DEFENDER V8i

Workshop Manual Supplement

Werkplaatshandboek supplement

Supplément au Manuel d'Atelier

Nachtrag zur Werkstatthandbuch

Supplemento Manuale d'Officina

Suplemento del Manual de Taller

Suplemento ao Manual de Oficina

Workshop manual supplement
DEFENDER V8i

This manual covers Defender 4.0 V8i vehicles from VIN 152368.

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01 - INTRODUCTION

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INFORMATION

INTRODUCTION

This workshop manual covers Defender 4.0 V8i vehicles only, and is designed to be used in conjunction with the Defender 300TDi workshop manual (LRL 0097ENG). Amendments and additional pages will be issued to ensure that the manual covers latest models. Amendments and additions will be identified by the addition of a dated footer at the bottom of the page.

This Workshop Manual is designed to assist skilled technicians in the efficient repair and maintenance of Land Rover Defender V8i vehicles.

Individuals who undertake their own repairs should have some skill and training, and limit repairs to components which could not affect the safety of the vehicle or its passengers. Any repairs required to safety critical items such as steering, brakes, suspension or supplementary restraint system should be carried out by a Land Rover Dealer. Repairs to such items should NEVER be attempted by untrained individuals.

WARNINGS, CAUTIONS and **NOTES** are given throughout this Manual in the following form:

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

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

NOTE: This calls attention to methods which make a job easier or gives helpful information.

DIMENSIONS

The dimensions quoted are to design engineering specification. Alternative unit equivalents, shown in brackets following the dimensions, have been converted from the original specification.

REFERENCES

References to the left or right hand side in the 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.

To reduce repetition, some 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.

REPAIRS AND REPLACEMENTS

When replacement parts are required it is essential that Land Rover parts are used.
Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories: Safety features embodied in the vehicle may be impaired if other than Land Rover parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the vehicle manufacturer's specification. Torque spanner values given in the Workshop Manual must be strictly adhered to. Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be replaced with a new one. Certain fasteners must not be re-used. These fasteners are specified in the Workshop Manual.

POISONOUS SUBSTANCES

Many liquids and other substances used are poisonous and therefore must not be consumed. It is also advisable to keep all substances away from open wounds. These substances among others include anti-freeze, brake fluid, fuel, windscreen washer additives, air conditioning refrigerant, lubricants and various adhesives.

FUEL HANDLING PRECAUTIONS

The following information provides basic precautions which must be observed if fuel is to be handled safely. It also outlines the other areas of risk which must not be ignored.

This information is issued for basic guidance only, and in any case of doubt, appropriate enquiries should be made of your local Fire Officer or Fire Department.

Fuel vapour is highly flammable and in confined spaces is also very explosive and toxic and when diluted with air becomes a readily ignitable mixture. The vapour is heavier than air and will always fall to the lowest level. It can readily be distributed throughout a workshop by air current, consequently, even a small spillage of fuel is very dangerous.

Always have a fire extinguisher containing **FOAM CO^2 GAS,** or **POWDER** close at hand when handling fuel, or when dismantling fuel systems and in areas where fuel containers are stored.

WARNING: It is imperative that the battery is not disconnected during fuel system repairs as arcing at the battery terminal could ignite fuel vapour in the atmosphere. Always disconnect the vehicle battery BEFORE carrying out work on the fuel system.
Whenever fuel is being handled, transferred or stored, or when fuel systems are being dismantled all forms of ignition must be extinguished or removed, any leadlamps used must be flame proof and kept clear of spillage.
No one should be permitted to repair components associated with fuel without first having had fuel system training.

Hot fuel handling precautions

WARNING: Before commencing any operation requiring fuel to be drained from the fuel tank, the following procedure must be adhered to:

1. Allow sufficient time for the fuel to cool, thus avoiding contact with hot fuels.
2. Vent the system by removing the fuel filler cap in a well ventilated area. Refit the filler cap until the commencement of fuel drainage.

Fuel transfer

WARNING: Fuel must not be extracted or drained from any vehicle while it is standing over a pit.

The transfer of fuel from the vehicle fuel tank must be carried out in a well ventilated area. An approved transfer tank must be used according to the transfer tank manufacturer's instructions and local regulations, including attention to grounding of tanks.

Fuel tank removal

A **FUEL VAPOUR** warning label must be attached to the fuel tank upon removal from the vehicle.

Fuel tank repair

Under no circumstances should a repair to any tank be attempted.

SYNTHETIC RUBBER

Many '0' ring seals, flexible pipes and other similar items which appear to be natural rubber are 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 heat, it can break down and produce highly corrosive Hydrofluoric acid which can cause serious burns on contact with skin. Should the material be in a burnt or overheated condition handle only with seamless industrial gloves. Decontaminate and dispose of the gloves immediately after use.

If skin contact does occur, remove any contaminated clothing immediately and obtain medical assistance without delay. In the meantime, wash the affected area with copious amounts of cold water or limewater for fifteen to sixty minutes.

RECOMMENDED SEALANTS

A number of branded products are recommended in this manual for use during maintenance and repair work.
These items include:
HYLOMAR GASKET AND JOINTING COMPOUND
and
HYLOSIL RTV SILICONE COMPOUND.

They should be available locally from garage equipment suppliers. If there is any problem obtaining supplies, contact the following company for advice and the address of the nearest supplier.

MARSTON LUBRICANTS LTD.
Hylo House,
Cale Lane,
New Springs,
Wigan WN2 1JR

Tel 01942 824242

USED ENGINE OIL

WARNING: Prolonged and repeated contact with engine or motor oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. Used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities should be provided.

Handling precautions

1. Avoid prolonged and repeated contact with oils, particularly used engine oils.
2. Wear protective clothing, including impervious gloves where applicable.
3. Do not put oily rags in pockets.
4. Avoid contaminating clothes, particularly underwear, with oil.
5. Overalls must be cleaned regularly. Discard unwashable clothing and oil impregnated footwear.
6. First aid treatment must be obtained immediately for open cuts and wounds.
7. Use barrier creams, before each work period, to help the removal of oil from the skin.
8. Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.
9. Do not use gasoline, kerosene, diesel fuel, petrol, thinners or solvents for washing the skin.
10. If skin disorders develop, obtain medical advice.
11. Where practicable, degrease components prior to handling.
12. Where there is a risk of eye contact, eye protection should be worn, for example, goggles or face shields; in addition an eye wash facility should be provided.

Disposing of used oils

Environmental protection precaution

It is illegal to pour used oil onto the ground, down sewers or drains, or into waterways.

Dispose of used oil through authorised waste disposal contractors. If in doubt contact your Local Authority for advice on disposal facilities.

ACCESSORIES AND CONVERSIONS

DO NOT FIT unapproved accessories or conversions, as they could affect the safety of the vehicle.
Land Rover will not accept liability for death, personal injury, or damage to property which may occur as a direct result of the fitting of non-approved conversions to the vehicle.

WHEELS AND TYRES

WARNING: DO NOT replace the road wheels with any type other than genuine Land Rover wheels which are designed for multi-purpose on and off road use and have very important relationships with the proper operation of the suspension system and vehicle handling. Replacement tyres must be of the make and sizes recommended for the vehicle, and all tyres must be the same make, ply rating and tread pattern.

STEAM CLEANING

To prevent consequential rusting, any steam cleaning within the engine bay **MUST** be followed by careful re-waxing of the metallic components affected. Particular attention must be given to the steering column, engine coolant pipes and hose clips.

SPECIFICATION

The specification details and instructions set out in this Manual apply only to a range of vehicles and not to any one. For the specification of a particular vehicle purchasers should consult their Dealer.
The Manufacturer reserves the right to vary specifications with or without notice, and at such times and in such manner as it thinks fit. Major as well as minor changes may be involved in accordance with the Manufacturer's policy of constant product improvement.

Whilst every effort is made to ensure the accuracy of the particulars contained in this Manual, neither the Manufacturer or Dealer, by whom this Manual is supplied, shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

SPECIAL SERVICE TOOLS

The use of approved special service tools is important. They are essential if service operations are to be carried out efficiently, and safely. Where special tools are specified, **only these tools should be used to avoid the possibility of personal injury or damage to the components.** Also, the amount of time which they save can be considerable.

Special tools bulletins will be issued periodically giving details of new tools as they are introduced.

All orders and enquiries from the United Kingdom should be sent direct to V. L. Churchill. Overseas orders should be placed with the local V. L. Churchill distributor, where one exists. Countries where there is no distributor may order direct from:
V. L. Churchill Limited,
PO Box 3,
Daventry, Northants,
England, NN11 4NF.

The tools recommended in this Workshop Manual are listed in a multi-language illustrated catalogue, obtainable from:
Messers. V. L. Churchill at the above address,
or from:
Land Rover Publications,
Character Mailing,
Heysham Road,
Bootle,
Merseyside, L70 1JL

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JACKING

The following instructions must be carried out before raising the vehicle off the ground.

1. Use a solid level ground surface.
2. Apply parking brake.
3. Select 1st gear in main gearbox.
4. Select Low range in transfer gearbox.

CAUTION: To avoid damage occurring to the under body components of the vehicle the following jacking procedures must be adhered to.

DO NOT POSITION JACKS OR AXLE STANDS UNDER THE FOLLOWING COMPONENTS.

Body structure
Bumpers
Fuel lines
Brake lines
Front radius arms
Panhard rod
Steering linkage
Rear Trailing links
Fuel tank
Engine sump
Gearbox bell housing

Jack or support vehicle by axles only.

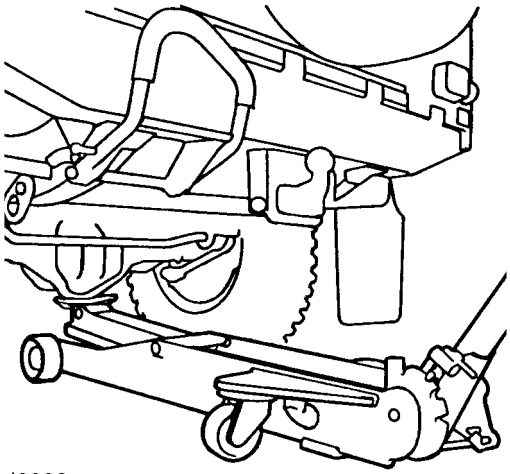
Vehicle jack

The jack provided with the vehicle is only intended to be used in an emergency, for changing a tyre. Do **NOT** use the jack for any other purpose. Refer to Owner's Manual for vehicle jack location points and procedure. Never work under a vehicle supported by the vehicle jack.

Hydraulic jack

A hydraulic jack with a minimum 1500 kg, (3,300 lbs) load capacity must be used, see J6083.

CAUTION: Do not commence work on the underside of the vehicle until suitable axle stands have been positioned under the axle, see J6084.



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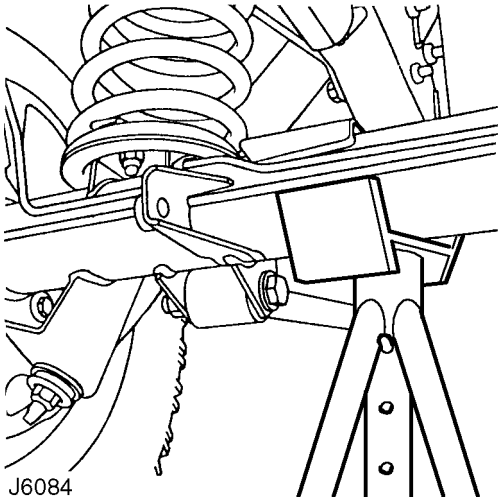


J6084

Raise the front of the vehicle

1. Position cup of hydraulic arm under differential casing.

NOTE: The differential casing is not central to the axle. Care should be taken when raising the front road wheels off the ground as the rear axle has less sway stiffness.

2. Raise front road wheels to enable an axle stand to be installed under left hand axle tube.

3. Position an axle stand under right hand axle tube, carefully lower jack until axle sits securely on both axle stands, remove trolley jack.
4. Before commencing work on underside of vehicle re-check security of vehicle on stands.
5. Reverse procedure when removing vehicle from stands.

Raise rear of vehicle

1. Position cup of hydraulic arm under differential casing.
2. Raise vehicle to enable axle stands to be installed under left and right hand axle tubes.
3. Lower jack until axle sits securely on axle stands, remove trolley jack.
4. Before commencing work on underside of vehicle re-check security of vehicle on stands.
5. Reverse procedure when removing vehicle from stands.

HYDRAULIC VEHICLE RAMP (FOUR POST)

Use only a 'drive on' type ramp which supports vehicle on its road wheels. If a 'wheel-free' condition is required, use a 'drive on' ramp incorporating a 'wheel-free' system providing support beneath axle casings. Alternatively, place vehicle on a firm, flat floor and support on axle stands.

TWO POST VEHICLE RAMPS

The manufacturer of LAND ROVER VEHICLES DOES NOT recommend using 'Two Post' ramps that employ four adjustable support arms. These are NOT considered safe for Land Rover vehicles. If vehicle is installed on a Two Post ramp responsibility for safety of vehicle and personnel performing service operations is in the hands of the Service Provider.

DYNAMOMETER TESTING

The front and rear axles cannot be driven independently.

WARNING: DO NOT attempt to drive individual wheels with vehicle supported on floor jacks or stands.

Four wheel dynamometers

Provided that front and rear dynamometer 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.

Two wheel dynamometers

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

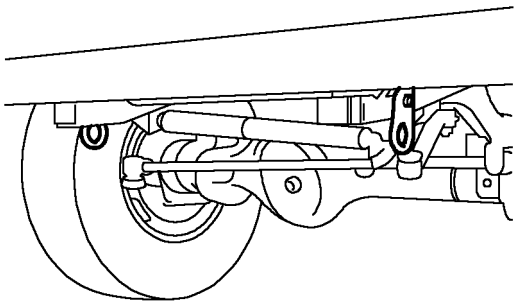
If brake testing on a single axle rig is necessary it must be carried out with propeller shaft to rear axle removed, AND neutral selected in BOTH main gearbox and transfer gearbox. When checking brakes, run engine at idle speed to maintain servo vacuum. If checking engine performance, the transfer box must be in high range and propeller shaft to stationary axle must be removed.

TOWING

CAUTION: The vehicle has permanent four-wheel drive. The following towing instructions must be adhered to:

Towing the vehicle on all four wheels with driver operating steering and brakes.

1. Turn ignition key to position '1' to release steering lock.
2. Select neutral in main gearbox and transfer gearbox.



10M0488

3. Secure tow rope, chain or cable to front towing eyes.
4. Release the parking brake.

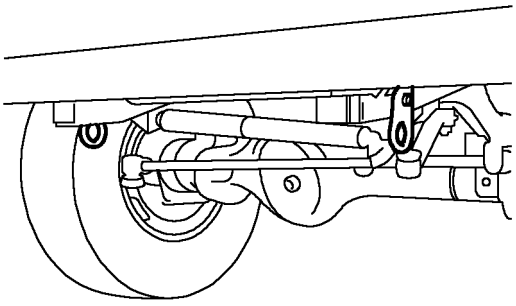
CAUTION: The brake servo and power assisted steering system will not be functional without the engine running. Greater pedal pressure will be required to apply the brakes, the steering system will require greater effort to turn the front road wheels. The vehicle tow connection should be used only in normal road conditions, 'snatch' recovery should be avoided.

Rear suspended tow by breakdown vehicle

1. If the front axle is to be trailed turn ignition key to position '1' to release steering lock.
2. Select neutral in main gearbox and transfer box.

CAUTION: The steering wheel and/or linkage must be secured in a straight ahead position. DO NOT use the steering lock mechanism for this purpose.

TRANSPORTING THE VEHICLE BY TRAILER



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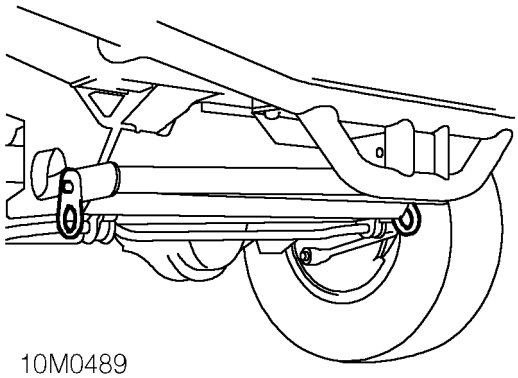


10M0489

Lashing/towing eyes are provided on front and rear of the chassis side members, to facilitate the securing of the vehicle to a trailer or other means of transportation.

CAUTION: Underbody components must not be used as lashing points.

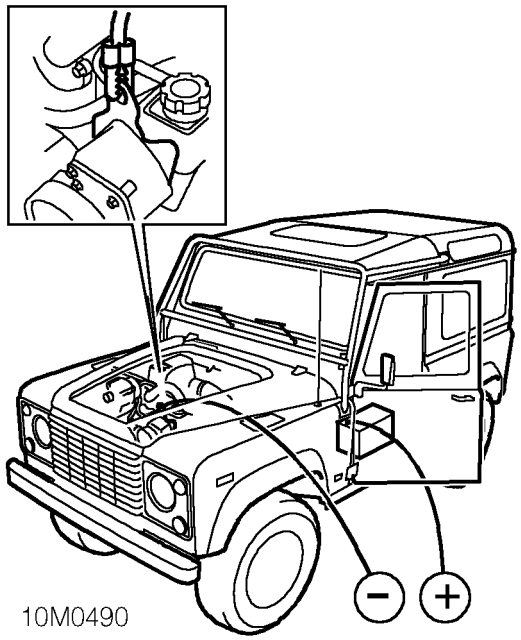
Install vehicle on trailer and apply park brake. Select neutral in main gearbox.

JUMP STARTING

WARNING: Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames, sparks or lighted tobacco are brought near battery. When charging or using a battery in an enclosed space, always provide ventilation and shield your eyes.

Keep out of reach of children. Batteries contain sulphuric acid. Avoid contact with skin, eyes, or clothing. Also, shield eyes when working near battery to protect against possible splashing of acid solution. In case of acid contact with skin, eyes, or clothing, flush immediately with water for a minimum of fifteen minutes. If acid is swallowed, drink large quantities of milk or water, followed by milk of magnesia, a beaten egg, or vegetable oil.

SEEK MEDICAL AID IMMEDIATELY.



To Jump Start - Negative Ground Battery

WARNING: To avoid any possibility of injury, use particular care when connecting a booster battery to a discharged battery.

1. Position vehicles so that jump leads will reach, ensuring that vehicles **DO NOT TOUCH,** alternatively a fully charged slave battery may be positioned on floor adjacent to vehicle.
2. Ensuring that ignition and all electrical accessories are switched off, that parking brake is applied and neutral is selected, connect the jump leads as follows;

A. Connect one end of first jumper cable to positive (+) terminal of booster battery.
B. Connect other end of first jumper cable to positive (+) terminal of discharged battery.
C. Connect one end of second jumper cable to negative (-) terminal of booster battery.
D. Connect other end of second jumper cable to a good earth point on the disabled vehicle (eg. engine front lifting eye, as shown in 10M0490), **NOT TO NEGATIVE TERMINAL OF DISCHARGED BATTERY.** Keep jumper lead away from moving parts, pulleys, drive belts and fan blade assembly.

WARNING: Making final cable connection could cause an electrical arc which if made near battery could cause an explosion.

3. If booster battery is installed in another vehicle, start engine and allow to idle.
4. Start engine of vehicle with discharged battery, following starting procedure in Owners' Manual.

CAUTION: If vehicle fails to start within a maximum time of 12 seconds, switch ignition off and investigate cause. Failing to follow this instruction could result in irrepairable damage to catalyst, if fitted.

5. Remove negative (-) jumper cable from the engine and then negative (-) terminal of booster battery.
6. Remove positive (+) jumper cable from positive terminals of booster battery and discharged battery.

ABBREVIATIONS AND SYMBOLS USED IN THIS MANUAL

Across flats (bolt size) ..... AF
After bottom dead centre ..... ABDC
After top dead centre ..... ATDC
Alternating current ..... a.c.
Ampere ..... amp
Ampere hour ..... amp hr
Before bottom dead centre ..... BBDC
Before top dead centre ..... BTDC
Bottom dead centre ..... BDC
Brake horse power ..... bhp
British Standards ..... BS
Carbon monoxide ..... CO
Centimetre ..... cm
Centigrade (Celsius) C
Cubic centimetre ..... cm^3
Cubic inch ..... in^3
Degree (angle) ..... deg or °
Degree (temperature) ..... deg or °
Diameter ..... dia.
Direct current ..... d.c.
Electronic Control Unit ..... ECU
Electronic Fuel Injection ..... EFI
Fahrenheit ..... F
Feet ..... ft
Feet per minute ..... ft/min
Fifth 5th
First 1st
Fluid ounce ..... fl oz
Foot pounds (torque) ..... lbf.ft
Fourth 4th
Gramme (force) ..... gf
Gramme (mass) ..... g
Gallons ..... gal
High tension (electrical) ..... H.T.
Internal diameter ..... I.D.
Inches of mercury ..... in. Hg
Inches ..... in
Kilogramme (force) ..... kgf
Kilogramme (mass.) ..... kg
Kilogramme centimetre (torque) ..... kgf.cm
Kilogramme per square millimetre ..... kgf/mm^2
Kilogramme per square centimetre ..... kgf/cm^2
Kilogramme metres (torque) ..... kgf.m
Kilometres ..... km
Kilometres per hour ..... km/h
Kilovolts ..... kV
Left-hand ..... LH
Left-hand steering ..... LHStg
Left-hand thread ..... LHThd
Litres ..... litre
Low tension ..... l.t.
Maximum ..... max.
Metre ..... m
Millilitre ..... ml
Millimetre ..... mm
Miles per gallon ..... mpg
Miles per hour ..... mph
Minute (angle) ..... '
Minus (of tolerance) ..... -
Negative (electrical) ..... -
Newton metres (torque) ..... Nm
Number ..... No.
Ohms ..... ohm
Ounces (force) ..... ozf
Ounces (mass) ..... oz
Outside diameter ..... O.D.
Part number ..... Part No.
Percentage ..... %
Pints ..... pt
Plus (tolerance) ..... +
Positive (electrical) ..... +
Pound (force) ..... lbf
Pounds inch (torque) ..... lbf.in
Pound (mass) ..... lb
Pounds per square inch ..... P.S.I.
Ratio ..... :
Reference ..... ref.
Revolution per minute ..... rev/min
Right-hand ..... RH
Second (angle) ..... "
Second (numerical order) 2nd
Specific gravity ..... sp.gr.
Square centimetres ..... cm^2
Square inches ..... in^2
Standard wire gauge ..... s.w.g.
Synchroniser/Synchromesh ..... synchro.
Third 3rd
Top dead centre ..... TDC
United Kingdom ..... UK
Vehicle Identification Number ..... VIN
Volts V
Watts ..... W

SCREW THREADS

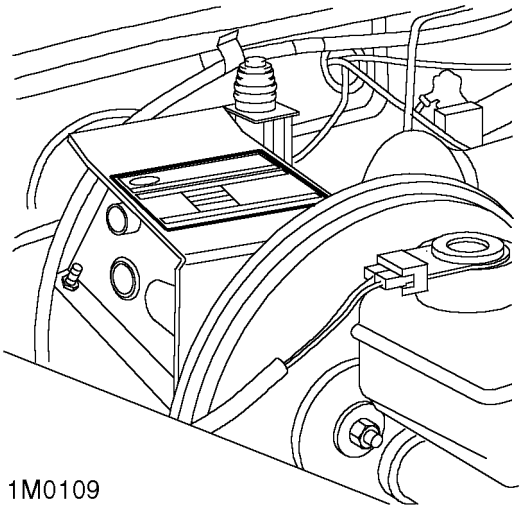
American Standard Taper Pipe ..... NPTF
British Standard Pipe ..... BSP
Unified Coarse ..... UNC
Unified Fine ..... UNF

CROSS REFERENCE OF EMISSION SYSTEM TERMINOLOGY

NEW TERM	(ACRONYM)	OLD TERM	(ACRONYM)
Accelerator pedal	(AP)	Throttle pedal	(-)
Air cleaner	(ACL)	Air cleaner	(-)
Air conditioning	(AC)	Air conditioning	(AC)
Battery positive voltage	(B+)	Battery plus, bat +, bat feed	(B+)
Closed loop	(CL)	Closed loop	(-)
Closed throttle position	(CTP)	Closed throttle, idle position	(-)
Canister purge valve	(CANPV)	Charcoal canister purge valve	(-)
Data link connector	(DLC)	Serial link	(-)
Diagnostic trouble code	(DTC)	Fault code	(-)
Distributor ignition	(DI)	Electronic ignition	(-)
Engine control module	(ECM)	Electronic control unit	(ECU)
Engine coolant level	(ECL)	Coolant level	(-)
Engine coolant temperature	(ECT)	Coolant temperature	(temp)
Engine coolant temperature sensor	(ECTS)	Coolant temperature thermistor	(-)
Engine speed	(RPM)	Engine speed	(rev/min)
Evaporative emission system	(EVAP)	Evaporative loss system	(ELC)
Engine fuel temperature sensor	(EFTS)	Fuel temperature thermistor	(-)
4th gear, 3rd gear etc.	(4GR, 3GR)	Fourth gear, 3rd gear	(-)
Fuel pump	(FP)	Fuel pump	(-)
Fan control module	(FCM)	Condenser fan timer	(-)
Generator	(GEN)	Alternator	(-)
Ground	(GND)	Ground, earth	(B-)
Heated oxygen sensor	(H02S)	Lambda (02) sensor	(-)
Idle air control	(IAC)	Idle speed control	(ISC)
Idle air control valve	(IACV)	Stepper motor	(-)
Ignition control module	(ICM)	Ignition module	(-)
Inertia fuel shut-off	(IFS)	Inertia switch	(-)
Inertia fuel shut-off switch	(IFSS)	Inertia switch	(-)
Intake air temperature	(IAT)	Intake temperature/ambient temperature	(-)
Malfunction indicator lamp	(MIL)	EFI warning lamp	(-)
Manifold vacuum zone	(MVZ)	Manifold depression, vacuum	(-)
Mass air flow sensor	(MAFS)	Air flow meter	(-)
Multiport fuel injection	(MFI)	Electronic fuel injection	(EFI)
On board diagnostic	(OBD)	Fault code display unit	(-)
Open loop	(OL)	Open loop	(-)
Park/neutral position	(PNP)	Park or neutral	(-)
Park/neutral position switch	(PNPS)	Start inhibit switch	(-)
Programmable read only memory	(PROM)	Chip, PROM	(PROM)
Relay module	(RM)	Relay	(-)
Service reminder indicator	(SRI)	Check engine light	(-)
Solid state relay module	(SSRM)	Control unit	(-)
Three way catalytic converter	(TWC)	Catalyst, catalytic converter	(CAT)
Throttle body	(TB)	Throttle housing	(-)
Throttle position sensor	(TPS)	Throttle potentiometer	(-)
Torque converter clutch	(TCC)	Direct drive clutch	(DDC)
Transmission range	(TR)	Transmission gear	(-)
Transmission range selector	(TRS)	Shift lever, shifter	(-)
Vehicle speed sensor	(VSS)	Road speed transducer	(-)
Wide open throttle	(WOT)	Full throttle, wide open throttle	(WOT)

VEHICLE IDENTIFICATION NUMBER (VIN)

The Vehicle Identification Number and the recommended maximum vehicle weights are stamped on a plate riveted to the brake pedal box in the engine compartment. The VIN is also stamped on a plate visible through the LH side of the windscreen, see J6088.



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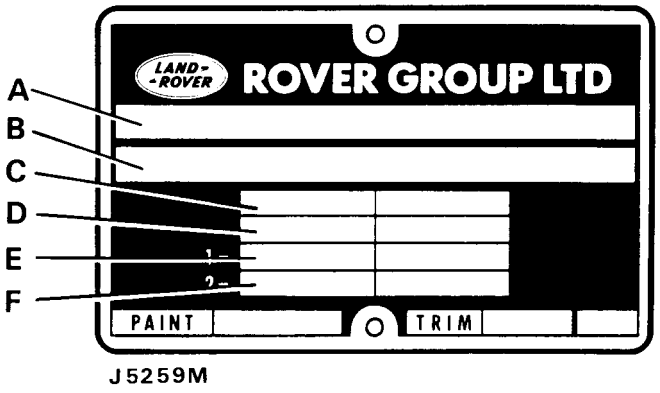
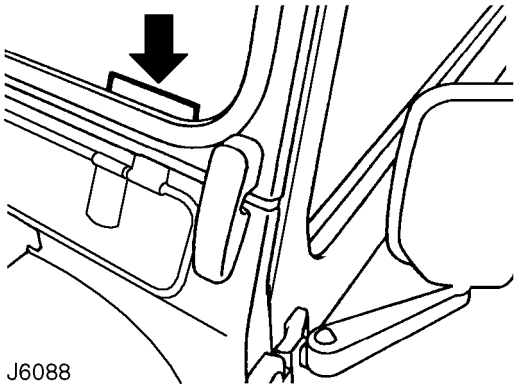


J5259M

A. Type approval
B. Identification
C. Maximum permitted laden weight for vehicle
D. Maximum vehicle and trailer weight
E. Maximum road weight-front axle
F. Maximum road weight-rear axle

The number is also stamped on the RH side of the chassis to the rear of the front lashing eye, see J6089.



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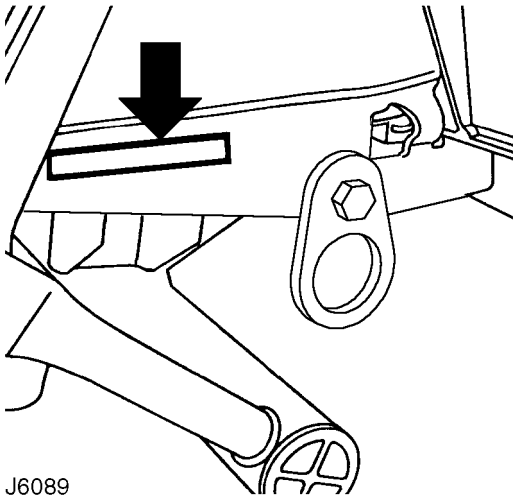


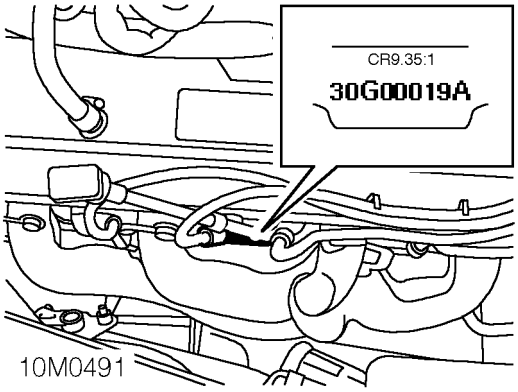
J6089

The Vehicle Identification Number identifies the manufacturer, model range, wheel base, body type, engine, steering, transmission, model year and place of manufacture. The following example shows the coding process.

SAL LD V B M 3 W A

SAL = World manufacturer identifier
LD = Land Rover Defender
V= 90inch
B= 2 door Station Wagon
M= 4.0 V8i
3= RH drive auto
W= 1998 MY, volume build
A= Solihull build

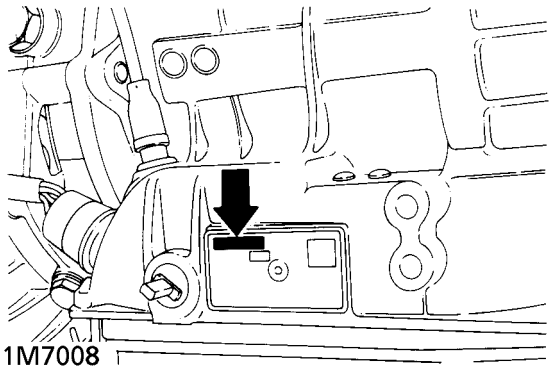
LOCATION OF IDENTIFICATION NUMBERS



Engine serial number - V8i Engine

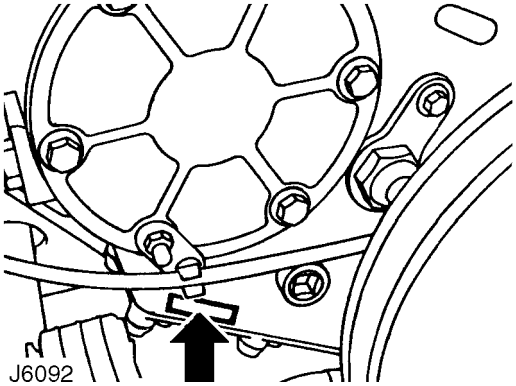
Stamped on a cast pad on the cylinder block, between numbers 3 and 5 cylinders.

NOTE: The appropriate engine compression ratio is stamped above the serial number.



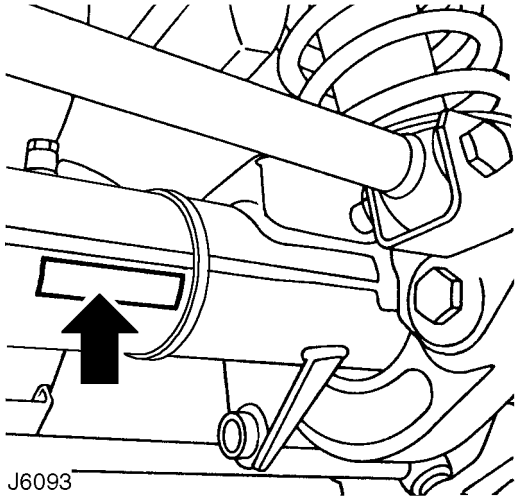
Automatic gearbox serial number

The serial number is stamped on a plate attached to the LH side of the casing.



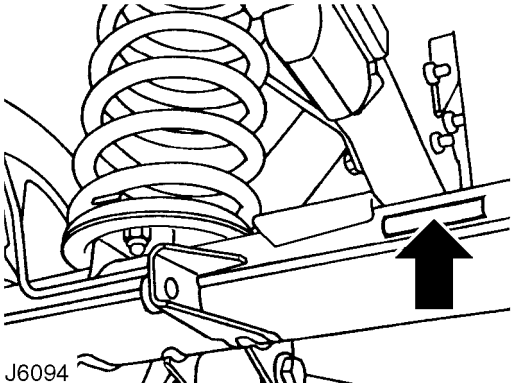
Transfer gearbox serial number

The serial number is stamped on the LH side of the gearbox casing below the mainshaft rear bearing housing adjacent to the bottom cover.



Front axle serial number

Stamped on the front of LH axle tube, inboard of radius arm mounting bracket.

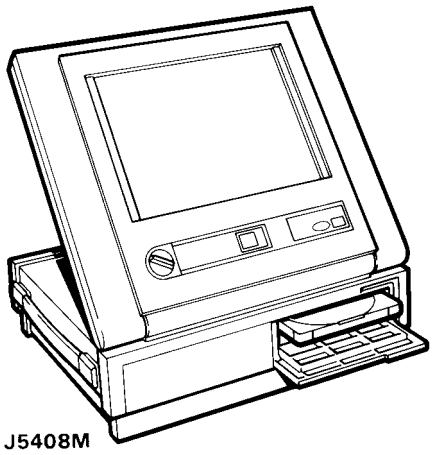


Rear axle serial number

Stamped on the rear of LH axle tube, inboard of spring mounting.

FAULT DIAGNOSTIC EQUIPMENT

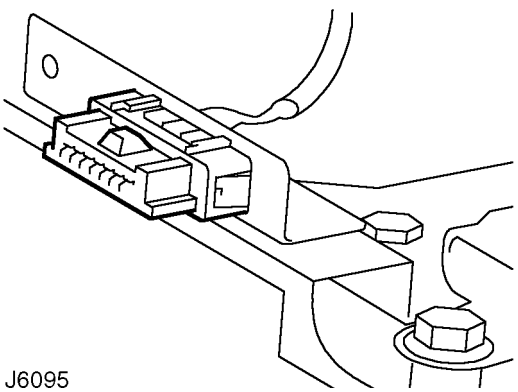
TESTBOOK



Land Rover Vehicles are equipped with substantial electronics to provide the best performance from the vehicle systems.

Diagnostic equipment named TestBook is available to expand the diagnostic and fault finding abilities of the Dealer workshop. A diagnostic connector, located below the passenger compartment fuse box, is provided to facilitate the procedures. This repair manual is produced with TestBook in mind. Features of TestBook include:-

- Fully upgradable support for the technician.
- Structured diagnostics to accomodate all skill levels.
- Touch screen operation.
- Direct print out of screen information and test results.



READING THIS MANUAL

This manual is divided into sections shown on the contents page, alongside a range of icons, familiar to service technicians.

Relevant information is contained within each of these sections. These are further divided into the following sub-sections which appear at the foot of each page :-

Description and operation.
Fault diagnosis.
Adjustment.
Repair.
Overhaul.
Specifications, Torque.

To avoid repeating information through the sections, where part of the repair operation impacts on another section, a cross reference is given to direct the reader to where the information is sited.

For example:
The maintenance section states the need to renew drive belt. A cross reference sites this information in:
Section 12 Engine
- Sub-section: Repairs
- Heading: Drive belt renew.

04 - GENERAL SPECIFICATION DATA

CONTENTS

Page

INFORMATION

ENGINE 4.0 V8i

Type	V8i	
Number of cylinders	Eight, two banks of four	
Bore	94,00 mm	3.70 in
Stroke	71,12 mm	2.80 in
Capacity	3950 cm^3	241 in^3
Compression ratio	9.35:1	
Valve operation	Overhead by push-rod	
Maximum power	140kW at 4750 rev/min	

Crankshaft

Main journal diameter	63,500-63,487 mm	2.500-2.4995 in
Minimum regrind diameter	62,471-62,484 mm	2.459-2.260 in
Maximum out of round	0,040 mm	0.0016 in
Crankpin journal diameter	55,513-55,500 mm	2.1855-2.1850 in
Minimum regrind diameter	54,484-54,497 mm	2.1450-2.1455 in
Crankshaft end thrust - end float		
Taken on thrust washers of centre main bearing	0,10-0,20 mm	0.004-0.008 in
Maximum run-out	0,08 mm	0.003 in

Main bearings

Number and material	5, Lead-indium overlay	
Diametrical clearance	0,015-0,060 mm	0.0006-0.0024 in
Undersize bearing shells	0,254 mm, 0,508 mm	0.010 in, 0.020 in

Connecting rods

Type	Horizontally split big-end, plain small-end	
Length between centres	155,12-155,22 mm	6.107-6.111 in

Big-end bearings

Type and material	Lead-indium overlay	
Diametrical clearance	0,015-0,060 mm	0.0006-0.0024 in
End-float on crank pin	0,15-0,36mm	0.006-0.014 in
Undersize bearing shells	0,25 mm, 0,50 mm	0.010, 0.020 in

Piston/gudgeon pins

Length	60.00-60,50 mm	2.362-2.382 in
Diameter	23,995-24,000 mm	0.9447-0.9449 in
Fit-in connecting rod	Press fit	
Clearance in piston	0,006-0,015 mm	0.0002-0.0006 in

Pistons

Clearance in bore, measured at bottom of skirt at right angles to piston pin	0,020-0,050 mm	0.0008-0.0020 in

Piston rings

Number of compression rings	2	
Number of oil control rings	1	
No 1 compression ring	Molybdenum barrel faced	
No 2 compression ring	Tapered and marked 'T' or 'TOP'	
Width of compression rings	1,48-1.49 mm	0.058-0.059 in
Top	1,21-1,23 mm	0.047-0.048 in
Compression ring gap	0,40-0,65 mm	0.016-0.26 in
Top	0.3-0.5 mm	0.012-0.020 in
Oil control ring type	Aclonoform	
Oil control ring width	3,0 mm	0.118 in
Oil control ring rail gap	0,38-1,40 mm	0.015-0.055 in

Camshaft

Location	Central	
Number of bearings	5	
Bearing type	Tin-aluminium - Non serviceable	
Camshaft end-float	0.076-0.355 mm	0.003-0.014 in
Drive	Chain 9,52 mm pitch x 54 pitches.	

Tappets

Type	Hydraulic-self-adjusting	

Valves

Length:	Inlet	116,59-117,35 mm	4.590-4.620 in
	Exhaust	116,59-117,35 mm	4.590-4.62 in
Seat angle:	Inlet	45°to 45°25'	
	Exhaust	45°to 45°25'	
Head diameter:	Inlet	39,75-40,00 mm	1.565-1.575 in
	Exhaust	34,23-34,48 mm	1.347-1.357 in
Stem diameter:	Inlet	8,664-8,679 mm	0.341-0.342 in
	Exhaust	8,651-8,666 mm	0.340-0.341 in
Stem to guide clearance:	Inlet	0,025-0,066 mm	0.001-.0026 in
	Exhaust	0,038-0,078 mm	0.0015-0.003 in
Valve lift (Inlet and Exhaust)		9,94 mm	0.391 in
Valve spring fitted length at pressure of 29,5 kg, 65 lb		40,4 mm	1.590 in

Lubrication

System type	Wet sump, pressure fed	
Oil pump type	Eccentric rotor	
Oil pressure at 2400 rev/min with engine at running temperature	2.1 - 2.8 bar	30 - 40 lbf/in^2
Oil filter - internal	Wire screen, pump intake filter.	
Oil filter - external	Full flow, self-contained cartridge	

ENGINE MANAGEMENT SYSTEM (GEMS)

Fuel system type	Sagam-Lucas GEMS hot wire system electronically controlled
Fuel pump type	High pressure electrical, immersed in the fuel tank
Fuel pump delivery pressure	2.4-2.6 bar 34-37 lbf/in^2
Fuel filter	In-line filter 'canister' type

Mass air flow sensor (MAF)

Make and type ..... Lucas 'Hot Wire' 20AM

Injectors

Make and type ..... Lucas D1000

Engine Control Module (ECM)

Make and type ..... Lucas GEMS 8.2

Fuel pressure regulator

Make and type ..... Lucas 8RV

Fuel temperature sensor

Make and type ..... Lucas 6TT

Coolant temperature sensor

Make and type ..... Lucas 8TT

Bypass air valve (Stepper motor)

Make and type ..... Lucas 3ACM

Throttle position sensor

Make and type ..... Lucas 3TP

Heated oxygen sensor

Make and type ..... Lucas 4LS - heated

Camshaft position sensor

Make and Land Rover part no. ..... Honeywell ERR2261

Crankshaft position sensor

Make and type ..... Lucas 4CS

Knock sensor

Make and type ..... Lucas 2KS

Intake air temperature sensor

Make and type	Lucas 10TT

Ignition coils

Make and type	Lucas 2DIS2

COOLING SYSTEM

Type	Pressurized system with cross-flow radiator and remote header tank, thermostat control, pump and fan assisted. Water and antifreeze mixture as coolant.	
Type of pump	Centrifugal impellor, belt driven	
Thermostat	88^0C	190^0F
Expansion tank cap pressure - system pressure	1.0 bar	15 lbf/in^2
Fan and viscous coupling assembly	11 blade axial flow 433mm, 17 in diameter.	

AUTOMATIC TRANSMISSION

Automatic gearbox

Model	ZF4HP22
Type	Four speed and reverse epicylic gears with fluid torque converter and lock-up

Transfer gearbox

LT230Q	Two speed reduction on main gearbox output, front and rear drive permanently engaged.
Transfer gearbox ratios:	
High	1.211:1
Low	3.269:1

Automatic gearbox ratios

4th	0.728:1
3rd	1.000:1
2nd	1.480:1
1st	2.480:1
Reverse	2.086:1

Overall ratios - final drive	**High transfer**	**Low transfer**
4th	3.46:1	9.34:1
3rd	4.75:1	12.83:1
2nd	7.03:1	18.98:1
1st	11.78:1	31.80:1
Reverse	9.91:1	26.75:1

Propeller shafts

Type	
Front	Solid bar 28.6mm, 1.125 in diameter
Rear	Tubular 51mm, 2.00 in diameter
Universal joints	Open type Hookes O3EHD

Rear axle

Type	Spiral bevel, fully floating shafts
Ratio	3.54:1

Front axle

Type	Spiral bevel, enclosed constant velocity joints, fully floating shafts
Angularity of universal joint on full lock	32°
Ratio	3.54:1

SHIFT SPEEDS - AUTOMATIC ZF

OPERATION	SELECTOR POSITION	VEHICLE SPEED APPROX.		ENGINE SPEED APPROX. REV/MIN
		KICKDOWN (KD)		
		MPH	**KPH**	
KD4 - 3	D	92 - 100	149 - 164	
KD3 - 2	3(D)	57 - 62	99 - 108	
KD2 - 1	2(D,3)	30 - 37	48 - 61	
KD3 - 4	D	N/A	N/A	
KD2 - 3	D(3)	66 - 69	105 - 114	4750 - 5200
KD1 - 2	D(3,2)	37 - 44	61 - 70	4600 - 5250
		FULL THROTTLE (FT)		
FT4 - 3	D	67 - 73	107 -118	
FT3 - 2	3(D)	44 - 53	70 - 80	
FT3 - 4	D	81 - 88	130 - 141	3980 - 4330
FT2 - 3	D(3)	60 - 66	96 - 105	4350 - 4800
FT1 - 2	D(3,2)	32 - 37	52 - 61	3950 - 4650
		PART THROTTLE (PT)		
PT4 - 3	D	51 - 60	82 - 94	
PT3 - 2	D(3)	32 - 41	53 - 65	
PT2 - 1	D(3,2)	11 - 13	18 - 21	
		LIGHT THROTTLE (LT)		
LT3 - 4	D	28 - 33	47 - 54	1430 - 1650
LT2 - 3	D(3)	20 - 24	32 - 38	1420 - 1820
LT1 - 2	D(3,2)	10 -11	15 - 18	1180 - 1220
		ZERO THROTTLE (ZT)		
ZT4 - 3	D	21 - 27	34 - 45	
ZT3 - 2	D(3)	13 - 16	21 - 26	
ZT2 - 1	D(3,2)	7 - 8	11 - 12	
		TORQUE CONVERTER		
Lock up (IN)	D	56 - 59	89 - 94	1875 - 2000
Unlock (OUT)	D	54 -57	85 - 91	1825 - 1930

NOTE: The speeds given in the above chart are approximate and only intended as a guide. Maximum shift changes should take place within these tolerance parameters.

STEERING

Power steering box

Make and type	Adwest Varamatic - worm and roller box
Ratio	Variable: straight ahead 19.3:1 to 17.2:1 on lock
Steering wheel turns lock to lock	3.75

Steering pump

Make and type	ZF Unicorn	
Operating pressure:	**bar**	**lbf/in²**
Straight ahead at idle - max	7.0	100
Full lock, left or right at idle - min	28	400
Full lock, left or right at 1000 rev/min	70-77	1000-1100

Steering geometery

Steering wheel diameter	412mm	16.25 in
Steering column type	Collapsible coupling	
Steering damper	Double acting fitted between drag link and pinion housing	
Toe-out - measurement	0 to 2.0mm	0 to 0.08 in
Toe-out - included angle	0° to 0° 20’	
Camber angle	0° *	
Castor angle	3° *	
Swivel pin inclination	7° *	

* Check with vehicle in static unladen condition with 23 litres, of fuel. Rock the vehicle up and down at the front to allow the suspension to take an unstressed position.

SUSPENSION

Type	Coil springs controlled by telescopic dampers front and rear.
Front	Transverse location of axle by Panhard rod, and fore and aft location by two radius arms. Anti-roll bar fitted.
Rear	Fore and aft movement inhibited by two tubular trailing links. Lateral location of axle by a centrally positioned ’A’ frame, upperlink assembly, bolted at the apex to a ball joint mounting. Anti-roll bar fitted.

Road spring data

90 model weight	2550 Kg	5622 lb
Front		
Driver side	NRC 9446 BLUE/GREEN	
Passenger side	NRC 9447 BLUE/YELLOW	
Rear		
Driver side	NRC 9448 RED/BLUE	
Passenger side	NRC 9449 YELLOW/WHITE	

Shock absorbers

Type	Telescopic, double-acting non-adjustable	
Bore diameter	35.47mm	1.396 in

BRAKES

Front service brake

Caliper	AP Lockheed, four opposed pistons	
Operation	Hydraulic, self adjusting	
Disc	Ventilated, outboard	
Disc diameter	298mm	11.73 in
Disc thickness	24mm	0.945 in
Wear limit - per side of disc	1mm	0.04 in
Disc run-out maximum	0.15mm	0.006 in
Pad area	58cm^2	9.0 in^2
Total swept area - per disc	801cm^2	124 in^2
Pad material	Ferodo 3440FM non asbestos	
Pad minimum thickness	3mm	0.12 in

Rear service brake

Caliper	AP Lockheed opposed piston	
Operation	Hydraulic, self adjusting	
Disc	Solid, outboard	
Disc diameter	290mm	11.42 in
Disc thickness	12.5mm	0.490 in
Wear limit - per side of disc	0.38mm	0.015 in
Disc run-out maximum	0.15mm	0.006 in
Pad area	30.5cm^2	4.73 in^2
Total swept area - per disc	694cm^2	106.98in^2
Pad minimum thickness	3mm	0.12 in
Pad material	Ferodo 3440FM non asbestos	

Parking brake

Type	Mechanical, cable operated drum brake on the rear of the transfer gearbox output shaft	
Drum internal diameter	254 mm	10.0 in
Width	70mm	2.75 in
Pad material	Ferodo 3611 non asbestos	

Servo/master cylinder

Manufacturer	Lucas	
Servo type	LSC 80, ratio 4.0:1	
Master cylinder tandem type - diameter	25.4 mm	1.0 in
Pressure reducing valve, failure conscious:		
Cut-in pressure	24 bar	360 lbf/in^2

AIR CONDITIONING

System	CFC free expansion valve system	
Compressor	Nippon Denso 10PA17	
Refrigerant	R134a	
Charge quantity	900 g ± 30 g	32 oz ± 1 oz
Refrigerant oil	180 ml	6.3 fl.oz

WIPER MOTORS

Windscreen wiper motor

Make/type	Lucas 14W uprated two speed	
Armature end float	0.1 to 0.2 mm	0.004 to 0.008 in
Brush length, minimum	4.8 mm	0.20 in
Brush spring tension	140 to 200 gf	5 to 7 ozf
Resistance of armature winding at 16°C, 68°F measured between adjacent commutatator segments	0.23 to 0.35 ohms	
Light running, rack disconnected: current at 13.5 V	2.0 A	
Wiper speed, wet screen, 60 seconds from cold:		
Low speed	45 ± 3 rev/min	
High speed	65 ± 5 rev/min	

Tailgate wiper motor

Make/type	IMOS (non-serviceable)
Running current, wet screen at 20°C, 68°F ambient	1.0 to 2.8 A
Wiper speed, wet screen at 20°C, 68°F ambient	37 to 43 cycles per minute

ELECTRICAL

System	12 volt, negative ground	

Battery

Make	Land Rover Parts and Equipment Lucas maintenance free	
Type - standard	9-plate 371	
Type - heavy duty	13-plate 389	

Generator

Manufacturer	Magnetti Marelli	
Type	A127 - 100amp	
Polarity	Negative ground	
Brush length:		
New	17 mm	0.67 in
Worn, minimum free protrusion from moulding	5 mm	0.20 in
Brush spring pressure flush with moulding	1.3 to 2.7N	0.25 to 0.60 lbf
Regulator voltage	13.6 to 14.4 volts	
Nominal output:		
Generator speed	6000 rev/min	
Control at 14 V	65 A	

Starter motor

Make and type	Magnetti Marelli M78R pre-engaged	
Brush spring tension	1020 gf	16 ozf
Brush minimum length	9.5 mm	0.37 in

Fuses

Type	Autofuse (blade type) Blow ratings to suit individual circuits	

Horns

Make/type	Klamix (Mixo) TR99	

BULBS

Exterior	Type
Headlamps	12V -60/55W Halogen
Side lamps	12V -5W bayonet capless
Side marker lamps	12V -3.5W capless
Tail/Stop lamps	12V -5W/21W bayonet
Stop lamps	12V -21W bayonet
High level stop lamp	12V -21W bayonet
Direction indicator lamps	12V -21W bayonet
Number plate lamp	12V -5W capless
Reverse lamp	12V -21W bayonet
Rear fog guard lamp	12V -21W bayonet

Interior	Type
Interior roof lamps	12V -10W festoon
Instrument illumination	12V -1.2W capless
Warning light panel	12V -1.2W bulb/holder unit
Hazard warning switch	12V -1.2W capless

CAUTION: The fitting of new bulbs with wattages in excess of those specified will result in damage to vehicle wiring and switches.

VEHICLE WEIGHTS AND PAYLOAD

When loading a vehicle to its maximum Gross Vehicle Weight (GVW), consideration must be taken of the unladen vehicle weight and the distribution of the payload to ensure that axle loadings do not exceed the permitted maximum values.

It is the customer's responsibility to limit the vehicle's payload in an appropriate manner such that neither maximum axle loads nor GVW are exceeded.

VEHICLE KERB WEIGHTS

Kerb weight = Vehicle weight + Full fuel tank (no occupants or pay load)

Hard top	1770 kg	3902 lb
Gross vehicle weight	2720 kg	6001 lb

VEHICLE GROSS AXLE WEIGHTS

Front axle (GAWF)	1225 kg	2701 lb
Rear axle (GAWR)	1495 kg	3300 lb

NOTE: Axle weights are not additive. The individual maximum axle weights and gross vehicle weight must not be exceeded.

TOWING WEIGHTS

	On-road	Off-road
Unbraked trailers	750 kg, 1653 lb	500 kg, 1102 lb
Trailers with overrun brakes	3500 kg, 8818 lb	1000 kg, 2204 lb
4 wheel trailers with coupled brakes *	4000 kg, 8818 lb	1000 kg, 2204 lb
Nose weight	160 kg, 350 lb	160 kg, 350 lb

NOTE: * Only applies to vehicles modified to accept coupled brakes.

NOTE: All weight figures are subject to local restrictions.

OFF-ROAD PERFORMANCE

Kerb weight, full fuel tank and 75 kg, 150 lb:		
Max. gradient	45°	
Approach angle	51°	
Departure angle	35°	
Wading depth	500 mm	20 in
Min. ground clearance (unladen):	229 mm	9.0 in
Ramp break over angle	146°	

NOTE: Departure angles do not account for the addition of a tow hitch.

WHEELS AND TYRES

Wheel size - Alloy		7J X 16	
Tyre size		265/75 - R16 MULTI-TERRAIN	
Tyre pressures:			
		Front	**Rear**
Normal - all load conditions		265/75 R16 All Terrain	
	Front	1,9 bar	28 lbf/in^2
	Rear	2,4 bar	35 lbf/in^2
Soft ride*	Front	1.6 bar	23 lbf/in^2
	Rear	2,1 bar	30 lbf/in^2

* Soft ride pressure is for limited use only and MUST NOT be used above 55 mph, 85 km/h.

WARNING: Tyre pressures must be checked with the tyres cold, as the pressure is about 0.2 bar, 3 lbf/in^2 higher at running temperature. If the vehicle has been parked in the sun or high ambient temperatures, DO NOT reduce the tyre pressures, move the vehicle into the shade and wait for the tyres to cool before checking the pressures.

WARNING: Always use the same make and type of radial-ply tyres, front and rear. DO NOT use cross-ply tyres, or interchange tyres from front to rear. If the wheel is marked 'TUBELESS', an inner tube must NOT be fitted.

VEHICLE DIMENSIONS

Overall length (including spare wheel)	4072 mm	160.5 in
Overall width (excluding mirrors)	1790 mm	70.5 in
Overall height	2037 mm	80.2 in
Wheelbase	2360 mm	92.9 in
Track front/rear	1486 mm	58.5 in
Interior width between wheel boxes	925 mm	36.4 in
Turning circle	12.65m	41ft 6in

05 - ENGINE TUNING DATA

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Page

INFORMATION

ENGINE 4.0 V8i

Type ..... 4.0 Litre V8i

Firing order 1-8-4-3-6-5-7-2

Cylinder Numbers
Left bank 1-3-5-7
Right bank 2-4-6-8

No 1 Cylinder location ..... Pulley end of left bank

Spark plugs
Make/type ..... Champion RN11YCC
Gap ..... 0.90 - 1.00 mm 0.035 - 0.040 in

Coils
Make ..... Lucas 2D1S2
Type ..... Double ended coil, bank of 4
Compression ratio ..... 9.35:1 - High Compression

Fuel injection system
Make ..... Sagem - Lucas
Type ..... GEMS Sequential Multipoint Fuel injection (SFi)
Hot-wire air flow sensor system electronically controlled

Valve Timing	**Inlet**	**Exhaust**
Opens	28°BTDC	66°BBDC
Closes	77°ABDC	39°ATDC
Duration	285°	285°
Valve peak	108°ATDC	110°BTDC

Idle speed - controlled by GEMS system
All loads off ..... 700 ± 20 rev/min
Base idle speed ..... Not adjustable
Idle air control valve position ..... Checked via **TestBook**
CO at idle ..... Less than 0.5%

Fuel
Fuel grade ..... 95 RON minimum - unleaded

07 - GENERAL FITTING REMINDERS

CONTENTS

Page

INFORMATION

GENERAL FITTING REMINDERS

WORKSHOP SAFETY IS YOUR RESPONSIBILITY!

The suggestions, cautions and warnings in the section are intended to serve as reminders for trained and experienced mechanics. This manual is not a defnitive guide to automotive mechanics or workshop safety.

Shop equipment, shop environment, and the use and disposal of solvents, fluids, and chemicals are subject to government regulations which are intended to provide a level of safety. It is your responsibility to know and comply with such regulations.

PRECAUTIONS AGAINST DAMAGE

1. Always fit protective wing covers before commencing work in engine compartment.
2. Cover seats and carpets, wear clean overalls and wash hands or wear gloves before working inside vehicle.
3. Avoid spilling hydraulic fluid or battery acid on paint work. Wash off with water immediately if this occurs. Use Polythene sheets to protect carpets and seats.
4. Always use a recommended Service Tool, or a satisfactory equivalent, where specified.
5. Protect temporarily exposed screw threads by replacing nuts or fitting plastic caps.

SAFETY PRECAUTIONS

1. Whenever possible, use a lift when working beneath vehicle in preference to jacking. Chock wheels as well as applying parking brake.

WARNING: Do not use a pit when removing fuel system components.

2. Never rely on a jack alone to support vehicle. Use axle stands carefully placed at jacking points to provide rigid support.
3. Ensure that a suitable form of fire extinguisher is conveniently located.
4. Check that any lifting equipment used has adequate capacity and is fully serviceable.
5. Disconnect battery negative lead.

WARNING: Do not disconnect any pipes in air conditioning system, unless trained and instructed to do so. A refrigerant is used which can cause blindness if allowed to contact eyes.

6. Ensure that adequate ventilation is provided when volatile degreasing agents are being used.
7. Do not apply heat in an attempt to free stiff fixings; as well as causing damage to protective coatings, there is a risk of damage to electronic equipment and brake linings from stray heat.

PREPARATION

1. Clean components and surrounding area prior to removal. Before removing a component, clean it and its surrounding areas as thoroughly as possible.
2. Blank off any openings exposed by component removal, using greaseproof paper and masking tape.
3. Immediately seal fuel, oil or hydraulic lines when separated, using plastic caps or plugs, to prevent loss of fluid and entry of dirt.
4. Close open ends of oilways exposed by component removal, with tapered hardwood plugs or readily visible plastic plugs.
5. Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
6. Before dismantling a component, clean it thoroughly with a recommended cleaning agent; check that agent is suitable for all materials of component.
7. Clean bench and provide marking materials, labels, containers and locking wire before dismantling a component.

DISMANTLING

1. 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 dangerous malfunction if trapped in these systems.
2. 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.
3. Use marking ink to identify mating parts, to ensure correct reassembly. If a centre punch or scriber is used they may initiate cracks or distortion of components.
4. Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
5. 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.
6. Do not discard a part due for renewal until it has been compared it with the new part, to ensure the correct replacement has been obtained.

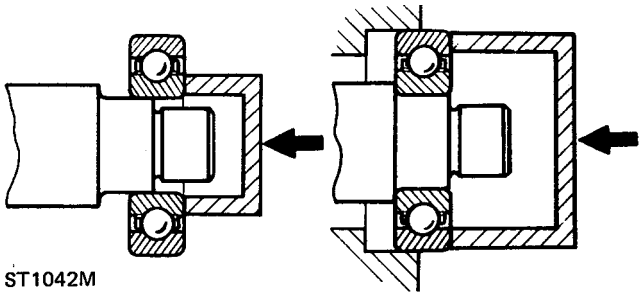
INSPECTION-GENERAL

1. Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal an incipient failure.
2. When a component is to be checked dimensionally against figures quoted for it, use correct equipment (surface plates, micrometers, dial gauges, etc.) in serviceable condition. Makeshift checking equipment can be dangerous.
3. Reject a component if its dimensions are outside limits quoted, or if damage is apparent. A part may, however, be refitted if its critical dimension is exactly limit size, and is otherwise satisfactory.
4. Use 'Plastigauge' 12 Type PG-1 for checking bearing surface clearances. Directions for its use, and a scale giving bearing clearances in 0,0025 mm steps are provided with it.

BALL AND ROLLER BEARINGS

CAUTION: Never refit a ball or roller bearing without first ensuring that it is in a fully serviceable condition.

1. Remove all traces of lubricant from bearing under inspection by washing in a suitable degreaser; maintain absolute cleanliness throughout operations.
2. Inspect visually for markings of any form on rolling elements, raceways, outer surface of outer rings or inner surface of inner rings. Reject any bearings found to be marked, since any marking in these areas indicates onset of wear.
3. Holding inner race between finger and thumb of one hand, spin outer race and check that it revolves absolutely smoothly. Repeat, holding outer race and spinning inner race.
4. Rotate outer ring gently with a reciprocating motion, while holding inner ring; feel for any check or obstruction to rotation, and reject bearing if action is not perfectly smooth.
5. Lubricate bearing generously with lubricant appropriate to installation.
6. Inspect shaft and bearing housing for discolouration or other marking suggesting that movement has taken place between bearing and seatings. (This is particularly to be expected if related markings were found in operation 2).
7. Ensure that shaft and housing are clean and free from burrs before fitting bearing.
8. If one bearing assembly of a pair shows an imperfection it is generally advisable to replace both with new bearings; an exception could be made if the faulty bearing had covered a low mileage, and it could be established that damage was confined to it only.
9. When fitting bearing to shaft, apply force only to inner ring of bearing, and only to outer ring when fitting into housing.



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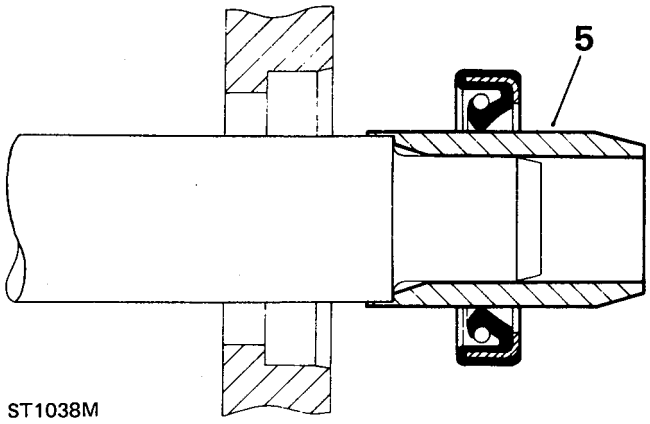
10. In the case of grease lubricated bearings (e.g. hub bearings) fill space between bearing and outer seal with recommended grade of grease before fitting seal.
11. Always mark components of separable bearings (e.g. taper roller bearings) in dismantling, to ensure correct reassembly. Never fit new rollers in a used outer ring, always fit a complete new bearing assembly.

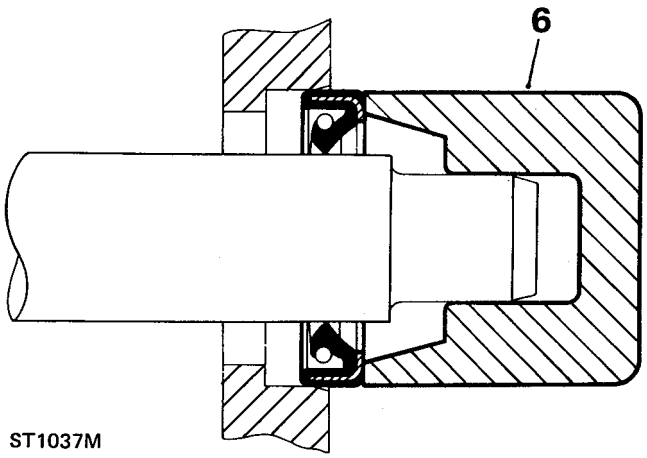
OIL SEALS

NOTE: Ensure that the seal running track is free from pits, scores, corrosion and general damage prior to fitting replacement seal.

1. Always fit new oil seals when rebuilding an assembly.
2. Carefully examine seal before fitting to ensure that it is clean and undamaged.
3. Coat the sealing lips with clean grease; pack dust excluder seals with grease, and heavily grease duplex seals in cavity between sealing lips.
4. Ensure that seal spring, if provided, is correctly fitted.



5. Place lip of seal towards fluid to be sealed and slide into position on shaft, using fitting sleeve when possible to protect sealing lip from damage by sharp corners, threads or splines. If fitting sleeve is not available, use plastic tube or tape to prevent damage to sealing lip.



6. 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 that 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.
7. If correct service tool is not available, use a suitable drift approximately 0.4mm (0.015 in) smaller than outside diameter of seal. Use a hammer **VERY GENTLY** on drift if a press is not suitable.
8. Press or drift seal in to depth of housing if housing is shouldered, or flush with face of housing where no shoulder is provided. Ensure that the seal does not enter the housing in a tilted position.

NOTE: Most cases of failure or leakage of oil seals are due to careless fitting, and resulting damage to both seals and sealing surfaces. Care in fitting is essential if good results are to be obtained. NEVER use a seal which has been improperly stored or handled, such as hung on a hook or nail.

JOINTS AND JOINT FACES

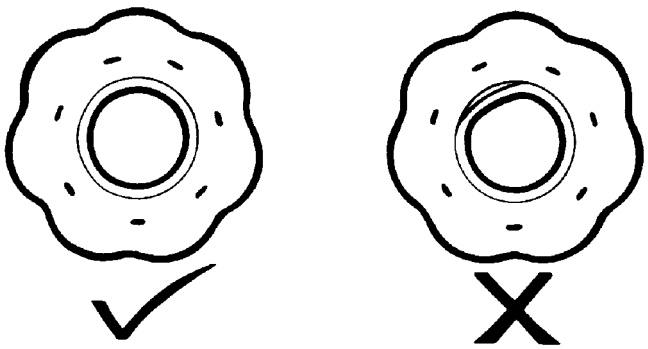
1. Always use correct gaskets where they are specified.
2. Use jointing compound only when recommended. Otherwise fit joints dry.
3. When jointing compound is used, apply in a thin uniform film to metal surfaces; take great care to prevent it from entering oilways, pipes or blind tapped holes.
4. Remove all traces of old jointing materials prior to reassembly. Do not use a tool which could damage joint faces.
5. Inspect joint faces for scratches or burrs and remove with a fine file or oil stone; do not allow removed material or dirt to enter tapped holes or enclosed parts.
6. Blow out any pipes, channels or crevices with compressed air, fit new 'O' rings or seals displaced by air blast.

FLEXIBLE HYDRAULIC PIPES, HOSES

1. Before removing any brake or power steering hose, clean end fittings and area surrounding them as thoroughly as possible.
2. Obtain appropriate plugs or caps before detaching hose end fittings, so that ports can be immediately covered to exclude dirt.
3. Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any hose found faulty.
4. When refitting hose, ensure that no unnecessary bends are introduced, and that hose is not twisted before or during tightening of union nuts.
5. Containers for hydraulic fluid must be kept absolutely clean.
6. Do not store brake fluid in an unsealed container. It will absorb water, and fluid in this condition would be dangerous to use due to a lowering of its boiling point.
7. Do not allow brake fluid to be contaminated with mineral oil, or use a container which has previously contained mineral oil.
8. Do not re-use brake fluid bled from system.
9. Always use clean brake fluid to clean hydraulic components.
10. Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
11. Absolute cleanliness must be observed with hydraulic components at all times.
12. After any work on hydraulic systems, inspect carefully for leaks underneath the vehicle while a second operator applies maximum pressure to the brakes (engine running) and operates the steering.

FUEL SYSTEM HOSES

CAUTION: 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 amoured outer sleeve. A new hose must be fitted if separation is evident.



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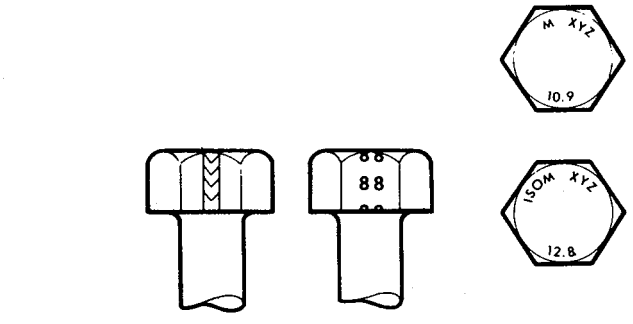
METRIC BOLT IDENTIFICATION

1. 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.
2. In addition to marks to identify the manufacture, the head is also marked with symbols to indicate the strength grade, e.g. 8.8, 12.9 or 14.9, where the first figure gives the minimum tensile strength of the bolt material in tens of kgf/mm^2.
3. Zinc plated ISO metric bolts and nuts are chromate passivated, a gold-bronze colour.



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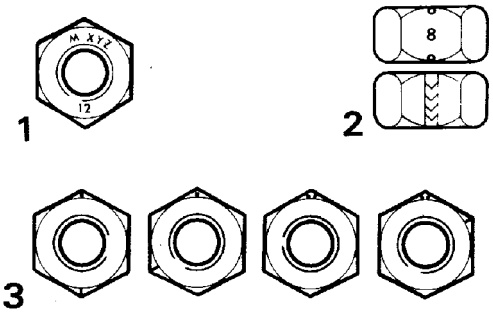
METRIC NUT IDENTIFICATION

1. 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 4, 5 or 6 are also marked and some have the metric symbol M on the flat opposite the strength grade marking.
2. 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.
3. 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.



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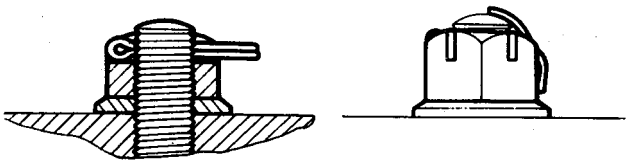
KEYS AND KEYWAYS

1. Remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.
2. Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

TAB WASHERS

1. Fit new washers in all places where they are used. Always fit a new tab washer.
2. Ensure that the new tab washer is of the same design as that replaced.

SPLIT PINS



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1. Fit new split pins throughout when replacing any unit.
2. Always fit split pins where split pins were originally used. Do not substitute spring washers: there is always a good reason for the use of a split pin.
3. All split pins should be fitted as shown unless otherwise stated.

NUTS

1. When tightening a slotted or castellated nut never loosen it to insert split pin or locking wire except in those recommended cases where this forms part of an adjustment. If difficulty is experienced, alternative washers or nuts should be selected, or washer thickness reduced.
2. Where self-locking nuts have been removed it is advisable to replace them with new ones of the same type.

△ **NOTE: Where bearing pre-load is involved nuts should be tightened in accordance with special instructions.**

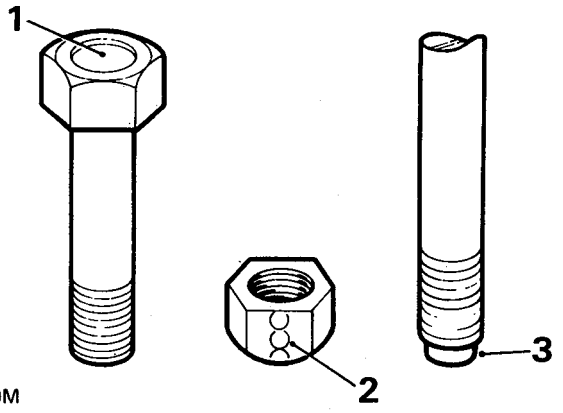
LOCKING WIRE

1. Fit new locking wire of the correct type for all assemblies incorporating it.
2. Arrange wire so that its tension tends to tighten the bolt heads, or nuts, to which it is fitted.

SCREW THREADS

1. Both UNF and Metric threads to ISO standards are used. See next page for thread identification.
2. Damaged threads must always be discarded. Cleaning up threads with a die or tap impairs the strength and closeness of fit of the threads and is not recommended.
3. Always ensure that replacement bolts are at least equal in strength to those replaced.
4. Do not allow oil, grease or jointing compound to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.
5. Always tighten a nut or bolt to the recommended torque value. Damaged or corroded threads can affect the torque reading.
6. To check or re-tighten a bolt or screw to a specified torque value first loosen a quarter of a turn, then re-tighten to the correct value.
7. 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.

UNIFIED THREAD IDENTIFICATION



1. **Bolts**
   A circular recess is stamped in the upper surface of the bolt head.
2. **Nuts**
   A continuous line of circles is indented on one of the flats of the hexagon, parallel to the axis of the nut.
3. **Studs, Brake Rods, etc.**
   The component is reduced to the core diameter for a short length at its extremity.

09 - LUBRICANTS, FLUIDS AND CAPACITIES

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INFORMATION

RECOMMENDED LUBRICANTS AND FLUIDS

COMPONENT	SPECIFICATION	VISCOSITY	AMBIENT TEMPERATURE °C -30 -20 -10 0 10 20 30 40 50
Engine V8i	Use oils to API service level SG, SH or RES.22.OL.G4 or ACEA A2:96	5W/20	
		5W/30 5W/40	
		10W/30	
		10W/40 10W/50	
		15W/40 15W/50	
		20W/40 20W/50	
Automatic gearbox	ATF Dexron IID		
Final drive units Swivel pin housings*	API or GL5 MIL - L - 2105 or MIL - L - 2105B, C or D	90 EP 80W EP	
LT 230 transfer gearbox	API GL4 or GL5 MIL - L - 2105 or MIL - L - 2105B	90 EP	
Power steering	ATF Dexron IID		
Brake reservoir	Brake fluid must have a minimum boiling point of 260°C (500°F) and comply with FMVSS/116/DOT 4		
Lubrication nipples (hubs, ball joints, etc.)	NLGI-2 multipurpose lithium based grease		

* Swivel pin housings with filler, level and drain plugs.

See table on page 2 for remaining vehicle components

Swivel pin housings **	Molytex EP 00 GREASE to specification XP153
Propeller shaft Front and Rear Lubrication nipples (hubs, ball joints etc.) Seat slides Door lock striker	NLGI - 2 Multi-purpose Lithium based GREASE
Brake reservoir	Brake fluids having a minimum boiling point of 260°C (500°F) and complying with FMVSS 116 DOT4
Engine coolant V8i (aluminium)	Use an ethylene glycol based anti-freeze (containing no methanol) with non-phosphate corrosion inhibitors suitable for use in aluminium engines to ensure the protection of the cooling system against frost and corrosion in all seasons. Use one part anti-freeze to one part water for protection down to -36°C (-33°F). **IMPORTANT: Coolant solution must not fall below proportions one part anti-freeze to three parts water, i.e. minimum 25% anti-freeze in coolant otherwise damage to engine is liable to occur. Or a maximum of 60% anti-freese.**
Battery lugs, Earthing surfaces where paint has been removed	Petroleum jelly. **NOTE: Do not use Silicone Grease**
Air Conditioning System Refrigerant	Use only refrigerant R134a
Compressor Oil	Nippon Denso ND-OIL8 Unipart ND-OIL8
Speed sensor bush-rear	Silicone grease: Staborags NBU - Wabco 830 502,0634 Wacker chemie 704 - Wabco 830 502,0164 Kluber GL301

** Swivel pin housings having a filler plug only.

LUBRICATION PRACTICE

Use a high quality oil of the correct viscosity range and service classification in the engine 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 oilways. Additional oil additives should not be used. Always adhere to the recommended servicing intervals.

WARNING: Many liquids and other substances used in motor vehicles are poisonous. They must not be consumed and must be kept away from open wounds. These substances, among others, include anti-freeze windscreen washer additives, lubricants and various adhesives.

CAPACITIES

The following capacity figures are approximate and are provided as a guide only.

Capacities (approx.)	Litres
Fuel tank usable fuel	59 (13.0 gal)
Engine sump oil - V8i	6.1 (10.7 gal)
Automatic gearbox *	9.1 (16.0 gal)
Transfer gearbox oil	2.3 (4.0 gal)
Front differential	1.7 (2.9 gal)
Rear differential	1.7 (2.9 gal)
Power steering box and reservoir	2.9 (5.1 gal)
Swivel pin housing oil / grease (each) **	0.35 (0.6 gal)
Cooling system	12.8 (22.5 gal)
Washer bottle	3.0 (5.3 gal)

NOTE: All levels must be checked by dipstick or level plugs as applicable.

*** When draining fluid from the ZF automatic gearbox, fluid will remain in the torque converter, refill to high level on dipstick only.**

**** Swivel pin housings with a filler plug only must be filled with GREASE.**

ANTI-FREEZE

ENGINE TYPE	MIXTURE STRENGTH	PERCENTAGE CONCENTRATION	PROTECTION LOWER TEMPERATURE LIMIT
V8i Engine	One part anti-freeze One part water	50%	
Complete protection Vehicle may be driven away immediately from cold			- 33°F - 36°C
Safe limit protection Coolant in mushy state. Engine may be started and driven away after warm-up period			- 41°C - 42°F
Lower protection Prevents frost damage to cylinder head, block and radiator. Thaw out before starting engine			- 47°C - 53°F

CAUTION: Anti-freeze content must never be allowed to fall below 25% otherwise damage to the engine is liable to occur. Also, anti-freeze content should not exceed 60% as this will greatly reduce the cooling effect of the coolant.

RECOMMENDED FUEL

Petrol engines

- with catalytic converter UNLEADED ONLY ..... 95 RON minimum

Catalyst vehicles

Vehicles equipped with catalytic converter are designed to use ONLY unleaded fuel. Unleaded fuel must be used for the emission control system to operate properly. Its use will also reduce spark plug fouling, exhaust system corrosion and engine oil deterioration.

Using fuel that contains lead will result in damage to the emission control system and could result in loss of warranty coverage. The effectiveness of the catalysts in the catalytic converters will be seriously impaired if leaded fuel is used. The vehicle is equipped with an electronic fuel injection system, which includes four oxygen sensors. Leaded fuel will damage the sensors, and will deteriorate the emission control system.

Regulations require that pumps delivering unleaded fuel be labelled **UNLEADED.** Only these pumps have nozzles which fit the filler neck of the vehicle fuel tank.

10 - MAINTENANCE

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MAINTENANCE

SPECIFICATIONS, TORQUE

SERVICE SCHEDULE

This section gives information on the range of service procedures.

Where required, instructions are given for carrying out each service procedure, or a cross reference is given, where the procedure can be found in this manual, or the 300 TDi workshop manual.

Service Schedule sheets are published separately to reflect the maintenance needs and intervals for each vehicle variant and model year. The procedures given must be used in conjunction with the Service Schedule sheets.

VEHICLE INTERIOR

CHECK SEATS & BELTS

Check condition and security of seats, seat belt mountings, seat belts, buckles and opertion of inertia seat belts.
Lubricate seat tilt pivots.

CHECK OPERATION OF FOOT BRAKE

If pedal feels 'spongy' bleed system. ***See BRAKES, Repair, Brake System Bleed***
Check all hoses and pipes for security, fractures and leaks. Fit new hoses and pipes as necessary.

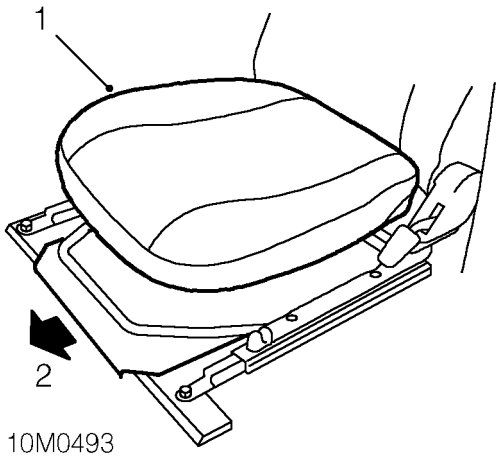
CHECK OPERATION OF LAMPS

Check operation of all lamps, horns and warning indicators.

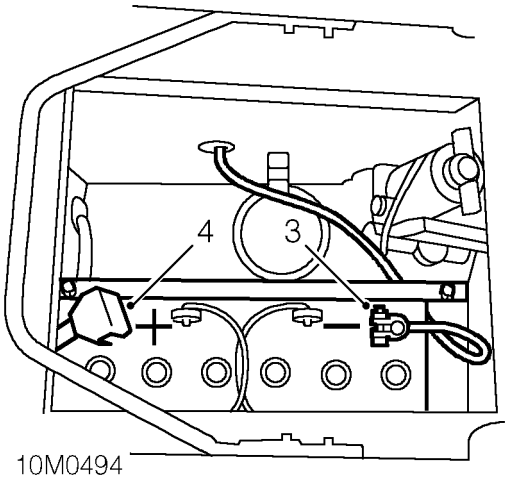
CHECK OPERATION OF WIPERS

Check operation of front/rear screen wipers and washers and condition of wiper blades.

CLEAN BATTERY TERMINALS



1. Remove LH front seat cushion.
2. Release retaining clip and remove battery access cover.



3. Disconnect both battery leads, negative '-' first. Clean off corrosion and neutralize. Smear terminals with petroleum jelly.
4. Reconnect battery leads, positive first, when maintenace operations have been completed.
5. Fit battery access cover and LH front seat cushion.

A low maintenance battery is fitted as original equipment. Dependent upon climatic conditions electrolyte levels should be checked as follows:
Temperate climates every 3 years.
Hot climates every year.

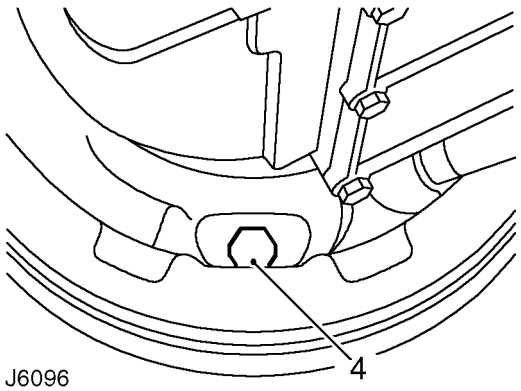
CHECK/ADJUST OPERATION OF PARK BRAKE

Park brake check

1. Check park brake is fully operational on third notch of ratchet. Readjust if necessary.

Park brake adjust

1. Select 'P' in main gearbox and chock road wheels.
2. Raise one rear wheel clear of ground and supprt securely with axle stand.
3. Release park brake lever.



4. Underneath vehicle, rotate brake adjuster clockwise to ***25 Nm, (18 lbf.ft))*** to fully expand shoes against drum.
5. Back off adjuster by $1^{1}/_{4}$ turns, check that drum is free to rotate.
6. Adjust park brake cable locknuts to give pawl 2 notches free movement on ratchet before being fully operational on third notch of ratchet.

⚠ **CAUTION: Cable adjustment must ONLY be used for initial setting and to compensate for cable stretch. It MUST NOT be used to take up brake shoe wear, which MUST be adjusted at brake drum.**

7. Operate parking brake to settle shoes. Recheck park brake is fully operational on third notch of ratchet. Readjust if necessary.
8. Remove axle stand and wheel chocks.

VEHICLE EXTERIOR

CHECK/ADJUST HEADLAMP ALIGNMENT

Check/adjust headlamp and auxiliary alignment.

REMOVE WHEELS, CHECK TYRES

Check tyres (including spare) for compliance with manufacturers' specification.

Check visually for cuts, lumps, bulges, uneven tread wear and tread depth. Check road wheels for damage.

Check/adjust tyre pressures.

INSPECT BRAKE PADS FOR WEAR, CALIPERS FOR LEAKS AND CONDITION

Check thickness of brake pads, fit new pads if minimum thickness is less than 3,0mm (0.12 in). Check brake pads for oil contamination. If new brake pads are required. ***See BRAKES, Repair, Front Brake Pads***
or. ***See BRAKES, Repair, Rear Brake Pads***

WARNING: When renewing brake pads, it is essential that only genuine components with correct grade of lining are used. Always fit new pads as complete axle sets, NEVER individually or as a single wheel set. Serious consequences could result from out of balance braking due to mixing of linings.

Refit road wheels

Fit road wheels in original hub position. Secure in position with wheel nuts, do not fully tighten wheel nuts at this stage, lower vehicle and finally tighten wheel nuts to correct torque.

Alloy wheels: ***130 Nm (95 lbf.ft).***

CHECK FRONT WHEEL ALIGNMENT

Use recognised wheel alignment equipment to perform this check and adjustment. ***See STEERING, Adjustment, Front Wheel Alignment***

LUBRICATE ALL HINGES, DOOR CHECK MECHANISMS, BONNET CATCHES AND FUEL FILLER FLAP

CHECK OPERATION OF ALL DOOR, BONNET AND TAILDOOR LOCKS

UNDER BONNET MAINTENANCE

CHECK COOLING/HEATER SYSTEMS

Check cooling/heater systems for leaks and hoses for security and condition.

Cooling system hoses should be changed at first signs of deterioration.

CHECK CONDITION OF ENGINE MOUNTING RUBBERS

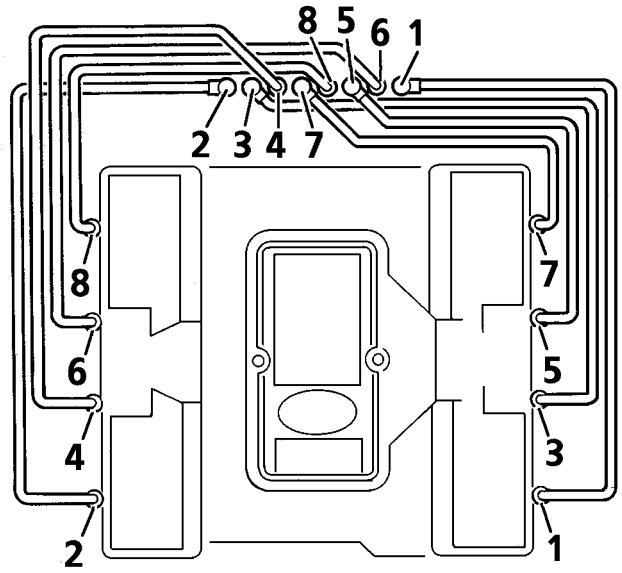
CHECK BRAKE SERVO HOSE FOR SECURITY AND CONDITION

CHECK FUEL EVAPORATIVE LOSS CONTROL SYSTEM FOR LEAKS

CHECK FUEL FILLER CAP SEAL FOR LEAKS

CHECK IGNITION WIRING

Check H.T. leads for fraying, chafing and deterioration. Ensure H.T. leads are correctly clipped in place.



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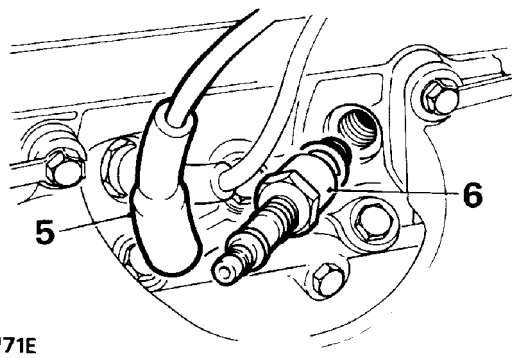
RENEW SPARK PLUGS - V8i

Clean, adjust and renew

1. Take great care when fitting spark plugs not to cross-thread plug, otherwise costly damage to cylinder head will result.
2. Clean or replace spark plugs as applicable.
3. It is essential that correct type of spark plugs are fitted.
4. Incorrect grade of plugs may lead to piston overheating and engine failure.

Remove



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5. Disconnect battery negative lead. Disconnect H.T. leads from spark plugs.
6. Remove plugs and washers.

Refit

7. Inspect spark plugs, renew as necessary.
8. Set plug gaps.

CAUTION: Use correct type and grade of plug.

9. Apply anti-seize to plug threads. Fit spark plugs. Tighten to ***15 Nm (11 lbf.ft).***
10. Connect and route spark plug leads correctly. Failure to route H.T. leads correctly may result in cross-firing between two closely fitted leads which are consecutive in firing order.

CAUTION: When pushing leads onto plugs, ensure that shrouds are firmly seated.

CLEAN PLENUM CHAMBER VENTILATION PASSAGEWAY - V8i

CAUTION: Care must be taken to prevent debris from passageway passing beyond throttle butterfly disc.

WARNING: Safety glasses must be worn when performing this operation. Ensure that debris is not blown into atmosphere which could be harmful to other persons close by.

1. Disconnect battery negative lead.
2. Release hose clamp and remove hose from plenum chamber inlet.
3. Remove crankcase ventilation hose from side of plenum chamber.
4. Insert a piece of lint free cloth down throttle butterfly bore to prevent debris passing throttle butterfly.
5. Place a cloth over tube protruding from side of plenum from which ventilation hose was removed to prevent debris from passageway being blown into atmosphere.
6. Use a compressed air line with a slim bent nozzle to enable passageway to be cleaned out from within throttle butterfly bore.
7. Any remaining matter can be dislodged using soft bent wire or pipe cleaner. Finally blow out passageway again to remove remaining debris.
8. Remove small 'T' piece between crankcase ventilation hoses and check it is free from blockages, clean as necessary.
9. Refit 'T' piece and hoses, tighten hose clamps securely.

RENEW AIR CLEANER ELEMENT - V8i

To renew air cleaner element - V8i
See FUEL SYSTEM, Repair, Air Cleaner

RENEW CHARCOAL CANISTER AND PURGE CONTROL VALVE - V8i

Renew charcoal canister and purge control valve. ***See EMISSION CONTROL, Repair, EVAP canister and purge control valve***

CHECK AUXILIARY DRIVE BELT - V8i

1. Check condition of drive belt, renew a belt that shows signs of wear, splitting or oil contamination.
2. Check belt length indicator, **belt MUST be renewed before indicator reaches RH end of slot.**

RENEW AUXILIARY DRIVE BELT - V8i

Renew drive belt. ***See ELECTRICAL, Repair, Auxiliary drive Belt***

CHECK/TOP-UP AUTOMATIC TRANSMISSION FLUID LEVEL

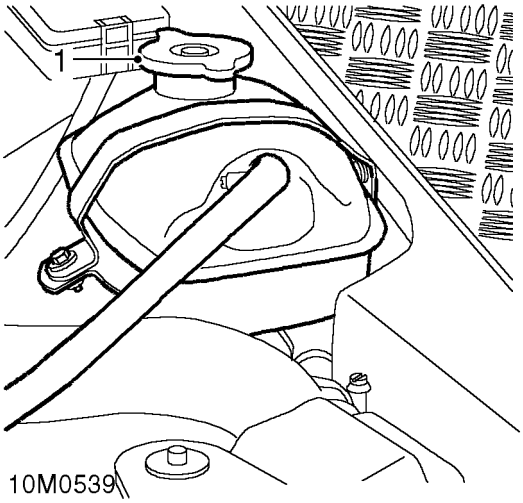
NOTE: Transmission fluid level is checked when fluid is cold with engine idling in 'N' (neutral).

1. Ensure vehicle is on level ground.
2. Check fluid level registers between the 2 level marks on dipstick.
3. Top-up to high mark on dipstick using the correct grade of transmission fluid. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***

CHECK/TOP-UP COOLING SYSTEM

To prevent corrosion of aluminium alloy engine parts it is imperative that cooling system is filled with a solution of water and phosphate free anti-freeze, at all times. **Never fill or top-up with plain water.**

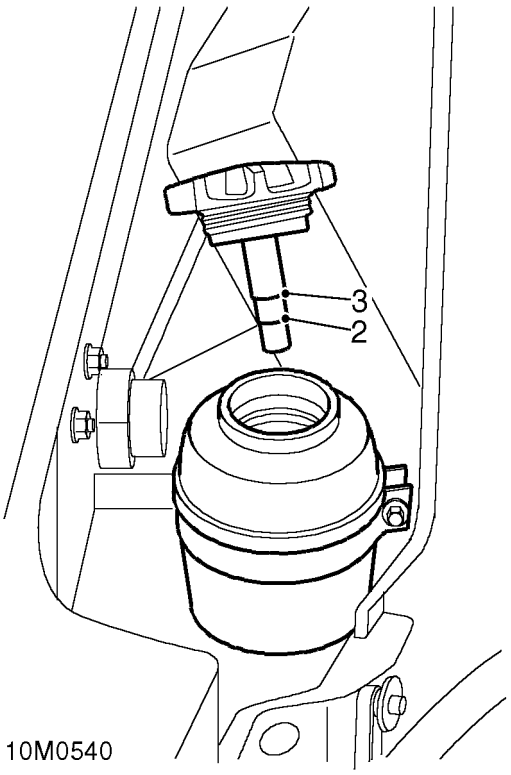
WARNING: Do not remove filler cap when engine is hot because cooling system is pressurised and personal scalding could result.



1. First turn filler cap slowly counter-clockwise to its stop, pause and allow all pressure to escape. Press down and continue to turn until cap is removed.
2. When engine is cold, expansion tank should be approximately half full with coolant.
3. If necessary, top-up cooling system with premixed coolant. Use soft water whenever possible, if local water supply is hard, rainwater should be used.
4. When replacing filler cap it is important that it is tightened down fully. Failure to tighten filler cap properly may result in water loss, with possible damage to engine

The cooling system should be drained and flushed at 2 year intervals or at onset of second winter. Refer to Coolant Requirements. ***See COOLING SYSTEM, Adjustment, Coolant Requirements***

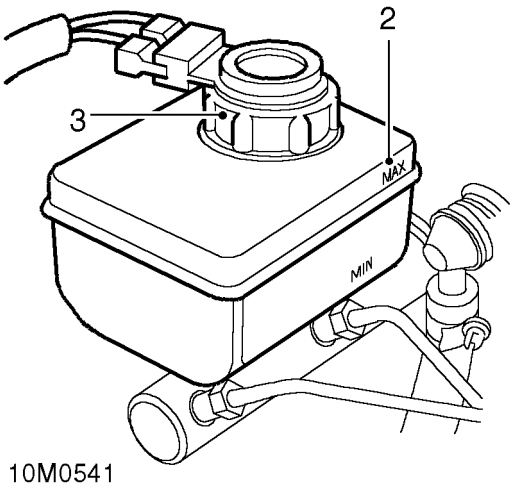
CHECK/TOP-UP POWER STEERING FLUID RESERVOIR



1. Clean area of fluid reservoir cap and remove cap.
2. Check that fluid level is not below lower mark on dipstick.
3. Top-up to high mark on dipstick using transmission fluid. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***

CHECK/ TOP-UP BRAKE FLUID RESERVOIR

CAUTION: Brake fluid can damage paintwork. If spillage occurs, wash affected area IMMEDIATELY with a large quantity of water.



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1. Clean area of filler cap and side of reservoir.
2. Check fluid level in reservoir by observing level through translucent side. Level must be above 'MIN' mark.

CAUTION: If level is below 'MIN' mark, check braking system for possibility of fluid leakage.

3. Remove filler cap and top-up to 'MAX' mark with NEW brake fluid of the correct specification from a sealed container. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***
4. Refit filler cap.

CHECK/TOP-UP WASHER RESERVOIR

Top-up washer reservoir to within 25 mm (1.0 in) of filler neck. Use a screen washer solvent/anti-freeze solution to assist removing mud, flies and road film and protect against freezing.

CHECK/ADJUST STEERING BOX

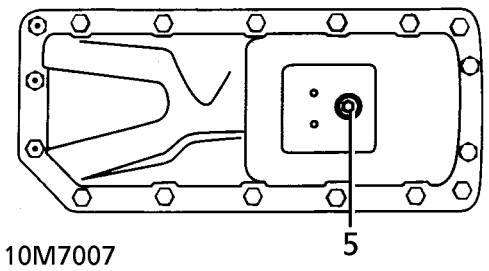
1. Check steering box for fluid leaks.
2. Check that there is no backlash in steering box in straight ahead position. Adjust steering box if necessary. ***See STEERING, Adjustment, Power Steering Box - adjust***

UNDER VEHICLE MAINTENANCE

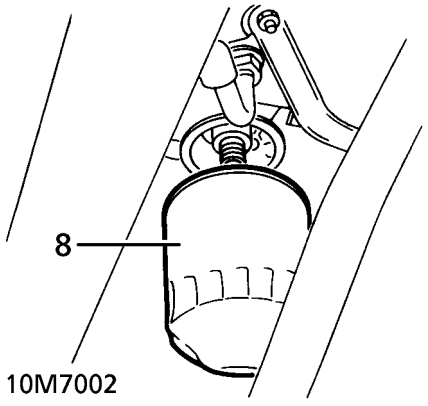
Vehicles operating under severe conditions of dust, sand, mud or water should have oils changed and lubrication carried out at more frequent intervals than is recommended in maintenance schedules.

RENEW ENGINE OIL AND FILTER - V8i

1. Ensure vehicle is level. If necessary, run engine to warm oil.
2. Disconnect battery. See Clean battery terminals.
3. Place drain tray under drain plug.
4. Remove engine oil dipstick.



5. Remove sump drain plug. Allow oil to drain completely.
6. Fit NEW copper washer and refit drain plug. Tighten to ***43 Nm (32 lbf.ft).***

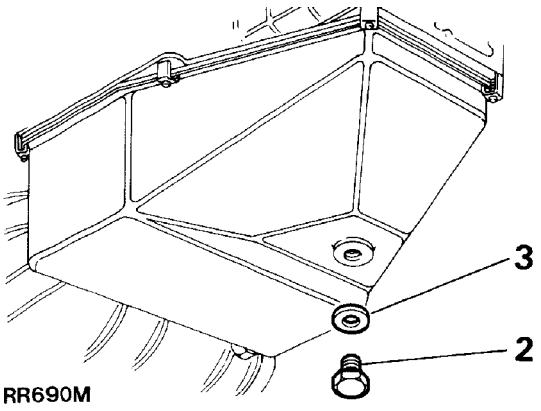


7. Place drain tray under filter.
8. Unscrew oil filter counter-clockwise.
9. Clean filter adaptor face. Coat sealing ring on NEW filter with clean engine oil. Screw filter on until sealing ring contacts sealing face (finger tight), then tighten a further half turn by hand only. **DO NOT** overtighten.
10. Remove engine oil filler cap. Clean inside and outside of cap.
11. Pour in correct quantity of NEW oil to 'FULL' mark on dipstick. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***
12. Reconnect battery, run engine and check for oil leaks from oil filter.
13. Stop engine, allow oil to return to sump for a few minutes, then recheck oil level and top-up if necessary.

NOTE: Oil can symbol on dipstick must be correct way up when viewed from LH side of vehicle.

RENEW AUTOMATIC GEARBOX FLUID AND FLUID SCREEN - ZF

1. Ensure vehicle is level. Place drain tray under drain plug.

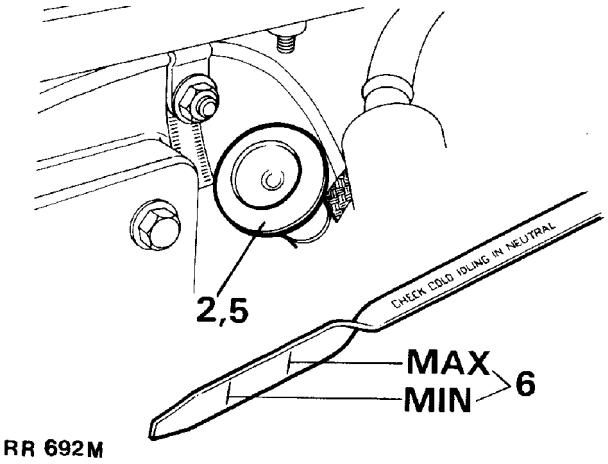


2. Remove gearbox dipstick, located at rear of RH rocker cover, to aid oil drainage. Remove drain plug from bottom of sump and allow fluid to drain completely.
3. Refit plug using a NEW sealing washer. Tighten to ***10 Nm (8 lbf.ft).***
4. Remove and replace fluid screen. ***See AUTOMATIC GEARBOX, Repair, Fluid Pan Gasket and Screen***

Refill and Check Fluid Level.

NOTE: The fluid level must checked when fluid is COLD and engine idling in 'N'.

5. Refill or top-up with correct quantity and grade of fluid. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***



6. With 'P' selected, start and run engine. Apply footbrake, move selector slowly to position '1' then back to 'N'. Check fluid level, this must be between the 2 level marks on dipstick.

CHECK/TOP-UP TRANSFER GEARBOX OIL

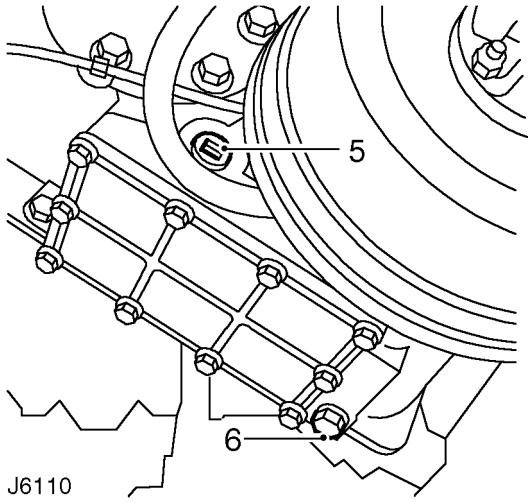
1. Ensure vehicle is level.
2. Disconnect battery negative lead.
3. Clean area around filler/level plug.
4. Remove plug and fill gearbox with recommended grade of oil, until oil starts to seep from filler/level hole. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***
5. Clean any previously applied sealant from filler/level plug.
6. Apply Hylomar sealant to threads of plug and refit plug. Tighten to ***30 Nm (22 lbf.ft).***
7. Wipe away any surplus oil.
8. Reconnect battery negative lead.

RENEW TRANSFER GEARBOX OIL

1. Ensure vehicle is level.
2. Disconnect battery negative lead.
3. Clean area around filler/level and drain plugs.

WARNING: When draining gearbox care should be taken to ensure that oil is not hot as personal scalding could result.

4. Place a suitable container under transfer gearbox.



5. Remove filler/level plug to vent transfer gearbox and assist draining.
6. Remove drain plug and sealing washer and allow oil to drain.
7. Thoroughly clean drain plug threads prior to applying fresh 'Hylomar' sealant. Fit plug and new sealing washer Tighten to ***30 Nm (22 lbf.ft).***
8. Fill gearbox with correct quantity and grade of oil until oil seeps from filler level hole. Wipe away any surplus oil. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids***
9. Thoroughly clean filler/level plug threads prior to applying fresh 'Hylomar' sealant. Fit plug Tighten to ***30 Nm (22 lbf.ft).***
10. Reconnect battery negative lead.

CHECK/TOP-UP FRONT AND REAR AXLE OIL

1. Ensure vehicle is level and area surrounding filler/level plug is clean.
2. Remove filler/level plug from axle.
3. If necessary inject oil of recommended grade until it reaches level hole. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***
4. Clean and refit filler/level plug and wipe away surplus oil.

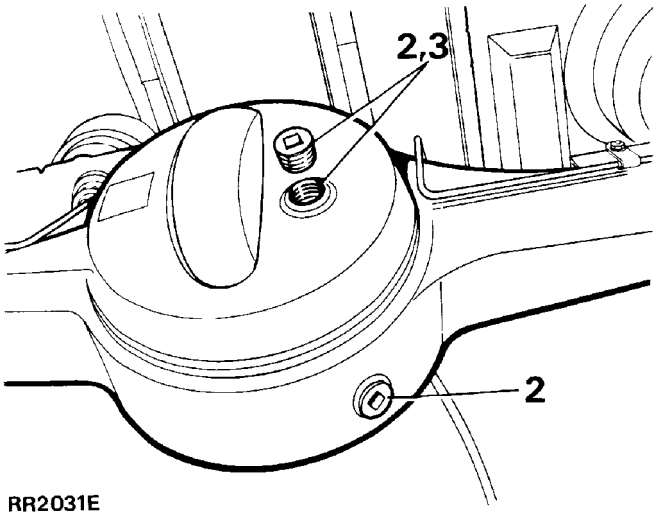
CHECK/TOP-UP SWIVEL PIN HOUSING OIL

CAUTION: Housings with filler plug only are filled with grease which does not require top-up or renewing.

1. Site vehicle on lift or level ground. Clean area of filler/level plug.
2. Remove filler/level plug and inject recommended grade of oil until it seeps from level hole.
3. Refit filler/level plug, wipe away any surplus oil.

RENEW FRONT AND REAR AXLE OIL

1. Site vehicle on lift or level ground. Place container under axle to be drained.



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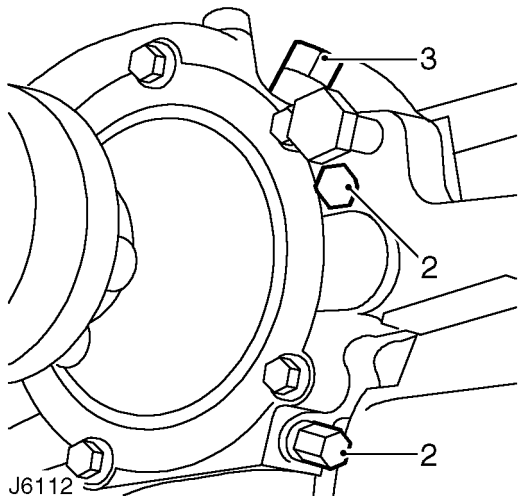
2. Remove drain and filler/level plugs from axle. Allow oil to drain completely. Clean and refit drain plug.
3. Inject new oil of recommended make and grade until it reaches level hole. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, recommended lubricants and fluids***
4. Clean and refit filler/level plug and wipe away surplus oil.

RENEW SWIVEL PIN HOUSING OIL

1. Site vehicle on lift or level ground. Place container under swivel to be drained.

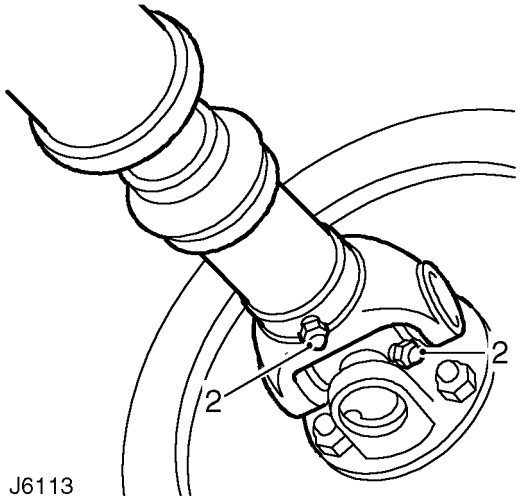


2. Remove drain and level plugs, allow oil to drain completely, clean and refit drain plug.
3. Remove filler plug and inject recommended grade of oil it reaches level hole.
4. Clean and refit level and filler plugs, wipe away any surplus oil.

NOTE: On later vehicles, the level and drain plugs have been deleted. The swivel pin housing is filled with grease for life. Service and maintenance is not required.

LUBRICATE PROPELLER SHAFT SLIDING AND UNIVERSAL JOINTS

1. Clean all grease nipples on front and rear propeller shafts.



2. Using a low pressure hand grease gun, apply recommended grease, to grease nipples at front and rear propeller shaft universal and sliding joints.

CHECK VISUALLY BRAKE, FUEL PIPES/UNIONS FOR CHAFING LEAKS AND CORROSION

CHECK EXHAUST SYSTEM FOR LEAKS, SECURITY AND DAMAGE

CHECK FOR FLUID LEAKS FROM POWER STEERING AND SUSPENSION SYSTEMS, HYDRAULIC PIPES AND UNIONS FOR CHAFING AND CORROSION

CHECK/TIGHTEN STEERING UNIT AND STEERING ROD BALL JOINT FIXINGS, CHECK CONDITION OF BALL JOINTS AND DUST COVERS

Ball joints are lubricated for their normal life during manufacture and require no further lubrication. This applies ONLY if rubber boot has not been dislodged or damaged. Joints should be checked at specified mileage intervals but more frequently if vehicle is used under arduous conditions.

1. Check for wear in joints by moving ball joint up and down vigorously. If free movement is apparent fit a new joint assembly.

CHECK/TIGHTEN FRONT AND REAR AXLE SUSPENSION LINK FIXINGS, CHECK CONDITION OF MOUNTING RUBBERS.

CHECK/TIGHTEN TOWING BRACKET FIXINGS.

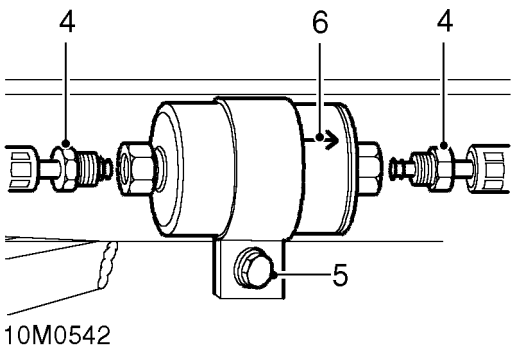
RENEW FUEL FILTER

WARNING: Ensure that fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions. ***See INTRODUCTION, Information, Fuel Handling Precautions***

WARNING: The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

The fuel line filter is located on RH chassis side member forward of the rear wheel arch.

1. Disconnect battery negative lead.
2. Thoroughly clean area around hose connections.
3. Position cloth around relevant union on fuel filter to protect against fuel spray as fuel line pressure is released. ***See FUEL SYSTEM, Repair, Fuel filter***



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4. Loosen 2 fuel unions and disconnect hoses from filter canister.
5. Loosen bolt securing bracket to chassis side member and remove filter.

Fit new filter

6. Fit a new filter and tighten bracket bolt. Ensure direction of flow ARROW on canister faces forward.
7. Fit inlet and outlet hoses. Tighten to ***30 Nm (22 lbf.ft).***
8. Reconnect battery negative lead.
9. Start engine and inspect hose connections for fuel leaks.

RENEW HEATED OXYGEN SENSORS (HO2S)

See FUEL SYSTEM, Repair, Heated Oxygen Sensor (HO2S) - Front
and
See FUEL SYSTEM, Repair, Heated Oxygen Sensor (HO2S) - Rear

RENEW CATALYTIC CONVERTERS

See EMISSION CONTROL, Repair, front pipe / catalytic converter

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CARRY OUT ROAD OR ROLLER TEST

WARNING: Two wheel roller tests must be restricted to 8 mph (5km/hour). The propeller shaft to the wheels NOT on the rolling road must be disconnected, and the differential lock engaged.

For details of dynamometer testing. ***See INTRODUCTION, Information, Dynamometer Testing***

Check following items:

1. Inhibitor switch only operates in 'P' and 'N'.
2. Engine for excessive noise.
3. Automatic gear selection/shift speeds.
4. Gear selection/noise - high/low range.
5. Steering for abnormal noise/effort.
6. Steering for free play.
7. All instruments, gauges and warning indicators.
8. Heater and air conditioning systems.
9. Heated rear screen.
10. Shock absorbers - ride irregularities.
11. Foot brake, on emergency stop, pulling to one side, binding, pedal effort.
12. Park brake operation.
13. Seat reclining and latching.
14. Fully extend seat belt, check operation of retraction and latching. Inertia belts lock when snatched or vehicle on slope.
15. Road wheel balance.
16. Transmission for vibrations.
17. Body noises, squeaks and rattles.
18. Excessive exhaust smoke.
19. Engine idle speed.
20. Endorse service record.
21. Report any unusual features of vehicle condition and additional work required.

ENDORSE SERVICE RECORD

RECOMMENDED SERVICE ITEMS

Refer to Service Schedule sheets for intervals.

Clean sunroof drain tubes, clean and lubricate guide rails and slides.

Renew the hydraulic brake fluid. ***See BRAKES, Repair, Brake System Bleed***

Renew all hydraulic brake fluid, seals, brake servo filter and flexible hoses.

All working surfaces of the master cylinder and caliper cylinders should be examined and renewed where necessary.

Air cleaner - When the vehicle is used in dusty or field conditions or deep wading, frequent attention to the air cleaner may be required.

TORQUE SETTINGS

	Nm	lbf.ft
Road wheel nuts	130	95
Spark plugs	20	15
Automatic gearbox drain plug	10	8
Transfer box drain/filler plugs	30	22
Fuel filter hose/pipe unions	30	22
Steering box drop arm nut	175	130
Steering box to chassis	80	60
Steering box tie-rod	80	60
Front radius arm to chassis	200	150
Rear radius arm to axle	175	130
Bottom link to axle/chassis	175	130

12 - ENGINE

CONTENTS

Page

4.0 V8i

REPAIR

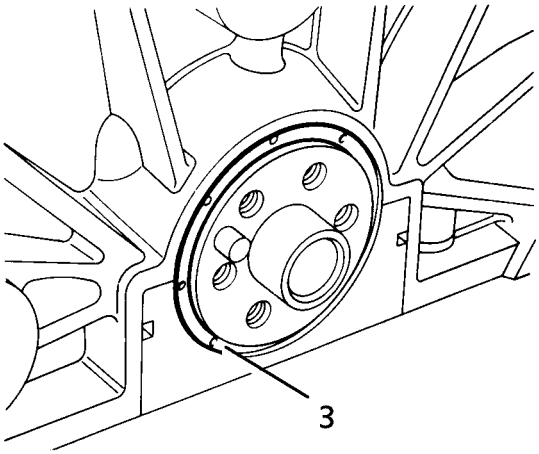
SPECIFICATIONS, TORQUE

CRANKSHAFT REAR OIL SEAL

Service repair no - 12.21.20

Remove

1. Disconnect battery negative lead.
2. Remove drive plate. ***See ENGINE 4.0 V8, Repair, Drive Plate***



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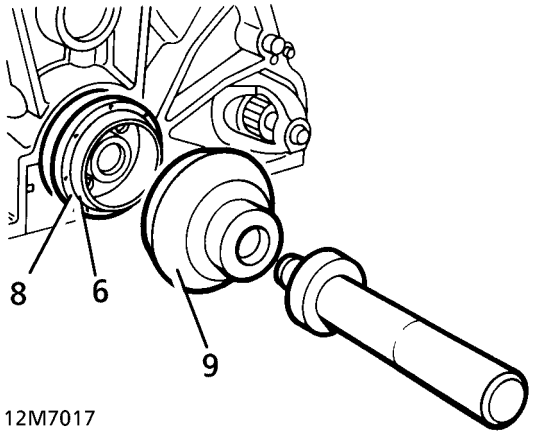
3. Remove oil seal from location.

CAUTION: Do not damage seal location or running surface on crankshaft.

Refit

4. Ensure both seal location and running surface on crankshaft are clean.
5. Ensure mating faces of flywheel and crankshaft are clean.
6. Lubricate seal guide **LRT-12-095** with clean engine oil. Position over crankshaft boss.



12M7017

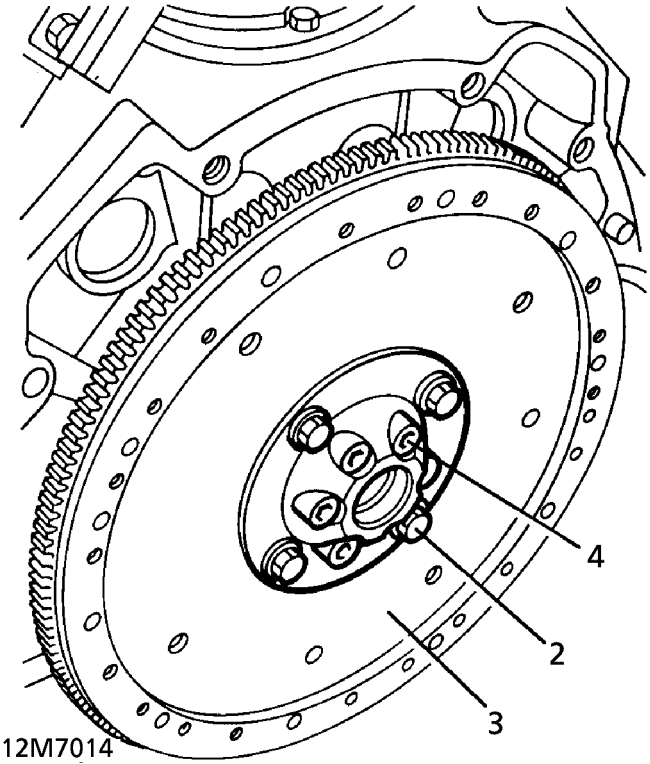
7. Lubricate oil seal lip.
8. Position seal squarely. Remove guide.
9. Drift seal into location using **LRT-12-091.**
10. Fit drive plate. ***See ENGINE 4.0 V8, Repair, Drive Plate; Refit***
11. Reconnect battery negative lead.

DRIVE PLATE

Service repair no - 12.53.13

Remove

1. Remove gearbox and transfer box assembly. ***See AUTOMATIC GEARBOX, Repair, gearbox and transfer box assembly***



2. Remove 4 clamp ring bolts. Collect clamp ring.
3. Remove flexible drive plate/starter ring gear assembly from hub aligner.
4. Remove 6 screws from hub aligner. Remove hub aligner from crankshaft.
5. Check drive plate for distortion or cracks. Check starter ring gear for chipped or broken teeth. If either component shows signs of damage, fit a new assembly.

Refit

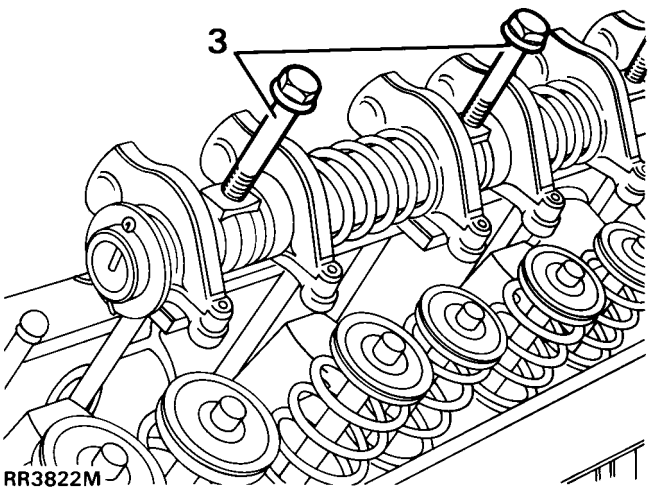
6. Ensure all mating surfaces are clean.
7. Fit hub aligner to crankshaft.
8. Fit hub aligner screws and tighten to ***85 Nm (63 lbf.ft).***
9. Fit drive plate and clamp ring.
10. Fit clamp ring bolts and tighten to ***45 Nm (33 lbf.ft).***
11. Fit gearbox and transfer box assembly. ***See AUTOMATIC GEARBOX, Repair, gearbox and transfer box assembly; Refit***

ROCKER SHAFT RENEW

Service repair no - 12.29.29

Remove

1. Disconnect battery negative lead.
2. Remove RH or LH rocker covers. ***See ENGINE 4.0 V8, Repair, rocker cover - right hand*** or. ***See ENGINE 4.0 V8, Repair, rocker cover - left hand***



3. Loosen four rocker shaft fixings.
4. Remove rocker shaft assembly.

NOTE: Each rocker shaft is notched at ONE end. Notch must be uppermost and towards front of engine on right hand side, towards rear on left hand side.

Refit

5. Clean rocker pedestal locations on cylinder head.
6. Fit rocker shaft assembly, locating push rods to rockers.
7. Tighten rocker shaft fixings to ***38 Nm (28 lbf.ft).***
8. Fit RH or LH rocker covers. ***See ENGINE 4.0 V8, Repair, rocker cover - right hand; Refit*** or ***See ENGINE 4.0 V8, Repair, rocker cover - left hand; Refit***
9. Reconnect battery negative lead.

OIL SUMP

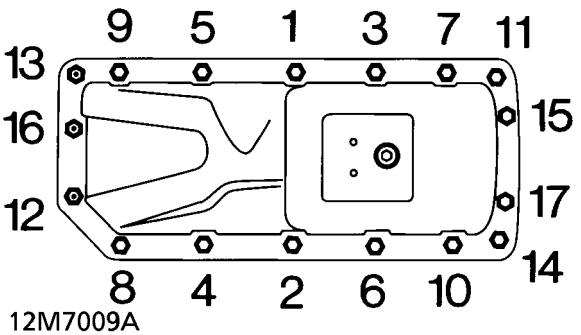
Service repair no - 12.60.44

Remove

1. Drain engine oil ***See MAINTENANCE , Under vehicle maintenance***
2. Fit and tighten drain plug to ***43 Nm (32 lbf.ft).***
3. Remove bolt securing dipstick tube to rocker cover.
4. Working from the centre outwards, progressively loosen and remove 3 screws and 14 bolts securing sump. Remove sump.
5. Remove all traces of sealant from mating surfaces of sump, cylinder block and timing cover, using a suitable solvent or plastic scraper.
6. Degrease mating surfaces of sump, cylinder block and front cover.

Refit

7. Apply RTV Hylosil White sealant to mating surface of sump.
8. Position sump, tighten bolts finger tight.



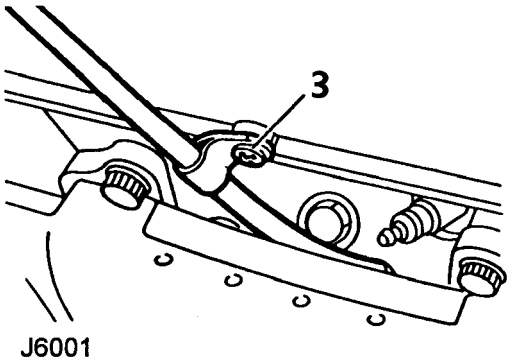
9. Tighten nuts and bolts progressively in sequence shown to ***23 Nm (17 lbf.ft).***
10. Fit bolt securing dipstick tube to rocker cover.

ROCKER COVER GASKET - LEFT HAND

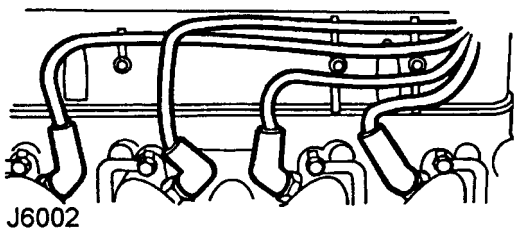
Service repair no - 12.29.40

Remove

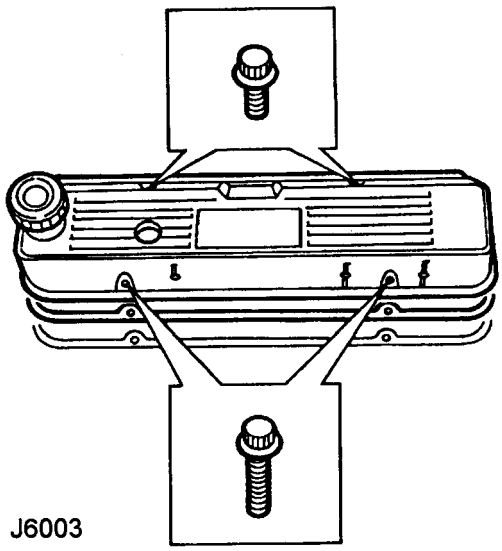
1. Disconnect battery negative lead.
2. Remove plenum chamber. ***See FUEL SYSTEM, Repair, plenum chamber***



3. Remove screw securing dipstick tube to rocker cover.



4. Release 4 spark plug leads from guide clips and disconnect leads from spark plugs.



5. Remove 4 bolts securing rocker cover to cylinder head.
6. Remove rocker cover.
7. Remove and discard rocker cover gasket.

Refit

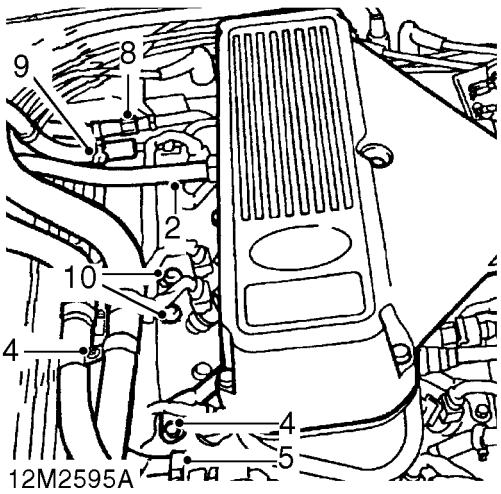
8. Clean mating faces of rocker cover and cylinder head.
9. Fit rubber gasket to rocker cover.
10. Fit rocker cover and gasket to cylinder head.
11. Fit rocker cover bolts, ensuring short bolts are fitted inboard, and tighten by diagnonal selection to:
    Stage 1 - ***4 Nm (3 lb.ft).***
    Stage 2 - ***8 Nm (6 lb.ft).***
    Stage 3 - Re-torque to ***8 Nm (6 lb.ft).***
12. Connect plug leads and secure to guide clips.
13. Align dipstick tube to rocker cover and tighten screw.
14. Fit plenum chamber. ***See FUEL SYSTEM, Repair, plenum chamber; Refit***
15. Reconnect battery negative lead.

ROCKER COVER GASKET - RIGHT HAND

Service repair no - 12.29.41

Remove

1. Disconnect battery negative lead.



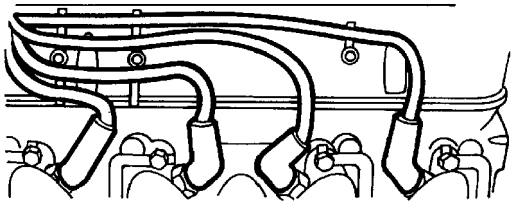
2. Disconnect breather hose from plenum chamber and remove hose from rocker cover.
3. Position container to collect coolant spillage.
4. Remove bolt securing coolant pipe brackets together and nut securing bracket to manifold.
5. Loosen clip and disconnect coolant return hose from manifold.
6. Depressurise fuel system. ***See FUEL SYSTEM, Adjustment, fuel system depressurise***
7. Position cloth to absorb fuel spillage.
8. Disconnect fuel feed hose union.

CAUTION: Plug the connections.

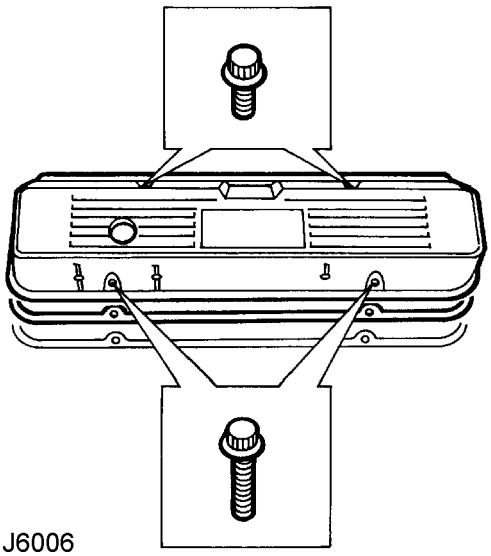
9. Loosen clip and disconnect fuel return hose.

CAUTION: Plug the connections.

10. Remove 2 bolts securing engine harness bracket to manifold.


J6005

11. Release 4 spark plug leads from guide clips and disconnect leads from spark plugs.


J6006

12. Remove 4 bolts securing rocker cover to cylinder head.
13. Remove rocker cover.
14. Remove and discard rocker cover gasket.

Refit

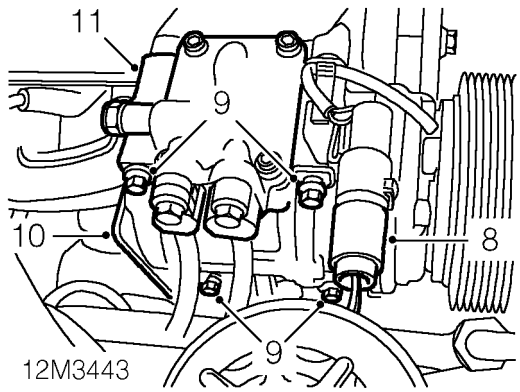
15. Clean mating faces of rocker cover and cylinder head.
16. Fit rubber gasket to rocker cover.
17. Fit rocker cover and gasket to cylinder head
18. Fit rocker cover bolts, ensuring short bolts are fitted inboard, and tighten by diagonal selection to:
    Stage 1 - ***4 Nm (3 lb.ft).***
    Stage 2 - ***8 Nm (6 lb.ft).***
    Stage 3 - Re-torque to ***8 Nm (6 lb.ft).***
19. Connect plug leads and secure to guide clips.
20. Position harness bracket to inlet manifold and tighten bolts.
21. Connect fuel feed and return hoses.
22. Connect coolant hose to inlet manifold and tighten clip.
23. Secure coolant pipe brackets
24. Fit breather hose.
25. Refill cooling system.
26. Reconnect battery negative lead.

ENGINE ASSEMBLY

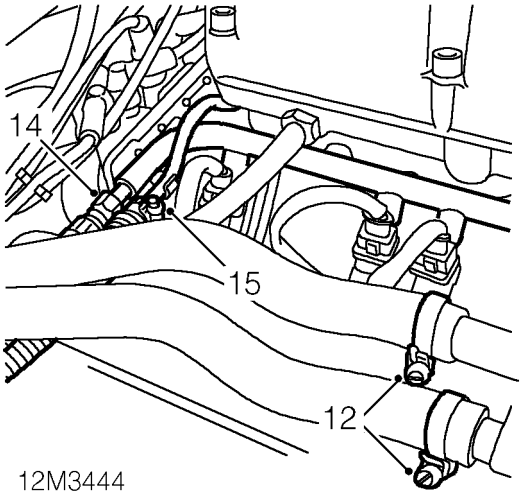
Service repair no - 12.41.01

Remove

1. Position vehicle on '4-post' ramp.
2. Drain engine oil. ***See MAINTENANCE , under vehicle maintenance***
3. Remove bonnet. ***See CHASSIS AND BODY, Repair, bonnet***
4. Remove radiator. ***See COOLING SYSTEM, Repair, radiator***
5. Restrain PAS pump pulley with an Allen key, and loosen 3 PAS pump pulley bolts.
6. Using a 15 mm ring spanner, release auxillary drive belt tension and release belt from alternator pulley.
7. Remove drive belt.



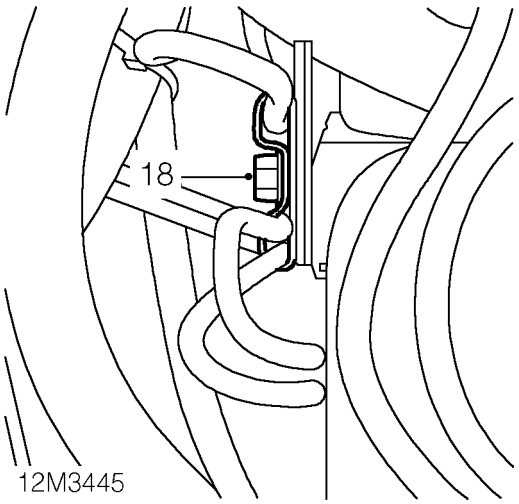
8. Disconnect A/C compressor multiplug.
9. Remove 4 bolts securing compressor to mounting bracket.
10. Collect compressor heat shield.
11. Tie compressor aside with string.



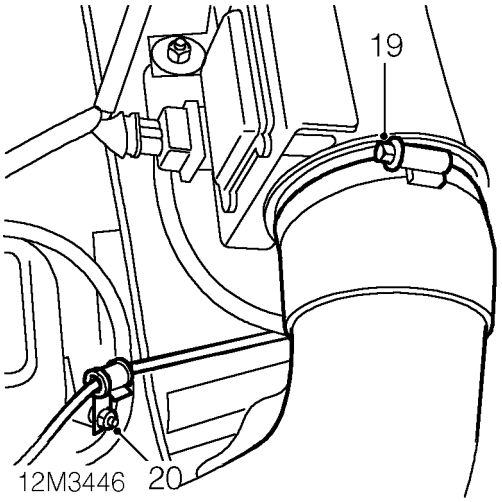
12. Loosen clip screws securing heater return and feed hoses to pipes and disconnect.
13. Position cloth to collect fuel spillage.
14. Loosen fuel feed hose to rail union, allow fuel to spill and disconnect union.
15. Loosen clip screw securing fuel return hose to fuel rail and disconnect hose.

CAUTION: Plug the connections.

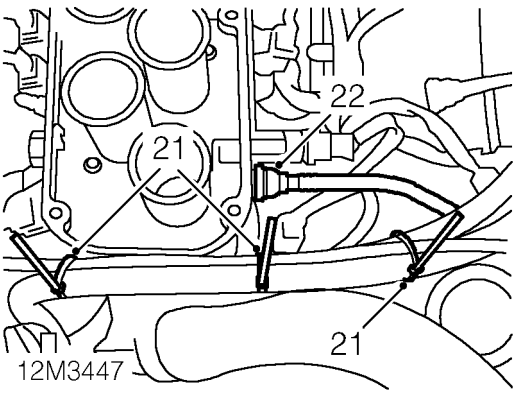
16. Remove cloth.
17. Remove plenum chamber. ***See FUEL SYSTEM, Repair, plenum chamber***



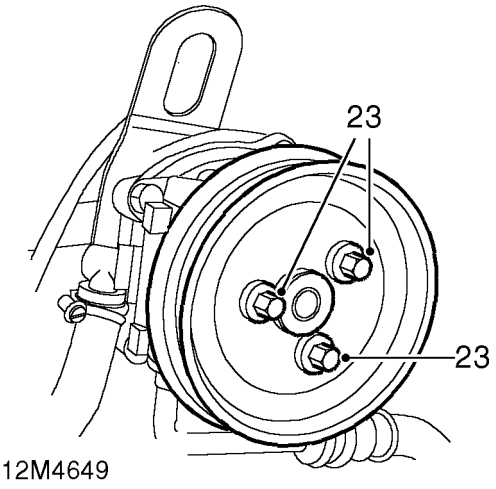
18. Remove bolt securing 2 breather pipe 'P' clip to rear of RH cylinder head.



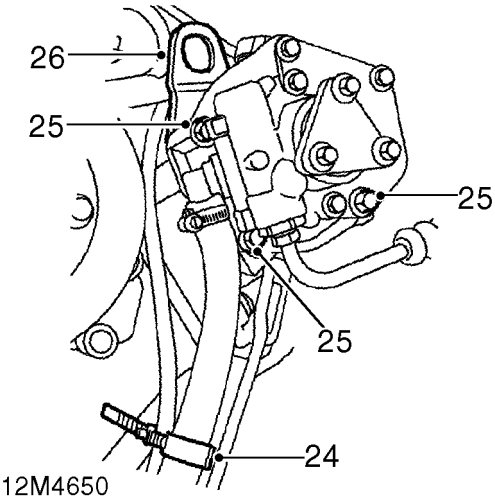
19. Loosen clip screw securing intake hose to MAF sensor housing and remove hose.
20. Remove nut securing kick-down cable clip to rear of LH cylinder head.



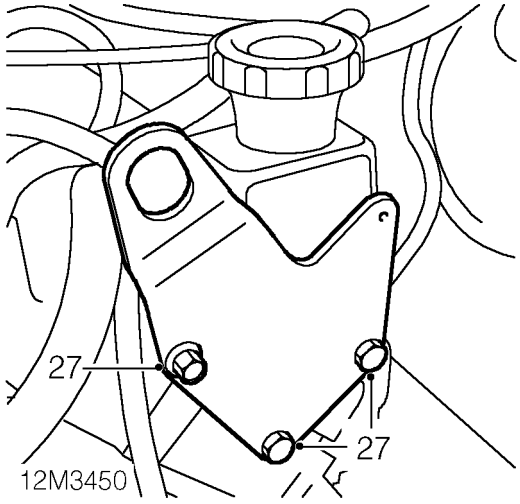
21. Remove 3 cable ties securing purge pipe to coolant hose and harness, position pipe aside.
22. Disconnect brake servo pipe from inlet manifold and position aside.



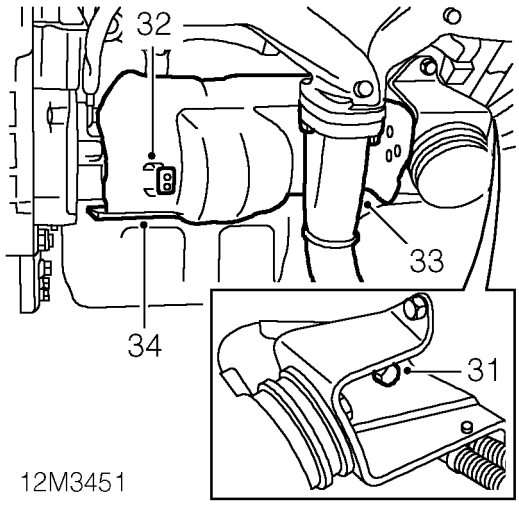
23. Remove 3 bolts securing PAS pulley and remove pulley.



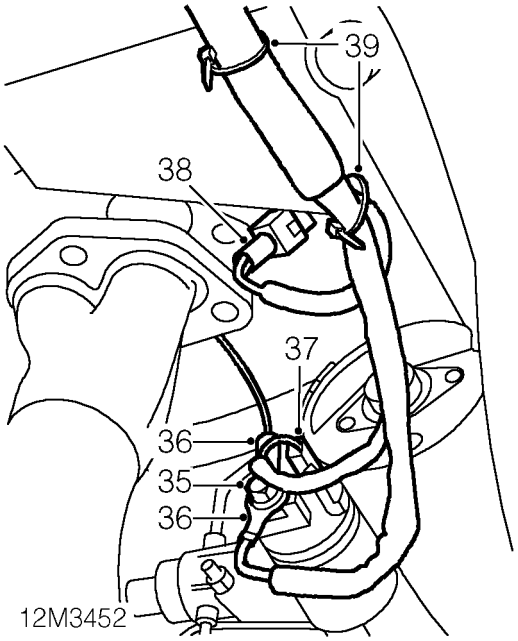
24. Release knock sensor harness clip from PAS return hose.
25. Remove 3 bolts securing PAS pump and position aside.
26. Collect engine lifting bracket.



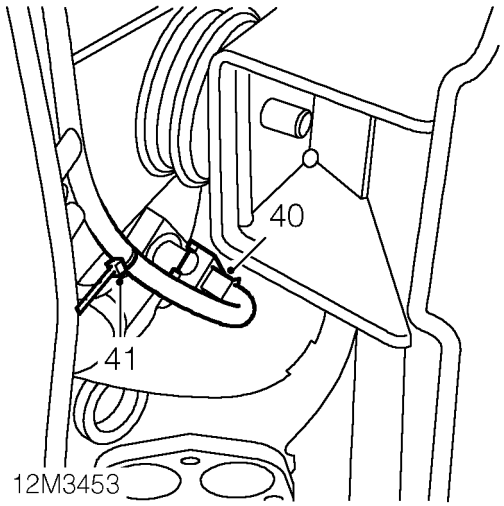
27. Position engine lifting bracket and secure with 3 (3/8'' UNC x 1'' MAX) bolts.
28. Raise vehicle on ramp.
29. Remove 6 nuts securing exhaust front pipe to manifolds.
30. Remove front bolt securing RH catalyst heat shield to chassis.



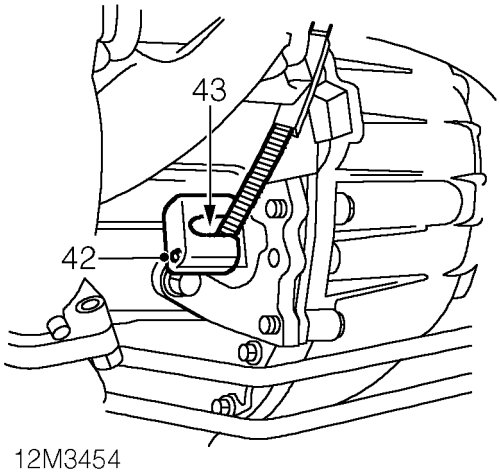
31. Remove bolt securing starter motor heat shield to RH engine mounting bracket.
32. Release starter motor heat shield clip from solenoid.
33. Release exhaust front pipe from manifold studs and remove and discard gaskets.
34. Remove starter motor heat shield.



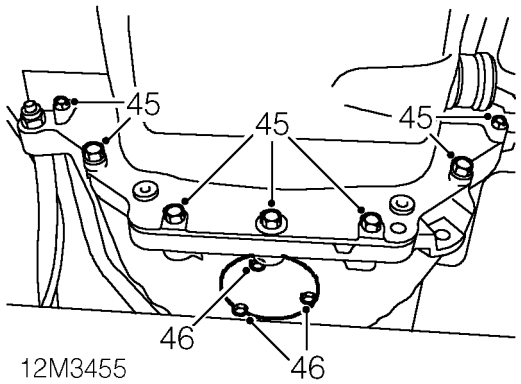
35. Remove starter motor solenoid terminal nut.
36. Release 2 battery leads from terminal.
37. Disconnect solenoid Lucar.
38. Disconnect multiplug from RH knock sensor.
39. Remove 2 cable ties securing engine harness to RH engine mounting bracket.



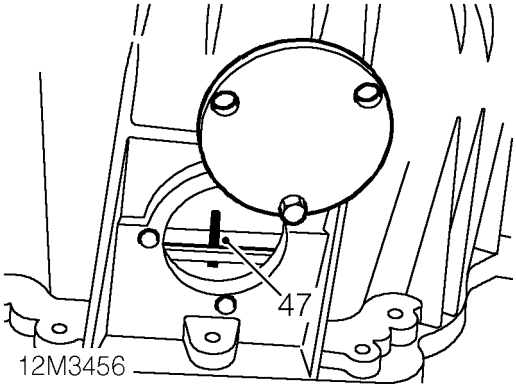
40. Disconnect multiplug from LH knock sensor.
41. Remove cable tie securing engine harness to LH engine mounting bracket.

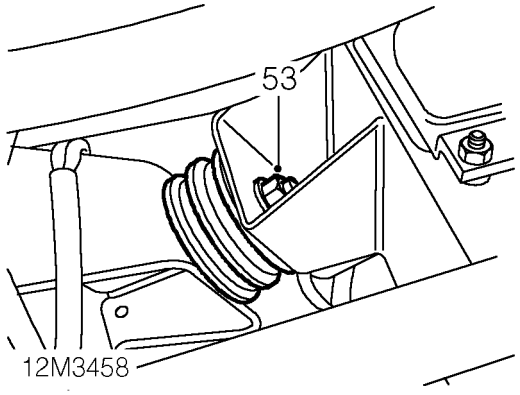


42. Remove screw securing crankshaft position sensor heat shield and remove heat shield.
43. Disconnect multiplug from crankshaft position sensor.
44. Remove bolt securing gearbox cooler pipes to engine sump bracket.

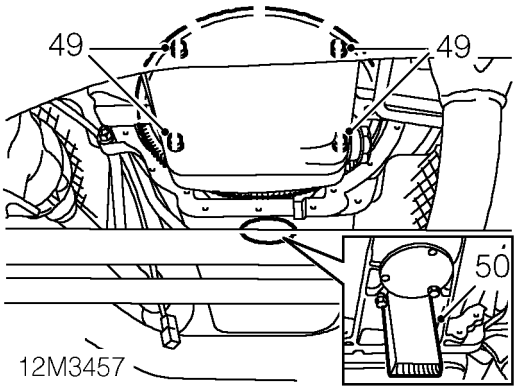


45. Remove 7 bolts securing bell housing closing plate and remove plate.
46. Remove 3 bolts securing bell housing access plate and remove plate.



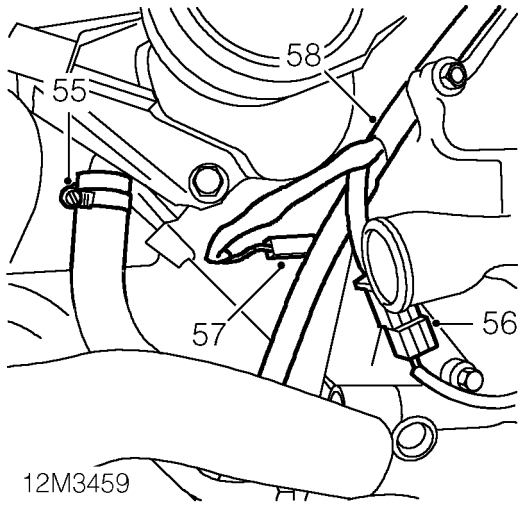


47. Mark relationship between converter and drive plate.
48. Rotate crankshaft to access drive plate to converter retaining bolts.

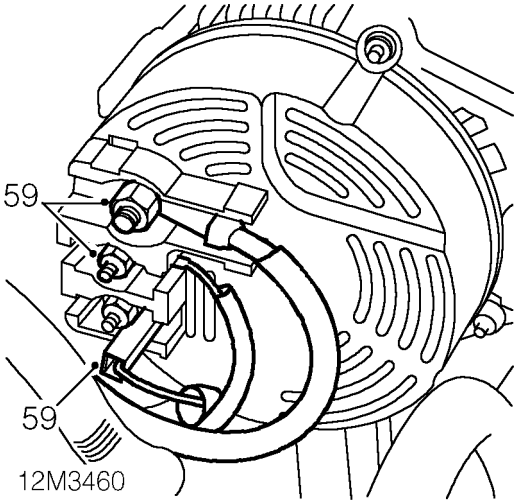


49. Remove 4 bolts securing drive plate to converter.
50. Fit suitable piece of wood through bell housing access hole to retain converter.
51. Remove 2 bell housing lower retaining bolts.

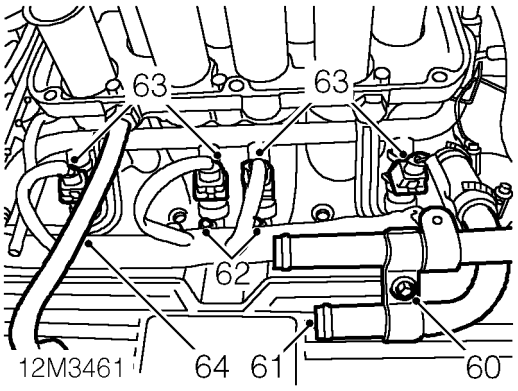
52. Remove nut securing RH engine mounting to chassis bracket.
53. Remove nut securing LH engine mounting to chassis bracket.
54. Lower vehicle.



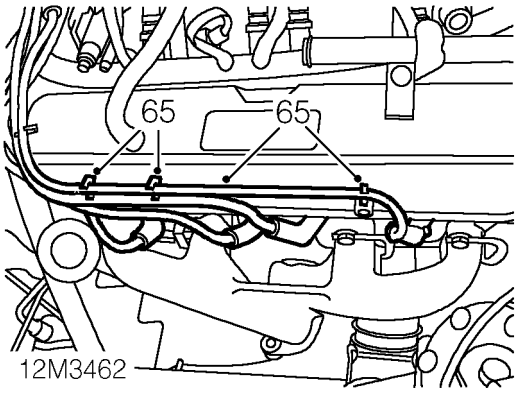
55. Loosen clip screw and disconnect radiator bottom hose from heater pipe.
56. Disconnect multiplug from camshaft position sensor.
57. Disconnect Lucar from oil pressure switch.
58. Release harness from front of engine.



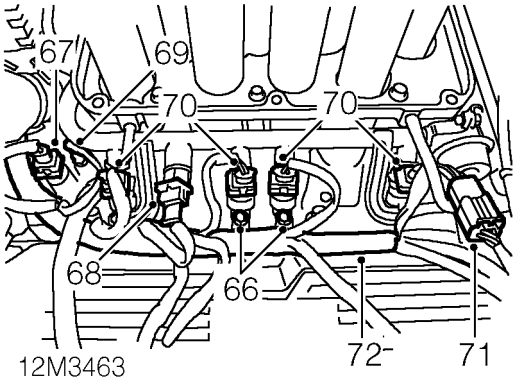
59. Remove 2 alternator terminal nuts and disconnect Lucar.



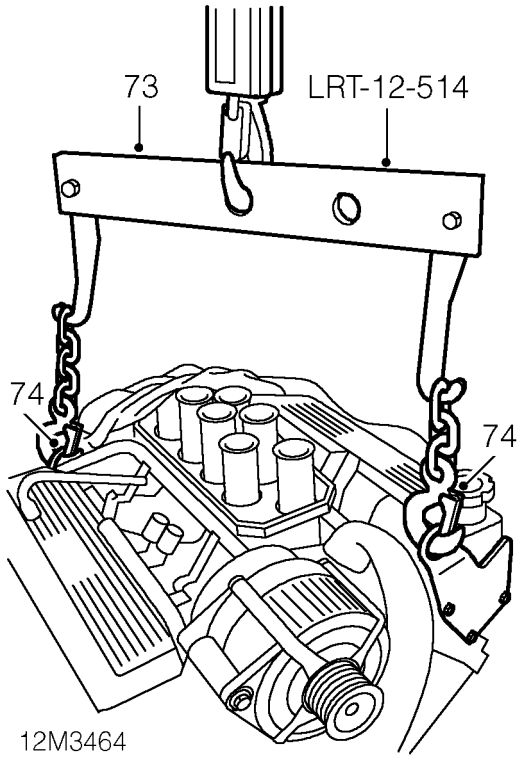
60. Remove screw securing heater pipe to bracket.
61. Loosen clip screw and remove heater hose/pipe assembly from inlet manifold.
62. Remove 2 screws securing engine harness to RH side of inlet manifold.
63. Disconnect 4 RH injector multiplugs.
64. Disconnect RH rocker cover breather pipe from ram housing.



65. Release RH bank HT leads from clips and disconnect from spark plugs.



66. Remove 2 screws securing engine harness to LH side of inlet manifold.
67. Disconnect multiplug from ECT sensor.
68. Disconnect multiplug from fuel temperature sensor.
69. Disconnect temperature sensor thermistor.
70. Disconnect 4 LH injector multiplugs.
71. Release ignition coil multiplug from mounting bracket and disconnect multiplug.
72. Position engine harness aside.



73. Fit engine lifting tool **LRT-12-514** to hoist.
74. Lower hoist and connect lifting chains to engine brackets.
75. Raise hoist until lifting chains become taught and use a jack to support gearbox.
76. Remove 6 bell housing to engine bolts.
77. With assistance, raise engine on hoist from engine compartment.

CAUTION: During the engine removal procedure ensure that the engine does not damage any surrounding components.

78. Move engine clear of vehicle and lower onto work bench.
79. Disconnect lifting chains from engine.
80. Raise hoist and position aside.

Refit

81. Clean engine and gearbox mating faces.
82. Clean dowel and dowel holes.
83. Position hoist above engine.
84. Connect lifting chains to engine.
85. Raise engine from work bench and position above engine compartment.
86. Position jack beneath gearbox fluid pan and raise transmission to ease alignment of bell housing to engine.

CAUTION: Use a block of wood or hard rubber pad to protect fluid pan.

87. With assistance, lower engine into engine compartment.

CAUTION: During the engine fitment procedure ensure that the engine does not damage any surrounding components.

88. With assistance, align engine to bell housing dowels.
89. Fit bolts securing bell housing to engine and tighten to ***46 Nm (34 lbf.ft).***

NOTE: Align harness brackets to 2 uppermost bell housing retaining bolts.

90. Remove jack supporting gearbox fluid pan.
91. Lower engine hoist ensuring mountings are aligned with chassis brackets.
92. Disconnect lifting chains from engine eyes.
93. Remove lifting tool **LRT-12-514** from hoist.
94. Remove hoist from above vehicle.
95. Position engine harness around engine.
96. Connect ignition coil multiplug and secure to bracket.
97. Connect LH injector multiplugs.
98. Connect gauge temperature thermistor.
99. Connect multiplug to fuel temperature sensor.
100. Connect multiplug to ECT sensor.
101. Connect RH bank HT leads to spark plugs and secure to guides.
102. Connect RH rocker cover breather pipe to ram housing.
103. Connect RH injector multiplugs.
104. Align engine harness to RH side of inlet manifold and secure with screws.
105. Fit heater hose/pipe assembly to inlet manifold and secure with clip.
106. Align heater pipe to bracket and secure with screw.
107. Position alternator terminal leads and secure.
108. Route harness down front of engine.
109. Connect Lucar to oil pressure switch.
110. Connect multiplug to camshaft position sensor.
111. Connect radiator bottom hose to heater pipe and secure with clip.
112. Raise vehicle.

113. Fit nut securing LH engine mounting rubber to chassis mounting and tighten to ***30 Nm (22 lbf.ft).***
114. Fit nut securing RH engine mounting rubber to chassis mounting and tighten to ***30 Nm (22 lbf.ft).***
115. Fit bell housing to engine bolts and tighten to ***46 Nm (34 lbf.ft).*** .
116. Remove piece of wood from bell housing access hole.
117. Align converter to drive plate.
118. Fit bolts securing converter to drive plate and tighten to ***45 Nm (33 lbf.ft).***

NOTE: Rotate crankshaft during the above procedure.

119. Fit bell housing access plate and secure with bolts tightened to ***9 Nm (7 lbf.ft).***
120. Clean bell housing cover plate and mating face.
121. Fit plate and secure with bolts tightened to ***9 Nm (7 lbf.ft).***
122. Connect multiplug to crankshaft position sensor.
123. Fit crankshaft position sensor heat shield and secure with screw.
124. Position engine harness to LH engine mounting bracket and secure with cable tie.
125. Connect multiplug to LH knock sensor.
126. Position engine harness to RH engine mounting bracket and secure with cable ties.
127. Connect multiplug to RH knock sensor.
128. Connect Lucar to starter motor solenoid.
129. Position battery leads to starter motor solenoid terminal and secure with nut.
130. Position starter motor heat shield.
131. Clean exhaust manifold to front pipe mating faces.
132. Fit NEW front pipe to manifold gaskets.
133. Connect front pipe to manifold studs and secure with nuts.
134. Secure starter motor heat shield clip to solenoid.
135. Align starter motor heat shield to RH engine mounting bracket and secure with bolt.
136. Align RH catalyst heat shield to chassis and secure with bolt.
137. Lower vehicle.
138. Remove 3 bolts securing engine front lifting bracket, retain bracket but discard bolts.
139. Position engine lifting bracket to PAS pump, align to cylinder head and secure with bolts tightened to ***35 Nm. (25 lbf.ft).***
140. Secure knock sensor harness clip to PAS return hose.
141. Fit PAS pulley to pump, fit bolts but do not tighten.
142. Position brake servo pipe and connect to inlet manifold.
143. Position purge pipe and secure to coolant hose and harness with cable ties.
144. Fit intake hose to MAF sensor housing and secure with clip.
145. Position breather pipe 'P' clip to RH cylinder head and secure with bolt.
146. Fit plenum chamber. ***See FUEL SYSTEM, Repair, plenum chamber; Refit***
147. Remove plugs from fuel return and feed hose connections.
148. Clean fuel feed pipe connections.
149. Connect feed hose to fuel rail and tighten union.
150. Connect fuel return hose to fuel rail and secure with clip.
151. Connect heater feed and return hoses to pipes and secure with clips.
152. Release A/C compressor and position to mounting bracket.
153. Position heat shield to compressor fixing, fit bolts and tighten to ***25 Nm (18 lbf.ft).***
154. Connect compressor multiplug.
155. Clean drive belt and pulley grooves.
156. Using a 15 mm spanner, rotate tensioner clockwise, fit belt to pulleys and release tensioner.
157. Tighten PAS pump pulley bolts to ***10 Nm (7 lbf.ft).***
158. Fit radiator. ***See COOLING SYSTEM, Repair, Radiator; Refit***
159. Fit bonnet. ***See CHASSIS AND BODY, Repair, Bonnet; Refit***
160. Refill engine oil. ***See MAINTENANCE , under vehicle maintenance***
161. Adjust kick-down cable. ***See AUTOMATIC GEARBOX, Adjustment, kickdown cable adjustment***

TORQUE VALUES

Engine V8i	Nm	lbf.ft)
Crankshaft pulley bolt	270	200
Camshaft gear bolt	58	43
Timing cover / coolant pump bolts***	22	16
Rocker cover to cylinder head	8	6
Rocker shaft bracket to cylinder head	38	28
Spark plug	15	11
Cylinder head bolts:*		
Stage 1:	20	15
Stage 2:	then 90 °	then 90 °
Stage 3:	further 90 °	further 90 °
Alternator / steering pump bracket to cylinder head	30	22
Lifting bracket to cylinder heads	40	30
Power steering hose unions:		
14 mm	15	11
16 mm	20	15
Power steering pump heat shield	25	18
Drive belt tensioner	50	39
Drive plate to converter	45	33
Drive plate to crankshaft	45	33
Drive plate hub aligner to crankshaft socket head screws	85	65
Bell housing bolts	46	34
Access plate	9	7
Bell housing cover plate	9	7
Main bearing cap rear bolts:		
Stage 1:	13	10
Stage 2:	72	53
Oil sump drain plug	43	32
Oil sump to cylinder block	23	17
Starter motor bolts	45	33
Starter motor heat shield	9	7
Oil cooler pipe unions to gearbox	30	22
Tie bar to gearbox	45	33
Gearbox breather pipe bracket	9	7
Engine harness bracket	9	7
Engine mountings to engine and chassis	55	40
Engine mounting rubbers to brackets	30	22
Compressor heat shield	25	18

* Lightly oil threads prior to assembly
** Apply Loctite 222 to threads before assembly
*** Apply Loctite 577 to threads before assembly

NOTE: The following torque values are for screws and bolts not specified in the previous table.

METRIC	Nm	lbf.ft
M5	6	5
M6	9	7
M8	25	18
M10	45	33
M12	90	65
M14	105	75
M16	180	130

UNC / UNF		
1/4	9	7
5/16	25	18
3/8	40	30
7/16	80	60
1/2	90	65
5/8	135	100

17 - EMISSION CONTROL

CONTENTS

EMISSION CONTROL

Three systems are used to control the vehicle atmospheric emissions, these are:

- Engine crankcase fume emissions.
- Fuel tank evaporative emissions
- Engine exhaust gas emissions.

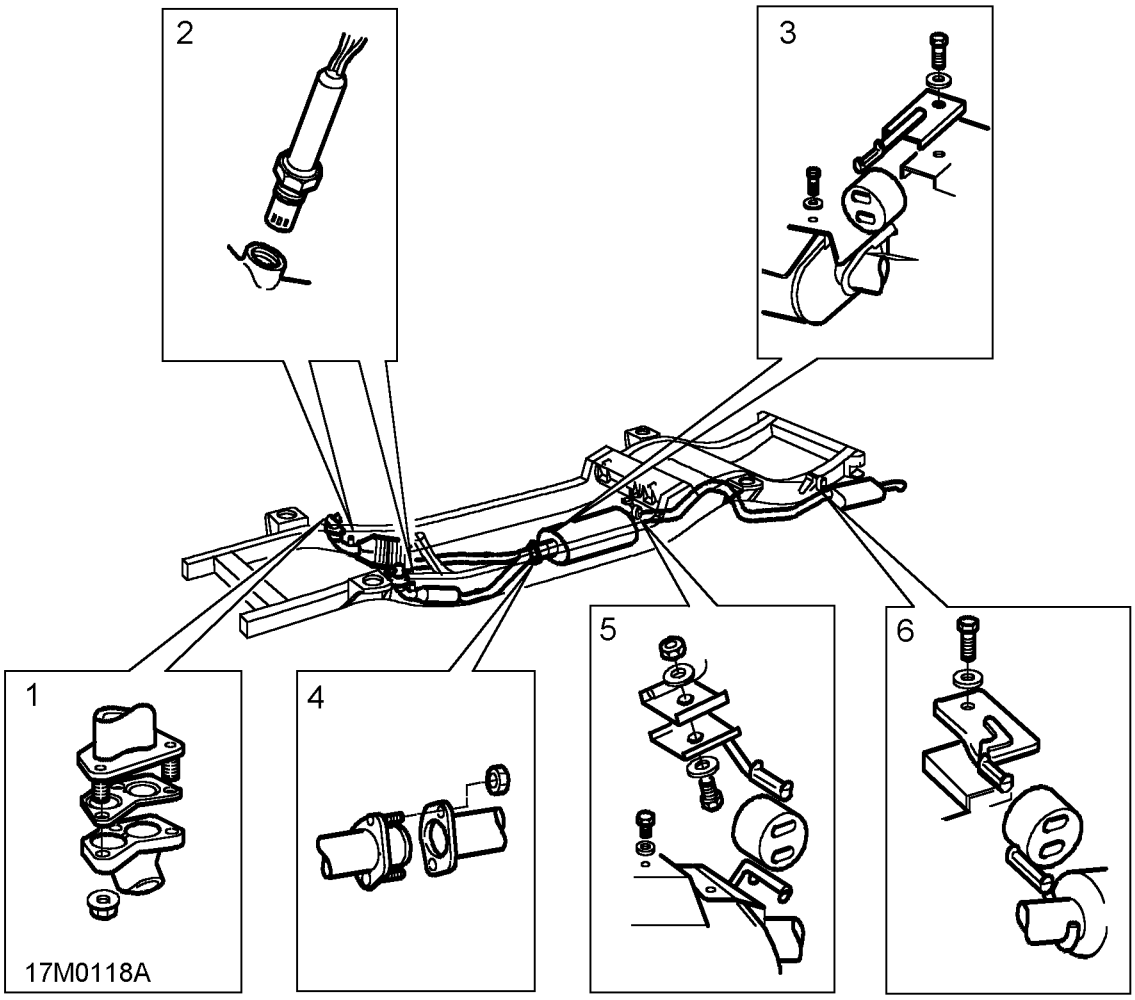
Crankcase ventilation system

The crankcase ventilation system, which is an integral part of the air supply to the engine combustion chambers, is often overlooked when diagnosing problems associated with engine performance. A blocked ventilation pipe or excessive air leak into the inlet system through a damaged pipe or leaking gasket can affect the mixture, performance and economy of the engine.

The purpose of the crankcase ventilation system is to ensure that any noxious gas generated in the engine crankcase is rendered harmless by burning in the combustion chambers as follows:
Oil laden noxious gas in the engine crankcase is drawn through an oil separator located in the RH cylinder head rocker cover, where the oil is separated and returned to the sump. The gas flows through a restrictor and via a hose into the inlet plenum chamber where it is drawn into the combustion chambers and burned. The volume of fresh air which is drawn from the atmospheric side of the throttle butterfly, via a hose into the LH rocker cover to mix with the gas, depends on the position of the throttle and the engine speed.

As the throttle opening increases, manifold depression increases, and at a given point, the crankcase gases are drawn into the throttle housing. This reversal helps to prevent excessive crankcase pressure or depression developing.

EXHAUST SYSTEM



1. Manifold to front pipe connection.
2. Oxygen sensor.
3. Front silencer support bracket.
4. Front pipe to silencer joint.
5. Silencer rear support bracket.
6. Rear silencer support bracket.

Exhaust emission control.

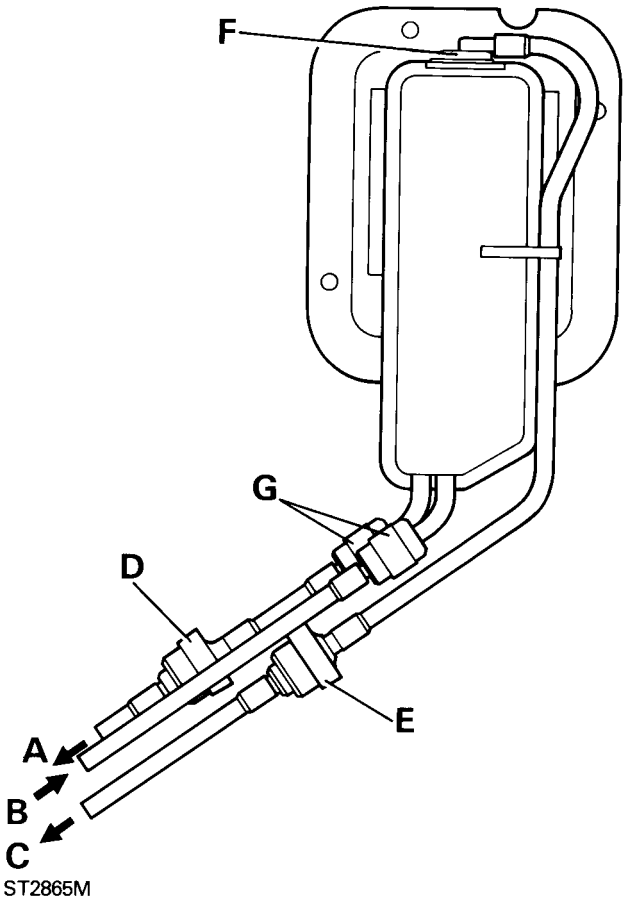
The multiport Sequential Fuel injection (SFi) system provides accurately metered quantities of fuel to the combustion chambers to ensure the most efficient air to fuel ratio under all conditions of operation. A further improvement to combustion is made by measuring the oxygen content of the exhaust gases to enable the quantity of fuel injected to be varied, according to conditions, to correct any unsatisfactory composition of the exhaust.

The main components of the exhaust emission system are two catalytic converters which are an integral part of the front exhaust pipe assembly. The catalytic converters are included in the system to reduce the emission, to atmosphere, of carbon monoxide, oxides of nitrogen, and hydrocarbons. The active constituents of the converters are platinum and rhodium. The correct functioning of the converters is dependent upon close control of the oxygen concentration in the exhaust gas entering the catalyst. The oxygen content of the exhaust gas is signalled to the Engine Control Module (ECM) by Heated Oxygen Sensors (HO2s) located in the exhaust front pipes. The ECM can then make an appropriate adjustment to the fuel supply to correct the composition of the exhaust gases.

CAUTION: Unleaded fuel only must be used on vehicles fitted with catalytic converters. As a reminder a label to indicate this is adhered to the inside of the fuel filler flap. As a further safeguard, the filler neck is designed to accommodate only unleaded fuel pump nozzles.

EVAPORATIVE EMISSION CONTROL SYSTEM

The system is designed to prevent harmful fuel vapour from escaping to the atmosphere. The system consists of a vapour separator tank, connected to the fuel tank and located between the body inner and outer panels on the right hand side of the vehicle near the rear wheel arch. An Evaporative Emissions (EVAP) canister, containing activated charcoal, is positioned in the engine compartment attached to the front right valance. The two components are connected by a pipe running the length of the chassis.



ST2865M

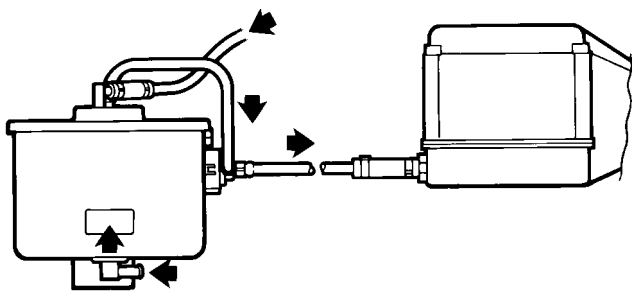
A Pressure relief to atmosphere.
B From fuel tank to separator.
C To evaporative emissions canister.
D Pressure relief valve.
E Pressure relief valve.
F Shut-off valve.
G "Speed Fit" connectors.

A pressure relief valve is fitted in the hose which is open to atmosphere. This valve acts as a safety valve should a build-up of pressure occur in the system, for example if a hose became blocked or kinked. The volume of vapour emitted, in such an instance, would be limited.

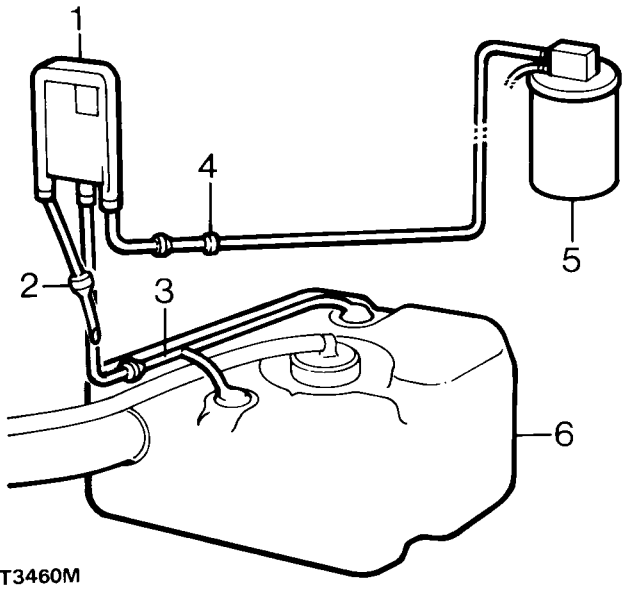
A pressure relief valve is also fitted in the hose connected to the adsorption canister and releases vapour to the canister when the pressure in the separator reaches between 5 and 7 Kpa (0.7 and 1.0 lbf/in^2).

In the top of the separator a shut-off valve is incorporated in the vapour exit port to prevent the possible presence of any liquid fuel being transmitted to the EVAP canister should the vehicle roll over.

The EVAP canister, which is connected by a hose to the plenum chamber, absorbs and stores the fuel vapour from the fuel tank while the engine is not running. When the engine is started, the vapour is purged from the canister by air drawn through an orifice in the base of the canister and by the influence of vacuum at the top. The vapour drawn into the plenum chamber through a solenoid operated purge valve is finally burnt in the combustion chambers.


ST2866M

The purge valve, which is attached to the EVAP canister support bracket, is controlled by the Engine Control Module ECM which determines the optimum time at which purging should take place. This will normally be at engine speeds above idle and when the vehicle is in motion. A signal from the ECM to the purge valve operates the solenoid and opens the valve to purge the canister of fuel vapour.



ST3460M

1. Vapour separator and pipes
2. Non-return valve to atmosphere
3. Pipe from fuel tank
4. Pipe to EVAP canister
5. EVAP canister and purge valve
6. Fuel tank

TESTING EVAPORATIVE EMISSION CONTROL

Equipment required.

Nitrogen cylinder (compressed air may be used to pressurize the system when there has NEVER been fuel present in the fuel or evaporative control systems).

The following pressure test procedure is intended to provide a method for ensuring that the system does not leak excessively and will effectively control evaporative emissions.

Water manometer 0 - 762mm (0 - 30" H2o or more).

Pipework and a "T" piece.

Method.

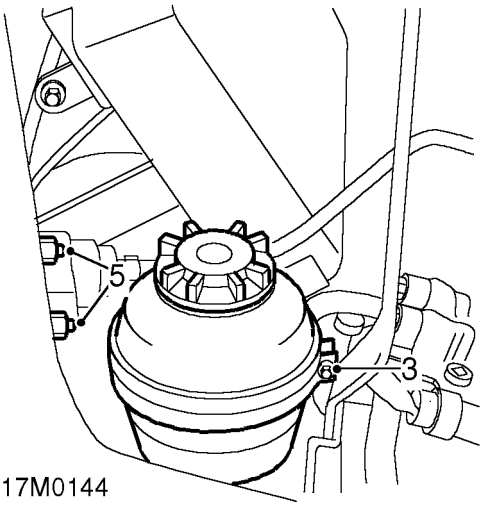
1. Ensure that there is at least two gallons of fuel in the petrol tank unless there has never been any fuel in the system.
2. Disconnect, at the EVAP canister, the pipe to the vapour separator.
3. Connect this pipe to the nitrogen cylinder and the water manometer using the "T" piece.
4. Pressurize the system to between 673.1 and 698.3mm (26.5 and 27.5 inches) of water, allow the reading to stabilize, then turn off the nitrogen supply.
5. Measure the pressure drop within a period of 2 minutes 30 seconds. If the drop is greater than 63.5mm (2.5 inches) of water the system has failed the test. Note that a fully sealed system will show a slight increase in pressure.
6. Should the system fail the test, maintain the pressure in the system and apply a soap solution round all the joints and connections until bubbles appear to reveal the source of the leak.
7. Repeat the test and if successful, dismantle the test equipment and reconnect the pipe to the EVAP canister.

EVAP CANISTER AND PURGE CONTROL VALVE

Service repair no - 17.15.13

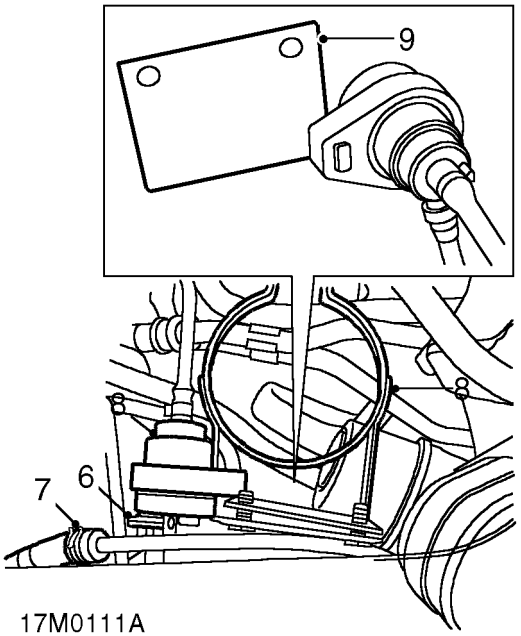
Remove

1. Depress tags securing purge pipe to plenum chamber.
2. Disconnect purge pipe from plenum chamber.



17M0144

3. Remove PAS reservoir clamp bracket bolt.
4. Open clamp and release reservoir from bracket.
5. Remove 2 nuts securing bracket to wing.



17M0111A

6. Release bracket from wing and disconnect multiplug from purge valve.
7. Release clip and disconnect fuel tank vapour separator pipe from canister pipe.
8. Move PAS reservoir aside, release and remove charcoal canister, purge valve and bracket assembly.

Do not carry out further dismantling if component is removed for access only.

9. Remove bracket from purge valve.

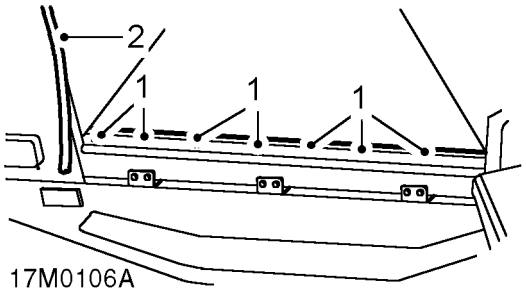
Refit

10. Fit bracket to purge valve.
11. Position assembly, connect vapour separator pipe to canister pipe and secure with clip.
12. Locate purge valve bracket and expansion hose clip to studs and locate assembly to wing.
13. Fit and tighten nuts.
14. Locate PAS reservoir to bracket clip, compress clip, fit bolt and tighten to ***8 Nm (6 lb ft).***
15. Connect purge pipe to plenum chamber.
16. Secure purge pipe to coolant hose with clips.

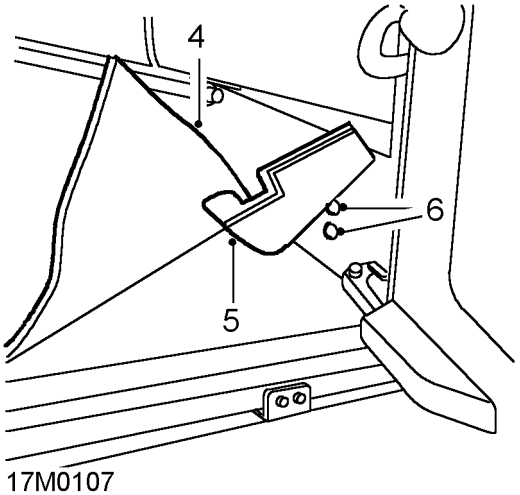
VAPOUR SEPARATOR

Service repair no - 17.15.19

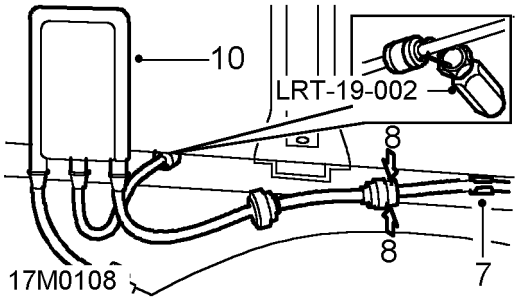
Remove



1. Remove 7 screws securing floor carpet rear retainer.
2. Release lower section of door sealing rubber on one side.
3. Remove carpet retainer.



4. Fold floor carpet back on RH side.
5. Release RH side carpet and move aside to reveal 2 screws securing vapour separator.
6. Remove 2 screws securing vapour separator.



7. Release vapour separator pipe from clip on fuel pipe.
8. Depress 2 lugs on vapour separator connector and disconnect pipe.
9. Using tool **LRT-19-002** depress collar at green end of 'speedfit' connector and disconnect pipe.
10. Remove vapour separator.

Refit

11. Position vapour separator and connect pipes.
12. Using assistance, align vapour separator and fit and tighten screws.
13. Apply adhesive to side carpet and body.
14. Fold down side and floor carpets.
15. Fit carpet retainer and fit and tighten screws.
16. Secure door sealing rubber.

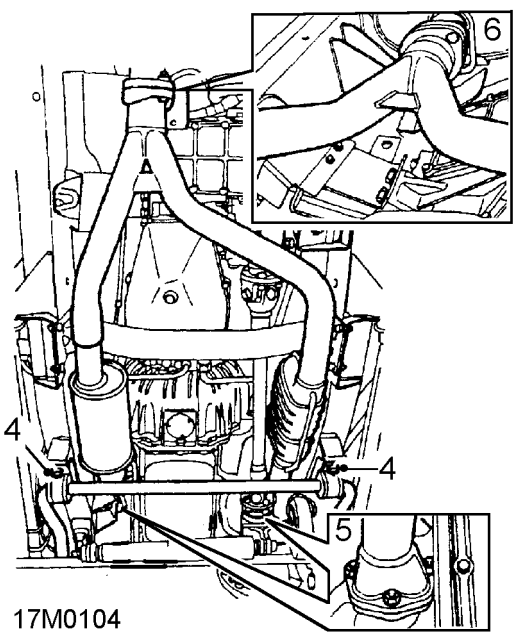
FRONT PIPE / CATALYTIC CONVERTER

Service repair no - 17.50.09

Remove

WARNING: The removal of the exhaust system must only be carried out when the engine is cold.

1. Raise vehicle on ramp.
2. Remove RH oxygen sensor. ***See FUEL SYSTEM, Repair, Heated oxygen sensor (HO2s)***
3. Remove LH oxygen sensor. ***See FUEL SYSTEM, Repair, Heated oxygen sensor (HO2s)***



17M0104

4. Remove 4 bolts securing front anti-roll bar mounting brackets.
5. Remove 6 nuts securing front pipe assembly to exhaust manifolds.
6. Remove 2 nuts securing front pipe assembly to intermediate pipe.
7. With assistance, release front pipe assembly from exhaust manifolds.
8. With assistance, release front pipe assembly from intermediate pipe.
9. With assistance, lower anti-roll bar and remove front pipe assembly.
10. Remove and discard flange gaskets.

Refit

11. Clean exhaust flange mating faces.
12. Fit new flange gaskets.
13. With assistance, position front pipe to vehicle.
14. With assistance, locate front pipe on exhaust manifolds and intermediate pipe.
15. Fit and tighten flange nuts.
16. Reposition front anti-roll bar and secure with bolts.
17. Fit heated oxygen sensors. ***See FUEL SYSTEM, Repair, Heated oxygen sensor (HO2s); Refit***
18. Lower vehicle.

19 - FUEL SYSTEM

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SFI

DESCRIPTION AND OPERATION

ADJUSTMENT

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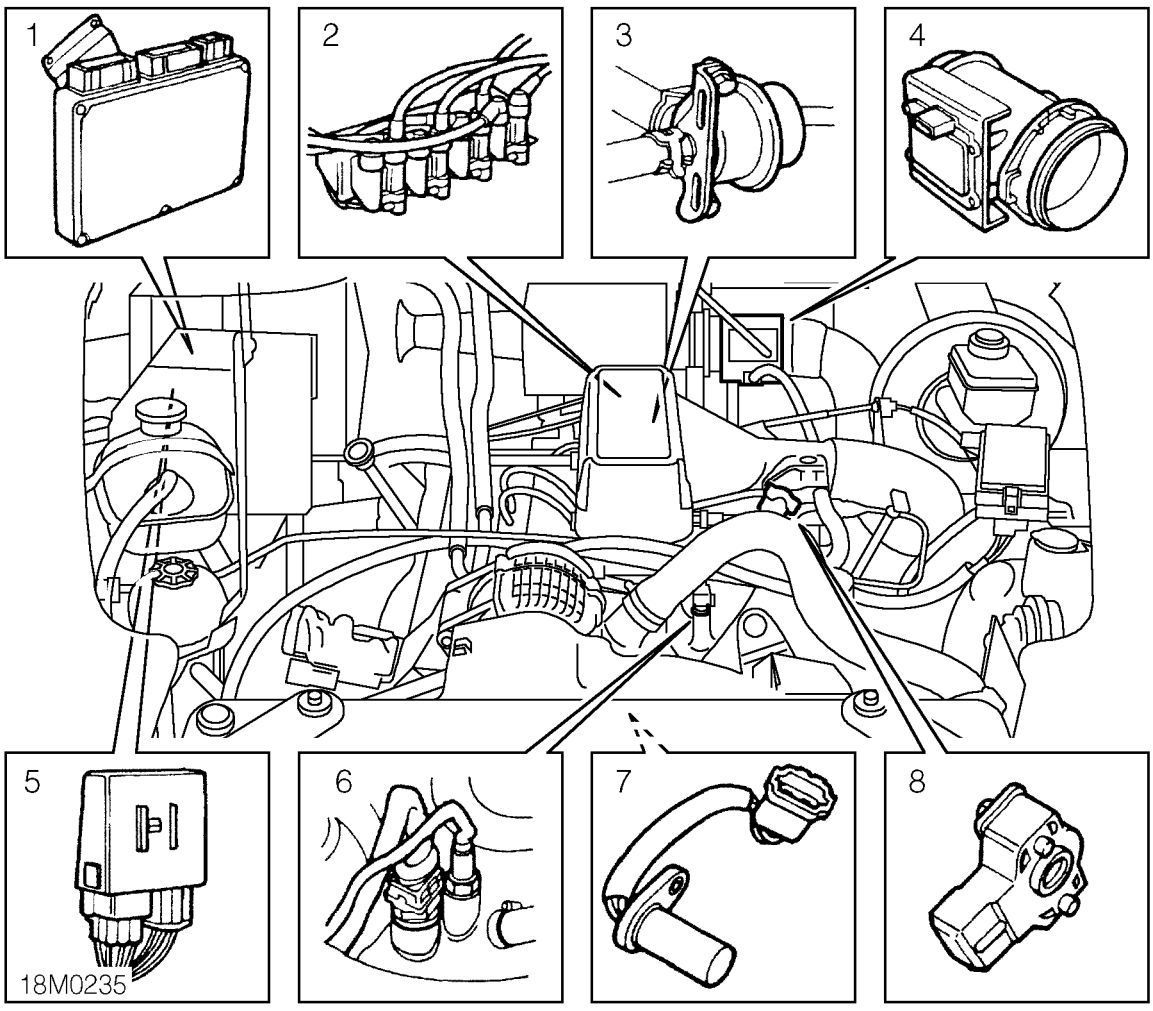
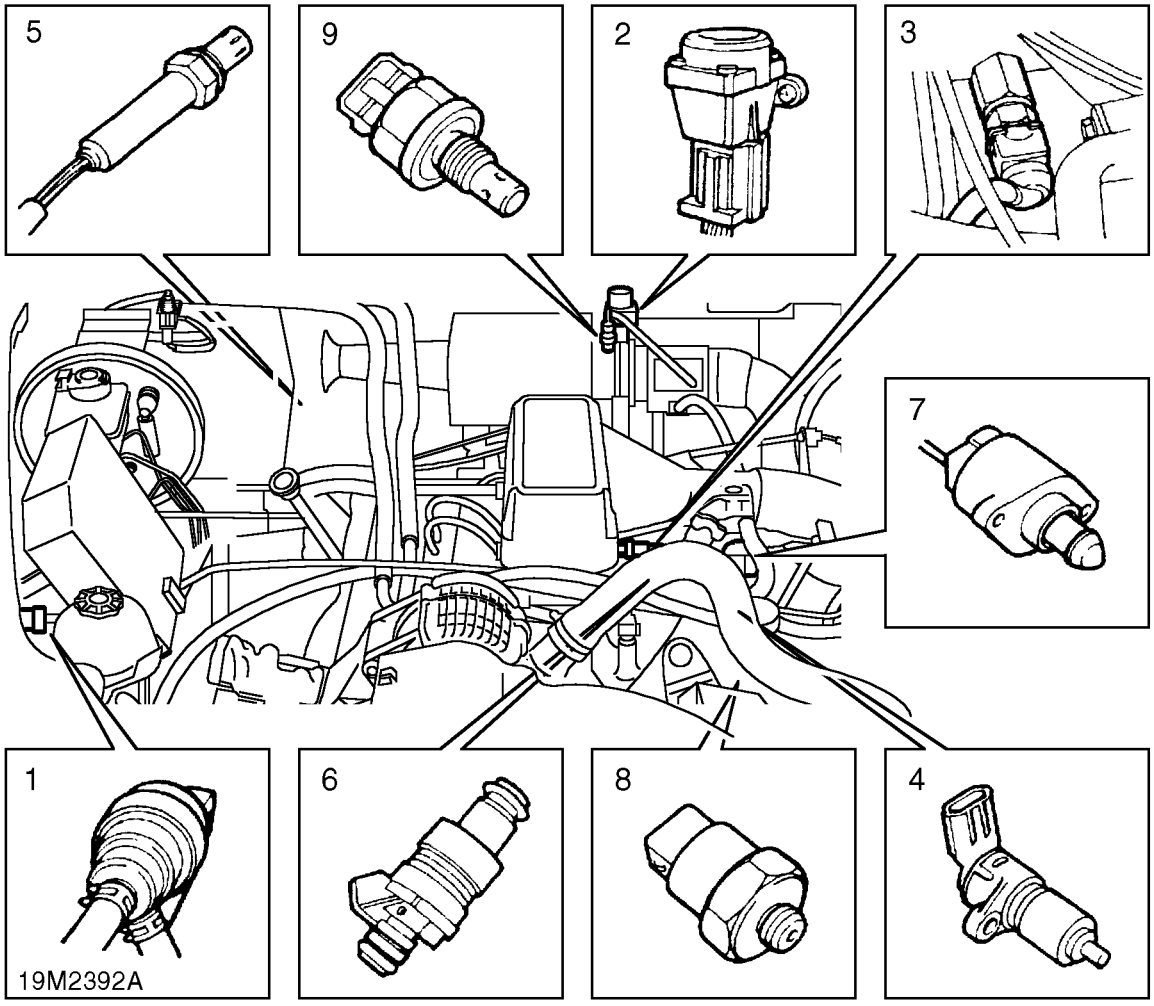
SPECIFICATIONS, TORQUE

ENGINE MANAGEMENT SYSTEM COMPONENT LOCATION



1. Engine Control Module (ECM)
2. Ignition coils
3. Fuel pressure regulator
4. Mass air flow (MAF) sensor
5. Relay module
- Main relay
- Fuel pump relay

6. Engine coolant temperature (ECT) sensor
7. Camshaft position (CMP) sensor
8. Throttle position (TP) sensor



1. EVAP purge valve
2. Inertia switch
3. Engine fuel temperature (EFT) sensor
4. Crankshaft position (CKP) sensor
5. Heated oxygen sensor (HO2S) - 2 off
6. Injectors - 8 off
7. Idle air control valve (IACV)
8. Knock sensors - 2 off
9. Intake air temperature (IAT) sensor

ENGINE MANAGEMENT SYSTEM

Description

The engine management system (EMS) maintains optimum engine performance over the entire operating range. The correct amount of fuel is metered into each cylinder inlet tract and the ignition timing is adjusted for each spark plug.

The system is controlled by the Engine Control Module (ECM) which receives data from sensors located on and around the engine. From this information it provides the correct fuel requirements and ignition timing to suit all engine loads and speeds.

The fuel injection system uses a hot wire Mass Air Flow sensor to calculate the amount of air flowing into the engine.

The ignition system does not use a distributor. It is a direct ignition system (DIS), using four double ended coils. The circuit to each coil is completed by switching inside the ECM.

The on board diagnostic system detects any faults which may occur within the EMS. Fault diagnosis includes failure of all EMS sensors and actuators, emissions related items, fuel supply and exhaust systems.

The system incorporates certain default strategies to enable the vehicle to be driven in case of sensor failure. This may mean that a fault is not detected by the driver.

Crankshaft position (CKP) sensor

The crankshaft position sensor is the most important sensor on the engine. It is located in the left hand side of the torque convertor housing. The signal it produces informs the ECM:
- that the engine is turning
- how fast the engine is turning
- at which stage the engine is, in the combustion cycle.

As there is no default strategy, failure of the crankshaft sensor will result in the engine failing to start.

Camshaft position (CMP) sensor

The camshaft position sensor is located in the engine front cover. It produces four pulses every two revolutions. The signals are used in two areas, injector timing corrections for fully sequential fuelling and active knock control.

If the camshaft sensor fails, default operation is to continue normal ignition timing. The fuel injectors will be actuated sequentially, timing the injection with respect to top dead centre. Injection will either be correct or one revolution out of synchronisation. The fault is not easily detected by the driver.

Mass air flow (MAF) sensor

The ’hot wire’ type mass air flow sensor is mounted rigidly to the air filter and connected by flexible hose to the plenum chamber inlet. The sensing element of the MAF Sensor is a wire which is heated. Air flows across the heated wire cooling it and thus changing its resistance. The ECM measures this change in resistance, and together with intake air temperature sensor resistance, calculates the amount of air flowing into the engine.

As there is no default strategy, failure will result in the engine starting, and dying when it reaches 550 rev/min, when the ECM detects no MAF Sensor signal.

Throttle position (TP) sensor

The throttle position sensor is mounted on the plenum chamber and connected directly to the throttle shaft. The sensor is a variable resistor, the signal from which (0 - 5V) informs the ECM of the actual position of the throttle disc. As there is no default strategy, failure of the sensor will result in poor idle and lack of throttle response. If failure occurs in the closed position the engine will only reach 1750 rev/min when the ECM will initiate overrun fuel cut off.

Engine coolant temperature (ECT) sensor

This sensor consists of a temperature dependant resistive metal strip. The resistance of the strip varies considerably with coolant temperature, i.e.
- 28K ohms at 30°C (86°F)
- 300 ohms at 85°C (185°F)
- 90 ohms at 130°C (266°F)

The ECT Sensor signal is vital to engine running, as the correct fuelling is dependant upon engine temperature i.e. richer mixture at low temperatures. If the sensor is disconnected or failure occurs a default value will be supplied to the system. The initial default value selected will be based on the value of the air intake temperature. This will increase to a nominal warmed up value over an individual time, programmed for each default value. The fault may not be evident to the driver, though there may be a hot restart problem.

Intake air temperature (IAT) sensor

This is another resistive sensor, located in the body of the air cleaner. The resistance varies with changes in air temperature. The signal from the IAT Sensor is used to retard the ignition timing if the air temperature rises above 55°C (130°F). If the sensor is disconnected or failure occurs a default value will be supplied to the system. The default value selected will represent normal operating conditions. The fault may not be evident to the driver, there may be slight power loss in high ambient temperatures.

Engine fuel temperature (EFT) sensor

The EFT sensor is located on the fuel rail. This sensor measures temperature of the rail rather than the fuel. The resistance varies with changes in temperature. The signal is used to increase the injection pulse time when undergoing hot restarts. When the fuel is hot, vapourisation occurs in the rail which may result in the formation of bubbles in the injectors. Increasing the pulse time helps flush the bubbles away and cools the fuel rail with fuel from the tank.

An EFT sensor fault may not be evident to the driver, there may be a hot restart problem.

Knock sensors

The knock sensors produce an output voltage in proportion to mechanical vibration caused by the engine. A sensor is located in each cylinder bank between 2/4 and 3/5 cylinders. The ECM calculates if the engine is knocking by taking camshaft and crankshaft sensor signals to determine the position of the engine in the combustion cycle.

The ECM can also work out exactly which cylinder is knocking and retards the ignition on that particular cylinder until the knock disappears. It then advances the ignition to find the optimum ignition timing for that cylinder.

The ECM can simultaneously adjust the timing of each cylinder for knock . It is possible that all eight cylinders could have different advance angles at the same time. If the camshaft sensor fails, the knock sensor will continue to work, but as the engine may be running one revolution out of sychronisation the ECM may retard the wrong cylinder of the pair e.g. 1 instead of 6. If the knock sensor fails engine knock will not be detected and corrected.

Ignition coils

The electronic ignition system uses four double ended coils. They are mounted on a bracket fitted to the rear of the engine. The circuit to each coil is completed by switching within the ECM, allowing each coil to charge up and fire. Sparks are produced in two cylinders simultaneously, one on compression stroke, the other on exhaust stroke. Note that coil 1 feeds cylinders 1 and 6, coil 2 feeds cylinders 5 and 8, coil 3 feeds cylinders 4 and 7, and coil 4 feeds cylinders 2 and 3. The resistance of the spark in the compression cylinder is higher than that in the exhaust cylinder. Coil failure will result in a lack of ignition, resulting in misfire in the affected cylinders.

Injectors

A multiport Sequential Fuel injection (SFI) system is used, one injector per cylinder. Each injector consists of a small solenoid which is activated by the ECM to allow a metered amount of fuel to pass into the combustion chamber. Due to the pressure in the fuel rail and the shape of the injector orifice, the fuel squirts into the cylinder in a fine spray to aid combustion. In the unlikely event of total injector failure or leakage which will cause rich mixture, a misfire will occur in the affected cylinder.

Idle air control (IAC)

Idle speed is controlled by a stepper motor which consists of two coils. When energised in the correct sequence the coils move a plunger which opens and closes the throttle bypass controlling the quantity of idle air. The stepper motor controls idle speed by moving the plunger a set distance called a step. Fully open is 200 steps and fully closed 0 steps. Failure of the stepper motor will result in low or high idle speed, poor idle, engine stall or non start.

Heated oxygen sensor (HO2S)

The oxygen sensors consist of a titanium metal sensor surrounded by a gas permeable ceramic coating. Oxygen in the exhaust gas diffuses through the ceramic coating on the sensor, and reacts with the titanium wire altering the resistance of the wire. From this resistance change the ECM calculates the amount of oxygen in the exhaust gas. The injected fuel quantity is then adjusted to achieve the correct air/fuel ratio, thus reducing the emissions of carbon monoxide (CO), hydrocarbons (HC),and oxides of nitrogen (NO_x). Two HO2 sensors are fitted in the exhaust front pipe, and are positioned behind each catalyst.

In the event of sensor failure, the system will default to ’open loop’ and fuelling will be calculated using signals from the remaining ECM inputs.

ECM diagnostics also use HO2 sensors to detect misfire and fuel system faults.

Fuel pressure regulator

The fuel pressure regulator is a mechanical device controlled by manifold depression and is mounted at the rear of the engine in the fuel rail. The regulator ensures that fuel rail 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 spill returned to the fuel tank swirl pot which contains the fuel pick-up strainer.

Failure of the regulator will result in a rich mixture at idle but normal at full load, or a rich mixture resulting in engine flooding, or a weak mixture.

Relay module

The engine management system employs a relay module, which houses the main relay and the fuel pump relay.

Main relay

The main relay supplies the power feed to the ECM and, the fuel injectors (8 amps) and mass air flow sensor (4 amps). This relay is controlled by the ECM. This enables the ECM to remain powered up after ignition is switched off.

During the ’ECM power down routine’ the ECM records all temperature readings and powers the stepper motor to the fully open position. Failure of this relay will result in the ECM not being switched on resulting in engine not starting due to absence of fuel and ignition.

Fuel pump relay

The fuel pump relay is fed from the ignition relay and controlled by the ECM. The relay is activated in ignition key position 2 to prime the fuel system for a period of time controlled by the ECM. Failure of this relay will result in no fuel pressure.

Inertia fuel shut-off switch

The inertia switch isolates the power supply to the fuel pump in the event of sudden deceleration. The inertia switch is located in the engine compartment. It is reset by depressing the central plunger at the top of the switch.

Engine immobilization

A coded signal is sent from the immobilization unit, located behind the instrument panel, to the vehicle ECM. If the coded signal does not match the signal expected by the ECM, the ECM immobilizes the starting and fuel circuits.

ENGINE TUNING

Service repair no - 19.22.13

The position of the Idle Air Control (IAC) valve can be checked using TestBook and adjusted if necessary through the by-pass screw in the plenum chamber. The by-pass screw is covered by a tamper proof plug which can be extracted using a self tapping screw.

All vehicles:

1. Ensure air conditioning and all electical loads are off. Vehicle must be in neutral or park.
2. Carry out tuning or base idle setting procedure as applicable using TestBook.

FUEL SYSTEM DEPRESSURISE

Service repair no - 19.50.02

WARNING: Fuel pressure of up to 2.5 bar (36lbf/in^2) will be present in the system, even if the engine has not been run for some time. Always depressurise the system before disconnecting any components in the fuel feed line (between fuel pump and pressure regulator). The spilling of fuel is unavoidable during this operation. Ensure that all precautions are taken to prevent fire and explosion.

NOTE: Fuel pressure can be relieved at fuel rail feed union or fuel filter unions.

1. Position cloth around relevant union to protect against fuel spray.
2. Carefully loosen union.
3. Tighten union to correct torque once pressure is relieved.

FUEL TANK DRAIN

Service repair no - 19.55.02

WARNING: Ensure that Fuel Handling Precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions.

CAUTION: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

1. Disconnect battery negative lead.
2. Remove fuel filler cap.
3. Using a fuel bowser with an 18 mm (0.75 in) outside diameter hose, pass hose into tank through filler neck.

NOTE: Because the fuel tank filler stub houses a restrictor, repeated attempts may be necessary to enter the hose into the fuel tank. Follow the fuel bowser manufacturers instructions for safe use of bowser.

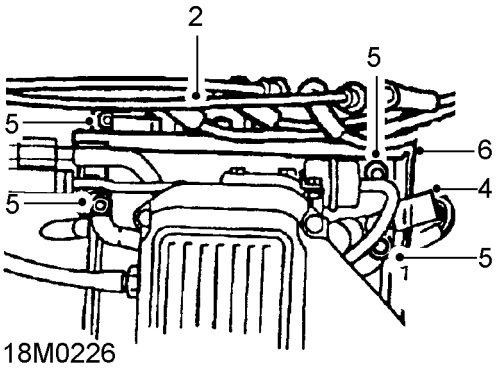
4. Siphon fuel from fuel tank.
5. Fit filler cap.

IGNITION COILS - SET

Service repair no - 18.20.45

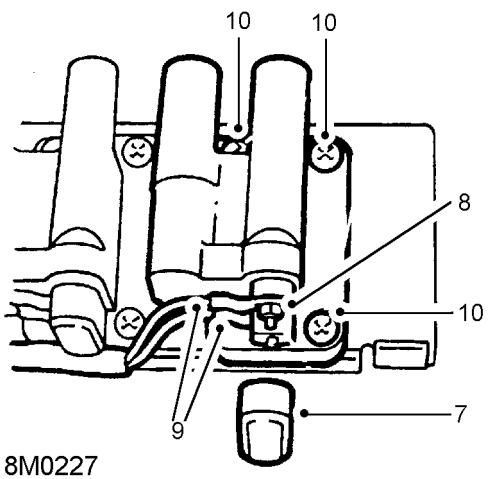
Remove

1. Disconnect battery negative lead.



18M0226

2. Noting their fitted positions, disconnect 8 h.t. leads from ignition coils.
3. Move leads aside.
4. Disconnect coil multiplug and release from mounting bracket.
5. Remove 4 nuts securing coil mounting bracket to engine.
6. Remove coils and mounting bracket assembly. ***Do not carry out further dismantling if component is removed for access only.***



18M0227

7. Remove terminal cover and note lead positions.
8. Remove 2 nuts securing leads to coil terminals.
9. Remove leads from terminals.
10. Remove 3 Torx screws securing ignition coil to mounting bracket.
11. Remove ignition coil.
12. Fit ignition coil to mounting bracket and secure with screws.
13. Fit leads to terminals and secure with nuts.

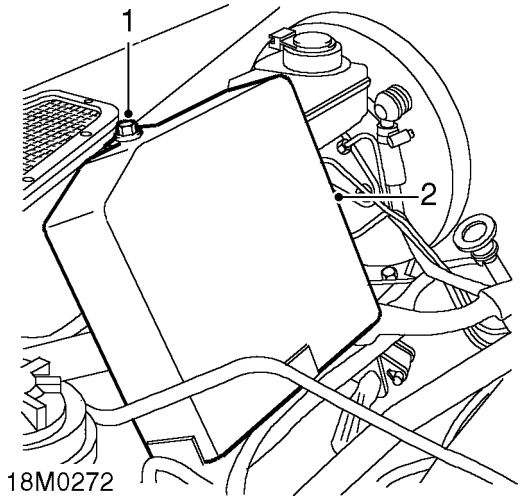
Refit

14. Position coils and mounting bracket assembly to engine.
15. Fit and tighten nuts securing mounting bracket to engine to ***8 Nm (6 lbf.ft).***
16. Connect coil multiplug and secure to mounting bracket.
17. Connect h.t. leads to ignition coils and fit terminal cover.
18. Reconnect battery negative lead.

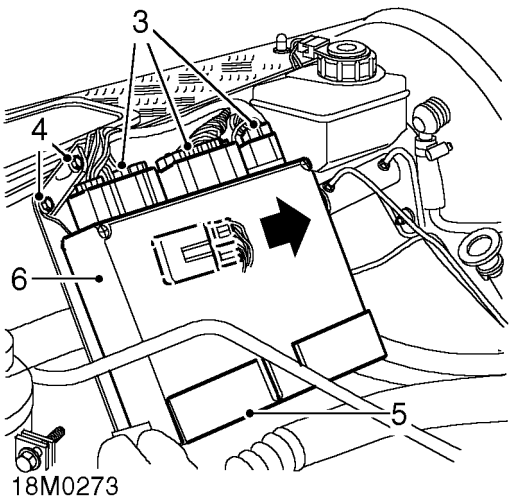
ELECTRONIC CONTROL MODULE (ECM)

Service repair no - 18.30.01

Remove



1. Remove screw securing ECM cover.
2. Remove cover.



3. Disconnect 3 multiplugs from ECM.
4. Remove 2 screws securing ECM.
5. Release ECM from 2 lower retainers.
6. Remove ECM.

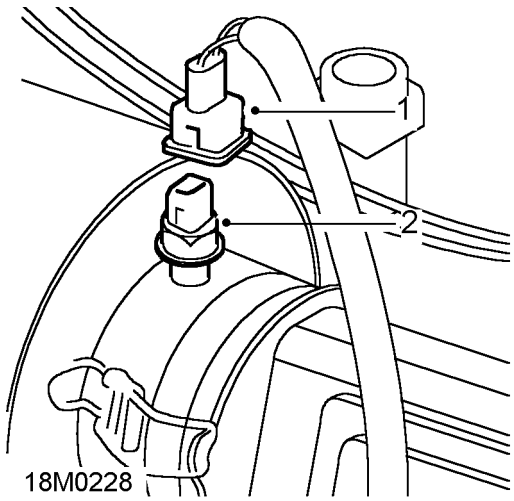
Refit

7. Position ECM and secure to lower retainers.
8. Fit and tighten screws securing ECM.
9. Connect multiplugs.
10. Fit cover and secure with screw.

INTAKE AIR TEMPERATURE (IAT) SENSOR

Service repair no - 18.30.09

Remove



1. Disconnect multiplug from IAT sensor.
2. Remove IAT sensor from air filter housing.

Refit

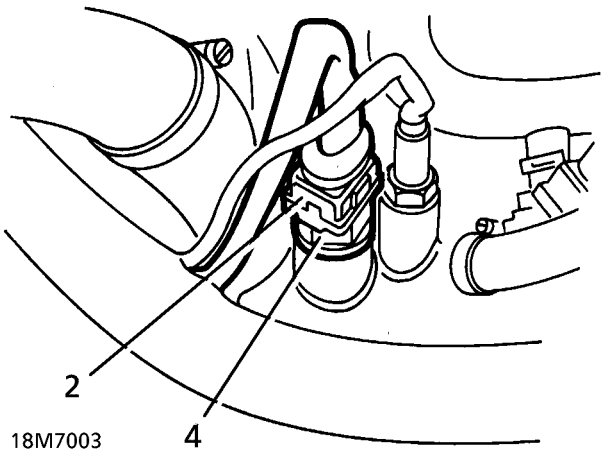
3. Clean sensor and mating face on filter housing.
4. Fit sensor and tighten to ***8 Nm (6 lbf.ft).***
5. Connect multiplug.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Service repair no - 18.30.10

Remove

1. Disconnect battery negative lead.



2. Depress spring clip and disconnect ECT sensor multiplug.
3. Position cloth around ECT sensor to absorb coolant spillage.
4. Remove ECT sensor.
5. Remove sealing washer and discard.

Refit

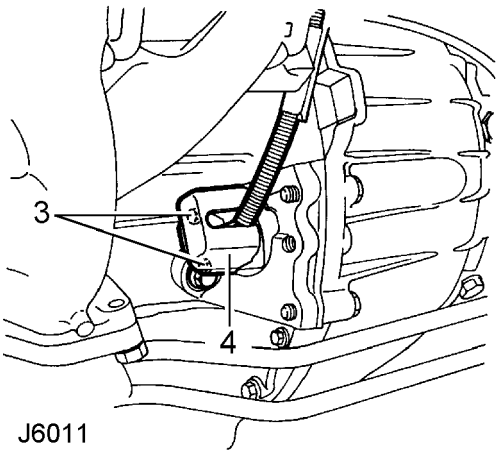
6. Clean sealing washer, sensor threads and sensor location.
7. Coat sensor threads with Loctite 577 and fit new sealing washer.
8. Fit ECT sensor and tighten to ***20 Nm (15 lbf.ft).***
9. Connect multiplug to ECT sensor.
10. Top up cooling system.
11. Run engine to normal operating temperature. Check for leaks around ECT sensor.
12. Reconnect battery negative lead.

CRANKSHAFT POSITION (CKP) SENSOR

Service repair no - 18.30.12

Remove

1. Disconnect battery negative lead.
2. Raise vehicle on ramp.



3. Remove 2 bolts securing sensor shield to engine backplate.
4. Release sensor shield.
5. Remove sensor shield.
6. Disconnect multiplug and remove sensor.
7. Remove spacer from sensor.

CAUTION: All vehicles have a spacer fitted to the sensor. Ensure spacer is correctly refitted.

Refit

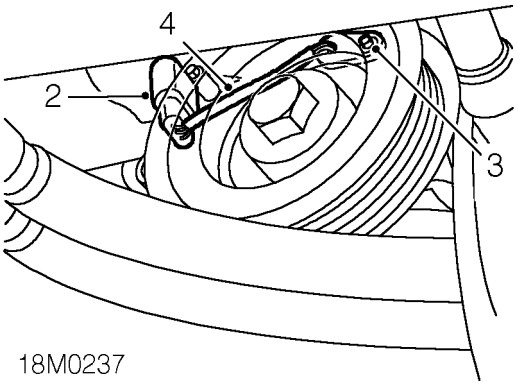
8. Clean mating faces of sensor and engine backplate.
9. Fit spacer to sensor.
10. Position sensor and connect multiplug.
11. Position shield to sensor and align to engine backplate.
12. Fit bolts and tighten to ***6 Nm (4 lbf.ft).***
13. Lower vehicle.
14. Reconnect battery negative lead.

CAMSHAFT POSITION (CMP) SENSOR

Service repair no - 18.30.24

Remove

1. Disconnect battery negative lead.



2. Release sensor multiplug from clip and disconnect multiplug.
3. Remove bolt securing sensor to front cover.
4. Remove sensor.
5. Remove and discard 'O' ring.

Refit

6. Clean sensor and mating face on front cover.
7. Lubricate and fit 'O' ring to sensor.
8. Fit sensor, fit bolt and tighten to ***8 Nm (6 lbf.ft).***
9. Connect sensor multiplug and secure to bracket.
10. Reconnect battery negative lead.

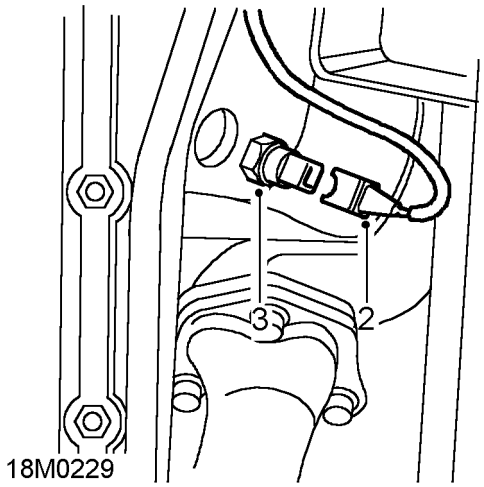
KNOCK SENSOR - LH

Service repair no - 18.30.28

CAUTION: Due to the sensitivity of the sensor, do not apply tape or sealant to sensor threads.

Remove

1. Raise vehicle on ramp.



2. Depress spring clip and disconnect multiplug from LH knock sensor.
3. Remove sensor from engine.

Refit

4. Clean mating faces of sensor and engine.
5. Fit sensor and tighten to ***16 Nm (22 lbf.ft).***

CAUTION: Failure to tighten sensor to correct torque will result in malfunction or sensor damage.

6. Connect multiplug to sensor.
7. Lower vehicle.

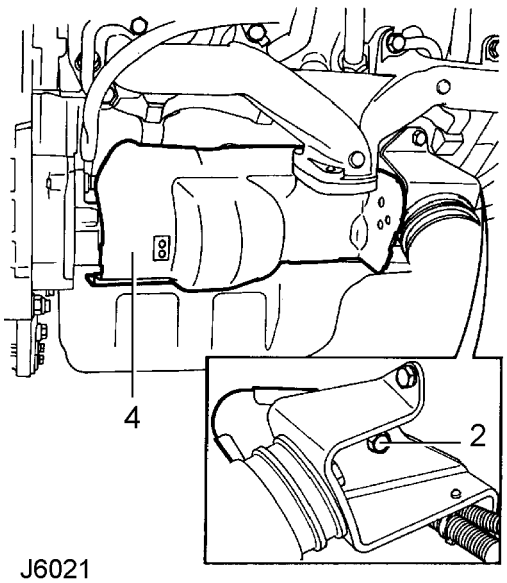
KNOCK SENSOR - RH

Service repair no - 18.30.30

CAUTION: Due to the sensitivity of the sensor, do not apply tape or sealant to sensor threads.

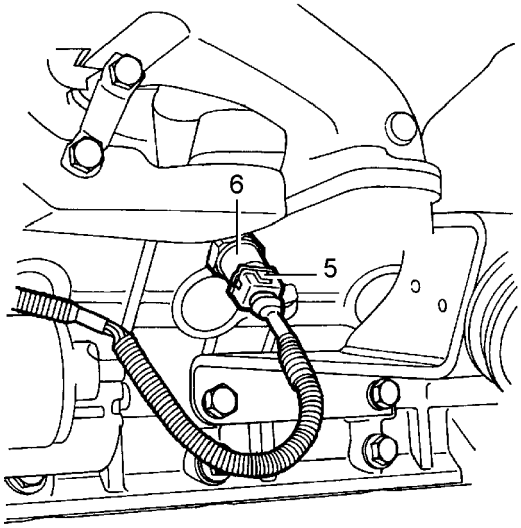
Remove

1. Raise vehicle on ramp.



J6021

2. Remove bolt securing starter motor heat shield to engine RH mounting.
3. Release heat shield clip from starter solenoid.
4. Move heat shield aside to gain access to knock sensor.



J6020

5. Depress spring clip and disconnect sensor multiplug.
6. Remove sensor.

Refit

7. Clean sensor and mating face.
8. Fit sensor and tighten to ***16 Nm (12 lbf.ft).***

CAUTION: Failure to tighten sensor to correct torque will result in malfunction or sensor damage.

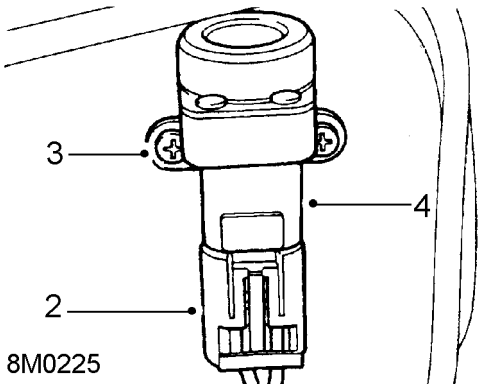
9. Connect multiplug to sensor.
10. Manoeuvre heat shield into position.
11. Secure heat shield clip to solenoid.
12. Align heat shield to mounting and secure with bolt.
13. Lower vehicle.

INERTIA FUEL SHUT OFF SWITCH

Service repair no - 19.22.09

Remove

1. Disconnect battery negative lead.



2. Disconnect multiplug from inertia fuel shut off switch.
3. Remove 2 screws securing shut off switch to mounting bracket.
4. Remove shut off switch.

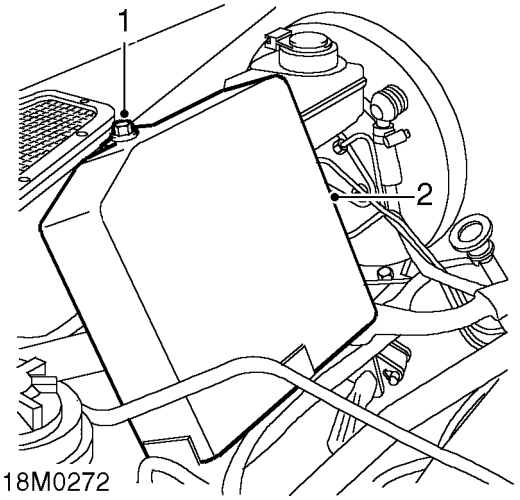
Refit

5. Position fuel shut off switch to mounting bracket and secure with screws.
6. Connect multiplug to inertia switch.
7. Reconnect battery negative lead.

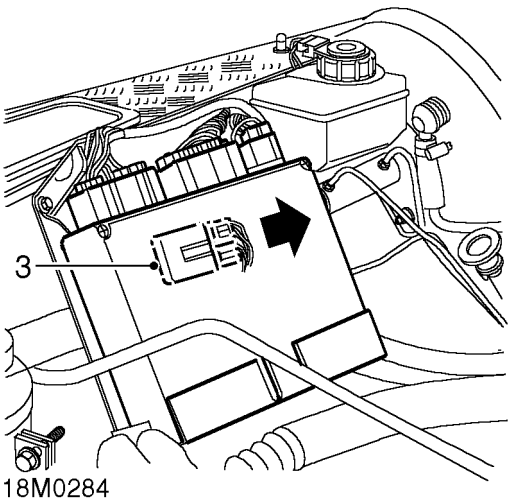
RELAY MODULE

Service repair no - 18.30.71

Remove



1. Remove screw securing ECM cover.
2. Remove cover.



3. Release relay module from bracket.
4. Disconnect 2 multiplugs from module.
5. Remove relay module.

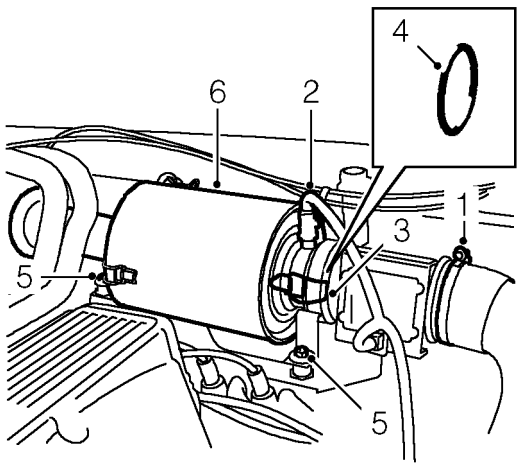
Refit

6. Position relay module
7. Connect multiplugs and secure module to bracket.
8. Fit ECM cover and tighten screw.

AIR CLEANER

Service repair no - 19.10.01

Remove



19M2349

1. Loosen clip securing intake hose to MAF sensor and disconnect hose.
2. Disconnect multiplug from IAT sensor.
3. Release 2 toggle clips and release MAF sensor from air cleaner.
4. Remove 'O' ring and carefully place sensor aside.
5. Remove 3 nuts securing air cleaner to mounting rubbers.
6. Remove air cleaner assembly.

Do not carry out further dismantling if component is removed for access only.

7. Remove IAT sensor.

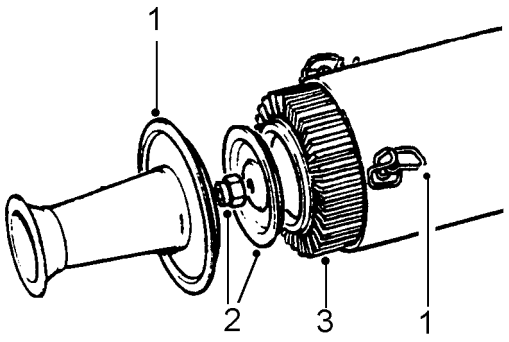
Refit

8. Clean threads of IAT sensor and fit sensor to air cleaner.
9. Position air cleaner to mountings and fit and tighten nuts.
10. Clean MAF sensor and mating face.
11. Fit NEW 'O' ring, fit sensor and secure toggle clips.
12. Connect multiplug to IAT sensor.
13. Connect air intake hose and tighten clip.

AIR CLEANER ELEMENT

Service repair no - 19.10.10

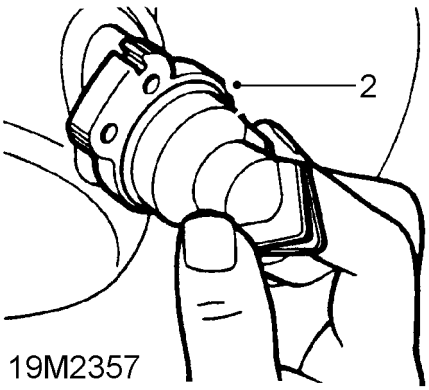
Remove



1. Release 3 toggle clips and remove inlet tube.
2. Remove nut and end plate retaining air cleaner element.
3. Remove air cleaner element and discard.

Refit

1. Clean inlet tube and inside of air cleaner.

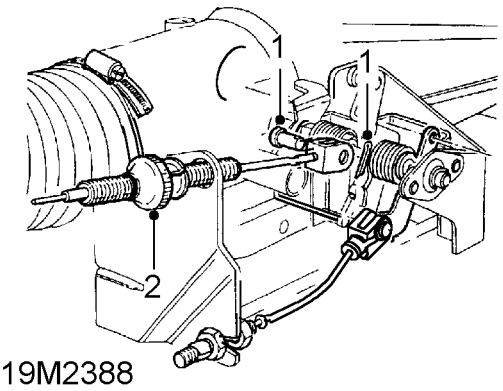


2. Squeeze open dump valve fitted at base of air cleaner and check that rubber is flexible and in good condition. Replace if necessary.
3. Fit new air cleaner element.
4. Fit retaining plate and fit and tighten nut.
5. Fit intake tube and secure toggle clips.

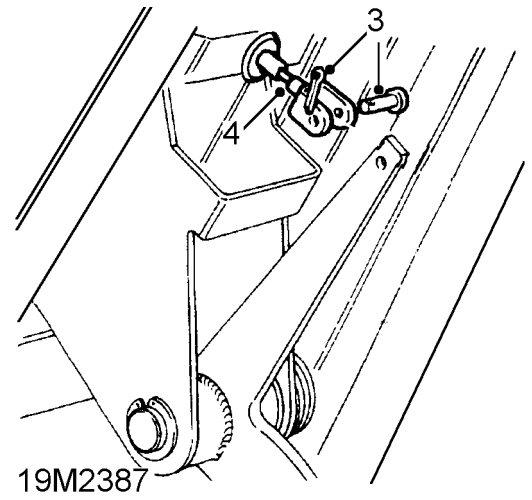
THROTTLE CABLE

Service repair no - 19.20.06

Remove



1. Remove split pin and clevis pin securing cable to throttle lever. Discard split pin.
2. Release cable adjusting nut from abutment bracket.



3. Remove split pin and clevis pin securing cable to throttle pedal. Discard split pin.
4. Release cable from bulkhead and remove cable.

Refit

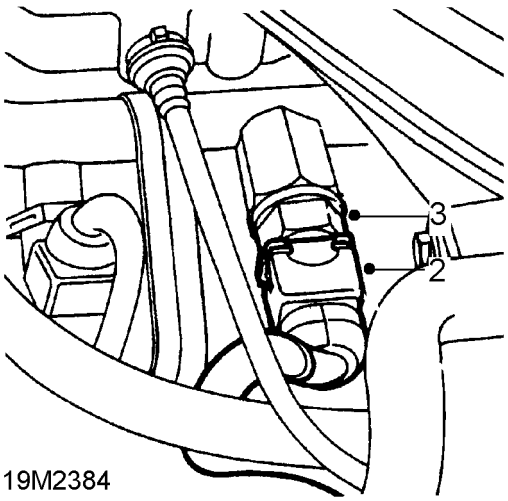
5. Clean area around cable hole in bulkhead.
6. Position cable and secure to bulkhead.
7. Clean and lubricate clevis pin.
8. Align inner cable to throttle pedal, fit clevis pin and secure with NEW split pin.
9. Secure outer cable to abutment bracket.
10. Clean and lubricate clevis pin.
11. Adjust outer cable and align inner cable yoke to throttle lever.
12. Fit clevis pin and secure with NEW split pin.
13. Adjust outer cable to give 1.6 mm (0.06 inch) of free play in inner cable.
14. Check throttle operation.

FUEL TEMPERATURE SENSOR

Service repair no - 19.22.08

Remove

NOTE: Because fuel leakage will not occur when sensor is removed, it is not necessary to depressurise the fuel system for this operation.



1. Release and move brake servo vacuum pipe aside for access to fuel temperature sensor.
2. Disconnect multiplug from fuel temperature sensor.
3. Remove sensor.

Refit

4. Clean threads of sensor and mating face on fuel rail,
5. Fit sensor and tighten to ***17 Nm (13 lbf.ft).***
6. Connect multiplug and vacuum pipe.

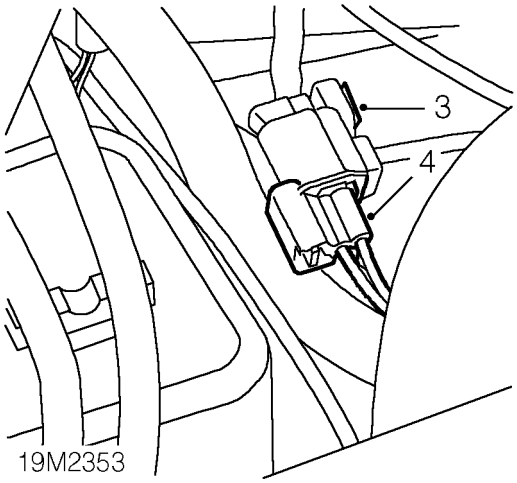
HEATED OXYGEN SENSOR (HO2S)

Service repair no - 19.22.16

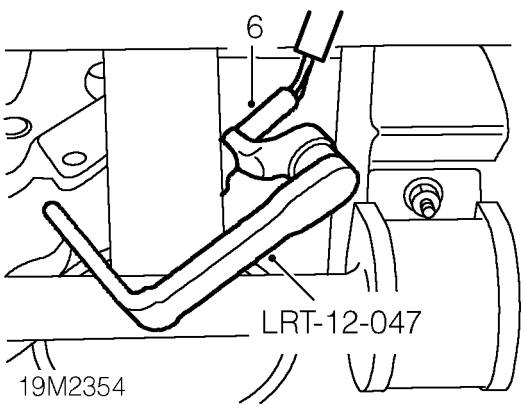
Remove

CAUTION: The sensor must only be removed when the exhaust pipe is cold.

1. Position vehicle on ramp.
2. Remove clip securing oxygen sensor lead to harness.



3. Release sensor multiplug from bracket behind cylinder head.
4. Disconnect multiplug.
5. Raise ramp.



6. Remove sensor using tool **LRT-12-047.**

CAUTION: Although robust within the vehicle enviroment, HO2 sensors are easily damaged by dropping, excessive heat and contamination. Care must be exercised when working on the exhaust system not to damage the sensor housing or tip.

7. Remove and discard sealing washer.

Refit

8. Clean sensor mating face on exhaust pipe.

NOTE: The new sensor thread is pre-treated with an anti-seize compound. If refitting old sensor, fit NEW sealing washer and apply anti-seize compound to threads.

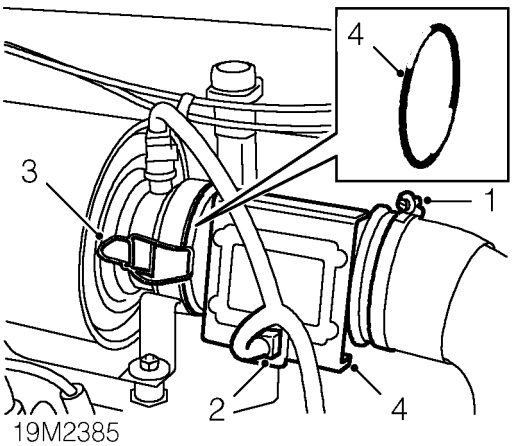
CAUTION: Do not allow anti-seize compound to come into contact with the sensor nose or enter the exhaust system.

9. Fit sealing washer to sensor and fit sensor. Tighten sensor to ***20 Nm (15 lbf.ft).***
10. Lower ramp.
11. Connect multiplug and secure to bracket.
12. Secure lead to harness with clip.

MASS AIR FLOW (MAF) SENSOR

Service repair no - 19.22.25

Remove



1. Loosen clip securing air intake hose to MAF sensor and disconnect.
2. Disconnect multiplug from sensor.
3. Release 2 clips securing sensor to air cleaner.
4. Remove sensor, collect and discard 'O' ring.

Refit

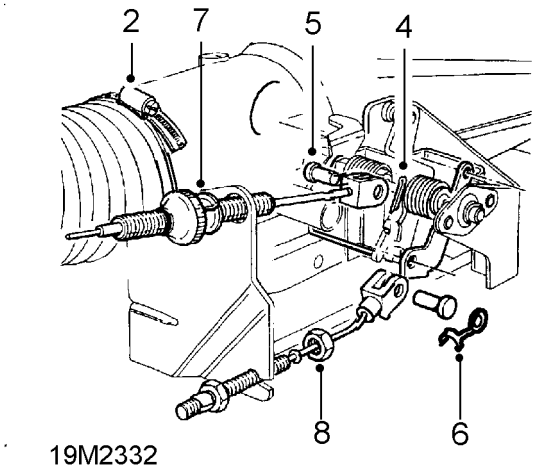
5. Clean sensor and mating faces.
6. Fit NEW 'O' ring to sensor.
7. Fit sensor to air cleaner and secure clips.
8. Connect multiplug.
9. Connect air intake hose to sensor and tighten clip.

PLENUM CHAMBER

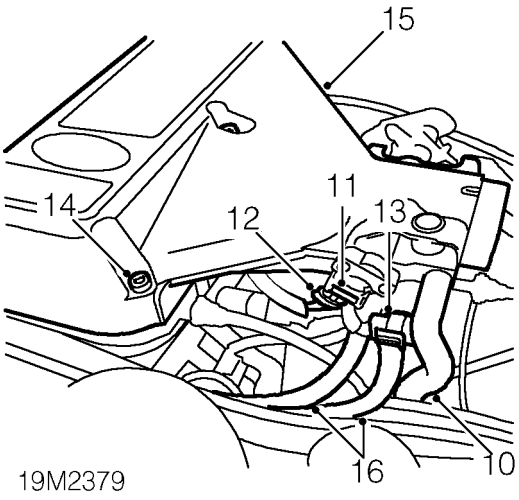
Service repair no - 19.22.46

Remove

1. Disconnect battery negative lead.

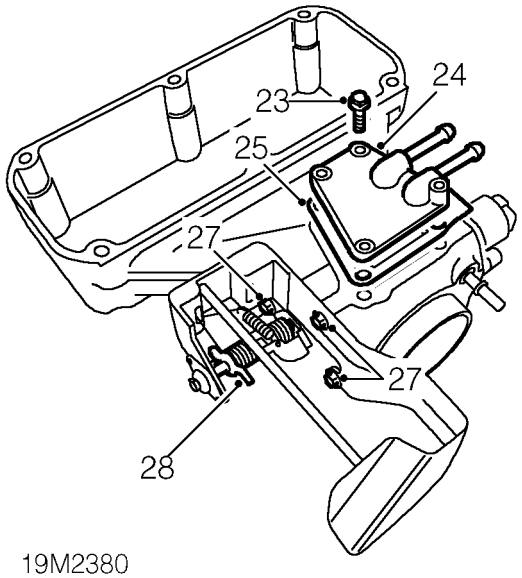


2. Loosen clip securing air intake hose to plenum chamber.
3. Disconnect air intake hose.
4. Remove split pin from throttle cable clevis pin. Discard split pin.
5. Remove clevis pin.
6. Release and remove kick down cable clevis pin.
7. Release throttle cable from abutment bracket.
8. Remove front locknut from kick down cable.
9. Release cable from bracket.

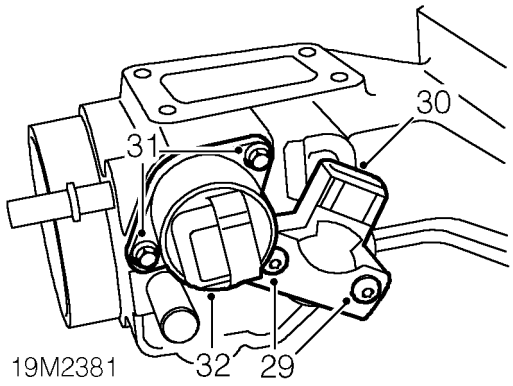


10. Disconnect purge hose from plenum chamber.
11. Disconnect breather hose from plenum chamber.
12. Depress spring clip and disconnect TP sensor multiplug.
13. Disconnect multiplug from IACV.
14. Remove 6 bolts securing plenum chamber to inlet manifold.
15. Release plenum chamber from inlet manifold.
16. Fit hose clamp to water jacket coolant hoses.
17. Tighten clamp.
18. Position cloth to absorb coolant spillage.
19. Loosen clips securing coolant hoses to plenum chamber.
20. Release hoses from plenum chamber.
21. Remove plenum chamber.
22. Place cloth over ram housing.

Do not carry out further dismantling if component is removed for access only.



23. Remove 4 bolts securing water jacket to plenum chamber.
24. Remove water jacket from plenum chamber.
25. Remove and discard gasket from water jacket.
26. Move throttle linkage aside to gain access to mounting bolts.
27. Remove 3 bolts securing throttle linkage to plenum chamber.
28. Remove throttle linkage and collect spring.



29. Remove 2 screws securing TP sensor to plenum chamber.
30. Remove TP sensor and collect clamping plate.
31. Remove 2 bolts securing IACV to plenum chamber.
32. Remove IACV and collect gasket.
33. Discard gasket.

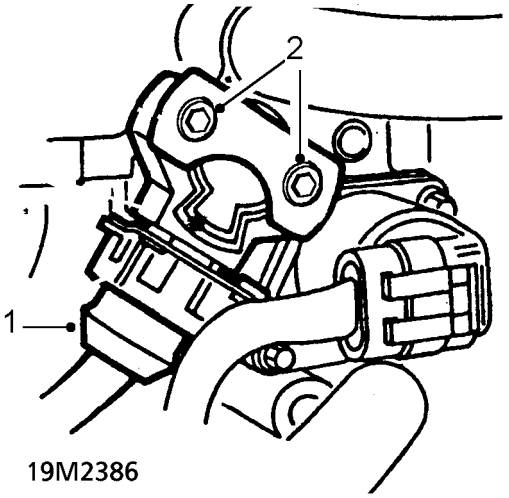
Refit

34. Position throttle linkage and spring to plenum chamber.
35. Fit spring to linkage.
36. Hold throttle open to gain access to mounting bolts.
37. Fit and tighten mounting bolts to ***8 Nm (6 lbf.ft).***
38. Clean mating faces of TP sensor and plenum chamber.
39. Fit TP sensor and engage spindle.
40. Fit clamping plate and tighten bolts to ***2 Nm (1.5 lbf.ft).***
41. Clean mating faces of IACV and plenum chamber.
42. Fit NEW gasket to IACV.
43. Fit IACV to plenum chamber and tighten bolts to ***2 Nm (1.5 lbf.ft).***
44. Clean mating faces of water jacket and plenum chamber.
45. Position NEW gasket to plenum chamber.
46. Fit water jacket to plenum chamber and tighten bolts to ***13 Nm (10 lbf.ft).***
47. Remove cloth from ram housing.
48. Clean plenum and inlet manifold mating faces.
49. Position plenum chamber.
50. Connect coolant hoses to plenum chamber.
51. Tighten hose clips.
52. Loosen and remove hose clamp.
53. Remove cloth.
54. Apply a thin, uniform coating of Loctite 577 sealant to sealing face of plenum chamber.
55. Fit plenum chamber and tighten bolts to ***24 Nm (18 lbf.ft).***
56. Connect multiplug to TP sensor.
57. Connect multiplug to IACV.
58. Connect breather hose to plenum chamber.
59. Connect purge hose to plenum chamber.
60. Fit kick down cable to abutment bracket, fit locknut and adust cable. ***See AUTOMATIC GEARBOX, Adjustment, Kickdown cable adjustment***
61. Connect throttle cable to abutment bracket.
62. Align throttle cable to lever, fit clevis pin and secure with NEW split pin.
63. Align kick down cable to lever.
64. Fit and secure clevis pin.
65. Connect air intake hose and secure with clip.
66. Reconnect battery negative lead.
67. Top up cooling system.

THROTTLE POSITION (TP) SENSOR

Service repair no - 19.22.49

Remove



1. Disconnect multiplug from TP sensor.
2. Remove 2 Torx screws securing TP sensor and collect clamp plate.
3. Remove TP sensor.

Remove

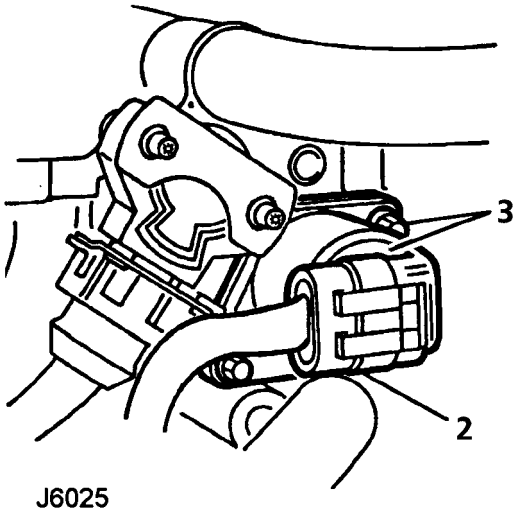
4. Clean TP sensor and mating face.
5. Fit sensor ensuring drive engages with throttle spindle.
6. Position clamp plate, fit Torx screws and tighten to ***2 Nm (1.5 lbf.ft).***
7. Connect multiplug.

IDLE AIR CONTROL VALVE (IACV)

Service repair no - 19.22.54

Remove

1. Disconnect battery negative lead.



2. Disconnect multiplug from IACV.
3. Remove 2 bolts securing IACV to plenum chamber.
4. Remove IACV.
5. Remove gasket and discard.

Refit

6. Clean mating faces of IACV and plenum chamber.
7. Clean plunger on IACV and plunger seat on plenum chamber.
8. Using a NEW gasket, fit IACV to plenum chamber.
9. Fit and tighten bolts securing IACV to plenum chamber to ***2 Nm (1.5 lbf.ft).***
10. Connect multiplug to IACV.
11. Reconnect battery negative lead.

FUEL FILTER

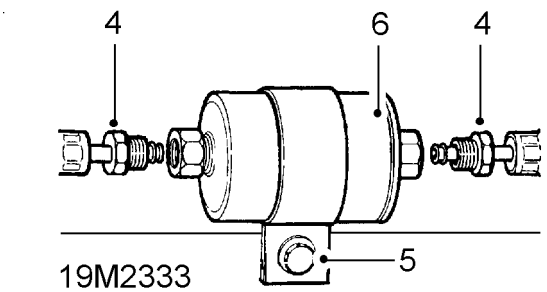
Service repair no - 19.25.02

WARNING: Spilling of fuel is unavoidable during this operation. Ensure all necessary precautions are taken to prevent fire and explosion.

WARNING: Ensure fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out the following instructions.

Remove

1. Depressurise fuel system. ***See Adjustment, fuel system depressurise***
2. Clean area around hose connections to prevent ingress of dirt into fuel system.



3. Clamp inlet and outlet hoses to reduce fuel spillage when disconnecting.
4. Loosen 2 unions and disconnect hoses from fuel filter.

CAUTION: Plug the connections.

5. Loosen bolt securing fuel filter to chassis member.
6. Remove fuel filter.

Refit

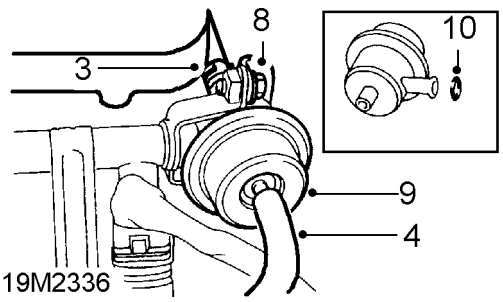
7. Position NEW filter to chassis member, observing direction of flow arrow stamped on side.
8. Tighten bolt securing filter to chassis member.
9. Remove plugs.
10. Connect hoses to fuel filter and tighten unions to ***30 Nm (22 lbf.ft).***
11. Remove clamps from hoses.
12. Start engine and inspect for fuel leaks.

FUEL PRESSURE REGULATOR

Service repair no - 19.45.06

Remove

1. Disconnect battery negative lead.
2. Depressurise fuel system. ***See Adjustment, fuel system depressurise***



3. Release clip and disconnect fuel return hose from fuel pipe.

CAUTION: Plug the connections.

4. Disconnect vacuum hose from pressure regulator.
5. Remove 4 nuts securing coil mounting bracket to inlet manifold.
6. Release coil mounting bracket from studs and move aside.
7. Release regulator connecting pipe from clip and position a cloth to absorb any fuel spillage.
8. Remove 2 bolts securing pressure regulator to fuel rail.
9. Remove regulator from fuel rail.
10. Remove and discard 'O' ring.
11. Release clip and remove fuel hose from regulator.

CAUTION: Plug the connections.

Refit

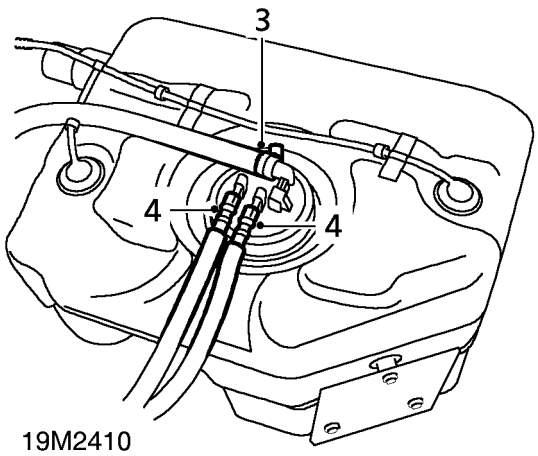
12. Clean mating faces of pressure regulator and fuel rail.
13. Remove plugs from pressure regulator and fuel rail.
14. Fit fuel hose to regulator and secure with clip.
15. Lubricate new pressure regulator 'O' ring.
16. Fit regulator to fuel rail.
17. Connect fuel hose to pipe and secure with clip.
18. Fit bolts securing regulator to fuel rail and tighten to ***10 Nm (7 lbf.ft).***
19. Position ignition coil mounting bracket to studs.
20. Fit nuts and tighten to ***8 Nm (6 lbf.ft).***
21. Remove plugs.
22. Connect fuel return hose and secure with clip.
23. Connect vacuum hose.
24. Remove cloth.
25. Reconnect battery negative lead.

FUEL PUMP

Service repair no - 19.45.08

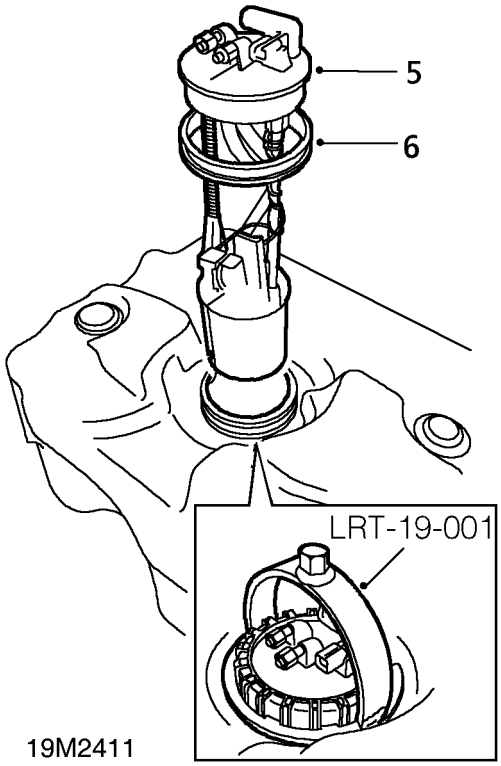
Remove

1. Disconnect battery negative lead.
2. Remove fuel tank. ***See fuel tank***



19M2410

3. Loosen clip and disconnect breather hose from fuel pump.
4. Remove fuel feed and return hoses from fuel pump.



19M2411

5. Using tool **LRT-19-001** remove locking ring securing pump. Withdraw fuel pump from fuel tank.

WARNING: A quantity of fuel will be retained in body of pump. Care must be taken to prevent spillage during above operation.

6. Remove and discard sealing ring.

Refit

7. Fit new sealing ring to pump and fit pump.
8. Fit locking ring and using tool **LRT-19-001**, tighten to ***48 Nm (35 lbf.ft).***
9. Fit feed and return hoses to pump.
10. Fit breather hose and tighten clip.
11. Fit fuel tank. ***See fuel tank; Refit***

FUEL TANK

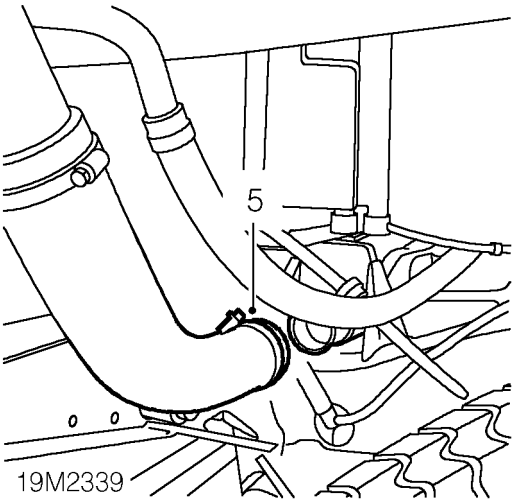
Service repair no - 19.55.26

WARNING: Ensure that fuel handling precautions given in Section 01 - Introduction are strictly adhered to when carrying out following instructions.

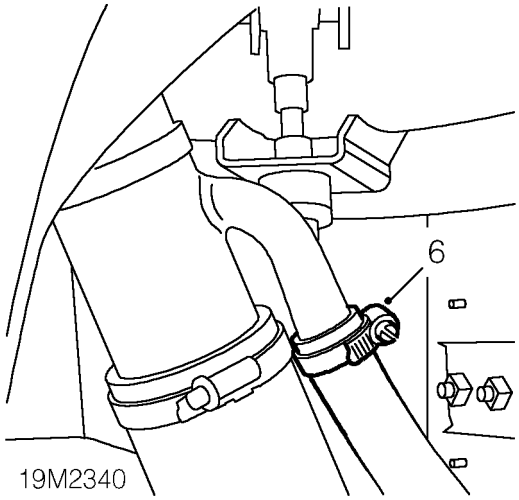
CAUTION: Before disconnecting any part of the fuel system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into fuel system.

Remove

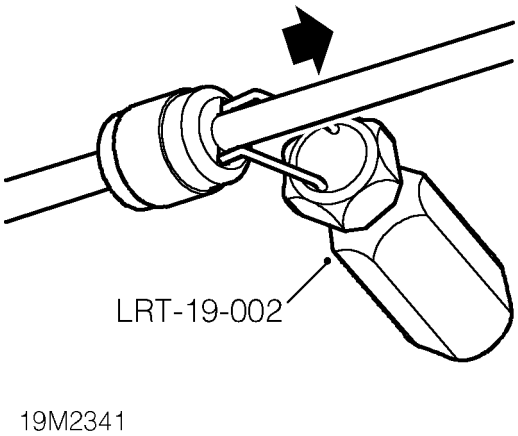
1. Position vehicle on ramp.
2. Disconnect battery negative lead.
3. Depressurise fuel system. ***See Adjustment, fuel system depressurise***
4. Drain fuel tank. ***See Adjustment, fuel tank drain***



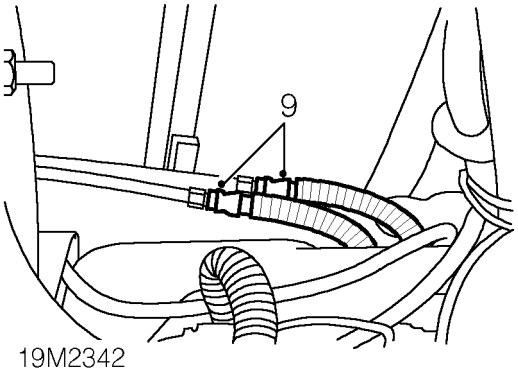
5. Loosen clip securing filler hose to fuel tank and disconnect hose.



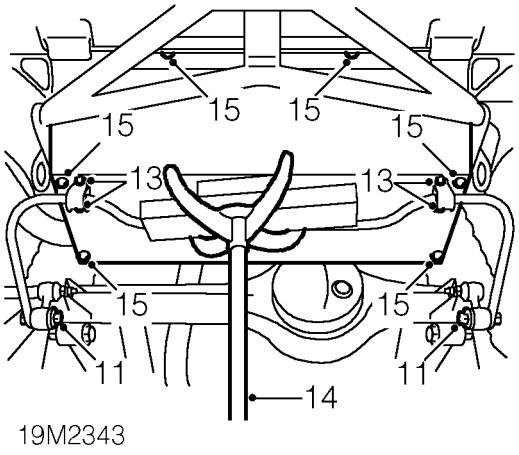
6. Loosen clip securing breather hose to filler neck and disconnect hose.



7. Using tool **LRT-19-002** disconnect vapour separator pipe at green end of 'speedfit' connector.
8. Position cloth to absorb fuel spillage.



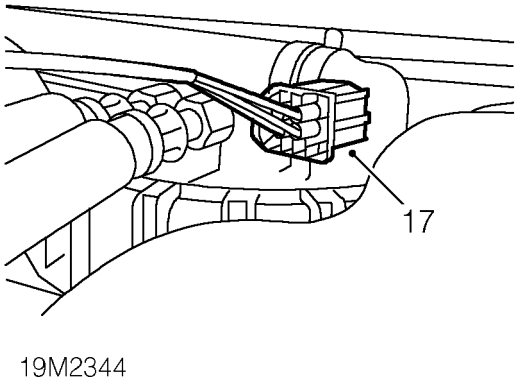
9. Disconnect fuel feed and return hose unions.
10. Plug the connections.



11. Loosen 2 anti-roll bar link bolts.
12. Mark location of anti-roll bar straps.
13. Remove 4 bolts securing anti-roll bar straps and swing bar down clear of fuel tank.
14. Position transmission jack under fuel tank cradle to support fuel tank.

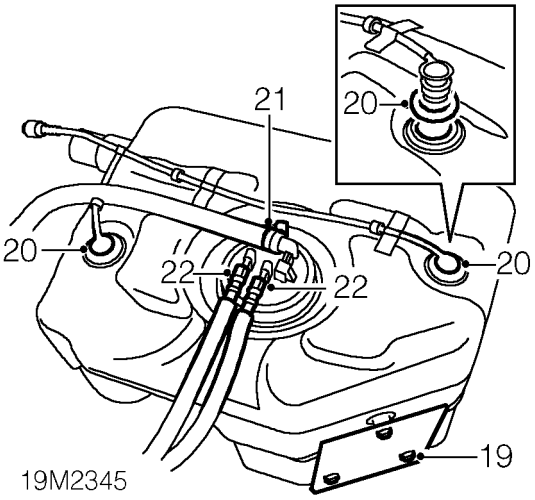
CAUTION: Use a block of wood or hard rubber pad to protect fuel tank.

15. Remove 6 bolts securing fuel tank cradle.
16. Lower fuel tank sufficiently to gain access to fuel pump multiplug.

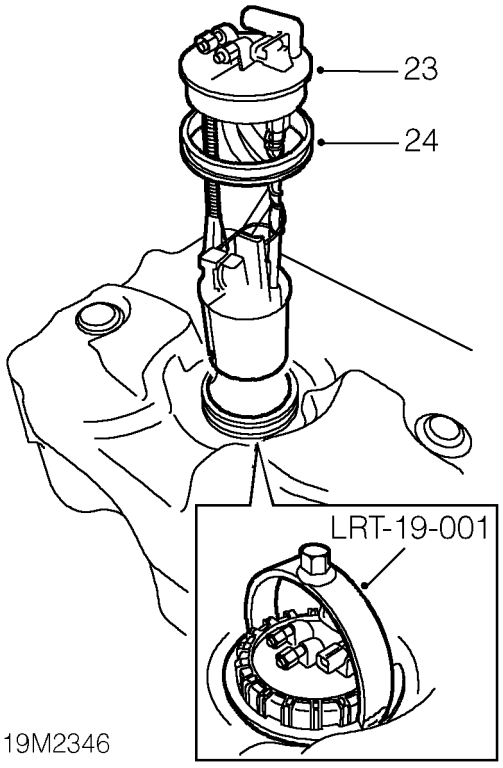


17. Disconnect multiplug and remove clip securing harness to fuel hoses.
18. With assistance, lower jack, remove fuel tank cradle and fuel tank.

Do not carry out further dismantling if component is removed for access only.



19. Remove 3 screws securing heat shield. Remove heat shield.
20. Release 2 fuel cut-off valves and remove valve and pipe assembly. Remove and discard 2 rubber seals.
21. Loosen clip and remove breather hose from fuel pump.
22. Remove fuel feed and return hoses from fuel pump.



23. Using tool **LRT-19-001** remove locking ring securing pump. Withdraw fuel pump from tank.

WARNING: A quantity of fuel will be retained in body of pump. Care must be taken to prevent fuel spillage during above operation.

24. Remove and discard sealing ring.
25. Fit new sealing ring to pump and fit pump.
26. Fit locking ring and using tool **LRT-19-001,** tighten to ***48 Nm (35 lbf.ft).***
27. Fit fuel feed and return hoses to pump.
28. Fit breather hose and tighten clip.
29. Fit new fuel cut-off valve seals.
30. Fit valve and pipe assembly.
31. Fit heat shield.

Refit

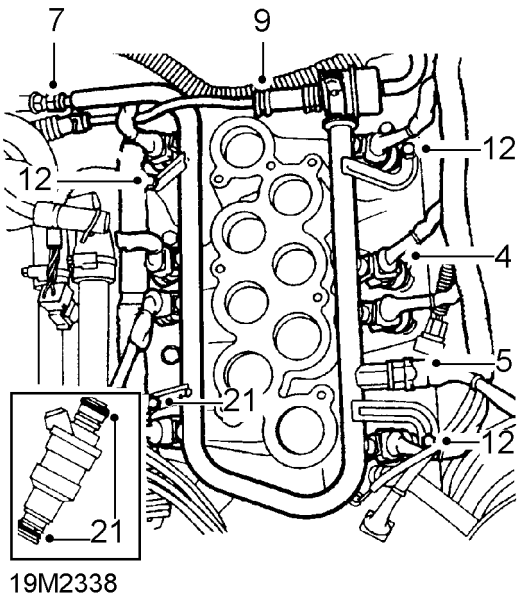
32. With assistance, locate fuel tank and position cradle.
33. Position jack to support tank.
34. Connect fuel pump multiplug.
35. Raise jack, align cradle and fit and tighten bolts.
36. Raise anti-roll bar, align straps and fit and tighten bolts.
37. Tighten anti-roll bar link bolts
38. Clean fuel pipes, connect pipes and tighten unions.
39. Secure harness to fuel pipes with clip.
40. Connect vapour separator pipe.
41. Connect breather hose to filler neck and tighten hose clip.
42. Connect filler hose to fuel tank and tighten hose clip.
43. Reconnect battery negative lead.
44. Run engine and check for leaks.

FUEL RAIL

Service repair no - 19.60.04

Remove

1. Disconnect battery negative lead.
2. Depressurise fuel system. ***See Adjustment, fuel system depressurise***
3. Remove ram housing. ***See ram housing***



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4. Disconnect 8 injector multiplugs.
5. Disconnect fuel temperature sensor multiplug.
6. Position cloth around fuel feed pipe union to absorb any fuel spillage.
7. Disconnect fuel feed pipe from fuel rail.
8. Plug fuel pipe and rail.
9. Loosen clip securing fuel return hose to fuel rail and disconnect hose.
10. Plug hose and rail.
11. Remove cloth.
12. Remove 6 nuts securing fuel rail and ignition coil mounting bracket to inlet manifold.
13. Release ignition coil mounting bracket from inlet manifold studs and move aside.
14. Release fuel rail and injectors from inlet manifold.
15. Remove fuel rail and injectors.

Do not carry out further dismantling if component is removed for access only.

16. Remove 2 bolts securing regulator to fuel rail.
17. Remove regulator.
18. Remove and discard 'O' ring.
19. Remove 8 clips securing injectors to fuel rail.
20. Remove injectors from fuel rail.
21. Remove and discard 'O' rings from injectors.
22. Clean lower mating faces on ram housing and manifold.
23. Lubricate new 'O' rings.
24. Fit NEW 'O' rings to injectors. Lightly coat 'O' rings with silicone grease.
25. Fit injectors to fuel rail.
26. Fit clips securing injectors to fuel rail.

CAUTION: Care must be taken when refitting the fuel rail and injectors to inlet manifold to prevent damage to 'O' rings.

27. Lubricate NEW 'O' ring of fuel regulator with silicone grease.
28. Fit 'O' ring.
29. Fit regulator to fuel rail and tighten bolts to ***10 Nm (7 lbf.ft).***

Refit

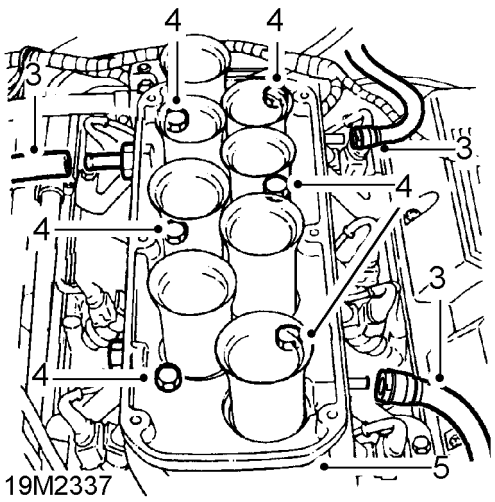
30. Position fuel rail.
31. Secure fuel rail.
32. Position coil bracket.
33. Fit nuts securing coil bracket and fuel rail and tighten to ***8 Nm (6 lbf.ft).*** .
34. Remove plugs from fuel feed and return pipes and fuel rail.
35. Connect return hose and secure with clip.
36. Clean feed pipe union.
37. Connect fuel feed pipe and tighten union to ***16 Nm (11 lbf.ft).***
38. Connect injector and fuel temperature sensor multiplugs.
39. Fit ram housing. ***See ram housing; Refit***
40. Reconnect battery negative lead.

RAM HOUSING

Service repair no - 19.70.04

Remove

1. Disconnect battery negative lead.
2. Remove plenum chamber. ***See plenum chamber***



3. Disconnect 3 hoses from ram housing.
4. Remove 6 bolts securing ram housing to inlet manifold.
5. Using a suitable lever and a block of wood, release ram housing from inlet manifold. Remove ram housing.

CAUTION: Do not use a mallet to break sealant joint with inlet manifold.

6. Place a protective cover over inlet bores to prevent ingress of dirt.

Refit

7. Clean mating faces of inlet manifold and ram housing.
8. Apply 'Hylomar' sealant to inlet manifold face.
9. Fit ram housing to inlet manifold.

NOTE: The ram housing can be fitted the wrong way round. Ensure fuel pressure regulator hose connection is on correct side when refitting.

10. Tighten ram housing bolts, working from 2 centre bolts, diagonally towards 4 outer bolts to ***24 Nm (18 lbf.ft).***
11. Connect hoses to ram housing.
12. Fit plenum chamber. ***See plenum chamber; Refit***
13. Reconnect battery negative lead.

TORQUE SETTNGS

	Nm	lbf.ft
Intake air temperature (IAT) sensor	8	6
Crank position (CKP) sensor bolts	6	4
Coolant temperature sensor	20	15
Fuel filter hose unions	30	20
Fuel pressure regulator	10	7
Coil bracket	8	6
Fuel feed pipe unions	16	12
Ram housing to manifold	24	18
Fuel temperature sensor	17	13
Throttle position (TP)sensor	2	1.5
Knock sensors	16	12
Idle air control valve (IACV)	2	1.5
Water jacket	13	10
Throttle bracket	8	6
Plenum chamber	24	18
Inlet manifold	38	28
Camshaft position (CMP) sensor bolts	8	6
Heated oxygen sensors	20	15
Fuel pump locking ring	48	35

26 - COOLING SYSTEM

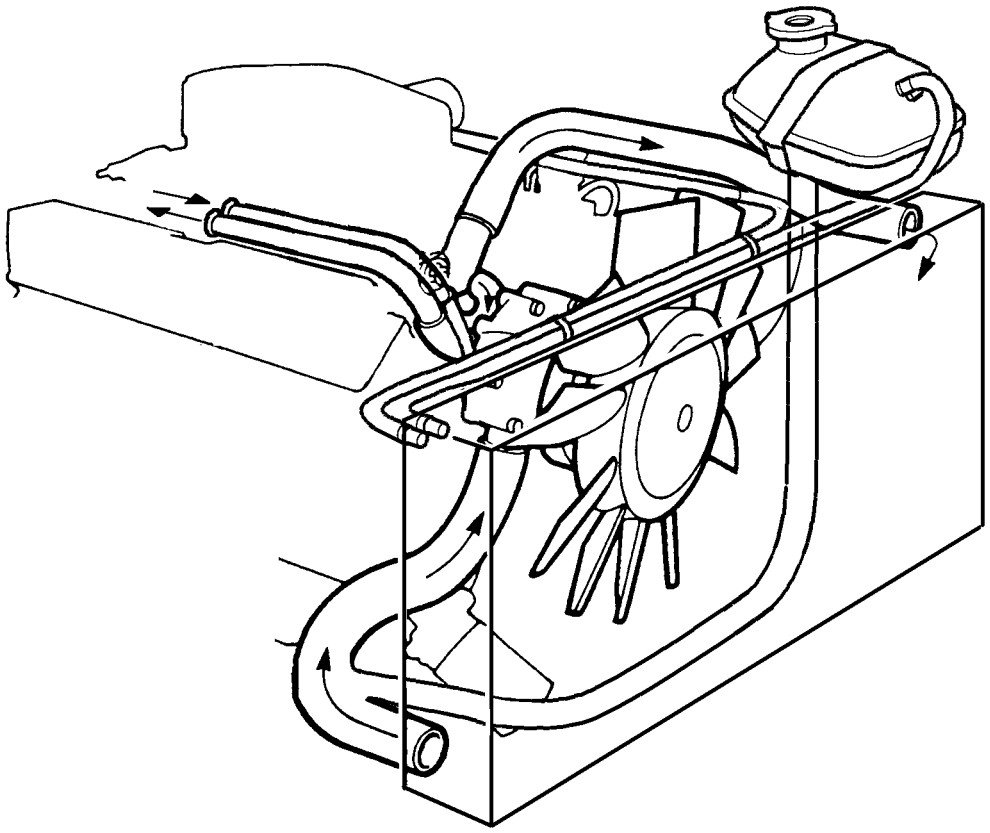
CONTENTS

ENGINE COOLING

Description

The V8i engine uses a pressurised cooling system and cross flow radiator which is supplied from a separate expansion tank. The coolant radiator also incorporates a section at the side for cooling the engine oil. The transmission fluid cooler is mounted below the radiator.

The belt driven viscous fan and centrifugal water pump is located in the engine front cover with ports for circulation of coolant to both banks of cylinders and cylinder heads. Coolant returns to the top of the radiator via ports in the inlet manifold where the thermostat is mounted horizontally.
Coolant also circulates through the vehicle heating system and is used to heat air entering the inlet manifold plenum chamber.



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Coolant circulation (engine hot)

1. Cross flow radiator
2. Expansion tank
3. Viscous fan and water pump
4. Heater pipes
5. Thermostat
6. Plenum chamber connection

COOLANT CIRCULATION

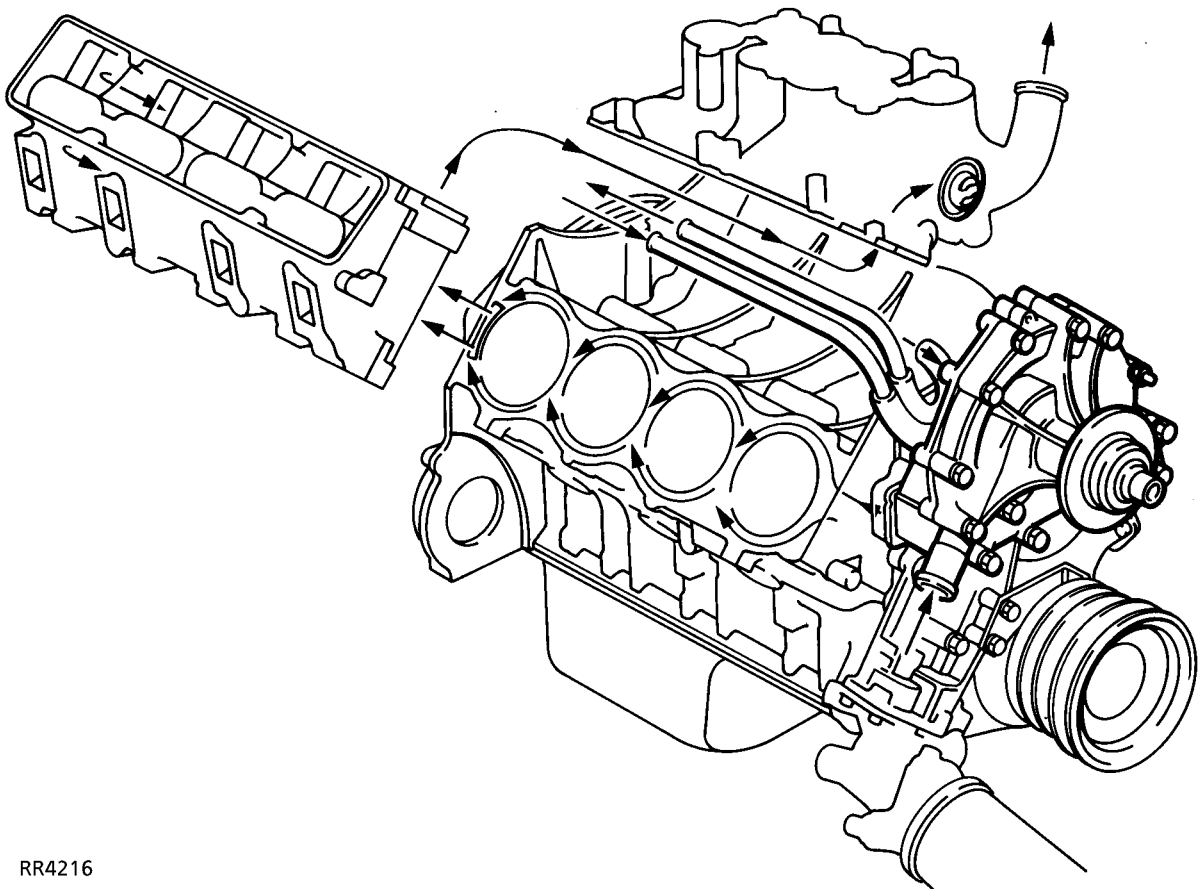
Operation

When the engine is started from cold the thermostat prevents any coolant circulation through the radiator by closing off the top hose. During the engine warm up period, the water pump, pumps coolant around the cylinders to the rear of the cylinder block along the main galleries in both cylinder banks. At the rear of the cylinder block the coolant rises through a large port in each cylinder head/block joint face, and then flows forward to connect with ports at the front of the inlet manifold. From the manifold the coolant is carried by an external pipe to the heater unit and from the heater through another external pipe to the pump inlet.

The coolant circulation through the cylinder block and heads, does not change when normal running temperature is reached and the thermostat opens. But with the thermostat open, coolant also flows through the top hose to the radiator where it is cooled and drawn back into the pump via the bottom hose.

Throttle housing heating

The base of the throttle housing is heated by a flow of coolant from the inlet manifold which returns through a long hose, to the top right corner of the radiator. The throttle housing is heated to prevent throttle disc icing.



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ENGINE OVERHEATING

Before conducting any cooling system diagnosis: ***See Description and operation, Engine Cooling***

1. Is coolant level correct?
NO - Allow engine to cool, top up level to expansion tank seam.
YES - Continue.

2. Is coolant in radiator frozen?
YES - Slowly thaw and drain system. ***See Adjustment, Coolant Requirements***
NO - Continue.

3. Is air flow through radiator restricted or blocked?
YES - Apply air pressure from engine side of radiator to clear obstruction.
NO - Continue.

4. Are there any external leaks, from hoses, coolant pump, engine gaskets or the heater unit?
YES - Investigate and rectify. ***See Adjustment, Coolant Requirements***
NO - Continue.

5. Are fan blades fitted correct way round, concave side towards engine?
NO - Rectify.
YES - Continue.

6. Is viscous unit operating correctly? ***See Description and operation, Viscous Fan***
NO - Renew. ***See Repair, Viscous Coupling***
YES - Carry out a pressure test on radiator cap and system. Check thermostat type, operation and correct fitting ***See Repair, Thermostat***

7. Is temperature sender and gauge giving accurate readings?
NO - Substitute parts and compare readings.
YES - Continue.

8. Carry out cylinder pressure test to determine if pressure is leaking into cooling system causing over pressurising and loss of coolant.

If problem is not diagnosed, check the coolant system for engine oil contamination and engine lubrication system for coolant contamination.

If the coolant only, or both systems are contaminated, suspect cylinder head gaskets or radiator.

If only the lubrication stystem is contaminated with coolant, suspect inlet manifold or front cover gaskets.

ENGINE RUNS COLD

Before conducting any cooling system diagnosis: ***See Description and operation, Engine cooling***

1. Check operation of viscous unit. ***See Description and operation, Viscous Fan***
   Is viscous unit operating correctly?
   NO - ***See Repair, Viscous coupling***
   YES - Continue.

2. Is thermostat correct type and operating? ***See Repair, Thermostat***
   If problem is not diagnosed: Continue.

3. Are the air conditioning fans operating continuously?
   YES - ***See Electrical Trouble Shooting Manual.***
   NO - Continue.

4. Is temperature sender and gauge giving accurate readings? Substitute parts and compare readings. If problem is not diagnosed repeat tests, starting at 1.

COOLANT REQUIREMENTS

Frost precautions and engine protection.

Cooling system **MUST ALWAYS** be filled and topped-up with solution of water and anti-freeze, winter and summer. **NEVER** use water alone, this may corrode aluminium alloy.

CAUTION: Do not use salt water otherwise corrosion will occur. In certain territories where only available natural water supply has some salt content use only rain or distilled water.

Recommended solutions

Anti-freeze: Universal anti-freeze or permanent type ethylene base, without methanol, containing a suitable inhibitor for aluminium engines and engine parts. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Anti-freeze***

Use one part of anti-freeze to one part of water.

Anti-freeze can remain in the cooling system and will provide adequate protection for two years provided that specific gravity of coolant is checked before onset of second winter and topped-up with new anti-freeze as required.

Vehicles leaving factory have cooling system filled with 50% solution of anti-freeze and water. This gives protection against frost down to minus 36°C, minus 33°F. Vehicles so filled are identified by a label affixed to radiator.

NOTE: Should ambient temperatures be below that stated above refer to Anti-Freeze Data in Recommended Lubricants, Fluids and Capacities in Section 09. Instructions in chart must be strictly adhered to before driving vehicle.

After the second winter the system should be drained and thoroughly flushed. Before adding new anti-freeze examine all joints and replace defective hoses to make sure that the system is leak proof.

For protection quantities. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, anti-freeze***

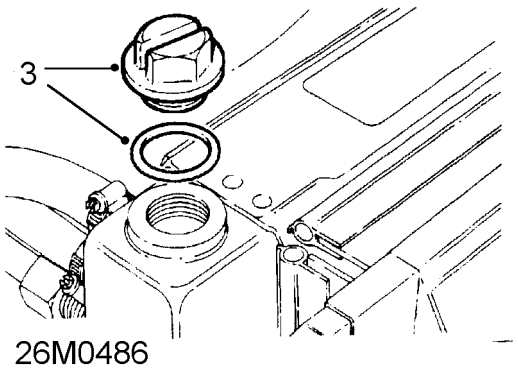
DRAIN AND REFILL

Service repair no - 26.10.01

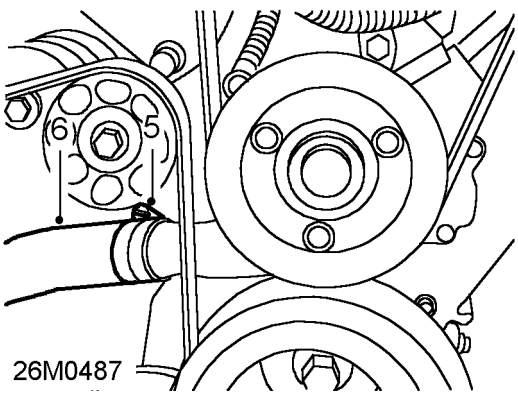
Drain

WARNING: Do not remove expansion tank filler cap when engine is hot. The cooling system is pressurised and personal scalding could result. See coolant requirements before refilling system.

1. Remove expansion tank filler cap by slowly turning it anti-clockwise. Pause to allow pressure to escape. Continue turning it in same direction and remove.
2. Remove viscous coupling. ***See Repair, viscous coupling***

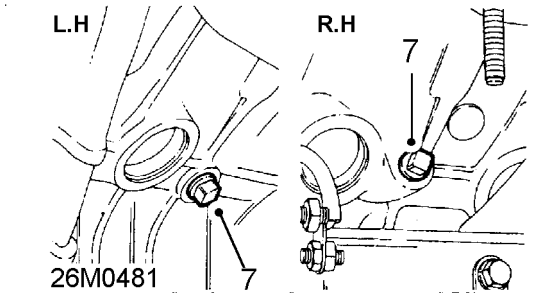


3. Remove radiator filler plug and 'O' ring to assist drainage. Discard 'O' ring.
4. Position container to collect coolant spillage and set heater controls to the 'HOT' position.



5. Loosen clip securing hose to coolant pump.
6. Release hose from coolant pump and allow coolant to drain.

NOTE: It is not possible to drain all coolant retained in heater system.



7. Remove engine drain plugs beneath exhaust manifolds and allow coolant to drain from engine.

Refill

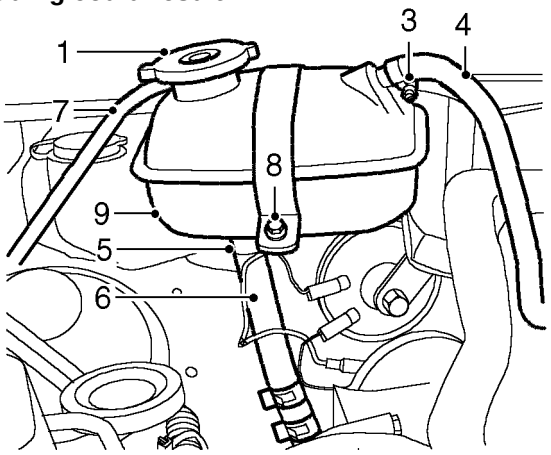
1. Fit drain plugs to engine.
2. Connect hose to coolant pump and secure with clip.
3. Fit viscous coupling. ***See Repair, viscous coupling***
4. Pour correct solution of water and anti-freeze into expansion tank until radiator is full.
5. Start engine and run until normal operating temperature is reached.
6. Top up coolant level as necessary.
7. Fit NEW 'O' ring to radiator filler plug.
8. Fit radiator filler plug and tighten to ***6 Nm (4 lbf.ft).***
9. Fit expansion tank filler cap.
10. Allow engine to cool and check coolant level.
11. Top-up expansion tank until level reaches seam.
12. Remove container.

EXPANSION TANK

Service repair no - 26.15.01

Remove

WARNING: Do not remove expansion tank filler cap when engine is hot. The cooling system is pressurised and personal scalding could result.



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1. Remove expansion tank filler cap by slowly turning it anti-clockwise. Pause to allow pressure to escape then continue to turn in same direction and remove.
2. Position container to collect any coolant spillage.
3. Loosen clip securing radiator hose to expansion tank.
4. Release radiator hose from expansion tank.
5. Loosen clip securing coolant hose to underside of expansion tank.
6. Release coolant hose from expansion tank.
7. Remove overflow pipe from expansion tank.
8. Remove clamping bolt from expansion tank mounting bracket and collect nut and washer.
9. Lift mounting bracket clamp and remove expansion tank.

Refit

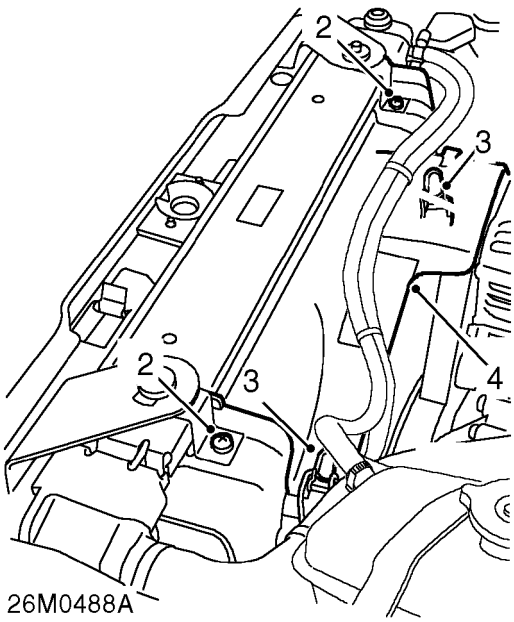
10. Fit expansion tank to mounting bracket.
11. Fit and tighten nut and bolt securing expansion tank to mounting bracket.
12. Fit overflow pipe to expansion tank.
13. Connect coolant hose to underside of expansion tank and secure with clip.
14. Connect radiator hose to expansion tank and secure with clip.
15. Remove container.
16. Top-up engine coolant.

VISCOUS COUPLING

Service repair no - 26.25.19

Remove

1. Disconnect battery negative lead and release clips securing coolant hoses to fan upper cowl.



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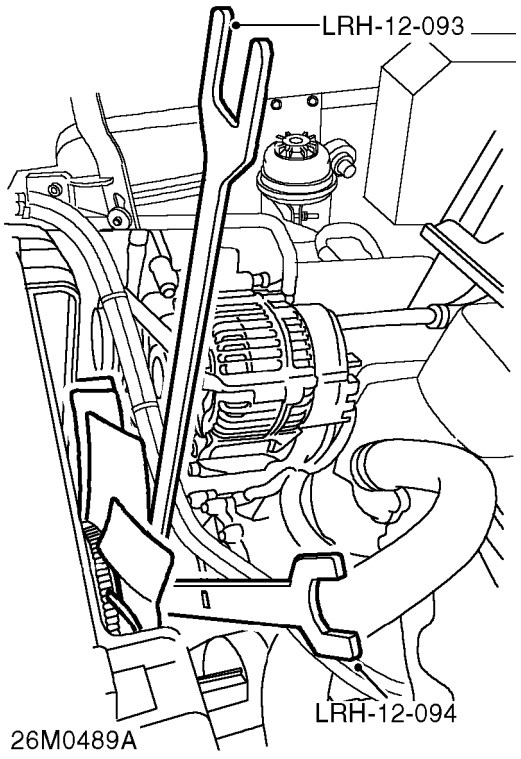
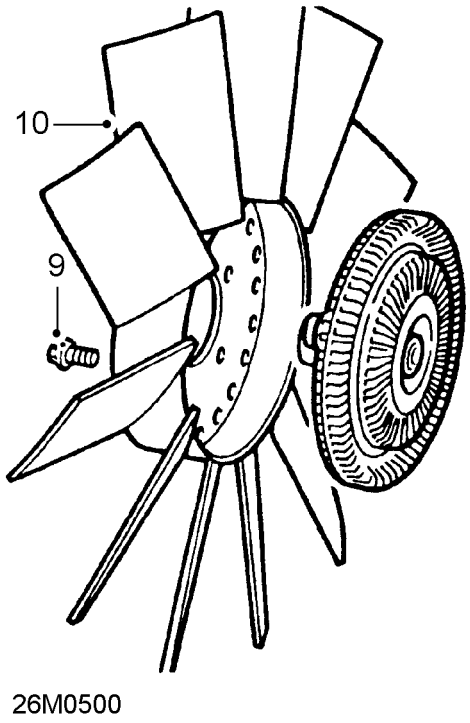
2. Remove 2 screws securing radiator top mountings to fan upper cowl.
3. Release 2 clips securing fan upper cowl to lower cowl.
4. Remove fan upper cowl.





5. Position tool **LRT-12-093** to hold coolant pump pulley.
6. Loosen viscous coupling nut using tool **LRT-12-094.**
7. Remove tool **LRT-12-093.**
8. Remove viscous coupling assembly.

Do not carry out further dismantling if component is removed for access only.

9. Remove 4 Allen screws securing fan blades to coupling.
10. Remove fan blades from coupling.

Refit

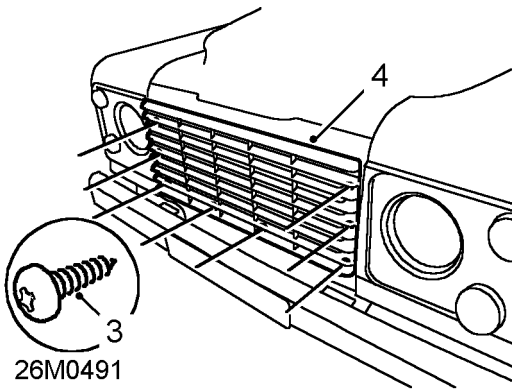
11. Clean mating faces of fan blades and coupling.
12. Fit fan blades to coupling and secure with Allen screws.
13. Position coupling assembly and start tightening nut.
14. Position tool **LRT-12-093** to hold pulley.
15. Tighten viscous coupling assembly nut using tool **LRT-12-094.**
16. Remove tools.
17. Fit fan upper cowl and secure with clips.
18. Secure coolant hoses to fan upper cowl and secure with clips.
19. Align fan cowl fixings to upper mounting brackets and secure with screws.
20. Reconnect battery negative lead.

RADIATOR

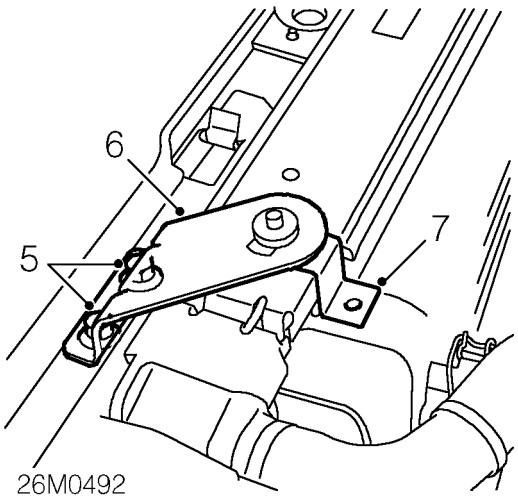
Service repair no - 26.40.01

Remove

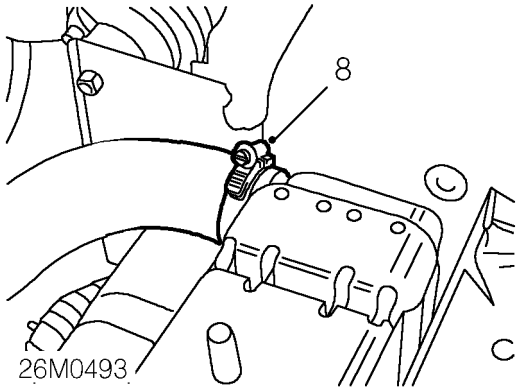
1. Disconnect battery negative lead.
2. Drain cooling system. ***See Adjustment, drain and refill***



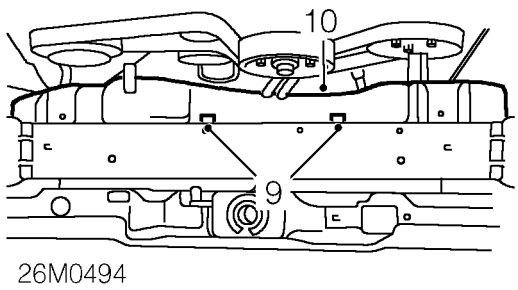
3. Remove 8 screws securing front grille to body.
4. Remove front grille.



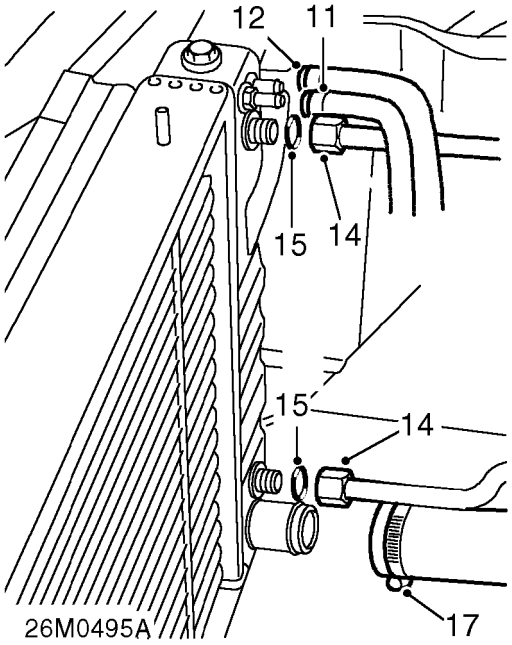
5. Remove 4 bolts securing radiator top mountings to bonnet locking panel and collect nuts.
6. Remove radiator top mountings.
7. Remove fan cowl upper mounting brackets.



8. Loosen clip and disconnect top hose from radiator.



9. Remove 2 clips securing fan cowl to radiator.
10. Remove fan cowl.



11. Loosen clip and disconnect throttle body to radiator hose.
12. Loosen clip and disconnect expansion tank to radiator hose.
13. Position container beneath engine oil cooler pipe unions.
14. Loosen engine oil cooler pipes and disconnect from radiator.
15. Remove and discard 'O' rings from oil cooler pipes.
16. Plug oil cooler pipe connections.
17. Loosen clip and disconnect bottom hose from radiator.
18. Release radiator from lower mounting rubbers and remove radiator.

Refit

19. Fit radiator and secure to lower mounting rubbers.

NOTE: Ensure condenser lower mounting brackets are located to radiator lower mounting brackets.

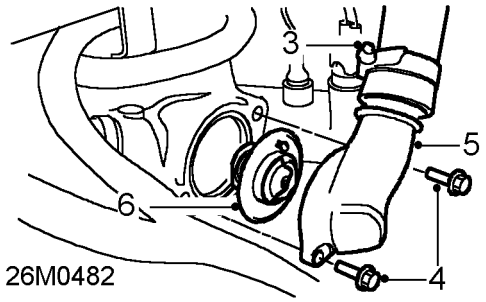
20. Connect bottom hose to radiator and secure with clip.
21. Remove plugs from engine oil cooler pipe connections.
22. Clean oil cooler pipe connections.
23. Lubricate NEW 'O' rings with clean engine oil and fit to pipes.
24. Connect oil cooler pipes to radiator and tighten unions to ***30 Nm (22 lbf.ft).***
25. Remove container.
26. Connect expansion tank hose to radiator and tighten clip.
27. Connect throttle body hose to radiator and tighten clip.
28. Fit fan cowl to radiator.
29. Fit fan cowl lower retaining clips.
30. Connect top hose to radiator and tighten clip.
31. Fit fan upper cowl and secure with clips.
32. Fit fan cowl upper mounting brackets.
33. Fit radiator top mountings and secure with screws and bolts.
34. Fit front grille and secure with screws.
35. Refill cooling system. ***See Adjustment, drain and refill***
36. Reconnect battery negative lead.
37. Top-up engine oil.

THERMOSTAT

Service repair no - 26.45.01

Remove

1. Disconnect battery negative lead.
2. Drain cooling system. ***See Adjustment, drain and refill***



3. Loosen clip and disconnect radiator top hose from coolant outlet elbow.
4. Remove 2 bolts securing coolant outlet elbow to engine.
5. Remove coolant outlet elbow and collect gasket.
6. Remove thermostat.

Refit

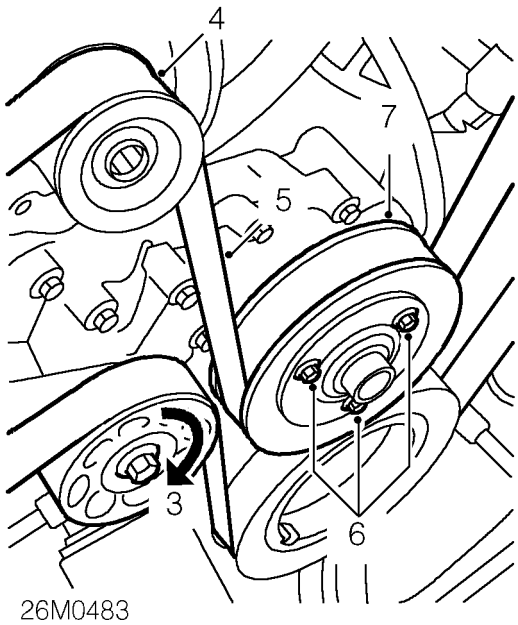
7. Fit thermostat ensuring jiggle pin/vent hole is uppermost.
8. Fit coolant outlet elbow with NEW gasket.
9. Fit and tighten bolts securing coolant outlet elbow to ***28 Nm (21 lbf.ft).***
10. Connect radiator top hose to coolant outlet elbow tighten clip.
11. Refill cooling system. ***See Adjustment, drain and refill***
12. Reconnect battery negative lead.

COOLANT PUMP

Service repair no - 26.50.01

Remove

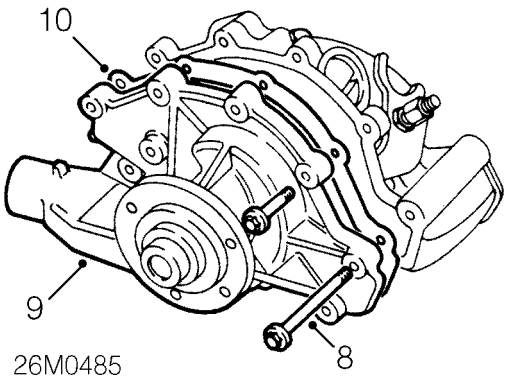
1. Drain cooling system. ***See Adjustment, drain and refill***



2. Loosen coolant pump pulley bolts.
3. Release auxillary drive belt tension by turning tensioner clockwise.
4. With tension released, remove belt from alternator pulley.
5. Remove drive belt.

NOTE: If belt is to be refitted, mark direction of rotation.

6. Remove bolts securing coolant pump pulley.
7. Remove coolant pump pulley.



8. Noting their fitted positions, remove 9 bolts securing coolant pump.
9. Remove coolant pump.
10. Remove and discard gasket.

Refit

11. Clean coolant pump and timing cover mating faces.
12. Lightly grease NEW gasket and position to timing cover.
13. Clean threads of all long bolts and coat with Loctite 572 thread sealant.
14. Position coolant pump, fit bolts and tighten to ***28 Nm (21 lbf.ft).***
15. Fit coolant pump pulley, fit bolts but do not tighten.
16. Clean auxillary drive belt pulley grooves and inspect for damage.
17. Fit belt to pulleys.
18. Turn drive belt tensioner clockwise and engage belt on alternator pulley.
19. Release drive belt tensioner.
20. Tighten coolant pump pulley bolts.
21. Refill cooling system. ***See Adjustment, drain and refill***

TORQUE VALUES

	Nm	lbf.ft
Oil cooler pipes	30	22
Radiator filler plug (plastic)	6	4.5
Coolant pump bolts	28	21
Coolant outlet elbow bolts	28	21

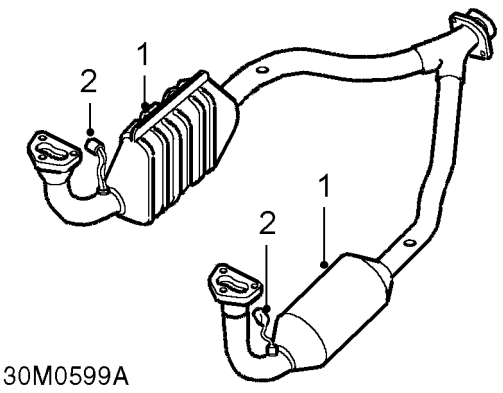
30 - MANIFOLD AND EXHAUST SYSTEM

CONTENTS

CATALYTIC CONVERTERS - V8i

Description

Catalytic converters which form part of the engine emission control system, are designed to 'clean' the exhaust gases, by chemically converting pollutant elements in the exhaust to gases less harmful to the environment.



1. Catalysts
2. Oxygen sensors

The front section of the exhaust system from each cylinder bank contain the ceramic elements of the catalytic converters. The oxygen sensors, which transmit information to the fuel ECM for control of the mixture, are located in the exhaust down pipes.

The Hydrocarbons (HC), Nitogen oxides (NO_x) and Carbon monoxide (CO) emitted by the engine react with the catalytic element and exhaust temperature to convert the toxic gas, into Nitrogen (N2), Carbon dioxide (CO_2) and water vapour (H_2O).

The sophisticated closed loop control system ensures that mixture is always kept at the optimum level for peak catalyst efficiency. Also, the advanced On Board Diagnostics ensure that any faults likely to cause damage to the catalyst are indicated to the driver.

However, should the engine be supplied with a rich mixture causing high CO in the exhaust gas, the ceramic element will become coated and the useful life of the catalyst reduced. If the mixture is too weak, excess oxygen in the exhaust gas will cause the catalysts to burn out. Similarly, should a cylinder misfire occur, the unburnt fuel and unburnt oxygen can cause a catalyst burn out.

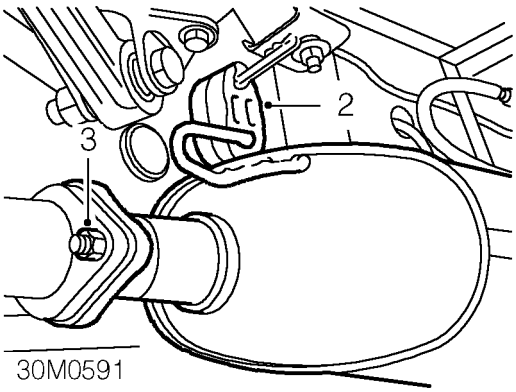
CAUTION: The catalyst matrices are fragile ceramic 'honeycombs' which can become damaged if roughly treated. Do not use a hammer or mallet when working on the exhaust system.

INTERMEDIATE PIPE

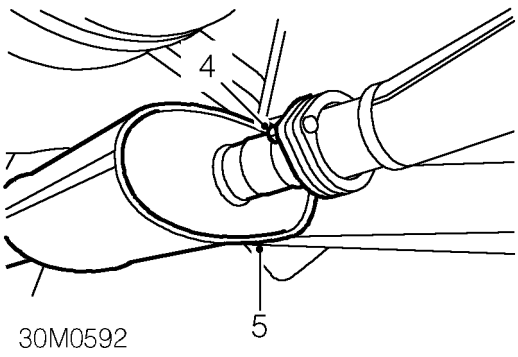
Service repair no - 30.10.11

Remove

1. Raise vehicle on ramp.



2. Release intermediate pipe from mounting rubber.
3. Remove 2 nuts securing intermediate pipe to tail pipe.



4. Remove 2 nuts securing intermediate pipe to front pipe.
5. Release intermediate pipe from front and tail pipes and remove.

Refit

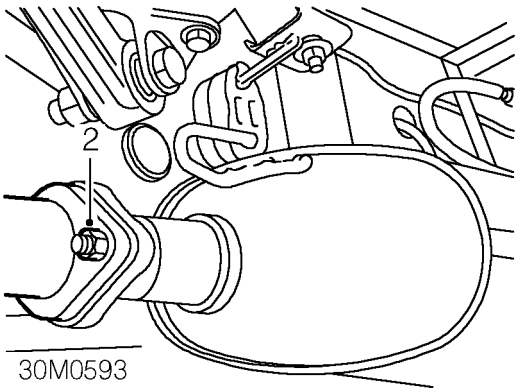
6. Fit intermediate pipe to front and tail pipes.
7. Secure intermediate pipe to mounting rubber.
8. Fit nuts securing intermediate pipe to front pipe and tighten to ***30 Nm (22 lbf.ft).***
9. Fit nuts securing intermediate pipe to tail pipe and tighten to ***30 Nm (22 lbf.ft).***
10. Lower vehicle.

TAIL PIPE

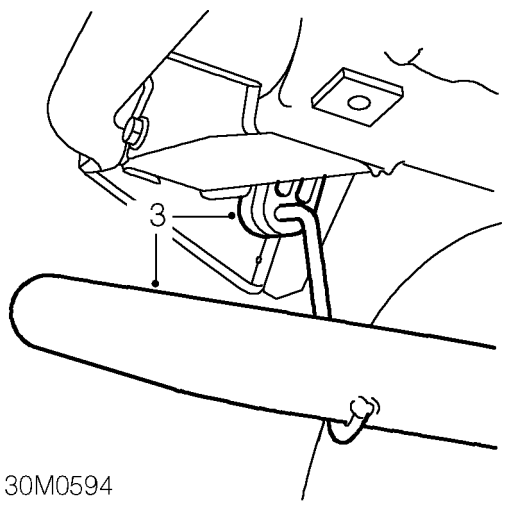
Service repair no - 30.10.22

Remove

1. Raise vehicle on a ramp.



2. Remove 2 nuts securing tail pipe to intermediate pipe.



3. Release tail pipe from mounting rubber.
4. Release tail pipe from intermediate pipe and feed over rear axle.
5. Remove tail pipe.

Refit

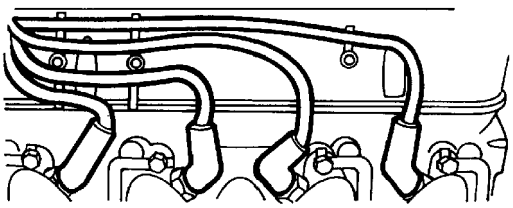
6. Feed tail pipe over rear axle and connect to intermediate pipe.
7. Secure tail pipe to mounting rubber.
8. Fit nuts securing tail pipe to intermediate pipe and tighten to ***30 Nm (22 lbf.ft).***
9. Lower vehicle.

INLET MANIFOLD GASKET

Service repair no - 30.15.08

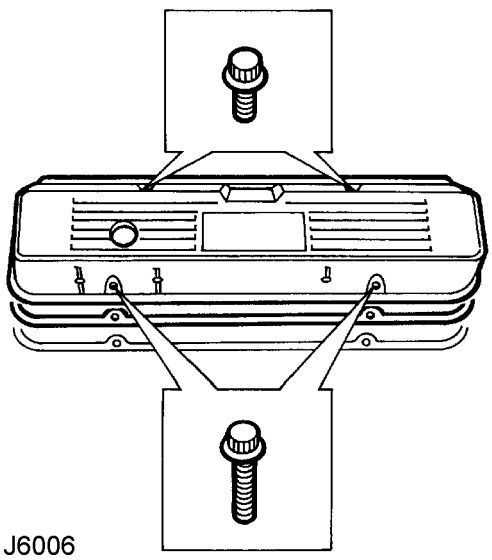
Remove

1. Disconnect battery negative lead.
2. Drain cooling system. ***See COOLING SYSTEM, Adjustment, drain and refill***
3. Remove fuel rail. ***See FUEL SYSTEM, Repair, fuel rail***
4. Remove breather hose from RH rocker cover.
5. Remove bolt securing coolant pipe brackets to RH rocker cover and collect nut.
6. Loosen clip and disconnect coolant return hose from inlet manifold.
7. Remove 4 bolts securing engine harness to inlet manifold.



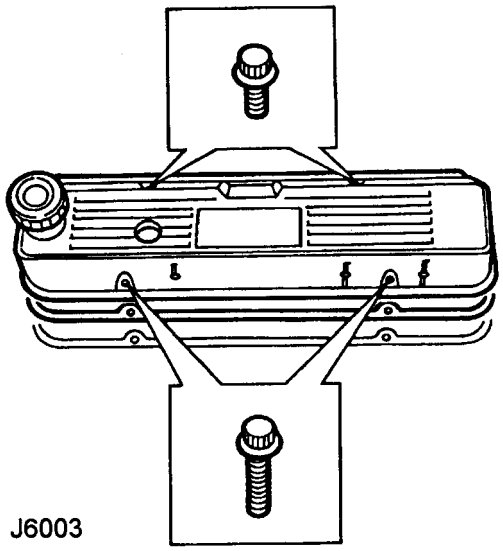
J6005

8. Release 8 spark plug leads from guide clips and disconnect leads from spark plugs.



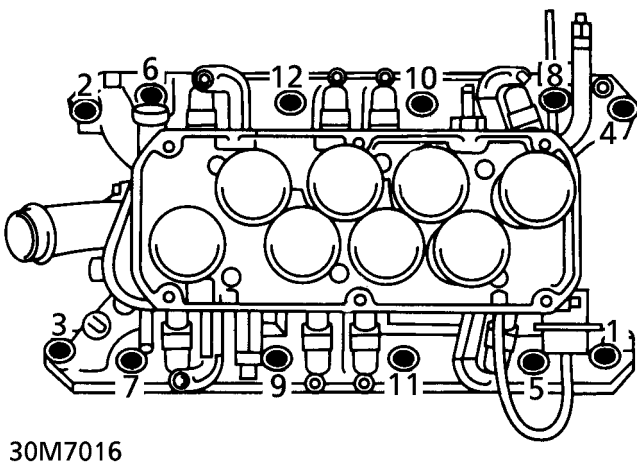
J6006

9. Remove 4 bolts securing RH rocker cover to cylinder head.
10. Remove RH rocker cover.
11. Remove and discard rocker cover gasket.
12. Remove screw securing dipstick tube to LH rocker cover.



J6003

13. Remove 4 bolts securing LH rocker cover to cylinder head.
14. Remove LH rocker cover.
15. Remove and discard rocker cover gasket.
16. Disconnect coolant temperature sensor multiplug.
17. Loosen clip and disconnect coolant return hose from inlet manifold.
18. Release coolant pipe bracket from manifold.
19. Loosen clip and remove plenum chamber coolant hose from inlet manifold.



30M7016

20. Remove 12 bolts securing inlet manifold in the sequence shown.

21. With assistance, move engine harness aside and remove inlet manifold assembly.
22. Remove 2 bolts and clamps securing inlet manifold gasket to cylinder block.
23. Remove and discard gasket and gasket seals.

Refit

24. Ensure mating faces of inlet manifold and cylinder head are clean.
25. Apply a thin bead of Loctite Superflex (black) sealant to the 4 notches between the cylinder head and block.
26. Position new gasket seals ensuring ends engage correctly in notches.
27. Fit new inlet manifold gasket.
28. Position inlet manifold gasket clamps and fit bolts.

NOTE: Do not fully tighten bolts at this stage.

29. With assitance, move engine harness aside and fit inlet manifold.
30. Fit inlet manifold bolts and initially tighten in sequence to ***10 Nm (7 lbf.ft).***

NOTE: When fitting inlet manifold bolts, tighten in reverse of removal sequence.

31. Tighten inlet manifold bolts in sequence to ***51 Nm (38 lbf.ft).***
32. Tighten gasket clamp bolts to ***18 Nm (13 lbf.ft).***
33. Fit plenum chamber coolant hose to inlet manifold and secure with clip.
34. Secure coolant pipe bracket to inlet manifold.
35. Connect coolant return hose to inlet manifold and secure with clip.
36. Connect coolant temperature sensor multiplug.
37. Clean mating faces of LH rocker cover and cylinder head.
38. Fit new rocker cover gasket to LH rocker cover.
39. Fit rocker cover and gasket to cylinder head.
40. Fit rocker cover bolts, ensuring short bolts are fitted inboard, and tighten by diagnonal selection to:
Stage 1 - ***4 Nm (3 lbf.ft).***
Stage 2 - ***8 Nm (6 lbf.ft).***
Stage 3 - Re-torque to ***8 Nm (6 lbf.ft).***

NOTE: This torque tightening sequence also applies to the RH rocker cover bolts.

41. Align dipstick tube to rocker cover and tighten screw.
42. Clean mating faces of RH rocker cover and cylinder head.
43. Fit new rocker cover gasket to RH rocker cover.
44. Fit rocker cover and gasket to cylinder head.
45. Tighten RH rocker cover bolts in sequence given for LH rocker cover bolts.
46. Connect spark plug leads to spark plugs and secure to guide clips.
47. Fit bolts securing engine harness to inlet manifold.
48. Connect coolant return hose to inlet manifold and secure with clip.
49. Fit nut and bolt securing coolant pipe bracket to RH rocker cover.
50. Connect breather hose to RH rocker cover.
51. Fit fuel rail. ***See FUEL SYSTEM, Repair, fuel rail; Refit***
52. Refill cooling system. ***See COOLING SYSTEM, Adjustment, drain and refill***
53. Reconnect battery negative lead.

TORQUE VALUES

MANIFOLDS AND EXHAUSTS - V8i

	Nm	lbf.ft
Inlet manifold to cylinder head	51	38
Exhaust manifold to cylinder head	20	15
Exhaust front pipe to manifold	45	33
Exhaust front pipe to intermediate pipe	30	22
Exhaust intermediate pipe to tail pipe	30	22
Inlet manifold gasket clamp bolts	18	13
Rocker cover bolts	8	6

41 - TRANSFER GEARBOX

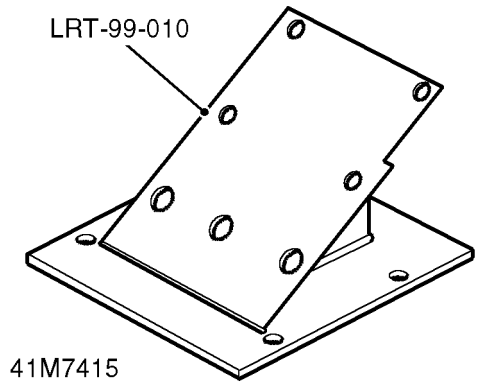
CONTENTS

LT230Q TRANSFER GEARBOX

Service repair no - 41.20.25/99

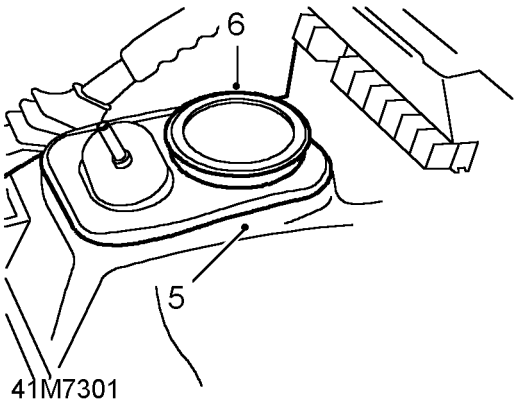
Remove

The transfer gearbox should be removed from underneath the vehicle, using a hydraulic transmission jack and adaptor plate **LRT-99-010.**

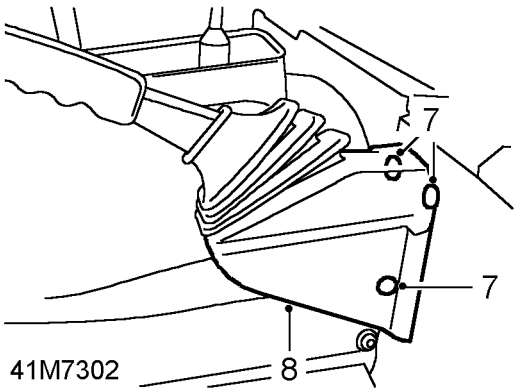


WARNING: Where use of a transmission jack is necessary, it is absolutely essential to follow the manufacturers' instructions to ensure safe and effective use of the equipment.

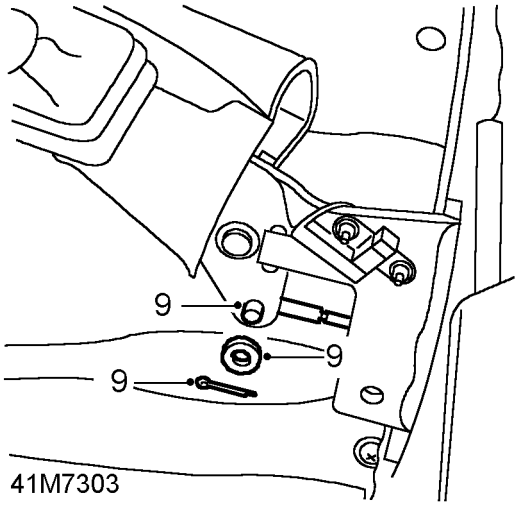
1. Position vehicle on a ramp.
2. Select LOW range gear and leave vehicle in neutral.
3. Disconnect battery negative lead.
4. Remove centre console. ***See CHASSIS AND BODY, Repair, centre console***



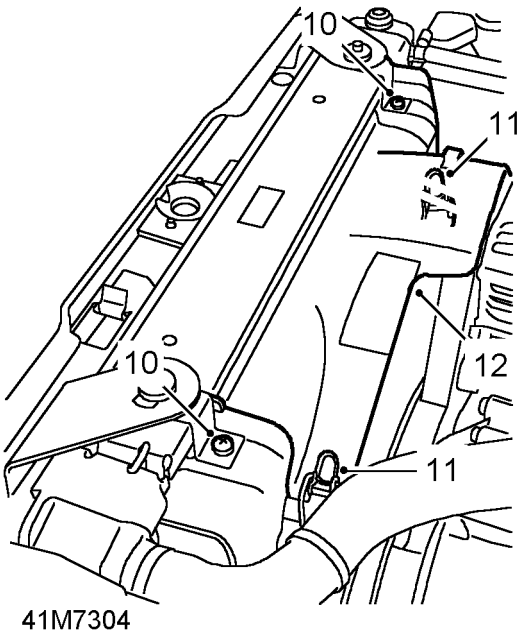
5. Remove carpet from transmission tunnel.
6. Remove high-low selector housing cover from transmission tunnel.



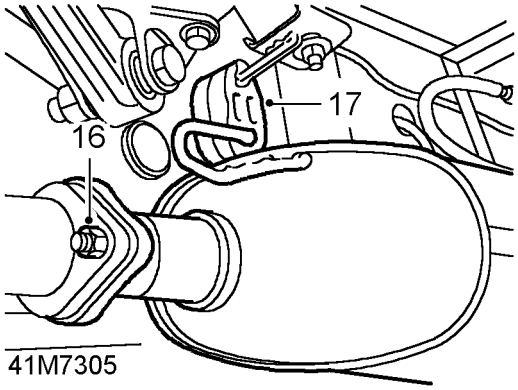
7. Remove 3 trim studs securing handbrake lever gaiter.
8. Release handbrake lever gaiter for access to handbrake cable linkage.



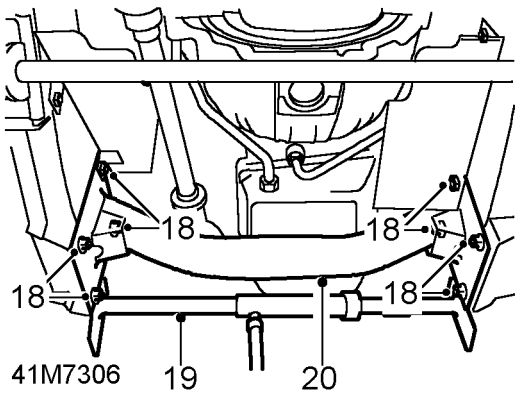
9. Remove split pin and clevis pin securing handbrake cable to lever. Discard split pin.



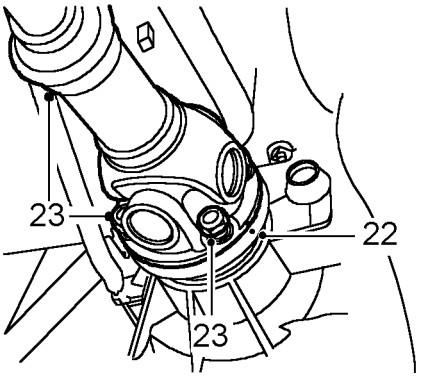
10. Remove 2 screws securing fan cowl to upper retaining brackets.
11. Release 2 clips securing upper fan cowl.
12. Remove upper fan cowl.
13. Raise ramp.
14. Drain transfer gearbox oil. ***See MAINTENANCE , under vehicle maintenance***
15. Remove exhaust front pipe. ***See EMISSION CONTROL, Repair, front pipe/catalytic converter***

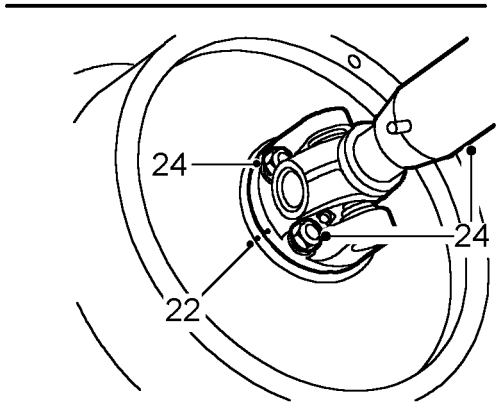


16. Remove 2 nuts securing intermediate pipe to tail pipe.
17. Release intermediate pipe from tail pipe and remove from mounting.



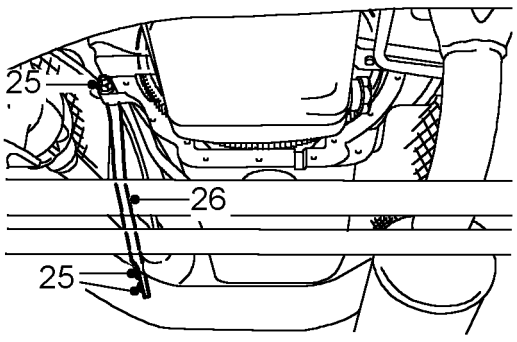
18. Remove 8 bolts securing chassis crossmember.
19. With assistance and using a body jack between chassis longitudinals, jack chassis sufficiently to enable removal of crossmember.
20. Remove crossmember.
21. Remove body jack.





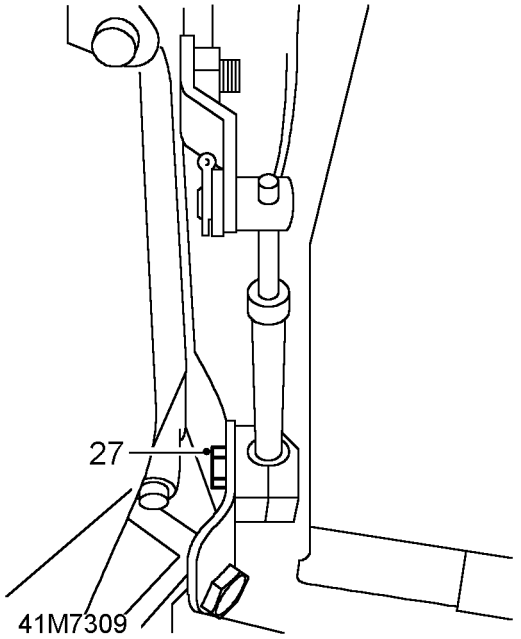
41M7307

22. Using a centre punch, mark relationship between front propeller shaft and transfer box drive flanges and rear propeller shaft and brake drum drive flanges.
23. Remove 4 nuts securing front propeller shaft to transfer box flange. Release propeller shaft from flange and tie aside.
24. Remove 4 nuts securing rear propeller shaft to brake drum flange. Release propeller shaft from flange and tie aside.



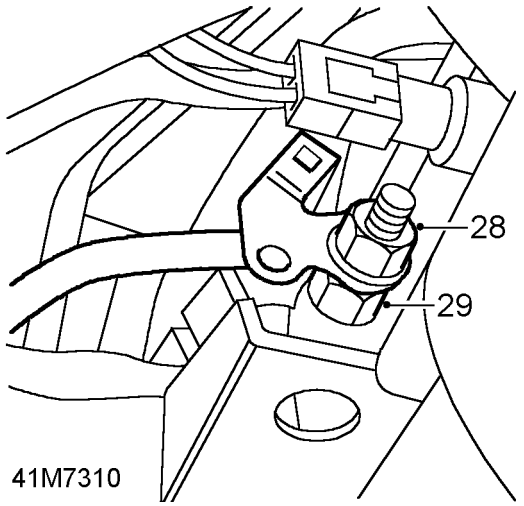
41M7308

25. Remove nut securing tie bar to gear box and 2 bolts securing tie bar to transfer box.
26. Remove tie bar.



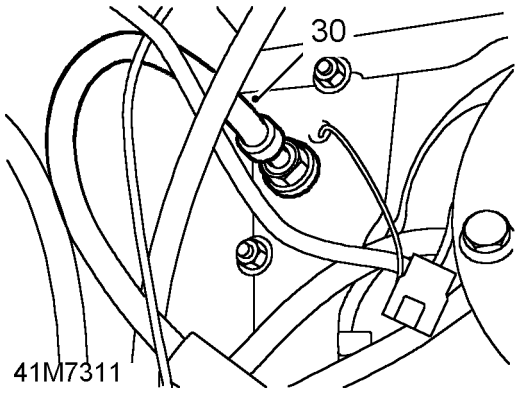
41M7309

27. Remove bolt securing selector outer cable clamp to transfer gearbox LH mounting.

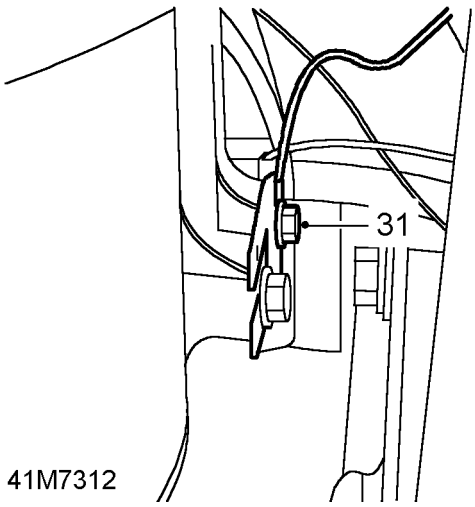


41M7310

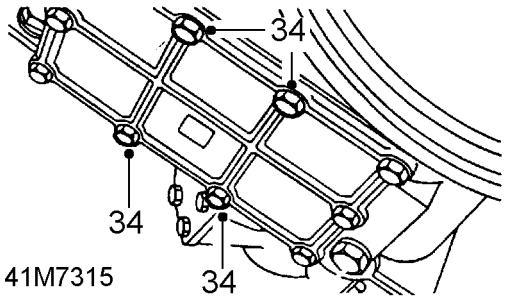
28. Remove nut securing oxygen sensor multiplug bracket to transfer gearbox earth bolt and collect bracket.
29. Remove nut securing earth strap to transfer gearbox and release strap.



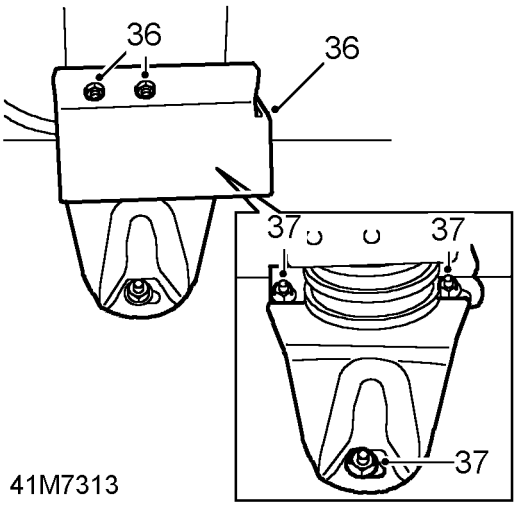
30. Release handbrake outer cable from body.



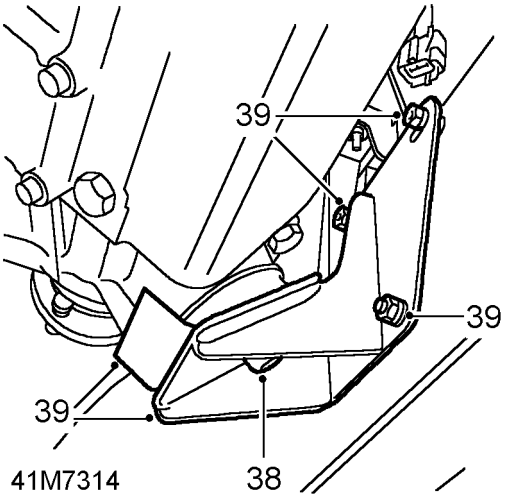
31. Remove bolt securing ground lead to RH side of transfer gearbox.
32. Remove bolt securing handbrake cable heat shield. Remove heat shield.
33. Position adaptor plate, **LRT-99-010**, and secure to transmission jack with 4 bolts.



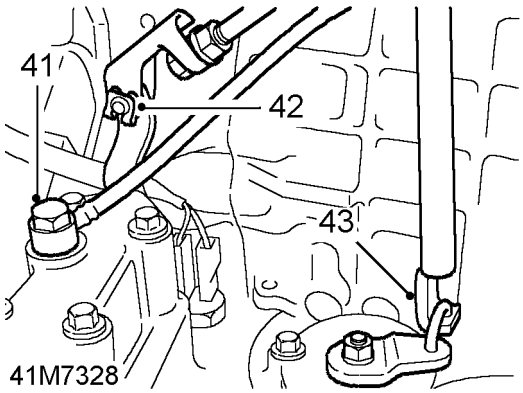
34. Remove 4 central bolts from transfer gearbox bottom cover, move jack into position and secure adaptor plate to transfer box.
35. Adjust hoist to take weight of transfer gearbox.



36. Remove 2 nuts and bolts securing heat shield to transfer gearbox LH mounting bracket. Remove heat shield.
37. Remove 3 nuts and bolts securing LH gearbox mounting bracket to chassis.



38. Remove nut securing transfer gearbox RH mounting to mounting rubber.
39. Remove 3 nuts and bolts securing transfer gearbox mounting bracket to chassis. Remove transfer box RH mounting bracket and collect rubber mounting heat shield.
40. Lower transmission sufficiently to gain access to harness connectors and transfer box breather pipe connection.



41. Remove banjo bolt from transfer box breather pipe and collect 2 sealing washers. Discard sealing washers.
42. Remove retaining clip and disconnect high/low lever from operating rod.
43. Remove 2 clips at lower end of pivot arm and disconnect differential lock lever link.
44. Disconnect the following multiplugs/connectors from transfer box:
Speed transducer
Parking solenoid
Neutral detection switch
Differential lock
Temperature sensor switch
45. Remove 2 clips securing harness to transfer box.
46. Position a jack to support main gearbox.

CAUTION: Use a block of wood or hard rubber pad to protect gearbox.

47. Remove nut and 4 bolts securing transfer box to main gearbox extension case.
48. Fit 3 guide studs, **LRT-41-009**, through transfer box bolt holes to support it during removal.
49. Lower hoist and withdraw transfer box from main gearbox.
50. Remove transfer box.

Refit

51. Ensure joint faces of transfer box and main gearbox are clean and guide studs, **LRT-41-009**, are fitted to extension case.
52. Lubricate oil seal in joint face of transfer box.
53. Secure transfer box to adaptor plate on lifting jack and raise jack until transfer box can be located over guide studs.
54. Remove guide studs, and secure transfer box to main gearbox extension case. Tighten fixings to ***45 Nm (33 lbf.ft).***
55. Connect muliplugs/connectors to transfer box.
56. Position breather pipe to transfer box, fit new sealing washers and tighten banjo bolt to ***15 Nm (11 lbf.ft).***
57. Fit link to differential lock lever and pivot arm and secure with retaining clips.
58. Connect high/low lever to operating rod and secure with retaining clip.
59. Raise transmission jack and remove jack supporting main gearbox.
60. Position RH mounting rubber heat shield and mounting bracket and secure loosely with retaining nut.
61. Align RH mounting bracket to chassis and secure with nuts and bolts.
62. Tighten nut securing RH mounting.
63. Align LH mounting bracket to chassis and secure with nuts and bolts.

NOTE: Position ground lead to mounting bolt.

64. Remove 4 bolts securing hoist adaptor plate to transfer box bottom cover.
65. Lower hoist and move aside.
66. Clean threads of the 4 bolts, coat with Loctite 290, and fit to transfer box bottom cover. Tighten to ***25 Nm (18 lbf/ft.***
67. Position handbrake cable heat shield and tighten bolt.
68. Position ground lead to RH side of transfer box and tighten bolt.
69. Feed handbrake cable through body.

NOTE: Apply a soap solution to aid fitment of cable.

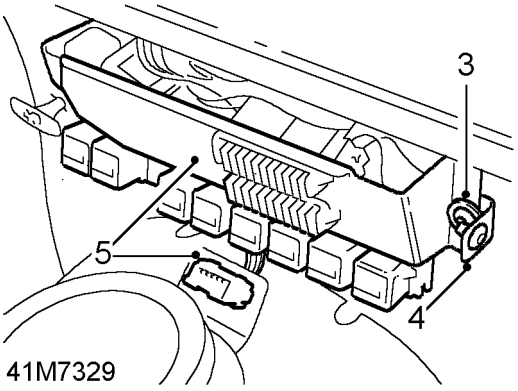
70. Position ground strap to transfer box stud and tighten nut.
71. Fit heated oxygen sensor multiplug bracket to stud and tighten nut.
72. Position selector outer cable clamp to transfer box LH mounting and tighten bolt.
73. Fit tie bar and tighten bolts and nut.
74. Clean rear propeller shaft and brake drum flange mating faces.
75. Release propeller shaft, align flange markings and connect to studs.
76. Fit nuts securing propeller shaft and tighten to ***47 Nm (33 lbf.ft).***
77. Clean front propeller shaft and transfer box flange mating faces.
78. Release propeller shaft, align flange markings and connect to studs.
79. Fit nuts securing propeller shaft and tighten to ***47 Nm (33 lbf.ft).***
80. With assistance and using a body jack between chassis longitudinals, jack chassis sufficiently to enable fitment of crossmember.
81. Fit crossmember and tighten bolts.
82. Clean intermediate and tail pipe flanges.
83. Fit intermediate pipe to mounting rubber, connect to tail pipe and tighten nuts to ***30 Nm (22 lbf.ft).*** .
84. Fit exhaust front pipe. ***See EMISSION CONTROL, Repair, front pipe/catalytic converter; Refit***
85. Refill transfer box with recommended oil. ***See MAINTENANCE , under vehicle maintenance*** .
86. Lower vehicle ramp.
87. Fit upper fan cowl and secure clips.
88. Align fan cowl to upper retaining brackets and tighten screws.
89. Align handbrake cable to lever, fit clevis pin and secure with NEW split pin.
90. Position handbrake lever cover and secure with trim studs.
91. Fit high-low selector housing cover to transmission tunnel.
92. Fit carpet to transmission tunnel.
93. Fit centre console. ***See CHASSIS AND BODY, Repair, centre console; Refit***
94. Reconnect battery negative lead.
95. Check park brake operation and adjust if necessary. ***See MAINTENANCE , vehicle interior***
96. Refill transfer box using correct grade oil. ***See MAINTENANCE , transfer box***

NEUTRAL SWITCH

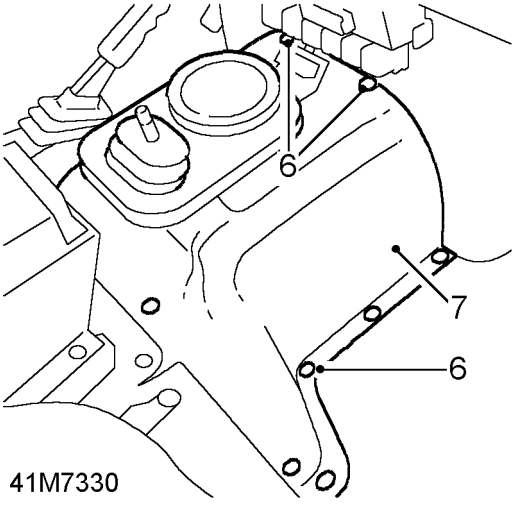
Service repair no - 41.20.64

Remove

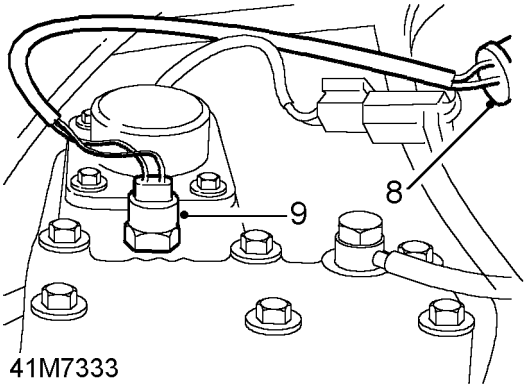
1. Remove centre console. ***See CHASSIS AND BODY, Repair, Centre console***
2. Remove carpet from transmission tunnel.



3. Remove 2 screws securing relay panel.
4. Retain 2 centre console screw brackets and spacers.
5. Release connector (J1962) from bracket on tunnel cover and move relay panel aside to gain access to tunnel cover top fixings.



6. Remove 15 screws securing tunnel cover.
7. Release and remove tunnel cover.



8. Disconnect neutral switch multiplug.
9. Remove neutral switch from transfer box.
10. Clean sealant from switch.

Refit

11. Apply Hylomar PL32/L20 or equivalent sealant to neutral switch.
12. Fit switch to transfer box and tighten to ***25 Nm (18 lbf.ft).***
13. Connect switch multiplug.
14. Fit tunnel cover.
15. Secure connector (J1962) to bracket on tunnel cover.
16. Position centre console screw bracket and spacers and fit relay panel.
17. Fit tunnel carpet.
18. Fit centre console. ***See CHASSIS AND BODY, Repair, Centre console; Refit***

TORQUE VALUES

LT230Q Transfer gearbox

	Nm	lbf.ft)
Bottom cover to transfer case	25	18
Transfer box breather banjo bolt	15	11
Transfer box front drive flange to propeller shaft	47	33
Transfer box rear drive flange to propeller shaft	47	33
Transfer box to gearbox extension case	45	33
Neutral switch	25	18
Intermediate to tail pipe	30	22

NOTE: The following torque values are for screws and bolts not specified in the previous table.

METRIC	Nm	lbf.ft
M5	6	5
M6	9	7
M8	25	18
M10	45	33
M12	90	65
M14	105	75
M16	180	130

UNC / UNF		
1/4	9	7
5/16	25	18
3/8	40	30
7/16	80	60
1/2	90	65
5/8	135	100

44 - AUTOMATIC GEARBOX

CONTENTS

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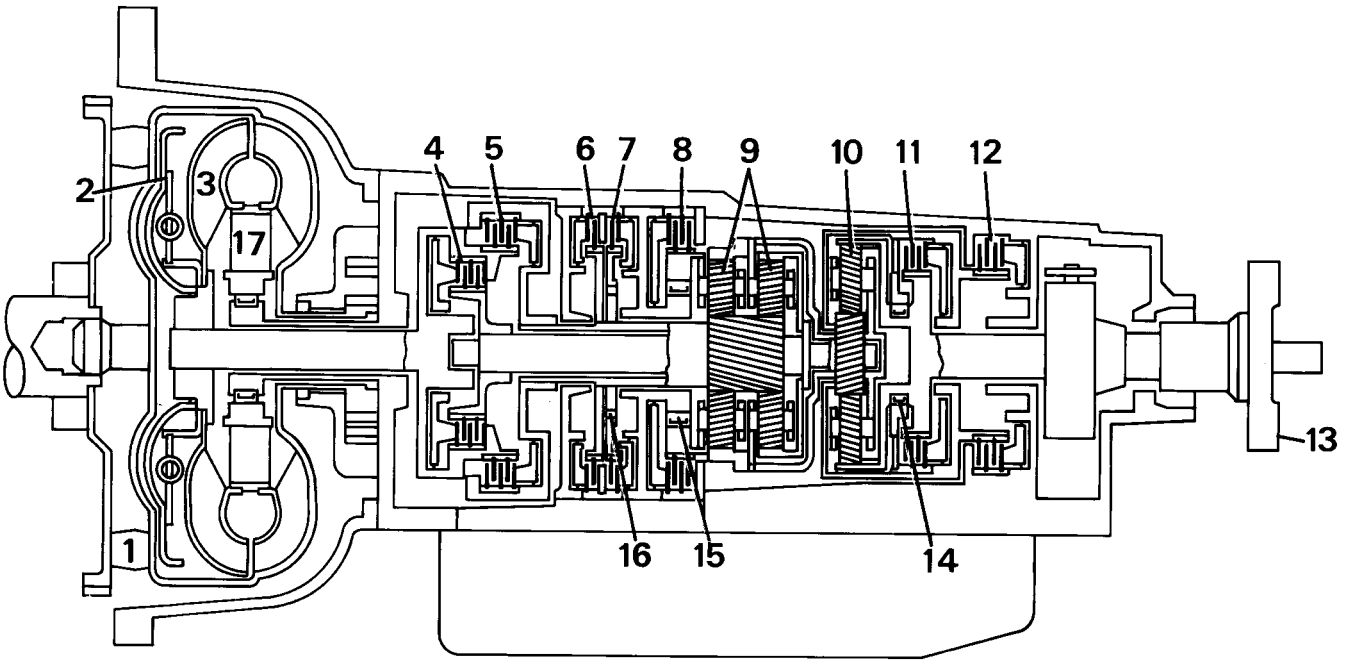
DESCRIPTION

The automatic transmission is a specially tailored version of the ZF 4HP22, used by many manufacturer's of high performance vehicles.

A three element torque converter delivers the power to a four speed epicyclic transmission. First, second and third gears are reduction ratios but fourth is an overdrive gear for high speed cruising. A direct drive clutch, integral with the torque converter operates to engage fourth gear.



RR3560A

The gear selector has seven positions as follows:

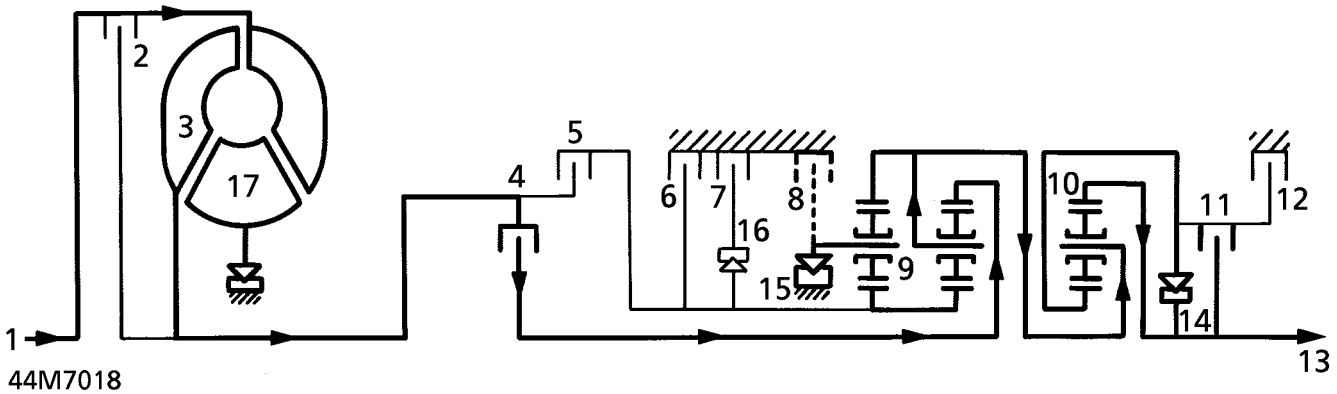
P = Park provides a mechanical lock on the output shaft.
R = Reverse gear.
N = Neutral.
D = Provides a 1st gear start and automatic shifts 1-2-3-4-3-2-1.
3 = Provides a 1st gear start and automatic shifts 1-2-3-2-1.
2 = Provides a 1st gear start and automatic shifts 1-2-1 or 3-2-1.
1 = Provides a 1st gear start with no up shifts, or 3-2-1.

All automatic shifts are automatically controlled by the valve block and an hydraulic governor driven by the output shaft.

Power flow

1st gear D selected

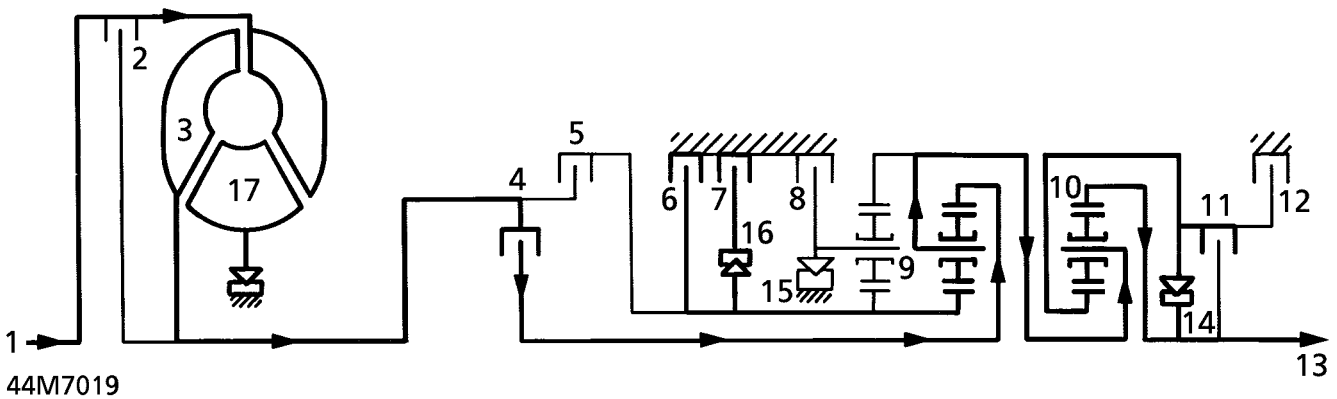
With D selected 1st gear engaged, clutches 4 and 11 are operative. The front planet gear carrier of gear set 9 is locked against the housing through freewheel 15 when the engine is pulling but freewheels when the vehicle is coasting. Epicyclic gear set 10 rotates as a solid unit with the front planet gear carrier. In selector position 1 with 1st gear engaged, clutch 8 operates to prevent the loss of drive on the overrun through freewheel 15, to provide engine braking.



44M7018

2nd gear D selected

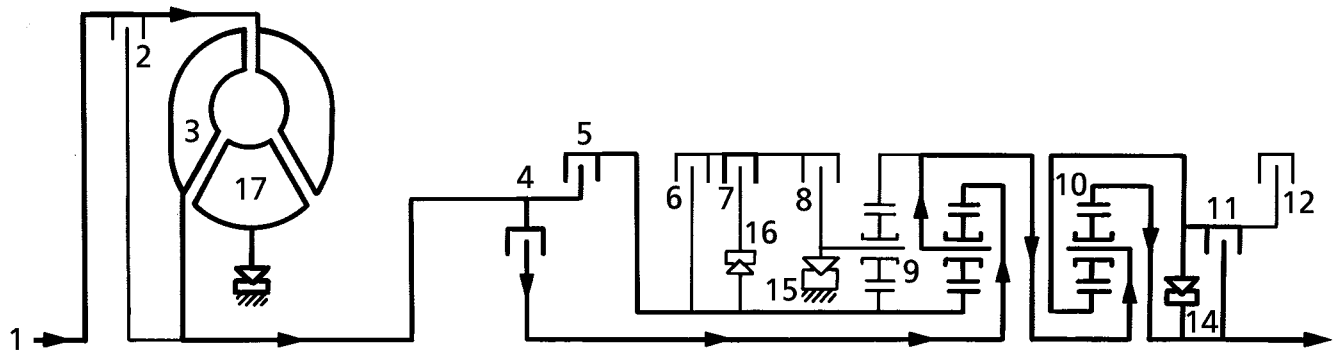
Clutches 4, 6, 7 and 11 are engaged. Freewheel 15 overruns, the hollow shaft with the sun wheel of epicyclic gear set 9 is locked. Epicyclic gear set 10 also rotates as a solid unit.



44M7019

3rd gear D selected

Clutches 4, 5, 7 and 11 are engaged. Freewheel 15 and 16 are overrun. Epicyclic gear set 9 and 10 rotate as a solid unit at a ratio of 1:1.

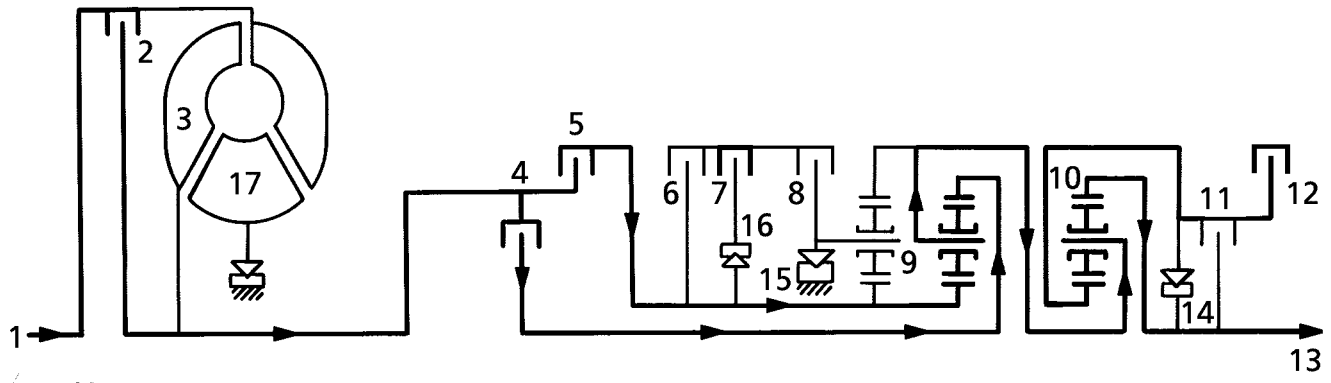


44M7020A

4th gear D selected

Clutches 4, 5, 7 and 12 are engaged. Freewheel 14, 15 and 16 are overrun. Epicyclic gear set 9 rotates as a solid unit. The hollow shaft with the sun wheel of epicyclic gear set 10 is locked.

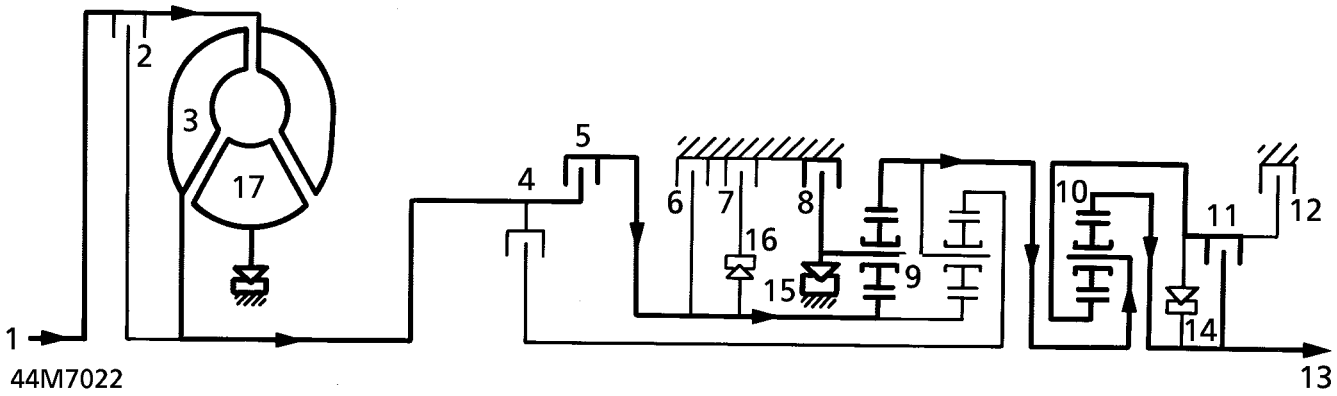
Above a predetermined road speed, clutch 2 locks the gearbox power input direct to the engine, by-passing the torque converter.



44M7021A

Reverse gear

Clutches 5, 8 and 11 are engaged. Since the front planet gear carrier of epicyclic gear set 9 is locked, the direction of output-shaft rotation is reversed. Epicyclic gear set 10 also rotates as a solid block.



ZF AUTOMATIC GEARBOX

Before referring to fault symptoms, carry out initial static checks first:

INITIAL STATIC CHECKS

Check start positions	'P' & 'N' only
Reverse lights	'R' only
Gear engagements	N-D,N-3,N-2,N-1,N-R
Full throttle	Engine switched off, check full travel at engine and at pedal.
Oil level	'N' selected, engine running at normal running temperature.

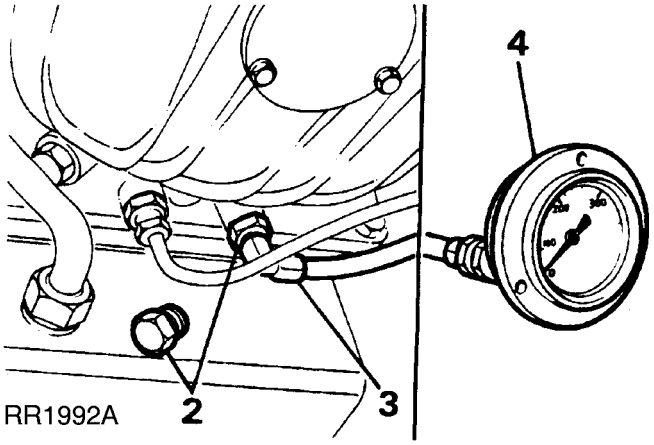
Pressure test

2000 rev/min	10 ± 0.3 bar	150 ± 5 lbf/in^2
Idle pressure at 665 to 735 rev/min.	6.9 ± 0.3 bar	100 ± 5 lbf/in^2

To fit pressure gauge

Service tools: ***See Service tools, Automatic Gearbox***

Pressure gauge 0 to 20 bar (0 to 300 lbf/in^2).
Flexible hose adaptor.



1. Site vehicle on a ramp.
2. From under gearbox, remove socket head plug (located 10cm, 4 in from oil pipe). Fit hose adaptor **LRT-44-009**.
3. Fit hose to adaptor.
4. Fit gauge **LRT-44-007** to hose and route into vehicle, ensuring hose is clear of rotating parts and exhaust pipes.
5. Carry out road test. ***See Road Test Procedure***
6. Remove pressure gauge

ROAD TEST PROCEDURE

Follow the procedure given commencing each test, from a standing start, on a level road, in good weather conditions.

ROAD TEST 1 = CHECKS 1-2-3-4-5-6-7-8

D SELECTED KICKDOWN START FROM REST

CHECK 1

Check for clutch squeal and slip. Check pressure is 10.3 bar (150 lbf/in^2).

CHECK 2

Check 1st to 2nd upshift speed and quality. Pressure should fall to 8.3 bar (120 lbf/in^2).

CHECK 3

Check 2nd to 3rd upshift speed and quality. Pressure should fall to 6.9 bar (100 lbf/in^2).

CHECK 4

Release throttle to allow simultaneous engagement 4th + DDC. Check shift quality and engine rpm drop of approximately 500 rev/min.

CHECK 5

To proceed to Check 5, release throttle and check drop out speed of direct drive clutch to 4th.

CHECK 6

Check down shift speed and quality 4th to 3rd.

NOTE: This shift is usually very smooth and difficult to detect.

CHECK 7

Check downshift speed and quality 3rd to 2nd.

CHECK 8

Check downshift speed and quality 2nd to 1st. Also difficult to detect.

ROAD TEST 2 = CHECKS 9-10-11

D SELECTED FROM REST

FULL THROTTLE START

CHECK 9

Check 1st to 2nd upshift speed and quality.

CHECK 10

Check 2nd to 3rd upshift speed and quality.

CHECK 11

Check 3rd, 4th and direct drive clutch upshift speed and quality.

NOTE: 4th and the direct drive clutch engage simultaneously.

ROAD TEST 3 = CHECKS 12-13-14-15-16-17-18-19-20-21-22-23

D SELECTED FROM REST

LIGHT THROTTLE START

CHECK 12

Check 1st to 2nd upshift speed and quality.

CHECK 13

Check 2nd to 3rd upshift speed and quality.

CHECK 14

Check 3rd to 4th upshift speed and quality.

NOTE: This shift is usually very difficult to detect but can be confirmed by a 200 rev/min drop in engine speed.

CHECK 15

Check speed and quality of shift into direct drive clutch, confirmed by 300 rev/min drop in engine speed.

NOTE: An intermediate throttle position engagement of 4th and the direct drive clutch, which is indicated by a fall of 500 rev/min in engine speed.

CHECK 16

At approximately 55 mph (88 kph), depress throttle to kickdown - gearbox should change down to 2nd - release throttle to re-engage 4th direct drive clutch continue to accelerate gently.

CHECK 17

At approximately 80 mph (128 kph), depress throttle to kickdown - gearbox should change down to 3rd - release throttle to re-engage 4th direct drive clutch and continue to accelerate gently.

CHECK 18

At approximately 85 mph (138 kph), select 3rd, gearbox should change immediately down to 3rd. Release throttle.

CHECK 19

De-accelerate to approximately 30 mph (47 kph), depress throttle to kickdown - geabox should downshift to 1st gear, continue accelerating at full throttle until 3rd gear is attained. To do this you will have repeated check 2 of Test 1.

CHECK 20

At 80 mph (128 kph), select 2nd no downshift should occur. Release throttle.

CHECK 21

At 65 mph (104 kph), an automatic downshift into 2nd gear should occur. Continue to de-accelerate.

CHECK 22

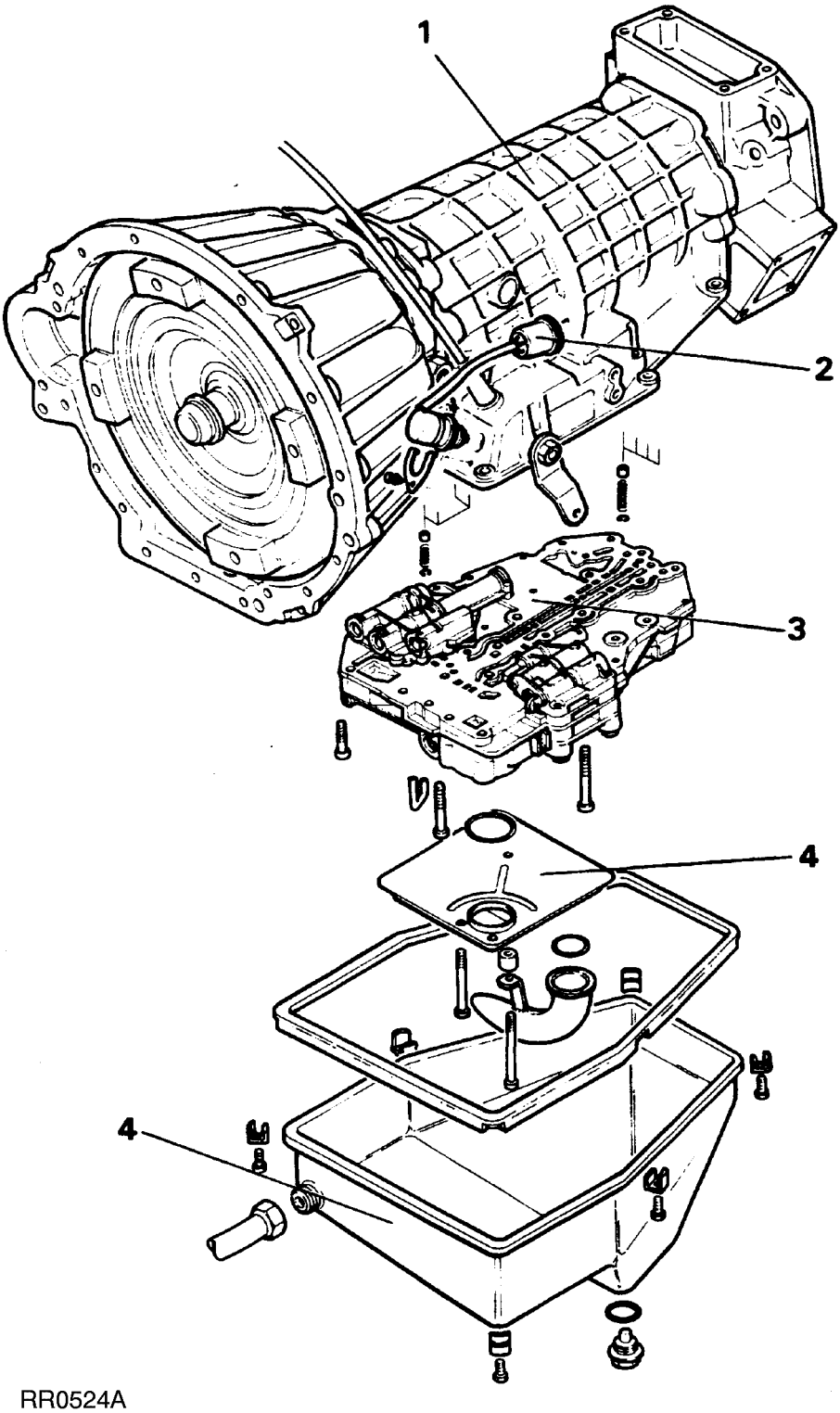
At 55 mph (88 kph), select 1st. No downshift should occur. Continue to de-accelerate.

CHECK 23

With 1 selected 2nd gear engaged, continue to de-accelerate and at 28 mph (45 kph), the box should automatically downshift to 1st gear after which no upshifts will occur in this selector position.

END OF ROADTEST

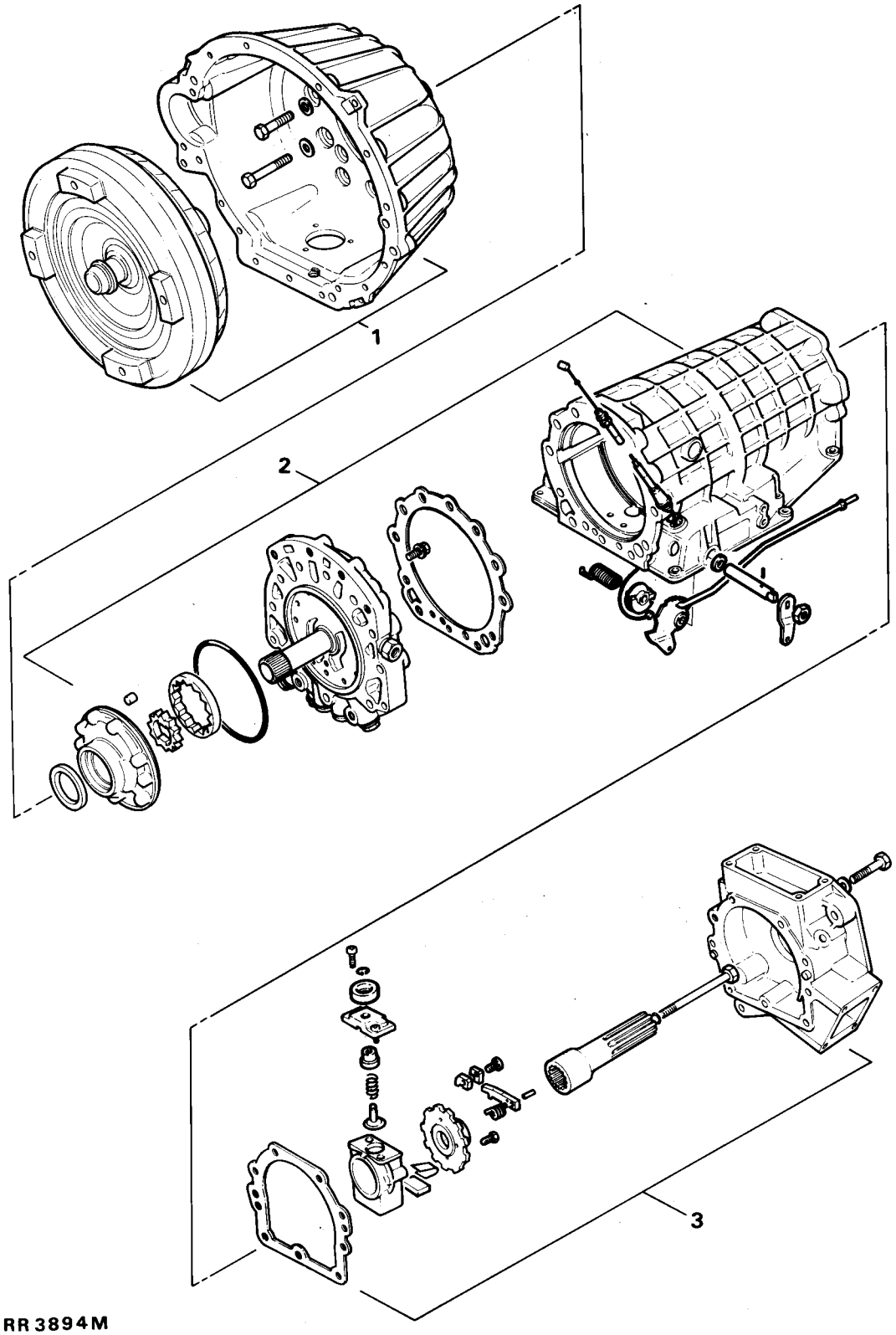
AUTOMATIC GEARBOX ASSEMBLY



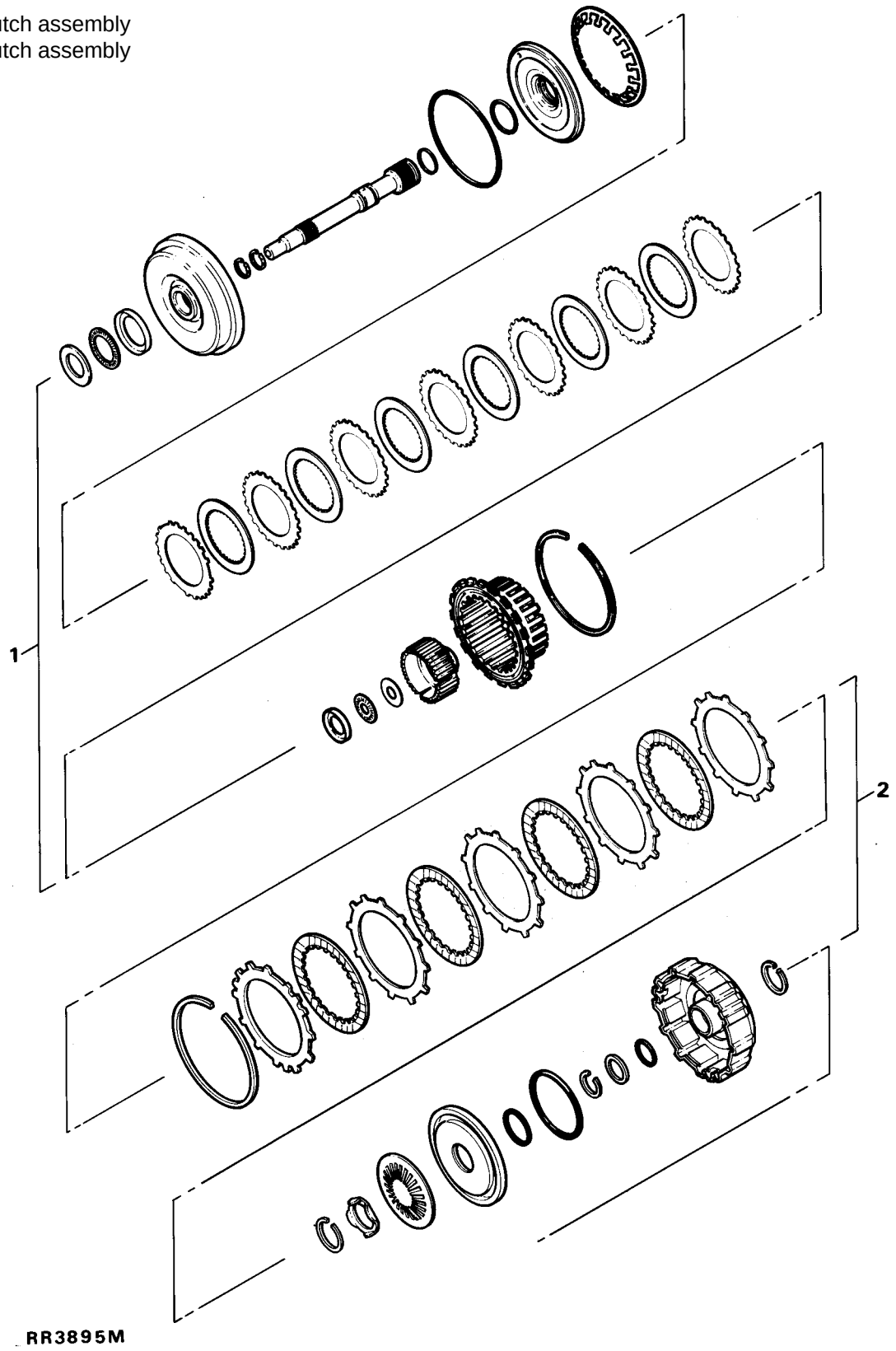
RR0524A

1. Gearbox assembly
2. Inhibitor switch assembly
3. Control unit assembly
4. Filter and sump assembly

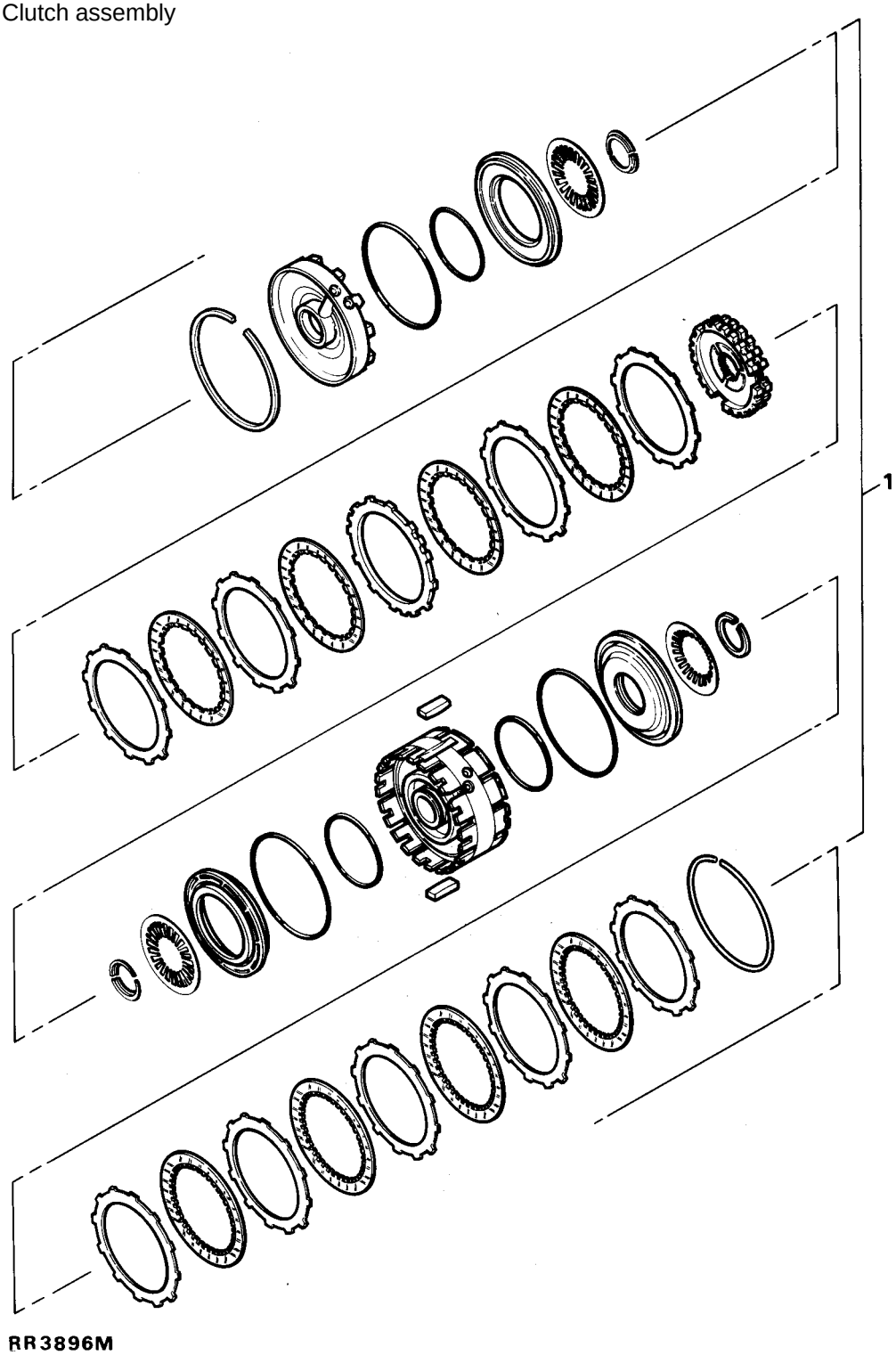
1. Torque converter housing assembly
2. Gearbox pump and casing assembly
3. Governor and adaptor housing assembly



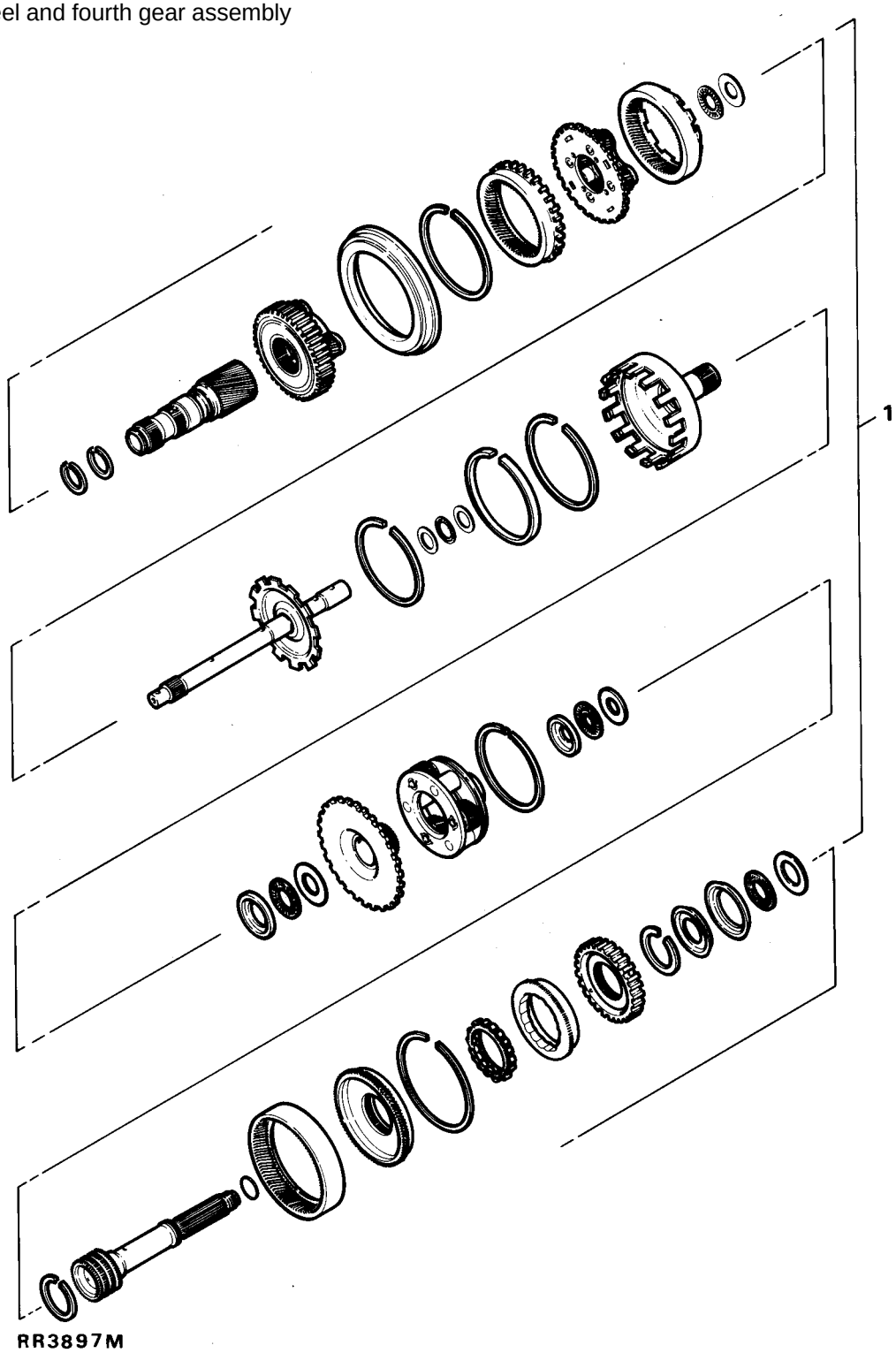
1. A Clutch assembly
2. B Clutch assembly



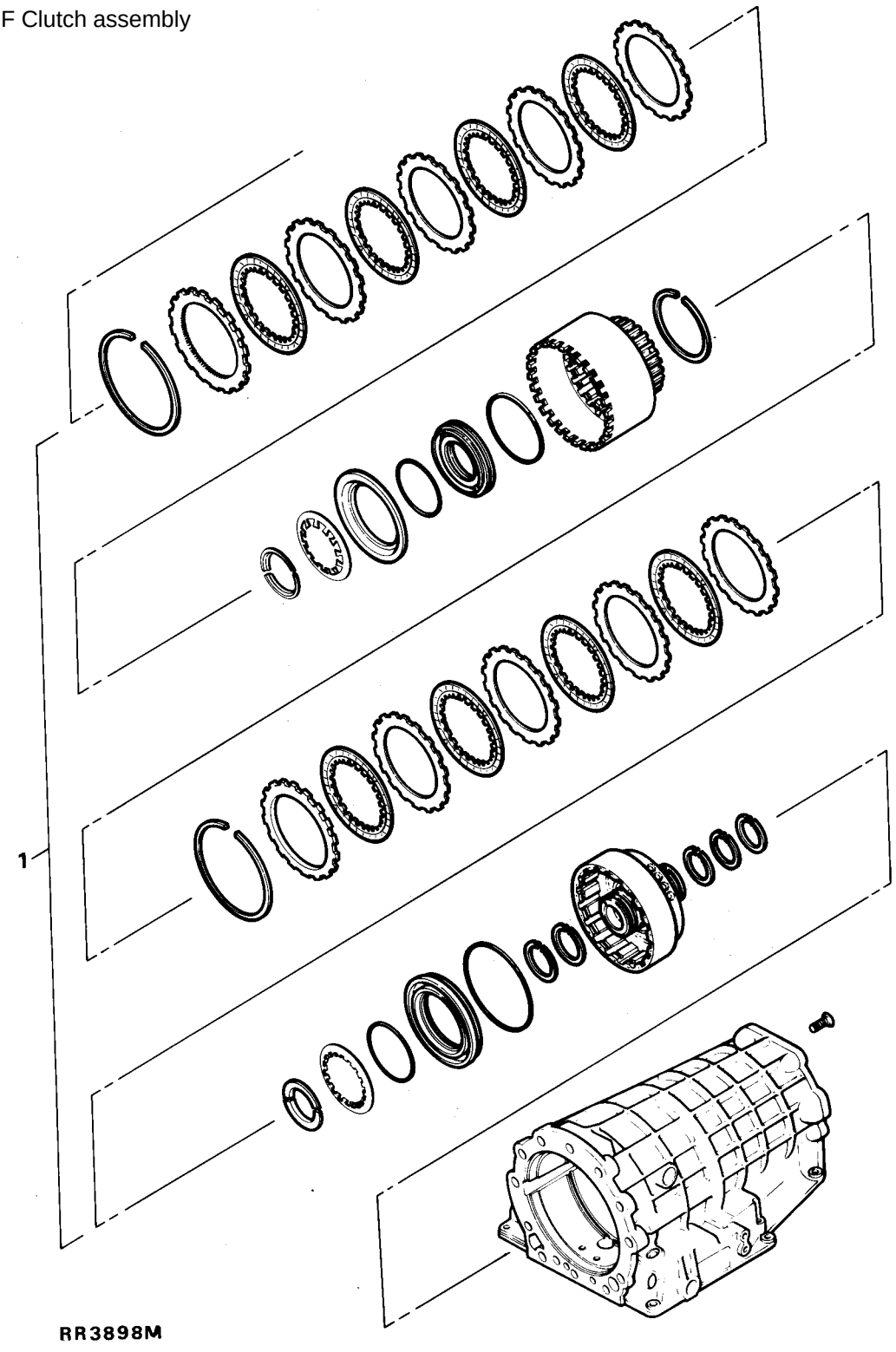
1. C and D Clutch assembly



1. Freewheel and fourth gear assembly



1. E and F Clutch assembly



FAULT SYMPTOMS

SYMPTOM 1 - Intermittent drive and high pitched noise

FAULT - Low fluid level or restricted filter

SYMPTOM 2 - No drive in reverse

Select ’D’
- No drive
  FAULT - Continue with Symptom 3
- Drives forward
  FAULT - Reverse gear interlock valve seized

Select ’1’
- No engine braking
  FAULT - Clutch brake 3

SYMPTOM 3 - No drive from rest with ’D’ selected

Select ’1’
- Vehicle drives
  FAULT - No 2 freewheel
- No drive

Carry out main line pressure check
- Normal pressure
  FAULT - Clutch ’A’
- No pressure
  FAULT - Blocked filter or pump failure
- Low pressure
  FAULT - Restricted filter or sticking primary regulator

SYMPTOM 4 - Slip in all forward gears

Carry out main line pressure check
- No pressure
  FAULT - Blocked filter or pump failure
- Low pressure
  FAULT - Restricted filter or sticking primary regulator
- Normal pressure
  FAULT - Clutch ’A’

SYMPTOM 5 - Harsh engagement ’N’ to ’D’

Check engine idle speed

Carry out main line pressure check
- High pressure
  FAULT - Primary regulator stuck
- Normal pressure
  FAULT - Clutch ’A’ or damper for clutch’A’

SYMPTOM 6 - Fierce shift or flare 1st to 2nd shift

Check engine idle speed

Carry out mainline pressure check
- High pressure
  FAULT - Continue with symptom 5
- Normal pressure
  FAULT - Modulator valve or dampers for clutch brake CB1 and/or clutch brake CB2
  FAULT - Clutch brake CB1 and/or clutch brake CB2

SYMPTOM 7 - Fierce shift or flare 2nd to 3rd

Carry out mainline pressure check
- High pressure
  FAULT - Continue with symptom 5
- Normal pressure
  FAULT - Modulator valve or clutch ’B’ damper
  FAULT - Clutch ’B’

SYMPTOM 8 - No 3rd gear

FAULT - 2-3 shift valve
FAULT - Clutch ’B’

SYMPTOM 9 - No 4th gear ’D’ selected

FAULT - 4th to 3rd downshift valve stuck or 3rd to 4th upshift valve stuck
FAULT - Clutch brake 4

SYMPTOM 10 - None or harsh engagement of direct drive clutch

NOTE: The direct drive clutch will only engage if 4th gear is engaged at 40 to 45 mph (64 to 72 kph).

Carry out road test pressure check with gauge connected to torque converter.

- Normal pressure
  FAULT - Failed direct drive clutch
- Pressures correct but remains high
  FAULTS POSSIBLE -
  Direct drive clutch and torque converter control valve stuck
  Hysteresis valve stuck
  Direct drive clutch control valve stuck

SYMPTOM 11 - Direct drive clutch shift point incorrect or at low speed

NOTE: Direct drive clutch engagement at low speed will cause vibration in the torque converter

Carry out mainline and torque converter pressure check

- Normal pressure
  FAULT - Governor valve sticking
- Low or incorrect pressure
  FAULTS POSSIBLE -
  Direct drive clutch and torque converter control valve sticking.
  Hysteresis valve stuck.
  Direct drive clutch control valve stuck.

SYMPTOM 12 - Drives in 'D' but immediately upshifts to 3rd

FAULT - 2nd to 3rd shift valve stuck.

SYMPTOM 13 - With 'D' selected vehicle starts in 2nd

FAULTS POSSIBLE -
1st and 2nd shift valve stuck.
Governor sleeve sticking.

SYMPTOM 14 - With 'D' selected vehicle starts in 3rd

FAULTS POSSIBLE -
1st to 2nd and 2nd to 3rd shift valves stuck.
Governor sleeve sticking.

SYMPTOM 15 - No kickdown 4th to 3rd

FAULT - 4th to 3rd kickdown valve stuck.

SYMPTOM 16 - Upshifts/downshifts and kickdown shifts at incorrect road speeds

Check throttle kickdown cable adjustment
Carry out main line pressure check

- Normal pressure
  FAULT - Governor valve sticking
- Incorrect pressure
  FAULTS POSSIBLE -
  Incorrect throttle valve adjustment
  Primary regulator sticking

SYMPTOM 17 - No upshifts at light throttle

FAULTS POSSIBLE
Governor valve sticking
Shift valves sticking

SYMPTOM 18 - No engine braking '3' selected 3rd gear

FAULT - Clutch 'C'

SYMPTOM 19 - Delayed or no downshift occurs when making a manual selection from '3' to '2'

FAULTS POSSIBLE -
2nd and 3rd upshift valve sticking.
Governor valve sticking.
'2' Position interlock valve sticking.

SYMPTOM 20 - At speeds below 28 mph (45 kph) when making a manual selection from '2' to '1', downshift is delayed or does not occur

FAULTS POSSIBLE -
Governor sticking.
1st to 2nd shift valve sticking.
'1' Position interlock valve sticking.

SYMPTOM 21 - '1' Selected 1st gear no engine braking

FAULT - Clutch brake 3

SYMPTOM 22 - '2' Selected 2nd gear no engine braking

FAULT - Clutch brake 1

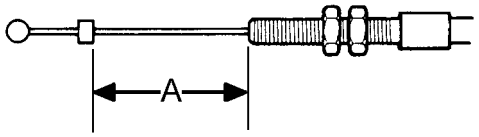
SYMPTOM 23 - Vehicle drives forward in 'N'

FAULT - Clutch 'A' stuck

KICKDOWN CABLE ADJUSTMENT

Service repair no - 44.30.02

1. Release and remove kickdown cable clevis pin.
2. Loosen locknut and release kickdown cable from abutment bracket.
3. Release outer cable sleeve from clip on rear of LH cylinder head.
4. Holding cable as straight as possible, extend inner cable to first detent.



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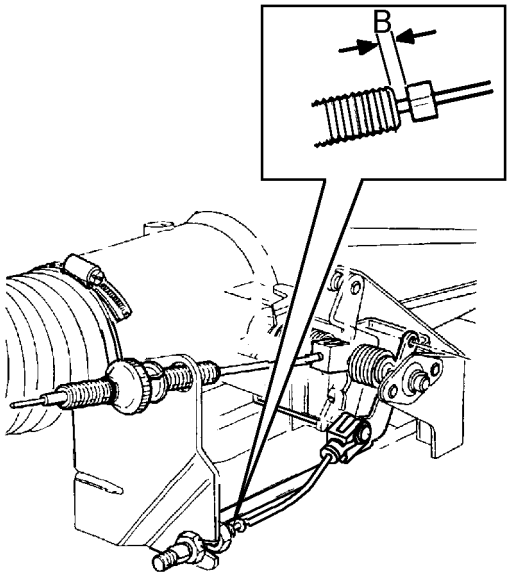


44M1026

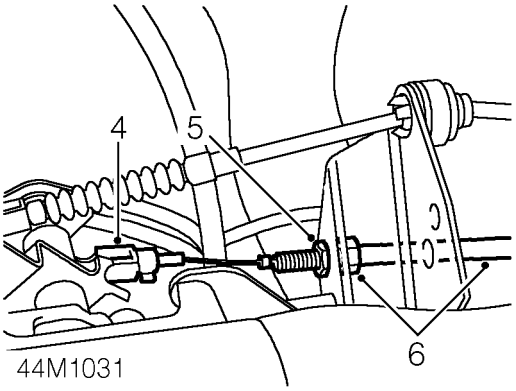
5. With inner cable extended, check dimension **A** between end of threads and crimped sleeve. Dimension **A** = 42 mm ± 3 mm (1.65 ± 0.10 in).
6. Connect cable to abutment bracket and fit locknut.
7. Secure outer cable sleeve to clip on rear of LH cylinder head.
8. Connect kick-down cable to throttle lever and secure with clevis pin.
9. Adjust outer cable until crimped sleeve is dimension **B** from end of outer cable. Dimension **B** = 1 mm (0.04 in).
10. Tighten locknut.

KICKDOWN CABLE

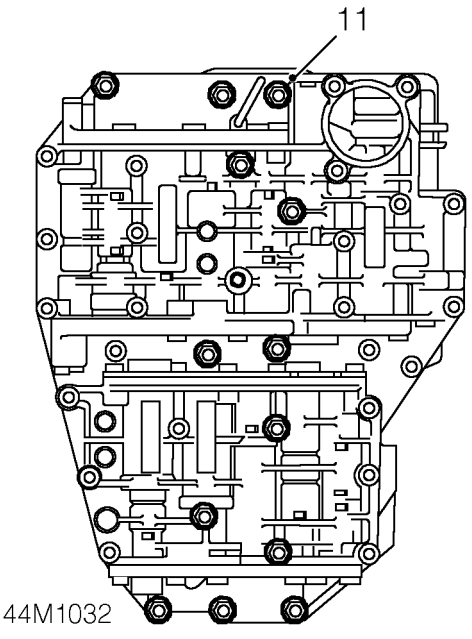
Service repair no - 44.15.01

Remove

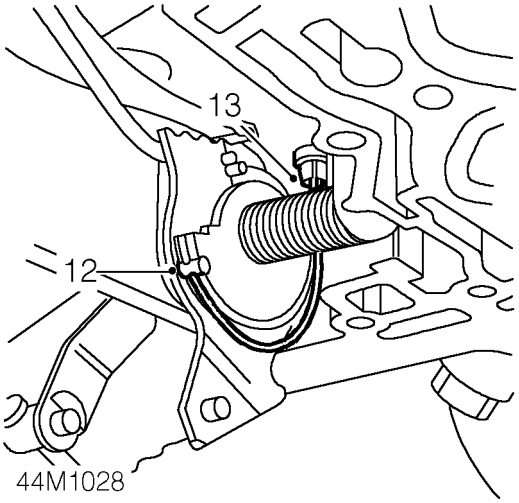
1. Site vehicle on a four post ramp.
2. Select neutral **'N'.**
3. Disconnect battery negative lead.



4. Remove clevis pin and release kickdown cable at throttle linkage.
5. Release outer cable locknut.
6. Disconnect cable from abutmet bracket.
7. Release cable from retaining clip at bracket attached to cylinder head.
8. Feed cable through to underside of vehicle.
9. Raise vehicle on ramp.
10. Remove gearbox fluid pan. ***See Fluid pan gasket and screen.***



11. Remove 13 bolts securing control unit assembly to gearbox.



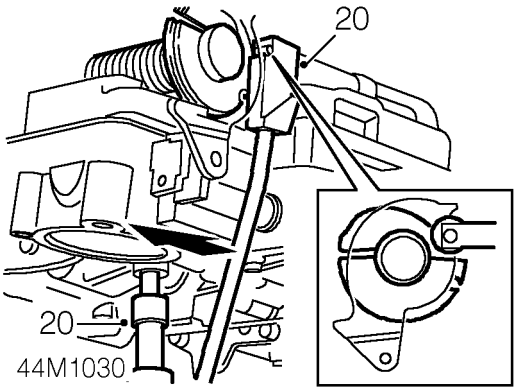
12. Rotate accelerator cam and release nipple of kickdown inner cable from cam.
13. Using special tool **LRT-44-004**, compress cable tangs and remove cable from gearbox.
14. If cable is to be refitted, remove and discard 'O' ring seal and clean cable assembly.

Refit

15. Fit NEW 'O' ring seal to cable and lubricate seal.
16. Fit cable to gearbox casing ensuring it is correctly seated.
17. Spring load cam by turning once and fit inner cable nipple into cam seat.

NOTE: When a new cable is fitted, to help locate nipple to cam, introduce a curve into the cable. DO NOT bend or kink cable.

18. Ensuring cable nipple remains engaged, feed free end of cable assembly into engine compartment.
19. Locate control unit assembly to gearbox and loosely fit 13 bolts. Ensure selector shaft locates into gear shift fork.



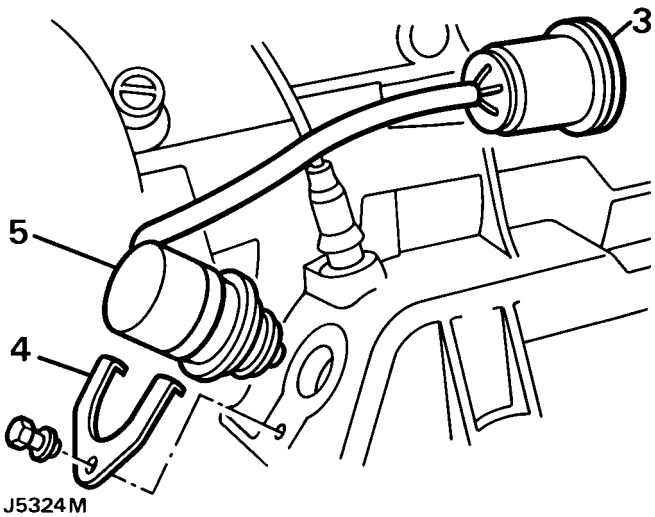
20. Locate selector linkage setting gauge **LRT-44-002** in position and gently press control unit forwards as shown. Tighten bolts to ***8 Nm (6 lbf.ft).***
21. Remove setting gauge.
22. Refit gearbox fluid pan ***See Fluid pan gasket and screen; Refit.***
23. Lower vehicle on ramp.
24. Adjust kickdown cable ***See Adjustment, Kickdown cable adjustment.***
25. Reconnect battery negative lead.
26. Refill gearbox oil using correct grade of oil ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids.***

INHIBITOR SWITCH

Service repair no - 44.15.19

Remove

1. Site vehicle on a four post ramp.
2. Disconnect battery negative lead. Raise vehicle.



3. Disconnect inhibitor switch multiplug.
4. Remove inhibitor switch retaining plate.
5. Remove inhibitor switch.
6. Remove and discard 'O' ring seal.
7. Clean inhibitor switch.

Refit

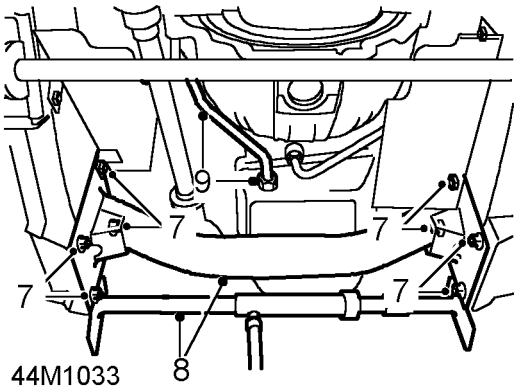
8. Clean mating face on casing.
9. Fit and lubricate NEW 'O' ring seal to switch.
10. Fit switch to casing.
11. Secure with retaining plate and bolt.
12. Connect multiplug to harness.
13. Reconnect battery and remove vehicle from ramp.

FLUID PAN GASKET AND SCREEN

Service repair no - 44.24.05 - Fluid pan gasket
Service repair no - 44.24.07 - Fluid screen

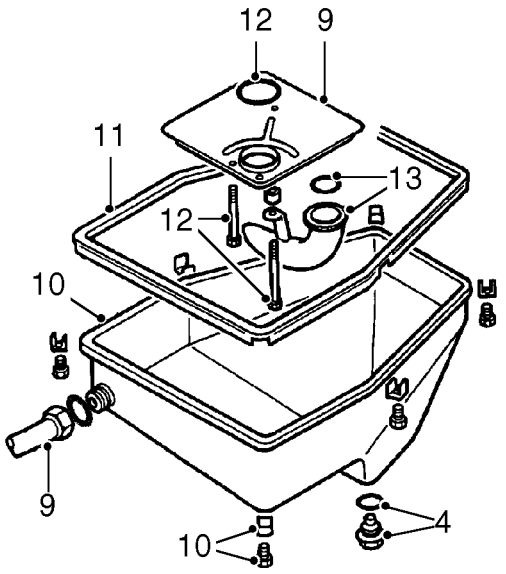
Remove

1. Site vehicle on a four post ramp.
2. Disconnect battery negative lead.
3. Raise vehicle.
4. Drain fluid and refit plug with new seal. Tighten to ***43 Nm (32 lbf ft).***
5. Remove catalytic converter assembly ***See EMISSION CONTROL, Repair, Front pipe/catalytic converter.***



44M1033

6. Release fuel pipes from retaining clip secured by top RH chassis crossmember bolt.
7. Remove 8 bolts securing chassis crossmember.
8. With assistance and using a body jack between chassis longitudinals, jack chassis sufficiently to enable removal of crossmember.



44M1127

9. Disconnect dipstick tube from fluid pan. Loosen securing bolt at bell housing and move tube aside.
10. Remove clamps securing fluid pan. Note their locations for refit and withdraw pan.
11. Remove gasket and discard gasket and clean gasket mating faces.
12. Remove securing screws and detach oil screen and suction pipe, taking care to retain suction pipe spacer, discard 'O' ring seal.
13. Detach suction pipe from fluid screen, discard 'O' ring seal.

Refit

14. Clean fluid screen and blow out with airline.
15. Clean suction pipe.
16. Fit NEW 'O' ring seals to fluid screen using transmission fluid to aid assembly.
17. Fit fluid screen and suction pipe with spacer and secure with bolts. Tighten to ***8 Nm (6 lbf.ft).***
18. Refit fluid pan using a NEW gasket. Tighten to ***8 Nm (6 lbf.ft).***
19. Connect dipstick tube to fluid pan, tighten bolt at bell housing. Fit filler tube union nut and tighten to ***70 Nm (52 lbf.ft).***

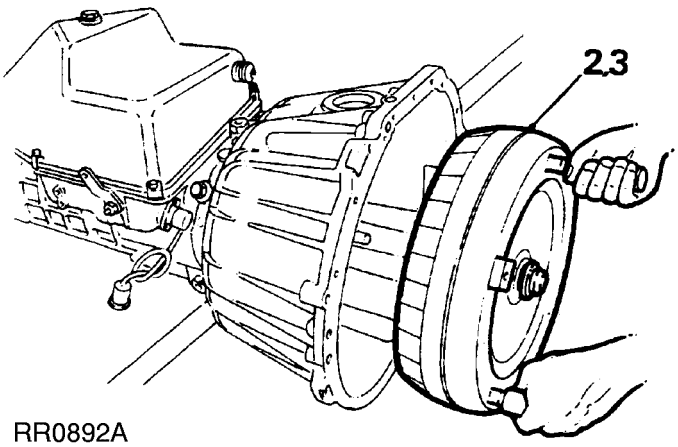
20. Position both exhaust heat shields and refit chassis cross-member. Secure fuel pipes to retaining clip.
21. Refit catalytic converter assembly ***See EMISSION CONTROL, Repair, Front pipe/catalytic converter; Refit***
22. Connect battery.
23. Refill transmission using correct grade of fluid ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended Lubricants and Fluids.***
24. Apply parking brake and with selector at 'P', run engine at idle.
25. Apply footbrake, from 'P', move selector to position '1' and back to 'N'. Check fluid level, this must be between the level marks. Top-up as necessary.

TORQUE CONVERTER

Service repair no - 44.17.04

Remove

1. Remove gearbox and transfer box assembly, ***See Gearbox and transfer box assembly***



RR0892A

2. Place gearbox on bench. Remove torque converter using torque converter handle **LRT-44-010**, taking care not to damage torque converter/oil pump housing oil seal.

Refit

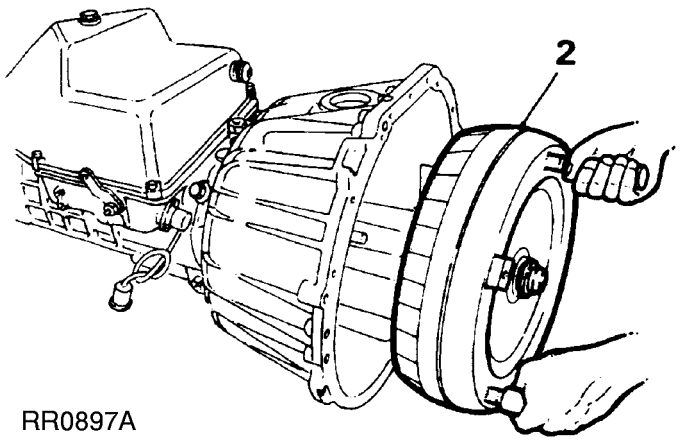
3. Fit NEW torque converter using torque converter handles **LRT-44-010**. Check dimension from converter fixing boss to converter housing face is 50 mm (1.968 in). This shows converter is correctly seated in housing.
4. Refit gearbox and transfer box assembly; Refit ***See Gearbox and transfer box assembly***

PUMP AND MAIN HOUSING

Service repair no - 44.20.11 - Intermediate plate gasket
Service repair no - 44.32.01 - Pump assembly
Service repair no - 44.32.07 - Pump oil seal

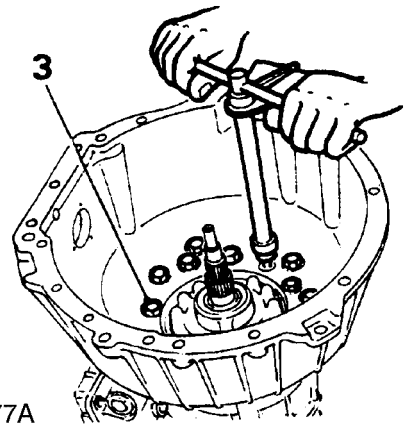
Remove

1. Remove gearbox and transfer box assembly, ***See Gearbox and transfer box assembly***



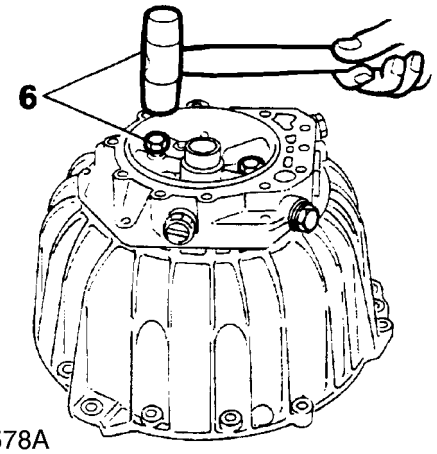
RR0897A

2. Place gearbox on bench. Remove torque converter using torque converter handles **LRT-44-010**, taking care not to damage torque converter/oil pump housing oil seal.



RR0577A

3. Remove 12 bolts (inner ring of bolts).
4. Remove bell housing and pump assembly, discard gasket.
5. Remove 8 bolts from rear of pump.



RR0578A

6. Screw in 2 bolts, diagonally opposite each other. Tap lightly using a soft headed mallet to remove pump assembly from intermediate plate.
7. Remove shaft sealing ring and 'O' ring from pump housing and discard.

Refit

8. Using oil seal replacer **LRT-44-001** fit shaft seal ring into pump housing.
9. Fit NEW 'O' ring onto circumference of pump housing.
10. Align dowel with hole in intermediate plate and press pump housing home.
11. Fit pump housing to intermediate plate, tighten bolts to ***10 Nm (7 lbf.ft).***
12. Place bell housing and intermediate plate assembly on bench, front face up. Using oil pump rotation sleeve **LRT-44-003**, check that pump gears rotate freely.
13. Before fitting intermediate plate and bell housing assembly, check that thrust washer and axial cage are seated on clutch housing.
14. Place NEW gasket and selective disc washer onto bell housing and intermediate plate assembly using Petroleum Jelly.
15. Fit bell housing and intermediate plate assembly to gearcase. Tighten bolts to ***46 Nm (34 lbf.ft).***
16. Place end float gauge **LRT-44-003** onto pump housing and check that axial play is between 0.2 - 0.4 mm (0.008 - 0.016in). Replace existing washer, situated at rear of intermediate plate, with a washer selected to give required end float.

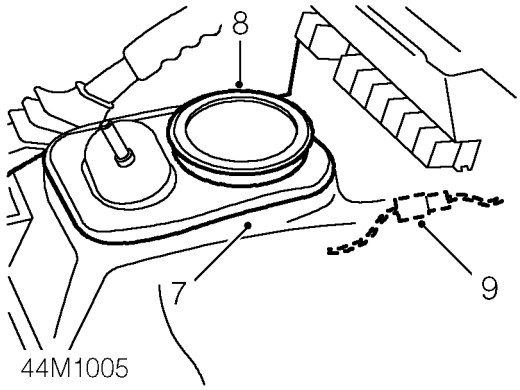
17. Refit torque converter into housing using torque converter handles **LRT-44-010**. Check that dimension from converter fixing bolt boss to converter housing face is 50 mm (1.968 in) to comfirm that converter is properly seated in housing.
18. Refit gearbox/transfer box assembly. ***See Gearbox and transfer box assembly; Refit***

GEARBOX AND TRANSFER BOX ASSEMBLY

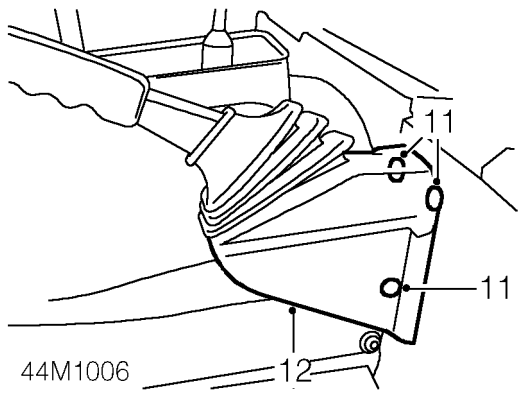
Service repair no - 44.20.04/99

Remove

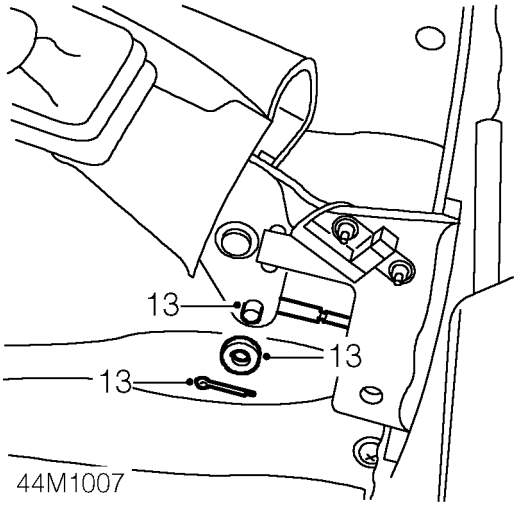
1. Position vehicle on '4-post' ramp.
2. Select LOW range gear and leave vehicle in neutral.
3. Disconnect battery negative lead.
4. Drain gearbox oil. ***See MAINTENANCE , under vehicle maintenance***
5. Drain transfer gearbox oil. ***See MAINTENANCE , under vehicle maintenance***
6. Remove centre console. ***See CHASSIS AND BODY, Repair, centre console***



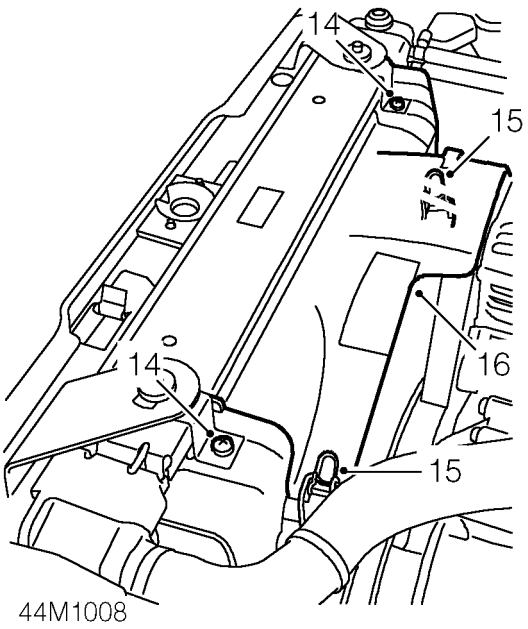
7. Remove carpet from transmission tunnel.
8. Remove hi-low selector housing cover from tunnel.
9. Working through hi-low gear lever aperture, disconnect inhibitor/reverse light switch multiplug.
10. Remove 2 cable ties securing gearbox and transfer box breather pipes to harness.



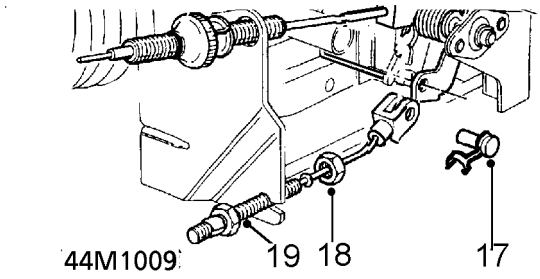
11. Remove 3 trim studs securing hand brake gaiter.
12. Release hand brake gaiter to access cable linkage.



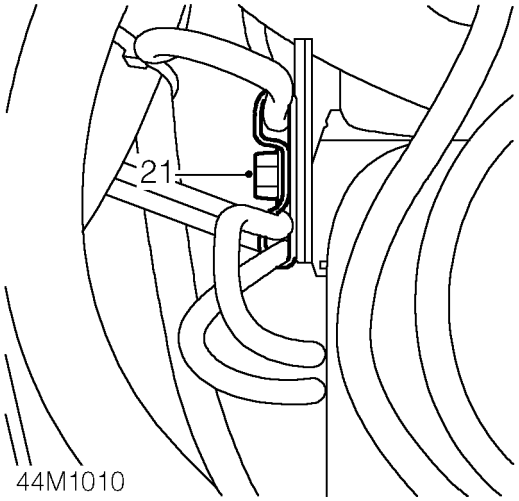
13. Remove split pin and clevis pin securing hand brake cable to lever. Discard split pin.



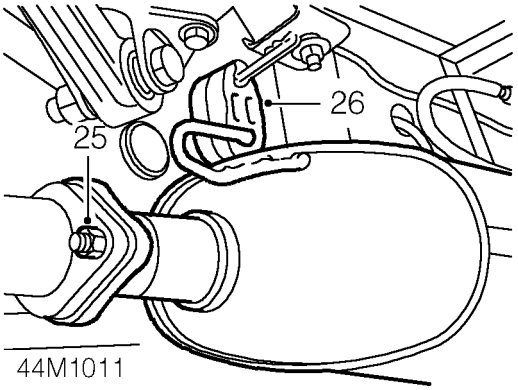
14. Remove 2 screws securing fan cowl to upper retaining brackets.
15. Release 2 clips securing upper fan cowl.
16. Remove upper fan cowl.



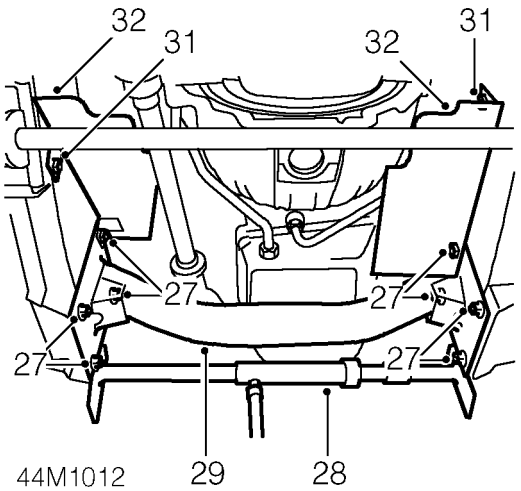
17. Remove kick-down cable clevis pin.
18. Release kick-down outer cable lock nut.
19. Release kick-down outer cable from abutment bracket.
20. Release kick-down outer cable from clip on rear of LH cylinder head.



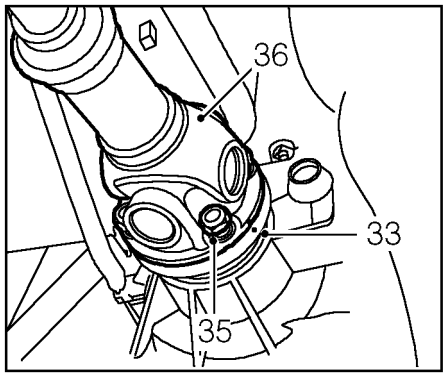
21. Remove bolt securing 2 breather pipe 'P' clips to rear of RH cylinder head.
22. Remove 6 bell housing to engine bolts.
23. Raise vehicle.
24. Remove exhaust front pipe. ***See EMISSION CONTROL, Repair, front pipe/catalytic converter***

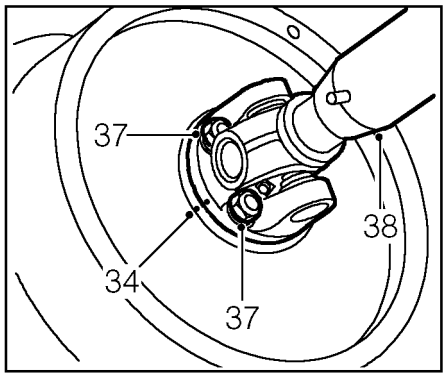


25. Remove 2 nuts securing intermediate pipe to tail pipe.
26. Release intermediate pipe from tail pipe and remove from mounting.



27. Remove 8 bolts securing chassis crossmember.
28. With assistance, and using a body jack between chassis longitudinals, jack chassis sufficiently to enable removal of crossmember.
29. Remove crossmember.
30. Remove body jack.
31. Remove bolt securing LH and RH catalyst heat shields to chassis.
32. Remove catalyst heat shields.





44M1013

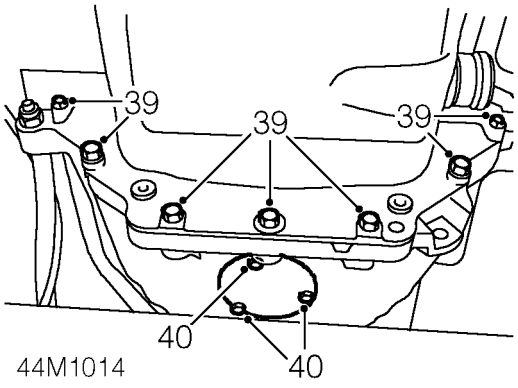
33. Using a centre punch, mark relationship between front propeller shaft to transfer box flanges.
34. Using a centre punch, mark relationship between rear propeller shaft to brake drum flanges.
35. Remove 4 nuts securing front propeller shaft to transfer box flange.

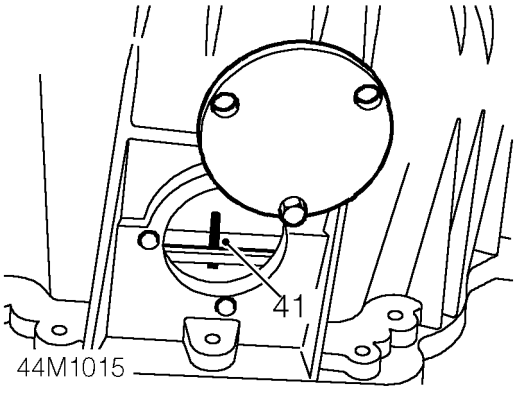
△ **NOTE: Rotate propeller shaft to gain access to all fixing.**

36. Release propeller shaft from transfer box flange bolts and tie aside.
37. Remove 4 nuts securing rear propeller shaft to brake drum flange.

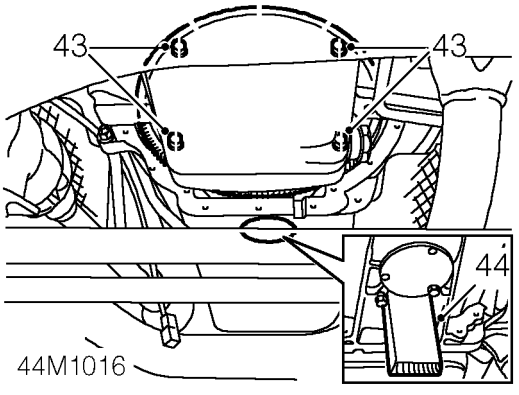
△ **NOTE: Rotate propeller shaft to gain access to all fixing.**

38. Release propeller shaft from brake drum bolts and tie aside.
39. Remove 7 bolts securing bell housing closing plate and remove plate.
40. Remove 3 bolts securing bell housing access plate and remove plate.

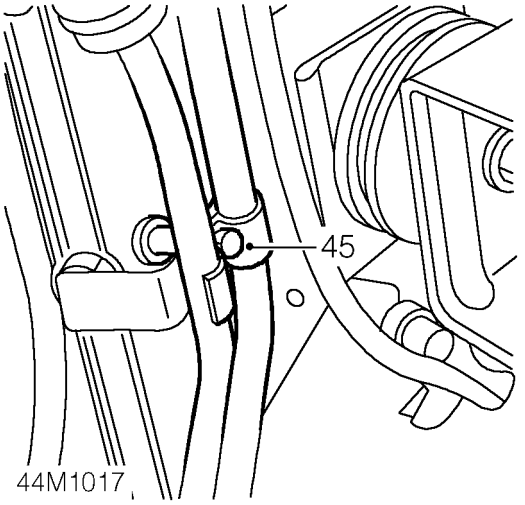




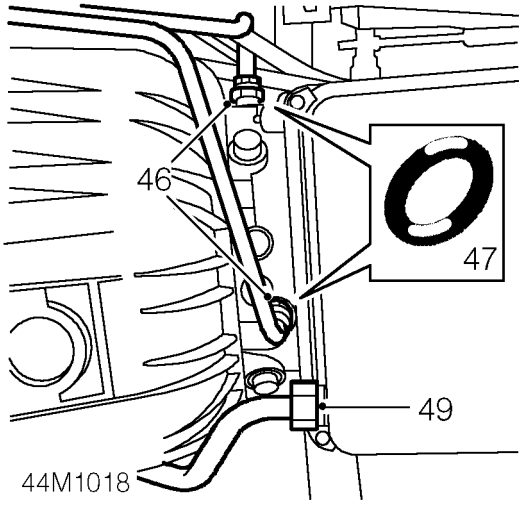
41. Mark relationship between converter and drive plate.
42. Rotate crankshaft to access drive plate to converter fixing.



43. Remove 4 bolts securing drive plate to converter.
44. Fit suitable piece of wood through bell housing access hole to retain converter.



45. Remove clamp bolt securing gearbox cooler pipes to engine sump bracket.

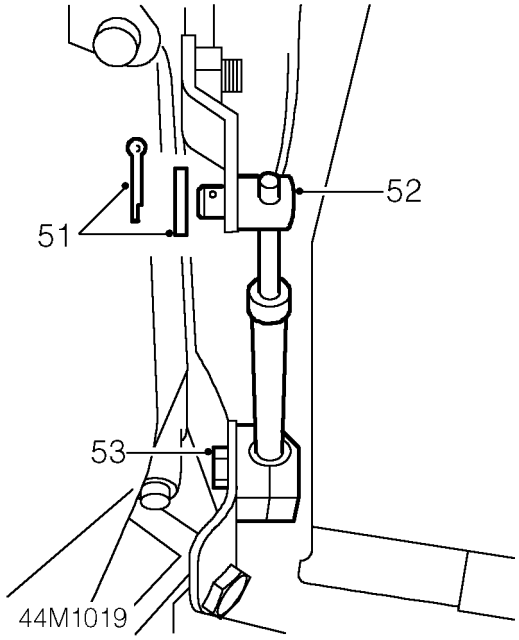


46. Loosen gearbox cooler pipe unions and disconnect from gearbox.
47. Remove and discard 'O' rings from pipes.

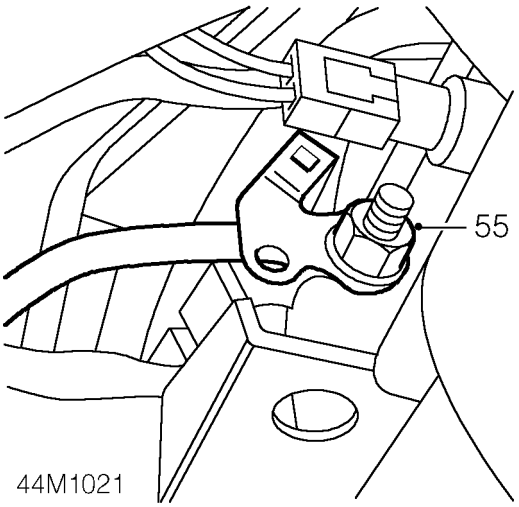
CAUTION: Plug the connections.

48. Tie cooler pipes aside.
49. Loosen gearbox filler tube union and remove from fluid pan.
50. Remove and discard 'O' ring from union.

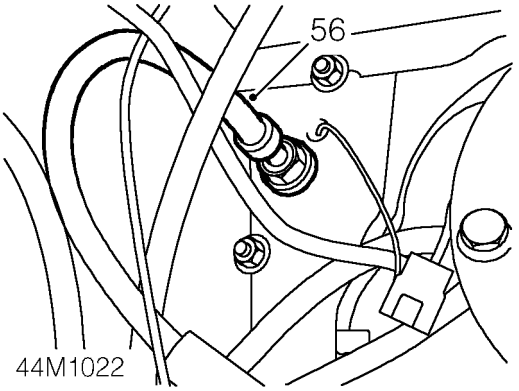
CAUTION: Plug the connections.



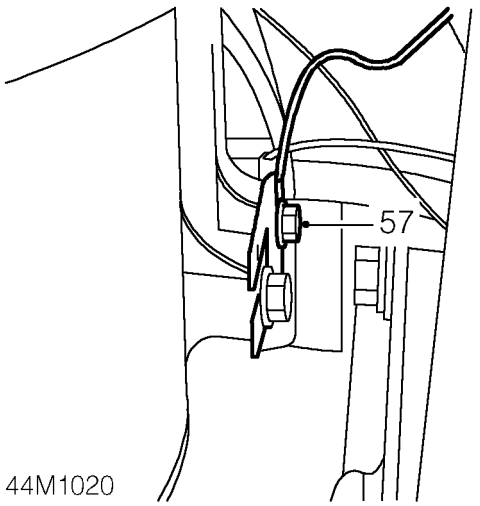
51. Remove split pin from selector cable yoke and collect washer. Discard split pin.
52. Release yoke from lever.
53. Remove bolt securing selector outer cable clamp to transfer box LH mounting.



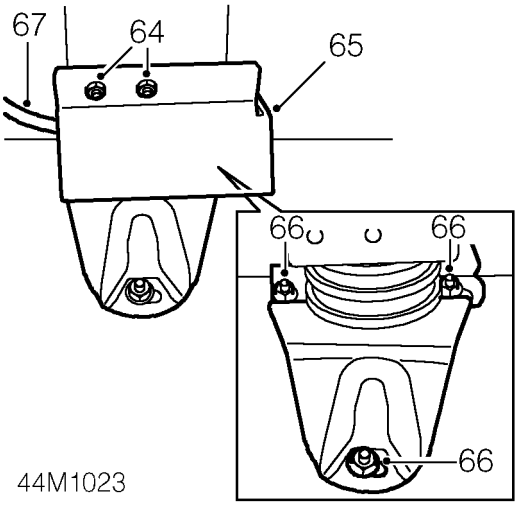
54. Remove nut securing oxygen sensor multiplug bracket from transfer box earth bolt and collect bracket.
55. Remove nut securing earth strap to transfer box and release strap.



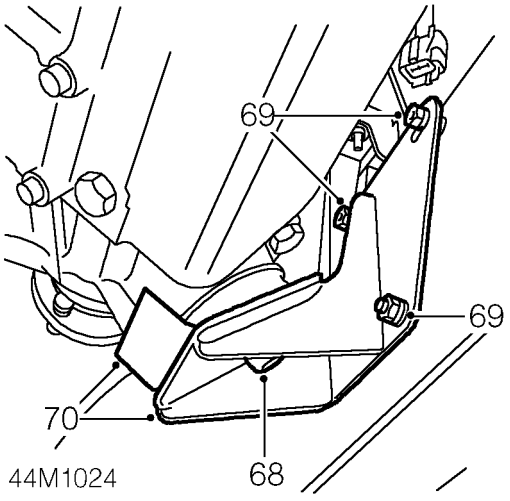
56. Release hand brake outer cable from body.



57. Remove bolt securing earth lead to RH side of transfer box.
58. Fit transmission cradle **LRT-99-008A** to transmission jack.
59. Fit and tighten bolts securing cradle to jack.
60. Remove 2 lower bolts securing transfer box rear cover.
61. Collect hand brake cable heat shield.
62. Raise jack and align cradle to transmission.
63. Refit previously removed transfer box rear cover bolts to secure cradle.



64. Remove 2 nuts and bolts securing heat shield to transfer box LH mounting bracket.
65. Remove heat shield.
66. Remove 3 nuts and bolts securing transfer box LH mounting bracket to chassis.
67. Release earth lead from fixing.



68. Remove nut securing transfer box RH mounting.
69. Remove 3 nuts and bolts securing transfer box RH mounting bracket to chassis.
70. Remove transfer box RH mounting bracket and collect flexible mount heat shield.
71. Lower transmission on jack to access harness connectors.
72. Disconnect the following multiplugs/connectors from transfer box:
Speed transducer
Parking solenoid
Neutral detection switch
Differential lock
Temperature sensor switch
73. Remove 2 cable ties securing harness to transfer box.
74. Position jack to support engine sump.

CAUTION: Use a block of wood or hard rubber pad to protect sump.

75. Remove 2 remaining bell housing to engine bolts.
76. With assistance, lower transmission and engine jacks until hi-low selector lever is clear of transmission tunnel aperture.
77. Separate transmission from engine and lower on jack.
78. Remove transmission assembly from beneath ramp.
79. Position lifting eyes to transmission and secure with bolts.
80. Fit lifting chains to eyes and connect.
81. Position lifting hoist and connect lifting chains.
82. Raise hoist until chains are taught.
83. Remove bolts securing cradle to transfer box.
84. Raise transmission from cradle.
85. Refit transfer box rear cover plate bolts.
86. Lower transmission assembly onto work bench.
87. Disconnect lifting chains from eyes.
88. Remove bolts securing eyes to transmission and remove eyes.

Refit

89. Position lifting eyes to transmission and secure with bolts.
90. Connect lifting chains to eyes.
91. Raise transmission assembly from bench and position above transmission cradle.
92. Remove 2 transfer box rear cover plate bolts.
93. Lower transmission onto cradle, align to transfer box rear cover plate and secure with previously removed bolts.
94. Lower hoist and disconnect lifting chains from eyes.
95. Remove chains from hoist.
96. Remove bolts securing lifting eyes to transmission and remove eyes.

97. Position transmission assembly beneath vehicle.
98. Clean engine to gearbox mating faces.
99. Clean engine to gearbox dowels and dowel holes.
100. With assistance, raise transmission on jack and position to engine dowels.
101. Fit 2 lower bell housing to engine bolts and tighten to ***46 Nm (34 lbf.ft).***
102. With assistance, raise engine and transmission jacks to position transmission assembly.

NOTE: Do not fully raise transmission at this stage as access is required for connection of connectors to transfer box.

103. Remove engine jack from beneath vehicle.
104. Secure harness to transfer box with cable ties.
105. Connect multiplugs/connectors to transfer box.
106. Raise transmission and align to mounting locations.
107. Fit transfer box RH flexible mounting heat shield and mounting bracket.
108. Align RH mounting to chassis and secure with nuts and bolts.
109. Fit and tighten nut securing RH mounting.
110. Align LH mounting to chassis and secure with nuts and bolts.

NOTE: Position earth lead to mounting fixing.

111. Position heat shield to LH mounting bracket and secure with fixings.
112. Remove bolts securing transmission cradle to transfer box.
113. Lower transmission jack and remove from beneath ramp.
114. Fit and tighten transfer box rear cover bolts.

NOTE: Position heat shield to cover plate fixing.

115. Position earth lead to RH side of transfer box and secure with bolt.
116. Feed hand brake outer cable through body.

NOTE: Apply a soap solution to aid fitment of cable to body.

117. Position earth strap to transfer box stud and secure with nut.
118. Fit oxygen sensor multiplug bracket to transfer box earth bolt and secure with nut.
119. Position selector outer cable clamp to transfer box LH mounting and secure with bolt.
120. Position selector cable yoke to lever, fit washer and secure with NEW split pin.
121. Remove plug from transmission filler tube union.
122. Lubricate NEW 'O' ring with gearbox oil and fit to filler tube.
123. Fit filler tube to gearbox and tighten union.
124. Release cooler pipes and remove plugs from connections.
125. Lubricate NEW 'O' rings with gearbox oil and fit to pipes.
126. Position cooler pipes to gearbox and tighten unions.
127. Position cooler pipes to engine sump bracket, fit clamp and secure with bolt.
128. Remove piece of wood from bell housing access hole.
129. Align converter to drive plate.
130. Fit bolts securing converter to drive plate and tighten to ***45 Nm (33 lbf.ft).***

NOTE: Rotate crankshaft during the above procedure.

131. Fit bell housing access plate and secure with bolts tightened to ***9 Nm (7 lbf.ft).*** .
132. Clean bell housing cover plate and mating face.
133. Fit plate and secure with bolts tightened to ***9 Nm (7 lbf.ft).***
134. Clean rear propeller shaft to brake drum mating faces.
135. Release rear propeller shaft, align flange markings and connect to studs.
136. Fit nuts securing rear propeller shaft to brake drum and tighten to ***47 Nm (35 lbf.ft).***

NOTE: Rotate propeller shaft to gain access to all fixings.

137. Clean front propeller shaft to transfer box mating faces.
138. Release front propeller shaft, align flange markings and connect to studs.
139. Fit nuts securing front propeller shaft to transfer box and tighten to ***47 Nm (35 lbf.ft).***

NOTE: Rotate propeller shaft to gain access to all fixings.

140. With assistance and using a body jack between chassis longitudinals, jack chassis sufficiently to enable fitment of crossmember.

141. Fit crossmember and align fixings.
142. Remove body jack.
143. Fit nuts and bolts securing chassis crossmember, but do not tighten.
144. Fit LH and RH catalyst heat shields to chassis, fit bolts but do not tighten.
145. Align LH and RH catalyst heat shields to chassis crossmember fixings and tighten all fixings.
146. Clean intermediate to tail pipe flange.
147. Fit intermediate pipe to mounting rubber, connect to tail pipe and secure with nuts.
148. Fit exhaust front pipe. ***See EMISSION CONTROL, Repair, front pipe/catalytic converter; Refit***
149. Lower vehicle.
150. Fit bolts securing bell housing to engine and tighten to ***46 Nm (34 lbf.ft)*** .

NOTE: Align harness brackets to 2 uppermost bell housing retaining bolts.

151. Align breather pipe 'P' clips to rear of RH cylinder head and secure with bolt.
152. Secure kick-down outer cable to clip on rear of LH cylinder head.
153. Secure kick-down outer cable to abutment bracket.
154. Secure kick-down outer cable lock nut.
155. Align kick-down cable to linkage and secure clevis pin.
156. Adjust kick-down cable. ***See Adjustment, kickdown cable adjustment***
157. Fit upper fan cowl and secure with clips.
158. Align fan cowl to upper retaining brackets and secure with screws.
159. Align hand brake cable to lever, fit clevis pin and secure with split pin.
160. Position hand brake gaiter and secure with trim studs.
161. Secure gearbox and transfer box breather pipes to harness with cable ties.
162. Connect inhibitor/reverse light switch multiplug.
163. Fit hi-low selector housing cover to tunnel.
164. Fit carpet to transmission tunnel.
165. Fit centre console. ***See CHASSIS AND BODY, Repair, centre console; Refit***
166. Refill transfer gearbox oil. ***See MAINTENANCE , under vehicle maintenance***
167. Refill gearbox oil. ***See MAINTENANCE , under vehicle maintenance***
168. Reconnect battery negative lead.
169. Select Hi range gear and park.
170. Remove vehicle from ramp.

TORQUE VALUES

	Nm	lbf.ft
Coupling shaft to mainshaft	42*	30*
Filler tube to sump	70	52
Gear change lever to gearbox	25	18
Cooler pipe adaptor to gearbox	42	30
Securing screws - clutch F	10	7
Securing screw - parking pawl	10	7
Securing screws - pump	10	7
Intermediate plate plugs (M20)	50	35
Intermediate plate plugs (M14)	40	30
Bell housing mounting bolts	46	34
Governor mounting screws	10	7
Extension housing bolts	23	17
Control unit mounting bolts	8	6
Drain plug - fluid pan	43	22
Mounting screws for fluid pan	8	6
Drive plate to converter	45*	33*
Gearbox to engine	42	31
Strut (threaded end)	42	31
Bottom cover to converter housing	9	7
Cover - converter housing	9	7
Drive plates to crankshaft adaptor	40*	30*
Adaptor to crankshaft	84	62
Fluid screen bolts	8	6
Pump housing to intermediate pipe	10	7
Propeller shaft nuts	47	35

NOTE: * These bolts MUST have threads coated with Loctite 270 prior to assembly.

Torque values below are for all screws and bolts used except for those that are specified otherwise.

METRIC	Nm	lbf.ft
M5	6	5
M6	9	7
M8	25	18
M10	45	33
M12	90	65
M14	105	75
M16	180	130

UNC / UNF	Nm	lbf.ft
1/4	9	7
5/16	24	18
3/8	39	28
7/16	78	58
1/2	90	65
5/8	136	100

ZF GEARBOX DATA

Axial end float	0.2 - 0.4 mm.	0.008 - 0.016 in
From torque converter boss to torque converter housing face	50 mm	1.968 in
Freewheel cage assembly to ring gear; minimum clearance	0.1 mm	0.004 in
Output shaft dimension above cylinder F assembly	10.00 mm	0.394 in
A cylinder maximum protrusion above gearbox front face	8.5 mm	0.335 in

51 - REAR AXLE AND FINAL DRIVE

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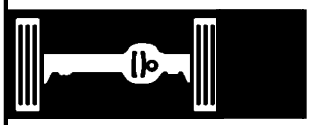
REPAIR



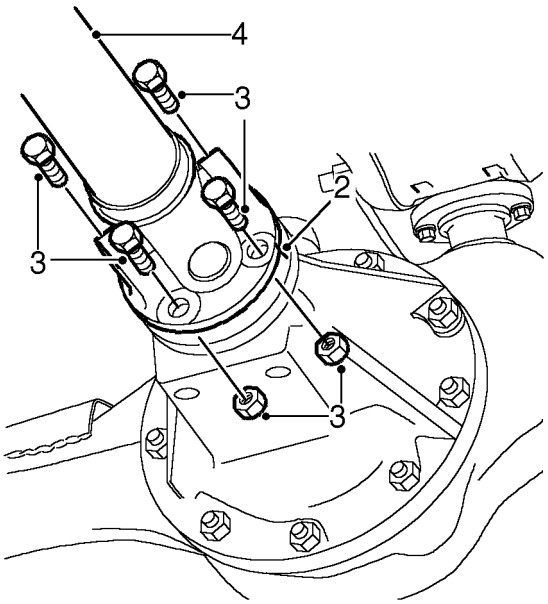
DIFFERENTIAL PINION OIL SEAL

Service repair no - 51.20.01

Remove

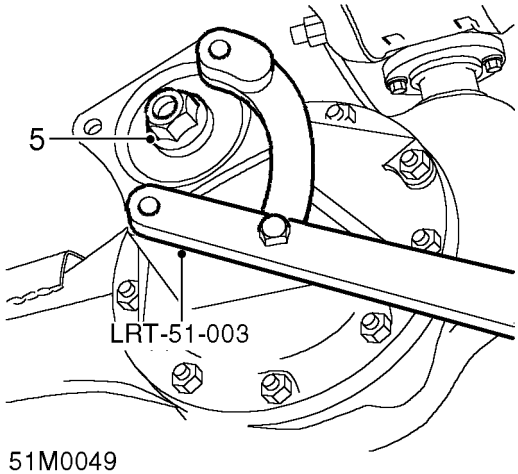
1. Raise rear of vehicle.

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



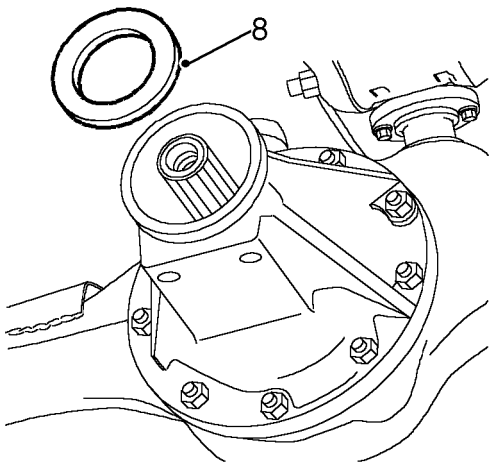
51M0048

2. Reference mark the propeller shaft flanges for reassembly.
3. Remove 4 nuts and bolts securing propeller shaft to differential housing.
4. Release propeller shaft and tie aside.



51M0049

5. Using **LRT-51-003** to restrain the pinion flange, remove bolt securing pinion flange.
6. Remove pinion flange.
7. Position container to catch oil spillage.



51M0050A

8. Using a suitable lever, remove and discard pinion oil seal.

CAUTION: Take care to avoid damage to oil seal recess.

Refit

9. Clean pinion oil seal recess and pinion flange.
10. Lubricate NEW oil seal lip with clean oil.
11. Using **LRT-51-010** fit pinion oil seal.
12. Fit pinion flange.
13. Restrain flange using **LRT-51-003** and fit bolt. Tighten bolt to ***100 Nm (74 lbf.ft).***
14. Position propeller shaft to differential housing and align reference marks.
15. Fit flange bolts and tighten to ***48 Nm (35 lbf.ft).***
16. Remove stands and lower vehicle.
17. Top-up differential oil level.

54 - FRONT AXLE AND FINAL DRIVE

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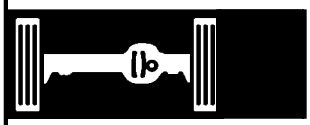
REPAIR



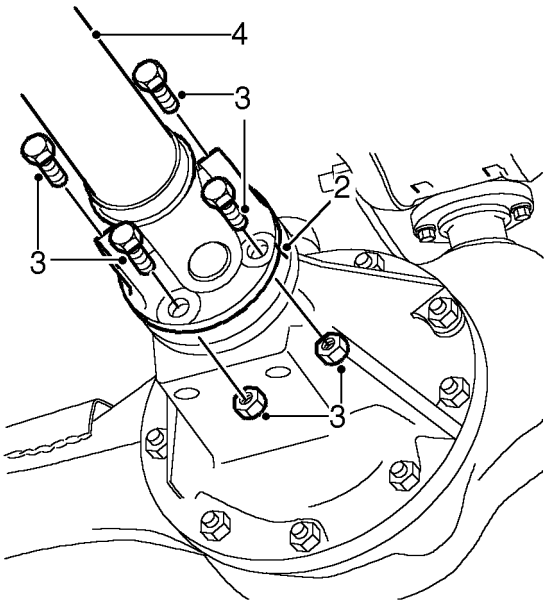
DIFFERENTIAL PINION OIL SEAL

Service repair no - 54.10.20

Remove

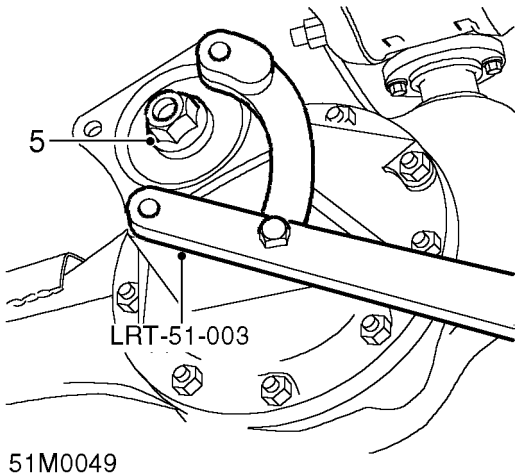
1. Raise front of vehicle.

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



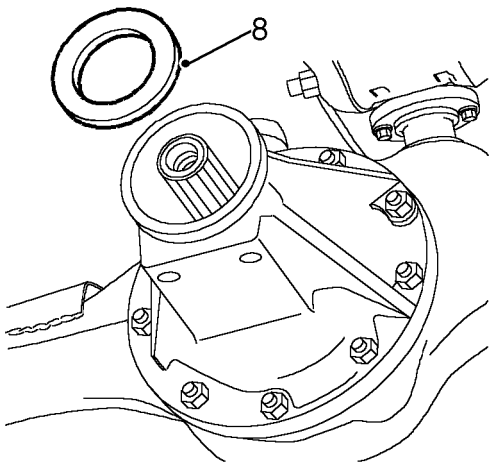
51M0048

2. Reference mark the propeller shaft flanges for reassembly.
3. Remove 4 nuts and bolts securing propeller shaft to differential housing.
4. Release propeller shaft and tie aside.



51M0049

5. Using **LRT-51-003** to restrain the pinion flange, remove bolt securing pinion flange.
6. Remove pinion flange.
7. Position container to catch oil spillage.



51M0050A

8. Using a suitable lever, remove and discard pinion oil seal.

CAUTION: Take care to avoid damage to oil seal recess.

Refit

9. Clean pinion oil seal recess and pinion flange.
10. Lubricate oil seal lip with clean oil.
11. Using **LRT-51-010** fit pinion oil seal.
12. Fit pinion flange.
13. Restrain flange using **LRT-51-003** and fit bolt. Tighten bolt to ***100 Nm (74 lbf.ft).***
14. Position propeller shaft to differential housing and align reference marks.
15. Fit flange bolts and tighten to ***48 Nm (35 lbf.ft).***
16. Remove stands and lower vehicle.
17. Top-up differential oil level.

57 - STEERING

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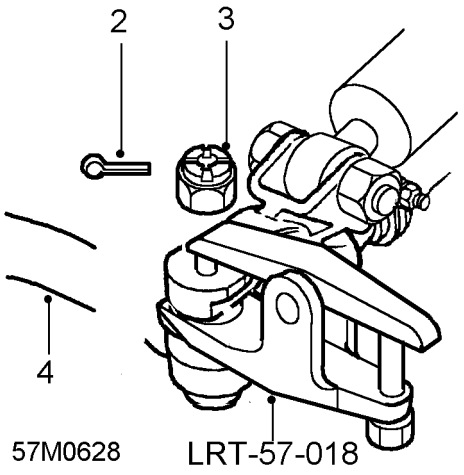
POWER STEERING BOX - CENTRALISE

Service repair no - 57.35.05

Adjust

1. Raise vehicle on ramp.



2. Remove split pin from castellated nut securing drag link to drop arm. Discard split pin.
3. Remove castellated nut.
4. Using tool **LRT-57-018** release drop arm from drag link.
5. Turn steering wheel to full RH lock.
6. Turn steering wheel back exactly 2 turns.
7. Fit drop arm to drag link and fit castellated nut.
8. Tighten castellated nut to ***40 Nm (30 lbf.ft)*** and fit NEW split pin.
9. Lower vehicle.

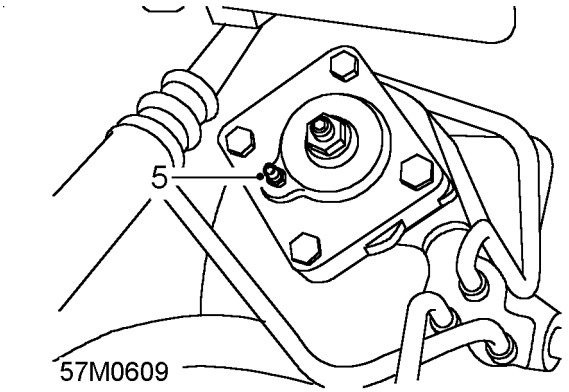
POWER STEERING SYSTEM - BLEED

Service repair no - 57.15.02

Check

1. Position container to collect any fluid spillage.
2. Ensure fluid in reservoir reaches dipstick maximum.
3. Run engine to normal operating temperature.
4. Recheck and correct reservoir fluid level.

NOTE: During instructions 4 to 6, maintain maximum fluid level in reservoir. Do not increase engine speed or move steering wheel.



5. With engine at idle speed, loosen bleed screw on steering box. Tighten bleed screw when fluid emerges.
6. Check fluid level.
7. Fit reservoir cap.
8. Clean away fluid around bleed screw.
9. Check hose connections, pump and steering box for fluid leaks by holding steering on full lock in both directions.

CAUTION: Do not maintain this pressure for more than 30 seconds in any one minute to avoid overheating fluid and possibly damaging seals.

10. Remove container.
11. Carry out road test.

POWER STEERING BOX

Service repair no - 57.10.01

General precautions

- Whenever any part of the system is removed or disconnected, utmost cleanliness must be observed.
- Disconnected ports and hoses must be plugged to prevent ingress of dirt. If metal sediment is found in system, establish the cause, rectify and flush system.
- Do not start engine until reservoir is full as pump will be damaged.
- Metric pipe fittings are used with 'O' ring pipe ends on fittings to steering box.
- Follow normal 'O' ring replacement procedure whenever pipes are disconnected.
- Ensure compatible metric components are used when fitting replacement pipes.

CAUTION: After refitting steering linkage parts, follow correct procedure to ensure that road wheels, steering box and steering wheel are correctly positioned relative to each other when in the straight ahead condition.

NOTE: When drag link is disconnected from steering box, travel available at steering wheel to each full lock is not equal.

Remove

1. Raise vehicle on ramp.
2. Remove Panhard rod. ***See FRONT SUSPENSION, Repair, Panhard rod***
3. Remove bolt securing steering damper to drag link.
4. Release steering damper from drag link.
5. Remove and discard split pin from castellated nut securing drag link to drop arm.
6. Remove castellated nut.

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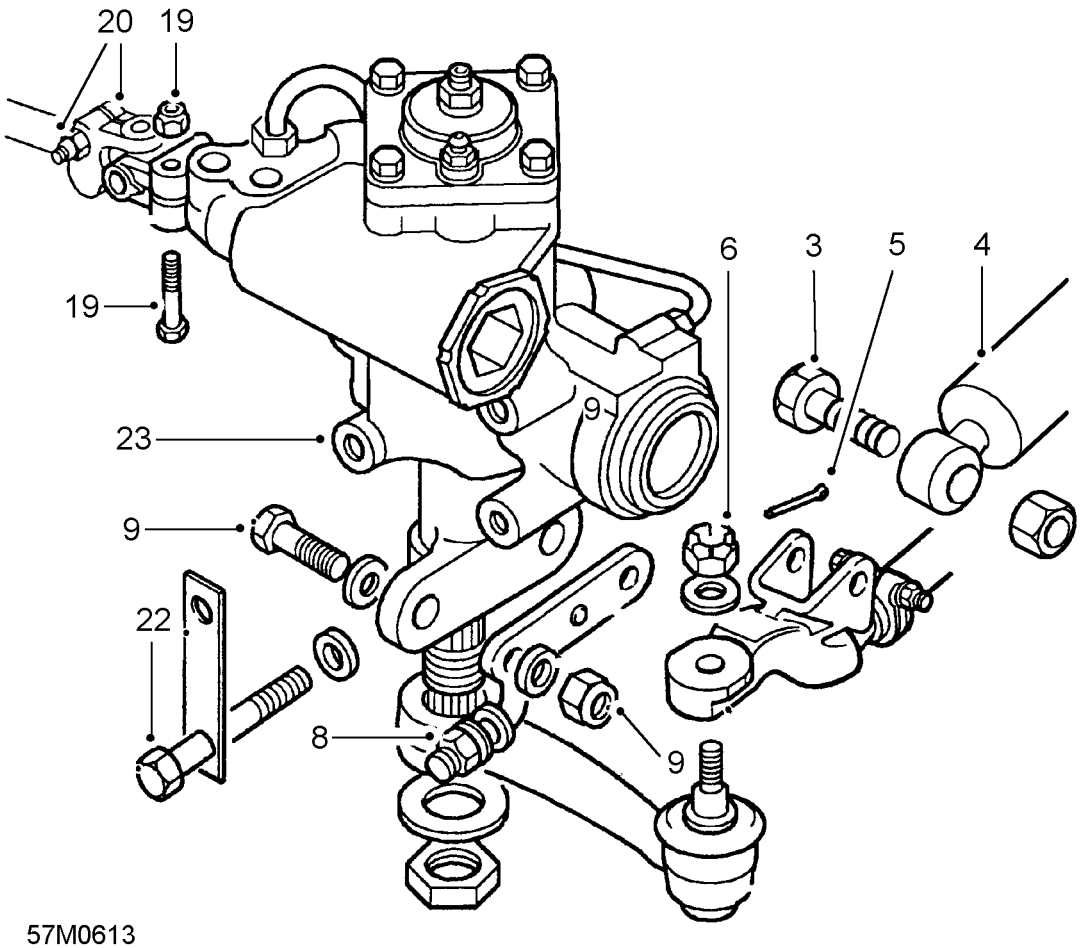
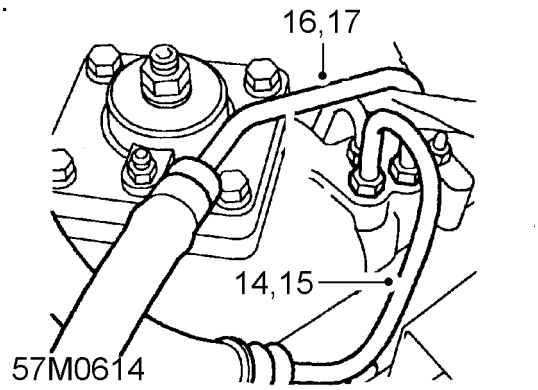


57M0613

7. Using tool **LRT-57-018** release drop arm from drag link.
8. Loosen, but do not remove, nut securing tie bar to mounting arm.
9. Remove 2 bolts securing tie bar to steering box.
10. Move tie bar aside.
11. Position container to collect any fluid spillage.
12. Lower vehicle.
13. Remove filler cap from power steering fluid reservoir.



14. Loosen union securing feed pipe to steering box.
15. Disconnect feed pipe from steering box.
16. Loosen union securing return pipe to steering box.
17. Disconnect return pipe from steering box.

CAUTION: Plug the connections.

18. Centralise steering. ***See Adjustment, power steering box - centralise***
19. Remove pinch bolt securing steering column universal joint to steering box.
20. Loosen pinch bolt securing universal joint to steering column.
21. Slide universal joint up steering column and release from steering box.
22. Remove 4 bolts securing steering box to chassis side member and collect 2 tab washers.
23. With assistance, lower steering box from vehicle and remove.

Refit

24. Clean mating faces of steering box and chassis side member.
25. With assistance, position steering box to vehicle, ensuring locating peg is engaged.
26. Fit bolts and tab washers securing steering box to chassis and tighten bolts to ***80 Nm (60 lbf.ft).***
27. Connect steering column to steering box.
28. Tighten universal joint pinch bolts to ***25 Nm (19 lbf.ft).***
29. Remove plugs from steering box and pipes.
30. Connect feed pipe to steering box and tighten union to ***15 Nm (11 lbf.ft).***
31. Connect return pipe to steering box and tighten union to ***20 Nm (15 lbf.ft).***
32. Fit fluid reservoir cap.
33. Raise vehicle on ramp.
34. Position tie bar to steering box and loosely fit bolts and washers.
35. Tighten nut securing tie bar to mounting arm to ***80 Nm (60 lbf.ft)*** and then back-off one complete turn.
36. Tighten bolts securing tie bar to steering box to ***81 Nm (60 lbf.ft)*** and then back-off one complete turn.
37. Fit drop arm to drag link and fit castellated nut.
38. Tighten castellated nut to ***40 Nm (30 lbf.ft)*** and fit NEW split pin.
39. Connect steering damper to drag link.
40. Fit and tighten bolt securing damper.
41. Fit Panhard rod. ***See FRONT SUSPENSION, Repair, Panhard rod; Refit***
42. Lower vehicle.
43. Bleed power steering system. ***See Adjustment, power steering system - bleed***
44. Test drive vehicle using both full locks to settle steering components. If possible, drive vehicle over uneven ground and include harsh braking.

WARNING: Do not test drive vehicle on public highway.

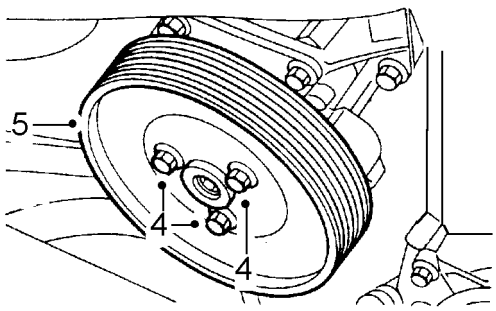
45. Drive vehicle in a straight line on level ground and stop.
46. Tighten nut securing tie bar to mounting to ***110 Nm (81 lbf.ft).***
47. Tighten bolts securing tie bar to steering box to ***81 Nm (60 lbf.ft).***
48. Ensure steering wheel is correctly aligned when wheels are positioned straight ahead.
49. Road test vehicle.

POWER STEERING PUMP

Service repair no - 57.20.14

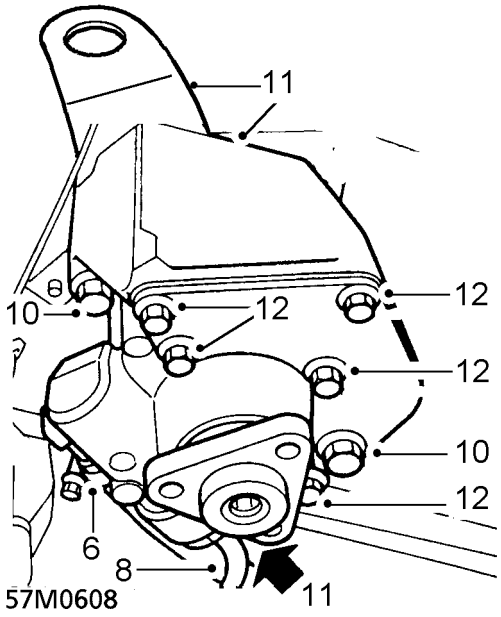
Remove

1. Disconnect battery negative lead.
2. Remove drive belt. ***See ELECTRICAL, Repair, Auxiliary drive belt***
3. Position container to collect any fluid spillage.



57M0610

4. Using an Allen key to restrain PAS pump pulley, remove 3 bolts securing pulley to pump.
5. Remove PAS pump pulley.



57M0608

6. Loosen clip securing PAS hose to pump.
7. Disconnect hose from pump.
8. Loosen union securing PAS pipe to pump.
9. Disconnect PAS pipe from pump.

CAUTION: Plug the connections.

10. Remove 3 bolts securing PAS pump to engine.
11. Remove PAS pump and collect engine lifting bracket.

Do not carry out further dismantling if component is removed for access only.

12. Remove 5 bolts securing clamping bracket to pump.
13. Remove clamping bracket from pump and fit to new pump.
14. Tighten bolts securing clamping bracket to pump to ***9 Nm (7 lbf.ft).***

Refit

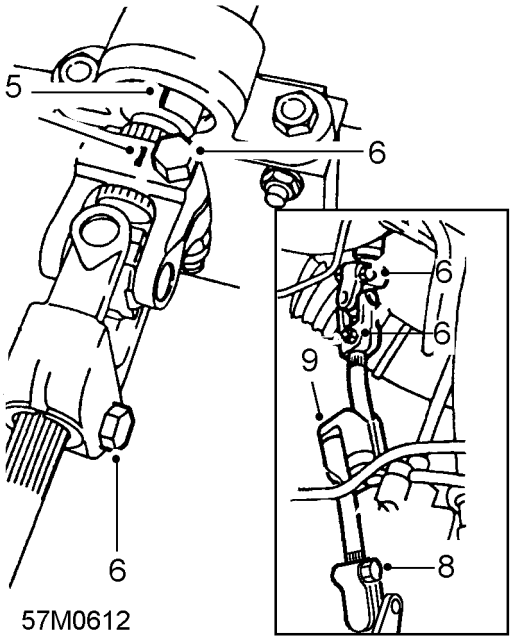
15. Clean mating faces of PAS pump and engine.
16. Fit PAS pump and engine lifting bracket to engine.
17. Fit and tighten bolts securing PAS pump to engine to ***35 Nm (26 lbf.ft).***
18. Remove plugs.
19. Connect PAS pipe to pump and tighten union to ***20 Nm (15 lbf.ft).***
20. Connect PAS hose to pump and secure with clip.
21. Position pulley to PAS pump.
22. Coat threads of PAS pump pulley bolts with Loctite 242.
23. Restrain pulley using Allen key and tighten bolts to ***10 Nm (7 lbf.ft).***
24. Fit drive belt. ***See ELECTRICAL, Repair, Auxiliary drive belt; Refit***
25. Reconnect battery negative lead.
26. Bleed power steering system. ***See Adjustment, power steering system - bleed***
27. Remove container.

STEERING LOWER SHAFT

Service repair no - 57.40.25

Remove

1. Set road wheels and steering wheel in straight ahead position.
2. Loosen clip securing air inlet hose to MAF sensor.
3. Loosen clip securing air inlet hose to plenum chamber.
4. Remove air inlet hose.



5. Mark relationship of steering column inner shaft to top universal joint.
6. Remove 2 bolts from top universal joint.
7. Remove lower bolt from bottom universal joint.
8. Loosen upper bolt from bottom universal joint.
9. Remove steering shaft and collect universal joints.
10. Inspect universal joints for wear and excessive play. Renew if necessary.
11. Inspect universal joints for stiffness. Lubricate if necessary.

Refit

12. Fit universal joints to steering shaft so pinch bolts line up with flats on shaft.
13. Fit steering shaft assembly to steering column and steering box.
14. Align bolt holes with grooves in splines. Fit pinch bolts and tighten to ***25 Nm (18 lbf.ft).***
15. Fit air inlet hose between plenum chamber and MAF sensor.
16. Tighten clips securing hose to plenum chamber and MAF sensor.

TORQUE VALUES

	Nm	lbf.ft
Drag link to drop arm	40	30
Ball joint nuts	40	30
Clamp bolt nuts	14	10
Steering column bracket nuts	22	16
Steering wheel nut	50	37
Tie bar to mounting nut - initial torque	80	60
Tie bar to mounting nut - final torque	110	80
Universal joint pinch bolt	25	18
PAS box		
Adjuster locknut	60	45
Drop arm nut	175	130
Sector shaft cover to steering box	75	55
Steering box to chassis	80	60
Steering box fluid pipes 14mm thread	15	11
Steering box fluid pipes 16mm thread	20	15
Tie bar	81	60
Adjuster grub screw	5	4
PAS pump		
High pressure fluid pipe	20	15
Power steering pump mounting	35	25
Pulley bolts, power steering pump	10	7
Hose clamp	3	2
Front clamping bracket bolts	9	7
PAS reservoir		
Hose clamp	3	2

The following Torque values are for screws and bolts that are not specified.

METRIC	**Nm**	**lbf.ft**
M5	6	4.5
M6	9	7
M8	25	18
M10	45	33
M12	90	65
M14	105	77
M16	180	133

UNC / UNF		
1/4	9	7
5/16	24	18
3/8	39	29
7/16	78	58
1/2	90	65
5/8	135	100

70 - BRAKES

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REPAIR

GENERAL BRAKE SERVICE PRACTICE

Brake fluid precautions

WARNING: Do not allow brake fluid to come into contact with eyes or skin.

CAUTION: Brake fluid can damage paintwork, if spilled wash off immediately with plenty of clean water.

CAUTION: Use only correct grade of brake fluid. If an assembly fluid is required use ONLY brake fluid. Do NOT use mineral oil, i.e. engine oil etc.

CAUTION: Thoroughly clean all brake calipers, pipes and fittings before commencing work on any part of the brake system. Failure to do so could cause foreign matter to enter the system and cause damage to seals and pistons which will seriously impair the efficiency of the brake system. To ensure the brake system efficiency is not impaired the following warnings must be adhered to :-

- **DO NOT use any petroleum based cleaning fluids or any proprietary fluids containing petrol.**
- **DO NOT use brake fluid previously bled from the system.**
- **DO NOT flush the brake system with any fluid other than the recommended brake fluid.**

The brake system should be drained and flushed at the recommended service intervals.

Cover all electrical terminals carefully to make absolutely certain that no fluid enters the terminals and plugs.

FLUID LEVEL CHECK / TOP-UP

WARNING: Clean reservoir body and filler cap before removing cap. Use only fluid from a sealed container.

1. Park vehicle on level ground.
2. Check level is between 'MIN' and 'MAX' marks.
3. If level is below 'MIN' mark top up fluid level to 'MAX' mark on reservoir, using correct fluid. ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Brake fluid reservoir***

CAUTION: Do not fill reservoir above maximum line.

BRAKE SYSTEM BLEED

Service repair no - 70.25.02

Preparation

WARNING: Before bleeding the brake system refer to general brake service practice. ***See General Brake Service Practice***

- During bleed procedure, brake fluid level must not be allowed to fall below the MIN level. Keep reservoir topped up to the MAX level.
- To bleed the hydraulic circuits, four bleed nipples are provided, one at each caliper.
- There are two methods by which air can be removed from the braking system:-

1. **MANUAL BLEED PROCEDURE.**
2. **PRESSURE BLEED PROCEDURE.**

Pressure bleed procedure

Purpose designed equipment for pressure filling and bleeding of hydraulic systems may be used on Land Rover vehicles. The equipment manufacturer's instructions must be followed and the pressure must not exceed 4.5 bar (65 lbf/in^2).

Manual bleed procedure

Equipment required

- Clean glass receptacle
- Bleed hose
- Wrench
- Approx 2 litres (3.5 pints) brake fluid ***See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids***

Master cylinder bleed

1. Disconnect battery.
2. Depress brake pedal fully and slowly 5 times.
3. Release the pedal and wait for ten seconds.
4. Air bubbles will rise into the reservoir during these instructions.
5. Repeat instructions until a firm resistance is felt at the pedal.

Complete circuit bleed

1. Fit bleed hose to any caliper bleed screw.
2. Dip free end of bleed hose into brake fluid in bleed bottle.
3. Open bleed screw of caliper.
4. Depress brake pedal fully several times until fluid is clear of air bubbles.
5. Keeping pedal fully depressed, tighten bleed screw, then release pedal.
6. Repeat the above procedure on remaining 3 calipers.
7. Fit all bleed screw protection caps.
8. Check/top-up fluid level when bleeding is complete. ***See Fluid Level Check / Top-Up***

76 - CHASSIS AND BODY

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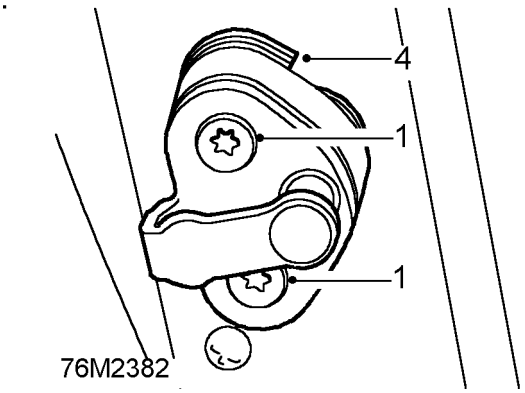
ADJUSTMENT

REPAIR

DOOR LOCK STRIKER - ADJUST

Service repair no - 76.37.23

Adjust

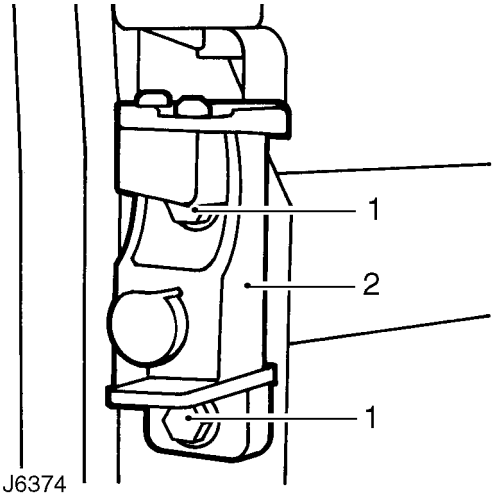


1. Loosen Torx bolts securing striker to 'B' post.
2. Adjust alignment of striker vertically and horizontally, lightly tighten bolts.
3. Close door, check for correct latching with door lock and for centering on striker.
4. Add or remove packing shims as necessary. Fully tighten bolts.
5. Carry out further adjustment as necessary. If full adjustment cannot be achieved carry out following:
6. Remove striker and nut plate.
7. Elongate striker bolt holes in 'B' post to increase movement in direction required.
8. Refit striker and adjust as necessary.

TAIL DOOR STRIKER - ADJUST

Service repair no - 76.37.25

Adjust

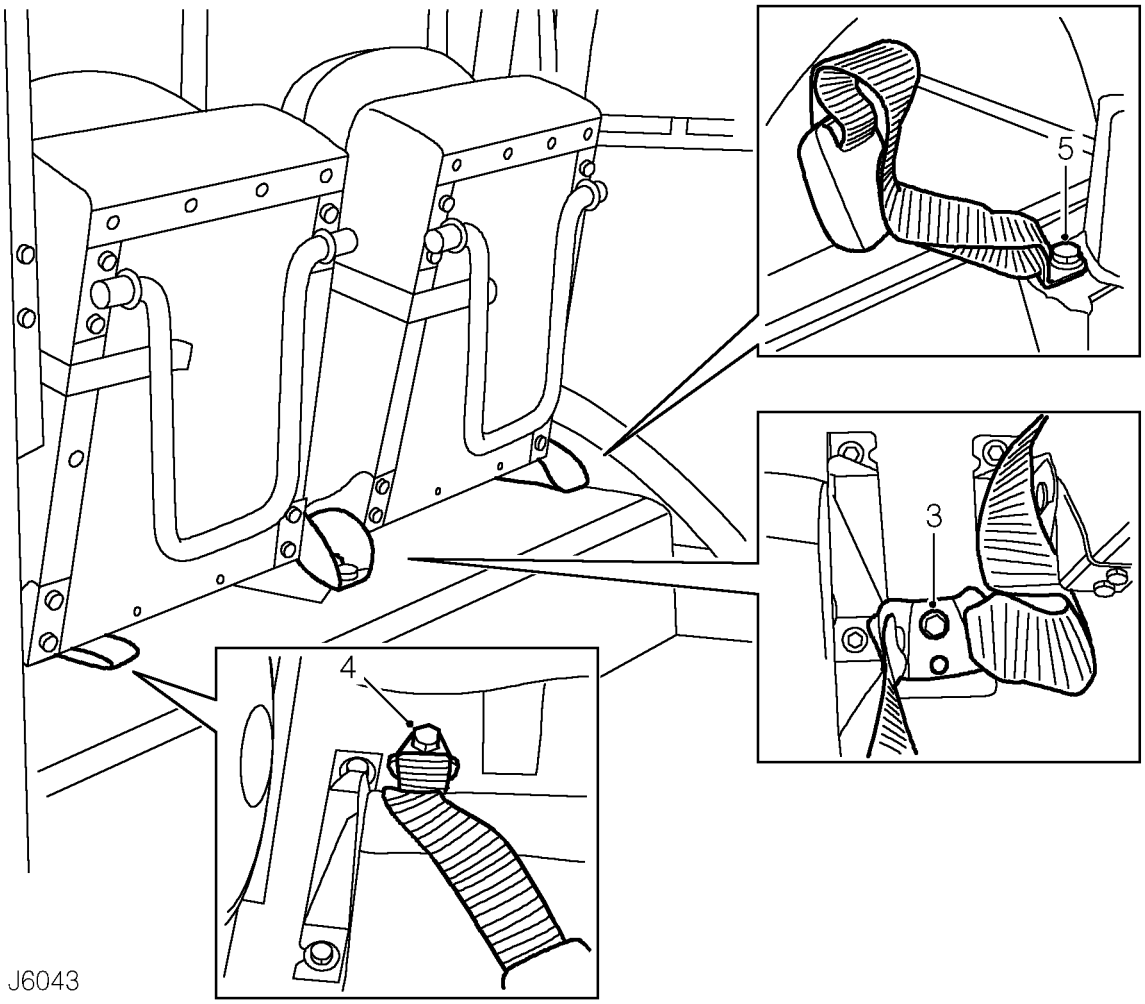


1. Loosen striker securing screws.
2. Adjust striker vertically and horizontally, lightly tighten screws.
3. Close door and check for correct latching with door lock.
4. Carry out further adjustment as necessary. If full adjustment cannot be achieved carry out following:
5. Remove striker and nut plate.
6. Elongate holes in body panel in direction required.
7. Refit striker and adjust as necessary.

REAR SEAT BELTS

Service repair no - 76.73.18

Remove



1. Release belt straps from buckles on both seats.
2. Raise both seat cushions and secure with stowage straps.
3. Unscrew bolt and remove bracket and inner seat belt straps.
4. Unscrew bolt and remove rear seat buckle strap from wheel arch.
5. Unscrew bolt and remove front seat buckle strap from interior roll-over bar mounting.

Refit

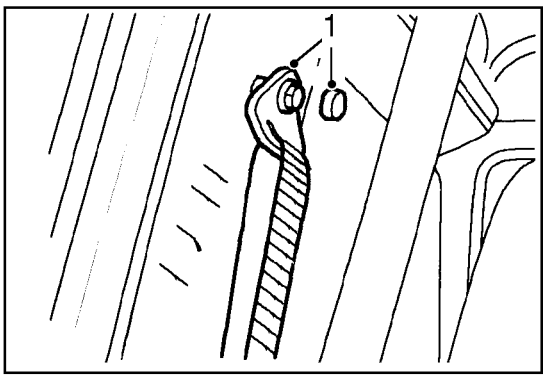
6. Reverse removal procedure, ensuring seat belt fixing bolts are tightened to ***32 Nm (24 lbf.ft).***

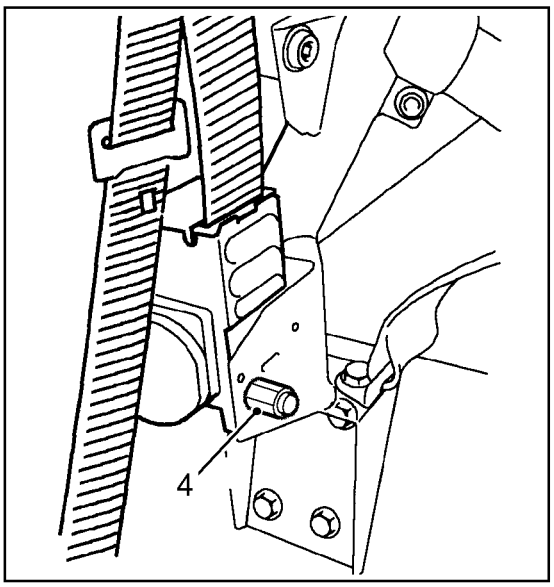
FRONT SEAT BELTS

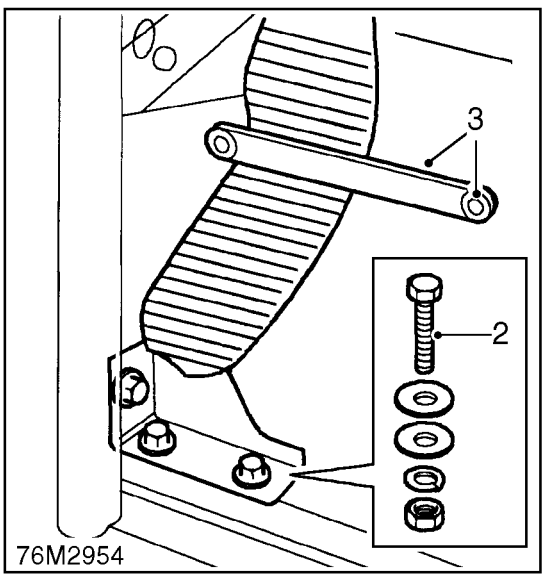
Service repair no - 76.73.13

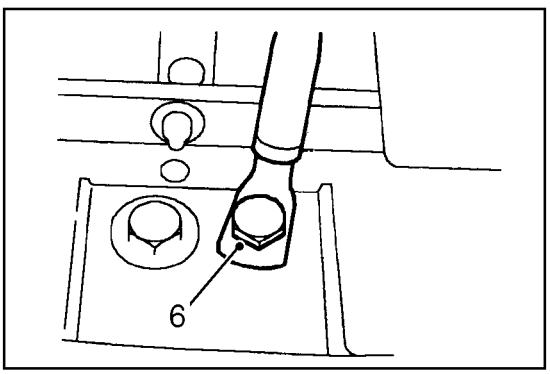
Remove

1. Remove cap and unscrew seat belt guide bracket fixing bolt from 'B/C' post.
2. Remove 3 bolts and plain washers securing seat belt mounting bracket to body on outside of seat base.
3. Prise seat belt retaining clip from side of seat mounting and remove trim studs.
4. Unscrew bolt and remove seat belt inertia reel from roll-over bar mounting bracket.
5. Remove seat belt and inertia reel assembly.
6. Unscrew bolt and washer and remove seat belt buckle stalk from roll-over mounting bracket.









Refit

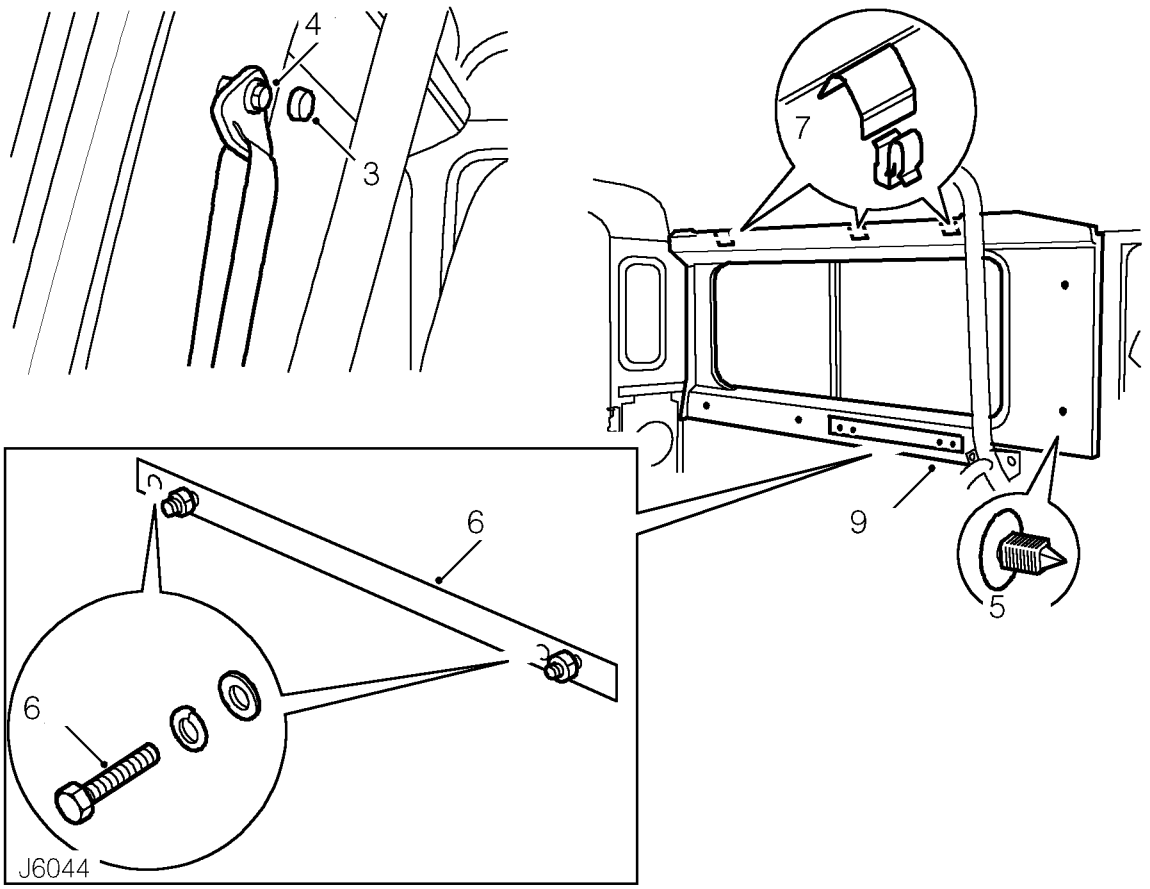
7. Position stalk on roll-over bar mounting bracket and tighten fixing bolt to ***32 Nm (24 lbf.ft).***
8. Secure seat belt inertia reel to roll-over bar mounting and tighten bolt to ***32 Nm (24 lbf.ft).***
9. Secure seat belt backet to floor on outside of seat base and tighten bolts to ***23 Nm (17 lbf.ft).***
10. Fit seat belt retaining clip to side of seat base and secure with trim studs.
11. Extend belt from inertia reel, secure slide bracket to 'B/C' post and tighten bolt to ***32 Nm (24 lbf.ft).***
12. Refit fixing bolt cap.

SIDE TRIM PANEL

Service repair no - 76.13.70

Remove

1. Remove rear seat squabs. ***See Rear seat squab***
2. Remove rear end trim panel. ***See Rear end trim panel***
3. Prise cap from front seat belt upper guide retaining bolt.
4. Unscrew retaining bolt and remove seat belt from 'B/C' post.
5. Carefully prise 2 trim studs from 'B/C'post.
6. Remove 4 bolts securing side trim panel and forward seat support to body side.
7. Release top edge of side trim panel by striking upwards with the hand to disengage 3 spring clips.
8. Carefully pull trim panel rearwards to clear interior roll-over bar.
9. Remove side trim panel from vehicle.



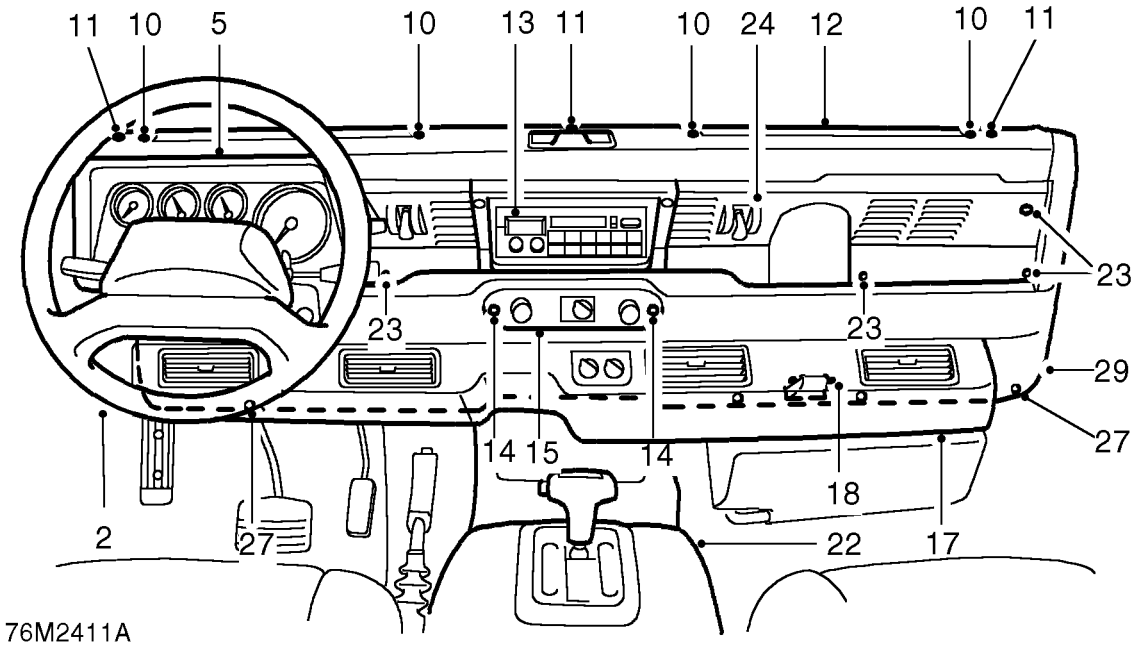
Refit

10. Fit new spring clips to the 3 brackets on top edge of side trim panel.
11. Carefully pull trim panel behind interior roll-over bar.
12. Align trim panel, ensuring it is correctly positioned around side window.
13. Locate trim panel spring clips on inner cant rail and press firmly down to secure top edge of trim panel.
14. Align bosses of trim panel and forward seat support bracket with body side fixing holes and secure with bolts and washers. **Do not** fully tighten at this stage.
15. Fit trim stud to secure bottom edge of trim panel to 'B/C' post.
16. Secure seat belt guide to 'B/C' post, tighten bolt to ***32 Nm (24 lbf.ft)*** and fit cap.
17. Fit rear end trim panel. ***See Rear end trim panel; Refit***
18. Fit rear seat squab. ***See Rear seat squab; Refit***

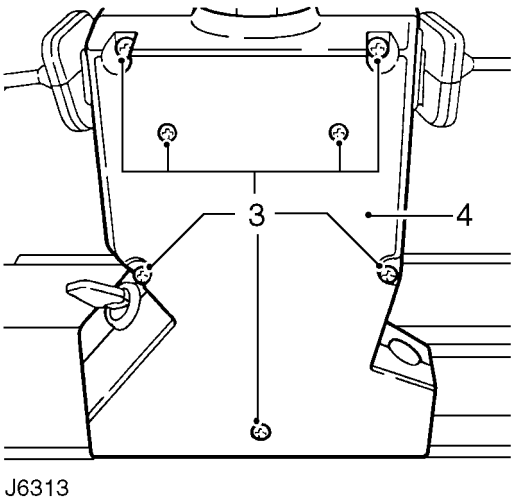
LOWER FASCIA PANEL (HEATER DUCT) ASSEMBLY

Service repair no - 76.46.05

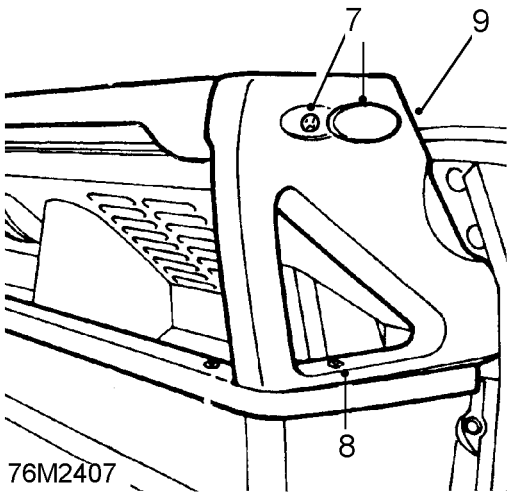
Remove



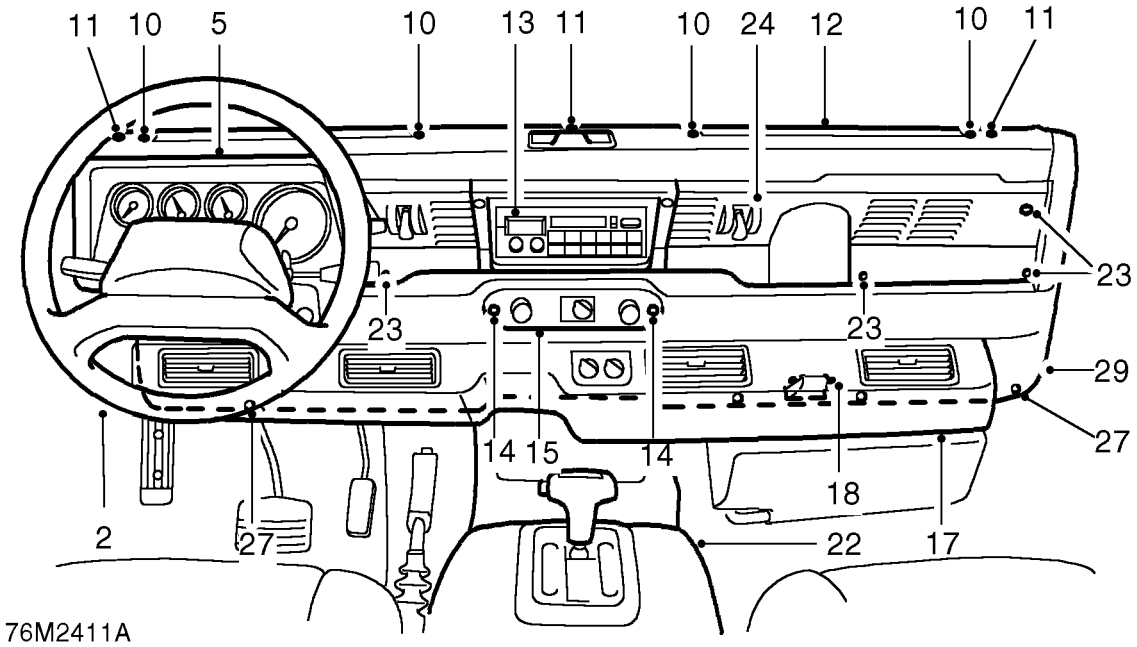
1. Disconnect battery.
2. Remove steering wheel. If necessary, use puller **LRT-57-014**.



3. Remove 7 screws and lift lift top half of nacelle from steering column switch assembly.
4. Ease bottom half of nacelle from switch gaiters/grommets and remove.
5. Remove instrument panel. ***See INSTRUMENTS, Repair, Instrument panel***
6. Disconnect heater control cable. ***See HEATING AND VENTILATION, Repair, Heater control cable - air distribution***

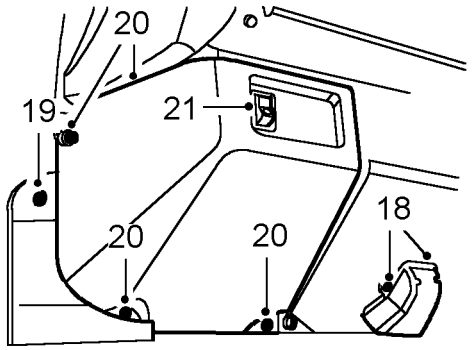


7. Prise out Land Rover decal and remove screw securing grab handle to crash pad.
8. Remove screw securing grab handle to lower fascia panel.
9. Lift grab handle to release locating pins from fascia panel.



76M2411A

10. Remove 4 screws and remove both demister vents from crash pad.
11. Remove 3 screws securing crash pad to fascia bulkhead.
12. Remove crash pad.
13. Remove radio. ***See ELECTRICAL, Repair, Radio***
14. Remove 2 screws, washers and nuts securing auxiliary switch panel to lower fascia panel and switch cover.
15. Withdraw switch panel and disconnect harness leads.
16. Remove 2 screws securing switch cover to parcel tray.
17. Remove air conditioning fascia duct bezel. ***See AIR CONDITIONING, Repair, Fascia duct bezel***
18. If air conditioning is not fitted, remove 4 screws and remove both footwell vents from lower fascia panel.



76M2408

19. Remove single screw and detach door check strap cover from LH and RH doors.
20. Remove 3 screws securing wiper motor cover to fascia bulkhead.

21. Release locating pins from fascia panel, lower wiper motor cover and disconnect instrument ilumination switch plug. Retain wiper motor rack cover.
22. Remove centre console. ***See Centre console***
23. Prise out 2 large and 5 small cap fasteners securing trim panel to parcel shelf and fascia bulkhead.
24. Carefully fold back trim panel to clear fresh air vent operating levers and remove panel from parcel shelf.
25. Release demist hose and lift parcel shelf from lower fascia panel (heater duct). Feed main harness leads and plugs through aperture in parcel shelf.
26. Remove parcel shelf.
27. Remove 4 screws securing bottom edge of lower fascia panel to fascia bulkhead, noting position of both footwell cover retaining plates. Remove retaining plates.
28. Unscrew 2 retaining bolts securing top edge of lower fascia panel to bulkhead.
29. With assistance, release lower fascia panel and remove from vehicle.

Refit

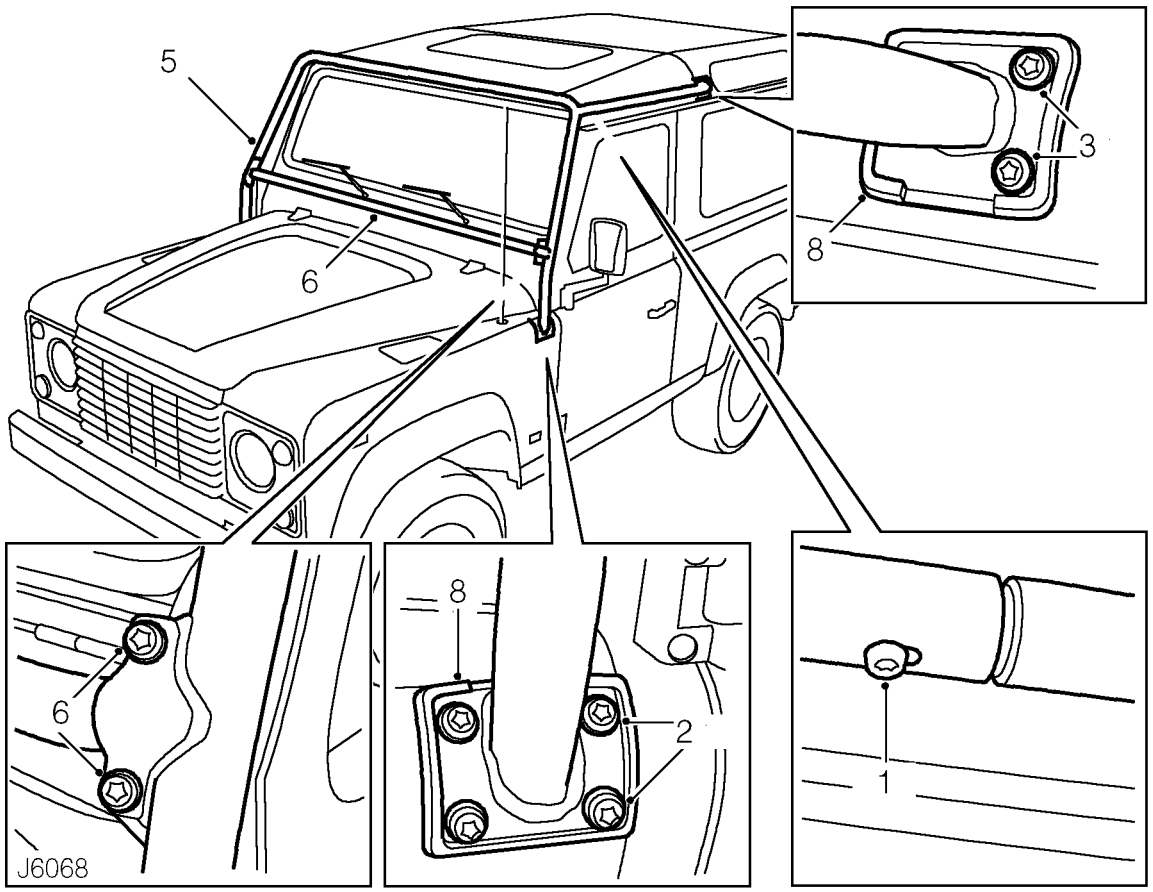
30. Position lower fascia panel to bulkhead and secure top edge with 2 bolts.
31. Locate RH footwell cover retaining plate under bottom edge of fascia panel and secure with 3 screws.
32. Repeat operation for LH footwell cover retaining plate.
33. Fit remaining lower fascia panel fixing screws.
34. Locate parcel shelf. Ensure all rear door services and auxiliary switch panel harness leads and plugs are fed through aperture in parcel shelf.
35. Fit demist hoses into heater duct of lower fascia panel. Ensure flanges of hose grommets are correctly seated.
36. Fit trim panel and secure with cap fasteners.
37. Fit centre console. ***See Centre console; Refit***
38. Reconnect instrument illumination switch plug and locate wiper motor cover pins in lower fascia panel and secure wth 3 screws. Ensure wiper rack cover is correctly seated.
39. Fit door check strap covers on both sides.
40. Fit air conditioning fascia duct bezel. ***See AIR CONDITIONING, Repair, Fascia duct bezel; Refit***
41. If air conditioning is not fitted, fit footwell vents to lower fascia panel.
42. Fit auxiliary switch cover to parcel tray.
43. Connect leads and plugs to auxiliary switches and clock.
44. Secure switch panel to lower fascia panel and switch cover.
45. Fit radio. ***See ELECTRICAL, Repair, Radio; Refit***
46. Fit crash pad to fascia bulkhead.
47. Fit demister vents in crash pad.
48. Fit grab handle to lower fascia panel and secure to crash pad. Refit Land Rover decal.
49. Connect multi-plugs to rear screen, hazard and interior lamp switches and fit switch panel to fascia panel.
50. Fit heater control cable. ***See HEATING AND VENTILATION, Repair, Heater control cable - air distribution; Refit***
51. Fit instrument binnacle. ***See ELECTRICAL, Repair, Instrument binnacle; Refit***
52. Fit steering column nacelle.
53. Fit steering wheel.
54. Reconnect battery.

EXTERIOR ROLL-OVER BAR

Service repair no - 76.11.39

Remove

1. Remove torx bolt, from both sides, securing top of roll-over bar to roof mounted bar.
2. With assistance to support roll-over bar at windscreen, remove 4 torx bolts, from both sides, securing roll-over bar to wing mounting.
3. Remove two torx bolts, from both sides, securing top bar to roof mounting.
4. Slide top bars rearwards to disengage from main roll-over bar assembly.
5. Lift main roll-over bar assembly from vehicle.
6. If necessary, remove 2 torx bolts and nuts, from both sides, and detach lower cross bar from main roll-over bar.



Refit

7. Locate lower cross bar into main roll-over bar mounting brackets and secure with torx bolts and nuts to ***25 Nm (18 lbf.ft).***
8. Ensure rubber gaskets are fitted correctly to roll-over bar mounting brackets.
9. With assistance, lift roll-over bar assembly and position on wings.
10. Slide top bars into main roll-over bar, position on roof mounting and secure with torx bolts to ***25 Nm (18 lbf ft.***
11. Secure roll-over bar to both wing mountings with torx bolts. Tighten to ***25 Nm (18 lbf.ft).***
12. Secure top bars to main roll-over bar and tighten fixing bolts to ***25 Nm (18 lbf.ft).***

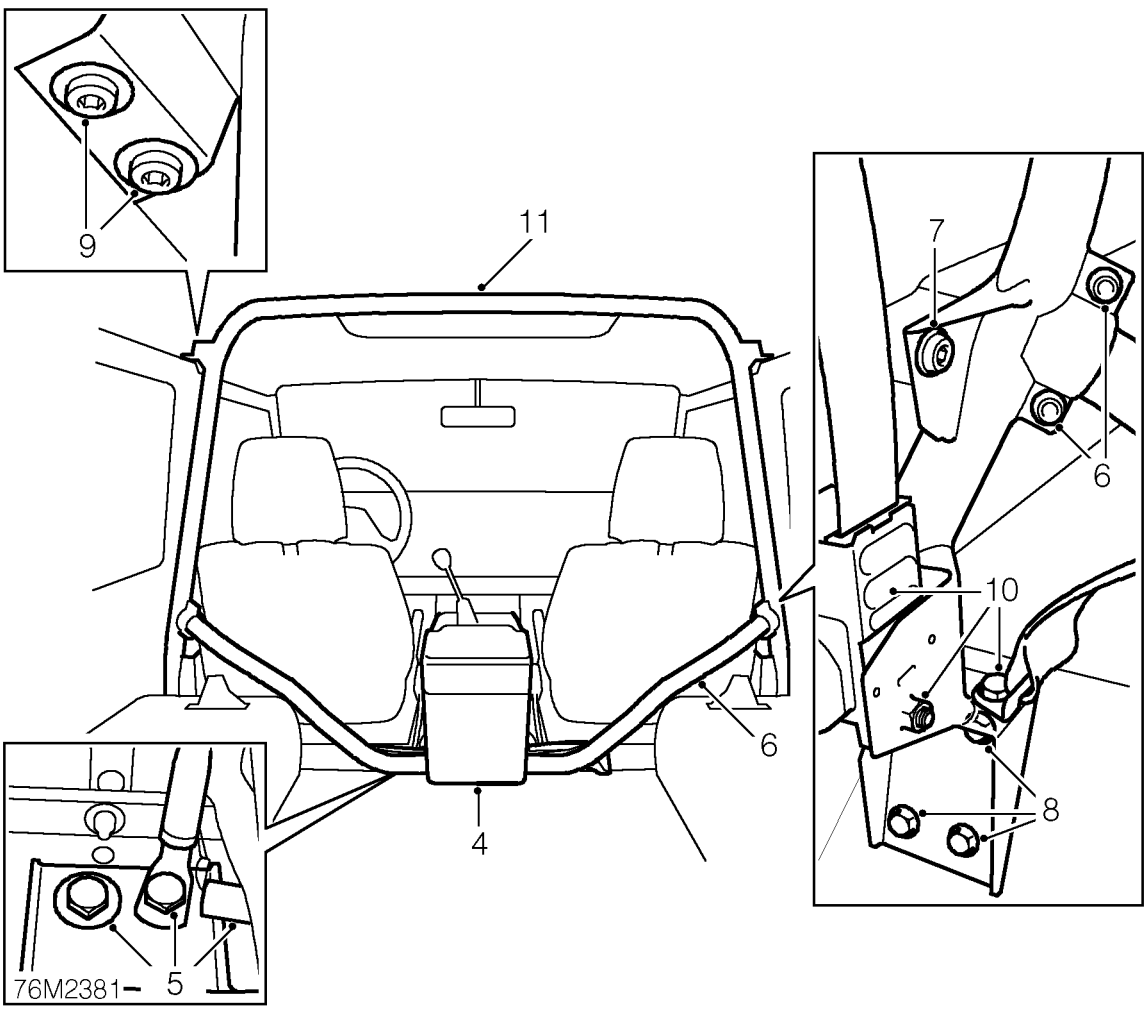
INTERIOR ROLL-OVER BAR

Service repair no - 76.11.40

Remove

1. Remove rear seat squabs. ***See rear seat squab***
2. Remove rear end trim panels. ***See rear end trim panel***
3. Remove side trim panels. ***See side trim panel***
4. Remove centre console. ***See centre console***
5. Remove 4 bolts securing centre section of roll-over bar and seat belt stalks to floor.
6. Remove 2 torx bolts and nuts from both sides and detach centre section of roll-over bar assembly.
7. Remove torx bolt, from both sides, securing roll-over bar to body side mounting brackets.
8. Remove 3 bolts and washers, from both sides, securing lower roll-over bar brackets to front of wheelarch.
9. Remove 2 torx bolts and washers, from both sides, securing roll-over bar upper mountings to roof fixing brackets and carefully lower complete assembly to floor.
10. Unscrew retaining bolts, from both sides, and remove front seat belt inertia reels and rear seat belts from roll-over bar mounting.
11. Supporting from both sides, raise and tilt roll-over bar rearwards to clear wheel arches.
12. Remove roll-over bar from vehicle.

NOTE: Assistance may be required to remove roll-over bar.



Refit

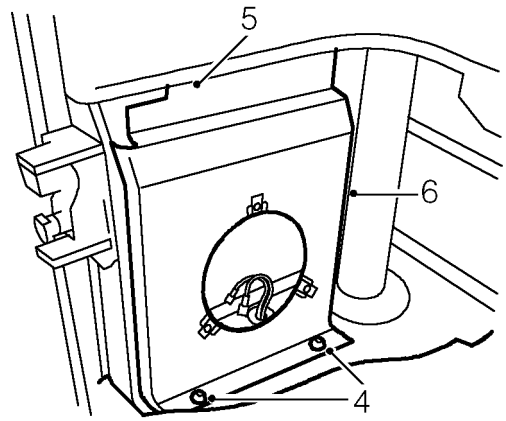
13. Supporting from both sides, position roll-over bar, engage struts in rear corners and front of side panels. Align on floor.
14. Secure front seat belt inertia reels and rear seat belts to roll-over bar mountings. Tighten bolts to ***32 Nm (24 lbf.ft).***
15. Raise roll-over bar assembly and secure to roof mounting brackets. Tighten bolts to ***45 Nm (33 lbf.ft).***
16. Secure roll-over bar to wheel arches. Tighten bolts to ***45 Nm (33 lbf.ft).***
17. Secure roll-over bar to body side mounting brackets, tightening bolts to ***45 Nm (33 lbf.ft).***
18. Secure centre section to main roll-over bar, but do not fully tighten fixing bolts at this stage.
19. Secure seat belt stalks and roll-over bar floor mounting brackets to chassis. Tighten bolts to ***32 Nm (24 lbf ft.***
20. Fully tighten roll-over bar centre section retaining bolts to ***45 Nm (33 lbf.ft).***
21. Fit centre console. ***See Centre console; Refit***
22. Fit side trim panel. ***See Side trim panel; Refit***
23. Fit rear end trim panels. ***See Rear end trim panel; Refit***
24. Fit rear seat squabs. ***See Rear seat squabs; Refit***

REAR SPEAKER PANEL

Service repair no - 76.13.11

Remove

1. Raise seat cushion and fit stowage strap.
2. Remove rear end trim panel. ***See rear end trim panel***
3. Remove rear speaker. ***See ELECTRICAL, Repair, rear speaker***



J6051

4. Peel back carpet and remove 2 screws securing speaker panel to wheel arch.
5. Prise top edge of panel down to release from body channel.
6. Remove speaker panel.

Refit

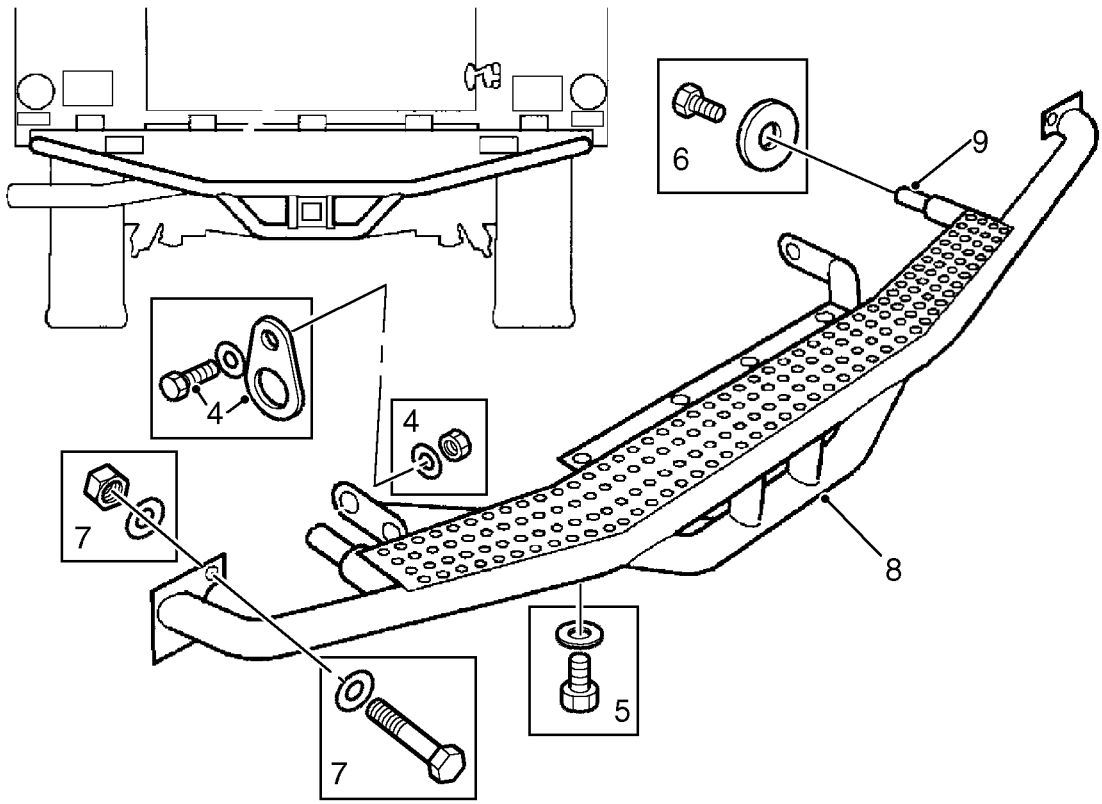
7. Position speaker panel on wheel arch.
8. Press top edge of panel down firmly and locate under body channel.
9. Secure speaker panel to wheel arch with screws and reposition carpet.
10. Fit rear speaker. ***See ELECTRICAL, Repair, rear radio speaker; Refit***
11. Fit rear end trim panel. ***See rear end trim panel; Refit***

REAR TOW BAR

Service repair no - 76.11.41

Remove

1. Remove 4 bolts securing anti-roll bar to rear undertray.
2. Remove 6 bolts securing rear undertray to chassis.
3. Remove rear undertray.
4. Remove bolt, washer and nut from both sides, securing tow bar lower mounting brackets and towing eyes to chassis.
5. Remove 4 bolts and spring washers securing tow bar centre mounting bracket to chassis.
6. Remove both bolts securing 2 tow bar locating tubes in rear chassis cross member.
7. Remove 2 bolts securing tow bar top mounting brackets to chassis.
8. With assistance, withdraw tow bar assembly from chassis.



76M2953

Refit

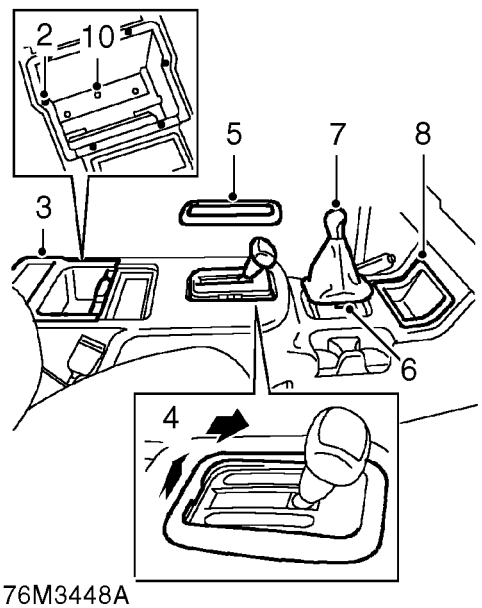
9. With assistance, lift tow bar assembly and locate both tubes in chassis crossmember.
10. Secure top tow bar mounting brackets to chassis but do not fully tighten fixings.
11. Secure tow bar locating tubes to rear of chassis and tighten bolts to ***25 Nm (18 lbf.ft).***
12. Secure tow bar centre mounting bracket to underside of chassis and tighten bolts to ***25 Nm (18 lbf.ft).***
13. Position towing eyes to lower mounting brackets and secure to chassis and tighten bolts to ***25 Nm (18 lbf.ft).***
14. Fully tighten tow bar top mounting bracket bolts to ***25 Nm (18 lbf.ft).***
15. Fit rear undertray and secure to chassis with bolts.
16. Fit bolts securing rear anti-roll bar and tighten to ***30 Nm (22 lbf.ft).***

CENTRE CONSOLE

Service repair no - 76.25.01

Remove

1. Open cubby box lid.



76M3448A

2. Remove 6 screws securing cubby box to console.
3. Remove cubby box.
4. Release rear edge of selector housing surround.
5. Remove surround.
6. Release hi-low gear lever gaiter from console.
7. Remove hi-low gear lever knob and gaiter assembly.
8. Remove tray from console.
9. Remove screw securing front edge of console.
10. Remove 3 screws securing rear of console.
11. Remove console.

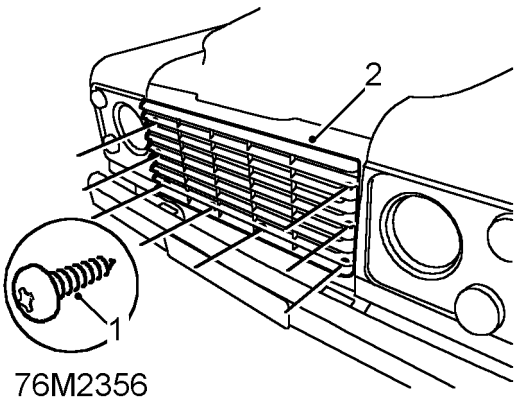
Refit

12. Fit and align console.
13. Fit and tighten screws securing console.
14. Fit tray to console.
15. Fit hi-low gear lever knob and gaiter assembly.
16. Secure hi-low gear lever gaiter to console.
17. Fit gear selector housing surround and secure.
18. Fit cubby box to console and secure with screws.
19. Close cubby box lid.

RADIATOR GRILLE

Service repair no - 76.55.03

Remove



1. Remove 8 screws securing grille to front panel.
2. Remove radiator grille

Refit

3. Position radiator grille to front panel.
4. Secure grille with screws.

GRILLE PANEL

Service repair no - 76.55.06

Remove

1. Remove radiator grille. ***See radiator grille***
2. Disconnect multiplug from condenser fan fly-lead.
3. Loosen bolts securing top panel and grille panel to fenders.
4. Remove bolts securing securing grille panel to wings.
5. Remove grille panel.

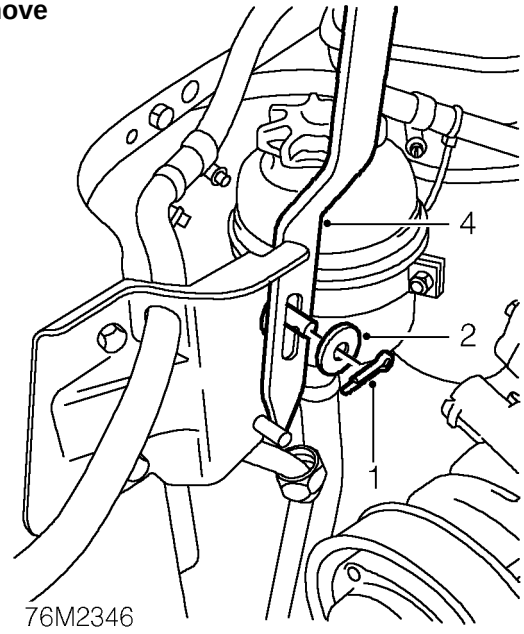
Refit

6. Position grille panel and fit bolts to wing, finger tight.
7. Fit plastic nuts to lower fixing, each side
8. Fit screws to top panel.
9. Align grille panel and tighten all fixings.
10. Fit radiator grille. ***See radiator grille; Refit***

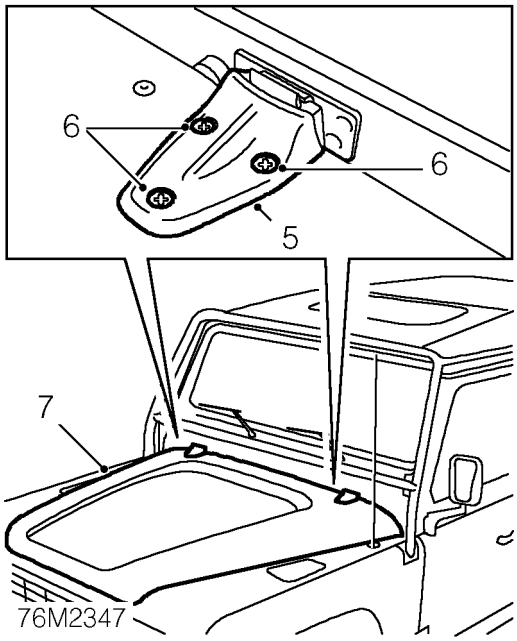
BONNET

Service repair no - 76.16.01.99

Remove



1. Remove split pin from bonnet stay lower pivot.
2. Remove washer and anti-rattle washer from pivot.
3. Position suitable chock to support bonnet in a position to gain access to hinge nuts.
4. Release bonnet stay from pivot, fold stay up into the bonnet and rest bonnet onto chock.



5. Mark outline of hinge on bonnet.
6. Remove 6 nuts and screws securing bonnet to hinges.
7. With assistance, remove bonnet.

Refit

8. With assistance, position bonnet to hinges.
9. With assistance, fit screws through hinges and bonnet and fit washers and nuts to screws.
10. Align hinges to bonnet markings.
11. Tighten hinge retaining screws.
12. Raise bonnet from chock and connect stay to pivot.
13. Fit anti-rattle and plain washers to pivot. Secure with split pin.
14. Release stay and close bonnet to check alignment and operation.

82 - AIR CONDITIONING

CONTENTS

REFRIGERATION SYSTEM FAULTS

For any refrigeration system to function properly all components must be in good working order. The unit cooling cycle and the relationship between air discharge temperature and ambient temperature and the pressures at the compressor can help to determine proper operation of the system.
The length of any cooling cycle is determined by such factors as ambient temperature and humidity, thermostat setting, compressor speed and air leakage into the cooled area, etc. With these factors constant, any sudden increase in the length of the cooling cycle would be indicative of abnormal operation of the air conditioner.
The low and high side pressures at the compressor will vary with changing ambient temperature, humidity, in-car temperature and altitude.
The following items should be checked before operating the system:

1. Compressor drive belt tension.
2. Compressor magnetic clutch operation.
3. Condenser fan operation.
4. Condenser fins, dirt will cause poor cooling and higher operating temperatures.

System check

The following conditions should be checked after operating the system for several minutes:

1. All high pressure lines and components should be hot to the touch.
2. All low pressure lines should be cool to the touch.
3. Inlet and outlet temperatures at the receiver/drier should be at the same temperature (warm). Any very noticeable temperature difference indicates a blocked receiver/drier.
4. Heavy frost on the inlet to the expansion valve may indicate a defective valve or moisture in the system.
5. Evaporation air temperature will vary with ambient temperature and humidity. As humidity increases the outlet temperature will be higher.

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 servicing operations on the air conditioning system.

WARNING: R134a is odourless and colourless. Do not handle or discharge in an enclosed area, or in any area where the vapour or liquid can come in contact with naked flame or hot metal. R134a is not flammable, but can form a highly toxic gas.

WARNING: Do not smoke or weld in areas where R134a is in use. Inhalation of concentrations of the vapour can cause dizziness, disorientation. uncoordination, narcosis, nausea or vomiting.

WARNING: Do not allow fluids other than R134a or compressor lubricant to enter the air conditioning system. Spontaneous combustion may occur.

WARNING: 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.

WARNING: The refrigerant used in an air conditioning system must be reclaimed in accordance with the recommendations given with a Refrigerant Recovery Recycling Recharging Station.

NOTE: Suitable protective clothing comprises: Wrap around safety glasses or helmet, heatproof 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 eyewash over the eye to raise the temperature. If eyewash is not available cool, clean water may be used. Cover eye with 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 actions if skin comes into contact with discharging cylinders. Wrap affected 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 unconscious, remove to fresh air, apply artificial respiration and/or oxygen and seek immediate medical attention.

NOTE: Due to its low evaporating temperature of -30°C, -22°F R134a should be handled with care.

WARNING: Do not allow a refrigerant container to be heated by a direct flame or to be placed near any heating appliance. A refrigerant container must not be heated above 50°C, 122°F.

WARNING: 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.

SERVICING PRECAUTIONS

Care must be taken when handling refrigeration system components. 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 fully tightening the 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 '0' ring but not to the threads.

Check the oil trap for the amount of oil lost.

All protective plugs on components must be left in place until immediately prior to connection.

The receiver/drier contains dessicant 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 the approved refrigerant lubricating oil - Nippon Denso ND-OIL 8.

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 ..... 40ml, 1.4 fl oz
Evaporator ..... 80ml, 2.8 fl oz
Pipe or hose ..... 20ml, 0.7 fl oz
Receiver/drier ..... 20ml, 0.7 fl oz
Total refrigerant oil in system = 180ml, 6.3 fl oz

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 caps in place and these must not be removed until immediately prior to fitting.

Fitting a new compressor

A new compressor is supplied with an oil fill (X) of 180ml, 5.3 fl oz.

A calculated quantity of oil must be drained from a new compressor before fitting.

To calculate the quantity of oil to be drained:

1. Remove sealing plugs from the OLD compressor.
2. Invert compressor and gravity drain oil into measuring cylinder. Rotating the compressor clutch plate will assist complete draining.
3. Note the quantity of oil drained (Y).
4. Calculate the quantity (Q) of oil to be drained from the NEW compressor using the following formula:

X - (Y + 20ml, 0.7 fl oz) = Q

Rapid refrigerant discharge

When the air conditioning system is involved in accident damage and the circuit is punctured, the refrigerant is discharged 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. Gravity drain all the oil, assist by rotating the clutch plate (not the pulley).
2. Refill the compressor with 130ml, 4.6 fl oz of new refrigerant oil.
3. Plug the inlet and outlet ports.

Servicing Equipment

The following equipment is required for full servicing of the air conditioning system.

Recovery, recycling and charging station
- Leak detector
- Thermometer +20°C to -60°C, 70°F to -70°F
- Safety goggles and gloves

REFRIGERANT RECOVERY, RECYCLING, RECHARGING

Service repair no - 82.30.20/01

WARNING: The air conditioning system is charged with a high pressure, potentially toxic refrigerant. Repairs or servicing must only be carried out by an operator 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.
Always wear safety goggles and gloves when opening refrigerant connections.

WARNING: Wear eye and hand safety protection. Open connections slowly in case liquid or pressure is present. Allow to bleed off slowly.

CAUTION: Overcharging air conditioning system will cause excessive head pressure.

An air conditioning portable Refrigerant Recovery Recycling Recharging Station for use with R134a refrigerant incorporates all the features necessary to recover refrigerant R134a from the air conditioning system, to filter and remove moisture, to evacuate and recharge with the reclaimed refrigerant. The unit can also be used for performance testing and air conditioning system analysis.

The operator must adhere to the equipment manufacturers' instructions.

Recovery and recycling

1. Connect a Refrigerant Station to the high and low pressure servicing connections.
2. Operate the refrigerant recovery system according to the manufacturer's instructions.
3. Measure the amount of oil discharged from the system. Add an equal amount of new refrigerant oil to compressor before evacuation sequence.

WARNING: Refrigerant must always be recycled before reuse, 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 refrigerant oil to compressor if necessary.
2. Renew the receiver/drier.

CAUTION: When a major repair has been carried out, a leak test should be carried out using inert gas.

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 manufactures instructions.

NOTE: If the vacuum reading is below 700 mm Hg, 28 in Hg after 15 minutes, suspect a leak in the system. Partially recharge the system and check for leaks using an electronic leak tester. Check suction lines first, then run the compressor for 5 minutes and then check the high pressure lines.

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.

   Refrigerant to charge system = 900 ± 30gm, 32 ± 1 oz.
6. If the full charge has not been accepted by the system, start the engine and run it at 1500 rev/min for a minimum of 2 minutes.
   Switch on the air conditioning system, open the vehicle windows, set the temperature control to cold and switch the blower to maximum speed.
7. Consult Refrigerant Station Manual for correct procedure to complete the charge.
8. Carry out the air conditioning system performance test.

LEAK TEST SYSTEM

The following instructions refer to an electronic type Refrigerant Leak Detector for use with R134a, which is the safest and most sensitive.

CAUTION: When a major repair has been carried out, a leak test should be carried out using an inert gas (see below).

1. Place the vehicle in a well ventilated area but free from draughts, as leakage from the system could be dissipated without detection.
2. Follow the instructions issued by the manufacturer of the particular leak detector being used.
3. Commence searching for leaks by passing the detector probe around all joints and components, refrigerant gas is heavier than air.
4. Insert the probe into an air outlet of the evaporator or into the evaporator drain tube. Switch the air conditioning blower on and off at intervals of ten seconds. Any leaking refrigerant will be gathered in by the blower and detected.
5. Insert the probe between the magnetic clutch and compressor to check the shaft seal for leaks.
6. Check all service valve connections, valve plate, head and base plate joints and back seal plate.
7. Check the condenser for leaks at the pipe unions.
8. If any leaks are found, the system must be discharged before rectification.
9. Rectify any leaks and recheck for leaks during evacuation prior to charging.

Leak test using inert gas

Use Nitrogen or Helium gas.

1. Connect gas line to recharging station.
2. Pressurise system to 3 bar (45 lbf/in^2).
3. Carry out leak test as above.

AIR CONDITIONING SYSTEM - PERFORMANCE TEST

WARNING: R134a is hazardous ***See Repair, General Precautions.***

Carry out this test with bonnet and doors or windows open, air conditioning switched on, temperature control set to cold 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 a Refrigerant Station to the high and low pressure servicing connections.
4. Insert dry bulb thermometer into cold air outlet and position dry and wet bulb thermometer close to outside air inlet.
   Do not spill water from the wet thermometer (psychrometer).
5. Start engine and run it at 1500 rev/min for 10 minutes with air conditioning switched on.
6. Read both pressure gauges and thermometers. Check readings against table below with humidity between 60% and 80%.
7. Switch off air conditioning, stop engine, disconnect test equipment.

Performance range

Intake temperature	Outlet temperature	Low pressure	High pressure
68 °F 20 °C	41 - 50°F 5 - 10°C	20 - 23 lbf/in^2 1.4 - 1.6 bar	116 - 190 lbf/in^2 8.0 - 13 bar
75°F 25°C	45 - 60°F 7 - 15°C	21 - 28 lbf/in^2 1.5 - 2.0 bar	130 - 200 lbf/in^2 9.0 - 14 bar
85°F 30°C	46 - 68°F 8 - 20°C	26 - 40 lbf/in^2 1.8 - 2.8 bar	190 - 230 lbf/in^2 13 - 16 bar
95°F 35°C	52 - 72°F 11 - 22°C	36 - 52 lbf/in^2 2.5 - 3.5 bar	230 - 270 lbf/in^2 16 - 19 bar

Table 1

Ambient Temperature		Compound Gauge Readings		High Pressure Gauge Readings	
°C	°F	bar	lbf/in^2	bar	lbf/in^2
16	60	1,3-1,4	15-20	6,9-10,3	100-150
27	80	1,4-1,7	20-25	9,7-13,1	140-190
38	100	1,7-2,1	25-30	12,4-15,5	180-225
43	110	2,1-2,4	30-35	14,8-17,2	215-250

SYSTEM TEST

1. Place the vehicle in a ventilated, shaded area free from excessive draught, with the doors and windows open.
2. Check that the surface of the condenser is not restricted with dirt, leaves, flies, etc. Do not neglect to check the surface between the condenser and the radiator. Clean as necessary.
3. Switch on the ignition and the air conditioner air flow control. Check that the blower is operating efficiently at low, medium and high speeds. Switch off the blower and the ignition.
4. Check that the evaporator drain tube is open and clear.
5. Check the tension of the compressor driving belt, and adjust if necessary.
6. Inspect all connections for the presence of refrigerant oil. If oil is evident, check for leaks, and repair as necessary.

NOTE: The compressor oil is soluble in Refrigerant R134a and is deposited when the refrigerant evaporates from a leak.

7. Start the engine.
8. Set the temperature controls to cold and switch the air conditioner blower control on and off several times, checking that the magnetic clutch on the compressor engages and releases each time.
9. With the temperature control at maximum cooling and the blower control at high speed, warm up the engine and fast idle at 1000 rev/min.
10. Repeat at 1800 rev/min.
11. Gradually increase the engine speed to the high range and check the sight glass at intervals.
12. Check for frosting on the service valves.
13. Check the high pressure hoses and connections by hand for varying temperature. Low temperature indicates a restriction or blockage at that point.
14. Switch off the air conditioning blower and stop the engine.
15. If the air conditioning equipment is still not satisfactory, carry out a pressure test as previously described in this section.

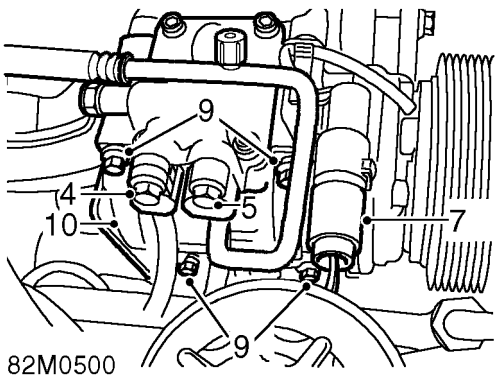
COMPRESSOR

Service repair no - 82.10.20

Remove

1. Disconnect battery negative lead.
2. Recover refrigerant from system. ***See Adjustment, refrigerant recovery recycling recharging***
3. Remove 2 bolts securing hose flanges to compressor.

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant. Plug all exposed connections immediately.



4. Disconnect high pressure pipe from compressor.
5. Disconnect low pressure pipe from compressor.
6. Remove and discard 'O' ring from each flange.
7. Disconnect multiplug from compressor clutch fly-lead
8. Release drive belt from compressor pulley. ***See ELECTRICAL, Repair, Auxiliary drive belt***
9. Remove 4 bolts securing compressor to mounting bracket.
10. Remove compressor from mounting bracket.

Refit

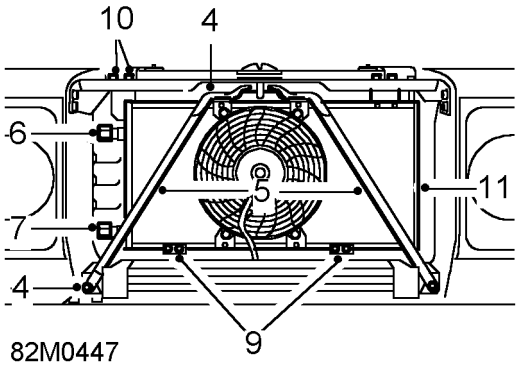
11. New compressor: Drain oil from new compressor outlet port. Drain and measure oil equal to amount drained from old compressor, add 30 ml (1 fl.oz) extra to this amount and refill new compressor through outlet port.
12. Locate compressor in mounting bracket, fit bolts and tighten to ***25 Nm (18 lbf.ft).***
13. Connect multiplug to fly-lead.
14. Fit NEW 'O' rings to each pipe flange, lubricate with refrigerant oil.
15. Engage pipe flanges, fit bolts and tighten to ***10 Nm (7 lbf.ft).***
16. Fit compressor drive belt. ***See ELECTRICAL, Repair, Auxiliary drive belt; Refit***
17. Recharge refrigerant system. ***See Adjustment, refrigerant recovery recycling recharging***
18. Reconnect battery negative lead.
19. Leak test disturbed joints. ***See Adjustment, leak test system***
20. Carry out system test. ***See Adjustment, System test***

CONDENSER

Service repair no - 82.15.07

Remove

1. Disconnect battery negative lead.
2. Recover refrigerant from system. ***See Adjustment, refrigerant recovery recycling recharging***
3. Remove condenser fan. ***See condenser fan***



4. Remove 4 bolts securing cross-braces to top panel and chassis brackets.
5. Remove 2 cross-braces.
6. Using a backing spanner, loosen union nut securing inlet pipe to condenser and disconnect.
7. Using a backing spanner, loosen union nut securing outlet pipe to condenser and disconnect.
8. Remove and discard 'O' ring from each union.

CAUTION: Plug the connections.

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant.

9. Remove 4 screws securing lower brackets to condenser.
10. Remove 4 bolts securing brackets to top panel.
11. Release pipes and remove condenser assembly. ***Do not carry out further dismantling if component is removed for access only.***
12. Transfer brackets to new condenser.

Refit

13. Fit NEW 'O' rings to each union, lubricate with refrigerant oil. New condenser, add 40 ml (1 fl.oz) refrigerant oil.
14. Add 40 ml (1 fl.oz) of refrigerant oil to new condenser.
15. Position condenser and engage pipes.
16. Secure brackets to top panel.
17. Secure lower brackets to condenser.
18. Using a backing spanner, tighten union nuts securing pipes to condenser.
19. Fit condenser fan. ***See condenser fan; Refit***
20. Recharge refrigerant system. ***See Adjustment, refrigerant recovery recycling recharging***
21. Reconnect battery negative lead.
22. Leak test disturbed joints. ***See Adjustment, leak test system***
23. Carry out system test. ***See Adjustment, System test***

RECEIVER DRIER

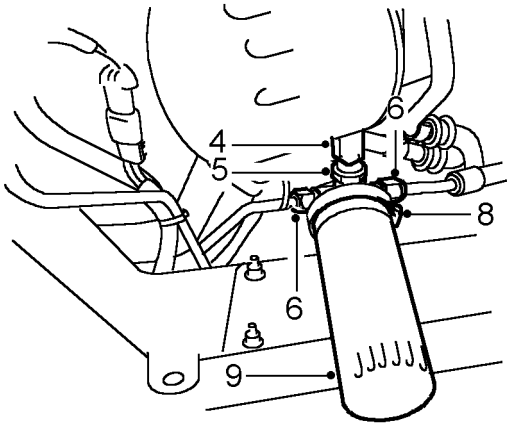
Service repair no - 82.17.01

Remove

CAUTION: If receiver drier is to be refitted, the ports must be blanked off immediately on disconnection. Exposed life of unit is 15 minutes.

1. Disconnect battery negative lead.
2. Recover refrigerant from system. ***See Adjustment, refrigerant recovery recycling recharging***

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant.



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3. Clean area around receiver drier connections.
4. Disconnect multiplug from trinary switch.
5. Remove trinary switch from receiver drier.

CAUTION: Plug the connections.

6. Disconnect 2 pipe unions from receiver drier.
7. Remove and discard 'O' rings from pipe flanges.
8. Fully loosen clip securing receiver drier to bracket.
9. Remove receiver drier from clip.

Refit

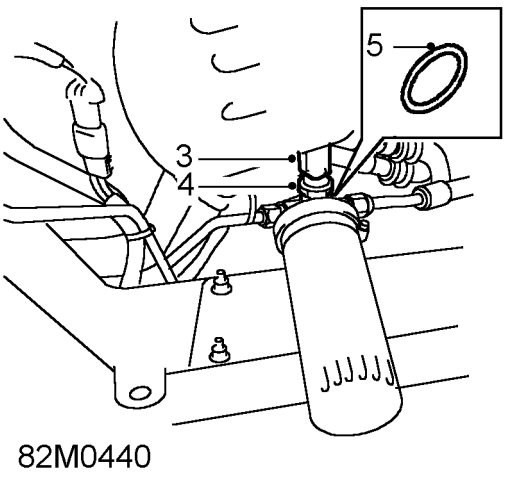
10. Fit NEW 'O' ring to each pipe flange, lubricate with refrigerant oil.
11. Add 20ml (0.7 fl.oz) of refrigerant oil to NEW receiver drier.
12. Position receiver drier in clip, tighten clip but do not clamp.
13. Engage pipes and tighten unions to ***6 Nm (4.5 lbf.ft)*** .
14. Fit trinary switch to receiver drier and tighten to ***11Nm (8 lbf.ft).***
15. Connect multiplug to trinary switch.
16. Tighten receiver drier clamp.
17. Evacuate and recharge air conditioning system. ***See Adjustment, refrigerant recovery recycling recharging***
18. Perform a leak test on disturbed joints.
19. Carry out system test. ***See Adjustment, System test***

TRINARY PRESSURE SWITCH

Service repair no - 82.20.04

Remove

1. Disconnect battery negative lead.
2. Recover refrigerant from system. ***See Adjustment, refrigerant recovery, recycling, recharging***



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3. Access below front RH of vehicle: Disconnect multiplug from switch.
4. Remove switch from adaptor.

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant.

5. Remove 'O' ring from switch and discard.

Refit

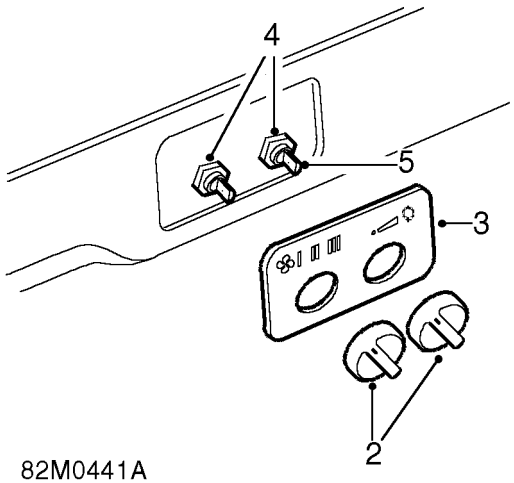
6. Lubricate NEW 'O' ring with refrigerant oil and fit to switch.
7. Fit switch to adaptor and tighten to ***11 Nm (8 lbf.ft).***
8. Connect multiplug.
9. Evacuate and recharge air conditioning system. ***See Adjustment, Refrigerant recovery, recycling, recharging***
10. Reconnect battery negative lead.
11. Carry out system test. ***See Adjustment, System test***

CONTROL SWITCHES

Service repair no - 82.20.10 - Temperature Control Switch
Service repair no - 82.20.11 - Fan Switch

Remove

1. Remove fascia duct bezel. ***See fascia duct bezel***



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2. Pull control knobs from switches.
3. Remove switch panel.
4. Remove nut securing switch to bezel.
5. Remove switch.

NOTE: Fan switch to left.

Refit

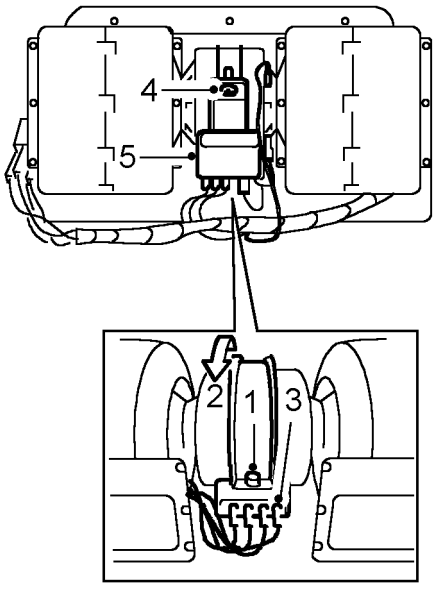
6. Fit temperature control switch. Position capillary tube inside duct to RH side.
7. Fit and tighten nut securing switch to bezel.
8. Fit switch panel.
9. Fit control knobs.
10. Fit fascia duct bezel. ***See fascia duct bezel; Refit***
11. Carry out system test. ***See Adjustment, System test***

RESISTOR UNIT

Service repair no - 82.20.26

Remove

NOTE: Access below evaporator unit.



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1. Loosen outer screw securing resistor unit to clamp.
2. Rotate resistor on motor.
3. Disconnect Lucars from resistor unit.

NOTE: Resistor wires: G, U, R and O

4. Remove screws securing resistor to clamp.
5. Remove resistor unit and clamp.

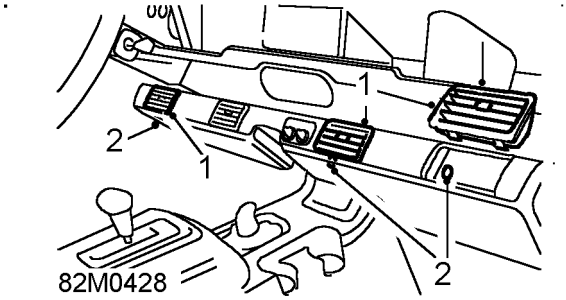
Refit

6. Position clamp over motor and place resistor, terminals downward, onto motor.
7. Fit screws and tighten inner screw only.
8. Fit Lucars to resistor unit, in correct sequence.
9. Rotate resistor to fitted position and tighten outer screw.
10. Carry out system test. ***See Adjustment, System test***

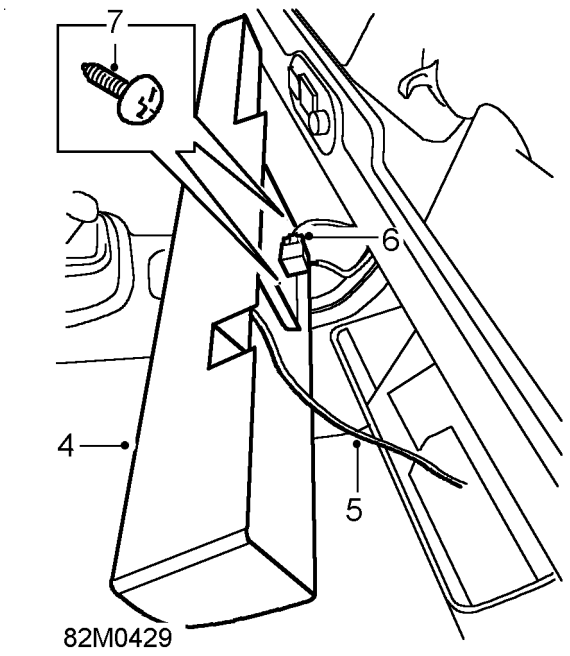
FASCIA DUCT BEZEL

Service repair no - 82.20.79

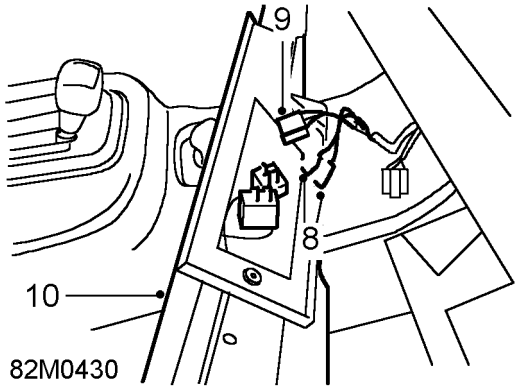
Remove



1. Lever under each bottom corner and remove cold air vents from bezel.
2. Remove screw securing underside of bezel to panel.
3. Remove 3 screws securing inside of bezel to panel.

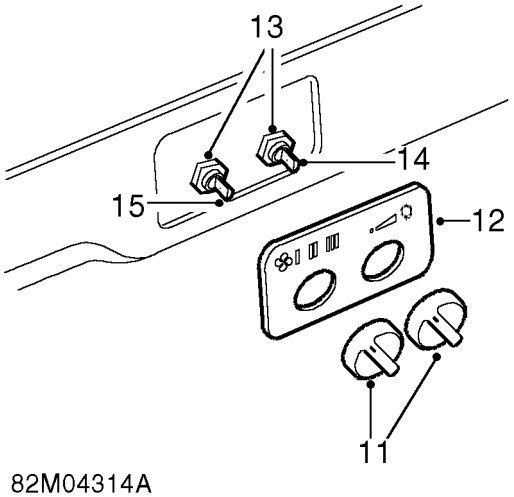


4. Lift bezel away from evaporator casing.
5. Withdraw capillary tube from evaporator fins.
6. Disconnect multiplug from fan interlock relay.
7. Remove 2 screws securing cover to rear of bezel.



8. Disconnect 2 Lucars from temperature control switch.
9. Disconnect multiplug from fan switch.
10. Remove bezel assembly.

Do not carry out further dismantling if component is removed for access only.



11. Pull control knobs from switches.
12. Remove switch panel.
13. Remove nuts securing switches to bezel.
14. Remove temperature control switch.
15. Remove fan switch.
16. Transfer components to new panel.

Refit

17. Position bezel assembly and connect multiplug to fan switch.
18. Connect Lucars to temperature control switch.
19. Position capillary tube to RH side of bezel.
20. Fit screws securing cover to rear of bezel.
21. Connect multiplug to fan interlock relay.
22. Position bezel assembly and insert capillary tube 60 mm (2.5 in) into evaporator fins.
23. Fit bezel assembly to panel and above evaporator casing, secure with screws.
24. Fit cold air vents.
25. Carry out system test. ***See Adjustment, System test***

EXPANSION VALVE

Service repair no - 82.25.01

Remove

1. Remove evaporator. ***See evaporator***
2. Using a backing spanner, loosen union nut and remove high pressure pipe.
3. Discard 'O' ring.
4. Pull insulation away from capillary tube coil and low pressure pipe.
5. Loosen clip and withdraw capillary tube coil from low pressure pipe.
6. Loosen capillary tube union and disconnect union from low pressure pipe. Discard 'O' ring.
7. Using a backing spanner, loosen union nut and remove expansion valve from pipe. Discard 'O' ring.

Refit

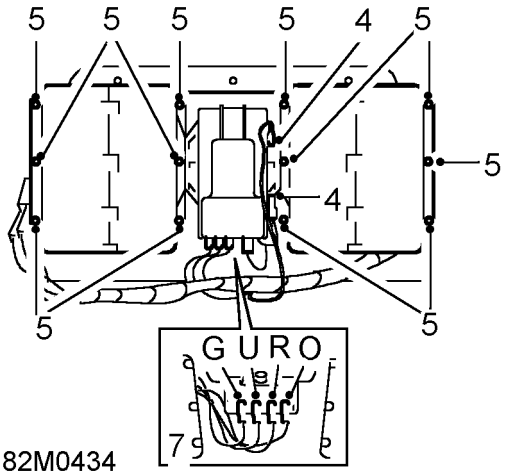
8. Lubricate NEW 'O' rings with refrigerant oil and fit to pipe ends.
9. Fit expansion valve to pipe, DO NOT tighten union nut.
10. Connect capillary tube and tighten union nut.
11. Position capillary tube coil on low pressure pipe and secure with clip.
12. Wrap capillary coil and union with 'Prestite' tape.
13. Connect high pressure pipe to expansion valve, carefully align with low pressure pipe and tighten union nut.
14. Tighten expansion valve union nut.
15. Fit evaporator. ***See evaporator; Refit***
16. Carry out system test. ***See Adjustment, System test***

BLOWER MOTOR ASSEMBLY

Service repair no - 82.25.14

Remove

1. Remove evaporator. ***See evaporator***
2. Move passenger seat fully rearward.
3. Position evaporator unit above centre console and seat panel.



4. Disconnect Lucars (B and O wires) from blower motor.
5. Remove screws securing blower units to casing.
6. Release blower unit flanges from casing, sealed with sealant.
7. Disconnect Lucars from resistor unit.

NOTE: Wire positions: G, U and R wires.

8. Remove blower motor unit.

Do not carry out further dismantling if component is removed for access only.

9. Remove screws securing resistor unit to blower motor. Note alignment of resistor unit.
10. Remove resistor unit and bracket.
11. Fit resistor unit to blower motor.

Refit

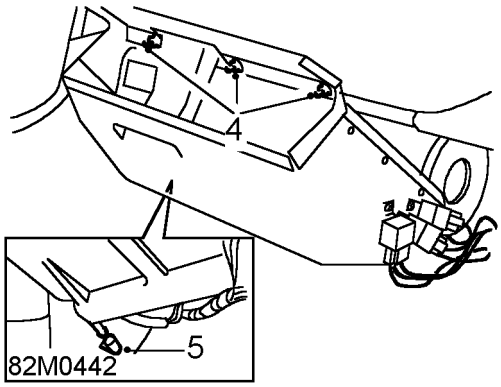
12. Clean sealant from blower flanges.
13. Apply a bead of Silicone Sealant around each blower flange.
14. Connect Lucars to resistor unit in correct order.
15. Position blower flanges on evaporator casing and secure with screws.
16. Connect Lucars (B and O wires) to blower motor.
17. Fit evaporator. ***See evaporato; Refit***
18. Carry out system test. ***See Adjustment, System test***

EVAPORATOR

Service repair no - 82.25.20

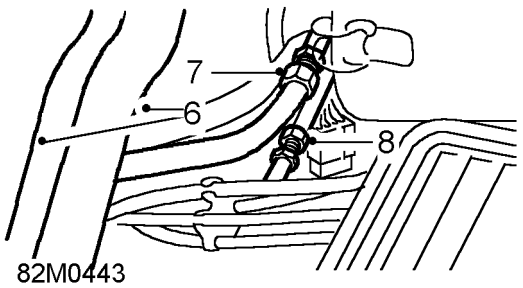
Remove

1. Disconnect battery negative lead.
2. Recovery refrigerant from air conditioning system. ***See Adjustment, Refrigerant recovery recycling recharging***
3. Remove fascia duct bezel. ***See fascia duct bezel***



4. Remove 3 nuts securing evaporator casing to mounting bracket.
5. Disconnect drain tube from drain pipe on LH side of casing.

WARNING: Wear eye and hand protection when disconnecting components containing refrigerant.

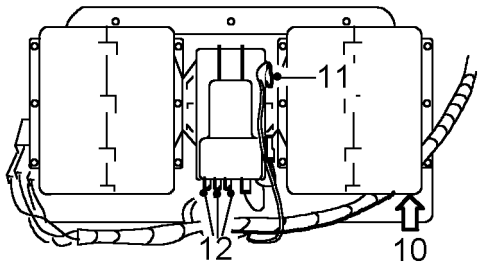


6. Position 2 heater hoses to side of air intake tube.
7. Using a backing spanner, loosen union nut from evaporator return pipe and disconnect. Discard 'O' ring.

8. Using a backing spanner, loosen union nut from evaporator feed pipe and disconnect. Discard 'O' ring.

CAUTION: Plug the connections.

9. Ease 2 evaporator studs from their rubber bushes, release grommet from bulkhead, withdraw pipes from aperture and position evaporator unit on floor.



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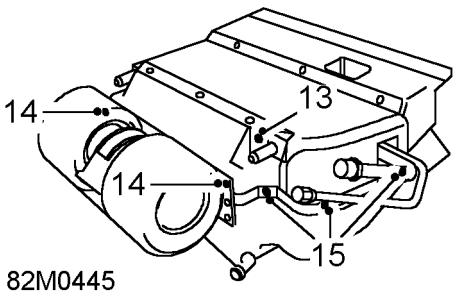
10. Remove screw securing harness 'P' clip to rear of casing.
11. Disconnect Lucar (B wire) from motor.
12. Disconnect Lucars (G, U, and R wires) from resistor unit.



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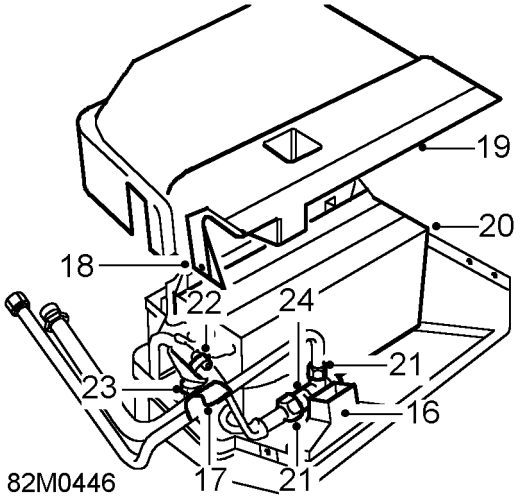
13. Remove screw securing mounting bracket flange to casing.
14. Remove screws securing each end of blower flanges to upper casing.
15. Remove 6 screws securing upper to lower casing.



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16. Remove tape sealing air duct inside casing.
17. Release tape sealing pipes to casing.
18. Cut through sealant along casing joint and gaskets.
19. Ease upper from lower casing and remove upper casing.
20. Lift evaporator unit from lower casing. ***Do not carry out further dismantling if component is removed for access only.***
21. Using a backing spanner, loosen union nut from pipe and remove high pressure pipe. Discard 'O' ring.
22. Loosen clip and withdraw capillary tube coil from low pressure pipe and withdraw coil from pipe.
23. Loosen capillary tube union nut and disconnect from low pressure pipe. Discard 'O' ring.
24. Using a backing spanner, loosen union nut and remove expansion valve from pipe. Discard 'O' ring.

Refit

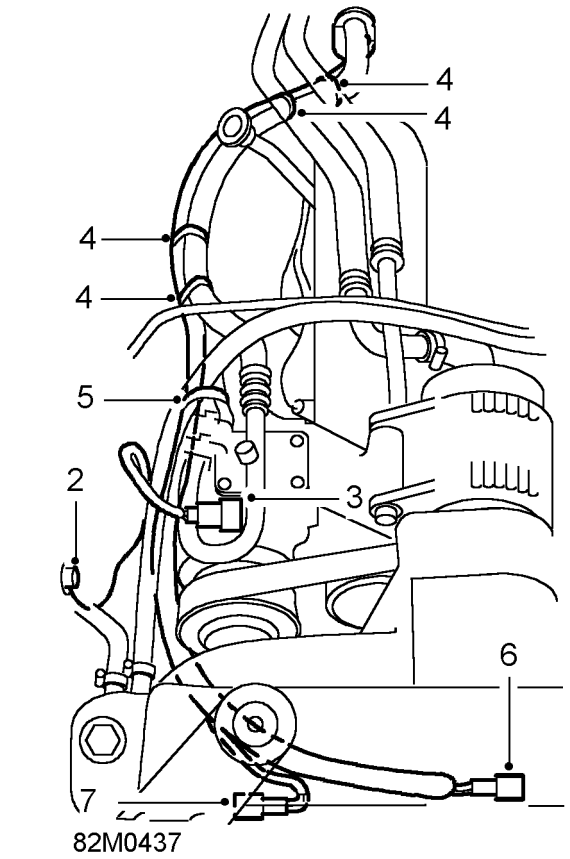
25. Lubricate NEW 'O' rings with refrigerant oil and fit to pipe ends.
26. Fit expansion valve to pipe, DO NOT tighten union nut.
27. Connect capillary tube and tighten union nut.
28. Position capillary tube coil on low pressure pipe and secure with clip.
29. Wrap capillary coil and union with Prestite tape.
30. Connect high pressure pipe to expansion valve, carefully align with low pressure pipe and tighten union nut.
31. Tighten expansion valve union nut.
32. Position evaporator unit in lower casing, align bracket and engage blower flange screws, DO NOT tighten.
33. Position upper casing, engage lower casing flange and secure with screws. Ensure mounting bracket screw engages evaporator bracket.
34. Tighten blower flange screws.
35. Apply Silicone sealant to casing joint and insulating tape to seal pipes to casing.
36. Apply sealing tape around air duct joint.
37. Position evaporator unit in footwell.
38. Connect multiplugs to compressor relays and secure harness 'P' clip.
39. Connect Lucars (G, U, and R) to resistor unit and (B) to motor.
40. Lift evaporator, insert pipes into aperture and engage mounting studs.
41. Connect drain tube to pipe.
42. Fit grommet into aperture.
43. Lubricate NEW 'O' rings with refrigerant oil and fit to joints.
44. Carry out a functional check.
45. Using a backing spanner, engage high pressure pipe and tighten union nut.
46. Using a backing spanner, engage low pressure pipe and tighten union nut.
47. Fit nuts and secure evaporator casing to mounting bracket.
48. Fit fascia duct bezel. ***See fascia duct bezel; Refit***
49. Evacuate and recharge air conditioning system. ***See Adjustment, refrigerant recovery recycling recharging***
50. Reconnect battery negative lead.
51. Perform leak test on disturbed joints
52. Carry out system test. ***See Adjustment, System test***

WIRING HARNESS - SUPPLEMENTARY

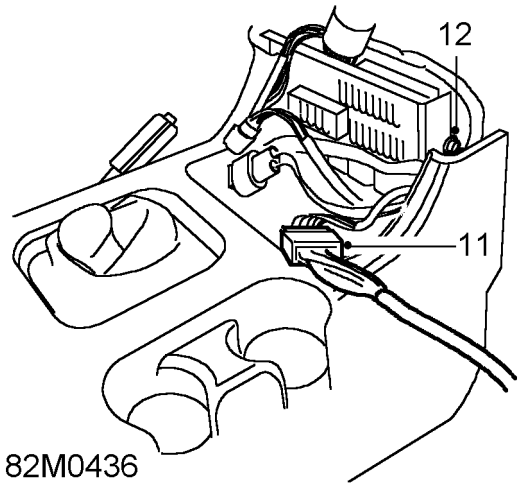
Service repair no - 86.70.23

Remove

1. Remove evaporator. ***See evaporator***



2. Remove nut and release earth eyelet from bulkhead.
3. Disconnect multiplug from compressor fly-lead.
4. Remove 4 ties securing harness to air conditioning hoses.
5. Remove tie securing harness to engine harness.
6. Above chassis front crossmember, disconnect multiplug from condenser fan fly-lead.
7. Disconnect multiplug from trinary switch.
8. Release ties securing harness to pipes.
9. Release harness.



10. Remove fusebox cover.
11. Disconnect multiplug from main harness.
12. Remove screw securing earth eyelet to fusebox bracket.
13. Pull harness from between centre console and bulkhead.
14. Remove grommet from harness.
15. Remove 'P' clip from harness.
16. Extract harness from front of engine compartment and pass through bulkhead into footwell area. Remove air conditioning harness.

Refit

17. Position harness in footwell and route harness into engine bay, follow evaporator and receiver drier hoses to receiver drier.
18. Fit grommet and 'P' clip to harness.
19. Position harness between centre console and bulkhead with multiplugs in fusebox area.
20. Secure earth eyelet to fusebox bracket.
21. Connect multiplugs to main harness.
22. Position switch harness to RH side of console, fit fusebox cover and secure with screws.
23. Connect multiplug to trinary switch and condenser fan fly-lead.
24. Secure earth eyelet to fender.
25. Connect multiplug to compressor fly-lead.
26. Secure harness to air conditioning hoses with ties.
27. Secure harness to engine harness with tie.
28. Fit evaporator. ***See evaporator; Refit***
29. Perform leak test on disturbed joints
30. Carry out system test. ***See Adjustment, System test***

TORQUE VALUES

Air conditioning	Nm	lbf.ft
Compressor to mounting bracket	25	18
Compressor pipe flange bolts	10	7
Receiver drier union bolts	6	4.5
Trinary pressure switch	11	8
Pressure pipe union nuts - M16	14	10
Discharge pipe union nuts - M22	22	16
Suction pipe union nuts - M24	33	24

86 - ELECTRICAL

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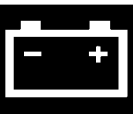
REPAIR



ELECTRICAL PRECAUTIONS

The following guidelines are intended to ensure the safety of the operator whilst preventing damage to electrical and electronic components fitted to the vehicle.

Polarity

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

High voltage circuits

WARNING: Before commencing work on an ignition system, all high tension terminals, adaptors and diagnostic equipment for testing should be inspected to ensure that they are adequately insulated and shielded to prevent accidental personal contacts and minimize the risk of shock. Wearers of surgically implanted pacemaker devices should not be in close proximity to ignition circuits or diagnostic equipment.

Whenever disconnecting live high tension circuits always use insulated pliers and never allow the open end of a high tension lead to come into contact with other components particularly electronic control units. Exercise caution when measuring the voltage on the coil terminals while the engine is running, since, high voltage spikes can occur on these terminals.

Connectors and harness

Always ensure that these items are dry and oil free before disconnecting and connecting test equipment. Never force connectors apart either by using tools or by pulling on the wiring harness. Always ensure locking tabs are disengaged before removal and note orientation to enable correct reconnection. Ensure that any protective covers and substances are 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 disconnecting

Before disconnecting the battery, switch off all electrical equipment.

Battery charging

Recharge the battery out of the vehicle and keep the top well ventilated. While being charged or discharged, and for approximately 15 minutes afterwards, batteries emit hydrogen gas which is flammable. Always ensure any battery charging area is well ventilated and that every precaution is taken to avoid naked flames and sparks.

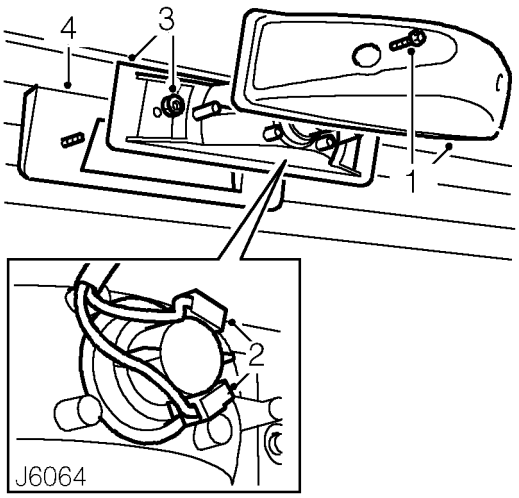
GENERAL PRECAUTIONS

Switch-off ignition prior to making any connection or disconnection in the system as electrical surge caused by disconnecting 'live' connections can damage electronic components.
Ensure hands and work surfaces are clean and free of grease, swarf, etc. as grease collects dirt which can cause tracking or high-resistance contacts.
When handling printed circuit boards, treat them as you would a disc - hold by the edges only.
Prior to commencing a test, and periodically during a test, touch a good earth, for instance, a cigar lighter socket, to discharge body static as some electronic components are vulnerable to static electricity.

CENTRE HIGH MOUNTED STOP LAMP

Service repair no - 86.41.32

Remove



1. Remove 2 screws and remove stop lamp cover.
2. Disconnect Lucars from bulb holder.
3. Unscrew 2 nuts and remove lamp unit from fixing studs and rubber gasket.
4. Remove gasket.

Refit

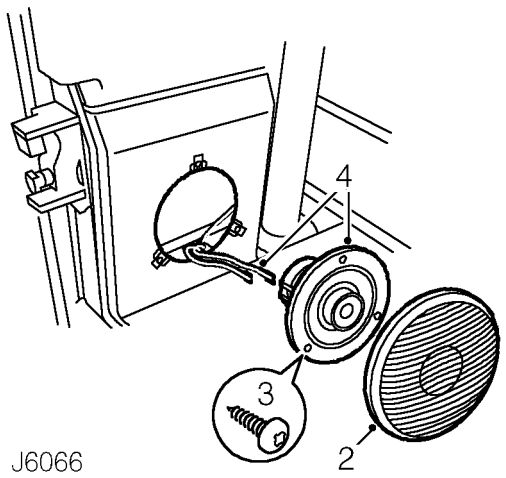
5. Position gasket and stop lamp. Secure with two nuts.
6. Connect Lukars to bulb holder.
7. Position cover and secure with screws.

RADIO SPEAKER - REAR

Service repair no - 86.50.12

Remove

1. Raise rear seat cushion and fit stowage strap.



2. Carefully prise grille from speaker .
3. Remove 3 screws and withdraw speaker from trim panel.
4. Disconnect two Lucars and remove speaker.

Refit

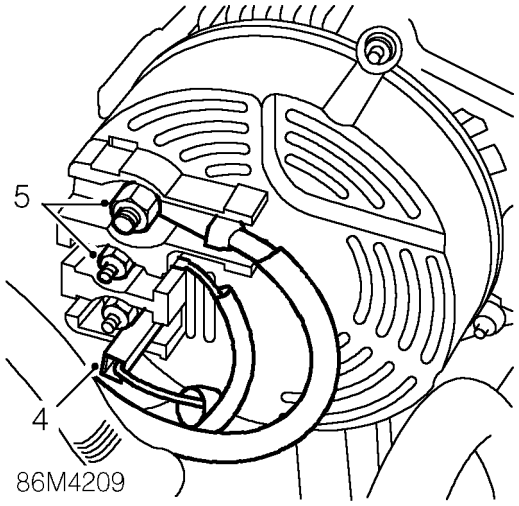
5. Connect Lucars, position speaker and secure with screws.
6. Position grille and press firmly to secure.

ALTERNATOR

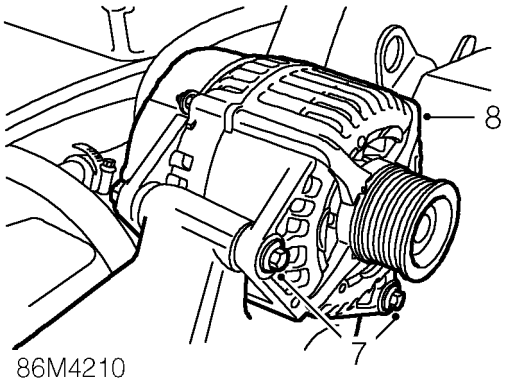
Service repair no - 86.10.02

Remove

1. Disconnect battery negative lead.
2. Remove drive belt. ***See Auxiliary drive belt***
3. Remove cover from rear of alterator.



4. Disconnect Lucar from rear of alterator and collect cover.
5. Remove 2 nuts securing leads to rear of alterator.
6. Disconnect leads from rear of alterator.



7. Remove 2 bolts securing generator to mounting bracket and collect nuts.
8. Remove alterator.

Refit

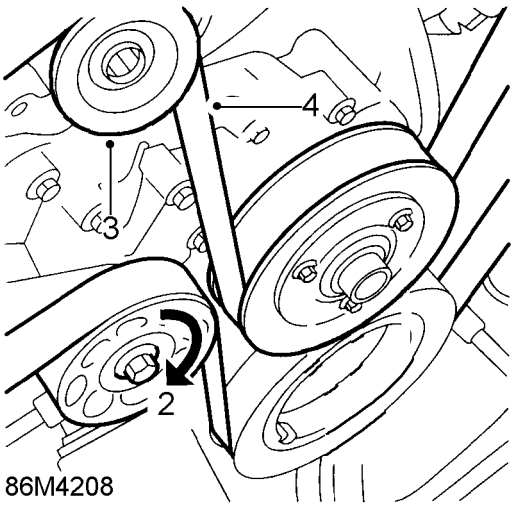
9. Fit alterator to mounting bracket.
10. Fit bolts and tighten nuts securing alterator to mounting bracket.
11. Connect leads to rear of alterator and secure with nuts.
12. Feed lucar through aperture in rear cover and connect to alterator.
13. Fit cover to rear of alterator.
14. Fit drive belt. ***See Auxiliary drive belt; Refit***
15. Reconnect battery negative lead.

AUXILIARY DRIVE BELT

Service repair no - 86.10.03

Remove

1. Remove viscous coupling. ***See COOLING SYSTEM, Repair, viscous coupling***



2. Release drive belt tension by turning tensioner clockwise.
3. With tension released, remove belt from alternator pulley.
4. Remove drive belt.

△ **NOTE: If belt is to be refitted, mark direction of rotation.**

Refit

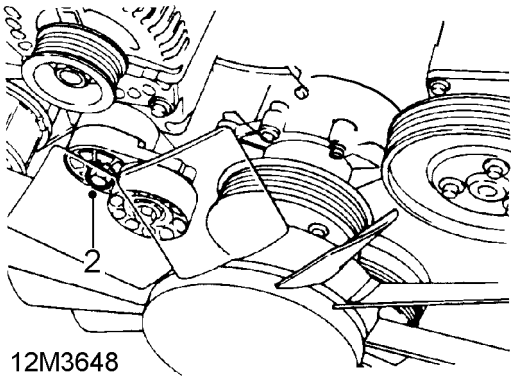
5. Clean drive belt pulley grooves and inspect for damage.
6. Fit belt to pulleys.
7. Turn drive belt tensioner clockwise and fit belt to alternator pulley.
8. Release drive belt tensioner.
9. Fit viscous coupling. ***See COOLING SYSTEM, Repair, viscous coupling; Refit***

DRIVE BELT TENSIONER

Service repair no - 86.10.09

Remove

1. Remove drive belt. ***See Auxiliary drive Belt***



2. Loosen tensioner centre bolt.
3. Remove bolt and tensioner.

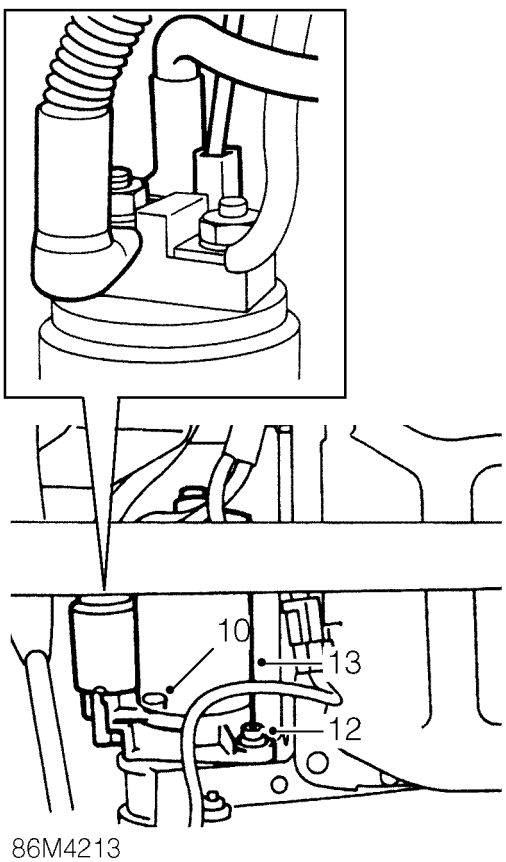
Refit

4. Fit tensioner and bolt, tighten bolt to ***50 Nm (39 lbf.ft.)***
5. Fit drive belt. ***See Auxiliary drive belt; Refit***

STARTER MOTOR

Service repair no - 86.60.01

1. Position vehicle on ramp.
2. Disconnect battery negative lead.
3. Remove RH front heated oxygen sensor. ***See FUEL SYSTEM, Repair, heated oxygen sensor (H02s)***
4. Remove front bolt and loosen rear bolt securing catalyst heat shield. Lower front edge of heat shield.
5. Remove bolt securing starter motor heat shield to RH engine mounting bracket.
6. Release heat shield clip from starter motor solenoid and move aside for access.
7. Lower ramp.



86M4213

8. Disconnect Lucar from solenoid.
9. Remove nut and disconnect feed wires from solenoid.
10. Remove top bolt securing starter motor.
11. Raise ramp.
12. Remove bottom bolt securing starter motor.
13. Remove starter motor.

Refit

14. Ensure mating faces are clean.
15. Locate starter motor and fit bottom bolt finger tight.
16. Lower ramp.
17. Fit top bolt and tighten to ***42 Nm (31 lbf.ft).***
18. Connect feed wires to solenoid terminal and secure with nut.
19. Connect Lucar to solenoid.
20. Raise ramp.
21. Tighten bottom starter motor bolt to ***42 Nm (31 lbf.ft).***
22. Manoeuvre heat shield into position and secure clip to solenoid.
23. Align heat shield to RH engine mounting bracket and fit retaining bolt.
24. Align catalyst heat shield and harness clip. Fit and tighten front bolt. Tighten rear bolt.
25. Fit heated oxygen sensor. ***See FUEL SYSTEM, Repair, heated oxygen sensor (H02s); Refit***
26. Reconnect battery negative lead.

RADIO

Service repair no - 86.50.03

Remove

1. Using tool **SMD 4091** release radio from cage.
2. Disconnect coaxial cable from radio.
3. Disconnect 2 multiplugs from radio.
4. Remove radio from fascia.

Refit

5. Position radio to fascia and connect multiplugs.
6. Connect coaxial cable to radio.
7. Secure radio in cage.

88 - INSTRUMENTS

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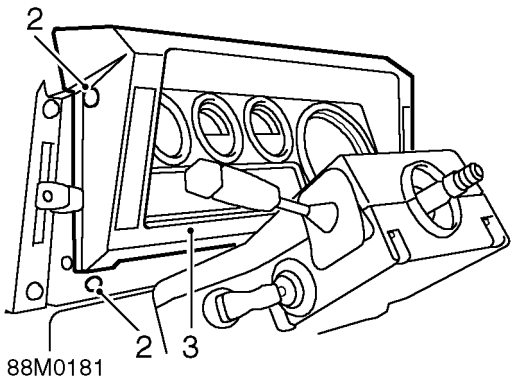
REPAIR

INSTRUMENT PANEL

Service repair no - 88.20.02

Remove

1. Disconnect battery negative lead.



2. Remove 4 screws securing instrument panel to fascia cowl.
3. Pull instrument panel away from fascia sufficent to reach behind speedometer.
4. Disconnect instrument harness multi-plug.
5. Disconnect 2 multi-plugs from warning light connectors.
6. Withdraw panel, complete with instruments.

Refit

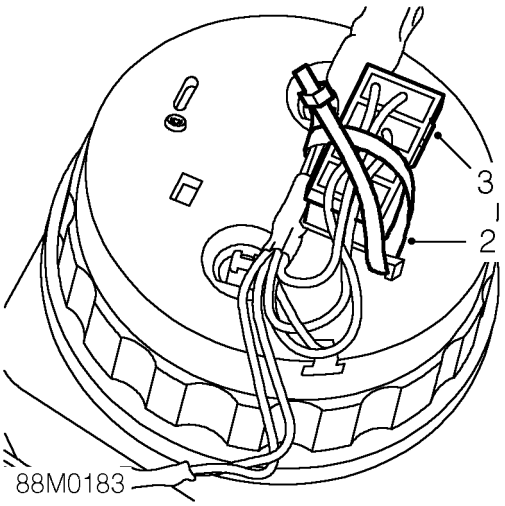
7. Offer up instrument panel and connect multi-plugs.
8. Secure instrument panel to fascia panel.

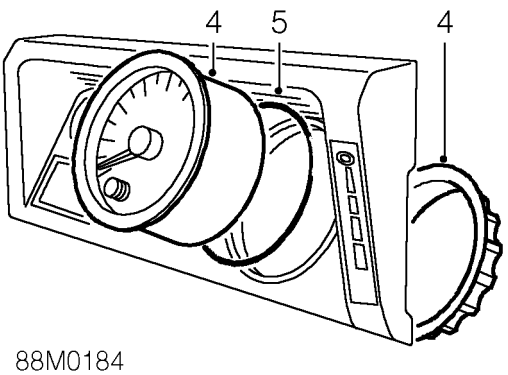
SPEEDOMETER

Service repair no - 88.30.01

Remove

1. Remove instrument panel assembly. ***See Instrument panel***





2. Release tie sucuring harness and multiplug to speedometer.
3. Disconnect multi-plug from speedometer.
4. Unscrew retaining ring and remove speedometer.
5. Remove 'O' ring from speedometer.

Refit

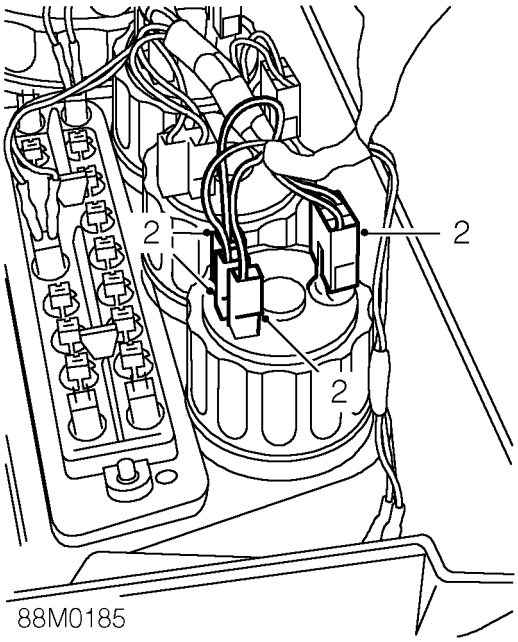
6. Fit 'O' ring to speedometer and position speedometer into instrument panel.
7. Fit retaining ring, align dial and tighten.
8. Connect multiplug to speedometer.
9. Secure harness and multiplug with tie.
10. Secure instrument panel to fascia cowl. ***See Instrument panel; Refit***

TACHOMETER

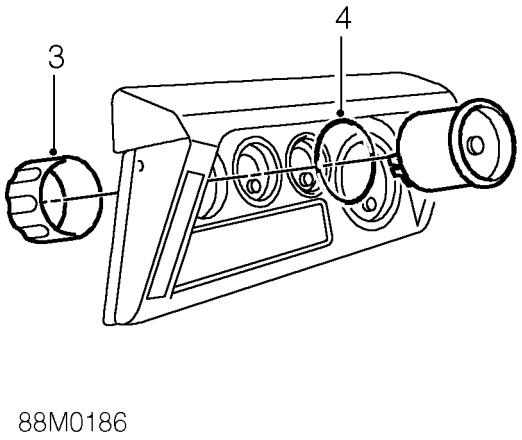
Service repair no - 88.30.21

Remove

1. Remove instrument panel. ***See Instrument panel***



2. Release illumination bulb holder and wiring connectors from tachometer.
   '-' = BLACK
   '+' = WHITE
   '2' = RED



3. Unscrew retaining ring and remove tachometer.
4. Remove 'O' ring from tachometer.

Refit

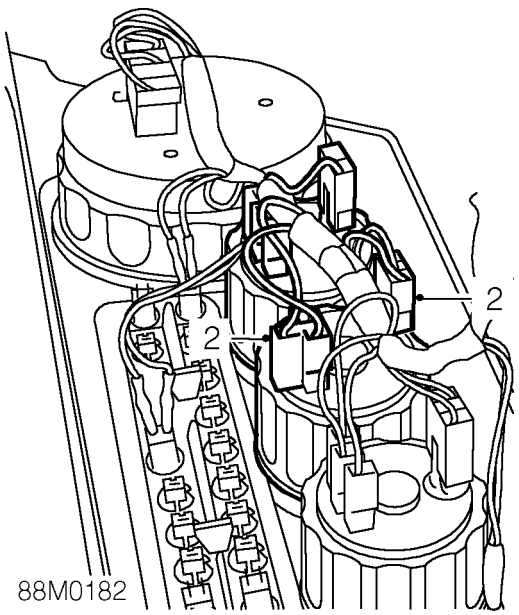
5. Fit 'O' ring to tachometer and position tachometer into instrument panel.
6. Fit retaining ring, align tachometer and tighten.
7. Fit bulb holder ensuring wires are connected to correct terminals.
8. Fit instrument panel. ***See Instrument panel; Refit***

FUEL AND TEMPERATURE GAUGES

Service repair no - 88.25.26 - Fuel gauge
Service repair no - 88.25.14 - Temperature gauge

Remove

1. Remove instrument panel. ***See Instrument panel***



2. Release illumination bulb holder and multiplug from gauge.
3. Unscrew retaining ring and remove gauge. ***See tachometer***
4. Remove 'O' ring from gauge.

Refit

5. Fit 'O' ring to gauge and position gauge into instrument panel.
6. Fit retaining ring, align gauge and tighten.
7. Fit bulb holder ensuring wires are connected to correct terminals.
8. Fit instrument panel. ***See Instrument panel; Refit***