release connection from fluid cooler and discard 'O' ring.
6. Remove release catch, refit in reverse position and release hose from intermediate pipe.
7. Remove pipe clamp clip, release pipe from clamp and remove pipe.
8. Refit release catch in safe position.

CAUTION: Plug the connections.

Refit

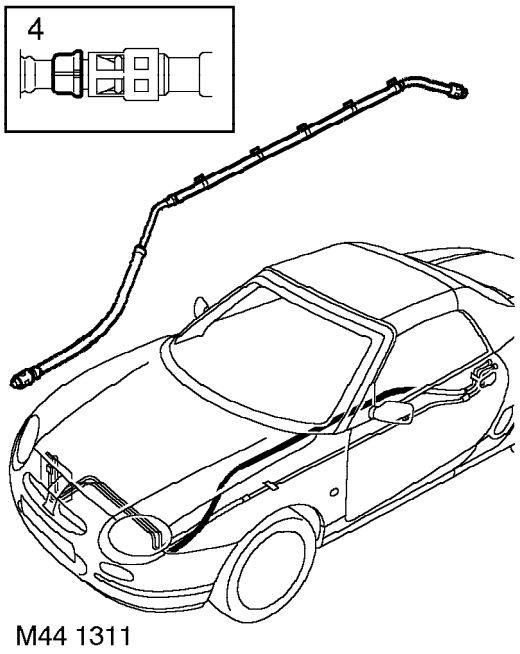
1. Clean pipe end and mating faces.
2. Connect hose to intermediate pipe.
3. Using new 'O' ring, align pipe to fluid cooler. Fit bolt and tighten to 10 Nm.
4. Position pipe in clamp and secure clamp clip.
5. Fit bonnet locking platform. ***See BODY, Exterior fittings.***
6. Top-up gearbox fluid level. ***See MAINTENANCE.***
7. Remove stand(s) and lower vehicle.

HOSE/PIPE - INTERMEDIATE - FEED

Service repair no - 44.24.28

Remove

1. Remove front underbelly panel. ***See BODY, Exterior fittings.***



M44 1311

2. Release pipe from 5 clips.
3. Position container to catch spillage.
4. Remove pipe release catches and refit in reverse position.
5. Release hoses from intermediate pipe and remove intermediate pipe.
6. Refit release catches in safe position.

CAUTION: Plug the connections.

Refit

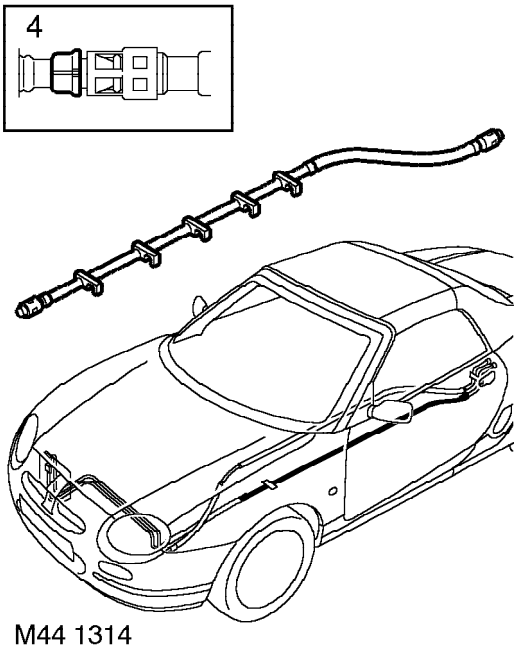
1. Clean pipe end and mating faces.
2. Position intermediate pipe and connect to hoses.
3. Secure intermediate pipe with new cable ties.
4. Fit front underbelly panel. ***See BODY, Exterior fittings.***
5. Top-up gearbox fluid level. ***See MAINTENANCE.***

HOSE/PIPE - INTERMEDIATE - RETURN

Service repair no - 44.24.29

Remove

1. Remove front underbelly panel. ***See BODY, Exterior fittings.***



M44 1314

2. Release pipe from 5 clips.
3. Position container to catch spillage.
4. Remove pipe release catches and refit in reverse position.
5. Release hoses from intermediate pipe and remove intermediate pipe.
6. Refit release catches in safe position.

CAUTION: Plug the connections.

Refit

1. Clean pipe end and mating faces.
2. Position intermediate pipe and connect to hoses.
3. Secure intermediate pipe in clips.
4. Fit front underbelly panel. ***See BODY, Exterior fittings.***
5. Top-up gearbox fluid level. ***See MAINTENANCE.***

HOSE/PIPE - FEED - INTERMEDIATE TO GEARBOX

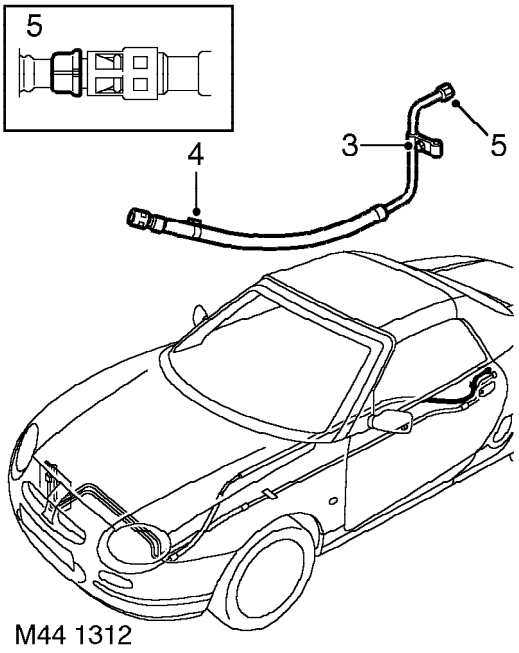
Service repair no - 44.24.30

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Position container to catch spillage.



M44 1312

3. Remove bolt securing pipe clamp and remove pipe clamp.
4. Loosen union on gearbox and release pipe from gearbox, remove and discard 'O' ring.
5. Remove release catch and refit in reverse position. Release pipe from intermediate pipe and remove pipe.
6. Refit release catch in safe position.

CAUTION: Plug the connections.

Refit

1. Clean pipe end and mating faces.
2. Connect pipe to intermediate pipe.
3. Using a new 'O' ring, position pipe to gearbox and tighten union to 14 Nm .
4. Position pipe clamp, fit and tighten clamp bolt to 10 Nm.
5. Remove stand(s) and lower vehicle.
6. Top-up gearbox fluid level. ***See MAINTENANCE.***

HOSE/PIPE - RETURN - INTERMEDIATE TO GEARBOX

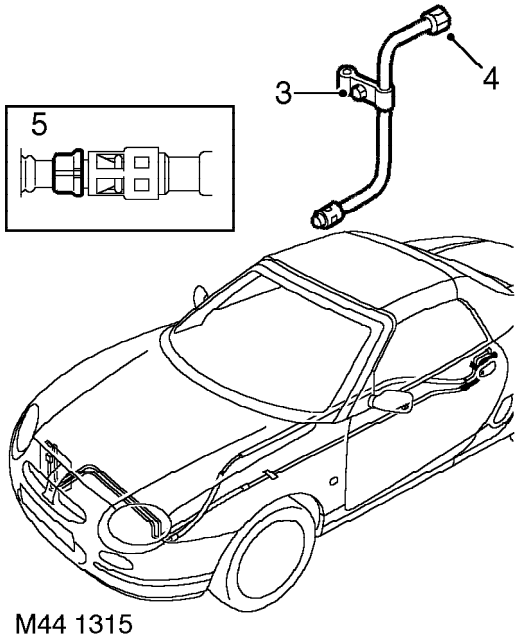
Service repair no - 44.24.31

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Position container to catch spillage.



M44 1315

3. Remove bolt securing pipe clamp and remove pipe clamp.
4. Loosen union on gearbox and release pipe from gearbox. Remove and discard 'O' ring.
5. Remove release catch and refit in reverse position. Release pipe from intermediate pipe and remove pipe.
6. Refit release catch in safe position.

CAUTION: Plug the connections.

Refit

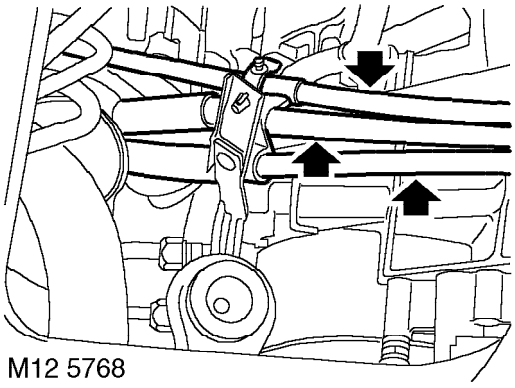
1. Clean pipe end and mating faces.
2. Connect pipe to intermediate pipe.
3. Using a new 'O' ring, position pipe to gearbox and tighten union to 14 Nm .
4. Position pipe clamp, fit and tighten clamp bolt to 10 Nm.
5. Remove stand(s) and lower vehicle.
6. Top-up gearbox fluid level. ***See MAINTENANCE.***

PRIMARY BEARING

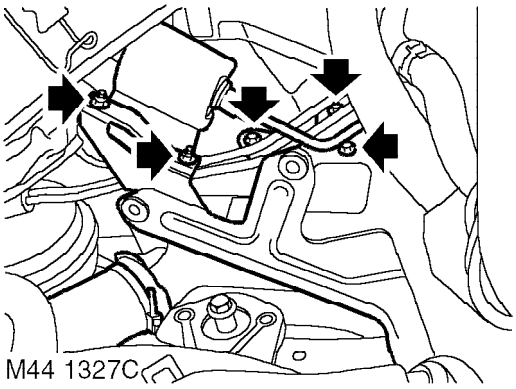
Service repair no - 44.36.14

Remove

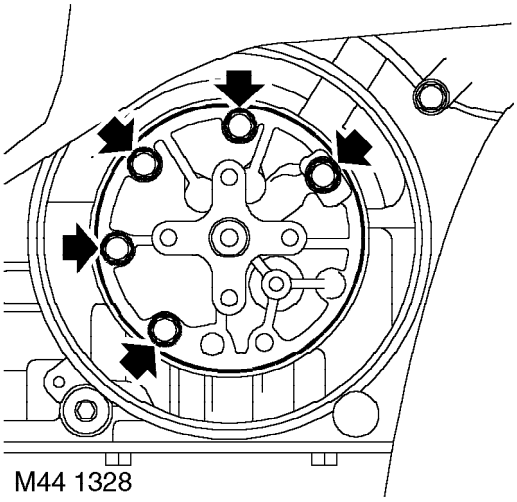
1. Raise rear of vehicle.
2. Remove LH rear road wheel.
3. Remove air cleaner. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***


M12 5768

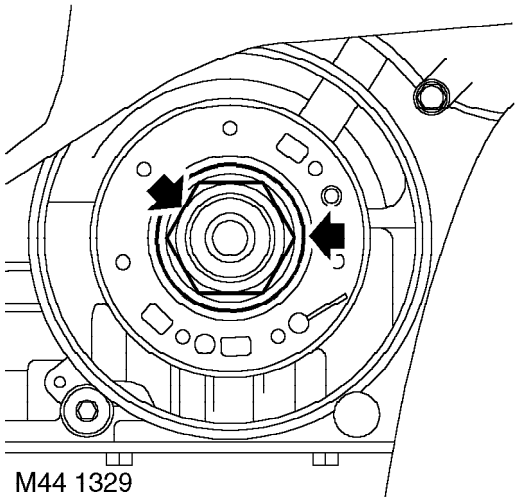
4. Release 2 hand brake cables and gear selector cable from clips on air cleaner mounting bracket.


M44 1327C

5. Remove 2 nuts securing fuel filter to air cleaner mounting bracket and release filter from bracket.
6. Remove 3 bolts securing air cleaner mounting bracket to body and remove bracket.
7. Remove gearbox primary cover seal. ***See this section.***



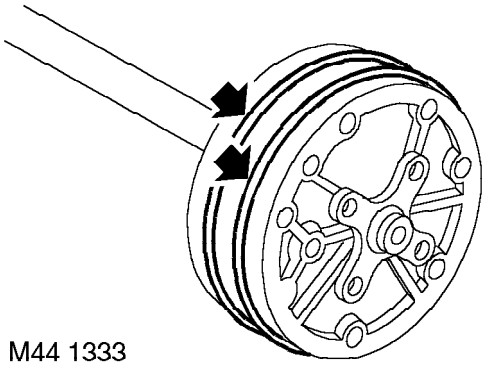
M44 1328



M44 1329

8. Remove 5 remaining bolts securing fluid pump.
9. With care, position 2 levers 180˚ apart and remove fluid pump.

NOTE: To prevent damage to primary housing, place 2 pieces of wood between levers and primary housing when removing oil pump.



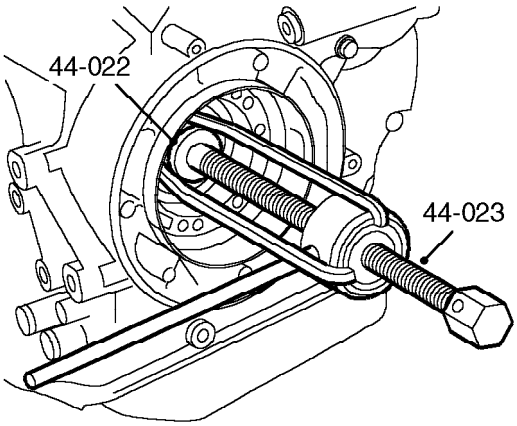
M44 1333

10. Remove and discard 2 'O' rings from oil pump.

11. Remove and discard belleville washer.
12. Using an air impact wrench with a torque capacity of 300 Nm, remove primary bearing nut.

NOTE: Initially start to undo nut with the impact wrench in the minimum position. Increase torque until nut is released.

13. Using a small screwdriver, lever out seal from primary bearing.

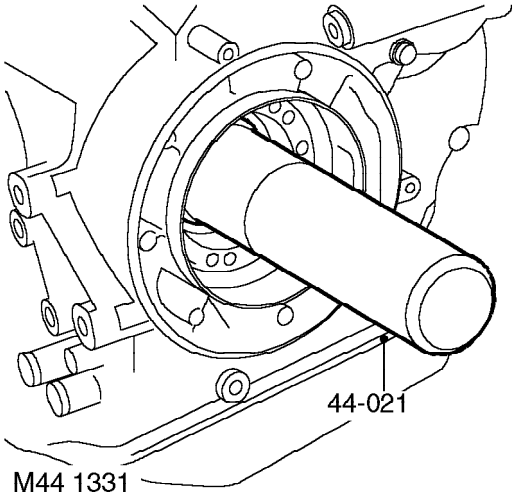


M44 1330

14. Position thrust button **44-022** into primary shaft.
15. Assemble tool **44-023** underneath the exterior ring of primary bearing.
16. Tighten centre bolt of tool **44-023** and remove primary bearing.

Refit

1. Clean primary bearing bore and shaft.
2. Clean sealant from threads in fluid pump drive shaft and clean fluid pump housing.
3. Position primary bearing with numbers on bearing facing outwards.



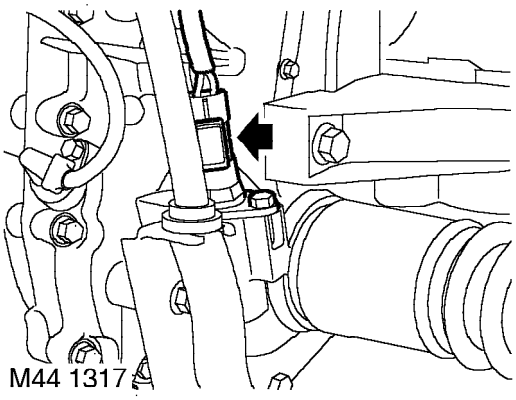
4. Drift in primary bearing using tool **44-021.**
5. Fit and tighten nut using an air impact wrench for sufficient duration until a minimum torque of 180 Nm is achieved.
6. Fit new belleville washer.
7. Lubricate and fit new 'O' rings to fluid pump.
8. Position fluid pump into gearbox, aligning feeder and pitot tube channels.
9. Fit 5 bolts and tighten in a diagonal sequence to 10 Nm.
10. Fit gearbox primary cover seal. ***See this section.***
11. Fit air cleaner mounting bracket to body, fit and tighten 3 bolts.
12. Fit fuel filter to air cleaner mounting bracket and secure with nuts.
13. Secure hand brake cables and gear selector cable to clips.
14. Fit air cleaner. ***See ENGINE MANAGEMENT SYSTEM - MEMS, Repairs.***
15. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm. ***See INFORMATION, Torque wrench settings.***
16. Lower vehicle.
17. Top-up gearbox fluid. ***See MAINTENANCE.***

ROAD SPEED TRANSDUCER

Service repair no - 44.38.08

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***



3. Disconnect multiplug from transducer.
4. Remove bolt securing transducer to gearbox.
5. Remove transducer and discard 'O' ring.

Refit

1. Clean sealing faces of transducer and gearbox.
2. Lubricate new 'O' ring with gearbox fluid and fit to transducer.
3. Fit transducer to gearbox and tighten to 9 Nm.
4. Connect multiplug to transducer.
5. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
6. Connect battery earth lead.

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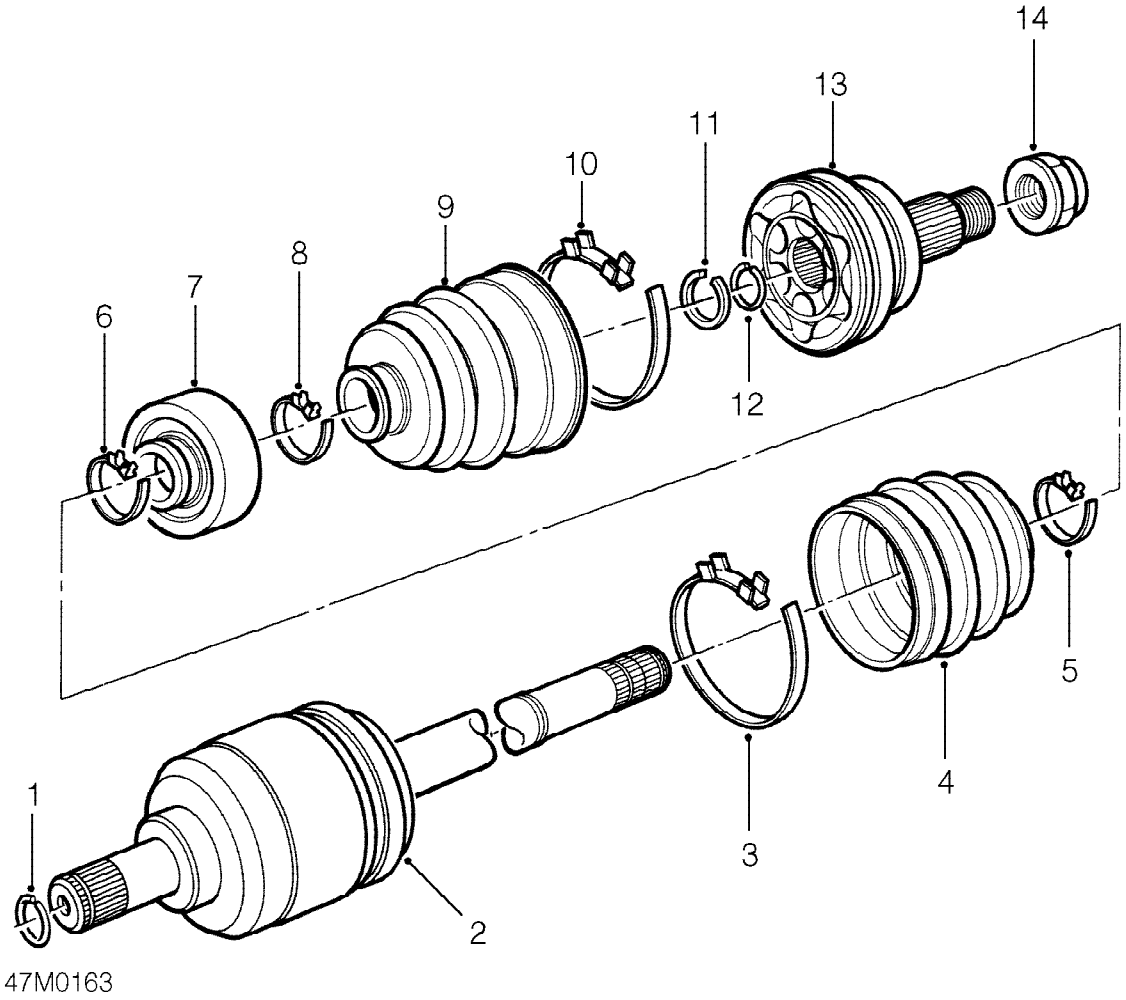
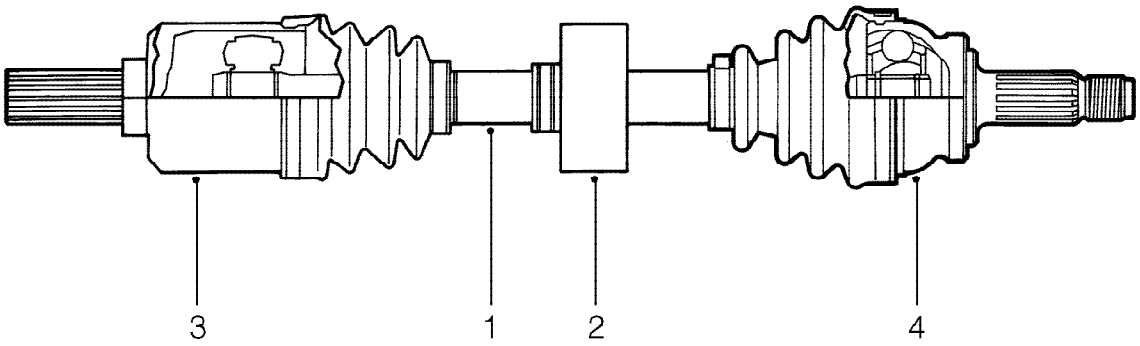
DRIVE SHAFT COMPONENTS



1. Circlip
2. Inner joint and shaft
3. Large clip - inner joint gaiter
4. Gaiter
5. Small clip - inner joint gaiter
6. Damper clip - RH shaft only
7. Dynamic damper - RH shaft only
8. Small clip - outer joint gaiter
9. Gaiter
10. Large clip - outer joint gaiter
11. Stopper ring
12. Circlip
13. Outer joint
14. Drive shaft nut

OPERATION



47M0164

1. Drive shaft
2. Dynamic damper
3. Inner joint
4. Outer joint

Drive from the power unit is transmitted to the rear wheels by the drive shafts. Due to the RH drive shaft being longer than the LH drive shaft, a dynamic damper is fitted to reduce harmonic vibration.

The inner joint is of the tripode type with spherical bushing to reduce sliding resistance; it cannot be serviced separate from the shaft. The outer joint is of the ball and socket type. The joints are sealed and pre-packed with grease.

SHAFT WITH BOTH JOINTS

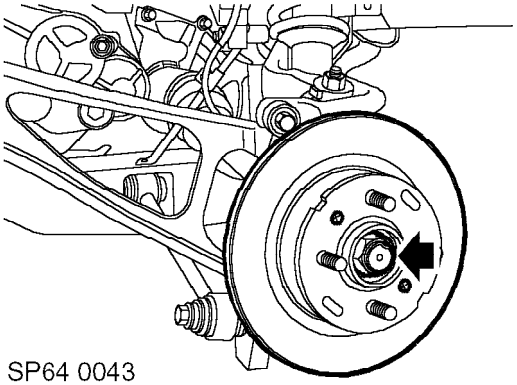
Service repair no - 47.10.01

Remove

1. Raise rear of vehicle.

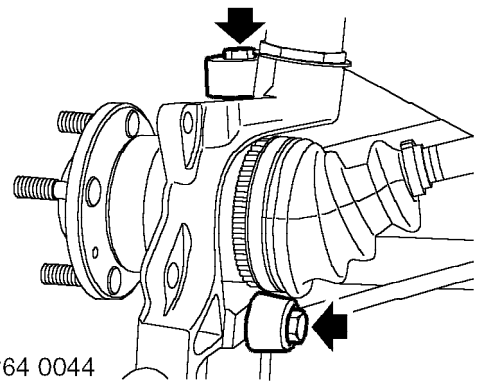
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel.



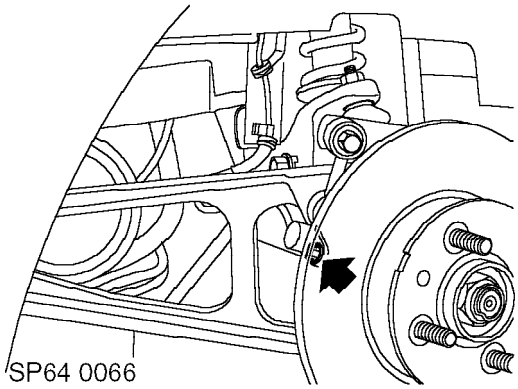
SP64 0043

3. Knock back drive shaft nut stake.
4. With assistance, depress brake pedal, remove and discard drive shaft nut.
5. Remove brake disc. ***See BRAKES, Repairs.***



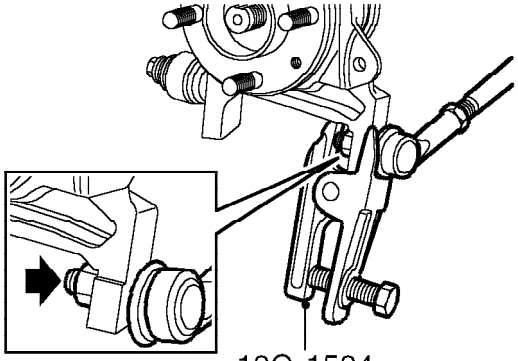
SP64 0044

6. Remove 2 bolts securing trailing arm to rear hub.



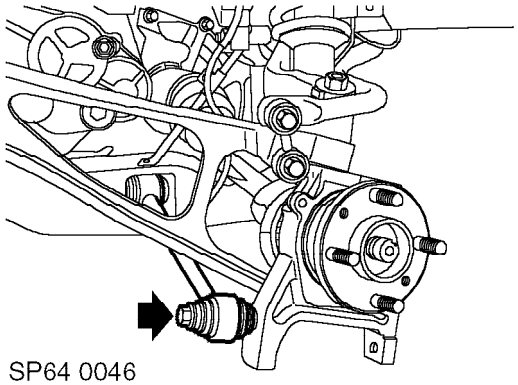
SP64 0066

7. Remove bolt securing ABS sensor to hub, release sensor and position aside.



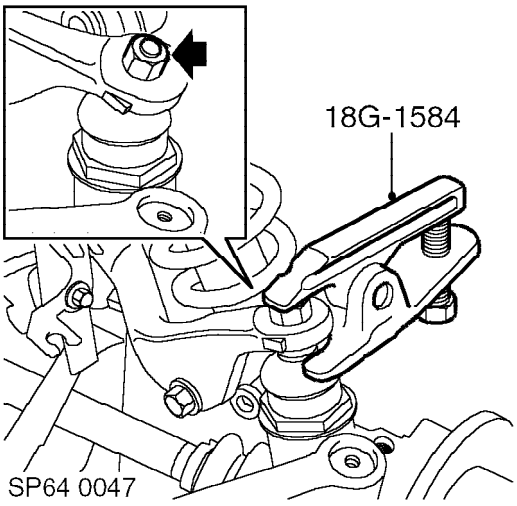
SP64 0045 18G-1584

8. Remove nut securing track control arm to rear hub.
9. Using tool **18G-1584,** release track control arm ball joint from rear hub.

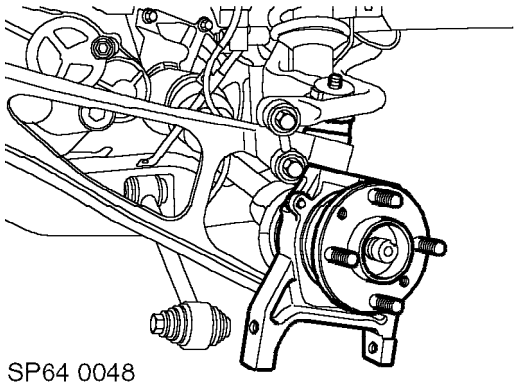


SP64 0046

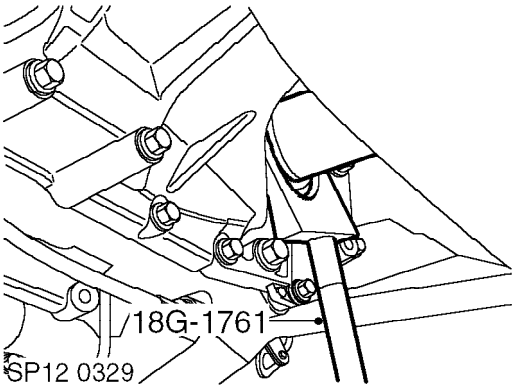
10. Remove bolt securing lower link to rear hub.



11. Remove lock nut from upper arm ball joint and discard lock nut.
12. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove**18G-1584** and slave nut.



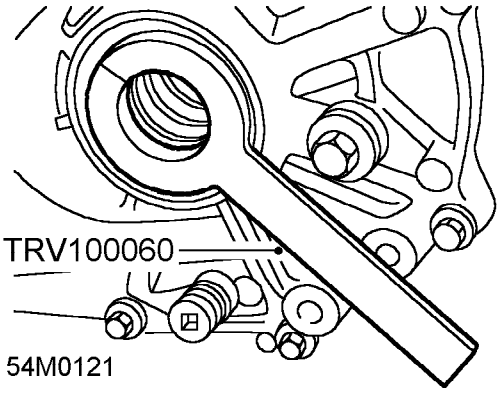
13. Remove rear hub assembly from drive shaft.



14. Using **18G 1761,** release drive shaft inboard joint from differential and remove drive shaft assembly.
15. Remove and discard circlip from drive shaft.

Refit

1. Clean drive shaft ends and locations in front hub and differential.
2. Fit new circlip to groove on drive shaft inner joint.



3. Fully insert oil seal protector tool **Unipart TRV 100060,** into differential oil seal so that oil seal lip is protected and that the split end of tool is butted correctly.
4. Keeping the drive shaft horizontal, insert drive shaft through seal protector until drive shaft engages with the differential splines.
5. Pull drive shaft outwards to ensure full engagement.
6. Clean drive shaft end and hub mating faces.
7. Fit hub to drive shaft.
8. Clean upper arm ball joint and mating face.

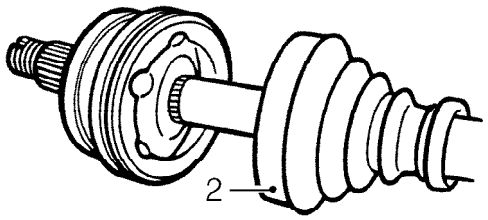
9. Engage ball joint pin to upper arm.
10. Fit new lock nut and tighten to 54 Nm.
11. Align lower link to rear hub, fit bolt but do not tighten at this stage.
12. Clean track control arm ball joint and mating face.
13. Engage track control arm ball joint to hub, fit nut and tighten to 38 Nm.
14. Clean and thoroughly dry bolts securing trailing arm to rear hub.
15. Apply Loctite 242 to the first 3 threads of bolts securing trailing arm to rear hub.
16. Fit bolts securing trailing arm to rear hub, do not tighten at this stage.
17. Position ABS sensor lead to hub, fit new bolt and tighten to 10 Nm.
18. Fit rear brake disc. ***See BRAKES, Repairs.***
19. With assistance tighten new drive shaft nut to 210 Nm.
20. Stake drive shaft nut to shaft.
21. With the weight of the vehicle on the rear suspension, tighten bolt securing lower link to rear hub to 100 Nm.
22. Tighten trailing arm to hub bolts to 60 Nm.
23. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
24. Remove stands and lower vehicle.

DRIVE SHAFT OUTER GAITER

Service repair no - 47.10.03

Remove

1. Remove drive shaft outer joint. ***See this section.***



47M0159

2. Slide gaiter from shaft.
3. Inspect gaiter for signs of damage and renew if necessary.

Refit

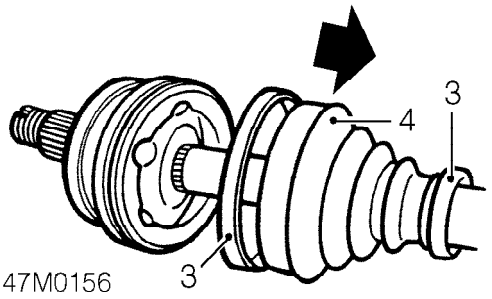
1. Fit gaiter to shaft.
2. Fit drive shaft outer joint. ***See this section.***

DRIVE SHAFT OUTER JOINT

Service repair no - 47.10.04

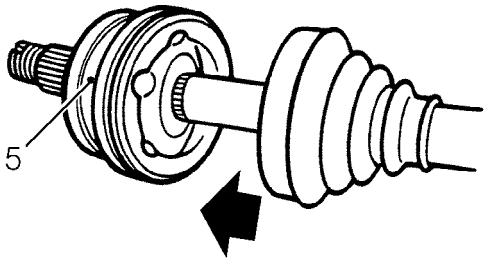
Remove

1. Remove drive shaft. ***See this section.***
2. Place drive shaft in a vice.



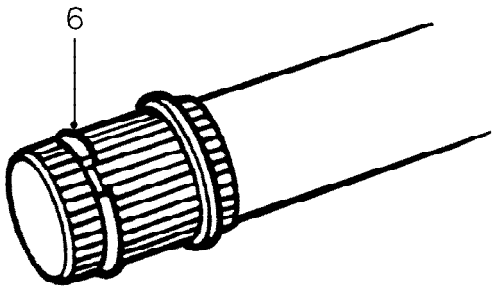
47M0156

3. Release both gaiter clips and discard.
4. Slide gaiter along shaft to gain access to outer joint.



47M0157

5. Bend the joint, and using a suitable drift against the inner part of the joint, remove from shaft.



47M0158

6. Remove circlip from shaft and discard.

Refit

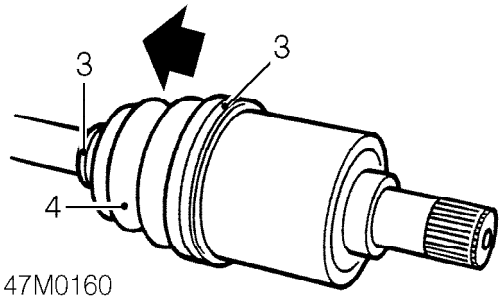
1. Fit new circlip to shaft.
2. Position outer joint to shaft, use a screwdriver to press circlip into its groove and push joint fully onto shaft.
3. Smear grease around joint.
4. Position gaiter to joint and use a band-it thriftool to secure the 2 new clips.
5. Fit drive shaft. ***See this section.***

DRIVE SHAFT INNER GAITER

Service repair no - 47.10.16

Remove

1. Remove drive shaft outer joint. ***See this section.***
2. Slide outer gaiter off shaft.



3. Release both inner gaiter clips and discard.
4. Slide inner gaiter off shaft.
5. Inspect gaiter for signs of damage and renew if necessary.
6. Clean shaft and joint.

Refit

1. Smear grease around joint.
2. Position gaiter to inner joint and use a band-it thriftool to secure 2 new clips.
3. Fit outer gaiter to shaft.
4. Fit outer joint. ***See this section.***

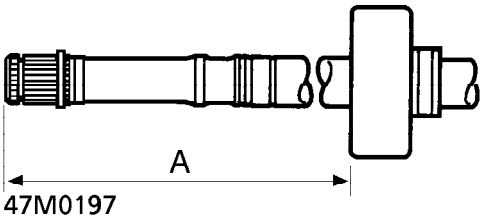
DYNAMIC DAMPER - DRIVE SHAFT - RH

Service repair no - 47.10.33

Remove

1. Remove drive shaft outer gaiter. ***See this section.***
2. Clean shaft with emery cloth to remove rust.
3. Lubricate shaft with liquid soap to aid damper removal.
4. Slide damper from shaft.

Refit



1. Measure along shaft for fitted position of damper.
2. Mark shaft for fitting position.
   Dimension 'A' = 398.5 mm. ± 3 mm.
3. Lubricate shaft for fitting of damper.
4. Position damper to mark.
5. Clean lubricant from shaft.
6. Fit drive shaft outer gaiter. ***See this section.***

OIL SEAL - DIFFERENTIAL HOUSING - LH - MANUAL TRANSMISSION MODELS

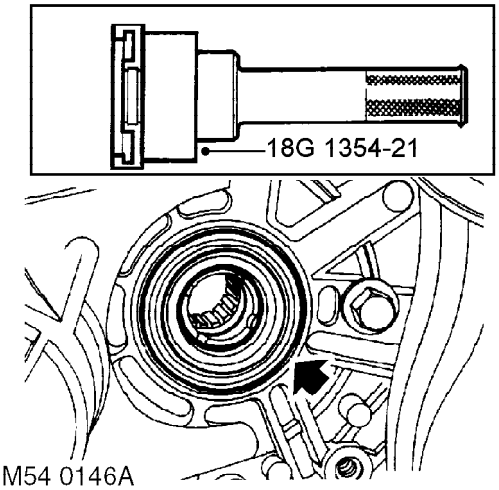
Service repair no - 54.10.18

Remove

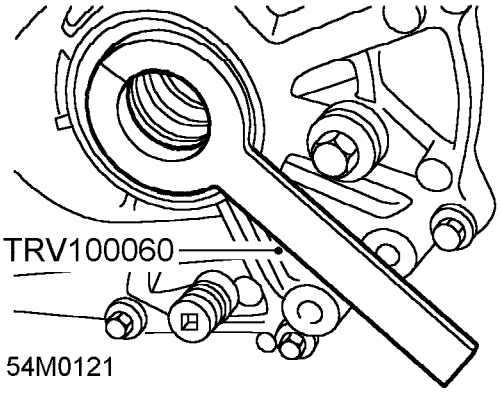
1. Remove LH drive shaft. ***See this section.***
2. Carefully remove oil seal from differential housing, discard oil seal.

Refit

1. Thoroughly clean oil seal recess in differential housing, splines and oil seal running surface on drive shaft.



2. Locate new oil seal on **18G-1354/21** with sealing lip facing towards differential housing.
3. Carefully drift oil seal into differential housing until it is fully seated in recess.
4. Remove **18G-1354/21** .



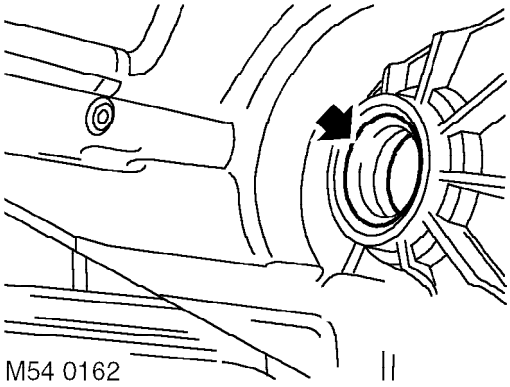
5. Fully insert oil seal protector tool **Unipart TRV 100060** into differential oil seal to protect oil seal lip. Ensure that the split end of tool is butted correctly.
6. Fit LH drive shaft. ***See this section.***
7. Check, and if necessary, top-up gearbox oil.

OIL SEAL - DIFFERENTIAL HOUSING - LH - STEPSPEED (Em-CVT) GEARBOX MODELS

Service repair no - 54.10.18

Remove

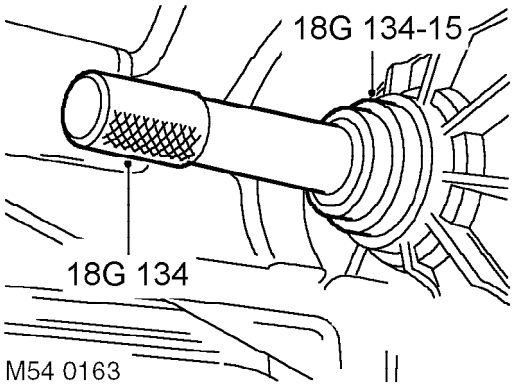
1. Remove LH drive shaft. ***See this section.***



2. Carefully remove oil seal from differential housing, discard oil seal.

Refit

1. Thoroughly clean oil seal recess in differential housing, splines and oil seal running surface on drive shaft.



2. Fit **18G-134-15** on to **18G-134,** position new oil seal onto **18G-134-15** with the sealing lip facing towards differential housing.
3. Carefully drift oil seal into differential housing until it is fully seated in recess.
4. Remove **18G-134-15** and **18G-134.**
5. Fit LH drive shaft. ***See this section.***
6. Check, and if necessary, top-up gearbox fluid.

OIL SEAL - DIFFERENTIAL HOUSING - RH - MANUAL TRANSMISSION MODELS

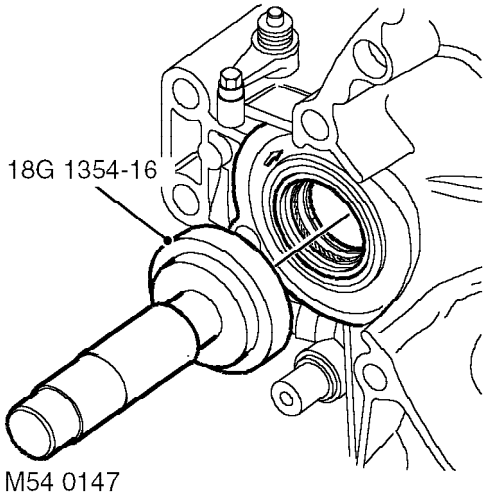
Service repair no - 54.10.21

Remove

1. Remove RH drive shaft. ***See this section.***
2. Carefully remove oil seal from differential housing, discard oil seal.

Refit

1. Thoroughly clean oil seal recess in differential housing, splines and oil seal running surface on drive shaft.



2. Fit **18G-1354/16** onto **18G-1354.**
3. Position new oil seal onto **18G-1354/16** with the sealing lip facing towards the differential.
4. Carefully drift oil seal into differential housing until it is fully seated in recess.
5. Remove **18G-1354/16** and **18G-1354.**
6. Fully insert oil seal protector tool **Unipart TRV100060** into differential oil seal to protect oil seal lip. Ensure that the split end of tool is butted correctly.
7. Fit RH drive shaft. ***See this section.***
8. Check, and if necessary, top-up gearbox oil.

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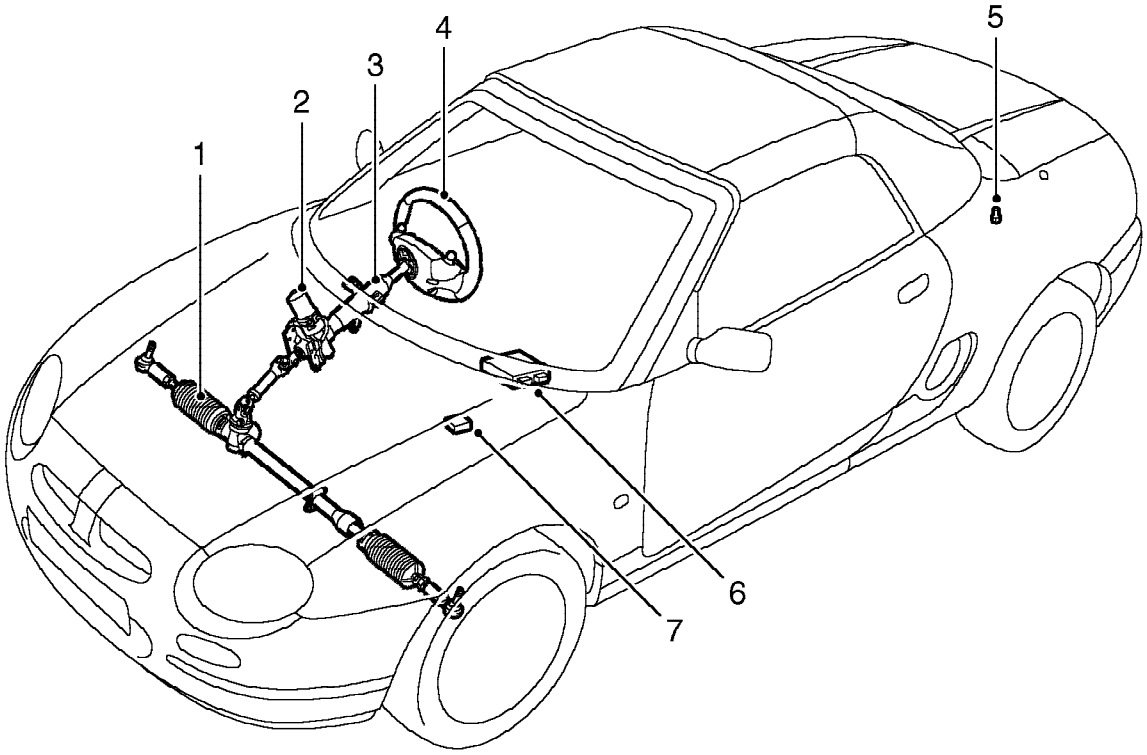
EPAS SYSTEM COMPONENT LOCATION

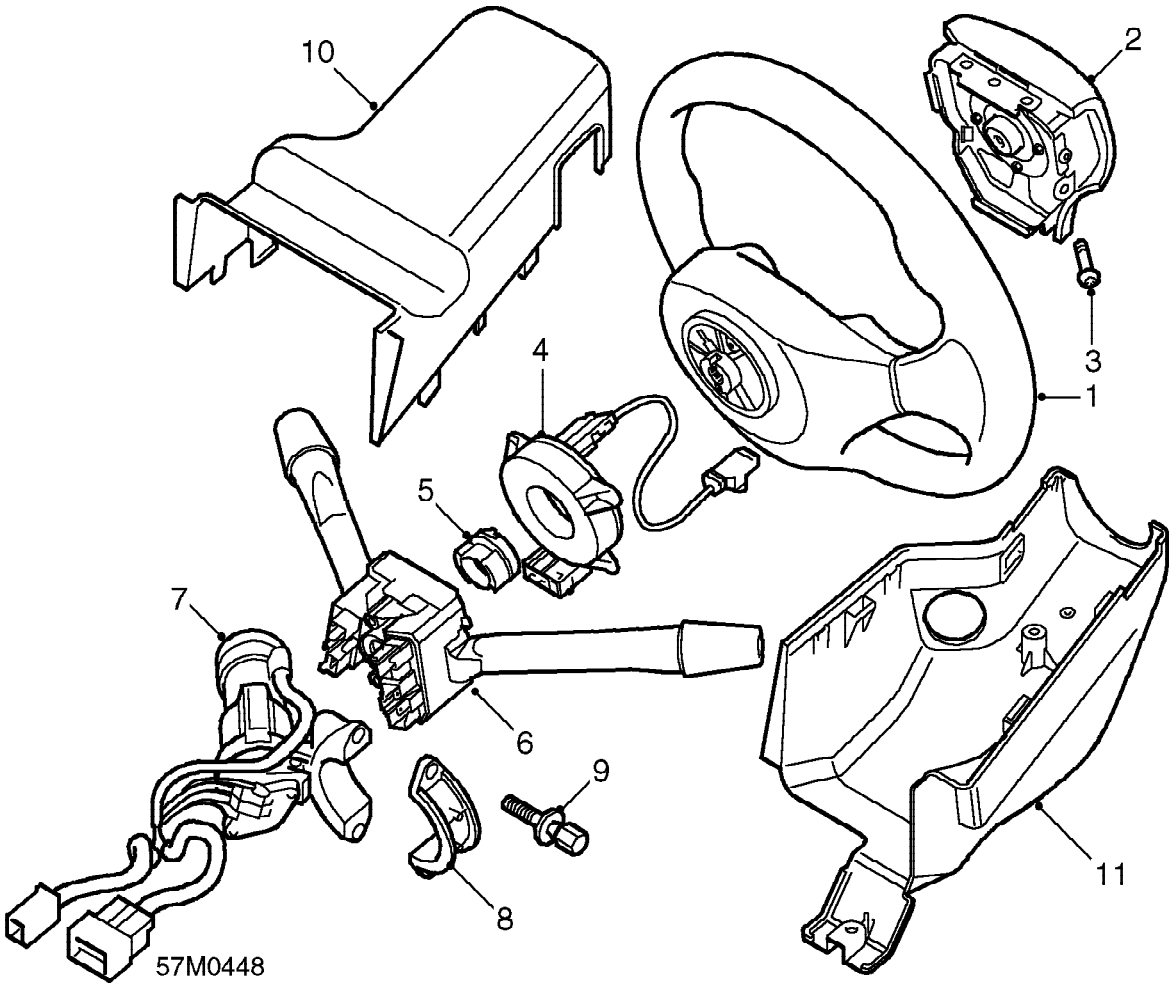


M57 0938

(RHD shown, LHD similar)

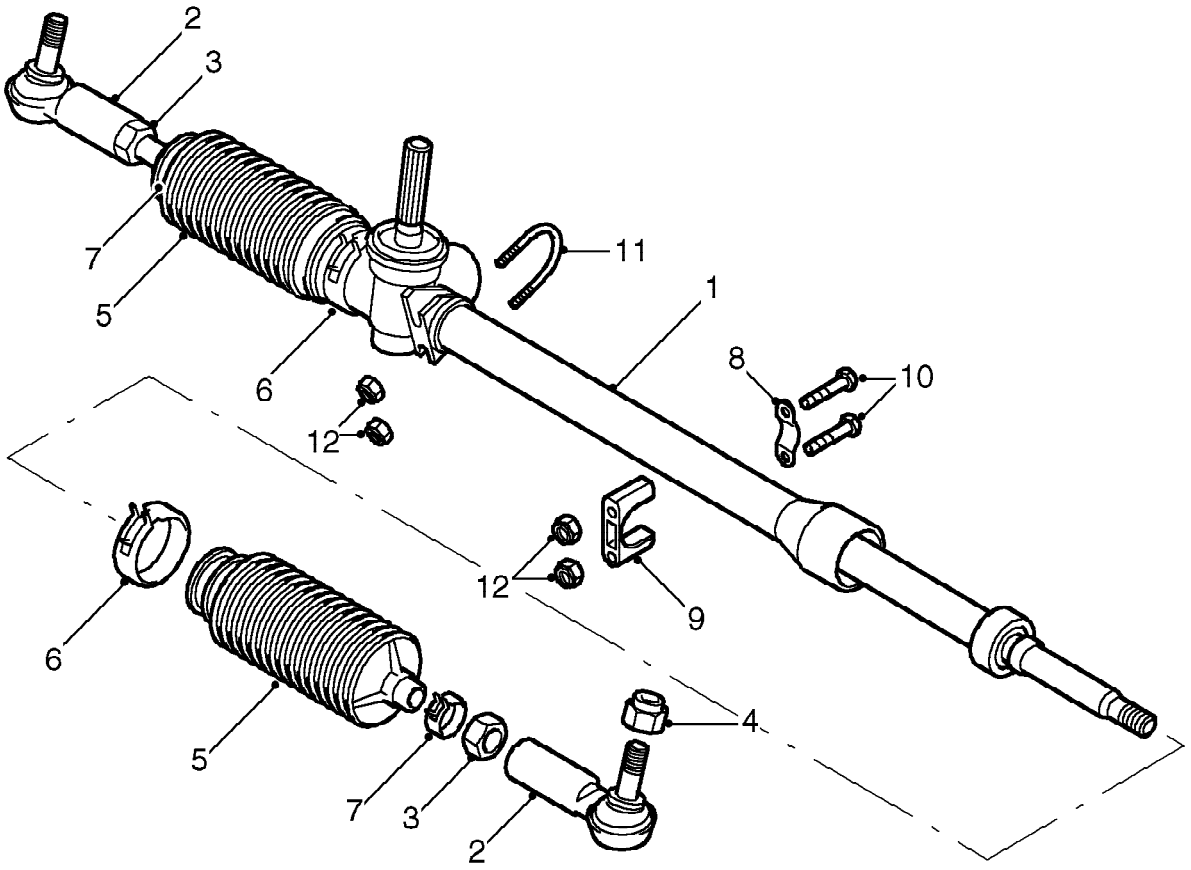
1. Steering rack
2. EPAS motor
3. Steering column
4. Steering wheel
5. Road speed transducer
6. EPAS ECU
7. EPAS System remote fuse (40A)

STEERING WHEEL



1. Steering wheel
2. Driver's airbag module
3. Torx bolt, 2 off
4. Rotary coupler
5. Cancel cam - indicator switch
6. Lighting, indicator and wiper switch assembly
7. Steering lock assembly
8. Bracket - steering lock
9. Shear bolt - steering lock, 2 off
10. Nacelle upper
11. Nacelle lower

STEERING RACK

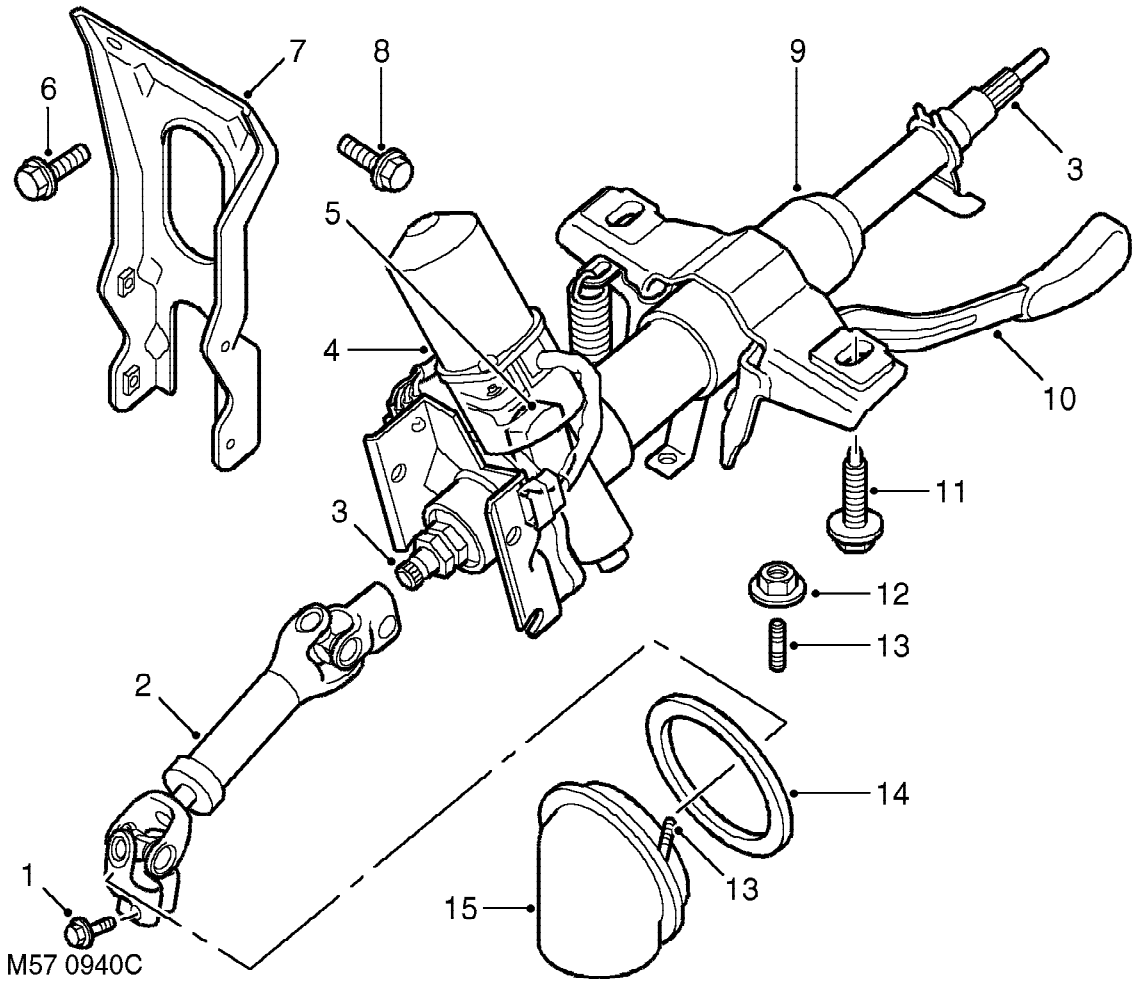


57M0445

1. Steering rack
2. Track-rod end
3. Locknut - track-rod end
4. Self locking nut - track-rod end to steering arm
5. Gaiter - steering rack
6. Clip inner
7. Clip outer
8. Clamp - steering rack
9. Spacer - steering rack
10. Bolt - steering rack to subframe
11. 'U' bolt - steering rack to subframe
12. Nut - steering rack to subframe

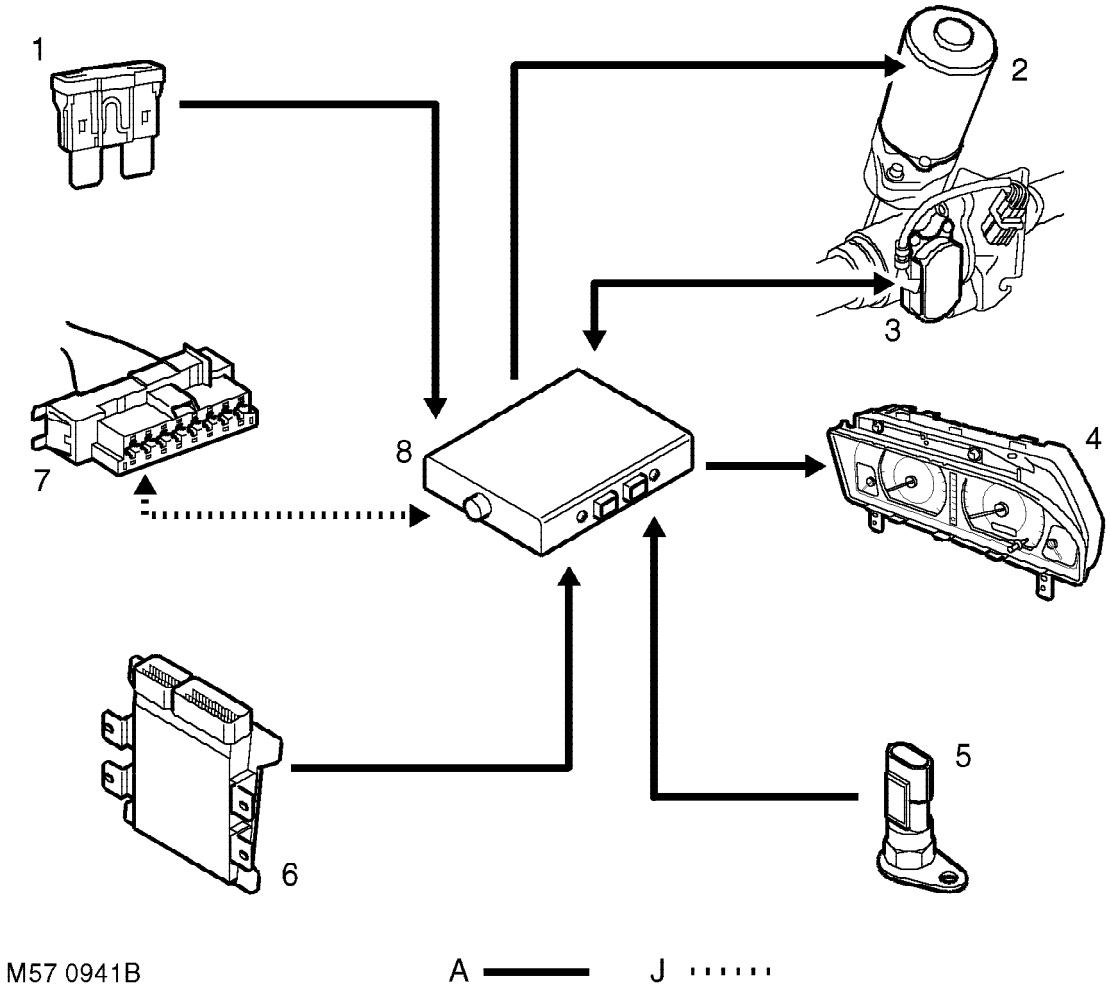
STEERING COLUMN (with Electrical PAS)

WARNING: The steering column is not serviceable. A damaged column must be renewed otherwise crash performance may be affected.



1. Bolt - intermediate shaft, 2 off
2. Intermediate shaft
3. Steering shaft
4. EPAS steering motor
5. Torque sensor
6. Bolt - bracket to body, 2 off
7. Bracket - steering column to body
8. Bolt - bracket to steering column, 4 off
9. Steering column
10. Column tilt adjustment lever
11. Bolt - steering column to body
12. Nut - pinion cover, 3 off
13. Stud - pinion cover, 3 off
14. Pinion cover seal
15. Pinion cover

EPAS SYSTEM CONTROL DIAGRAM



A= Hardwired; **J**= Diagnostic ISO 9141 K Line

1. EPAS fuse 40A
2. Steering motor and clutch
3. Torque sensor
4. Instrument pack
5. Road speed transducer
6. Engine Control Module (ECM)
7. Diagnostic socket
8. EPAS ECU

DESCRIPTION

Steering column

The steering column is secured to the body by two brackets. The column consists of two sections that telescopically collapse in the event of a frontal impact. The steering shaft also consists of two telescopic collapsible sections secured by two shear pins. The steering shaft rotates in the steering column via a ball-bearing at its upper end and two ball bearings at its base.

When the steering wheel is rotated, the turning effort of the shaft is transmitted to the pinion shaft of the the steering rack via the intermediate shaft. The intermediate shaft comprises two universal joints which counter the varying angle between steering shaft and rack; and a telescopic internal shaft which acts as a damper. This construction limits intrusion of the column in the event of a crash and also prevents suspension movement and vibration being transmitted through the steering column.

The steering column has a torque sensor, an electric motor and gearbox positioned at the lower part of the column which are integral components of the Electrical Power Assisted Steering (EPAS) system.

No parts of the steering column are serviceable and failure of any electrical or mechanical component will require column replacement.

EPAS System

The EPAS system is based on a conventional rack and pinion steering system, and also includes updated EPAS ECU software to improve steering response and characteristics and a column tilt adjustment feature.

EPAS provides variable power assistance depending on vehicle speed and driver's steering effort. Power assistance will be most evident to the driver when maneuvering the vehicle at low speeds, this assistance reduces progressively as vehicle speed increases.

Steering motor

Steering assistance is provided by a motor mounted on the steering column. The motor is attached to a cast housing which forms part of the column and is secured with two Torx screws. A single connector connects the motor to the main harness.

The motor drives a wormwheel attached to the steering shaft to provide the power steering assistance. The level of assistance provided by the motor varies according to torque sensor output and road speed.

The EPAS ECU calculates the required torque using inputs from the torque sensor and road speed transducer, and supplies a current to the motor of the appropriate amperage to provide the necessary steering assistance.

An electrically operated clutch connects the motor drive to the column when assistance is required. If a system failure occurs, the EPAS ECU will not engage the clutch, disconnecting motor assistance to the column.

Torque sensor

Driver steering effort is measured by a torque sensor mounted on the steering column. This information is sent to the EPAS ECU, which also monitors engine and vehicle speed.

The torque sensor comprises a rotary potentiometer with two tracks. The potentiometer is connected, via a pin and bearing, to a track on a slider. The slider moves axially depending on steering torque input from the steering wheel. This axial movement is converted, via the track, into rotary movement of the potentiometer in proportion to the torque input. The potentiometer passes information to the EPAS ECU for torque input and direction.

The EPAS ECU uses this information to calculate the ideal level of power assistance required for the driving conditions and applies a current of the applicable amperage to the electric motor mounted on the steering column. The electric motor applies the required torque to the steering shaft via a worm gear.

EPAS ECU

The EPAS ECU is located above the glove box, behind the fascia. The ECU is rubber mounted to a bracket on the front bulkhead and is secured by a bracket with two bolts to the body cross tube.

The EPAS system incorporates fail-safe devices which cause it to revert to conventional manual steering in the event of a system failure. The EPAS ECU integral fault monitor sends a signal to the electromagnetic clutch which disconnects the motor mechanical drive to the column. Fault codes are stored in the EPAS ECU memory, for identification by TestBook.

If a fault occurs, the EPAS ECU illuminates the EPAS warning lamp in the instrument pack. If, when the ignition is switched off and back on again, the fault is no longer present, the ECU will not illuminate the fault lamp after the engine is started. The ECU stores a fault code for the fault. If the fault does not re-occur in the next twenty ignition cycles, the ECU will erase the fault code.

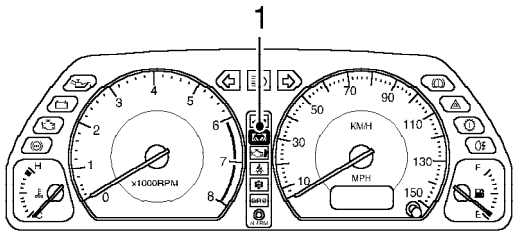
Field Effect Transistors (FET's) in the ECU protect the system from overload. If excessive use or component failure causes the motor to overheat, the FETS will become hot. As the temperature increases, the FET's and the EPAS ECU gradually decrease the level of steering assistance provided. As the system cools the level of steering assistance is progressively reinstated.

Permanent battery voltage is supplied to the EPAS ECU via a dedicated EPAS 40A fuse which is located remotely adjacent to the underbonnet fusebox.

Two multiplugs provide input and output connections to and from the ECU. The following tables show the harness connector pin numbers and input/output information.

Instrument pack

The EPAS ECU informs the driver of any malfunctions via a warning lamp on the instrument pack. The warning lamp receives a 12V supply from fuse 1 in the passenger compartment fusebox when the ignition is in position II. The EPAS ECU connects the warning lamp to earth when fault warning lamp illumination is required.



M57 0943

1. EPAS warning lamp

Diagnostics

A diagnostic socket allows the exchange of information between the EPAS ECU and TestBook. The diagnostic socket is located in the passenger compartment fusebox which is below the fascia on the driver's side.

The EPAS ECU monitors inputs and outputs relating to the EPAS system. If a fault is detected, a code applicable to that fault is stored in a fault log in the ECU.

EPAS ECU connector C0316 pin details

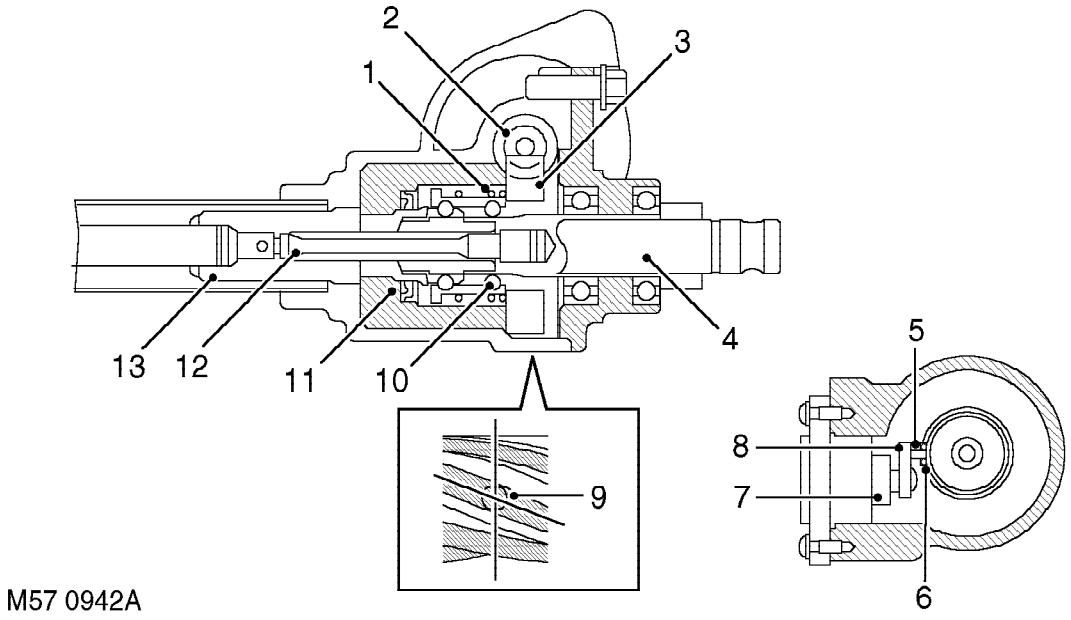
Pin No.	Description	Input/Output
1	Clutch earth	Input
2	EPAS instrument pack warning lamp	Output
3	Not used	-
4	Torque sensor earth	Input
5	Torque sensor	Input
6	Torque sensor 5V supply	Output
7	Road speed signal	Input
8	Ignition ON signal	Input
9	Clutch 12V supply	Output
10	Not used	-
11	Not used	-
12	Not used (connected in parralel with pin 4)	-
13	Torque sensor	Input
14	Not used (connected in parallel with pin 6)	-
15	Engine speed	Input
16	Diagnostic socket	Input/Output

CAUTION: The torque sensor potentiometers are connected in series, therefore, pins 12 and 14 are not used. Wires are still present in harness connector but are unterminated in the torque sensor. DO NOT short circuit either of these pins.

EPAS ECU connector C0317 pin details

Pin No.	Description	Input/Output
1	Battery +12V permanent supply	Input
2	Motor +ve PWM signal (right turn)	Input
3	Earth	Input
4	Motor -ve PWM signal (left turn)	Input

OPERATION



1. Spring
2. Worm gear
3. Worm wheel
4. Output shaft
5. Ball bearing
6. Pin
7. Lever pin
8. Rotary potentiometer
9. Slider/ball bearing (inset)
10. Ball
11. Slider
12. Torsion bar
13. Input shaft

EPAS Mechanical operation

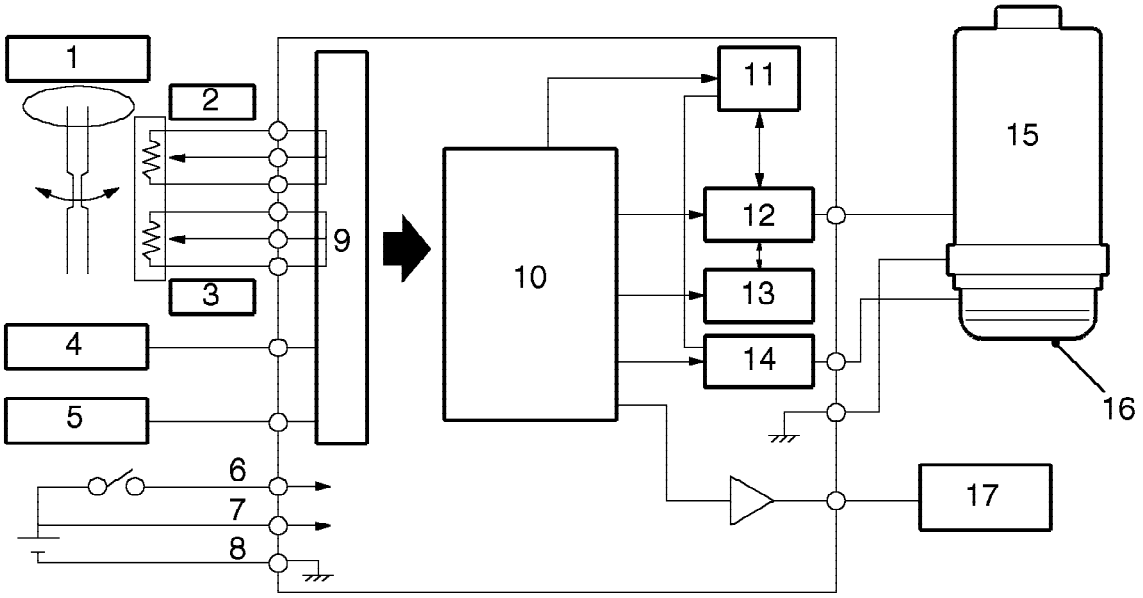
The motor, clutch and motor worm gear are mounted on the cast gear housing on the column. The worm wheel is attached to the output shaft. The input shaft and the output shaft are joined by a torsion bar.

When the steering wheel is rotated, torque is applied to the torsion bar which twists causing an angular deflection between the input and output shafts.

The deflection causes the slider to rotate via the balls in the ball groove which causes linear movement of the slider along the axis of the output shaft.

The rotary potentiometer in the torque sensor has a pin, which is fitted with a ball bearing. The bearing locates in a groove in the slider. The linear movement of the slider is converted back to rotational movement of the potentiometer, via the bearing and pin. The torque sensor converts the torque applied into an electrical signal which is proportional to the steering torque.

EPAS electrical operation



M57 0944

EPAS ECU

1. Torque sensor
2. Main Potentiometer
3. Sub Potentiometer
4. Speed sensor
5. Engine revolution sensor
6. Ignition switch supply
7. Battery supply
8. Earth
9. Interface
10. Main control computer
11. Fail safe relay
12. Motor drive circuit
13. Current control circuit
14. Clutch drive circuit
15. Motor
16. Clutch
17. Warning lamp

The torque sensor has two potentiometers. The potentiometers share a power supply and earth connection from the ECU and operate in the same direction. One potentiometer provides the torque data and the other potentiometer acts as a fault monitor. The ECU checks the output from each potentiometer and will illuminate the EPAS warning lamp and suspend power assistance whilst the fault is present.

When the ignition is switched on, the EPAS ECU performs a start-up (diagnostic) check procedure. The ECU illuminates the EPAS fault warning lamp in the instrument pack. The lamp will remain illuminated until the engine is started and the ECU receives an engine running signal from the crankshaft position (CKP) sensor.

The inputs from the torque sensor, CKP sensor (engine running signal) and road speed transducer are passed to the ECU and, via the interface, to the main control computer.

The computer processes the data and calculates the required steering assistance and outputs the required current to the motor. The motor then operates to apply torque via the worm gear in the required direction to the worm wheel.

FRONT WHEEL ALIGNMENT

Service repair no - 57.65.01

Check

1. Ensure tyre pressures are correct.
2. Ensure that equipment is properly calibrated.

NOTE: Only use equipment recommended in the STEP (Service Tools and Equipment Programme) Manual.

3. Check front wheel alignment is within tolerance.

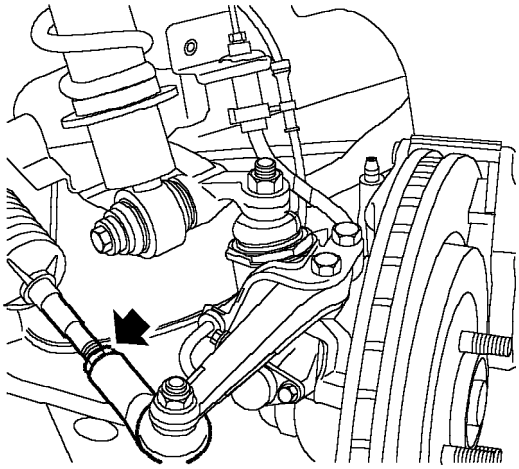
NOTE: The following steering geometry settings are given in A - degrees and minutes, B - decimal parts of a degree and C - millimetres. Steering and Suspension geometry settings are for a vehicle at unladen weight.

DATA

Front wheel alignment - toe-out - per side:

A - 0 °0' ±0° 6'
B - 0° ±0.1°
C - 0 mm ±0.665 mm (15" wheels)
- 0 mm ±0.709 mm (16" wheels).

Adjust



SP57 0009

1. Mark track-rods for reference.
2. Loosen track-rod lock nut.
3. Release clip securing gaiter.
4. Adjust track-rod to obtain correct alignment.

CAUTION: Both track-rods must be rotated an equal amount.

5. Tighten track-rod lock nut to 50 Nm and secure gaiter clip.

REAR WHEEL ALIGNMENT

Service repair no - 57.65.06

Check

1. Ensure tyre pressures are correct.
2. Ensure that equipment is properly calibrated.

NOTE: When adjusting rear wheel alignment 4 turntables must be used, one for each wheel. Only use equipment recommended in the STEP (Service Tools and Equipment Programme) Manual.

3. Ensure front wheel alignment is correct. ***See this section.***
4. Check rear wheel alignment is within tolerance.

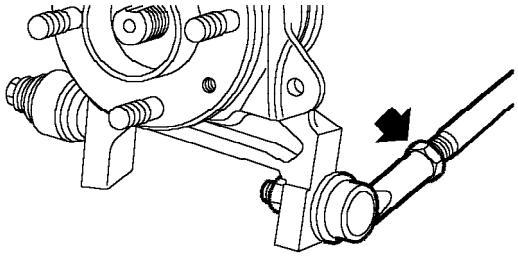
NOTE: The following settings are given in A - degrees and minutes, B - decimal parts of a degree and C - millimetres. Settings are for a vehicle at unladen weight.

DATA

Rear wheel alignment = toe-in - per side:

A - 0° 15' ±0° 6'
B - 0.25° ±0.1°
C - 1.662 mm ±0.67 mm (15 " wheels)
- 1.772 mm ±0.71 mm (16" wheels)

Adjust



SP57 0008

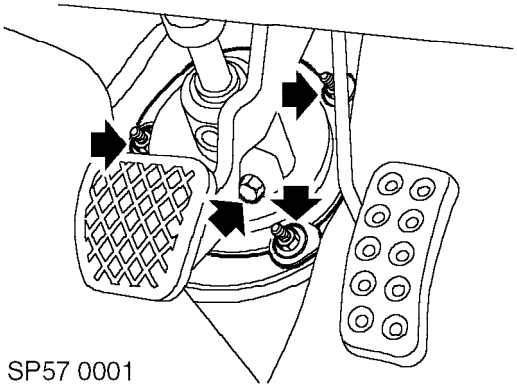
1. Loosen 2 lock nuts securing track control arm adjuster.
2. Turn adjuster to obtain correct alignment.
3. Tighten lock nuts.
4. Settle suspension.
5. Recheck alignment, when correct tighten lock nuts to 50 Nm.
6. Repeat check and adjust operation on other side of vehicle.

CAUTION: After adjusting the rear wheel alignment, ensure that the track control arm has rotational movement. This can be checked by grasping the track control arm and rotating it backwards and forwards on the ball joints.

RACK & PINION ASSEMBLY

Service repair no - 57.25.01

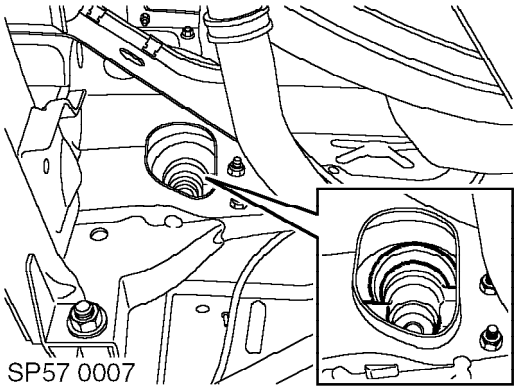
Remove


SP57 0001

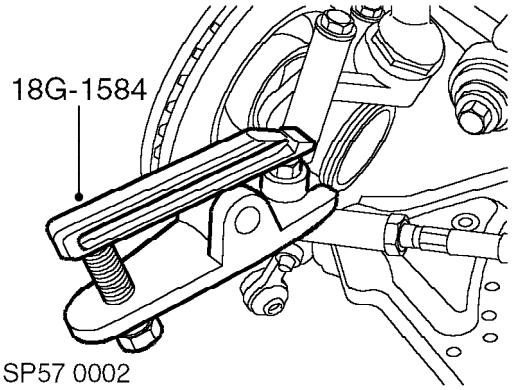
1. Remove bolt securing steering column universal joint to rack pinion.
2. Release steering column universal joint from rack pinion.
3. Remove 3 nuts securing steering rack pinion cover to body.
4. Raise front of vehicle and support on stand(s).

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

5. Remove road wheel(s).

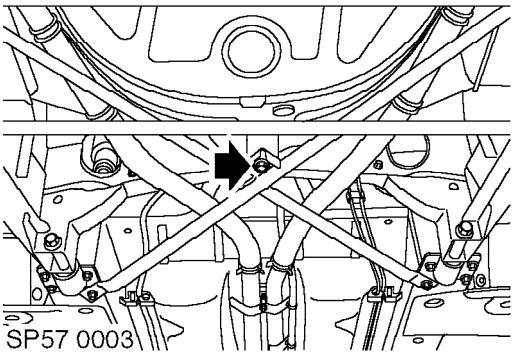

SP57 0007

6. Release pinion cover from steering rack pinion housing and retaining studs.

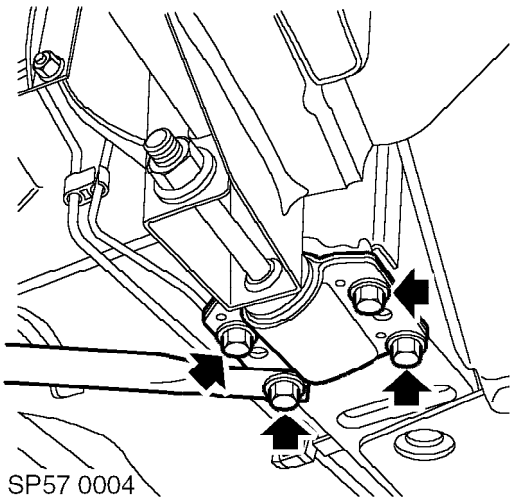


SP57 0002

7. Remove nuts securing RH and LH track rod end ball joints.
8. Using **18G 1584,** break taper joints and release ball joints.

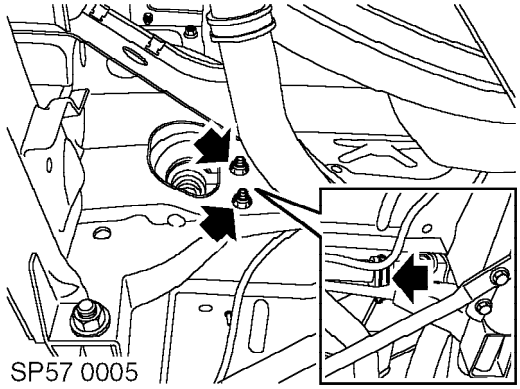

SP57 0003

9. Remove bolt securing cross brace to centre mounting.
10. Support rear of front subframe on a jack.

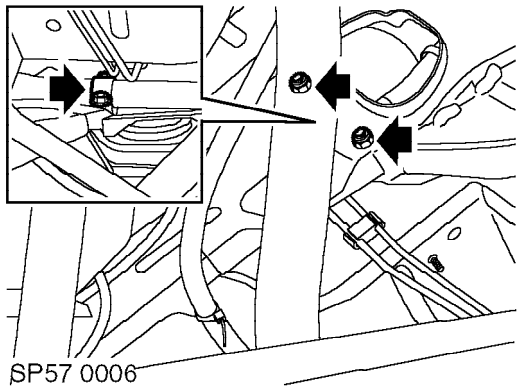

SP57 0004

11. Remove 8 bolts securing cross brace and front subframe rear mountings to body.

12. Lower subframe on jack sufficiently to remove steering rack.



13. Remove nuts securing steering rack 'U' bolt to subframe and remove 'U' bolt.



14. Remove bolts securing steering rack clamp to subframe and remove clamp.
15. Withdraw steering rack out through drivers side wheel arch.

Refit

1. Clean steering rack and subframe mating faces, 'U' bolt and clamp.
2. Position steering rack to subframe.
3. Fit 'U' bolt securing steering rack to subframe, fit nuts but do not tighten at this stage.
4. Fit steering rack clamp, fit nuts and tighten to 22 Nm.
5. Tighten 'U' bolt nuts to 22 Nm, ensure that thread protrusion behind each nut is equal.
6. Raise subframe on jack.
7. Align subframe to body mountings, fit bolts securing rear mountings and cross brace, and tighten to 45 Nm.
8. Fit and tighten bolt securing cross brace to centre mounting to 45 Nm.
9. Clean steering rack ball joint tapers and mating faces on hubs.
10. Position LH and RH track rod ends, fit and tighten nuts to 30 Nm.
11. Locate pinion cover on studs and secure to steering rack pinion housing, fit and tighten nuts to 8 Nm.
12. Align and connect steering column intermediate shaft joint to rack pinion.
13. Fit bolt and tighten to 22 Nm.
14. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
15. Remove stand(s) and lower vehicle.
16. Check front wheel alignment. ***See Adjustments.***

STEERING RACK GAITER

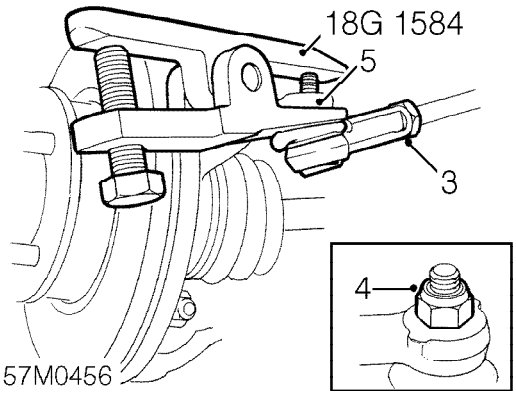
Service repair no - 57.25.03

Remove

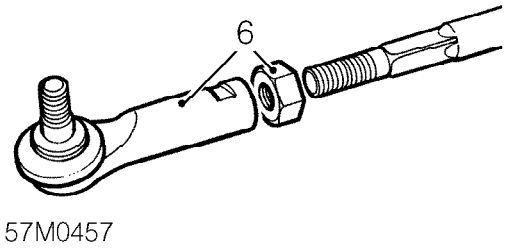
1. Raise front of vehicle.

WARNING: Support on safety stands.

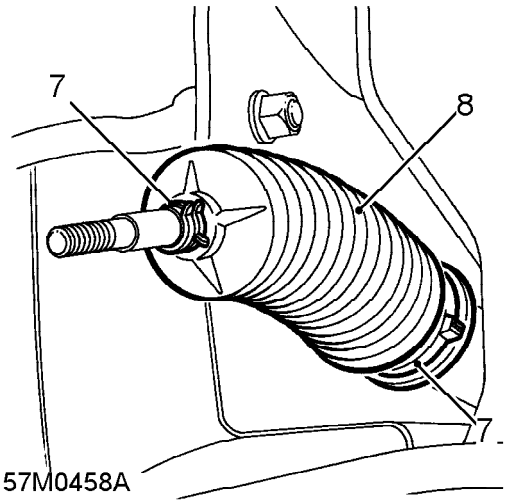
2. Remove road wheel(s).



3. Loosen track-rod end lock nut.
4. Remove nut securing track-rod end to steering arm.
5. Using tool **18G 1584** , break track-rod end taper joint.



6. Noting the number of complete turns remove track-rod end, and lock nut.



7. Remove 2 gaiter clips.
8. Remove gaiter from rack.

Refit

1. Apply grease to gaiter. ***See INFORMATION, Capacities, fluids and lubricants.***
2. Position inner gaiter clip to gaiter.
3. Fit gaiter and secure with clips.
4. Fit lock nut and track-rod end to rack.

NOTE: Rotate the track-rod end the same amount of turns noted on the removal.

5. Clean taper and position track-rod end to steering arm.
6. Fit nut and tighten to 30 Nm.
7. Tighten track-rod end lock nut to 50 Nm.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Remove stand(s) and lower vehicle.
10. Check and adjust wheel alignment. ***See Adjustments.***

STEERING COLUMN

Service repair no - 57.40.01

WARNING: *See RESTRAINT SYSTEMS, Precautions.*

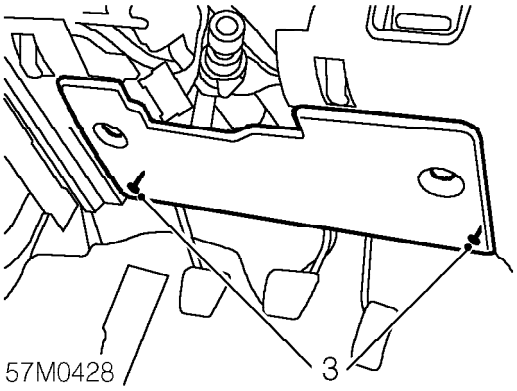
Remove

1. Make the SRS system safe ***See RESTRAINT SYSTEMS, Precautions.***

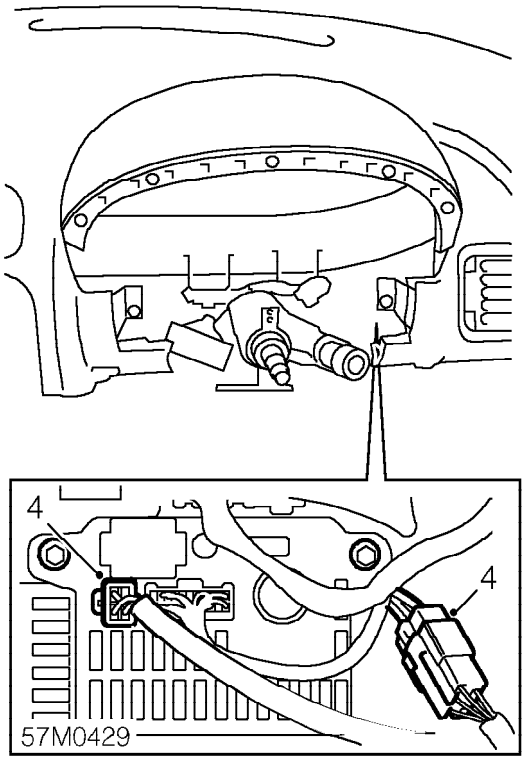
CAUTION: The steering column upper mountings have breakout capsules which are critical to crash performance. Do not clamp the capsules in a vice or otherwise mishandle them.

WARNING: If the breakout capsules on the upper mountings are damaged the steering column must be replaced.

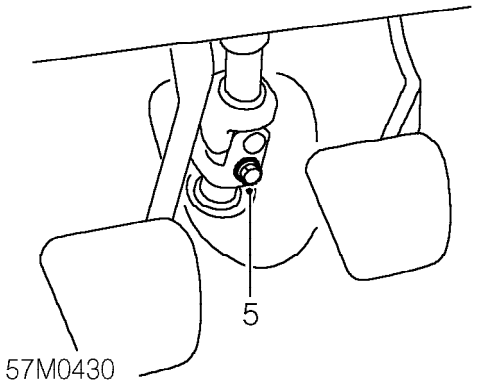
2. Remove steering column switch pack. ***See ELECTRICAL, Repairs.***



3. Loosen 2 screws securing fuse box cover to fascia and remove fuse box cover.

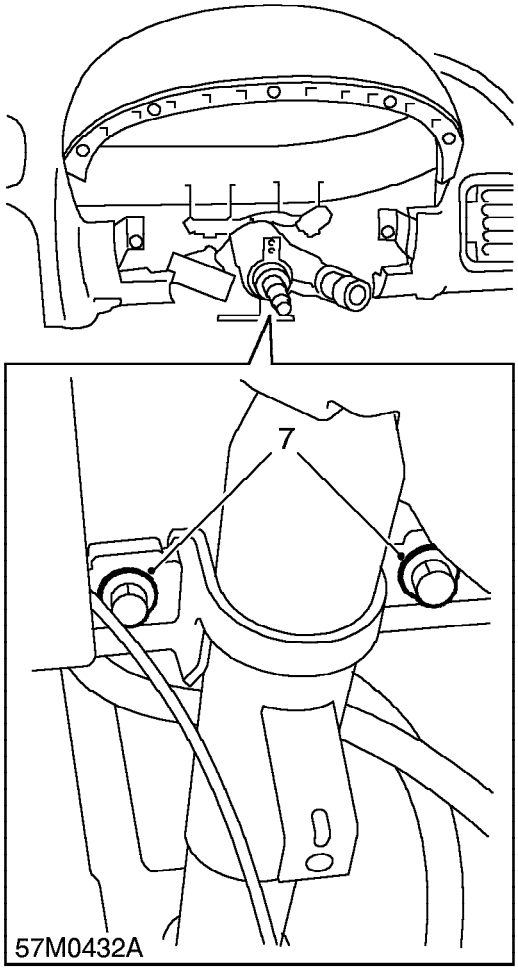


4. Disconnect 2 ignition switch multiplugs from fusebox and harness.

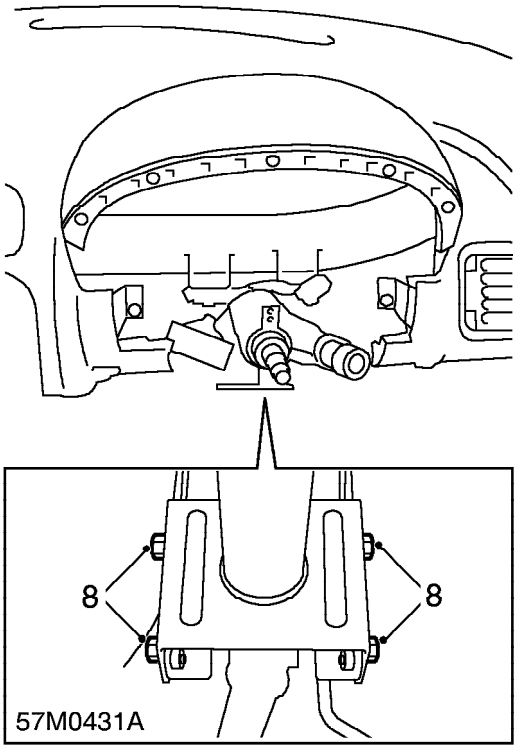


5. Remove bolt securing intermediate shaft to steering rack pinion.
6. Remove 2 nuts securing passenger fusebox to body and position fusebox aside.

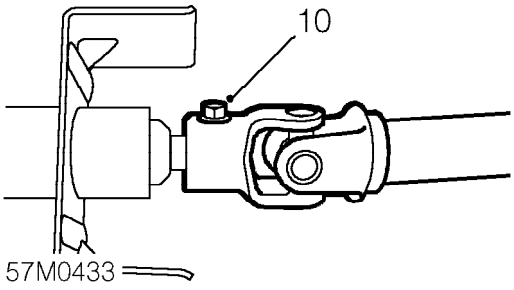
CAUTION: The steering column, upper mounting bolts must be removed before the lower mounting bolts. This is to prevent the weight of the steering column damaging the upper mounting breakout capsules.



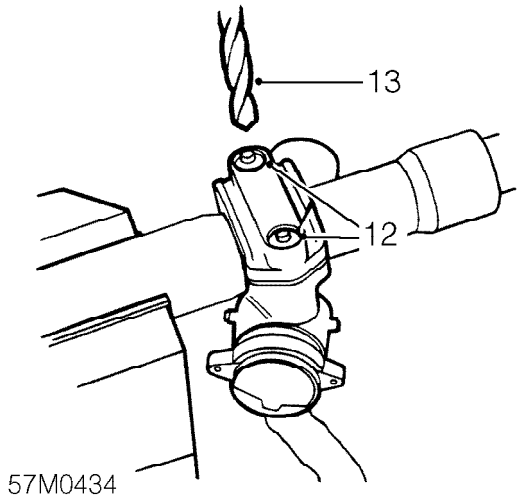
7. Remove 2 bolts securing upper steering column to fascia rail.



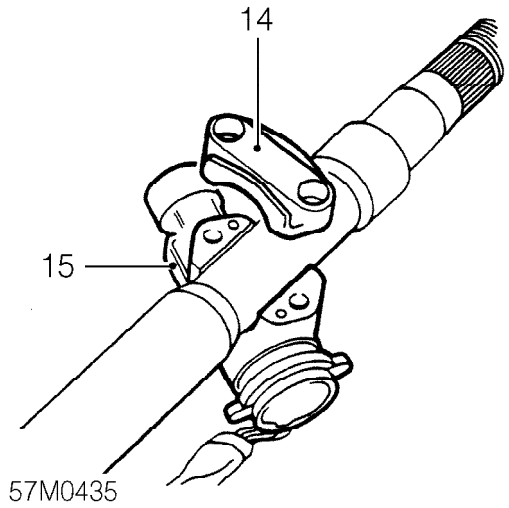
8. Remove 4 bolts securing lower steering column to bracket.
9. Release column assembly and remove from steering rack pinion, remove steering column from vehicle.



10. Remove clamping bolt securing steering column to intermediate shaft. Remove intermediate shaft.
11. Position steering column assembly in vice.



12. Mark ignition lock shear bolt heads with centre punch.
13. Drill out shear bolt heads.



14. Remove lock 'saddle' from column.
15. Remove lock assembly from column.
16. Remove shear bolts from lock assembly.

Refit

1. Remove key from ignition barrel to ensure steering lock pin is protruding.
2. Fit ignition switch to column, locating steering lock pin in groove on inner column.
3. Fit lock saddle.
4. Fit and nip up shear bolts.
5. Test operation of lock and switch prior to tightening shear bolts.
6. Tighten both shear bolts progressively to ensure lock and saddle sit level on column.
7. Tighten bolts until heads shear.
8. Remove column assembly from vice.
9. Fit intermediate shaft to steering column and tighten clamping bolt to 22 Nm.

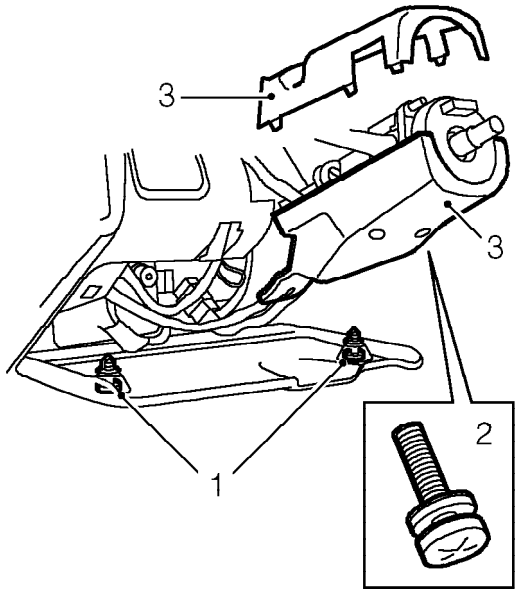
WARNING: Intermediate shafts are supplied in LH and RH drive variants. The two shafts have different phase angles, and cars fitted with the incorrect shafts will have defective steering.
It is essential that all RH drive cars are fitted with shafts with blue marks, and all LH drive cars are fitted with unmarked shafts.

10. Fit column assembly to steering rack pinion.
11. Align column to lower mounting and loosely fit bolts.
12. Align column to upper mounting and loosely fit bolts.
13. Tighten lower mounting bolts to 22 Nm.
14. Tighten upper mounting bolts to 22 Nm.
15. Fit and tighten clamping bolt securing intermediate shaft to steering rack pinion to 22 Nm.
16. Fit fuse box to body and tighten nuts to 10 Nm.
17. Connect ignition switch multiplugs to fusebox and harness.
18. Fit fuse box cover and secure with screws.
19. Fit steering column switch pack. ***See ELECTRICAL, Repairs.***
20. Connect battery earth lead.

STEERING COLUMN NACELLE

Service repair no - 57.40.29

Remove



57M0362

1. Release 2 clips securing fascia fusebox cover.
2. Remove 3 screws securing nacelle to column.
3. Release upper nacelle from lower nacelle and remove from column.
4. Remove ignition switch grommet from lower nacelle.

Refit

1. Fit ignition switch grommet to lower nacelle.
2. Fit lower and upper steering column nacelle and clip together.
3. Align nacelle to fixings and tighten screws.
4. Position fascia fusebox cover and secure fasteners.

IGNITION SWITCH AND STEERING LOCK

Service repair no - 57.40.31

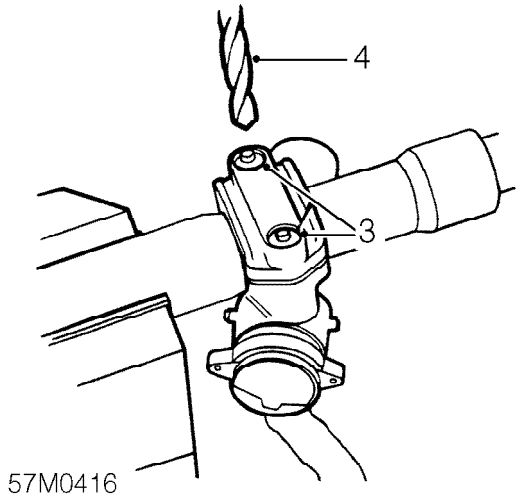
WARNING: ***See RESTRAINT SYSTEMS, Precautions.***

Remove

CAUTION: The steering column upper mountings have breakout capsules which are critical to crash performance. Do not clamp the capsules in a vice or otherwise mishandle them.

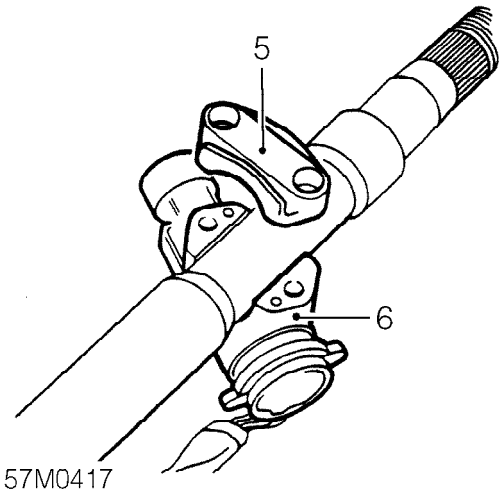
WARNING: If the breakout capsules on the upper mountings are damaged the steering column must be replaced.

1. Remove steering column assembly. ***See this section.***
2. Position steering column assembly in vice.



57M0416

3. Mark ignition switch shear bolt heads with centre punch.
4. Drill out shear bolt heads.



5. Remove lock 'saddle' from column.
6. Remove lock assembly from column.

Refit

1. Remove key from ignition barrel to ensure steering lock pin is protruding.
2. Fit ignition switch to column, locating steering lock pin in groove on inner column.
3. Fit lock saddle.
4. Fit and nip up shear bolts.
5. Test operation of lock and switch prior to tightening shear bolts.
6. Tighten both shear bolts progressively to ensure lock and saddle sit level on column.
7. Tighten bolts until heads shear.
8. Remove column assembly from vice.
9. Fit column assembly to vehicle. ***See this section.***

STEERING COLUMN

Service repair no - 57.43.01

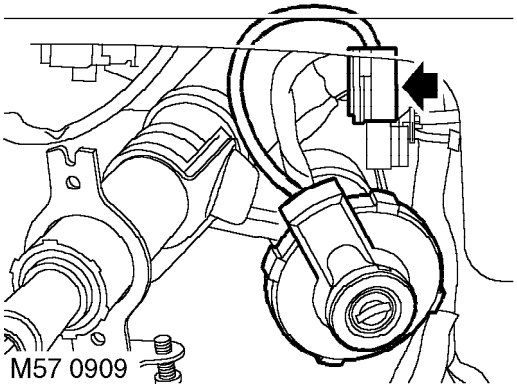
Remove

1. Make the SRS system safe. ***See RESTRAINT SYSTEMS, Precautions.***

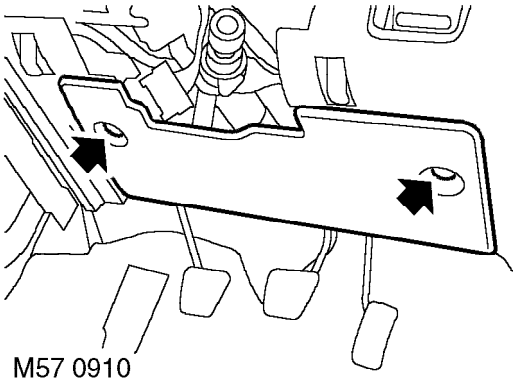
CAUTION: The steering column upper mountings have breakout capsules which are critical to crash performance. Do not clamp the capsules in a vice or otherwise mishandle them.

WARNING: If the breakout capsules on the upper mountings are damaged the steering column must be replaced.

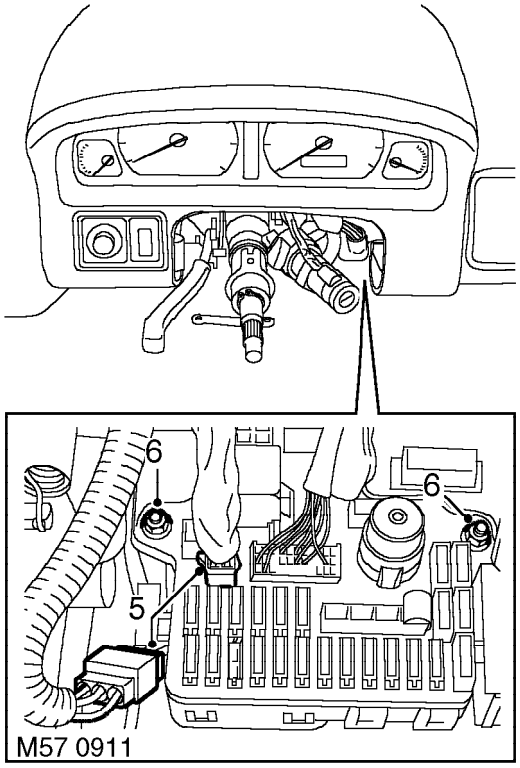
2. Remove steering column switch pack. ***See ELECTRICAL, Repairs.***



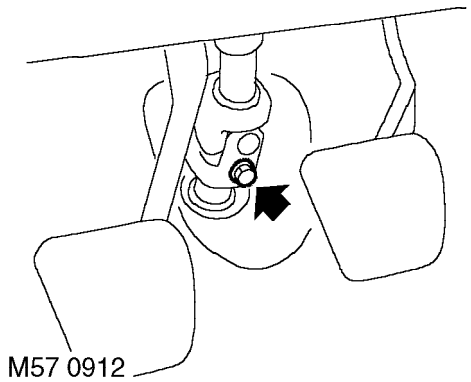
3. Release transponder coil from ignition switch, disconnect multiplug and remove transponder coil.



4. Loosen 2 screws and scrivets securing fuse box cover to fascia and remove fusebox cover.

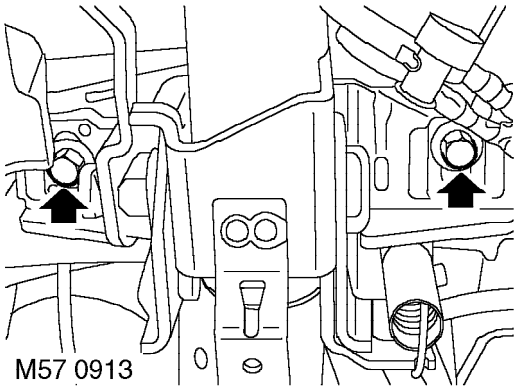


5. Disconnect ignition switch multiplugs from fusebox and main harness.
6. Remove 2 nuts securing passenger compartment fusebox to body and position aside.

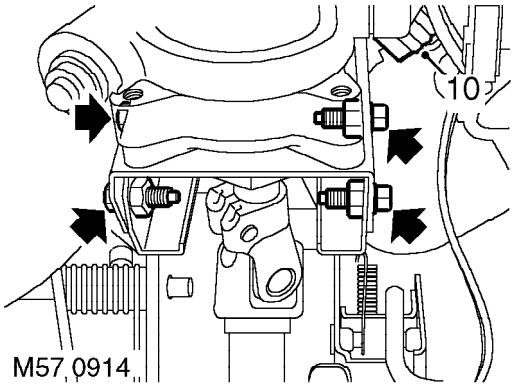


7. Remove bolt securing universal joint to steering rack pinion.

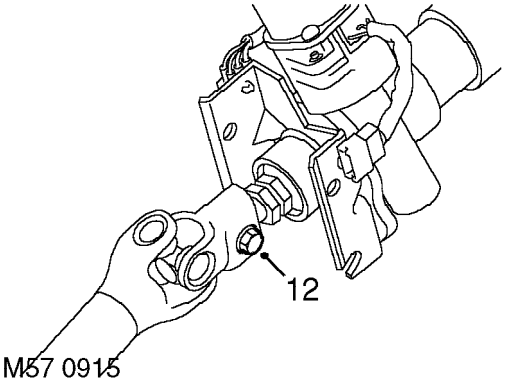
CAUTION: The steering column upper mounting bolts must be removed before the lower mounting bolts. This is to prevent the weight of the steering column damaging the upper mounting breakout capsules.



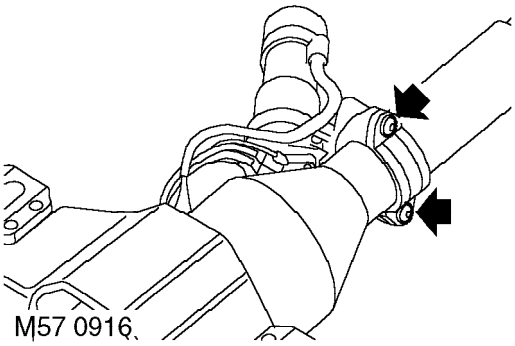
8. Remove 2 bolts securing upper steering column to fascia rail.



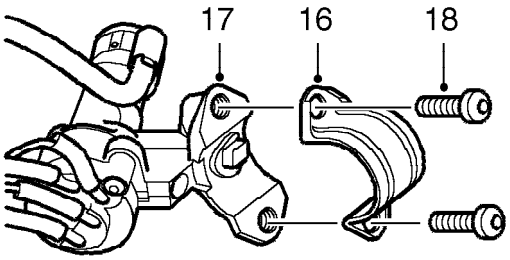
9. Remove 4 bolts securing lower steering column to bracket.
10. Lower steering column and disconnect 2 multiplugs.
11. Release column assembly from steering rack pinion and remove from vehicle.



12. Remove clamping bolt securing steering column to universal joint and remove joint.
13. Position steering column assembly in vice.



14. Mark shear bolt heads with centre punch.
15. Drill out shear bolt heads.



M57 0917

16. Remove lock 'saddle' from column.
17. Remove lock assembly from column.
18. Remove shear bolts from lock assembly.
19. Remove column from vice.

Refit

1. Remove key from ignition barrel to ensure steering lock pin is protruding.
2. Fit ignition switch to column, locating steering lock pin in groove on inner column.
3. Fit lock saddle and loosely fit shear bolts.
4. Test operation of lock and switch prior to tightening shear bolts.
5. Tighten both shear bolts progressively to ensure lock and saddle sit level on column.
6. Tighten bolts until heads shear.
7. Fit universal joint to steering column and tighten clamping bolt to 22 Nm.

WARNING: Intermediate shafts are supplied in LH and RH drive variants. The two shafts have different phase angles, and cars fitted with the incorrect shafts will have defective steering.
It is essential that all RH drive cars are fitted with shafts with blue marks, and all LH drive cars are fitted with unmarked shafts.

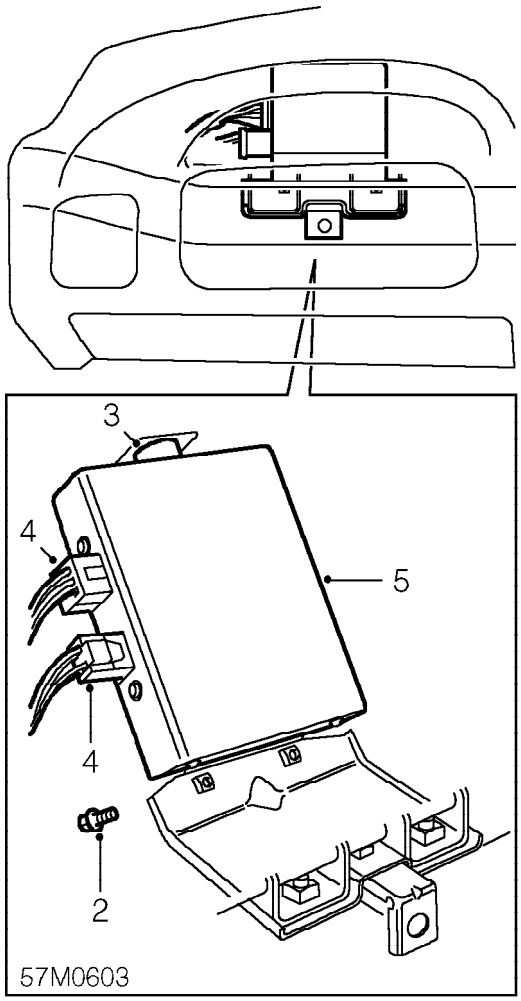
8. Fit column assembly to steering rack pinion.
9. Connect column multiplugs.
10. Align lower column mounting bracket and locate 2 bolts in slots.
11. Fit remaining 2 bolts into column lower mounting bracket and tighten all bolts to 22 Nm.
12. Align column to upper mounting bracket and fit bolts. Tighten bolts to 22 Nm.
13. Fit and tighten clamping bolt securing universal joint to steering rack pinion to 20 Nm.
14. Fit passenger compartment fuse box to body and tighten nuts to 10 Nm.
15. Connect ignition switch multiplugs to passenger compartment fusebox and harness.
16. Fit passenger compartment fuse box cover and secure with screws and scrivets.
17. Position transponder coil, connect multiplug and secure transponder coil to ignition switch.
18. Fit steering column switch pack. ***See ELECTRICAL, Repairs.***
19. Connect battery earth lead.

EPAS ECU

Service repair no - 57.43.05

Remove

1. Remove glovebox. ***See BODY, Interior trim components.***



WARNING: Do not remove EPAS ECU bracket from fascia rail on vehicles fitted with a passenger airbag.

2. Remove 2 bolts securing ECU to fascia rail bracket.
3. Release ECU from rubber mounting.
4. Disconnect 2 multiplugs from ECU.
5. Remove ECU.

Refit

1. Position ECU and connect multiplugs.
2. Fit ECU to mounting and tighten bolts to 10 Nm.
3. Connect multiplugs.
4. Fit glovebox. ***See BODY, Interior trim components.***

TRACK-ROD END

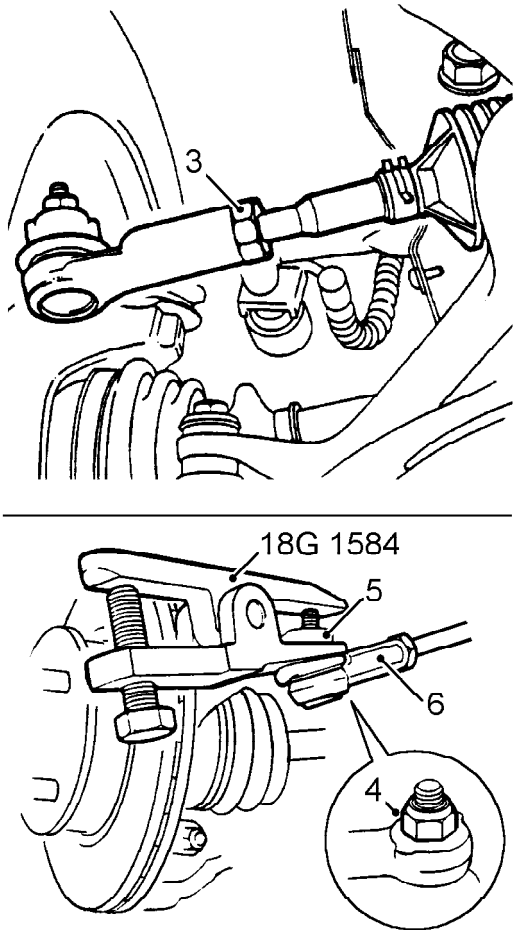
Service repair no - 57.55.02

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove road wheel(s).



57M0462A

3. Loosen track-rod end lock nut.
4. Remove nut securing track-rod end to steering arm.
5. Using tool **18G 1584,** break taper joint.
6. Noting the number of complete turns, remove track-rod end.

Refit

1. Fit new track-rod end and position taper to steering arm.

NOTE: Rotate the track-rod end the same amount of turns noted on the removal.

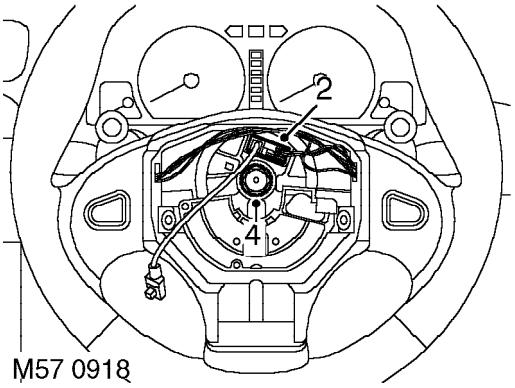
2. Tighten nut to 30 Nm.
3. Tighten lock nut to 50 Nm.
4. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
5. Remove stand(s) and lower vehicle.
6. Check and adjust front wheel alignment. ***See Adjustments.***

STEERING WHEEL

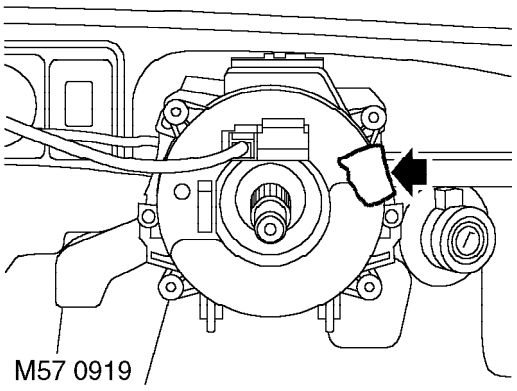
Service repair no - 57.60.01

Remove

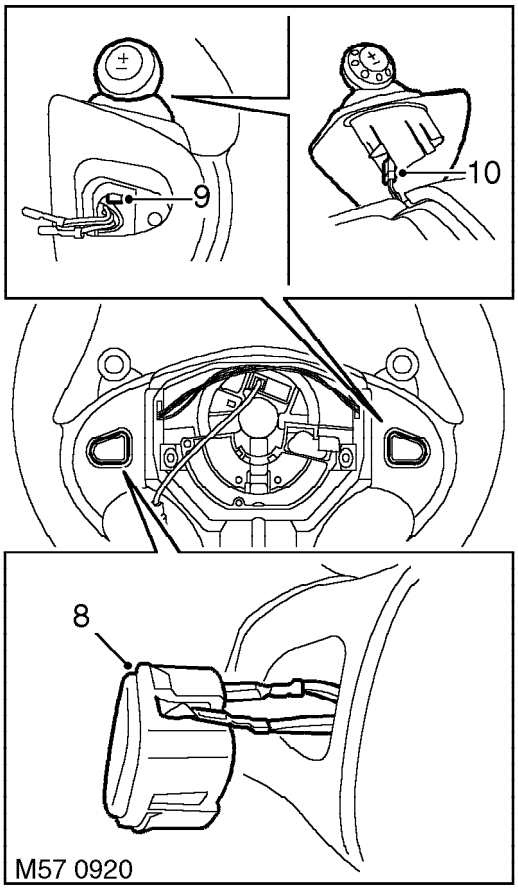
1. Remove driver's airbag. ***See RESTRAINT SYSTEMS, Repairs.***



2. Disconnect horn/sequential gear change switch multiplug.
3. Centralise steering wheel with road wheels in straight ahead position.
4. Restrain steering wheel and loosen nut securing steering wheel to column.
5. Release steering wheel from column.
6. Remove steering wheel.



7. Attach tape across edge of rotary coupler to retain correct setting and to prevent rotational damage to rotary coupler.



8. Release horn switches, disconnect Lucar connections and remove horn switches.
9. Release clips securing sequential gear change switches, release switches from steering wheel.
10. Disconnect gear change switch multiplugs and remove switches from steering wheel.
11. Remove steering wheel harness.

Refit

1. Position harness to steering wheel and locate to switch recesses.
2. Position gear change switches, connect multiplugs and secure switches to steering wheel.
3. Position horn switches, connect Lucar connections and secure horn switches to steering wheel.
4. Remove tape from rotary coupler.
5. Ensure road wheels are in straight ahead position and indicator cancelling cam is aligned horizontally.
6. Fit steering wheel to column.
7. Connect horn/sequential gear change switch multiplug.
8. Fit and tighten nut securing steering wheel to column to 63 Nm.
9. Fit driver's airbag. ***See RESTRAINT SYSTEMS, Repairs.***

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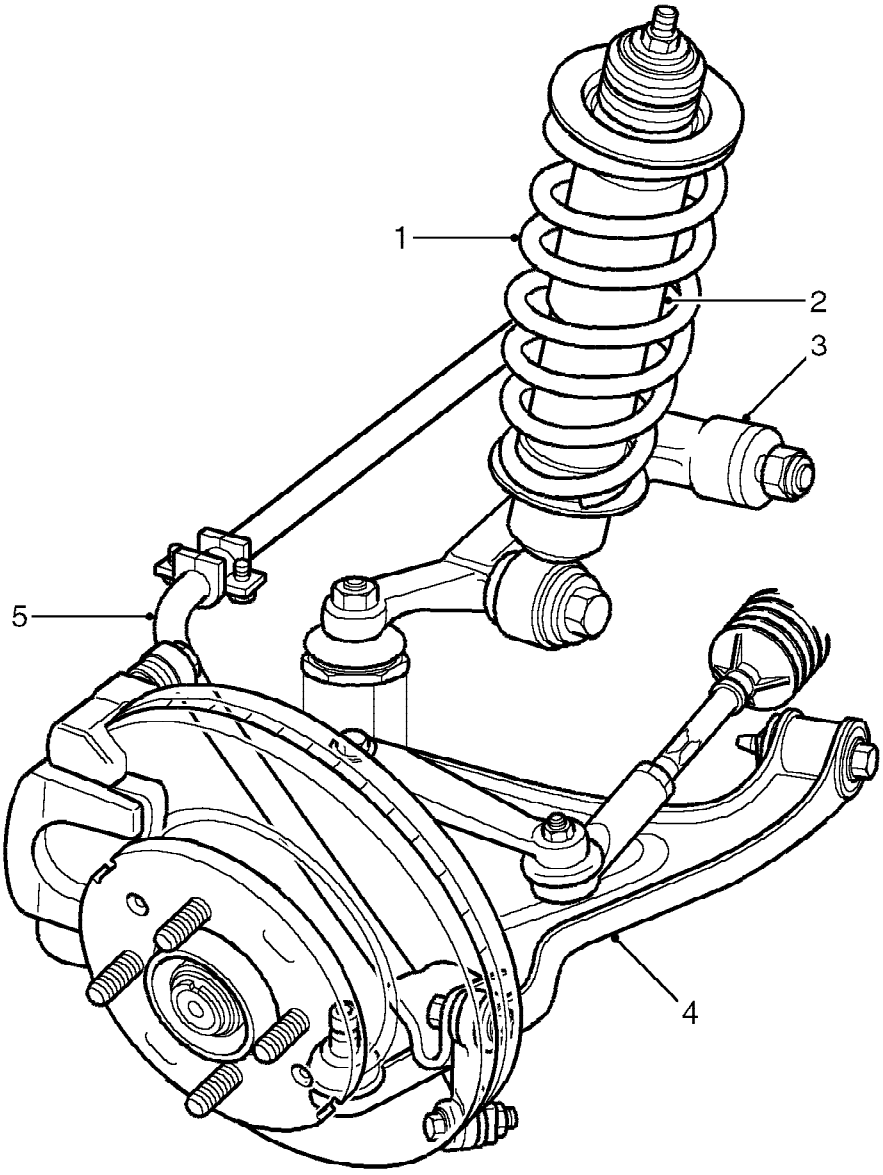
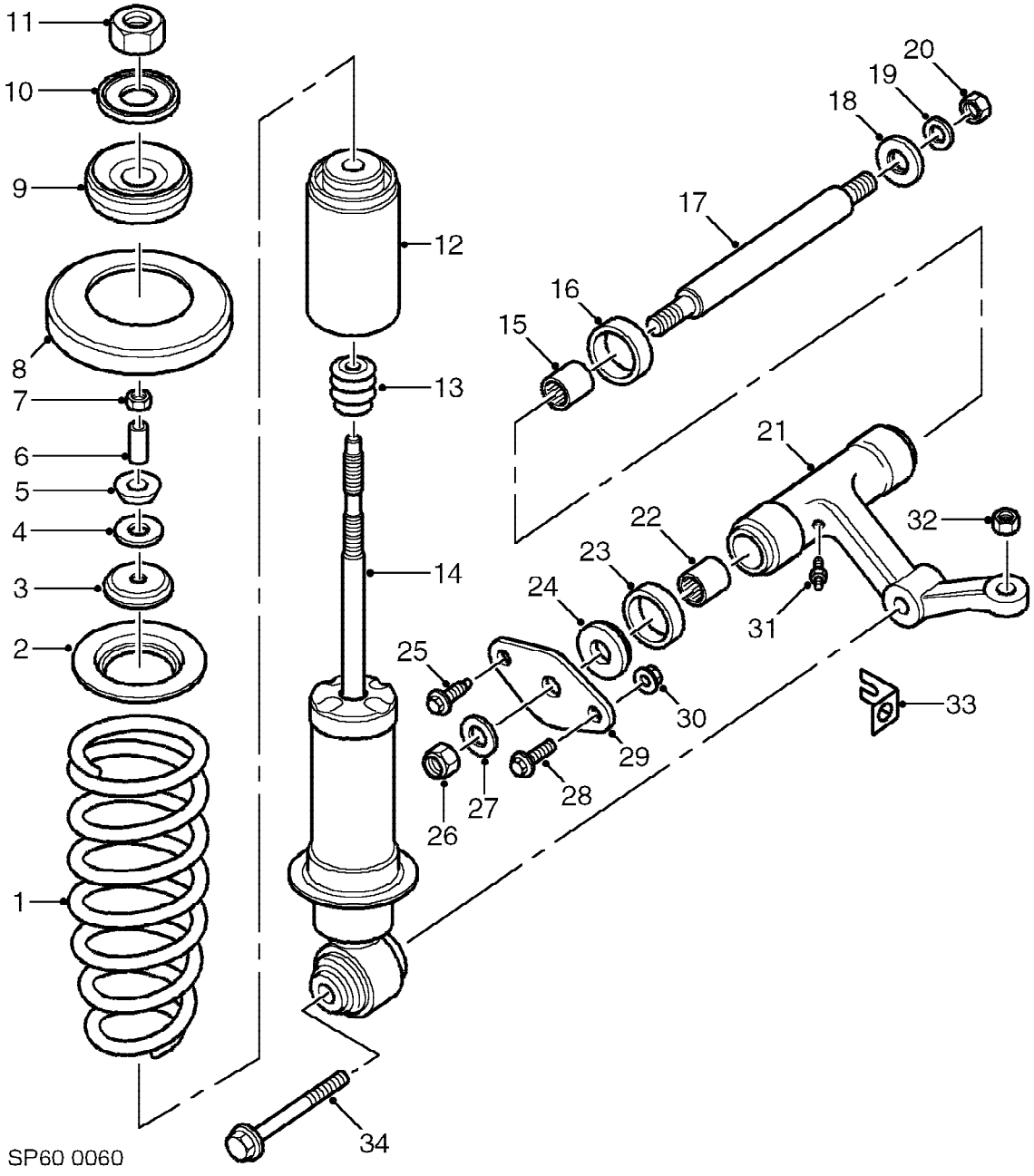
FRONT SUSPENSION

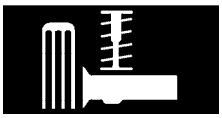


SP60 0059

1. Coil spring
2. Damper unit
3. Upper suspension arm
4. Lower suspension arm
5. Anti-roll bar

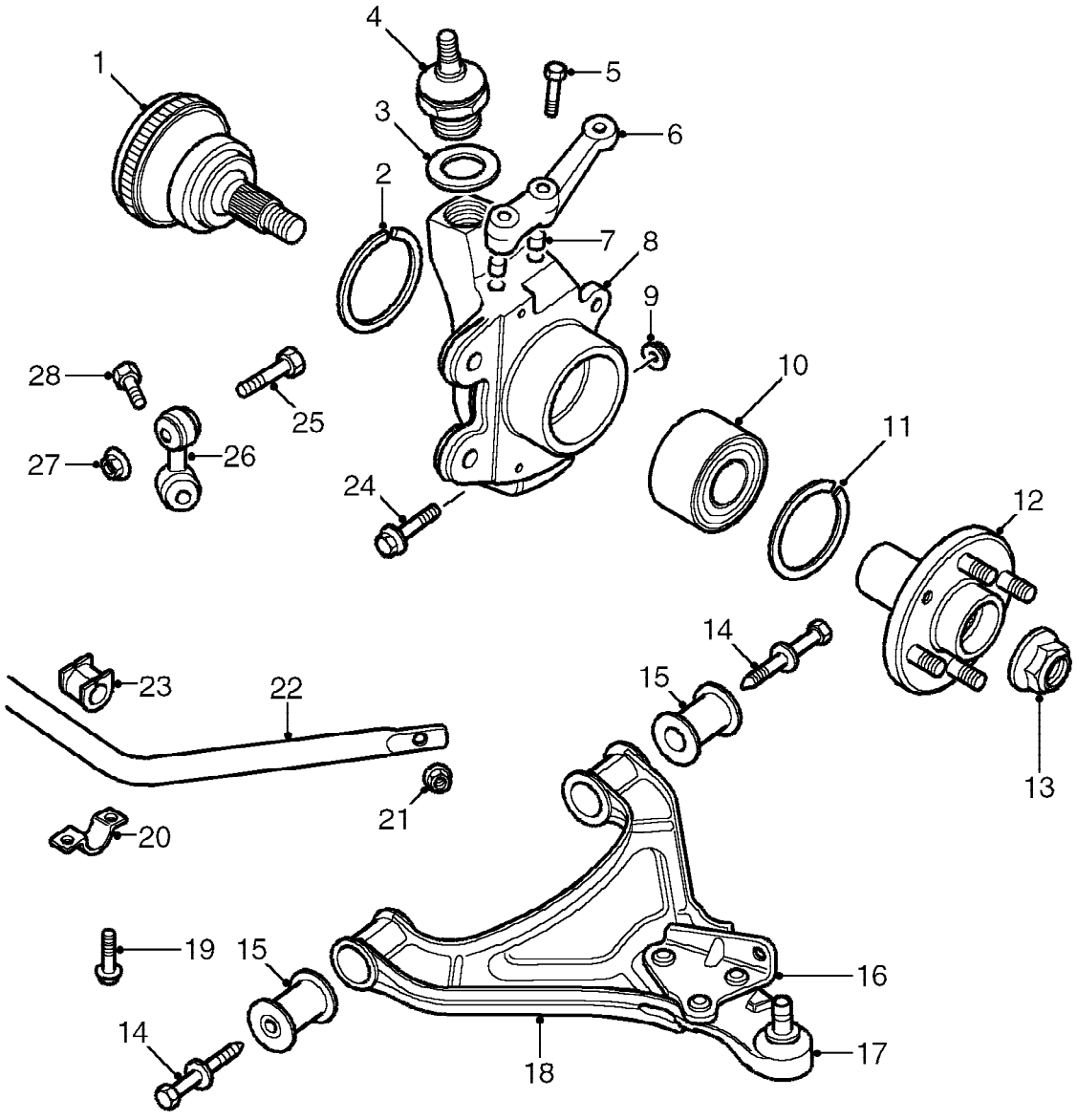
FRONT SUSPENSION COMPONENTS



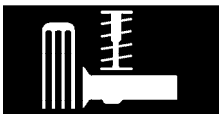


1. Coil spring
2. Spring retainer
3. Bump washer
4. Spacer
5. Mounting cushion
6. Distance piece
7. Locknut
8. Spring seat
9. Rubber bush
10. Retaining washer
11. Self locking nut
12. Dust shield
13. Rebound rubber
14. Damper unit
15. Needle roller bearing
16. Sealing ring
17. Upper arm pivot shaft
18. Thrust washer
19. Flat washer
20. Locking nut
21. Suspension upper arm
22. Needle roller bearing
23. Sealing ring
24. Thrust washer
25. Bolt - retaining plate
26. Locking nut
27. Flat washer
28. Bolt - retaining plate
29. Retaining plate - upper arm pivot shaft
30. Self locking nut
31. Grease nipple
32. Nut - upper ball joint
33. Brake hose bracket
34. Bolt - Damper lower mounting

FRONT SUSPENSION COMPONENTS - continued



SP60 0061



1. Stub axle
2. Retaining clip (inner) - drive flange bearing
3. Lock washer
4. Upper balljoint
5. Steering arm bolt
6. Steering arm
7. Steering arm dowels
8. Swivel hub
9. Self locking nut - lower arm ball-joint
10. Bearing - drive flange
11. Retaining clip (outer) - drive flange bearing
12. Drive flange
13. Hub nut
14. Mounting bolt - lower arm
15. Bush - lower arm
16. Bracket - ball-joint to lower arm
17. Lower balljoint
18. Lower suspension arm
19. Bolt - anti-roll bar bracket
20. Clamp bracket - anti-roll bar
21. Self locking nut - anti-roll bar link
22. Anti-roll bar
23. Bush - anti-roll bar
24. Bolt - lower balljoint
25. Bolt - anti-roll bar link (upper)
26. Anti-roll bar link
27. Self-locking nut - anti-roll bar link (upper)
28. Bolt - anti-roll bar link (lower)

SUSPENSION

General

The front suspension is of the independent type and comprises the following main components:

- Two coil springs
- Two damper units
- Two upper pivot arms
- Two lower wishbones
- Two swivel hubs
- One anti-roll bar
- Two anti-roll bar links
- Peripheral subframe

The front suspension system consists of a spring/damper unit at each front wheel. Each spring/damper combination is mounted between the vehicle's body and upper suspension arm.

There are two grades of suspension configuration, Standard and Sports. The Sports version has a lower (10 mm) and stiffer suspension than for the Standard.

Damper and Spring Unit

Two damper and spring units control the damping of the front suspension. The coil springs support the weight of the vehicle, maintain ride height and absorb road shock. When additional load is placed on the coil springs (e.g. through deceleration), or when the vehicle passes over bumps in the road, the springs compress to absorb the change and ensure ride comfort is maintained.

The coil spring is retained in a compressed condition between the strut spring seat and the top (body) mounting. The coil springs and the upper ball joints support the weight of the vehicle which is transmitted through the springs to the upper control arms and then through the upper ball joints.

Isolators are fitted at each end of the spring/damper units to reduce noise transmitted from the suspension to the body.

The damper units assist in absorbing the energy stored in the coil spring after passing a bump. Quickly terminating the reciprocating motion of the suspension and returning the coil spring to the rest position.

Each damper is gas and oil filled and is of twin tube construction. The twin tube construction allows the damper piston to operate against hydraulic fluid in an inner tube. The damper unit is fully displaced on rebound and uses rod displaced valving during compression.

As the suspension travels through the bump and rebound phases, the hydraulic fluid in the inner tube of the damper unit is forced through tiny holes inside the piston and the base valve, this changing pressure in the hydraulic fluid slows down the piston and consequently slows down spring and suspension movement. The damper units provide velocity sensitive hydraulic damping, the amount of resistance depending on the speed of the suspension and the number and size of the holes in the piston and base valve. The faster the suspension moves, the more resistance the damper units will provide. As a result, the damper units reduce:

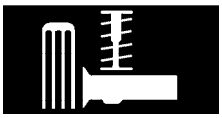
- Bounce
- Body roll or sway
- Brake dive
- Acceleration squat

An oil cavity between the inner and outer tubes is used as a reserve tube to store excess hydraulic fluid. A low pressure charge of nitrogen gas in the reserve tube provides resistance to fluid entering the reserve tube and with the hydraulic fluid under pressure, aeration of the fluid is greatly reduced to provide better ride comfort and improved handling. Besides minimising oil cavitation this two-tube design helps eliminate the effect of damage to the outer tube affecting piston operation.

A compression valve is included in the base of the piston inner pressure tube to control fluid movement between the inner and outer chambers during the compression cycle. The diameter of the piston and inside diameter of the pressure tube is 30 mm (1.18 in.).

The damper rod is secured at the top mounting to the front wing valance with a washer and nut. The damper rod passes through a bushing and low friction seal at the upper end of the pressure tube to keep it aligned and allow the piston to move freely. A 5mm hexagon socket is provided at the top end of the damper to restrain the rod from rotating when the nut is tightened.

NOTE: The front suspension dampers are colour coded BLUE, whereas the rear suspension dampers are colour coded RED.



A dust shield and bump stop rubber is fitted between the damper unit and the top mounting, to protect the damper rod from dirt and damage.

Lower suspension arm

The suspension lower arm is of the wishbone type and is designed to provide fore-and-aft stiffness, to restrain braking torque. Both lower suspension arms are interconnected by an anti-roll bar which provides the required stiffness to prevent body roll.

The front lower arm has replaceable, pressed-in bushes which should be lubricated with Merlene 148 rubber lubricant.

The lower ball joint is attached to the lower arm via a bracket and three rivets, if the ball joints need to be replaced, the rivets have to be drilled out and the new ball joint attached to the lower suspension arm using three nuts and bolts. The lower ball joint has a tapered stub which is attached to the hub using a pinch clamp and a bolt and locknut. The ball-joint allows vertical movement as the wheels pass over dips and bumps and side-to-side motion as the wheels are turned for cornering.

Upper suspension arm

The upper suspension arm uses a pivot shaft incorporating needle roller bearings to facilitate up and down movement of the arm at its inner end. The lower mounting of the suspension damper connects to a fixing point in the centre of the upper arm. An upper ball joint is attached to the outer end of the upper arm and connects to the hub steering knuckle through a tapered stud held in position with a nut and tab washer.

Anti-roll bar

A 20 mm solid spring steel anti-roll bar is used which operates via anti-roll bar links on the lower suspension arms. The anti-roll bar is attached to the front subframe with two PTFE bushes which are secured with clamp plates and bolts. The low friction PTFE bushes require no additional greasing and allow the anti-roll bar to rotate freely with quiet operation. This allows the bar to respond quickly to roll inputs.

Each anti-roll bar link has a ball joint fitting at each end which improves response and efficiency. The top ball-joint is attached by a bolt and self locking nut to a bracket which is riveted to the lower ball joint / lower suspension arm assembly. The lower ball-joint is attached to the anti-roll bar with a nut and bolt.

CAUTION: The head of the bolt securing the anti-roll bar links to the lower suspension arms must face forward. This is to allow clearance between bolt head and front hub.

Front subframe

The subframe is fabricated from hydro-formed tubing providing a light and strong structure. All machining of critical geometric locations is performed after fabrication to ensure accurate location of the front suspension and steering components.

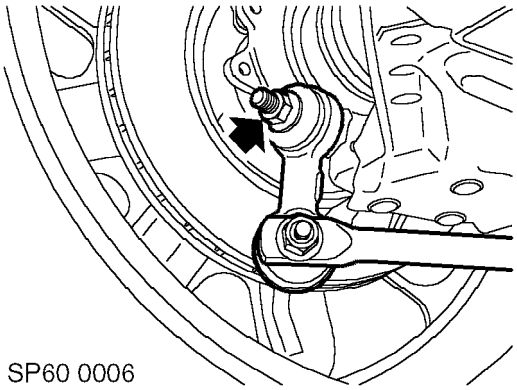
The subframe is mounted to the body at the front and rear and has a cross-bracing fitted beneath, with fixings at front rear and centre to provide additional rigidity.

ANTI-ROLL BAR

Service repair no - 60.10.01

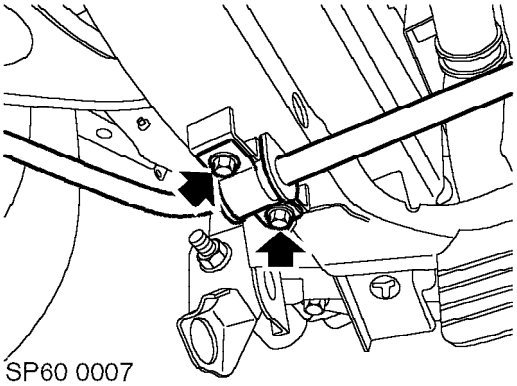
Remove

1. Position vehicle on 4 post ramp.



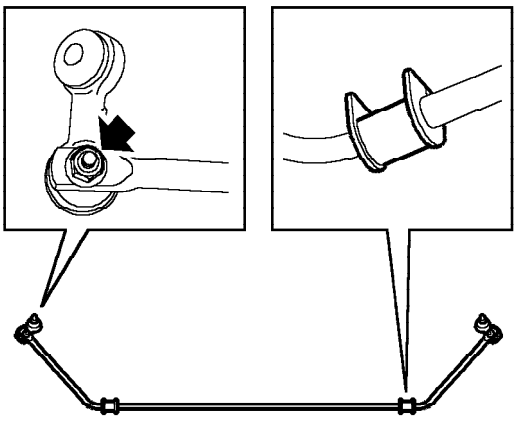
SP60 0006

2. Remove nuts and bolts securing anti-roll bar links to each lower suspension arm.



SP60 0007

3. Remove 2 bolts securing each anti-roll bar mounting rubber clamps to subframe.
4. Remove clamps and anti-roll bar.



SP60 0008

5. Remove 2 mounting rubbers from anti-roll bar.
6. Remove nut and bolt securing each link to anti-roll bar and remove links.
7. Check link bushes for wear.

Refit

1. Clean anti-roll bar and links.
2. Position links to anti-roll bar, fit nuts and bolts but do not tighten at this stage.
3. Fit mounting rubbers to anti-roll bar.
4. Position anti-roll bar, align links to lower suspension arms, fit nuts and bolts but do not tighten at this stage.

CAUTION: The head of the bolt securing the anti-roll bar links to the lower suspension arms must face forward. This is to allow clearance between bolt head and front hub.

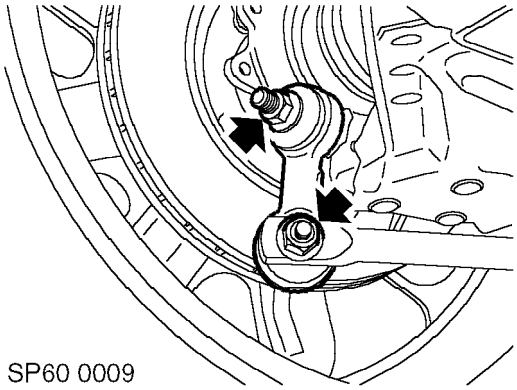
5. Position mounting rubbers, align clamps to bolt holes in subframe, fit and tighten bolts to 22 Nm.
6. With the weight of the vehicle on the front suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
7. Lower vehicle on ramp.

LINK - ANTI-ROLL BAR

Service repair no - 60.10.02

Remove

1. Position vehicle on 4 post ramp.


SP60 0009

2. Remove nut and bolt securing anti-roll bar link to anti-roll bar.
3. Remove nut and bolt securing anti-roll bar link to lower suspension arm and remove anti-roll bar link.

Refit

1. Clean anti-roll bar link.
2. Position anti-roll bar link to lower arm, fit nut and bolt but do not tighten at this stage.

CAUTION: The head of the bolt securing the anti-roll bar links to the lower suspension arms must face forward. This is to allow clearance between bolt head and front hub.

3. Align anti-roll bar link to anti-roll bar, fit nut and bolt but do not tighten at this stage.
4. With the weight of the vehicle on the front suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
5. Lower vehicle on ramp.

BALL JOINT - UPPER

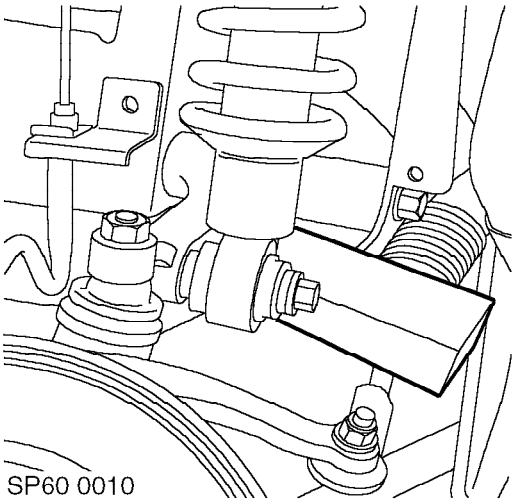
Service repair no - 60.15.02

Remove

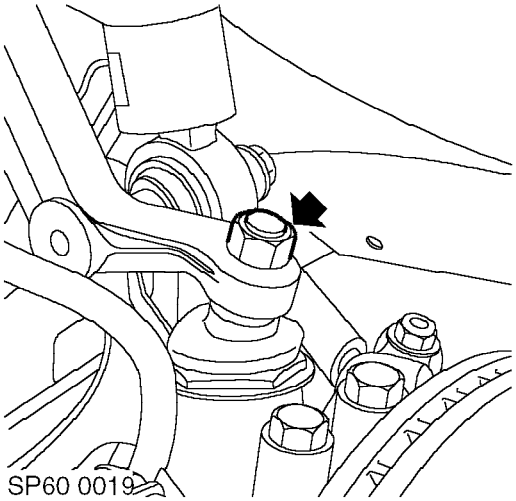
1. Raise front of vehicle and support on stand(s).

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

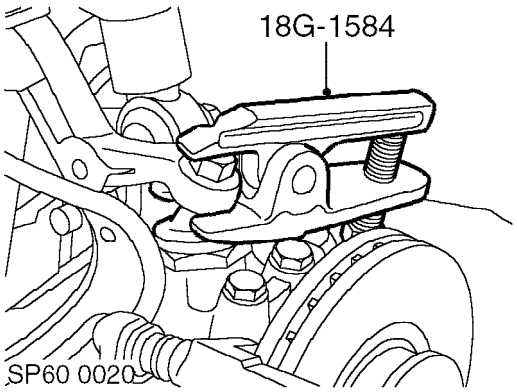
2. Remove road wheel(s).


SP60 0010

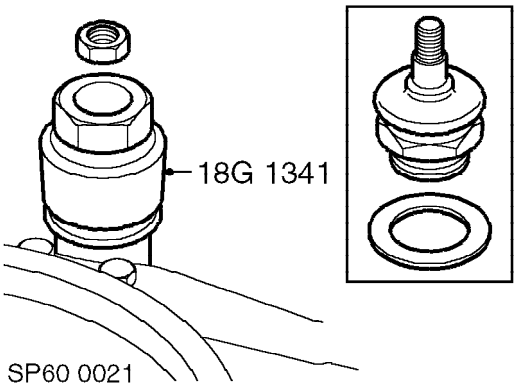
3. Position jack under lower suspension arm, raise jack sufficiently and fit a suitable block between upper suspension arm and subframe. Lower jack.


SP60 0019

4. Remove and discard lock nut securing ball joint to upper suspension arm.



5. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.
6. Release ball joint from upper suspension arm.



7. Knock back lock washer securing ball joint to front hub.
8. Using ball joint retaining nut, secure **18G-1341** to ball joint. Attach a suitable socket and socket bar to **18G-1341** and remove ball joint from front hub.
9. Remove and discard lock washer.

Refit

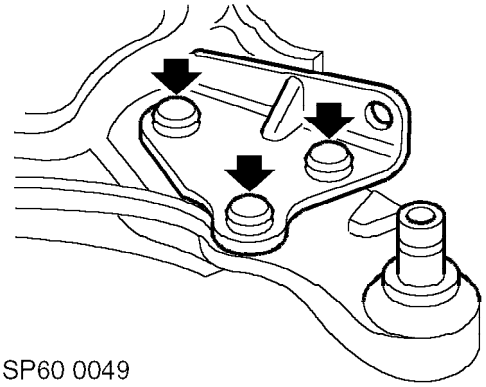
1. Clean ball joint threads and mating threads in front hub. Ensure threads are clean and dry.
2. Apply Loctite 242 to ball joint threads.
3. Fit new lock washer on hub.
4. Fit ball joint to front hub, and using **18G-1341** , tighten ball joint to 105 Nm.
5. Knock over lock washer to front hub and ball joint nut.
6. Raise jack and position ball joint to upper suspension arm, fit and tighten new lock nut to 54 Nm.
7. Raise jack and remove support block from upper suspension arm.
8. Lower and remove jack from lower suspension arm.
9. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
10. Remove stand(s) and lower vehicle.

BALL JOINT - LOWER

Service repair no - 60.15.03

Remove

1. Remove front lower arm. ***See this section.***



SP60 0049

2. Centre punch centres of rivet heads.
3. Drill pilot hole in rivet heads.

NOTE: Use pedestal drill for accuracy.

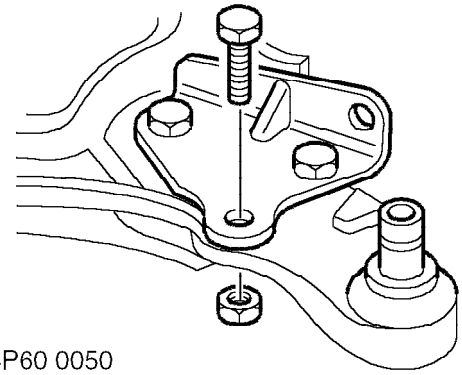
4. Enlarge pilot hole to remove rivets.

CAUTION: Do not enlarge holes in lower arm.

5. Press out rivet studs.
6. Remove ball joint assembly.

Refit

1. Clean ball joint and lower arm mating faces.



SP60 0050

2. Fit ball joint to lower arm.
3. Fit 3 nuts and bolts and tighten to 40 Nm.

NOTE: Ensure bolt heads are fitted above the lower arm.

4. Fit front lower arm. ***See this section.***

BEARINGS - HUB

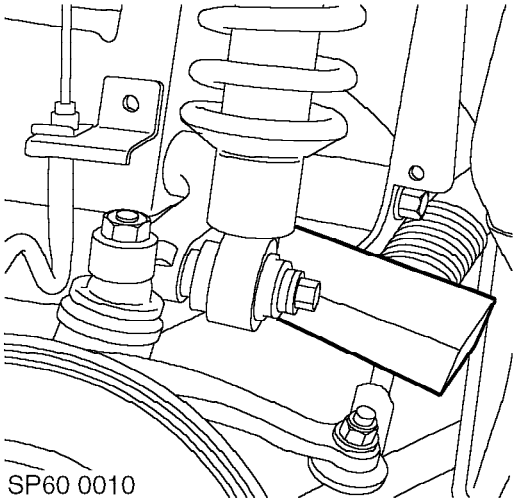
Service repair no - 60.25.14

Remove

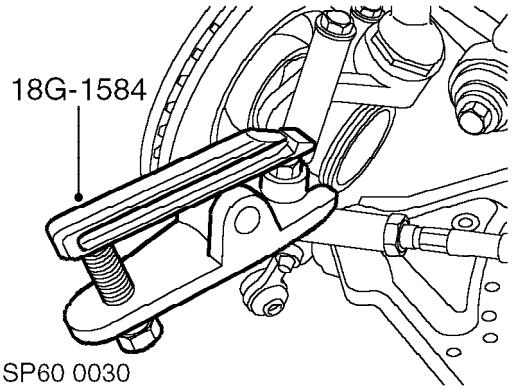
1. Raise front of vehicle and support on stand(s).

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

2. Remove road wheel(s).
3. Knock back hub nut stake and remove hub nut.
4. Remove front brake disc. ***See BRAKES, Repairs.***

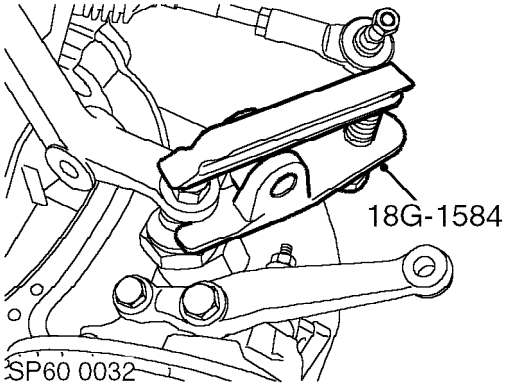

SP60 0010

5. Position jack under lower suspension arm, raise jack sufficiently and fit a suitable block between upper suspension arm and subframe. Lower jack.



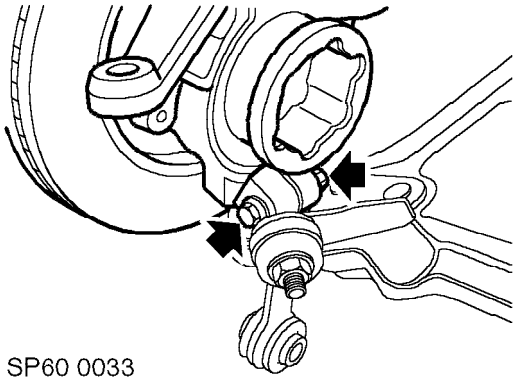
SP60 0030

6. Remove nut securing steering rack ball joint to steering arm.
7. Release ball joint taper from steering arm using **18G-1584** .

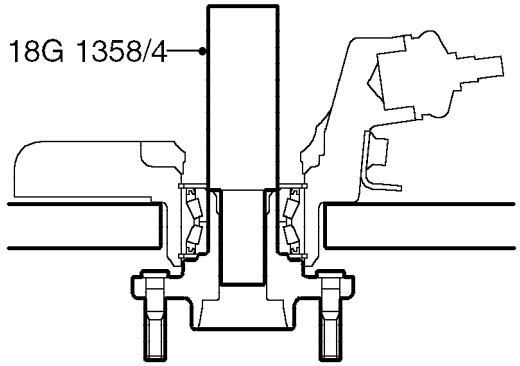


SP60 0032

8. Remove and discard lock nut securing ball joint to upper suspension arm.
9. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.

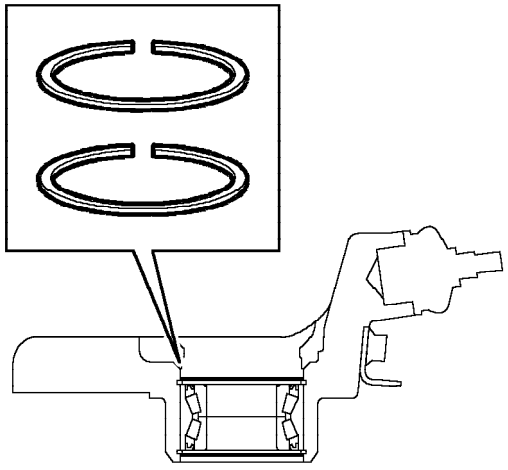

SP60 0033

10. Remove nut and bolt securing hub to lower suspension arm ball joint.
11. Release hub from lower ball joint and remove hub assembly.



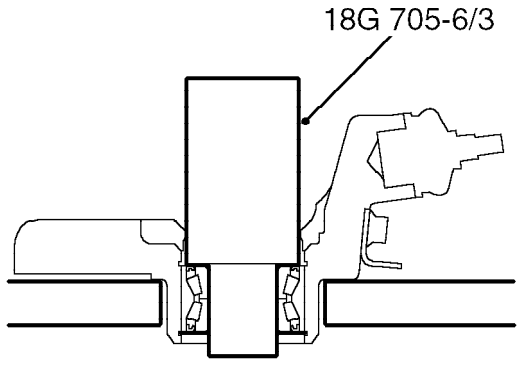
SP60 0051

12. Position hub to press.
13. Press out drive flange using **18G 1358/4** .
14. Collect drive flange and remove hub from press.



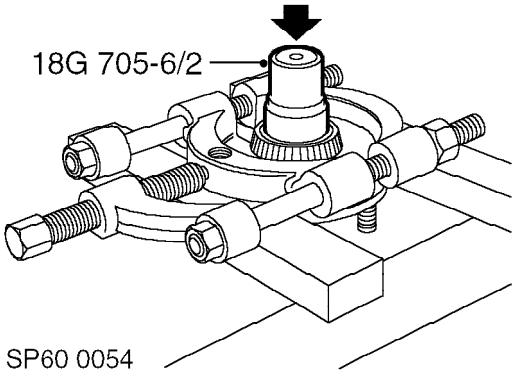
SP60 0052

15. Remove bearing inner and outer circlips.



SP60 0053

16. Position hub to press.
17. Position **18G 705-6/3** to bearing, press out bearing and remove hub from press.



SP60 0054

18. Position drive flange to press, fit universal bearing splitter around bearing as shown.
19. Position thrust button, **18G-705-6/2** to drive flange, press out drive flange from inner bearing track.
20. Collect drive flange and remove bearing inner track.

Refit

1. Clean hub, drive flange and bearing mating faces.
2. Fit new bearing outer circlip to hub.
3. Position hub to press.
4. Position new bearing to hub, press bearing into hub using **18G-705-6/3** .
5. Fit new bearing inner circlip to hub.
6. Using **18G-134BD** and **18G-705-6/3** , press drive flange into hub bearing.
7. Remove hub from press.
8. Clean drive shaft end and hub mating faces.
9. Clean lower ball joint to hub mating faces.
10. Clean ball joint to upper suspension arm mating faces.
11. Position hub to lower ball joint, fit and tighten nut and bolt to 45 Nm.
12. Position hub assembly to upper suspension arm, fit and tighten new ball joint lock nut to 54 Nm.
13. Raise jack and remove support block from upper suspension arm.
14. Clean steering rack ball joint to steering arm mating faces.
15. Align steering rack ball joint to steering arm, fit and tighten nut to 30 Nm.
16. Fit front brake disc. ***See BRAKES, Information.***
17. Fit and tighten new hub nut to 210 Nm.
18. Stake hub nut to shaft.
19. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
20. Remove stand(s) and lower vehicle.

DAMPER - LH

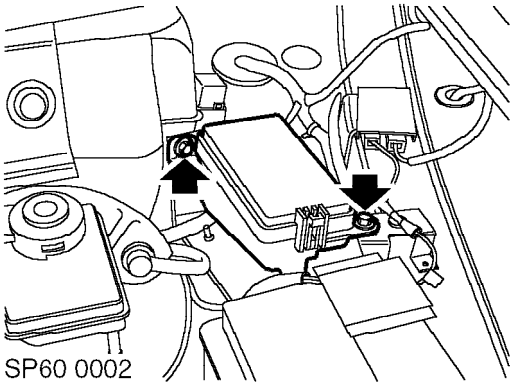
Service repair no - 60.30.02

Remove

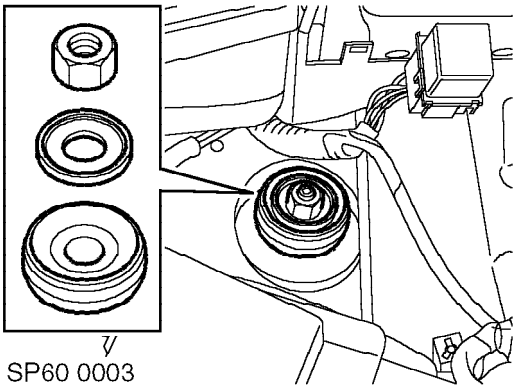
1. Raise front of vehicle and support on stand(s).

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

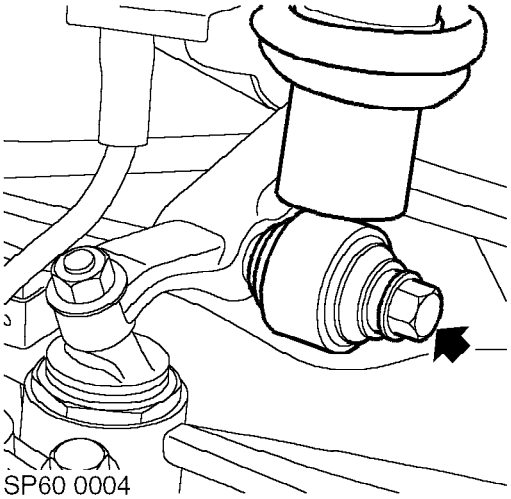
2. Remove road wheel(s).


SP60 0002

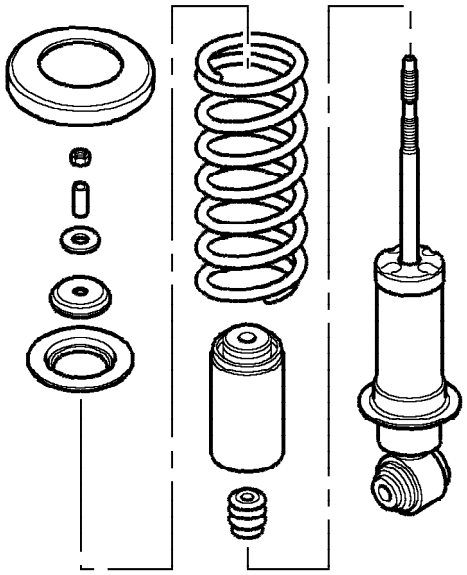
3. Remove 2 bolts securing fuse box in luggage compartment, move fuse box aside.


SP60 0003

4. Position 5 mm Allen key in top of damper shaft, remove nut securing damper to front wing valance.
5. Remove retaining washer and rubber bush.


SP60 0004

6. Remove bolt securing damper to upper suspension arm, remove damper/spring assembly and collect spring isolator.
7. Position damper/spring assembly in vice.


SP60 0005

8. Progressively loosen and remove spring retainer nut, remove distance piece, flat washer, steel cup washer and spring retainer. Note fitted position of steel cup washer.
9. Remove spring, dust shield and rebound rubber bush from damper.
10. Remove damper from vice.

Refit

1. Inspect dust shield and rebound rubber bush for deterioration and damage.
2. Clean damper and spring mating faces.
3. Prime new damper by operating it at least 3 full strokes.
4. Position new damper in vice.
5. Position rebound rubber bush on damper shaft.
6. Correctly position spring and dust shield onto damper.
7. Correctly position spring retainer, steel cup washer, flat washer and distance piece. Fit and tighten nut securing spring retainer to damper to 25 Nm.
8. Position isolator on spring retaining plate.
9. Position damper assembly in subframe turret, fit top bush, washer and nut. Do not tighten nut at this stage.
10. Position damper assembly to upper suspension arm, fit and tighten bolt to 100 Nm.
11. Position 5 mm Allen key in top of damper shaft, tighten nut to 45 Nm
12. Position fuse box, fit and tighten bolts to 10 Nm.
13. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
14. Remove stand(s) and lower vehicle.

SUSPENSION ARM ASSEMBLY - UPPER

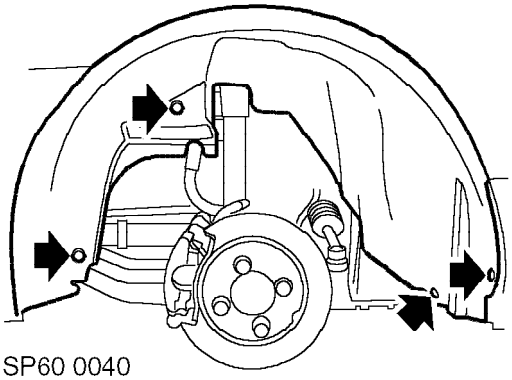
Service repair no - 60.35.01

Remove

1. Raise front of vehicle and support on stand(s).

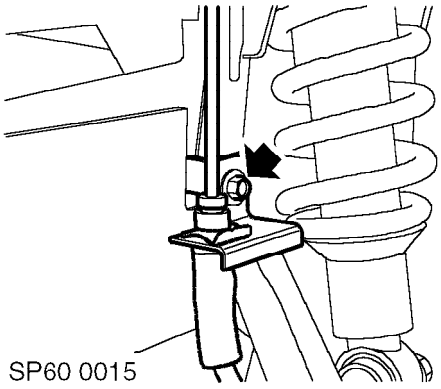
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel(s).
3. Remove front bumper armature. ***See BODY, Exterior fittings.***



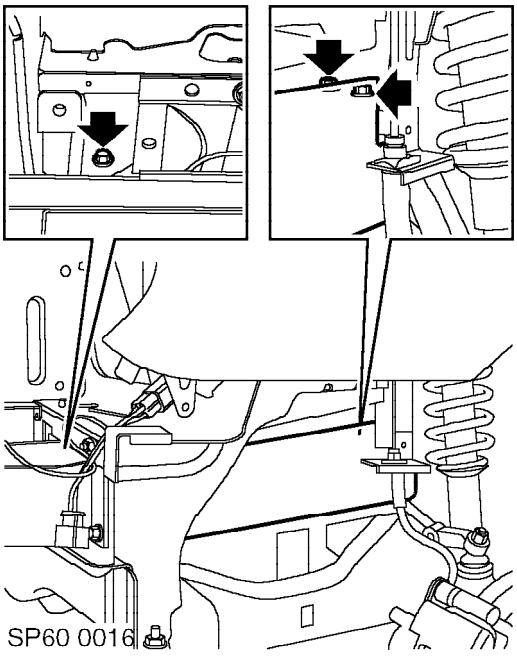
SP60 0040

4. Remove screw and 3 scrivets securing wheel arch liner and remove wheel arch liner.

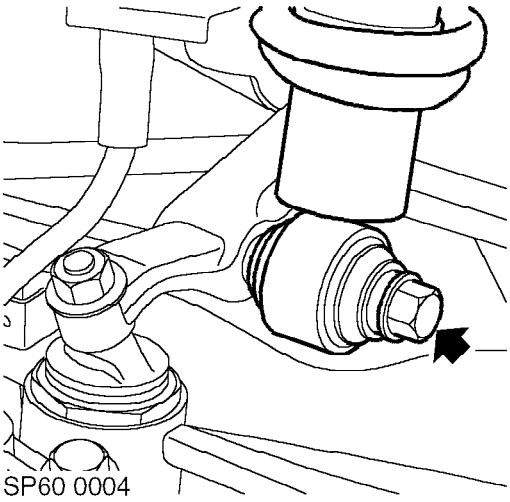


SP60 0015

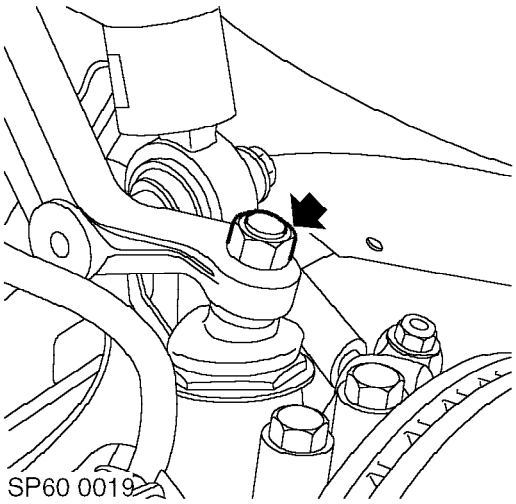
5. Remove bolt securing brake pipe bracket to subframe turret, move brake pipe aside.



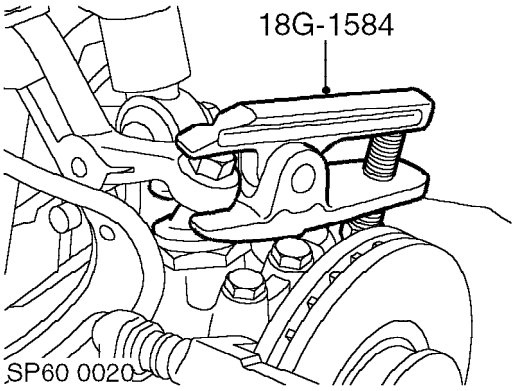
6. Remove 3 bolts securing crash can to subframe and remove crash can.



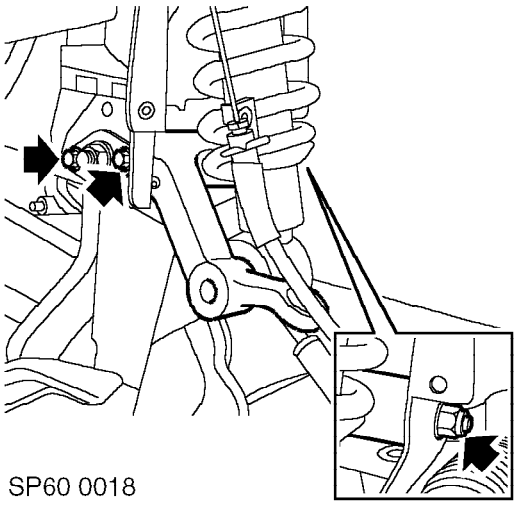
7. Remove bolt securing damper assembly to upper suspension arm, move damper aside.



8. Remove and discard nut securing upper ball joint and remove nut.

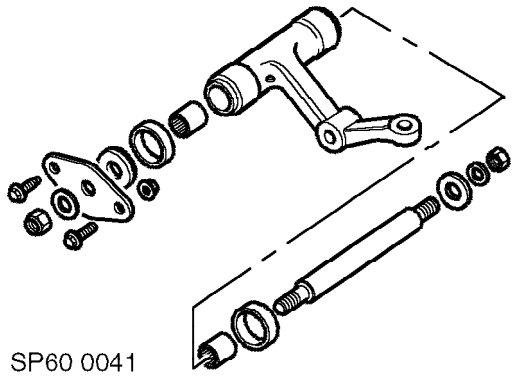


9. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.



SP60 0018

10. Remove nut securing rear most end of upper suspension arm pivot shaft.
11. Remove bolt and nut and bolt securing pivot shaft retaining plate to subframe.
12. Remove pivot shaft from subframe.



SP60 0041

13. Remove upper suspension arm from subframe, noting fitted position of rear thrust washer and rubber seals at each end of suspension arm.
14. Secure pivot shaft in soft jawed vice, remove front nut, plain washer, retaining plate and thrust washer.

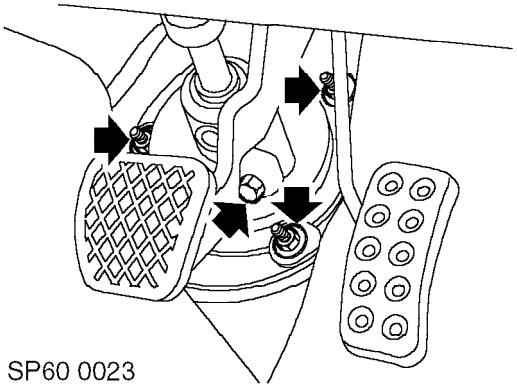
Refit

1. Clean upper suspension arm, pivot shaft, thrust washers and mating faces in subframe.
2. Lubricate pivot shaft and thrust washers with Dextragrease Super GP.
3. Fit rear thrust washer and rubber seals to upper suspension arm, position suspension arm in subframe.
4. Align upper suspension arm and fit pivot shaft.
5. Fit front thrust washer, retaining plate, plain washer and nut, fit and tighten retaining plate bolt and nut and bolt to 10 Nm.
6. Tighten front and rear pivot shaft nuts to 74 Nm.
7. Position hub to upper suspension arm, fit new lock nut, and tighten ball joint nut to 54 Nm.
8. Position crash can in subframe, fit and tighten bolts to 45 Nm.
9. Position damper assembly to upper suspension arm, fit and tighten bolt to 100 Nm.
10. Position brake pipe bracket to subframe turret, fit and tighten bolt to 25 Nm.
11. Position wheel arch liner, fit screw and scrivets securing wheel arch liner.
12. Fit front bumper armature. ***See BODY, Exterior fittings.***
13. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
14. Remove stand(s) and lower vehicle.

SUSPENSION ARM - LOWER FRONT

Service repair no - 60.35.03

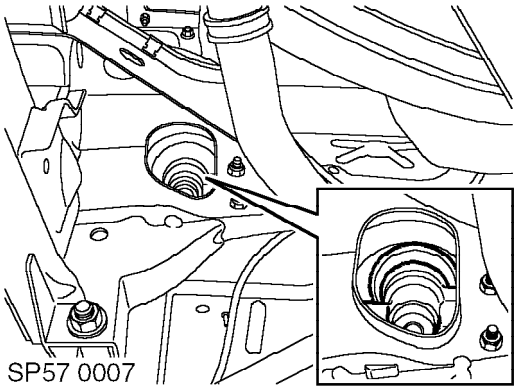
Remove


SP60 0023

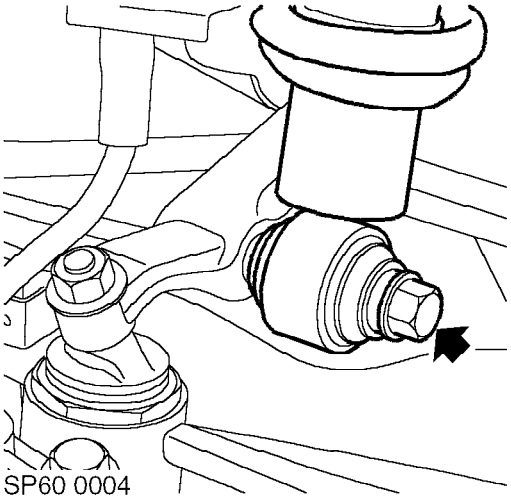
1. Remove bolt securing steering column universal joint to rack pinion.
2. Release steering column universal joint from rack pinion.
3. Remove 3 nuts securing steering rack pinion cover to body.
4. Raise front of vehicle and support on stand(s).

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

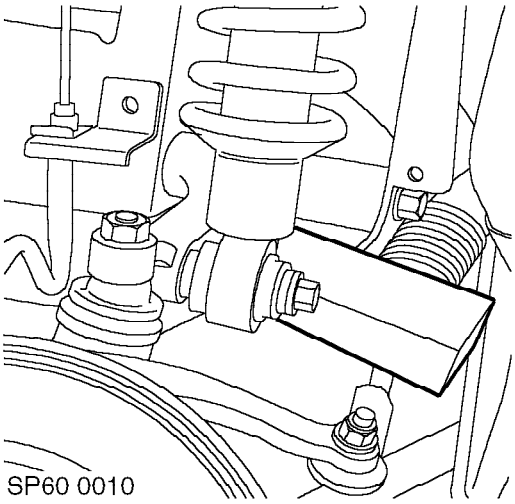
5. Remove road wheel(s).


SP57 0007

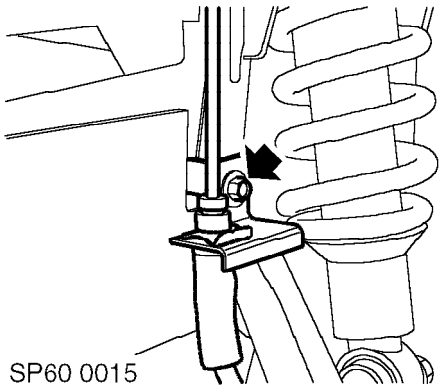
6. Release pinion cover from steering rack pinion housing and retaining studs.


SP60 0004

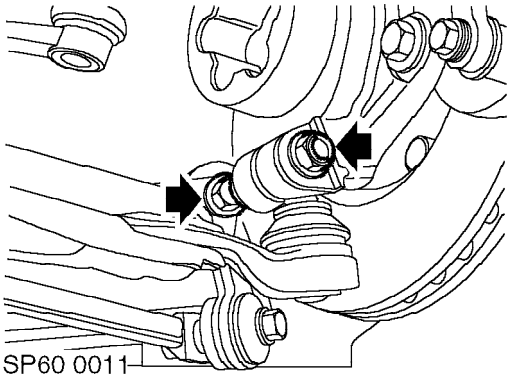
7. Remove bolts securing damper assemblies to upper suspension arms, move dampers aside.


SP60 0010

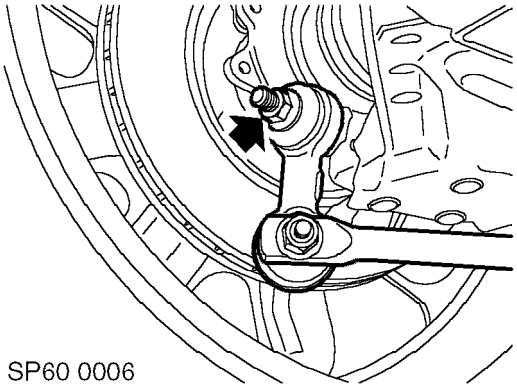
8. Raise suspension and fit a suitable block between upper arm and subframe.


SP60 0015

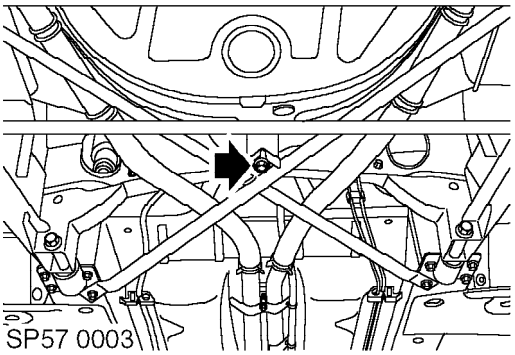
9. Remove 2 bolts securing LH and RH brake pipe support brackets to subframe turret.


SP60 0011

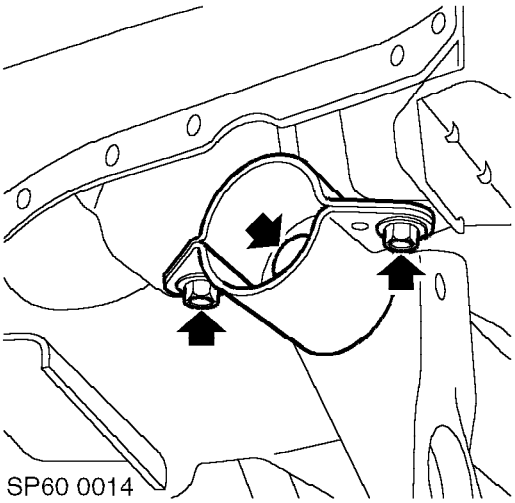
10. Remove nut and bolt securing lower arm ball-joint to hub.
11. Release ball-joint from lower arm.


SP60 0006

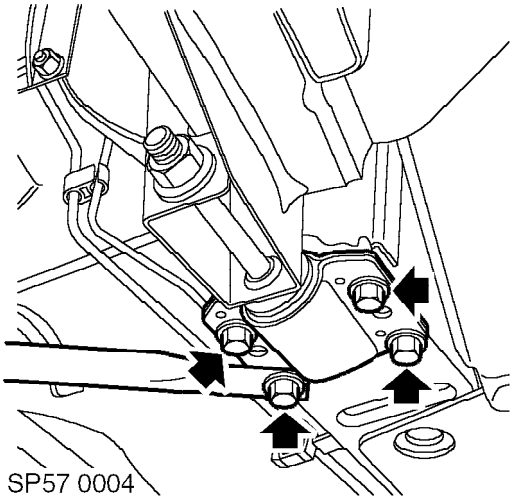
12. Remove nut and bolt securing anti-roll bar link to lower arm.


SP57 0003

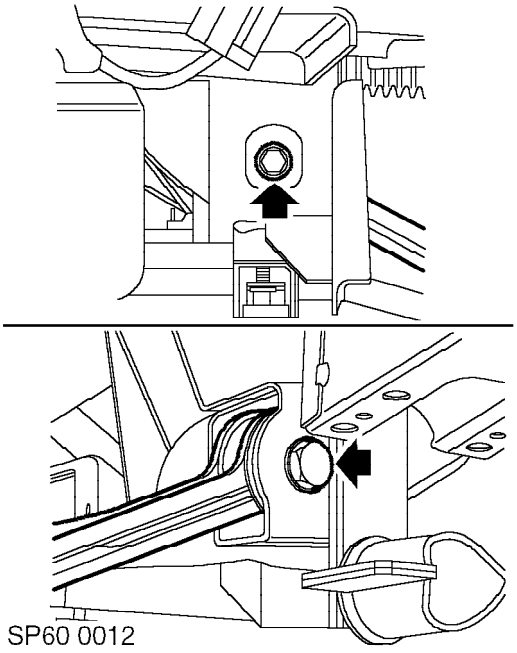
13. Remove bolt securing cross brace to centre mounting.
14. Support rear of front subframe on a jack.


SP60 0014

15. Loosen 2 bolts and 2 nuts and bolts securing front subframe mountings to body.


SP57 0004

16. Remove 8 bolts securing front subframe rear mountings to body.
17. Remove lower arm bolt access grommet from subframe.
18. Lower subframe on jack to gain access to lower suspension arm rear retaining bolts.


SP60 0012

19. Remove front bolt securing lower arm to subframe.
20. Remove rear bolt securing lower arm to subframe.
21. Remove lower arm.

Refit

1. Clean lower arm bushes, bush recesses and pivot bolts.
2. Fit lower arm to subframe.
3. Fit bolts securing lower arm to subframe, do not tighten at this stage.
4. Raise subframe on jack.
5. Align subframe mountings and cross brace to body. Fit and tighten bolts securing subframe mountings and cross brace to 45 Nm.
6. Tighten nuts and bolts securing front subframe mountings to body to 30 Nm.
7. Fit and tighten bolt securing cross brace to centre mounting to 45 Nm.
8. Clean lower ball joint and seat.
9. Position hub to lower ball joint, fit and tighten nut and bolt to 45 Nm.
10. Raise suspension and remove support blocks, align dampers, fit bolts and tighten to 100 Nm.
11. Align anti-roll bar link to lower arm.
12. Fit nut and bolt securing anti-roll bar link to lower arm, do not tighten at this stage.
13. Position brake pipe brackets to subframe turret, fit and tighten bolts to 25 Nm.
14. Locate pinion cover on studs and secure to steering rack pinion housing, fit and tighten nuts to 8 Nm.
15. Align and connect steering column intermediate shaft joint to rack pinion.
16. Fit bolt and tighten to 22 Nm.
17. Tighten lower arm to subframe bolts to 85 Nm. - Tighten anti-roll bar link to lower arm nuts and bolts to 35 Nm.

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

18. Fit bolt access grommet to subframe.
19. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
20. Remove stand(s) and lower vehicle.

BEARINGS - SUSPENSION ARM ASSEMBLY - UPPER

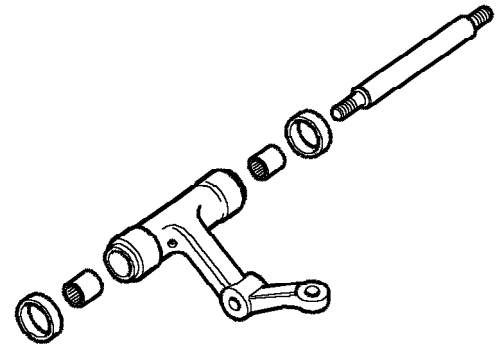
Service repair no - 60.35.05

Remove

1. Raise front of vehicle and support one side on stand.

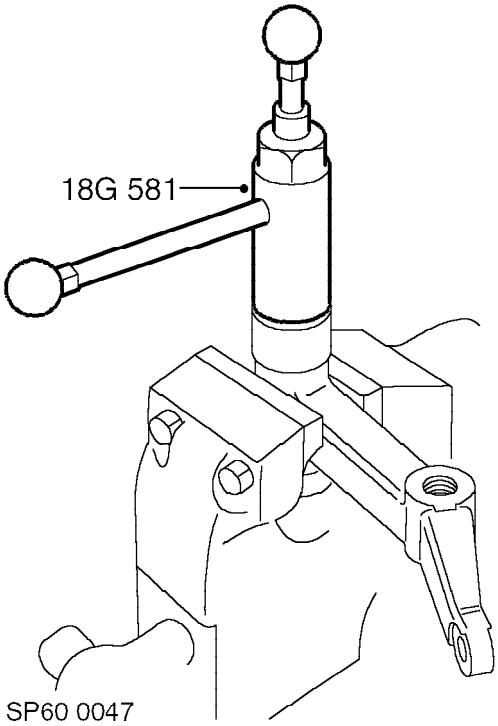
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel(s).
3. Remove upper suspension arm. ***See this section.***



SP60 0042

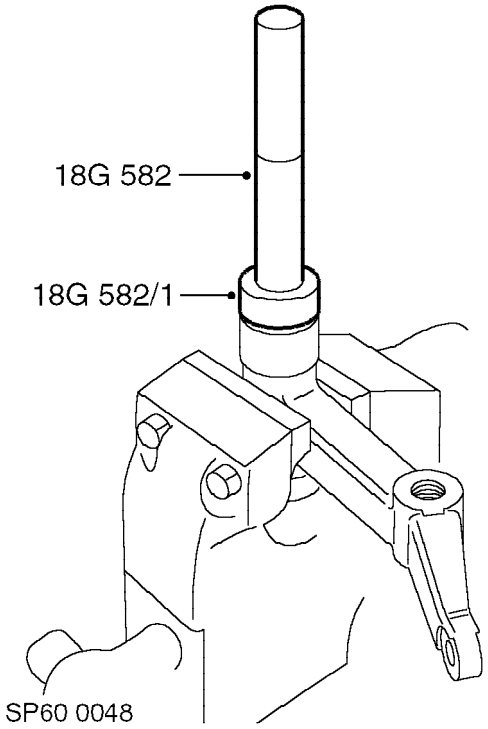
4. With the pivot shaft and rubber seals removed, note fitted position of bearings in upper suspension arm.



SP60 0047

5. Position upper suspension arm in vice.
6. Remove needle roller bearings from upper suspension arm using **18G-581** .

CAUTION: Clean and inspect bearing housings prior to reassembly. If any wear or damage is present due to worn bearings, the suspension arm must be replaced.



Refit

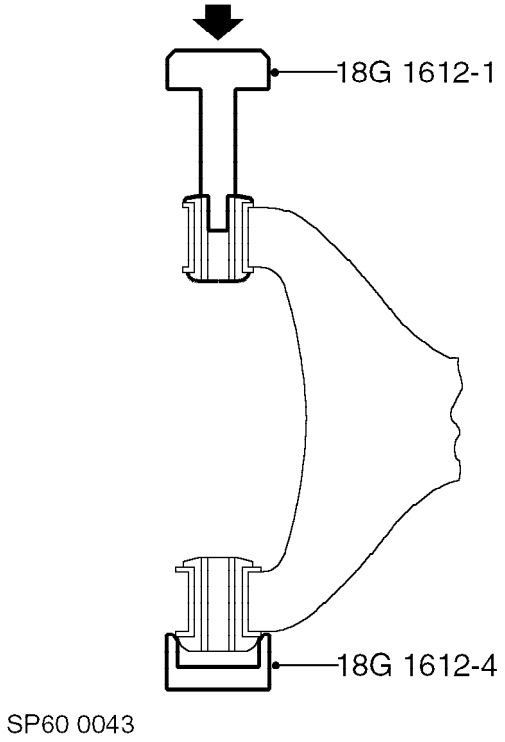
1. Align and carefully drift new needle roller bearings into upper suspension arm using **18G 582** and **18G 582/1** .
2. Fit upper suspension arm. ***See this section.***
3. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
4. Remove stand(s) and lower vehicle.

BUSH - SUSPENSION LOWER ARM - FRONT

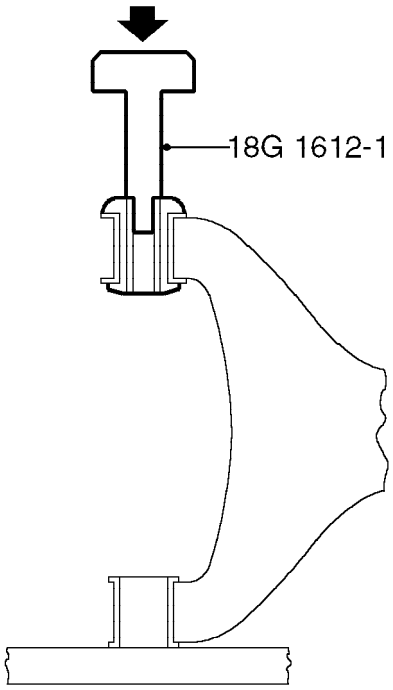
Service repair no - 60.35.24

Remove

1. Remove front lower arm. ***See this section.***



2. Remove front bush using press, position lower arm with front bush uppermost and support with tool **18G 1612-4** under rear bush.
3. Fit tool **18G 1612-1** to front bush and press bush from lower arm.
4. Reposition arm under press with rear bush uppermost.

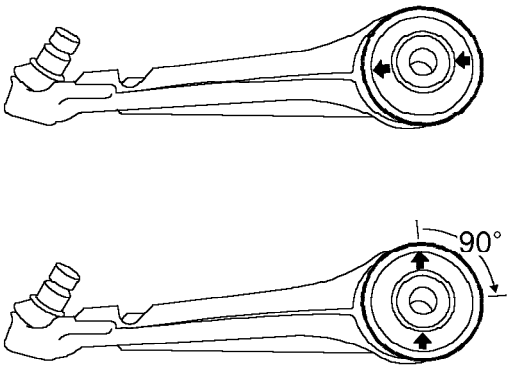


SP60 0044

5. Fit tool **18G 1612-1** to rear bush and press bush from arm.

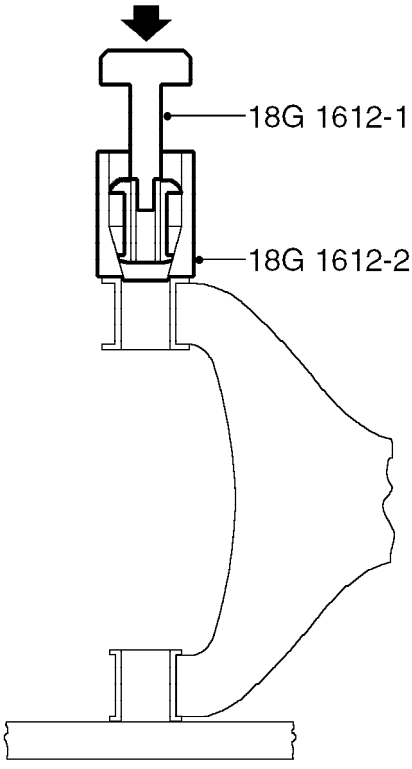
Refit

1. Clean lower arm and bush locations.
2. Position lower arm in press with rear bush located uppermost.
3. Lubricate rear bush with Marlene 148 rubber lubricant.
4. Fit tool **18G 1612-2** to rear bush location.



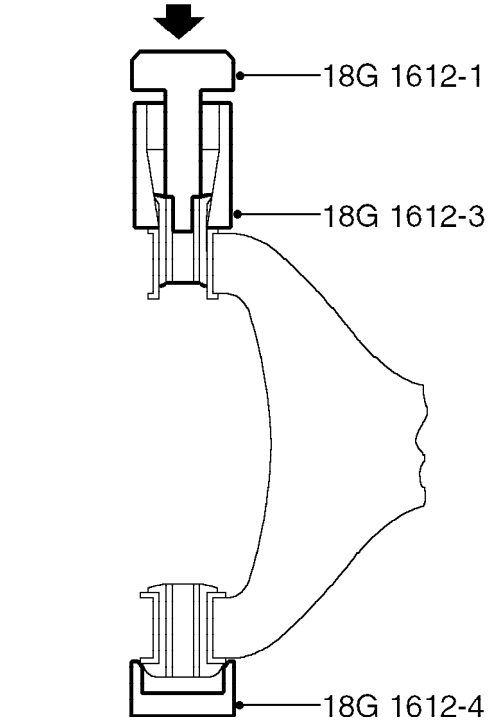
SP60 0001

5. Fit rear bush into tool **18G 1612-2** with the rounded flange uppermost with the arrows on bush pointing 90˚ from ball joint.



SP60 0045

6. Fit tool **18G 1612-1** to the rear bush and press into lower arm.



SP60 0046

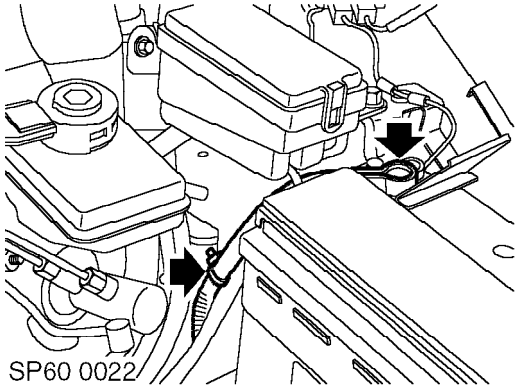
7. Position lower arm with tool **18G 1612-4** .
8. Fit tool **18G 1612-3** to front bush location.
9. Lubricate front bush with Marlene 148 rubber lubricant.
10. Fit bush into tool **18G 1612-3** with flat flange uppermost.
11. Press bush into lower arm using tool **18G 1612-1** .
12. Remove arm from press.
13. Fit front lower arm. ***See this section.***

SUB FRAME - FRONT SUSPENSION - MANUAL TRANSMISSION MODELS

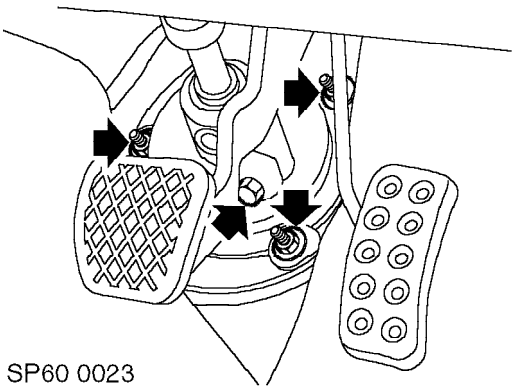
Service repair no - 60.35.78

Remove

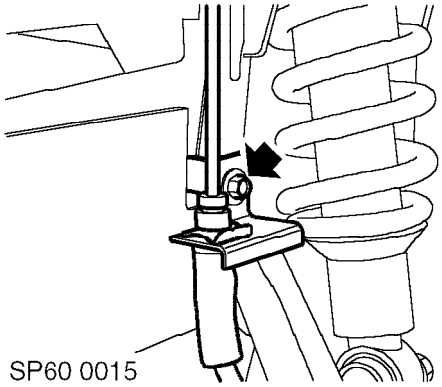
1. Position vehicle on a 2 post ramp.
2. Disconnect battery earth lead.
3. Disconnect battery positive lead,


SP60 0022

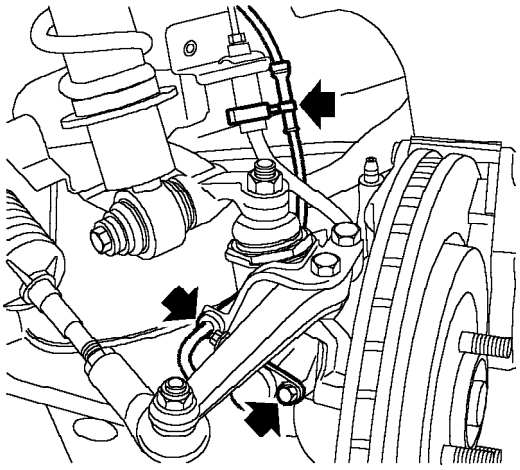
4. Release main fuse and fuse box connections, release from clips and position aside.


SP60 0023

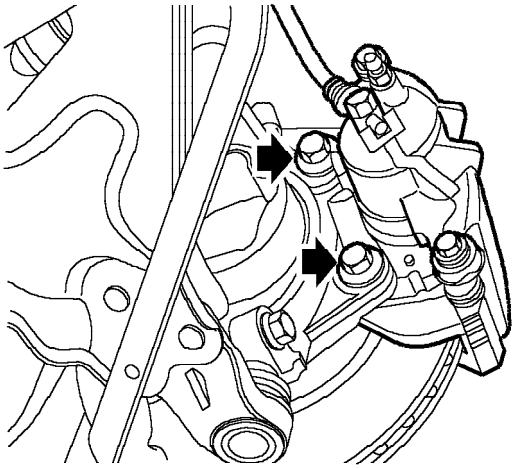
5. Remove bolt securing steering column universal joint to steering rack.
6. Release steering column from steering rack.
7. Remove 3 nuts securing steering rack pinion cover to body.
8. Remove front road wheels.


SP60 0015

9. Remove 2 bolts securing LH and RH brake pipe support brackets to subframe turret.


SP12 0362

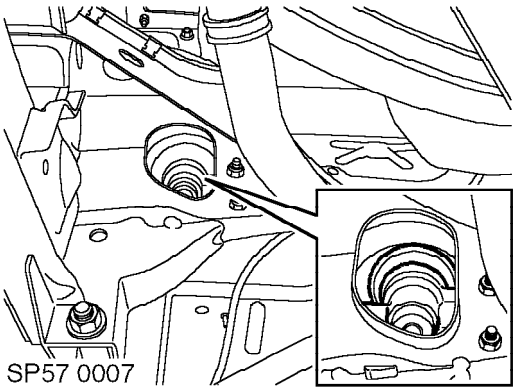
10. Remove bolts securing LH and RH ABS sensors to calipers. Release sensors and collect spacers.
11. Release LH and RH ABS sensor lead grommets from each bracket on front hubs, clips and grommet brackets on subframe turret.


SP60 0024

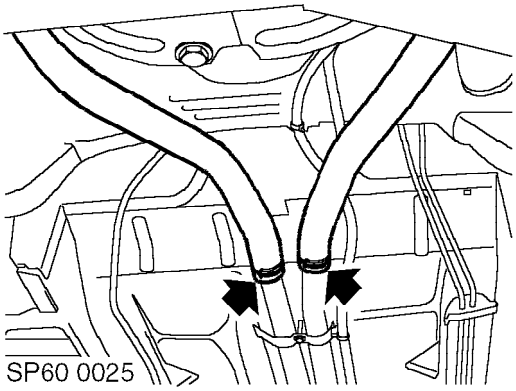
12. Remove bolts securing LH and RH brake calipers to front hubs. Release calipers from hubs and tie calipers aside.

CAUTION: Do not allow caliper to hang on brake hose.

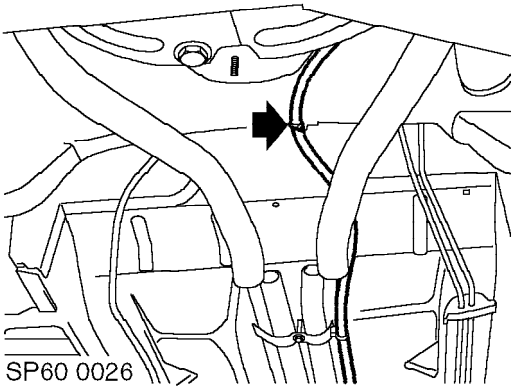
13. Raise vehicle on ramp.


SP57 0007

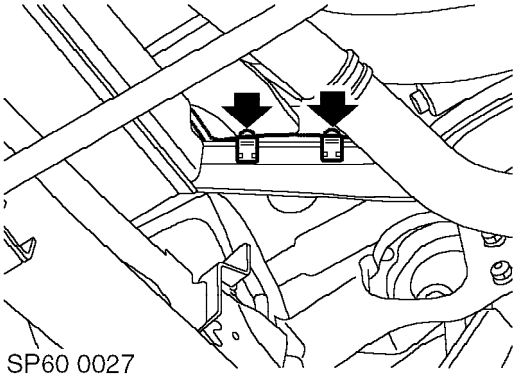
14. Release pinion cover from steering rack pinion housing and retaining studs.
15. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***


SP60 0025

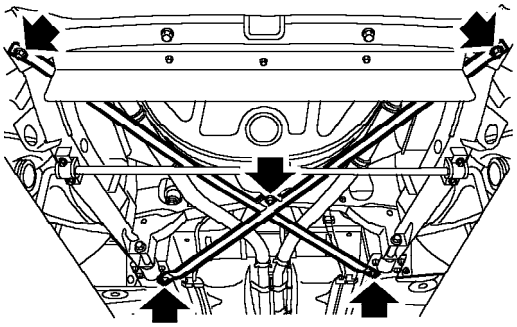
16. Release clips and disconnect coolant hoses under floor.


SP60 0026

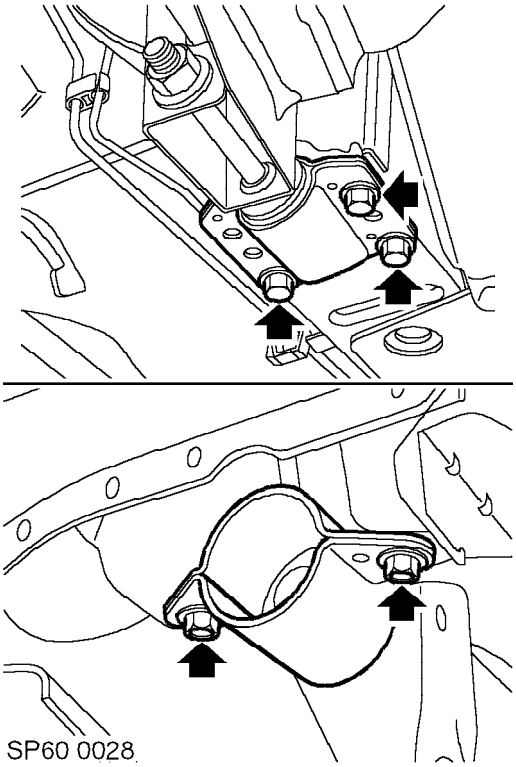
17. Remove and discard cable tie securing battery lead to subframe, position battery lead aside.


SP60 0027

18. Release screen washer tube from 2 clips on subframe.

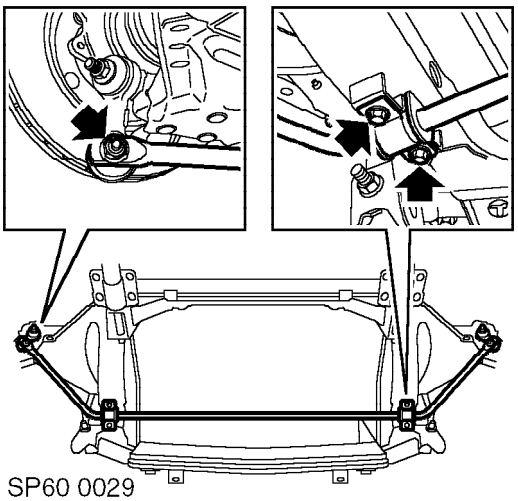

SP12 0364

19. Remove 2 bolts securing cross brace to front of subframe.
20. Remove LH and RH bolts securing cross brace and rear subframe mountings to body.
21. Remove bolt securing cross brace to centre mounting and remove cross brace.
22. Position suitable table beneath front subframe.
23. Lower vehicle on ramp until subframe makes contact with table.

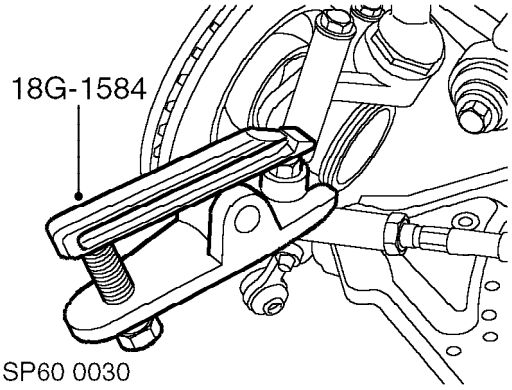

SP60 0028

24. Remove 6 bolts and 2 nuts and bolts securing LH and RH subframe mountings to body.
25. Slowly raise vehicle away from subframe.

NOTE: Do not carry out further dismantling if component is removed for access only.

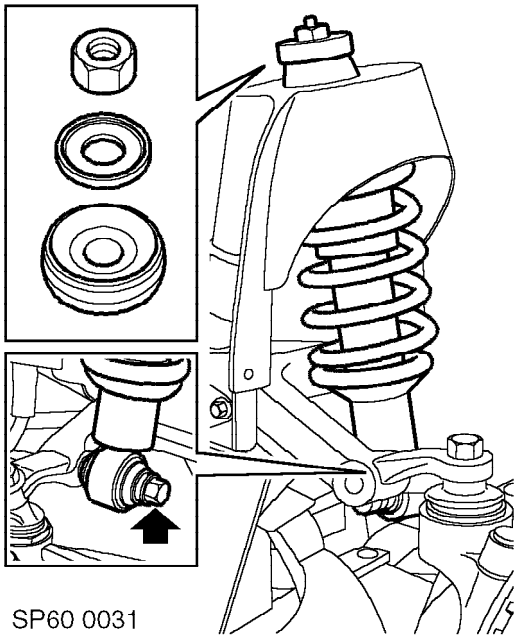

SP60 0029

26. Remove nuts and bolts securing anti-roll bar links to anti-roll bar.
27. Remove 4 bolts securing anti-roll bar to subframe, remove anti-roll bar. Collect anti-roll bar clamps and mounting rubbers.

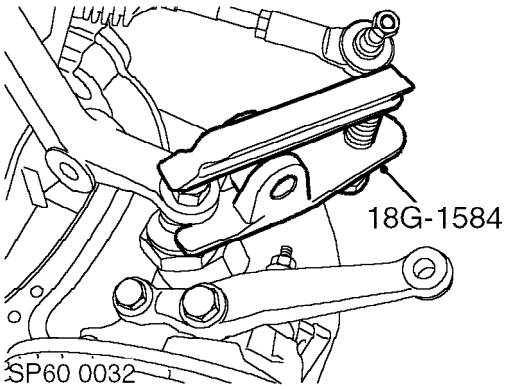


SP60 0030

28. Remove nuts securing steering rack ball joints to front hubs. Using **18G-1584** , release ball joint tapers from hubs.

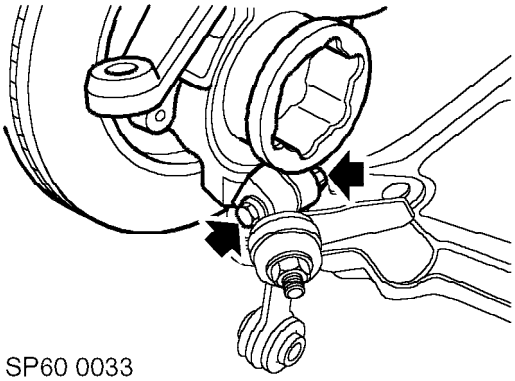

SP60 0031

29. Position 5 mm Allen key in top of damper shaft, remove nut securing damper to subframe turret.
30. Remove retaining washer and rubber bush.
31. Remove bolt securing damper to upper suspension arm, remove damper/spring assembly and collect spring isolator.



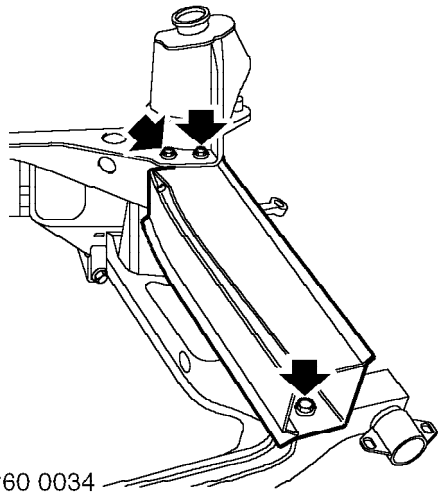
SP60 0032

32. Remove and discard lock nut securing ball joint to upper suspension arm.
33. Fit slave nut to ball joint threads, position tool **18G-1584,** release ball joint taper from upper suspension arm. Remove slave nut.



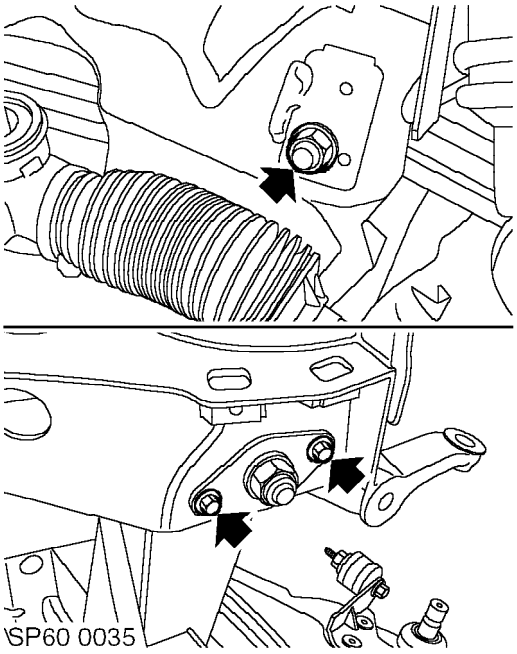
SP60 0033

34. Remove nut and bolt securing ball joint to lower arm, release ball joint and remove hub assembly.



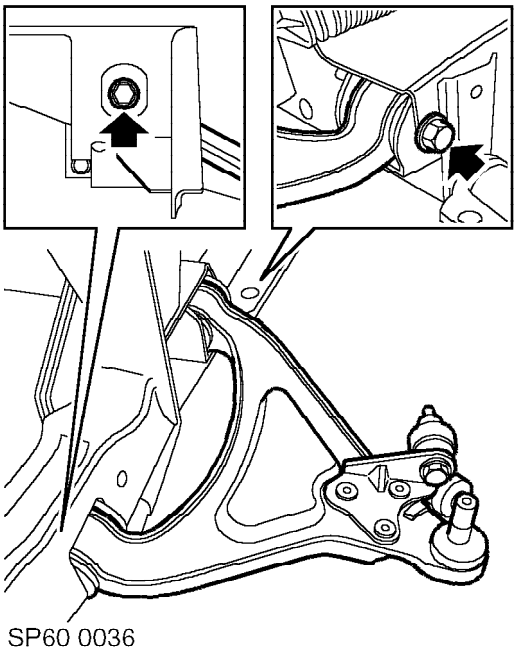
SP60 0034

35. Remove 3 bolts securing LH crash can to subframe and remove crash can.



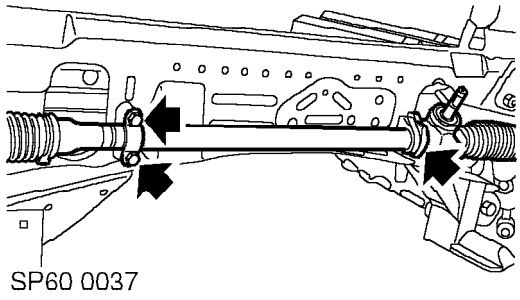
SP60 0035

36. Remove rear nut and plain washer securing upper suspension arm pivot shaft to subframe.
37. Remove bolt and nut and bolt securing pivot shaft retaining plate to subframe.
38. Remove pivot shaft from subframe.
39. Remove upper suspension arm from subframe, noting fitted position of rear thrust washer and rubber seals at each end of suspension arm.

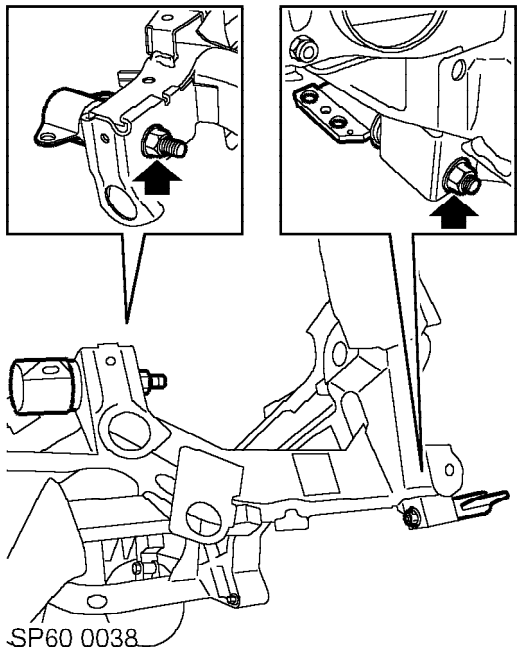


SP60 0036

40. Remove front and rear bolts securing lower arm to subframe and remove lower arm.
41. Repeat operations for opposite side of suspension.

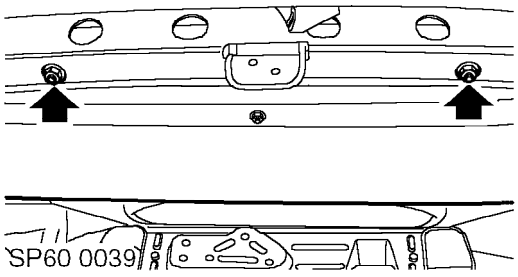

SP60 0037

42. Remove 2 nuts and bolts and 'U' bolt securing steering rack to subframe, remove steering rack and collect 'U' bolt and clamp.


SP60 0038

43. Remove nuts and bolts securing LH and RH front mountings to subframe and collect mountings.

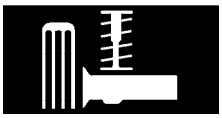
44. Remove nuts and bolts securing LH and RH rear mountings to subframe and collect mountings.


SP60 0039

45. Remove 2 nuts securing splash guard mounting bracket to subframe, remove splash guard mounting bracket.

Refit

1. Position splash guard mounting bracket to subframe, fit and tighten nuts to 30 Nm.
2. Position LH and RH front mountings to subframe, fit and tighten nuts and bolts to 100 Nm.
3. Position LH and RH rear mountings to subframe, fit and tighten nuts and bolts to 100 Nm.
4. Position steering rack to subframe, fit 'U' bolt and clamp. Fit and tighten nuts and bolts to 22 Nm.
5. Position lower arm in subframe, fit and tighten bolts to 85 Nm.
6. Ensure that thrust washer and rubber seals are correctly positioned on upper suspension arm.
7. Position upper suspension arm in subframe and fit pivot shaft.
8. Align pivot shaft retaining plate to holes in subframe, fit bolt, nut and bolt and tighten to 10 Nm.
9. Position plain washer, fit and tighten rear nut securing pivot shaft to subframe to 74 Nm.
10. Repeat operations for opposite side of suspension.
11. Position crash can in subframe, fit and tighten bolts to 45 Nm.
12. Clean hub assembly and ball joint locations in suspension arms.
13. Position hub assembly to upper suspension arm, fit and tighten new ball joint lock nut to 54 Nm.
14. Ensure bottom ball joint pin is fully engaged in hub.
15. Fit and tighten nut and bolt securing bottom ball joint to hub to 45 Nm.
16. Position isolator on spring retaining plate.
17. Position damper assembly in subframe turret, fit top bush, washer and nut. Do not tighten nut at this stage.



18. Position damper assembly to upper suspension arm, fit and tighten bolt to 100 Nm.
19. Position 5 mm Allen key in top of damper shaft, tighten nut to 45 Nm
20. Repeat operations for opposite side of suspension.
21. Clean steering rack ball joint tapers and mating faces on hubs.
22. Position steering rack ball joints to hubs, fit and tighten nuts to 30 Nm.
23. Clean anti-roll bar.
24. Fit mounting rubbers to anti-roll bar.
25. Position anti-roll bar to subframe, position clamps and align to bolt holes. Fit and tighten bolts to 22 Nm.
26. Align anti-roll bar links to anti-roll bar, fit nuts and bolts but do not tighten at this stage.
27. Correctly position subframe underneath vehicle. Slowly lower vehicle onto subframe.
28. Align subframe mountings to body.
29. Fit nuts and bolts securing subframe mountings to body. Tighten rear mounting bolts to 45 Nm and front mounting bolts to 30 Nm.
30. Raise vehicle on ramp and remove table.
31. Position cross brace to subframe, fit and tighten bolts securing cross brace to rear mountings, front of subframe and centre mounting to 45 Nm.
32. Connect coolant hoses and secure with clips.
33. Position battery lead to subframe and secure with new cable tie.
34. Secure screen washer tube in clips on subframe.
35. Release LH and RH front brake calipers, position to hubs, fit and tighten bolts to 85 Nm.
36. Position LH and RH brake pipes to subframe turrets, fit and tighten bolts to 25 Nm.
37. Fit LH and RH ABS sensors and spacers, fit and tighten bolts to 10 Nm.
38. Secure LH and RH ABS sensor lead grommets in brackets on front hubs, clips and grommet brackets on subframe turret.
39. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
40. Lower vehicle on ramp.
41. With the weight of the vehicle on the front suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
42. Locate pinion cover on studs and secure to steering rack pinion housing, fit and tighten nuts to 8 Nm.
43. Position steering column universal joint,fit and tighten clamp bolt to 22 Nm.
44. Connect battery positive lead, fuse box and main fuse leads, secure leads in clips.
45. Fill cooling system. ***See COOLING SYSTEM, Adjustments.***
46. Connect battery earth lead.
47. Check front wheel alignment. ***See STEERING, Adjustments.***

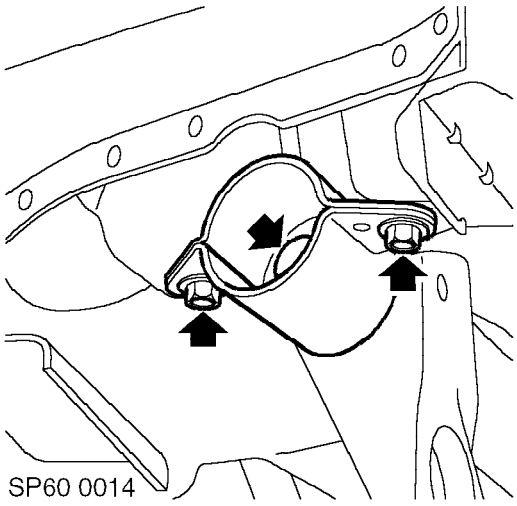
MOUNTING - FRONT SUB FRAME - FRONT

Service repair no - 60.35.80

Remove

1. Raise front of vehicle and support on stand(s).

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



2. Remove bolt and nut and bolt securing front mounting to body.
3. Remove nut and bolt securing mounting to subframe and remove mounting.

Refit

1. Position mounting to subframe, fit bolt and nut but do not fully tighten at this stage.
2. Fit and tighten bolts securing subframe mounting to body to 30 Nm.
3. Tighten nut and bolt securing mounting to subframe to 100 Nm.
4. Remove stand(s) and lower vehicle.

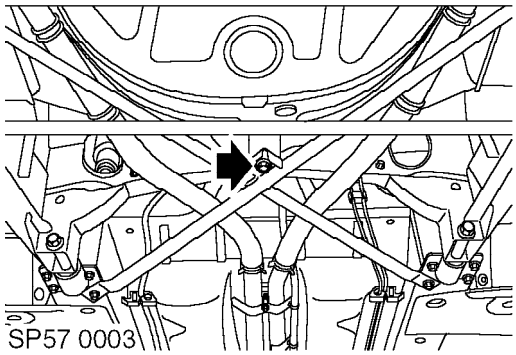
MOUNTING - FRONT SUB FRAME - REAR

Service repair no - 60.35.82

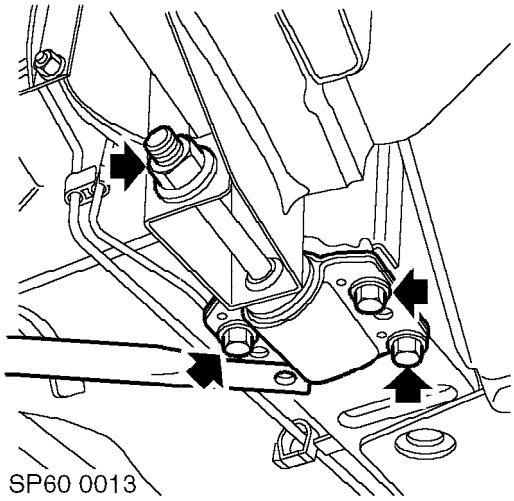
Remove

1. Raise front of vehicle and support on stand(s).

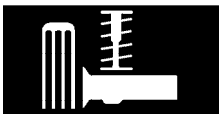
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.



2. Remove bolt securing cross brace to centre mounting.



3. Remove 4 bolts securing cross brace and rear subframe mounting to body.
4. Remove nut and bolt securing mounting to subframe and remove mounting.



Refit

1. Position mounting to subframe, fit bolt through subframe and mounting.
2. Fit and tighten bolts securing rear subframe mounting and cross brace to body to 45 Nm.
3. Fit nut securing mounting to subframe, tighten nut and bolt to 100 Nm.
4. Fit and tighten bolt securing cross brace to centre mounting to 45 Nm.
5. Remove stand(s) and lower vehicle.

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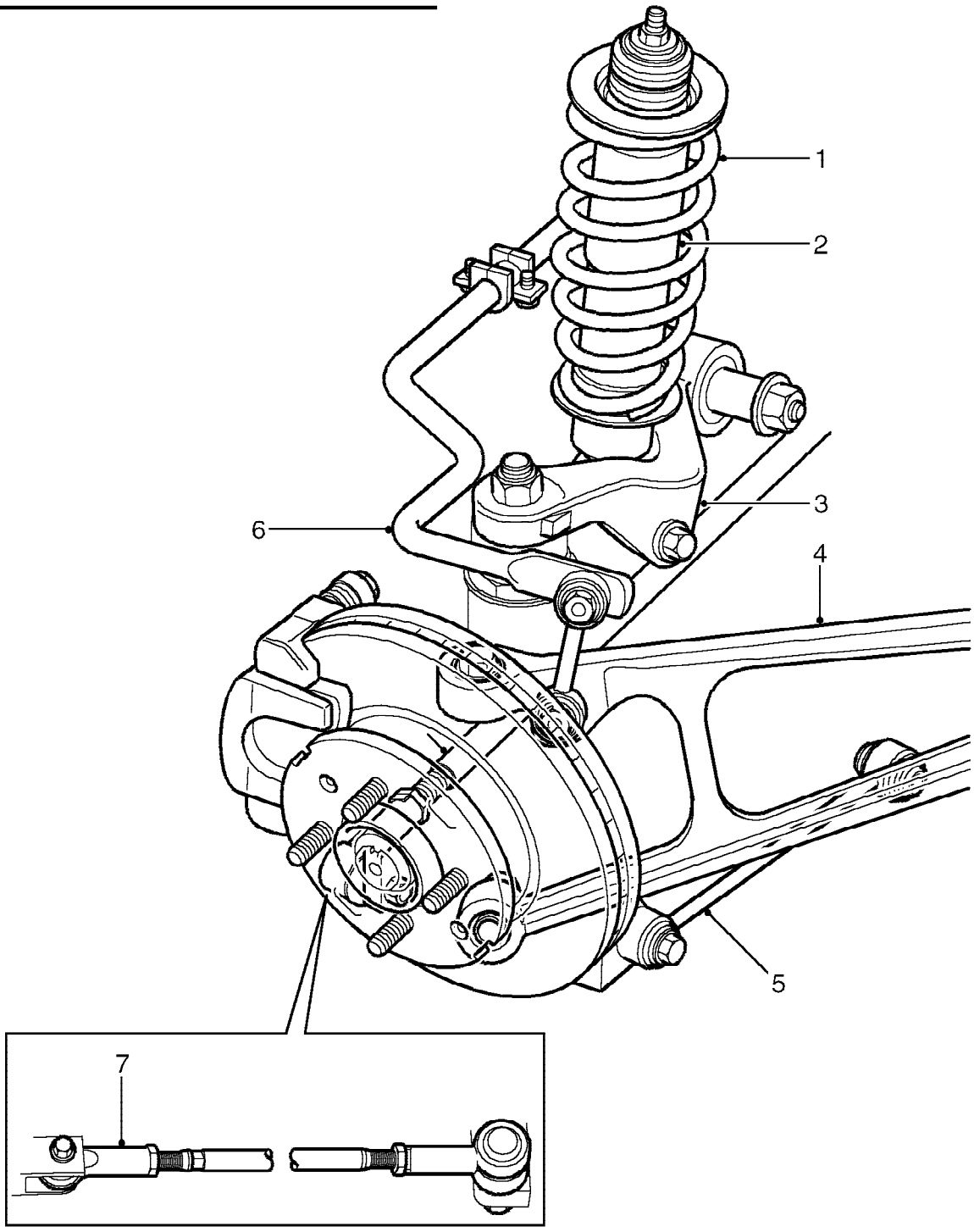
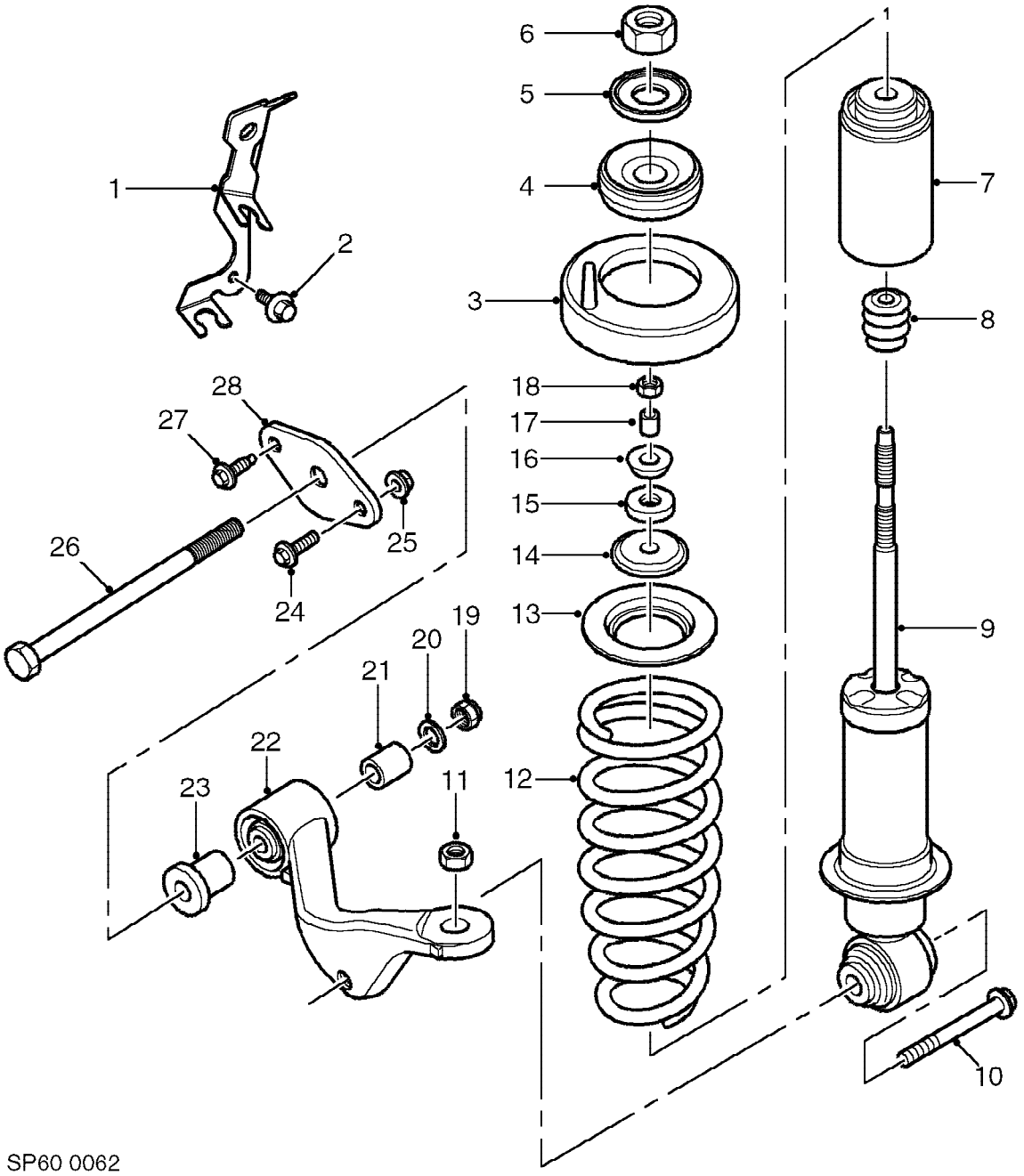
REAR SUSPENSION

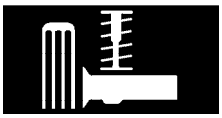


SP60 0064

1. Coil spring
2. Damper unit
3. Upper suspension arm
4. Trailing arm
5. Lower link
6. Anti-roll bar and links
7. Adjustable track control arm

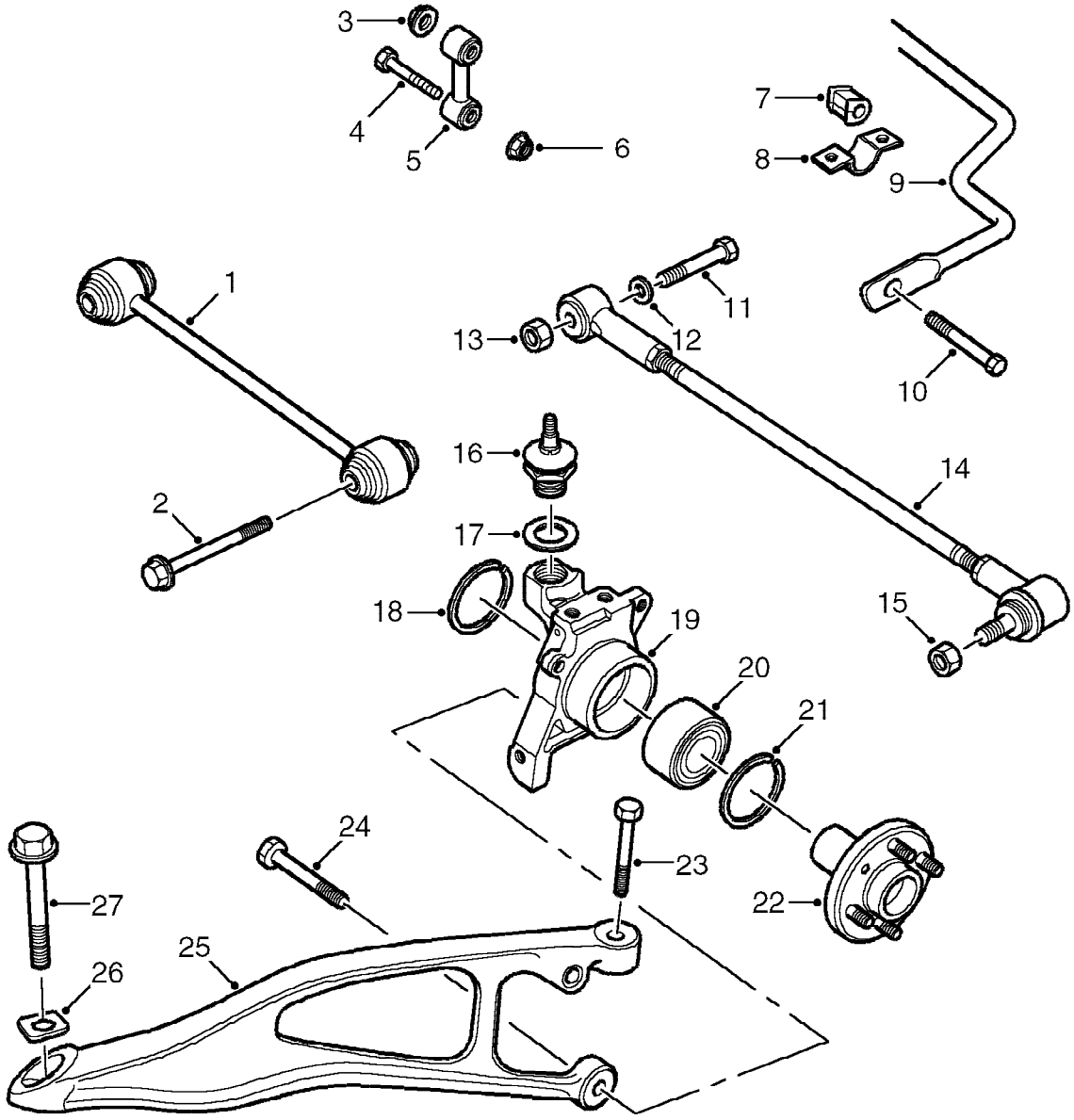
REAR SUSPENSION COMPONENTS



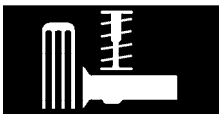


1. ABS sensor lead bracket
2. Bolt - ABS sensor lead bracket
3. Spring seat
4. Rubber bush - top damper mounting
5. Retaining washer - top damper mounting
6. Locknut - top damper mounting
7. Dust shield
8. Bump stop rubber
9. Damper unit
10. Bolt - damper lower mounting
11. Nut - upper balljoint
12. Coil spring
13. Spring retainer
14. Cup washer
15. Spacer
16. Mounting cushion
17. Distance piece
18. Locknut - damper rod
19. Locknut - upper arm pivot
20. Washer - upper arm pivot
21. Spacer - upper arm pivot
22. Upper arm
23. Top hat spacer - upper arm pivot
24. Bolt - retaining plate
25. Self locking nut - pivot retaining plate
26. Pivot shaft - upper arm
27. Bolt - retaining plate
28. Retaining plate

REAR SUSPENSION COMPONENTS - continued



SP60 0063



1. Lower link
2. Bolt - lower link
3. Locknut - anti-roll bar link
4. Bolt - anti-roll bar link
5. Link - anti-roll bar
6. Locknut - anti-roll bar link
7. Bush - anti-roll bar
8. Clamp - anti-roll bar
9. Anti-roll bar
10. Bolt - anti-roll bar link
11. Bolt - track control arm
12. Washer - track control arm
13. Self locking nut - track control arm
14. Track control arm
15. Nut - track control arm
16. Upper ball-joint
17. Lock washer
18. Retaining clip (inner) - drive flange bearing
19. Hub
20. Bearing
21. Retaining clip (outer) - drive flange bearing
22. Drive flange
23. Bolt (upper) - trailing arm
24. Bolt (lower) - trailing arm
25. Trailing arm
26. Snubber plate
27. Bolt - trailing arm compliance bush

REAR SUSPENSION

General

The rear suspension is of the independent type and is a four-link system which comprises the following main components:

- Two coil springs
- Two damper units
- Two upper pivot arms
- Two trailing arms
- Two lower links
- Two adjustable track control arms
- Two swivel hubs
- One anti-roll bar
- Two anti-roll bar links
- Peripheral subframe

The rear suspension system consists of a spring/damper unit at each rear wheel. Each spring/damper combination is mounted between the vehicle's body and upper suspension arm.

There are two grades of suspension configuration, Standard and Sports. The Sports version has a lower (10 mm) and stiffer suspension than for the Standard.

Damper and Spring Unit

Two damper and spring units control the damping of the rear suspension. The coil springs support the weight of the vehicle, maintain ride height and absorb road shock. When additional load is placed on the coil springs (e.g. through acceleration), or when the vehicle passes over bumps in the road, the springs compress to absorb the change and ensure ride comfort is maintained.

The coil spring is retained in a compressed condition between the strut spring seat and the top (body) mounting. The coil springs and the upper ball joints support the weight of the vehicle which is transmitted through the springs to the upper control arms and then through the upper ball joints.

Isolators are fitted at each end of the spring/damper units to reduce noise transmitted from the suspension to the body. The upper spring isolator has a locating tag on its top surface which is used to orientate it correctly by locating it through a hole in the front of the subframe turret.

The damper units assist in absorbing the energy stored in the coil spring after passing a bump to quickly terminate the reciprocating motion of the suspension and return the coil spring to the rest position.

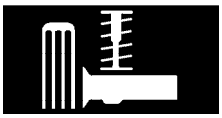
Each damper is gas and oil filled and is of twin tube construction. The twin tube construction allows the damper piston to operate against hydraulic fluid in an inner tube. The damper unit is fully displaced on rebound and uses rod displaced valving during compression.

As the suspension travels through the bump and rebound phases, the hydraulic fluid in the inner tube of the damper unit is forced through tiny holes inside the piston and the base valve, this changing pressure in the hydraulic fluid slows down the piston and consequently slows down spring and suspension movement. The damper units provide velocity sensitive hydraulic damping, the amount of resistance depending on the speed of the suspension and the number and size of the holes in the piston and base valve. The faster the suspension moves, the more resistance the damper units will provide. As a result, the damper units reduce:

- Bounce
- Body roll or sway
- Brake dive
- Acceleration squat

An oil cavity between the inner and outer tubes is used as a reserve tube to store excess hydraulic fluid. A low pressure charge of nitrogen gas in the reserve tube provides resistance to fluid entering the reserve tube and with the hydraulic fluid under pressure, aeration of the fluid is greatly reduced to provide better ride comfort and improved handling. Besides minimising oil cavitation this two-tube design helps eliminate the effect of damage to the outer tube affecting piston operation.

A compression valve is included in the base of the piston inner pressure tube to control fluid movement between the inner and outer chambers during the compression cycle. The diameter of the piston and inside diameter of the pressure tube is 30 mm (1.18 in.).



The damper rod is secured at the top mounting to the rear wing valance with a washer and nut. The damper rod passes through a bushing and low friction seal at the upper end of the pressure tube to keep it aligned and allow the piston to move freely. A 5mm hexagon socket is provided at the top end of the damper to restrain the rod from rotating when the nut is tightened.

NOTE: The rear suspension dampers are colour coded RED, whereas the front suspension dampers are colour coded BLUE.

A dust shield and bump stop rubber is fitted between the damper unit and the top mounting, to protect the damper rod from dirt and damage.

Upper suspension arm

The upper suspension arm uses a pivot shaft to facilitate up and down movement of the arm at its inner end. The pivot end of the upper arm contains a replaceable bush which must be fitted in the correct orientation if being replaced.

The lower mounting of the suspension damper connects to a fixing point in the centre of the upper arm. An upper ball joint is attached to the outer end of the upper arm and connects to the rear hub through a tapered stud held in position with a nut and tab washer.

A rebound rubber is mounted on a bracket which is fitted below the upper arm to protect the suspension components in the case of full rebound.

Track control arm and lower link

The track control arm and lower link make up the lower suspension wishbone to provide the necessary fore-and-aft stiffness to resist braking torque. A lower link is fitted between the front of each hub and the subframe, these help resist longitudinal dynamic loads and braking torque.

An adjustable track control arm is fitted between the rear of each hub and a bracket at the midpoint of the rear subframe. The track control arm is bushed at its inner end and has a ball joint at its hub connection. ***See STEERING, Repairs.***

Trailing Arm

The rear suspension trailing arms are of cast iron construction and are designed to provide optimum camber compensation, counter brake lift and give fore-and-aft stiffness to restrain acceleration torque. The utilisation of trailing arm rear suspension also allows both wheels to move independently. Both trailing arms are interconnected by an anti-roll bar which provides the required stiffness to prevent body roll.

The forward end of each trailing arm is fitted with a compliance bush which controls sideforce steer performance, enhances ride and reduces noise levels. Snubber plates are included at the compliance bush fixings. If the snubber plates are removed during repair operations, they must be refitted in the same orientation as they were before removal. The rear end of each trailing arm is secured to their respective rear hub by two bolts.

Anti-roll bar

An 18 mm solid spring steel anti-roll bar is used which operates via anti-roll bar links on the rear trailing arms. The anti-roll bar is attached to the rear subframe with two PTFE bushes which are secured with clamp plates and bolts. The low friction PTFE bushes require no additional greasing and allow the anti-roll bar to rotate freely with quiet operation. This allows the bar to respond quickly to roll inputs.

Each anti-roll bar link has a ball joint fitting at each end which improves response and efficiency. The top ball-joint is attached by a bolt and self locking nut to the outer side of the anti-roll bar. The lower ball-joint is attached to a fixing point on the trailing arm. Each link must be attached to the anti-roll bar with the ball joint on the outboard side of the anti-roll bar and the locking nut on the inboard side.

CAUTION: The rear anti-roll bar is handed, the letter 'R' denotes the link for the RH side of the suspension.

Rear subframe

The subframe is fabricated from hydro-formed tubing providing a light and strong structure. All machining of critical geometric locations is performed after fabrication to ensure accurate location of the rear suspension components.

BALL JOINT - UPPER

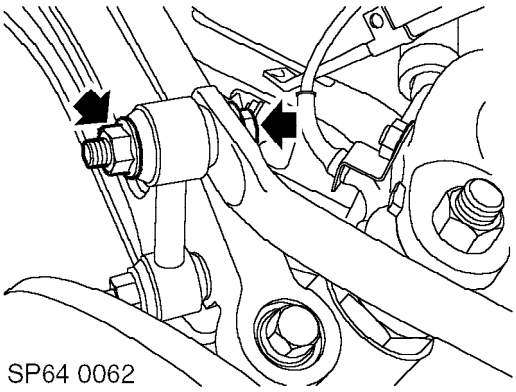
Service repair no - 64.15.02

Remove

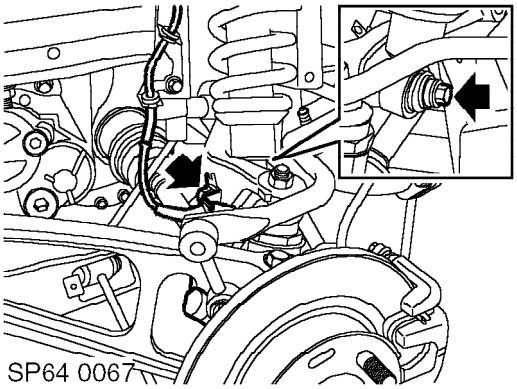
1. Raise rear of vehicle and support on stand(s).

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

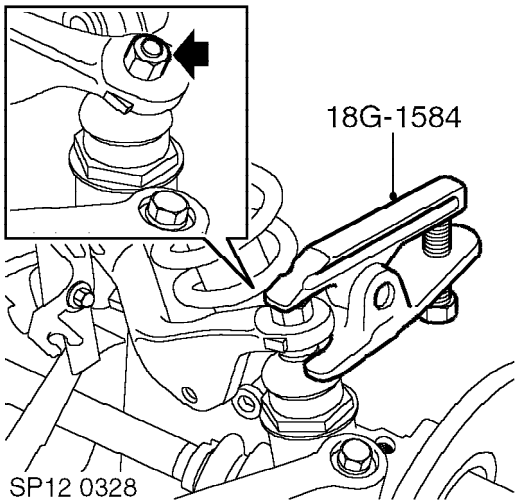
2. Remove road wheel(s).


SP64 0062

3. Remove nuts and bolts securing LH and RH anti-roll bar links to anti-roll bar.

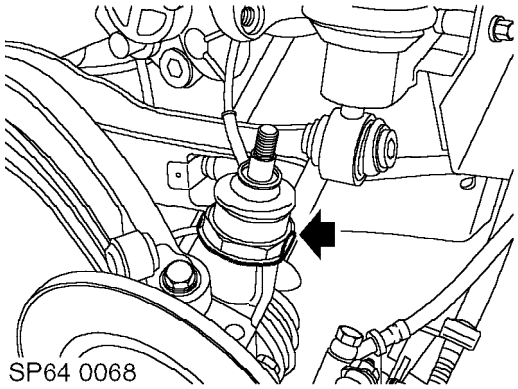

SP64 0067

4. Remove nut and bolt securing damper to upper suspension arm.
5. Release ABS sensor harness bracket.
6. Raise anti-roll bar and upper arm to access ball joint.

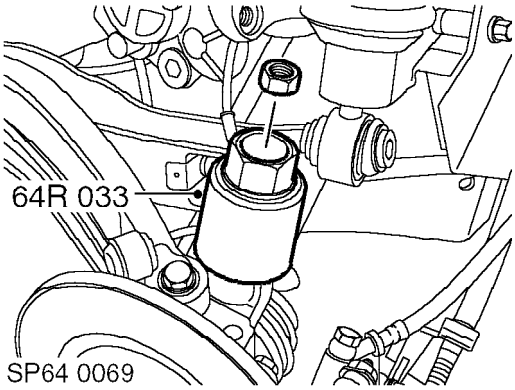


SP12 0328

7. Remove and discard lock nut securing ball joint to upper suspension arm.
8. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.


SP64 0068

9. Knock back lock washer securing ball joint to rear hub.



10. Using ball joint retaining nut, secure **64R033** to ball joint. Attach a suitable socket and socket bar to **64R033,** remove ball joint from rear hub.
11. Remove and discard lock washer.

Refit

1. Clean ball joint and mating face on rear hub.
2. Apply Loctite 242 to ball joint threads.
3. Fit new ball joint lock washer.
4. Fit ball joint to rear hub, and using **64R003** , tighten ball joint to 105 Nm.
5. Knock over lock washer to rear hub and ball joint nut.
6. Position ball joint to upper suspension arm, fit new lock nut and tighten nut to 54 Nm.
7. Align damper to upper arm, fit bolt and tighten to 100 Nm.
8. Align ABS harness bracket fit nut and tighten to 30 Nm.
9. Align anti-roll bar links to anti-roll bar fit nuts and bolts and tighten to 35 Nm.
10. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
11. Remove stand(s) and lower vehicle.

BEARING(S) - HUB - ONE SIDE

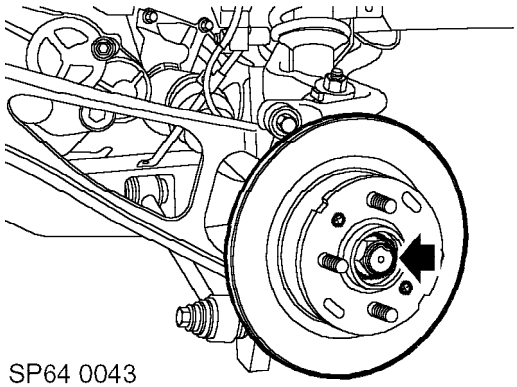
Service repair no - 64.15.14

Remove

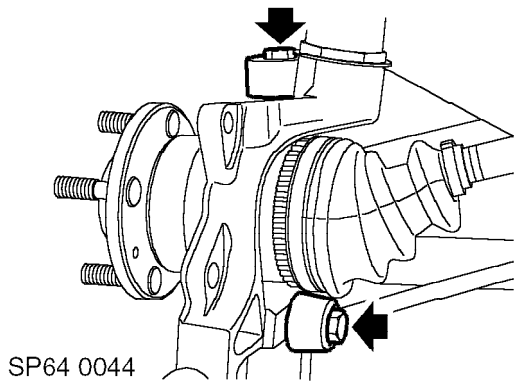
1. Raise rear of vehicle and support on stand(s).

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

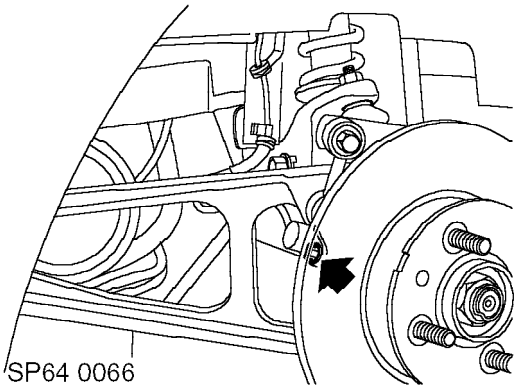
2. Remove road wheel.



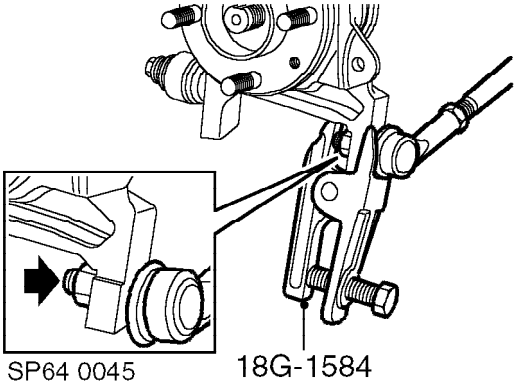
3. Knock back drive shaft nut stake.
4. With assistance, depress brake pedal, remove and discard drive shaft nut.
5. Remove brake disc. ***See BRAKES, Repairs.***



6. Remove 2 bolts securing trailing arm to rear hub.

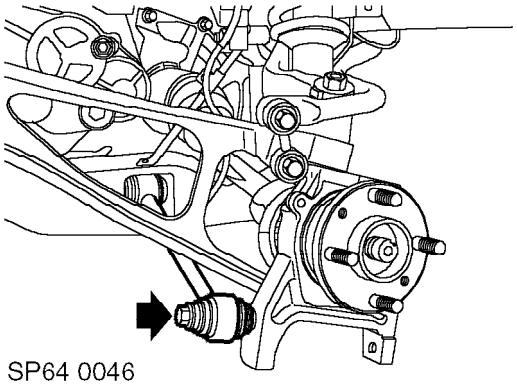

SP64 0066

7. Remove bolt securing ABS sensor to hub, release sensor and position aside.

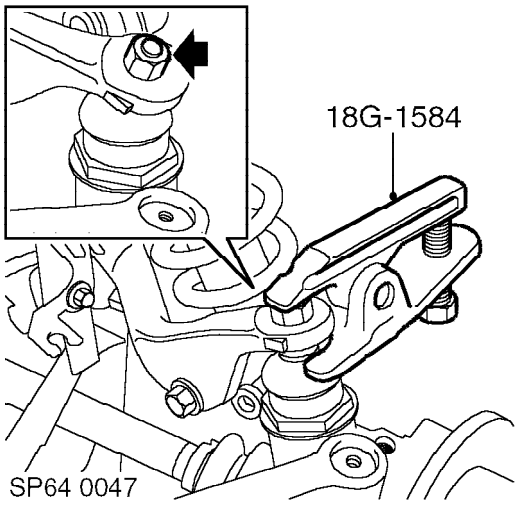


SP64 0045

8. Remove nut securing track control arm to rear hub.
9. Using tool **18G-1584** , release track control arm ball joint from rear hub.

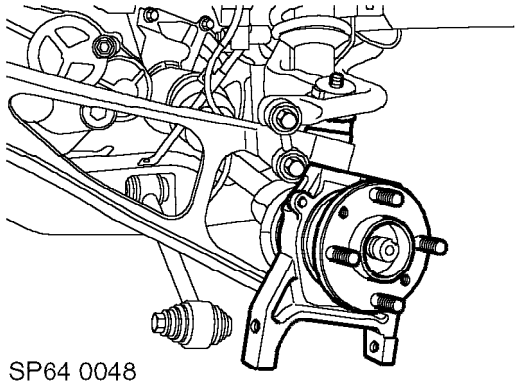

SP64 0046

10. Remove bolt securing lower link to rear hub.

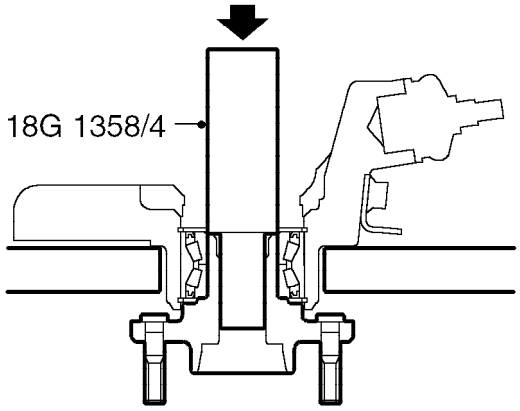


SP64 0047

11. Remove and discard lock nut from upper arm ball joint.
12. Fit slave nut to ball joint threads, position **18G-1584** and release ball joint taper from upper suspension arm. Remove **18G-1584** and slave nut.

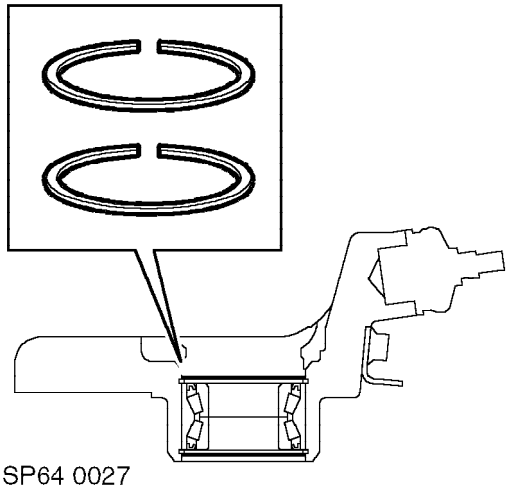

SP64 0048

13. Remove rear hub assembly from drive shaft.
14. Position hub to press.



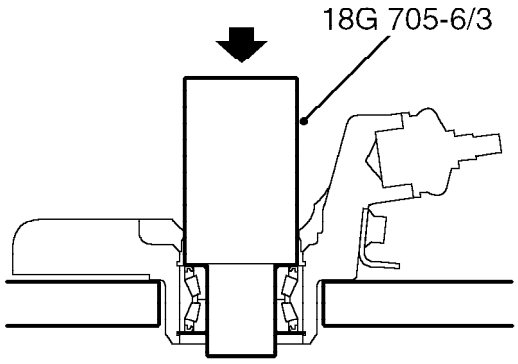
SP64 0026

15. Press out drive flange using tool **18G 1358/4** .
16. Collect drive flange.
17. Remove hub from press.



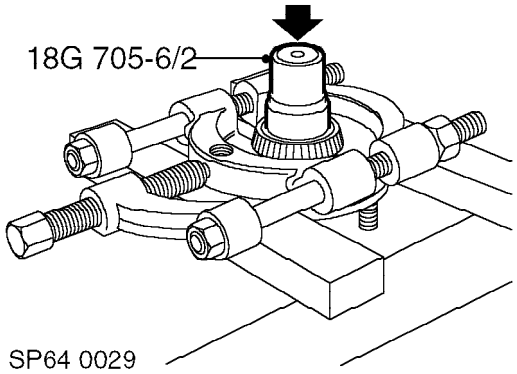
SP64 0027

18. Remove bearing outer circlip.
19. Remove bearing inner circlip.
20. Position hub to press.



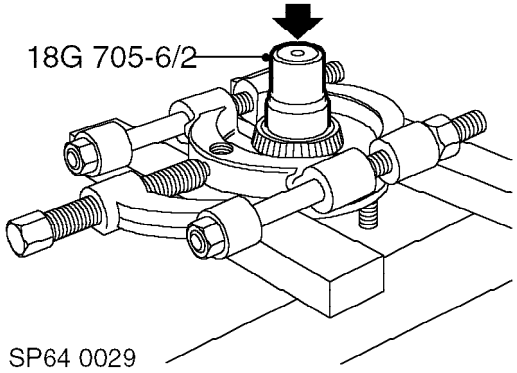
SP64 0028

21. Fit tool **18G 705-6/3** to bearing and press out bearing.
22. Remove hub from press.
23. Position drive flange to press.



SP64 0029

24. Fit a universal bearing splitter to bearing as shown.



SP64 0029

25. Fit thrust button, tool **18G 705-6/2** to drive flange and press out drive flange from inner track.
26. Collect drive flange and remove bearing inner track.

Refit

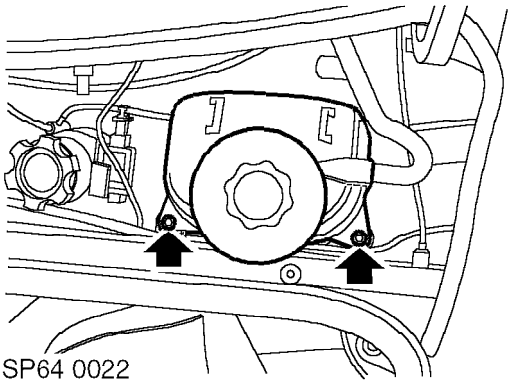
1. Clean hub and bearing mating faces.
2. Fit new bearing outer circlip to hub.
3. Position hub to press.
4. Position new bearing to hub, press bearing into hub using **18G-705-6/3** .
5. Fit new bearing inner circlip to hub.
6. Clean drive flange to bearing mating faces.
7. Using tools **18G 134BD** and **18G 18 705-6/3** press drive flange into hub.
8. Remove hub from press.
9. Clean drive shaft end and hub mating faces.
10. Fit hub to drive shaft.
11. Clean upper arm ball joint and mating face.
12. Position ball joint to upper suspension arm, fit new lock nut and tighten to 54Nm.
13. Align lower link to rear hub, fit bolt but do not tighten at this stage.
14. Clean track control arm ball joint and mating face.
15. Clean and thoroughly dry bolts securing trailing arm to rear hub.
16. Engage track control arm ball joint to hub, fit nut and tighten to 38 Nm.
17. Apply Loctite 242 to the first 3 threads of bolts securing trailing arm to rear hub.
18. Fit bolts securing trailing arm to rear hub, do not tighten at this stage.
19. Position ABS sensor lead to hub, fit new bolt and tighten to 10 Nm.
20. Fit rear brake disc. ***See BRAKES, Repairs.***
21. With assistance tighten new drive shaft nut to 210 Nm.
22. Stake drive shaft nut to shaft.
23. Tighten trailing arm to hub bolts to 60 Nm.
24. With the weight of the vehicle on the rear suspension, tighten bolt securing lower link to rear hub to 100 Nm.
25. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
26. Remove stand(s) and lower vehicle.

DAMPER - RH

Service repair no - 64.30.02

Remove

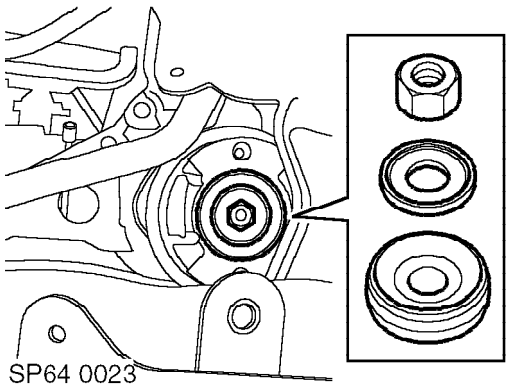
1. Remove engine compartment access panel. ***See ENGINE, Repairs.***


SP64 0022

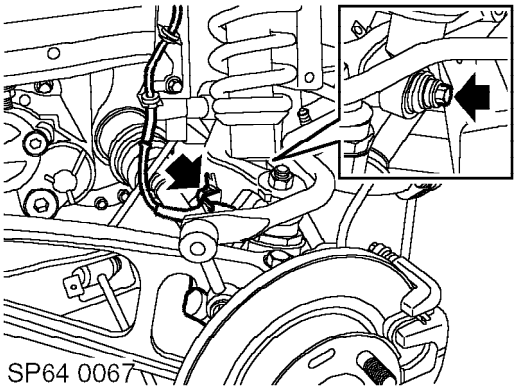
2. Remove 2 bolts securing expansion tank to body, position expansion tank aside.
3. Raise rear of vehicle and support on stand(s).

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

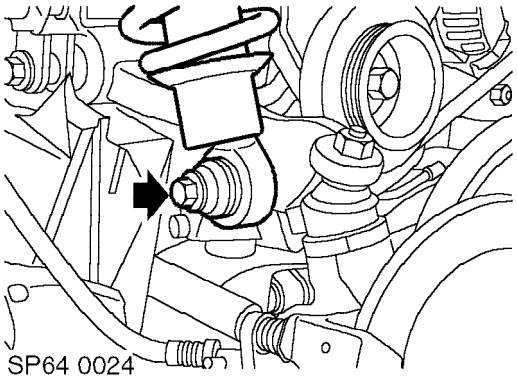
4. Remove road wheel(s).


SP64 0023

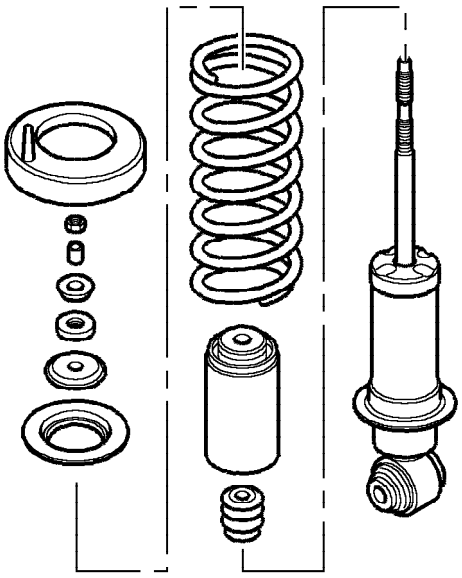
5. Position 5 mm Allen key in top of damper shaft, remove nut securing damper to subframe turret.
6. Remove retaining washer and rubber bush.


SP64 0067

7. Remove nut from RH damper retaining bolt securing ABS lead support bracket and release bracket.


SP64 0024

8. Remove bolt securing damper to upper suspension arm, remove damper/spring assembly and collect spring isolator.
9. Position damper/spring assembly in vice.


SP64 0025

10. Progressively loosen and remove spring retainer nut, remove distance piece, flat washer, steel cup washer and spring retainer. Note fitted position of steel cup washer.
11. Remove spring, dust shield and rebound rubber bush from damper.
12. Remove damper from vice.

Refit

1. Prime new damper by operating it at least 3 full strokes.
2. Position new damper in vice.
3. Position rebound rubber bush on damper shaft.
4. Correctly position spring and dust shield onto damper.
5. Correctly position spring retainer, steel cup washer, flat washer and distance piece. Fit and tighten nut securing spring retainer to damper to 25 Nm.
6. Correctly position spring isolator, ensure locating tag is located through front hole in subframe turret.
7. Position damper assembly in subframe turret, fit top bush, washer and nut. Do not tighten nut at this stage.
8. Position damper assembly to upper suspension arm, fit and tighten bolt to 100 Nm.
9. Position 5 mm Allen key in top of damper shaft, tighten nut to 45 Nm
10. Position ABS harness support bracket, fit and tighten nut to 30 Nm.
11. Position expansion tank, fit and tighten bolts to 8 Nm.
12. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
13. Remove stand(s) and lower vehicle.
14. Fit engine compartment access panel. ***See ENGINE, Repairs.***

ANTI-ROLL BAR - REAR

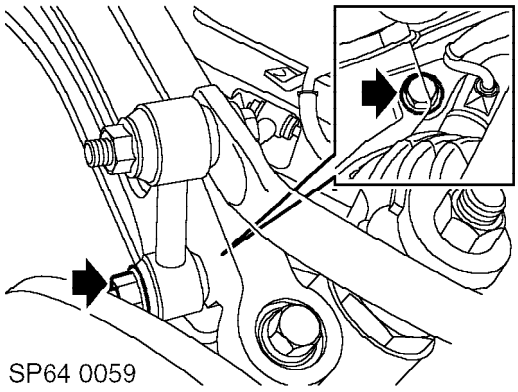
Service repair no - 64.35.08

Remove

1. Raise rear of vehicle and support on stand(s).

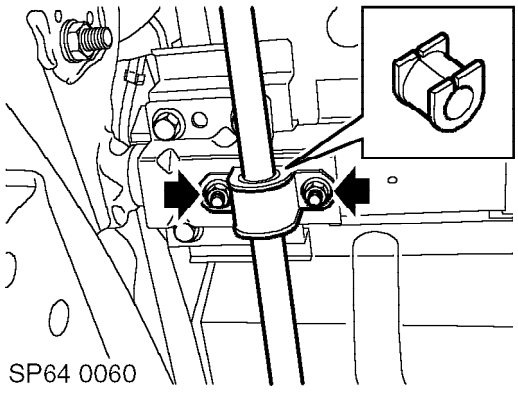
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
3. Remove road wheel(s).


SP64 0059

4. Remove nuts and bolts securing anti-roll bar links to LH and RH trailing arms.

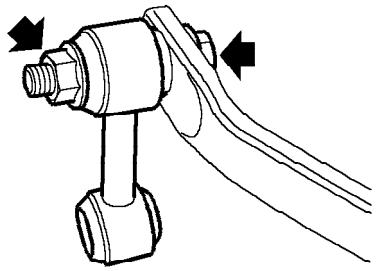
NOTE: Fitted position of link retaining nuts and bolts and anti-roll bar to link.


SP64 0060

5. Remove 2 nuts securing each anti-roll bar mounting rubber clamp to subframe, remove clamps and anti-roll bar.

CAUTION: The rear anti-roll bar is handed, the letter 'R' denotes RH side of suspension.

6. Remove 2 mounting rubbers from anti-roll bar.



SP64 0061

7. Remove nuts and bolts securing anti-roll bar links to anti-roll bar.
8. Check anti-roll bar link bushes for wear.

Refit

1. Clean anti-roll bar and anti-roll bar links.
2. Correctly position links to anti-roll bar, fit bolts and nuts but do not tighten at this stage.
3. Fit mounting rubbers to anti-roll bar.
4. Correctly position anti-roll bar, align anti-roll bar links to LH and RH trailing arms. Fit bolts and nuts but do not tighten at this stage.
5. Position mounting rubbers, fit clamps, fit and tighten nuts to 22 Nm.
6. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
7. With the weight of the vehicle on the rear suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Remove stand(s) and lower vehicle.

LINK - ANTI-ROLL BAR

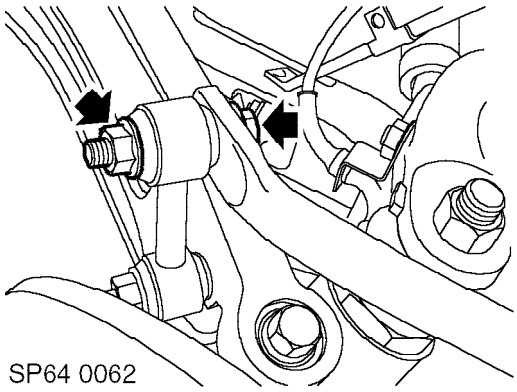
Service repair no - 64.35.24

Remove

1. Raise rear of vehicle and support on stand(s).

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

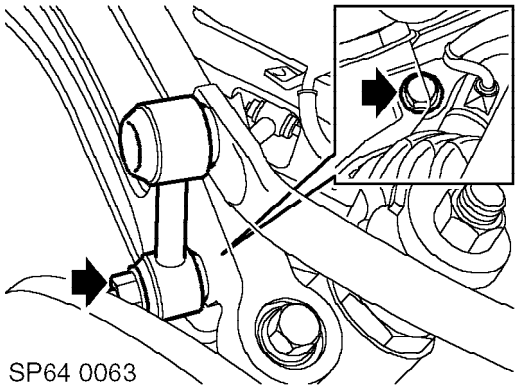
2. Remove road wheel(s).



SP64 0062

3. Remove nut and bolt securing anti-roll bar link to anti-roll bar.

NOTE: Note fitted position of link retaining nuts and bolts and anti-roll bar to link.



SP64 0063

4. Remove nut and bolt securing anti-roll bar link to trailing arm and remove link.

Refit

1. Clean anti-roll bar link.
2. Correctly position anti-roll bar link to trailing arm, fit bolt and nut but do not tighten at this stage.
3. Correctly position anti-roll bar to anti-roll bar link, fit bolt and nut but do not tighten at this stage.
4. With the weight of the vehicle on the rear suspension, tighten anti-roll bar link nuts and bolts to 35 Nm.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stand(s) and lower vehicle.

LOWER LINK - REAR

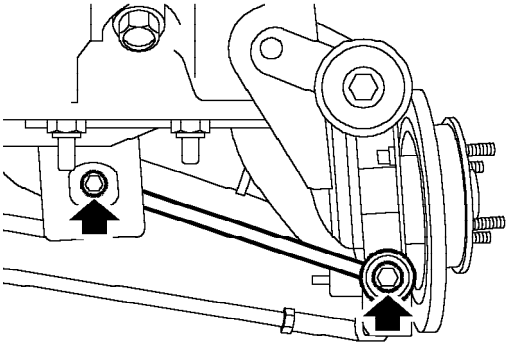
Service repair no - 64.35.13

Remove

1. Raise rear of vehicle and support on stand(s).

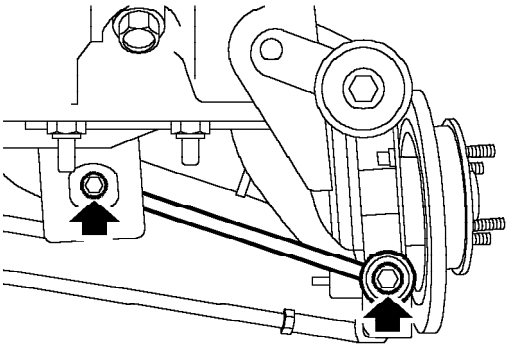
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel.



SP64 0036

3. Remove lower link access grommet from subframe.



SP64 0036

4. Remove 2 bolts securing lower link to subframe and rear hub.
5. Remove lower link assembly.
6. Collect lower link bush spacer.

Refit

1. Position lower link to subframe and rear hub.
2. Fit lower link bush spacer.
3. With the weight of the vehicle on the suspension, tighten lower link to subframe bolt to 85 Nm and lower link to rear hub bolt to 100 Nm.
4. Fit bolt access grommet to subframe.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.

TRACK CONTROL ARM

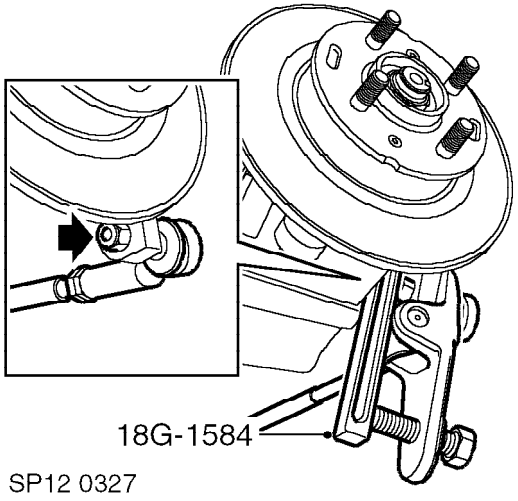
Service repair no - 64.35.14

Remove

1. Raise rear of vehicle.

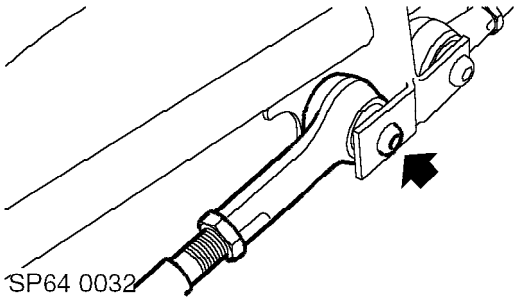
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel.



SP12 0327

3. Remove nut securing track control arm ball joint to rear hub.
4. Fit slave nut to ball joint threads, position tool **18G 1584** , release ball joint taper from rear hub. Remove slave nut.


SP64 0032

5. Remove torx bolt securing track control arm to subframe and remove track control arm.

Refit

1. Clean ball joint taper, track control arm and subframe mating faces.
2. Position track control arm to subframe and rear hub.
3. Fit and tighten torx bolt securing track control arm to rear subframe to 60 Nm.
4. Fit and tighten nut securing track control arm to rear hub to 38 Nm.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.
7. Check rear wheel alignment. ***See STEERING, Adjustments.***

TRAILING ARM

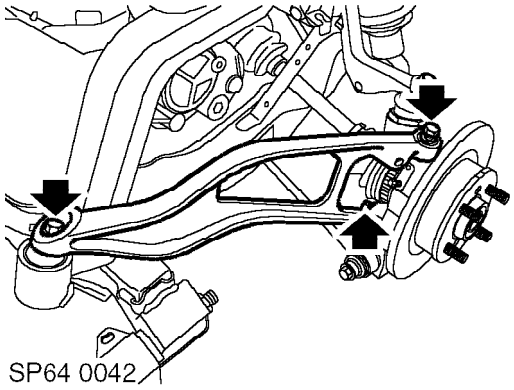
Service repair no - 64.35.46

Remove

1. Raise rear of vehicle and support on stand(s).

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

2. Remove road wheel.
3. Remove wheel arch access panel (RH side only).



4. Remove nut and bolt securing trailing arm to trailing arm compliance bush.
5. Remove 2 bolts securing trailing arm to rear hub.
6. Manoeuvre trailing arm from vehicle.

Refit

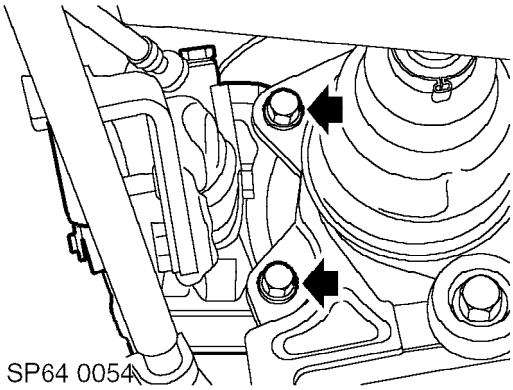
1. Clean mating faces of trailing arm and trailing arm bushes.
2. Clean and thoroughly dry bolts securing trailing arm to rear hub.
3. Manoeuvre trailing arm into position.
4. Apply Loctite 242 to the first 3 threads of bolts securing trailing arm to rear hub.
5. Fit bolts securing trailing arm to rear hub, do not tighten at this stage.
6. Ft nut and bolt securing trailing arm to trailing arm compliance bush and tighten to 100 Nm.
7. Tighten trailing arm to hub bolts to 60 Nm.
8. Fit wheel arch access panel and secure with screws (RH side only).
9. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
10. Remove stands and lower vehicle.

BUSH - TRAILING ARM

Service repair no - 64.35.48

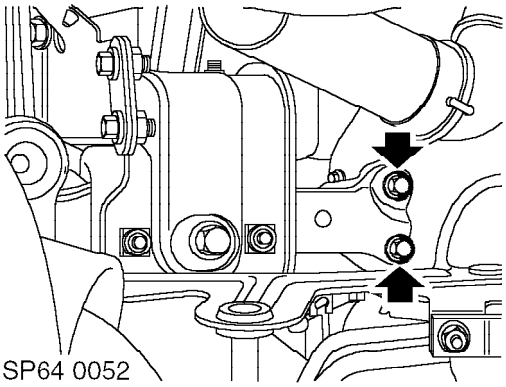
Remove

1. Disconnect battery earth lead.
2. Raise vehicle on a 2 post ramp.
3. Remove road wheel(s).
4. Remove rear silencer heat shield. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
5. Remove trailing arm. ***See this section.***

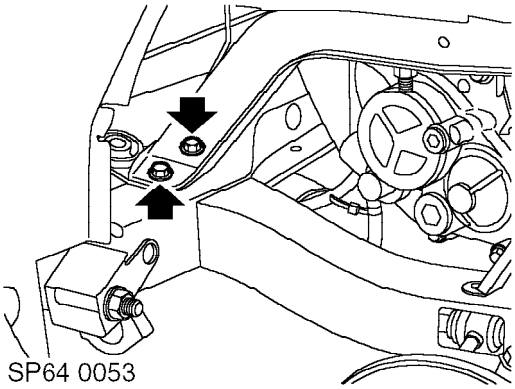

SP64 0054

6. Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.

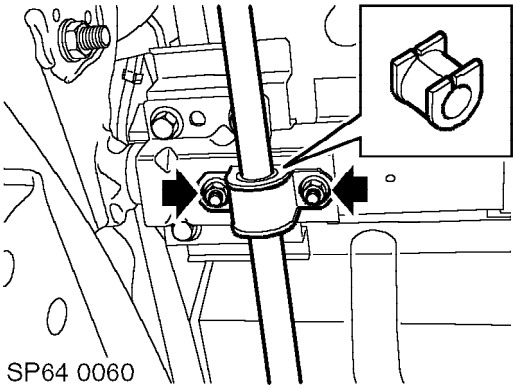
CAUTION: Do not allow caliper to hang on brake hose.


SP64 0052

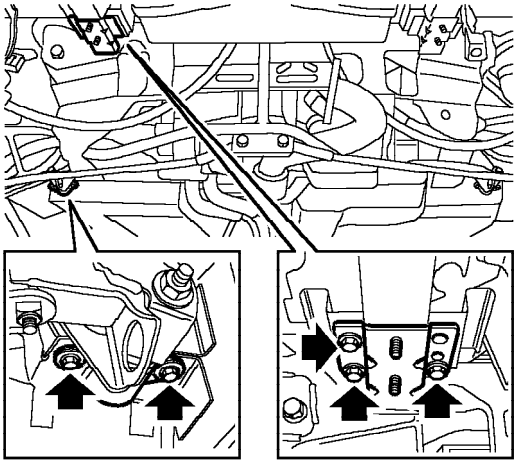
7. Loosen 2 bolts securing rear of buttress to subframe.


SP64 0053

8. Remove 2 bolts securing front of buttress to subframe.


SP64 0060

9. Remove 4 nuts securing anti-roll bar mounting clamps to both rear subframe mountings and collect clamps.
10. Support subframe with trolley jack.


SP64 0050

11. Remove 2 bolts securing front subframe mounting to body.

12. Remove 3 bolts securing rear subframe mounting to body.
13. Carefully lower subframe on trolley jack until sufficient room is gained to remove the trailing arm bush.
14. Support the weight of the gearbox and raise sufficiently to release trailing arm bush from the buttress.

CAUTION: To prevent damage to components, cushion the jack pad with a block of wood or hard rubber.

15. Release trailing arm bush from subframe and remove trailing arm bush.

NOTE: If trailing arm bush mounting includes a separate snubber plate this must be retained and refitted in the same orientation as orignally fitted.

Refit

1. Position trailing arm bush to subframe and align to buttress, fit bolts securing buttress, but do not tighten at this stage.
2. Remove gearbox support.
3. Raise subframe on trolley jack, fit and tighten bolts securing rear subframe mounting to body to 45 Nm.
4. Position anti-roll bar, fit clamps, fit and tighten nuts to 22 Nm.
5. Fit and tighten bolts securing front subframe mounting to body to 30 Nm.
6. Tighten buttress bolts to 45 Nm.
7. Fit trailing arm. ***See this section.***
8. Clean mating faces of caliper and hub.
9. Position caliper to hub, fit and tighten bolts to 85 Nm.
10. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
11. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
12. Lower vehicle on ramp.
13. Connect battery earth lead.

BUSH - TRAILING ARM TO HUB

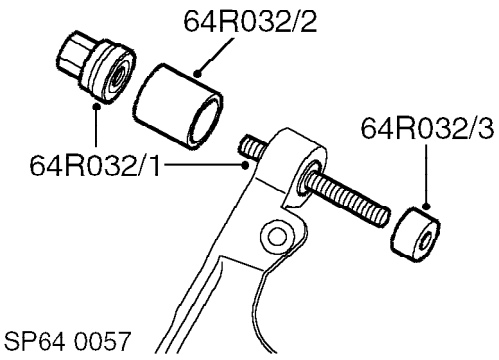
Service repair no - 64.35.49

Remove

1. Raise rear of vehicle.

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

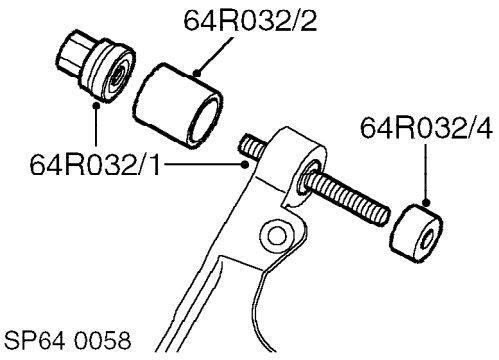
2. Remove road wheel.
3. Remove trailing arm. ***See this section.***



4. Note the fitted position of trailing arm bushes.
5. Using tool **64R032** with adaptor **64R032/3** remove trailing arm bushes.

Refit

1. Clean trailing arm bushes and bush recesses.



2. Ensure correct orientation of trailing arm bushes.
3. Using tool **64R032** with adaptor **64R032/4** fit trailing arm bushes.

4. Fit trailing arm. ***See this section.***
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.

BUSH - ARM ASSEMBLY - UPPER

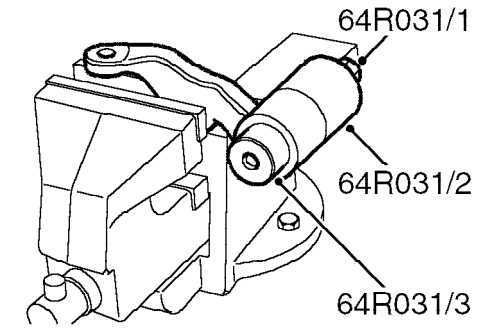
Service repair no - 64.35.56

Remove

1. Raise rear of vehicle and support on stand(s).

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

2. Remove road wheel.
3. Remove upper suspension arm. ***See this section.***

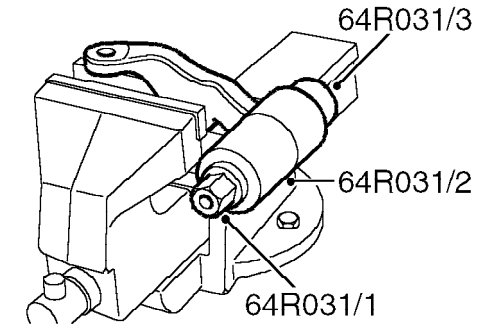


SP64 0055

4. Position upper suspension arm in vice.
5. Note the fitted position of upper arm bush.
6. Using **64R031** remove upper arm bush.

Refit

1. Clean upper arm bush and bush mating face.



SP64 0056

2. Ensure correct orientation of upper arm bush.
3. Using **64R031** fit upper arm bush.
4. Remove upper arm assembly from vice.

5. Fit upper suspension arm. ***See this section.***
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stands and lower vehicle.

ARM ASSEMBLY - UPPER

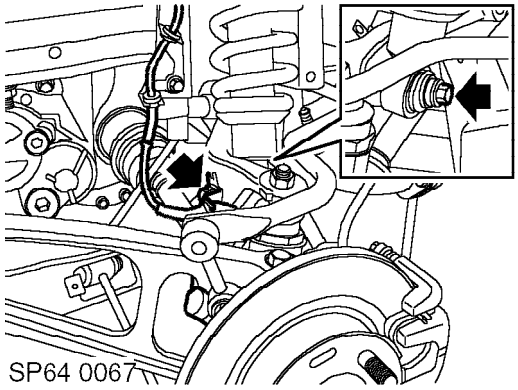
Service repair no - 64.35.60

Remove

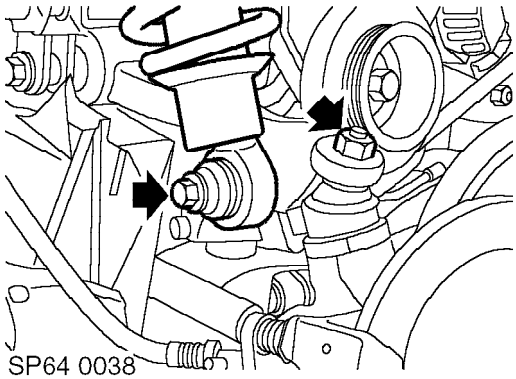
1. Raise rear of vehicle and support on stand(s).

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

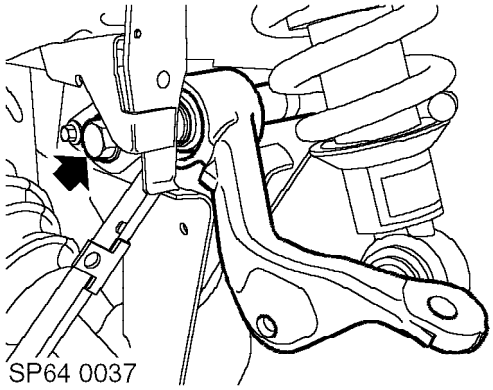
2. Remove road wheel.


SP64 0067

3. Remove nut and bolt securing damper to upper suspension arm.
4. Release ABS sensor harness bracket.


SP64 0038

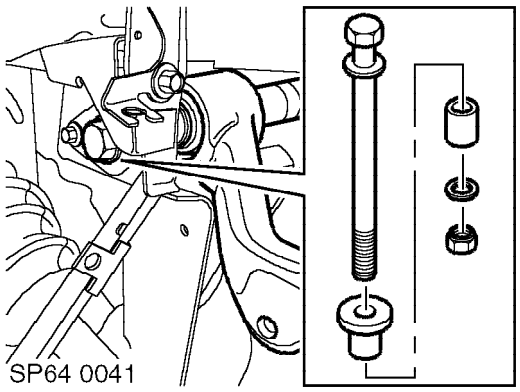
5. Remove and discard lock nut securing ball joint to upper suspension arm.
6. Fit slave nut to ball joint threads, position tool **18G-1584,** release ball joint taper from upper suspension arm. Remove slave nut.


SP64 0037

7. Remove nut and bolt securing upper arm to subframe.
8. Noting the position of spacers, remove upper arm and spacers.

Refit

1. Clean upper arm bolt, spacers and upper arm and subframe mating faces,


SP64 0041

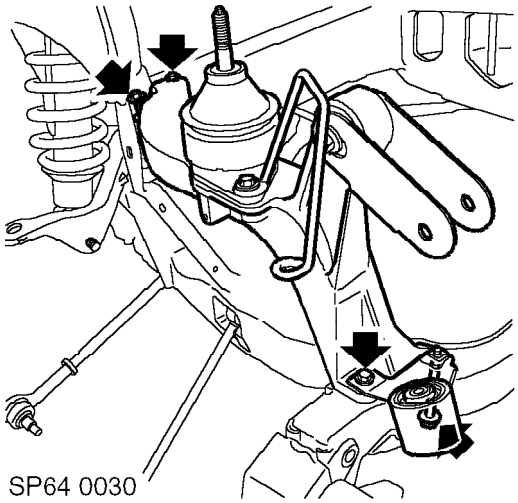
2. Position upper arm and spacers. Ensure top hat spacer is fitted correctly.
3. Fit nut and bolt securing upper arm, do not tighten at this stage.
4. Position ball joint to upper suspension arm, fit new lock nut and tighten nut to 54 Nm.
5. Align damper to upper arm, fit bolt and tighten to 100 Nm.
6. Align ABS harness bracket fit nut and tighten to 30 Nm.
7. With the weight of the vehicle on the suspension, tighten upper arm bolt to 100 Nm.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Remove stand(s) and lower vehicle.

SUB FRAME - REAR SUSPENSION - MANUAL TRANSMISSION MODELS

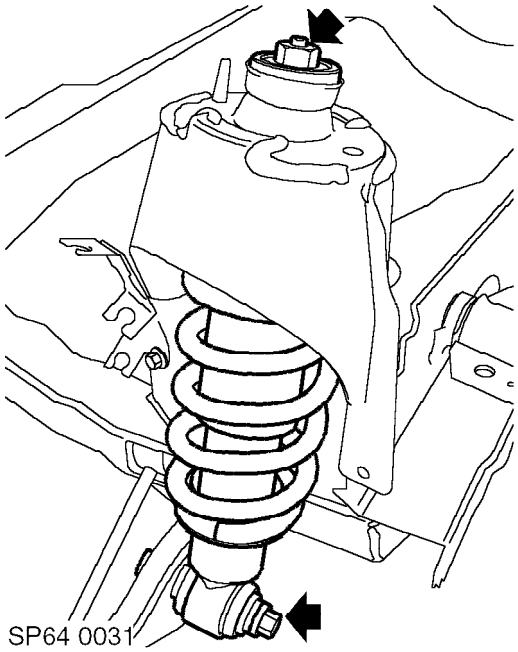
Service repair no - 64.35.78

Remove

1. Remove engine and gearbox assembly. ***See ENGINE, Repairs.***
2. Collect LH trailing arm bush.

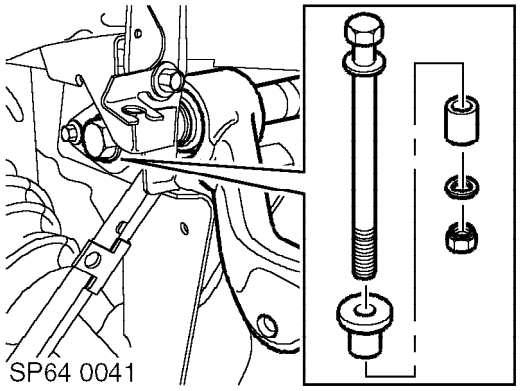

SP64 0030

3. Remove 4 bolts securing RH buttress to subframe, remove buttress and trailing arm bush.

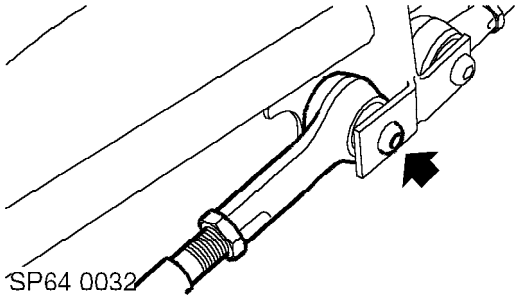

SP64 0031

4. Position 5 mm Allen key in top of damper shaft, remove nut securing damper to subframe turret.

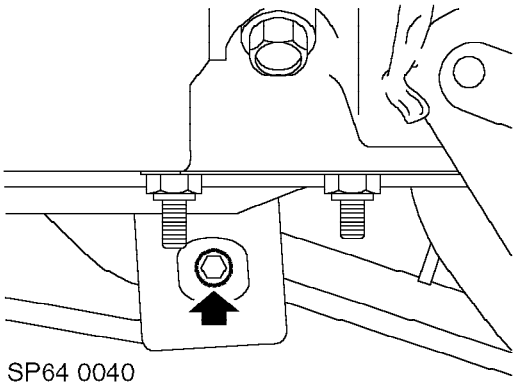
5. Remove retaining washer and rubber bush.
6. Remove bolt securing damper to upper suspension arm, remove damper/spring assembly and collect spring isolator.


SP64 0041

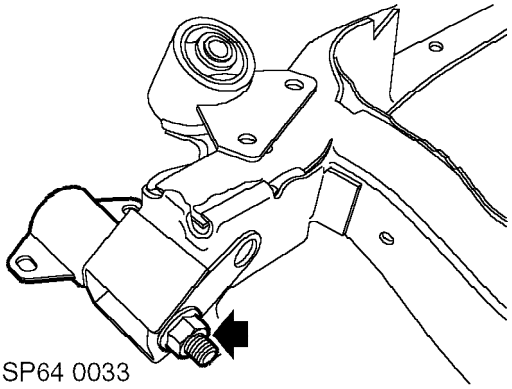
7. Remove nut and bolt securing upper arm to subframe.
8. Noting the position of spacers, remove upper arm and spacers.


SP64 0032

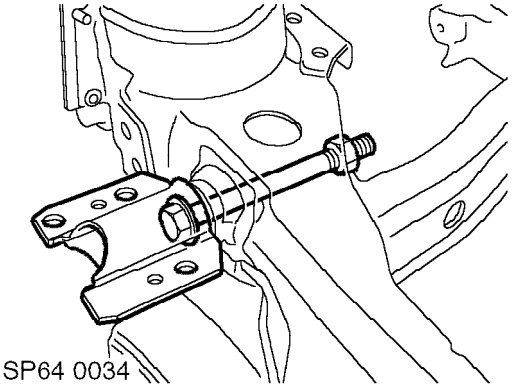
9. Remove torx bolt securing track control arm to subframe and remove track control arm.


SP64 0040

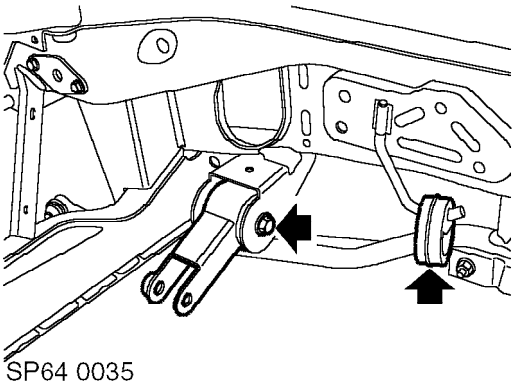
10. Remove access grommet and remove bolt securing lower link to subframe.
11. Noting the fitted position remove lower link.
12. Collect lower link bush spacer.
13. Repeat operations for opposite side of suspension.


SP64 0033

14. Remove nut and bolt securing front mounting to subframe and collect mounting.


SP64 0034

15. Remove nut and bolt securing rear mounting to subframe and collect mounting.
16. Repeat operations for opposite side of suspension.


SP64 0035

17. Remove bolt securing rear engine mounting tie-rod to subframe and collect tie-rod.
18. Remove exhaust mounting rubber from subframe.

Refit

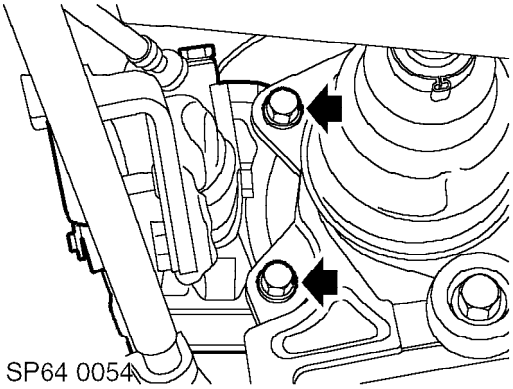
1. Fit exhaust mounting rubber to subframe.
2. Position LH and RH front mountings to subframe, fit and tighten nuts and bolts to 100 Nm.
3. Position LH and RH rear mountings to subframe, fit and tighten nuts and bolts to 100 Nm.
4. Position rear engine mounting tie-rod to subframe,fit and tighten bolt to 85 Nm.
5. Position RH buttress and trailing arm bush to subframe, fit and tighten bolts to 45 Nm.
6. Ensuring correct orientation, position lower link and lower link bush spacer, fit bolt but do not tighten at this stage.
7. Position upper arm and spacers. Ensure top hat spacer is fitted correctly.
8. Fit nut and bolt securing upper arm, do not tighten at this stage.
9. Correctly position spring isolator, ensure locating tag is located through front hole in subframe turret.
10. Position damper assembly in subframe turret, fit top bush, washer and nut. Do not tighten nut at this stage.
11. Position damper assembly to upper suspension arm, fit and tighten bolt to 100 Nm.
12. Position 5 mm Allen key in top of damper shaft, tighten nut to 45 Nm
13. Position RH track control arm to subframe, fit and tighten torx bolt to 60 Nm.
14. Repeat operations for opposite side of suspension.
15. Position LH trailing arm bush.
16. Fit engine and gearbox assembly. ***See ENGINE, Repairs.***
17. With the weight of the vehicle on the suspension tighten lower link to subframe bolt to 85 Nm.
18. With the weight of the vehicle on the suspension tighten upper arm bolt to 100 Nm.
19. Fit bolt access grommet to subframe.
20. Check rear wheel alignment. ***See STEERING, Adjustments.***

REAR SUB FRAME - LH - FRONT MOUNTING

Service repair no - 64.35.90

Remove

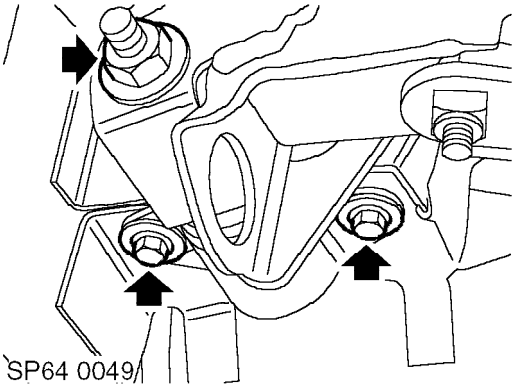
1. Raise vehicle on a 2 post ramp.
2. Remove road wheel(s).
3. Remove rear silencer heat shield. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***



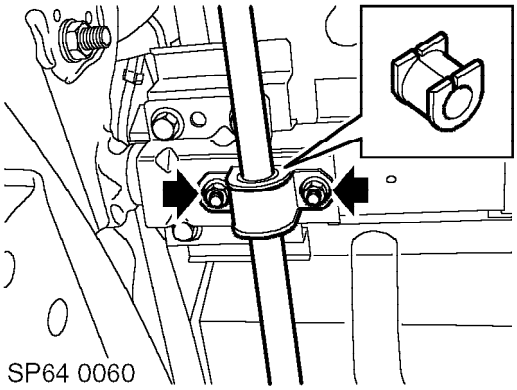
4. Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.

CAUTION: Do not allow caliper to hang on brake hose.

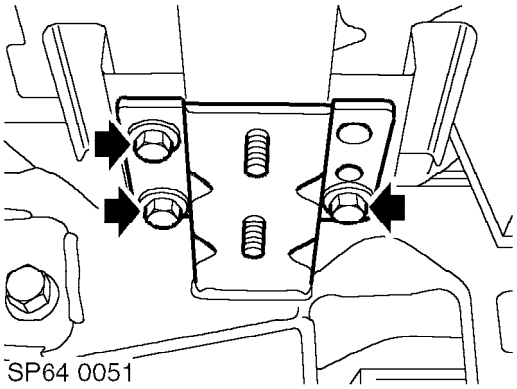
5. Support subframe with trolley jack.



6. Remove nut from front subframe mounting centre bolt.
7. Remove 2 bolts securing front subframe mounting to body.



8. Remove 4 nuts securing anti-roll bar mounting clamps to both rear subframe mountings and collect clamps.



9. Remove 3 bolts securing rear subframe mounting to body.
10. Carefully lower subframe on trolley jack until sufficient room is gained to remove centre bolt and front subframe mounting.

Refit

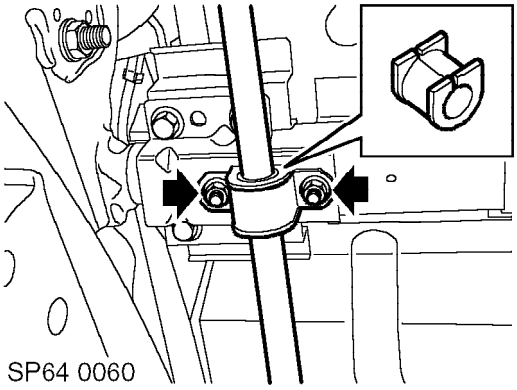
1. Position mounting and centre bolt to subframe, fit nut but do not tighten at this stage.
2. Raise subframe on trolley jack, fit and tighten bolts securing rear subframe mounting to body to 45 Nm.
3. Position anti-roll bar, fit clamps, fit and tighten nuts to 22 Nm.
4. Fit and tighten bolts securing front subframe mounting to body to 30 Nm.
5. Tighten front subframe mounting centre nut and bolt to 100 Nm.
6. Clean mating faces of caliper and hub.
7. Position caliper to hub, fit and tighten bolts to 85 Nm.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
10. Lower vehicle on ramp.

REAR SUB FRAME - LH - REAR MOUNTING

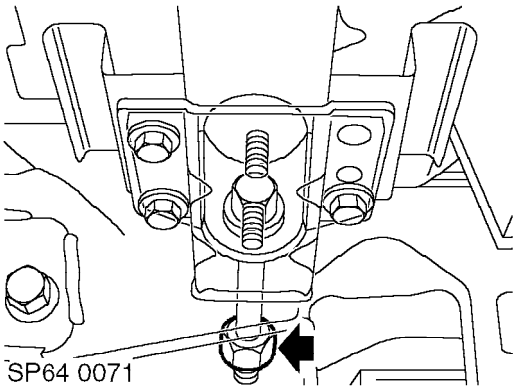
Service repair no - 64.35.91

Remove

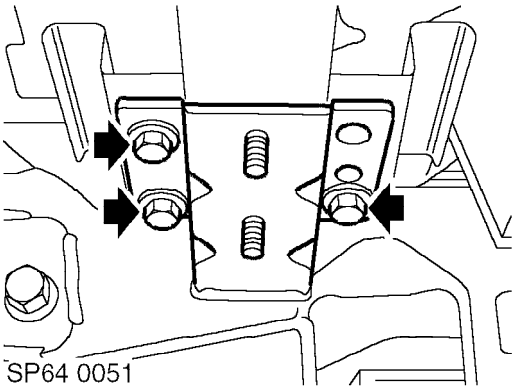
1. Raise vehicle on a 2 post ramp.
2. Remove heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***


SP64 0060

3. Remove 2 nuts securing anti-roll bar clamp to subframe, remove clamp and rubber mounting.
4. Support subframe with trolley jack.


SP64 0071

5. Remove centre nut securing rear subframe mounting to subframe.


SP64 0051

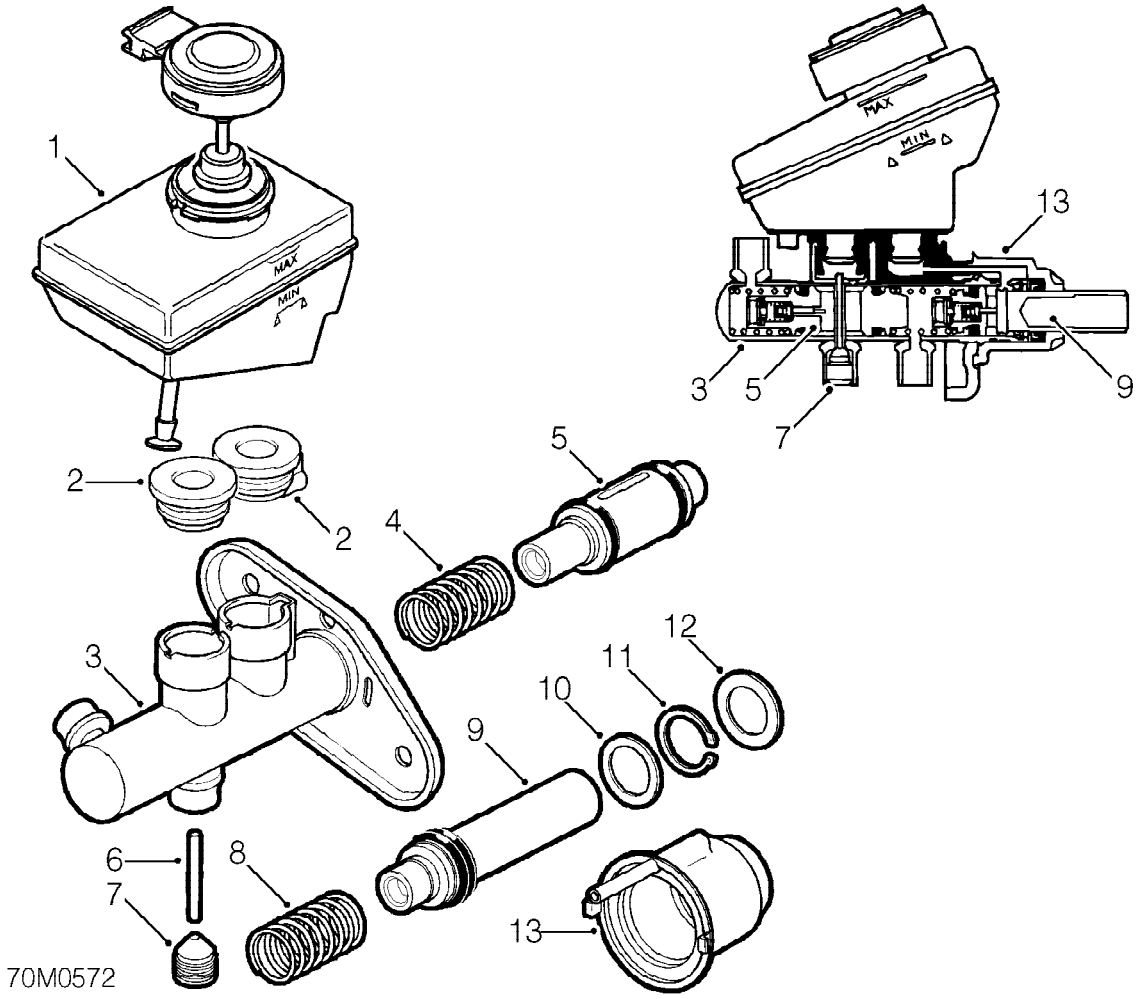
6. Remove 3 bolts securing rear subframe mounting to body.
7. Carefully lower subframe on trolley jack, remove centre bolt and rear subframe mounting.

Refit

1. Position mounting to subframe, fit centre bolt, fit nut but do not tighten at this stage.
2. Raise subframe on jack.
3. Fit and loosely tighten one bolt each side of rear subframe mounting to hold mounting in position. DO NOT fit anti-roll bar bracket at this stage.
4. Tighten centre bolt and nut to 100 Nm.
5. Remove bolts holding rear subframe mounting in position.
6. Position anti-roll bar bracket to subframe, fit and tighten rear suspension mounting to body bolts to 45 Nm.
7. Position mounting rubber and clamp to anti-roll bar, fit and tighten nuts to 22 Nm.
8. Fit heat shield - rear silencer. ***See MANIFOLD & EXHAUST SYSTEMS, Repairs.***
9. Lower vehicle on ramp.

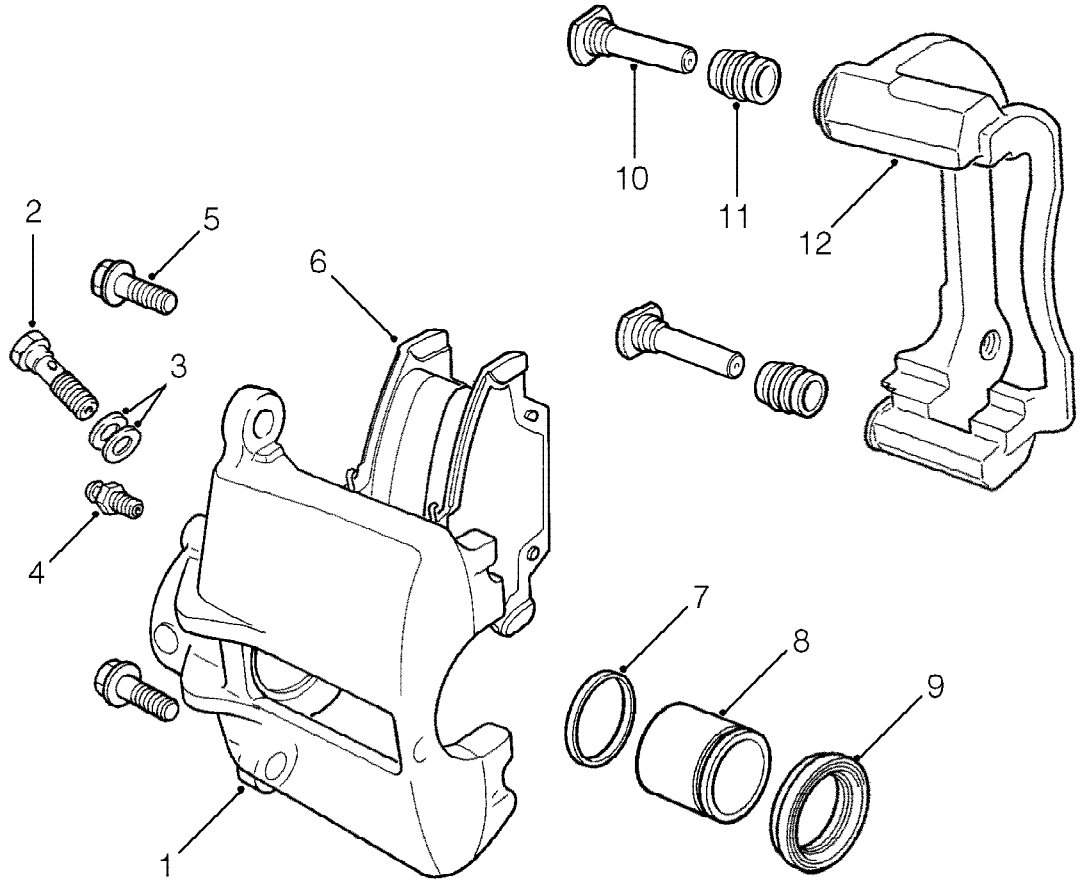
CONTENTS

MASTER CYLINDER COMPONENTS



1. Brake fluid reservoir
2. Seals
3. Cylinder body
4. Spring
5. Secondary plunger assembly
6. Stop pin secondary plunger
7. Pin securing screw
8. Spring
9. Primary plunger assembly
10. Washer
11. Circlip
12. Flat washer
13. Transfer housing

FRONT BRAKE CALIPER COMPONENTS

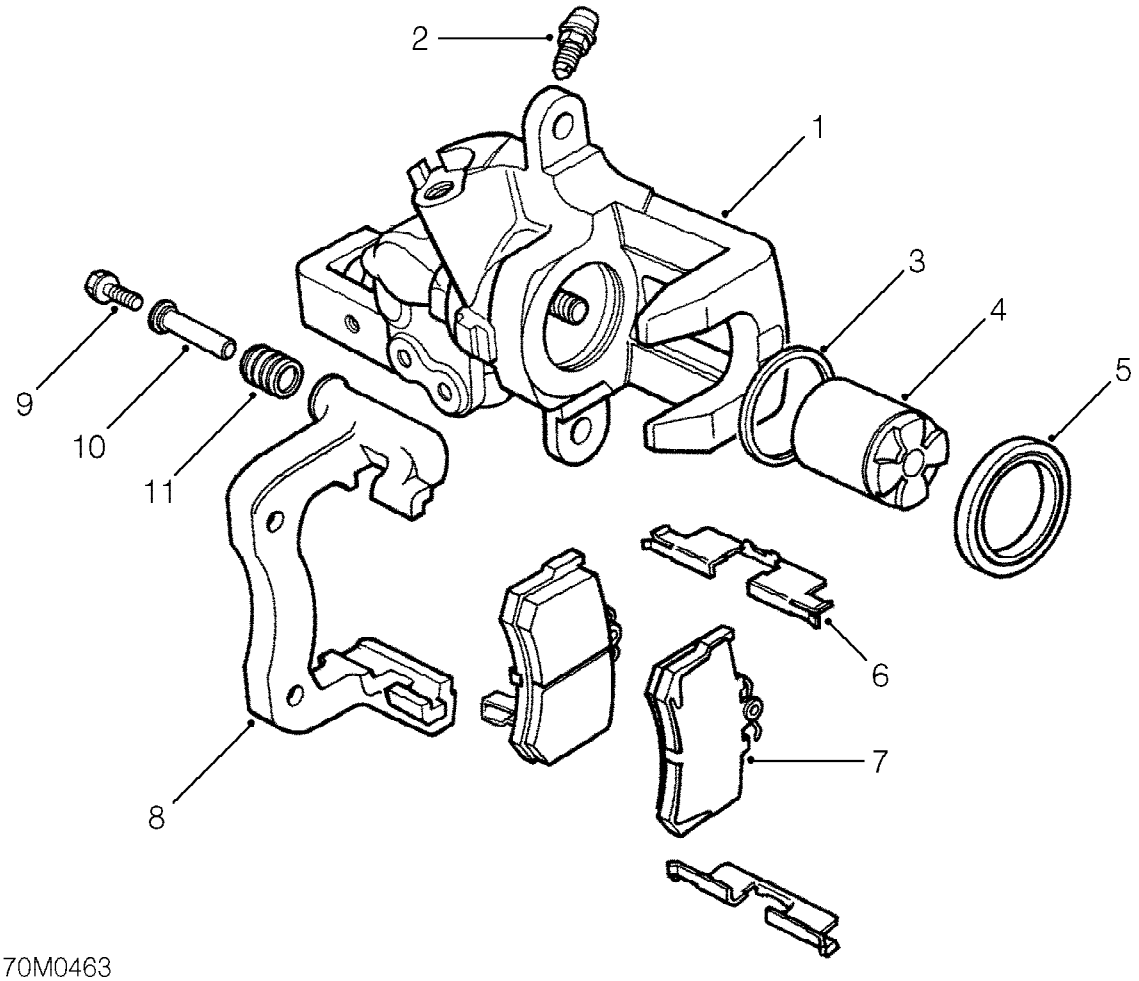


70M0462

Standard calipers shown, Sports version similar

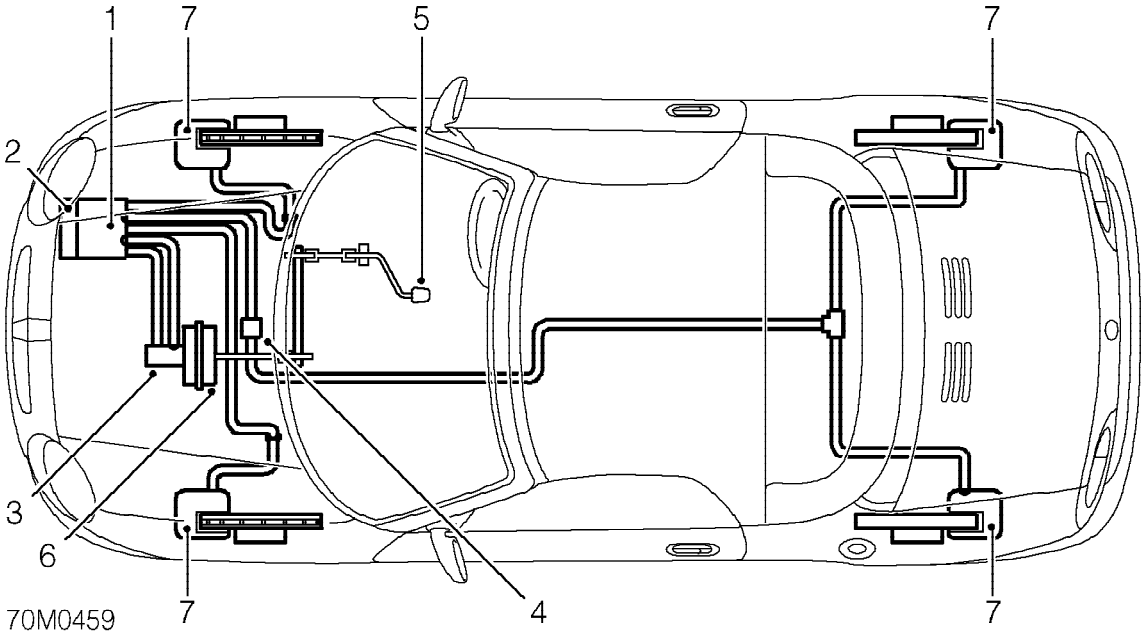
1. Caliper body
2. Hose banjo bolt
3. Hose banjo washer
4. Bleed screw
5. Guide pin bolt
6. Brake pad
7. Piston seal
8. Piston
9. Dust cover
10. Guide pin
11. Boot
12. Caliper carrier

REAR BRAKE CALIPER COMPONENTS



1. Caliper body
2. Bleed screw
3. Piston seal
4. Piston
5. Dust cover
6. Shim
7. Brake pad
8. Caliper carrier
9. Guide pin bolt
10. Guide pin
11. Boot

ABS ANTI-LOCK BRAKING SYSTEM



1. ABS modulator unit
2. Electronic control unit
3. Master cylinder
4. Brake pressure proportioning valve
5. Brake pedal
6. Servo unit
7. Brake caliper

Description

The ABS system is an electronic control unit (ECU), controlled system deriving its input from four speed sensors, one mounted at each wheel, which allow the ABS to control the hydraulic modulator to prevent the wheels locking during braking.

The operation of the ABS is completely dependent upon electronic signals. To prevent the ABS responding to any inaccurate signals, a built in safety circuit monitors all electric and electronic signals, including battery voltage. If an inaccurate signal or low battery voltage is detected, the ABS is shut down immediately and the warning light on the fascia is illuminated to inform the driver that the brake system will respond to pedal pressure in the same manner as a non ABS.

Operation

Servo

Inlet manifold vacuum is transmitted through a hose and non-return valve to the servo. Inside the servo, this vacuum is felt on both sides of the diaphragm. When the brake pedal is pressed, the servo push rod opens a valve and allows atmospheric pressure to be drawn through the filter into the pedal side of the diaphragm. The pressure differential, acting on the diaphragm, increases the pressure being applied at the brake pedal and transmits it to the master cylinder through a push rod.

Master cylinder

When the foot brake is applied the primary plunger moves up the bore of the cylinder and the pressure created acts in conjunction with the primary spring to overcome the secondary spring, thus moving the secondary plunger up the bore of the cylinder simultaneously. Initial movement of both plungers causes them to be pushed off their stop pins, thus closing both primary and secondary centre valves. Further movement of the plungers pressurises the fluid which is directed into the two separate hydraulic circuits connected to the hydraulic modulator.

The primary circuit operates the front brakes and the secondary circuit operates the rear brakes.

The fluid in the chambers behind the plungers is unaffected by any movement of the plungers and can flow unrestricted between chamber and reservoir both before and during brake application.

When the brake pedal is released, the primary and secondary springs force their respective pistons back down the bore of the cylinder. As the plungers contact the stop pins the primary and secondary centre valves are opened allowing fluid to circulate unrestricted between the two hydraulic circuits and the fluid reservoir.

The movement of fluid during brake application/release is compensated for by fluid from the separate reservoirs within the supply tank moving through the feed holes in the cylinder. Conversely the final movement of the plungers causes any surplus fluid to move through the cut-off holes in the fluid reservoirs.

Should a failure occur in one system, the remaining system will still operate effectively, although the brake pedal travel will increase.

Calipers

Pressure at the caliper forces the caliper piston against the inner brake pad and, in turn, against the disc. The caliper body reacts and slides on the guide pins to bring the outer pad into contact with the disc.

Modulator operation

Type: ABS 5.3

For information on the electrical operation of ABS 5.3 See **ELECTRICAL REFERENCE LIBRARY, Description and Operation.**

With the vehicle in motion, the ECU receives signals from the four wheel sensors. From these signals the ECU can determine the speed of the vehicle. This is the speed which the ECU uses as a reference when evaluating the deceleration of each wheel.

This reference speed is continually calculated, even during braking. If one or more of the wheels are decelerating faster than the others, indicating a wheel is near the point of locking, the anti-lock sequence will be initiated.

The hydraulic modulator has three operation phases:

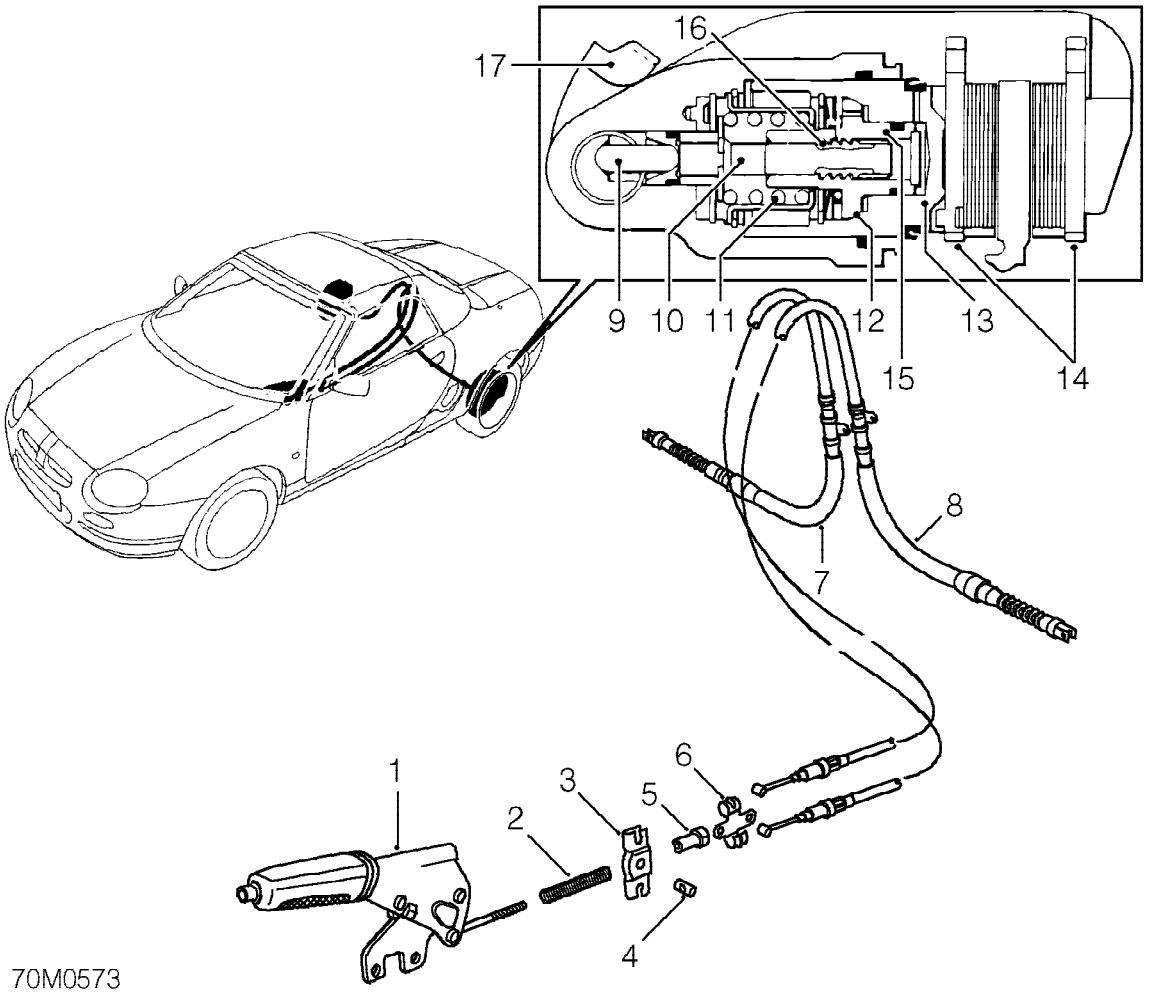
1. Increase pressure phase: The ABS system is at rest and fluid pressure from the master cylinder is allowed to pass through the solenoid valves in the hydraulic modulator to operate the caliper on each wheel.
2. Maintain pressure phase: The caliper is isolated from the master cylinder preventing any pressure increase due to increased pedal pressure.
3. Decrease pressure phase: The caliper is connected to the return pump which pumps the fluid back to the master cylinder.

Brake pressure proportioning valve

The fluid line for the rear brake circuit is connected to the proportioning valve. The circuit for the front brakes uses a separate three way connector for distribution.

Pressure to the rear brakes passes through a piston sleeve, past a poppet valve and out to the rear brakes. The same pressure is also felt on the top of the piston, forcing the piston against spring pressure, towards the valve centre until the piston sleeve contacts the poppet valve and forms a seal. Input pressure is now balanced with output pressure. As further input pressure is applied from the master cylinder, it overcomes output pressure being felt on the piston and forces the piston outwards slightly away from the poppet valve allowing pressure past the poppet valve until output pressure is again balanced with input pressure.

HANDBRAKE OPERATION



1. Handbrake lever
2. Compensator spring
3. Compensator
4. Lever to compensator, retainer
5. Adjuster nut
6. Handbrake cable, abutment bracket
7. Handbrake cable, RH
8. Handbrake cable, LH
9. Plunger
10. Push rod
11. Spring
12. Cone seating
13. Piston
14. Brake pads
15. Adjuster nut
16. Push rod thread
17. Caliper lever

The handbrake operates on both rear discs via two rear cables, compensator and an intermediate rod which connects to the handbrake lever.

As the handbrake lever is applied, movement is transmitted through the intermediate rod to the compensator which, in turn, transmits movement to the two rear cables. Each rear cable pulls on a lever on a rear caliper.

Rotational movement of the caliper lever is changed to linear movement by a plunger which is forced out of its location by its inclined seating. The plunger contacts the push rod which, in turn, pushes the piston down its bore and forces the brake pads into contact with the disc.

Automatic adjustment of the disc brake pads is maintained by operation of the foot brake. With the brake pedal released, the piston is stationary in its bore and the adjuster nut is held against a cone seating inside the piston by the compression ring.

When the brake pedal is pressed, fluid pressure forces the piston down its bore and the compression spring causes the adjuster nut to follow. Initially the nut remains against its cone seating and just takes up the clearance between the push rod and its own thread, and if piston movement is within this tolerance no automatic adjustment takes place.

Further movement of the piston moves the cone seating away from the adjuster nut. This allows the compression spring to rotate the adjuster nut along the push rod thread until it again contacts the cone seating.

This extending action of the push rod assembly maintains adjustment of the handbrake mechanism.

When fluid pressure is released, the piston moves back and re-establishes the clearance between the push rod thread and the adjuster nut thread.

Manual adjustment of the handbrake cables is effected via the adjusting nut on the threaded intermediate rod bearing upon the compensator. ***See Adjustments.***

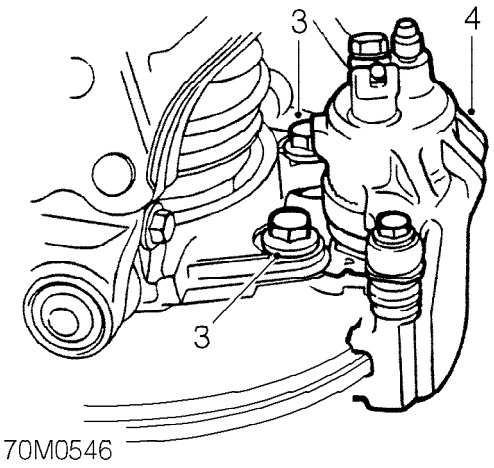
FRONT BRAKE DISC - STANDARD - CHECK THICKNESS AND RUN-OUT

Service repair no - 70.10.14

1. Raise front of vehicle.

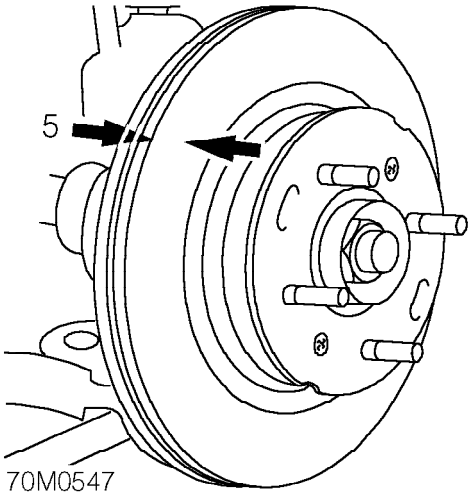
WARNING: Support on safety stands.

2. Remove road wheel(s).



3. Remove 2 bolts securing brake caliper to hub.
4. Release caliper from disc. Tie caliper clear of brake disc, ensuring that weight of caliper is supported.

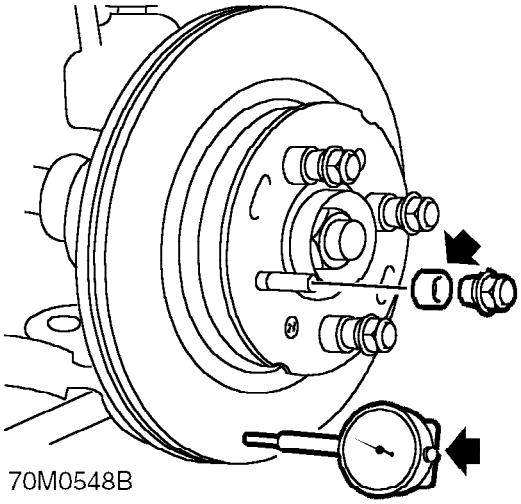
CAUTION: Do not allow caliper to hang on brake hose as weight of caliper may damage hose.



5. At 4 points around disc, measure disc thickness using a micrometer; renew disc if less than service limit or if maximum variation is exceeded:

   Disc thickness, new = 22.00 mm.
   Service limit = 20.00 mm.
   Thickness variation, maximum = 0.015 mm.

NOTE: Maximum variation limit: Both brake discs must be renewed at the same time, unless one disc requires changing at 1000 mile service. Only in this situation is renewal of one disc permissible.



6. Position a suitable spacer to each wheel stud and secure brake disc using wheel nuts. Tighten wheel nuts in a diagonal sequence to 70 Nm.
7. Secure and position dial test indicator probe 6 mm from outer edge of brake disc. Zero dial test indicator, rotate brake disc one complete turn to measure disc run-out.
   Disc run-out limit = 0.05 mm.
8. If run-out exceeds limit, mark disc to show position on drive flange; remove 2 screws retaining disc, remove disc and refit after rotating 180°. Tighten disc securing screws to 7 Nm and re-check disc run-out.
9. Renew disc if run-out exceeds limit even after re-positioning of disc on drive flange.
10. Untie caliper and support caliper weight.
11. Align caliper carrier to hub ensuring correct positioning of brake pads. Fit and tighten bolts to 85 Nm.
12. Apply foot brake several times to enable brake pads to position correctly.
13. Remove wheel nuts and spacers. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
14. Remove stand(s) and lower vehicle.

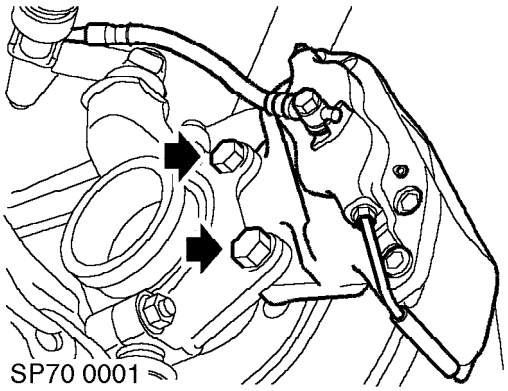
FRONT BRAKE DISC - SPORTS - CHECK THICKNESS AND RUN-OUT

Service repair no - 70.10.14

1. Raise front of vehicle.

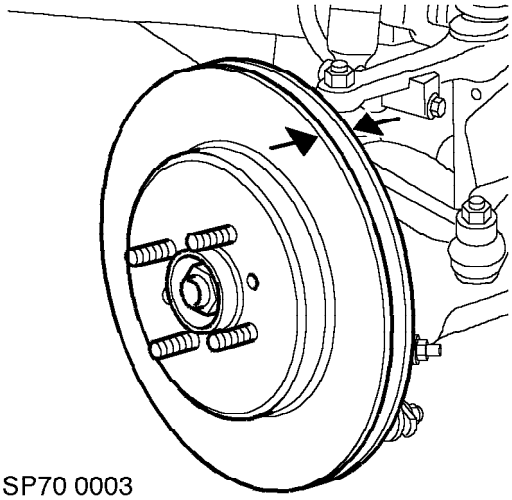
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Check brake disc run-out. ***See SUSPENSION, Adjustments.***



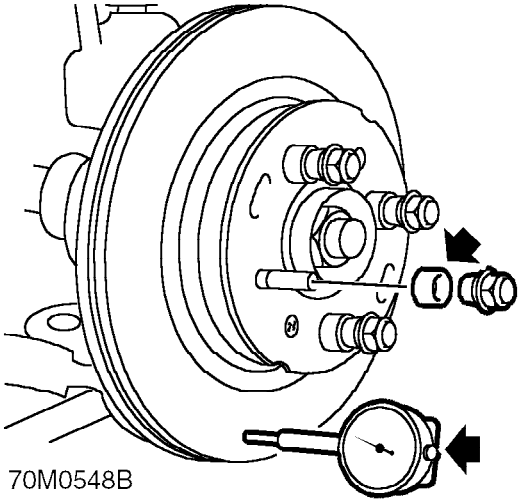
3. Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.

CAUTION: Do not allow caliper to hang on brake hose.



SP70 0003

4. At 4 points around disc, measure disc thickness using a micrometer; renew disc if less than service limit:
   Disc thickness, new = 24.00 mm.
   Service limit = 22.00 mm.



70M0548B

5. Position a suitable spacer to each wheel stud and secure brake disc using wheel nuts. Tighten wheel nuts in a diagonal sequence to 70 Nm.
6. Secure and position dial test indicator probe 6 mm from outer edge of brake disc. Zero dial test indicator, rotate brake disc one complete turn to measure disc run-out.
   Disc run-out limit = 0.05 mm.
7. If run-out exceeds limit, mark disc to drive flange location; remove wheel nuts, spacers and disc retaining screws. Remove disc, rotate 180° ; refit disc to drive flange. Fit and tighten disc retaining screws to 7 Nm, fit spacers and wheel nuts and tighten wheel nuts in a diagonal sequence to 70 Nm.
8. Renew disc if run-out exceeds limit even after re-positioning of disc on drive flange.

CAUTION: Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1500 kilometeres) from new.

9. Untie caliper, position caliper to hub, fit and tighten bolts to 85 Nm.
10. Remove wheel nuts and spacers.
11. Apply foot brake several times to enable brake pads to position correctly.
12. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
13. Remove stand(s) and lower vehicle.

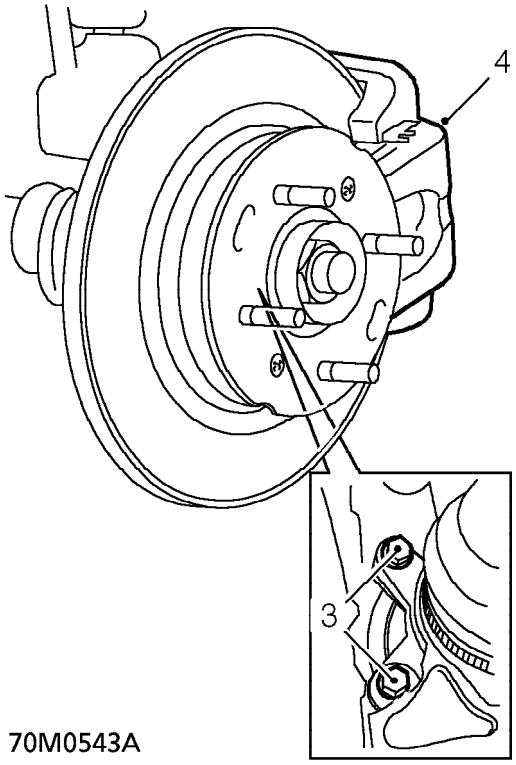
REAR BRAKE DISC - CHECK

Service repair no - 70.10.35

1. Raise rear of vehicle.

WARNING: Support on safety stands.

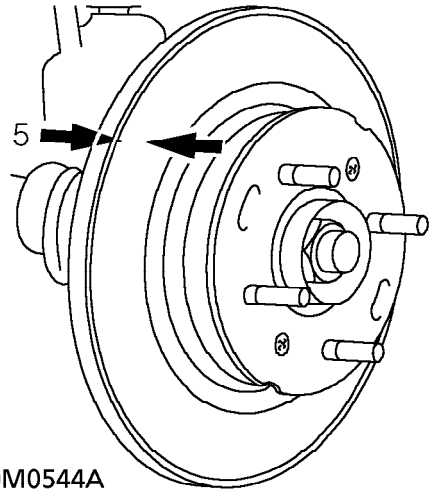
2. Remove road wheel(s).



70M0543A

3. Remove 2 bolts securing brake caliper to hub.
4. Release caliper from disc. Tie caliper clear of brake disc, ensuring that weight of caliper is supported.

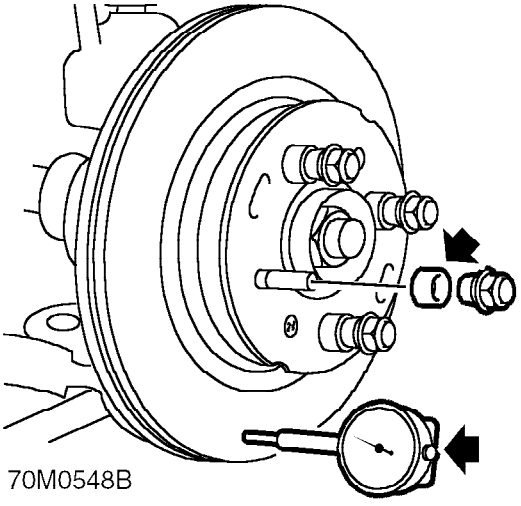
CAUTION: Do not allow caliper to hang on brake hose as weight of caliper may damage hose.



70M0544A

5. At 4 points around disc, measure disc thickness using a micrometer; renew disc if less than service limit or if maximum variation is exceeded:
   Disc thickness, new = 10.00 mm.
   Service limit = 8.00 mm.
   Thickness variation, maximum = 0.015 mm.

NOTE: Maximum variation limit: Both brake discs must be renewed at the same time, unless one disc requires changing at 1000 mile service. Only in this situation is renewal of one disc permissible.



70M0548B

6. Position a suitable spacer to each wheel stud and secure brake disc using wheel nuts. Tighten wheel nuts in a diagonal sequence to 70 Nm.

7. Secure and position dial test indicator probe 6 mm from outer edge of brake disc. Zero dial test indicator, rotate brake disc one complete turn to measure disc run-out.
   Disc run-out limit = 0.05 mm.
8. If run-out exceeds limit, mark disc to show position on drive flange; remove 2 screws retaining disc, remove disc and refit after rotating 180°. Tighten disc securing screws to 7 Nm and re-check disc run-out.
9. Renew disc if run-out exceeds limit even after re-positioning of disc on drive flange.
10. Untie caliper and support caliper weight.
11. Align caliper carrier to hub ensuring correct positioning of brake pads. Fit and tighten bolts to 85 Nm.
12. Apply foot brake several times to enable brake pads to position correctly.
13. Remove wheel nuts and spacers.
14. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
15. Remove stand(s) and lower vehicle.

BRAKE SYSTEM - BLEED - STANDARD

Service repair no - 70.25.02

The following procedure covers bleeding the complete system but where only the primary or secondary circuit have been disturbed, partial bleeding is permissible if a brake pipe or hose has been disconnected with only minor loss of fluid.

CAUTION: Never re-use fluid that has been bled from the system.

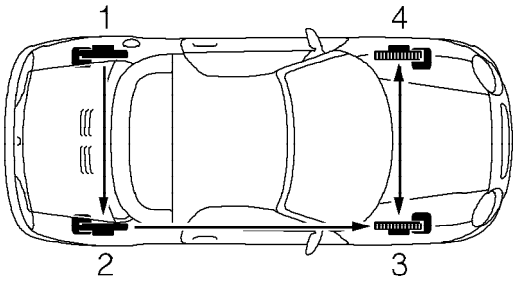
- **Never re-use fluid that has been bled from the brake system.**
- **Do not allow fluid level in master cylinder to fall below 'MIN' level during bleeding.**
- **Do not fill reservoir above 'MAX' level.**

1. Raise front and rear of vehicle.

WARNING: Support on safety stands.

2. Check all pipe and hose connections are tight and there are no signs of leakage.
3. Top-up fluid level in brake reservoir to 'MAX' mark. ***See INFORMATION, Capacities, fluids and lubricants.***

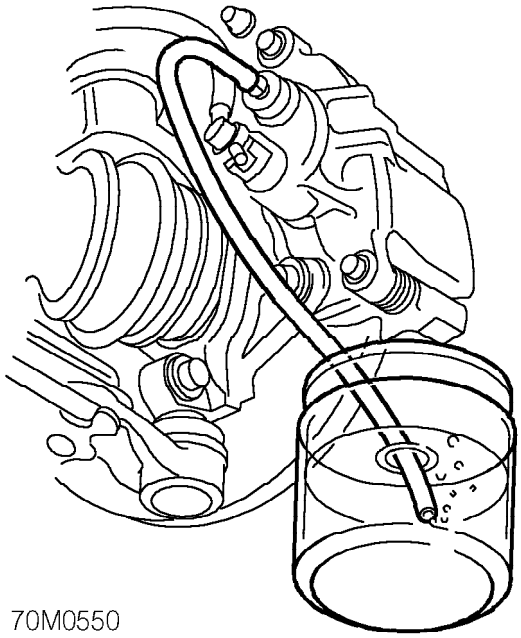
CAUTION: Use only NEW brake fluid of the recommended grade.



70M0551

Bleed sequence - non ABS and ABS systems:
LH rear to RH rear
RH front to LH front

CAUTION: Braking efficiency may be seriously impaired if wrong bleed sequence is used.



70M0550

4. Attach bleed tube to LH rear brake caliper bleed screw, submerge free end in brake fluid in a clear container.
5. Apply pressure to brake pedal several times, then apply steady pressure.
6. Loosen bleed screw to release brake fluid and air. Allow pedal to return unassisted.
7. Depress brake pedal steadily through its full stroke and allow to return unassisted. Repeat procedure until a flow of clean air-free fluid is purged into container then, whilst holding pedal at end of downward stroke, tighten bleed screw to 10 Nm.

CAUTION: Maintain brake fluid level above 'MIN' mark during this procedure.

8. Top-up brake fluid level.
9. Repeat procedure at each wheel in the sequence shown.

CAUTION: Braking efficiency may be seriously impaired if wrong bleed sequence is used.

10. Remove bleed tube. Apply brakes and check for leakage.
11. Remove stand(s) and lower vehicle.
12. Road test vehicle. Check brake pedal for short firm travel when brakes are applied.

BRAKE SYSTEM - BLEED - SPORTS

Service repair no - 70.25.02

The following procedure covers bleeding the complete system but where only the primary or secondary circuit have been disturbed in isolation, it should only be necessary to bleed that system. Partial bleeding of the hydraulic system is only permissible if a brake pipe or hose has been disconnected with only minor loss of fluid.

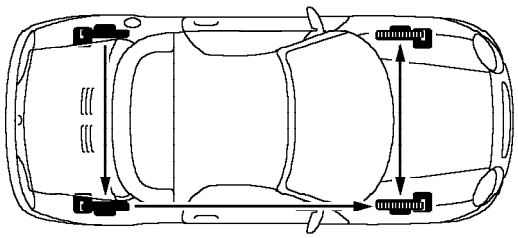
CAUTION: Never re-use fluid that has been bled from the system.

1. Raise front and rear of vehicle.

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

2. Check all pipe and hose connections are tight and there are no signs of leakage.
3. Top-up brake fluid level to 'MAX' mark.

CAUTION: Only use new brake fluid of the recommended grade. *See INFORMATION, Capacities, fluids and lubricants.*



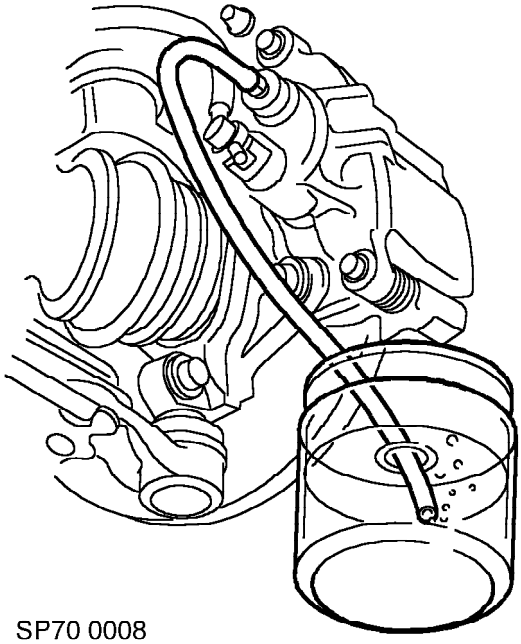
SP70 0007

Bleed sequence - ABS systems with "Sports" front brake calipers fitted:
LH rear to RH rear
RH front to LH front

NOTE: Two bleed screws are fitted on each brake caliper. When bleeding the brake system, bleed the outer bleed screw followed by the inner bleed screw in the same sequence as shown above.

CAUTION: Braking efficiency may be seriously impaired if the wrong bleed sequence is used.

4. Clean area around bleed screws and remove dust seals.



SP70 0008

5. Attach bleed tube to LH rear brake caliper bleed screw, submerge free end of tube in brake fluid in a clear container.
6. Apply pressure to brake pedal several times, then apply steady pressure.
7. Loosen bleed screw to release brake fluid and air. Allow pedal to return unassisted.
8. Depress brake pedal steadily through its full stroke and allow to return unassisted. Repeat procedure until a flow of clean air-free fluid is purged into container then, whilst holding brake pedal at end of downward stroke, tighten bleed screw to 10 Nm.

CAUTION: Maintain brake fluid level above 'MIN' mark during this procedure.

9. Top-up brake fluid level.
10. Repeat procedure at each wheel in the sequence shown.

CAUTION: Braking efficiency may be seriously impaired if wrong bleed sequence is used.

11. Remove bleed tube from bleed screw and fit bleed screw dust cap.
12. Apply brakes and check for leakage.
13. Road test vehicle. Check brake pedal for short firm travel when brakes are applied.

HANDBRAKE - ADJUST

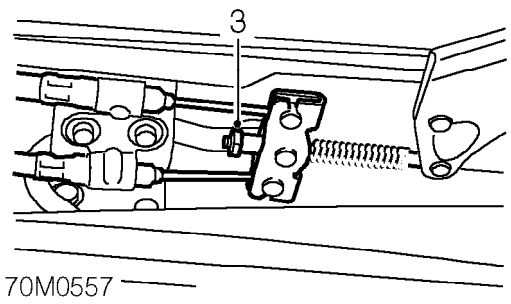
Service repair no - 70.35.10

Adjust

1. Raise rear of vehicle.

WARNING: Support on safety stands.

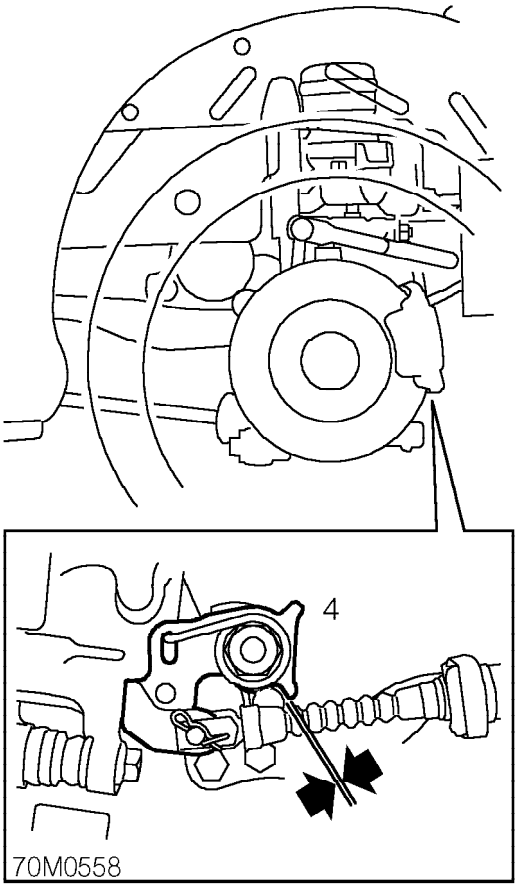
2. Remove front console storage bin.



NOTE: Depress brake pedal several times to ensure that automatic adjustment clearance is taken up.

3. Tighten adjuster nut $^{1}/_{2}$ turn and check caliper lever clearance.

CAUTION: Do not depress brake pedal until caliper adjustment clearance is correct.



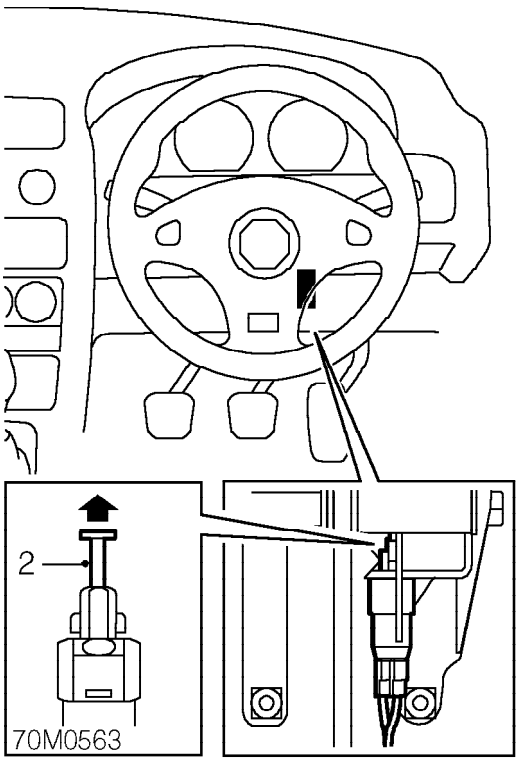
4. Repeat adjustment until caliper lever clearances are between 1 & 2 mm each side.
5. Fit storage bin.
6. Remove stand(s) and lower vehicle.

BRAKE LIGHT SWITCH - ADJUST

Service repair no - 70.35.41

Adjust

1. Depress and hold brake pedal.



2. Reset switch by pulling plunger.
3. Release brake pedal to set switch adjustment.

FRONT BRAKE DISC - STANDARD

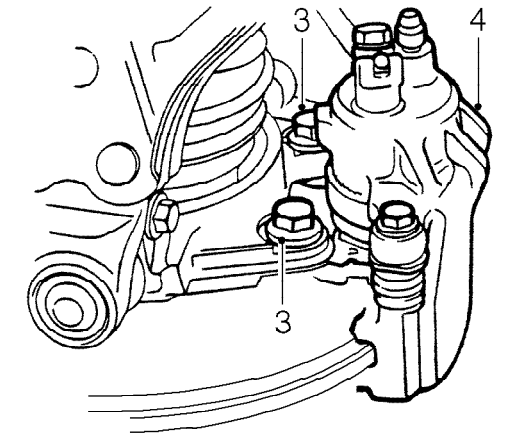
Service repair no - 70.10.10

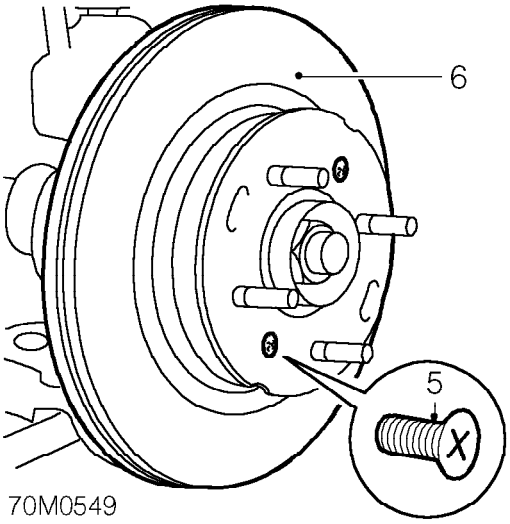
Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove road wheel(s).





3. Remove 2 bolts securing brake caliper to hub.
4. Move caliper aside. Tie caliper clear of brake disc, ensuring that weight of caliper is supported.

CAUTION: Do not allow caliper to hang on brake hose as weight of caliper may damage hose.

5. Remove 2 screws securing brake disc to drive flange.
6. Remove brake disc.

Refit

CAUTION: Brake discs must be replaced in pairs.

1. Wire brush drive flange to remove all corrosion deposits. Clean new brake disc.
2. Fit brake disc to drive flange, fit screws and tighten to 7 Nm.
3. Check disc run-out. ***See Adjustments.***
4. Examine brake pads and renew if necessary.
5. Fit brake caliper to hub, fit and tighten bolts to 85 Nm .
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stand(s) and lower vehicle.

FRONT BRAKE DISC - SPORTS

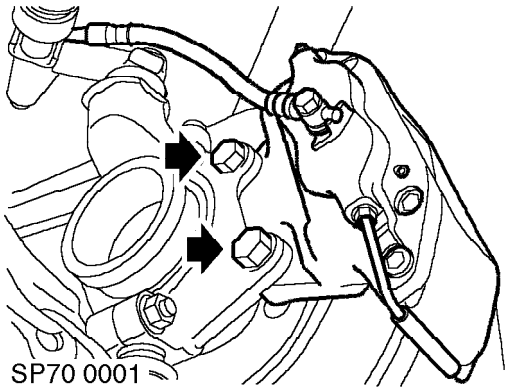
Service repair no - 70.10.10

Remove

1. Raise front of vehicle.

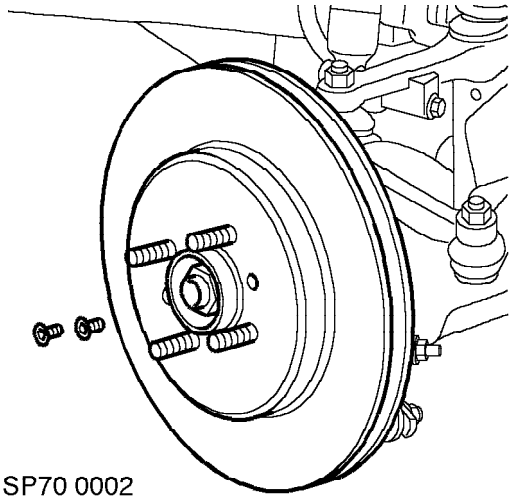
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel(s).


SP70 0001

3. Remove 2 bolts securing brake caliper assembly to hub.
4. Remove caliper assembly from hub and tie aside.

CAUTION: Do not allow caliper to hang on brake hose.


SP70 0002

5. Remove 2 screws securing brake disc to drive flange.
6. Remove brake disc.

CAUTION: Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1500 kilometres) from new.

Refit

1. Wire brush drive flange to remove all corrosion deposits. Clean new brake disc.
2. Fit brake disc to drive flange, fit screws and tighten to 7 Nm.
3. Examine brake pads and renew if necessary.
4. Check brake disc run-out. ***See Adjustments.***
5. Position brake caliper to hub, fit and tighten bolts to 85 Nm.
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stand(s) and lower vehicle.

REAR BRAKE DISC

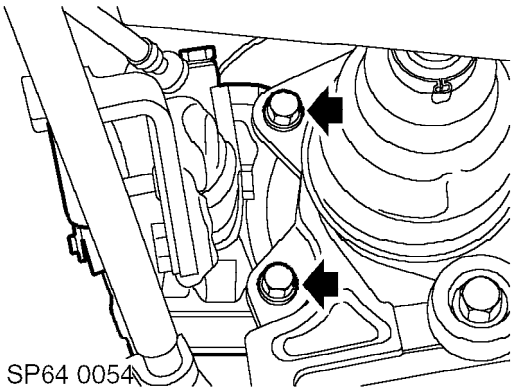
Service repair no - 70.10.33

Remove

1. Raise rear of vehicle.

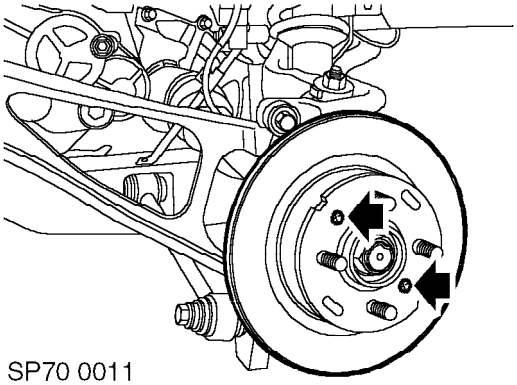
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel.


SP64 0054

3. Remove 2 bolts securing caliper assembly to hub.
4. Release caliper from disc. Tie caliper clear of brake disc, ensuring the weight of the caliper is supported.

CAUTION: Do not allow caliper to hang on brake hose.


SP70 0011

5. Remove 2 screws securing brake disc to drive flange.
6. Remove brake disc.

Refit

1. Wire brush drive flange to remove all corrosion deposits. Clean new brake disc.

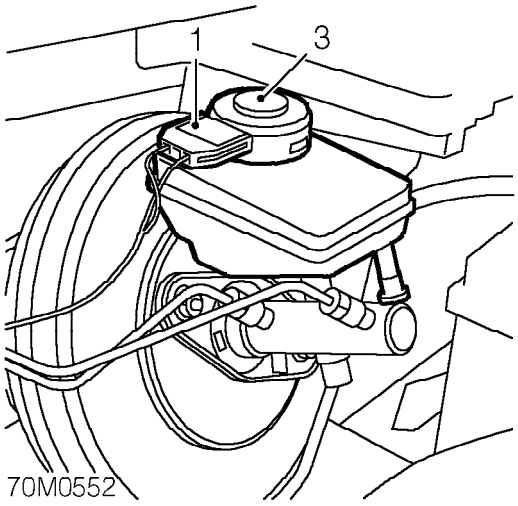
CAUTION: Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1500 kilometers) from new.

2. Fit brake disc to drive flange. Tighten screws to 7 Nm.
3. Check brake disc runout. ***See Adjustments.***
4. Examine brake pads and renew if necessary.
5. Untie caliper, position caliper to hub, fit and tighten bolts to 85 Nm.
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stands and lower vehicle.

FLUID LEVEL SWITCH

Service repair no - 70.25.08

Remove



1. Disconnect switch multiplug.
2. Clean area around reservoir cap.
3. Remove cap/switch assembly.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

Refit

1. Check and top-up fluid level.
2. Fit cap/switch assembly.
3. Connect switch multiplug.

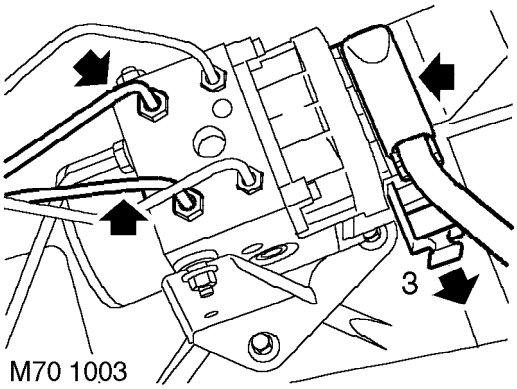
ABS HYDRAULIC MODULATOR

Service repair no - 70.25.12

Remove

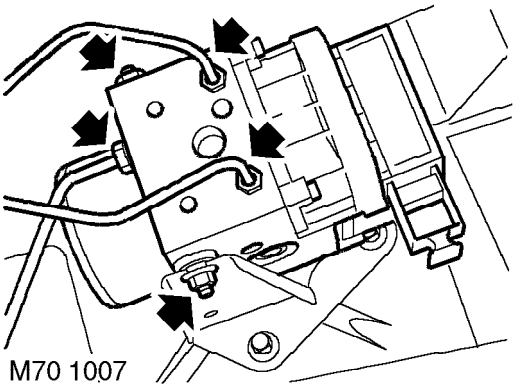
1. Disconnect battery earth lead.
2. Position cloth under modulator to absorb brake fluid.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.



3. Release clip securing ABS modulator multiplug and disconnect multiplug.
4. Disconnect 2 inlet brake pipe unions from top of modulator.

CAUTION: Plug the connections.



5. Disconnect 3 outlet brake pipe unions from modulator.

CAUTION: Plug the connections.

6. Loosen 2 nuts securing modulator to mounting bracket.
7. Release modulator from mounting bracket and remove modulator.

Refit

1. Remove 2 mounting rubbers and studs from modulator.
2. Fit mounting rubbers and studs to new modulator.
3. Fit modulator to mounting bracket and tighten mounting nuts to 10 Nm.
4. Connect brake pipe unions to modulator, ensuring pipes are connected to their correct ports as follows:
   MC 1 = Master cylinder primary
   MC 2 = Master cylinder secondary
   RF = Right hand front
   LF = Left hand front
   R = Right & Left hand rear
5. Connect multiplug to modulator and secure clip.
6. Bleed brakes. ***See Adjustments.***
7. Connect battery earth lead.

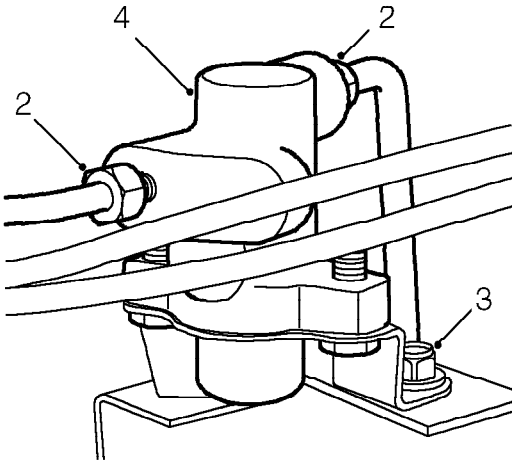
BRAKE PROPORTIONING VALVE

Service repair no - 70.25.15

Remove

1. Position cloth to catch spillage.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.



70M0560A

2. Release 2 brake pipe unions and position pipes aside.

CAUTION: Plug the connections.

3. Remove 2 bolts securing valve to body.
4. Remove valve.

Refit

1. Fit valve to body and tighten bolts to 10 Nm.
2. Align unions to valve and tighten to 14 Nm.
3. Bleed rear brakes. ***See Adjustments.***

ABS SENSOR - FRONT WHEEL

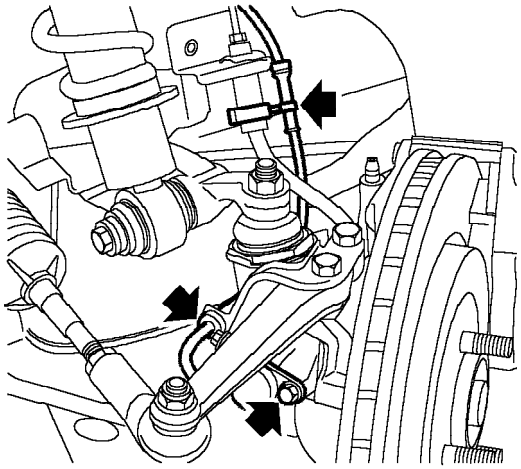
Service repair no - 70.25.32

Remove

1. Disconnect battery earth lead.
2. Raise front of vehicle.

WARNING: Support on safety stands.

3. Remove road wheel(s).



SP12 0362

4. Disconnect ABS sensor lead from main harness.
5. Release ABS sensor lead from clips on subframe turret.
6. Remove bolt securing ABS sensor to hub.
7. Remove ABS sensor and spacer from hub.

Refit

1. Fit ABS sensor and spacer to hub and tighten bolt to 10 Nm.
2. Fit ABS sensor lead to clips on subframe turret.
3. Connect ABS sensor lead to main harness.
4. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
5. Remove stand(s) and lower vehicle.

ABS SENSOR - REAR WHEEL

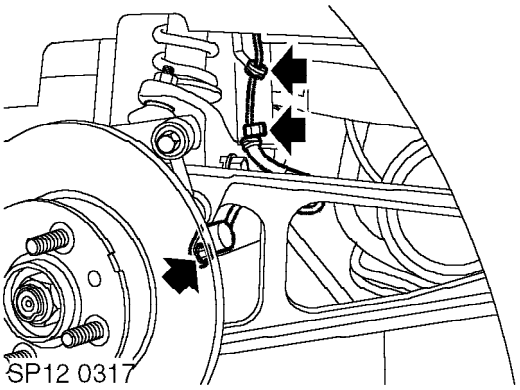
Service repair no - 70.25.33

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
3. Raise rear of vehicle.

WARNING: Support on safety stands.

4. Remove road wheel(s).



5. Disconnect ABS sensor lead from main harness.
6. Release ABS sensor lead from clips on subframe turret.
7. Remove bolt securing ABS sensor to hub.
8. Remove ABS sensor and spacer from hub.

Refit

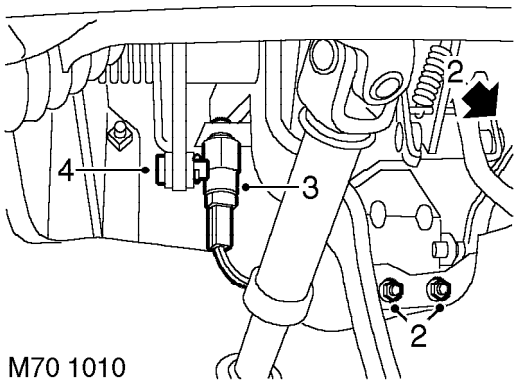
1. Fit ABS sensor and spacer to hub and tighten bolt to 10 Nm.
2. Fit ABS sensor lead to clips on suspension turret.
3. Connect ABS sensor lead to main harness.
4. Connect battery earth lead.Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
5. Remove stand(s) and lower vehicle.
6. Fit engine compartment access panel. ***See BODY, Exterior fittings.***

PEDAL BOX ASSEMBLY

Service repair no - 70.35.03

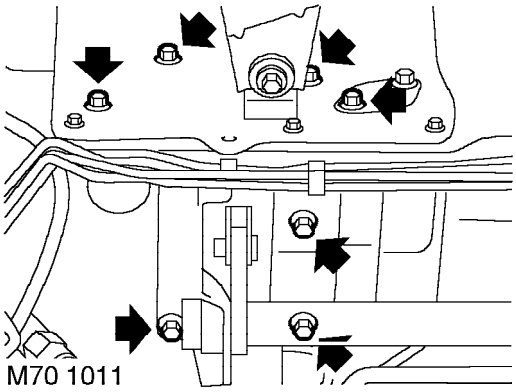
Remove

1. Remove bulkhead closing panel. ***See BODY, Repairs.***

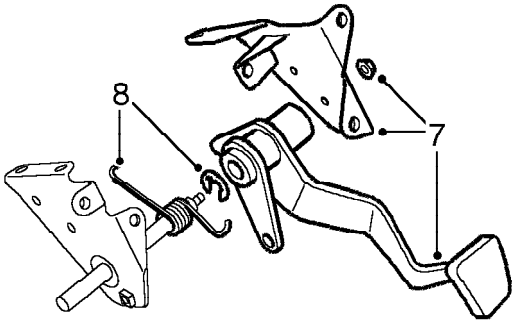


M70 1010

2. Remove 2 nuts and 1 bolt securing throttle pedal. Release pedal and position aside.
3. Release brake light switch and position aside.
4. Remove clip securing brake pedal push rod clevis pin and remove clevis pin.


M70 1011

5. With assistance, remove 3 nuts and bolts and 4 bolts securing pedal box assembly.
6. Manoeuvre pedal box assembly over steering column and remove assembly.



M70 1012

7. Remove nut securing end bracket and remove end bracket and pedal.
8. Remove return spring circlip and return spring from pivot shaft.

Refit

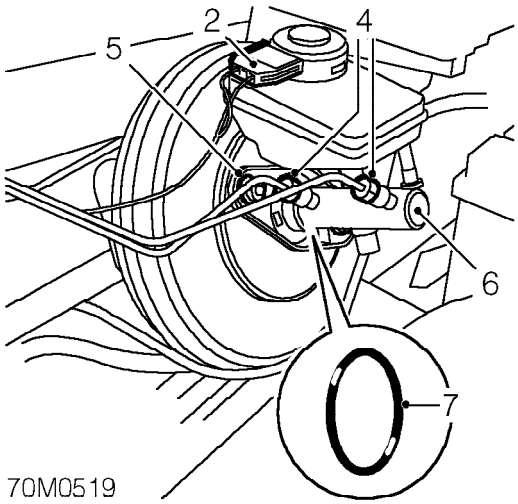
1. Position return spring on pivot shaft and secure with circlip.
2. Examine pedal bushes for wear or damage and replace as required.
3. Position pedal and end bracket, fit nut and tighten to 22 Nm.
4. Position pedal box assembly, manoeuvre over steering column and align to bulkhead.
5. Fit and tighten nuts and bolts securing pedal box assembly to 22 Nm.
6. Align brake pedal push rod, fit clevis pin and secure with clip.
7. Position brake light switch and secure in end bracket.
8. Position throttle pedal, fit nuts and tighten to 6 Nm.
9. Fit bulkhead closing panel. ***See BODY, Repairs.***

BRAKE MASTER CYLINDER

Service repair no - 70.30.08

Remove

1. Remove underbonnet closing panel. ***See BODY, Exterior fittings.***



2. Disconnect fluid level switch.
3. Position cloth under master cylinder to absorb spilled fluid.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

4. Disconnect pipe unions at master cylinder.

CAUTION: Plug the connections.

5. Remove 2 nuts and plain washers securing master cylinder to brake servo.
6. Remove master cylinder.
7. Collect and discard 'O' ring.

Refit

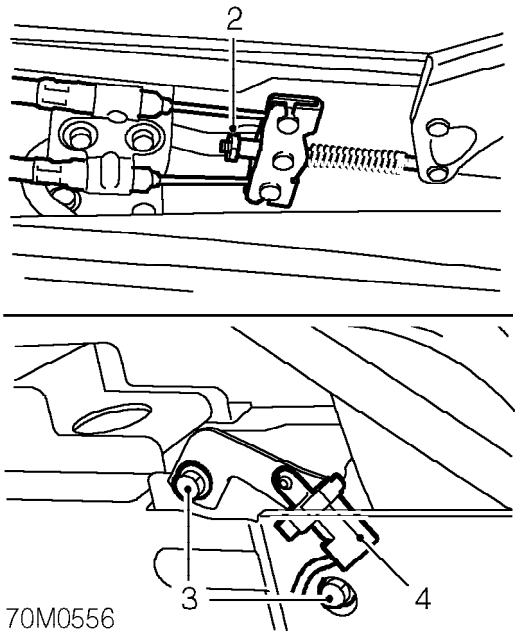
1. Clean master cylinder and servo mating surfaces.
2. Fit new 'O' ring to master cylinder.
3. Align servo push rod and fit master cylinder to servo.
4. Secure master cylinder with nuts and plain washers. Tighten to 20 Nm.
5. Connect primary and secondary brake pipes, tighten unions to 15 Nm.
6. Connect fluid level switch.
7. Bleed brake system. ***See Adjustments.***
8. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

HANDBRAKE LEVER

Service repair no - 70.35.08

Remove

1. Remove front console. ***See BODY, Interior trim components.***



2. Loosen cable adjuster nut and disconnect 2 cables from compensator.
3. Remove 2 bolts securing lever to body.
4. Disconnect Lucar from switch and remove handbrake lever.

Refit

1. Connect Lucar to switch.
2. Position handbrake lever to body, fit and tighten bolts to 25 Nm.
3. Connect cables to compensator.
4. Adjust handbrake cables. ***See Adjustments.***
5. Fit front console. ***See BODY, Interior trim components.***

HANDBRAKE CABLES

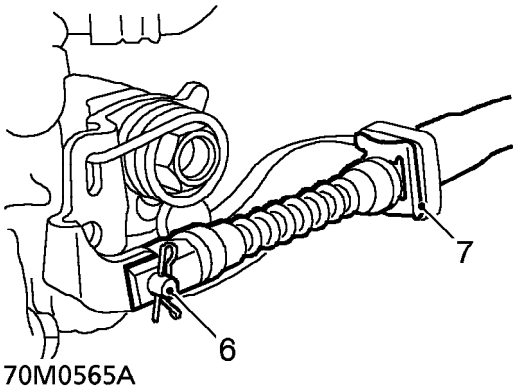
Service repair no - 70.35.28

NOTE: Handbrake cables have colour coded identification bands: Purple - RH, Orange - LH.

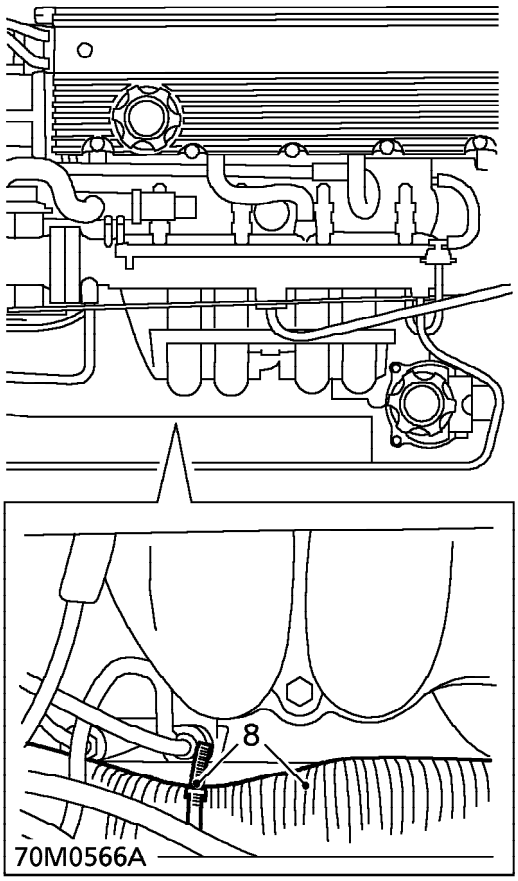
WARNING: *See GENERAL INFORMATION, SRS Precautions.*

Remove

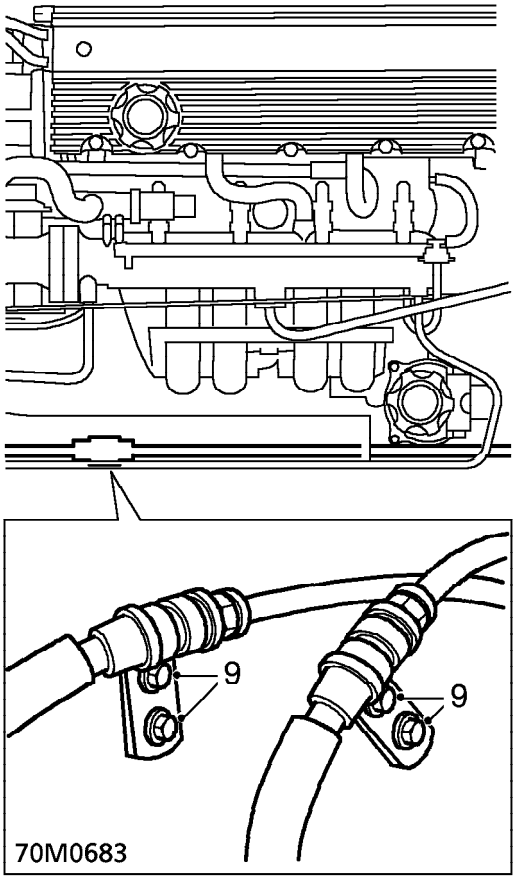
1. Position vehicle on a 2 post ramp.
2. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
3. Remove engine cover. ***See ENGINE, Repairs.***
4. Remove engine compartment access panel. ***See BODY, Exterior fittings.***
5. Release handbrake to off position.



6. Remove and discard 2 'R' clips, and remove 2 clevis pins securing handbrake cables to rear calipers.
7. Remove and discard 2 clips securing handbrake cable abutments to caliper brackets and release cables.

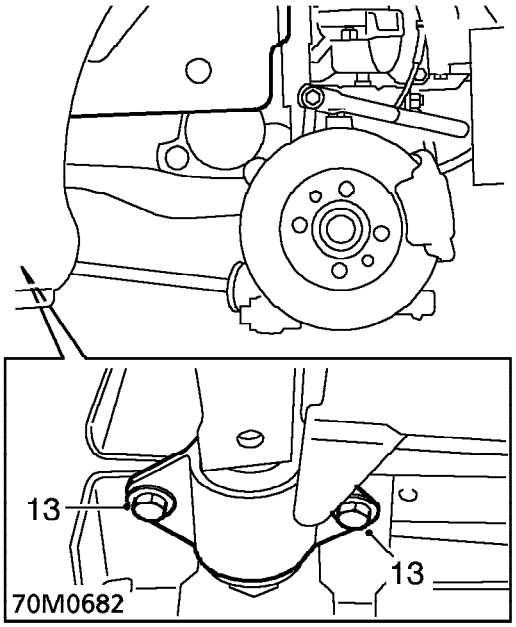


8. Release air intake duct from subframe clip and position duct aside.



9. Remove 2 bolts securing each handbrake cable to luggage compartment bulkhead.
10. Release handbrake cables from air cleaner mounting bracket.
11. Drain engine coolant. ***See COOLING SYSTEM, Adjustments.***
12. Place support jack underneath engine sump and support engine weight.

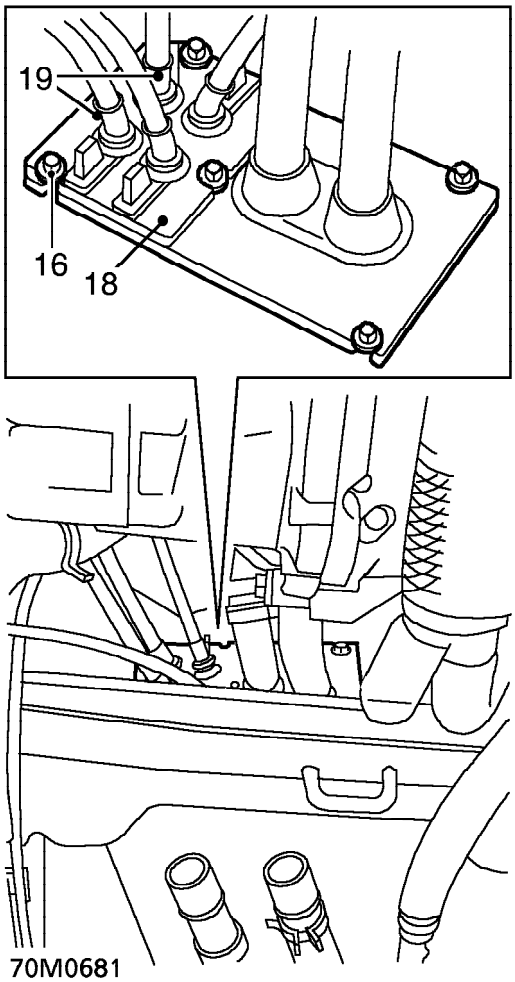
CAUTION: To prevent damage to sump place a piece of wood between jack and sump.



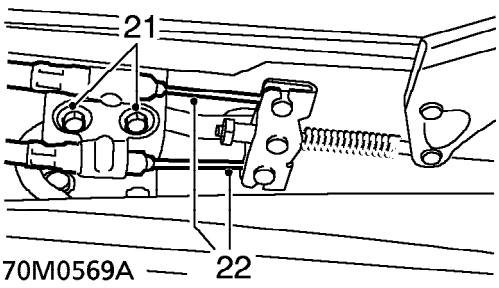
13. Remove 2 bolts securing both front subframe mountings to body brackets.
14. Lower jack carefully, to allow access to closing plate bolts.

CAUTION: Care must be taken that no cables or pipes are stretched when lowering front of subframe.

15. Tie coolant pipes aside to allow access to closing plate.



16. Release 2 upper and remove 3 remaining bolts securing closing plate to bulkhead.
17. Apply soft soap to all four closing plate cables, to ease movement of closing plate.
18. Release closing plate from bulkhead and slide along cables.
19. Noting their fitted positions release 2 handbrake cable grommets from closing plate.
20. Remove front console. ***See BODY, Interior trim components.***



21. Remove 2 bolts securing handbrake abutment clamp to tunnel and remove clamp.

22. Release handbrake cables from compensator.
23. Remove handbrake cables from tunnel and engine compartment.

Refit

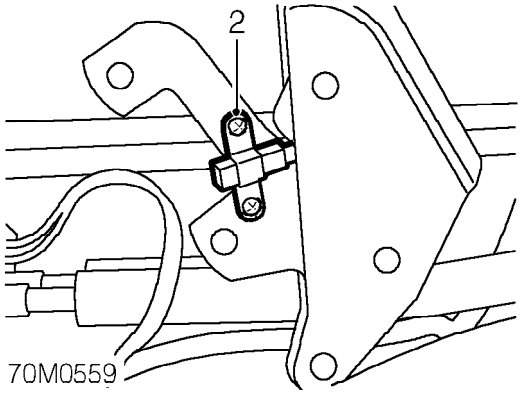
1. Position handbrake cables to tunnel and feed through rear bulkhead.
2. Feed handbrake cables into position in engine compartment.
3. Lubricate all four cables with soft soap to ease grommet movement on cables.
4. Position handbrake cables into closing plate slots and secure with grommets.
5. Align closing plate to bulkhead and secure with bolts.
6. Lift subframe on jack, fit subframe front mounting bolts and tighten to 30 Nm .
7. Position handbrake cable abutments to caliper brackets and secure with new clips.
8. Align handbrake cables to calipers, fit clevis pins and secure with new 'R' clips.
9. Position handbrake cables to luggage compartment bulkhead and secure clips with bolts.
10. Position air intake duct to subframe and secure with clip.
11. Fit handbrake cables to air cleaner mounting bracket.
12. Fit cables to handbrake compensator.
13. Position cables and secure with handbrake abutment clamp.
14. Fit front console. ***See BODY, Interior trim components.***
15. Untie and position coolant hoses.
16. Fill engine coolant. ***See COOLING SYSTEM, Adjustments.***
17. Fit engine cover. ***See ENGINE, Repairs.***
18. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
19. Adjust handbrake cable. ***See Adjustments.***

HANDBRAKE WARNING SWITCH

Service repair no - 70.35.40

Remove

1. Remove handbrake lever. ***See this section.***



2. Remove 2 screws securing switch to lever and collect switch.

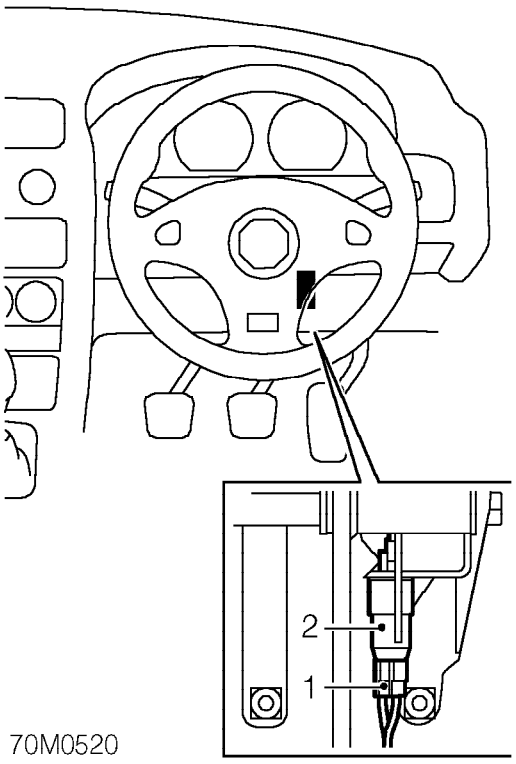
Refit

1. Fit switch and secure with screws.
2. Fit handbrake lever. ***See this section.***

BRAKE LIGHT SWITCH

Service repair no - 70.35.42

Remove



1. Release 2 Lucar connectors from switch.
2. Release bayonet fixing and remove switch.

Refit

1. Fit switch to pedal box.
2. Connect Lucar connectors.
3. Adjust switch. ***See Adjustments.***

BRAKE PADS - FRONT - STANDARD

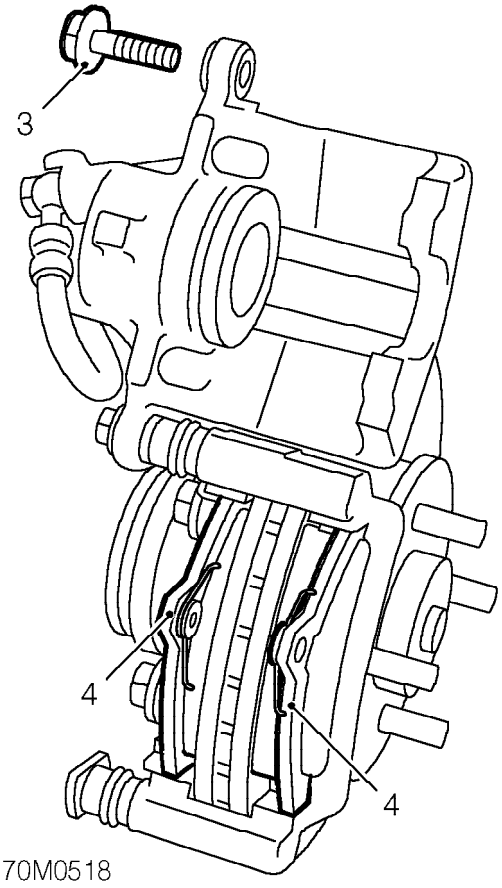
Service repair no - 70.40.02

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove road wheel(s).



3. Remove lower guide pin bolt from caliper and pivot caliper body upwards.
4. Remove 2 brake pads from caliper carrier.

Refit

CAUTION: Always fit correct grade and specification of brake pads, and renew in axle set. Braking efficiency may otherwise be impaired.

1. Clean caliper abutments and piston.
2. Clean area around fluid reservoir cap.
3. Remove cap from brake reservoir and position cloth to catch spillage.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

4. Using tool **18G 590,** press piston into caliper body.
5. Remove tool.
6. Remove backings from pad shims and fit pads to carrier.
7. Position caliper body to carrier, fit and tighten guide pin bolt to 45 Nm.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Top-up brake fluid to 'MAX' mark. ***See MAINTENANCE.***
10. Depress brake pedal several times to seat pads.

NOTE: Pedal travel may be longer than normal during first brake applications.

11. Remove stand(s) and lower vehicle.

BRAKE PADS - FRONT - SPORTS

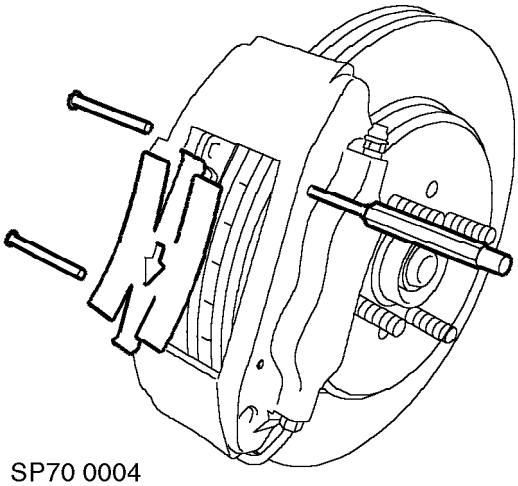
Service repair no - 70.40.02

Remove

1. Raise front of vehicle.

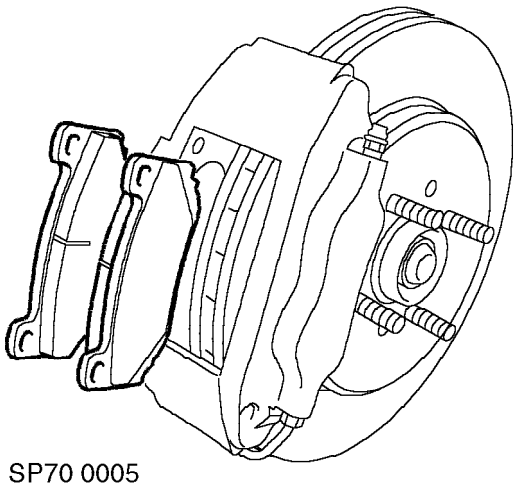
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel(s).



SP70 0004

3. Using a parallel punch, drift out brake pad retaining pins and collect anti-squeal plate.



SP70 0005

4. Remove brake pads from caliper housing.

Refit

1. Clean brake pad abutment areas in caliper's retaining pins and anti-squeal plates.
2. Clean area around brake fluid reservoir cap.
3. Disconnect multiplug from brake fluid level indicator, remove reservoir cap and position a piece of cloth over reservoir to collect any brake fluid spillage.

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

4. Using a suitable flat lever, retract caliper pistons into housing.
5. Remove backings from brake pad shims.

CAUTION: Always fit correct grade and specification of brake pads, and renew in axle set. Braking efficiency may otherwise be impaired.

6. Fit brake pads to caliper housing.
7. Fit brake pad retaining pins and anti-squeal plate.
8. If necessary, top-up brake fluid reservoir.
9. Remove cloth, fit fluid reservoir cap and connect multiplug to fluid level indicator.
10. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
11. Depress brake pedal several times to seat pads.
12. Remove stand(s) and lower vehicle.

BRAKE PADS - REAR

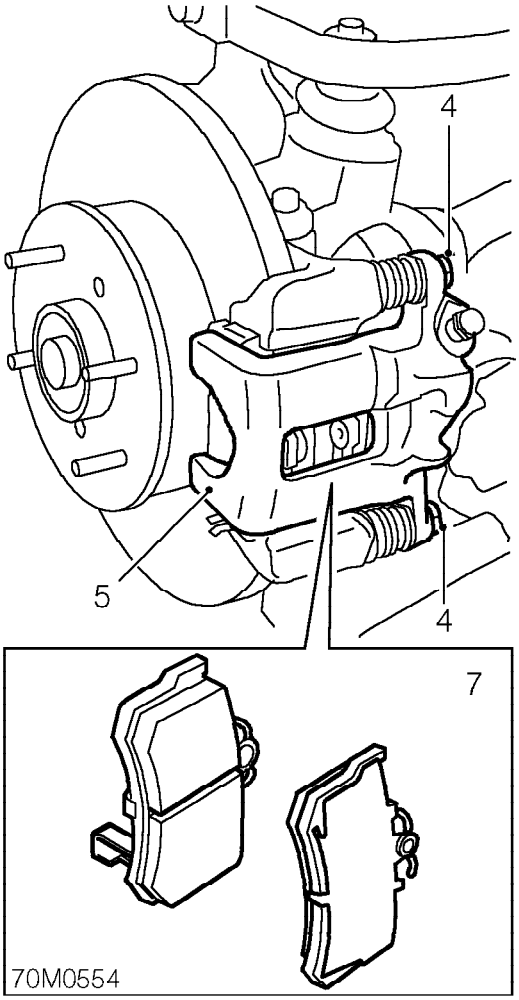
Service repair no - 70.40.03

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.

2. Release handbrake lever.
3. Remove road wheel(s).



4. Remove guide pin bolts from caliper.
5. Release caliper body from carrier.
6. Tie caliper aside.

CAUTION: Do not allow weight of caliper to hang on hose, as damage may occur to hose.

7. Remove brake pads from carrier.

CAUTION: Do not operate handbrake with brake pads removed.

Refit

WARNING: Always fit the correct grade and specification of brake pads, and renew in axle set. Braking efficiency may otherwise be impaired.

1. Remove old shims from caliper.
2. Fit new shims to replacement pads.
3. Clean area around fluid reservoir cap.
4. Remove cap from brake reservoir and position cloth to catch spillage.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with warm water.

5. Screw piston into caliper using **18G 1596** ensuring piston is fully retracted.
6. Clean components using methylated spirit or denatured alcohol. Do not use any petroleum based fluids.
7. Fit new pads to caliper carrier.
8. Untie caliper body and position to carrier.
9. Fit guide pin bolts and tighten to 45 Nm .
10. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
11. Top-up brake fluid to 'MAX' mark. ***See MAINTENANCE.***
12. Operate brake pedal several times to adjust brake pads and the handbrake linkage.

CAUTION: Do not apply the handbrake before the brake pads have been adjusted or incorrect brake operation will result.

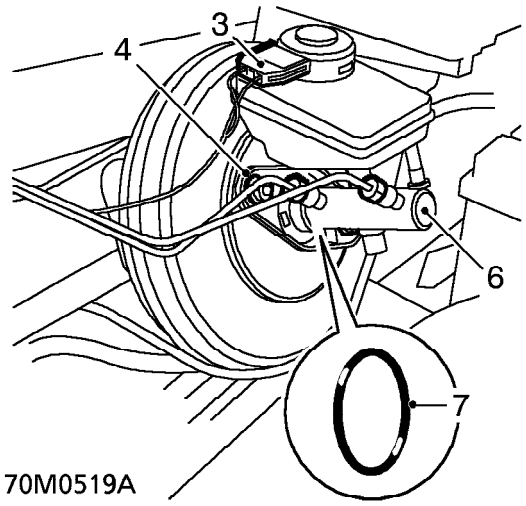
13. Remove stand(s) and lower vehicle.

BRAKE SERVO

Service repair no - 70.50.01

Remove

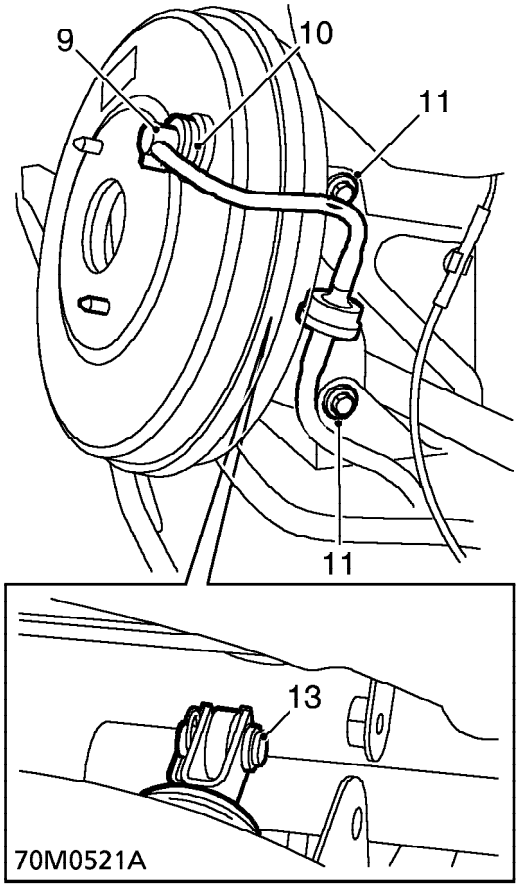
1. Remove underbonnet closing panel. ***See BODY, Exterior fittings.***
2. Remove spare wheel.



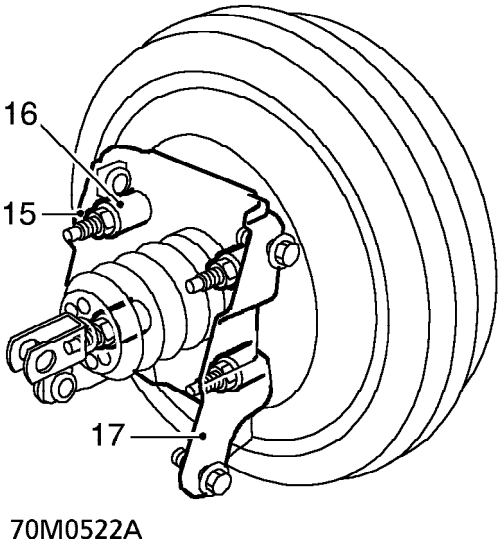
3. Disconnect fluid level switch.
4. Remove 2 nuts and washers securing master cylinder to brake servo.
5. Release brake pipes from bulk head clips.

CAUTION: Do not bend brake pipes when removing master cylinder.

6. Remove master cylinder from brake servo.
7. Remove 'O' ring from master cylinder and discard.
8. Tie master cylinder aside so that weight of master cylinder is supported.



9. Carefully prise vacuum hose connection from brake servo.
10. Remove and discard sealing rubber.
11. Remove 2 inboard bolts and loosen 2 outboard bolts securing servo bracket.
12. Release servo from bracket for access to clevis pin.
13. Remove split pin and withdraw clevis pin securing crank to servo push rod.
14. Remove servo assembly.



15. Remove 4 nuts securing bracket to servo.
16. Collect spacers.
17. Remove bracket.

Refit

1. Position bracket to servo, fit spacers and secure with nuts, tighten nuts to 20 Nm.
2. Position servo assembly and align servo push rod.
3. Fit clevis pin and secure with new split pin.
4. Align servo and engage outboard bolts to slots in bracket.
5. Fit inboard bolts. Tighten all bolts to 20 Nm.
6. Engage harness clip to bracket.
7. Fit new sealing rubber to vacuum hose.
8. Connect vacuum hose to servo.
9. Untie master cylinder.
10. Clean master cylinder and servo mating surfaces.
11. Fit new 'O' ring to master cylinder.
12. Align servo push rod and fit master cylinder to servo.
13. Fit nuts and washers securing master cylinder to servo, tighten nuts to 20 Nm.
14. Fit brake pipes to clips.
15. Connect fluid level switch.
16. Fit spare wheel.
17. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

BRAKE CALIPER HOUSING - FRONT - STANDARD

Service repair no - 70.55.24

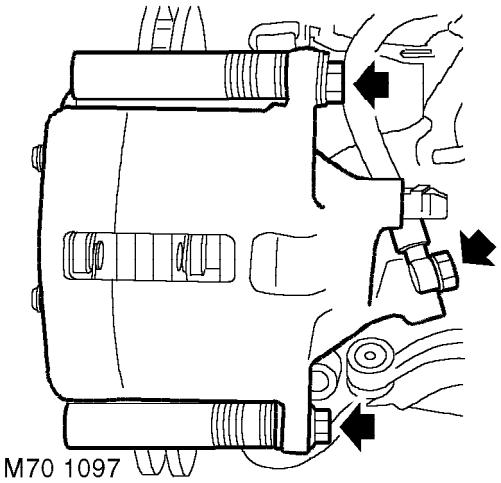
Remove

1. Raise front of vehicle, one side.

WARNING: Support on safety stands.

2. Remove road wheel(s).
3. Clamp brake hose to prevent fluid lose.

CAUTION: An approved brake hose clamp must be used.

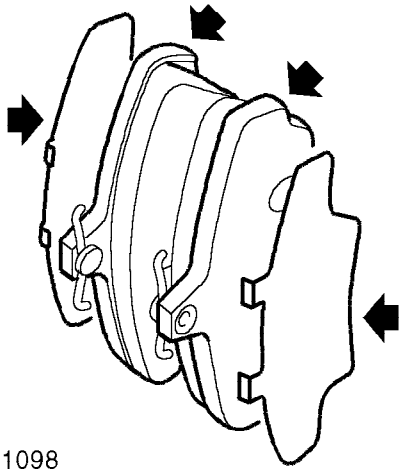


M70 1097

4. Remove brake hose banjo bolt.
5. Remove and discard 2 sealing washers

CAUTION: Plug the connections.

6. Remove 2 guide pin bolts.
7. Remove caliper housing from caliper bracket.



M70 1098

8. Remove 2 brake pads and discard shims.

NOTE: Note location of pads if same ones are to be replaced. Pads must be fitted in original locations.

Refit

1. Rotate disc by hand and scrape all scale and rust from around edge of disc. Scrape clean abutment surfaces on caliper carrier.
2. Clean dust from brake parts using brake cleaning fluid or industrial alcohol.
3. Using tool **18G 590,** press piston back into caliper.
4. Fit new shims to pads and fit pads to caliper carrier.
5. Position caliper housing to carrier, fit and tighten guide pin bolts to 45 Nm.
6. Clean brake hose banjo connection, fit new sealing washers and tighten banjo bolt to 30 Nm.
7. Remove clamp from brake hose.
8. Bleed brake caliper. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Remove stand(s) and lower vehicle.

BRAKE CALIPER CARRIER - FRONT - STANDARD

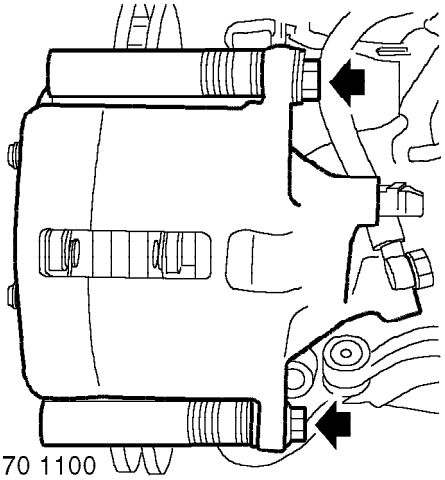
Service repair no - 70.55.28

Remove

1. Raise front of vehicle, one side.

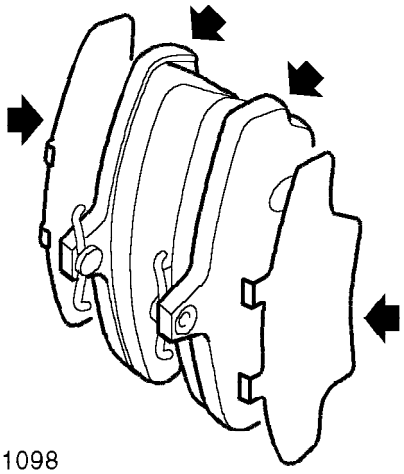
WARNING: Support on safety stands.

2. Remove road wheel(s).



M70 1100

3. Remove 2 guide pin bolts securing caliper housing to carrier.

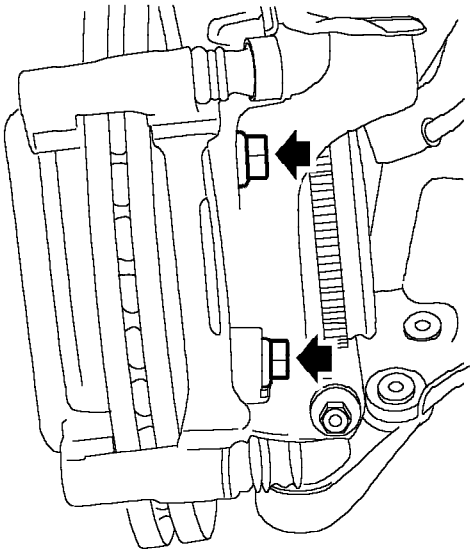


M70 1098

NOTE: Mark location of pads if same ones are to be replaced. Pads must be refitted to original locations.

4. Position caliper housing aside and remove 2 brake pads.
5. Remove and discard 2 shims from pads.

CAUTION: Do not allow caliper to hang from hose as damage may result.



M70 1099

6. Remove 2 bolts securing caliper carrier to swivel hub and remove carrier.

Refit

1. Position caliper carrier to hub, fit and tighten bolts to 85 Nm.
2. Remove cap from brake fluid reservoir and position cloth to catch any spillage.

CAUTION: Do not allow brake fluid to contact paint finished surfaces as paint may be damaged. If spilled, remove fluid and clean area with clean warm water.

3. Clean housing abutment and piston.
4. Using tool **18G 590,** press piston fully into caliper.
5. Fit new shims to pads and position to carrier.
6. Position caliper housing to carrier, fit and tighten guide pin bolts to 45 Nm.
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stand(s) and lower vehicle.
9. Depress brake pedal several times to seat pads to discs. Pedal travel may be longer than normal during first brake applications.
10. Top up fluid level if required and fit cap.

BRAKE CALIPER HOUSING - FRONT - SPORTS

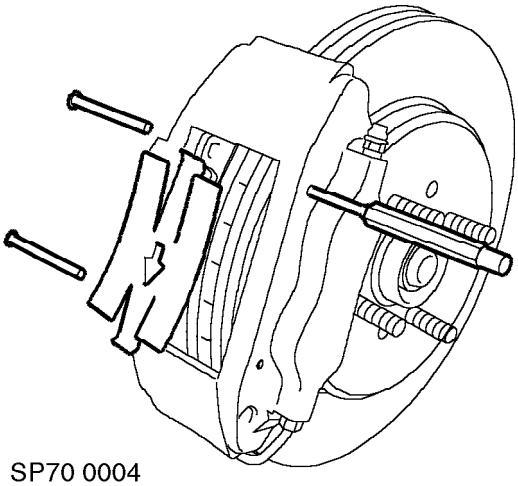
Service repair no - 70.55.02

Remove

1. Raise front of vehicle, one side.

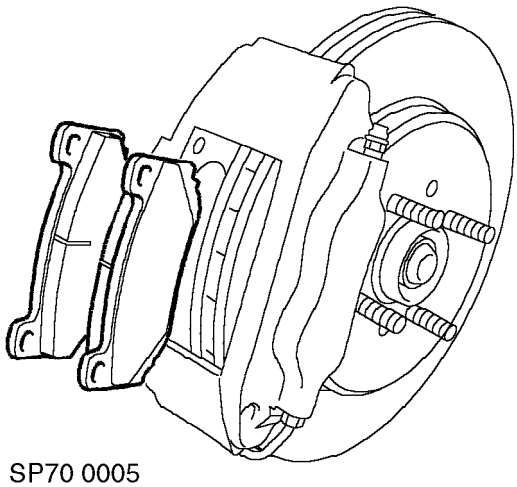
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

2. Remove road wheel(s).



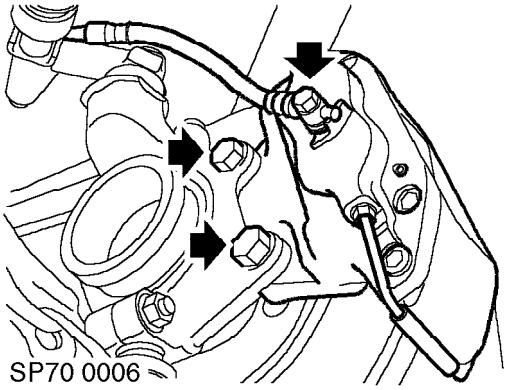
SP70 0004

3. Using a parallel punch, drift out brake pad retaining pins and collect anti-squeal plate.



SP70 0005

4. Remove brake pads from caliper housing, mark their fitted position if they are to be refitted.
5. Use a recommended brake hose clamp to clamp brake hose.



SP70 0006

6. Remove banjo bolt securing brake hose to caliper, remove and discard sealing washers.

CAUTION: Always fit plugs to open connections to prevent contamination.

7. Remove 2 bolts securing caliper assembly to hub and remove caliper.

Refit

1. Rotate disc by hand and scrape all scale and rust from around edge of disc.
2. Clean mating faces of caliper and hub.
3. Position caliper to hub, fit and tighten bolts to 85 Nm.
4. Remove plug from brake hose banjo.
5. Clean brake hose banjo connection, fit NEW sealing washers and tighten banjo bolt to 35 Nm.
6. Remove clamp from brake hose.
7. Using a suitable flat lever, retract caliper pistons into housing.
8. Fit brake pads to caliper housing.
9. Fit brake pad retaining pins and anti-squeal plate.
10. Bleed brake caliper.
11. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
12. Depress brake pedal several times to seat pads.
13. Remove stand(s) and lower vehicle.

HOSE - FRONT - PRIMARY - LH

Service repair no - 70.15.02

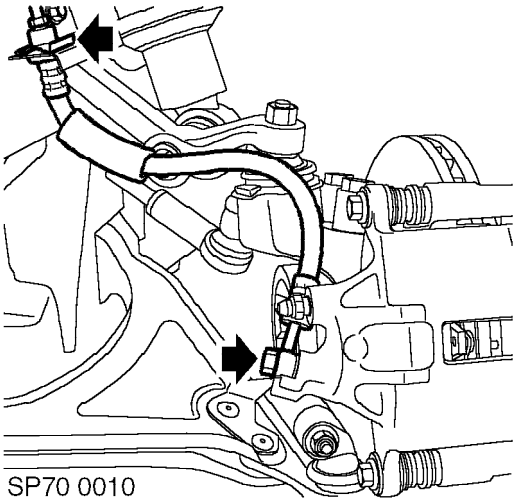
Remove

1. Raise front of vehicle.

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

2. Remove road wheel.

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



3. Remove banjo bolt securing brake hose to caliper, remove and discard sealing washers.

CAUTION: Always fit plugs to open connections to prevent contamination.

4. Loosen and release union securing brake hose to brake pipe.

CAUTION: Always fit plugs to open connections to prevent contamination.

5. Remove clip securing brake hose to support bracket.
6. Release brake hose from support bracket and remove brake hose.

Refit

1. Clean brake fluid spillage.
2. Clean brake pipe union, banjo bolt and caliper mating face.
3. Position brake hose to support bracket, ensure flat on brake hose is engaged in support bracket recess and secure with clip.
4. Align brake pipe union to brake hose and tighten union to 15 Nm .
5. Ensure brake hose is not kinked or twisted, align to brake caliper. Using new sealing washers fit banjo bolt and tighten to 30 Nm .
6. Bleed brakes. ***See Adjustments.***
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stands and lower vehicle.

HOSE - REAR

Service repair no - 70.15.17

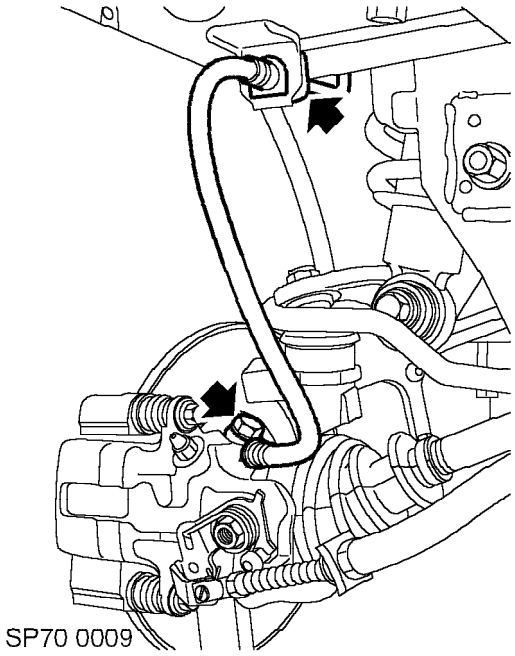
Remove

1. Raise rear of vehicle.

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

2. Remove road wheel.

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


SP70 0009

3. Remove banjo bolt securing brake hose to caliper, remove and discard sealing washers.

CAUTION: Always fit plugs to open connections to prevent contamination.

4. Loosen and release union securing brake hose to brake pipe.

CAUTION: Always fit plugs to open connections to prevent contamination.

5. Remove clip securing brake hose to support bracket.
6. Release brake hose from support bracket and remove brake hose.

Refit

1. Clean brake fluid spillage.
2. Clean brake pipe union, banjo bolt and caliper mating face.
3. Position brake hose to support bracket, ensure flat on brake hose is engaged in support bracket recess and secure with clip.
4. Align brake pipe union to brake hose and tighten union to 15 Nm .
5. Ensure brake hose is not kinked or twisted, align to brake caliper. Using new sealing washers fit banjo bolt and tighten to 30 Nm .
6. Bleed brakes. ***See Adjustments.***
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stands and lower vehicle.

CONTENTS

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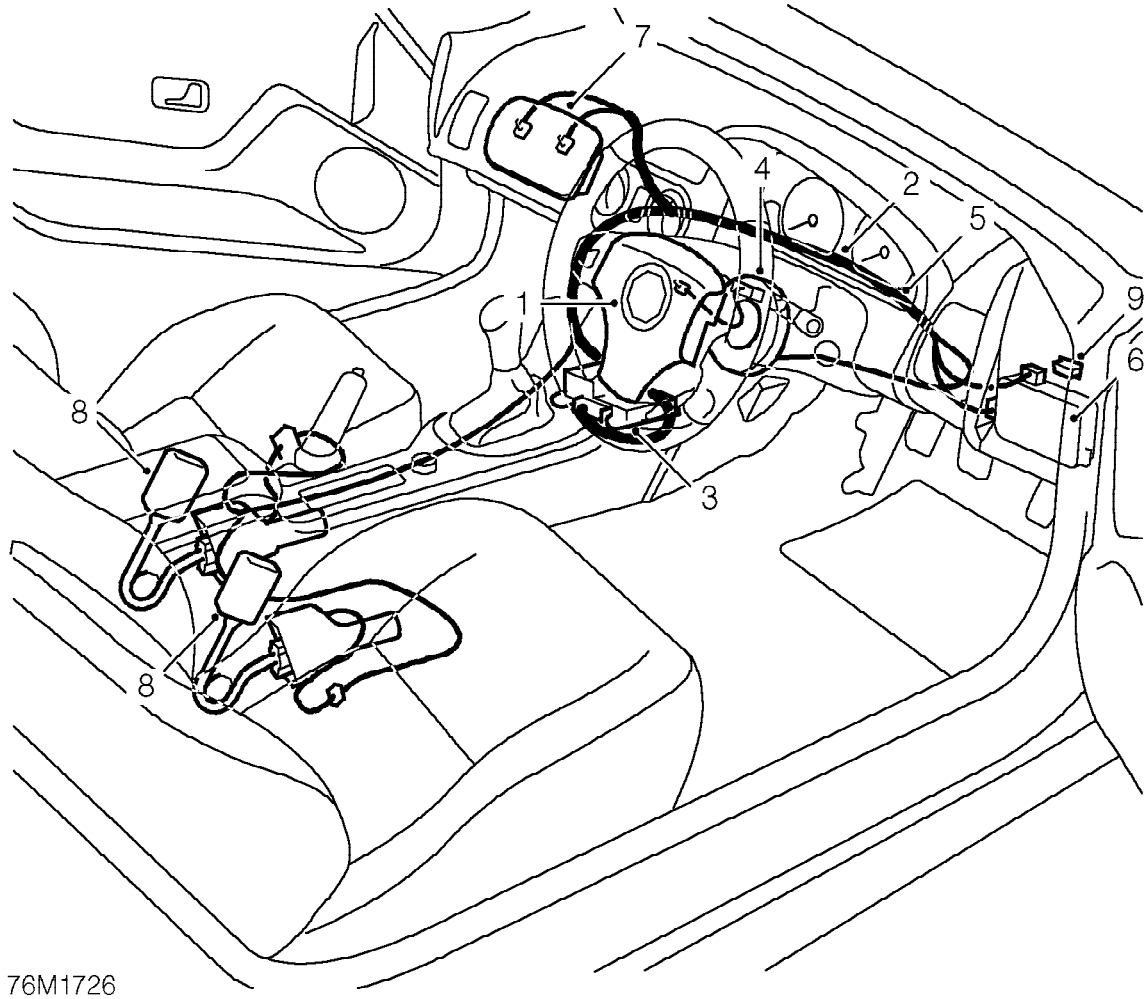
COMPONENT LOCATION

NOTE: LHD type is symmetrical to RHD type.



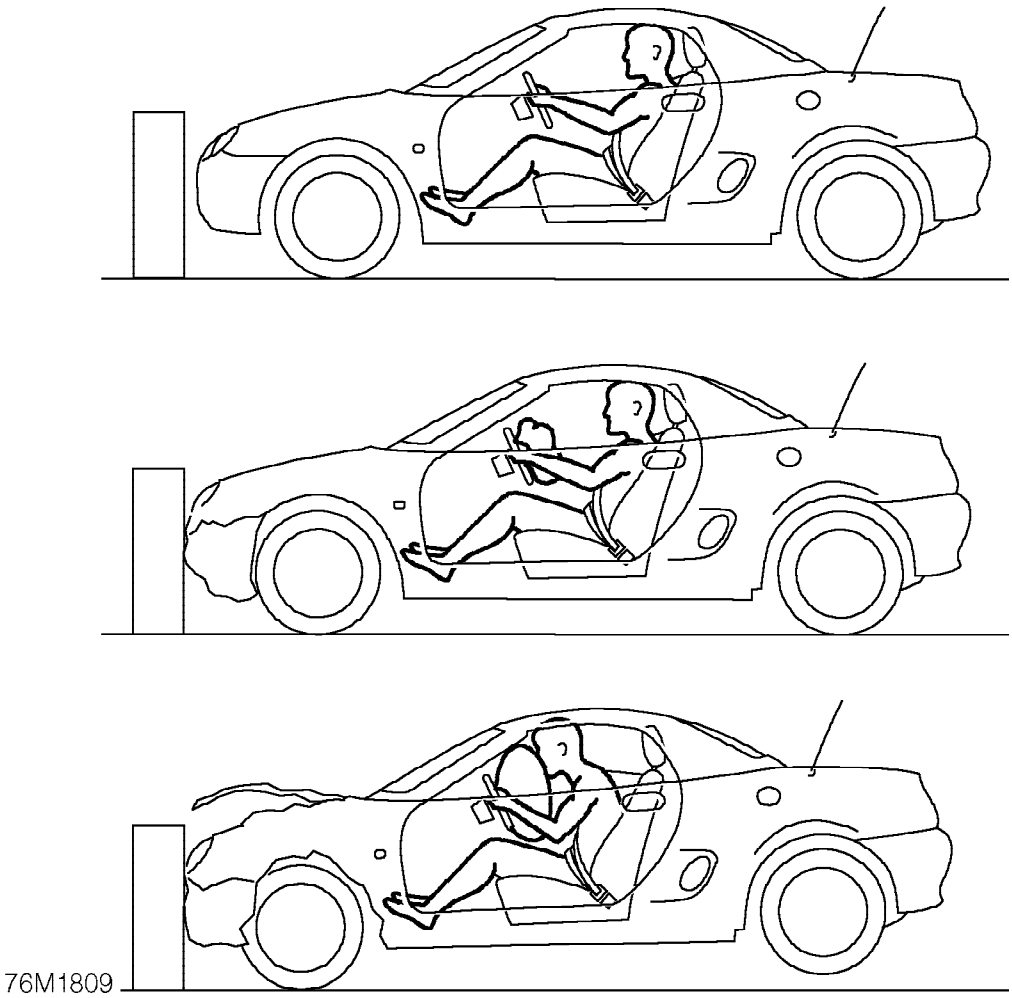
1. Driver's airbag module *
2. SRS warning light
3. Diagnostic control unit *
4. Rotary coupler *
5. SRS harness (YELLOW) *
6. Fuse/relay box
7. Passenger's airbag module (optional) *
8. Seat belt pre-tensioners *
9. Diagnostic socket

* Components to be renewed following system deployment.

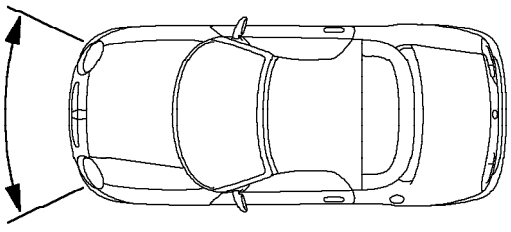
Following deployment of the Supplementary Restraint System (SRS), under any circumstances, the above components marked with an asterisk must be renewed.

Impacts which do not deploy airbags, check for structural damage in the area of impact, paying particular attention to bumper armatures, longitudinals, crash cans and bracketry.

DESCRIPTION



The airbag Supplementary Restraint System (SRS) is a safety device which, when deployed in the event of a severe frontal impact, provides additional protection to the driver's face and upper torso. The airbag is designed to inflate when the vehicle is exceeding a set speed and receives a frontal impact within the area shown.



OPERATION

Diagnostic Control Unit

CAUTION: The diagnostic control unit is a non-serviceable component and no attempt should be made to repair or modify the unit.

The diagnostic control unit which is mounted within the passenger compartment performs two functions:

1. It monitors the airbag system for faults;
2. It provides a fire signal to the airbag(s) in the event of a crash.

The warning lamp illuminates to inform the driver of any airbag system faults.

The diagnostic control unit comprises of the following circuits which control the airbag system:

1. The crash sensor determines the severity of any impact and can discriminate between rough road conditions and an actual crash.
2. The safing sensor is wired in series with the crash sensor. The fire signal from the crash sensor therefore, passes through the safing sensor which confirms a crash is taking place.
3. The regulator circuit maintains stability of the system in the event of battery voltage drop.
4. The back-up power supply provides power to the system in the event of the battery being damaged or disconnected during the impact.
5. Internal diagnostics continually monitor the SRS system.

The fire signal from the diagnostic control unit passes via the airbag harness to the airbag modules and pretensioners. Grains of Nitrocellulose and Nitroglycerine inside the airbag module, ignite and combine in a chemical reaction to form a large amount of Nitrogen gas leading to inflation of the airbag in approximately 30 milli-seconds.

As the occupant moves forward into the airbag it immediately deflates to provide progressive deceleration and reduce the risk of injuries.

Sequence of operation:

1. The main sensor and the safing sensor are activated.
2. Power is supplied to the airbag igniter by the battery or the back-up circuit.
3. The airbag deploys.

It takes approximately 0.1 seconds from the beginning of the airbag deployment until it is completely deflated.

System check

The warning light, located in instrument pack illuminates when the electrical circuits are switched on whilst the system performs a self diagnosis test. If the system finds no fault during self diagnosis the light will extinguish after approximately 5 seconds and remain extinguished.

In the event of a fault in the system, the warning light will illuminate continuously or fail to illuminate during the self diagnosis test.

Fault finding diagnosis

Faults in the SRS system can be identified by connecting TestBook into the diagnostic socket, located on the passenger compartment fuse box.

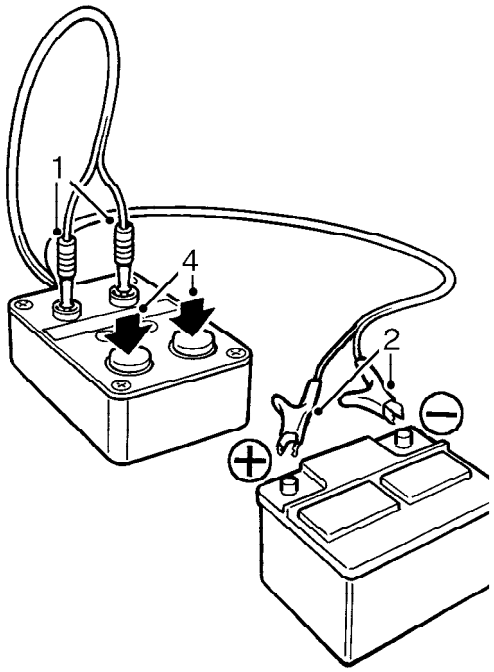
AIRBAG AND PRE-TENSIONER, MANUAL DEPLOYMENT

NOTE: Pre-tensioner deployment is done in car only.

If a vehicle is to be scrapped and contains an undeployed airbag module, or pre-tensioner, the components must be manually deployed. This operation should only be carried out using the following recommended manual deployment procedure.

Before deployment is started the deployment tool self test procedure should be carried out.

Deployment tool SMD 4082/1 self test procedure



M76 3660

1. Insert BLUE and YELLOW connectors of the deployment tool lead into the corresponding sockets on the face of the deployment tool.
2. Connect crocodile clips of the second deployment tool lead to the battery, red to positive and black to negative.
3. RED "READY" light should illuminate.
4. Press and hold both operating buttons.
5. GREEN "DEFECTIVE" light should illuminate.
6. Release both operating buttons.
7. RED "READY" light should illuminate.
8. Disconnect the deployment tool from the battery.
9. Disconnect the BLUE and YELLOW connectors from the deployment tool face sockets.
10. Deployment tool self-test is now complete.

Deployment of seat belt pre-tensioner

These guidelines are written to aid authorised personnel to carry out the safe manual deployment and disposal of the seat belt pre-tensioners.

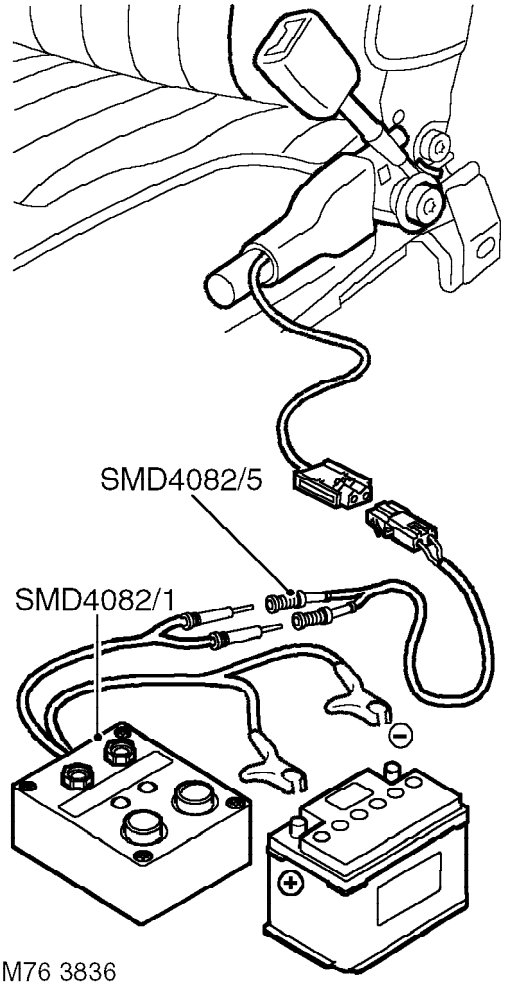
WARNING: Always read and adhere to the SRS deployment precautions outlined in this workshop manual. *See GENERAL INFORMATION, SRS Precautions.*

- **Always remove the key from the ignition switch and disconnect the vehicle battery (negative lead first) before starting the deployment procedures.**
- **Always observe the system safe time of 10 minutes (to allow the energy reserve capacitors to discharge) before disconnecting or removing any SRS components.**
- **Only use the MG Rover approved deployment equipment.**
- **Deploy the seat belt pre-tensioners in a well ventilated, specially designated area.**
- **Ensure the seat belt pre-tensioner is not damaged or ruptured before deploying.**
- **Notify the relevant authorities.**

Deploy

1. Carry out deployment tool **SMD 4082/1** self test.
2. Slide the front seat fully forward to access the pre-tensioner harness connector.
3. Disconnect pre-tensioner harness connector.

WARNING: Ensure deployment tool SMD 4082/1 is not connected to the battery.



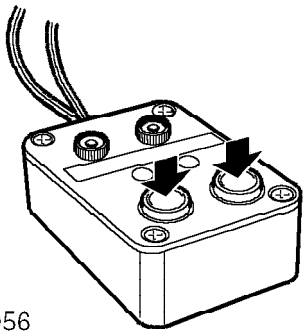
M76 3836

4. Connect deployment tool flylead **SMD 4082/5** to the pre-tensioner connector.
5. Connect deployment tool flylead **SMD 4082/5** to deployment tool **SMD 4082/1** .

WARNING: Ensure the pre-tensioner is secured tightly to the seat.

WARNING: Ensure all personnel are standing at least 15 metres (50 ft.) away from the pre-tensioner module.

6. Connect deployment tool **SMD 4082/1** to the battery.



M76 3056

7. Press both operating buttons of deployment tool **SMD 4082/1** to deploy the pre-tensioner.

WARNING: A deployed pre-tensioner gas generator will be very hot, DO NOT return to the pre-tensioner for 30 minutes.

CAUTION: Wear a face shield and gloves when handling a deployed pre-tensioner unit. Wash hands and rinse well after handling a deployed pre-tensioner unit.

8. Remove the front seat belt pre-tensioner assembly from the vehicle. ***See Repairs.***
9. Wipe down the deployment tools with a damp cloth.
10. Place the pre-tensioner in a strong plastic bag and seal the bag.
11. Transport the deployed pre-tensioner to the designated area for incineration.

NOTE: DO NOT transport the deployed pre-tensioner unit in the vehicle passenger compartment.

12. Scrap all remaining parts of the seat belt and pre-tensioner assembly. **DO NOT** re-use or salvage any parts of the seat belt and pre-tensioner assembly.

Deployment of driver airbag module

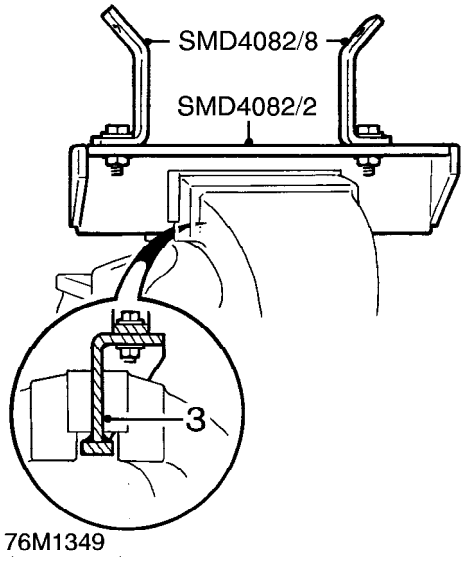
These guidelines are written to aid authorised personnel to carry out the safe manual deployment and disposal of airbag modules when they are removed from the vehicle.

WARNING: Always read and adhere to the SRS deployment precautions outlined in this workshop manual. *See GENERAL INFORMATION, SRS Precautions.*

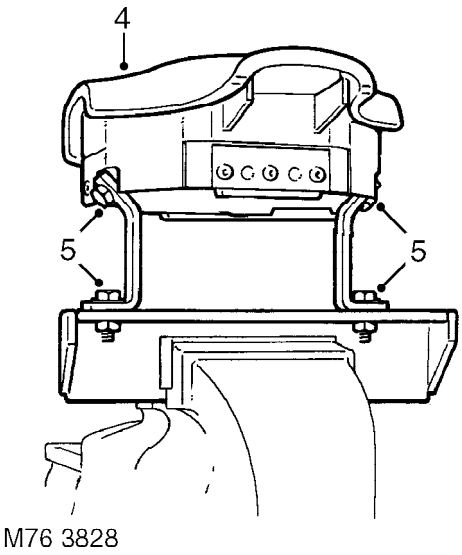
- **Always remove the key from the ignition switch and disconnect the vehicle battery (negative lead first) before starting the deployment procedures.**
- **Always observe the system safe time of 10 minutes (to allow the energy reserve capacitors to discharge) before disconnecting or removing any SRS components.**
- **Only use the MG Rover approved deployment equipment.**
- **Deploy the airbag modules in a well ventilated, specially designated area.**
- **Ensure the airbag module is not damaged or ruptured before deploying.**
- **Notify the relevant authorities.**

Deploy

1. Carry out deployment tool **SMD 4082/1** self test.
2. Remove the airbag module from the steering wheel. ***See Repairs.***

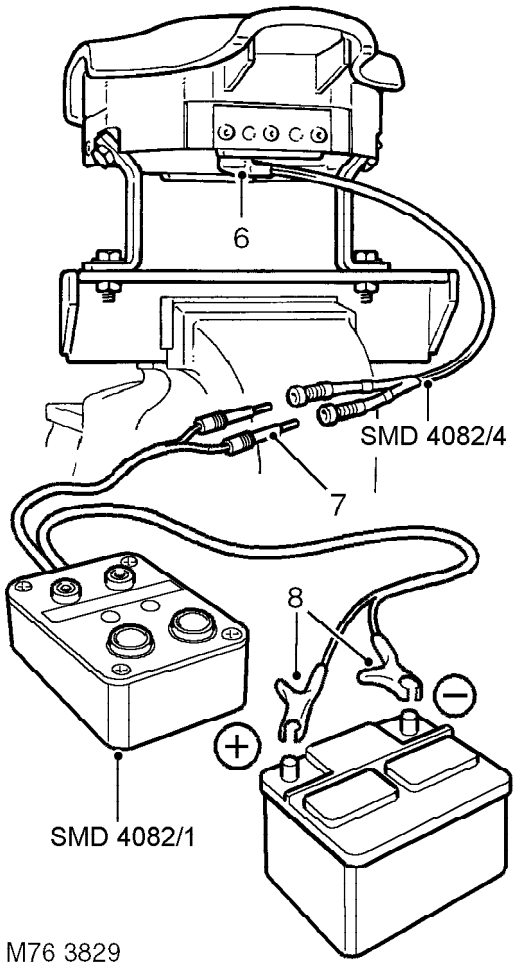


3. Position tool **SMD 4082/2** in a vice, ensuring that the vice jaws grip the tool above the bottom flange to prevent the possibility of the tool being forced upwards from the vice. Tighten the vice.



4. Secure the airbag module to tool **SMD 4082/2** using the appropriate mounting brackets (e.g. **SMD 4082/8**).
5. Ensure the airbag module mounting brackets are secure.

WARNING: Ensure deployment tool SMD 4082/1 is not connected to the battery.

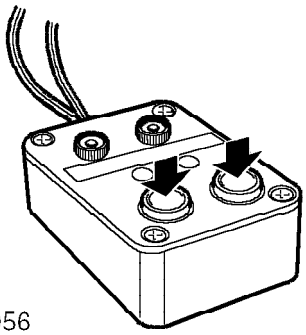


6. Connect deployment tool flylead **SMD 4082/4** to the driver airbag module.
7. Connect deployment tool flylead **SMD 4082/4** to deployment tool **SMD 4082/1.**

WARNING: Do not lean over the airbag module whilst connecting.

WARNING: Ensure all personnel are standing at least 15 metres (50 ft.) away from the airbag module.

8. Connect deployment tool **SMD 4082/1** to the battery.

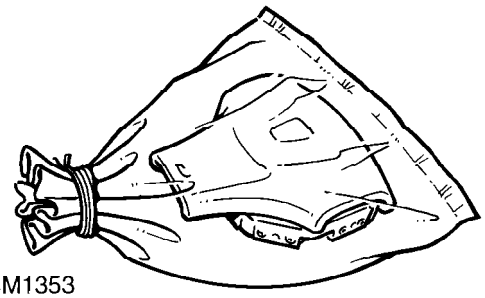


M76 3056

9. Press both operating buttons of deployment tool **SMD 4082/1** to deploy the airbag module.

WARNING: A deployed airbag module will be very hot. DO NOT return to the airbag module for 30 minutes.

CAUTION: Wear a face shield and gloves when handling a deployed airbag module. Wash hands and rinse well after handling a deployed airbag module.



76M1353

10. Remove the driver airbag module from the deployment tools and place the deployed airbag module in a strong plastic bag, and seal bag.
11. Wipe down the deployment tools with a damp cloth.
12. Transport the deployed driver airbag module to the designated area for incineration.

NOTE: DO NOT transport the airbag module in the vehicle passenger compartment.

13. Scrap all remaining parts of airbag system. **DO NOT** re-use or salvage any parts of the airbag system.

Deployment of passenger airbag module

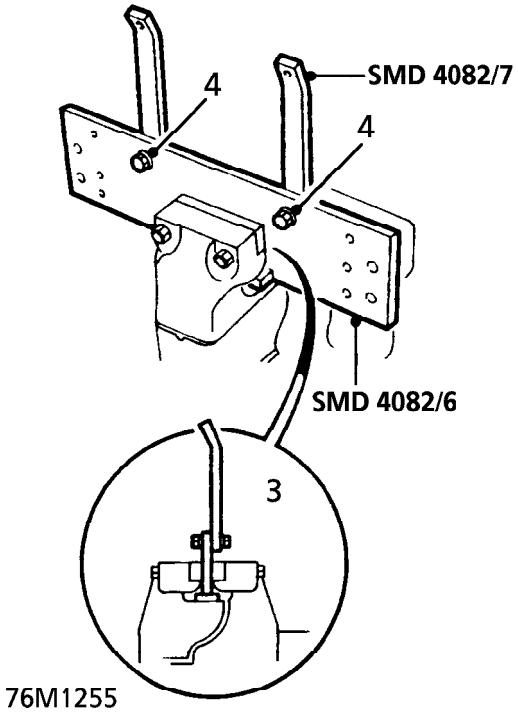
These guidelines are written to aid authorised personnel to carry out the safe manual deployment and disposal of airbag modules when they are removed from the vehicle.

WARNING: Always read and adhere to the SRS deployment precautions outlined in this workshop manual. *See GENERAL INFORMATION, SRS Precautions.*

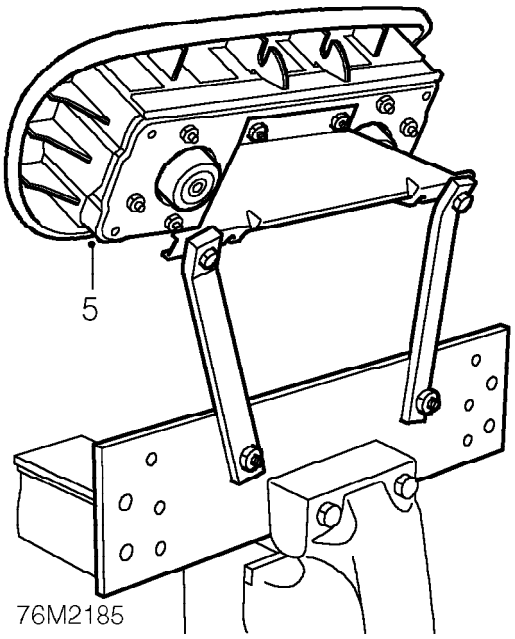
- **Always remove the key from the ignition switch and disconnect the vehicle battery (negative lead first) before starting the deployment procedures.**
- **Always observe the system safe time of 10 minutes (to allow the energy reserve capacitors to discharge) before disconnecting or removing any SRS components.**
- **Only use the MG Rover approved deployment equipment.**
- **Deploy the airbag modules in a well ventilated, specially designated area.**
- **Ensure the airbag module is not damaged or ruptured before deploying.**
- **Notify the relevant authorities.**

Deploy

1. Carry out deployment tool **SMD 4082/1** self test.
2. Remove the passenger airbag module. ***See Repairs.***

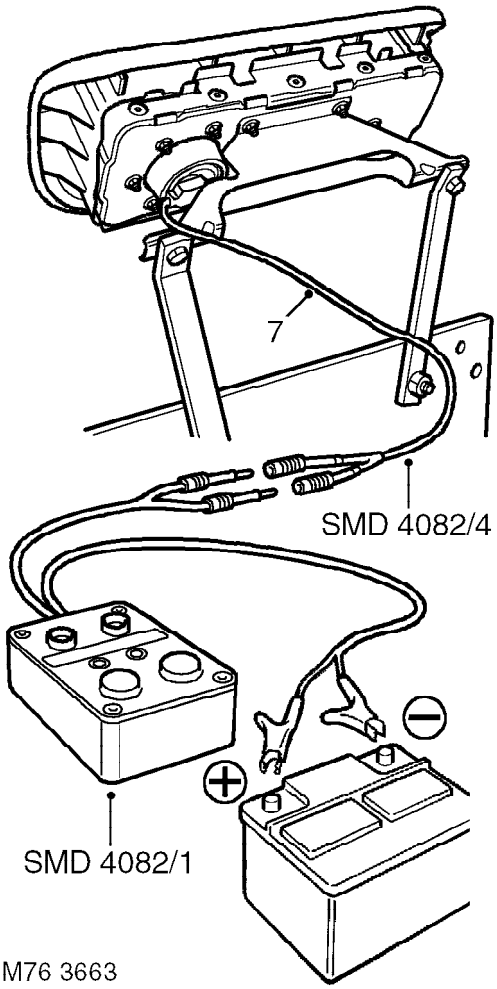


3. Position tool **SMD 4082/6** in a vice, ensuring that the vice jaws grip the tool above the bottom flange to prevent the possibility of the tool being forced upwards from the vice. Tighten the vice.
4. Position brackets **SMD 4082/7** to tool **SMD 4082/6** , lightly tighten the bolts.



5. Position the airbag module to tool **SMD 4082/6**.
6. Ensure all the airbag module and mounting bracket fixings are secure.

WARNING: Ensure tool SMD 4082/1 is not connected to the battery.

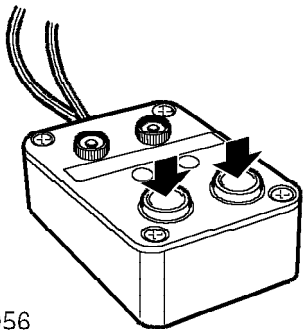


7. Connect deployment tool flylead **SMD 4082/4** to the passenger airbag module.
8. Connect deployment tool flylead **SMD 4082/4** to the deployment tool **SMD 4082/1.**

WARNING: Do not lean over the airbag module whilst connecting.

WARNING: Ensure all personnel are standing at least 15 metres (50 ft.) away from the airbag module.

9. Connect deployment tool **SMD 4082/1** to the battery.



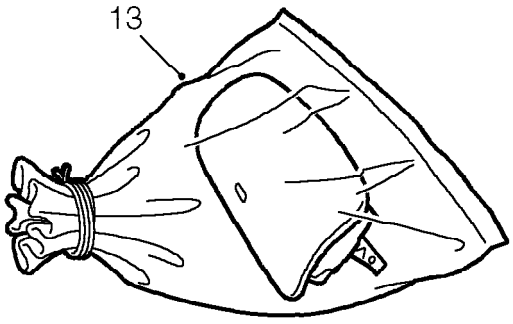
M76 3056

10. Press both operating buttons of deployment tool **SMD 4082/1** to deploy the airbag module.

WARNING: A deployed airbag module will be very hot. DO NOT return to the airbag module for 30 minutes.

CAUTION: Wear a face shield and gloves when handling a deployed airbag module. Wash hands and rinse well after handling a deployed airbag module.

11. Disconnect the passenger airbag module from deployment tool **SMD 4082/1** and remove the airbag module from the mounting brackets.
12. Wipe down the deployment tools with a damp cloth.



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13. Place the deployed passenger airbag module in a strong plastic bag and seal the bag.
14. Transport the deployed airbag module to the designated area for incineration.

NOTE: DO NOT transport the airbag module in the vehicle passenger compartment.

15. Scrap all remaining parts of the airbag system. **DO NOT** re-use or salvage any parts of the airbag system.

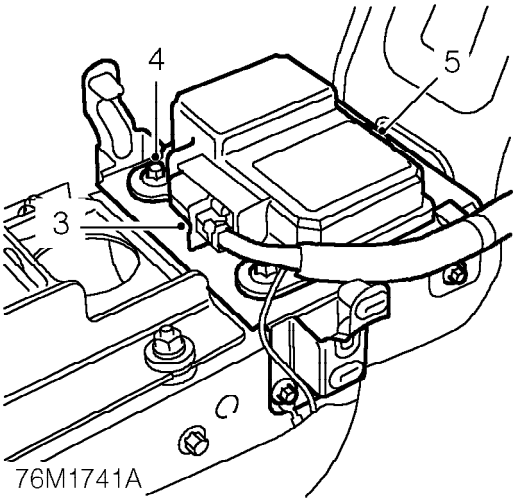
DIAGNOSTIC CONTROL UNIT (DCU)

Service repair no - 76.73.72

WARNING: *See GENERAL INFORMATION, SRS Precautions.*

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove centre console panel. ***See BODY, Interior trim components.***



3. Disconnect multiplug from DCU.
4. Remove 3 Torx bolts securing DCU to bracket.
5. Remove DCU.

Refit

WARNING: Because the crash sensor is incorporated inside the DCU, it is imperative that bolts securing the DCU are tightened to their correct torque.

1. Position DCU to support bracket, fit and tighten Torx bolts to 10 Nm.
2. Connect multiplug.

CAUTION: Before connecting multiplug ensure that clip is in the open position, pointing away from the harness. Lock the connector into position by pushing clip towards harness.

3. Fit centre console panel. ***See BODY, Interior trim components.***
4. Carry out system check using TestBook.

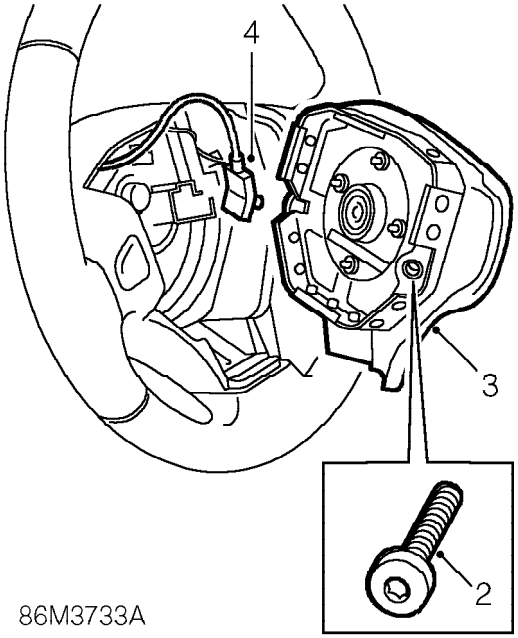
DRIVER AIRBAG MODULE

Service repair no - 76.74.71

WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***



2. Remove 2 Tx30 Torx screws securing module to steering wheel.
3. Release air bag module from steering wheel.

CAUTION: Do not allow the air bag module to hang by the air bag harness.

4. Disconnect multiplug from air bag module.
5. Remove air bag module.

CAUTION: Store the air bag module in accordance with the storage procedures outlined in the precautions part of this manual. ***See GENERAL INFORMATION, SRS Precautions.***

NOTE: If the air bag module is to be replaced, the bar code must be recorded.

Refit

1. Position module to steering wheel and connect harness multiplug.
2. Align module to steering wheel, fit Torx screws and tighten to 8 Nm
3. Carry out system check using TestBook.

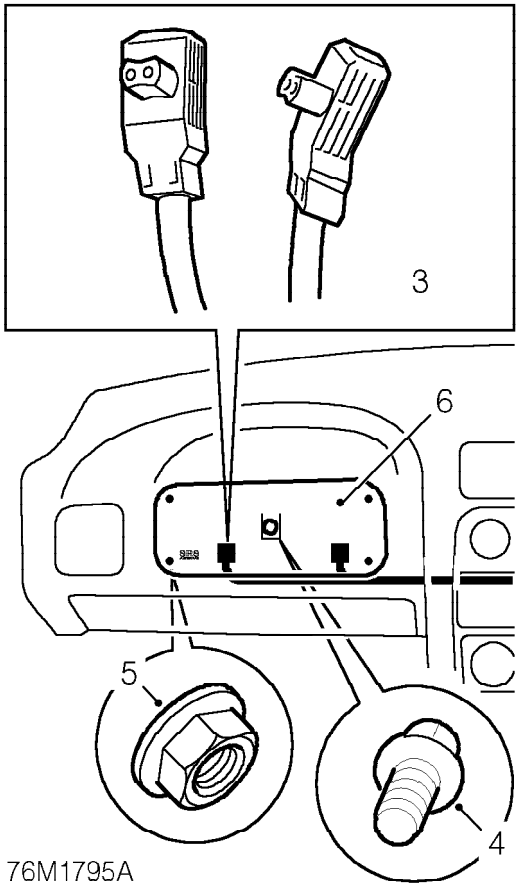
PASSENGER AIRBAG MODULE

Service repair no - 76.74.69

WARNING: *See GENERAL INFORMATION, SRS Precautions.*

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove glovebox. ***See BODY, Interior trim components.***



3. Disconnect 2 multiplugs from airbag.
4. Remove bolt securing bracket to fascia cross rail.
5. Remove 4 nuts securing airbag to bracket.
6. Remove airbag module.

CAUTION: Store the airbag module in accordance with the storage procedures outlined in the precautions part of this manual. *See GENERAL INFORMATION, SRS Precautions.*

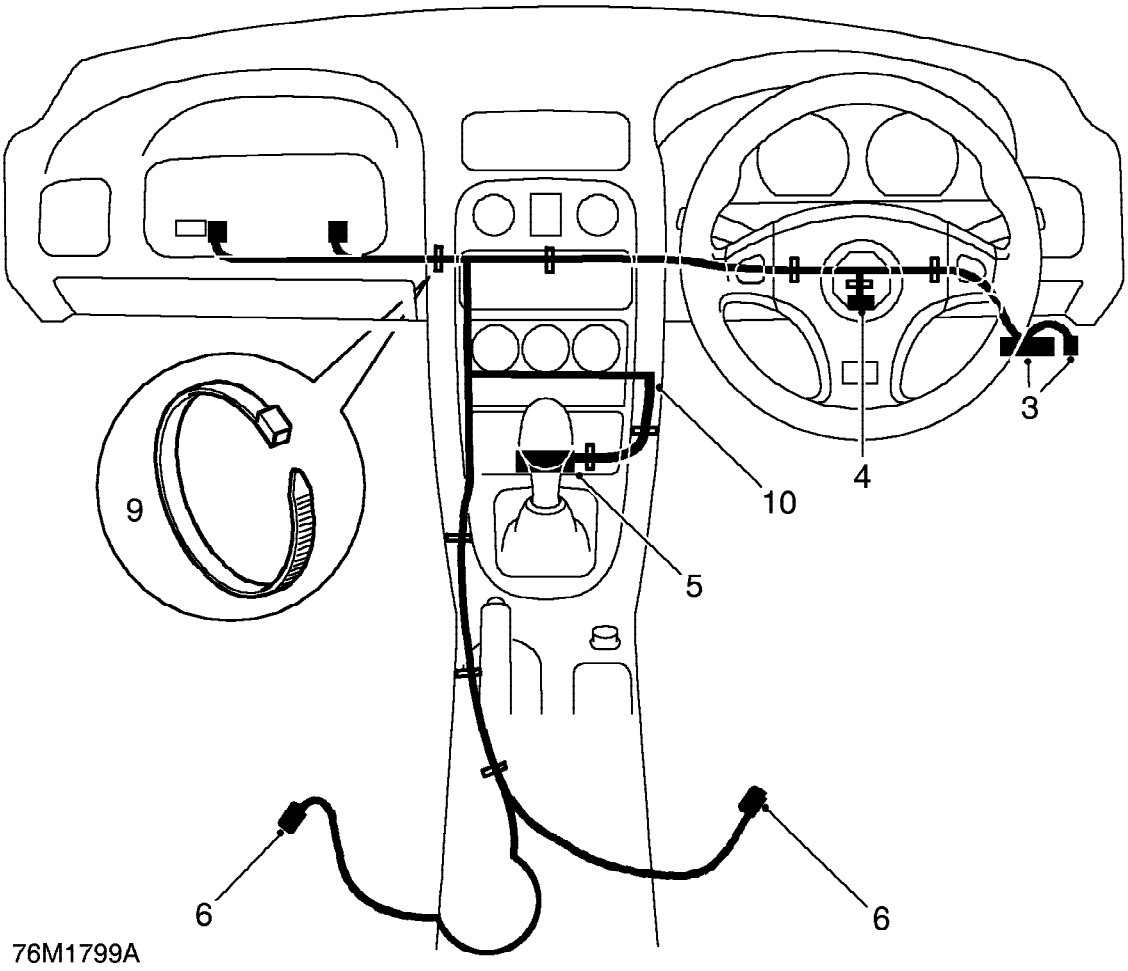
NOTE: If the airbag module is to be replaced, the bar code must be recorded.

Refit

1. Position module to fascia bracket and tighten nuts to 8 Nm.
2. Tighten bolt securing bracket to fascia rail to 9 Nm.
3. Connect multiplugs.
4. Fit glovebox. ***See BODY, Interior trim components.***
5. Carry out system check using TestBook.

SRS HARNESS

Service repair no - 76.73.73



WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove fascia. ***See BODY, Interior trim components.***
3. Disconnect SRS multiplug and SRS fuse satellite from fusebox.
4. Disconnect multiplug from steering column.
5. Disconnect multiplug from DCU and release harness from bracket clip.
6. Disconnect 2 multiplugs from seatbelt pre-tensioners.
7. Remove 4 Torx bolts securing DCU bracket to tunnel, release harness earth and position DCU aside.
8. Remove 4 nuts and 3 bolts securing gear lever assembly to tunnel and position assembly aside.
9. Release 11 cable clips securing SRS harness to main harness.
10. Remove SRS harness.

Refit

1. Position harness to body.
2. Connect fuse satellite and multiplug to fusebox.
3. Connect multiplugs to seatbelt pre-tensioners.
4. Secure harness with clips.

CAUTION: Ensure that pre-tensioner leads pass through grommets in centre console area.

5. Position gear lever assembly to tunnel and tighten fixings to 9 Nm.

WARNING: Because the crash sensor is incorporated inside the DCU, it is imperative that all bolts securing the DCU are tightened to their correct torque.

6. Position DCU bracket to tunnel, fit harness earth lead and tighten fixings to 10 Nm.
7. Connect multiplug to steering column.

CAUTION: Before connecting DCU multiplug ensure that clip is in the open position, pointing away from the harness. Lock the connector into position by pushing clip towards the harness.

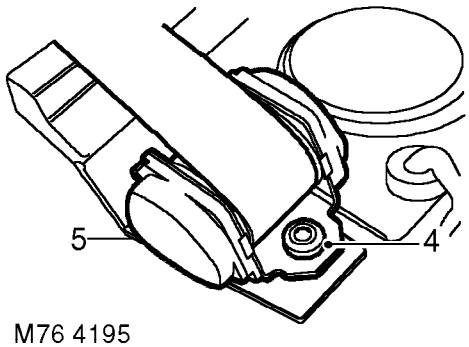
8. Connect multiplug to DCU and fit harness to clip.
9. Fit fascia. ***See BODY, Interior trim components.***
10. Carry out system check using TestBook.

SEAT BELT

Service repair no - 76.73.13

Remove

1. Remove seat. ***See BODY, Interior trim components.***
2. Remove Torx bolt securing seat belt strap to seat frame.
3. Remove hoodwell trim. ***See BODY, Interior trim components.***



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4. Remove Torx screw securing seat belt reel to body.
5. Remove seat belt.

Refit

1. Position seat belt reel to body, fit and tighten Torx screw to 35 Nm.
2. Fit hoodwell trim. ***See BODY, Interior trim components.***
3. Position seat belt strap to seat, fit bolt and tighten to 30 Nm.
4. Fit seat. ***See BODY, Interior trim components.***

SEAT BELT PRE-TENSIONER

Service repair no - 76.73.75

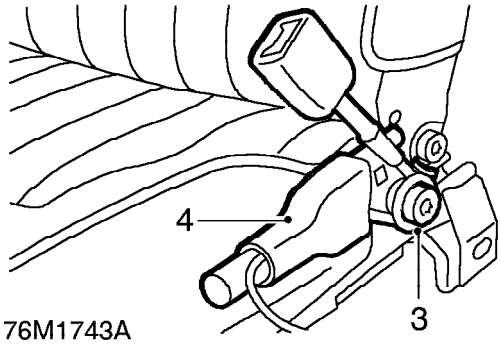
WARNING: *See GENERAL INFORMATION, SRS Precautions.*

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***

CAUTION: Ensure pre-tensioner multiplug is disconnected before seat is removed.

2. Remove seat. ***See BODY, Interior trim components.***



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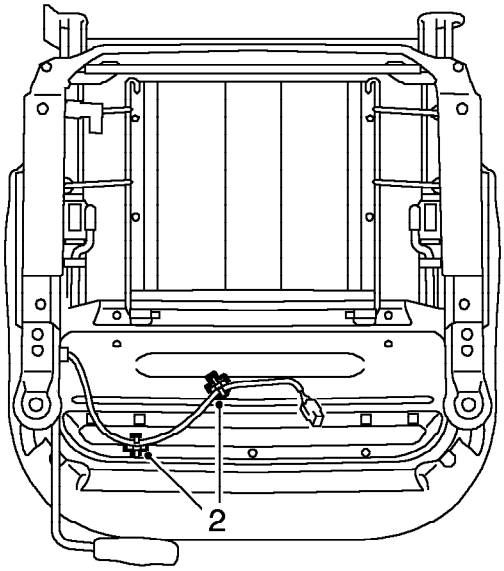
3. Remove bolt securing pre-tensioner to seat.
4. Remove pre-tensioner.

Refit

1. Position pre-tensioner to seat and tighten bolt to 45 Nm.



76M2318

2. Ensure that pre-tensioner lead is correctly clipped to seat base.
3. Fit seat. ***See BODY, Interior trim components.***
4. Carry out system check using TestBook.

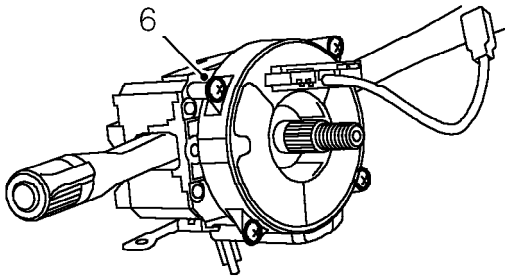
ROTARY COUPLER

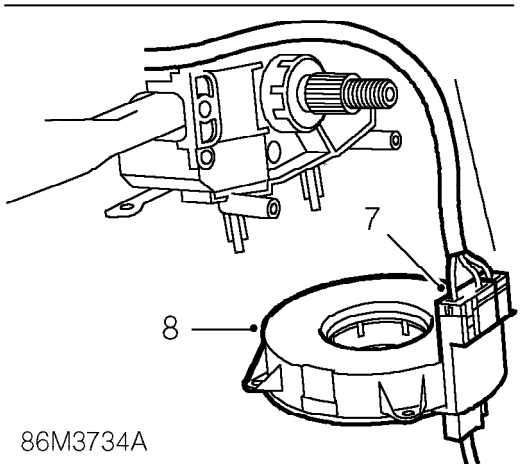
Service repair no - 86.65.85

WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Ensure wheels are in the straight ahead position.
3. Remove steering wheel. ***See STEERING, Repairs.***
4. Remove steering column nacelle. ***See STEERING, Repairs.***
5. If the rotary coupler is being re-used, place adhesive tape around moulding to prevent rotation.





6. Remove 4 screws securing rotary coupler to steering column switch pack.
7. Release rotary coupler from column and disconnect 2 multiplugs.
8. Remove rotary coupler.

CAUTION: Do not dismantle the rotary coupler. It has NO serviceable parts and must be replaced as a complete assembly.

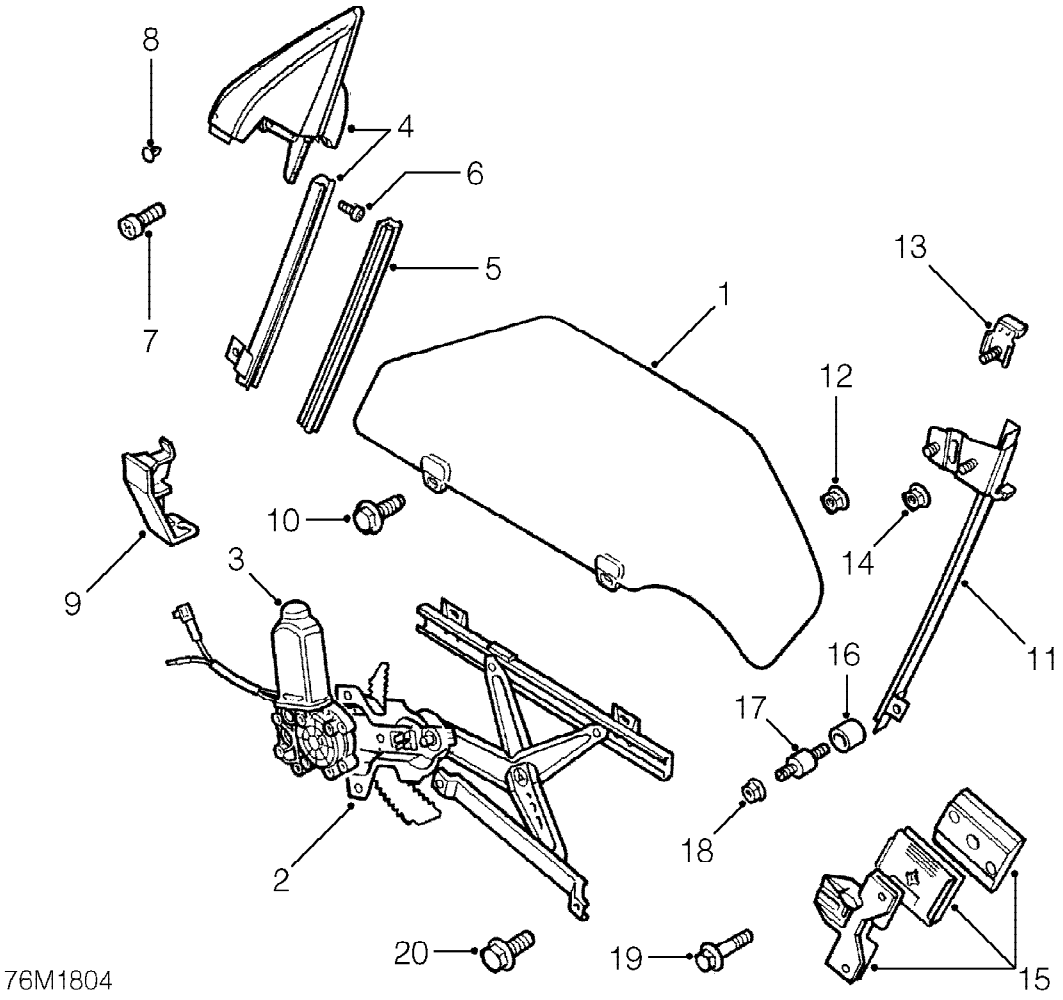
Refit

1. Position rotary coupler to switch pack.
2. Connect multiplugs.
3. Fit and tighten screws.
4. Remove adhesive tape.
5. Fit steering column nacelle. ***See STEERING, Repairs.***
6. Fit steering wheel. ***See STEERING, Repairs.***
7. Carry out system check using TestBook.

CONTENTS

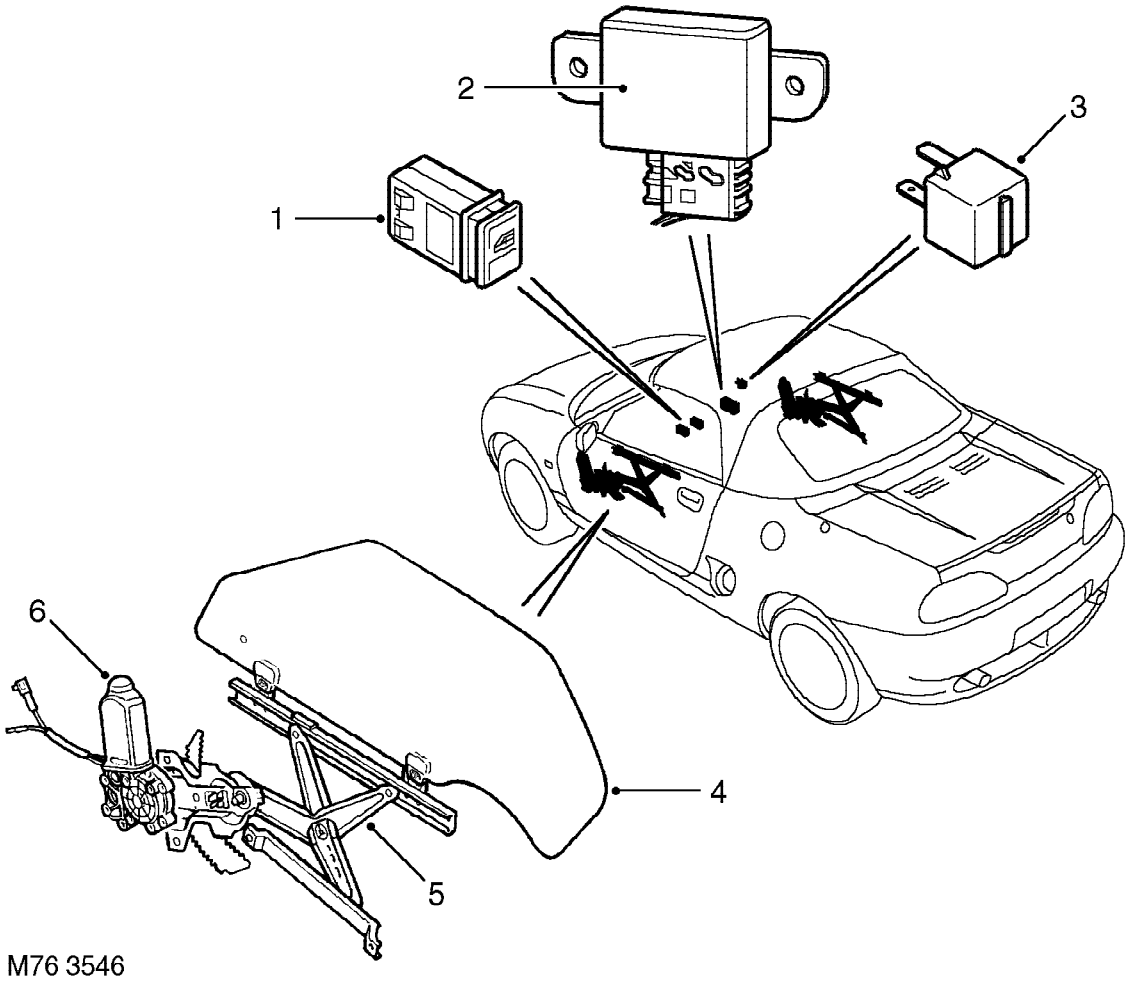
CONTENTS

ELECTRIC WINDOW LIFT COMPONENTS



1. Door glass
2. Regulator
3. Motor
4. Cheater assembly
5. Sash
6. Screw - sash to cheater, 2 off
7. Screw - cheater, 2 off
8. Fastener - cheater
9. Glass stop,
10. Bolt - glass to regulator, 2 off
11. Sash
12. Nut - upper rail bracket, 2 off
13. Stud bracket - glass retention
14. Nut - glass retention
15. Glass retention assembly
16. Sleeve - sash adjuster, 2 off
17. Screw - sash adjuster, 2 off
18. Nut - sash adjuster, 2 off
19. Bolt - glass retention
20. Bolt - regulator, 2 off

ELECTRIC WINDOW OPERATION



(RHD shown, LHD similar)

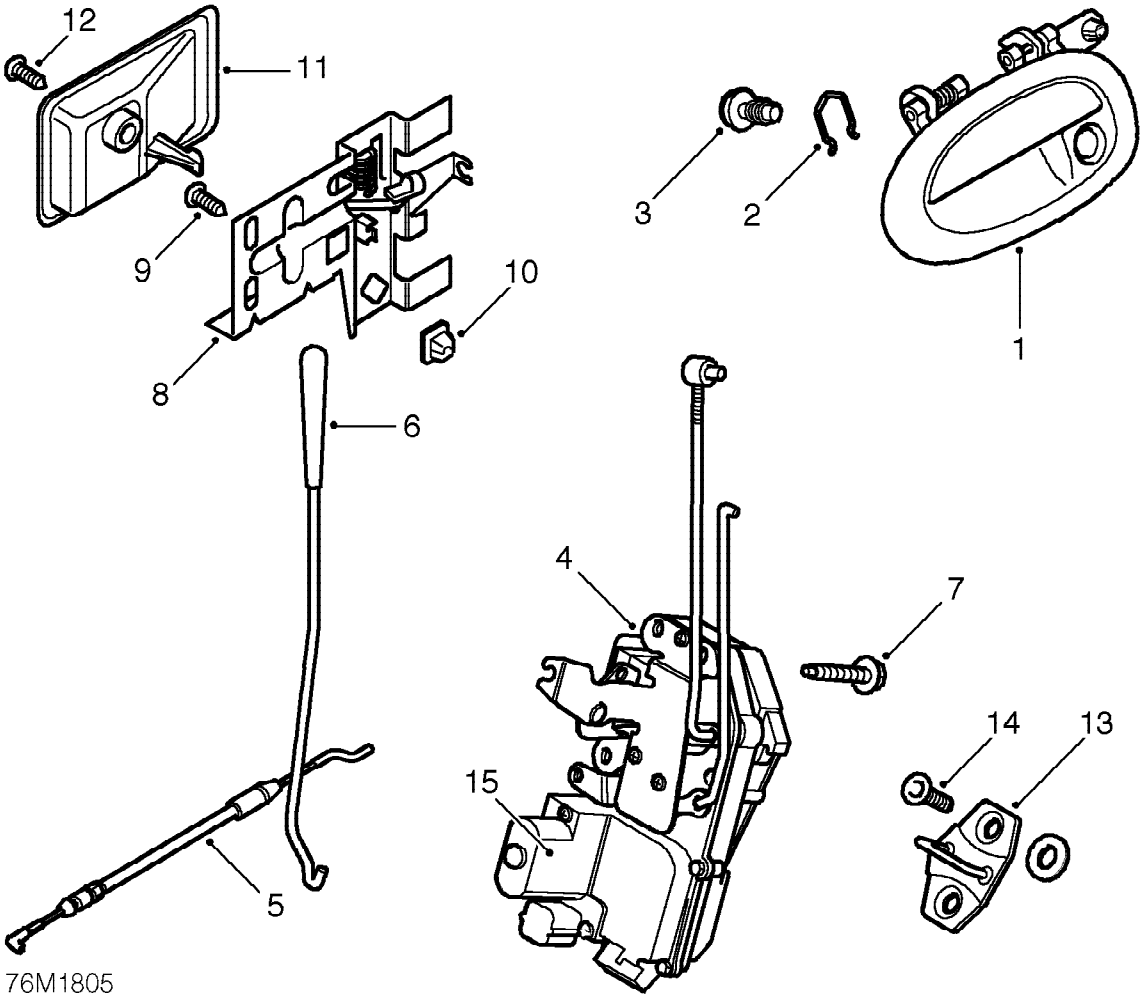
1. Window switch
2. Window lift ECU
3. Window relay
4. Glass
5. Regulator
6. Motor

The two window lift system is controlled by switches fitted in the centre console. When the ignition is switched on, the electric window relay located on the passenger compartment fusebox, switches power supply to the window circuit. The electric motor via an integral gearbox, operates the regulator assembly to lift and lower the window glass.

Battery supply from the electric window relay to the window switches is via two fuses, one for each door, located in the driver's compartment fusebox.

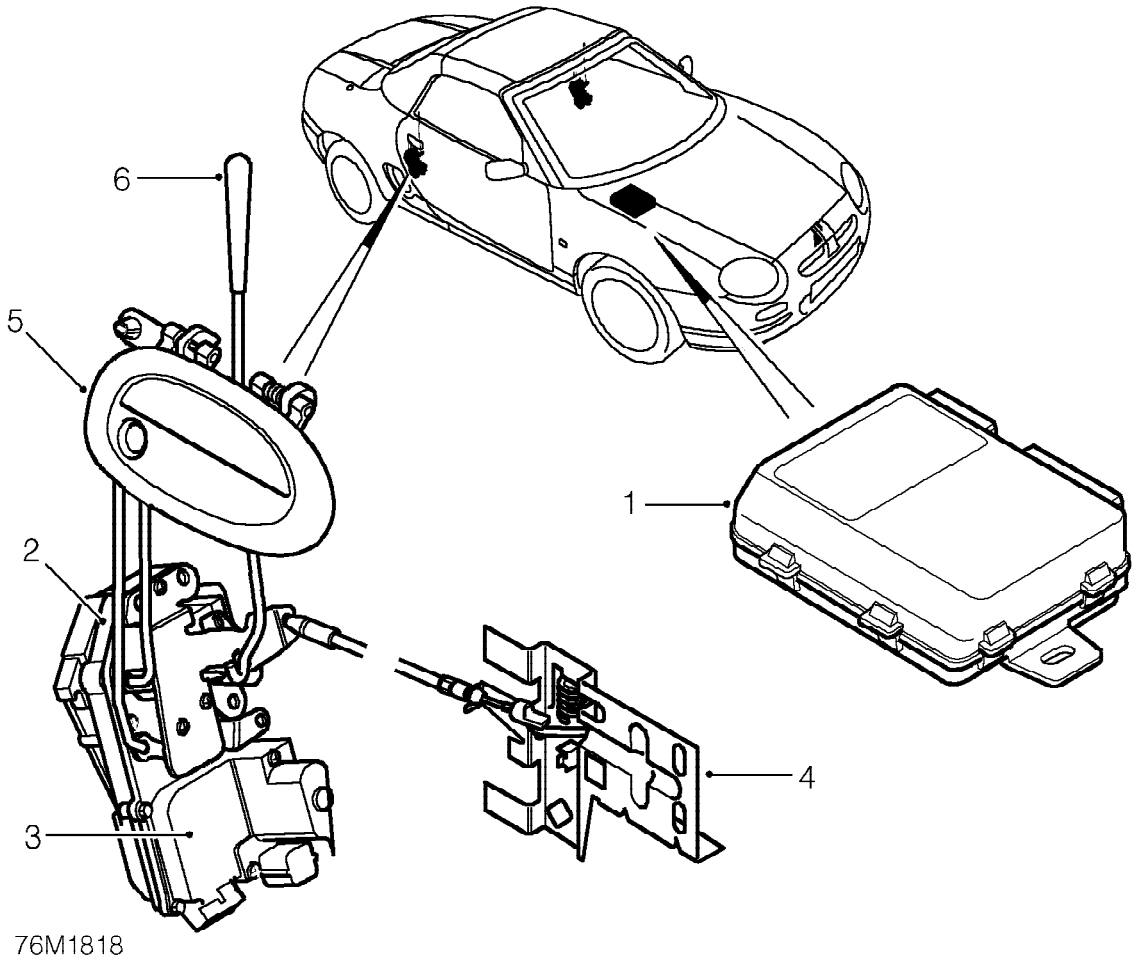
The driver's door window has a 'one-shot' down facility which allows the window to be fully lowered with a single press of the window switch. This is controlled by a window lift ECU which is located at the bottom of the 'A' post, behind the carpet. The ECU controls all functions of the driver's window. The passenger window remains controlled by the multi function ECU and the window lift relay as on previous models.

DOOR - CENTRAL LOCKING COMPONENTS



1. External door handle assembly
2. Retaining clip - cylinder block
3. Bolt - outer door handle
4. Latch assembly
5. Cable - remote door handle
6. Sill button and rod
7. Screw - latch assembly
8. Remote door handle assembly
9. Screw - inside door handle
10. Holder - lock rod
11. Escutcheon - remote door handle
12. Screw - escutcheon
13. Striker - door lock
14. Bolt - striker
15. Lock motor

DOOR CENTRAL LOCKING - OPERATION



1. Anti-theft alarm ECU
2. Latch assembly
3. Lock motor
4. Internal door handle
5. External door handle and lock
6. Sill button

Central door locking is operated by using any one of the following:

- Remote handset,
- Key in the driver's door lock,
- Driver's door sill button.

Both door locks are operated by separate integral lock motors which function simultaneously. They are controlled by the alarm ECU mounted behind the fascia centre console, below the heater control unit.

A signal from the remote handset is received by the alarm ECU. Depending on this signal the ECU will either lock or unlock the doors by controlling the direction of electrical current sent to the lock motors.

When the driver's door key is turned or the sill button is depressed, the driver's door is mechanically locked by the door latch which triggers the latch switch. The latch switch sends an earth signal to the alarm ECU, which in turn controls the electrical current sent to the passenger door motor to lock the door.

Operation of the passenger door sill button will lock or unlock the passenger door but will not operate the central door locking system.

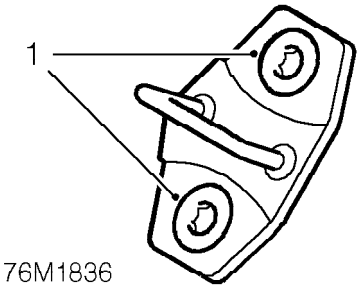
DOOR - ALIGN ON HINGES

Service repair no - 76.28.07

1. Turn wheel in lock for access to wheel arch liner screws.
2. Remove 3 screws and 3 scrivets securing wheel arch liner.
3. Remove wheel arch liner to gain access to hinge bolts.
4. Open door.
5. Remove screws securing door striker to 'B' post collect striker.
6. Loosen bolts securing hinges to 'A' post.
7. Align door to meet the profile of adjacent panels, and ensure all surrounding door gaps are parallel.
8. Tighten door hinge bolts.
9. Re-check door alignment.
10. Position door striker and fit screws.
11. Adjust door striker so that the door closes without the need for slamming it.
12. Tighten door striker screws to 18 Nm .
13. Fit wheel arch liner and secure with screws and scrivets.

DOOR STRIKER - ADJUST

Service repair no - 76.28.05



1. Using a Torx bit loosen 2 striker screws and close door.
2. Check door for flush fit to adjacent panels and edges for equal gap.
3. Open door and tighten striker screws to 18 Nm.

DOOR GLASS - ADJUST

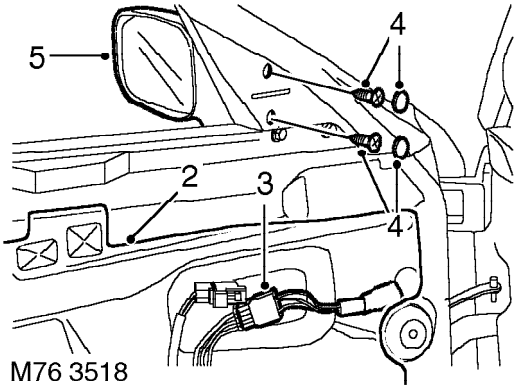
1. For information on adjustment of the door glass, see hood seals and door glass - adjust. ***See Hood.***

MIRROR - EXTERIOR - ELECTRIC

Service repair no - 76.10.57

Remove

1. Remove front door casing. ***See this section.***



2. Release plastic sheet to access mirror multiplug.
3. Disconnect mirror multiplug and attach draw string to mirror harness.
4. Remove 2 screw caps and screws securing mirror.
5. Remove exterior mirror.
6. Remove draw string from mirror harness.

Refit

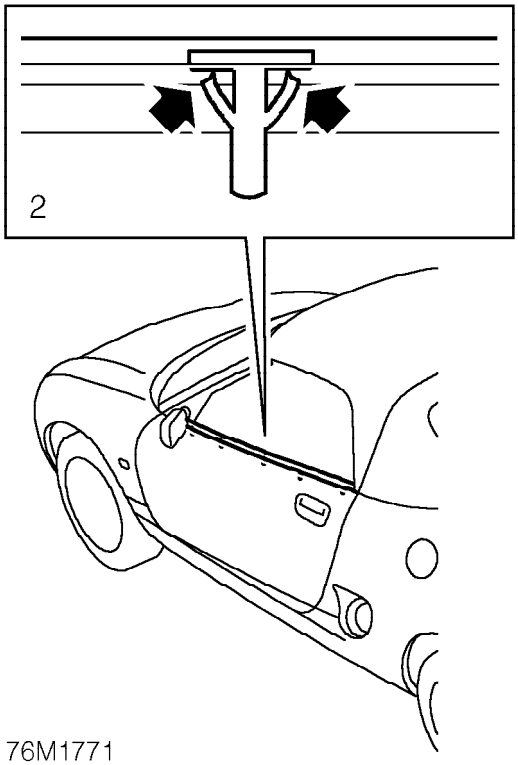
1. Attach draw string to mirror harness and feed harness into door. Remove draw string from mirror harness.
2. Position exterior mirror to door and secure with screws.
3. Fit screw caps.
4. Connect mirror multiplug.
5. Secure plastic sheet in correct position.
6. Fit front door casing. ***See this section.***

GLASS

Service repair no - 76.31.01

Remove

1. Remove trim casing. ***See this section.***



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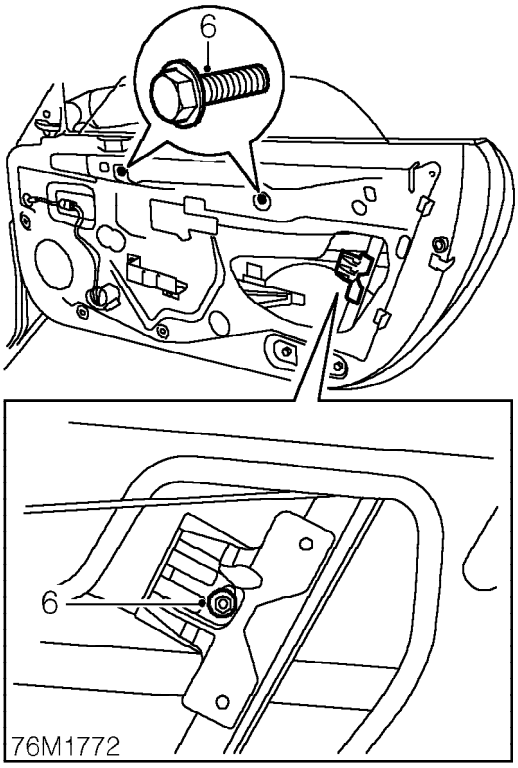
2. Release 5 clips securing outer waist seal to door and remove seal.
3. Peel back plastic sheet to allow access to inner door.
4. Switch ignition ON and lower window to allow access to bolts.
5. Switch ignition OFF.



6. Remove 3 bolts securing glass to regulator.
7. Remove glass.

Refit

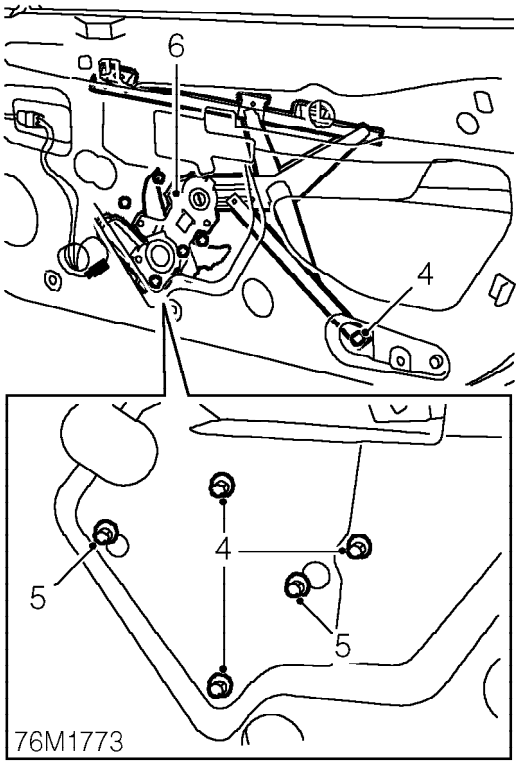
1. Position glass to regulator and align rear guide to glass.
2. Fit bolts securing glass to regulator but do not tighten.
3. Adjust door glass. ***See this section.***
4. Position plastic sheet and secure in place.
5. Fit outer waist seal and secure with clips.
6. Fit trim casing. ***See this section.***

DOOR GLASS REGULATOR

Service repair no - 76.31.45

Remove

1. Remove glass. ***See this section.***
2. Remove plastic sheet. ***See this section.***
3. Disconnect multiplug from motor.



4. Remove 4 bolts securing regulator to door.
5. Loosen 2 bolts securing regulator to door.
6. Remove regulator.

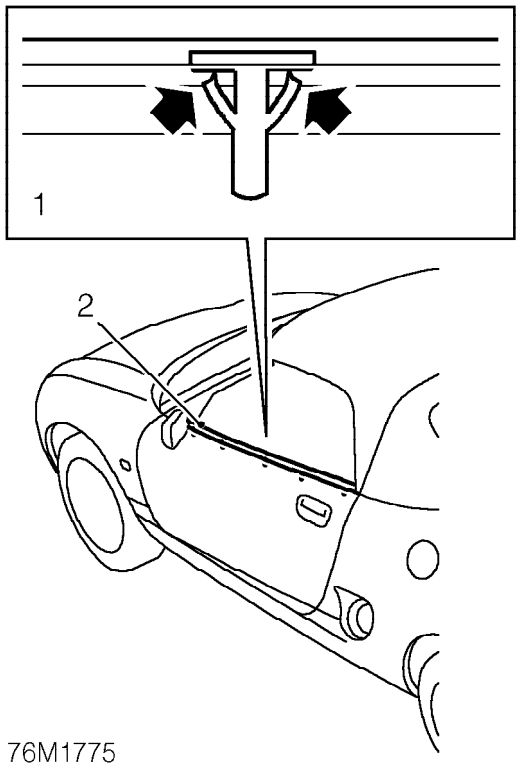
Refit

1. Position regulator to door and feed multiplug through aperture.
2. Align bolts to slotted holes and tighten to 7 Nm.
3. Fit and tighten bolts to 7 Nm.
4. Fit glass. ***See this section.***
5. Fit plastic sheet. ***See this section.***

OUTER WAIST SEAL

Service repair no - 76.31.53

Remove



1. Starting from the rear of the door, release 5 clips securing seal to door.
2. Remove seal.

Refit

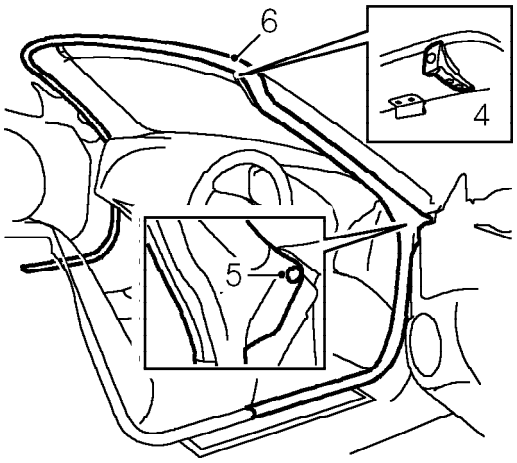
1. Position seal to door and align clips.
2. Fit seal and engage clips.

DOOR AND HEADER SEAL

Service repair no - 76.31.85

Remove

1. Open both doors.
2. Lower both sun visors.
3. Release catches and lower hood.



76M1552

4. Remove 2 Tx30 Torx screws securing each hood striker and remove both strikers.
5. Remove 2 studs securing seal to 'A' posts.
6. Remove seal.

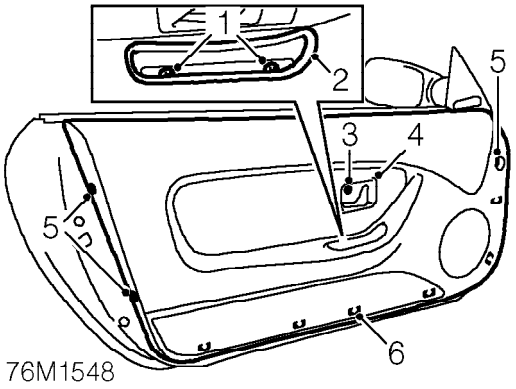
Refit

1. Position and centralise seal to header rail.
2. Secure seal to 'A' posts with studs.
3. Engage seal to flanges of header, 'A' posts and sills.
4. Fit hood strikers and tighten screws to 6 Nm.
5. Reposition sun visors.
6. Raise hood and secure catches.
7. Close doors.

TRIM CASING

Service repair no - 76.34.01/99

Remove



76M1548

1. Remove 2 screws securing door pull.
2. Remove door pull from trim casing.
3. Remove screw securing remote door handle escutcheon.
4. Remove remote door handle escutcheon.
5. Remove 3 screws securing trim casing.
6. Release 6 lower trim casing retaining clips, remove trim casing.

Refit

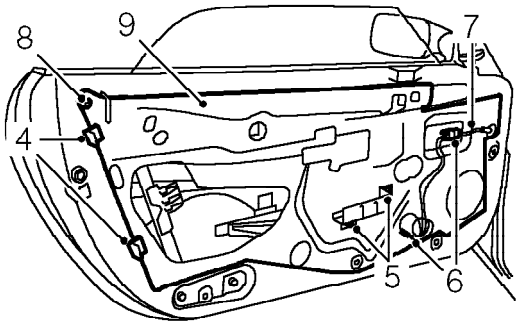
1. Fit trim casing to door and secure with clips.
2. Fit screws securing trim casing to door.
3. Fit remote door handle escutcheon and secure with screw.
4. Fit door pull to trim casing and secure with screws.

PLASTIC SHEET

Service repair no - 76.34.26

NOTE: A new plastic sheet must always be fitted, do not attempt to repair an existing plastic sheet.

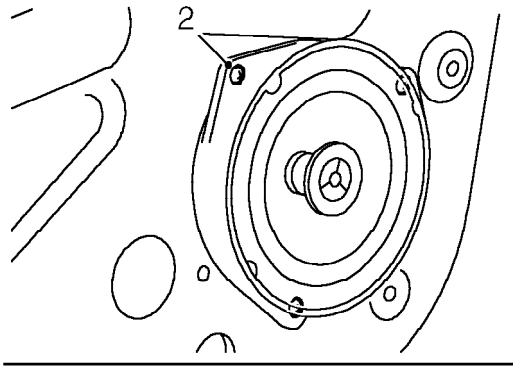
NOTE: To obtain an effective seal when fitting a new plastic sheet, ensure that the plastic sheet and door contact surface are at room temperature: between 18 °C to 30 °C.

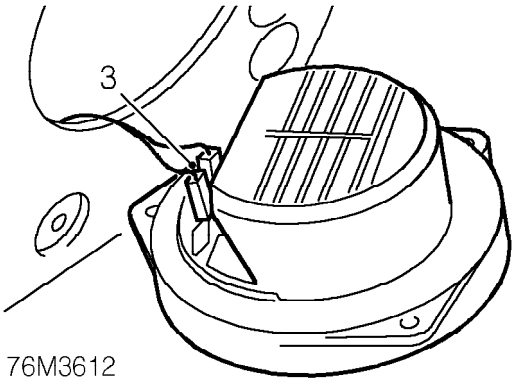


76M1551

Remove

1. Remove the remote door handle. ***See this section.***





76M3612

2. Remove 3 screws securing door speaker.
3. Release speaker, disconnect 2 Lucars and remove speaker.
4. Remove 2 trim rear fixing clips from door.
5. Remove 2 screws securing door pull fixing bracket to door, remove bracket.
6. Release 2 door harness retaining clips from door.
7. Disconnect heated door mirror multiplug.
8. Remove trim casing rear upper fixing clip from door.
9. Release plastic sheet from door. Feed harness connectors through sheet and remove plastic sheet.

Refit

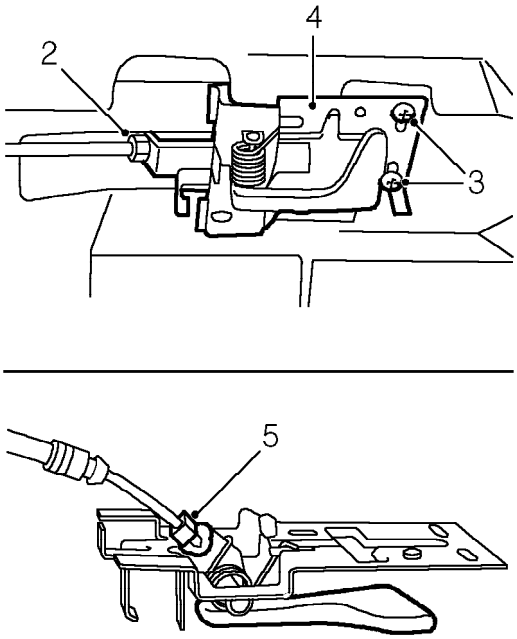
1. Ensure door is clean and dry where it comes in contact with the adhesive strip on the plastic sheet.
2. Fit plastic sheet, by fitting the adhesive strip to the bottom centre of the door first.
3. Starting from the bottom centre of the adhesive strip apply even pressure along the strip in both directions simultaneously, until the top centre of seal is reached.
4. Feed harness connectors through sheet and secure to door.
5. Fit fixing clips to door.
6. Connect heated door mirror multiplug.
7. Secure harness retaining clips to door.
8. Fit door pull fixing bracket to door and tighten screws.
9. Fit trim casing rear fixing brackets to door.
10. Position door speaker, connect Lucars and tighten screws.
11. Fit the remote door handle. ***See this section.***

REMOTE DOOR HANDLE

Service repair no - 76.37.31

Remove

1. Remove trim casing. ***See this section.***



2. Release latch operating cable from remote door handle abutment bracket.
3. Remove 2 screws securing remote door handle.
4. Release remote door handle from door by sliding in a forward direction.
5. Release clip securing latch operating cable to remote door handle, remove remote door handle.

Refit

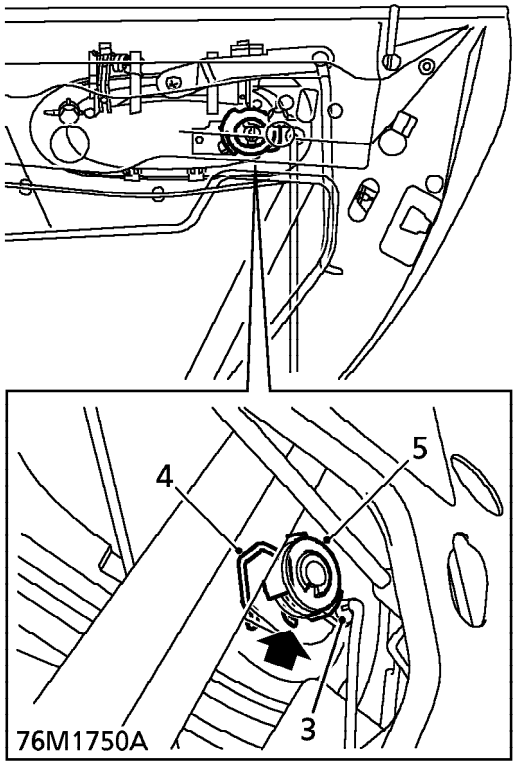
1. Fit latch operating cable to remote door handle and secure with clip.
2. Position remote door handle to door and secure with screws.
3. Secure latch operating cable to remote door handle abutment bracket.
4. Fit trim casing. ***See this section.***

PRIVATE LOCK

Service repair no - 76.37.39

Remove

1. Remove trim casing. ***See this section.***
2. Carefully peel back plastic sheet to allow access to inner door.



3. Unclip link rod from lock.
4. Release spring clip from lock.
5. Remove private lock.

Refit

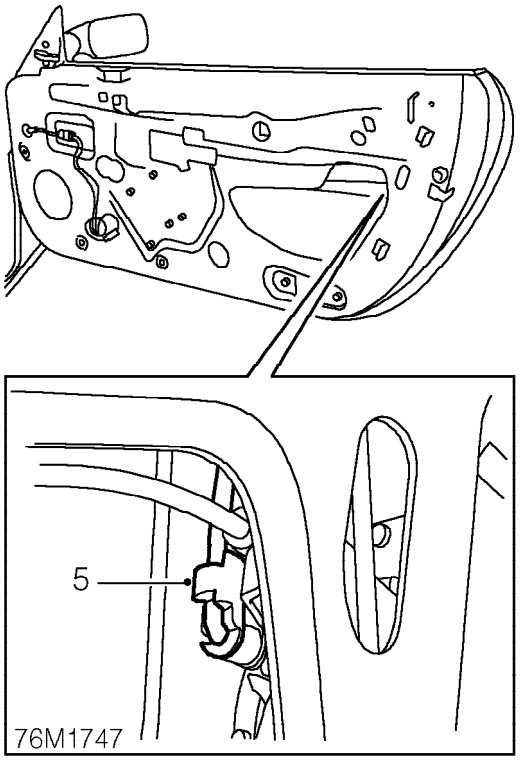
1. Fit lock to handle and secure with spring clip.
2. Engage link rod to lock.
3. Position plastic sheet and press into place.
4. Fit trim casing. ***See this section.***

OUTSIDE HANDLE

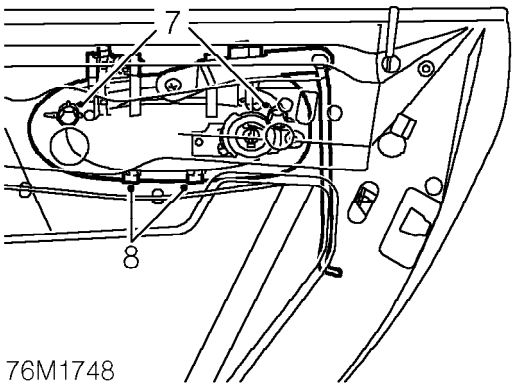
Service repair no - 76.58.07

Remove

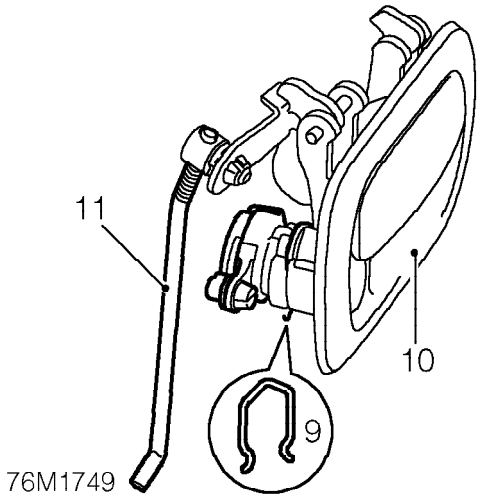
1. Remove trim casing. ***See this section.***
2. Switch the ignition ON and fully lower door glass.
3. Switch ignition OFF.
4. Carefully peel back corner of plastic sheet to allow access to door latch.



5. Release clip securing door handle link rod to latch assembly and position aside.
6. ***Driver's side:*** release lock link rod from lock.



7. Remove 2 bolts securing handle to door.
8. Release 2 clips retaining handle to door and position handle.



9. Release clip securing lock to handle and remove lock.
10. Remove handle.
11. Remove rod from handle.

Refit

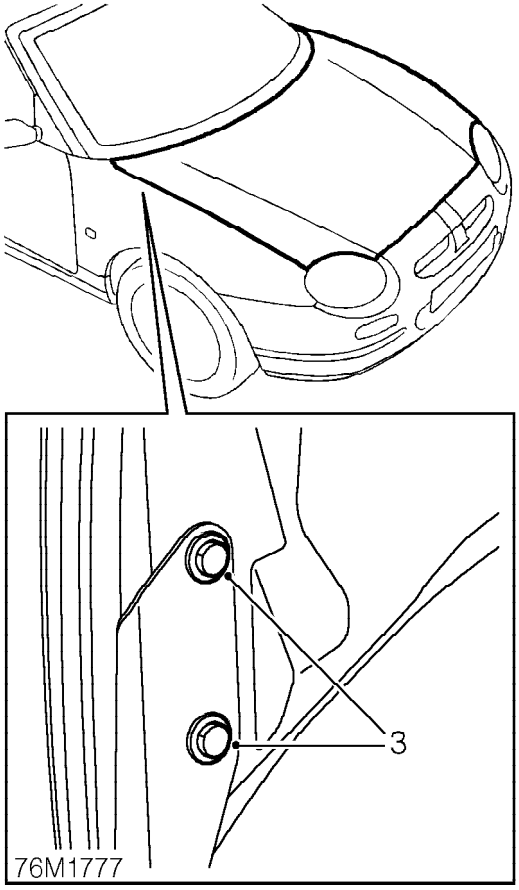
1. Fit rod to handle and position handle to door.
2. Engage handle to door and tighten bolts to 2.5 Nm.
3. Adjust rod length to align rod to latch.
4. Position rod and secure with clip.
5. ***Driver's side:*** engage lock connecting rod.
6. Fully raise door window.
7. Position lock to handle and secure with clip.
8. Secure plastic sheet.
9. Fit trim casing. ***See this section.***

BONNET - ADJUST

Service repair no - 76.16.02/01

Adjust

1. Check alignment of bonnet.
2. Open bonnet.



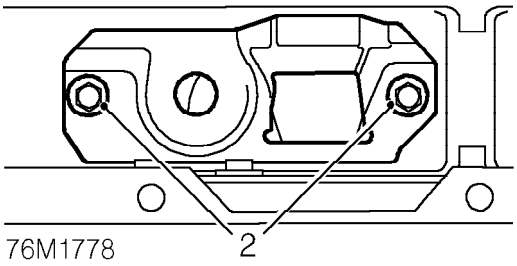
3. Loosen 4 bolts securing bonnet to hinges and adjust bonnet.
4. Lightly tighten bolts and close bonnet.
5. Check gaps are equal and bonnet is aligned with adjacent panels.
6. Open bonnet, adjust hinges if necessary and tighten bolts to 9 Nm.
7. If necessary, adjust bonnet locking plate. ***See this section.***

BONNET LOCK PLATE - ADJUST

Service repair no - 76.16.20

Adjust

1. Open bonnet.



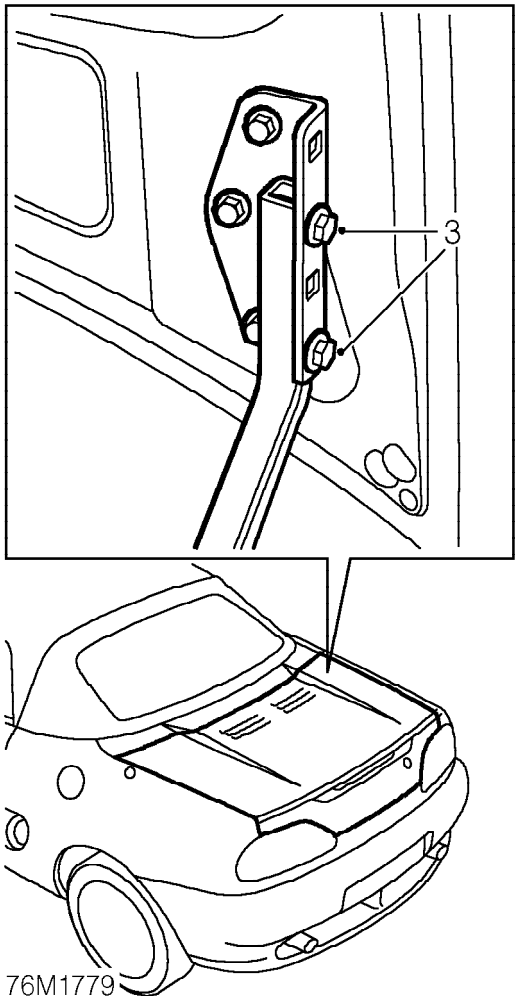
2. Loosen 2 bolts securing lock plate to body.
3. Position lock plate fully forward.
4. Gently lower bonnet. Align striker pin with lock and ensure safety catch engages in lock plate.
5. Tighten bolts to 25 Nm.
6. Check correct operation of bonnet latch and alignment of bonnet.
7. If necessary adjust bonnet. ***See this section.***

BOOT LID - ADJUST

Service repair no - 76.19.03

Adjust

1. Check for equal gaps around boot and alignment with adjacent panels.
2. Open boot lid.



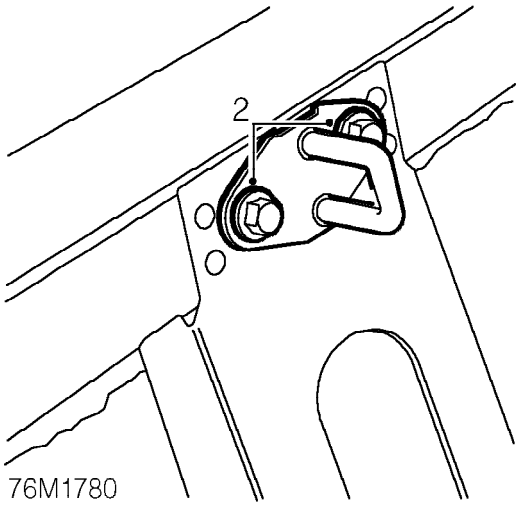
3. Loosen 4 bolts securing boot lid to hinges and adjust boot lid.
4. Lightly tighten bolts and close boot.
5. Check alignment of boot lid.
6. Open boot lid.
7. Adjust boot lid if necessary and tighten bolts to 9 Nm.
8. If necessary, adjust boot striker. ***See this section.***

BOOT LID STRIKER - ADJUST

Service repair no - 76.19.04

Adjust

1. Open boot lid.



2. Loosen 2 bolts securing striker to body and approximately position striker.
3. Lightly tighten bolts and close boot lid. Check for equal gaps and alignment with adjacent panels.
4. Open boot lid, re-position latch as necessary, tighten latch and striker bolts to 10 Nm.

FRONT WHEEL ARCH LINER

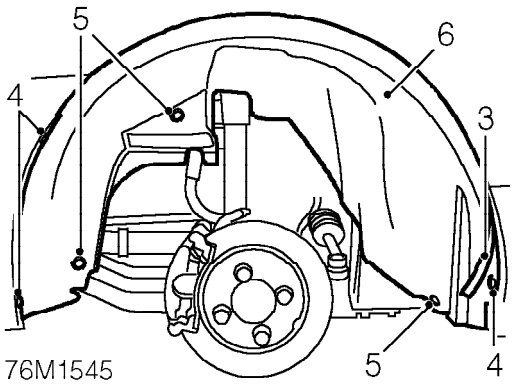
Service repair no - 76.10.48

Remove

1. Raise front of vehicle.

WARNING: Support on safety stands.

2. Remove road wheel(s).



3. Release wheel arch flange seal from rear lower edge of wing panel.
4. Remove 3 screws securing wheel arch liner.
5. Remove 3 scrivet screws securing wheel arch liner, remove scrivets.
6. Remove wheel arch liner.

Refit

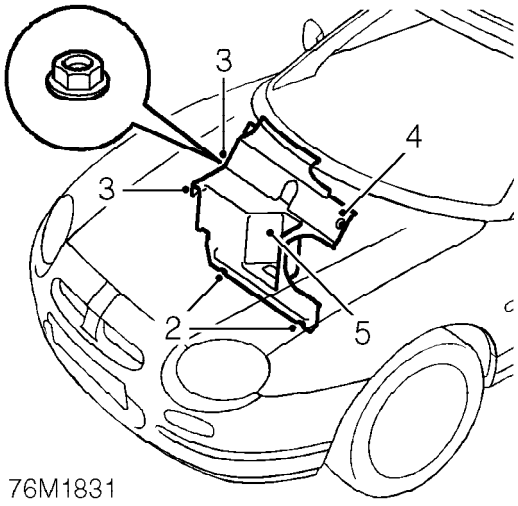
1. Fit and align wheel arch liner.
2. Fit scrivet fasteners securing wheel arch liner.
3. Fit and tighten screws securing wheel arch liner.
4. Secure wheel arch flange seal.
5. Fit road wheel(s) and tighten wheel nuts to 70 Nm.
6. Remove stand(s) and lower vehicle.

UNDERBONNET CLOSING PANEL

Service repair no - 76.10.94

Remove

1. Open bonnet.



2. Remove 2 fixings securing closing panel to spare wheel well.
3. Remove 2 fixings securing closing panel to scuttle.
4. Remove fixing securing closing panel to air intake plenum.
5. Remove closing panel.

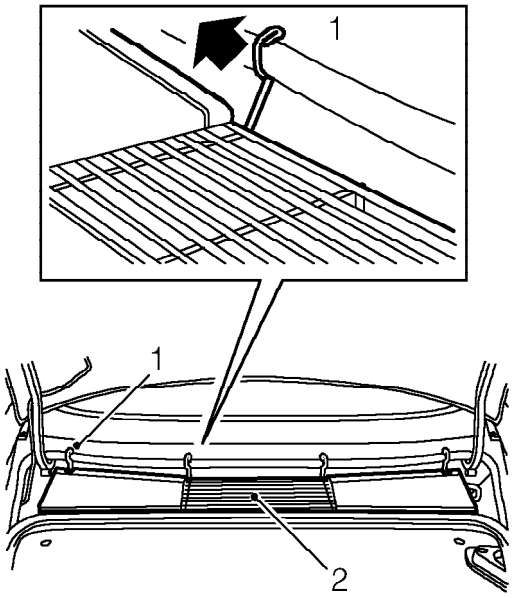
Refit

1. Fit closing panel to body studs and secure fixings.
2. Close bonnet.

ENGINE COMPARTMENT ACCESS PANEL

Service repair no - 76.11.05/99

Remove



76M1745

1. Release 4 retaining clips along front edge of closing panel by pulling each clip away from the seal and lifting upwards.
2. Remove panel.
   Do not carry out further dismantling if component is removed for access only.
3. Remove 6 screws securing LH plate to panel, remove plate.
4. Remove 3 screws securing RH plate to panel, remove plate.

Rebuild

5. Fit RH plate to panel and secure with screws.
6. Fit LH plate to panel and secure with screws.

Refit

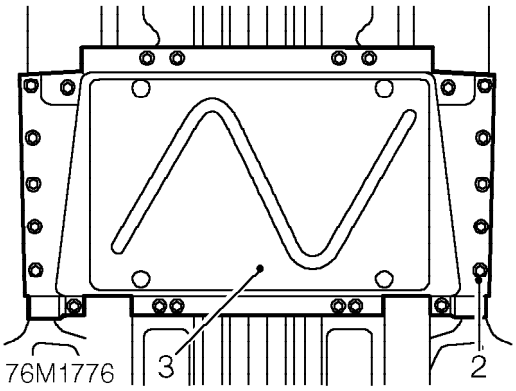
1. Fit closing panel and secure.

PANEL - FRONT UNDERBELLY - CENTRE

Service repair no - 76.10.50

Remove

1. Raise vehicle on a 2 post ramp.



2. Remove 22 bolts securing underbelly panel to floorpan.
3. Remove underbelly panel.

Refit

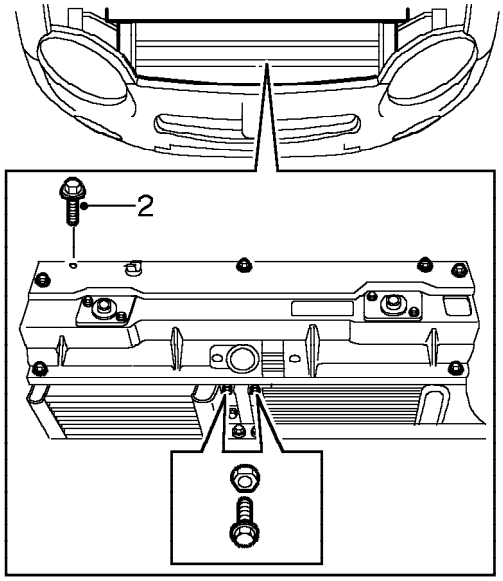
1. Position underbelly panel to floorpan and tighten bolts to 22 Nm.
2. Lower vehicle.

BONNET LOCKING PLATFORM - R/R ACCESS

Service repair no - 76.16.22/99

Remove

1. Remove front bumper valance. ***See this section.***



M76 3522

2. Remove 7 bolts and 2 nuts and bolts securing bonnet locking platform. Release bonnet locking platform from 4 location pegs.
3. Disconnect bonnet cable from bonnet catch and remove bonnet locking platform.

Refit

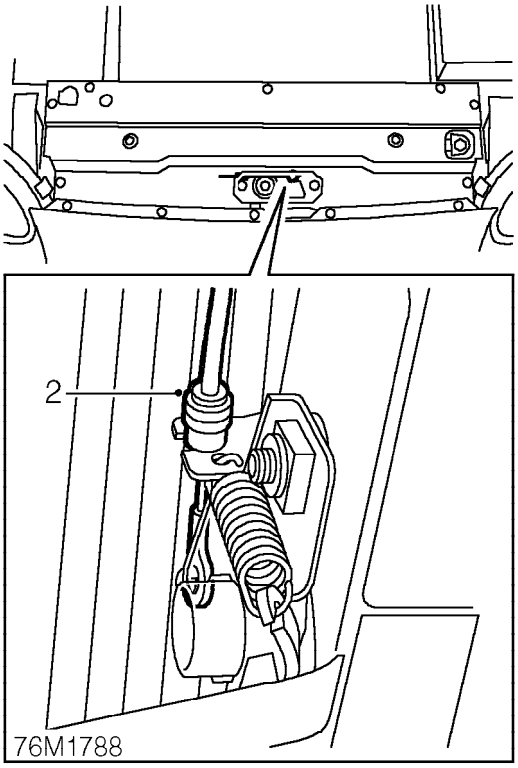
1. Position bonnet locking platform and connect bonnet cable to bonnet catch.
2. Fit bonnet locking platform and engage platform in location pegs. Fit nuts and bolts and tighten to 10 Nm.
3. Fit front bumper valance. ***See this section.***

BONNET RELEASE CABLE

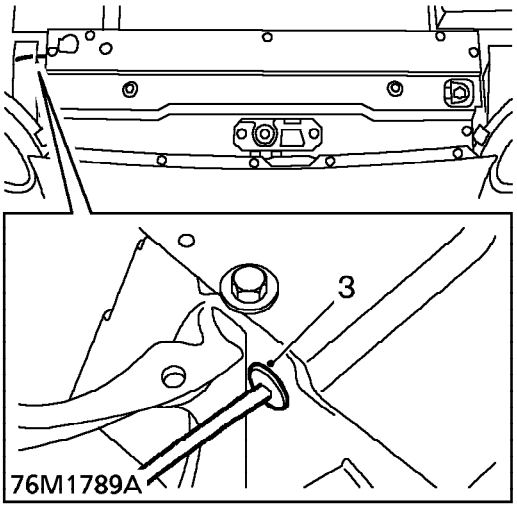
Service repair no - 76.16.29

Remove

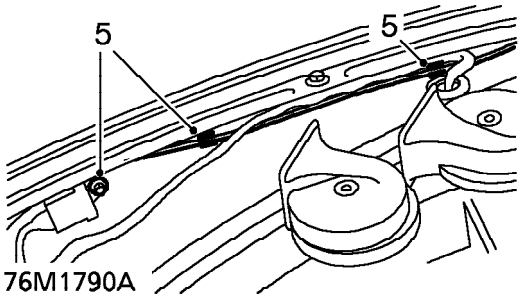
1. Remove headlamp assembly. ***See ELECTRICAL, Repairs.***



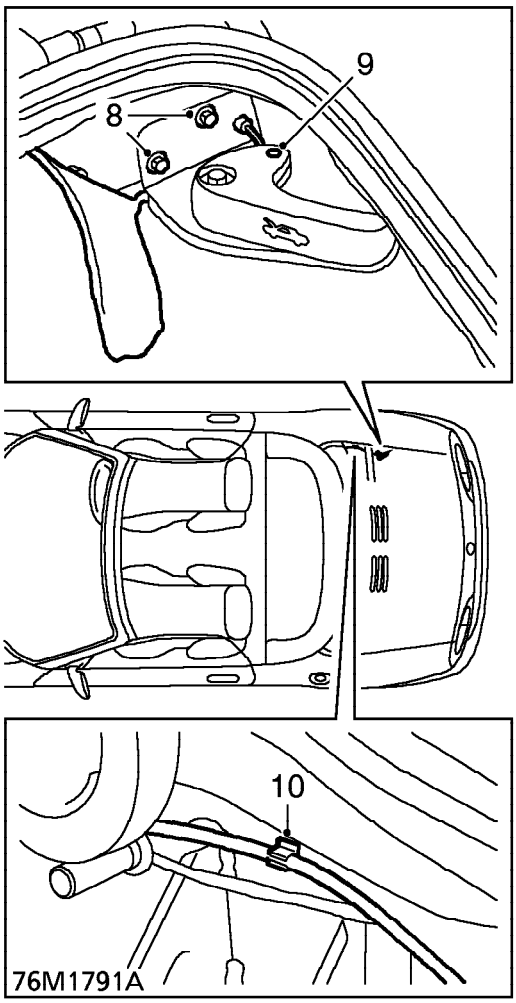
2. Release cable from bonnet lock plate.



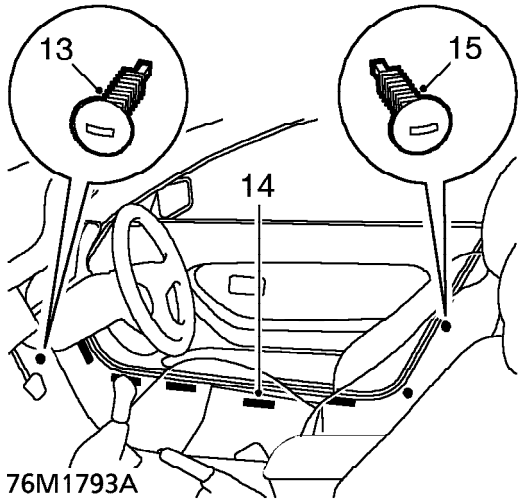
3. Release grommet from body
4. Feed bonnet release cable through hole.



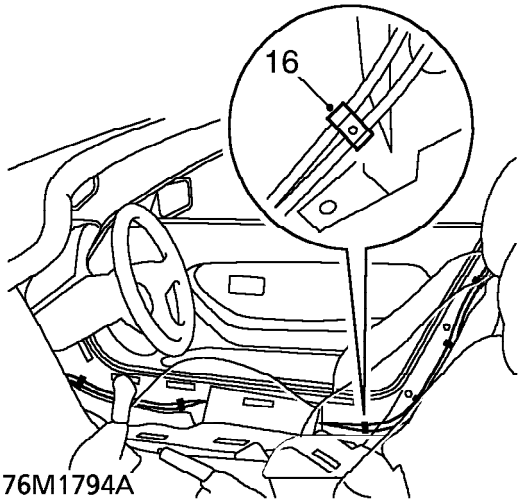
5. Loosen bolt securing earth header to inner wing and release cable from 2 inner wing clips.
6. Remove engine compartment access panel. ***See this section.***
7. Remove hoodwell trim. ***See Interior trim components.***



8. Position carpet aside and remove 2 bolts securing bonnet release lever to luggage compartment bulkhead.
9. Release cable abutment and cable from lever assembly.
10. Release cable from rear, inner wing clip.
11. Position felt pad aside and release grommet from hoodwell panel.
12. Feed cable through body holes and remove grommet from cable.



13. Remove stud securing carpet to inner wheel arch.
14. Release carpet from door seal and 5 velcro strips.
15. Remove 2 studs securing carpet to 'B' post, and release carpet from door seal and velcro to reveal cables.



16. Release cable from 3 sill clips and 3 'B' post clips.
17. Release cable from floorpan crossmember.
18. Release grommet from scuttle and remove cable.

Refit

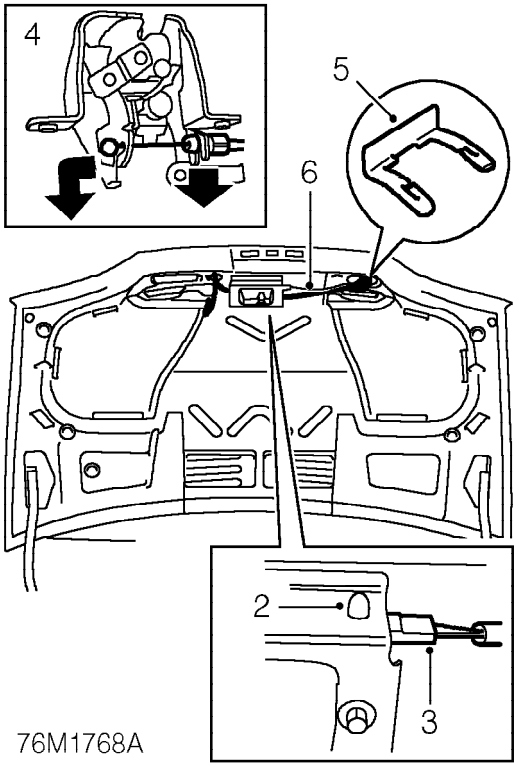
1. Feed cable through scuttle and under carpet insulation.
2. Position grommet to cable timing mark and engage grommet to scuttle.
3. Position cable to front inner wing and through hole in body.
4. Engage cable and abutment to bonnet lock plate.
5. Engage grommet to body.
6. Fit headlamp assembly. ***See ELECTRICAL, Repairs.***
7. Engage cable to inner wing clip and tighten earth header bolt to 9 Nm.
8. Feed cable through floorpan crossmember and engage to clips.
9. Position carpet and secure with studs and velcro.
10. Position carpet beneath door flip seal.
11. Fit grommet to cable and position to timing mark.
12. Position cable through hole in hoodwell panel and luggage compartment bulkhead.
13. Engage cable and abutment to bonnet release lever.
14. Position lever to bulkhead and tighten bolts to 9 Nm.
15. Position carpet beneath luggage compartment flip seal.
16. Engage grommet and cable clip.
17. Fit hoodwell trim. ***See Interior trim components.***
18. Fit engine compartment access panel. ***See this section.***
19. Fit front bumper valance. ***See this section.***

PRIVATE LOCK - BOOT LID

Service repair no - 76.19.10

Remove

1. Open boot lid.



2. Release multiplug from boot lid latch, bracket.
3. Disconnect multiplug.
4. Disconnect release cable from boot lid latch.
5. Remove clip securing lock to boot lid.
6. Remove lock assembly from boot lid.

Refit

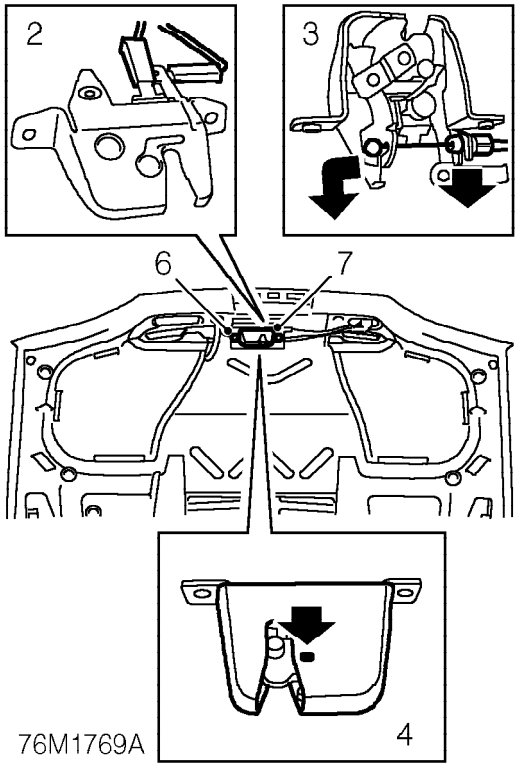
1. Position lock to boot lid and secure with clip.
2. Connect release cable to boot lid latch.
3. Connect multiplug.
4. Secure multiplug to boot lid latch, bracket.

BOOT LID LATCH

Service repair no - 76.19.11

Remove

1. Open boot lid.



2. Disconnect 2 Lucars and multiplug from latch assembly.
3. Release cable from latch.
4. Release clip and remove cover from latch.
5. Mark position of latch to boot for reference.
6. Remove 2 bolts securing latch to boot lid.
7. Remove latch assembly.

Refit

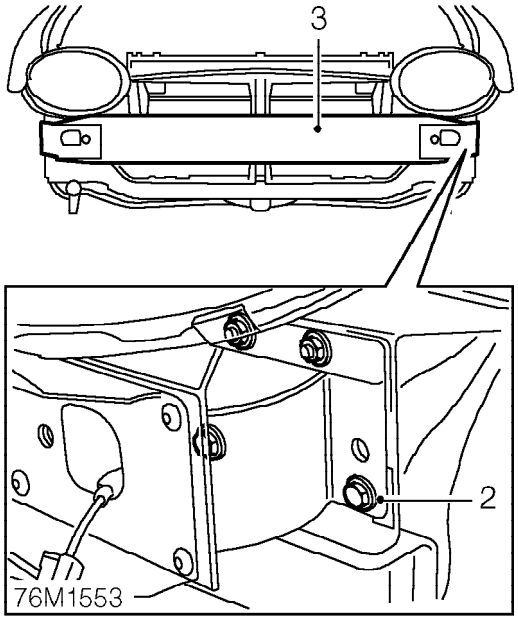
1. Position latch to boot lid using reference marks and tighten bolts to 10 Nm.
2. Connect cable and secure to latch.
3. Connect Lucars and multiplug, and fit latch cover.
4. Check latch operation and if necessary, adjust boot lid striker. ***See this section.***

FRONT BUMPER ARMATURE

Service repair no - 76.22.49

Remove

1. Remove front bumper valance. ***See this section.***



2. Remove 2 bolts and 2 nuts securing each end of armature to front panel.
3. Remove armature.

Refit

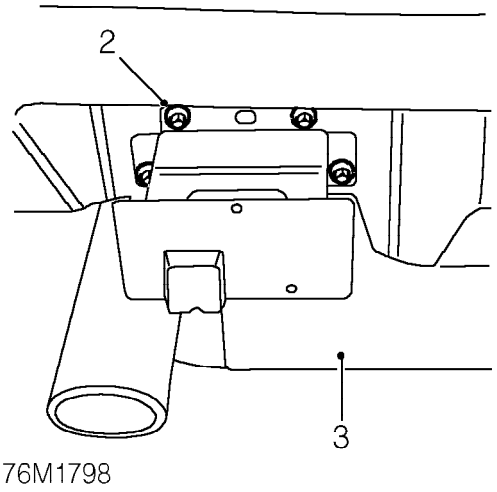
1. Fit armature to fixing studs.
2. Fit nuts and bolts and tighten to 25 Nm.
3. Fit front bumper valance. ***See this section.***

REAR BUMPER ARMATURE

Service repair no - 76.22.52

Remove

1. Remove rear bumper valance. ***See this section.***



2. Position luggage compartment carpet aside and remove 4 bolts securing bumper armature to body.
3. Remove bumper armature.

Refit

1. Align armature to body and tighten bolts to 22 Nm.
2. Fit rear bumper valance. ***See this section.***

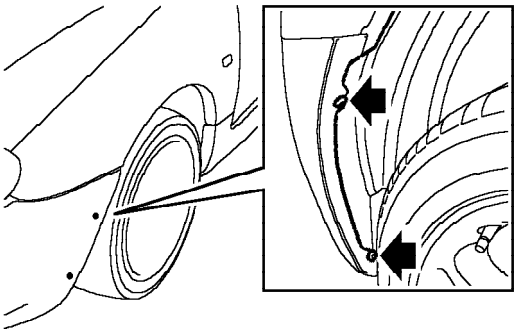
BUMPER VALANCE - FRONT

Service repair no - 76.22.72

Remove

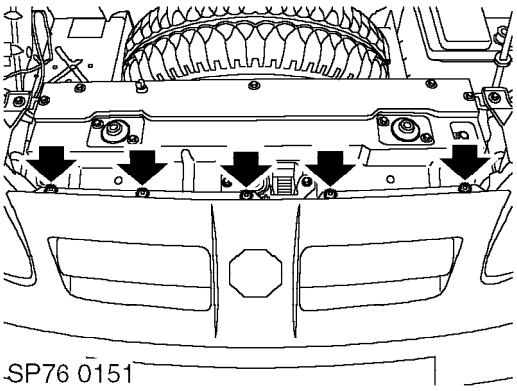
1. Raise front of vehicle.

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



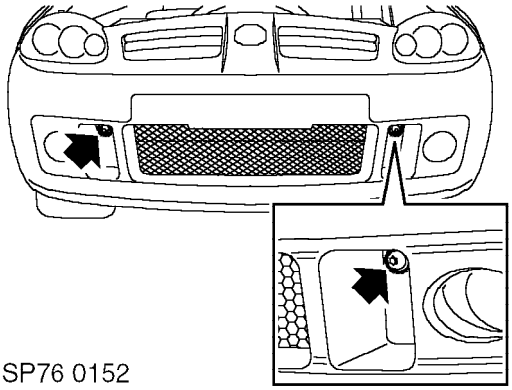
SP76 0149

2. Remove 2 screws securing each end of bumper valance to wheel arch liners.
3. Remove 2 screws securing each end of bumper valance to front wing.



SP76 0151

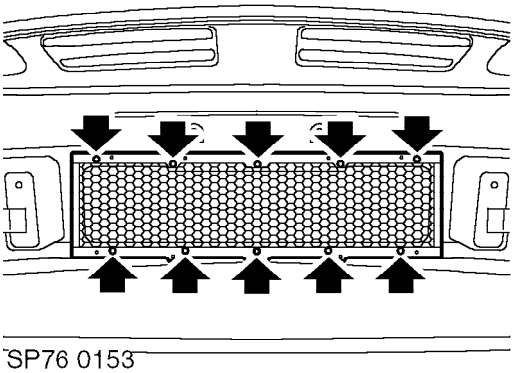
4. Remove 5 screws securing bumper valance to bonnet locking panel.



SP76 0152

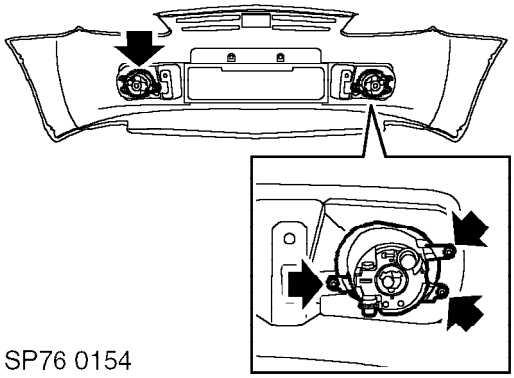
5. Remove 2 Torx bolts securing bumper valance to bumper armature.
6. Disconnect fog/driving lamp multiplugs and remove front bumper valance.

NOTE: Do not carry out further dismantling if component is removed for access only.



SP76 0153

7. Remove 10 screws securing bumper valance grille and remove grille.
8. Remove bumper valance badge.


SP76 0154

9. Remove 3 screws securing each fog lamp and remove fog lamps.
10. Remove front number plate.

Refit

1. Clean number plate and mating face.
2. Fit number plate.
3. Clean bumper badge and mating face, fit badge.
4. Position bumper grille, fit and tighten screws.
5. Position fog/driving lamps, fit and tighten screws.
6. Fit front bumper valance and connect fog/driving lamp multiplugs.
7. Fit Torx bolts securing bumper valance to bumper armature and tighten to 25 Nm.
8. Fit and tighten screws securing bumper valance to bonnet locking panel.
9. Fit and tighten screws securing bumper valance to front wings.
10. Fit and tighten screws securing front bumper to both wheel arch liners.
11. Remove stands and lower vehicle.

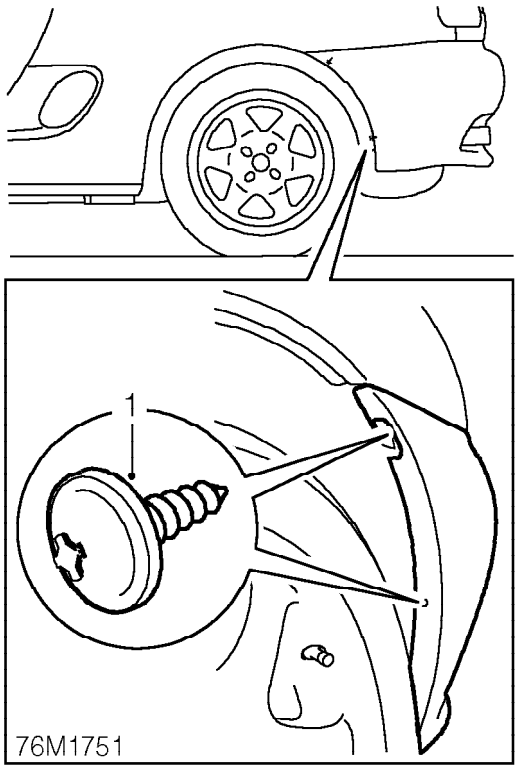
REAR BUMPER VALANCE

Service repair no - 76.22.74

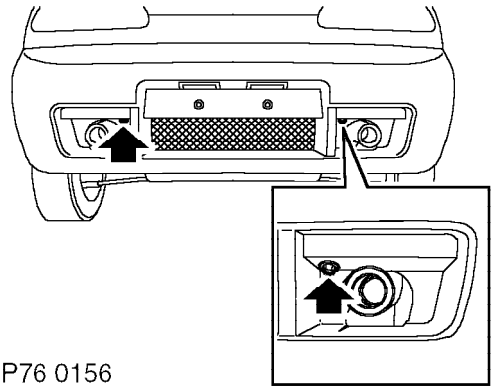
Remove

1. Raise rear of vehicle.

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

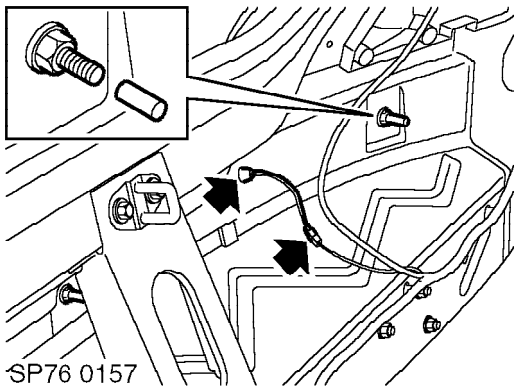


2. Remove 2 screws securing bumper valance to rear of both wheel arches.



SP76 0156

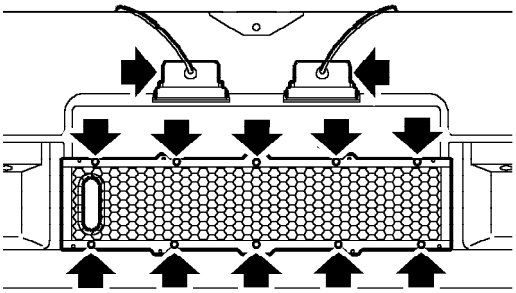
3. Remove 2 Torx bolts securing bumper valance to bumper armature.
4. Open boot lid and position luggage compartment carpet aside to access multiplugs and bumper valance retaining nuts.



SP76 0157

5. Disconnect both number plate illuminating lamp multiplugs.
6. Release both number plate illuminating lamp harness grommets from rear panel.
7. Remove 3 thread covers and 3 nuts securing bumper valance to rear panel.
8. Release bumper valance from body, taking care to withdraw number plate illuminating lamp harnesses through rear panel. Remove bumper valance.

NOTE: Do not carry out further dismantling if component is removed for access only.



SP76 0158

9. Release and remove both number plate illuminating lamps.
10. Remove 10 screws securing bumper valance grille and remove grille.

Refit

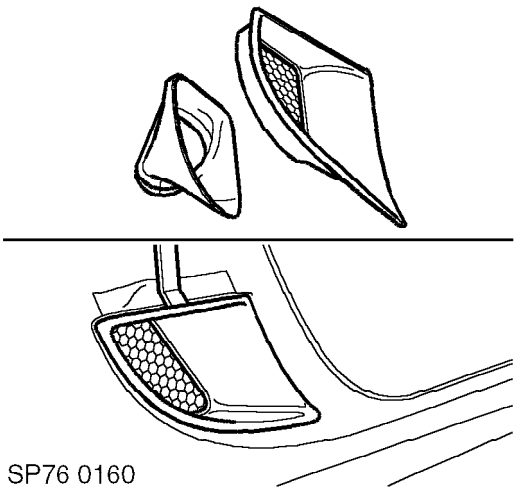
1. Position bumper grille, fit and tighten screws.
2. Position number plate illuminating lamps and secure to bumper valance.
3. Position bumper valance to body, feed number plate illuminating lamp harnesses through rear panel and align bumper valance to body.
4. Fit bolts securing bumper valance to bumper armatures and tighten to 25 Nm.
5. Fit nuts securing bumper valance to rear panel and tighten to 25 Nm.
6. Fit thread covers.
7. Connect number plate illuminating lamp multiplugs and secure harness grommets.
8. Fit and tighten screws securing bumper valance to rear of both wheel arches.
9. Remove stands and lower vehicle.

AIR VENT - SIDE

Service repair no - 76.55.19

Remove

1. Apply protective tape to paintwork around side air vent.

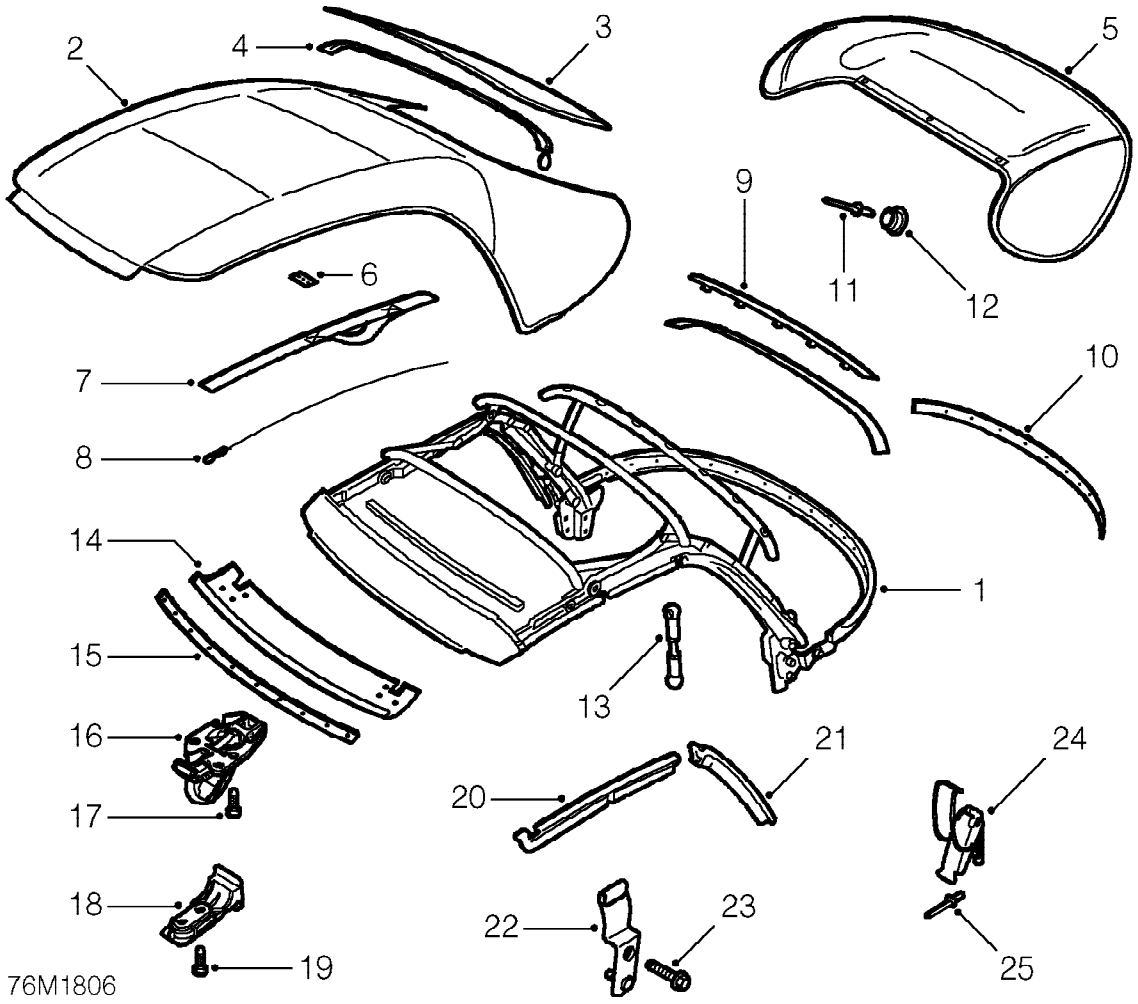

SP76 0160

2. Using a thin flat blade in the position shown release side air vent from body.
3. Release side air vent from adhesive tape and remove side air vent.
4. Release and remove air intake duct.

Refit

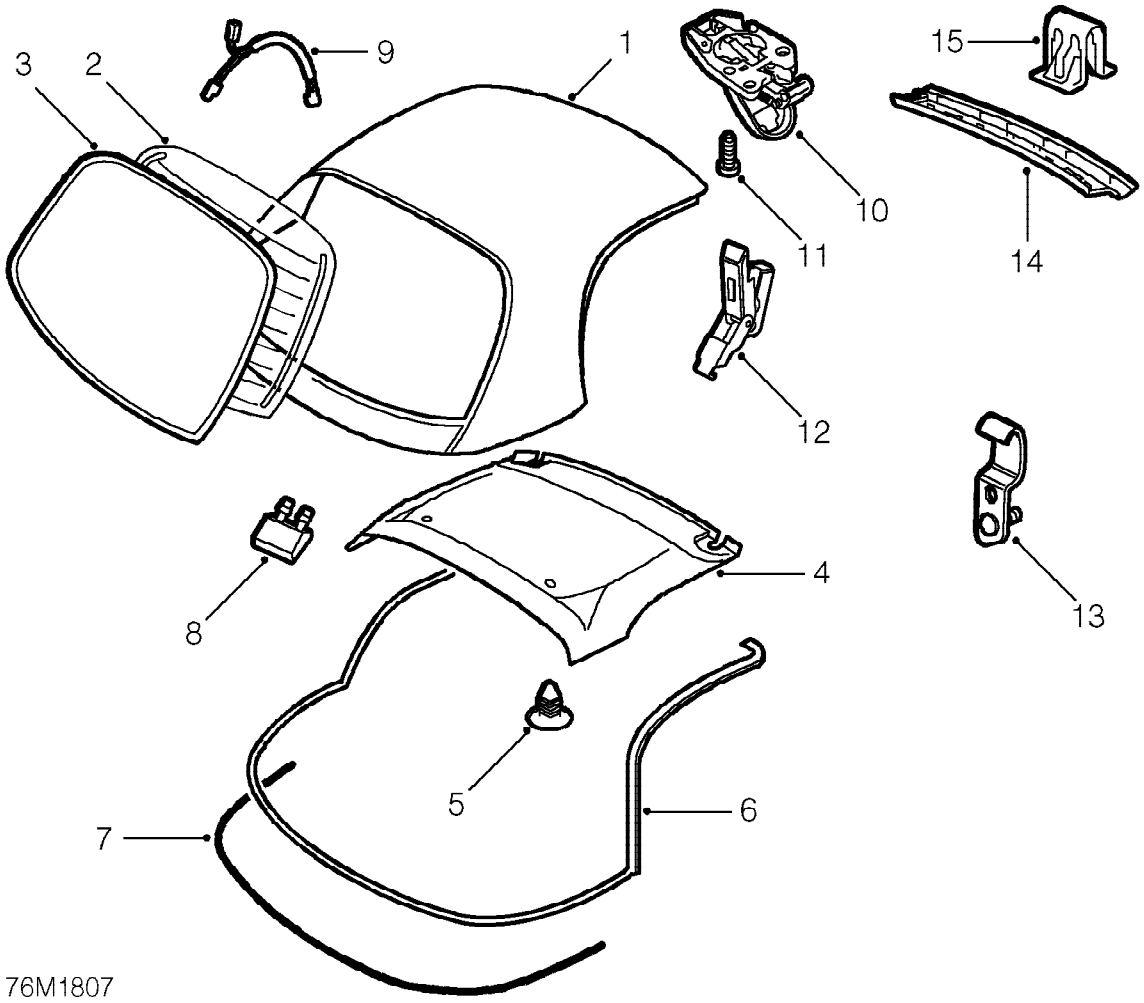
1. Clean side air vent and mating face of body.
2. Position air intake duct and secure to body.
3. Remove adhesive backing from side air vent retaining tape.
4. Position side air vent to air intake duct, align retaining pegs and secure side air vent to body.
5. Remove protective tape, clean and inspect paintwork.

HOOD ASSEMBLY COMPONENTS - SOFT TOP



1. Hood frame
2. Hood
3. Backlight
4. Backlight zip
5. Hood cover, tonneau
6. Retaining plate, 6 off
7. Tape elastic, 2 off
8. Tension cable, 2 off
9. Rear bow extrusion
10. Rear bow, canopy insert
11. Pop rivet - tonneau panel, 2 off
12. Stud - tonneau panel, 2 off
13. Link rod, 2 off
14. Front header fabric cover
15. Front header insert
16. Catch - front header, 2 off
17. Torx screw - catch, 6 off
18. Striker - front header, 2 off
19. Torx screw - striker, 4 off
20. Seal - cantrail, 2 off
21. Seal - B post, 2 off
22. Mounting plate - B post, 2 off
23. Screw - plate to body, 4 off
24. Catch - rear hoodwell, 5 off
25. Rivet - hoodwell catch, 10 off

HOOD ASSEMBLY COMPONENTS - HARD TOP



1. Hard top assembly
2. Backlight glass
3. Weatherstrip - backlight
4. Headlining
5. Trim stud - headlining, 2 off
6. Seal
7. Finisher - lower edge
8. Block spacer, 2 off
9. Harness extension
10. Catch assembly - front header, 2 off
11. Screw - front catch assembly, 6 off
12. Catch assembly - B post, 2 off
13. Mounting plate - B post, 2 off
14. Header finisher - front
15. Clip - header seal, 6 off

HOOD SEALS AND DOOR GLASS - ADJUST

Service repair no - 76.31.04

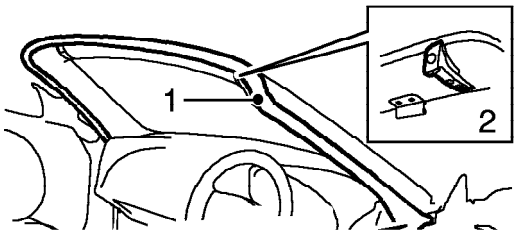
1. Check door alignment. ***See Doors.***

Adjust

Cantrail seal

1. Check that cantrail seal butts up to 'A' post seal correctly, the cantrail seal must not be distorted when the hood is closed.
2. To adjust cantrail seal release hood and carefully slide seal either backwards or forwards in its channel.
3. Ensure seals are located correctly in their channels.

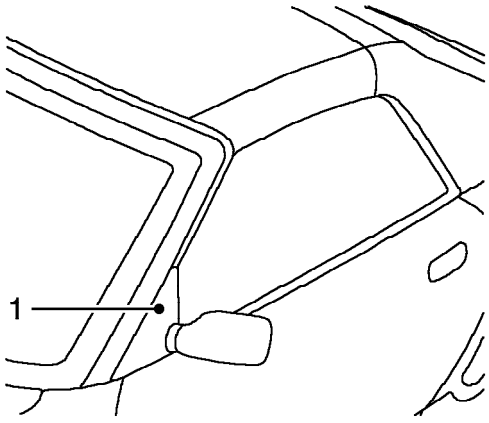
'A' post seal



76M2334

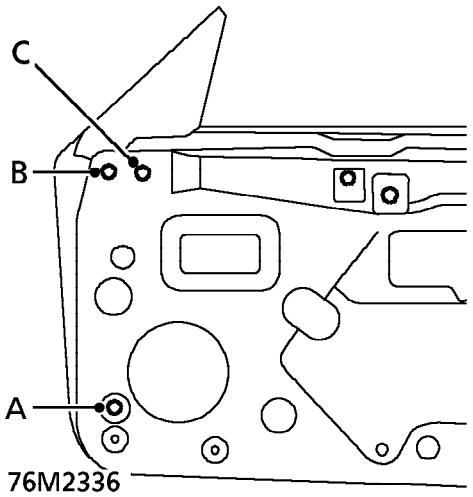
1. Check that 'A' post seal is positioned square at the corner of the 'A' post and header.
2. To adjust 'A' post seal remove 2 Torx screws securing header striker and remove striker.
3. Manoeuvre 'A' post seal to its correct position.
4. Close hood and secure with opposite side hood catch, apply downward pressure on hood and check that 'A' post seal is aligning correctly.
5. Release hood and fit header striker and secure with Torx screws, tighten to 6 Nm .

Cheater



76M2335

1. Check position of cheater, the cheater must be parallel with 'A' post when viewed from the side and front of vehicle.
2. If cheater is protruding out at the top when viewed from the front it will hold the door glass away from the seal.
3. To access cheater adjusters remove door speaker. ***See ELECTRICAL, Repairs.***

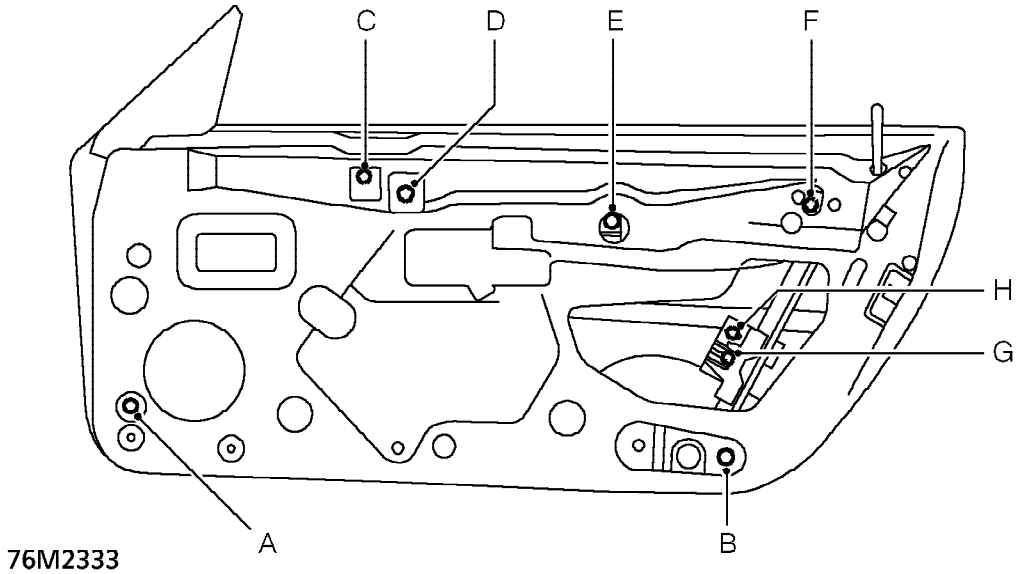


76M2336

4. Lower window and loosen screws **B** and **C** .
5. Loosen lock-nut on adjuster **A** , position adjuster screw so that it is level with the back of the nut it screws in to.
6. Push cheater down and pull inboard as far as possible.
7. Hold cheater in this position and tighten screws **B** and **C,** and the adjuster lock nut **A.**

8. Ensure window can be raised and lowered smoothly.
9. Close door and check cheater is positioned correctly, this can be judged by the bulge made by the glass on the 'A' post seal which should be uniform along the seal.
10. Fit speaker. ***See ELECTRICAL, Repairs.***
11. Fit door trim casing ***See Doors.***

Door Glass



A: Glass deflection adjustment (pivoting at waist rail).
B: Glass deflection adjustment (pivoting at waist rail).
C: Glass height adjustment (this is also the glass stop).
D: Glass lateral and vertical adjustment.
E: Glass lateral and vertical adjustment.
F: Glass height adjustment (this is also the glass stop).
G: Used at beginning of adjustment to position the door glass centrally in waist rail slot. Tighten bolt to 7 Nm.
H: Positioned at rear glass rail at final stage of adjustment and tightened to 7 Nm.

NOTE: All glass adjustments must be done before the upstroke of the glass.

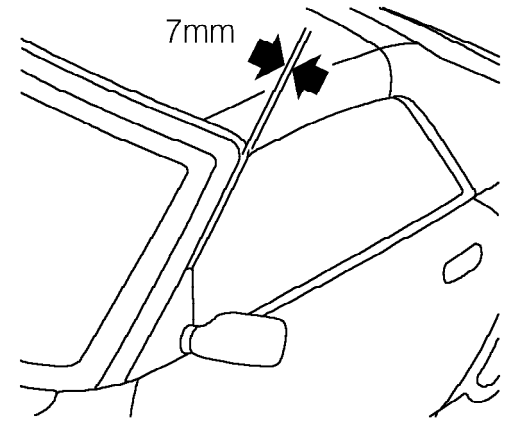
1. Remove door speaker. ***See ELECTRICAL, Repairs.***
2. Peel back water shedder to access adjusters.

Height

NOTE: Glass height is correct when pressure is being applied to the soft part of the cantrail seal.

1. Lower glass slightly and loosen adjusters **C** and **F** these also act as glass stops.
2. Raise glass to height required, pull adjusters down in slots and tighten adjusters.
3. Lower glass and then raise fully to ensure required height has been obtained.

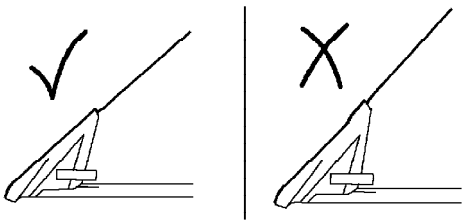
Parallelism



76M1797

NOTE: The glass is parallel when it is in the fully raised position and there is a constant clearance of 7 mm between the glass and the rear face of the 'A' post.

1. Loosen two height adjusters **C** and **F** .
2. Lower glass sufficiently to gain access to adjusters **D** and **E**, loosen adjusters.
3. Lower glass further to gain access to rear sash rail bracket.
4. Loosen adjuster bolt **H** .
5. Raise glass until adjusters **D** and **E** can be accessed, then close the door.
6. Adjust the position of the glass until it is parallel with the 'A' post, tighten adjusters **D** and **E** .


76M2332

7. Open door and lower glass then raise fully, check that front edge of glass and cheater are in line.
8. Close door by pushing on glass, check glass height.
9. If glass height is correct, pull adjusters down in slots and tighten adjusters **C** and **F** .

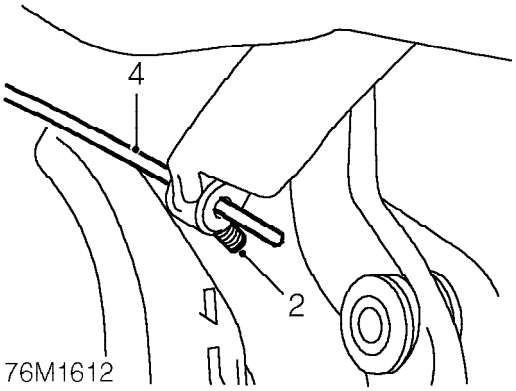
NOTE: If glass height is incorrect refer to height adjustment above.

10. Lower glass to access rear sash bracket, tighten adjuster **H**.
11. Raise glass and ensure it pre-loads all surrounding seals.
12. If pre-load is not sufficient loosen lock-nut on adjuster **B**.
13. Position adjuster so that it is level with the back of nut it is screwed in to, this will tilt the top edge of the glass inwards.
14. Tighten lock-nut and check pre-load of glass on seal.
15. If pre-load is still not sufficient loosen bolt **G** and slide the bolt down one notch, tighten bolt.
16. Repeat previous instruction until pre-load is correct.
17. Secure water shedder.
18. Fit speaker. ***See ELECTRICAL, Repairs.***
19. Fit door trim casing ***See Doors.***

CANTRAIL TENSIONING CABLES - ADJUST

Service repair no - 76.61.25

1. Partially lower hood.



2. Loosen cable locking screws.
3. Raise hood fully, but do not secure catches.
4. Using pliers, pull cables taught and tighten locking screws.
5. Secure hood catches and check cable tension.
6. If necessary, release hood catches, loosen cable locking screws and adjust cable tension. Tighten locking screws.
7. Secure catches.

HARDTOP - ADJUST

Service repair no - 76.61.02

NOTE: Check that soft top hood fit is correct before making any adjustments to the hardtop fit. *See this section.*

1. Fit hardtop. ***See this section.***

Adjust

NOTE: If necessary, only make adjustments to the cantrail seal and glass height. It should not be necessary to disturb any other settings.

Cantrail seal

1. Check that cantrail seal butts up to 'A' post seal correctly, the cantrail seal must not be distorted when the hardtop is secured.
2. To adjust cantrail seal release hardtop and carefully slide seal either backwards or forwards in its channel.
3. Ensure seals are located correctly in their channels.

Glass height

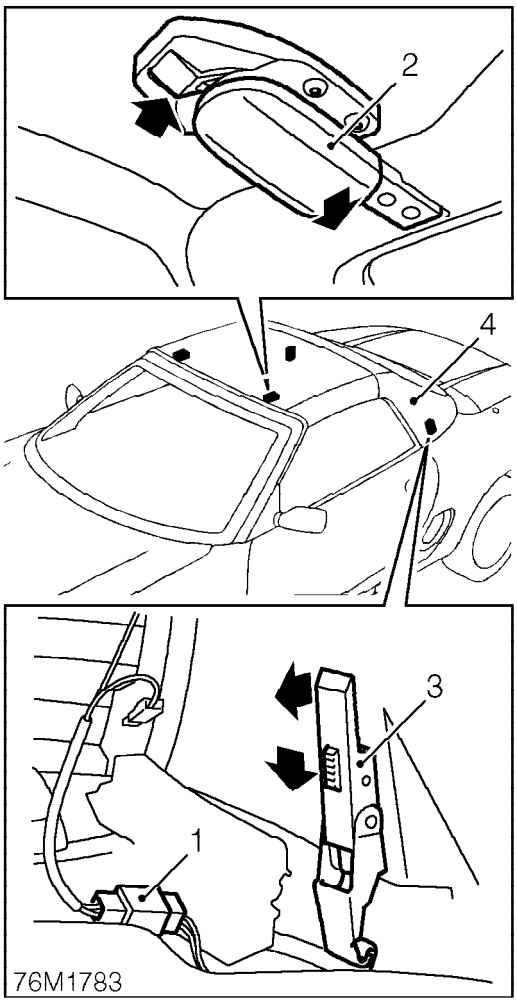
NOTE: If glass height is incorrect adjust the height to the minimum requirement, to prevent too much disturbance to the soft top hood settings.

1. Adjust glass height. ***See this section.***

HARD TOP

Service repair no - 76.61.01

Remove



1. Disconnect multiplug from heated rear window.
2. Release 2 catches securing hard top to header rail.
3. Release 2 catches securing hard top to hood mounting brackets.
4. With assistance, remove hard top from vehicle.

Refit

NOTE: Ensure side catches are in the raised position before fitting the hard top to the vehicle.

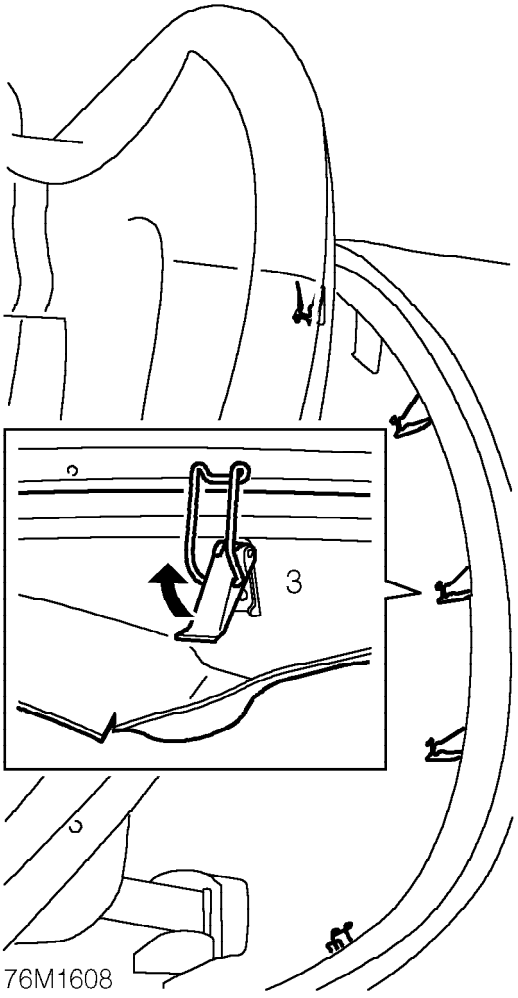
1. With assistance, position hard top to vehicle.
2. Secure hard top to header rail with catches.
3. If necessary, release clips and adjust catches.
4. Secure hard top to hood mounting brackets.
5. Adjust catches if required.
6. Connect screen heater multiplug.

HOOD ASSEMBLY

Service repair no - 76.61.10/99

Remove

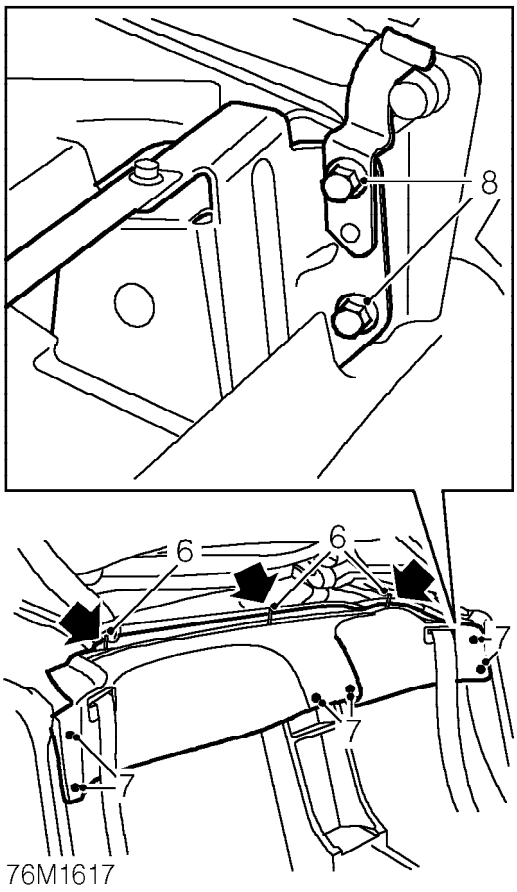
1. Lower both windows.
2. Release both hood catches, but do not lower hood.



3. Release rear edge of hoodwell carpet and release 5 clips securing hood to body.
4. Fold rear of hood, up to release from body.

CAUTION: Clips must be fully released to ensure that backlight is not damaged when hood is lowered.

5. Tilt both seat squabs forward.



6. Remove 3 screws securing bulkhead finisher. Collect press studs.
7. Release 6 clips and position bulkhead finisher aside.
8. Remove 4 bolts securing hood to body.
9. Collect 2 hard top strikers.
10. With assistance, remove hood assembly.

CAUTION: Support assembly beneath backlight and hinges during removal.

11. Position hood on a soft covered work surface.

Refit

1. With assistance, position hood to body.
2. Position hard top strikers.
3. With assistance, align hinge brackets to body and fit bolts but do not tighten at this stage.
4. Raise hood but do not secure catches.
5. Tighten hinge bracket bolts to 45 Nm.
6. Position bulkhead finisher and engage clips.
7. Position press studs and secure bulkhead finisher with screws.
8. Return seat squabs to original positions.
9. Engage clips to secure rear of hood to body.
10. Engage hoodwell carpet beneath flip seal.
11. Secure catches to secure front of hood.
12. Raise windows.

HOOD OUTER COVER

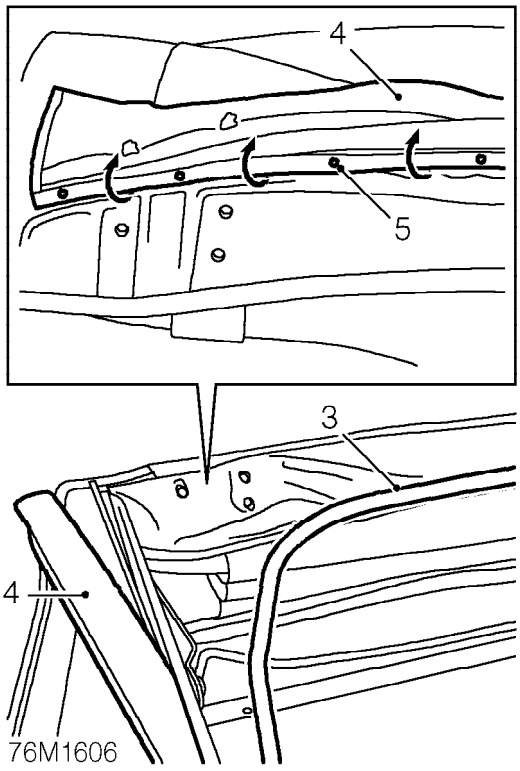
Service repair no - 76.61.11

Remove

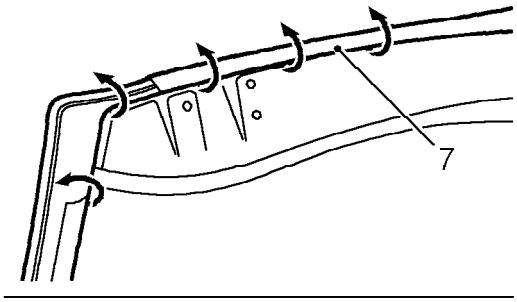
The following operation involves the bonding of fabric backed vinyl to various steel components of the hood frame. If adhesive is to be applied to the fabric backing, Dunlop 758 adhesive or equivalent should be used. For direct application on vinyl surfaces, use Dunlop S1588 adhesive or equivalent.

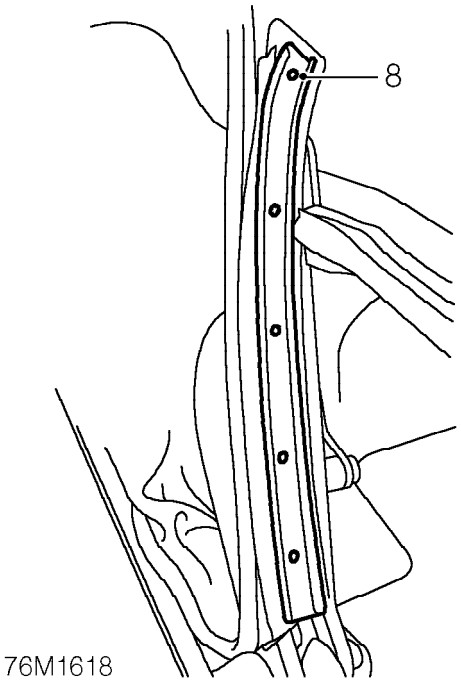
A thin coating of adhesive should be applied to both surfaces and then allowed to cure, until just touch dry, for between 5 and 10 minutes, before the bond is made.

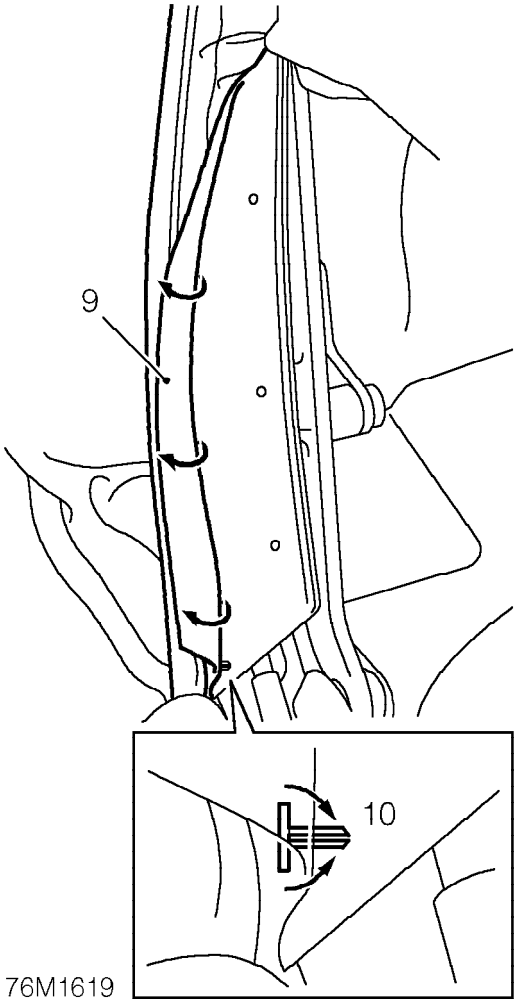
1. Remove both hood catches. ***See this section.***
2. Remove both 'B' post seals. ***See this section.***



3. With hood in the lowered position, remove edge protector from rear of header rail.
4. Release forward 150 mm of cantrail seals from retainers. release covering from rear of header rail and fold cover forward to reveal retaining strip.
5. Locally release foam from retaining strip to reveal 11 rivets, drill out rivets.
6. Collect header cover assembly.

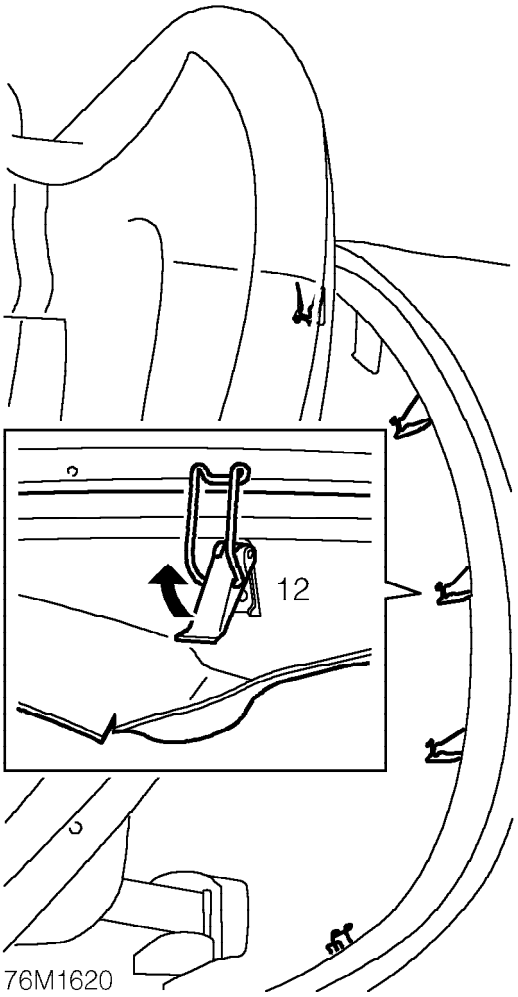




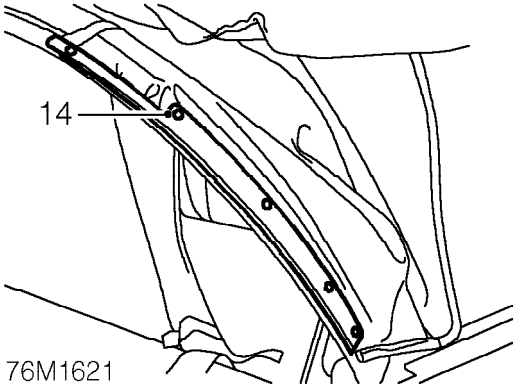


7. Release outer cover from adhesive on underside of header rail.
8. Drill out 5 pop rivets securing each 'B' post seal retainer. Collect retainers.

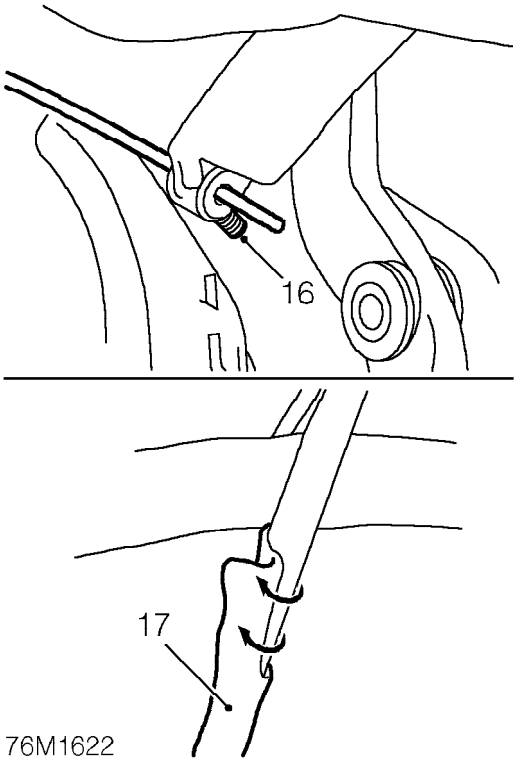
9. Release outer cover from adhesive on 'B' post brackets.
10. Bend up tabs and release 'rivet' plates securing outer cover to base of 'B' post brackets.
11. Raise hood frame.



12. Release rear edge of hoodwell carpet and release 5 clips.
13. Fold rear of hood, up to release from body.



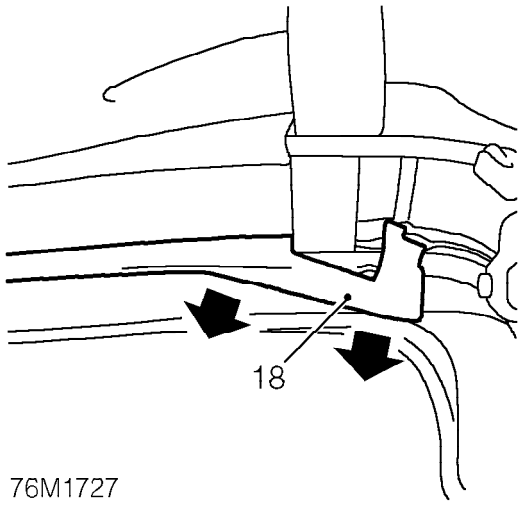
14. Drill out 5 pop rivets securing each retaining strip and collect retaining strips.
15. Drill out any rivet heads still captive in hood frame.



16. Loosen cable locking screws and release cables from outer cover.

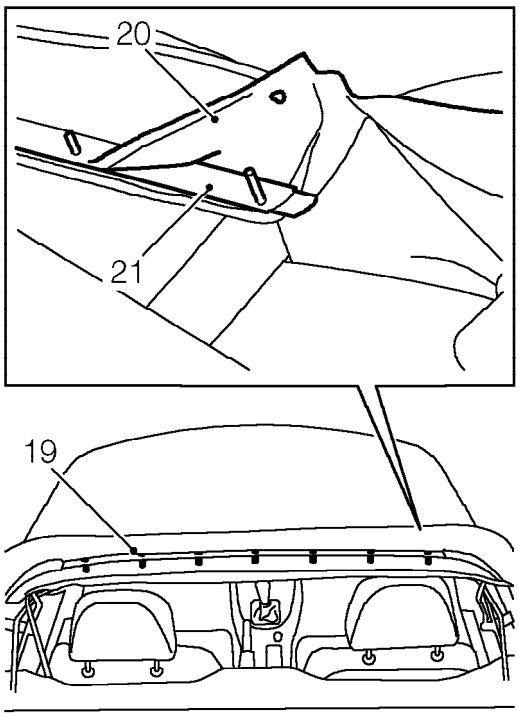
NOTE: Leave cables attached at header rail.

17. Release outer cover flaps from adhesive on 1st and 2nd hood bows.



76M1727

18. Release felt covering from 3rd hood bow.

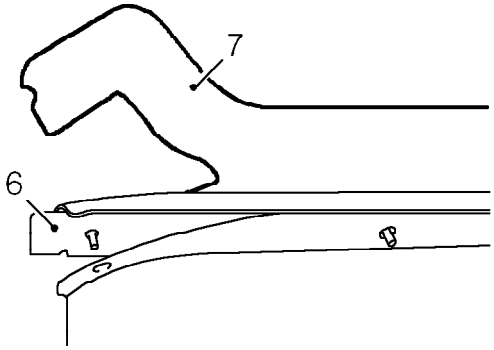


76M1623

19. Remove 7 nuts securing outer cover clamp rail to 3rd hood bow.
20. Release clamp rail studs from bow and remove outer cover assembly.
21. Remove clamp rail from outer cover.
22. Remove 4 bolts securing hood frame and with assistance remove hood frame.
23. Invert frame and shake vigorously to remove rivets and swarf from frame.

Refit

1. Position hood frame, fit and tighten bolts.
2. Remove any uneven deposits of adhesive from 'B' post brackets, clamp rail and header rail using a suitable solvent.
3. Position new outer cover to a soft covered work surface.
4. Fold outer cover in half and chalk centre line to aid alignment.
5. Measure and mark centre line on underside of hood header rail.
6. Apply adhesive to clamp rail and outer cover.

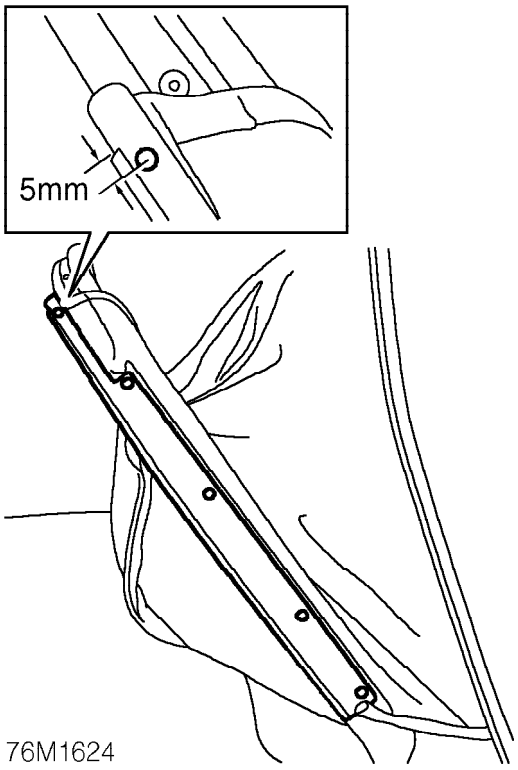


76M1728

7. Bond clamp rail to outer cover with larger flange towards edge of material.
8. If necessary, apply adhesive to clamp rail and felt covering. Bond covering centrally to clamp rail, ensuring that slotted ends remain free.
9. Position outer cover over raised hood frame and engage clamp rail studs to bow.
10. Secure clamp rail with nuts.
11. Apply adhesive to 3rd hood bow and mating surface of felt covering.

CAUTION: Ensure underside of outer cover does not become contaminated with adhesive.

12. Bond felt covering to 3rd bow, ensuring that slots are correctly positioned around frame straps.



13. Align hood rear quarters to lower rail, ensuring that:
    Lower edge of rail and cover reinforcement strip are aligned.
    Centre of rivet hole in lower rail is 5 mm from end of reinforcement strip as shown.
14. Transfer holes from lower rail into outer cover, using a bradawl or similar tool.
15. With careful use of a drill, open out holes to 3.5 mm.
16. Position retaining strips and secure hood rear quarters to lower rail with pop rivets.
17. Raise backlight into position and secure with zip.
18. Engage clips to secure rear of hood to body.
19. Engage hoodwell carpet beneath flip seal.
20. Partially lower hood frame.
21. Apply adhesive to underside of header rail and mating surface of outer cover.
22. Temporarily fit hood catches.
23. Position outer cover to header, then make adhesive joint in three small areas.

CAUTION: Do not make a permanent joint at this stage as adjustment may be necessary.

24. Raise hood and secure catches.
25. Check outer cover tension.
26. Lower hood partially.
27. Adjust position of outer cover and recheck tension if necessary.
28. Remove hood catches.
29. Bond outer cover securely to header rail, ensuring cover does not crease.
30. Trim off excess material using a sharp knife.
31. Lower hood fully.
32. Position header cover assembly.
33. Transfer holes in header cover retainer through outer cover into header rail.
34. Secure header cover retainer with pop rivets.
35. Apply adhesive to header rail and mating surface of header cover.

CAUTION: Ensure underside of outer cover does not become contaminated with adhesive.

36. Bond header cover.
37. Fit edge protector to rear of header rail.
38. Secure forward ends of cantrail seals in retainers.
39. Fit hood catches. ***See this section.***
40. Raise hood partially.
41. Engage outer cover rivet plates to 'B' post brackets and bend over tabs to secure.
42. Apply adhesive to 'B' post brackets and mating surfaces of outer cover.
43. Raise hood, but do not secure catches.

44. Thread cantrail cables through pockets in outer cover and engage in frame locations.
45. Bond outer cover to 'B' post brackets, ensuring that even tension is applied as bond is made.
46. Position 'B' post seal retainers.
47. Transfer holes in retainers through outer cover into brackets.
48. Secure retainers with pop rivets.
49. Fit 'B' post seals. ***See this section.***
50. Apply adhesive to outer cover flaps and mating surfaces of 1st and 2nd hood bows.

CAUTION: Ensure that underside of outer cover does not become contaminated with adhesive.

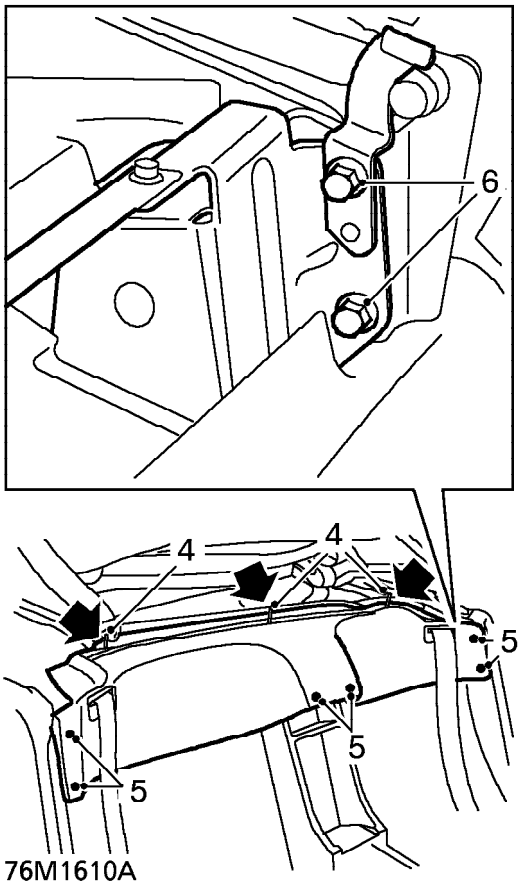
51. Check cosmetic appearance of hood.
52. Adjust cantrail cables. ***See this section.***
53. Remove protection.
54. Secure hood catches.
55. Close windows.

HOOD FRAME

Service repair no - 76.61.12

Remove

1. Remove outer cover. ***See this section.***
2. Remove backlight. ***See this section.***
3. Tilt both seat squabs forward.



4. Remove 3 screws securing bulkhead finisher, collect press studs.
5. Release 6 clips and position bulkhead finisher aside.
6. Remove 4 bolts securing hood frame to body.
7. Collect hard top strikers.
8. With assistance, remove hood frame.
9. Remove cantrail seals. ***See this section.***
10. Bend up tabs securing cantrail tensioning cables to header rail.
11. Remove tensioning cables.

Refit

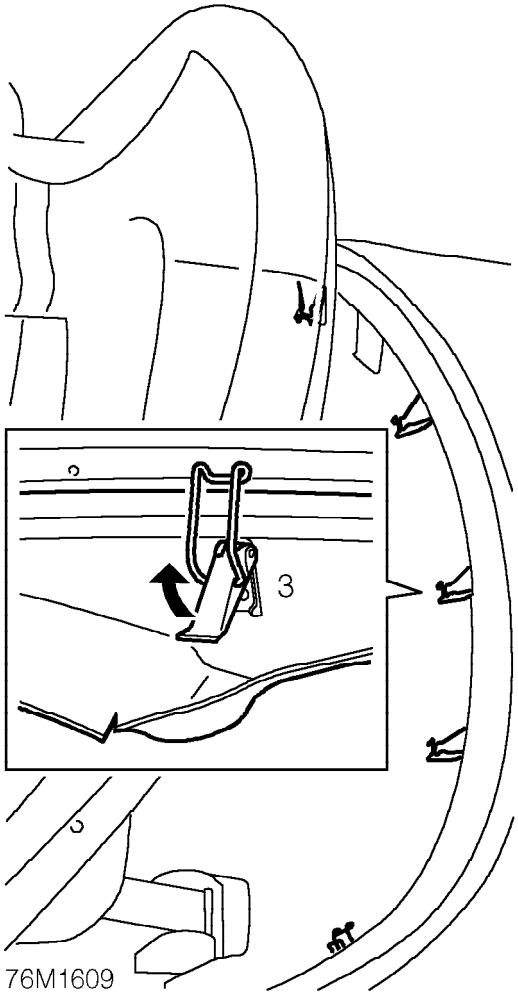
1. Position cantrail tensioning cables to header rail.
2. Secure cables top header rail by bending tabs.
3. Fit cantrail seals, leaving forward ends disengaged from retainer. ***See this section.***
4. With assistance, position frame.
5. Position hard top strikers.
6. With assistance, align hinge brackets to body and secure with bolts. Tighten bolts to 45 Nm.
7. Raise hood frame.
8. Position bulkhead finisher and engage clips.
9. Position press studs and secure bulkhead finisher with screws.
10. Return seat squabs to original positions.
11. Fit outer cover. ***See this section.***
12. Fit backlight. ***See this section.***

BACKLIGHT

Service repair no - 76.61.15

Remove

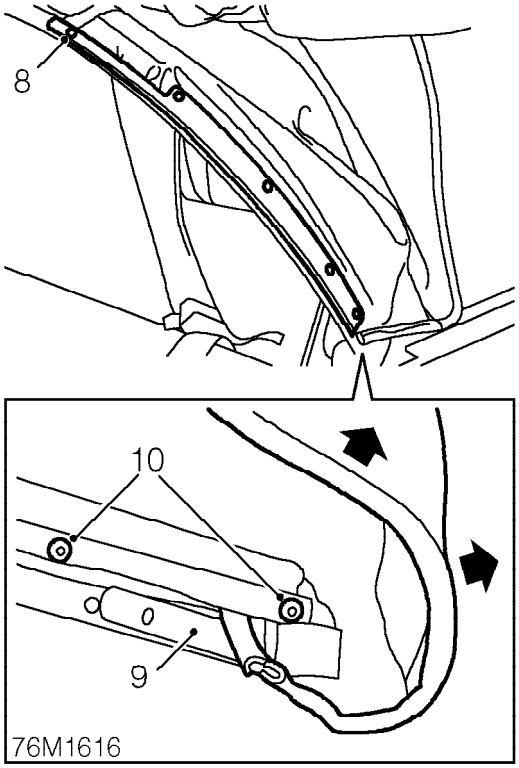
1. Lower both windows.
2. Release hood catches, but do not lower hood.



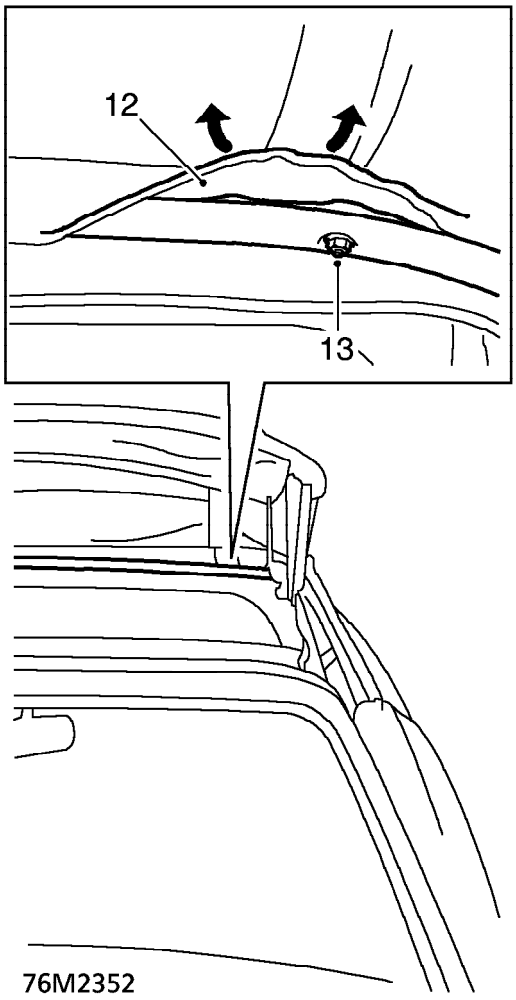
3. Release rear edge of hoodwell carpet and release 5 clips.
4. Fold rear of hood, up to release from body.

CAUTION: Clips must be fully released to ensure that backlight is not damaged.

5. Unzip backlight.
6. Lay backlight flat in hoodwell.
7. Place protective covering over backlight and boot.



8. Remove 2 rivets securing ends of hood rear quarter retaining strips.
9. Carefully bend back ends of strips to reveal rivets.
10. Drill out 13 pop rivets securing backlight retaining strip.
11. Collect retaining strip and remove backlight.



12. Release felt covering from 3rd hood bow.
13. Remove 7 nuts securing outer cover clamp rail.
14. Partially lower hood frame.
15. Release clamp rail studs from hood frame.
16. Lay protective sheet over backlight, luggage compartment lid and seats.
17. Release foam from ends of zip retainer to reveal pop rivets.
18. With assistance to hold outer cover aside, drill out 9 pop rivets securing zip retainer to hood frame.
19. Remove backlight zip.

Refit

1. Drill out any rivet heads still captive in hood frame.

CAUTION: Clear away swarf from protective covering to ensure that new backlight does not become scratched.

2. With assistance, position backlight to frame, centralise and transfer holes into backlight.
3. Position backlight to a soft covered work surface.
4. With careful use of a drill, enlarge holes to 3.5 mm.
5. Position backlight to frame, align retainer and secure with pop rivets.

NOTE: Start at the centre location and work outwards.

6. Secure ends of rear quarter retaining strips with rivets.
7. Position zip assembly to frame and secure with rivets.
8. Fit foam pads to both ends of hood bow.

NOTE: Foam pads are designed to prevent outer cover being damaged by ends of hood bow and zip retainer.

9. Position outer cover clamp rail to frame and engage studs.
10. Raise hood, but do not secure catches.
11. Secure outer cover, clamp rail with nuts.
12. Apply adhesive to 3rd hood bow and mating surface of felt covering.

CAUTION: Ensure underside of outer cover does not become contaminated with adhesive.

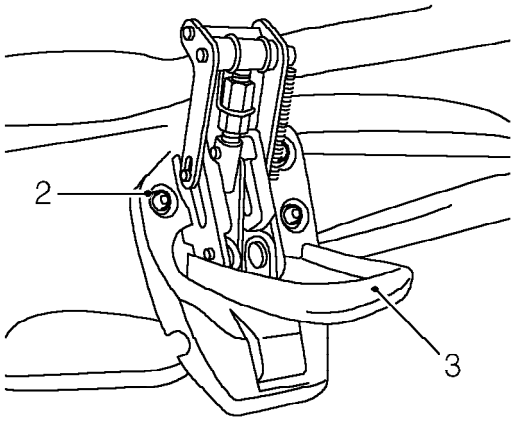
13. Bond felt covering to 3rd bow, ensuring that slots are correctly positioned around frame straps.
14. Remove protective covering.
15. Raise backlight into position and secure with zip.
16. Engage clips to secure rear of hood to body.
17. Engage hoodwell carpet beneath flip seal.
18. Secure hood catches.
19. Raise windows.

HOOD CATCH

Service repair no - 76.61.17

Remove

1. Lower hood.



76M1611

2. Remove 3 Allen screws securing catch to hood header rail.
3. Remove hood catch.

Refit

1. Position catch and fit screws, finger tight.
2. Raise hood, but do not secure catches.
3. Align catch to striker and tighten screws to 20 Nm.
4. Check operation of hood catches. If necessary, release locking wire and turn hexagonal adjuster to give correct action.
5. Secure locking wire.
6. Secure hood catches.

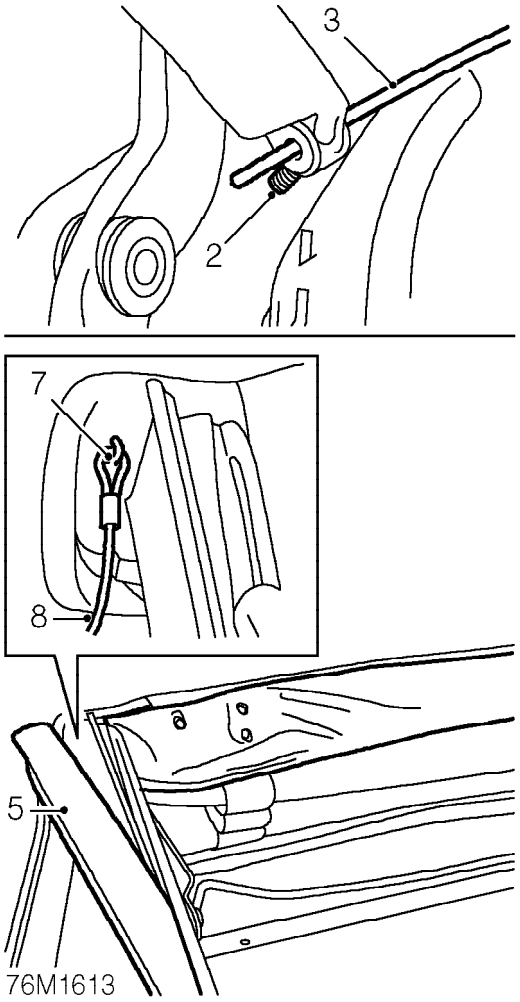
CANTRAIL TENSIONING CABLE

Service repair no - 76.61.26

The following operation involves the bonding of fabric backed vinyl to various steel components of the hood frame. If adhesive is to be applied to the fabric backing, Dunlop 758 adhesive or equivalent should be used. For direct application on vinyl surfaces, use Dunlop S1588 adhesive or equivalent.

A thin coating of adhesive should be applied to both surfaces and then allowed to cure, until just touch dry, for between 5 and 10 minutes, before the bond is made.

1. Partially lower hood.



2. Loosen cable locking screw.
3. Release cable from location.
4. Lower hood fully.
5. Release forward 100 mm of cantrail seal from retainer.
6. Peel outer cover away from header in immediate area of cable location.
7. Bend location tag up by minimum amount necessary and release cantrail tensioning cable from header rail.
8. Remove cantrail tensioning cable.

Refit

1. Locate cable loop over location tag in header rail and bend tag over to retain cable.
2. Apply adhesive to outer cover and header rail.
3. Bond outer cover to header rail, ensuring that beading at side of header is correctly positioned.
4. Fit forward end of cantrail seal to retainer.
5. Partially raise hood.
6. Insert new cable into pocket of outer cover.
7. Thread cable through location in 2nd hood bow.
8. Raise hood fully, but do not secure catches.
9. Using pliers, pull cable taught and tighten locking screw.
10. Secure hood catches and check cable tension.
11. If necessary, release hood catches, loosen cable locking screw and adjust cable tension. Tighten locking screw.
12. Secure catches.

BACKLIGHT ZIP

Service repair no - 76.61.21

Remove

1. Remove backlight assembly. ***See this section.***
2. Entrust replacement of zip to trim specialist.

Refit

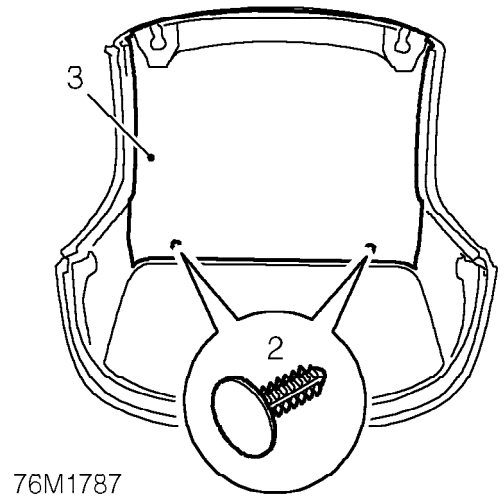
1. Refit backlight assembly. ***See this section.***

HARD TOP HEADLINING

Service repair no - 76.61.31

Remove

1. Remove front catches. ***See this section.***



2. Remove 2 trim studs securing rear of headlining to hard top.
3. Remove headlining.

Refit

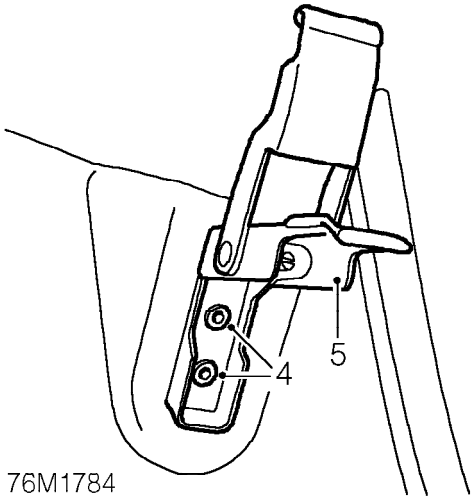
1. Position headlining and secure with trim studs.
2. Fit front catches. ***See this section.***

HARD TOP CATCH - REAR

Service repair no - 76.61.32

Remove

1. Remove hard top. ***See this section.***
2. Invert hard top on a soft covered work surface.
3. Position protection over headlining and backlight.



4. Drill out 2 pop rivets securing catch to hard top.
5. Remove catch.

Refit

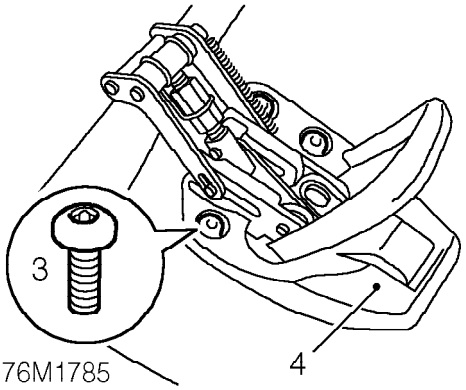
1. Position catch and secure with rivets.
2. Fit hard top. ***See this section.***
3. Check operation of catch. If necessary, turn adjuster to give correct action.
4. Secure catch.

HARD TOP CATCH - FRONT

Service repair no - 76.61.33

Remove

1. Remove hard top. ***See this section.***
2. Invert hard top on a soft covered work surface.



3. Remove 3 Allen screws securing catch to hard top.
4. Remove catch.

Refit

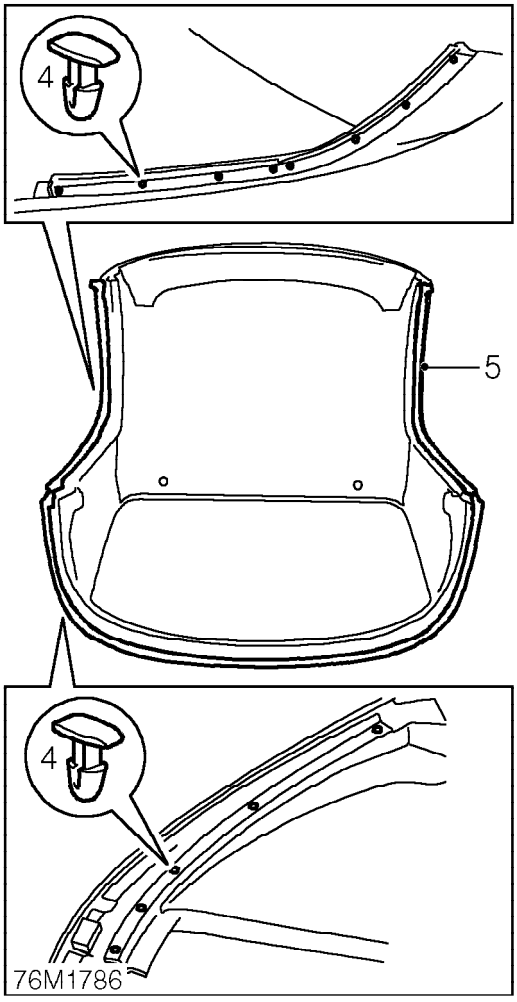
1. Position catch and tighten screws to 10 Nm.
2. Fit hard top. ***See this section.***
3. Check operation of catch. If necessary, release locking wire and turn hexagonal adjuster to give correct action.
4. Secure locking wire.
5. Secure catch.

HARD TOP SEAL

Service repair no - 76.61.34

Remove

1. Remove hard top. ***See this section.***
2. Invert hard top on a soft covered work surface.
3. Release seal from adhesive at header and below backlight.



4. Release 26 studs securing seal to hard top.
5. Remove seal.

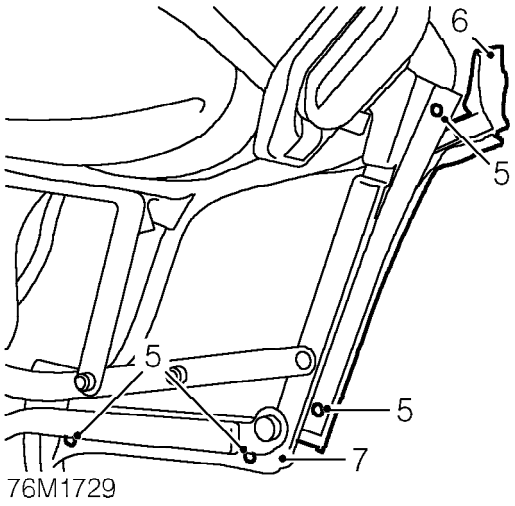
Refit

1. Remove all traces of dirt and grease from surfaces to be bonded using a suitable mild solvent.
2. Apply Loctite 401 to hard top using old deposits as a guide.
3. Position seal, centralise and carefully bond to hard top.
4. Engage studs securing seal to hard top.
5. Fit hard top. ***See this section.***

CANTRAIL SEAL

Service repair no - 76.61.35

1. Lower both windows.
2. Depress locking buttons and release both hood catches.
3. Partially lower hood.
4. Position protective covering beneath frame.



5. Drill out pop rivets securing seal to frame channels.
6. Release seal from 2 retainers.
7. Remove seal.

Refit

1. Apply liquid soap to seal retainers.
2. Position seal and engage to retainers.
3. Raise hood and check seal fit.
4. If necessary, partially lower hood, reposition seal in retainers and recheck.
5. Carefully transfer rivet holes into seal using a 3 mm drill bit.

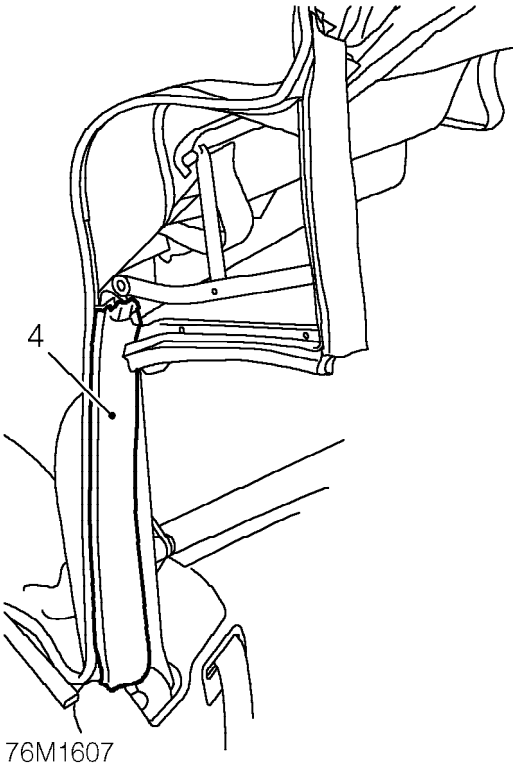
CAUTION: Care must be taken not to drill through the outer surface of the seal.

6. Secure seal with pop rivets.
7. Raise hood and secure catches.
8. Raise windows.

'B' POST SEAL

Service repair no - 76.61.38

1. Lower both windows.
2. Depress locking buttons and release both hood catches.
3. Partially lower hood.



4. Remove seal from retainer.

Refit

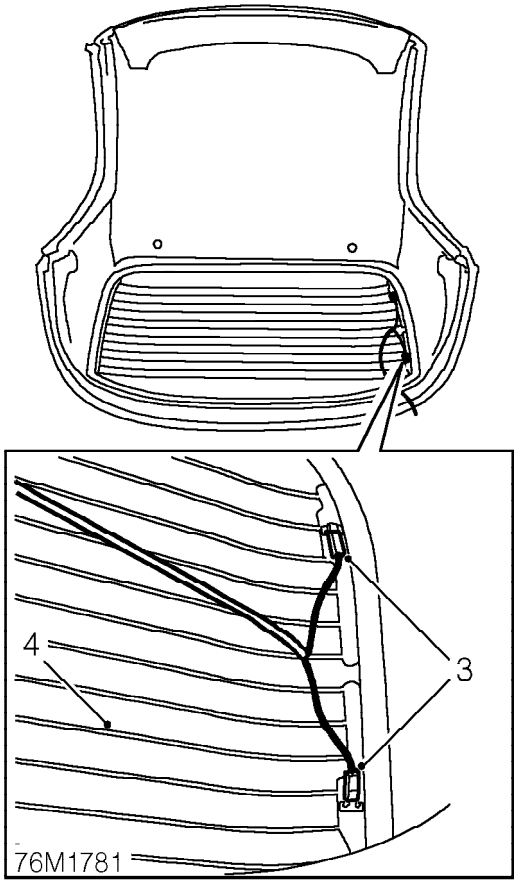
1. Apply liquid soap to seal retainer.
2. Fit seal to retainer.
3. Raise hood and check seal fit.
4. If necessary, partially lower hood, reposition seal in retainer and recheck.
5. Raise hood and secure catches.
6. Raise windows.

HARD TOP - BACKLIGHT

Service repair no - 76.61.40

Remove

1. Remove hard top. ***See this section.***
2. Invert hard top on a soft covered work surface.



3. Disconnect 2 Lucar terminals and remove heated screen harness.

WARNING: Gloves and suitable eye protection must be worn when removing glass.

4. Working from inside hard top and commencing from lower LH corner, release sealing rubber. Remove glass and seal.

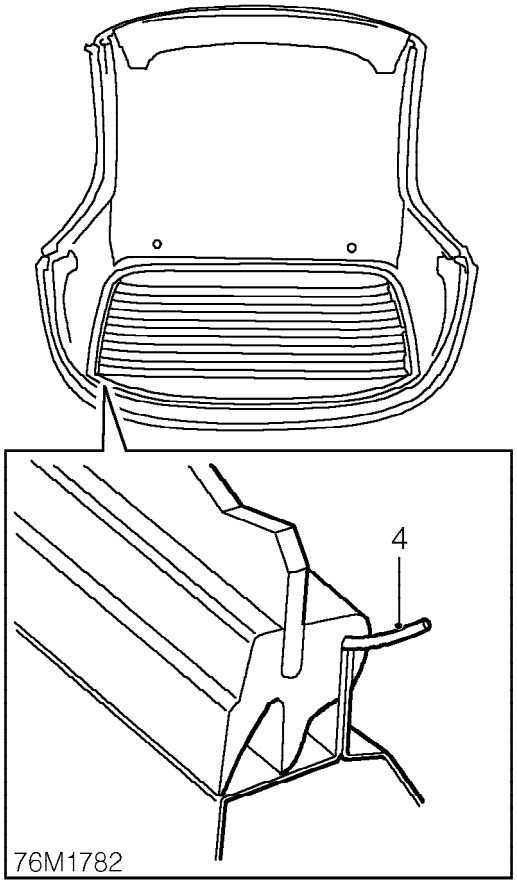
CAUTION: Use assistance to support glass as it is removed.

5. Remove and discard rubber seal.

Refit

1. Clean hard top aperture and edge of glass.
2. Apply rubber lubricant to seal channels.
3. Fit sealing rubber to glass.

WARNING: Gloves and suitable eye protection must be worn when fitting glass.



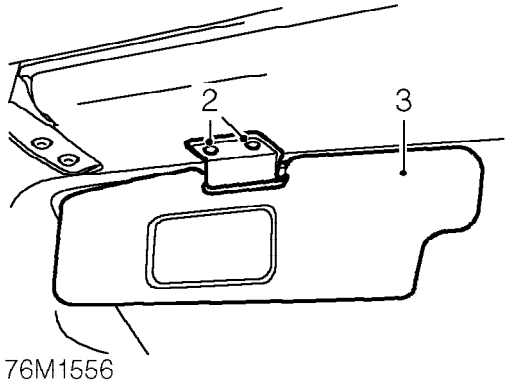
4. Insert a suitable length of cord in hard top aperture channel of sealing rubber.
5. Using assistance, push glass against hard top aperture whilst using cord to pull lip of seal over aperture flange.
6. Clean all traces of rubber lubricant from glass and hard top using white spirit.
7. Fit heated screen harness and connect Lucar terminals.
8. Fit hard top. ***See this section.***
9. Press firmly around outside edges of glass to ensure that seal is fully seated.

SUN VISOR

Service repair no - 76.10.47

Remove

1. Lower sun visor.



2. Remove 2 screws securing visor to header rail.
3. Remove visor.

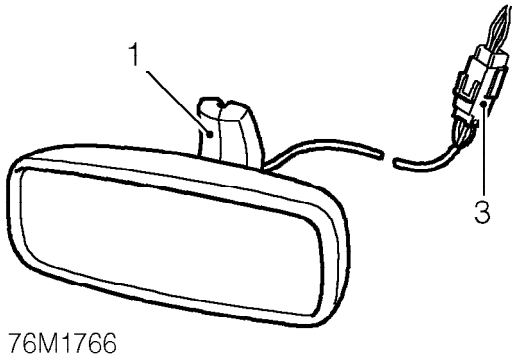
Refit

1. Position visor and secure with screws.

INTERIOR MIRROR

Service repair no - 76.10.51

Remove



1. Release mirror from screen mounted clip.
2. Release cable and multiplug from header finisher.
3. Disconnect multiplug and remove mirror.

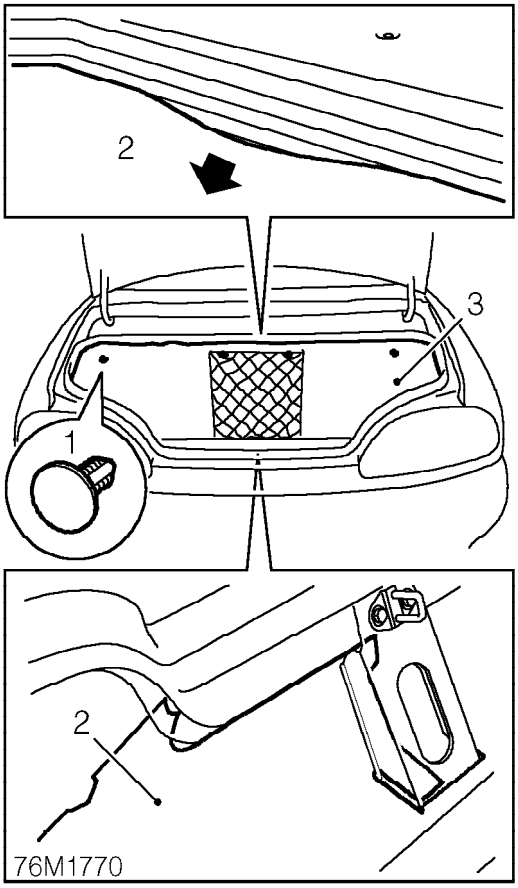
Refit

1. Connect multiplug and position cable to recess in mirror mounting.
2. Fit mirror to windscreen.
3. Position excess cable and multiplug behind header finisher.

LUGGAGE COMPARTMENT TRIM

Service repair no - 76.13.17

Remove



1. Remove 4 clips securing trim to engine compartment bulkhead.
2. Release trim from flip seal, bonnet release lever and boot lid striker.
3. Remove trim.

Refit

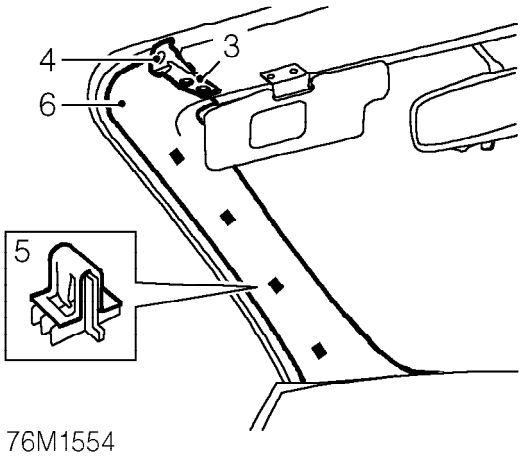
1. Fit trim and secure with clips.
2. Position trim behind flip seal.
3. Position trim to bonnet release lever and boot lid striker.

'A' POST TRIM

Service repair no - 76.13.26

Remove

1. Lower sun visor.
2. Release catches and lower hood.



3. Remove 2 Tx30 Torx screws securing hood striker.
4. Remove striker.
5. Release 4 sprag clips securing trim to 'A' post.
6. Remove 'A' post trim.

Refit

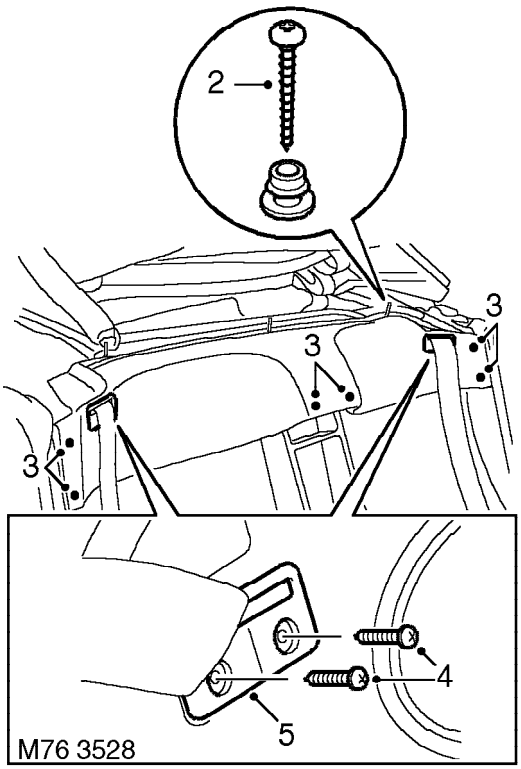
1. Position trim and engage sprag clips.
2. Fit hood striker and tighten screws to 6 Nm.
3. Reposition sun visor.
4. Raise hood and secure catches.

REAR BULKHEAD FINISHER

Service repair no - 76.13.49

Remove

1. Remove front seats. ***See this section.***



2. Remove 3 screws securing finisher and collect press studs.
3. Release finisher from fixings.
4. Remove 4 screws securing belt guides to finisher.
5. Release belt guides from finisher and remove from belt.
6. Slide seat belts through finisher and remove finisher from vehicle.

Refit

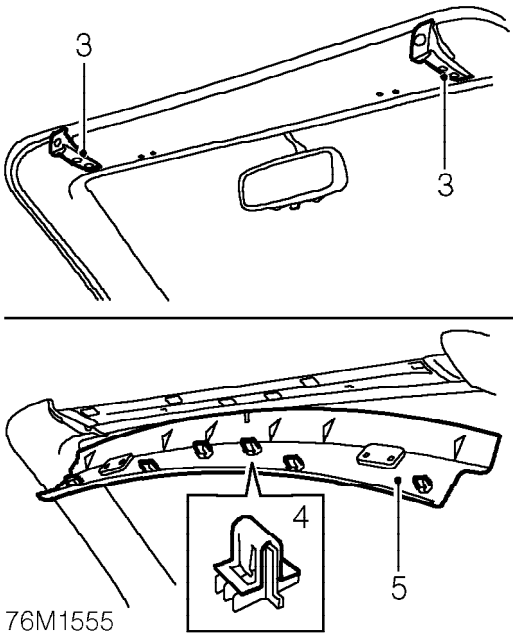
1. Position finisher and thread seat belts into position.
2. Fit seat belt guides and locate guides into position.
3. Secure guides with screws.
4. Align finisher to studs and secure into position.
5. Position press studs and secure with screws.
6. Fit front seats. ***See this section.***

HEADER TRIM

Service repair no - 76.13.69

Remove

1. Remove both sun visors. ***See this section.***
2. Release catches and lower hood.



3. Remove 2 Tx30 Torx screws securing each hood striker and remove strikers.
4. Release 6 sprag clips securing trim to header rail.
5. Remove trim.

Refit

1. Position trim and engage sprag clips.
2. Fit hood strikers and tighten screws to 6 Nm.
3. Fit sun visors. ***See this section.***
4. Raise hood and secure catches.

FRONT CONSOLE

Service repair no - 76.25.01

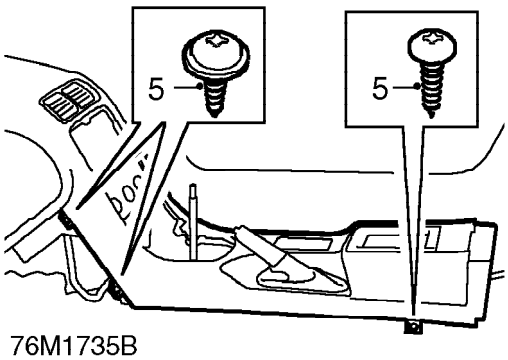
WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

1. Make SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove centre console panel. ***See this section.***

CAUTION: Ensure pre-tensioner multiplug is disconnected before seat is removed.

3. Remove rear console. ***See this section.***
4. Remove both console closing panels. ***See this section.***



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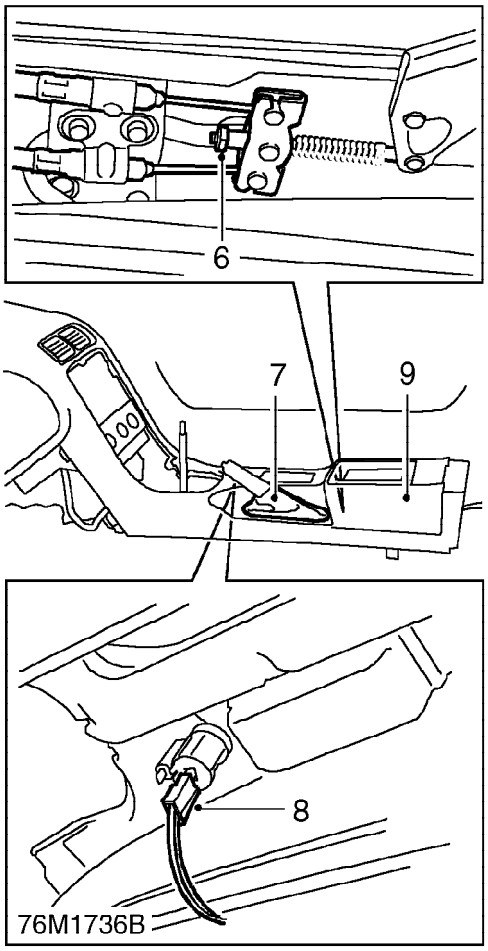
5. Remove 6 screws securing console to tunnel.



76M1736B

6. Loosen handbrake adjustment and position hand brake lever in ON position.
7. Release handbrake gaiter from console and remove gaiter from handbrake.
8. Release console and disconnect multiplug from cigar lighter.
9. Release volumetric sensor cable and remove console.

Refit

1. Position front console, connect cigar lighter multiplug and position volumetric sensor cable.
2. Position console and secure with screws.
3. Fit handbrake gaiter and secure with band.
4. Engage gaiter to console.
5. Adjust handbrake. ***See BRAKES, Adjustments.***
6. Fit console closing panels. ***See this section.***
7. Fit rear console. ***See this section.***

CAUTION: Ensure that pre-tensioner flylead is correctly clipped to seat base before fitting seat, as shown in seat refit. ***See this section.***

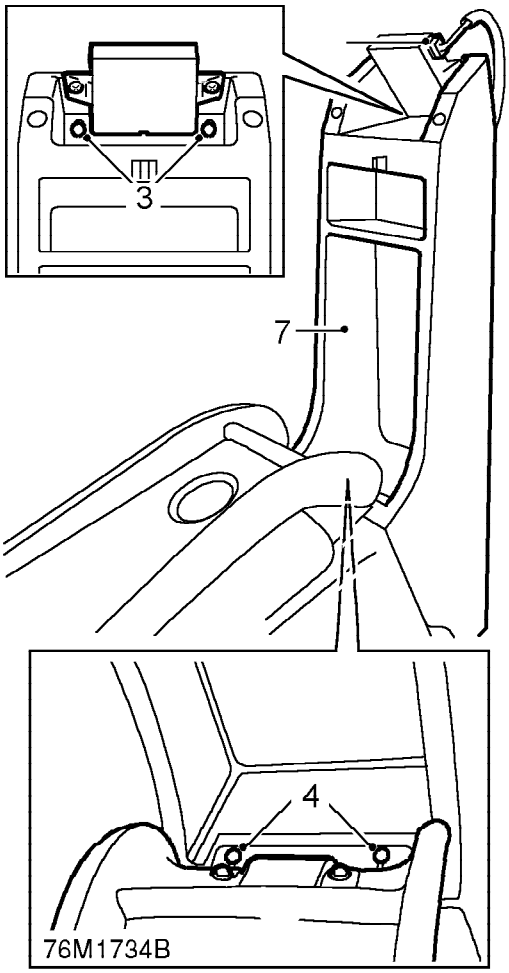
8. Fit centre console panel. ***See this section.***
9. Connect both battery terminals, earth lead last.

REAR CONSOLE

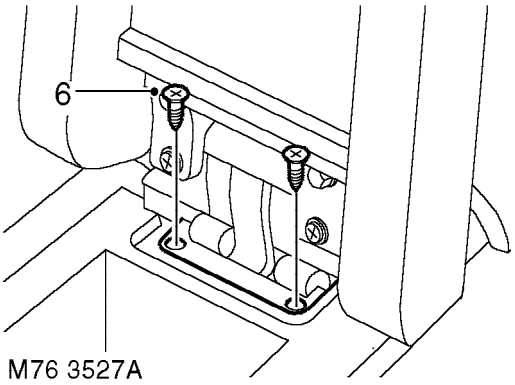
Service repair no - 76.25.04

Remove

1. Remove rear bulkhead finisher. ***See this section.***



2. Disconnect multiplug from volumetric sensor.
3. Remove 2 screws securing rear console to rear bulkhead.
4. Open rear console lid and remove 2 screws securing console lid bracket to rear console.
5. Open front console lid and remove storage bin from front console.



6. Remove 2 screws securing console lid bracket to front console and remove console lid assembly.
7. Remove rear console.
8. Remove 2 screws securing volumetric sensor to rear console and remove sensor.

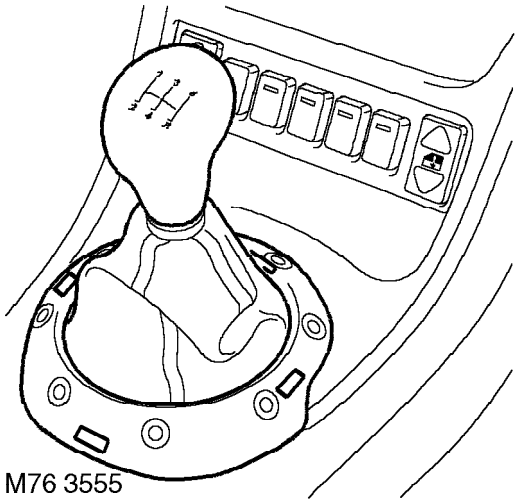
Refit

1. Fit sensor to console and secure with screws.
2. Fit rear console to bulkhead and secure with 2 upper screws. Ensure correct position of cable.
3. Fit console lid assembly and secure with screws.
4. Fit front console storage bin.
5. Connect multiplug to sensor.
6. Fit rear bulkhead finisher. ***See this section.***

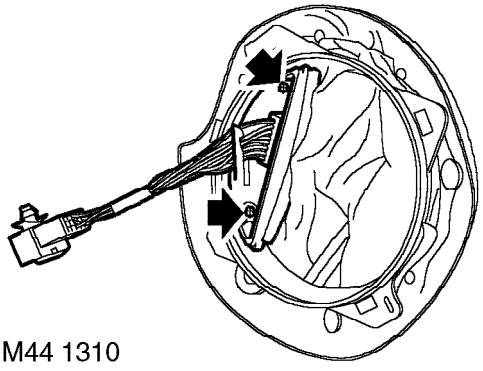
GEAR LEVER GAITER

Service repair no - 76.25.06

Remove



1. **Manual models:** Unscrew and remove gear knob.
2. **Stepspeed (Em-CVT) models:** Select position 'D', pull gear selector lever sharply upwards and remove.
3. **All models:** Release gaiter from centre console.



4. **Stepspeed (Em-CVT) models:** Disconnect gearshift selector indicator multiplug.
5. Remove 2 screws securing gearshift selector indicator and remove selector indicator.
6. **All models:** Remove gaiter.

Refit

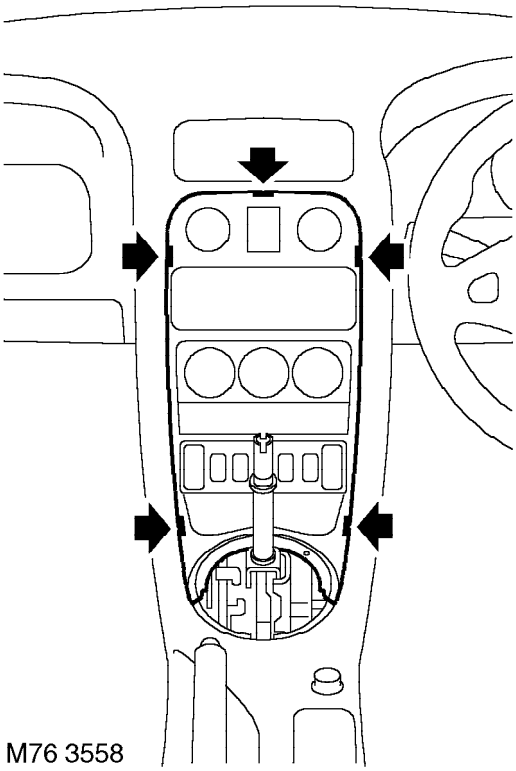
1. Position gaiter.
2. **Stepspeed (Em-CVT) models:** Fit gearshift selector indicator and secure with screws.
3. Connect multiplug to selector indicator.
4. **All models:** Secure gaiter to centre console.
5. Fit gear change selector knob.

CENTRE CONSOLE PANEL

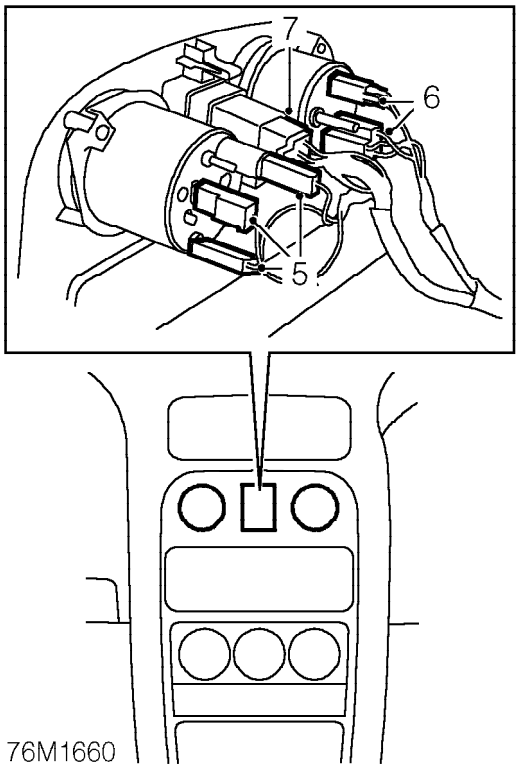
Service repair no - 76.25.23

Remove

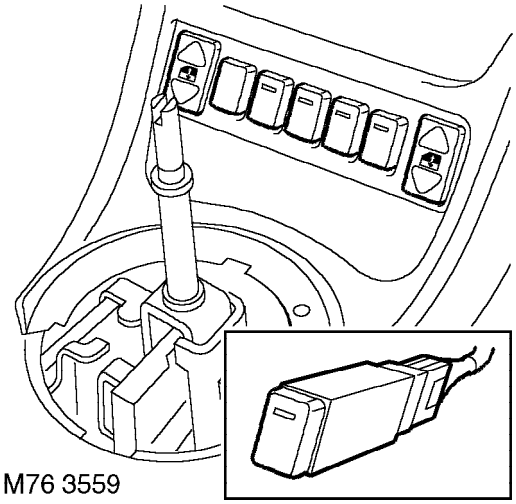
1. Disconnect battery earth lead.
2. Remove radio. ***See ELECTRICAL, Repairs.***
3. Remove gear lever gaiter. ***See this section.***



4. Release 5 clips securing console to fascia.



5. Release 3 Lucars from clock.
6. Release multiplug and bulb holder from oil temperature gauge.
7. Release hazard switch multiplug.



8. Release multiplugs from switches.
9. Remove centre console panel.

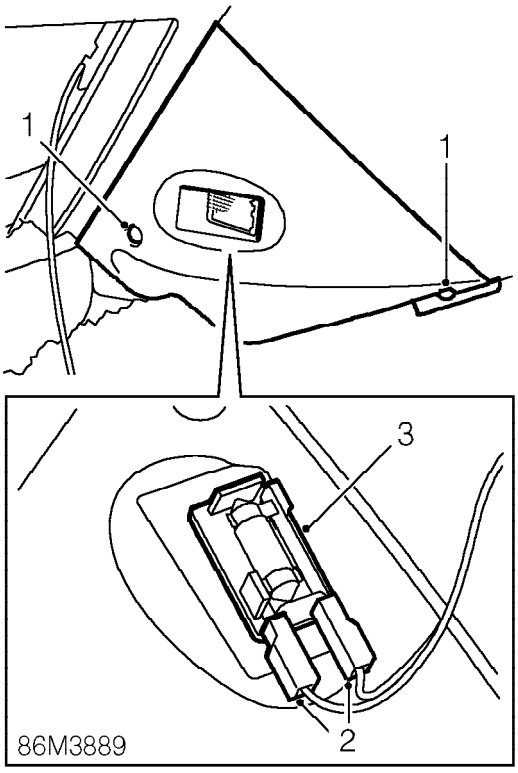
Refit

1. Position console and connect multiplugs, Lucars and bulb holder.
2. Secure console clips to fascia.
3. Fit gear lever gaiter. ***See this section.***
4. Fit radio. ***See ELECTRICAL, Repairs.***
5. Connect battery earth lead.

CONSOLE CLOSING PANEL

Service repair no - 76.25.31

Remove



1. Remove 2 screws securing panel to console.
2. Release panel and disconnect 2 Lucars from lamp.
3. Remove lamp from panel.

Refit

1. Fit lamp to panel and connect Lucars.
2. Position panel and secure with screws.

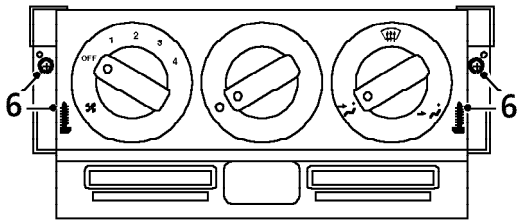
FASCIA PANEL

Service repair no - 76.46.23

WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

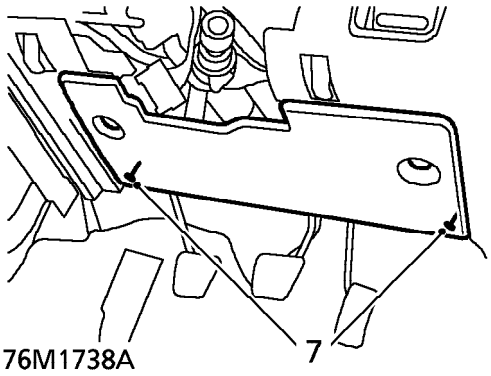
Remove

1. Make SRS system safe.***See GENERAL INFORMATION, SRS Precautions.***
2. Remove front console. ***See this section.***
3. Remove steering column switch pack. ***See ELECTRICAL, Repairs.***
4. Remove instrument pack. ***See INSTRUMENTS, Repairs.***
5. Remove glovebox. ***See this section.***



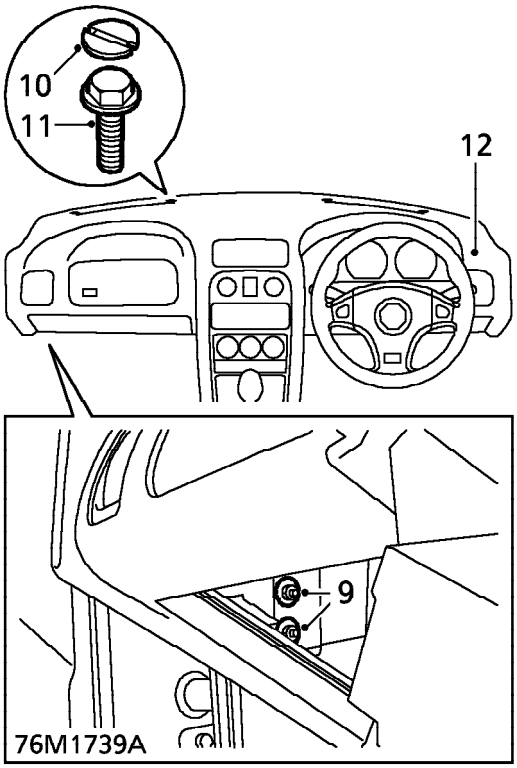
76M1737A

6. Remove 4 screws securing heater controls to fascia and position aside.



76M1738A

7. Loosen 2 screws securing fuse box cover to fascia and remove cover.
8. Release both screen heater ducts from fascia and position aside.



9. Loosen 4 nuts securing fascia to lower 'A' post.
10. Release 4 retaining bolt caps from fascia and collect caps.
11. Remove 4 bolts securing fascia to scuttle.
12. Remove fascia panel.

Refit

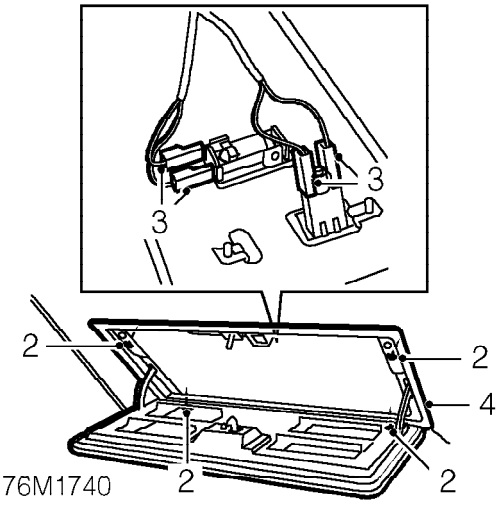
1. Position fascia to scuttle.
2. Align fascia and secure with nuts and bolts.
3. Fit retaining bolt caps.
4. Engage heater ducts to fascia.
5. Position fuse box cover to fascia and secure with screws.
6. Align heater controls to fascia and secure with screws.
7. Fit glovebox. ***See this section.***
8. Fit instrument pack. ***See INSTRUMENTS, Repairs.***
9. Fit steering column switch pack. ***See ELECTRICAL, Repairs.***
10. Fit front console. ***See this section.***

GLOVEBOX

Service repair no - 76.52.03

Remove

1. Open glovebox lid.



2. Remove 4 screws securing glovebox to fascia.
3. Release glovebox and disconnect 4 Lucars.
4. Remove glovebox.

Refit

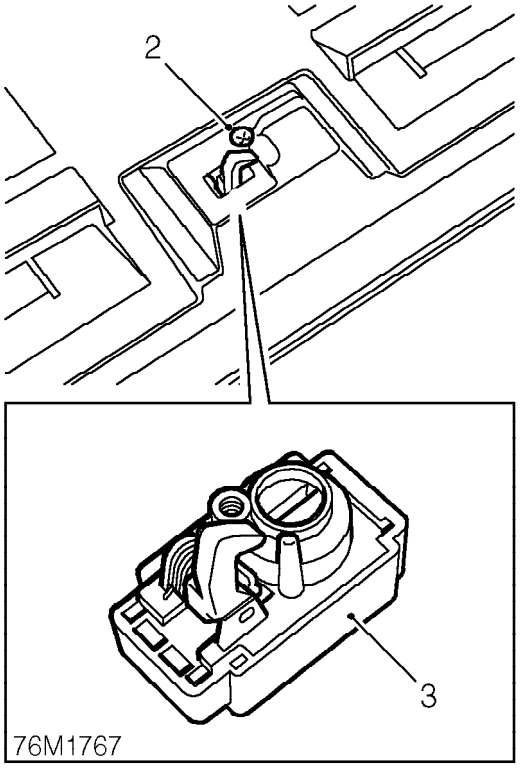
1. Position glovebox and connect Lucars.
2. Engage glovebox to fascia and secure with screws.
3. Close glovebox lid.

GLOVEBOX LATCH

Service repair no - 76.52.08

Remove

1. Open glovebox lid.



2. Remove screw securing latch to glovebox lid.
3. Remove latch.

Refit

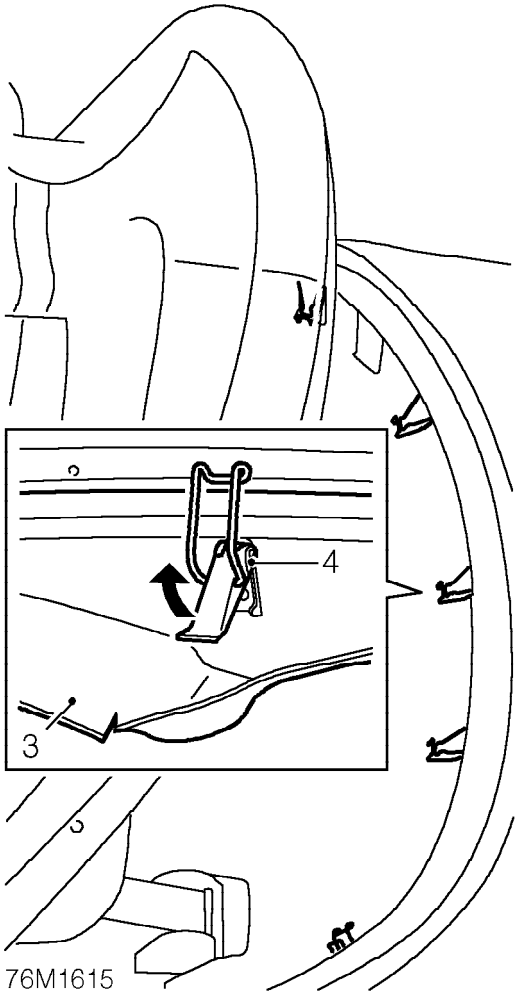
1. Position latch to glovebox lid and secure with screw.
2. Close glovebox lid.

HOODWELL TRIM

Service repair no - 76.67.06

Remove

1. Lower both windows.
2. Release hood catches, do not lower hood.



3. Release rear edge of hoodwell trim to reveal 5 clips.
4. Release clips securing rear of hood to body.
5. Raise rear edge of hood.
6. Remove hoodwell trim.

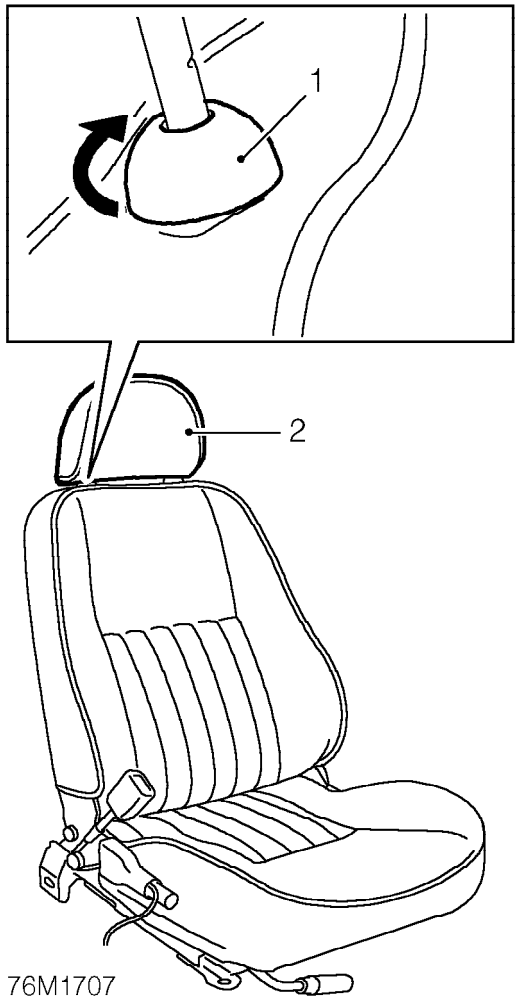
Refit

1. Fit trim and engage beneath lip of bulkhead finisher.
2. Reposition rear edge of hood.
3. Engage clips to secure rear of hood to body.
4. Engage hoodwell trim beneath flip seal.
5. Secure hood catches.
6. Raise windows.

HEAD RESTRAINT

Service repair no - 78.10.36/99

Remove



1. Rotate inboard head restraint, guide cap 90°.
2. Remove head restraint.

Refit

1. Fit head restraint.
2. Rotate inboard head restraint, guide cap back 90° to lock head restraint.

SEAT

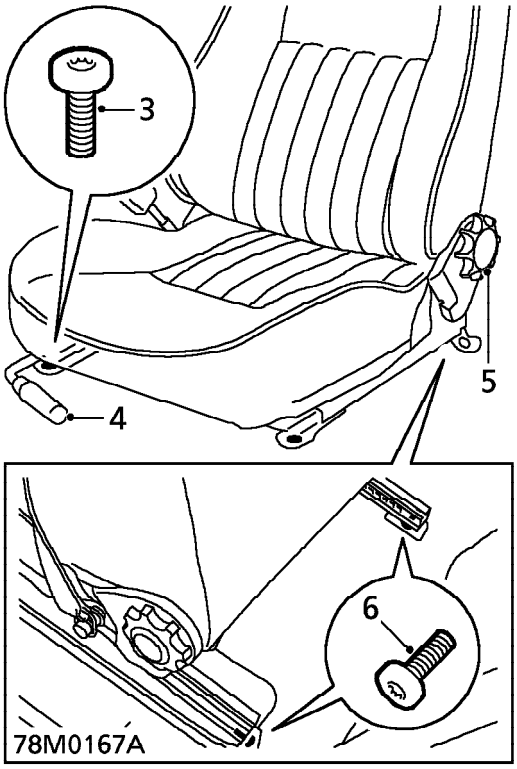
Service repair no - 78.10.44/99

Remove

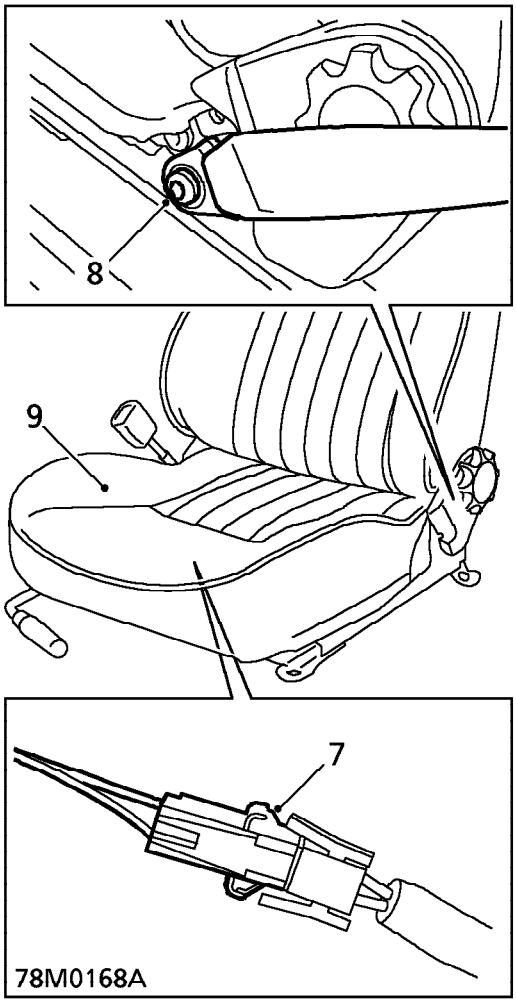
1. Make the SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***

WARNING: Always remove the ignition key from the ignition switch, disconnect the vehicle battery and wait 10 minutes before commencing work on the SRS system.

2. Lift seat adjuster, move seat rearwards.



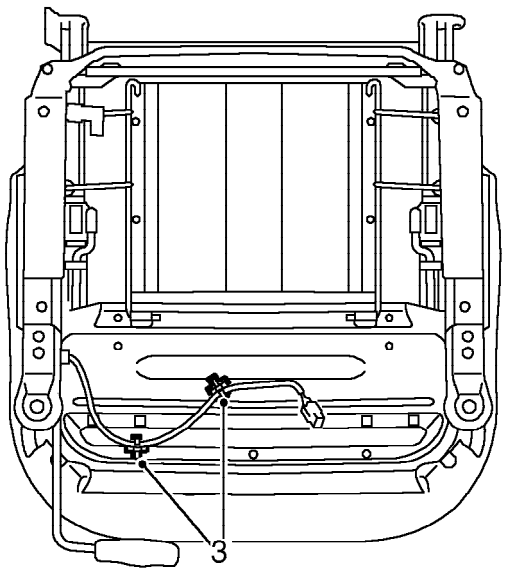
3. Remove Torx screw from front of each seat runner.
4. Lift seat adjuster, move seat forwards.
5. Rotate recline handle to tilt squab fully forward.
6. Remove Torx screw from rear of each seat runner.



7. Disconnect seat belt pre-tensioner multiplug.
8. Position seat and remove Torx screw securing seat belt strap to seat frame.
9. Remove seat.

Refit

1. Ensure harness lead does not become trapped under seat runner when fitting seat.
2. Position seat belt strap to seat frame and tighten Torx screw to 30 Nm.



M76 4196

3. Ensure that pre-tensioner lead is correctly clipped to seat base.
4. Position seat and align runners to floor bolt holes.
5. Connect pre-tensioner multiplug.
6. Fit but do not tighten Torx screw securing rear of each seat runner.
7. Lift seat adjuster, move seat rearwards.
8. Fit Torx screw securing front of each seat runner and tighten to 45 Nm.
9. Lift seat adjuster, move seat forwards.
10. Tighten Torx screw securing rear of each seat runner to 45 Nm.
11. Connect both battery leads, earth lead last.
12. Carry out system check using TestBook.

SEAT SQUAB ASSEMBLY

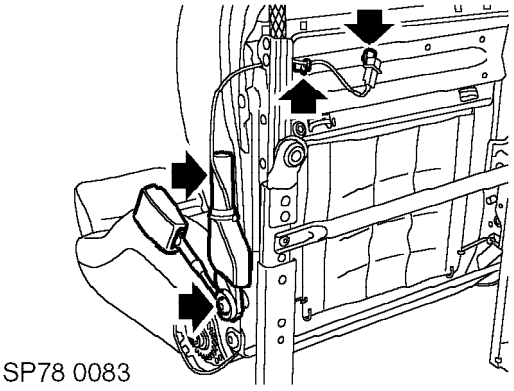
Service repair no - 78.10.50/99

Remove

1. Make SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***

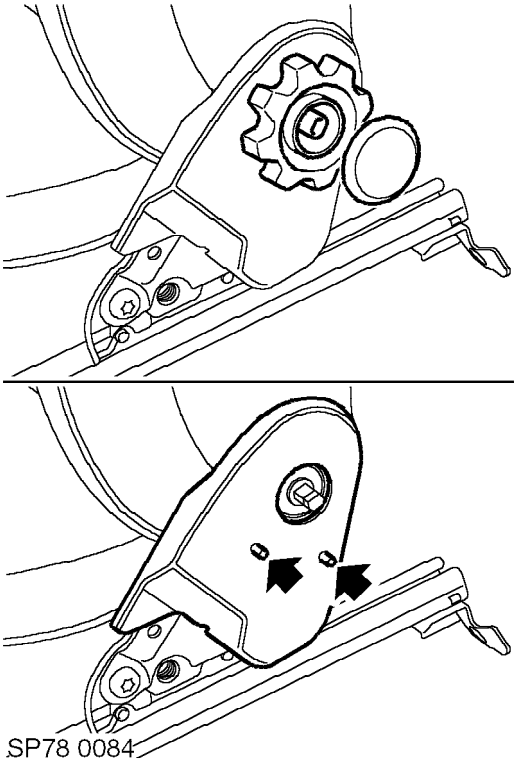
WARNING: Always remove the ignition key from the ignition switch, disconnect the vehicle battery and wait 10 minutes before commencing work on the SRS system.

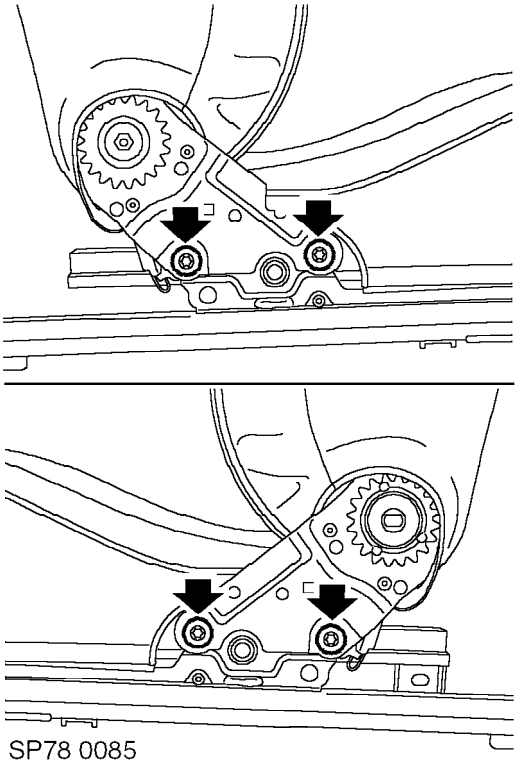
2. Remove front seat. ***See this section.***



SP78 0083

3. Release 2 clips securing pre-tensioner harness to underside of seat.
4. Remove Torx bolt securing pre-tensioner to seat and remove pre-tensioner.


SP78 0084


SP78 0085

5. Remove outer half of squab recline control handle.
6. Remove inner half of recline control handle.
7. Using a suitable punch, drive out 2 retaining pins securing the side valance.
8. Remove side valance.
9. Remove 4 Torx bolts securing squab frame to cushion frame.
10. Remove seat squab assembly.

Refit

1. Position squab frame to cushion frame, fit Torx bolts and tighten to 45 Nm.
2. Fit side valance and secure with retaining pins.
3. Fit inner half of squab recline handle.
4. Fit outer half of squab recline handle.
5. Fit pre-tensioner to squab frame, fit Torx bolt and tighten to 45 Nm.
6. Secure pre-tensioner harness clips to underside of seat.
7. Fit front seat. ***See this section.***

COVER - ONE PIECE - FRONT SEAT CUSHION

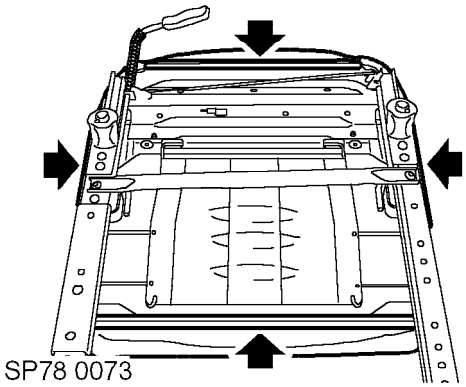
Service repair no - 78.30.01

Remove

1. Make SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***

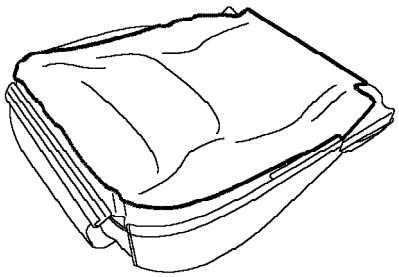
WARNING: Always remove the ignition key from the ignition switch, disconnect the vehicle battery and wait 10 minutes before commencing work on the SRS system.

2. Remove seat squab assembly. ***See this section.***



SP78 0073

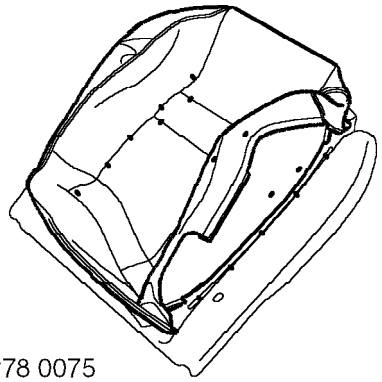
3. Release 2 retainers securing sides of cushion cover to seat frame.
4. Release retainer securing rear of cushion cover to seat frame.
5. Release retainer securing front of cushion cover to seat frame.
6. Release cushion cover from seat frame and remove cushion assembly.



SP78 0074

7. Remove seat membrane.

NOTE: Do not carry out further dismantling if component is removed for access only.



SP78 0075

8. Noting the fitted position, remove and discard 16 hog rings securing cushion cover to cushion pad.
9. Remove cushion cover from cushion pad.

Refit

1. Position cushion cover to cushion pad and secure with new hog rings using **78 R002** .
2. Position seat membrane.
3. Position cushion cover assembly to cushion frame.
4. Secure front, rear and side cushion retainers to cushion frame.
5. Fit seat squab assembly. ***See this section.***
6. Carry out system check by turning the ignition on and checking the SRS warning light illuminates for 4 seconds and then extinguishes.

COVER - SQUAB - FRONT SEAT

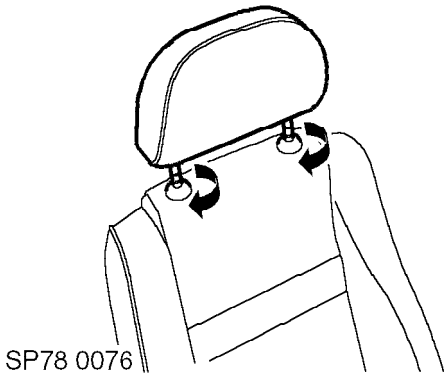
Service repair no - 78.90.08

Remove

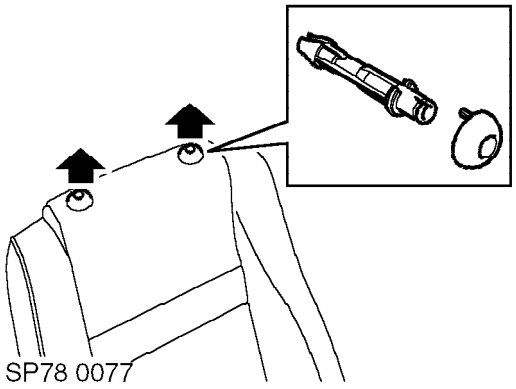
1. Make SRS system safe. ***See GENERAL INFORMATION, SRS Precautions.***

WARNING: Always remove the ignition key from the ignition switch, disconnect the vehicle battery and wait 10 minutes before commencing work on the SRS system.

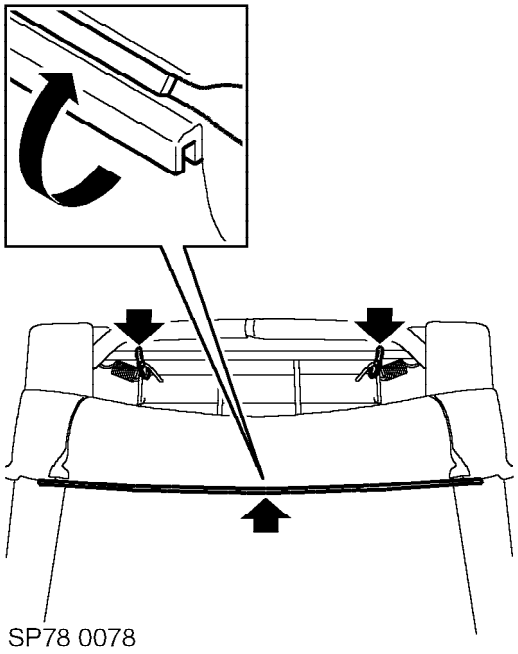
2. Remove seat squab assembly. ***See this section.***


SP78 0076

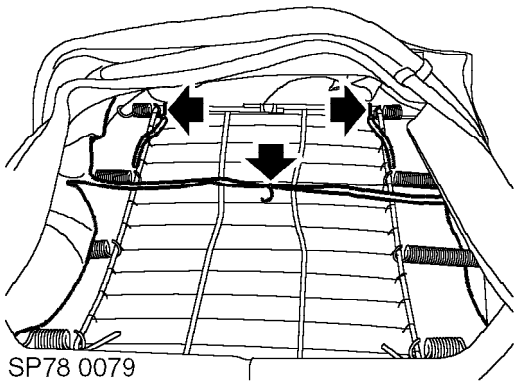
3. Rotate inboard head restraint guide cap 90° and remove head restraint.


SP78 0077

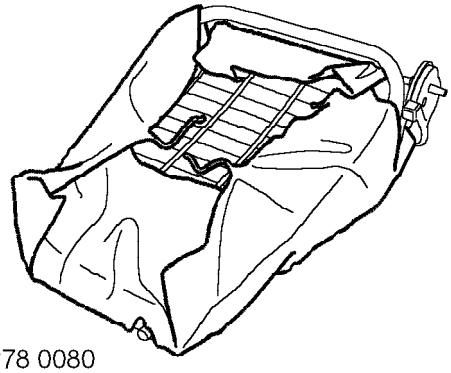
4. Remove head restraint guide tube caps.


SP78 0078

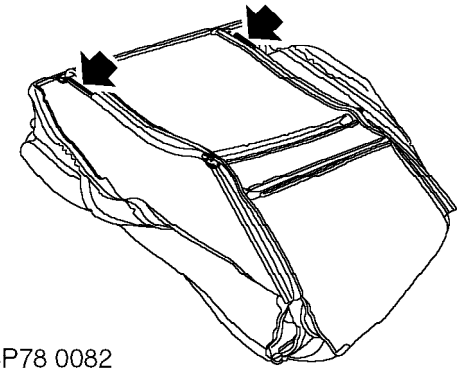
5. Release squab cover lower retainer.
6. Release seat membrane from bottom of seat frame.
7. Noting the fitted position, release shock cords from pullmaflex and seat frame.


SP78 0079

8. Raise squab cover to access other end of shock cords.
9. Noting the fitted position, release shock cords from pullmaflex.



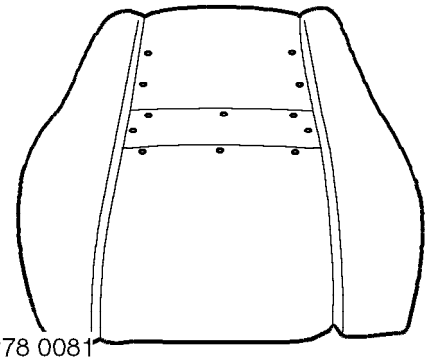
SP78 0080



SP78 0082

10. Untie and release seat membrane.
11. Remove squab frame from squab pad.
12. Remove seat membrane.

NOTE: Do not carry out further dismantling if component is removed for access only.



SP78 0081

13. Release squab cover from squab pad to access hog rings.
14. Noting the fitted position, remove and discard 12 hog rings.
15. Remove squab cover from squab pad.
16. Remove shock cords from squab cover.

Refit

1. Position shock cords to squab cover.
2. Position squab cover to squab pad and secure with new hog rings using **78 R002** .
3. Align squab cover to squab pad.
4. Position seat membrane.
5. Fit squab cover and pad to frame.
6. Secure seat membrane to squab frame.
7. Align shock cords and secure to pullmaflex frame.
8. Align squab cover to seat frame.
9. Align shock cords and secure to pullmaflex frame.
10. Align seat membrane to bottom of squab frame.
11. Secure squab cover lower retainer.
12. Fit head restraint guide tube caps.
13. Fit head restraint.
14. Fit seat squab assembly. ***See this section.***
15. Carry out system check by turning the ignition on and checking the SRS warning light illuminates for 4 seconds and then extinguishes.

WINDSCREEN

Service repair no - 76.81.01

NOTE: The following equipment is required:

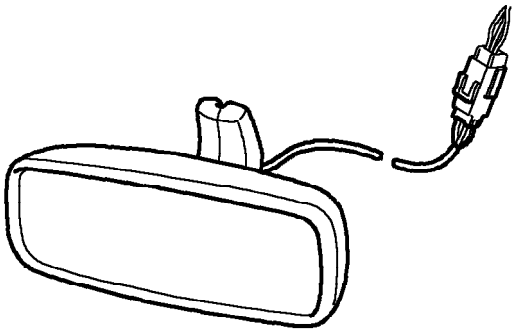
Cutting wire and handles
Windscreen repair kit
Sealer applicator gun
Suction cups

WARNING: Wear protective gloves when handling glass, solvents and primers.

WARNING: Wear suitable eye protection when removing and refitting glass.

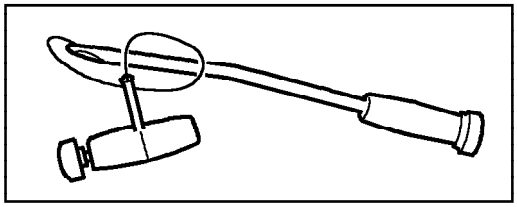
Remove

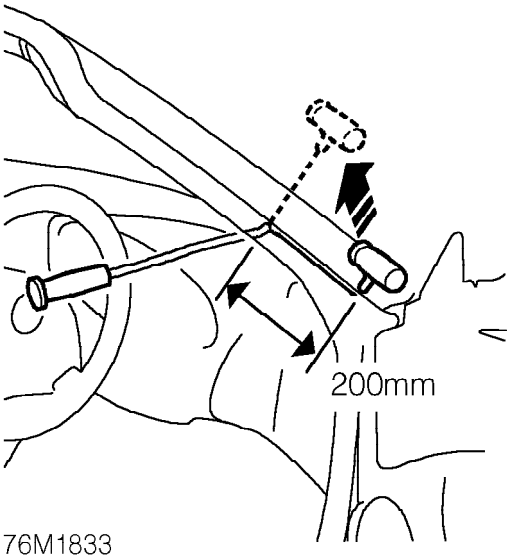
1. Remove air intake panel. ***See HEATING & VENTILATION, Repairs.***
2. Remove header trim. ***See Interior trim components.***
3. Remove 'A' post trim, ***See Interior trim components.***



76M1832

4. Remove interior mirror. ***See Interior trim components.***
5. Fit protection to bonnet and areas around screen.
6. Cover heater ducts with masking tape.
7. Cover interior of vehicle with protective sheet.
8. Make knife cut in sealant at bottom of 'A' post.





76M1833

9. Insert cutting wire through previously made knife cut and fit handles as shown, with approximately 200 mm of wire between handles.
10. With assistance, wedge tube of handle **A** between glass and body, ahead of cutting position, and carefully cut sealer using a continuous pull on handle **B** from the outside. Ensure that glass is retained as last sealant is cut.

NOTE: If multi-strand cutting wire is used, a sawing action can be used to cut through heavy sealant deposits around corners.

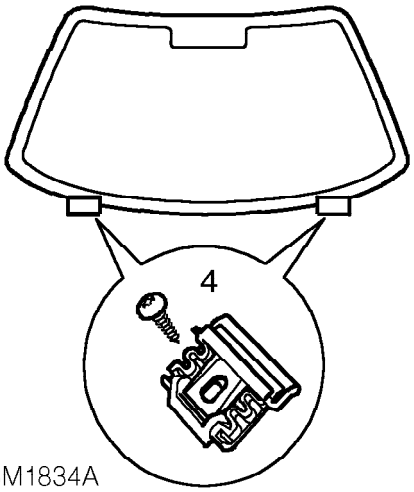
CAUTION: Use of a sawing action may overheat and break single strand wire.

11. Attach suction cups and use assistance to remove glass from body.

CAUTION: Lay glass on felt covered supports. Do not stand on edge. Any chipping of glass edge may develop into cracks.

Refit

1. Carefully remove excess sealer from body leaving a smooth surface.
2. Use a vacuum cleaner to clear away any waste.
3. Original glass: Carefully cut back old sealer to obtain a smooth surface without damaging obscuration band on glass.

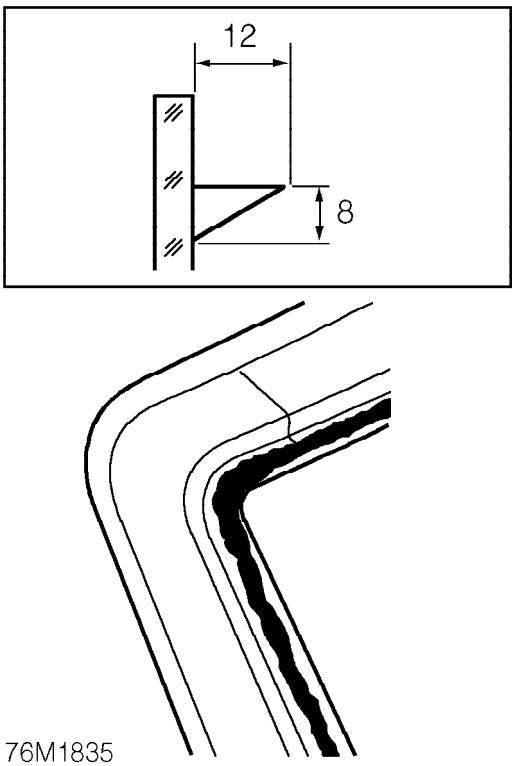


4. Fit 2 brackets and tighten screws.
5. With assistance, locate screen upright on brackets and then lay in position in body frame.
6. Carefully centre screen in body frame and apply masking tape reference marks from screen to body, on each side of lower screen.
7. Cut tape at edge of screen, and with assistance remove screen and place aside.
8. Clean frame and edge of screen with solvent.

CAUTION: Do not touch cleaned or primed surfaces with fingers.

9. Apply etch primer to any bare metal on frame.
10. Apply bonding agent to screen and allow to cure.
11. Apply primer over etch primer on frame.
12. Apply activator over old sealer on frame.
13. Allow activator to cure.
14. Fit pre-cut nozzle to sealer cartridge, remove lid and shake out crystals, and install in applicator gun.

NOTE: Nozzle will need modification to achieve required bead section.



15. Apply a continuous bead of sealer around edge of frame as shown. Make bead slightly thicker at each corner.
16. Check for breaks and air bubbles in sealer.
17. With assistance, lift screen into place and align to brackets and tape. Lightly press glass to seat sealer.
18. Remove protective covers and tape.
19. Test sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around glass and check for leaks. Mark any area that leaks. Dry glass and sealer then apply additional sealer.
20. Fit 'A' post trim. ***See Interior trim components.***
21. Fit header trim. ***See Interior trim components.***

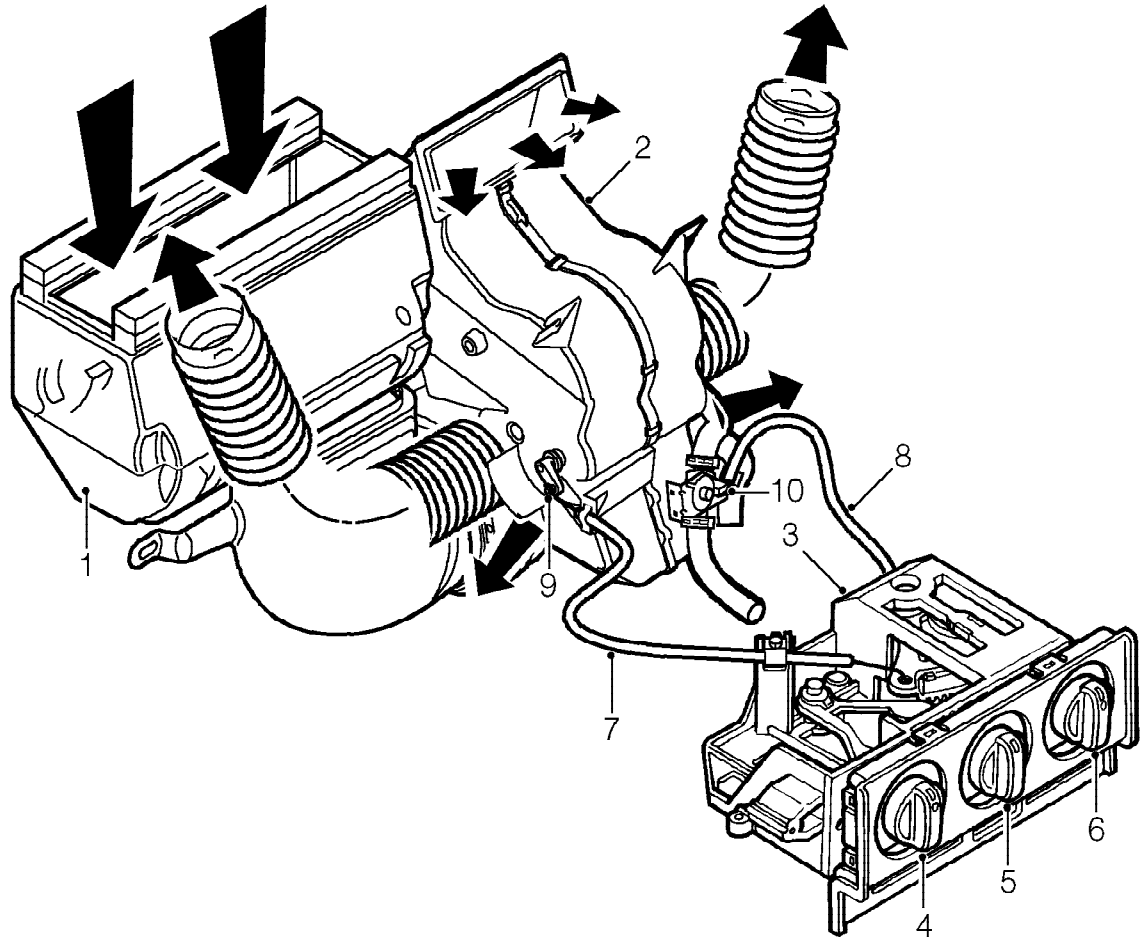
22. Fit interior mirror. ***See Interior trim components.***
23. Fit air intake panel. ***See HEATING & VENTILATION, Repairs.***

CAUTION: A curing time of 6 hours is desirable, during this time leave a window open and do not slam the doors. If the car must be used, drive slowly.

CONTENTS

A/C

OPERATION



80M0185

1. Heater duct
2. Heater and blower unit
3. Heater control unit
4. Blower switch
5. Temperature control
6. Distribution control
7. Control cable - air distribution
8. Control cable - temperature control
9. Distribution control, lever
10. Heater valve

Air drawn through the intake below the windscreen, passes through a heater duct into the heater unit to enter the interior of the car through fascia vents, via a moulded heater duct in the fascia.

When the temperature control is rotated towards the heated air position it opens a heater valve in the engine cooling system allowing hot coolant from the engine to circulate through the heater matrix.

The distribution of air entering the car through the heater is dependent on the positions of distribution flaps inside the heater unit.

The distribution flaps are adjusted by rotation of the distribution control to direct the air in various proportions to the vents at face level, foot level and the windscreen.

When the blower switch is switched off, the volume of air entering the blower unit depends on the ram effect of the car's forward motion. Four fan speeds are available on the switch to supplement the ram effect.

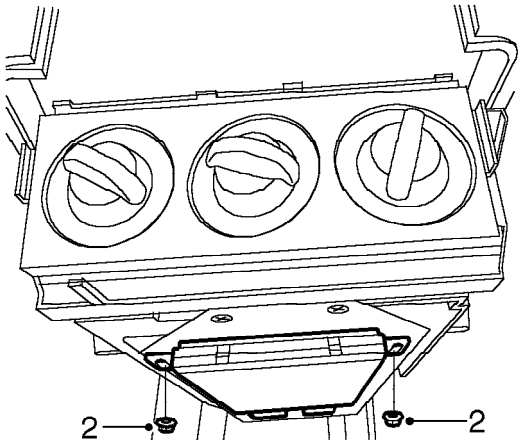
Operation of the thumb-wheel in either, the side or centre face level vents will open or close the vents.

CONTROLS - HEATER

Service repair no - 80.10.02

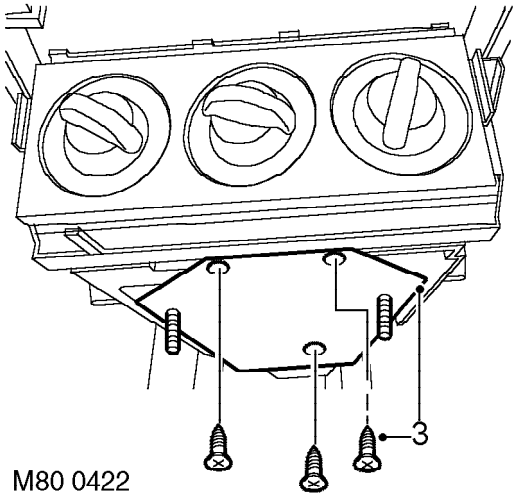
Remove

1. Remove centre console. ***See BODY, Interior trim components.***



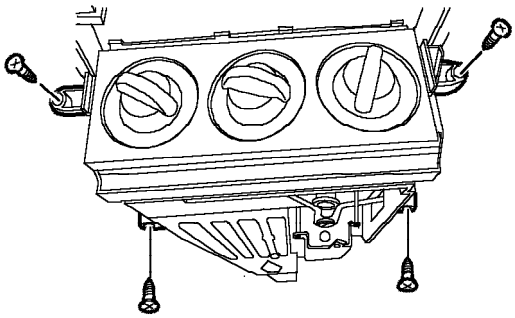
M80 0421

2. Remove 2 nuts securing alarm ECU, release ECU and position aside.



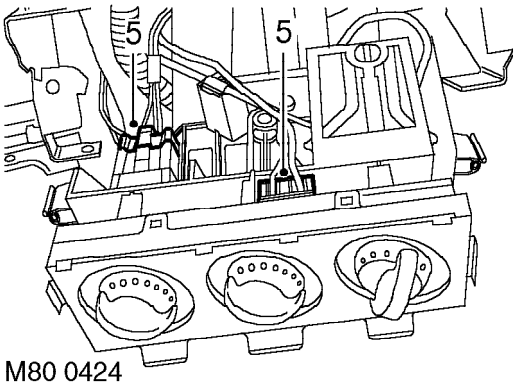
M80 0422

3. Remove 3 screws securing alarm ECU support plate and remove support plate.



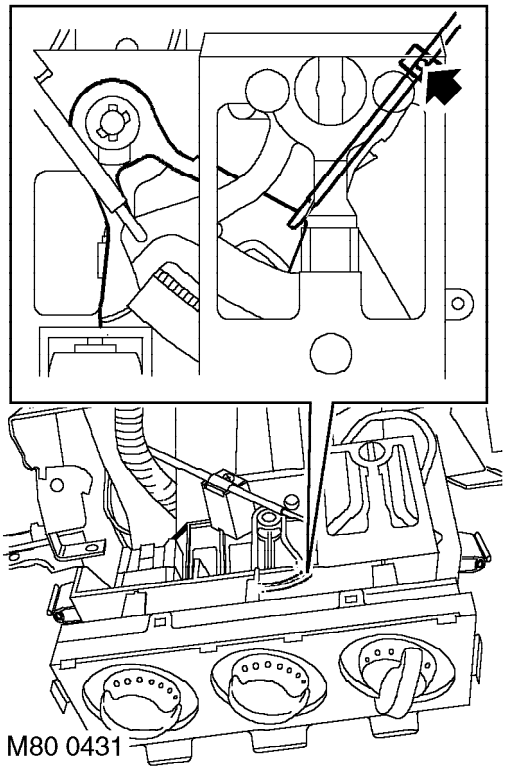
M80 0423

4. Remove 4 screws securing heater controls and release controls from support bracket.

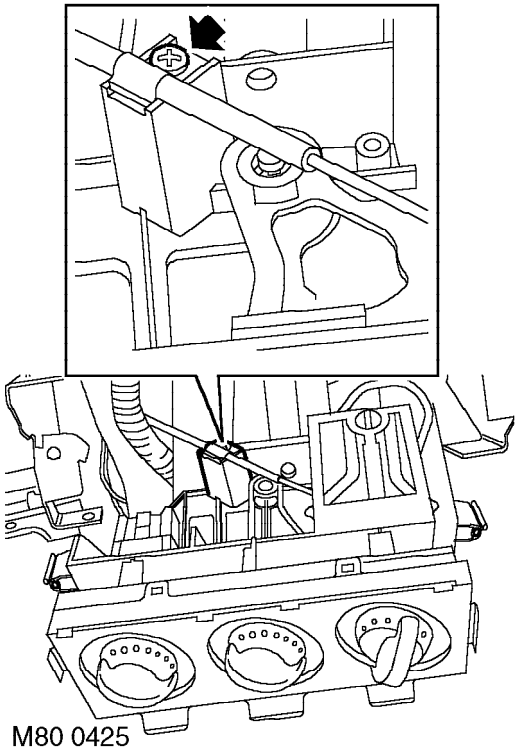


M80 0424

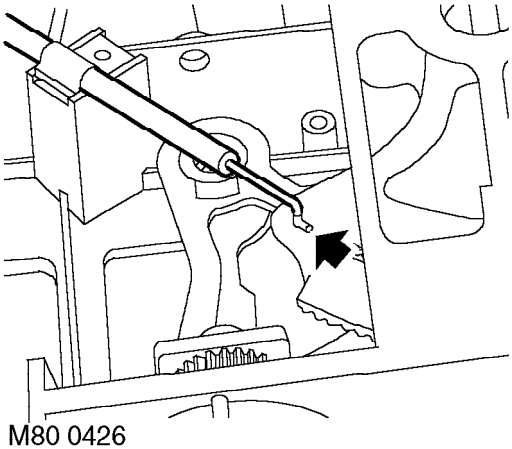
5. Disconnect heater control multiplugs.


M80 0431

6. Loosen screw securing temperature control outer cable and release inner cable from control lever.


M80 0425

7. Loosen screw securing distribution cable control outer cable.


M80 0426

8. Release inner cable from control lever.
9. Remove control assembly.

Refit

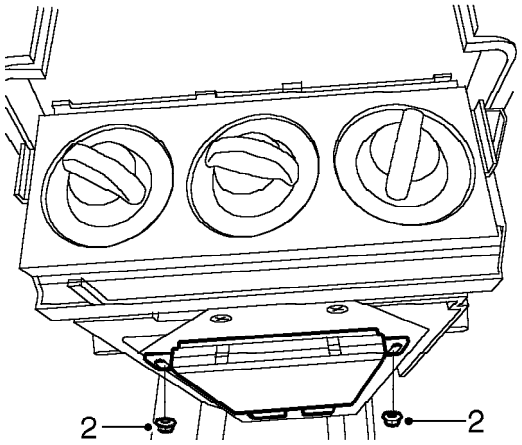
1. Position control assembly and connect inner cables.
2. Secure outer cables in clips, do not clamp screws at this stage.
3. Connect control multiplugs.
4. Align controls to support bracket. Fit and tighten screws.
5. Turn distribution control fully anti-clockwise to face vent position.
6. Position air distribution lever fully forward.
7. Align outer cable to abutment and secure clamp screw.
8. Turn heater control to 'cold' and heater valve lever fully clockwise.
9. Secure outer cable clamp screw.
10. Position alarm ECU support plate, fit and tighten screws.
11. Position alarm ECU, fit and tighten nuts.
12. Fit centre console. ***See BODY, Interior trim components.***

CABLE - WATER VALVE CONTROL

Service repair no - 80.10.07

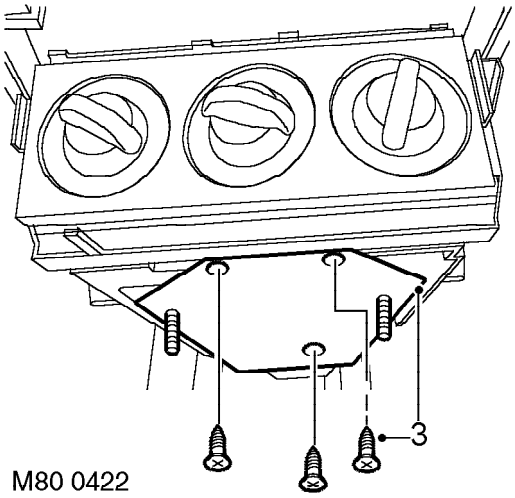
Remove

1. Remove front console. ***See BODY, Interior trim components.***



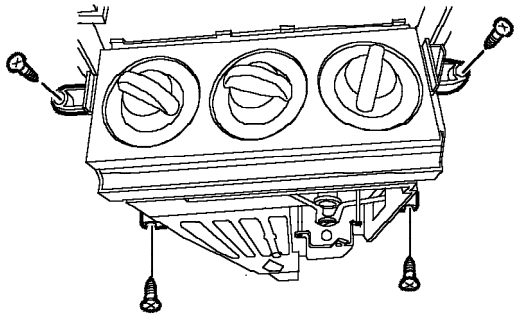
M80 0421

2. Remove 2 nuts securing alarm ECU to heater control unit and position alarm ECU aside.



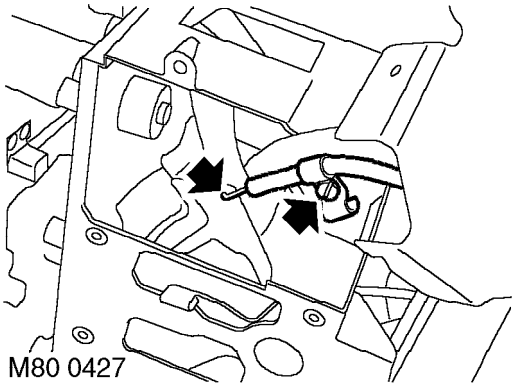
M80 0422

3. Remove 3 screws securing alarm ECU support plate and remove support plate.



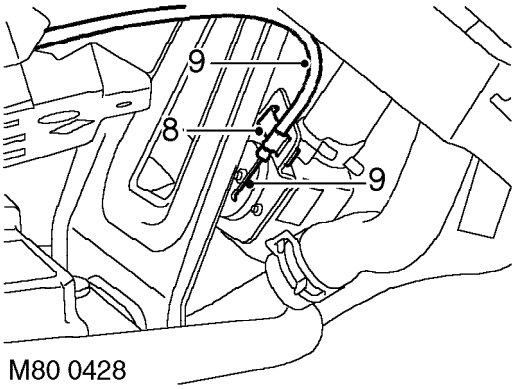
M80 0423

4. Remove 4 screws securing controls to fascia.
5. Release controls from fascia.



M80 0427

6. Remove screw securing cable clamp to controls and collect clamp.
7. Release cable from controls.



M80 0428

8. Remove clip securing cable outer to heater valve.
9. Release cable from valve and remove cable.

Refit

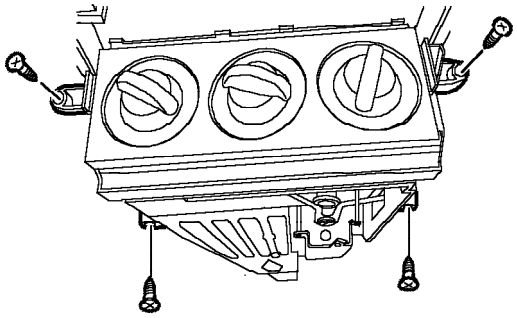
1. Engage cable to heater valve.
2. Engage cable to heater controls and secure cable clamp.
3. Turn heater control to 'COLD' and heater valve lever fully clockwise.
4. Secure outer cable to valve with clip.
5. Position controls to fascia and secure with screws.
6. Position alarm ECU support plate and secure with screws.
7. Position alarm ECU to heater control unit, fit and tighten nuts to 4 Nm.
8. Fit front console. ***See BODY, Interior trim components.***

CABLE - AIR DISTRIBUTION CONTROL

Service repair no - 80.10.12

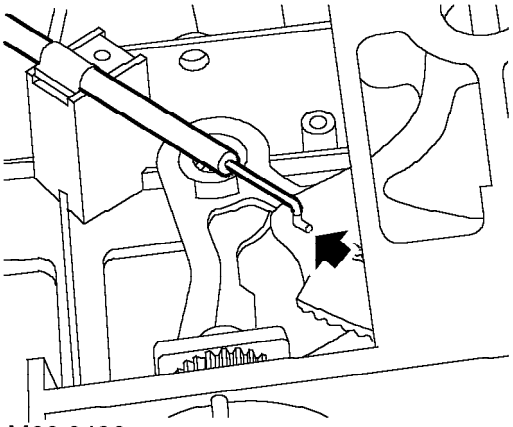
Remove

1. Remove front console. ***See BODY, Interior trim components.***



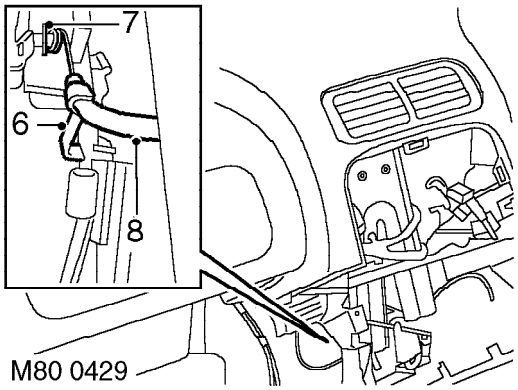
M80 0423

2. Remove 4 screws securing controls to fascia.
3. Release controls from fascia.



M80 0426

4. Remove screw securing cable clamp to controls and collect clamp.
5. Release cable from controls.



M80 0429

6. Remove clip securing cable outer to heater.
7. Remove star washer securing cable to air distribution control lever.
8. Remove cable from heater.

Refit

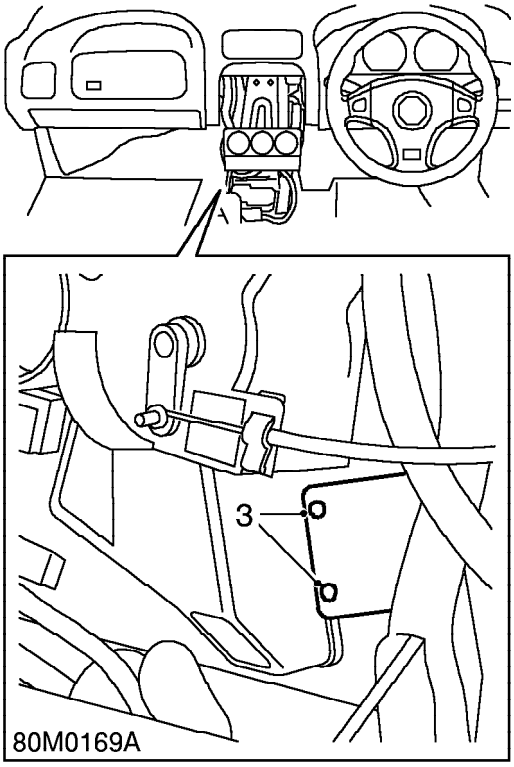
1. Position cable to air distribution control lever and secure with star washer.
2. Engage cable to heater controls.
3. Align collar of outer cable to heater control abutment and secure with clamp.
4. Turn distribution control fully anti-clockwise to face vent position.
5. Position air distribution lever fully forward.
6. Align outer cable to abutment and secure with clip.
7. Position controls to fascia and secure with screws.
8. Fit front console. ***See BODY, Interior trim components.***

HEATER VALVE

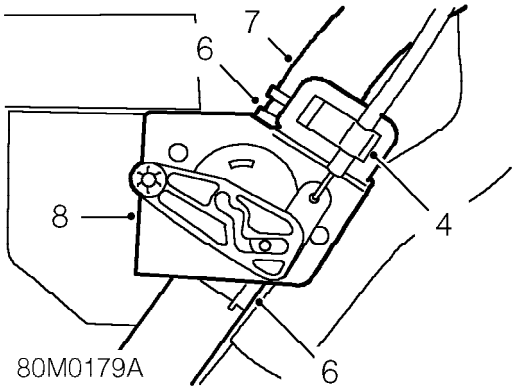
Service repair no - 80.10.16

Remove

1. Drain coolant system. ***See COOLING SYSTEM, Adjustments.***
2. Remove both console closing panels. ***See BODY, Interior trim components.***



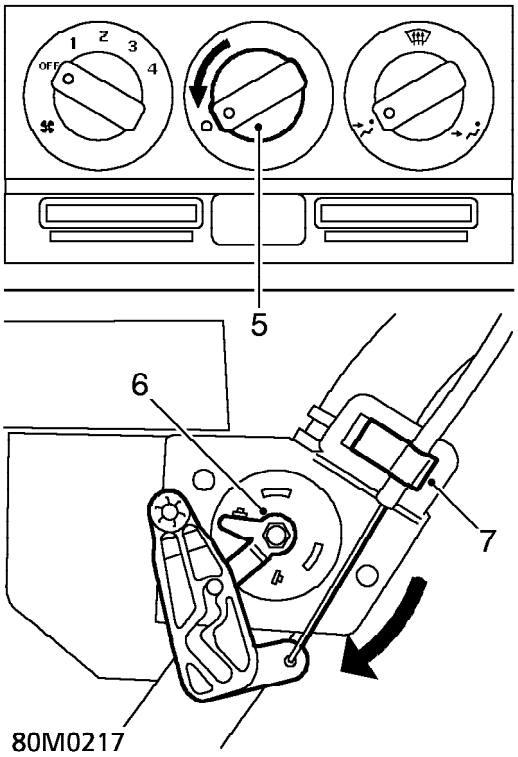
3. Remove 2 screws securing valve to heater assembly.



4. Remove clip securing cable outer to valve and release cable from valve lever.
5. Position cloth and container to catch spillage.
6. Release 2 clips securing hoses to valve.
7. Release top hose.
8. Remove valve from bottom hose.

Refit

1. Fit valve to lower hose and secure with clip.
2. Position upper hose to valve and secure with clip.
3. Engage cable to valve lever.
4. Position valve to heater assembly and secure with screws.



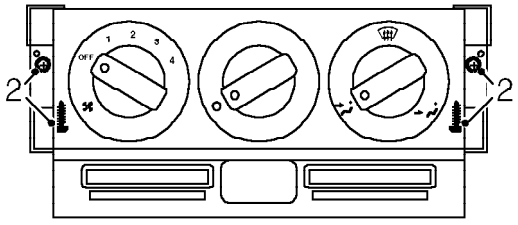
5. Turn heater control fully to 'COLD'.
6. Turn valve lever fully clockwise.
7. Position cable outer and secure with clip.
8. Fit console closing panels. ***See BODY, Interior trim components.***
9. Refill coolant system. ***See COOLING SYSTEM, Adjustments.***

HEATER FAN SWITCH

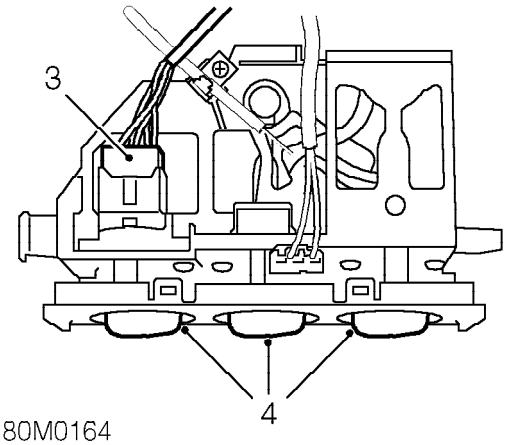
Service repair no - 80.10.22

Remove

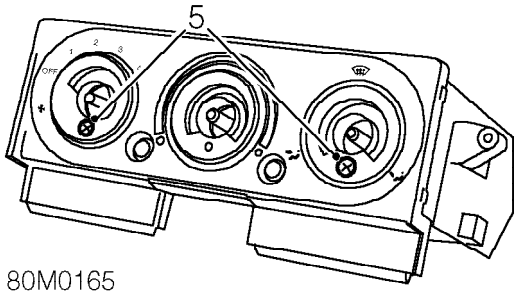
1. Remove front console. ***See BODY, Interior trim components.***



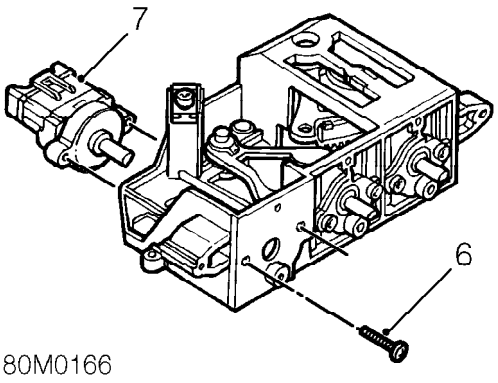
2. Remove 4 screws securing heater control unit to fascia and position control unit aside.



3. Disconnect multiplug from control unit.
4. Remove 3 knobs from control assembly.



5. Remove 2 screws securing illumination housing to assembly and remove housing.



6. Remove 2 screws securing fan switch to assembly.
7. Remove switch.

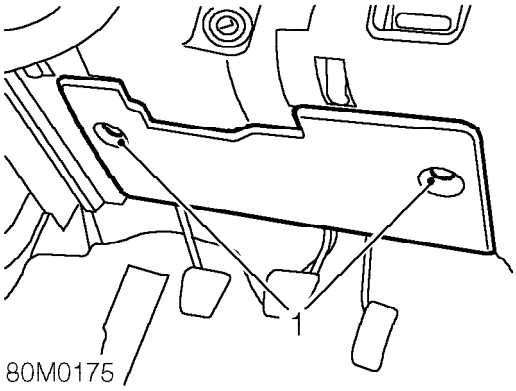
Refit

1. Position switch to assembly and secure with screws.
2. Position illumination housing to assembly and secure with screws.
3. Fit control knobs.
4. Connect multiplug.
5. Position control unit to fascia and secure with screws.
6. Fit front console. ***See BODY, Interior trim components.***

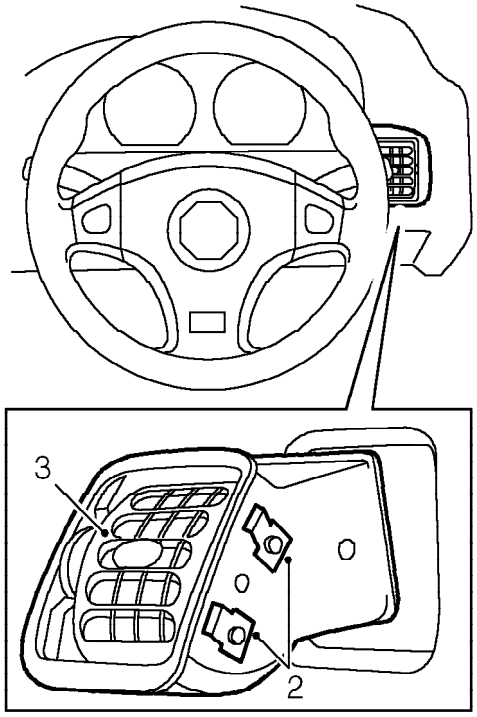
FACE LEVEL VENT - RH

Service repair no - 80.15.04

Remove



1. Turn clips securing fuse box cover $^{1}/_{4}$ turn and open cover.



2. Release 4 clips securing vent to fascia.
3. Remove vent.

Refit

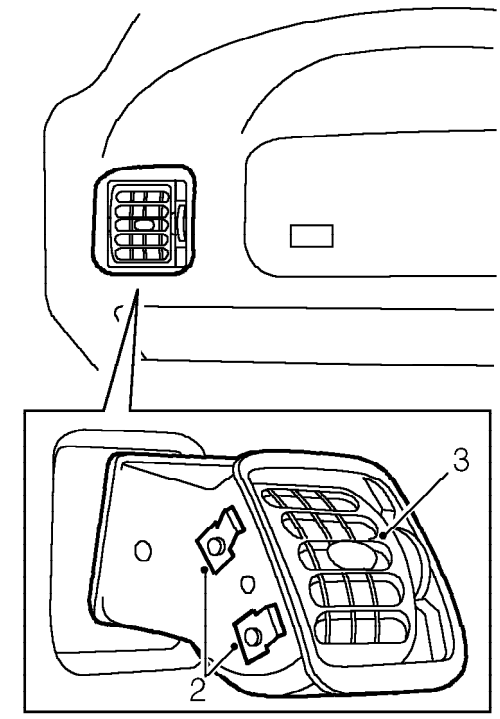
1. Fit vent to fascia and engage clips.
2. Close fuse box cover and secure with clips.

FACE LEVEL VENT - LH

Service repair no - 80.15.05

Remove

1. Remove glovebox. ***See BODY, Interior trim components.***



80M0178

2. Release 4 clips securing vent to fascia.
3. Remove vent.

Refit

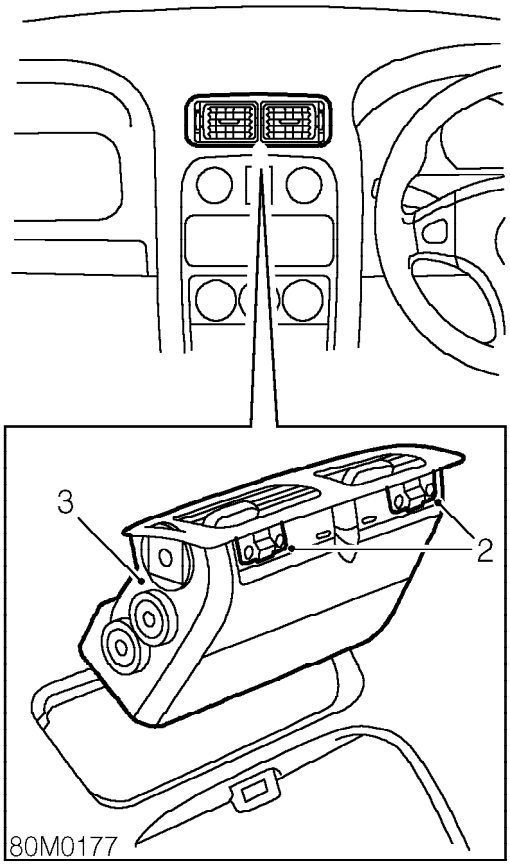
1. Fit vent to fascia and engage clips.
2. Fit glovebox. ***See BODY, Interior trim components.***

FACE LEVEL VENT - CENTRE

Service repair no - 80.15.63

Remove

1. Remove centre console panel. ***See BODY, Interior trim components.***



80M0177

2. Release 4 clips securing vent to fascia.
3. Remove vent.

Refit

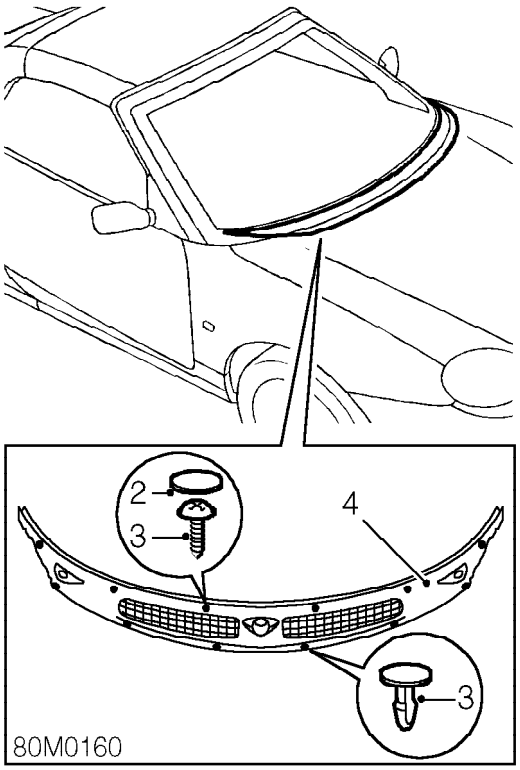
1. Fit vent to fascia and engage clips.
2. Fit centre console panel. ***See BODY, Interior trim components.***

AIR INTAKE PANEL

Service repair no - 80.15.62

Remove

1. Remove wiper arms. ***See WIPERS & WASHERS, Repairs.***



2. Remove 6 retaining screw caps from intake moulding.
3. Remove 6 screws and 6 clips securing panel to scuttle.
4. Release intake panel from clips and remove panel.

Refit

1. Position panel to scuttle and secure with clips and screws.
2. Fit screw caps.
3. Fit wiper arms. ***See WIPERS & WASHERS, Repairs.***

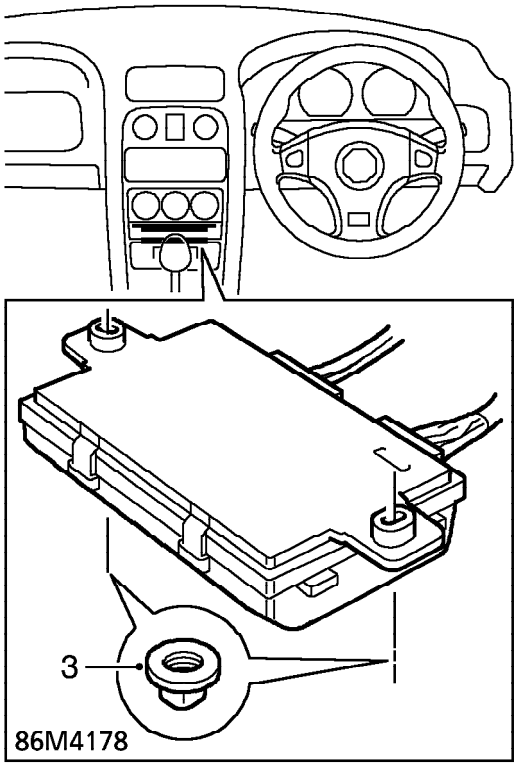
HEATER

Service repair no - 80.20.01

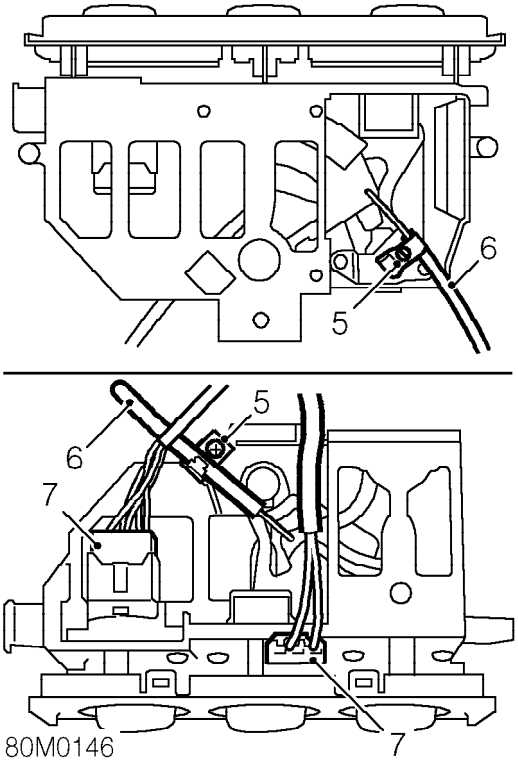
WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

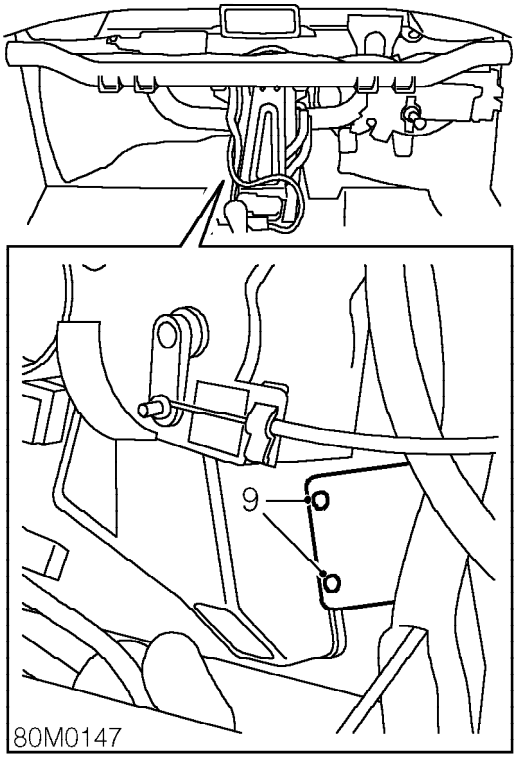
1. Make the SRS system safe ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove fascia. ***See BODY, Interior trim components.***



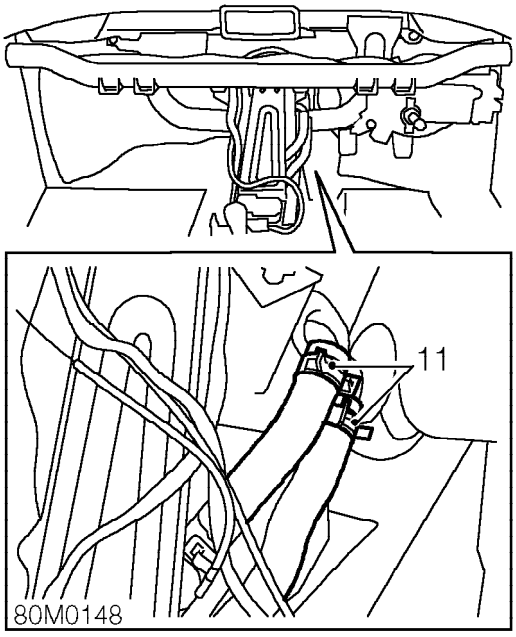
3. Remove 2 nuts securing anti-theft alarm ECU to heater control unit, position ECU aside.
4. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***



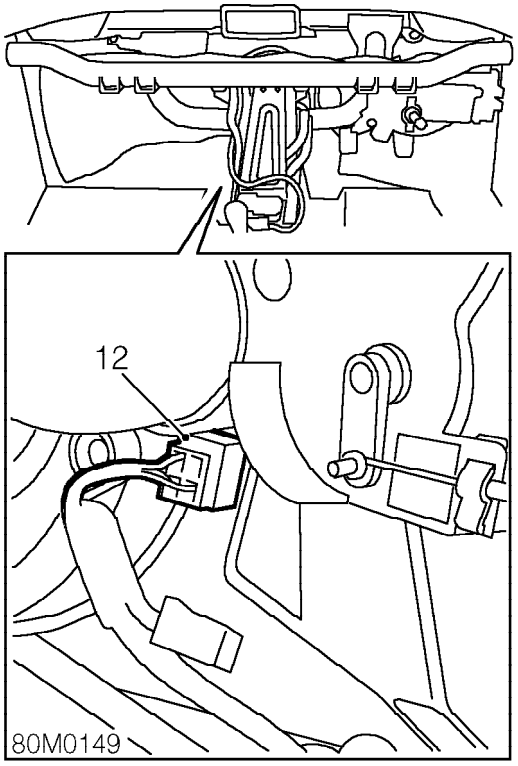
5. Remove 2 screws retaining outer cables to control unit.
6. Release cables from control unit.
7. Disconnect 2 multiplugs and remove control unit.
8. Remove 2 screen ducts from heater.



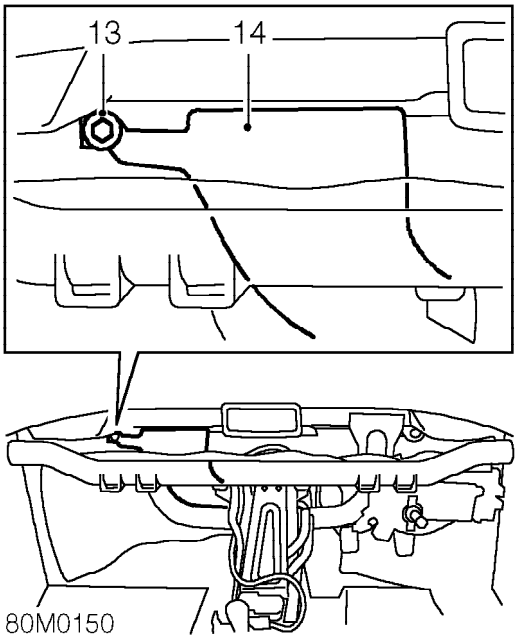
9. Remove 2 screws securing valve to heater casing.
10. Position container beneath heater to catch spillage.



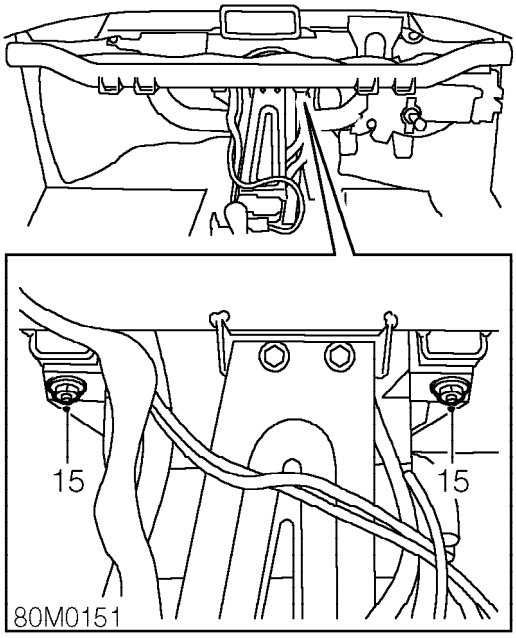
11. Release clips and disconnect both hoses from heater matrix. Allow matrix to drain.



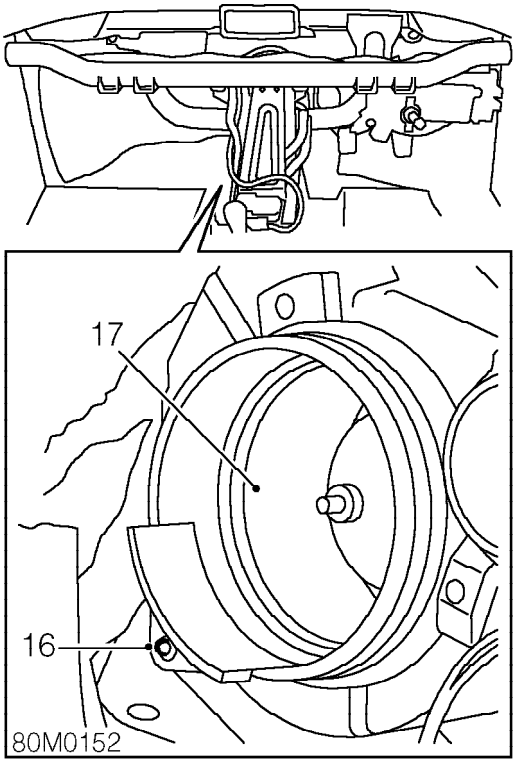
12. Disconnect multiplug from heater blower.



13. Remove nut securing intake duct to body.
14. Remove intake duct.



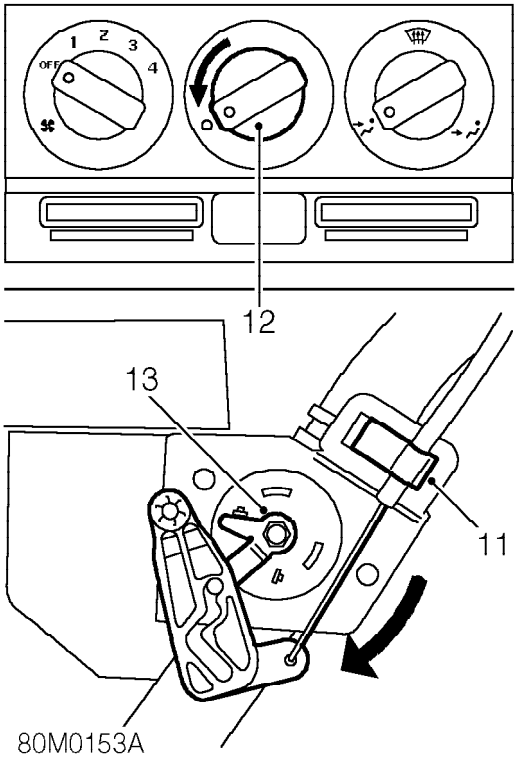
15. Remove 2 nuts securing heater unit to crossmember.



16. Remove bolt securing heater unit to bulkhead.
17. Remove heater unit.

Refit

1. Position heater to mountings.
2. Tighten all fixings to 10 Nm.
3. Position intake duct and tighten nut to 10 Nm.
4. Connect multiplug to heater blower.
5. Connect hoses to heater matrix and secure with clips.
6. Position valve and secure with screws.
7. Fit screen ducts.
8. Connect multiplugs to control unit.
9. Position control cables and connect to control unit.
10. Align cable outers to control unit and tighten clamp screws.



11. Release clip securing cable outer to heater valve.
12. Turn temperature control to COLD.
13. Push heater control valve to the cold position and secure cable clip.
14. Position alarm ECU to control unit, fit and tighten nuts to 4 Nm.
15. Refill cooling system. ***See COOLING SYSTEM, Adjustments.***
16. Fit fascia. ***See BODY, Interior trim components.***

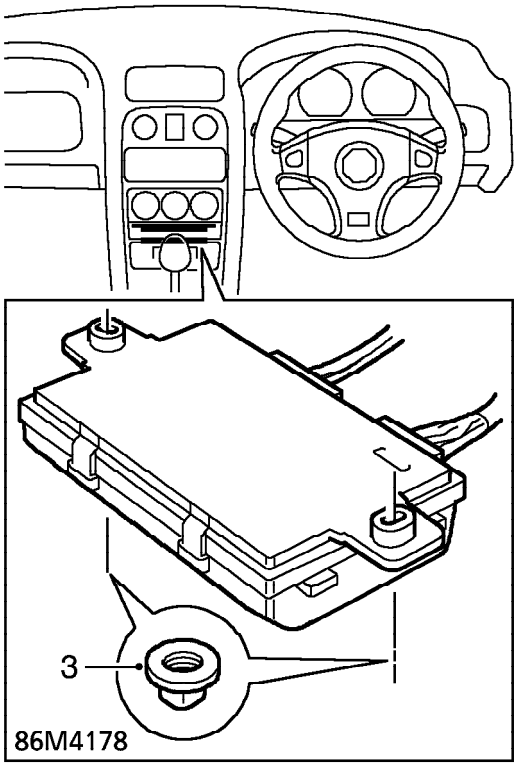
HEATER - WITH AIR CONDITIONING

Service repair no - 80.20.01/20

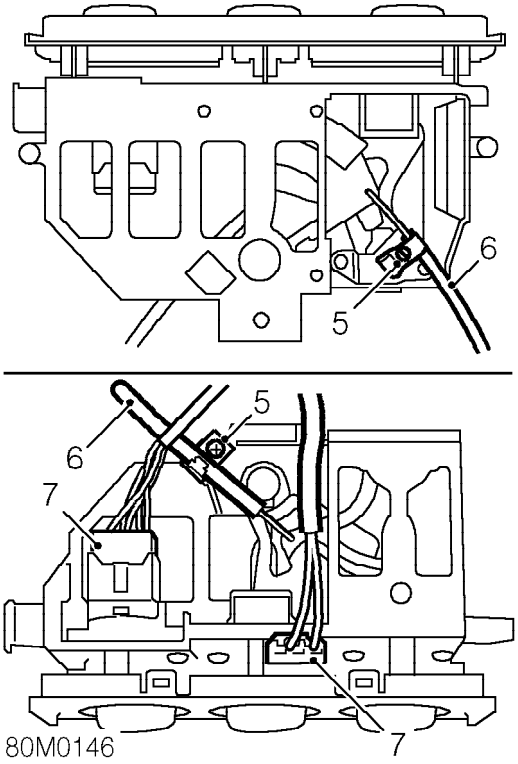
WARNING: ***See GENERAL INFORMATION, SRS Precautions.***

Remove

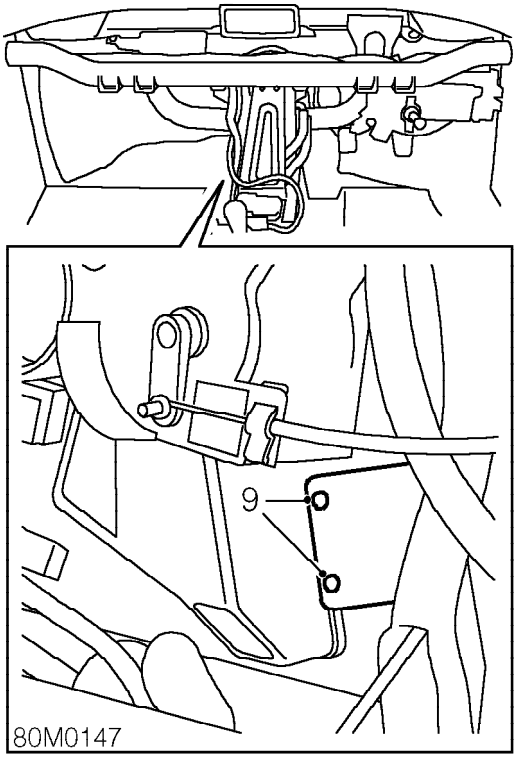
1. Make the SRS system safe ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove evaporator. ***See AIR CONDITIONING, Repairs.***



3. Remove 2 nuts securing anti-theft alarm ECU to heater control, position ECU aside.
4. Drain cooling system. ***See COOLING SYSTEM, Adjustments.***

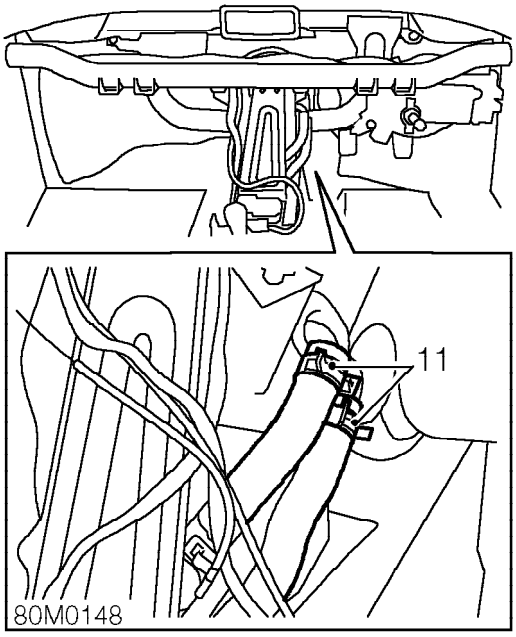


5. Remove 2 screws retaining outer cables to control unit.
6. Release cables from control unit.
7. Disconnect 2 multiplugs and remove control unit.
8. Remove screen duct from heater.

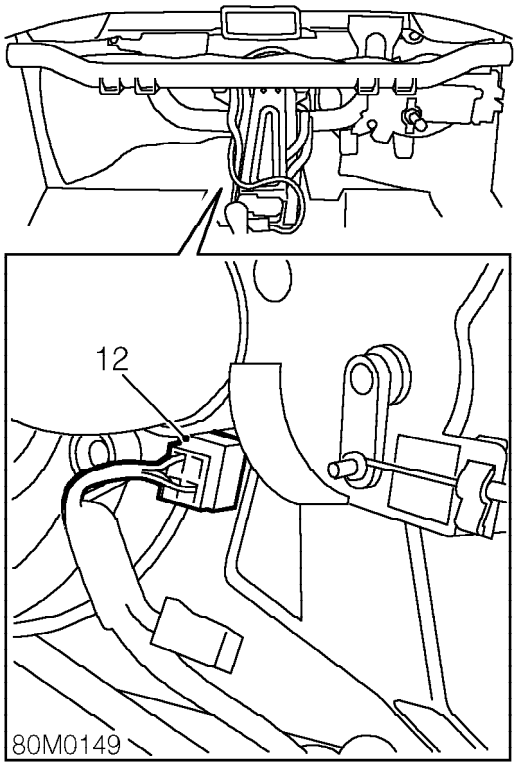


9. Remove 2 screws securing valve to heater casing.

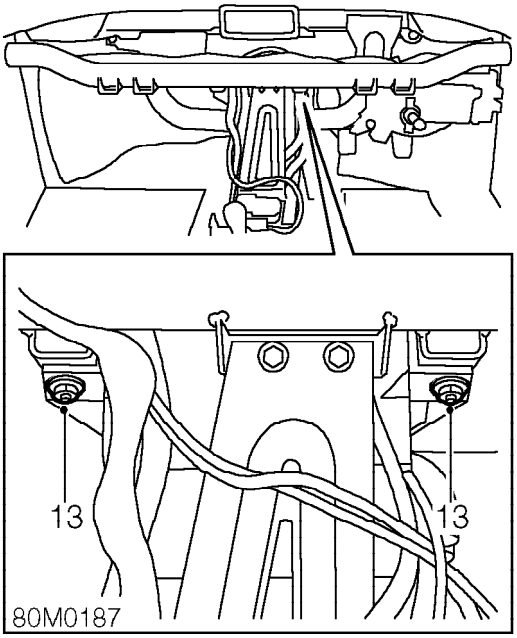
10. Position container beneath heater to catch spillage.



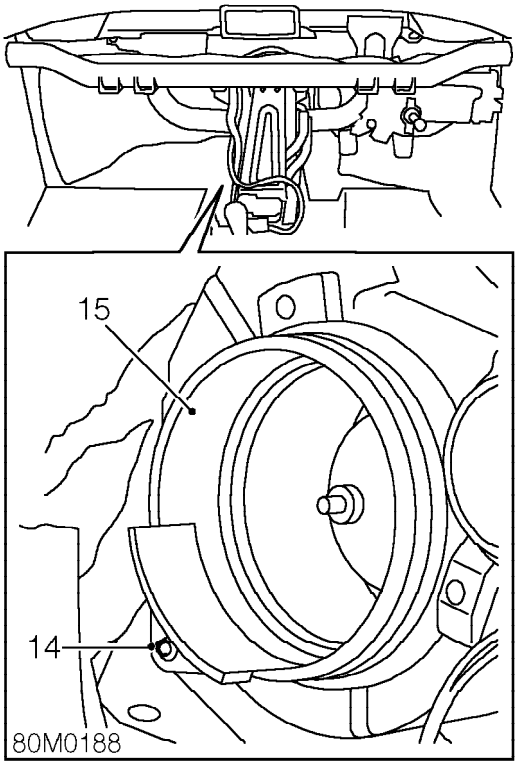
11. Release clips and disconnect both hoses from heater matrix. Allow matrix to drain.



12. Disconnect multiplug from heater blower.



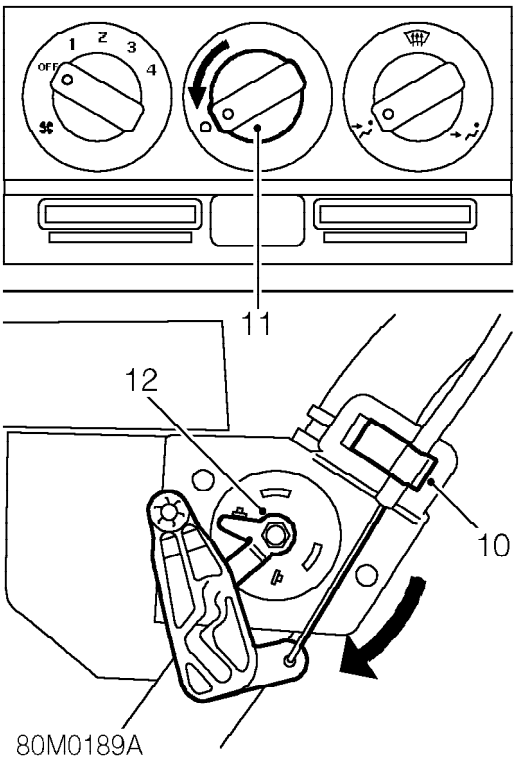
13. Remove 2 nuts securing heater unit to crossmember.



14. Remove nut securing heater unit to bulkhead.
15. Remove heater unit.

Refit

1. Position heater to mountings.
2. Tighten all fixings to 10 Nm.
3. Connect multiplug to heater blower.
4. Connect hoses to heater matrix and secure with clips.
5. Position valve and secure with screws.
6. Fit screen duct.
7. Connect multiplugs to control unit.
8. Position control cables and connect to control unit.
9. Align cable outers to control unit and tighten clamp screws.



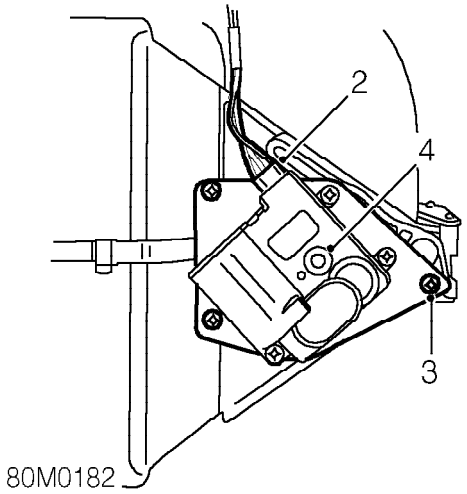
10. Release clip securing cable outer to heater valve.
11. Turn temperature control to COLD.
12. Push heater control valve to the COLD position and secure cable clip.
13. Refill cooling system. ***See COOLING SYSTEM, Adjustments.***
14. Position alarm ECU to heater control, fit and tighten nuts to 4 Nm.
15. Fit evaporator. ***See AIR CONDITIONING, Repairs.***

RECIRCULATION SERVO MOTOR

Service repair no - 80.20.10

Remove

1. Remove glovebox. ***See BODY, Interior trim components.***



2. Disconnect multiplug from servo motor.
3. Remove 3 screws securing servo motor to evaporator casing.
4. Remove servo motor.

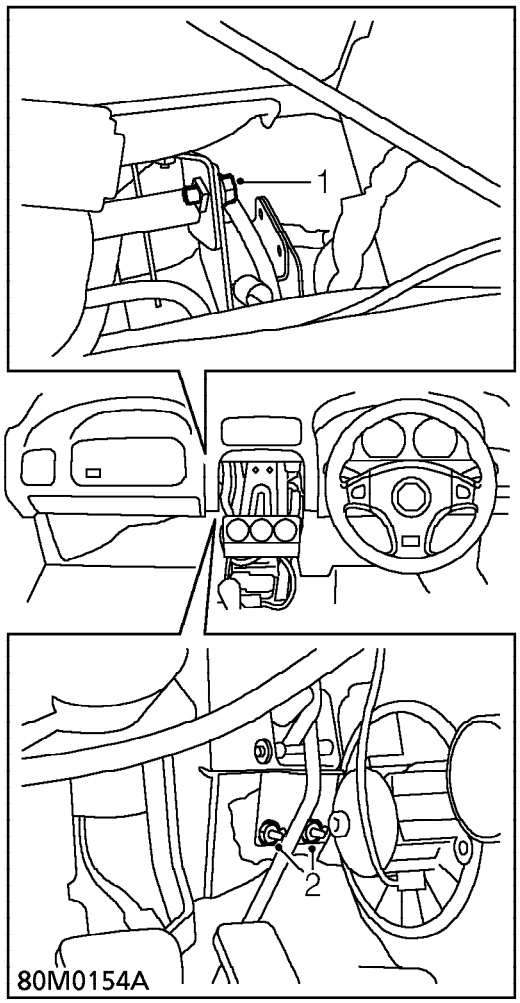
Refit

1. Position servo motor and engage output crank to recirculation flap lever.
2. Secure servo motor with screws.
3. Connect multiplug.
4. Fit glovebox. ***See BODY, Interior trim components.***

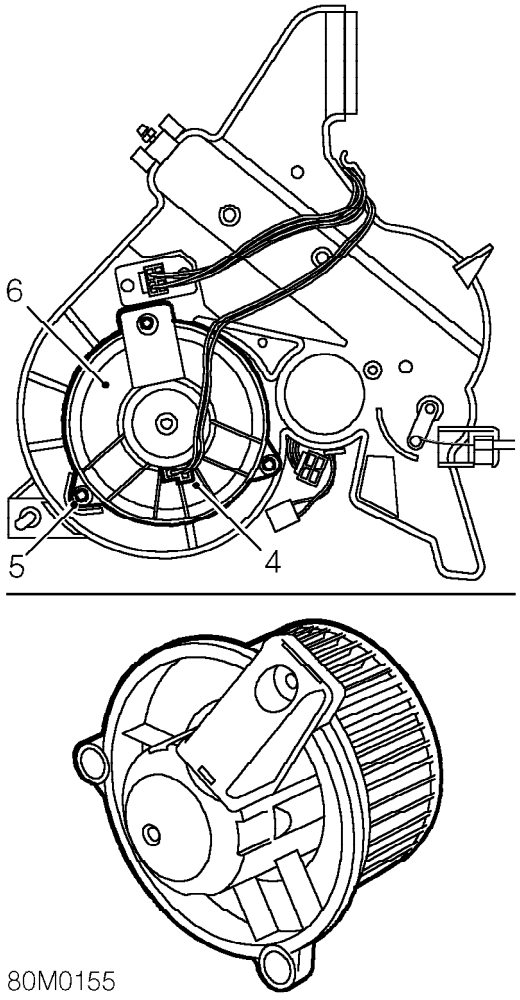
HEATER BLOWER

Service repair no - 80.20.12

Remove



1. Remove bolt securing throttle pedal bracket to pedal box.
2. Remove 2 nuts securing throttle pedal bracket to bulkhead and position throttle pedal assembly aside.
3. Remove heater duct.



4. Disconnect multiplug from heater blower.
5. Remove 3 screws securing blower to heater.
6. Remove heater blower.
7. Release armature cover and collect sleeve.

Refit

1. Position screw and sleeve to top location of heater blower.
2. Position blower to heater and secure with screws.

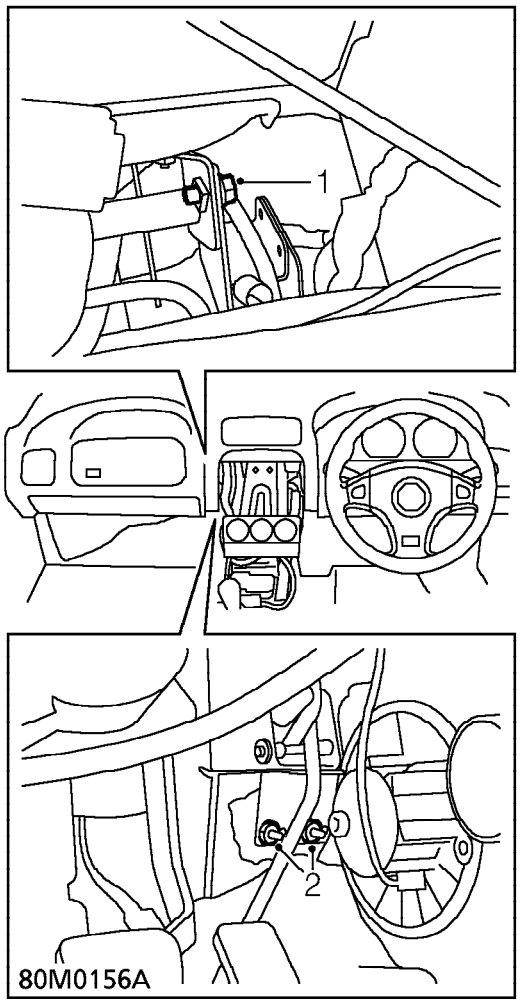
CAUTION: Ensure screw sleeve does not fall into blower motor.

3. Connect multiplug to blower.
4. Fit heater duct.
5. Position throttle pedal assembly, fit and tighten nuts to 6 Nm.
6. Fit and tighten bolt to 22 Nm.

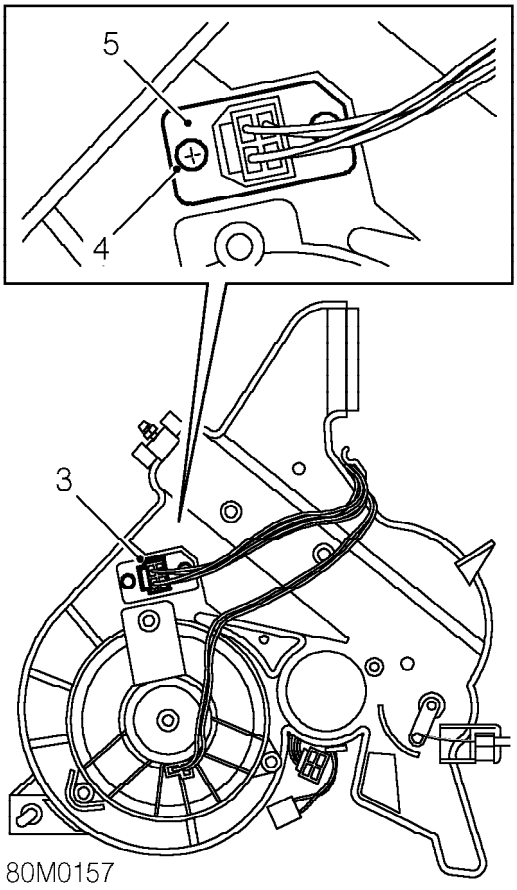
HEATER RESISTOR

Service repair no - 80.20.17

Remove



1. Remove bolt securing throttle pedal bracket to pedal box.
2. Remove 2 nuts securing throttle pedal bracket to bulkhead and position throttle pedal assembly aside.



3. Disconnect multiplug from resistor.
4. Remove 2 screws securing resistor.
5. Remove heater resistor.

Refit

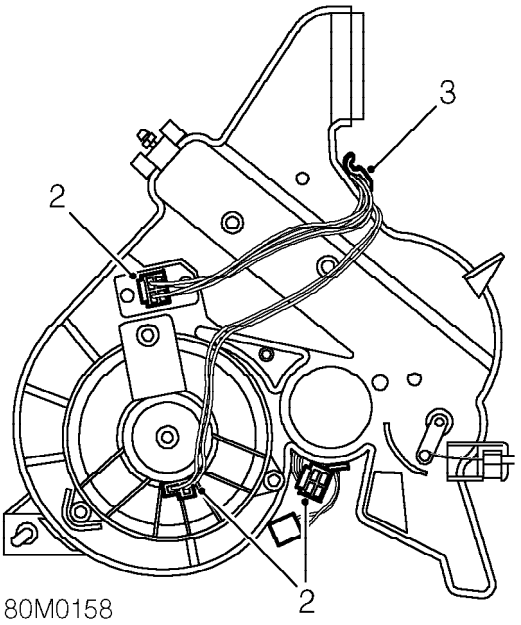
1. Position resistor to heater and secure with screws.
2. Connect resistor multiplug.
3. Position throttle pedal assembly, fit and tighten nuts to 6 Nm.
4. Fit and tighten bolt to 22 Nm.

HEATER MATRIX

Service repair no - 80.20.29

Remove

1. Remove heater. ***See this section.***



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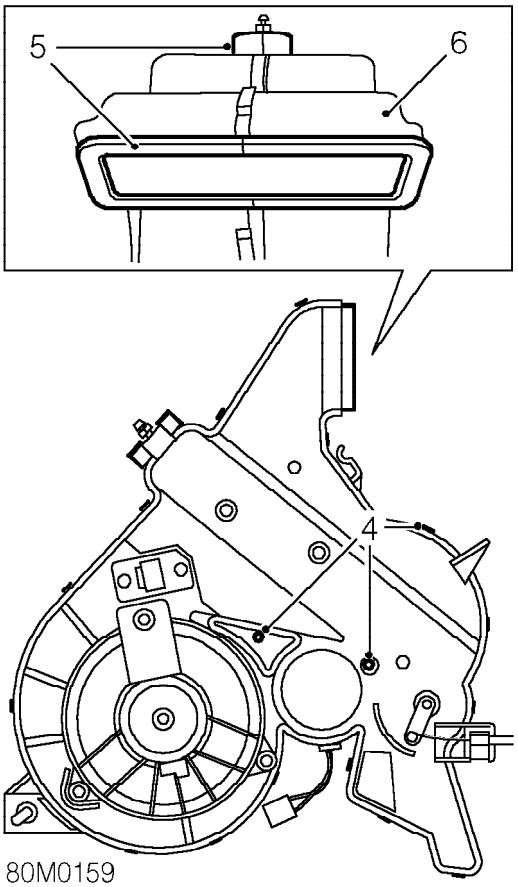
2. Disconnect multiplugs from blower and resistor.
3. Release harness from 2 clips and position aside.



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4. Remove 15 clips and 2 screws securing two halves of casing.
5. Remove foam seal from outlet vent and matrix bleed nipple.
6. Separate two halves of casing.
7. Remove heater matrix.

Refit

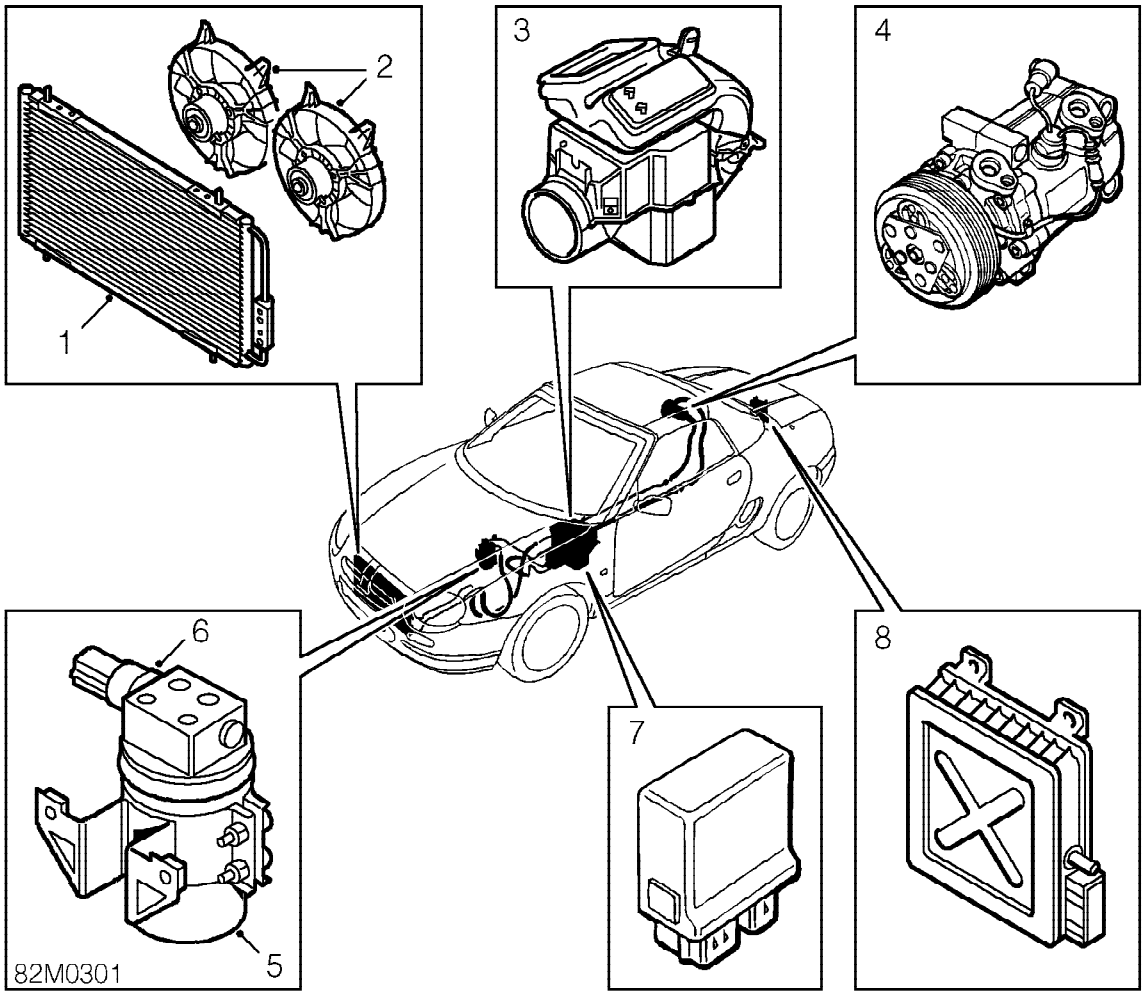
1. Position matrix to heater.
2. Position two halves of casing, ensuring correct location of flow direction flap.
3. Secure casing halves with clips and screws.
4. Clean sealing faces.
5. Fit foam seals to outlet vent and bleed nipple.
6. Engage harness clips and connect multiplugs.
7. Fit heater. ***See this section.***

CONTENTS

Page

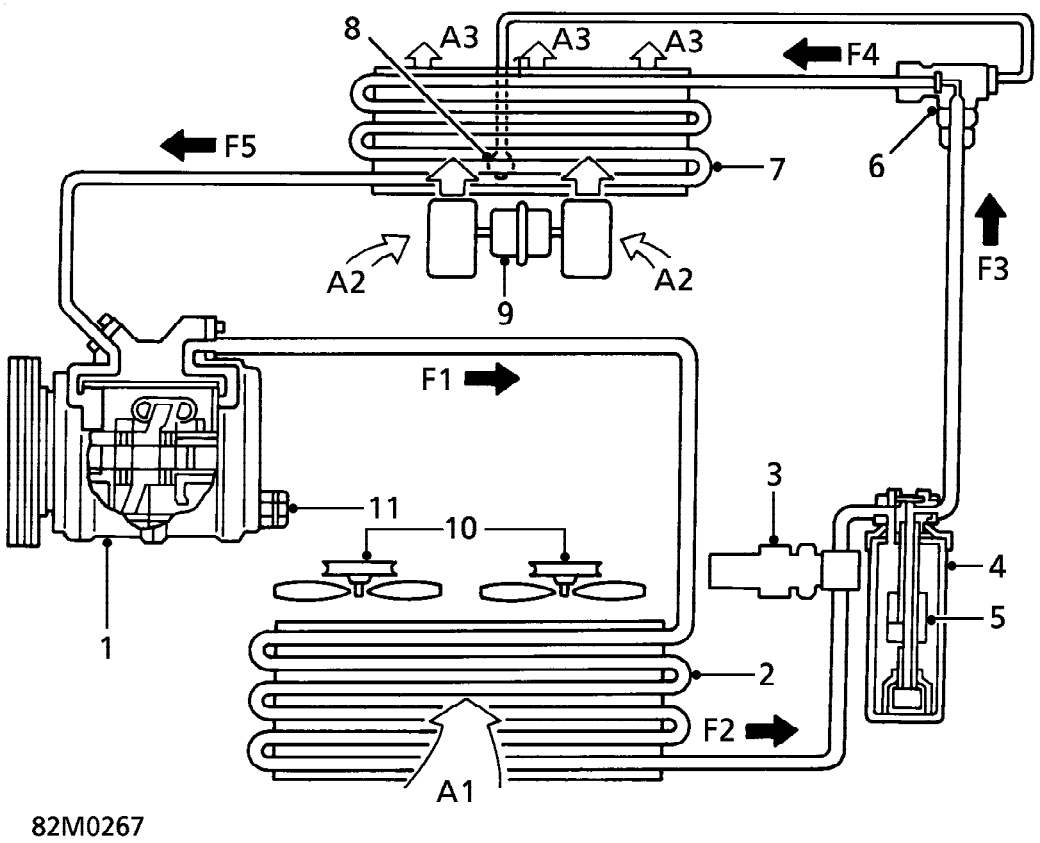
A/C

AIR CONDITIONING COMPONENTS



1. Condenser
2. Cooling fans
3. Evaporator
4. Compressor
5. Receiver/drier
6. Trinary pressure switch
7. Air conditioning, relay module
8. ECM

SCHEMATIC LAYOUT OF AIR CONDITIONING SYSTEM



1. Compressor
2. Condenser
3. Trinary pressure switch
4. Receiver/drier
5. Drying agent - receiver/drier
6. Thermostatic expansion valve
7. Evaporator
8. Capillary tube
9. Heater blower motor
10. Condenser cooling fans
11. Compressor high pressure relief valve

A1. Ambient air flow through condenser
A2. Ambient air flow through fan and evaporator
A3. Cooled air flow to vehicle interior
F1. High pressure, high temperature refrigerant vapour
F2. High pressure, slightly subcooled refrigerant liquid
F3. High pressure, slightly subcooled refrigerant liquid with moisture, vapour bubbles and foreign matter removed
F4. Low pressure, low temperature mixed liquid and vapour
F5. Low pressure, slightly superheated refrigerant vapour

AIR CONDITIONING SYSTEM OPERATION

The air conditioning system provides the means of supplying cooled and dehumidified, fresh or recirculated air to the interior of the vehicle. The cooling effect is obtained by blowing air through the matrix of an evaporator unit and when required, heating the air to provide the conditions required inside the vehicle. The volume of the conditioned air being supplied is controlled by a variable speed blower.

Sealed refrigerant

A sealed system, charged with Refrigerant R134a, together with a blower unit, blend unit and control system combine to achieve the cooled air condition.

The sealed system comprises of the following main components:

1. Compressor
2. Condenser
3. Receiver/drier
4. Thermostatic expansion valve
5. Evaporator

Refrigeration cycle

The compressor is driven by a belt from the crankshaft pulley. The compressor pressurises and circulates the refrigerant through the system. Mounted on the compressor, an electro-mechanical clutch maintains the correct temperature and pressure of the refrigerant by engaging or disengaging the compressor to support the systems requirements. Operation of the clutch is controlled by the engine control module (ECM), the trinary (triple) pressure switch and a thermostatic switch located on the exterior fins of the evaporator.

If the temperature at the evaporator falls low enough for ice to form on the fins, the thermostatic switch will open, breaking the circuit to the clutch and releasing the drive on the compressor. The ECM detects that the air conditioning system is not operating and switches off the condenser cooling fan. When the temperature at the evaporator rises sufficiently for the thermostatic switch to close, the air conditioning system will be restarted.

If the system pressure becomes excessive or drops sufficiently to cause damage to the compressor, a trinary pressure switch located in the high pressure line at the receiver drier will break the electrical circuit to the compressor clutch, releasing drive from the compressor. The compressor also has an internal thermal cut-out switch which disengages the compressor's clutch to prevent the compressor oil overheating. The clutch will re-engage when the oil temperature has returned to normal.

The two cooling fans are controlled by the ECM and operating conditions are dependent upon engine coolant temperature and air conditioning system pressure. With the air conditioning system switched off, the (radiator) cooling fans are operated with the ECM controlling the fan speed according to engine temperature. With the air conditioning system switched on, condenser (radiator) cooling fans are connected in series by the ECM and operate at low speed. As the pressure of the air conditioning refrigerant rises above the threshold of the medium pressure setting on the trinary pressure switch, the cooling fans are connected in parallel and operate at high speed.

If engine coolant temperature continues to rise with both cooling fans running at high speed, the ECM will break the circuit to the compressor clutch releasing drive to the compressor. This reduces the load on the engine whilst maintaining a high cooling fan speed to lower the engine coolant temperature. Once engine coolant temperature has dropped sufficiently the air conditioning system will be reinstated.

From the compressor, high pressure vaporised refrigerant is passed to the condenser which is mounted in front of the radiator.
Ram air passing through the condenser, supplemented by the cooling fans, cools the refrigerant vapour in the condenser sufficiently to form a high pressure slightly subcooled liquid.

This subcooled liquid then passes to the receiver/drier which extracts moisture from the refrigerant as well as acting as a reservoir.

From the receiver/drier the moisture free refrigerant liquid passes through a thermostatic expansion valve to the evaporator unit. The thermostatic expansion valve incorporates a restrictor which converts the liquid refrigerant into a low temperature, low pressure liquid vapour mixture. To prevent liquid refrigerant passing into the evaporator unit, the thermostatic expansion valve senses the evaporator outlet pressure and controls the amount the valve opens and closes.

Fan blown air is passed through the evaporator where it is cooled by absorption due to the low temperature refrigerant in the evaporator. Most of the moisture being held in the air is condensed into water by the evaporator and drains away beneath the vehicle via a drain tube.

From the evaporator, low pressure slightly heated refrigerant passes to the compressor to complete the cycle. The compressor pressurises the refrigerant vapour which becomes very hot and is passed to the condenser to be converted into liquid.

AIR CONDITIONING CONTROL SYSTEM

The air conditioning control system comprises of relays, a thermostatic switch, a trinary pressure switch and a control panel. Together these controls, in conjunction with the cooling fans, compressor clutch, blower and heater distribution enable minimal input to maintain the required environment inside the vehicle.

When air conditioning is not selected, air is supplied by ram effect or blower to the areas selected by the air distribution control. The heater valve on the heater matrix controls the temperature of the air being delivered. No cooled air is available.

Selecting air conditioning provides the added facility of cooled air which can be re-heated by the heater matrix if required. When required a fully cold condition can be selected by turning the temperature control to cold, which automatically closes the heated coolant access to the heater matrix. Mixtures of cooled, fresh, and hot air can be selected to give the required interior environmental conditions by selection at the control panel.

Trinary pressure switch

The trinary (triple) pressure switch is located in the high pressure line between the condenser and the receiver drier. The trinary pressure switch detects refrigerant pressure and by means of the ECM controls the following system functions:

1. Refrigerant pressure drops below 2.0 bar (due to possible leakage), the compressors electro-mechanical clutch is disengaged. When pressure rises above 2.4 bar the compressors clutch is re-engaged.
2. Refrigerant pressure exceeds 19 bar the cooling fan speed is increased by the ECM switching the relays in the relay module to connect the cooling fans in parallel supplying a direct feed to each fan motor.
3. Refrigerant pressure rises above 27 bar even with maximum cooling fan operation (due to possible blockage), the compressor electro-mechanical clutch is disengaged. The high pressure switch resets when the pressure drops to approximately 21 bar.

Condenser cooling fans

The condenser cooling fans operate automatically whenever the air conditioning system is switched on, providing the system pressure is correct.

The cooling fans are controlled by the ECM, thermostatic switch and trinary pressure switch. If engine coolant temperature and air conditioning system pressure are normal then the cooling fans operate at low speed.
If the engine coolant temperature reaches 108°C or the air conditioning refrigerant pressure exceeds 19 bar then the cooling fans will operate at high speed.

Blower control

The blower can be operated at any one of four speeds by rotating the blower switch to the required position. When the blower is switched off the air conditioning system will not operate.

The fresh air/recirculation flap has two positions and is operated by pressing the button in the centre console. In the recirculation position, air is drawn into the heater from the vehicle by closing the exterior air inlet and opening the interior inlet. In the fresh air position, air is drawn into the heater from outside the vehicle by opening the exterior air inlet and closing the interior inlet.

Heater distribution and blend unit control

Blower unit air flow, having passed through the evaporator passes into the heater unit to be heated, if required. It is then directed into the vehicle interior in accordance with the flap positions, which are designated by the air distribution control on the fascia panel.

The temperature control knob moves the heater valve, allowing engine coolant to flow through the heater matrix back to the engine when the control is moved towards the hot position. The temperature of the heated air flow into the vehicle interior is controlled by the relative movement of the heater valve.

The distribution control moves a flap which controls the direction of the air flow into the interior of the vehicle.

The face level vents have a permanent feed of heated or unheated air from the heater unit and are opened or shut by rotary thumbwheels on each face level vent.

ECM control

In addition to its various functions of controlling the air conditioning system, the ECM also controls the compressor's clutch for system safety.

A. To protect the discharge hose material from excessive high refrigerant temperatures produced at high speed. The ECM will disengage the compressor clutch when an engine speed of 5000 rpm is reached and re-engage when the speed drops below 4900 rpm.

B. To allow more power for vehicle acceleration the compressor's clutch is disengaged when the throttle disc angle is opened above 85°(fully open is 90°). The clutch is re-engaged when the throttle disc angle is below 80°.

C. To protect the engine's cooling system the ECM will disengage the compressor's clutch when the coolant temperature exceeds 117°C. The clutch re-engages when the coolant temperature drops below 112°C.

GENERAL PRECAUTIONS

The refrigerant used in the air conditioning system is HFC (Hydrofluorocarbon) R134a.

WARNING:

- **R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing must be worn when carrying out service operations on the air conditioning system.**
- **Do not allow a refrigerant container to be heated by direct flame or to be placed near any heating appliance. A refrigerant container must not be heated above 50°C.**
- **Do not leave a container of refrigerant without its cap fitted. Do not transport a container of refrigerant that is unrestrained, especially in the boot of a car.**
- **R134a is odourless and colourless. Do not handle or discharge in an enclosed area, or any area where the vapour and liquid can come in contact with a naked flame or hot metal. R134a is not flammable but can cause a highly toxic gas.**
- **Do not smoke or weld in areas where R134a is in use. Inhalation of concentrations of vapour can cause dizziness, disorientation, narcosis, nausea or vomiting.**
- **Do not allow fluids other than R134a or compressor lubricant to enter the air conditioning system. Spontaneous combustion may occur.**
- **R134a splashed on any part of the body will cause immediate freezing of that area. Also refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.**
- **The refrigerant used in an air conditioning system must be reclaimed in accordance with the recommendations given by a Refrigerant Recovery Recycling Recharging Station.**

NOTE: Suitable protective clothing comprises:
Wrap round safety glasses or helmet, heat proof gloves, rubber apron, or waterproof overalls and rubber boots.

REMEDIAL ACTIONS

1. If liquid R134a strikes the eye, do not rub it. Gently run large quantities of eye wash off it to raise the temperature. If eye wash is not available, cool, clean water may be used. Cover eye with a clean pad and seek immediate medical attention.
2. If liquid R134a is splashed on the skin run large quantities of water over the area as soon as possible to raise the temperature. Carry out the same action if the skin comes in contact with discharging cylinders. Wrap effected parts in blankets or similar material and seek immediate medical attention.
3. If suspected of being overcome by inhalation of R134a vapour seek fresh air. If a person overcome by inhalation is unconscious move them to fresh air, apply artificial respiration and/or oxygen and seek immediate medical attention.

NOTE: Due to its low evaporating temperature of -26.1°C, R134a should be handled with care.

SERVICE PRECAUTIONS

Care should be taken when handling the components in the refrigeration system. Units must not be lifted by their hoses, pipes or capillary lines. Hoses and lines must not be subjected to any twist or stress. Ensure that hoses are positioned in their correct run before tightening couplings, and ensure that all clips and supports are used. Torque wrenches of the correct type must be used when tightening refrigerant connections to the stated value. An additional spanner must be used to hold the union to prevent twisting of the pipe.

Before connecting any hose or pipe ensure that refrigerant oil is applied to the seat of the new 'O' ring seals but not to the threads.

Check the oil trap for the amount of oil lost.

All protective plugs must be left in place until immediately prior to connection.

The receiver/drier contains desiccant which absorbs moisture. It must be positively sealed at all times.

CAUTION: Whenever the refrigerant system is opened, the receiver/drier must be renewed immediately before evacuating and recharging the system.

Use alcohol and a clean cloth to clean dirty connections.

Ensure that all new parts fitted are marked for use with **R134a.**

Refrigerant oil

Use an approved refrigerant lubricating oil:

Seiko Seiki SK-20
Unipart SK-20
Idemitsu SK-20

CAUTION: Do not use any other type of refrigerant oil.

Refrigerant oil easily absorbs water and must not be stored for long periods. Do not pour unused oil back into the container.

When renewing system components, add the following quantities of refrigerant oil:

Condenser 30cm^3
Evaporator 30cm^3
Pipe or hose 10cm^3
Receiver drier 30cm^3

Total amount of oil in the system: 170 cc

A new compressor is sealed and pressurised with Nitrogen gas, slowly release the sealing cap, gas pressure should be heard to release as the seal is broken.

NOTE: A new compressor should always have its sealing cap in place and must not be removed until immediately prior to fitting the compressor air conditioning pipes.

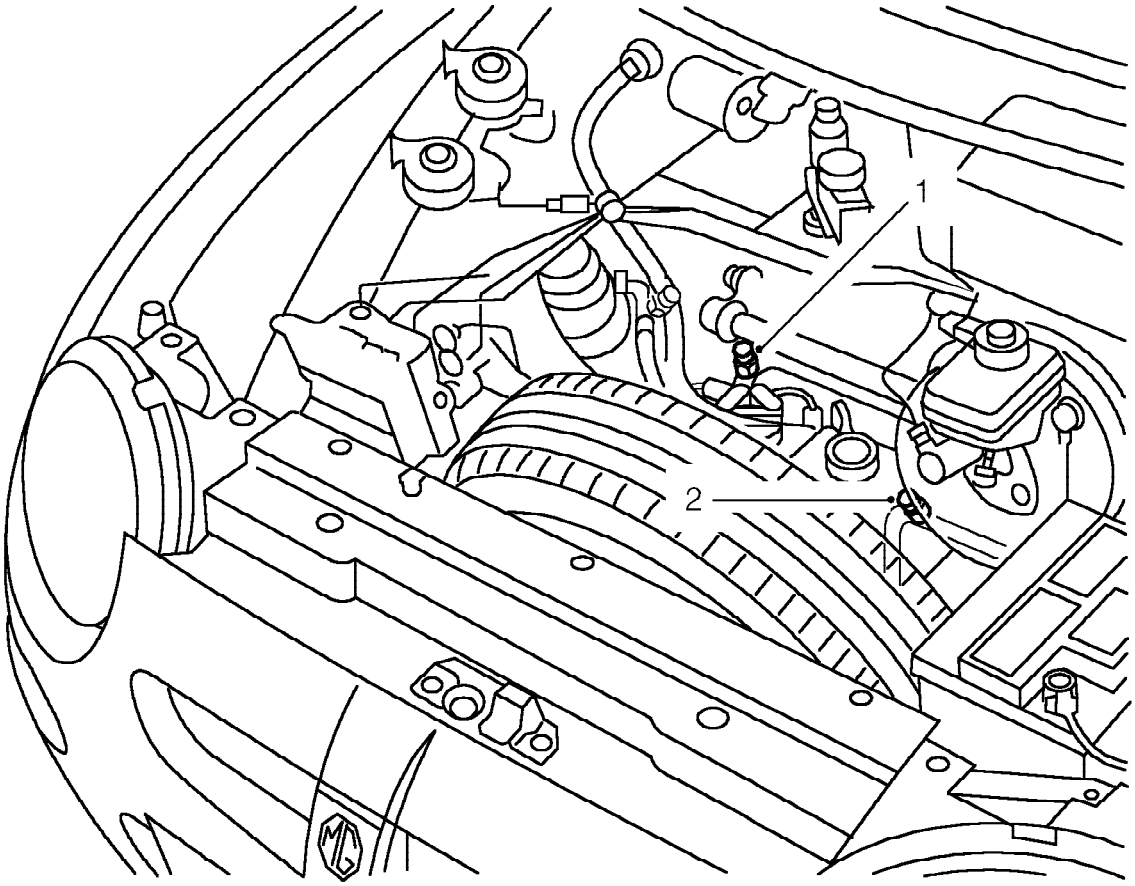
Rapid refrigerant discharge

If the air conditioning system is involved in accident damage and the circuit is punctured, the refrigerant will discharge rapidly. The rapid discharge of refrigerant will also result in the loss of most of the oil from the system. The compressor must be removed and all the remaining oil in the compressor drained and refilled as follows:

1. Remove the drain plug and gravity drain all the oil, assisted by rotating the clutch plate (not the pulley).
2. Refit the compressor with the following amount of new refrigerant oil: 170cm^3
3. Refit the drain plug and plug the inlet and outlet port.

REFRIGERANT RECOVERY, RECYCLING AND RECHARGING

NOTE: An air conditioning portable Refrigerant Recovery, Recycling and Recharging Station for use with R134a refrigerant incorporates all the features necessary to recover refrigerant R134a from the A/C system, to filter and remove moisture, to evacuate and recharge with reclaimed refrigerant. The unit can also be used for performance testing and air conditioning system analysis.



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Service connections

1. High pressure
2. Low pressure

Recovery and recycling

1. Remove underbonnet closing panel. ***See BODY, Exterior fittings.***
2. Connect a refrigerant station to high and low pressure servicing connections.
3. Operate the refrigerant recovery system in accordance to the manufacturer's instructions.

WARNING: Refrigerant must always be recycled before re-use, to ensure that the purity of the refrigerant is high enough for safe use in the air conditioning system.

Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SAE - J1991. Other equipment may not recycle refrigerant to the required level of purity.

A R134a Refrigerant Recovery Recycling Recharging Station must not be used with any other type of refrigerant.

Refrigerant R134a from domestic and commercial sources must not be used in motor vehicle air conditioning systems.

Evacuation and recharging

1. Add calculated refrigerant oil to the compressor as necessary.
2. Renew receiver/drier. ***See Repairs.***
3. Connect a Refrigerant Station to the high and low pressure servicing connections.

CAUTION: Whenever the refrigerant system is opened, the receiver/drier must be renewed immediately before evacuating and recharging the system.

4. Operate the refrigerant evacuation system according to the manufacturer's instructions.

NOTE: If the vacuum reading is below 700 mm/Hg after 15 minutes, suspect a leak in the system. Partially recharge the system and check for leaks using an electronic leak tester.

CAUTION: The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted.

5. Operate the refrigerant recharging system according to the manufacturer's instructions.

   Amount of refrigerant required to charge system is:
   - 620 ± 10 g for manual gearbox models
   - 720 ± 10 g for automatic gearbox models

   For each 1.2 m of hose length used to connect the charging trolley to the vehicle's air conditioning system, add 5 g of refrigerant.

6. If the full charge has not been accepted by the system, start the engine and run it at 1500 rev/min.
7. Switch on the air conditioning system, open the car windows, set the temperature control to cold and switch the blower to maximum speed.
8. Consult the Refrigerant Station Manual for the correct procedure to complete the charge.
9. Carry out the air conditioning system performance test.
10. Switch off air conditioning and wait for pressures to equalize, before disconnecting charging hoses from vehicle.

Performance Guide-lines

Carry out this test with bonnet, doors or windows open; air conditioning switched on, temperature control set to cold, face vent mode and blower at maximum speed. Set the air supply control to supply fresh air.

1. Close low pressure valve on Refrigerant Station.
2. Close high pressure valve on Refrigerant Station.
3. Connect Refrigerant Station to the high and low pressure servicing connections.
4. With a thermometer measure the air intake temperature, close to the outside air inlet at the plenum.
5. With a thermometer measure the air outlet temperature, at the centre vent outlet.
6. Run the engine at idle speed for 10 minutes or until normal operating temperature is reached.
7. Read both pressure gauges and thermometers. Check readings against the guide-lines shown in the table below.

Ambient	**20°C**	**25°C**	**30°C**	**35°C**	**40°C**
Outlet Temperature (°C)	5 - 10	7 - 15	8 - 20	11 - 22	14 - 25
Low Pressure (bar)	1.6 - 2.4	1.8 - 2.6	2.0 - 3.2	2.2 - 3.5	2.4 - 3.8
High Pressure (bar)	14 - 19	14 - 19	14 - 21	18 - 23	19.6 - 24.8
Notes	A + B	A + B	A + B	B	B

NOTES

- The temperatures and pressures may be slightly increased for high humidity conditions.

- The varying air conditioner pressure will dictate whether the fans operate in series or parallel, which will itself cause the temperatures and pressures to fluctuate. For example:
  A = Condenser and cooling fan both running at half speed (series)
  B = Condenser and cooling fan both running at full speed (parallel)
  A + B = Fans switching from series to parallel.

COMPRESSOR

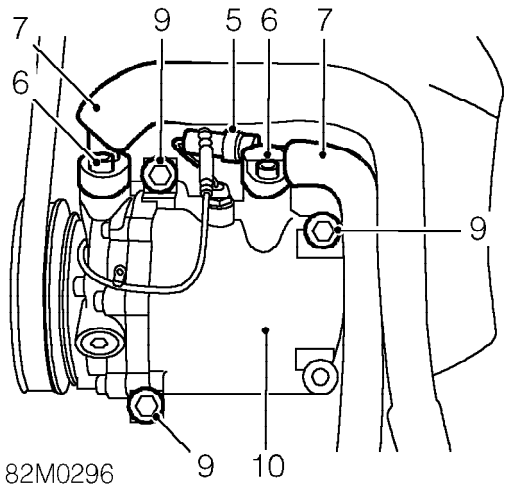
Service repair no - 82.10.20

Remove

1. Recover refrigerant from air conditioning system. ***See Adjustments.***
2. Disconnect battery earth lead.
3. Raise rear of vehicle.

WARNING: Support on safety stands.

4. Remove alternator. ***See ELECTRICAL, Repairs.***



5. Disconnect multiplug from air conditioning compressor.
6. Remove 2 Allen screws securing air conditioning pipe unions to compressor.
7. Release air conditioning pipe unions from compressor.
8. Remove and discard 2 'O' ring seals from pipe unions.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.

9. Remove 3 bolts securing compressor to mounting bracket and collect 2 washers from each bolt.
10. Remove compressor.

Fitting a new compressor

A new compressor is sealed and pressurised with Nitrogen gas, slowly release the sealing cap, gas pressure should be heard to escape as the seal is broken.

NOTE: A NEW compressor should always have its sealing cap in place and must not be removed until immediately prior to fitting.

A NEW compressor is supplied with an oil fill quantity (X cm^3) of 170 cm^3. A calculated quantity of oil must be drained from a new compressor before fitting.

To calculate the quantity to be drained:

1. Remove the drain plug from the old compressor.
2. Invert compressor and gravity drain the oil into a calibrated measuring cylinder. Rotating the compressor clutch plate will assist complete draining.
3. Note the quantity of oil drained (Y cm^3).
4. Calculate the quantity of oil to be drained from the NEW compressor using the following formula:

   X cm^3 - (Y cm^3 + 20 cm^3) = Q cm^3

5. Remove drain plug from NEW compressor and drain Q cm^3 of oil. Fit and tighten compressor drain plug.

Fitting an existing compressor

When refitting an existing compressor a quantity of refrigerant oil equivalent to the amount obtained when the system was discharged must be added to the compressor.

Use only an approved refrigerant lubricating oil:

Seiko SK-20
Unipart SK-20
Idemitsu SK-20

CAUTION: Do not use any other type of refrigerant oil.

Refrigerant oil easily absorbs water and must not be stored for long periods. Do not pour unused oil back into the container.

Refit

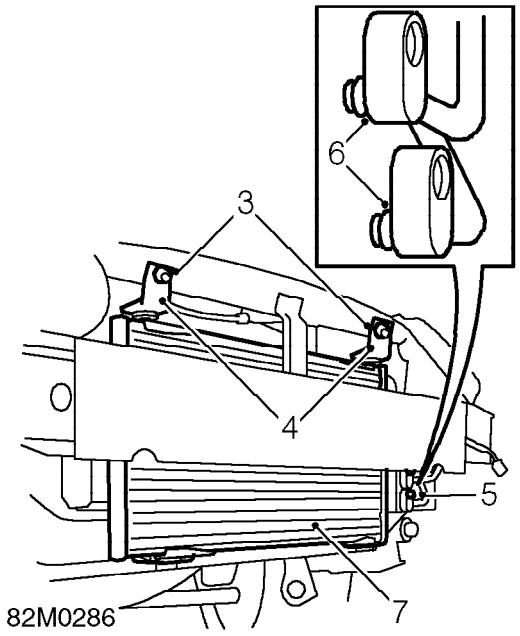
1. Fit bolts to compressor.
2. Position compressor to engine, fit washers to bolts and tighten to 45 Nm.
3. Clean compressor and pipe connections.
4. Remove caps from compressor and pipe connections.
5. Lubricate 2 new 'O' rings with refrigerant oil and fit to pipes.
6. Position air conditioning pipe unions to compressor, fit securing bolts and tighten to 25 Nm.
7. Connect multiplug to compressor.
8. Fit alternator. ***See ELECTRICAL, Repairs.***
9. Replace receiver drier. ***See this section.***
10. Remove stand(s) and lower vehicle.
11. Connect battery earth lead.
12. Recharge air conditioning system. ***See Adjustments.***

CONDENSER

Service repair no - 82.15.07

Remove

1. Recover refrigerant from air conditioning system. ***See Adjustments.***
2. Remove front bumper valance. ***See BODY, Exterior fittings.***



3. Remove 2 bolts securing top condenser mounting brackets to striker plate panel.
4. Remove brackets from condenser.
5. Remove 2 bolts securing air conditioning pipe connections to condenser and release pipes.
6. Remove and discard 2 'O' rings from air conditioning pipes.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.

7. Release condenser from lower mountings and remove condenser.

Refit

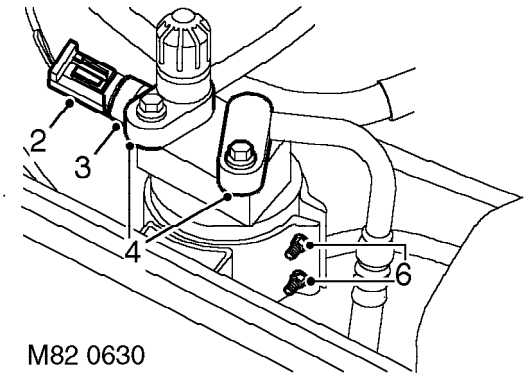
1. Clean air conditioning pipe connections.
2. Lubricate new 'O' rings with refrigerant oil and fit to air conditioning pipes.
3. Remove caps from new condenser and fit to old condenser.
4. Position condenser to lower mountings.
5. Fit mounting brackets to condenser.
6. Align mounting brackets to striker plate panel and tighten bolts to 17 Nm.
7. Align air conditioning pipes to condenser and tighten bolts to 5 Nm.
8. Renew receiver drier. ***See this section.***
9. Fit front bumper valance. ***See BODY, Exterior fittings.***
10. Recharge air conditioning system. ***See Adjustments.***

RECEIVER DRIER

Service repair no - 82.17.03

Remove

1. Recover refrigerant from A/C system. ***See Adjustments.***



M82 0630

2. Disconnect multiplug from trinary switch.
3. Loosen and remove trinary switch, remove and discard 'O' ring.
4. Remove 2 bolts securing A/C pipes to receiver drier.
5. Remove and discard 2 'O' ring seals from pipes.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.

6. Loosen 2 Allen screws clamping receiver drier bracket.
7. Position pipes aside and remove receiver drier.

Refit

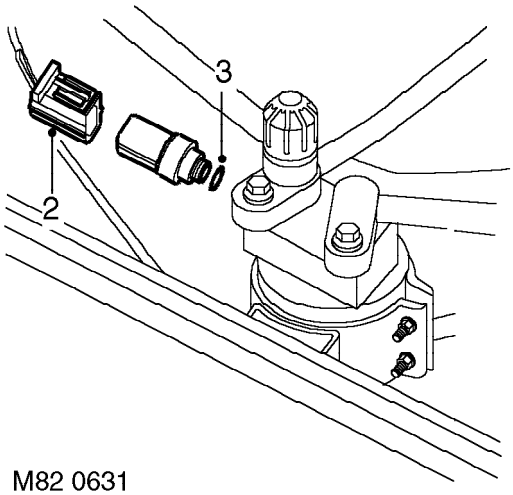
1. Clean A/C pipe connections.
2. Lubricate new 'O' ring seals with clean refrigerant oil and fit to air conditioning pipes.
3. Remove caps from new receiver drier and fit to old unit.
4. Fit receiver drier to bracket and secure bracket clamp screws.
5. Engage A/C pipes to receiver drier and tighten retaining bolts to 5 Nm.
6. Lubricate new trinary switch 'O' ring with clean refrigerant oil and fit 'O' ring to trinary switch.
7. Fit trinary switch and tighten to 10 Nm.
8. Connect multiplug.
9. Recharge A/C system. ***See Adjustments.***

SWITCH - TRINARY

Service repair no - 82.20.86

Remove

1. Recover refrigerant from A/C system. ***See Adjustments.***



M82 0631

2. Disconnect trinary switch multiplug.
3. Remove trinary switch and discard 'O' ring.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.

Refit

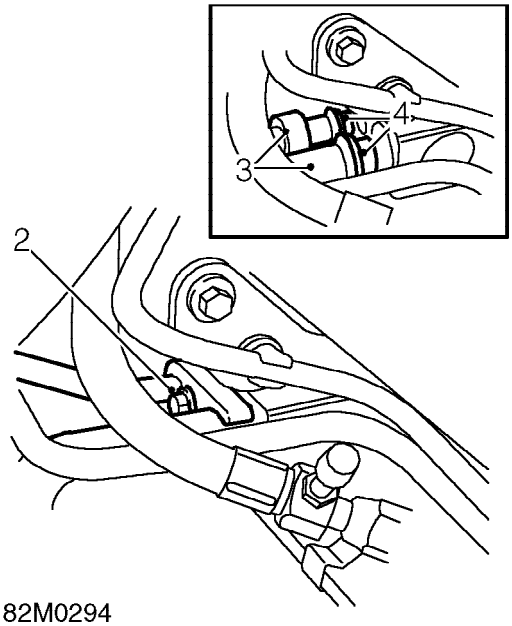
1. Lubricate new 'O' ring with clean refrigerant oil and fit to trinary switch.
2. Fit trinary switch and tighten to 10 Nm.
3. Connect trinary switch multiplug.
4. Recharge A/C system. ***See Adjustments.***

THERMOSTATIC EXPANSION VALVE

Service repair no - 82.25.01

Remove

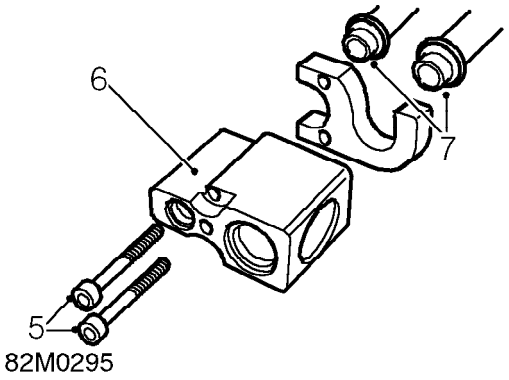
1. Recover refrigerant from air conditioning system. ***See Adjustments.***



82M0294

2. Remove bolt securing pipe clamp to thermostatic expansion valve.
3. Release 2 air conditioning pipes from valve.
4. Remove and discard 2 'O' rings from air conditioning pipes.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.



5. Remove 2 Allen bolts securing evaporator pipe clamp to thermostatic expansion valve.
6. Remove thermostatic expansion valve from evaporator pipes.
7. Remove and discard 2 'O' rings from evaporator pipes.

CAUTION: Immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.

Refit

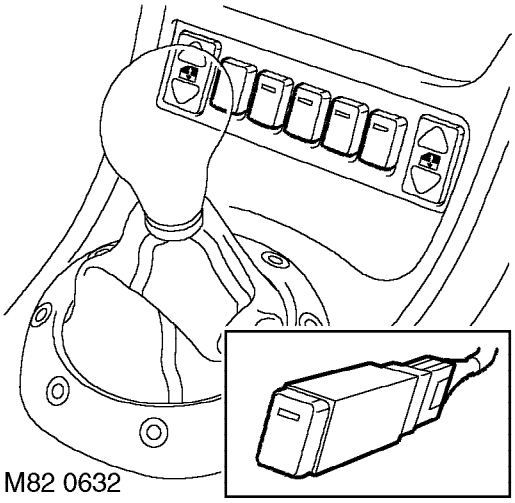
1. Clean air conditioning pipe connections.
2. Lubricate new 'O' rings with refrigerant oil and fit to air conditioning pipes.
3. Remove caps from new thermostatic expansion valve and fit to old unit.
4. Engage valve to evaporator pipes.
5. Position evaporator pipe bracket, fit and tighten Allen bolts to 7 Nm.
6. Engage pipes to valve and position pipe clamp.
7. Tighten pipe clamp bolt to 5 Nm.
8. Renew receiver drier. ***See this section.***
9. Recharge air conditioning system. ***See Adjustments.***

CONTROL SWITCH

Service repair no - 82.20.07

Remove

1. Remove console closing panel. ***See BODY, Interior trim components.***



2. Release switch from centre console.
3. Disconnect multiplug from switch.
4. Remove switch.

Refit

1. Connect multiplug to switch and fit switch to centre console.
2. Fit console closing panel. ***See BODY, Interior trim components.***

EVAPORATOR

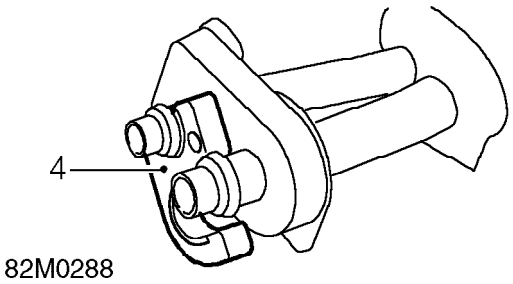
Service repair no - 82.25.20

Remove

1. Raise front of vehicle.

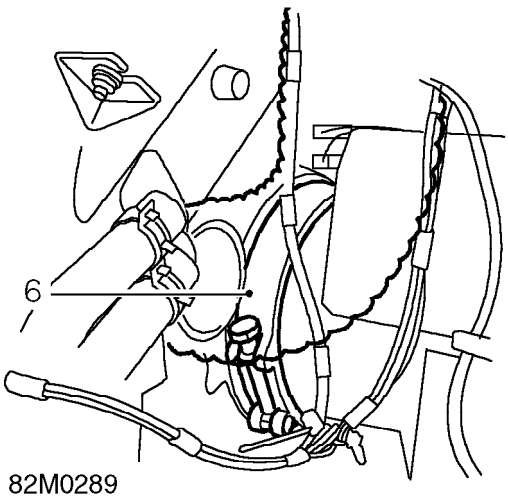
WARNING: Support on safety stands.

2. Remove fascia panel. ***See BODY, Interior trim components.***
3. Remove thermostatic expansion valve. ***See this section.***



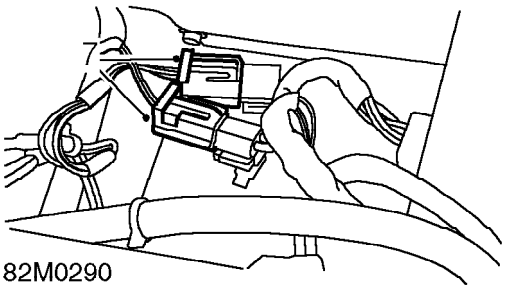
82M0288

4. Remove pipe clamp from evaporator pipes.
5. Remove screen vent duct from heater.



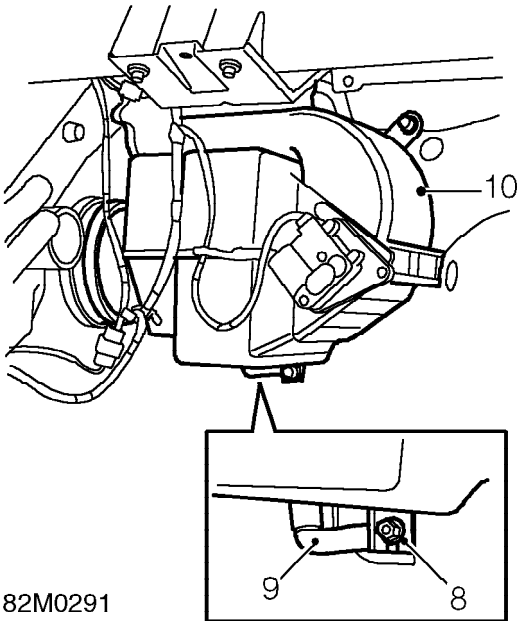
82M0289

6. Remove clamp securing evaporator to heater.



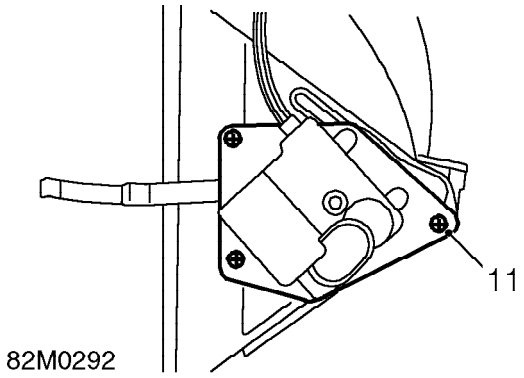
82M0290

7. Disconnect 2 multiplugs from evaporator.

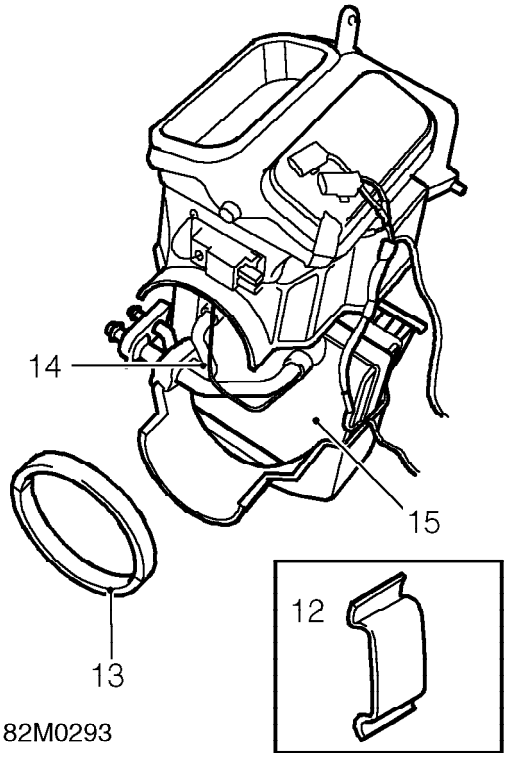


82M0291

8. Remove 2 nuts securing evaporator to lower dash panel.
9. Release evaporator drain hose from evaporator.
10. Remove evaporator assembly.



11. Remove 3 screws securing recirculation servo to casing and position aside.



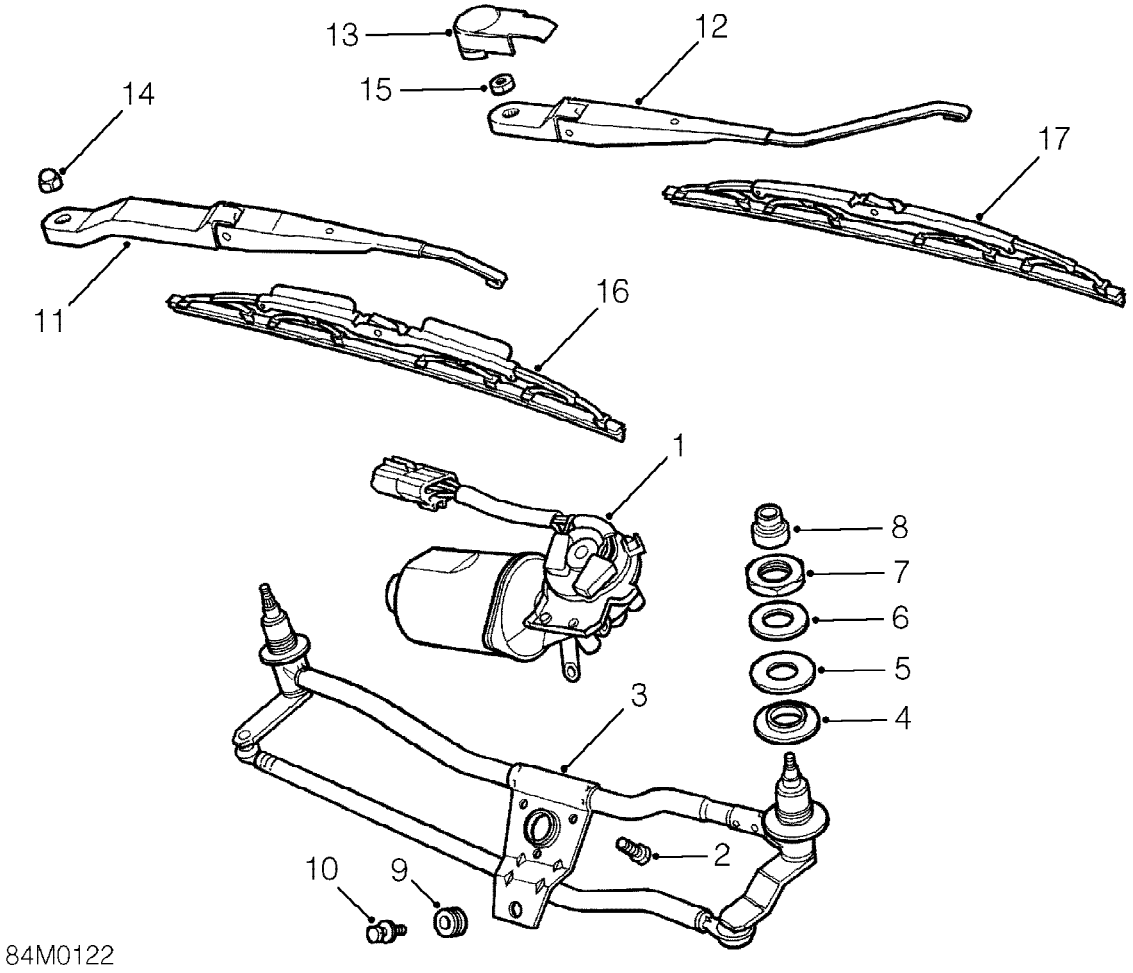
12. Remove 7 clips securing casing halves.
13. Remove and discard foam seal from output duct.
14. Release thermocouple from evaporator matrix.
15. Separate evaporator casing and remove evaporator matrix.

Refit

1. Position matrix to casing.
2. Align casing halves and secure with clips.
3. Insert tip of thermocouple into centre of matrix fins.
4. Position servo output crank to recirculation flap lever and secure servo with screws.
5. Fit new foam seal to output duct.
6. Position evaporator, fit nuts but do not tighten.
7. Engage hose to drain pipe.
8. Fit clamp securing evaporator to heater and tighten nut to 3 Nm.
9. Tighten nuts securing evaporator to lower dash panel to 9 Nm.
10. Connect multiplugs.
11. Remove evaporator pipe caps and clean air conditioning pipe connections.
12. Lubricate new 'O' rings with refrigerant oil.
13. Fit pipe bracket to evaporator pipes.
14. Fit thermostatic expansion valve. ***See this section.***
15. Fit fascia panel. ***See BODY, Interior trim components.***
16. Remove stand(s) and lower vehicle.

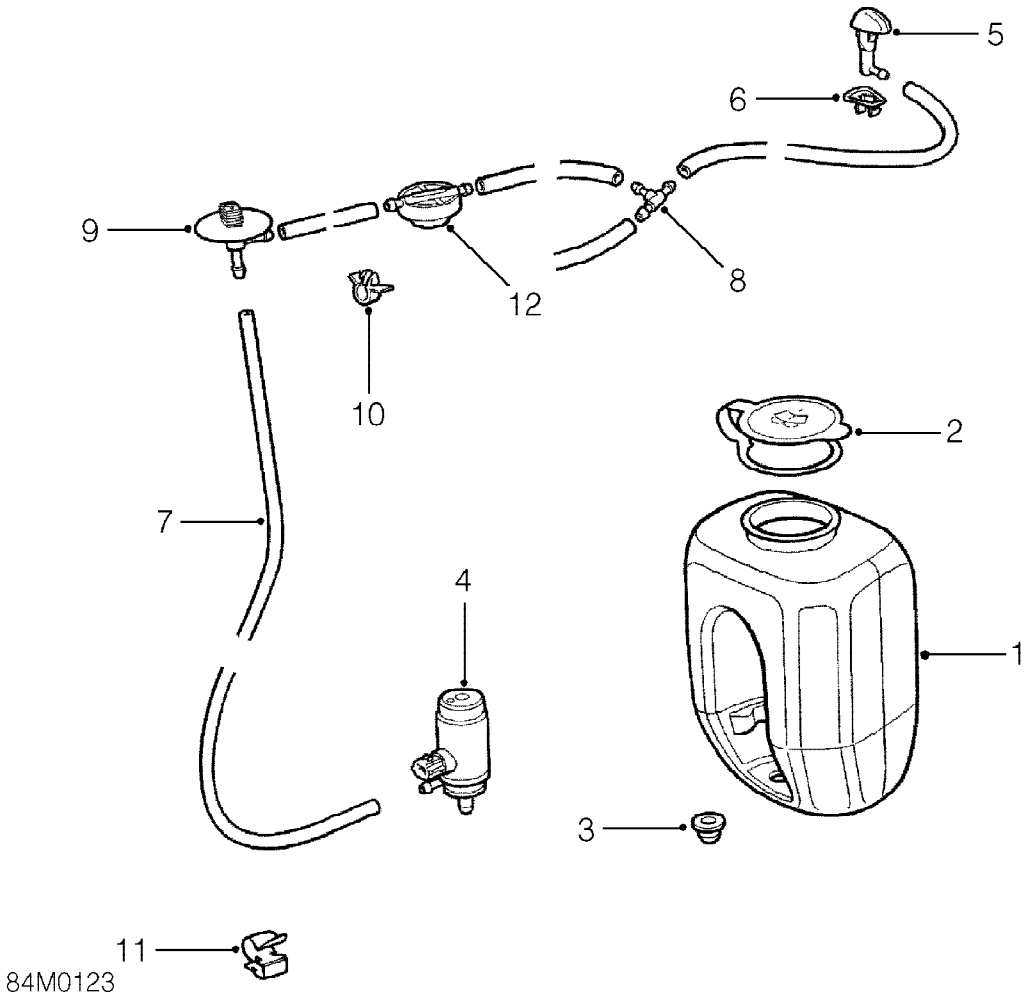
CONTENTS

WINDSCREEN WIPER COMPONENTS



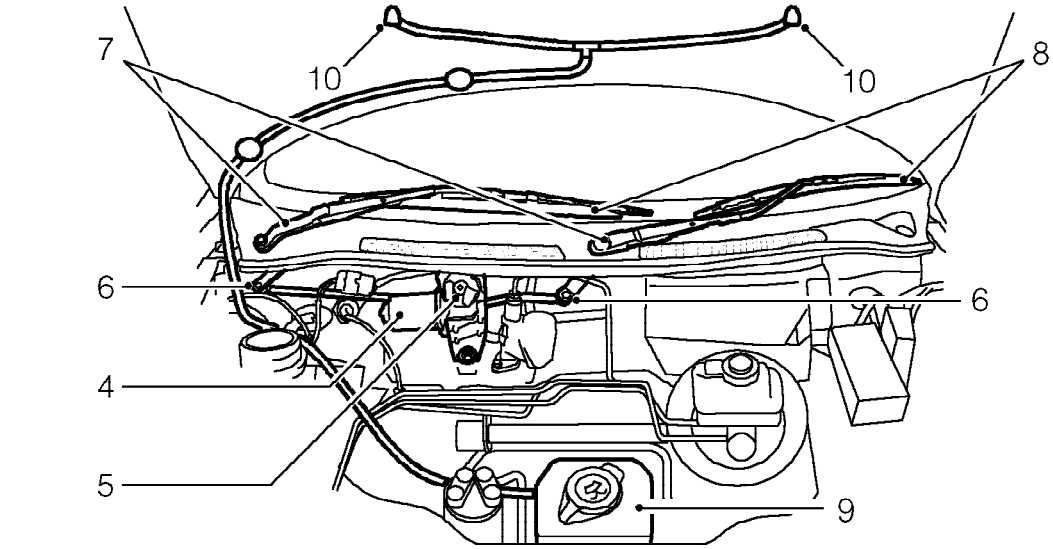
1. Wiper motor
2. Bolt - motor to mechanism, 3 off
3. Wiper mechanism assembly
4. Sealing washer - spindle, 2 off
5. Washer - spindle, 2 off
6. Washer - spindle, 2 off
7. Nut - spindle, 2 off
8. Spindle cap, 2 off
9. Rubber grommet
10. Bolt - mechanism to body plate
11. Wiper arm - driver side
12. Wiper arm - passenger side
13. Cover
14. Bevel nut - wiper arm
15. Nut - wiper arm
16. Windscreen wiper - driver side
17. Windscreen wiper - passenger side

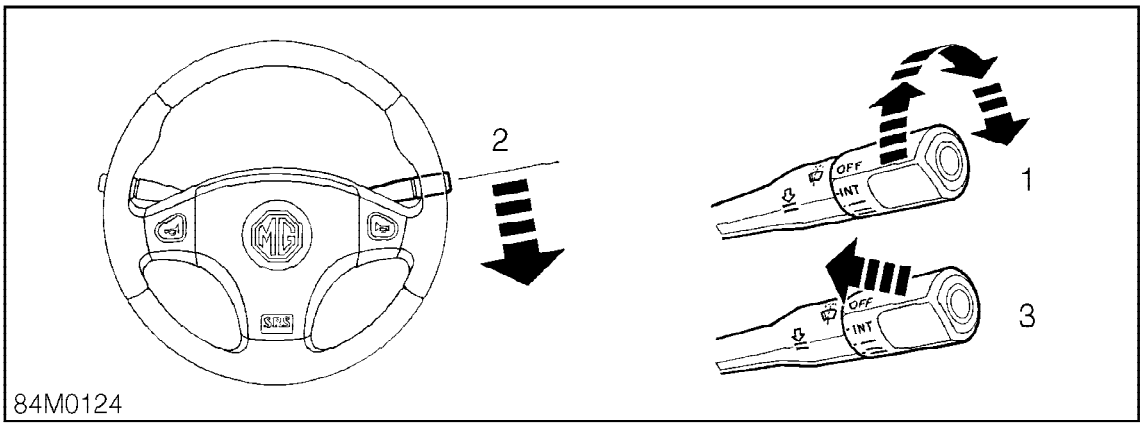
WASHER COMPONENTS



1. Reservoir
2. Reservoir cap
3. Bush washer - reservoir
4. Pump - windscreen washer
5. Jet washer, 2 off
6. Gasket - jet washer, 2 off
7. Washer tube
8. Tee connector
9. Elbow connector
10. Clip - tube to bonnet, 4 off
11. Clip - tube to body, 2 off
12. Non-return valve

WINDSCREEN WASHER AND WIPER OPERATION





Operation of the windscreen wipers and washers is controlled by the wash/wipe switch mounted on the stalk on the RH side of the steering column. The wiper switch may be rotated from the OFF position to selected positions; Intermittent, Normal or Fast wipe speeds (1). Single wipe is obtained by a downward movement of the stalk, when in the OFF position (2). The windscreen washer will operate when the stalk is pulled towards the steering wheel (3).

When any wiper function is selected, a 2 speed wiper motor (4) provides drive through a rotary link (5) to a wiper mechanism (6) which converts the lateral motion of the links into the sweeping motion of the wiper arms (7) and blades (8).

The fast, normal and intermittent speeds, when selected, are controlled by the multi-function unit.

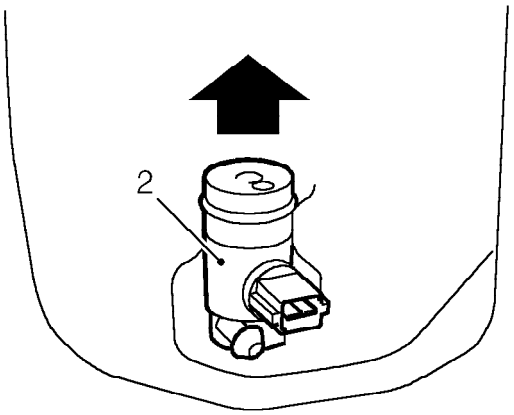
When the windscreen washer is operated, washer fluid is drawn by an electric pump from the reservoir (9); located behind the spare wheel compartment. The washer fluid is sprayed onto the windscreen by washer jets (10).

WASHER RESERVOIR

Service repair no - 84.10.01

Remove

1. Remove reservoir and pump assembly. ***See this section.***



84M0114

2. Remove pump from reservoir.

Refit

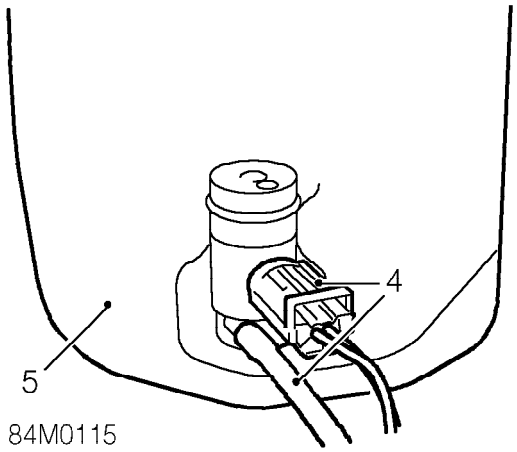
1. Fit pump to reservoir.
2. Fit reservoir and pump assembly. ***See this section.***

RESERVOIR AND PUMP

Service repair no - 84.10.06

Remove

1. Remove underbonnet closing panel. ***See BODY, Exterior fittings.***
2. Position container to catch spillage.
3. Release reservoir from body bracket.



84M0115

4. Disconnect multiplug and washer hose.
5. Remove reservoir assembly.

Refit

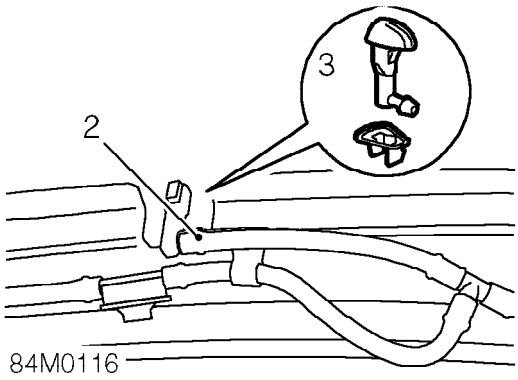
1. Position reservoir.
2. Connect multiplug and hose.
3. Engage reservoir to body.
4. Fill reservoir with washer fluid.
5. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

WASHER JET

Service repair no - 84.10.08

Remove

1. Open bonnet.



2. Disconnect hose from washer jet.
3. Remove jet and collect seat.

Refit

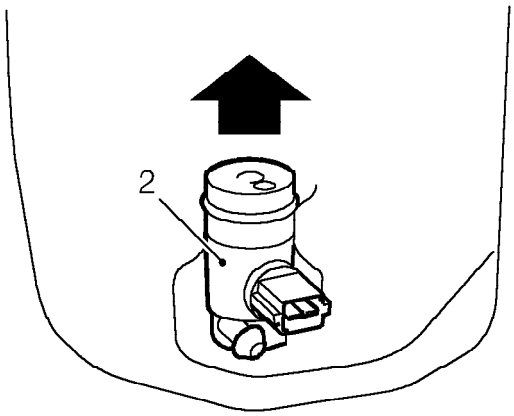
1. Position seat and engage jet to bonnet.
2. Connect hose.
3. Adjust jets.

WASHER PUMP

Service repair no - 84.10.21

Remove

1. Remove reservoir and pump. ***See this section.***



2. Remove pump from reservoir.

Refit

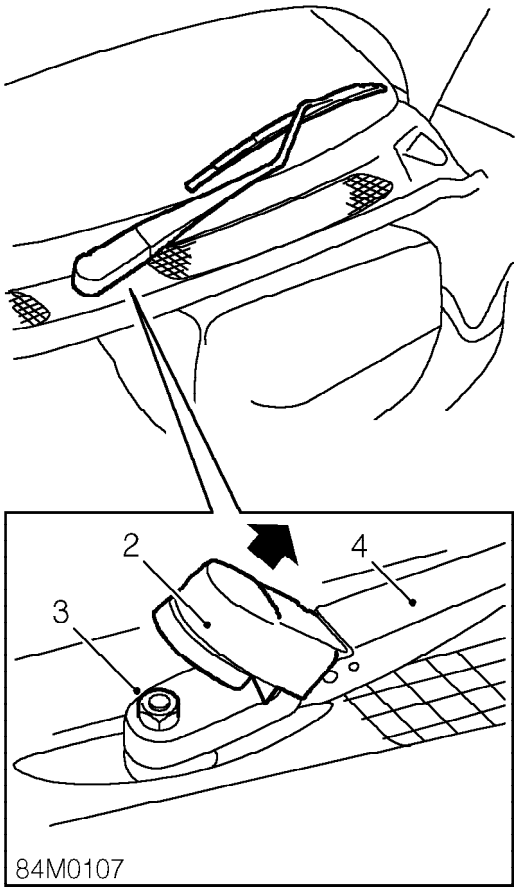
1. Fit pump to reservoir.
2. Fit reservoir and pump assembly. ***See this section.***

WIPER ARM

Service repair no - 84.15.02

Remove

1. Open bonnet.



2. Remove cover from wiper arm.
3. Remove nut securing wiper arm to spindle.
4. Remove wiper arm.

Refit

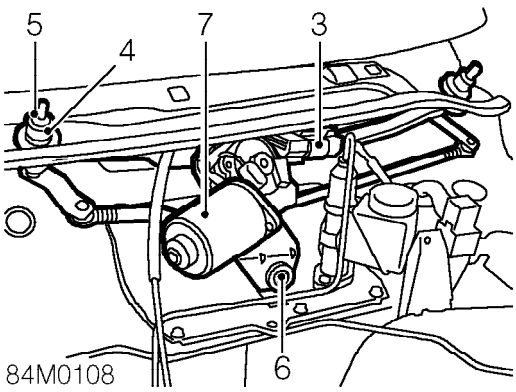
1. Fit wiper arm to spindle and align blade to screen.
2. Fit and tighten nut to 20 Nm.
3. Fit cover.

WIPER MOTOR AND LINKAGE

Service repair no - 84.15.11

Remove

1. Remove air intake panel. ***See HEATING & VENTILATION, Repairs.***
2. Remove underbonnet closing panel. ***See BODY, Exterior fittings.***



3. Disconnect multiplug from motor.
4. Remove cover from spindle.
5. Remove 2 nuts securing spindles to scuttle.
6. Remove bolt securing motor to pedal box.
7. Remove motor and linkage assembly.

Refit

1. Position motor and linkage assembly to scuttle.

NOTE: Ensure spindle seals are correctly positioned to scuttle apertures.

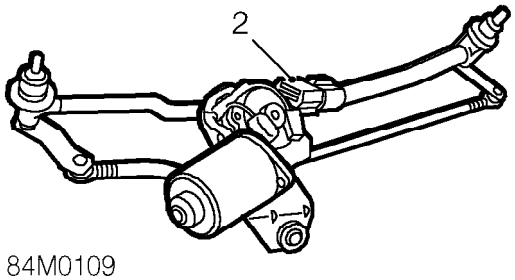
2. Tighten fixings to 10 Nm.
3. Fit spindle cover.
4. Connect multiplug.
5. Fit air intake panel. ***See HEATING & VENTILATION, Repairs.***
6. Fit underbonnet closing panel. ***See BODY, Exterior fittings.***

WIPER MOTOR

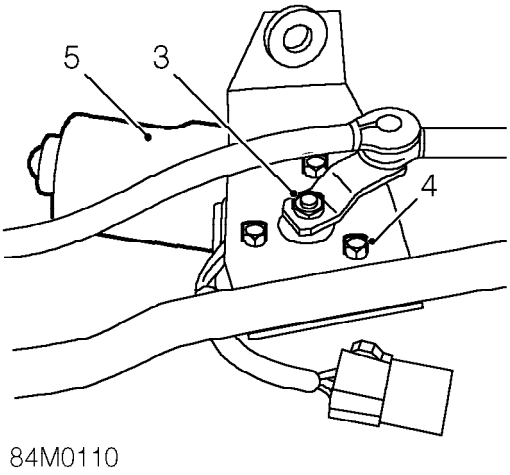
Service repair no - 84.15.12

Remove

1. Remove wiper motor and linkage assembly. ***See this section.***



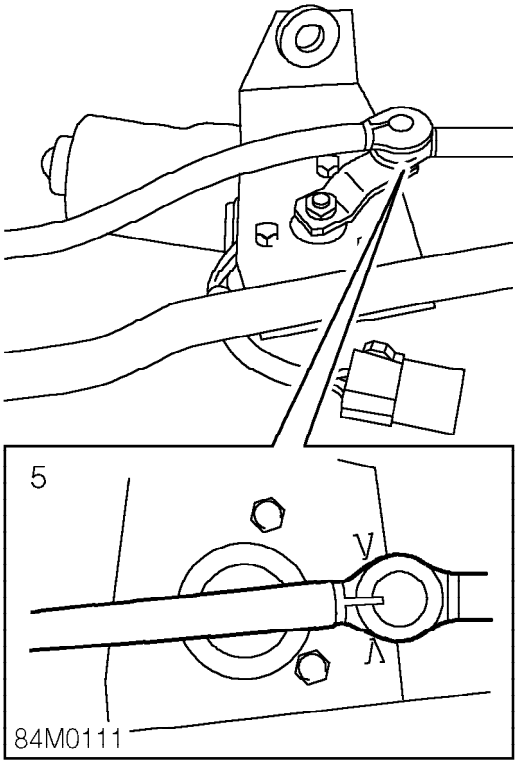
2. Release multiplug clip from linkage.



3. Remove nut securing crank to motor spindle and release crank.
4. Remove 3 bolts securing motor.
5. Remove motor.

Refit

1. Connect multiplug to harness.
2. Operate wipers to park motor.
3. Disconnect multiplug.
4. Fit motor to linkage bracket and tighten bolts to 12 Nm.



5. Align crank between timing marks and fit to motor spindle.
6. Fit and tighten crank nut to 18 Nm.
7. Engage multiplug.
8. Fit wiper motor and linkage. ***See this section.***

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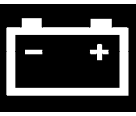


DRIVE BELT - ALTERNATOR - CHECK & ADJUST TENSION - NON AIR CONDITIONING

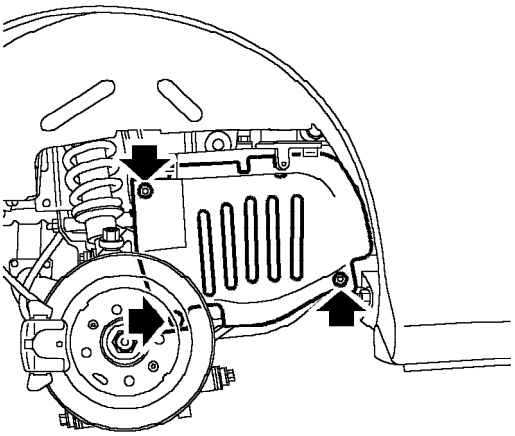
Check

Service repair no - 86.10.05

1. Disconnect battery earth lead.
2. Raise rear of vehicle and support on stand(s).

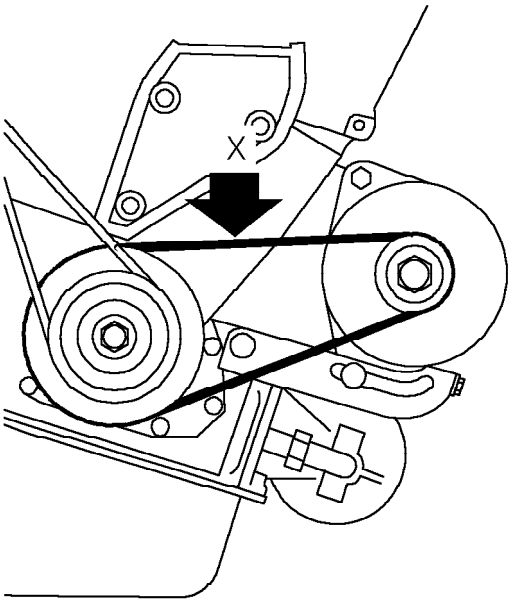
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

3. Remove road wheel.



SP12 0348

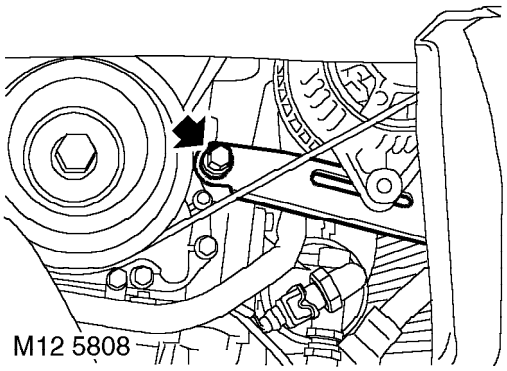
4. Remove 2 scrivets and Torx screw securing closing panel and remove closing panel.
5. Check condition of drive belt, renew a belt that shows signs of wear and splitting.



86M3909

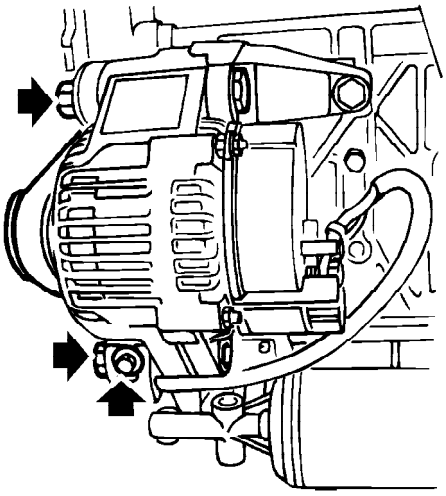
6. Apply a force of 10 kg. to auxiliary drive belt at position 'X' and measure deflection between crankshaft pulley and alternator pulley. Deflection should be 6-8 mm.

Adjust



M12 5808

1. Loosen bolt securing alternator adjustment bracket.



M12 5760A

2. Loosen 2 alternator clamp bolts.

CAUTION: Ensure that bolts are loosened sufficiently for alternator to move freely.

3. Turn adjustment bolt in a clockwise direction to increase belt tension.

CAUTION: Do not apply excessive torque to adjusting bolt or damage to bolt will result. If bolt appears to be seized or is difficult to turn, apply suitable anti-seize lubricant to bolt.

4. Check belt tension and re-adjust if necessary.
5. Tighten clamp bolts to 45 Nm.
6. Tighten adjustment bracket bolt to 25 Nm.
7. Position closing panel to body and secure with scrivets and Torx screw.
8. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
9. Remove stand(s) and lower vehicle.
10. Connect battery earth lead.

ALTERNATOR DRIVE BELT - WITH AIR CONDITIONING - ADJUST

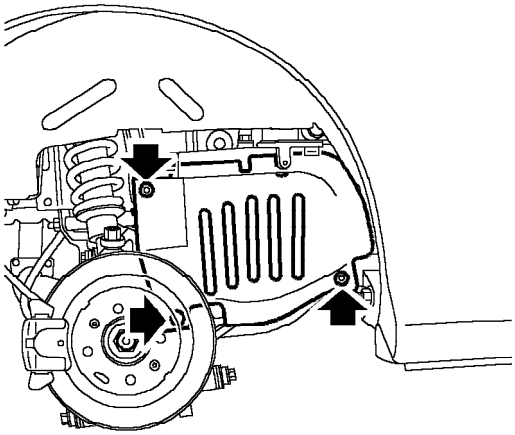
Service repair no - 86.10.05/20

Check

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

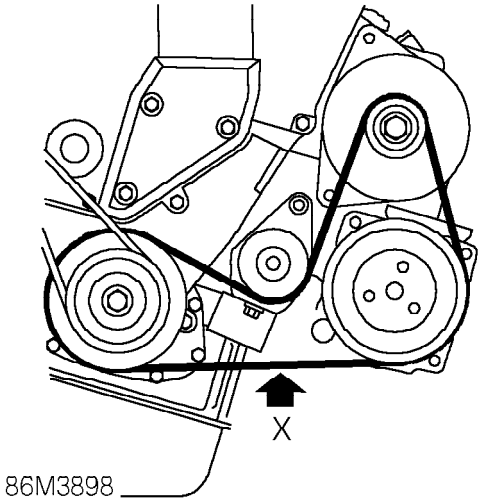
WARNING: Support on safety stands.

3. Remove road wheel(s).



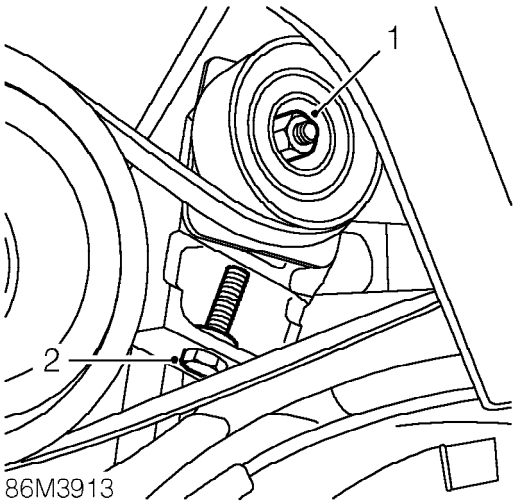
SP12 0348

4. Remove 2 scrivets and Torx screw securing closing panel.
5. Remove closing panel.
6. Check condition of drive belt. Renew a drive belt that shows signs of wear and splitting.



7. Apply a force of 10 kg to the drive belt at position 'X' and measure the deflection between the crankshaft pulley and air conditioning compressor pulley. Deflection must be 9 - 10 mm.

Adjust



1. Loosen nut securing drive belt, tensioner pulley.
2. Increase drive belt tension by turning the tension adjusting bolt clockwise.
3. Tighten drive belt tensioner pulley securing nut to 25 Nm.
4. Recheck drive belt tension.
5. Fit closing panel and secure with fixings.
6. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
7. Remove stand(s) and lower vehicle.
8. Connect battery earth lead.

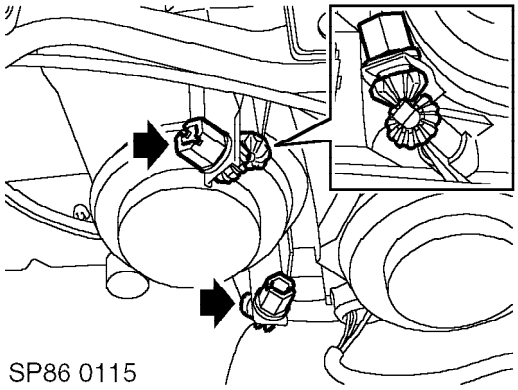
HEADLAMPS - PAIR - ALIGN BEAM

Service repair no - 86.40.17

Check

1. Before adjustment, ensure tyre pressures are at correct settings.
2. Line up suitable beam setting equipment to headlamp.
3. Switch on headlamps and check alignment; Alignment figures = 1.0% Vertical , 0.0% Horizontal.

Adjust



1. Adjust headlamp accordingly to achieve correct alignment.
2. Turn adjuster for vertical alignment.
3. Turn adjuster for horizontal alignment.
4. Repeat above procedure for 2nd headlamp.
5. Switch off headlamps.

ALTERNATOR - NON AIR CONDITIONING

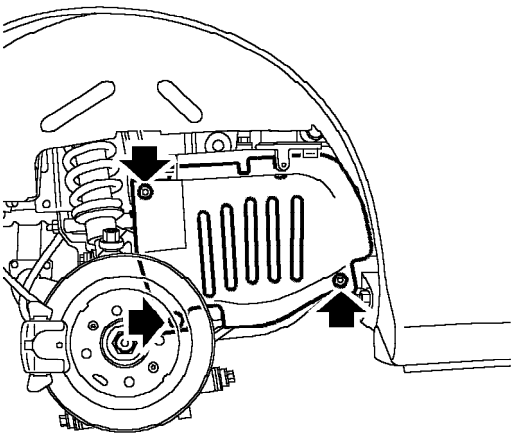
Service repair no - 86.10.02

Remove

1. Disconnect battery earth lead.
2. Remove engine cover, ***See ENGINE, Repairs.***
3. Raise rear of vehicle.

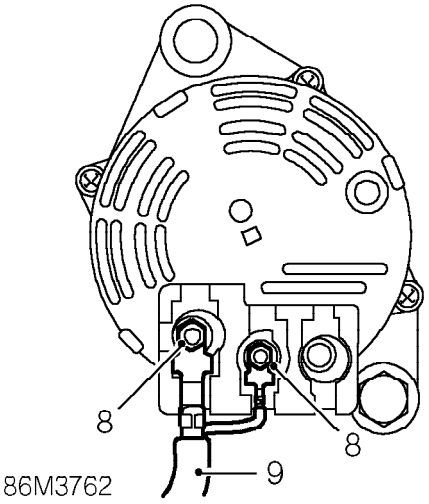
WARNING: Support on safety stands.

4. Remove road wheel(s).



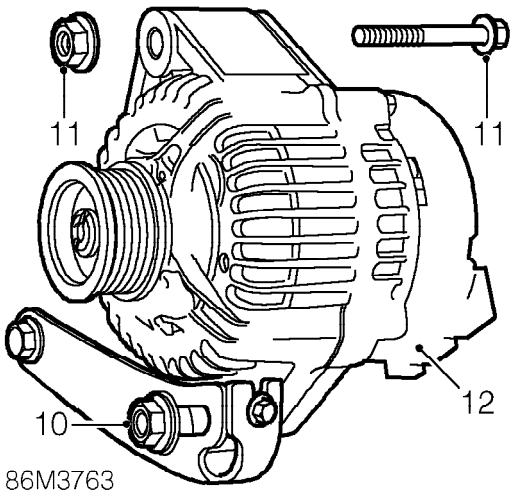
SP12 0348

5. Remove 2 scrivets and Torx screw securing closing panel.
6. Remove closing panel.
7. Remove alternator drive belt. ***See this section.***



86M3762

8. Loosen 2 nuts securing cables to alternator.
9. Disconnect cables from alternator.



86M3763

10. Remove nut and bolt securing alternator to adjustment bracket.
11. Remove nut and bolt securing alternator to engine.
12. Remove alternator.
    Do not carry out further dismantling if component is removed for access only.
13. Restraining the alternator shaft with an 8 mm Allen key, remove nut securing pulley to alternator shaft using tool **18G 1653.**
14. Remove pulley from alternator.
15. Clean pulley and alternator shaft.

Refit

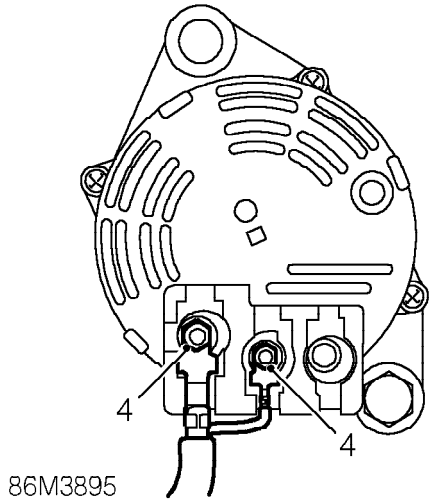
1. Fit pulley to alternator shaft.
2. Fit alternator pulley nut, hold shaft with an 8 mm Allen key and tighten nut to 25 Nm using tool **18G 1653.**
3. Position alternator to engine.
4. Fit nut and bolt securing alternator to engine, do not tighten at this stage.
5. Fit bolt securing alternator to adjustment bracket, but do not tighten.
6. Fit alternator drive belt. ***See this section.***
7. Tighten bolt securing alternator to engine to 45 Nm.
8. Refit closing panel and secure with scrivets and Torx screw.
9. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
10. Remove stand(s) and lower vehicle.
11. Connect alternator leads to terminals and tighten nuts.
12. Fit engine cover. ***See ENGINE, Repairs.***
13. Connect battery earth lead.

ALTERNATOR - WITH AIR CONDITIONING

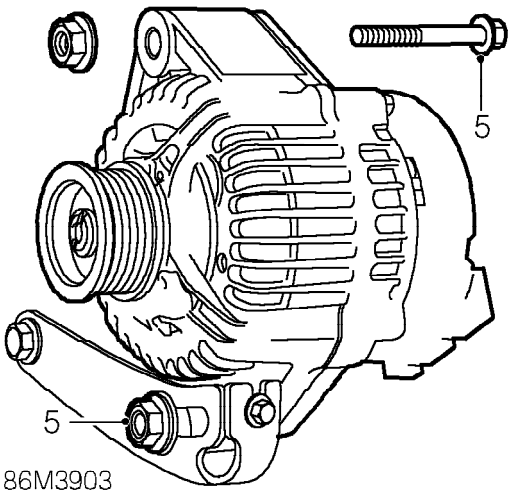
Service repair no - 86.10.02/20

Remove

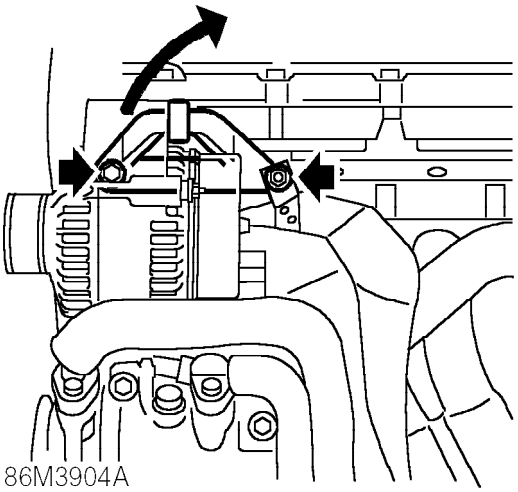
1. Disconnect battery earth lead.
2. Raise rear of vehicle.and remove engine cover. ***See ENGINE, Repairs.***
3. Remove alternator drive belt, ***See this section.***



4. Remove 2 nuts securing connections to alternator and position aside.



5. Remove upper and lower bolts securing alternator to mounting bracket.



6. Remove bolt and loosen nut securing alternator upper mounting bracket to cylinder head.
7. Rotate bracket aside.
8. Remove alternator.
   Do not carry out further dismantling if component is removed for access only.
9. Restraining the alternator shaft with an 8 mm Allen key, remove nut securing pulley to alternator shaft using tool **18G 1653.**
10. Remove pulley from alternator.
11. Clean pulley and alternator shaft.

Refit

1. Fit pulley to alternator shaft.
2. Fit alternator pulley nut, hold shaft with an 8 mm Allen key and tighten nut to 25 Nm using tool **18G 1653.**
3. Fit alternator to engine.
4. Align top bracket and tighten fixings to 25 Nm.
5. Position alternator to top bracket and tighten fixings to 45 Nm.
6. Connect cables and secure nuts.
7. Fit alternator drive belt. ***See this section.***
8. Fit engine cover. ***See ENGINE, Repairs.***

DRIVE BELT - ALTERNATOR - NON AIR CONDITIONING

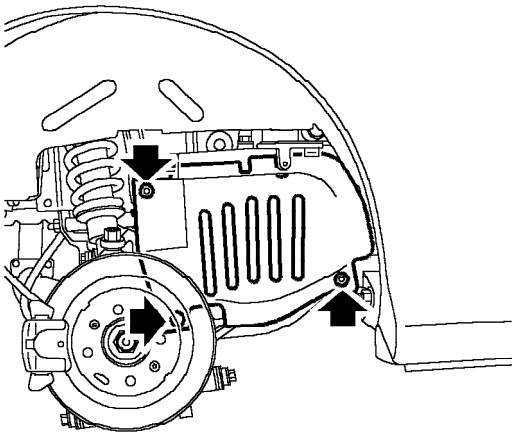
Service repair no - 86.10.03

Remove

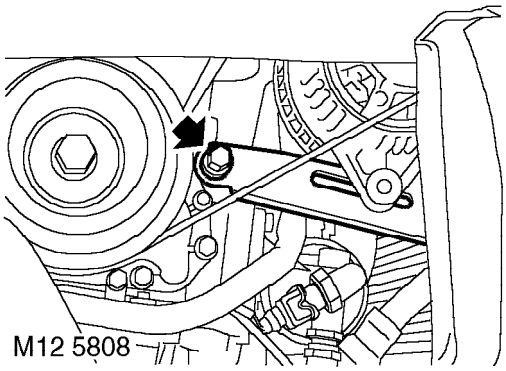
1. Disconnect battery earth lead.
2. Raise rear of vehicle.

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

3. Remove road wheel.



4. Remove 2 scrivets and Torx screw securing closing panel and remove closing panel.



5. Loosen bolt securing alternator adjustment bracket.
6. Loosen 2 alternator clamp bolts.

CAUTION: Ensure that bolts are loosened sufficiently for alternator to move freely.

7. Loosen adjusting bolt until there is sufficient free movement to remove the drive belt.

CAUTION: Do not apply excessive torque to adjusting bolt or damage to bolt will result. If bolt appears to be seized or is difficult to turn, apply suitable anti-seize lubricant to bolt.

8. Remove auxiliary drive belt.

Refit

1. Clean auxiliary drive belt pulleys and ensure that pulley grooves are not damaged.
2. Fit drive belt. Ensure drive belt is correctly located in pulley grooves.
3. Adjust auxiliary drive belt tension. ***See Adjustments.***
4. Position closing panel to body and secure with scrivets and Torx screw.
5. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
6. Remove stands and lower vehicle.
7. Connect battery earth lead.

ALTERNATOR DRIVE BELT - WITH AIR CONDITIONING

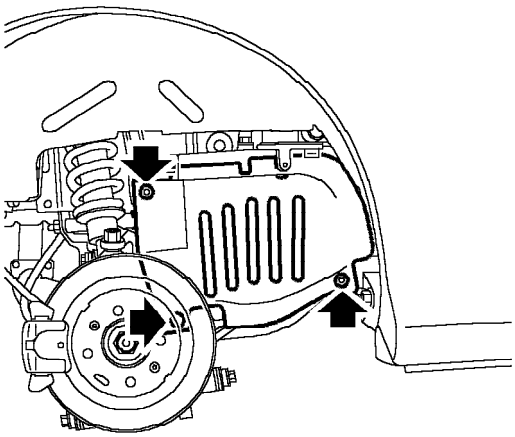
Service repair no - 86.10.03/20

Remove

1. Disconnect battery earth lead.
2. Raise rear of vehicle.

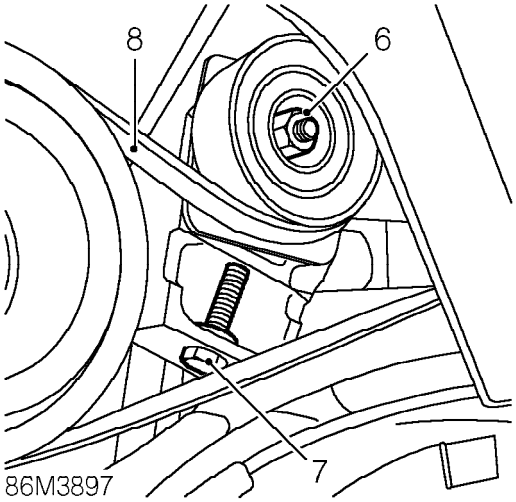
WARNING: Support on safety stands.

3. Remove road wheel(s).



SP12 0348

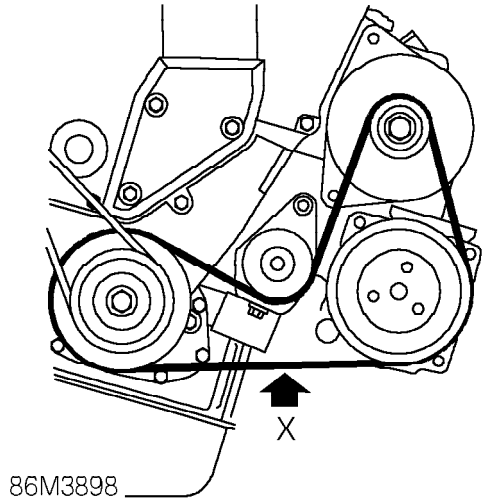
4. Remove 2 scrivets and Torx screw securing closing panel.
5. Remove closing panel.



6. Loosen drive belt tensioner pulley securing nut.
7. Release drive belt tension by turning the tension adjusting bolt anti-clockwise.
8. Release drive belt from alternator and compressor pulleys.
9. Remove and discard drive belt.

Refit

1. Clean pulley 'V's.
2. Fit new drive belt to crankshaft pulley and engage to alternator and compressor pulleys. Ensure grooves on drive belt and pulleys are correctly located.
3. Increase drive belt tension by turning the tension adjusting bolt clockwise.
4. Tighten drive belt tensioner pulley securing nut to 25 Nm.



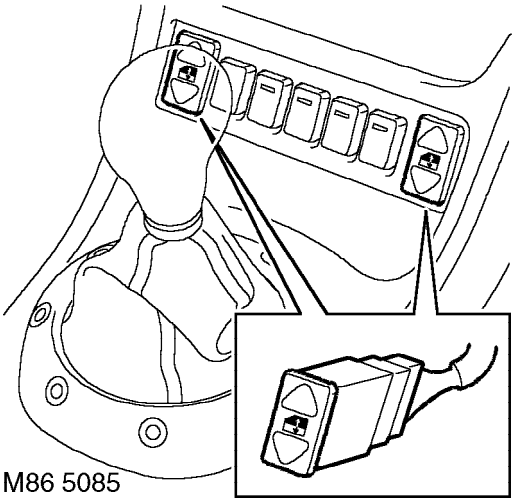
5. Apply a force of 10 kg to the drive belt at position 'X' and measure the deflection between the crankshaft pulley and air conditioning compressor pulley. Deflection must be 9 - 10 mm.
6. Fit closing panel and secure with fixings.
7. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
8. Remove stand(s) and lower vehicle.
9. Connect battery earth lead.

ELECTRIC WINDOW SWITCH

Service repair no - 86.25.19

Remove

1. Remove console closing panel. ***See BODY, Interior trim components.***



2. Release switch from centre console.
3. Disconnect multiplug from switch.
4. Remove switch.

Refit

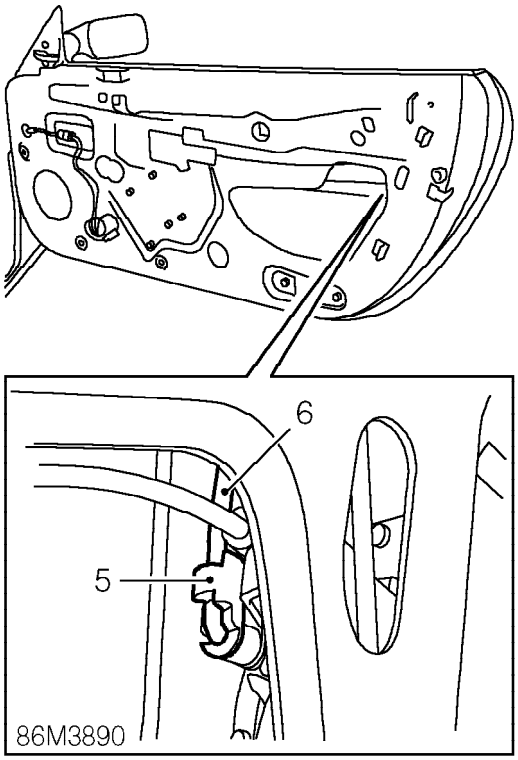
1. Connect multiplug to switch and fit switch to centre console.
2. Fit console closing panel ***See BODY, Interior trim components.***

CENTRAL DOOR LOCKING MOTOR AND LATCH

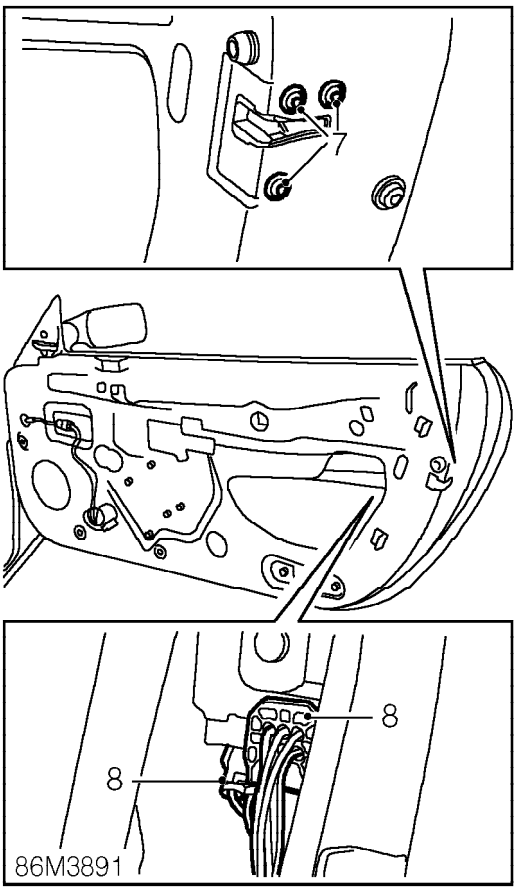
Service repair no - 86.26.08

Remove

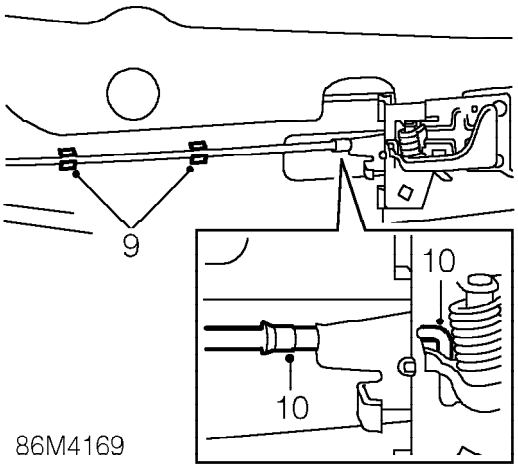
1. Remove door trim casing. ***See BODY, Doors.***
2. Switch the ignition ON and fully lower door glass.
3. Switch ignition OFF.
4. Carefully peel back corner of plastic sheet to allow access to door latch.



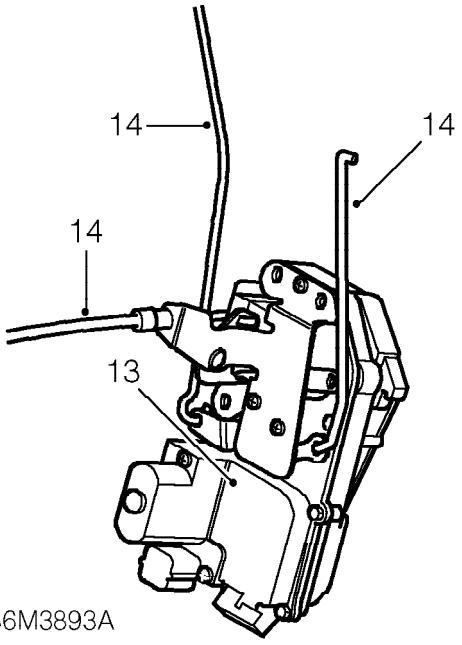
5. Release clip securing door handle link rod to latch assembly and position aside.
6. Release lock link rod from lock.



7. Remove 3 Tx25 Torx screws securing latch assembly to door.
8. Position latch assembly and disconnect 2 multiplugs.



9. Release cable from 2 inner door panel clips.
10. Disconnect cable from remote door handle.
11. Switch ignition ON and fully raise door glass.
12. Switch ignition OFF.



13. Remove latch assembly from door.
14. Remove sill button, lock link rod and cable from latch assembly.

Refit

1. Fit sill button, lock link rod and cable to latch assembly.
2. Position latch assembly to door and guide sill button through door aperture.
3. Switch ignition ON and fully lower door glass.
4. Switch ignition OFF.
5. Connect multiplugs to latch assembly.
6. Connect door release cable to remote door handle and secure to inner door panel clips.
7. Align exterior handle, link rod to latch assembly and secure with clip.

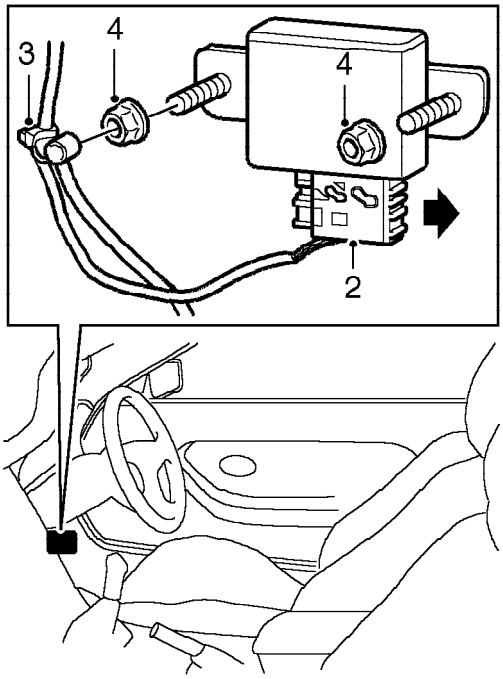
NOTE: A small amount of free-play should be evident between the exterior handle and latch. If necessary adjust the exterior handle, link rod trunnion.

8. Engage lock link rod to lock.
9. Fit Torx screws securing latch assembly to door and tighten to 5 Nm.
10. Secure plastic sheet to door.
11. Fit door trim casing. ***See BODY, Doors.***

CONTROL UNIT - ONE TOUCH WINDOW

Service repair no - 86.25.37

Remove



M86 5055

1. Release RH lower section of door seal and carpet to access control unit.
2. Release multiplug catch and disconnect multiplug.
3. Release harness clip from control unit retaining stud.
4. Remove 2 nuts securing control unit and remove control unit.

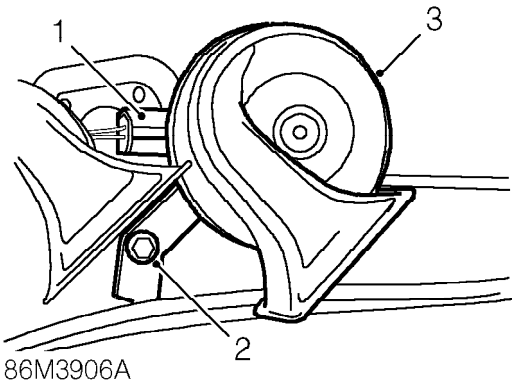
Refit

1. Position control unit, fit and tighten nuts.
2. Connect multiplug and secure catch.
3. Connect harness clip to retaining stud.
4. Reposition carpet and door seal.

HORN

Service repair no - 86.30.10

Remove



1. Disconnect horn multiplug.
2. Remove bolt securing horn to valance.
3. Remove horn.

Refit

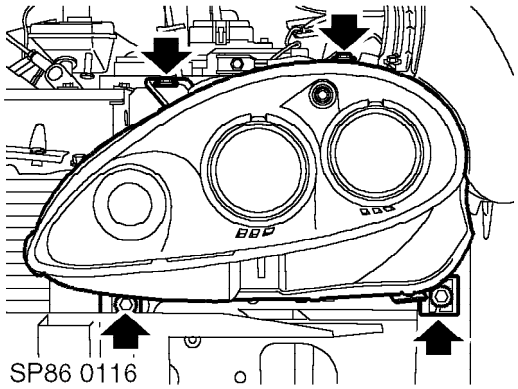
1. Position horn to valance fit bolt and tighten to 8 Nm.
2. Connect multiplug.

HEADLAMP ASSEMBLY

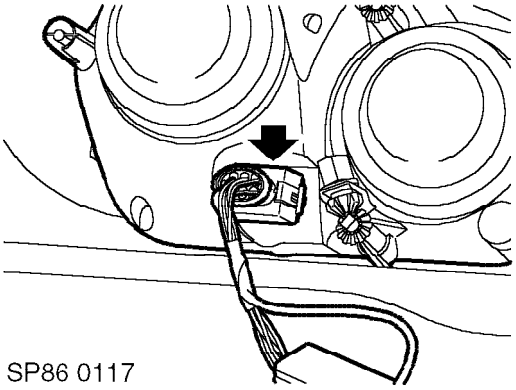
Service repair no - 86.40.49

Remove

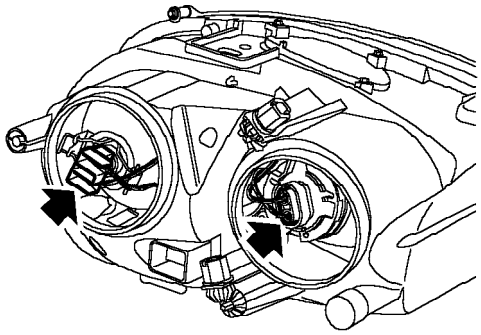
1. Remove front bumper valance. ***See BODY, Exterior fittings.***



2. Remove 4 bolts securing headlamp assembly to front panel and release headlamp assembly.

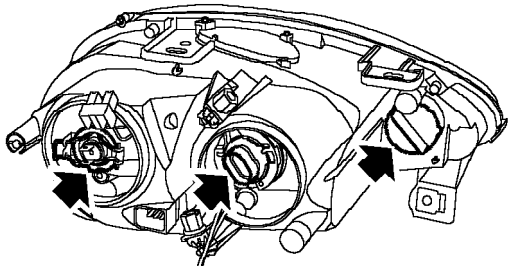


3. Disconnect headlamp multiplug and remove headlamp assembly.
4. Remove both headlamp bulb covers.



SP86 0119

5. Disconnect both headlamp bulb multiplugs.



SP86 0120

6. Release bulb holders and remove both headlamp bulbs.
7. Release and remove indicator bulb holder and bulb.

Refit

1. Fit indicator bulb and bulb holder.
2. Fit headlamp bulbs and secure bulb holders.
3. Connect headlamp bulb multiplugs.
4. Fit headlamp bulb covers.
5. Position headlamp assembly to front panel and connect headlamp multiplug.
6. Fit bolts securing headlamp to front panel and tighten to 10 Nm.
7. Fit front bumper valance. ***See BODY, Exterior fittings.***
8. Check/adjust headlamp alignment. ***See BODY, Adjustments.***

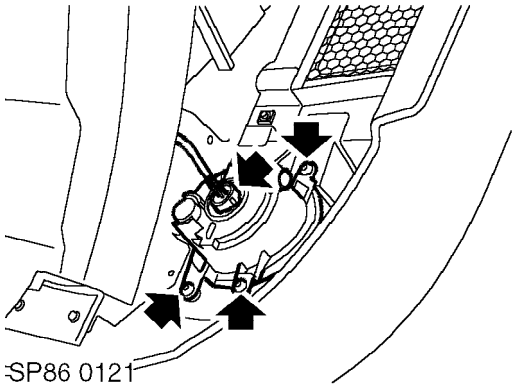
LAMP ASSEMBLY - FOG/DRIVING

Service repair no - 86.40.96

Remove

1. Raise front of vehicle.

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



SP86 0121

2. Disconnect fog/driving lamp multiplug.
3. Remove 3 screws securing fog/driving lamp to bumper valance.
4. Remove fog/driving lamp from bumper valance.

Refit

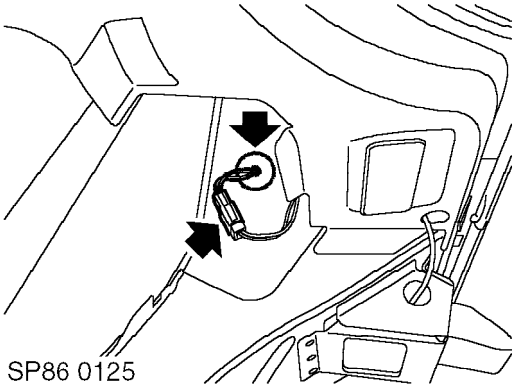
1. Position fog/driving lamp to bumper valance, fit and tighten screws.
2. Connect fog/driving lamp multiplug.
3. Remove stands and lower vehicle.
4. Check operation and alignment of fog lamp.

LAMP ASSEMBLY - CENTRE HIGH MOUNTED STOP (CHMSL)

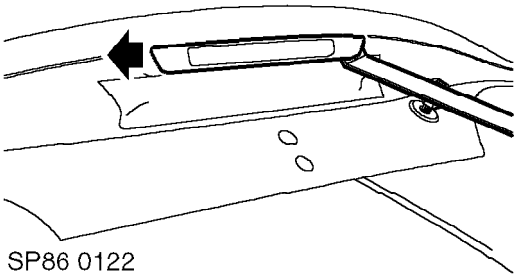
Service repair no - 86.41.32

Remove

1. Apply protective tape to the area around CHMSL.
2. Open boot lid.


SP86 0125

3. Disconnect CHMSL multiplug and release harness grommet.


SP86 0122

4. Using a thin round edged flat blade bent to 20° at the tip, apply pressure to one side of the CHMSL and release from retaining clip.
5. Slide CHMSL from remaining retaining clip.
6. Withdraw harness and CHMSL from boot lid.
7. Remove CHMSL retaining clips from boot lid.

Refit

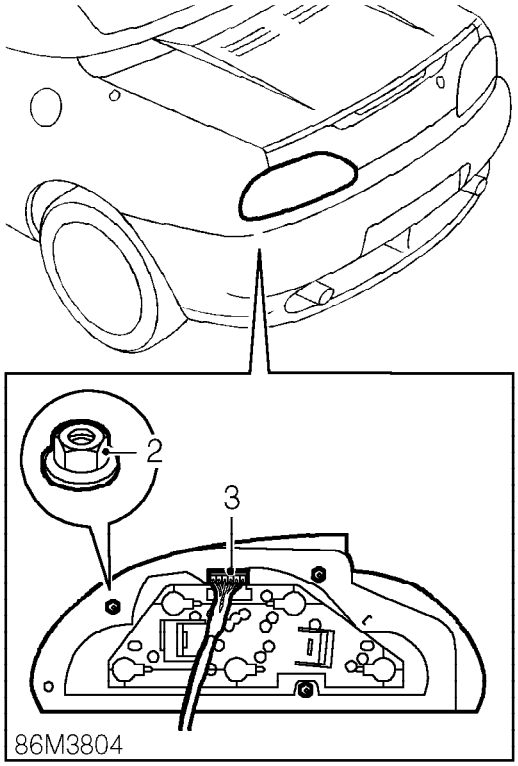
1. Fit retaining clips to CHMSL.
2. Position CHMSL and feed harness through boot lid.
3. Secure CHMSL retaining clips to boot lid.
4. Connect CHMSL multiplug and secure harness grommet.
5. Remove protection from boot lid, clean and inspect paintwork.

TAIL LAMP ASSEMBLY

Service repair no - 86.40.70

Remove

1. Disconnect battery earth lead.



2. Remove 3 nuts securing tail lamp.
3. Release tail lamp and disconnect multiplug.

Refit

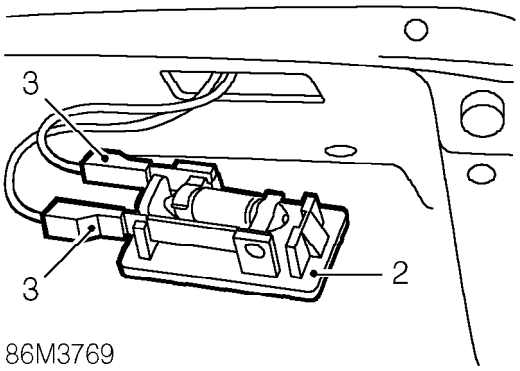
1. Connect multiplug to tail lamp.
2. Fit tail lamp and tighten nuts to 2 Nm.
3. Connect battery earth lead.

GLOVEBOX LAMP

Service repair no - 86.45.08

Remove

1. Open glove box.



2. Release lamp from glovebox.
3. Disconnect 2 Lucars from lamp.
4. Remove lamp.

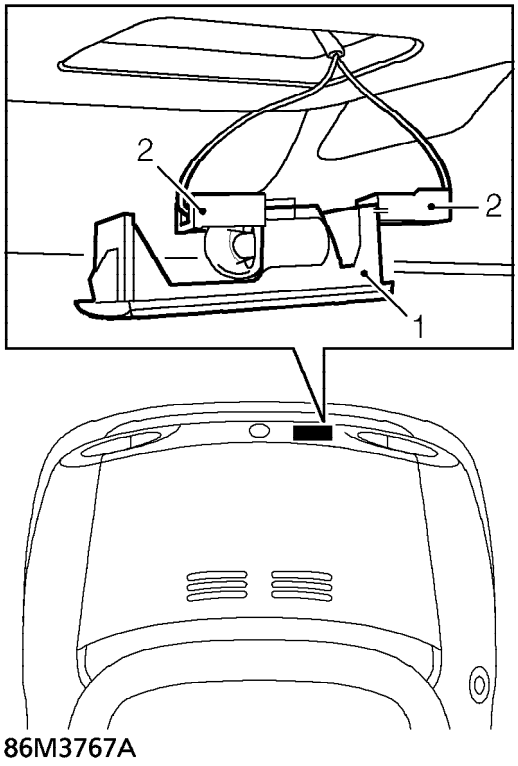
Refit

1. Position lamp and connect Lucars.
2. Secure lamp in glovebox.

BOOT LID LAMP

Service repair no - 86.45.16

Remove



1. Release lamp from boot lid.
2. Disconnect 2 Lucars.
3. Remove lamp.

Refit

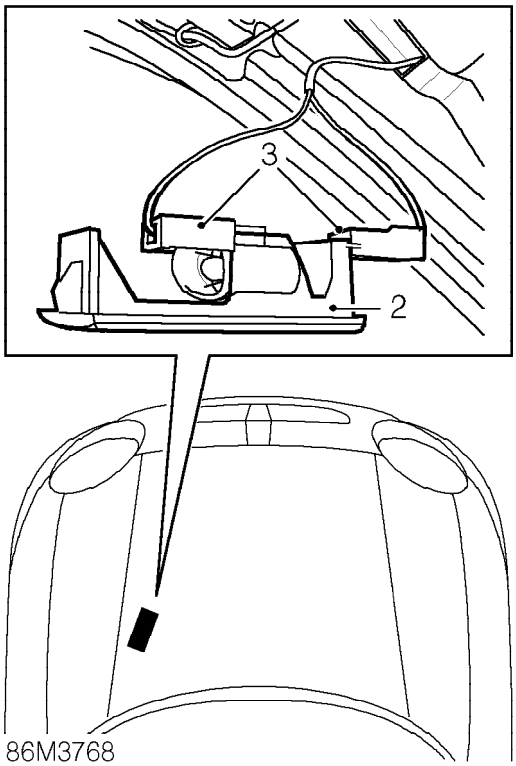
1. Position lamp and connect Lucars.
2. Secure lamp in boot lid.

BONNET LAMP

Service repair no - 86.45.24

Remove

1. Open bonnet.



2. Release lamp from bonnet.
3. Disconnect 2 Lucars.
4. Remove lamp.

Refit

1. Position lamp and connect Lucars.

CAUTION: Ensure black wire is connected to terminal closest to the bulb.

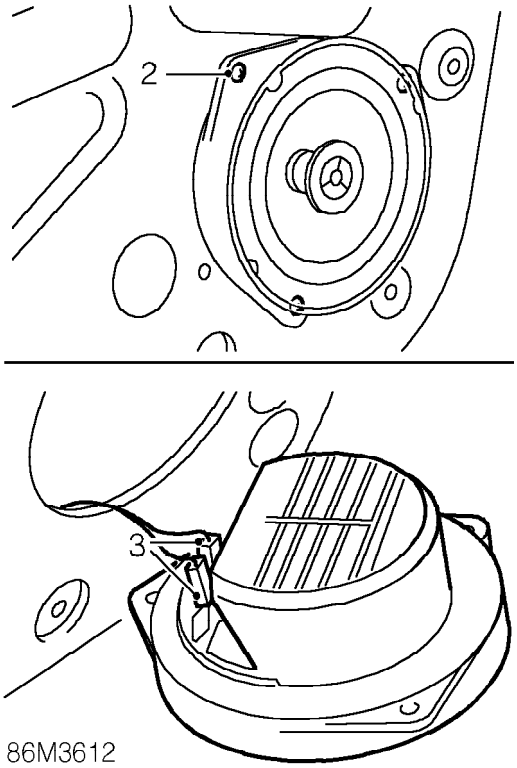
2. Secure lamp in bonnet.

FRONT SPEAKER

Service repair no - 86.50.15

Remove

1. Remove front door trim casing. ***See BODY, Doors.***



86M3612

2. Remove 3 screws securing speaker to door.
3. Release speaker from door, disconnect 2 Lucars.
4. Remove speaker.

Refit

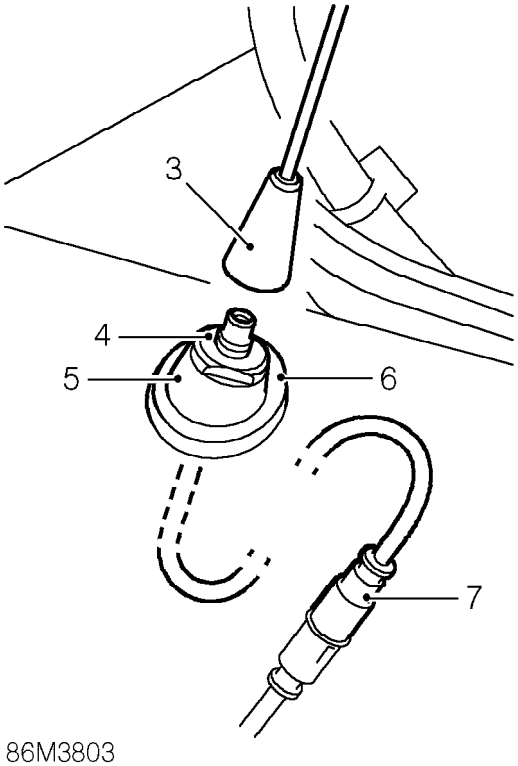
1. Position speaker to door and connect Lucars.
2. Align speaker to door and secure with screws.
3. Fit front door trim casing. ***See BODY, Doors.***

AERIAL

Service repair no - 86.50.18

Remove

1. Remove engine compartment access grille. ***See BODY, Exterior fittings.***



86M3803

2. Unscrew aerial from base.
3. Using a 17 mm open ended spanner, remove aerial base locking nut.
4. Collect locking nut and outer sleeve.
5. Remove aerial base from body.
6. Disconnect aerial coaxial lead from harness.

Refit

1. Position aerial base in body.
2. Fit sleeve and tighten locking nut to 3 Nm.

NOTE: If the vehicle is fitted with a rear spoiler ensure the aerial mast does not contact the rear spoiler before tightening the locking nut.

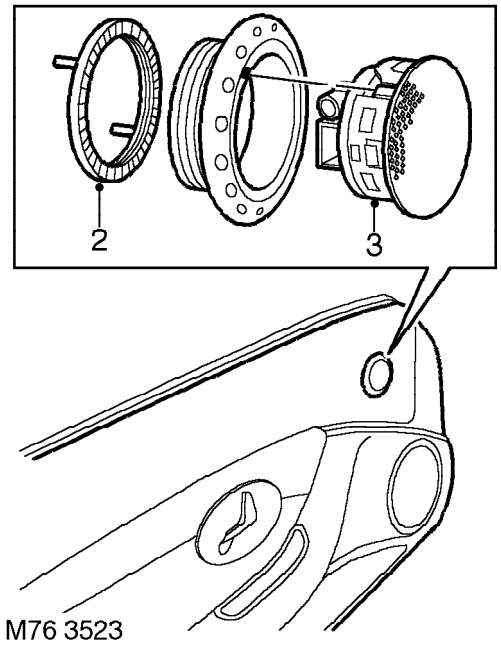
3. Connect aerial coaxial lead to harness.
4. Screw aerial into base.
5. Fit engine compartment access grille. ***See BODY, Exterior fittings.***

SPEAKER - TWEETER

Service repair no - 86.50.34

Remove

1. Remove door casing. ***See BODY, Doors.***



2. Remove backing nut from tweeter assembly and remove tweeter assembly from door casing.
3. Release tweeter from finisher.

Refit

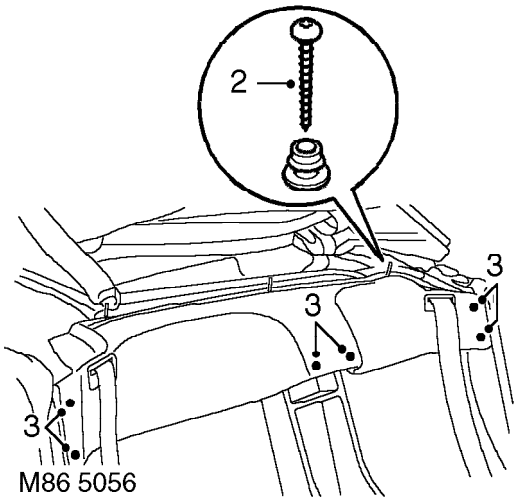
1. Fit tweeter to finisher ensuring correct alignment of key and keyway in finisher.
2. Fit tweeter assembly to door casing and fit backing nut.
3. Fit door casing. ***See BODY, Doors.***

SUBWOOFER ASSEMBLY

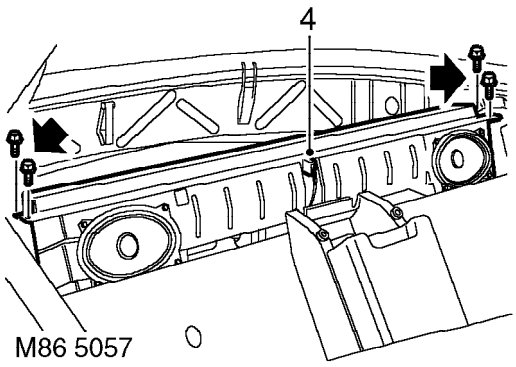
Service repair no - 86.50.51

Remove

1. Move both seats fully forwards.



2. Remove 3 screws securing finisher and collect press studs.
3. Release finisher from fixings and slide downwards for access to subwoofer assembly.



4. Disconnect multiplug from subwoofer.
5. Remove 4 bolts securing subwoofer to body fixings and remove subwoofer assembly.

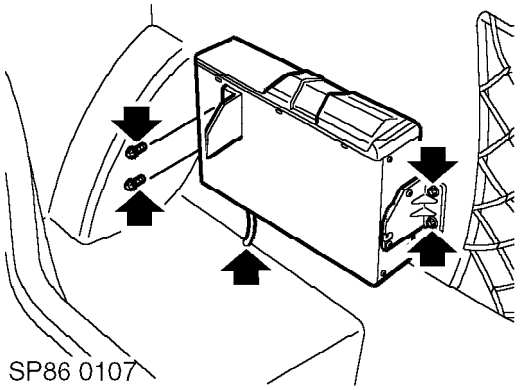
Refit

1. Position subwoofer assembly and connect multiplug.
2. Fit and tighten 4 bolts securing subwoofer to body.
3. Align finisher to fixings and secure into position.
4. Position press studs and secure with screws.
5. Return seats to original position.

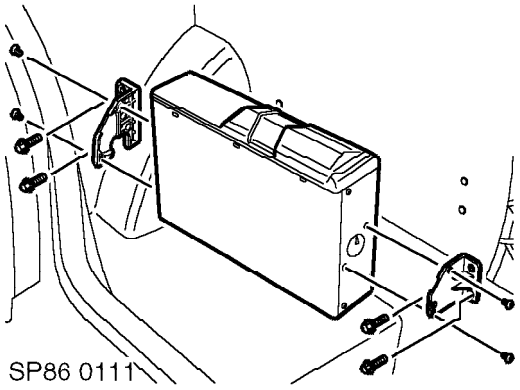
AUTO CHANGER - KENWOOD AUDIO SYSTEMS

Service repair no - 86.50.60

Remove

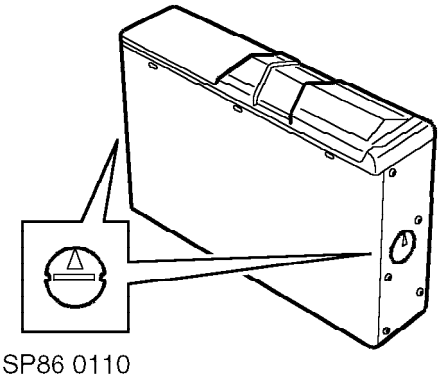


1. Release multiplug from auto changer. Remove 4 bolts securing auto changer to vehicle and remove autochanger.



2. Remove 4 screws securing support brackets to auto changer and remove brackets.

Refit



SP86 0110

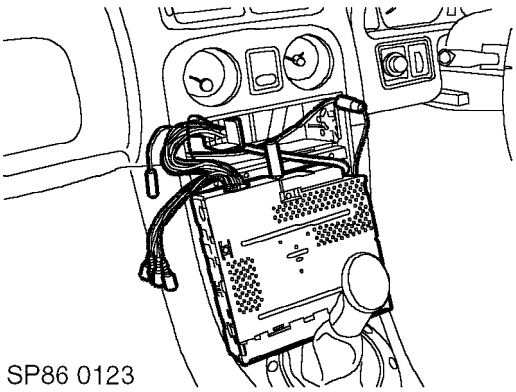
1. Set the angle adjustment switches on the auto changer to 90° .
2. Attach brackets to auto changer with 4 screws and secure to vehicle with 4 bolts. Tighten bolts to 5 Nm.
3. Connect auto changer multiplug to auto changer.
4. Check head unit and auto changer for correct operation.

HEAD UNIT - KENWOOD AUDIO SYSTEMS

Service repair no - 86.50.81

Remove

1. Disconnect battery earth lead.
2. Remove audio unit escutcheon.
3. Insert Kenwood removal tools into slots either side of head unit. Push removal tools upwards and pull head unit out of aperture.

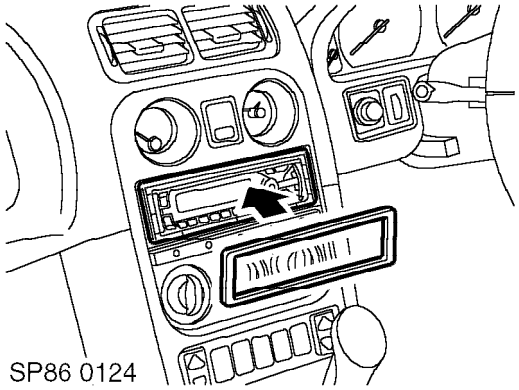


SP86 0123

4. Disconnect multiplugs, aerial cable and auto changer data cable (if fitted). Remove head unit.
5. Release retaining tags and remove cage from centre console.

Refit

1. Position audio unit cage to centre console and secure with retaining tags.
2. Position audio unit, fit threaded rubber bung, connect aerial cable, CD auto changer data cable (if fitted) and multiplugs.
3. Slide audio unit into cage until retaining clips engage. Ensure that rubber support stud locates in rear support plate.



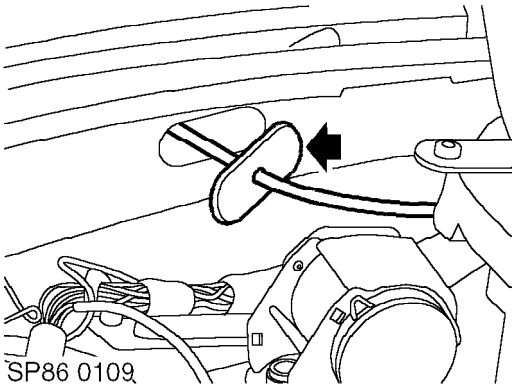
4. Fit audio unit escutcheon, ensuring that the felt strip is located on the bottom inner edge. Locate the top edge lugs and then push the bottom edge in until the retaining tags click into position.
5. Connect battery earth lead.
6. Check audio unit including CD auto changer for correct operation and program suitable radio stations on all pre-sets.

HEAD UNIT AND AUTO CHANGER - KENWOOD AUDIO SYSTEMS - RENEW

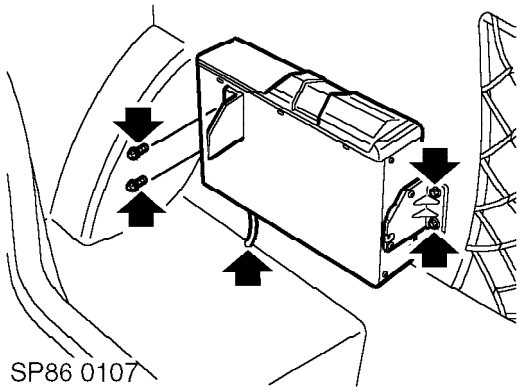
Service repair no - 86.50.93

Remove

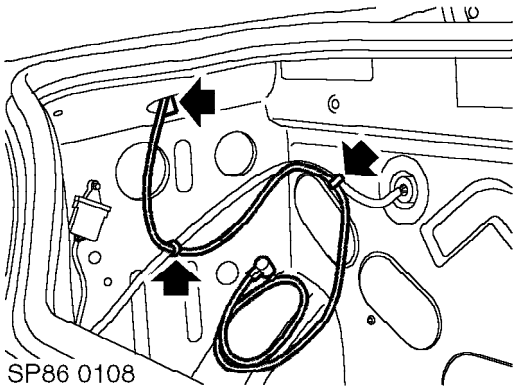
1. Lower both windows and release both hood catches but do not lower hood.
2. Release rear edge of hoodwell carpet and release 5 clips.
3. Unzip top edge or rear window and lay window in hoodwell.
4. Fold rear of hood up to release from body.
5. Disconnect battery earth lead.
6. Remove head unit. ***See this section.***
7. Remove centre console closing panel.
8. Release lower section of LH door seal to release carpet.
9. Remove 5 trim clips securing carpet to LH side of vehicle.
10. Pull back carpet from sill to access harness.
11. Fold back carpet and sound deadening in LH footwell.
12. Release cable ties securing auto changer data cable to harness.



13. Release grommet from body. Remove grommet from auto changer data cable.

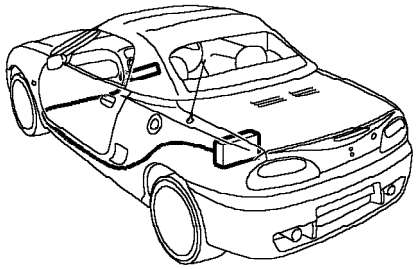

SP86 0107

14. Disconnect auto changer data cable from auto changer, remove 4 bolts securing auto changer brackets to vehicle and remove auto changer.
15. Remove luggage compartment trim. ***See BODY, Interior trim components.***

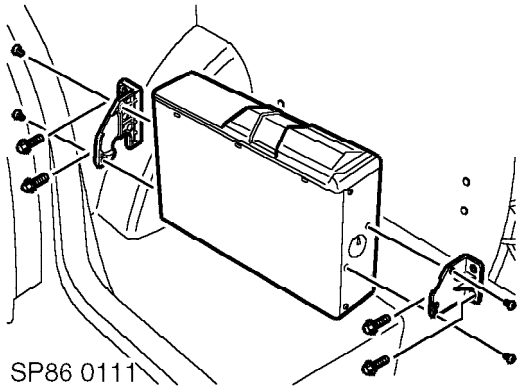

SP86 0108

16. Remove cable ties securing auto changer data cable to harness.
17. Remove auto changer data cable.

Refit


SP86 0114

1. Route auto changer cable behind console closing panel and into audio unit aperture.
2. Route auto changer data cable under sound deadening and carpet in LH footwell and along harness. Secure with cable ties.
3. Route auto changer data cable under roof hinge and into hood compartment. Secure with cable ties.
4. Replace sound deadening and secure carpet with trim clips.
5. Position centre console closing panel, connect Lucar connectors and secure closing panel with screws.
6. Fit lower section of LH door seal to secure carpet.
7. Fit new grommet to auto changer data cable. Feed data cable through aperture and fit new grommet to body.
8. Feed auto changer data cable along cavity and into luggage compartment. Secure with supplied cable tie clip and attach to body to prevent damage to cable.
9. Secure auto changer data cable to harness with cable ties and feed through luggage compartment trim.
10. Position luggage compartment trim.
11. Feed auto changer data cable through slit in luggage compartment trim.
12. Refit luggage compartment trim. ***See BODY, Interior trim components.***



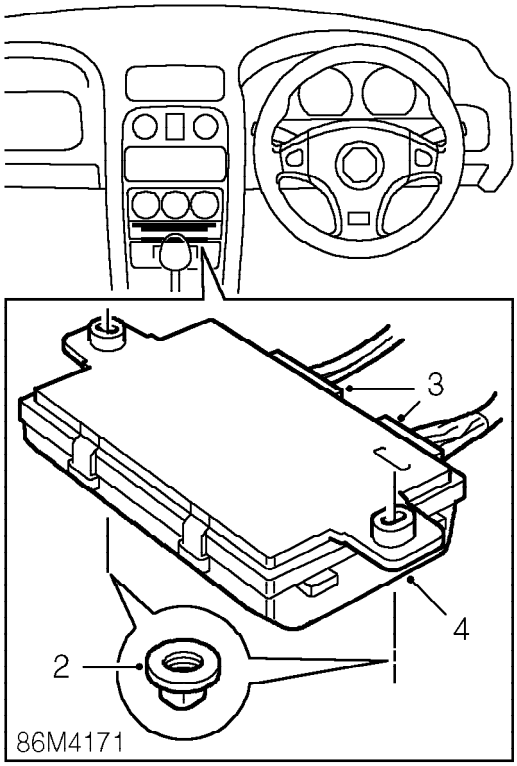
13. Attach brackets to auto changer with 4 screws and secure to vehicle with 4 bolts. Tighten bolts to 5 Nm.
14. Connect auto changer multiplug to auto changer.
15. Lower rear of hood and engage clips to secure rear of hood to body.
16. Engage hoodwell carpet beneath flip seal.
17. Position rear window and zip up top edge.
18. Secure catches to secure front of hood.
19. Fit head unit. ***See this section.***
20. Connect battery earth lead.
21. Raise windows.
22. Check audio unit including CD auto changer for correct operation and program suitable radio stations on all pre-sets.

ANTI-THEFT ALARM ECU

Service repair no - 86.55.85

Remove

1. Remove 4 screws securing both closing panels to front console and position panels aside.



2. Remove 2 nuts securing alarm ECU to heater control unit.
3. Disconnect 2 multiplugs from alarm ECU.
4. Remove alarm ECU.

Refit

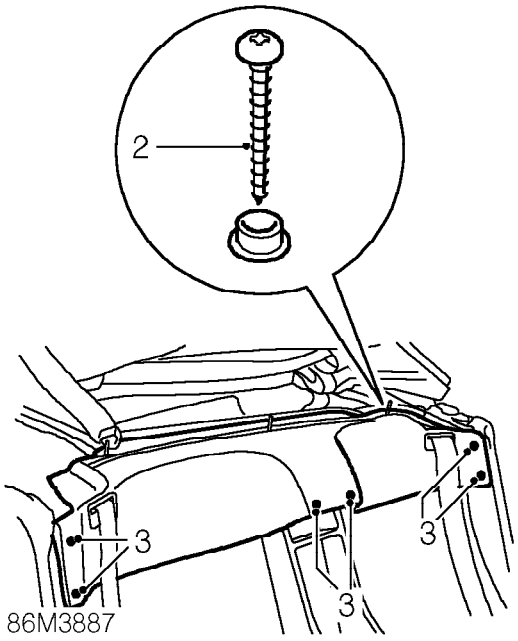
1. Connect multiplugs to alarm ECU.
2. Position alarm ECU to heater control unit and tighten nuts to 4 Nm.
3. Fit closing panels and secure with screws.

VOLUMETRIC SENSOR

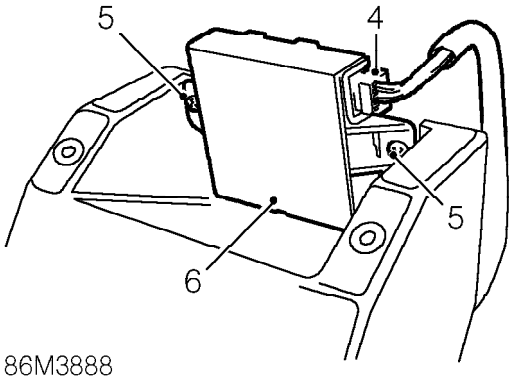
Service repair no - 86.77.29

Remove

1. Position both seats fully forward and position seat squab forward.



2. Remove 3 screws securing rear bulkhead finisher to rear bulkhead and collect 3 studs.
3. Release finisher from 6 clips and position aside.



4. Disconnect multiplug from sensor.
5. Remove 2 screws securing sensor to rear console.
6. Remove sensor.

Refit

1. Fit sensor to console and secure with screws.
2. Connect multiplug.
3. Locate bulkhead finisher and engage clips.
4. Fit studs and secure with screws.
5. Return seats to original position.

STARTER MOTOR

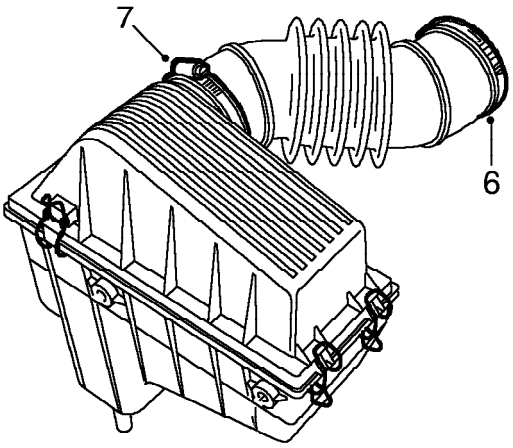
Service repair no - 86.60.01

Remove

1. Disconnect battery earth lead.
2. Remove engine compartment access panel ***See BODY, Exterior fittings.***
3. Raise rear of vehicle.

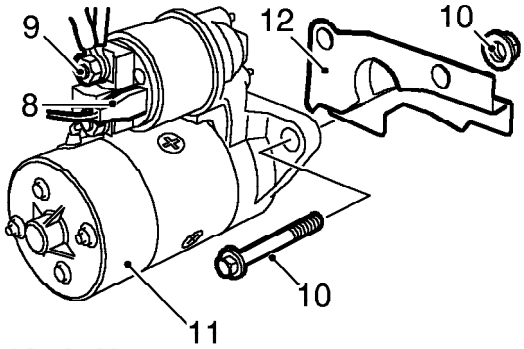
WARNING: Support on safety stands.

4. Remove LH rear wheel.
5. Release EVAP canister from bracket and position canister aside.



86M4177

6. Remove clip and disconnect air intake hose from throttle body.
7. Loosen clip and remove air intake hose from air filter.



86M3760A

8. Disconnect Lucar and release cable tie from starter motor solenoid.
9. Remove nut from solenoid and release 2 leads.
10. Remove 2 nuts and bolts securing starter motor.
11. Remove starter motor.
12. Remove flywheel closing plate.

Refit

1. Clean mating faces of starter motor and gearbox.
2. Fit starter motor.
3. Fit closing plate.
4. Fit nuts and bolts and tighten nuts to 80 Nm.
5. Fit leads to starter solenoid and tighten terminal nut.
6. Connect Lucar to starter solenoid.
7. Secure cables to starter solenoid with cable tie.
8. Fit air intake hose to air filter and to throttle body.
9. Tighten clip securing air intake hose to air filter, fit clip securing air intake hose to throttle body.
10. Fit EVAP canister.
11. Fit road wheel(s), fit wheel nuts and tighten in a diagonal sequence to 70 Nm.
12. Remove stand(s) and lower vehicle.
13. Fit engine compartment access panel. ***See BODY, Exterior fittings.***
14. Connect battery earth lead.

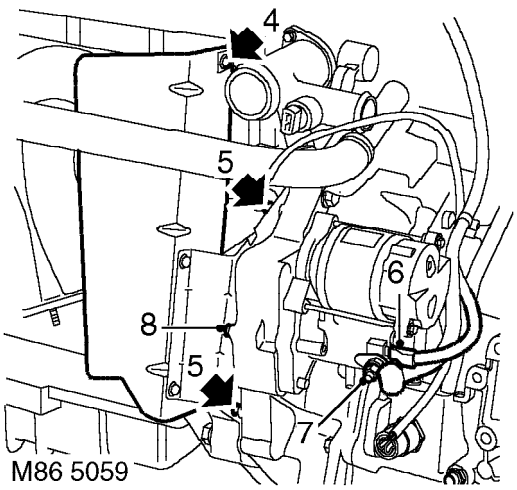
STARTER MOTOR - STEPSPEED (Em-CVT) MODELS

Service repair no - 86.60.01

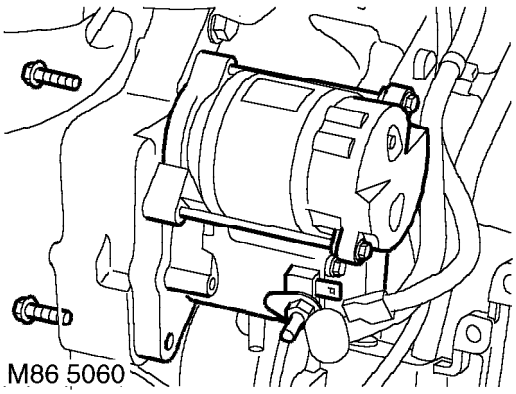
Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***
3. Raise rear of vehicle.

WARNING: Support on safety stands.



4. Remove bolt securing coolant hose heat shield to bracket on exhaust manifold.
5. Remove 2 bolts securing coolant hose heat shield to cylinder block and remove heat shield.
6. Disconnect Lucar from starter solenoid.
7. Remove nut from starter solenoid and release 2 leads.
8. Remove 1 bolt and remove flywheel cover.



9. Remove 2 bolts securing starter motor and remove starter motor.

Refit

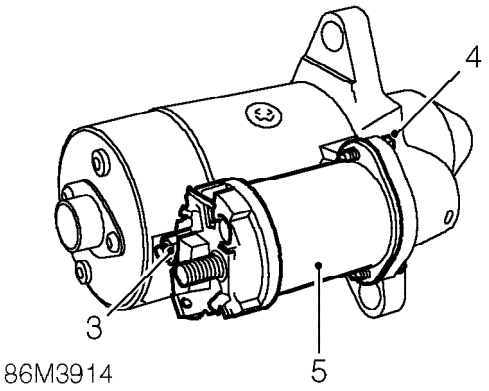
1. Clean mating faces of starter motor and gearbox.
2. Fit starter motor and align to dowel.
3. Fit bolts and tighten to 80 Nm.
4. Fit leads to starter solenoid and tighten terminal nut.
5. Connect Lucar to starter solenoid.
6. Fit flywheel cover and tighten bolt to 9 Nm.
7. Fit exhaust manifold heat shield and tighten bolts to 9 Nm.
8. Remove stand(s) and lower vehicle.
9. Fit engine cover. ***See ENGINE, Repairs.***
10. Connect battery earth lead.

STARTER SOLENOID

Service repair no - 86.60.08

Remove

1. Disconnect battery earth lead.
2. Remove starter motor. ***See this section.***



3. Remove nut from solenoid and disconnect lead.
4. Remove 2 bolts securing solenoid to starter motor housing.
5. Remove solenoid from starter motor housing.
6. Remove plunger from starter.

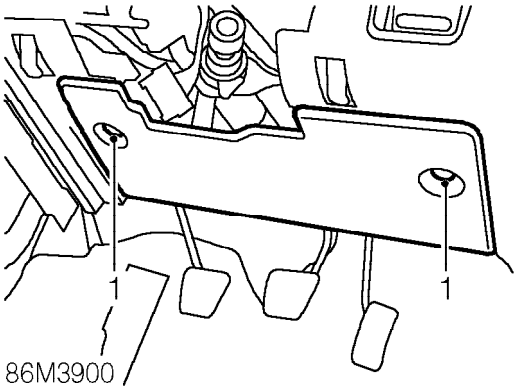
Refit

1. Apply grease to lever end of plunger.
2. Fit starter solenoid to starter motor housing and tighten bolts.
3. Fit lead to rear of solenoid and tighten nut.
4. Fit starter motor. ***See this section.***
5. Connect battery earth lead.

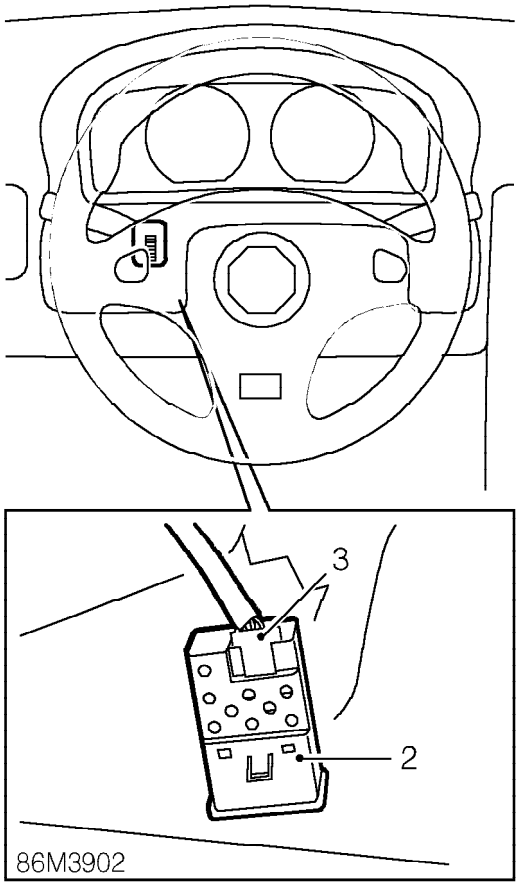
PANEL DIMMER RESISTOR

Service repair no - 86.65.37

Remove



1. Release 2 clips and open fuse box cover.



2. Release dimmer resistor from instrument cowl.
3. Disconnect multiplug from dimmer.

Refit

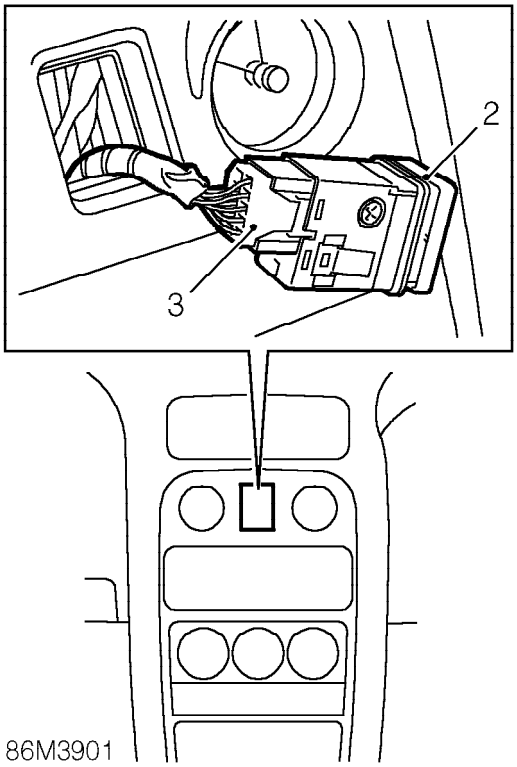
1. Connect multiplug and engage dimmer to cowl.
2. Position fuse box cover and secure with clips.

HAZARD WARNING LAMP SWITCH

Service repair no - 86.65.50

Remove

1. Release radio from console. ***See this section.***



2. Release hazard warning lamp switch from console.
3. Disconnect multiplug from switch.

Refit

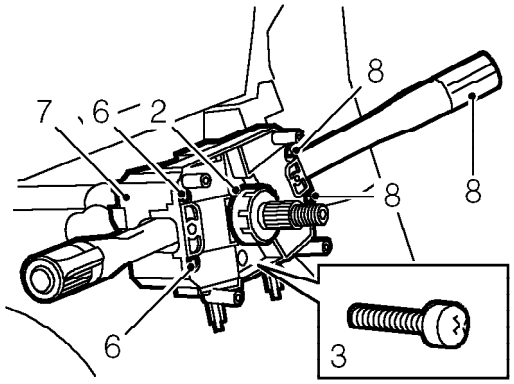
1. Connect multiplug and engage switch to console.
2. Secure radio to console. ***See this section.***

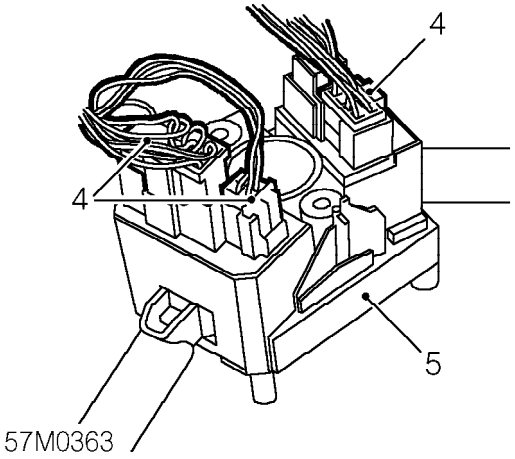
STEERING COLUMN SWITCH PACK

Service repair no - 86.65.55

Remove

1. Remove rotary coupler. ***See GENERAL INFORMATION, SRS Precautions.***





2. Remove direction indicator cancellation cam from column.
3. Remove 2 screws securing switch pack to steering column.
4. Release switch pack from column and disconnect 3 multiplugs.
5. Remove switch pack.
6. Remove 2 screws securing direction/ headlamp stalk to switch pack.
7. Remove direction/headlamp stalk from switch pack.
8. Remove 2 screws securing wash wipe stalk to switch pack.
9. Remove wash wipe stalk from switch pack.

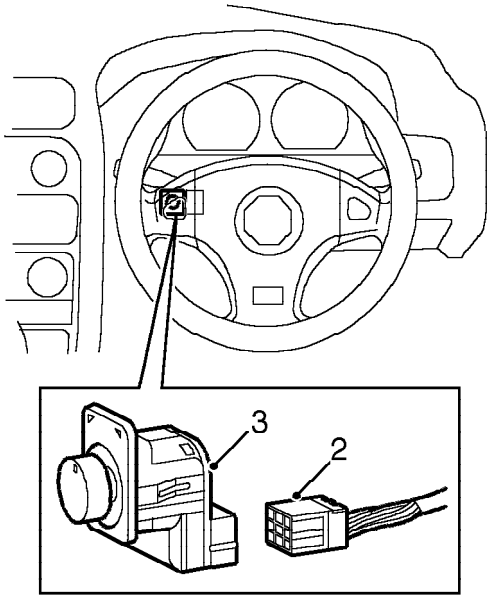
Refit

1. Fit wash wipe stalk to switch pack and secure with screws.
2. Fit indicator/headlamp stalk to switch pack and tighten screws.
3. Position switch pack to steering column, connect 3 multiplugs and tighten screws.
4. Fit direction indicator cancellation cam to steering column.
5. Fit rotary coupler. ***See GENERAL INFORMATION, SRS Precautions.***

SWITCH - EXTERIOR MIRROR

Service repair no - 86.65.75

Remove



M86 5066

1. Carefully remove switch from fascia.
2. Disconnect multiplug from switch.
3. Remove switch.

Refit

1. Position switch and connect multiplug.
2. Carefully push switch back into position.

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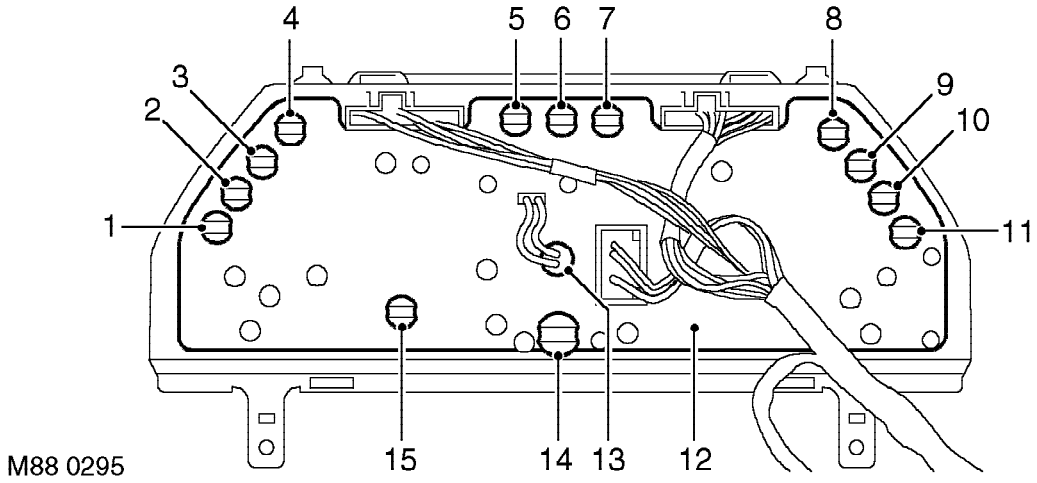
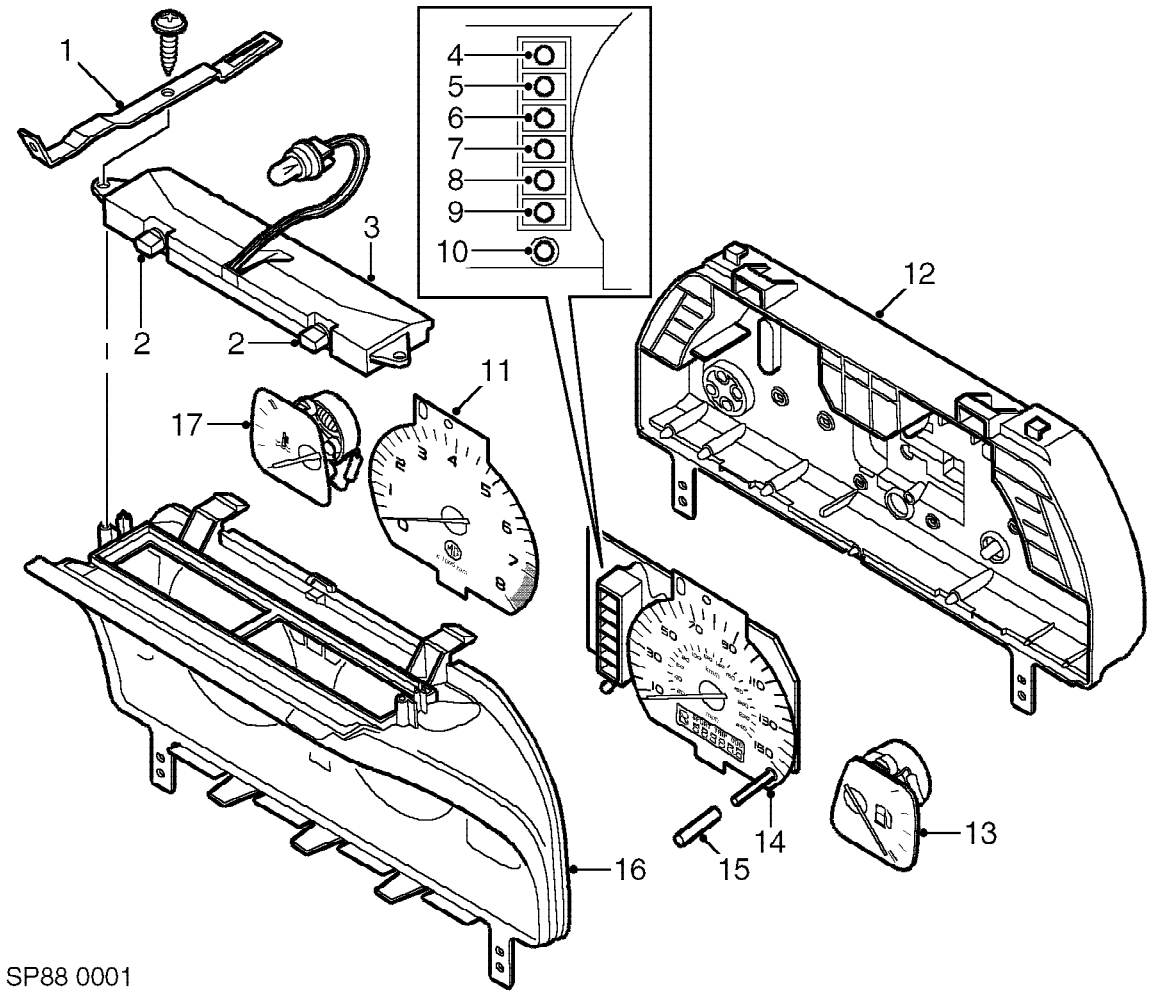
INSTRUMENT PACK COMPONENTS - REAR VIEW



1. Rear fog lamps - warning light bulb
2. Gearbox fault (Stepspeed gearbox only) - warning light bulb
3. Hazard warning lamps - warning light bulb
4. Brake fail / Handbrake - warning light bulb
5. RH direction indicator - warning light bulb
6. Main beam - warning light bulb
7. LH direction indicator - warning light bulb
8. Low oil pressure - warning light bulb
9. Ignition / No charge - warning light bulb
10. Malfunction Indicator Lamp (MIL) - warning light bulb
11. ABS - warning light bulb
12. Main printed circuit board
13. Panel rear illumination bulb
14. Anti-theft alarm LED
15. LCD illumination bulb

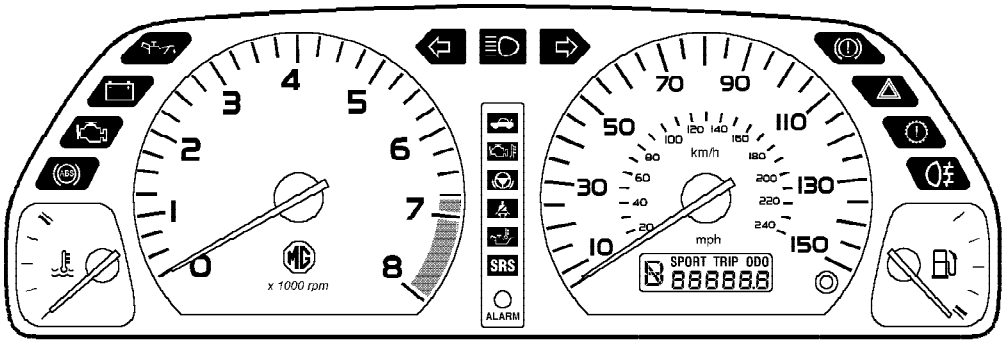
INSTRUMENT PACK COMPONENTS - EXPLODED VIEW



1. Support bracket
2. Panel front illumination bulbs
3. Panel illumination and printed circuit
4. Boot open - warning light bulb
5. Engine bay cooling fan - warning light bulb
6. EPAS - warning light bulb
7. Seat belt - warning light bulb
8. Oil temperature - warning light bulb
9. SRS - warning light bulb
10. Anti-theft warning LED
11. Tachometer
12. Instrument panel housing
13. Fuel gauge
14. Speedometer
15. Control knob - trip distance
16. Instrument panel and face plate
17. Coolant temperature gauge

INSTRUMENT PACK

Instrument pack



SP88 0002

Speedometer

The speedometer is operated electronically by a signal output from a speed transducer fitted to the gearbox. The transducer output is shared with the EPAS ECU.

Odometer and trip distance is displayed on an LCD located at the bottom of the speedometer. A button allows the trip and odometer to be displayed individually. The button will also reset the trip meter if pressed and held. The LCD also shows gearbox information when the vehicle is fitted with a Stepspeed (Em-CVT) gearbox.

Tachometer

The tachometer signal is taken from the MEMS ECU to the control board which is secured to the rear of the tachometer sub-assembly. The instrument panel display reading is averaged over all the engine cylinders to reduce fluctuations due to individual cylinder retardation in spark timing which may occur on engines fitted with programmed ignition systems.

Fuel gauge

The fuel gauge is driven by an air cored electronic movement which is fluid damped. Fluid damping reduces the movement of the gauge pointer caused by fluid movement in the tank.

The fuel tank gauge unit comprises a float and is connected to a wire-wound resistor which is connected to the fuel gauge and back through the instrument panel to earth. The resistor controls the current flow through to the fuel gauge circuit, which in turn drives the gauge movement against the resistance of the fluid damping.

When the gauge unit float is at its lowest point, indicating an empty fuel tank, the resistance to earth is at its greatest. The resistance value to fuel gauge position to earth is:

Sender resistance	Fuel gauge position
105 Ω	Empty
32.5 Ω	Half full
5 Ω	Full

The fuel gauge pointer will display the level of fuel in the tank when the ignition was last switched off.

Coolant temperature gauge

The coolant temperature gauge is fitted with a return magnet causing the gauge to return to zero when the ignition is switched off.

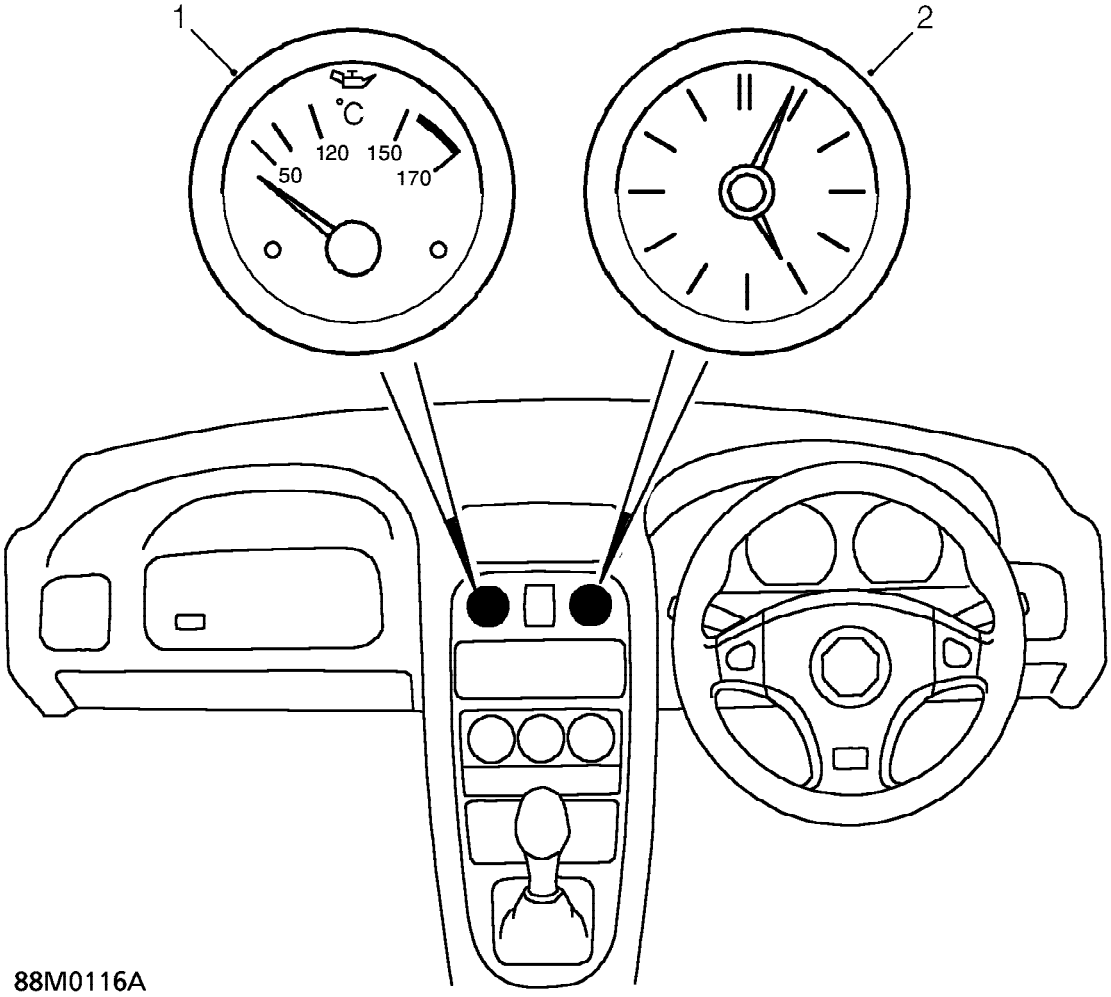
Thermistor resistance	Temperature	Gauge position
142 Ω	56°C	No movement
49 - 98 Ω	65°C - 85°C	Approx. one third
24.6 - 32.1 Ω	100°C - 110°C	Approx. halfway
16.9 Ω	125°C	Enters red sector

Instrument illumination

Four bulbs provide instrument illumination, 2 x 14V, 1.4W for back illumination and 2 x 14V, 1.4W for front illumination.

Operation

For operation of the instrument pack. See **ELECTRICAL REFERENCE LIBRARY, Description and Operation.**



1. Oil temperature gauge
2. Analogue clock

Oil temperature gauge

Th oil temperature gauge (1) is fitted with a return magnet causing the gauge to return to zero when the ignition is switched off.

170°C sender

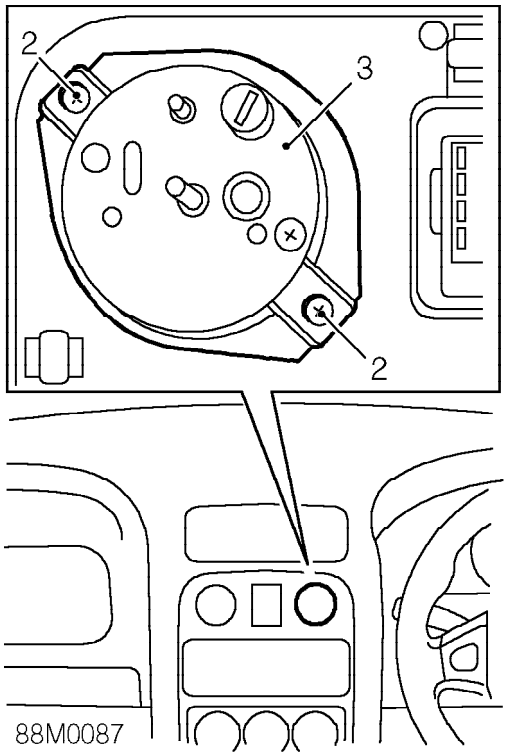
Sender resistance	Temperature
574 Ω ±71 Ω	60°C
202 Ω ±24 Ω	90°C
84 Ω ±9 Ω	120°C

CLOCK

Service repair no - 88.15.07

Remove

1. Remove centre console panel. ***See BODY, Interior trim components.***



2. Remove 2 screws securing clock to console.
3. Remove retaining bracket, clock and 'O' ring.

Refit

1. Position 'O' ring and clock to console.
2. Fit retaining bracket and secure with screws.

NOTE: Ensure correct orientation of clock in console.

3. Fit centre console panel. ***See BODY, Interior trim components.***

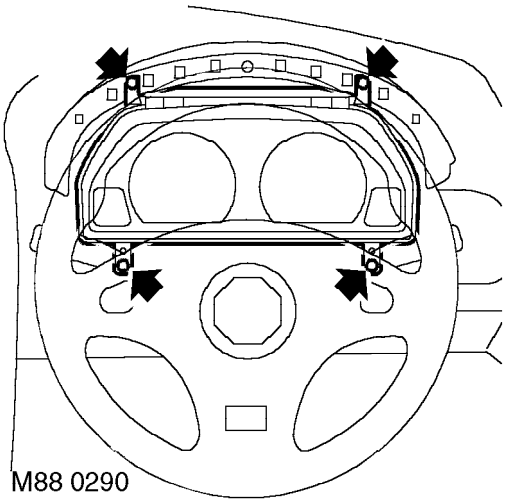
INSTRUMENT PACK

Service repair no - 88.20.01/99

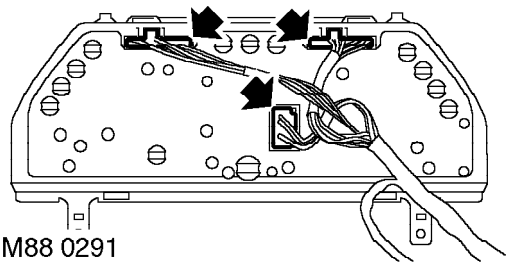
WARNING: *See GENERAL INFORMATION, SRS Precautions.*

Remove

1. Make the system safe. ***See GENERAL INFORMATION, SRS Precautions.***
2. Remove instrument cowl. ***See this section.***



3. Remove 4 screws securing instrument pack to fascia.
4. Release instrument pack from fascia.



5. Release 3 multiplugs from pack and remove instrument pack.

Refit

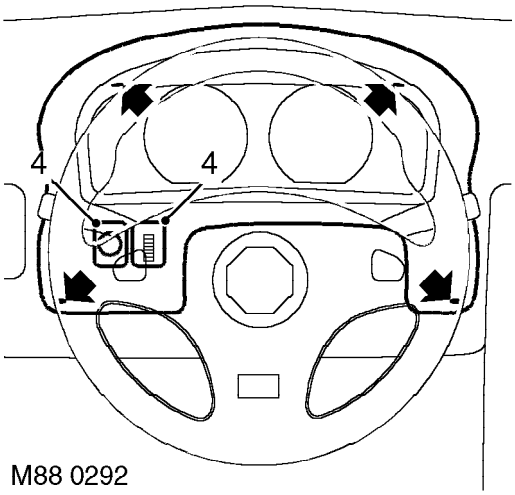
1. Position instrument pack to fascia and connect multiplugs.
2. Position instrument pack and secure with screws.
3. Fit instrument cowl. ***See this section.***

INSTRUMENT COWL

Service repair no - 88.20.02

Remove

1. Remove steering column nacelle. ***See STEERING, Repairs.***



M88 0292

2. Remove 4 screws securing instrument cowl to fascia.
3. Release cowl from fascia.
4. Disconnect multiplugs from dimmer resistor and door mirror selector switch.
5. Remove cowl.
6. Remove dimmer and mirror switch from cowl.

Refit

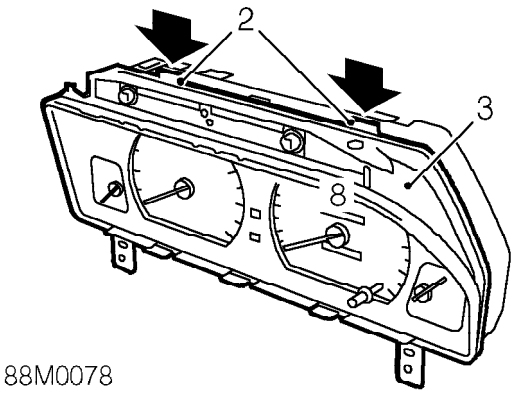
1. Fit dimmer and mirror switch to cowl.
2. Position cowl and connect multiplugs.
3. Position cowl to fascia and secure with screws.
4. Fit steering column nacelle. ***See STEERING, Repairs.***

INSTRUMENT PACK WINDOW

Service repair no - 88.20.06

Remove

1. Remove instrument illumination housing. ***See this section.***



88M0078

2. Release 4 clips securing panel window to instruments.
3. Remove instrument pack window.

Refit

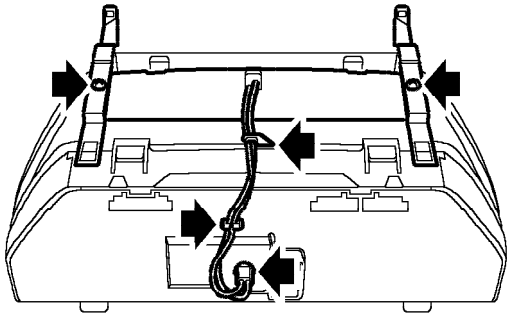
1. Fit pack window and secure with clips.
2. Fit instrument illumination housing. ***See this section.***

INSTRUMENT ILLUMINATION HOUSING

Service repair no - 88.20.07

Remove

1. Remove instrument pack. ***See this section.***


SP88 0003

2. Remove 2 screws securing brackets to instrument pack and collect brackets.
3. Release bulb holder from casing and cables from 2 casing clips.
4. Remove instrument illumination housing.

Refit

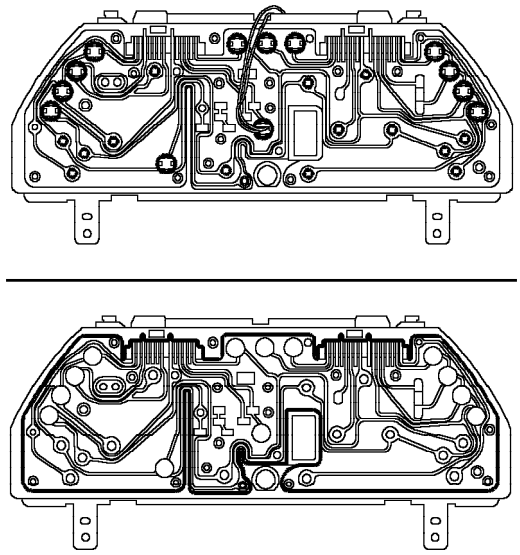
1. Position illumination housing to casing.
2. Fit brackets and secure with screws.
3. Secure bulb holder and secure cables to clips.
4. Fit instrument pack. ***See this section.***

PRINTED CIRCUIT BOARD

Service repair no - 88.20.19

Remove

1. Remove instrument pack. ***See this section.***



SP88 0004

2. Noting their fitted positions remove 12 bulbs from PCB.
3. Remove 14 screws securing PCB to casing.
4. Release PCB from 14 lugs and remove PCB.

Refit

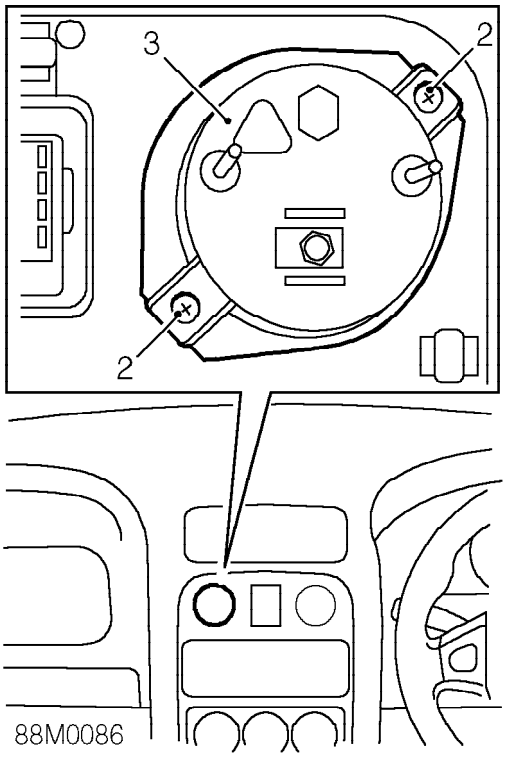
1. Position PCB and engage lugs.
2. Secure PCB with screws.
3. Fit bulbs.
4. Fit instrument pack. ***See this section.***

OIL TEMPERATURE GAUGE

Service repair no - 88.25.02

Remove

1. Remove centre console panel. ***See BODY, Interior trim components.***



2. Remove 2 screws securing gauge to console.
3. Remove retaining bracket, gauge and 'O' ring.

Refit

1. Position 'O' ring and gauge to console.
2. Fit retaining bracket and secure with screws.

NOTE: Ensure correct orientation of gauge in console.

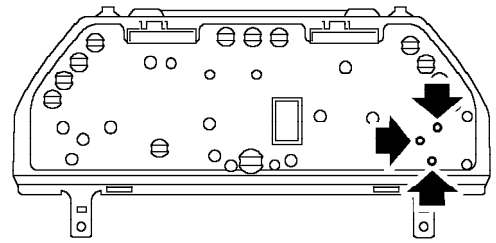
3. Fit centre console panel. ***See BODY, Interior trim components.***

COOLANT TEMPERATURE GAUGE

Service repair no - 88.25.14

Remove

1. Remove instrument pack window. ***See this section.***


SP88 0005

2. Remove 3 screws securing temperature gauge to casing.
3. Remove gauge.

Refit

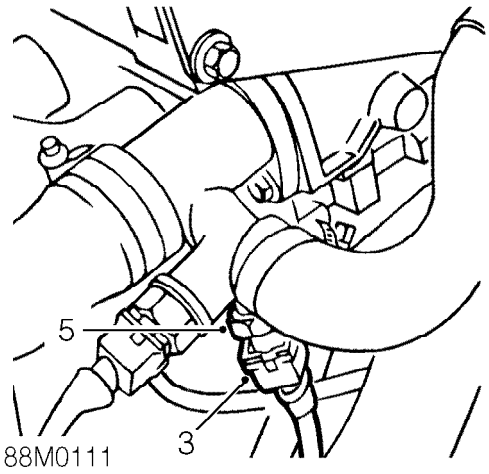
1. Fit gauge to instrument pack and secure with screws.
2. Fit instrument pack window. ***See this section.***

ENGINE COOLANT TEMPERATURE GAUGE SENSOR

Service repair no - 88.25.20

Remove

1. Disconnect battery earth lead.
2. Remove engine cover. ***See ENGINE, Repairs.***



3. Disconnect multiplug from sensor.
4. Position a container below sensor to collect coolant spillage
5. Remove sensor.

Refit

1. Clean threads of sensor.
2. Apply Loctite 577 to threads of sensor.
3. Fit sensor and tighten to 6 Nm.
4. Connect multiplug to sensor.
5. Fit engine cover. ***See ENGINE, Repairs.***
6. Connect battery earth lead.
7. Top-up coolant, ***See COOLING SYSTEM, Adjustments.***

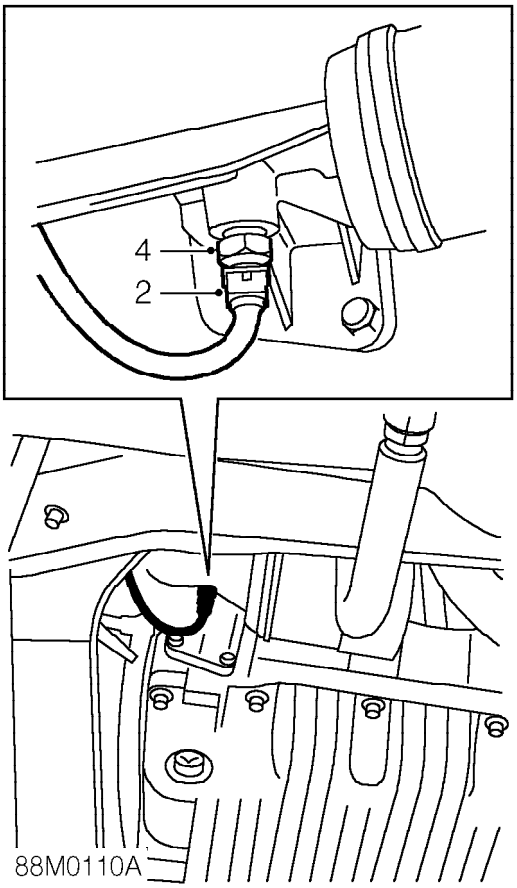
ENGINE OIL TEMPERATURE GAUGE SENSOR

Service repair no - 88.25.21

Remove

1. Raise rear of vehicle.

WARNING: Support on safety stands.



2. Disconnect multiplug from sensor.
3. Position spillage tray.
4. Remove sensor from oil filter housing.

Refit

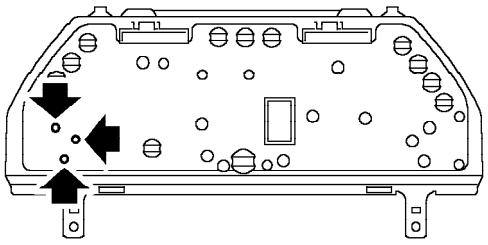
1. Fit oil temperature sensor to oil filter housing and tighten to 15 Nm.
2. Remove spillage tray.
3. Connect multiplug to sensor.
4. Remove stand(s) and lower vehicle.
5. Check and top up engine oil level. ***See MAINTENANCE.***

FUEL GAUGE

Service repair no - 88.25.26

Remove

1. Remove instrument pack window. ***See this section.***


SP88 0006

2. Remove 3 screws securing fuel gauge to casing.
3. Remove gauge.

Refit

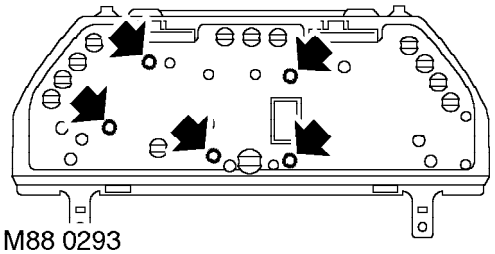
1. Fit gauge to instrument pack and secure with screws.
2. Fit instrument pack window. ***See this section.***

SPEEDOMETER

Service repair no - 88.30.01

Remove

1. Remove tachometer. ***See this section.***


M88 0293

2. Remove 5 screws securing speedometer to casing.
3. Remove speedometer.

Refit

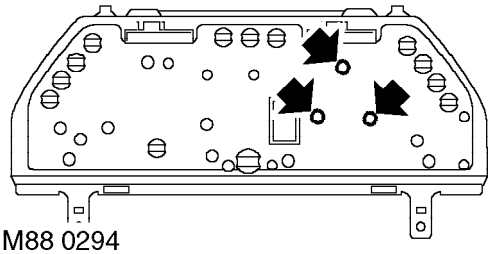
1. Fit speedometer to instrument pack and secure with screws.
2. Fit tachometer. ***See this section.***

TACHOMETER

Service repair no - 88.30.21

Remove

1. Remove instrument pack window. ***See this section.***


M88 0294

2. Remove 3 screws securing tachometer to casing.
3. Remove tachometer .

Refit

1. Fit tachometer to instrument pack and secure with screws.
2. Fit instrument pack window. ***See this section.***